Wirral Traffic Model 2015 Model Extension and Rebase

Local Model Validation Report

April 2016

Mott MacDonald

Wirral Traffic Model
2015 Model Extension and Rebase

Local Model Validation Report

April 2016

Mott MacDonald

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
A	07.04.2016	Harry Probert	Sarah Pierce	Nick Green	Issue

Information class: Standard

This document is issued for the party which commissioned it and for specific purposes connected with the above-captioned project only. It should not be relied upon by any other party or used for any other purpose.

We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from us and from the party which commissioned it.

Contents

Executive Summary

Mott MacDonald has been appointed by Wirral Council to undertake an extension of the East Wirral Traffic Model (EWTM) to include the entire Wirral district, and rebase the model to represent 2015 traffic conditions. This has led to the creation of the Wirral Traffic Model (WTM).

A series of surveys have been undertaken to inform the update of WTM. These consist of a set of Automatic Traffic Counts (ATC) on model cordons and screenlines, seven Roadside Interviews (RSIs) to provide details on trip origins and destinations along the M53 corridor and origin-destination surveys at the Kingsway and Queensway Tunnels (carried out by Merseytravel).

The model has been calibrated against a comprehensive count data-set, arranged over cordons and screenlines. The flow calibration results show a good match to observed flows when compared at an individual and collective level. The calibration statistics achieve the recommended Department for Transport's Appraisal Guidance (WebTAG) guidance of 85% of the sample achieving the specified flow criteria.

The 'individual count' comparisons show that the model exceeds the TAG recommended threshold of 85% of links achieving a flow difference of GEH less than 5. The results achieved for the AM, IP and PM time periods are 94%, 98% and 97%, respectively. When compared to the TAG flow difference criteria, all time periods also exceed the recommended 85% threshold, with the AM, IP and PM modelled hours achieving a flow calibration of 95%, 99%, and 97% respectively.

Collectively, when the counts are formed over cordons/screenlines, it is evident that the model achieves a good correspondence to TAG flow difference criteria (less than 5%), with the AM, IP and PM achieving 96%, 100%, and 92%, respectively.

An independent model validation of traffic flows has been undertaken using available count data that has not been used for model development. The independent model validation shows a reasonable performance against TAG criteria. The AM, IP and PM time periods achieve a 75%, 75% and 70% match

against the TAG flow difference threshold (GEH < 5). When compared to the TAG flow difference criteria the AM, IP and PM time periods achieve 70%, 85% and 75% respectively.

The model has also been validated from the comparison of observed and modelled journey times for a sample of sixteen routes (32 routes by direction). The model achieves a 100% match against TAG time difference criteria in all time periods (where the TAG criteria is within 15% or 1 minute if higher).

In summary, the 2015 base year model performance demonstrates that the model is a suitable platform for the development of future year traffic models to support the following requirements:

- prediction of future congestion levels and the subsequent impact on network operation;
- detailed assessment of highway impacts associated with proposed land use developments and transport policy changes; and also
- to assess the impacts of major highway improvement schemes.

350170/ITD/ITN/1/A 07 April 2016
\\mottmac\project\Liverpool\ITD\MISData\Modelling\WirralModel\WP5-BaseYearAssignments\WP5a-
Documents\Wirral_2015_Model_Rebase_LMVR_RevA_Draft_v2.docx

ii

1   Introduction

1.1   Project Brief

Mott MacDonald has been appointed by Wirral Council to undertake an extension of the East Wirral Traffic Model (EWTM) to include the entire Wirral district, and rebase the model to represent 2015 traffic conditions.

The update of the EWTM to a model of the entire district has led to the creation of the Wirral Traffic Model (WTM) and is a valuable exercise for a number of reasons. Firstly, to provide an enhanced representation of traffic movements in west Wirral; secondly to better represent current traffic levels in the study area; and finally continued investment in the model ensures that this valued asset is maintained.

1.2   Background

The EWTM was originally developed by Mott MacDonald as a 2008 base year model. The EWTM is a lower-tier local highway model to the over-arching, strategic level, Liverpool City Region Transport Model (LCRTM).

