Robust Foundations

Galway Public Transport Feasibility Study

Report for Galway City Council

In Association With HKT&T

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mvaconsultancy

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Executive Summary

Study Context and Purpose

The past two decades have seen unprecedented population growth in Galway. The quality of life and the economic opportunities afforded by Galway City and its surrounding area have attracted more people to live and work in the City. Alongside this growth has been the rapidly increasing car ownership which has created opportunities to travel greater distances and live further away from the centre of the City. As a result we see increasing numbers of trips by car, from an increasingly dispersed area, with resultant rise in congestion and threatening the quality of the urban environment.

Not surprisingly, the increase in car travel has corresponded with downward trends in public transport use, walking and cycling. This has been exacerbated by a further decentralisation of settlement and business patterns, reinforcing car dependency. An important element in reversing these unsustainable trends is the provision of an integrated pubic transport system – the subject of this study.

The scene has been set in previous work, namely - the **Galway Transportation and Planning Study (GTPS)** undertaken in 1999, the subsequent **GTPS Integration Study** undertaken in 2002 (each jointly commissioned by Galway City and County Councils) and the **Galway Strategic Bus Study** undertaken in 2007 (commissioned by Galway City Council). In this new piece of work, attention has concentrated on a more detailed examination of all public transport options identified by its predecessors, including Bus Rapid Transit, Light Rail and associated Park and Ride facilities. To achieve the objective of developing a delivery plan for improved public transport more in-depth analysis and forecasting of the current and future public transport needs of the City have been undertaken to support the recommendations and prioritise the subsequent actions.

The starting point has been the common objectives identified across the aforementioned studies that continue to be relevant, including:

- facilitating growth in an economically and environmentally sustainable manner to support Galway as a 'Gateway' city;
- managing advantageously the region's unprecedented population growth; and
- mitigating the impact of increasing traffic levels notable on the approaches to Galway City.

An integrated approach to land use planning and transport provision has therefore been a shared theme that continues to have an important resonance throughout this study.

What approach was taken?

Against this background this study included:

- A comprehensive assessment of transport and planning issues in the study area, supported by the development of multi-modal model, used in assessing potential transport solutions. This involved reviewing existing data sources and other reference and policy documents relevant to establish key underlying trends and issues, current travel patterns and demographic profiles. Data sources included the Central Statistics Office (CSO) Census 2006 Journey to Work/ School data; CSO Census Place of Work – Census of Anonymised Records (POWCAR); and CSO Census 2006 Small Area Population Statistics (SAPS);

- Public and stakeholder consultation was an integral element to help further our understanding of the public viewpoint on existing transport issues in Galway; to be aware of ideas from the public and stakeholders that could be incorporated into the study, and of any stakeholder plans of concern to the study;
- The development of evaluation objectives, which serve to define what a 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 appraisal process, facilitating the assessment of the preferred package of interventions in terms of how well they contribute to the achievement of objectives;
- A Galway multi-modal transport model developed in house by MVA Consultancy to assess the comparative transport impact of potential public transport options. The model was also used as a basis for appraising the wider economic and environmental benefits of the preferred strategy;
- A financial and economic appraisal, engineering feasibility of recommended future public transport and other sustainable transport options for Galway; and
- Identification of integrative and complementary measures.

The Baseline Evaluation: so what?

The baseline evaluation found a very high level of car use particularly for work journeys in the City and in the remainder of the study area. The regionally dispersed settlement patterns challenges public transport provision. In addition, with poor permeability provided for walking or cycling in residential locations, and the car culture apparently established in key employment areas such as Ballybrit/ Parkmore and the NUIG/ University Hospital serve to reinforce the very high car use. This is indisputably unsustainable, from economic, environmental, social and public health perspectives.

Conversely there are indications of unrealised potential for more walking and cycling. This comes from census data relating to work and school trips made in the City, where walking and cycling levels are found to be nearly double the national average and constitute the highest mode of travel. This together with the fact that walking and cycling levels for work purposes were higher just twelve years ago suggesting that Galway has strong potential to support higher levels of both. This suggests that there might be some value in exploring in more detail why more work trips are not also being made by foot or on bike as a form of 'active travel'.

Starting from a very low base, and albeit it very small, there was nevertheless an increase in public transport modal share in Galway between 2002 and 2006. The baseline findings therefore suggest that there is scope for reducing car reliance in Galway if a coordinated approach is taken.

What do the people of Galway want? Issues, concerns and vision for future?

As already alluded to, the consultation process demonstrated that Galway citizens are passionate about the future of the City. A range of issues were raised, ranging from unreliable public transport services and poor information to poor provision for walking and cycling and the car dependent nature of travel to school. However, there was near unanimous concern about the levels of congestion experienced in the city.

Viewpoints differed on particular solutions, but they did not differ in their shared vision and aspiration for a solution to support significant change towards a more sustainable vibrant Galway City and Centre. The future public transport system attributes reported related to improved reliability, frequency and

connectivity; service integration and ticketing; whole journey accessibility; and low emission services. There was also a call for service and route provision that both considers and supports a better environment for walking, cycling and more integrated journey opportunities.

Understanding that there is this shared desire is a very helpful starting point in that we know that we are working towards a shared ultimate goal. This is a vision for the City where travel efficiency and opportunity are central.

Developing Options

The first step in developing future transport options was to consider what they might be measured against. At a relatively qualitative level, it is helpful to develop a set of evaluation objectives: a key step in the development of any strategy or plan. The evaluation objectives define what the transport system should aim to achieve, either directly or through their influence on other aspects of spatial planning facilitating the assessment of the preferred package of interventions. To ensure that the study is undertaken without prejudice, whilst keeping the interests of Galway and a sustainable transport future central, they are based on an examination of key policy and spatial planning documents, in addition to the public and key stakeholder consultation responses.

The appraisal **objectives**, developed from the background facts and the public perceptions are:

- To reduce delay and improve predictability for all journey types;
- To increase capacity for movement to the City Centre without the provision of additional road infrastructure, car parking or land take for transport;
- To allow increased levels of economic activity in Galway without significant increases in road traffic across the network;
- To enhance the ambience of the City Centre for employees, shoppers and visitors through a programme of public realm enhancements, noise and air quality improvements, reduced conflict between pedestrians and vehicles and quality 24/7 activity; and
- To create a public transport system which is inclusive and accessible in order to give all residents an opportunity to travel and take part in the full range of activities offered in the region.

There are a broad range of options that would be able to meet the objectives and ultimately fulfil Galway's public transport needs in the future. The primary considerations impacting on the determination of the most appropriate system are:

- Impact on urban form;
- Meeting passenger expectations and requirements;
- Supporting the needs of Galway City and future developments; and
- Feasibility of implementation in terms of space required, timescale for delivery and acceptable cost.

The multi-modal transport model allowed an examination of the implications of a number of options and combinations of options at a broad level before narrowing down the choice. This also allowed consideration of the impact of combining the best parts of various scenarios, to give an overall 'best fit' for the region. The key options considered were:

- an enhanced Conventional Bus Network;

- an Extended Coverage Low Operational Capacity (ECLOC) bus system;
- Bus Rapid Transit; and
- Light Rail.

These were compared with 'Do nothing', 'do minimum' and 'perfect service' scenarios. The latter scenario is one in which an idealised very high frequency public transport service, operating at very competitive and guaranteed speed on all main transport corridors, is provided (Note: there was no attempt to demonstrate technical feasibility of this – it is a hypothetical comparator).

The Analysis

The 'do nothing' and 'do minimum' scenarios clearly demonstrated that without further intervention public transport mode share will continue to remain very low, with insufficient competition to shift people from the car as a preferred modal choice.

By contrast the 'perfect service' network with ultimate public transport provision in the projected best corridor/ catchment area illustrated a potential for up to a half of all trips to be by public transport by 2020.

This first analysis set the boundaries, which indicates that, at best, public transport can only cater for around half the current journeys in the City and its environs. In practice this could never be achieved, as the measures needed to give the 'perfect service' would be very costly and extremely disruptive both to other traffic and the built environment. The analysis then took each of the realistic options and considered how closely they:

- met the objectives;
- attracted passengers; and
- were feasible within the constraints.

The results of this detailed analytical work showed that the most effective and certain solution was an enhanced bus network built around a sustainable east-west rapid transit corridor through the city centre, together with Park and Ride provision at a number of 'edge of city' locations, and city centre traffic management. This solution offered the best future public transport mode share potential. As a result of transfer from car to public transport it also improved general traffic speeds throughout the area.

The recommended measurers have been subject to economic appraisal and have been found to deliver a medium return on the investment required; and to give a reduction in carbon emissions of 9%. Further benefits of the strategy would be realised through the introduction of complimentary measures.

What else is needed? Complimentary measures

The assessment of proposed public transport options illustrated that public transport improvements are not sufficient on their own to curb the dominance of car and associated traffic impacts in Galway City. Traffic related congestion and other delays each heavily impact on public transport provision in terms of efficiency, reliability, timetabling and future viability. The improved public transport service can only be delivered if there is a reallocation of road space to support public transport and cycling, and also if walking in both the City centre and suburbs is attractive and safe.

A review of 'best practice' internationally showed that traffic management measures that provide priority for public transport, walking and cycling, whilst restricting car movement in a City Centre are essential to achieving the objectives in the immediate future. Residential and destination streetscape improvements were also found to play an important role in creating an improved sense of place and area recognition, but also by providing better permeability for walking and cycling, with more appropriate and safe shortcuts for walking and cycling serving to extend the public transport catchment area. The dispersed nature of Galway County was additionally considered, leading to a recommendation to better integrate land use and transport planning in the longer term and supporting greater future fuel independence. Destination based areas that include NUIG and the University Hospital to the north west of the city and Ballybrit/ Parkmore to the north east of the city were each identified as having maximum potential for benefiting from an area travel plan/mobility management plan to manage travel demand to the workplaces within these sites.

Providing better whole journey accessibility can benefit all sustainable users. The key integrative measures within the public transport system required to improve the whole journey quality are:

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

Some of these can only be fully delivered with a change to current regulatory practices, however this is not seen as an obstacle to implementation.

Consultation also suggested strongly that there is a need for a shift of hearts and minds towards alternatives to car travel in Galway. Travel behaviour change is no easy task but it is an essential and urgent endeavour that is required across Ireland.

"Investment in the necessary infrastructure elements will be challenging. However, the real challenge is to change mindsets, so that our institutions and individual citizens realise the benefits from altering their travel behaviour. I recognise that policies right across all areas of Government will have to be aligned in that regard"

From the Foreword, to A Sustainable Transport Future: A New Transport Policy for Ireland 2009-2020 by An Taoiseach Brian Cowen.

The study also examined the potential of mobility management or travel planning techniques in Galway city. The evidence found suggests that where public transport and other traffic management measures are being introduced, targeted mobility management plans (such as in destination areas of NUIG/University Hospital and Ballybrit/Parkmore) are key to the final chapter of stimulating modal shift.

Feasibility and Implementation

A number of key considerations were identified as being important in ensuring the timely delivery of public transport improvements as recommended by this Report, and in a manner that benefits all in the City and surrounding area. These included:

- Phasing issues for public transport interventions, taking into consideration the timeline for planning, designing and implementing bus network/ service improvements and the BRT system;
- The need to significantly increase public transport use in the short term by first improving the operation and performance of the current bus service and by implementing supporting traffic management measures (e.g. the City Centre Traffic Management Plan), planning and parking policies, and informative/ integrative measures;
- Availability of funding throughout the current decade and beyond, allowing the incremental development of the public transport system, growing passenger demand accordingly;
- The identification of the key policy and planning triggers for the staged development of BRT, in particular as it relates to supporting measures, and development along the length of the corridor; and
- Supportive institutional arrangements that includes the development of a Programme Board.

Next Steps

This piece of work is the essential first stage in facilitating the step change required to manage Galway's traffic and congestion, and to help secure a more sustainable future for Galway city and its surrounds. It has established:

- The need for change;
- The objectives against which success can be measured;
- The most suitable option to pursue;
- The changes and the infrastructure needed to establish the chosen solution; and
- The funding required and the time line for implementation.

The next stage is to complete the detailed planning while simultaneously beginning the implementation strategy. This will include three core activities:

- complete the Bus Enhancement Implementation Plan, with the detailed design of reconfigured bus network, including the specifics of route alignment and service frequency, determination of appropriate bus priority infrastructure and stop locations;
- commence the BRT Planning, Design and Business Case development; and
- formalise responsibilities by way of a programme delivery office, and formalisation of other supportive institutional arrangements that can facilitate efficient and cooperative programme delivery.

1 Introduction

1.1 Background

1.1.1 MVA Consultancy, in association with Healy Kelly, Turner and Townsend (HKTT), was commissioned by Galway City Council in December 2008 to undertake a public transport feasibility study for Galway City and its environs.

1.1.2 This study has been carried out to support the sustainable future development of Galway City and its environs. Specifically, the Study is required to determine the potential for introducing new transport modes, including Bus Rapid Transit, Light Rail Transit and associated Park and Ride facilities.

1.1.3 A number of past studies that have led to and support this study include:

- *The Galway Transportation and Planning Study and Integration Study* – a land use and transportation study jointly commissioned by Galway City and County Councils which reported in 2002. This was adopted in 2003, establishing a framework for a more integrated approach to development and transportation in the City and a 30km hinterland area.
- *The Galway Strategic Bus Study* – this was commissioned in 2006 by Galway City Council. The study identified quality bus corridors and park and ride opportunities, and recommended that these be backed up by integrated land use planning, traffic management, car restraint and marketing.

1.1.4 Also significant was the establishment, in 2008, of the Galway Transportation Unit. Working in partnership with transport stakeholders, the unit aims to develop an integrated "transport solution for Galway City" that prioritises "increased use of public and non-car based transport services to overcome exiting congestion and delays in the network and promote a sustainable transport system".

1.2 The purpose of this study

1.2.1 This study is intended to support and compliment the aforementioned Galway Transportation and Planning Study (GTPS), 1999, and subsequent GTPS Integration Study, 2002 by determining the types and extent of public transport intervention required to support the desired future development pattern. Interventions would be sustainable by reference to a range of social, economic and environmental criteria. Such solutions would be developed in a manner which is feasible, given financial, engineering and geographic constraints.

1.2.2 Specifically the study brief set out **the scope** in the following terms:

- to demonstrate the type(s) and extent of public transport and Park and Ride facilities required to ensure the sustainable development of the City and it's environs;
- to consider the phased implementation of a public transport network and the package of supporting infrastructure measures that includes all modes of travel, including BRT and/or LRT and public transport priorities which are capable of catering for the short (2013), medium (2020) and long term (2030) demands of the City and environs;

- to include an examination of the role that park and ride has to offer in the context of public transportation and in the development of the new transport system; and
- to make recommendations on the feasibility of developing and augmenting an integrated public transport network, which may include Park and Ride, and Bus Rapid Transit and/or Light Rail, and that is capable of catering for the short (2013), medium (2020) and long term (2030) demands of the city and region.

1.2.3 Finally and importantly, this study:

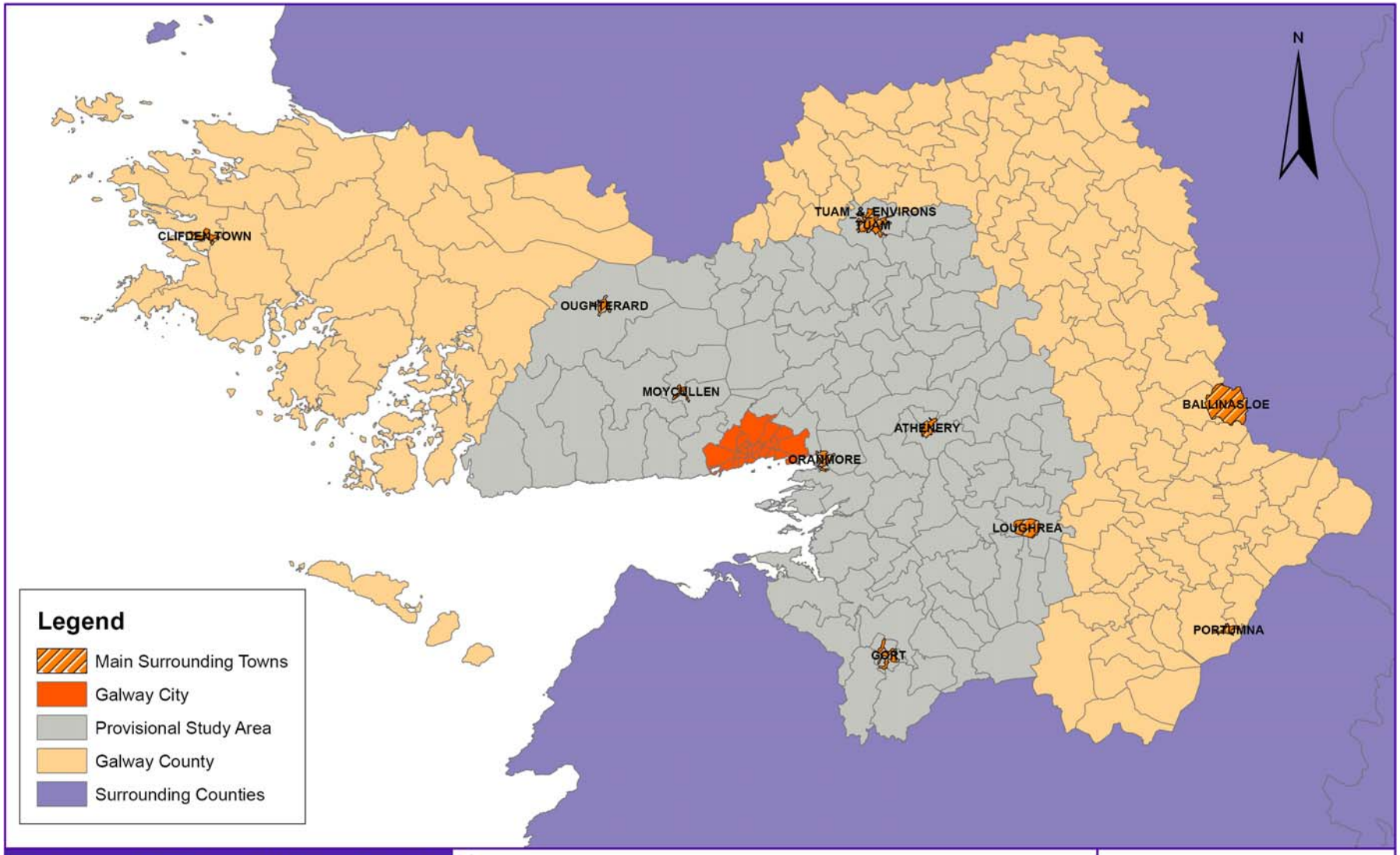
- sets out a strategy for developing public transport in Galway, and is NOT a study with a single end point;
- allows for changing land use and rising expectations; and
- seeks to support a more sustainable and magnetic city centre served with a more effective and efficient mass transit system to accommodate better city access, less delay with higher levels of activity.

1.3 The Study Area

1.3.1 The area defined as the study area for the purposes of the Galway Transport and Planning Study is shown in the following figure. The study area boundary extends approximately 30km from Galway City Centre, which marks the principal 'travel to work area'/ 'sphere of influence' around Galway, and as such continues to be relevant. This has been referred to in previous studies as the GTPS study area.

1.3.2 For the purposes of this study, the GTPS study area has been adjusted slightly to fit the Electoral District boundaries more precisely. This was done to accommodate census and other necessary ED related data analysis. The study area mapped in this way is shown in Figure 1.1. The boundaries of both maps are closely aligned with both extending beyond Galway City to include the Galway hinterland as defined by the Galway Transport and Planning Strategy.

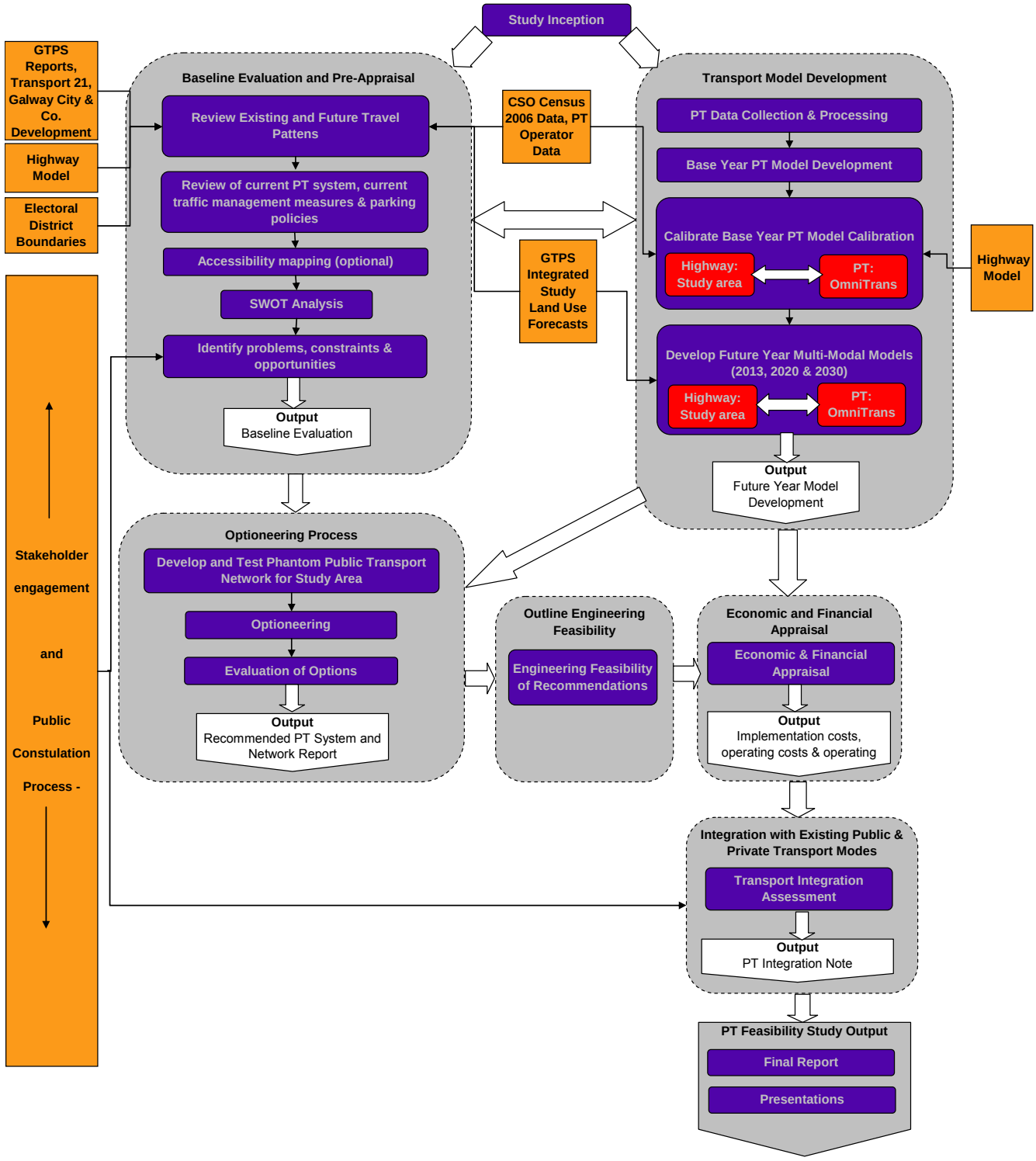
Figure 1.1 Galway Public Transport Study – Area included in detailed analysis



1.4 Outline Feasibility Study Methodology

1.4.1 The outline methodology for the Galway Public Transport Feasibility Study is illustrated in the flow chart below. The approach involved a comprehensive assessment of baseline transport issues in the study area, multi-modal model development, option development, option 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 1.2 Outline of Study Methodology



1.5 The Galway Multi-Modal Transport Model

1.5.1 The Galway multi-modal transport model was developed in-house by MVA consultancy with the support of key inputs provided by Transportation Planning (International) Ltd, and uses two modelling software packages, SATURN highway modelling software and OmniTRANS traffic planning software.

1.5.2 The model makes use of the existing Galway City SATURN highway model provided by TPi Ltd. 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 Galway 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.

1.5.3 OmniTRANS is used to model public transport in the study area. This modelling software platform was used for modelling 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 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 model.

1.5.4 The multi-modal transport model uses bespoke programs developed by MVA to link the 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.

1.5.5 The 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.

1.5.6 Future year scenarios were developed using the population and employment allocations from the Regional Planning Guidelines for the Western Region, 2004 to 2016; and through subsequent discussions with Galway City and County Councils to disaggregate the aggregated land use data to an electoral district level. The multi-modal transport model development process and structure is shown in diagrammatical form on the figure, overleaf.

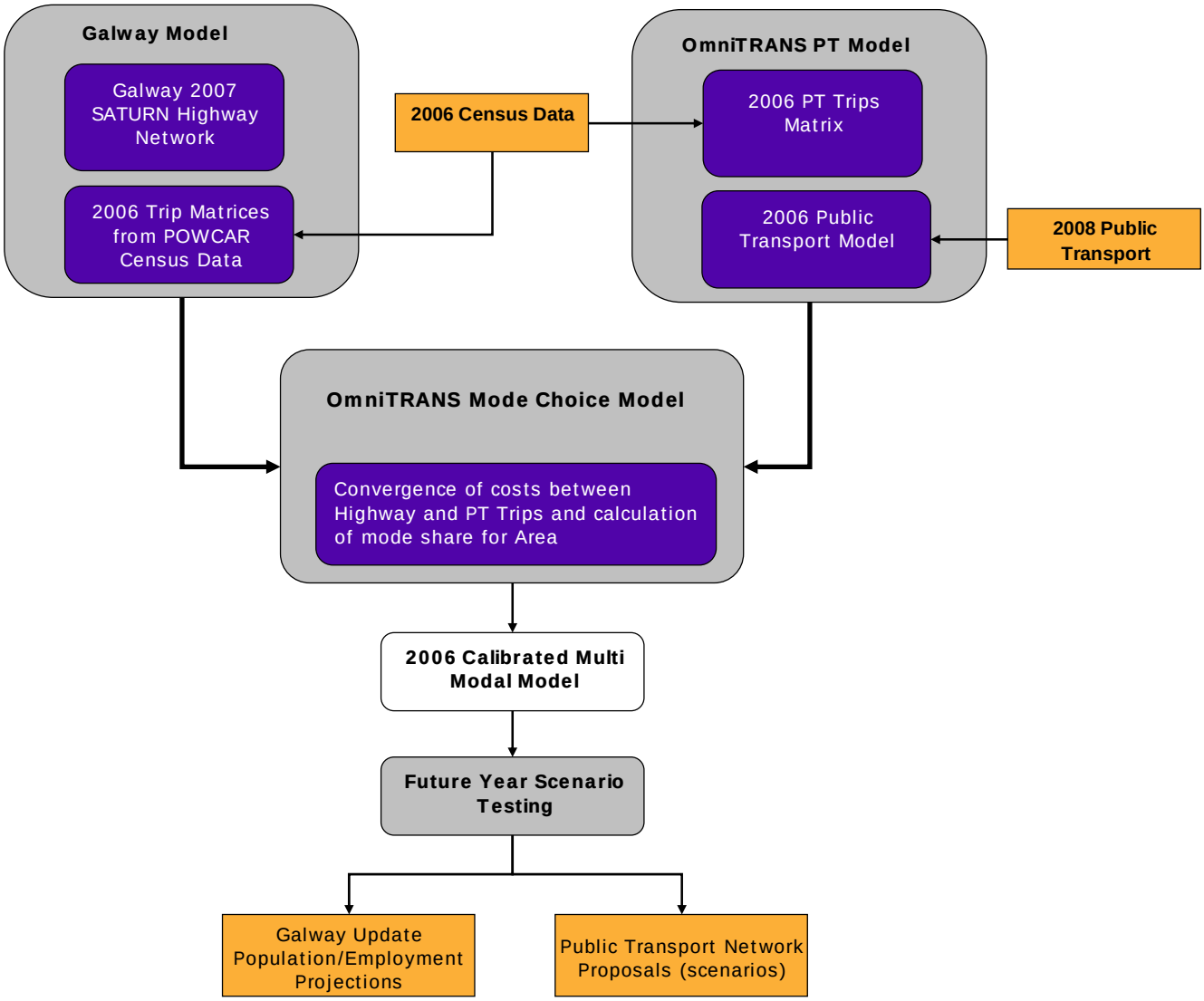
1.5.7 The multi-modal transport model represents an appropriate assessment tool for undertaking the Study for the following reasons:

- It accurately represents base (2006) and planned future highway networks for the area, having been developed from the existing highway (Saturn) model;
- It accurately represents base (2006) and committed future public transport schemes (e.g. existing city and regional bus services, and committed introduction of Suburban Rail services on the Athenry to Galway Rail Corridor);

- The base year model has been calibrated and validated to Census 2006 conditions; and
- The future year model for 2020, used in the option development and evaluation processes of the Study have been developed to represent future population and employment allocations. This facilitates an assessment of a public transport network/ service that best meets transport demand arising from this plan.

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

Figure 1.3 Multi-Modal Transport Model Structure



1.6 Definition of Terms

1.6.1 Within this Report the following terms are used with these specific meanings:

- **GTPS**: The Galway Transportation and Planning Study (GTPS). This was jointly commissioned by Galway City Council and Galway County Council in 1999, and carried out by Colin Buchanan Consultants to establish a framework for transportation development in the City and its environs. A review of the 1999 GTPS study was carried out in 2002 to integrate relevant issues arising from the then emerging national policies from the National Development Plan and The National Spatial Strategy.
- **The GTPS Study Area:** Defined by the GTPS study, the area encompasses Galway City and the surrounding area extending approximately 30 km from the City Centre. This area has been used for this study, with minor modification to fit closely to electoral district boundaries to accommodate modelling and census data analysis (illustrated in Figure 1.1 and 1.2).
- **Galway City**: the administrative area covered by Galway City Council, covers an area of approximately 50.6 km^2 and includes the City's commercial core area, the City Centre retail area and industrial area to the north east of the Centre. The population of the City is 72,729, as determined from Census 2006. The City Council area is bounded by Barna Rd to the west, a rough line running between the northern perimeters of Mionlach and Ballybrit to the north, and to the east a line roughly 1km west of Bothar na Dtreabh and finally by the sea to the south;
- **Main Development Centres**: these are the key outlying towns within the study area that are identified for development and include Tuam, Oranmore, Athenry, Loughrea and Gort;
- **Satellite Towns:** these are towns within the study area that are within easy reach of Galway City for employment, those identified are Oughterard, Headford, Claregalway, Moycullen, Bearna and Spiddal;
- **Census Data and Electoral Divisions**: The smallest administrative area for which population statistics are published is the Electoral Division (ED) (formerly called District Electoral Division). In rural areas each ED consists of an aggregation of entire townlands. There are 3,440 EDs in the State. Data has been obtained from the Central Statistics Office for the EDs within the study area. The ED names have been referenced in the description of all baseline Census data;
- **Intercity Rail** long distance rail services on the intercity rail network from Dublin to Galway, which stop at Athlone and Athenry;
- **Commuter Rail** includes existing and potential future local services operated by Iarnród Éireann between Galway and Athenry, including a local services planned for opening in 2009 between Galway and Gort as part of the Western Rail Corridor;
- **City Bus Services:** those operating within Galway City on the city bus network provided by Bus Eireann and City Bus;
- **Regional Bus Services:** include scheduled bus services connecting Galway City and County Galway 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, with restricted stopping patterns operating along inter-urban corridors providing connections between towns and cities

1.7 Report Structure

1.7.1 This remainder of this report is structured as follows:

Identification of Issues

- The **Study Context** (Chapter 2) – a summary of the material included in the Baseline Report, setting the key issues for the study;
- A summary of the responses collected during **Public and Stakeholder Consultation** (Chapter 3);
- A set of **Evaluation Objectives** (Chapter 4) derived from the context and the consultation, and congruent with the methodology;

Option Development and Evaluation

- The broad range of **Transport Options** which should be considered (Chapter 5);
- **Evaluation of these options** (Chapter 6);

Supporting Policies

- A description of the **supporting transport and land use policy** elements for the successful delivery of any strategy (Chapter 7);

Appraisal of Preferred Strategy

- **Appraisal** of preferred strategy (Chapter 8);
- **Outline Engineering Feasibility** (Chapter 9);
- A comparative analysis of the merits of **BRT and LRT** (Chapter 10);
- **Integration** of public and private transport modes (Chapter 11);

Implementation

- **Outline Implementation Plan** for preferred strategy (Chapter 12); and
- Recommendations and Next Steps (Chapter 13).

