Údarás Náisiúnta Iompair
National Transport Authority

# Limerick Shannon Metropolitan Area Transport Strategy

## Transport Modelling Assessment Report

## July 2020

National Transport Authority,
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# CONTENTS

# 1 Introduction

## 1.1 Background

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

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

## 1.2 Purpose of Report

The methodology for the development of the Limerick Shannon Metropolitan Area Transport Strategy (LSMATS) 2040 is undertaken on a step by step basis, from: reviewing the existing policy and transport baseline, undertaking a detailed future demand analysis, developing transport options, optimisation of land use to align with high performing transport corridors, developing the draft Strategy for public consultation and subsequently finalising the Strategy, as shown in Figure 1-1.


Figure 1-1: Limerick Shannon Metropolitan Area Transport Strategy Methodology

This report describes the process of modelling the proposed transport measures for all modes (public transport, walking, cycling, car and freight) within the National Transport Authority's (NTA) Mid-West Regional Model (MWRM). This modelling process inputted into the development of the transport options (within the "Transport Options and Network Development Report") to serve the anticipated demand requirements for the study area up to 2040. The report also outlines the modelling undertaken as for the preferred Transport Strategy. The land use and network assumptions are outlined for all modelled scenarios.

An appraisal of the Strategy options, utilising the Regional Modelling System (RMS) appraisal toolkit has been undertaken which provides a quantitative appraisal that aligns with the Department of Transport, Tourism and Sport (DTTAS) Common Appraisal Framework (CAF). Other Key Performance Indicators (KPIs) have also been assessed to understand the performance of the proposed LSMATS network across all modes.

## 1.3 Report Structure

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

- **Section 2** summarises the Transport Network Option Development Methodology which includes the Transport Modelling Assessment.
- **Section 3** provides an overview of the NTA Regional Modelling System (RMS) which includes the Mid-West Regional Transport Model (MWRM) used for the assessment of LSMATS.
- **Section 4** describes the 2040 land use assumptions used in the modelling.
- **Section 5** outlines modelling undertaken to inform the optioneering and refinement of the preferred strategy.
- **Section 6** details the approach to the modelling assessment and appraisal which is in-line with Common Appraisal Framework (CAF) guidance.
- **Section 7** outlines the results of the appraisal of LSMATS under each of the CAF criteria; and
- **Section 8** concludes the report.

# 2 Transport Network Option Development Methodology

## 2.1 Option Development and Assessment Methodology

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

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

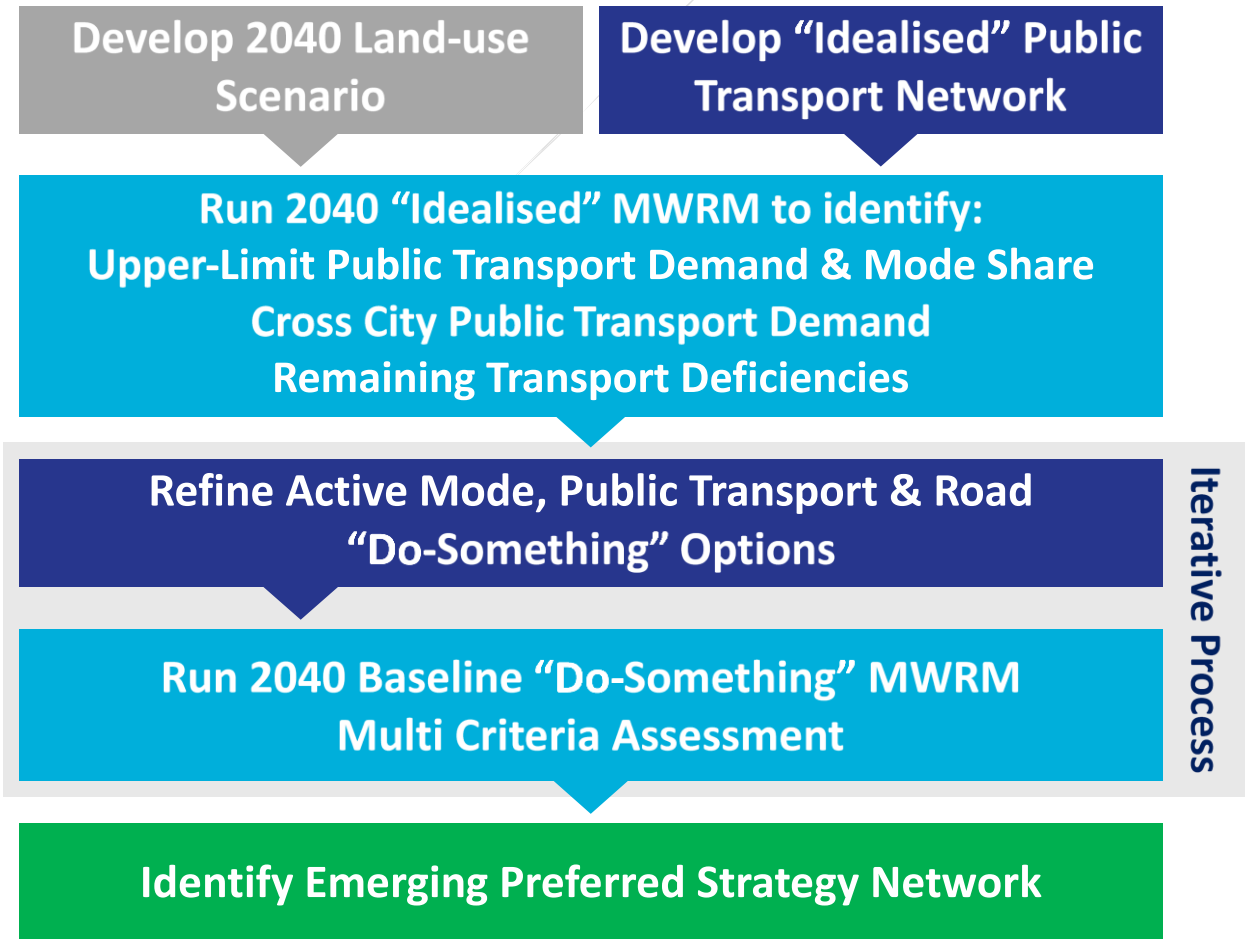



Figure 2-1: Option Development and Assessment Methodology

# 3 NTA Regional Modelling System

## 3.1 Introduction

This section describes the NTA Regional Modelling System (RMS), outlining its scope, extent, components, functionality and its suitability for use in developing the LSMATS. The national remit of the NTA requires a system of regional models to help it deliver on its planning and appraisal needs. The NTA Regional Modelling System comprises five regional transport models covering the Republic of Ireland and centred on the five main cities of Dublin, Cork, Galway, Limerick, and Waterford and are summarised in Table 3-1 below.

Table 3-1: Regional Modelling System

| Regional Modelling System | Abbreviation | Counties Covered |
|---|---|---|
| Eastern Regional Model | ERM | Louth, Monaghan, Cavan, Longford, Westmeath, Meath, Offaly, Laois, Kildare, Dublin, Wicklow, Carlow & Northern Wexford |
| South East Regional Model | SERM | Wexford, Kilkenny, Waterford & Tipperary South |
| South West Regional Model | SWRM | Cork & Kerry |
| Mid-West Regional Model | MWRM | Limerick, Clare & North Tipperary |
| Western Regional Model | WRM | Galway, Mayo, Roscommon, Sligo, Donegal & Leitrim |

Each regional model has the following key attributes:

- Full geographic coverage of the relevant region;
- A detailed representation of the road network, particularly the impact of congestion on on-street public transport services and include modelling of residents' car trips by time period from origin to destination;
- A detailed representation of the public transport network & services, and can predict demand on the different public transport services within the regions;
- A representation of all major transport modes including active modes (walking and cycling) and includes accurate mode-choice modelling of residents;
- A detailed representation of travel demand, e.g. by journey purpose, car ownership/availability, mode of travel, person types, user classes & socio-economic classes, and representation of four time periods (AM, Inter-Peak, PM and Off-Peak); and
- A prediction of changes in trip destination in response to changing traffic conditions, transport provision and/or policy.

The Mid West Regional Model (MWRM), which covers Limerick County & City and Shannon, has been used to support the development of the LSMATS. The figure on the following page illustrates the geographical extent of each of the Regional Models.

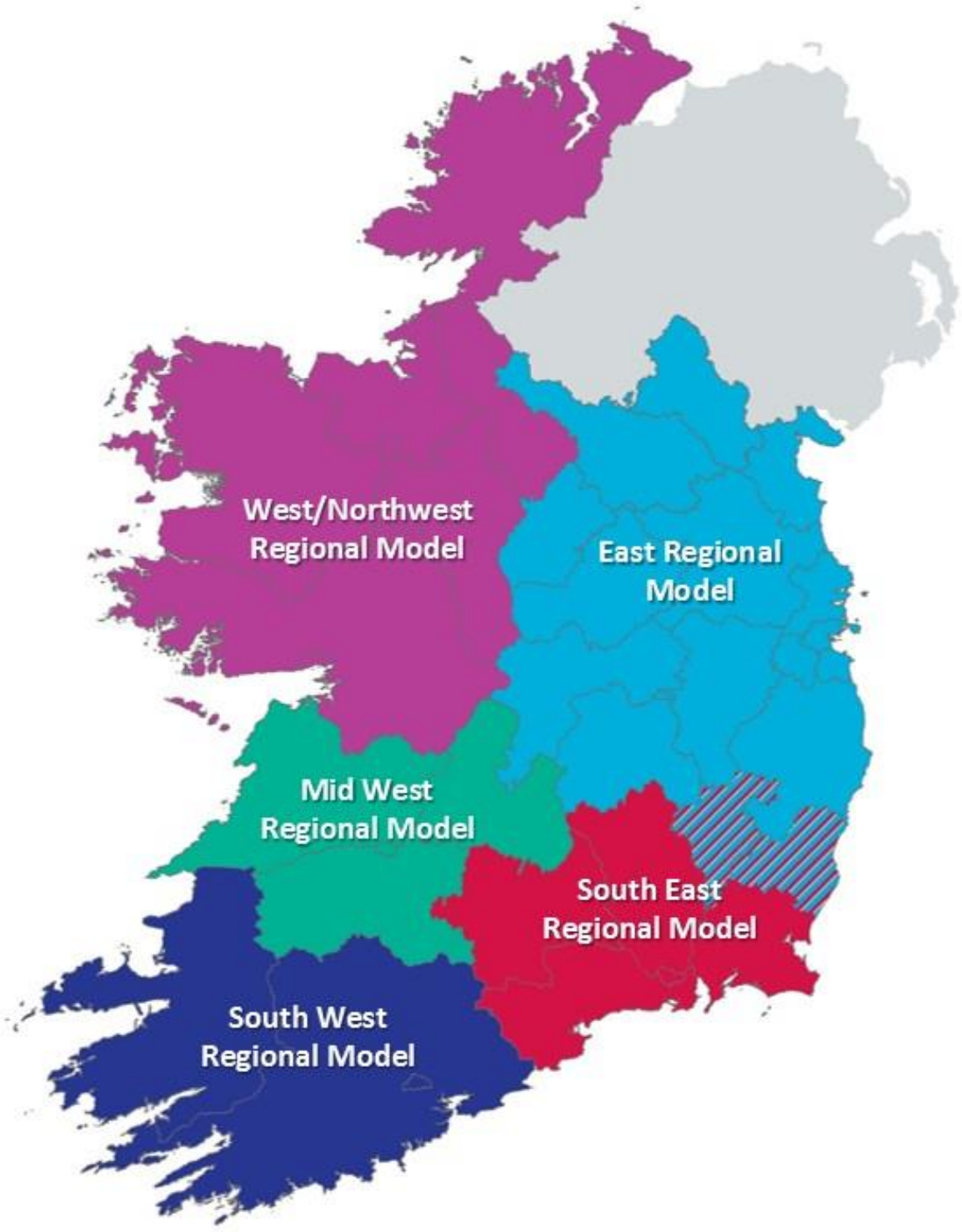



Figure 3-1: Modelling System Regional Model Areas

## 3.2 Regional Modelling System Dimensions

The regional modelling system features or dimensions are defined in terms of:

- Zone system;
- Modes of travel represented;
- Base year;
- Time-periods; and
- Demand segmentation.

### 3.2.1 Zone System

The zone system definitions for each of the regional models were based on Census Small Area (CSA) boundaries and Electoral Districts (EDs). The 2016 CSAs are the core base layer for each zoning system. CSAs are the smallest geographic unit of data available with which to define the model zone system. Each CSA is a defined geographic area associated with demographic data (e.g. population, age distribution, employment status), and the work / school travel characteristics of the population (via *Place of Work, School or College - Census of Anonymised Records* (POWSCAR)).

CSAs are subsets of EDs. ED boundaries are commonly used as the unit of geographic information in Ireland and as such it was desirable to maintain a transparent relationship between EDs and the model zone system. Regional Model zones can be smaller or larger than either of these units where required. The criteria used for developing zone boundaries for the MWRM and other regional models included:

- Population, Employment and Education – maximum values were specified for zone population, number of jobs and persons in education;
- Activity Levels – limits were applied to zone activity levels ensuring that zones with either very low, or very high, levels of trips were not created;
- Intra-zonal Trips – threshold values were applied to the proportion of intra-zonal trips, within each zone, to avoid an underestimation of flow, congestion and delay on the network;
- Land Use – zones were created with homogeneous land use and socio-economic characteristics where possible;
- Zone Size/Shape – thresholds were applied to zone size, and irregularity of shape, to avoid issues with inaccurate representation of route choice;
- Political Geography – as mentioned above, it is possible to aggregate all zones to ED level i.e. zone boundaries do not intersect ED boundaries;
- Special Generators/Attractors – large generators/attractors of traffic such as Airports, Hospitals, shopping centres etc. were allocated to separate zones.

The MWRM zone system includes a total of 456 zones with a geographical breakdown as follows:

- Limerick City zones: 94;
- Limerick County zones: 126;
- Clare County zones: 131;
- North Tipperary County: 77;
- External zones: 26; and.
- Special zones: 2.

Figure 3-2 shows the MWRM Zone System. External zones represent national demand from areas across the country to/ from the Mid-West (area shown in blue). The two special zones in the

model are Foynes Port & Shannon Airport. Further information on the MWRM Zone System can be found in the MWRM zone system development report.[1]

[1] MWRM Zone System Development Report: https://www.nationaltransport.ie/wp-content/uploads/2018/06/MWRM_Zone_System_Development_Report-1.pdf

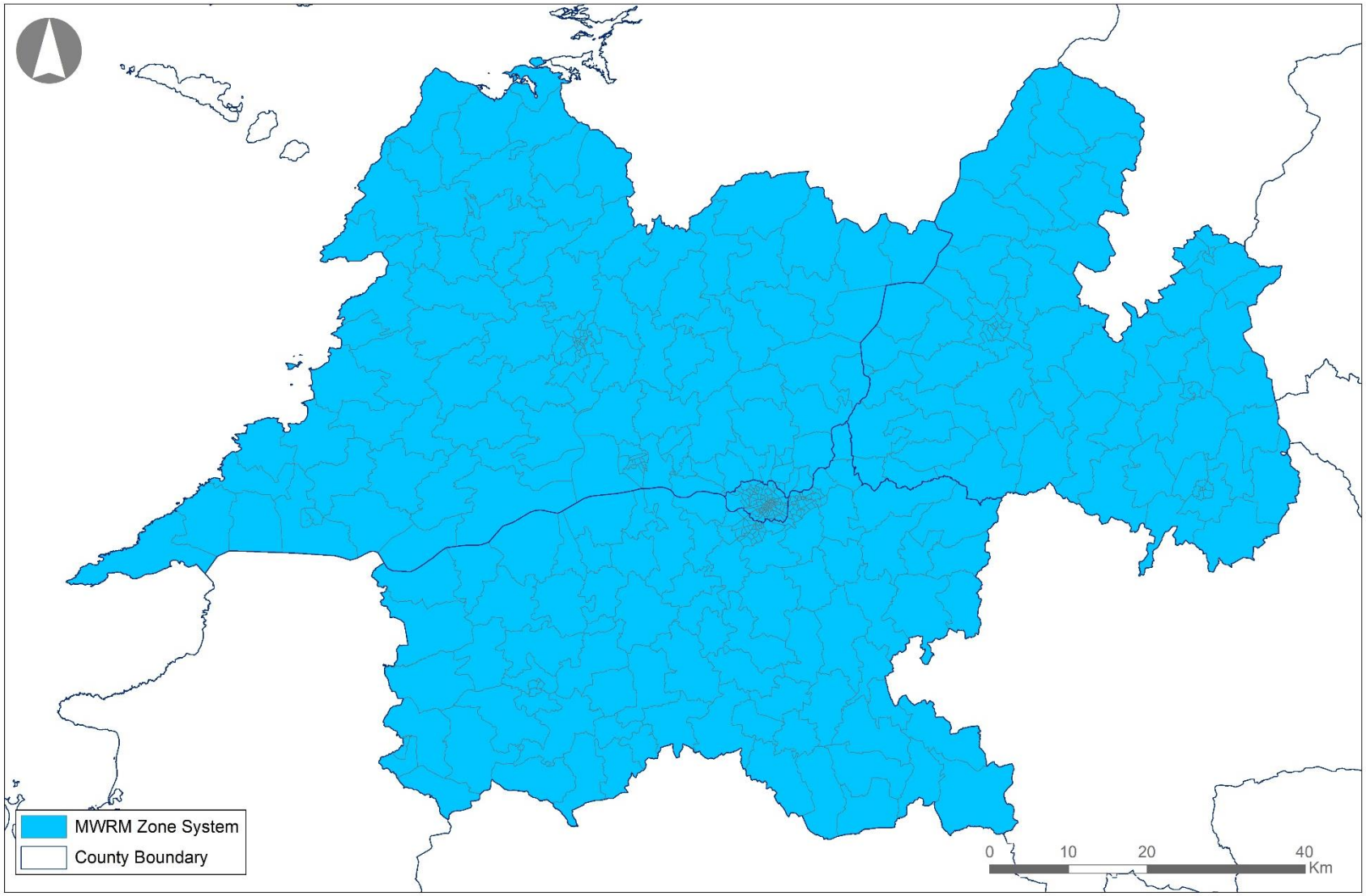



Figure 3-2: MWRM Zone System

### 3.2.2 Modes of Travel

The regional model system covers all surface access modes for personal travel and goods vehicles:

- Private vehicles – taxis and cars;
- Public transport – bus, rail, Luas, BRT, Metro;
- Active modes – walking and cycling; and
- Goods vehicles – light goods vehicles and heavy goods vehicles.

### 3.2.3 Base Year

The base year of each model is 2012 with a nominal month of April. This is largely driven by the date of the Census (POWSCAR) and the National Household Travel Survey (NHTS). It should be noted that the POWSCAR dates to 2011 but the travel patterns are assumed to be broadly the same in 2012.

### 3.2.4 Time Periods

The model represents an average weekday. The day is split into five time periods considered within each of the regional models, detailed in Table 3-2 below. The periods allow the relative difference in travel cost between time periods to be represented. Representative peak hours are used in the assignment models, which are based on period to peak hour factors derived from survey data for each time period and mode.

Table 3-2: Time Periods

| Period | DEMAND MODEL FULL PERIOD | ASSIGNMENT PERIOD |
|---|---|---|
| **AM Peak** | 07:00-10:00 | Peak hour – based on a Peak Hour factor of 0.393 for cars, 0.393 for active modes and 0.47 for public transport |
| **Morning Inter Peak (IP1)** | 10:00-13:00 | Average hour from full period - based on a Peak Hour factor of 0.33 for cars, 0.33 for active modes and 0.33 for public transport |
| **Afternoon Inter Peak (IP2)** | 13:00-16:00 | Average hour from full period (not assigned) |
| **PM Peak** | 16:00-19:00 | Peak hour - based on a Peak Hour factor of 0.358 for cars, 0.358 for active modes and 0.4 for public transport |
| **Off Peak** | 19:00-07:00 | Free flow assignment |

## 3.3 MWRM Structure

### 3.3.1 Overarching Structure

As mentioned above, the MWRM is the model used to support the development of the LSMATS. All the regional models, including the MWRM, include 3 core modelling processes (i.e. Demand Model, Road Assignment Model and Public Transport Assignment Model) which receive inputs from the National Demand Forecast Model (NDFM) and provide outputs for transport appraisal and secondary analysis. This process is shown in Figure 3-3 below.

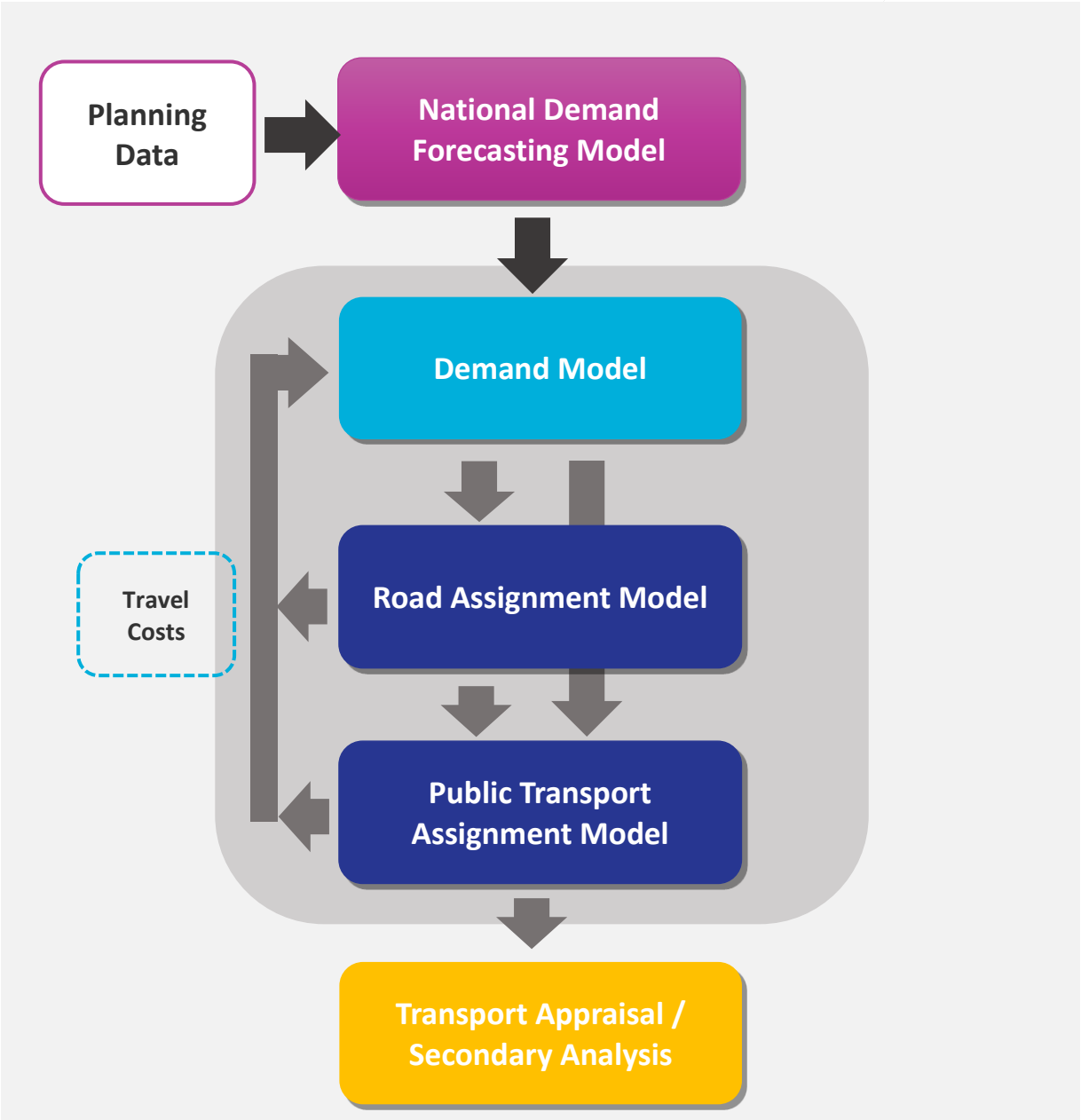



Figure 3-3: Model Structure

### 3.3.2 Planning Data

The Planning Data referred to above is a national database of 99 demographic and spatial variables for each of the 18,488 CSAs in the state. The main categories of planning data are:

- References and spatial definitions;
- Origin-based person types; e.g. age bands, gender, principal economic status (PES), employment type, and various combinations of categories;
- Destination-based person types; e.g. employment type or education type; and
- Households.

### 3.3.3 National Demand and Forecasting Model (NDFM)

The ***NDFM*** is a separate modelling system that estimates the total quantity of travel demand generated by and attracted to every Census Small Area (CSA) daily. The level of demand from, and to, each zone (referred to as trip ends) is related to characteristics such as population, number of employees and land-use data as outlined in Section 2.

The NDFM comprises the set of models and tools that are used to derive national levels of trip making, for input to each of the regional models. The NDFM outputs levels of trip making at the smallest available spatial aggregation (CSA).

The key components of the NDFM are as follows:

- The **Planning Data Adjustment Tool** (PDAT) controls the planning data inputs to the core NDFM system. It is used to amend planning data to represent the combination of general changes over time and the relevant land-use planning scenarios;
- The **Car Ownership/Car Competition Models** estimate the level of car ownership in a CSA, (sub-dividing the number of households in each CSA between 'No Car', 'Cars < Adults' and 'Cars >= Adults' households) i.e. the car competition bands;
- The **Car Availability Model** classifies the set of individual person trips as either 'Car Available' or 'Car-not-available' using calibrated relationships between the three car competition bands and the trip purpose;
- The **National Trip-End Model (NTEM)** converts the planning data into person trips, using calibrated trip rates; and
- The **Regional Modelling System Integration Tool (RMSIT)** estimates the level of trip-making by main mode (car, bus, rail and goods vehicles) between 38 of the main urban settlements in Ireland.

Figure 3-4 shows the system of NDFM models and the key regional model components that the NDFM interacts with.

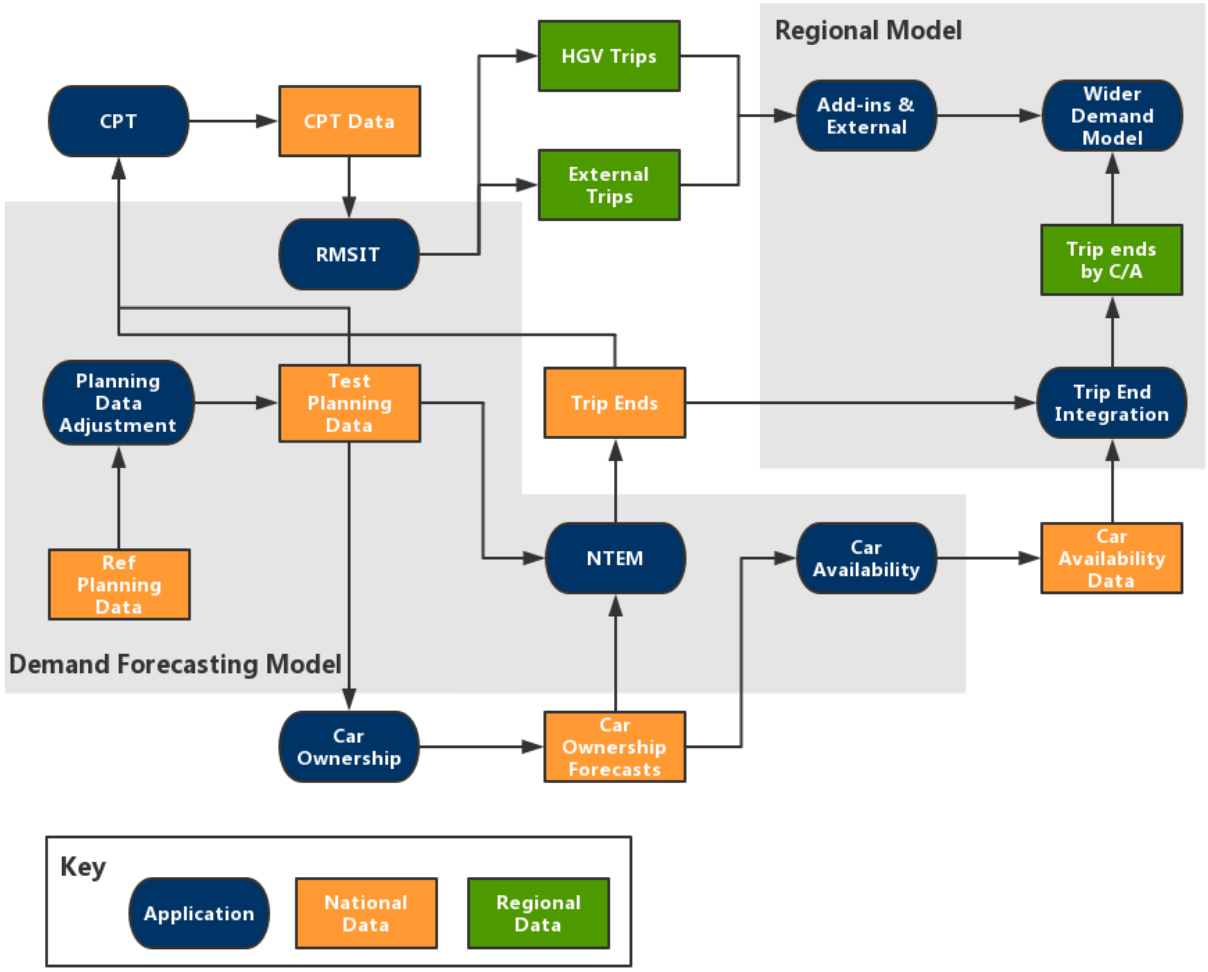



Figure 3-4: NDFM Structure

### 3.3.4 Demand Segments

Groups of people with similar travel behaviours (for example, commuters who own a car) are represented by distinct demand segments in the regional modelling system. This allows those groups to be treated differently in the regional demand model according to their behaviour.

The NDFM demand segments were derived from the National Household Travel Survey (NHTS) data and *Place of Work, School or College - Census of Anonymised Records* (POWSCAR) data sets. They have been segmenting into 33 distinct classifications as noted below in Table 3-3.

**Table 3-3: Demand Segments**

| No. | Purpose | Car Availability | Third Level of Segmentation |
|---|---|---|---|
| **1** | Commute | Available | Blue collar |
| **2** | Commute | Available | White collar |
| **3** | Commute | Not available | Blue collar |
| **4** | Commute | Not available | White collar |
| **5** | Education | Available | Primary |
| **6** | Education | Available | Secondary |
| **7** | Education | Available | Tertiary |
| **8** | Education | Not available | Primary |
| **9** | Education | Not available | Secondary |
| **10** | Education | Not available | Tertiary |
| **11** | Escort to education | Available | Primary |
| **12** | Escort to education | Available | Secondary |
| **13** | Escort to education | Available | Tertiary |
| **14** | Escort to education | Not available | Primary |
| **15** | Escort to education | Not available | Secondary |
| **16** | Escort to education | Not available | Tertiary |
| **17** | Other | Available | Employed |
| **18** | Other | Available | Non-working |
| **19** | Other | Not available | Employed |
| **20** | Other | Not available | Non-working |
| **21** | Shopping - food | Available | Employed |
| **22** | Shopping - food | Available | Non-working |
| **23** | Shopping - food | Not available | All |
| **24** | Visit friends / relatives | Available | Employed |
| **25** | Visit friends / relatives | Available | Non-working |
| **26** | Visit friends / relatives | Not available | All |
| **27** | Employers Business | All | All |

| No. | Purpose | Car Availability | Third Level of Segmentation |
|---|---|---|---|
| **28** | All | Available | Retired |
| **29** | All | Not Available | Retired |
| **30** | One-way business | Available | All |
| **31** | One-way business | Not available | All |
| **32** | One-way other | Available | All |
| **33** | One-way other | Not available | All |

### 3.3.5 Tours

**Tours** are an important aspect of how Trip Ends are modelled. The main concept is that every person is expected to make a distinct series of trips beginning from their house and ultimately returning home (signalling the end of a tour). The five distinct trip types which may comprise a tour are shown graphically below in Figure 3-5 and include:

- Simple from Home;
- Simple to Home;
- One-way from Home;
- One-way to Home; and
- Non-Home-Based (NHB) trips.

All tours are defined relative to a home or a destination. This corresponds to the concept of productions and attractions where productions are associated with homes and attractions are associated with destinations. The terms productions and attractions are not used when discussing one-way or NHB trips. These are dependent on direction, are not defined to return to a home or a particular attraction, and therefore in these cases the labels origin and destination are used referring to the start and finish location of such trips.

It is worth noting that trip chains (a tour comprising more than two trips) are modelled as multiple single trips. These consist of an outbound (one way From Home) and an inbound (one-way To Home) as well as any number of intermediate NHB trips. An example of this is shown in Figure 3-5.

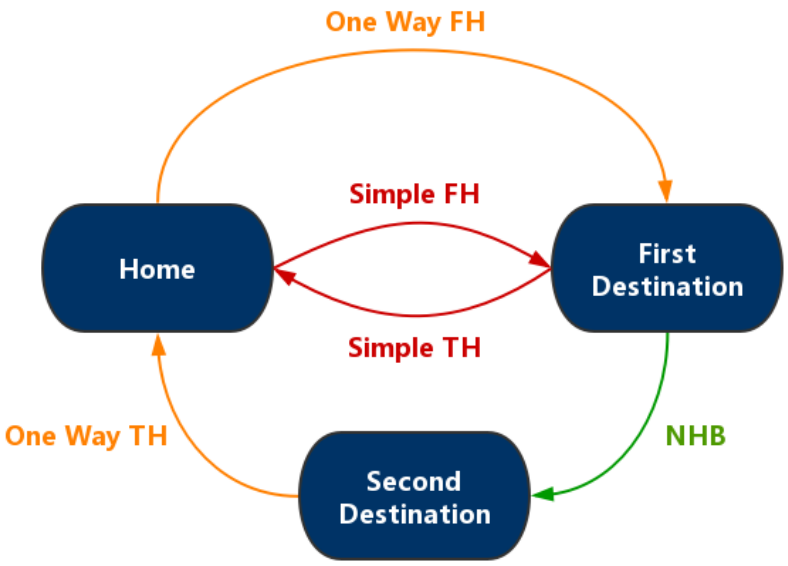



Figure 3-5 Trip Chains

Figure 3-6 shows the most basic relation of origins and destinations with respect to directional trips, comparable to simple tours.

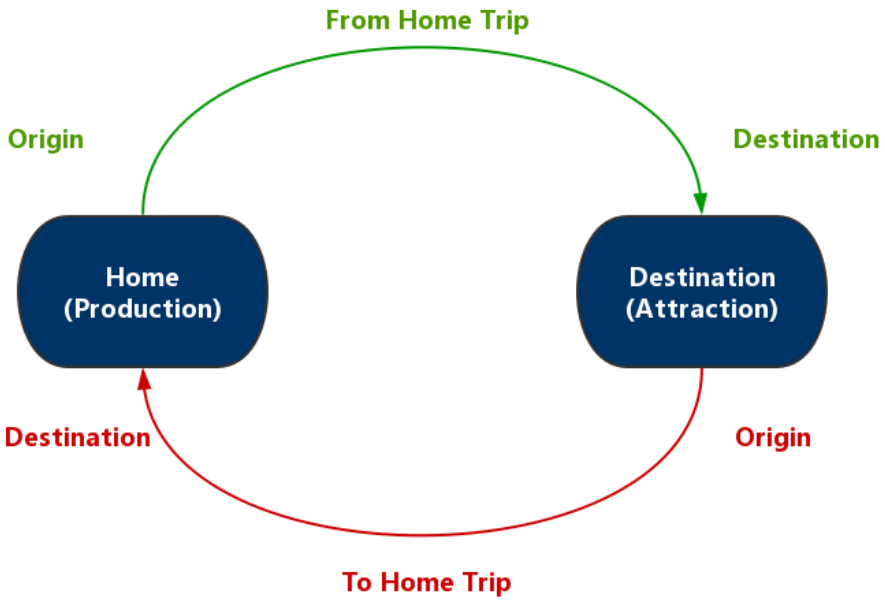



Figure 3-6 PA V OD for Simple Tours

Figure 3-7 below shows the same relationship for trip chains, where it is particularly noted that both ends of a non-home-based tour correspond to attractions.

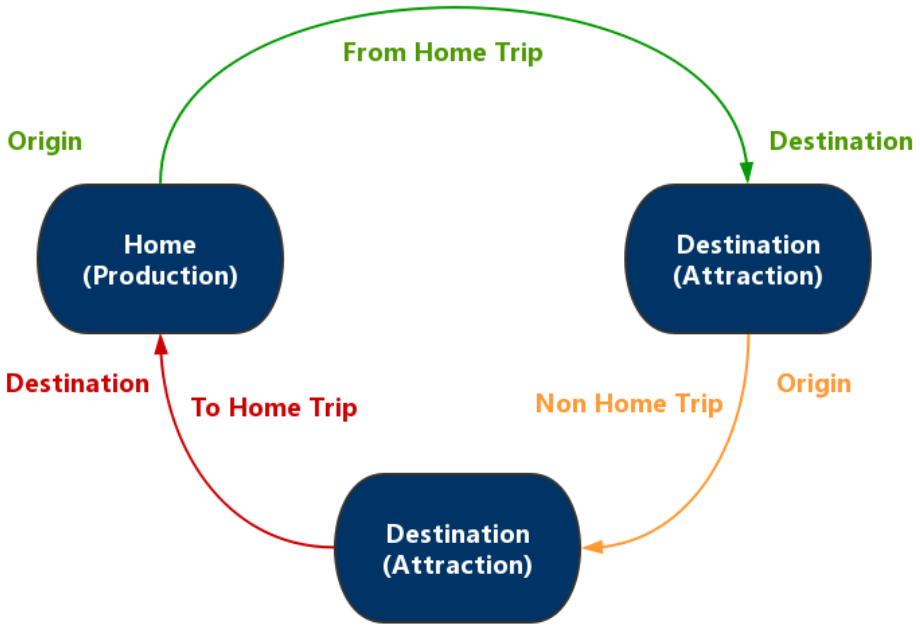



Figure 3-7 PA V OD for Extended Tours

Tours are considered as movements within or from time period to time period as shown in the Tour Grid in Table 3-4. The tours under the diagonal for the IP1, IP2 and PM time periods (marked in green) are those which are not considered in any calculations while the off-peak tours (marked in red) are considered only in commute demand segments. Time period demand is derived either by summing the rows (From Home) or the columns (To Home).

Table 3-4: Tour Grid

| TP Out\ TP In | AM | IP1 | IP2 | PM | OP |
|---|---|---|---|---|---|
| AM | 1 | 2 | 3 | 4 | 5 |
| IP1 | 6 | 7 | 8 | 9 | 10 |
| IP2 | 11 | 12 | 13 | 14 | 15 |
| PM | 16 | 17 | 18 | 19 | 20 |
| OP | 21 | 22 | 23 | 24 | 25 |

### 3.3.6 SWRM Demand Model

The **Demand Model** models travel behaviour and is implemented in Cube Voyager. The demand model processes all-day travel demand from the NDFM through a series of choice models to represent combined mode, time of day, destination and parking decision making. The outputs of the demand model are a set of trip matrices which are assigned to the Road and Public Transport models to determine the route-choice and generalised costs.