The development of EWTM was initially undertaken in 2010 following the completion of LCRTM. The model was built using data from the Wirral 2009 Road Side Interview (RSI) survey commission and also utilised data sources collected for the development of LCRTM. The EWTM base year was set at 2008 to be consistent with the LCRTM.

A model update was subsequently undertaken in autumn 2010 to include traffic survey data that was not available during the time-frame for the development of the original model. It was identified that there was substantial merit to include further data to enhance observed trip movements; and to provide supplementary comparisons between observed and modelled traffic conditions

The objectives for carrying out the 2008 base year model update were as follows:
1. To enhance and refine origin and destination trip movements outside of the Birkenhead town centre cordons, using Ellesmere Port RSI data;
2. To provide additional calibration / validation comparisons within the Birkenhead area;
3. To provide supplementary comparisons in relation to competing journey time routes; and
4. To calibrate / validate flows within the Bromborough Local Development Framework (LDF) area.

For background information relating to the development of the 2008 base year model and subsequent update, reference should be made to the following reports:
- 2008 Local Model Validation Report[1]; and
- 2008 Addendum Report[2].

---

[1] 2008 Base Year Model Version 1 - EWTM SATURN Model LMVR V01.pdf

[2] 2008 Base Year Model Version 2 - 283902-EWTM_LMVR_Addendum_Report_RevC.pdf

The model was then updated to represent 2012 traffic conditions. This update of EWTM was undertaken to make use of newly available data in the form of traffic counts collected for the rebase of the LCRTM model to a 2012 base year. This update had the benefits of keeping EWTM remaining directly compatible with LCRTM; better representing current traffic levels in the study area and improving the reliability of the model as a basis for forecasting; and finally continued investment in the model ensured that this valued asset was maintained.

For background information relating to the development of the 2012 base year model, reference should be made to the following report:
- 2012 Local Model Validation Report[3]

In relation to model application, the EWTM model has been used as a base for the development of forecasting models that have been applied to provide an evidence base in support of Wirral Council's Local Development Framework - Core Strategy and to support funding bids in relation to the Wirral Docks Bridges.

1.3 Requirements of the Wirral Traffic Model

The WTM has been developed to extend the functionality of the EWTM over the *entire* Wirral district and thus fulfil the following key objectives at a district level:
- To assess the impact of land use and transport policy changes on the local highway network;
- To provide an evidence base to support major scheme business cases; and
- To assess the impact of future levels of congestion.

1.4 Geographic Coverage of the Wirral Traffic Model and Network Hierarchy

The geographical coverage of the WTM is shown in Figure 1.1. Three levels of network detail are included in the model:

- Simulation area;
- Buffer area; and
- External area.

The *Simulation Area* is defined as the entire Wirral district. Within the simulation area junction delay is modelled in detail and influences route choice.

The *Buffer Area* is needed to allow vehicles to enter the simulation area via the most sensible route. It is not necessary to model junction delay in this area. For the WTM the buffer area boundary is equivalent to the study area of the LCRTM model and comprises the districts of Liverpool, Halton, Warrington, Knowsley, St Helens, Sefton and West Lancashire.

---

[3] EWTM 2012 Model Rebase LMVR RevB.pdf

The area outside of the boundary, which is effectively the rest of the UK, is referred to as the *External Area* of the model.

The extent of the network included within the WTM simulation area, and an indication of the junctions coded ("simulation node"), is presented in Figure 1.2.