2 Introduction: The Baseline Study Report

2.1 Introduction

2.1.1 The starting point in undertaking this Feasibility Study is an examination of existing travel behaviour within the study area. This is undertaken in the context of public transport infrastructure and services operating within the study area.

2.1.2 This chapter includes a summary of demographics trends and travel demand, in the Study Area. A much more comprehensive analysis is included in the Baseline Evaluation Report, which was an important first step in setting the scene for identifying the most appropriate Public Transit system for Galway. It documents in more detail baseline travel patterns, existing public transport infrastructure and services, and key existing traffic management arrangements within the Study Area.

2.2 Planning and Policy Context

2.2.1 An understanding of relevant policy priorities and objectives is essential to set the context for undertaking this study.

2.2.2 As a result, relevant plans and studies were reviewed as part of the Baseline Study. For this purpose, the Galway City Development Plan and both the existing and Draft County Development Plans were reviewed. At a higher level, key regional and national policy documents reviewed as part of this exercise include the Regional Planning Guide Lines Western Region, 2002-2020; the National Development Plan, 2007-2013; and Transport 21.

2.2.3 The recommendations and issues raised in previous transport studies were also been reviewed for their relevance to this study. Of particular note were:

- The 'Galway Transport and Planning Study' (GTPS) 1999, jointly commissioned by Galway City and County Council;
- The ensuing GTPS Integration Study 2002, which integrated relevant emerging elements and strengthened policies from the then draft National Spatial Strategy and National Development Plan; and
- The Galway Strategic Bus Study 2007, commissioned by Galway City Council to further development of bus transport in Galway.

2.2.4 Common issues identified in the abovementioned studies are:

- the opportunity to maximise opportunity in an economically and environmentally sustainable manner, Galway's contribution as a 'Gateway';
- to manage advantageously the region's unprecedented population growth; and
- to mitigate increasing traffic levels notable on the approaches to Galway City.

2.2.5 An integrated approach to land use planning and transport provision has been seen therefore to be central, and this theme has in part driven previous transport studies, in particular the GTPS study and has been a key consideration throughout this study. The related theme of sustainability has also been common to the objectives of most policy documents, defined with relevance primarily to the economy and the local environment. Table 2.1 overleaf provides a summary of the objectives driving the principal plans and previous studies that are relevant to this study.

Table 2.1 Summary Objectives from relevant principal plans and previous studies

	Galway Transport Unit	Galway City Development Plan	Draft Galway County Development Plan 2009 - 2015	GTPS	Galway Strategic Bus Study
Overriding Principles e.g. key aim or Strategic priorities	To develop public transportation and other travel modes to the extent that the city will become a model for a sustainable traffic system in an urban environment.	To ensure a coordinated and sustainable approach is taken in planning for the current and future development of Galway ■ *Facilitate the future development of Galway City within the strategic framework of the GTPS; and* ■ *Support and promote the development of a **high quality transport system** within and linking the city.*	To set out an overall strategy for the proper planning and sustainable development of the administrative area of Galway County Council, in accordance with the Planning and Development Acts, 2000-2006	To establish "a development framework in land use and transportation terms for the overall Galway area and its two constituent components, Galway City and Galway County"	Commissioned in 2006 to review Galway bus provision and its future requirements. Additionally it set out to identify the opportunities and constraints to providing an efficient and attractive bus service appropriate for Galway
Objectives	■ To ensure city has necessary transport infrastructure and services to support it **as a gateway and regional centre**; ■ To improve availability and potential usage of all modes of **public transport**; ■ To develop other travel modes i.e. **cycling and walking**; ■ To influence public's travel choice and **encourage** increased use of public transport services; ■ To engage in a marketing strategy that will **promote** new measures introduced; ■ To improve journey times; ■ To **integrate** different transport modes; and ■ To minimise traffic congestion within the city.	■ Promote **balanced sustainable economic development** and employment opportunities; ■ Maximise **economic opportunities** for all persons in the city and facilitate a wide range of **access** to social, community and housing facilities; ■ Promote a high quality built environment through protection of heritage and **good urban design**; ■ Protect and promote the natural heritage of the city and provide for **sustainable recreational opportunities**; ■ Protect city centre role and **promote regeneration;** ■ Provide for **essential infrastructure** and **minimise adverse environmental impacts**; and ■ Support the development of tourism, arts and preserve the distinct culture of Galway City.	■ Implement development strategy to achieve **balanced and Sustainable development** in a **strategic and plan led** manner; ■ Improve the **quality of life** for the people of Galway and maintain the County as a uniquely attractive place; ■ Create a receptive development environment in response to national and regional policy and to secure development of the identified major **infrastructural projects**, which will underpin **sustainable development**; ■ **Conserve** the natural, built and cultural **uniqueness of the County** and its potential to generate economic well being, quality of life and vibrant communities; ■ Drive forward the balanced economic and social development of by **facilitating new strategic developments** at appropriate locations; ■ Develop Gaeltacht as an Irish speaking community; ■ Recognise the Galway Metropolitan Region as a location with the **potential to attract investment** both to the City and to the County; ■ Facilitate and encourage greater public involvement in the planning process; ■ More **sustainable and integrated** land use, transportation and services provisions	■ Enhance and maintain **prosperity** within the region; ■ Minimise the cost of growth; ■ Strengthen the **relationship between City and County**; ■ Support the overall vision for **balanced regional development** across Ireland; ■ Create some of the key conditions through which it can be achieved The GTPS integration study confirmed the role of a bus based transit system and when developed the Ardaun corridor; and identified an opportunity for integrated planning and rail development to support greater regional balance and Galway as a Gateway.	■ To identify a framework for the development of a Bus Route Network; ■ To **identify corridors** that require to be developed ; ■ To **address transport integration** and consider the needs of all road users; ■ To identify **traffic management** measures; ■ To engage in full **consultation** with all relevant parties; ■ To identify intelligent transport solutions; ■ To determine the level of service, capacity, bus frequency, fleet size and vehicle types required; ■ To take into account major road and other developments "Core components" of strategy (not objectives) ■ A redesigned bus network; ■ **Quality Bus Corridors**; ■ **Park and Ride** into the City; ■ General **Traffic management** measures; ■ Marketing.

2.3 Baseline Study Data Analysis

2.3.1 The Baseline Study reviewed a range of existing data sources and other reference and policy documents relevant to the development of the study. A variety of data sources were used to establish current travel patterns and demographic profiles, including the Central Statistics Office (CSO) Census 2006 Journey to Work/ School data; CSO Census Place of Work – Census of Anonymised Records (POWCAR); and CSO Census 2006 Small Area Population Statistics (SAPS).

2.3.2 To illustrate demographic profiles, travel patterns and desire lines in a more meaningful way, a Geographic Information Systems (GIS) software package was employed. Site visits were also carried out to develop an understanding of public transport infrastructure and services in Galway City and the surrounding area.

2.3.3 Trip patterns were explored further by looking more closely at the geographical pattern of trips being made. The CSO Census 2006 POWCAR Data was used to generate maps showing trip 'desire lines'. These are the trip patterns between home and work destinations by car and public transport modes. In essence they illustrate the strongest origin-destination trip patterns, i.e. the areas between which journeys are more commonly made.

2.3.4 CSO census data is considered to be the most credible and consistent data available for measuring the quantum and the distribution pattern of study area trips. The Census data used in the baseline assessment focused on AM peak period trips comprising of work and education trips, i.e. the vast majority of all trips in this time period. This gives an excellent picture of the principal trip desire lines during the AM peak period.

2.4 Key Findings

Population and Settlement Pattern

2.4.1 Following an analysis of Census 2006 data, the following key findings/ issues were identified:

- Galway City currently has a population of 72,414. The total population of the study area (approx 30km from city centre) in 2006 was 168,259. The population has experienced considerable growth with a 14% population increase in the study area from that found in 2002 (at 147,191).
- Galway City itself however has a relatively compact centre, and has a higher than average proportion of young adults, as might be expected in a university city. Families with younger children tend to live in the more rural hinterlands rather than in towns.
- The population outside of the City is relatively dispersed. Only Tuam has a population density greater than 1,000 per km^2, at 1,218 per km^2. This is followed by Loughrea with a population density of 850 per km^2 in its urban centre. Gort, Oranmore, An Carn Mor, and Athenry have relatively low population densities of 258 per km^2, 158 per km^2, 111 per km^2, 159 per km^2.
- The rural nature of the rest of the study area is highlighted by its population density of less than 100 people per km^2. Over four out of ten people living in the study area live in rural areas or small villages of less than 1,000 people.

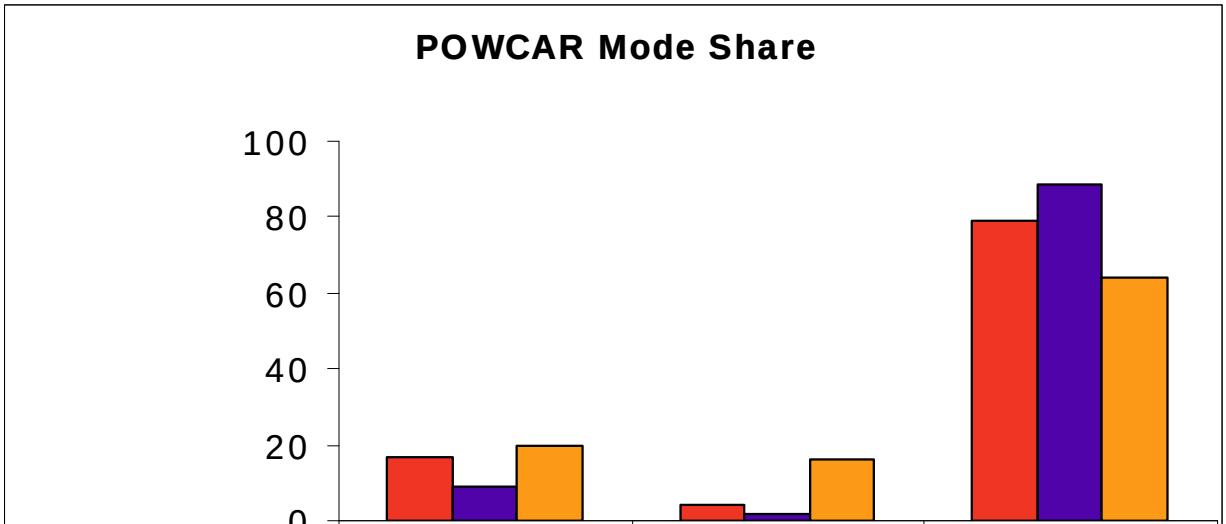
- The high proportion of the area population living outside of the major settlements poses obvious challenges for any connectivity based on public transport, and in particular for families with young children. In general, these families have almost universal car ownership (often two cars), whose residential location choice does not appear to have been based on the availability of non car travel options.

Travel Patterns to Work and School

2.4.2 Key findings relating to travel to school and work trip patterns following analysis of Census 2006 POWCAR and SAPS data are that:

- Travel by car is the choice of the majority of people in County Galway and in the study area. The car share of journeys is higher than the national average for both work trips, and for work and school trips combined in nearly all cases. This is particularly notable for work trips in the study area and city, and combined work and school trips outside of the City.
- A comparison between the 1996 and 2006 Census travel statistics reveals that the number of people walking to work was, in relative terms, 28% higher in 1996 than in 2006 (i.e. in real terms the percentages are 11.8% in 2006 compared to 15.1% in 1996). Furthermore the number cycling to work in 1996 was relatively 86% higher than 2006 (i.e. in real terms 2.2% in 2006 compared to 4.1% in 1996).

Figure 2.1 Modal Share for Galway City and Remaining Study Area

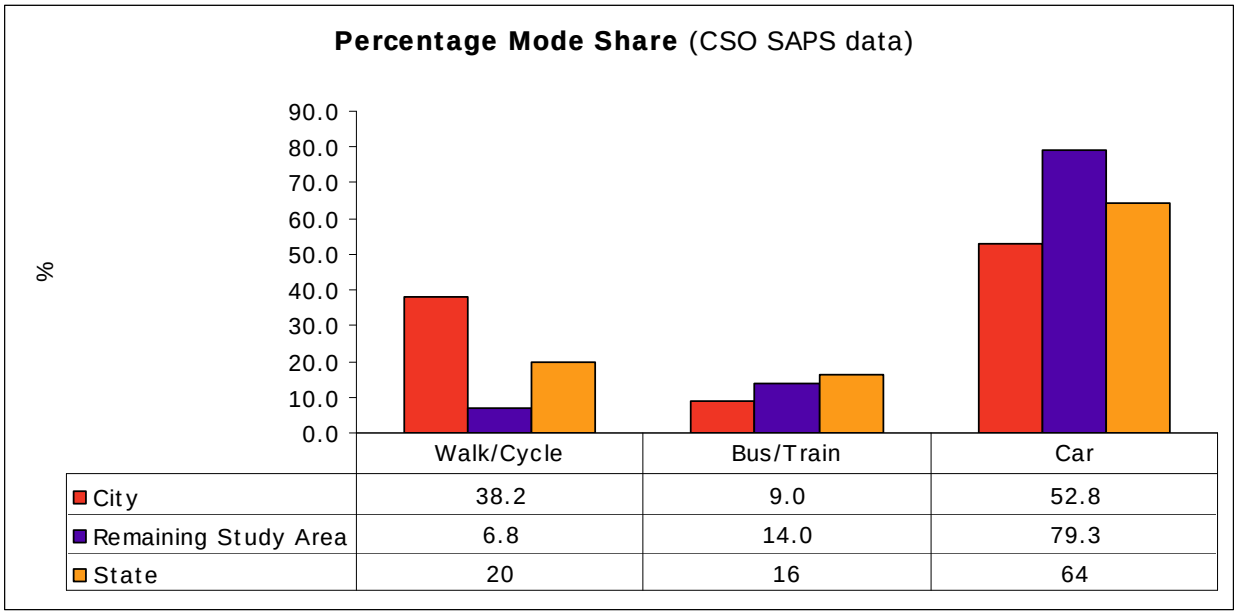


	%Walk/Cycle	%Bus/Train	%Car/Passenger
City	17	4	79
Remaining Study Area	9	2	89
State	20	16	64

Source: Census 2006 People over 15, Means of Travel to Work

- For combined (work & school) trips made in the City, walking and cycling are nearly double the national average and constitute the majority mode of travel Figure 2.1. This together with the fact that walking and cycling levels to work were higher only twelve years ago suggests that Galway has the potential to support higher levels walking and cycling as a form of 'active travel'. It also suggests a need to explore in more detail why more work trips are not also being made by foot or on bike.

Figure 2.2 Mode Share - Work and Education, for Galway City



	Walk/Cycle	Bus/Train	Car
City	38.2	9.0	52.8
Remaining Study Area	6.8	14.0	79.3
State	20	16	64

- Public transport represents only 4% of work trips in the City, and 2% in the rest of the study area. The decline in the more sustainable travel choices in County Galway in the ten year period 1996 to 2006 is notable, public transport too saw a decline of 26%.
- Of the principal towns across the study area, Oranmore, despite its relative proximity to Galway city, was noted for having a very high car modal share for work and education trips with as many as 82.8% being made by car and just 5.8% by public transport. Gort was found to have the lowest car dependency with 56% of work and education trips being made by car, 10.7% of trips being made by public transport and 33% being made on foot or by bicycle.
- School and work trips that are within the City were concentrated into the classic 08:00 to 09:00hrs time-band. The 2006 Census also found that most trips (70%) were recorded as being less than 30 minutes with 42% being recorded as less than 15 minutes. By contrast journeys in and from the surrounding area started earlier (30% before 08:00hrs) and took longer (70% less than 30 minutes). Early consultation paints a more time challenged picture: this maybe due to changes in journey times since 2006 Census or infrequent delays which amplify the perception of the typical time taken to complete a journey. An understanding of the local perception of journey times must equally be considered where the aim is to provide a more desirable transport system.

The geographical pattern of trips – where are people travelling to and from?

2.4.3 Desire line maps are particularly useful for showing commuting patterns to centres of employment, which maps of the road network may fail to highlight. Understanding the pattern of trips can then be used to assess the adequacy of the existing public transport system. Figure 2.3

2.4.4 Figure 2.4 is a desire line map of car trip patterns as recorded by the census. It illustrates the high number of relatively unique between zone trips and their randomness. Figure 2.4 shows the top five (electoral district) destinations in Galway City.

2.4.5 The maps together illustrate that:

- The many relatively unique trips that are not replicated over a twenty four hour period. They are reflective of the dispersed land use patterns with dispersed residential and workplace destinations and this poses a challenge in providing public transport services that are inclusive – a recurring theme.
- The most significant individual travel to work movements were from both Ballybaan and Bearna to Ballybrit, where there is a concentration of employment around the industrial park. Though not marked on the map below, the census showed that these two routes had just over 550 and 440 journeys per day being recorded respectively. Ballybrit, together with a second key city destination, Shantalla, were noted for their very high car usage and low public transport modal shares.

Figure 2.3 Desire Lines – Car Network

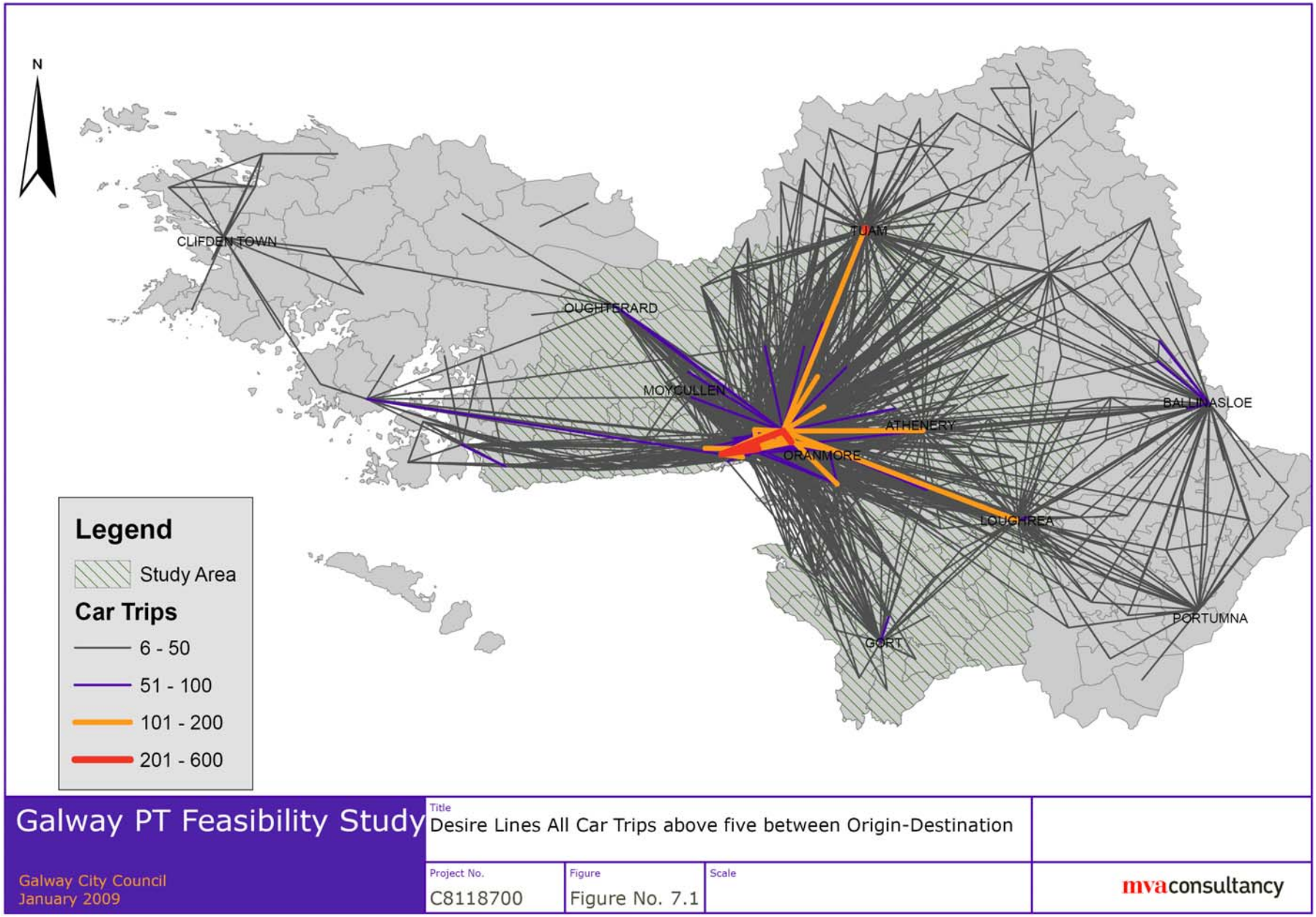
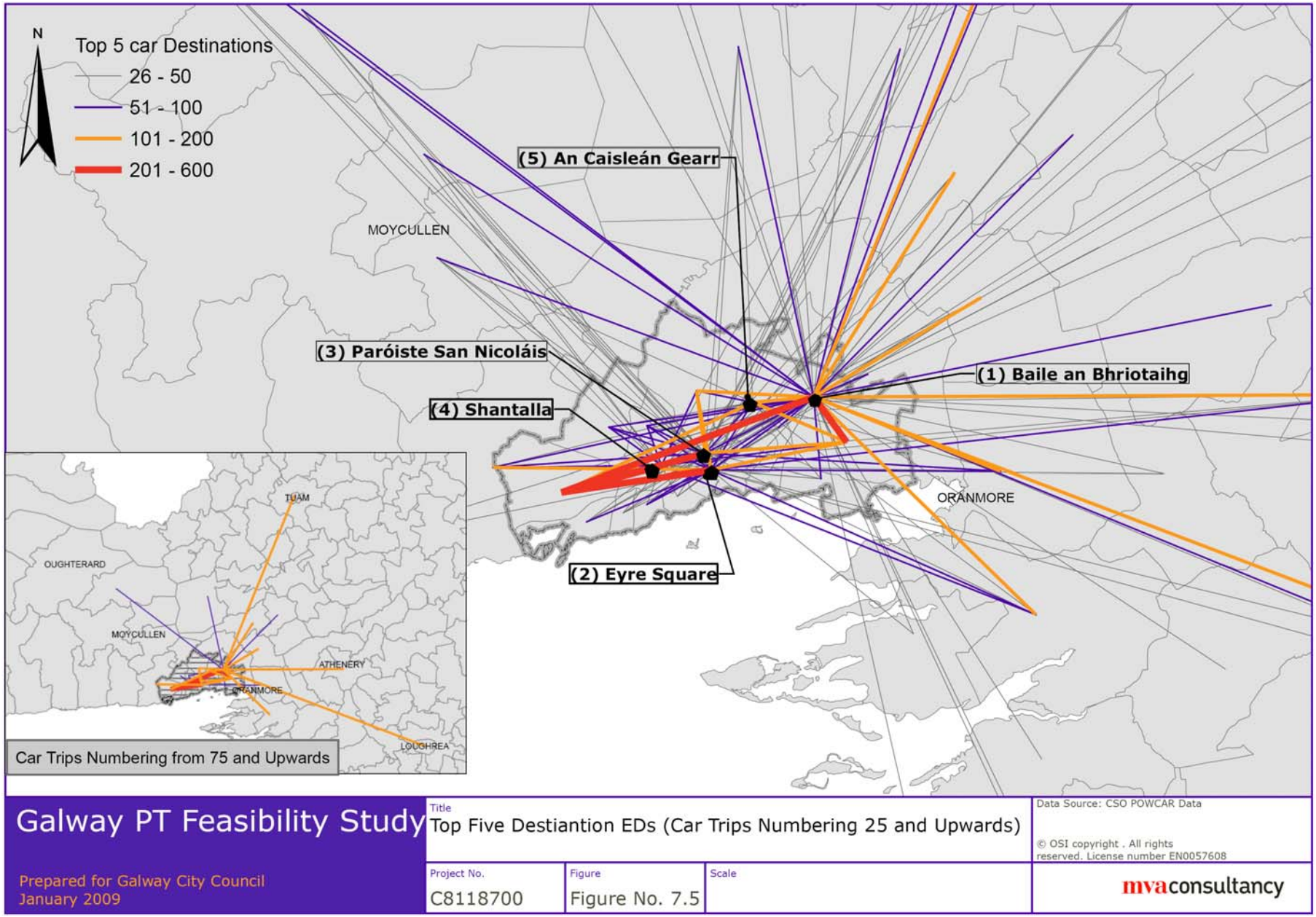


Figure 2.4 Top Five Destinations



2.5 Current Public Transport Services

2.5.1 The study area is served by a range of rail and bus based public transport services. The main public transport service groups are:

- City Bus Services;
- School Bus Services;
- Regional Bus Services;
- Inter urban Bus Services;
- Commuter Rail; and
- Intercity Rail.

2.5.2 Bus Éireann is the primary bus operator. All rail services within Galway are operated by Iarnród Éireann.

The Bus Network

2.5.3 Galway's public transport is primarily bus based, with:

- City Bus Services (provided by Bus Éireann and City Direct);
- Local Bus Services to Galway County (provided by Bus Éireann, Burke Bros., Healy and a number of other private operators); and
- National Long Distance Express Services (mainly provided by Bus Éireann, CityLink and Go Bus).

2.5.4 There are also a large number of specialist bus services that are primarily operated in relation to school transport and tour services.

2.5.5 The existing bus network is illustrated in figure Figure 2.5 overleaf.

Figure 2.5 Existing Bus Network

Galway PT Feasibility Study

Prepared for Galway City Council
April 2009

Title			
Existing Bus Network			
Project No. C8118700	Figure	Scale	Ordnance Survey Ireland License No. EN 0057607 © Ordnance Survey Ireland / Government of Ireland

mvaconsultancy

2.5.6 The scheduled bus network in and around Galway has some of the highest levels of direct competition in Ireland. This can be advantageous in offering the public a wider choice of services and competitive fare structures. However in practice for a range of issues further discussed below, it appears that in Galway to have contributed to the poor image of bus services in Galway. Several separate strands contribute to this. At the most basic level the provision of public transport information is complicated as there is no common source of information. There is good provision of information on central bus stops in and around Eyre Square, but a scoping exercise by the study team indicated that this deteriorates quickly moving out. It is understood that there are improvements planned for bus stop information provision but it is not yet clear how this addresses the issue of integrating information from competing operators.

2.5.7 Prior to the establishment of the National Transport Authority (NTA) and the initiation of its remit in relation to bus licensing, the administrative arrangements for awarding route licences was complex. Previously, Bus Éireann operated services under a Public Services Obligation contract with the Department for Transport. Private operators wishing to provide wholly non subvented services applied directly to the Department of Transport for a bus operator's licence. The Department of Transport had only basic control over the performance of a private service. This system of route licensing was not designed to effectively manage alternative submissions for services within the same area from competing operators. This appears to have lead to some of the indirect service routings adopted for the Galway city services and also leads to some difficulties in relation to stop locations. The process was also slow and outcomes uncertain – neither of which is helpful when a much more dynamic bus network is required to meet the overall objectives of the City. The recent Public Transport Regulation Act, 2009, will bring about a new regime in the regulation of passenger bus services under the direction of the NTA.

2.5.8 Looking to the longer term the new structure will provide a better basis for the adoption of integrated fares (as opposed to a common payment card, which is often confused with 'integrated ticketing'), a co-ordinated pattern of service, using the most direct routes and potentially higher levels of transfer between services.

City Bus Network Analysis

2.5.9 The bus network within the City is relatively comprehensive and a good level of coverage is offered. The concentration of services on Eyre's Square allow for passengers to transfer between services in order to complete Cross-City trips.

2.5.10 The level of coverage of City services is encouraging and the desire line analysis of POWCAR indicates a good level of correlation between trip patterns and bus use, particularly within the east and west of the City. There are a small number of links which show a large number of car trips without corresponding bus journeys which indicates an absence of links in the bus network. These comprise:

- Barna to Salthill;
- Murroogh to Ballybrit; and
- Mionlach to the City Centre.

2.5.11 There is no significant bus mode share for commuter trips from the County. The analysis of POWCAR data indicates that there is poor correlation between existing trip patterns from the County and bus use. Trips from the County are highly dispersed at their origin and can be difficult to serve by public transport. The desire line maps in the Baseline Report indicated that there is demand from

the County to the Ballybrit Area that is not served by the existing network of public transport services.

2.5.12 Throughout Galway City bus operators provide reasonably good coverage, but with inadequate frequency, lack of supporting traffic management measures, and some timetabling issues, the services are not being used as much as they might otherwise be.

2.5.13 Traffic congestion, in the absence of extensive bus priority, gives rise to both unreliable and slow bus journey times. This issue, when considered in the context of the relatively short duration of most journeys leads to a significant reduction in the attractiveness of bus compared to car, or even walking. Furthermore, services are provided by a number of different operators, which has an impact on the design of the bus network and also the perception of coverage.

2.5.14 Nevertheless hours of operation are good, with reasonable fixed interval headways. Information is good at city bus stops in Eyre Square Figure 2.6, however beyond this it quickly deteriorates with a lack of integration and no single information source.

