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Modelling Services Framework

South East Regional Model Active Modes Model Development Report Údarás Náisiúnta lompair National Transport Authority

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Foreword

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

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

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

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

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

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

The development of the South East Regional Model (SERM) 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 SERM relates only to Version 1 of the SERM model. The AMM component of SERM differs from this original specification in that it was necessary to reduce the number of time periods to be consistent with the SERM PT Model (see the Public Transport Model Specification Report).

1.3.1 SERM Zone System

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



Figure 1.3 SERM Zone System

The key zone system statistics include:

- Total zones: 535
 - Waterford City zones: 82;
 - Waterford County zones: 59;
 - Wexford County zones: 138;
 - Kilkenny County zones: 113;
 - South Tipperary County zones: 81;
 - Carlow County zones: 55; and
 - External zones: 7.

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 Waterford 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 SERM 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.

Period	Demand Model Full Period	Assignment Period	Period To Peak Hour Factors (walk)	Period To Peak Hour Fatcors (cycle)
AM Peak	07:00-10:00	Peak hour (factored from period)	0.475	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)	0.337	0.360
Off Peak	19:00-07:00	Not Assigned	N/A	N/A

Table 1.2 SERM Time Periods

1.4 This Report

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

- Chapter 2: SERM AMM Development: provides information on the specification of the AMM and an overview of its development;
- Chapter 3: SERM 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 SERM AMM Development

2.1 Overview

As per Section 3.9 of the AMM Specification Report, the SERM 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 SERM 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 SERM Public Transport Model Development Report for further information.

2.1.1 Cycle Speeds

As the SERM does not have any coded cycle links there is not a cycle infrastructure diagram detailing the cycle quality of service for the South-East region.

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 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.

No such links have been coded in the SERM.

2.2 SERM AMM Cube Voyager Implementation

Figure 2.1 below is a screenshot of the AMM Cube Application. It shows the different steps and the sequential order different tasks are executed.



Figure 2.1 Screenshot of the Active Modes Cube application

The role of the Cube application modules shown in 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 Section 2.1.2) and specific Cycle speed (as discussed in Section 2.1.1) 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 Section 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 SERM AMM Validation

3.1 Introduction

This section presents the validation of the SERM 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 modelled flows can be compared against count data as a sense check. In the case of SERM v1, walking and cycle data was available in the Waterford city area. Pedestrian and cyclist counts were undertaken in November 2014.

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 RM Full Model Development Report.

Figure 3.1 and Figure 3.2 below are extracted from the demand dashboard.

For each time period (except AM), total Walk demand modelled is within +/- 20% of the factored NHTS demand, which is used as the reference the model should replicate.

The cycle demand modelled and the factored NHTS demand are quite different. The small sample size of cycle trips in NHTS for the SERM area makes the factored NHTS demand less reliable than for the other RM. The total cycle trips modelled by time period pattern is similar to the other RMs, which give confidence in the SERM cycle demand modelled.



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 trips 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

Loca	tion	Walk Flow (AMM)	Walk Flow (PT Model)	Total Walk Flow	Count	Diff	GEH
67	Terminus Street	0	4	4	15	-11	3.5
67	Terminus Street	25	6	31	8	23	5.3
67	Bridge Street	215	291	506	18	488	30.1
67	Bridge Street	424	327	752	52	700	34.9
67	Dock Road	0	0	0	25	-25	7.0
67	Dock Road	174	45	218	9	210	19.7
69	Gracedieu Heights	0	0	0	1	-1	1.4
69	Gracedieu Heights	0	0	0	0	0	1.0
69	Carrickphienish Road	32	24	56	8	48	8.5
69	Carrickphienish Road	36	19	55	6	49	8.9
69	Gracedieu Heights	36	19	55	7	48	8.6
69	Gracedieu Heights	32	24	56	7	49	8.7
73	Six Cross Road	50	11	61	5	57	9.8
73	Six Cross Road	39	12	51	3	48	9.1
73	Outer Ring Road	1	0	1	2	-1	0.6
73	Outer Ring Road	3	0	3	3	0	0.1
73	Kilbarry	5	0	5	0	5	3.0