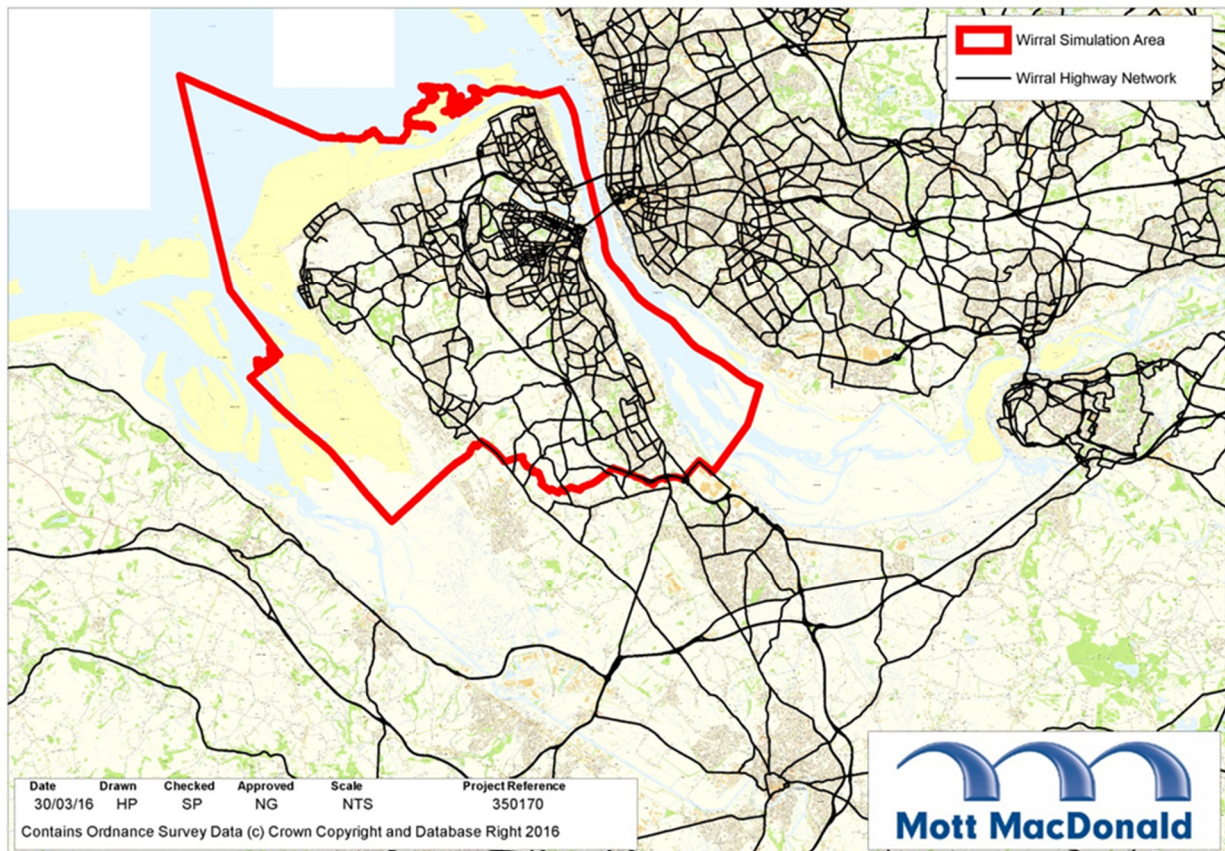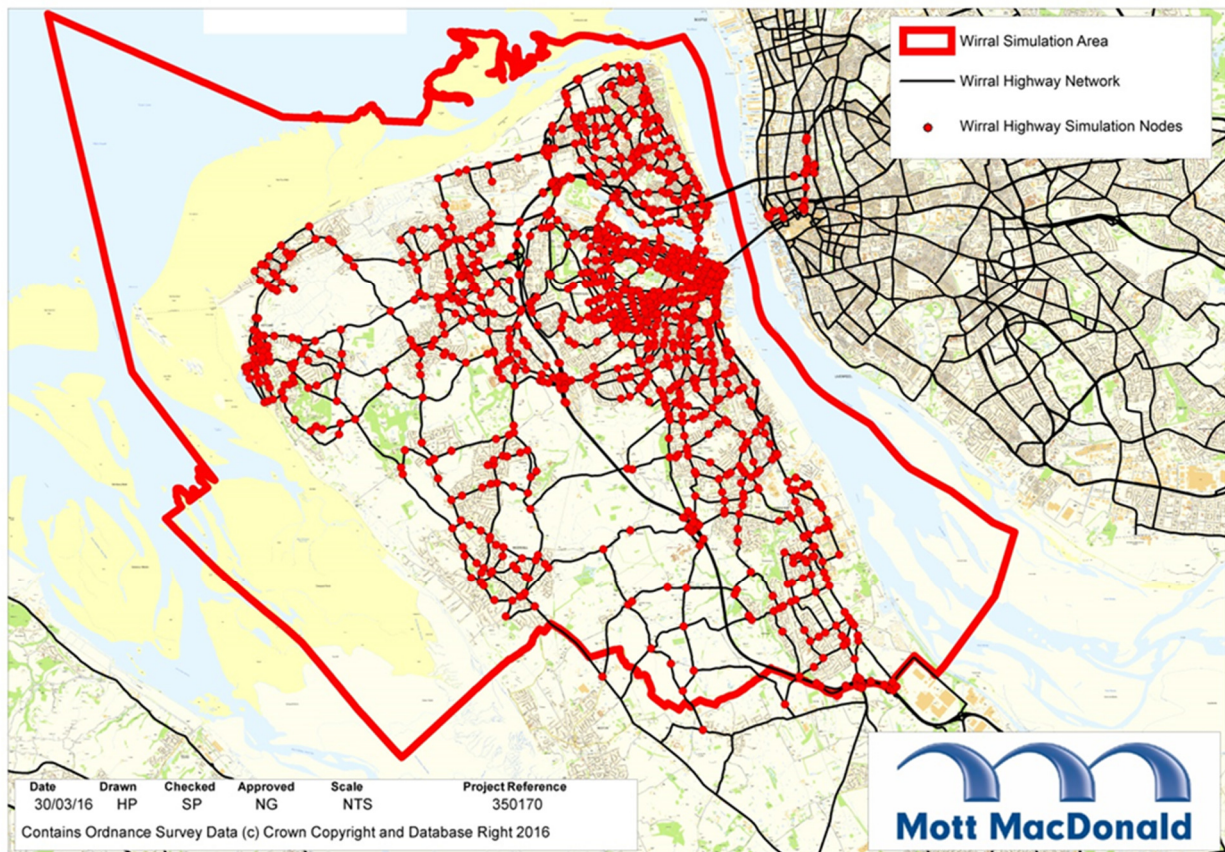Figure 1.1:   Geographical Extent of the WTM Study Area

