REGIONAL MODELLING SYSTEM

Modelling Services Framework

West Regional Model

Zone System Development Report

Údarás Náisiúnta Iompair
National Transport Authority

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Foreword

The NTA has developed a Regional Modelling System (RMS) for Ireland that allows for the appraisal of a wide range of potential future transport and land use alternatives. The RMS was developed as part of the Modelling Services Framework (MSF) by the National Transport Authority (NTA), SYSTRA and Jacobs Engineering Ireland.

The National Transport Authority's (NTA) Regional Modelling System comprises the National Demand Forecasting Model, five large-scale, technically complex, detailed and multi-modal regional transport models and a suite of Appraisal Modules covering the entire national transport network of Ireland. The five regional models are focussed on the travel-to-work areas of the major population centres in Ireland, i.e. Dublin, Cork, Galway, Limerick, and Waterford.

The development of the RMS followed a detailed scoping phase informed by NTA and wider stakeholder requirements. The rigorous consultation phase ensured a comprehensive understanding of available data sources and international best practice in regional transport model development.

The five discrete models within the RMS have been developed using a common framework, tied together with the National Demand Forecasting Model. This approach used repeatable methods; ensuring substantial efficiency gains; and, for the first time, delivering consistent model outputs across the five regions.

The RMS captures all day travel demand, thus enabling more accurate modelling of mode choice behaviour and increasingly complex travel patterns, especially in urban areas where traditional nine-to-five working is decreasing. Best practice, innovative approaches were applied to the RMS demand modelling modules including car ownership; parking constraint; demand pricing; and mode and destination choice. The RMS is therefore significantly more responsive to future changes in demographics, economic activity and planning interventions than traditional models.

The models are designed to be used in the assessment of transport policies and schemes that have a local, regional and national impact and they facilitate the assessment of proposed transport schemes at both macro and micro level and are a pre-requisite to creating effective transport strategy.

1 Introduction

1.1 Regional Modelling System

The NTA has developed a Regional Modelling System for the Republic of Ireland to assist in the appraisal of a wide range of potential future transport and land use options. The Regional Models (RM) are focused on the travel-to-work areas of the major population centres of Dublin, Cork, Galway, Limerick, and Waterford. The models were developed as part of the Modelling Services Framework by NTA, SYSTRA and Jacobs Engineering Ireland.

An overview of the 5 regional models is presented below in Table 1.1 and

Figure 1.1.

Table 1.1 List of Regional Models

Model Name	Standard Abbreviation	Counties
West Regional Model	WRM	Galway, Mayo, Roscommon, Sligo, Leitrim, Donegal
East Regional Model	ERM	Dublin, Wicklow, Kildare, Meath, Louth, Wexford, Carlow, Laois, Offaly, Westmeath, Longford, Cavan, Monaghan
Mid-West Regional Model	MWRM	Limerick, Clare, Tipperary North
South East Regional Model	SERM	Waterford, Wexford, Carlow, Tipperary South
South West Regional Model	SWRM	Cork and Kerry

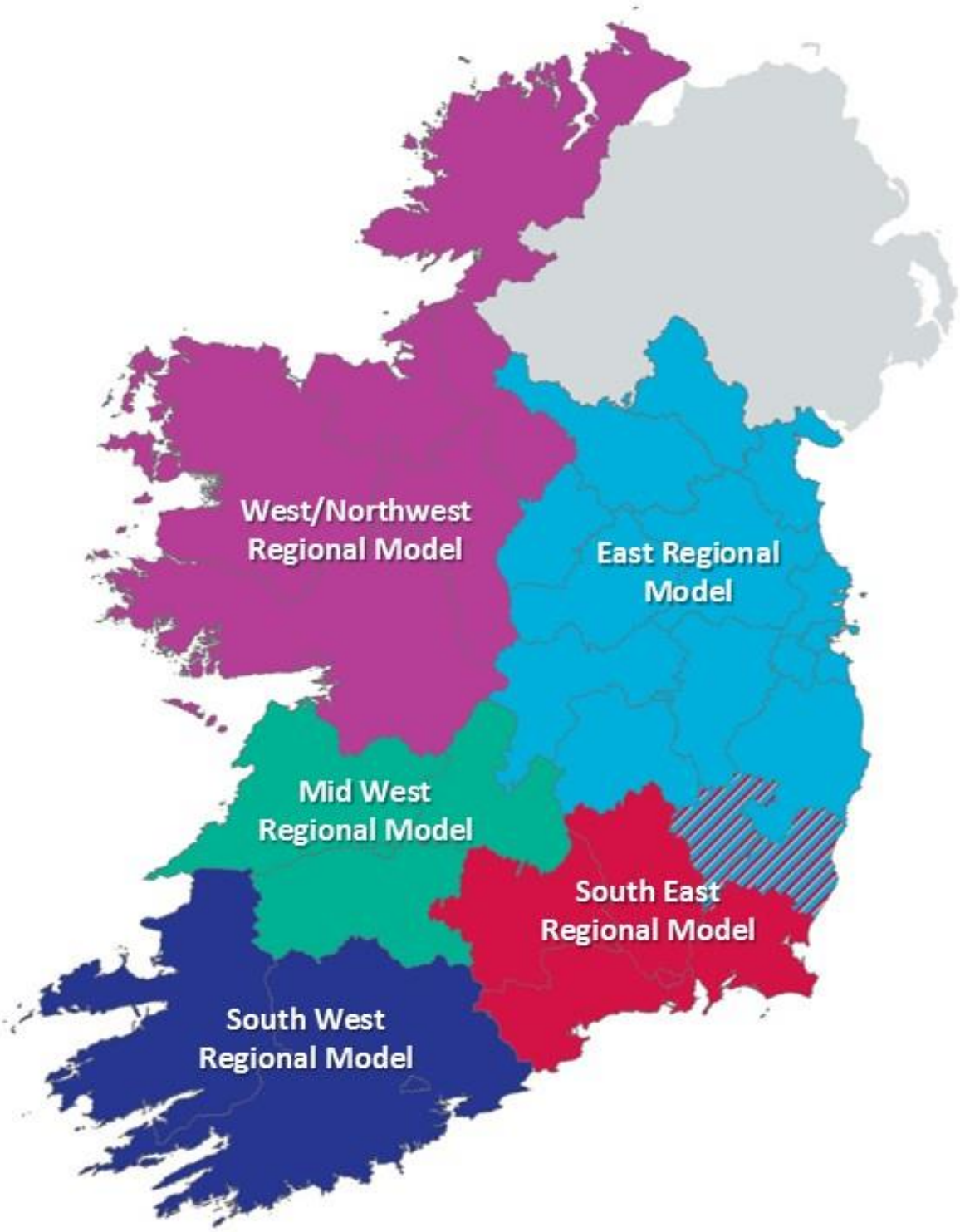

Figure 1.1 Regional Model Areas

1.2 Regional Modelling System Structure

The Regional Modelling System is comprised of three main components, namely:

- The National Demand Forecasting Model (NDFM)
- 5 regional models; and
- A suite of Appraisal Modules

The modelling approach is consistent across each of the regional models. The general structure of the SERM (and the other regional models) is shown below in Figure 1.2. The main stages of the regional modelling system are described below.

1.2.1 National Demand Forecasting Model (NDFM)

The NDFM is a single, national system that provides estimates of the total quantity of daily travel demand produced by and attracted to each of the 18,488 Census Small Areas. Trip generations and attractions are related to zonal attributes such as population, number of employees and other land-use data. See the NDFM Development Report for further information.

1.2.2 Regional Models

A regional model is comprised of the following key elements:

Trip End Integration

The Trip End Integration module converts the 24 hour trip ends output by the NDFM into the appropriate zone system and time period disaggregation for use in the Full Demand Model (FDM).

The Full Demand Model (FDM)

The FDM processes travel demand and outputs origin-destination travel matrices by mode and time period to the assignment models. The FDM and assignment models run iteratively until an equilibrium between travel demand and the cost of travel is achieved.

See the RMS Spec Full Demand Model Specification Report, RM Full Demand Model Development Report and SERM Full Demand Model Calibration Report for further information.

Assignment Models

The Road, Public Transport, and Active Modes assignment models receive the trip matrices produced by the FDM and assign them in their respective transport networks to determine route choice and the generalised cost for origin and destination pair.

The Road Model assigns FDM outputs (passenger cars) to the road network and includes capacity constraint, traffic signal delay and the impact of congestion. See the RM Spec Road Model Specification Report for further information.

The Public Transport Model assigns FDM outputs (person trips) to the PT network and includes the impact of capacity restraint, such as crowding on PT vehicles, on people's perceived cost of travel. The model includes public transport networks and services for all PT sub-modes that operate within the modelled area. See the RM Spec Public Transport Model Specification Report for further information.

Secondary Analysis

The secondary analysis application can be used to extract and summarise model results from each of the regional models.

1.2.3 Appraisal Modules

The Appraisal Modules can be used on any of the regional models to assess the impacts of transport plans and schemes. The following impacts can be informed by model outputs (travel costs, demands and flows):

- Economy;
- Safety;
- Environmental;
- Health; and
- Accessibility and Social Inclusion.

Further information on each of the Appraisal Modules can be found in the following reports:

- Economic Module Specification Report;
- Safety Module Specification Report;
- Environmental Module Specification Report;
- Health Module Specification Report; and
- Accessibility and Social Inclusion Module Specification Report.

