A1 Birtley to Coal House

Scheme Number: TR010031

7.3 Transport Assessment Report

APFP Regulation 5(2)(q)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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A1 Birtley to Coal House

Development Consent Order 20[ ]

TRANSPORT ASSESSMENT REPORT

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1 INTRODUCTION

1.1 Purpose of this Document

1.1.1 This Transport Assessment Report (this “TAR”) relates to an application made by Highways England (the “Applicant”) to the Secretary of State under the Planning Act 2008 (the “2008 Act”) for a Development Consent Order (DCO). If made, the DCO would grant consent for the Applicant to undertake the A1 Birtley to Coal House (the “Scheme”). A detailed description of the Scheme can be found in **Chapter 2** of the Environmental Statement (**Application Document Reference: TR010031/APP/6.1**).

1.1.2 This TAR comprises part of a suite of application documents and is included in compliance with Regulation 5(2)(q) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009:

(q) any other documents considered necessary to support the application

1.1.3 The purpose of this TAR is to provide information about the transport assessment undertaken as part of the development of the Scheme. In line with guidance published by the Department for Transport (2007)[1], the TAR provides an assessment of the likely transport impacts resulting from the Scheme.

1.2 Existing Situation

1.2.1 As set out in Chapter 3 of this TAR, the existing network in this location suffers from congestion with a detrimental effect upon the performance of the network. This affects both the A1 itself, but also other elements of the highway network.

1.2.2 The A1 is a crucial section of the Strategic Road Network (SRN), and the Newcastle-Gateshead Western Bypass (NGWB) currently has some of the most congested links on the north-east road network[2].

1.2.3 The existing layout currently comprises a dual two lane all-purpose (D2AP) carriageway and, on some sections of the route, a three lane carriageway, as well as climbing lanes to the south of Smithy Lane Overbridge.

[1] Guidance on Transport Assessment (Department for Transport and Communities and Local

1.2.4 In 2016, the section of the A1 (and NGWB) between junction 71 (Metro Centre) and junction 67 (Coal House) was improved to increase capacity and improve journey time reliability on this key section of the SRN. However, the improvements between junction 71 (Metro Centre) and junction 67 (Coal House) do not address issues of congestion on the mainline A1 at junction 65 (Birtley) and junction 67 (Coal House). These issues have been highlighted within the Highways England London to Scotland East Route Strategy Report (2017).[3]

1.2.5 Based on the Road Traffic Forecasts (DfT, 2018), traffic in the North East is forecast to grow in the future. This is largely driven by projected growth in population levels and changes in vehicle running costs (DfT, 2018). Additionally, allocations brought forward as part of the Core Strategy and Urban Core Plan for Gateshead and Newcastle Upon Tyne 2010-2030 impacts upon the level of traffic growth experienced. This additional traffic demand will further exacerbate issues associated with journey time reliability and vehicle speeds on the A1.

1.3 Local Transport Policy

1.3.1 In order to inform the preparation of this TAR, the following local policy/advice notes have been considered. In line with best practice set out in DfT guidance, the local policy documents are reviewed in order to contextualise the Scheme in relation to existing policy documentation, ensuring that there is a strategic case locally for the proposed development:

Local Policy and Advice Notes

- Tyne and Wear Local Transport Plan 3
- Gateshead Local Plan 3
- Planning for the Future – Core Strategy and Urban Core Plan for Gateshead and Newcastle Upon Tyne 2010-2030
- Gateshead Unitary Development Plan (UDP) 2007 – Remaining Saved Policies
- Making Spaces for Growing Places – Submission Draft 2018

[2] A1 Newcastle-Gateshead Western Bypass – Feasibility Summary Study (DfT, 2015)

[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/600317/London_to_Scotland_East_Final.pdf

- Gateshead Placemaking Supplementary Planning Document 2012
- Sunderland Core Strategy and Development Plan 2015-2033

1.4 Report Structure

1.4.1 The following sections of this TAR comprise:

- **Chapter 2 – Baseline Data and Model Development** – this section provides details of the baseline data collection and development of the traffic model. This outlines the scenarios applied in the assessment of the Scheme within the traffic model, whilst summarising future year growth scenarios and committed development trips in the context of the Scheme.
- **Chapter 3 – Current Network Performance** – this section summarises the current performance of the transport network between junction 65 (Birtley) and junction 67 (Coal House) that would occur as a result of without the Scheme (Do Minimum) and the likely impact that would occur with the implementation of the Scheme (Do Something).
- **Chapter 4 – Future Network Performance** – this section outlines the likely traffic flow and journey time impacts that would occur in the result of a Do Minimum scenario, in which no improvements are implemented, and the likely impacts that would occur with the implementation of the Scheme.
- **Chapter 5 – Road Safety** – this section summarises the existing safety record along the extent of road network within the study area. Additionally, forecasts of the impact upon accidents with the implementation of the Scheme are presented.
- **Chapter 6 – Walking, Cycling and Horse riding (WCHs)** – this section provides the details of existing WCHs facilities within the vicinity of the proposed Scheme. Furthermore, an assessment of the likely impacts that would occur as a result of the Scheme are summarised.
- **Chapter 7 – Summary and Conclusion** – this section provides a summary of the assessment of transport issues that have been discussed within the TAR.
- **Glossary**

2 Baseline Data and Development of Model

2.1 Introduction

2.1.1 This chapter provides the details of baseline data collection and development of the model which includes:

- Model development process;
- Forecast years and scenario;
- Local and national growth assumptions; and
- Local development.

2.1.2 The overall impact of the Scheme and the resulting traffic flows and journey times has been derived from the Northern Regional Transport Model (NRTM) – this is one of a package of Regional Transport Models (RTM) developed by Highways England for the purpose of interurban analysis.

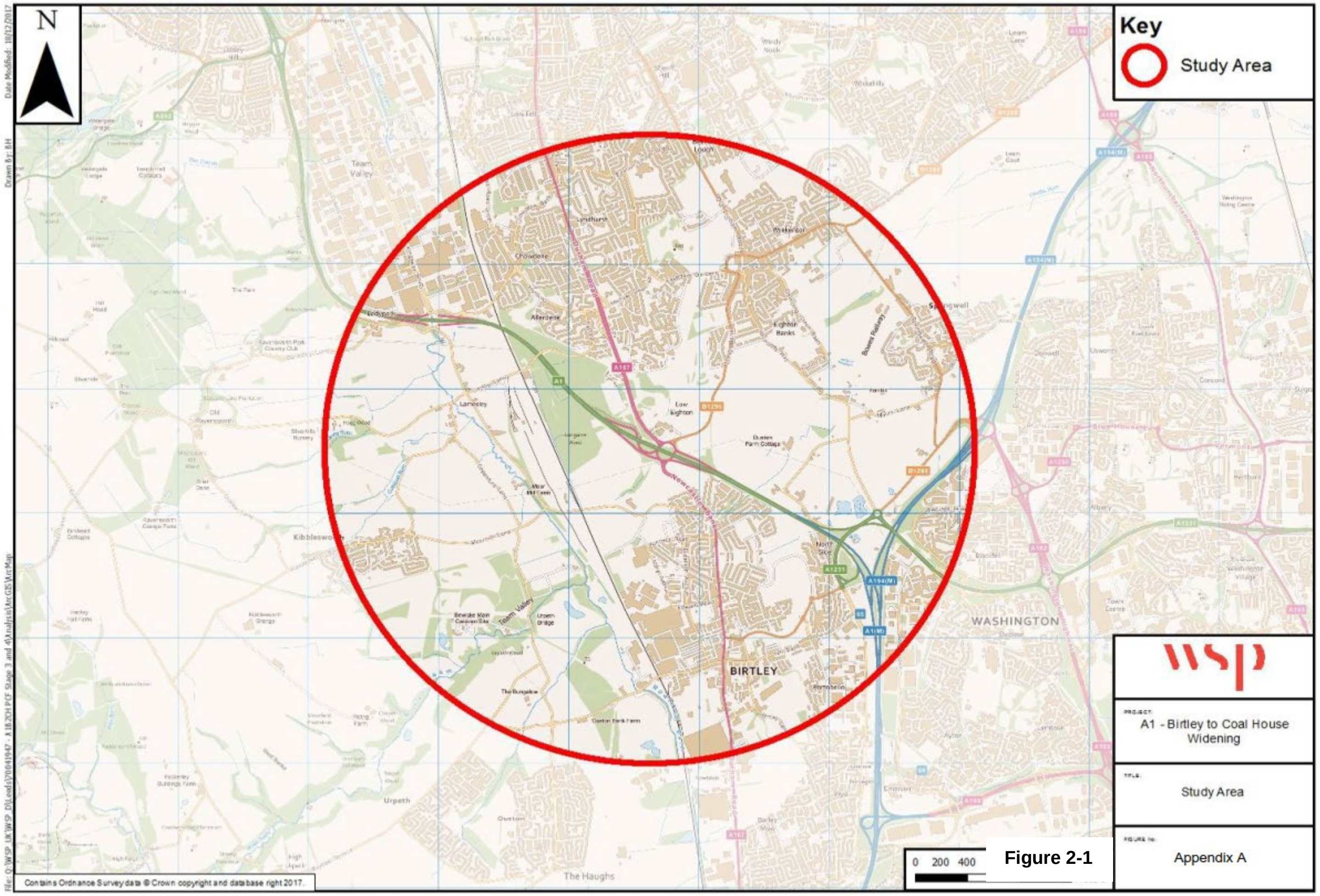
2.1.3 A detailed NRTM document containing the method and outputs of how the baseline data was collected is included within **Appendix A** of this TAR.

2.2 Study Area

2.2.1 The study area, which encompasses the Scheme Footprint, is located in Gateshead, and includes the assessment area over the A1 between junction 65 (Birtley) and junction 67 (Coal House). The extent of the study area is shown in **Figure 2-1** below. The study area for the Scheme was developed as part of the DfT Road Investment Strategy, which identified the NGWB. The NGWB improvements includes two schemes, namely:

- This Scheme (A1-BCH), junction 65 – junction 67
- A1 Scotswood to North Brunton Improvement scheme (A1-SNB), junction 74 – junction 79

Figure 2-1 - A1 - Birtley to Coal House Widening Study Area



2.2.2 The area is coded within the NRTM to a high level of detail to include minor roads with all junction details, such as signal timings and lane capacity. This is important in order to carry out an accurate assessment of the Scheme impacts on the strategic road network. All key minor and major roads are modelled. Key roads are considered to be those that strategically link existing and proposed areas of housing and employment.

2.3 Baseline Data Collection

2.3.1 Model development involves an exercise of extensive traffic data collection, gathering and modelling.

2.3.2 For the development of the Scheme traffic model, a large volume of data was collected through primary traffic surveys sourced from the Highways England WebTRIS database and the local TADU[4] database.

2.3.3 Secondary data collection included mobile phone trip matrix data from Telefonica (O2) UK. Origin-destination and journey time data from Trafficmaster Ltd. As part of the Preliminary Design stage, a number of technical notes (BTN) have been produced, outlining methods, data and results from the modelling an appraisal tasks undertaken. BTN 20 provides a record of the Traffic Master data collected for the period of March to June 2017. The BTN 20 report provided in **Appendix G** of this TAR.

2.4 Traffic Count Data

2.4.1 Volumetric and classified data has primarily been sourced from the Highways England WebTRIS database and the local TADU database[5].

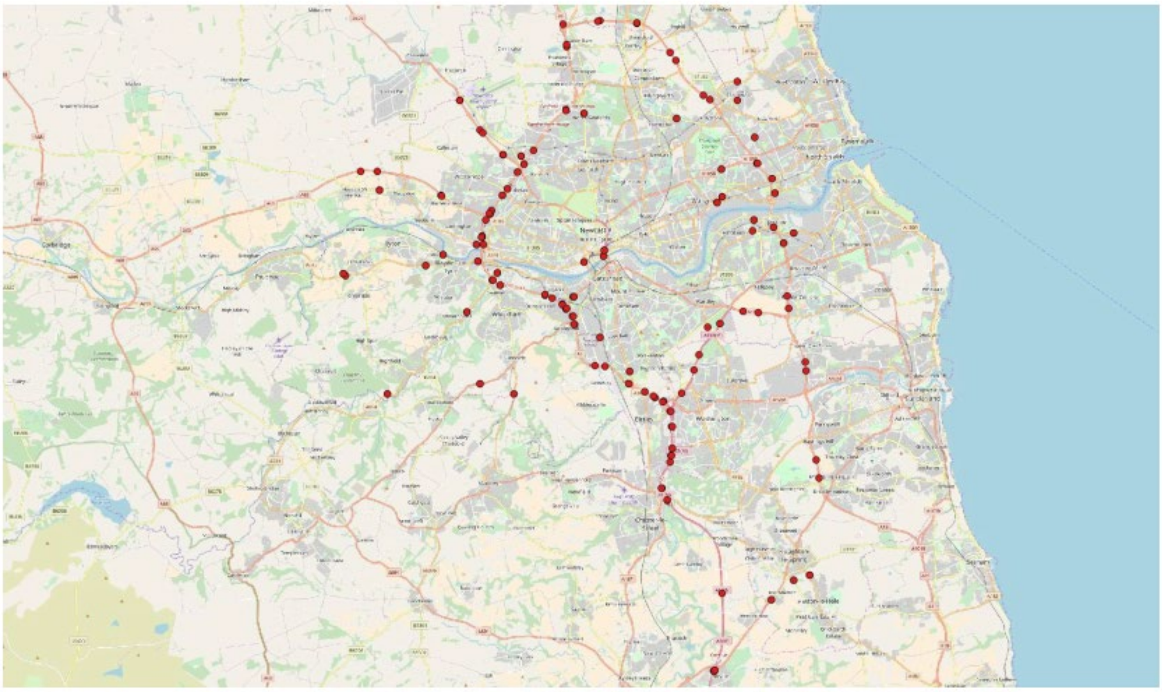
2.4.2 **Figure 2-2** shows the location of counts. Most are located on links with counts previously used for the validation of the NRTM, but there are also 19 WebTRIS sites on links not used in the NRTM validation, mainly on the A1. As the existing NRTM was designed by Highways England for the purpose of interurban trips across the north, additional counts allowed for the model to better represent the intraurban impact of the Scheme based on the study area outlined in **Figure 2-1.** The additional counts added as part of the validation process therefore ensure increased accuracy in the traffic modelling process of the Scheme.

2.4.3 A summary of traffic count sources is presented in **Table 2-1** below. The locations are also illustrated in **Figure 2-2** below.

Table 2-1 - Summary: Traffic Count Sources

Type	No. of Links
WebTRIS, on links counted in NRTM	79
WebTRIS, on links not counted in NRTM	19
TADU, with classification	25
TADU, without classification	51

Figure 2-2 - Traffic Count Locations



[4] The Tyne and Wear Road Traffic and Accident Data Unit (TADU)

[5] http://www2.gateshead.gov.uk/TADU/home.aspx

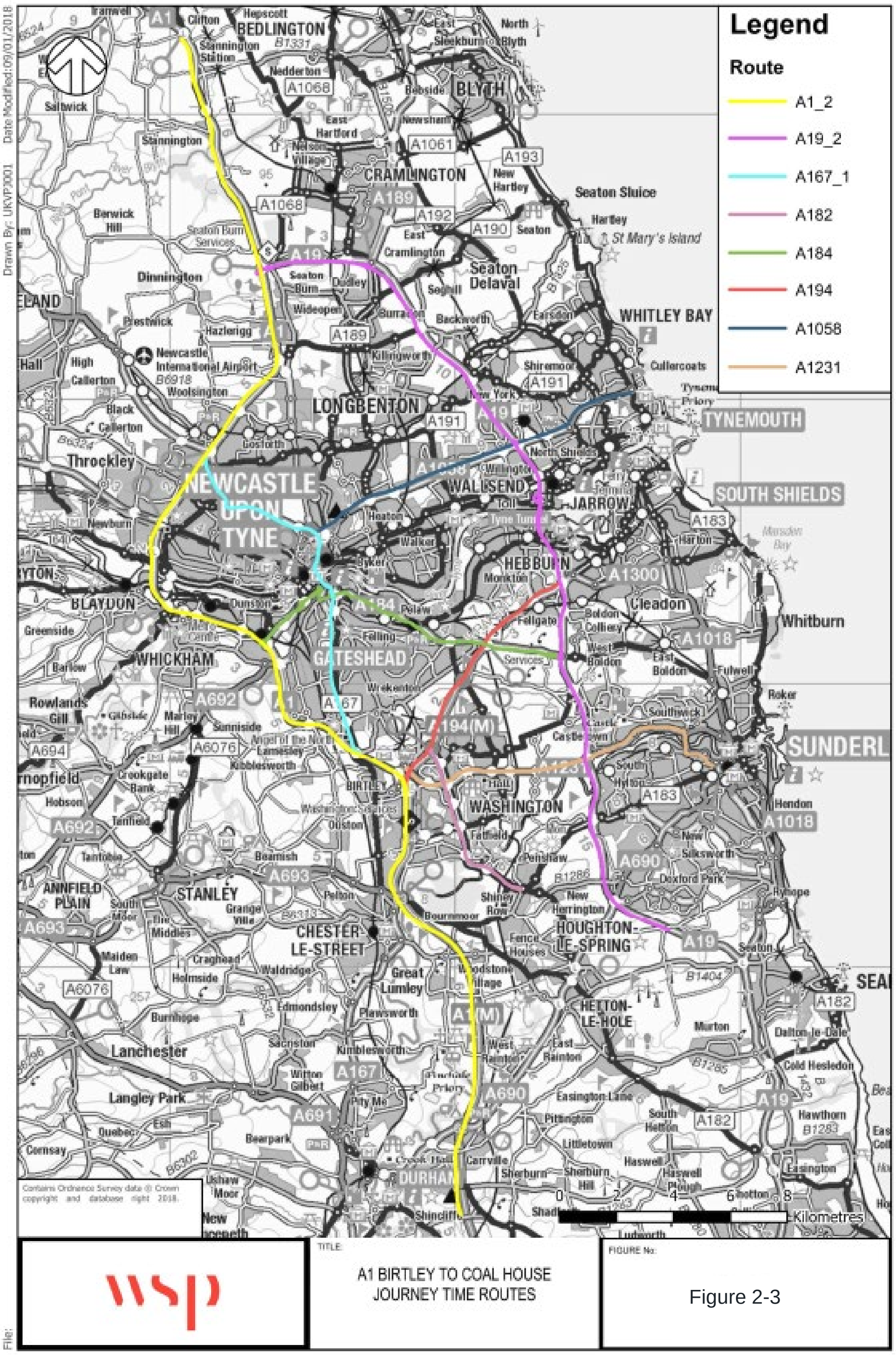
2.4.4 Hourly flows were derived from Spring 2017 for up to 43 neutral days (Monday to Thursday) of data – WebTAG (online Transport Appraisal Guidance) Unit M1.2 specifies that neutral days are those that avoid main and local holiday periods, school holidays and half terms, and any other periods of abnormal traffic (see paragraph 3.3.6 of TAG Unit M1.2). Only data from full days of consistent observations were used. Counts were checked for internal consistency by comparing with counts prepared for annualisation (TN11), and counts previously used in NRTM. Overall, the final dataset included as part of the validation process comprised traffic counts on 174 links within the study area.

2.5 Journey Time Data

2.5.1 In order to provide journey time data for validation of the model, a request was made to the Department for Transport for relevant data from Traffic Master. This provides individual journey time information by 15-minute time period for each day and for each link within the Ordnance Survey's Integrated Transport Network (ITN) map layer. The Traffic Master based journey time routes are highlighted below in **Figure 2-3.**

2.5.2 In order to maintain consistency with the traffic flow information as described in **paragraph 2.4.4** above, the journey time data was requested for the neutral period of March to June 2017. The original data included weekends, bank holidays and school holiday periods. These days were cleaned from the data in order to provide data for Mondays to Fridays for school term time only.

Figure 2-3 - A1 Birtley to Coal House Journey Time Routes



2.6 Approach to Modelling

2.6.1 A modelling exercise has been undertaken to support the assessment and analysis of the traffic and economic impacts that would result from the implementation of the Scheme.

2.6.2 The primary purpose of the NRTM is to provide validity to the assessment of the likely impacts resulting from this Scheme. The NRTM was built with the key purposes to code in a scheme within the model in order to produce outputs which allow analysis of the Scheme's impact on a wide range of environmental and economic impacts.

2.6.3 The NRTM produced a validation report, which details the process of calibration and validation. To ensure the NRTM is fit for the purpose of the traffic assessment of the Scheme, the existing NRTM has been updated for the purpose of the study. This included validating the model against observed values for factors such as link length and route delay/speed. The validation process did not require matrix estimation, as 2017 observed data has been used to validate the model.

2.6.4 The time periods used within the NRTM represent a 2017 average hourly peak flow over the following time periods:

- AM average hour: 07:00 – 10:00;
- Interpeak average hour: 10:00 - 16:00; and
- PM average hour: 16:00 - 19:00.

2.6.5 Additionally, forecast years area represented as follows:

- Opening Year – 2023; and
- Design Year – 2038.

2.6.6 **T**he NRTM Model Validation Report can be found at **Appendix E** of this TAR.

2.7 NTEM and the National Transport Model

2.7.1 The model forecast is based on inputs from the National Trip End Model (NTEM) and National Transport Model. The TEMPRO software presents the output of the Department for Transport's (DfT) NTEM. The role of this model is to act as a nationally consistent benchmark, available for the distribution of growth in planning data and trip ends.

2.7.2 NTEM growth factors extracted from TEMPRO V7.2 for the Scheme are summarised in **Table 2-2** below.

Table 2-2 - TEMPRO Growth for A1B2CH

Year	AM	IP	PM
2023	8%	9%	8%
2038	21%	25%	22%
2051	33%	38%	34%

2.7.3 The growth factors outlined in the table above demonstrate the core growth scenario. In addition to this scenario within the model, the following scenarios have been tested to ensure a robust assessment:

- Optimistic (High TEMPRO growth); and
- Pessimistic (Low TEMPRO growth).

2.7.4 The growth factors in the above table represent traffic growth including cars, LGVs and HGVs. Traffic forecasts have been assessed for two scenarios: A Do Minimum (DM) and a Do Something (DS). The DM scenario includes all development categorised as Near Certain or More than Likely (following the DfT's Transport Appraisal Guidance, WebTAG unit M4, which is industry standard guidance for forecasting development trips), including the A1 Scotswood to North Brunton scheme. The DS modelling scenario comprises the traffic growth included within the DM scenario, but with the addition of the Scheme into the model network. This is for testing the impact of the Scheme based on future traffic conditions.

2.8 Uncertainty in Forecasting

2.8.1 As part of the modelling forecasting, a review of the proposed housing and employment developments within the study area was undertaken. Predicted levels of development included within the model are based on specific development assumptions of the following local authorities:

- Gateshead Council;
- Newcastle City Council;
- Northumberland County Council; and
- Durham County Council

2.8.2 During Options Identification stage of the Scheme, the above authorities were contacted in October 2015 in order to discuss and outline which planned developments were appropriate to be included within the model forecasting assumptions for the Scheme.

2.8.3 Sunderland is in close proximity to the Scheme. However, Sunderland City Council was not consulted as the model did not extend into Sunderland i.e. there was no network in Sunderland where developments could be directly added to the network.

2.8.4 As part of the uncertainty log created for the Scheme, alongside a review of the existing planning applications within the local authorities' areas, the following documents have been analysed:

- The Core Strategy and Urban Core Plan for Gateshead and Newcastle upon Tyne (2010-2030);
- Newcastle Draft Housing and Economic Land Availability Assessment (HELAA) (2017)
- Gateshead Strategic Housing Land Availability Assessment (SHLAA) (2017)
- Gateshead Employment Land Review (ELR)- Draft Report (2017)
- Northumberland Interactive Strategic Housing Land Availability Assessment (SHLAA)
- Gateshead and Newcastle Infrastructure Delivery Plan (February 2014), Update (February 2016);
- The Newcastle City Council Annual Monitoring Report (2015-2016);
- Gateshead Council Local Plan Annual Monitoring Report (2015-2016);
- Local Authorities masterplan and development framework documents.

2.8.5 All developments considered within the modelling process for the Scheme, and the documents from which they have been derived are presented within the 'Uncertainty Log'. This contains an assessment of the likelihood of any development within the policy documents to be constructed. Based upon guidance within TAG Unit M4, the uncertainty log is divided into four key categories:

- Near Certain;
- More than Likely;
- Reasonably Foreseeable; and
- Hypothetical.

2.8.6 The above categories are classified in **Table 2-3** below:

Table 2-3 - Uncertainty Log Classification

Near Certain	The outcome will happen or there is a high probability that it will happen	Intent announced by proponent to regulatory agencies. Approved development proposals. Schemes under construction
More Than Likely	The outcome is likely to happen but there is some uncertainty	Submission of planning or consent application imminent. DCO application.
Reasonably Foreseeable	The outcome may happen, but there is significant uncertainty	Identified within a development plan. Not directly associated with the transport strategy/scheme, but may occur if the Scheme is implemented. Development conditional upon the transport strategy/scheme proceeding. Or, a committed policy goal, subject to tests (e.g. of deliverability) whose outcomes are subject to significant uncertainty.
Hypothetical	There is considerable uncertainty whether the outcome will ever happen	Conjecture based upon currently available information. Discussed on a conceptual basis. One of a number of possible inputs in an initial consultation process. Or, a policy aspiration.

2.8.7 A complete breakdown of the developments considered within the modelling of the Scheme is included within **Appendix B**: Uncertainty Log of this TAR.

2.9 Highway Schemes

2.9.1 As well as the consideration of housing and employment development sites within a 2km buffer of the Scheme route, forecasting considers any proposed transport infrastructure schemes. A similar process has been taken in order to address the treatment of uncertainty within the model forecasting – the infrastructure schemes considered within the study are shown in **Table 2-4**. It is expected that all of the schemes, should be complete by 2030 should they be implemented.

Table 2-4 - Infrastructure Schemes Considered Within the Modelling

Near Certain	Blaydon roundabout
	Bensham Rd (A692) Bus Corridor [COMMITTED]
	Northern Access Corridor Phase 2 (Cowhill to Osborne Road)
	Northern Access Corridor Phase 3 (Osborne Road to Haddricks Mill)
	Junction improvements and Indicative Access Road A696 to A69
	A1 Leeming to Barton
	A19/A1058 Coast Road
	A19 Testo's Junction Alteration
	A19 Downhill Lane Junction Improvement
	A1 in Northumberland (A1 North of Ellingham, Morpeth to Felton and Alnwick to Ellingham)
	A1 Scotswood to North Brunton

	A1 Birtley to Coal House
	A19 Norton to Wynyard
More Than Likely	Dunston Hill (Watergate) park and ride
	Durham Road bus corridor
	Junction 4: A695 Scotswood Road / Scotswood Bridge
	Junction 11: Kingston Park Rd / A1
	Junction 31: B6324 Stamfordham Rd / Newbiggin Ln
	Junction 38: A69 Blucher Interchange
	Junction 39: West Rd / Silver Lonnen
	Junction 41: A167 Stamfordham Rd / Pooley Rd
	Junction 42: A167 Stamfordham Rd / Springfield Rd
	Junction 45: A167 Ponteland Rd / Springfield Rd
	Junction 49: B1318 Great North Rd / A1056 / Rotary Way
	Junction 16: Broadway / Kingston Park Rd
	Junction 22: Brunton Ln / Brunton Rd
	Junction 52: B6918 Ponteland Rd / Station Rd

	Junction 5: A695 Scotswood Rd / A1 slip
	Junction 9: A167 Stamfordham Rd / A1
	Junction 10: A167 Ponteland Rd / A1 / A696
	Junction 12: A1 North Brunton Interchange
Reasonably Foreseeable	A694 bus lane extension
	Eighton Lodge park and ride
	Lamesley roundabout
	Metro Green access improvements
	Haggs Lane/Greenford Lane signalisation
	A1 Coal House roundabout
	GTI - Great North Road - Speed limit proposals
	West Rd Bus Corridor

3 Current Network Performance

3.1 Introduction

3.1.1 This chapter provides an overview of the current network performance on the A1 between Birtley (junction 65) and Coal House (junction 67).

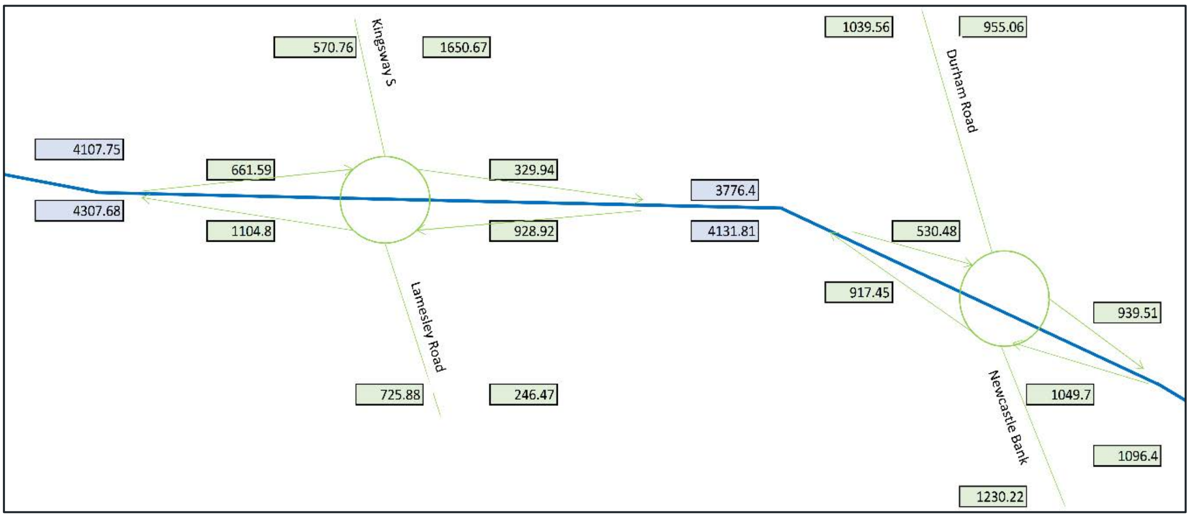
3.2 Existing Traffic Flows

3.2.1 Traffic flows have been derived from the NRTM. These trips, which are presented in the Passenger Car Units (PCUs), are summarised in the appropriate figures below.

A1 junction 66 (Eighton Lodge) and junction 67 (Coal House) Turning Counts and Annual Average Daily Traffic (AADT) Flows

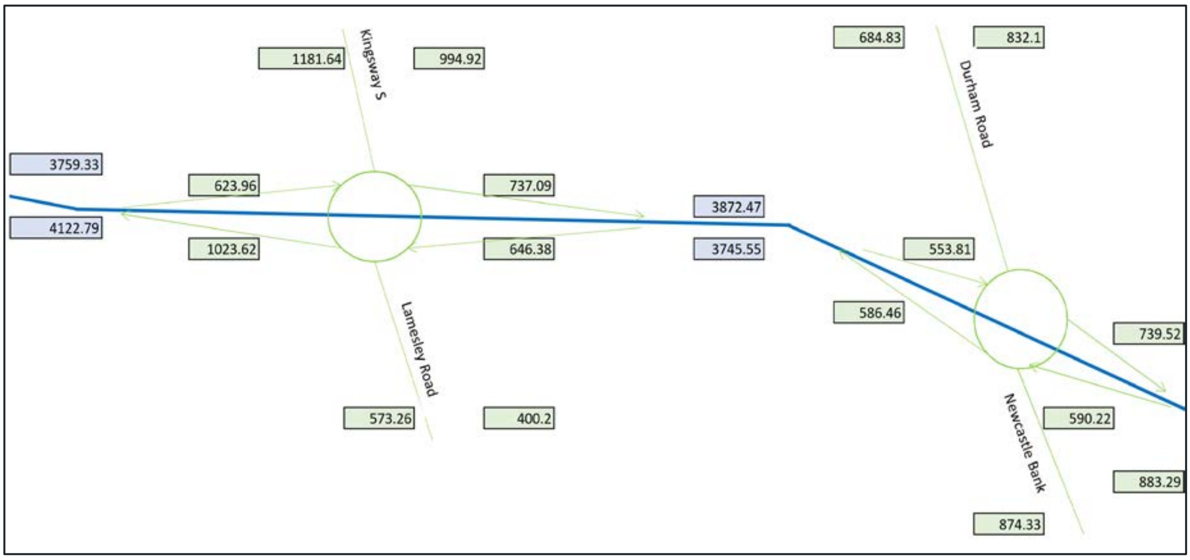
3.2.2 **Figure 3-1** below summarises the turning proportions for junction 66 and junction 67 during the AM peak period. The data shows that there is a considerable volume of traffic heading both northbound and southbound.

Figure 3-1 - Weekday Turning Proportions AM Peak for A1 junction 66 (Eighton Lodge) and junction 67 (Coal House) (08:00-09:00)



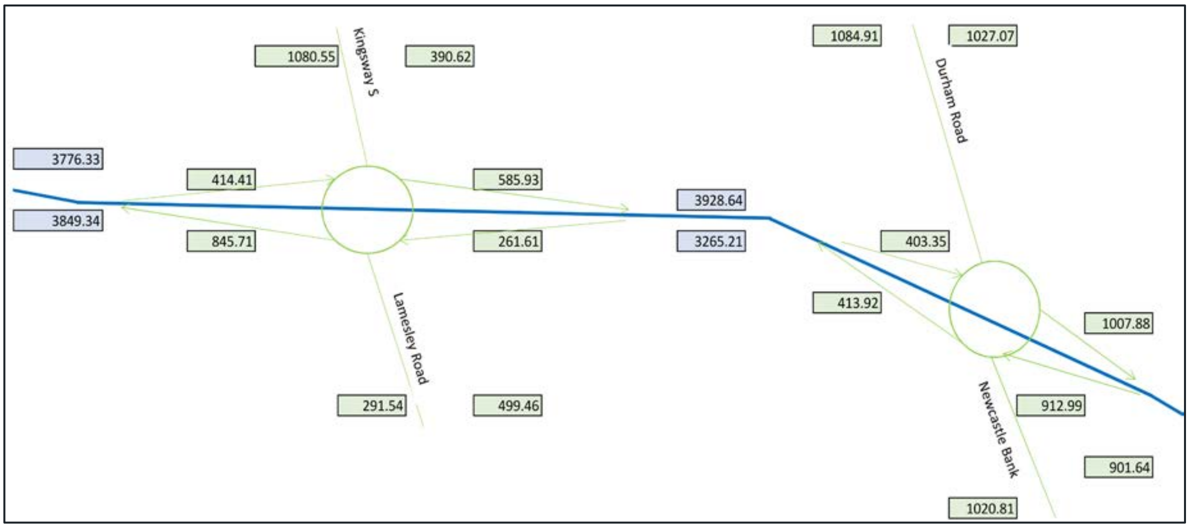
3.2.3 In the Interpeak period, there are considerably fewer vehicles on the network between junction 66 and junction 67. **Figure 3-2** below illustrates an overall reduction in vehicles. However, it is notable that there is a significant increase in the number of PCUs heading northbound via Kingsway South towards Team Valley Trading Estate (1182 PCUs in the inter peak compared to 571 PCUs in AM).

Figure 3-2 - Weekday Turning Proportions Interpeak for A1 junction 66 (Eighton Lodge) and junction 67 (Coal House) (Average hour 10:00-15:00)



3.2.4 During the PM weekday peak, between the A1 junction 66 and junction 67 there is a higher proportion of PCUs heading southbound via the A1 (3,929 PCUs heading southbound versus 3,265 heading northbound). **Figure 3-3** summarises the PM peak situation below which suggests that the traffic flows are tidal in nature, and that this is a key commuter route for people travelling to Newcastle city centre.

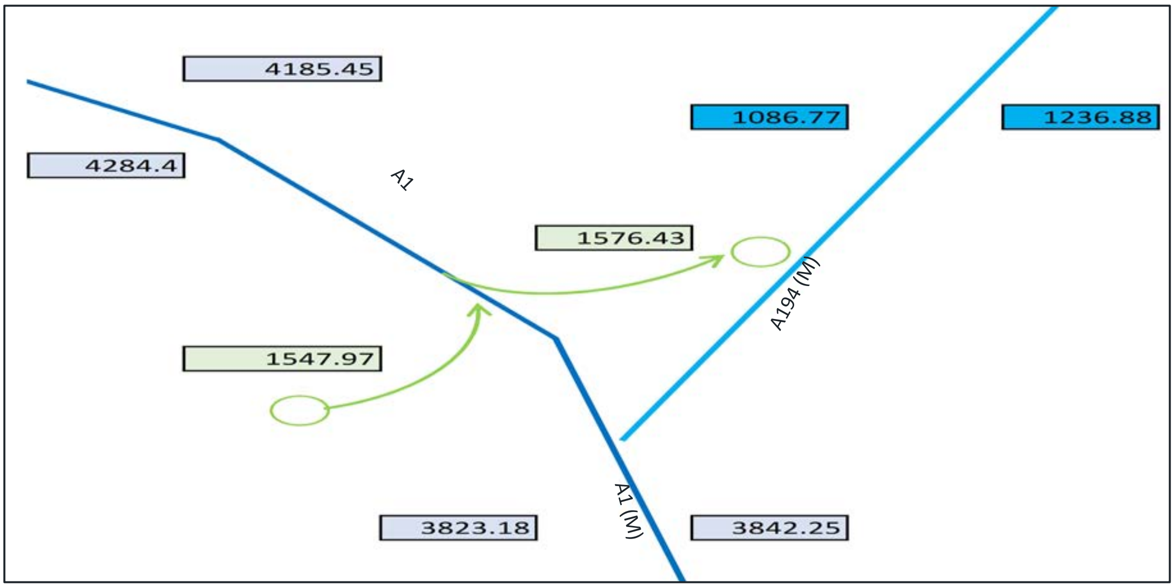
Figure 3-3 - Weekday Turning Proportions PM Peak for A1 junction 66 (Eighton Lodge) and junction 67 (Coal House) (17:00-18:00)



A1 junction 65 (Birtley) Turning Counts and AADT Flows

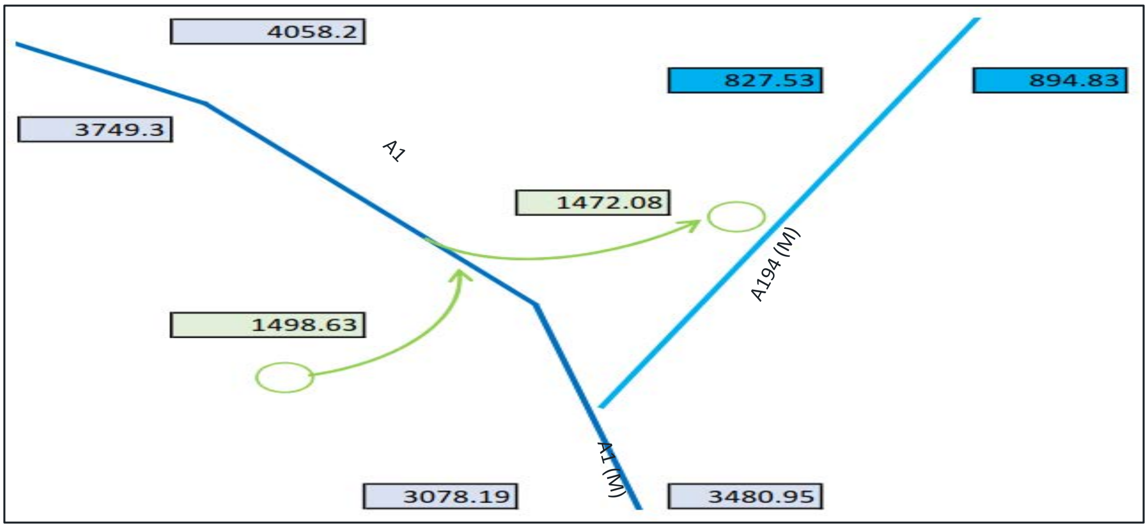
3.2.5 At the southernmost extent of the study area for the Scheme, the A1 merges and diverges with the A1231. **Figure 3-4** summarises the turning proportions during the AM peak period. The volume of PCUs merging and diverging is consistent from the A1 at junction 65. This may be attributable to the mix of residential and employment areas located nearby to this section of the road network.

Figure 3-4 - Weekday Turning Proportions AM Peak for A1 junction 65 (Birtley) (8:00-09:00)



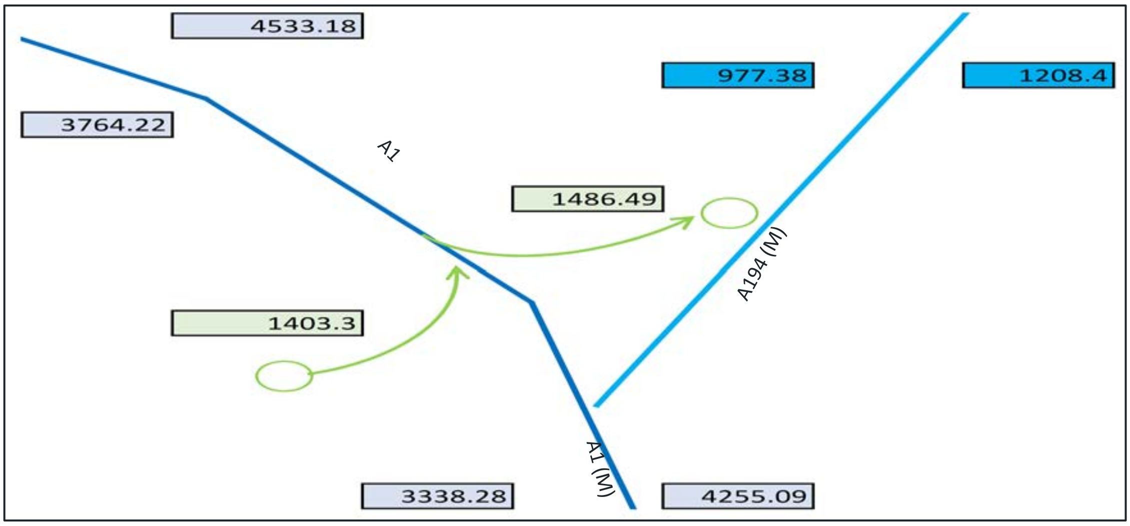
3.2.6 **Figure 3-5** demonstrates that although there is a significant reduction of around 500 PCUs travelling northbound, there is little variation in the number of PCUs heading northbound via the A1. During this period, there is also a reduction in the number of PCUs utilising the A194 (M) in both north-south directions.

Figure 3-5 - Weekday Turning Proportions Interpeak for A1 junction 65 (Birtley) (Average hour 10:00-15:00)



3.2.7 The PM peak experiences the largest number of PCUs travelling southbound via the A1. This is as a result of large volumes of traffic merging with the A1 at junction 66 heading southbound. **Figure 3-6** illustrates the PM Peak hour situation for A1 junction 65.

Figure 3-6 - Weekday Turning Proportions PM Peak for A1 junction 65 (Birtley) (17:00-18:00)



3.3 Congestion Indicators

3.3.1 In this section, the demands on, level of service and capacity offered by the A1 between junction 67 (Coal House) and junction 65 (Birtley) are investigated. The study utilises data received from the Highways England Yorkshire and North-East Performance Intelligence Unit, and data used to inform the A1 Newcastle Gateshead Western Bypass Options Selection Report (February 2015). The detailed report is provided in **Appendix C** of this TAR.

3.3.2 The congestion indicators analysed to gauge performance and level of service of the section between junction 67 and junction 65 are as follows;

- AADT
- Average Monthly Hourly Delay
- Percentage of Reduced Capacity Hours
- On-time Reliability Measure

AADT

3.3.3 The data visualised in **Figures 3-7** and **3-8** is annualised from data covering the period October 2009 to September 2011. The figures indicate that the section between junction 67 (Coal House) and junction 65 (Birtley) experiences significant congestion with two-way traffic flows exceeding the North of England (NW, NE, YandH) benchmark for Dual Links. It is noted that the benchmark includes 3-lane links, and that the A1 NGWB is largely comprised of 2-lane links. This illustrates the high level of demand experienced on certain sections of the network. Data obtained from Highways England network journey time and traffic flow data (WebTRIS) suggests that along the extent of the Scheme there was a similar flow level in 2018.

Figure 3-7 - AADT

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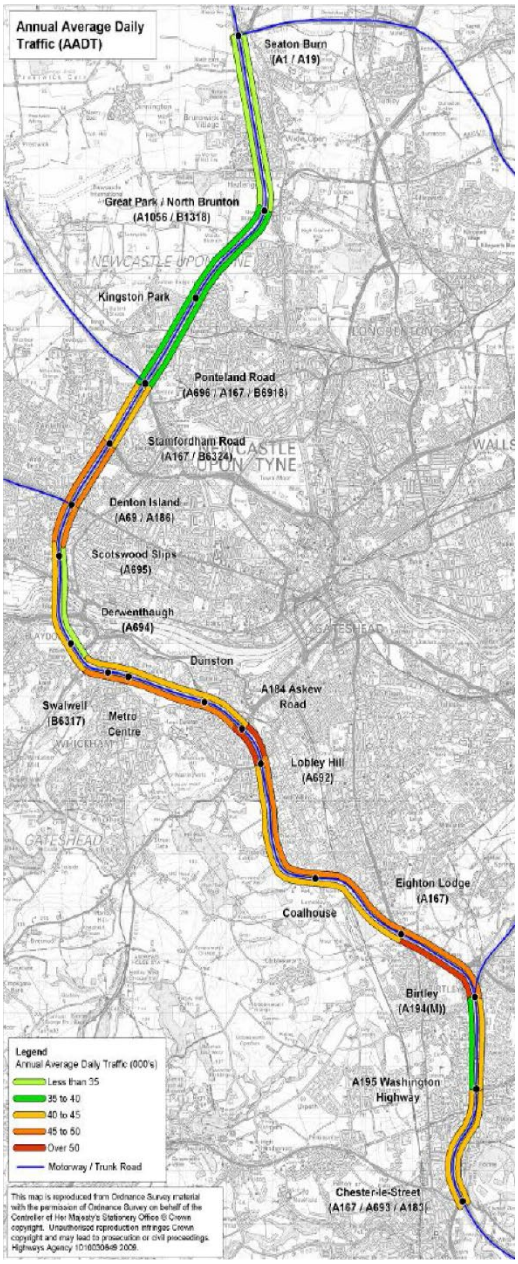
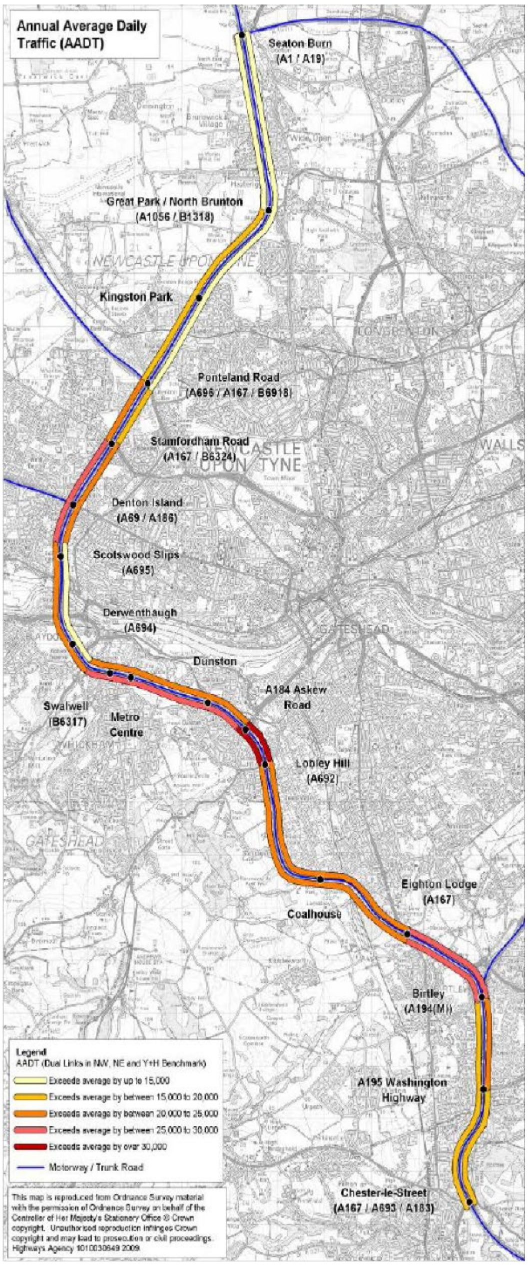


Figure 3-8 - AADT Compared to the North of England Benchmark



Average Monthly Vehicle Delay

3.3.4 The data in **Figure 3-9** summarises the annualised data from April 2017 to March 2018 showing seconds of delay per vehicle per mile. This shows that November is the worst month for delay, with April shown as having the least delay (this mirroring a typical profile of traffic through the months of the year). The southbound direction has a higher average delay compared to the northbound, with an average over the year of 16.7 seconds per vehicle per mile, compared to 15.5 seconds per vehicle per mile. When compared to the average figures for northern England, it is shown that delay is worse along the length of the Scheme in its current form. The average for northern England, in all directions, is 11.7 seconds per vehicle per mile.

Average Speed

3.3.5 **Figure 3-10** summarises the average speed in each direction along the A1, in miles per hour (mph) for the period April 2017 to March 2018. For most months, the northbound direction has a higher average speed than the southbound, and is higher over the course of the year. The average speed for the northbound direction is 50.2mph, compared to 50.0mph southbound which experience higher average delay compared to northbound. Following the same pattern as the seconds of delay per vehicle per mile, the current average speed along the length of the Scheme is lower than the average speed for northern England, suggesting more congestion. The average for northern England, in all directions, is 56.1mph.

Percentage of Reduced Capacity Hours

3.3.6 Reduced Capacity Hours are defined as traffic conditions where vehicles are travelling at a speed below the speed at link capacity. Under these traffic conditions, link throughput is reduced due to flow breakdown, with queuing and stop-start conditions resulting. It is seen from **Figures 3-11** and **3-12**, from 2009 to 2011 (the latest available data for this metric), that the southbound carriageway is much more affected than the northbound, with particular issues on the Gateshead section approaching junction 68 (Lobley Hill), and again approaching junction 65 (Birtley).