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

Location		Walk	Walk Flow	Total	Count	Diff	GEH
		Flow	(PT Model)	Walk			
		(AMM)		Flow		-	4 7
73	Kilbarry	4	0	4	1	3	1.7
73	Outer Ring Road	1	0	1	2	5	2.5
73	Outer Ring Road	4	0	4	1	3	2.0
78	R686	141	17	158	16	141	15.2
78	R686	109	14	123	10	112	13.8
78	Cork Road	269	23	291	47	244	18.8
78	Cork Road	394	22	416	108	308	19.0
78	R680	253	5	259	79	180	13.8
78	R680	160	9	168	31	138	13.8
81	Tramore Road	0	0	0	16	-16	5.7
81	Tramore Road	0	0	0	44	-44	9.3
81	R709	100	10	110	12	98	12.5
81	R709	201	9	210	37	173	15.6
81	Tramore Road	0	0	0	11	-11	4.8
81	Tramore Road	0	0	0	9	-9	4.1
81	R709	263	13	276	87	189	14.0
81	R709	115	28	142	21	121	13.4
82	R708	120	69	189	63	126	11.2
82	R708	256	83	340	67	273	19.1
82	Inner Ring Road	283	56	338	35	303	22.2
82	Inner Ring Road	296	94	390	109	282	17.8
82	Lower Grange	195	44	239	42	197	16.6
82	Lower Grange	75	13	88	14	73	10.3
82	The Folly	186	23	209	56	153	13.3
82	The Folly	156	16	172	34	138	13.6
83	Ballytruckle Road	45	42	87	25	61	8.2
83	Ballytruckle Road	168	55	223	56	167	14.2
83	Poleberry	124	56	180	25	155	15.3
83	Poleberry	138	63	201	38	162	14.8
83	Ballytruckle Road	256	83	340	79	260	18.0
83	Ballytruckle Road	120	69	189	37	152	14.3
86	The Mall	58	18	75	16	59	8.8
86	The Mall	38	10	48	14	34	6.1
86	The Mall	53	90	143	19	124	13.8
86	The Mall	126	195	320	28	292	22.1
86	Lombard Street	164	155	319	42	277	20.6
86	Lombard Street	111	99	210	27	184	16.9
115	Belmont Road	45	2	48	19	28	4.9
115	Belmont Road	64	6	71	21	49	7.3
115	Belmont Road	64	5	69	1	68	11.4

Location		Walk	Walk Flow	Total	Count	Diff	GEH
		Flow	(PT Model)	Walk			
		(AMM)		Flow		45	0.4
115	Belmont Road	45	1	47	2	45	9.1
118	Cleaboy Road	151	38	189	34	156	14.7
118	Cleaboy Road	50	14	64	26	37	5.6
118	Keane's Road	9	1	10	24	-15	3.5
118	Keane's Road	30	5	35	27	8	1.4
118	Upper Yellow Road	41	13	54	20	34	5.5
118	Upper Yellow Road	121	34	155	34	121	12.5
119	John's Hill	91	22	114	8	105	13.5
119	John's Hill	187	21	207	25	182	16.9
119	The Folly	156	16	172	17	155	16.0
119	The Folly	186	14	199	19	180	17
119	Upper Grange Road	290	23	314	35	279	21.2
119	Upper Grange Road	166	28	193	10	183	18.2
119	St Patrick's Way	75	1	75	3	72	11.5
119	St Patrick's Way	75	0	75	10	66	10.1
120	Upper Grange Road	166	28	193	15	179	17.5
120	Upper Grange Road	290	23	314	26	288	22.1
120	Upper Grange Road	259	15	273	24	249	20.4
120	Upper Grange Road	171	26	197	10	187	18.3
120	Grange Park Ave	68	9	77	4	73	11.5
120	Grange Park Ave	31	10	41	1	40	8.6
121	Keane's Road	77	21	99	21	78	10.1
121	Keane's Road	33	7	40	17	23	4.2
121	Matties Hill	13	2	15	27	-12	2.6
121	Matties Hill	9	1	10	27	-17	4.0
121	Roanmore Terrace	42	8	49	18	32	5.5
121	Roanmore Terrace	90	24	114	24	90	10.8
122	Cannon Street	94	36	130	58	72	7.4
122	Cannon Street	90	30	120	45	76	8.3
122	Barrack Street	198	78	276	38	238	18.9
122	Barrack Street	273	52	325	45	280	20.6
123	Military road	178	200	377	75	303	20.1
123	Military road	99	113	212	84	129	10.6
123	Ozanam Street	86	50	136	65	72	7.2
123	Ozanam Street	161	166	327	219	108	6.6
123	Morrisson's road	144	85	229	53	175	14.8
123	Morrisson's road	158	70	229	171	57	4.0
123	Lower Yellow Road	121	54	175	108	67	5.6
123	Lower Yellow Road	109	9	118	83	35	3.5
125	Gracedieu Road	158	69	227	54	173	14.6