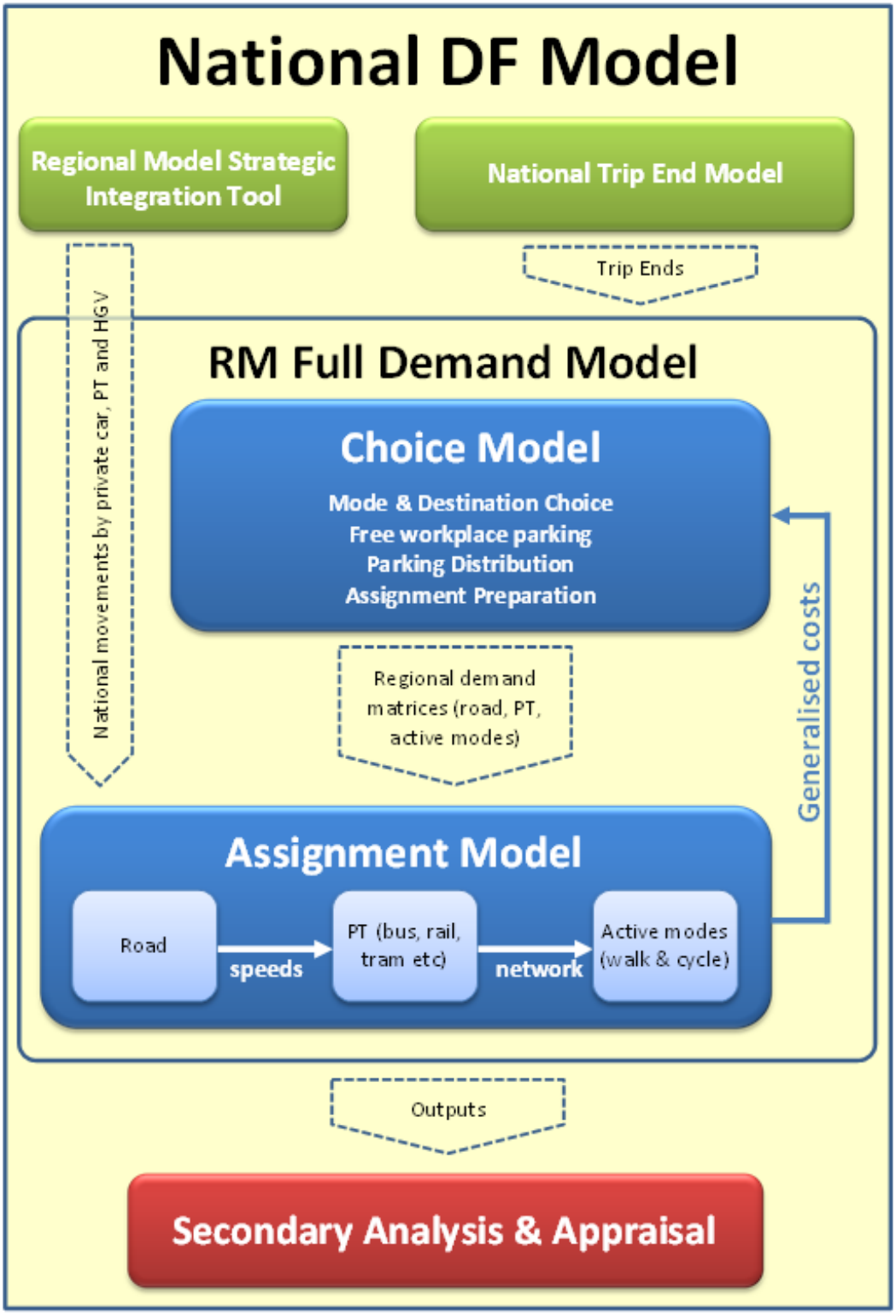

Figure 1.2 National and Regional Model Structure

1.3 Approach

The development of the WRM has followed a ‘Repeatable Methods’ approach (developed for the ERM), which provides the methodology, guidance and techniques to develop the Regional Modelling System. The methods used for both road network and zone system development are based on earlier development work and emerging guidance undertaken for the ERM. For the majority of aspects to date, the zoning development has adopted the methodology as outlined in “ZN TN05 Guidance for Zoning Delineation Process”. The document has been reviewed as part of the WRM development programme with updates provided where gaps were identified or further detail was required.

1.4 This Report

This report focuses on the development of an appropriate Zone System for the West Regional Model (WRM) and includes the following chapters:

- **Chapter 2:** WRM Zone System Development: provides information on the specification of the WRM Zone System and an overview of its development;
- **Chapter 3:** WRM Zone Development Review Process: details the review process carried out on the WRM Zone System;
- **Chapter 4: WRM Zone Area Review:** describes the specific review of zone areas;
- **Chapter 5: WRM Sectoring and numbering system:** Outlines the sectoring and hierarchical zone numbering system for the WRM; and
- **Chapter 6: WRM Final Zoning System:** presents the final zoning system.

2 WRM Zone System Development

2.1 Introduction

The zone system is used to segregate the modelled area into a number of disaggregate areas, enabling travel patterns to be separated and described in detail for each relevant origin-destination (OD) movement. The resultant travel demand associated with each zone is loaded onto or assigned to the modelled network using a series of zone centroid connectors.

The regional model zone delineation process aims to create a zone system which allows accurate modelling in the area concerned. The process, which has been established for all regional models, involves taking Census Small Areas, (the smallest spatial level at which data for building demand is available) and manipulating zone boundaries to create zones that take account of physical boundaries (motorways, rivers, etc.), and representative homogenous land use types and activity. This chapter outlines the process undertaken to develop the initial WRM zone system.

2.2 WRM Regional Zoning System Overview

The WRM zone system was produced using established NTA Regional Modelling approaches for developing a zoning system. However, in order to reduce development time, the WRM reused as much of the existing Galway Interim Model (GIM) zone system as could be allowed within the established methodology. Outside the usable area of the GIM system, the same methodology to the one used for the other Regional Models, as described in the “ZN TN05 Guidance for Zoning Delineation Process”, has been applied.

2.3 GIM Zoning System

The starting point for the development of the WRM zoning system is the GIM zoning system, shown in Figure 2.1 and Figure 2.2 below. The detailed central area (shaded in yellow) will be retained for the WRM and, therefore, the pre-existing simulation zones, as defined by the GIM model, were not altered and are consistent between the two models. Simulation coding within the SATURN road assignment model is confined to within this area. The GIM model area is represented by the shaded areas (yellow-simulation; blue-buffer) shown in the figures.

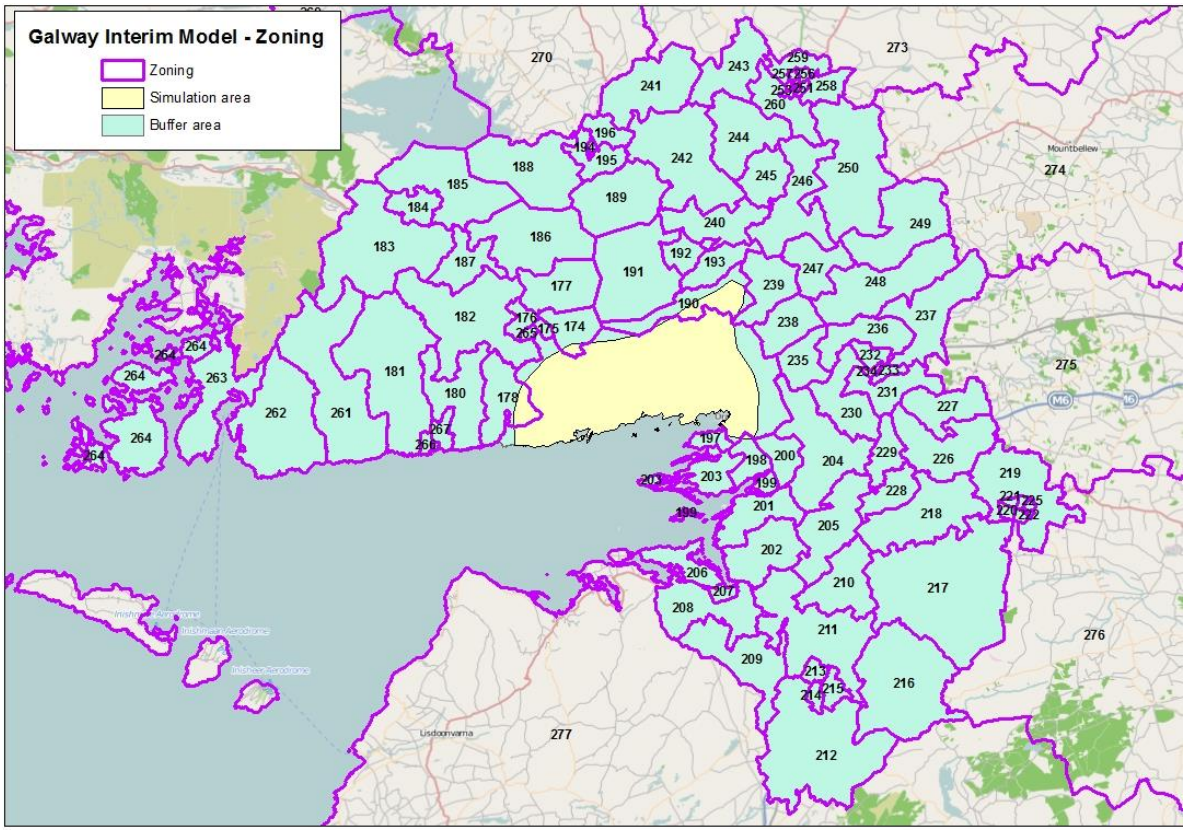

Figure 2.1 Galway Interim Model Zoning (Buffer Area)