Figure 3-9 - Average Seconds of delay per vehicle per mile

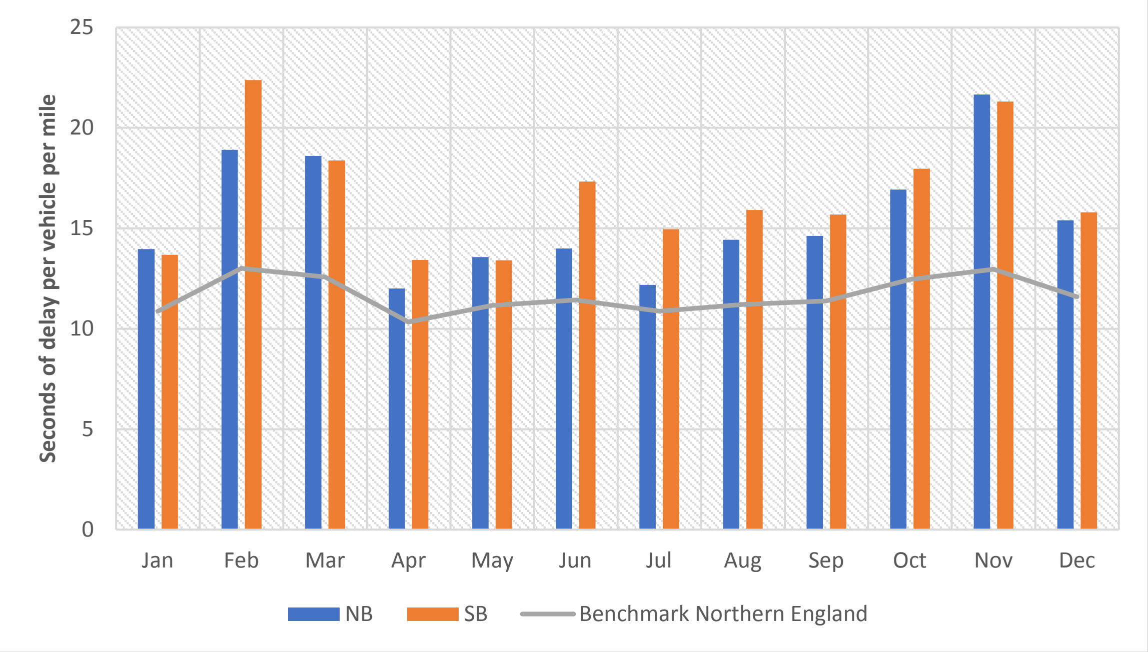


Figure 3-10 - Average Speed

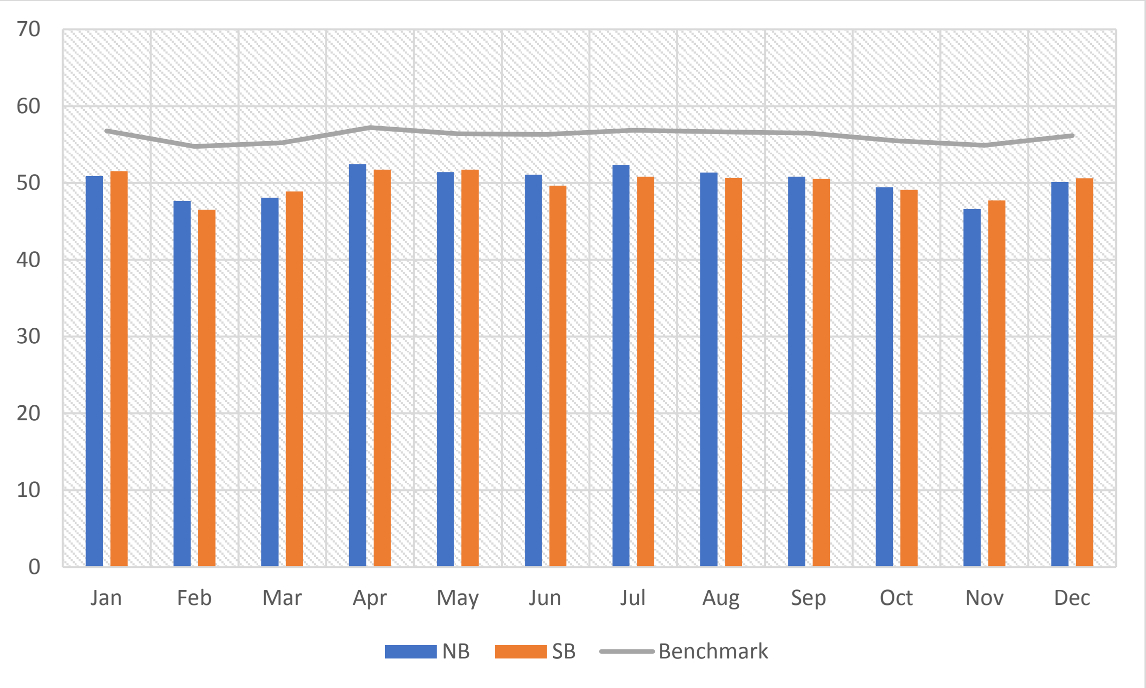


Figure 3-11 - % of Reduced Hour Capacity (Hours)

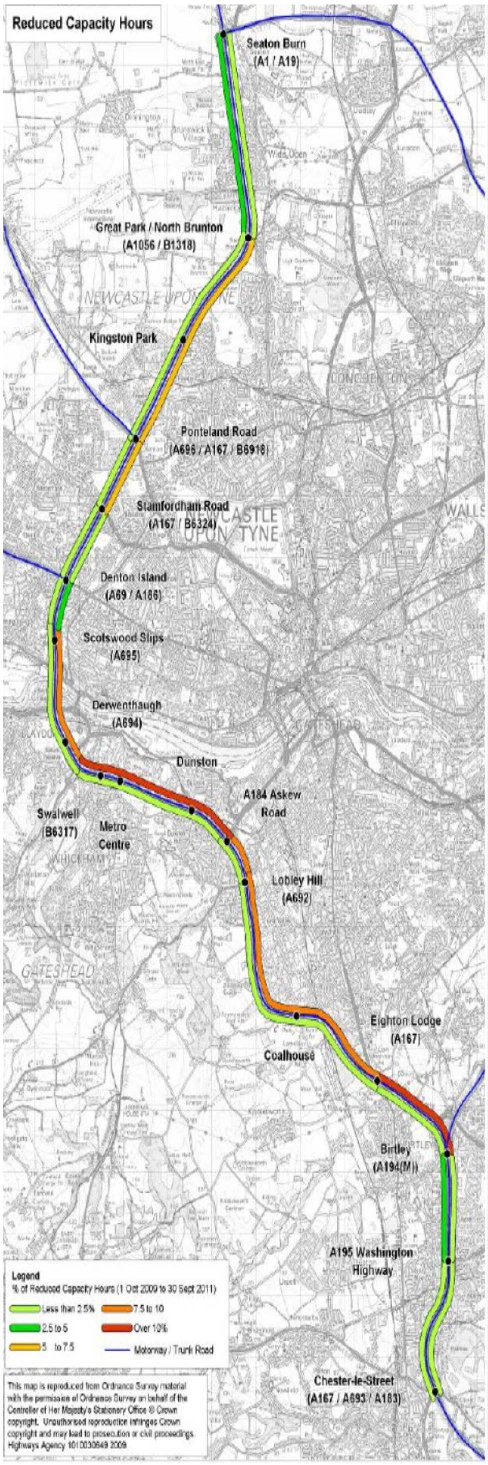
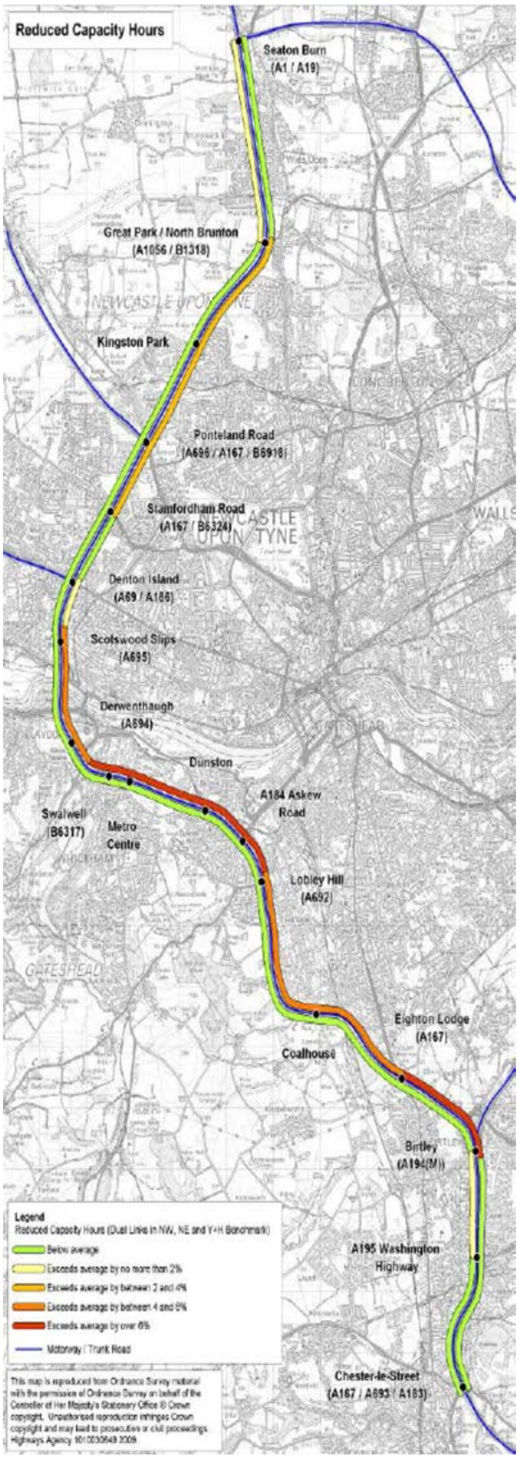


Figure 3-12 – Reduced Capacity Compared to the North of England



4 Future Network Performance

4.1 Introduction

4.1.1 This section compares the likely impacts that would result both in the Do Minimum scenario and from the implementation of the Scheme (Do Something). This section focuses on the following impacts:

- Traffic Flows;
- Journey Times; and
- User Experience.

4.2 Future Forecast Traffic Flows

4.2.1 The base year and forecast year link flows for the Scheme are displayed in **Table 4-1**:

Table 4-1 - Forecast Link Flows for the Scheme

Year	Scheme	J65-66 N'bound	J65-66 S'bound	J66-67 N'bound	J66-67 S'bound	J67+ N'bound	J67+ N'bound
AM Average Hourly Flow							
2017	Base	4284	4185	4131	3776	4308	4108
2023	Do Min	4544	4334	4164	3900	4299	4232
	Do Some	4788	4552	4857	4225	4699	4416
2038	Do Min	5004	4779	4199	3970	4549	4769
	Do Some	5449	5214	5545	4808	5328	4765
Interpeak Average Hourly Flow							
2017	Base	3749	4058	3746	3873	4123	3759
2023	Do Min	3955	4274	3959	3936	4373	4149
	Do Some	4014	4506	4077	4508	4381	4284
2038	Do Min	4398	4730	4145	3970	4876	4708
	Do Some	4734	5210	4825	5169	4842	4750

PM Average Hourly Flow							
2017	Base	3764	4533	3265	3929	3849	3776
2023	Do Min	4019	4706	3457	3946	4135	4083
	Do Some	4046	5096	3509	4852	4093	4151
2038	Do Min	4533	4892	3927	3970	4611	4450
	Do Some	4698	5621	4174	5372	4616	4571

4.2.2 The above table shows that, in all instances, there is a significant increase in the volume of traffic utilising the route in comparison with the Do Minimum scenario. This can be attributed to the additional capacity gained as a result of the Scheme.

4.2.3 This impact of the Scheme on traffic flow is greatest during the AM peak period. During this period, between junction 65 (Birtley) and junction 66 (Eighton Lodge) there is a forecast 26% increase in traffic expected on the A1 in the 2038 DS scenario, and around a 16% increase within the 2038 DM scenario in both directions when compared with Baseline conditions. This shows that the Scheme generates additional capacity on this section of the road network, ensuring that congestion is negated through its implementation.

4.3 Future Forecast Journey Times

4.3.1 **Table 4-2** shows forecast journey times for the complete extent of the NGWB, and the Birtley (junction 65) to Coal House (junction 67) section only. The forecast journey times have been generated using the NRTM in order to assess the impact of the Scheme on daily traffic.

Table 4-2 – Forecast Link Journey Times

A1	Route	2023		2038		2023	2038
AM Period (0700-1000 average hour)							
		DM	**DS**	**DM**	**DS**	**Change (DM-DS)**	**Change (DM-DS)**
ALL	NB	00:33:00	00:31:54	00:36:10	00:35:01	(00:01:06)	(00:01:09)

	SB	00:28:58	00:28:25	00:31:59	00:31:09	(00:00:33)	(00:00:50)
BCH	NB	00:11:12	00:10:08	00:13:00	00:11:40	(00:01:05)	(00:01:19)
	SB	00:09:45	00:08:33	00:11:05	00:09:32	(00:01:12)	(00:01:34)
IP Period (1000-1600 average hour)							
		DM	**DS**	**DM**	**DS**	**Change (DM-DS)**	**Change (DM-DS)**
ALL	NB	00:32:24	00:31:54	00:33:20	00:32:00	(00:00:30)	(00:01:21)
	SB	00:28:17	00:28:25	00:30:24	00:29:29	00:00:09	(00:00:55)
BCH	NB	00:09:44	00:09:32	00:11:33	00:10:17	(00:00:11)	(00:01:16)
	SB	00:09:39	00:08:59	00:10:55	00:09:15	(00:00:40)	(00:01:39)
PM Period (1600-1900 average hour)							
		DM	**DS**	**DM**	**DS**	**Change (DM-DS)**	**Change (DM-DS)**
ALL	NB	00:32:26	00:31:54	00:34:01	00:33:41	(00:00:32)	(00:00:20)
	SB	00:28:42	00:28:25	00:30:57	00:29:48	(00:00:17)	(00:01:09)
BCH	NB	00:09:29	00:09:29	00:10:33	00:10:20	00:00:00	(00:00:13)
	SB	00:09:45	00:08:54	00:11:07	00:08:56	(00:00:51)	(00:02:11)

4.3.2 The table above shows that notwithstanding increased traffic flows, generally the greatest journey time benefits are expected within the 2038 scenario. Between junction 65 (Birtley) and junction 67 (Coal House) with the implementation of the Scheme, it is expected that the greatest reductions in journey times are on southbound traffic during the PM period (2 minutes and 11 seconds). This is expected to benefit commuter traffic heading southbound from Newcastle city centre, a key economic hub within the region.

4.3.3 Furthermore, when compared with the complete extent of the NGWB journey times, there are greater relative reductions for the Birtley (junction 65) to Coal House (junction 67) section of the north-south route in a southbound direction across all time periods.

4.4 User Experience

4.4.1 One of the main objectives of the Scheme is to reduce delays and congestion on the A1 between junctions 65 (Birtley) and 67 (Coal House). As set out within this TAR, congestion is an issue on this section of the SRN, and the Scheme will complement the recent upgrade between Coal House and the Metro Centre.

4.4.2 **Table 4-2** illustrates that there are journey time reductions in both directions during all hours, despite an increase in traffic with the implementation of the Scheme. A Social Impact (SI) Appraisal has been carried out as part of the project (BTN 41). The assessment was prepared in alignment with WebTAG guidance A4.1, and demonstrates that, with the implementation of the Scheme, there will be reduced frustration amongst drivers as a result of reduced congestion and delays. Additionally, BTN 41 also summarises that noise levels are forecasted to reduce due to the Scheme, denoting improvements to the environment also. This demonstrates that the Scheme will improve the user experiences by reducing frustration and stress, whilst also improving the surrounding environment.

4.4.3 Overall, the Scheme would bring benefits for road users. Journey times would be reduced during the peak hours, thus reducing congestion and improving the performance of this section of the A1 for road users.

5 Road Safety

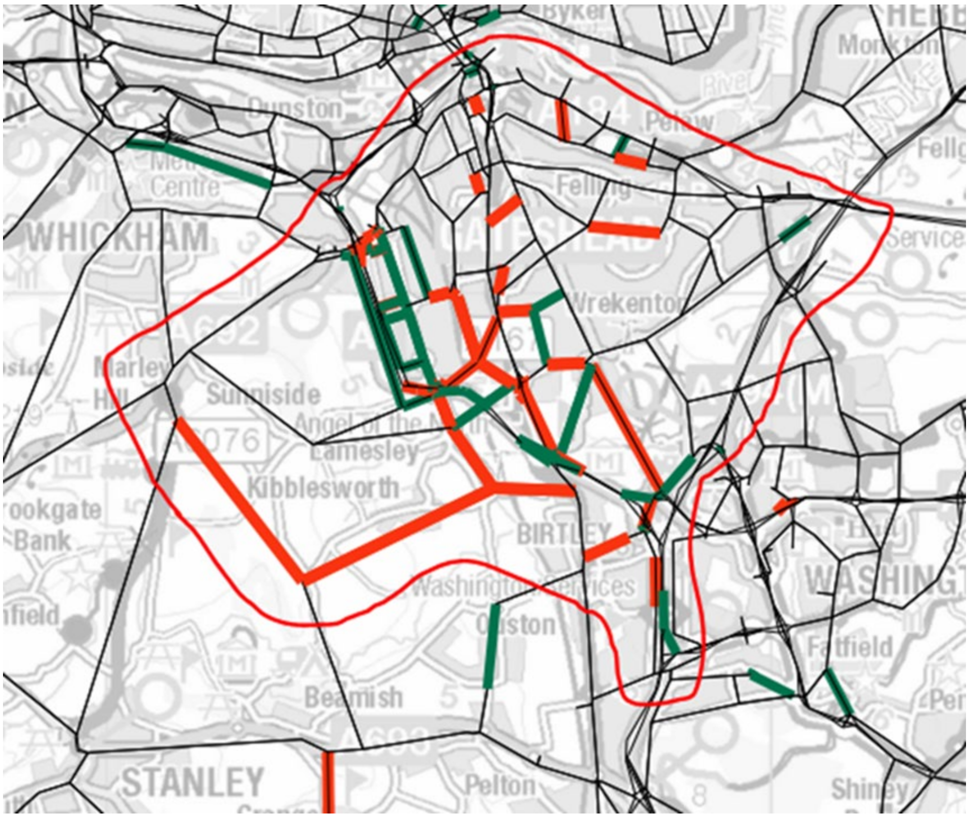
5.1 Introduction

5.1.1 This section provides a summary of the existing road safety record on the A1 between junction 65 (Birtley) and junction 67 (Coal House) and the forecast impact on accidents over a period of 60 years.

5.2 Affected Road Network

5.2.1 The affected road network is defined as the area of road network likely to be influenced by the Scheme. To determine the area where the Scheme could realistically result in a significant enough change in flow to make an impact on the volume of personal injury collisions (PICs), a boundary was developed from the NRTM Saturn model based on a 10% change in AADT on modelled links between the DM and DS models in 2038. This provides a similar study area in proportion and extent to other schemes, including the nearby A19/A184 Testo's Junction Alteration scheme. This area is shown in **Figure 5-1** below.

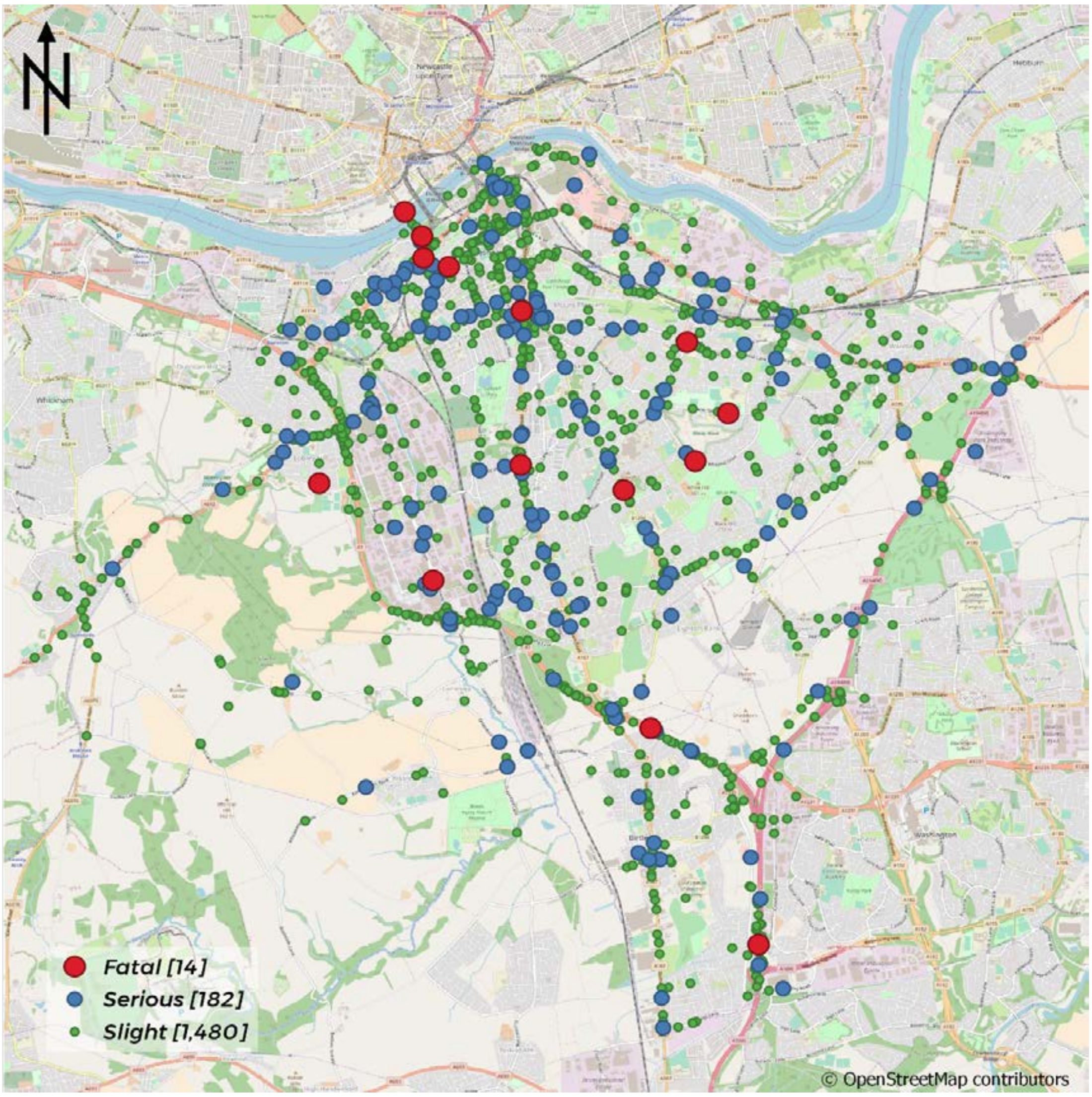
Figure 5-1 - Affected road network - 2038 (Red shows a reduction of at least 10% and green an increase of at least 10%)



5.3 Overview of Personal Injury Collisions

5.3.1 Within the area shown in **Figure 5-2** below, during the five-year period between 2013 and 2017 there were a total of 1676 PICs, with less than 1% being fatal and 11% being serious. **Figure 5-2** shows the location of the PICs on the network. Along the extent of the Scheme itself during the same time period, there have been 123 slight collisions, 8 serious collisions and 1 fatal collision. The majority of the PICs along the Scheme occur near to, or at, junctions and slip roads. Compared to alternative routes through Newcastle and Gateshead, such as Durham Road or Old Durham Road, the A1 has a lower proportion of Killed or Seriously Injured (KSI) PICs.

Figure 5-2 - Location of PICs 2013-2017

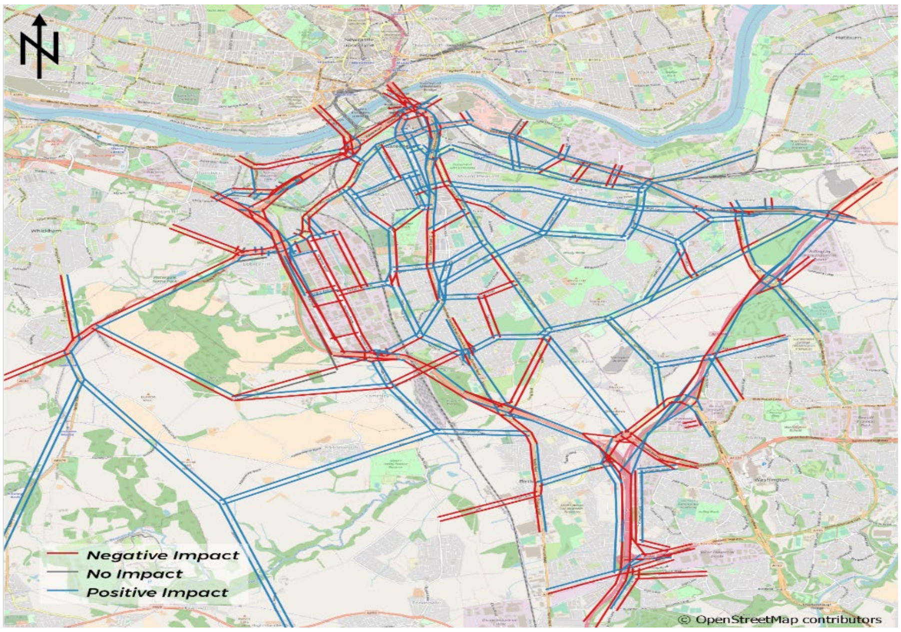


5.4 Accident Analysis Result

5.4.1 A COBALT (Cost and Benefit to Accidents – Light Touch) model has been developed for the Scheme to assess the impact upon the economic cost of collisions and the absolute number of collisions on the highway network. The assessment is based on a comparison of accidents by severity and associated costs across the modelled network in the DM and DS forecasts. COBALT determines accident benefits based on road type, speed and the volume of traffic on any link or junction where there is a change in traffic flow, due to the Scheme. **Figure 5-3** below, shows the output from the COBALT assessment for the affected links. Where links are blue, the Scheme has had a positive impact on the number of accidents, where links are red there are negative impacts as a result of the Scheme.

5.4.2 Within the area of influence, the benefits are not generated from the Scheme improving safety on the A1 itself, but rather from drawing traffic from roads that have higher accident rates than the A1. The Scheme does not inherently alter the safety or accident rate of the A1, but increases the number of vehicles travelling along it, which therefore increases the number of collisions. Similarly, the accident rates on the local roads do not change, but instead have less traffic travelling along them, which leads to a reduction in collisions. This is shown by **Figure 5-3,** where the Scheme has had a negative impact on collisions on the A1. The accident rates for the A1 are lower than those for the local roads, with the A1 generally being built and designed to a higher standard than the local roads. This means that the increase in collisions on the A1 is outweighed by the reduction on the local roads, leading to an overall benefit. In addition to this, on and off slips which are being upgraded as part of the Scheme experience a reduction in collisions.

Figure 5-3 - COBALT Output



5.4.3 **Table 5-1** summarises the number of casualties predicted over a 60-year appraisal period with and without the Scheme, by severity. The COBALT appraisal tool equates these casualty savings to a saving of 290 accidents over the appraisal period.

Table 5-1 - Casualty Savings (over 60 years)

Severity	Without Scheme (Do Minimum)	With Scheme (Do Something)	Casualty Saving
Slight	22,278	21,940	338
Serious	2,291	2,249	42
Fatal	179	176	3

5.4.4 The Scheme has been assessed by COBALT which is a relatively high-level tool to appraise safety aspects of the road schemes. The COBALT assessment indicated that overall the Scheme would reduce accident rates as compared to without Scheme (Do Minimum) scenario. The Scheme is being designed to modern safety standards following Design Manual for Roads and Bridges (DMRB). It will also be subject to detailed examination in relation to safety via the road safety audit process. The results of the COBALT assessment therefore suggest that the Scheme would provide a safer highways configuration when compared to the existing situation.

6 Walking, Cycling and Horse riding (WCH)

6.1 Introduction

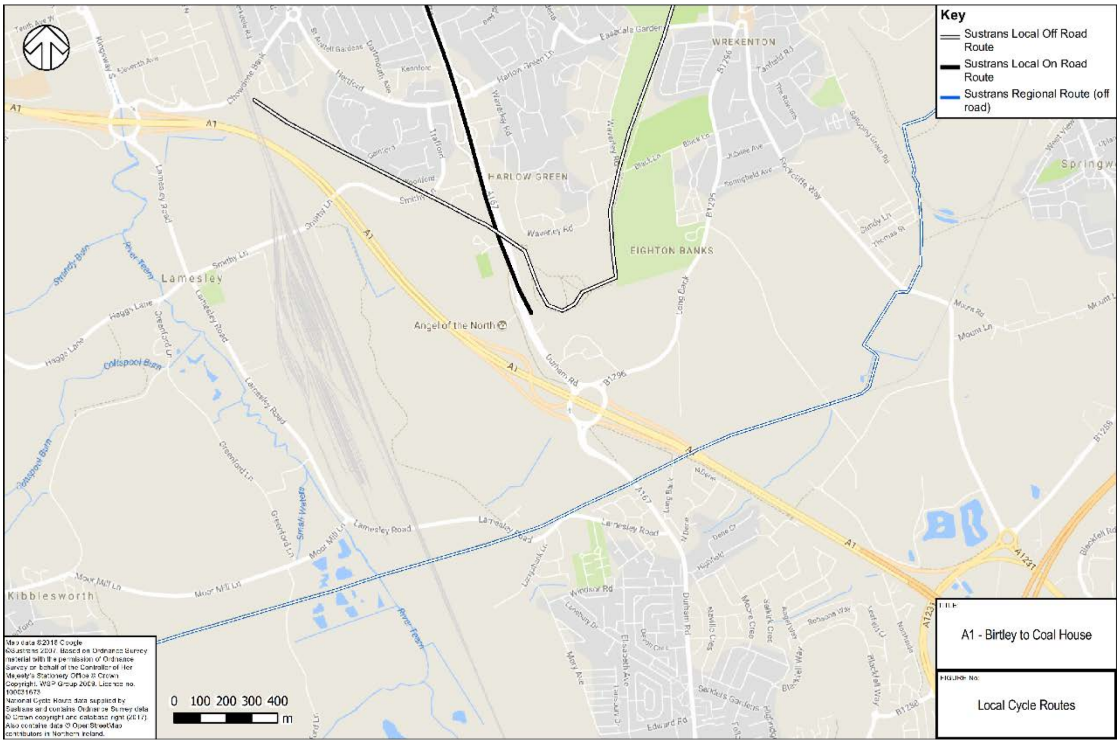
6.1.1 This section summarises the existing Walking, Cycling and Horse riding (WCH) facilities in the vicinity of the Scheme and the potential impacts.

6.2 Existing WCH Facilities

6.2.1 As there are a number of residential and employment sites within the vicinity of the Scheme, these are likely to attract WCH trips which interact at the junctions.

6.2.2 **Figure 6-1** below shows that, due to the A1, local cycling networks are constrained. The only cycling facilities within the vicinity of the Scheme are located on Durham Road, which is a major cycling link to Newcastle City Centre.

Figure 6-1 - Local Cycling Routes



6.2.3 There are currently three key sections of the Scheme that accommodate the movement of pedestrians or cyclists:

- A1 junction 67 – Coal House Roundabout;
- Smithy Lane – approximately 0.5 miles south of the A1 junction 67; and

- A1 junction 66 – approximately 1.4 miles south of the A1 junction 67.

6.2.4 Pedestrians wishing to interact within Coal House Roundabout can do so using the eastern section of the roundabout. Dropped kerbs are in operation at this point on the road network to allow pedestrians to move around this regularly busy roundabout. This allows access to the supermarket to the north east of the junction, and the bus stops located on Kingsway.

6.2.5 Smithy Lane is an important route for WCHs travelling between A1 junction 65 (Birtley) and junction 67 (Coal House). A pedestrian footway is located on the southbound lane of Smithy Lane which allows pedestrians to utilise this route safely. Additionally, although not part of the Sustrans National Cycle Network, Smithy Lane is in good condition and is a well-used route by cyclists travelling southbound past Lamesley to the Green Belt and northbound towards residential areas. This is evidenced by the fully classified surveys which were conducted at this location (over 24-hour periods) on Thursday 9th and Saturday 11th November 2017 to establish existing usage levels for all WCH modes of travel, as shown in **Appendix F** of this TAR.

6.2.6 The A1 junction 66 (Eighton Lodge) has the best facilities to accommodate WCH traffic along the Scheme route. The roundabout ensures pedestrians are able to move freely and safely around the junction with dropped kerbs on each of the arms of the junction, thus creating strong pedestrian links to the bus stops served by the 21 bus service, an important route between Newcastle upon Tyne and Durham. Additionally, the junction is served by the 725 Sustrans National Cycle route. To the south of the roundabout, there are online facilities accommodating cyclists, and to the north of the roundabout there is an offline route extending to the Low Fell ward of Gateshead.

6.3 Public Transport

6.3.1 Due to the location of the Scheme on the SRN, the provision of public transport options is limited. Currently, most bus routes within the vicinity of the Scheme, only use the junctions rather than the A1 mainline. Additionally, there are no rail options available as a sustainable mode of transport.

6.3.2 Further afield, the following alternative modes are available:

- Local Bus Services;
- Regional Rail Services; and
- National Rail Services.

6.4 WCH Infrastructure

6.4.1 The impact of the proposed Scheme on WCHs has been considered in the form of a Walking, Cycling and Horse-Riding Assessment and Review (WCHAR). A copy is provided at **Appendix D** of this TAR. The purpose of a WCHAR is to facilitate the inclusion of all walking, cycling and horse-riding modes within the Scheme design process from an early stage, enabling opportunities for improved facilities and integration with local, regional or national networks through the design process.

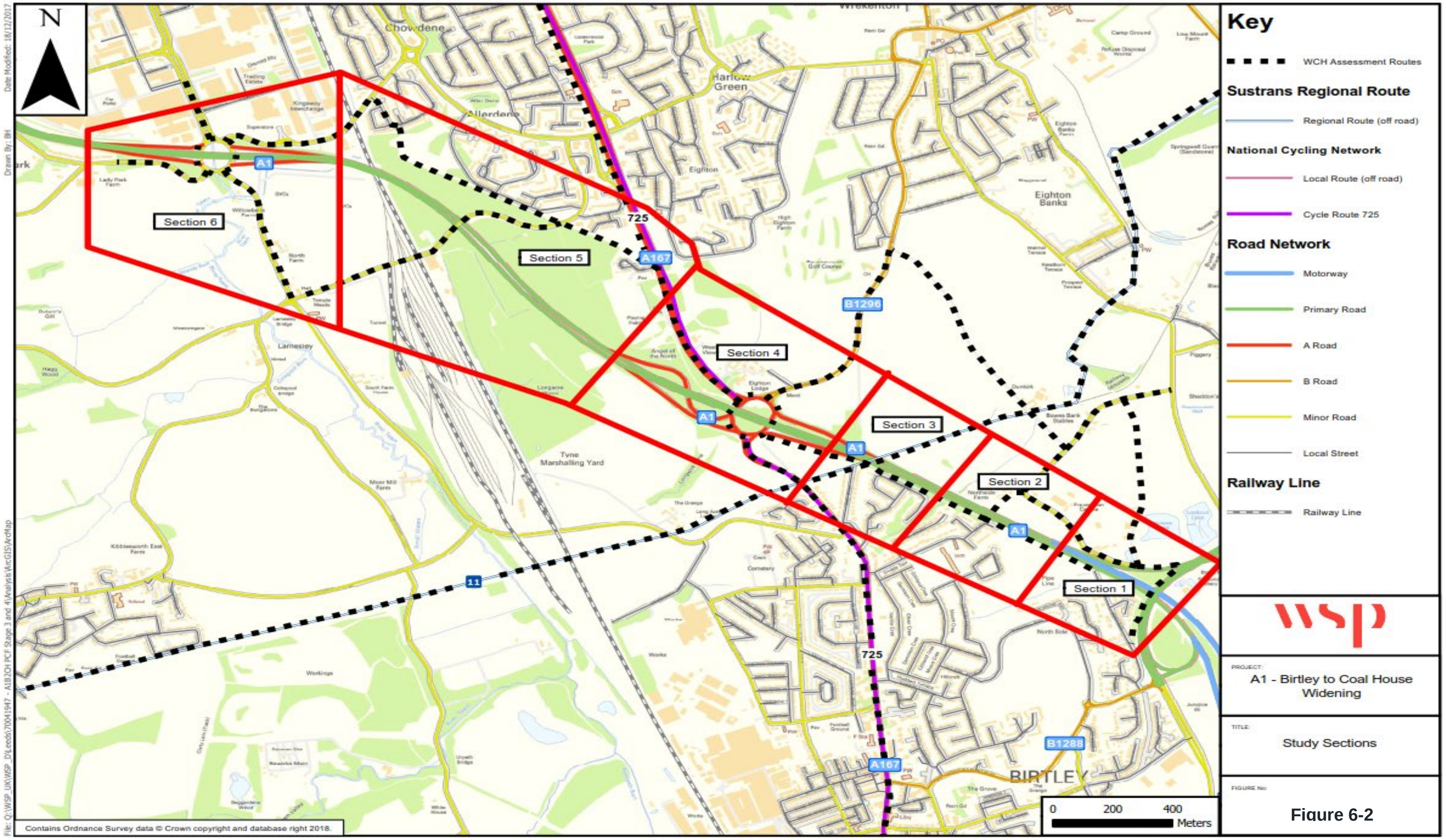
6.4.2 The Scheme objectives also ensure that conditions are improved (where practicable to do so) for WCHs. Current crossing opportunities and associated infrastructure is fully appraised within the WCHAR.

6.4.3 The assessment area used for the WCHAR study broadly comprises the crossing opportunities over the A1 between junction 65 (Birtley) and junction 67 (Coal House) with the principal pedestrian, cycle and equestrian routes considered between these locations for completeness.

6.4.4 The overall study area as shown in **Figure 6-2**, has been sub-divided into the following sections, in order to facilitate detailed appraisal of the various routes and infrastructure available to pedestrians, cyclists and equestrians:

- Section 1 - Northside Overbridge
- Section 2 – Northside to North Dene Footway and the North Dene Footbridge
- Section 3 - North Dene to Longbank Footway and the Longbank Bridleway underbridge
- Section 4 - Longbank to Eighton Lodge Footway and the Eighton Lodge Interchange
- Section 5 - Smithy Lane Overbridge and the Angel Cycleway/Chowdene Bank Bridge
- Section 6 - Coal House Interchange

Figure 6-2 - A1 – Birtley to Coal House Widening – Study Sections



6.4.5 It is likely that WCHs would be directly impacted during the construction of the Scheme due to the requirement to temporarily close footpaths in the vicinity; the temporary closure of Longbank Bridleway; and during the re-construction of the North Dene Footbridge. Wherever possible, alternative routes for WCHs will be provided, although some may be longer than the permanent routes that they temporarily substitute.

6.4.6 Following detailed consideration of the existing routes and connection opportunities have been identified in the WCHAR, which would provide potential improvements to the existing infrastructures for WCHs and could be delivered as part of the Scheme, however permission for them requires grant of a DCO under the Planning Act 2008 by the Secretary of State for Transport.

6.4.7 Further information about the improvements identified can be found in the WCHAR at **Appendix D** of this TAR. These improvements have been considered as part of the preliminary design of the Scheme.

6.5 Preliminary Design Stage Improvements for WCHs

6.5.1 Opportunities have been considered throughout the progression of the scheme design. The table below provides a summary of the opportunities identified that form the preliminary design for the Scheme.

Table 6-1 - WCHs Preliminary Design Stage improvements

No	Identified Issue	Improvements
1	There is no boundary fence treatment between the Northside Footway and the A1 mainline.	Installation of a fence to restrict access to the northbound carriageway for pedestrians and animals.
2	The North Dene Footbridge deck and ramp is substandard in width (on both the eastern and western sides) in light of its use by both pedestrians and cyclists. North Dene Footbridge is designated as 'a National Cycle Network off-road cycle path' and is identified as Route 11 a 'Regional Cycle Network' on the Gateshead Cycle Map.	Provision of a 3.5m (unsegregated) pedestrian/cycle path over the bridge deck (with a 1.4m high parapet fence).
3	North Dene Footbridge is accessed via a stepped ramp with a single landing, which features a 1 in 6 gradient between ground level and the bridge deck.	Provision of a 1 in 12 (minimum) gradient ramp to provide improved access for WCHs.
4	The bridge deck and ramp landings on either side do not currently benefit from tactile paving provisions.	Installation of corduroy tactile paving to aid the movement of partially sighted WCHs.
5	The condition of the concrete post and wire-mesh fencing between the North Dene to Longbank Footway and the A1 mainline is poor.	Installation of a fence to restrict access to the northbound carriageway for pedestrians and animals.
6	The Longbank Bridleway Underpass is an unlit 80.0m long, domed corrugated-steel lined structure, which is intimidating to pedestrians and cyclists.	The eastern headwall of the Longbank Bridleway Underpass to be located between a brick built parapet wall and 2.0m high wooden close-board fence treatment,

No	Identified Issue	Improvements
		with the available width varying between approximately 1.5m (substandard) and 3.0m.
7	The eastern headwall of the Longbank Bridleway Underpass is located between a brick built parapet wall and 2.0m high wooden close-board fence treatment, with the available width varying between approximately 1.5m (substandard) and 3.0m	Provide a higher wooden close-board fence treatment to ensure that horses are not exposed to oncoming traffic and ensure a standard 3.0m wide passage is available across the entire width of the headwall.
8	The condition of the concrete post and wire-mesh fencing between the Longbank to Eighton Lodge Footway and the A1 mainline is poor.	Installation of a fence to restrict access to the northbound carriageway for pedestrians and animals.

7 Summary and Conclusions

7.1 Overview

7.1.1 The Report has assessed the impact of the Scheme on the strategic and local highway network and road safety.

7.1.2 The A1 is a critical section of the SRN, and the NGWB is currently congested, with traffic flow pinch points at junction 65 (Birtley) and junction 67 (Coal House). This is summarised within the Highways England Route Strategy (2017).[6]

7.1.3 The Scheme aligns with the goals and objectives of several local policies such as Tyne and Wear Local Transport Plan 3, Gateshead Local Plan 3 and Planning for the Future – Core Strategy and Urban Core Plan for Gateshead and Newcastle Upon Tyne 2010-2030.

7.2 Current Network Performance

7.2.1 The overall impact of the Scheme and the resulting traffic flows and journey times has been derived from the NRTM. The AM, Interpeak and PM average hour are represented as a 2017 average hourly peak flow over these time periods

7.2.2 Base network performance suggests a considerable volume of traffic heading both northbound and southbound in AM peak between junction 66 (Eighton Lodge) and 67 (Coal House), however in interpeak there are considerably fewer vehicles on the network between junction 66 (Eighton Lodge) and junction 67 (Coal House). The PM peak situation suggests that the traffic flows are tidal in nature.

7.2.3 At junction 65 (Birtley) on the A1, the base network situation suggests that volume of PCUs merging and diverging is consistent in the AM peak. The interpeak situation suggests little variation in the number of PCUs heading northbound via the A1. The PM peak situation suggests that considerable number of PCUs travelling southbound via the A1 due to large volumes of traffic merging with the A1 at junction 66 (Eighton Lodge) heading southbound.

[6] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/600317/London_to_Scotland_East_Final.pdf

Future Network Performance

7.2.4 From the traffic modelling undertaken as part of the Scheme assessment, it is estimated that there would be a saving in journey times along the Scheme, as outlined below:

Table 7-1 – Journey Time Reduction at the Smithy Lane overbridge and Angel Cycleway/Chowdene Bank Bridge

A1	Route	Journey Time Reduction	
		2023	2038
AM (0700 – 1000)			
BCH	NB	(00:01:05)	(00:01:19)
	SB	(00:01:12)	(00:01:34)
IP (1000 – 1600)			
BCH	NB	(00:00:11)	(00:01:16)
	SB	(00:00:40)	(00:01:39)
PM (1600 - 1900)			
BCH	NB	00:00:00	(00:00:13)
	SB	(00:00:51)	(00:02:11)

7.2.5 By improving journey times, the Scheme will impact positively from an economic perspective. It is anticipated that there would be around £116.3m worth of net benefits through journey time savings for commuters, consumers and business users.

7.2.6 Greatest journey time benefits are expected within the 2038 scenario. Between junction 65 (Birtley) and junction 67 (Coal House) with the implementation of the Scheme, it is expected that the greatest reduction in journey time of 2.11 minutes is on southbound traffic during the PM period.

7.2.7 Overall, the Scheme would bring benefits for road users. Journey times would be reduced during the peak hours, reducing congestion seeing improvements for road users on this section of the A1. Furthermore, from the local network, improving conditions on local roads as well as the SRN would occur due to the improved operational capacity.

7.3 Road Safety

7.3.1 An overall reduction in the number of accidents with the Scheme in place is observed, with a saving of 290 accidents. The majority of accident savings is seen on the local roads leading up to the A1. Therefore, the increase in collisions on the A1 is outweighed by the reduction on the local roads, leading to an overall benefit.

7.3.2 A reduction in casualties of types serious, slight and fatal is predicted over the appraisal period.

7.3.3 In summary, the Scheme achieves one of its key objectives of improving safety by reducing the numbers of accidents and fatalities.

7.4 WCHs

7.4.1 It is likely that WCHs would be directly impacted during the construction of the Scheme due to the requirement to temporarily close footpaths in the vicinity. Therefore, Preliminary Design stage improvements to the existing infrastructure for WCHs have been identified in **Table 6-1** which are subject to DCO and will be delivered as part of the Scheme.

7.5 Conclusions

7.5.1 The assessment presented indicates that the Scheme:

- Meets the requirements of central government's transport objectives around economy, environment, social and public accounts;
- Aligns with national and local planning policy;
- Addresses future traffic demand and creates improved traffic congestion conditions and journey experience for motorists;
- Improves facilities for WCHs; and
- Creates a safer environment for all road users as a result of a forecast reduction in Accidents.

8 Glossary

AADT	Annual Average Daily Traffic
ATC	Automated Traffic Counts
COBALT	Cost and Benefit to Accidents – Light Touch
DCO	Development Consent Order
DM	Do Minimum
DS	Do Something
ES	Environmental Statement
HE	Highways England
HELAA	Housing and Economic Land Availability Assessment
KSI	Killed or Seriously Injured
ITN	Integrated Transport Network
MVR	Model Validation Report
NE	North East
NGWB	Newcastle Gateshead Western Bypass
NRTM	Northern Regional Transport Model
NTEM	National Trip End Model
NW	North West
WCH	Walking, Cycling and Horse riding
PCF	Project Control Framework
PCU	Passenger Car Unit
PICS	Personal Injury Collisions
SHLAA	The Strategic Housing Land Availability Assessment
SRN	Strategic Road Network
TA	Transport Assessment
TADU/TRADS	The Tyne and Wear Road Traffic and Accident Data Unit
TAG	Transport Appraisal Guidance
TEMPro	Trip End Model Presentation Program
TRADS	Traffic Flow Data System
UDP	Unitary Development Plan
WCHAR	Walking, Cycling and Horse-Riding Assessment and Review
WebTAG	(Web based) Transport Analysis Guidance
Y+H	Yorkshire and Humber

Appendix A

A1 BIRTLEY TO COAL HOUSE NRTM MODEL DATA COLLECTION REPORT

North Regional Transport Model
Model Data Collection Report

April 2016

Document Control

Document Title	Model Data Collection Report
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Appendix G – Traffic Flows – Screenlines

List of Abbreviations

Abbreviation	Name
AAWT	Annual Average Weekday Traffic
Area 13	The Highways England network within Cumbria and North Lancashire
Area 14	The Highways England network within the North East
ATC	Automatic Traffic Count
ATCO	Association of Transport Co-ordinating Offices
BC	Borough Council
BRES	Business Register and Employment Survey
BYFM	Base Year Freight Matrix
CAA	Civil Aviation Authority
CC	County Council (or City Council for Newcastle only)
CSRGT	Continuing Survey of Road Goods Transport
DfT	Department for Transport
DIADEM	Dynamic Integrated Assignment and Demand Modelling (software)
HGV	Heavy Goods Vehicle
ITN	Integrated Transport Network
LA	Local Authority
LENNON	Latest Earnings Nationally Networked Over-Night (rail fares data)
LGV	Light Goods Vehicle
LSOA	Lower Super Output Area
MCC	Manual Classified Count
MCTC	Manual Classified Turning Count
MNO	Mobile Network Operator
MOIRA	Model of Inter Regional Activities (rail services)
MPOD	Mobile Phone Origin-Destination
MSOA	Middle Super Output Area
MSR	Model Specification Report
NAPALM	National Air Passenger Allocation Model
NRTM	North Regional Transport Model
NRTS	National Rail Travel Survey
NTEM	National Trip End Model
NTM	National Transport Model

NTS	National Travel Survey
OFCOM	Office of Communications
OGV	Other Goods Vehicle
ONS	Office for National Statistics
ORR	Office of Rail Regulation
OS	Ordnance Survey
PDFH	Passenger Demand Forecasting Handbook
PT	Public Transport
RIS	Road Investment Strategy
RoF	Region of Focus (model study area)
RSI	Roadside Interview
RTM	Regional Traffic Model (suffix for all five model names)
SATURN	Simulation and Assignment of Traffic in Urban Road Networks (software)
SRN	Strategic Road Network
TADU	Traffic Accident Data Unit (covering Tyne and Wear)
TAG	Transport Analysis Guidance
TAME	Traffic Appraisal, Modelling and Economics
TCG	Technical Consistency Group
TechMAC	Technology Managing Agent Contractor
TEMPRO	Trip End Model Presentation Program
TIS	Trip Information System
T-PSM	Trans-Pennine South Transport Model
TRADS	Traffic Accident Data System
VDM	Variable Demand Modelling
VOC	Vehicle Operating Cost
VOT	Value of Time

Executive Summary

The Model Data Collection Report presents a summary of data collected for the base model build of the North Regional Transport Model, one of five Regional Models currently being developed for Highways England to cover the whole of the country. The report covers:

- Data requirements of the model;
- A review of data sources;
- Collection of new data;
- Checking and cleaning of data;
- Processing of data and its use in the model; and
- Presentation of headline results from counts and demand data.

The process of data collection broadly followed these steps regardless of the exact dataset. Before beginning data collection a list of potential data sources was identified to meet the requirements of the Regional Models' specification. This stage was initially covered as part of the Model Specification Report (MSR) which was drafted early in the project, although this is very much an ongoing process which adapts as methodologies emerge and are finalised. Data requirements at all stages have been drawn up to meet the objectives of the model build and in line with other regions and discussions within the various Technical Consistency Groups (TCGs). Data feeds into all elements of the model development including:

- Network development;
- Matrix development;
- Variable Demand Modelling; and
- Assignment Model Calibration and Validation.

A wide range of data has been collated from various sources including DfT, ONS, other Government offices and agencies (CAA, OFCOM etc.), Local Authorities, Highways England and its contractors (Telefonica, Arup etc.). In addition to this use of existing data new traffic counts were commissioned and took place in November 2015 and February 2016. This followed analysis which identified gaps or issues with existing count data.

