REGIONAL MODELLING SYSTEM

NTA Modelling Scoping Report

Údarás Náisiúnta Iompair
National Transport Authority

CONTENTS

TABLES

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 strategies

1 Introduction

1.1 Background

The National Transport Authority's (NTA) responsibilities include strategic transport planning, integrated public transport network development, walking and cycling promotion, public transport infrastructure provision, effective management of traffic and transport demand and the regulation of public transport services. Transport modelling has a fundamental role to play in helping the NTA deliver on these responsibilities. The Modelling Services Framework was commissioned in 2012 to support the NTA in developing and enhancing its transport modelling capabilities as well as supporting the modelling, testing and appraisal of transport and land use plans.

Under the NTA Modelling Framework, SYSTRA and Jacobs Engineering Ireland along with sub-consultants Minnerva Transport Planning have been tasked with advancing the modelling capability of the NTA in line with its national transport planning remit.

1.2 Purpose of Scoping Report 1

The purpose of this Scoping report is to review NTA roles and responsibilities with respect to policy and scheme appraisal needs and the consequent transport modelling requirements in each of the following regional city areas:

- The Greater Dublin Area;
- The Cork Region;
- The Limerick Area;
- The Galway Area; and
- The South-East Area (including Waterford and Wexford).

This Scoping Report is one of four Scoping Reports which provide the basis for the specification of the development of a Regional Modelling System for Ireland, the other Scoping Reports being:

- RMS Scope 2 Greater Dublin Area Model Review;
- RMS Scope 3 Best Practice Approaches; and
- RMS Scope 4 Modelling Data Review.

The key findings and recommendations from each of the four scoping reports are combined and presented in the overall Regional Modelling System scoping report, RMS Scope 5 Scoping Report.

1.3 Overview of this Scoping Report

The remainder of this scoping report is structured as described in Table 1.1 below.

Table 1.1 Report Contents

Chapter	Description
Chapter 2	NTA Remit Overview
Chapter 3	Transport Modelling to Support NTA Responsibilities
Chapter 4	Summary of Regional Modelling System Requirements

2 NTA Remit Overview

2.1 Core NTA Remit

The core mission statement of the NTA is “Greater use of sustainable modes of transport across the country”. The vision has three distinct but interlinked parts, they are:

- To regulate and develop the provision of integrated public transport services by public and private operators in the State;
- To secure the development and implementation of an integrated transport system within the Greater Dublin Area; and
- To contribute to the effective integration of transport and land use planning in a manner that contributes to environmental sustainability and social cohesion and promotes economic progress.

To fulfil its statutory remit, the NTA undertakes a wide range of tasks ranging from high level policy and strategy development to local scheme assessment. These tasks must be supported by appropriate data analysis, transport modelling and appraisal. These tools must also support the following roles in the city regions, and particularly the Greater Dublin Area:

- Preparation and regular review of a transportation strategy;
- Adoption of an integrated implementation plan and a strategic traffic management plan;
- Financing the construction of public transport infrastructure;
- Promoting an integrated public transport network;
- Implementing integrated ticketing, fares and information schemes;
- Regulating fares and encouraging increased public transport use;
- Implementing demand management measures (excluding road pricing); and
- Ensuring integration of land use and transport planning in Development Plans, Local Area Plans and Strategic Development Zones.

The NTA’s remit in each of the above areas applies nationally, and therefore a consistent assessment framework is required in each region. The primary objective of this framework, therefore, is to develop a ‘state of the art’, robust and transparent modelling system that supports NTA decision across all regional levels and at an appropriate scale.

2.2 The NTA's Need for Transport Models in the GDA and Regional Cities

There are four models[1] in existence nationally corresponding to the regions noted in Chapter 1, as follows:

- The Greater Dublin Area (GDA) Model;
- The Cork Area Strategic Planning (CASP) Model;
- The Mid-West Area Strategic Planning (MWASP) Model (Limerick City); and
- The Galway Transport Model (GTM).

There are common features among these models such as a strategic network with multi-modal representation (e.g. road and public transport) and use of Census travel data. They are, however, built to varying degrees of complexity and sophistication and all use different software platforms.

To date the NTA, local authorities, other transport agencies and public transport operators have made extensive use of these models to provide support for the assessment of local area plans, strategic development zones, large scheme assessments and in support of Environmental Impact Assessments (EIAs). For example, the GDA Model has been used extensively to test and appraise all major infrastructure projects built over the past 15-20 years in the GDA (e.g. the M50 Widening, the Dublin Port Tunnel, the Red and Green Luas Lines (and other Luas extensions) and the Quality Bus Network).

Each regional model is currently based on Census 2006 travel data. The release of new Census 2011 travel data provides significantly more detail than the previous 2006 data requiring that each model be updated to the latest work and school travel patterns, in combination with the latest National Household Survey data and traffic survey information. The models will also likely require updating in terms of road and public transport network detail and land use zone representation.

To support the NTA's national remit the regional city models should also be updated in line with the modelling needs of the NTA relative to their remit.

2.3 Conclusion

Given the need to update the regional city models the next chapter examines modelling functionality and features for a regional modelling system which would be required to support NTA functions with respect to its national remit.

[1] Currently there is no regional city model covering the South East (Waterford / Wexford) area.