Location		Walk	Walk Flow	Total	Count	Diff	GEH
		Flow	(PT Model)	Walk			
		(AMM)		Flow			
125	Gracedieu Road	95	51	146	16	130	14.4
125	Military road	99	113	212	19	193	17.9
125	Military road	178	200	377	47	330	22.7
125	Morgan Street	57	6	63	13	50	8.1
125	Morgan Street	106	6	112	29	83	9.8
125	Summerhill	170	239	409	29	380	25.6
125	Summerhill	105	170	276	19	256	21.1
126	Bridge Street	278	292	570	48	522	29.7
126	Bridge Street	166	221	387	46	341	23.2
126	Anne Street	30	5	35	22	13	2.4
126	Anne Street	26	5	31	25	6	1.1
127	Bridge Street	424	327	752	48	704	35.2
127	Bridge Street	215	291	506	18	488	30.1
127	Grattan Quay	0	0	0	13	-13	5.2
127	Grattan Quay	0	0	0	7	-7	3.8
127	Bridge Street	187	127	314	10	304	23.9
127	Bridge Street	373	157	530	14	516	31.3
127	Merchants Quay	28	164	192	17	176	17.2
127	Merchants Quay	51	170	222	51	171	14.6
129	Ballybricken	18	9	28	19	9	1.9
129	Ballybricken	55	21	76	5	71	11.2
129	Ballybricken	55	4	59	9	50	8.5
129	Ballybricken	18	36	54	9	45	8.0
130	Ballybricken	121	25	146	60	86	8.5
130	Ballybricken	63	29	92	23	70	9.2
130	Ballybricken	55	21	76	6	70	11.0
130	Ballybricken	18	9	28	19	8	1.7
130	Patrick Street	0	0	0	29	-29	7.6
130	Patrick Street	0	0	0	45	-45	9.4
131	Stephen Street	48	23	71	31	40	5.6
131	Stephen Street	73	10	83	58	25	3.0
131	Newgate Street	60	4	64	81	-17	2.0
131	Newgate Street	22	2	25	36	-11	2.0
131	New Street	6	6	11	28	-17	3.7
131	New Street	13	3	16	58	-42	6.9
133	Silverwood	0	0	0	2	-2	2.2
133	Silverwood	0	0	0	1	-1	1.4
133	Rockshire Road	53	25	78	3	75	11.8
133	Rockshire Road	35	9	44	3	41	8.4
133	Rockshire Road	54	18	72	3	68	11.2

Locat	tion	Walk Flow (AMM)	Walk Flow (PT Model)	Total Walk Flow	Count	Diff	GEH
133	Rockshire Road	135	53	188	6	183	18.5
	TOTAL	14,518	6,546	21,065	4,203	16,861	150.0



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	Walk	Total	Count	Diff	GEH
		Flow	Flow (PT	Walk			
		(AMM)	Model)	Flow			
67	Terminus Street	0	0	0	13	-12	4.9
67	Terminus Street	25	4	30	19	11	2.3
67	Bridge Street	223	56	279	43	236	18.6
67	Bridge Street	134	145	279	33	246	19.7
67	Dock Road	0	0	0	19	-19	6.2
67	Dock Road	187	14	201	19	182	17.4
69	Gracedieu Heights	0	0	0	4	-4	2.8
69	Gracedieu Heights	0	0	0	2	-2	2.2
69	Carrickphienish Road	19	11	30	14	16	3.3
69	Carrickphienish Road	15	13	28	14	13	2.9
69	Gracedieu Heights	15	13	28	13	14	3.1
69	Gracedieu Heights	19	11	30	13	17	3.7
73	Six Cross Road	26	9	35	3	32	7.3
73	Six Cross Road	37	9	46	4	42	8.4
73	Outer Ring Road	4	0	4	4	0	0.2
73	Outer Ring Road	2	2	5	3	1	0.6
73	Kilbarry	2	0	2	0	2	1.5
73	Kilbarry	3	0	3	1	3	1.9
73	Outer Ring Road	2	0	2	3	-1	0.8
73	Outer Ring Road	11	0	11	4	7	2.6
78	R686	60	14	74	6	68	10.8
78	R686	85	1	86	10	75	10.9
78	Cork Road	238	3	241	135	106	7.7
78	Cork Road	159	20	180	63	117	10.6
78	R680	100	6	106	60	46	5.1
78	R680	154	2	155	131	25	2.1
81	Tramore Road	0	0	0	54	-54	10.4
81	Tramore Road	0	0	0	42	-42	9.2
81	R709	123	2	125	48	77	8.3
81	R709	66	9	75	25	51	7.2
81	Tramore Road	0	0	0	19	-19	6.1
81	Tramore Road	0	0	0	29	-29	7.7
81	R709	76	12	89	60	29	3.3
81	R709	154	7	161	88	73	6.6
82	R708	126	33	158	49	109	10.7
82	R708	76	42	117	38	79	9.0