Figure 2.6 Bus stop information provision at Eyre Square

Recent Developments

2.5.15 The Galway Bus Development Plan, prepared by Bus Éireann, plans for service enhancements under Transport 21. In August 2007, the first additional buses provided for under Transport 21 came into service in Galway. These additional buses facilitated the provision of a high frequency bus service to Doughiska Road / Parkmore upgraded from hourly to every fifteen minutes. A total of 53 new buses are allocated to Galway under the plan. To improve punctuality, Bus Éireann has set about revising some of the City routes to move away from cross-city routes towards a more radial network.

Rail Services

2.5.16 In the context of rail services, while Galway is recognised as a national rail destination, there are limited train services into the city, particularly for commuter services. There is just one commuter service available between Athenry and Galway to facilitate a standard working day. This arrives in Ceannt Station from Athenry at 08:10hrs and the evening return trip departs at 18:05hrs. The

journey time is approximately 20 minutes. By comparison, the distance by road is 24km and takes approximately 30 minutes. The potential for a more frequent service is currently limited by the single track route from the City and single platform at Ceannt Station.

Recent Developments

2.5.17 Developments under Transport 21, the Government's capital investment framework plan, include infrastructure improvements and re-signalling completed on the rail corridor into Galway. However the most significant Transport 21 Rail Project for Galway is the Western Rail Corridor which allows for the phased re-opening of sections of the Western Rail Corridor. When all three phases are completed, the project will provide for a rail link between the cities of Limerick and Galway (due for completion this year), and with an onward connection to Claremorris. New stations are also planned to be opened at Sixmilebridge, Ardrahan, Craughwell, Oranmore and Gort.

Ceannt Station Re-development

2.5.18 To cater for expansion of both bus and rail services, it is proposed to redevelop Ceannt Station into an integrated facility. The re-development will enhance rail capacity through the development of three platforms, allowing for Intercity and Commuter service expansion. It is further proposed that a total of 25 dedicated bus bays will be provided at the interchange to facilitate the expected increase in bus passengers. In addition to the enhanced public transport links to Ceannt Station, approximately 500 parking spaces dedicated for public transport users will be available, and enhanced set-down facilities for cars, and rank facilities for taxis will also be provided.

2.6 Future Road Provision

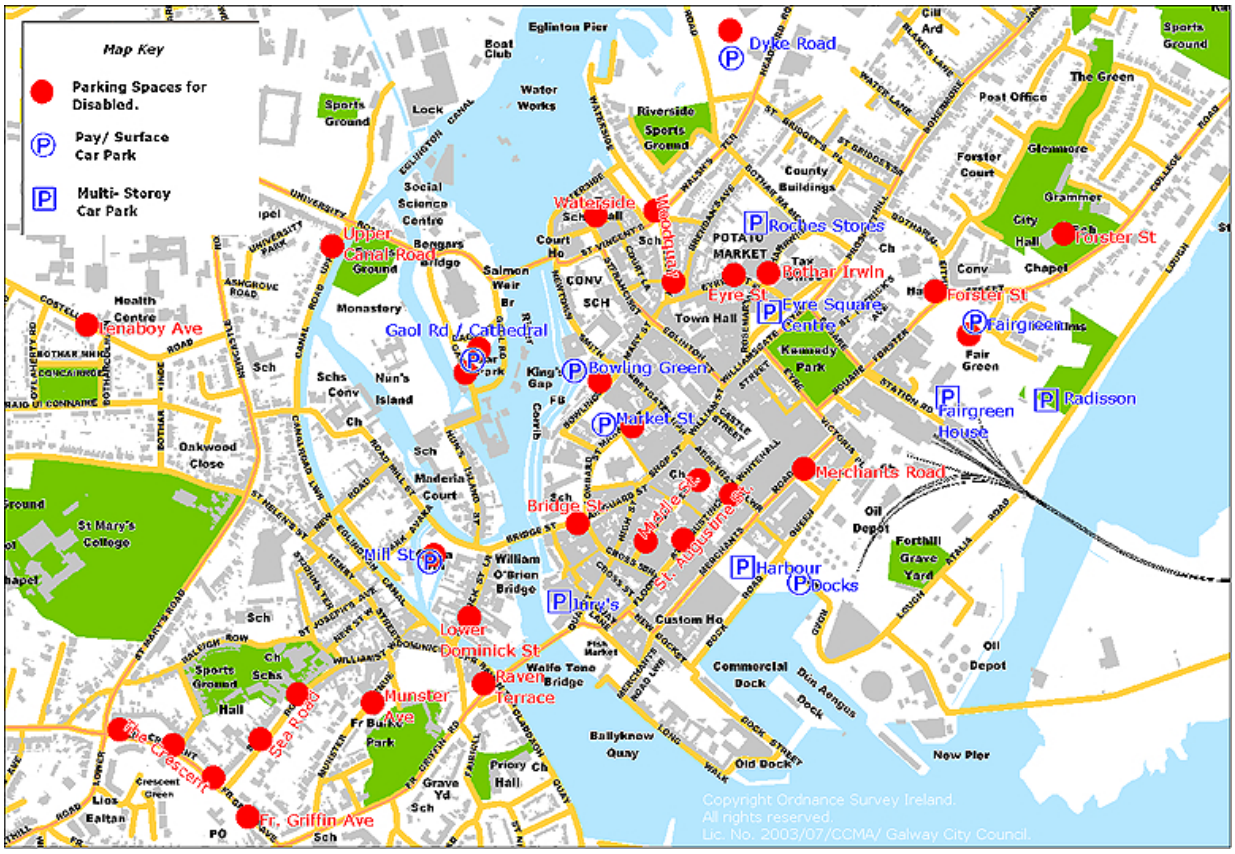
2.6.1 The majority of Transport 21 investment within the study area relates to road infrastructure notably new M6 Dublin/Galway road with a bypass provided at Loughrea.

2.6.2 The proposed N6 Galway City Outer Bypass to be undertaken by Galway County Council and on behalf of Galway City Council was granted permission in part by An Board Pleanala for the development of the dual carriageway between Garraun and the junction at Gortatleva, which is to the north west of the city.

2.7 Public Car Parking Provision

2.7.1 There are in the region of 1,800 on street car parking spaces in the centre of Galway as well as significant number of spaces in multi-story car parks. There is also evidence of parking illegally on some streets, and it is apparent from site observations that this can hinder bus and traffic movements e.g. Eglington street. Figure 2.7 illustrates the main car parking facilities in the city.

Figure 2.7 Location of car parking facilities in Galway City



2.8 SWOT Analysis

2.8.1 Using the results described in the Baseline Report an analysis of the strengths, weaknesses, opportunities and threats (SWOT) associated with public transport network in the study area was undertaken. This is summarised in Table 2.2.

Table 2.2 SWOT Analysis

STRENGTHS	WEAKNESSES
■ University city with good walk/cycle levels ■ Strength of Tuam Hub town and other key towns such as Athenry, Gort and Loughrea ■ Galway population are highly informed and motivated about environmental issues and others of local concern such as transport. They are likely to be supportive of appropriate public transport improvement and other sustainable travel initiatives. ■ Transport 21 investment commitments, notably western rail corridor investment and quality bus corridor ■ Iarnród Éireann one hourly bus service Galway-Dublin plus additional services from other operators. ■ Concentration of public transport services around Eyre Sq allows convenient transfer ■ Multi-operator network provides competition by comparison ■ Compact city with concentration of services and key destinations ■ Major employers such as NUIG, University hospital and Ballybrit industrial estate provide potential for implementation of Workplace and Destination based travel plans/mobility management plans	■ High proportion of population (43%) in relatively rural areas outside of Galway City and outside of any of the main outlying towns. ■ High reliance on the car ■ Limited bus priority resulting in unreliable journey times ■ Lack of integrated fares and ticketing ■ Lack of integrated timetables ■ Complicated timetabling for longer distance bus services ■ No one stop shop for information ■ Quality of information in particular for city services, no good map. ■ Limited capacity for rail ■ Long intervals for services particularly for rail ■ Relatively low frequency public transport ■ Single track rail with limited stations ■ Residential sprawl and dispersed trip origins
OPPORTUNITIES	**THREATS**
■ Galway City Outer bypass ■ Transport 21 with significant rail expansion with Western Rail Corridor and Galway commuter services ■ Planned redevelopment of Ceannt station ■ Development of Oranmore and Ardaun corridor ■ Planned future expansion of bus priority ■ Expansion of bus fleet under Transport 21 ■ New administrative controls provided to the National Transport Authority	■ Projected growth in population, employment and housing and uncertainty of the same ■ Cost/ Investment challenges ■ Galway city outer bypass ■ Failure to deliver integrated land use and transport provisions ■ High car ownership and car parking availability

2.9 Summary of Issues

2.9.1 A review of policy and development plan documents and previous studies that have a bearing on this current study found commonality in their shared goal to maximise Galway's contribution as a 'Gateway' city; to manage advantageously the region's unprecedented population growth; and to mitigate increasing traffic levels notable in and approaching Galway City. An integrated approach to land use planning and transport provision must be central, as indeed has been the case in particular in the GTPS study and has been a key consideration throughout this study.

2.9.2 The importance of an integrated approach to land use planning and transport provision has been reinforced by the baseline analysis carried out, and summarised in this Chapter. A very high level of car use particularly for work journeys in the City and in the remainder of the study area was found. The dispersed settlement patterns with often poor permeability offered for walking or cycling, together with a strong tendency to be segregated from key employment areas such as Ballybrit/ Parkmore play a symbiotic role in reinforcing a culture of car dependency. This high level of car use is regarded as unsustainable, from economic, environmental, social and public health perspectives, and without further intervention cannot be reversed.

2.9.3 The high proportion of the study area population living outside of the major settlements poses obvious challenges for public transport provision, and in particular in reaching families with young children.

2.9.4 Substantial improvements to the road network in the study area are planned up to 2020 including an outer bypass, as are commitments to improving public transport, e.g. signal improvements, and introduction of Suburban Rail services on the western rail corridor. These investments, in the absence of the development of an integrated public transport system, supported by complimentary travel demand management and traffic management measures are likely to be insufficient to reverse unsustainable current travel patterns.

2.9.5 There are however indications of unrealised potential for more walking and cycling. This comes from census data relating to work & school trip made in the City, where walking and cycling are nearly double the national average and constitute the majority mode of travel Table 2.1. This, together with evidence of 1996 levels of walking and cycling being respectively 28% and nearly 100% higher than 2006 suggest that Galway has the potential to support higher levels walking and cycling as a form of 'active travel'. It also suggests that it is worth exploring further why more work trips are not also being made by foot or on bike.

2.9.6 Within the City, there is much scope for significantly reducing car reliance if a coordinated approach is taken. A new priority given to improving the permeability for walking and cycling within and around the City together with the implementation of improved public transport provision would yield significant benefit to the City. This would need to be undertaken in the context of appropriate demand management interventions, thus inducing some initial pain for significant gain. This will, in turn, support a more desirable and accessible Galway City Centre with a defined sense of place.

2.9.7 There are a number of deficiencies in public transport provision that were noted including poor frequency, slow speeds, unreliability, and some regulatory weaknesses.

2.9.8 The challenge for the Galway City 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 to ensure transport system characteristics meet the future travelling needs of the region; and
- given the degree of uncertainly as to the scale, the rate and pattern of future development in the study area, there is no single 'right answer' – but a strategy that will cater for different land use development patterns in Galway City and the wider study area.

3 Public and Stakeholder Consultation

3.1 Introduction

3.1.1 Pubic and key stakeholder consultation was a core element of the study process. This chapter provides the rational for the consultation, an overview of the approach taken and a summary of the key outcomes.

3.2 Purpose of the Consultation Process

3.2.1 Consultation activities undertaken in relation to the Galway Public Transport Feasibility Study had the following objectives:

- To further our understanding of the existing transport issues in Galway;
- To invite input from key stakeholders relating to any plans that are considered of concern to the study; and
- To gather new ideas from the public and stakeholders that could be incorporated into the Feasibility Study.

3.3 Approach Taken

3.3.1 The consultation process was initiated following a baseline presentation on the 16 February 2009 to key stakeholders outlining the objectives of the study and early baseline issues identified. This was followed by discussion and inputs from attendees. To ensure the engagement and consultation process was open and did not limit the opportunity to provide input, other avenues were identified for accessing information about the project and for providing submissions.

Approach taken in relation to Key Stakeholder Engagement

3.3.2 The key stakeholders comprised of members of the Integrated Transportation Coordinating Group, which forms a substructure of Galway City Development Board; and the Strategic Policy Committee comprising representation primarily from City Councillors and members of Galway City Community Forum and service providers. Following the baseline presentation in the City Hall, a letter was sent to all relevant members encouraging stakeholders to provide their viewpoint via a follow up meeting or written representation. The meetings scheduled were as detailed in Table 3.1 below.

Table 3.1 Summary of Consultation

Group	Consultation method	Date of consultation
GLUAS	Consultation Meeting	18th March 2009
Iarnród Éireann	Consultation Meeting	19th March 2009
Galway Chamber of Commerce	Consultation Meeting	19th March 2009
Galway County Council	Consultation Meeting	19th March 2009
City of Galway VEC	Consultation Meeting	19th March 2009
Galway Healthy Cities	Consultation Meeting	19th March 2009
Galway Cycling Campaign	Consultation Meeting & Written Representation	19th March 2009
NUI Galway	Consultation Meeting	20th March 2009
Bus Éireann	Consultation Meeting	20th March 2009
City Link	Consultation Meeting	20th March 2009
Tourism West	Consultation Meeting	20th March 2009
City Direct	Consultation Meeting & Written Representation	20th March 2009
Harbour Company	Consultation Meeting	20th March 2009
An Taisce	Consultation Meeting & Written Representation	14th April 2009

Public Consultation

3.3.3 The first stage of the public consultation on the Galway Public Transport Feasibility Study was carried out following a public notice on Galway City Website, a press release and newsletter prepared by Galway City Council. A notice was published in the Galway Advertiser March 12 2009 welcoming submissions from stakeholders and the general public on the Study.

3.4 Consultation Outcomes

3.4.1 The comments and viewpoints received through discussions and meetings with the key stakeholders were complied, along with the additional responses received by Galway City Council from a variety of individuals and organisations. In all 13 additional submissions were received. The key stakeholder inputs and submissions received are discussed under key headings below.

3.4.2 Note: The tables below highlight issues and solutions put forward during consultation. Each issue raised does not necessarily have a corresponding solution. Issues and suggested solutions are simply grouped under a common heading so the reader may look at both issues and suggested solutions in a straightforward manner.

3.5 A Common Theme

3.5.1 All individual and group respondents expressed concern about the need to improve public transport in Galway notably in terms of quality, reliability and information provided. The need to reduce traffic congestion in the city was also commonly mentioned. There was also a shared viewpoint that Galway has greater potential as a walking (and cycling) friendly city, with average distances travelled little more than 4km.

3.6 Issues raised relating to existing public transport

3.6.1 Consultees acknowledge the existing bus network and the introduction of quality bus corridors (on the Dublin Road), however respondents were of the view that there are a wide range of issues that remain to be address. A summary of the problems and issues in relation to existing public transport in Galway as set out in the submissions are provided under key headings in Table 3.2.

Table 3.2 Issues and Solutions relating to Public Transport

Heading	Issue	Solution
Under-investment in Bus Services	Historical under-investment in services Failure to allocate road space more appropriately in support of bus operations Timetabling issues e.g. stated that services to An Spidéal are same since the 1970's when morning bus took 45 minutes to Eyre Sq, now up to 90 minutes Service in some cases no longer on time for school; therefore children are being driven to the city Need for modal shift targets, and steps to be put in place to remove equivalent car capacity from the roads network	Provide bus shelters with seating, lighting and maps Introduce clearways to increase operational capacity Subsidy for loss making routes for private operators Provision of bus pull in bays Ban right turns from Newtownsmith onto St Vincents Ave Provision of a regular service to airport Three Park & Ride sites on West, North and East sides of the city More QBCs to relieve traffic congestion Increase frequency of routes Investigate potential for guided buses as in Ipswich and in Leeds.
Service Issues	Poor reliability Impact of congestion Inadequate provision of bus stops The need for a more integrated public transport network Poor connectivity e.g. no link from Knocknacarra to Ballybrit Too many "phantom" bus services, such as the 14:25 service from Seacrest which rarely if ever arrives	Combat illegal parking on roads, loading bays and bus stops Restrict deliveries to off peak hours only Consider congestion charging in centre Connect major shopping centres e.g. on the Western Distributor Road, the Westside Shopping Centre and Salthill Low floor buses – disability access, and provide appropriate stopping facilities Commuter towns such as Bearna, Moycullen, Claregalway and Oranmore should be integrated into new routes Provide more integrated opportunities e.g. allow bike carriage: bus and train,

Heading	Issue	Solution
Service Information	Lack of location names at bus stops Lack of timetable information No real time information Time consuming on board ticket sales for both passenger and driver	Provide quality up to-date timetables of all service providers, and maps at each bus stop Provide countdown or real time information Introduce an integrated ticketing system that all bus operators use Introduce Smartcards Provide marketing campaign to improve awareness of services
Institutional Barriers	Lack of fair competition	Permit all operators to use bus shelters on their licensed route
Bus Terminus		Centralise all Westside bus service terminal points. Busses 1,2,5,8 to start from one central point located at Knocknacarra. Similar termini could be added at Ballybrit and Merlin
Commuter Rail	Unrealised commuter potential of the Dublin-Galway Line	Build a rail link between Galway and Tuam Use Salzburg as a best practice example for rail and PT services Reopening of the unused north-south county line
Ceannt Station Interchange	CIE's proposal unacceptable as Galway has no high rise building policy Development would use valuable land needed for LRT/ BRT construction	Submissions recommend station redevelopment A framework plan should be drawn up between key stakeholders to ensure that development is focused at providing key PT solutions not commercial development of retail outlets and hotels

Table 3.3 Issues and Solutions relating to Walking

Heading	Issue	Solution
General Safety	Junction signage obscures pedestrians from driver vision No efforts made to identify dangerous pedestrian places	30kph speed limit in all residential areas Walking should be planned as a mode of transport
Pedestrian Crossing	System for provision of crossings "warrant-based" and fails to accommodate lower demand crossings High flow junction design and layout dangerous and does not accommodate pedestrians Multi lane roundabouts dangerous for pedestrians	Provide adequate crossing opportunities Permanent crossings at all major roundabouts Permanent crossings at busy junctions, retail areas, schools, employment areas and logical crossing points leading to residential areas
Promotion/ Hierarchy	Pedestrians needs considered secondary to those of motorists Needs for the disabled not taken into account in roundabout design	Reorganize the hierarchy of road users, consider pedestrians first ahead of motorists Pedestrianise Galway City Centre Reduce the use of road guard rails Adopt the European Charter of Pedestrian Rights

Table 3.4 Issues and Solutions relating to Cycling

Heading	Issue	Solution
Provision/ Integration	Dangerous and poorly maintained cycle tracks and parking facilities	Provide facilities for the carriage of bikes on busses.
	Lack of cycle parking provision at Ceannt Station, Athenry and Ballinsloe, while car parking is discounted for rail users	At peripheral locations provide supervised, secure parking at bus stops to promote Cycle-PT integration
	Rail carriages with cycle accommodation has been removed	Provide facilities for charging electric bicycles
Promotion	Between 2002-2006 commuter cycling trips grew by 51%	Provide sheltered secure facilities in central Galway to encourage use
Safety	Multi Lane, high flow roundabouts for cyclists carry an accident rate that is 14-16 times that of motorists	Regarding bus lanes, provide training for bus/taxi drivers and cyclists on sharing space
	Slip Roads, free left turns, filter lanes	When constructing high speed single carriageway use class RT181 or S2 standard carriageway to ensure a minimum 2 meter wide hard shoulder
	Inappropriate road design speeds	Provide a bus lane width of 4.25m+ to ensure space for cyclists
Mobility	Traffic management Interventions - One way streets, slip roads, filter lanes and road speeds	Two way cycle lanes on one way streets
	Poor housing estate design based on Cul-de-sacs	Shared bus/ cycle lanes
		Allow free left turns where safe and appropriate

Table 3.5 Issues and Solutions relating to Roads

Heading	Issue	Solution
Safety	Excessive use of sight lines or "visibility envelopes" at priority junctions leading to increased collision risk Inappropriate speed limits The increased use of acceleration/ merge lanes carries increased risk to cyclists in 30kpm areas The focus on maintaining traffic flow on one way streets creates difficulties for pedestrians trying to cross	Reassess all speed limits
Traffic Management	Congestion issue on multilane roundabouts Evaluate congestion issues	Traffic conditions to be examined to revaluate current TM system with the view to improve flows Eyre square reserved for public transport only Study and synchronise all traffic lights Reduce right hand turns at city bridges e.g. Wolfe Tone Bridge Examine one way streets for compatibility with community forum policies and targets Revaluate Multi-lane roundabouts with the following, 1. Signalised Junctions, 2. Full time signal control or 3. Reshape roundabout geometry Consider measures to make inbound roads one way for AM peak and one way outbound for Pm Peak to accommodate increased peak flows.
Environment	Pollutants and noise from cars now extends far into rural areas eroding the tranquillity of the countryside New roads scar the landscape and villages lose their character	Encourage car sharing as a means of reducing congestion

Heading	Issue	Solution
Provision	New roads and PT infrastructure has failed to meet the needs of rapidly expanding Galway	An Taisce recommends a proposed access road crossing Lough Atalia from Renmore Bishop O'Donnell/ Seamus Quirke roads to be upgraded to be upgraded to dual carriageway. Construct a bridge at Nimmos Pier to allow coastal traffic out of the city Consider further the proposed M6 and new Conamara Road (R336) as a economic and tourism driver
Outer Ring Road	An Taisce raises concern regarding the loss of amenity with the river Corrib crossing at Menlo	Public Transport options could be put in place quicker than developing the outer ring road Many submissions support the development but acknowledge it won't resolve congestion issues

Table 3.6 Issues and Solutions relating to Institutional Arrangements and Policy

Heading	Issue	Solution
Development Plan	DP policies are geared towards providing for the private car Continued low density land use policies and peripheral commercial developments only create further congestion and promote car use	
Institutional Arrangements	A lack of communication exists between adjoining planning authorities especially in relation to planning major infrastructure Galway has failed to take advantage of funding available for major projects	The implementation of a integrated transport strategy is required A transport office/forum should be set up including city and county councils and public representation to come up with long and short term transport measures A Galway Transport Authority should be set up and develop a Master transport plan for Galway and region

Heading	Issue	Solution
Ardaun	Concern is expressed about the location of the Ardaun development and its lack of utilization with the nearby rail line. It instead is focused towards car use	

3.7 In Conclusion: An Overview of the Issues Raised

3.7.1 A wide range of stakeholders inclusive of service providers, chamber of commerce, An Taisce, representatives for cycling and walking, health and social inclusion and interested public were consulted at an early stage in this study. Each came with their particular viewpoint, expectations and issues, but all with concern about traffic impacts and the City's future ambiance supported by a hope for a more healthy and vibrant Galway City.

3.7.2 While Galway County provided a long list of road improvements intended to make travel to Galway by car easier, other stakeholders were concerned about poor provision of active travel options notably walking and cycling to support a healthier population and, more independent travel opportunities for school children.

3.7.3 To support a fairly unanimous vision for a more sustainable Galway, there was a general sense that a step change in public transport provision is required. The common attributes noted are reliability, good frequency, connectivity, service integration, better ease and choice of ticketing, whole journey accessibility and low emission services. There was also a call for service and route provision that both considers and supports a better environment for walking, cycling and more integrated journey opportunities.

3.7.4 Finally transport stakeholders cited unpredictable traffic and illegal parking as a key factor in bus unreliability. The bus licensing system was also considered to be a significant contributor to the current weakness in the quality and attractiveness of bus. The Ceannt station redevelopment offers an opportunity to create a public transport gateway, though concern was expressed by some by the nature of development in its vicinity.

4 Study Evaluation Objectives

4.1 Introduction

4.1.1 The development of evaluation objectives is a key step in the development of any strategy or plan. These objectives are not the primary purpose of the study as outlined earlier in the Report, i.e. to determine the type and extent of public transport intervention required to support the desired development pattern in Galway. In this context, the evaluation 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 appraisal process, facilitating the assessment of the preferred package of interventions on the basis on how well they contribute to the achievement of objectives.

4.1.2 This section of the Report sets out the objectives developed for the Galway Public Transport Feasibility study. To ensure that the study is undertaken without prejudice, whilst keeping the interests of Galway and a sustainable transport future central, they are based on an examination of key policy and spatial planning documents Table 2.1, in addition to public and key stakeholder consultation responses.

4.2 Appraisal Objective Development

4.2.1 The development of objectives will be a key element in shaping the strategy. They should reflect the vision for Galway City and surrounding area. If they are to be useful as a means of measuring the appropriateness of transport options, the objectives must also be 'SMART'. That is they should be:

- **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.

4.2.2 In this process of objective setting it is important to ensure that objectives are not confused with actions or solutions. Hence the evaluation 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.

4.3 Working towards a Shared Vision

4.3.1 The Galway City Council mission statement establishes their intention for the future of Galway city as desired by Galway citizens, and in general terms how they intend to work towards it:

> "*To provide in a democratic and transparent manner, efficient and effective services which will make Galway a better place in which to live, work and visit."*

4.3.2 The Galway Transportation Unit's overall aim provides a statement in general terms of how they will support this mission in relation to transport:

> *"To develop public transportation and other travel modes to the extent that the City will become a model for a sustainable traffic system in an urban environment."*

4.3.3 The City Council's mission statement and the GTU's overall aim provides the study team with an overview context for the study and some understanding of what is required by Galway City and its citizens.

4.3.4 The study's objectives have been developed to be commensurate with these, and will be further informed by objectives set out in key national and regional strategies, baseline research and meetings with some of the key stakeholders.

4.3.5 In carrying out this exercise, it has become apparent that though sustainable development is a strong common theme in the relevant planning objectives, previous related studies and in consultation responses. However, there appears to be a range of interpretations with regard to what 'sustainable development' encompasses.

4.3.6 The 1987 Brundtland definition of 'sustainable development' is the one that is most commonly referenced and it is the one that this study will refer to:

> '*Meeting the needs of current generations, without compromising the ability of future generations to meet their own needs'*.

4.3.7 Inherent in this is that development including transport provisions must take place with due sensitivity to the interdependence of environmental, economic and social systems, and recognition of the responsibility that comes with it.

4.4 Appraisal Objectives of Galway Public Transport Feasibility Study

4.4.1 Having taken on board consultation feedback and reviewed key policy and planning documents for Galway, the project team identified five objectives for a transport system in which:

- Trips are **predictable** with reduced congestion and delay, and
- There is **increased capacity** for movement, which, in turn
- Allows for future economic growth without transport constraints, whilst
- Can give a Better **ambience** in city centre; and
- **Can ensure accessibility and inclusivity irrespective of car availability**.

4.5 Each objective is discussed in turn below.

Appraisal Objective 1: A reduction in congestion providing reduced delay and greater predictability

4.5.1 Key considerations in relation to this objective are that:

- The most common issue raised by consultees was the unpredictability of travel times, caused by congestion.
- Improved public transport and the complementary measures must lead to, and reinforce reductions from the current level of traffic so that the network flows freely.
- The implication of this objective is that car use reduces now and forms a decreasing proportion of journeys into the future. Public transport, walking and cycling must therefore take an increasing share.

Appraisal Objective 2: There is increased capacity for Movement

To increase capacity for movement to the City Centre without the provision of additional road infrastructure, car parking or land take for transport

4.5.2 Key considerations in relation to this objective are that:

- As and when economic activity picks up and the population grows there will be increasing movement in and around the city (on the basis of past experience).
- If objective 1 is to be met this increased capacity must be provided by public transport or through walking / cycling.

Appraisal Objective 3: Allows for future economic growth without transport constraints

To allow increased levels of economic activity in Galway without significant increases in road traffic across the network

4.5.3 Key considerations in relation to this objective are that:

- This can only be achieved if an increasing proportion of journeys are made by alternatives to the car; **AND**
- These alternatives provide the connectivity, accessibility and quality of travel that would be given by a free flowing road network; **IF**
- The alternatives effectively improve the overall quality of the transport system to support growth.

Appraisal Objective 4: There is a better ambience in City Centre

Enhance the ambience of the City Centre for employees, shoppers and visitors through a programme of public realm enhancements, noise and air quality improvements, reduced conflict between pedestrians and vehicles and quality 24/7 activity.

4.5.4 There is a strong desire to see the City Centre ambience further enhanced, encouraging people to linger in the centre. This needs:

- Fewer City Centre streets used by circulating traffic;
- An environmentally benign public transport system – which does not replace one environmental problem with another; and
- A City Centre alignment for public transport which minimises the impact on the public realm.

Appraisal Objective 5: The system is accessible and inclusive

To create a public transport system which is inclusive and accessible in order to give all residents an opportunity to travel and take part in the full range of activities offered in the region

4.5.5 These are standard requirements but must be included to ensure that a system which meets other objectives does not do so at the expense of:

- Those who have difficulties using public transport built to earlier standards;
- Those on lower incomes; or
- Those who cannot walk long distances.

"Social Inclusion" can be defined as a series of positive actions to achieve equality of access to goods and services, to assist all individuals participate in their community and society, to encourage the contribution of all persons to social and cultural life and to be aware of, and to challenge all forms of discrimination."

Source: Combat Poverty Agency

4.6 What are the objectives aiming to achieve and how can they be measured?

Objective	Measure	Achievable and realistic
A **reduction in congestion** giving reduced delay and greater predictability	Modal split, total trips and measure of delay	Traffic management and TDM e.g. parking restraint, integrated planning, travel planning
An **increase in network capacity** and reduce constraints with little or no new road allocation to car travel.	Total corridor capacity Degree of priority Infrastructure	Priority, reallocation, removal of constraints: support higher capacity travel choices
To **support future economic growth** unconstrained by traffic and other transport barriers	Analysis of GDP, footfall and traffic delays	Pedestrianisation, traffic management/priority measures elsewhere show sustainable shift can support increased footfall

Objective	Measure	Achievable and realistic
Ambiance: to **support a more vibrant city centre** with reputation as a sustainable city	Footfall, retail activity, city parking spaces, and local survey	Programme of public realm improvements to reduce non car/car conflict, support quality 24/7 activity
To **provide a more accessible and socially inclusive system** for wider participation in range of activities region offers	Accessibility analysis Survey accessibility: the local perspective	Involves commitment to improving whole journey e.g. access/egress at bus stops

4.7 Summary

4.7.1 The primary purpose of the study as outlined earlier in the Report, i.e. to determine the type and extent of public transport intervention required to support the desired development pattern in Galway.

4.7.2 The development of evaluation objectives is a key step in the development of any strategy or plan. The objectives form a critical input to the appraisal process, facilitating the assessment of the preferred package of interventions on the basis on how well they contribute to the achievement of objectives.