3 Transport Modelling to Support NTA Responsibilities

3.1 Introduction

The remit of the NTA (discussed in Chapter 2) includes the following key roles and responsibilities:

- Developing and implementing transport strategy and policy in the GDA and other regional cities;
- Developing strategic traffic management plans for Dublin and the regional cities;
- Funding/delivering public transport infrastructure;
- Delivering (subsidised) public transport services;
- Regulating bus services;
- Regulation of the taxi industry;
- Promoting integrated transport;
- Fares and ticketing-related policy and infrastructure;
- Increasing public transport use;
- Travel demand management;
- Promoting cycling and walking; and
- Improving the integration of land-use and transport.

The transport modelling functionality and features required in the regional city models to support the NTA remit are discussed in this chapter under the headings of each of the above roles and responsibilities.

The level of model functionality required is categorised in terms of strong, moderate and slight need.

3.2 Developing, Appraising and Implementing Transport Strategy and Policy

This broad NTA responsibility is likely to be the area which makes most use of models within each of the city regions.

The typical uses are likely to include the provision of evidence to support the initial development of policy and strategies, the use of model outputs to appraise the impacts of proposed new transport infrastructure and various measures included within these strategies and on-going refinement of these strategies over time.

Policies to be appraised could include changes in parking costs or supply (for example parking charges or time restrictions), changes to public transport fares, integrated ticketing, changes in fuel prices, or investment in behavioural change campaigns. The aspiration to test parking policy options strengthens the case to include parking restraint in the model specification.

Impacts of 'smarter travel' behavioural change campaigns will need to be reflected within the modelling system in some way, since these have the potential to generate significant reductions in traffic and increase the use of public transport and active modes by residents living in the targeted areas. This 'Strategy and Policy' role also implies a potential need for:

- An ability to understand and predict the travel behaviour of visitors;
- An understanding of the impact of policies and strategies on goods traffic;
- A detailed road network model (to inform the economic and environment appraisal of different strategies);
- Sophisticated modelling of parking (and Park and Ride) and its impact on mode and destination choice;
- Detailed representation of current and future public transport services;
- Flexibility to test a range of public transport fares and ticketing-related policies;
- Inclusion of taxis within the mode choice, both for residents and visitors;
- Inclusion of active travel (i.e. walking and cycling) with the mode choice (and the corresponding impact of the changes in the number of cars and on-street bikes in the traffic model); and
- Consideration of surface access to airports (e.g. Dublin, Cork and Shannon airports) and possibly other 'special' zones (e.g. Dublin, Cork and Foynes Ports).

These responses will in turn require a full set of appraisal modules which can be used to capture the impacts of various changes in future travel conditions created by the strategy or policy.

In summary, the role of developing, appraising and implementing transport strategy and policy implies:

MODELLING REQUIREMENTS for Developing, Appraising and Implementing Transport Strategy and Policy	STRONG Need	MODERATE Need	SLIGHT Need
All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).	✓		
Model all major transport modes including active modes.	✓		
Time period Origin to Destination modelling of residents car trips.	✓		
Time of day choice to consider the impacts of PT crowding.	✓		
Origin-Destination modelling of mode choice of residents travel.	✓		
The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.		✓	
Public Transport use by visitors.			✓
Some representation of visitor travel.			✓
Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).	✓		
Accurate mode-choice modelling.	✓		
Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.	✓		
Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.	✓		
A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).	✓		
Predict demand on the different public transport services within the GDA & other regions.	✓		
A detailed representation of the road network, including congestion at individual junctions.	✓		
A detailed representation of the road network particularly the impact of congestion on on-street public transport services.	✓		
A detailed representation of the public transport network & services.	✓		

MODELLING REQUIREMENTS for Developing, Appraising and Implementing Transport Strategy and Policy	STRONG Need	MODERATE Need	SLIGHT Need
A range of appraisal modules.	✓		
The ability to link from-home & to-home trips or *'simple tours'*.		✓	
The ability to predict changes in destination in response to changing transport provision and/or policy.		✓	
The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.		✓	
The ability to test the impacts of traffic management schemes on Public Transport services.		✓	
Good representation of Park and Ride.		✓	
The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.		✓	
The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.		✓	
Some ability to represent the contribution of taxis to general traffic levels.		✓	
Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.			✓
A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.		✓	
The particular features of surface access to Dublin airport.		✓	
Good links with other NTA tools & processes.		✓	
Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.		✓	
An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.		✓	
The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).		✓	
Land Use & Transport Interaction (LUTI) Modelling			✓

3.3 Strategic Traffic Management in the Cities

NTA's role in developing a sustainable approach to traffic management in Dublin and the other main cities (Cork, Limerick, Galway and Waterford) will require the ability to predict future traffic levels (including goods vehicles and taxis) and a corresponding need to predict the impact of changes in road capacity on travel behaviour, such as when, where and how to travel.

This role is also likely to require a requisite level of detail contained within the road model component of the modelling system that will enable strategic traffic management schemes to be assessed but also to provide outputs that can be incorporated into more detailed local micro models used for localised traffic management and junction design. The impact of on-street parking on road capacity and car use may also need to be considered if parking provision is considered integral to future strategic traffic management.