Following collation of data, checking, cleaning and processing of data took place to ensure the quality of data which will be used in the model build. Although each of these checks was unique to the data in question, checks typically consisted of formal reviews of calculations and statistical tests, followed by logic and sense-type checks which identified any suspicious values. As part of these checks a large amount of analysis was also carried out on the count and demand datasets.

A summary of key outputs from the count and demand dataset are presented in the final chapters of this report. This shows major flows of traffic for key movements such as entering and leaving the region at the northern and southern borders, between the region's major urban centres of Tyne and Wear and Teesside and also in and out of the Tyne and Wear conurbation. Other long distance movements such as east to west (and vice-versa) on the Trans Pennine routes are shown to have relatively low flows, although these routes are important in the context of emerging initiatives such as Northern Powerhouse and

improving connectivity across the North. These flows will be used in network and matrix calibration and validation.

Demand data is derived from a mix of mobile phone data and other sources including factors derived from NTS, Trafficmaster and BFYM. A series of verification checks using data have been undertaken.

The NRTM makes use of a diverse range of sources to ensure that network supply, travel demand and model verification data is appropriately specified for the required purpose, namely the development of a Strategic Regional Transport Model for the North of England, with all the attendant requirements of accuracy to deliver travel forecasts according to the current specified technical guidance.

The process has followed a systemic pattern of specification of needs, collation of data, sourcing of additional information and verification of content. Adopting this diligent approach has led to an enhanced confidence in the content of the products to be delivered to Highways England.

Data collection will continue in the project with the collation of forecast year information, both infrastructure and development related. Similar techniques will be adopted to ensure that the information utilised is of the highest quality notwithstanding uncertainties expected into the future.

1 Need for Traffic Data

1.1 Background to Regional Models

In summer 2015 Highways England commissioned a team led by Mouchel to build a transport model of the North region of England. This is in response to the need for Highways England to progress a range of road schemes throughout England identified in the Road Investment Strategy (RIS) within the first Road Period (2015-2020) and for developing subsequent RIS periods. A significant amount of modelling and appraisal work is required to progress these plans and a 'Traffic Modelling Strategy' was developed for Highways England by the Traffic Appraisal, Modelling and Economics (TAME) group. This document identified the creation of five 'regional' models as one of the components with the greatest potential to increase the speed of future delivery of schemes.

The regional models have a clear set of high level objectives, namely:

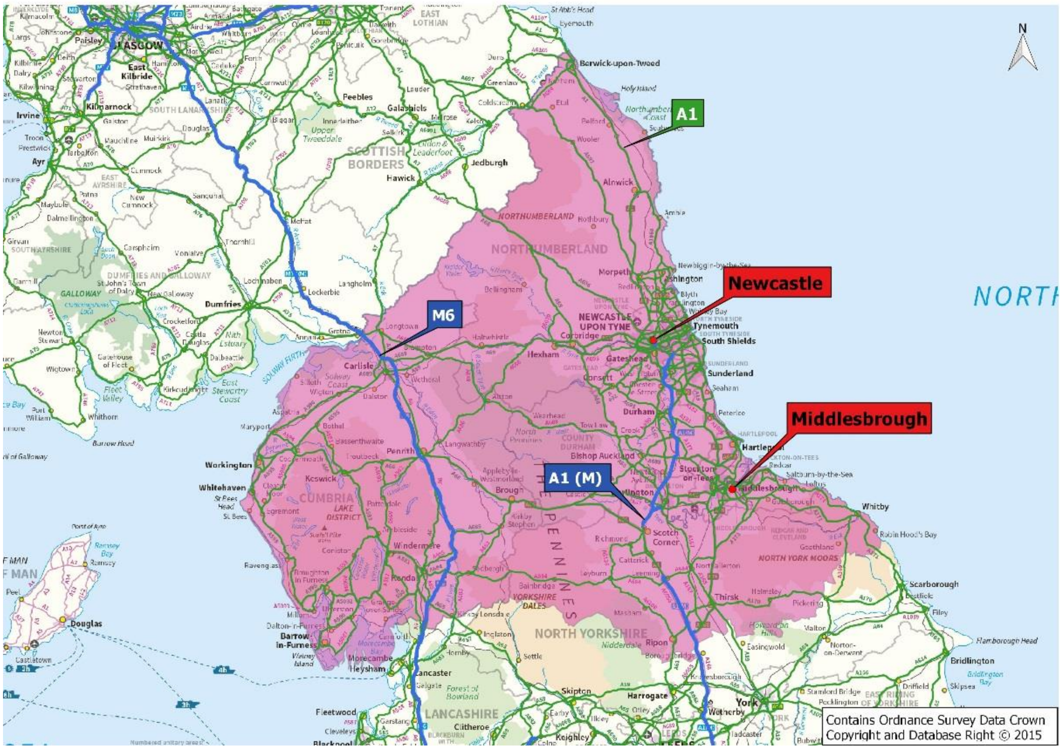
- To provide a multi-modal platform for transport scheme assessment;
- To ensure that a common approach is employed using common data sources and software to ensure consistent outcomes between regional models; and
- To provide the basis for the development and appraisal of RIS schemes.

This report covers the data collection for the North Regional Model (NRTM).

1.2 North Region

NRTM covers the northernmost region of England. It is roughly bounded by an area north of Lancaster and York through to the Scottish Border. A map of the proposed model area is shown in Figure 1-1.

Figure 1-1 – NRTM Model Area



Geographically the region is diverse with a mixture of upland and lowland terrain. The area covered by the model is made up of the North East region as defined by the Government, as well as parts of the North West and Yorkshire and Humber regions.

The larger centres of population and economic activity are on the eastern side of the region; the largest of these being the metropolitan county of Tyne and Wear with a population of around 1.1 million. The area includes the city of Newcastle upon Tyne, which is a 'Core City' in the Northern Powerhouse as well as other large centres of Gateshead and Sunderland.

South of Tyne and Wear is the Tees Valley region – consisting of the unitary authorities of Darlington, Hartlepool, Middlesbrough, Redcar and Cleveland and Stockton – which is located between the more rural areas of County Durham and North Yorkshire and has a combined population of around 700,000.

On the western side of the region is the ceremonial county of Cumbria; a predominantly rural area with only two areas with a population greater than 50,000 – Carlisle (73,270) and Barrow-in-Furness (56,745). It contains the Lake District National Park which covers an area of 2,292 square kilometres and it is a very popular tourist destination with more than 23 million annual day visitors making it the most visited national park in England and Wales. Major employers in this area include Sellafield and the shipyard at Barrow in Furness.

The uplands include some of the most mountainous areas in England. The Yorkshire Dales and Northumberland National Park cover areas of 1,769 and 1,048 square kilometres respectively. The North Pennines split the eastern conurbations from Cumbria in the west covering an area of almost 2,000 square kilometres.

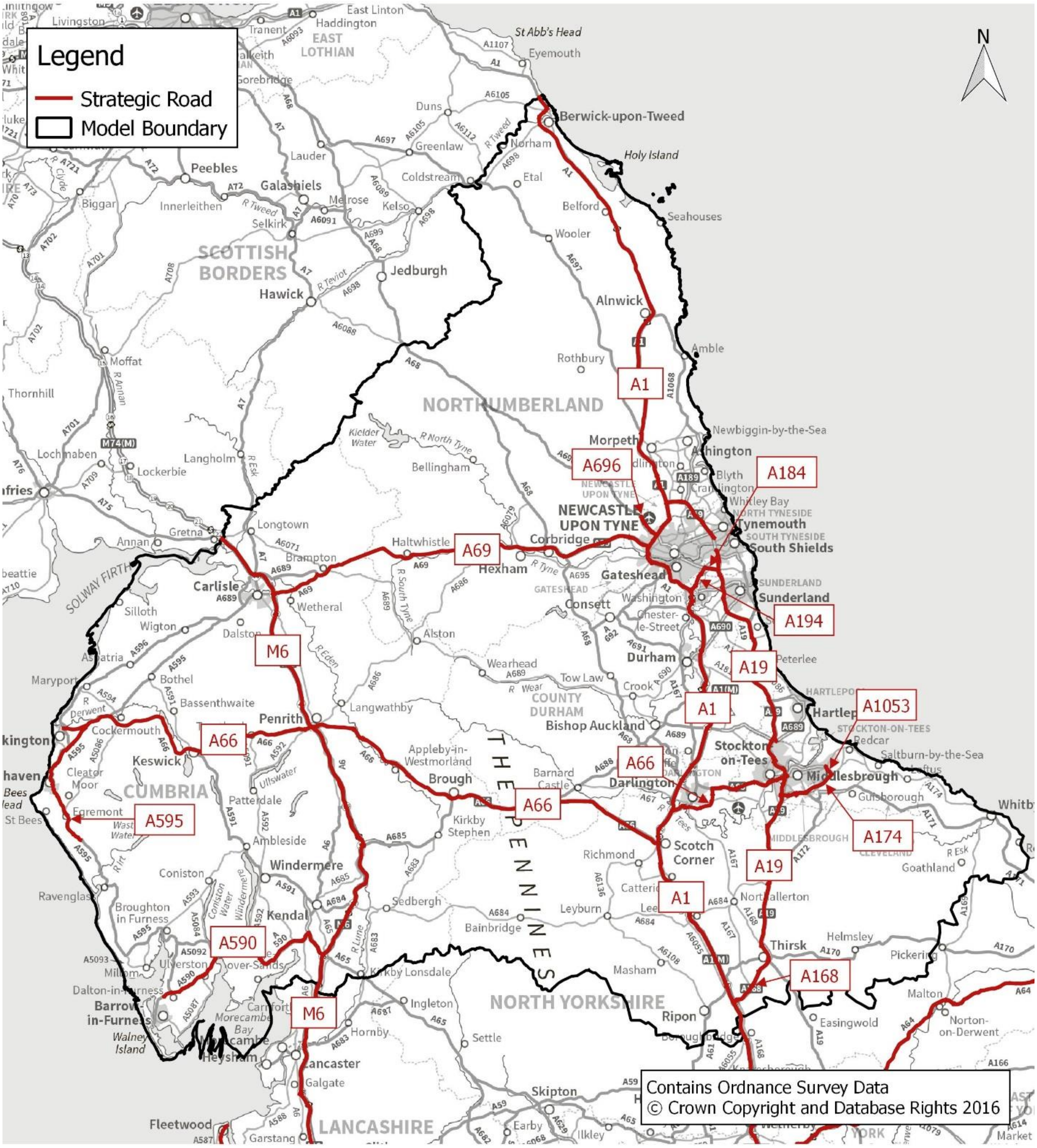
1.3 North Region Transport Network

These distinct areas are linked to each other and the rest of the country by a network of roads as shown in **Figure 1-2** with larger urban areas and some rural locations also served by the rail network. The A1 forms the major dual carriageway spine to the east with the A19 supplementing connectivity between Tyneside and Teesside. The M6 provides key north to south links in the west of the region. The A66 and A69 are predominantly single carriageway routes across the North Pennines with the former extending through the Lake District to West Cumbria. The A590 provides a link to the Furness Peninsula in South Cumbria. The A1 and M6 provide the key strategic links to Scotland in the north and to the rest of England in the south via the Trans Pennine South region.

There are also subsections of A roads that provide strategic connectivity within the region. The A168 connects the A1(M) at Dishforth with the A19 at Thirsk; the A194(M) / A184 likewise south of Newcastle city centre. North east of the city centre is Newcastle International Airport which is connected to the A1 by a section of the A696. Teesport is the third largest port in the United Kingdom; trips can circumvent Middlesbrough town centre to/from the A19 by using the A174 and A1053. Sellafield Nuclear Decommissioning Site and the proposed location for the NuGen Nuclear Power Station are connected to the A66 by a section of the A595 parallel to the West Cumbria coastline.

The region is part of the Government's Northern Powerhouse initiative which aims to bring investment into the area by encouraging cities to work together to maximise urban agglomeration benefits. In order to maximise these opportunities, various plans to improve transport links between the Core Cities are currently proposed, thereby reducing travel costs, some of which will be modelled using NRTM. It is therefore critical the model is specified to a sufficient level to accurately model existing conditions and capable of appraising interventions.

Figure 1-2 – Strategic Road Network in NRTM Region



1.4 Key base model features

NRTM will include the following base model features which need to be considered when collecting and processing data:

- SATURN highways assignment model
- DIADEM variable demand model
- March 2015 base month
- Modelling of the following average time periods:
    - AM average hour: 0700-1000;

  - Inter-peak average hour: 1000-1600; and
  - PM average hour: 1600-1900.
- Modelling of the following forecast years:
  - 2020;
  - 2035; and
  - 2041.

1.5 Data Requirements

In building this model, as with all models there is a requirement to collect and process data which feed into the various steps of building the base year model:

- Network development;
- Demand matrix development;
- Traffic model calibration and validation; and
- Variable demand modelling.

NRTM is one of five regional models currently being developed by different teams across the country. In order to ensure consistency and inter-operability across the regions Technical Consistency Groups (TCGs) were formed by Highways England with representatives from each region. TCGs were organised for each of the areas listed in the bullet points above as well as a separate group for data consistency with the objective agreeing standard approaches to data management and processing. Various approaches documented in this report were agreed within the Data Consistency and/or other TCGs and where this is the case it is referenced. Further to this, where national datasets were required for the development of all models, these requests were typically made as a single request from Highways England. Further information on the Data Consistency and some of the key decisions taken in this group are documented in the technical note appended to this report as Appendix A.

Further data will be collected for forecasting including forecasts information from:

- National datasets such as National Trip End Model (NTEM) and National Transport Model (NTM);
- Planning data from Local Authorities (LAs); and
- Details of transport schemes from Highways England and LAs.

In the future the model could be used for a variety of purposes including optioneering and appraisal of RIS and other Highways England schemes. The model may also be used for spatial planning and the assessment of development. For each of these projects the fitness for purpose will need to be reviewed and additional base or future year data may need to be collected to refine the model.

1.6 Purpose of this report

This report has been developed in line with guidance contained in Highways England *Interim Advice Note 106/08* and PCF product guidance which sets out the requirements of a Traffic Data Collection Report. It covers the collection of existing and newly commissioned data and then goes onto describe the process of checking and summarising this data. Finally, a summary of the base year data is presented. The subsequent content of this report is structured as follows:

- Chapter 2 considers the **data requirements** and how available **data sources can be used in the modelling.**
- Chapter 3 considers **models** used to obtain **traffic signal** and **traffic flow data.**
- Chapter 4 summarises commissioned **traffic surveys.**
- Chapter 5 considers the **checking, data cleaning and processing** that was carried out for traffic flow data, as well as summarises **traffic flow data** from traffic counts.
- Chapter 6 covers **checking and processing** of **demand data** including a summary.
- Chapter 7 considers **checking** and **processing** of **journey time data**.
- Chapter 8 covers the **database** and **format** of data.
- Chapter 9 includes a **summary** and **conclusions**.

A checklist of contents based on PCF guidance is provided as appendix B.

2 Summary and Review of Existing Data

2.1 Introduction

This chapter of the report goes into more detail on the data requirements of the model and identifies existing sources of data which will be used in the model build process. The chapter is divided into the following sections:

- Data used in the network build;
- Traffic count data;
- Data used in the demand matrix build including public transport data; and
- Journey time and speed data.

2.2 Network Data

2.2.1 Mapping

The initial network structure was developed using an automated process which takes the Ordnance Survey's (OS) ITN layer and converts to a SATURN buffer network. In addition to that, OS data further mapping was downloaded from Highways England's GeoStore (see Table 2-1) and was used for various tasks including network refinement.

Table 2-1 – GIS commercial Ordnance Survey datasets

Data Name	Data Type	Availability
Ordnance Survey MiniScale Maps	Raster	Open Data
Ordnance Survey 1:50,000 Scale Colour Map	Raster	Commercial
Ordnance Survey 1:25,000 Scale Colour Map	Raster	Commercial
Ordnance Survey 1:10,000 Scale Colour Map	Raster	Commercial
Ordnance Survey MasterMap ITN	ESRI Shapefile	Commercial
Ordnance Survey MasterMap Topography	ESRI Shapefile	Commercial
Ordnance Survey VectorMap Local	ESRI Shapefile	Commercial
Ordnance Survey Address Base Plus	Comma Delimited (.csv)	Commercial

2.2.2 Traffic Signal Timings

Traffic signal data was collected in order to code signalised junctions in the model simulation area. The information has been collected from the following Local Authorities and one of the Highways England TechMAC.

- Cumbria County Council;
- Durham County Council;

- Middlesbrough Borough Council;
- Newcastle City Council;
- Area 14.

In addition the following donor models have been obtained to provide signal data for additional junctions

- West of Newcastle A1 Corridor SATURN model;
- Ulverston S-Paramics model.

The following information was collected in these locations:

- Scans of as-built junction drawings, including stage diagrams. The as-built drawings are usually prepared at a scale of at least 1:500 and include details of lane allocations, positions of stoplines and pedestrian crossings and signal equipment. This information will be used to orientate to the stage/phase diagram and understand lane markings/lane usage, and will be most relevant where short lanes and mixed turning movements are present to inform decisions on assigning SATURN movements to stages.
- Controller specification documents.
- Front sheet (description, SCN number, date).
- Stage diagram – graphical form if available or stage/phase allocation table.
- Phase types.
- Phase minimums and max sets.
- Phase intergreens (note, use phase intergreens table NOT handset values).
- Timetable defining max sets – so that correct max set values can be applied to each time period.
- Where observed or previously modelled timings could not be collected, a template approach agreed by the network TCG was adopted. Table 2-2 provides a summary signalised junctions by source of timings.

Table 2-2 – Summary of Signalised Nodes Data Sources

Area	LA or TechMAC	Donor Model	Template	Total
Area 13	0	3	20	23
Area 14	41	9	0	50
Cumbria	0	0	44	44
Durham	19	0	22	41
North Yorkshire	0	0	9	9
Northumberland	0	0	6	6

Tees Valley	72	0	28	100
Tyne and Wear	161	29	94	284
Total	**293**	**41**	**223**	**557**

2.3 Traffic Count Data

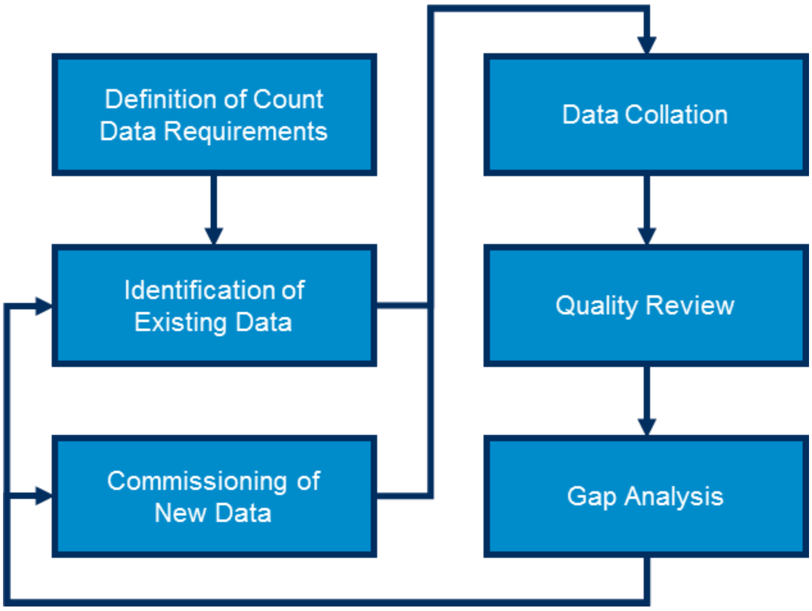
Traffic count data has been collected for two main purposes:

- Matrix calibration and validation; and
- Network assignment calibration and validation.
- The following section sets out the process for this data collection and provides information on this data. A technical specification for use of this data was agreed in the Data Consistency Technical Group (Appendix A) based on guidance contained in WebTAG Unit M1.2:
- Count data to be processed into average weekday hours (including Friday) for:
  - AM period (0700-1000)
  - IP period (1000-1600)
  - PM period (1600-1900)
- Automatic traffic count (ATC) used for total flow;
- Manual Classified Count (MCC) used for classification (car, LGV and OGV) of volumetric flows. The exception to this rule is TRADS sites on the SRN which have the capability of classifying light and heavy vehicles by vehicle length
- Ideally these counts should have been conducted in the base model month of March 2015, although to maximise the use of existing count data, older data is permitted. For a limited number of sites, surveys from before 2012 had to be used. Where counts were not conducted in the base month factors were derived to convert from the survey month to base month.
- ATCs should have been undertaken for a minimum duration of 2 weeks, although exceptions to this guidance may have to be considered if no alternative count data exists. For limited number of sites, five days of survey data was accepted.
- MCCs may be single day surveys, although confidence levels will be higher if these have been undertaken over multiple days.
- Commentary on the data quality of each count location will be provided.

2.3.1 Count Data Collation Process

A period of count data collation was undertaken between August 2015 and March 2016. This included several iterations of data collation, designed to maximise the use of existing data, thus reducing the requirement for additional data collection. This process is illustrated in the flowchart below and described in the chapters below:

Figure 2-1 – Count Data Collation Process



Details concerning each step are in the following sections:

- Definition of count data requirements: Chapter 2.3.2
- Identification of existing data: Chapter 2.3.3
- Data collation: Chapter 2.3.4
- Quality review: Chapter 5.1
- Gap analysis: Chapter 2.3.4
- Commissioning of new data: Chapter 2.3.4

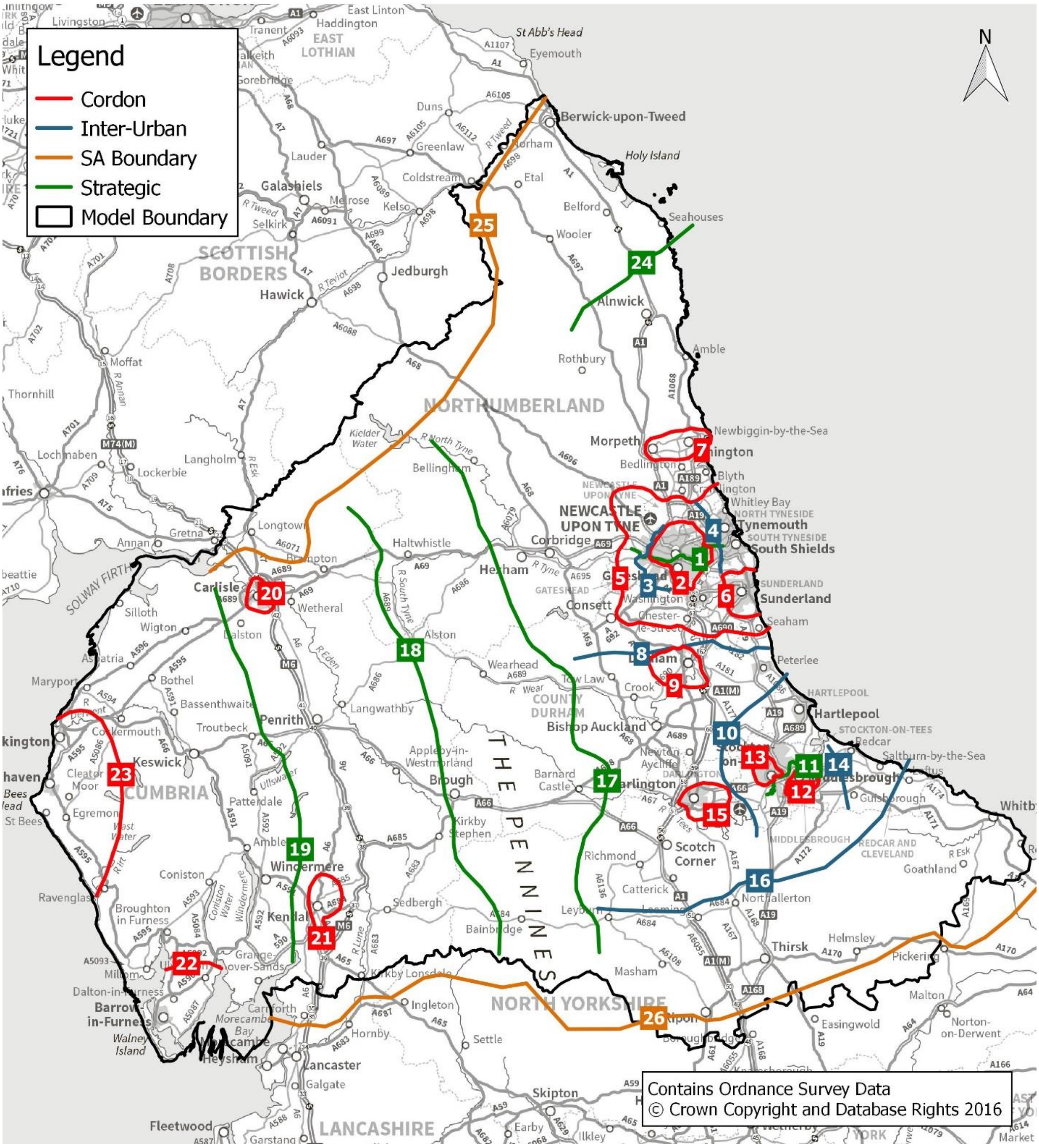
2.3.2 Definition of Count Data Requirements

The selection of counts and commissioning of further counts are based on the screenlines. These were defined in line with the guidance set out by the Cal/Val Technical Consistency Group and can be divided into four categories:

- Boundary: Provide full coverage of model boundaries and are to be shared with neighbouring regions. The NRTM shares a boundary with the Trans-Pennine South region – a common screenline has been agreed with the Trans-Pennine South Model. The northern boundary of the model is with Scotland.
- Inter-urban: Cover key inter-regional movements between adjacent conurbations within the study area. These are predominately on the eastern side of the region and have been defined between all neighbouring counties.
- Strategic: Track long distance movements across the study area – such as the Trans Pennine routes – and where route choice is restricted by a physical feature such as the River Tyne.
- Cordon: Defined around all major towns, cities within the study area as a check on the quality of the trip matrices to validate the quantity of trips entering and leaving that sector. An additional larger cordon has been defined for the Tyne and Wear region.

The screenlines are shown in Figure 2-2.

Figure 2-2 – NRTM Study Area Screenlines



Locations at which counts were required were identified by creating a list of points at which the modelled network intersects these screenlines. In addition to screenline counts it was also agreed that the model should be calibrated and validated against a number of counts on the Strategic Network which do not form part of a screenline.

2.3.3 Existing data sources

Existing counts were identified by contacting all Local Authorities and consultants currently working on RIS models in the region. In the model region, there are a large number of permanent traffic counts locations where traffic flow data is collected on an ongoing basis. In addition to permanent sites there are also temporary counts undertaken by various authorities (including Highways England and Local Authorities) which are used for a range of purposes. Data about these counts have been collected in an initial stage for later use and are summarised in Table 2-3.

Table 2-3 – Traffic Count Data

Source	Count Type	Survey Period	Data Type
TRADS (Highways England[1])	Permanent automatic count sites on the SRN	Permanent – data obtained for NRTM base year and month.	Data is not fully classified.
TADU (covering Cumbria and Tyne and Wear)	Permanent automatic count sites	Permanent – data obtained for NRTM base year and month.	Data is not fully classified.
DfT Counts – Major Roads[2]	Classified Counts	Single day counts.	Data provenance is poor. This data is only used for classification purposes.
DfT Counts – Minor Roads[3]	Classified Counts	Single day counts.	Data provenance is poor. This data is only used for classification purposes.
AECOM (Trans Pennine South)	Temporary Automatic Traffic Count	Two weeks in November and December 2015.	Data available for 1h intervals.
Arup (Coast Road model)	Temporary Automatic Traffic Count	A two week period between 15th October 2012 and 26th October 2012.	Data available for 1h intervals.
	Manual Classified Count	A 12 hour period during the week beginning Monday 22nd October 2012.	Counts have been classified into 5 vehicle classes (Car/Taxi, LGV, OG1, OGV2 and PSVs).
	Manual Classified Turning Count	A 12 hour period during the week beginning Monday 22nd October 2012.	Counts have been classified into 5 vehicle classes (Car/Taxi, LGV, OG1, OGV2 and PSVs).
Jacobs (A1 North of Newcastle model)	Temporary Automatic Traffic Count	A two week period between 6th July 2012 and 19th July 2015.	Good quality classified data (cycle, cars, LGV, OGV1 & PSV and OGV2) data available for 15 min intervals.

[1] https://trads.hatris.co.uk/
[2] http://data.gov.uk/dataset/gb-road-traffic-counts
[3] http://data.gov.uk/dataset/gb-road-traffic-counts

	Manual Classified Count	The 8th July 2015	Data available for 15 min intervals, classified into Cars/Taxis, Towing Car (caravan/trailer), LGV, OGV1, OGV2, Bus/Coach, Motorcycle, Pedal Cycle, Agricultural Vehicles and Other.
	Manual Classified Turning Count	Carried out for time period between 07:00 to 19:00, 2015.	Data available for 15 min intervals, classified into Cars/Taxis, Towing Car (caravan/trailer), LGV, OGV1, OGV2, Bus/Coach, Motorcycle, Pedal Cycle, Agricultural Vehicles and Other.
Cumbria County Council	Permanent Automatic Traffic Count	Permanent – data obtained for NRTM base year and month.	Data is not fully classified.
	Temporary Automatic Traffic Count	Various – 6 days to 30 days between 2007 and 2015.	Volumetric data for 1h intervals.
	Manual Classified Turning Count	Various - various duration and times. No full day counts.	Data available for 15 min intervals, classified into Motorcycle/Car, LGV, OGV1, OGV2, Bus/Coach,
Darlington Borough Council	Permanent Automatic Traffic Count	Permanent – data obtained for NRTM base year and month.	Data available for five vehicle classes for 1 hour intervals.
Durham County Council	Temporary/ Permanent Automatic Traffic Count	Various – 1 week, 2 weeks, a full month.	Volumetric data for 1h intervals.
Middlesbrough Borough Council	Temporary/ Permanent Automatic Traffic Count	Various – 2 weeks to a full month between 2007 and 2015.	Volumetric data for 15min intervals. Classified data for <5.2m, 5.2-6.5, 6.5-11.5 and >11.5m.
North Yorkshire County Council	To be confirmed.	The most recent data available is for July/August 2015.	Data available for various intervals.
Northumberland County Council	Temporary Automatic Traffic Count	Various – between 2005 and 2015.	Volumetric data for 1h intervals.

Redcar and Cleveland Borough Council	Temporary/ Permanent Automatic Traffic Count	Various – 2 weeks to a full month between 2007 and 2015.	Volumetric data for 15min intervals. Classified data for <5.2m, 5.2-6.5, 6.5-11.5 and >11.5m.
Stockton-On-Tees Borough Council	Temporary Automatic Traffic Count	Various – between 2006 and 2014. To be confirmed.	To be confirmed. Some data was identified as corrupted.

The location of all existing counts are shown in Figure 2-3 for ATCs and MCCs and MCTC are shown in Figure 2-4.

Figure 2-3 – Existing ATC Locations

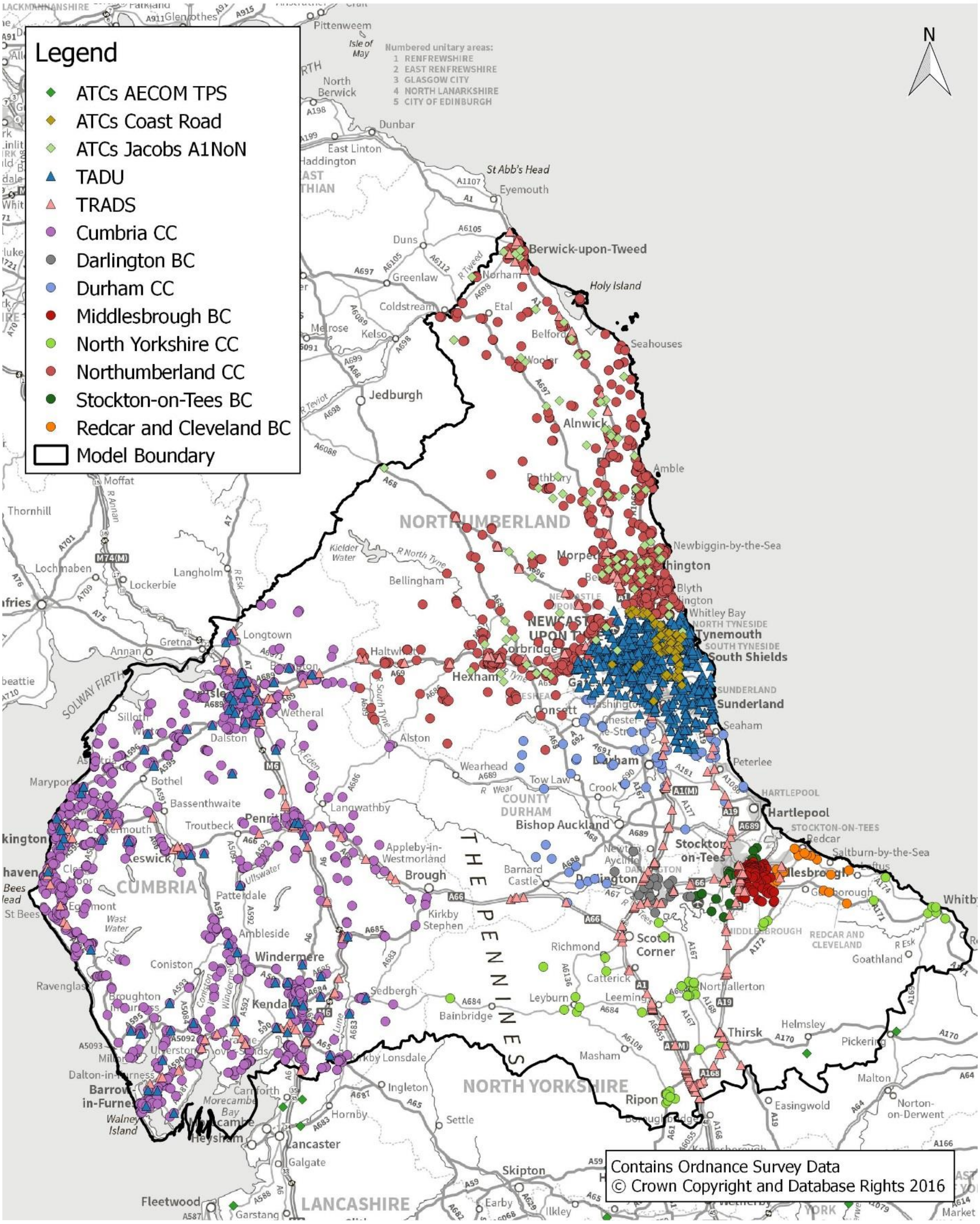
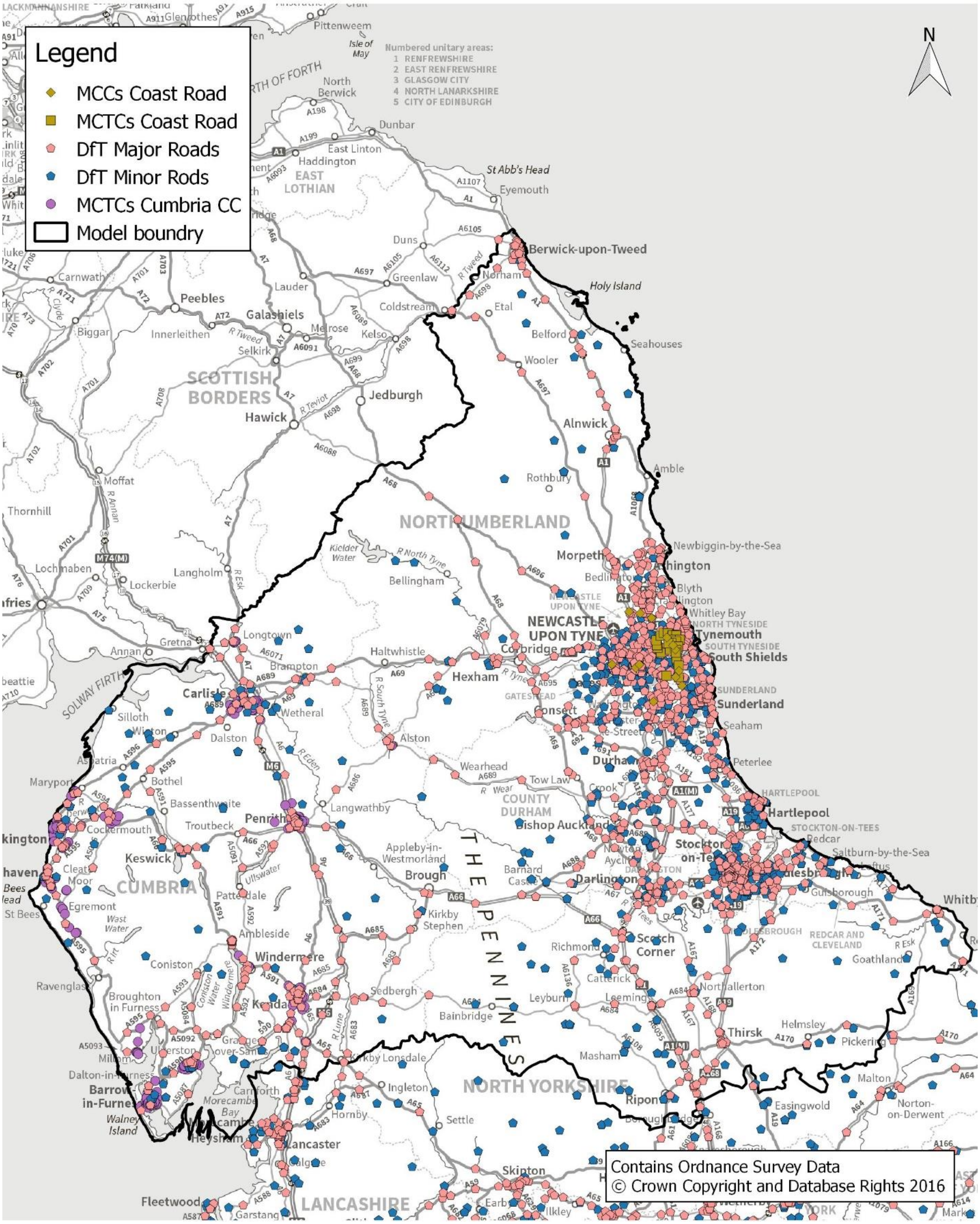


Figure 2-4 – MCC and MCTC Locations



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2.3.4 Data Collation

Count data was then collated and are shown in Figure 2-5 and Figure 2-6.

Figure 2-5 – ATC Counts from Existing Sources Used.

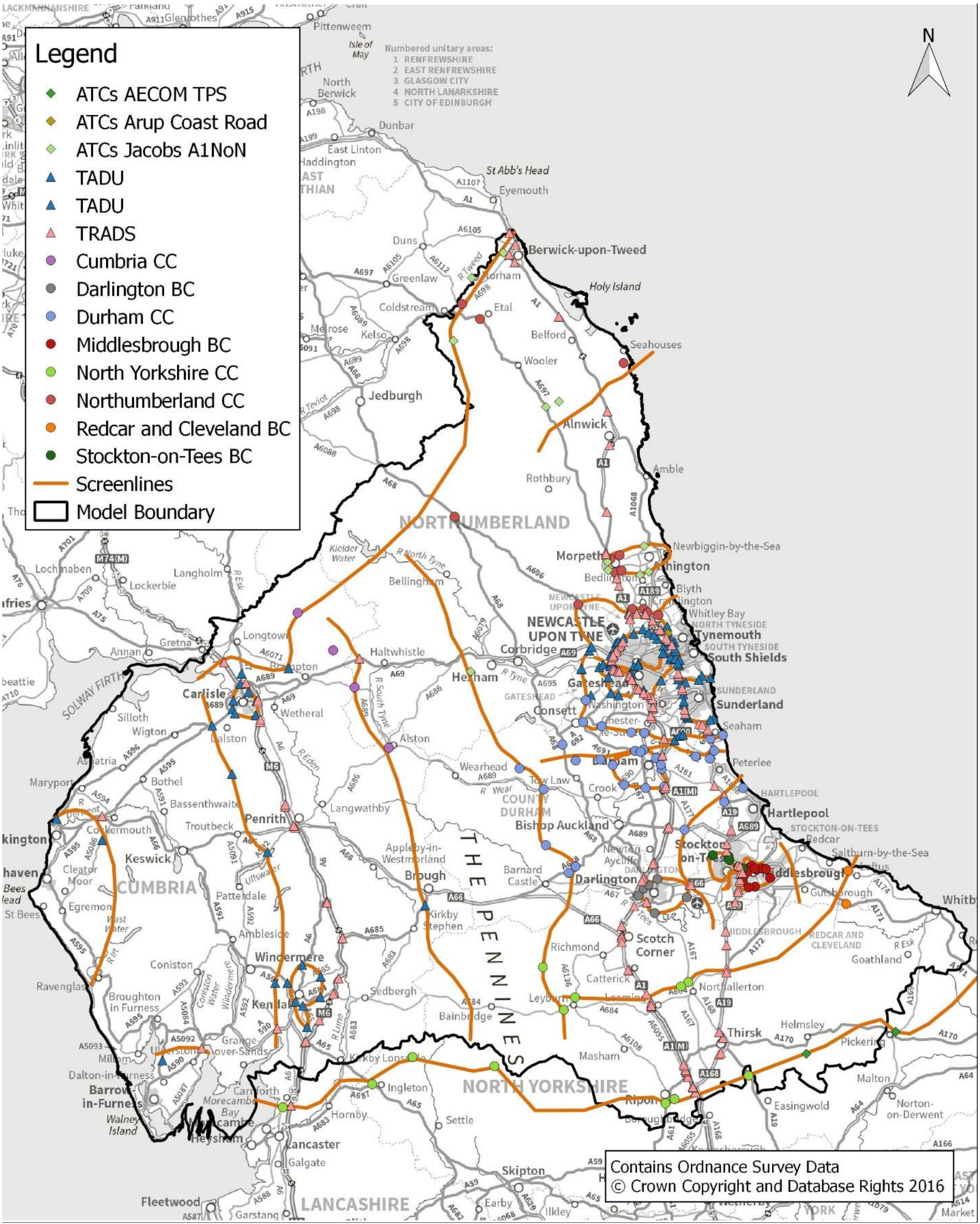
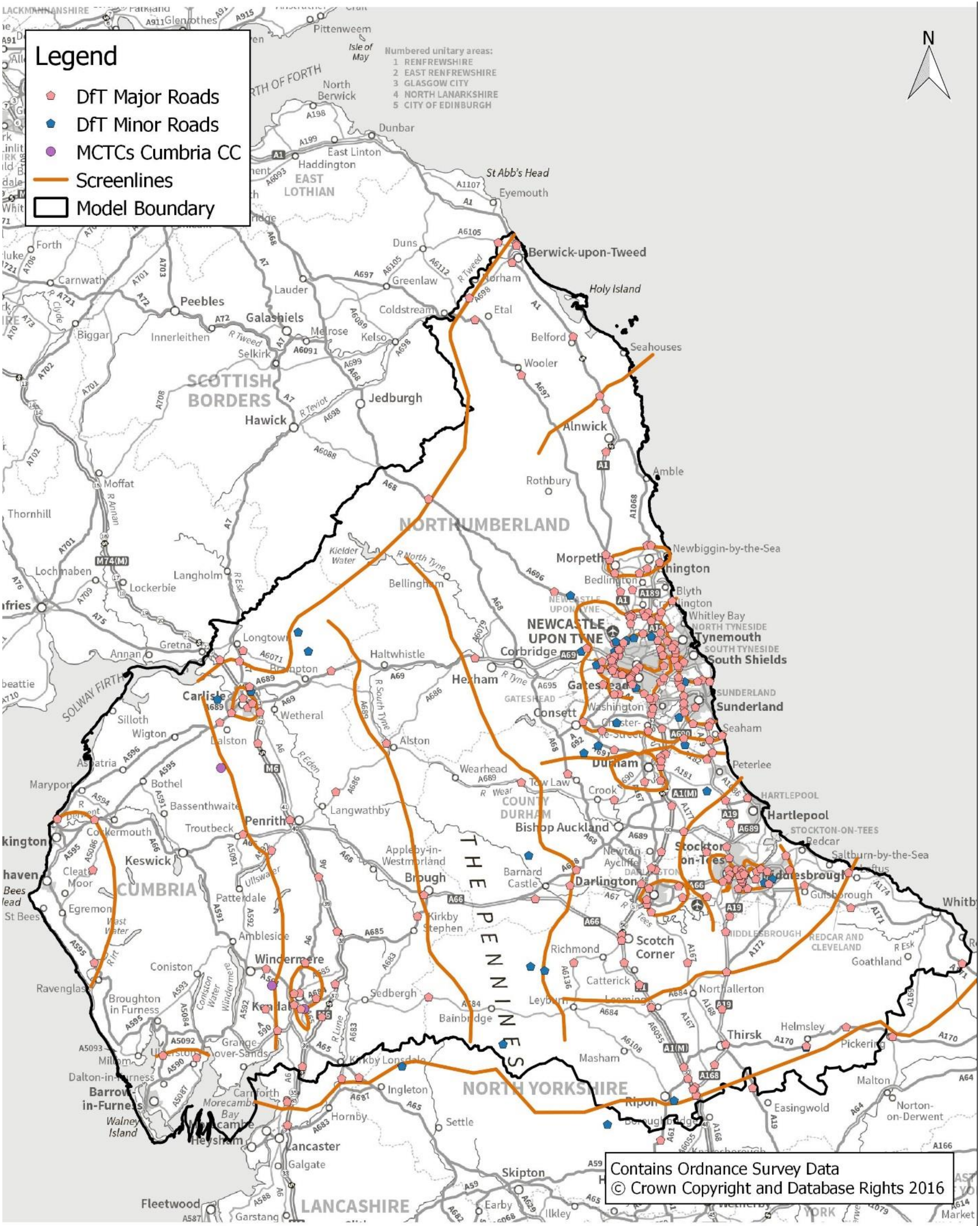


Figure 2-6 – Existing MCC and MCTC Sites Used



2.4 Demand Data

2.4.1 Mobile Phone Data

Development of a highway assignment model requires a set of trip matrices to be produced. For the NRTM, there are fifteen required:

- Car matrices for three trip purposes:
    - home based employer business,
    - home based commute, and
    - home based other

  for three average hours: AM, IP and PM,
- LGV matrices for AM, IP and PM average hours and
- HGV matrices for AM, IP, and PM average hours.

It is unfeasible to use RSI data to develop trip matrices for a model of the size of the NRTM. This approach would typically be used for a local model where it is possible to define a cordon around the Region of Focus (RoF) and set up sites on all main routes across the cordon. The trip matrices for the NRTM will need to track a broader range of trip patterns and travel behaviour, including:

- short distance local movements on the SRN or competing routes;
- inter-urban movements between the larger conurbations on the eastern side;
- Trans-Pennine movements between the east and west sides of the RoF; and
- trips using the SRN to pass through the RoF between 'external' areas of England and Scotland.

It was decided by Highways England to use mobile phone data as the primary data source for the car trip matrices because it provided the best source for representing the varied trip movements; in particular the long distance trips.

A consultant and mobile network operator (MNO) team were appointed by Highways England to process a year's worth of mobile phone movements across the UK into matrices suitable for transport modelling. This 'cellular' data represents a large sample (around 30%) of the population but does not provide sufficient spatial detail or information regarding trip purposes and vehicle types. Therefore, the data received from the project requires further processing to make it suitable as a set as car matrices for assignment.

The data was supplied to the NRTM modelling team in summer 2015 based on the MNO's current technology, herein referred to as the provisional dataset. A Trip Information System (TIS) is being developed by the MNO which will supply additional information about each cellular trip within the network. However the TIS will not be available within the timescales of the NRTM project and so the matrices have been derived from the provisional dataset.

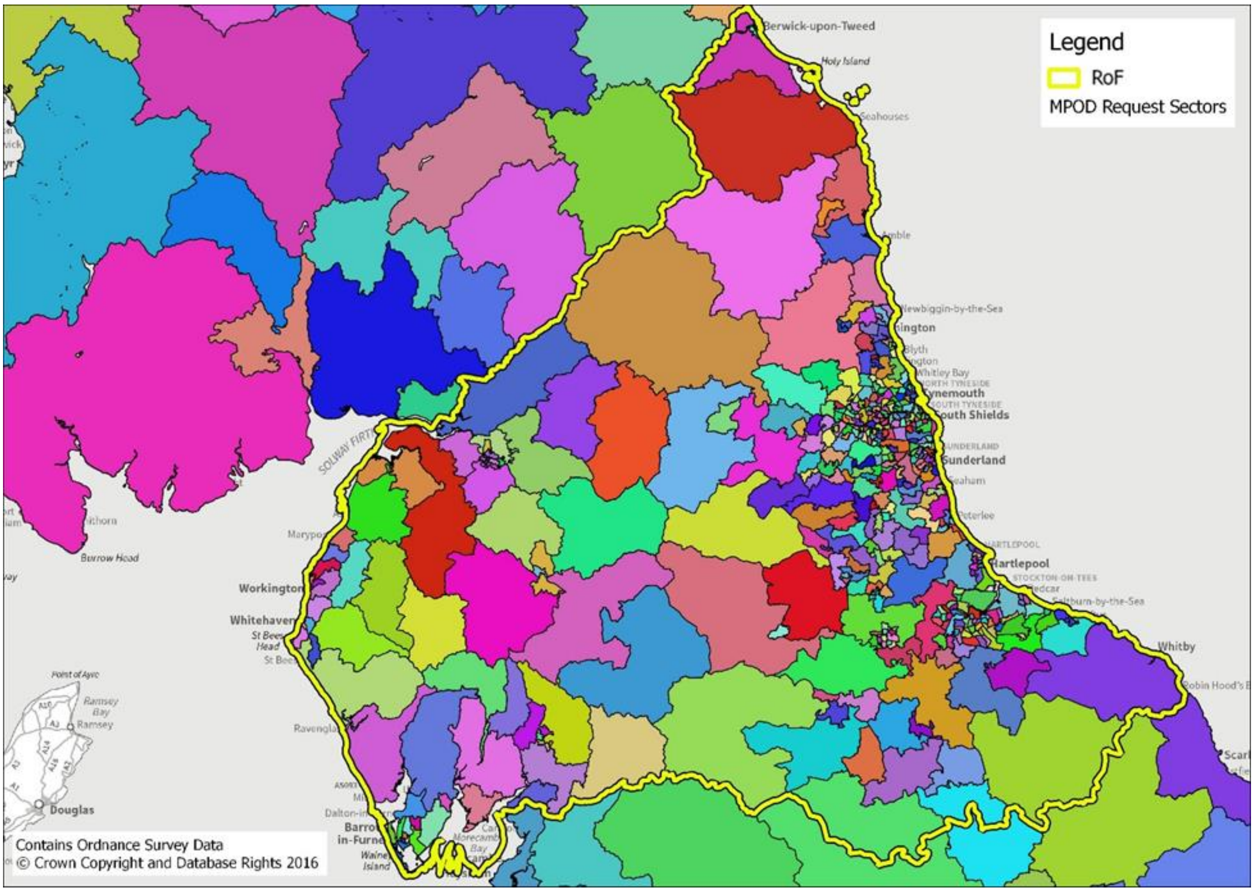
The data has been supplied for the whole of the UK mainland in the form of origin-destination (OD) matrices. An original version of the dataset contained all road based trips only (car, goods vehicles, bus and coach). However, verification checks undertaken by the Matrix Development Technical Consistency Group (Matrix TCG) raised concerns that rail trips had not been extracted correctly.