4.7.3 The objectives must be 'SMART', i.e. **Specific**, **Measurable**, **Achievable**, **Realistic and Timed**.

4.7.4 The appraisal objectives, developed for the purposes of the study are:

- To reduce to and then maintain levels of car use in Galway to give reduced delay and greater predictability for all journey types;
- To increase capacity for movement to the City Centre without the provision of additional road infrastructure, car parking or land take for transport;
- To allow increased levels of economic activity in Galway without significant increases in road traffic across the network;
- Enhance the ambience of the City Centre for employees, shoppers and visitors through a programme of public realm enhancements, noise and air quality improvements, reduced conflict between pedestrians and vehicles and quality 24/7 activity; and
- To create a public transport system which is inclusive and accessible in order to give all residents an opportunity to travel and take part in the full range of activities offered in the region.

5 Option Development

5.1 Introduction

5.1.1 Having considered the baseline evaluation findings and their implications in the context of the future settlement patterns in Galway City and the wider study area, a series of options were developed with a view to meeting the study objectives outlined in the previous section of this Report.

5.1.2 The baseline analysis and the process of consultation have identified a number of key elements which need to inform the selection of scenarios. The consultation process in particular has identified a number of different but not necessarily consistent concepts that have been used to guide the option development process.

5.1.3 The **baseline** analysis shows that:

- Galway City has a population of around 75,000, with very rapid growth in the last 10 years;
- this population is relatively dispersed for an urban city;
- employment is largely on the fringe of the City Centre and at peripheral business parks and industrial estate;
- that most journeys to work are by car and not public transport;
- that much of the most recent housing has been built as a series of disconnected estates which do not have many suitable through routes for public transport, and where walking routes to the main roads can be circuitous with many roundabouts that are not favourable to pedestrians and cyclists;
- the surrounding rural area has an equally large population, but is very dispersed;
- much of the work travel from the County is destined to the peripheral employment areas of the City, and these trips are undertaken nearly exclusively by car;
- use of the current public transport services is increasing, albeit from a low base; and
- the current bus service is provided by a number of operators within a regulatory framework which is not ideal.

5.1.4 The primary considerations impacting on the determination of the most appropriate system are:

- Impact on urban form;
- Meeting passenger expectations and requirements;
- Supporting the needs of Galway City and future developments; and
- Feasibility of implementation in terms of space required, timescale for delivery and acceptable cost.

5.2 What would drive the urban form?

5.2.1 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.

5.2.2 Figure 5.1 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 5.1 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			

5.3 What would suit the passenger?

5.3.1 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 5.2 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			

5.4 Further Consideration of Options

5.4.1 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 Galway context. Those which clearly did not fit were excluded from further consideration at an early stage, are listed in Table 5.1 with a brief summary as to the reasons why.

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

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

Table 5.1 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	Limited coverage of existing rail infrastructure and little scope for providing more stations in the City. Requires continuous reserved right of way – not possible without extensive tunnelling within Galway City	Station spacing would be too long for likely travel patterns Distances not sufficient for greater speed to compensate for long access times and interchange (e.g. bus transfer to stations) Capacity substantially in excess of requirements for new lines
Heavy LRT / Light Metro	Requires continuous reserved right of way – not possible without extensive tunnelling within Galway City	Distances not sufficient for greater speed to compensate for long access times and interchange Capacity substantially in excess of requirements
Segregated LRT	Available road widths within Galway are not sufficient to allow for segregated LRT and the maintenance of access requirements. Tunnelling would be required in built up areas.	Partially segregated LRT may be suitable.
All Other Systems	Are appropriate for consideration for Galway.	Only systems with significant dedicated infrastructure will have an impact on urban form

5.5 Scenario Development

5.5.1 The key **physical constraints** in the City are:

- the limited number of Corrib crossings points (four in total in the City); and
- relatively narrow roads, particularly within and close to the City Centre, which limits the potential to increase capacity.

5.5.2 With consideration to the objectives set out in the previous Chapter and the system attributes detailed above, these suggest that:

- a public transport network based around lower capacity vehicles operating at high frequencies and able to penetrate residential areas might be appropriate given the dispersed nature of the area;
- the public transport system needs to make a clean break with the past if it is to overcome an inbuilt scepticism on the part of many people who do not currently use it;
- there will have to be some reallocation of traffic priorities to allow a more predictable service to operate on the existing road network; and
- additional transport capacity is needed if the city is to develop further without gridlock.

5.6 Options Considered

5.6.1 There are a broad range of options that would be able to meet the objectives and ultimately fulfil Galway's public transport needs in the future. The multi-modal transport model developed for the purposes of this study allow us to examine the implications of a number of options and combinations of options at a broad level before narrowing down the choice. They also allow consideration of the impact of combining the best parts of various scenarios, to give an overall 'best fit' for the region. The key options considered are:

- Enhanced Conventional Bus Network;
- Extended Coverage Low Operational Capacity (ECLOC) bus system;
- Bus Rapid Transit; and
- Light Rail.

5.6.2 The rationale and characteristics of each option are described in turn in the following table.

Enhanced Conventional Bus

Rationale:

- This builds on what is currently there and so is incremental – low risk
- Low densities do not suit high capacity systems
- Can be designed to meet accessibility / mobility objectives

Characteristics:

- Direct route network with a common impact across operators
- Bus priority along line of routes
- Park & Ride at outer termini
- Special services for employment locations – possible with interchange and employer participation

Extended Coverage Low Operational Capacity (ECLOC) Bus System

Rationale:

- Movements are highly dispersed
- Residential density is low
- Passenger volumes are moderate even if a highly competitive system is offered

Characteristics:

- Moderate size (30 passenger) vehicles
- High levels of penetration of residential areas
- Attractive 'many to many' links
- Priority provided by use of 'bus only' turns at key junctions

Bus Rapid Transit

Rationale:

- Will be more attractive than conventional bus to attract current car users
- A Rapid Transit Network with fixed infrastructure allows for concentration of services and provides permanence
- Possibility of developing a number of 'trolleybuses'
- Hybrid vehicles are low emission

Characteristics:

- High level of priority including junction priority
- Some BRT/ bus only infrastructure along the route
- One or more BRT/ bus only links through residential areas
- Limiter number of services, but reliably spread across the City
- Park & Ride along the route

Light Rail Transit

Rationale:

- Will achieve the wider objectives
- Sustainability is the key and therefore electric power and energy efficiency are very important

Characteristics:

- Light Rail (LRT) network with very high level of priority
- A route alignment with the maximum number of people within 1km
- Interchange required for many journeys

Scenario Development

5.6.3 The key aspects of the scenario development process are:

- An assessment of the potential for public transport within Galway, 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.

5.7 Scenarios

5.7.1 In total seven scenarios were developed, each of which comprising specific changes to allow for the comparison of options. The scenarios are summarised in the text below. All scenarios were assessed in a 2020 future year, given that this represents the horizon year of the regional spatial strategy, as outlined in the 'Regional Planning Guide Lines Western Region 2002-2020'.

Scenario 1: Do Nothing 2009 and 2020

5.7.2 The Do Nothing Scenario represented the following:

- Do Nothing 2009: 2009 transport network with 2009 transport demand; and
- Do Nothing 2020: 2009 transport network with 2020 transport demand, i.e. derived from assumed population/ employment growth projects as included in the Regional Planning Guide Lines Western Region 2002-2020.

5.7.3 These scenarios were developed to allow for an examination of the relative change in mode share and average network speeds between now and 2020 in the absence of any future transport intervention over that time period.

5.7.4 Both scenarios allow for an evaluation of the comparative performance of future transport developments in Galway.

Scenario 2: Do Minimum 2020

5.7.5 The next scenario was developed to facilitate a consideration of the transport impact of committed transport infrastructural improvements, such as those contained within Transport 21, and current Galway City and County Development Plans. This scenario represented an enhanced 2020 transport network (compared to the Do Nothing Scenario), with 2020 transport demand.

5.7.6 The following specific transport interventions are assumed to be in place in this scenario:

- Road infrastructure schemes, namely the Galway Outer Bypass and the completion of the M6 and associated road links; and
- Committed future public transport schemes, such as the Western Rail Corridor, commuter rail services between Athenry and Galway, new rail stations such as Oranmore and expansion of the bus network as per current business development plans.

5.7.7 Details of assumed network changes and their timeline for operation are shown in the following table.

Table 5.2 Do Minimum Transport Network and Service Changes

Transport	Scheme	Frequency	2009	2013	2020	2030
Road	Outer Ring Road		✗	✓	✓	✓
Road	M6		✗	✓	✓	✓
Road	N1 Oranmore to Gort		✗	✓	✓	✓
Road	N17 Tuam to Galway		✗	✗	✓	✓
Rail	Ennis to Athenry (hourly rail service)		✗	✓	✓	✓
Rail	Athenry to Galway Commuter Services (hourly Rail Service)	60 min	✓	✓		
		30 min	✗	✗	✓	
		15 min	✗	✗	✗	✓
Rail	Athenry to Tuam	60 min	✗	✓	✓	✓
Rail	Tuam to Claremorris	60 min	✗	✗	✓	✓
Rail	Oranmore Station		✗	✓	✓	✓
Rail	Gort Station		✗	✓	✓	✓
Bus	City Bus Services	15 min	✗	✓	✓	✓
Bus	New Ardaun Route 10	15 min	✗	✓	✓	✓
Bus	Moycullen – Galway (421)	30 min	✗	✓	✓	✓
Bus	Spiddal – Galway (424)	45 min	✗	✓	✓	✓
Bus	Claregalway – Galway (420)	30 min	✗	✓	✓	✓
Bus	Gort – Galway (434)	60 min	✗	✓	✓	✓

5.7.8 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 are assessed.

5.7.9 The following option development scenarios were used as a basis for determining the public transport interventions required to meet the future needs of Galway City and its surrounds.

- Scenario 3: Phantom Network with Park and Ride;
- Scenario 4: Extended Coverage Low Operational Capacity (ECLOC) Bus System;
- Scenario 5: Enhanced Conventional Bus Based Option;
- Scenario 6: Bus Rapid Transit; and
- Scenario 7: Bus Rapid Transit with Park and Ride.

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

Scenario 3: Phantom Network

5.7.11 The phantom network concept facilitates an unconstrained analysis of potential public transport demand within the Galway study area. In modelling the phantom network, it is assumed that the entire public transport network will operate with optimal characteristics in terms of frequency and speed, thus representing the most attractive mode for the people of Galway. In adopting this approach, it ensures that the maximum theoretical potential for public transport within Galway City can be ascertained.

5.7.12 Further analysis of passenger demand on each section of the network facilitates a determination of the most appropriate mode to cater for available passenger demand. A central aim in developing and assessing the Phantom Network is to determine where the greatest benefit can be derived from a step change in the level of public transport service provision.

5.7.13 The Phantom Network Scenario is modelled on the assumption that there will be no loss in capacity for general traffic associated with the introduction of new public transport infrastructure.

5.7.14 The existing City and Suburban Bus and Rail Network has been used as a basis for developing the Phantom Network. The existing bus network provides a high level of coverage within the City on key transport links, however, the services frequency and speeds are assumed to have significantly increased. In addition, a small number of additional routes have been added. From the baseline analysis, strong transport demand was identified between the residential areas to the west of the City and the business park areas to the east. A direct link between these origins and destinations was added to the public transport network.

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

- Frequency: 30/ hour; and
- Speed: 30 km/h.

5.7.16 Transport demand in this scenario is the same as per the 2020 Do-Nothing and Do-Minimum Scenarios (i.e. derived from 2020 population and employment forecasts).

Scenario 4: Extended Coverage Low Operation Capacity Bus Network

5.7.17 An analysis of the baseline data shows that Galway has a low density development pattern. The impact on transport is significant and there are dispersed patterns of origins and destinations.

5.7.18 Further analysis also clearly shows that average journey lengths within the City are relatively short, with most commuter trips taking less than thirty or forty minutes. Therefore, public transport travel time will be of primary importance if it is to represent and attractive alternative. Walk time to and from bus stops or stations can constitute a significant proportion of the overall journey time.

5.7.19 For these reasons, an option was developed that would provide a dense public transport network with extended coverage. This would extend the immediate catchment of the network and reduce walk times to bus stops.

5.7.20 A fleet of smaller capacity bus vehicles would be ideally suited to operate throughout this network. They could more easily manoeuvre on narrow streets and would allow for the greatest penetration of public transport.

5.7.21 The network would comprise a combination of two-way loops and direct radials along key corridors, as shown in Figure 5.3. The extended coverage bus option, as modelled, is assumed to have the following characteristics:

- Frequency: 6 / hour; and
- Speed: as per the general traffic network.

Figure 5.3 Extended Coverage Low Operation Capacity Bus Network

Galway PT Feasibility Study

Prepared for Galway City Council
May 2009

Title: Low Capacity Bus Network

Project No.	Figure	Scale	
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Scenario 5: Enhanced Bus Network

5.7.22 The bus network within Galway has developed over a long period of time. In recent years, Galway's bus network has experienced change in a competitive market. However, the existing network does not presently meet user needs in terms of the areas served and connectivity between key residential and employment locations.

5.7.23 An analysis of existing trip patterns was undertaken which highlighted areas where improvements to the network could be made. In addition to alternations to the network to address these deficiencies, the enhance bus network would operate at higher frequencies. As identified in the baseline analysis, frequency of service is a key characteristic of Galway's public transport network given the relatively short journey lengths. High frequency is particularly important in ensuring that public transport represents an attractive alternative to the private car.

5.7.24 The Enhanced Bus Scenario, as modelled, is assumed to have the following characteristics:

- Frequency: 6 / hour; and
- Speed: as per the general traffic network speeds, excluding dwell time at stops.

5.7.25 Compared with the existing network, the Enhanced Bus Network provides more direct links at a high frequency and with higher speeds. The indicative network is shown in Figure 5.4.

Figure 5.4 Enhanced Bus Network

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Prepared for Galway City Council
May 2009

Title: Enhanced Bus Network

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Scenario 6: Rapid Transit

5.7.26 The Phantom Network Scenario development and assessment facilitated the testing of a wide range of routes which are deemed to have the maximum potential in terms of passenger demand.

5.7.27 Of the corridors assessed, only one, the west-east corridor from Ballyburke to the City Centre, Ardaun and Oranmore has forecasted passenger flows of the magnitude that could justify additional investment beyond that provided by conventional bus. The line flows along this corridor indicate potential for implementation of a Rapid Transit system.

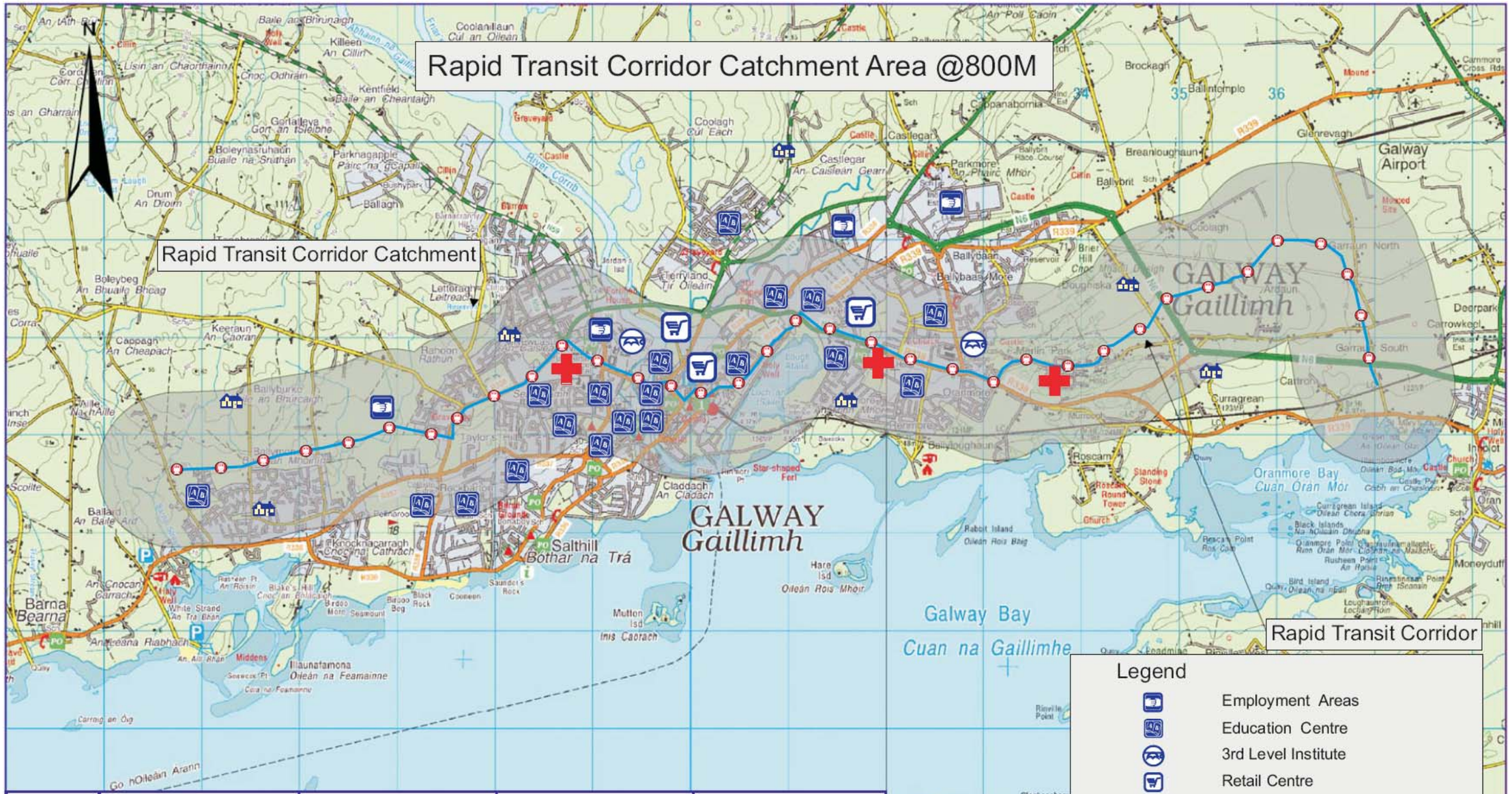
5.7.28 The alignment of the Rapid Transit Corridor has been developed taking cognisance of the following key land uses along its length to maximise the benefit, attractiveness and economic viability:

- Ballyburke;
- University College Hospital;
- University College Galway;
- Shop Street;
- Eyre's Square (interchange with regular bus services);
- Ceannt Station;
- Coach Station;
- Galway-Mayo Institute of Technology;
- Merlin Park Hospital;
- The Ardaun Local Area Plan area; and
- Alignment of existing and future road network.

5.7.29 A revised bus network was examined to compliment the introduction of Rapid Transit along the east-west corridor through the City. The supporting bus network is based on the enhanced bus network scenario (Scenario 5). Figure 5.5 illustrates the general alignment and catchment area of the Rapid Transit Corridor, while Figure 5.6 shows the Rapid Transit Corridor integrated with the Enhanced Bus Network.

5.7.30 Key interchange points have been identified where bus and rail services will link with Rapid Transit, thereby integrating the public transport network and extending the benefits of the new system to a wider catchment area.

Figure 5.5 BRT Catchment Areas



Catchment Area	2006 Population	2006 Employment	2013 Population	2013 Employment	2020 Population	2020 Employment	2030 Population	2030 Employment
	45,020	26,137	51,419	28,370	58,602	30,604	62,124	33,795

Galway PT Feasibility Study

Prepared for Galway City Council
May 09

Title
Rapid Transit Catchment Area of 800m with Catchment Population and Employment figures for 2006, 2013, 2020 and 2030

Project No.
C8118700

Scale
1cm equals 0.4Km

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Figure 5.6 Scenario 6 Rapid Transit Corridor with Enhanced Bus Network

Galway PT Feasibility Study

Prepared for Galway City Council
May 2009

Title: Rapid Transit Corridor

Project No.	Figure	Scale	
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5.7.31 As discussed earlier in the Chapter there are a limited number of Corrib crossings points (four in total in the City). Furthermore, the road network in the City Centre is quite constrained, and the potential to increase capacity by physically widening roads is very limited. A further consideration is the congested nature of the road network in Galway City.

5.7.32 The success of Rapid Transit is entirely dependent on the operational attributes of the system. Specifically Rapid Transit needs to provide a more competitive journey time than that available by car. Furthermore, successful Rapid Transit operations are dependent on the reliability of journey times along the entire length of the corridor.

5.7.33 In light of these considerations, it is essential that supporting traffic management measures are implemented to ensure the system attributes meet transport user expectations. This included priority measures along the alignment, including:

- On-street priority along major roads outside the City Centre;
- New road links providing direct connections between key areas (through University College Hospital and connecting Merlin Park Hospital with the Ardaun LAP area, and onwards to the terminus); and
- Extensive traffic management measures in the City Centre, to reduce traffic volumes along the length of the alignment in this area, and to maintain operational speeds and reliable headways at all times, and irrespective of prevailing traffic conditions.

5.7.34 Within the City Centre a number of key traffic management changes are recommended. The objective of introducing these revised traffic management arrangements is to improve accessibility to the City Centre for all road users, and to increase the capacity of the transport network to cater for increased movements to, from and within this area.

Scenario 7: Rapid Transit with Park and Ride

5.7.35 Park & Ride has the potential to extend the public transport catchment to those living away from its alignment. It will also extend the benefits of investment in Rapid Transit to a wider population. This scenario therefore represents Scenario 6 (Rapid Transit, enhanced bus network and associated traffic management restrictions as outlined above) plus the addition of park & ride at strategically important locations.

5.7.36 Park & Ride needs to be carefully planned and the strategy for Park & Ride is described in detail later in this Report.

5.7.37 The Park and Ride Sites, as assessed in this scenario are located at the following locations:

- Baile an Mhóinín to the west of the City;
- Bóthar Na dTreabh linking with the new M6 at the new Coolagh Roundabout; and
- Claregalway as proposed by Galway County Council.

5.8 Scenario Development Summary

5.8.1 In summary, seven scenarios have been developed for the purposes of determining future public transport network requirements for Galway and its environs. These scenarios are assessed using the Galway Transport Model in the next section of this Report, to determine their relative transport impact.

6 Evaluation of Options

6.1 Introduction

6.1.1 The option development process, as outlined in the preceding section of the Report has led to the development of seven scenarios, each of which was assessed using the multi-modal transport model developed for the purposes of this study. This allowed for an assessment of the comparative transport performance of each scenario.

6.2 Scenarios Assessed

6.2.1 The following scenarios were assessed using the purpose built Galway multi-modal model for the future forecast years 2009, 2013, 2020, and 2030:

- Scenario 1: Do Nothing 2009;
- Scenario 2: Do Minimum 2020;
- Scenario 3: Phantom Network (Phantom + PnR);
- Scenario 4: Extended Coverage Low Operation Capacity Bus Network (Small Bus Network {SBN});
- Scenario 5: Enhanced Bus Network;
- Scenario 6: Rapid Transit (RT + TM); and
- Scenario 7: Rapid Transit with Park and Ride (RT + TM + PnR).

6.3 Modelling Outputs

6.3.1 The key modelling outputs used to indicate the transport 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; and
- Mode share along the Rapid Transit Corridor.

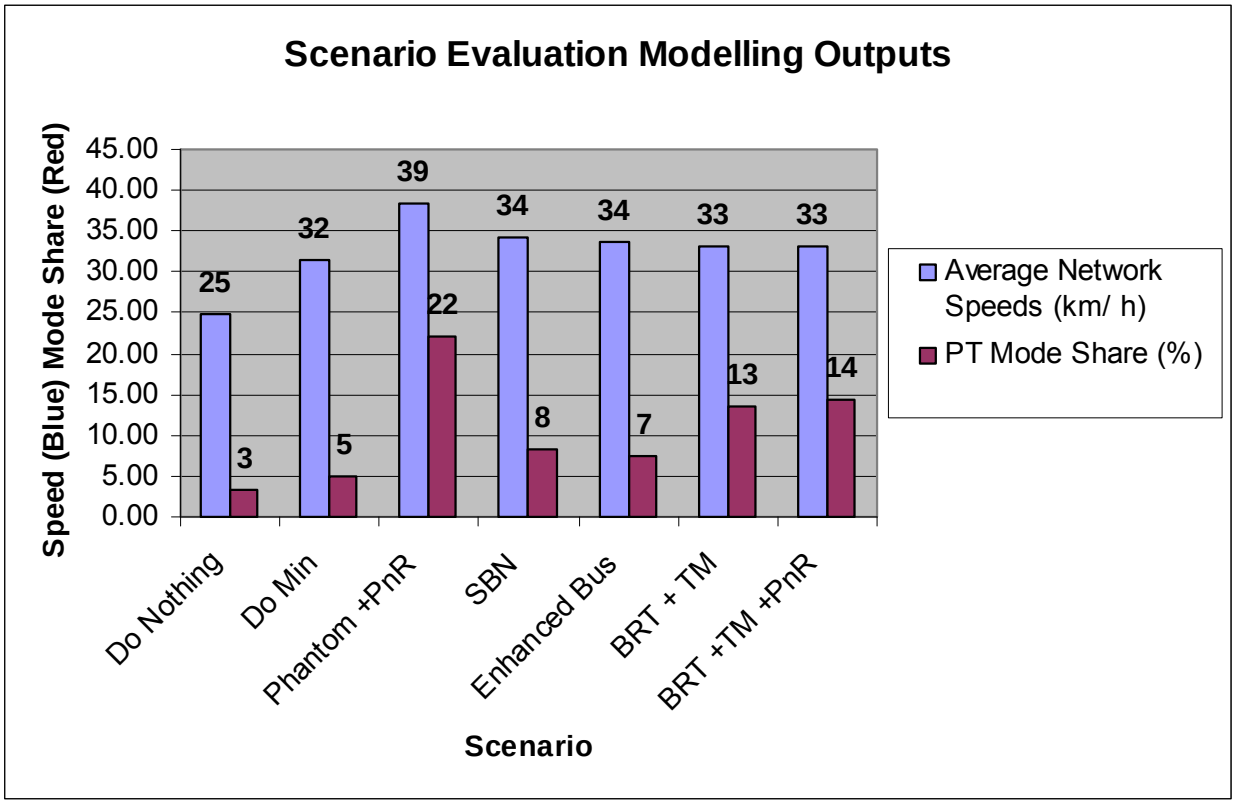
6.3.2 Modelled outputs were extracted for 2009, and three future year (2013, 2020, and 2030); however a particular focus has been on the 2020 future year as this represented a year in which all scenarios developed in the preceding section of this Report could likely be implemented.

6.3.3 Model outputs are used to determine the comparative transport performance of each scenario, with a particular focus on the degree to which levels of public transport use, and general traffic speeds, improve under each scenario.

6.4 Scenario Results

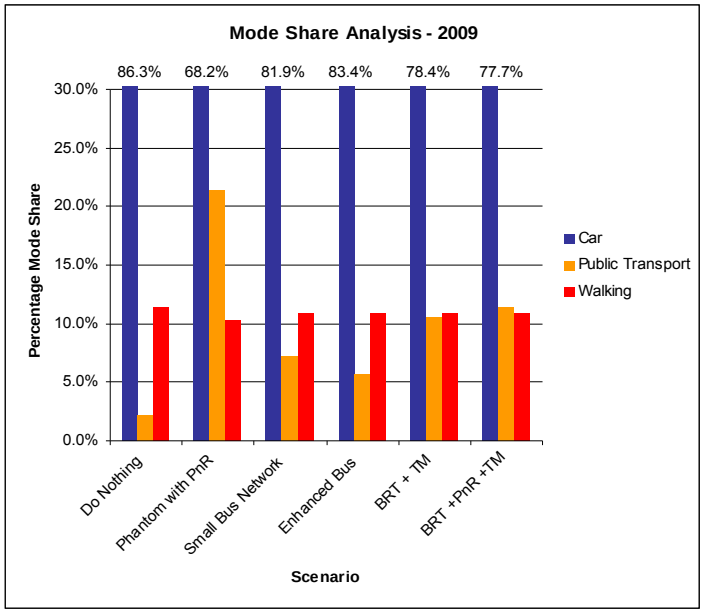
6.4.1 This section of the Report presents the headline transport model outputs of each scenario. The following figure summarises the forecast 2020 AM peak public transport mode share and general traffic network wide speeds associated with each scenario.

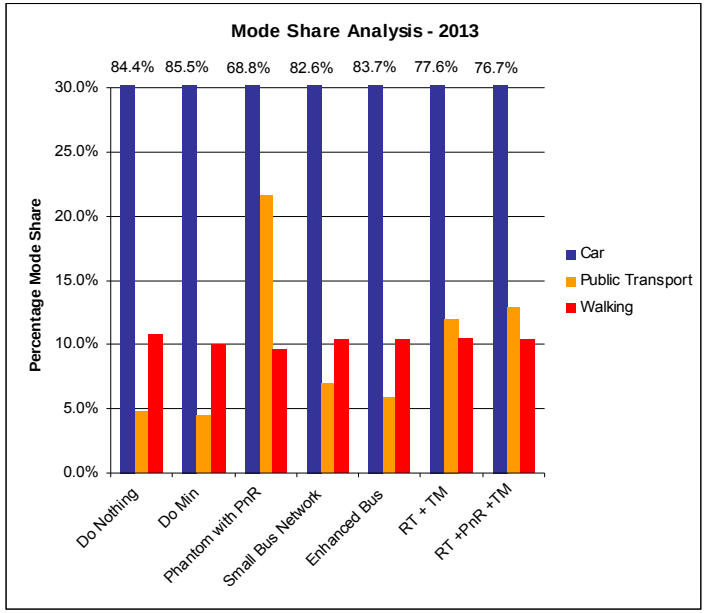
Figure 6.1 2020 Key Scenario Model Outputs

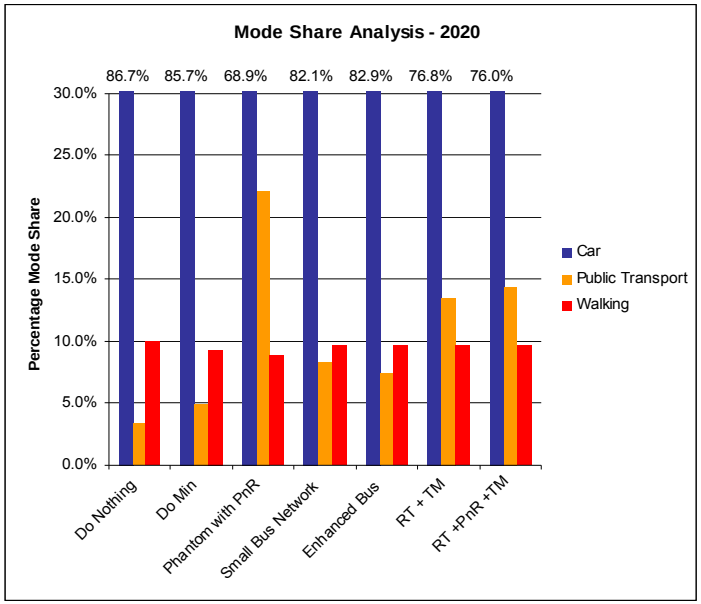


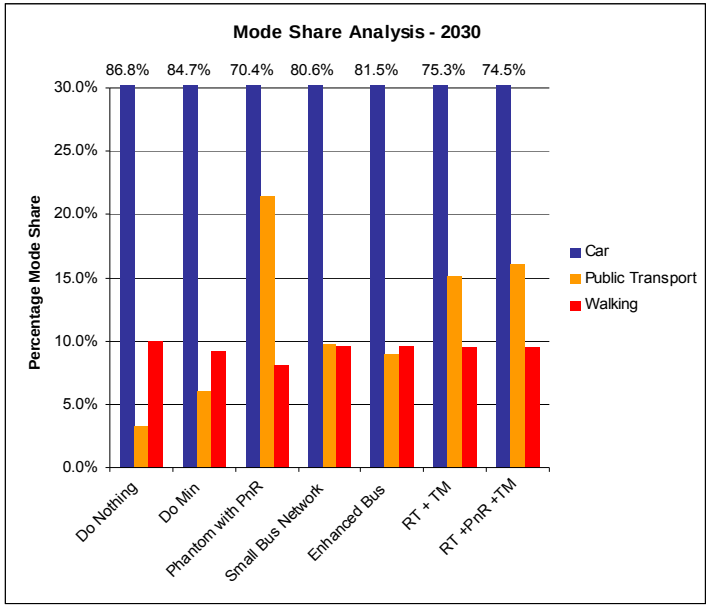
6.4.2 Further forecast mode share output for each of the seven scenarios for 2009, 2013, 2020 and 2030 can be seen in the following figure.

