REGIONAL MODELLING SYSTEM

Modelling Services Framework

South West Regional Model

Active Modes Model Development Report – Tender Issue

Údarás Náisiúnta Iompair
National Transport Authority

DOCUMENT IDENTIFICATION TABLE

Client/Project owner	National Transport Authority
Title of Document	SWRM Active Modes Model Development Report
Task Order	19
Model Version	2.0.8e
Document Status	Final

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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 strategies.

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

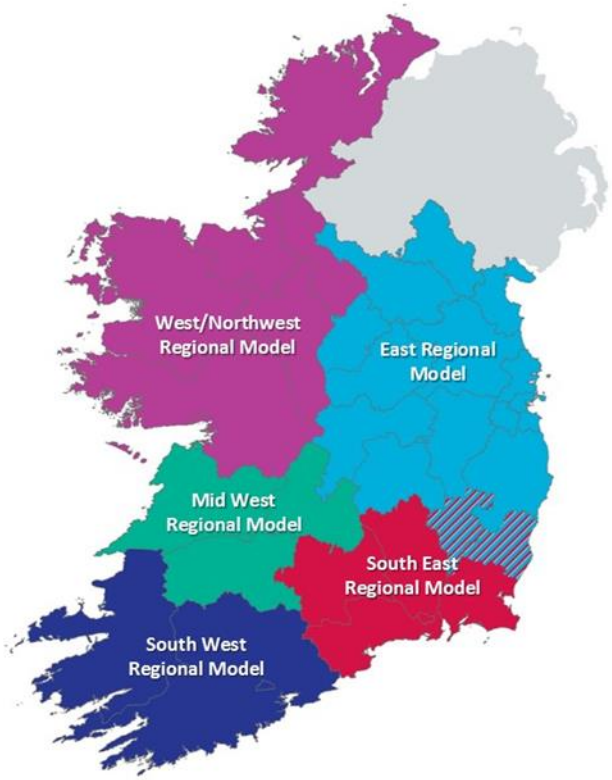

Figure 1.1 Regional Model Areas

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 (RM)

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.

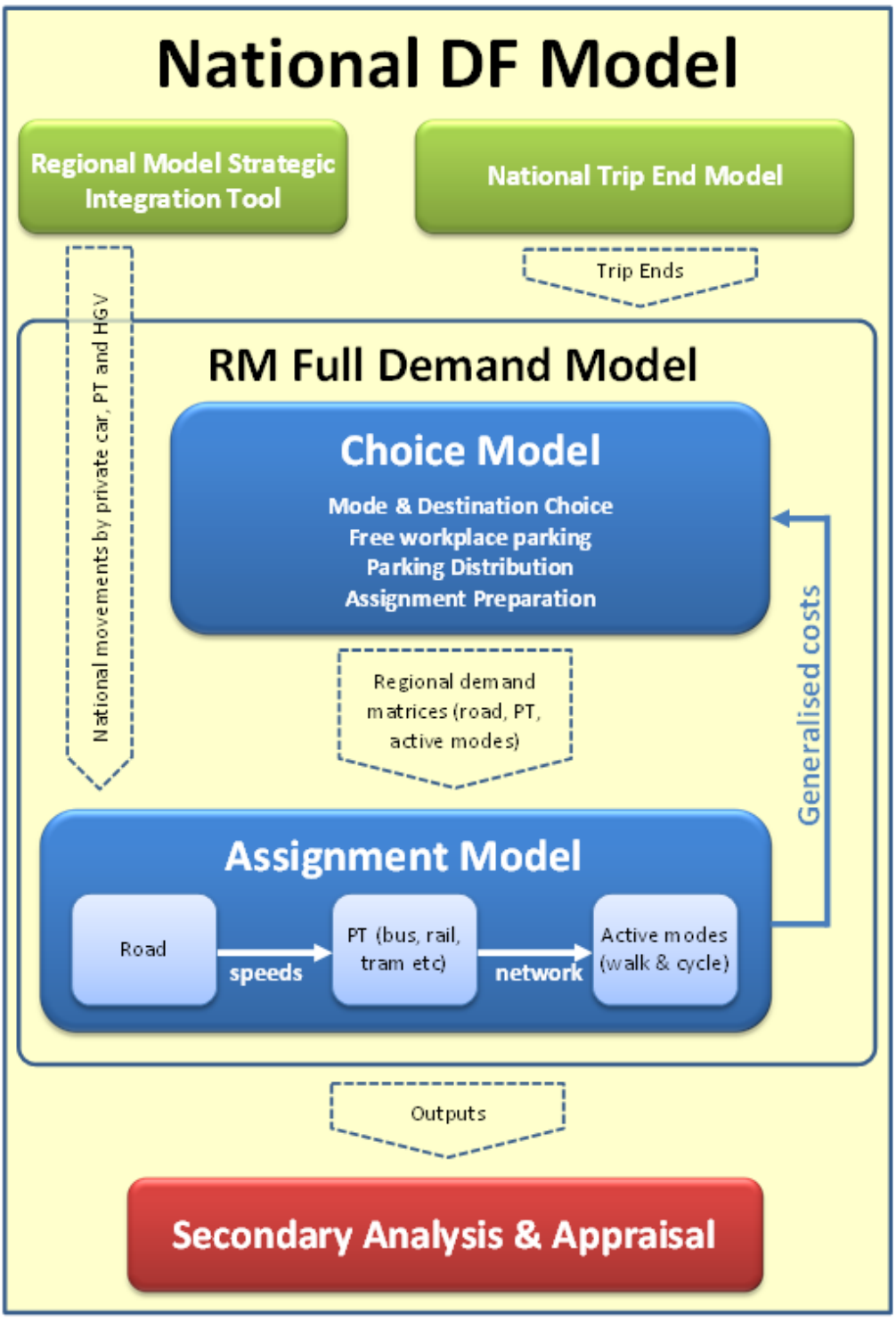

Figure 1.2 National and Regional Model Structure

1.3 SWRM Active Modes Model

The development of the South West Regional Model (SWRM) Active Modes Model (AMM) is based on the specification set out in the *Active Modes Model Specification Report*. The AMM implementation described within this report for the SWRM relates only to Version 1 of the SWRM model. The AMM component of SWRM differs from this original specification in that it was necessary to reduce the number of time periods to be consistent with the SWRM v1 PT Model (see the Public Transport Specification Report).

1.3.1 SWRM Zone System

The AMM zone system is consistent with the overall SWRM as described in the SWRM Zone System Development Report, and illustrated in Figure 1.3.