A second version of the provisional dataset containing movements made by all modes was provided; this is the version that has been used for the matrix development process. This related to person trips between every Middle Super Output Area (MSOA) in England, Scotland (equivalent thereof) and Wales. The data has been provided to in the form of a sectoring system, herein referred to as MPOD (mobile phone origin-destination) request sectors.

The request sectors consisted of MSOAs within the RoF and aggregations of MSOAs outside the RoF up to district or county level based on proximity to the RoF. The data provided are:

- Monday to Friday averages (based on trips made between 2nd March and 27th March 2015) listed by origin start hour for trips beginning between 05:00 and 20:00 and aggregated for the remainder of the day.
- Given in expanded form representing person trips made by the whole population on an average weekday during the study period. The expansion is based on the ratio of MSOA population to number of phone with a home location in that MSOA.

Figure 2-7 – Request Sectors for the NRTM RoF



2.4.2 Supplementary Data Sources

Several biases were identified in the dataset – see Section 6.1.1. In particular, there was low confidence in the short distance trips within the MPOD matrices. It was decided by the Matrix TCG that a set of synthetic matrices would be developed by each region. These would be used to displace short distance trips – specifically intra-MPOD sector trips – within the MPOD data. Independent sources were also required for the verification checks outlined in Section 6.1.1.

The synthetic matrix build process required planning data from the census to generate the trip ends plus generalised costs and observed trip distributions for the gravity modelling process. Further datasets were also required to develop separate LGV, HGV and rail matrices plus air travel profiles.

A high level summary of the datasets used in the matrix development process is given in Table 2-4; a more thorough description of each dataset is given in Sections 6.1.3 to 6.1.13.

Table 2-4 – Summary of Demand Data Sources

Data Set	Source	Year(s)	Usage in NRTM
MPOD Provisional Dataset	Telefonica	2015	Car origin-destination trip matrices
National Travel Survey (NTS)	DfT via UK Data Service	2009 - 2014	Observed trip length distributions, trip rates and trip purpose splits by various variables
Media Use and Attitudes Report 2015	OFCOM	2014 - 2015	Mobile phone ownership by age and socio-economic group
UK Census Data	NOMIS	2011	Planning data inputs for CTripEnd
Mid-Year Population Estimates	ONS	2011 - 2014	Generate factors for census population data to base year
Business Register Employment Survey	ONS	2011 - 2014	Generate factors for census employment data to base year
Households and Families Survey	ONS	2011 - 2014	Generate factors for census household data to base year
TEMPRO	DfT	2015	Trip ends for Scotland
WebTAG	DfT	2014, 2015	VOC, VOT and occupancy values
TrafficMaster	DfT	2015	LGV origin-destination trip movements
Base Year Freight Matrix (BYFM)	DfT	2006	HGV origin-destination trip movements
Continuing Survey of Road Goods Transport	DfT	2006 - 2014	Generate factors for BFYM values to base year
MOIRA	ATOC	2015	Rail fares, generalised costs and base year rail demand
National Rail Transport Survey	DfT	2007	Derive zone to zone movements from data extracted from MOIRA
NAPALM	DfT	2015 and forecast years	Modelled air travel passenger demand for forecasting
Civil Aviation Authority Passenger Surveys	DfT	2014	Overlay airport demand distributions onto MPOD data

2.5 Journey Time and Speed Data

2.5.1 Background

Trafficmaster data is a GPS-based database of vehicle trips. Records of speed from this database have been used in both the development of the network and for validation of journey times. The dataset holds records of journeys made by vehicles fitted with Trafficmaster GPS tracking devices (SmartNav). These GPS reports are then mapped to the Ordnance Surveys Integrated Transport Network (ITN) and are used to reconstruct the routes taken by the vehicles as they move through the road network.

A request for this data was made on behalf of all regional models to the DfT, who hold Trafficmaster data for England. The period of data requested was an important consideration due to a change in the HGV speed limit which came into effect on April 6th 2015. It was felt this change would not only impact HGVs but also the speed of light vehicles particularly on single carriageway routes where overtaking opportunities may be limited. A decision was therefore made to use data from the time after this change in speed occurred. However it was also noted that the Easter holiday period also landed during April in 2015 and therefore it was felt this was not representative of an ‘average month’. As a result, a request for weekday (exclude bank holidays) data covering May and June 2015 was made to provide a richer dataset.

2.5.2 Network speeds

Trafficmaster data is used to code fixed speed buffer links in the network.

2.5.3 Journey time

The data will also be used to validate journey time routes in the model. Average travel times by links will be formed into routes and compared to modelled journey times. This approach was agreed in the calibration-validation TCG.

2.5.4 Journey Times in Scotland

Trafficmaster data is not available from DfT for Scotland. Contact was made with Transport Scotland to investigate alternative sources of journey time and speed data. The LATIS model which covers all of Scotland and contains base and forecast year speeds was identified as an alternative source of journey time and speed information. Following a request to Transport Scotland this data was made available to the Regional Model teams.

3 Use of Available Processed Data and Models

3.1 Existing Models

Existing strategic and microsimulation models are a potential source of data for NRTM. Existing models which cover substantial areas in the NRTM area were identified through the data collection process. Within the NRTM base model build, counts undertaken for previous model builds have been used as well as signal timings in some locations. Information from existing model uncertainty logs will also be used in forecasting.

Table *3-1* –Table 3-1 summarises the models which were identified as part of this process.

Table 3-1 – Reviewed models

Model	Software	Base Year	Regions Covered
Tees Valley Multi Modal Model (TVMMM)	CUBE TRIPS (updates from Voyager)	2005	Middlesbrough, Redcar and Cleveland
West Cumbria Multi-Model Transport Model (WCTM)	SATURN/ VISUM	2011	Cumbria
Kendal Transport Model	SATURN	2011	Cumbria
Penrith Transport Model	SATURN	2012	Cumbria
Carlisle Transport Model	SATURN, VISUM, DIADEM	2008	Cumbria
Barrow-in-Furness Transport Model	SATURN	2009	Cumbria
Ulverston Model	S-Paramics	2014	Cumbria
North of Newcastle A1 Model	SATURN		Tyne & Wear, Northumberland
A1Gateshead Newcastle Western Bypass	SATURN	2013	Tyne & Wear
A19 Highway Assignment Model for the A19/ A1058 Coast Road junction and A184 Testos Roundabout	SATURN	2012	Tyne & Wear

4 Specification and Execution of Surveys

4.1 Commissioned Counts – Batch 1

The first round of count data gap analysis was undertaken in October 2015 when the bulk of count data from LAs had been received by the NRTM team. Following this analysis 36 ATCs were commissioned to fill gaps in screenlines. These surveys were undertaken over a 2 week period between 21st November and 4th December.

Issues relating to permissions from the relevant highways authority prevented surveys at two sites of these sites taking place:

- Site 3 (A1/ north of Alnwick) has only received the permission in a later date and therefore, the traffic survey was undertaken as part of count batch 2.
- Site no 36 (A66/ west of Brough) – permission was not received and therefore, volumetric data for this location was obtained using a DfT count located in proximity of the original location.

4.2 Commissioned Counts – Batch 2

A second round of gap analysis was undertaken when all data had been received and checked by the NRTM team. In several locations there were issues with existing count data which had been received and therefore a new count was commissioned. Secondly, some screenlines had also been modified in line with discussions in the calibration-validation TCG and following finalisation of network structure.

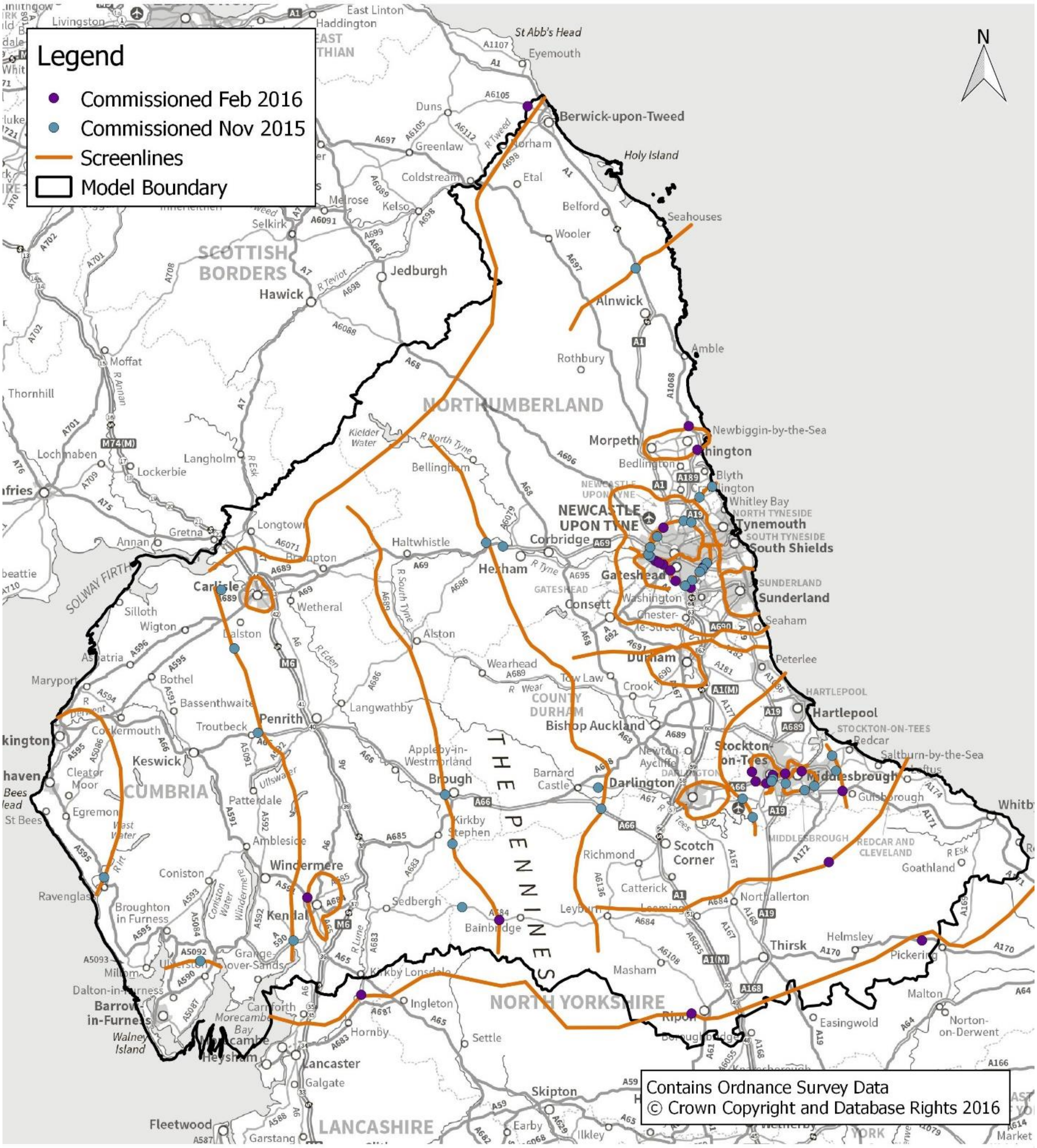
A further 25 counts were therefore commissioned and took place between 19th February 2016 and 7th March 2016 to fill these further gaps in the screenlines. The issues which emerged from this traffic survey included lack of permission due to:

- Safety issues (site 50 and 56);
- Stolen counter (site 60); and
- Corrupted data (site 61).

As a result, volumetric data for site 50 and 61 was obtained using DfT counts located in the proximity of the original counts. Data for the site 61 was obtained from a permanent traffic counter sourced from the highway contractor, Sir Robert McAlpine. For site 60, data was received for the period the count was in situ.

Figure 4-1 shows the locations of the counts commissioned in November 2015 and February 2016. In Appendix C, higher resolution maps of the location of the ATC sites are shown. Both traffic survey specification documents are appended to this report as Appendix D.

Figure 4-1 – Newly Commissioned ATCs



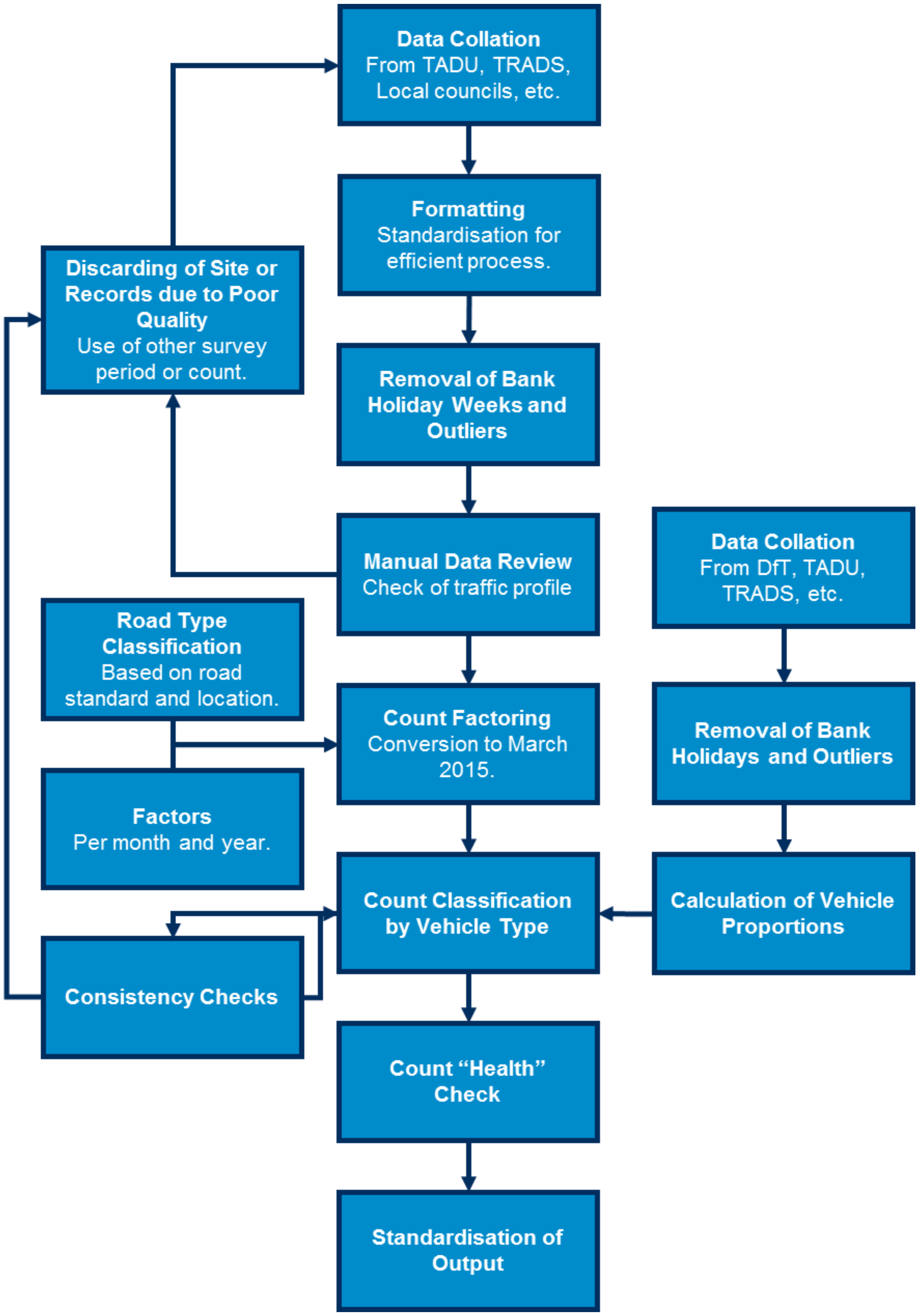
5 Final Volumetric Dataset

5.1 Count Data

5.1.1 Introduction

The process of checking count data and processing is illustrated in Figure 5-1.

Figure 5-1 – Flow Chart of Processing



5.1.2 Formatting

The first step of processing is to reformat the various sources into a standard template, which allows for the most efficient processing of data. When formatted, each site has a record of flow for each hour of the survey period.

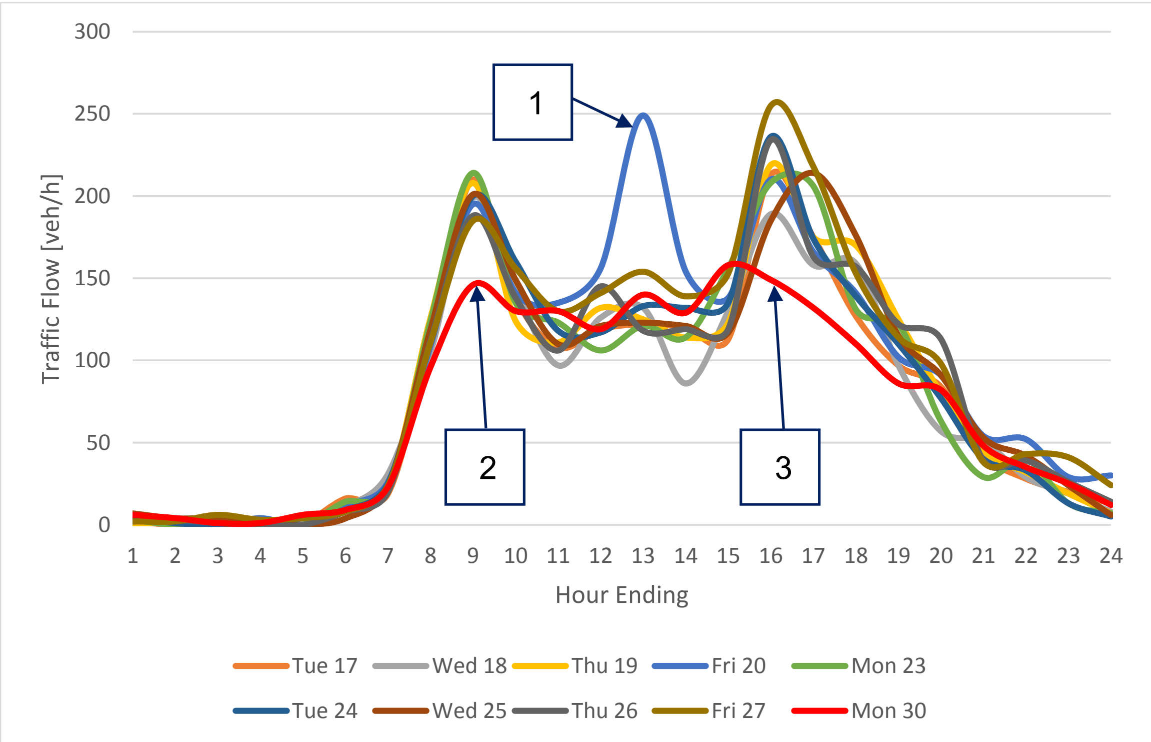
5.1.3 Removal of Bank Holidays and Outliers

Once in this format, weekends and entire weeks in which bank holidays fell were removed as recommended in TAG Unit M1.2.

An automated analysis of outliers was then undertaken with records for hours removed from the dataset if they were found to be greater than two standard deviations from the mean. This analysis was carried out to determine possible errors in the data collection process or disruption to normal traffic flow patterns.

For the purpose of this analysis, hourly traffic flow was compared between days. Figure 5-2 demonstrates an example of this analysis for a site located on the B6324 Stamfordham Road. It can be observed that on Friday 20th, the flow during the IP peak period (1) was abnormally high and exceeded the flow observed for both AM and PM peak periods. Additionally, it was observed that the traffic volume during the AM and PM peak periods on Monday 30th (2 & 3) was considerably lower in comparison to the rest of the sample. In this example, the traffic flow in (1) and (2) was removed as the variation exceeds two standard deviation of the mean, i.e outside of the 95% confidence interval for the sample. However, the deviation in (3) is too small to be excluded in this process.

Figure 5-2 – Removal of Outliers



5.1.4 Manual Data Review

In addition to the automated process for removing outliers, manual checks were also undertaken to check for consistency of data or missing data. A key part of the checking process was to review the ATC data and flow profiles on a site by site basis to identify if any records are inconsistent between days or hours of the survey. Using this process, the following potential issues can be observed:

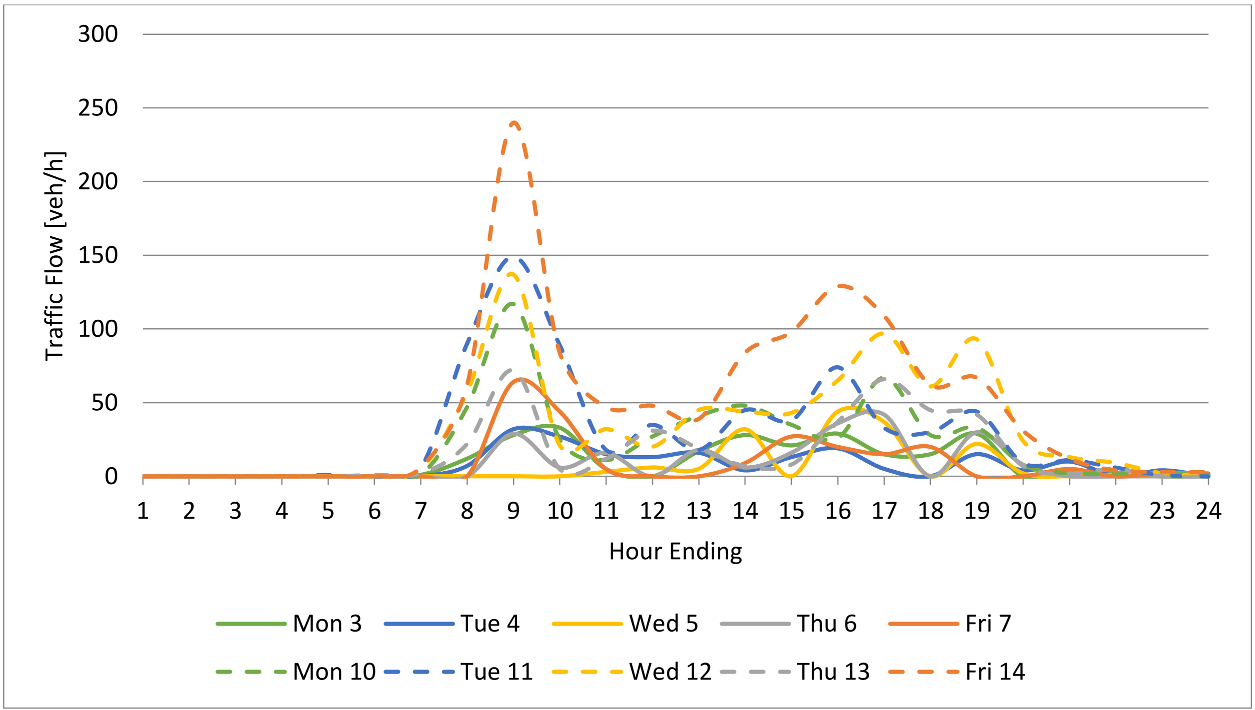
- Data collection error (human or equipment);
- Day-to-day variations in flow;
- Variations in flows by week;
- Hourly flow profiles – this can be used to identify unusual peak hours or inconsistent tidal flows;

All outcomes of this manual checking, whether exclusion of data or simply commentary on the quality were recorded in a master spreadsheet.

5.1.5 Data Collection Errors

An example of a data collection error is illustrated in Figure 5-3 below. This graph highlights a situation when the traffic pattern is irregular and low. In this example, the abnormalities are persistent throughout the data collection period but they could also have been present for a shorter time. It may be that these abnormalities were caused by an equipment error, poor siting of a pneumatic tube or, if short term, a network incident. In these instances, the source data was checked for comments relating to weather, accidents, road works or other causes. If this error was only for parts of the period, these days were excluded or if available a count from a different period was used. Where the decision on whether to exclude data is less clear cut, a commentary was logged within the checking spreadsheet.

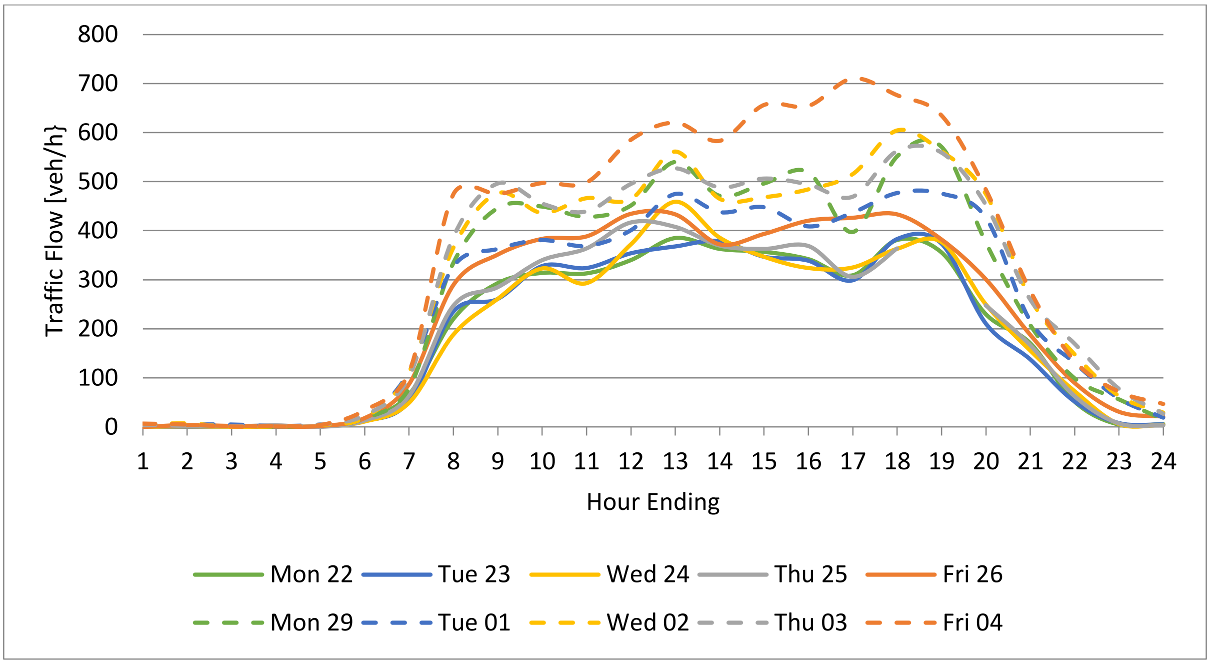
Figure 5-3 – Data collection error



5.1.6 Day to Day Variation

The day-to-day variation issue occurs when there is large variation of the flows between days, which cannot be explained. Variations of 50% between days have been observed. This day-to-day variation increases the standard deviation and thereby reduces the number of values excluded. On these occasions, checks are made with other time periods and other potential influences are considered. In one example at Chowdene Bank in Gateshead, it was found that the road had just re-opened following a four month closure and as a result there was a gradual increase in usage over the survey period as people returned to their previous journey route.

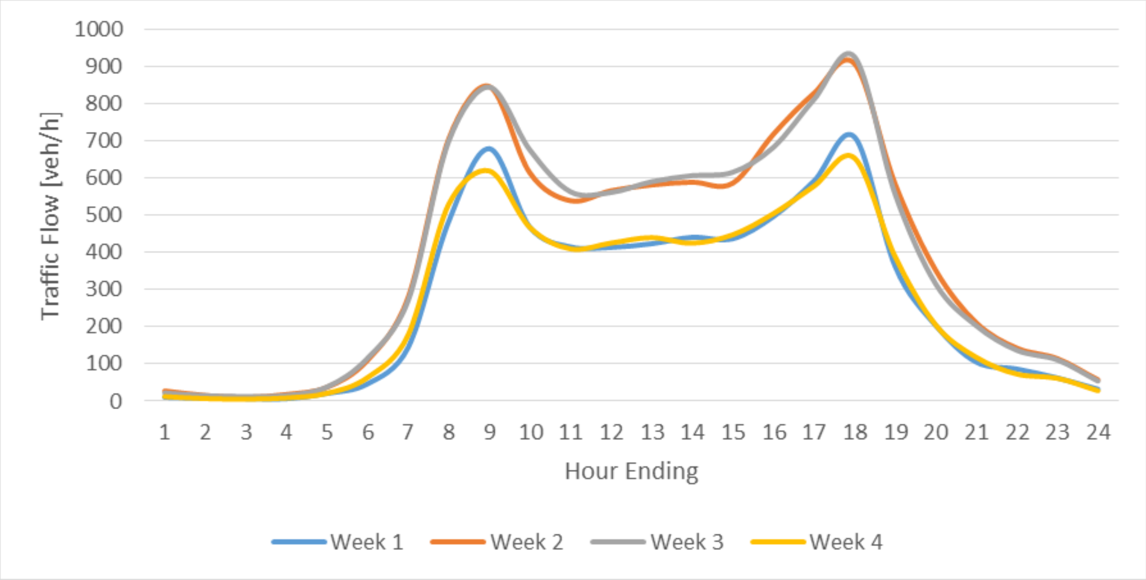
Figure 5-4 – Chowdene Road in Gateshead



5.1.7 Variations in flow by Week

Average hourly flows were also compared by week as shown in Figure 5-5. This shows consistent levels of traffic and profiles for weeks 1 and 4, the profile of traffic for weeks 2 and 3 is similar but at a higher overall volume for each hour. In this case, it is impossible to tell which flow is correct. Where data is available for an alternative month, a comparison has been made and in some cases data from the alternative month has been used. If another month is not available, the mean average will be used, but a comment is added to the count quality log.

Figure 5-5 – Variations in Flow by Week



5.1.8 Hourly Flow Profiles

A further quality check for any inconsistencies was then undertaken by comparing average hourly flows. Figure 5-6 represent an example of an average hourly traffic flow assessed separately for each direction. The figure demonstrates the tidal nature of flows in many locations, in this peak flow is southbound in the morning and northbound in the evening. Comparisons of directional peak flow were made at all locations. If any locations show a clear peak in both directions in the same hour these will be investigated further with consideration given to whether this can be explained or whether it could be an erroneous result.

Figure 5-6 – Average Hourly Flow

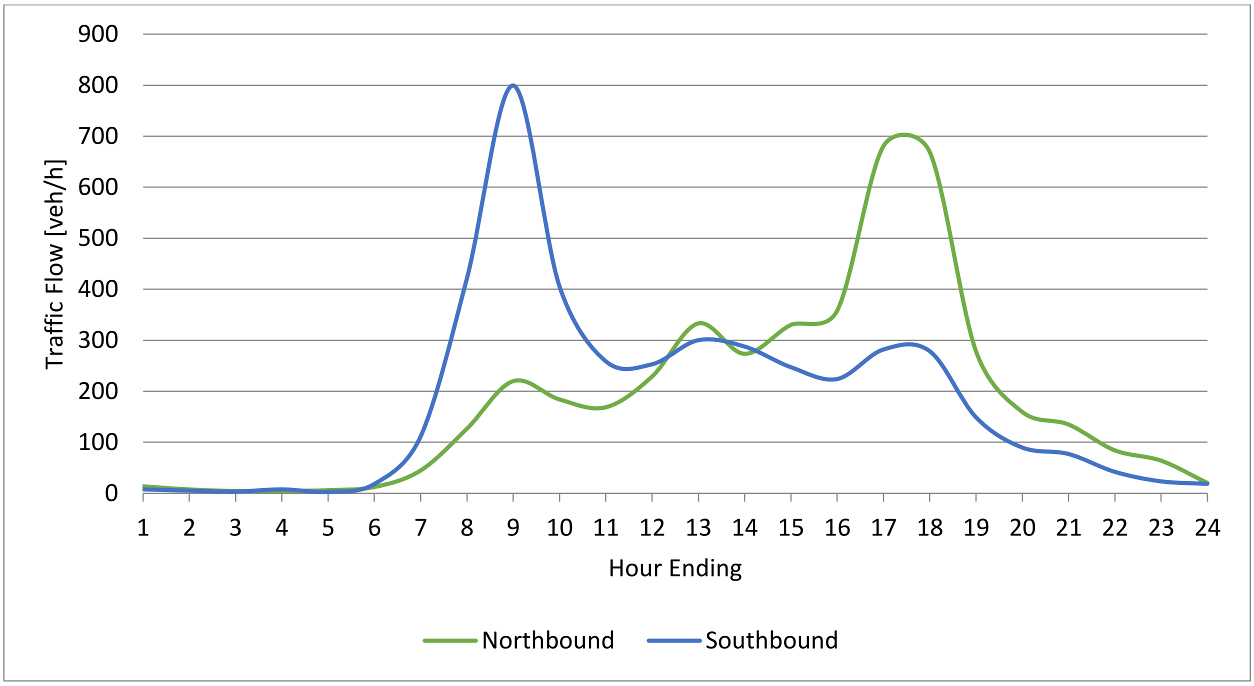
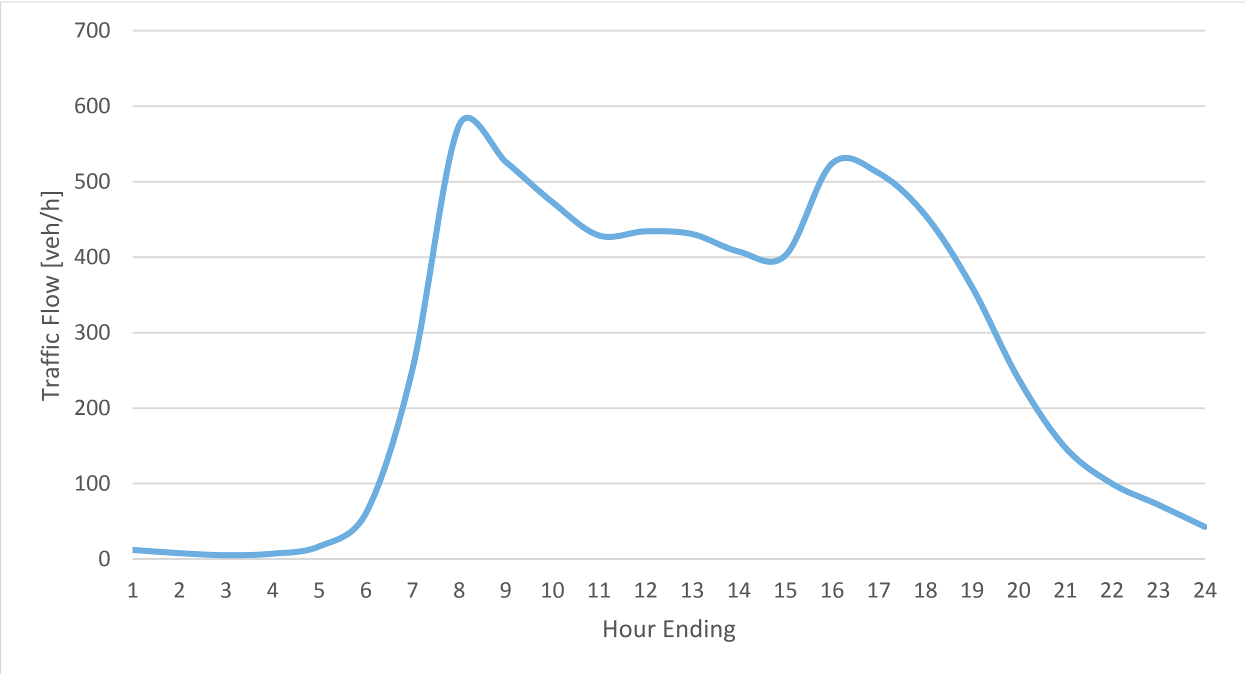


Figure 5-7 shows a different pattern to the example above. This shows peaks in both the morning and evening periods. In this example the peak seems less dependent on the direction of travel, although comparisons were still made with the opposite direction of travel. In this process, no clear errors were found and therefore no data was excluded.

Figure 5-7 – Average Hourly Flow



In all instances, the removal of data and irregularities were documented. The exact approach for further action varies between each count. For permanent count sites such as TADU and TRADS, data was available for other months which could be used in place of erroneous data. For temporary ATCs, this option was not always available. A decision therefore had to be taken on whether to include the count (recognising the limitations of the data quality) or exclude the data and identify an alternative existing count or commission a new count. This decision took into account the sample of data available after exclusion of information. In some cases issues appeared to effect certain hours or days, whereas in other cases there was no discernible pattern to flow profiles in which case whole counts had to be excluded. In total 29 sites were discarded or revised using a different time period.

5.1.9 Summary of Count Data

When the data was checked and passed the quality control, the next step was to convert flows to March 2015 using monthly and annual factors. This approach was agreed within the data consistency and calibration-validation TCGs. As seen in Figure 5-8 and Figure 5-9, the majority of counts took place in March and/or 2015, though there are counts for every month and a small number of counts that are older than 2012. A small number of counts took place in non-neutral months, which was agreed as acceptable with the TCG.

Figure 5-8 – Month of Count Survey

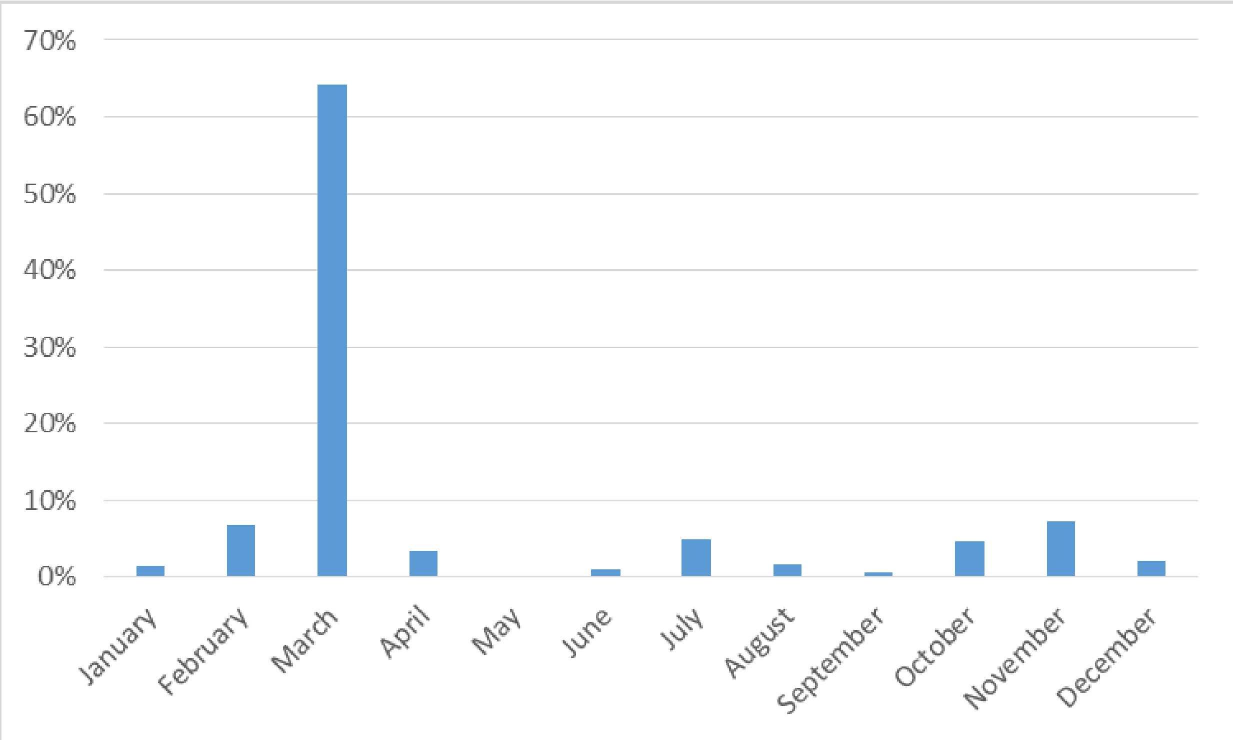
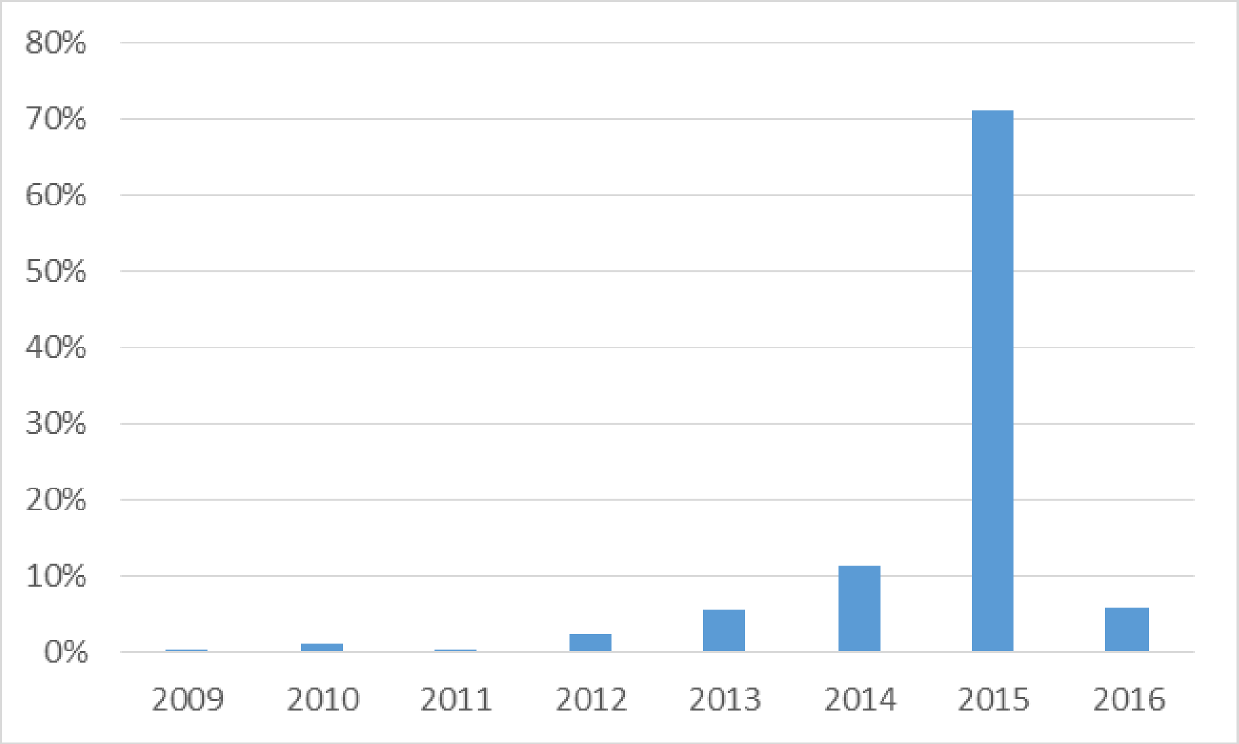


Figure 5-9 – Year of Count Survey



5.1.10 Count Factoring

Permanent TADU and TRADS sites in the model area were used to generate factors to. In total, 376 sites were used with 7 years of data from 2009 to 2015 which gave a large sample of data. To assure quality of data, the following process was followed for each site:

- A minimum of ten days of data collection was required for the month.
- Bank holiday weeks were excluded from the data.
- A simple check was undertaken to remove extreme monthly and annual variations.
- Annual factors were derived by comparing counts from March of each year.

For monthly factors it was felt that different types of roads required different factors. Road types were agreed within the technical consistency group with every count classified into one of the following categories:

- Motorway;
- A-Road Dual-carriageway;
- A-Road Signal-carriageway; or
- Other.

As well as classifying by road type, each count was also classed as either a rural or urban site. Although this is a somewhat subjective classification it was felt necessary to reflect seasonality which can particularly effect flows in rural areas with the Northern region, as evidenced by Figure 5-10. Generally roads were classified as urban or rural based on local characteristics and the classification of nearby sites. Where the distinction was not clear the count was checked and counts which showed morning and evening peaks - indicative of a commuter route - were classed as urban. The full classification of screenline and ad-hoc counts are shown in Figure 5-11.

Figure 5-10 – Monthly Traffic Variation

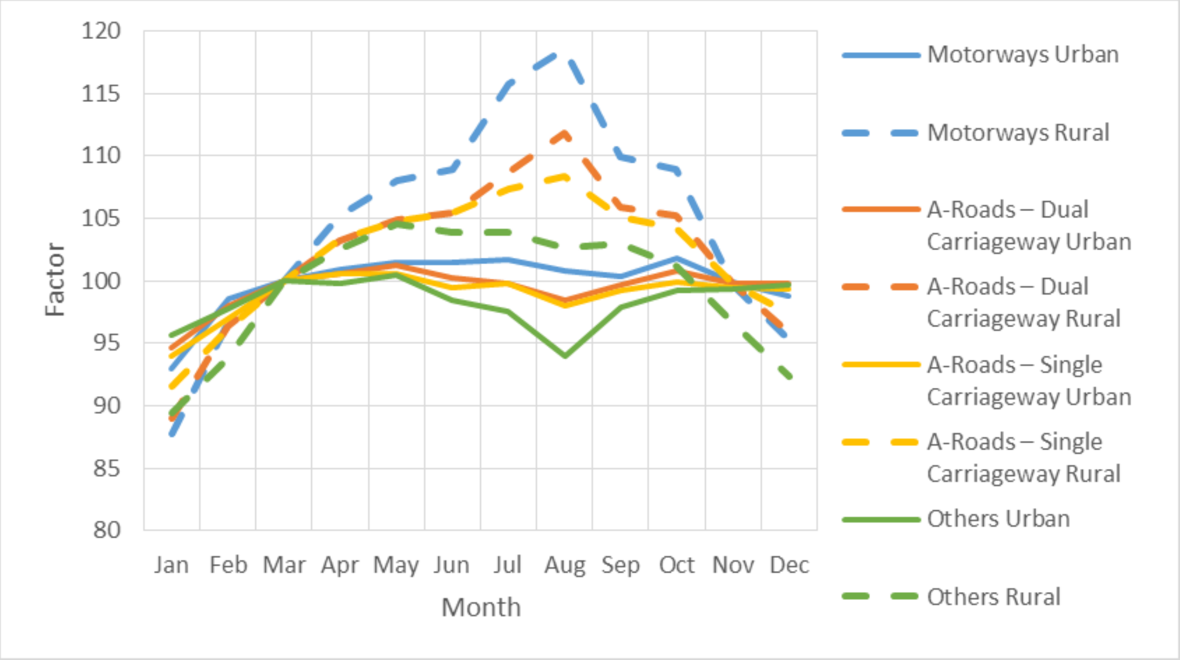
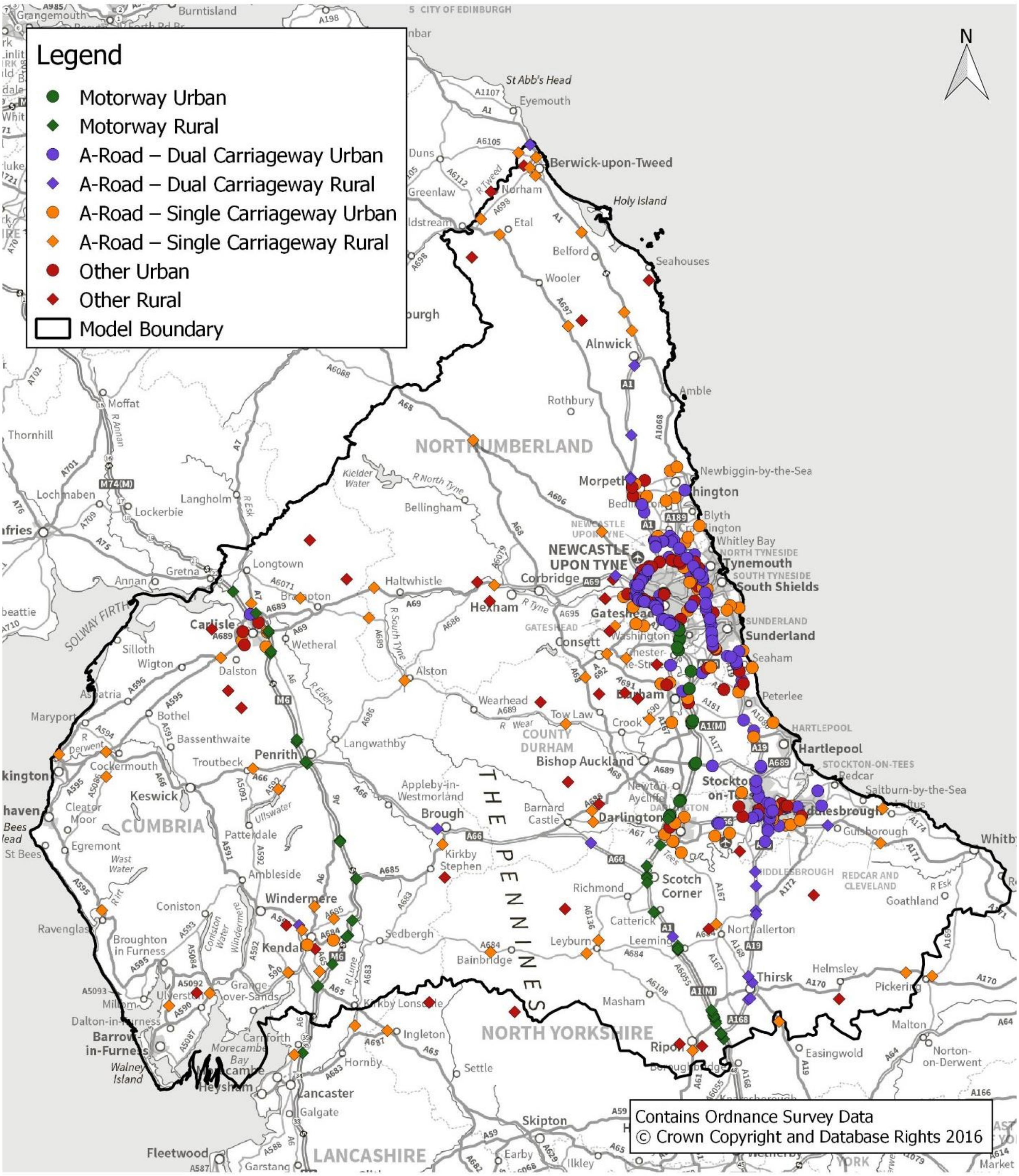


Figure 5-11 – Road Type Classification of Counts



For the monthly factors, the factors vary between AM, IP and PM and is also dependent on the road type, Table 5-1 shows these monthly factors. The largest factors are for the inter-peak period and on rural roads, suggesting more use by recreational and long distance trips which are less likely to be travelling in the morning or evening peaks. Urban routes show less variation across the year with the notable exceptions of August and December – traditional holiday periods when less people commute to work or education.