Location		Walk	Walk	Total	Count	Diff	GEH
		FIOW (AMM)	FIOW (PI Model)	Walk			
82	Inner Ring Road	172	46	218	43	175	15.3
82	Inner Ring Road	151	28	179	36	143	13.8
82	Lower Grange	57	14	70	25	46	6.7
82	Lower Grange	100	18	118	48	70	7.7
82	The Folly	84	11	95	20	75	9.9
82	The Folly	112	13	125	22	103	12.0
83	Ballytruckle Road	76	23	99	35	63	7.7
83	Ballytruckle Road	33	39	72	24	48	7.0
83	Poleberry	72	34	106	33	73	8.7
83	Poleberry	65	31	96	28	68	8.6
83	Ballytruckle Road	76	42	117	40	77	8.6
83	Ballytruckle Road	126	33	158	60	98	9.4
86	The Mall	27	6	33	30	3	0.5
86	The Mall	33	4	37	50	-12	1.9
86	The Mall	64	69	132	53	79	8.2
86	The Mall	33	80	113	37	76	8.8
86	Lombard Street	66	80	147	74	73	6.9
86	Lombard Street	90	55	145	60	86	8.5
115	Belmont Road	37	2	38	13	26	5.1
115	Belmont Road	25	1	26	13	13	2.9
115	Belmont Road	25	0	25	1	24	6.5
115	Belmont Road	37	1	37	2	36	8.1
118	Cleaboy Road	32	8	40	34	6	1.0
118	Cleaboy Road	67	18	85	34	51	6.7
118	Keane's Road	16	1	17	25	-7	1.6
118	Keane's Road	6	1	7	28	-21	4.9
118	Upper Yellow Road	52	17	69	26	43	6.2
118	Upper Yellow Road	26	8	34	23	11	2.0
119	John's Hill	94	12	106	21	85	10.7
119	John's Hill	56	8	64	15	49	7.7
119	The Folly	112	9	120	12	109	13.4
119	The Folly	84	11	95	14	81	11
119	Upper Grange Road	95	9	104	20	84	10.7
119	Upper Grange Road	154	12	165	23	142	14.7
119	St Patrick's Way	43	1	44	5	39	7.8
119	St Patrick's Way	50	0	51	8	43	7.9
120	Upper Grange Road	154	12	165	30	136	13.7
120	Upper Grange Road	95	9	104	25	79	9.9
120	Upper Grange Road	86	5	91	20	71	9.6
120	Upper Grange Road	136	7	142	24	118	13.0