Figure 1.2:   WTM Network and Nodes in the Model Simulation Area

1.5   Wirral Traffic Model Overview

1.5.1   Software

The WTM model has been developed using SATURN software version 11.3.12U.

1.5.2   Base Year

The base year model represents an average weekday in October 2015.

1.5.3   Modelled Time Periods

- Assignment models have been developed for the following time periods:
- AM peak hour (08:00 – 09:00);
- Average inter peak hour (10:00 – 16:00); and
- PM peak hour (17:00 – 18:00).

1.5.4   Assignment User Classes

- The following assignment user classes (UC) are represented in the WTM:
- UC1 - Car Commute;
- UC2 - Car Other;
- UC3 - Car Employers Business;
- UC4 – Light Goods Vehicles (LGV); and
- UC5 – Other Goods Vehicles (OGV).

Buses are coded into the network as a fixed flow by time period, and their utilisation of highway capacity is taken into account in the assignment of other road vehicles.

1.6   Report Structure

This report documents the development of WTM - 2015 Base Year model. The content and structure of this report is as follows:

- Chapter 2 identifies the updates to the highway network;
- Chapter 3 documents the data collection for the model update;
- Chapter 4 discusses the development of highway demand matrices;
- Chapter 5 presents the model calibration performance;
- Chapter 6 discusses the independent model validation; and
- Chapter 7 presents conclusions from the model development.