The demand model consists of several components that interact in a sequential manner between the trip end model and the assignment models. It includes the following distinct components:

- Macro Time of Day;
- Mode Choice;
- Destination Choice;

- Parking; and
- Tours and One-Way.

A simple representation of the model structure is shown in Figure 3-8.

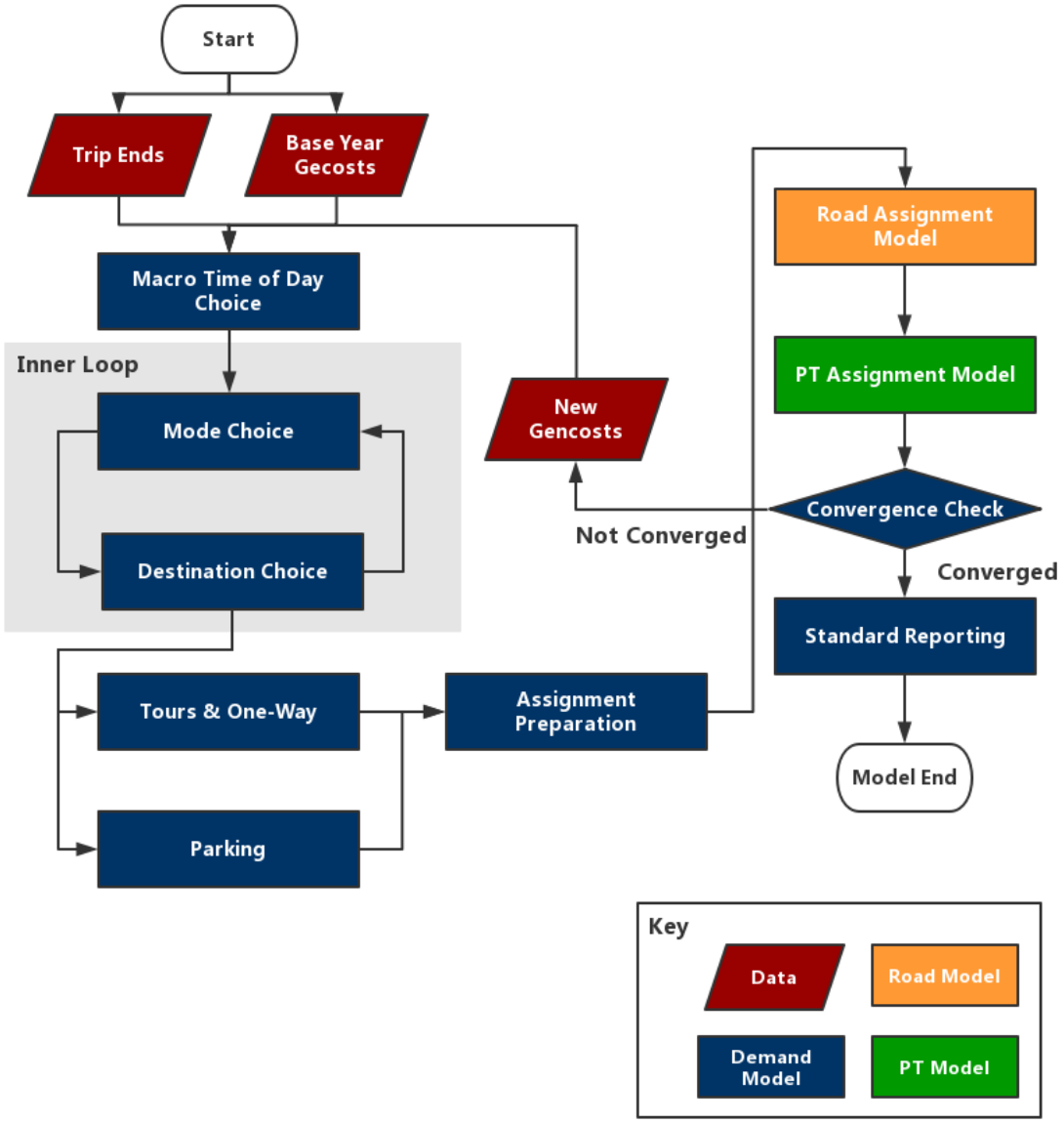



Figure 3-8: Demand Model Structure

### 3.3.7 MWRM Road Assignment Model

The **Road Assignment Model** (RDAM) is implemented in SATURN and includes capacity restraint whereby travel times are recalculated in response to changes in assigned flows. The main purpose of the RDAM is to assign road users to routes between their origin and destination zones. The cost of travel is then calculated by the RDAM for input to the demand model and economic appraisal.

It should be noted that SATURN is a macroscopic model and considers the aggregate behaviour of traffic flows. It does provide detail on junction delay and queueing along links it is a strategic model used to look at impacts across a wider area. Whilst suitable for the purposes of this strategic assessment it is not suitable for detailed junction modelling which consider the interaction of individual vehicles which should be undertaken using a microscopic model such as VISSIM or PARAMICs.

The inputs to the Road Assignment model from the demand model are the road assignment matrices from the assignment preparation stage. The outputs from the Road Assignment model for the demand model processes consist of generalised costs skims by time period and assigned road networks in CUBE Voyager format which are passed on to the PT model.

In addition to these requirements for demand model processes, there are a series of standard SATURN outputs that are produced for use in the specific interrogation of the road networks for scheme and/or scenario assessment.

### 3.3.8 MWRM Public Transport Assignment Model

To generate costs to update the choice model processes, a PT assignment must be undertaken to establish new generalised costs. The **Public Transport Assignment Model** (PTAM) is implemented in Voyager and is used to allocate PT users to services between their origin and destination zones. The model includes a representation of the public transport network and services for existing and planned modes within the modelled area. The model includes:

- Rail;
- DART;
- Luas;
- Metro.
- Urban Bus;
- Inter-Urban Bus; and
- Bus Rapid Transit (BRT).

The outputs of the PT assignment model fall into two categories, those required by the demand model, and those produced for reporting and analysis purposes.

The outputs from the Public Transport Assignment model for the demand model processes consist of the assigned networks which are passed on to active mode assignment as the starting point for their network build procedure, and generalised cost skim matrices by user class for each of the assigned time periods that feed back into the main Mode and Destination choice demand model loop. An overview of the PT model process is shown in Figure 3-9.

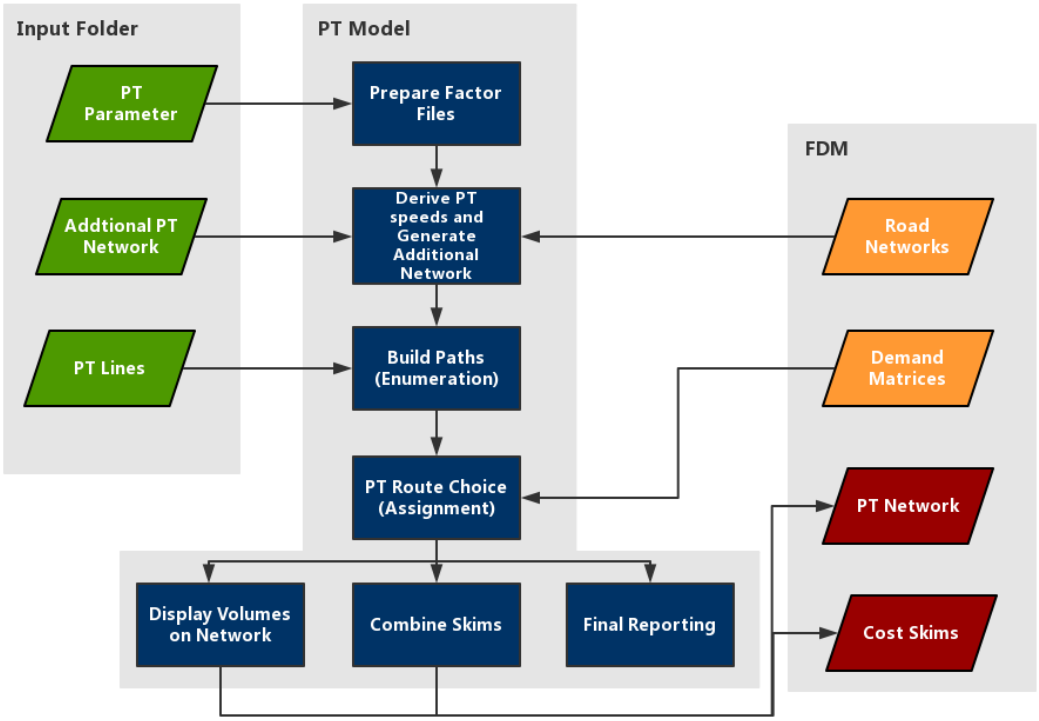



Figure 3-9: PT Model Process

### 3.3.9 MWRM Active Modes Model

The Regional Modelling System represents active modes (i.e. walking and cycling) within the demand model to improve the realism of travel choices. To generate costs to update the choice model processes, an **active modes assignment** must take place to establish new generalised costs. This active mode assignment assumes no crowding or delays.

The inputs for the active assignment model are the output CUBE format PT networks, the demand model produced assignment matrices and separate input pedestrian only links and cycle lanes. The outputs of this process include an assigned network with walk and cycle flows by user class, and a set of generalised cost skims. The active assignment is a CUBE-based lowest cost path assignment model with no junction modelling based purely on distance and a constant speed by mode.

Walk speeds are taken as 4.8 kph for all user classes while cycle speeds are set to 12 kph as default except in specified cases as indicated by the cycle data network input. Improvements to cycling mode provision are included through associating improvements to cycling Quality of Service to increases in service user speeds.

## 3.4 Suitability of Mid-West Regional Model in Developing the Strategy

### 3.4.1 Model Calibration and Validation

It is important that a strategic transport model is appropriately calibrated and validated in line with best practice guidelines. The MWRM has been subject to a comprehensive calibration and validation process whereby a substantial amount of observed data has been incorporated into both the demand model and the assignment models as presented in Table 3-5.

Table 3-5: Observed data used for model calibration and validation

| Demand Model | Assignment Models |
|---|---|
| **Tour proportions** | Road traffic volumes |
| **Generalised cost distributions** | Road journey times |
| **Travel distance distributions** | Road trip length distribution |
| **Modal share** | Public transport in-vehicle time factors |
| **Journey time distribution** | Public transport fares and ticket types |
| | Public transport passenger flows |
| | Public transport boardings and alightings |
| | Public transport journey times |
| | Public transport interchange/transfers |

The calibration and validation process ensure that the MWRM accurately reflects existing conditions and 'costs' associated with travel. This allows changes in the forecasting of transport demand and strategic transport infrastructure schemes and appropriate transport policies to be modelled and tested using the MWRM. Further details on the model calibration can be found in the MWRM Demand, Road, PT and Active Mode development reports, available on the NTA's website[2].

### 3.4.2 Use of MWRM for Strategic Transport Planning

The model has many strengths and features that make it the ideal tool to aid the strategic planning process. The MWRM has been developed from first principles making best use of the most recently available data (POWSCAR and NHTS) to replicate travel choices and transport network conditions as accurately as possible.

Several distinct journey purposes and characteristics including car availability, employment status, and education level are considered within the model to evaluate travel choices more accurately. This carries through to forecasting whereby specific person type demand can be forecast to derive appropriate trip distributions and future year travel conditions.

The model utilises a tour-based approach which allows for more accurate mode choice modelling and consideration of travel costs, particularly with respect to the inclusion of parking charges.

Four main modes of travel: private car, public transport, walking, and cycling are included in the model. Each mode has been calibrated individually, for each journey purpose, to replicate observed trip cost distributions.

The use of SATURN software in the road model allows for junction modelling to be included in the model which improves typical network representation in congested areas over an entirely link-based approach. Link speeds and delays are transferred to the public transport model which allows journey times of on-street modes (Bus, BRT) to reflect perceived traffic conditions rather than a strict timetable.

[2] https://www.nationaltransport.ie/regional-transport-model/regional-model-overview/regional-model-structure/mwr/

The model covers the L-SMA region plus surrounding counties, and takes full account of travel within, into and out of the L-SMA area. As the model is also used as the basis for scheme evaluation, the transport networks represented contain a level of detail beyond that which would be normally required for its use as a strategic transport planning tool.

To account for the availability of parking facilities in Limerick and Shannon City Centre, both a free workplace parking model and a parking constraint model have been implemented to re-evaluate mode choice based on whether parking was available at the travellers' ultimate destination.

There are however, as with all transport models, limitations to what the model can be used to assess. There are a number of potential measures which cannot be assessed using the MWRM. These include, amongst others;

- Intelligent Transport measures which improve wayfinding, management of parking and route choices;
- Behavioural Change Initiatives which influence choice of mode and time of travel;
- Public Transport measures such as Real Time Information and integrated ticketing;
- Public Ream enhancements – which improve the quality of the environment and likelihood for walking/cycling trips.

With respect to the performance of individual junctions SATURN does provide information on the performance of individual junction but operational assessments of junctions should be undertaken at a more localised level using microscopic modelling. However, for the purposes of this strategy this level of detail is not required. Any measures identified in the strategy will need to undergo further assessment as part of their future appraisal which may include further modelling.

### 3.4.3 Summary

The Mid-West Regional Model (MWRM) provides a comprehensive representation of travel patterns across the Limerick and Shannon Metropolitan Area and is a suitable tool for the testing and appraisal of the Strategy. The limitations of strategic transport models are recognised and fully understood. The MWRM is considered the appropriate tool for fulfilling the NTA's requirements in terms of its planning and appraisal needs.

# 4 2040 Land-Use Assumptions

## 4.1 Introduction

The NTA, in association with Limerick City and County Council (LCCC) and Clare County Council (CCC) prepared a Planning Datasheet for the 2040 Land-use Scenario for the application within the LSMA Transport Strategy. This Planning Datasheet has been used as the baseline land-use scenario for all modelling of the strategy options and preferred strategy. This section details the land-use assumptions within the Planning Datasheet and outlines the projected growth assumed in terms of population, employment and education and the distribution of this growth.

## 4.2 2040 Planning Datasheet Summary

The sections below present population, employment and education numbers for the derived 2040 Baseline Land Use Scenario at a high level for Counties Limerick & Clare, Limerick & Shannon Metropolitan Area and CSO Limerick City and Suburbs Boundary. Comparison between 2016 and 2040 scenario are also made to present the growth between the two scenarios. The areas within the metropolitan area are shown below in Figure 4-1.

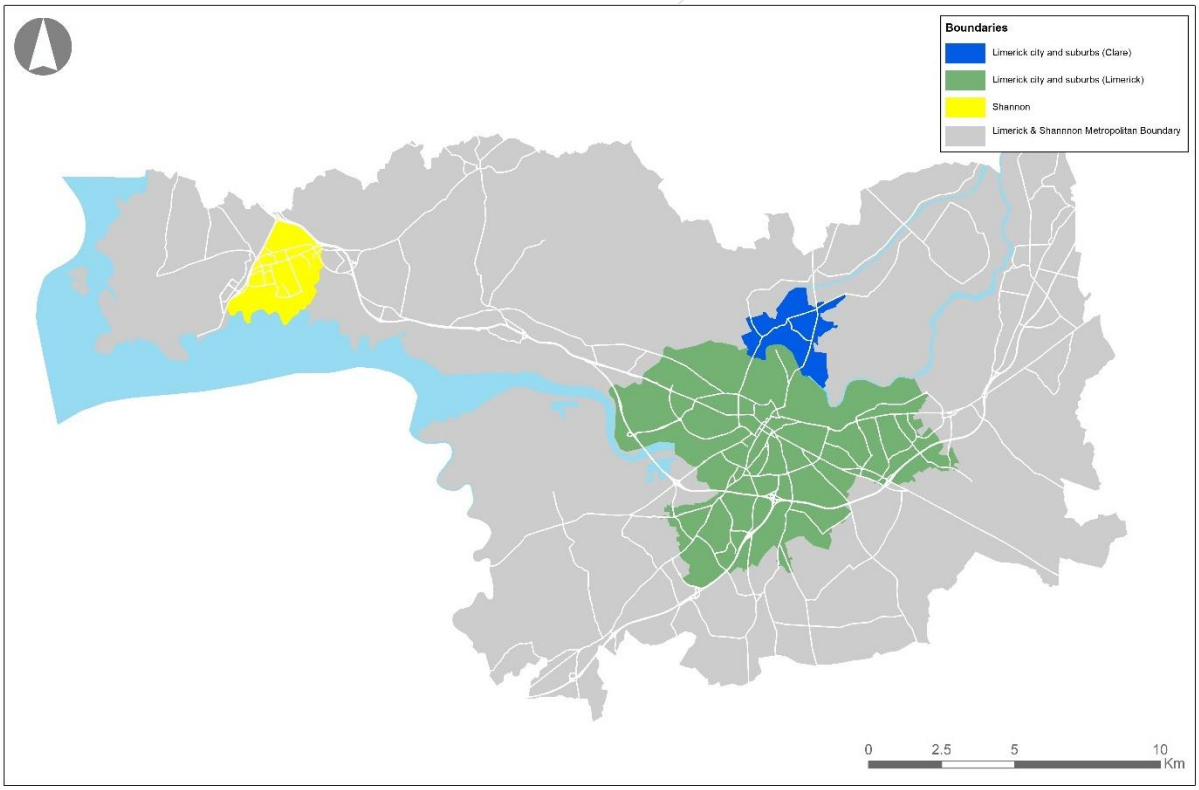



Figure 4-1: Limerick City & Suburbs & Shannon Area Boundaries

### 4.2.1 Population

Table 4-1 provides a comparison between the 2016 and the 2040 Planning Datasheets for the areas defined above. The table presents a proportional higher growth within the CSO defined Limerick City & Suburbs than in Limerick City & County and County Clare with a significant population increase within urban areas.

Within the remaining Metropolitan Area, there are significant population increases close to the existing City & Suburbs in areas such as Mungret, Annacotty & the proposed South Clare Economic Strategic Development Zone (SDZ) which lie immediately outside the existing CSO city boundaries. Approximately a third of all growth projected for County Clare lies within this proposed SDZ.

Table 4-1: Population Comparison

| County | Population | | Population Growth | |
|---|---|---|---|---|
| | 2016 | 2040 | 2016 to 2040 | |
| **Limerick City & County** | 194,899 | 261,475 | 66,576 | 34% |
| **Clare County** | 118,817 | 147,910 | 29,093 | 24% |
| **Metropolitan Areas** | | | | |
| **L-SMATS Area** | 132,420 | 206,444 | 74,024 | 56% |
| **-Limerick City & Suburbs** | 93,102 | 145,406 | 52,304 | 56% |
| -Limerick City & Suburbs (Limerick) | 88,668 | 139,880 | 51,212 | 58% |
| -Limerick City & Suburbs (Clare) | 4,434 | 5,527 | 1,093 | 25% |
| **-Shannon** | 10,442 | 13,807 | 3,365 | 32% |
| **-Remaining Metropolitan Area** | 28,876 | 47,231 | 18,355 | 64% |

It should be noted that the CSO Limerick City & Suburbs boundary does not align with the boundaries of CSO Small Areas. For the purposes of this comparison the population by SA was needed to compare to 2040. Thus, the population figure given is marginally lower than the official Census population for Limerick City and Suburbs (94,192). It should also be noted that the South Clare SDZ is not considered to be within the boundary of Limerick City and Suburbs and is within the remaining Metropolitan Area, which is partly responsible for the disproportionate increase in population in the remaining Metropolitan Area. There is also significant growth within parts of Mungret and Annacotty which lie outside the boundary of the city and suburbs, as per the CSO definition.

### 4.2.2 Employment

Table 4-2 provides a comparison between the 2016 and the 2040 Planning Datasheets for the areas defined by the NTA. Overall employment grows at a higher rate than population as the age profile and work force size increases. A higher proportion of growth is concentrated within the Limerick City & Suburbs area. As with the population growth, the high level of growth in the remaining metropolitan area is driven primarily by significant levels of employment growth in Mungret & the South Clare Economic SDZ.

Table 4-2: Job Comparison

| County | Employment | | Employment Growth | |
|---|---|---|---|---|
| | 2016 | 2040 | 2016 to 2040 | |
| **Limerick City & County** | 63,434 | 84,211 | 20,777 | 33% |
| **Clare County** | 30,914 | 40,982 | 10,068 | 33% |
| **Metropolitan Areas** | | | | |
| **L-SMATS Area** | 57,010 | 83,680 | 26,670 | 47% |
| **-Limerick City & Suburbs** | 41,983 | 58,252 | 16,268 | 39% |
| -Limerick City & Suburbs (Limerick) | 41,720 | 57,971 | 16,251 | 39% |
| -Limerick City & Suburbs (Clare) | 263 | 280 | 17 | 7% |
| **-Shannon** | 9,990 | 13,989 | 3,999 | 40% |
| **-Remaining Metropolitan Area** | 5,037 | 11,439 | 6,402 | 127% |

As before it should also be noted that the South Clare SDZ is not considered to be within the boundary of Limerick City and Suburbs and is within the remaining Metropolitan Area, along with parts of Mungret and Annacotty which experience significant growth which results in a high level of proportional growth within the remaining Metropolitan Area.

### 4.2.3 Education

Table 2-3 provides a comparison between the 2016 and the 2040 Planning Datasheets for education places which includes primary, secondary and tertiary education. Again, it should also be noted that much of the high growth in the remaining metropolitan area is within the South Clare SDZ, Mungret and Annacotty which lie just outside the boundary of the city and suburbs.

Table 4-3: Education Comparison

| County | Education | | Education Growth | |
|---|---|---|---|---|
| | 2016 | 2040 | 2016 to 2040 | |
| **Limerick City & County** | 49,211 | 65,201 | 15,990 | 32% |
| **Clare County** | 19,936 | 24,745 | 4,809 | 24% |
| **Metropolitan Areas** | | | | |
| **L-SMATS Area** | 37,911 | 55,171 | 17,260 | 46% |
| **-Limerick City & Suburbs** | 31,282 | 44,795 | 13,513 | 43% |
| -Limerick City & Suburbs (Limerick) | 31,011 | 44,325 | 13,314 | 43% |
| -Limerick City & Suburbs (Clare) | 271 | 470 | 199 | 73% |
| **-Shannon** | 2,583 | 3,217 | 634 | 25% |
| **-Remaining Metropolitan Area** | 4,045 | 7,159 | 3,113 | 77% |

## 4.3 Settlement Level Comparison

The sections below present population, job and education numbers for the 2040 Baseline Land Use Scenario at a more granular detail, showing the distribution of growth at a settlement level. Comparison between the 2016 base and the 2040 scenario are also made to present the growth between the two scenarios.

### 4.3.1 Limerick City and County and Clare County Settlements

The population, employment and education data at its most disaggregated form consists of 1,566 Census Small Areas (CSAs) for the MWRM. In the interest of simplicity these CSAs were grouped into specific settlements that allowed for sensible analysis of these locations. The settlements do not match Electoral District boundaries but are defined based on a best match between the Mid-West Regional Model Zoning System and the planning data at a CSA level. Additional growth is added at a settlement level in order to test future year scenarios. The settlements are illustrated in Figure 2-2.

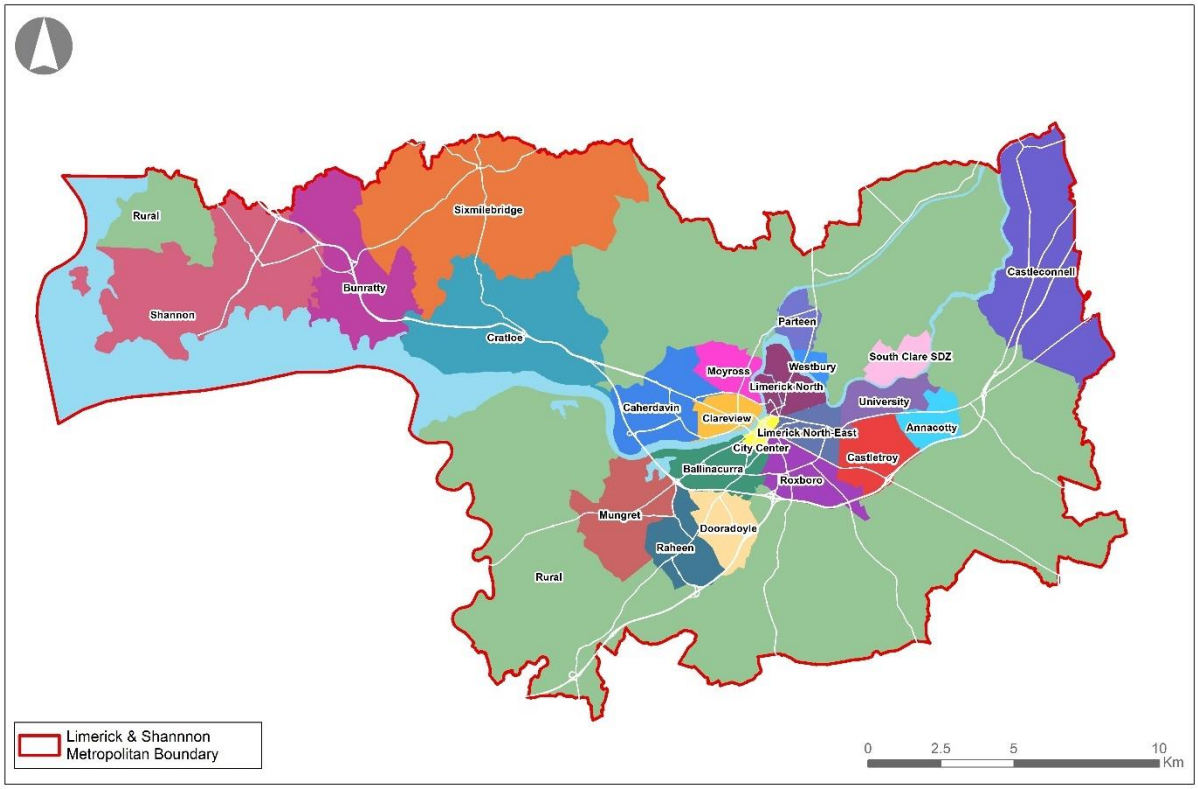



Figure 4-2: Metro Area Settlements

### 4.3.2 Population

Table 4-4 provides a comparison between the 2016 and the 2040 Planning Datasheets at a settlement level for population. As shown, significant levels of population growth are planned for the proposed South Clare Economic SDZ & Mungret with areas adjacent to the City such as Ballinacurra, Caherdavin, Raheen and Annacotty also experiencing high population growth.

Table 4-4: Population Comparison at a Settlement Level

| Metro Settlements | Population | | Population Growth | |
|---|---|---|---|---|
| | 2016 | 2040 | 2016 to 2040 | 2016 to 2040 % |
| Annacotty | 5,497 | 9,146 | 3,649 | 66% |
| Ballinacurra | 6,956 | 13,294 | 6,338 | 91% |
| Bunratty | 983 | 1,092 | 109 | 11% |
| Caherdavin | 5,487 | 10,820 | 5,333 | 97% |
| Castleconnell | 3,332 | 5,722 | 2,390 | 72% |
| Castletroy | 5,998 | 9,120 | 3,122 | 52% |
| City Centre | 6,071 | 8,443 | 2,372 | 39% |
| Clareview | 7,035 | 10,594 | 3,559 | 51% |
| Cratloe | 1,514 | 1,792 | 278 | 18% |
| Dooradoyle | 13,350 | 18,107 | 4,757 | 36% |
| Limerick North | 6,803 | 10,826 | 4,023 | 59% |

| | | | | |
|---|---|---|---|---|
| **Limerick North-East** | 12,344 | 17,518 | 5,174 | 42% |
| **Moyross** | 6,918 | 10,511 | 3,593 | 52% |
| **Mungret** | 1,259 | 3,969 | 2,710 | 215% |
| **Parteen** | 1,061 | 1,338 | 277 | 26% |
| **Raheen** | 3,446 | 6,335 | 2,889 | 84% |
| **Roxboro** | 7,774 | 12,045 | 4,271 | 55% |
| **Rural** | 15,887 | 25,062 | 9,175 | 58% |
| **Shannon** | 10,028 | 13,404 | 3,376 | 34% |
| **Sixmilebridge** | 3,962 | 4,769 | 807 | 20% |
| **South Clare Economic SDZ** | 379 | 3,534 | 3,155 | 832% |
| **University** | 2,963 | 4,813 | 1,850 | 62% |
| **Westbury** | 3,373 | 4,189 | 816 | 24% |
| **Total** | **132,420** | **206,444** | **74,024** | **56%** |

The population growth distribution between 2016 and 2040 is shown for each small area in Figure 2-3 and shows the high levels of growth in areas adjacent to the city centre as population intensifies in suburban areas. There is also considerable population growth within Shannon.

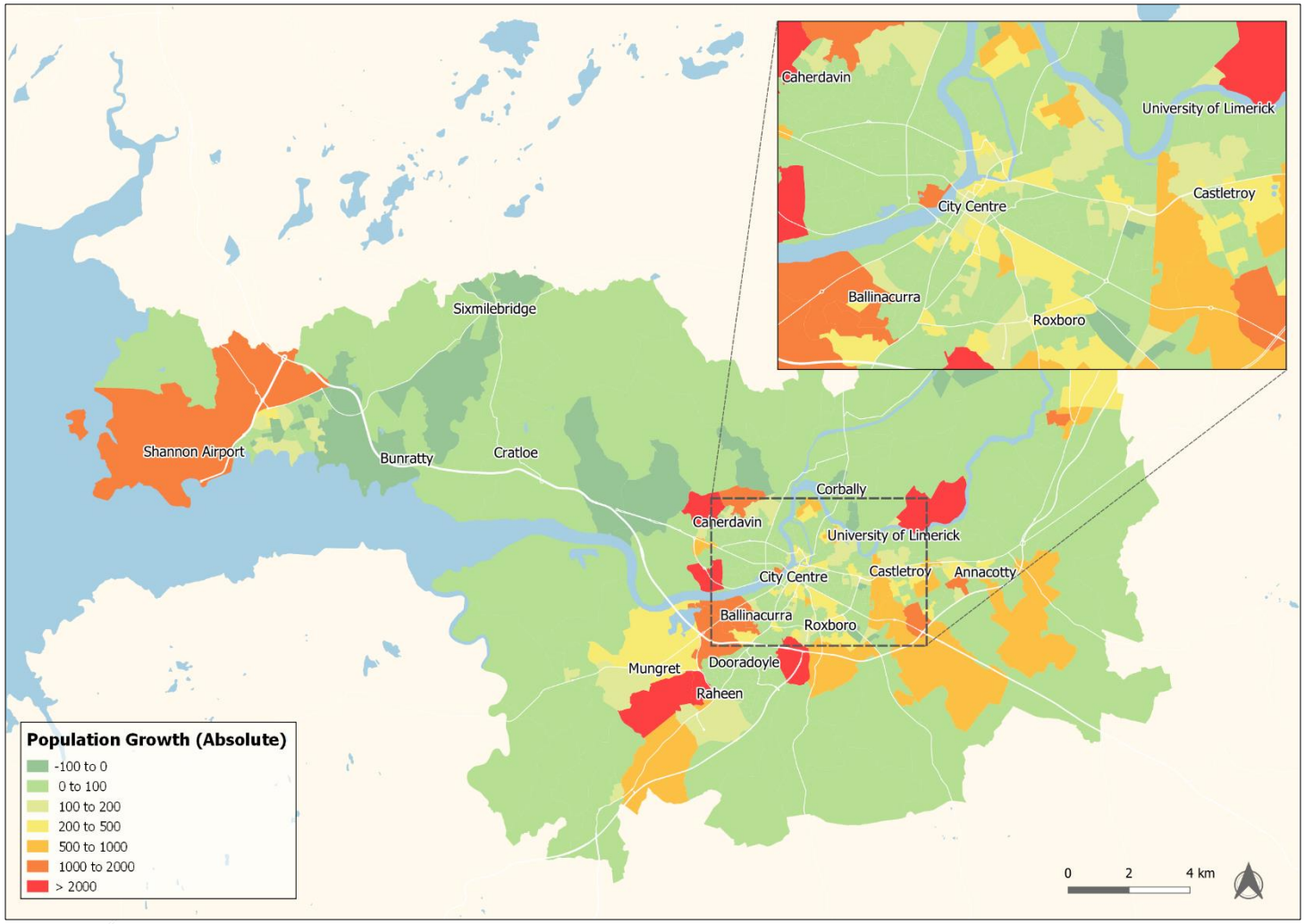



Figure 4-3: Population Growth 2016 to 2040

### 4.3.3 Employment

Table 4-5 provides a comparison between the 2016 and the 2040 Planning Datasheets at a settlement level for employment. The greatest absolute growth is seen in Ballinacurra which includes the Limerick Docklands. There is also significant employment growth within the City Centre, Mungret, Shannon and the proposed South Clare Economic SDZ.

Table 4-5: Job Comparison at a Settlement Level

| Metro Settlements | Employment | | Employment Growth | |
|---|---|---|---|---|
| | 2016 | 2040 | 2016 to 2040 | 2016 to 2040 % |
| Annacotty | 1,484 | 2,586 | 1,103 | 74% |
| Ballinacurra | 3,219 | 9,202 | 5,982 | 186% |
| Bunratty | 479 | 577 | 98 | 21% |
| Caherdavin | 900 | 1,836 | 936 | 104% |
| Castleconnell | 295 | 301 | 6 | 2% |
| Castletroy | 767 | 1,356 | 589 | 77% |
| City Centre | 9,842 | 12,749 | 2,907 | 30% |
| Clareview | 1,544 | 1,517 | -27 | -2% |
| Cratloe | 207 | 249 | 42 | 20% |
| Dooradoyle | 4,840 | 5,359 | 519 | 11% |
| Limerick North | 1,375 | 1,555 | 180 | 13% |
| Limerick North-East | 3,350 | 4,597 | 1,247 | 37% |
| Moyross | 1,562 | 1,507 | -55 | -4% |
| Mungret | 286 | 4,644 | 4,358 | 1523% |
| Parteen | 164 | 172 | 8 | 5% |
| Raheen | 4,606 | 5,254 | 649 | 14% |
| Roxboro | 3,831 | 5,143 | 1,312 | 34% |
| Rural | 3,314 | 4,160 | 846 | 26% |
| Shannon | 9,839 | 13,794 | 3,955 | 40% |
| Sixmilebridge | 229 | 312 | 83 | 36% |
| South Clare Economic SDZ | 28 | 1,136 | 1,108 | 3921% |
| University | 4,750 | 5,564 | 814 | 17% |
| Westbury | 99 | 108 | 9 | 9% |
| **Total** | **57,010** | **83,680** | **26,670** | **47%** |

The job growth distribution between 2016 and 2040 is represented by CSO small area in Figure 2-4.

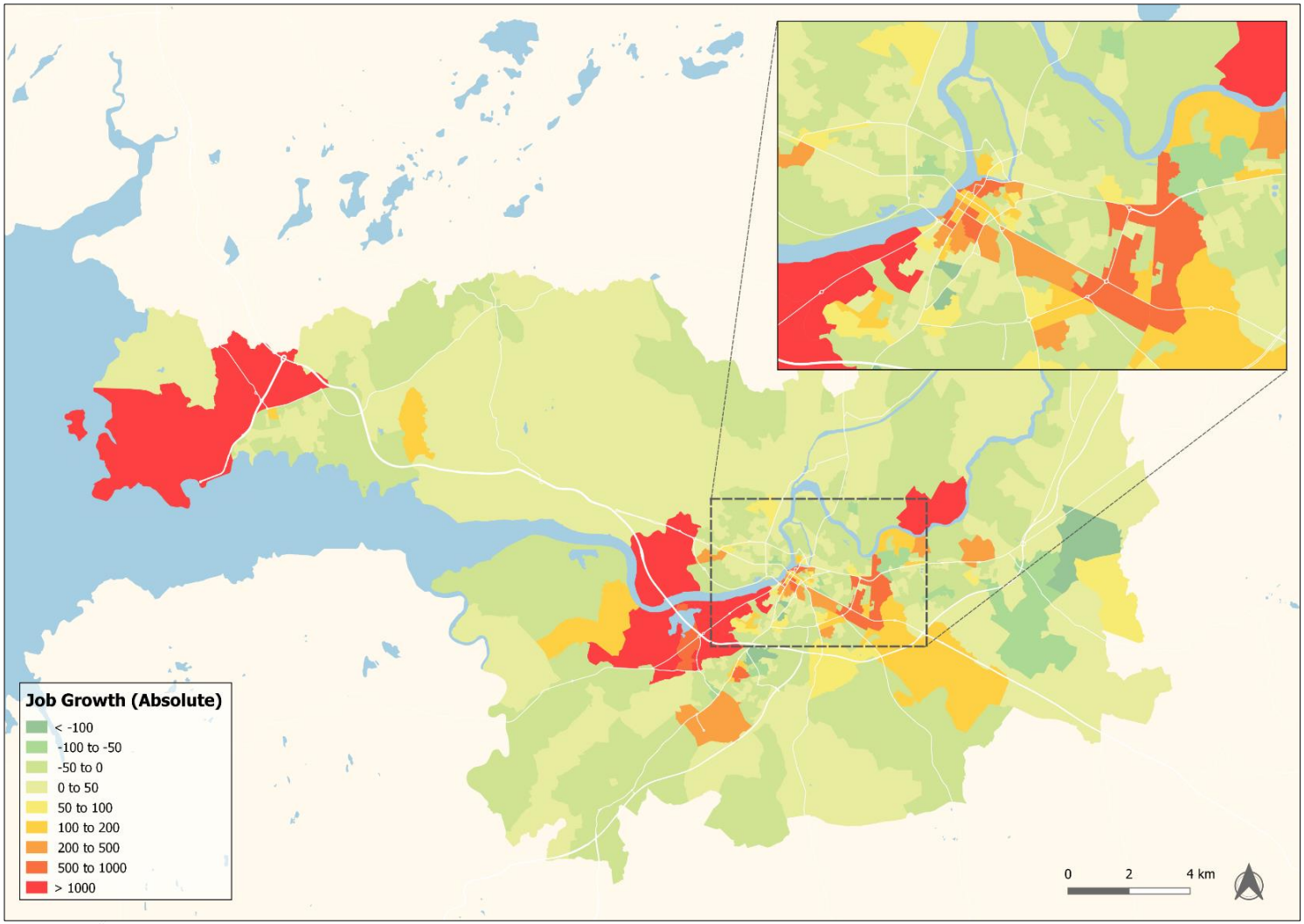



Figure 4-4: Job Growth 2016 to 2040

### 4.3.4 Education

Table 4-6 provides a comparison between the 2016 and the 2040 Planning Datasheets at a settlement level for education. As before, there is significant growth in education places in the Limerick Suburbs and areas with significant population growth forecast such as Mungret and the proposed South Clare SDZ.