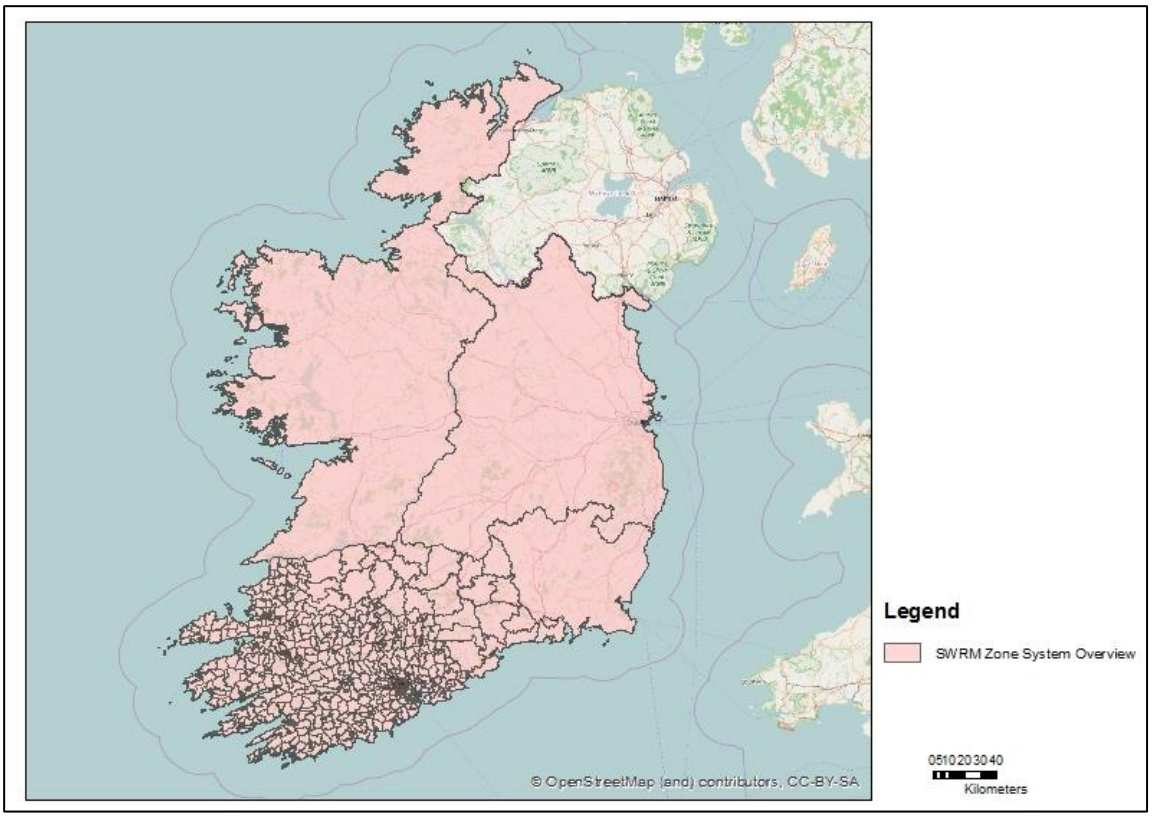

Figure 1.3 SWRM Zone System

The key zone system statistics include:

- Total zones: 792:
- Cork City zones: 148;
- County Cork zones: 421;
- County Kerry zones: 188;
- External zones: 31; and
- Special zones: 4.

The high level of zonal detail allows the AMM to be modelled to a greater degree of accuracy. Increased zonal density in urban areas such as Cork City allows for the accurate representation of walk and cycle times. This allows the cost of travel by active modes to be calculated with greater accuracy within the model.

1.3.2 Base Year

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

1.3.3 Time Periods

The five weekday periods modelled in the SWRM are detailed in Table 1.2. The periods allow the relative differential in travel cost to be represented. Travel cost by active modes is the same through all time periods as no congestion is represented for walk and cycle in the model. The five time periods have been kept to be consistent with the other assignment models (Road and PT), and to allow mode share comparison across all time periods.

The table below also shows the period to hour factors employed to reduce the period demand (output by the demand model) to the assignment demand (1-hour demand to be assigned to the network). The period to peak hour factors were derived from count data.

Table 1.2 SWRM Time Periods

Period	Demand Model Full Period	Assignment Period	Period To Peak Hour Factors (walk)	Period To Peak Hour Factors (cycle)
AM Peak	07:00-10:00	Peak hour (factored from period)	0.498	0.445
Morning Interpeak (IP1)	10:00-13:00	Average hour from full period	0.333	0.333
Afternoon Interpeak (IP2)	13:00-16:00	Average hour from full period	0.333	0.333
PM Peak	16:00-19:00	Peak hour (factored from period)	0.368	0.360
Off Peak	19:00-07:00	Not Assigned	N/A	N/A

1.4 This Report

This report focuses on the development of the Active Modes Model (AMM) within the South West Regional Model (SWRM) and includes the following chapters:

- Chapter 2: SWRM AMM Development provides information on the specification of the AMM and an overview of its development;
- Chapter 3: SWRM AMM Validation sets out the specification and execution of the model validation process; and
- Chapter 4: Conclusion and Recommendations outlines the key points of the AMM development and next steps required to improve the modelling of active modes.

2 SWRM AMM Development

2.1 Overview

As per Section 3.9 of the AMM Specification Report, the SWRM AMM network comprises a number of input components, as follows:

- Road network links (e.g. the same links database that holds the road component of the PT Cube Voyager network);
- Walking links (e.g. any walk links included in the SWRM PT model plus any further links that allow walk access);
- Cycle speeds on any cycle accessible link – these were set as per Section 3.9.3 of the AMM Specification Report; and
- Zone connectors (the connection points from zone centroids to 'physical' network) – these are completely consistent with the PT Model; therefore, please see SWRM Public Transport Model Development Report for further information.

Figure 2.1 provides a summary of the available Quality of Service and/or link type/characteristic information in the central Cork area. This indicates where a complete Quality of Service grading is available (coloured links) or where no attributes are available (grey links). Link characteristics categories are:

- B1: Bus Lane;
- C1: Cycle track – separated from road;
- C2: Cycle track – immediately adjacent;
- C3: Cycle lane – even within a Bus lane;
- G1: Cycle trail or Greenway;
- S1: Shared with Traffic; and
- S2: Shared Space (Ped's).

A default cycle speed is defined on the network, which can be overwritten if better information on cycling facilities is available. More details on this in the following sections.

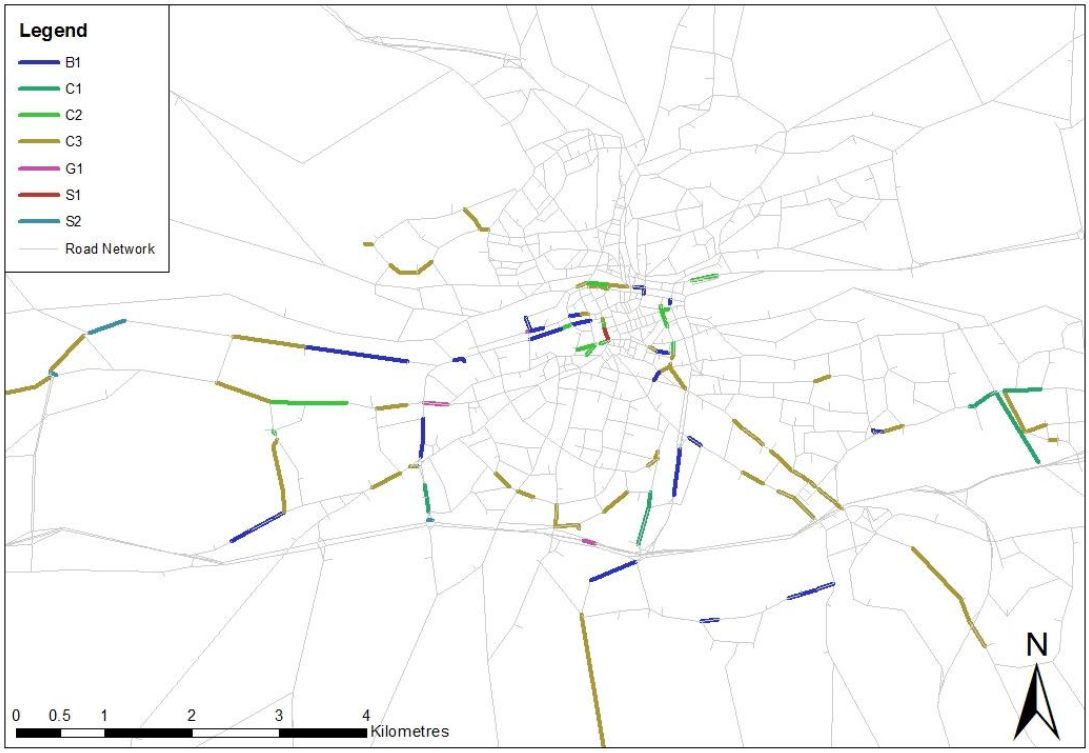

Figure 2.1 Cycle Infrastructure Information

The location and characteristics of cycling facilities are imported from a GIS shape file used in the NTA cycle planner (Introute – see Section 3.2 of the AMM Specification Report for further information).

The cycle data GIS shape file has been linked to the modelled PT network, using automatic ArcGIS spatial join tool. Special care was taken to ensure link directions were coded correctly.

2.1.1 Cycle Speeds

As detailed in the AMM Specification Report, the “cycle-friendliness” of infrastructure is modelled by an increase in cycle speed. The cost of cycling will then be lower on links with cycle facilities and this will make them more attractive at the assignment stage.

As per the AMM Specification Report, base cycle speed (without any specific cycling infrastructure) was modelled as 12 km/h. Maximum cycle speed was set to 20 km/h. A cycle speed on each cycle facility type, between 12km/h and 20km/h, was assigned based on the rules set out in the AMM Specification Report.