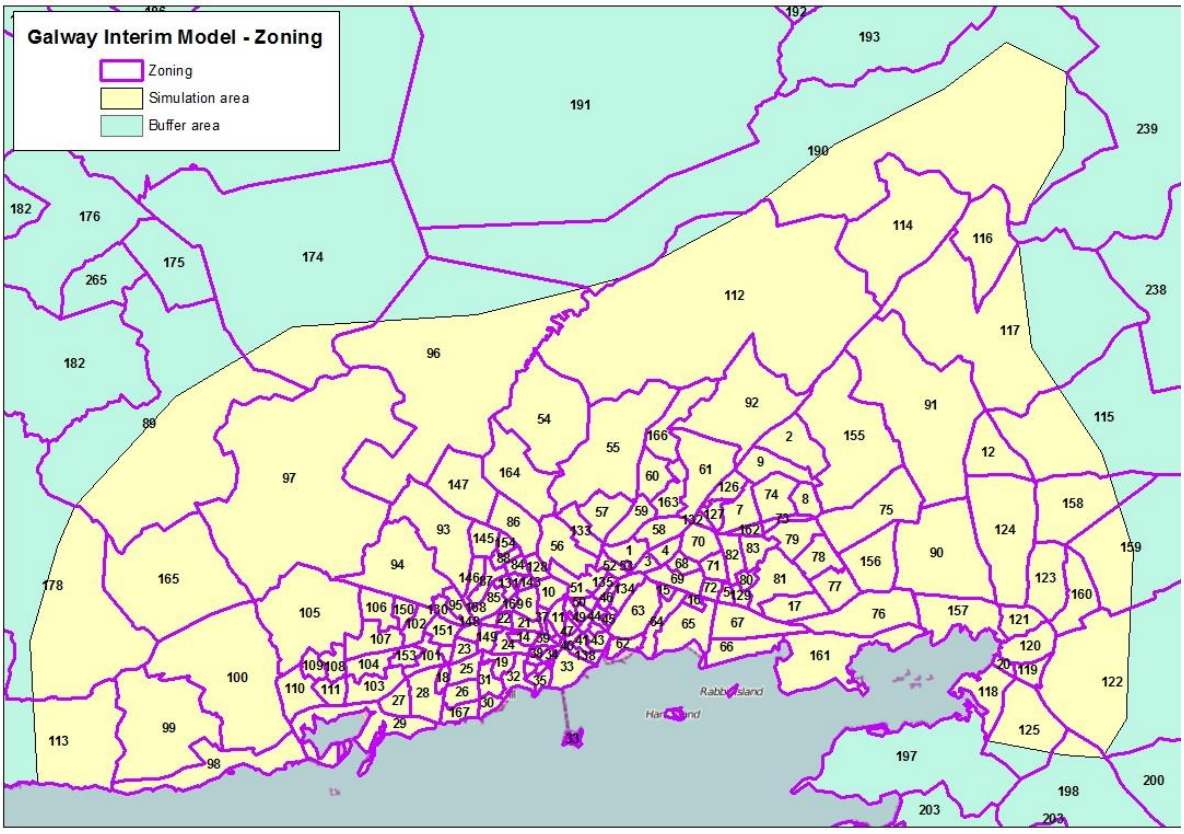

Figure 2.2 Galway Interim Model Zoning (Simulation Area)

The required coverage of the WRM zoning system is shown in

Figure 2.3 below and is significantly larger than the existing GIM model. As mentioned above, the WRM zone system for the geographic area not covered by the GIM zone system was produced using established NTA Regional Modelling approaches and is discussed in more detail in the following sections of this Report.

Figure 2.3 WRM Area

2.4 WRM Zone System Development

The remaining areas of the WRM model area (outside the pre-existing GIM simulation area) were defined according to the guidelines set out by the regional modelling programme and followed the steps described in the "ZN TN05 Guidance for Zoning Delineation Process", with some updates being applied where appropriate.

This process has been split into two main steps: Preparation Work and Zone Delineation. Within these steps the process is broken down into further sequences of sub-tasks. Figure 2.4 sets out the zone delineation process with arrows representing the chronological order of tasks. The process is iterative in order to achieve an acceptable balance between the various zone delineation conditions.

Preparation Work

Preparation Work comprises the following sub-tasks:

- **Data Review**
  - Collation and review of existing data sources.
- **Model Area Definition**
  - Review of the zonal detail included within previous regional models, the proposed level of model network detail and the potential applications of the completed model.
- **Define Zones Criteria**
  - Definition of criteria used to aggregate/ disaggregate zones.

Zone Delineation

Zone Delineation comprises the following sub-tasks:

- **Small Area Disaggregation**
  - Applying the disaggregation criteria to further disaggregate Small Areas if necessary;
- **Aggregation in Zones**
  - Applying the aggregation criteria to combine Small Areas into zones; and
- **Review Against Criteria**
  - Review of proposed zone system against criteria to check it meets the requirements.

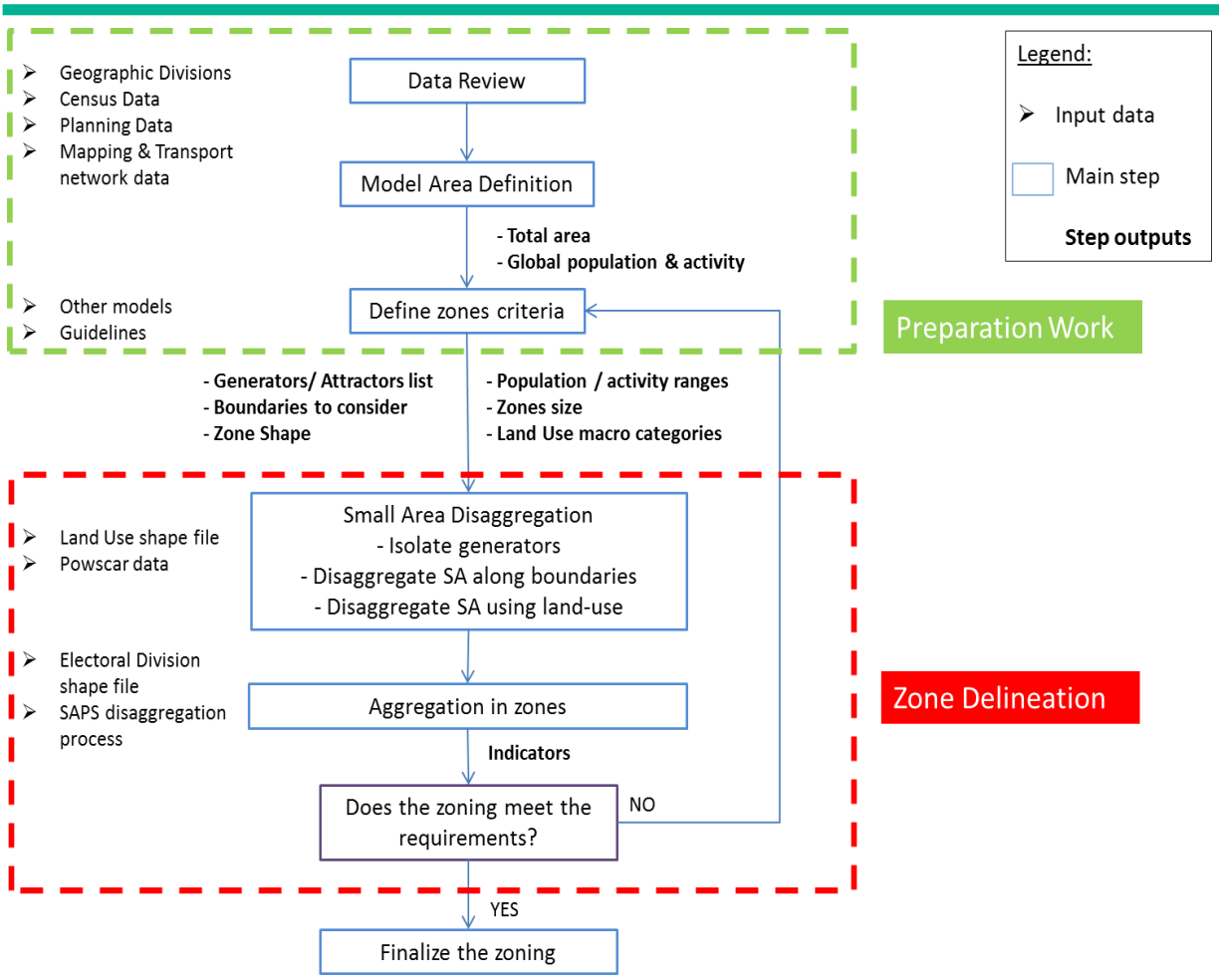

Figure 2.4 Overview of Zone Delineation Process

2.5 Preparation Work

2.5.1 Data Review

The Zone Delineation Guide identifies a number of zone characteristics, such as population and employment, which are correlated with travel activity levels. To understand the level of travel activity across the modelled area, the Small Area Population Statistics (SAPS) database, that contains the population and administration data from the 2011 Census, was interrogated. This GIS shapefile was cross-referenced with the Place of Work, School or College Census of Anonymised Records (POWSCAR) travel data (both data sets based on the 2011 Census). This level of geocoded detail allows for each CSA to be assigned the following data:

- total population;
- number of trips (Work and Education) from the Small Area in the AM peak; and
- number of trips (Work and Education) to the Small Area in the AM peak.

This data was used to build a database of population and trip generation across the modelled area to compare activity levels. A map of the Small Areas is shown below in Figure 2.5.

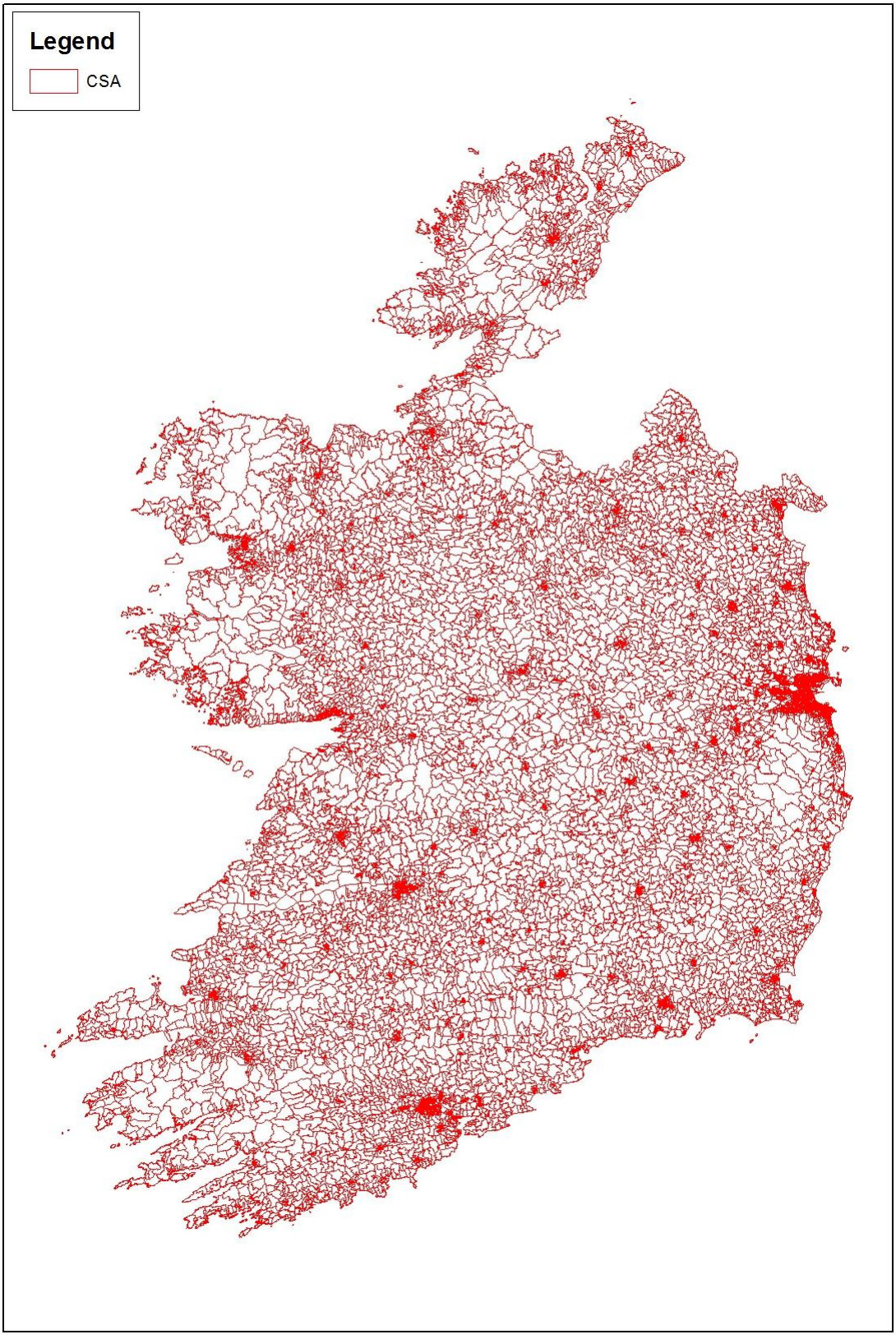

Figure 2.5 Map of Small Areas

Additionally, in accordance with the Zone Delineation Guide, data from a number of other sources was extracted and assigned to the relevant CSA. This included:

- MyPlan data: MyPlan is a database containing data relating to existing land use types in urban areas;
- Geo Directory data: Geo Directory is a database of addresses with geographic coordinates, each of which is categorised as either residential or commercial, with different addresses in the same building included;
- Electoral Divisions; and
- Road and rail networks.

2.5.2 Model Area Definition

The model boundary was defined as part of the Modelling Services Framework Model Scoping Task, as shown previously in Figure 2.3. The WRM zoning system includes Galway City, Counties Galway, Donegal, Leitrim, Sligo, Roscommon and Mayo. Following on from the Data Review, the next step in developing the zone system was Model Area Definition.

The WRM will be used to forecast changes in traffic levels and congestion on existing routes, appraise the benefits of proposed transport interventions and policies and predict the impact associated with land use development plans. These types of model application require a relatively detailed zone system and network to capture evidence relating to a wide range of potential impacts.

The WRM model network is composed of a simulation area, which includes modelling of individual junction layouts, and a buffer network which contains less detailed junction coding. As the zones tend to be of similar level of activity, the zoning is more detailed in city/town centres than in rural areas. Figure 2.6 illustrates the simulation and buffer areas of the WRM.

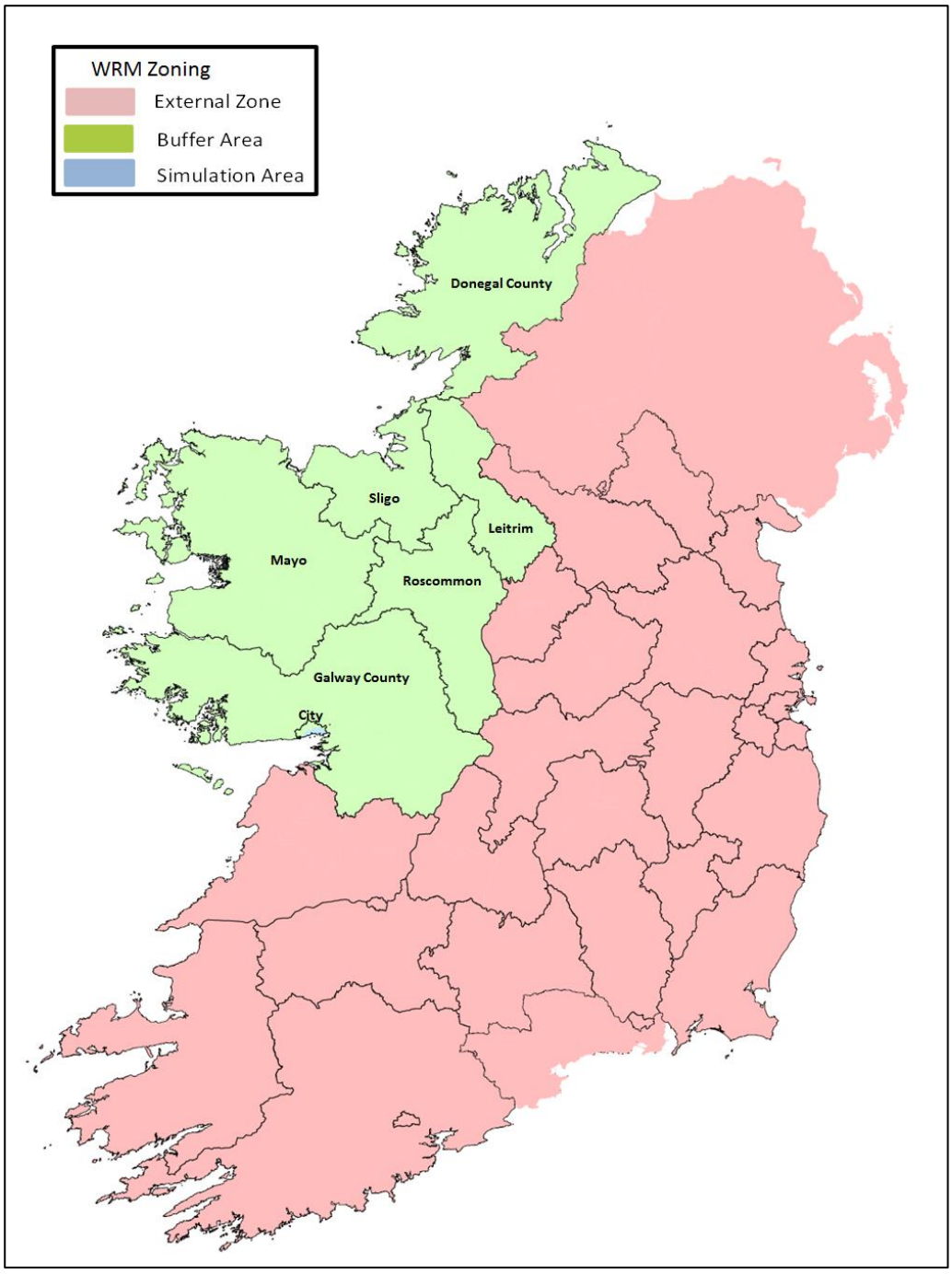

Figure 2.6 Map of WRM Area

2.5.3 Zone Criteria

The Zone Delineation Guide describes the range of conditions and thresholds to be taken into account when compiling a regional model zone system. This involves combining or segregating the individual CSAs into relevant zones. These conditions include:

- **Trip Generators / Attractors**:
  - Areas with an identified purpose and associated with a considerable level of travel activity/ trip movement (for example airports, universities, hospitals and shopping centres) should be isolated into separate zones representing specific travel patterns.

- **Geographical Boundaries**:
  - CSAs which intersected physical boundaries such as motorways, rivers and railways should be identified and disaggregated.
- **Land use**:
  - Areas with similar land use characteristics should be consolidated where appropriate to aggregate similar travel purposes.
- **Level of travel activity**:
  - Zones should lie within and not intersect a District Electoral Division (DED)
  - Zone activity should be in the 500-2,000 range (total trip generation/ attractions during the morning period)
  - A zone should not contain more than two incompatible land-use categories (only categories over 15% of the zone area are considered for this)
  - Zone population should be below 3,000 people.

2.6 Zone Delineation

2.6.1 Small Area Disaggregation

Three criteria were used to identify CSAs to be disaggregated:

- Significant trip attractors;
- Geographical boundaries; and
- Incompatible land-uses.

Significant Trip Attractors

Areas with an identified purpose and associated with a considerable level of travel activity / trip movement (for example airports, universities, hospitals, shopping centres) were isolated into separate zones representing specific travel patterns. Places considered as an attractor were identified using POWSCAR to select CSAs which attracted more than 2,000 trips over a three hour morning period.

The following high demand areas have been identified:

- NUIG (10,000 Education trips);
- Ballybrit Industrial Estate (8,000 work trips);
- University Hospital Galway (3,600 work trips & education trips);
- G.M.I.T (3,500 Education and Work trips); and
- Mervue Business Park (3,000 work & Education trips).

Geographical Boundaries

CSAs which intersected physical boundaries such as motorways, rivers and railways were identified and disaggregated. For the WRM zoning, the following boundaries have been considered:

- River Shannon

- M7 motorway
- Waterford – Limerick, Limerick – Galway & Cork - Dublin railway lines.

Land Use

Areas with similar land use characteristics were consolidated where appropriate to aggregate similar travel purposes. Using the MyPlan land-use database, macro-categories of land-use were defined, with incompatible categories identified (e.g. industry and residential) and isolated within separate zones.

The Geodirectory database (which provides locational data for residential & commercial buildings) was used to determine the appropriate split within zones where CSAs were required to be disaggregated.

2.6.2 Zone Aggregation

Following the disaggregation of the CSAs, the remaining CSAs were aggregated based on the criteria outlined previously to a logical and detailed zoning system, with an optimal level of travel activity within each zone. This process followed the approach and criteria developed for the ERM, which included:

- Zones should lie within and not intersect a District Electoral Division;
- Zone activity should be in the 500-2,000 range (total trip generation / attractions during the morning period (0630-0930, Time of Departure, source POWSCAR);
- A zone shouldn't contain more than two incompatible land-use categories. Only categories over 15% of the zone area are considered for this; and
- Zone population should be below 3,000 people.

The application of the criteria was treated as a hierarchy on occasions when not all conditions could be met. On occasions when conditions were not met, specific zones have been highlighted for potential review during the travel demand modelling development phase. The uncertainty surrounding these zones mostly relates to the potential level of travel activity, which will be confirmed during matrix development phase, at which point there may be an opportunity to further aggregate or disaggregate zones.

An example of zone aggregation in Tuam is illustrated in Figure 2.7. The first map shows the CSAs and the number of trip activity in each (in red). The five CSAs highlighted have a total trip attraction of 1,392, which is below the acceptable limit. Therefore, these five CSAs were combined to make one zone (zone 260).