Table 4-6: Education Comparison at a Settlement Level

| Metro Settlements | Population | | Population Growth | |
|---|---|---|---|---|
| | 2016 | 2040 | 2016 to 2040 | 2016 to 2040 % |
| Annacotty | 1,036 | 1,693 | 658 | 63% |
| Ballinacurra | 5,286 | 6,894 | 1,609 | 30% |
| Bunratty | 131 | 168 | 37 | 28% |
| Caherdavin | 484 | 1,443 | 959 | 198% |
| Castleconnell | 196 | 637 | 440 | 225% |
| Castletroy | 761 | 1,420 | 659 | 87% |
| City Centre | 864 | 1,582 | 717 | 83% |
| Clareview | 2,048 | 2,627 | 579 | 28% |
| Cratloe | 258 | 311 | 53 | 20% |
| Dooradoyle | 1,662 | 2,598 | 936 | 56% |
| Limerick North | 2,469 | 3,235 | 765 | 31% |
| Limerick North-East | 1,919 | 3,118 | 1,199 | 62% |
| Moyross | 3,793 | 5,245 | 1,452 | 38% |
| Mungret | 142 | 637 | 494 | 348% |
| Parteen | 269 | 315 | 45 | 17% |
| Raheen | 706 | 1,220 | 514 | 73% |
| Roxboro | 1,833 | 2,660 | 828 | 45% |
| Rural | 2,171 | 3,685 | 1,514 | 70% |
| Shannon | 2,583 | 3,200 | 617 | 24% |
| Sixmilebridge | 379 | 525 | 146 | 38% |
| South Clare Economic SDZ | 1 | 502 | 501 | 49645% |
| University | 8,916 | 11,302 | 2,386 | 27% |
| Westbury | 2 | 156 | 154 | 7572% |
| **Total** | **37,911** | **55,171** | **17,260** | **46%** |

As many small areas have no schools the education absolute growth rather than percentage growth in education places between 2016 and 2040 is represented in Figure 2-5.

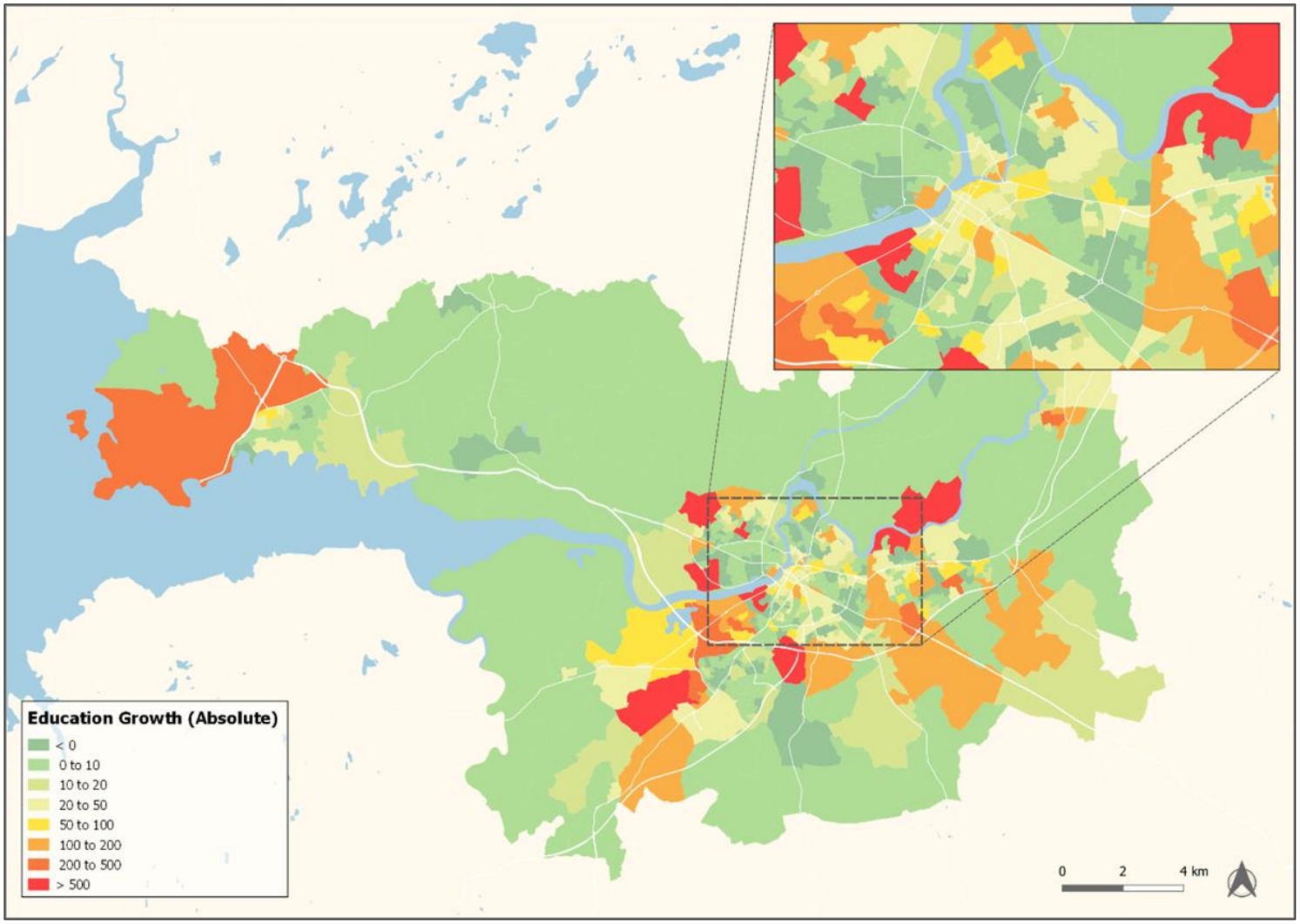



Figure 4-5: Education Growth 2016 to 2040

# 5 Modelling for Options Development

## 5.1 Overview

The following section provides a high-level overview of the supporting modelling undertaken using the NTA's Mid-West Regional Model (MWRM) to aid the options development and assessment. Public Transport options were developed prior to modelling based on the idealised demand outlined and the principles outlined in section 3.3. A number of options were also developed to make best use of the existing available infrastructure, such as existing rail lines. The modelling was then undertaken iteratively with each run used to refine the inputs and assumptions for the next run. The outputs of these runs were used to inform the options assessment for each corridor and refine the options outlined in Section 3.6-3.11. Further option development detail is provided in the LSMATS Transport Options and Network Development Report.

Improvements to public transport modes were modelled separately and prior to any road improvements to understand the likely maximum demand for public transport, the remaining road congestion issues with an improved PT network in place and the subsequent impact of the road infrastructure on car and public transport demand. The modelling runs undertaken as part of the options development are outlined in Table 3-3 along with the main additional inputs included in each run.

Table 5-1 Options Development – Model Runs

| Scenario | LNDR Phase 1 | Bus Network & Priority | Cycle Network | Improved Rail Network | City Centre PT Measures | Full LNDR | Foynes to Limerick |
|---|---|---|---|---|---|---|---|
| Do Min | ✓ | | | | | | |
| It 1: Bus | ✓ | ✓ | ✓ | | | | |
| It 2: Bus & Rail | ✓ | ✓ | ✓ | ✓ | | | |
| It 3: Bus & City Centre | ✓ | ✓ | ✓ | | ✓ | | |
| It 4: Bus, City Centre & Roads | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |

## 5.2 Scenario Description

### 5.2.1 Do-Minimum (AAD)

The Do-Minimum run included the existing road, public transport, walking and cycling networks with Phase 1 of the Limerick Northern Distributor Road from Coonagh to Knockalisheen, due to open in 2020. The AM peak mode share for the Metropolitan Area for the 2040 Do-Minimum and 2016 base year are shown in Figure 5-1.

As illustrated, there is a significant increase in the car mode share with a decline in the proportion of walking, cycling and public transport trips. However, in absolute terms there is growth across all modes as illustrated in the total number of trips shown in Figure 5-2.

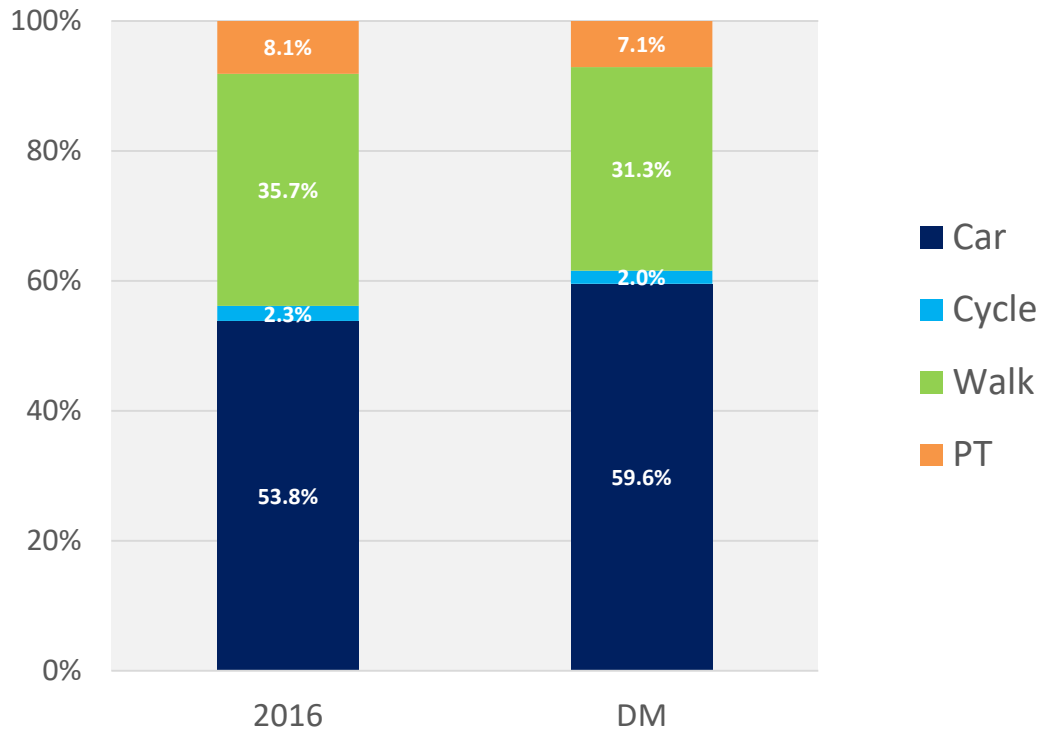



Figure 5-1: Metropolitan Area AM Peak Mode Share – 2016 & 2040 Do-Minimum

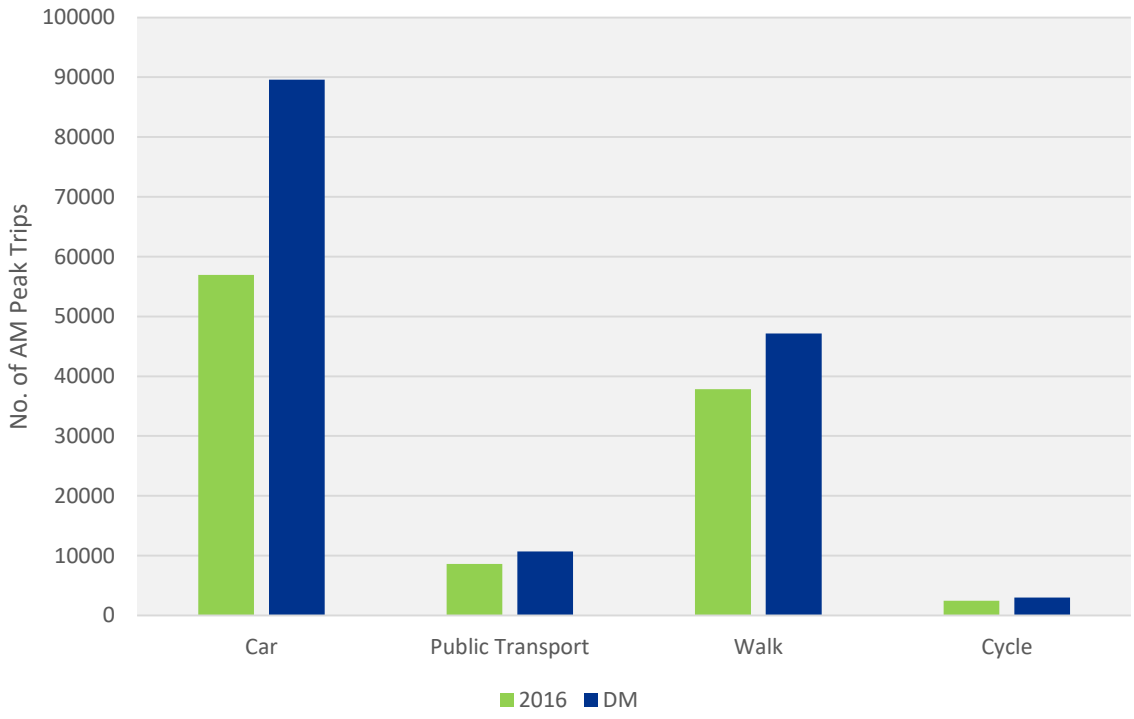



Figure 5-2: Metropolitan Area AM Peak Total Trips by Mode – 2016 & 2040 Do-Minimum

### 5.2.2 Iteration 1 – Bus (AAE)

Iteration 1 (AAE) included a comprehensive network of frequent radial and orbital bus routes developed to meet targeted maximum public transport demand outlined in the Demand Report and in accordance with the principles outlined in Options Development Report. A high level of bus priority along the network was assumed in addition to the existing road capacity. In reality, this level of priority may not be feasible along the entire network or would likely require some decrease in road capacity and/or traffic management. The initial bus network tested is shown below.

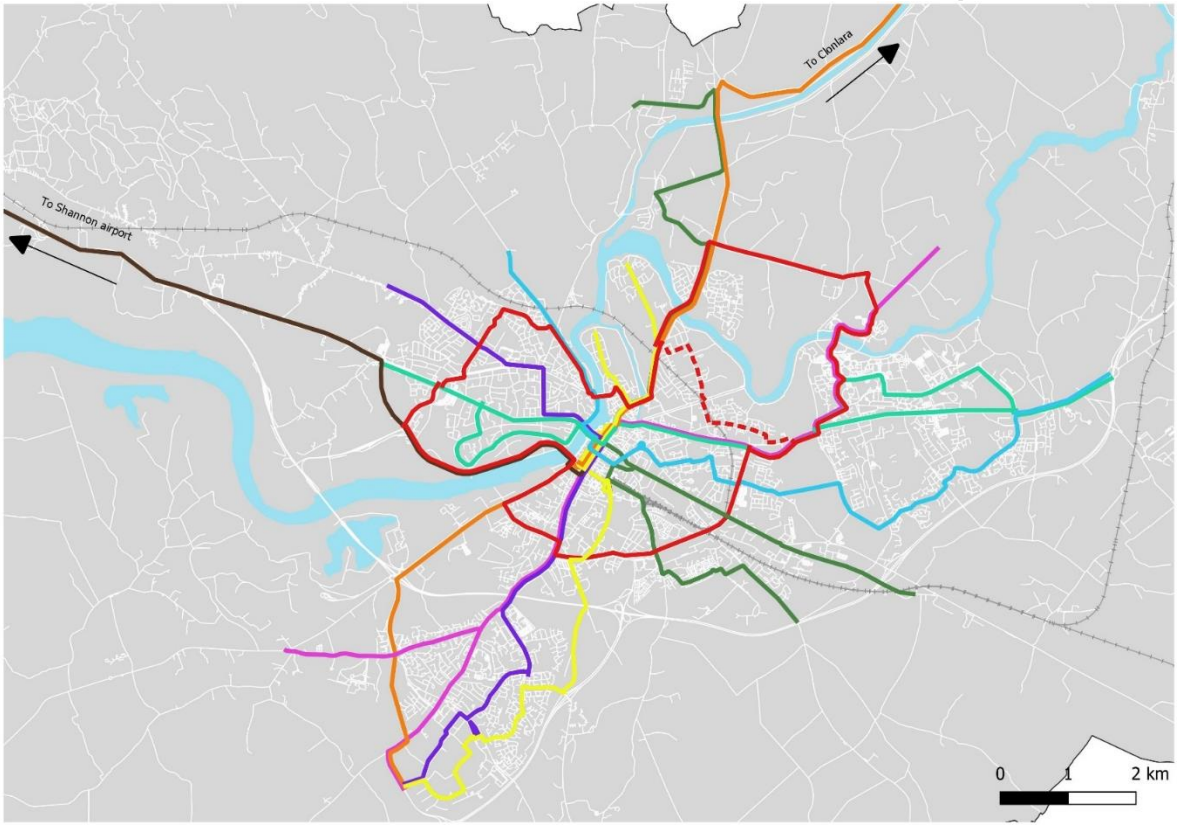



Figure 5-3: Iteration 1 (AAE) – Assumed Bus Network

This run also included an improved cycle network based on the Limerick Metropolitan Cycle network. The mode shares for Iteration 1 (AAE) and the Do-Minimum are outlined for the AM Peak period are outlined in Figure 5-4. As shown the improved bus network increases the public transport patronage by approximately 45% in absolute terms and increases the overall mode share by over 3%. This results in a drop in both walking and driving. The number of cyclists increases by 30% though this represent a small change in its overall mode share.

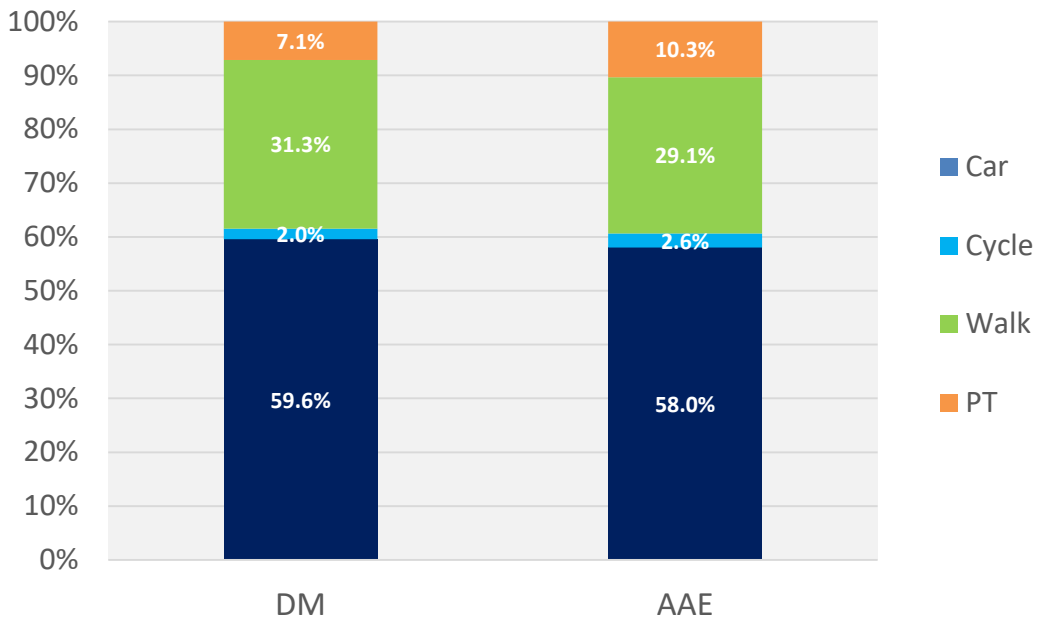



Figure 5-4: Metropolitan Area AM Peak Mode Share –2040 Do-Minimum & AAE

The improved frequency and catchment of the bus routes also results in significant journey time savings to the city centre by public transport. Figure 5-5 & Figure 5-6 show the average journey times by public transport to zones within the city core from across the metropolitan area from the Do-Minimum and Iteration 1 respectively. As shown, there is significant improvement in journey times across the LSMA particularly within Limerick City and wider suburbs. Overall, public transport journey times on average are reduced by 10mins or 27%.

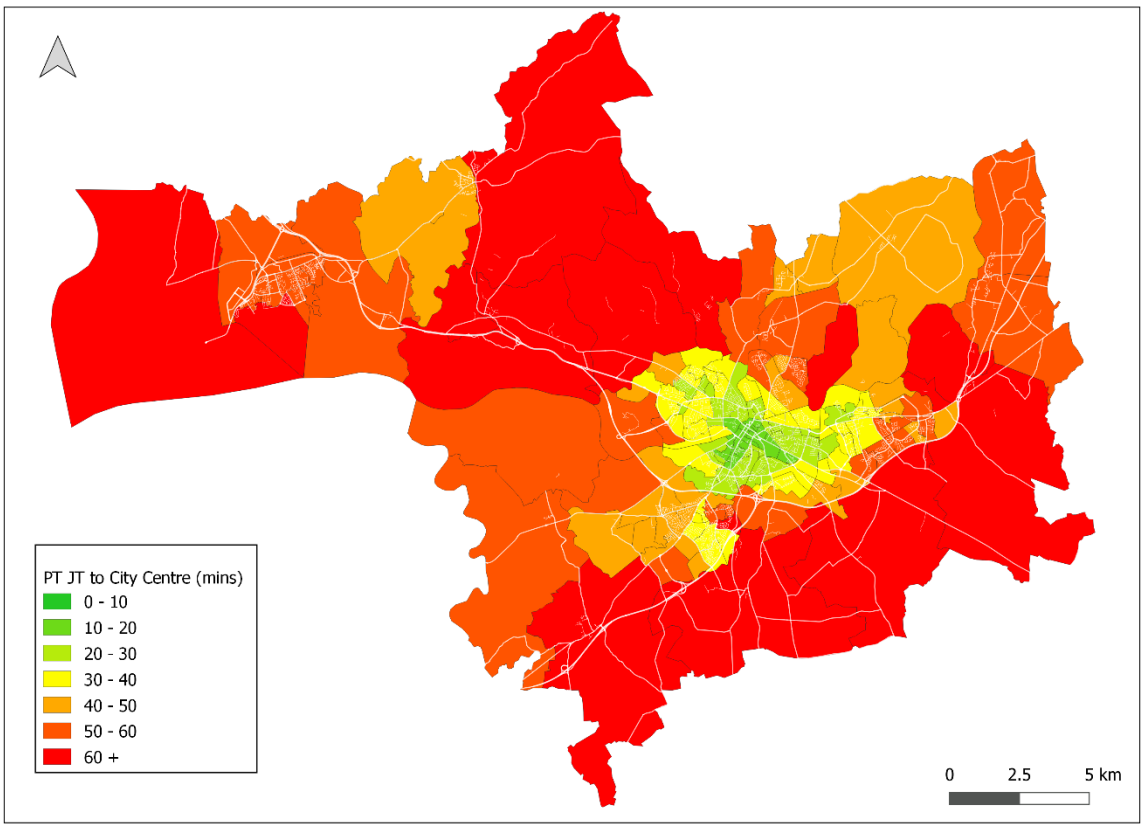



Figure 5-5: 2040 Do-Minimum Average Public Transport Journey Times to the City Centre – AM Peak

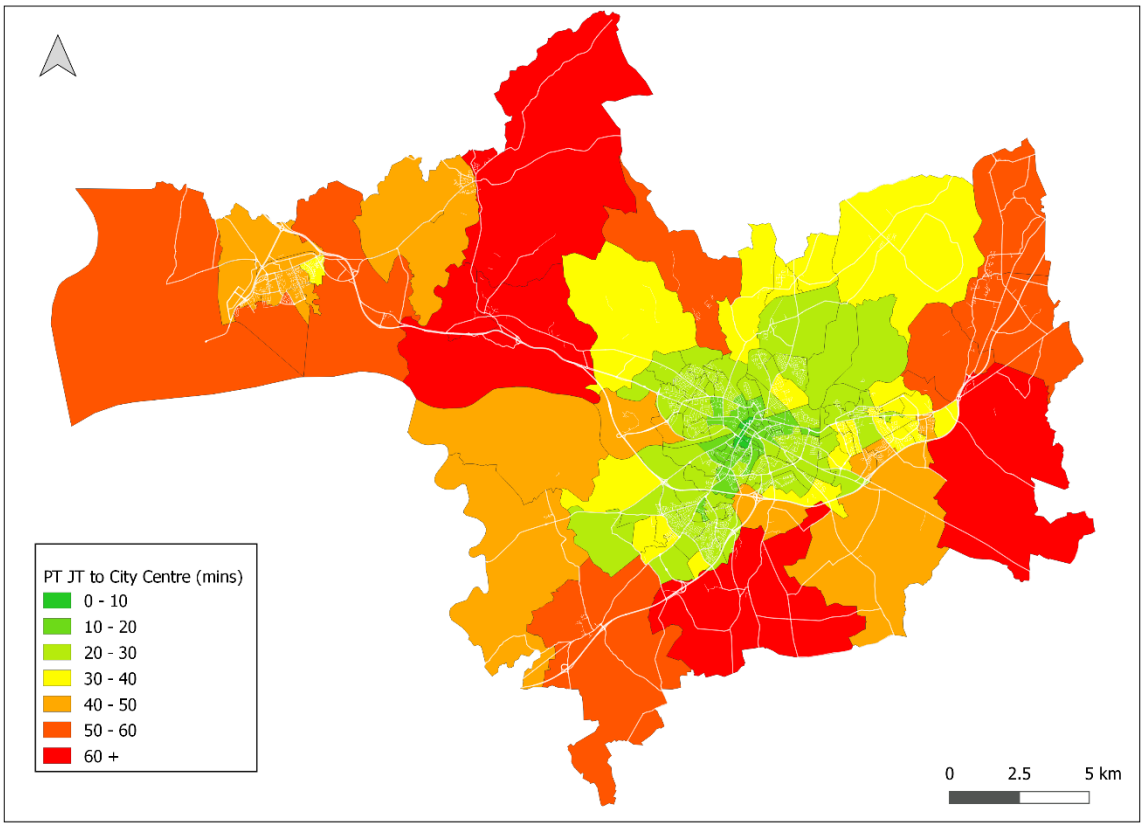



Figure 5-6: Iteration 1 (AAE) Average Public Transport Journey Times to the City Centre – AM Peak

The majority of buses also have a reasonable level of patronage, particularly during the morning and evening peak hour. The passenger volume over design capacity is shown as a percentage for each service for each peak hour, as illustrated by Table 5-2. The pink, purple, orange and brown lines in particular attract significant demand. The brown line to Shannon is over the design capacity in some peak, though under the crush capacity. The yellow and blue 'coverage routes' along with the northern orbital options to do not attract significant demand.

Table 5-2 Passenger Volume/Design Capacity of Improved Bus Services by Peak

| Line No. | Line Colour | Max Volume/Design Capacity | | | |
|---|---|---|---|---|---|
| | | AM | LT | SR | PM |
| 6010 | Dark green line / With north branch / Southbound | 63% | 32% | 49% | 41% |
| 6011 | Dark green line / With north branch/ Northbound | 76% | 28% | 39% | 35% |
| 6012 | Dark green line / With south branch / Southbound | 58% | 32% | 58% | 48% |
| 6013 | Dark green line / With south branch / Northbound | 91% | 32% | 50% | 38% |
| 6020 | Pink line / With west branch / Southbound | 97% | 62% | 83% | 74% |
| 6021 | Pink line / With west branch / Northbound | 83% | 55% | 70% | 56% |
| 6022 | Pink line / With East branch / Southbound | 87% | 52% | 67% | 55% |
| 6023 | Pink line / With East branch / Northbound | 74% | 45% | 59% | 43% |
| 6030 | Turquoise line / 2 North branches / Eastbound | 61% | 31% | 40% | 35% |
| 6031 | Turquoise line / 2 North branches / Westbound | 56% | 35% | 40% | 37% |
| 6032 | Turquoise line / 2 South branches / Eastbound | 45% | 27% | 42% | 42% |
| 6033 | Turquoise line / 2 South branches / Westbound | 80% | 40% | 39% | 37% |
| 6040 | Purple line / Southbound | 95% | 43% | 65% | 55% |
| 6041 | Purple line / Northbound | 90% | 59% | 78% | 56% |
| 6050 | Blue line / Eastbound | 39% | 21% | 30% | 27% |
| 6051 | Blue line / Westbound | 44% | 20% | 27% | 23% |
| 6060 | Orange line / Southbound | 93% | 37% | 47% | 37% |
| 6061 | Orange line / Northbound | 71% | 42% | 67% | 57% |
| 6080 | Yellow line / With west branch / Southbound | 31% | 13% | 23% | 22% |
| 6081 | Yellow line / With west branch / Northbound | 26% | 13% | 16% | 12% |
| 6082 | Yellow line / With east branch / Southbound | 38% | 19% | 24% | 26% |
| 6083 | Yellow line / With east branch / Northbound | 32% | 13% | 18% | 25% |
| 6090 | Brown line / To Limerick | 106% | 79% | 73% | 55% |
| 6091 | Brown line / To Shannon | 74% | 124% | 66% | 82% |
| 6100 | Orbital South / Eastbound | 51% | 22% | 36% | 31% |
| 6101 | Orbital South / Westbound | 58% | 22% | 35% | 28% |
| 6110 | Orbital North, option 1 / Eastbound | 20% | 12% | 19% | 12% |
| 6111 | Orbital North, option 1 / Westbound | 22% | 11% | 20% | 13% |
| 6112 | Orbital North, option 2 / Eastbound | 45% | 16% | 26% | 19% |
| 6113 | Orbital North, option 2 / Westbound | 41% | 20% | 36% | 29% |

### 5.2.3 Iteration 2 – Bus & Rail (AAF)

Iteration 2 (AAF) included all measures from the previous iteration along with an improved suburban rail network. This included the following:

- Rail Spur to Shannon Airport;
- 20-minute headways from Colbert Station to Limerick Junction, Nenagh, Shannon & Ennis;
- Assumed dual tracking on each of these lines to enable the more frequent services;
- New stations at existing urban settlements along each line including Garryowen, Corbally, Moyross, Cratloe, Bunratty, Castleconnell, Ballysimon, Pallas & Oola.

The AM peak mode share for Iteration 2 (AAF) and the previous runs is outlined in Figure 5-7. As shown, the significant improvement in rail infrastructure has a relatively limited impact in mode shares with an increase of 0.6% in the public transport mode share. The majority of this increase is

due to a shift from walking and cycling which decrease by a combined 0.4%. The car mode share decreases by just 0.2%.

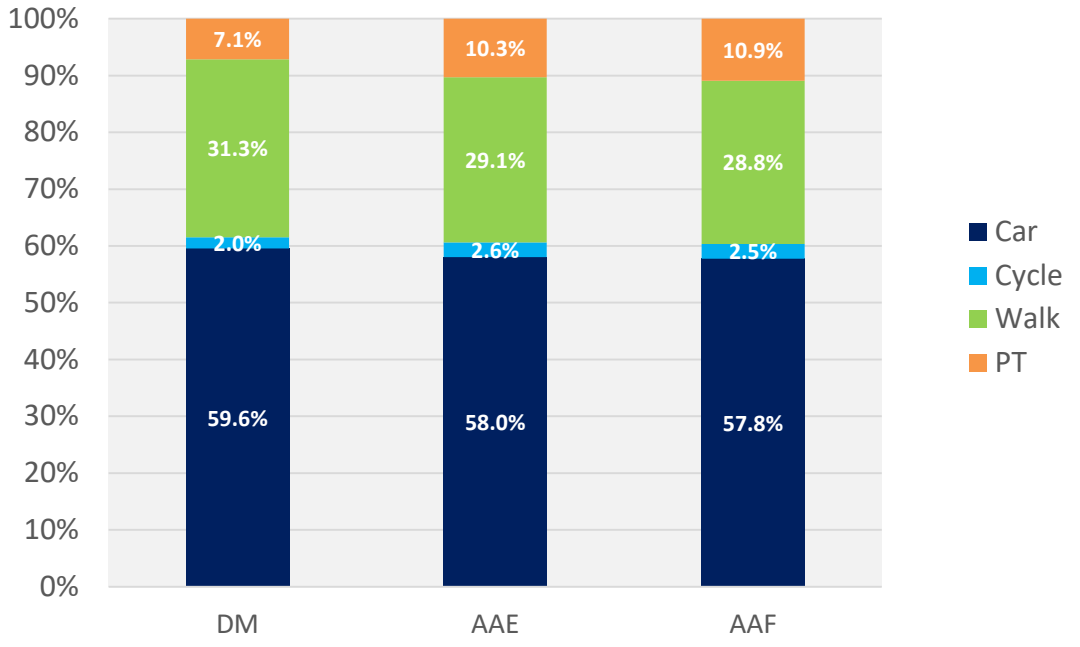



Figure 5-7: Metropolitan Area AM Peak Mode Share –2040 Do-Minimum, AAE & AAF

The patronage of each individual rail service shows that majority of services are well below their design capacity, as outlined in Table 5-3 which illustrates the volume over design capacity of the rail services during each peak.

Table 5-3 Patronage of Improved Rail Services by Peak

| Service | Time Period | | | |
|---|---|---|---|---|
| | AM | LT | SR | PM |
| Nenagh to Limerick | 26% | 6% | 7% | 9% |
| Limerick to Nenagh | 9% | 6% | 13% | 10% |
| Ennis to Limerick | 53% | 11% | 15% | 14% |
| Limerick to Ennis | 18% | 14% | 38% | 26% |
| Limerick to Limerick Junction | 12% | 16% | 25% | 21% |
| Limerick Junction to Limerick | 34% | 14% | 14% | 13% |
| Limerick Train Station to Shannon | 19% | 10% | 13% | 13% |
| Shannon to Limerick Train Station | 28% | 12% | 15% | 13% |

To assess the performance of individual new stations within the metropolitan area, the boardings and alightings from the AM peak have extracted for each proposed station and compared against the equivalent patronage for buses service local to the station. This is outlined in Figure 5-8. The population growth in these areas surrounding these stations, as outlined in Table 4-4, is below or equal to the average growth across the LSMA. To support the level of rail infrastructure proposed in this scenario these areas would require significant intensification of development around the stations.

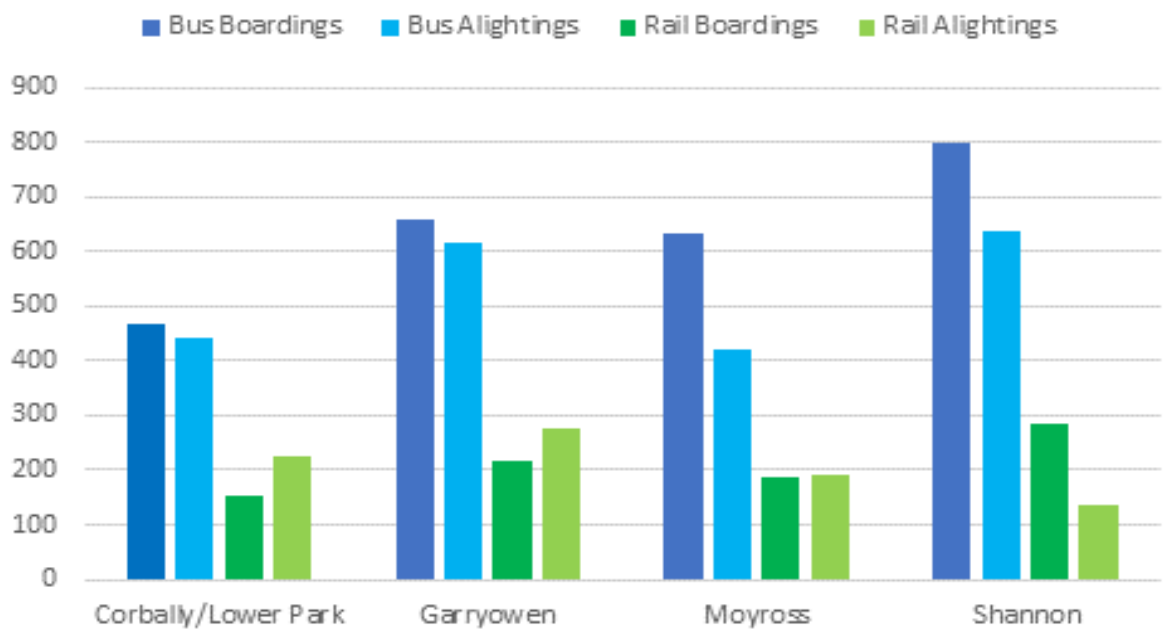



Figure 5-8: AM Peak Boardings and Alightings for proposed Metropolitan Rail Stations

The lower rail boardings and alighting compared to bus at these locations is partly due to the journey times to the city centre. Rail demand terminates in Colbert Station which is removed from the city centre. However, the improved bus network has multiple stops within the core of the city centre and runs and many of the proposed lines run at a higher frequency than that of the rail. As shown, in Figure 5-9: the average journey times by public transport to the City Core are largely unchanged compared to the Iteration 1 journey times presented in Figure 5-6. Overall, there is a 1% average reduction in public transport journey times.

