North Yorkshire County Council

CATTERICK TRAFFIC MODEL

Local Model Validation Report

V01
MARCH 2020

CONFIDENTIAL

North Yorkshire County Council

CATTERICK TRAFFIC MODEL

Local Model Validation Report

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70040744

OUR REF. NO. V01

DATE: MARCH 2020

WSP

Three White Rose Office Park
Millshaw Park Lane
Leeds
LS11 0DL

Phone: +44 113 395 6200

Fax: +44 113 395 6201

WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Issue			
Date	March 2020			
Prepared by	Samuel Callaghan			
Signature	SG			
Checked by	Narendra Sadhale			
Signature	NSS			
Authorised by	Richard Crossley			
Signature	RC			
Project number	70040744			
Report number	01			
File reference	NYCC_Catterick Model LMVR_v01_Final.docx			

This Report is presented to North Yorkshire County Council and may not be used or relied on by any other person or by the client in relation to any other matters not covered specifically by the scope of this Report.

Notwithstanding anything to the contrary contained in the Report, WSP Limited is obliged to exercise reasonable skill, care and diligence in the performance of the services required by 'North Yorkshire County Council' and WSP Limited shall not be liable except to the extent that it has failed to exercise reasonable skill, care and diligence, and this report shall be read and construed accordingly.

This North Yorkshire County Council Report has been prepared by WSP Limited. No individual is personally liable in connection with the preparation of this Report. By receiving this Report and acting on it, the client or any other person accepts that no individual is personally liable whether in contract, tort, for breach of statutory duty or otherwise.

CONTENTS

TABLES

FIGURES

APPENDICES

SPEED FLOW CURVES

APPENDIX B

EXAMPLE RSI FORM

APPENDIX C

RSI RELATED ADJUSTMENTS

APPENDIX D

NETWORK ACCEPTANCE CHECKS

APPENDIX E

EFFECTS OF MATIX ESTIMATION

APPENDIX F

FLOW CALIBRATION AND VALIDATION

APPENDIX G

JOURNEY TIME ROUTE PLOTS

APPENDIX H

TRAFFIC DATA REPORT

1 INTRODUCTION

1.1 BACKGROUND TO CATTERICK MODEL

National planning policy places Local Plans at the heart of the planning system, so it is essential that they are in place and kept up to date. Local Plans set out a vision and a framework for the future development of the area, addressing needs and opportunities in relation to housing, the economy, community facilities and infrastructure.

Richmondshire District Council (RDC) is the local planning authority, whose administrative area includes the towns of Richmond, Catterick Garrison and Leyburn.

The Council is preparing a Review of the Local Plan which will include a Masterplan for the growth of Catterick Garrison.

RDC wishes to test the transport impacts of the development of the Garrison and the associated development of the sites in Catterick Garrison. The Strategic Highway Model (SHM) is required to assist NYCC's transport and development teams to review and determine the transport impacts of proposed Garrison developments.

North Yorkshire County Council has requested its transport consultants, WSP, to develop a new Strategic Highway Model (SHM) for the area covering the areas of Easby, Hipswell, Colburn, Scotton, Tunstall and Catterick Garrison. The model outputs must stand up to scrutiny through the Examination in Public (EiP) of the Local Plan Review.

RDC and NYCC previously had a SATURN traffic model developed using 2009 base data.

This report covers the Development and Validation of the Model in form of a Local Model Validation Report

1.2 STRUCTURE OF REPORT

The subsequent content of this report is structured as follows:

- Chapter 2 – model descriptions and modelling structures;
- Chapter 3 – model standards.
- Chapter 4 – data collection that was used for the model development;
- Chapter 5 – development of the highway network, including junctions, links and volume delay relations.
- Chapter 6 – highway trip matrix development, including surveys, other sources of data, expansion and merging of data.
- Chapter 7 – model calibration methods. This include network, route choice, trip matrix and assignment calibrations and levels of acceptability;
- Chapter 8 – model validation results. This includes flow and journey time validation; and
- Chapter 9 – conclusion and summary

2 MODEL DESCRIPTION

2.1 OVERALL MODELLING STRUCTURE

A SATURN highway assignment model has been developed to fulfil the objectives identified in the brief. SATURN is the most established highway assignment modelling software in the UK due to its enhanced simulation routines. Further, it has the ability to interact with other software packages including software focussed on demand modelling and GIS software for presentation purposes

2.2 STUDY AREA

A study area has been defined to cover Catterick Garrison and Catterick Village as shown in **Figure 2-1**.

The area highlighted in green shows the extent of the core modelling area (simulation area) where the highway network and junctions have been coded in detail. It provides a sufficient area of detailed modelling to allow developments to be rigorously tested within and in proximity to areas of interest.

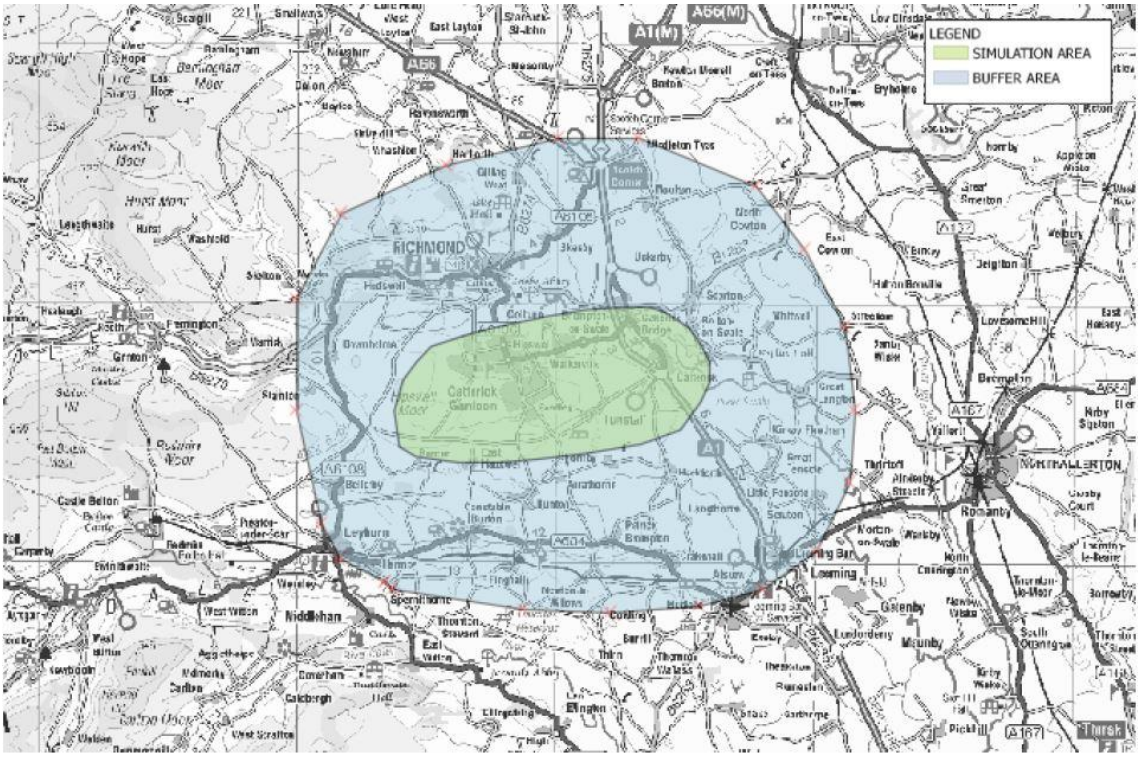
The area highlighted in blue shows extents of the immediate (local) buffer modelling area where the highway network has been coded in less detail. Including these areas within the local buffer area allows coverage of highway network in the adjacent areas to adequately model them as destination choices.

The remainder of Richmondshire District forms an area of skeletal network coverage (strategic roads only) to allow connection to the rest of the country and other areas in the country.

It should be noted that although the junctions outside the simulation area have not been modelled in as much detail, the model will accurately assess route choice. The ‘buffer area’ thus provides an accurate assessment of route choice to / from the simulation area, but does not provide enough detail for a detailed assessment of those junctions.

The simulation area extends east of Catterick Village up to the River Swale and up to Brompton on Swale to the north. To the south the simulation area extends to south of Moor Lane covering the villages of Scotton and Tunstall. To the west the simulation area extends to Range Road covering the areas of Vimy Barracks and the Catterick Golf Club.

Figure 2-1 - Study Area



2.3 MODELLED PERIODS

Traffic patterns, trip purposes and vehicle type proportions, traffic flows and congestion vary by time of day. WebTAG M3.1 states that highway assignment models should therefore normally represent the morning and evening peaks and the inter-peak period as a minimum.

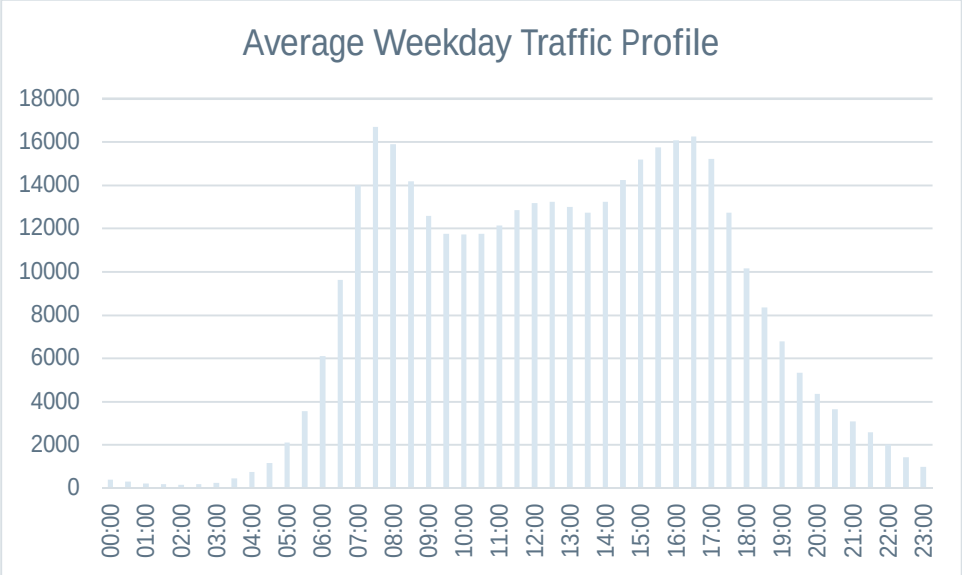
As agreed with NYCC, the base year model was developed to represent an average neutral weekday in 2019. Any data collected outside of the neutral period of 2019 has been therefore adjusted where appropriate. Only data collected from “neutral” traffic months has been used thereby limiting the impacts of seasonality.

As agreed with NYCC, the three models have been developed for the base year 2019 that represent three peak hours for an average weekday, which covers:

- AM peak hour model;
- Average inter-peak period model; and
- PM peak hour model.

Analysis of all the observed count data within the study area (including commissioned traffic survey and available data source) indicates the distinction in terms of traffic volume during the peak hour. **Figure 2-2** provides a summary of an average weekday flow profile that has been obtained from the observed traffic count data.

Figure 2-2 - Average Weekday Traffic Profile



Based on the traffic profile, it was decided that apart from the inter-peak model, the two distinct peak hour models will be developed to represent the AM and PM peak hours as below.

- AM Peak Hour (0730-0830);
- Inter-Peak Average hour of flows from (1000-1600); and
- PM Peak Hour (1630-1730).

2.4 ASSIGNMENT USER CLASSES

As stated in section 2.6 of the WebTAG M3.1, operating costs vary by vehicle type and values of time vary by the purpose of the trip being made. This means that different combinations of vehicle and user may have different distance coefficients and therefore should be modelled separately as they are likely to choose different routes through the network.

The demand matrices should therefore be split into a number of user classes, each of which should have distinctly different distance coefficients in their generalised cost formulation.

- For the purpose of the highway models for Catterick, it was decided that 5 user classes would be modelled separately, in accordance with the WebTAG M3.1, as below:
- Car – Employer Business;
- Car – Commuting;
- Car – Others;
- LGV; and
- HGV

All the demand segments that were produced during the development of the demand matrices (described in detail in the matrix Development chapter) were therefore aggregated to the 5 user classes prior to carrying out the highway assignment models.

2.5 MODEL PLATFORM

SATURN version 11.4.07H has been used for the highway model development.

3 MODEL STANDARDS

3.1 OVERVIEW

The model has been developed in accordance with guidance in WebTAG 2 Unit M3-1: Highway Assignment Modelling, which is important to ensure that the base year model is suitable for future use of model for local plan testing.

This states that comparisons should be carried out in three areas:

- Assigned flows and counts totalled for each screenline or cordon as a check on the quality of the trip matrices;
- Modelled and observed journey times along routes as a check on the quality of the assignment; and
- Assigned flows and counts on individual links and turning movements at junctions as a check on the quality of the network and the assignment.

3.2 NETWORK CALIBRATION STANDARDS

Upon completion of the network coding, a number of checks were carried out to ensure that the network coding is satisfactorily, as far as can be determined, before commencement of the calibration/validation stage. A total of 6 tests were undertaken as below:

- Test 1 – completeness check: to ensure that the network produced is complete according to the scope agreed with the NYCC;
- Test 2 – SATURN compilation check: to ensure that all the errors/warnings produced by SATURN have been reviewed and addressed;
- Test 3 – Inspection of key junctions: to ensure that all the key junctions within the study area are codded accurately;
- Test 4 – link consistency check: to ensure that link type, distance, speed limit, etc. are consistent between directions and up/downstream links;
- Test 5 – network routeing: to ensure that routeings on the network are realistic; and
- Test 6 – flat matrix assignment check: to ensure that the model assignment with a flat matrix produces plausible set of routeings and also to investigate whether or not locations with excessively high delays are a result of significantly high traffic or due to coding error.

For test 4, the number of OD pairs that should be examined is set out in TAG Unit 3-1; this is relative to the size of the model using the following expression:

Number of OD pairs = $(number\ of\ zones)^{0.25} \times number\ of\ user\ classes$

Based on the initial proposed zoning system, this equates to 18 routes.

Route choice tests were carried out during the network build using the ‘Tree Build’ feature within SATURN and comparing this against Google Maps route planning tool. This ensured that the routing in the network is logical and representative of ‘on the ground’ behaviour and choices.

This is extended into the calibration process using ‘Select Link’ analysis within SATURN for the number of OD pairs formulated above whereby the chosen routes:

- Relate to a significant number of trips;
- Are of significant length or costs;
- Pass through the areas of interest;
- Coincide with journey time routes; and

- Are analysed separately by user class.

3.3 MATRIX CALIBRATION STANDARDS

The developed trip matrices have been assigned for each modelled period and the modelled flows compared at a full screenline level against the observed counts. A matrix estimation (ME) process has been used to refine the trip matrices by vehicle type.

In this instance, the changes brought about by ME have been reported against the significance checks given in TAG Unit M3-1 and reproduced in **Table 3-1**. Any exceedance of these criteria has been examined and assessed for their importance to the accuracy around the FMA.

Table 3-1 Significance of Matrix Estimation Changes

Measure	Significance Criteria
Matrix zonal cell values	Slope within 0.98 and 1.02; intercept near zero; R2 > 0.95
Matrix zonal trip ends	Slope within 0.99 and 1.01; intercept near zero; R2 > 0.98
Trip length distributions	Means within 5%; standard deviations within 5%
Sector to sector level matrices	Differences within 5%

The trip matrices have been validated against the criteria set out in **Table 3-3**, reproduced from TAG Unit M3-1.

Presentation of the outputs is in accordance with the reporting guidelines as follows:

- Screenlines have been made up of 5 links or more;
- The comparisons for screenlines containing high flow routes such as motorways have been presented both including and excluding such routes; and
- The comparisons have been presented by vehicle type, by modelled time period and separately for (a) RSI screenlines, (b) other screenlines used as constraints in the ME process and (c) screenlines used for independent validation.

3.4 LINK & SCREENLINE FLOW CALIBRATION AND VALIDATION CRITERIA

The measures used for link flow validation are:

- The absolute and percentage differences between modelled flows and counts; and
- The GEH statistic which is a hybrid of the Chi-squared statistic to incorporate both relative and absolute errors. It is defined by

$$GEH = \sqrt{\frac{(M-C)^2}{(M+2)/2}}$$

- Where: M is the modelled flow and C is the observed flow.

Both measures are considered broadly consistent and meeting either is considered generally satisfactory by TAG Unit M3-1. The following should be noted:

- The above criteria have been applied to both link flow and turning movements however it is accepted that it may be more difficult to achieve for the latter;

- The comparisons have been presented separately for each modelled time period for all vehicles; and
- comparisons against both measures have been reported in this LMVR.

The acceptability criteria are given in **Table 3-2**, reproduced from TAG Unit M3-1.

Table 3-2 Link Flow and Turning Movement Validation Criteria

Criteria	Description	Acceptability Guideline
1	Individual flows within 100 veh/hr of counts for flows less than 700 veh/hr	> 85% of cases
	Individual flows within 15% of counts for flows from 700 veh/hr to 2,700 veh/hr	> 85% of cases
	Individual flows within 400 veh/hr of counts for flows more than 2,700 veh/hr	> 85% of cases
2	GEH < 5 for individual flows	> 85% of cases

In addition, the following stipulation is indicated for screenlines (**Table 3-3**)

Table 3-3 Screenline Criteria

Criteria	Acceptability Guideline
Differences between modelled flows and counts should be less than 5% of the counts	All or nearly all screenlines

3.5 JOURNEY TIME VALIDATION CRITERIA

Journey time routes have been validated against the criteria set out in **Table 3-4**, reproduced from TAG Unit M3-1.

Presentation of the outputs is in accordance with the reporting guidelines as follows:

- Comparisons have been presented for all vehicles; and
- Comparisons have been presented separately by modelled period.

Table 3-4 Journey Time Routes Validation Criteria

Criteria	Acceptability Guideline
Modelled times along routes should be within 15% of surveyed times (or 1 minute if higher than 15%)	> 85% of routes

3.6 ASSIGNMENT METHODOLOGY AND CONVERGENCE CRITERIA

The assignment model splits the trips according to the route they take through the network, and then calculates the cost of travelling via each route. The assignment procedure used for the highway model is based on an equilibrium assignment with multiple demand segments for three modelled time periods.

Model assignment of trips to the highway network was undertaken using a standard approach based on a 'Wardrop User Equilibrium', which seeks to minimise travel costs for all vehicles in the network. The Wardrop User Equilibrium is based on the following proposition:

"*Traffic arranges itself on congested networks such that the cost of travel on all routes used between each origin-destination pair is equal to the minimum cost of travel and unused routes have equal or greater costs."*

The Wardrop User Equilibrium as implemented in SATURN is based on the 'Frank-Wolfe Algorithm', which employs an iterative process. This process is based on successive 'All or Nothing' iterations, which are combined to minimise an 'Objective Function'. The travel costs are recalculated after each iteration and compared to those from the previous iteration. The process is terminated once successive iteration costs have not changed significantly. This process enables multi-routeing between any origin-destination pair.

The convergence criteria for the model are set to match those set out in TAG Unit M3-1 and reproduced in **Table 3-5**. It recommends that model iterations should continue until at least four successive values of the percentage of links with flow or cost changes only change by at most 1% for at least 98% of cases. This corresponds to setting to setting the following SATURN parameters as follows:

ISTOP: 98% PCNEAR: 1 NISTOP: 4

Within SATURN, the percentage flows report how stable the assignment is. The proximity between the assignment and simulation loop is given by %GAP in the reporting tables, i.e. how close the assignment is to Wardop's equilibrium.

Table 3-5 Convergence Criteria

Criteria	Base Model Acceptance Values
Delta and %GAP	Less than 0.1%
Percentage of links with flow change (P)<1%	Four consecutive iterations > 98%
Percentage of links with cost change (P2)<1%	Four consecutive iterations > 98%
Percentage change in total user costs (V)	Four consecutive iterations > 0.1%

4 SUMMARY OF DATA COLLECTION

4.1 BACKGROUND

In order to facilitate the development of a fully validated base model, a detailed data collection programme was undertaken and is reported in more detail in the 'Report of Surveys'. A series of manual classified link counts, automatic traffic counts, Gatehouse and roadside interviews were commissioned to supplement the data already available from the national agencies. The data collection report is included on Appendix H.

4.2 TRAVEL DEMAND DATA

4.2.1. ROADSIDE INTERVIEW AND GATEHOUSE SURVEYS

It is essential in any traffic model to replicate, not just the traffic flows on any link, but also the origin and destination of these vehicles. This enables identification of any vehicles that may benefit from any proposed future year scheme. A programme of roadside interview surveys (RSI) and Gatehouse surveys (GH) was commissioned in March 2019. This survey programme was large in scale and involved interviewing drivers to gather data concerning origin / destination and trip purpose at nine RSI sites and 7 GH sites in and around Catterick.

A cordon approach was undertaken to identifying traffic movements to, from and within the town. RSI Survey locations are summarised in Table 4-1 and their location is shown in Figure 4-1. The GH surveys are summarised in Table 4-2 and their location is shown in Figure 4-2.

Figure 4-1 - Roadside Interview Survey Sites

Table 4-1 Roadside Interview Locations

Site	Site Description	Dir	Survey Date
1	Range Road, North of Moor Lane Junction	NB	Tuesday 26th March 2019
2	Hunton Road, North of Hawkswell Lane Junction	NB	Tuesday 26th March 2019
3	Bedale Road, North of Hawkswell Lane Junction	NB	Tuesday 26th March 2019
4	James Lane, North of Moor Lane Junction	NB	Wednesday 27th March 2019
5	A6055 Leeming Lane, South of Leeming Lane Junction	NB	Wednesday 27th March 2019
6	A6055 Gatherly Road, South of Howe Hill Lane	SB	Thursday 28th March 2019
7	A6136 Catterick Road, West of A6055 Catterick Road Junction	WB	Thursday 28th March 2019
8	A6136 Richmond Road, North of Junction with Hispwell Road	SB	Thursday 28th March 2019
9	Plumer Road, North of Bagerbeck Road Junction (in layby)	SB	Thursday 28th March 2019

Figure 4-2 - Gatehouse Interview Survey Sites

Table 4-2 - Gatehouse Interview Locations-

Site	Site Description	Direction	Survey date
1	Horne Road, entrance to Somme Barracks	Inbound	12th March 2019
2	Scotton Road, Helles Barracks	Inbound	12th March 2019
3	Scotton Road, Vimy Barracks	Inbound	12th March 2019
4	Leyburn Road, entrance to Paive Line access (Catterick Garrison)	Inbound	13th March 2019
5	Hipswell Road East, Gaza Barracks	Inbound	13th March 2019
6	Ava Road, entrance to Munster Barracks	Inbound	14th March 2019
7	Leeming Lane, Marne Barracks	Inbound	14th March 2019

Information collected was classified by unique serial number, recorded time (15-minute intervals), vehicle type, occupancy, trip purpose, origin address, and destination address.

All RSI and GH survey sites were undertaken over 12-hour periods (0700 – 1900) and completed in accordance with standard RSI survey guidance (including in particular, analysis of vehicle occupancy, vehicle type and specific journey purpose). The vehicles were classified to the following level of disaggregation:

- Car/Taxi;
- LGV;
- OGV1;
- OGV2;
- Motorcycle/Moped; and
- Other

The RSI data was further split into 8 journey purposes for the car classification in order to give a more detailed view of the different aims of the traffic travelling into and out of Catterick. The 8 journey purposes are detailed below:

- Home-Based Commute (HBW);
- Home-Based Employer Business (HBEB);
- Home-Based Education (HBED);
- Home-Based Other (HBO);
- Non- Home-Based Commute (NHBW)
- Non- Home-Based Employer Business (NHBEB);
- Non- Home-Based Education (NHBED); and
- Non- Home-Based Other (NHBO)

ATC data were simultaneously collected at each RSI and GH site to provide expansion control for the sample data.

4.2.2. TRAFFICMASTER ORIGIN/DESTINATION (TMOD) DATA

Trafficmaster OD data provide a sample of all the trips made by each vehicle types detailed to LSOA level for the UK. Whilst this is understood to provide low sample in general, the Trafficmaster OD

data cover a wider range of Origin/Destination movements due to longer observation period and provide a strong sample size for Goods Vehicles. Thus, the data can be used to:

- Verify trip distribution by vehicle types for a study area where any other form of observed data is available such as RSI database; and/or
- Provide a secondary source to supplement data where data is not available or partially available such as external or internal movements of the RSI cordon.

4.3 MANUAL COUNTS

Manual Classified Counts (MCC) provide an indication of the turning movements observed at key junctions in the network. A package of turning counts was commissioned at key locations identified within the study area. The counts have been used to support the calibration and validation of the base year models. The site locations are listed in and shown in **Table 4-3** and **Figure 4-3**.

Table 4-3 - Commissioned MCC Locations

Site	Site Description	Survey Date
1	Hakswell Lane/ Range Road	Thursday 14th March 2019
2	Range Road/ Ava Road	Thursday 14th March 2019
3	Leyburn Road/ Plumer Road	Thursday 14th March 2019
4	Plumer Road/ Gough Road	Thursday 14th March 2019
5	Plumer Road/ Hipswell Road West	Thursday 14th March 2019
6	Plumer Road/ Haig Road	Thursday 14th March 2019
7	A6136 Richmond Road/ Haig Road	Thursday 14th March 2019
8	A6136 Richmond Road/ Hipswell Road West/ Hipswell Rd East	Thursday 14th March 2019
9	A6136 Richmond Road/ Mons Road	Thursday 14th March 2019
10	A6136 Richmond Road/ Gough Road	Thursday 14th March 2019
11	A6136 Richmond Road/ Leyburn Road/ A6136 Catterick Road	Thursday 14th March 2019
12	Scotton Road/ Segrave Road	Thursday 14th March 2019
13	Scotton Road/ Church Road	Thursday 21st March 2019
14	Scotton Road/ Loos Road	Thursday 14th March 2019
15	Bedale Road/ Hunton Road	Thursday 21st March 2019
16	Hawkswell Lane/ Hunton Road	Thursday 14th March 2019
17	Bedale Road/ Hawkswell Lane	Thursday 14th March 2019
18	Craggs Lane/ Moor Lane	Thursday 14th March 2019
19	Moor Lane/ James Lane	Thursday 14th March 2019
20	Horne Road/ Loos Road	Thursday 21st March 2019
21	Horne Road/ Wensleydale Road	Thursday 14th March 2019
22	A6136 Catterick Road/ Byng Road/ Horne Road	Thursday 14th March 2019
23	A6136 Catterick Road/ Colburn Lane	Thursday 21st March 2019
24	A6055/ A1(M) (West)	Thursday 14th March 2019
25	A6055/ A1(M) (East)	Thursday 14th March 2019
26	A6055 Catterick Rd/ A6136 Leeming Lane/ A6136 Gatherly Rd	Thursday 14th March 2019

Site	Site Description	Survey Date
27	A6136 Gatherly Road/ B6272 Bridge Road	Thursday 14th March 2019
28	B6272 Bridge Road/ B6271 Station Road	Thursday 14th March 2019
29	Station Road/ Gatherly Road	Thursday 14th March 2019
30	A6136 High Street/ High Green	Thursday 14th March 2019
31	A6136 High Street/ Lowe Green	Thursday 14th March 2019
32	Leeming Lane/ Catterick Lane	Thursday 14th March 2019
33	Catterick Lane/ A6055	Thursday 14th March 2019
34	A6055/ overbridge over A1(M)	Thursday 14th March 2019
35	Catterick Lane/ overbridge over A1(M)	Thursday 14th March 2019
36	Catterick Lane/ Tunstall Lane	Thursday 14th March 2019
37	A6108/ Unnamed Road leading to Richmond	Thursday 14th March 2019
38	A6136 Richmond Road/ Phoenix recovery centre entrance	Thursday 14th March 2019
39	Scotton Road/ Helles Barracks entrance	Thursday 14th March 2019
40	Horne Road/ Somme Barrcaks entrance	Thursday 14th March 2019
41	Leyburn Road/ Piave Lines entrance	Thursday 14th March 2019
42	Hipswell Road/ Gaza Barracks	Thursday 14th March 2019

Figure 4-3 - Location of MCC Surveys

The MCC counts were undertaken for twelve hours (07:00-19:00) on dates summarised in Table 4-3 within the survey period specified for the ATCs. Data collected from the MCC counts were provided in a form of 6 classified vehicle types:

- Pedal cycle / motorcycle;
- Car;
- LGV;
- OGV1;

- OGV2; and
- Buses and coaches.

4.4 AUTOMATIC COUNTS

Automatic Traffic Count (ATC) data can provide detailed link count information throughout the year and smooth out any day-to-day variations that may not be picked up by a single day count. Due to the limited number of counts available from existing sources around Catterick, a series of new ATC counts have been commissioned.

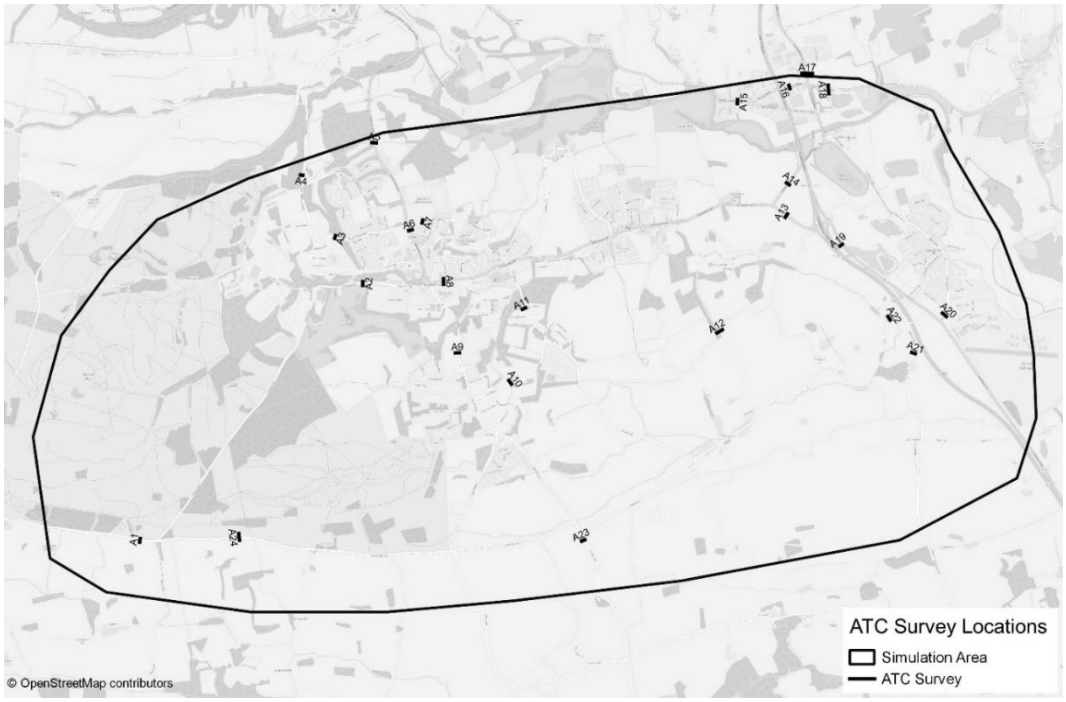
Twenty-four ATCs were undertaken at various locations within Catterick. These are used to analyse the variations in traffic flows at particular sites and to support the model calibration and validation. ATCs at the RSI and GH sites were conducted between the 14th of March and 7th of April (with sites 6 and 7 extending for a further week).

The site locations are listed in Table 4-4 and shown in Figure 4-4.

Table 4-4 - Commissioned ATC Locations

Site	Site Description
1	Hawkswell Lane, Barden Moor, west of A6108 before Range Road junction
2	Leyburn Road, east of access to Paive Live (Catterick Garrison)
3	Hipswell Road West, west of Wardrop Road
4	Plumer Road, north of junction with Haig Road
5	Richmond Road, north of junction with Haig Road
6	Richmond Road, south of junction with Hipswell Road East
7	Hipswell Road east of junction with Richmond Road
8	A6136 Catterick Road east of Heatherdene Road
9	Scotton Road, north of Vimmy Barracks access roundabout
10	Loos Road, east of Ringwood Road junction
11	Horne Road, north of Harley Crescent junction
12	Unnamed Road connecting A6055 Catterick Road and Tunstall Road
13	A6055 between A6136 Catterick Road and A1(M)
14	A6055 Catterick Road between A6136 Catterick Road and Leeming Lane
15	B6271 Richmond Road, west of Grange Road junction
16	B6271 Station Road between B6271 Richmond Road and A6055 Gatherly Road
17	A6055 Gatherly Road, north of B6271 Station Road junction
18	B6271 Station Road, east of junction with Gatherly Road
19	A6055, south of junction with A1(M)
20	Leeming Lane, leading to Marne Barracks
21	Catterick Lane, south of new junction leading to overbridge over A1(M)
22	Tunstall Road, west of Catterick Lane junction
23	Craggs Lane, south of Moor Lane junction
24	Hawkswell Lane, Barden Road, east of A6108 before Range Road junction
25	A6136 Catterick Road

Figure 4-4 - Commissioned ATC Surveys

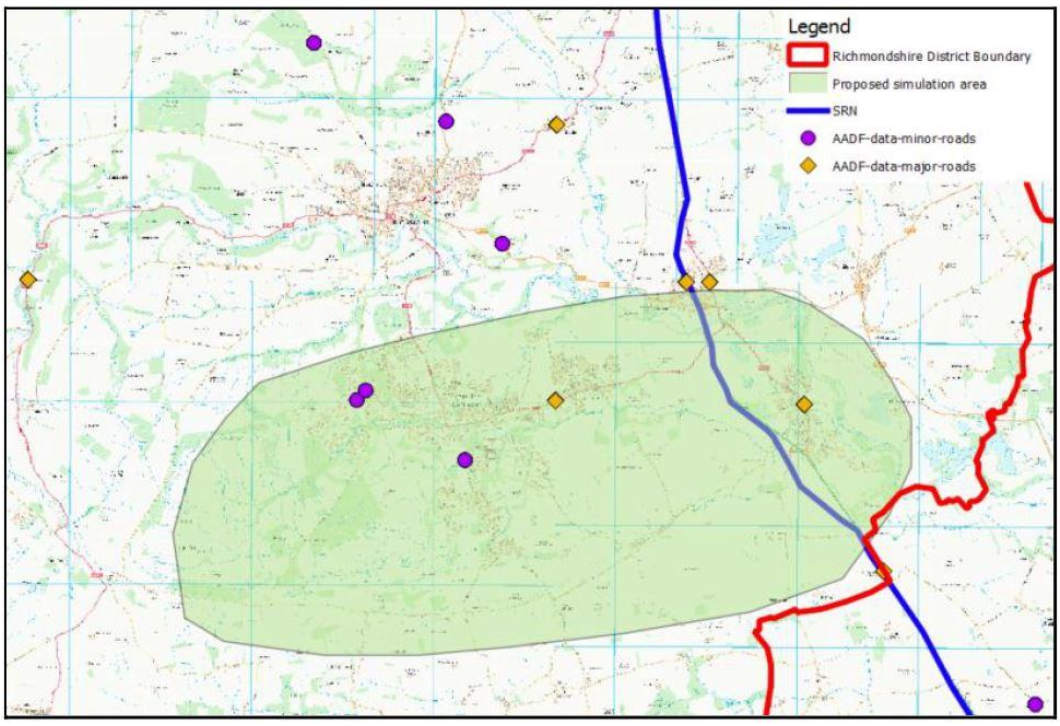


4.5 EXISTING DATA SOURCES

Highways England maintain a rich source of traffic data, TRADS. This is however focussed on the Strategic Road Networks (SRN) and therefore not of use to the Catterick model development.

The DfT also maintains a database of counts conducted for single days across various major and minor roads. These do not meet the criteria to be used for validation however they offer an option for cross-checking against other sources. Locations are presented in figure below.

Figure 4-5 - DfT Count Database Site Locations



North Yorkshire County Council have an online database of both permanent and temporary ATCs. WSP has been given access to this data. The permanent sites record daily volume in 15-minute intervals. Speed data is also recorded at the site locations. There are 9 within Richmondshire district and their locations are shown in Figure below.

Figure 4-6 - NYCC Count Database Locations

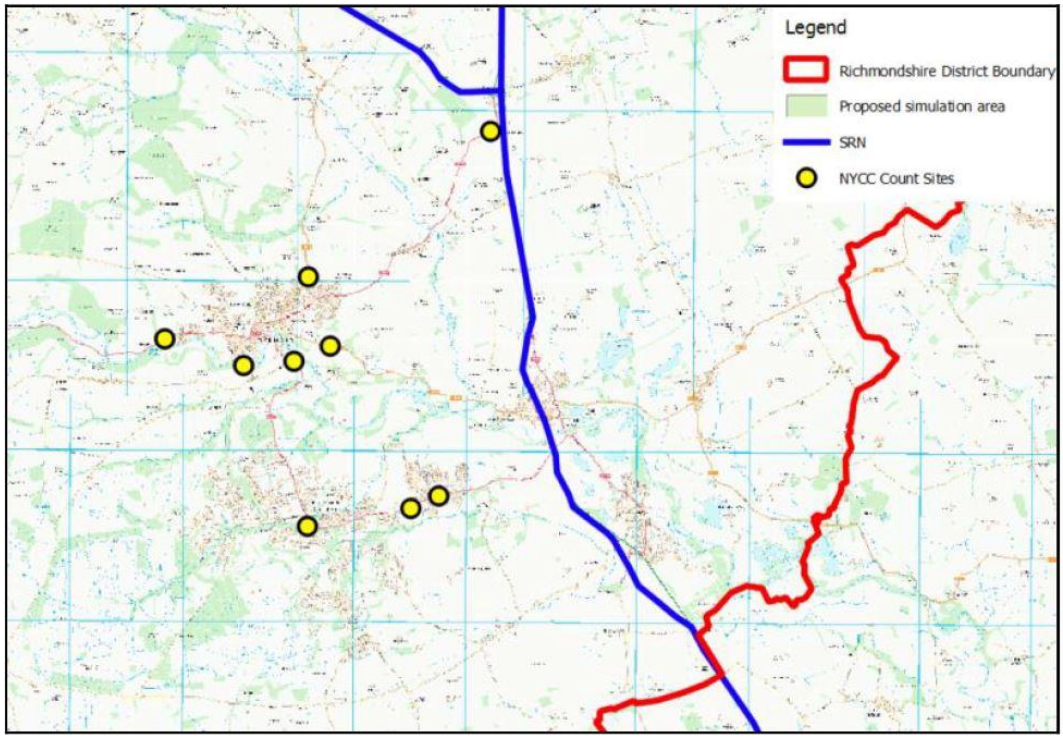
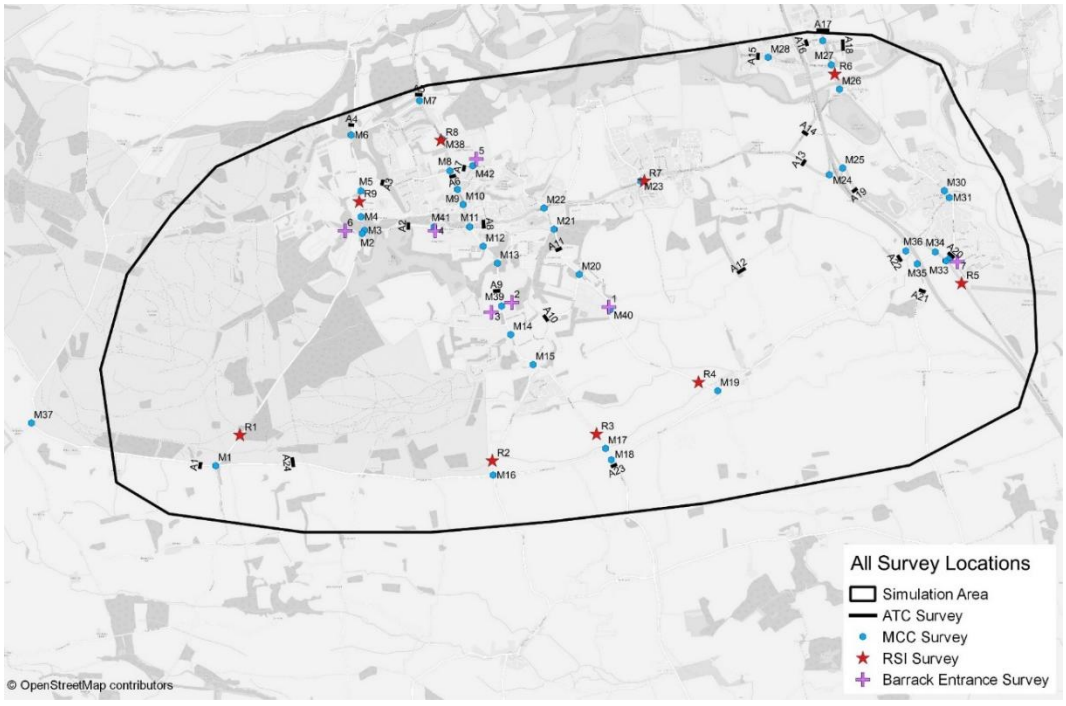


Figure 4-7 shows the locations and types of counts that have been used for the model development.

Figure 4-7 - Count Database for Model Development



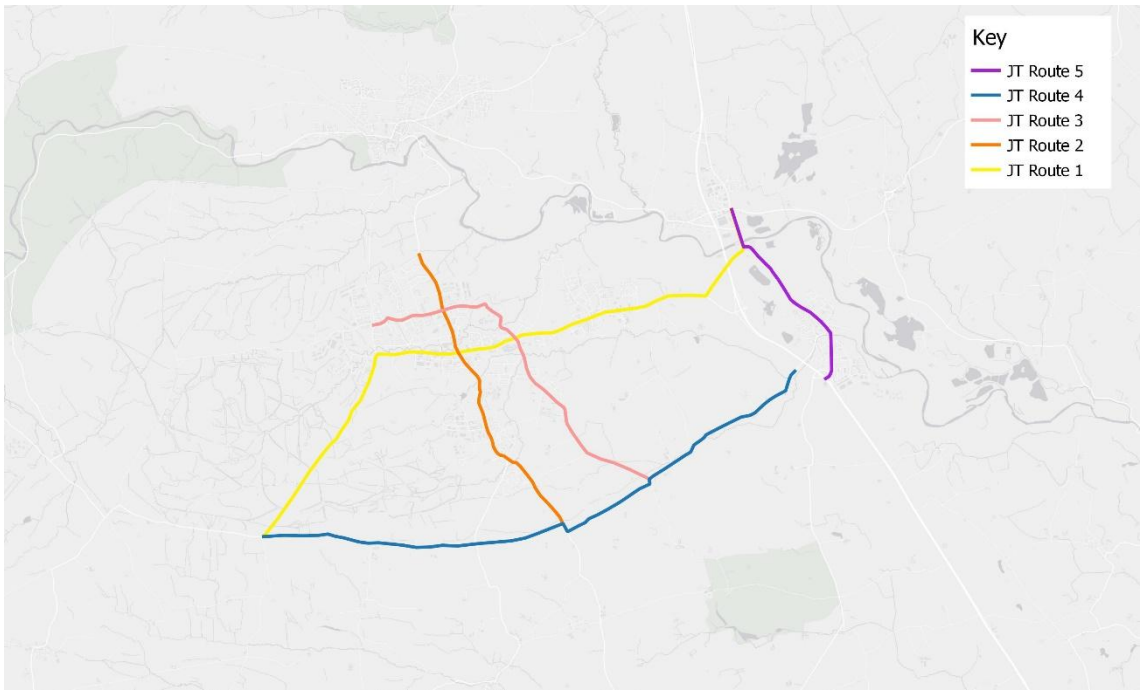
4.6 JOURNEY TIME DATA

Trafficmaster is a rich data source for journey time data available from the DfT for all links on the Integrated Transport Network (ITN). The travel time is recorded as a vehicle traverses a link using GPS devices fitted in high end luxury cars plus fleet vehicles for LGVs, HGVs and buses. It is acknowledged that this can lead to a skew within the raw data.

The data provided includes a link ID corresponding to an attribute within the shapefile of the ITN plus the average journey time and sample size used to calculate the observed journey time data for the model development.

A total of 5 bi-directional journey time routes have been defined which cover all the key routes within the study area. They have been used for the model validation that is described in more detail in the next chapter. The coverage of the journey time routes within Catterick is shown in Figure below.

Figure 4-8 - Journey Time Routes



Information obtained from the Trafficmaster JT data (2019) was extracted for all the links that constitute the defined journey time routes and subsequently processed to aggregate data to produce average observed journey time data.

Extreme values or anomalies which could occur due to limitation of the recording of the TrafficMaster data were analysed and excluded from the database where relevant.

The following table summarises the routes and their associated observed travel time and distance as extracted from the Trafficmaster JT data.

Table 4-5 - Observed Travel Time Summary

No.	Route	Dir	Description	Len (km)	Observed Journey Time (mm:ss)		
					AM	IP	PM
1	Range Road/A6136	EB	A6136 EB from Range Road	10.5	13:16	12:58	13:32
		WB	A63 WB from Gatherly Road	10.5	13:03	12:47	12:54
2	A6136/Scotton Road/Bedale Road	NB	A6136 NB from Bedale Road	5.1	06:58	07:05	06:46
		SB	A6136 SB from Richmond Road	5.1	06:40	06:54	06:42
3	James Lane/Horne Road/Byng Road/Hispwell Road	NB	NB from James	6.0	08:19	08:11	07:56
		SB	SB from Hipswell Road West	6.0	07:57	08:13	07:42
4	Unnamed Road/Moor Lane/ Tunstall Road	EB	EB from Unnamed Road	9.6	09:15	09:06	09:21
		WB	WB from Tunstall Road	9.6	09:18	09:18	09:38
5	A6136	NB	A6136 NB from Catterick Lane	3.3	04:19	04:21	04:18
		SB	A6136 SB from Gatherly Road	3.3	03:43	03:40	03:38

4.7 TRAFFIC SIGNAL DATA

Traffic signal data were obtained from NYCC for all signalised junctions within the simulation area. A total of 4 signalised junctions within the FMA area for which the following data were obtained:

- Staging and phasing diagrams;
- Mode of operation (e.g. fixed time, MOVA, SCOOT);
- Observed or recorded green splits; and
- Inter-green times.

4.8 ADDITIONAL DATA SOURCES

Additional data sources have been required for the base matrix build – this includes various socio-economic and land use data from the Census plus National Travel Survey (NTS) information including:

- Mode shares;
- Trip length distributions;
- Trip purpose splits; and
- Trip return profiles.

A large amount of GIS data is available through the Ordnance Survey's (OS) OpenData program. This can be used freely providing that OS copyright acknowledgement is included. Data used for the model have included:

- Base mapping at various scales for reporting and presentation; and
- Shapefiles for various geographical boundary definitions to define the zone system.

4.9 DESCRIPTION OF CALIBRATION AND VALIDATION DATA

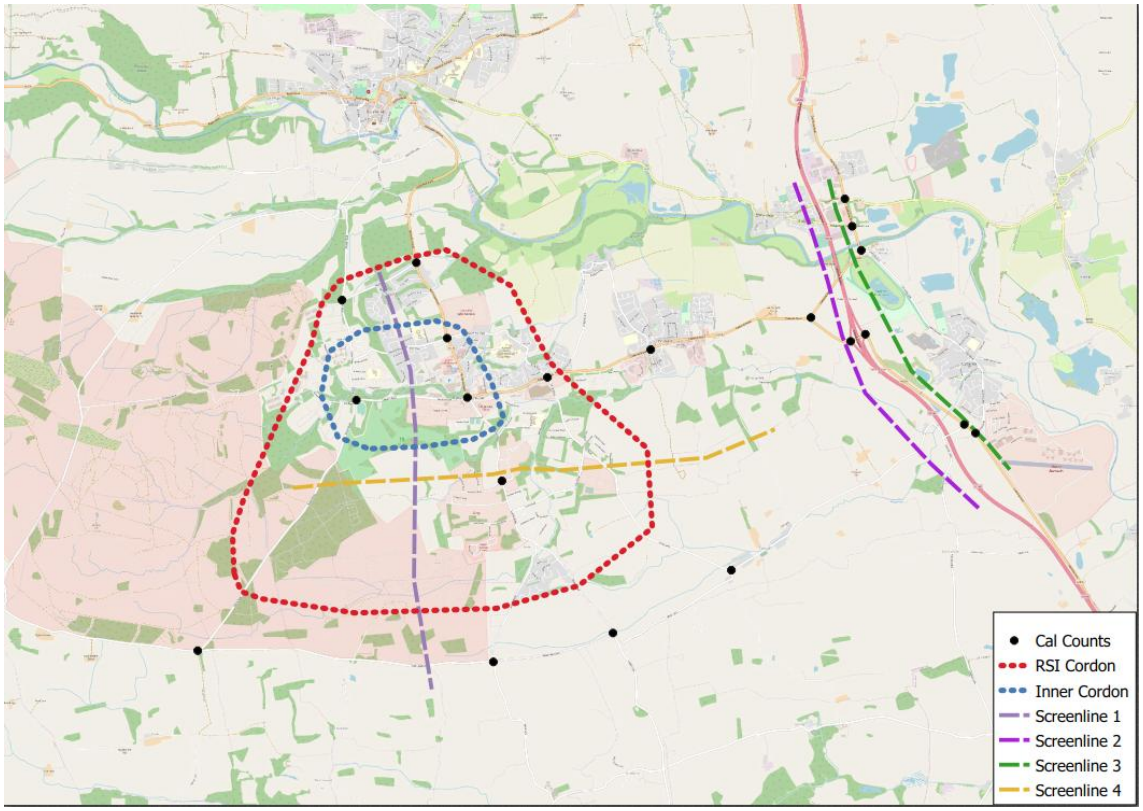
Prior matrices, whilst being able to represent accurately the fully observed trips (i.e. trips crossing the RSI cordon), are not able to represent trips made internally and externally of the RSI cordon (partially or non-observed trips). A selective number of traffic counts were therefore used in the Matrix Estimation process to help refine the movements that are not fully observed. Apart from the counts used for the calibration process, the remaining counts were used for validation.

In addition to the counts used for calibration and validation, a set of screenlines and cordons were also defined to:

- Verify that traffic resulted from the models representing trips crossing the RSI cordon are within the acceptability criteria;
- Check particular movements (e.g. east-west and north-south movements) of trips that travels from/to or passing through the study area.

Locations of counts that were used for the calibration/validation process and the relevant screenlines/cordons are presented in figure below.

Figure 4-9 - Calibration/Validation Counts



A summary of the number of link/turn counts that were used for the calibration and validation process is provided in table below.

Table 4-6 - Calibration/Validation Count Summary

Source	Calibration		Validation		Total	
	Sites	Counts	Sites	Counts	Sites	Counts
RSI	9	18	0	0	9	18
Additional ATC	18	32	10	18	28	50
MCC	27	163	5	9	32	172
A1(M) (DfT traffic count)	1	2	0	0	1	2

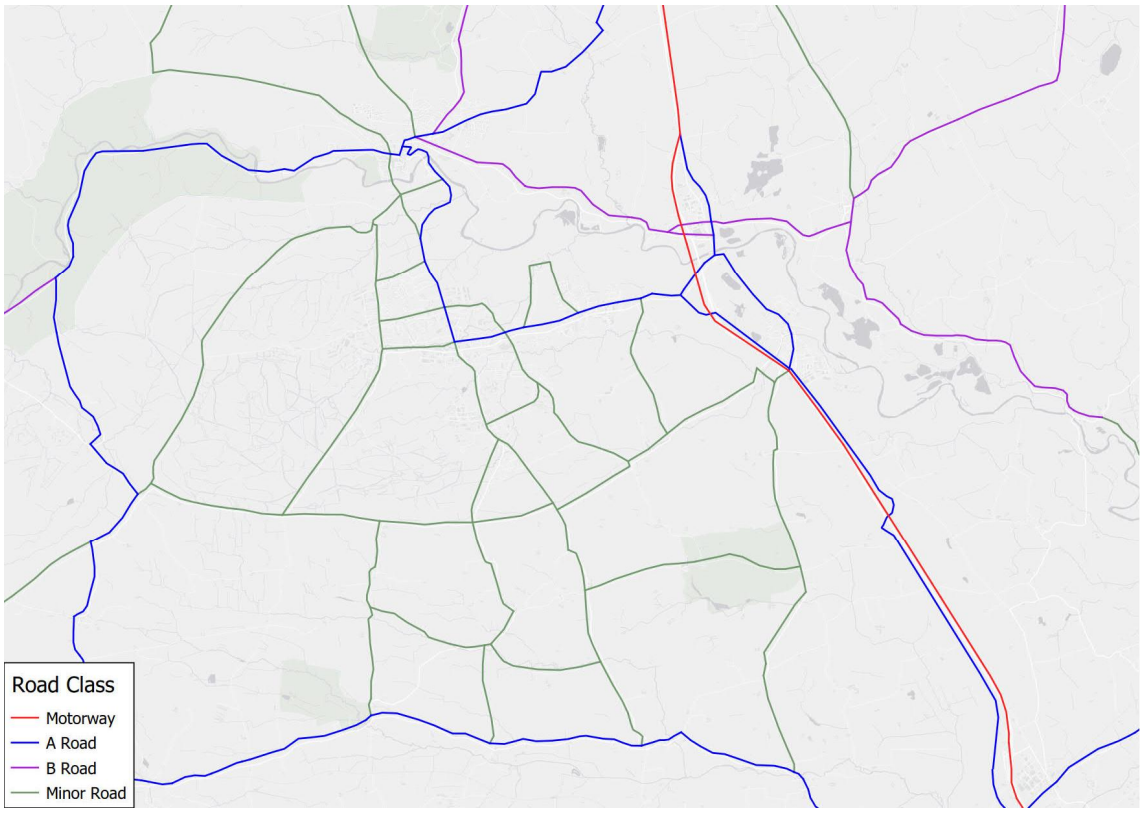
5 HIGHWAY NETWORK DEVELOPMENT

5.1 INTRODUCTION

Highway assignment models require a simplified representation of the highway network using a series of nodes and links where links represent particular sections of the roads and nodes represent junctions.

The extent of the network coverage is shown in **Figure 5-1** below.

Figure 5-1 - Model Coverage – Study Area



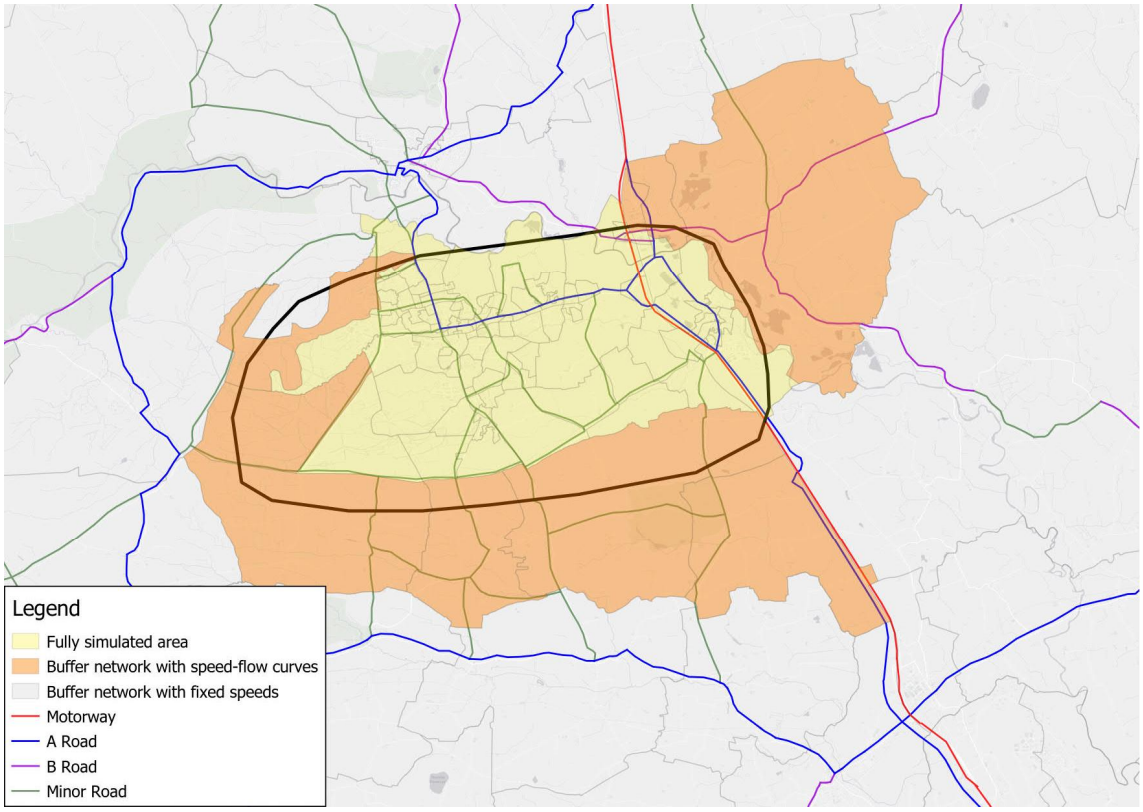
5.2 NETWORK STRUCTURE

For the Catterick highway network, a three-level structure was developed as below and shown in **Figure 5-2**

- Within Catterick: fully simulation with accurate junction coding in combination of speed-flow curve to represent accurately travel costs within the study area
- Outside study area but within Richmondshire district: a less detailed coding was adopted in which travel costs are represented in a form of speed-flow curve

Externally from Richmondshire district (A1(M) to the North and South), fixed speed coding was adopted

Figure 5-2 - Hierarchical Network Structure



The network has been built using a range of information. The ITN contains all motorways, A roads and B roads and provided a useful starting point for the buffer network within the district. This has been enhanced with local detail within the FMA. Data from Google Maps has been referenced to determine road type, speed limit and the number of lanes.

The network includes sufficient detail to rigorously model the impacts of the proposed developments on the local transport network. Within the FMA all A and B roads are included plus C and local roads which provide connectivity within the town centre or offer access to major trip generator zones.

For the remainder of the district all motorways, A and B roads are included plus minor roads which offer strategic connectivity between settlements or into the town centre.

- Checks on the network have included:
- Comparing travel distances in the network against crow-fly distances; and
- Comparing travel speeds against the speed limit.

WSP has engaged with NYCC to ensure local knowledge has been used for sense checks on both the network and traffic routing. The model highway network has been verified by NYCC in GIS format prior to development of the detailed junction coding.

5.3 ZONE SYSTEM

It was necessary to develop a zoning system for the study. The key criteria for developing a zoning system are that the level of detail should be fine enough to enable detailed modelling within the areas of interest, but not too detailed to compromise development time and subsequent run times for the model.

A total of 155 zones were created for the base year model, as summarised in Table below.

Table 5-1 - Zone Definition

Local Authority	Number of zones created
Richmondshire District (within RSI cordon)	85
Richmondshire District (outside RSI cordon)	27
Harrogate	5
Hambleton	20
External	18
Total	155

The final zone system is, in part, defined by the level of detail provided within the network. The level of detail provided in the network away from the main areas of interest determined the level of disaggregation required within the zoning system. Within the core study area zones are defined by individual output area with aggregation of output area with distance from the town.

There are 170 OAs within Richmondshire district. These form the building blocks as they represent the smallest spatial area for downloading land use and planning data from the census.

Where new development has occurred or it is felt that the existing zone structure is too coarse, new zones have been created. Most model zones represent geographical areas, bounded by ONS area or other distinct boundaries. This may include features such as roads, rivers or railways within the town centre. Others represent particular traffic attractors such as individual car parks. External zones have been compressed to (largely notional) cordon zones, each zone representing the traffic expected to use individual cordon links to access the Catterick area.

A separate consideration for the zone structure was the location of planned future year development. To allow better for future demand responsive tests, compatibility was required between future and base year network zone structures. Therefore, new zones were also added where significant development was identified within the Catterick Development Log.

Figure 5-3, **Figure 5-4** and **Figure 5-5** show the structure of the resulting zones.