2 Network Update

2.1 Scope of Highway Network Update

The extension of the highway network has comprised of the following elements:
- A review of East Wirral coding and traffic signal staging and timings (in conjunction with Wirral Council);
- Additional network detail in West Wirral (as presented in Figure 1.2);
- Coding of all junctions in West Wirral, including traffic signal staging and timings;
- Update of bus volumes;
- Update of the buffer network to take into account the latest version of LCRTM; and
- Update of generalised cost coefficients and toll values.

Full details of the network development are presented in Appendix B.

2.2 Generalised Cost Coefficients and Toll Values

Assignment of vehicles is based on the lowest cost route that combines both journey times, vehicle operating costs and toll charges, by means of a generalised cost.

The generalised cost coefficient values: pence per minute (PPM); and pence per kilometre (PPK) for model assignment are shown in Table 2.1. These values are representative of 2010 prices, consistent with TAG guidance. It must be noted that the value of time for OGVs has been factored by a value of 2.3 to take account of the influence of owners on the routing of vehicles[4]

Table 2.1:   2015 Base Year - Generalised Cost Coefficients

	Car Commute	Car Other	Car EB	LGV	OGV
PPM	14.81	19.96	50.05	22.95	53.46
PPK	7.75	7.75	15.60	15.37	55.68

The Mersey Tunnel toll values included for model assignment are shown in Table 2.2.

Table 2.2:   Mersey Tunnel Toll Values for Model Assignment

User Class	2015 Toll Value (Pence) (2015 Prices)	2015 Toll Value (Pence) (2015 Prices)	2015 Toll Value (Pence) (2015 Prices)
Car Commute	170	150	144
Car Other	170	150	144
Car Employers Business	170	150	144
LGV	340	300	289
OGV	595	525	506

---

[4] Section 2.8, Department for Transport's Transport Appraisal Guidance (TAG) Unit M3.1 Highway Assignment Modelling

3 Data Collection

3.1 Background

The development of EWTM was based on a comprehensive data collection exercise in 2009 and 2010. In addition, the model development made best use of available traffic survey data collected for the development of the LCRTM, and also consisted of a large scale collection of Road Side Interview (RSI) data, along with supporting Automatic Traffic Count (ATC) and Manual Classified Count (MCC) data in the autumn of 2009 for EWTM.

The RSI survey that was commissioned by Wirral Council in autumn 2009 for the development of EWTM was comprised of a total of 25 surveys, which formed an inner and outer cordon of the Birkenhead and north east Wirral areas. Figure 3.1 shows the locations of Wirral 2009 RSI surveys.

The model also included RSI data sourced from the Ellesmere Port Town Centre Model, and also made use of ATC and MCC data collected from a data collection exercise in 2010 to enhance the Bromborough Local Development Framework (LDF) - Employment Area and the Birkenhead town centre area of EWTM. Figure 3.2 shows the location of Ellesmere Port 2010 RSI surveys.

Reference should be made to the following reports which document the collection of traffic survey data that was utilised for the development of the 2008 base year model:
- 2008 LMVR; and
- 2008 LMVR Addendum Report.

An ATC commission comprising of 82 surveys was carried out in June 2013, specifically for rebasing EWTM to a 2012 base year. In addition, model development has also taken account of traffic survey data (~19 counts) that was collected in autumn 2012, and spring 2013 for the development of the LCRTM 2012 base year model. All ATC traffic surveys were undertaken for a two-week neutral period.

Following a review of the existing traffic survey data-set and consultation with Wirral Council, it was agreed that there would be no requirement to collect new RSI data as there was a substantial amount of data that was within a three-year time-frame of the model base year of 2012.