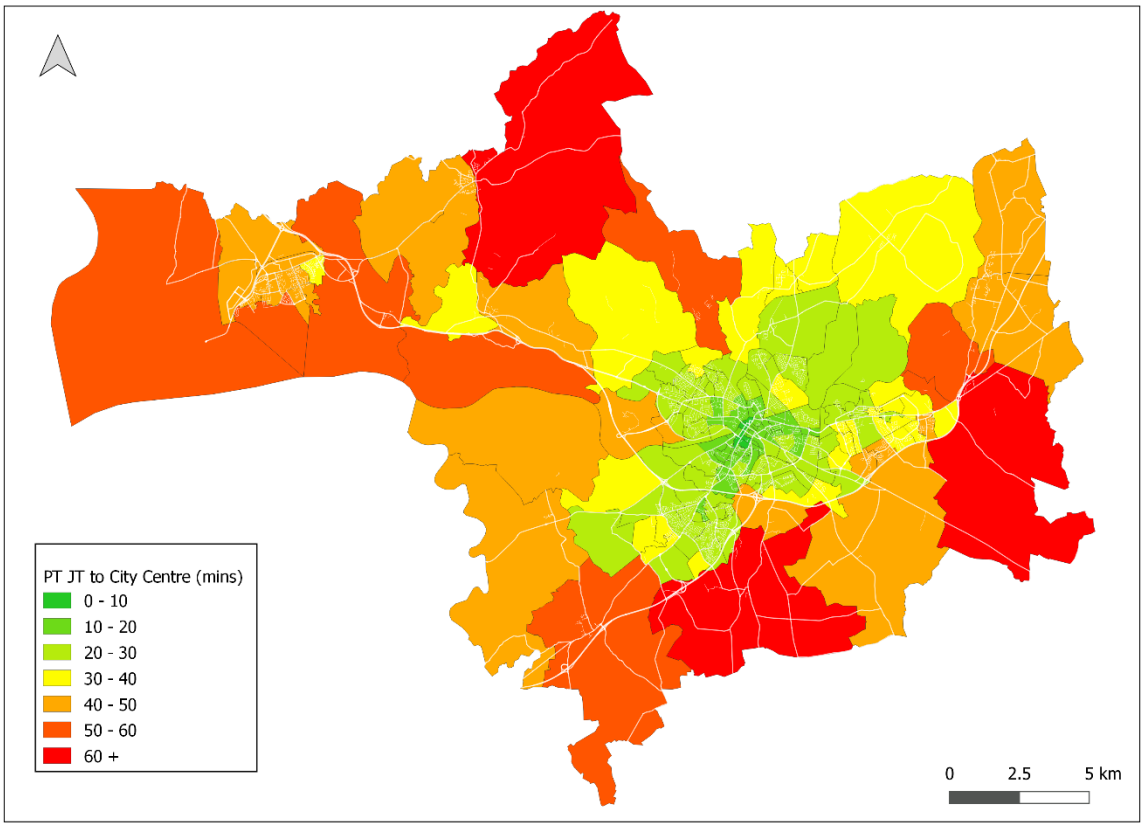
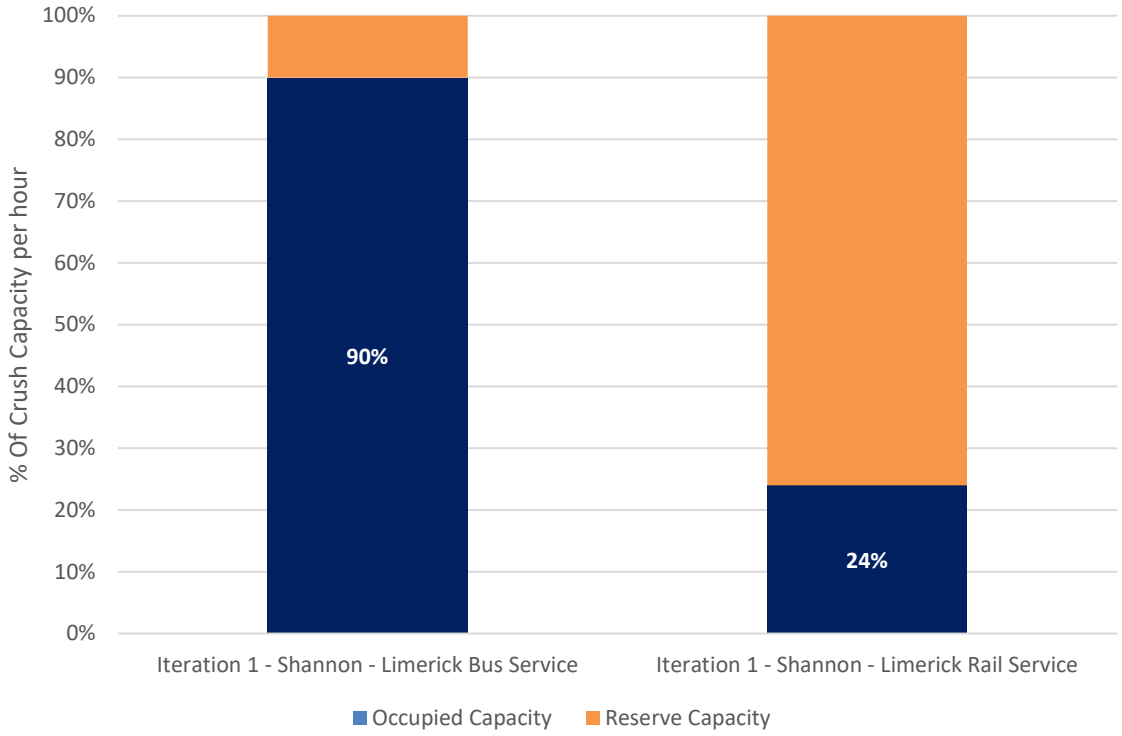



Figure 5-9: Iteration 2 (AAF) Average Public Transport Journey Times to the City Centre – AM Peak

the modelling shows that there is potential for an improved, more frequent service to Ennis, and potentially Limerick Junction, along existing lines based on the below but likely not to the extent assumed for modelling purposes. The new Shannon rail service in particular is unlikely to be feasible given the level of new infrastructure required to facilitate this service. As outlined in Figure 5.10, comparing the efficiency of the morning peak bus and rail services from Shannon to Limerick in Iteration 1 and Iteration 2 in terms of passenger demand as a percentage of crush capacity shows that the rail option would only be 24% occupied whilst the bus would be 90% occupied. Whilst this indicates a more frequent bus service may be required to serve future demand it is very unlikely that investment in rail could be justified by the passenger demand outlined.

Figure 5-10: AM Peak Passenger Demand/Crush Capacity of Shannon Iteration 1 Bus Service vs Iteration 2 Rail Service.




### 5.2.4 Iteration 3 – Bus & City Centre Strategy (AAG)

Iteration 3 included all measures contained within Iteration 1 along with traffic management measures and additional bus priority within Limerick City Centre. This includes public transport only measures along O'Connell Street and Sarsfield Bridge with Henry Street becoming two-way to general traffic. The rail improvements were not included based on the performance of rail in Iteration 2 which indicated low demand along the higher frequency services and low demand at each of the new rail stations. The city centre measures included are as outlined in Figure 5-11.

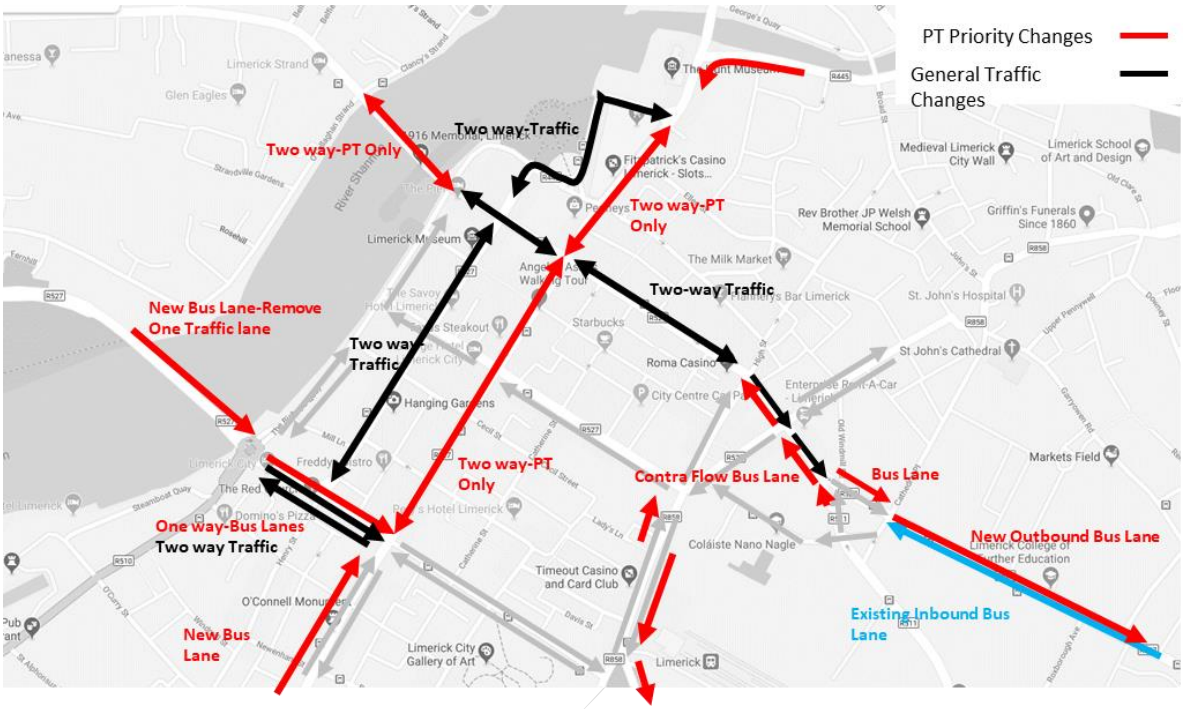



Figure 5-11: Iteration 3 (AAG) – City Centre Traffic Management & Bus Priority

The mode shares for this iteration and previous iterations are shown below.

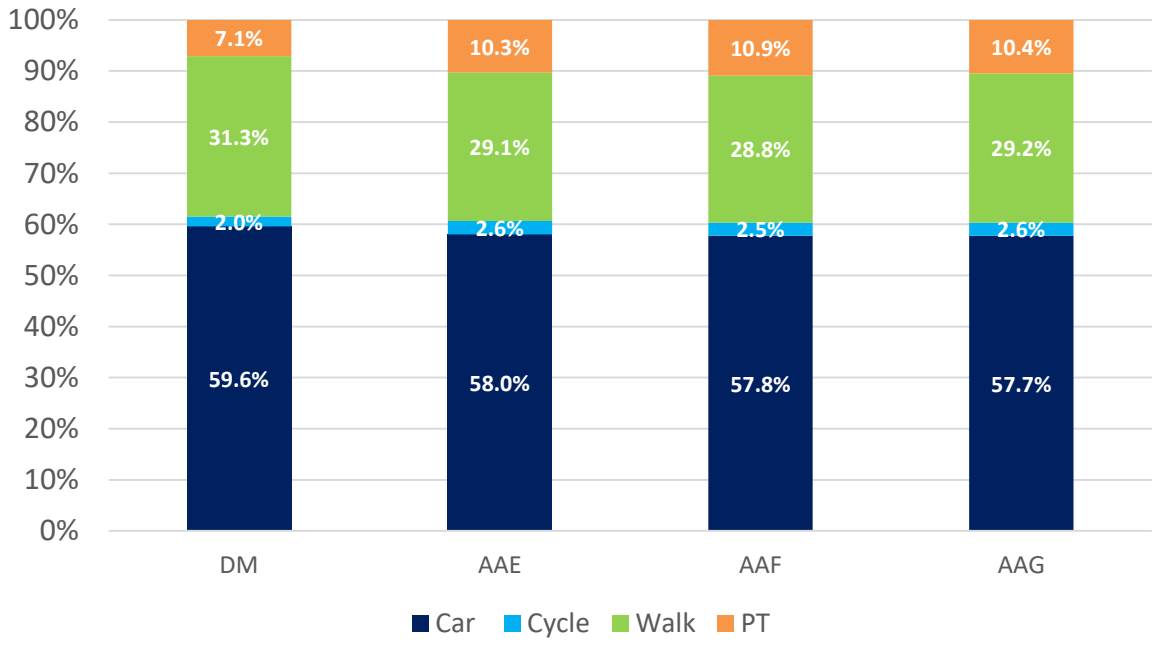



Figure 5-12: Iteration 3 (AAG) Mode Share -AM Peak

As shown, the traffic management measures and increased priority through the city has a greater impact on car mode shares than the provision of additional rail infrastructure. There is also an uplift in walking and cycling as more people choose these modes for shorter distance trips to the city centre.

### 5.2.5 Iteration 4 – Bus, City Centre Strategy & Roads (AAH)

This included the bus and city centre measures along with the N69 Foynes to Limerick incorporating Adare Bypass and full Limerick Northern Distributor Road (LNDR). The LNDR was

modelled as a 80kph dual lane with grade separated junctions. The resultant mode shares for this iteration are shown in Figure 5-13.

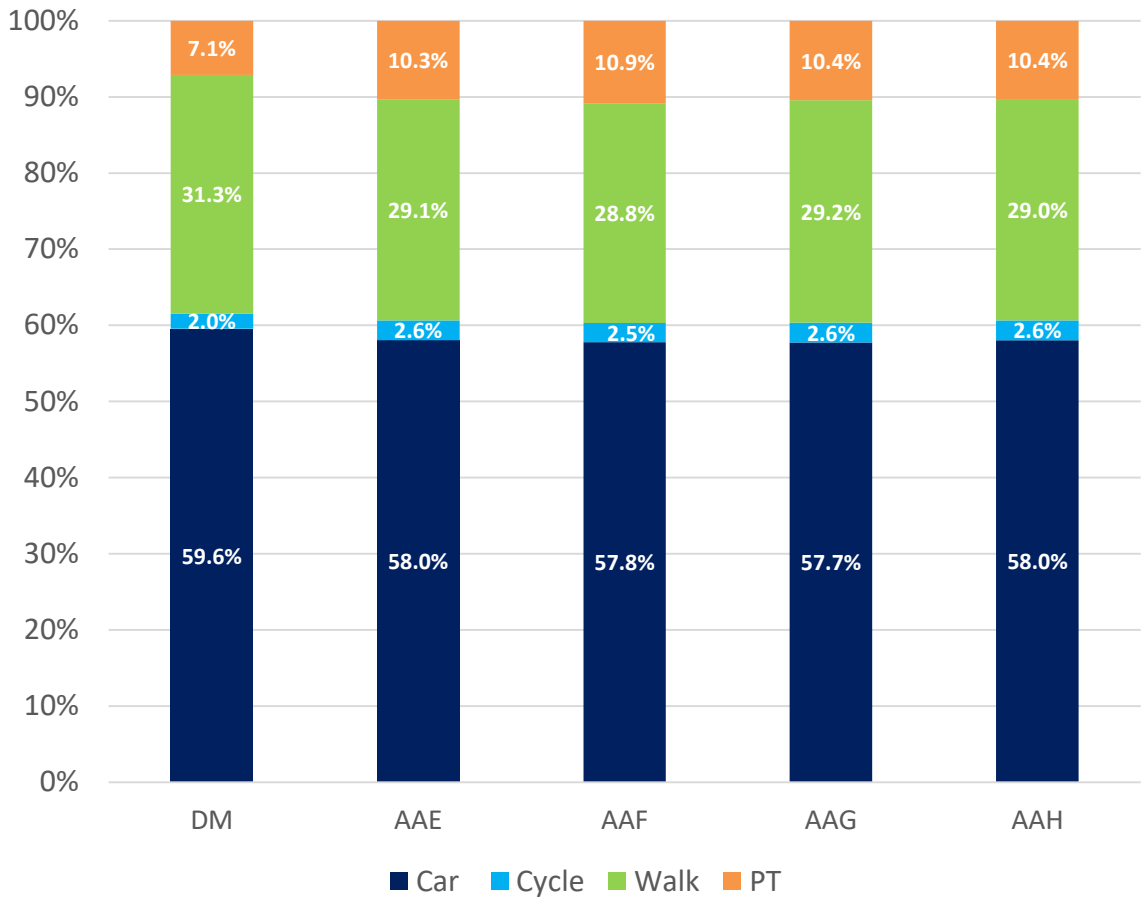



Figure 5-13: Iteration 4 (AAH) Mode Share -AM Peak

As shown, the introduction of the LNDR results in a slight increase in car mode share as a result of a decrease in walking. Public transport and cycling mode shares are unchanged. The would suggest a very slight increase in shorter distance car trips resulting from the scheme. The difference in traffic flows between AAG and AAH was plotted in SATURN for the AM peak and is shown in Figure 5-14. The green bands indicate an increase in traffic volumes and the purple bands a decrease.

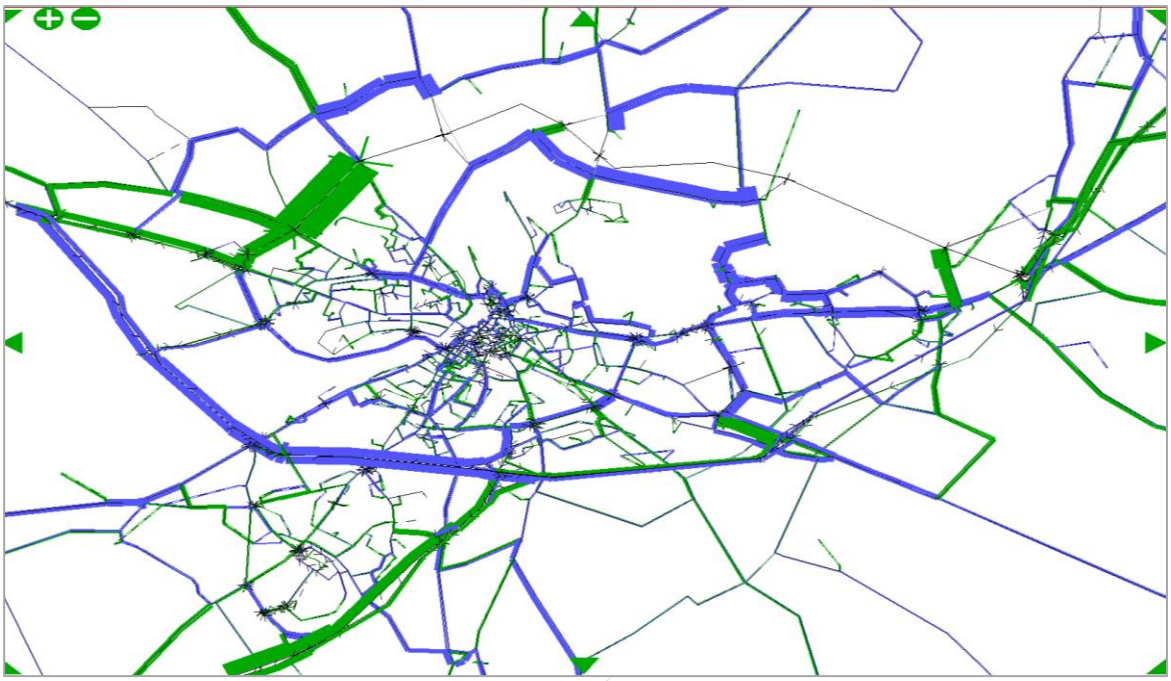


Figure 5-14: AAG vs AAH AM Peak Traffic Flows

As shown, there is a drop-in traffic along the N18 and M7 with an increase in traffic volumes along the Ennis Road. There is also an increase in traffic volumes along the M20 as a result of the N69 upgrade which ties into the M20. To assess these changes in more detail the volumes across each vehicular bridge over the Shannon, including the LNDR, was extracted from each model for the AM peak period, as shown below.

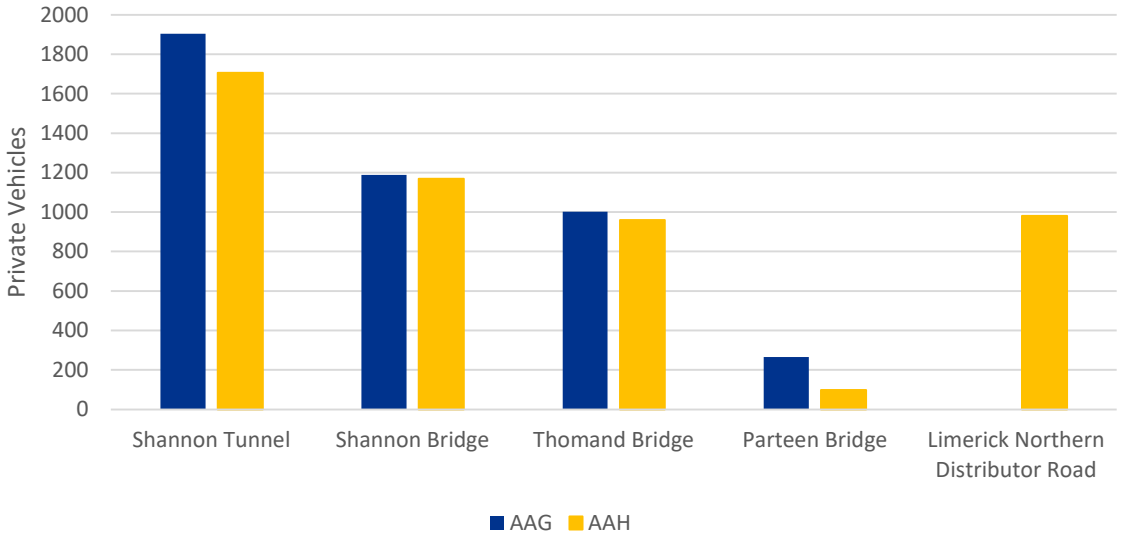



Figure 5-15: AAG vs AAH AM Peak Traffic Flows-Shannon Bridge Crossings

As shown, the LNDR has limited impact in the bridges within the city, Shannon and Thomond bridge, but has a more significant impact on the Shannon Tunnel and Parteen Bridge. Based on these preliminary assessments it is important the implementation of the LNDR and subsequent development of the corridor are carefully managed to ensure that the car mode share doesn't not increase further, undermining the sustainable mode share for the Limerick Shannon Metropolitan Area and the demand through the N18 Shannon Tunnel.

## 5.3 Emerging Strategy & Further Refinements

### 5.3.1 Public Transport Network Refinement

Based on the results from the initial model runs and feedback from the Strategy Steering group a number of revisions were made to the bus network. Firstly, the northern orbital routes outlined previously were removed due to the poor patronage and journey times along these routes. It was agreed that a frequent, reliable service would be difficult to implement prior to the delivery of the LNDR given the network constraints on the north side of the city. Any northern orbital route provided should run along the LNDR supported by Park & Ride Sites at each end of the route.

There was also consensus that the patronage of the rail service provided to Shannon and the new stations along this route were unlikely to justify the considerable investment needed. As an interim measure, a second bus route was provided to Shannon which would act as a local service alongside an express route. In addition, a local shuttle service would be provided between Sixmilebridge and Shannon Town and Airport serving the rail station.

It is important to note that the bus network has been developed based on the land-use assumption outlined for the purposes of strategy development. The changes to the bus network will be more incremental over time and respond to the evolving land-use. However, development should be prioritised along the core routes outlined.

### 5.3.2 LNDR Refinement

As outlined, the LNDR as previously modelled results in a drop-in traffic through the Shannon Tunnel. To address this and to help ensure the LNDR fulfils its function as distributor road and not as a bypass for strategic traffic it is proposed that the speed limit, cross section and junction strategy is refined. It is assumed the LNDR will have a 60kph speed limit, single carriageway cross-section for cars, at grade signalised junction and bus priority, walking and cycling provision. With these revised measures in place the decrease in traffic volumes through the Shannon Tunnel is 62 vehicles compared to the previous 200 vehicles decrease. The assessment highlights that the LNDR predominantly provides road-based travel alternative to the tolled Shannon Tunnel and the congested Parteen Bridge. Again, there is a slight increase in car mode share associated with the introduction of the LNDR with an associated reduction in sustainable mode share.

It should be noted that a more detailed, multi-modal modelling assessment of the LNDR will need to be undertaken as part of the future appraisal of the scheme. This assessment should include the need for the scheme, impact on Limerick City-wide public transport usage, LNDR public transport usage, regional and localised car mode shares and on traffic volumes through the Shannon Tunnel. Any likely induced car demand as a result of the scheme should also be assessed. The appraisal should also detail the planned phasing and implementation of the road.

### 5.3.3 Additional City Centre Public Transport Priority & Parking Restrictions

To ensure the LNDR does not have a negative impact on sustainable mode shares and does not result in the oversupply of road capacity for private vehicles public transport services and priority are proposed to be delivered in advance of the LNDR. The additional priority is proposed to the north of the city in the form of bus gates during the AM morning peak along Bridge Street and Charlotte's Quay, however, further analysis will be required to determine the appropriate form this priority will take.

A restriction on city centre destination parking supply was also tested. This was to reflect the potential removal of on-street parking spaces required to facilitate improved access for walking, cycling and public transport. These measures along with increased priority are intended to be

indicative of what could be realistically be implemented for the purposes of the strategy appraisal. However, a more detailed assessment and appraisal of the impacts would be required before they could be approved and implemented.

The metropolitan area AM peak mode share with each of the refinements in place is outlined in Figure 5-16 and shows a more drop in the car mode share as a result of the additional measures.

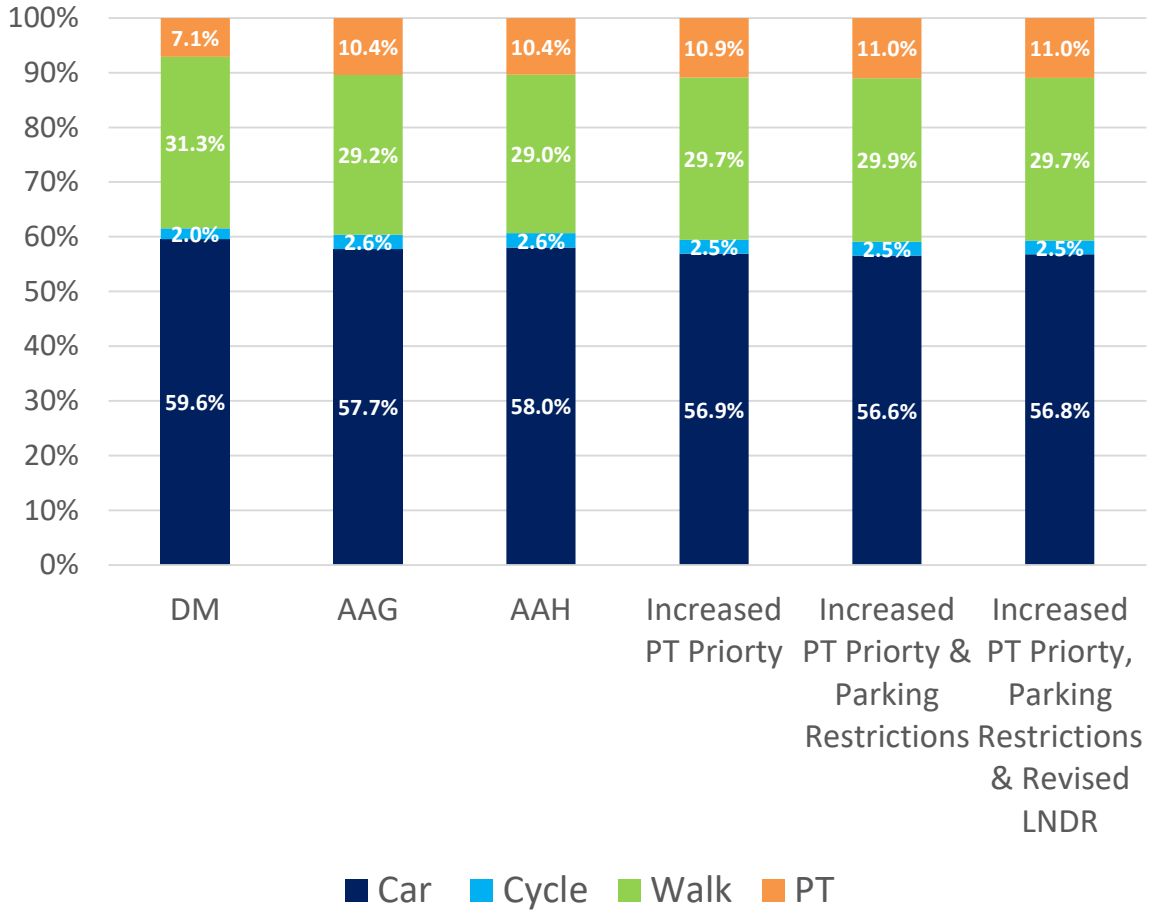



Figure 5-16: Strategy Refinement Mode Share -AM Peak

# 6 Emerging Preferred Strategy

## 6.1 Overview

This section outlines the final measures included in the Do-Minimum and Do-Strategy model runs for appraisal purposes. The measures have been informed by the optioneering run outlined in the previous chapter as well as feedback from key stakeholder.

## 6.2 Do-Minimum

The Do-Minimum is as described previously in Section 5.2.1 and includes the existing road, public transport, walking and cycling networks with Phase 1 of the Limerick Northern Distributor Road from Coonagh to Knockalisheen, due to open in 2020.

## 6.3 Do-Strategy

### 6.3.1 Public Transport

LSMATS proposes a comprehensive network of high frequency bus services providing radial services between corridors either side of the city core and orbital services across the network and is shown in Figure 6-1. The Core Radial Bus Network connect the external corridors to the City Centre and have been refined to pair Cross-City travel demand to maximise the utilisation of the bus services on these corridors. A significant improvement in the frequency of bus services on these radial routes is also proposed.

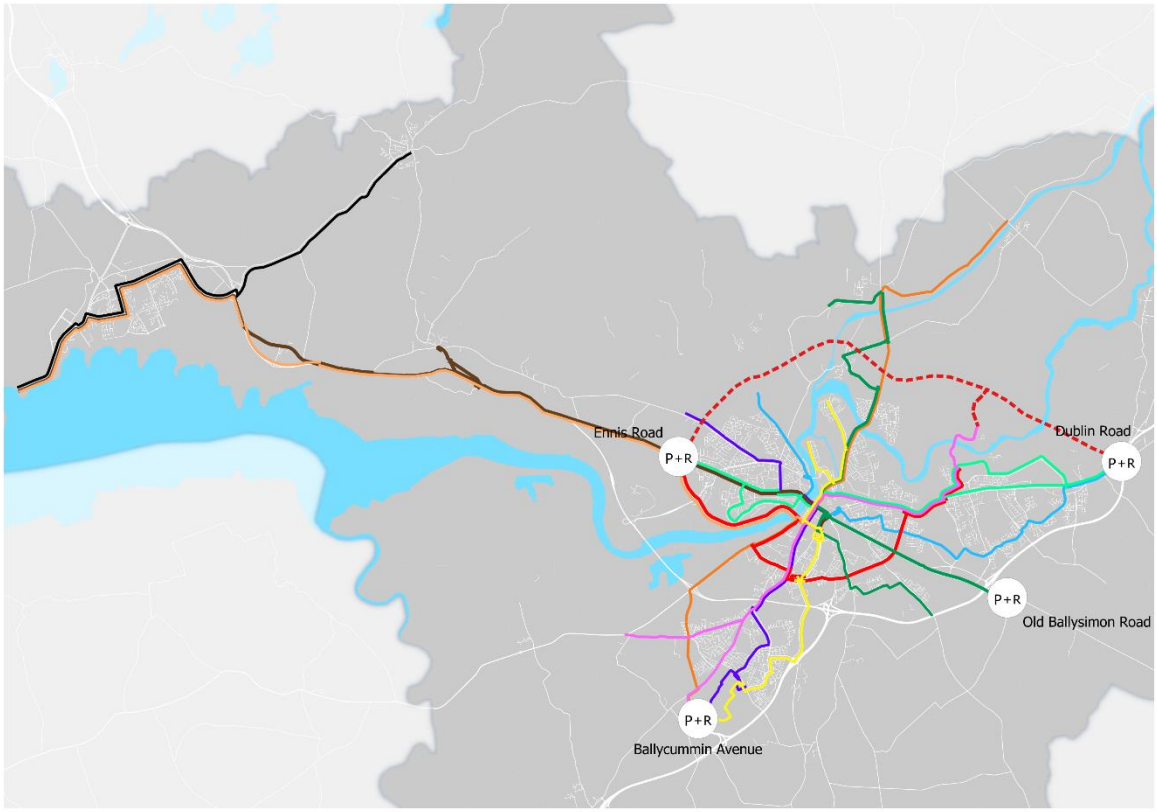



Figure 6-1: LSMATS Bus Connects Network

A number of core and orbital routes will serve strategic Park & Ride sites located along the periphery of the city, as shown in Figure 6-1. This are designed to capture demand travelling to the city that would otherwise be inclined to use car for the entirety of the journey.

The proposed frequencies of the routes are outlined in Table 6-1.

Table 6-1 Proposed Frequency of LSMATS Bus Network

| Line No. | Line Name | Modelled Headway |
|---|---|---|
| 6010 | Ballysimon-Ardnacrusha | 20 |
| 6011 | Ardnacrusha - Ballysimon | 20 |
| 6012 | Ardnacrusha - Crossagalla | 20 |
| 6013 | Crossagalla-Ardnacrusha | 20 |
| 6020 | SDZ/UL-Mungret | 15 |
| 6021 | Mungret-SDZ/UL | 15 |
| 6022 | SDZ/UL-Raheen | 15 |
| 6023 | Raheen-SDZ/UL | 15 |
| 6030 | Caherdavin-UL-Annacotty | 20 |
| 6031 | Annacotty-UL-Caherdavin | 20 |
| 6032 | Caherdavin/North Circular-Annacotty | 20 |
| 6033 | Annacotty-Caherdavin/North Circular | 20 |
| 6040 | Ballygrennan-Raheen | 7.5 |
| 6041 | Raheen-Ballygrennan | 7.5 |
| 6050 | Annacotty-Moyross | 10 |
| 6051 | Moyross-Annacotty | 10 |
| 6060 | Clonlara-Raheen | 15 |
| 6061 | Raheen-Clonlara | 15 |
| 6080 | King's Island-Raheen | 30 |
| 6081 | Raheen-King's Island | 30 |
| 6082 | Corbally-Raheen | 30 |
| 6083 | Raheen-Corbally | 30 |
| 6090 | Shannon-Limerick Express | 10 |
| 6091 | Limerick-Shannon Express | 10 |
| 6114 | Shannon-Limerick Local | 15 |
| 6115 | Limerick-Shannon Local | 15 |
| 6116 | Sixmilebridge-Shannon | 20 |
| 6117 | Shannon-Sixmilebridge | 20 |
| 6100 | Southern Orbital Eastbound | 10 |
| 6101 | Southern Orbital Westbound | 10 |
| 6118 | Northern Orbital Eastbound via LNDR | 20 |
| 6119 | Northern Orbital Westbound via LNDR | 20 |

### 6.3.2 Cycling

The cycle network development for LSMATS is based on the Limerick Metropolitan Cycle Network Study 2015 and Shannon Town and Environs LAP, each was reviewed to ensure integration and alignment with the transport proposals within this strategy and is shown in Figure 6-2 & Figure 6-3. The proposed cycle network was coded into the MWRM in the Do-Strategy scenario to represent the increased cycle speeds associated with the various levels of service provided by the proposed network.

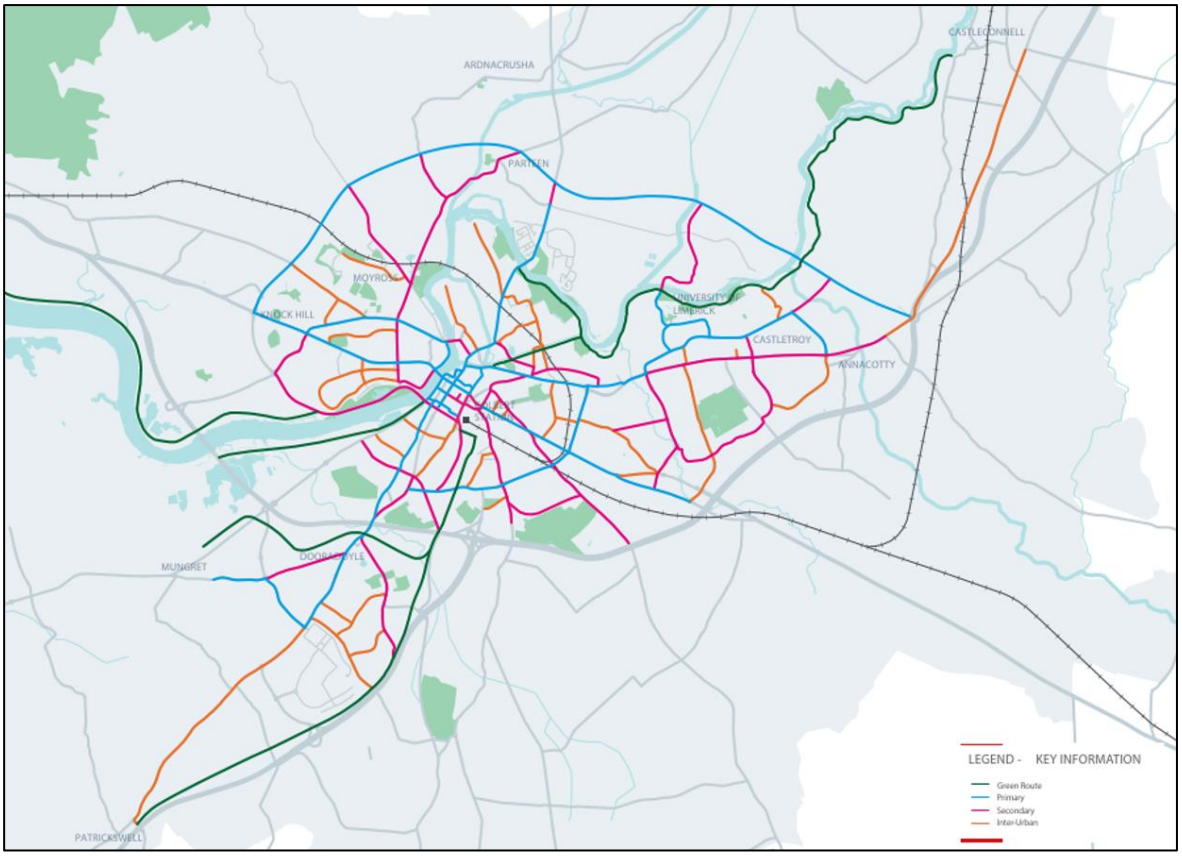



Figure 6-2: LSMATS Cycle Network- Limerick City and Suburbs

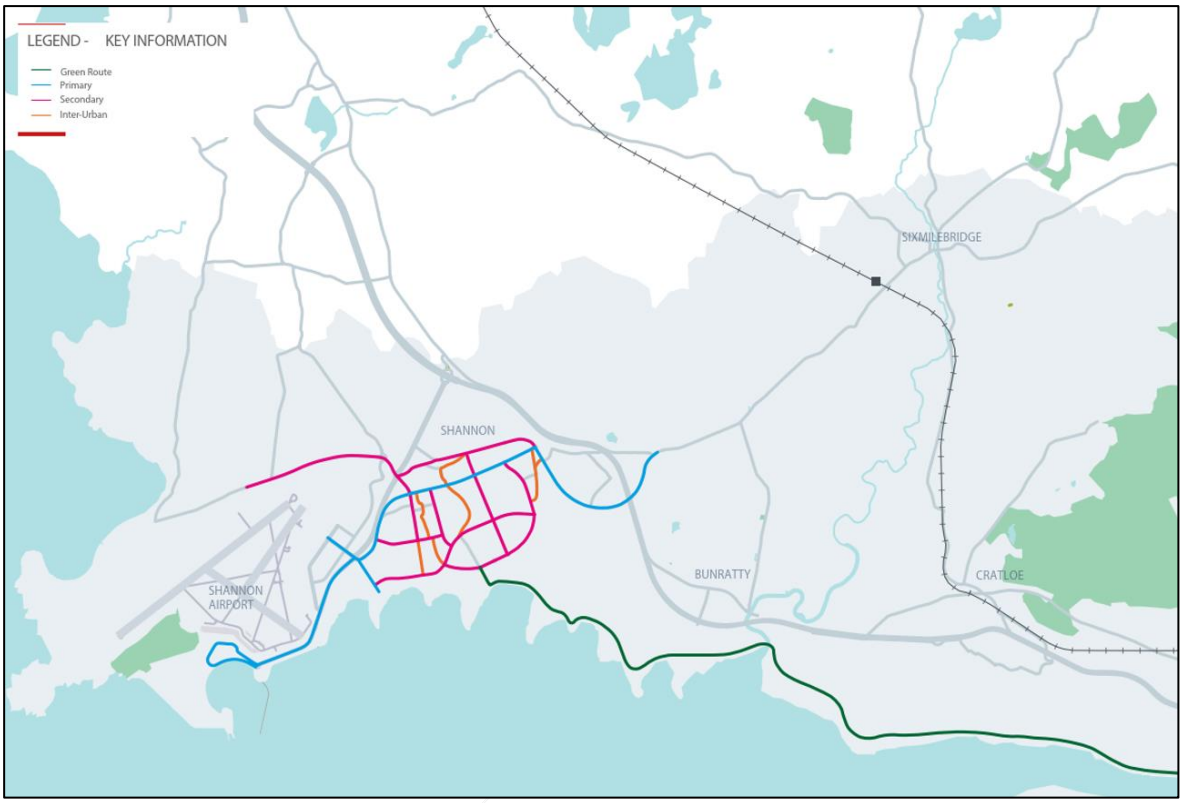



Figure 6-3: LSMATS Cycle Network- Shannon Town

### 6.3.3 Walking

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

- St. Nessan's Road – UHL, Dooradoyle and Ballinacurra Crescent Shopping Centre;
- Ennis Road – connecting the predominantly pedestrian areas of west Limerick to the city centre;
- LIT / Old Cratloe Road Area – Thomond Park / Moyross;
- University of Limerick Area – R445 Dublin Road and Plassey Park Road / Castletroy / Annacotty;
- Ballycummin Road – Raheen Business Park;
- Corbally Road / Athlunkard Street – Kings Island through to the City Centre;
- Canal Route – connecting Shannon Fields to University of Limerick and the City Centre;
- Rhebogue Neighbourhood Greenway;
- Shannon town centre to Shannon Free Zone;
- Childers Road; and
- R527 Ballysimon Road.