Location		Walk Flow	Walk Flow (PT	Total Walk	Count	Diff	GEH
		(AMM)	Model)	Flow			
120	Grange Park Ave	14	7	20	7	14	3.7
120	Grange Park Ave	23	7	29	8	22	5.0
121	Keane's Road	21	7	28	19	9	1.8
121	Keane's Road	42	11	53	19	34	5.7
121	Matties Hill	6	0	6	25	-19	4.9
121	Matties Hill	7	1	8	29	-21	4.8
121	Roanmore Terrace	49	12	61	16	45	7.3
121	Roanmore Terrace	26	8	34	16	18	3.6
122	Cannon Street	57	16	73	50	22	2.9
122	Cannon Street	48	26	74	45	29	3.8
122	Barrack Street	146	31	176	30	146	14.4
122	Barrack Street	123	43	166	26	139	14.2
123	Military road	58	66	124	57	67	7.1
123	Military road	90	68	158	69	89	8.3
123	Ozanam Street	49	76	125	56	69	7.3
123	Ozanam Street	33	27	60	22	39	6.1
123	Morrisson's road	95	22	117	88	29	2.9
123	Morrisson's road	85	53	138	55	83	8.5
123	Lower Yellow Road	54	8	62	55	7	1.0
123	Lower Yellow Road	48	19	67	57	11	1.4
125	Gracedieu Road	66	31	98	31	67	8.4
125	Gracedieu Road	92	41	134	39	94	10.2
125	Military road	90	68	158	18	140	14.9
125	Military road	58	66	124	17	107	12.7
125	Morgan Street	63	9	72	29	42	5.9
125	Morgan Street	43	2	45	27	17	2.9
125	Summerhill	60	96	156	18	138	14.8
125	Summerhill	86	94	180	19	161	16.2
126	Bridge Street	97	122	219	36	183	16.2
126	Bridge Street	148	104	251	40	211	17.5
126	Anne Street	17	1	18	34	-16	3.1
126	Anne Street	16	3	19	30	-11	2.2
127	Bridge Street	134	145	279	32	247	19.8
127	Bridge Street	223	56	279	40	239	18.9
127	Grattan Quay	0	0	0	20	-20	6.3
127	Grattan Quay	0	0	0	15	-15	5.4
127	Bridge Street	194	24	218	16	201	18.6
127	Bridge Street	114	73	186	18	168	16.7
127	Merchants Quay	29	32	61	46	15	2.1
127	Merchants Quay	21	73	93	43	50	6.0

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Location		Walk Flow (AMM)	Walk Flow (PT Model)	Total Walk Flow	Count	Diff	GEH
129	Ballybricken	31	4	35	12	23	4.7
129	Ballybricken	14	2	16	12	4	1.0
129	Ballybricken	14	1	15	9	6	1.8
129	Ballybricken	31	5	36	7	29	6.2
130	Ballybricken	41	12	52	58	-6	0.8
130	Ballybricken	68	4	72	62	10	1.3
130	Ballybricken	14	2	16	16	0	0.1
130	Ballybricken	31	4	35	14	20	4.1
130	Patrick Street	0	0	0	58	-58	10.8
130	Patrick Street	0	0	0	60	-60	11.0
131	Stephen Street	38	13	52	45	7	1.0
131	Stephen Street	32	6	38	31	6	1.1
131	Newgate Street	19	3	23	43	-20	3.5
131	Newgate Street	32	1	33	58	-24	3.6
131	New Street	10	1	12	49	-38	6.8
131	New Street	5	3	8	39	-31	6.4
133	Silverwood	0	0	0	3	-3	2.3
133	Silverwood	0	0	0	3	-3	2.3
133	Rockshire Road	21	5	26	9	18	4.2
133	Rockshire Road	30	12	42	9	33	6.4
133	Rockshire Road	64	27	91	10	82	11.5
133	Rockshire Road	33	14	47	10	37	7.0
	TOTAL	8,208	2,880	11,089	4,150	6,939	79.5



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 Flows

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

Location		Cycle Flow (AMM)	Count	Difference	GEH
67	Terminus Street	6	0	6	3.4
67	Terminus Street	2	0	2	2.2
67	Bridge Street	11	0	11	4.7
67	Bridge Street	23	0	23	6.8
67	Dock Road	18	0	18	5.9
67	Dock Road	0	0	0	0.0
69	Gracedieu Heights	0	0	0	0.0
69	Gracedieu Heights	0	0	0	0.0
69	Carrickphienish Road	1	0	1	1.4
69	Carrickphienish Road	1	0	1	1.6
69	Gracedieu Heights	1	0	1	1.6
69	Gracedieu Heights	1	0	1	1.4
73	Six Cross Road	3	0	3	2.6
73	Six Cross Road	3	0	3	2.3
73	Outer Ring Road	0	0	0	1.0
73	Outer Ring Road	1	0	1	1.1
73	Kilbarry	1	0	1	1.0
73	Kilbarry	0	0	0	0.7
73	Outer Ring Road	4	0	4	2.7
73	Outer Ring Road	0	0	0	0.9
78	R686	0	0	0	0.0
78	R686	3	0	3	2.6
78	Cork Road	9	0	9	4.2
78	Cork Road	20	0	20	6.3
78	R680	20	0	20	6.3
78	R680	5	0	5	3.3
81	Tramore Road	0	0	0	0.0
81	Tramore Road	3	0	3	2.5
81	R709	4	0	4	2.9
81	R709	13	0	13	5.0
81	Tramore Road	0	0	0	0.0
81	Tramore Road	0	0	0	0.0
81	R709	14	0	14	5.2
81	R709	5	0	5	3.1