In summary, the NTA's strategic traffic management role implies:

MODELLING REQUIREMENTS for Strategic Traffic Management in the Cities	STRONG Need	MODERATE Need	SLIGHT Need
All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).	✓		
Model all major transport modes including active modes.			✓
Time period Origin to Destination modelling of residents car trips.	✓		
Time of day choice to consider the impacts of PT crowding.			
Origin-Destination modelling of mode choice of residents travel.		✓	
The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.		✓	
Public Transport use by visitors.			
Some representation of visitor travel.			✓
Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).	✓		
Accurate mode-choice modelling.	✓		
Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.		✓	
Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.	✓		
A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).		✓	
Predict demand on the different public transport services within the GDA & other regions.			✓
A detailed representation of the road network, including congestion at individual junctions.	✓		
A detailed representation of the road network particularly the impact of congestion on on-street public transport services.	✓		
A detailed representation of the public transport network & services.			✓
A range of appraisal modules.	✓		
The ability to link from-home & to-home trips or *'simple*		✓	

tours'.			
The ability to predict changes in destination in response to changing transport provision and/or policy.		✓	
The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.		✓	
The ability to test the impacts of traffic management schemes on Public Transport services.	✓		
Good representation of Park and Ride.			✓
The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.		✓	
The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.		✓	
Some ability to represent the contribution of taxis to general traffic levels.		✓	
Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.			
A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.		✓	
The particular features of surface access to Dublin airport.		✓	
Good links with other NTA tools & processes.		✓	
Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.	✓		
An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.		✓	
The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).		✓	
Land Use & Transport Interaction (LUTI) Modelling			

3.4 Delivering Transport Infrastructure

The NTA role in the planning and delivery of sustainable transport schemes in both urban and non-urban areas requires a rigorous assessment framework to ensure value for money and the achievement of policy objectives. Assessment of metro/LRT/BRT schemes or local rural transport services for example must both follow a rigorous process that requires an understanding of passenger demand for the scheme and alternative strategies in future years. Understanding how well proposals for such schemes compete with car based transport and other existing sustainable modes must be part of this process. It is usually required to assess the general attributes of the PT scheme such as operating speeds, fares, capacities and how the scheme interfaces with other modes of transport.

In summary, the role of Delivering Transport Infrastructure implies:

MODELLING REQUIREMENTS for Delivering Transport Infrastructure	STRONG Need	MODERATE Need	SLIGHT Need
All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).	✓		
Model all major transport modes including active modes.	✓		
Time period Origin to Destination modelling of residents car trips.	✓		
Time of day choice to consider the impacts of PT crowding.	✓		
Origin-Destination modelling of mode choice of residents travel.	✓		
The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.		✓	
Public Transport use by visitors.		✓	
Some representation of visitor travel.			
Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).		✓	
Accurate mode-choice modelling.	✓		
Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.	✓		
Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.	✓		
A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).		✓	
Predict demand on the different public transport services within the GDA & other regions.	✓		
A detailed representation of the road network, including congestion at individual junctions.	✓		
A detailed representation of the road network particularly the impact of congestion on on-street public transport services.		✓	
A detailed representation of the public transport network & services.	✓		
A range of appraisal modules.	✓		
The ability to link from-home & to-home trips or *'simple*		✓	

tours'.			
The ability to predict changes in destination in response to changing transport provision and/or policy.		✓	
The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.		✓	
The ability to test the impacts of traffic management schemes on Public Transport services.		✓	
Good representation of Park and Ride.		✓	
The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.		✓	
The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.	✓		
Some ability to represent the contribution of taxis to general traffic levels.		✓	
Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.			✓
A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.		✓	
The particular features of surface access to Dublin airport.			✓
Good links with other NTA tools & processes.		✓	
Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.		✓	
An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.	✓		
The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).		✓	
Land Use & Transport Interaction (LUTI) Modelling			

3.5 Delivering Public Transport Services

The NTA's role in procuring supported bus services requires an ability to predict the impacts of changes in public transport supply on travel demand patterns. There is also a need to predict off-peak demand, when the need for subsidy and the level of concessionary travel is greatest. At off-peak times, the viability of a particular supported bus service can often be driven by demand by passengers whose fares are being subsidised as part of a concessionary travel scheme. Knowledge of current and future traffic conditions may also be required when considering the number of buses needed to reliably deliver a particular timetable on a given route.

In summary, the role of Delivering Public Transport Services implies:

MODELLING REQUIREMENTS for Delivering Public Transport Services	STRONG Need	MODERATE Need	SLIGHT Need
All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).	✓		
Model all major transport modes including active modes.	✓		
Time period Origin to Destination modelling of residents car trips.	✓		
Time of day choice to consider the impacts of PT crowding.	✓		
Origin-Destination modelling of mode choice of residents travel.	✓		
The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.	✓		
Public Transport use by visitors.			✓
Some representation of visitor travel.			✓
Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).	✓		
Accurate mode-choice modelling.	✓		
Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.	✓		
Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.	✓		
A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).			
Predict demand on the different public transport services within the GDA & other regions.	✓		
A detailed representation of the road network, including congestion at individual junctions.		✓	
A detailed representation of the road network particularly the impact of congestion on on-street public transport services.	✓		
A detailed representation of the public transport network & services.	✓		
A range of appraisal modules.	✓		
The ability to link from-home & to-home trips or *'simple*	✓		

tours'.			
The ability to predict changes in destination in response to changing transport provision and/or policy.		✓	
The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.		✓	
The ability to test the impacts of traffic management schemes on Public Transport services.	✓		
Good representation of Park and Ride.		✓	
The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.		✓	
The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.			
Some ability to represent the contribution of taxis to general traffic levels.		✓	
Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.			✓
A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.			✓
The particular features of surface access to Dublin airport.			✓
Good links with other NTA tools & processes.	✓		
Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.	✓		
An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.	✓		
The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).		✓	
Land Use & Transport Interaction (LUTI) Modelling			

3.6 Regulation of Public Transport (Buses and Taxis)

The NTA's role in licensing bus and taxi services may require analysis of the contribution of various sections of the bus and taxi fleet to traffic emissions (air quality pollutants and greenhouse gases), which could inform policies relating to minimum emissions standards in different areas of the city.