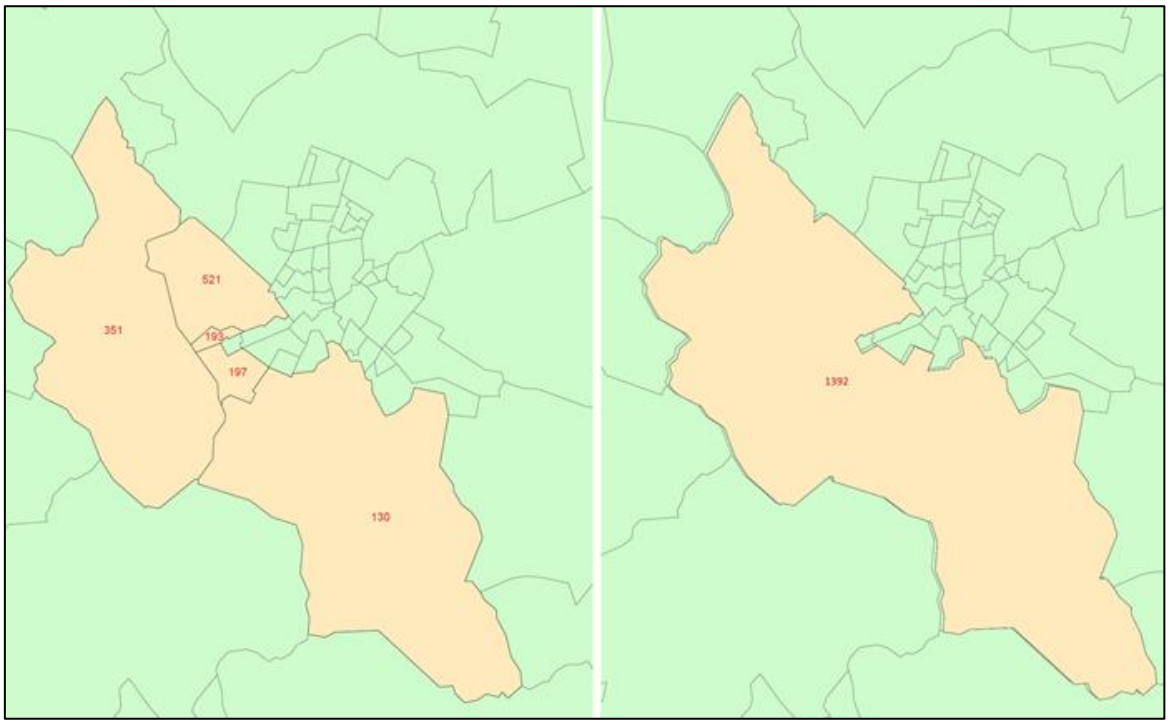

Figure 2.7 Zone Aggregation Example

2.7 External Zone Refinement

Based on emerging guidance from the ERM, the external zones were reviewed and refined. Specifically, Northern Ireland was disaggregated from one zone into four separate zones in order to allow more detailed modelling of trips taking place between the Western Region and Northern Ireland.

2.8 First Pass Zone System

The application of all of the process outlined above resulted in the First Pass WRM zone system (Version 1.0). This zone system had 693 zones in total:

- Galway City: 138
- Galway County: 206
- Donegal County: 109
- Leitrim County: 28
- Sligo County: 43
- Roscommon County: 44
- Mayo County: 123
- Special Zones (Airport and Port of Galway): 2

This zone system was then passed to the NTA and the Local Authorities in the WRM area for review.

3 WRM Zone Development Review Process

3.1 Overview

A first version of the zoning, following the zone delineation process, was sent to the Road Network Development team, the NTA and the relevant Local Authorities for review. The purpose of this step is to improve the initial zone system with respect to network and land use configuration whilst taking into account each of the previously discussed zone criteria.

3.2 Road Network Development Team Review

The WRM road network, which was developed separately and in parallel with the zoning system, is linked to the zone system via zone centroids and their connectors. Zone centroids can be defined in the road network, once a first version of the zoning is available. Centroids can be defined as geographical centres of a zone boundary. Zone centroid access (e.g. connectors) was defined using the road development method, which is detailed in WRM Road Model Development Report. That task (and preliminary assignment tests) raised issues that indicated some changes were required in the initial zoning system. Table 3.1 below contains examples of the type of issues that were identified and how they were addressed:

Table 3.1 WRM Road Network Access Review

Issue	Solution
Several actual accesses to a large zone	Zone disaggregated further to represent each main access point
Network locally overloaded due to link capacity limitation where a zone is connected	Zone disaggregated further if activity level allows it, modification to the access point if not
No road network coded within the zone (externals)	External zones have been redefined to represent “corridor access” to the simulation area

3.3 NTA and Local Authority Final Review

The NTA planning team reviewed the WRM zoning system to check against relevant local plans and to ensure the zoning system is consistent with the other regional model systems. Following this review no modifications were required.

No comments were received from the relevant Local Authorities.

3.4 External Zones

The model zoning system covers all of Ireland, with a fine level of detail within the Demand Model area (i.e., all of the 'Internal Zones'), a coarser level of zones surround these followed by large Outer External zones. The long border between the modelled area and the rest of Ireland requires detailed external zoning system (see Figure 3.1) to represent accurately interactions between these two areas.

56 external zones are represented in the WRM (52 in the Republic of Ireland and 4 in Northern Ireland). The external demand loads onto this network using centroid connectors with representative distances and speeds. External zones are connected to an appropriate motorway or national road node at the edge of the model road network.

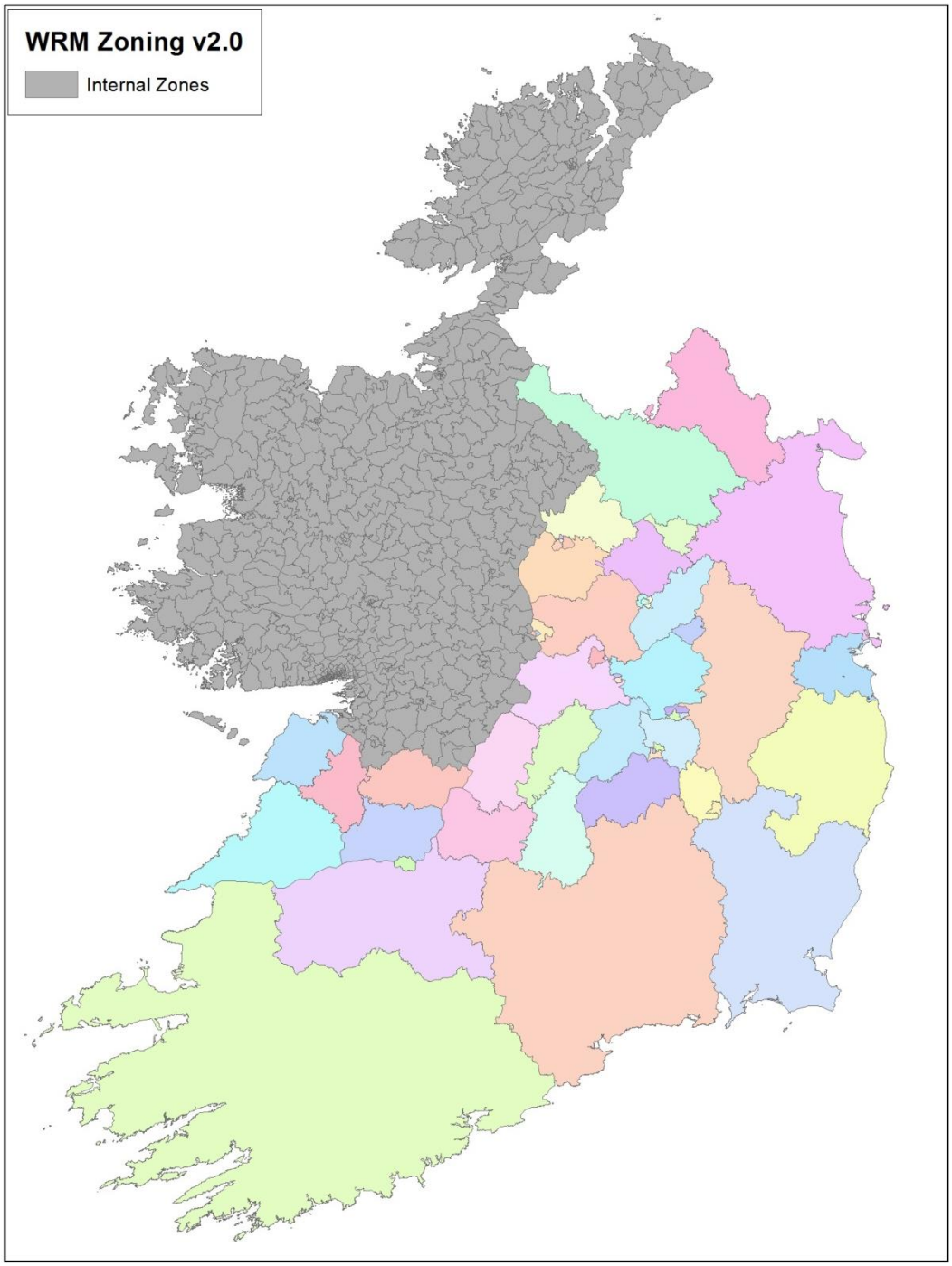

Figure 3.1 WRM External Zones

4 WRM Zone Area Review

4.1 Introduction

Emerging guidance from the development of ERM and tests carried out on the SWRM identified an issue relating to the area of some of the zones and the representation of active modes in the Regional Models. Application of the aggregation criteria outlined above resulted in some large zones in rural areas (where there were low levels of activity).

In the initial PT assignment of these models, the length of the public transport walk connector was taken to be proportional to the area of the zone (it was taken to be 2/3 of the radius of the zone, with the assumption that each zone was a perfect circle). This resulted in long walk connectors, and hence a high PT access cost, for some zones, which impacted on the calibration of the FDM. It also led to the over estimation of intra-zonal walking and cycling trips, with the error in the proportion of these trips proportional to the length of the centroid connector.

In order to avoid this issue arising in the WRM, large zones were reviewed and disaggregated if necessary. This process is described in more detail in the following sections.