Figure 5-3 - Catterick Model Zone – Study Area

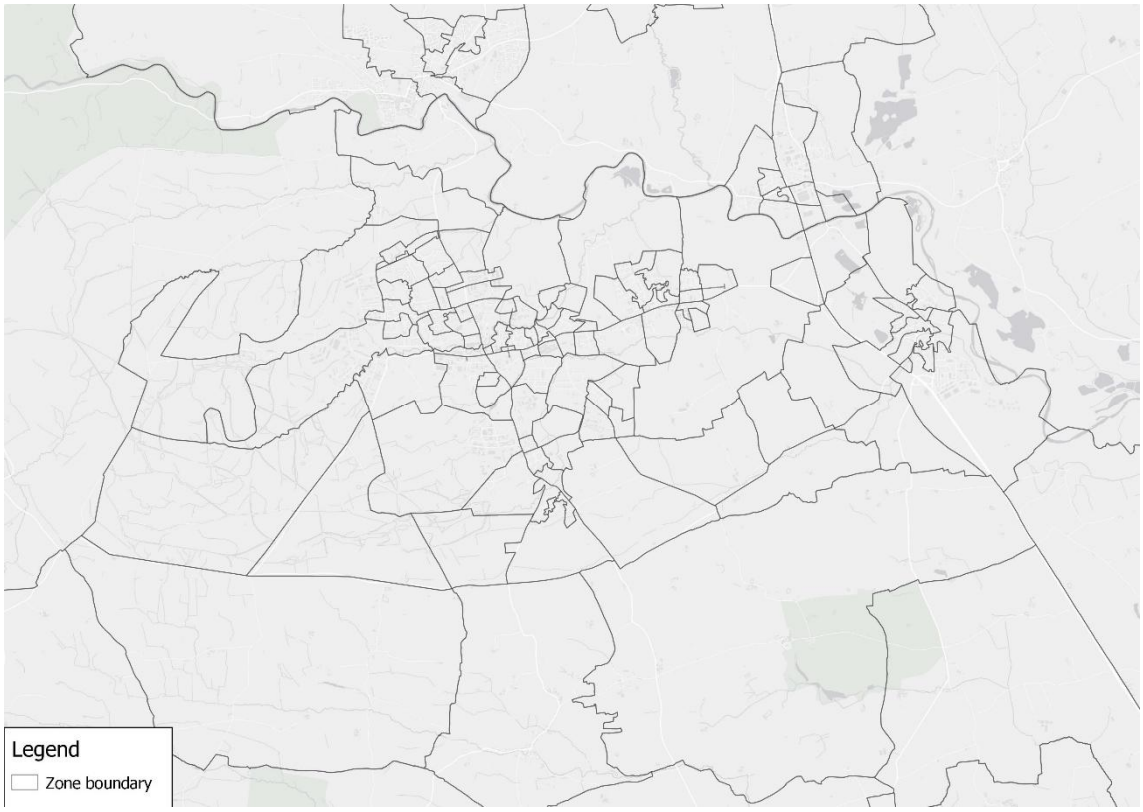


Figure 5-4 - Catterick Model Zones – North Yorkshire

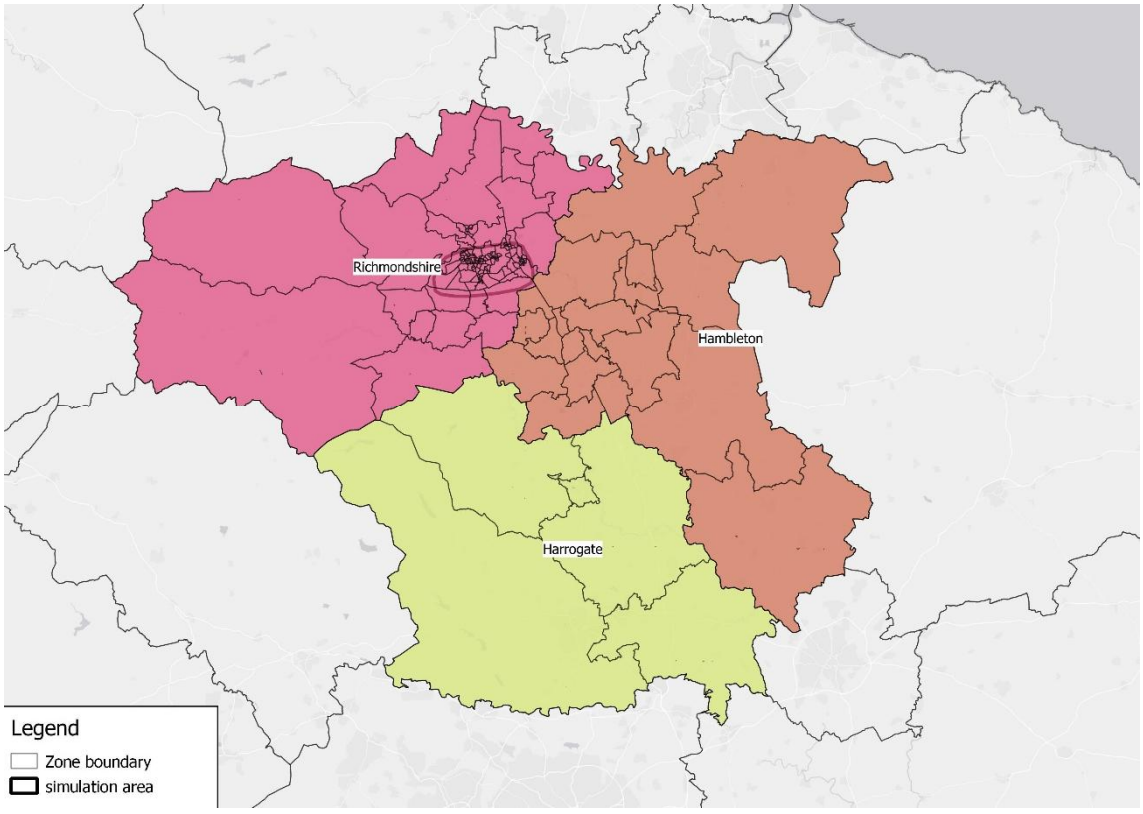
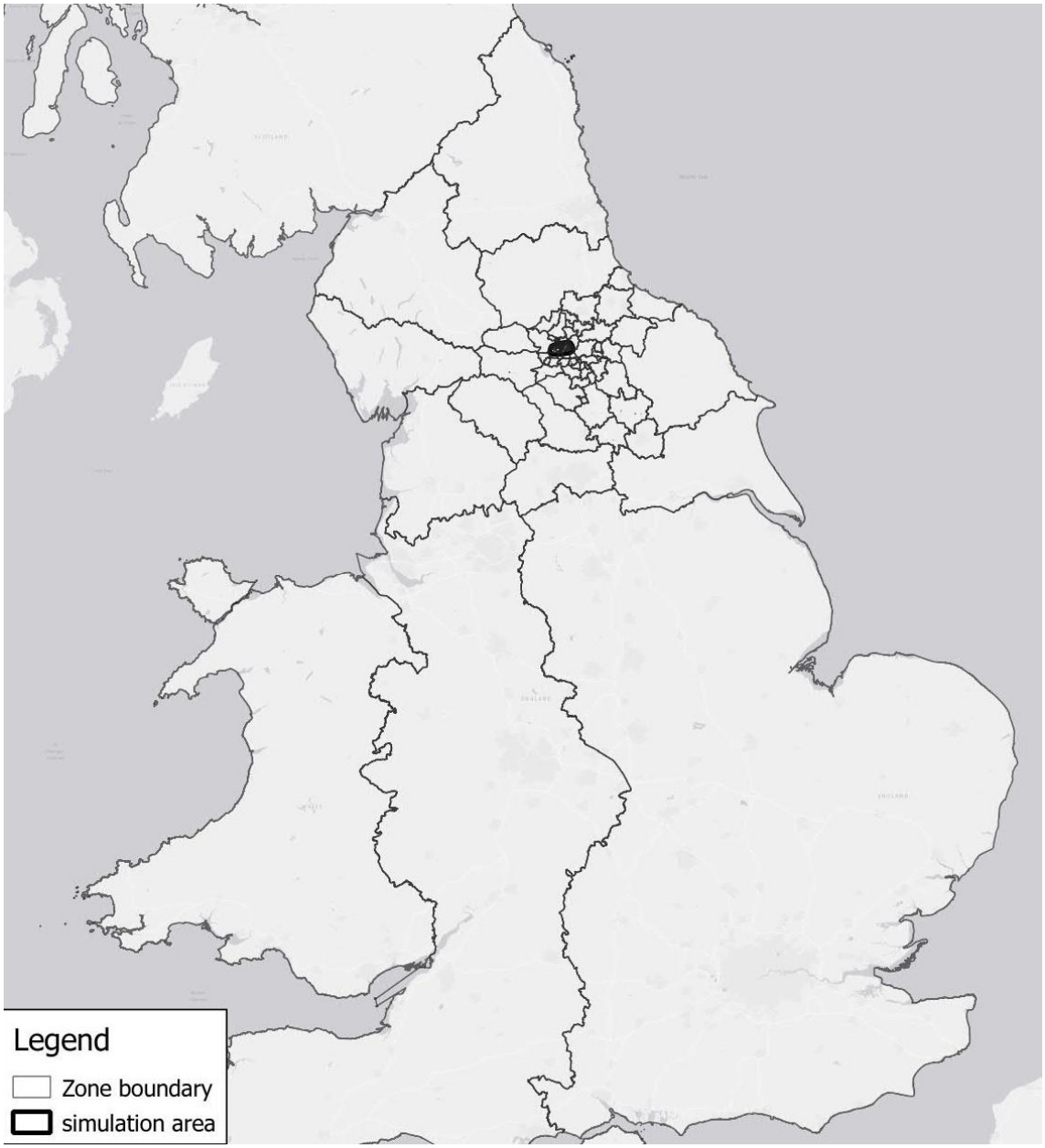


Figure 5-5 - Catterick Model Zone – External



5.4 LINK CODING

Links in SATURN have been coded by direction and include the following characteristics:

- Number of lanes;
- Link capacity (PCU per hour);
- Maximum free flow speed in kilometres per hour; and
- Classes of vehicles permitted to traverse the link (e.g. bus only).

The capacity is determined by various factors including the road class, road type (dual or single carriageway), number of lanes and street characteristics including on street parking which may impede the free flow of traffic. This is considered alongside the speed limit to determine the appropriate maximum free-flow speed.

Aerial images have provided a valuable source of information on the network to be modelled. Detail such as the number of lanes, lane markings and flare lengths have been ascertained based on this data source. Where no existing layers or aerial photography were available, detailed site visits were undertaken. Site survey sheets were prepared to ensure that the required data was picked up from site in the one visit.

Speed flow data are derived from COBA curves and used within the buffer area and on longer links within the simulation area where volume delay is likely to be of importance.

Link and Volume Delay curve parameters are tabulated in Appendix A**.**

5.5 JUNCTION CODING

Simulated nodes in SATURN are coded with the following characteristics:

- Junction type (priority, roundabout, signalised, mini roundabout);
- Saturation flows for all movements;
- Number of approach arms, the width of each approach plus flare lengths and lane discipline including permitted or banned turned; and
- Additional parameters relevant to specific junction types (e.g. signal timings, gap acceptance values, cycle time).

A total of 177 junctions were explicitly coded within the model, distributed as per **Table 5-2**.

Table 5-2 - Junction coding by Type

Junction Type	Number of junctions coded
Signalised junction	10
Normal roundabout	7
Mini-roundabout	6
Exploded roundabout	2 (A1(M))
Priority junction	152
Total	177

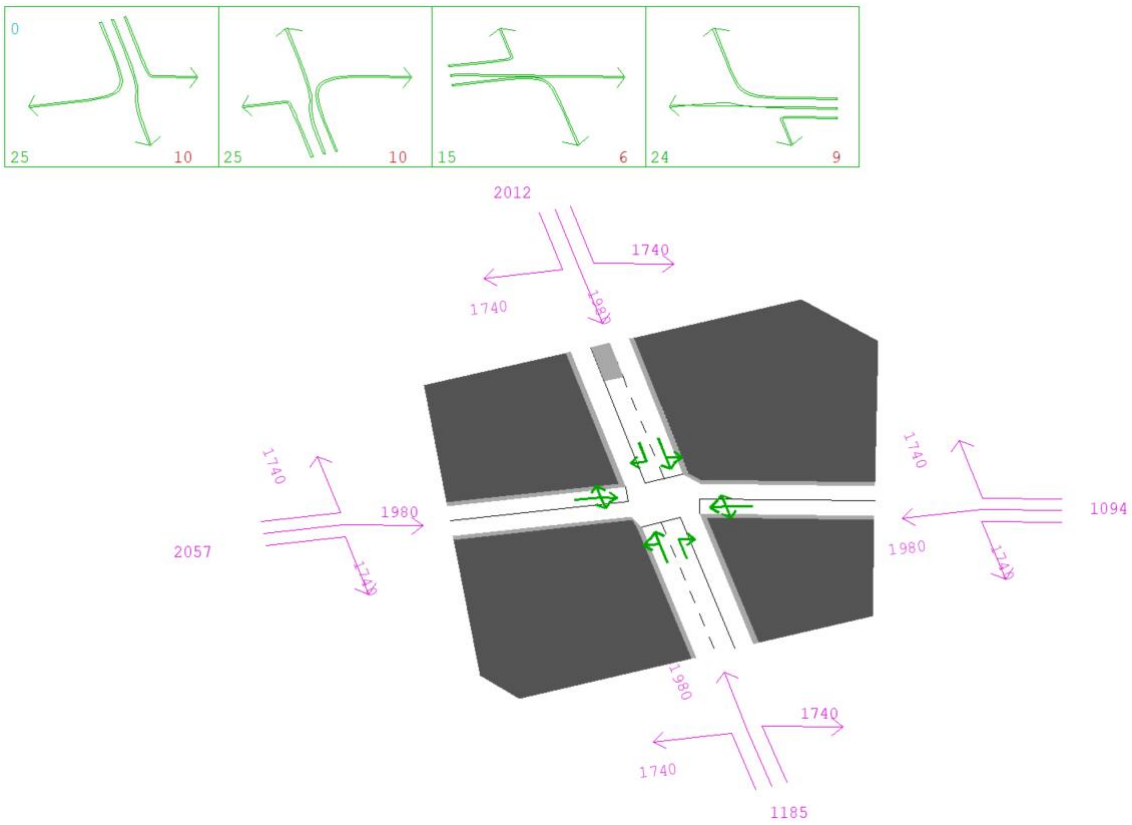
5.5.1. SIGNALISED JUNCTIONS

Signal timings were obtained from the Council and converted to SATURN format. Saturation flows were based on calculations given in Research Report 67 (Kimber, McDonald and Hounsell, Transport Research Laboratory). The report provides calculation of saturation flows for different movement types (left turn, ahead movement, right turn) by lane width, turning radius. The information obtained on the ground has been used to determine the appropriate saturation flows at signalised junctions during the network development and further adjusted where relevant during the calibration/validation process. An example of a signalised junction coding is shown in **Figure 5-6**, which includes:

- Staging diagram;
- Green time and inter-green time for each stage;
- Lane configuration and permitted movement; and

- Saturation flows (pcu/h) for each turning movement.

Figure 5-6 - Coding Example - Signalised Junction

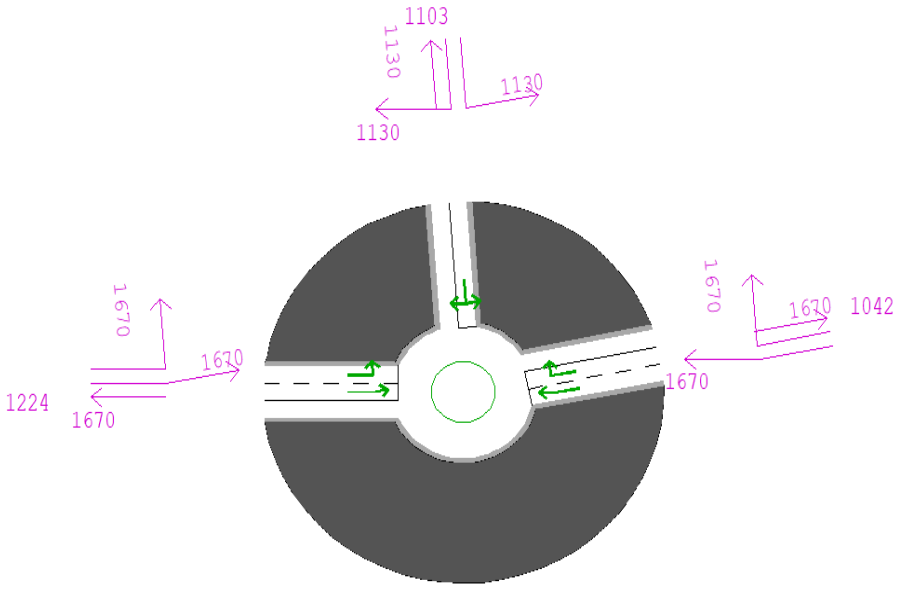


5.5.2. ROUNDABOUT/MINI-ROUNDABOUT

Explicit roundabout parameters such as entry width, inscribed diameter and flare length were used to derive the entry and circulatory capacity using the Kimber TRL method that has been used for ARCADY(JUNCTIONS). An example for a roundabout/mini-roundabout junction coding is shown in Table below, which includes:

- Entry capacity at each approach (pcu/h);
- Circulatory capacity (pcu/hr); and
- Time to circulate around the roundabout (seconds).

Figure 5-7 - Coding Example - Roundabout

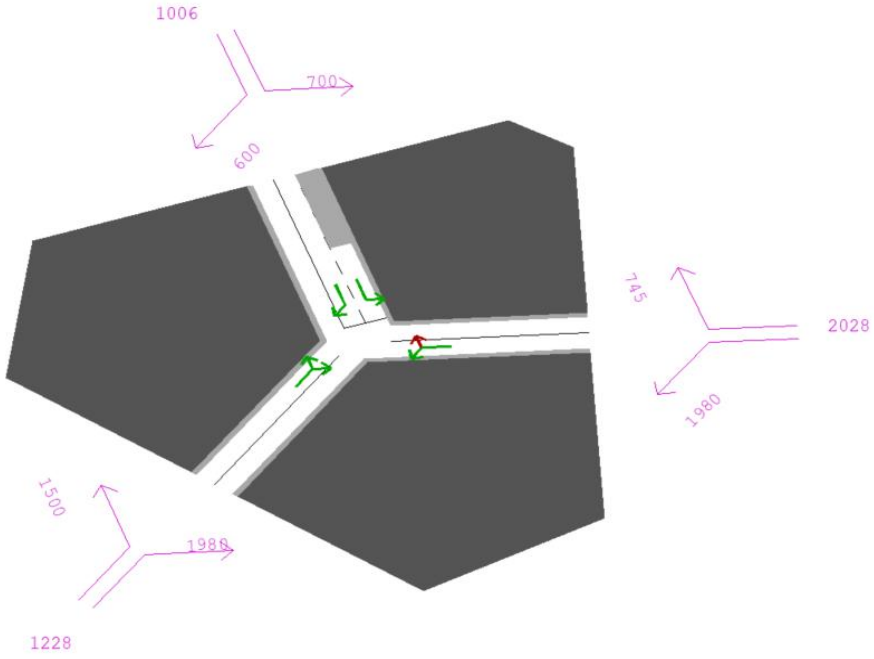


5.5.3. PRIORITY JUNCTIONS

Default sets of saturation flows for major arm and minor arms have been based on the calculations provided in the DMRB volume 6 section 2 part 6 TD42/95. During the calibration/validation these were adjusted, where appropriate, in order to represent more accurately delays at junctions. An example of a priority junction coding is shown in **Figure 5-8** which includes:

- Saturation flows at stop lines on each approach (pcu/hr)

Figure 5-8 - Coding Example - Priority Junction



All junction values were reviewed and adjusted to reflect local site variation.

5.6 PUBLIC TRANSPORT SERVICES

Bus services have been coded into the model but not assigned as a demand category. Traffic volume and network delays would likely be underestimated if they were not included.

The bus routes were therefore included in the models with information on service frequency. This was then translated into fixed volume or pre-loaded flows to the network. The following routes are included within the model (as provided in **Table 5-3**)

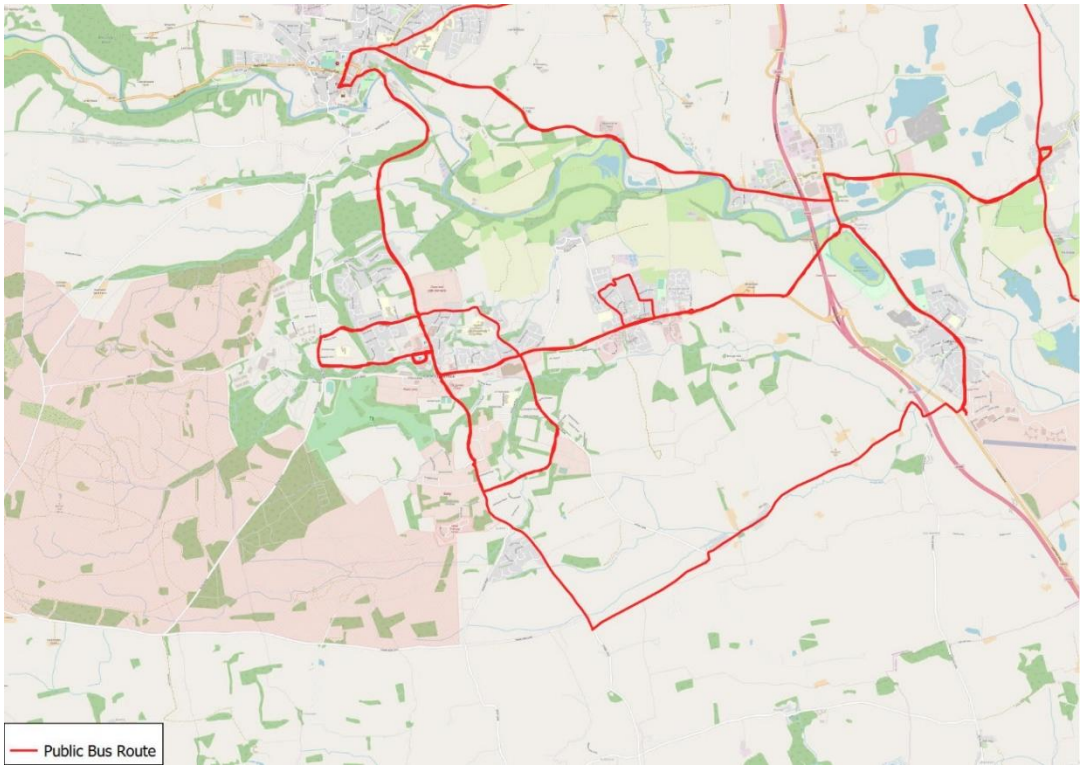
Table 5-3 - Bus Route Coding

Bus Route(s)	Description	Type	Av W'day Freq
X34	Darlington to Richmond	Public	5 Services
X26	Darlington to Catterick Bridge	Public	2 Services/Hour
X27	Darlington to Hipswell	Public	1 Service/Hour
X54	Marne Barracks to Richmond	Public	1 Service
RR1	Richmond to Catterick	Public	2 Services
55	Richmond to Friarage	Public	3 Services

Source http://www.northyorks.gov.uk/article/25851/Transport---timetable-information

Allocation of bus routes to the network is indicated in **Figure 5-9**.

Figure 5-9 - Catterick Bus Routes



5.7 PASSENGER CAR UNIT

The highway assignment models operate in passenger car units (PCU). Traffic counts and demand matrices were therefore converted to the PCU unit prior to the assignment.

As mentioned in the previous chapter, the MCC count data provided consists of 6 vehicle types. With exclusion of Pedal cycle/motorcycle (i.e. not modelled), the corresponding PCU factors for each vehicle type is as below:

- Car – 1.00
- LGV – 1.00
- OGV1 – 1.90
- OGV2 – 2.90
- Buses – 2.50.

Since the heavy good vehicle matrices consists of OGV1 and OGV2, it was required that a common PCU factor was to be derived from the OGV1 and OGV2 elements.

The average PCU factor for the HGV matrices was adopted as the proportional weighted from OGV1 and OGV2. The PCU factors adopted for the Catterick highway models are as below:

- Car – 1.00
- LGV – 1.00; and
- HGV – 2.30

5.8 GENERALISED COSTS

Traffic routeing is modelled within SATURN is implemented through a function of generalised costs. This normalises time, distance and monetary charges into a standard unit. The function is presented in SATURN assignment in a form of:

$$G.Cost = Time + \frac{PPK}{PPM} xDist + Charge$$

Where:

- G.Cost — Generalised cost in pence;
- Time — Travel time in minutes (including delays and time penalties)
- Dist — Travel distance in kilometres;
- Charge — Monetary charges in pence (e.g. toll fares);
- PPM — Value of time in pence per minute (PPM); and
- PPK — Vehicle operating costs in pence per kilometre (PPK).

The parameters adopted for the 2019 base year are shown in

Table 5-4 below. For the HGV class, local ATC data was used to determine the split of vehicles which could be classified as OGV1 and OGV2 by peak hour. This split was used to calculate average generalised cost parameters for HGV.

For HGV, as stated in the WebTAG M3.1, the value of time provided in the WebTAG Databook only relates to driver's time and does not take into account the influence of owners of the routeing of these vehicles. The PPM for HGV was therefore adjusted in accordance with the WebTAG guidance.

Table 5-4 summarises the PPM and PPK values adopted for the Catterick base year 2019 highway models.

Table 5-4 - Time and Distance Parameters

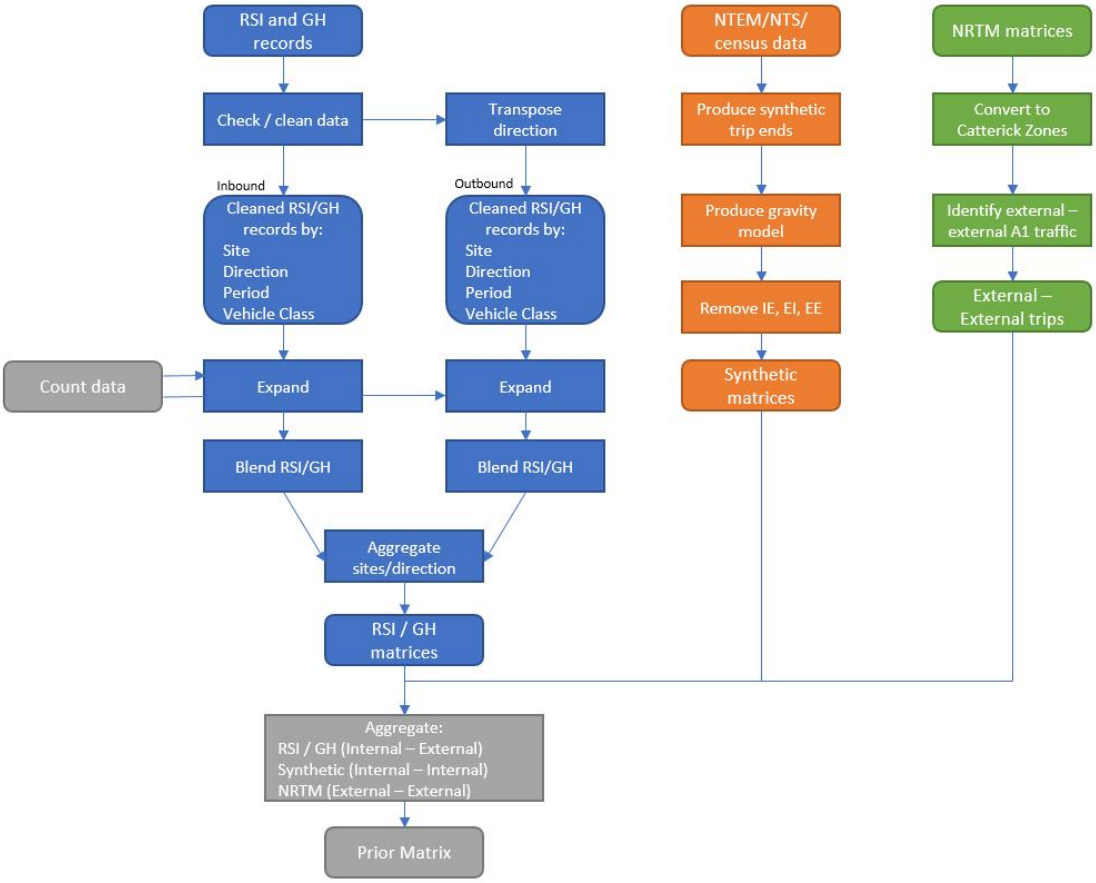
User Class	AM Peak		Inter Peak		PM Peak	
	PPM	PPK	PPM	PPK	PPM	PPK
Business	31.01	14.20	31.78	14.20	31.46	14.20
Commute	20.80	6.71	21.14	6.71	20.87	6.71
Other	14.35	6.71	15.29	6.71	15.03	6.71
LGV	21.92	15.28	21.92	15.28	21.92	15.28
HGV	51.19	48.89	51.19	48.89	51.19	48.89

6 HIGHWAY MATRIX DEVELOPMENT

6.1 INTRODUCTION

The primary source of data for developing trip matrices comes from Road Side Interview and Gatehouse Surveys, conducted to capture trips travelling towards Catterick. This chapter describes how these surveys were collected, how the data was utilised to produce a set of prior matrices, and how additional sources of data were used to supplement the Road Side Interview Surveys to produce a set of Prior matrices for the base year model. The process of producing the prior matrices from the three sources of data is presented in **Figure 6-1**.

Figure 6-1 - Matrix Building Methodology



The following sections of this chapter describe in more detail each of the steps in producing the prior matrices for the purpose of the base year model development.

6.2 PRODUCTION OF RSI MATRICES

6.2.1. INTRODUCTION

To develop a robust matrix from observed data, Roadside Interview Surveys (RSIs) were conducted between Tuesday 26th and Thursday 28th March 2019 for the inbound direction, at 9 locations surrounding Catterick. In addition, the Gatehouse Surveys (GH) were conducted between Tuesday 12th and Thursday 14th March 2019. These provide a source of travel demand data including details of journey origin, destination and purpose.

Nine sites have been surveyed, forming a cordon around the town centre. The details of RSI and GH sites summarised in Section 4 of this report.

The surveys were undertaken for a twelve-hour period (07:00-19:00). The data was collected by direct interviews with drivers at the roadside with the intention of securing a 30% 'on the ground' sample rate to allow sufficient leeway for securing a target 20% sample rate post checking and processing (with a minimum expected sample rate of around 10% for each vehicle type). The form used for data collection is shown in Appendix B. Data reported by the survey contractor includes the following information:

- Unique Serial Number;
- Site (location and road name/number);
- Recorded time (15-minute intervals);
- Vehicle type;
- Occupancy;
- Trip purpose;
- Origin address; and
- Destination address.

6.2.2. REVIEW OF RSI AND GH DATA

Prior to calculation of expansion factors and production of trip matrices from the RSI and GH surveys, the data was scrutinised to determine whether the trips recorded are actually logical. Illogical trips may appear in the database as a result of coding errors or incorrect information given at interview. Trip patterns for each survey site were analysed to show whether any origin or destination (or both) appeared to be illogical. Review has been conducted in respect of

- Received data removed which is incomplete or clearly erroneous;
- Illogical trips filtered out based on the location of the RSI site compared to the trip origin and destination;
- Origin and destination patterns reviewed based on observed locations; and
- High level checks against independent data sources such as National Travel Survey (NTS) for trip purpose split

In total 8,494 and 4,164 trip records were provided for RSI and GH respectively. For the RSI records, 5,357 were classified as logical, 2,905 were classified as illogical, 135 were classified as incomplete and 94 were classified as unnecessary. For the GH records, 4,091 were classified as logical, 22 were classified as incomplete and 51 were classified as unnecessary.

Figure 6-2 provides a quick summary of the RSI records prior and post cleaning.

Figure 6-2 - Summary of RSI trip records after cleaning

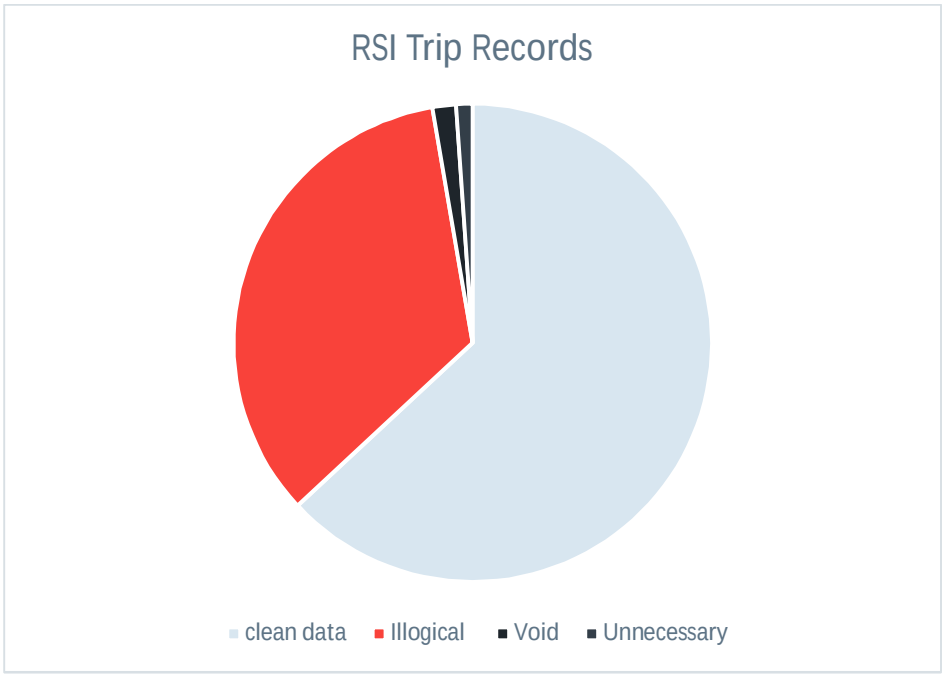
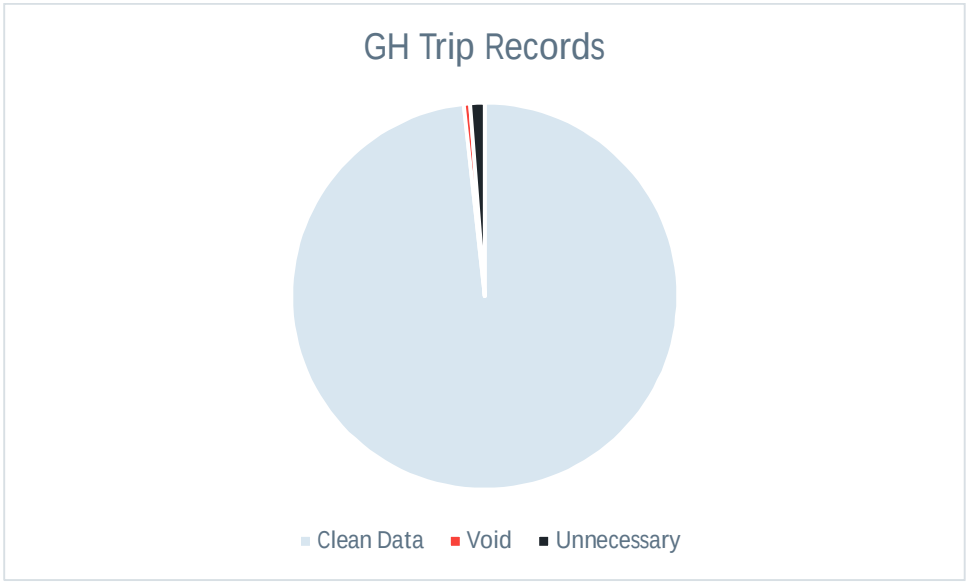


Figure 6-3 - Summary of GH trip records after cleaning



Trip purposes are an important requirement in building matrices as users of a transport network respond differently (for example in choosing a route through a network) depending on the purpose of their trip.

Purpose splits amongst the RSI trips have been compared against NTS. Data from across North Yorkshire have been used to provide a reliable NTS sample.

Broadly purpose splits align closely between the RSI data and NTS. This helps to instil confidence in the purposes infilled. Education trips make up a smaller proportion of the RSI trips than in NTS in AM and IP periods. For the AM period this may be a reflection of lower sample rates in the peak hour (07:30 – 08:30). Purpose splits for Catterick RSI data would not be expected to be identical to the NTS data which is for a wider area; nevertheless, a reasonably close match helps to verify a

sensible purpose split in the RSI data and therefore that the RSI sample are likely to be representative of the population.

Table 6-1 - **RSI Purpose splits against NTS**

Purpose	AM Peak		Inter-Peak		PM Peak	
	NTS	RSI	NTS	RSI	NTS	RSI
Employers Business	7%	13%	4%	17%	6%	7%
Commuting	38%	51%	15%	15%	33%	35%
Education	22%	4%	11%	3%	3%	4%
Other	33%	32%	70%	65%	58%	55%

6.2.3. EXPANSION OF SURVEY RECORDS

A two directional MCC video link count was conducted on the survey date at each RSI and GH location. This data is used to expand the RSI and GH sample to the total observed flow in the surveyed (inbound) direction.

Sample rates are reflected in **Table 6-2** together with the removal rates post cleaning of the data. Expansion factors are the inverse of sample rates. Expansion has been conducted by Car, LGV and HGV on an hourly basis. Traffic flows are highest for site 7, which limits the scope for achieving a high sample rate due to operational challenges (i.e. the minimum time to complete each survey).

Table 6-2 - **RSI Data Records by Period –**

Site	Period	Direction	Count			Records	Clean Records			Removal %	Sample Rate		
			Cars	LGV	HGV		Cars	LGV	HGV		Cars	LGV	HGV
1	AM	NB	276	45	30	311	186	17	5	33%	67%	38%	17%
	IP		586	70	75	667	378	28	13	37%	65%	40%	17%
	PM		309	69	12	300	198	21	2	26%	64%	30%	17%
2	AM	NB	102	9	3	80	55	6	1	23%	54%	67%	33%
	IP		128	16	1	136	92	15	1	21%	72%	94%	100%
	PM		84	9	0	90	67	6	0	19%	80%	67%	
3	AM	NB	291	24	6	224	165	17	0	19%	57%	71%	0%
	IP		416	49	6	388	267	28	4	23%	64%	57%	67%
	PM		240	48	3	214	167	16	2	14%	70%	33%	67%
4	AM	NB	348	33	3	178	110	4	0	36%	32%	12%	0%
	IP		165	29	14	160	101	15	1	27%	61%	52%	7%
	PM		180	24	0	105	72	1	0	30%	40%	4%	
5	AM	NB	462	66	9	190	33	4	1	80%	7%	6%	11%
	IP		541	111	75	376	77	8	1	77%	14%	7%	1%

Site	Period	Direction	Count			Records	Clean Records			Removal %	Sample Rate		
			Cars	LGV	HGV		Cars	LGV	HGV		Cars	LGV	HGV
	PM		666	84	21	256	62	7	0	73%	9%	8%	0%
6	AM	SB	951	204	114	523	293	33	8	36%	31%	16%	7%
	IP		1518	290	158	761	434	46	16	35%	29%	16%	10%
	PM		1137	195	21	320	199	13	1	33%	18%	7%	5%
7	AM	WB	2067	267	99	303	225	18	2	19%	11%	7%	2%
	IP		2500	345	143	369	225	21	5	32%	9%	6%	3%
	PM		1914	207	36	177	119	6	0	29%	6%	3%	0%
	AM		927	78	18	425	268	24	4	30%	29%	31%	22%
8	IP	SB	1713	170	35	729	491	21	3	29%	29%	12%	9%
	PM		1044	105	3	394	289	9	1	24%	28%	9%	33%
	AM		366	15	3	210	74	4	0	63%	20%	27%	0%
9	IP	SB	315	41	11	418	140	15	2	62%	44%	37%	18%
	PM		165	15	0	184	90	2	0	50%	55%	13%	

Table 6-3 - **GH Data Records by Period**

Site	Period	Direction	Count			Records	Clean Records			Removal %	Sample Rate		
			Cars	LGV	HGV		Cars	LGV	HGV		Cars	LGV	HGV
1	AM	IB	411	9	6	74	68	5	0	1%	17%	56%	0%
	IP		323	21	11	58	51	3	4	0%	16%	14%	36%
	PM		135	3	3	24	17	5	1	4%	13%	167%	33%
2	AM	IB	306	24	0	143	125	8	0	7%	41%	33%	
	IP		276	34	14	194	156	19	4	8%	57%	56%	29%
	PM		99	3	3	33	28	1	0	12%	28%	33%	0%
3	AM	IB	723	42	18	260	239	10	7	2%	33%	24%	39%
	IP		411	64	22	314	288	13	8	2%	70%	20%	36%
	PM		201	15	0	91	86	2	0	3%	43%	13%	
4	AM	IB	369	30	9	215	198	13	4	0%	54%	43%	44%
	IP		242	62	32	193	163	23	4	2%	67%	37%	13%
	PM		48	6	3	37	35	2	0	0%	73%	33%	0%
5	AM	IB	447	15	9	145	136	6	3	0%	30%	40%	33%
	IP		290	26	7	155	143	9	2	1%	49%	35%	29%
	PM		105	6	3	65	63	1	0	2%	60%	17%	0%

Site	Period	Direction	Count			Records	Clean Records			Removal %	Sample Rate		
			Cars	LGV	HGV		Cars	LGV	HGV		Cars	LGV	HGV
6	AM	IB	1101	60	12	382	366	15	1	0%	33%	25%	8%
	IP		920	80	27	736	694	34	2	1%	75%	43%	7%
	PM		297	15	12	279	270	3	0	2%	91%	20%	0%
7	AM	IB	576	57	15	299	276	16	1	2%	48%	28%	7%
	IP		329	63	26	326	284	25	10	2%	86%	40%	38%
	PM		138	21	6	133	116	10	5	2%	84%	48%	83%

Whilst a target sample rate is broadly achieved, for some sites Light and Heavy Goods Vehicles do not achieve a minimum sample rate of 15%. Where sample rates are below the target, they are capped at an expansion factor of 15. Expanding to the count would in such cases result in an unrepresentative stream of traffic in as much as it would not contain the likely spread of origins and destinations that would occur in reality.

In addition to MCCs, ATCs were collected at the site locations at a later date to provide an additional level of confidence in the expansion of the RSI and GH records (to overcome the day-to-day variation in the MCCs). ATC data are collected by direction separately. After expanding RSI and GH records to MCC totals, trips are adjusted to reflect the ATC totals. It must be noted that for RSI site 3, there was missing ATC data, so an adjacent ATC was used instead.

6.2.4. REVERSING INBOUND RSI TRIPS

The return (outbound non-surveyed) trips for home-based segments are generated by calculating probabilities of what time trips are made from NTS data. For 'From Home' trips interviewed, the outbound 'To Home' trips are based on the distribution of times that return trips are made given the time the original From Home trips were made in NTS. Equivalently for 'To Home' trips interviewed, the outbound 'From Home' trips are based on the distribution of times that the first leg of trips are made given the time the return 'To Homes' trip were made in NTS. This is aggregated over demand segment in order to retain the purpose split from the interviewed inbound direction.

The sample area for this analysis was North Yorkshire. These are controlled for each site to the respective MCC link count in the non-surveyed direction.

6.2.5. CORDON GAPS

The cordon of RSI sites around the Catterick area is considered watertight.

Regarding trips to Catterick Garrison from the East - it should be noted that trips at sites 5 and 6 are considered likely to intercept short distance trips, whereas trips from further away would be assumed to take the A1(M) and therefore arrive in Catterick via site 7. This has been incorporated whilst filtering out illogical or implausible routes from the RSI records that would be difficult for the model to replicate.

6.2.6. DOUBLE COUNTING OF TRIPS

Some trips in the GH surveys may pass through the RSI sites before getting to the GH site, hence being picked up twice. This also includes trips that are picked up at RSI site 7 that have come from outside Catterick, as these will be picked up at the other sites. It is important not to double-count

trips to and from the military barracks. Consideration has been given to this when building RSI matrices for trips to and from the barracks. Given the different dates of the respective RSI and GH surveys, it was considered useful to retain representation of both survey types through blending to effectively make maximum use of the sample available.

Each barrack was given its own zone in the model. Trips to and from the barrack model zones have been calculated as a blend of the RSI and GH records (after expanding the records to the sample). The blend was calculated based on the respective sample strengths of the two observations. This methodology was based on recommendations from interim matrix building guidance from a technical note written by Arup for the Department for Transport *(matrix-building-guidance.pdf – appendix B1 Merging Data from Different Sources).* The final blended value for a trip to/from each barrack zone was calculated as the sum of the number of records divided by the sampling fractions.

- The Synthetic Matrices are described in section 6.3, but it is worth noting that equivalent trips to and from the barracks model zones in the Synthetic Matrices are removed for two reasons:
- To prevent double counting (with the RSI/Gatehouse records, which have already been blended together), and
- There is limited confidence in the synthetic matrices to military barracks as the synthetic trips are based on general NTEM purposes (such as commute or other), whereas the makeup of trips to and from military barracks is less well known hence an observed source of information (e.g. the RSI and Gatehouse records) would be preferable. Hence there is no perceived need to blend RSI/Gatehouse and synthetic records.

6.2.7. DEMAND SEGMENTATION

The expanded RSI data at each RSI and GH site have been partitioned into the following demand segments:

- Car:
  - Home-Based Commute (HBW);
  - Home-Based Employer Business (HBEB);
  - Home-Based Education (HBED);
  - Home-Based Other (HBO);
  - Non- Home-Based Commute (NHBW)
  - Non- Home-Based Employer Business (NHBEB);
  - Non- Home-Based Education (NHBED);
  - Non- Home-Based Other (NHBO);
  - LGV; and
  - HGV.

The car demand segments are subsequently aggregated into the 3 user classes as shown in table below for summary and also for the assignment purpose.

Table 6-4 - Assignment User Classes and Demand Segmentation

Business	Commute	Other
· HBEB	· HBW	· HBED
· NHBEB	· NHBW	· HBO
		· NHBED
		· NHBO

6.2.8. SUMMARY OF EXPANDED RSI TRIPS

The following number of RSI and GH trips have been yielded after expanding to MCC totals and adjusting to reflect ATC peak hour totals. **Table 6-5** and **Table 6-6** summarise the results for RSI sites and **Table 6-7** and **Table 6-8** summarise the results for the GH sites. Where the minimum target sample rate is not met, a 'cap' of 15 is applied to the expansion factor. Target sample rates are met for all car trips and most Light and Heavy Goods Vehicle trips.

Table 6-5 - **Expanded RSI Trips Inbound**

Site	Location	Period	Dir	Count			Expanded RSI Trips		
				Cars	LGV	HGV	Cars	LGV	HGV
1	Range Road, north of Moor Lane junction	AM	NB	87	14	9	87	14	9
		IP		101	12	13	101	12	13
		PM		102	23	4	102	23	4
2	Hunton Road, north of Hawkswell Lane junction	AM	NB	28	2	1	28	3	1
		IP		21	3	0	21	3	0
		PM		26	3	0	26	3	0
3	Bedale Road, north of Hawkswell Lane junction	AM	NB	97	8	2	97	8	2
		IP		69	8	1	69	8	1
		PM		80	16	1	80	16	1
4	James Lane, north of Moor Lane junction	AM	NB	113	11	1	113	11	1
		IP		32	6	3	32	6	3
		PM		49	7	0	49	7	0
5	A6055 Leeming Lane	AM	NB	145	21	3	145	21	3
		IP		82	17	11	82	17	5
		PM		203	26	6	203	26	6
6	A6055 Gatherly Road	AM	SB	292	63	35	292	63	35
		IP		249	47	26	249	48	26
		PM		377	65	7	377	65	7
7	A6136 Catterick Road	AM	WB	597	77	29	597	77	29
		IP		407	56	23	407	56	23
		PM		563	61	11	563	61	11

Site	Location	Period	Dir	Count			Expanded RSI Trips		
				Cars	LGV	HGV	Cars	LGV	HGV
		AM		312	26	6	312	26	6
8	A6136	IP	SB	277	27	6	277	28	6
		PM		309	31	1	309	31	1
		AM		82	3	1	82	3	1
9	Plumber Road	IP	SB	44	6	2	44	6	2
		PM		50	5	0	50	5	0

Table 6-6 - Expanded RSI Trips Outbound

Site	Location	Period	Dir	Count			Expanded RSI Trips		
				Cars	LGV	HGV	Cars	LGV	HGV
1	Range Road, north of Moor Lane junction	AM	SB	73	14	17	73	14	17
		IP		106	14	12	106	14	12
		PM		122	10	5	122	10	5
2	Hunton Road, north of Hawkswell Lane junction	AM	SB	24	6	0	24	6	0
		IP		22	2	0	22	2	0
		PM		28	2	0	28	3	0
3	Bedale Road, north of Hawkswell Lane junction	AM	SB	87	19	0	87	19	0
		IP		67	11	2	67	11	2
		PM		102	7	0	102	7	0
4	James Lane, north of Moor Lane junction	AM	SB	106	8	3	53	4	1
		IP		41	7	3	41	7	4
		PM		67	8	0	67	8	0
5	A6055 Leeming Lane	AM	SB	207	30	11	207	24	11
		IP		86	16	11	86	15	11
		PM		144	19	0	144	11	0
6	A6055 Gatherly Road	AM	NB	379	70	32	379	70	32
		IP		256	53	35	256	53	35
		PM		361	83	27	361	83	28
7	A6136 Catterick Road	AM	EB	477	51	34	477	40	25
		IP		442	64	23	442	60	23
		PM		636	54	7	636	31	5
8	A6136	AM	NB	228	28	5	228	29	5
		IP		274	27	4	274	27	4
		PM		352	23	0	352	23	0
9	Plumber Road	AM	NB	41	1	1	41	1	1
		IP		51	6	1	51	6	1
		PM		67	6	0	67	6	0

Table 6-7 - Expanded GH Trips Inbound

Site	Location	Period	Direction	Count			Expanded RSI Trips		
				Cars	LGV	HGV	Cars	LGV	HGV
1	Horne Road, Somme Barracks	AM	NB	67	5	1	70	2	1
		IP		23	2	1	24	2	1
		PM		15	0	0	15	0	0
2	Scotton Road, Helles Barracks	AM	NB	92	8	1	94	7	0
		IP		42	6	1	43	5	2
		PM		28	1	0	28	1	1
3	Scotton Road, Vimy Barracks	AM	NB	249	16	3	248	14	6
		IP		67	9	2	64	10	3
		PM		53	3	0	52	4	0
4	Leyburn Road, Paive Line access (Catterick Garrison)	AM	NB	118	8	3	116	9	3
		IP		38	9	4	37	10	5
		PM		14	1	0	13	2	1
5	Hipswell Road East, Gaza Barracks	AM	NB	125	5	0	123	4	3
		IP		39	3	1	38	3	1
		PM		28	1	0	27	2	1
6	Ava Road, entrance to Munster Barracks	AM	SB	269	12	2	266	15	3
		IP		129	10	3	128	11	4
		PM		107	2	0	101	5	4
7	Leeming Lane, Marne Barracks	AM	WB	151	17	4	153	15	4
		IP		47	6	2	44	8	4
		PM		40	2	1	36	5	2

Table 6-8 - Expanded GH Trips Outbound

Site	Location	Period	Direction	Count			Expanded RSI Trips		
				Cars	LGV	HGV	Cars	LGV	HGV
1	Horne Road, Somme Barracks	AM	SB	18	1	0	17	1	2
		IP		28	3	1	29	2	1
		PM		37	1	0	37	1	0
2	Scotton Road, Helles Barracks	AM	SB	33	4	2	33	5	2
		IP		48	6	1	47	6	2
		PM		66	3	0	66	3	0
3	Scotton Road, Vimy Barracks	AM	SB	58	6	2	57	6	3
		IP		95	10	2	92	11	4
		PM		131	6	0	128	8	1
4	Leyburn Road, Paive Line access (Catterick Garrison)	AM	SB	25	10	4	26	8	6
		IP		54	9	4	53	9	4
		PM		70	3	0	67	5	1
5	Hipswell Road East, Gaza Barracks	AM	SB	34	2	0	32	2	2
		IP		52	3	1	52	4	1

		PM		79	2	0	77	4	1
6	Ava Road, entrance to Munster Barracks	AM	NB	159	4	1	155	3	6
		IP		152	12	3	150	13	3
		PM		226	6	0	224	9	0
7	Leeming Lane, Marne Barracks	AM	EB	50	4	1	51	2	2
		IP		65	8	3	61	10	4
		PM		103	7	1	96	14	1

Table below shows the final blend of the RSI and GH matrices at the Internal-Internal (RSI to RSI, within simulation area), Internal-External (RSI area to external buffer area), External-Internal movements (external buffer area to RSI area) and external to external area.

Table 6-9 - Final Blended RSI/GH Matrices (Vehs)

	AM Peak			Inter-Peak			PM Peak		
Sector	RSI	External	Total	RSI	External	Total	RSI	External	Total
Business									
RSI cordon	91	39	130	84	106	190	101	180	281
External	135	25	160	121	41	162	88	39	127
Total	226	64	290	205	147	352	189	219	408
Commute									
RSI cordon	365	591	956	142	334	476	147	463	610
External	859	230	1,089	177	76	253	639	157	796
Total	1224	821	2,045	319	410	729	786	620	1,406
Other									
RSI cordon	111	522	633	93	580	673	152	805	957
External	431	143	574	691	165	856	792	198	990
Total	542	665	1,207	784	745	1,529	944	1003	1,947
LGV									
RSI cordon	47	155	202	74	150	224	43	133	176
External	198	95	293	145	69	214	176	106	282
Total	245	250	495	219	219	438	219	239	458
HGV									
RSI cordon	27	56	83	20	59	79	8	18	26
External	59	69	128	51	65	116	17	34	51
Total	86	125	211	71	124	195	25	52	77

The table below shows the percentage or distribution of the trips by sector over the internal and external area.

Table 6-10 - Distribution of RSI/GH Trips by Sector

	AM Peak			Inter-Peak			PM Peak		
Sector	RSI	External	Total	RSI	External	Total	RSI	External	Total
Business									
RSI Cordon	31%	13%	**45%**	24%	30%	**54%**	25%	44%	**69%**
External	47%	9%	**55%**	34%	12%	**46%**	22%	10%	**31%**
Total	**78%**	**22%**	**100%**	**58%**	**42%**	**100%**	**46%**	**54%**	**100%**
Commute									
RSI Cordon	18%	29%	**47%**	19%	46%	**65%**	10%	33%	**43%**
External	42%	11%	**53%**	24%	10%	**35%**	45%	11%	**57%**
Total	**60%**	**40%**	**100%**	**44%**	**56%**	**100%**	**56%**	**44%**	**100%**
Other									
RSI Cordon	9%	43%	**52%**	6%	38%	**44%**	8%	41%	**49%**
External	36%	12%	**48%**	45%	11%	**56%**	41%	10%	**51%**
Total	**45%**	**55%**	**100%**	**51%**	**49%**	**100%**	**48%**	**52%**	**100%**
LGV									
RSI Cordon	9%	31%	**41%**	17%	34%	**51%**	9%	29%	**38%**
External	40%	19%	**59%**	33%	16%	**49%**	38%	23%	**62%**
Total	**49%**	**51%**	**100%**	**50%**	**50%**	**100%**	**48%**	**52%**	**100%**
HGV									
RSI Cordon	13%	27%	**39%**	10%	30%	**41%**	10%	23%	**34%**
External	28%	33%	**61%**	26%	33%	**59%**	22%	44%	**66%**
Total	**41%**	**59%**	**100%**	**36%**	**64%**	**100%**	**32%**	**68%**	**100%**

6.3 PRODUCTION OF SYNTHETIC TRIP MATRICES

6.3.1. OVERVIEW

Trips from the blended RSI/GH data form a partial matrix in that only trips into and out of Catterick are observed. Trips not captured by the RSI and GH data (i.e. trips made internally and externally of the RSI cordon) were therefore infilled through the development of Synthetic matrices.

Synthetic matrices are based on likely movements which are generated using population, employment and car ownership data and distributed between zones against a cost skim and an observed trip length distribution. They do not contain any actual observed trips and are unlikely to fully replicate local movements or distributions to/from specific trip generators. This section describes how Synthetic Matrices are developed.

Although the synthetic matrices were used to infill movements not captured by the RSI/GH surveys, a complete synthetic matrix was built for redundancy (including internal to external movements), just in case a decision was made later on to incorporate some alternative representations of internal to external movements (say, if the RSIs had a poor sample after processing). To that end, since the

gravity model would determine the interaction between origin and destination trip ends, a full set of trip ends was produced for Great Britain to facilitate the synthetic matrix build.

6.3.2. ASSUMPTIONS AND METHODOLOGY

The National Trip End Model (NTEM) was used to derive estimates of total trip origins and destinations. This was for person trips (albeit made using private car) across Great Britain, for all day, in origin destination format. Since it was not perceived that there would be a demand model build, there was no requirement to produce matrices in a production attraction format.

NTEM produces detailed outputs at a Middle Super Output Area (MSOA) level. However, many Catterick model zones are smaller than this. Therefore, a set of splitting factors was required to convert to model zones, depending on trip purpose (e.g. edubase data determine the zones that are likely to be destinations for education trips). A number of census data sources were used to do this:

- KS101EW – Resident Population
- QS601EW – Economically Active Population
- WD1101EW – Workday Population
- WD605EW – Workplace Population
- Edubase data

Trip Ends were split into From Home and To Home AM, IP, PM and OP trips using splitting factors from National Travel Survey data. The From and To Home split allowed for a realistic direction in each time period (e.g. AM would contain a lot of trips from residential to commercial areas as people typically commute from home to work, whereas PM matrices would be likely to contain the opposite movements predominantly).

The distribution of origin productions to destination zones are undertaken using the gravity model approach. A bespoke application in Python software is used which performs an iterative search on the parameters of the chosen deterrence function to find the optimal pair of values. That is, the values which generate the Trip Length Distribution (TLD) based on the zonal trip ends and pairwise generalised costs that has the closest fit to the observed TLD.

The gravity model with a tanner function was used as the deterrence function, which estimates number of trips from zone i to zone j using the formula:

$$t_{ij} = P_i \frac{A_j F_{ij}}{\sum_x A_x F_{ix}}$$

Where:

- P_i is the number of productions for zone i; and
- A_i is the number of attractions for zone j.
- The 'attractiveness' from zone i to zone j, F_{ij} , by purpose and time period was defined here to be the value of the tanner function with some fitted parameters time period and purpose specific parameters α and β:

$$F_{ij} =, \; x > 0$$

The gravity model application required three data inputs as below:

- Trip Ends: were generated using NTEM;
- Generalised Cost Skims: distance and time skims were extracted from the Catterick network then converted to generalised costs; and

- Observed Trip Length Distributions: observed distance profile were derived from NTS for the North Yorkshire by purposes.

A limitation of synthetic matrices is that they can only generate likely movements based on the locality of population zones and employment zones. More local patterns such as school catchment areas will not be reflected.

As the model is built to represent Catterick and the immediate surroundings, the network is coded in limited detail in external areas. This limits opportunities for traffic to route externally to Catterick (e.g. a trip from Birmingham to Newcastle). The gravity model is therefore calibrated based on Internal-Internal (within simulation area), Internal-External (simulation area to buffer area) and External-Internal movements (buffer area to simulation area). External-External (buffer area to buffer area) movements are discarded.

Occupancy values from WebTAG have also been used to convert from person trips to vehicle trips prior to inclusion with the observed RSI matrices.

6.3.3. OUTPUT SYNTHETIC MATRICES

NTEM, NTS data, population/employment data were used to derive the synthetic elements. As the RSI matrices already capture all the Internal-External and External-Internal movements, and were assumed to have a strong sample, these elements are removed, along with trips to and from barracks zones, and uncalibrated External-External trips.

The synthetic elements produced are for car only. **Table 6-11** shows the total number of trips produced in the synthetic matrices at each stage of development: the full synthetic matrix (all Internal-Internal, External-External, Internal-External and External-Internal trips), after removing External-External, Internal-External and External-Internal, and after removing double counting. It must be noted that these figures include intra-zonal trips.

Table 6-11 - Total Synthetic Matrix Trips (Vehs)

	AM Peak			Inter-Peak			PM Peak		
Sector	RSI	External	Total	RSI	External	Total	RSI	External	Total
Business									
RSI Cordon	174	0	174	166	0	166	149	0	149
External	0	31	31	0	30	30	0	27	27
Total	174	31	205	166	30	196	149	27	176
Commute									
RSI Cordon	753	0	753	451	0	451	651	0	651
External	0	195	195	0	117	117	0	169	169
Total	753	195	948	451	117	568	651	169	820
Other									
RSI Cordon	1,720	0	1,720	3,620	0	3,620	1,748	0	1,748
External	0	245	245	0	487	487	0	232	232
Total	1,720	245	1,965	3,620	487	4,107	1,748	232	1,980
Car									
RSI Cordon	2,647	0	2,647	4,237	0	4,237	2,548	0	2,548
External	0	471	471	0	634	634	0	428	428
Total	2,647	471	3,118	4,237	634	4,871	2,548	428	2,976

6.3.4. INTERNAL TO INTERNAL GOODS VEHICLE MOVEMENTS

The synthetic matrices described thus far only cover trips made by private car. An estimate of the internal to internal GV trips were therefore calculated based on the distribution of the synthetic Other car trips, scaled suitably to reflect likely Car/GV fleet volumes (85/10/5 Car/LGV/HGV).

6.4 EXTERNAL TO EXTERNAL MOVEMENTS

It was considered essential to have some background traffic along the A1(M) external to Catterick. This helps to provide a realistic level of cost of travel along the A1(M) which would affect movements to and from Catterick, and hence adds confidence to the output assignments of the model. Such traffic would not be present in the RSI/GH matrices. Although the synthetic matrices could offer this traffic, they were not calibrated for external to external movements so not considered to be of sufficient quality.

The source of these external to external movements was the North Regional Transport Model (NRTM), developed by WSP/WSP for Highways England. A request for use of the matrices was granted by Highways England.

The NRTM was built to evaluate inter-urban traffic on the Strategic Road Network. It contains demand between aggregate zones north and south of Catterick that are assumed to travel along the A1(M). The following process steps were undertaken:

- Identify NRTM zones north and south of the Catterick
- Convert NRTM matrices to Catterick Zones, retaining vehicle splits (car, LGV and HGV) and purpose splits for car (business, commute, other)
- Scale resultant trips to counts collected along the A1 to generate a suitable scale of demand
- Run an assignment of the SATURN model with these external – external matrices to check routeing (i.e. check the trips travel along the A1(M), and not through Catterick). If necessary the NRTM zone selection can be refined, but this assignment also provides an opportunity to assess network coding of the A1(M).

6.5 PRODUCTION OF PRIOR MATRIX

The RSI/GH, Synthetic (including GV as described in 6.3.4) and NRTM matrices were aggregated in the following way:

- RSI/GH: internal to external and external to internal
- Synthetic: internal to internal
- NRTM: external to external along the A1(M)

This process yielded the following number of trips in total, summarised in table below. It must be noted that these figures include intra-zonal trips.

Table 6-12 - Prior Matrix Totals (Vehs)

	AM Peak			Inter-Peak			PM Peak		
Sector	RSI	External	Total	RSI	External	Total	RSI	External	Total
Business									
RSI cordon	265	39	304	250	106	356	250	180	430
External	135	2,961	3,096	121	4,191	4,312	88	5,347	5,435
Total	400	3,000	3,400	371	4,297	4,668	338	5,527	5,865
Commute									
RSI cordon	1,118	591	1,709	593	334	927	798	463	1,261
External	859	2,125	2,984	177	1,227	1,404	639	2,816	3,455
Total	1,977	2,716	4,693	770	1,561	2,331	1,437	3,279	4,716
Other									
RSI cordon	1,831	522	2,353	3,713	580	4,293	1,900	805	2,705
External	431	827	1,258	691	1,869	2,560	792	1,588	2,380
Total	2,262	1,349	3,611	4,404	2,449	6,853	2,692	2,393	5,085
LGV									
RSI cordon	438	155	593	779	150	929	438	133	571
External	198	1,263	1,461	145	1,402	1,548	176	1,331	1,507
Total	636	1,418	2,054	924	1,553	2,477	614	1,464	2,078
HGV									
RSI cordon	268	56	324	454	59	513	251	18	269
External	59	1,968	2,027	51	2,373	2,424	17	1,928	1,945
Total	327	2,024	2,351	505	2,432	2,937	268	1,946	2,214

6.6 MATRIX VERIFICATION

The merged matrices were assigned to the developed network and screenline totals for modelled flows and observed counts compared against the 5% acceptability criteria from TAG Unit M3-1 (summarised in **Table 3-3** in this report). These results are presented in **Table 7-2**.