Location		Cycle Flow (AMM)	Count	Difference	GEH
82	R708	3	0	3	2.6
82	R708	8	0	8	4.1
82	Inner Ring Road	10	0	10	4.5
82	Inner Ring Road	14	0	14	5.3
82	Lower Grange	8	0	8	3.9
82	Lower Grange	3	0	3	2.4
82	The Folly	11	0	11	4.6
82	The Folly	6	0	6	3.6
83	Ballytruckle Road	1	0	0	0.5
83	Ballytruckle Road	4	5	-1	0.5
83	Poleberry	3	0	3	2.1
83	Poleberry	5	0	5	2.8
83	Ballytruckle Road	8	6	3	1.0
83	Ballytruckle Road	3	1	2	1.7
86	The Mall	5	0	5	3.1
86	The Mall	5	0	5	3.2
86	The Mall	2	0	2	1.9
86	The Mall	1	0	1	1.6
86	Lombard Street	6	0	6	3.4
86	Lombard Street	6	0	6	3.5
115	Belmont Road	3	0	3	2.3
115	Belmont Road	5	0	5	3.1
115	Belmont Road	5	0	5	3.1
115	Belmont Road	3	0	3	2.3
118	Cleaboy Road	5	0	5	3.1
118	Cleaboy Road	2	0	2	1.9
118	Keane's Road	0	0	0	0.8
118	Keane's Road	1	0	1	1.3
118	Upper Yellow Road	1	0	1	1.7
118	Upper Yellow Road	4	0	4	2.8
119	John's Hill	3	0	3	2.1
119	John's Hill	8	3	5	2.2
119	The Folly	6	2	5	2.3
119	The Folly	11	8	3	0.9
119	Upper Grange Road	13	6	7	2.1
119	Upper Grange Road	6	0	6	3.2
119	St Patrick's Way	6	3	3	1.2
119	St Patrick's Way	3	0	3	2.1
120	Upper Grange Road	6	0	6	3.5
120	Upper Grange Road	13	2	11	4.1
120	Upper Grange Road	11	2	10	3.8

Location		Cycle Flow (AMM)	Count	Difference	GEH
120	Upper Grange Road	6	0	6	3.4
120	Grange Park Ave	2	0	2	1.8
120	Grange Park Ave	1	0	1	1.4
121	Keane's Road	2	0	2	2.0
121	Keane's Road	1	0	1	1.6
121	Matties Hill	0	0	0	0.9
121	Matties Hill	0	0	0	0.9
121	Roanmore Terrace	2	0	2	1.8
121	Roanmore Terrace	2	0	2	2.2
122	Cannon Street	3	0	3	2.5
122	Cannon Street	6	1	4	2.3
122	Barrack Street	6	0	6	3.1
122	Barrack Street	10	0	9	4.1
123	Military road	10	1	9	3.6
123	Military road	4	1	4	2.2
123	Ozanam Street	2	0	2	2.0
123	Ozanam Street	2	0	2	1.7
123	Morrisson's road	6	1	5	2.6
123	Morrisson's road	10	2	8	3.3
123	Lower Yellow Road	2	1	1	0.8
123	Lower Yellow Road	3	0	3	2.4
125	Gracedieu Road	5	3	3	1.3
125	Gracedieu Road	4	1	3	2.0
125	Military road	4	0	4	3.0
125	Military road	10	1	9	3.9
125	Morgan Street	2	1	1	1.1
125	Morgan Street	3	3	1	0.4
125	Summerhill	10	1	9	4.0
125	Summerhill	5	0	5	3.1
126	Bridge Street	17	2	15	4.9
126	Bridge Street	7	0	7	3.4
126	Anne Street	0	0	0	0.9
126	Anne Street	1	0	1	0.6
127	Bridge Street	23	0	23	6.8
127	Bridge Street	11	0	11	4.7
127	Grattan Quay	0	0	0	0.0
127	Grattan Quay	0	0	0	0.0
127	Bridge Street	7	0	7	3.7
127	Bridge Street	18	0	18	6.0
127	Merchants Quay	5	0	5	3.0
127	Merchants Quay	6	0	6	3.3