The above routes are shown in Figure 6-4 below.

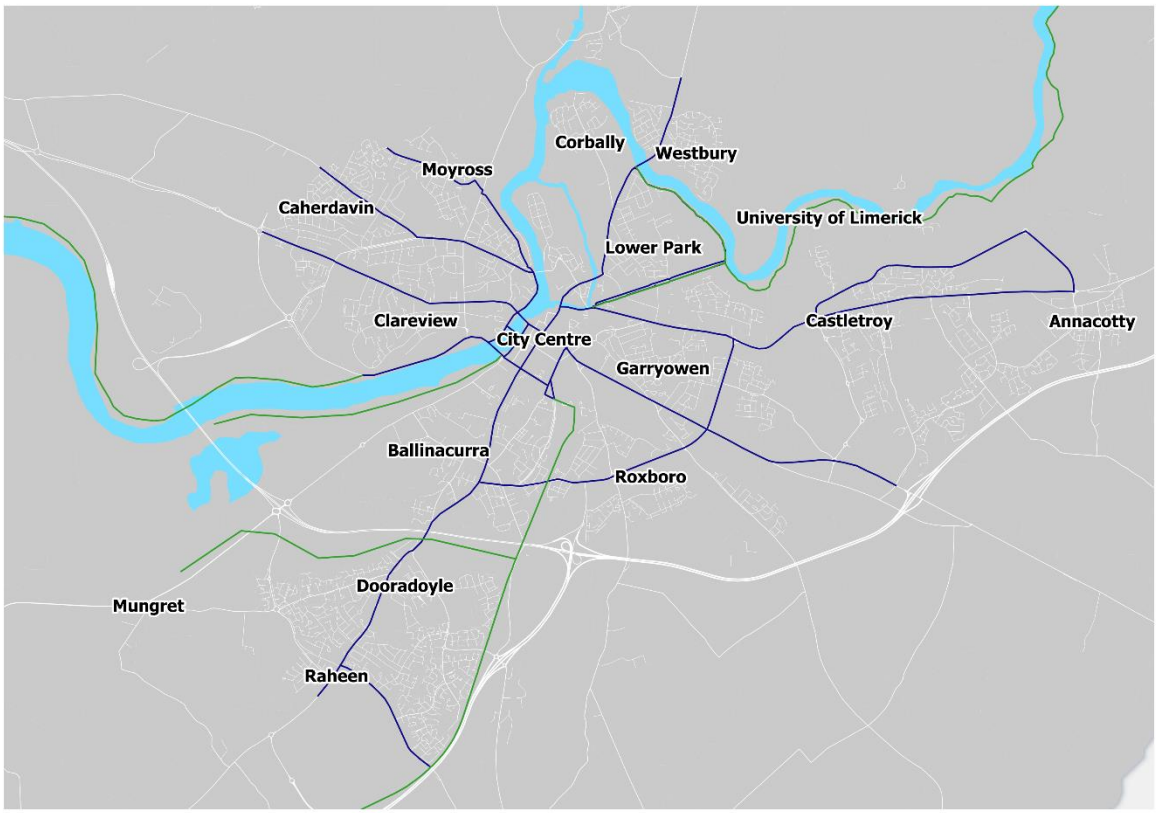



Figure 6-4: Strategic Walking Routes

Improvements are also identified within the city centre of Limerick. Whilst Limerick City Centre's historic core is compact, pedestrian access is inhibited in some areas by a limited number of pedestrian bridges over the River Shannon, substandard crossing facilities, wide multi-lane one-way streets and high volumes of vehicular traffic and speeds on approach roads. Limerick City Centre has significant potential to enhance its walkability due to its favourable flat topography and recent public realm improvements including pedestrian priority areas and improved crossing facilities. Walkability improvements envisaged for the City Centre over the lifetime of the Strategy include:

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

There will also be local improvements within towns throughout the LSMA. Given the high level of out-commuting experienced in the Metropolitan towns, walking should be promoted as part of linked trips with public transport. The pedestrian environment around bus stops and train stations should be improved in Cratloe, Shannon, Sixmilebridge and other metropolitan town and village centres. These will be undertaken in tandem with land use proposals that consolidate village

centres, strengthen their place function and reduce the ribbon-development patterns evident in villages like Clarina and Patrickswell. LAP objectives for the pedestrian environment for Castleconnell, Askeaton, Castletroy and Patrickswell are supported by LSMATS.

### 6.3.4 Roads

LSMATS proposes significant investment in roads schemes up to 2040 which are summarised below. Further details on the individual schemes is provided in the Main Strategy Report and also in the "Transport Options and Network Development Report".

*National Roads*

- N21/N69 Foynes to Limerick incorporating Adare Bypass;
- N18/N19 Shannon;
- M7/N18 Junction Improvements

The N/M20 Cork to Limerick is also supported by the strategy thought not included in the modelling process as the project is still in the earlier stages of the appraisal process.

*Regional Roads*

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

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

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

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

The following specific new regional roads have been included in the strategy modelling:

- Limerick Norther Distributor Road (60kph with at grade junctions and bus priority);
- Link road from the Childers Road to Golf Links Road via Bloodmill Road and Groody Road (with bus priority);

As detailed in the options report, it is recommended, subject to future appraisal outcomes, that the LNDR not be delivered in advance of the substantive public transport elements of the Strategy, and that its provision is also linked to the delivery of substantive elements of Clare South East SDZ. As discussed in Section 5.3.2, the modelling undertaken as part of any future appraisal of the LNDR should also include a detailed, multi-modal assessment of the impact of the scheme.

In addition to the new links and national road improvements described above, significant bus priority measures have been included in the MWRM SATURN road model to account for the proposed BusConnects network. For the purposes of model coding, it was assumed that this would be achieved through the provision of 2-way bus lanes along the majority of routes. To ensure this could be achieved, some reductions in road capacity within the model had to be accounted for in

areas where full bus priority could not be feasibly accommodated. The following traffic management measures were coded into the model where applicable:

- Reduction in the number of lanes;
- Right-turn bans; and
- Introduction of Peak hour Bus Gates into the City;

Bus speeds in the MWRM are taken as 80% of the uncongested speed of the adjacent road network link, where a bus lane is provided. Where there are no bus lanes, the congested road speeds are applied. The extent of the proposal is shown in Figure 6-5.

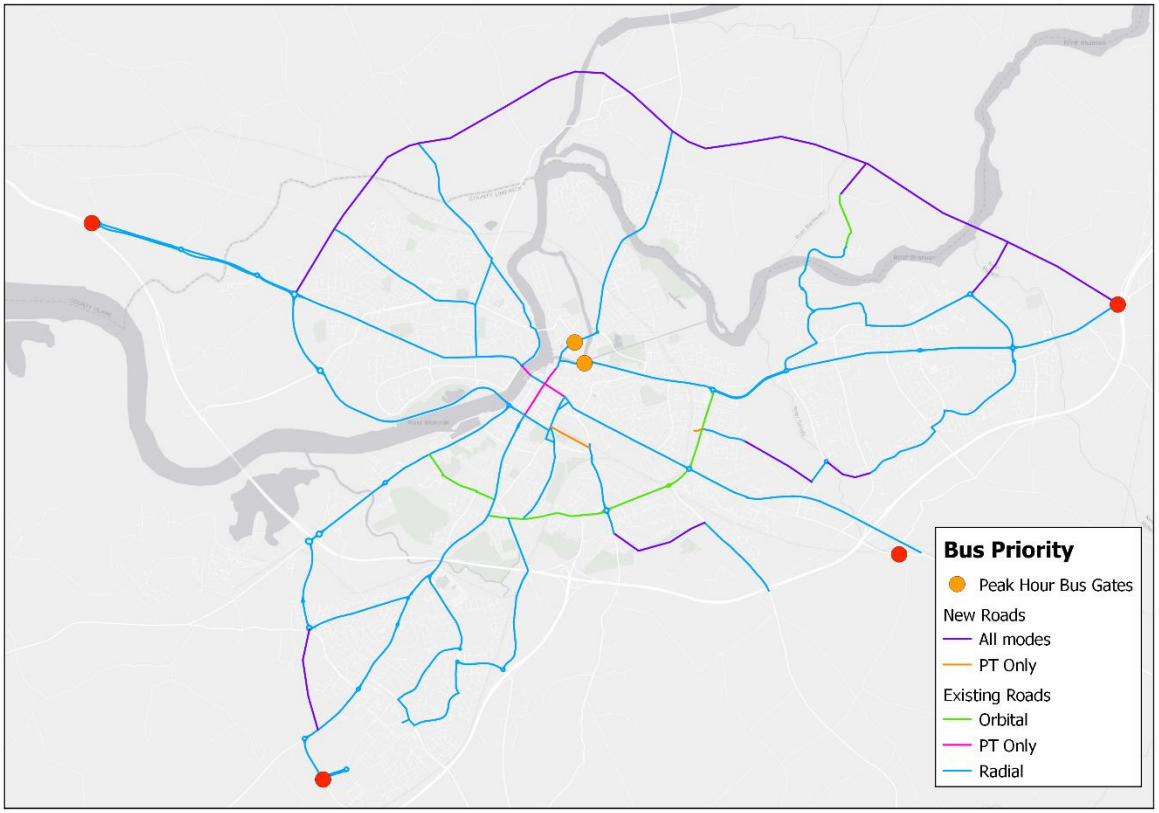



Figure 6-5: LSMATS Bus Priority

### 6.3.5 City Centre Traffic Management

There are also a number of measures proposed within the City Centre to rationalise the bus network and provide priority. These measures include removal of one-way bus loops where possible and providing a significant level of bus priority. This priority will be required to ensure the competitiveness of public transport as an attractive alternative to car. The proposed measures are shown in Figure 6-6. As illustrated the main change is along O'Connell Street, and part of Patrick's Street, which will become Public Transport only (in addition to walking and cycling) and two-way. As a result, Henry Street becomes two-way for general traffic to accommodate traffic displaced from O'Connell Street. There are a number of changes to the traffic circulation North & South to accommodate these measures. In addition, Sarsfield Bridge is also proposed as a PT only link.

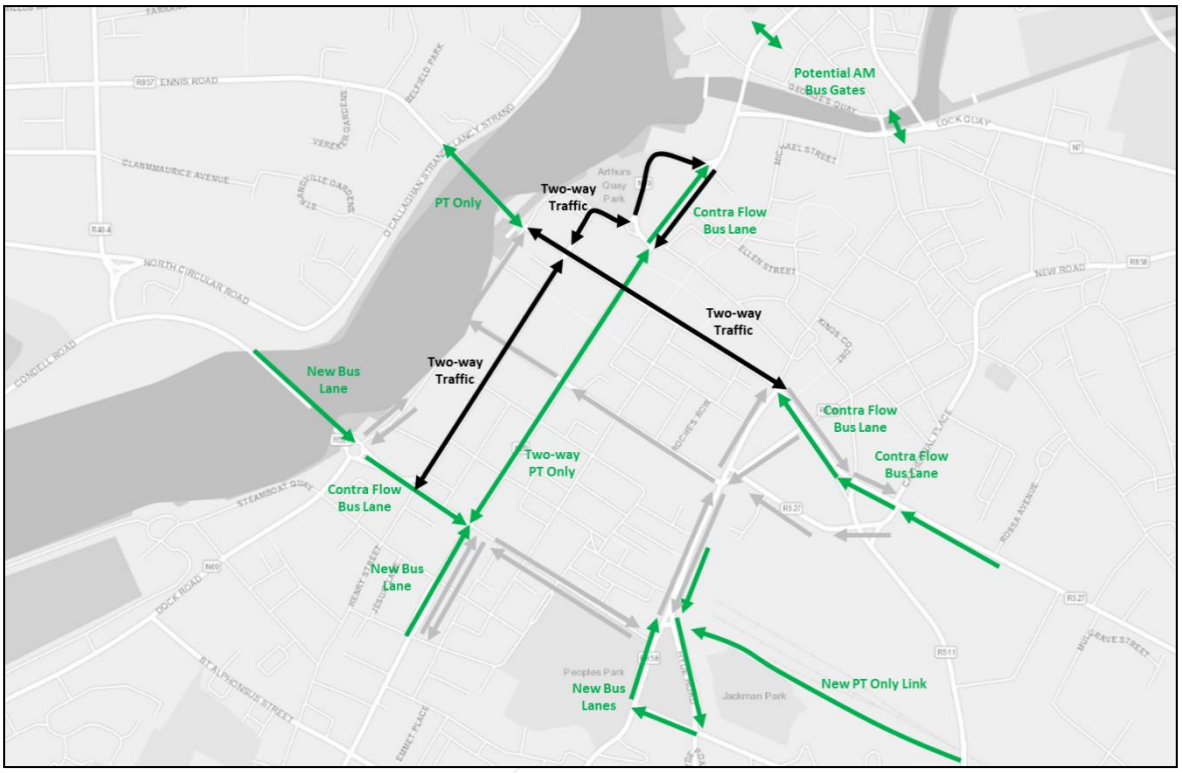



Figure 6-6: Limerick City Centre Priority Measures

### 6.3.6 HGV Traffic Restrictions

The HGV restrictions are proposed similar to those already implemented in both Dublin & Waterford. HGVs play an integral role in moving goods throughout the LSMA and nationwide. HGV movement can have significant impacts on traffic operations, noise, air pollution and the safety of other road users, particularly within urban environments.

The central area of Limerick City is unsuitable for heavy goods traffic and should be restricted to only those vehicles of a suitable size with an origin or destination in the centre. LSMATS proposes further consideration of restriction of the movement of HGV within the area bounded by the N18, M7 South Ring Road and proposed LNDR.

According to the Limerick HGV Study 2015, banning HGVs from the City Centre from 07:00 to 19:00 would contribute to the creation of a safe and friendly environment for cyclists and pedestrians through the recovery of street space and the reduction of conflicts between modes. The implementation of designated 'lorry routes' on National roads at designated times of the day will also help reduce through traffic and mitigate delays and conflict with other modes.

In addition, regulating delivery times by limiting them to off-peak periods would contribute to off-setting local traffic congestion. This could also bring additional benefits to freight operators in terms of reductions on travel times and operating costs.

## 6.4 Do-Strategy Plus Demand Management

### 6.4.1 Overview

In the 2016 census, 34% of commuting trips made by residents of Limerick City and County were under 15mins with 68% recorded under 30mins. This proportion of shorter distance car trips with the LSMA presents a significant challenge in trips of encouraging sustainable trip making and a shift from car to public transport. When comparing the combined walk, wait and travel time for

Public Transport against a short distance car trip it is difficult to increase the attractiveness of public transport even with frequent and high priority services.

Another significant challenge is the high levels of prevailing Car Ownership within the LSMA. In 2016, only 16% of households in Limerick City and County had no car with 43% having more than one car per household. This high level of car ownership further encourages shorter distance commuting and leisure trips by private vehicle.

To address the current level of car ownership with urban area the National Planning Framework states that *'there should also generally be no car parking requirement for new development in or near the centres of the five cities, and a significantly reduced requirement in the inner suburbs of all five'*. To reflect this the Design Standards for New Apartments Guidelines for Planning Authorities, published by the Department of Housing, Planning and Local Government in 2018, proposed significantly reduced parking for development in accessible, urban locations. Accessible locations include sites within easy walking distance (i.e. up to 5 minutes or 400-500m) to/ from high frequency (i.e. min 10-minute peak hour frequency) urban bus services. With the LSMATS bus network implemented the vast majority of Limerick City and Suburbs will therefore be considered to be within accessible locations.

Within the model runs to date the proportion of car ownership has been assumed to remain constant from the base year. To address this and reflect recent changes in national policy the car ownership within accessible locations within the model has been adjusted as described in the following section.

### 6.4.2 Origin Parking Restrictions

The reduction in Car Ownership has been applied at a Small Areas level broadly based on the corridor/sector structure used in the demand analysis and options assessment. Some larger corridors which contained both urban and more rural locations were split. The areas used to adjust the car ownership are shown below.

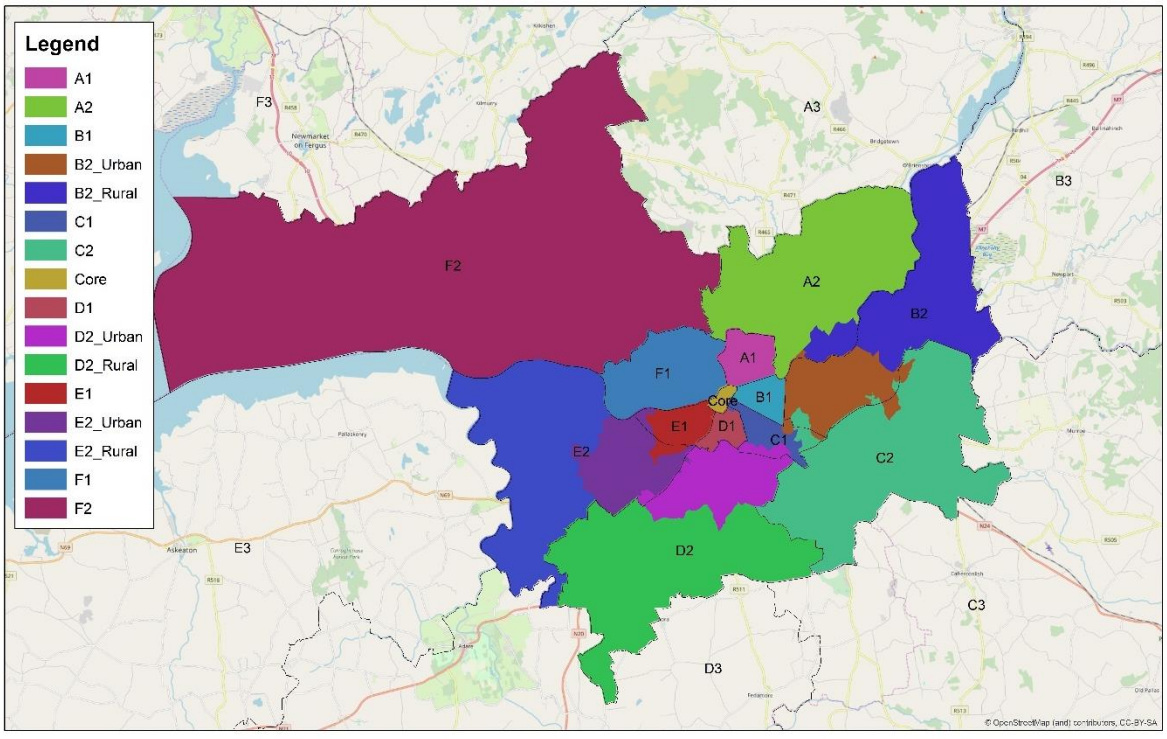



Figure 6-7: Sectors used for Car Ownership Adjustments

The reduction in car ownership (CO) was applied as a factor to all modelled zones within each area to reduce the overall proportion of car available trips. However, each factor was derived based on the certain assumptions around parking constraints on new residential development. The broad assumptions are listed below.

- City Core: Existing households CO reduced by 33% intended as proxy for removal of on-street parking, no cars assumed in any new households;
- A1, B1, C1, D1, E1 & F1: Existing households retain current levels of CO. CO of new households is assumed to be 33% less than existing within each area.
- Urban areas of B2, E2 and D2: CO of existing household is retained. New households are capped at 1 car per household.
- South Clare SDZ: Existing CO remains the same, new households capped at 0.75 cars per household.
- CO of the remaining LSMA continues at the existing proportion.

This results in an overall drop in the number of cars per household. However, it should be noted that the number of cars overall still grow significantly and at a higher rate than population as a reduction in the average household size is assumed between 2016 & 2040.

The number of cars per household in the Do-Minimum, Do-Strategy & Do-Strategy Plus scenario along with reduction as a percentage for each area is outlined in Table 6-2.Table 6-2

**Table 6-2 Cars per Household by Area and reduction applied.**

| Area | 2040 Cars Per Household DM/Strategy | Strategy+DM | Reduction |
|---|---|---|---|
| Core | 0.47 | 0.18 | -61.3% |
| A1 | 1.15 | 0.98 | -14.7% |
| B1 | 0.91 | 0.78 | -14.0% |
| D1 | 0.73 | 0.61 | -16.0% |
| C1 | 0.95 | 0.80 | -15.8% |
| E1 | 1.26 | 0.99 | -21.3% |
| F1 | 1.14 | 0.95 | -16.4% |
| A2 | 1.77 | 1.77 | 0.0% |
| B2 Urban | 1.53 | 1.28 | -16.5% |
| B2 Rural | 1.56 | 1.56 | 0.0% |
| C2 | 1.83 | 1.83 | 0.0% |
| D2 Urban | 1.45 | 1.25 | -13.9% |
| D2 Rural | 1.70 | 1.70 | 0.0% |
| E2 Urban | 1.51 | 1.22 | -19.1% |
| E2 Rural | 1.84 | 1.84 | 0.0% |
| F2 | 1.38 | 1.38 | 0.0% |
| South Clare SDZ | 1.20 | 0.79 | -33.9% |
| **LSMA** | **1.25** | **1.09** | **-12.7%** |

### 6.4.3 Appraisal of Do-Strategy Plus Demand Management

As the measures outlined in the Do-Strategy Plus Demand Management are heavily reliant on the realisation of development in key areas and the enforcement of parking policy at a local level the strategy has been appraised both with and without these measures in place. This ensures that the benefits of the strategy are not overstated but also demonstrates the importance of residential parking policy within Limerick and the associated additional benefits.

### 6.4.4 Other Supporting Measures

There are a number of other measures proposed as part of the strategy which the impact of cannot be captured in the modelling and appraisal process. These measures will have an additional impact on the travel demand and patterns with the LSMA and include the following:

- Mobility Management Measures;
- Wayfinding;
- Intelligent Traffic Systems;
- Cycle & Car Share Schemes;
- Improved Public Transport Stops;
- Integrated/Smart Ticketing;
- Real Time Passenger Information;
- Public Realm Enhancements.

# 7 LSMA Transport Strategy Appraisal

## 7.1 Introduction

This section of the report outlines the appraisal methodology and appraisal criteria that have assessed as part of the evaluation process to determine the performance of the LSMATS strategy measures. The results of this evaluation for both the Do-Strategy & Do-Strategy Plus are outlined in this section for each criterion identified.

## 7.2 Strategy Appraisal Methodology

### 7.2.1 Methodology

The procedure for the assessment of LSMATS is guided by the 'Common Appraisal Framework (CAF) for Transport Projects and Programmes, March 2016' published by the Department of Transport, Tourism and Sport (DTTAS), which requires schemes to be appraised under the objective headings below.

- Safety;
- Physical Activity;
- Environment;
- Integration;
- Accessibility and Social Inclusion; and
- Economy.

It should be noted that a more detailed appraisal of the individual public transport schemes identified within LSMATS will be required at a later stage in the planning process for each scheme. The LSMA Transport Strategy has been assessed under the 6 CAF criteria with the Key Performance Indicators (KPIs) and method of measurement for each KPI displayed in Table 7-1.

Table 7-1: LSMATS CAF Criteria and KPIs

| CAF Criteria | KPI | Measure |
|---|---|---|
| **Safety** | Safety improvements as a result of the Strategy implementation | Monetised benefits as output from COBALT software within the NTA Safety Appraisal Tool |
| **Physical Activity (Health)** | Health Benefits | Monetised Health benefits calculated using the NTA Health Appraisal Tool |
| **Environment** | Change in Transport Emissions related to the Strategy implementation | Transport emission from the ENEVAL Appraisal Tool |
| **Integration** | Public Transport Integration | Number of public transport interchange trips |
| | Transport Policy Integration | Average Mode Shift to Public Transport |
| **Accessibility and Social Inclusion** | Accessibility to Key Attractors | Trips to Key Attractors (schools, hospitals etc.) by Public Transport |
| | Accessibility by PT from Socially Deprived Areas | Trips by Public Transport from Socially Deprived Areas |
| **Economy** | Transport User Benefits | TUBA Output |
| | Cost | Scheme Cost Estimates |

In addition to the CAF assessment the transport modelling results have been analysed further to examine the difference in performance compared to the Do-Minimum scenario. This additional analysis is undertaken on selective model outputs and used to better understand the impact of the LSMATS measures. The following additional indicators were assessed using MWRM outputs:

- Demand and Mode Share Analysis;
- Public Transport Network Operations;
- Active Mode Network Operations; and
- Road Network Operations.

## 7.3 Safety

### 7.3.1 Road Safety

The Safety Appraisal Module within the RMS Appraisal toolkit was used to assess the Safety benefits associated with the LSMATS measures. The Safety Appraisal Module process is based on a bespoke version of the COBALT spreadsheet. The bespoke version of the COBALT Ireland spreadsheet has been developed by Transport Infrastructure Ireland (TII) for use with the regional transport models. COBALT (Cost and Benefit to Accidents – Light Touch) is a computer program developed by the UK Department of Transport (DfT) to undertake the analysis of the impact on accidents as part of economic appraisal for a road scheme.

Table 7-2 below displays the Safety Appraisal results comparing the Do-Minimum, the Do-Strategy and the Do-Strategy Plus scenarios.

Table 7-2: LSMATS Safety Appraisal Results

| Item | Do-Minimum (DM) | Do-Strategy (DS) | Savings (DS vs DM) | Do-Strategy + Demand Management (DS+) | Savings (DS+ vs DM) |
|---|---|---|---|---|---|
| **Economic Summary (€000)** | 639,734.6 | 630,914.7 | 8,919.9 | 627,926.9 | 11,807.7 |
| **Accident Summary** | 24,472.2 | 24069.1 | 403.1 | 23,922.0 | 550.2 |
| **Casualty Summary** | | | | | |
| **Fatal** | 637.5 | 630.6 | 6.9 | 628.2 | 9.3 |
| **Serious** | 1,680.6 | 1,652.0 | 28.7 | 1,644.2 | 36.4 |
| **Slight** | 35,135.4 | 34,576.3 | 559.1 | 34,371.1 | 764.3 |

As shown in the table above, the LSMATS strategy measures result in significant savings (approx. €9m) in collision costs. There are also significant reductions in the levels of casualties on the road network, with the reductions of approximately 7, 29 and 560 in fatal, serious and slight casualties respectively.

If the additional benefits of the Do Strategy Plus Demand Management scenario are realised there will be a further economic savings of approximately €3m and further reductions of approximately 3, 7 and 205 fatal, serious and slight casualties respectively.

## 7.4 Physical Activity (Health Appraisal)

Active travel modes, i.e. walking and cycling, can bring about significant benefits for our health and environment. The consideration of health benefits arising from transport is an integral part of the appraisal process adopted to inform transport policy and investment decisions.

Transport related changes to the following factors can have health impacts and have been assessed for LSMATS:

- Physical activity – increased levels of activity can positively impact on reducing the risk of death and occurrence diseases such as heart, diabetes and cancer related illnesses; and
- Absenteeism – this is expected to decrease when more people walk or cycle. Moderate physical activity can lead to a reduction in the number of sick days and a healthier workforce can, in turn, provide benefit to employers and overall economy;

### 7.4.1 Physical Activity Benefits

The health benefits associated with physical activity are derived from a reduction in the relative risk of premature death - the 'Relative Risk of Mortality' is directly linked to the time spent walking and cycling based on the average length, speed and frequency of new trips encouraged by active travel modes. This indicator provides a calculation of the lives saved due to the health benefits of cycling and walking.

Table 7-3 shows the monetised benefits of the change in walking and cycling based on the relative difference between the Do-Minimum and Do-Strategy scenario. The results of the assessment show positive benefits for Cycling due to the increase in cycling mode share between the scenarios. There is a dis-benefit for walkers when comparing the Do-Minimum and Do-Strategy scenarios. This is due to the large mode shift from walking to public transport and cycling modes due to the improved infrastructure for these modes provided by LSMATS.

However, in the Do-Strategy Plus scenario there is a higher uptake in cycling and slightly less of a decrease in walking demand as the reduced levels of car ownership encourage more active modes trips. This results in an overall net positive monetised health benefit.

Table 7-3: LSMATS Monetised Physical Activity Health Benefits

| Net Impact per annum (€) | Do Strategy | Do Strategy + |
|---|---|---|
| **Cyclists** | **€140,690.14** | **€852,719.69** |
| **Walkers** | **-€756,471.69** | **-€707,435.08** |

It should be noted that the attractiveness of walking and cycling is not fully represented within the MWRM and mode choice is based predominantly on perceived cost of travel. In reality, many people may choose to walk or cycle for the health benefits regardless of perceived journey costs particularly given the proposed improvements in the walking and cycling network.

## 7.5 Environment

### 7.5.1 Emissions

The percentage change in transport emissions has been estimated from modelling outputs using the Environmental module of the RMS appraisal toolkit. It estimates emission levels for the following emission categories:

- Nitrogen Oxide & dioxide;
- Particulate Emissions;
- Hydrocarbon;
- Carbon Monoxide & Dioxide;
- Benzene;
- Methane; and
- Butadiene.

Table 7-4 below provides a summary of the emissions levels for the Do-Minimum and Do-Strategy scenarios in metric tonnes. The implementation of the LSMATS measures is shown to reduce some environmental emissions by 0.7-3.3%. However, particulate emissions and Carbon emissions remain relatively unchanged.

The Do Strategy + Demand Management scenario results in significantly more benefits with reductions of between 3.7-10.7% modelled. The 3.7% reduction in particulate emissions is particularly beneficial as this is considered to be particularly harmful to the health of people in close proximity to the emitted particulate.

Table 7-4: LSMATS Environmental Emissions Summary (kgs)

| Scenario / Emission Type | Nitrogen Oxide & dioxide | Particulate Emissions | Hydrocarbon | Carbon Monoxide & Dioxide | Benzene | Methane | Butadiene |
|---|---|---|---|---|---|---|---|
| **Do-Minimum** | 1,570.7 | 14.6 | 68.6 | 1,080,128.3 | 0.6 | 16.9 | 0.9 |
| **Do-Strategy** | 1,560.4 | 14.7 | 67.8 | 1,079,803.3 | 0.5 | 16.3 | 0.9 |
| **% Difference** | -0.7% | 0.1% | -1.2% | 0.0% | -1.5% | -3.3% | -1.2% |
| **Do-Strategy +** | 1,491.1 | 14.1 | 64.4 | 1,042,306.0 | 0.5 | 15.1 | 0.8 |
| **% Difference** | -5.1% | -3.7% | -6.1% | -3.5% | -7.6% | -10.7% | -6.4% |

## 7.6 Accessibility and Social Inclusion

The SWRM model has been used to assess the Accessibility and Social Inclusion benefits associated with the implementation of LSMATS.

Transport investment, by its nature, has a particularly strong role to play in respect of improving accessibility for people living in rural areas with poor access, people who suffer from mobility and sensory deprivation, connecting young people, particularly those who live in disadvantaged areas, to services, education and work opportunities.

To quantify this, public transport accessibility changes have been extracted from the MWRM for the Do-Minimum and Do-Strategy scenarios and are discussed further below.

### 7.6.1 Public Transport Isochrone Assessment

Isochrone maps are useful for displaying changes in public transport accessibility and journey time improvements between scenarios. Figure 7-1, Figure 7-2 & Figure 7-3 show the PT Journey Time to City Centre changes for the Do-Minimum, Do-Strategy & Do-Strategy Plus scenarios respectively. As shown in the figures, the analysis indicates increased public transport accessibility levels across the Metropolitan area in the Do-Strategy scenario. There are further slight improvements forecast to journey times to the City Centre in the Strategy Plus scenario as congestion decreases due to the lower levels of car traffic.

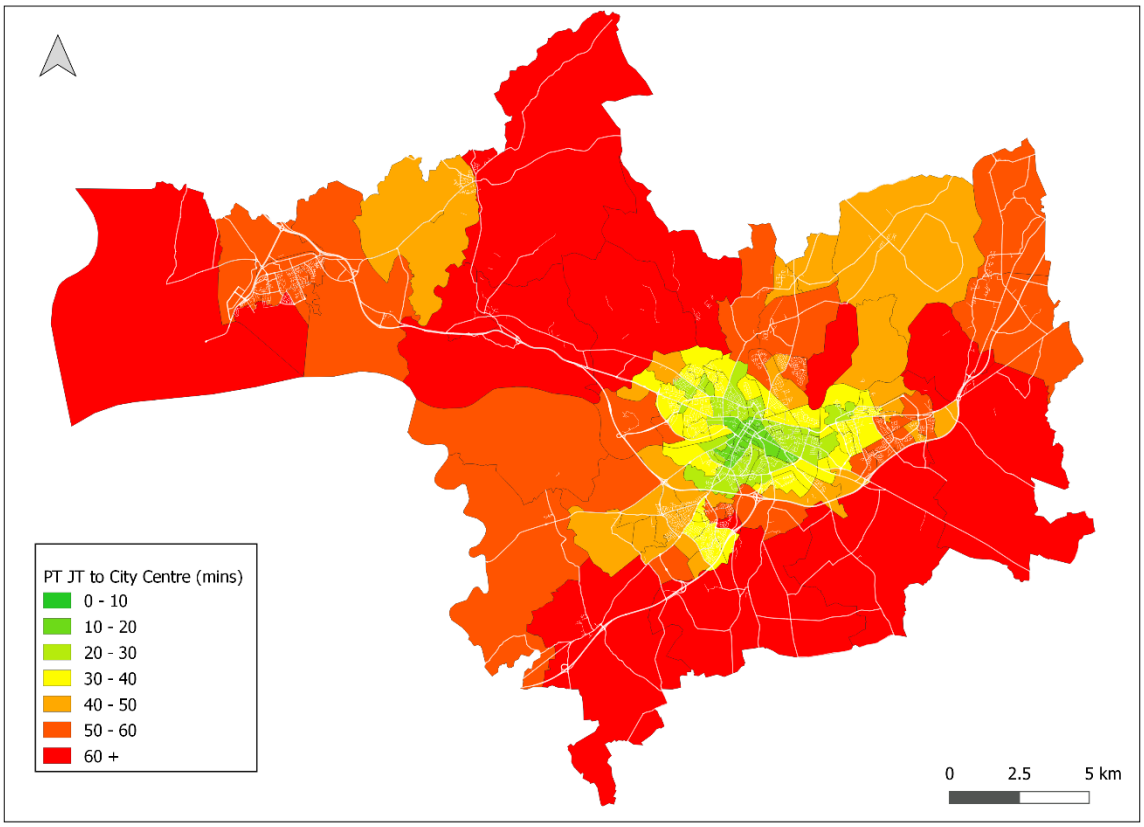



Figure 7-1: Do-Minimum Average Journey Times to the City Centre

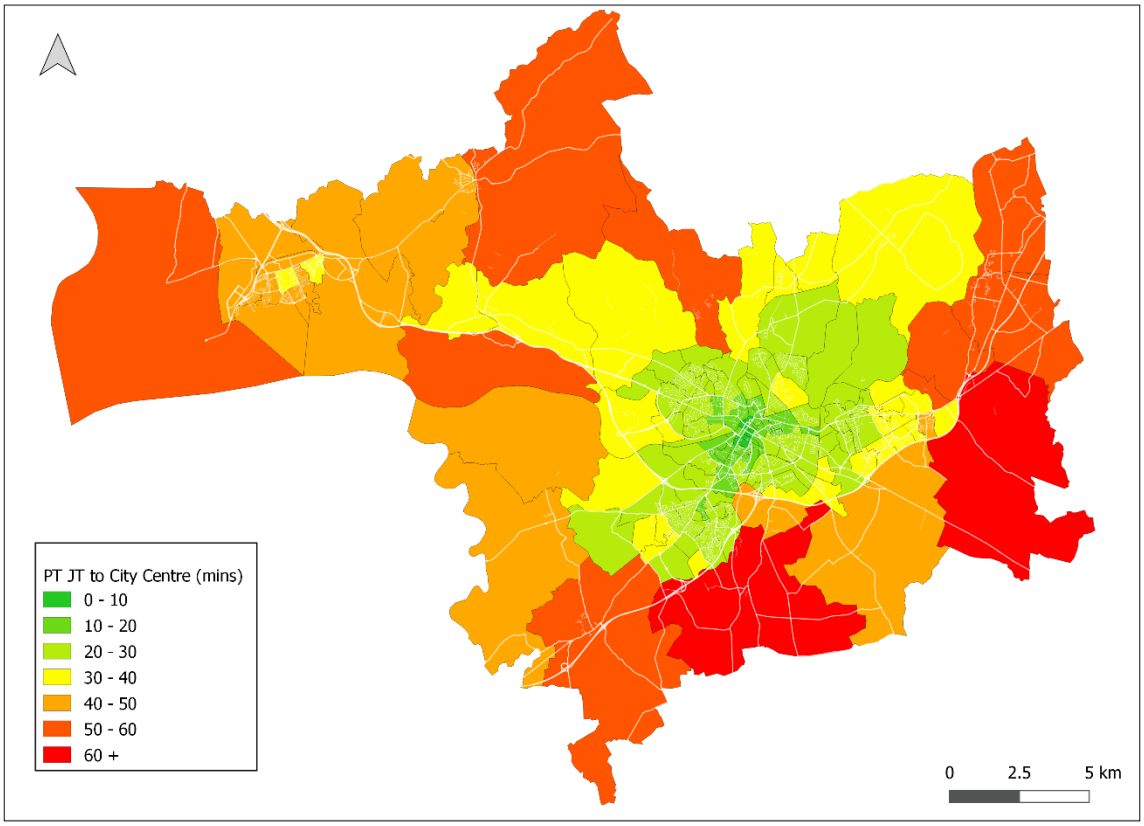



Figure 7-2: Do Strategy Average Journey Times to the City Centre

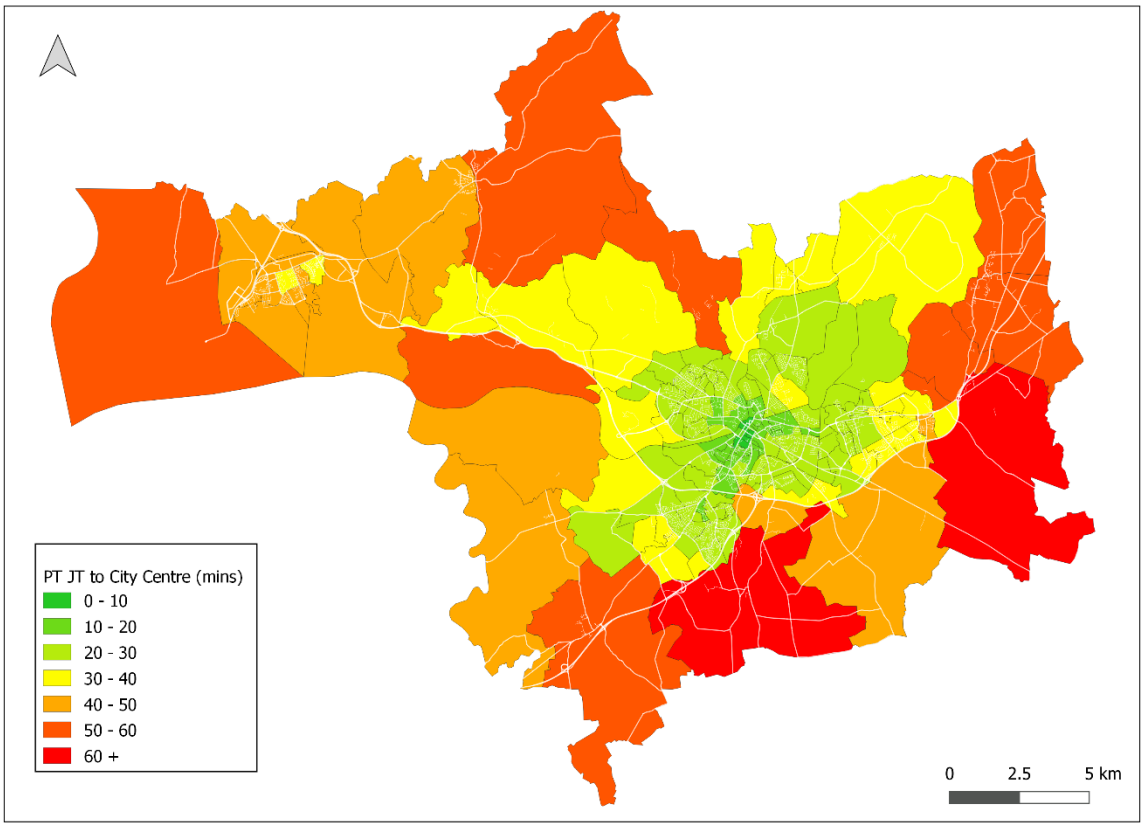



Figure 7-3: Do-Strategy+ Average Journey Times to the City Centre

### 7.6.2 Accessibility by Public Transport to Key Attractors

The change in public transport mode share to key trip attractors across the LSMA, has been used to assess accessibility. A summary of the AM Trips to Key Attractors for the Do-Minimum and Do-Strategy is presented in the Table 7-5.