There may also be a requirement (for example) to forecast future demand for taxis, which will influence decisions regarding the number of licensed taxis in the future. This may be of particular importance if policies are being introduced which might affect the future demand for taxi travel.

In summary, the NTA's role in the regulation of Public Transport implies:

MODELLING REQUIREMENTS for the Regulation of Public Transport (Buses and Taxis)	STRONG Need	MODERATE Need	SLIGHT Need
All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).		✓	
Model all major transport modes including active modes.			✓
Time period Origin to Destination modelling of residents car trips.			✓
Time of day choice to consider the impacts of PT crowding.		✓	
Origin-Destination modelling of mode choice of residents travel.	✓		
The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.		✓	
Public Transport use by visitors.		✓	
Some representation of visitor travel.		✓	
Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).		✓	
Accurate mode-choice modelling.	✓		
Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.		✓	
Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.	✓		
A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).			
Predict demand on the different public transport services within the GDA & other regions.	✓		
A detailed representation of the road network, including congestion at individual junctions.		✓	
A detailed representation of the road network particularly the impact of congestion on on-street public transport services.		✓	
A detailed representation of the public transport network & services.	✓		
A range of appraisal modules.	✓		
The ability to link from-home & to-home trips or *'simple*			✓

tours'.			
The ability to predict changes in destination in response to changing transport provision and/or policy.			✓
The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.			✓
The ability to test the impacts of traffic management schemes on Public Transport services.		✓	
Good representation of Park and Ride.		✓	
The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.		✓	
The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.		✓	
Some ability to represent the contribution of taxis to general traffic levels.	✓		
Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.			✓
A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.	✓		
The particular features of surface access to Dublin airport.		✓	
Good links with other NTA tools & processes.	✓		
Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.	✓		
An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.	✓		
The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).			
Land Use & Transport Interaction (LUTI) Modelling			

3.7 Promoting Integrated Transport

The NTA's role in improving integration between transport modes includes the role of parking and Park and Ride policy in influencing demand for public transport and the identification of duplication and gaps in public transport provision. This NTA's role also requires an ability to understand the impact of timetables and to identify adjustments to better achieve integration at interchanges, particularly where infrequent services are involved.

In summary, the NTA's role in promoting integrated transport implies:

MODELLING REQUIREMENTS for Promoting Integrated Transport	STRONG Need	MODERATE Need	SLIGHT Need
All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).	✓		
Model all major transport modes including active modes.	✓		
Time period Origin to Destination modelling of residents car trips.	✓		
Time of day choice to consider the impacts of PT crowding.	✓		
Origin-Destination modelling of mode choice of residents travel.	✓		
The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.		✓	
Public Transport use by visitors.			✓
Some representation of visitor travel.			✓
Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).	✓		
Accurate mode-choice modelling.	✓		
Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.	✓		
Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.	✓		
A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).			
Predict demand on the different public transport services within the GDA & other regions.	✓		
A detailed representation of the road network, including congestion at individual junctions.			✓
A detailed representation of the road network particularly the impact of congestion on on-street public transport services.			✓
A detailed representation of the public transport network & services.	✓		
A range of appraisal modules.	✓		
The ability to link from-home & to-home trips or *'simple*		✓	

tours'.			
The ability to predict changes in destination in response to changing transport provision and/or policy.		✓	
The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.		✓	
The ability to test the impacts of traffic management schemes on Public Transport services.			
Good representation of Park and Ride.		✓	
The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.			
The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.	✓		
Some ability to represent the contribution of taxis to general traffic levels.			
Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.			✓
A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.			✓
The particular features of surface access to Dublin airport.			
Good links with other NTA tools & processes.	✓		
Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.	✓		
An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.	✓		
The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).			✓
Land Use & Transport Interaction (LUTI) Modelling			✓

3.8 Fares and Ticketing – Regulation and Policy

The NTA's role in setting, regulating and potentially subsidising public transport fares and helping deliver various different forms of integrated / smart ticketing would benefit from mechanisms within the models designed to facilitate and support the modelling of different fare structures and ticket types. These mechanisms would include responses to the impact of significant changes in perceived fare on trip frequency, destination choice, time-of-day choice, mode and sub-mode choice.