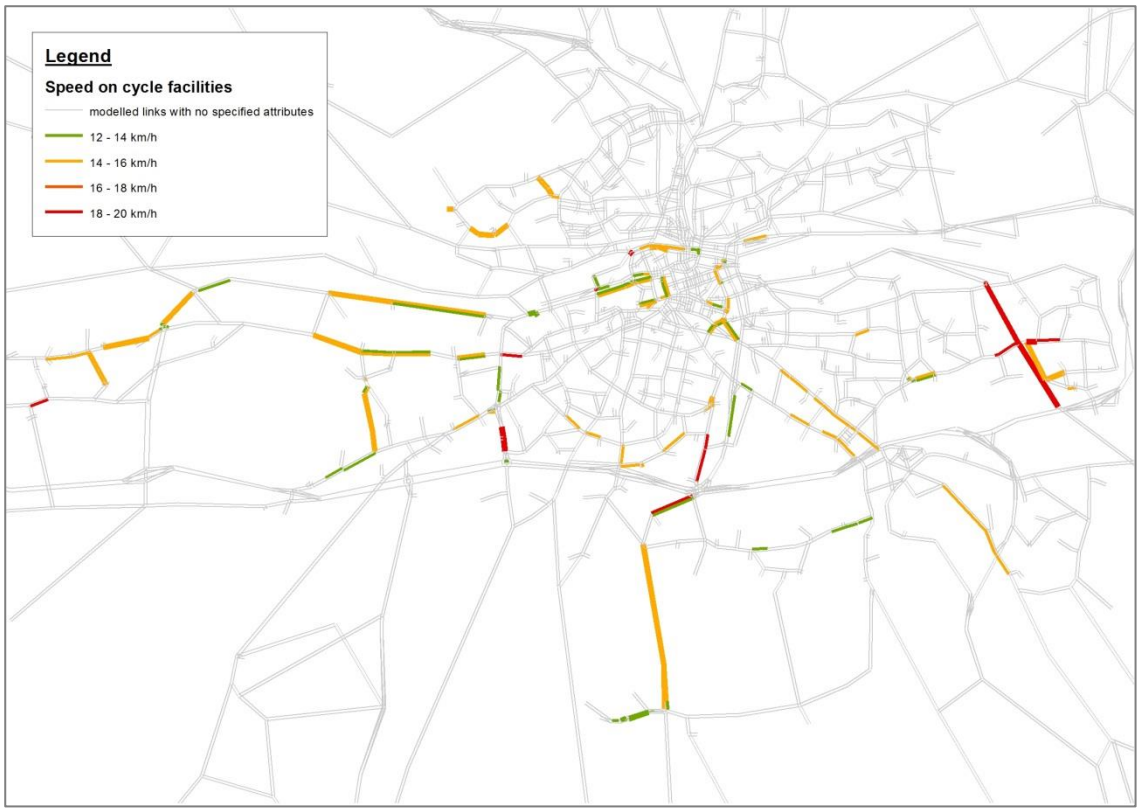

Figure 2.2 Estimated Cycle Speeds based on Infrastructure

Average walk and cycle speeds differ by age. To take this into account in the AMM, three age categories have been defined and average walk and cycle speeds calculated based on NHTS 2012 data. Age categories considered are:

- 0 to 20 years;
- 20 to 60 years; and
- Over 60 years.

Default walk and cycle speeds coded in the AMM are values corresponding to the 20 to 60 years age category. Additional factors are applied to walk and cycle speeds for Education (EDU) and Retired (RET) user classes. The youngest age category (0-20 years) speeds are used for EDU and the oldest age category (over 60 years) speeds are used for RET. Table 2.1 provides walk and cycle speed factors used in the AMM.

Table 2.1 Default Walk and Cycle speed factors coded in the AMM

User Class	Walk Speed Factor	Cycle Speed Factor
EMP, COM and OTH	1.00	1.00
EDU	0.96	0.83
RET	0.86	0.79

2.1.2 Importing Cycle Data into the Model

Table 2.2 Cycle speed coded on links with Characteristics data

Quality of Service	Mandatory (Solid Line) Cycle Speed (km/h)	Advisory (Dashed Line) Cycle Speed (km/h)
B1 - Bus Lane (no cycle lane)	12.8	12.6
C1 - Cycle Track - separated	19.5	17.6
C2 - Cycle Track - immediately adjacent	15.2	14.4
C3 - Cycle Lane (even within Bus Lane)	15.2	14.4
G1 - Cycle Trail or Greenway	19.5	17.6
S1 - Shared with Traffic	12.8	12.6
S2 - Shared Space (Ped's)	12.8	12.6

The link by link cycle speeds are stored in a dbf file, named “Cycle_Speed.dbf”, to be included in the model input folder. This file stores all cycle infrastructure information, and thus any cycle scheme for testing in the model is coded in this file.

2.1.3 Pedestrian Only Links

Certain links are restricted to pedestrians only, and do not allow access for cyclists. These links are defined as inputs to the model in the file PED_ONLY.DBF. This information has been coded based on local knowledge, supported by a review of mapping / Street View.

In the SWRM, one link was modelled as pedestrian only: the footbridge over the River Lee between University College Cork and Western Road. This is shown on the map below.

Figure 2.3 SWRM - Map of pedestrian only links

2.2 SWRM AMM Cube Voyager Implementation

Figure 2.4 below is a screenshot of the AMM Cube Application. It shows the different steps and the sequential order different tasks are executed.

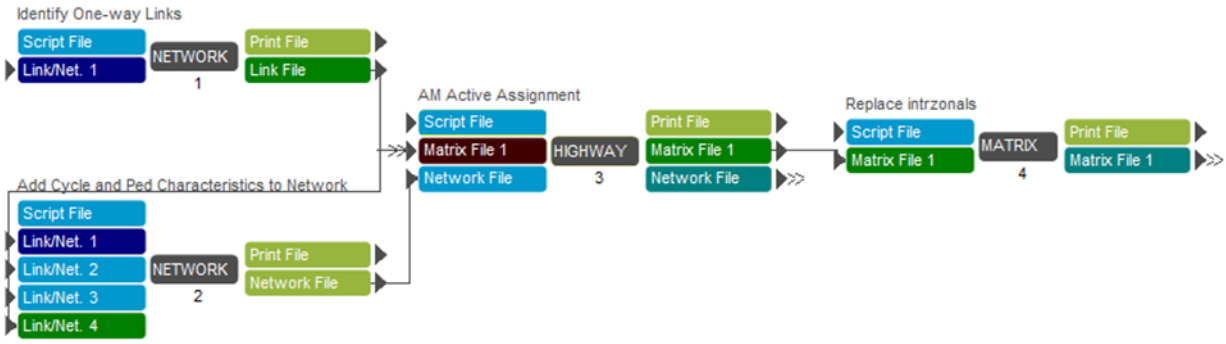

Figure 2.4 Screenshot of the Active Modes Cube application

The role of the Cube application modules shown in Figure 2.4 are detailed below:

- Network module (execution order 1): Take the network links from the PT model, delete the rail links (no walking or cycling on those links) and generate reversed links for walking.

- Network module (execution order 2): Add cycle speeds (when defined) to the network, delete links banned from walking/cycling (such as motorways). Pedestrian only links (as discussed in 2.1.4) and specific Cycle speed (as discussed in 2.1.3) are input at that stage.
- Highway module (execution order 3): All-or-nothing assignment of both walk and cycle matrices onto the network. Fastest path considered. Different speeds by user class (as discussed in 2.1.1) are coded in that module.
- Matrix module (execution order 4): Calculate intrazonal cost as the minimum between 40% of the quickest route and 30 minutes.

3 SWRM AMM Validation

3.1 Introduction

This section presents the validation of the SWRM v1 Active Modes Model. As discussed in the AMM Specification report individual link flows are not calibrated and direct matrix estimation is not used. However, the overall active modes demand and total numbers crossing a cordon or screenline can be compared as a sense check.

3.2 Active Modes Demand

The overall walk and cycle demands are compared to the National Household Travel Survey (NHTS) 2012, by time period. For further information on the demand, please refer to SWRM FDM Calibration Report.

Figure 3.1 and Figure 3.3 below are extracted from the demand dashboard.

For each time period (except AM, +40%), total Walk demand modelled is within +/- 25% of the factored NHTS demand, which is used as the reference the model should replicate.