7 MODEL CALIBRATION

7.1 OVERVIEW

This chapter outlines the calibration process undertaken for the Catterick base year traffic model. This includes the following sections:

- Network calibration;
- Prior matrix assignment results;
- Matrix calibration and Matrix Estimation Process; and
- The Impact of Matrix Estimation on to the PostME matrices and assignments.

The overall network performance statics are summarised in **Table 7-1** below:

Table 7-1 - **Network Performance, 2019 Base year**

Peak Hour	Scenario	Total Distance Travelled (pcu km)	Total Travel Time (pcu hr)	Transient Queueing (pcu hr)	Over-Capacity Queueing (pcu hr)	Total Trips on Network (pcu)
AM Peak	Base 2019	58,130	905	140.7	0.0	17,058
IP	Base 2019	59,290	855	117.8	14.1	18,624
PM Peak	Base 2019	67,070	992	149.4	0.0	20,581

Queues and travel times and speeds are used as indicators of overall network performances, explained as:

- Travel Distance Travelled – Total distance travelled across the network by all vehicles in the model during the modelled time period;
- Total Travel Time – Total journey time of all vehicles within the model during the modelled time period;
- Transient Queueing – Queues that occur at junctions operating within their designed capacity; for example, vehicles stopping momentarily at a give-way line, or during one traffic signal cycle;
- Over-Capacity Queueing – Queues that occur due to there being more traffic than there is network capacity to deal with; for example, traffic held for more than one cycle at a traffic signal junction;
- Total Trips on Network – The total number of vehicles travelling on the network in the modelled time period. It must be noted that these figures do not include intra-zonal trips.

7.2 NETWORK CALIBRATION

Upon the completion of the network building, 6 checks were carried out to ensure the network has been coded satisfactorily prior to commencement of the calibration/validation stage. The summary of these checks is provided below:

7.2.1. TEST 1: COMPLETENESS CHECK

The network coding was completed in accordance with the scope agreed with the NYCC for the study area. All the roads within the study area had been coded in the simulation network, outside the study area within Richmondshire district, all the roads have been coded in the buffer network with a

form of speed-flow curve. Outside Richmondshire district, only major roads that connect traffic to/from/or pass through the study area were coded in a form of fixed-speed network.

7.2.2. TEST 2: SATURN COMPILATION CHECK

A total of 747 warnings were produced by SATURN and was broken down to 4 non-fatal errors, 289 serious warnings and 454 warnings. The 4 non-fatal errors were associated with missing nodes in bus routes therefore no action was required. The remaining serious warnings were reviewed and addressed where appropriate.

7.2.3. TEST 3: INSPECTION OF KEY JUNCTIONS

Junction coding was based on Google maps for junction type and junction layout and signal timings for signalised junctions were obtained from the NYCC. The following checks were carried out and completed:

- All junctions had correct definition;
- All junctions had consistent and appropriate representations based on available source;
- Signalised junctions had correct timing based and staging diagrams based on the data available;
- Roundabouts/mini-roundabouts had been coded accurately according to the data available;
- Opposed right turn at priority junction and signalised junctions were checked against the data available.

7.2.4. TEST 4: LINK CONSISTENCY CHECK

- Link lengths are identical between directions, unless each of the direction was coded as separate link in the model;
- Link types are identical between directions, unless there is specific justification such as difference in speed or number of lanes;
- Change in link type was consistent providing changes in speed limit when moving between urban and rural areas;

7.2.5. TEST 5: NETWORK ROUTEING

Guidance presented in section 7.3 of TAG Unit M3.1 (January 2014), with the number of OD pairs determined as follows:

- Number of OD pairs = (number of zones)0.25 x number of user classes

Based on the initial proposed zoning system, this equates to 18 routes.

The outcomes of this are included in Appendix D**.** All route choices are deemed to be reasonable.

7.2.6. TEST 6: FLAT MATRIX ASSIGNMENT TEST

The flat matrix assignment was carried out to check that:

- routeing between OD pairs appeared plausible with majority of traffic using the major roads as opposed to local roads.

7.3 PRIOR MATRIX ASSIGNMENT

Prior to the calibration process, the Prior matrix assignments were carried out. The outcomes from this process serves two purposes:

Verify that the traffic flows output from the prior matrix assignment match the observed counts at the RSI cordon, this is to ensure that the resultant RSI matrices expanded from the RSI/TMOD records were produced correctly within the acceptable criteria; and

To check if the models are plausible in terms of magnitude, delays and traffic routeing. During this, network refinement was carried out where appropriate in order to improve the network prior to the calibration/validation stage.

A summary of the Prior matrix assignment results is provided in **Table 7-2**.

Table 7-2 - Prior Matrix Assignment Results

Measure	Direction	Links	AM Peak		Inter-Peak		PM Peak	
			Flow	GEH	Flow	GEH	Flow	GEH
Cordon/Screenline performance								
RSI Cordon	Inbound	7	18%	7	17%	5.4	10%	3.5
	outbound	7	3%	1	15%	5	6%	2.3
Inner Cordon	Inbound	6	1%	0.5	0%	0	10%	4.1
	outbound	6	-7%	2.6	-2%	0.9	1%	0.3
Screenline 1	EB	5	2%	0.5	-14%	3.1	-31%	7.8
	WB	5	-37%	9.8	-8%	1.7	-7%	1.4
Screenline 2	EB	6	-7%	2.8	16%	4.9	-5%	1.8
	WB	6	3%	1.2	23%	6.9	0%	0.1
Screenline 3	EB	4	13%	3.7	23%	5.8	14%	4.1
	WB	4	16%	4.6	20%	5.1	1%	0.2
Screenline 4	NB	5	11%	2.8	-15%	3.5	-18%	4.7
	SB	5	-26%	7.8	-1%	0.1	12%	2.9
Calibration/Validation Count performance								
Calibration Counts	All	215	194/215	155/215	199/215	175/215	193/215	149/215
			-4%	6.7	1%	0.8	-7%	13
Validation Counts	All	27	20/27	17/27	20/27	19/27	20/27	17/27
			16%	10.7	31%	17.5	17%	11.6

Note:

Flow	GEH	
9/9	9/9	Number of links that passed the Flow and GEH criteria respectively
2%	1.3	Difference from observed counts in terms of %Flow and GEH at screenline/cordon totals

As can be seen, the RSI cordon total flows vs. observed counts are within the acceptability criteria for all the three modelled hours. The other screenlines/cordon are generally higher than the observed counts, which is normally anticipated as the nature of the synthetic elements produced to represent trips made internally and externally from the RSI cordon.

7.4 MATRIX CALIBRATION - MATRIX ESTIMATION METHODOLOGY

The matrix estimation process employed as part of the calibration process is designed to refine the travel patterns using the observed traffic counts. The calibration counts used within the ME2 process have been listed in **Table 7-3**:

Table 7-3 Calibration Count Locations

Link ID	Site Description	Site Location
1	A6136 Richmond Road/ Haig Road	MCC7
4	Barff Lane (between Field Avenue and St Wilfrid's Crescent)	ATC3
5	Plumer Road/ Gough Road	MCC4
7	Hawkswell Lane, Barden Road, east of A6108 before Range Road junction	ATC24
8	A6136 Richmond Road/ Haig Road	MCC7
11	Barff Lane (between Field Avenue and St Wilfrid's Crescent)	ATC3
12	Plumer Road/ Gough Road	MCC4
14	Hawkswell Lane, Barden Road, east of A6108 before Range Road junction	ATC24
15	B6271 Station Road between B6271 Richmond Road and A6055 Gatherly Road	ATC16
18	A6055 west of A6136 Catterick road east of the A1(M)	ATC13
20	Catterick Lane, south of new junction leading to overbridge over A1(M)	ATC21
30	B6271 Station Road between B6271 Richmond Road and A6055 Gatherly Road	ATC16
31	A6055 Catterick Road/ A6136 Leeming Lane/ A6136 Gatherly Road	MCC26
32	Leeming Lane, leading to Marne Barracks	ATC20
34	Scotton Road/ Helles Barracks entrance	MCC39
35	Greenlands Lane (between Second Common Lane and Hospital Lane)	ATC10
36	Horne Road/ Loos Road	MCC20
38	Dam Lane (between Thorpe Wood and Selby Dam)	ATC12
40	Scotton Road/ Helles Barracks entrance	MCC39
41	Greenlands Lane (between Second Common Lane and Hospital Lane)	ATC10
42	Horne Road/ Loos Road	MCC20
44	Dam Lane (between Thorpe Wood and Selby Dam)	ATC12
47	A6136 Catterick Road/ Byng Road/ Horne Road	MCC22
49	Bedale Road/ Hawkswell Lane	MCC17
51	Range Road, North of Moor Lane Junction	RSI1
53	Portholme Road (between New Lane and Portholme Crescent)	ATC5
55	A6136 Catterick Road/ Byng Road/ Horne Road	MCC22
57	Bedale Road/ Hawkswell Lane	MCC17
59	Range Road, North of Moor Lane Junction	RSI1
61	A6136 Richmond Road, North of Junction with Hispwell Road	RSI8
63	York Road (between Northfield and Beech Croft)	ATC8
64	Scotton Road/ Church Road	MCC13
65	Plumer Road, North of Bagerbeck Road Junction (in layby)	RSI9
67	A6136 Richmond Road, North of Junction with Hispwell Road	RSI8
69	York Road (between Northfield and Beech Croft)	ATC8
70	Scotton Road/ Church Road	MCC13
71	Plumer Road, North of Bagerbeck Road Junction (in layby)	RSI9
77	Hunton Road, North of Hawkswell Lane Junction	RSI2

Link ID	Site Description	Site Location
78	Hunton Road, North of Hawkswell Lane Junction	RSI2
81	James Lane, North of Moor Lane Junction	RSI4
82	James Lane, North of Moor Lane Junction	RSI4
83	A6055 Leeming Lane, South of Leeming Lane Junction	RSI5
84	A6055 Leeming Lane, South of Leeming Lane Junction	RSI5
85	A6055 Gatherly Road, South of Howe Hill Lane	RSI6
86	A6055 Gatherly Road, South of Howe Hill Lane	RSI6
87	A6136 Catterick Road, West of A6055 Catterick Road Junction	RSI7
88	A6136 Catterick Road, West of A6055 Catterick Road Junction	RSI7
91	Plumer Road, North of Bagerbeck Road Junction (in layby)	RSI9
92	Plumer Road, North of Bagerbeck Road Junction (in layby)	RSI9

The junction turning counts used for Calibration, which are also plotted in Figure 4-9 have been listed in Table 7-4.

Table 7-4 - Junction Turn Count Locations

Junction ID	Site Description	Site Location
1	Hakswell Lane/ Range Road	MCC1
3	Leyburn Road/ Plumer Road	MCC3
6	Plumer Road/ Haig Road	MCC6
7	A6136 Richmond Road/ Haig Road	MCC7
8	A6136 Richmond Road/ Hipswell Road West/ Hipswell Road East	MCC8
11	A6136 Richmond Road/ Leyburn Road/ A6136 Catterick Road	MCC11
16	Hawkswell Lane/ Hunton Road	MCC16
17	Bedale Road/ Hawkswell Lane	MCC17
19	Moor Lane/ James Lane	MCC19
22	A6136 Catterick Road/ Byng Road/ Horne Road	MCC22
23	A6136 Catterick Road/ Colburn Lane	MCC23
26	A6055 Catterick Road/ A6136 Leeming Lane/ A6136 Gatherly Road	MCC26
27	A6136 Gatherly Road/ B6272 Bridge Road	MCC27
29	Station Road/ Gatherly Road	MCC29
33	Catterick Lane/ A6055	MCC33
34	A6055/ overbridge over A1(M)	MCC34
36	Catterick Lane/ Tunstall Lane	MCC36
39	Scotton Road/ Helles Barracks entrance	MCC39

The counts were grouped into screenlines to ensure that the total flow across the screenline was constrained to the total observed counts. The counts used as constraints were input by vehicle class so that the ME2 process would be able to adjust Light (Car and LGV) and HGV (OGV1 and OGV2) trips separately.

Trips were adjusted in the matrix to produce the estimated matrix, which is most likely to be consistent with the traffic counts. The matrix of trips input to matrix estimation is known as the prior matrix, while the output matrix from matrix estimation is known as the post matrix.

For the calibration of the Catterick base year traffic model, it was decided that 5 Matrix Estimation loops would be sufficient to produce an improved goodness of fit to the prior matrices. There are no specific convergence criteria for matrix estimation, but the aim of the procedure is to improve the goodness of fit between modelled flows and counts. The parameters that were adopted for the Matrix Estimation within SATURN are listed in **Table 7-5**.

Table 7-5 - **Parameters used for Matrix Estimation**

Parameter	Description	Value
XAMAX	The maximum balancing factor to be applied to avoid large changes to the prior matrix. (The minimum balancing factor is taken as the inverse)	1.5
EPSILN	The convergence criteria for the difference between individual observed counts and their respective model flow.	0.01
ITERMX	The maximum number of iterations that will be run to achieve convergence.	199

The XAMAX parameter was used to limit the change that could be made to each cell in the matrix (E.g. a XAMAX value of 1.5 means that the cell value can only change by 50%), between each iteration of matrix estimation. The values were chosen to limit the changes made in order to conform to the matrix change criteria set out by WebTAG Unit M3-1.

7.5 IMPACTS OF MATRIX ESTIMATION ON PRIOR MATRIX

The matrix estimation was carried out using the calibration counts as summarised in section 4.9. This section summarises the impacts of the Matrix Estimation in terms of changes in trips, trip length distribution and statistics and traffic flows in comparison with observed counts that were used for the calibration at the “total vehicles” level. Detailed analysis of the impacts of the ME2 by user classes are presented in Appendix E.

The change in the matrix totals by each user class is summarised in **Table 7-6**.

Table 7-6 - **Impacts of Matrix Estimation – Change in Matrix Totals (Vehs)**

User Class	AM Peak		Inter Peak		PM Peak	
	Prior	PostME	Prior	PostME	Prior	PostME
Business	3,401	3,437	4,680	4,666	5,866	5,879
%Change		1.1%		-0.3%		0.2%
Commute	4,694	4,861	2,301	2,268	4,717	4,865
%Change		3.5%		-1.5%		3.2%
Other	3,610	3,569	6,862	6,757	5,083	5,192
%Change		-1.1%		-1.5%		2.1%
LGV	2,053	2,043	2,478	2,470	2,078	2,082
%Change		-0.5%		-0.3%		0.2%

User Class	AM Peak		Inter Peak		PM Peak	
	Prior	PostME	Prior	PostME	Prior	PostME
HGV	2,351	2284	2,937	2,873	2,213	2192.613
%Change		-2.9%		-2.2%		-0.9%
Totals	16,109	16,193	19,259	19,034	19,958	20,212
%Change		0.5%		-1.2%		1.3%

The table shows that matrix estimation has had a limited impact on the matrix totals. It must be noted that these figures include intra-zonal trips. The impact is the same across all the user classes with the largest change being the Commute trip totals in the AM peak matrix. There are no changes greater than 3.5%. It is important to demonstrate that the matrix estimation has had a limited impact on the overall matrix composition and that the prior matrix (that consists of primarily observed data) has not had to be altered excessively to achieve model calibration.

It is important to look at the difference in the trip length distribution and analyse the regression statistics between the prior and final matrices on a cell, row and column basis. The changes have to conform to WebTAG criteria from Unit M3-1.

The regression statistics and trip length distribution changes are presented in **Table 7-7**. This table demonstrates that changes between the prior and final matrices are acceptable and fall comfortably within the specified criteria.

Table 7-7 Impacts of Matrix Estimation – Regression Statistics

Period	Aspect	Measure	Require	Value	Pass
AM	Cells	Slope	0.98 -1.02	0.999	ü
		Intercept	Near 0	0	ü
		R Squared	>0.95	0.9977	ü
	Rows	Slope	0.98 -1.02	0.998	ü
		Intercept	Near 0	0.032	ü
		R Squared	>0.95	0.9981	ü
	Columns	Slope	0.98 -1.02	0.996	ü
		Intercept	Near 0	0.389	ü
		R Squared	>0.95	0.9963	ü
	Mean	Prior		66.2	
		PostME		66.3	
		%Diff	<5%	-0.24%	ü
	SD	Prior		58.6	
		PostME		58.7	
		%Diff	<5%	-0.20%	ü
IP	Cells	Slope	0.98 -1.02	1	ü
		Intercept	Near 0	-0.002	ü
		R Squared	>0.95	0.9992	ü
	Rows	Slope	0.98 -1.02	0.998	ü
		Intercept	Near 0	-0.291	ü

Period	Aspect	Measure	Require	Value	Pass
		R Squared	>0.95	0.9987	ü
	Columns	Slope	0.98 -1.02	0.996	ü
		Intercept	Near 0	-1.242	ü
		R Squared	>0.95	0.9985	ü
	Mean	Prior		67.89	
		PostME		68.44	
		%Diff	<5%	-0.81%	ü
	SD	Prior		61.69	
		PostME		61.89	
		%Diff	<5%	-0.32%	ü
PM	Cells	Slope	0.98 -1.02	0.999	ü
		Intercept	Near 0	0.002	ü
		R Squared	>0.95	0.9987	ü
	Rows	Slope	0.98 -1.02	0.999	ü
		Intercept	Near 0	0.281	ü
		R Squared	>0.95	0.998	ü
	Columns	Slope	0.98 -1.02	0.999	ü
		Intercept	Near 0	1.384	ü
		R Squared	>0.95	0.9981	ü
	Mean	Prior		74.21	
		PostME		73.89	
		%Diff	<5%	0.44%	ü
	SD	Prior		58.37	
		PostME		58.49	
		%Diff	<5%	-0.20%	ü

Based on the criteria set out in **Table 3-1** it can be seen that all of the criteria have been met in each category for each modelled time period. No change in Mean or Standard Deviation (SD) is greater than 1%.

The sector to sector movements were analysed to ensure the matrix estimation process did not distort the matrix. A summary of the change in matrices at the 2x2 sector level is presented in **Table 7-6**, **Table 7-7** and **Table 7-8**. It must be noted that these figures include intra-zonal trips.

Table 7-8 - **Impacts of ME2 – Matrix Change at Sector Level: AM Peak**

Sector	Type	RSI	External	Total
RSI	Prior	3,920	1,363	5,283
	PostME	4,074	1,320	5,394
	%Diff	3.9%	-3.2%	2.1%
External	Prior	1,682	9,144	10,826

	PostME	1,605	9,164	10,769
	%Diff	-4.5%	0.2%	-0.5%
Total	Prior	5,602	10,507	16,109
	PostME	5,679	10,484	16,163
	%Diff	1.4%	-0.2%	0.3%

Table 7-9 - **Impacts of ME2 – Matrix Change at Sector Level: Inter-Peak**

Sector	Type	RSI	External	Total
RSI	Prior	5,785	1,226	7,011
	PostME	5,785	1,139	6,924
	%Diff	0.0%	-7.1%	-1.2%
External	Prior	1,185	11,063	12,248
	PostME	1,100	11,010	12,111
	%Diff	-7.2%	-0.5%	-1.1%
Total	Prior	6,970	12,289	19,259
	PostME	6,885	12,149	19,035
	%Diff	-1.2%	-1.1%	-1.2%

Table 7-10 - **Impacts of ME2 – Matrix Change at Sector Level: PM Peak**

Sector	Type	RSI	External	Total
RSI	Prior	3,638	1,599	5,237
	PostME	3,906	1,633	5,539
	%Diff	7.4%	2.2%	5.8%
External	Prior	1,711	13,010	14,722
	PostME	1,643	13,030	14,672
	%Diff	-4.0%	0.1%	-0.3%
Total	Prior	5,349	14,609	19,958
	PostME	5,549	14,663	20,212
	%Diff	3.7%	0.4%	1.3%

Table 7-8 to **Table 7-10** generally show that the changes at a sector level are no more than 5% and conforms to the WebTAG criteria. There are a few exceptions to this, but these are relatively small sectors and contain the fewest number of trips when compared to other sectors. The actual change in trips is acceptable when taking this into account and therefore the changes of greater than 5% can be deemed acceptable.

8 MODEL VALIDATION

8.1 OVERVIEW

This chapter reports the validation results of the Catterick base year traffic models, in terms of the following:

- Trip matrix validation;
- Link flow/turn flow validations; and
- Journey time validation.

The validation of the base year models utilises two key sources of data:

Traffic count data: a subset of the traffic counts have been defined as independent from those that were used for the calibration (see section **4.9)**; and

Journey time routes that have been defined for number of key routes in/out, within and through Catterick (see section **4.7**)

8.2 ASSIGNMENT CONVERGENCE

The model convergence criterion has been set out in section 3.6 of this document as per that recommended by the WebTAG M3.1. For the Catterick traffic model, the convergence criteria were tightened further in order to achieve higher stability in terms of delays and route choice within the models. The list of the convergence criteria adopted within SATURN is provided in **Table 8-1**.

Table 8-1 - SATURN Convergence Criteria

Parameter	Description	Required value	Model Value		
			AM	IP	PM
ISTOP	The percentage of links which change by less that the values defined by PCNEAR	98	99.5	99.5	99.5
PCNEAR	Defines the threshold maximum percentage flow change (for ISTOP% of links)	1.00	1.00	1.00	1.00
NISTOP	Number of successive loops for the criteria to be met	4	4	4	4

A summary of convergence statistics for the PostME matrix assignments is provided in **Table 8-2**. The results show that all the models converge within the guidance.

Table 8-2 - Convergence Statistics

AM Peak			Inter-Peak			PM Peak		
Loop	%Flow	%GAP	Loop	%Flow	%GAP	Loop	%Flow	%GAP
10	99.7	0	9	99.2	0.00001	7	99.1	0.00003
11	99.3	0.00001	10	99.5	0.00001	8	99	0.00002
12	99.6	0	11	99.5	0.00001	9	99.9	0.00001
13	100	0	12	99.9	0	10	99.8	0.00001
14	100	0	13	99.9	0	11	99.9	0.00001
15	100	0	14	99.9	0	12	99.8	0.00001

8.3 MATRIX VALIDATION

Trip matrix validation on the two validation screenlines (Screenline 2 WB and Screenline 3 EB) is presented in **Table 8-3** to **Table 8-6**.

Table 8-3 - AM Validation Screenline Performance

Screenline/Cordon	Observed	Modelled	Difference	% Difference	GEH
RSI Cordon 1 IB	1603	1675	71	4%	1.8
RSI Cordon 1 OB	1157	1130	-27	-2%	0.8
RSI Cordon 2 IB	1728	1748	20	1%	0.5
RSI Cordon 2 OB	1379	1308	-71	-5%	1.9
Screenline 1 EB	453	456	3	1%	0.1
Screenline 1 WB	553	506	-47	-9%	2.0
Screenline 2 EB	1433	1439	6	0%	0.2
Screenline 2 WB	1451	1497	45	3%	1.2
Screenline 3 EB	892	935	43	5%	1.4
Screenline 3 WB	940	939	-2	0%	0.1
Screenline 4 NB	627	623	-4	-1%	0.1
Screenline 4 SB	751	663	-88	-12%	3.3

Table 8-4 - IP Validation Screenline Performance

Screenline/Cordon	Observed	Modelled	Difference	% Difference	GEH
RSI Cordon 1 IB	1113	1131	19	2%	0.6
RSI Cordon 1 OB	1189	1191	2	0%	0.1
RSI Cordon 2 IB	1347	1307	-40	-3%	1.1
RSI Cordon 2 OB	1416	1286	-130	-9%	3.5
Screenline 1 EB	433	386	-47	-11%	2.3
Screenline 1 WB	408	374	-33	-8%	1.7
Screenline 2 EB	1034	990	-44	-4%	1.4
Screenline 2 WB	992	945	-48	-5%	1.5
Screenline 3 EB	694	678	-16	-2%	0.6
Screenline 3 WB	687	651	-37	-5%	1.4
Screenline 4 NB	541	507	-34	-6%	1.5
Screenline 4 SB	532	512	-20	-4%	0.9

Table 8-5 - PM Validation Screenline Performance

Screenline/Cordon	Observed	Modelled	Difference	% Difference	GEH
RSI Cordon 1 IB	1369	1386	17	1%	0.4
RSI Cordon 1 OB	1594	1644	50	3%	1.2
RSI Cordon 2 IB	1525	1425	-100	-7%	2.6
RSI Cordon 2 OB	1705	1739	34	2%	0.8
Screenline 1 EB	522	465	-57	-11%	2.6
Screenline 1 WB	430	405	-25	-6%	1.2

Screenline/Cordon	Observed	Modelled	Difference	% Difference	GEH
Screenline 2 EB	1464	1458	-6	0%	0.2
Screenline 2 WB	1469	1485	16	1%	0.4
Screenline 3 EB	975	964	-10	-1%	0.3
Screenline 3 WB	933	898	-35	-4%	1.1
Screenline 4 NB	622	583	-39	-6%	1.6
Screenline 4 SB	598	662	65	11%	2.6

Table 8-6 - Validation Screenline Performance Summary

Screenline / Cordon	Direction	Links	AM Peak		Inter-Peak		PM Peak	
			Flow	GEH	Flow	GEH	Flow	GEH
RSI cordon 1	Inbound	7	4%	1.8	2%	0.6	1%	0.4
	Outbound	7	-2%	0.8	0%	0.1	3%	1.2
RSI cordon 2	Inbound	6	1%	0.5	-3%	1.1	-7%	2.6
	Outbound	6	-5%	1.9	-9%	3.5	2%	0.8
Screenline 1	EB	5	1%	0.1	-11%	2.3	-11%	2.6
	WB	5	-9%	2.0	-8%	1.7	-6%	1.2
Screenline 2	EB	6	0%	0.2	-4%	1.4	0%	0.2
	WB	6	3%	1.2	-5%	1.5	1%	0.4
Screenline 3	EB	4	5%	1.4	-2%	0.6	-1%	0.3
	WB	4	0%	0.1	-5%	1.4	-4%	1.1
Screenline 4	NB	5	-1%	0.1	-6%	1.5	-6%	1.6
	SB	5	-12%	3.3	-4%	0.9	11%	2.6

Table 8-3 to **Table 8-6** show that the assignment provides a high-level of model validation when compared to the observed link flows. The validation results for the majority of the screenlines across the AM, IP and PM meet the 5% relative flow difference threshold with the absolute difference in total screenline flows are less than 100 vehicles.

Whilst WebTAG guidelines require that nearly all of the modelled screenline totals lie within 5% of observed totals, the fact that flows across screenlines are low made the 5% target difficult to achieve. The GEH statistic, although no longer used within WebTAG for screenline validation, was nevertheless considered a relevant indicator since it provides weighting in accordance with the scale of traffic flow. A GEH value of less than 4 had previously been considered acceptable for screenline validation. In all cases the screenline validations achieved a GEG value less than 4.

In those instances where the difference between the modelled and observed hourly flows are more than 5%, in only five instances across all time periods does the actual difference exceed 50 vehicles per hour. For a strategic highway model, hourly flow differences of less than 50 can be considered insignificant. In the five other instances the actual differences for each time period are the following:

- 88 – AM peak Screenline 4 SB
- 130 – Inter peak RSI Cordon 2 OB
- 100 – PM peak RSI Cordon 2 IB
- 57 – PM peak Screenline 1 EB; and

- 65 – PM peak Screenline 4 SB.

From this we can see that there is one instance in the AM; one in the interpeak and three in the PM. Out of all of these instances does only one screenline appear more than once, which is Screenline 4 SB. Even then the differences are only 88 and 65 vehicles respectively. Hence the changes of greater than 5% can be deemed acceptable and it can be concluded that the trip matrix validation is satisfactory. This is further emphasised by the strong performance in GEH.

8.4 LINK/TURN FLOW VALIDATION

The calibration and validation results for all user classes in all assignment periods are shown in **Table 8-4**, **Table 8-5** and **Table 8-6** below. Detailed comparisons on a link by link and user class basis are presented in **Appendix F**.

Table 8-7 - Link/Turn Flow Performance – AM Peak

Criteria		Calibration			Validation		
		Count	Pass	%Pass	Count	Pass	%Pass
Link Flow							
Flow criteria							
<700 veh	+/-100 veh	61	61	100%	27	27	100%
700 - 2700 veh	+/-15%	4	3	75%	0	0	NA
> 2700 veh	+/-400 veh	0	0	NA	0	0	NA
Total		65	64	98%	27	27	100%
GEH criteria							
GEH <5 for individual links		65	63	97%	27	26	96%
Turning Flow							
Flow criteria							
<700 veh	+/-100 veh	149	147	99%	0	0	NA
700 - 2700 veh	+/-15%	1	1	100%	0	0	NA
> 2700 veh	+/-400 veh	0	0	NA	0	0	NA
Total		150	148	99%	0	0	NA
GEH criteria							
GEH <5 for individual links		150	134	89%	0	0	NA
Total							
Flow criteria							
<700 veh	+/-100 veh	210	208	99%	27	27	100%
700 - 2700 veh	+/-15%	5	4	80%	0	0	NA
> 2700 veh	+/-400 veh	0	0	NA	0	0	NA
Total		215	212	99%	27	27	100%
GEH criteria							
GEH <5 for individual links		215	197	92%	27	26	96%

Table 8-8 - Link/Turn Flow Performance – Inter-Peak

Criteria		Calibration			Validation		
		Count	Pass	%Pass	Count	Pass	%Pass
Link Flow							
Flow criteria							
<700 veh	+/-100 veh	63	62	98%	27	27	100%
700 - 2700 veh	+/-15%	2	2	100%	0	0	NA
> 2700 veh	+/-400 veh	0	0	NA	0	0	NA
Total		65	64	98%	27	27	100%
GEH criteria							
GEH <5 for individual links		65	63	97%	27	26	96%
Turning Flow							
Flow criteria							
<700 veh	+/-100 veh	150	147	98%	0	0	NA
700 - 2700 veh	+/-15%	0	0	NA	0	0	NA
> 2700 veh	+/-400 veh	0	0	NA	0	0	NA
Total		150	147	98%	0	0	NA
GEH criteria							
GEH <5 for individual links		150	137	91%	0	0	NA
Total							
Flow criteria							
<700 veh	+/-100 veh	213	209	98%	27	27	100%
700 - 2700 veh	+/-15%	2	2	100%	0	0	NA
> 2700 veh	+/-400 veh	0	0	NA	0	0	NA
Total		215	211	98%	27	27	100%
GEH criteria							
GEH <5 for individual links		215	200	93%	27	26	96%

Table 8-9 - Link/Turn Flow Performance – PM Peak

Criteria		Calibration			Validation		
		Count	Pass	%Pass	Count	Pass	%Pass
Link Flow							
Flow criteria							
<700 veh	+/-100 veh	62	61	98%	27	27	100%
700 - 2700 veh	+/-15%	2	2	100%	0	0	NA
> 2700 veh	+/-400 veh	1	1	100%	0	0	NA
Total		65	64	98%	27	27	100%
GEH criteria							
GEH <5 for individual links		65	61	94%	27	27	100%
Turning Flow							
Flow criteria							

Criteria		Calibration			Validation		
		Count	Pass	%Pass	Count	Pass	%Pass
<700 veh	+/-100 veh	149	144	97%	0	0	NA
700 - 2700 veh	+/-15%	1	1	100%	0	0	NA
> 2700 veh	+/-400 veh	0	0	NA	0	0	NA
Total		150	145	97%	0	0	NA
GEH criteria							
GEH <5 for individual links		150	132	88%	0	0	NA
Total							
Flow criteria							
<700 veh	+/-100 veh	211	205	97%	27	27	100%
700 - 2700 veh	+/-15%	3	3	100%	0	0	NA
> 2700 veh	+/-400 veh	1	1	100%	0	0	NA
Total		215	209	97%	27	27	100%
GEH criteria							
GEH <5 for individual links		215	193	90%	27	27	100%

The results in the tables show that the model is demonstrating a very good representation of highway conditions when compared to observed data.

They show that for all peaks that at least 88% of turns and links pass the GEH criteria. This is in excess of the required 85% stipulated by WebTAG.

This shows that the base model is suitable to provide a representation of the 2019 base year and will provide a realistic base from which to project forecast traffic flows from.

8.5 JOURNEY TIME VALIDATION

The summary for the journey time validation in the Post-ME matrix assignments are presented in Table 8-10, Table 8-11 and Table 8-12. Detailed comparisons by routes on a segment basis are presented in **Appendix G**

In summary, the criteria set out in the WebTAG M3.1 have been achieved for all the three modelled peak periods.

Table 8-10 - Journey Time Validation – AM Peak

No	Route Description	Dir	Journey Time (hh:mm:ss)				Passed WebTAG
			Observed	Modelled	Diff	%Diff	
1	Range Road/A6136	EB	00:13:17	00:13:59	00:00:42	5%	ü
		WB	00:13:03	00:14:14	00:01:11	11%	ü
2	A6136/Scotton Road/Bedale Road	NB	00:06:59	00:06:49	-00:00:10	-2%	ü
		SB	00:06:40	00:06:41	00:00:01	0%	ü
3	James Lane/Horne Road/Byng Road/Hispwell Road	NB	00:08:19	00:08:16	-00:00:03	-1%	ü
		SB	00:07:57	00:08:15	00:00:18	4%	ü
		EB	00:09:15	00:08:40	-00:00:35	-6%	ü

4	Unnamed Road/Moor Lane/	WB	00:09:19	00:08:46	-00:00:33	-6%	ü
5	A6136	NB	00:04:18	00:04:33	00:00:15	6%	ü
		SB	00:03:43	00:03:36	-00:00:07	-3%	ü

Table 8-11 - Journey Time Validation – Inter-Peak

No	Route Description	Dir	Journey Time (hh:mm:ss)				Passed WebTAG
			Observed	Modelled	Diff	%Diff	
1	Range Road/A6136	EB	00:12:59	00:13:58	00:00:59	8%	ü
		WB	00:12:47	00:12:55	00:00:08	1%	ü
2	A6136/Scotton Road/Bedale Road	NB	00:07:04	00:06:58	-00:00:06	-1%	ü
		SB	00:06:53	00:06:43	-00:00:10	-2%	ü
3	James Lane/Horne Road/Byng Road/Hispwell Road	NB	00:08:11	00:07:55	-00:00:16	-3%	ü
		SB	00:08:14	00:08:04	-00:00:10	-2%	ü
4	Unnamed Road/Moor Lane/ Tunstall Road	EB	00:09:06	00:08:40	-00:00:26	-5%	ü
		WB	00:09:18	00:08:44	-00:00:34	-6%	ü
5	A6136	NB	00:04:22	00:04:20	-00:00:02	-1%	ü
		SB	00:03:40	00:03:35	-00:00:05	-2%	ü

Table 8-12 - Journey Time Validation – PM Peak

No	Route Description	Dir	Journey Time (hh:mm:ss)				Passed WebTAG
			Observed	Modelled	Diff	%Diff	
1	Range Road/A6136	EB	00:13:33	00:14:50	00:01:17	9%	ü
		WB	00:12:53	00:13:58	00:01:05	8%	ü
2	A6136/Scotton Road/Bedale Road	NB	00:06:45	00:06:56	00:00:11	3%	ü
		SB	00:06:43	00:06:47	00:00:04	1%	ü
3	James Lane/Horne Road/Byng Road/Hispwell Road	NB	00:07:56	00:07:58	00:00:02	0%	ü
		SB	00:07:42	00:08:11	00:00:29	6%	ü
4	Unnamed Road/Moor Lane/ Tunstall Road	EB	00:09:22	00:08:42	-00:00:40	-7%	ü
		WB	00:09:39	00:08:45	-00:00:54	-9%	ü
5	A6136	NB	00:04:18	00:04:32	00:00:14	5%	ü
		SB	00:03:38	00:03:36	-00:00:02	-1%	ü

9 SUMMARY AND CONCLUSION

9.1 SUMMARY OF DEVELOPMENT

The previous Catterick Traffic Model has been comprehensively rebuilt with a comprehensive data compilation, collection and checking process.

A new network in SATURN has been developed together with a revised zone system of sufficient detail for intended purposes.

An observed prior matrix was derived from RSI and GH data which formed a cordon around the main study area and major internal locations. A gravity model was then used to form a synthetic matrix based on NTEM Version 7.2 trip ends and 2011 census data updated by 2015 mid-year values. The synthetic matrix was used to infill the prior matrix for traffic movements not represented in the observed matrix. Matrix estimation was then carried out to produce a final assignment.

9.2 SUMMARY OF STANDARDS

The base year model validation has been developed closely following latest TAG M3.1 'Highway Assignment Modelling' guidance (January 2014). The model is shown to satisfactorily converge across all three peaks which is important as the model will be deployed on local plan testing. In these instances, it is required that models are converged so that the impacts of developments and schemes are the result of the infrastructure improvements and not changes to model convergence.

Modelled flows across screenlines which capture the key strategic movements within the model have been shown to closely match the observed. Across all three modelled periods, all calibration screenlines are shown to achieve a suitable proximity, with the majority of validation screenlines also achieving this standard.

Link validation is shown to be consistently high in terms of both flow and GEH across all three peaks. Combining the observed counts within calibration and validation, 92% of counts in the AM peak, 93% of counts in the inter-peak and 91% of counts in the PM peak achieve a GEH of 5 or lower above the minimum threshold of 85%.

Journey time performance exceeds the required standard of 85% of modelled journey time routes being within 15% or 1 minute of the observed data, with 100% of the routes passing the WebTAG guidance.

Manual classified turning counts were carried out at major junctions across the network, and the model is shown to align well with the observed movements at these junctions.

9.3 SUMMARY OF FITNESS FOR PURPOSE

The latest 2019 Catterick Traffic Model is deemed fit for purpose in terms of its ability to replicate existing strategic traffic movements within the Area of Detailed Modelling (ADM). The base year model forms a suitable basis from which forecast year models can be built to create reference case, do minimum and do something scheme testing.

The model provides a suitable evidence base to underpin Local Plan testing for Catterick.

Appendix A

SPEED FLOW CURVES

Index	Description	S0	S2	Capacity	N
1	Motorway D4 Carriageways (70mph)	112	82	9320	2.78
2	Motorway D4 Carriageways (70mph)	111	81	9320	2.78
3	Motorway D4 Carriageways (70mph)	110	80	9320	2.78
4	Motorway D3 Carriageways (70mph)	111	81	6990	2.78
5	Motorway D3 Carriageways (70mph)	110	80	6990	2.78
6	Motorway D3 Carriageways (70mph)	109	78	6990	2.79
7	Motorway D2 Carriageways (70mph)	105	74	4660	2.88
8	Motorway D2 Carriageways (70mph)	104	73	4660	2.88
9	Motorway D2 Carriageways (70mph)	102	71	4660	2.89
10	Motorway D2 Carriageways (70mph)	101	70	4660	2.89
11	All-Purpose D3 Carriageways (70mph)	109	82	6300	2.7
12	All-Purpose D3 Carriageways (70mph)	108	81	6300	2.7
13	All-Purpose D3 Carriageways (60mph)	98	72	6300	2.71
14	All-Purpose D3 Carriageways (60mph)	95	71	6300	2.71
15	All-Purpose D2 Carriageways (70mph)	105	78	4200	2.71
16	All-Purpose D2 Carriageways (70mph)	101	74	4200	2.79
17	All-Purpose D2 Carriageways (60mph)	98	70	4200	2.71
18	All-Purpose D2 Carriageways (60mph)	95	69	4200	2.79
19	All-Purpose D3 Carriageways (50mph)	80	56	5580	2.82
20	All-Purpose D3 Carriageways (50mph)	79	55	5580	2.83
21	All-Purpose D2 Carriageways (50mph)	80	56	3720	2.82
22	All-Purpose D2 Carriageways (50mph)	78	55	3720	2.83
31	D3 Carriageways (40mph)	64	35	4710	2.42
32	D3 Carriageways (40mph)	64	35	4380	2.1
33	D3 Carriageways (40mph)	64	35	4110	1.79
34	D2 Carriageways (40mph)	64	35	3280	2.79
35	D2 Carriageways (40mph)	64	35	3100	2.35
36	D2 Carriageways (40mph)	64	35	2900	2.01
37	D3 Carriageways (30mph)	47	25	4290	2.61
38	D3 Carriageways (30mph)	45	25	4020	2.09
39	D3 Carriageways (30mph)	43	25	3720	1.59
40	D2 Carriageways (30mph)	46	25	2760	2.37
41	D2 Carriageways (30mph)	44	25	2580	1.84
42	D2 Carriageways (30mph)	42	25	2380	1.41
51	S2 Carriageways: SW2-10.0m A Road 60mph	93	58	1760	2.25
52	S2 Carriageways: S2-7.3m A Road 60mph	87	59	1390	2.08
53	S2 Carriageways: S2-7.0m A Road 60mph	84	57	1330	2.07
54	S2 Carriageways: S2-6.6m A Road 60mph	81	56	1240	2.06
55	S2 Carriageways: S2-6.3m B Road 60mph	78	54	1170	2.02
56	S2 Carriageways: S2-6.0m B Road 60mph	76	54	1090	2
57	S2 Carriageways: S2-5.6m B Road 60mph	73	53	970	1.94
58	S2 Carriageways: S2-5.2m Other Road 60mph	71	54	830	1.88

Index	Description	S0	S2	Capacity	N
59	S2 Carriageways: S2-5.0m Other Road 60mph	66	51	750	1.88
60	S2 Carriageways: S2-4.6m Other Road 60mph	57	40	570	1.84
61	S2 Carriageways: S2-4.4m Other Road 60mph	54	35	440	1.58
71	Suburban Roads - Single 40mph (Good)	63	26	1380	2.51
72	Suburban Roads - Single 40mph (Good)	58	25	1240	2.16
73	Suburban Roads - Single 40mph (Average)	55	25	1200	1.94
74	Suburban Roads - Single 40mph (Average)	53	25	1060	1.72
75	Suburban Roads - Single 40mph (Poor)	51	25	980	1.53
76	Suburban Roads - Single 30mph (Good)	48	25	1300	3.91
77	Suburban Roads - Single 30mph (Good)	46	25	1210	2.61
78	Suburban Roads - Single 30mph (Average)	45	25	1170	2.4
79	Suburban Roads - Single 30mph (Average)	40	25	950	1.37
80	Suburban Roads - Single 30mph (Poor)	38	25	860	1.32
81	Urban Non-central 50% development	48	31	930	1.97
82	Urban Non-central 80% development	48	26	930	1.65
83	Urban Non- central 90% development	47	25	840	1.52
84	Urban Central INT = 2	38	15	910	1.87
85	Urban Central INT = 4.5	33	15	710	1.72
86	Urban Central INT = 9	30	15	560	1.61
87	Urban Central INT = 15	20	10	560	1.61
91	Small Town 10% development	64	34	1400	2.95
92	Small Town 25% development	60	30	1370	2.96
93	Small Town 40% development	58	30	1300	2.94
94	Small Town 60% development	48	25	1300	3.91
95	Small Town 80% development	48	25	1240	3.35
96	Small Town 95% development	45	25	1120	2.81
97	Small Town 95% development - 20mph	32	15	950	1.72

Appendix B

EXAMPLE RSI FORM

Surveyor Initials

Site Location

- ¡ RS 01 - Range Road
- ¡ RSI 02 - Hunton Road
- ¡ RSI 03 - Bedale Road
- ¡ RSI 04 – James Lane
- ¡ RSI 05 – A6055 Leeming Lane
- ¡ RSI 06 – A6066 Gatherly Road
- ¡ RSI 07 – A6136 Catterick Road
- ¡ RSI 08 – A6136 Richmond Road
- ¡ RSI 09 – Plumber Road

Introduction Text

- q Proceed
- q Refused

Q1. Would you please tell me the full address you have come from? Postcode

House Name / Number / Organisation

Street

Town

County

Q2. What was your reason for being there?

- q Home
- q Hotel / Holiday Home
- q Usual Workplace
- q Employers Business
- q Education
- q Shopping / Using Services
- q Collect / Deliver Goods
- q Escort - School
- q Escort - Work
- q Refused
- q Other (specify)_____

Q3. Woud you please tell me the full address you are going to now? Postcode

House Name / Number / Organisation

Street

Town

County

Q4. What is your reason for going there?

q Home
q Hotel / Holiday Home
q Usual Workplace
q Employers Business
q Education
q Shopping / Using Services
q Collect / Deliver Goods
q Escort - School
q Escort - Wor
q Refused
q Other (specify) _____

Q5. Vehicle Type

q Car/Taxi
q Light goods vehicle
q OGV1 (Rigid, 2-3 axles)
q OGV2 (Articulated, 3+ axles)
q Buses / Coaches
q Motorcycles
q Pedal Cycle
q Other (specify) _____

Q6. Occupancy (including driver)

(must be superior to 1)

Q7. What is the time of your Reverse Trip?

Appendix C

RSI RELATED ADJUSTMENTS

Missing ATC data at RSI Site 3. In this instance, an adjacent ATC was used.

Regarding trips to Catterick Garrison from the East - it should be noted that trips at sites 5 and 6 are considered likely to intercept short distance trips, whereas trips from further away would be assumed to take the A1(M) and therefore arrive in Catterick via site 7. This has been incorporated whilst filtering out illogical or implausible routes from the RSI records that would be difficult for the model to replicate.

Some trips in the GH surveys may pass through the RSI sites before getting to the GH site, hence being picked up twice. This also includes trips that are picked up at RSI site 7 that have come from outside Catterick, as these will be picked up at the other sites. It is important not to double-count trips to and from the military barracks. Consideration is given to this when building RSI matrices for trips to and from the barracks. Given the different dates of the respective RSI and GH surveys, it was considered useful to retain representation of both survey types through blending to effectively make maximum use of the sample available.

Appendix D

NETWORK ACCEPTANCE CHECKS

Appendix D – Network Acceptance Checks

1.1.1 Test 1: Completeness Check

The network coding was complete to the scope agreed with the NYCC for the study area. All the roads within the study area had been coded in the simulation network, outside the study area within Richmondshire district, all the roads have been coded in the buffer network with a form of speed-flow curve. Outside Richmondshire district, only major roads that connect traffic to/from/or pass through the study area were coded in a form of fixed-speed network.

1.1.2 Test 2: SATURN Compilation Check

A total of 747 warnings were produced by SATURN and was broken down to 4 non-fatal errors, 289 serious warnings and 454 warnings. The 4 non-fatal errors were associated with missing nodes in bus routes therefore no action was required. The remaining serious warnings were reviewed and addressed where appropriate.

1.1.3 Test 3: Inspection of key junctions

Junction coding was based on Google maps for junction type and junction layout with signal timings for signalised junctions were obtained from the NYCC. The following checks were carried out and completed:

- All junctions had correct definition;
- All junctions had consistent and appropriate representations based on available source;
- Signalised junctions had correct timing based and staging diagrams based on the data available;
- Roundabouts/mini-roundabouts had been coded accurately according to the data available;
- Opposed right turn at priority junction and signalised junctions were checked against the data available.

1.1.4 Test 4: Link Consistency Check

- Link length are identical between directions, unless each of the direction was coded as separate link in the model;
- Link type are identical between directions, unless there is specific justification such as difference in speed or number of lanes;
- Change in link type was consistent providing changes in speed limit when moving between urban and rural areas;

1.1.5 Test 5: Network Routeing

Guidance presented in section 7.3 of TAG Unit M3.1 (January 2014), with the number of OD pairs determined as follows:

- Number of OD pairs = (number of zones)$^{0.25}$ x number of user classes

Based on the initial proposed zoning system, this equates to 18 routes. The routes that were for the traffic routing checks are provided in Table 1.

Route	Origin	Destin	Name
1	127	139	Gatherly Road to Vimy Road
2	161	116	Field House to Richmond Road
3	148	190	Swale Lane to Richmond Road
4	157	125	Leyburn Road to Leeming Lane
5	914	124	Turner Close to Catterick Lane
6	115	169	Jaffa Road to Ava Road
7	137	169	Meanee Road to Ava Road
8	503	532	Richmond to A6108
9	509	537	Richmond to Patrick Brompton
10	501	125	Richmond to Leeming Lane
11	518	137	Scotch Corner to Meanee Road
12	510	169	Scorton to Ava road
13	176	505	Colburn to Leyburn
14	161	536	Ypres Road to Leeming Bar
15	507	516	Downholme to Great Langton
16	501	517	Richmond to Northallerton
17	518	505	Scotch Corner to Leyburn
18	510	505	Scorton to Leyburn