Table 7-5 PT Demand to Key Attractors

| Key Attractor | Do-Minimum - AM Demand | | | | | Do-Strategy - AM Demand | | | | | Do-Strategy + - AM Demand | | | | | AM PT Mode Share | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Road | PT | Walk | Cycle | Tot | Road | PT | Walk | Cycle | Tot | Road | PT | Walk | Cycle | Tot | Do-Minimum | Do-Strategy | Do-Strategy + |
| **Raheen Business Park** | 515 | 53 | 83 | 11 | 662 | 492 | 85 | 75 | 13 | 666 | 465 | 99 | 110 | 29 | 703 | 8.0% | 12.8% | 14.1% |
| **University Hospital** | 851 | 156 | 241 | 22 | 1269 | 859 | 166 | 231 | 31 | 1287 | 823 | 175 | 268 | 52 | 1318 | 12.3% | 12.9% | 13.3% |
| **City Centre** | 2700 | 741 | 1771 | 159 | 5371 | 2264 | 1092 | 1775 | 173 | 5304 | 973 | 1390 | 2479 | 469 | 5311 | 13.8% | 20.6% | 26.2% |
| **University** | 1182 | 109 | 342 | 30 | 1663 | 1093 | 230 | 290 | 32 | 1644 | 993 | 249 | 316 | 52 | 1611 | 6.5% | 14.0% | 15.5% |
| **Shannon Airport** | 765 | 87 | 138 | 7 | 997 | 824 | 147 | 159 | 6 | 1136 | 807 | 119 | 173 | 5 | 1104 | 8.8% | 12.9% | 10.7% |
| **Crescent Shopping Centre** | 267 | 8 | 36 | 2 | 313 | 268 | 14 | 32 | 3 | 317 | 271 | 20 | 55 | 6 | 352 | 2.6% | 4.4% | 5.6% |
| **National Technology Park** | 489 | 56 | 104 | 13 | 661 | 472 | 80 | 89 | 16 | 657 | 431 | 97 | 117 | 28 | 673 | 8.5% | 12.2% | 14.5% |
| **Westpark, Shannon Free zone** | 187 | 4 | 24 | 1 | 216 | 204 | 10 | 28 | 1 | 243 | 211 | 16 | 49 | 2 | 279 | 2.0% | 4.3% | 5.8% |
| **Limerick Institute of Technology** | 160 | 7 | 38 | 2 | 207 | 147 | 20 | 37 | 2 | 206 | 133 | 19 | 37 | 4 | 192 | 3.3% | 9.7% | 9.7% |

The results of the assessment show substantial improvements in public transport mode share for trips to the key attractors outlined above. Overall the public transport mode share increases from 7.1% to 11.0% across the metropolitan area in the Do-Strategy Scenario and to 13% in the Do Strategy Plus Demand Management scenario. Shannon Airport public transport mode shares drop slightly in the Do-Strategy+ scenario as the reduced traffic levels, resulting lower car ownership levels within the city, improve journey times by car for traffic from Shannon thus inducing slightly more car traffic and less public transport demand. Though the public transport demand is still higher than the Do-Minimum scenario.

### 7.6.3 Public Transport Accessibility to Socially Deprived Areas

The social inclusiveness of the transport networks provided in each scenario has been measured by assessing the change in public transport mode share for trips from socially deprived areas across the Limerick & Shannon Metropolitan Area. Areas across the LSMA have been classified based on the POBAL Deprivation Index[3]. The index provides a method of measuring the relative affluence or disadvantage of a particular geographical area using data compiled from various censuses.

The Table 7-6 below represents the Average AM PT mode shift between the Do-Minimum, Do-Strategy and Do-Strategy Plus scenarios disaggregated by social category of areas across the LSMA.

Table 7-6 Average AM PT mode shift between the Do-Minimum and Do-Strategy by area type

| Min | Max | Description | Counts | Do-Strategy | Do-Strategy+ |
|---|---|---|---|---|---|
| -30 | -20 | very disadvantaged | 49 | 4.3% | 6.2% |
| -20 | -10 | disadvantaged | 59 | 3.6% | 5.3% |
| -10 | 0 | marginally below average | 140 | 4.2% | 6.4% |
| 0 | 10 | marginally above average | 184 | 3.7% | 5.4% |
| 10 | 20 | affluent | 74 | 3.4% | 5.6% |
| 20 | 30 | very affluent | 14 | 3.1% | 5.6% |
| -30 | 30 | **Total** | **520** | **3.8%** | **5.8%** |

The results of the assessment show that the overall AM PT mode share changes on average by 3.8% and 5.8% across the metropolitan area in the Do-Strategy & Do-Strategy Plus scenario respectively. However, PT mode shift is greater in areas considered marginally below average and very disadvantaged.

## 7.7 Integration

LSMATS aims to support integration between Sustainable Transport and Land Use. In order to assess the integration performance of LSMATS, the percentage change in the modelled sustainable mode share was calculated for each scenario to assess the compatibility with national Smarter Travel policies. In addition, the level of interchange between public transport modes was measured for the Do-Minimum, Do-Strategy & Do-Strategy Plus scenarios to assess how well the LSMATS proposals integrate with one another.

### 7.7.1 Policy Integration

The percentage change in the modelled sustainable mode share was calculated for each scenario to assess the compatibility with Smarter Travel policy, which aims to prioritise sustainable modes.

[3] Haase, T. and Pratschke, J. (2017) The 2016 Pobal HP Deprivation Index, provide by the NTA under their agreement.

Table 7-7 below shows the public transport mode share for the Do-Minimum, Do-Strategy & Do-Strategy Plus Demand Management scenarios for both the AM peak hour and over a full day for the LSMA. The results show substantial improvement in PT mode share between the two scenarios.

Table 7-7 Average AM PT mode shift between the Do-Minimum and Do-Strategy- Metropolitan Area

| | Do-Minimum | Do-Strategy | Do-Strategy+ |
|---|---|---|---|
| **AM PT Mode Share** | 7.1% | 11.0% | 13.0% |
| **24hr PT Mode Share** | 6.6% | 9.6% | 11.6% |

The PT mode shares for Limerick City and Suburbs are also shown below in Table 7-8 and show a slightly greater increase in PT demand proportionally.

Table 7-8 Average AM PT mode shift between the Do-Minimum and Do-Strategy- City & Suburbs

| | Do-Minimum | Do-Strategy | Do-Strategy+ |
|---|---|---|---|
| **AM PT Mode Share** | 7.6% | 11.7% | 14.4% |
| **24hr PT Mode Share** | 7.3% | 10.3% | 12.9% |

### 7.7.2 Interchange between Public Transport Services

Table 7-9 below show the overall level of interchange between public transport modes for the Do-Minimum, Do-Strategy & Do-Strategy Plus Demand Management scenarios respectively.

Table 7-9 AM Peak Hr Do-Minimum Interchange

| To | Do-Minimum | | Do-Strategy | | Do-Strategy+ | |
|---|---|---|---|---|---|---|
| **From** | **Bus** | **Rail** | **Bus** | **Rail** | **Bus** | **Rail** |
| **Bus** | 749 | 215 | 2,034 | 206 | 2,265 | 216 |
| **Rail** | 161 | 191 | 367 | 292 | 356 | 286 |

The results show a substantial increase in the level of passengers interchanging between public transport services in the AM peak following the introduction of the LSMATS measures. There are an additional 1583 & 1807 passenger transferring in the Do-Strategy & Do-Strategy Plus scenarios relative to the Do-Minimum, an increase of 120% & 137% respectively. There is also an increase of 52% in the number of passengers transferring between Rail and Bus as a result of the routing of key bus routes through Colbert Rail station. This clearly demonstrates the integration benefits of the LSMATS measures.

## 7.8 Economy

This section sets out an assessment of estimated transport user benefits for the LSMA Transport Strategy scenario. This provides a high-level indication of whether the proposed investment required for the Strategy is worthwhile. This assessment has taken account of relevant guidance of the Department of Public Expenditure and Reform and the Department for Transport, Tourism and Sport (DTTAS).

The purpose of this assessment is to provide an initial high-level indication of the performance of the package of strategy infrastructure schemes, i.e. do the benefits of implementing the Strategy

exceed the costs. It is undertaken at a level of detail that is appropriate for this stage of transport strategy development, i.e.

- Cost estimates for the proposals are developed based on cost outturns for similar projects rather than detailed design; and
- Benefits are forecast based on outputs from the transport modelling assessment of the proposals which use broad assumptions regarding scheme operation and design.

It should be noted an economic assessment of the Do-Strategy Plus scenario has not been undertaken as there is no associated 'cost' of the proposed changes to parking policies. It is important that the economic benefits are not overestimated or reliant on enforcement of policy standards. The Do-Strategy has been solely assessed to ensure the return on infrastructural costs exceed the investment with or without supporting policy measures which may take time to implement and provide benefits.

### 7.8.1 Cost Estimate

An outline cost estimate of the Strategy has been prepared based on estimates of per/km costs used for the NTA Greater Dublin Area Transport Strategy, Cork Metropolitan Area Transport Strategy and other studies. The profile of expenditure is based on an estimated programme of works to deliver the Strategy by 2040 and are in line with outline implementation plan provided in the Main Report.

The outline cost estimates are high level estimates based on values from individual scheme development, broad per km rates, and other general assumptions for each strategy option. The estimates are provided for the purposes of this high-level estimate of transport user benefits only and should not be used or relied upon for any other purposes.

More detailed cost estimates will be undertaken at each scheme development stage for each individual scheme included in the Strategy, as appropriate. The estimates of scheme capital costs are presented in Table 7-10, in 2016 prices and exclusive of VAT.

Table 7-10 LSMATS Outline Scheme Cost Estimates

| Scheme | Capital Expenditure (€m) |
|---|---|
| Bus Lanes & Priority | €425 |
| New Buses | €25 |
| New Park & Ride Sites | €7.6 |
| Cycling Network | €68.5 |
| Walking Network | €5.4 |
| Newport/Mackey Roundabout Upgrade | €10 |
| Ballysimon Interchange Improvements | €10 |
| N19/N18 Junction Improvements | €10 |
| Regeneration & LAP Roads | €120 |
| Limerick Northern Distributor Road | €140 |
| Other Costs (incl. ITS) | €90 |
| **Sub total** | **€912m** |
| **Contingency & Risk @ 50%** | **€456m** |
| **Total Cost** | **€1,367m** |

In addition to the capital costs of the schemes, an allowance was made for appropriate annual operation and maintenance (O&M) costs and an allowance for fleet and infrastructure renewal requirements over the assessment period.

Estimates were developed based on comparative costs of similar schemes and previous experience. The total annual operating cost estimate and fleet renewal cost estimate over the assessment period for the entire LSMA Transport Strategy is detailed in Table 7-11 below.

Table 7-11 LSMATS Operational and Maintenance Costs

| Estimate | Cost (€m) |
|---|---|
| **Average Annual O&M Cost/Fleet Renewal** | 6.8 |

### 7.8.2 Transport User Benefits Appraisal

The Transport User Benefits Appraisal (TUBA) (v1.9.4) program has been used to estimate transport user benefits arising from the Strategy. The assessment compares the "Do-Minimum" scenario (i.e. not to progress with the proposals) with a "Do-Something" scenario (i.e. the scheme) and estimates the benefits resulting from the scheme in terms of:

- Transport user time impacts;
- Vehicle operating cost impacts;
- Transport provider revenue impacts; and
- Impacts related to emissions (greenhouse gases).

2.5.2 TUBA is the 'best practice' software used in transport scheme appraisal across the UK and Ireland and was developed specifically for the purpose of cost benefit analysis and economic appraisal.

**Inputs from the Transport Models**

In order to calculate the changes in travel costs as a result of the implementation of the Strategy, travel demand and cost skims are extracted from the Do-Minimum and Do-Strategy transport model runs. The demand is split by purpose with common value of time and the travel costs are split into the appropriate sub-components as required in the guidance.

For the purposes of this assessment, it is assumed that all the schemes proposed as part of the Strategy start operating on a phased basis up to 2040. Full details of the phasing of transport schemes is contained in the Main Report.

**Standard economic parameters**

Standard transport appraisal parameters in Ireland are available from the following documents:

- Department of Public Expenditure and Reform 'Public Spending Code', 2013;
- Department of Transport 'Guidelines on a Common Appraisal Framework for Transport Projects and Programmes', 2016 - Appendix 1: Application Rules for Cost-Benefit Parameter Values; and
- NRA 2011 'Project Appraisal Guidelines', 2011 - Unit 6.11 National Parameters Values Sheet.

All general transport appraisal parameters are taken from the above documents. Updated vehicle purpose splits and vehicle occupancy rates were derived from the NTA's National Household Travel Survey (2012).

The other main input assumptions to the assessment are as follows:

- A price base year and present value year of 2016;
- A strategy opening year of 2040;
- A standard appraisal period of 30 years;
- Residual value period of a further 30 years;
    - *No growth in transport demand beyond 2040 has been assumed in the TUBA assessment.*
- A discount rate of 4% as per the DPER 'Public Spending Code';
- Shadow pricing has been included in line with the DPER 'Public Spending Code', i.e. a shadow price of public funds of 130% and a shadow price of labour of 80%;
- All outputs are presented in market prices; and
- Annualisation factors have been developed from a detailed analysis of observed data and transport model outputs.

### 7.8.3 Cost Benefit Analysis

A simple assessment was undertaken to compare the estimated transport user benefits to the set of outline cost estimates. Generally, if the forecast benefits for the Strategy exceed the estimated costs, then the investment can be considered worthwhile. The results of the assessment of the Strategy are presented below in Table 7-12. As shown,

Table 7-12 Transport Economic Efficiency (TEE) Table

| | € m |
|---|---|
| Present Value of Transport User Benefits (30 Year) | €2,084 |
| Present Value of Transport User Benefits (Residual) | €1,172 |
| **Combined Present Value of User Benefits (60 Year)** | **€3,256** |
| **Present Value of Strategy Costs** | **€1,162** |
| **Net Present Value** | **€2,094** |
| **Transport User Benefit to Cost Ratio** | **2.8:1** |

It should be noted, when benchmarking and comparing the Cost Benefit Analysis against that undertaken for the Cork Metropolitan Area Transport Strategy (CMATS), that the discount rate applied to costs and benefits was 5% in CMATS and 4% in LSMATS. Were a 5% discount rate applied to the LSMATS Cost Benefit Analysis the Benefit to Cost Ratio would have been lower at 1.7.

## 7.9 Demand and Mode Share Analysis

### 7.9.1 Demand Analysis

Figure 7-4 and Figure 7-5 below show the Limerick Shannon Metropolitan Area (LSMA) 24Hr and AM Demand Distribution by mode for the Base Year (2016) and the forecast (2040) Do-Minimum, Do-Strategy & Do-Strategy Plus scenarios. The analysis shows in an increase in overall trips within the LSMA from approximately 416,000 in the base year 2016 to 579,000 trips in 2040 – representing a 39% increase in demand.

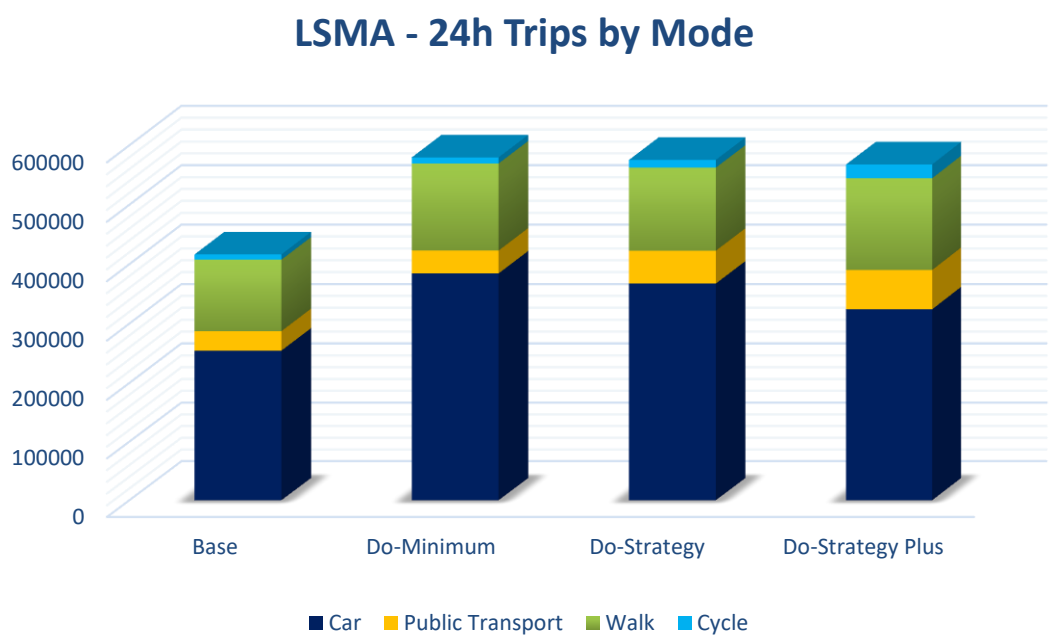



Figure 7-4: LSMA 24Hr Demand Distribution

Trips within the AM time period across the LSMA increase from approximately 105,000 in the base year 2011 to 150,000 trips in 2040 – representing a 42% increase in demand.

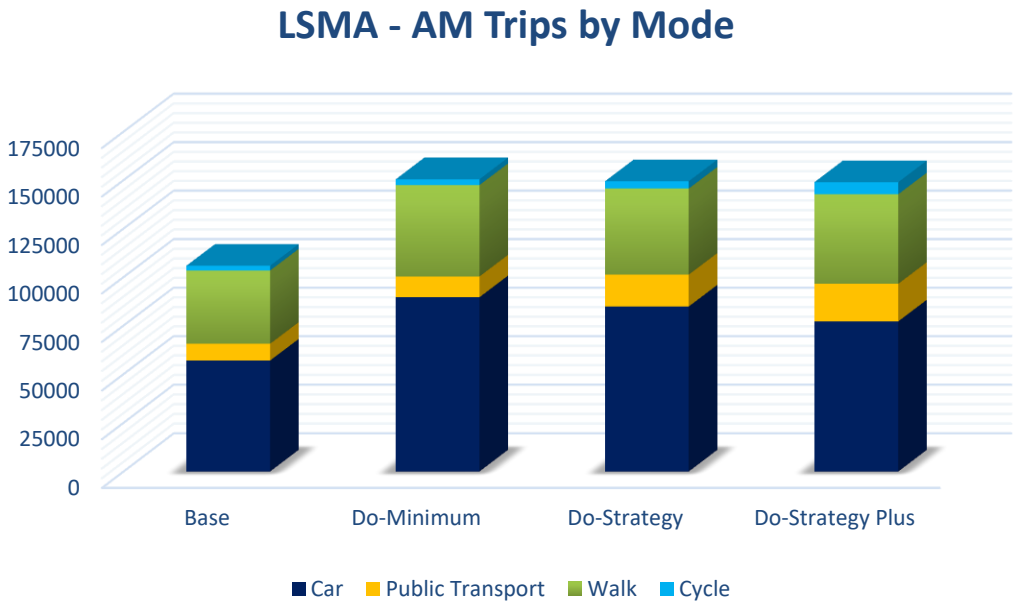



Figure 7-5: LSMA - AM Demand Distribution

### 7.9.2 Mode Share Analysis

This section provides an analysis of mode share for trips within the LSMA in 2040. The mode shares for 24-hour, each individual time period and by area for the Do-Minimum, Do-Strategy and Do-Strategy Plus Demand Management scenarios are shown in Figure 7-6 to Figure 7-14.

In the Do-Strategy scenario the overall 24-hour public transport and cycling mode share increase by 3% and 0.5% respectively. There is a resulting drop of 2.5% & 1% in the car and walking mode

share respectively. There is a similar pattern observed in each modelled time periods and across each area within the LSMA.

In the Do-Strategy Plus Demand Management scenario there are more notable changes in mode shift with an overall increase in PT, walking and cycling modes shares of 5%, 1.9% and 2.3% respectively. This combined shift to sustainable modes results in a 9.2% drop in metropolitan area car mode share over 24-hours. There is a similar shift in each time period with the AM car mode share dropping from 60% to 52%. By area the additional parking measures included in this strategy have a greater impact on Limerick City and Suburbs where the parking standards have been applied. The car mode share for Shannon increases due to the lower travel times on the road network due to the lower demand from urban areas within the city.

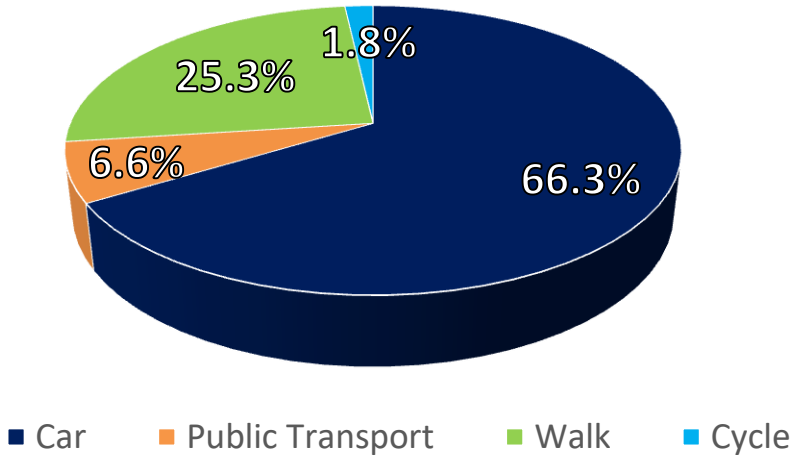



Figure 7-6: Do-Minimum - 24 Hr Metropolitan Area Mode Share

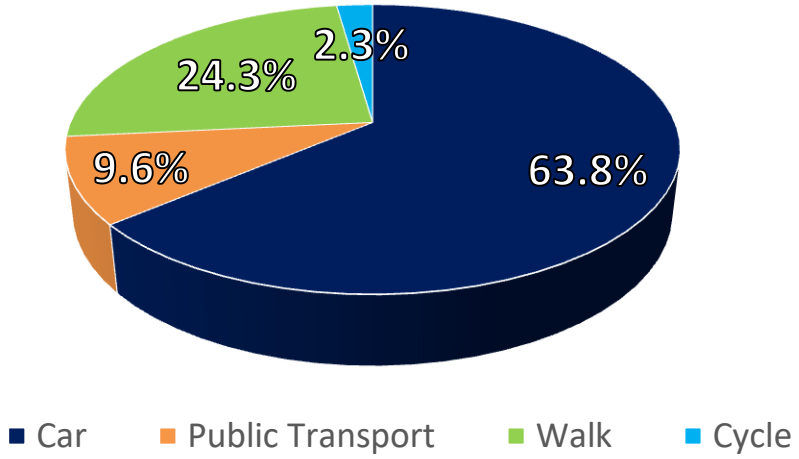



Figure 7-7: Do-Strategy - 24 Hr Metropolitan Area Mode Share

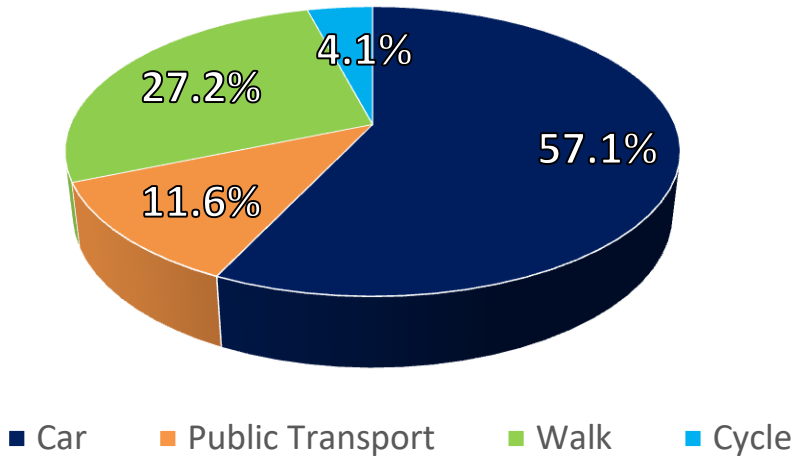



Figure 7-8: Do-Strategy Plus - 24 Hr Metropolitan Area Mode Share

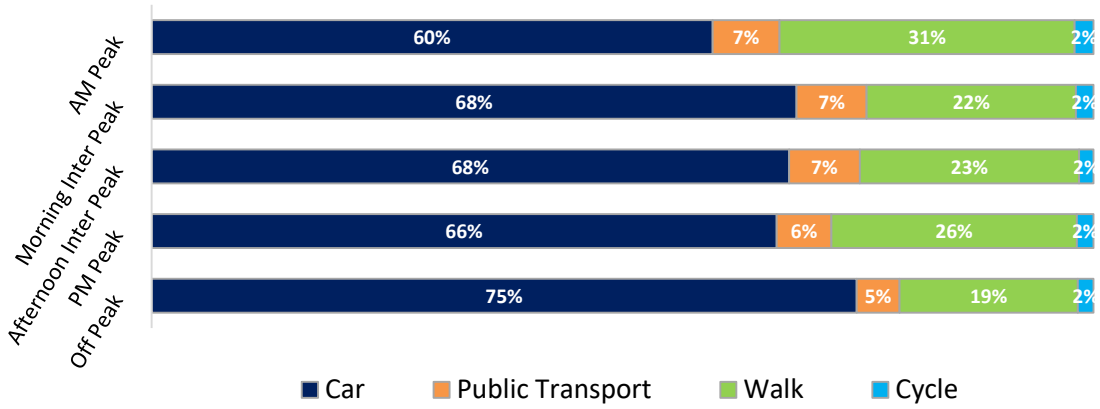



Figure 7-9: Do-Minimum Metropolitan Area Mode Share by Time Period

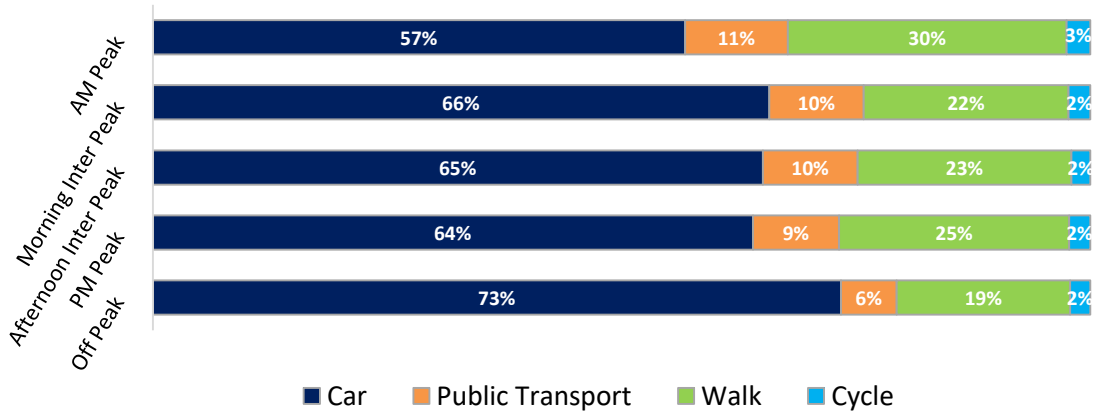



Figure 7-10: Do-Strategy Metropolitan Area Mode Share by Time Period

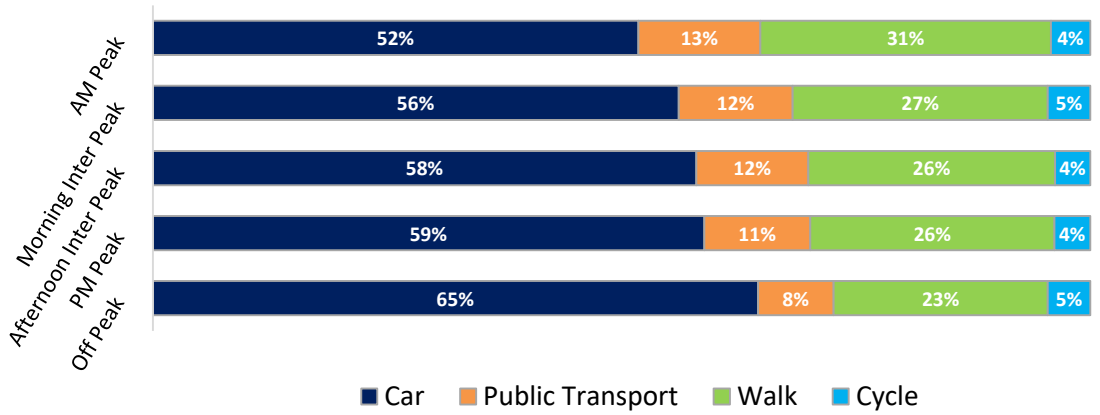



Figure 7-11: Do-Strategy Plus Demand Management Metropolitan Area Mode Share by Time Period

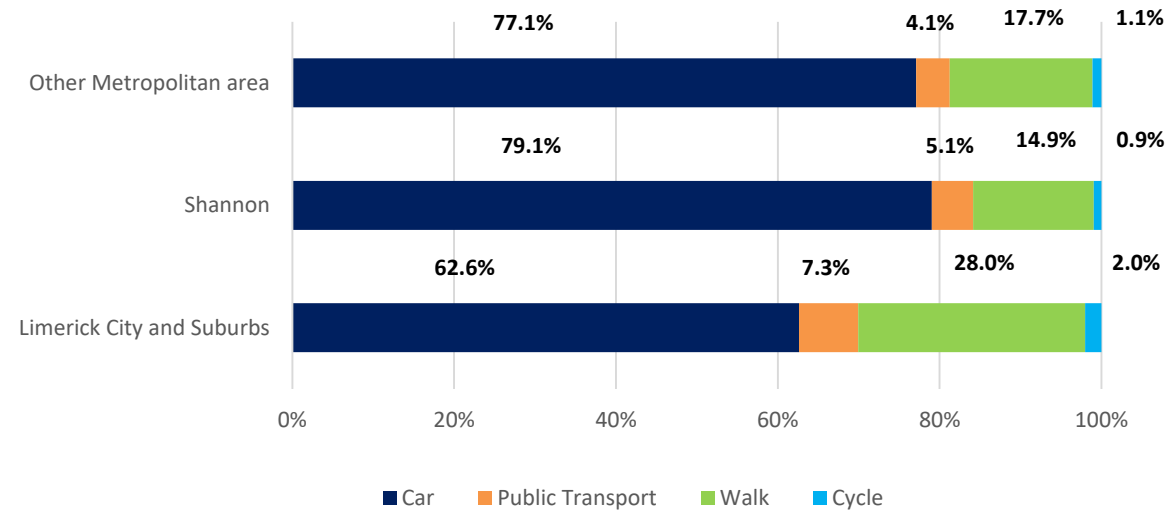



Figure 7-12: Do-Minimum Metropolitan Area Mode Share by Area

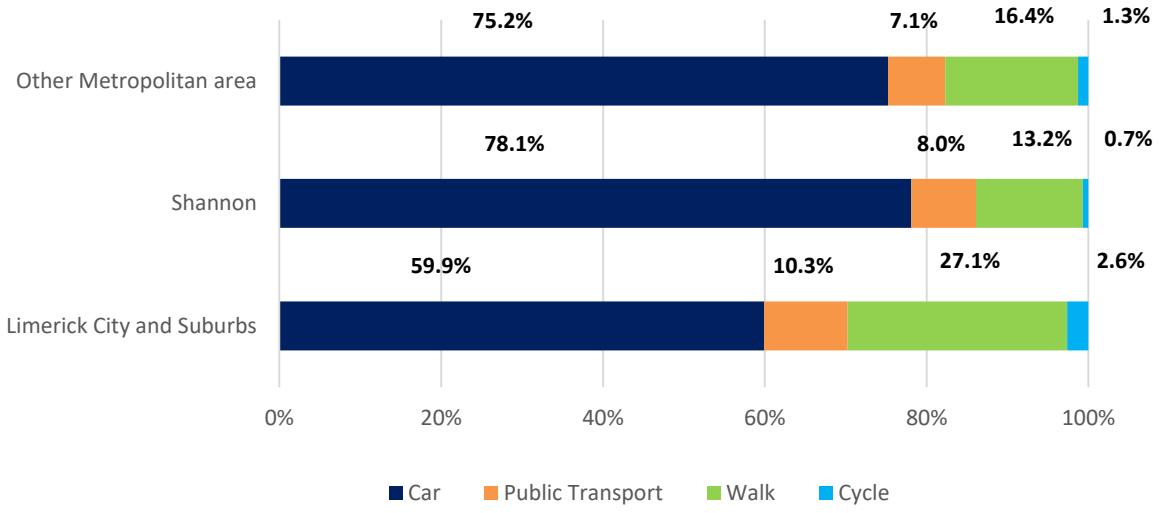



Figure 7-13: Do-Strategy Metropolitan Area Mode Share by Area

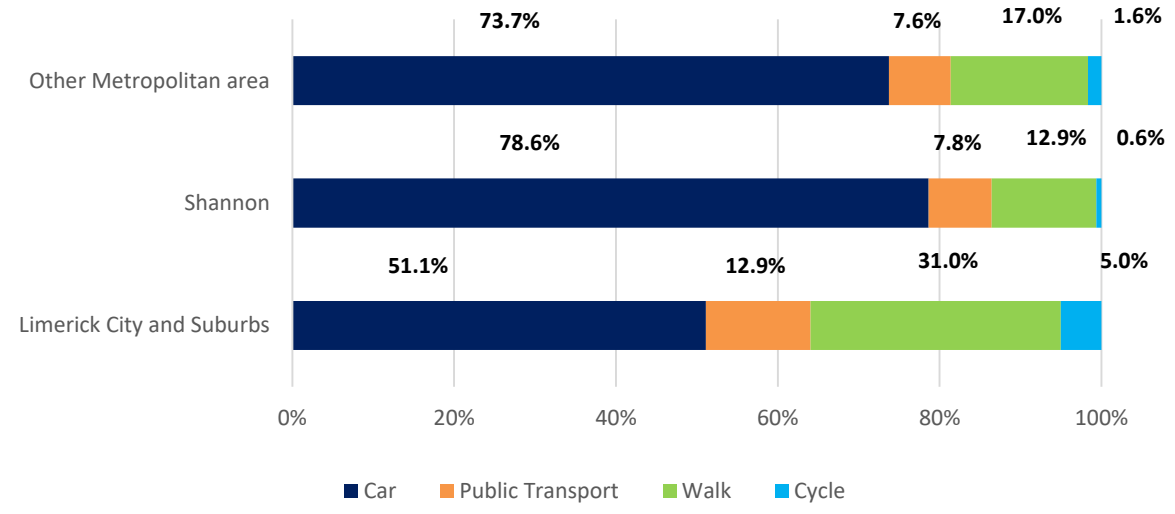



Figure 7-14: Do-Strategy Plus Demand Management Metropolitan Area Mode Share by Area

The mode for each scenario by MWRM model zone is mapped in Figure 7-15 & Figure 7-17. As shown, there are significant improvements across the Metropolitan Area in the Do-Strategy Scenario relative to the Do-Minimum. This is most notable around Limerick City and Shannon Town. In the Do-Strategy Plus Demand Management scenario there are further decrease in car mode share within the city and suburbs. There is also a significant decrease in the car mode share of the South Clare SDZ, north of the university, as a result of the more stringent parking standards applied to the significant development proposed.