Table 5-1 – Monthly Factors

Month	Motorways						A-Roads – Dual Carriageway						A-Roads – Single Carriageway						Others					
	Urban			Rural			Urban			Rural			Urban			Rural			Urban			Rural		
	AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM
Jan	95	92	93	91	86	88	96	94	94	92	88	88	95	94	93	94	91	90	96	96	95	92	90	86
Feb	97	100	98	94	98	97	96	99	97	94	98	96	94	99	96	94	98	95	95	99	98	92	96	91
Mar	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Apr	99	102	102	101	107	106	98	101	101	100	105	103	99	101	102	100	104	105	98	100	101	99	103	105
May	100	102	102	103	110	109	100	102	102	101	106	107	100	100	102	102	105	107	99	100	102	102	105	106
Jun	99	103	101	103	112	108	99	101	100	101	108	106	98	100	100	101	107	106	97	99	100	101	104	107
Jul	97	105	100	102	124	113	94	103	99	99	114	108	94	102	100	97	112	108	93	100	99	96	107	106
Aug	91	107	98	98	130	116	88	105	97	95	121	110	86	104	98	91	117	109	84	99	95	85	110	105
Sep	98	101	101	103	114	109	98	100	100	101	108	106	98	99	101	101	106	107	96	98	100	101	103	106
Oct	98	103	102	100	114	108	97	102	101	99	109	105	97	101	101	99	106	105	96	100	101	97	103	102
Nov	98	101	100	99	101	98	99	101	98	99	101	98	99	100	99	100	101	98	97	100	100	99	98	92
Dec	96	101	97	95	97	92	97	103	96	95	98	92	98	102	96	97	100	93	97	102	98	94	95	86

Table 5-2 shows the annual factors where no distinction has been made between road type or time period. A drop in traffic flows for 2013 was observed. This has been investigated and it was hypothesised that the drop could be the result of poor weather in March 2013, counts were therefore compared over a longer period of January to March. This comparison also showed a drop in traffic volumes from 2012 to 2013. The provided reassurance that this small drop in traffic volumes between 2012 and 2013 is consistent over a wide set of counts, although the exact cause remains unexplained.

Table 5-2 – Annual Factors

Year	All road types
2009	99.37
2010	99.61
2011	97.64
2012	97.70
2013	96.37
2014	98.45
2015	100.00
2016	100.00

5.1.11 Count Classification by Vehicle Type

All processing of count data to this point has focused on summarising total flows. However flows need to be classified into car, LGV and OGV to be used in matrix development and model calibration and validation. Two slightly different approaches for the vehicle classification of volumetric flow were used. This approach was agreed in the Data Consistency TCG:

- Method 1: For TADU and TRADS counts – total flow was first divided into light and heavy vehicles based on the 6.6 metre length classification which is available for these sites. Lights were then classified using method 2.
- Method 2: At other sites, and to classify cars and LGVs at TADU and TRADS counts, Manual Classified Counts (MCCs) were used. Total flow is classified using MCCs on the same link or within a reasonable distance of the ATC (no major junctions in between, similar road characteristics). These MCCs are almost exclusively DfT counts. These are counts undertaken on an annual basis by trained DfT enumerators and feed into road traffic estimates[4]. For the HGV calculation, same month and year as the ATC data were used and holidays were excluded. For other MCC data, it was assumed to be quality checked earlier.

All DfT counts are undertaken on neutral days and wherever possible, MCCs from 2015 have been used in factoring. Where this is not possible due to a lack of 2015 data, MCCs

[4] http://data.dft.gov.uk/gb-traffic-matrix/all-traffic-data-metadata.pdf

from previous years has been employed. This is considered acceptable as it is unlikely the proportion of each vehicle type will alter significantly from one year to the next.

For 14.5% of all ATC site, there were no MCCs available in the vicinity or on the same road and generic factors were calculated based on DfT table TRA0204[5] for 2014 (the most recent year available). Generic classification proportions are shown in Table 5-3.

Table 5-3 – Generic Vehicle Classification by Road Type

Road Types	Vehicle Type (%)		
	Car	LGV	HGV
Motorway Urban	75%	14%	12%
Motorway Rural	75%	14%	12%
A-road Dual Carriageway Urban	82%	14%	5%
A-road Dual Carriageway Rural	78%	15%	7%
A-road Single Carriageway Urban	82%	14%	5%
A-road Single Carriageway Rural	78%	15%	7%
Other Urban	83%	14%	3%
Other Rural	81%	17%	3%

5.1.12 Consistency Checks

When the all flows were calculated and classified, further checks were undertaken. For the strategic routes of the A1, A19 and M6, the flows were checked for inconsistencies. These checks were carried out in two stages, an initial check was carried out on the traffic flow for large and unexpected variation of flow between junctions. In this check, the effects of the ongoing A1 Coal House to Metro Centre road works (start date: August 2014) were observed and as a result it was decided that counts from this area undertaken before September 2014 would not be included.

The second consistency check examined sections of the SRN where counts were present on consecutive links. This highlighted an issue with some counts on the A1 to the south of the region. Although total flows were consistent on these sections there was a large variation in HGV flows. To correct this, an average HGV proportion was calculated and applied to the total flows.

5.1.13 Count "Health" Check

In the case of traffic count data, TAG Unit M1-2 advises that the following confidence intervals of 95% should be assumed:

- Automatic Traffic Counts: total vehicles: ± 5%;
- Manual Classified Counts: total vehicles: ± 10%;
- Cars: ± 10%;
- Light goods vehicles: ± 24%;

[5] https://www.gov.uk/government/statistical-data-sets/tra02-traffic-by-road-class-and-region-kms

- Other goods vehicles: ± 28%;
- All goods vehicles: ± 18%

The ATC confidence intervals relate to counters with tube vehicle detectors; counters with inductive loop (eg. TRADS) may achieve greater levels of accuracy. The accuracy of radar counters is less certain but may be assumed to be the same as that of tube counters.

Discussions in the Data Consistency and Calibration-Validation TCGs have focused on how this could be applied to Regional Models. It was agreed that a simple scoring system should be devised to act as a 'health check' based on a set of attributes which effect the confidence levels of a survey. For NRTM the attributes and scoring system are illustrated in **Table 5-4** below:

Table 5-4 – Count 'Health Check' Scoring Criteria

Score	Type	Duration	Year	Month
5 (High Confidence)	Permanent ATC (inductive loop)	Full month	2015	March (base month)
4		2 – 4 weeks	2014 or 2016	
3	Temporary ATC (tubes)	6 – 9 weekdays	2012 or 2013	Neutral month
2		2 – 5 weekdays		
1 (Lower confidence)	Manual	Single weekday	< 2012	Non-neutral month

Table 5-5 presents a summary of count 'health check' scores averaged across the four attributes.

Table 5-5 – Count Quality Score

Score	Counts	Percentage
4.75 – 5.0	395	52%
4.25 – 4.5	113	15%
3.75 – 4.0	23	3%
3.25 – 3.5	82	11%
2.75 – 3.0	132	17%
2.25 – 2.5	16	2%
1.75 – 2.0	4	1%
Average score: 4.25		

In addition to this scoring system which is based on count attributes, NRTM counts are also supplemented by comments based on observations of the data following processing. Typical examples of comments include counts showing higher levels of traffic on a Friday or large day to day variations in flow. These comments will be taken into account when validating modelled flows against these counts. Full scores for every NRTM count are presented in Appendix E

5.1.14 Standardisation of formatting

A dashboard for standardising presentation of traffic survey data has been agreed within the Data Consistency TCG. This allows data to be collated and presented in a consistent manner for all regional models. Key elements of the NRTM dashboard is included as Appendix F to this report.

5.2 Traffic Flow Data Analysis

This section presents a high level overview of traffic flows based on the processing approach described in the previous section.

Figure 5-12, Figure 5-13 and Figure 5-14 show the traffic flows across larger screenlines for the AM, IP and PM time periods. The traffic flow at each count is presented in Appendix F.

Figure 5-12 – AM Flows across Screenlines

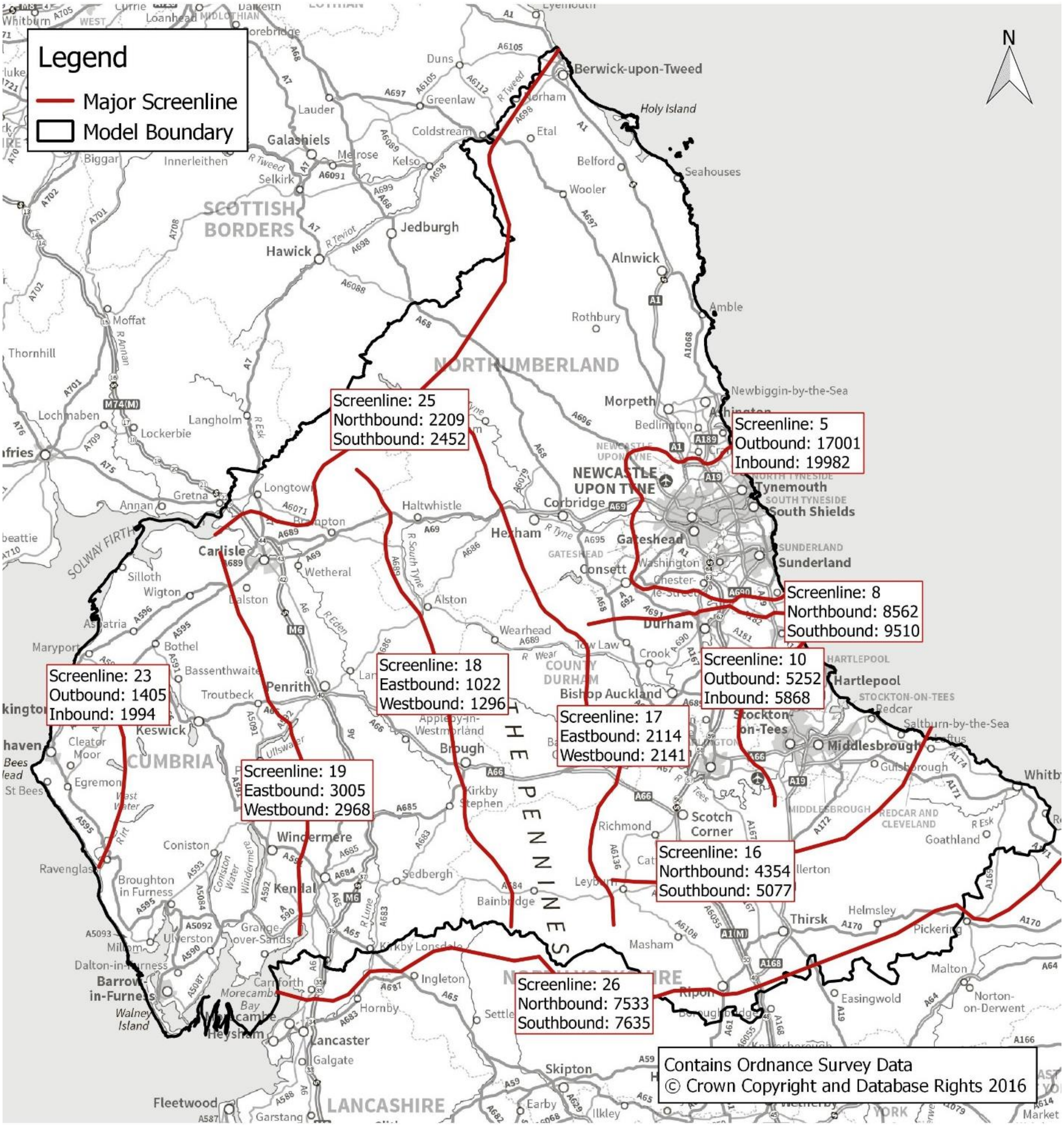


Figure 5-13 – IP Flows across Screenlines

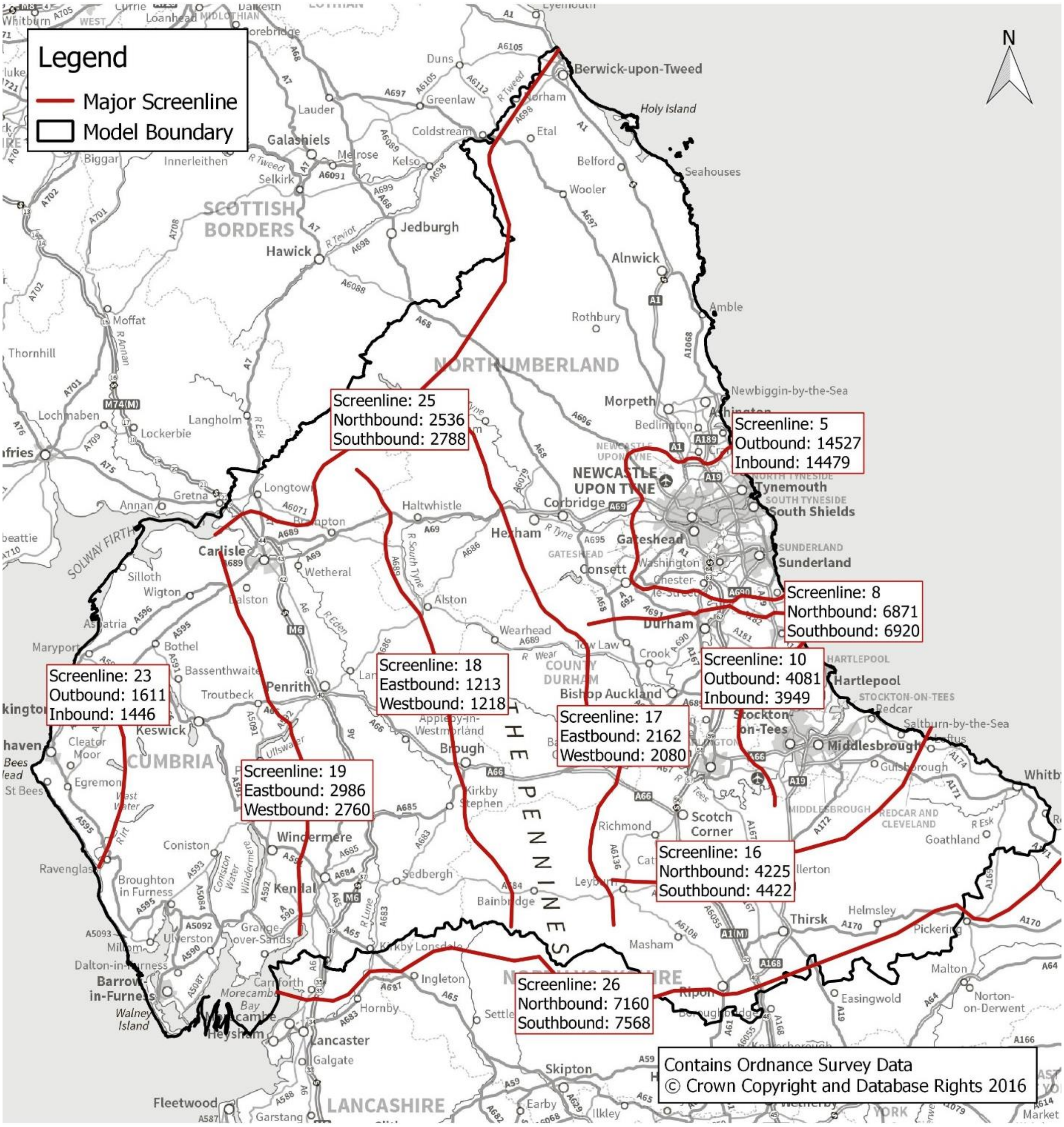


Figure 5-14 – PM Flows across Screenlines

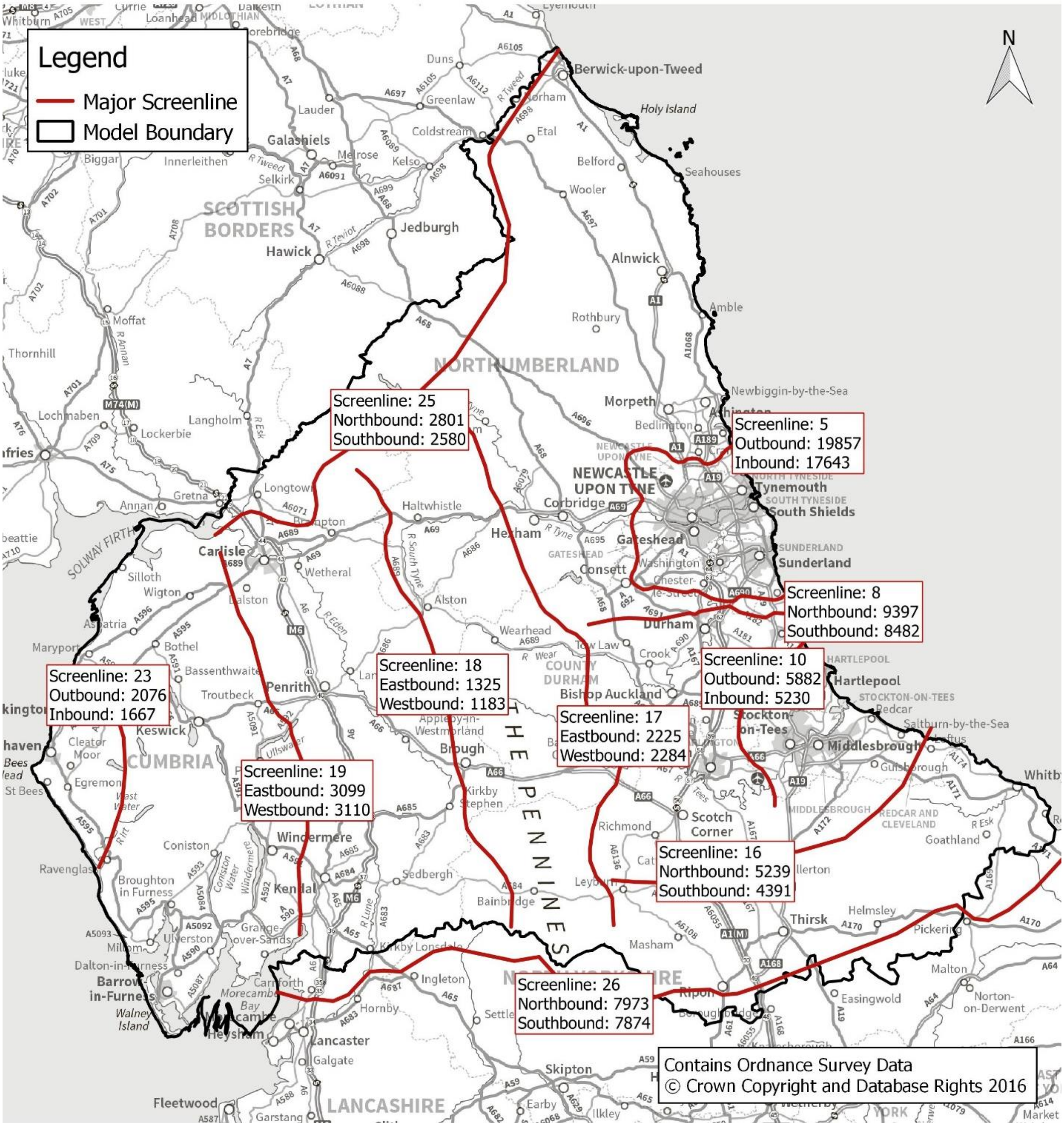


Table 5-6 shows the flows across all screenlines in a tabular form. There the tidal flows are visible at most urban cordon screenlines where the inbound traffic flows are high in the morning and the reverse in the evening. For example, see screenlines 2, 6 and 9. This tidal pattern is not shown on most strategic screenlines such as screenlines 17, 19, 25 and 26.

Table 5-6 – Traffic Flows across Screenlines (vehicles / hr)

Screenline	Direc-tion	AM	IP	PM	Direc-tion	AM	IP	PM
1 - River Tyne	NB	12,518	8,188	10,431	SB	9,471	8,527	11,751
2 - Newcastle Cordon	Outbd	23,205	23,672	30,493	Inbd	32,207	23,935	27,120
3 - A1 Newcastle	EB	8,434	7,269	7,831	WB	6,538	7,237	9,623
4 - A19 Newcastle	EB	7,802	7,861	10,525	WB	9,404	7,580	8,522
5 - Tyne and Wear Cordon	Outbd	17,001	14,527	19,857	Inbd	19,982	14,479	17,643
6 - Sunderland Cordon	Outbd	6,776	6,175	8,037	Inbd	8,633	6,387	7,928
7 - Morpeth and Ashington Cordon	Outbd	4,663	3,872	4,574	Inbd	4,600	3,827	4,749
8 – Tyneside / County Durham	NB	8,562	6,871	9,397	SB	9,510	6,920	8,482
9 - Durham Cordon	Outbd	4,817	4,819	6,588	Inbd	6,820	4,660	5,243
10 – Teesside / County Durham	Outbd	5,252	4,081	5,882	Inbd	5,868	3,949	5,230
11 - River Tees	NB	8,091	7,175	8,843	SB	9,069	7,322	8,969
12 - Middlesbrough Cordon	Outbd	6,819	7,313	8,293	Inbd	7,187	7,070	8,069
13 - Stockton Cordon	Outbd	7,033	6,111	7,293	Inbd	6,422	6,141	7,809
14 – Middlesbrough / Redcar	EB	2,490	2,361	3,561	WB	3,561	2,352	2,612
15 - Darlington Cordon	Outbd	5,464	4,009	5,338	Inbd	5,192	4,035	5,632
16 – Cleveland / North Yorks Boundary	NB	4,354	4,225	5,239	SB	5,077	4,422	4,391
17 - North East Western Boundary	EB	2,114	2,162	2,225	WB	2,141	2,080	2,284
18 - Cumbria Eastern Boundary	EB	1,022	1,213	1,325	WB	1,296	1,218	1,183
19 - Western Cumbria Boundary	EB	3,005	2,986	3,099	WB	2,968	2,760	3,110
20 - Carlisle Cordon	Outbd	2,736	2,925	3,556	Inbd	3,543	2,970	3,252
21 - Kendal Cordon	Outbd	1,803	1,797	2,201	Inbd	2,032	1,664	1,846

22 - Furness Peninsula Cordon	NB	913	830	973	SB	1,029	774	1,003
23 - West Cumbria Cordon	Outbd	1,405	1,611	2,076	Inbd	1,994	1,446	1,667
24 - Alnwick North	NB	575	637	612	SB	509	689	582
25 - Study Area Northern Boundary	NB	2,209	2,536	2,801	SB	2,452	2,788	2,580
26 - Study Area Southern Boundary	NB	7,533	7,160	7,973	SB	7,635	7,568	7,874

Table 5-7 below shows classified flows at a 24 hour level. These were calculated by summing AM, IP and PM average hour flows to give 12 hour flow. A factor was then applied to convert from 12 to 24 hour Average Annual Weekday Traffic (AAWT) flow. Classified flow per AM, IP and PM are presented in Appendix G.

Table 5-7 – 24h Classified Traffic Flows across Screenlines (vehicles / hr)

Screenline	Direc -tion	Car	LGV	OGV	Direc -tion	Car	LGV	OGV
1 - River Tyne	NB	111,184	21,221	9,164	SB	110,026	19,187	8,581
2 - Newcastle Cordon	Outbd	300,478	48,251	15,028	Inbd	318,305	51,736	15,869
3 - A1 Newcastle	EB	91,219	14,285	5,389	WB	90,701	14,166	5,418
4 - A19 Newcastle	EB	100,220	16,411	5,945	WB	98,224	15,706	5,179
5 - Tyne and Wear Cordon	Outbd	186,492	33,284	17,504	Inbd	190,026	32,209	17,461
6 - Sunderland Cordon	Outbd	80,876	12,533	4,379	Inbd	88,126	13,166	4,316
7 - Morpeth and Ashington Cordon	Outbd	50,532	8,018	2,584	Inbd	50,678	8,010	2,525
8 – Tyne and Wear / County Durham	NB	87,575	16,937	9,606	SB	87,655	17,358	9,578
9 - Durham Cordon	Outbd	62,527	9,836	3,394	Inbd	62,948	10,597	3,433
10 – Teesside / County Durham	Outbd	53,158	10,292	6,014	Inbd	52,253	10,081	6,050
11 - River Tees	NB	88,204	16,480	7,945	SB	92,022	17,284	8,350
12 - Middlesbrough Cordon	Outbd	90,575	13,385	3,097	Inbd	89,821	12,974	3,031
13 - Stockton Cordon	Outbd	78,150	13,116	4,307	Inbd	78,006	13,264	4,180

14 – Middlesbrough / Redcar	EB	31,775	5,006	2,000	WB	31,765	5,351	2,046
15 - Darlington Cordon	Outbd	53,167	9,584	4,999	Inbd	53,502	9,371	5,150
16 – Teesside / North Yorks Boundary	NB	45,316	9,617	10,024	SB	45,913	9,865	10,147
17 - North East Western Boundary	EB	22,432	4,598	4,160	WB	22,402	4,488	4,016
18 - Cumbria Eastern Boundary	EB	11,623	2,305	3,256	WB	11,977	2,548	3,173
19 - Western Cumbria Boundary	EB	34,086	5,581	3,804	WB	32,320	5,789	3,640
20 - Carlisle Cordon	Outbd	34,732	6,006	2,971	Inbd	36,498	6,209	3,139
21 - Kendal Cordon	Outbd	22,145	3,768	1,436	Inbd	21,023	3,558	1,360
22 - Furness Peninsula Cordon	NB	9,902	1,819	1,044	SB	9,870	2,015	1,006
23 - West Cumbria Cordon	Outbd	19,051	3,403	1,672	Inbd	18,317	3,505	1,765
24 - Alnwick North	NB	6,312	1,394	1,158	SB	6,214	1,452	1,220
25 - Study Area Northern Boundary	NB	24,962	4,842	6,494	SB	26,052	5,015	7,123
26 - Study Area Southern Boundary	NB	77,162	14,801	15,412	SB	77,604	16,022	16,697

Flows over 24 hours show that the screenlines / cordons with the largest flow are in Tyne and Wear (Newcastle cordon, River Tyne, Sunderland) and Teesside (Middlesbrough cordon) which is to be expected as these are the most populous areas in the model region and also the location of the densest network. Large strategic movements can be seen at the southern boundary of the model, the northern boundary (to a lesser extent) and between Tyne and Wear / County Durham and County Durham and Teesside. Flows in the rural and sparsely populated, west of the region are much lower, although there are still a number of strategically important links in this area such as the M6, A66 and A590.

A final set of checks were carried out at this stage to ensure:

- Proportions of different vehicle classes seem reasonable.
- 24 hour AAWT flows in each direction are broadly similar.

6 Final Trip Dataset

6.1 Demand Data

6.1.1 Mobile Phone Data Verification

The MPOD data was provided for each hour from 05:00-20:00 and aggregated for the 'overnight' period by five purposes:

- home based work Outbound;
- home based work Inbound;
- home based other Outbound (including Employer Business);
- home based other Inbound; and
- non-home based.

Checks on the MPOD data compared against NTS data showed that:

- average trip lengths in the MPOD data are generally higher than NTS with a much lower proportion of short distance trips; and
- from initial assignments at a high level the MPOD data was overstating total traffic by 25% on average for long screenlines compared to the count data; this was highest on the study area boundary screenlines.

The Matrix TCG investigated potential causes of sample bias from using mobile phones as a data source for trip patterns. This research focussed on age, income and multiple phone ownership across for different trip distance bands and areas. Further data sources described in Sections 6.1.3 to 6.1.12 have been used to adjust or supplement the MPOD data to in order to develop a set of assignment matrices.

A list of verification checks have been defined by the Matrix TCG that each regional modelling team will undertake to report the confidence and limitations of the MPOD dataset. Verification checks on the provisional dataset will be a comparison of different aspects of the trip matrix from the provisional data with various sources of independent data. Statistical analysis techniques will be used to undertake these comparisons, taking into account the uncertainties and errors in the two sources of data being compared.

The data processing for the mobile phone data has not been explicitly defined and there is therefore no statistical model available to estimate errors in the mobile data. The tests will therefore necessarily be limited to an assessment of differences given the known errors in the other verification data sources. It is therefore appropriate to accept variations that exceed typical 95% confidence tests implicitly to accept some error in the mobile phone data. An upper bound is to assume that the errors in mobile data must be no larger than those that would be accepted from the existing independent data. On this basis and assuming that errors are independent the test of statistical significance can be based on doubling the variance estimated for the 'conventional' verification data source.

In particular, the following key aspects of the Provisional data will be reviewed and verified through comparisons with independent data sources:

- Trip-ends;
- Symmetry of the matrix;
- Trip rates;

- Trip distribution pattern;
- Trip length profile;
- Trip purpose allocation;
- Daily profile of trips; and
- Level of vehicle flows.

6.1.2 Data Flow through Matrix Development Process

To address the biases and limitations of the MPOD data arising from the verification checks, various other data sources were required to go from raw MPOD matrices to assignment matrices.

The following flowcharts summarise the flow of data through the base demand matrix development process:

- Figure 6-1 shows the data inputs to build the assignment matrices from the provisional dataset, and
- Figure 6-2 shows the data used to derive the synthetic input for the main MPOD process.

Figure 6-1 – Data Inputs for NRTM Matrix Build Process

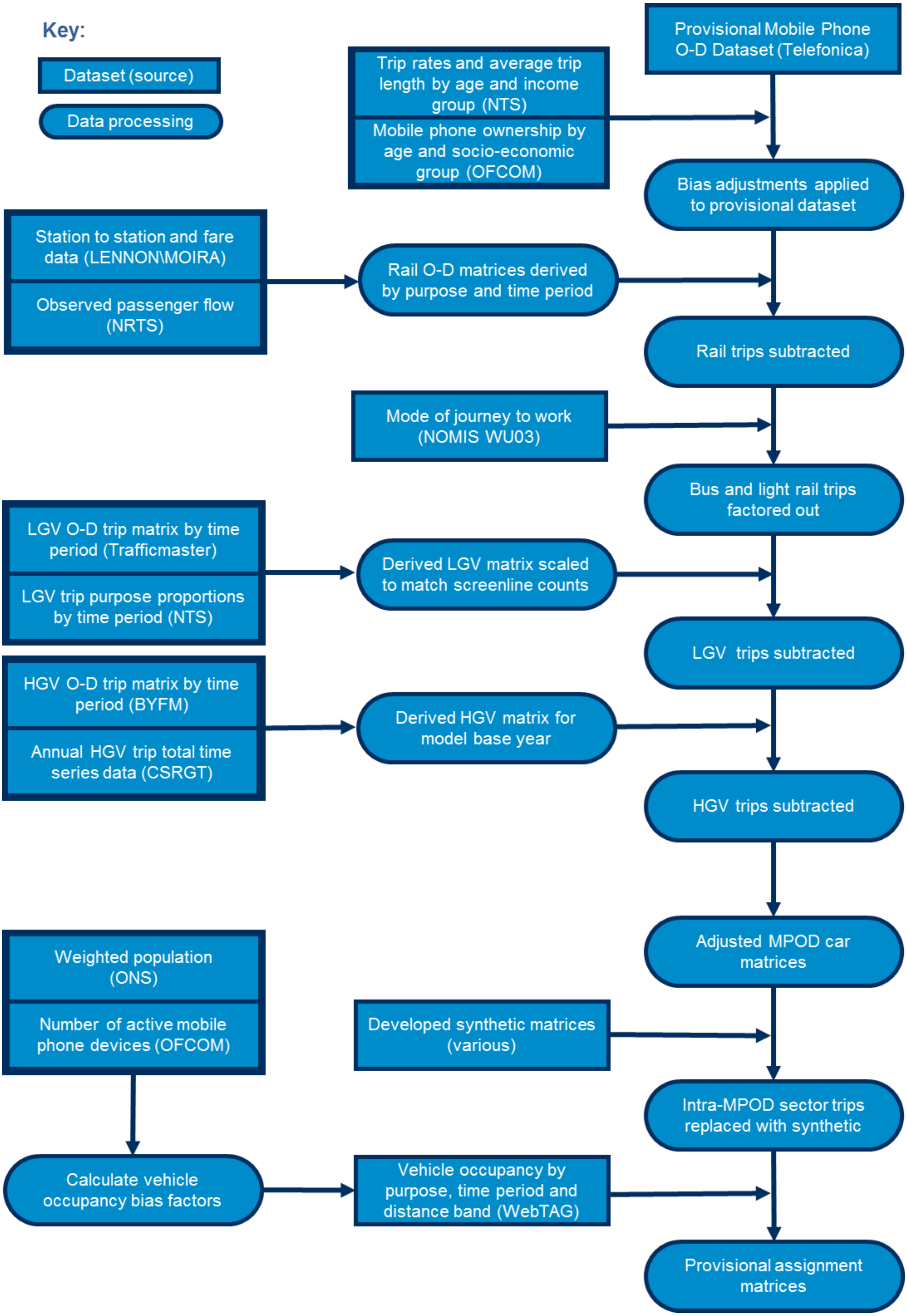
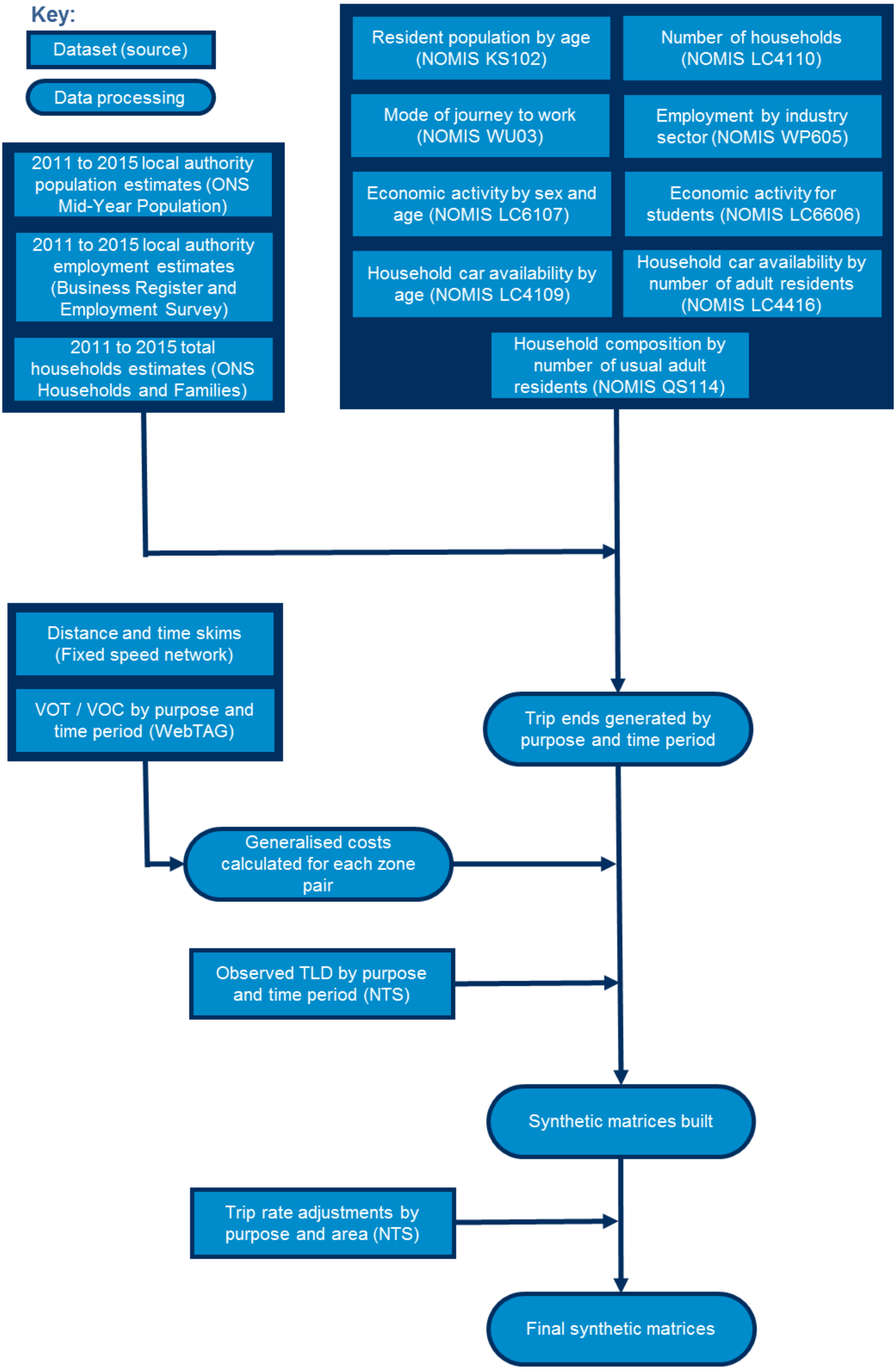


Figure 6-2 – Data Inputs for NRTM Synthetic Matrix Build Process



6.1.3 National Travel Survey

The National Travel Survey (NTS) is an annual survey undertaken by the DfT containing travel diary information for journeys made from a sample of UK households. It provides a rich data source and allows the trip making characteristics across the country to be understood for a range of variables.

NTS data has been used to derive various factors for adjustments and also verification checks. These were:

- observed trip length distributions by purpose and time period for the RoF;
- trip rates by purpose and time period at Government Region level;
- trip rates and average trip lengths by age and income quantile group; and
- trip purpose splits for LGVs by time period.

6.1.4 OFCOM Reports

The Office of Communications (OFCOM) is the government-approved regulator of various industries including telecommunications.

Analysis of the provisional dataset found substantial bias in the dataset towards more frequent and longer distance trips after comparison against NTS data and screenline counts. NTS traveller type analysis showed a significant variation in these variables across different income and socio-economic groups. It was agreed by the Matrix TCG that a national set of bias adjustment factors should be applied to the raw MPOD data to account for this. Reports released by OFCOM were considered the most useful data sources available.

The following data was taken from tables in these respective reports published by OFCOM:

- Take up of mobile phone for adults by age and socio-economic group (Adults: Media Use and Attitudes Report, 2015); and
- Smartphone and non-smartphone ownership by age (Children and Parents: Media Use and Attitudes Report, 2015).

This data was combined with trip rates and trip lengths derived by age group and income quantile group from NTS to derive a set of bias adjustment factors by trip distance band. This process will be fully reported in subsequent deliverables.

6.1.5 Census Data

Nomis is an online system for downloading data tables from the UK census. Many of the datasets are multidimensional and available from output area level creating an invaluable resource for obtaining planning data.

The DfT software package CTripEnd was used to generate productions and attractions for the NRTM synthetic matrix build. CTripEnd derives the trip productions and attractions in the national trip end model from socio economic and demographic data via a series of income, trip production and attraction and car ownership/availability models. The software has a major advantage in that it allows the user to define their own bespoke zoning system for the output. This allowed a more representative and localised set of trip ends to be generated compared to taking output from TEMPRO for the National Trip End Model (NTEM) zoning system and retrofitting this into the NRTM zoning system.

The input tables for CTripEnd required planning data at model zone level split into:

- 88 person types categorised by age, sex, economic activity and car availability;
- total employment for 13 industry sectors; and
- journey to work mode split for both resident and workforce population.

This level of detail was not available within single Nomis census datasets; there was a requirement for data fusion between tables by linking shared characteristics. The data tables used were:

- KS102 Resident population by age (Output Area level);
- LC4110 Number of households (Output Area level);
- WU03 Mode of journey to work (MSOA level);
- WP605 Employment by industry sector (Workplace Zone level);
- LC6107 Economic activity by sex and age (Output Area level);
- LC6606 Economic activity for students (Output Area level);
- LC4109 Household car availability by age (Output Area level);
- LC4416 Household car availability by number of usual adult residents (Output Area level); and
- QS114 Household composition by number of usual adult residents (Output Area level).

Where it was necessary to fuse data tables, they were first checked for consistency in shared totals – for example total population at output area level – to ensure the resulting output would be sensible. This was particularly important when subtraction was taking place otherwise there would have been a risk of negative values.

NTEM trip rates were inbuilt into the software using NTS data up to 2006. However NTS has reported a steady decline in trip rates every year since 1995/7; this created an implicit risk of overestimating trip rates. Consequently, the NTEM trip rates required factoring at Government Region level by trip purpose following a comparison against NTS rates from 2012-2014.

The data table WU03 Mode of journey to work (2011 Census) was also used in the main matrix build process to remove bus and light rail trips from the MPOD data as a proportion. This was important for Newcastle where the Metro provides a popular method of transport across the city but this is not covered by the rail data detailed in Section 6.1.12.

6.1.6 Office for National Statistics

The Office for National Statistics (ONS) releases various annual reports with accompanying data tables related to the population, society and economy of the United Kingdom.

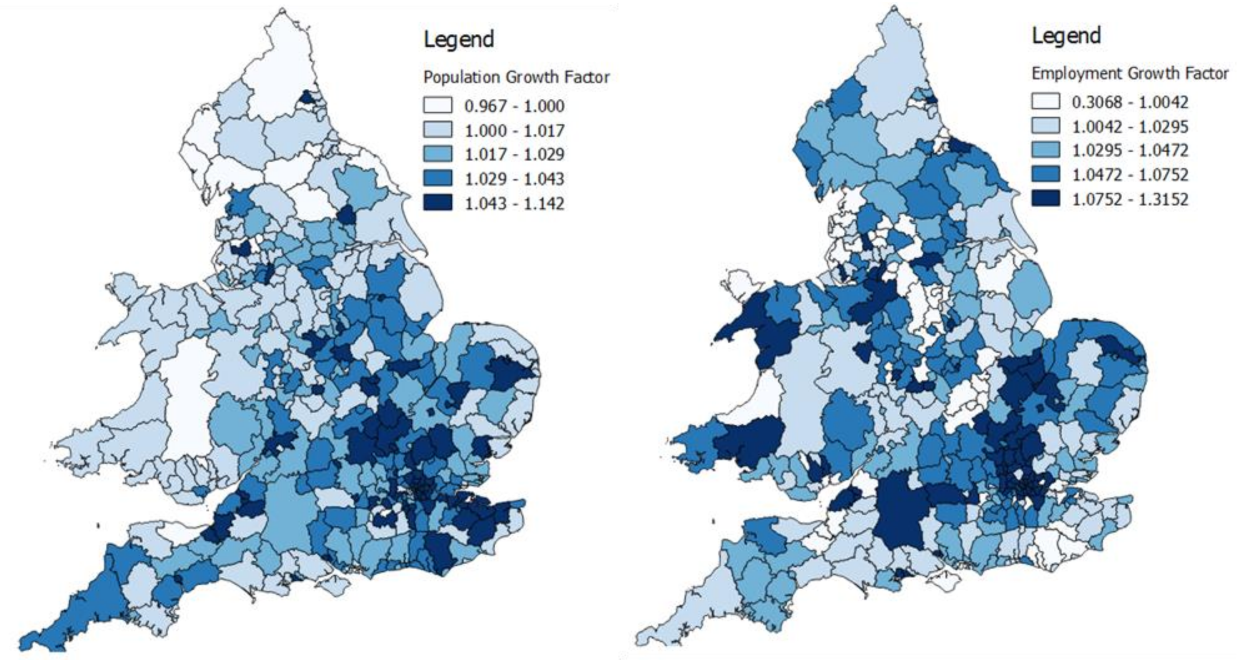
Time series data between 2011 and 2014 was available for the following variables from these respective data releases:

- Population change: Mid-Year Population Estimates (local authority district level);
- Employment change: Business Register and Employment Survey (BRES) (local authority district level); and
- Number of households: Households and Families (national level).

The data was downloaded for local authority districts as the smallest spatial area available. Applying national factors for population and employment would overstate the extrapolated values for 2015 within the RoF.

Values at district level for 2015 were forecast at from this time series data; these were required to scale the Nomis census data to the model base year 2015.

Figure 6-3 – Population and Employment Growth Factors to 2015



The mid-year population estimates were also used to expand the NTS sample to the whole population in order to calculate comparable trip rates as a verification exercise for the MPOD data.

6.1.7 TEMPRO

TEMPRO is a DfT software package used for forecasting in transport planning including assumptions on trip ends. The data comes for the pre-defined NTEM zoning system which consists of districts and unitary authorities outside of London and boroughs within London.

Nomis data does not cover Scotland; this is administered by the National Records of Scotland. It was not necessary to process planning data for Scotland separately since it is an external area with larger zones. CTripEnd had been chosen for the ability to reflect localised trip behaviour for the smaller zones within the RoF; the spatial granularity of the NTEM zoning system was sufficient. Implicitly the England and Wales travel demand relationships have been applied to Scotland. There are no reasons to suggest that, at a strategic level, this is unreasonable.

Productions and attractions were extracted from TEMPRO at NTEM level; this was rezoned into the NRTM zoning system and merged with the output generated from CTripEnd for England and Wales.

6.1.8 WebTAG

The WebTAG databook is a data source provided by the DfT. It contains various base year and forecast values for use in transport modelling and appraisal.

An Excel workbook was provided by Highways England with perceived value of time (VOT) and vehicle operating cost (VOC) by purpose and time period based on the WebTAG databook released in November 2014. These values were used in the synthetic matrix development.

A refined set of values averaged by distance band as well as purpose and time period have been provided by Highways England for assignments and forecasting.

Occupancy values by purpose and time period were also taken from the WebTAG 2014 databook for initial assignments. It is required that the occupancy values per vehicle kilometre are used for economic appraisal. Final matrices will include occupancy adjustments implicit from NTS evaluation of urban- rural differences and corrections for MPOD bias based on multiple phones per vehicle. Modification of occupancy by distance based on skim distance will be considered for the final matrices.

6.1.9 Trafficmaster

Trafficmaster is a dataset available through the DfT which samples movements from GPS recordings using devices fitted to a range of vehicles.

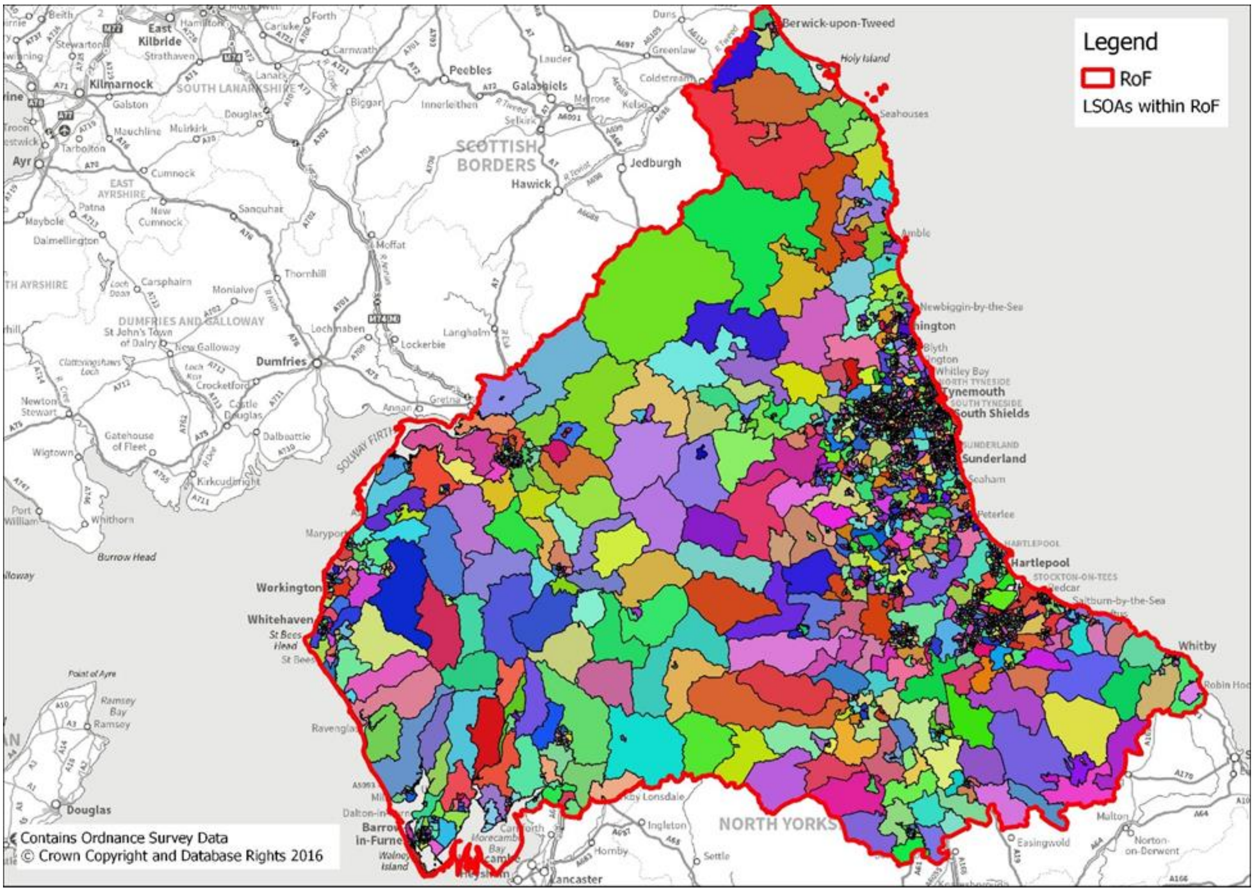
Whilst it is usually used in transport modelling for journey time sampling, the available data includes origin-destination LGV demand movements between every Lower Super Output Area (LSOA) within England, Scotland (or equivalent thereof) and Wales. The sample is around 75,000 vehicles; roughly 2% of the national LGV population.

The dataset gives the absolute number of LGV trips fitted with a device between each LSOA pair by time period; it is not split by purpose. Global purpose splits were derived by timer period using NTS.

Despite the small sample size, this was considered the best available source of LGV trip movements. The LSOA boundaries were rezoned to the NRTM zoning system to develop the basis of the LGV matrix.

Since this only represented a subset of LGVs, it was necessary to scale the data. The LGV totals from the classified counts were calculated at a screenline level; these totals were used to scale the Trafficmaster LGV data at a sector level across screenlines.