Figures 1-1 to 1-18 show the traffic routing output from the models

Figure 1-1 Route 1

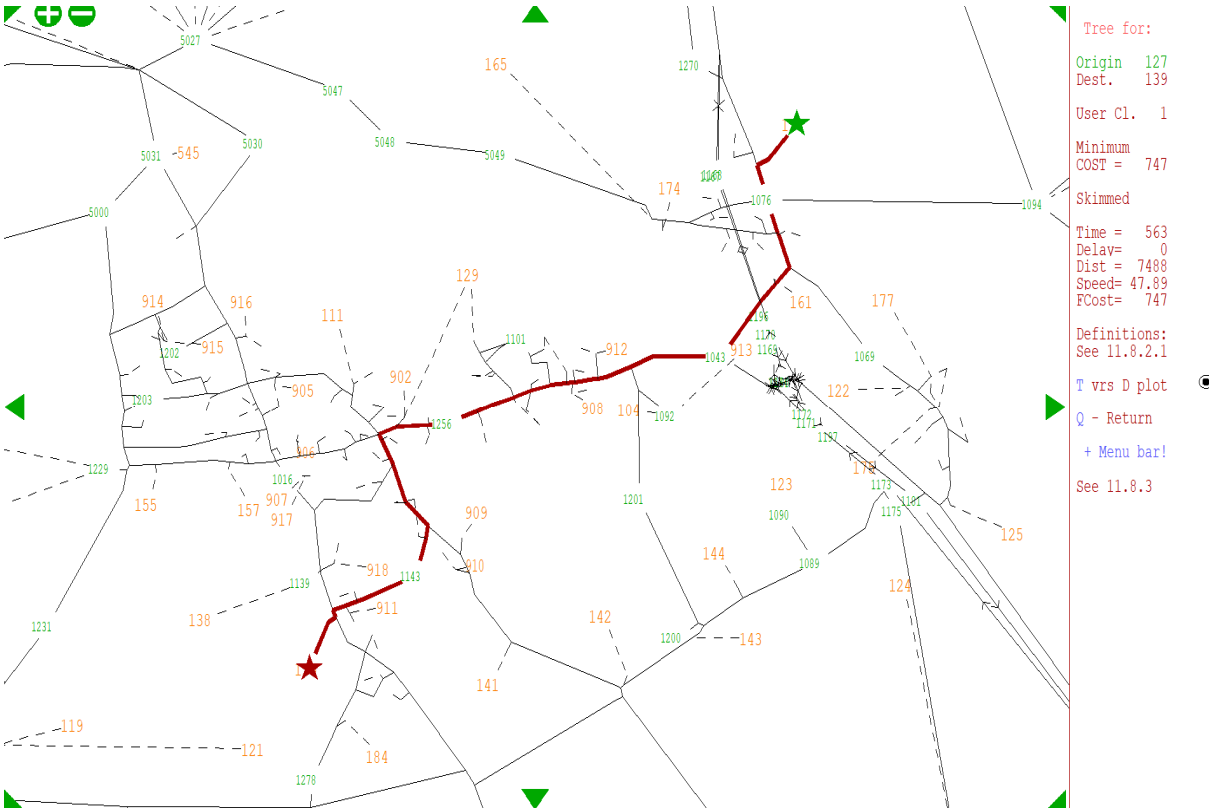


Figure 1-2 Route 2

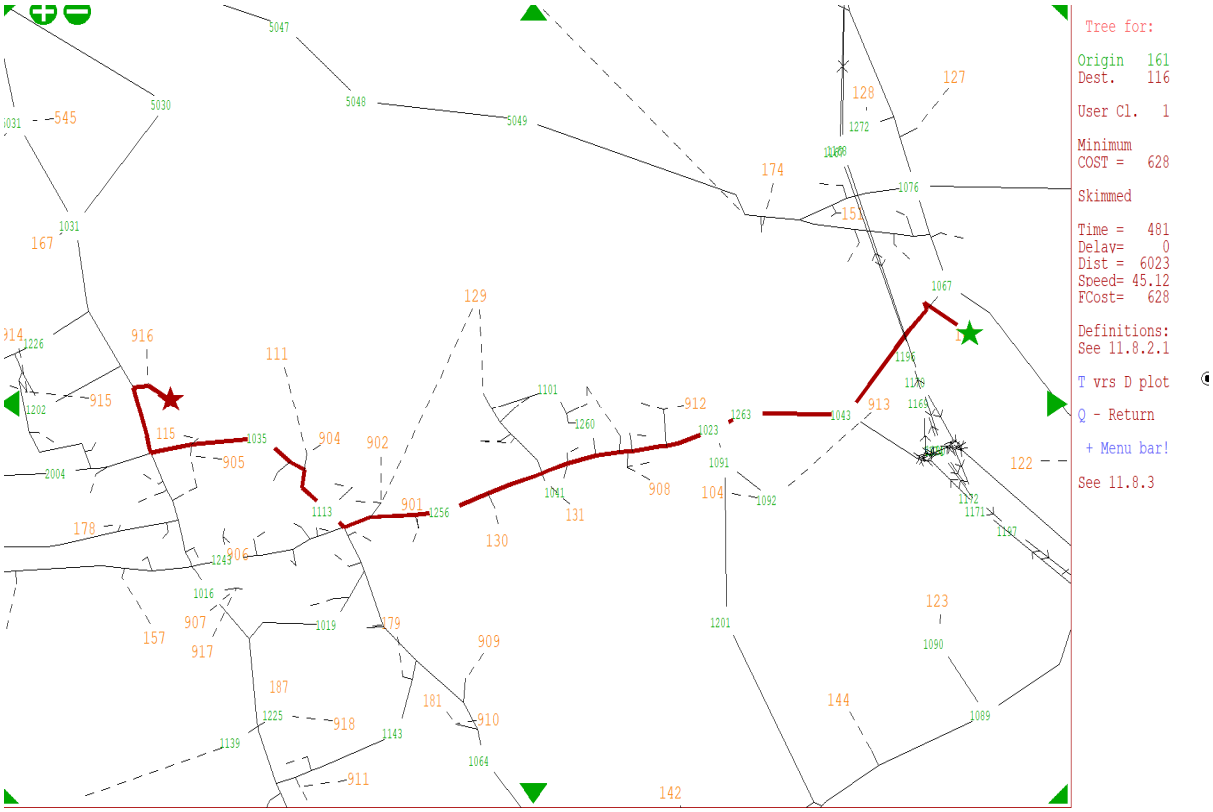


Figure 1-3 Route 3

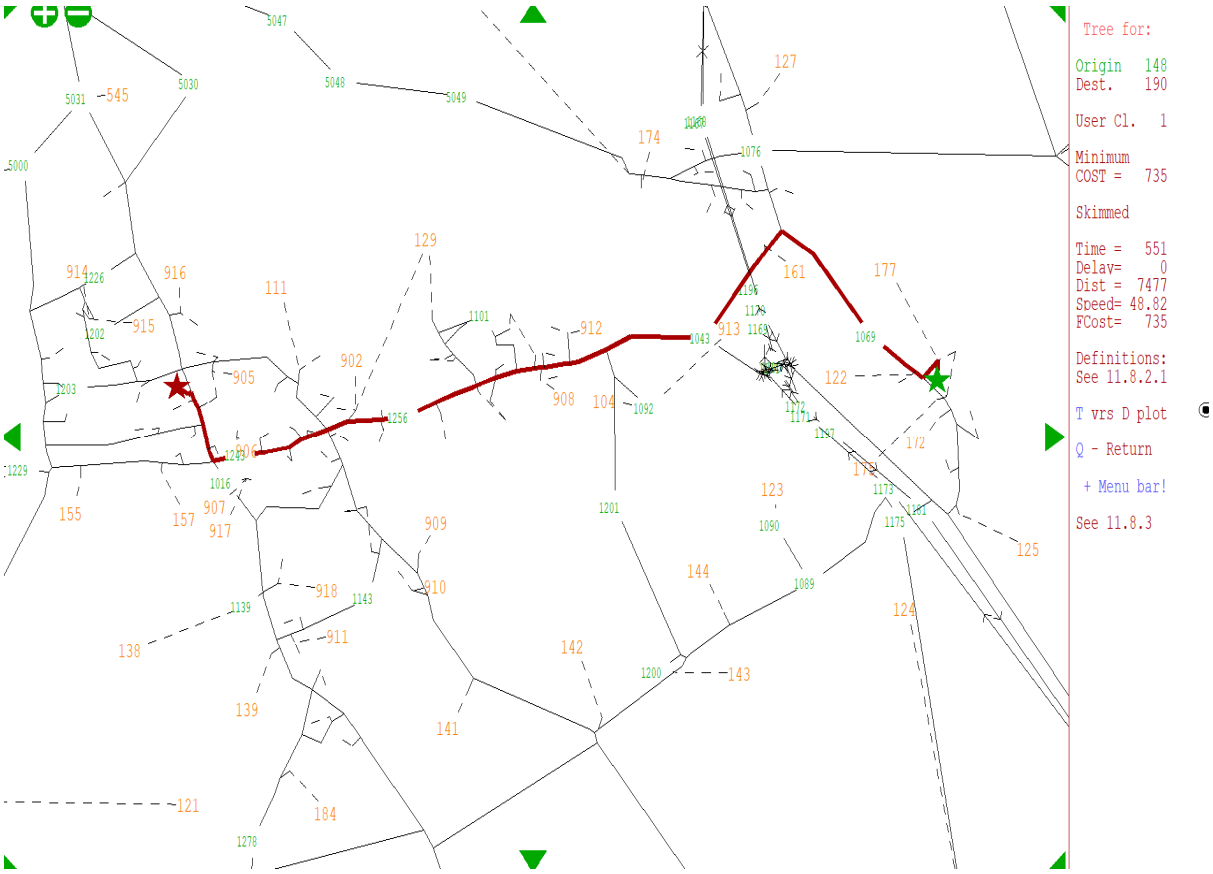


Figure 1-4 Route 4

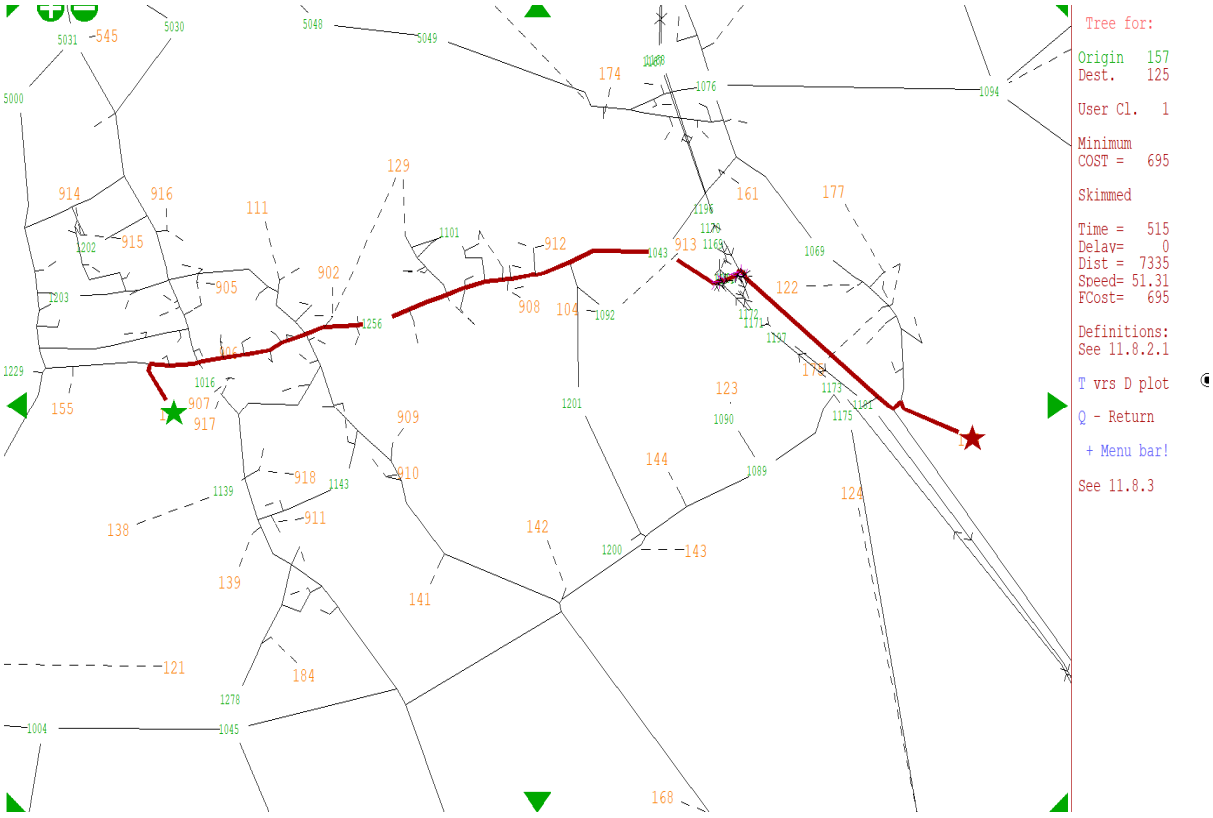


Figure 1-5 Route 5

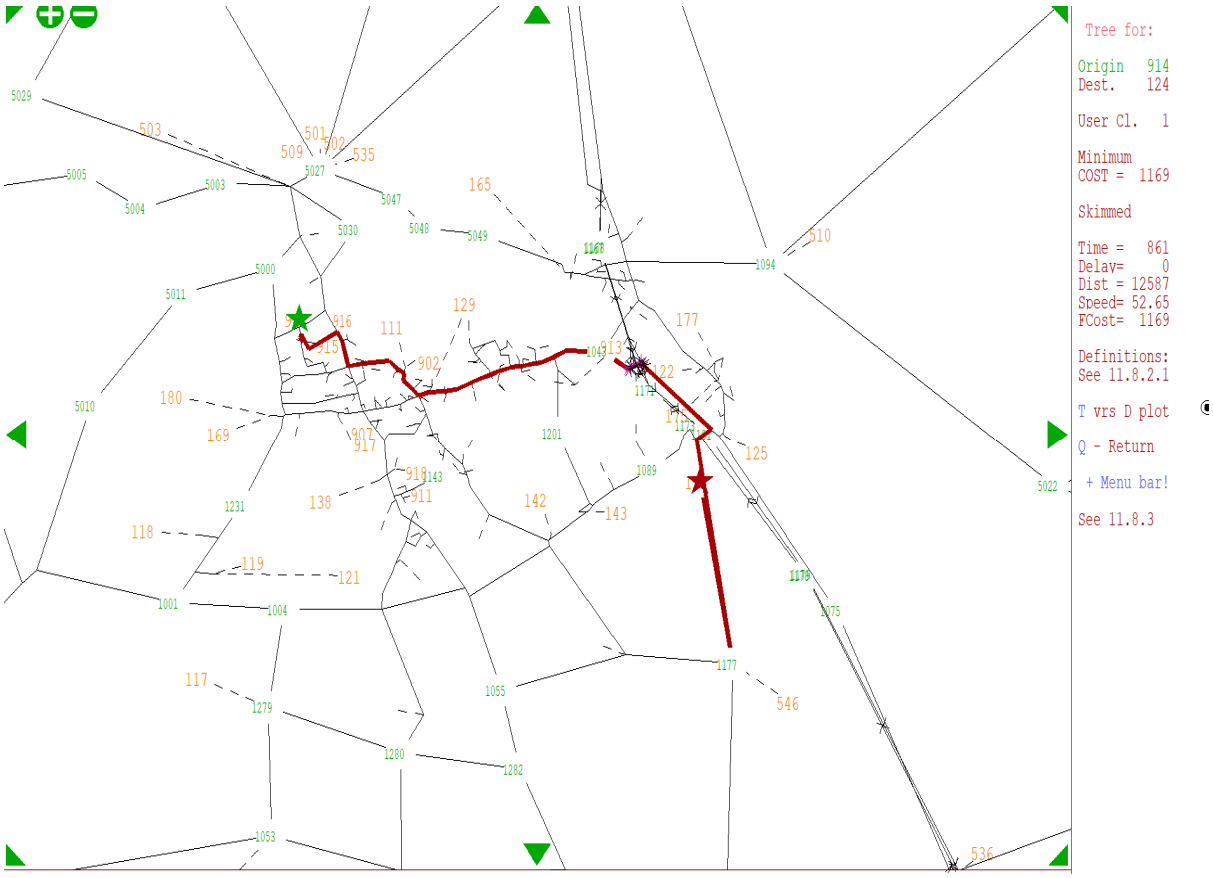


Figure 1-6 Route 6

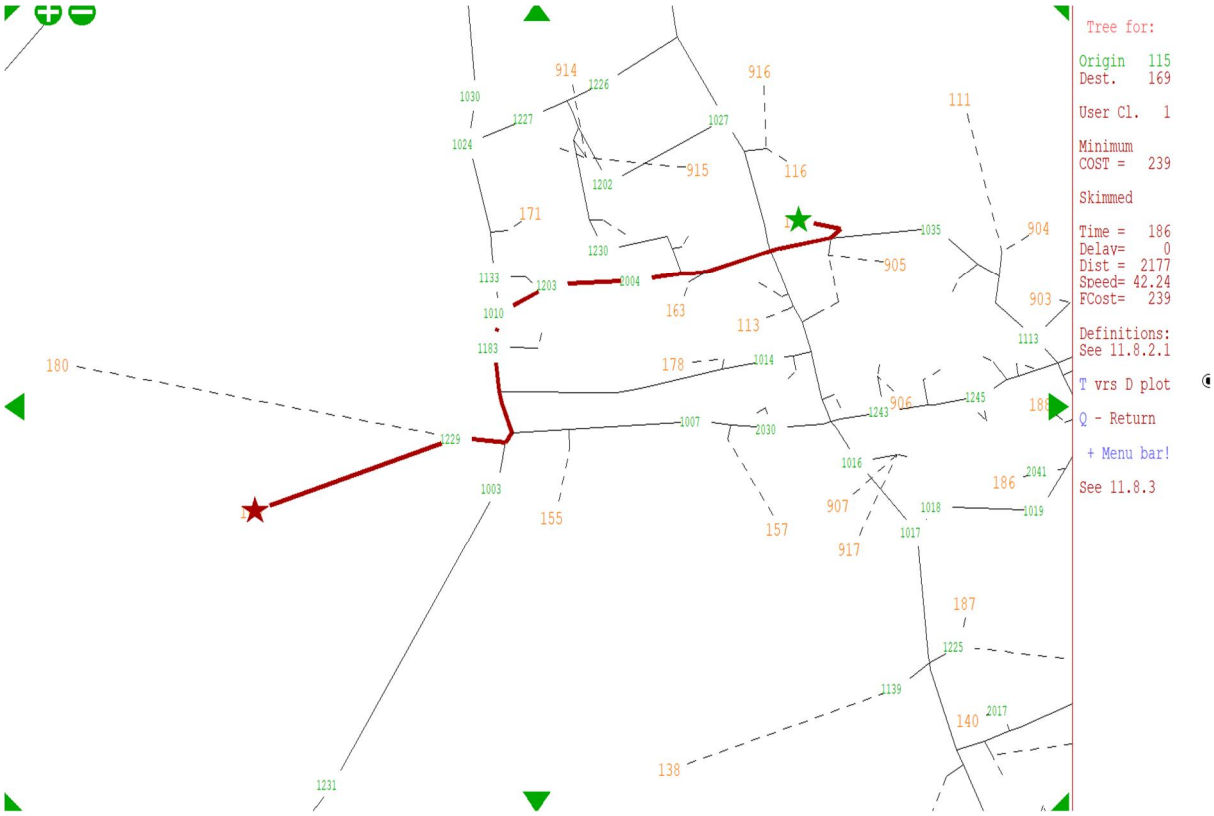


Figure 1-7 Route 7

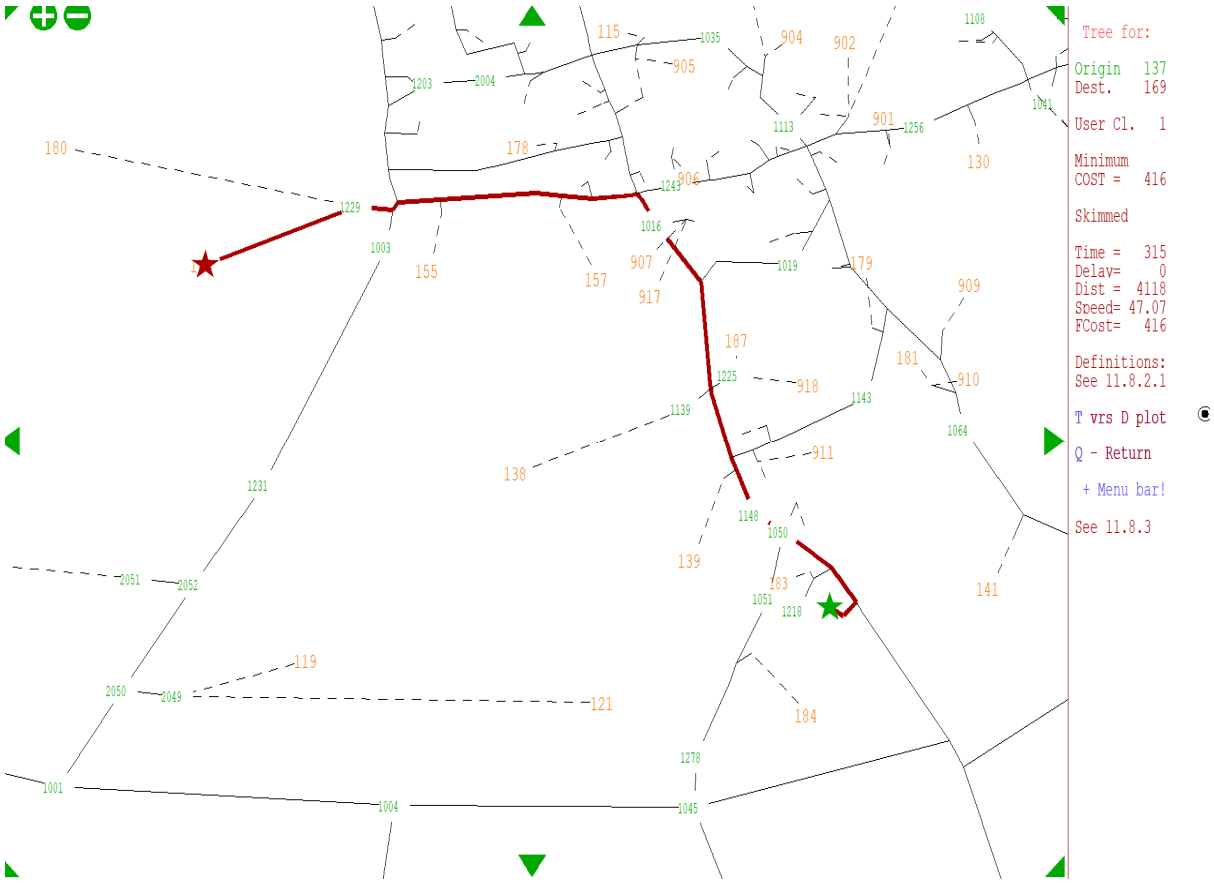


Figure 1-8 Route 8

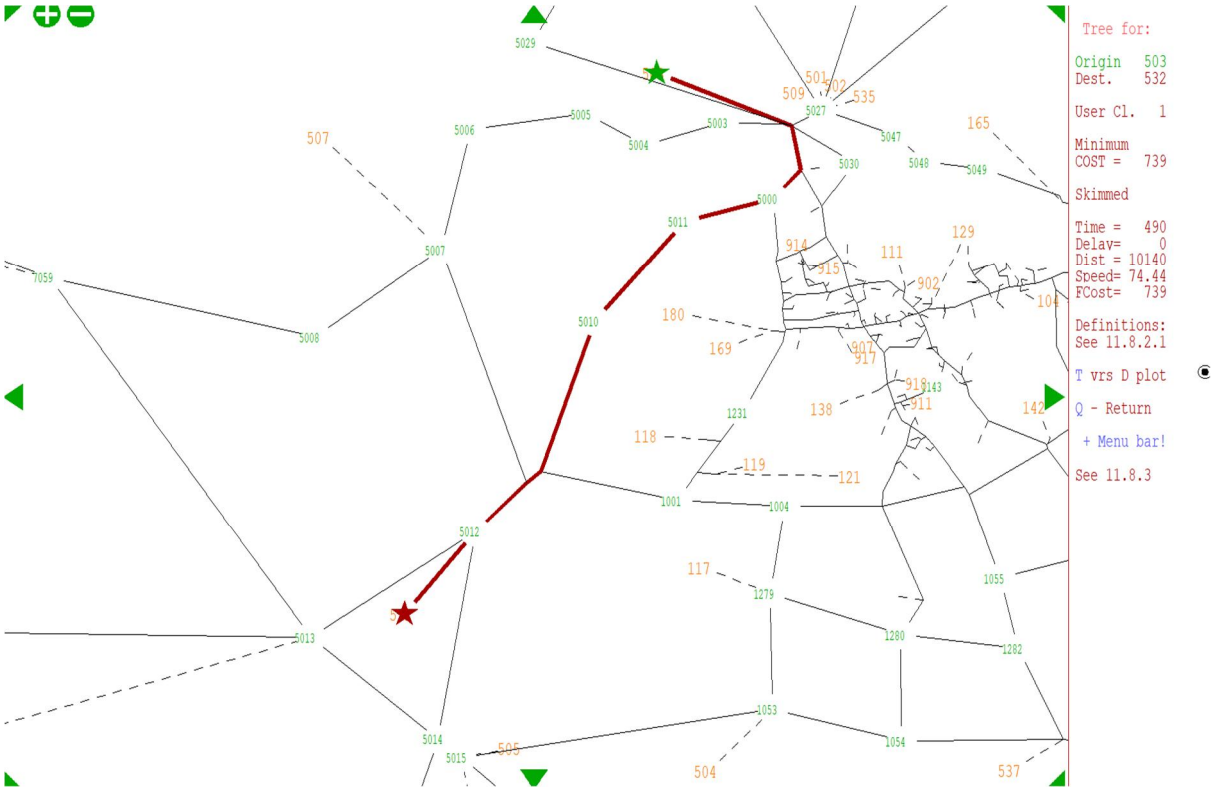


Figure 1-9 Route 9

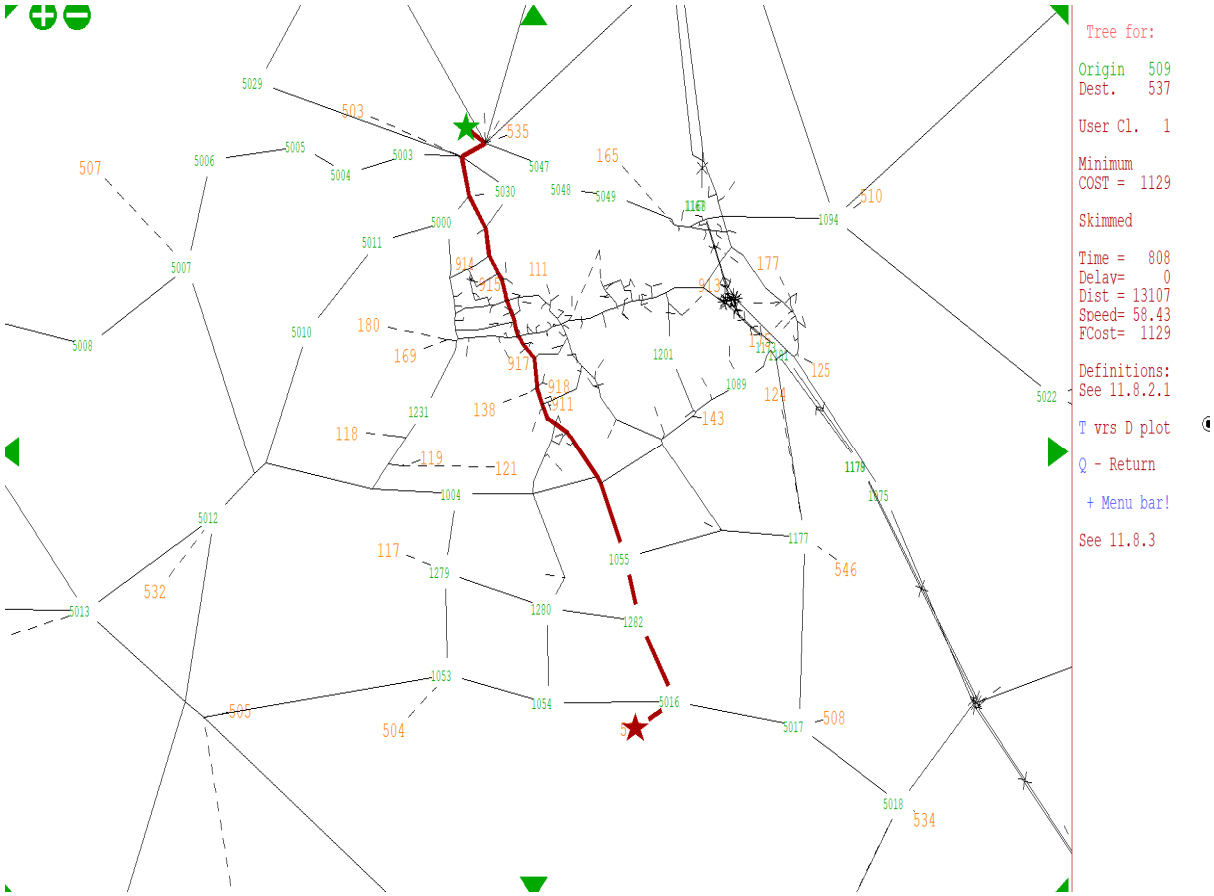


Figure 1-10 Route 10

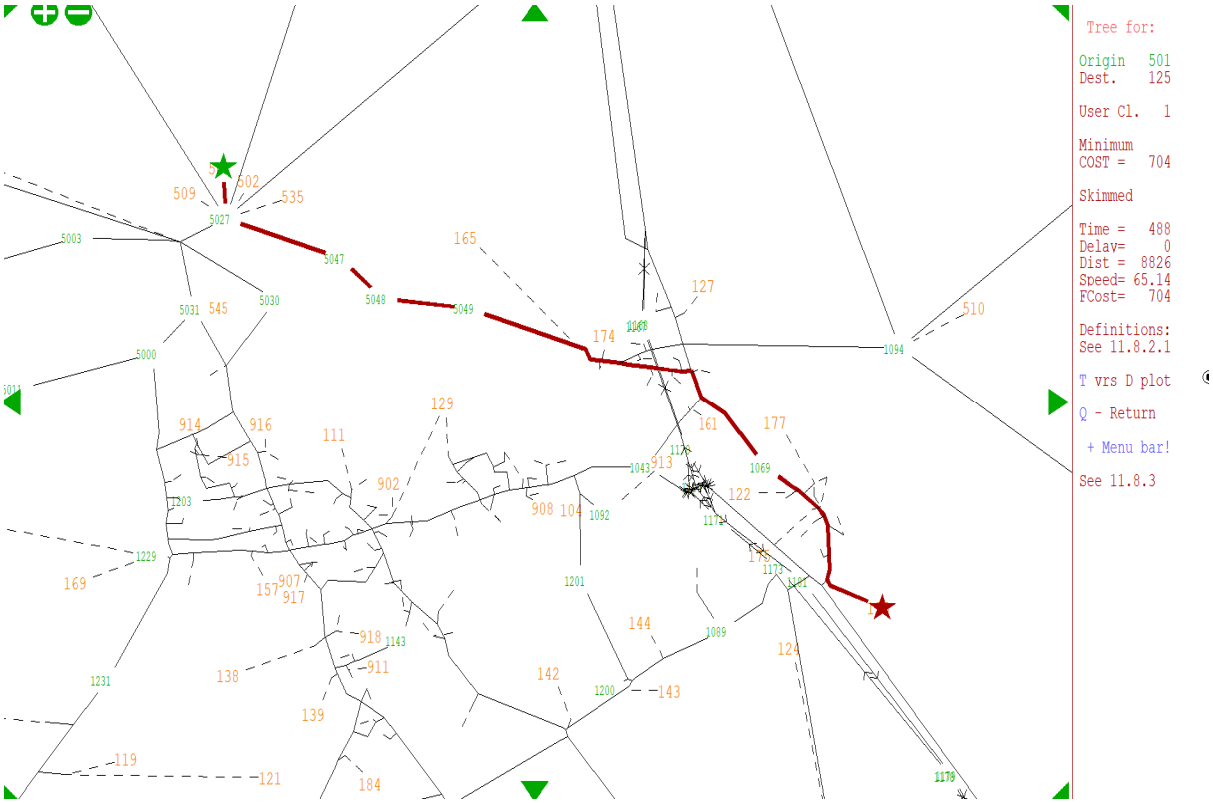


Figure 1-11 Route 11

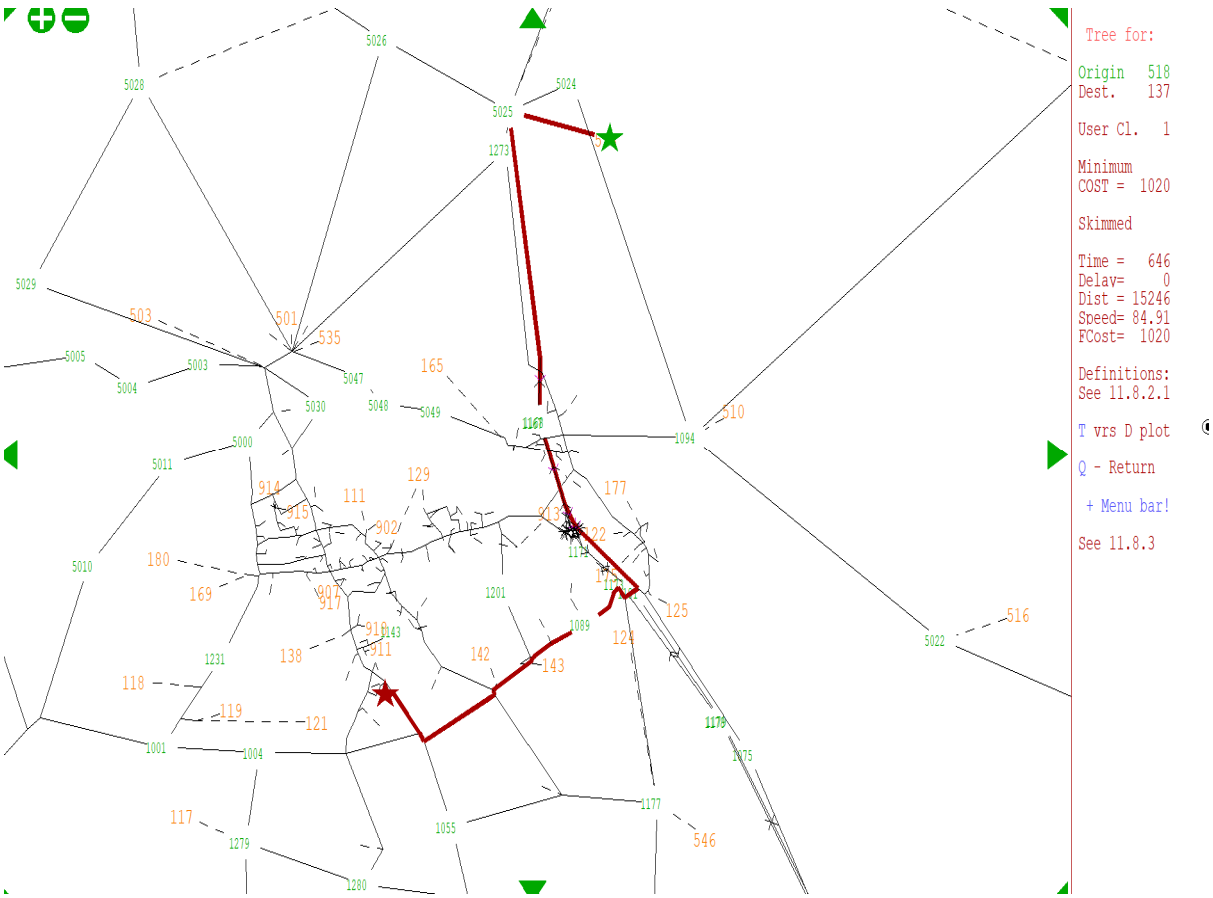


Figure 1-12 Route 12

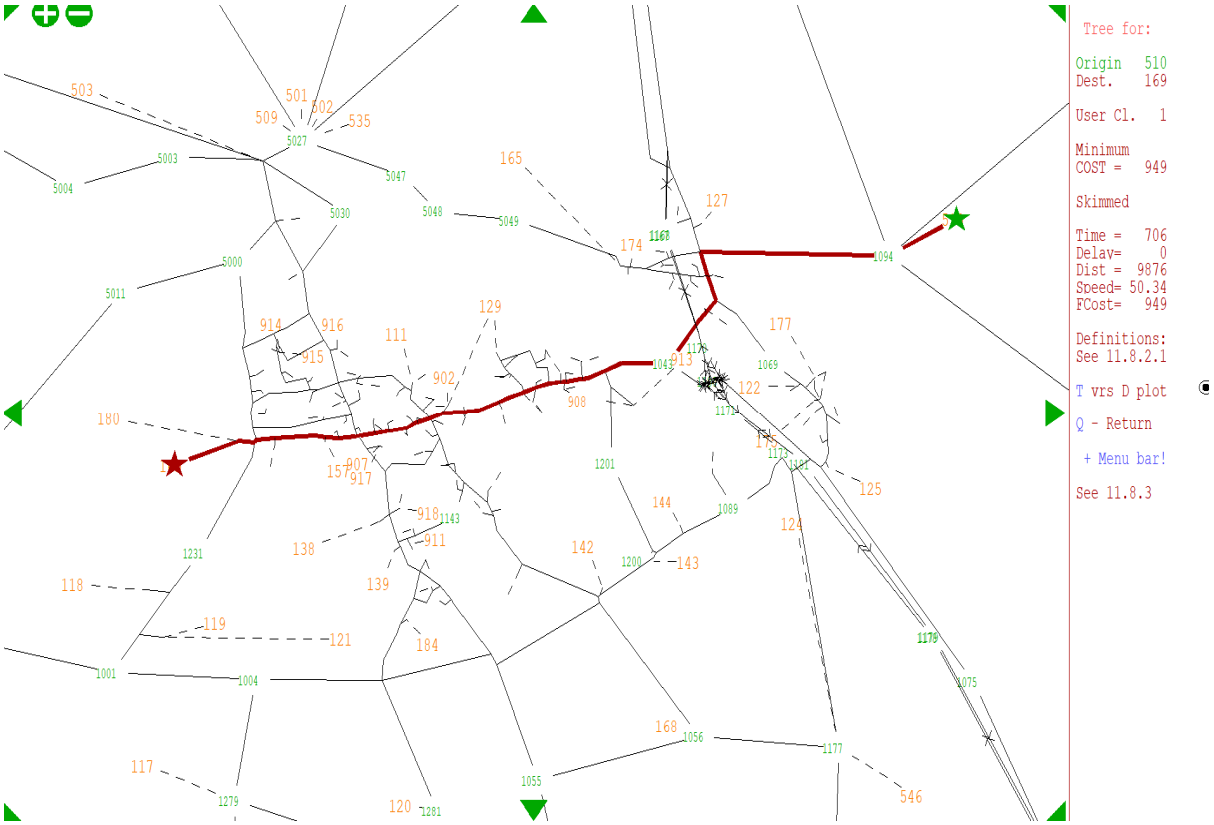


Figure 1-13 Route 13

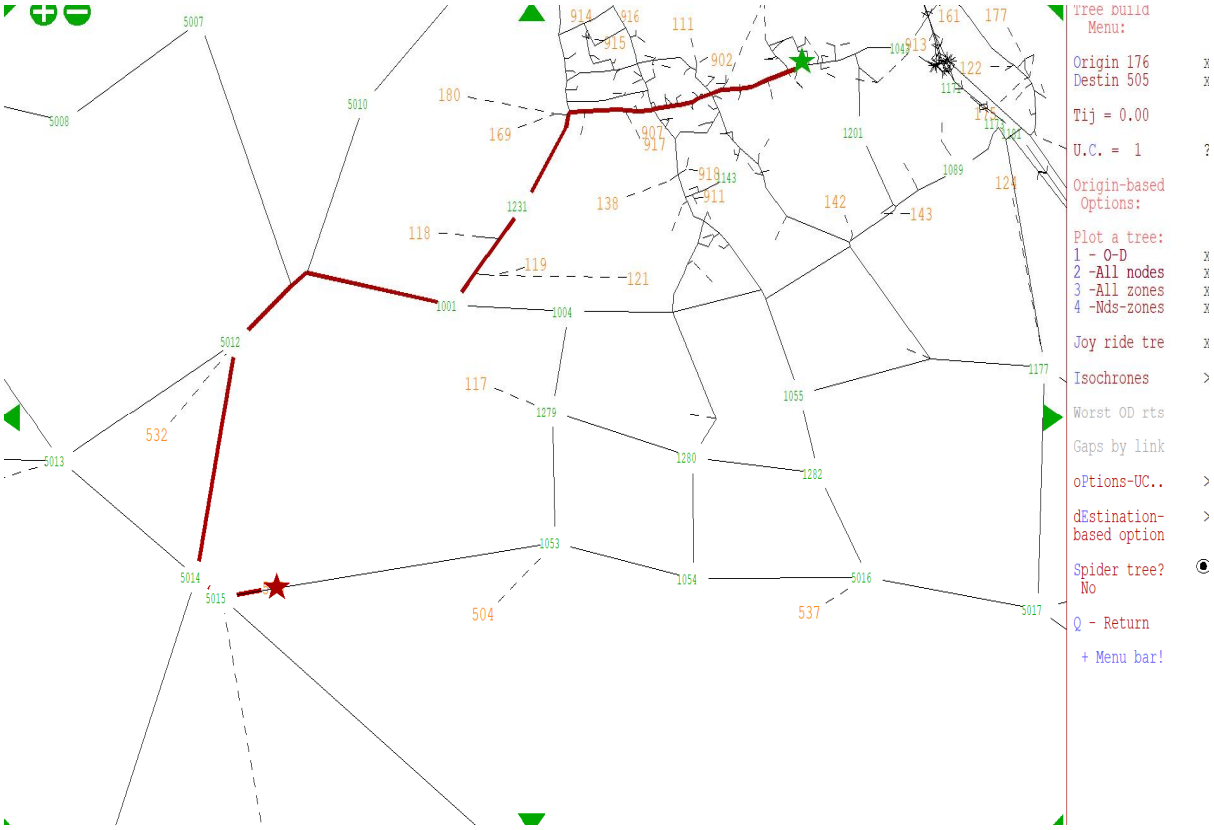


Figure 1-14 Route 14

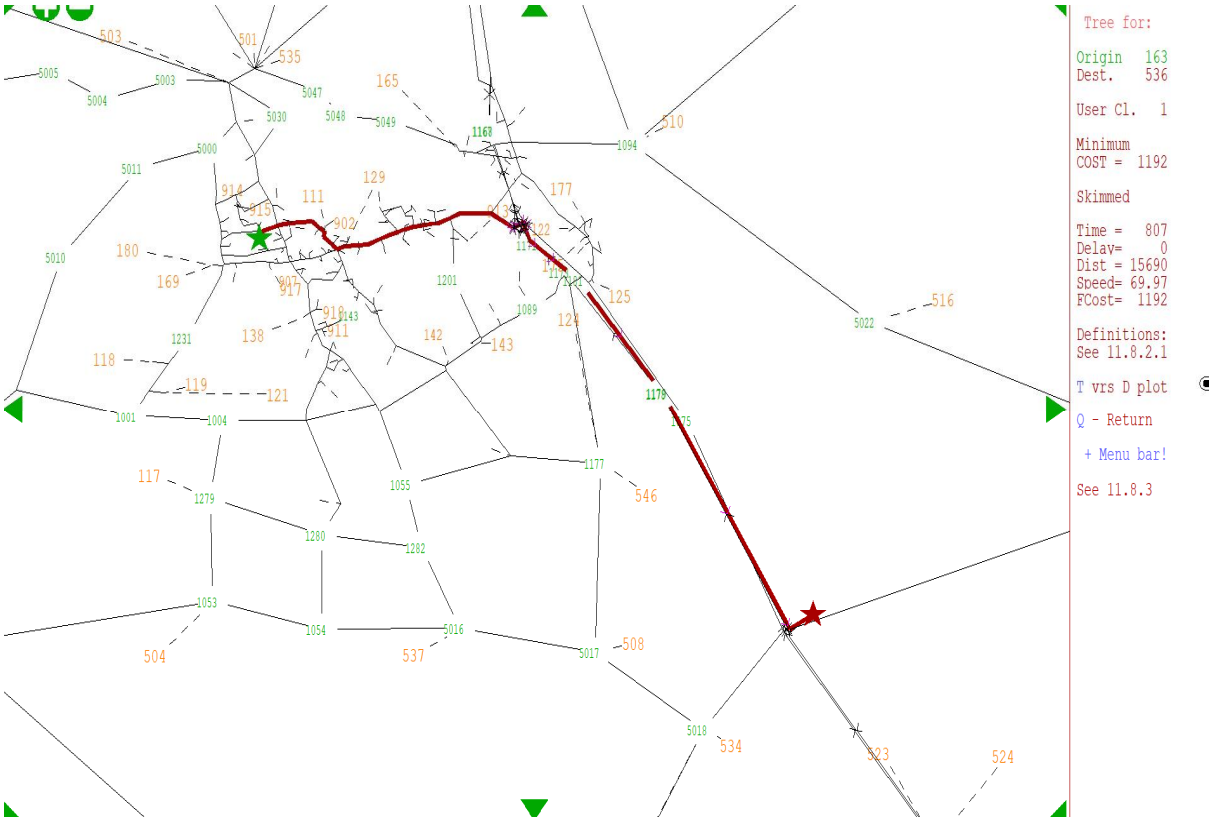


Figure 1-15 Route 15

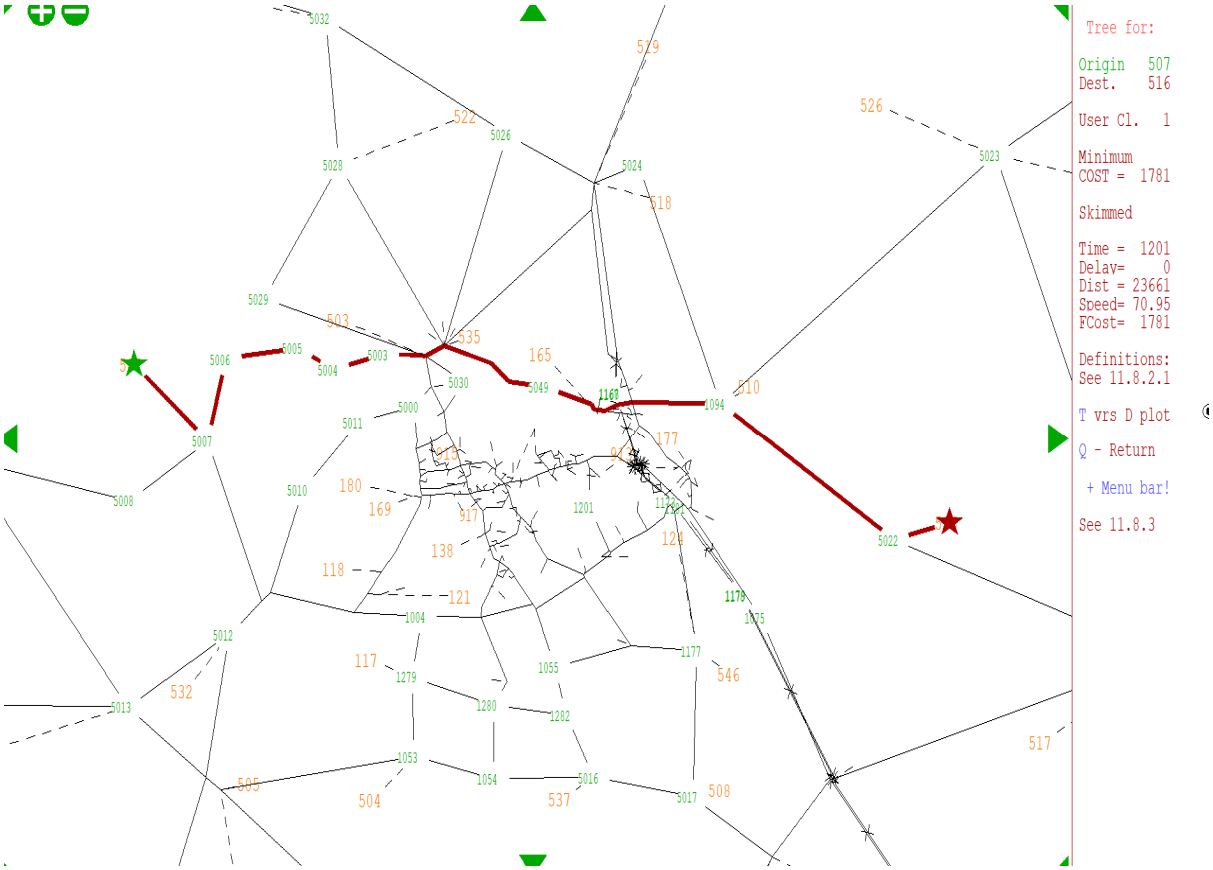


Figure 1-16 Route 16

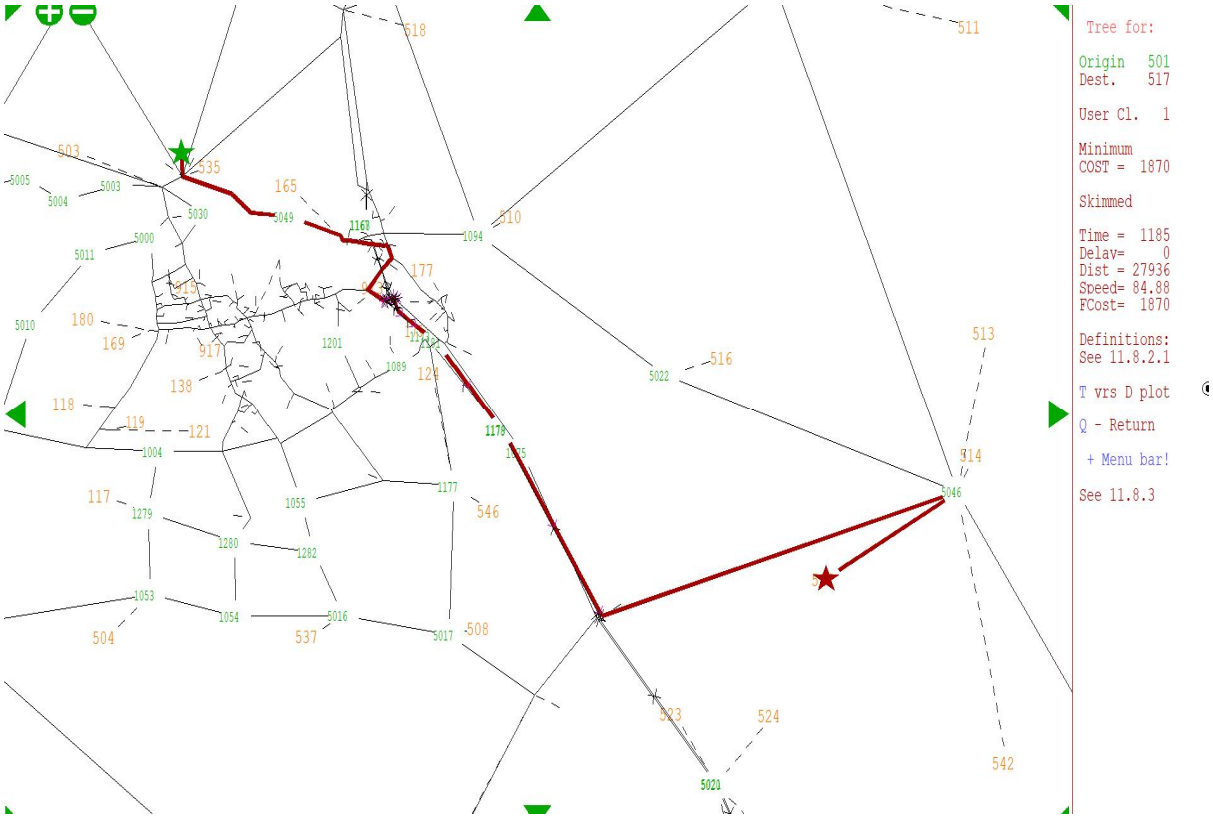


Figure 1-17 Route 17

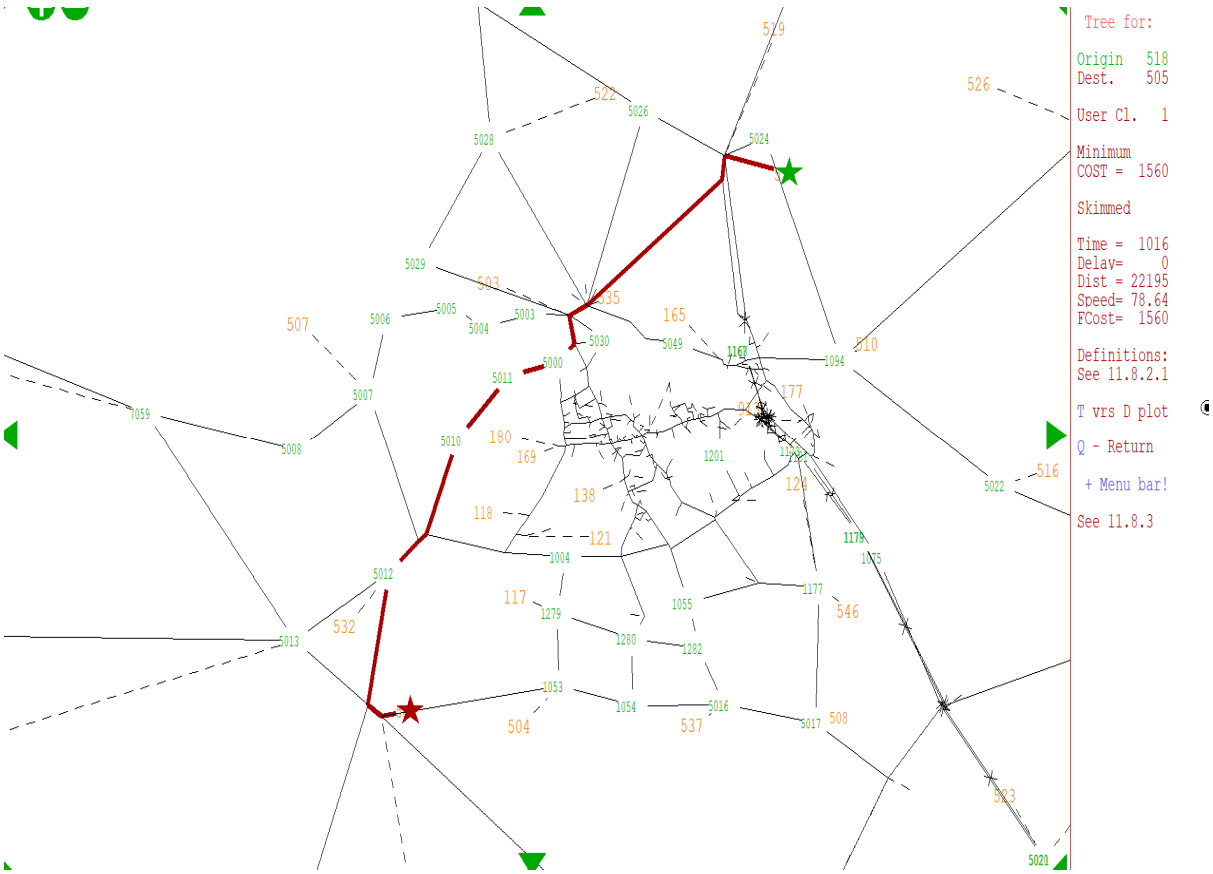
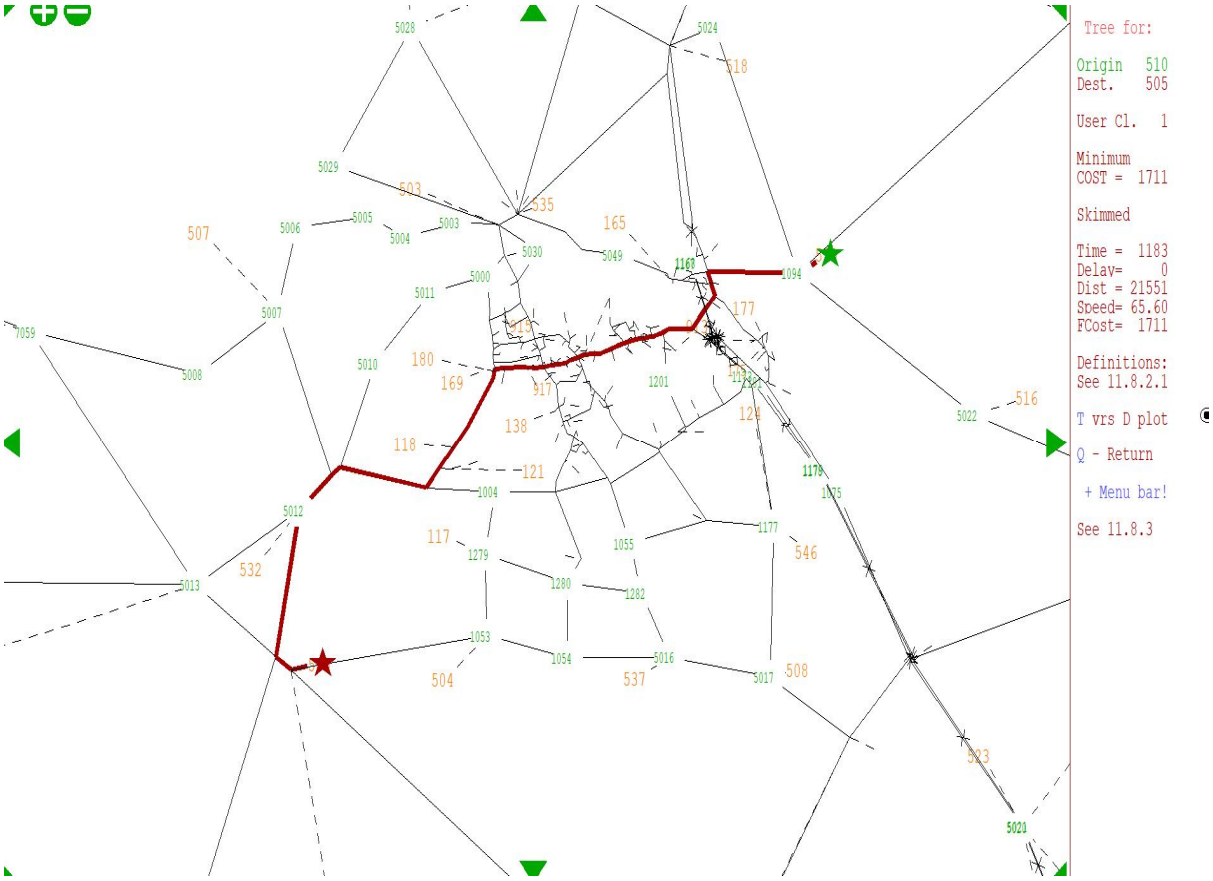


Figure 1-18 Route 18



1.1.6 Test 6: Flat Matrix Assignment Test

The flat matrix assignment was carried out to check completed showing:

- Routeing between OD pairs appeared plausible with majority of traffic using the major roads as opposed to local roads.

Figures 1-19 to 1-28 below show the routing between these OD pairs. In some instances, some plots have a before and after plot to show that any routing issues were resolved in the network.