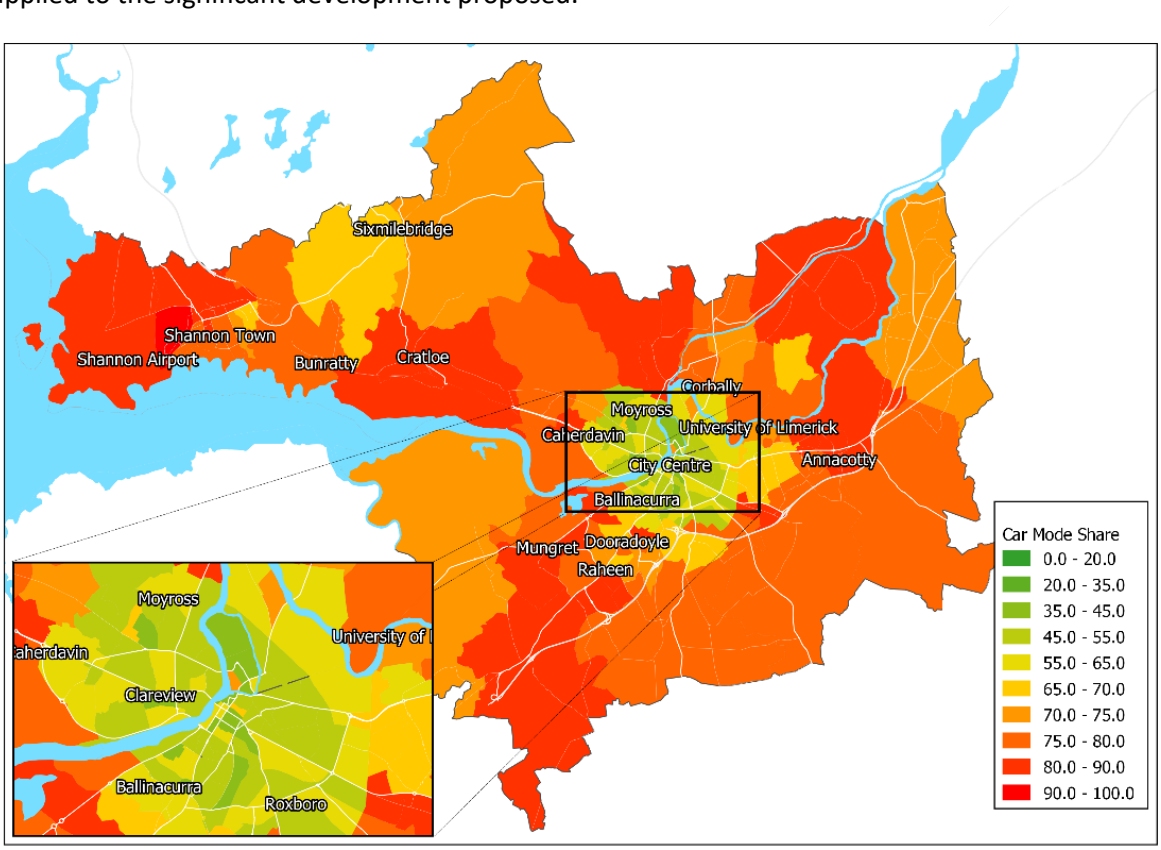



Figure 7-15: Do-Minimum Metropolitan Area Mode Share by MWRM Zone

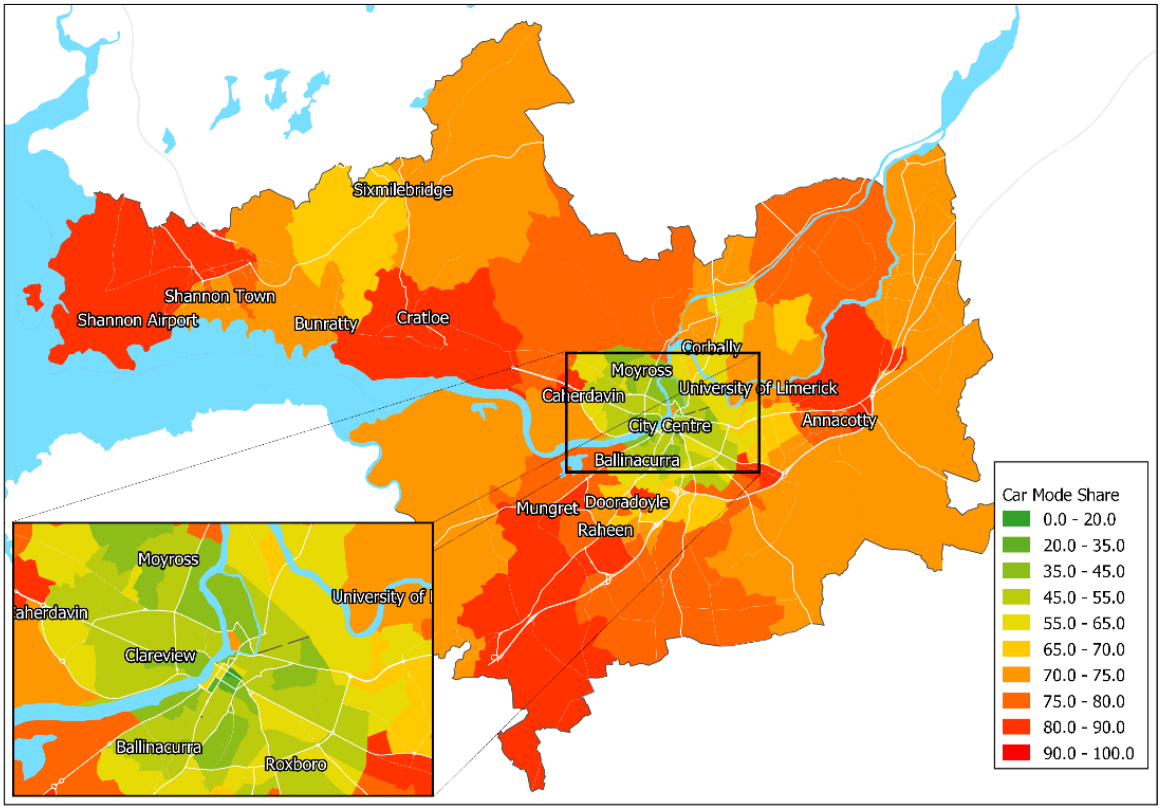



Figure 7-16: Do-Strategy Metropolitan Area Mode Share by MWRM Zone

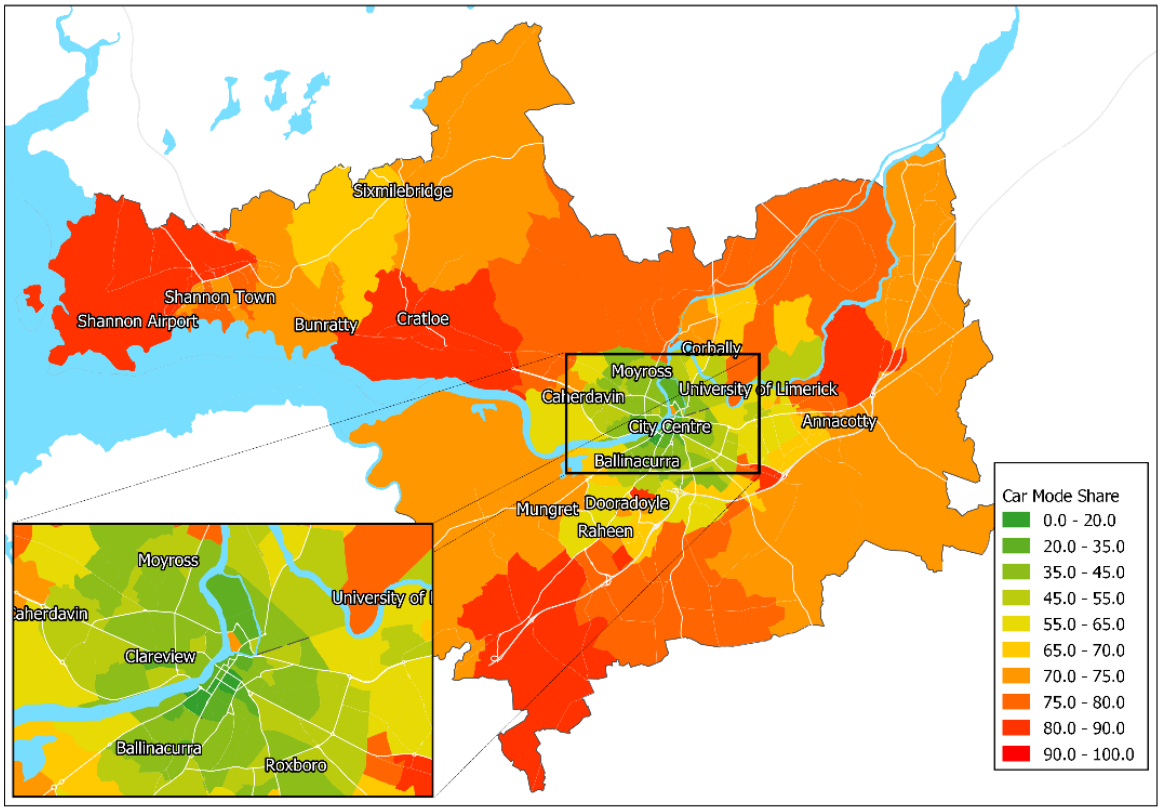



Figure 7-17: Do-Strategy Plus Metropolitan Area Mode Share by MWRM Zone-

### 7.9.3 Trip Length Distribution

Another Key Performance Indicator (KPI) used in the assessment is Trip Length Distribution (TLD). TLDs provide detail on the number of trips by journey length for each mode. They can be used to compare scenarios and indicate how trip patterns are changing. The Trip Length Distribution for the Do-Minimum, Do-Strategy & Do-Strategy Plus Demand Management for all AM peak trips is displayed in the Figure 7-18 below. Overall the distribution of trips lengths is similar with a slight increase in mid-range length trips, 8-12km, in both Do-Strategy scenarios compared to the Do-Minimum.

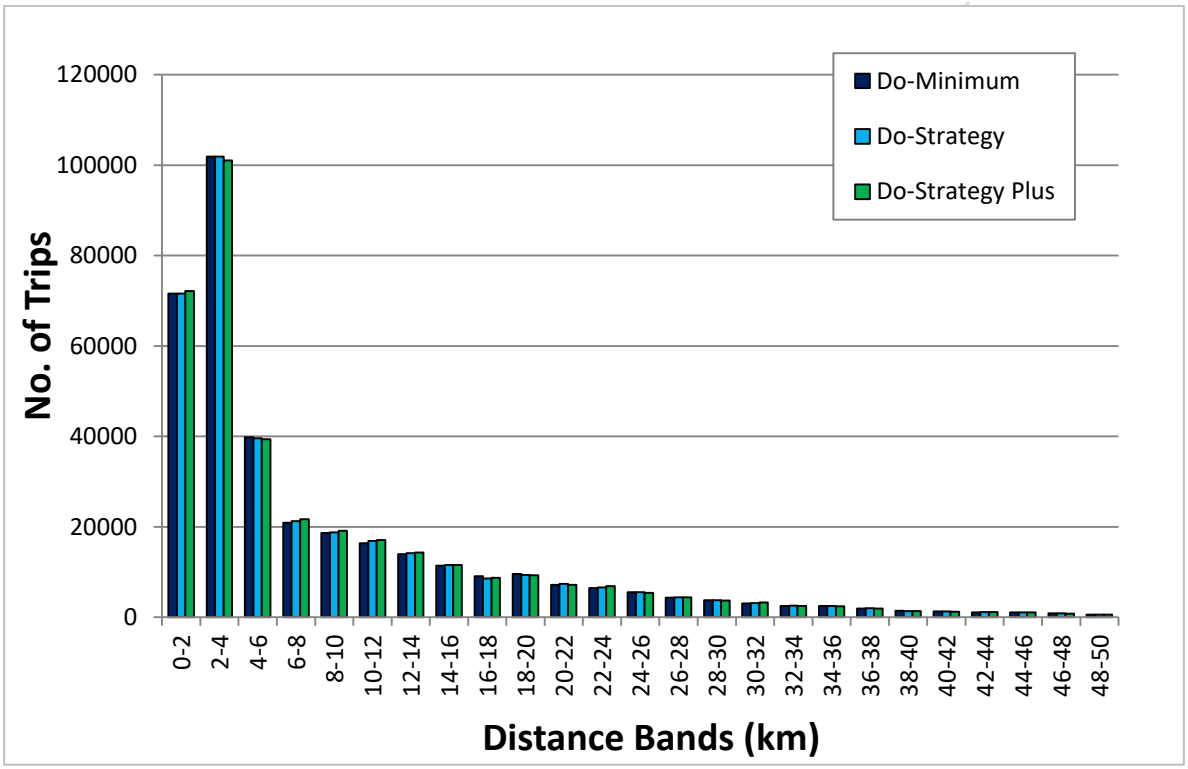



Figure 7-18: Do-Minimum, Do-Strategy & Do-Strategy Plus Demand Management Trip Length Distribution

The Trip Length Distribution for each Mode - Car, PT, Walk and Cycle are presented in Figure 7-19, Figure 7-20, Figure 7-21 and Figure 7-22 respectively below.

The results show reduced levels of Car trips across all distance bands, particularly over short distance (<10km). Public Transport trips are shown to increase substantially across all distance bands in the Do-Strategy & Do-Strategy Plus scenarios, as the new LSMATS public transport measures provide a viable alternative to travel by car.

Walking trips are shown to reduce compared to the Do-Minimum scenario, with the exception of shorter distance trips in the Do-Strategy Plus Demand Management scenario. This is because within the Do-Minimum scenario the increased level of trips could not be accommodated on the existing public transport and cycle network. The road network is also heavily congested resulting in many people forced to walk to complete their trip.

The introduction of the LSMATS cycle network results in large increases in cycling trips compared to the Do-Minimum scenario, particularly over the 4-10km range, due to the provision of high-quality cycle routes across the LSMA to access the city centre core.

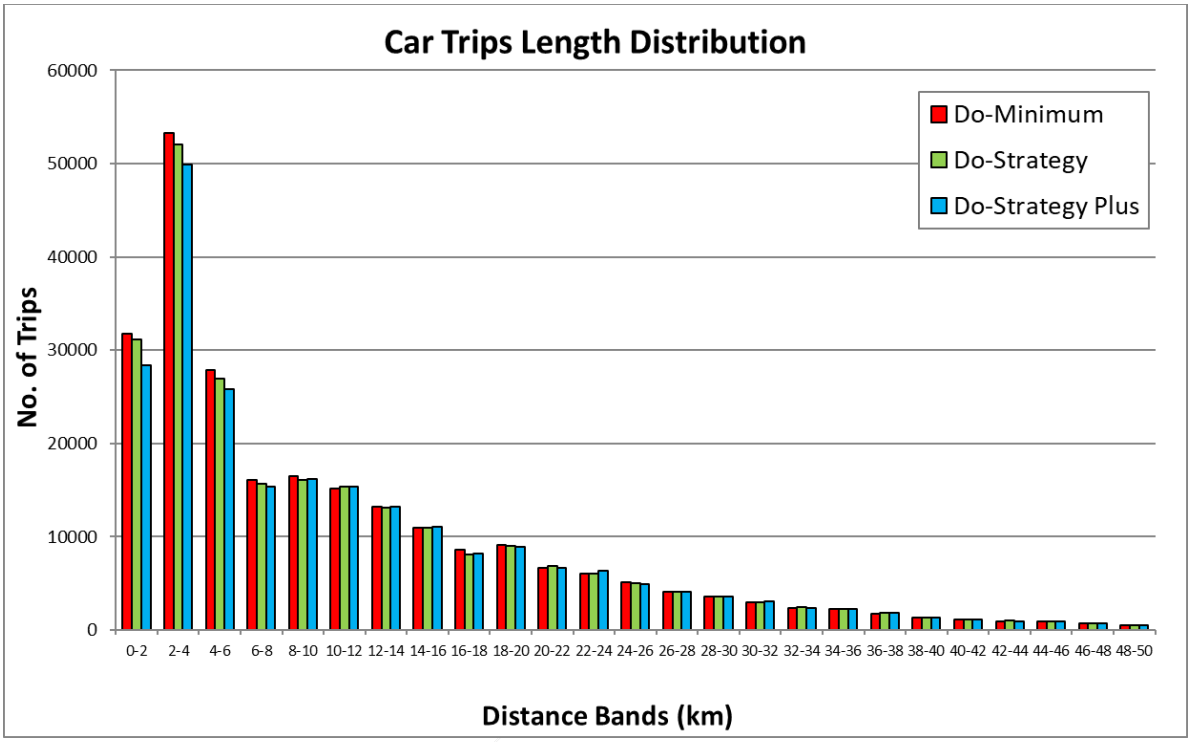



Figure 7-19: Road Trip Length Distribution

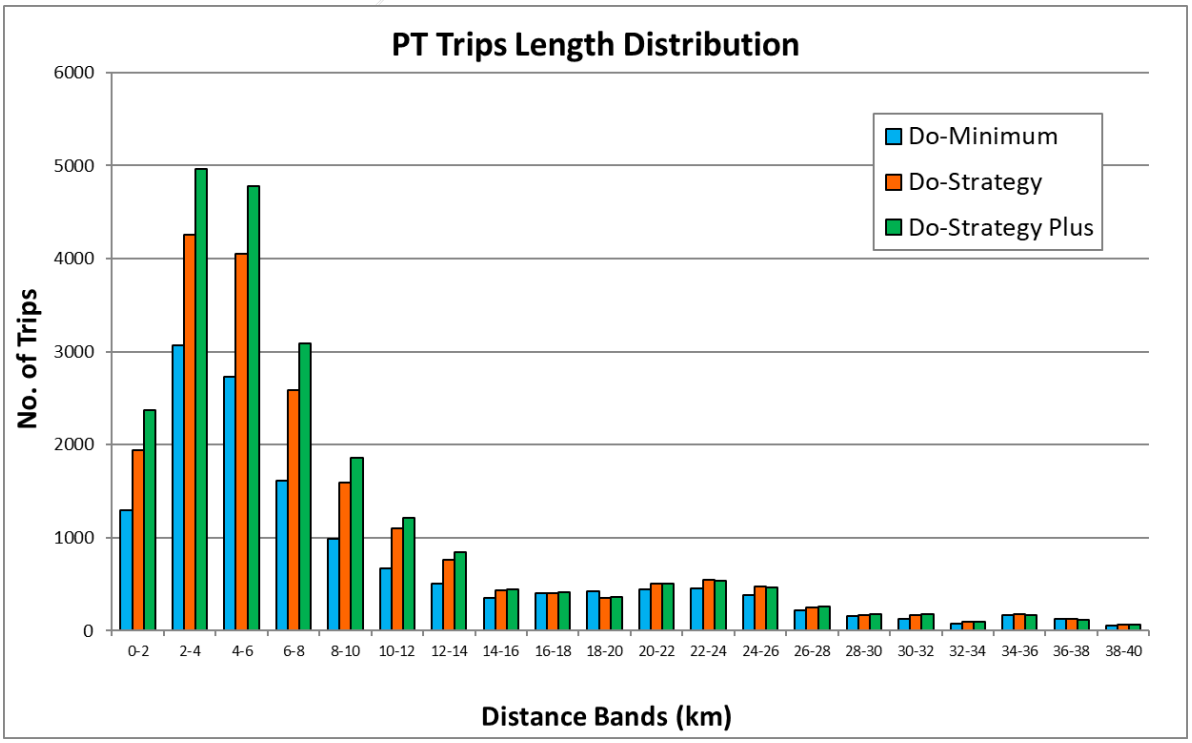



Figure 7-20: PT Trip Length Distribution

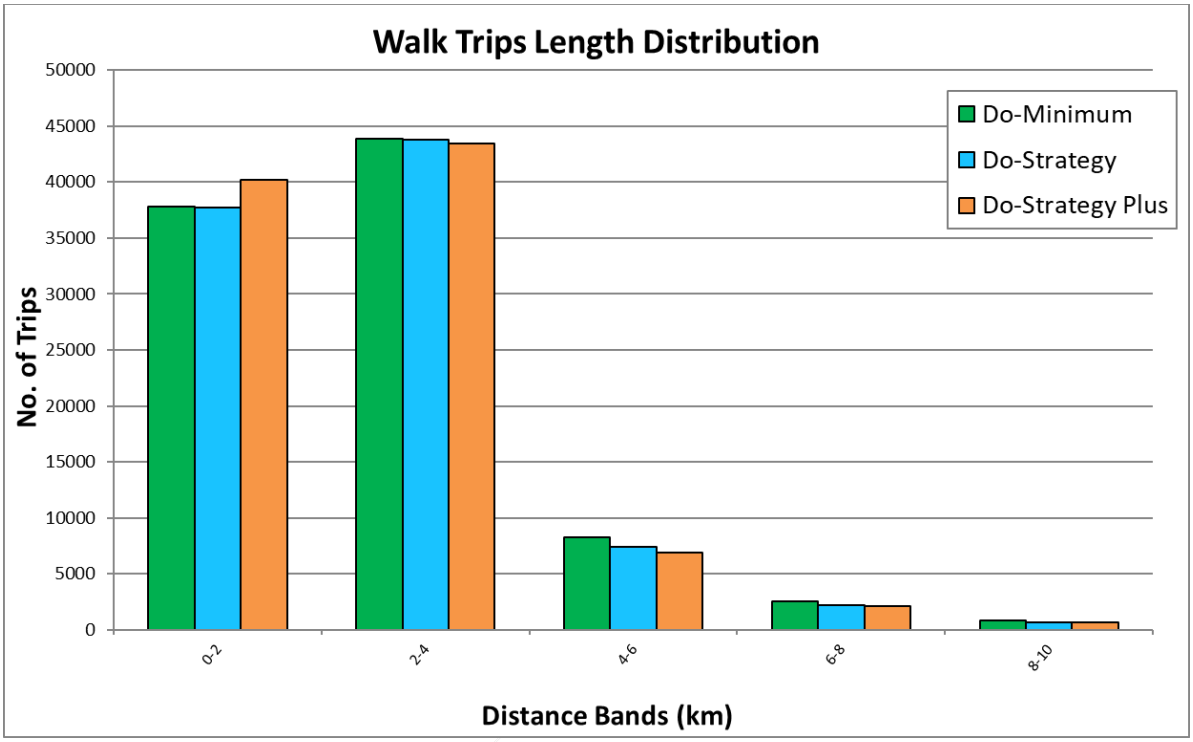



Figure 7-21: Walk Trip Length Distribution

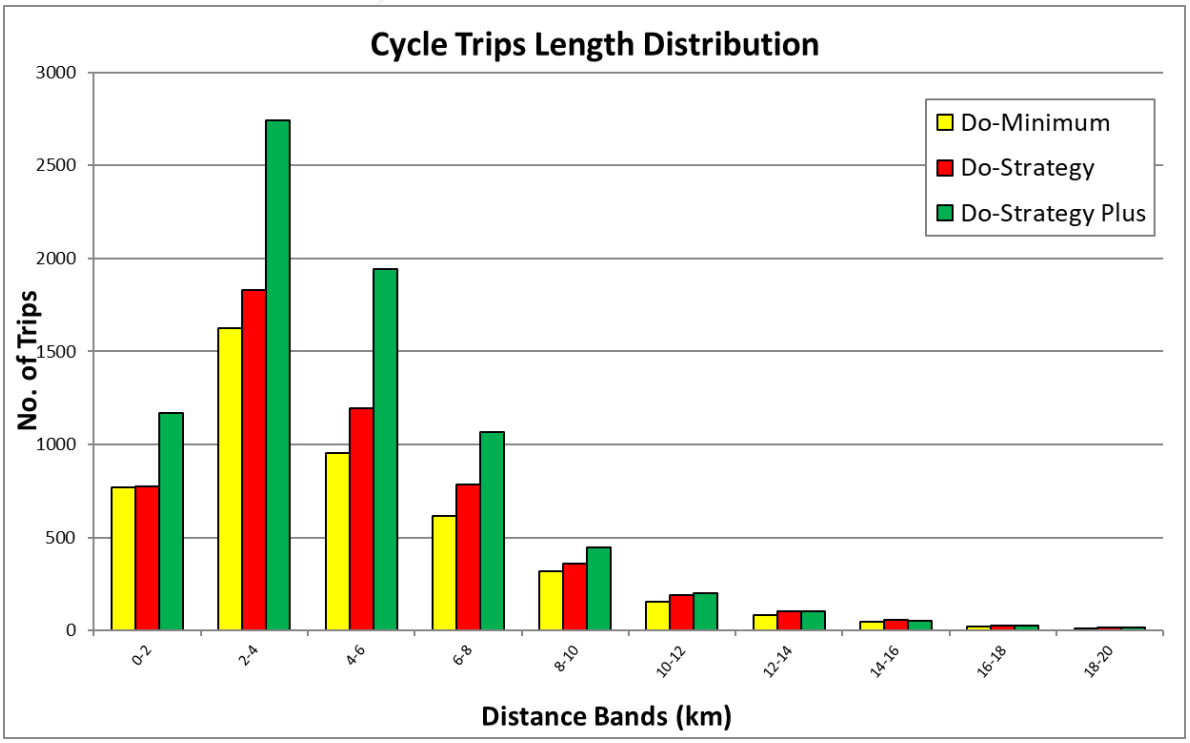



Figure 7-22: Cycle Trip Length Distribution

## 7.10 Public Transport Network Analysis

This section provides further detail on the performance of the LSMATS Do-Strategy & Do-Strategy Plus Demand Management public transport network compared to the Do-Minimum scenario. Table 7-13 below shows the breakdown of AM Trips by PT Sub-Mode for the Do-Minimum, Do-Strategy & Do-Strategy Plus scenarios.

Table 7-13 AM Peak Hr PT trips by Sub-mode

| Sub-mode | Do-Minimum | Do-Strategy | Do-Strategy+ |
|---|---|---|---|
| **Bus** | 8,704 | 13,726 | 15,613 |
| **Rail** | 1,532 | 1,862 | 1,943 |
| **Total** | **10,235** | **15,588** | **17,555** |

The Do-Strategy results show a 52% increase in public transport trips compared to the Do-Minimum scenario with substantial increases on both public transport sub-modes. There is a further approximately 2,000 trips in the Do-Strategy Plus Scenario, a 72% increase compared to the Do-Minimum.

### 7.10.1 Bus Network Service Operational Assessment

This section provides a summary of the performance of the proposed BusConnects network within LSMATS. Figure 7-23 &

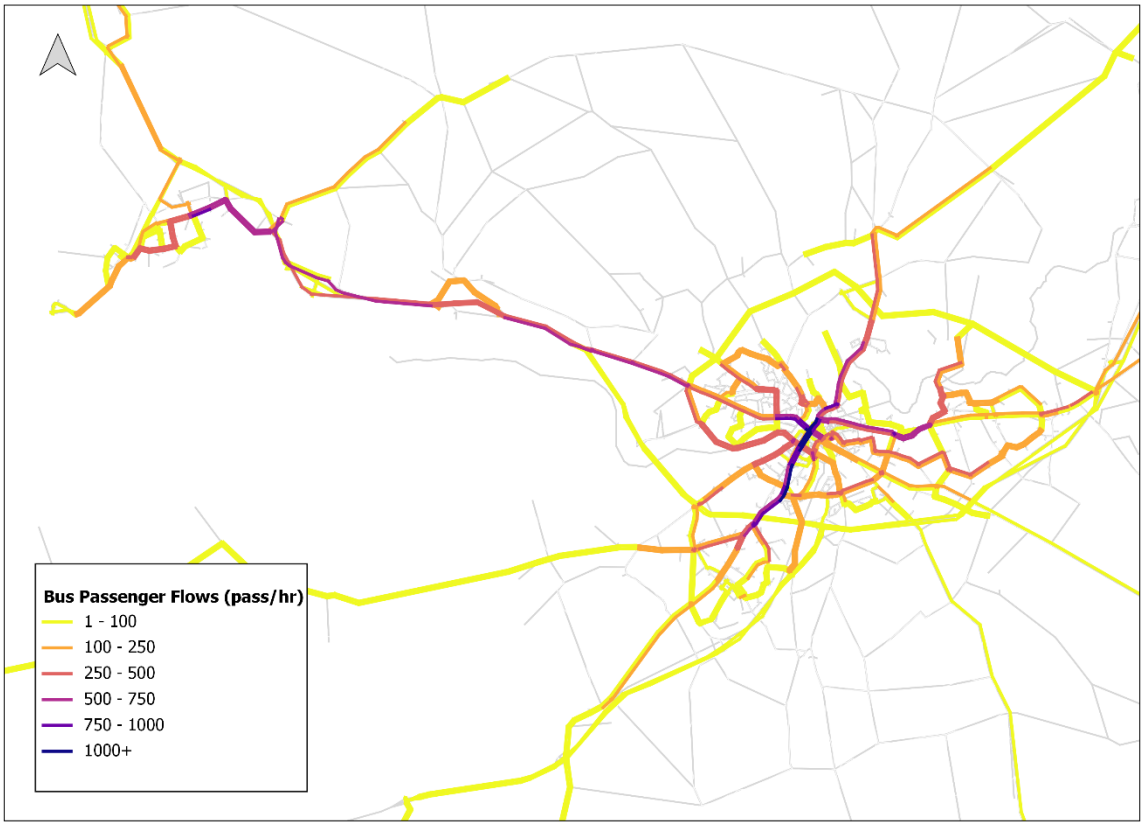



Figure 7-24 show the AM peak hour flows on the Bus network in the Do-Strategy & Do-Strategy Plus scenario respectively. This shows substantial usage of the bus network across the LSMA in both scenarios. In particular, the southern corridor from the City towards Dooradoyle along the Ballinacurra Road and through the city along O'Connell Street. O'Connell Street carries approximately 2,000 & 2,450 passengers during the AM peak in the Do-Strategy and Do-Strategy Plus respectively. Other corridors with very high passenger flows are the Dublin Road, Corbally Road, N18 Corridor to Shannon and Ennis Road. There are approximately 1,600 & 1,750 bus passengers crossing the Sarsfield bridge in the Do-Strategy and Do-Strategy Plus respectively

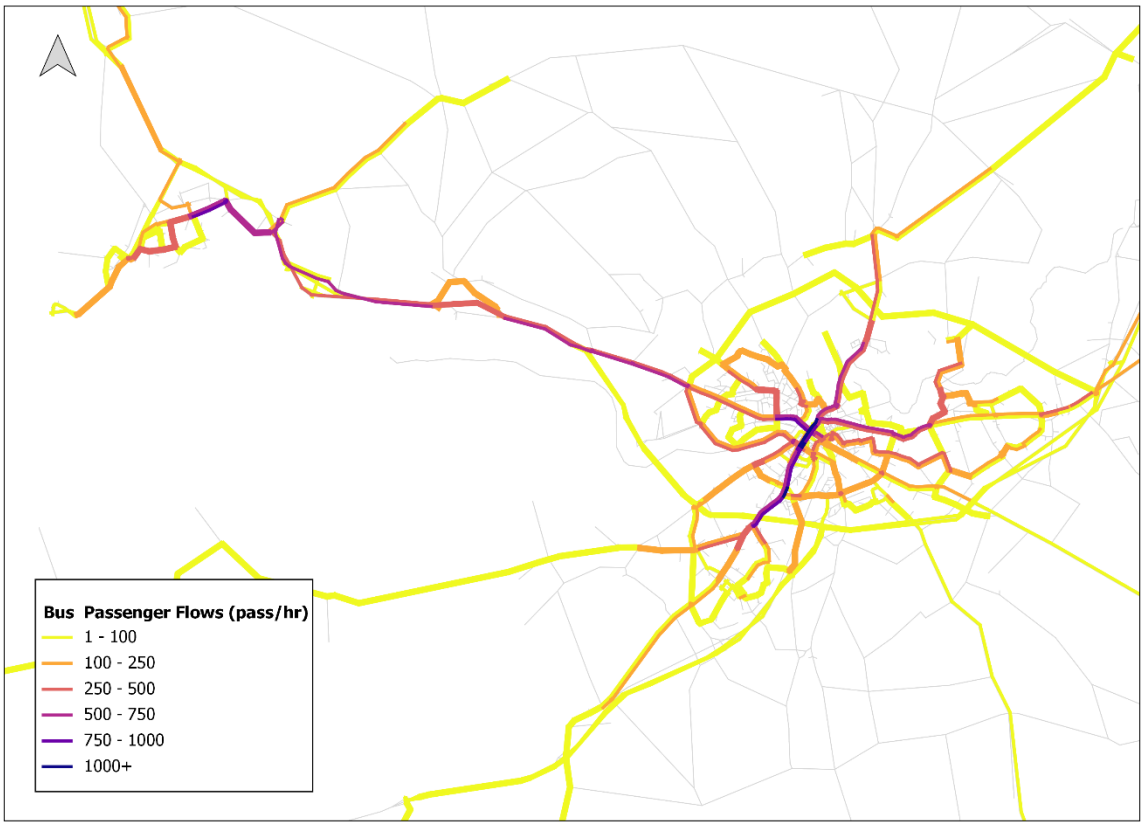



Figure 7-23: Do Strategy AM Peak Hour - Bus Flow Bandwidths

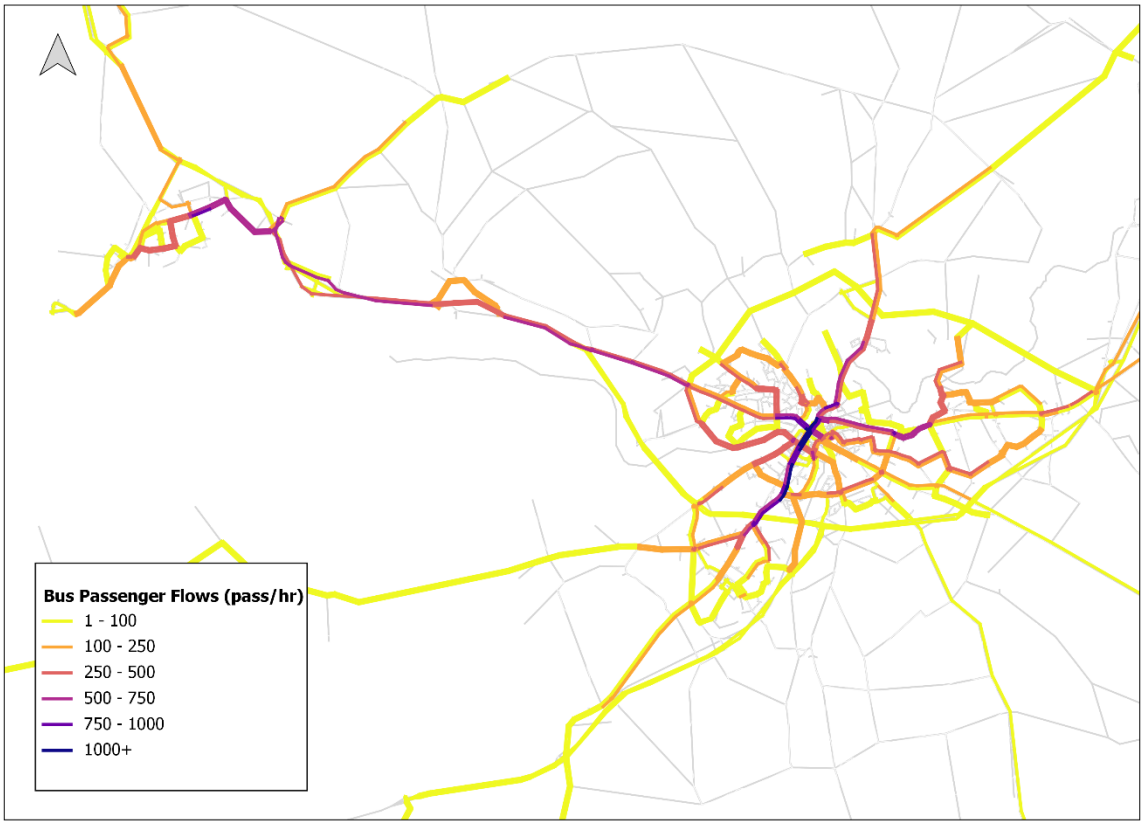



Figure 7-24: Do Strategy Plus AM Peak Hour - Bus Flow Bandwidths

A summary of bus patronage by line in the AM peak hour is provided in Table 7-14 for both the Do-Strategy and Do-Strategy Plus Demand Management Scenario. For each route, the table details the Headway (HW), Maximum Volume at any point on the route, Max Volume over Capacity and also the total boardings for each line.

The results show that the majority of routes perform well in terms of forecast patronage for their modelled frequency and capacity, particularly the core routes. The highest performing individual routes are:

- Pink Route: Mungret/Raheen - South Clare SDZ/University of Limerick,
- Purple Route: Ballygrennan - Raheen,
- Blue Route: Moyross – Annacotty eastbound,
- Orange Route: Clonlara to Raheen southbound,
- Shannon to Limerick Express and Local routes, and
- Sixmilebridge to Shannon.

**Table 7-14 Summary of Bus Patronage for the AM Peak**

| Line No. | Line Name | Modelled Headway | Do-Strategy | | | Do-Strategy Plus | | |
|---|---|---|---|---|---|---|---|---|
| | | | Max Vol. | Volume/ Capacity | Total Boardings | Max Vol. | Volume/ Capacity | Total Boardings |
| 6010 | Ballysimon-Ardnacrusha | 20 | 131 | 63% | 254 | 141 | 67% | 276 |
| 6011 | Ardnacrusha - Ballysimon | 20 | 125 | 60% | 197 | 128 | 61% | 209 |
| 6012 | Ardnacrusha - Crossagalla | 20 | 122 | 58% | 259 | 131 | 63% | 287 |
| 6013 | Crossagalla-Ardnacrusha | 20 | 166 | 79% | 258 | 184 | 88% | 291 |
| 6020 | SDZ/UL-Mungret | 15 | 229 | 77% | 451 | 277 | 93% | 568 |
| 6021 | Mungret-SDZ/UL | 15 | 200 | 67% | 415 | 249 | 83% | 527 |
| 6022 | SDZ/UL-Raheen | 15 | 215 | 72% | 397 | 255 | 85% | 489 |
| 6023 | Raheen-SDZ/UL | 15 | 172 | 57% | 324 | 207 | 69% | 386 |
| 6030 | Caherdavin-UL-Annacotty | 20 | 92 | 41% | 185 | 115 | 51% | 227 |
| 6031 | Annacotty-UL-Caherdavin | 20 | 94 | 42% | 224 | 116 | 52% | 270 |
| 6032 | Caherdavin/North Circular-Annacotty | 20 | 63 | 28% | 133 | 83 | 37% | 161 |
| 6033 | Annacotty-Caherdavin/North Circular | 20 | 143 | 64% | 222 | 159 | 71% | 254 |
| 6040 | Ballygrennan-Raheen | 7.5 | 430 | 72% | 792 | 482 | 81% | 936 |
| 6041 | Raheen-Ballygrennan | 7.5 | 482 | 81% | 940 | 573 | 96% | 1118 |
| 6050 | Annacotty-Moyross | 10 | 198 | 44% | 505 | 231 | 52% | 586 |
| 6051 | Moyross-Annacotty | 10 | 344 | 77% | 612 | 421 | 94% | 724 |
| 6060 | Clonlara-Raheen | 15 | 253 | 85% | 500 | 283 | 95% | 562 |
| 6061 | Raheen-Clonlara | 15 | 166 | 56% | 373 | 250 | 83% | 495 |
| 6080 | King's Island-Raheen | 30 | 51 | 36% | 94 | 60 | 43% | 112 |
| 6081 | Raheen-King's Island | 30 | 32 | 23% | 62 | 40 | 29% | 76 |
| 6082 | Corbally-Raheen | 30 | 62 | 44% | 131 | 73 | 53% | 158 |
| 6083 | Raheen-Corbally | 30 | 35 | 25% | 84 | 45 | 32% | 103 |
| 6090 | Shannon-Limerick_Express | 10 | 341 | 82% | 464 | 316 | 76% | 462 |
| 6091 | Limerick-Shannon_Express | 10 | 232 | 55% | 421 | 251 | 60% | 475 |
| 6114 | Shannon-Limerick_Local | 15 | 211 | 76% | 341 | 200 | 72% | 338 |
| 6115 | Limerick-Shannon_Local | 15 | 134 | 48% | 322 | 145 | 52% | 352 |
| 6116 | Sixmilebridge-Shannon | 20 | 157 | 75% | 224 | 166 | 79% | 232 |
| 6117 | Shannon-Sixmilebridge | 20 | 107 | 51% | 152 | 106 | 51% | 151 |
| 6100 | Southern Orbital Eastbound | 10 | 152 | 50% | 368 | 182 | 60% | 449 |
| 6101 | Southern Orbital Westbound | 10 | 193 | 63% | 369 | 246 | 80% | 465 |
| 6118 | Northern Orbital Eastbound via LNDR | 20 | 64 | 43% | 97 | 82 | 54% | 121 |
| 6119 | Northern Orbital Westbound via LNDR | 20 | 34 | 23% | 58 | 42 | 28% | 72 |

## 7.11 Active Modes Network Operations

### 7.11.1 Active Modes Assignment

This section provides a summary of the performance of the Active Modes (Walking and Cycling) network within LSMATS. Figure 7-25 & Figure 7-26 present the combined active flows (Walk + Cycle) in the AM Peak hour across the LSMA for the Do-Strategy and Do-Strategy Plus respectively. As shown, there are significant volumes of pedestrians and cyclists throughout Limerick City, particularly through the city centre and along each main arterial route to the city including Corbally Road, Dublin Road, Ballysimon Road, Ballinacurra Road and Ennis Road. There is a combined 1,800 pedestrian and cyclists crossing the 3 Shannon bridges within the city centre, including the new pedestrian bridge.