Figure 6-4 – LSOAs within NRTM RoF



6.1.10 Base Year Freight Matrix

The Base Year Freight Matrix (BFYM) is a road freight trip movement matrix owned by the Department for Transport (DfT) with a base year of 2006 covering both UK and foreign registered vehicles. It consists of a HGV trip matrix for a zoning system split into two parts:

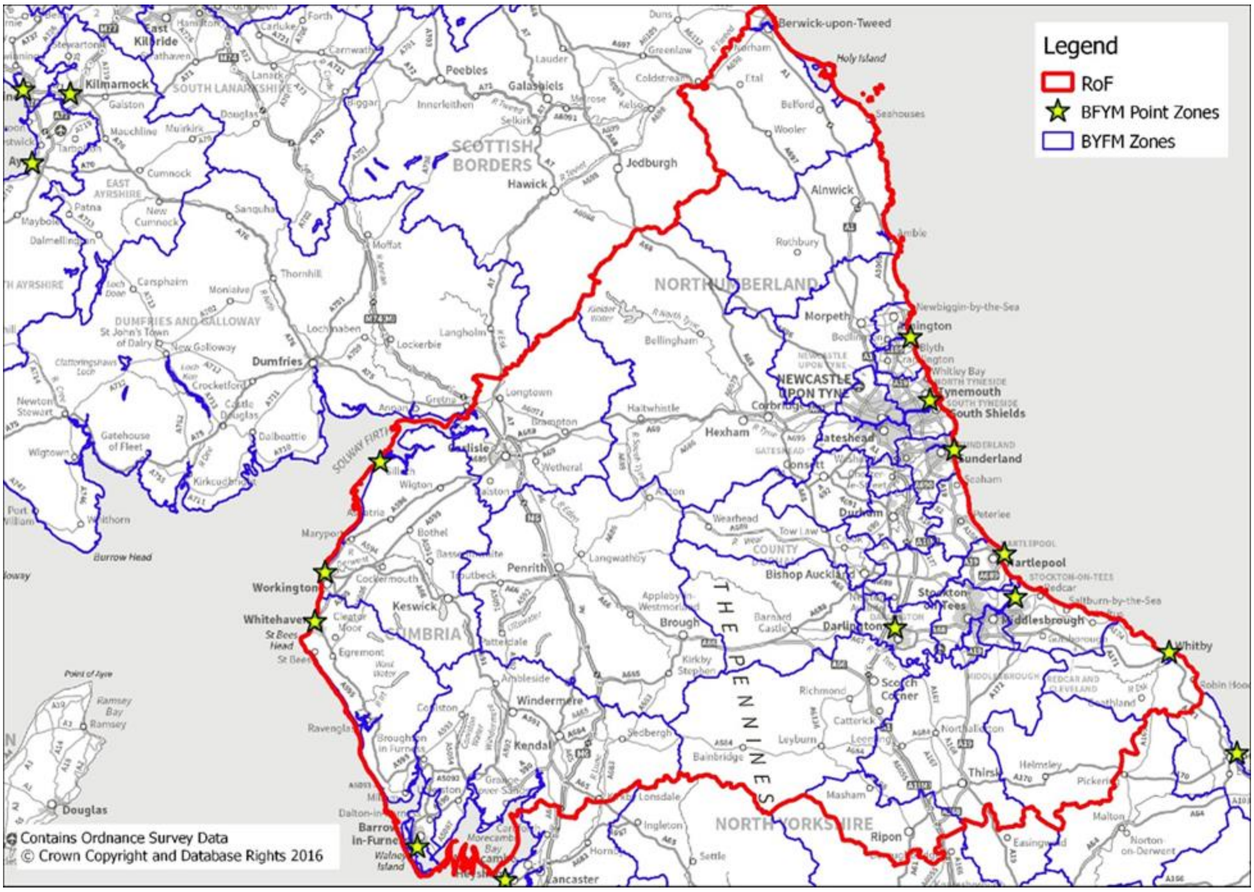
- 408 areas at district, unitary authority or London borough spatial granularity for the whole of the United Kingdom; plus
- 108 ‘point zones’ for major ports, airports and distribution centres which have their own distributions within the dataset.

These are shown for the NRTM RoF in Figure 6-5.

The BYFM was considered by the matrix development TCG as the best source of freight movements available. The sample from TrafficMaster data for HGVs is only 1870 vehicles; roughly 0.3% of the HGV population. This was inadequate for developing a trip matrix for the NRTM therefore a different dataset was required.

The BYFM geography needed to be rezoned to the NRTM zoning system; a set of scaling factors to the model base year were also required due to the age of the data. High level reporting within DfT statistical tables show a long term trend for the reduction of vehicle kilometres travelled by HGVs – see Figure 3.1 in Appendix A. Although distance travelled is not a complete representation of trip patterns and is subject to other factors, a reduction in HGV movements will be a facet of this trend.

Figure 6-5 – BYFM Zones within NRTM RoF



6.1.11 CSRGT

The Continuing Survey of Road Goods Transport (CSRGT) produces high level statistics on the domestic activity of Great Britain registered HGVs within the United Kingdom. It does not contain information for any trips made by foreign registered vehicles.

The NRTM modelling team acquired by request through the DfT time series data for total annual HGV trips from 2006 through to 2014. Since the data was required for generating a factor and not absolute values, this was deemed to be the best dataset available for scaling the HGV trip matrices derived from BYFM.

The data is shown in Table 6-1.

Table 6-1 – Annual Domestic HGV Trip Totals (UK Registered Vehicles)

Year	No. of HGV Trips	Index
2006	273,852,000	1.000
2007	279,104,000	1.019
2008	252,815,000	0.923
2009	209,926,000	0.767
2010	216,785,000	0.792
2011	215,691,000	0.788
2012	206,162,000	0.753
2013	187,698,000	0.685
2014	185,789,000	0.678

6.1.12 Public Transport Data

The requirements for various types of public transport (PT) data is driven by the agreed approach to Variable Demand Modelling (VDM) and the general requirements of forecasting. Data has been obtained for the following key aspects of PT modelling:

- PT costs: a representation of generalised costs between each zone for journeys that make use of the rail network (as strategic bus or park and ride are not being considered for this version of the modelling). The costs will be representative of a neutral month in 2015 and will include a combination of:
  - In vehicle time;
  - Station access;
  - Interchange (between modes); and
  - Waiting times.
- Fares: a representation of the fare costs between each rail station.
- Base Year Travel Demand: a zone to zone travel demand matrix for journeys that make use of the rail network.

The following key data has been collated to derive the above requirements:

- Standard parameters and sensitivity testing from TAG and the Passenger Demand Forecasting Handbook (PDFH).
- Annual passenger ticket sale data from MOIRA – the Model of Inter Regional Rail Activity – for the period May 2014 - April 2015.
- The National Rail Travel Survey (NRTS). This data is representative of 2006-2007 travel patterns on the UK rail network and has been used to assist in deriving zone to zone movements from the station to station data from MOIRA.
- Office of Rail Regulation (ORR) data from 2015. This has been used to assist in matching passenger loading at each station.
- Nomis table WU03 Mode of journey to work (see Section 6.1.5) has been used to verify travel to work via rail.

6.1.13 Airport Data

The Air Passenger to Airport Allocation Model (NAPALM) is an aviation model owned by the DfT which provides forecasts of air passenger demand between districts and the 23 largest airports in the United Kingdom. It had been agreed by the Forecasting Technical Consistency Group (TCG) that airport travel demand would be overlaid onto the developed MPOD assignment matrices.

The following data was obtained from NAPALM model through the DfT:

- Modelled total passenger demand (two-way movements) for 18 airports and by district for the base year and five forecast years.

The following data was provided by the DfT from the Civil Aviation Authority (CAA)

- Group sizes at county level for trips to/from airports by twelves modes (CAA Passenger Interview Surveys), and
- Tabulations of arrivals and departures by month, day and hour (CAA 2014 Passenger Statistics).

6.2 Demand Data Analysis

6.2.1 MPOD Demand Data

The total demand from the raw MPOD data as received from Telefonica for all vehicle modes, including rail, and prior to any bias adjustments is summarised in Table 6-2.

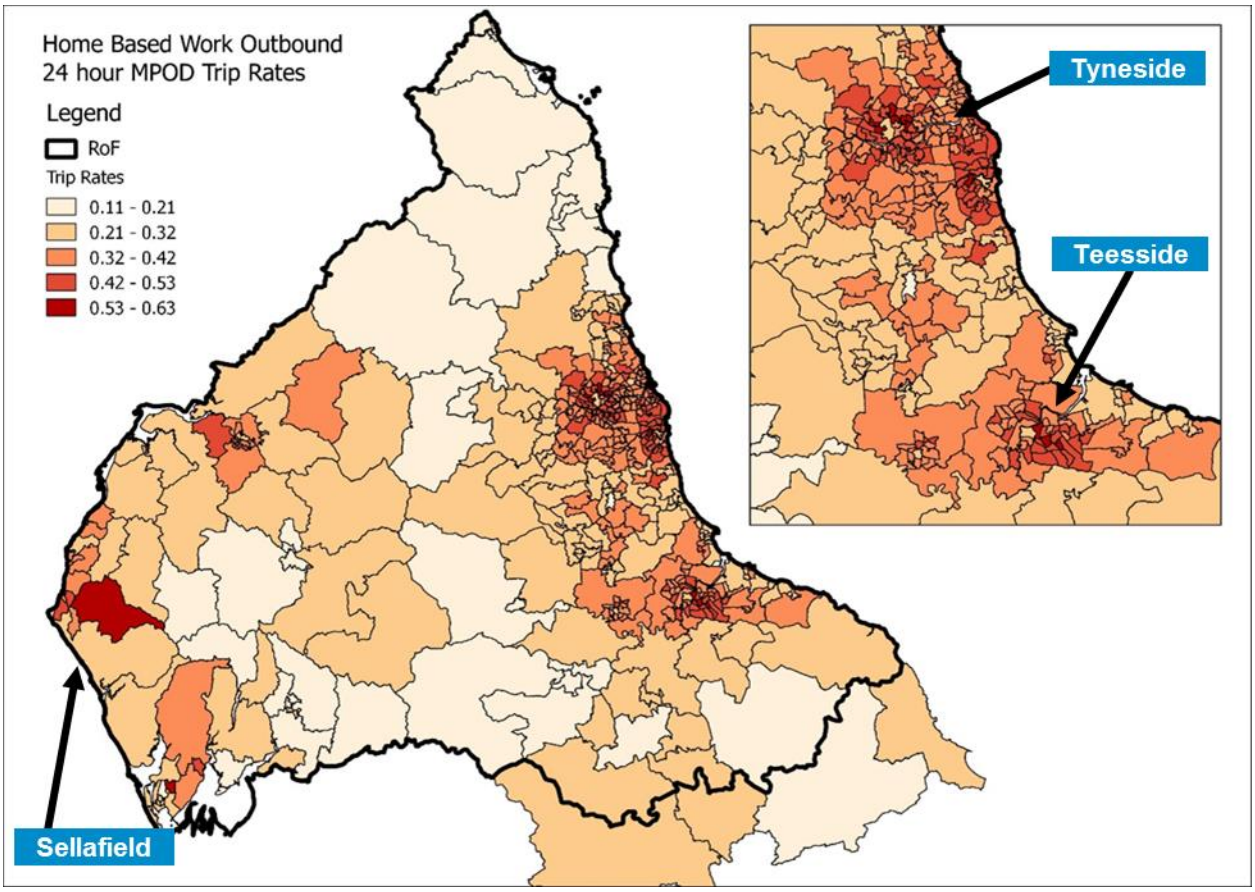
Table 6-2 – Raw MPOD Demand Totals by Purpose

Purpose	24 hour MPOD Demand (all vehicles)
Home Based Work Outbound	21,412,628
Home Based Work Inbound	20,717,493
Home Based Other Outbound	46,479,972
Home Based Other Inbound	45,768,090
Non-Home Based	32,939,394
Total	167,317,577

Using the 2014 ONS Mid-Year Population estimate of 62,756,300 for Great Britain, this gives a daily national vehicle trip rate of 2.66 trips per person within the dataset.

The twenty-four hour trip rates for home based work outbound are shown at MPOD request sector level for the raw data in Figure 6-6.

Figure 6-6 – MPOD Study Area Trip Rates – Home Based Work Outbound

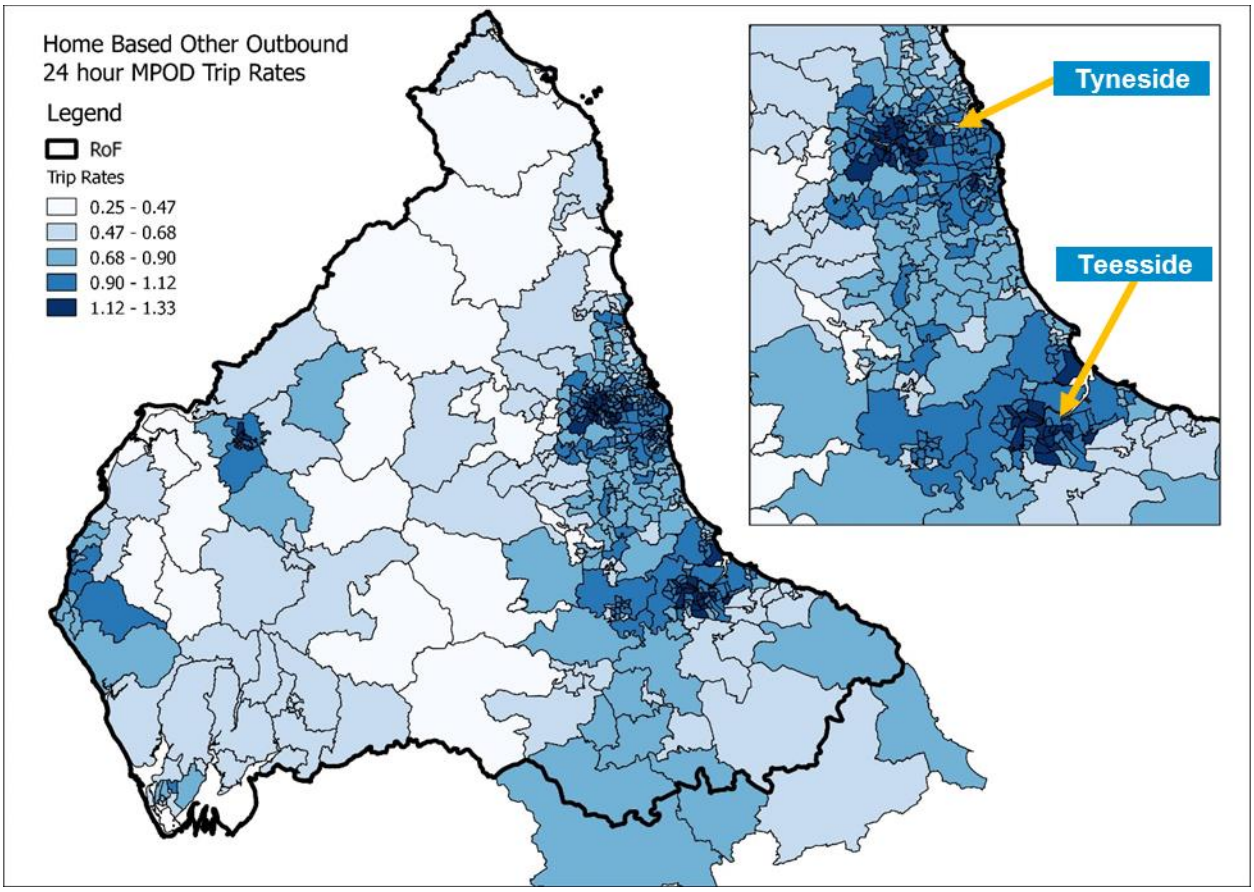


Note: due to a revision of the study area boundary post defining the request sectors, there are four request sectors in North Yorkshire which straddle the revised study area boundary.

The highest trip rates are in the urban areas; in particular Middlesbrough and around Newcastle City Centre. Rural trip rates are generally lowest however apart from one sector in Copeland, West Cumbria. This is close to Sellafield Nuclear Power Station which may explain the higher rate there.

Likewise, the twenty-four hour trip rates for home based other Inbound are shown at request sector level for the raw data in **Figure 6-7** and show a similar pattern.

Figure 6-7 – MPOD Study Area Trip Rates – Home Based Other Outbound

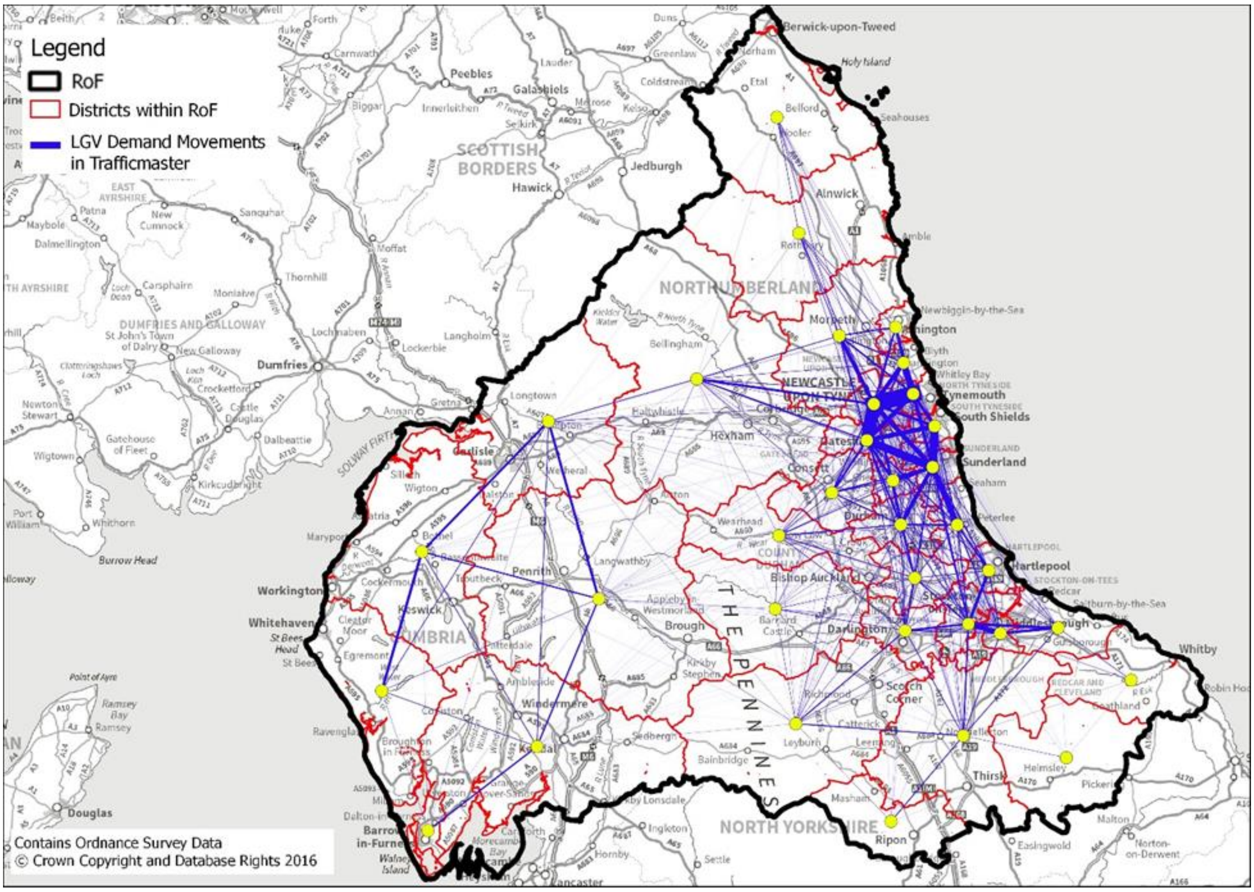


6.2.2 LGV Demand Data

The LGV demand dataset consisted of a sample of the national population which required scaling using the count data at a screenline level. Therefore, total demand or trip rates cannot be implicitly derived from the raw Trafficmaster data without external inputs to assist processing.

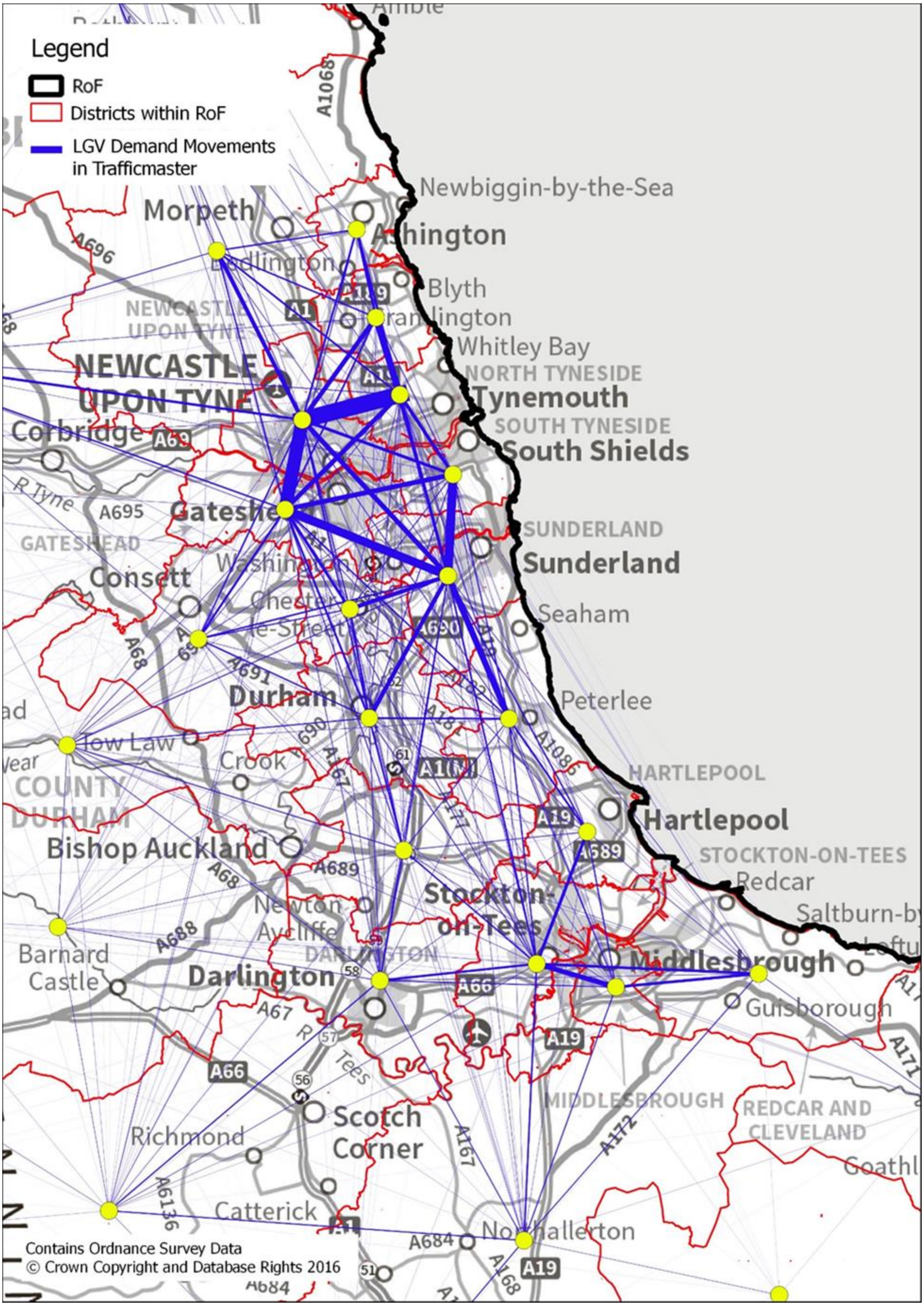
Presented in Figure 6-8 are the demand movements at a district level within the raw LGV Trafficmaster data strictly for trips solely within the RoF – this prevents demand from large external zones skewing the line weighting. These show the desire lines for LGV movements within the raw Trafficmaster data at district level.

Figure 6-8 – Desire Lines for Trafficmaster LGV Demand – Study Area



Most of the demand is concentrated within the North East corridor connecting the larger urban areas of Tyne and Wear and the Tees Valley; strategic movements between those conurbations will utilise the A1(M) and the A19. However, the largest demand is more localised within the five districts which comprise the Tyne and Wear region – Newcastle-upon-Tyne, North Tyneside, South Tyneside, Gateshead and Chester-Le-Street. Figure 6-9 shows this corridor section in detail.

Figure 6-9 – Desire Lines for Trafficmaster LGV Demand – North East



6.2.3 HGV Demand Data

Demand data for HGVs has been derived from the BFYM matrix with a base year of 2006.

- Figure 6-10 shows the total demand from each BFYM zone within the RoF, including trips to BFYM zones outside of the RoF.
- Figure 6-11 shows the total demand to each BFYM zone within RoF, including trips originating in BYFM zones outside of the RoF.

In both cases, the data presented is the raw BYFM data prior to scaling adjustments.

The largest HGV trip ODs are close to the urban areas. There are several industrial towns within the NRTM region. In particular, Middlesbrough is traditionally known for iron and steel works plus shipbuilding and maritime trade through Teesport.

It is noticeable that the BFYM zones are very large for the rural areas within the RoF. Each BYFM zone will contain many NRTM model zones. A process has been developed to rezone the BFYM demand to NRTM zones based on employment totals within NRTM zones. The employment data has been taken from the model zone totals calculated for the synthetic matrix build process – see Section 3.2.5 – so that the splitting process could be weighted towards jobs which are more likely to produce and attract goods movements.

Figure 6-10 – HGV Demand for BFYM Zones – Origin zone

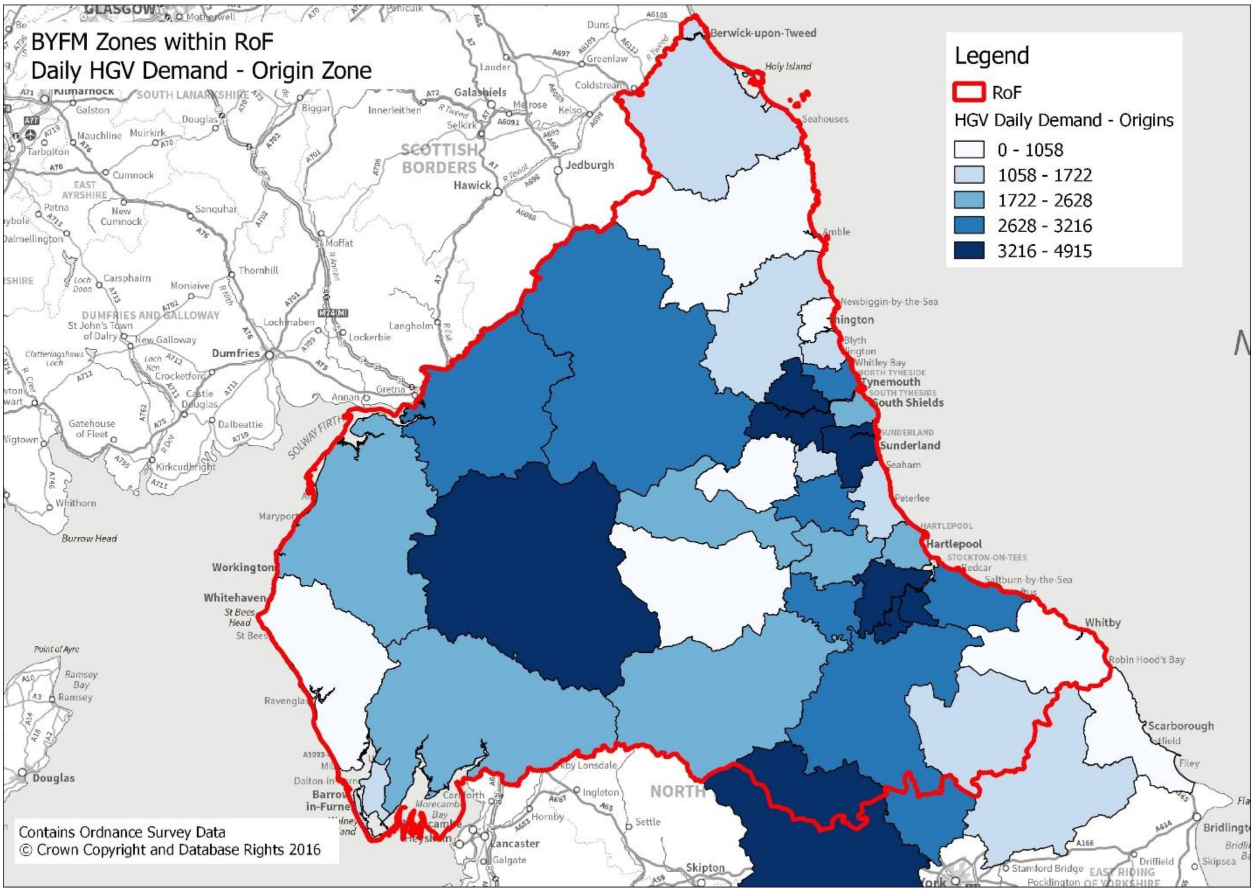
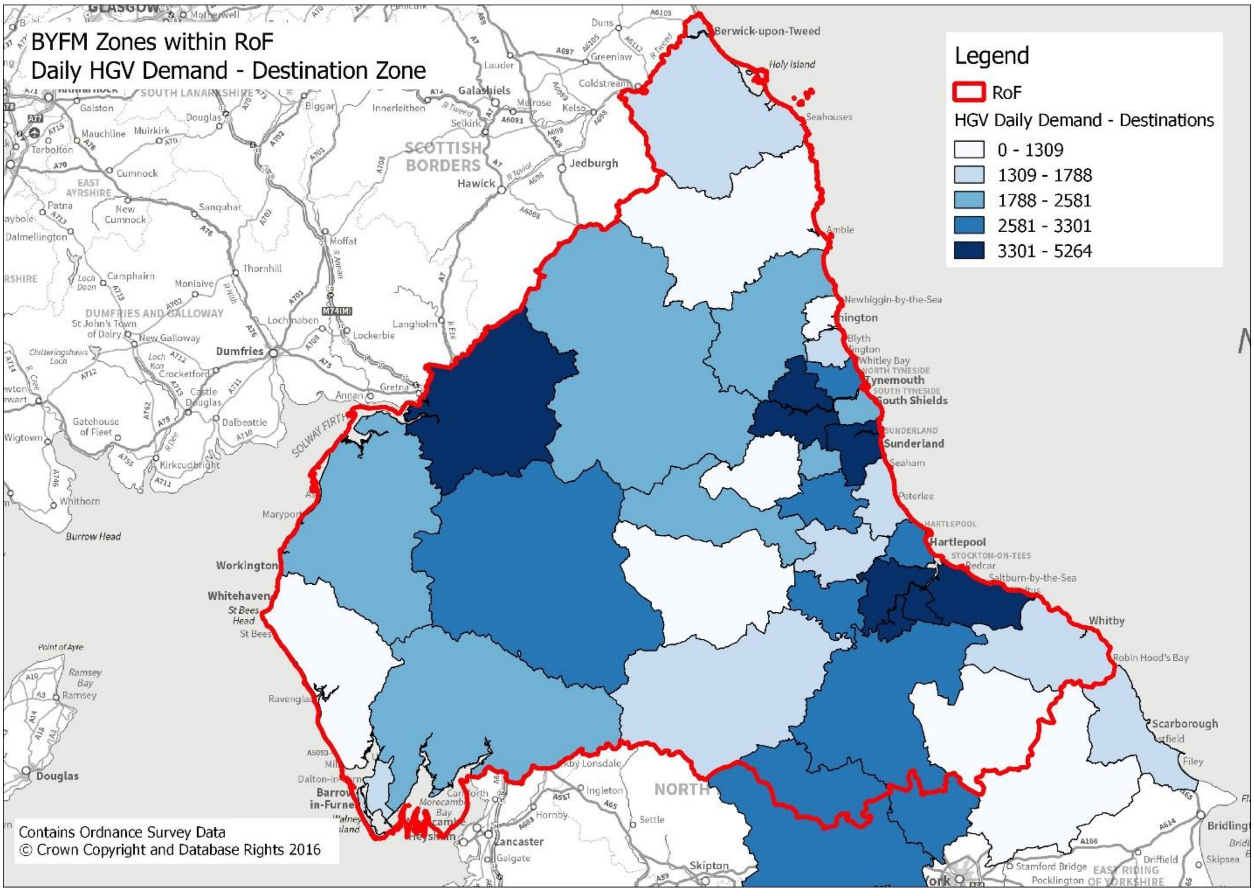


Figure 6-11 – HGV Demand for BFYM Zones – Destination zone



7 Journey Time Data

7.1 Trafficmaster data

Trafficmaster journey time data is a large dataset processed by DfT. This processing includes the number of observations and the ‘sum of squares’ which can be used to calculate variance. Confidence intervals can be calculated for this data.

7.1.1 Processing for journey times

Within the data consistency and calibration / validation TCGs, consideration was given to whether mean or median Trafficmaster journey times should be used in for the modelling. The following is copied from a note produced by the calibration / validation group.

“Mean Journey Times – Consideration of a sample of mean journey times and the Standard Deviations (SD) associated with these datasets has highlighted that in many cases the SD can be extremely high. This is caused in part by a ‘long tail’ associated with random events etc. that cause significant delays for a relatively small number of observations. This has the potential to increase the mean journey times and hence may cause an issue in the model validation and calibration, as these ’outlying’ journey times will not necessarily be reflected by the traffic counts.”

Median Journey Times – The median journey times have recently been used for the calibration and validation of the A14 transport model and were adopted for the same issues as highlighted above. As this model is currently going through the DCO stage it is considered appropriate to apply a consistent approach between the models.

7.1.2 Vehicle Proportions

In order to apply a pragmatic approach, and through discussions with the network consistency group, it has been agreed that the median journey times will be weighted by the Trafficmaster vehicle proportions. As these are predominately LGVs (~70%) and cars (~25%) it is considered that this approach is acceptable.

7.1.3 Journey Time Route Coverage

Further guidance on journey time route coverage was issued by the Calibration-Validation TCG:

Paragraph 4.4.3 of TAG Unit M3.1 outlines a requirement to cover as wider range of route types as possible and cover the Fully Modelled Area (FMA) as evenly as possible. Given the extent of the RTMs, the FMA tends to cover the full region potentially thousands of kms of road network. The core requirement for each RTM is to:

- Include journey time validation routes covering 100% of the Strategic Road Network relevant to each RTM. [SRN Routes];
- Include journey time validation routes covering the main access routes to the SRN. [Access Routes];
- Include journey time validation routes covering key alternatives to the SRN (e.g. parallel routes). [Alternatives]

Furthermore, relevant to the RIS 1 schemes, additional local journey time validation routes should be included to provide greater resolution of model performance adjacent to each scheme. These will typically be of smaller length than the type of route outlined above.

Paragraph 4.4.4 suggest routes should be between 3km and 15km. For the RTMs the length of SRN would result in hundreds of routes being assessed if this guidance is followed. In the SWRTM there is around 1,700km of SRN and would result in around 110+ routes just on the SRN.

Given that the RTMs will be average hour models for a peak period, the requirement to capture peak hour travel is not required and therefore routes can be of greater length. It is recommended that routes on the SRN are structured to represent a length of up to 100km. This would typically mean routes that take around 1 hour. Routes should be structured to represent sections of network providing a core function. This can be defined as:

- Sections between key urban areas (both SRN and non SRN based);
- Sections between key feeder routes to the SRN.

NRTM journey time routes are shown in Figure 7-1 and Figure 7-2.

Figure 7-1 – NRTM Journey Time Routes

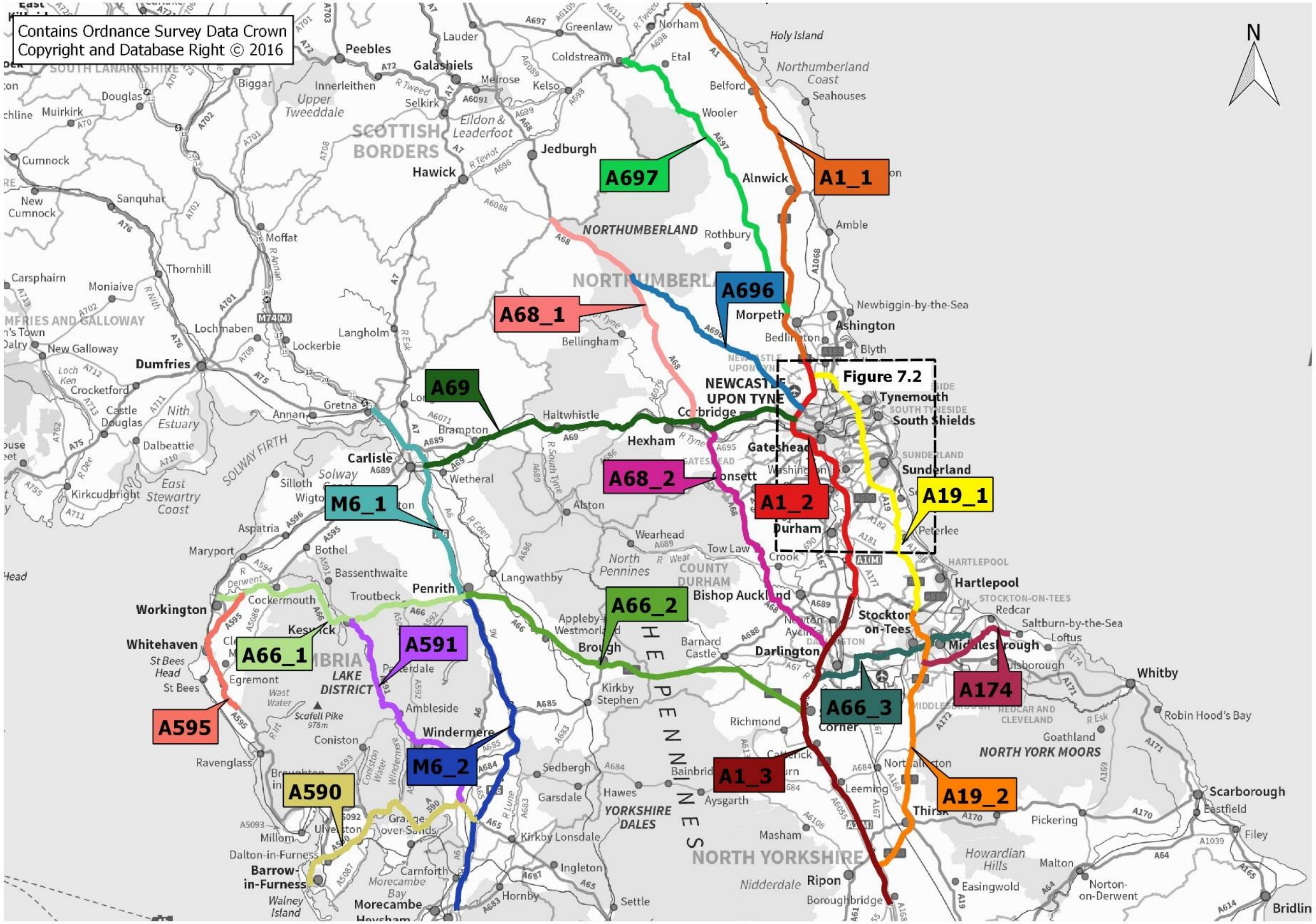
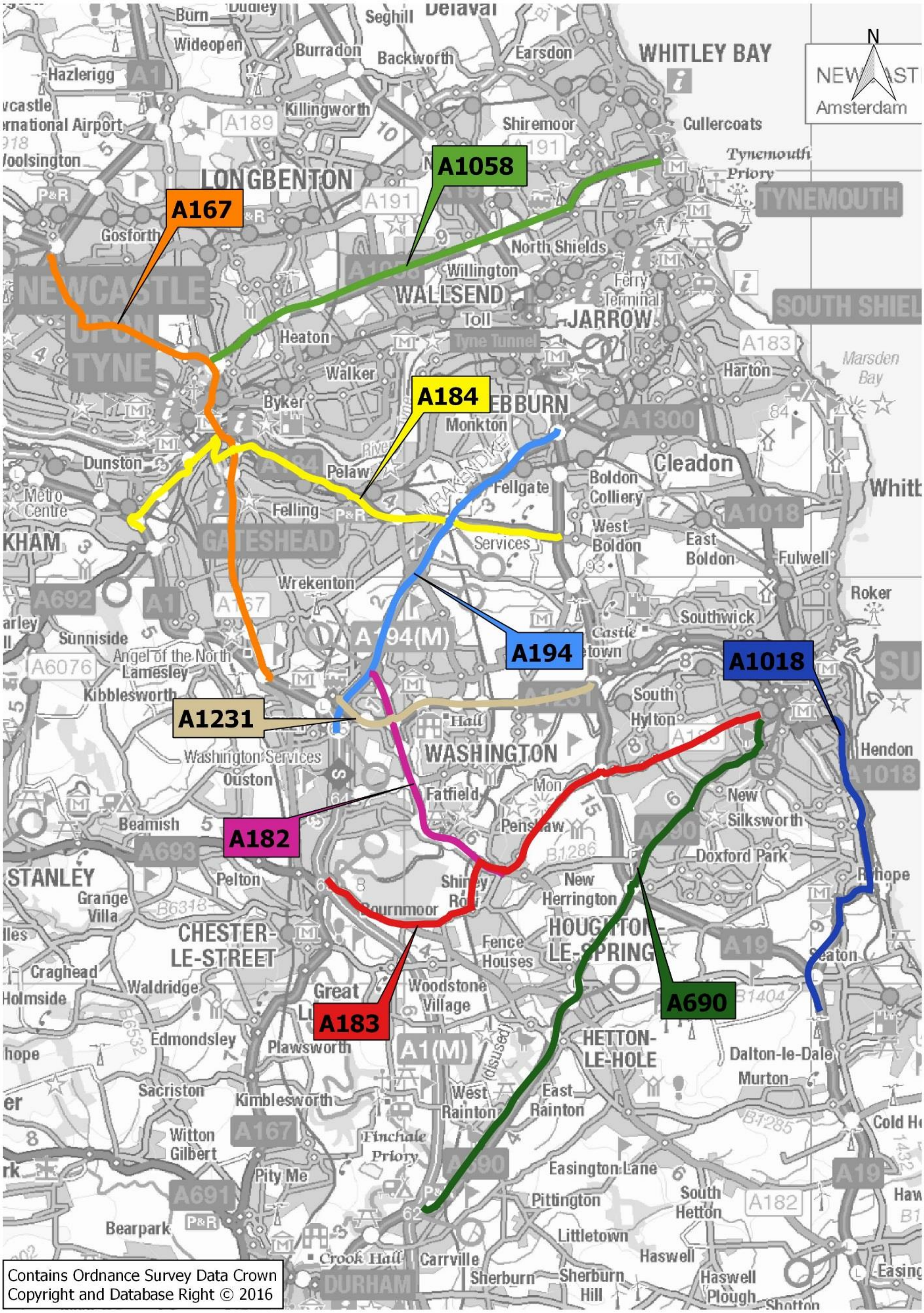


Figure 7-2 – NRTM Journey Time Routes (Tyne and Wear)



7.2 Journey Time Analysis

A summary of median journey time routes is provided in Table 7-1.

Table 7-1 Speeds for Journey Time Routes by direction

			ITN length (km)	AM	IP	PM
Route	A19_1	Time (secs)	61.267	00:49:05	00:41:25	00:45:16
Dir	NB	Speed (kph)		74.9	88.8	81.2
Route	A19_1	Time (secs)	60.374	00:42:42	00:40:44	00:44:34
Dir	SB	Speed (kph)		84.8	88.9	81.3
Route	A19_2	Time (secs)	60.787	00:35:24	00:35:49	00:35:07
Dir	NB	Speed (kph)		103.0	101.8	103.9
Route	A19_2	Time (secs)	60.670	00:35:53	00:35:26	00:35:20
Dir	SB	Speed (kph)		101.4	102.7	103.0
Route	A66_1	Time (secs)	59.752	00:42:14	00:42:51	00:41:58
Dir	EB	Speed (kph)		84.9	83.7	85.4
Route	A66_1	Time (secs)	59.781	00:44:30	00:44:54	00:43:04
Dir	WB	Speed (kph)		80.6	79.9	83.3
Route	A66_2	Time (secs)	80.083	00:51:35	00:52:15	00:51:21
Dir	EB	Speed (kph)		93.1	92.0	93.6
Route	A66_2	Time (secs)	80.024	00:51:50	00:53:13	00:51:59
Dir	WB	Speed (kph)		92.6	90.2	92.4
Route	A66_3	Time (secs)	38.676	00:31:08	00:30:17	00:30:34
Dir	EB	Speed (kph)		74.5	76.6	75.9
Route	A66_3	Time (secs)	38.071	00:29:51	00:29:29	00:29:43
Dir	WB	Speed (kph)		76.5	77.5	76.9
Route	M6_1	Time (secs)	44.671	00:23:44	00:23:55	00:23:25
Dir	NB	Speed (kph)		112.9	112.1	114.5
Route	M6_1	Time (secs)	44.477	00:23:53	00:24:04	00:23:41
Dir	SB	Speed (kph)		111.7	110.9	112.7
Route	M6_2	Time (secs)	72.450	00:38:01	00:38:03	00:37:09
Dir	NB	Speed (kph)		114.3	114.2	117.0
Route	M6_2	Time (secs)	72.774	00:38:17	00:38:19	00:37:32
Dir	SB	Speed (kph)		114.1	114.0	116.3
Route	A1_1	Time (secs)	90.616	01:00:38	01:01:49	00:59:18
Dir	NB	Speed (kph)		89.7	88.0	91.7
Route	A1_1	Time (secs)	91.075	01:00:07	01:01:56	01:00:09
Dir	SB	Speed (kph)		90.9	88.2	90.8
Route	A1_2	Time (secs)	59.681	00:45:21	00:42:02	00:44:47

Dir	NB	Speed (kph)		79.0	85.2	80.0
Route	A1_2	Time (secs)	59.505	00:43:15	00:42:27	00:45:46
Dir	SB	Speed (kph)		82.5	84.1	78.0
Route	A1_3	Time (secs)	70.485	00:43:06	00:43:12	00:42:38
Dir	NB	Speed (kph)		98.1	97.9	99.2
Route	A1_3	Time (secs)	70.459	00:43:34	00:43:33	00:42:36
Dir	SB	Speed (kph)		97.0	97.1	99.2
Route	A68_1	Time (secs)	53.528	00:39:13	00:39:52	00:38:57
Dir	NB	Speed (kph)		81.9	80.6	82.5
Route	A68_1	Time (secs)	53.572	00:37:51	00:39:30	00:39:00
Dir	SB	Speed (kph)		84.9	81.4	82.4
Route	A68_2	Time (secs)	63.600	00:53:05	00:53:06	00:51:16
Dir	NB	Speed (kph)		71.9	71.9	74.4
Route	A68_2	Time (secs)	63.565	00:51:33	00:53:17	00:51:44
Dir	SB	Speed (kph)		74.0	71.6	73.7
Route	A167	Time (secs)	13.623	00:21:04	00:16:51	00:18:31
Direction	NB	Speed (kph)		38.8	48.5	44.1
Route	A167	Time (secs)	13.585	00:18:29	00:17:22	00:22:46
Direction	SB	Speed (kph)		44.1	46.9	35.8
Route	A183	Time (secs)	13.570	00:16:46	00:16:27	00:16:08
Direction	EB	Speed (kph)		48.6	49.5	50.5
Route	A183	Time (secs)	13.549	00:16:22	00:17:01	00:19:08
Direction	WB	Speed (kph)		49.7	47.8	42.5
Route	A174	Time (secs)	20.179	00:14:19	00:14:21	00:14:08
Direction	EB	Speed (kph)		84.6	84.4	85.7
Route	A174	Time (secs)	20.026	00:14:14	00:13:52	00:13:29
Direction	WB	Speed (kph)		84.4	86.7	89.1
Route	A697	Time (secs)	68.888	00:52:22	00:54:24	00:52:16
Direction	NB	Speed (kph)		78.9	76.0	79.1
Route	A697	Time (secs)	69.099	00:52:33	00:54:16	00:52:30
Direction	SB	Speed (kph)		78.9	76.4	79.0
Route	A690	Time (secs)	15.202	00:15:52	00:15:46	00:15:45
Direction	NB	Speed (kph)		57.5	57.9	57.9
Route	A690	Time (secs)	15.367	00:17:11	00:16:27	00:16:18
Direction	SB	Speed (kph)		53.7	56.0	56.6
Route	A184	Time (secs)	13.022	00:17:51	00:19:42	00:18:28
Direction	EB	Speed (kph)		43.8	39.7	42.3
Route	A184	Time (secs)	12.760	00:18:56	00:15:35	00:16:54
Direction	WB	Speed (kph)		40.4	49.1	45.3

Route	A696	Time (secs)	47.816	00:36:53	00:37:34	00:36:49
Direction	NB	Speed (kph)		77.8	76.4	77.9
Route	A696	Time (secs)	47.811	00:35:26	00:37:42	00:36:07
Direction	SB	Speed (kph)		81.0	76.1	79.4
Route	A591	Time (secs)	51.911	00:44:39	00:49:33	00:46:59
Direction	NB	Speed (kph)		69.8	62.9	66.3
Route	A591	Time (secs)	51.666	00:44:11	00:49:01	00:47:04
Direction	SB	Speed (kph)		70.2	63.2	65.9
Route	A595	Time (secs)	28.485	00:25:26	00:26:45	00:28:57
Direction	NB	Speed (kph)		67.2	63.9	59.0
Route	A595	Time (secs)	28.458	00:26:16	00:26:01	00:25:43
Direction	SB	Speed (kph)		65.0	65.6	66.4
Route	A69	Time (secs)	84.392	01:00:08	01:00:30	00:58:33
Direction	EB	Speed (kph)		84.2	83.7	86.5
Route	A69	Time (secs)	84.360	00:58:53	00:59:50	00:57:48
Direction	WB	Speed (kph)		86.0	84.6	87.6
Route	A1231	Time (secs)	6.668	00:05:36	00:05:15	00:05:06
Direction	EB	Speed (kph)		71.4	76.2	78.4
Route	A1231	Time (secs)	6.674	00:05:32	00:05:27	00:05:21
Direction	WB	Speed (kph)		72.4	73.5	74.9
Route	A182	Time (secs)	6.299	00:04:37	00:04:42	00:04:28
Direction	NB	Speed (kph)		81.9	80.4	84.6
Route	A182	Time (secs)	6.540	00:04:44	00:04:50	00:04:41
Direction	SB	Speed (kph)		82.9	81.2	83.8
Route	A1018	Time (secs)	8.280	00:08:07	00:08:13	00:07:57
Direction	NB	Speed (kph)		61.2	60.5	62.5
Route	A1018	Time (secs)	7.876	00:07:56	00:08:05	00:08:06
Direction	SB	Speed (kph)		59.6	58.5	58.3
Route	A194	Time (secs)	9.498	00:08:54	00:07:02	00:08:06
Direction	NB	Speed (kph)		64.0	81.0	70.4
Route	A194	Time (secs)	9.499	00:06:59	00:06:50	00:06:52
Direction	SB	Speed (kph)		81.6	83.4	83.0
Route	A1058	Time (secs)	11.859	00:11:51	00:11:43	00:14:37
Direction	EB	Speed (kph)		60.0	60.7	48.7
Route	A1058	Time (secs)	11.965	00:14:47	00:12:16	00:13:15
Direction	WB	Speed (kph)		48.6	58.5	54.2
Route	A590	Time (secs)	52.210	00:40:23	00:41:27	00:41:07
Direction	EB	Speed (kph)		77.6	75.6	76.2
Route	A590	Time (secs)	52.994	00:42:21	00:42:13	00:41:09
Direction	WB	Speed (kph)		75.1	75.3	77.3

All routes are in line with the criteria set out by the calibration-validation TCG. Checks have been carried out to ensure modelled and observed distances are consistent and that observed speeds do not exceed the speed limit. Route M6_2 does exceed the 70 mph (113 kph) speed limit in both directions for all time periods which is perhaps reflective of the rural and free-flowing characteristic of this section of motorway. As modelled speeds cannot exceed the speed limit, this speed will be capped for journey time validation.