Figure 1-19 Gatherly Road to Vimy Road Before

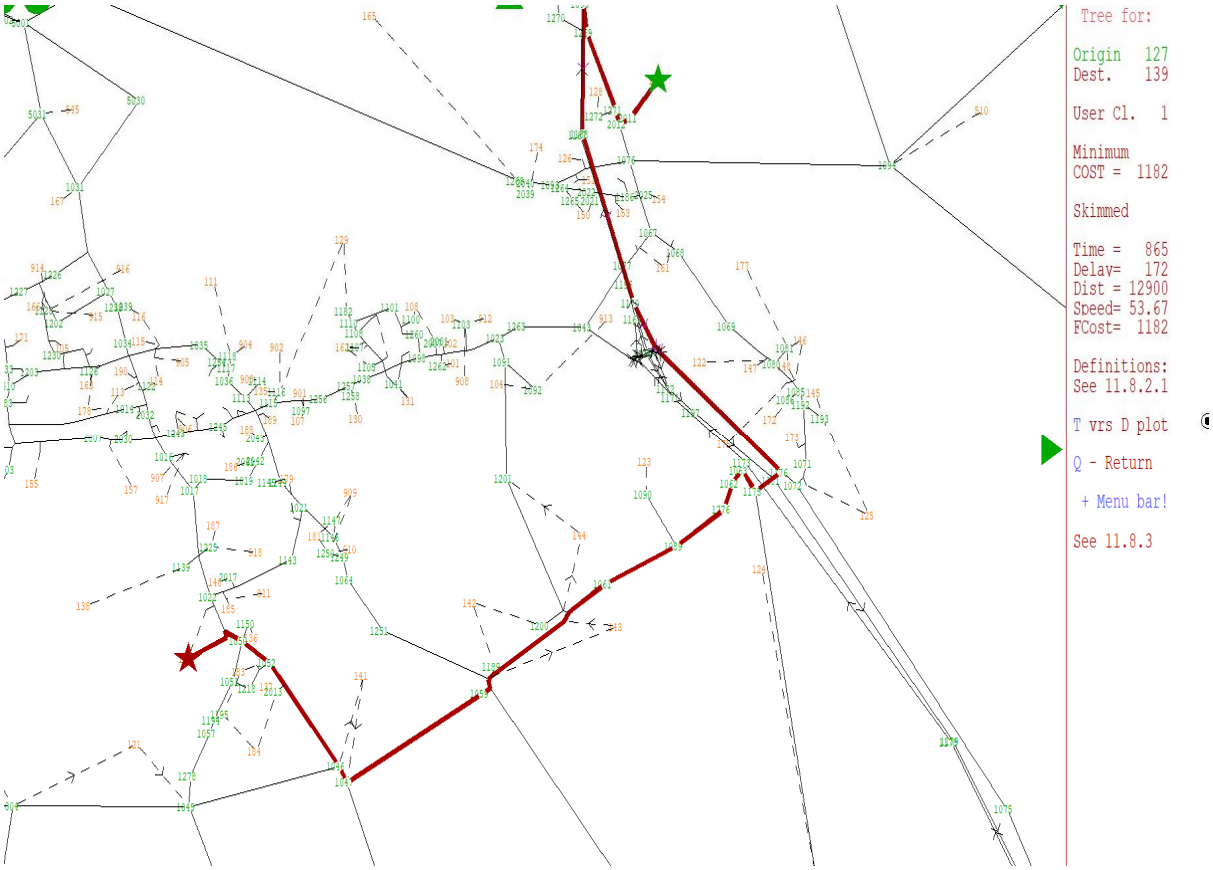


Figure 1-20 Gatherly Road to Vimy Road After

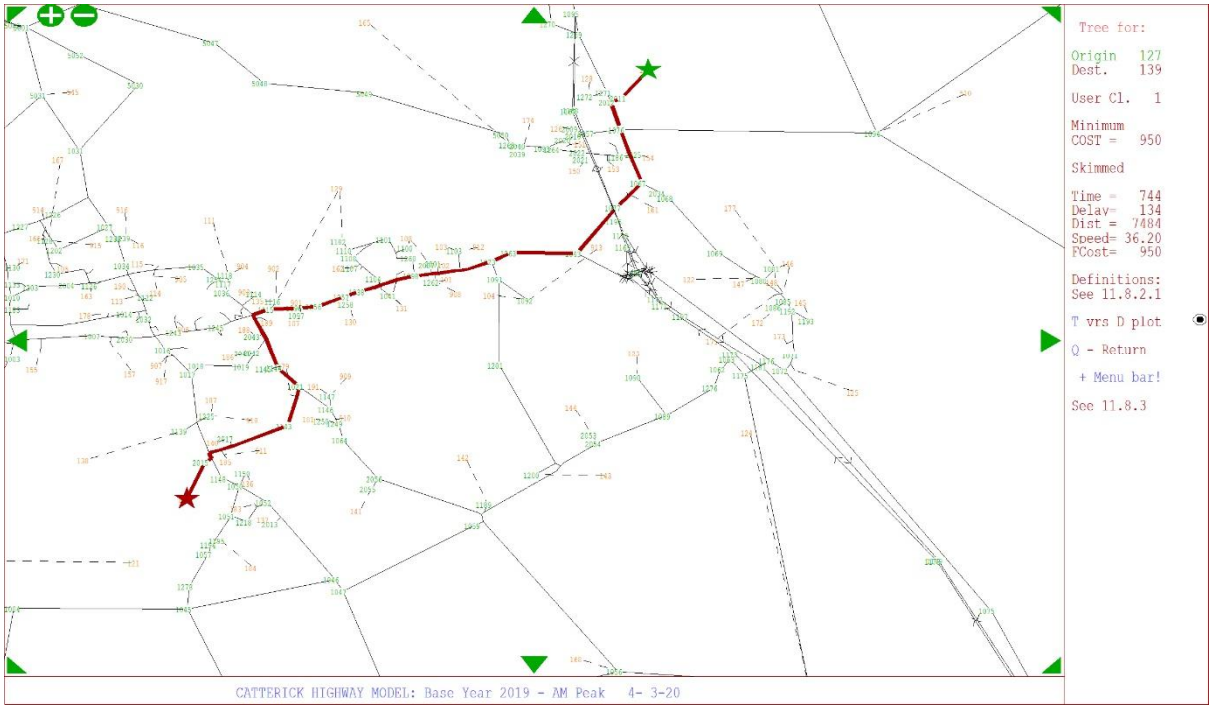


Figure 1-21 Swale Lane to Richmond Road Before

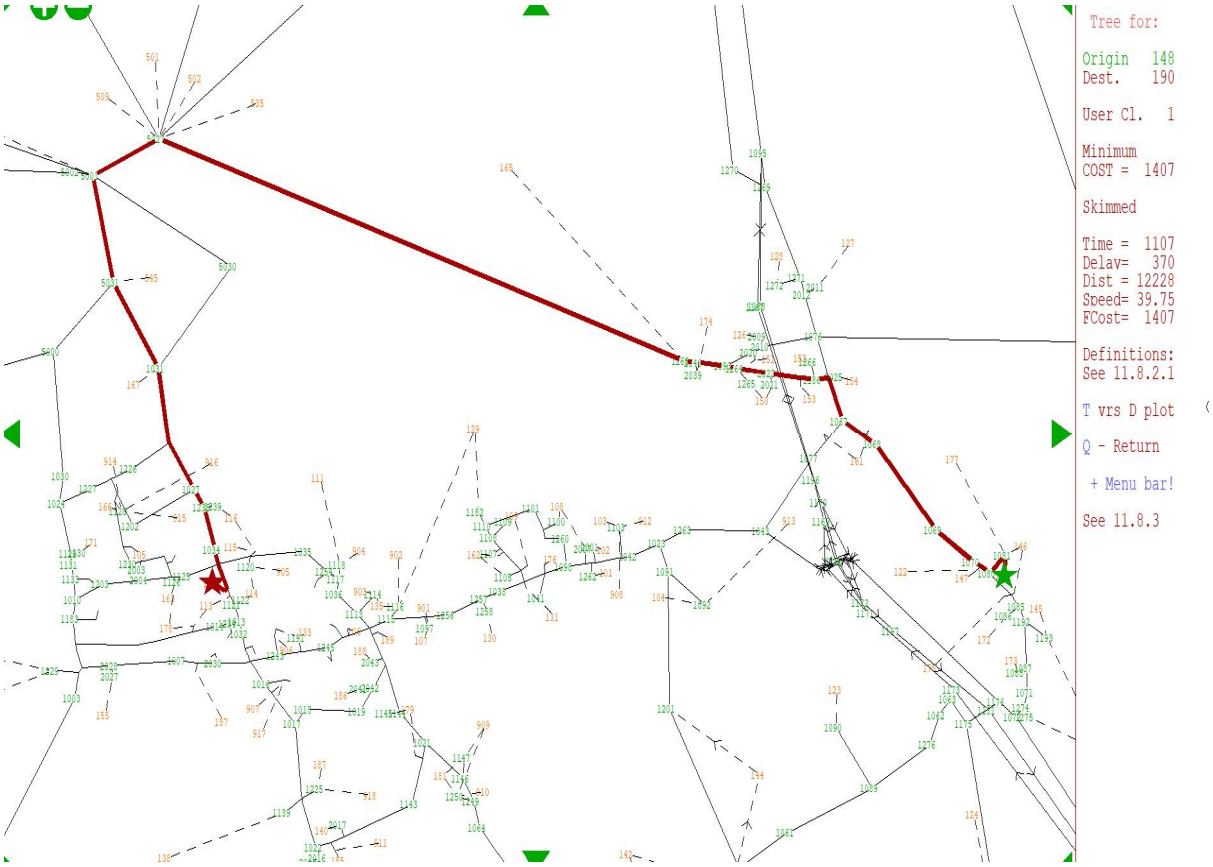


Figure 1-22 Swale Lane to Richmond Road After

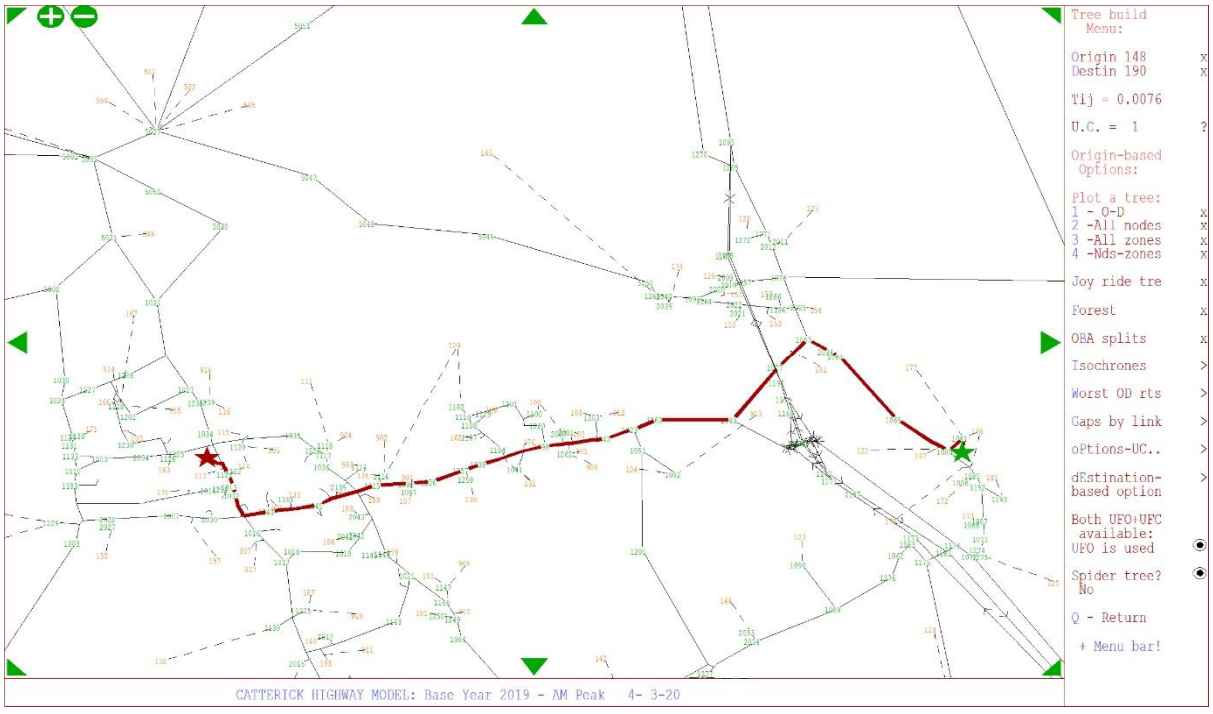


Figure 1-23 Meanee Road to Ava Road

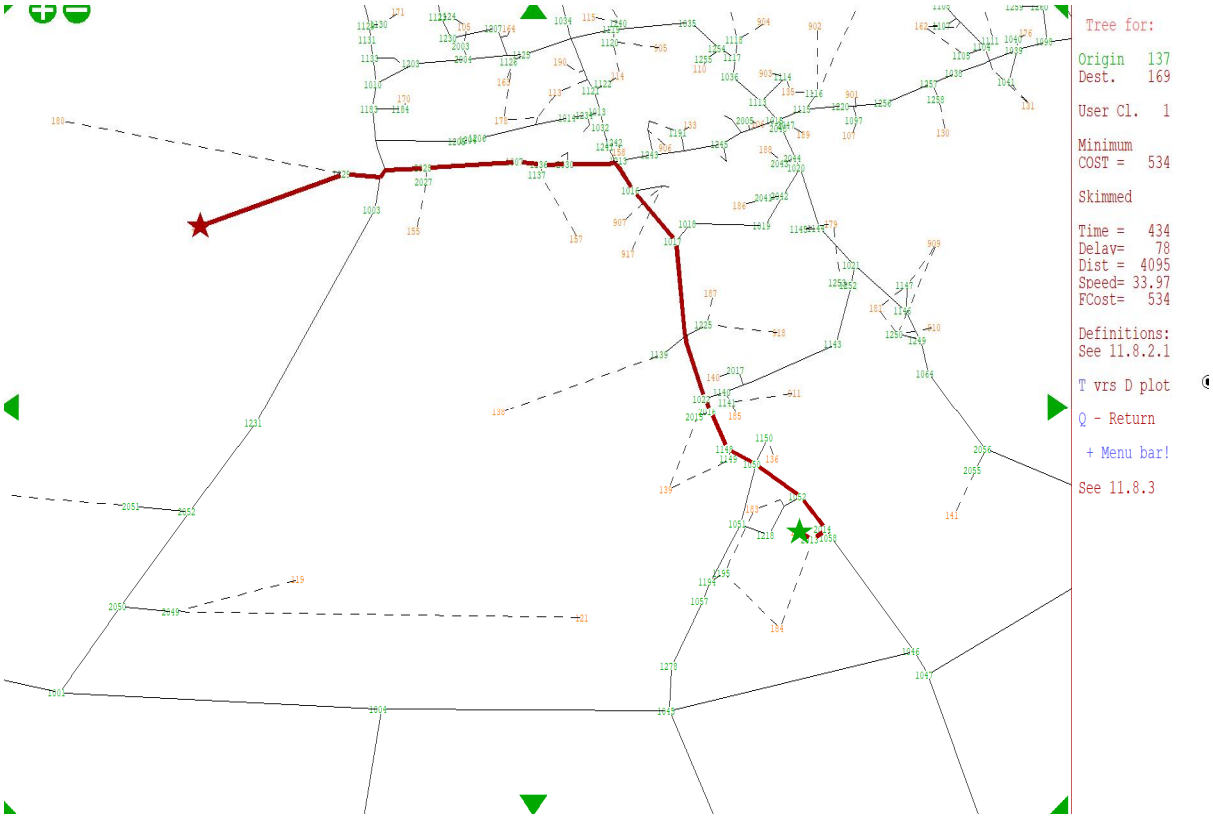


Figure 1-24 Downholme to Great Langton

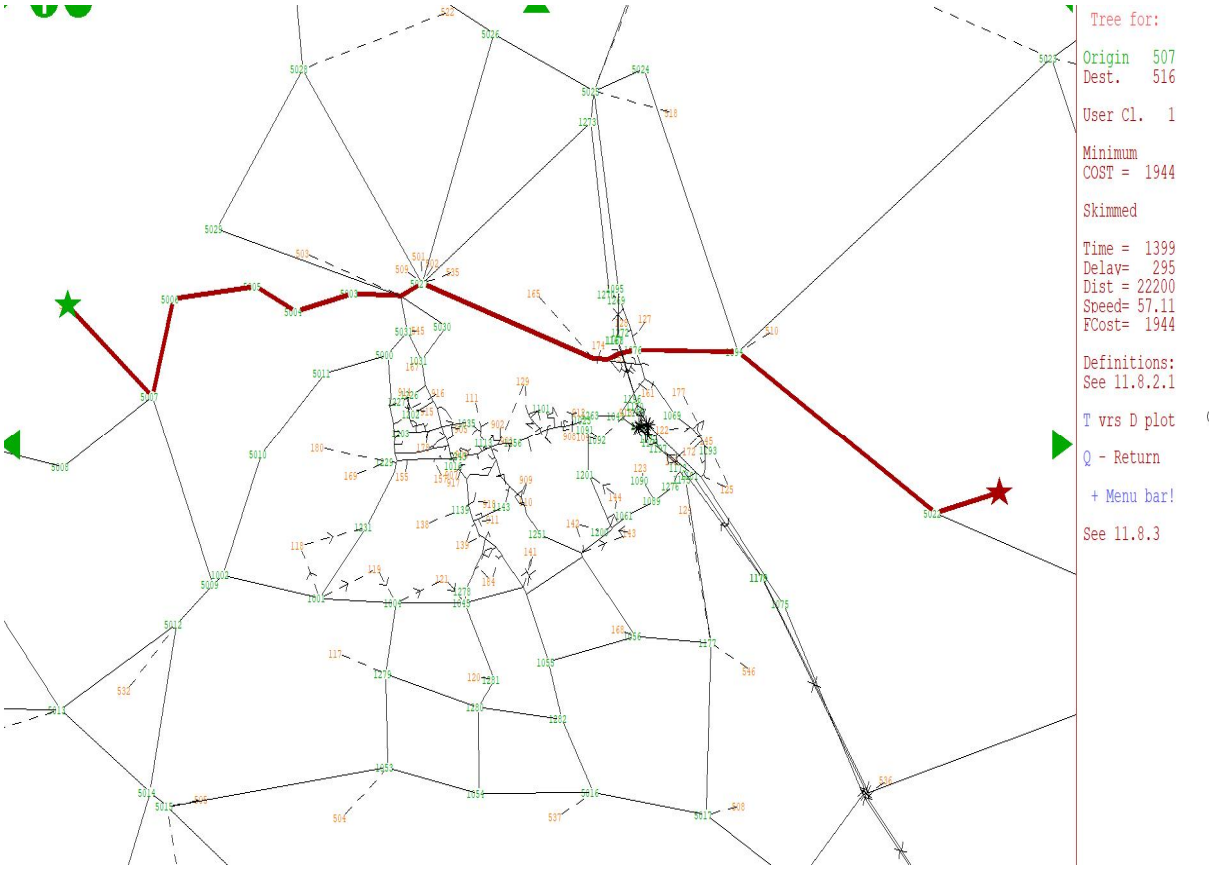


Figure 1-25 Richmond to Patrick Brompton Before

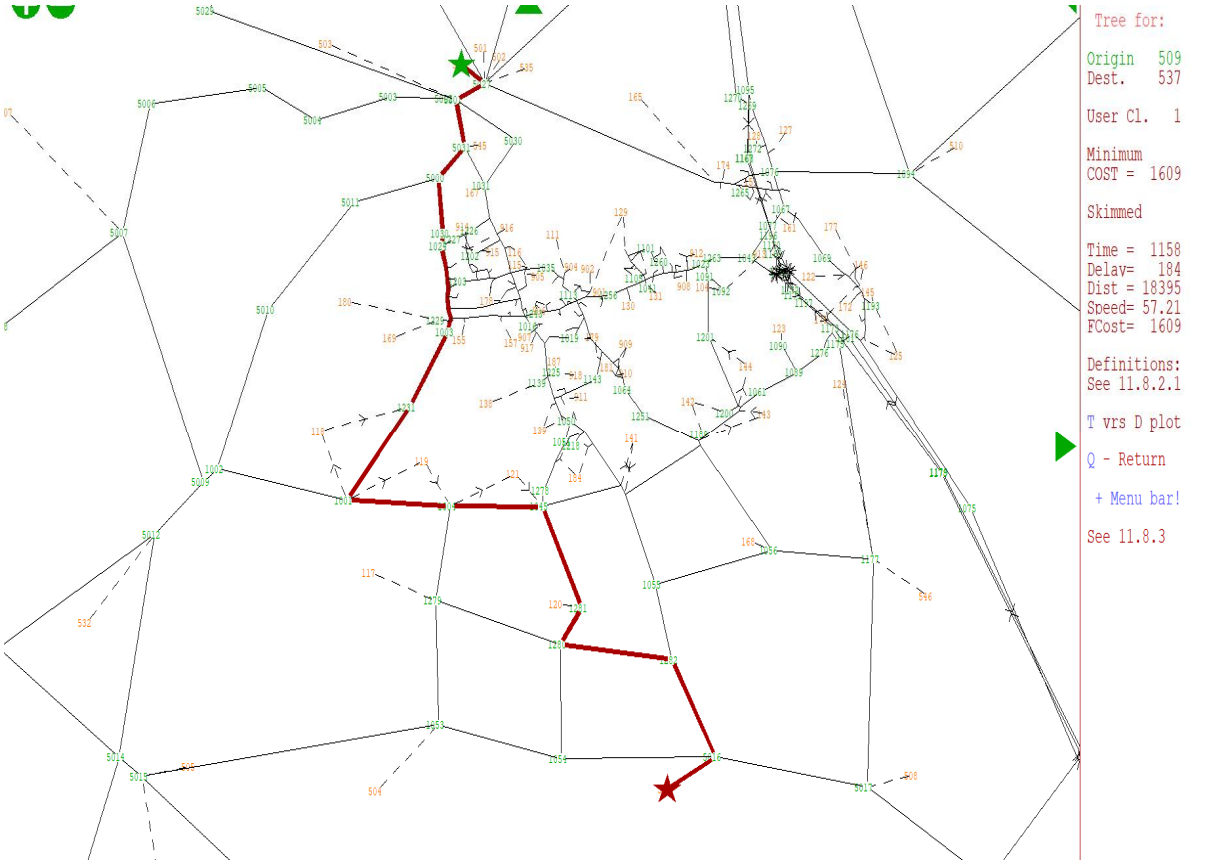


Figure 1-26 Richmond to Patrick Brompton After

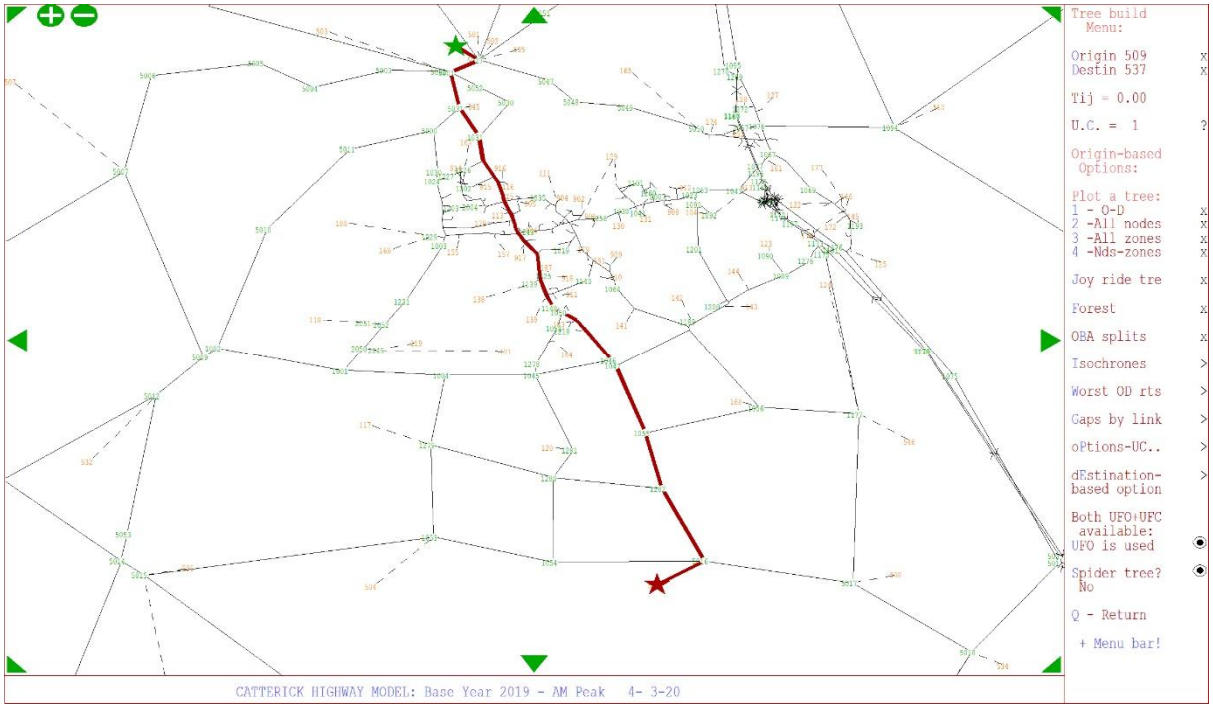


Figure 1-27 Scorton to Ava Road Before

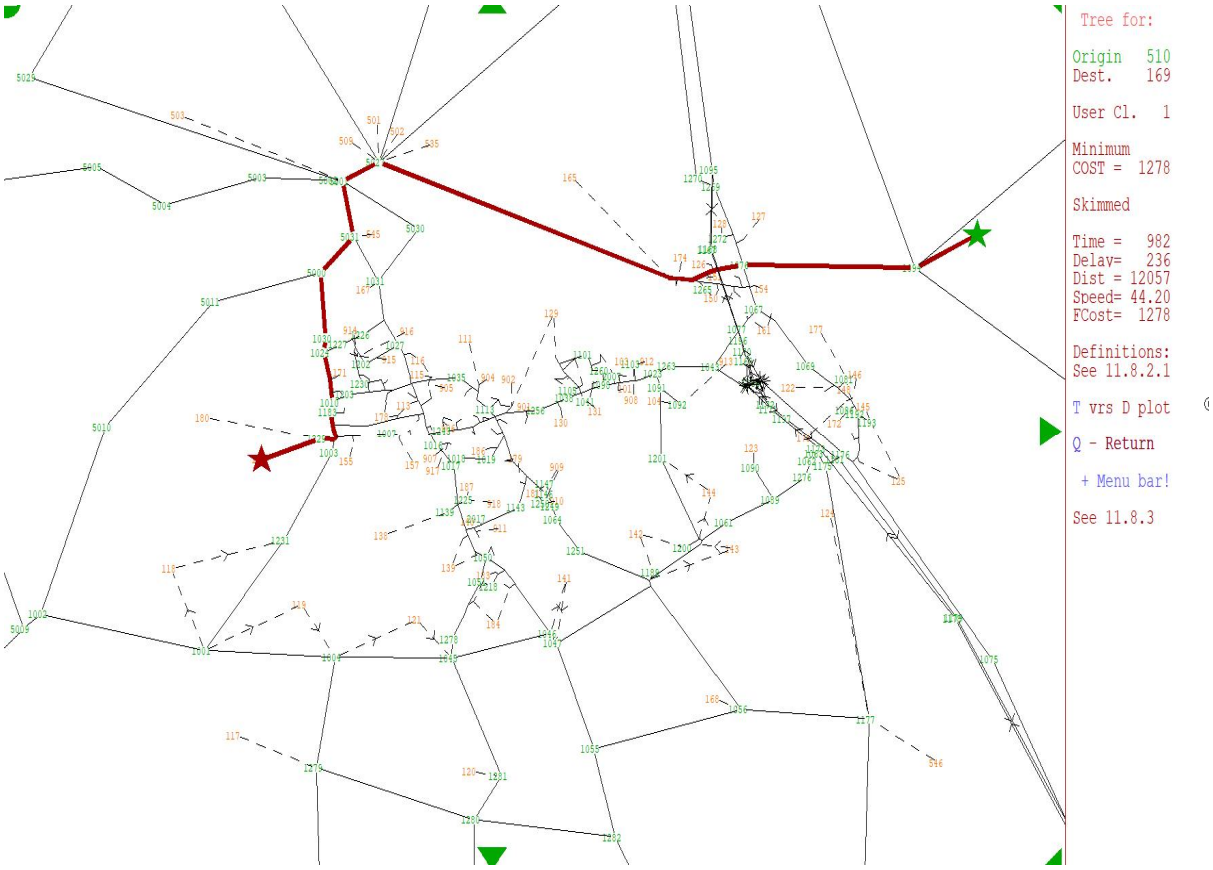
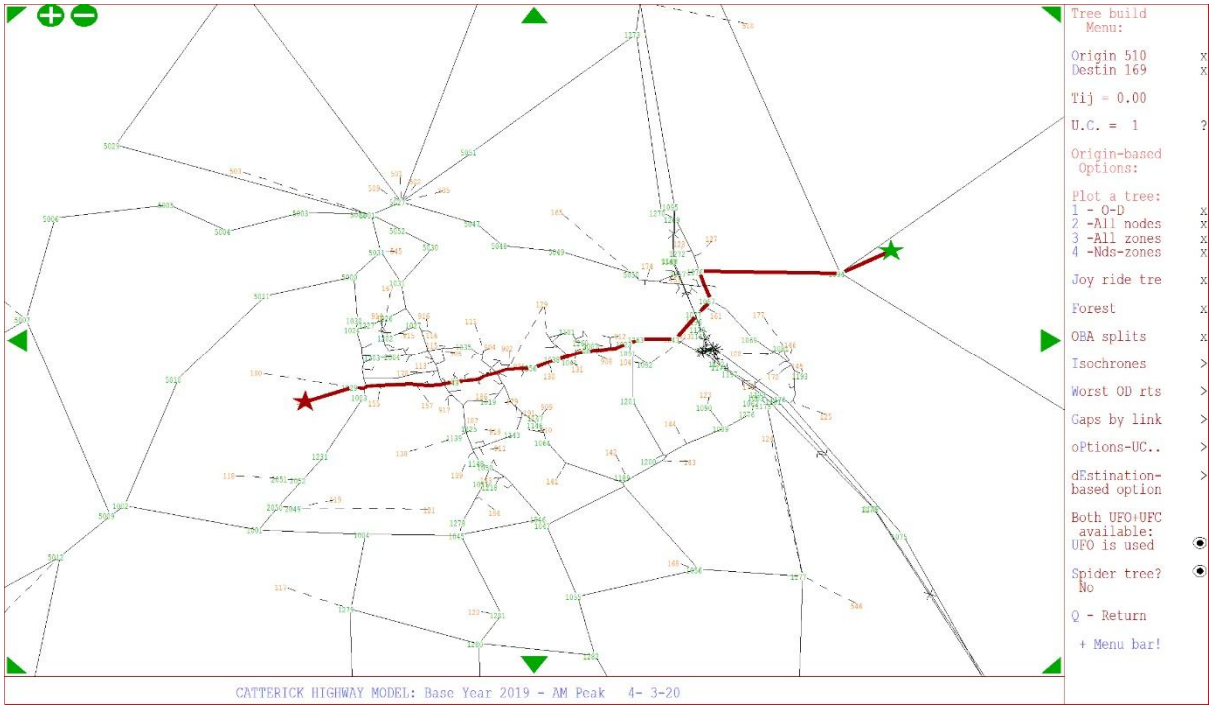


Figure 1-28 Scorton to Ava Road After



Appendix E

EFFECTS OF MATIX ESTIMATION

Appendix E – Impacts of Matrix Estimation

The change in the matrix totals by each user class is summarised in Table 1 below.

Table 1 Impacts of Matrix Estimation – Change in Matrix Totals (Vehs)

User Class	AM Peak		Inter Peak		PM Peak	
	Prior	PostME	Prior	PostME	Prior	PostME
Business	3,401	3,437	4,680	4,667	5,866	5,879
%Change		*1.1%*		*-0.3%*		*0.2%*
Commute	4,694	4,850	2,301	2,268	4,717	4,865
%Change		*3.3%*		*-1.4%*		*3.1%*
Other	3,610	3,554	6,862	6,757	5,083	5,192
%Change		*-1.6%*		*-1.5%*		*2.1%*
LGV	2,053	2,038	2,478	2,470	2,078	2,082
%Change		*-0.7%*		*-0.3%*		*0.2%*
HGV	2,351	2284	2,937	2,873	2,213	2193
%Change		*-2.8%*		*-2.2%*		*-0.9%*
Totals	**16,109**	**16,163**	**19,258**	**19,035**	**19,957**	**20,211**
%Change		***0.3%***		***-1.2%***		***1.3%***

The above table shows that the impact of the matrix estimation has had a limited impact on the matrix totals. It must be noted that these figures include intra-zonal trips. The impact is the same across all the user classes and the largest absolute change being the Commute trip totals in the AM peak matrix. There are no absolute changes greater than 3.3%. It is important to demonstrate that the matrix estimation has had a limited impact on the overall matrix composition and that the prior matrix (that consists of primarily observed data) has not had to be altered excessively to achieve model calibration.

Appendix F

FLOW CALIBRATION AND VALIDATION

Appendix F – Flow Calibration and Validation

Calibration/Validation Summary: Post-ME assignment - AM Peak

Calibration

Link	Road Name	Observed	Modelled	Diff	%Diff	GEH	GEH Pass?	Flow Pass?
1227-1066	*A6136 Richmond Road*	16	7	-9	-57%	2.7	Yes	Yes
2004-1011	*Barff Lane*	90	74	-15	-17%	1.7	Yes	Yes
1206-1236	*Plumer Road*	59	56	-3	-5%	0.4	Yes	Yes
1001-1004	*Hawkswell Lane*	38	15	-23	-62%	4.6	Yes	Yes
1066-1227	*A6136 Richmond Road*	40	24	-16	-40%	2.8	Yes	Yes
1011-2004	*Barff Lane*	84	58	-26	-31%	3.1	Yes	Yes
1236-1206	*Plumer Road*	71	42	-29	-42%	3.9	Yes	Yes
1004-1001	*Hawkswell Lane*	50	27	-22	-45%	3.6	Yes	Yes
2020-2010	*B6271 Station Road*	205	198	-7	-4%	0.5	Yes	Yes
1043-1074	*A6055*	636	636	0	0%	0.0	Yes	Yes
1177-1175	*Catterick Lane*	44	23	-21	-49%	3.7	Yes	Yes
1076-2057	*B6271 Station Road*	170	165	-4	-2%	0.3	Yes	Yes
1067-2032	*A6055 Catterick Road*	299	322	23	8%	1.3	Yes	Yes
1274-1072	*Leeming Lane*	292	280	-11	-4%	0.7	Yes	Yes
1216-1017	*Scotton Road*	291	287	-4	-1%	0.2	Yes	Yes
1143-1252	*Greenlands Lane*	71	68	-4	-5%	0.4	Yes	Yes
1249-1146	*Horne Road*	149	120	-29	-19%	2.5	Yes	Yes
1199-1201	*Dam Lane*	6	37	31	553%	6.8	No	Yes
1017-1216	*Scotton Road*	388	347	-41	-11%	2.1	Yes	Yes
1252-1143	*Greenlands Lane*	85	80	-5	-6%	0.5	Yes	Yes
1146-1249	*Horne Road*	168	109	-59	-35%	5.0	Yes	Yes
1201-1199	*Dam Lane*	6	22	15	239%	4.1	Yes	Yes
1115-1015	*A6136 Catterick Road*	872	940	68	8%	2.2	Yes	Yes
1046-1058	*Bedale Road*	107	109	2	2%	0.2	Yes	Yes
2050-2052	*Range Road*	110	111	1	1%	0.1	Yes	Yes
1033-1031	*Portholme Road*	268	234	-34	-13%	2.1	Yes	Yes
1015-1115	*A6136 Catterick Road*	587	575	-12	-2%	0.5	Yes	Yes
1058-1046	*Bedale Road*	106	104	-2	-2%	0.2	Yes	Yes
2052-2050	*Range Road*	104	105	1	1%	0.1	Yes	Yes
1238-1034	*A6136 Richmond Road*	344	330	-14	-4%	0.8	Yes	Yes
1243-1213	*York Road*	662	653	-9	-1%	0.3	Yes	Yes
1017-2059	*Scotton Road*	291	300	9	3%	0.5	Yes	Yes
1129-1131	*Plumer Road*	86	93	8	9%	0.8	Yes	Yes
1034-1238	*A6136 Richmond Road*	261	253	-8	-3%	0.5	Yes	Yes
1213-1243	*York Road*	373	314	-60	-16%	3.2	Yes	Yes
2059-1017	*Scotton Road*	362	337	-25	-7%	1.4	Yes	Yes
1131-1129	*Plumer Road*	44	30	-14	-32%	2.3	Yes	Yes
1278-1057	*Hunton Road*	31	34	2	7%	0.4	Yes	Yes

1057-1278	*Hunton Road*	30	43	13	43%	2.1	Yes	Yes
1060-2056	*James Lane*	125	106	-19	-15%	1.8	Yes	Yes
2056-1060	*James Lane*	116	57	-60	-51%	6.4	No	Yes
1075-1072	*A6055 Leeming Lane*	169	158	-11	-6%	0.9	Yes	Yes
1072-1075	*A6055 Leeming Lane*	248	238	-10	-4%	0.6	Yes	Yes
2026-1067	*A6055 Gatherly Road*	390	391	1	0%	0.1	Yes	Yes
1067-2026	*A6055 Gatherly Road*	480	432	-48	-10%	2.3	Yes	Yes
1039-1223	*A6136 Catterick Road*	703	817	115	16%	4.2	Yes	No
1223-1039	*A6136 Catterick Road*	563	647	84	15%	3.4	Yes	Yes
1131-1133	*Plumer Road*	86	93	8	9%	0.8	Yes	Yes
1133-1131	*Plumer Road*	44	30	-14	-32%	2.3	Yes	Yes
1228-1005-1006	*Range Road*	67	85	18	27%	2.1	Yes	Yes
1228-1005-2028	*Range Road*	224	224	0	0%	0.0	Yes	Yes
1006-1005-1228	*Plumer Road*	177	150	-27	-15%	2.1	Yes	Yes
1006-1005-2028	*Plumer Road*	72	72	0	0%	0.0	Yes	Yes
2028-1005-1228	*Leyburn Road*	299	290	-9	-3%	0.5	Yes	Yes
2028-1005-1006	*Leyburn Road*	33	30	-3	-8%	0.4	Yes	Yes
1030-1024-1227	*Plumer Road North*	2	0	-2	-100%	2.0	Yes	Yes
1030-1024-1129	*Plumer Road North*	23	58	35	151%	5.5	No	Yes
1227-1024-1129	*Haig Road*	40	23	-17	-43%	3.1	Yes	Yes
1129-1024-1030	*Pulmer Road South*	10	22	12	121%	3.0	Yes	Yes
1129-1024-1227	*Pulmer Road South*	12	4	-8	-64%	2.7	Yes	Yes
1278-1045-1046	*Hunton Road*	8	11	3	33%	0.9	Yes	Yes
1278-1045-1281	*Hunton Road*	14	14	0	0%	0.0	Yes	Yes
1278-1045-1004	*Hunton Road*	17	17	0	0%	0.0	Yes	Yes
1046-1045-1278	*Hawks Well Lane East*	2	2	0	-2%	0.0	Yes	Yes
1046-1045-1281	*Hawks Well Lane East*	1	3	2	194%	1.4	Yes	Yes
1046-1045-1004	*Hawks Well Lane East*	43	43	0	0%	0.0	Yes	Yes
1281-1045-1278	*Moor Lane*	21	17	-4	-20%	1.0	Yes	Yes
1281-1045-1046	*Moor Lane*	1	4	3	260%	1.7	Yes	Yes
1281-1045-1004	*Moor Lane*	2	1	-1	-53%	0.9	Yes	Yes
1004-1045-1278	*Hawks Well Lane West*	14	14	0	0%	0.0	Yes	Yes
1004-1045-1046	*Hawks Well Lane West*	36	31	-5	-15%	0.9	Yes	Yes
1208-1012-1209	*Richmond Road North*	84	106	22	26%	2.3	Yes	Yes
1208-1012-1210	*Richmond Road North*	222	207	-15	-7%	1.0	Yes	Yes
1208-1012-1211	*Richmond Road North*	29	12	-17	-57%	3.7	Yes	Yes
1209-1012-1208	*Hipswell Road East*	94	94	0	0%	0.0	Yes	Yes
1209-1012-1210	*Hipswell Road East*	65	67	2	4%	0.3	Yes	Yes
1209-1012-1211	*Hipswell Road East*	91	93	2	3%	0.3	Yes	Yes
1210-1012-1208	*Richmond Road South*	148	143	-5	-3%	0.4	Yes	Yes
1210-1012-1209	*Richmond Road South*	49	36	-13	-27%	2.0	Yes	Yes
1210-1012-1211	*Richmond Road South*	69	69	0	0%	0.0	Yes	Yes
1211-1012-1208	*Hipswell Road West*	19	12	-8	-39%	1.9	Yes	Yes
1211-1012-1209	*Hipswell Road West*	122	122	0	0%	0.0	Yes	Yes
1211-1012-1210	*Hipswell Road West*	107	97	-10	-10%	1.0	Yes	Yes
1212-1009-1213	*Richmond Road*	191	74	-117	-61%	10.2	No	No

1212-1009-1214	*Richmond Road*	210	200	-11	-5%	0.7	Yes	Yes
1212-1009-1215	*Richmond Road*	52	41	-11	-21%	1.6	Yes	Yes
1213-1009-1212	*Catterick Road*	251	215	-36	-14%	2.3	Yes	Yes
1213-1009-1214	*Catterick Road*	125	128	3	3%	0.3	Yes	Yes
1213-1009-1215	*Catterick Road*	293	289	-4	-1%	0.2	Yes	Yes
1214-1009-1212	*Scotton Road*	163	166	3	2%	0.2	Yes	Yes
1214-1009-1213	*Scotton Road*	50	50	0	0%	0.0	Yes	Yes
1214-1009-1215	*Scotton Road*	105	108	3	3%	0.3	Yes	Yes
1215-1009-1212	*Leyburn Road*	27	37	10	37%	1.8	Yes	Yes
1215-1009-1213	*Leyburn Road*	171	172	1	0%	0.0	Yes	Yes
1215-1009-1214	*Leyburn Road*	86	100	14	16%	1.4	Yes	Yes
2050-1001-1004	*Range Road*	1	1	0	0%	0.0	Yes	Yes
2050-1001-1002	*Range Road*	90	86	-4	-4%	0.4	Yes	Yes
1004-1001-2050	*Unnamed Road East*	3	3	0	0%	0.0	Yes	Yes
1004-1001-1002	*Unnamed Road East*	54	24	-31	-56%	4.9	Yes	Yes
1002-1001-2050	*Unnamed Road West*	104	98	-6	-6%	0.6	Yes	Yes
1002-1001-1004	*Unnamed Road West*	44	13	-31	-71%	5.9	No	Yes
1048-1049-1060	*Moor Lane*	7	10	3	39%	0.9	Yes	Yes
1048-1049-1188	*Moor Lane*	64	62	-2	-3%	0.2	Yes	Yes
1060-1049-1048	*James Lane*	7	18	11	154%	3.1	Yes	Yes
1060-1049-1188	*James Lane*	36	38	2	4%	0.3	Yes	Yes
1188-1049-1048	*Unnamed Road*	56	56	0	-1%	0.0	Yes	Yes
1188-1049-1060	*Unnamed Road*	120	96	-24	-20%	2.3	Yes	Yes
1027-1026-1033	*Richmond Road South*	222	210	-13	-6%	0.9	Yes	Yes
1226-1026-1027	*Haigh Road*	16	0	-16	-100%	5.7	No	Yes
1226-1026-1033	*Haigh Road*	22	22	0	0%	0.0	Yes	Yes
1033-1026-1027	*Richmond Road North*	305	286	-19	-6%	1.1	Yes	Yes
1033-1026-1226	*Richmond Road North*	21	16	-5	-22%	1.1	Yes	Yes
1104-1112-1223	*Colburn Lane*	65	65	0	0%	0.0	Yes	Yes
1104-1112-1283	*Colburn Lane*	1	5	4	426%	2.4	Yes	Yes
1104-1112-1222	*Colburn Lane*	99	97	-2	-2%	0.2	Yes	Yes
1223-1112-1104	*Catterick Road East*	30	31	1	4%	0.2	Yes	Yes
1223-1112-1283	*Catterick Road East*	7	0	-7	-100%	3.7	Yes	Yes
1223-1112-1222	*Catterick Road East*	740	755	15	2%	0.6	Yes	Yes
1283-1112-1104	*Unnamed Road*	2	2	0	0%	0.0	Yes	Yes
1283-1112-1223	*Unnamed Road*	18	18	0	0%	0.0	Yes	Yes
1283-1112-1222	*Unnamed Road*	53	18	-35	-65%	5.8	No	Yes
1222-1112-1104	*Catterick Rd W*	39	54	15	39%	2.2	Yes	Yes
1222-1112-1223	*Catterick Rd W*	534	531	-3	-1%	0.1	Yes	Yes
1222-1112-1283	*Catterick Rd W*	19	19	0	0%	0.0	Yes	Yes
2012-1076-1094	*Gatherby Road North*	44	18	-26	-59%	4.6	Yes	Yes
2012-1076-1185	*Gatherby Road North*	71	71	0	0%	0.0	Yes	Yes
2012-1076-2057	*Gatherby Road North*	56	50	-6	-11%	0.9	Yes	Yes
1094-1076-2012	*B6271 East*	31	16	-15	-49%	3.1	Yes	Yes
1094-1076-1185	*B6271 East*	139	104	-35	-25%	3.1	Yes	Yes
1094-1076-2057	*B6271 East*	107	74	-33	-31%	3.5	Yes	Yes

1185-1076-2012	*Gatherby Road South*	78	79	1	1%	0.1	Yes	Yes
1185-1076-1094	*Gatherby Road South*	129	126	-3	-2%	0.2	Yes	Yes
1185-1076-2057	*Gatherby Road South*	49	37	-13	-26%	1.9	Yes	Yes
2057-1076-2012	*Station Road*	49	49	0	-1%	0.0	Yes	Yes
2057-1076-1094	*Station Road*	128	88	-40	-31%	3.9	Yes	Yes
2057-1076-1185	*Station Road*	37	0	-37	-100%	8.6	No	Yes
1047-1046-1045	*Craggs Lane*	42	47	5	12%	0.7	Yes	Yes
1047-1046-1058	*Craggs Lane*	103	108	5	4%	0.5	Yes	Yes
1045-1046-1047	*Hawks Well Lane*	45	45	0	0%	0.0	Yes	Yes
1045-1046-1058	*Hawks Well Lane*	2	0	-2	-100%	2.0	Yes	Yes
1058-1046-1047	*Bedale Road*	104	102	-2	-2%	0.2	Yes	Yes
1058-1046-1045	*Bedale Road*	2	1	-1	-54%	0.9	Yes	Yes
2138-1015-1115	*Byng Road*	139	137	-2	-1%	0.2	Yes	Yes
2138-1015-2048	*Byng Road*	57	57	0	1%	0.0	Yes	Yes
2138-1015-2006	*Byng Road*	43	1	-42	-97%	8.8	No	Yes
1115-1015-2138	*Walkerville Road East*	224	285	61	27%	3.8	Yes	Yes
1115-1015-2048	*Walkerville Road East*	98	111	13	13%	1.3	Yes	Yes
1115-1015-2006	*Walkerville Road East*	518	502	-16	-3%	0.7	Yes	Yes
2048-1015-2138	*Horne Road*	70	65	-5	-7%	0.6	Yes	Yes
2048-1015-1115	*Horne Road*	85	70	-15	-17%	1.7	Yes	Yes
2048-1015-2006	*Horne Road*	60	36	-24	-40%	3.4	Yes	Yes
2006-1015-2138	*Walkerville Road West*	32	32	0	0%	0.0	Yes	Yes
2006-1015-1115	*Walkerville Road West*	337	335	-2	-1%	0.1	Yes	Yes
2006-1015-2048	*Walkerville Road West*	65	75	10	16%	1.2	Yes	Yes
2034-1067-2032	*Leeming Lane*	18	24	6	32%	1.3	Yes	Yes
2034-1067-2026	*Leeming Lane*	160	155	-5	-3%	0.4	Yes	Yes
2032-1067-2034	*Catterick Road*	26	23	-3	-13%	0.7	Yes	Yes
2032-1067-2026	*Catterick Road*	246	247	1	0%	0.1	Yes	Yes
2026-1067-2034	*Gatherly Road*	137	75	-62	-45%	6.0	No	Yes
2026-1067-2032	*Gatherly Road*	248	286	38	15%	2.3	Yes	Yes
2026-1185-1186	*Gatherly Road South*	164	171	7	5%	0.6	Yes	Yes
2026-1185-1076	*Gatherly Road South*	247	229	-18	-7%	1.2	Yes	Yes
1186-1185-2026	*Bridge Road*	150	183	33	22%	2.6	Yes	Yes
1186-1185-1076	*Bridge Road*	14	13	-1	-9%	0.3	Yes	Yes
1076-1185-2026	*Gatherly Road North*	239	175	-64	-27%	4.4	Yes	Yes
1076-1185-1186	*Gatherly Road North*	12	0	-12	-100%	4.9	Yes	Yes
1176-1072-1274	*A6055 North*	205	202	-3	-1%	0.2	Yes	Yes
1176-1072-1075	*A6055 North*	101	48	-53	-53%	6.2	No	Yes
1274-1072-1176	*Catterick Lane*	175	86	-89	-51%	7.8	No	Yes
1274-1072-1075	*Catterick Lane*	127	170	43	34%	3.6	Yes	Yes
1075-1072-1176	*A6055 South*	113	67	-46	-41%	4.8	Yes	Yes
1075-1072-1274	*A6055 South*	63	89	26	41%	3.0	Yes	Yes
1263-1043-1077	*Catterick Road West*	171	169	-2	-1%	0.2	Yes	Yes
1263-1043-1074	*Catterick Road West*	467	467	0	0%	0.0	Yes	Yes
1077-1043-1263	*Catterick Road East*	119	157	38	32%	3.2	Yes	Yes
1077-1043-1074	*Catterick Road East*	145	151	6	4%	0.5	Yes	Yes

1074-1043-1263	*A6055*	553	565	12	2%	0.5	Yes	Yes
1074-1043-1077	*A6055*	97	103	6	6%	0.6	Yes	Yes
1216-1138-1225	*Scotton Road North*	67	67	0	0%	0.0	Yes	Yes
1216-1138-1217	*Scotton Road North*	129	107	-22	-17%	2.0	Yes	Yes
1216-1138-1139	*Scotton Road North*	181	166	-15	-8%	1.1	Yes	Yes
1225-1138-1216	*Unnamed Road*	15	17	2	13%	0.5	Yes	Yes
1225-1138-1139	*Unnamed Road*	23	23	0	0%	0.0	Yes	Yes
1217-1138-1216	*Scotton Road South*	227	222	-5	-2%	0.4	Yes	Yes
1217-1138-1225	*Scotton Road South*	14	16	2	14%	0.5	Yes	Yes
1217-1138-1139	*Scotton Road South*	51	70	19	37%	2.4	Yes	Yes
1139-1138-1216	*Messines Road*	42	42	0	0%	0.0	Yes	Yes
1139-1138-1225	*Messines Road*	29	20	-9	-30%	1.8	Yes	Yes
1139-1138-1217	*Messines Road*	9	9	0	0%	0.0	Yes	Yes
1072-1176-1175	*A6055 South*	136	101	-35	-26%	3.2	Yes	Yes
1072-1176-1073	*A6055 South*	156	52	-104	-67%	10.2	No	No
1175-1176-1072	*Unnamed Road*	75	80	5	6%	0.5	Yes	Yes
1175-1176-1073	*Unnamed Road*	90	32	-58	-64%	7.4	No	Yes
1073-1176-1072	*A6055 North*	230	171	-59	-26%	4.2	Yes	Yes
1073-1176-1175	*A6055 North*	60	58	-2	-3%	0.2	Yes	Yes
1225-1138-1217	*Unnamed Road*	0	3	3	0%	2.6	Yes	Yes
1027-1026-1226	*Richmond Road South*	0	0	0	0%	0.0	Yes	Yes
1004-1045-1281	*Hawks Well Lane West*	0	0	0	0%	0.3	Yes	Yes
1227-1024-1030	*Haigh Road*	0	0	0	0%	0.0	Yes	Yes
Cal - Total		26013	24748	-1265	-5%	7.9	No	No
							185/199	196/199
							93%	98%

Validation

Ref	Road Name	Observed	Modelled	Diff	%Diff	GEH	GEH Pass?	Flow Pass?
2028-1007	*Leyburn Road*	251	304	53	21%	3.2	Yes	Yes
1007-2028	*Leyburn Road*	308	354	46	15%	2.6	Yes	Yes
1264-2022	*Bridge Road*	149	190	41	28%	3.2	Yes	Yes
1043-1077	*Catterick Road*	293	301	8	3%	0.5	Yes	Yes
1089-1276	*Unnamed Road*	106	91	-15	-14%	1.5	Yes	Yes
2010-2020	*Station Road*	170	146	-24	-14%	1.9	Yes	Yes
2022-1264	*Bridge Road*	172	165	-7	-4%	0.5	Yes	Yes
1077-1043	*Catterick Road*	296	320	24	8%	1.4	Yes	Yes
1074-1043	*A6055*	640	705	65	10%	2.5	Yes	Yes
1276-1089	*Unnamed Road*	137	140	3	2%	0.3	Yes	Yes
1175-1177	*Catterick Lane*	36	20	-16	-44%	3.0	Yes	Yes
2057-1076	*Station Road*	205	140	-65	-32%	5.0	Yes	Yes
2032-1067	*Catterick Road*	295	298	3	1%	0.2	Yes	Yes
1072-1274	*Leeming Lane*	219	297	78	36%	4.9	Yes	Yes
1231-1003	*Range Road*	110	111	1	1%	0.1	Yes	Yes

1003-1231	*Range Road*	104	105	1	1%	0.1	Yes	Yes
1031-1033	*Richmond Road*	326	306	-20	-6%	1.1	Yes	Yes
2056-1064	*James Lane*	131	115	-16	-12%	1.4	Yes	Yes
1057-1194	*Hunton Road*	31	34	2	7%	0.4	Yes	Yes
1030-1024	*Plumer Road*	26	60	34	131%	5.2	No	Yes
1064-2056	*james Lane*	46	47	1	3%	0.2	Yes	Yes
1194-1057	*Hunton Road*	30	43	13	43%	2.1	Yes	Yes
1024-1030	*Plumer Road*	17	22	5	32%	1.2	Yes	Yes
1119-1209	*Hipswell Road East*	236	261	26	11%	1.6	Yes	Yes
1209-1119	*Hipswell Road East*	234	270	36	15%	2.3	Yes	Yes
2024-1186	*Bridge Road*	173	200	27	15%	2.0	Yes	Yes
1186-2024	*Bridge Road*	180	171	-9	-5%	0.7	Yes	Yes
Val - Total		4920	5218	298	6%	4.2	**Yes**	**Yes**
							26/27	27/27
							96%	100%

Calibration/Validation Summary: Post-ME assignment – Interpeak

Calibration

Link	Road Name	Observed	Modelled	Diff	%Diff	GEH	GEH Pass?	Flow Pass?
1227-1066	*A6136 Richmond Road*	15	13	-2	-14%	0.5	Yes	Yes
2004-1011	*Barff Lane*	56	50	-6	-11%	0.8	Yes	Yes
1206-1236	*Plumer Road*	102	72	-31	-30%	3.3	Yes	Yes
1001-1004	*Hawkswell Lane*	35	20	-15	-42%	2.8	Yes	Yes
1066-1227	*A6136 Richmond Road*	11	11	0	-1%	0.0	Yes	Yes
1011-2004	*Barff Lane*	57	62	6	10%	0.7	Yes	Yes
1236-1206	*Plumer Road*	114	72	-41	-36%	4.3	Yes	Yes
1004-1001	*Hawkswell Lane*	28	15	-13	-47%	2.9	Yes	Yes
2020-2010	*B6271 Station Road*	143	95	-47	-33%	4.3	Yes	Yes
1043-1074	*A6055*	433	404	-29	-7%	1.4	Yes	Yes
1177-1175	*Catterick Lane*	34	9	-24	-72%	5.2	No	Yes
1076-2057	*B6271 Station Road*	152	147	-5	-3%	0.4	Yes	Yes
1067-2032	*A6055 Catterick Road*	259	236	-24	-9%	1.5	Yes	Yes
1274-1072	*Leeming Lane*	173	166	-7	-4%	0.5	Yes	Yes
1216-1017	*Scotton Road*	261	240	-21	-8%	1.3	Yes	Yes
1143-1252	*Greenlands Lane*	55	50	-5	-10%	0.7	Yes	Yes
1249-1146	*Horne Road*	94	68	-26	-28%	2.9	Yes	Yes
1199-1201	*Dam Lane*	4	22	18	406%	4.9	Yes	Yes
1017-1216	*Scotton Road*	240	230	-10	-4%	0.6	Yes	Yes
1252-1143	*Greenlands Lane*	61	70	9	15%	1.1	Yes	Yes
1146-1249	*Horne Road*	95	66	-29	-31%	3.2	Yes	Yes
1201-1199	*Dam Lane*	5	15	10	203%	3.2	Yes	Yes
1115-1015	*A6136 Catterick Road*	522	540	18	3%	0.8	Yes	Yes
1046-1058	*Bedale Road*	79	66	-12	-16%	1.5	Yes	Yes
2050-2052	*Range Road*	126	128	1	1%	0.1	Yes	Yes
1033-1031	*Portholme Road*	295	267	-28	-9%	1.7	Yes	Yes

1015-1115	*A6136 Catterick Road*	593	603	10	2%	0.4	Yes	Yes
1058-1046	*Bedale Road*	80	75	-6	-7%	0.6	Yes	Yes
2052-2050	*Range Road*	132	131	0	0%	0.0	Yes	Yes
1238-1034	*A6136 Richmond Road*	310	329	19	6%	1.1	Yes	Yes
1243-1213	*York Road*	444	385	-59	-13%	2.9	Yes	Yes
1017-2059	*Scotton Road*	259	234	-25	-10%	1.6	Yes	Yes
1129-1131	*Plumer Road*	52	49	-3	-6%	0.4	Yes	Yes
1034-1238	*A6136 Richmond Road*	305	305	0	0%	0.0	Yes	Yes
1213-1243	*York Road*	517	387	-130	-25%	6.1	No	No
2059-1017	*Scotton Road*	252	235	-18	-7%	1.1	Yes	Yes
1131-1129	*Plumer Road*	58	59	1	2%	0.2	Yes	Yes
1278-1057	*Hunton Road*	24	27	3	10%	0.5	Yes	Yes
1057-1278	*Hunton Road*	24	25	1	2%	0.1	Yes	Yes
1060-2056	*James Lane*	41	49	8	21%	1.3	Yes	Yes
2056-1060	*James Lane*	51	46	-6	-11%	0.8	Yes	Yes
1075-1072	*A6055 Leeming Lane*	111	100	-10	-9%	1.0	Yes	Yes
1072-1075	*A6055 Leeming Lane*	114	112	-2	-2%	0.2	Yes	Yes
2026-1067	*A6055 Gatherly Road*	322	304	-18	-6%	1.0	Yes	Yes
1067-2026	*A6055 Gatherly Road*	344	338	-6	-2%	0.3	Yes	Yes
1039-1223	*A6136 Catterick Road*	486	492	6	1%	0.3	Yes	Yes
1223-1039	*A6136 Catterick Road*	528	548	19	4%	0.8	Yes	Yes
1131-1133	*Plumer Road*	52	49	-3	-6%	0.4	Yes	Yes
1133-1131	*Plumer Road*	58	59	1	2%	0.2	Yes	Yes
1228-1005-1006	*Range Road*	111	113	2	2%	0.2	Yes	Yes
1228-1005-2028	*Range Road*	182	182	0	0%	0.0	Yes	Yes
1006-1005-1228	*Plumer Road*	122	122	0	0%	0.0	Yes	Yes
1006-1005-2028	*Plumer Road*	34	34	0	0%	0.0	Yes	Yes
2028-1005-1228	*Leyburn Road*	164	164	0	0%	0.0	Yes	Yes
2028-1005-1006	*Leyburn Road*	36	35	-1	-4%	0.2	Yes	Yes
1030-1024-1227	*Plumer Road North*	0	0	0	0%	0.0	Yes	Yes
1030-1024-1129	*Plumer Road North*	19	34	15	81%	3.0	Yes	Yes
1227-1024-1129	*Haig Road*	11	11	0	0%	0.0	Yes	Yes
1129-1024-1030	*Pulmer Road South*	21	41	20	94%	3.6	Yes	Yes
1129-1024-1227	*Pulmer Road South*	15	13	-2	-16%	0.6	Yes	Yes
1278-1045-1046	*Hunton Road*	2	4	2	90%	1.1	Yes	Yes
1278-1045-1281	*Hunton Road*	13	13	0	0%	0.0	Yes	Yes
1278-1045-1004	*Hunton Road*	7	7	0	1%	0.0	Yes	Yes
1046-1045-1278	*Hawks Well Lane East*	2	3	1	62%	0.8	Yes	Yes
1046-1045-1281	*Hawks Well Lane East*	1	1	0	0%	0.0	Yes	Yes
1046-1045-1004	*Hawks Well Lane East*	14	14	0	-3%	0.1	Yes	Yes
1281-1045-1278	*Moor Lane*	14	14	0	0%	0.0	Yes	Yes
1281-1045-1046	*Moor Lane*	2	2	0	-8%	0.1	Yes	Yes
1281-1045-1004	*Moor Lane*	0	0	0	0%	0.5	Yes	Yes
1004-1045-1278	*Hawks Well Lane West*	8	8	0	0%	0.0	Yes	Yes
1004-1045-1046	*Hawks Well Lane West*	25	21	-4	-16%	0.8	Yes	Yes
1208-1012-1209	*Richmond Road North*	56	77	21	37%	2.5	Yes	Yes

1208-1012-1210	*Richmond Road North*	245	238	-7	-3%	0.4	Yes	Yes
1208-1012-1211	*Richmond Road North*	13	11	-2	-18%	0.7	Yes	Yes
1209-1012-1208	*Hipswell Road East*	55	65	10	19%	1.3	Yes	Yes
1209-1012-1210	*Hipswell Road East*	58	59	1	2%	0.1	Yes	Yes
1209-1012-1211	*Hipswell Road East*	51	54	3	6%	0.4	Yes	Yes
1210-1012-1208	*Richmond Road South*	233	226	-7	-3%	0.5	Yes	Yes
1210-1012-1209	*Richmond Road South*	53	39	-14	-26%	2.0	Yes	Yes
1210-1012-1211	*Richmond Road South*	69	69	0	0%	0.0	Yes	Yes
1211-1012-1208	*Hipswell Road West*	12	11	-1	-9%	0.3	Yes	Yes
1211-1012-1209	*Hipswell Road West*	48	48	0	0%	0.0	Yes	Yes
1211-1012-1210	*Hipswell Road West*	62	62	0	0%	0.0	Yes	Yes
1212-1009-1213	*Richmond Road*	303	186	-117	-39%	7.5	No	No
1212-1009-1214	*Richmond Road*	189	181	-8	-4%	0.6	Yes	Yes
1212-1009-1215	*Richmond Road*	58	58	0	0%	0.0	Yes	Yes
1213-1009-1212	*Catterick Road*	301	198	-103	-34%	6.5	No	No
1213-1009-1214	*Catterick Road*	39	51	12	30%	1.8	Yes	Yes
1213-1009-1215	*Catterick Road*	111	117	6	6%	0.6	Yes	Yes
1214-1009-1212	*Scotton Road*	194	189	-5	-3%	0.4	Yes	Yes
1214-1009-1213	*Scotton Road*	60	43	-17	-29%	2.4	Yes	Yes
1214-1009-1215	*Scotton Road*	54	54	0	0%	0.0	Yes	Yes
1215-1009-1212	*Leyburn Road*	68	59	-9	-13%	1.1	Yes	Yes
1215-1009-1213	*Leyburn Road*	135	137	2	2%	0.2	Yes	Yes
1215-1009-1214	*Leyburn Road*	54	54	0	0%	0.0	Yes	Yes
2050-1001-1004	*Range Road*	7	7	0	1%	0.0	Yes	Yes
2050-1001-1002	*Range Road*	114	113	-1	-1%	0.1	Yes	Yes
1004-1001-2050	*Unnamed Road East*	3	5	2	52%	0.8	Yes	Yes
1004-1001-1002	*Unnamed Road East*	19	9	-10	-54%	2.7	Yes	Yes
1002-1001-2050	*Unnamed Road West*	106	110	4	4%	0.4	Yes	Yes
1002-1001-1004	*Unnamed Road West*	26	12	-14	-55%	3.3	Yes	Yes
1048-1049-1060	*Moor Lane*	6	22	16	269%	4.3	Yes	Yes
1048-1049-1188	*Moor Lane*	33	31	-2	-6%	0.4	Yes	Yes
1060-1049-1048	*James Lane*	7	7	0	5%	0.1	Yes	Yes
1060-1049-1188	*James Lane*	27	35	8	31%	1.5	Yes	Yes
1188-1049-1048	*Unnamed Road*	23	24	1	2%	0.1	Yes	Yes
1188-1049-1060	*Unnamed Road*	27	25	-2	-9%	0.5	Yes	Yes
1027-1026-1033	*Richmond Road South*	273	259	-14	-5%	0.9	Yes	Yes
1226-1026-1027	*Haigh Road*	8	0	-8	-100%	4.0	Yes	Yes
1226-1026-1033	*Haigh Road*	8	7	-1	-10%	0.3	Yes	Yes
1033-1026-1027	*Richmond Road North*	287	277	-10	-3%	0.6	Yes	Yes
1033-1026-1226	*Richmond Road North*	8	7	-1	-15%	0.4	Yes	Yes
1104-1112-1223	*Colburn Lane*	40	50	10	26%	1.5	Yes	Yes
1104-1112-1283	*Colburn Lane*	3	5	2	50%	0.8	Yes	Yes
1104-1112-1222	*Colburn Lane*	54	54	0	0%	0.0	Yes	Yes
1223-1112-1104	*Catterick Road East*	40	45	5	14%	0.8	Yes	Yes
1223-1112-1283	*Catterick Road East*	8	0	-8	-100%	4.0	Yes	Yes
1223-1112-1222	*Catterick Road East*	426	420	-6	-1%	0.3	Yes	Yes

1283-1112-1104	*Unnamed Road*	3	5	2	56%	0.9	Yes	Yes
1283-1112-1223	*Unnamed Road*	8	0	-8	-100%	4.0	Yes	Yes
1283-1112-1222	*Unnamed Road*	20	20	0	0%	0.0	Yes	Yes
1222-1112-1104	*Catterick Rd W*	61	59	-3	-4%	0.3	Yes	Yes
1222-1112-1223	*Catterick Rd W*	467	473	6	1%	0.3	Yes	Yes
1222-1112-1283	*Catterick Rd W*	24	22	-2	-10%	0.5	Yes	Yes
2012-1076-1094	*Gatherby Road North*	26	19	-7	-26%	1.4	Yes	Yes
2012-1076-1185	*Gatherby Road North*	87	79	-8	-9%	0.8	Yes	Yes
2012-1076-2057	*Gatherby Road North*	51	37	-14	-27%	2.0	Yes	Yes
1094-1076-2012	*B6271 East*	37	18	-19	-51%	3.6	Yes	Yes
1094-1076-1185	*B6271 East*	86	81	-5	-5%	0.5	Yes	Yes
1094-1076-2057	*B6271 East*	75	66	-9	-12%	1.1	Yes	Yes
1185-1076-2012	*Gatherby Road South*	92	80	-12	-13%	1.3	Yes	Yes
1185-1076-1094	*Gatherby Road South*	97	111	14	14%	1.3	Yes	Yes
1185-1076-2057	*Gatherby Road South*	46	46	0	1%	0.1	Yes	Yes
2057-1076-2012	*Station Road*	52	45	-7	-13%	1.0	Yes	Yes
2057-1076-1094	*Station Road*	72	57	-16	-22%	1.9	Yes	Yes
2057-1076-1185	*Station Road*	40	0	-40	-100%	8.9	No	Yes
1047-1046-1045	*Craggs Lane*	17	17	0	1%	0.0	Yes	Yes
1047-1046-1058	*Craggs Lane*	75	63	-12	-16%	1.4	Yes	Yes
1045-1046-1047	*Hawks Well Lane*	27	26	-1	-5%	0.3	Yes	Yes
1045-1046-1058	*Hawks Well Lane*	3	1	-2	-63%	1.3	Yes	Yes
1058-1046-1047	*Bedale Road*	76	73	-4	-5%	0.4	Yes	Yes
1058-1046-1045	*Bedale Road*	3	1	-2	-80%	1.8	Yes	Yes
2138-1015-1115	*Byng Road*	96	98	2	2%	0.2	Yes	Yes
2138-1015-2048	*Byng Road*	22	40	18	82%	3.2	Yes	Yes
2138-1015-2006	*Byng Road*	21	23	2	10%	0.5	Yes	Yes
1115-1015-2138	*Walkerville Road East*	80	158	78	98%	7.2	No	Yes
1115-1015-2048	*Walkerville Road East*	58	58	0	0%	0.0	Yes	Yes
1115-1015-2006	*Walkerville Road East*	362	294	-68	-19%	3.7	Yes	Yes
2048-1015-2138	*Horne Road*	24	63	39	163%	5.9	No	Yes
2048-1015-1115	*Horne Road*	57	68	11	20%	1.4	Yes	Yes
2048-1015-2006	*Horne Road*	57	54	-3	-5%	0.4	Yes	Yes
2006-1015-2138	*Walkerville Road West*	24	6	-18	-74%	4.6	Yes	Yes
2006-1015-1115	*Walkerville Road West*	416	410	-6	-2%	0.3	Yes	Yes
2006-1015-2048	*Walkerville Road West*	51	53	2	3%	0.2	Yes	Yes
2034-1067-2032	*Leeming Lane*	39	34	-5	-12%	0.8	Yes	Yes
2034-1067-2026	*Leeming Lane*	108	92	-16	-15%	1.6	Yes	Yes
2032-1067-2034	*Catterick Road*	44	34	-10	-23%	1.6	Yes	Yes
2032-1067-2026	*Catterick Road*	199	214	15	7%	1.0	Yes	Yes
2026-1067-2034	*Gatherly Road*	108	93	-15	-13%	1.4	Yes	Yes
2026-1067-2032	*Gatherly Road*	194	188	-6	-3%	0.4	Yes	Yes
2026-1185-1186	*Gatherly Road South*	85	97	12	14%	1.2	Yes	Yes
2026-1185-1076	*Gatherly Road South*	223	207	-16	-7%	1.1	Yes	Yes
1186-1185-2026	*Bridge Road*	96	131	35	36%	3.3	Yes	Yes
1186-1185-1076	*Bridge Road*	16	30	14	89%	3.0	Yes	Yes

1076-1185-2026	*Gatherly Road North*	205	149	-56	-27%	4.2	Yes	Yes
1076-1185-1186	*Gatherly Road North*	11	0	-11	-100%	4.7	Yes	Yes
1176-1072-1274	*A6055 North*	117	49	-68	-58%	7.4	No	Yes
1176-1072-1075	*A6055 North*	57	23	-34	-59%	5.3	No	Yes
1274-1072-1176	*Catterick Lane*	110	73	-37	-34%	3.9	Yes	Yes
1274-1072-1075	*Catterick Lane*	57	76	19	34%	2.4	Yes	Yes
1075-1072-1176	*A6055 South*	62	24	-38	-62%	5.8	No	Yes
1075-1072-1274	*A6055 South*	47	68	21	45%	2.8	Yes	Yes
1263-1043-1077	*Catterick Road West*	172	172	0	0%	0.0	Yes	Yes
1263-1043-1074	*Catterick Road West*	316	320	4	1%	0.2	Yes	Yes
1077-1043-1263	*Catterick Road East*	163	154	-9	-5%	0.7	Yes	Yes
1077-1043-1074	*Catterick Road East*	66	68	2	3%	0.2	Yes	Yes
1074-1043-1263	*A6055*	291	293	2	1%	0.1	Yes	Yes
1074-1043-1077	*A6055*	70	77	7	10%	0.8	Yes	Yes
1216-1138-1225	*Scotton Road North*	22	22	0	0%	0.0	Yes	Yes
1216-1138-1217	*Scotton Road North*	168	159	-9	-5%	0.7	Yes	Yes
1216-1138-1139	*Scotton Road North*	43	43	0	0%	0.0	Yes	Yes
1225-1138-1216	*Unnamed Road*	27	26	-1	-5%	0.2	Yes	Yes
1225-1138-1139	*Unnamed Road*	25	24	-1	-3%	0.1	Yes	Yes
1217-1138-1216	*Scotton Road South*	160	145	-15	-9%	1.2	Yes	Yes
1217-1138-1225	*Scotton Road South*	3	3	0	11%	0.2	Yes	Yes
1217-1138-1139	*Scotton Road South*	12	12	0	0%	0.0	Yes	Yes
1139-1138-1216	*Messines Road*	65	62	-3	-4%	0.3	Yes	Yes
1139-1138-1225	*Messines Road*	27	27	0	0%	0.0	Yes	Yes
1139-1138-1217	*Messines Road*	15	15	0	0%	0.0	Yes	Yes
1072-1176-1175	*A6055 South*	45	40	-5	-10%	0.7	Yes	Yes
1072-1176-1073	*A6055 South*	125	56	-69	-55%	7.2	No	Yes
1175-1176-1072	*Unnamed Road*	51	44	-7	-13%	1.0	Yes	Yes
1175-1176-1073	*Unnamed Road*	37	15	-22	-61%	4.4	Yes	Yes
1073-1176-1072	*A6055 North*	123	29	-94	-77%	10.8	No	Yes
1073-1176-1175	*A6055 North*	28	14	-14	-49%	3.0	Yes	Yes
1225-1138-1217	*Unnamed Road*	5	5	0	0%	0.0	Yes	Yes
1027-1026-1226	*Richmond Road South*	6	0	-6	-100%	3.5	Yes	Yes
1004-1045-1281	*Hawks Well Lane West*	1	0	-1	-85%	1.1	Yes	Yes
1227-1024-1030	*Haigh Road*	1	0	-1	-100%	1.4	Yes	Yes
Cal - Total		20139	18852	-1287	-6%	9.2	No 187/199 94%	No 196/199 98%

Validation

Ref	Road Name	Observed	Modelled	Diff	%Diff	GEH	GEH Pass?	Flow Pass?
2028-1007	*Leyburn Road*	226	232	6	3%	0.4	Yes	Yes
1007-2028	*Leyburn Road*	198	214	16	8%	1.1	Yes	Yes
1264-2022	*Bridge Road*	97	155	58	60%	5.2	No	Yes
1043-1077	*Catterick Road*	271	277	6	2%	0.4	Yes	Yes
1089-1276	*Unnamed Road*	57	50	-7	-12%	1.0	Yes	Yes
2010-2020	*Station Road*	152	155	3	2%	0.3	Yes	Yes
2022-1264	*Bridge Road*	84	95	11	13%	1.2	Yes	Yes
1077-1043	*Catterick Road*	257	235	-22	-9%	1.4	Yes	Yes
1074-1043	*A6055*	419	404	-15	-4%	0.7	Yes	Yes
1276-1089	*Unnamed Road*	53	45	-8	-15%	1.2	Yes	Yes
1175-1177	*Catterick Lane*	27	10	-17	-62%	3.9	Yes	Yes
2057-1076	*Station Road*	143	109	-34	-24%	3.0	Yes	Yes
2032-1067	*Catterick Road*	273	276	3	1%	0.2	Yes	Yes
1072-1274	*Leeming Lane*	161	130	-30	-19%	2.5	Yes	Yes
1231-1003	*Range Road*	126	128	1	1%	0.1	Yes	Yes
1003-1231	*Range Road*	132	131	0	0%	0.0	Yes	Yes
1031-1033	*Richmond Road*	300	285	-15	-5%	0.9	Yes	Yes
2056-1064	*James Lane*	38	50	12	31%	1.8	Yes	Yes
1057-1194	*Hunton Road*	24	27	3	10%	0.5	Yes	Yes
1030-1024	*Plumer Road*	23	36	12	54%	2.3	Yes	Yes
1064-2056	*james Lane*	40	48	8	19%	1.2	Yes	Yes
1194-1057	*Hunton Road*	24	25	1	2%	0.1	Yes	Yes
1024-1030	*Plumer Road*	24	42	18	76%	3.1	Yes	Yes
1119-1209	*Hipswell Road East*	156	183	27	17%	2.1	Yes	Yes
1209-1119	*Hipswell Road East*	152	169	17	11%	1.3	Yes	Yes
2024-1186	*Bridge Road*	118	162	45	38%	3.8	Yes	Yes
1186-2024	*Bridge Road*	104	102	-2	-1%	0.1	Yes	Yes
Val - Total		3678	3774	96	3%	1.6	**Yes**	**Yes**
							26/27	27/27
							96%	100%

Calibration/Validation Summary: Post-ME assignment - PM Peak

Calibration

Link	Road Name	Observed	Modelled	Diff	%Diff	GEH	GEH Pass?	Flow Pass?
1227-1066	*A6136 Richmond Road*	37	14	-23	-62%	4.5	Yes	Yes
2004-1011	*Barff Lane*	55	48	-7	-13%	1.0	Yes	Yes
1206-1236	*Plumer Road*	152	68	-84	-55%	8.0	No	Yes
1001-1004	*Hawkswell Lane*	43	26	-18	-41%	3.0	Yes	Yes
1066-1227	*A6136 Richmond Road*	11	9	-2	-19%	0.7	Yes	Yes
1011-2004	*Barff Lane*	56	64	8	14%	1.0	Yes	Yes
1236-1206	*Plumer Road*	122	94	-28	-23%	2.7	Yes	Yes
1004-1001	*Hawkswell Lane*	40	14	-26	-66%	5.1	No	Yes