The NTA's role in fares and ticketing implies:

MODELLING REQUIREMENTS for Fares & Ticketing – Regulation and Policy	STRONG Need	MODERATE Need	SLIGHT Need
All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).	✓		
Model all major transport modes including active modes.			✓
Time period Origin to Destination modelling of residents car trips.			
Time of day choice to consider the impacts of PT crowding.		✓	
Origin-Destination modelling of mode choice of residents travel.		✓	
The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.			
Public Transport use by visitors.			
Some representation of visitor travel.			
Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).			✓
Accurate mode-choice modelling.	✓		
Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.		✓	
Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.		✓	
A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).			
Predict demand on the different public transport services within the GDA & other regions.	✓		
A detailed representation of the road network, including congestion at individual junctions.			
A detailed representation of the road network particularly the impact of congestion on on-street public transport services.	✓		
A detailed representation of the public transport network & services.	✓		
A range of appraisal modules.		✓	
The ability to link from-home & to-home trips or *'simple*		✓	

tours'.			
The ability to predict changes in destination in response to changing transport provision and/or policy.			✓
The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.			✓
The ability to test the impacts of traffic management schemes on Public Transport services.			
Good representation of Park and Ride.			✓
The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.			✓
The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.		✓	
Some ability to represent the contribution of taxis to general traffic levels.			
Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.	✓		
A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.			
The particular features of surface access to Dublin airport.			
Good links with other NTA tools & processes.		✓	
Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.	✓		
An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.		✓	
The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).			
Land Use & Transport Interaction (LUTI) Modelling			

3.9 Promoting Increased Public Transport Use

The NTA's role in promoting public transport use would benefit from model outputs which identify the sectors of the market (broken down by location, journey purpose, car availability, economic status, etc.) that are most-likely to yield increases in public transport patronage or are conversely most prone to move towards less-sustainable modes if the relative level of service offered by the public transport service declines. The most-relevant aspects here will be the ability to predict changes in mode choice, particularly among residents, and the ability to identify the aspects of current public transport services (e.g. fare, journey time, frequency, reliability) which are likely to have the biggest or most cost-effective impact on public transport patronage.

In summary, the NTA's role in promoting increased public transport use implies:

MODELLING REQUIREMENTS for Promoting Increased Public Transport Use	STRONG Need	MODERATE Need	SLIGHT Need
All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).	✓		
Model all major transport modes including active modes.	✓		
Time period Origin to Destination modelling of residents car trips.	✓		
Time of day choice to consider the impacts of PT crowding.	✓		
Origin-Destination modelling of mode choice of residents travel.	✓		
The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.		✓	
Public Transport use by visitors.			✓
Some representation of visitor travel.			✓
Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).		✓	
Accurate mode-choice modelling.	✓		
Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.	✓		
Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.	✓		
A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).			
Predict demand on the different public transport services within the GDA & other regions.	✓		
A detailed representation of the road network, including congestion at individual junctions.			
A detailed representation of the road network particularly the impact of congestion on on-street public transport services.		✓	
A detailed representation of the public transport network & services.	✓		
A range of appraisal modules.	✓		
The ability to link from-home & to-home trips or *'simple*		✓	

tours'.			
The ability to predict changes in destination in response to changing transport provision and/or policy.	✓		
The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.			
The ability to test the impacts of traffic management schemes on Public Transport services.		✓	
Good representation of Park and Ride.			✓
The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.			✓
The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.		✓	
Some ability to represent the contribution of taxis to general traffic levels.			✓
Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.			✓
A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.			
The particular features of surface access to Dublin airport.			
Good links with other NTA tools & processes.	✓		
Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.	✓		
An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.	✓		
The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).			
Land Use & Transport Interaction (LUTI) Modelling			

3.10 Demand Management

The NTA's role in demand management will require the models to be able to predict how travel demand, and particularly car use, will respond to changes in the costs of the various modes, particularly costs such as parking and congestion which directly affect the (generalised) cost of trips by car. The key requirements of effective Demand Management modelling are a detailed and accurate traffic model, sophisticated inclusion of parking and a robust mode and destination-choice component within the residents' demand model.

The NTA's role in designing and implementing demand management strategies implies:

MODELLING REQUIREMENTS for Demand Management	STRONG Need	MODERATE Need	SLIGHT Need
All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).	✓		
Model all major transport modes including active modes.	✓		
Time period Origin to Destination modelling of residents car trips.	✓		
Time of day choice to consider the impacts of PT crowding.	✓		
Origin-Destination modelling of mode choice of residents travel.	✓		
The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.	✓		
Public Transport use by visitors.			
Some representation of visitor travel.			
Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).	✓		
Accurate mode-choice modelling.	✓		
Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.	✓		
Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.	✓		
A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).		✓	
Predict demand on the different public transport services within the GDA & other regions.	✓		
A detailed representation of the road network, including congestion at individual junctions.	✓		
A detailed representation of the road network particularly the impact of congestion on on-street public transport services.	✓		
A detailed representation of the public transport network & services.	✓		
A range of appraisal modules.	✓		
The ability to link from-home & to-home trips or *'simple*	✓		

tours'.			
The ability to predict changes in destination in response to changing transport provision and/or policy.		✓	
The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.		✓	
The ability to test the impacts of traffic management schemes on Public Transport services.			
Good representation of Park and Ride.		✓	
The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.		✓	
The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.	✓		
Some ability to represent the contribution of taxis to general traffic levels.			✓
Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.			
A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.			
The particular features of surface access to Dublin airport.			
Good links with other NTA tools & processes.	✓		
Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.			
An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.	✓		
The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).		✓	
Land Use & Transport Interaction (LUTI) Modelling			✓

3.11 Promoting Active Travel

This NTA role includes promoting, supporting and delivering increased levels of active travel covering both walking and cycling. Factors known to influence levels of walking and cycling need to be better understood, including

- Details of local land-use such as proximity of local shops and schools,
- Levels of off-street or on-street cycle lane provision,
- Variations in bicycle ownership, and
- 'Critical mass' effects, where the perception of the safety or attractiveness of cycling increases as the number of cyclists grows.