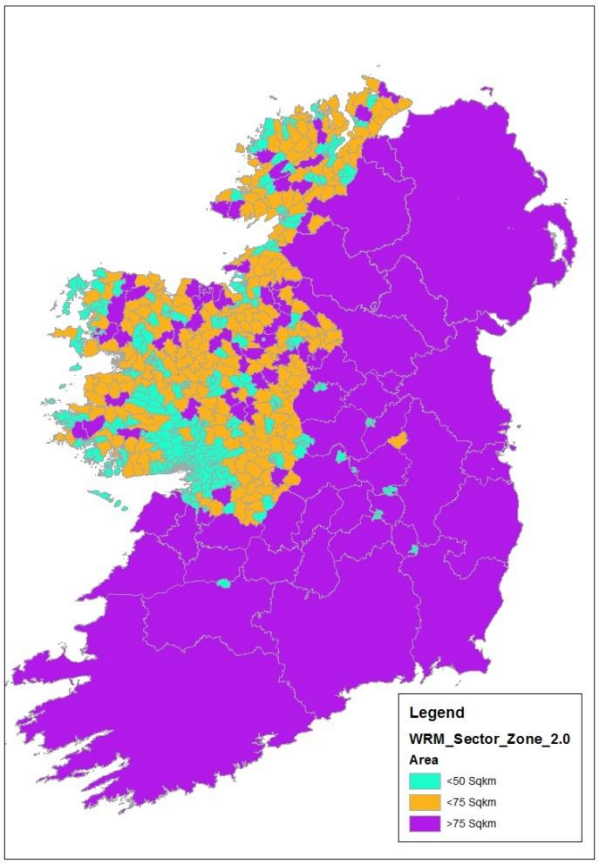

Figure 4.1 WRM Zone Area

4.2 Zone Disaggregation Criteria

If a zone had a walk connector longer than 3km then it was flagged for review, with zones being disaggregated to create a system with the majority of zones aiming for the following target attributes where possible:

- Zone activity target of 2,000;
- Zone population max target of 5,000; and
- Zone size below 70km^2.

The application of the targets was on a case-by-case basis, so that some zones' attributes remain above the thresholds, but the overall system is much more disaggregate.

4.3 Zone Area Analysis

The following graph illustrates the distribution of zone sizes in sq km. As can be seen 81% of the zones are smaller than the target 70 sq km, with only 19 % above. Of these, approximately half (10%) have been kept this size, as to reduce further would require splitting of a CSO small area. The remaining 9% lie just above the 70 sq km threshold (under 75 sq km). The distribution of zone areas is shown in Figure 4.2 below.

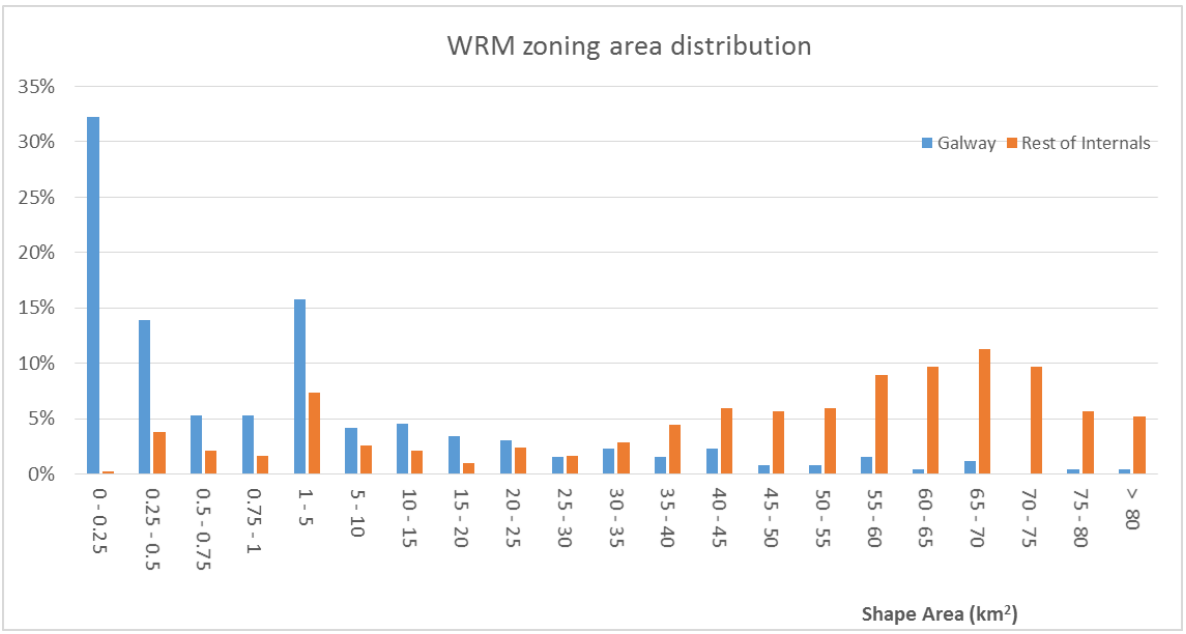

Figure 4.2 Zone Area Analysis

4.4 Network Changes

In addition to the zone disaggregation, weighted zone centroids were also introduced, based on the highest concentration of population and jobs in a zone. This more accurately reflects the generalised cost of trips to/ from zones where there was a small town or village in a large rural zone. More detail on the methodology employed for this and the impact is given in WRM Public Transport Development Report. The length of centroid connectors was also capped at 500m. Both of these measures further improved the representation of PT and active modes trips.

5 WRM Sectoring system & Special zones

5.1 ERM Guidance

As set out in the ERM Guidance “ZN TN07 GDA Sectoring System Information Note”, a sector system has been developed for the WRM. This sector system is presented below, and is used to define a hierarchical zone and node numbering system. It also facilitates the analysis of the demand and travel patterns at a more aggregated level.

5.2 Sectoring System

A number of resources have been used in the development of the sectoring system, including:

- the finalised zone boundaries of the WRM;
- key geographical features, notably motorways, rail lines and rivers;
- county boundaries; and
- a 19-settlement type classification system provided by the NTA.

In total, fifteen sectors have been developed for the WRM. These are listed in the table below, and are also shown on the following map.

Table 5.1 WRM Sectors

SECTOR	NAME
1	Galway City Centre - East
2	East of Galway Centre
3	North of Galway Centre
4	Galway City Centre West
5	West of Galway Centre
6	Northern Ireland
7	South East of Ireland
8	South West of Ireland
9	East of Ireland
10	South East Connacht
11	South West Connacht
12	North West Connacht
13	North Connacht
14	North East Connacht
15	Donegal

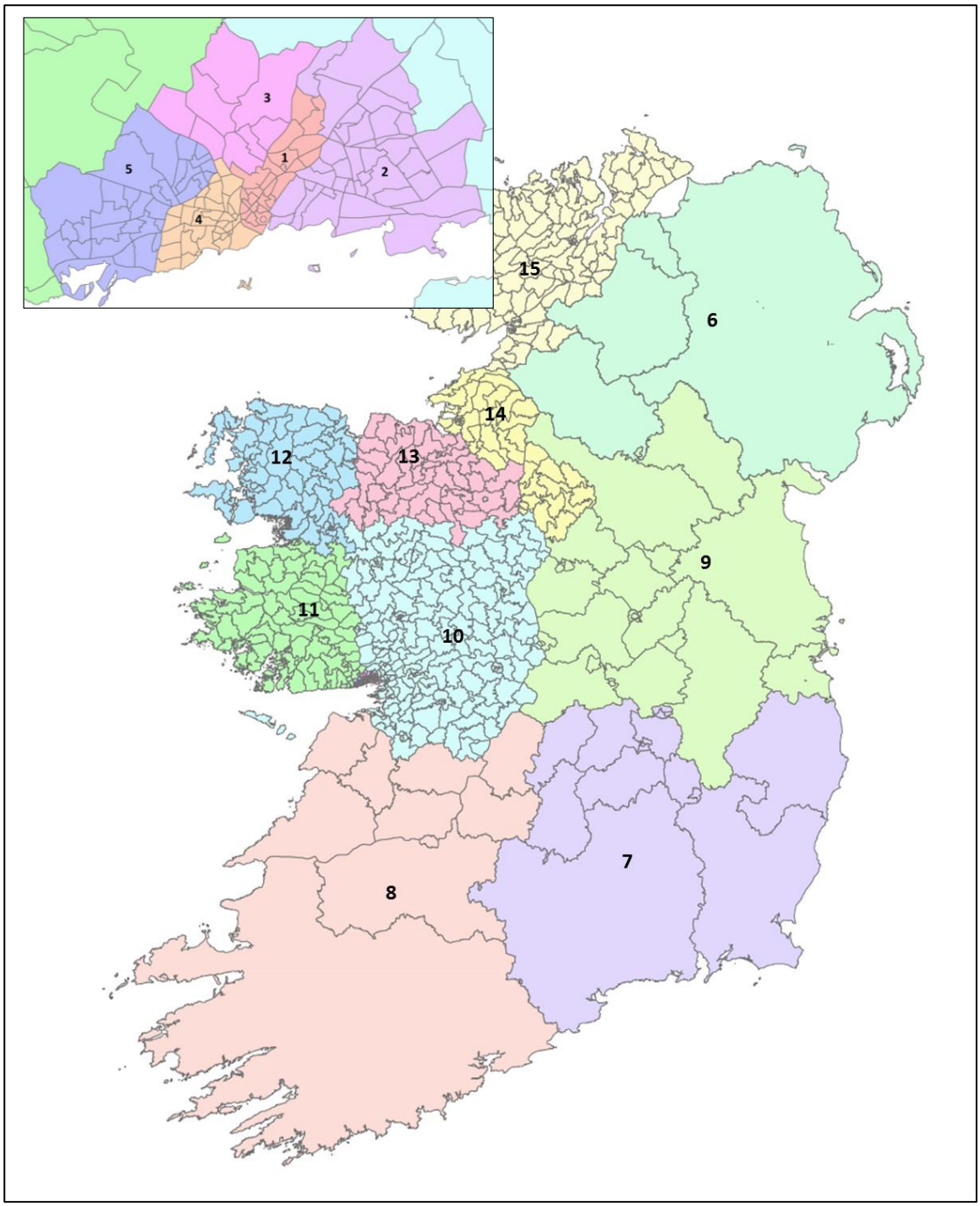

Figure 5.1 WRM Sectoring system

5.3 Special zones

Transport infrastructures where passengers travel from/to foreign destinations (such as airports or ports) can generate and attract a large number of trips. People that are working at these places are considered in the “regular” demand model as both origins and destinations are within the model area. Trips made by the travellers have a part of their journey outside the model area and a part made within the model area. These trips have

then to be considered separately in the model and transport demand for these hubs is modelled differently from the rest of the zones.