The cycle demand is overestimated in the model for each time period.

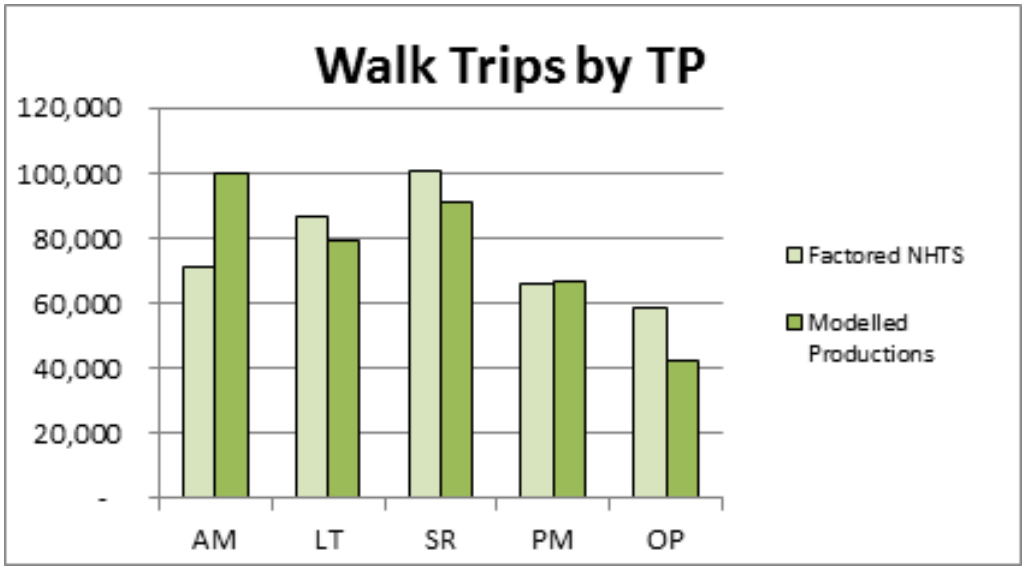

Figure 3.1 Total Walk trips by Time Period – Demand dashboard

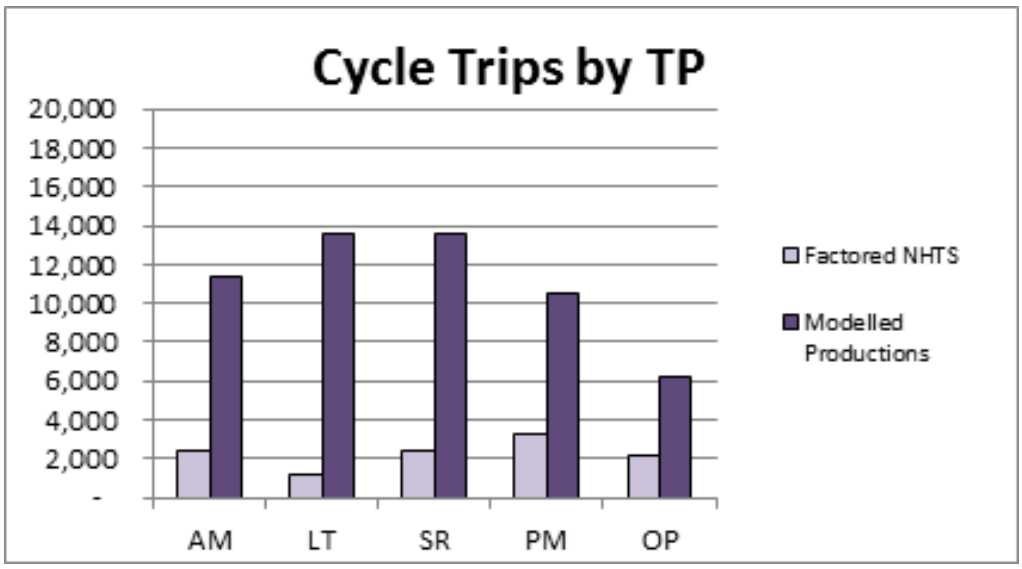

Figure 3.2 Total Cycle trips by Time Period – Demand dashboard

3.3 Walk mode

Walk flows output from the Public Transport model (walk trip between zones and PT stops) have to be considered in the validation process as observed data includes those flows. Both flows (from the AMM and the PT model) are then added and compared against counts, as detailed in table below.

3.3.1 AM Inbound

Table 3.1 Modelled Walk Flows vs. Counts - AM peak hour Inbound

Location		Walk Flow (AMM)	Walk Flow (PT Model)	Total Walk Flow	Count	Diff	GEH
42	Curraheen Road	119	33	151	35	116	12.0
42	Curraheen Road	88	32	120	30	90	10.4
42	Bishopstown Road	111	23	133	23	110	12.5
42	Bishopstown Road	45	3	49	10	38	7.0
42	Woodbrook Road	0	0	0	36	-36	8.5
42	Woodbrook Road	0	0	0	6	-6	3.5
42	Bishopstown Road	134	14	148	41	106	10.9
42	Bishopstown Road	229	61	290	88	202	14.7
44	Victoria Cross	106	2	108	96	13	1.3
44	Victoria Cross	91	14	105	71	35	3.7
44	Model Farm Road	83	1	84	45	38	4.8

44	Model Farm Road	115	1	116	57	60	6.4
44	Wilton Road	124	79	203	88	115	9.6
44	Wilton Road	149	17	166	86	81	7.2
44	Magazine Road	154	67	221	53	168	14.4
44	Magazine Road	111	28	139	83	56	5.4
45	Magazine Road	16	0	16	18	-2	0.5
45	Magazine Road	46	6	52	50	2	0.3
45	Glasheen Road	153	3	156	72	85	7.9
45	Glasheen Road	129	11	140	48	92	9.5
45	Bandon Road	133	11	144	93	51	4.7
45	Bandon Road	161	4	165	87	78	6.9
46	Barrack Street	349	40	388	47	341	23.1
46	Barrack Street	452	75	527	299	228	11.2
46	Barrack Street	223	46	269	232	38	2.4
46	Barrack Street	151	30	181	44	137	12.9
46	Evergreen Street	228	29	258	115	143	10.4
46	Evergreen Street	197	10	207	32	175	16.0
47	Evergreen Street	258	53	311	112	200	13.7
47	Evergreen Street	224	76	301	65	235	17.4
47	Evergreen Street	105	5	109	51	58	6.5
47	Evergreen Street	77	26	103	13	90	11.8
47	Travers Street	149	102	252	28	223	18.9
47	Travers Street	211	58	269	117	152	11.0
48	Glen Ave	93	3	96	1	95	13.6
48	Glen Ave	82	2	84	0	84	12.8
48	N20	77	8	85	0	84	12.9
48	N20	88	17	105	0	104	14.4
48	N20	93	16	109	2	107	14.3
48	N20	114	18	132	11	121	14.3
50	Summerhill N	472	76	548	173	376	19.8
50	Summerhill N	323	115	438	41	398	25.7
50	MacCurtain Street	237	99	336	175	162	10.1
50	MacCurtain Street	624	429	1,052	250	802	31.4
50	Brian Boru Street	329	310	639	274	365	17.1
50	Brian Boru Street	880	369	1,249	125	1,124	42.9
50	Lower Glanmire Road	115	632	747	255	492	22.0