8 Suitability of Accumulated Database

A DVD of count data will be supplied to Highways England in addition to this report. This covers the process from raw count data, through to checking and processing and finally the dashboard. The process utilised Microsoft Excel workbooks some of which are macro-enabled.

Further data will be supplied as part of the Model Validation and Model Forecasting Reports including information on the fully processed demand data and an uncertainty log. Data can be supplied to other Highways England teams or contractors as requested. In the future it may be necessary for additional data to be collected depending on the projects NRTM is used for.

9 Summary and Conclusions

9.1 Summary

The Model Data Collection Report presents a summary of data collected for the base model build of the North Regional Transport Model. Specifically, the report covers:

- Data requirements of the model;
- A review of data sources;
- Collection of new data;
- Checking and cleaning of data;
- Processing of data and its use in the model; and
- Presentation of headline results from counts and demand data.

The process of data collection broadly followed these steps regardless of the exact dataset. Before beginning data collection a list of potential data sources was identified to meet the requirements of the Regional Models' specification. This stage was initially covered as part of the Model Specification Report (MSR) which was drafted early in the project, although this is very much an ongoing process which adapts as methodologies emerge and are solidified. Data requirements at all stages have been drawn up to meet the objectives of the model build and in line with other regions and discussions within the various TCGs.

A wide range of data has been collated from various sources including DfT, ONS, other Government offices and agencies (CAA, OFCOM etc.), Local Authorities, Highways England and its contractors (Telefonica, Arup etc.). In addition to this use of existing data new traffic counts were commissioned and took place in November 2015 and February 2016. This followed analysis which identified gaps or issues with existing count data.

Following collation of data, checking, cleaning and processing of data took place to ensure the quality of data which will be used in the model build. Although each of these checks was unique to the data in question, checks typically consisted of formal reviews of calculations and statistical tests, followed by logic and sense-type checks which identified any suspicious values. As part of these checks a large amount of analysis was also carried out on the count and demand datasets, some of which is presented in this report. Further findings from these datasets and detailed methodologies of the model build will be presented in the Model Validation Report.

A summary of key outputs from the count and demand dataset are presented in the final chapters of this report. Count data is presented in the main body of the report for the larger screenlines in the model. This shows flows of traffic for key movements such as entering and leaving the region at the northern and southern borders, between the region's major urban centres of Tyne and Wear and Teesside and also in and out of the Tyne and Wear conurbation. Other long distance movements such as east to west (and vice-versa) on the Trans Pennine routes are shown to have relatively low flows, although these are important in the context of emerging initiatives such as Northern Powerhouse and improving connectivity across the North. These flows will be used in network and matrix calibration and validation. More detailed information relating to traffic counts and observed flows can be found in the appendices to this report.

Demand data is presented at a high level in its raw format prior to processing. Initial checks on the quality of the MPOD data against independent sources such as NTS show a much lower proportion of short distance trips within the MPOD data which leads to a higher average trip length. This could be a facet of using mobile phones as a primary data source since short distance trips may not register as an event. Trips within rural areas may be underrepresented due to poorer network coverage. A process for going from raw MPOD data to assignment matrices was set out by the Matrix TCG to assure a consistent approach to the matrix build process across all regions using supplementary datasets including factors derived from NTS, Trafficmaster and BFYM. A series of verification checks have been defined to determine the suitability of the adjusted MPOD data for assignment which will be presented in the Model Validation Report.

9.2 Conclusions

NRTM makes use of a diverse range of sources to ensure that network supply, travel demand and model verification data is appropriately specified for the required purpose, namely the development of a Strategic Regional Transport Model for the North of England, with all the attendant requirements of accuracy to deliver travel forecasts according to the current specified technical guidance.

The process has followed a systemic pattern of specification of needs, collation of data, sourcing of additional information and verification of content. Adopting this diligent approach has led to an enhanced confidence in the content of the products to be delivered to Highways England.

Data collection will continue in the project with the collation of forecast year information, both infrastructure and development related. Similar techniques will be adopted to ensure that the information utilised is of the highest quality notwithstanding uncertainties expected into the future.

Appendix B

UNCERTAINTY LOG

APPENDIX C - FINAL UNCERTAINTY LOG

Near Certain to Reasonably Foreseeable Major Employment Developments within 2km of the A1

A1B2C Ref	Ref	Development	Location	Land Use	Net Developable Area (Ha)	Remaining Floorspace (sq m GFA)	Probability	2022	2023	2024	2037	2038	2039	Document	Easting	Northing	Reviewed	Core / High
SED1	E102	Saltwell Business Park	Gateshead	B1a	0.66	1,130	MTL	0	1,130	1,130	1,130	1,130	1,130	Gateshead ELR - Draft Report 2017	425689	560570		Y
SED2	G300b	Land south of Portobello Trade Park	Gateshead	B1b/c, B2, B8	1.2	4,800	RF	0	4,800	4,800	4,800	4,800	4,800	Gateshead ELR - Draft Report 2017	428321	555485		Y
SED3	E115	Princesway North	Gateshead	B1, B2, B8, B1a	4.41	17,640	NC	17,640	17,640	17,640	17,640	17,640	17,640	Gateshead ELR - Draft Report 2017	424124	560060		Y
SED4	G201	Council depot, Swalwell	Gateshead	B1b/c, B2, B8	0.85	3,400	RF	3,400	3,400	3,400	3,400	3,400	3,400	Gateshead ELR - Draft Report 2017	419931	561999		Y
SED5	AOC2	Metrogreen	Gateshead	B1a	3.75	15,000	RF	TBC	TBC	TBC	TBC	TBC	TBC	Gateshead ELR - Draft Report 2017	421796	562345		Y
SED6	G49	Site of Former Huwoods Factory, Kingsway North	Gateshead	B1, B2, B8, B1a	2.87	11,930	NC	11,930	11,930	11,930	11,930	11,930	11,930	Gateshead ELR - Draft Report 2017	424059	560764		Y
SED7	G395	Fifth Avenue Business Park	Gateshead	B1, B2, B8, B1a	1.89	7560	RF	0	0	0	7560	7560	7560	Gateshead ELR - Draft Report 2017	424908	560187		Y
SED8	G19	Land Between Kingsway South & Sainsbury's, Eleventh Avenue	Gateshead	B1c, B2, B8	0.79	3160	RF	0	0	0	3160	3160	3160	Gateshead ELR - Draft Report 2017	424977	558688		Y
SED9	G396	Princesway/Centralway	Gateshead	B1c, B2, B8	1.28	5126	RF	0	0	0	5126	5126	5126	Gateshead ELR - Draft Report 2017	424366	559753		Y
SED10	G494	Derwenthaugh Industrial Estate	Gateshead	B1b/c, B2, B8	0.91	3640	RF	3640	3640	3640	3640	3640	3640	Gateshead ELR - Draft Report 2017	419680	563300		Y
SED11	2703	Sandy Lane, Brunswick Industrial Estate	Newcastle	B2/B8	1.12	2661	NC	2661	2661	2661	2661	2661	2661	Newcastle HELAA 2017 - Appendix 2 Schedule of Suitable Standard Economic Sites, ELR 2017	422795	572613		Y
SED12	5320	Goldcrest Way, Newburn Riverside	Newcastle	B2/B8	1.12	4480	NC	4480	4480	4480	4480	4480	4480	Newcastle HELAA 2017 - Appendix 2 Schedule of Suitable Standard Economic Sites, ELR 2017	418345	563936		Y
SED13	5321	Kingfisher Boulevard North, Newburn Riverside	Newcastle	B2/B8	2.54	10160	NC	10160	10160	10160	10160	10160	10160	Newcastle HELAA 2017 - Appendix 2 Schedule of Suitable Standard Economic Sites, ELR 2017	418254	564152		Y

Developments of more than 200 dwellings within 2km of the A1

ore

High

A1B2C Ref Ref Development Location Remaining no.

Dwellings Probability 2022 2023 2024 2037 2038 2039 Document Easting Northing Reviewe

SRD1	AOC2	MetroGreen	Gateshead	1859	RF/H	30	60	198	1859	1859	1859	N&G Core Strategy and Urban Core Plan 2010 - 2030	421550	562839
SRD2	MSGP10.66, 10.67 and 10.68	Northside	Gateshead	291	NC	159	159	189	291	291	291	Gateshead Draft SHLAA - Oct 2017	427767	556803
SRD3	GN1	Dunston Hill	Gateshead	540	MTL	135	185	225	540	540	540	Gateshead Draft SHLAA - Oct 2017	422552	560706
SRD4	GV5	Kibblesworth	Gateshead	225	MTL	83	113	143	225	225	225	Gateshead Draft SHLAA - Oct 2017	423903	556723
SRD5	MSGP10.5	BAE Systems	Gateshead	334	RF	0	0	14	334	334	334	Gateshead Draft SHLAA - Oct 2017	426726	556014
SRD6	5203, AOC1	Newburn, Riverside	Newcastle	1000	RF	0	0	0	1000	1000	1000	Newcastle HELAA 2017	417924	564252
SRD7	4661, 4662, 4663, 4819, 4820, 4930, 4949, 4951, 4961	Kingston Park/ Kenton Bank Foot	Newcastle	746	RF	405	484	588	746	746	746	Newcastle HELAA 2017	420592	569199
SRD8	3106	Scotswood Development Area (Phases 2 to 5)	Newcastle	1422	NC	360	450	540	1422	1422	1422	Newcastle HELAA 2017	420367	564027
SRD9	2644	Newcastle Great Park Cell A (South of Coach Lane)	Newcastle	1200	RF	300	400	500	1200	1200	1200	Newcastle HELAA 2017	421879	571326
SRD10	5143	Upper Callerton	Newcastle	1200	RF	140	255	370	1200	1200	1200	Newcastle HELAA 2017	419500	568888
SRD11	4959	NGP Expansion site	Newcastle	950	RF	60	120	180	850	900	950	Newcastle HELAA 2017	421173	570570
SRD12	2643	Newcastle Great Park Cell D	Newcastle	600	NC	350	430	510	600	600	600	Newcastle HELAA 2017	421833	570547
SRD13	4603	Middle Callerton East	Newcastle	446	NC	320	390	446	446	446	446	Newcastle HELAA 2017	418642	568171
SRD14	4936	Hazlerigg SLR	Newcastle	462	RF	200	280	360	462	462	462	Newcastle HELAA 2017	422755	572174

SRD15	5152	Scotswood Development Area (Phase 1)	Newcastle	377	NC	377	377	377	377	377	377	Newcastle HELAA 2017	420936	563890
SRD16	2646	Newcastle Great Park Cell C	Newcastle	393	NC	393	393	393	393	393	393	Newcastle HELAA 2017	423202	571205
SRD17	4429	Springfield Centre	Newcastle	308	NC	308	308	308	308	308	308	Newcastle HELAA 2017	421483	566825
SRD18	5297	Site of former Redewood School, Etal Lane	Newcastle	253	NC	253	253	253	253	253	253	Newcastle HELAA 2017	420500	567198
SRD19	4828	Newbiggin Hall	Newcastle	230	RF	35	85	135	230	230	230	Newcastle HELAA 2017	420738	568151
SRD20		Dissington Garden village - Planning App	Northumberland	2500	MTL	TBC	TBC	TBC	TBC	TBC	TBC	Planning Application	414843	572998
SRD21	4652	South West Sector Application Site	Northumberland	706	NC	476	476	476	706	706	706	Northumberland SHLAA Interactive	424900	576590
SRD22	4703	Land at South West Sector	Northumberland	2091	MTL	575	1341	1341	2091	2091	2091	Northumberland SHLAA Interactive	424616	576277
SRD23	6886	South West Sector, Cramlington (phase 3)	Northumberland	850	NC	0	0	0	850	850	850	Northumberland SHLAA Interactive	425642	575645

Notes

Foreseeable

Includes sites within 2km of A1

Includes dwellings over 200 only

Includes Near Certain, More than Likely and Reasonably Foreseeable development

RF: Reasonably

MTL: More than Likely

NC: Near Certain

H: Hypothetical

Appendix C

GATESHEAD AND WESTERN BYPASS

STAGE REPORT (FEBRUARY 2015)

Safe roads, Reliable journeys, Informed travellers

HIGHWAYS AGENCY

A1 Newcastle Gateshead Western Bypass

Stage 1 Report

February 2015

Halcrow Hyder

Contents

Executive Summary

Introduction

The A1 Newcastle Gateshead Western Bypass (A1 NGWB) is a key linkage in the economy of the North East of England. It is also one of the most congested sections of the Strategic Road Network, with poor journey time reliability. The degraded operation of the corridor is considered to be a major barrier to the future economic development of the area. The Government have identified this section of the road network for investment aimed at tackling issues on the route. This report covers Stage 1 of a study to develop investment options for the A1 NGWB and focusses on reviewing evidence and identifying problems and issues on the route.

Traffic flows exceed the design capacity of the road, resulting in delays and unreliable journey times, particularly in peak periods. The Gateshead Western bypass in particular performs poorly against benchmarks in terms of safety. There are few performance issues to the south of J65 Birtley on the A1(M), and north of J79 North Brunton on the A1. The Gateshead section exhibits the worst performance.

The design of the Gateshead section of the A1 NGWB Western Bypass between J65 Birtley and J73 Derwentaugh is substandard with varying cross sections. It also has particularly closely spaced intersections. The substandard design contributes to the operational challenges for the corridor in terms of resilience, safety and capacity.

Public transport currently plays a relatively minor role, and offers little alternative for the local orbital journeys that utilise the corridor. Local heavy rail use is insignificant compared to the flows on the A1 NGWB, with a poor local service.

There are potential public transport improvements in the corridor, such as the reopening of the Leamside Line, which have been considered by previous, (and current) studies, and which could have some impact on modal share for certain travel movements in the corridor.

A strong stakeholder consensus exists concerning the issues and challenges in the corridor, and the need for action. Previous studies have proposed a number of potential improvements to the highway network, and the Lobley Hill to Dunston Scheme (incorporating extensions to Coalhouse and Metrocentre) has been recently approved with construction occurring between August 2014 and Spring/Summer 2016.

A number of environmental constraints exist in the corridor including the Hadrian's Wall World Heritage site, and other official safeguarded designations. Much of the corridor is immediately flanked by residential and commercial development.

A key issue concerns the role of the corridor, the balance between its strategic and local roles, and whether the performance targets and expectations for the corridor are appropriate given the balance between these roles. Travel demand data shows that more than 95% of journeys on the A1 NGWB are to, from or within the surrounding area, rather than more long-distance trips, emphasising the importance of the route for local and regional journeys.

There are significant development plans in Durham, Gateshead, Newcastle and Northumberland which will have an impact on travel demand on the A1 NGWB. Developments at Cramlington in Northumberland and in County Durham, particularly in the North of the City of Durham, are likely to load additional traffic at either end of the A1 NGWB corridor.

Although the Metrocentre to Coalhouse scheme will provide much needed relief to that section, without further intervention, conditions on the A1 NGWB will deteriorate, particularly south of Coalhouse to Birtley and between Scotswood and Ponteland Road to the north of the river.

Consideration is being given to potential major public transport improvements, such as extensions to the Metro system serving the corridor and reopening of the Leamside Line, which could potentially have an impact on travel demand on the A1 NGWB. In terms of buses, planned bus priority schemes on the Local Road Network (LRN) may displace traffic to the Strategic Road Network (SRN), unless the modal shift achieved is commensurate with the loss of general traffic capacity.

Given the current spatial pattern of development, and the demand for travel associated with it, the road in its current form is incapable of meeting the demands placed upon it. Compounding this issue, the committed plans for changes to the transport network are not commensurate with the increase in demand expected due to future planned development and background growth.

The distribution of future planned development will reinforce these patterns increasing the importance of the A1 NGWB as a key *local* artery within the city of Newcastle and Borough of Gateshead.

Resolving the conflict between the different roles, from local rat-run through to strategic highway is essential to achieving an optimal outcome. Should it be managed as a local road, with a residual strategic function, or should the – comparatively small in number – strategic users be prioritised?

It is clear, that given the current issues, future development plans and criticality of the corridor in providing reliable accessibility to enable and foster robust economic growth, that intervention is required.

1 Introduction and Purpose

1.1 Introduction

1.1.1 The HM Treasury document, Investing in Britain's Future (July 2013), set out details of the programmes of infrastructure investment expected through to 2020/21.This included the tripling of annual investment on Highways Agency major roads enhancements from today's levels to over £3bn by 2020/21. As part of that investment programme, the Government announced that it would identify and fund solutions, initially through feasibility studies to tackle some of the most notorious and long-standing road hot spots in the country. The A1 Newcastle Gateshead Western Bypass (A1 NGWB) is one of those locations.

1.1.2 The north-south link of the A1 NGWB is approximately 25km of predominantly two-lane dual carriageway with limited three-lane carriageway sections. It runs between Junction 65 at Birtley through to Junction 80 at Seaton Burn. In addition, this study covers a 14km section of the A1(M) between Carrville at Junction 62 and Birtley at Junction 65. The A1(M) is two-lane dual carriageway motorway between Junction 62 and Junction 63, and then gains a lane through Junction 65 where it meets the A1 NGWB. The study corridor is shown in Figure 1-1, with the configuration of the road layout shown in Appendix A.

1.1.3 The A1 NGWB is one of the most congested highway links in the North-East Region. More than 110,000 vehicles use the route every day on the busiest section, which is more than double the theoretical design capacity of the road; indeed this flow exceeds the recommended Maximum Opening Year flow for a dual four-lane motorway. The route is of critical economic importance for the region as it strongly aids both internal and external connectivity. At a national level, the A1 provides the main north-south link connecting Scotland, North East England, Yorkshire & Humber, East England and London.

1.1.4 The road suffers from a high level of congestion and journey time reliability issues. With significant development pressures on the route for much needed regeneration, the existing situation is forecast to worsen if no mitigation measures are implemented.

1.2 Study Purpose and Objectives

1.2.1 The aim of this study is to identify the opportunities and understand the case for future investment solutions on the A1 NGWB that are deliverable, affordable and offer value for money.

1.2.2 The specific objectives of the study are to:

- Identify and assess the case for, deliverability and timing of specific road investments that address existing problems on the A1 NGWB;
- Identify and assess the case for, deliverability and timing of specific complementary investment on local transport modes that improve the performance of the A1 NGWB;

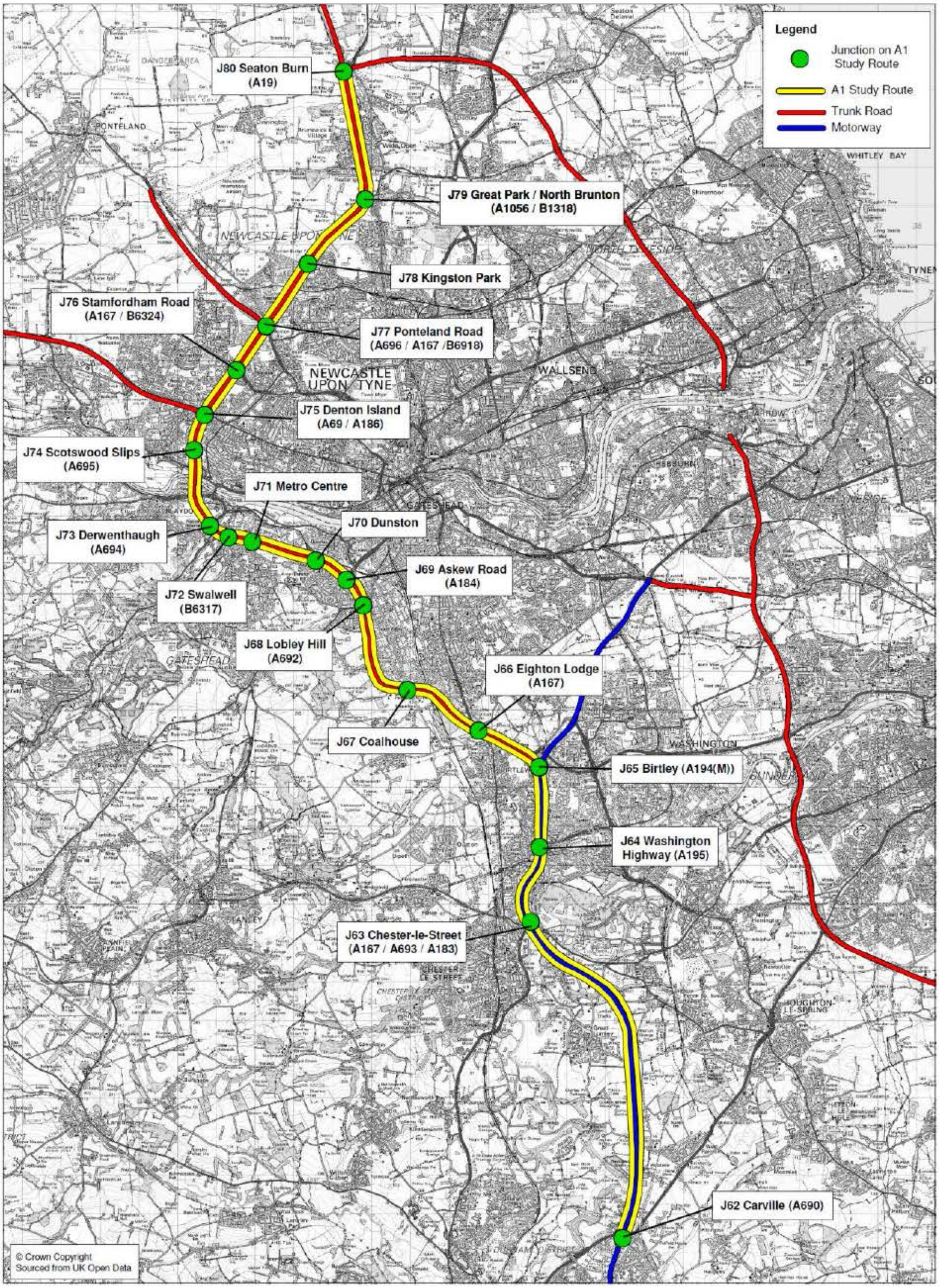


Figure 1-1 Study Corridor

- Understand the balance of benefits and impacts from potential individual investment proposals and any additional benefits or impacts from investment on a corridor basis; and
- Evidence where possible, the wider economic benefits from the transport investment in the corridor.

1.2.3 The study will also address the following questions:

- Given the assessment of current and future performance of the A1 Western Bypass, and the surrounding local transport network, are there specific priority locations/problems that should be addressed?
- Are there viable potential solutions to these problems which are deliverable, affordable and offer value for money?
- What are the potential timescales for the delivery of identified potential solutions?
- Are there additional benefits or impacts from combinations of potential solutions over and above those for individual solutions?
- Is there evidence of the impact of investment in potential solutions on the resilience of the road network?
- Have the potential solutions identified fully considered and optimised the environmental opportunities and mitigation that the potential transport investment could bring?
- Is further work/analysis required for Government to be able to make specific investment decisions, and if so what are the timescales of such work?

1.3 Study stages

1.3.1 The study is split into three stages, the first of which is reported here. These are:

- Stage 1: Review of evidence and identification of problems and issues;
- Stage 2: Finalise the range of proposals that could address the identified problems and issues; and
- Stage 3: Assess the affordability, value for money and deliverability of the proposals.

1.3.2 The three stages encompass the steps of the Transport Appraisal Process (TAP), contained within the Department for Transport's Transport Appraisal Guidance (TAG) as follows:

- Stage 1: TAP steps 1-4;
- Stage 2: TAP steps 5-9 (Produce Option Assessment Report); and
- Stage 3: Produce Strategic Outline Business Case (SOBC).

1.3.3 It is noted that the definition of the stages for this study differs from the Stages as described in TAP, as shown in Figure 1-2.

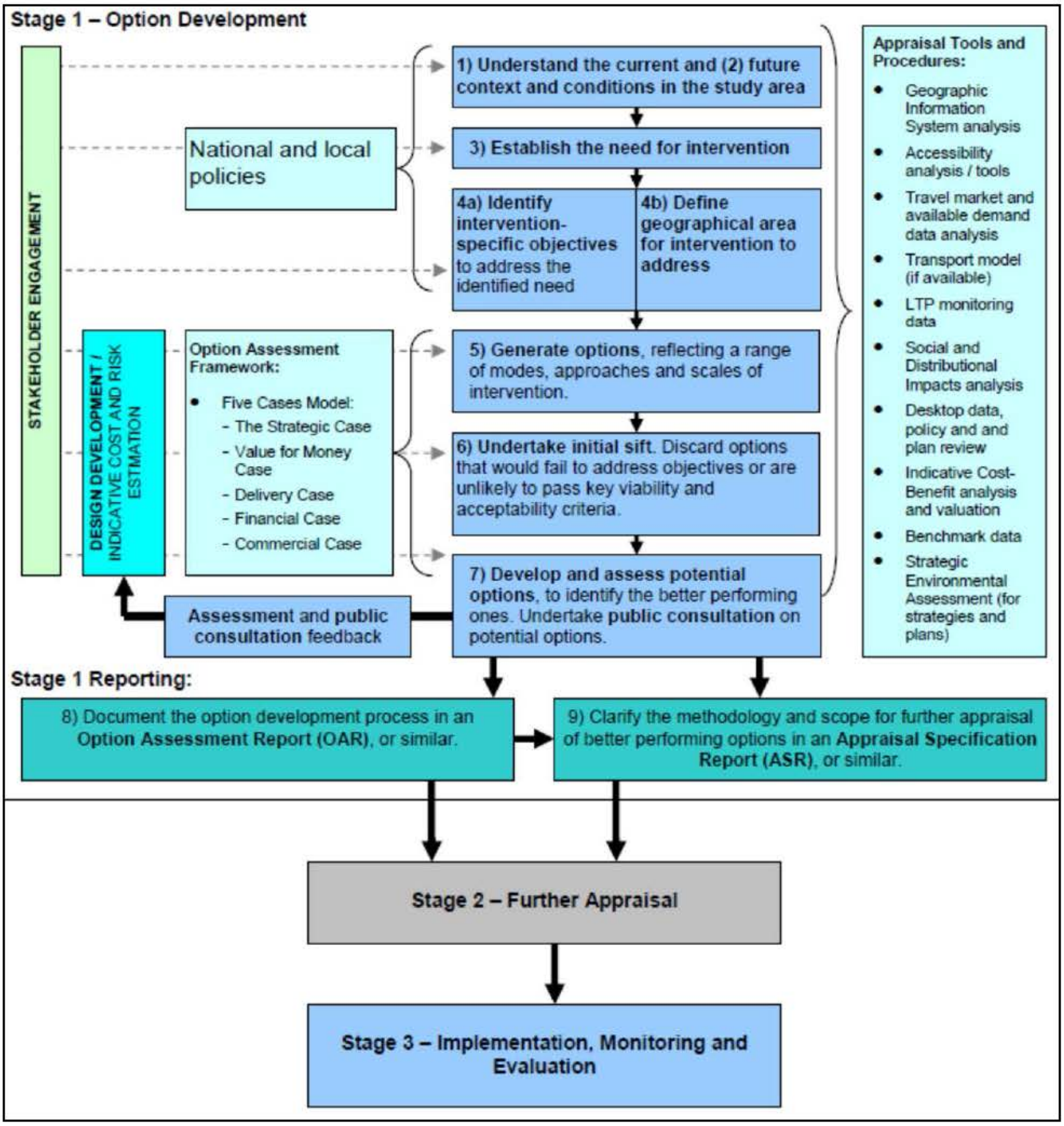


Figure 1-2: Steps in the Option development process

(Source: Transport Appraisal Process, DfT Transport Appraisal Guidance)

1.4 Stage 1 Objectives

1.4.1 The purpose of Stage 1 of the study is to review the evidence and identify problems within the study area. In particular Stage 1 will:

- review any relevant evidence gathered as part of the development and completion of the A1 J62 to A1/A19 pilot Route Based Strategy, as well as any emerging evidence from the Highways Agency's London to Scotland East and North Pennines Route Based Strategies;

- gather and review any other related work from other studies and analysis, and form a view as to the nature and scale of current and future performance along the A1 Western Bypass;
- set out details of previous historical work and decisions taken in terms of the approach to investment or management of the A1 Western Bypass, with the aim of reaching agreement on the historical position in relation to previous investment proposals.
- establish both the availability of transport modelling and the need to undertake specific transport modelling necessary to provide analysis that would be needed to evidence answers to some of the questions to be addressed in the study; and
- present findings for consideration by the Project Board and the Reference Group where appropriate.

This Stage 1 Report presents the outputs from the study to deliver these objectives.

2 Background and Historical Context

2.1 Introduction

2.1.1 The purpose of Chapter 2 of this study is to:

- Summarise previous work undertaken in the study area, focussing on the problems and issues identified by those studies; any information on the potential for mode shift and any decisions taken about potential schemes; and
- Establish the availability of any transport modelling tools, and the need to undertake any further modelling work, to carry out any analysis of potential schemes required in later stages of this study.

2.2 Previous Studies and Reports

2.2.1 The following documents have been reviewed as part of the review of historical information:

- TAMMS Multi Modal Study (2002);
- A1 Western Bypass Scheme Appraisal Report (2003);
- A1 Gateshead Newcastle Western Bypass Options Assessment Report (2008);
- A1 Gateshead & Newcastle Western Bypass Congestion Relief Schemes (2010);
- Access to Tyne and Wear DaSTS study (2010);
- North East DaSTS Strategic Connectivity Study Report (2010);
- SRN Future Operations: Gateshead Infrastructure Study (2011);
- SRN Future Operations: Newcastle Infrastructure Study (2011);
- Newcastle City Deal (2012);
- A1 West of Newcastle Route Based Strategy (2013);
- “Go for Jobs” campaign, 2005 – 2008;
- DRAFT Route-based strategy: Evidence Report London to Scotland East (February 2014); and
- More and Better Jobs: North East Strategic Economic Plan (March 2014).

2.2.2 Each of these documents has been reviewed in order to identify issues raised, summarise previous decisions and establish the potential for mode shift along the corridor.

2.3 TAMMS Multi-Modal Study (2002)

2.3.1 The Tyneside Area Multi-Modal Study was set up specifically with the aim of developing a transport strategy to address problems on the A1 and A19 trunk roads in the Tyneside area. This study is now over ten years old, and as such should be regarded with caution.

2.3.2 The key issues identified through the study were:

- Transport Issues – car ownership, traffic growth, the highway network and public transport networks;
- Environmental Issues – local and regional environmental planning constraints and policies; and
- Social and Economic Issues – employment, deprivation, economic regeneration and restructuring.

2.3.3 Also through the consultation, key 'stress' points were identified on the A1 as being at:

- J80 Seaton Burn;
- J73 Derwenthaugh;
- J68 Lobley Hill; and
- J65 Birtley.

2.3.4 On the A1 NGWB, the number of closely spaced junctions was identified as an issue, with peak hour congestion on the stretch of the A1 between J65 Birtley and Derwenthaugh noted as a particular problem. The movement between Lobley Hill and Askew Road was highlighted as particularly problematic, where traffic from the A692 Lobley Hill Road joins the A1 for a short distance before leaving on the A184.

2.3.5 By the 2031 time horizon, the entire A1 between Birtley and Seaton Burn was predicted to be over capacity by a factor of 25%, with the exception of Blaydon Bridge. Road congestion was seen as affecting the operation of major transport interchanges such as Newcastle International Airport and the Port of Tyne.

2.3.6 Bus services were seen as suffering from road congestion, lack of enforcement of regulations and being poorly integrated with other modes. On the railways, lack of integration, uncertainty over franchises and capacity were seen as issues, with a conflict between the needs of freight, regional and long distance passengers and those of local travel.

2.4 A1 Western Bypass Scheme Appraisal Report (2003)

2.4.1 This report for the Highways Agency summarised a validation exercise of a scheme that was proposed by TAMMS involving the provision of full three lane widening on the A1 NGWB. It did not seek to verify the issues and problems identified in TAMMS. The conclusion was that the proposals for the A1 did not represent value for money due to required land take and property demolition. This conclusion highlights a critical issue for the corridor: the fact that the corridor is extremely constrained by development for much of the length of the A1 NGWB.

2.4.2 The ministerial response to the proposals that came forward was as follows:

> "The Secretary of State is concerned that in the medium to longer term, in the absence of an effective local management strategy, it would draw more local traffic on to the A1 and not provide lasting benefits to the strategic road network... However, it went on: "He is asking the Highways Agency to continue to monitor the performance of the A1, to carry out further development work on the widening scheme in the light of the emerging local strategy for resolving local congestion problems and to report back to him."

2.4.3 This statement highlights a 'local' versus 'strategic' conflict over the role of the road, with it being implied that the problems are local issues to be resolved locally, and that improvements to the strategic network are only considered as beneficial if they are protected for use by strategic traffic, rather than local traffic.

2.5 "Go for Jobs" campaign, 2005 - 2008

2.5.1 The primary issue concerning stakeholders in the corridor is the impact of the degraded operation of the A1 NGWB on the local economy. This was highlighted by this campaign started in 2005 by the local newspapers on Tyneside and Teeside in conjunction with the North East Chamber of Commerce. It aimed "to convince the Highways Agency to lift Article 14 notices on business, which block developments that could put extra traffic on the A1 or A19". A memorandum to the Transport Select Committee on the issue from the North East Chamber of Commerce suggested that this was" putting 10,000 potential jobs and £1bn of investment at risk".

2.5.2 This campaign contributed towards a widening perception that congestion on the SRN, and the A1 NGWB in particular was a block to economic development on Tyneside. It is notable that public perception was highlighted as an issue in TAMMS as well. Subsequently, the Agency has worked hard to foster a closer relationship with local stakeholders.

2.6 A1 Gateshead Newcastle Western Bypass – Option Identification and Selection (2008)

2.6.1 This study reported an ongoing stream of work emanating from the response to TAMMS. The study objective was to produce a package of engineering measures to reduce congestion, improve journey time reliability and improve safety, which were all identified as issues in TAMMS. Nine full length options were considered, ranging from full widening (£1,654m) to a technology only scheme (£132m), in addition to three shorter congestion relief options.

2.7 A1 Gateshead & Newcastle Western Bypass - Congestion Relief Schemes (2010)

2.7.1 Following option identification, the Secretary of State gave the DfT approval to continue with the continued development and appraisal of schemes with the potential for early completion and delivery of benefits to drivers.

2.7.2 This resultant study identified three early delivery schemes which targeted specific key issues, and were considered 'deliverable'. One of these involved the provision of new parallel link collector distributor roads between the A692 Lobley Hill and A184 Askew Road junctions. This was further developed and approval was given from the Secretary of State for a scheme between Dunston Road through to south of Lobley Hill in 2013. An extension to this scheme, which will see three lanes being provided between Metrocentre and Coalhouse junctions was given approval in 2014.

2.8 Access to Tyne and Wear DaSTS study (Phase 1 - 2010) and North East DaSTS Connectivity Study (2010)

2.8.1 A number of studies were commissioned by DfT in 2009 under the "Delivering a Sustainable Transport System" (DaSTS) initiative. This approach sought to introduce an objectives led approach to transport planning, with a focus on non-transport goals in order to set transport within a wider context. Two studies concerned the study area:

- Access to Tyne and Wear City Region Study; and
- North East DaSTS Connectivity Study.

2.8.2 The Evidence Review of the Access to Tyne & Wear City Region Study, dated May 2010 and prepared for the Department for Transport provides a comprehensive review of evidence associated with transport related issues in the Tyne & Wear City Region.

2.8.3 The DaSTS studies were envisaged in two phases. The first phase involved baselining and a strategic sift of options. The second phase would have developed and applied an analytical approach, however this stage was not taken forward after the 2010 General Election.

2.8.4 The aim of this study was to assess transport issues and potential solutions throughout Tyne and Wear, with the study area extending to cover parts of County Durham and Northumberland. Key issues identified for the A1 corridor were

- Reducing delay and improving journey times on the A1;
- Supporting sustainable economic growth by improving reliability and predictability of journeys on the A1 and other regionally important corridors;
- Consideration of barriers to enhanced social and economic participation and improved access to employment;
- Reviewing locations for growth;
- Considering carbon emissions and poor local air quality;
- Unlocking barriers to more physically active travel; and
- Seeking an appropriate balance between the needs of different types of travellers.

2.8.5 Analysis was carried out using data provided by the Highways Agency, including the Regional Network Report, data from the Regional Intelligence Unit and traffic monitoring systems. From this, information was included for the 'top ten' links in terms of delay in the study area. These are reproduced below in Table 2-1.

Road Link (Current)	Road Link Length Km (Current)	Total Vehicle Hour Delay	Total Vehicle Hour Delay per Km
A1 between A184 and A692	0.82	181,586	221,447
A1 between A692 and A167	5.01	985,211	196,649
A1 between A694 and A184	3.53	499,744	141,571
A1 between A692 and A184	0.95	87,796	92,417
A1 between A184 and A694	3.52	304,762	86,580
A1 between A167 and A692	5.01	376,103	75,070
A1 between A1(M) J65 and A167	2.05	146,070	71,253
A1 between A1 and A694	2.43	104,919	43,177
A19 between A191 and A1056	2.6	106,573	40,990
A1 between A696 and A167	1.27	45,103	35,515

Table 2-1: Top ten delay links from Access to Tyne and Wear DaSTs study.

2.8.6 This analysis indicated a high level of stress concentrated within the Gateshead section, with the Lobley Hill area and Eighton Lodge areas being particularly problematic. Forecasts for 2014 showed a worsening situation. Outputs from the Tyne and Wear Transport Planning Model (TPM) were also analysed. These illustrated issues at the same locations as the stress analysis and Highway Agency information.

2.8.7 The study identified that local traffic and movements to and from County Durham formed the majority of demand on the A1. It considered the potential impact from development proposals, and the role to be played by the various modes of transport. Similar issues were identified in the parallel North East DaSTS Strategic Connectivity Study report.

2.9 SRN Future Operations Studies, Newcastle, Gateshead (2011)

2.9.1 The aim of these studies was to identify potential issues for the SRN arising from development proposals contained within the emerging local plans of the local Gateshead Borough and Newcastle City Councils.

2.9.2 Using a mesoscopic model of the SRN in Tyne and Wear, described in Section 2.17, forecasts were produced of the likely future impact of these new developments. The key network issues identified were common with those identified in other studies, however it was also found that the distribution and quotient of development proposed would exacerbate these issues over and above the impact of background growth.

2.9.3 The majority of key development sites in Newcastle and Gateshead fall within the A1 corridor, these being:

- Team Valley (adjacent to the Lobley Hill and Coalhouse interchanges);
- Metro Green (adjacent to the Metrocentre);
- Callerton Park (in the vicinity of Newcastle Airport, between 696 and Great Park);
- Great Park (adjacent to the North Brunton Interchange); and
- Dunston Hill.

2.9.4 Engagement was undertaken with Gateshead Borough and Newcastle City Councils throughout the process. This process continues, with a refresh of the information included in these studies being undertaken currently. This follows the finalisation of the Local Plan, and its submission, and is due to complete prior to the Examination in Public (EIP). This will inform the Highways Agency's submission to the Inspector. Issues surrounding future development proposals are considered further in Chapter 4.

2.10 Newcastle City Deal (2012)

2.10.1 In September 2012, City Deals were finalised between Central Government and eight of the largest cities in England. The Newcastle City Deal, which encompasses both Newcastle and Gateshead, seeks to give the area the powers needed to drive economic growth and unlock projects or initiatives that will boost the local economy.

2.10.2 Transport and Connectivity forms one of the five key parts of the city deal, it commits to:

> Produce an investment programme with Government to reduce congestion on the A1 Western Bypass, to reduce journey times on one of the most congested links in the national network[1.]

2.10.3 The Government made the following commitment in the City Deal:

> DfT and the Highways Agency to work with Gateshead and Newcastle councils to develop local transport investment proposals to address congestion on the A1 Western Bypass

2.10.4 For its part, Newcastle and Gateshead committed to:

> Establish a joint governance deliver and accountability arrangement between Newcastle and Gateshead councils, DfT and the Highways Agency to address congestion problems on the A1 Western Bypass;
>
> Develop initiatives through the Tyne and Wear Local Transport Plan capital programme to improve integration of the local and truck road network;
>
> Work with the LEP and partner local authorities to develop further local complementary measures for the post 2015 period; and
>
> Invest £2.5 million in Tyne and Wear's Urban Traffic Management and Control (UTMC system).

2.11 Route Based Strategies (2012; 2014)

2.11.1 The report *A Fresh Start for the Strategic Road Network* proposed Route Based Strategies, with the consideration that they would enable a smarter approach to investment planning and support greater participation in planning for the strategic road network from local and regional stakeholders.

2.11.2 The A1/A1(M) Carrville to Seaton Burn Route Based Strategy (RBS) was one of the pilot RBSs, and was developed to ascertain the performance of the SRN, and highlight challenges and opportunities, both present and future. The study was designed to ensure that stakeholders had a voice in setting the vision and objectives for the future of the SRN.

2.11.3 The strategy, which was retitled for publication as "A1 West of Newcastle RBS", has been used to inform this report generally, and provides much of the information for Chapter 3, looking at the current situation, and Chapter 4, looking at the future situation. The consultation undertaken as part of this RBS has informed this study.

2.11.4 The London to North East RBS, having a much wider focus, provides little information related to the A1 NGWB that is not provided in more detail elsewhere.

2.12 Potential for Modal Shift in the Corridor

2.12.1 There is relatively little previous work on the potential for modal shift along the corridor, other than the TAMMS study, which is now dated. Currently, there are few public transport services which operate along the corridor itself. There are, however, a number of services which traverse the corridor and others that run parallel to it. These may provide alternatives for some journeys which use the A1 NGWB for part of their trip.

2.12.2 The documents reviewed as part of this consideration include:

- Leamside Line Study (2007) – Nexus (as lead organisation);
- Connecting Communities (2009) – ATOC ;
- Leamside Line Highway Network Improvements (2009) – Highways Agency; and
- Go Smarter to Work (2012) – Tyne and Wear Integrated Transport Authority.

2.13 Leamside Line Studies

2.13.1 Of particular relevance to the A1 corridor are proposals involving the reopening of the Leamside Line, which ran from Durham, via Washington through to Newcastle via Pelaw. It closed to passengers in the 1960s, and to freight in 1992 and is officially 'mothballed' for potential future use. This is an official designation, meaning the line is not active, but neither is it disused. The route remains part of the Network Rail Network (Figure 2-1).

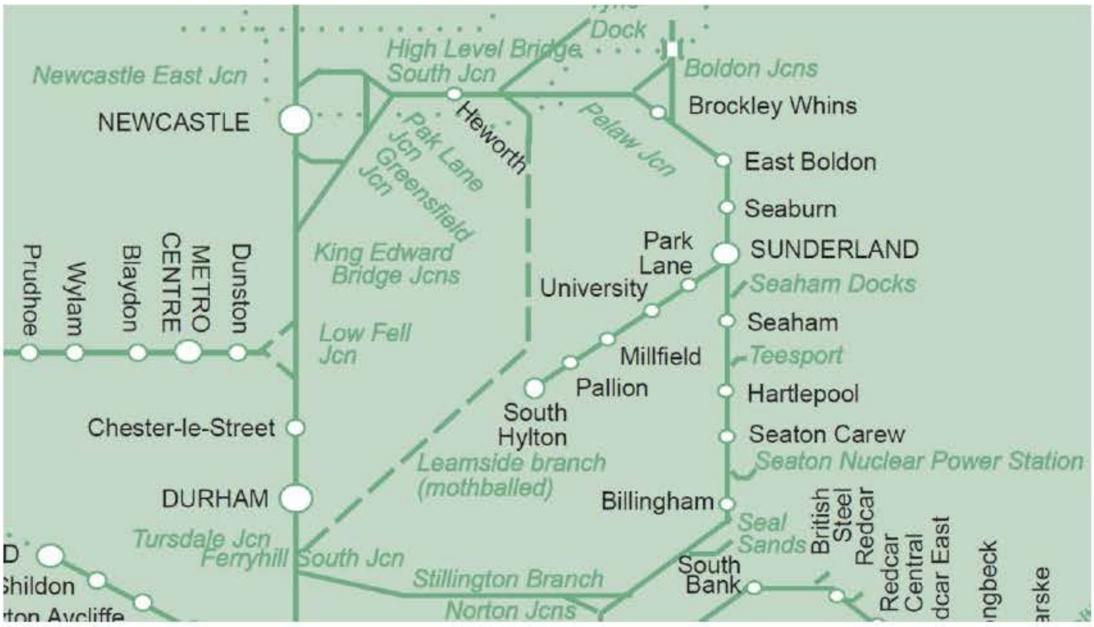


Figure 2-1: Leamside Line (mothballed)

1 HM Treasury (18/09/12) Government formalises Newcastle city deal Press Notice PN 84/12

(source: Network Rail East Coast Mainline Route Utilisation Strategy, 2008)

2.13.2 A key driver behind proposals to reopen the Leamside Line has been cited as the opportunity to remove car trips from the A1 NGWB. There would be the possibility of a major park and ride facility at J62 Carrville, which could have a role in removing trips from the A1. The site, adjacent to the track bed, currently operates as a bus based park and ride facility for Durham.

2.13.3 The Association of Train Operating Companies report *Connecting Communities* identified Washington, with a population of 53,400, as being a key town that would benefit from rail services being restored. Washington is currently a car focused new town. This analysis assumed diversion of the hourly Newcastle to Manchester Airport TransPennine Service, but noted that options for local services also exist. The capital cost was estimated at £86m, with a Benefit Cost Ratio of 1.4.

2.13.4 The opportunity to deal with network path capacity constraints is another reason that the reopening of the Leamside line has been considered. The Network Rail *East Coast Mainline 2016 Capacity Review,* published in 2008, identified that the East Coast Mainline between Northallerton and Newcastle is already approaching capacity, and services are currently flighted to meet current demand. Any move to increase service, or provide more even stopping patterns on this section on line would exceed available capacity. The reopening of the Leamside Line for freight was cited "the best solution to provide additional capacity", but this would only be considered post-2019.

2.14 Go Smarter to Work

2.14.1 The successful Tyne and Wear 2012 Local Sustainable Transport Fund allocation of £5m focused on access to employment sites adjacent to, and served by the A1 corridor. A specific aim of the project was to relieve congestion on the A1 NGWB and support access to employment.

2.14.2 Entitled Go Smarter to Work, it is focussed on Newcastle City Centre, Gateshead Town Centre, Washington, Team Valley and Metro Centre. Sections of the bid that won funding were centred around information provision, bus priority, cycle facilities and helping job seekers access employment. Funding bids for 2015/6 seek to continue and expand the Go Smarter to Work programme.

2.15 Existing Transport Models

2.15.1 In order to determine if a suitable transport model existed for use within this study, a review has been undertaken of three relevant existing models. The suitability of each is discussed in turn within this section.

2.16 Tyne and Wear Transport Planning Model Version 3 (TPM3)

2.16.1 The Tyne and Wear Transport Planning Model (TPM), a CUBE Voyager/TRIPS multi-modal model, was developed for the Tyne and Wear authorities in 2005 to inform their Transport Innovation Fund (TIF) submission. It is a full 4-stage model, with a zoning structure that covers the whole of Great Britain (Figure 2-1).

2.16.2 Investigation of the TPM model in 2008 for its potential use in the 2008/9 studies of the A1 NGWB indicated that there were issues in regard to the suitability in the appraisal of prospective schemes in the A1 corridor. Of particular concern is the lack of congestion shown in the model on the A1 NGWB (Figure 2-3), as compared to the daily congestion experienced in reality.

2.16.3 As a result of the limitations, Jacobs were sub-contracted to modify, re-calibrate and re-validate the TPM model for the assessment of potential improvements in the A1 corridor using newly collected survey data, however as they noted at the time:

> The TPM was developed as a large and detailed multimodal variable demand model (VDM) based on WebTAG guidance and originally for TIF purposes covering a large area. It is built on the CUBE software platform, which has served it well bearing in mind the emphasis on VDM, incremental demand model and forecasting capability, but it has some certain limitations in particular with respect to wrt [with respect to] junction modelling and flow metering in congested situations.

2.16.4 Therefore, although improved in terms of validation in the A1 corridor, the basis of the model is still the 2005 origin-destination data, with validation at the level of a particular corridor such as the A1 still being regarded as problematic.