2020-2010	*B6271 Station Road*	163	121	-42	-26%	3.5	Yes	Yes
1043-1074	*A6055*	598	578	-20	-3%	0.8	Yes	Yes
1177-1175	*Catterick Lane*	38	15	-23	-59%	4.4	Yes	Yes
1076-2057	*B6271 Station Road*	210	202	-8	-4%	0.6	Yes	Yes
1067-2032	*A6055 Catterick Road*	302	331	29	9%	1.6	Yes	Yes
1274-1072	*Leeming Lane*	230	192	-38	-17%	2.6	Yes	Yes
1216-1017	*Scotton Road*	298	265	-33	-11%	1.9	Yes	Yes
1143-1252	*Greenlands Lane*	75	40	-35	-47%	4.6	Yes	Yes
1249-1146	*Horne Road*	114	126	12	10%	1.1	Yes	Yes
1199-1201	*Dam Lane*	6	25	18	296%	4.7	Yes	Yes
1017-1216	*Scotton Road*	274	304	30	11%	1.8	Yes	Yes
1252-1143	*Greenlands Lane*	70	71	1	1%	0.1	Yes	Yes
1146-1249	*Horne Road*	110	122	12	11%	1.1	Yes	Yes
1201-1199	*Dam Lane*	7	28	21	308%	5.1	No	Yes
1115-1015	*A6136 Catterick Road*	684	674	-10	-1%	0.4	Yes	Yes
1046-1058	*Bedale Road*	97	79	-18	-18%	1.9	Yes	Yes
2050-2052	*Range Road*	129	128	-1	-1%	0.1	Yes	Yes
1033-1031	*Portholme Road*	365	395	30	8%	1.5	Yes	Yes
1015-1115	*A6136 Catterick Road*	843	779	-64	-8%	2.3	Yes	Yes
1058-1046	*Bedale Road*	109	141	32	29%	2.9	Yes	Yes
2052-2050	*Range Road*	137	137	1	0%	0.1	Yes	Yes
1238-1034	*A6136 Richmond Road*	341	368	27	8%	1.5	Yes	Yes
1243-1213	*York Road*	513	426	-87	-17%	4.0	Yes	Yes
1017-2059	*Scotton Road*	293	249	-44	-15%	2.7	Yes	Yes
1129-1131	*Plumer Road*	55	40	-14	-26%	2.1	Yes	Yes
1034-1238	*A6136 Richmond Road*	375	415	40	11%	2.0	Yes	Yes
1213-1243	*York Road*	656	594	-62	-9%	2.5	Yes	Yes
2059-1017	*Scotton Road*	278	301	23	8%	1.4	Yes	Yes
1131-1129	*Plumer Road*	73	76	4	5%	0.4	Yes	Yes
1278-1057	*Hunton Road*	29	34	5	16%	0.8	Yes	Yes
1057-1278	*Hunton Road*	31	32	1	3%	0.2	Yes	Yes
1060-2056	*James Lane*	56	113	57	102%	6.2	No	Yes
2056-1060	*James Lane*	75	103	28	37%	2.9	Yes	Yes
1075-1072	*A6055 Leeming Lane*	235	231	-4	-2%	0.3	Yes	Yes
1072-1075	*A6055 Leeming Lane*	163	134	-29	-18%	2.4	Yes	Yes
2026-1067	*A6055 Gatherly Road*	448	446	-2	0%	0.1	Yes	Yes
1067-2026	*A6055 Gatherly Road*	472	466	-6	-1%	0.3	Yes	Yes
1039-1223	*A6136 Catterick Road*	635	667	32	5%	1.3	Yes	Yes
1223-1039	*A6136 Catterick Road*	697	691	-6	-1%	0.2	Yes	Yes
1131-1133	*Plumer Road*	55	40	-14	-26%	2.1	Yes	Yes
1133-1131	*Plumer Road*	73	76	4	5%	0.4	Yes	Yes
1228-1005-1006	*Range Road*	214	152	-62	-29%	4.6	Yes	Yes
1228-1005-2028	*Range Road*	252	252	0	0%	0.0	Yes	Yes
1006-1005-1228	*Plumer Road*	99	123	24	24%	2.2	Yes	Yes
1006-1005-2028	*Plumer Road*	41	43	2	4%	0.3	Yes	Yes
2028-1005-1228	*Leyburn Road*	139	161	22	16%	1.8	Yes	Yes

2028-1005-1006	*Leyburn Road*	63	59	-4	-7%	0.6	Yes	Yes
1030-1024-1227	*Plumer Road North*	2	0	-2	-100%	2.0	Yes	Yes
1030-1024-1129	*Plumer Road North*	31	31	0	1%	0.0	Yes	Yes
1227-1024-1129	*Haig Road*	11	5	-6	-57%	2.2	Yes	Yes
1129-1024-1030	*Pulmer Road South*	37	55	18	49%	2.7	Yes	Yes
1129-1024-1227	*Pulmer Road South*	35	14	-21	-60%	4.2	Yes	Yes
1278-1045-1046	*Hunton Road*	0	5	5	0%	3.3	Yes	Yes
1278-1045-1281	*Hunton Road*	14	15	1	5%	0.2	Yes	Yes
1278-1045-1004	*Hunton Road*	11	11	0	0%	0.0	Yes	Yes
1046-1045-1278	*Hawks Well Lane East*	9	9	0	0%	0.0	Yes	Yes
1046-1045-1281	*Hawks Well Lane East*	4	4	0	0%	0.0	Yes	Yes
1046-1045-1004	*Hawks Well Lane East*	25	23	-2	-10%	0.5	Yes	Yes
1281-1045-1278	*Moor Lane*	14	14	0	0%	0.0	Yes	Yes
1281-1045-1046	*Moor Lane*	1	1	0	19%	0.2	Yes	Yes
1281-1045-1004	*Moor Lane*	1	0	-1	-100%	1.4	Yes	Yes
1004-1045-1278	*Hawks Well Lane West*	8	11	3	36%	0.9	Yes	Yes
1004-1045-1046	*Hawks Well Lane West*	40	38	-2	-5%	0.4	Yes	Yes
1208-1012-1209	*Richmond Road North*	90	109	19	21%	1.9	Yes	Yes
1208-1012-1210	*Richmond Road North*	286	249	-37	-13%	2.3	Yes	Yes
1208-1012-1211	*Richmond Road North*	7	8	1	20%	0.5	Yes	Yes
1209-1012-1208	*Hipswell Road East*	91	95	4	4%	0.4	Yes	Yes
1209-1012-1210	*Hipswell Road East*	75	48	-27	-36%	3.4	Yes	Yes
1209-1012-1211	*Hipswell Road East*	58	67	9	15%	1.1	Yes	Yes
1210-1012-1208	*Richmond Road South*	312	304	-8	-3%	0.5	Yes	Yes
1210-1012-1209	*Richmond Road South*	55	57	2	4%	0.3	Yes	Yes
1210-1012-1211	*Richmond Road South*	64	64	0	0%	0.0	Yes	Yes
1211-1012-1208	*Hipswell Road West*	20	13	-7	-36%	1.8	Yes	Yes
1211-1012-1209	*Hipswell Road West*	45	46	1	3%	0.2	Yes	Yes
1211-1012-1210	*Hipswell Road West*	61	48	-13	-21%	1.7	Yes	Yes
1212-1009-1213	*Richmond Road*	365	304	-61	-17%	3.4	Yes	Yes
1212-1009-1214	*Richmond Road*	197	196	-1	0%	0.0	Yes	Yes
1212-1009-1215	*Richmond Road*	39	52	13	34%	1.9	Yes	Yes
1213-1009-1212	*Catterick Road*	352	215	-137	-39%	8.1	No	No
1213-1009-1214	*Catterick Road*	31	51	20	65%	3.2	Yes	Yes
1213-1009-1215	*Catterick Road*	136	152	16	12%	1.3	Yes	Yes
1214-1009-1212	*Scotton Road*	223	218	-5	-2%	0.3	Yes	Yes
1214-1009-1213	*Scotton Road*	93	68	-25	-27%	2.8	Yes	Yes
1214-1009-1215	*Scotton Road*	35	52	17	50%	2.6	Yes	Yes
1215-1009-1212	*Leyburn Road*	62	58	-4	-7%	0.5	Yes	Yes
1215-1009-1213	*Leyburn Road*	244	216	-28	-11%	1.8	Yes	Yes
1215-1009-1214	*Leyburn Road*	60	88	28	46%	3.2	Yes	Yes
2050-1001-1004	*Range Road*	3	3	0	10%	0.2	Yes	Yes
2050-1001-1002	*Range Road*	131	129	-2	-2%	0.2	Yes	Yes
1004-1001-2050	*Unnamed Road East*	3	3	0	-1%	0.0	Yes	Yes
1004-1001-1002	*Unnamed Road East*	33	10	-23	-69%	4.9	Yes	Yes
1002-1001-2050	*Unnamed Road West*	123	122	-1	-1%	0.1	Yes	Yes

1002-1001-1004	*Unnamed Road West*	42	22	-20	-47%	3.4	Yes	Yes
1048-1049-1060	*Moor Lane*	17	63	46	268%	7.2	No	Yes
1048-1049-1188	*Moor Lane*	71	51	-20	-28%	2.5	Yes	Yes
1060-1049-1048	*James Lane*	11	11	0	0%	0.0	Yes	Yes
1060-1049-1188	*James Lane*	70	91	21	30%	2.4	Yes	Yes
1188-1049-1048	*Unnamed Road*	57	51	-6	-11%	0.9	Yes	Yes
1188-1049-1060	*Unnamed Road*	51	50	-1	-1%	0.1	Yes	Yes
1027-1026-1033	*Richmond Road South*	399	382	-17	-4%	0.9	Yes	Yes
1226-1026-1027	*Haigh Road*	7	0	-7	-100%	3.7	Yes	Yes
1226-1026-1033	*Haigh Road*	24	12	-12	-52%	2.9	Yes	Yes
1033-1026-1027	*Richmond Road North*	334	324	-10	-3%	0.5	Yes	Yes
1033-1026-1226	*Richmond Road North*	14	14	0	0%	0.0	Yes	Yes
1104-1112-1223	*Colburn Lane*	41	25	-16	-40%	2.9	Yes	Yes
1104-1112-1283	*Colburn Lane*	11	5	-6	-59%	2.3	Yes	Yes
1104-1112-1222	*Colburn Lane*	47	46	-1	-2%	0.2	Yes	Yes
1223-1112-1104	*Catterick Road East*	77	51	-26	-34%	3.3	Yes	Yes
1223-1112-1283	*Catterick Road East*	19	0	-19	-100%	6.2	No	Yes
1223-1112-1222	*Catterick Road East*	610	607	-3	0%	0.1	Yes	Yes
1283-1112-1104	*Unnamed Road*	5	5	0	0%	0.0	Yes	Yes
1283-1112-1223	*Unnamed Road*	11	0	-11	-100%	4.7	Yes	Yes
1283-1112-1222	*Unnamed Road*	30	25	-5	-17%	0.9	Yes	Yes
1222-1112-1104	*Catterick Rd W*	72	79	7	10%	0.8	Yes	Yes
1222-1112-1223	*Catterick Rd W*	715	657	-58	-8%	2.2	Yes	Yes
1222-1112-1283	*Catterick Rd W*	36	24	-12	-34%	2.2	Yes	Yes
2012-1076-1094	*Gatherby Road North*	50	24	-26	-51%	4.2	Yes	Yes
2012-1076-1185	*Gatherby Road North*	111	111	0	0%	0.0	Yes	Yes
2012-1076-2057	*Gatherby Road North*	69	61	-8	-12%	1.0	Yes	Yes
1094-1076-2012	*B6271 East*	38	13	-25	-66%	4.9	Yes	Yes
1094-1076-1185	*B6271 East*	139	136	-3	-2%	0.2	Yes	Yes
1094-1076-2057	*B6271 East*	132	86	-46	-35%	4.4	Yes	Yes
1185-1076-2012	*Gatherby Road South*	87	97	10	11%	1.0	Yes	Yes
1185-1076-1094	*Gatherby Road South*	180	151	-29	-16%	2.3	Yes	Yes
1185-1076-2057	*Gatherby Road South*	57	49	-8	-13%	1.0	Yes	Yes
2057-1076-2012	*Station Road*	35	25	-10	-28%	1.8	Yes	Yes
2057-1076-1094	*Station Road*	109	81	-28	-26%	2.9	Yes	Yes
2057-1076-1185	*Station Road*	61	0	-61	-100%	11.0	No	Yes
1047-1046-1045	*Craggs Lane*	35	35	0	0%	0.0	Yes	Yes
1047-1046-1058	*Craggs Lane*	95	78	-17	-18%	1.8	Yes	Yes
1045-1046-1047	*Hawks Well Lane*	44	44	0	0%	0.0	Yes	Yes
1045-1046-1058	*Hawks Well Lane*	1	0	-1	-62%	0.7	Yes	Yes
1058-1046-1047	*Bedale Road*	107	140	33	31%	2.9	Yes	Yes
1058-1046-1045	*Bedale Road*	2	1	-1	-75%	1.3	Yes	Yes
2138-1015-1115	*Byng Road*	147	150	3	2%	0.2	Yes	Yes
2138-1015-2048	*Byng Road*	38	45	7	17%	1.0	Yes	Yes
2138-1015-2006	*Byng Road*	23	10	-13	-57%	3.2	Yes	Yes
1115-1015-2138	*Walkerville Road East*	112	228	116	103%	8.9	No	No

1115-1015-2048	*Walkerville Road East*	89	86	-3	-3%	0.3	Yes	Yes
1115-1015-2006	*Walkerville Road East*	471	348	-123	-26%	6.1	No	No
2048-1015-2138	*Horne Road*	32	94	62	194%	7.8	No	Yes
2048-1015-1115	*Horne Road*	94	87	-7	-8%	0.8	Yes	Yes
2048-1015-2006	*Horne Road*	48	43	-5	-10%	0.7	Yes	Yes
2006-1015-2138	*Walkerville Road West*	38	29	-9	-25%	1.6	Yes	Yes
2006-1015-1115	*Walkerville Road West*	593	531	-62	-11%	2.6	Yes	Yes
2006-1015-2048	*Walkerville Road West*	45	104	59	131%	6.8	No	Yes
2034-1067-2032	*Leeming Lane*	36	16	-20	-56%	3.9	Yes	Yes
2034-1067-2026	*Leeming Lane*	140	90	-50	-36%	4.7	Yes	Yes
2032-1067-2034	*Catterick Road*	49	30	-19	-38%	3.0	Yes	Yes
2032-1067-2026	*Catterick Road*	329	351	22	7%	1.2	Yes	Yes
2026-1067-2034	*Gatherly Road*	184	128	-56	-31%	4.5	Yes	Yes
2026-1067-2032	*Gatherly Road*	260	311	51	20%	3.0	Yes	Yes
2026-1185-1186	*Gatherly Road South*	164	169	5	3%	0.4	Yes	Yes
2026-1185-1076	*Gatherly Road South*	307	267	-40	-13%	2.3	Yes	Yes
1186-1185-2026	*Bridge Road*	146	189	43	30%	3.3	Yes	Yes
1186-1185-1076	*Bridge Road*	29	29	0	2%	0.1	Yes	Yes
1076-1185-2026	*Gatherly Road North*	294	248	-47	-16%	2.8	Yes	Yes
1076-1185-1186	*Gatherly Road North*	16	0	-16	-100%	5.7	No	Yes
1176-1072-1274	*A6055 North*	166	83	-83	-50%	7.5	No	Yes
1176-1072-1075	*A6055 North*	97	66	-31	-32%	3.5	Yes	Yes
1274-1072-1176	*Catterick Lane*	185	123	-62	-33%	5.0	Yes	Yes
1274-1072-1075	*Catterick Lane*	81	64	-17	-21%	2.0	Yes	Yes
1075-1072-1176	*A6055 South*	140	76	-64	-46%	6.1	No	Yes
1075-1072-1274	*A6055 South*	110	149	39	36%	3.5	Yes	Yes
1263-1043-1077	*Catterick Road West*	240	240	0	0%	0.0	Yes	Yes
1263-1043-1074	*Catterick Road West*	556	487	-69	-12%	3.0	Yes	Yes
1077-1043-1263	*Catterick Road East*	206	242	36	18%	2.4	Yes	Yes
1077-1043-1074	*Catterick Road East*	93	88	-5	-5%	0.5	Yes	Yes
1074-1043-1263	*A6055*	532	524	-8	-2%	0.4	Yes	Yes
1074-1043-1077	*A6055*	127	140	13	10%	1.2	Yes	Yes
1216-1138-1225	*Scotton Road North*	19	19	0	0%	0.0	Yes	Yes
1216-1138-1217	*Scotton Road North*	216	243	27	13%	1.8	Yes	Yes
1216-1138-1139	*Scotton Road North*	38	39	1	2%	0.1	Yes	Yes
1225-1138-1216	*Unnamed Road*	42	42	0	0%	0.0	Yes	Yes
1225-1138-1139	*Unnamed Road*	21	21	0	0%	0.0	Yes	Yes
1217-1138-1216	*Scotton Road South*	148	118	-30	-20%	2.6	Yes	Yes
1217-1138-1225	*Scotton Road South*	2	2	0	0%	0.0	Yes	Yes
1217-1138-1139	*Scotton Road South*	13	11	-2	-12%	0.5	Yes	Yes
1139-1138-1216	*Messines Road*	104	104	0	0%	0.0	Yes	Yes
1139-1138-1225	*Messines Road*	13	13	0	0%	0.0	Yes	Yes
1139-1138-1217	*Messines Road*	33	28	-5	-14%	0.8	Yes	Yes
1072-1176-1175	*A6055 South*	88	102	14	16%	1.4	Yes	Yes
1072-1176-1073	*A6055 South*	235	98	-137	-58%	10.7	No	No
1175-1176-1072	*Unnamed Road*	106	125	19	18%	1.8	Yes	Yes

1175-1176-1073	*Unnamed Road*	61	25	-36	-59%	5.5	No	Yes
1073-1176-1072	*A6055 North*	158	23	-135	-85%	14.1	No	No
1073-1176-1175	*A6055 North*	58	30	-28	-49%	4.3	Yes	Yes
1225-1138-1217	*Unnamed Road*	9	9	0	0%	0.0	Yes	Yes
1027-1026-1226	*Richmond Road South*	20	0	-20	-100%	6.3	No	Yes
1004-1045-1281	*Hawks Well Lane West*	1	0	-1	-82%	1.1	Yes	Yes
1227-1024-1030	*Haigh Road*	0	0	0	0%	0.0	Yes	Yes
Cal - Total		26996	25306	-1690	-6%	10.5	No 180/199 90%	No 194/199 97%

Validation

Ref	Road Name	Observed	Modelled	Diff	%Diff	GEH	GEH Pass?	Flow Pass?
2028-1007	*Leyburn Road*	234	310	75	32%	4.6	Yes	Yes
1007-2028	*Leyburn Road*	201	225	23	12%	1.6	Yes	Yes
1264-2022	*Bridge Road*	156	206	50	32%	3.7	Yes	Yes
1043-1077	*Catterick Road*	390	402	12	3%	0.6	Yes	Yes
1089-1276	*Unnamed Road*	119	135	16	13%	1.4	Yes	Yes
2010-2020	*Station Road*	210	175	-35	-17%	2.5	Yes	Yes
2022-1264	*Bridge Road*	157	160	3	2%	0.2	Yes	Yes
1077-1043	*Catterick Road*	305	334	29	9%	1.6	Yes	Yes
1074-1043	*A6055*	667	684	17	2%	0.6	Yes	Yes
1276-1089	*Unnamed Road*	90	111	21	23%	2.0	Yes	Yes
1175-1177	*Catterick Lane*	39	21	-18	-46%	3.3	Yes	Yes
2057-1076	*Station Road*	163	110	-53	-33%	4.6	Yes	Yes
2032-1067	*Catterick Road*	401	403	2	1%	0.1	Yes	Yes
1072-1274	*Leeming Lane*	234	238	4	2%	0.3	Yes	Yes
1231-1003	*Range Road*	129	128	-1	-1%	0.1	Yes	Yes
1003-1231	*Range Road*	137	137	1	0%	0.1	Yes	Yes
1031-1033	*Richmond Road*	339	338	0	0%	0.0	Yes	Yes
2056-1064	*James Lane*	62	102	40	64%	4.4	Yes	Yes
1057-1194	*Hunton Road*	29	34	5	16%	0.8	Yes	Yes
1030-1024	*Plumer Road*	29	31	2	6%	0.3	Yes	Yes
1064-2056	*james Lane*	80	105	25	32%	2.6	Yes	Yes
1194-1057	*Hunton Road*	31	32	1	3%	0.2	Yes	Yes
1024-1030	*Plumer Road*	30	56	26	87%	4.0	Yes	Yes
1119-1209	*Hipswell Road East*	194	213	19	10%	1.3	Yes	Yes
1209-1119	*Hipswell Road East*	187	216	28	15%	2.0	Yes	Yes
2024-1186	*Bridge Road*	177	213	36	21%	2.6	Yes	Yes
1186-2024	*Bridge Road*	191	174	-17	-9%	1.3	Yes	Yes
Val - Total		4982	5292	309	6%	4.3	**Yes** 27/27 100%	**Yes** 27/27 100%