This role also indicates a need to be able to take account of the impact of on-street cycling on junction capacity.

The NTA's role in promoting active travel implies:

MODELLING REQUIREMENTS for Promoting Active Travel	STRONG Need	MODERATE Need	SLIGHT Need
All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).		✓	
Model all major transport modes including active modes.	✓		
Time period Origin to Destination modelling of residents car trips.	✓		
Time of day choice to consider the impacts of PT crowding.			
Origin-Destination modelling of mode choice of residents travel.	✓		
The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.			
Public Transport use by visitors.			
Some representation of visitor travel.			
Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).		✓	
Accurate mode-choice modelling.	✓		
Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.		✓	
Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.		✓	
A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).			
Predict demand on the different public transport services within the GDA & other regions.	✓		
A detailed representation of the road network, including congestion at individual junctions.			
A detailed representation of the road network particularly the impact of congestion on on-street public transport services.			
A detailed representation of the public transport network & services.		✓	
A range of appraisal modules.	✓		
The ability to link from-home & to-home trips or *'simple*			✓

tours'.	
The ability to predict changes in destination in response to changing transport provision and/or policy.	✓
The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.	✓
The ability to test the impacts of traffic management schemes on Public Transport services.	
Good representation of Park and Ride.	
The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.	
The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.	
Some ability to represent the contribution of taxis to general traffic levels.	
Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.	
A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.	
The particular features of surface access to Dublin airport.	
Good links with other NTA tools & processes.	✓
Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.	
An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.	✓
The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).	
Land Use & Transport Interaction (LUTI) Modelling	

3.12 Integration of Land-use and Transport Planning

As development plans are formulated, the impact of a range of options on the transport network can be predicted and compared. The regional models can be used to identify transport and accessibility impacts of new developments. Guidelines on what scale of development should be tested within the strategic GDA model, or within more localised models will be developed.

A key remit of the NTA is to undertake regular updates of the integrated transport and land use strategy for the GDA. The new GDA model will be the main assessment tool to be used in this task. The task will require the use of the model to test the impacts of a number of future transport and land use scenarios, including collections of transport and policy interventions, when compared against the base or current year scenario. Development and land use plans may entail construction on locations which are currently undeveloped or that change in use. In such cases it is necessary for the demand modelling system to be able to derive plausible spatial and temporal distributions, and mode shares for transport demand.

Within the modelling the spatial distribution of land use attributes such as households, population, jobs, shopping floorspace, and education places could be taken as a user-defined input. Alternatively, there are methods for allocating population and travel attractors using 'Land use transport Interaction (LUTI) models', in which land-use changes over time respond to changes in transport costs, such as accessibility to employment and other services, or increasing congestion in specific corridors. The pros and cons of using fixed land use forecasts versus LUTI modelling will be considered in RMS Scope 3 Best Practice Approaches.

The NTA's role in ensuring the appropriate level of integration between land-use and transport implies:

MODELLING REQUIREMENTS for the Integration of Land Use and Transport Planning	STRONG Need	MODERATE Need	SLIGHT Need
All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).	✓		
Model all major transport modes including active modes.	✓		
Time period Origin to Destination modelling of residents car trips.		✓	
Time of day choice to consider the impacts of PT crowding.		✓	
Origin-Destination modelling of mode choice of residents travel.		✓	
The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.	✓		
Public Transport use by visitors.			✓
Some representation of visitor travel.			✓
Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).	✓		
Accurate mode-choice modelling.	✓		
Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.	✓		
Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.	✓		
A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).		✓	
Predict demand on the different public transport services within the GDA & other regions.	✓		
A detailed representation of the road network, including congestion at individual junctions.		✓	
A detailed representation of the road network particularly the impact of congestion on on-street public transport services.		✓	
A detailed representation of the public transport network & services.		✓	
A range of appraisal modules.	✓		
The ability to link from-home & to-home trips or *'simple*		✓	

tours'.			
The ability to predict changes in destination in response to changing transport provision and/or policy.	✓		
The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.		✓	
The ability to test the impacts of traffic management schemes on Public Transport services.		✓	
Good representation of Park and Ride.		✓	
The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.		✓	
The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.	✓		
Some ability to represent the contribution of taxis to general traffic levels.			✓
Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.			✓
A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.		✓	
The particular features of surface access to Dublin airport.			✓
Good links with other NTA tools & processes.	✓		
Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.	✓		
An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.	✓		
The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).		✓	
Land Use & Transport Interaction (LUTI) Modelling		✓	

4 Summary of the Regional Modelling System Requirements

4.1 Introduction

The previous chapters of this scoping report have presented the NTA's remit, roles and responsibilities and identified transport modelling functionality and features that would be required to support the NTA.

Table 4.1 below summarises the main links between the NTA's current roles and responsibilities and the potential key functionality and features of the regional city model system which would be required to support these roles.