50	Lower Glanmire Road	33	172	205	132	73	5.6
51	Capwell Road	18	38	56	24	31	4.9
51	Capwell Road	18	10	29	55	-26	4.1
51	S Douglas Road	141	42	183	76	107	9.4
51	S Douglas Road	147	17	164	73	91	8.4
51	N27 Slip Road	0	0	0	16	-16	5.7
51	N27 Slip Road	0	0	0	0	0	1.0
51	S Douglas Road	148	10	157	110	47	4.1
51	S Douglas Road	141	61	202	95	107	8.8
52	N27	146	55	201	80	121	10.2
52	N27	30	12	43	75	-32	4.2
52	Andersons Quay	1	2	3	45	-42	8.5
52	Andersons Quay	25	5	30	34	-4	0.7
52	N27	30	10	40	62	-23	3.2
52	N27	121	50	171	88	83	7.3
53	Penrose Quay	0	50	50	41	9	1.4
53	Penrose Quay	0	10	10	51	-41	7.5
53	N27	30	12	43	85	-42	5.3
53	N27	146	55	201	75	126	10.8
53	Penrose Quay	146	5	151	61	89	8.7
53	Penrose Quay	30	2	33	40	-7	1
54	Southern Road	130	44	175	52	122	11.5
54	Southern Road	131	45	176	110	65	5.5
54	High Street	158	5	162	54	108	10.4
54	High Street	219	79	298	56	242	18.2
54	Capwell Road	18	10	29	61	-32	4.8
54	Capwell Road	18	38	56	124	-68	7.2
54	Southern Road	353	118	471	172	299	16.7
54	Southern Road	292	16	308	51	257	19.2
55	S Douglas Road	141	61	202	104	99	8.0
55	S Douglas Road	148	10	157	99	58	5.1
55	N27 Slip	0	0	0	35	-35	8.3
55	N27 Slip	0	0	0	0	0	1.0
55	S Douglas Road	148	11	158	96	63	5.6
55	S Douglas Road	141	134	275	133	142	9.9
56	Churchyard Lane	5	2	7	7	0	0.1

56	Churchyard Lane	9	2	11	5	5	1.9
56	Boreenmanna Road	55	1	56	8	48	8.4
56	Boreenmanna Road	95	0	95	8	87	12.1
56	Boreenmanna Road	9	2	12	7	4	1.3
56	Boreenmanna Road	5	2	7	10	-3	1.0
59	N28 Slip	13	2	15	0	15	5.5
59	N28 Slip	12	2	15	0	15	5.4
59	Maryborough Hill	41	0	41	6	35	7.3
59	Maryborough Hill	63	4	67	12	55	8.7
59	Maryborough Hill	55	5	60	10	50	8.3
59	Maryborough Hill	34	2	36	6	30	6.5
	TOTAL	**12,092**	**4,269**	**16,361**	**6,226**	**10,134**	**95.4**

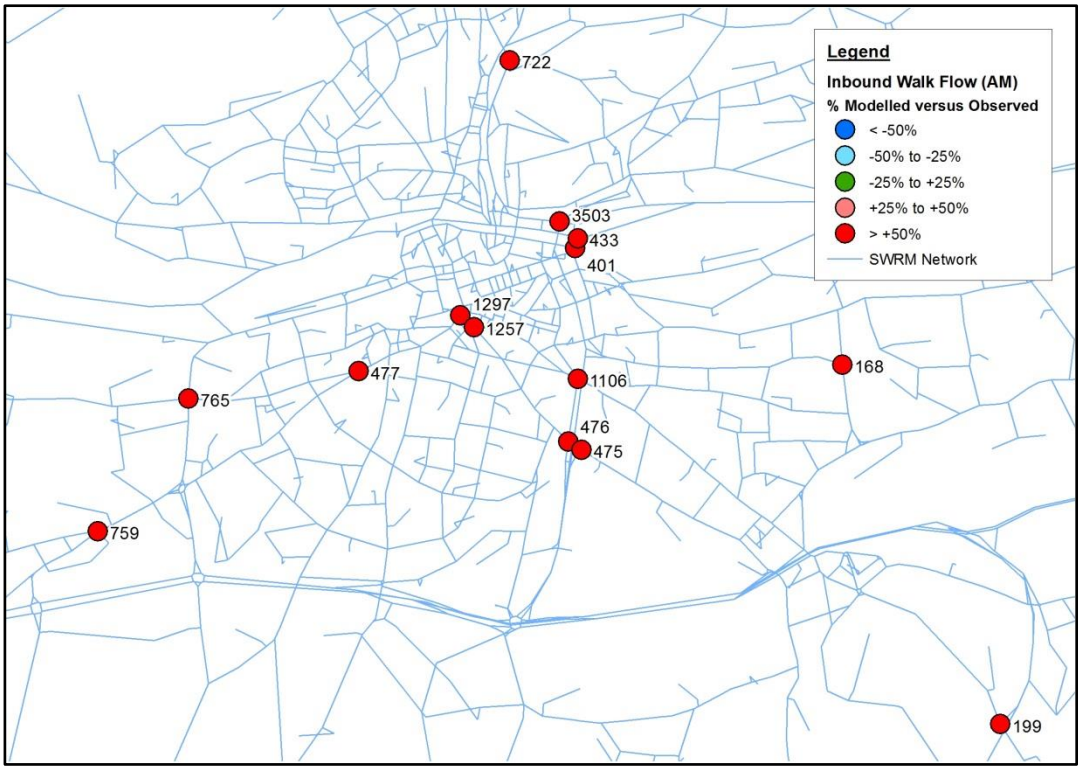

Figure 3.3 Modelled Walk Flows vs. Counts - AM peak hour Inbound

3.3.2 PM Outbound

Table 3.2 Modelled Walk Flows vs. Counts - PM peak hour Outbound

Location		Walk Flow (AMM)	Walk Flow (PT Model)	Total Walk Flow	Count	Diff	GEH
42	Curraheen Road	49	46	95	42	53	6.3
42	Curraheen Road	57	19	76	48	28	3.6
42	Bishopstown Road	27	4	32	15	17	3.4
42	Bishopstown Road	55	14	69	29	40	5.7
42	Woodbrook Road	0	0	0	7	-7	3.8
42	Woodbrook Road	0	0	0	21	-21	6.4
42	Bishopstown Road	112	8	120	91	29	2.9
42	Bishopstown Road	77	24	101	62	39	4.3
44	Victoria Cross	59	8	67	143	-76	7.4
44	Victoria Cross	65	10	75	188	-112	9.8
44	Model Farm Road	59	1	59	68	-9	1.1
44	Model Farm Road	56	1	57	52	5	0.7
44	Wilton Road	84	10	94	90	4	0.4
44	Wilton Road	85	36	122	80	41	4.1
44	Magazine Road	80	27	107	131	-24	2.2
44	Magazine Road	75	39	114	128	-15	1.3
45	Magazine Road	23	0	23	32	-9	1.6
45	Magazine Road	8	2	10	21	-11	2.9
45	Glasheen Road	77	5	82	47	35	4.4
45	Glasheen Road	92	9	101	59	42	4.7
45	Bandon Road	94	9	103	96	8	0.8
45	Bandon Road	79	6	85	123	-38	3.7
46	Barrack Street	254	57	311	302	10	0.6
46	Barrack Street	197	39	236	197	39	2.7
46	Barrack Street	90	28	118	176	-58	4.8
46	Barrack Street	134	36	170	256	-86	5.9
46	Evergreen Street	107	11	118	63	55	5.8
46	Evergreen Street	120	21	141	110	31	2.8
47	Evergreen Street	117	39	156	73	83	7.8

47	Evergreen Street	146	61	207	72	134	11.4
47	Evergreen Street	49	2	51	21	30	5.1
47	Evergreen Street	48	10	58	40	18	2.6
47	Travers Street	118	70	188	71	118	10.3
47	Travers Street	90	41	132	55	76	7.9
48	Glen Ave	45	3	49	1	48	9.6
48	Glen Ave	60	1	62	0	62	11.1
48	N20	59	14	73	3	70	11.5
48	N20	48	13	61	2	60	10.6
48	N20	74	19	93	7	86	12.2
48	N20	57	16	73	6	67	10.7
50	Summerhill N	158	105	263	122	141	10.2
50	Summerhill N	300	59	359	181	177	10.8
50	MacCurtain Street	139	350	488	189	300	16.3
50	MacCurtain Street	280	115	394	178	217	12.8
50	Brian Boru Street	330	349	678	140	539	26.6
50	Brian Boru Street	293	362	655	158	497	24.7
50	Lower Glanmire Road	49	299	348	190	158	9.7
50	Lower Glanmire Road	19	557	576	204	372	18.9
51	Capwell Road	6	4	10	29	-19	4.2
51	Capwell Road	10	23	33	22	10	2.0
51	S Douglas Road	86	8	94	39	55	6.7
51	S Douglas Road	64	17	82	44	37	4.7
51	N27 Slip Road	0	0	0	3	-3	2.3
51	N27 Slip Road	0	0	0	1	-1	1.2
51	S Douglas Road	66	36	101	45	57	6.6
51	S Douglas Road	83	8	90	55	36	4.2
52	N27	57	26	83	60	22	2.6
52	N27	27	39	66	57	9	1.1
52	Andersons Quay	2	7	9	26	-17	4.1
52	Andersons Quay	8	2	11	46	-36	6.7
52	N27	25	32	57	68	-11	1.4
52	N27	48	24	72	53	19	2.3
53	Penrose Quay	0	24	24	46	-22	3.8
53	Penrose Quay	0	32	32	55	-23	3.5
53	N27	27	39	66	65	2	0.2