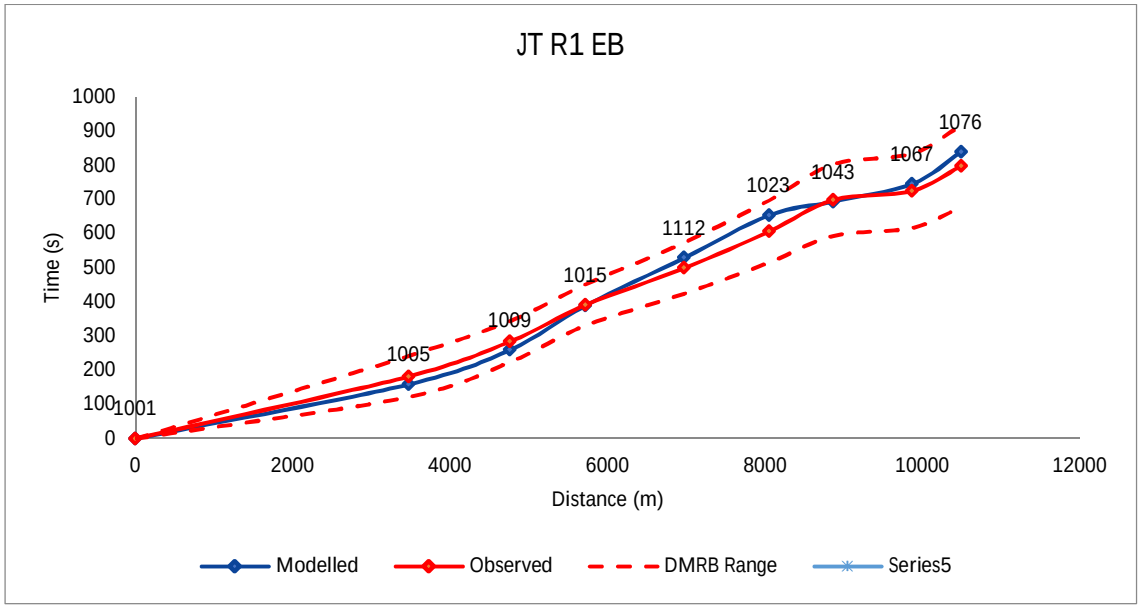
Appendix G

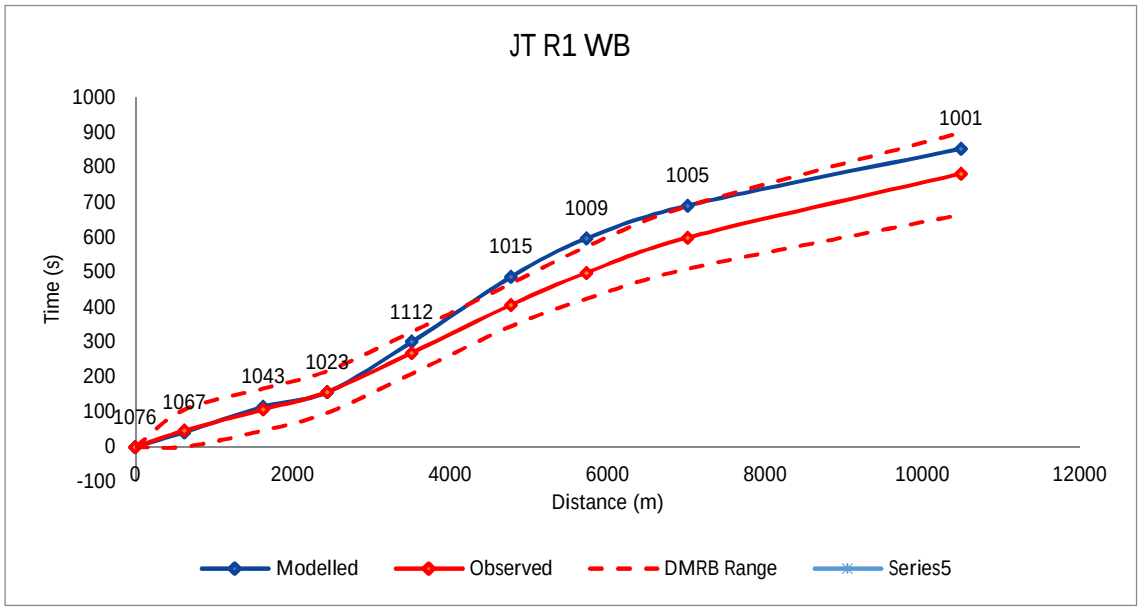
JOURNEY TIME ROUTE PLOTS

Appendix G – Journey Time Route Plots

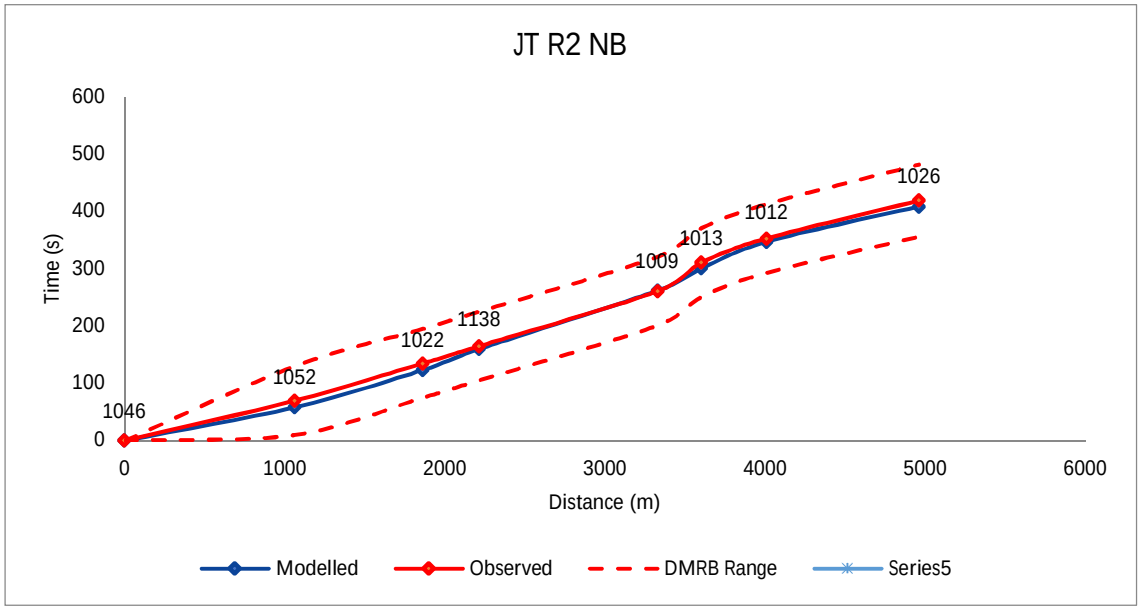
AM PEAK

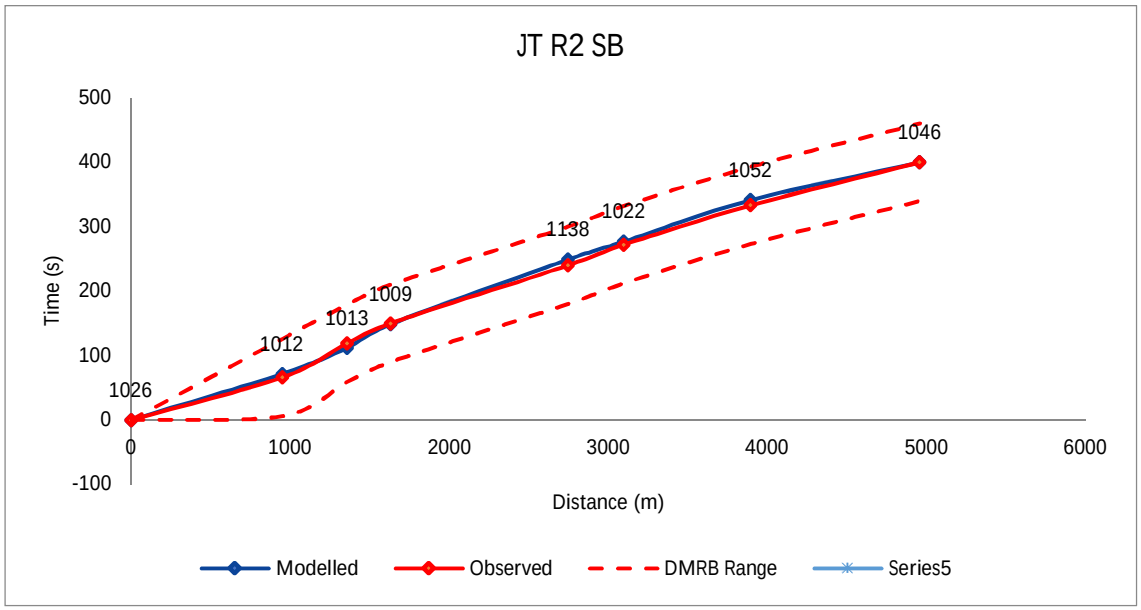
Journey Time Route no 1



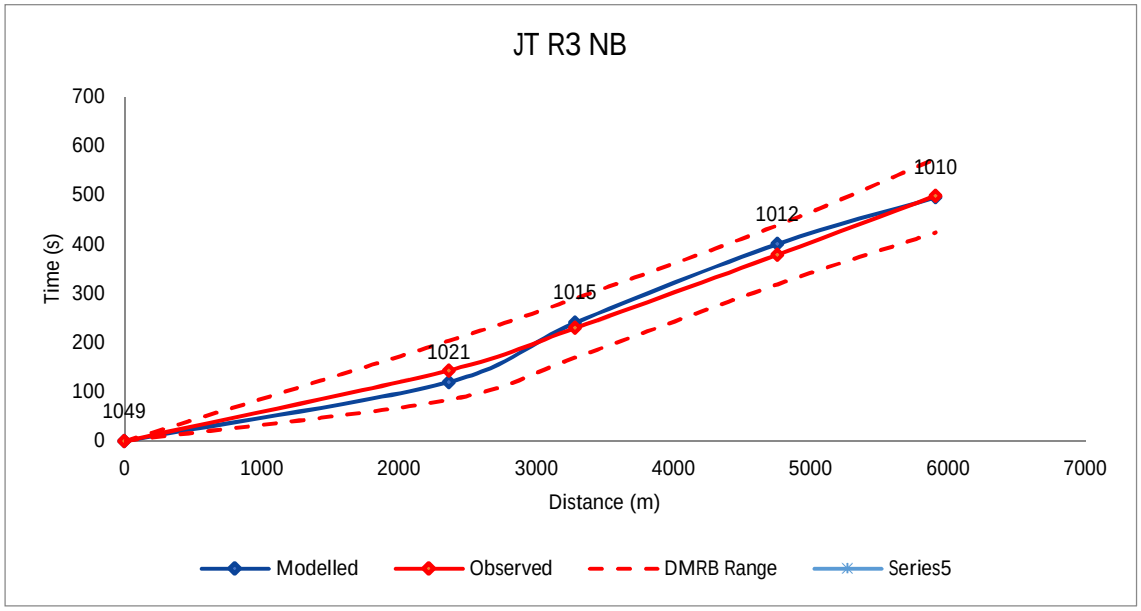


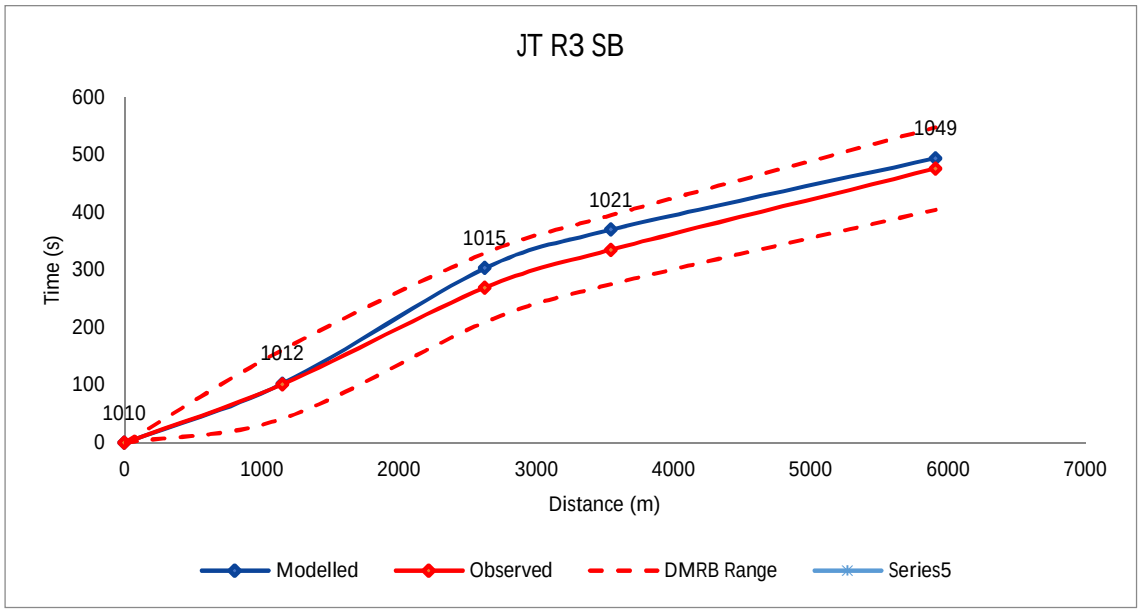
Journey Time Route no 2



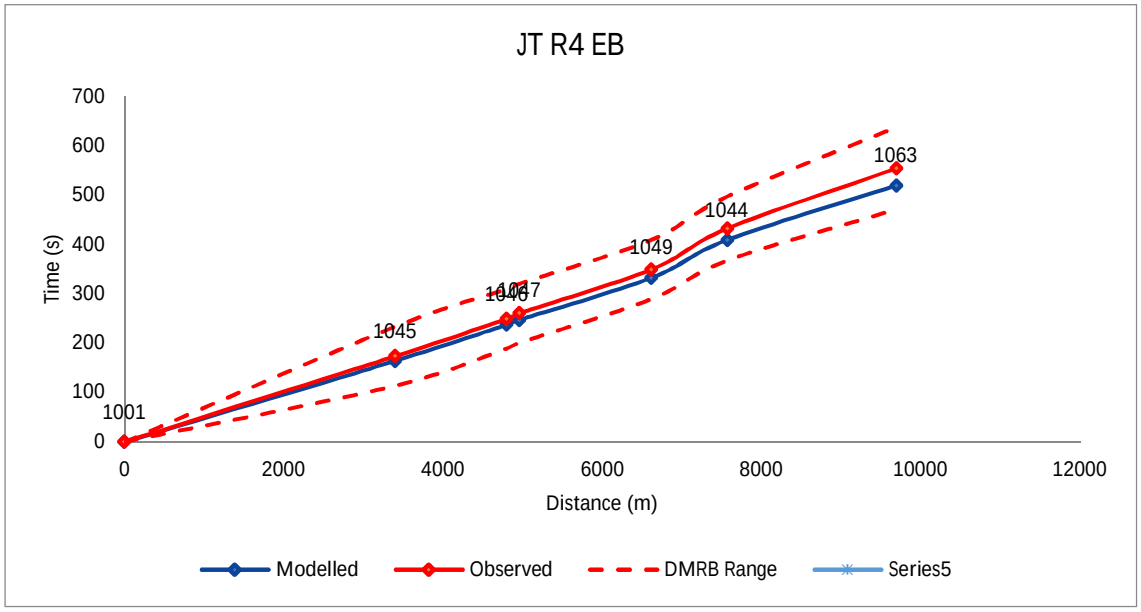


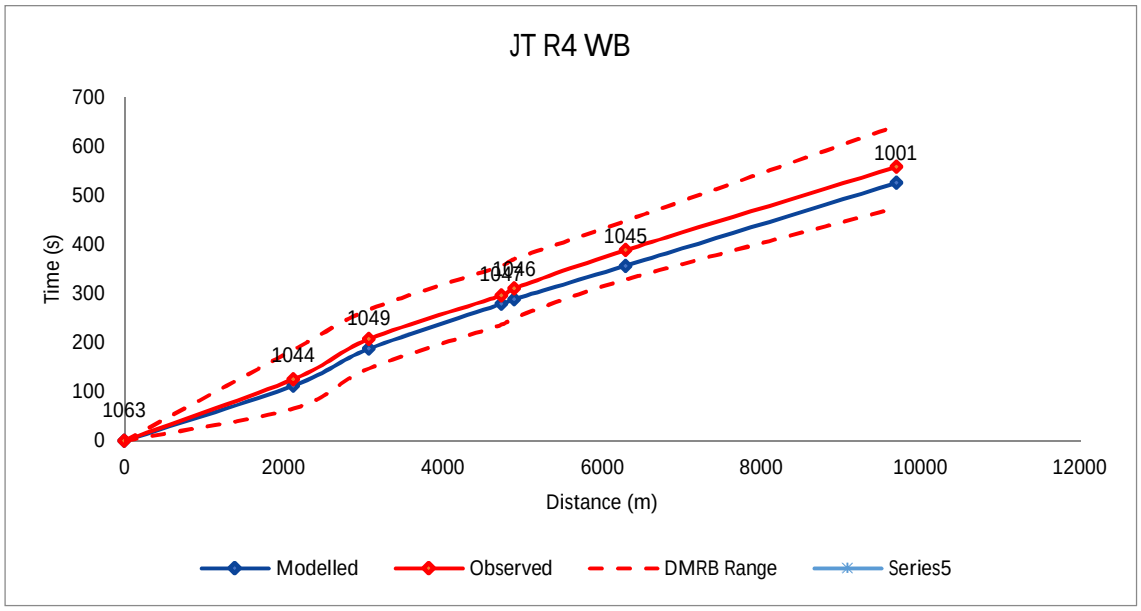
Journey Time Route no 3



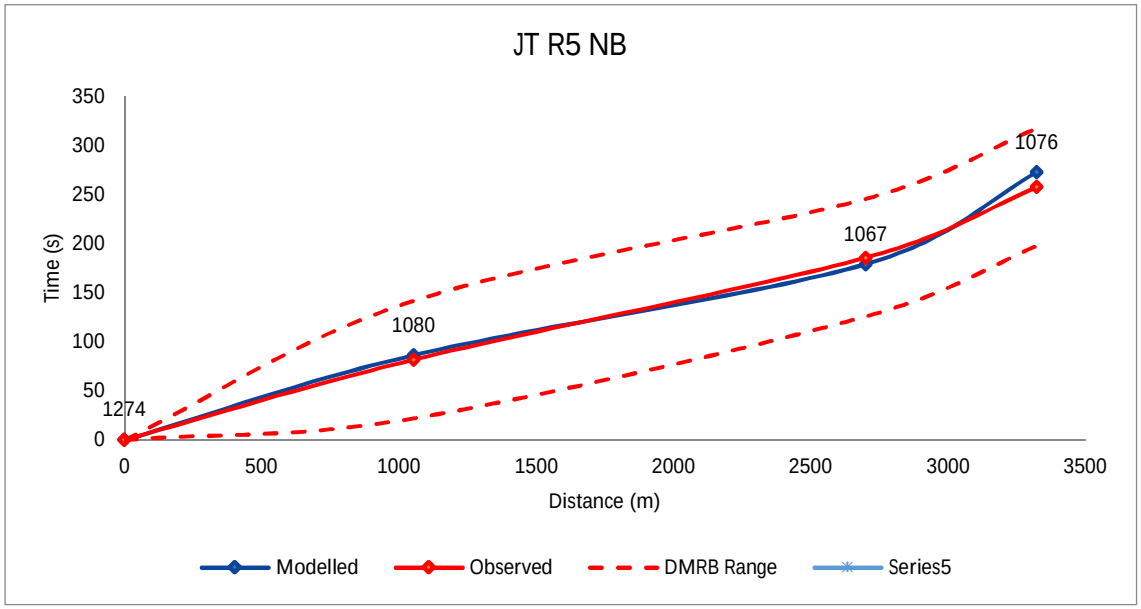


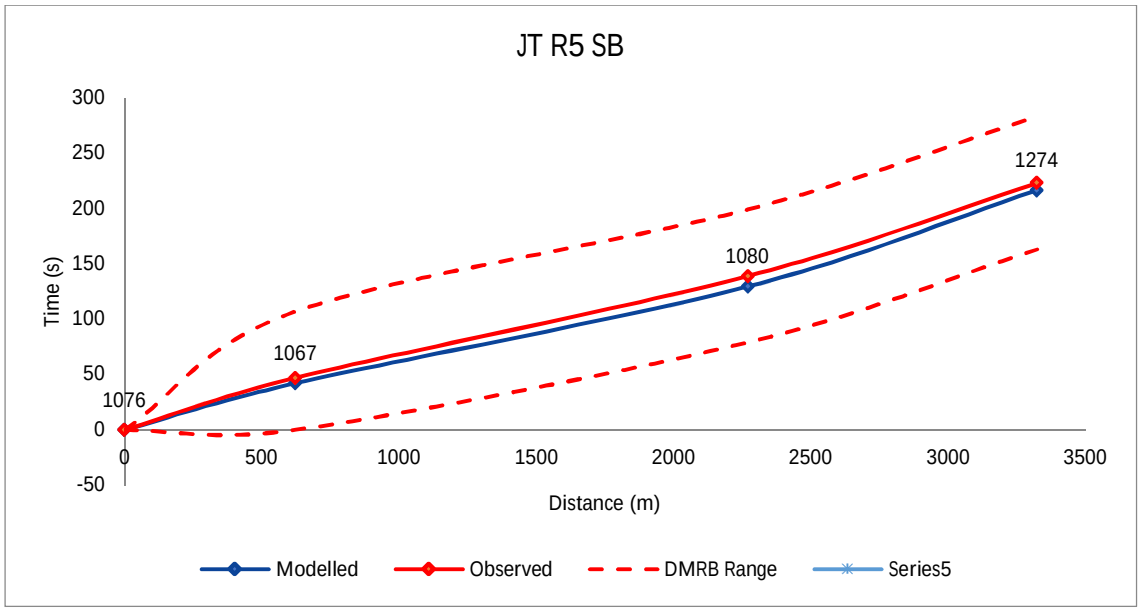
Journey Time Route no 4





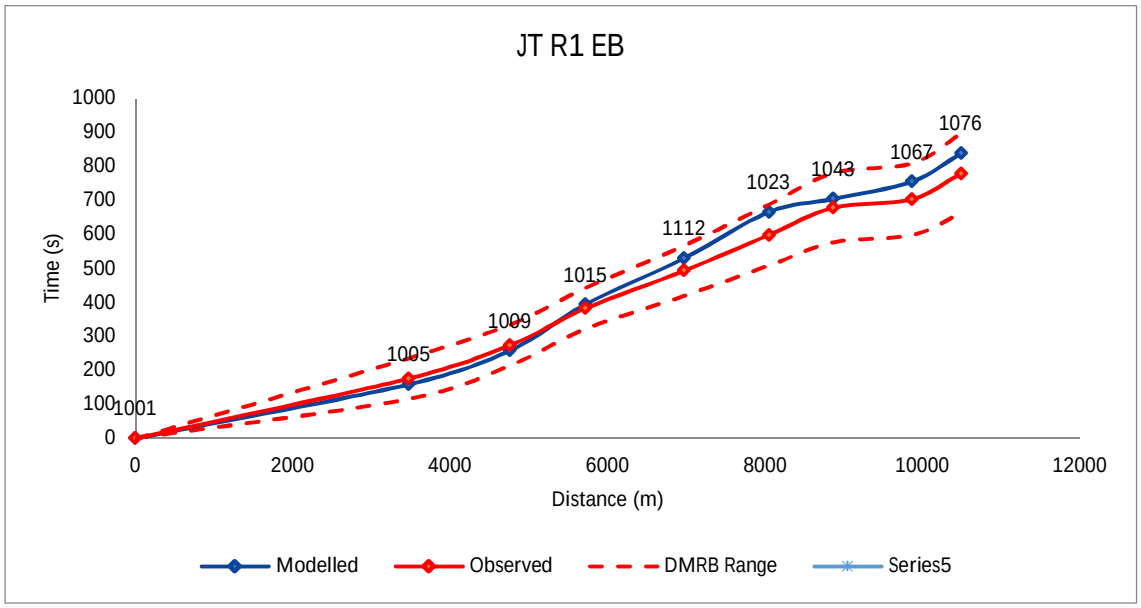
Journey Time Route no 5

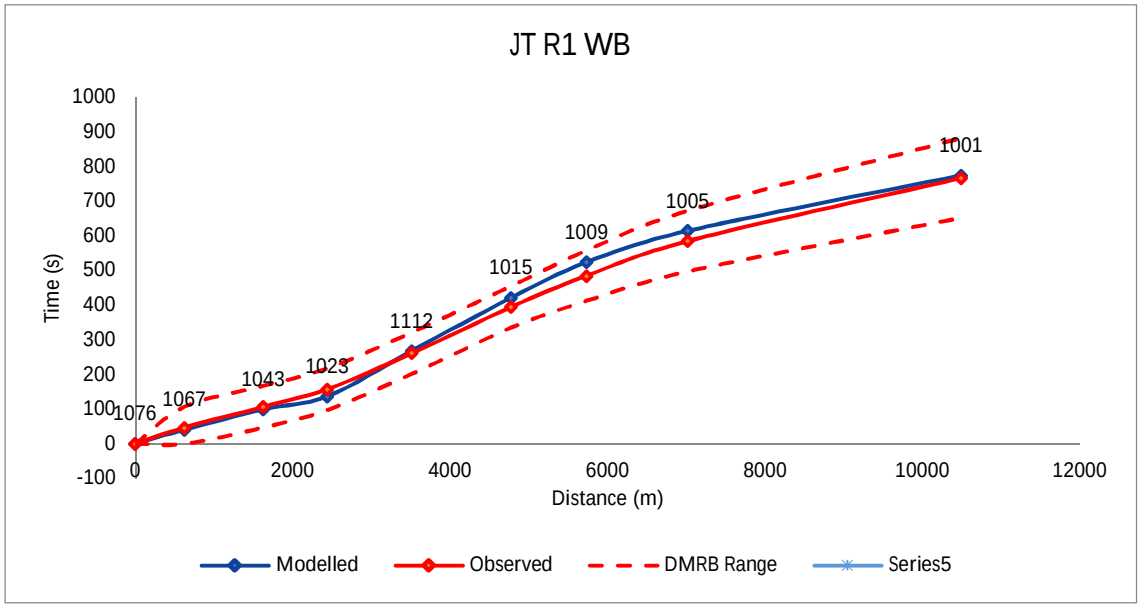




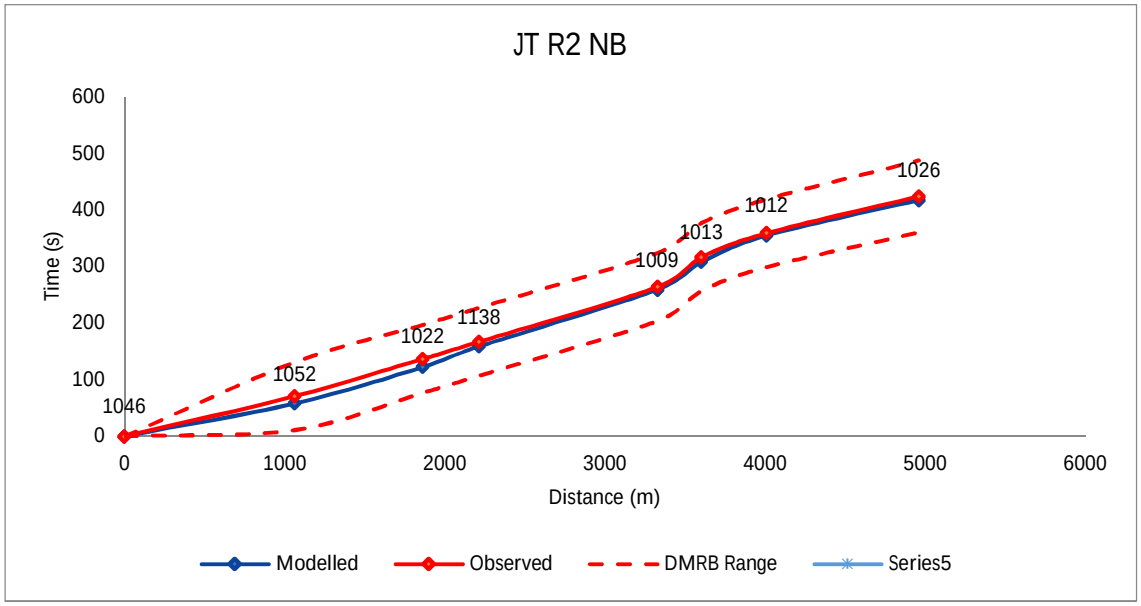
Interpeak

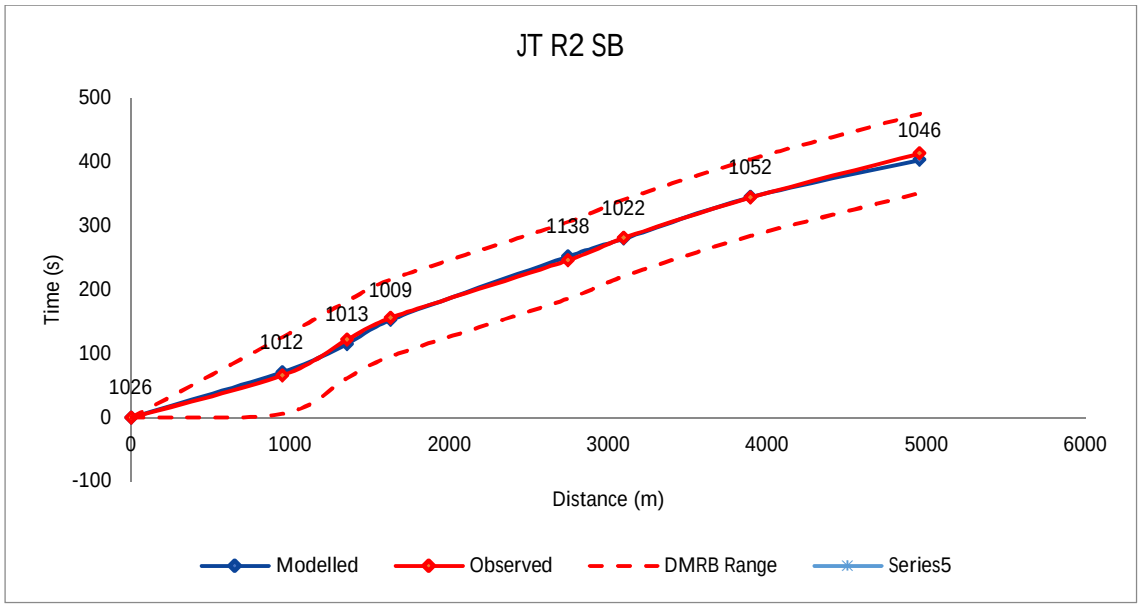
Journey Time Route no 1



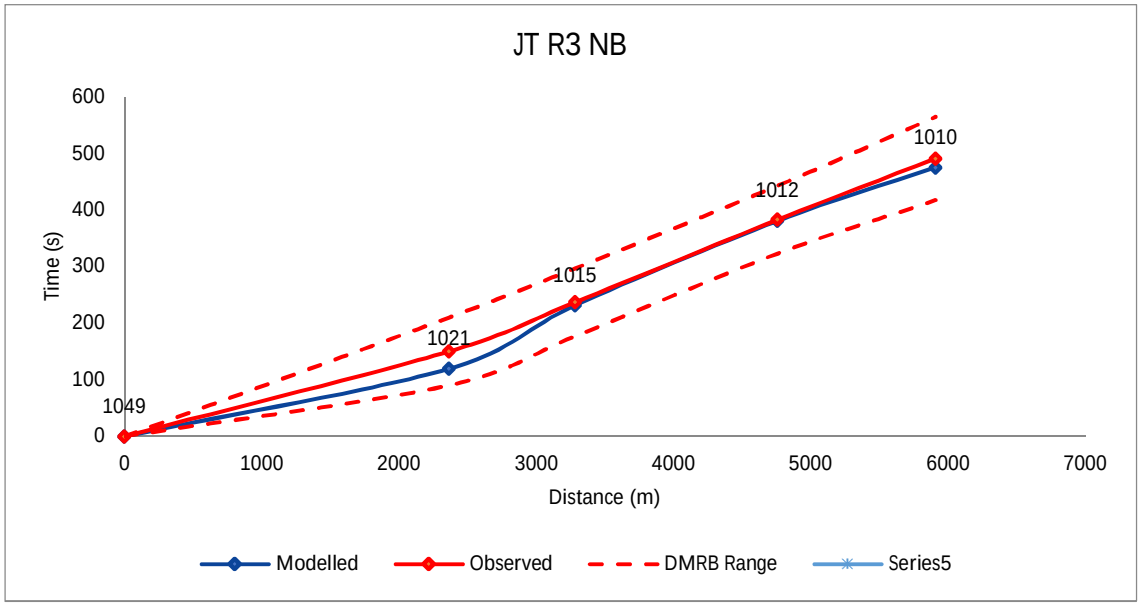


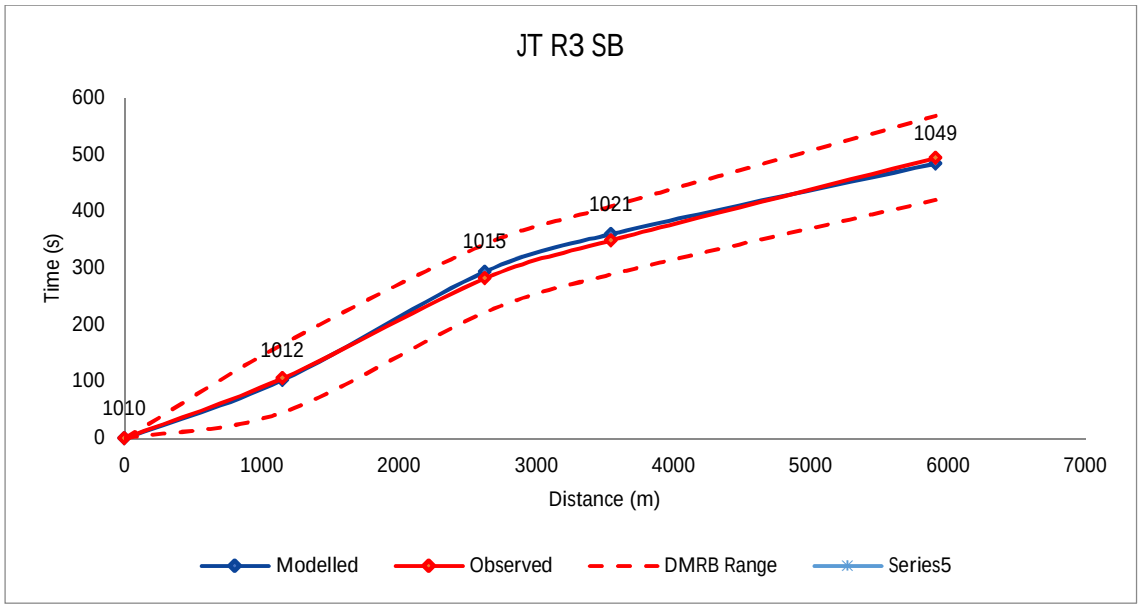
Journey Time Route no 2



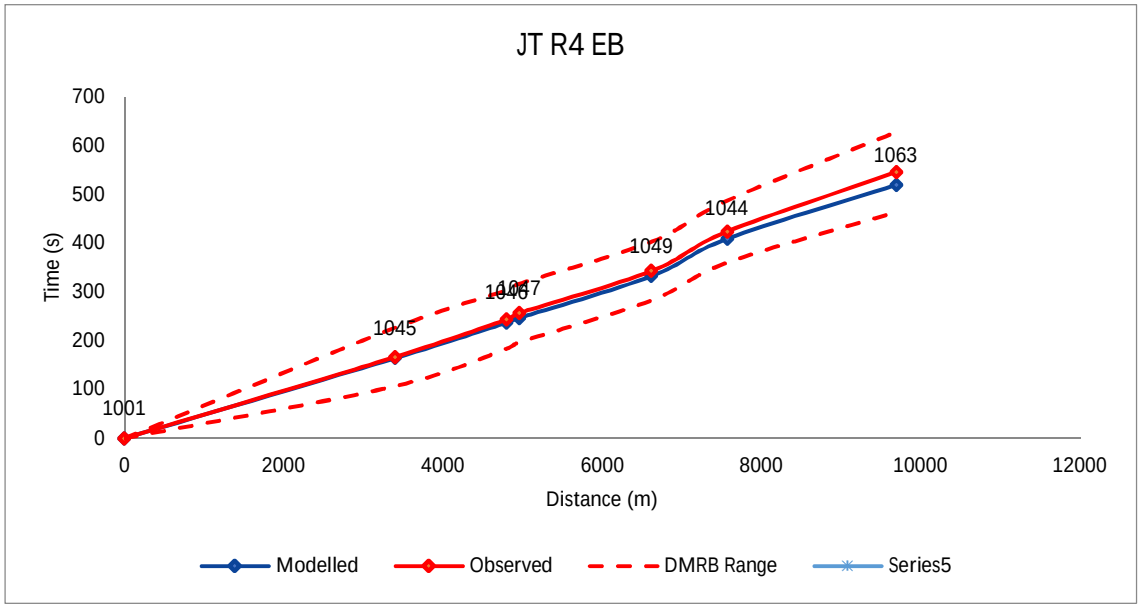


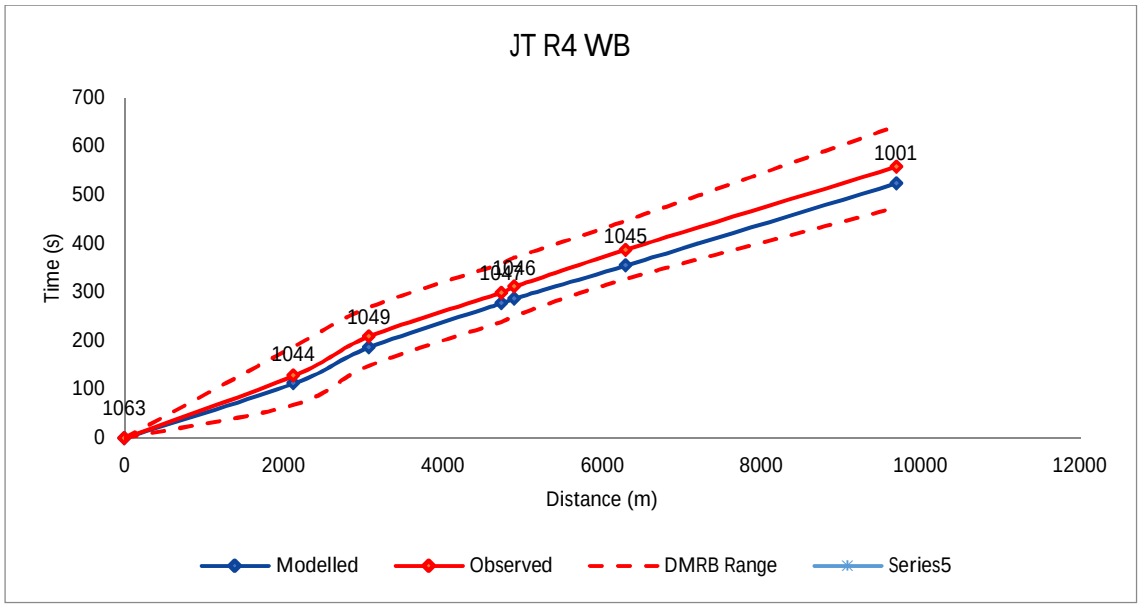
Journey Time Route no 3



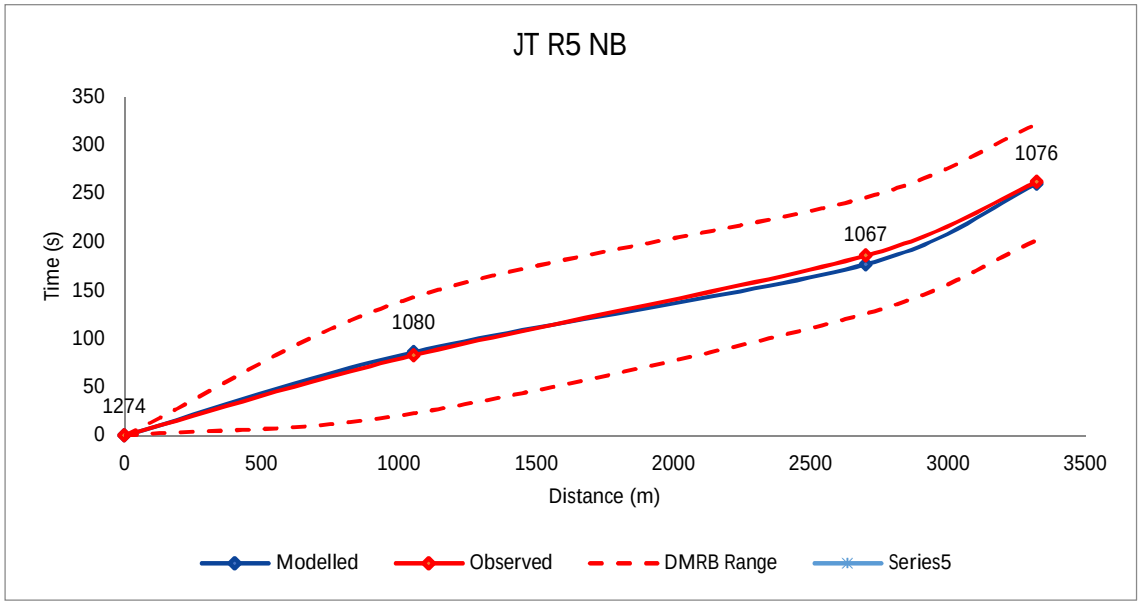


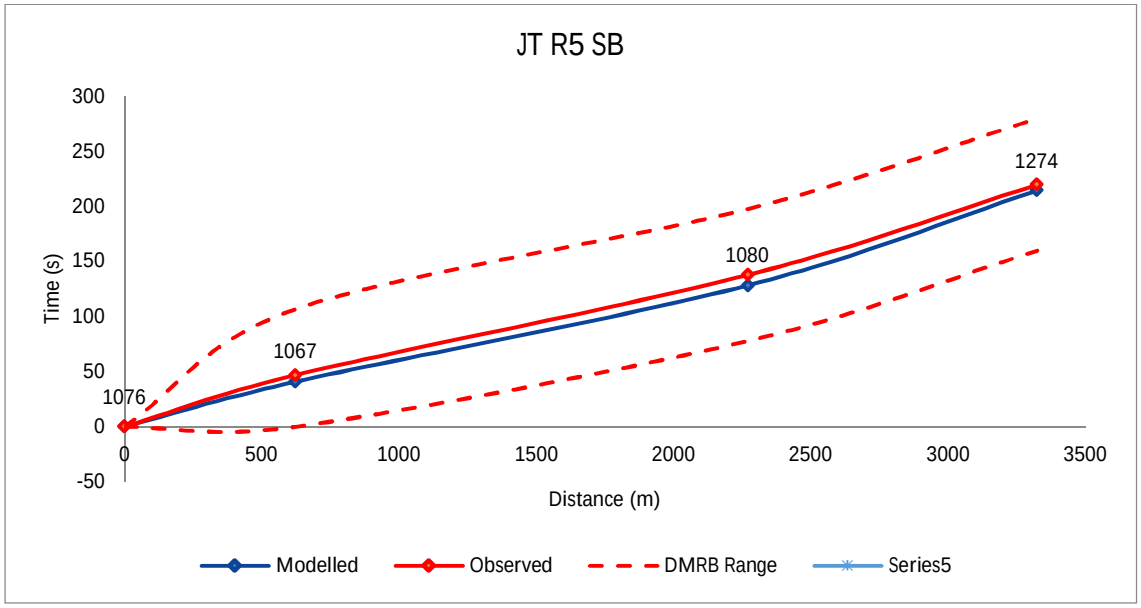
Journey Time Route no 4





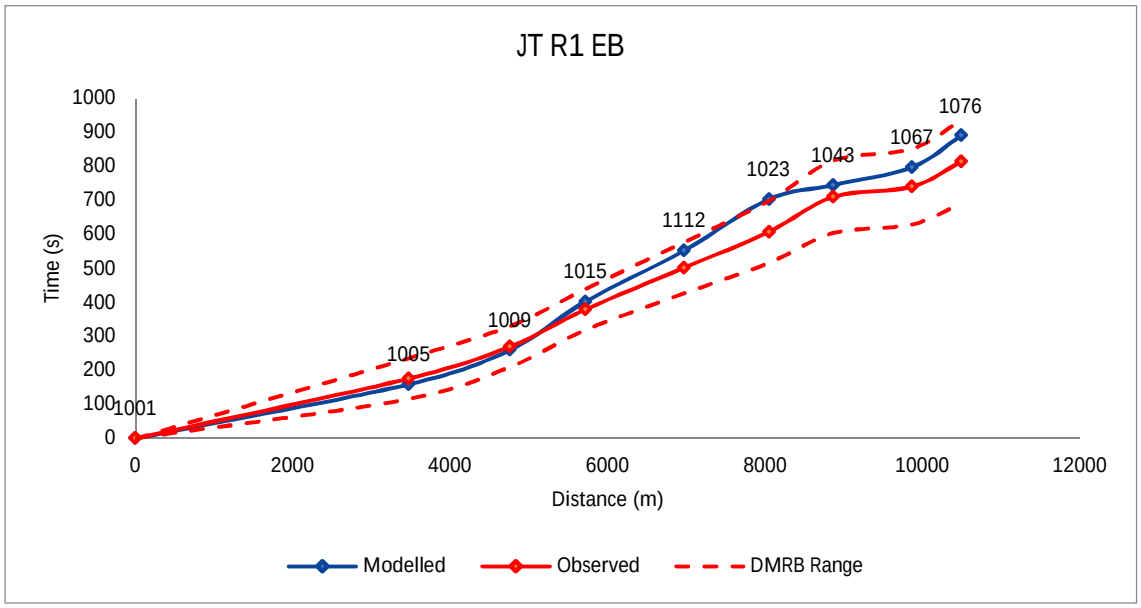
Journey Time Route no 5

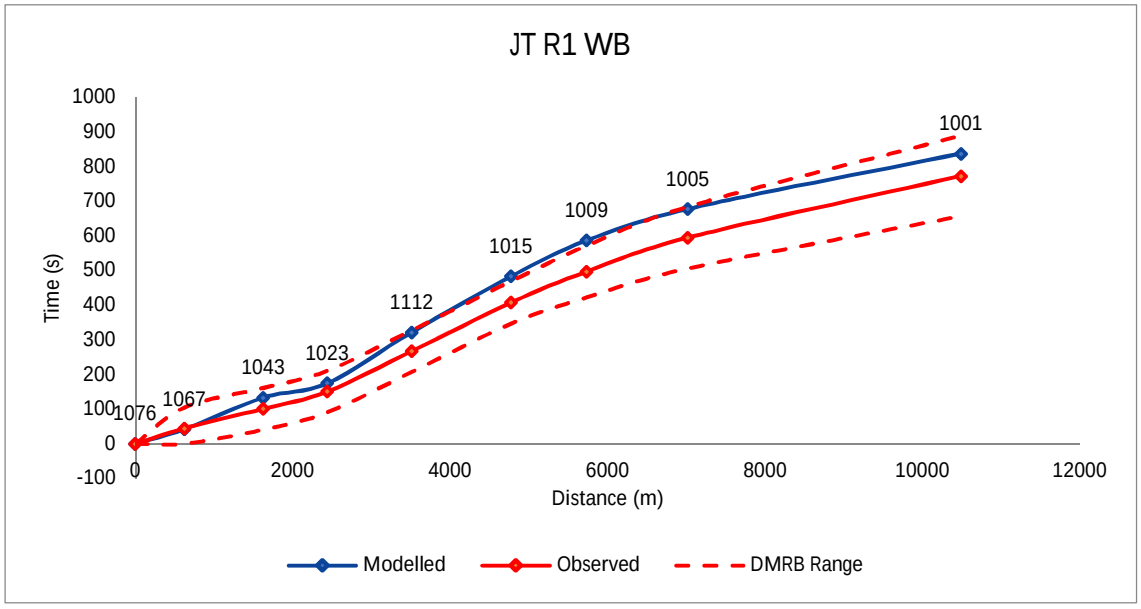




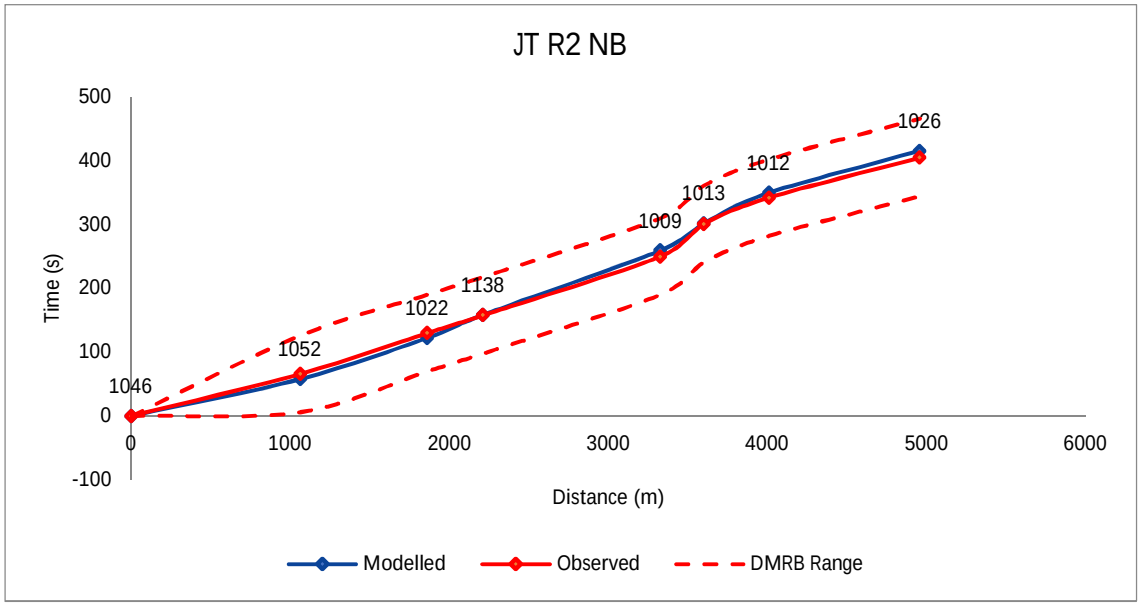
PM Peak

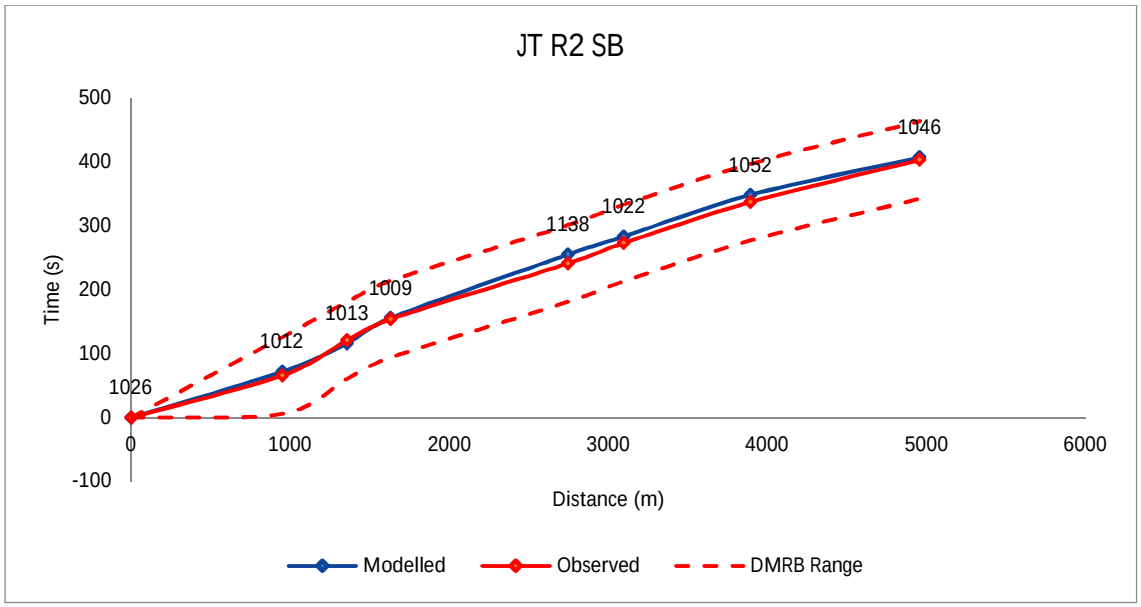
Journey Time Route no 1



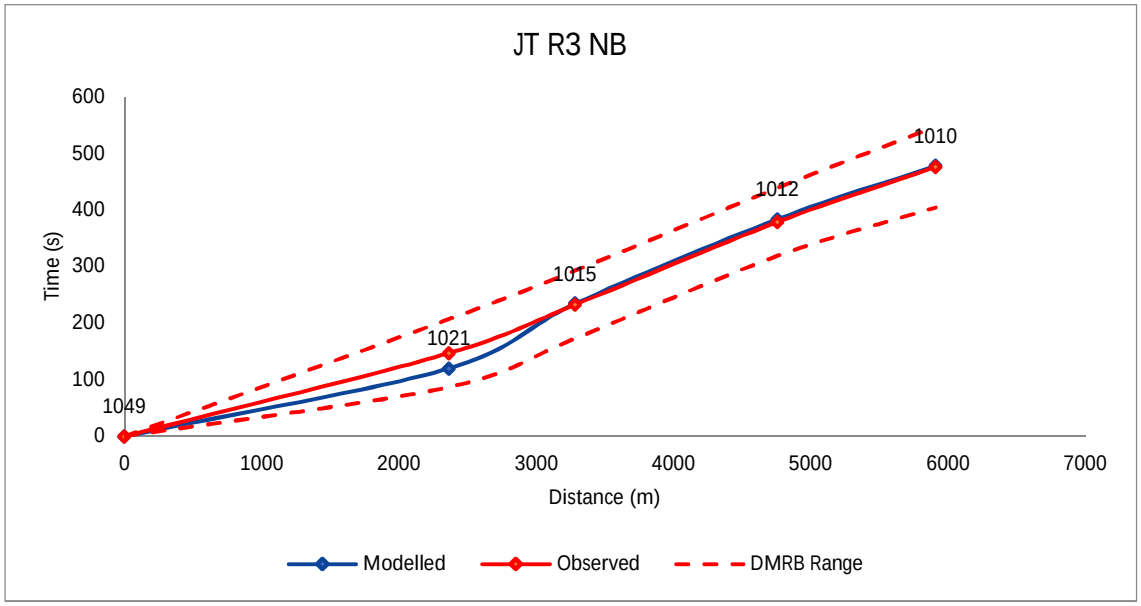


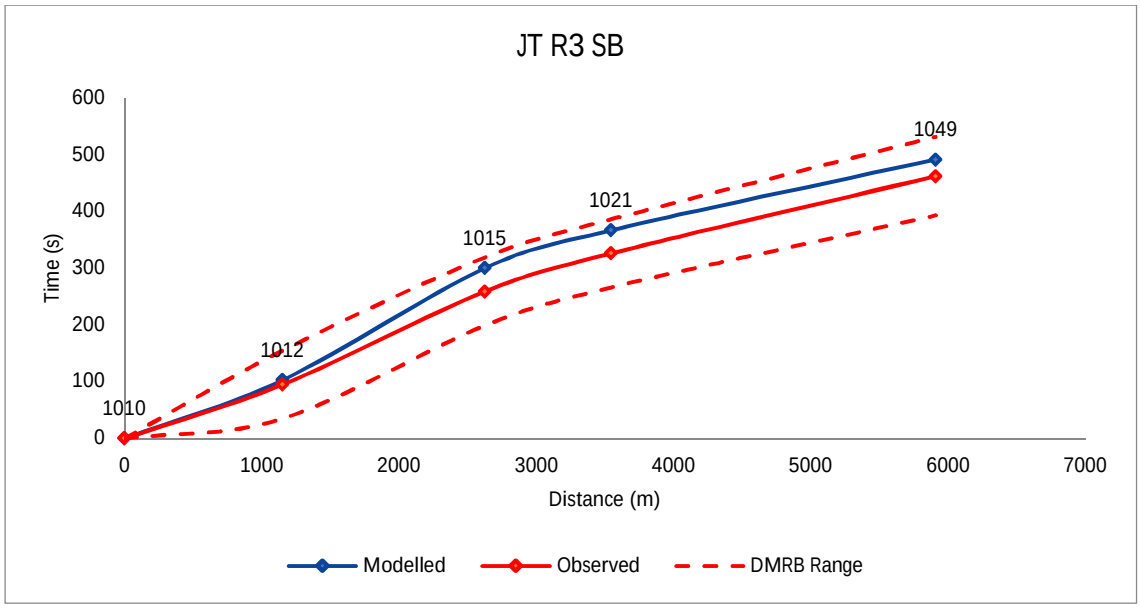
Journey Time Route no 2



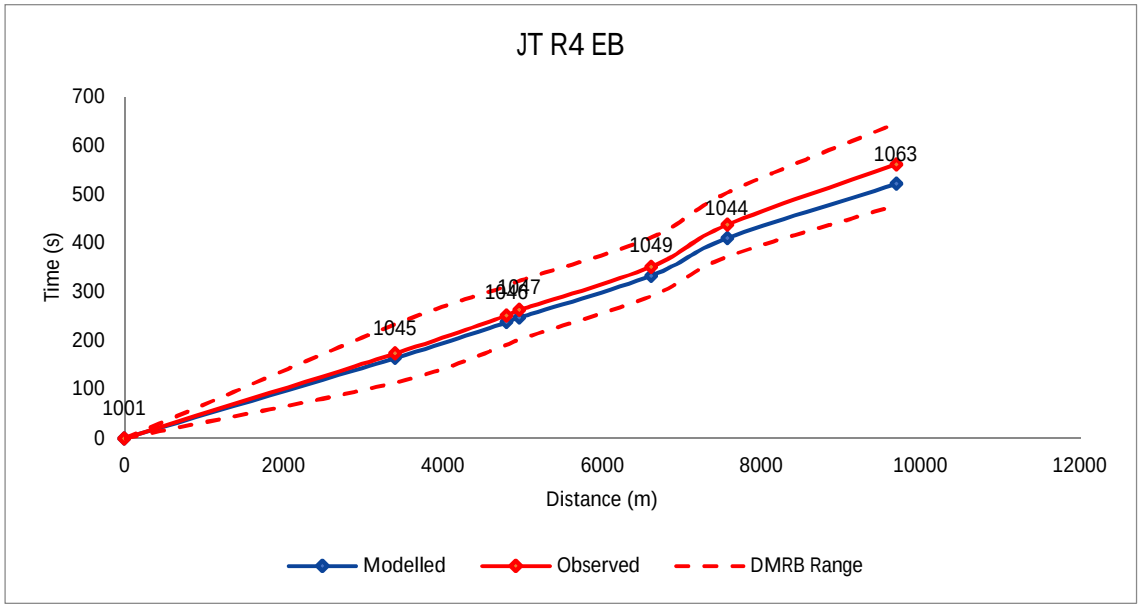


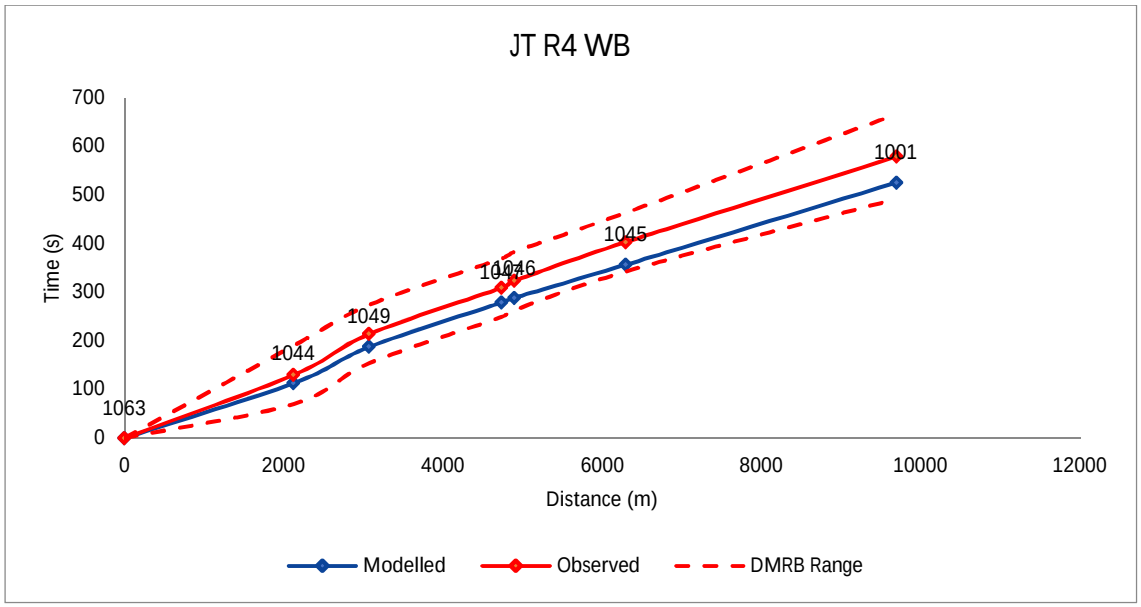
Journey Time Route no 3



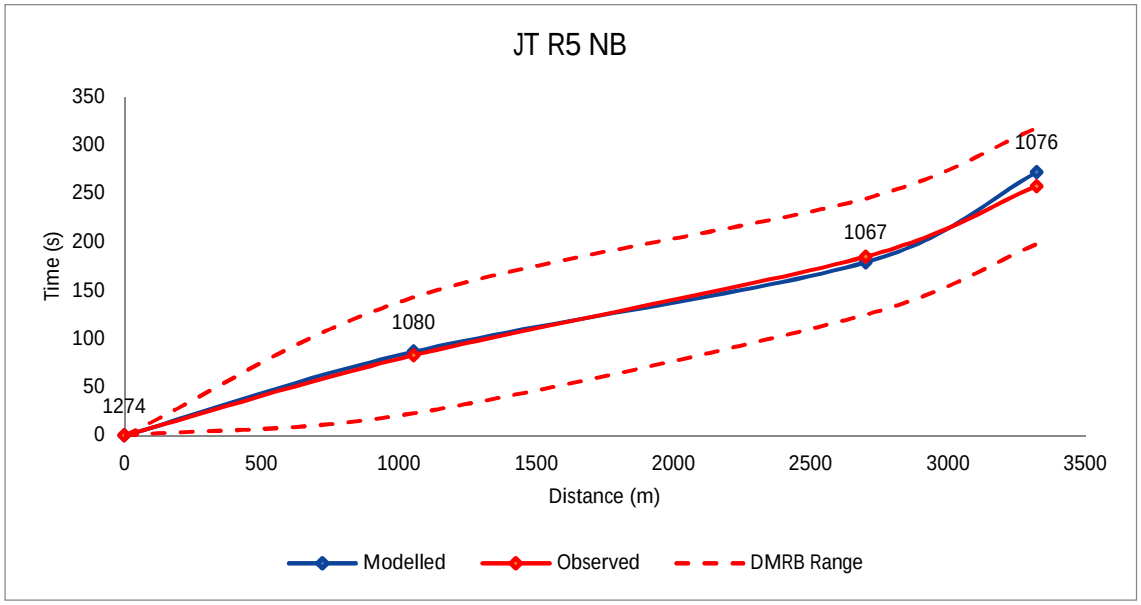


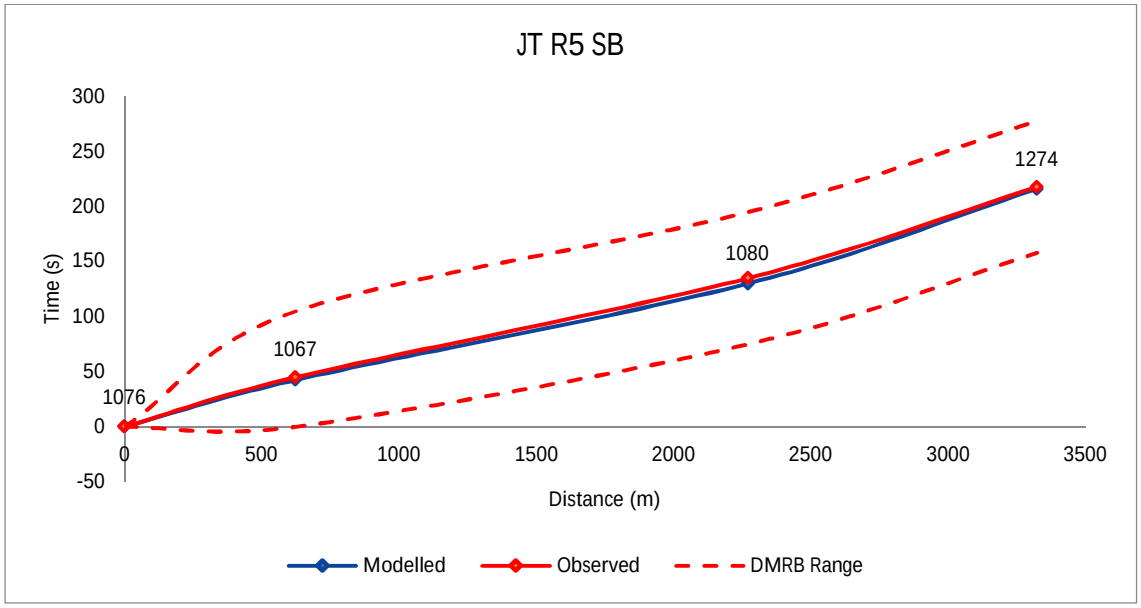
Journey Time Route no 4





Journey Time Route no 5





Appendix H

TRAFFIC DATA REPORT

North Yorkshire County Council

CATTERICK TRAFFIC MODEL

Data Collection Report

DCR
DECEMBER 2019

RESTRICTED

TYPE OF DOCUMENT (VERSION) RESTRICTED

PROJECT NO. 70040744

OUR REF. NO. DCR

DATE: DECEMBER 2019

WSP

Three White Rose Office Park
Millshaw Park Lane
Leeds
LS11 0DL

Phone: +44 113 395 6200

Fax: +44 113 395 6201

WSP.com

QUALITY CONTROL

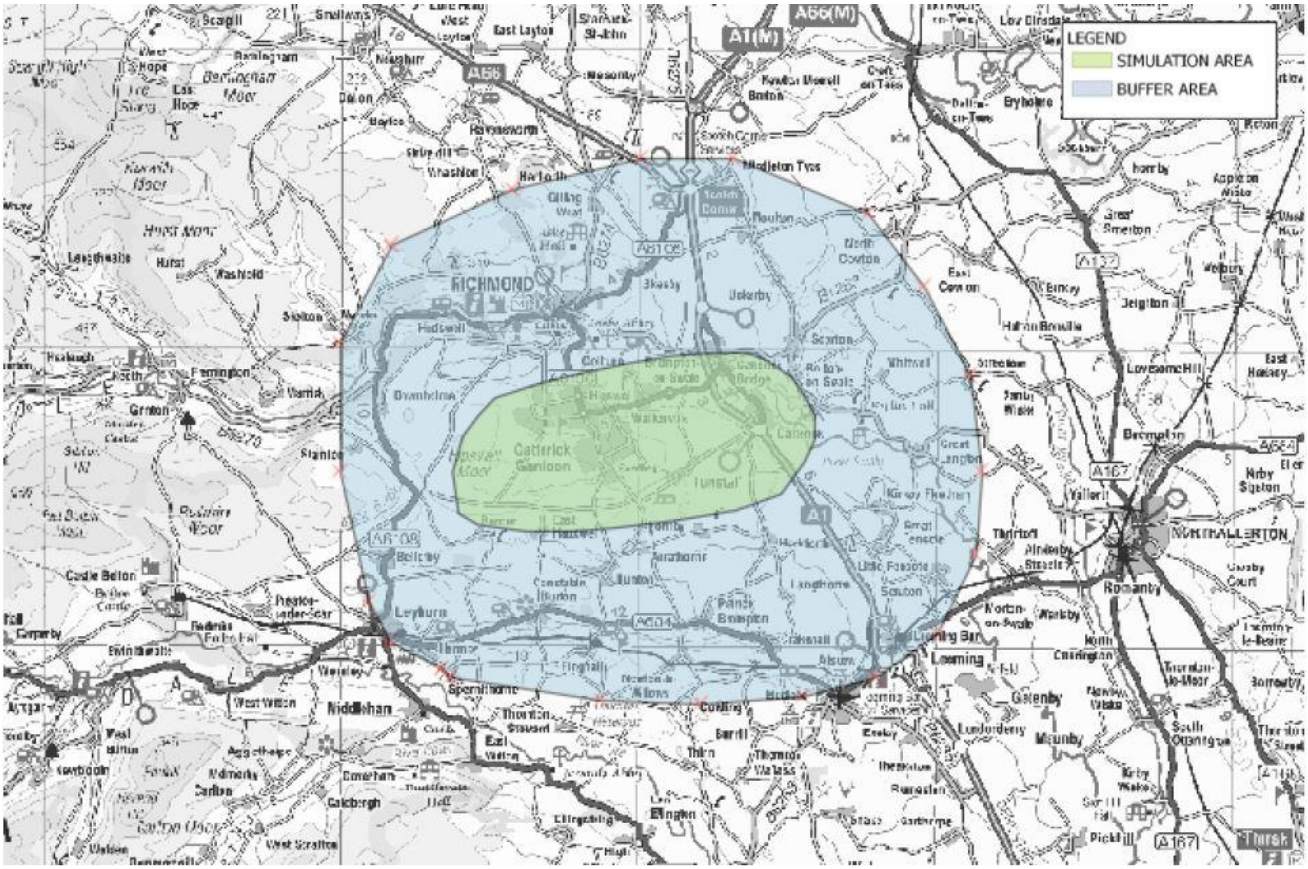
Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Issue			
Date	December 2019			
Prepared by	Samuel Callaghan			
Signature	SG			
Checked by	Narendra Sadhale			
Signature	NSS			
Authorised by	Richard Crossley			
Signature	RC			
Project number	70040744			
Report number	01			
File reference				

CONTENTS

TABLES

FIGURES

Figure 1-1 - Area of Detailed Modelling



2

1 INTRODUCTION

1.1 BACKGROUND TO THE CATTERICK TRAFFIC MODEL

North Yorkshire County Council (NYCC) has requested its transport consultants, WSP, to develop a new Strategic Highway Model (SHM) covering the areas of Easby, Hipswell, Colburn, Scotton, Tunstall and Catterick Garrison. The SHM is required to assist NYCC and Richmondshire District Council to review and determine the transport impacts of proposed Garrison developments. Richmondshire District Council (RDC) is the local planning authority, whose administrative area includes the towns of Richmond, Catterick Garrison and Leyburn. It is understood that RDC is preparing a Review of the Local Plan, which will include a Masterplan for the growth of Catterick Garrison

National planning policy places Local Plans at the heart of the planning system, so it is essential that they are in place and kept up to date. Local Plans set out a vision and a framework for the future development of the area, addressing needs and opportunities in relation to housing, the economy, community facilities and infrastructure.

RDC and NYCC currently have a SATURN traffic model developed using 2009 base data. The coverage of this existing traffic model includes parts of Richmond, Catterick Garrison and Catterick Village. This traffic model was developed from an earlier 2005 traffic model for the morning and evening peak hours. The existing traffic model has a 2009 base year and is believed to have been further updated in 2015 to take into account the change in layout at the junction near Catterick Racecourse. However, to ensure a robust basis for the review of the Local Plan, WSP was to provide a new version of with a base year of 2019.

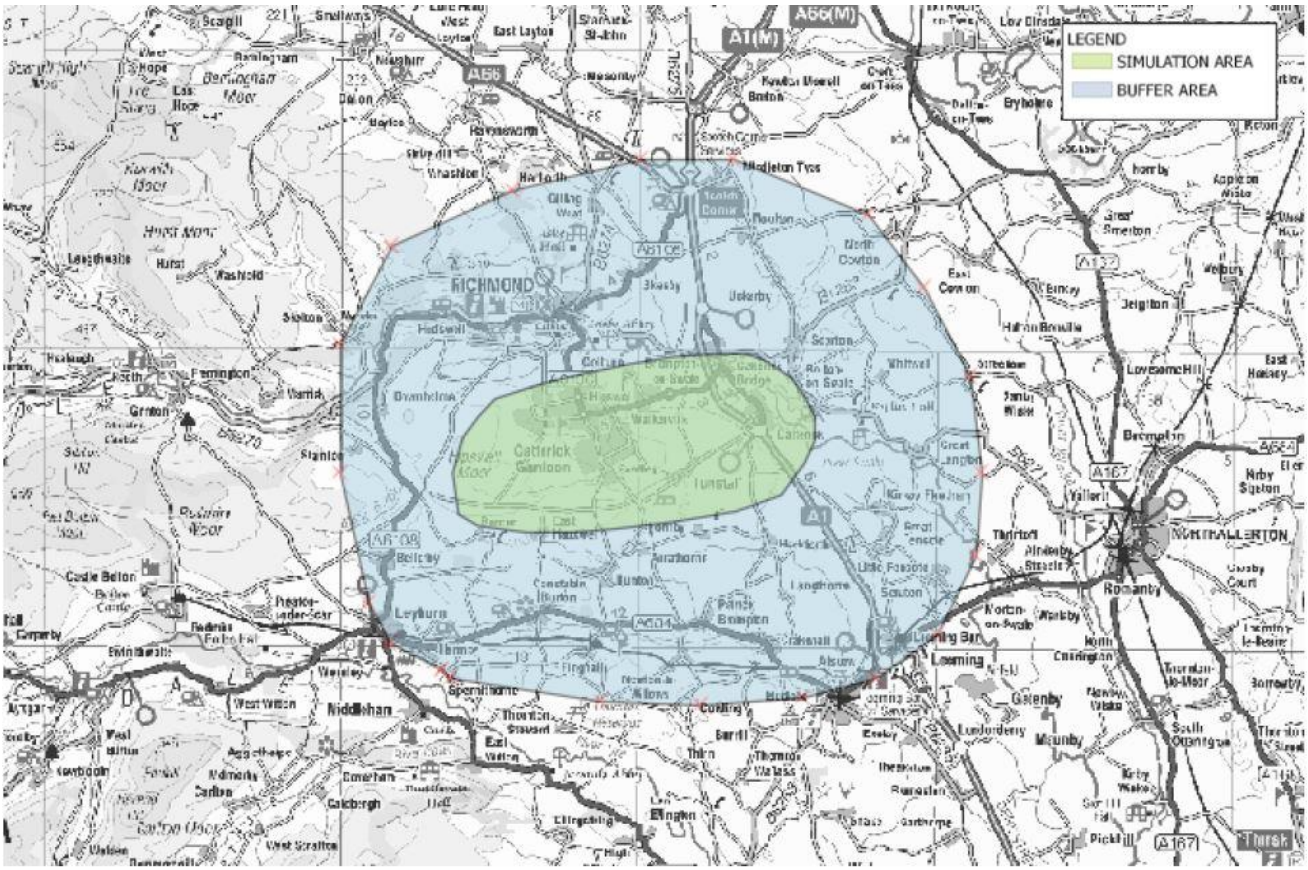
1.2 OVERVIEW OF TRAFFIC MODEL

“A transport model is a tool that converts readily available forecasting assumptions into a forecast of demand (number of trips) and supply (level of service / cost of travel) on the transport network.” (DfT TAG Unit M1.1)

A SATURN (Simulation and Assignment of Traffic in Urban Road Networks) model has been developed covering the Richmondshire district area. SATURN is the most established strategic highway assignment modelling software in the UK due to its enhanced simulation routines. It can interact with other packages including CUBE and DIADEM for variable demand and public transport modelling functionality should this be required.

The detailed model area will focus on Catterick Garrison itself (i.e. the study area). The network includes all main roads as well as those secondary routes and roads in residential areas (especially ‘rat runs’). The wider district is modelled in less detail to enable a broad assessment of trips. The modelled area is shown in Figure 1-1 below.

Figure 1-1 - Area of Detailed Modelling



The model will represent a weekday in March 2019, being a neutral period of the year as defined by TAG unit M1.2.

The following scenarios are to be modelled for the AM, IP and PM peak hour:

- 2019 Base year model. A comprehensive set of traffic surveys around the Garrison and Catterick settlements (including Road Side Interviews (RSI) to understand travel demand data) will inform the Base year model; and,
- 2035 Reference orecast uture year model to test the forecast effects of future land use changes and consequent impacts of increased travel demands.

To provide an up to date and robust traffic model that is reflective of existing conditions it has been necessary to collect a variety of travel related data. The following typesof data have been collated by utilising existing data or through commissioning new surveys:

- the transport network, including the physical layout, number of lanes, signal timings;
- counts of vehicles on links or at junctions;
- journey times;
- traveller's origins and destinations, reason for travel etc by means of roadside interview surveys and gatehouse surveys.

This report summarises the sources of traffic data that have been used, and provides supporting information on the suitability of the data collected for the development of the SHM.

1.3 NEED FOR ADDITIONAL DATA

"Data collection is necessary in order to inform the parameters that represent the model responses (calibration) and to provide a source of information against which the model can be compared to assure its quality (validation)." (DfT TAG Unit M1.1)

To ensure that a robust platform for modelling has been built for 2019, calibration and validation of the model to the correct levels of traffic flows, speeds and routing need to be undertaken. This is done using a variety of datasets and ensuring that all key routes are covered by a traffic count or journey time observation. Therefore, Highways England (HE) and NYCC have been consulted on the data they hold that can be assessed for suitability for inclusion within the calibration and validation process. This section outlines the available datasets and any potential shortcomings regarding its suitability that may arise before data processing.

HE maintains two main sources of traffic data, from the WebTRIS online portal. These are:

- Permanent Automatic Traffic Count (ATC) sites, which record traffic volumes at 15-minute intervals. Classification is determined by axle length; and,
- The Journey Time Database (JTDB), which holds observed journey times, and observed amount of traffic and the level of traffic flows for links of the network recorded in 15-minute intervals.

A limitation for this project is that both data sources only cover Highways England's Strategic Road Network (SRN). There are only two count sites located on the A1(M) and two counts in close proximity to study area.

The DfT also maintains a database of counts conducted for single days across various major and minor roads. These do not meet the criteria to be used for model validation as they are presented as Annual Average Daily flows, however they offer an option for cross-checking against other sources and a sense check for levels of flow.

WSP has been given access to North Yorkshire County Council's online database of both permanent and temporary ATCs. The permanent and temporary ATC sites record daily volume of all vehicles in 15-minute intervals. Speed data is also recorded at the 34 site locations, allowing traffic behaviour on routes to be replicated within the modelling process as well as the patterns covered.

Due to the limited number of counts available from existing sources around Catterick, a series of new counts have been commissioned. Twenty-four 2 week ATCs have been undertaken at various locations within Catterick. These cover the remaining key routes and allow analysis of the variations in traffic flows at particular sites to support the model calibration and validation process. In addition, forty-two single day Manual Classified Counts (MCCs) have been undertaken at various junctions within Catterick. These will be used to develop the vehicle matrices for turning movements at junctions, ensuring that both vehicle proportions and turning proportions are reasonable and of an appropriate magnitude to support model calibration and validation.

1.4 STRUCTURE OF REPORT

The subsequent content of this report is structured as follows:

- Chapter 2 considers the existing traffic data that is available for the model.
- Chapter 3 covers the collection and analysis of new traffic data collected to inform the model matrix update.

- Chapter 4 considers the validity of the data collected, and documents the actions that have been undertaken to ensure that the data is robust and 'fit for purpose'.
- Chapter 5 Summary and Conclusion

2 REVIEW OF EXISTING DATA

2.1 INTRODUCTION

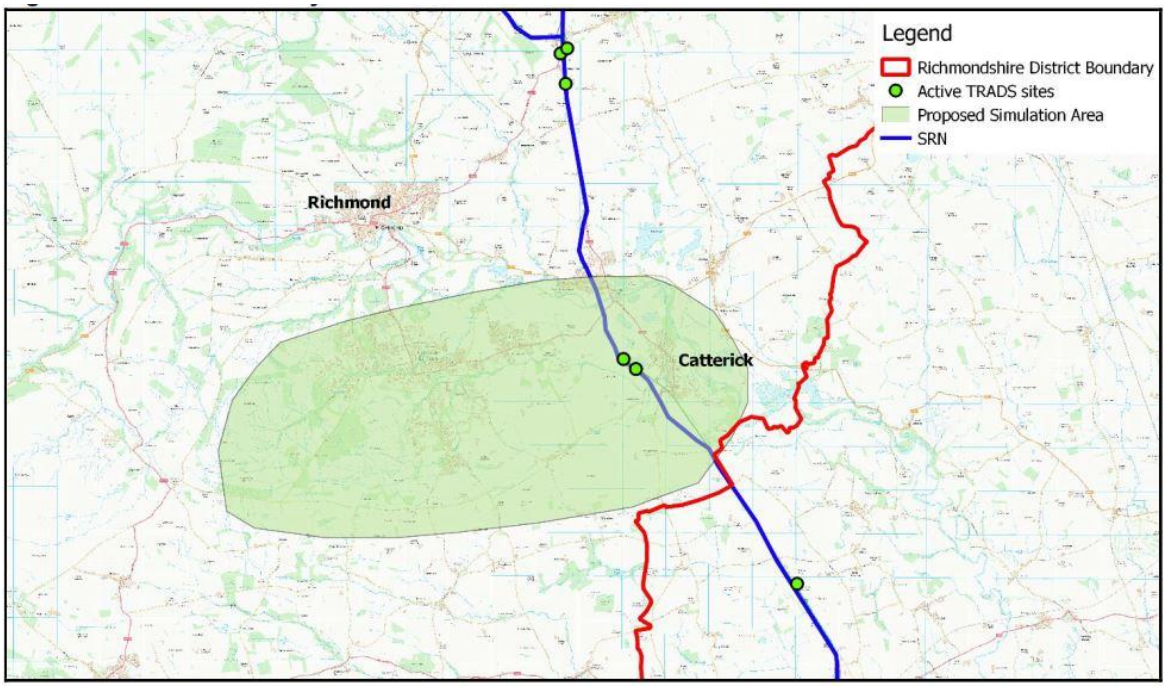
Highways England maintain a database of traffic information collected on the Strategic Highway Network. They also maintain a database of journey time information on Integrated Transport Network (ITN) links. North Yorkshire County Council maintain their own database of traffic count information. All this data has been reviewed to determine its suitability for inclusion in the modelling process the model, and used to determine the key time periods for the model. This section seeks to discuss each data source, and outline any areas of interest where data can be included or discounted from the process.

2.2 TRAFFIC DATA

The Highways England's WebTRIS data has been examined to identify locations where permanent automatic traffic count sites are located within the model area that can be used to inform the traffic model.

Figure 2-1 below shows the locations where WebTRIS data is available in relation to the area of Catterick Traffic Model. A limitation is that this data source only covers Highways England's Strategic Road Network (SRN).

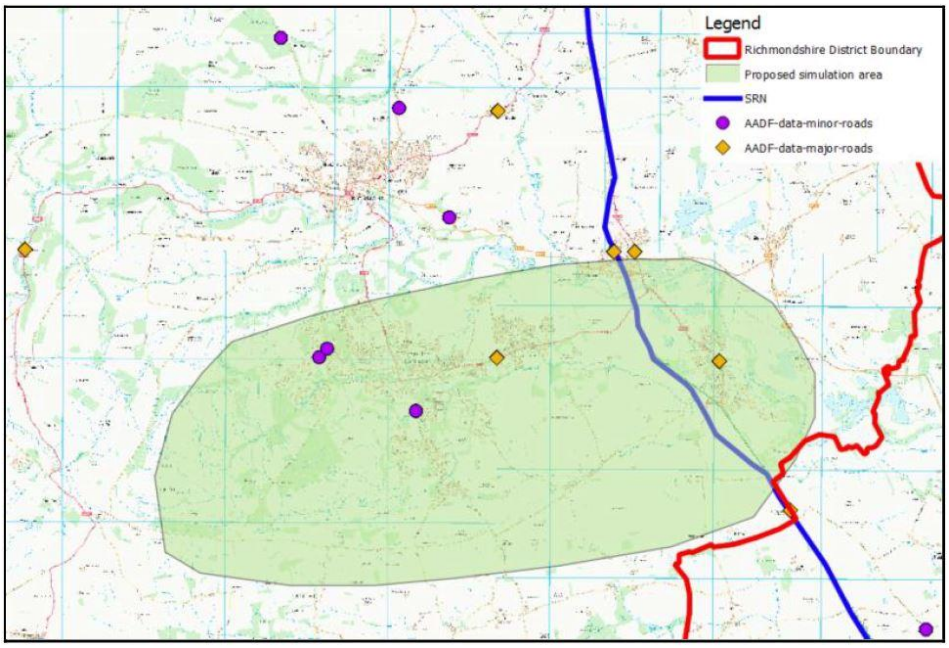
Figure 2-1 - WebTRIS Site Locations



The Department for Transport also maintain a database of temporary traffic counts conducted on various major and minor roads. The locations of these counts is shown in **Figure 2-2** below. Similarly, as with the TRADS data there are a limited number of counts available within the model simulation area. As stated previously, these counts do not meet the criteria for use as validation data as they are reported as Annual Average Daily Flow (incorporating holidays and weekends), but

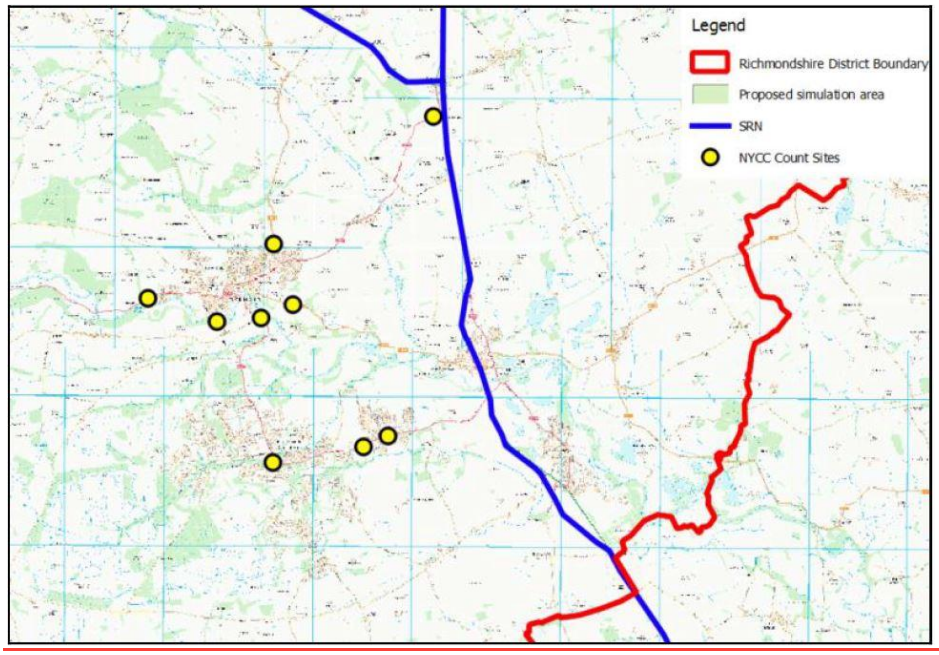
they do offer the potential for cross-checking against other data sources for consistency. The Local Model Validation Report (LMVR) will provide details on the data used in the model development.

Figure 2-2 - Count Database Site Locations



NYCC online database of both permanent and temporary ATCs. These permanent and temporary ATC sites record daily volumes, classification and speeds in 15-minute intervals at the site locations. They record bi-directional flow, speed of traffic, and vehicle length at some locations. Temporary data usually covers a 2-week period but can be anything from a few days to a few months data. **Figure 2-3** shows the locations where data is available from this database. This data has been used to complement the proposed surveys.

Figure 2-3 - NYCC Count Database Locations



2.3 TRAVEL TIME DATA

North Yorkshire County Council has access to up to date Trafficmaster data, giving a record of journey times and speeds along all of the ITN links within the modelled area. Trafficmaster data is sourced from GPS data gathered from devices and trackers fitted to a variety of fleet vehicles, LGVs, HGVs and buses and is gathered by identifying the location of every device every 1 to 10 seconds, giving an extensive dataset of journey times on ITN links.

Every time a signal is relayed to the Trafficmaster database it is recorded as an observation, therefore if there are more observations it will increase the reliability of the data. It is expected on most routes for there to be a substantial amount of observations due to the volume of traffic, therefore the route would be counted as being representative of the network conditions. It is possible for the Trafficmaster data to have zero observations on either rural or low flow links, and therefore other assumptions must be made to ensure that the route is covered..

This data has been made available to WSP to inform the model building process and to aid calibration and validation of the model. This journey time data has been used specifically to ensure that network travel times are representative of reality and to provide specific journey time data against which network calibration can be evaluated.

The following parameters were used to extract the journey time information from Trafficmaster.

Criteria	Parameter used
Date Range:	01/01/2018 to 31/12/2018
Time range:	AM, IP and PM peak hours
Vehicle Types:	All
Selected Days:	Tues, Wed, Thurs (neutral days)
Percentile:	5%
Include school holidays:	No
Ave Factor Value:	0
Min no. of counts per link:	0
Road Types:	All

3 NEW DATA COLLECTION

3.1 INTRODUCTION

To develop robust model trip matrices, it is necessary to collect observed demand data around the region of interest. A gap analysis of the existing available data was undertaken; based on which the decision was taken to commission traffic surveys to collect traffic data within the simulation area.

Streetwise Services was selected to undertake the surveys at Catterick. A copy of the survey specification is included in Appendix A

It was agreed with the client that Roadside Interview Surveys (RSIs) (and in this case Gatehouse Surveys) would be conducted as the most appropriate method of collecting data on journey origin, destination and purpose.

Manual classified counts (MCCs) at each of the RSI sites and longer period automatic traffic counts (ATCs) have been commissioned, to enable expansion of the RSI data to reflect total travel demand by the user classes contained within the model. It is important to have an ATC and MCC at a point close to the RSI's as the RSI only captures a sample of the overall traffic on one day. An MCC is used to provide and accurate split of vehicle classes, while an ATC gives the longer term volumetric average used for expansion. Further ATCs and MCCs have also been commissioned where there are gaps in existing data, and to support model calibration and validation.

Given the availability of Trafficmaster data, there was no requirement for new journey time data collection.

3.2 ROADSIDE INTERVIEW AND GATEHOUSE SURVEYS

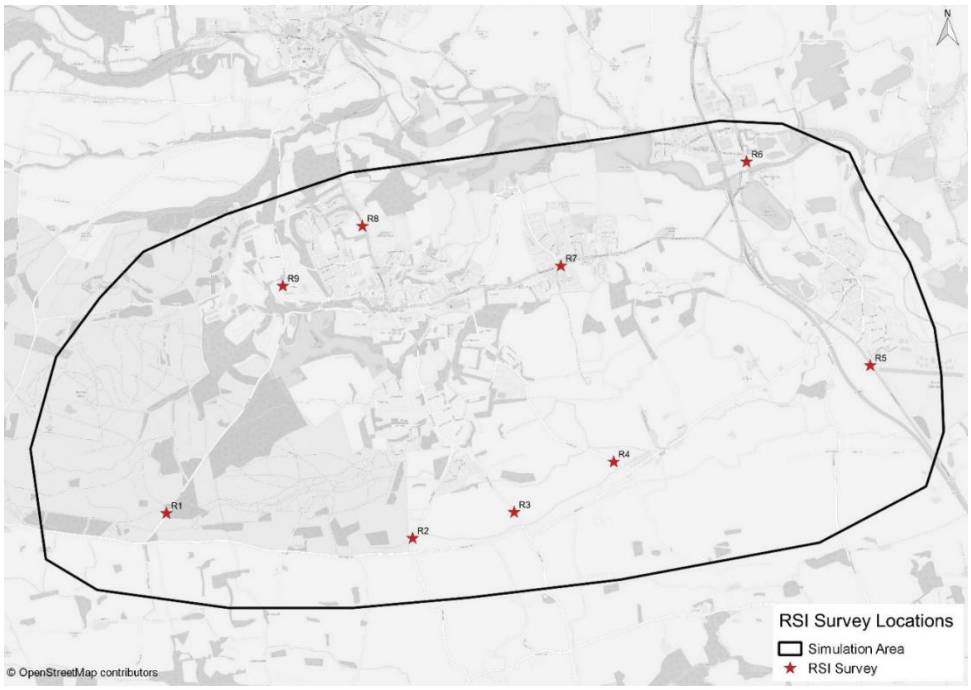
RSI surveys were undertaken at nine locations around Catterick, capturing inbound traffic towards Catterick and forming a watertight cordon. The site locations are shown in Figure 3-1 and listed in Table 3-1.

Table 3-1 – RSI Site Locations

Site	Road	RSI Direction
1	Range Road, North of Moor Lane Junction	NB
2	Hunton Road, North of Hawkswell Lane Junction	NB
3	Bedale Road, North of Hawkswell Lane Junction	NB
4	James Lane, North of Moor Lane Junction	NB
5	A6055 Leeming Lane, South of Leeming Lane Junction	NB
6	A6055 Gatherly Road, South of Howe Hill Lane	SB
7	A6136 Catterick Road, West of A6055 Catterick Road Junction	WB
8	A6136 Richmond Road, North of Junction with Hispwell Road	SB
9	Plumer Road, North of Bagerbeck Road Junction (in layby)	SB

A copy of the sample RSI form and the privacy notice from NYCC is included in Appendix A

Figure 3-1 - RSI Site Locations



The RSI data was supplemented by additional surveys conducted at the Gatehouse entrances/exits to the Garrison. Gatehouse (GH) surveys are similar to RSI surveys; the main difference being that these are conducted off the public highway at the access points to the Garrison. The GH surveys were undertaken at 7 locations, capturing inbound traffic into the Garrisons. The site locations are shown in Figure 3-2 and listed in Table 3-2.

Figure 3-2 - GHs Site Locations

Table 3-2 – GH Site Locations

Site	Road	RSI Direction
1	Horne Road, entrance to Somme Barracks	IB
2	Scotton Road, Helles Barracks	IB
3	Scotton Road, Vimy Barracks	IB
4	Leyburn Road, entrance to Paive Line access (Catterick Garrison)	IB
5	Hipswell Road East, Gaza Barracks	IB
6	Ava Road, entrance to Munster Barracks	IB
7	Leeming Lane, Marne Barracks	IB

Both sets of surveys were undertaken for a twelve-hour period (07:00-19:00). GH surveys were undertaken on the 12th, 13th and 14th of March while the RSI surveys were conducted on the 26th, 27th and 28th of March. The data was collected by direct interviews with drivers at the roadside with the intention of securing a 30% 'on the ground' sample rate to allow sufficient leeway for securing a 20% sample rate post checking and processing.

The GH and RSI surveys were staggered to take into account available resources for conducting the surveys and also the police to provide support.

The data reported by the survey contractor includes the following information:

- Unique Serial Number;
- Site Number;
- Recorded time (15-minute intervals);
- Vehicle type;
- Occupancy;
- Trip purpose;
- Origin address; and
- Destination address.

A summary of each of the RSI sites is contained in Table 3-2 below, showing the date of survey for each site, the weather conditions and any operational issues that may have affected data capture.

At each RSI and GH sites traffic data was recorded on the same day and time as the RSI and GH surveys to allow RSI and GH data to be expanded. These surveys recorded traffic flow by direction and by vehicle class for the 12-hour period 07:00 to 19:00.

Table 3-3 below shows the number of sampled vehicles recorded at the RSI sites compared to the observed traffic flow during the same period for the survey periods.

Table 3-3 – Sampling Profile by time Period – All RSI sites

Time Period	Site								
	RSI 1	RSI 2	RSI 3	RSI 4	RSI 5	RSI 6	RSI 7	RSI 8	RSI 9
07:00 to 08:00	100%	85%	69%	81%	75%	71%	16%	67%	91%
08:00 to 09:00	91%	100%	78%	98%	73%	51%	17%	38%	78%
09:00 to 10:00	78%	92%	91%	95%	71%	70%	17%	46%	56%
10:00 to 11:00	87%	100%	91%	80%	89%	67%	13%	42%	88%
11:00 to 12:00	102%	94%	96%	84%	96%	72%	11%	41%	83%
12:00 to 13:00	102%	78%	86%	83%	79%	68%	11%	38%	87%
13:00 to 14:00	89%	100%	94%	69%	95%	49%	11%	43%	90%
14:00 to 15:00	64%	100%	93%	90%	89%	62%	7%	40%	75%
15:00 to 16:00	76%	94%	83%	80%	81%	40%	11%	38%	76%
16:00 to 17:00	82%	100%	97%	88%	71%	39%	5%	41%	77%
17:00 to 18:00	83%	94%	68%	96%	56%	38%	8%	38%	99%
18:00 to 19:00	71%	100%	90%	72%	83%	42%	8%	50%	100%

It can be seen that all sites have recorded high sample rates, above the target of 30%, with the exception of site 7, which required the use of postcards due to its location. However, it should be acknowledged that this is the busiest site of those surveyed and therefore the absolute number of returns is still high (681 over 12 hours). **Table 3-4** below shows the number of sampled vehicles recorded at the GH surveys compared to the observed traffic flow during the same period for the survey periods.

Table 3-4 - Gate House Survey Sample rates

Time Period	Site						
	GH 1	GH 2	GH 3	GH 4	GH 5	GH 6	GH 7
07:00 to 08:00	86%	64%	46%	77%	61%	64%	97%
08:00 to 09:00	72%	75%	53%	84%	47%	43%	90%
09:00 to 10:00	80%	64%	61%	57%	65%	51%	38%
10:00 to 11:00	40%	58%	57%	65%	44%	66%	79%
11:00 to 12:00	50%	74%	53%	48%	57%	77%	80%
12:00 to 13:00	60%	71%	58%	40%	36%	91%	82%
13:00 to 14:00	84%	52%	58%	56%	74%	61%	74%
14:00 to 15:00	36%	51%	56%	59%	43%	79%	86%
15:00 to 16:00	60%	49%	52%	75%	48%	64%	95%
16:00 to 17:00	65%	53%	52%	48%	41%	68%	82%
17:00 to 18:00	85%	40%	35%	79%	94%	84%	57%
18:00 to 19:00	67%	46%	73%	29%	81%	82%	71%

It can be seen that the sample rates for the GH surveys are all high, with the exception of a single hour for site 4 (which is marginally below the target).

A two directional MCC video link count was conducted on the survey date at each RSI and GH location. This data is being used to expand the RSI and GH samples to the total observed flow in the surveyed (inbound) direction.

ATC counts were conducted on the same road and within reasonable proximity to the RSI and GH locations. These are being used to investigate day to day variability over the survey period and calculate appropriate adjustment factors; this is in line with the guidance in TAG Unit M1-2.

Within this process there is variance associated with:

- The MCC count itself;
- Expanding the RSI and GH data to the observed flow; and
- Calculating the adjustment factor derived from the ATC analysis.

The data collected is considered sufficient for the purposes of supporting the strategic model build. All statistical analysis and confidence levels will be reported in later documentation in line with the guidance set out in TAG Unit M1-2.

3.3 AUTOMATIC TRAFFIC COUNTS

Twenty-five ATCs have been undertaken at various locations within Catterick. These are being used to analyse the variations in traffic flows at particular sites and to support the model calibration and validation process. The ATCs were undertaken for a three-week period between Monday 11th March and Tuesday 7th April. Sites A3, A4, A5 and A25 started on Wednesday 13th March while sites A8, A9, A11, A12, A15, A22, A24 and A25 were extended to finish on Sunday the 14th of April.

The site locations are shown in Figure 3-2 and listed in Table 3-4.

Figure 3-3 - Commissioned ATC Surveys

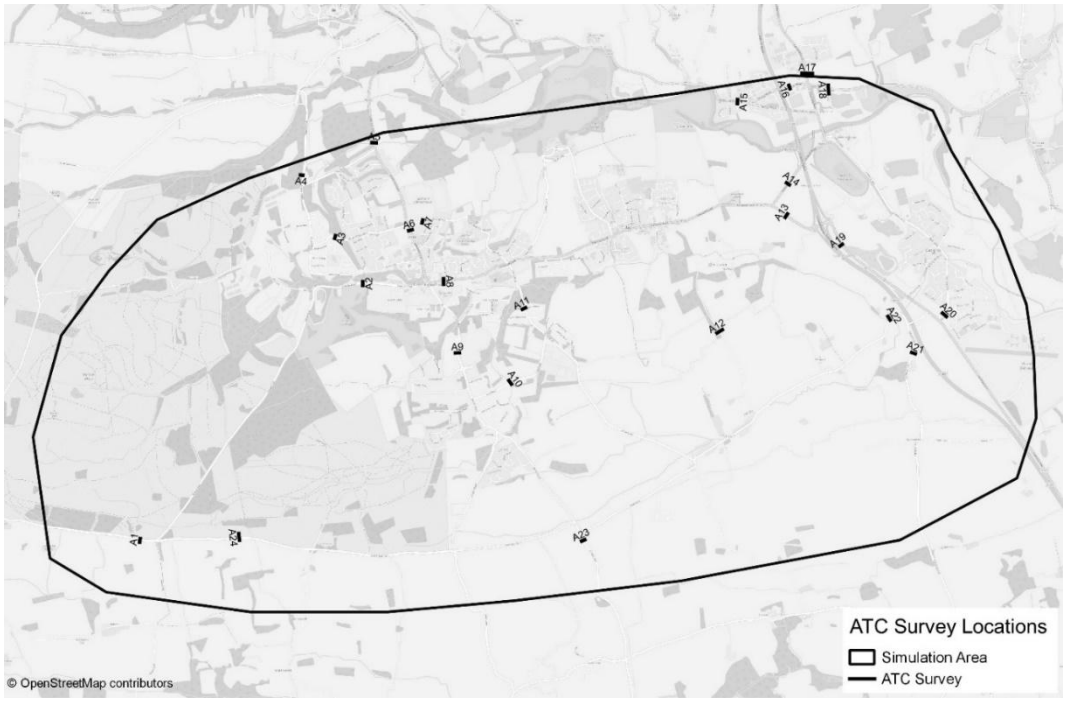


Table 3-5 – Commissioned ATC Locations

Site	Site Description
1	Hawkswell Lane, Barden Moor, west of A6108 before Range Road junction
2	Leyburn Road, east of access to Paive Live (Catterick Garrison)
3	Hipswell Road West, west of Wardrop Road
4	Plumer Road, north of junction with Haig Road
5	Richmond Road, north of junction with Haig Road
6	Richmond Road, south of junction with Hipswell Road East
7	Hipswell Road east of junction with Richmond Road
8	A6136 Catterick Road east of Heatherdene Road
9	Scotton Road, north of Vimmy Barracks access roundabout
10	Loos Road, east of Ringwood Road junction
11	Horne Road, north of Harley Crescent junction
12	Unnamed Road connecting A6055 Catterick Road and Tunstall Road
13	A6055 between A6136 Catterick Road and A1(M)
14	A6055 Catterick Road between A6136 Catterick Road and Leeming Lane
15	B6271 Richmond Road, west of Grange Road junction
16	B6271 Station Road between B6271 Richmond Road and A6055 Gatherly Road
17	A6055 Gatherly Road, north of B6271 Station Road junction
18	B6271 Station Road, east of junction with Gatherly Road
19	A6055, south of junction with A1(M)
20	Leeming Lane, leading to Marne Barracks
21	Catterick Lane, south of new junction leading to overbridge over A1(M)
22	Tunstall Road, west of Catterick Lane junction
23	Craggs Lane, south of Moor Lane junction
24	Hawkswell Lane, Barden Road, east of A6108 before Range Road junction
25	A6136 Catterick Road

A summary of the average weekday flows recorded by hour from each site are shown in Appendix B, averaged from the three-week data recorded at the ATCs.