In the WRM, two special zones are considered:

- Knock airport; and
- Galway Port

6 WRM Final Zone System

6.1 Overall Figures

The final WRM zone system (v2.0) is shown in Figure 6.1. It has 693 zones as follows:

- **Total Internal Zones: 693**
- Galway City: 138
- Galway County: 201
- Donegal County: 108
- Leitrim County: 27
- Sligo County: 46
- Roscommon County: 48
- Mayo County: 123
- Special Zones: 2

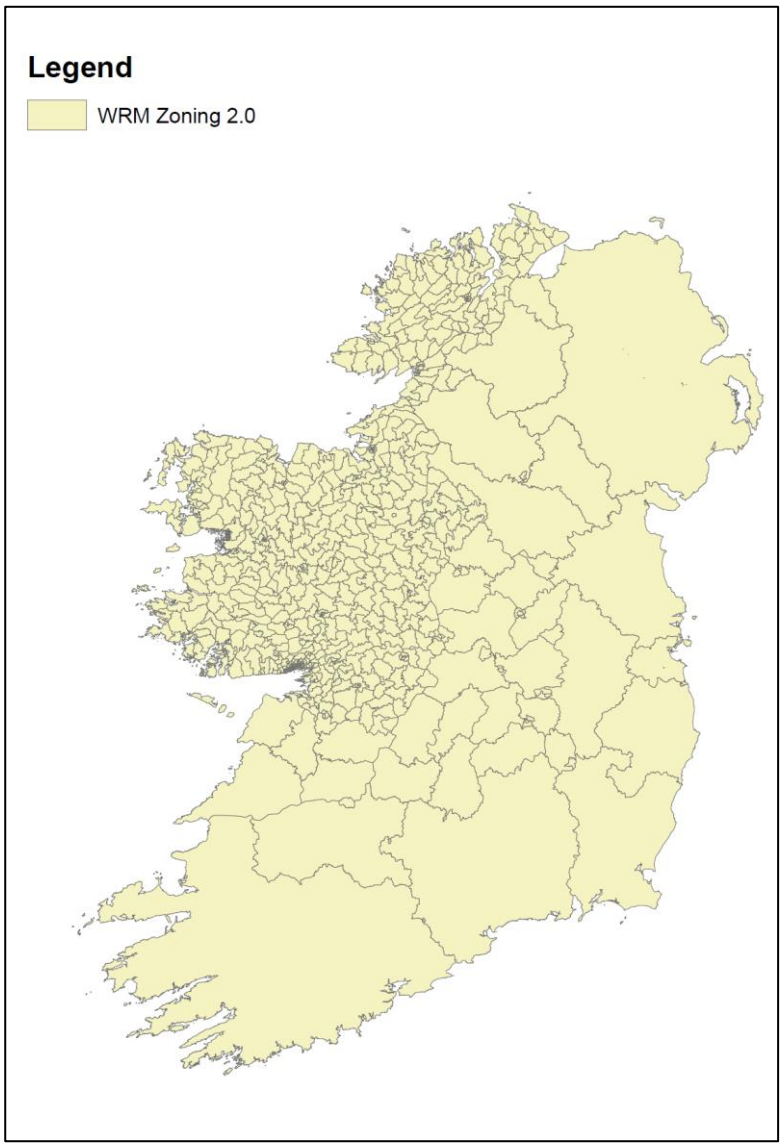

Figure 6.1 WRM Zone system v2.0

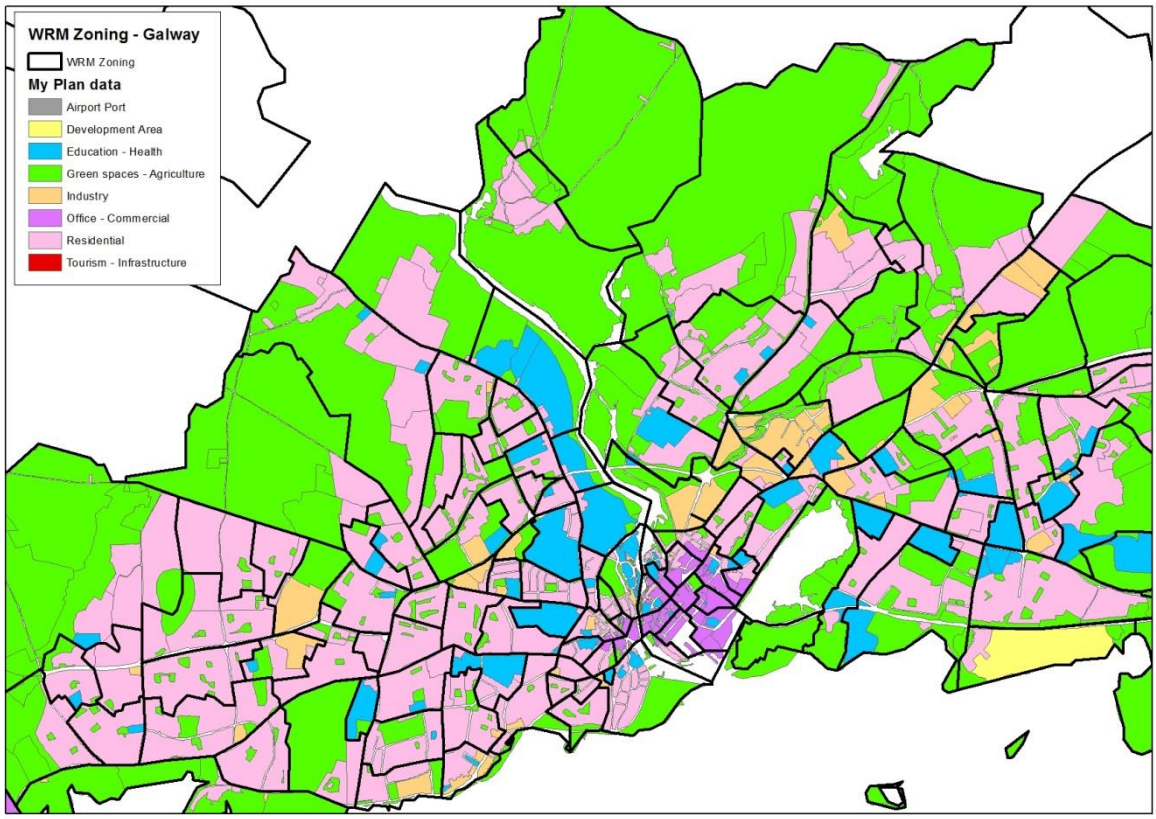

Figure 6.2 WRM Zoning V2.0 & My Plan data – Galway City

6.2 Zoning analysis

Along with the GIS shapefiles of the zone system, an analysis spreadsheet is produced to check that the zoning is acceptable and meets the criteria defined in the repeatable method process.

The following criteria have been applied across the final zone system to appraise its quality, and to compare it with the other Regional Model zone systems:

- **Population** below 3,000;
- **Activity** between 500 and 2,000 trips;
- Less than 2 different **land use categories**; and
- **Intrazonal trip ratio** below 5%.

6.2.1 Population

The population distribution for the WRM zone system is illustrated in Figure 6.3, overleaf, and is calculated using the Census Small Area data. In the WRM, there are nine zones (except externals) which have a population that exceed the 3,000 threshold criteria.

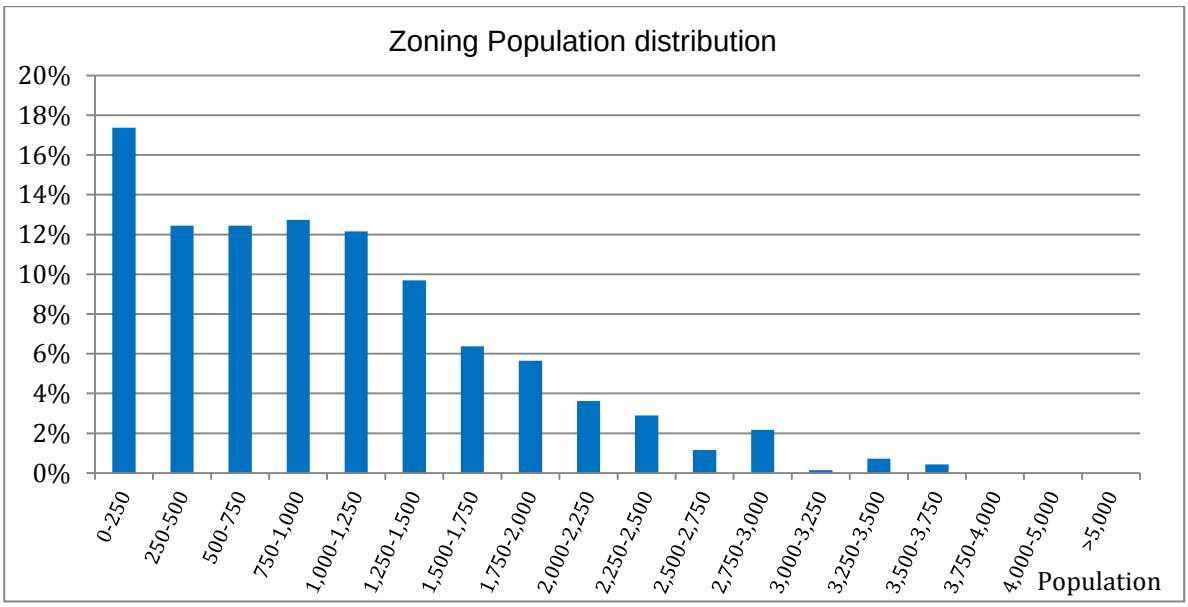

Figure 6.3 Final WRM Zoning – Population distribution

6.2.2 Activity

Activity is defined at the zonal level as the sum of trip productions and attractions. It is calculated at the zoning development stage and is derived from the POWSCAR 2011 database, for all modes and all time periods. This indicator provides a useful mechanism to compare zones of different types, i.e. residential zones (which are mostly trip producers in the POWSCAR database) and employment zones (which are mostly trip attractors).

The target activity range, defined by the repeatable method process, is 500 to 2,000 trips. The activity distribution for the final WRM zone system is shown in Figure 6.4, overleaf. Approximately 25% of the zones within the WRM have an activity level below the specified minimum threshold of 500 trips. This is acceptable due to the fact that these zones are mostly located in rural areas, and aggregating them to meet this criterion would have led to very large zones.