53	N27	57	26	83	61	22	2.5
53	Penrose Quay	57	2	59	57	2	0.2
53	Penrose Quay	27	7	34	56	-22	3
54	Southern Road	82	30	112	88	24	2.4
54	Southern Road	65	36	102	50	51	5.9
54	High Street	123	4	126	48	78	8.4
54	High Street	97	20	117	44	73	8.1
54	Capwell Road	10	23	33	46	-13	2.1
54	Capwell Road	6	4	10	51	-41	7.4
54	Southern Road	163	16	179	72	107	9.5
54	Southern Road	210	12	222	105	117	9.1
55	S Douglas Road	83	8	90	51	40	4.7
55	S Douglas Road	66	36	101	48	53	6.2
55	N27 Slip	0	0	0	1	-1	1.7
55	N27 Slip	0	0	0	2	-2	1.9
55	S Douglas Road	66	88	154	47	107	10.7
55	S Douglas Road	83	6	88	48	40	4.9
56	Churchyard Lane	5	1	6	21	-15	4.2
56	Churchyard Lane	3	5	8	10	-2	0.6
56	Boreenmanna Road	47	2	48	39	9	1.4
56	Boreenmanna Road	28	1	30	27	3	0.5
56	Boreenmanna Road	3	5	8	52	-44	8.1
56	Boreenmanna Road	5	0	5	44	-39	7.8
59	N28 Slip	7	2	9	0	9	4.3
59	N28 Slip	8	2	10	0	10	4.5
59	Maryborough Hill	35	1	36	8	28	6.0
59	Maryborough Hill	25	5	29	8	21	4.8
59	Maryborough Hill	20	5	25	9	17	4.0
59	Maryborough Hill	30	2	31	8	23	5.2
	TOTAL	**6,613**	**3,624**	**10,238**	**6,204**	**4,033**	**44.5**

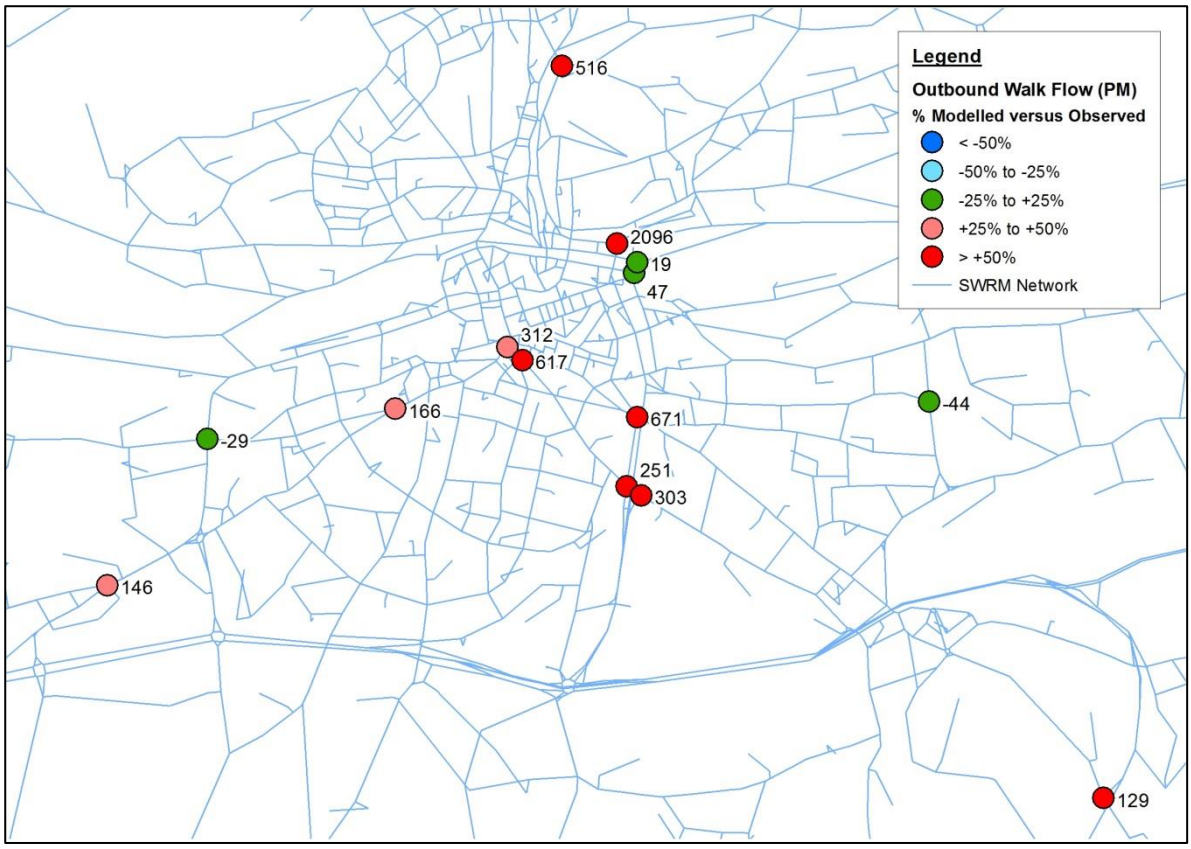

Figure 3.4 Modelled Walk Flows vs. Counts - PM peak hour Outbound

3.4 Cycle mode

Cycle flows considered in the validation are shown in the table below.

3.4.1 AM Inbound

Table 3.3 Modelled Cycle Flows vs. Counts - AM peak hour Inbound

Location		Cycle Flow (AMM)	Count	Difference	GEH
42	Curraheen Road	41	8	33	**6.7**
42	Curraheen Road	25	8	17	**4.3**
42	Bishopstown Road	33	6	27	**6.1**
42	Bishopstown Road	11	1	10	**4.2**
42	Woodbrook Road	0	1	-1	**1.6**
42	Woodbrook Road	0	0	0	**0.0**
42	Bishopstown Road	36	7	29	**6.2**
42	Bishopstown Road	73	13	60	**9.1**

44	Victoria Cross	32	10	22	**4.8**
44	Victoria Cross	27	14	13	**2.8**
44	Model Farm Road	55	6	49	**8.9**
44	Model Farm Road	50	13	37	**6.6**
44	Wilton Road	20	16	4	**0.9**
44	Wilton Road	52	10	43	**7.6**
44	Magazine Road	68	14	54	**8.4**
44	Magazine Road	45	8	36	**7.1**
45	Magazine Road	3	4	-1	**0.4**
45	Magazine Road	10	10	0	**0.1**
45	Glasheen Road	47	8	39	**7.4**
45	Glasheen Road	26	8	17	**4.2**
45	Bandon Road	31	18	13	**2.6**
45	Bandon Road	48	12	37	**6.7**
46	Barrack Street	107	2	105	**14.2**
46	Barrack Street	47	12	35	**6.5**
46	Barrack Street	43	8	35	**6.9**
46	Barrack Street	42	0	42	**9.2**
46	Evergreen Street	5	8	-3	**1.1**
46	Evergreen Street	65	6	59	**9.9**
47	Evergreen Street	74	13	61	**9.3**
47	Evergreen Street	30	8	22	**5.1**
47	Evergreen Street	48	8	40	**7.5**
47	Evergreen Street	0	0	0	**0.0**
47	Travers Street	0	0	0	**0.0**
47	Travers Street	92	13	79	**10.9**
48	Glen Ave	50	1	49	**9.6**
48	Glen Ave	16	0	16	**5.7**
48	N20	17	1	17	**5.5**
48	N20	33	1	31	**7.6**
48	N20	28	0	27	**7.2**
48	N20	48	1	47	**9.4**
50	Summerhill N	110	15	94	**12.0**
50	Summerhill N	58	1	57	**10.5**
50	MacCurtain Street	124	5	119	**14.8**
50	MacCurtain Street	0	0	0	**0.0**