Figure 7-25: Do-Strategy AM Peak Hr Active Mode Flows


Figure 7-26: Do-Strategy Plus AM Peak Hr Active Mode Flows

## 7.12 Road Network Operations

This section provides detail on the performance of the road network. Table 7-15 below presents High-Level Road Network statistics for the Do-Minimum, Do-Strategy & Do-Strategy Plus Demand Management extracted from the MWRM SATURN road model in the AM peak hour.

Table 7-15 AM Road Network Assignment Statistics

| Assignment Stats | Do-Minimum | Do-Strategy | Do-Strategy+ |
|---|---|---|---|
| **Transient Queues (PCU.HRS)** | 5,407 | 4,860 | 4,472 |
| **Over-Capacity Queues (PCU.HRS)** | 1,721 | 1,332 | 1,130 |
| **Link Cruise Time (PCU.HRS)** | 39,710 | 39,370 | 38,989 |
| **Total Travel Time (PCU.HRS)** | 46,840 | 45,560 | 44,591 |
| **Travel Distance (PCU.KMS)** | 2,663,000 | 2,666,000 | 2,649,747 |
| **Average Speed (KPH)** | 56.9 | 58.5 | 59.4 |

The results show substantial improvements in road network performance between the Do-Minimum and both Do-Strategy scenarios. Over-capacity queueing – a measure of congestion on the wider road network shows a reduction of 22.6% % 34.3% in the Do-Strategy and Do-Strategy Plus Demand Management respectively compared to the Do-Minimum.

# 8 Land Use Sensitivity Testing

## 8.1 Introduction

An additional model run was undertaken to assess the impact of more consolidated growth within Limerick City Centre and Suburbs as a sensitivity test of the strategy land use assumptions. The model run included all the additional infrastructure included within the Strategy Runs and the car ownership restrictions of the Strategy Plus Runs. This section of the report outlines the land use assumptions of this sensitivity test and the impact of the changes on the modelling results.

## 8.2 Demographic Summary

The change in demographics at a county and metropolitan level of presented in Tables 8.1-8.3 for population, employment and education respectively. As shown, there is substantial increase in the level of growth assumed for each with the majority of targeted within Limerick City and Suburbs. There is also significant growth in the 'Remaining Metropolitan Area' which is largely driven by additional growth in the South Clare Economic SDZ which lies outside though adjacent to the existing city and suburbs boundary.

Table 8-1: Population Sensitivity Test Comparison

| County | Population | | Population Difference | |
|---|---|---|---|---|
| | 2040 | 2040 Sensitivity | | |
| **Limerick City & County** | 261,475 | 291,677 | 30,202 | 12% |
| **Clare County** | 147,910 | 158,311 | 10,401 | 7% |
| **Metropolitan Areas** | | | | |
| **L-SMATS Area** | 206,444 | 246,948 | 40,504 | 20% |
| **-Limerick City & Suburbs** | 145,406 | 174,324 | 28,918 | 20% |
| -Limerick City & Suburbs (Limerick) | 139,880 | 168,141 | 28,261 | 20% |
| -Limerick City & Suburbs (Clare) | 5,527 | 6,183 | 656 | 12% |
| **-Shannon** | 13,807 | 13,807 | 0 | 0% |
| **-Remaining Metropolitan Area** | 47,231 | 58,817 | 11,586 | 25% |

Table 8-2: Employment Sensitivity Test Comparison

| County | Employment | | Employment Difference | |
|---|---|---|---|---|
| | 2040 | 2040 Sensitivity | | |
| **Limerick City & County** | 84,211 | 93,938 | 9,727 | 12% |
| **Clare County** | 40,982 | 43,862 | 2,880 | 7% |
| **Metropolitan Areas** | | | | |
| **L-SMATS Area** | 83,680 | 94,763 | 11,083 | 13% |
| **-Limerick City & Suburbs** | 58,252 | 64,861 | 6,609 | 11% |
| -Limerick City & Suburbs (Limerick) | 57,971 | 64,576 | 6,605 | 11% |
| -Limerick City & Suburbs (Clare) | 280 | 284 | 4 | 2% |
| **-Shannon** | 13,989 | 14,177 | 188 | 1% |
| **-Remaining Metropolitan Area** | 11,439 | 15,726 | 4,287 | 37% |

Table 8-3: Education Sensitivity Test Comparison

| County | Education | | Education Difference | |
|---|---|---|---|---|
| | 2040 | 2040 Sensitivity | | |
| **Limerick City & County** | 65,201 | 70,905 | 5,704 | 9% |
| **Clare County** | 24,745 | 26,434 | 1,689 | 7% |
| **Metropolitan Areas** | | | | |
| **L-SMATS Area** | 55,171 | 62,494 | 7,323 | 13% |
| **-Limerick City & Suburbs** | 44,795 | 50,220 | 5,425 | 12% |
| -Limerick City & Suburbs (Limerick) | 44,325 | 49,644 | 5,319 | 12% |
| -Limerick City & Suburbs (Clare) | 470 | 576 | 106 | 23% |
| **-Shannon** | 3,217 | 3,223 | 6 | 0% |
| **-Remaining Metropolitan Area** | 7,159 | 9,051 | 1,892 | 26% |

## 8.3 Settlement Level Comparison

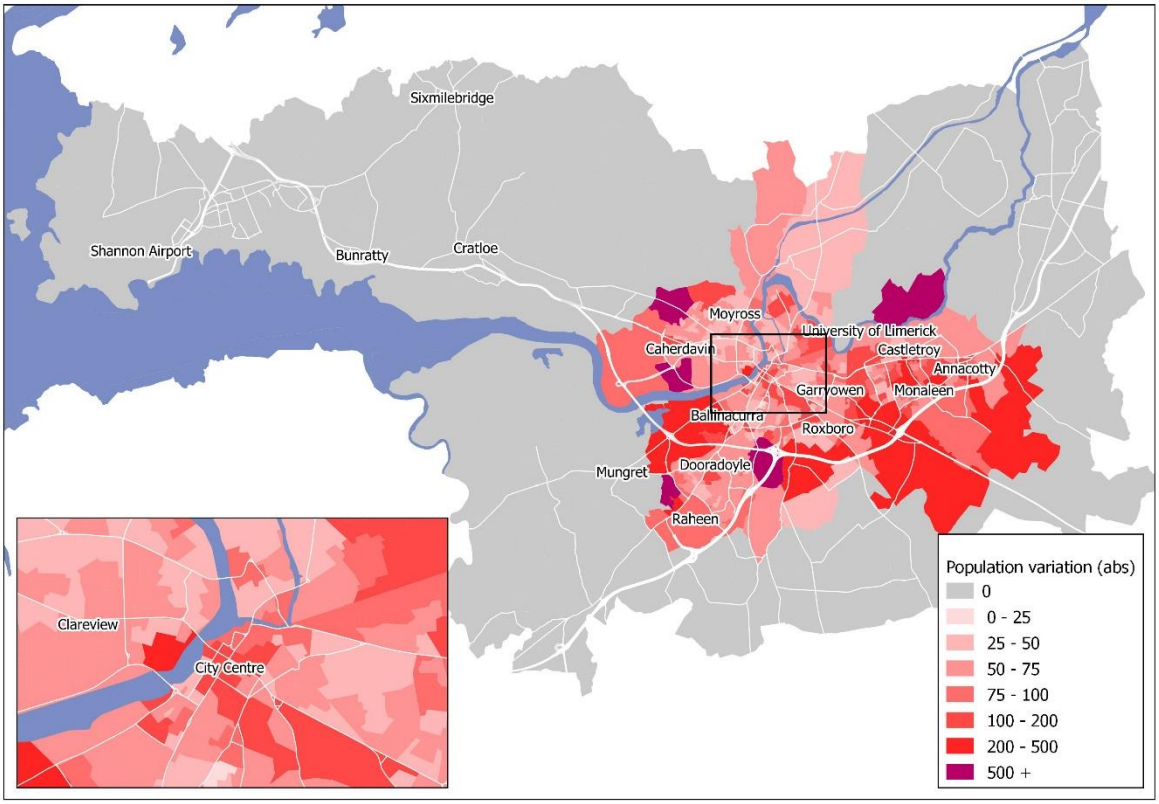
The additional population growth is further disaggregated to a settlement level within Table 8.4. As shown, the most significant growth is within the SDZ as outlined. There is also significant extra growth assumed in the wider Limerick Suburbs particularly Ballinacurra, Caherdavin, Limerick North-East and Dooradoyle amongst others.

Table 8-4: Population Sensitivity Comparison at a Settlement Level

| Metro Settlements | Population | | Population Difference | |
|---|---|---|---|---|
| | 2040 | 2040 Sensitivity Test | | |
| **Annacotty** | 9,146 | 11,151 | 2,005 | 22% |
| **Ballinacurra** | 13,294 | 16,374 | 3,080 | 23% |
| **Bunratty** | 1,092 | 1,092 | 0 | 0% |
| **Caherdavin** | 10,820 | 13,712 | 2,892 | 27% |
| **Castleconnell** | 5,722 | 5,722 | 0 | 0% |
| **Castletroy** | 9,120 | 11,127 | 2,007 | 22% |
| **City Centre** | 8,443 | 10,337 | 1,894 | 22% |
| **Clareview** | 10,594 | 12,422 | 1,828 | 17% |
| **Cratloe** | 1,792 | 1,792 | 0 | 0% |
| **Dooradoyle** | 18,107 | 20,962 | 2,855 | 16% |
| **Limerick North** | 10,826 | 12,883 | 2,057 | 19% |
| **Limerick North-East** | 17,518 | 20,522 | 3,004 | 17% |
| **Moyross** | 10,511 | 12,421 | 1,910 | 18% |
| **Mungret** | 3,969 | 4,223 | 254 | 6% |
| **Parteen** | 1,338 | 1,498 | 160 | 12% |
| **Raheen** | 6,335 | 7,858 | 1,523 | 24% |
| **Roxboro** | 12,045 | 14,306 | 2,261 | 19% |
| **Rural** | 25,062 | 27,063 | 2,001 | 8% |
| **Shannon** | 13,404 | 13,404 | 0 | 0% |
| **Sixmilebridge** | 4,769 | 4,769 | 0 | 0% |
| **South Clare Economic SDZ** | 3,534 | 13,000 | 9,466 | 268% |
| **University** | 4,813 | 5,624 | 811 | 17% |
| **Westbury** | 4,189 | 4,686 | 497 | 12% |
| **Total** | **206,444** | **246,948** | **40,504** | **20%** |

The absolute growth in population by small area is shown in Figure 8.1 below and illustrates the concentration of growth close to the city.

Figure 8-1: Population Difference by Small Area for Sensitivity Test




The additional employment growth assumed by settlement is outlined in Table 8.5 and shows significant additional growth in the City Centre, Ballinacurra, Mungret and the South Clare SDZ.

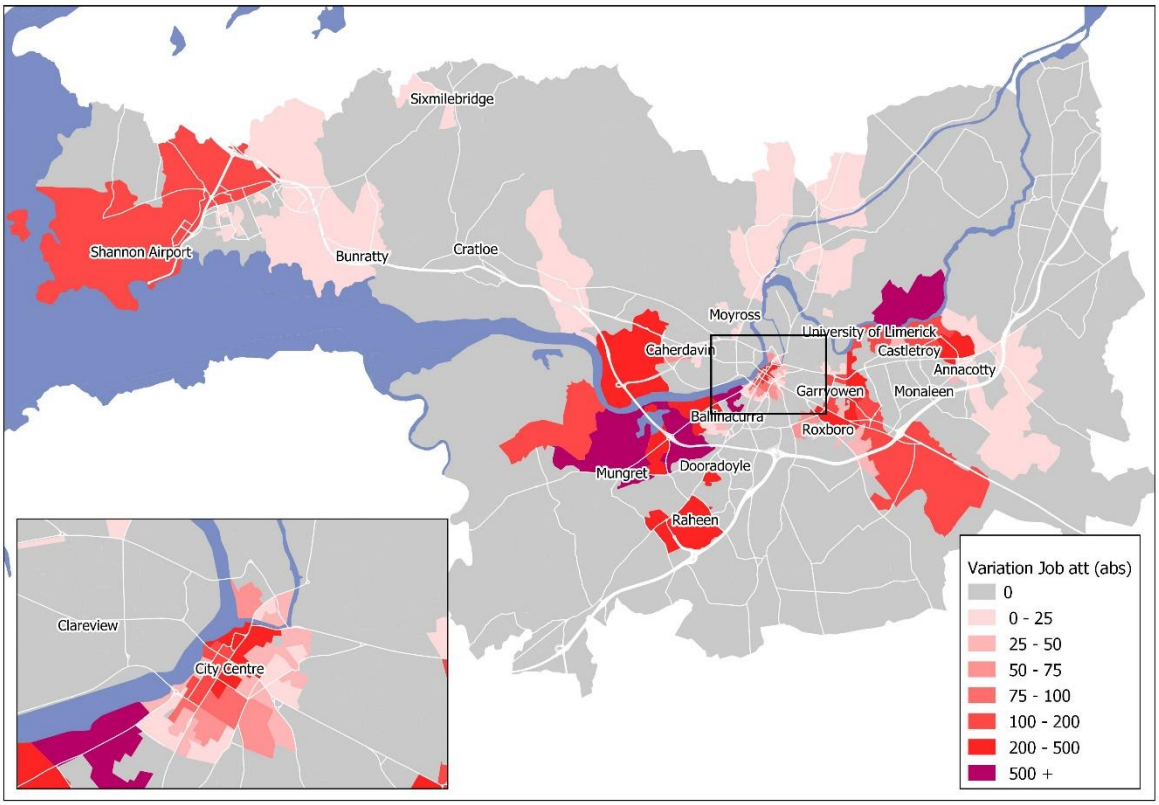
Table 8-5: Employment Sensitivity Comparison at a Settlement Level

| Metro Settlements | Employment | | Employment Difference | |
|---|---|---|---|---|
| | 2040 | 2040 Sensitivity Test | | |
| Annacotty | 2,586 | 2,961 | 375 | 14% |
| Ballinacurra | 9,202 | 11,253 | 2,051 | 22% |
| Bunratty | 577 | 582 | 5 | 1% |
| Caherdavin | 1,836 | 2,196 | 360 | 20% |
| Castleconnell | 301 | 301 | 0 | 0% |
| Castletroy | 1,356 | 1,577 | 221 | 16% |
| City Centre | 12,749 | 14,101 | 1,352 | 11% |
| Clareview | 1,517 | 1,547 | 30 | 2% |
| Cratloe | 249 | 252 | 3 | 1% |
| Dooradoyle | 5,359 | 5,673 | 314 | 6% |
| Limerick North | 1,555 | 1,655 | 100 | 6% |
| Limerick North-East | 4,597 | 5,117 | 520 | 11% |
| Moyross | 1,507 | 1,524 | 17 | 1% |
| Mungret | 4,644 | 6,362 | 1,718 | 37% |
| Parteen | 172 | 173 | 1 | 1% |
| Raheen | 5,254 | 5,506 | 252 | 5% |

| | | | | |
|---|---|---|---|---|
| **Roxboro** | 5,143 | 5,670 | 527 | 10% |
| **Rural** | 4,160 | 4,435 | 275 | 7% |
| **Shannon** | 13,794 | 13,979 | 185 | 1% |
| **Sixmilebridge** | 312 | 316 | 4 | 1% |
| **South Clare Economic SDZ** | 1,136 | 3,500 | 2,364 | 208% |
| **University** | 5,564 | 5,971 | 407 | 7% |
| **Westbury** | 108 | 111 | 3 | 3% |
| **Total** | 83,680 | 94,763 | 11,083 | 13% |

The employment growth by small area in absolute terms is mapped in Figure 8.2 and whilst the majority of employment is concentrated adjacent to or within the city and suburbs there is some smaller pockets of additional employment growth in the wider metropolitan area particularly in and around Shannon.

**Figure 8-2: Employment Difference by Small Area for Sensitivity Test**



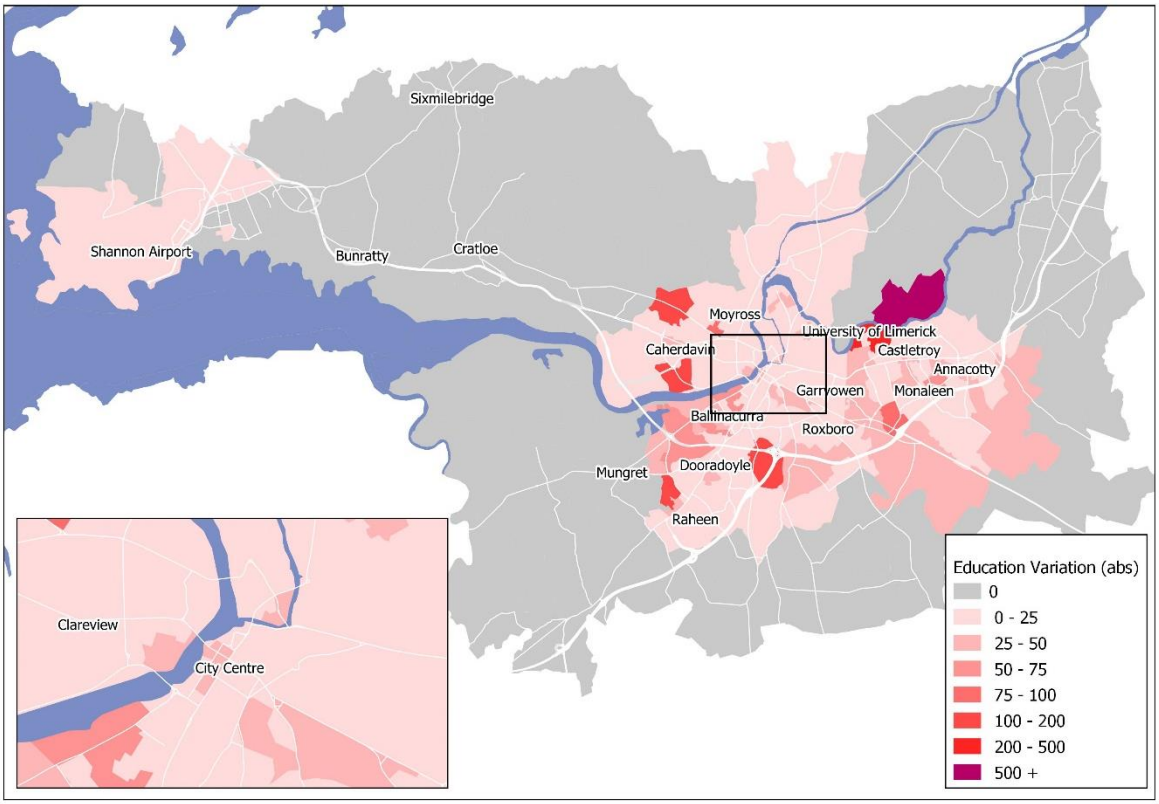

The additional growth in education places by settlement is outlined in Table 8.6 and overall shows a similar dispersion to the population growth with a higher proportional growth in the South Clare SDZ.

Table 8-6: Education Sensitivity Comparison at a Settlement Level

| Metro Settlements | Education | | Education Difference | |
|---|---|---|---|---|
| | 2040 | 2040 Sensitivity Test | | |
| Annacotty | 1,693 | 2,043 | 350 | 21% |
| Ballinacurra | 6,894 | 7,491 | 597 | 9% |
| Bunratty | 168 | 168 | 0 | 0% |
| Caherdavin | 1,443 | 1,947 | 504 | 35% |
| Castleconnell | 637 | 636 | -1 | 0% |
| Castletroy | 1,420 | 1,770 | 350 | 25% |
| City Centre | 1,582 | 1,920 | 338 | 21% |
| Clareview | 2,627 | 2,946 | 319 | 12% |
| Cratloe | 311 | 311 | 0 | 0% |
| Dooradoyle | 2,598 | 3,096 | 498 | 19% |
| Limerick North | 3,235 | 3,604 | 369 | 11% |
| Limerick North-East | 3,118 | 3,662 | 544 | 17% |
| Moyross | 5,245 | 5,657 | 412 | 8% |
| Mungret | 637 | 681 | 44 | 7% |
| Parteen | 315 | 340 | 25 | 8% |
| Raheen | 1,220 | 1,486 | 266 | 22% |
| Roxboro | 2,660 | 3,063 | 403 | 15% |
| Rural | 3,685 | 4,030 | 345 | 9% |
| Shannon | 3,200 | 3,206 | 6 | 0% |
| Sixmilebridge | 525 | 525 | 0 | 0% |
| South Clare Economic SDZ | 502 | 2,029 | 1,527 | 304% |
| University | 11,302 | 11,649 | 347 | 3% |
| Westbury | 156 | 236 | 80 | 51% |
| Total | 55,171 | 62,494 | 7,323 | 13% |

The difference in education places by small area is outlined in Figure 8.3 and again shows a concentration of growth within the city with the highest absolute growth in the South Clare SDZ which is adjacent to the University of Limerick.

Figure 8-3: Education Places Difference by Small Area for Sensitivity Test




## 8.4 Modelling Results

### 8.4.1 Demand Analysis

The total absolute demand by mode for the 24-hour period for the Do-Minimum, Strategy Runs and Sensitivity Test are shown in Figure 8.4. As illustrated by the graph, there is a significant increase in overall demand as a result of the additional graph in population and associated employment and education. However, the majority of these growth is catered for by sustainable modes which show an increase in absolute demand of 22.7%. Car demand grows by approximately 9.9%.

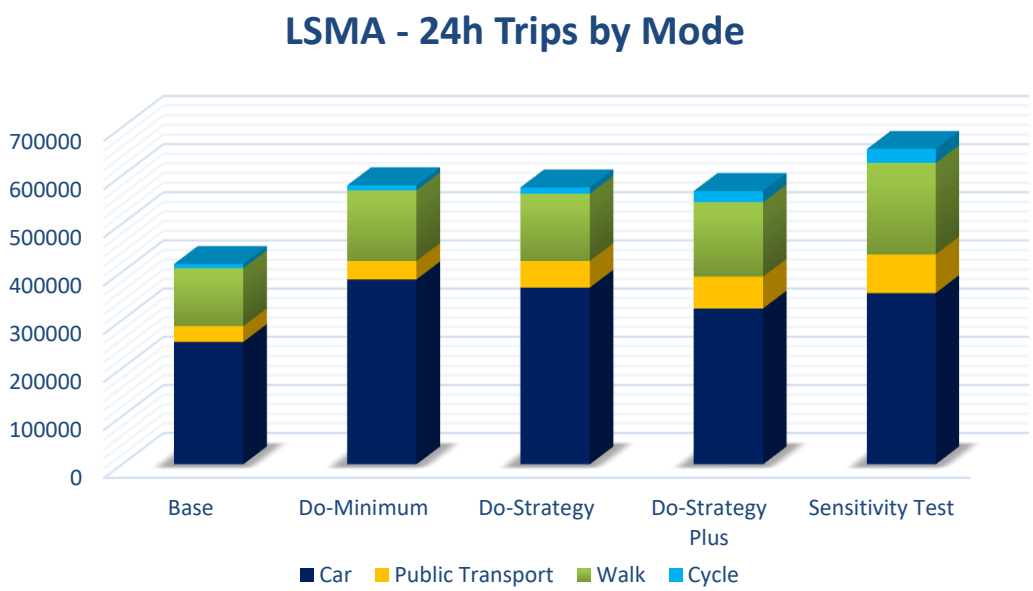



Figure 8-4: LSMA 24Hr Demand Distribution – Sensitivity Test Comparison

Similarly, in the AM peak demand for sustainable modes grows by 24.0% whilst car demand grows by 10.2%. This shows the advantages of consolidation of demand in higher density particularly in areas where maximum parking standards can be applied to new households.

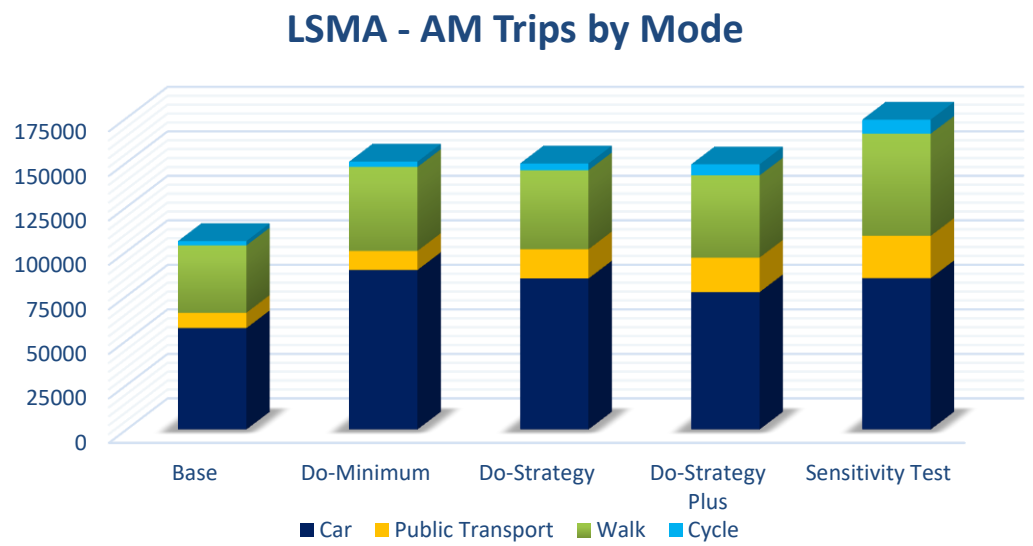



Figure 8-5: LSMA AM Demand Distribution – Sensitivity Test Comparison

### 8.4.2 Mode Share Analysis

The overall mode share split for the Metropolitan Area over 24 hours is shown in Figure 8.6. Compared to the results presented previously for the so Strategy Plus Scenario there is a 2.7% drop in the car mode share and increases if 0.6%, 1.8% and 0.4% in public transport, walking and cycling respectively.

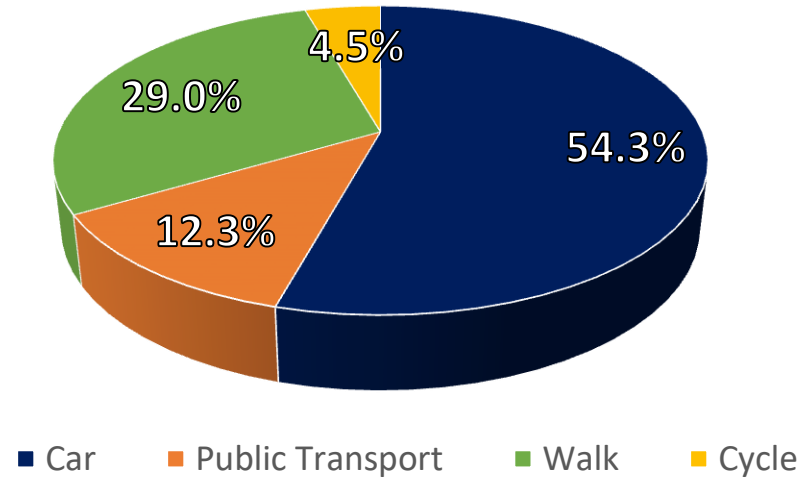



Figure 8-6: Do-Strategy Plus & Sensitivity Testing - 24 Hr Metropolitan Area Mode Share

By urban area within the LSMA, the car mode share of Limerick City and Suburbs drops by 2.1% as outlined in Figure 8.7. The car mode share of Shannon is relatively unchanged as the growth in Shannon is largely unchanged. The car mode share of the 'Other Metropolitan Area' decreases by a 5.5%, this is due to the significant increase in population within the SDZ. It should be noted that there are maximum parking restrictions applied to all new households within the SDZ as outlined in Section 6.4.2 which helps significantly reduce the car mode share.

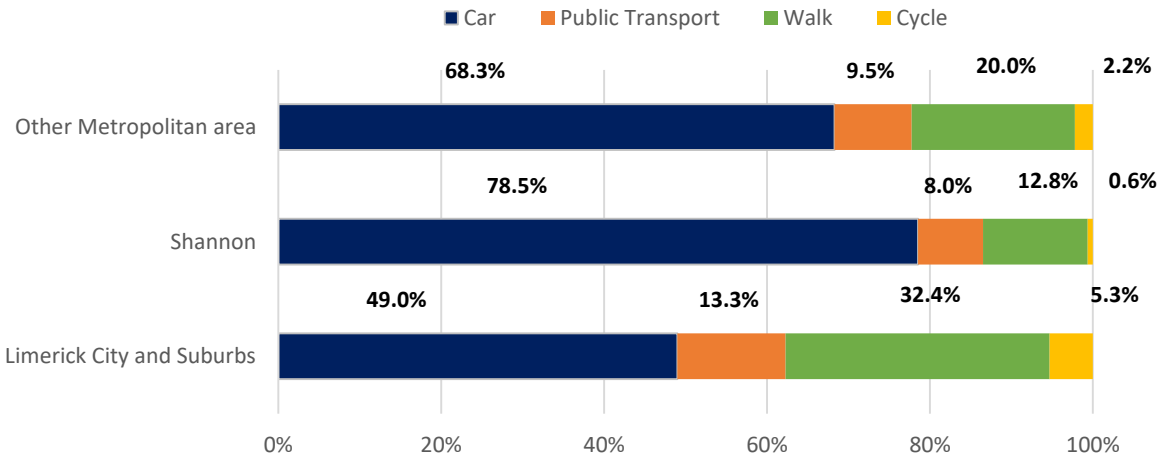



Figure 8-7: Do-Strategy Plus & Sensitivity Testing Metropolitan Area Mode Share by Area

The car mode share by model zone is mapped in Figure 8.8 and compared to the Do-Strategy Plus results presented previously in Figure 7-17 shows a broadly lower car mode share across much of the city and suburbs particularly Dooradoyle, Annacotty and the South Clare SDZ.

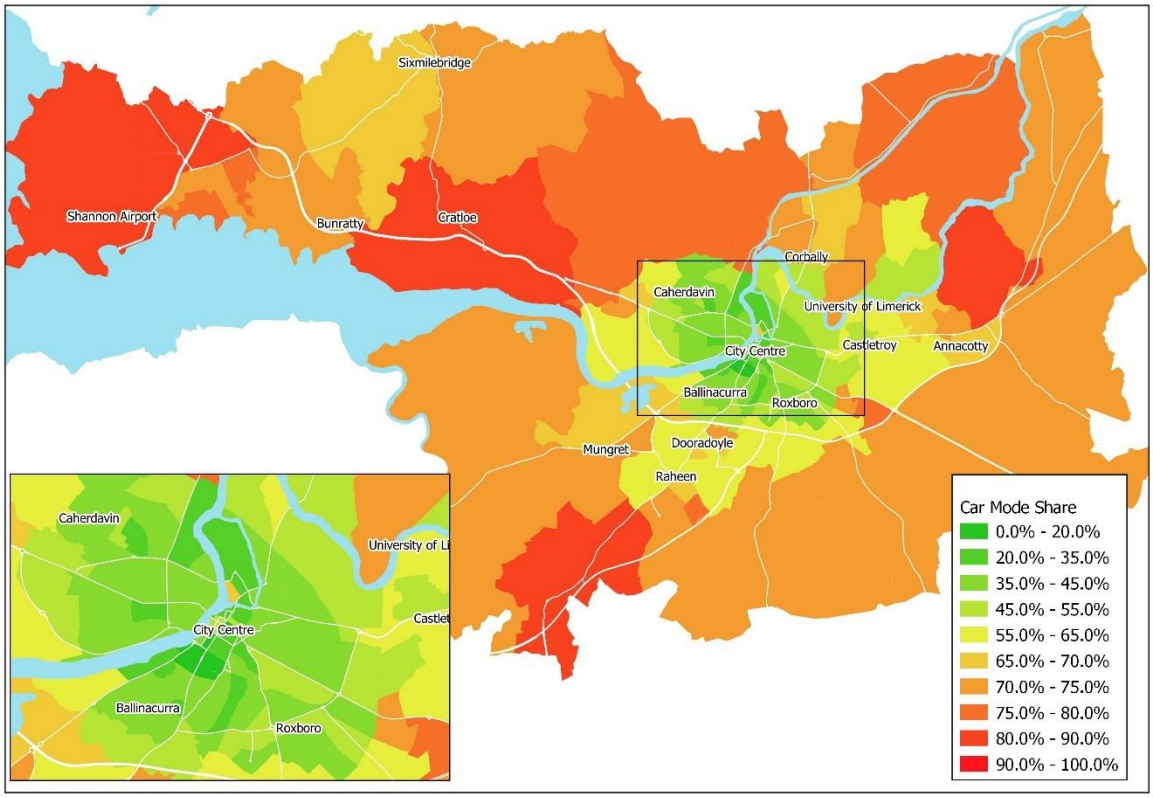



Figure 8-8: Do-Strategy Plus with Sensitivity Testing Metropolitan Area Mode Share by MWRM Zone

### 8.4.3 Bus Network Operational Assessment

To address the increase in public transport demand as a result of the increased population the frequencies of the modelled bus network was increased. This included increased frequencies on the Pink, Purple, Orange and Blue routes. Table 8-7 outlines the frequencies, the maximum volume modelled along each route and the maximum volume over design capacity of the Do-Strategy Plus run and the land use sensitivity test.

As outlined in the table, the increased frequencies in the bus services mentioned above adequately caters for the increase in demand with all routes operating below their design capacity. These results indicate that the proposed bus based public transport network will offer sufficient flexibility to ensure demand is met in the future efficiently.

### Table 8-7 Do- Strategy Plus & Sensitivity Test Bus Patronage

| Line No. | Line Name | Modelled Headway | Do-Strategy Plus | | | Modelled Headway | Do-Strategy Plus- Senstivity Test | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Max Vol. | Volume/ Capacity | Total Boardings | | Max Vol. | Volume/ Capacity | Total Boardings |
| 6010 | Ballysimon-Ardnacrusha | 20 | 141 | 67% | 276 | 20 | 167 | 80% | 321 |
| 6011 | Ardnacrusha - Ballysimon | 20 | 128 | 61% | 209 | 20 | 150 | 72% | 240 |
| 6012 | Ardnacrusha - Crossagalla | 20 | 131 | 63% | 287 | 20 | 155 | 74% | 332 |
| 6013 | Crossagalla-Ardnacrusha | 20 | 184 | 88% | 291 | 20 | 210 | 95% | 332 |
| 6020 | SDZ/UL-Mungret | 15 | 277 | 93% | 568 | **10** | 370 | 83% | 825 |
| 6021 | Mungret-SDZ/UL | 15 | 249 | 83% | 527 | **10** | 288 | 64% | 629 |
| 6022 | SDZ/UL-Raheen | 15 | 255 | 85% | 489 | **10** | 339 | 76% | 707 |
| 6023 | Raheen-SDZ/UL | 15 | 207 | 69% | 386 | **10** | 238 | 53% | 471 |
| 6030 | Caherdavin-UL-Annacotty | 20 | 115 | 51% | 227 | 20 | 137 | 61% | 273 |
| 6031 | Annacotty-UL-Caherdavin | 20 | 116 | 52% | 270 | 20 | 147 | 65% | 326 |
| 6032 | Caherdavin/North Circular-Annacotty | 20 | 83 | 37% | 161 | 20 | 99 | 44% | 190 |
| 6033 | Annacotty-Caherdavin/North Circular | 20 | 159 | 71% | 254 | 20 | 193 | 86% | 299 |
| 6040 | Ballygrennan-Raheen | 7.5 | 482 | 81% | 936 | **5** | 577 | 64% | 1096 |
| 6041 | Raheen-Ballygrennan | 7.5 | 573 | 96% | 1118 | **5** | 646 | 72% | 1288 |
| 6050 | Annacotty-Moyross | 10 | 231 | 52% | 586 | **7.5** | 270 | 45% | 702 |
| 6051 | Moyross-Annacotty | 10 | 421 | 94% | 724 | **7.5** | 536 | 89% | 886 |
| 6060 | Clonlara-Raheen | 15 | 283 | 95% | 562 | **10** | 355 | 85% | 682 |
| 6061 | Raheen-Clonlara | 15 | 250 | 83% | 495 | **10** | 282 | 67% | 561 |
| 6080 | King's Island-Raheen | 30 | 60 | 43% | 112 | 30 | 72 | 52% | 131 |
| 6081 | Raheen-King's Island | 30 | 40 | 29% | 76 | 30 | 48 | 35% | 90 |
| 6082 | Corbally-Raheen | 30 | 73 | 53% | 158 | 30 | 88 | 63% | 189 |
| 6083 | Raheen-Corbally | 30 | 45 | 32% | 103 | 30 | 53 | 38% | 119 |
| 6090 | Shannon-Limerick_Express | 10 | 316 | 76% | 462 | 10 | 319 | 76% | 489 |
| 6091 | Limerick-Shannon_Express | 10 | 251 | 60% | 475 | 10 | 272 | 65% | 522 |
| 6114 | Shannon-Limerick_Local | 15 | 200 | 72% | 338 | 15 | 202 | 73% | 357 |
| 6115 | Limerick-Shannon_Local | 15 | 145 | 52% | 352 | 15 | 158 | 57% | 382 |
| 6116 | Sixmilebridge-Shannon | 20 | 166 | 79% | 232 | 20 | 172 | 82% | 239 |
| 6117 | Shannon-Sixmilebridge | 20 | 106 | 51% | 151 | 20 | 106 | 51% | 151 |
| 6100 | Southern Orbital Eastbound | 10 | 182 | 60% | 449 | 10 | 224 | 70% | 568 |
| 6101 | Southern Orbital Westbound | 10 | 246 | 80% | 465 | 10 | 326 | 90% | 603 |
| 6118 | Northern Orbital Eastbound via LNDR | 20 | 82 | 54% | 121 | 10 | 147 | 48% | 208 |
| 6119 | Northern Orbital Westbound via LND | 20 | 42 | 28% | 72 | 10 | 64 | 21% | 119 |

# 9 Conclusions

A detailed assessment of the transport proposals outlined as part of the Limerick Shannon Metropolitan Area Transport Strategy (LSMATS) was undertaken using outputs from the Mid-West Regional Model.

As a result of this assessment, the main impacts of the Strategy can be summarised as follows:

- A substantial proportion of projected growth in travel demand in the LSMA will be accommodated by sustainable transport modes;
- The Strategy is forecast to provide an increase in mode share for sustainable transport modes and a reduction in the demand to travel by private car;
- The public transport network is forecast to have very high usage with a significant increase in total passenger boardings;
- Journey times to the city centre by public transport are forecast to reduce significantly compared to the Do-Minimum;
- Travel times on the road network are forecast to reduce as a result of the Strategy – compared to the Do-Minimum;
- The Strategy is forecast to reduce transport related emissions, particularly with the additional supporting parking policies;
- The Strategy is forecast to improve accessibility by reducing severance and increasing the accessibility to public transport, particularly from socially deprived areas across the LSMA;
- A more integrated public transport network provided by the Strategy results in an increased level of public transport interchange; and
- The Strategy represents a worthwhile investment with transport user benefits forecast to exceed the outline estimate cost of delivering the Strategy.