12% of the WRM zones have an activity level above the maximum threshold of 2,000 trips, and these represent large attractors (e.g. industrial estates, education and commercial areas).

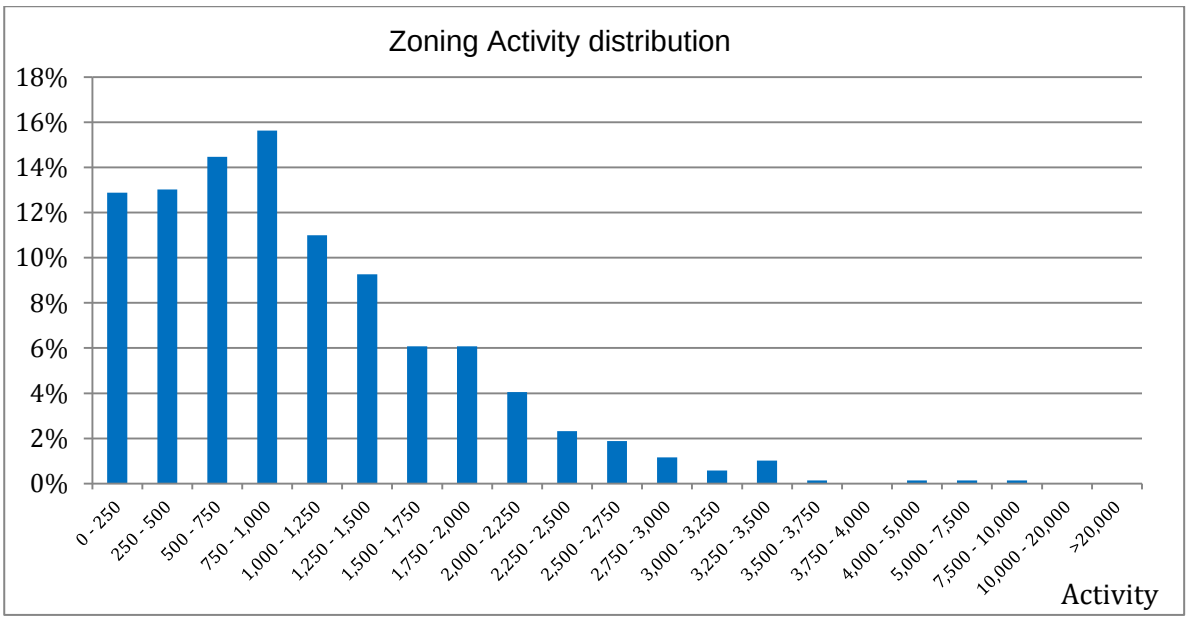

Figure 6.4 Final WRM Zoning – Activity distribution

6.2.3 Land Use Categories

Having homogeneous zones from a land use point of view is important as these areas will then exhibit similar travel purposes. As detailed earlier in this report, MyPlan data has been used to separate (where possible) areas with different land use. Figure 6.5 provides an overview of the number of different land use categories within zones in the WRM. It should be noted that MyPlan data was unavailable for more than 50% of the zones within the WRM. The results in Figure 6.5 indicate that only 16% of WRM zones contain more than a single land use category.

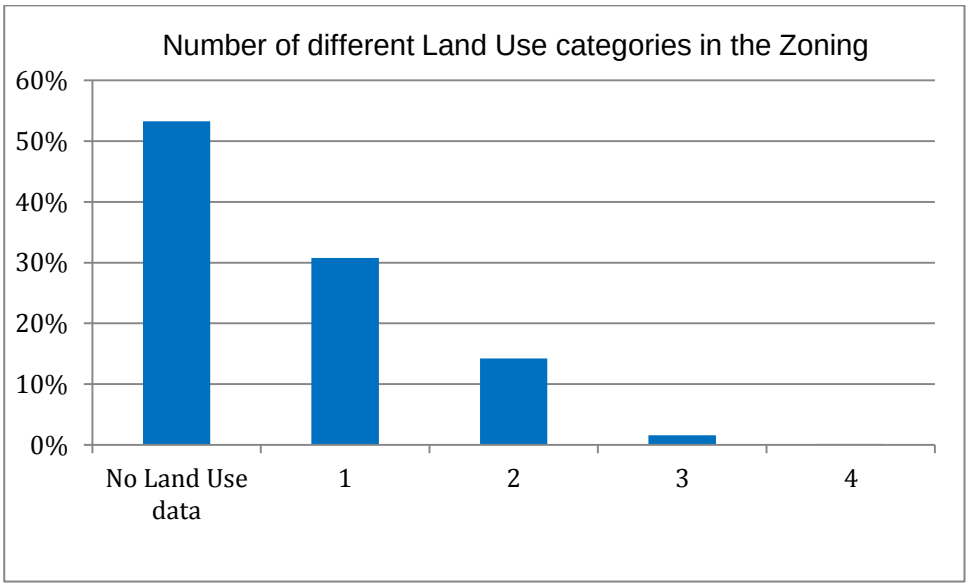

Figure 6.5 Final WRM Zoning – Different Land Use categories

6.2.4 Intrazonal Trip Ratio

The Intrazonal Trip Ratio is calculated as the ratio of trips that remain within a zone (intrazonal trips) over the sum of trips arriving and leaving the zone. This has been calculated for all zones within the WRM and measures the level of detail of the zone system. A high intrazonal trip ratio means that a large number of trips are not loaded on to the modelled network as they are made within the zone.

In the WRM zone system, 45% of zones have an intrazonal trip ratio below the threshold criteria of 5%. Zones with higher intrazonal trip ratios are mostly large in size with low activity levels. Further disaggregation of these zones to meet the intrazonal trip ratio criteria would have a negative impact on the minimum activity threshold of 500 trips outlined previously.

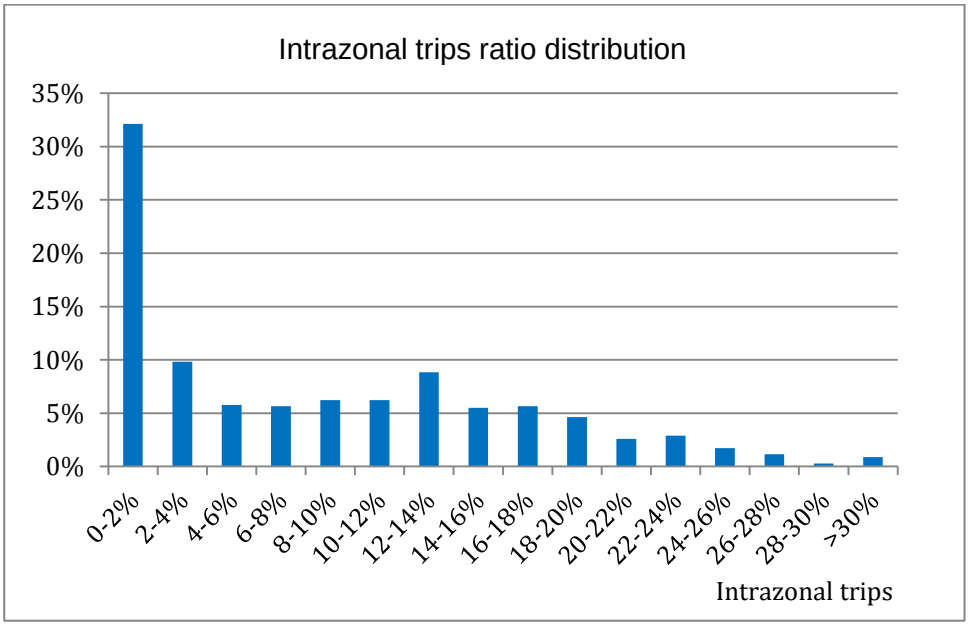

Figure 6.6 Final WRM Zoning – Intrazonal trip ratio distribution

6.2.5 Summary

The previous sections of this chapter outline the criteria utilised to appraise the quality of the WRM zone system. Figure 6.7, overleaf, illustrates the proportion of WRM zones which meet each of these criteria thresholds. The analysis indicates that:

- 24% of zones meet all the criteria;
- 58% of the zones fail one criterion;
- 17% fail two criteria; and
- 1% fail three criteria; and
- No zone fails more than three criteria.

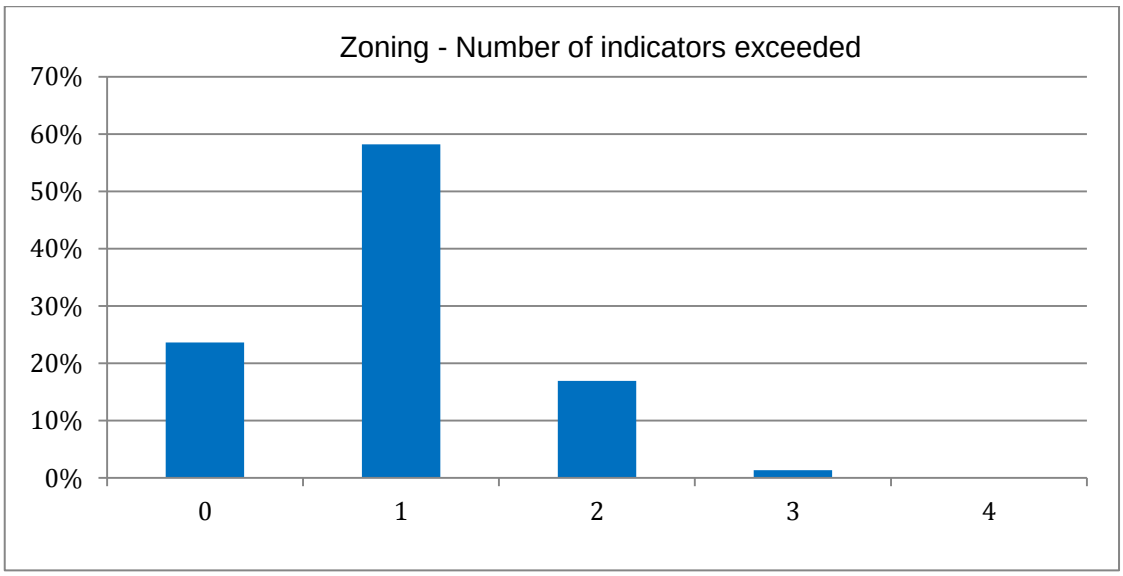

Figure 6.7 Final WRM Zoning – Number of indicators exceeded

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