Reference should be made to the following reports which document the collection of traffic survey data that was utilised for the development of the 2012 base year model:
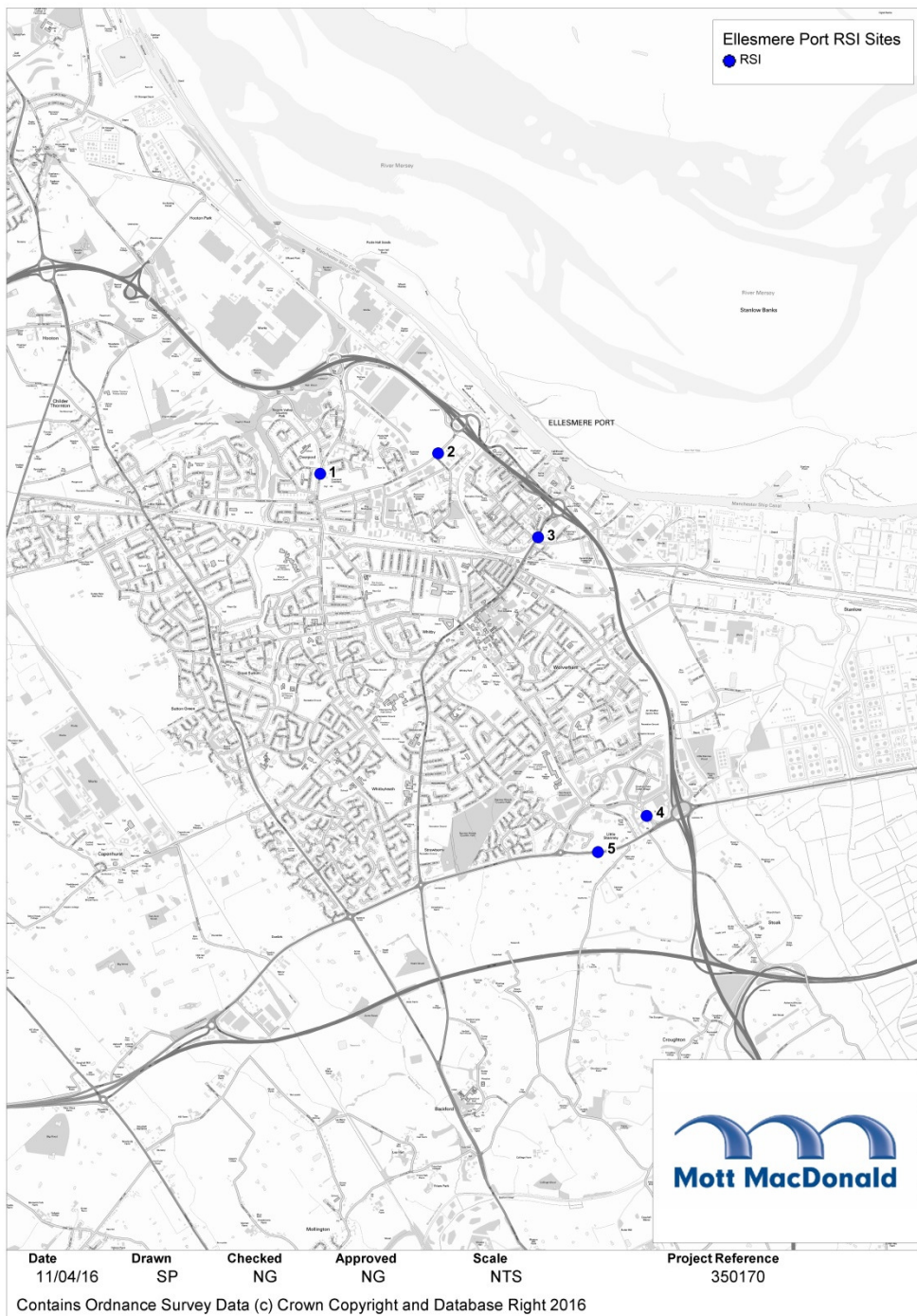- 2012 Local Model Validation Report

The data collection undertaken for the update and extension of the Wirral Traffic Model (WTM) is described in this section.

Figure 3.1: 2009 Wirral RSI Surveys

Figure 3.2:   2010 Ellesmere Port RSI Surveys

3.2   Scope of Traffic Survey Data Collection

A series of surveys have been undertaken to inform the update of WTM. These consist of a set of Automatic Traffic Counts (ATC) on model cordons and screenlines, seven Roadside Interviews (RSIs) to provide details on trip origins and destinations along the M53 corridor and origin-destination surveys at the Kingsway and Queensway Tunnels (carried out by Merseytravel).