Figure 6.2 Mode Share Analysis









6.4.3 The key findings of this assessment are:

- The Do-nothing scenario (Scenario 1) for 2020 assesses the impact of growing demand for travel on the present day network, and considers no improvement in either public transport or highway infrastructure. As such this is the worst case scenario, with an average network wide speed of 25kph and a public transport mode share of 3%. The other scenarios tested aim to improve both public transport mode share and average highway network speeds.
- The Do-minimum scenario (Scenario 2) demonstrates the impact of already committed infrastructure improvements, which are detailed in the previous section of this Report. The key differences between the Do-nothing network and the Do-Minimum relate to road network enhancements. These road network changes are responsible for the substantial increase in network speed of 7kph, or 28% compared to the equivalent 2020 Do-nothing network. Increased frequency on some public transport routes is forecast to increase the public transport mode share, although this remains small, at 5% of all trips in 2020;
- The Phantom Network scenario (Scenario 3) tests an ideal public transport network for Galway with very high frequency services operating at very competitive and guaranteed speed on all main transport corridors. Average AM peak traffic speeds for 2020 are forecast to increase to 39kph, and the public transport mode share, to 22%. These results demonstrate the maximum potential impact of an idealised public transport network in the City. Despite the massive investment that would be required to implement a network with similar operating characteristics, the relatively low pubic transport mode share is as a result of the dispersed travel patterns in the area. Furthermore, car continues to remain an attractive mode as a result of transfer to public transport and the resulting in creases in average traffic speeds.
- The figure below shows a direct output from Omnitrans. The links have been coloured to indicate the volume of line flow on the transit lines using that link.

6.4.4 In referring back to the Phantom network description provided in the previous chapter, it was described how each line in this network was given optimal attributes, on a global level across the network. The output of the model run using those network attributes, shown below, indicates the strongest public transport corridor is on an east west axis through the city centre extending to suburbs at either end.

Figure 6.3 Phantom Network Line Flows

- The Extended Coverage Low Operation Capacity Bus Network, or SBN (Small Bus Network) scenario {Scenario 4} represents a completely reconfigured bus network with more services operating within loops in the suburbs. The idea is to increase public transport accessibility by shortening walk distances. However, the need to interchange to undertake most journeys and the relatively long journey times when compared to point to point travel on more conventional public transport networks limits the attractiveness of public transport. As a result, the forecast overall mode share is low, at 8% of trips in the AM peak period. Then low transfer to public transport gives rise to a small (2kph) increase in average AM peak traffic speeds.
- The Enhanced Bus Network (Scenario 5) is based on the existing bus network with amendments/ improvements to some routes, as detailed in the previous section of this Report. The scenario results in a mode share for public transport of 7%, a reduction compared with the SBN scenario, and the same general traffic speeds as per the SBN Scenario. The Enhanced Bus network does not therefore appear to represent a solution in itself in that it will not significantly alter traffic conditions/ travel behaviour.
- The Rapid Transit scenario (Scenario 6), incorporates an Enhanced Bus Network, and is supported by comprehensive traffic management interventions in the City Centre. Competing bus services along the Rapid Transit alignment have been removed. Traffic management measures, including turning restrictions and public transport only links,

were coded in the SATURN component of the Galway Transport Model. The modelling results show that in this scenario the public transport mode share rises to 13% which is substantially higher than that achieved in Scenarios 4 or 5. Increased use of public transport will result in higher car speeds compared to the Do-minimum, at 33kph averaged over the model area.

- The final scenario tested (Scenario 7) related to the development of Park and Ride sites onto the Scenario 6 network, i.e. Rapid Transit + Enhanced Bus Network. In this scenario, park and ride sites were located at three locations, two of which were located on the Rapid transit Corridor, and one on the bus network. The results show a small (1%) increase in the public transport mode share, with little or no change in general traffic speeds.

6.5 Public Transport Corridor Mode Split

6.5.1 The east-west corridor through the City has demonstrated the strongest passenger flows, and thus is the focus of investment in improved public transport services. It is the only public transport corridor with sufficiently high demand to justify rapid transit.

6.5.2 In the mode share analysis presented below, we split the mode share statistical reporting into two areas: within the catchment of the Rapid Transit Corridor, and outside the Corridor. Furthermore, mode share statistics are disaggregated by movement type within and to/ from these areas, i.e.

- Trips with origins and destinations within the catchment area of the corridor;
- Trips with origins inside the catchment area, but with destinations outside;
- Trips with both origins and destinations outside the corridor's catchment (note: such trips could travel into the catchment area then out again, using the public transport network to interchange at some point); and
- Trips with origins outside the catchment area, and destinations inside the catchment area.

6.5.3 The catchment area of the Rapid Transit Corridor was therefore defined as that located within 800m of the corridor, and illustrated in Figure 5.5 .The area in grey defines the geographical limit of the 'catchment' area of a hypothetical rapid transit line. As can be seen from the map underlay, most of the existing urban form of Galway is included in the catchment, and hence the majority population could reach a line through the spine of the area within a 10 minute walk.

6.5.4 The summary mode share findings are shown in the following table for home to work trips only. This table displays mode share for mechanised trip only, and as such excludes the walking component referred to so far.

6.5.5 Trips travelling inside the catchment area only will be best served by public transport if there is a high quality service along the central east west axis. All other trips outside the area will see some benefit arising from integration of Rapid Transit and conventional bus services on the City's PT network along a high quality spine.

Table 6.1 Area Wide and Rapid Transit Corridor Mode Share

Scenario No.	Home to Work Trips Only	Inside to Inside	Inside to Outside	Outside to Inside	Outside to Outside	Overall
1	Do Nothing 2009	4%	2%	4%	2%	3%
	Do Nothing 2013	9%	5%	7%	4%	6%
	Do Nothing 2020	6%	2%	7%	2%	4%
	Do Nothing 2030	6%	2%	6%	2%	4%
2	Do Min2013	9%	4%	7%	3%	5%
	Do Min2020	9%	5%	7%	3%	6%
	Do Min2030	11%	7%	8%	4%	7%
	Do Min2030	11%	7%	8%	4%	7%
3	Phantom 2009	44%	22%	30%	17%	26%
	Phantom 2013	51%	24%	34%	18%	29%
	Phantom 2020	53%	25%	35%	19%	30%
	Phantom 2030	48%	31%	24%	18%	28%
4	SBN 2009	21%	5%	12%	4%	9%
	SBN 2013	19%	5%	10%	4%	9%
	SBN 2020	22%	6%	13%	4%	10%
	SBN 2030	25%	8%	15%	5%	12%
5	Enhanced Bus 2009	14%	4%	9%	3%	7%
	Enhanced Bus 2013	15%	4%	9%	3%	7%
	Enhanced Bus 2020	18%	5%	12%	4%	9%
	Enhanced Bus 2030	22%	7%	14%	5%	11%
6	Rapid Transit Enhanced Bus 2009	36%	7%	19%	5%	14%
	Rapid Transit Enhanced Bus 2013	42%	7%	21%	5%	15%
	Rapid Transit Enhanced Bus 2020	46%	9%	23%	6%	18%
	Rapid Transit Enhanced Bus 2030	51%	12%	25%	7%	20%
7	Rapid Transit Enhanced Bus 2009 PnR	37%	7%	19%	5%	13%
	Rapid Transit Enhanced Bus 2013 PnR	43%	7%	21%	5%	15%
	Rapid Transit Enhanced Bus 2020 PnR	48%	9%	22%	6%	17%
	Rapid Transit Enhanced Bus 2030 PnR	52%	12%	24%	7%	20%

6.5.6 The Do minimum situation demonstrates that even within the area where most PT demand exists, if better services are not provided, then the PT mode share remains low at 11% in 2020. In this case there is simply not enough capacity on the network, and no serious competition to shift people out of their cars.

6.5.7 The Phantom network is next in the table. This scenario provided the definition for the best potential public transport system in the city as a whole. The mode share is therefore very high at 53% in 2020.

6.5.8 Other scenarios were then developed following analysis of the phantom network output. The first of these was the Small Bus Network scenario (Scenario 4). While the 2020 public transport mode share captured in the catchment area is moderately high, at 22% in 2020, significantly higher levels of public transport use will be required to achieve a more sustainable balance between use of car and other modes.

6.5.9 The next scenario represented the Enhanced Bus Network. The mode share is slightly lower than the Small Bus Network, and as such, does not seem to represent a sufficiently attractive public transport network to attract significant number of travellers onto public transport.

6.5.10 The next scenario, represented the east-west Rapid Transit corridor, supported by the Enhanced Bus Network. The forecast mode share for this scenario clearly demonstrates the potential for a step change in public transport intervention along the east-west corridor through the City, supported by improvement in the bus network. In 2020, the public transport mode share is 46% in this scenario. With park and ride facilities at either end of the line, then there is the potential to accommodate an additional 2% of trips by public transport in 2020 (though with park and ride there is technically a neutral effect: for each PT trip there must also be a car trip, albeit a shorter car trip).

6.6 Scenario Evaluation Summary

6.6.1 Of all the scenarios tested, only one; the introduction of Rapid Transit along an east-west corridor through the City, supported by an enhanced bus network throughout the City substantially change travel patterns in the City.

6.6.2 The introduction of Rapid Transit in the City is dependent on the introduction of a City Centre Traffic Management Plan, the primary objective of which is to facilitate fast and reliable public transport operations. To achieve this objective, it will be necessary to reduce traffic volumes along the Rapid Transit Corridor, via appropriate general traffic restrictions.

6.6.3 The introduction of Rapid Transit should also be supported by Park and Ride, thus extending the catchment of the service to those living outside the City.

6.6.4 The introduction of Rapid Transit, and enhanced bus network, City Centre Traffic Management restrictions and park and ride is forecast to nearly treble levels of public transport use in the AM peak in 2020, increasing from 5% without the recommended measures to 14% with all measures in place.

6.6.5 Maximum forecast passenger flows along the Rapid Transit Corridor in the 2020 AM peak are 692 passengers per hour eastbound (at NUIG) and 670 passengers per hour westbound (at GMIT). In 2030, these passenger flows are 807 and 740 passengers per hour respectively. These passenger flows indicate that investment in Light Rail Transit (LRT) would not be required, and that Bus Rapid Transit (BRT) solution would represent the most suitable mode along this corridor.

7 Complimentary Measures

7.1 Introduction

7.1.1 The pervious chapter's assessment of proposed public transport options illustrates that whilst the best performing options have a measurable impacts on increasing public transport modal share, none of the options on their own, can sufficiently curb the dominance of car and associated traffic impacts in Galway City. Traffic, related congestion and other delays each heavily impact on public transport provision in terms of efficiency, reliability, timetabling and future viability. If left unchecked, Galway City's traffic levels will continue to severely impact on public transport provision as well as on business productivity and local community vitality.

7.1.2 This section of the Report focuses on the range of complimentary measures that are essential to support the development of the preferred public transport system, as outlined in the previous chapter.

7.1.3 A number of case studies have also been assembled and where relevant included to illustrate overseas best practice. A common feature of these is that they all rely on a series of measures in combination to improve transport – no one measure in isolation will solve a city's transport problems.

7.2 What do we mean by Complimentary Measures

7.2.1 Complimentary measures are a range of travel demand management tools that include both carrot and stick interventions that can:

- Support the running of a more efficient and viable public transport system;
- Make non car traffic options more viable;
- Extend the connectivity of the public transport system e.g. walking and cycling connections;
- Reduce or eliminate obstacles that slow down public transport and other non car alternatives e.g. illegal parking; and
- Increase awareness and promote usage of alternative modes the car.

7.3 Why are complimentary measures relevant to Galway?

7.3.1 Galway is not alone in having to face the prospect of continued rising fuel costs and increasing congestion. The escalating financial squeeze on both government and business have led to the need to get the most out of existing transport networks. Increasing realisation of the links between transport choices, health and the environment are emerging to focus more attention on prioritising sustainable modes across the board from land use planning through to traffic management and investment in travel awareness. Prioritising more sustainable choices including public transport, increases the route capacity to the centre, in turn helping to support the economic and social potential within the City.

7.3.2 Furthermore it is clear for this study that the return on investment in terms of achieving a desired mode share will be diminished unless it is supported by traffic management and other travel demand measures in the short term, and by a more integrated approach to land use and transport planning in the longer term.

7.4 Working towards a smarter more vibrant Galway City

7.4.1 'Galwegians' are passionate about the future of the City. Whilst responses to the consultation responses may have differed on particular solutions fit for Galway city, they did not differ in their shared vision for change towards a more sustainable vibrant Galway City and Centre. The vision created for the ten-year economic, social and cultural strategy for Galway City, 'Gaillimh! Beo agus Bríomhar!' seems to capture the local perception of the city and aspiration for its future quite well:

> "*Gaillimh! Beo agus Bríomhar! A City that people are proud to be part of, to work in, to live in and which is attractive to visitors and investors alike".*

7.4.2 This vision is supported by Galway City Council Transportation Unit's overall aim:

> *"To develop public transportation and other travel modes to the extent that the City will become a model for a sustainable traffic system in an urban environment."*

7.4.3 Understanding that there is a shared desire for a smarter more vibrant and sustainable City Centre is a very helpful starting point in that we know that we are working towards a shared ultimate goal. This is a vision for the City where travel efficiency and opportunity are central.

7.4.4 What follows below is an overview of how complimentary measures or travel demand management tools can help unlock car dependence to help achieve a more vibrant healthy Galway, and which have been identified as being important enabling measures for a more efficient system. Traffic management measures are considered to be critical, and are therefore a top priority in freeing up Galway City Centre to support an efficient and reliable public transport system for Galway. These measures are therefore given priority in the discussion below. The key complimentary measure categories which are discussed in turn below are:

- Traffic management;
- Integration of land use and transport planning;
- Urban design and streetscape; and
- Mobility Management or Travel Planning – the emerging 'Smarter Choices' Agenda.

7.5 Traffic Management

7.5.1 Measures to manage traffic demand and congestion levels in Galway are critical to the success of providing a green travel corridor and enhanced bus network in Galway. It is essential to alleviate delays to allow for a more efficient and reliable public transport alternative. Such an approach will commence the positive feedback process where one factor (e.g. increased reliability and speed) enhances another (e.g. public transport's real and perceived benefits, improved PT services and increased use, more attractive City Centre, higher footfall etc) so that they start to outweigh the car as a modal choice.

7.5.2 As a starting point the implementation of City Centre traffic management and corridor management strategies along the length of and in particular the east-west sustainable/ green transport corridor is essential to ensure an enhanced bus and future Rapid Transit operations are not undermined by general traffic congestion. The objective is to provide the necessary infrastructure to support public transport operations, i.e. high operating speeds and reliable service operations. City Centre traffic and corridor management strategies will also be required on routes indirectly impacted as a result of redistributed traffic flows.

7.5.3 The implementation of a number of strategic traffic management interventions is recommended in the City Centre. These aim to achieve a more optimal use of the road network, by re-allocating road space on key City Centre streets from general traffic to public transport use. These measures are described in section ten of this Report. The impact of these measures will be to significantly reduce through traffic volumes in the City Centre generally, thus improving the environment for all remaining road users, i.e. sustainable transport modes (public transport, walking, cycling) and local access vehicles

Case Study: Bruges, Belgium

- Bruges has a population of approximately 117,224 and population density of approximately 847 inhabitants/ km².
- Driving within the historical centre is discouraged by traffic management schemes, including a network of one way streets. The system encourages the use of set routes leading to central car parks and direct exit routes.
- In support of the municipal traffic management, free public transport is available for those who park their cars in the main railway station car park.
- Cars are required to yield to pedestrians and cyclists.
- Plans for a north–south light rail connection through Bruges, from Zeebrugge to Lichtervelde, and a light rail connection between Bruges and Ostend are under construction.

Parking Management Strategy

7.5.4 If capacity in terms of overall footfall is to be increased in the Centre of Galway, other demand management measures such as consideration to the level of car parking availability is also required. Overall footfall capacity is increased in the Centre by enabling and encouraging higher occupancy vehicles notably public transport and walking and cycling options into the Centre. More simply this is achieved by supporting more sustainable travel options including walking and cycling, and restricting single or low occupancy car travel by demand management measures such as parking management.

7.5.5 As noted under study context, there are in the region of 1,800 on street car parking spaces in the centre of Galway as well as significant number of spaces in multi-story car parks. There is also evidence of parking contraventions on some streets, and it is apparent from site observations that this can hinder bus and traffic movements e.g. on Eglington Street.

7.5.6 From the baseline study analysis of Census 2006 data it is apparent that 89% of trips to work are made by car. This high level of car use suggests unacceptably high levels of car parking availability

in the City, i.e. current parking standards at workplaces in the City may promote car use, rather than being used as a means to promote more sustainable travel options.

7.5.7 It was also noted that the extent of car parking facilities in the City together with insufficient enforcement of illegal parking supports the car as a primary mode choice, which in turns limits the city's capacity in terms of footfall, encourages congestion, and impacts on bus efficiency. In discussing service provision, it is therefore also important to consider what role parking and/or applying appropriate car parking charges can play as a complimentary travel demand management tool with the aim of providing more efficient public transport services.

7.5.8 The management of City Centre traffic is intrinsically related to the strategic control of parking activities, and this in turn requires an understanding of the factors that can be used to influence car drivers' parking behaviour and their needs for parking information. Control over its availability can be a key policy instrument in limiting car trips and encouraging the use of alternatives. Parking management is no longer about predict and provide, but about balancing a range of objectives that include the economic well being of the City

Case Study: Durham Traffic Management

A small scale road user charging scheme that is in essence a sort of parking management strategy was implemented by Durham County Council in October 2002. It was designed to "significantly reduce the pedestrian and vehicular conflict" in its central core in particular, "by the removal of a substantial proportion of the existing traffic.[1]" The Council had previously considered introducing a permit scheme to reduce the number of non-essential car journeys into the area (for example, to visit banks or shops or to try to park as close as possible to the Cathedral), but could not find a means of differentiating between essential and non-essential traffic. The differentiation was considered to be feasible by means of road user charging. The scheme requires vehicles using the central Market Place and Saddler Street to pay £2 on exit. It operates between 10 am and 4 pm, Monday to Saturday: access outside these times is free of charge. Residents on the streets affected, and those with existing parking facilities within the controlled zone, are exempt from the charge, but the Council says it has kept other exemptions to a minimum. Bus services into the Market Place area have been developed and enhanced.

The scheme is measured against six criteria, including the reduction of traffic impact on the local environment, reduction of accidents and the perception of accident risk, and the improvement of the economic viability of the Market Place and the Peninsula area. Early indications are that the scheme has been extremely successful, and that traffic volumes in the central Durham area have been reduced by up to 90 per cent, rather than the 50 per cent initially projected.

[1]Durham County Council, Saddler Street Road User Charge Scheme, Monitoring Report , 2003

7.5.9 There is an opportunity to coordinate a car parking reduction strategy in the Centre with park and ride provision on the perimeter of the City, so that the provision of park and ride does not increase overall levels of car use. Park and Ride is discussed under integration of services below.

Recommendations

- The implementation of a City Centre Traffic Management Plan to improve City Centre accessibility, and the environment for public transport vehicles, pedestrians and cyclists in the City Centre;
- The implementation of an integrated and coordinated urban traffic control system for Galway City supported where relevant by coordinated CCTV operations; and
- The joint development, by Galway City and County of parking standards that manage the car mode share and supports the use of public transport and other sustainable modes. This is essential if the benefits of new public transport 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 supportive of the study outcomes.

7.6 Integrated land use and transport planning measures

7.6.1 Land use planning has seen a change in priorities in the last decade from one that has supported an increasingly dispersed population to one that is supports a more sustainable development form.

7.6.2 If Galway is to continue to support future population increases with better access to its City Centre, and to support a more vibrant centre, future residential and commercial locational decisions need to prioritises public transport, walking and cycling.

7.6.3 Focusing more closely on the recommendations of this Report, as noted in the Appraisal Section, some fairly substantial capital investment is required. The majority of this investment will be focused on the development of a central sustainable transport corridor from Ballymoon at the end of Western Distributor/Bóthar na Ceapai through to Garraun South, through the City Centre.

Recommendations

7.6.4 The following recommendations are made following analysis of the capacity of the corridor and the wider enhanced bus network:

- To seek opportunities for higher density but nonetheless locally sensitive development along the Rapid Transit corridor, which would be beneficial to the development of the system. Locating additional development along the corridor and enhanced network can support:
  - Better utilisation of system capacity in both peak and off-peak periods; and
  - Increased public transport mode share.
- The performance of a Rapid Transit has been assessed in the context of estimated future population and employment allocations informed by the City and County Development Plans and Regional Planning Guidelines, which has allocated significant growth in the Ardaun area by 2020. To support the development of Rapid Transit, development along the corridor should be prioritised (taking on board Rapid Transit phasing considerations). This is particularly important in a growth scenario that is lower than that envisaged in the development plan.

- To support a more accessible public transport network with wider catchment areas, it is recommended that walking and cycling connectivity to the Rapid Transit corridor is put at the heart of street design and proposed new developments e.g. in Ardaun.
- Walking and cycling permeability and supporting requirements (e.g. workplace showers) should be introduced as a key complimentary along the corridor.
- To assess the existing and future highway network with regard to its potential for maximising sustainable travel and public transport. This is in recognition of the dispersed trip distribution patterns that exist in Galway City and County, and the corresponding need to reduce congestion in the city. Park and Ride (or where there are a range of travel options provided such as bus, train and bike, this might be called Park and Choose) sites at the key locations that are recommended in this report can also support this endeavour.
- The development, in future of integrated land use and transport plans for the City and Region.

Case Study: Freiburg, Germany

- Freiburg is a city with approximately 220,000 residents on the south-western edge of Germany.
- The population density is approximately 1,400 persons/ km^2.
- Early decision to move away from car-centric transport planning. The transportation master plan of 1979 favoured environmentally friendly types of traffic.
- A common German tool of reducing traffic volumes in local street networks is the provision of one-way streets, channelling through traffic onto arterial routes.
- Freiburg has approximately 120 one-way streets. A change in the German traffic regulations in 1997 enabled the opening of one-way streets for cycling in a contra-flow direction. This has resulted in nearly 50% of its one-way streets containing contra-flow cycling.
- Freiburg received the first European Public Transport Award for its public transport system.
- Given the coverage of the public transport system (which extends slightly beyond the city boundaries), it represents 0.8 public transport journeys per person per day.
- Citywide integrated ticketing was introduced in 1984, and by now covers the wider region.

7.7 Urban Design and Streetscape: Improving Galway's Existing Urban Spaces

7.7.1 The economic, environmental, social and health costs of relentless urban sprawl has been demonstrated in urban areas throughout the world: as we move forward into the future, the need for more compact and integrated planning is essential and has been touched on above. On a local scale, creating attractive, safe and stimulating urban spaces increases footfall and local vitality, but doing so requires receptiveness to the changes in planning priorities.

7.7.2 The compact nature of the Centre of Galway provides it with all the potential for a City renowned for active travel and a sense of wellbeing. It already is a walking city, and its relatively compact nature also provides significant potential for cycling.

7.7.3 A place dominated by the car only serves to inhibit movement and local access, and the related car parking requirements consume valuable land. Jan Gehl's much referenced report 'Towards a Finer City,' has illustrated how improving the quality of streetscape and public realm can bring many social and economic benefits and a stronger sense of local identity.

Case Study: Sandnes, Norway

- Norwegian municipality with a population of approximately 56,000.
- In the early 1990's the Norwegian Ministry of Environment chose Sandnes to participate in a 4 year pilot bicycle project aimed at reducing car traffic. The primary goal of the project was to promote the use of bicycles as main means of transport for as many inhabitants as possible.
- The campaign has continued well past the 4 year mark and today Sandnes has the best facilities for cyclists in Norway.
- The first Norwegian public bike system was introduced in June 1996.

7.7.4 In his synopsis of 'The City Street: Public Space in Perspective'[1], Dr. H.C. van der Wouden (editor and political scientist, Social and Cultural Planning Office) roughly summarised the following key design elements as being crucial to the improvement of the quality of public space:

- finding a strong visual focus (often riverbanks or port areas) for the city;
- unity and differentiation (supporting local identity with overlapping but distinctive public space);
- spatial and temporal continuity;
- architectural quality and cohesion; themes (catering for the users' different demands); and, finally,
- a cultural and multicultural dimension.

7.7.5 The streetscape makes up the greater part of the public realm, contributing significantly to the quality of the built environment. A quality streetscape will provide a sense of place where it is designed for people over cars and in a manner that is sensitive to the character of local environment. The UK Department for Transport '**Manual for Streets'** (2007) has been referenced in the absence of a similar manual here in Ireland; it aims to "to redress the imbalance in design for cars over people "by encouraging a more holistic approach assigning a higher priority to the needs of pedestrians, cyclists and public transport. The intention is to create streets that encourage greater social interaction and enjoyment while still performing successfully as conduits for moment". In

[1] A collection of essays about urban public spaces written by experts from a variety of disciplines. Contributors include Prof. R.W. Boomkens (cultural philosopher, University of Amsterdam), Dr. J.P.L. Burgers (sociologist, Rotterdam Erasmus University), Dr. J.J.M. Hemel (planner, National Land Use Planning Agency), Prof. A.M.J. Kreukel (planner, University of Utrecht), E.C. van Uum (planner, National Land Use Planning Agency),

effect, it demonstrates the many economic, social and environmental benefits gained from good street design.

7.7.6 Design that appreciates and supports permeability throughout for walking and cycling, whilst supporting a sense of place or an urban identity is an essential enabler of greater public transport use. Galway has great potential and has already demonstrated the value of this approach with the pedestriansiation of Shop Street and transformation of Eyre Square. There may be much more however that could be done to further improve the Centre. This is particularly relevant in the context of the City Centre traffic management recommendations emerging from this study. Case studies in the report 'Paved with gold, the real value of good street design' by Cabe demonstrate the direct links between street quality and residential and retail property prices.

7.7.7 Creating 'permeable' networks that encourage walking and cycling and make places easier to navigate through is increasingly being recognised as being central to planning for sustainability. Recent MVA Consultancy findings have demonstrated that quality streetscape can add real value to homes and retail rents and we can now put a figure on this effect.

Case Study: Goningen, Netherlands

Groningen has a population of approximately 185,000, as it is a university city its student population is about 50,000 students. Groningen's population density is 2,324/km^2

The city of Groningen has implemented a number of permanent measures in favour of sustainable transport modes:

- re-allocation of road space: plan 'Binnenstad Beter' (better inner city) which consists of the redesign of the inner city reserving more space for slow traffic and pedestrians,
- on-street parking regulations: implementation of parking garages to limit on-street parking,
- improvement of public transport: introduction of quick express lines to important commuter destinations,
- improvement of the bicycle network and extension of guarded bicycle parking facilities.
- Approximately 57% of journeys within the city are made by bicycle.

Recommendation

- It is recommended that Galway 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'.

This is about moving away from designing streets (and buildings) primarily to meet the needs of motor traffic to ones that encourage walking and cycling and better serve public transport.

7.7.8 The principles for inclusive design are those that:

- Put people at the heart of the design process;
- Acknowledge diversity and difference;
- Offer choice where a single solution cannot accommodate all users;
- Provide for flexibility in use; and
- Provide building and environments that are convenient and enjoyable to use for everyone.

7.8 Mobility Management or Travel Planning – the emerging 'Smarter Choices' Agenda

7.8.1 Nobody will argue that a good transport system is vital for the Irish economy; however we accept that costs associated with an escalation in car use and congestion in Ireland is not economically or otherwise sustainable. The Irish Government has responded by seeking new 'smarter transport and travel' policies and measures to support a more sustainable transport future. The product of this endeavour is the Government policy framework "Smarter Travel - A Sustainable Transport Future". It is "*designed to show how we can reverse current unsustainable transport and travel patterns and reduce the health and environmental impacts of current trends and improve our quality of life*".

A new way of thinking

> "*Investment in the necessary infrastructure elements will be challenging. However, the real challenge is to change mindsets, so that our institutions and individual citizens realise the benefits from altering their travel behaviour. I recognise that policies right across all areas of Government will have to be aligned in that regard"*
>
> From Foreword by An Taoiseach Brian Cowen, A Sustainable Transport Future: A New Transport Policy for Ireland 2009-2020

7.8.2 Travel behaviour change requires a mix of push factors to provoke change and pull factors to encourage change: supporting organisations or residents to rethink travel habits. The pull factors can combine improved streetscape design (as discussed below); improved transport services and as discussed here behaviour change techniques in the form of travel planning. Travel planning is also referred to as 'mobility management' or 'smarter choices'; it is the softer side of travel demand management that aims to positively engage workplaces, schools and the wider community.

7.8.3 A **travel or mobility mangement plan** is a package of measures aimed at promoting sustainable and healthy travel and can be applied by a workplace, hopspital, university, school or other organisation. By reducing car travel, Travel Plans can improve health and wellbeing, free up carparking space and reduce associated costs, and make a positive contribution to the community and the environment.