The number of ticks in each cell of the table indicates the need for a particular model function or features in relation to each of the roles identified and discussed in the previous chapter, as follows:

- ✓✓✓ represents a strong need
- ✓✓ represents a moderate need
- ✓ represents a slight need

Table 4.1 Regional Modelling System key functionality and features to support NTA Remit

		NTA REMIT											
		Developing, Appraising and Implementing Transport Strategy and Policy	Strategic Traffic Management in the Cities	Delivering Transport Infrastructure	Delivering Public Transport Services	Regulation of Public Transport (Buses and Taxis)	Promoting Integrated Transport	Fares & Ticketing – Regulation and Policy	Promoting Increased Public Transport Use	Demand Management	Promoting Active Travel	Integration of Land Use and Transport Planning	TOTAL
REGIONAL MODEL FUNCTIONALITY AND FEATURES	All-day modelling; particularly resident's travel. Represent a minimum of four time periods (AM, Inter-Peak, PM & Off-Peak).	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	31
	Model all major transport modes including active modes.	✓✓✓	✓	✓✓✓	✓✓✓	✓	✓✓✓	✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	27
	Time period Origin to Destination modelling of residents car trips.	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓	✓✓✓		✓✓✓	✓✓✓	✓✓✓	✓✓	27
	Time of day choice to consider the impacts of PT crowding.	✓✓✓		✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓		✓✓	24
	Origin-Destination modelling of mode choice of residents travel.	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	30
	The ability to predict changes in trip destination & time-of-day choice in response to changing traffic conditions.	✓	✓✓	✓✓	✓✓✓	✓✓	✓✓		✓✓	✓✓✓		✓✓✓	20
	Public Transport use by visitors.			✓✓	✓✓	✓✓	✓		✓			✓	9
	Some representation of visitor travel.		✓		✓✓	✓✓	✓		✓			✓	8
	Disaggregate journey purpose for home based trips (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other).	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓	✓✓	✓✓✓	✓✓	✓✓✓	27
	Accurate mode-choice modelling.	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	33
	Demand represented in a detailed level of segmentation in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes.	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	29
	Full geographic coverage of the regional area for each city particularly to capture commuting trip patterns.	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	31
	A reasonable representation of goods vehicle routing (perhaps with some additional logistics modelling capability (i.e. predicting changes in the goods vehicle fleet over time).	✓✓✓	✓✓	✓✓						✓✓		✓✓	11
	Predict demand on the different public transport services within the GDA & other regions.	✓✓✓	✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	31
	A detailed representation of the road network, including congestion at individual junctions.	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓	✓			✓✓✓		✓✓	19
	A detailed representation of the road network particularly the impact of congestion on on-street public transport services.	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓	✓	✓✓✓	✓✓	✓✓✓		✓✓	24
	A detailed representation of the public transport network & services.	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓	30
	A range of appraisal modules.	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	32
	The ability to link from-home & to-home trips or 'simple tours'.	✓✓	✓✓	✓✓	✓✓✓	✓	✓✓	✓✓	✓✓	✓✓✓	✓	✓✓	22
	The ability to predict changes in destination in response to changing transport provision and/or policy.	✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓	✓✓✓	✓✓	✓✓✓	✓✓✓	23
	The ability to predict changes in trip frequency and/or destination in response to changing transport provision and/or policy including some representation of visitor travel.	✓✓	✓✓	✓✓	✓✓	✓	✓✓	✓		✓✓	✓✓✓	✓✓	19
	The ability to test the impacts of traffic management schemes on Public Transport services.	✓✓	✓✓✓	✓✓	✓✓✓	✓✓			✓✓			✓✓	16
	Good representation of Park and Ride.	✓✓	✓	✓✓	✓✓	✓✓	✓✓	✓	✓	✓✓		✓✓	17
	The ability to test the impacts of changes in parking supply and parking policy including 'Park and Ride' provision.	✓✓	✓✓	✓✓	✓✓	✓✓		✓	✓	✓✓		✓✓	16
	The need for consistent hierarchical modelling with higher (national) & lower (local junction) traffic models.	✓✓	✓✓	✓✓✓		✓✓	✓✓✓	✓✓	✓✓	✓✓✓		✓✓✓	22
	Some ability to represent the contribution of taxis to general traffic levels.	✓✓	✓✓	✓✓	✓✓	✓✓✓			✓	✓		✓	14
	Relatively sophisticated representation of different fares & ticketing including integrated ticketing, season tickets & concessionary travel demand.	✓		✓	✓	✓✓	✓	✓✓✓	✓			✓	11
	A general need to represent travel demand to/from key 'special' zones, particularly Dublin airport.	✓✓	✓✓	✓✓	✓	✓✓✓	✓					✓✓	13
	The particular features of surface access to Dublin airport.	✓✓	✓✓	✓	✓	✓						✓	8
	Good links with other NTA tools & processes.	✓✓	✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	29
	Reasonable links with other NTA processes related to the procurement & delivery of transport infrastructure.	✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓			✓✓✓	25
	An easy to use model, built on a software platform that is scalable, customisable, system independent, interoperable and supported.	✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	30
	The ability to predict the impacts of 'complex tours', involving 3 or more legs between leaving & returning home (e.g. escorting children to school on the way to work or visiting shops on the way home).	✓	✓✓	✓✓	✓✓		✓			✓✓		✓✓	12
	Land Use & Transport Interaction (LUTI) Modelling						✓			✓		✓✓	4

4.2 Key Requirements

As can be seen from Table 4.1 there are NTA roles which require all levels of model functionality and features to some degree, such as:

- Develop transport strategy and policy;
- Promoting integrated transport;
- Integration of land use and strategy; and
- Demand management.