In addition to the 25 sites referred to above, ATC sites were also established at each of the nine RSI sites and seven GH sites to enable a comparison between longer term variations in traffic flows and travel demand data from a single day.

ATCs at the RSI and GH sites were conducted between the 14th of March and 7th of April (with sites 6 and 7 extending for a further week). The data collected from these ATCs consisted of the volume by direction, vehicle class (13 vehicle classifications) and vehicle speeds.

The following classification was used to categorise the ATC data

Class No	Vehicle Description	Class No	Vehicle Description
1	Car, Light Van Taxi	5	Rigid 2 Axle HGV + 2 Axle (Close coupled) Trailer
1	Light Goods Vehicle	6	Rigid 3 Axle HGV + 2 Axle Drawbar Trailer
1	Car or Light Goods Vehicle + 1 Axle Caravan or Trailer	6	Rigid 3 Axle HGV + 3 Axle Drawbar Trailer
1	Car or Light Goods Vehicle + 2 Axle Caravan or Trailer	7	Artic, 2 Axle Tractor + 1 Axle Semi-Trailer
2	Rigid 2 Axle Heavy Goods Vehicle	8	Artic, 2 Axle Tractor + 2 Axle Semi-Trailer
3	Rigid 3 Axle Heavy Goods Vehicle	9	Artic, 2 Axle Tractor + 3 Axle Semi-Trailer
3	Rigid 3 Axle Heavy Goods Vehicle	10	Artic, 3 Axle Tractor + 1 Axle Semi-Trailer
4	Rigid 4 Axle Heavy Goods Vehicle	10	Artic, 3 Axle Tractor + 2 Axle Semi-Trailer
4	Rigid 4 Axle Heavy Goods Vehicle	11	Artic, 3 Axle Tractor + 3 Axle Semi-Trailer
5	Rigid 2 Axle HGV + 2 Axle Drawbar Trailer	12	Bus or Coach, 2 Axle
5	Rigid 2 Axle HGV + 3 Axle Drawbar Trailer	12	Bus or Coach, 3 Axle
5	Rigid 2 Axle HGV + 1 Axle Caravan or Trailer	13	Vehicle with 7 or more Axles

3.4 MANUAL CLASSIFIED COUNTS

Forty-Two Manual Classified Counts (MCCs) have been undertaken at various junctions within Catterick. These will be used to develop the vehicle matrices to calculate vehicle turning proportions and to support calibration and validation. They were undertaken for twelve hours (07:00-19:00) on a Tuesday, Wednesday or Thursday within the survey period specified for the ATCs. Data was classified by six vehicle types:

- Pedal cycle / motorcycle;
- Car;
- LGV;
- OGV1;
- OGV2; and
- Buses and coaches.

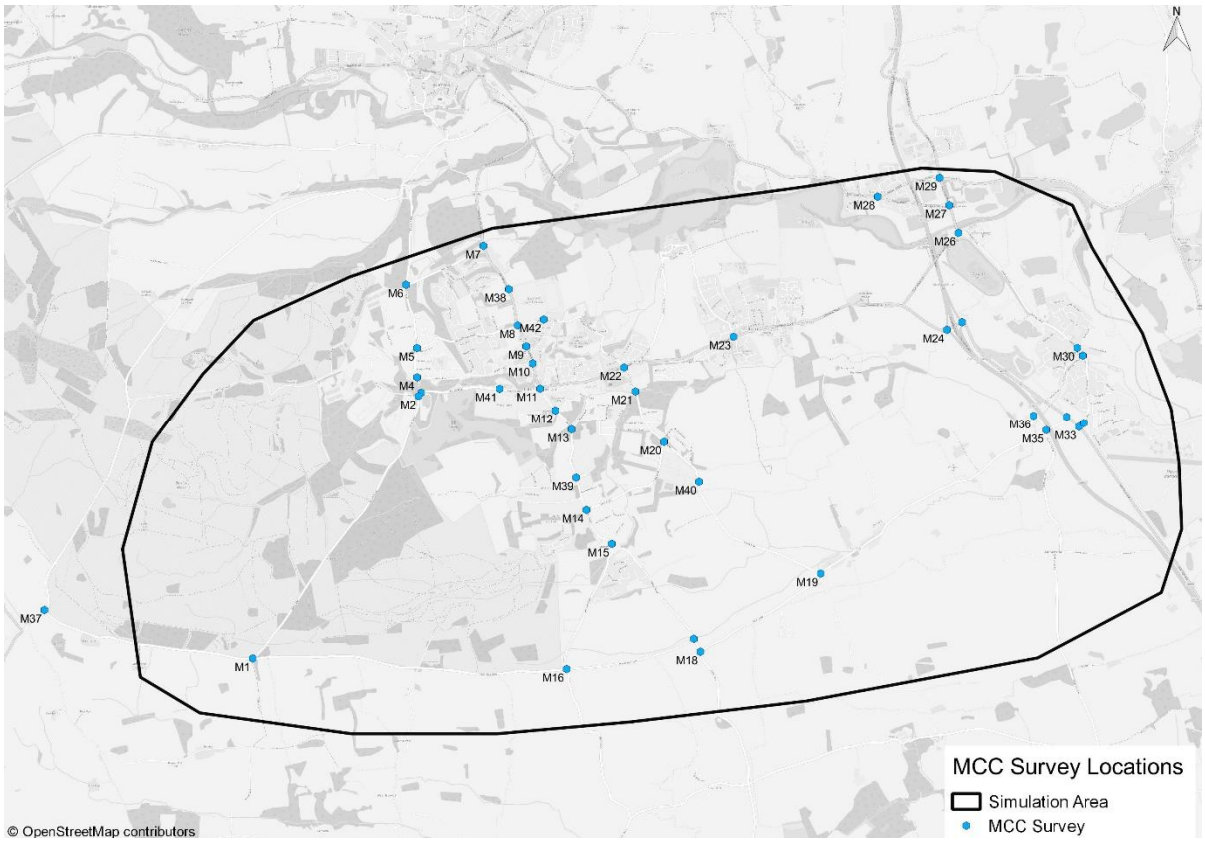
The site locations are listed in Table below and shown in Figure 3-4.

Table 3-6 – Commissioned MCC Locations

Site	Site Description
1	Hakswell Lane/ Range Road
2	Range Road/ Ava Road
3	Leyburn Road/ Plumer Road
4	Plumer Road/ Gough Road
5	Plumer Road/ Hipswell Road West
6	Plumer Road/ Haig Road
7	A6136 Richmond Road/ Haig Road
8	A6136 Richmond Road/ Hipswell Road West/ Hipswell Road East
9	A6136 Richmond Road/ Mons Road
10	A6136 Richmond Road/ Gough Road
11	A6136 Richmond Road/ Leyburn Road/ A6136 Catterick Road
12	Scotton Road/ Segrave Road
13	Scotton Road/ Church Road
14	Scotton Road/ Loos Road
15	Bedale Road/ Hunton Road
16	Hawkswell Lane/ Hunton Road
17	Bedale Road/ Hawkswell Lane
18	Craggs Lane/ Moor Lane
19	Moor Lane/ James Lane
20	Horne Road/ Loos Road
21	Horne Road/ Wensleydale Road
22	A6136 Catterick Road/ Byng Road/ Horne Road
23	A6136 Catterick Road/ Colburn Lane
24	A6055/ A1(M) (West)
25	A6055/ A1(M) (East)
26	A6055 Catterick Road/ A6136 Leeming Lane/ A6136 Gatherly Road
27	A6136 Gatherly Road/ B6272 Bridge Road
28	B6272 Bridge Road/ B6271 Station Road
29	Station Road/ Gatherly Road
30	A6136 High Street/ High Green
31	A6136 High Street/ Lowe Green
32	Leeming Lane/ Catterick Lane
33	Catterick Lane/ A6055
34	A6055/ overbridge over A1(M)
35	Catterick Lane/ overbridge over A1(M)

Site	Site Description
36	Catterick Lane/ Tunstall Lane
37	A6108/ Unnamed Road leading to Richmond
38	A6136 Richmond Road/ Phoenix recovery centre entrance
39	Scotton Road/ Helles Barracks entrance
40	Horne Road/ Somme Barrcaks entrance
41	Leyburn Road/ Piave Lines entrance
42	Hipswell Road/ Gaza Barracks

Figure 3-4 - Commissioned MCC Surveys



3.5 KEY TIME PERIODS

The data from the 25 ATCs commissioned for the traffic model has been interrogated to identify the key peak period time periods on which to base the model.

The average Monday to Thursday flow at each site has been calculated and combined to produce a total flow profile, outlined in section 4 of this report. This demonstrates that the morning peak hour is between 07:30 and 08:30, and the evening peak hour is between 16:30 and 17:30. Further analysis and justification of the peak periods to be used for the model will be contained in the future Local Model Validation Report (LMVR). Friday, Saturday and Sunday have been discounted from the count data as they have been denoted as non-neutral working days (following TAG unit M1.2).

4 DATA VERIFICATION AND CLEANSING

4.1 INTRODUCTION

Before using collected traffic data, a level of confidence must first be established. This section outlines the cleaning and verification checks that have been undertaken on the ATC, MCC, RSI and GH data. The survey contactor undertook their own initial checks on the data collected before sharing it with WSP.

The traffic datasets received were then processed and 'cleaned' by WSP such that any records in which there is insufficient confidence or appear as anomalies are removed. WSP has liaised with the contractor to verify the data where required.

For the ATCs, checks are made regarding flow profiles, vehicle splits and directionality at the site. For RSI data, checks are made against purpose splits.

4.2 DATA QUALITY

Initial checks were undertaken on the data received from which the following observations can be made:

4.3 DATA VERIFICATION

For the ATC sites within close proximity to the RSI and GH locations, vehicle type splits have been checked against the nearest MCC. Aggregated across the twenty-four sites, for an average Monday-Thursday over the three weeks, with the vast majority of trips undertaken by cars.

Table 4-1 – Vehicle Type Proportions at RSI sites

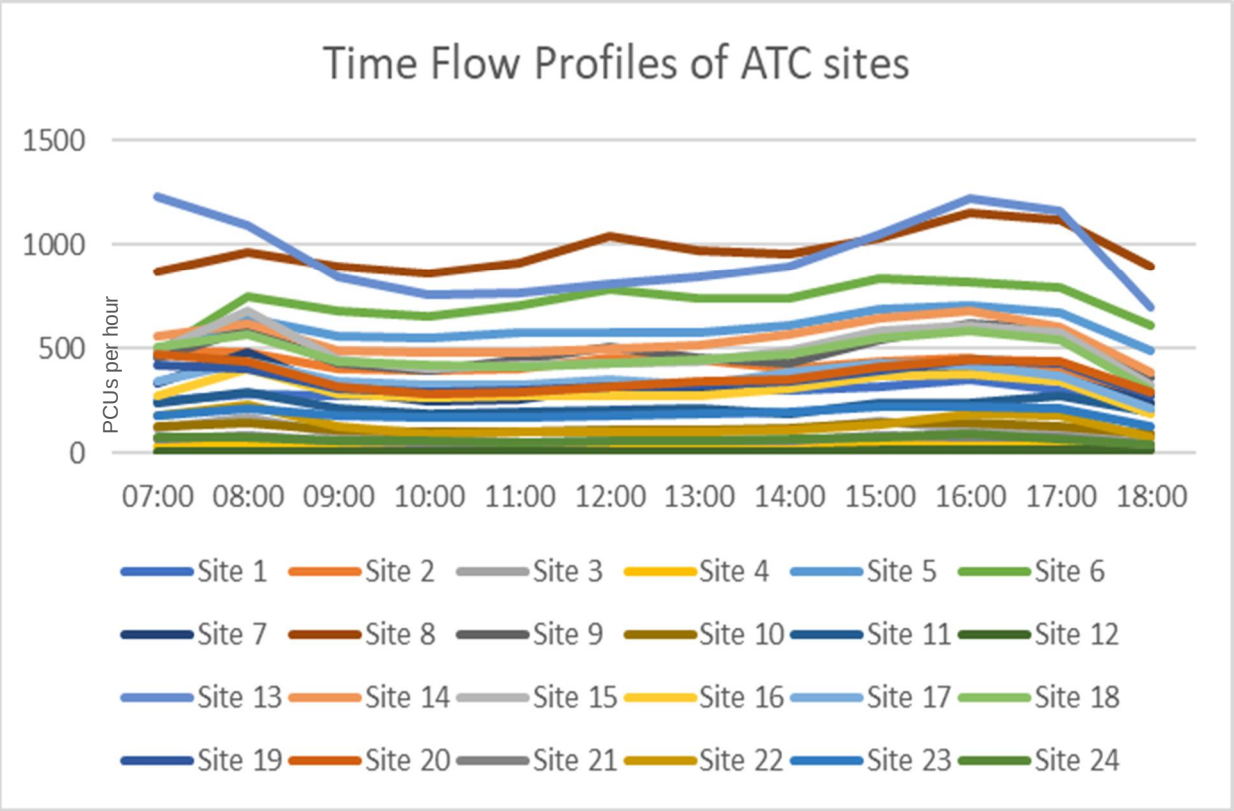
Vehicle type	Trips	Proportions
Motor Cycle & Pedal Cycle	34	0.4%
Cars	7466	88%
LGV	726	8.6%
HGV	202	2.4%
Other	60	0.7%

Table 4-2 - Vehicle Type Proportions at GH sites

Vehicle type	Trips	Proportions
Motor Cycle & Pedal Cycle	10	0.2%
Cars	3815	91.8%
LGV	225	5.4%
HGV	66	1.6%
Other	40	1%

Daily time flow profiles averaged over the three weeks indicate broadly expected AM and PM peaks (typically hours commencing 08:00 and 16:00 respectively). The PM peak is more marked than AM.

Figure 4-1 - Average daily time flow profiles at ATC sites



Broadly similar flows occur across both directions at each ATC site over a 12 hour period (0700 to 1900). The percentage difference across direction is greatest for site 11 along Horne Road (1440 trips EB and 1263 trips WB, percentage difference of 14%). For the other twenty-three sites percentage difference by direction exceed 10% only once (12.7% for site 21, Catterick Lane).

For RSI data, the purpose splits have been compared with National Travel Survey (NTS) data. The following steps were taken to gather NTS data representative of the conditions/location of the RSIs:

- Households for N Yorkshire, Lincolnshire, Humberside and Co. Durham up to small/medium town (<25k pop) were considered, to get a large enough sample,
- All trips recorded by 'car driver' or 'car passenger' were extracted for households in the above areas for years 2012-2014, for weekdays during school times (so bank holidays and school holidays excluded),
- Trips were aggregated into 10 segments; home or non-home by work (commute), education, employer business, shopping and other.

Purposes compare well against NTS, although education trips in the AM period make up a smaller proportion of the RSI trips than in NTS, however this is likely to be as a result of Catterick Garrison containing schools with a more localised catchment than seen nationally. Typicall,y there are more 'Shopping' and fewer 'Other' trips in the RSI data compared to NTS, but both 'Shopping' and 'Other' trips are set to be subsumed into the same category in the matrix build for the model (Home Based Other and Non-Home Based Other).

RSI data will be expanded from the sample to match the trip totals from MCCs collected from the same site. Expansion factors will be reviewed and any abnormally high factors investigated.

Since ATC datasets were collected over several weeks but RSI datasets were collected over only 3 days in that period, the ATC data was used to shed light on any atypical traffic conditions during the days RSI data were collected. In compliance with WEBTAG M1-2, factors will be calculated to convert the RSI data to typical days within the two-week period.

4.4 CLEANSING

RSI trips were cleaned based on two criteria:

- Is the movement logical or illogical?
- Are the origin and addresses valid/complete?
- Does the trip have the correct vehicle class?

A logical movement means the RSI site could conceivably have been passed through on the way from the stated origin to the stated destination. This is identified by WSP as a criterion on which to judge the validity of the trip. To achieve this, 10 sectors were applied for areas across the country and movements between sectors were analysed. For example, any outbound movements out of Catterick were considered illogical as these would not be picked up at the inbound RSI sites. Catterick was split into east and west sectors, to better analyse Westbound movements through RSI site 7.

WSP also reviewed the validity of RSI records. Trips were considered incomplete/unusable/void if:

- There were no address/postcode/co-ordinates provided,
- The response had been spoilt (e.g. address of ‘Northern Ireland’),
- The postcode was invalid,
- No time period was given,
- There were abnormal vehicle occupancies (e.g. occupancies of 6 or above for cars, LGVs and HGVs),
- No trip purposes.

WSP also reviewed any unnecessary records. These included Motor Cycles/ Pedal Cycles, Buses and coaches or any ‘Other’ vehicle types, such as tractors.

After reviewing, out of the 8494 trips provided:

- 5626 were considered logical and useable,
- 2639 were considered illogical,
- 135 were considered incomplete/unusable/void, and
- 94 were considered unnecessary.

GH trips were analysed in a similar way to the RSI trips, however with no illogical movements. All trips were considered logical as all trips have barrack destinations. GH trips were therefore cleaned based on two criteria:

- Are the origin and addresses valid/complete?
- Does the trip have the correct vehicle class?

After reviewing, out of the 4164 trips provided:

- 4091 were considered usable,
- 22 were considered incomplete/unusable/void, and
- 51 were considered unnecessary.

4.5 OBSERVATIONS – SURVEY DATA

This section summarises the issues noted during the surveys and steps taken to mitigate those issues.

ATC link counts

The ATC link counts were installed on 10/03/2019 to begin recording from 11/03/2019.

During the site visit by WSP personnel on 11/03/2019, an issue with the RSI site ATC was identified. These were installed on the 13th March so began recording on the 14th March.

In order to compensate the loss for data or two days, the ATC tubes were extended to record

the complete data set for three weeks.

During the site visit, it was also noted that ATC sites A3, A4 and A5 were installed in the wrong location so were moved to the correct location on the Tuesday 12th March so these three sites began recording on Wednesday 13/03/2019.

The additional site (ATC 25) requested by WSP was installed on Tuesday 12th March to begin recording on the 13th March.

Due to the issues at RSI ATC sites and 3 ATC sites beginning after the agreed survey date it was agreed between Streetwise and WSP that all RSI and Link count ATCs should continue to the 7/4/19 (inclusive).

Due to repeated damage, the following sites were left in situ to record until the 14/4/19 (inclusive). A8, A9, A11, A12, A15, A22, A24, A25, RSI 6 and RSI 7.

The following issues were also identified as part of WSP's review of the traffic data and subsequently corrected.

- ATC 6: when checking against adjacent JTC 8 the directions had been labelled incorrectly on the ATC
- ATC 8: when checking against adjacent JTC 11 the directions had been labelled incorrectly on the ATC
- ATC 24: when checking against adjacent JTC 1 the directions had been labelled incorrectly on the ATC
- RSI (ATC) 4: when checking against adjacent JTC 19 the directions had been labelled incorrectly on the ATC

It was agreed with the survey company that data was missing at ATC sites A9, A8 and A25 and RSI sites 3 and 6.

MCC Surveys

All Sites filmed successfully except for Sites M23, M20, M13 and M15. These Sites were refilmed successfully on Thursday 21st March.

RSI Surveys

All the RSI surveys were conducted successfully.

It can be seen that all sites have recorded high sample rates, above the target of 30%, with the exception of site 7 where police requested the use postal cards due to the queuing and proximity to the adjacent junction.

Gatehouse surveys

No issues were observed at GH survey sites.

The issues observed during the survey data collection have been mitigated to ensure that there is no detrimental impact. RSI site 7 were postal method was used showed low percentage returns for the site. WSP has used other methods to supplement the data observed at this site.

WSP has also negotiated a discount of £1725 (excl. vat) for the loss of data at the five ATC sites which would require re-surveying.

5 SUMMARY AND CONCLUSIONS

5.1 EXISTING DATA

Existing traffic data in the Catterick area has been collated and compiled into a repository of information related to traffic flow volumes. This information has been reviewed and offers sufficient coverage for the purposes of developing a traffic model. The specific allocation of data to the model has not yet been implemented but as and when this is undertaken issues relating to consistency will be investigated and resolved.

5.2 NEW DATA

Key gaps in data availability have been resolved by the collection of new information. This has been focussed on RSI and GH sites, supplementary ATC and MCC data together with separate count sites in areas without any appropriate data content.

5.3 FURTHER INFORMATION

Data deficiencies observed have been referenced in this report and remedial methods to provide an integral solution for the needs of the project have been discussed.

Trafficmaster data has been downloaded from the DfT. This presents information on travel times and levels of congestion based on a sample of vehicles travelling within the general traffic fleet. This data will be used to develop travel speeds both to verify the network development and to provide a source of observed travel time data to calibrate against. Details of this data are not included within this document but use will be identified within the LMVR.

Appendix A

SURVEY SPECIFICATION

North Yorkshire County Council

CATTERICK STRATEGIC HIGHWAY MODEL

Traffic Survey Specification

V03
OCTOBER 2018

CONFIDENTIAL

North Yorkshire **County Council**

CATTERICK STRATEGIC HIGHWAY MODEL

Traffic Survey Specification

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70040744
OUR REF. NO. V03

DATE: OCTOBER 2018

WSP
1st Floor
LS1 Headrow
Unit 113 The Headrow, Leeds
LS1 5JW

WSP.com

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks				
Date	17/09/2018	28/09/2018	03/10/2018	
Prepared by	Narendra Sadhale	Narendra Sadhale	Narendra Sadhale	
Signature				
Checked by				
Signature				
Authorised by				
Signature				
Project number	70040744	70040744	70040744	
Report number	V01	V02	V03	
File reference				

CONTENTS

1 INTRODUCTION

INTRODUCTION

WSP have been commissioned by North Yorkshire County Council (NYCC), Richmondshire District Council (RDC) and Ministry of Defence (MOD) to develop a strategic highway model of Catterick. In order to develop the model, a comprehensive set of traffic surveys is required around the Catterick area. You are therefore invited to tender for all or part of the survey programme specified in this report.

1.1 TRAFFIC SURVEY PROGRAMME

The following types of traffic surveys are required for development of the Catterick Strategic Highway Model:

- 9 Roadside Interview Surveys (RSI's);
- 7 Gatehouse Surveys (GHS's);
- 24 Automatic Traffic Counts (ATC's); and
- 42 Manual Classified Junction Counts (MCJC's).

Further details on the above surveys are presented in the following chapters.

A figure showing the location of all the surveys is enclosed in Appendix A

1.2 SURVEY DATES

All of the surveys are to be completed within a three-week period during the month of March in 2019. Further detail will be provided once exact dates have been confirmed with the client.

1.3 TENDER SUBMISSION

Completed tenders should be returned within two weeks to Narendra Sadhale via email at narendra.sadhale@wsp.com.

1.4 QUERIES

Any queries arising from this survey specification should be addressed to Narendra Sadhale via phone on 0113 301 6273 or via email at narendra.sadhale@wsp.com. The deadline for queries will be 48 hours prior to the tender submission deadline.

1.5 SUBMISSION REQUIREMENTS

As part of the survey tender submission, the following information is required;

a.) Quotations (excluding VAT) for the cost of each survey element specified in this report;

b.) Details of all Quality Assurance procedures;

c.) Outline of Methodology;

d.) Project specific method statements;

e.) Confirmation of survey programme;

f.) Timetable for delivery of data;

g.) Evidence of applicable experience;

h.) breakdown of the costs for each survey type, including unit costs for each survey type should additional surveys be required;

i.) Details of company Health and Safety Policy with particular reference to the safe installation, maintenance and removal of survey equipment; and

j.) Confirmation the company has Public Liability Insurance of £10m or more.

1.6 CONTRACTOR APPOINTMENT

The contractor will be appointed by NYCC on the advice of WSP in consultation with MOD and RDC. Once all tenders have been received and analysed, NYCC reserve the right to either select a single survey contractor to undertake the above surveys or a number of contractors that undertake a specific type of survey as outlined above or not to select any of the tenders. Only contractors that demonstrate they can satisfy the Quality Assurance procedures will be considered for this work.

The chosen contractor(s) will be required to attend a meeting to discuss the survey programme in detail and get a firm agreement on delivery dates for the survey data (anticipated to be a maximum of 4 weeks post surveys).

The successful contractor(s) will be required to attend a site visit with WSP, MOD and possibly the police, to discuss the exact locations of the survey locations and will be required to liaise with the clients/WSP to confirm the survey arrangements, as required.

Payment will be made by NYCC, to the traffic survey contractor(s) on completion of the work commissioned, as per the dates agreed based on the agreed programme.

For late delivery of data, a penalty of 10% of the total commission value will be applied for each week delay (or part thereof).

2 AUTOMATIC TRAFFIC COUNTS

2.1 INTRODUCTION

Automatic Traffic Counts (ATC) are required at various locations across the Catterick area, including the RSI and GHS sites. The data will be used to analyse the variations in traffic flows at sites within the study area and also be used to support the model calibration and validation.

2.2 SURVEY SCOPE

Two-way ATC's are to be undertaken at approximately 24 locations around the simulation area in Catterick during the survey period noted.

The ATC counts are to be undertaken for a three-week period in March 2019 (exact dates to be confirmed). All the other surveys (MCC, Gatehouse and RSI surveys) are required to be undertaken within these 3 weeks when the ATC surveys are being undertaken.

2.3 LOCATIONS

The approximate ATC locations are presented in Table 1 and illustrated in Figure 1. The successful survey contractor(s) once appointed will need to assess the suitability of each site, and agree on exact site locations with WSP. Exact locations should be chosen to minimise health and safety risks and consideration should be given to sites which will enhance the accuracy of survey data.

Figure 1- ATC Survey Locations

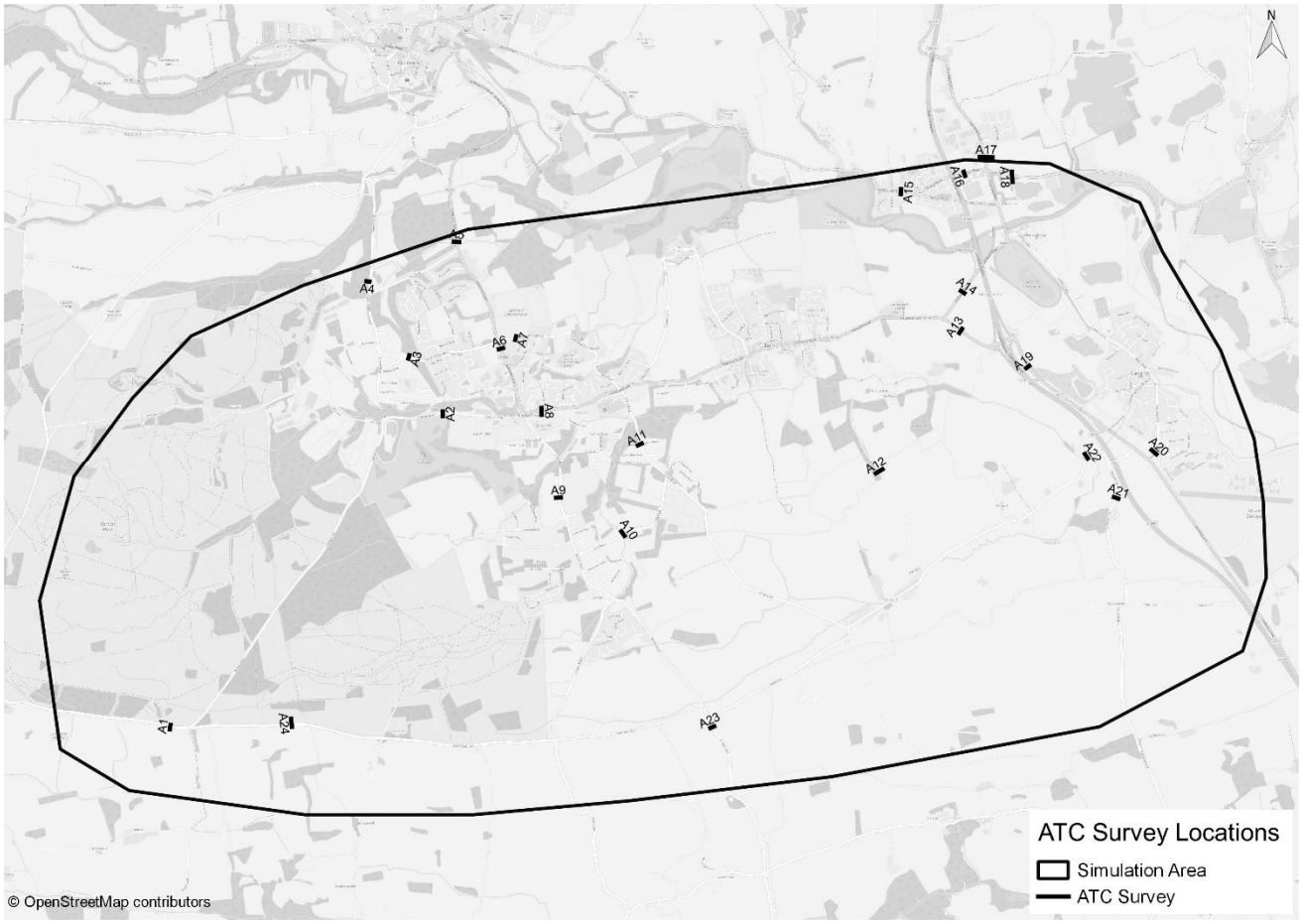


Table 1– ATC Survey Locations

Site	Site Description
A1	Hawkswell Lane, Barden Moor, west of A6108 before Range Road junction
A2	Leyburn Road, east of access to Paive Live (Catterick garrison)
A3	Hipswell Road West, west of Wardrop Road
A4	Plumer Road,north of junction with Haig Road
A5	Richmond Road,north of junction with Haig Road
A6	Richmond Road, south of junction with Hipswell Road East
A7	Hipswell Road east of junction with Richmond Road
A8	A6136 Catterick Road east of Heatherdene Road
A9	Scotton Road, north of Vimmy barracks access roundabout
A10	Loos Road, east of Ringwood Road junction
A11	Horne Road, north of Harley Crescent junction
A12	Unnamed Road connecting A6055 Catterick Road and Tunstall Road
A13	A6055 between A6136 Catterick Road and A1(M)
A14	A6055 Catterick Road between A6136 Catterick Road and Leeming Lane
A15	B6271 Richmond Road, west of Grange Road junction
A16	B6271 Station Road between B6271 Richmond Road and A6055 Gatherley Road
A17	A6055 Gatherley Road, north of B6271 Station Road junction
A18	B6271 Station Road, east of junction with Gatherly Road
A19	A6055, south of junction with A1(M)
A20	Leeming Lane, leading to Marne barracks
A21	Catterick Lane, south of new junction leading to overbridge over A1(M)
A22	Tunstall Road, west of Catterick Lane junction
A23	Craggs Lane, south of Moor Lane junction
A24	Hawkswell Lane, Barden Moor, east of A6108 before Range Road junction

2.4 REQUIREMENTS

The survey contractor will be required to:

a.) Liaise with NYCC, MOD, RDC and WSP to finalise the survey arrangements, and timetable;

b.) Provide a detailed site layout plan for each ATC site;

c.) Provide all equipment necessary for the counts, including signage to install the ATC equipment;

d.) Maintain a survey diary to record any incidents that may have disrupted normal travel patterns or the conduct of the survey itself;

e.) Undertake the ATC's to provide directional traffic flows classified into Car, Light and Heavy (rigid/articulated) vehicle types;

f.) Monitor equipment at reasonable intervals (to be confirmed in the method statement) during the survey period to ensure that the ATC remains operational; and

g.) Download ATC data at least on a weekly basis to ensure that no data is lost.

2.5 OUTPUT DATA

Once the data has been recorded, logic checks should be undertaken by the contractor. The recorded data should then be analysed per direction for each site, by Car, Light and Heavy vehicles and be provided in 15 minute intervals.

The ATC data should be provided in a database format in MS Excel, including plans of the site locations and a photograph of the site setup to demonstrate that the site has been set up in a manner that will minimise inaccuracies.

3 MANUAL CLASSIFIED JUNCTION COUNTS

3.1 INTRODUCTION

Manual Classified Junction Counts (MCJCs) are required at various junctions across the Catterick Garrison and Catterick area. The data will be used to assist in the development of the vehicle matrices and also be used to support the model calibration and validation.

3.2 SURVEY SCOPE

MCJCs using video cameras are to be undertaken at 41 locations across the Catterick Garrison and Catterick areas. These counts are to be undertaken at each site between 07:00-19:00 hours on any Tuesday, Wednesday or Thursday during the three-week period as specified in section 1.2.

The data should be classified by six vehicle types as follows:

- Pedal Cycle / Motorcycle
- Car
- LGV
- OGV1
- OGV2
- Buses and Coaches

3.3 LOCATIONS

The MCJC locations are presented in Table 2 and illustrated in Figure 2.

Figure 2- MCC Survey Locations

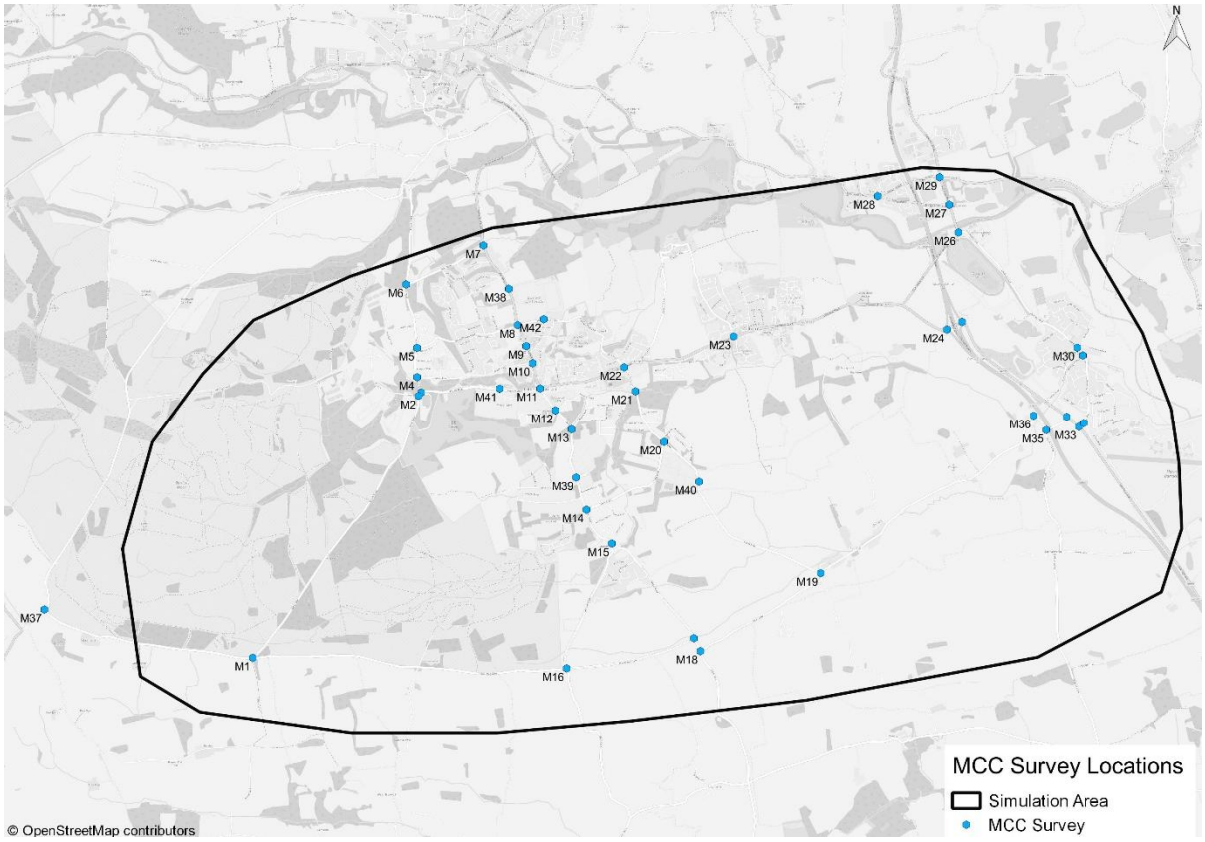


Table 2 – MCJC locations

Site Ref	Junction
M1	Hawkswell Lane/ Range Road
M2	Range Road/ Ava Road
M3	Leyburn Road/ Plumer Road
M4	Plumer Road/ Gough Road
M5	Plumer Road/ Hipswell Road West
M6	Plumer Road/ Haig Road
M7	A6136 Richmond Road/ Haig Road
M8	A6136 Richmond Road/ Hipswell Road West/ Hipswell Road East
M9	A6136 Richmond Road/ Mons Road
M10	A6136 Richmond Road/ Gough Road
M11	A6136 Richmond Road/ Leyburn Road/ A6136 Catterick Road
M12	Scotton Road/ Segrave Road
M13	Scotton Road/ Church Road
M14	Scotton Road/ Loos Road
M15	Bedale Road/ Hunton Road
M16	Hawkswell Lane/ Hunton Road
M17	Bedale Road/ Hawkswell Lane
M18	Craggs Lane/ Moor Lane
M19	Moor Lane/ James Lane
M20	Horne Road/ Loos Road
M21	Horne Road/ Wensleydale Road
M22	A6136 Catterick Road/ Byng Road/ Horne Road
M23	A6136 Catterick Road/ Colburn Lane
M24	A6055/ A1(M) (west)
M25	A6055/ A1(M) (east)
M26	A6055 Catterick Road/A6136 Leeming Lane/A6136 Gatherly Road
M27	A6136 Gatherley Road/ B6272 Bridge Road
M28	B6272 Bridge Road/ B6271 Station Road
M29	Station Road/ Gatherley Road
M30	A6136 High Street/ High Green
M31	A6136 High Street/ Low Green
M32	Leeming Lane/ Catterick Lane
M33	Catterick Lane/ A6055
M34	A6055 / Ovebridge over A1(M)
M35	Catterick Lane/ Overbridge over A1(M)

M36	Catterick Lane/ Turnstall Road
M37	A6108 / unnamed road leading to Richmond
M38	A6136 Richmond Road/ Phoenix Recovery centre entrance
M39	Scotton Road/ Helles barracks entrance
M40	Horne Road/ Somme Barracks entrance
M41	Leyburn Road/ Piave Lines entrance
M42	Hipswell Road/ Gaza Barracks

3.4 REQUIREMENTS

The survey contractor will be required to:

a) Liaise with WSP, MOD, RDC and NYCC to finalise the survey arrangements, and timetable;

b) Provide all equipment necessary for the counts, including video cameras;

c) Set up video cameras to include observation of all allowable movements at the survey location by vehicle type; and

d) Maintain a survey diary to record any incidents that may have disrupted normal travel patterns or the conduct of the survey itself.

3.5 OUTPUT DATA

Once the raw data has been input, range and logic checks should be undertaken by the contractor. The junction counts should be analysed to create origin/ destination turning matrices for each junction.

The MCJC data should be provided in a database format in MS Excel, including diagrams showing the layout of the junctions, and should be provided in 15 minute intervals. Video recordings of the MCJC sites should also be provided on memory stick media and the provision of this should be included in the price.

4 ROADSIDE INTERVIEW SURVEYS AND GATEHOUSE SURVEYS

4.1 INTRODUCTION

Roadside Interview (RSI) Surveys and gatehouse surveys (GH's) are planned to provide a primary source of travel demand data, including details of journey origin/ destination and trip purpose.

The main difference between them is that RSI surveys are planned to be undertaken on public highway and the GH surveys are planned at the entrances of a few Barracks (on MOD land).

4.2 ROADSIDE INTERVIEW SURVEYS

4.2.1 INTRODUCTION

Roadside Interview (RSI) Surveys provide a primary source of travel demand data, including details of journey origin/ destination and trip purpose. RSI's are proposed for all the main routes into Catterick which will form an outer cordon.

4.2.2 SURVEY SCOPE

RSI surveys are to be undertaken at nine locations around Catterick, with inbound traffic towards Catterick. The surveys are to be conducted over a 12-hour period (07:00-19:00) on either a Tuesday, Wednesday or Thursday during the survey period noted in section 1.2.

The data will be collected by direct interviews at the roadside with drivers and not by self-completion questionnaires.

Concurrent two-way manual classified link counts (using video) are also required at each of the RSI sites on the survey day, for the same time period. In addition, two-way automatic traffic counts will also be required at the same locations for a three-week period (confirmed at a later date) thereafter. The requirements and the outputs for these ATC should be as per the specifications outlined in Chapter 2.

Data is to be collected for six vehicle types as follows:

- Pedal Cycle / Motorcycle
- Car
- LGV
- OGV1
- OGV2
- Buses and Coaches

Both the RSI and gatehouse surveys should be undertaken on the same day within the three week period covered by the ATC's as in section 1.2

4.2.3 LOCATIONS

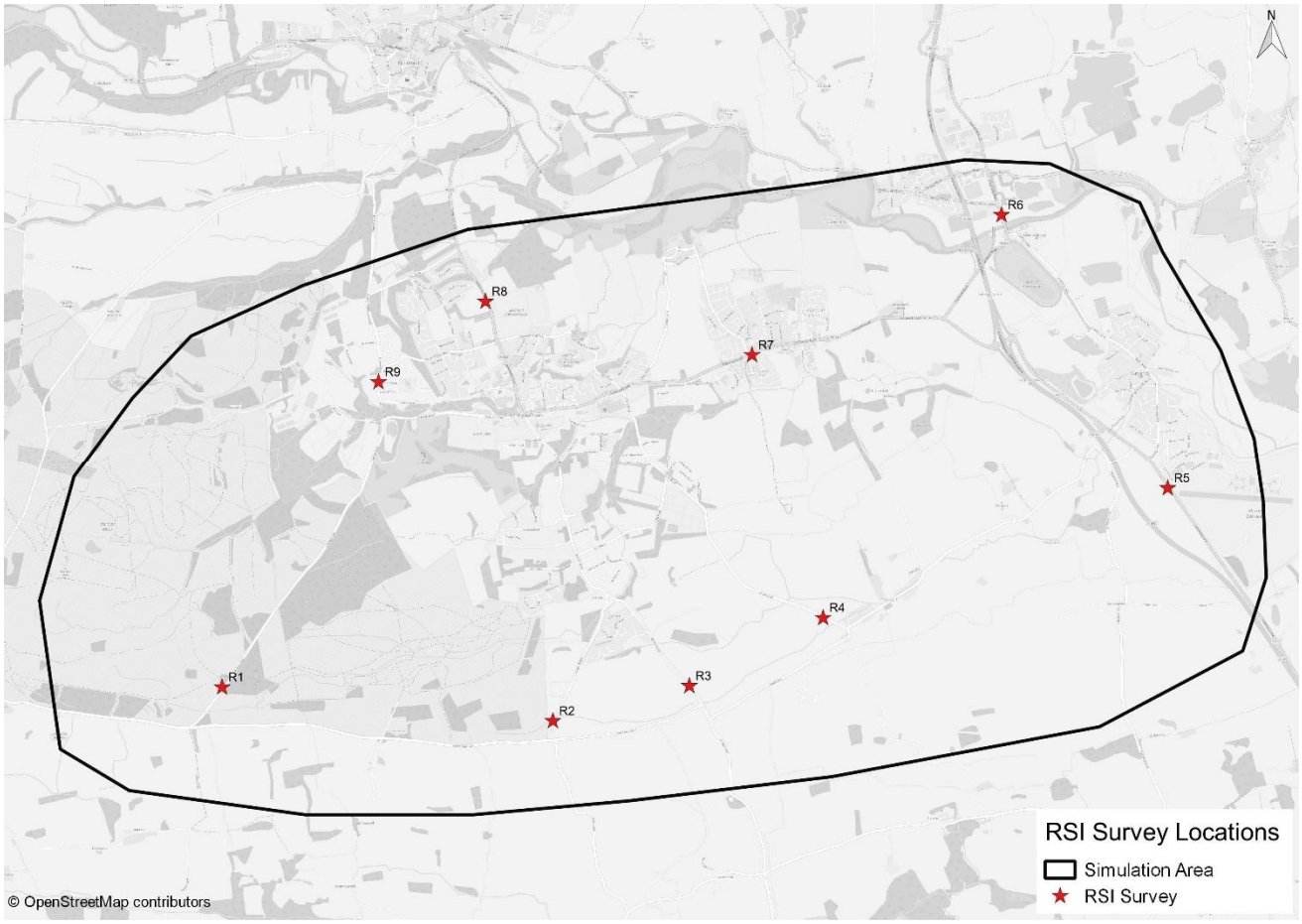
The approximate RSI locations are presented in Table 1 and displayed graphically in Figure 1. The successful survey contractor(s) once appointed will need to assess the suitability of each site, and agree on exact site locations with WSP and the police. Exact locations should be chosen to minimise health and safety risks and consideration should be given to sites which will enhance the accuracy of survey data.

Table 3 - RSI Locations

Site	Road	RSI Dir	ATC (2-way)	MCLC (2-way)
1	Range Road, north of Moor Lane junction	NB	ü	ü
2	Hunton Road, north of Hawkswell Lane junction	NB	ü	ü
3	Bedale Road, north of Hawkswell Lane junction	NB	ü	ü
4	James Lane, north of Moor Lane junction	NB	ü	ü
5	A6055 Leeming Lane, south of Leeming Lane junction	NB	ü	ü
6	A6055 Gatherley Road, south of Howe Hill Lane	SB	ü	ü
7	A6136 Catterick Road, west of A6055 Catterick Road junction	WB	ü	ü
8	A6136 Richmond Road, north of junction with Hipswell Road	SB	ü	ü
9	Plumer Road, north of Bagerbeck Road junction (in layby)	SB	ü	ü

Please note that the number and exact location of the RSI surveys is subject to approval from North Yorkshire Police (NYP).

Figure 3 - RSI Survey Locations



4.3 GATEHOUSE SURVEYS (GHS) SURVEYS

GHS's are similar to RSI surveys; the main difference being that these are proposed to be conducted off the highway at the access to the Garrison.

The surveys are to be conducted at 7 locations over a 12-hour period (07:00-19:00) on same day as the RSI surveys. The data will be collected by direct interviews at the roadside with drivers.

Concurrent manual classified turning counts (using video) will also be undertaken at each of the GHS sites on the survey day, for the same time period. In addition, two-way automatic traffic counts will also be collected at the same locations for the three-week period.

Please note that the interview forms for the RSI and GH surveys will be separate and the questions will vary between both the forms.

Figure 2 indicates the potential locations of the GHS's listed in Table 2.

Figure 4 - Gatehouse Survey Locations

Table 4 - Gatehouse Survey Locations

Site	Road	GHS Dir	ATC (2-way)	MCLC (2-way)
1	Horne Road, entrance to Somme Barracks	Inbound	ü	ü
2	Scotton Road, Helles Barracks	Inbound	ü	ü
3	Scotton Road, Vimy Barracks	Inbound	ü	ü
4	Leyburn Road, entrance to Paive Line access (Catterick Garrison)	Inbound	ü	ü
5	Hipswell Road East, Gaza Barracks	Inbound	ü	ü
6	Ava Road, entrance to Munster Barracks	Inbound	ü	ü
7	Leeming Lane, Marne Barracks	Inbound	ü	ü

4.4 REQUIREMENTS FOR BOTH RSI AND GH SURVEYS

The survey contractor will be required to:

a.) Liaise with the Police, WSP and NYCC to finalise the RSI survey arrangements, timetable and resources, as required;

b.) Liaise with the MOD, WSP and NYCC to finalise the GH survey arrangements, timetable and resources, as required;

c.) Provide a detailed site layout plan and risk assessment for each RSI and GH site and agree the site layout and survey arrangements with the police and MOD respectively;

d.) Agree the design of the interview form for both RSI and GH with WSP and MOD (for GH survey). The contractor will also be responsible for the printing of the forms (if applicable);

e.) Provide all signage and equipment required;

f.) Undertake the survey with appropriately trained and supervised staff, with special instructions given to staff on collecting the O/D postcodes;

g.) Monitor and record the sample rates at ½ hourly intervals throughout the survey with the aim of securing a minimum sample rate of 20% of all vehicle types in all time periods. We have noted a minimum sample rate of 20% is to be achieved, however, from previous experience we have added a margin to take into account the non-valid return forms and therefore request an estimate of return forms of 30% to achieve the minimum sample rate;

h.) Maintain a survey diary to record any incidents that may have disrupted normal travel patterns or the conduct of the survey itself, including any amendments to the layout or operation of the RSI and GH sites;

i.) Each RSI and GH interview record should have a unique serial number;

j.) Undertake the ATC's to provide directional traffic flows classified into Car, Light and Heavy (rigid/articulated) vehicle types;

k.) Monitor equipment at reasonable intervals (please define) during the survey period to ensure that the ATC remains operational; and

l.) Download ATC data on a weekly basis to ensure that no data is lost.

4.5 OUTPUT DATA

4.5.1 RSI AND GH SURVEYS

Once the raw data has been input, range and logic checks as agreed with WSP should be undertaken by the contractor. The addresses should then be completed (adding postcodes where available) by the survey contractor where partial addresses have been provided.

The output data from the interviews should be provided in 15 minute intervals in MS Excel. The output data should be provided in a database format giving the following information:

- Unique Interview Serial Number;
- Site (location and road name/ number);
- Direction;
- Date;
- Recorded Time (15 minute intervals);
- Vehicle Type;
- Number of people in the vehicle;
- Trip Purpose;
- Origin Address of the journey (including postcode);
- Destination Addresses of the journey (multiple fields with full postcode);
- OSGR of origin and destination of the trips.

4.5.2 ATC

Once the data has been recorded, logic checks should be undertaken by the contractor. The recorded data should then be analysed per direction for each site, by Car, Light and Heavy vehicles and be provided in 15 minute intervals.

The ATC data should be provided in a database format in MS Excel, including plans of the site locations, OSRG of the site locations, and a photograph of the site setup to demonstrate that the site has been set up in a manner that will minimise inaccuracies.

4.5.3 MCC

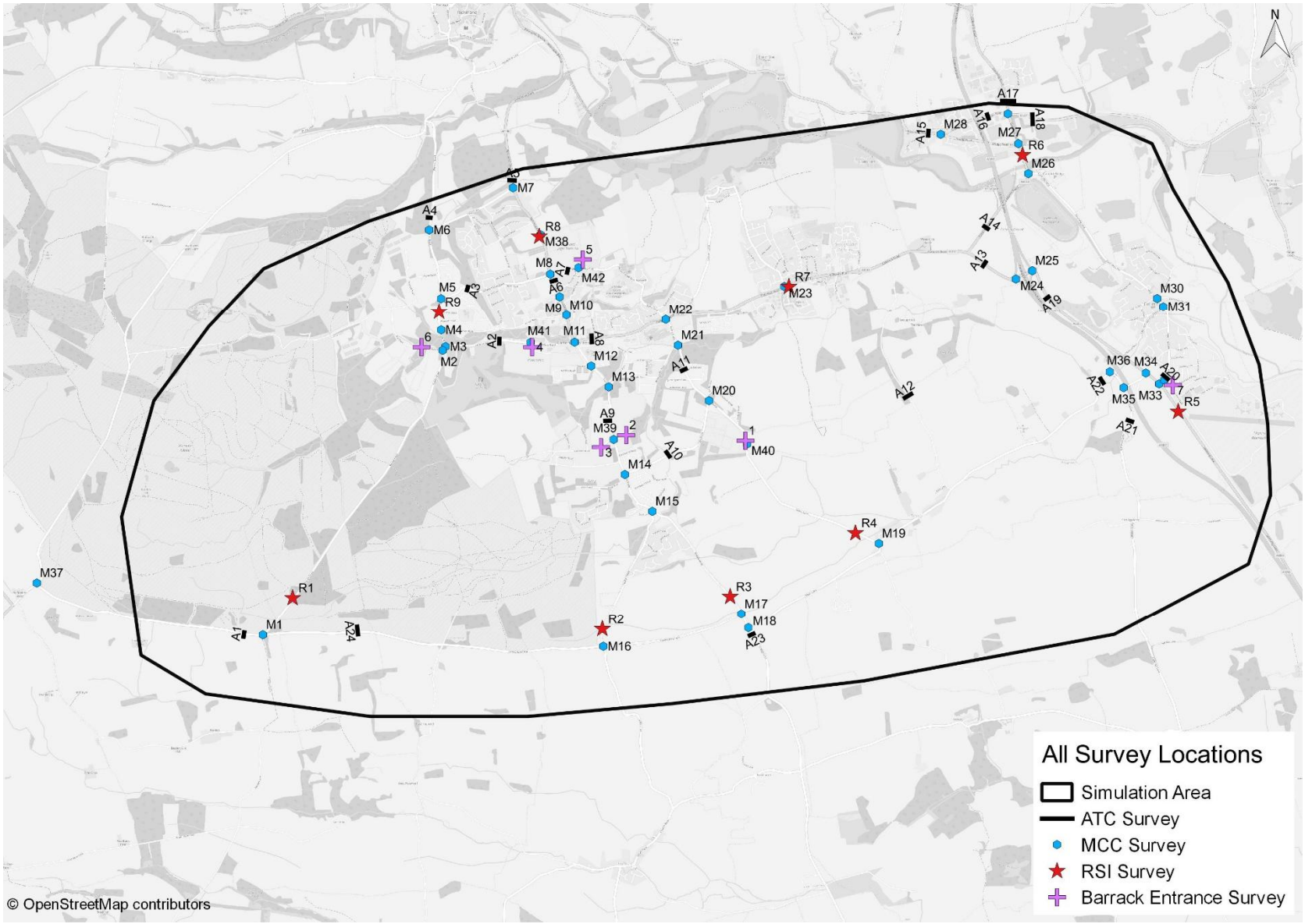
Video recordings of the MCC sites should also be provided on memory stick media and the provision of this should be included in the price.

Once the raw data has been input, range and logic checks should be undertaken by the contractor. The data should then be analysed per direction for each site, by the six vehicle classifications specified in Section 2.2.

The MCC data should be provided in a database format in MS Excel, including diagrams showing the layout of the junctions and should be provided in 15 minute intervals. OSRG of the site locations should also be provided.

Appendix A

APPENDIX A - SURVEY LOCATIONS


N
All Survey Locations
Simulation Area
ATC Survey
MCC Survey
RSI Survey
Barrack Entrance Survey
© OpenStreetMap contributors

Appendix B

ATC SITES AVERAGE TRAFFIC FLOWS

Average Weekday 2-way traffic flow at ATC sites

	Site 1 Ave W'day	Site 2 Ave W'day	Site 3 Ave W'day	Site 4 Ave W'day	Site 5 Ave W'day	Site 6 Ave W'day	Site 7 Ave W'day	Site 8 Ave W'day	Site 9 Ave W'day	Site 10 Ave W'day	Site 11 Ave W'day	Site 12 Ave W'day
00:00	4	15	2	1	18	20	6	38	8	2	6	0
01:00	2	8	0	0	10	13	4	20	4	0	2	0
02:00	1	5	0	0	6	8	2	15	7	1	2	0
03:00	4	7	0	0	6	7	1	15	3	1	2	0
04:00	20	23	2	0	17	17	4	37	19	8	10	0
05:00	54	65	6	4	56	53	18	119	53	20	21	0
06:00	126	212	33	13	168	166	94	329	136	67	75	4
07:00	249	491	119	33	461	484	331	871	456	129	239	9
08:00	283	478	174	46	643	749	484	961	592	149	294	11
09:00	275	404	97	41	560	677	300	896	432	113	216	10
10:00	281	395	84	37	548	656	252	863	396	103	184	9
11:00	284	407	101	44	576	702	258	911	445	107	197	8
12:00	293	452	113	50	579	786	315	1037	510	115	205	9
13:00	301	448	111	49	577	739	300	967	455	112	219	8
14:00	302	403	114	47	609	737	316	957	430	116	189	9
15:00	320	438	151	54	686	838	406	1033	538	142	243	13
16:00	353	458	110	59	706	816	379	1149	618	147	243	14
17:00	304	390	108	55	666	794	362	1116	593	131	277	13
18:00	208	274	74	42	494	607	242	891	359	92	198	12
19:00	130	163	49	29	354	439	161	623	254	60	125	6
20:00	85	106	27	16	233	276	101	397	151	35	74	2
21:00	63	80	17	11	149	171	59	261	109	28	51	1
22:00	37	53	12	8	92	109	36	186	69	14	33	0
23:00	16	30	5	5	47	51	19	84	20	6	14	0
Total	**3993**	**5804**	**1511**	**644**	**8259**	**9912**	**4450**	**13776**	**6651**	**1698**	**3119**	**139**
07:00-19:00	3453	5038	1357	556	7104	8583	3944	11653	5821	1456	2703	126
06:00-22:00	3857	5599	1483	626	8008	9635	4359	13262	6469	1646	3030	139
06:00-24:00	3909	5682	1500	639	8147	9795	4414	13532	6558	1666	3077	139
00:00-24:00	3993	5804	1511	644	8259	9912	4450	13776	6651	1698	3119	139

	Site 13 Ave W'day	Site 14 Ave W'day	Site 15 Ave W'day	Site 16 Ave W'day	Site 17 Ave W'day	Site 18 Ave W'day	Site 19 Ave W'day	Site 20 Ave W'day	Site 21 Ave W'day	Site 22 Ave W'day	Site 23 Ave W'day	Site 24 Ave W'day	Site 25 Ave W'day
00:00	47	20	7	2	13	5	9	9	1	1	3	0	43
01:00	31	9	4	1	5	3	7	6	1	1	1	0	32
02:00	26	7	3	1	5	4	5	5	1	0	1	0	16
03:00	45	17	6	2	12	8	9	10	2	1	1	0	22
04:00	119	50	20	7	38	21	17	25	3	2	6	2	67
05:00	273	142	59	28	103	85	53	60	10	8	22	12	199
06:00	700	337	198	99	208	259	191	222	39	41	75	30	562
07:00	1227	556	488	274	344	503	421	469	71	181	180	77	1270
08:00	1095	620	679	403	434	563	403	437	86	233	212	80	1314
09:00	838	491	447	281	341	437	311	314	56	129	183	60	975
10:00	753	477	406	262	325	422	293	280	51	98	174	56	867
11:00	767	477	423	274	329	413	298	293	54	101	172	53	907
12:00	805	498	433	276	352	431	315	320	58	103	178	60	964
13:00	844	519	439	276	330	446	325	341	61	104	184	59	974
14:00	893	570	493	312	388	474	341	355	61	115	197	68	1052
15:00	1049	646	584	367	432	552	391	413	82	139	225	79	1247
16:00	1217	675	613	374	425	585	449	446	77	188	225	90	1404
17:00	1159	605	574	343	373	542	426	435	74	184	213	72	1485
18:00	693	388	326	189	213	300	272	290	46	78	127	45	978
19:00	434	238	195	113	128	180	173	177	26	45	78	26	633
20:00	311	177	121	69	100	123	97	106	15	24	52	15	385
21:00	251	173	89	48	117	83	71	77	11	16	37	14	278
22:00	175	113	48	28	68	51	46	46	7	12	23	8	209
23:00	96	55	19	10	34	20	24	23	2	4	7	3	115
Total	**13849**	**7860**	**6672**	**4040**	**5115**	**6510**	**4948**	**5159**	**893**	**1809**	**2575**	**910**	**15998**
07:00-19:00	11341	6522	5904	3631	4285	5669	4245	4393	776	1653	2269	799	13437
06:00-22:00	13036	7447	6507	3961	4837	6314	4777	4974	866	1779	2511	884	15295
06:00-24:00	13308	7615	6574	3998	4938	6385	4847	5044	875	1795	2541	895	15619
00:00-24:00	13849	7860	6672	4040	5115	6510	4948	5159	893	1809	2575	910	15998

Privacy Notice

Highways and Transportation Consultation

North Yorkshire County Council

This Privacy Notice is designed to help you understand how and why the County Council processes your personal data in relation to this Traffic Survey Consultation. This notice should be read in conjunction with the Council's Corporate Privacy Notice.

Who are we?

North Yorkshire County Council is a 'Data Controller' as defined by Article 4(7) of the General Data Protection Regulation (GDPR).

The Council has appointed **Veritau Ltd** to be its Data Protection Officer. Their contact details are:

Data Protection Officer
Veritau Ltd
County Hall
Racecourse Lane
Northallerton
DL7 8AL
infogov@northyorks.gov.uk / 01609 53 2526

What personal information do we collect?

As part of this consultation we collect and process your:

- Address (travelling to and from)
- Reason for travel
- Reason for being at a location

Why do we collect your personal information?

The traffic consultation is specifically concerned with examining travel patterns of people in and around Catterick. The collection of the above information will allow us to develop a Transport Model which will be used to plan and hopefully improve future transport requirements in the area.

Who do we share this information with?

Only the Council's communications unit, network strategy and the Council's appointed consultants will have routine access to this data. The Council uses consultants (WSP - https://www.wsp.com/en-GL/legal/privacy-policy) to analyse the data that you provide to us.

Consultation feedback could be disclosed if North Yorkshire County receives a Freedom of information request, however the responses would be anonymised before release, so no personal information will be disclosed.

How long do we keep your information for?

Data held	Retention period
• Address (travelling to and from) • Reason for Travel • reason for location	**Will be retained for the length of the consultation and until the proposed transport model is completed** **Information provided through snap survey will be retained for six months after the consultation concludes.**
Anonymised aggregated data	**Will be retained for historical analysis**

What is our lawful basis for processing your information?

Our lawful basis for processing this information is as part of our public task

For More information about how the County Council uses your data, including your privacy rights and the complaints process, please see our Corporate Privacy Notice.

Three White Rose Office Park
Millshaw Park Lane
Leeds
LS11 0DL

wsp.com