Location		Cycle Flow (AMM)	Count	Difference	GEH
129	Ballybricken	2	2	0	0.3
129	Ballybricken	0	0	0	0.0
129	Ballybricken	0	0	0	0.0
129	Ballybricken	2	2	0	0.3
130	Ballybricken	6	3	3	1.5
130	Ballybricken	0	0	0	0.0
130	Ballybricken	0	0	0	0.0
130	Ballybricken	2	2	0	0.3
130	Patrick Street	0	0	0	0.9
130	Patrick Street	0	2	-2	1.9
131	Stephen Street	4	0	4	2.8
131	Stephen Street	5	2	2	1.3
131	Newgate Street	2	2	0	0.2
131	Newgate Street	1	0	0	0.3
131	New Street	2	1	1	1.1
131	New Street	0	0	0	0.0
133	Silverwood	0	0	0	0.0
133	Silverwood	0	0	0	0.0
133	Rockshire Road	3	0	2	1.7
133	Rockshire Road	2	0	2	2.0
133	Rockshire Road	2	0	2	2.2
133	Rockshire Road	6	0	5	3.0
	TOTAL	657	77	579	30.2

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
67	Terminus Street	2	0	2	1.9
67	Terminus Street	3	0	3	2.3
67	Bridge Street	13	0	13	5.2
67	Bridge Street	6	0	6	3.6
67	Dock Road	5	0	5	3.0
67	Dock Road	0	0	0	0.0
69	Gracedieu Heights	0	0	0	0.0
69	Gracedieu Heights	0	0	0	0.0
69	Carrickphienish Road	0	0	0	1.0
69	Carrickphienish Road	0	0	0	1.0
69	Gracedieu Heights	0	0	0	1.0
69	Gracedieu Heights	0	0	0	1.0
73	Six Cross Road	2	0	2	1.9
73	Six Cross Road	2	0	2	2.2
73	Outer Ring Road	0	0	0	1.0
73	Outer Ring Road	0	0	0	0.7
73	Kilbarry	0	0	0	0.5
73	Kilbarry	0	0	0	0.8
73	Outer Ring Road	0	0	0	0.8
73	Outer Ring Road	3	0	3	2.3
78	R686	0	0	0	0.0
78	R686	5	0	5	3.0
78	Cork Road	13	0	13	5.1
78	Cork Road	4	0	4	3.0
78	R680	4	0	4	3.0
78	R680	8	0	8	4.1
81	Tramore Road	0	0	0	0.0
81	Tramore Road	1	0	1	1.1
81	R709	8	0	8	4.0
81	R709	2	0	2	2.2
81	Tramore Road	0	0	0	0.0
81	Tramore Road	0	0	0	0.0
81	R709	2	0	2	2.2
81	R709	9	0	9	4.2
82	R708	4	0	4	2.8
82	R708	2	0	2	1.9
82	Inner Ring Road	9	0	9	4.2