50	Brian Boru Street	0	0	0	**0.0**
50	Brian Boru Street	162	16	146	**15.5**
50	Lower Glanmire Road	0	0	0	**0.0**
50	Lower Glanmire Road	5	4	1	**0.5**
51	Capwell Road	7	0	6	**3.3**
51	Capwell Road	3	2	1	**0.7**
51	S Douglas Road	34	9	25	**5.4**
51	S Douglas Road	26	16	10	**2.2**
51	N27 Slip Road	0	0	0	**0.9**
51	N27 Slip Road	0	1	-1	**1.3**
51	S Douglas Road	24	16	8	**1.8**
51	S Douglas Road	36	8	29	**6.1**
52	N27	13	5	8	**2.7**
52	N27	42	9	32	**6.4**
52	Andersons Quay	0	5	-5	**3.2**
52	Andersons Quay	28	2	25	**6.6**
52	N27	62	10	53	**8.8**
52	N27	6	8	-2	**0.9**
53	Penrose Quay	0	0	0	**0.0**
53	Penrose Quay	47	19	28	**5.0**
53	N27	42	9	32	**6.4**
53	N27	13	5	8	**2.7**
53	Penrose Quay	18	14	4	**1.0**
53	Penrose Quay	0	0	0	**0.0**
54	Southern Road	49	6	43	**8.2**
54	Southern Road	75	31	44	**6.1**
54	High Street	41	4	37	**7.8**
54	High Street	26	14	11	**2.6**
54	Capwell Road	3	0	3	**2.4**
54	Capwell Road	7	0	7	**3.6**
54	Southern Road	103	0	103	**14.3**
54	Southern Road	89	0	89	**13.3**
55	S Douglas Road	36	4	33	**7.3**
55	S Douglas Road	24	16	8	**1.8**
55	N27 Slip	0	0	0	**0.0**
55	N27 Slip	0	0	0	**0.9**

55	S Douglas Road	24	16	8	**1.8**
55	S Douglas Road	36	3	33	**7.4**
56	Churchyard Lane	1	0	1	**1.5**
56	Churchyard Lane	2	0	2	**1.7**
56	Boreenmanna Road	7	0	7	**3.8**
56	Boreenmanna Road	23	0	23	**6.8**
56	Boreenmanna Road	2	0	2	**1.8**
56	Boreenmanna Road	1	0	1	**1.5**
59	N28 Slip	0	0	0	**0.0**
59	N28 Slip	2	0	2	**2.0**
59	Maryborough Hill	8	0	8	**4.1**
59	Maryborough Hill	18	1	17	**5.5**
59	Maryborough Hill	18	1	17	**5.6**
59	Maryborough Hill	7	0	7	**3.6**
	TOTAL	**2,935**	**554**	**2,381**	**57.0**

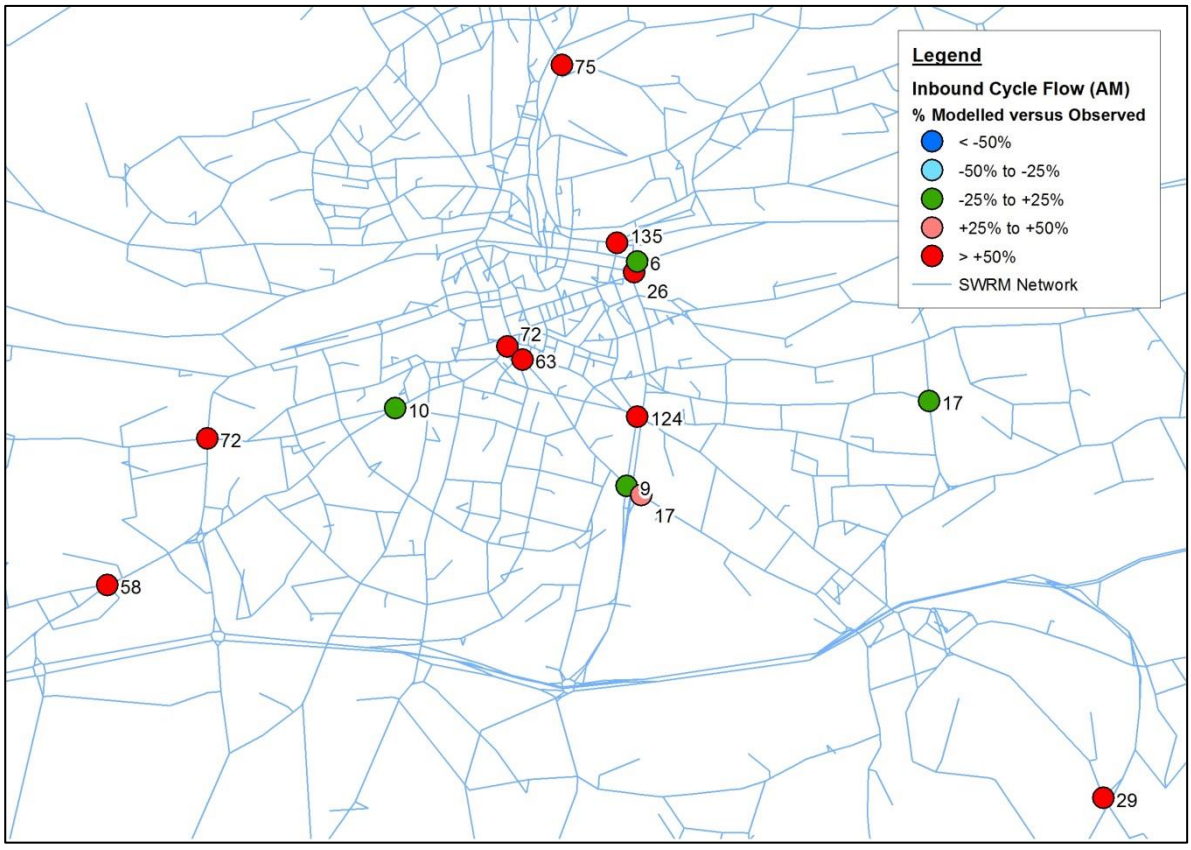

Figure 3.5 Modelled Cycle Flows vs. Counts - AM peak hour Inbound

3.4.2 PM Outbound

Table 3.4 Modelled Cycle Flows vs. Counts - PM peak hour Outbound

Location		Cycle Flow (AMM)	Count	Difference	GEH
42	Curraheen Road	29	8	21	4.8
42	Curraheen Road	24	5	19	5.0
42	Bishopstown Road	15	1	14	4.8
42	Bishopstown Road	24	6	18	4.8
42	Woodbrook Road	0	0	0	0.0
42	Woodbrook Road	0	1	-1	1.2
42	Bishopstown Road	48	12	36	6.7
42	Bishopstown Road	43	9	34	6.6
44	Victoria Cross	30	6	24	5.7
44	Victoria Cross	28	9	19	4.4
44	Model Farm Road	61	12	49	8.2
44	Model Farm Road	33	3	30	7.1
44	Wilton Road	14	8	5	1.6
44	Wilton Road	53	9	44	8.0
44	Magazine Road	53	6	46	8.5
44	Magazine Road	43	12	32	6.0
45	Magazine Road	5	8	-3	1.2
45	Magazine Road	6	2	4	1.9
45	Glasheen Road	35	4	32	7.1
45	Glasheen Road	28	6	23	5.5
45	Bandon Road	32	8	24	5.4
45	Bandon Road	36	12	25	5.0
46	Barrack Street	120	7	113	14.1
46	Barrack Street	31	8	24	5.4
46	Barrack Street	28	11	16	3.7
46	Barrack Street	56	0	56	10.6
46	Evergreen Street	4	1	2	1.6
46	Evergreen Street	64	12	52	8.4
47	Evergreen Street	59	11	48	8.1
47	Evergreen Street	19	1	18	5.5