7.8.4 A good travel plan becomes part of a phased management strategy supported by clear objectives, usually includes a site audit, a baseline survey, target setting, as the implementation of agreed measures. Implementation measures might include car sharing schemes, a commitment to improve cycling facilities, a bicycle user group, car parking allocation, a dedicated bus, etc.

7.8.5 In Dublin alone, IBEC estimate that congestion is costing business in the region of €2.5 EUR billion annually. A good travel plan can succeed in cutting the number of people driving to work by 15%[2]. Organisations that have embarked on implementing travel plans have learnt that there are major cost savings to be had e.g. BAA estimate their cost savings to be in the region of £8million due to deferral of multi-deck build through reduction of car parking requirement, cost savings through video conferencing and alternative work styles improving efficiencies and the health of staff. Other well known organisations that have benefited are Sky, BBC, MORI, Coca-Cola, ITV, Hunter, Harpter Collins Publishers. It is not about do gooding, it is about good business. The focus is on improving existing travel choices and often involves only limited capital expenditure on items such as new cycle shelters, walkways or bus stops, which are backed up by a staff information and engagement campaign.

> *"We were surprised just how easy it was to motivate staff to be involved, and to create camaraderie and friendly rivalry. At no stage did we treat motorists as pariahs - in fact the (unplanned) first stage of implementing our plan was to improve parking facilities and stop interlopers using our car park. This meant that no-one felt threatened by a positive initiative which might have been interpreted otherwise."*
>
> Chris Parrott, Director, Journey Latin America

7.8.6 Increasingly businesses in the UK, Germany and Holland are voluntarily implementing travel plans as evidence showing a range of benefits that include reducing overheads, helping to create a healthier workforce, increasing productivity, improving staff retention and increasing the organisations profile. The increase is to the extent that 10% of London's workforce is now supported by a workplace travel plan, and they between them, they have achieved a 13% point mean average mode shift (or a 27% relative shift) away from car journeys to other modes as a result of workplace travel plan initiatives.

7.8.7 A variation of workplace travel plans is '**destination / area based travel plans**' that are relevant to business districts, shopping or leisure centres. They follow similar key steps but because they are also applied to a more transient population as well as their workforce, they require some variations in approach.

7.8.8 Most relevant to a city like Galway is a further variation known as an '**area based travel plan'**. They have the advantage of helping to identify a shared problem and creating efficiencies through utilising shared resources of many organisations located within a defined area and providing additional critical mass to support measures such as car sharing and cycling support schemes such as bike buddy schemes (where a novice bike rider is supported by an experienced rider on a particular route) etc. A key requirement is the management of a steering group of multiple stakeholders made up of each of the organisations in the particular area.

7.8.9 An area based travel plan has particular relevance in Galway for both the highly car dependent industrial area of Ballybrit/ Parkemore and for the equally car dependent area shared by the NUIG and the University College Hospital grounds. The areas contain major employers in close proximity with extensive car parking requirements. Traffic congestion is costing businesses in terms of late deliveries, reduced productivity and can impact on staff turnover.

[2] Making Travel Plans Work: Lessons from UK case Studies, Department for Transport, 2002

Recommendation

7.8.10 The study recommends that:

- Two important area based travel plans are initiated imminently: the first would cover the Ballybritt/ Parkmore industrial area, and the second of equal importance would cover the area around NUIG and the University Hospital. To initiate these, it is recommended that the City Council constructively engage with major employers (or business representatives) at the earliest opportunity to explore the merits of taking this forward;
- Other major destinations/ employers lying outside this area such as GMIT need also to be supported in, at a minimum, realising the merits of having a travel plan in place; and
- All new developments with significant transport implications are covered by a travel plan.

7.9 School Travel Plans

7.9.1 From MVA Consultancy's on the ground observations in Galway in addition to desktop analysis of data, it has become apparent that the school run is contributing significantly to traffic, and impacting bus efficiency and reliability. It is further commonly understood that the preferred choice on school travel options is to have the opportunity to travel by more independently or by more active travel means such as walking or cycling.

Recommendation

- MVA Consultancy acknowledges the excellent work that An Taisce are already doing to support School Travel Plans in Galway, and recommend that sufficient budget is made available to continue and expand this good work.

7.10 Personalised Travel Planning

7.10.1 Personal travel planning (PTP) is another form of travel planning that shares the objective of encouraging more sustainable travel choices but engages directly with individuals, usually in a particular target residential community, though it can be applied as a component of a workplace or other destination based travel plan.

7.10.2 PTP provides personalised information, incentives and motivation to help individuals or households make more informed travel choices. The delivery differs from project to project but will usually include a one-to-one conversation either at the door step or by telephone.

Recommendation

7.10.3 The study recommends that Personalised Travel Planning is considered:

- Along the alignment of principal public transport radials; and
- For residential areas within walking/ cycling distance from the City with a view to optimising the potential of each of these modes and to optimising potential community engagement in supportive activities such as Walk to School schemes, Bicycle User Groups, Bike Buddy Schemes etc.

7.11 A Market Strategy and a Quality Galway Public Transport Brand Identity

7.11.1 It is very clear from the public consultation process carried out during the course of this study that the public has a very poor perception of bus services on offer in Galway, and of their potential relevance in their lives. Services might be faulted for being somewhat out of step with some of the public's needs in terms of frequency and information availability. The central recommendations of this Report are made to bring public transport services more in line with customer needs. The customer experience must be the central focus of a coordinated marketing strategy. From accessing information, to buying a ticket through to disembarking the bus, what is the whole journey experience from the customers' perspective? A coordinated public information and marketing campaign is essential to reviving a healthier perception of the bus as a real alternative.

7.11.2 The previous Galway Strategic Bus Study (1997) emphasised the importance of "a well thought out marketing strategy" as being "critical" to the success of any bus enhancement programme. This report fully endorses this viewpoint and what follows below is a discussion about public perception and the value of re-branding the Galway Bus, together with some of the key information and ticketing elements

7.11.3 As part of a coordinated investment in enhancing bus services in Galway inclusive of a phased introduction of a Rapid Transit central spine, there is much to be gained for giving consideration to the re-branding of Galway bus and appropriate future branding of Rapid Transit services. Some consideration should be given to a supportive Galway Bus brand enshrined by core values. The process of doing so could help to reposition Galway Bus with a more positive public perception. The process of brand repositioning towards one that has greater customer focus and more relevance to a modern Galway must be undertaken in conjunction with network and service improvements, and supporting traffic management interventions. Such an approach has the potential to provide the step change that Galway citizens are looking for. Ideally a single new brand name for public and private operators to use would be identified, together with a logo and design guidelines, and a supportive marketing strategy. The study team would recommend that the National Transport Agency in conjunction with Galway City Council takes a lead thereby providing the support a local and national level to enable Galway to be a test bed in managing the change in bus regulation.

7.12 Integration of services and ticketing

7.12.1 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 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.

Integrated fares

7.12.2 **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 they use to complete their trips.

7.12.3 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.

7.12.4 The key advantages of introducing integrated fares on a network wide basis are:

- An 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;
- That it should in the medium to 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; and
- The benefits of choice through integrated fares/ ticketing, integrated Public Transport Information, public transport interchanges, park and ride (e.g two sites on the Rapid Transit corridor at Ballymoon in the west and at Garraun South in the east).

7.12.5 The enhancement of the bus network, and the future introduction of Rapid Transit present an opportunity to introduce integrated fares, as an element of overall public transport.

Trondheim, Norway

- Trondheim municipality has a population of approximately 145,000 inhabitants.
- The total area of the municipality is 342km$^{2.}$
- Trondheim is an environmentally friendly city that promotes sustainable modes of transport including cycling.
- **Trondheim** is a university city with 30 000 students, 90 % of whom using their bicycles as their main transport tool.
- The city has invested significantly in a cycle network and operates a public bike rental project.
- In the Transport Plan for the Trondheim region, four goals are given priority:
  - Less transport intensive land use policies;
  - More environmental friendly transport;
  - Reduced number and seriousness of accidents;
  - Good accessibility.
- ITS technology is used as an active instrument in local transport policy. The primary objectives for the use of ITS technology in Trondheim are:
  - Increased service for more people at a lower cost;
  - Rewarding those with "desired" behaviour;
  - Create effective instruments for fulfillment of the local transport policy; and
  - Utilise existing and planned ITS-infrastructure.
- For an area covering most of the urban part of the municipality a flat fare is charged for use of the bus system.

Interchanges

7.12.6 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.

7.12.7 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.

7.12.8 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.

7.12.9 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 Galway for introducing planned interchange facilities at all locations where interchange takes place.

7.12.10 The key public transport interchange locations in Galway on the existing and recommended future public transport network are at Ceannt Station and the nearby bus station. Both locations would represent important future interchange locations on the Rapid Transit corridor.

7.12.11 Planning and design for key designated public transport interchanges will need to 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.

Acknowledging Historical Dispersed Settlement Pattern: Park and Ride

7.12.12 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.

7.12.13 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.

7.12.14 Park and ride offers those living in 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.

7.12.15 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. However park and ride can be integrated into the network of existing services that may include rail, and can be further complimented by providing additional travel options by providing cycle parking and links to good walking and cycling networks. Where multi-travel options are provided, the provision might alternatively be referred to as a 'Park and Choose'.

7.12.16 The dispersed nature of settlement outside of Galway city, and the high level of traffic that is projected onto the city perimeters via the current construction of the M6 link from Ballinasloe is likely to have significant traffic impacts if left unchecked. It is therefore essential that a 'Park and Ride' or a 'Park and Choose' site is in place and balanced against demand management measures such as car parking restrictions in the Centre. Because such measures are considered by the study as being essential provisions, proposed locations are incorporated into proposed solutions and have been modelled accordingly.

Basel, Switzerland

- The City of Basel has a population of 192,000 and an area of only 37 Sq Km.
- Basel also has three trolley bus lines and 13 natural gas busses however it has been said that the natural gas busses have no future in Basel.
- 1984 saw the introduction of environmental travel cards which saw the number of single trips drop from 565% to 45% and increased PT usage by 22%
- Basel has 6.2 km of pedestrianised streets.
- Basel carries a ban since the 1980's on the development of any car parking spaces within the city centre ring. Basel City centre contains only 860 car parking spaces.
- The city also employs traffic calming measures and a city centre speed limit of 30kph.
- Car ownership in is low despite being one of the wealthiest cities in Europe. Reliance on PT is highlighted by the fact that in 1999 there were 311 cars per 1000 population and 366 travel cards per 1000 population. Basels' car ownership growth over the last 14 years was 7% in comparison to the average in Switzerland of 32%.

Transport Information (iPTI)

7.12.17 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." iPTI can be divided into two broad categories, Fixed PTI and Real Time PTI.

7.12.18 For Fixed Time PTI

- Display cases at bus, rail stations, shopping centre, airport, etc. for display of fixed time information, network and local area maps.

7.12.19 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.

7.12.20 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.

7.12.21 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.

7.12.22 It is recommended that measures are put in place at a national, regional and local level to support the realisation of customer focused and integrated public transport information that supports whole journey preparation and decision making.

Demand Responsive Transport

7.12.23 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.

7.12.24 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.

7.12.25 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.

7.12.26 The role of DRT requires further investigation to determine its role on a regional wide basis. In terms of target markets for DRT in Galway, the 5 key areas are likely to be:

- Special needs;
- Periphery;
- Local journeys;
- Connectivity; and
- Hinterland/ rural.

7.12.27 Given that a large portion of the population live outside the main towns, it is likely that DRT would have particular potential at the recommended park and ride sites outside the City, and potentially in some of the more rural areas in the City's hinterland. In this respect, it could reduce car dependency, and act as a viable means of accessing public transport for residents in these areas.

7.13 Summary

7.13.1 It became apparent from transport modelling undertaken in relation to preferred public transport enhancements that regardless of the level of investment, the options as stand alone measures were not sufficient to achieve significant modal shift, and thereby improve efficiency of movement and related ambiance and quality of life in Galway. This chapter examined a range of carrot and stick measures that compliment investment in public transport to enable real change benefiting the future of Galway. Traffic management measures that give better priority to public transport, walking and cycling, whilst restricting car movement in the Centre are considered essential. The dispersed nature of Galway County was considered, leading to a recommendation to better integrate land use and transport planning in the longer term.

7.13.2 Destination based areas that include NUIG and the University Hospital to the north west of the city and Ballybrit/Parkmore to the north east of the city were each identified as having maximum potential for benefiting from an area travel plan/mobility management plan to manage travel demand to the workplaces within these two sites.

7.13.3 Better permeability for walking and cycling provided by improving the streetscape was recommended by creating a sense of place with appropriate and safe shortcuts for walking and cycling. The chapter also acknowledged that providing better whole journey accessibility benefits all sustainable users and further specific recommendations on the integrative measures needed to achieve this aim are made. The key integrative measures required to improve the whole journey quality are:

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

8 Appraisal of Preferred Strategy

8.1 Introduction

8.1.1 Previously in this Report, an outline of the key objectives of the Study has been presented. The primary purpose of the study is to determine the type and extent of public transport intervention required to support the desired development pattern in Galway. This led to the establishment of five objectives, which would be used in appraising recommended interventions.

8.1.2 The recommended strategy, Scenario 7, consisting of Rapid Transit, an enhanced bus network, City Centre traffic management restrictions and park and ride; has been subjected to a more detailed appraisal, consisting of:

- Detailed area specific appraisal;
- Financial and economic appraisal; and
- Environmental appraisal.

8.2 Detailed Appraisal against Study Objectives

8.2.1 The recommended interventions, outlined earlier in this Report, are subjected to a more detailed appraisal against the study objectives:

Improved Reliability

- A reduction in congestion with reduced delay and greater predictability.

Increase Public Transport Capacity

- To increase capacity for movement to the City Centre without the provision of additional road infrastructure, car parking or land take for transport; and
- To allow increased levels of economic activity in Galway without significant increases in road traffic across the network.

Support vibrant, accessible and sustainable Galway City

- Enhance the ambience of the City Centre for employees, shoppers and visitors through a programme of public realm enhancements, noise and air quality improvements, reduced conflict between pedestrians and vehicles and quality 24/7 activity; and
- To create a public transport system which is inclusive and accessible in order to give all residents an opportunity to travel and take part in the full range of activities offered in the region.

8.2.2 Appendix A of this Report contains the detailed area by area appraisal of the recommended public transport network and services with proposals for more regional park and ride sites. This has been undertaken for the following parts of the City and its environs:

- Central Area;
- North East;
- North West;

- South East; and
- South West.

8.2.3 Overall, it has been found that the recommended interventions contribute positively to the achievement of the study objectives listed above.

8.3 Financial and Economic Appraisal

Introduction

8.3.1 The option evaluation section of this Report has indicated that, based on forecast future passenger demand, BRT would meet the transport needs of areas along the Rapid Transit Corridor in the context of the 2020 allocation of future development, and subsequent assumed growth of the City and Region between that point and 2030. Despite this, capital costs have been developed for both BRT and LRT along the Rapid Transit Corridor, and an economic appraisal of the full strategy for both modes has been undertaken.

8.3.2 Preliminary capital cost estimates for the BRT/ LRT Corridor, and the enhanced bus network have been developed for the purposes of assessing the overall capital investment costs, and subsequently undertaking an economic appraisal.

8.3.3 Capital costs for developing BRT/ LRT and improving bus priority on a general basis have been provided by Healy Kelly Turner and Townsend, Cost Management Consultants.

BRT Preliminary Construction Cost Estimates

8.3.4 Table 8.1 overleaf includes preliminary cost estimates for the full BRT / LRT alignment from Ballyburke to the terminus east of Ardaun, a length of 14.6km. The cost estimates used for this work are based on May 2009 rates.

8.3.5 The work items covered in the costs include:

- Removing / relocation of services;
- Demolition of walls and simple structures;
- Provision of Stops including electronic ticketing / validation units;
- Terminals and depots (LRT only);
- Traffic signals and traffic management;
- Provision of rolling stock; and
- Design, Risk and Insurances.

8.3.6 As can be seen from this table, the preliminary cost estimates in 2009 values indicate that it would cost approximately €86 million to **construct** BRT, and €524 million to **construct** LRT, along the full alignment. The total capital costs will, however, be higher when other costs such as land acquisition are considered.

Table 8.1 BRT and LRT Preliminary Construction Costs

Section	Description	Length (m)	BRT Costs (€)	LRT Costs (€)
1	Western Section at Ballyburke: Suburban environment (includes terminus)	3,000	16,000,000	47,000,000
2	Taylor's Lane to Newcastle Roundabout - suburban environment	1,500	4,700,000	84,000,000
3	At Galway General Hospital - suburban environment	460	1,700,000	7,000,000
4	University College Galway - suburban environment	450	1,400,000	7,000,000
5	Cathedral, through city centre to Lochatalia roundabout - City Centre environment	2,130	13,200,000	104,000,000
6	Renmore Road to Merlin Park - suburban environment	2,160	6,700,000	59,000,000
7	Meerlin Park to N6 - suburban environment	2,070	6,300,000	57,000,000
8	Ardaun - rural / greenfield environment	2,880	20,000,000	73,000,000
			70,000,000	438,000,000
9	Rolling Stock	Assumed 26 units	13,000,000	83,000,000
10	Park and Ride	2 no. park and ride sites with 400 combined capacity	3,000,000	3,000,000
	Total		**86,000,000**	**524,000,000**

Note: all prices are based at May 2009.

Enhanced Bus Network and Additional Fleet Requirements

8.3.7 The enhanced bus network represents a significant improvement 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.

8.3.8 In order to implement the changes to the City Bus network, approximately 38 additional buses[3] would be required. This would represent an almost doubling of the current city fleet.

8.3.9 Given the level of improvement, it is estimated that an investment of €9,500,000 would be necessary to acquire additional fleet (38 buses at an estimated €250,000).

8.3.10 Other construction costs would be incurred in order to achieve the needs of the expanded bus fleet, and to ensure bus operations are not negatively impacted by traffic congestion, namely investment in:

- Extended bus priority over and above that included in the current development plan;
- New bus stop infrastructure;
- Real Time Passenger Information (RTPI);
- Expanded provision of bus information on an ongoing basis; and
- Inflation after May, 2009.

8.3.11 Analysis of each element of bus infrastructure will need further assessment to determine the specific nature of enhanced bus priority, specific improvements to bus stop and ancilliary infrastructure, and associated costs. This would be determined through an upfront facility audit, and through comprehensive performance monitoring (e.g. undertaken on an annual basis) of the bus network, to determine the location and nature of bus priority measures required to ensure that bus speeds and reliability are not undermined by traffic congestion.

8.3.12 An average bus infrastructure cost of €3.1 million/ km has been used as a basis for determining the cost of developing bus infrastructure to support the reconfigured bus network in suburban areas. This figure rises to €9 million/ km in the City Centre.

8.3.13 The average cost per km of implementing the new/ improved bus network used as a basis for the above bus cost estimates, allows for the construction of one 5m wide bus lane, and includes:

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

[3] The requirement for additional buses has been determined on the basis of a modelled bus speed across the network. If these speeds are not achieved on a network wide basis, this will have an impact on the bus fleet requirements (and attractiveness of bus). The additional bus fleet requirement is based on a PVR (peak vehicle requirement) of 32 buses and 6 out of service buses accounting for routine maintenance/ repairs etc.

8.3.14 It has been assumed that 25% of the above construction costs would be incurred across the full network to ensure bus passenger needs are met on a network wide basis. This includes facilities at the stop itself, such as bus shelters, RTPI, etc. and improved stop access for pedestrians (new pedestrian crossings etc.) at bus stops 500m apart on both sides of the road. Where bus priority is required, it is assumed that the full cost of €3.1 million/ km and €9 million/ km for suburban and City Centre areas respectively would be incurred.

8.3.15 When estimating construction development costs for the bus network, we have assumed that improved bus priority measures are applied only within the core City Centre, where there is a frequency of more than 10 buses an hour.

Table 8.2 Bus Preliminary Construction Costs

Item	Description		Cost (€)
1	Bus Priority Improvements	Road Infrastructure Improvements	18,300,000
		Bus Stop Infrastructure Improvements	47,900,000
			66,200,000
2	Rolling Stock	38 number buses assumed	9,500,000
		Total	**75,700,000**

Note: all prices are based at May 2009.

8.3.16 The above BRT cost estimates, include the following:

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

8.3.17 The above rates exclude the following:

- Demolition of major structures;
- Major road junction realignment;
- Land acquisition;
- Legal Costs;
- Planning/ development Costs; and
- Inflation post May 2009.

8.3.18 The construction costs presented in the above tables represent a conservative estimate of bus infrastructure costs. Further detailed assessment will be required to determine the specific infrastructure measures required, and the associated costs.

Estimating Total Capital Costs for BRT / LRT and Bus Networks

8.3.19 NRA Guidance[4] recommends applying assumed additional costs calculated as a percentage of construction cost. These additional costs are defined as 10% of construction cost for land acquisition, 6% for preparation, 5% for supervision, and 4% for miscellaneous costs.

8.3.20 Following these guidelines the total capital costs associated with constructing the BRT, LRT and enhanced bus network were estimated. They are shown in Table 8.3 below. All costs are presented in May 2009 prices.

Table 8.3 Total Capital Costs of BRT / LRT Construction

	BRT Costs (€)	LRT Costs (€)	Bus Costs (€)
Construction	86,000,000	524,000,000	75,700,000
Land Acquisition	11,500,000	69,900,000	0
Preparation	6,900,000	41,900,000	5,300,000
Supervision	5,700,000	34,900,000	4,500,000
Miscellaneous Costs	4,600,000	27,900,000	3,600,000
Total Capital Cost	**114,700,000**	**698,600,000**	**89,100,000**

Note: all prices are based at May 2009.

8.3.21 We have assumed that all increases in bus priority can be incorporated within the existing road network, and so no land acquisition costs will be incurred. The total capital cost of implementing the enhanced bus network could be adjusted should land acquisition be required following the detailed design stage.

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

Cost Benefit Analysis (CBA) Concept

8.3.23 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.

8.3.24 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.

[4] NRA Guidance for CBA 2004

8.3.25 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 [5]:

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

8.3.26 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.

8.3.27 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 [6]. Other factors include:

- Practicality/ deliverability;
- Public acceptability;
- Distributional and equity impacts;
- Affordability and financial sustainability;
- Contribution to central government, local and regional objectives; and
- The amelioration of identified problems.

Scenarios Assessed

8.3.28 An economic appraisal for the Rapid Transit Corridor was undertaken using the TUBA (Transport User Benefit Appraisal) software package. TUBA was developed for the UK Department for Transport, for undertaking transport economic appraisals, primarily those involving variable demand.

8.3.29 Irish input parameters, as detailed in the Cost Benefit Parameters and Application Rules for Transport Project Appraisal Report, were used in undertaking this appraisal. [7]

8.3.30 The economic appraisal was undertaken for two scenarios, to ascertain the economic return from investing in the extensive set of public transport improvements recommended. The scenarios assessed are shown in Table 8.4.

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5 Guidance on Value for Money, January 2006

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

7 Goodbody Economic Consultants, August 2004

Table 8.4 CBA Scenarios Assessed

Scenario	Years
BRT with Enhanced Bus Network including improved Traffic Management arrangements and associated Park & Ride facilities	2020 2030
LRT with Enhanced Bus Network including improved Traffic Management arrangements and associated Park & Ride facilities	2020 2030

8.3.31 The option evaluation section of this Report has indicated that BRT would meet capacity requirements along the Rapid Transit Corridor whilst at the same time achieving a step change in levels of public transport use. It has been subjected to CBA using the Capital costs outlined above. The CBA for an LRT system along the same alignment has also been undertaken for the purposes of comparison.

8.3.32 Model output from the respective 2020 Galway Transport Model scenarios was used in undertaking the CBA in conjunction a second forecast year, for 2030, details for which are outlined above.

8.3.33 Each scenario was compared to the Do-Minimum Scenario, representing committed highway and Suburban Rail improvements, and an enhanced bus network as outlined in the Galway City Council Development Plan 2005-2011.

8.3.34 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, if developed as either BRT or LRT, would have net beneficial economic impacts.

Cost Benefit Analysis Results

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

Table 8.5 CBA Outcome, BRT and LRT

	BRT with Enhanced Bus Network and Traffic Management and Park & Ride	LRT with Enhanced Bus Network and Traffic Management and Park & Ride
Net present Value of Benefits (PVB)[8]	€548,258,000	€548,258,000
Net present Value of Costs (PVC)	€312,471,000	€1,024,050,000
Net present Value (NPV)	€235,787,000	- €475,792,000
Benefit to Cost Ratio (BCR) = (PVB / PVC)	1.755	0.535

[8] PVB is calculated in TUBA and is based on information received from the Multi-Modal Transport Model. This information includes output matrices extracted from the model for each mode of transport (i.e. car, bus, rail, BRT or LRT) for distance, time, number of trips, fares etc.

8.3.36 The results of the CBA indicate that there is an economic case for the development of the Rapid Transit Corridor, as BRT, in the context of future population and employment allocations contained within the Galway City Council Development Plan and the Regional Planning Guidelines for the Western Region. The BCR in this scenario is 1.755, representing medium value for money.

8.3.37 If LRT were to be developed along the corridor the system would deliver poor economic return (BCR = 0.535).

8.3.38 It is therefore evident that either much higher levels of population and employment growth, over and above those currently forecast, would be required to generate additional benefits (tripling the benefit level) to make LRT medium value for money; or' alternatively the cost of the LRT option needs to be significantly reduced for the some benefit, around little more than the BRT alternative.

Cost Benefit Analysis Sensitivity Test

8.3.39 The economic appraisal of the recommended public transport system was undertaken in the context of base year land use data (Census 2006, projected forward to 2009), and future land use data sourced from statuary planning documents (e.g. Regional Planning Guidelines, Galway City and County Development Plans). Future land use data was supplemented by information provided by Galway City and County Councils. As such, the forecast economic return is dependent on future development within Galway City and County. Therefore, a lower rate of development would give rise to a lower economic return. This represents a potential investment risk, as the recommended measures may not be economically justifiable if future development does not progress. This issue is particularly pertinent in the context of the significantly lower rates of development presently being experienced and the possibility of future growth projections not materialising.

8.3.40 In light of the above, a sensitivity test on the economic return of the recommended public transport system in the absence of the Ardaun LAP development was undertaken. Ardaun represents a key designated development area, straddling Galway City and County. It is envisaged that the area would accommodate a residential population of 18,000, and a commercial workforce of 1,625. This area is of interest, not only because of the extent of development envisaged, but also as the recommended rapid transit corridor's alignment would intercept it.

8.3.41 In undertaking the economic appraisal, it is assumed that the Rapid Transit Corridor would terminate adjacent to the N6 at Bothar Na Dtreabh, with the park and ride site positioned to intercept strategic car based trips at this location. This would reduce the construction costs by approximately €20 million, however this cost has not been factored into any of the cost benefit analyses undertaken, as it is assumed to be raised through developer contributions, and not therefore a publicly incurred cost.

8.3.42 The findings of this sensitivity test indicate a BCR of 1.525, i.e. a medium economic return. As such, the development of the Rapid Transit Corridor as Bus Rapid Transit (BRT) from Ballymoon to N6/ Bothar Na Dtreabh, via the City Centre is deemed to deliver a medium economic return, which would be strengthened by further development along its length.

8.4 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

8.4.1 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 (CO_2), methane (CH_4) and nitrous oxide (N_2O). 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 [9] indicates a 46.6% (excluding international al aviation) overall growth in CO_2 emissions over the period from 1990 to 2007. The most recent trends for the period between 2007 indicate a reduction in CO_2 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.
- 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 CO_2 emissions outputs.
- The following table provides output from the GTM multi-modal transport model in relation to general traffic related pollutants in the full Galway Model area. This has been undertaken in the context of 2020 GTM Update population/ employment allocations for the full study area, using available emissions outputs from Saturn component of the model for the Do minimum Scenario and the preferred scenario (BRT, enhanced bus, City Centre Traffic Management Plan and Park & Ride). The outputs within this table are intended only to give a guide as to the comparative emissions levels in both the Do Minimum and preferred scenarios.

[9] Energy in Ireland 1990 – 2007, 2008 Report published by Sustainable Energy Ireland

Table 8.6 General Traffic Related Environmental Pollutants (for 08:00 to 09:00hrs Time Period)

Environmental Pollutant	Do-Minimum	Preferred Scenario	% Change
CO_2 (kg)	13,385	12,366	8%
CO (kg)	1,300	1,198	8%
NO_X (kg)	307	288	6%
HC (kg)	234	216	8%
PB (kg)	1.31	1.22	7%
PM_{10} (kg)	1.31	1.22	7%

Ambient Air Quality Impacts

8.4.2 The primary sources of key environmental emissions namely NO_2, PM_{10}, 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 PM_{10} only.

8.4.3 As can be seen from this table, the Strategy performs positively in terms of improving local ambient air quality. For CO, an 8% reduction in emissions values is forecast, and for PM_{10} a 7% 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 6-8%.

National Emissions Impacts

8.4.4 The key environmental emission type for which output limits have been set through international agreements is CO_2. The full implementation of the preferred strategy will give rise to an 8% reduction in CO_2 emissions. This equates to an annual reduction of 6,118 tonnes and represents a significant decrease in transport related CO_2 emissions. Such a reduction will have a significant role to play in the achievement of reduced emissions at a national level.

8.5 Summary of Galway Strategy Appraisal

Detailed Appraisal against Study Objectives

8.5.1 The Recommended 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.

8.5.2 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 Recommended Strategy Implementation

8.5.3 The recommended reconfiguration of bus network and expansion of the bus fleet is estimated to cost approximately €89 million.

8.5.4 The capital cost estimates associated with the implementation of the Rapid Transit Corridor, as either BRT or LRT are:

- BRT system implementation = **€115** million, and
- LRT system implementation = **€699** million.

8.5.5 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 = **€204** million, and
- Overall cost, LRT + Bus = **€788** million.

8.5.6 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 **€584** million, compared to those associated with LRT implementation.

Economic Appraisal

8.5.7 The Benefit to Cost Ratio (BCR) for BRT from Ballyburke to Ardaun, via the City Centre in the scenario is **1.755**, representing medium value for money. Should a greater portion of future development in the City be located along the length of the Corridor, this would improve the economic return from investing in BRT.

8.5.8 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 Galway City Council Development Plan (BCR = 0.535). This low BCR results from the higher capital cost of LRT with no compensating gain in benefit.

8.5.9 Significantly higher levels of population and employment growth, over and above those forecast for the Galway 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 Galway area. This would give volumes in the corridor commensurate with the capacity provided by LRT.

Environmental Appraisal

8.5.10 The Strategy performs very positively in terms of reduced environmental general traffic related pollutants. For CO_2, there would be an 8% reduction in emissions following implementation of the CATS Strategy. This equates to an annual reduction of 6,118 tonnes and represents a significant reduction in transport related CO_2 emissions. Such a reduction will have a significant role to play in the achievement of reduced emissions at a national level.