Generally all 34 of the functionality and features used to classify the NTA's needs should be considered in the update of the regional city models. The 'Top 20' ranked key model functionality and feature requirements indicate that the regional city models should:

1. Have accurate **mode-choice modelling** of residents;
2. Have a comprehensive and well-integrated set of **appraisal modules;**
3. Have a **full geographic coverage of the regional area** for each city particularly to capture commuting trip patterns;
4. Include **all-day modelling**, particularly of **residents' travel** with representation of a minimum of four time periods (AM, Inter-Peak, PM and Off-Peak);
5. Predict **demand on the different public transport services** within the regions;
6. Include **Origin-Destination modelling of mode choice** of residents travel;
7. Have a **detailed representation of the public transport network & services**;
8. Have **demand represented in a detailed level of segmentation** in terms of journey purposes, car ownership/availability, modes, person types, user classes & socio-economic classes;
9. Be an **easy to use model**, built on a software platform that is scalable, customisable, system independent, interoperable and supported;
10. Have **good links with other NTA tools & processes**;
11. Model **all major transport modes** including active modes;
12. Have **time period Origin to Destination modelling** of residents car trips;
13. Have **disaggregate journey purpose for home based trips** (i.e. commute, employers business, shopping and education) & for non-home based trips (i.e. employers business & other);
14. Have **reasonable links with other NTA processes** related to the procurement & delivery of transport infrastructure;
15. Include **time of day choice to consider the impacts of PT** crowding;
16. Have a **detailed representation of the road network** particularly the impact of congestion on on-street public transport services;
17. Have the ability to **predict changes in destination** in response to changing transport provision and/or policy;
18. Have the ability **to link from-home & to-home trips or 'simple tours'**;
19. Include for **consistent hierarchical modelling** with higher (national) & lower (local junction) traffic models; and
20. Have the ability to **predict changes in trip destination & time-of-day choice** in response to changing traffic conditions.

The above list can be considered as providing a 'minimum specification' for the required level of modelling functionality and features for inclusion in a regional city modelling system that will support NTA's remit. Most of the functionality and features, however,

identified in Table 4.1 should be introduced where feasible (which will be evaluated in later technical notes).

Importantly, these model functionality and features should be developed in a regional modelling system that is efficient to operate by the NTA and its stakeholders. This means that the modelling system should be easy to use, built on a software platform that is scalable, customisable, system independent, interoperable and fully supported. It is also advisable that the regional model system should:

- Have a **modularised structure** so that its component procedures and processes are contained within modules. Individual modules can be replaced with a different process or procedure depending on the required uses for the model at a particular time. In addition, some modules may also be turned on or off.
- Incorporate an efficient methodology for undertaking transport assessments by providing **an analytical toolkit for assessing model outputs**. This toolkit will include methods for conveniently extracting the required model data the required model data for economic, operational, accident and environmental appraisal and convenient automated methods for comparing the outputs of different modelled scenarios.
- Have a **graphical user interface (GUI)** to enable a wide user group with varying degrees of technical knowledge of the model system to easily perform single, multiple or partial (e.g. fixed matrix) model runs. The user interface should provide point-and-click functionality for the specification of model assumptions, making the process of running the model easier and quicker. Furthermore, this functionality also provides an audit and reference process to document and control all model runs.
- Be **transparent** with the technical detail of the model development and application will be clearly specified to ensure that both the 'implementation of' and 'outcomes from' model outcomes are made easy to understand. All key procedures and model components will be supported by extensive technical documentation and the software implementation will be clearly commented and documented.
- Have **consistent model software** with the full model structure housed within a single model control system (the GUI) to ensure a seamless flow of model execution and ease of maintenance. This approach will also enable specialised external programmes to be called from the main model as required.

4.3 Conclusion & Recommendations

In summary, transport modelling is particularly important in supporting the NTA's remit particularly in developing and appraising plans and strategies, because of the need to forecast and quantify scheme benefits and the impacts of a range of transport policies and options. A system of updated regional city models providing full coverage of all the

regions would greatly support the NTA in this role and significantly advance the ability to consistently assess the transport, environmental and economic impacts of a wide range of infrastructural and land use policy interventions.

Importantly, this system of regional city models should make the best use of existing NTA transport modelling capabilities, extensive and recent land-use, demographic and other transport-related data, best practice in modelling procedures and the in-depth experience of the framework partnership of the NTA, MVA, Jacobs and Minnerva.

It is recommended that, as the most complex region to model, the updated model for the GDA be the exemplar for model innovation and technique development and the approach adopted be standardised and applied for the development of the other regional city models. This approach has a number of benefits as follows:

- It will provide a consistent framework for the development of the regional city models;
- It will significantly reduce the cost of model development;
- It will provide consistency in policy and scheme appraisal nationally; and
- It will reduce the cost of future regional model updates.

It is also recommended that a regional city model be developed for the South East / Waterford City area as a model for the area does not currently exist.

The recommendations presented in this note for the functionality and features required for the regional city models form the basis for the subsequent stages of the Regional Model Scoping process. In particular, they are used to structure the consideration of the strengths and weaknesses of the current GDA Model, as described in RMS Scope 2 Greater Dublin Area Model Review.

Údarás
Náisiúnta Iompair
National **Transport** Authority

National Transport Authority
Dún Scéine
Harcourt Lane
Dublin 2

Údarás Náisúnta Iompair
Dún Scéine
Lána Fhearchair
Baile Átha Cliath 2

Tel: +353 1 879 8300
Fax: +353 1 879 8333

www.nationaltransport.ie

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