The origin-destination information for the Kingsway and Queensway Tunnels was collected as part of the Mersey Tunnel Customer Survey. This was a postcard survey incorporating details on trip origins and destinations as well as questions specific to the Tunnels.

Figure 3.3 presents the location of the ATCs and Figure 3.4 the location of the origin-destination surveys. Full details of the survey locations can be found in Appendix A.

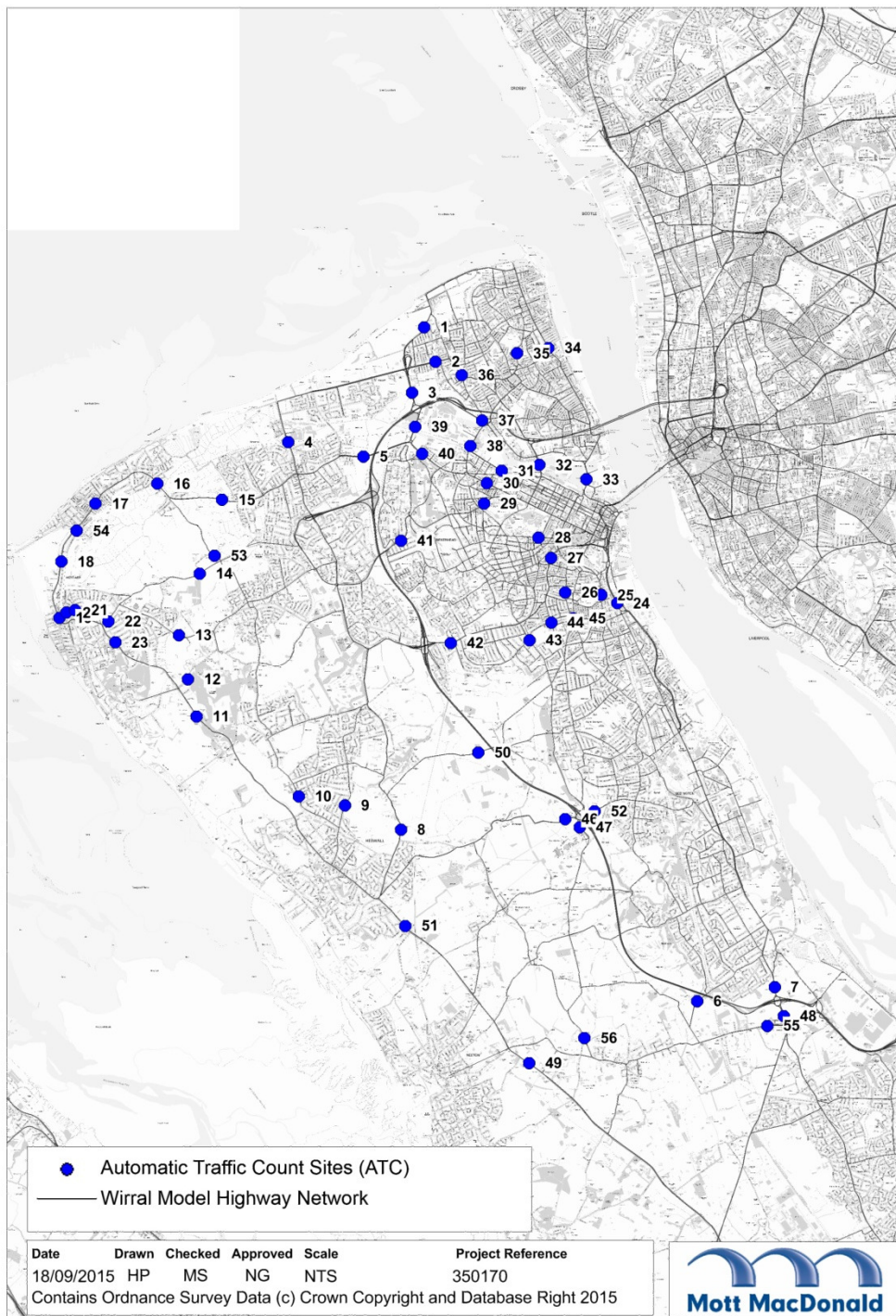Figure 3.3: WTM 2015: Location of Traffic Count Surveys