8.5.11 Recommended public transport interventions 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, an 8% reduction in emissions values is forecast, and for PM_{10} a 7% reduction is forecast.

Conclusion

8.5.12 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 €700 million for LRT, compared to €115 million for BRT). As a result, if the Rapid Transit Corridor was developed as LRT, this would be a 'poor' value for money economic return from the investment. If, however, BRT is implemented along the Rapid Transit Corridor, there will be a medium value for money return.

9 Outline Engineering Feasibility

9.1 Introduction

9.1.1 An outline engineering feasibility assessment of the Rapid Transit Corridor from Cappagh to Garraun South 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 traffic management arrangements during the operational phase, 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.

9.1.2 The option evaluation section of this Report has indicated that BRT represents the best solution along the Rapid Transit Corridor in the context of employment allocations up to 2020, and subsequent assumed growth of the study area between the base year and 2030. As a result, an assessment of the outline engineering feasibility of the corridor was undertaken. Further consideration is given to the attributes of LRT and 'Light Touch LRT', given that these solutions have been proposed as being best suited to the needs of Galway.

9.2 Appraising BRT and LRT as Options for Galway

9.2.1 Detailed consideration has been given to the comparative attributes of both BRT and LRT systems. 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. As a result, LRT would deliver much lower value for money return than the equivalent investment in BRT.

9.2.2 The text below provides information on the characteristics of both systems, with a view to determining the most appropriate system for Galway.

9.3 System Characteristics – BRT and LRT

9.3.1 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).

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

Figure 9.1 Typical system characteristics, BRT (Nantes)

Figure 9.2 Typical system characteristics, LRT (Dublin)

9.4 Bus Rapid Transit – System Characteristics

System Attributes

9.4.1 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

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

- Vehicle type; and
- Frequency.

Vehicle Type

9.4.3 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.

9.4.4 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

9.4.5 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

9.4.6 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 overleaf

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

9.5 Light Rail Transit – System Characteristics

9.5.1 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.

9.5.2 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 (> €524 million compared to > €86 million for BRT).

Examples of Existing LRT Systems

9.5.3 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

9.6 Light Touch LRT

9.6.1 The proposed Gluas system falls into the 'Light Touch LRT' category, and it is claimed to have the following attributes:

- New technology Rail Installations involving less excavation of the road surface, approximately 300mm;
- Less road disruption during installation;
- Trams weigh approximately 22 tons; more common trams exceed 30 tons;
- Installation costs to be retained at €210m maximum – for 21 KVA (Kilo Volt Ampre) service over two lines; and
- The Gluas system, as proposed, would involve the installation of own renewable power generation facilities locally to supply power (and also sell surplus to the grid).

9.6.2 A short section of the LR55 track proposed for GLUAS has been laid on the Sheffield Supertram. To date, the light touch LRT has not been widely tested or used, and as such would represent a high risk strategy for addressing Galway City's public transport deficiencies.

9.7 Summary System Recommendation

9.7.1 In the context of Galway, BRT is considered to represent the best solution to the transport demands along the east-west corridor from Ballymoneen to Garraun South 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 on the basis of forecast future transport demands;
- Future land use projections indicate a spatial planning strategy into Ardaun east of the city. BRT represents the most appropriate system that allows the implementation of a strong sustainable transport corridor supported by traffic management measures, whilst giving some flexibility for allocation of development to be designed to align its future extension;
- Whilst additional development along the Rapid Transit Corridor is recommended if the system is developed as BRT, developing the system as LRT would be a higher risk strategy, as its operational success would be dependent on massive future development/ redevelopment along the corridor;
- Current demand management measures in place in the City, namely the extensive provision of private non-residential car parking facilitates a very high car mode share throughout the City. It would be significantly more onerous to reduce the levels of parking provision to levels supportive of LRT;
- 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 2019 at the earliest (BRT could be implemented by as early as late as 2015). Furthermore, opportunities to locate additional public transport oriented development along the corridor would be undermined by such a lengthy timeline for delivery;
- The alignment through the centre of Galway would incur some tight manoeuvrings and potentially require bridge widening/ construction and property acquisition or demolition;

- The capital costs of implementing BRT are significantly lower, at approximately 80% less than the cost of a full LRT or 60% less than the Light Touch LRT alternative (without accounting for the higher risk of the Light Touch LRT alternative). 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 €520+ million implementation costs for LRT would indicate that funding for LRT would not likely be secured until post 2015; thus supporting the view that 2019 would be the earliest possible implementation date;
- As a result of the lower capital implementation costs, the economic return of investing in BRT plus enhanced bus network is substantially stronger than for LRT**;** 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.

9.7.2 In light of the above issues, the implementation of BRT, in conjunction with an enhanced bus network, is considered to represent the most appropriate solution to the existing and future transport needs of Galway City.

9.8 Typical Cross Sections for BRT

9.8.1 As essential step in determining the feasibility of implementing BRT or LRT is to understand the typical cross section applying in different circumstances. The typical cross sections of each BRT alignment are illustrated on the following figures. The typical cross sections have been developed, taking cognisance of the needs of all road users, including cyclists

Figure 9.3 BRT Typical Cross Sections

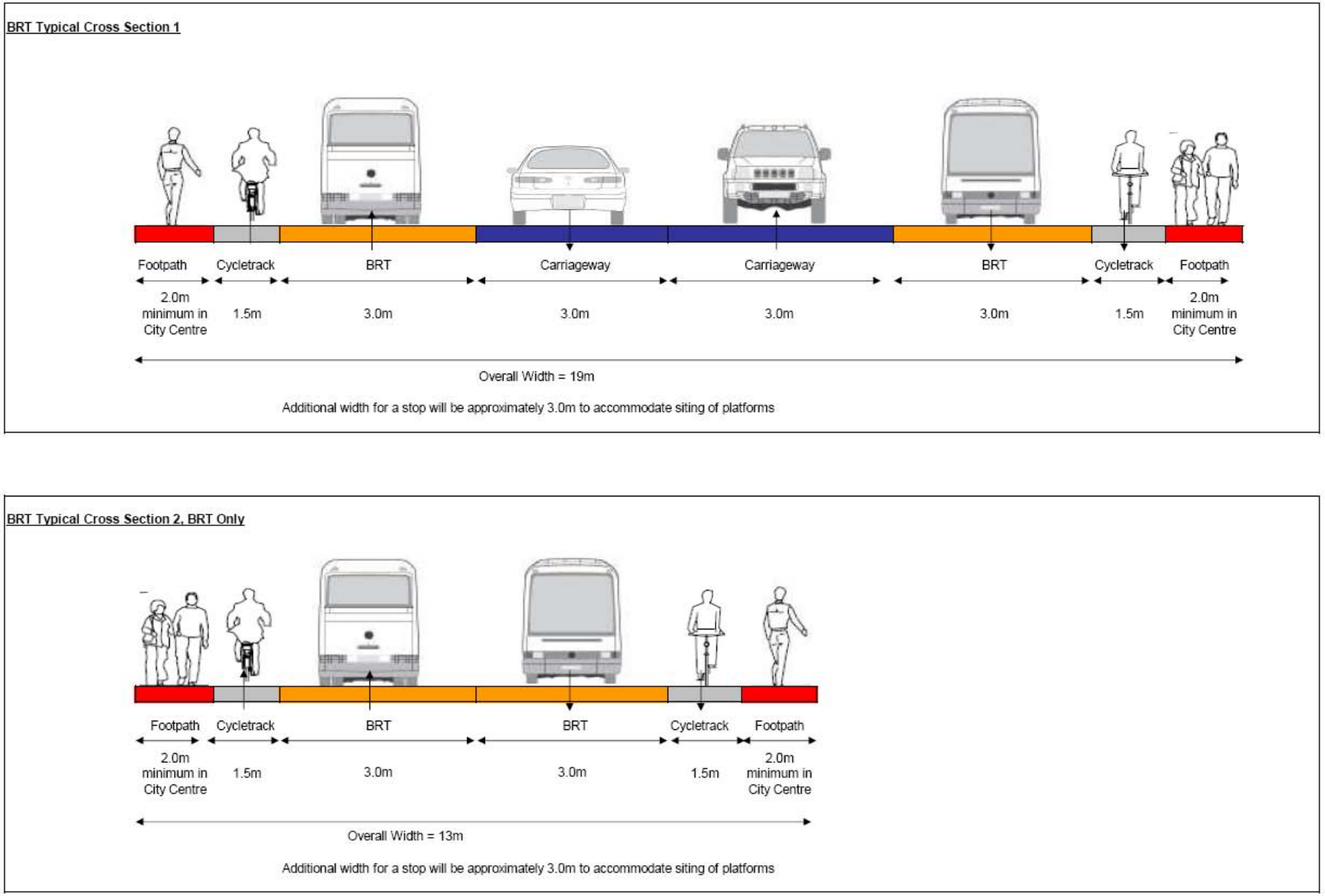
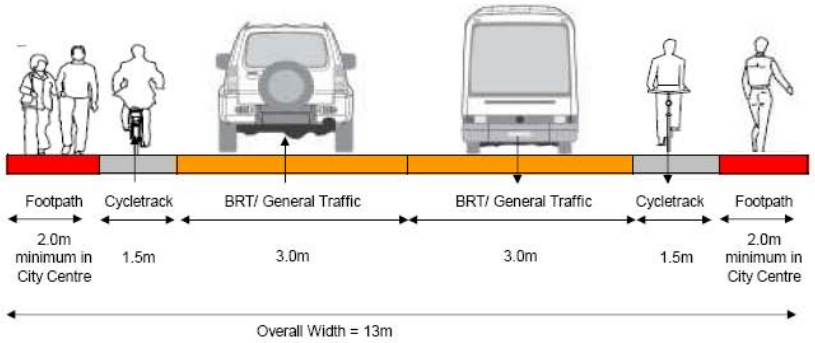


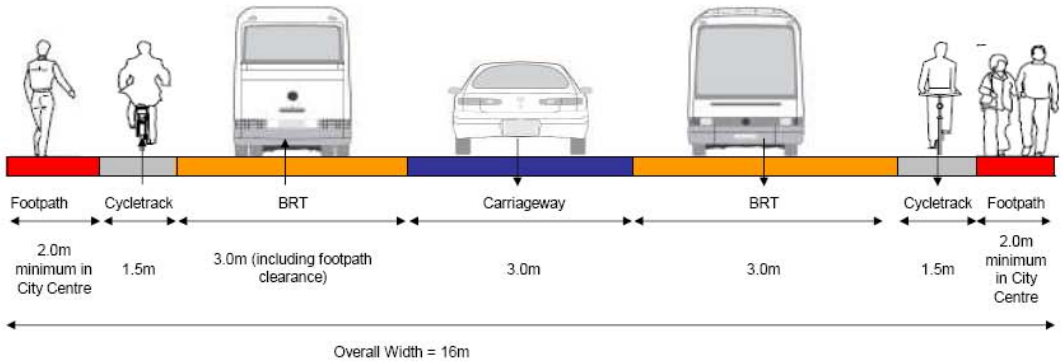
Figure 9.3,Continued BRT Typical Cross Sections

BRT Typical Cross Section 3, Shared BRT and local access traffic



Additional width for a stop will be approximately 3.0m to accommodate siting of platforms

BRT Typical Cross Section 4, Segregated BRT and one-way general traffic



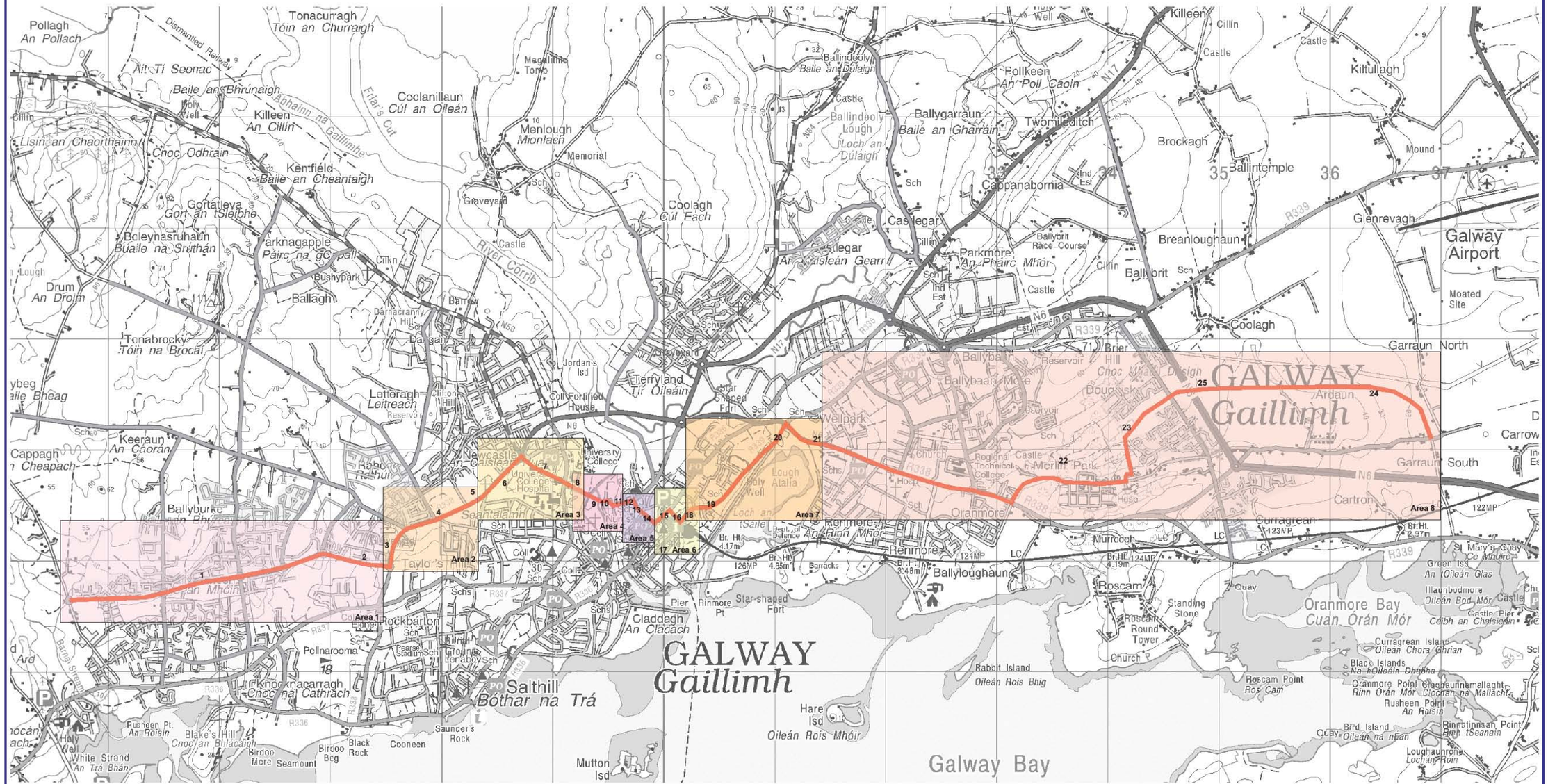
Additional width for a stop will be approximately 3.0m to accommodate siting of platforms

9.8.2 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.

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

9.9.1 Figures 9.4 to 9.12 below illustrate the likely traffic management restrictions and land take requirements to cater for the introduction of the Rapid Transit Corridor.

Figure 9.4 Rapid Transit Corridor Areas



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Title: Rapid Transit Corridor Areas

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Figure 9.5 Area 1 – Western Distributor Road

Area 1 - Western Distributor Road

Area 1 - Western Distributor Road

Section Number	Name of Road/ Section	Existing Road Type	Future Road Type	Rapid Transit Cross Section Type	Traffic Management Requirements	Land Take Requirements	Photo Ref.
1	Western Distributor Road, between Bóthar Na Ceapaí and Gort na Bró Roundabouts.	Wide single lane carriageway with on-road cycle lanes. Wide grass verge along much of the route.	2 rapid transit lanes sharing with local traffic, plus cycle lanes.	Cross Section 3. Potential long term need for segregated rapid transit priority (Cross Section 1) subject to on-going monitoring of system performance.	No specific rapid transit priority measures needed in the short to medium term, however with implementation of P&R, it will be important that this is monitored. Signalised junctions should be considered if traffic increases, especially on minor roads.	None, unless future need to upgrade to Cross Section 1.	1.1 - 1.7
2	Western Distributor Road, between Gort na Bró and Deane Roundabouts.	Wide single lane carriageway with on-road cycle lanes. Deane Roundabout is a 5 arm roundabout with 2 lane approaches on all arms except Cuan Glas.	2 rapid transit lanes, 2 general traffic lanes, 2 cycle lanes.	Cross Section 1.	Signalised junction giving rapid transit priority - may be more efficient to remove Fort Lorenzo arm. Replace with access onto Bishop O'Donnell Rd south of junction, at Carraig Ard.	None.	1.8 - 1.10

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Title
Area 1 - Western Distributor Road

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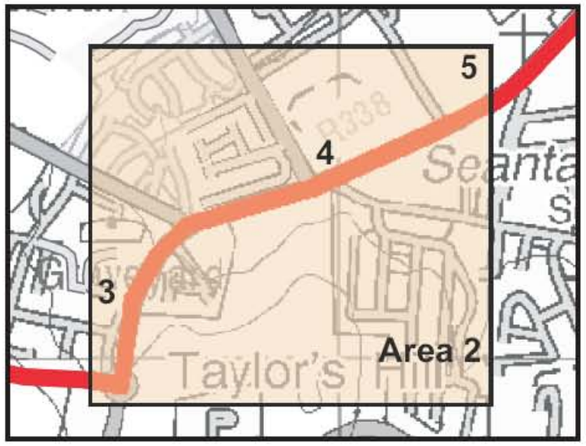
Figure 9.6 Area 2 –Bishop O'Donnell Road

Area 2 - Bishop O'Donnell Road



Area 2 - Bishop O'Donnell Road

Section Number	Name of Road/ Section	Existing Road Type	Future Road Type	Rapid Transit Cross Section Type	Traffic Management Requirements	Land Take Requirements	Photo Ref.
3	Bishop O'Donnell Rd between Deane Roundabout & Rahoon Rd Junction.	2 general traffic lanes in each direction. Carriageway approx 8.5m inclusive of right turn lanes.	2 rapid transit lanes, 2 general traffic lanes, 2 cycle lanes.	Cross Section 1.	Signalise junctions giving rapid transit priority.	Removal of grass verges along this road. Need for land take adjacent to apartments at Dun Aras.	2.1 - 2.2
4	Bishop O'Donnell Rd between Rahoon Rd and Bothar Le Cheile Junctions.	Single lane carriageway approx 8.5m wide including right turn lanes. 7m grass verge to west of road.	2 rapid transit lanes, 2 general traffic lanes, 2 cycle lanes.	Cross Section 1.	Signalise junctions giving rapid transit priority.	Removal of grass verge and 2-3m of GAA grounds.	2.3 - 2.4
5	Seamus Quirke Rd.	Carriageway circa 9m wide, with right turn lanes. 7m grass verge to west of road.	2 rapid transit lanes, 2 general traffic lanes, 2 cycle lanes.	Cross Section 1.	Signalise junctions giving rapid transit priority.	Removal of grass verge to west of Road.	2.5 - 2.11

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Title
Area 2 - Bishop O'Donnell Road

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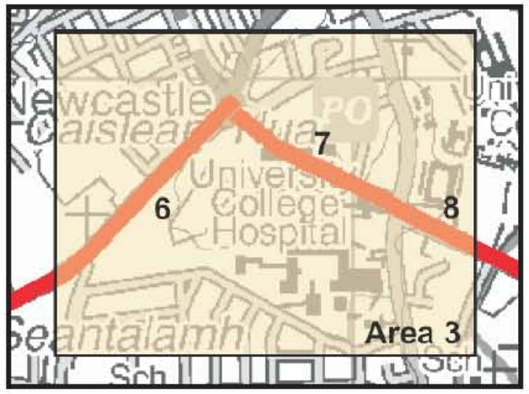
Figure 9.7 Area 3 – Hospital to University

Area 3 - Hospital and University



Area 3 - Hospital and University

Section Number	Name of Road/ Section	Existing Road Type	Future Road Type	Rapid Transit Cross Section Type	Traffic Management Requirements	Land Take Requirements	Photo Ref.
6	Seamus Quirke Rd (approx 200m in advance of Browne Roundabout).	Carriageway circa 9 m wide. 7m grass verge west of c/way.	2 rapid transit lanes, 2 general traffic lanes, 2 cycle lanes.	Cross Section 1.	Rapid transit (also emergency vehicle) access at new signalised junction approximately 200m to south of Browne Roundabout providing right turn into hospital. Traffic signalisation at Browne's Roundabout can be considered at detailed design stage.		3.1 - 3.3
7	UCG Hospital.	Carriageway c 5.5m wide.	2 rapid transit lanes sharing with local traffic, plus cycle lanes.	Cross Section 3 (local access only).	Consultation required with hospital in context of proposed hospital ring plan. Recommended: no through route between Seamus Quirke Rd and Newcastle Rd. Rapid transit / emergency vehicle only hospital access/egress at University Rd Junction. Visitor and staff entrance from Browne Roundabout or from a new access point on pathway entrance from Newcastle Rd approximately 70m south of University Rd Junction (south of car park).	Approximate 20m wide section of green field adjoining hospital. Some loss/ relocation of car parking spaces to accommodate rapid transit alignment.	3.4
8	University Rd to Canal Rd Upper.	Carriageway circa 10.5 m wide (including turning lanes). Approx 15 residential parking spaces on residential side of street. 7m grass verge west of c/way. 2 priority accesses to University.	2 rapid transit lanes sharing with local traffic, plus cycle lanes.	Cross Section 3.	None required. Note that with closure of Salmon Weir Bridge (as recommended), University Rd to Canal Rd Upper will be used for local access only. The University entrances will remain open with access retained from the north and south on Newcastle Road. Traffic which would have used Salmon Weir Bridge will re-route.	None.	3.5 - 3.6

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Title: Area 3 - Hospital and University

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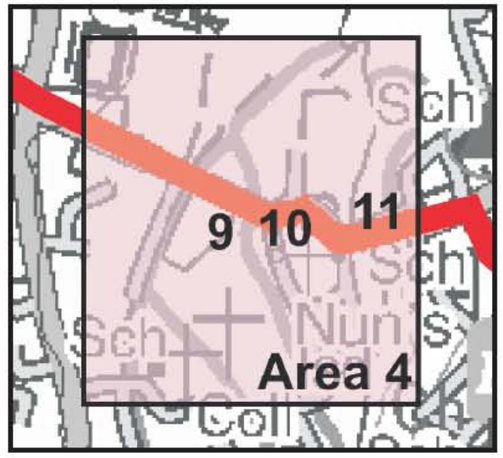
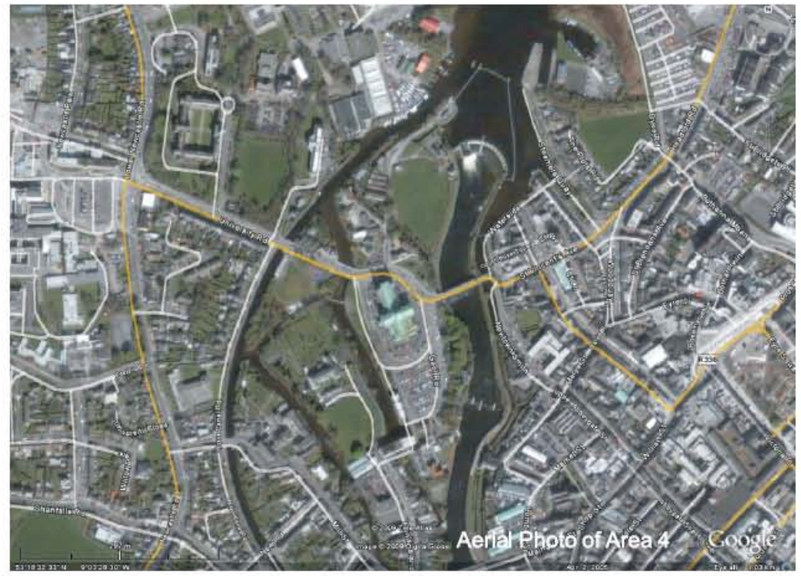
Figure 9.8 Area 4 – Nun's Island

Area 4 - Nun's Island





Area 4 - Nun's Island							
Section Number	Name of Road/ Section	Existing Road Type	Future Road Type	Rapid Transit Cross Section Type	Traffic Management Requirements	Land Take Requirements	Photo Ref.
9	University Road between Canal Rd Upper and Gaol Rd.	Single lane carriageway with turning lanes, C. 8.5m.	2 rapid transit lanes sharing with local traffic, plus cycle lanes.	Cross Section 3.	None required.	None.	4.1 - 4.2
10	University Rd between Gaol Rd and Salmon Weir Bridge.	Single lane carriageway with turning lanes, C. 9m.	2 rapid transit lanes sharing with local traffic, plus cycle lanes.	Cross Section 3.	None required. BRT alignment does not have to conflict with bus termini, however the study would support a review of potential bus terminal locations and the general reduction in city centre traffic would support retention of cross city centre bus route, so that the need for the Cathedral terminus should be revisited.	None.	4.3
11	Salmon Weir Bridge.	Carriageway circa 6m wide, with tight turning circles at either end of bridge. Narrow footpaths approximately 1.2 - 1.5m wide.	Public transport, walking and cycling priority facilitating all bus services. Detailed planning/ design will assess need for specific traffic management arrangements, including general traffic restrictions.	Cross Section 2 (one lane only).	Need for specific traffic management changes to be assessed in more detail, as part of BRT planning/ design. Traffic management also required to safeguard pedestrian and cyclists (based on observation that current situation entails a level of risk to cyclists and oncoming large vehicles).	None.	4.4

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Title: Area 4 - Nun's Island

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Figure 9.9 Area 5 – St. Vincent's Avenue to Eyre Square

Area 5 - St. Vincents Avenue to Eyre Square

Area 5 - St. Vincents Avenue to Eyre Square

Section Number	Name of Road/ Section	Existing Road Type	Future Road Type	Rapid Transit Cross Section Type	Traffic Management Requirements	Land Take Requirements	Photo Ref.
12	St Vincent's Ave to St Francis St	Single lane carriageway way c. 8.5m wide.	2 rapid transit lanes sharing with local traffic, plus cycle lanes.	Cross Section 3.	Some traffic management measures may be required: the balance of what is reqd will be influenced by the extent of traffic management measures that are put in place at Salmon Weir Bridge.	None.	5.1 - 5.2
13	St Francis St	Single lane carriageway way c. 7m wide.	2 rapid transit lanes sharing with local traffic and cyclists.	Cross Section 3.	Introduce clearways to control significant illegal parking observed. Manage school drop off/pick up (e.g. school travel plan), potential existing safety risk also observed. Increase enforcement.	None.	
14	Eglington St	Single lane carriageway way c. 7m wide plus loading bays on eastern side of street.	2 rapid transit lanes sharing with local traffic and cyclists.	Cross Section 3.	Review of kerbside activities, and strict enforcement of unauthorised parking/ loading activities. Restricted road width at junction of Eglington Street and Williamsgate requiring signalisation of the junction.	None.	5.3 - 5.6

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Title
Area 5 - St. Vincents Avenue to Eyre Square

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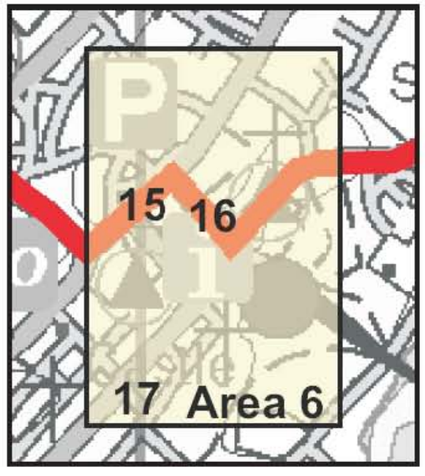
Figure 9.10 **Area 6 – Eyre Square**

Area 6 - Eyre Square

Area 6 - Eyre Square

Section Number	Name of Road/section	Existing Road Type	Future Road Type	Rapid Transit Cross Section Type	Traffic Management Requirements	Land Take Requirements	Photo Ref.
15	Williamsgate St and Eyre Square North to Prospect Hill	Two way traffic. Carriageway c. 7m. Bus bays along lengths of Eyre Sq North.	2 rapid transit lanes sharing with other local bus services, traffic and cyclists. Bus stop/ taxi bay provision to be incorporated into future alignment subject to detailed design of BRT.	Cross Section 3.	Traffic management measure requirement (if any) will be influenced by those in place at Salmon Weir Bridge and Merchants Road/ Victoria Place. Traffic management priorities and balance of measures across town centre should be agreed and determined at detailed design stage.	None.	6.1 - 6.2
16	Eyre Square East	2 Lanes northbound: 1 left turn, 1 right turn. Loading and taxi bays on eastern side of street. Bus bays on Eyre Sq/western side of street.	2 rapid transit lanes sharing with other bus services, cyclists and local northbound traffic. BRT/bus shared space and central BRT/bus stop will support facilitation of bus and BRT co-existence. Area priority with balance of traffic management measures and time restrictions applied to loading to be reviewed in detailed design.	Cross Section 3 (general traffic northbound only).	2 way Bus and rapid transit sharing with local access northbound traffic (1 lane), and cyclists.	None.	6.3 - 6.5
17	Merchants Road/ Queen Street/ Forthill Street	Merchants Road one-way eastbound, Queen Street one-way westbound, Forthill Street provides a southbound link between both streets.	Subject to detailed planning/ design, with the aim of reducing through traffic movements in both directions. This is required to reduce traffic volumes, and delay on Eyre Square.		Restrict straight ahead movements on Merchants Road and Queen Street at Forthill Street. The mechanism for achieving this restriction will be determined following further planning/ design.	None.	