Location		Cycle Flow (AMM)	Count	Difference	GEH
82	Inner Ring Road	5	0	5	3.2
82	Lower Grange	2	0	2	1.8
82	Lower Grange	4	0	4	2.8
82	The Folly	3	0	3	2.6
82	The Folly	7	0	7	3.7
83	Ballytruckle Road	2	3	0	0.3
83	Ballytruckle Road	1	1	-1	0.6
83	Poleberry	2	2	0	0.2
83	Poleberry	2	1	1	1.0
83	Ballytruckle Road	2	1	0	0.3
83	Ballytruckle Road	4	4	0	0.2
86	The Mall	4	0	4	3.0
86	The Mall	3	0	3	2.6
86	The Mall	1	0	1	1.4
86	The Mall	2	0	2	2.0
86	Lombard Street	4	0	4	2.7
86	Lombard Street	4	0	4	2.7
115	Belmont Road	3	0	3	2.4
115	Belmont Road	2	0	2	1.8
115	Belmont Road	2	0	2	1.8
115	Belmont Road	3	0	3	2.4
118	Cleaboy Road	1	0	1	1.2
118	Cleaboy Road	3	0	3	2.3
118	Keane's Road	1	0	1	1.1
118	Keane's Road	0	0	0	0.5
118	Upper Yellow Road	2	0	2	2.0
118	Upper Yellow Road	1	0	1	1.2
119	John's Hill	4	0	4	2.4
119	John's Hill	2	1	1	0.8
119	The Folly	7	2	5	2.5
119	The Folly	3	2	1	0.8
119	Upper Grange Road	3	1	2	1.3
119	Upper Grange Road	7	1	7	3.3
119	St Patrick's Way	2	2	0	0.2
119	St Patrick's Way	3	1	2	1.3
120	Upper Grange Road	7	1	6	2.8
120	Upper Grange Road	3	0	3	2.2
120	Upper Grange Road	3	0	3	2.1
120	Upper Grange Road	7	1	5	2.5
120	Grange Park Ave	0	0	0	0.9
120	Grange Park Ave	1	0	1	1.3

Location		Cycle Flow (AMM)	Count	Difference	GEH
121	Keane's Road	1	0	1	1.0
121	Keane's Road	1	0	1	1.7
121	Matties Hill	0	0	0	0.7
121	Matties Hill	0	0	0	0.6
121	Roanmore Terrace	2	0	2	1.8
121	Roanmore Terrace	1	0	1	1.2
122	Cannon Street	3	0	3	2.2
122	Cannon Street	1	2	-1	0.6
122	Barrack Street	5	2	3	1.7
122	Barrack Street	3	0	3	2.6
123	Military road	3	0	2	1.9
123	Military road	5	3	2	1.0
123	Ozanam Street	1	0	1	0.9
123	Ozanam Street	1	1	0	0.3
123	Morrisson's road	5	5	1	0.3
123	Morrisson's road	3	1	2	1.4
123	Lower Yellow Road	1	1	1	0.6
123	Lower Yellow Road	1	1	0	0.1
125	Gracedieu Road	2	2	1	0.5
125	Gracedieu Road	3	1	2	1.7
125	Military road	5	1	4	2.4
125	Military road	3	0	2	1.9
125	Morgan Street	2	1	1	0.8
125	Morgan Street	1	1	0	0.0
125	Summerhill	3	0	3	2.2
125	Summerhill	6	1	4	2.2
126	Bridge Street	6	1	4	2.3
126	Bridge Street	7	2	6	2.6
126	Anne Street	0	0	0	0.8
126	Anne Street	0	0	0	0.1
127	Bridge Street	6	0	6	3.6
127	Bridge Street	13	0	13	5.2
127	Grattan Quay	0	0	0	0.0
127	Grattan Quay	0	0	0	0.0
127	Bridge Street	7	0	7	3.9
127	Bridge Street	6	0	6	3.5
127	Merchants Quay	7	0	7	3.7
127	Merchants Quay	1	0	1	1.7
129	Ballybricken	2	1	1	1.2
129	Ballybricken	0	0	0	0.0
129	Ballybricken	0	0	0	0.0

Location		Cycle Flow (AMM)	Count	Difference	GEH
129	Ballybricken	2	1	1	1.2
130	Ballybricken	2	1	1	0.9
130	Ballybricken	0	0	0	0.0
130	Ballybricken	0	0	0	0.0
130	Ballybricken	2	1	1	1.2
130	Patrick Street	0	1	-1	1.2
130	Patrick Street	0	1	-1	1.5
131	Stephen Street	3	0	3	2.6
131	Stephen Street	2	0	2	1.9
131	Newgate Street	0	0	0	0.7
131	Newgate Street	1	0	1	1.6
131	New Street	1	0	1	1.7
131	New Street	0	0	0	0.0
133	Silverwood	0	0	0	0.0
133	Silverwood	0	0	0	0.8
133	Rockshire Road	1	0	1	1.4
133	Rockshire Road	2	0	2	1.5
133	Rockshire Road	4	1	3	2.1
133	Rockshire Road	1	0	1	1.5
	TOTAL	377	62	315	21.3

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 East 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 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 for both walk and cycle 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 SERM.

4.4 Recommendations

Following the development and the calibration/validation of the overall SERM, 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.

Údarás Náisiúnta lompair 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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