Figure 3.4:   WTM: Location of 2015 Origin-Destination Surveys

3.3 Origin Destination Surveys – Data Checks

The following checks were undertaken on the origin destination data:
- the time the survey was undertaken was within the survey period of 07:00 to 19:00;
- vehicle occupancies were appropriate: car occupancy should not be greater than 7, motorcycle not greater than 2 and LGV, OGV1 and OGV2 not greater than 3;
- postcode and purpose: all data was checked for the presence of records with the same origin/destination postcode or journey purpose;
- journey purpose: the proportion of trips by origin and destination purposes were reviewed in relation to the site location in order to convey any systematic problems with the data;
- ATC cross-check: manual vehicle counts from interview and postcard sites were compared with the ATC data for the same site; and
- origin and destination check: origin and destination postcodes were plotted and visually checked that the journey records were in the appropriate direction (i.e. the origin and destination appeared on the correct side of the survey location) and that the recorded trip was likely to have passed through the survey site.

3.4 Traffic Survey – Data Processing Checks

Extensive checks have been carried out during data processing to check the reliability and accuracy of data. The ATC survey data has been checked to ensure that the following appears reasonable:
- traffic flow volumes;
- flow tidality;
- peak hour flows; and
- hourly flow profiles.

Reference should be made to Figure 3.5, which shows an example of hourly flow profiles (all vehicles) by direction for Site 1: Bayswater Road, Wallasey and has been checked for reasonableness against the criteria above.

Figure 3.5:   Site 1 – Bayswater Road, Wallasey - Hourly Flow Profiles by Direction
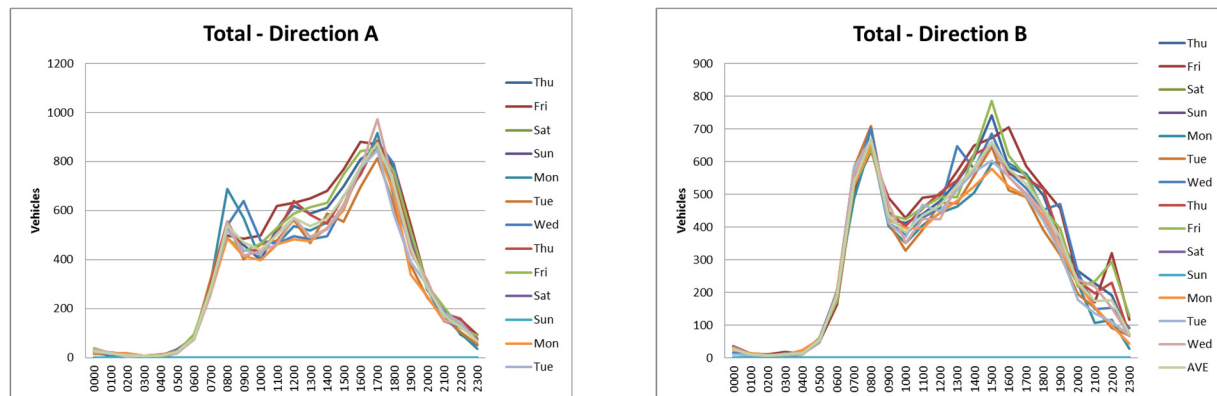
3.5   Scope of Observed Journey Time Data Collection

Observed journey time data for has been extracted from the Trafficmaster database. This database developed by Trafficmaster captures the movements of fleet vehicles across the UK using GPS technology.

The journey time data has been extracted for September 2014 to March 2015 to provide details of the cruise speed of each road, and to validate the model journey times.