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Title
Area 6 - Eyre Square

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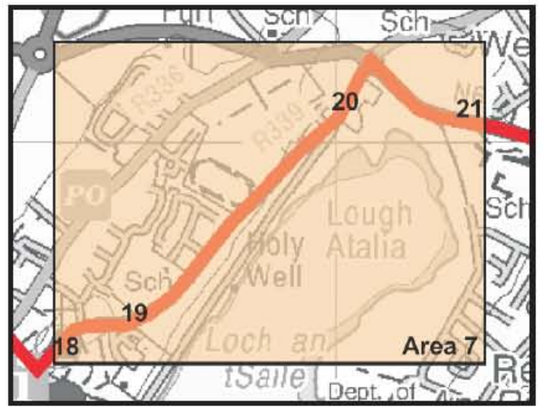
Figure 9.11 **Area 7 – College Road**

Area 7 - College Road

Area 7 - College Road							
Section Number	**Name of Road/section**	**Existing Road Type**	**Future Road Type**	**Rapid Transit Cross Section Type**	**Traffic Management Requirements**	**Land Take Requirements**	**Photo Ref.**
18	Forster St	Carriageway approximately 8 - 9m kerb to kerb: one way system (westbound) with taxi parking from Eyre Sq spilling back onto Forster St resulting in significant queuing. Illegal parking observed.	2 rapid transit lanes sharing with local traffic and cyclists.	Cross Section 3 (local access only).	No specific traffic management measures required: facilitated by closure of Salmon Weir Bridge and Merchants Road/ Victoria Place to through traffic. 2 way Bus and rapid transit sharing with local access traffic and cyclists subject to detailed design.	None.	
19	College Rd, between Forster Street and Lough Atalia Road	Carriageway varies in width from approximately 7m to 10.5m, with on-street car parking on wider sections of the road.	2 rapid transit lanes sharing with local traffic and cyclists.	Cross Section 3 (local access only).	Local access restrictions implemented to limit through traffic movements, and eliminate delays to public transport vehicles.	None.	7.1 - 7.3
20	College Rd, between Lough Atalia Road and Dublin Road	Carriageway approximately 9m wide, with two lanes westbound and one eastbound adjacent to Lough Atalia Road and two lanes eastbound plus one westbound adjacent to Moneenageisha Cross.	Eastbound: one rapid transit lane plus one general traffic lane. Westbound: As at present.	Cross Section 3 with rapid transit priority in eastbound direction only.	Rapid transit priority through junctions at either end of road. Resultant traffic impact assessment on Lough Atalia Road is recommended.	Approximately 3-4m of land required from front gardens of houses adjoining road (between Loyola Park and Gleann Noinin).	
21	Dublin Road between Moneenageisha Cross and Merlin Hospital	Carriageway approximately 10.5 -11m wide, flaring out adjacent to Moneenageisha Cross. Eastbound bus priority in place between Moneeageisha and Renmore Road. Westbound bus priority in place between Doughiska and Renmore Road.	2 rapid transit lanes, 2 general traffic lanes, 2 cycle lanes.	Cross Section 1.	Provide rapid transit priority through junctions.	Localised land acquisition (up to approximately 5m) required along sections of the road to give proper priority. A signalised alternative is an alternative option that might be considered in detailed design.	7.4-7.5



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Area 7 - College Road

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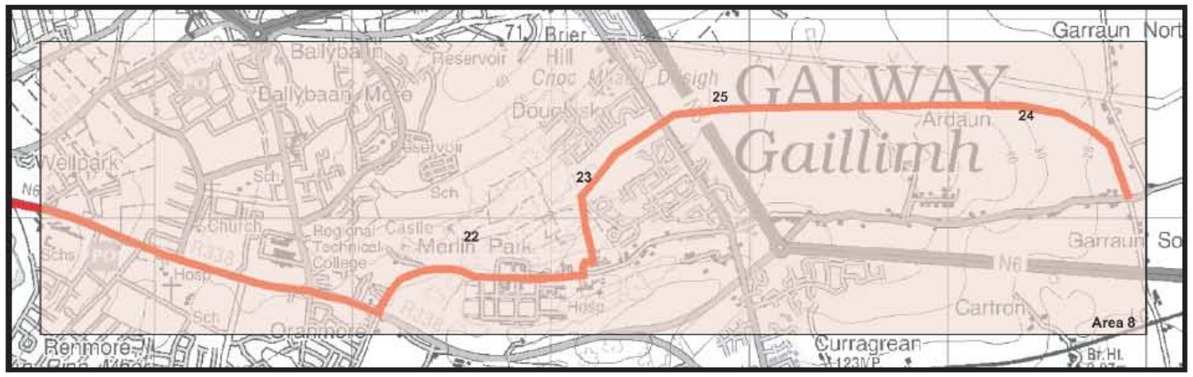
Figure 9.12 Area 8 – Dublin Road Entrance to Merlin Park

Area 8 - Dublin Road Entrance at Merlin Park



Area 8 - Dublin Road Entrance at Merlin Park

Section Number	Name of Road/section	Existing Road Type	Future Road Type	Rapid Transit Cross Section Type	Traffic Management Requirements	Land Take Requirements	Photo Ref.
22	Merlin Hospital	Single lane carriageway - local access road.	2 rapid transit lanes sharing with general traffic, plus cycle lanes.	Cross Section 3.	None. This route is suggested to link the hospital to the BRT alignment but an alternative suggested route north of the hospital is a feasible alternative	None.	8.1
23	North of Merlin Hospital	Greenfield.	Introduce rapid transit route north along eastern perimeter of Merlin Park Wood and cut through land just north of Túr Uisce development and across Doughiska Road and Bothar Na Dtreabth (N6). Alternative route is through Merlin Park Wood.	Cross Section 2.	None.	Section of green field north of Merlin Park Wood and Tur Uisce development.	
24	Ardaun	Greenfield.	Develop rapid transit line alongside new development access roads, running through centre.	Cross Section 1 (alongside future development access roads).	Provide rapid transit priority at any future junctions.	Section of green field within new development.	
25	Ardaun Park and Ride Site	Greenfield.	Provide strategic Park and Ride site adjacent to where proposed N6 joins perpendicularly with Bothar Na Dtreabth (N6).	Cross Section 1.	Provide rapid transit priority access to P&R site.	Greenfield for P&R site.	

Galway PT Feasibility Study

Prepared for Galway City Council
May 2009

Title
Area 8 - Dublin Road Entrance at Merlin Park

Project No.	Figure	Scale	
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9.10 Summary: Engineering Feasibility

9.10.1 In summary, the outline engineering feasibility review has concluded that it will be possible to implement the BRT Corridor linking Ballybaun to Garraun South, via the City Centre. However, the following generic infrastructural and traffic management interventions will be required:

- Some utility and service diversions (desirable in some areas but not essential and extensive as in case of LRT);
- Road construction / widening;
- Land take;
- Traffic signal and junction reconfiguration to prioritise Rapid Transit movement;
- Re-allocation of roadspace; 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.

10 Implementation

10.1 Introduction

10.1.1 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 traffic management and other travel demand management measures requiring significant targeted up-front investment are prioritised 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 in the short to medium term.

10.1.2 It is also crucial that public transport capacity is increased in the short term to coincide with the introduction of recommended traffic management measures in the City Centre. There is a compelling need to enhance the bus network and services along the east-west corridor through the City, to grow public transport use in the short term along the BRT corridor. A further related priority is the improvement of public transport connections between residential areas in the West of the City and employment/ retail areas in the north-east.

10.1.3 Planning for key future public transport related improvements, whether they are directly related to the network itself, or supportive demand management measures, need to commence in the short term to ensure the timely delivery of those measures with medium to long lead in times, e.g. BRT, improved bus priority.

10.1.4 A critical additional issue ensuring the effective implementation of the strategy for Galway is coordinating the multi-agency project within an evolving regulatory and institutional framework.

10.1.5 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 (Western Rail etc).

10.1.6 Implementing change of the order recommended in this Report, is not easy. However, Galway is not alone among European cities in implementing a BRT system. Two current examples from the UK where BRT systems are in the latter stages of planning/ implementation are Cambridge and Luton. The Cambridge system is scheduled to open in November 2009. In the case of Luton, final business case approval is scheduled for late 2009/ early 2010. In both cities, the local authority has powers to construct a BRT system consisting of on-street traffic management, and off-route dedicated roadway. Planning/ design for BRT systems in both cities has progressed via implementation teams consisting of local authority staff and consultants (as programme managers, designers and overall designers). Phase 1 of the Nottingham Tram has also been implemented by the local authority, with funding having recently been granted for phase 2.

10.2 Institutional Arrangements

10.2.1 In the past the bus route licensing system has been a barrier to managing system wide change in the bus market. In November 2009, the Public Transport Regulation Act 2009 was passed into legislation. The Act brought about the creation of the National Transport Authority (NTA) and assigned it the remit of overseeing the regulation of competition in the provision of licensed public bus passenger services at a national level.

10.2.2 It will be a principal function of the NTA to secure the provision of public passenger transport services and to licence public bus passenger services that are not subject to a public transport services contract. Non-commercial bus services that require ongoing subvention will be provided under open tender public services contracts. The NTA will be obliged to consult with the local authorities in relation to future public service obligation contracts.

10.2.3 In the near future, a new regulatory regime will be introduced for the licensing of commercial bus operations which will apply to all services including Bus Éireann. The new regulations will be supported by a system of penalties which can be applied by the NTA to address poor performance and revoke licenses where necessary. The NTA is currently preparing guidelines outlining the new regulatory system operation and it is anticipated that the guidelines will be published by mid 2010. Once the guidelines are adopted by Oireachtas and published, the current licensing arrangements will be transferred from the Department of Transport to the NTA.

10.2.4 The Public Transport Regulation Act will deliver change in the management and control of bus route licensing that will address many of the historical difficulties. Under the NTA, it is hoped that it will be possible to take forward some of the more radical proposals in this strategy.

10.2.5 To bring about the successful realisation of this strategy, one of two approaches must be adopted, either:

- a network owned and operated as a public service by an integrated group of companies, or
- a network planned and marketed by the NTA in conjunction with a public local authority and then operated under one or more tenders by the private sector.

10.2.6 Given the remit of the NTA it may be more appropriate to adopt the latter approach wherein the planning and licensing of the strategy components is overseen by the NTA. Should this approach be implemented, the NTA will be responsible for securing the provision of the improved public transport services in Galway.

10.2.7 The broad ranging recommendations contained within this Report, and the complex multi-agency nature of the measures contained therein, will require a higher level of co-ordination between the various transport agencies that include the NTA, Galway City and County Councils, service providers, An Garda Siochána etc in the study area than that which has existed up to now. As a result, a formalisation of the relationships between key agencies is considered an imperative to the timely and efficient delivery and success of the Strategy.

10.2.8 A Programme Board could strengthen existing arrangements as they relate to transport, planning and facilitation of the strategy implementation. A Programme Board could report to the NTA, and might consist of:

- An independent Chairman, with responsibility for delivering the strategy, and reporting directly to the NTA;
- Senior officials representing Galway City, Galway County, Bus Éireann, Iarnród Éireann, other relevant service providers, An Garda Siochána, DoT and other interested parties as nominated by the NTA and/or the Galway Transport Unit (e.g. relevant members of the Integrated Transportation Coordinating Group and Strategic Policy Committee); and
- A Programme Manager.

10.2.9 If the implementation of the abovementioned institutional changes are delayed, it will likely result in delays in the planning process, additional costs, and a diminution of the overall benefits of public transport. If this is deemed likely, then a joint agreement between key stakeholders, including Bus Eireann and private operators must be sought with a view to facilitating speedy decision making by the Department of Transport and/or the National Transport Authority. This is of utmost importance in the short term in relation to bus route licensing.

10.3 Essential Supporting Processes

10.3.1 To support the implementation and success of the strategy proposed here, it is essential that the following issues are addressed by the programme board:

- The integration of land use and transport plans, through co-ordination of Galway City and County Councils, bus and rail operators and An Gardai Siochana;
- 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/area based Travel Planning (notably University and University Hospital and Ballybrit), School Travel Planning and Personalised Travel Planning; and
- The development of a Communications Strategy.

10.4 Phasing

10.4.1 The proposed strategy is intended to provide a roadmap for the delivery of a radically enhanced public transport network for Galway City. 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.

10.4.2 The key aspects of this phasing strategy are:

- Planning for the delivery of the proposed strategy, and the supporting institutional arrangements needs to commence immediately to ensure the timely delivery of public transport improvements;
- The introduction of a BRT corridor from Ballymoneen to Garraun South, via the City Centre, which would be introduced in two phases as follows:
  - Phase 1, from Ballymoneen to Merlin Park Hospital, via the Galway Regional Hospital, NUI Galway, and the City Centre; and
  - Phase 2, from Merlin Park Hospital to Ardaun.
- To accommodate future passenger demand along the BRT corridor, articulated (18m) buses are deemed most appropriate. Buses need to be of high specification:
  - multi-door and low floor for speedy boarding/ alighting and to improve accessibility;

- high seating ratio; and
- on board audio/ visual passenger information.

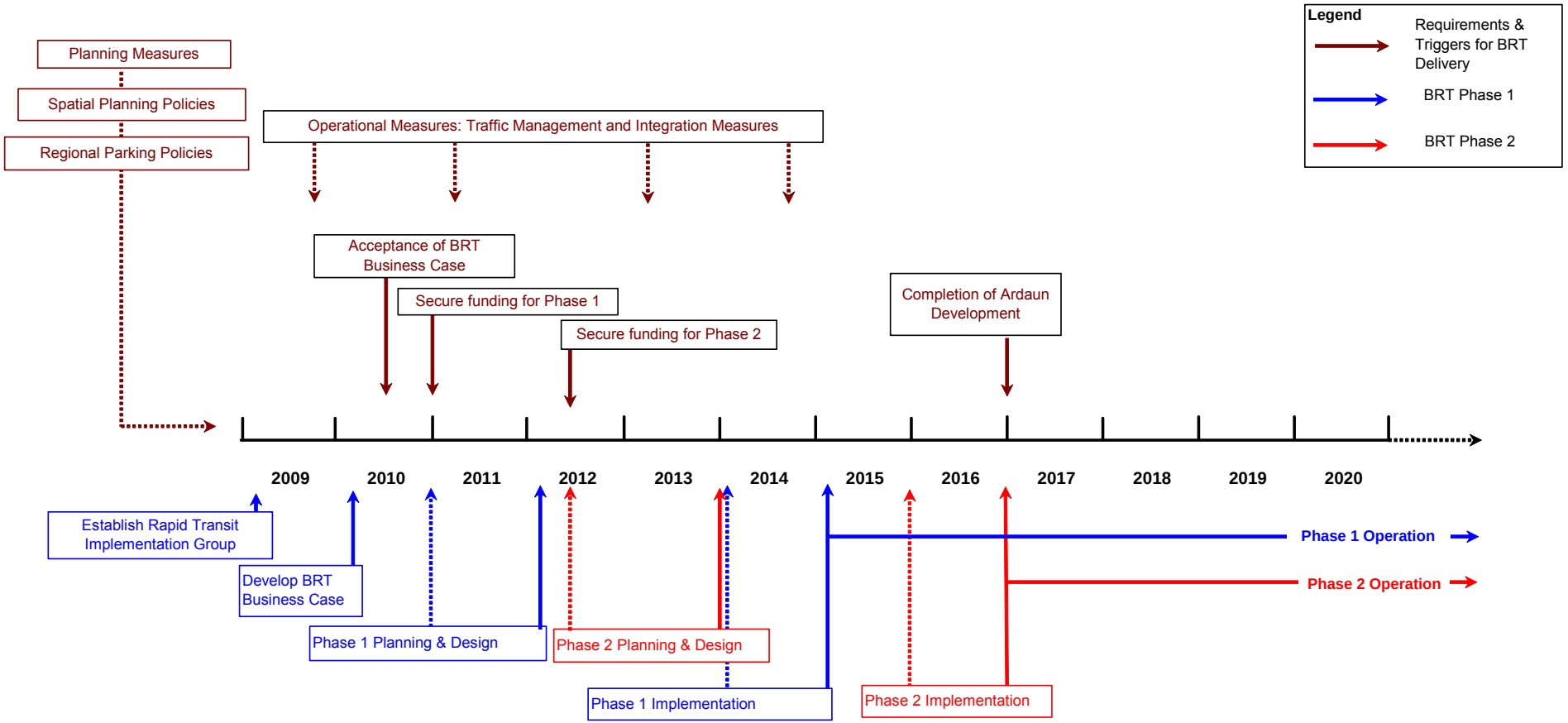
Careful consideration needs to be given to the powering system utilised, with diesel, LPG, electric, or some hybrid of these system used. The whole life environmental benefits, the capital/ operating costs, and the perceptions of transport users will inform such a decision.

- The east west sustainable transport corridor would also provide for the enhancement of facilities for cyclists and pedestrians, crucial considerations given the size of the City. Park and Ride at both ends of the alignment can help to capture and funnel some of the more regional car trips at this point. This will also serve to capture trips from the M6, which without this and a traffic management strategy could threaten the familiar essence of Galway city centre.
- The introduction of BRT would be preceded by improvements to bus services along the corridor, to build up demand from low levels at present. Crucially, it is recommended that this corridor is supported by an enhanced bus network on a City wide basis to cater for the public transport needs of the wider City. This will support important links such as that from the western residential areas to Ballybrit, and as Ardaun is developed to Balybrit from new residential developments in Ardaun;
- It is recommended that an on-going review of priority requirements along Western Distributor Road be commenced post introduction of BRT, with a view to determining the longer term development of priority infrastructure.
- 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 1 could be delivered in the medium term (by 2015);
- The reconfiguration of the enhanced 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 2015, with priority given to the connections supporting the east-west BRT corridor, and links to Ballybrit. The phased introduction of improvements will facilitate operators in planning and resourcing the expanded bus fleet; and
- Supporting measures, such as those earlier in this Report, and the City Centre Traffic Management Plan need to be implemented in conjunction with the roll-out of public transport improvements. Planning for the City Centre Traffic Management Plan should commence immediately with a view to introducing it in the short term to coincide with improvements to bus services along the east-west corridor.

10.4.3 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. This would form part of a subsequent Bus Network Implementation Plan incorporating a detailed business plan for bus service improvements.

10.4.4 Figure 10.1 overleaf details the timeline for implementation of BRT, the key triggers for development of the system.

Figure 10.1 BRT Implementation Time Line



10.5 Summary

10.5.1 To ensure the timely delivery of public transport improvements as recommended earlier in this Report, and that the benefits of the system are realised for the benefits of all in the City and surrounding area, 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 significantly increase public transport use in the short term by first improving the operation and performance of bus and by implementing supporting traffic management measures (e.g. the City Centre Traffic Management Plan), planning and parking policies, and informative/ integrative measures;
- Available funding sources throughout the next decade and beyond and the desire to incrementally develop the public transport system, and to grow passenger demand accordingly;
- The identification of the key triggers as regards the development of BRT, in particular as it relates to supporting policy measures, and development along the length of the BRT corridor; and
- Supportive institutional arrangements, i.e. the Programme Board.

11 Recommendations and Next Steps

11.1 Summary of Study Process

11.1.1 This section of the Report brings together the recommendations that have been identified and brought together following an in-depth study process that has included:

- a baseline study to identify the statues quo of traffic, transport and land use planning issues in Galway based on a review of relevant previous studies, policy documents and technical analysis of relevant data (notably Census data);
- a consultation process to identify and understand relevant issues and concerns amongst key stakeholders and the public;
- the development of appraisal objectives, which defined what the transport system should aim to achieve, either directly or through their influence on other policy or other related measures (e.g. spatial planning) and thereby facilitated the assessment of the preferred package of interventions;
- the development of a multi modal model for Galway City and its surrounds, used for the purpose of assessing the relative transport merits of various transport options, and for subsequent appraisal of the economic and environmental benefits of the preferred set of recommendations;
- A financial and economic appraisal, engineering feasibility of recommended future pubic transport and other sustainable transport options for Galway; and
- Consideration of complementary measures, some of which were considered necessary to support integration and feasibility of future transport options.

11.1.2 The baseline study and consultation revealed the high level of car dependence that exists in Galway City and its surrounding area that is set against a strong public drive for change and a vision for a more sustainable moving city. The baseline findings suggest that there is scope for a change of a heart and minds towards public transport, together with an unrealised potential for walking and cycling usefully serving to extend catchment of public transport provisions. The realisation of this change however requires a set of compelling integrated measures that are assertively delivered in a coordinated and timed manner.

11.2 Recommendations

11.2.1 The key recommendations of the Galway Public Transport Feasibility Study are:

Reconfigured Bus Network

11.2.2 Some reconfiguration of the bus network is required to better cater for existing and future travel patterns in Galway City and would support the introduction of BRT along the west to corridor, thus supporting reliable, efficient and sustainable travel patterns. The reconfigured bus network would provide essential public transport coverage away from the BRT corridor, and in residential areas to the west of the city to retail/ employment areas to the north-east. The network also makes allowances for network extensions to support future developmental areas such as Ardaun.

11.2.3 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 38 vehicles over current levels and the development of an additional bus maintenance depot. The study acknowledges that some of this will be provided for through the commitments that are being driven by the City Council on the back of the previous Galway Strategic Bus Study.

11.2.4 Bus priority measures are deemed essential to increase bus speeds, and to insulate bus operations from general traffic congestion. The purpose is a significant increase in the performance of the bus network from current levels. Though there is some uncertainty relating to overall population/ employment growth in the shorter term, current levels of traffic and future development plans for the study area nonetheless support the need to implement continuous bus priority at critical points along the reconfigured bus network. A speed of 20km/h should be viewed as a minimum value to be achieved on all key corridors across the network. This supports the viability and attractiveness of the bus as an alternative higher capacity and sustainable option, and is essential to the achievement of the overall strategy aims.

BRT Implementation

11.2.5 The implementation of a single Rapid Transit Corridor running along a west-east alignment from Ballyburke to Ardaun, via the City Centre and connecting with key interchanges such as the Ceannt Station and the Bus Station is recommended. BRT has been found to represent the optimal mode along the Rapid Transit Corridor for a number of reasons that include:

- BRT representing the most appropriate solution in terms of its ability to meet passenger demands up to 2020, and beyond (to 2030);
- Current demand levels falling significantly short of what is required to justify a Light Rail System. Developing the system as LRT would therefore be a sign higher risk strategy, as its operational success would be dependent on massive future development/ redevelopment along the corridor;
- The timeline for implementing LRT typically is typically in the order 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;
- A lighter touch approach to LRT implementation and the installation of its own renewable power generation facilities to support its operational feasibility, as proposed by the GLUAS group, would represent a very high risk approach. To date, the light touch LRT lacks the same road surface support as provided by deeper excavation and concrete support of LRT more generally in place, which by default relies on having relatively solid road surface and subgrade. This has not been widely tested or used to date. In order to develop a better appreciation of any benefits which may be available from such an innovative system, funding for further development and research in regard to this Light Touch LRT (Gluas) type installation would be appropriate. Potential cost savings may result, therefore, if the new system was found to be implementable. In the absence of further research and development into this system it is considered at this time that a Gluas Type System would represent a high risk strategy for addressing Galway City's public transport deficiencies.
- The capital costs of implementing BRT being significantly lower, at approximately 84% less than the cost of a full LRT or 50% less than the alternative Lighter Touch LRT

alternative based on light touch LRT cost of €210 M (para 9.6.1), which does not account for its higher associated risk;

- BRT representing a more flexible solution in the context of a city such as Galway, where new infrastructure is required to facilitate implementation and potential future growth; and
- Critically it has the potential to provide a step change in the quality of public transport provision in the City, thus altering travel patterns throughout the City.

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

- Phase 1, from Ballymoneen to Merlin Park Hospital, via the Galway Regional Hospital, NUI Galway, and the City Centre; and
- Phase 2, from Merlin Park Hospital to Ardaun.

11.2.7 Emphasis is placed on the centre of the city and links to residential areas in the west of the city. However though Phase 2 of the BRT alignment is not immediately justified on the basis of current development levels, it will be a requirement as the surrounding lands are developed and traffic levels on the new M6 increase over time. Therefore the provision of Phase 2, with a supportive Park and Ride at the M6 interchange, should follow a similar timeline. Extension from this point into Ardaun should form part of the areas development and land use plan, and the timeline for this further extension should be planned accordingly.

11.2.8 The recommended reconfiguration of bus network and expansion of the bus fleet is estimated to cost approximately €89 million. This together with the capital costs associated with the implantation of the central Bus Rapid Transit system is estimated at €204 million; however this is subject to further assessment of the specific needs of the network as a whole. This compares to the overall cost for an LRT and enhanced bus study of €788 million.

Implementation of Traffic Management Strategies

11.2.9 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 fast and reliable BRT operations, allowing for a consistent and high quality experience. Corridor management strategies will also be required on routes indirectly impacted as a result of redistributed traffic flows.

11.2.10 The implementation of a City Centre Traffic Management Plan is considered critical in improving City Centre accessibility, and the environment for public transport vehicles, pedestrians and cyclists in Galway's City Centre. 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 Galway City and County

11.2.11 The joint development, by Galway 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 Strategy, as forecasted through multi-modal transport modelling, are to be realised. This issue needs to be addressed immediately to ensure that parking provisions and

standards associated with future developments are consistent with achieving the study recommendations.

Park and Ride

11.2.12 Park and Ride, or 'Park and Choose' (allowing for public transport and cycling options) should be designed with the objective of alleviating traffic and congestion in the centre of Galway as opposed to extending car parking opportunities. The role that Park and Ride/Choose sites can play in support of the BRT alignment and in the context of the development of the M6 is discussed under BRT Implementation (par 11.2.7) above. Consideration of the location is important in that it should not be too far away from the city that it fails to attract motorists or too near that it can be used simply as an additional car park. Appendix A of this Report contains the detailed area by area appraisal of the recommended public transport network and services with proposals for central and more regional park and ride sites.

The Implementation of Integrative Measures

11.2.13 The introduction of a range of integrative measures including integrated fares/ ticketing, integrated Public Transport Information and all operator bus stop provisions, public transport interchanges, park and ride.

The Consolidation of Development along the Rapid Transit Corridor

11.2.14 Development along the corridor including in the City and Ardaun areas should be 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 might be lower than envisaged in developing the current City and County planning forecasts.

Introduction of New Street Design Standards

11.2.15 The development of more sustainable communities throughout the city and wider study area, with an emphasis on sustainable transport modes (walking, cycling and public transport) is recognised as an imperative to reducing car dependency. There is a need to consider street design both in terms of its surrounding area context and sense of place, and in terms of increasing access and priority for more sustainable choices. 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 addition to contributing to the city's congestion levels that in turn reduce footfall potential in the centre. In this respect, it is recommended that Galway 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

11.2.16 The implementation of 'softer' measures to promote the use of public transport, walking and cycling is considered essential to maximise the benefits of the Strategies measures. The following specific measures are therefore considered to be applicable and to offer significant benefit Galway City:

- Destination Based Travel (or Mobility Management) Plans: there is a notable and significant car dependency in some of the cities key work place destinations, which not only impact on local congestion but also require a significant allocation of valuable land to

car parking provision. The study recommends that priority is given to implementing a shared area destination based travel Plans encompassing both NUIG and the University Hospital; and also Ballybrit/Parkmore area;

- School Travel Plans in cooperation with An Taisce; and
- Personalised Travel Planning in key residential areas notably along the BRT alignment.

Development of a Marketing and Communications Strategy

11.2.17 There is a poor public perception of public transport alternatives in Galway. Improvements that have been made and those recommended here risk going unnoticed due to long held viewpoints and assumptions as well as entrenched behaviour preventing alternatives from being trialled. The customer experience must be the central focus of a coordinated marketing strategy. This should consider the whole journey experience from the customers' perspective. A coordinated public information and marketing campaign is essential to reviving a healthier perception of the bus as a real alternative.

11.2.18 There is a good argument also for a supportive Galway Public Transport brand supported by an identified set of core values, which might entail greater customer focus and more relevance to a modern Galway. If undertaken in conjunction with the implementation of the recommended network and service improvements, and supporting traffic management interventions, the step change in public transport provision that Galway citizens are looking for can be provided.

11.2.19 An integral element of the success of the 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 marketing strategy would be to communicate the vision, objectives, recommendations and supporting policy requirements relating to implementation the strategy. Of equal importance is a communication strategy that provides easy access through a range of mediums to relevant information (timetables, ticketing etc) on services provided by all operators.

11.3 Strategy Appraisal Findings

11.3.1 The recommendations have been appraised against the study objectives, and had been found to perform positively in the study area for which the appraisal was undertaken. Furthermore, an economic and environmental appraisal of the strategy has been undertaken and has found that:

- The strategy as a whole, would deliver a benefit to cost ratio (BCR) of 1.75, representing medium value for money; 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 9% reduction in CO_2 levels. Such a reduction will have a significant role to play in the achievement of reduced emissions at a national level.

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

11.4.1 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.

11.4.2 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.

11.4.3 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 Eyre Square, thus ensuring all bus boarding/ alighting activities occur off the mainline carriageway.

11.5 Next Steps

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

Strategy Implementation

11.5.2 Section 10 (overview in Figure 10.1) of this study outlines the potential implementation programme for the recommended strategy. This highlights issues for additional consideration and outlines the recommended way forward for implementation of the Strategy.

11.5.3 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 implementation of supportive institutional arrangements through the NTA at the national level and the integration with supportive regulatory and institutional requirements at local/regional level.

11.5.4 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.

11.5.5 The broad ranging recommendations contained within this study, 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 study area than that which has existed up to now.

11.5.6 Supporting institutional arrangements are therefore required to deliver some of the key recommendations here. The establishment of a Programme Office (which may for part of the Galway Transport Unit) is also recommended, with adequate resources to manage co-ordination, planning and implementation of the Strategy.

11.5.7 These institutional arrangements should be progressed at the earliest possible opportunity to progress the timely delivery and success this strategy.

Bus Implementation Plan

11.5.8 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 Galway Bus Services and its network has been assessed at a preliminary feasibility level and indicative recommendations for revised routings and service frequencies are included in the strategy. In order to deliver this element of the study recommendations, a detailed Bus Implementation Plan will need to be prepared by, or on the behalf of, the bus operators affected. 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.

11.5.9 Detailed routings for each new/ reconfigured bus route would have to be determined by bus operators, in conjunction with the Programme Office, given that infrastructural considerations (bus priority, bus stop infrastructure etc.) will have a significant bearing on route selection along the alignment.

11.5.10 The reconfigured/ enhanced bus network has the potential to increase public transport use in the short term, from present levels of use. Furthermore 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.

11.5.11 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

11.5.12 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.

11.5.13 The Multi-Modal Transport Model developed for the purposes of this study would represent a suitable assessment tool in the development of the Business Case.

11.5.14 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

11.5.15 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, including an examination development potential;
- Detailed engineering feasibility for the preferred alignment option; and
- Detailed costing for the preferred alignment option.

11.5.16 To maximise system use, BRT stops should be located adjacent to existing and future employment and residential nodes.

11.5.17 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.

11.5.18 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.

11.6 Future Land Use and Transport Planning

11.6.1 The sequencing of development along the Rapid Transit Corridor should be consistent with its phased implementation, notably in relation to additional development along Phase 2 through Ardaun.

11.6.2 Failure to prioritise development along the corridor will undermine the financial and economic case for the system in the future, and in addition to the strategy benefits at a regional level.

11.6.3 Park and Ride sites recommended in the report should not replace the need for greater consideration to improved integration of planning and regional transport services; however they will support access to the system by those in more rural locations. The suggested park and ride sites will require a site suitability assessment and audit. Demand Response Transit (DRT) arrangement have the potential to compliment such Park and Ride arrangements.

11.6.4 In future, it is recommended that the following approach be adopted:

- 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;

- 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 city and county; and
- It is recommended that the identification of future transport network interventions would be undertaken as part of an updated integrated land use and transport strategy for the area.

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