47	Evergreen Street	32	1	31	7.5
47	Evergreen Street	0	0	0	0.0
47	Travers Street	0	0	0	0.0
47	Travers Street	72	11	61	9.4
48	Glen Ave	29	0	29	7.6
48	Glen Ave	20	0	20	6.4
48	N20	21	0	20	6.3
48	N20	21	0	21	6.4
48	N20	26	0	26	7.2
48	N20	32	0	32	7.9
50	Summerhill N	72	4	68	11.1
50	Summerhill N	69	4	65	10.8
50	MacCurtain Street	116	14	102	12.7
50	MacCurtain Street	0	0	0	0.0
50	Brian Boru Street	0	0	0	0.0
50	Brian Boru Street	118	6	112	14.3
50	Lower Glanmire Road	0	0	0	0.0
50	Lower Glanmire Road	6	8	-2	0.9
51	Capwell Road	2	3	-1	0.5
51	Capwell Road	3	1	2	1.2
51	S Douglas Road	31	12	19	4.1
51	S Douglas Road	15	6	9	2.7
51	N27 Slip Road	0	1	-1	1.2
51	N27 Slip Road	0	0	0	0.0
51	S Douglas Road	14	4	10	3.2
51	S Douglas Road	30	13	17	3.6
52	N27	8	3	5	2.2
52	N27	39	10	29	5.9
52	Andersons Quay	0	7	-7	3.5
52	Andersons Quay	24	1	23	6.6
52	N27	58	7	51	8.9
52	N27	4	6	-3	1.2
53	Penrose Quay	0	0	0	0.0
53	Penrose Quay	43	13	30	5.7
53	N27	39	8	31	6.3
53	N27	8	3	4	1.9

53	Penrose Quay	11	8	4	1.3
53	Penrose Quay	0	0	0	0.0
54	Southern Road	52	20	32	5.4
54	Southern Road	44	9	35	6.9
54	High Street	44	11	33	6.3
54	High Street	17	1	16	5.4
54	Capwell Road	3	0	3	2.4
54	Capwell Road	2	0	2	2.2
54	Southern Road	61	0	61	11.1
54	Southern Road	98	0	98	14.0
55	S Douglas Road	30	9	21	4.8
55	S Douglas Road	14	4	10	3.2
55	N27 Slip	0	0	0	0.0
55	N27 Slip	0	0	0	0.0
55	S Douglas Road	14	4	10	3.2
55	S Douglas Road	30	9	21	4.8
56	Churchyard Lane	1	0	1	1.5
56	Churchyard Lane	1	0	1	1.2
56	Boreenmanna Road	12	0	12	4.8
56	Boreenmanna Road	11	0	11	4.7
56	Boreenmanna Road	1	0	1	1.2
56	Boreenmanna Road	1	0	1	1.5
59	N28 Slip	0	0	0	0.0
59	N28 Slip	2	0	2	2.0
59	Maryborough Hill	10	1	9	4.0
59	Maryborough Hill	8	0	8	3.9
59	Maryborough Hill	8	0	8	4.0
59	Maryborough Hill	8	1	7	3.5
	TOTAL	**2,454**	**420**	**2,034**	**53.7**

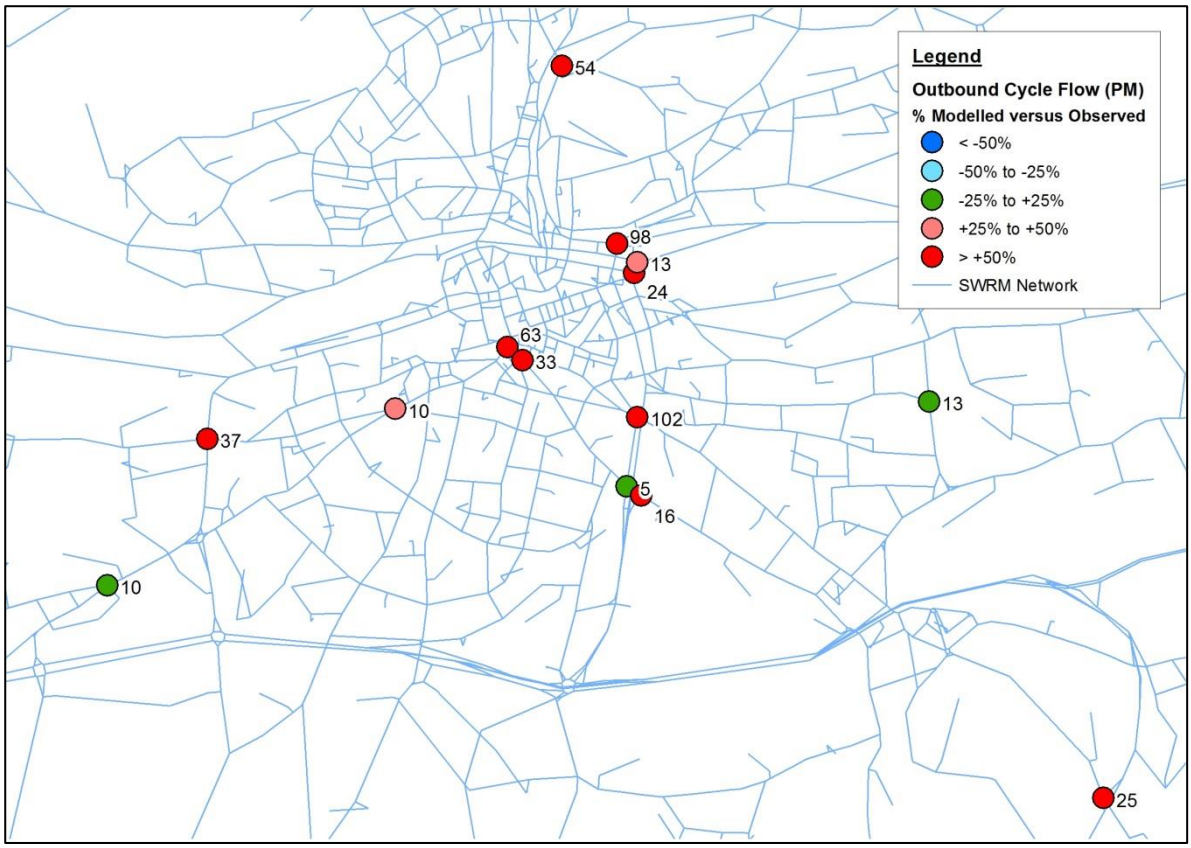

Figure 3.6 Modelled Cycle Flows vs. Counts - PM peak hour Outbound

4 Conclusion and Recommendations

4.1 Overview

This report provides information on the development and validation of the Active Modes Model component of the South West Regional Model. This section summarises the key points of the model development, the strength and weakness of the model and a set of recommendations for possible further enhancements.

4.2 Model Development – Key points

The AMM network is the aggregation of different networks (road and walking), with equivalent node, link, zone connectors, and numbering convention.

Network speeds are set based on fixed assumptions for walking, and on a rule-based approach for cycling. Walking is assumed at a constant rate of 5.1kph, independent of link type, for Employee (EMP), Commuter (COM) and Others (OTH) user classes. Following similar approach as for cycling (see Section 2.1.1), Education and Retired user classes walk speeds are factored (by 0.96 for EDU and by 0.86 for RET). Assignment is based on a shortest distance path.

For cycling, a system was developed during model specification to assign speeds based on link type, where information on Quality of Service, and/or descriptions of other characteristics (road type, presence of marked cycle lanes, etc.) were used to assign speeds of between 12kph and 20kph. As for walking, assignment is based on shortest path. For both walk and cycle, no account of congestion is taken account of in determining route choice.

The Active Modes Model is used to output costs skims, based purely on time travelled, to the demand model. Otherwise, it is not intended for analysis of actual walking and cycling journeys, as there is insufficient representation of the on-the-ground conditions that influence the speed and routing of such trips.

4.3 Model Validation

Modelled flows at each of the count sites are significantly higher in both of the peak (AM & PM) periods. No attempt has been made to address this, but is deemed acceptable for this version of the SWRM.

4.4 Recommendations

Following the development and the calibration/validation of the overall SWRM, some areas have been identified where potential improvements could be made, as follows:

- Conduct surveys of walking and cycling speeds and routing across a range of road users, which would allow development of more refined assignment;
- Conduct surveys which differentiate visitors from the standard modelled journey purposes;

- Consider how cyclists in particular are affected by congestion effects and/or particular characteristics of junctions; and
- Classify links using pedestrian oriented characteristics (pedestrianized area, number of shops, large sidewalks) to reflect their attractiveness for walking in the assignment.

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