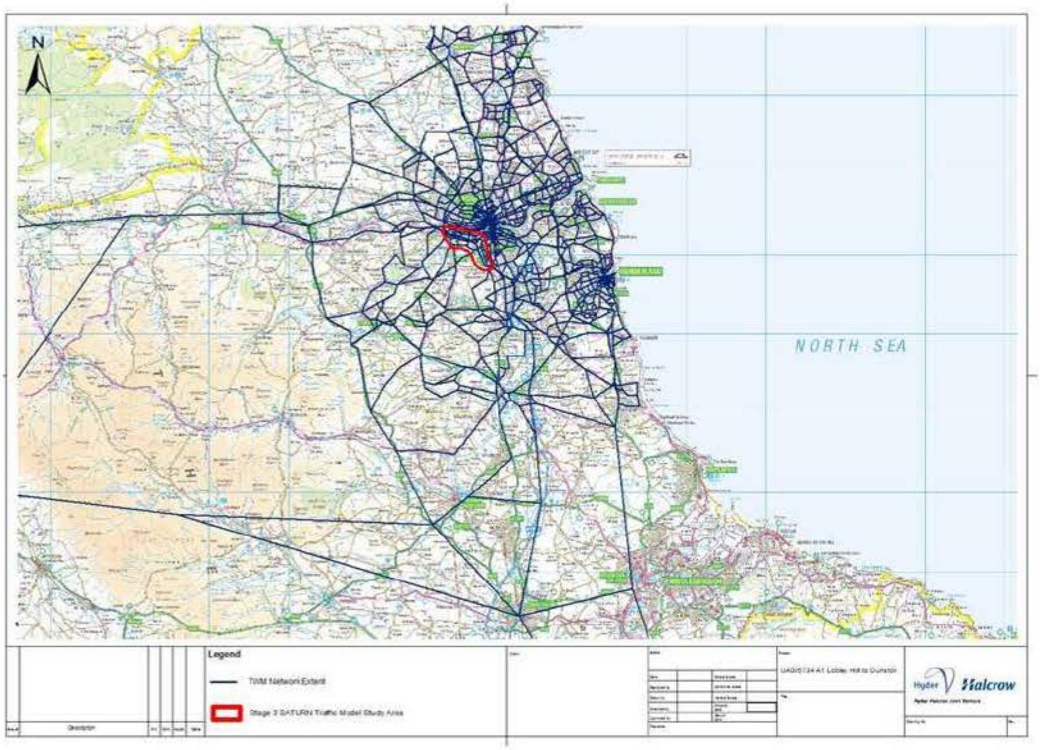


Figure 2-2: TPM3 Modelled Network in Tyne and Wear

Figure 2-3: TPM3 congested links in AM Period, 2005

2.17 A1 Lobley Hill to Dunston SATURN model

2.17.1 In 2013 a SATURN highway assignment model was developed for the appraisal of the A1 Lobley Hill to Dunston Improvement Scheme. The scheme was subsequently extended to encompass the section of highway between Metrocentre and Coalhouse, providing three mainline lanes throughout this section.

2.17.2 The SATURN model covers the A1 mainline between Coalhouse and Derwenthaugh, extending to cover a small area of the local road network either side of the A1 itself. The coverage is shown in Figure 2-4. Demand in the base year model was derived from survey information gathered specifically for the study.

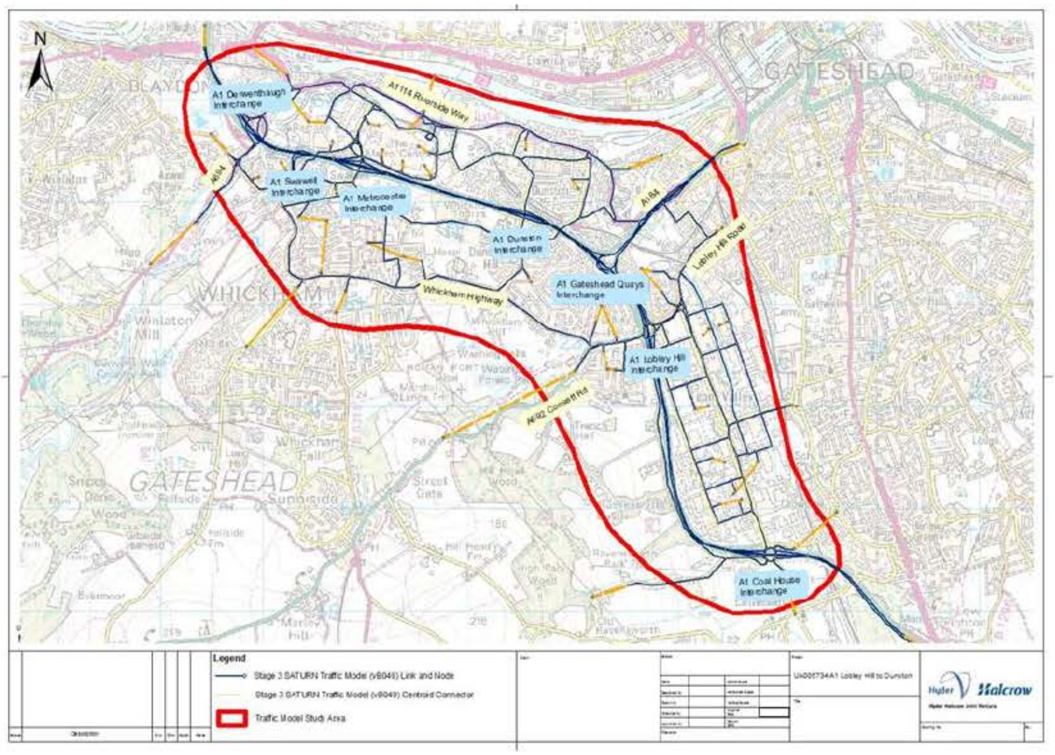


Figure 2-4: Lobley Hill scheme appraisal model (Source Lobley Hill Study, 2013)

2.18 North East SRN Mesoscopic Model (NESMM)

2.18.1 The Highways Agency Spatial Planning team maintains a mesoscopic simulation model that covers much of the Strategic Road Network in the North East. This is a corridor based model, which extends to cover key development areas adjacent to the SRN, such as the Metrocentre and Team Valley.

2.18.2 The model, which uses the Dynameq software package, covers the A1/A1(M) between Scotch Corner to Morpeth, A19 between Peterlee and its termination at the A1 at Seaton Burn, A184, A194(M) and the A690. Originally validated for 2010, it has recently been revalidated to using data collected in November 2012. The coverage of the A1 mesoscopic model in relation to the study corridor is shown in Figure 2-5, with an example of model graphical output in Figure 2-6.

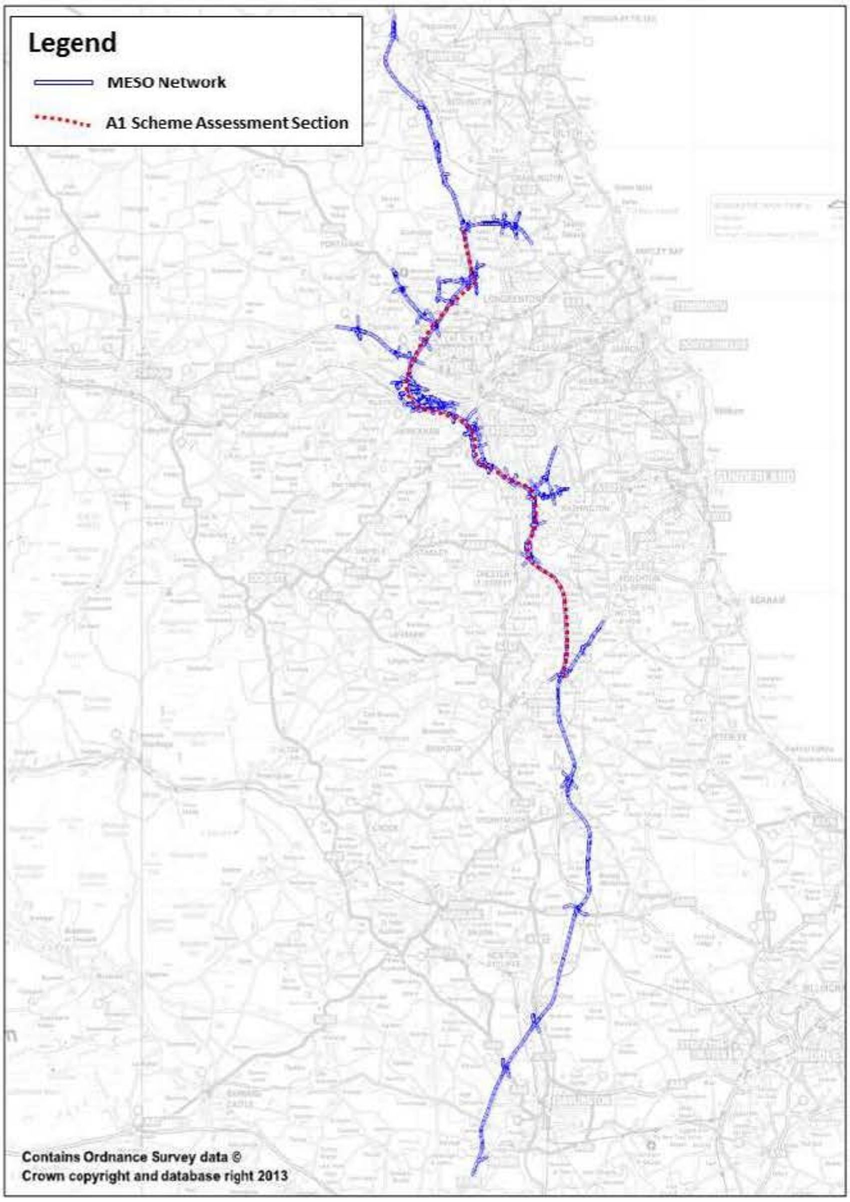


Figure 2-5: A1 Mesoscopic Model Network Coverage (Source: A1 RBS study)

2.18.3 The demand information used to populate the 2012 model was derived from Bluetooth surveys. These capture vehicles with mobile devices as they enter and leave the cordoned network. As such, they do not represent true origins and destinations.

2.18.4 The model was conceived as being a basis for the assessment of the impacts of local authorities Local Development Plans on the SRN. It has been used for the assessment of minor schemes such as the pinch point scheme at Seaton Burn, and a LNMS scheme at Birtley, however it was advised by the HA's Traffic Appraisal, Modelling and Economics team (TAME) that the mesoscopic model would not be suitable for the assessment of scheme options proposed on the stretch between the Scotswood and Kingston Park Road interchange for full economic appraisal, given the likely wider impacts. Therefore, it would be considered suitable for consideration of high level feasibility analysis of alternative options, which would then have to be considered in more detail with different tools.

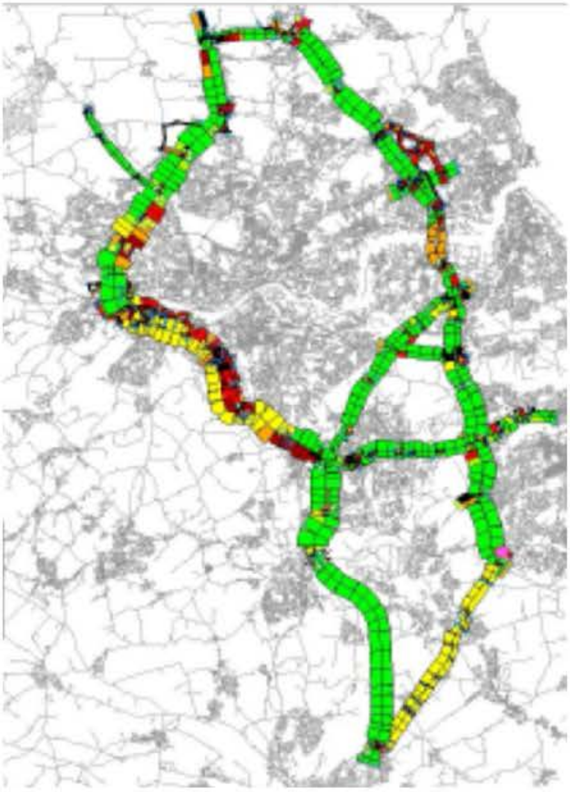


Figure 2-6: Example of NESMM graphical output (Source: Newcastle Infrastructure Study, 2011)

2.19 Summary and Conclusions on Available Transport Models

2.19.1 Table 2.2 presents a summary of different aspects of the models in relation to their potential use in informing the initial feasibility analysis of potential schemes in the A1 NGWB corridor.

2.19.2 The review does not imply any criticism of the models, and the comments here do not imply that they may not be considered fit for the purpose for which they were constructed. Based on the evidence presented in Table 3.1, use of either TPM3 or the A1 Lobley Hill SATURN model for the initial feasibility work would require significant updates to the models. Scheme testing would involve significant model run time, as TPM3 runs would also be required for an extended SATURN model. The amount of time required to update and run these models means that this could not be achieved within the timescale constraints of this feasibility study.

2.19.3 NESMM is a modelling tool which is available for use with coverage of the feasibility study corridor. It is based on recently collected travel demand data, and, as a validated model, can provide reliable estimates of journey time benefits.

	TPM3 (TRIPS/CUBE)	A1 Lobley Hill (SATURN)	Mesoscopic (Dynameq)
Base Year	**2009** - with underlying OD data from 2005	**2013**	**2012**
Coverage	**Entire study area**	**Limited** – to A1 between Blaydon Bridge and Eighton Lodge	**Covers whole corridor** with feeder roads at each junction
OD Data	**Needs updating –** age is outside window of acceptability	**Up to date surveys** but does not include entire corridor	**Up to date surveys** includes entire corridor
Count Data	**Needs updating**	**Insufficient coverage** full set of count data required for extended model	**Recent Count Data used**
Network Coding	Needs to incorporate any post 2009 changes	**Insufficient coverage** – extended network would need to be coded	**No additional data required**
VDM	**Yes**	**No** – in the A1 Lobley Hill to Dunston scheme TPM3 was used for VDM impacts	**No** – could use elasticities
Re-Routing	**Yes**	**Limited** – restricted to very localised rerouting	**Very limited** – network limited to A1 & feeder roads at every junction
Journey Time Benefits	**Yes**	**Yes** – restricted by model coverage	**Yes**
Time Periods	**AM IP PM**	**AM IP PM**	**AM PM**
User Classes / Vehicle Types	**5**	**2**	**2**
Run Times	**Long** (30+ hours)	**Minimal** for assignment **Long** where TPM3 is required	**Minimal** (1 hour)
DMRB Convergence Criteria	**Yes**	**Yes**	**Yes**
DMRB Link Flow Validation	**Yes** – but limited counts on A1 included	**Yes**	**Yes**
DMRB Journey Time Validation	**Yes** – limited consideration of A1 corridor	**Yes**	**Yes**
Availability of Resources	Unknown but likely to be restricted	**No** – extending the model will exceed current time constraints	**Yes** – model runs required only
Suitability for initial HA Scheme Assessment	**No – out of date**	**Yes** – limited to model length	**Yes**
Suitable for full HA Scheme Assessment including economics	**No – out of date**	**Yes** – limited to model length	**Yes** – small scale limited schemes only

Table 2-2: Existing Model Features

2.19.4 NESMM is not without limitations, which are listed below, however, though they are not considered as having a significantly detrimental effect at the feasibility stage.

- Lack of an Interpeak model. TAME has advised that the outputs from AM and PM peak models will suffice for this study and an indicative non-validated Interpeak can be developed based on AM and PM matrices;
- No traffic reassignment facility. The evidence from the A1 Lobley Hill to Dunston modelling is that in there is very little traffic reassignment from a scheme of that scale and that the main beneficiaries of the scheme are A1 users. (The modelling framework approved for that study was predicated on the major impacts being in the area encompassed by the SATURN model);
- Lack of a Variable Demand Modelling (VDM) facility. An elasticity-based approach has previously been adopted to other projects on behalf of the Agency. It is considered that this approach will be investigated for use within this feasibility study.

2.19.5 As a result, a multimodal approach is not proposed at this stage, though the potential for public transport and active mode interventions to contribute part of the response to the issues and challenges is noted, in particular with respect to the recently commenced study regarding the Leamside Line. Likewise the possibility of public transport interventions elsewhere to potentially exacerbate the issues by displacing traffic from the LRN to the SRN demand is a critical concern.

2.19.6 The conclusion is that in the time available, the NESMM is the only practical choice for the appraisal of options for this study. It will provide the information required for initial economic appraisal and production of the Strategic Outline Business Case (SOBC).

2.20 Summary and Conclusions

2.20.1 The corridor has been the subject of a number of studies over recent years, and a number are ongoing. In summary:

- The importance of the A1 NGWB in assisting the economic performance of the corridor, and the region as a whole, is a recurrent theme;
- The key issue identified by previous work is traffic congestion on the A1 NGWB and its impact on journey time reliability along the corridor;
- The degraded operation of the corridor is considered to be a major barrier to future economic development of the area;
- The studies have proposed a number of potential improvements to the highway network, and the Lobley Hill to Dunston Scheme (incorporating extensions to Coalhouse and Metrocentre) has been recently approved and construction commenced in August 2014;
- There are potential public transport improvements in the corridor, such as the reopening of the Leamside Line, which have been considered by previous (and current) studies and which could have some impact on modal shift for certain travel movements in the corridor; and

- There are a number of traffic models available for the modelling and appraisal of potential corridor interventions, and the mesoscopic model would appear to be the optimal choice for initial consideration of highway improvement options.

3 Current Situation

3.1 Introduction

3.1.1 Chapter 3 of this study presents the analysis of the current situation in the study area, in particular:

- Current transport and other policies;
- Current travel demand and levels of service; and
- Current opportunities and constraints.

3.1.2 In doing so, it seeks to consider the current performance of the local road network and rail services. The analysis is based on:

- Data collected as part of the RBS process, together with analysis of other available study work; and
- Information gathered through informal engagement with stakeholders.

3.2 Current Transport and Other Policies

3.2.1 The following policies and documents provide the policy context for this study.

3.3 National Strategies and Policies

National Infrastructure Plan

3.3.1 The National Infrastructure Plan, cited previously, sets the following objective for the road network:

> The government is committed to developing and maintaining a road network that will facilitate people's day-to-day activities, drive economic growth and meet the needs of road-users now and in the future. In particular, it is focused on:
>
> - Addressing road quality, increasing capacity and tackling congestion

Investing in Growth

3.3.2 Investing in Growth was published by the HM Treasury in June 2013. Reporting the outputs of the mid-term review of Government spending, it set out a commitment to identifying and funding solutions to tackle some of the most notorious and longstanding road hotspots in the country. Amongst the feasibility studies announced was this study, looking at the A1 Gateshead Newcastle Western Bypass.

Draft National Policy Statement for the National Road and Rail Networks

3.3.3 The Consultation on a Draft National Policy Statement for the National Road and Rail Networks was published by the Department for Transport in December 2013. This again cited transport as "an engine for growth". The Government's vision and strategic objectives for the national networks are as follows:

> The Government will deliver national networks that meet the country's long term needs, supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system. This means:
>
> - Networks with the capacity and connectivity to support national and local economic activity and facilitate growth and create jobs;
> - Networks which support and improve journey quality, reliability and safety;
> - Networks which support the delivery of environmental goals and the move to a low carbon economy; and
> - Networks which join up our communities and link effectively to each other.

3.4 Key Regional Policies and Plans

North East Strategic Economic Plan

3.4.1 The North East Strategic Economic Plan (SEP) was published by the North East Local Enterprise Partnership (LEP) on 9th April 2014. The title sets out the driving focus of the plan "More and Better Jobs". It notes that growth has returned to the North East; indeed Gross Value Added (GVA) growth has exceeded that of any other local enterprise partnership area over the last three years.

3.4.2 The vision is that:

By 2024, our economy will provide over one million jobs.

3.4.3 This represents 100,000 new jobs and an increase of 11% in employment. The SEP cites the 2013 North East Independent Economic Review, undertaken by Lord Adonis. This reached the following conclusions:

- The North East has an absolute shortage of jobs;
- Productivity is a problem;
- Skill levels are not good enough; and
- Connectivity, locally, nationally and internationally needs to be improved to help open and strengthen the North East's economy.

3.4.4 The plan is more specific about transport than the LEP's 2011 draft Transport Strategy, and notes that there are a number of important development sites where new development is constrained by transport issues. It welcomes the Government's announcement of the Lobley Hill Improvement Scheme which "will address one of the worst single congestion points on the A1 Western by-pass, itself one of the most congested pieces of dual carriageway in the country".

3.4.5 The following are cited as key priorities for action with Government:

- Ongoing investment in a reliable strategic road network with reduced congestion. Key priorities are known bottlenecks on the A1;
- Deliver a programme of improvements on the A1 including the Lobley Hill scheme, the renewal of Allerdene Bridge, and the A1/A19 Seaton Burn Interchange; and

- Secure a rolling programme for additional capacity along the whole length of the A1 Western Bypass, with the objective of dual three lanes along all of its length, excluding Blaydon Bridge[2].

3.5 Key Local Plans and Policies

Local Plans

3.5.1 Gateshead Borough and Newcastle City Councils are currently in the final stages of the Local Plan preparation and approval process. The plan, entitled *Planning for the Future Core Strategy and Urban Core Plan for Gateshead and Newcastle upon Tyne* The One Core Strategy, was submitted in February 2014 and the EIP took place in summer 2014.

3.5.2 Local Plans for Northumberland and County Durham are not at such an advanced stage; the former is at Consultation Draft stage, the latter at Pre-Submission Draft. The content of these plans, and their implications for the SRN are considered further in Chapter 4.

Local Transport Plan

3.5.3 The current local transport plan for Tyne and Wear was produced in 2011. The third such plan, it covers a period of ten years from 2011 to 2021. It was produced by the Tyne and Wear Integrated Transport Authority on behalf of the five Tyne and Wear local authorities; (Gateshead, Newcastle, North Tyneside, Sunderland and South Tyneside) plus the Tyne and Wear Passenger Transport Executive (NEXUS).

3.5.4 The plan is complementary to the North Eastern LEP transport strategy, and was subject to public consultation. It set out the strategy for transport in the county over the ten years, and is accompanied by a more detailed strategy for delivery over the period.

3.6 Current Travel Demand and Levels of Service

Existing Road Infrastructure

3.6.1 The A1 NGWB generally comprises of dual two lane all purpose (D2AP) carriageway, with some dual three lane sections between adjacent junctions, and a climbing lane at Bowes Incline southbound.

3.6.2 The Gateshead and Newcastle sections of the route differ in standard. The section south of the river, between J65 Birtley and J73 Derwenthaugh, was originally constructed as the A613, a local bypass for Gateshead, opening in 1976. It was built to various non-standard cross-sections along its length.

3.6.3 The Gateshead Western Bypass was designated as part of the A1 upon the opening of the Newcastle Western Bypass between J73 and J80, and Blaydon Bridge in 1990, the designation moving from what is now the A19/ A194(M) corridor via the Tyne Tunnel.

3.6.4 The Newcastle Western Bypass was built to full DMRB standard, with consistent cross sections throughout, though, as with the Gateshead bypass, it has a number of closely spaced junctions which cause weaving issues and turbulence in traffic flow. In total, there

[2] Although the document refers to excluding the bridge over river and ECML from three lane sections, the aim in the paragraph above refers to Allerdene Bridge, which is the crossing over the ECML. If/when replaced, this would offer an opportunity to deliver three lanes.

are 16 junctions, including J80 Seaton Burn and J65 Birtley, within the 25km extent of the bypass.

3.6.5 The route has a posted speed limit of 50 mph between Eighton Lodge and Derwenthaugh, with the National Speed Limit applying on the remainder of the route. The introduction of the 50mph speed limit facilitated a scheme to provide three narrow lanes through the Dunston Road junction northbound. The route is lit throughout.

3.6.6 The study section between J62 Carrville and J65 at Birtley is dual two-lane motorway (D2M) between Junction 62 and Junction 63, and then dual three-lane motorway between Junction 63 and the bifurcation with the A194(M) at Birtley. The section J62 to J63, part of the Durham Motorway, was opened in 1969. The remaining section, the Birtley Bypass, was opened in 1970 along with the A194(M).

3.6.7 A ban on slow moving vehicles on a section of the A1 NGWB was introduced between Seaton Burn and Birtley in 1999. This apples as follows:

> Any vehicle which cannot attain a speed of 30mph on the level in free-flowing conditions will be prohibited from entering the A1 Gateshead and Newcastle Western By-Passes. This will include the sections between Lobley Hill, the Tyne Crossing at Blaydon and North Brunton. The ban, when introduced, will be in force between the hours of 7am to 9am and 4pm to 6pm from Monday to Friday.

This was in response to the “considerable peak hour congestion that occurs on the A1 in Tyneside” (Parliamentary Written Answer, Hansard 19/01/99).

3.7 Performance Indicators

3.7.1 In this section, the demands on, and level of service and capacity offered by the A1 between J62 Carrville and J80 Seaton Burn are investigated. This utilises data provided by the Regional Intelligence Unit (RIU), and is the data that fed into the Highways Agency’s internal Regional Network (RBA) 2012 report. It was also used to inform the A1 West of Newcastle RBS. It is noted that the RIU link sections used in some cases encompass an intermediate junction. For example a single RIU link covers J75-J77.

3.7.2 Where possible, this data is contrasted against regional or national benchmarks, to better illustrate the operational circumstances of the A1 NGWB. This was not possible in the case of air quality, pedestrian incidents, incidents involving a lane closure and breakdowns.

3.8 Traffic Flows – Annual Average Daily Traffic

3.8.1 The data visualised in Figures 3.1 and 3.2 is annualised from data covering the period October 2009 to September 2011. The most heavily trafficked sections are between J69 Askew Road and J68 in both directions, closely followed by J65 Eighton Lodge to J66 Lobley Hill. All links exceed the Northern of England (NW, NE, Y&H) benchmark for Dual Links. It is noted that the benchmark includes 3-lane links, and that the A1 NGWB is largely comprised of 2-lane links. This illustrates the high level of demand experienced on certain sections of the network.

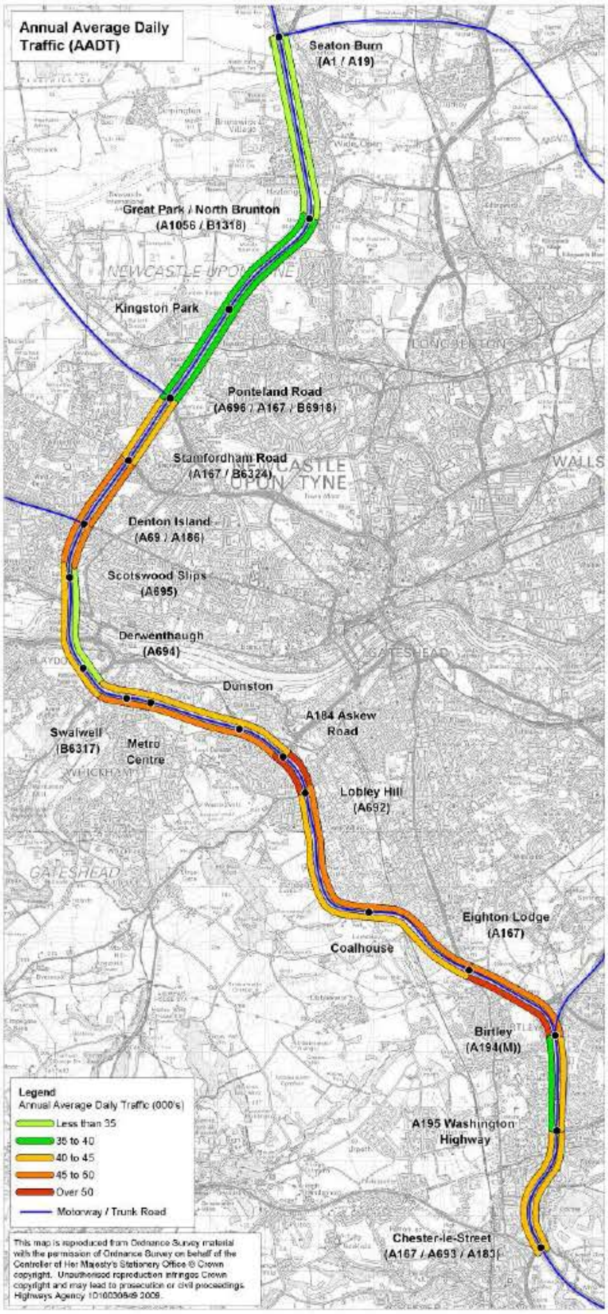


Figure 3-1 Annual Average Daily Traffic

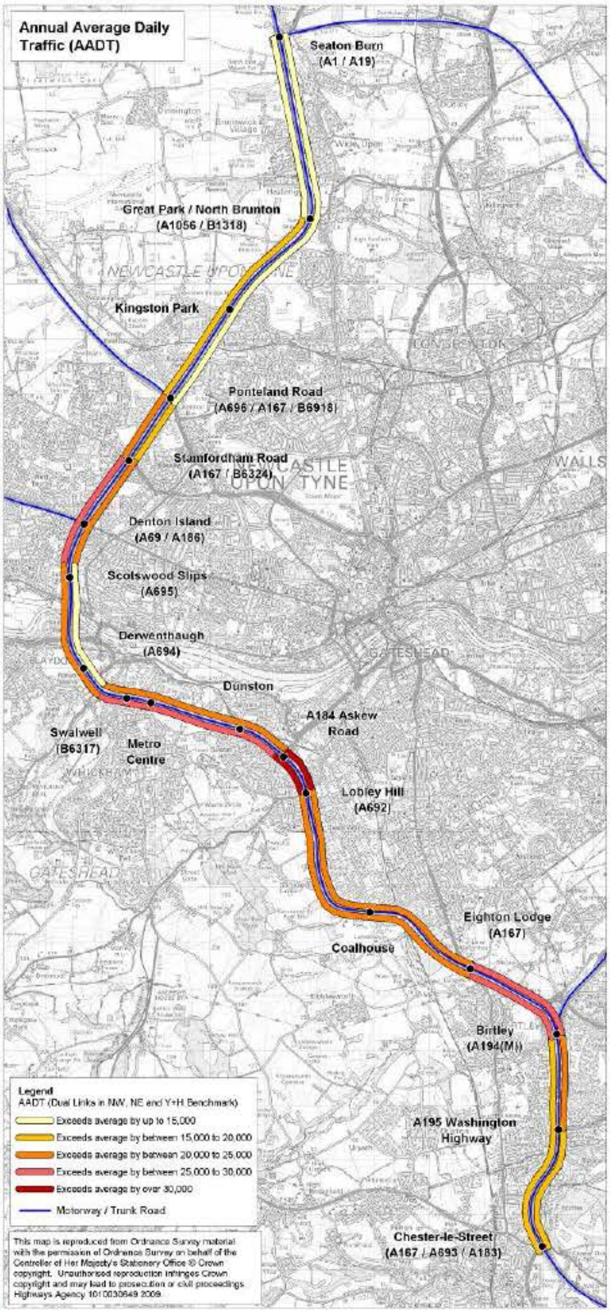


Figure 3-2 ...compared to North of England benchmark

3.9 Average Monthly Vehicle Hour Delay

3.9.1 The data shown in Figure 3.3 is annualised from data covering the period October 2009 to September 2011. The Gateshead bypass between J65 and J73 experiences the worst overall delay, particularly in the southbound direction, where the average monthly vehicle hour delay is over 4000 hours per km. The northbound direction exceeds this threshold between J66 Eighton Lodge and J69 Askew Road. For the Birtley to Eighton Lodge link, which shows lower levels of delay, the bottleneck occurs at the merge from the A1231 in the AM peak. It is noted that, due to relative free flow outside the AM peak period, the monthly metrics do not clearly capture this.

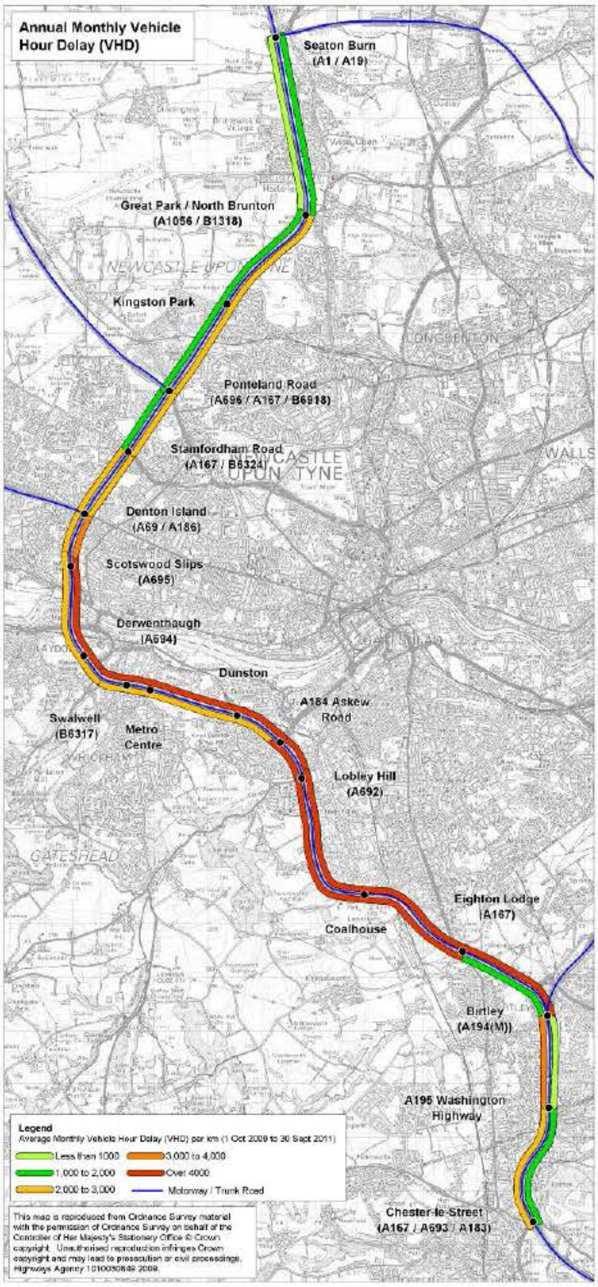


Figure 3-3 Average Monthly Vehicle Hour Delay per km

3.10 Percentage of Reduced Capacity Hours

3.10.1 Reduced Capacity Hours are defined as traffic conditions where vehicles are travelling at a speed below the speed at link capacity. Under these traffic conditions, link throughput is reduced due to flow breakdown, with queuing and stop-start conditions resulting. It is seen that the southbound carriageway is much more affected than the northbound, with particular issues on the Gateshead section approaching J68 Lobley Hill, and again approaching J65 Birtley.

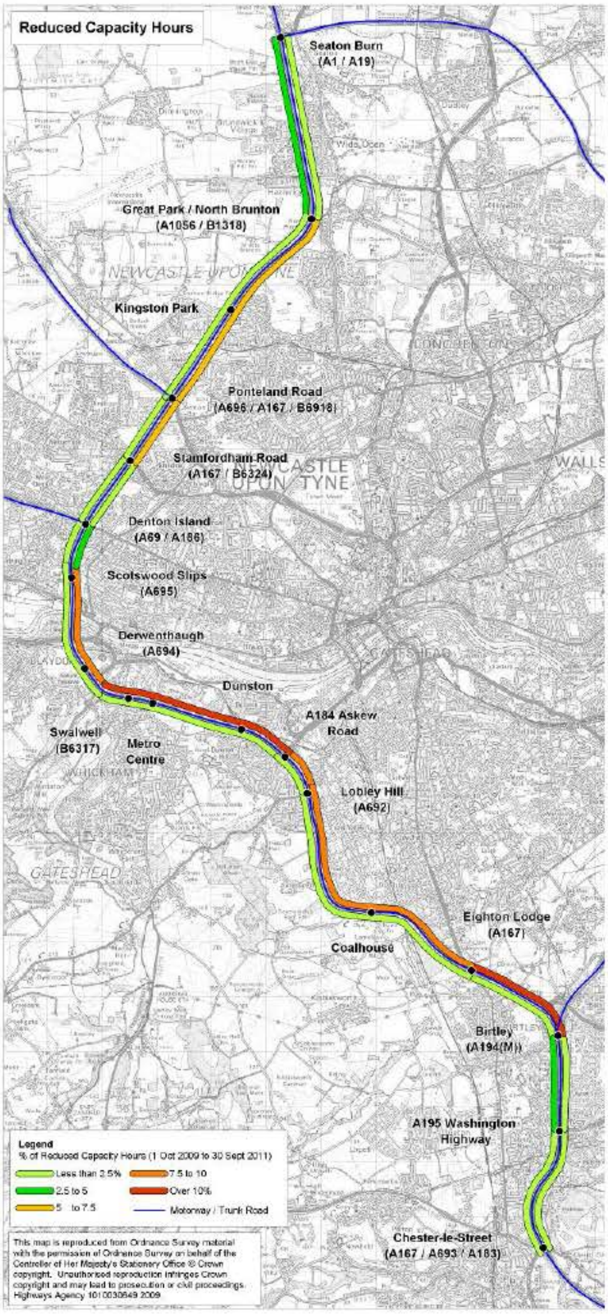


Figure 3-4 % of Reduced Capacity Hours

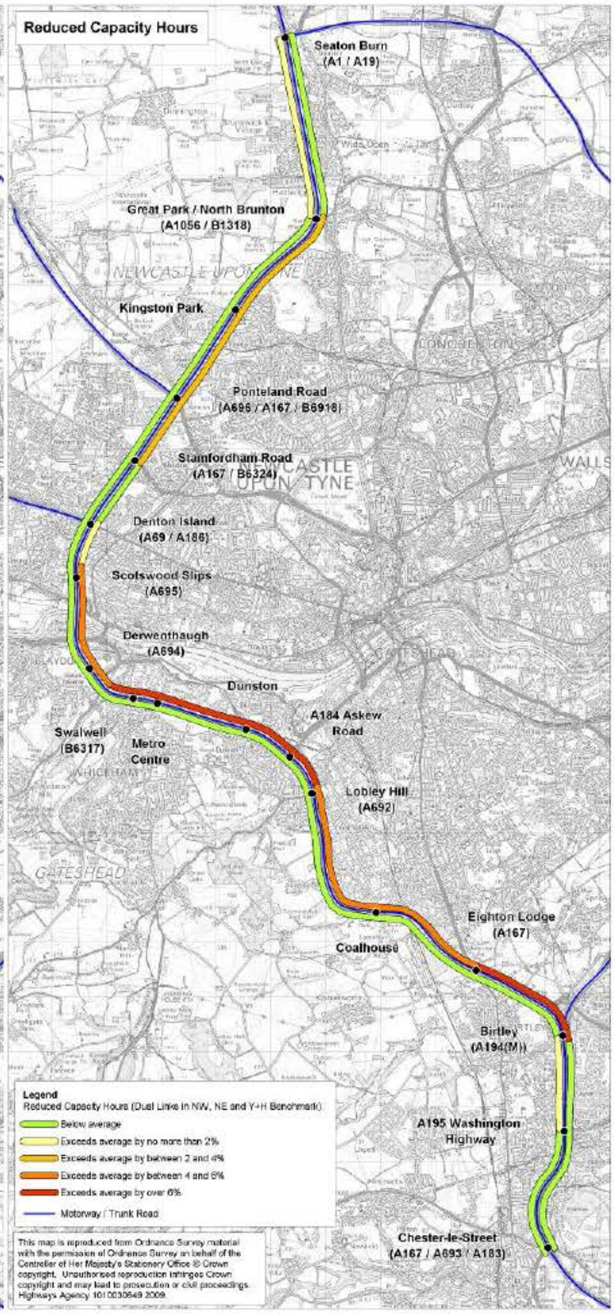


Figure 3-5...compared to North of England benchmark

3.11 On-time Reliability Measure

3.11.1 ‘On-Time’ refers to journey times for a link that are equal to, or less than the defined free flow speed of a link. The reliability measure is shown as a percentage of Link Transit Times (LTT) that are on-time. It illustrates where congestion and flow breakdown causes journey time unreliability. This shows that only the section between Eighton Lodge and Birtley, in both directions, and between North Brunton and Seaton Burn northbound exhibit an on-time reliability of more than 70%. The southbound stretch between Derwenthaugh and Askew Road, and northbound between Lobley Hill and Askew Road have less than 50% on-time reliability. The benchmarking shows that, compared to North of England benchmark data, the A1 NGWB performs poorly, with the Lobley Hill to Swalwell stretch worst performing and having a reliability over 25% lower than the national benchmark.

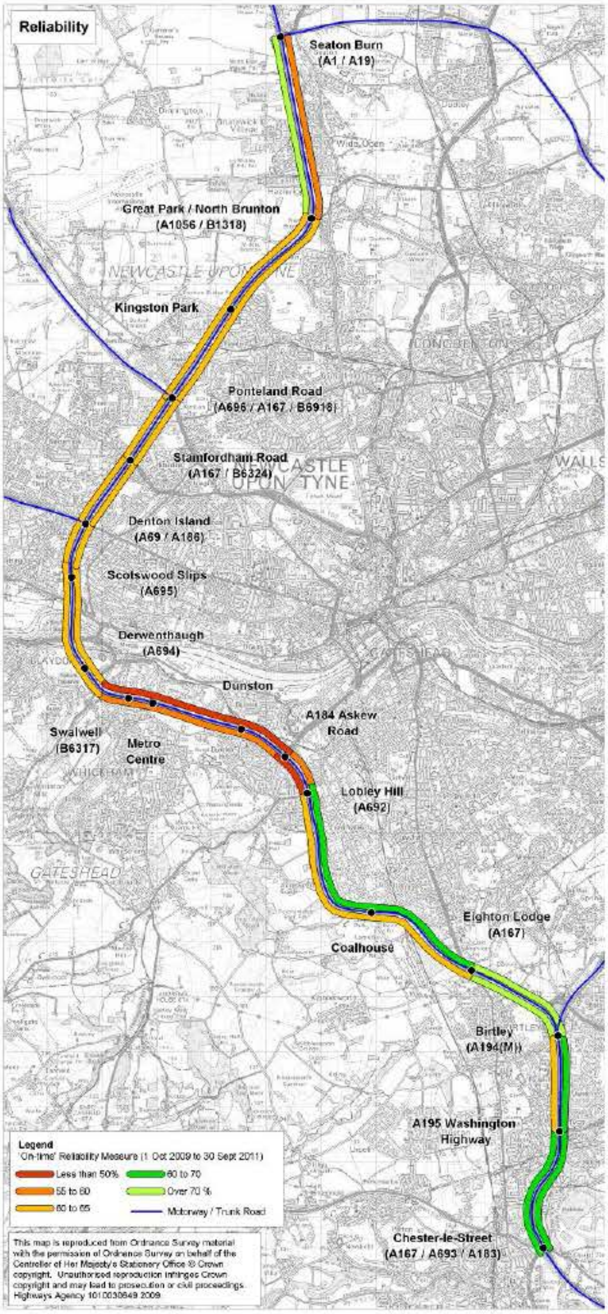


Figure 3-6 On-time Reliability

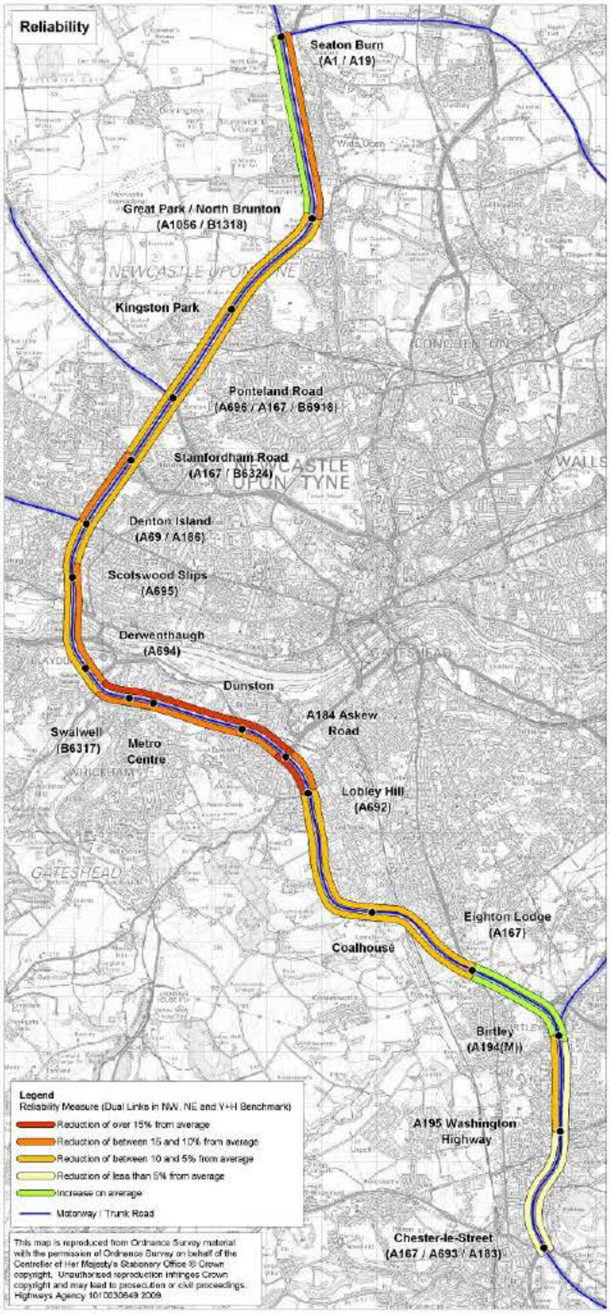


Figure 3-7...compared to North of England benchmark

3.12 Killed or Serious Injury (KSI) per km

3.12.1 The northbound link between Birtley and Eighton Lodge has the worst record on the KSI indicator, with more than 3 people killed or seriously injured per km in the years 2008 - 2010. The remainder of the A1 NGWB as far north as Lobley Hill falls in the 2-3 category, in each direction. Both carriageways have over 1 more casualty than the northern benchmark in this section. The section between Askew Road and Lobley Hill actually has lower than benchmark KSI casualties, though this is probably due in part to the low speeds experienced through this section. Further north, the only section below benchmark is that between Derwenthaugh and Denton in both directions. The Denton Island to Stamfordham Road section northbound shows in increase of over 1 KSI on average as compared to the northern benchmark.

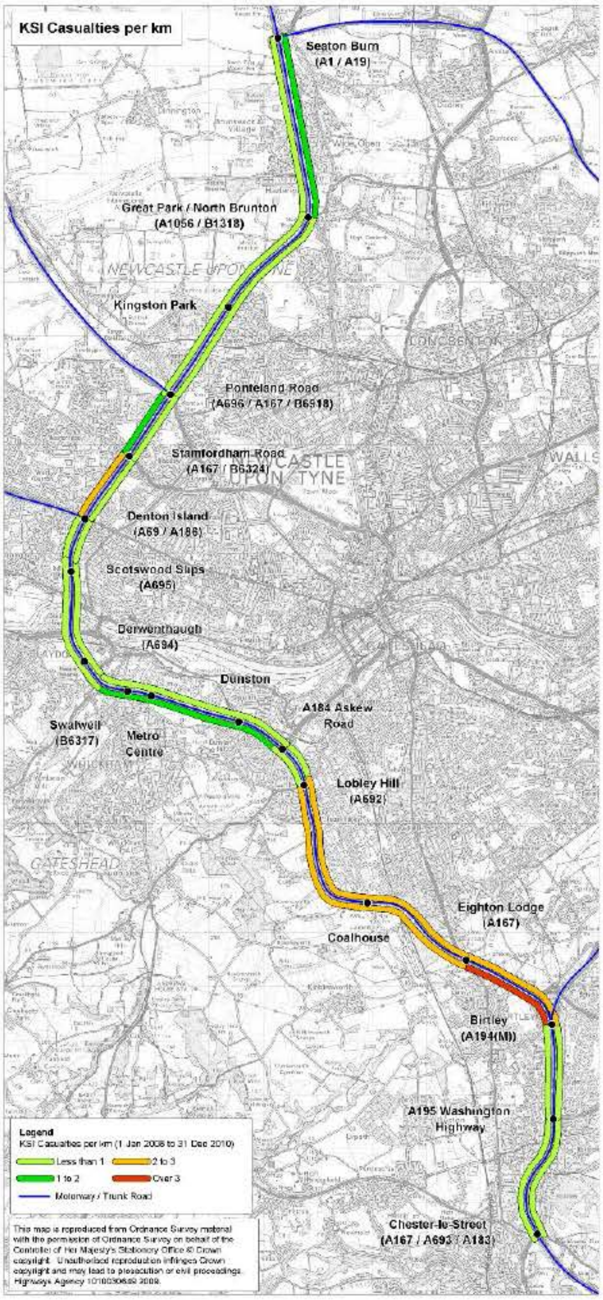


Figure 3-8 KSI per km, 2008 – 2010

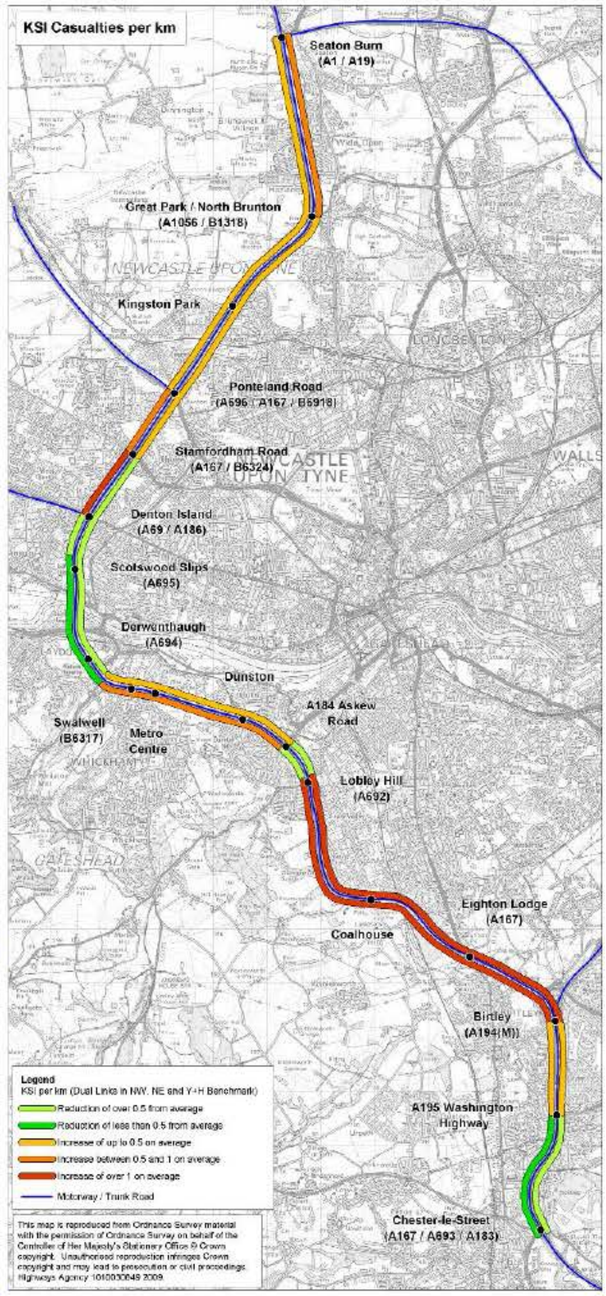


Figure 3-9 ...compared to North of England benchmark

3.13 Casualties per Billion Vehicle Miles

3.13.1 This metric includes all injuries and takes into account the flow on each link. A similar pattern is seen to the KSI metric. The weaving section between Eighton Lodge and Birtley is seen to perform poorly, as is that between Denton Island and Stamfordham Road. The former has over 1200 casualties per billion miles for this measure, the latter between 900 – 1200. Benchmarked against the north of England dual links, these links have over 400 casualties per billion miles more. The remainder of the Gateshead Bypass (J65-J73) also performs worse than the benchmark, with the exception of the southbound carriageway between J73 Derwenthaugh and J69 Askew Road.

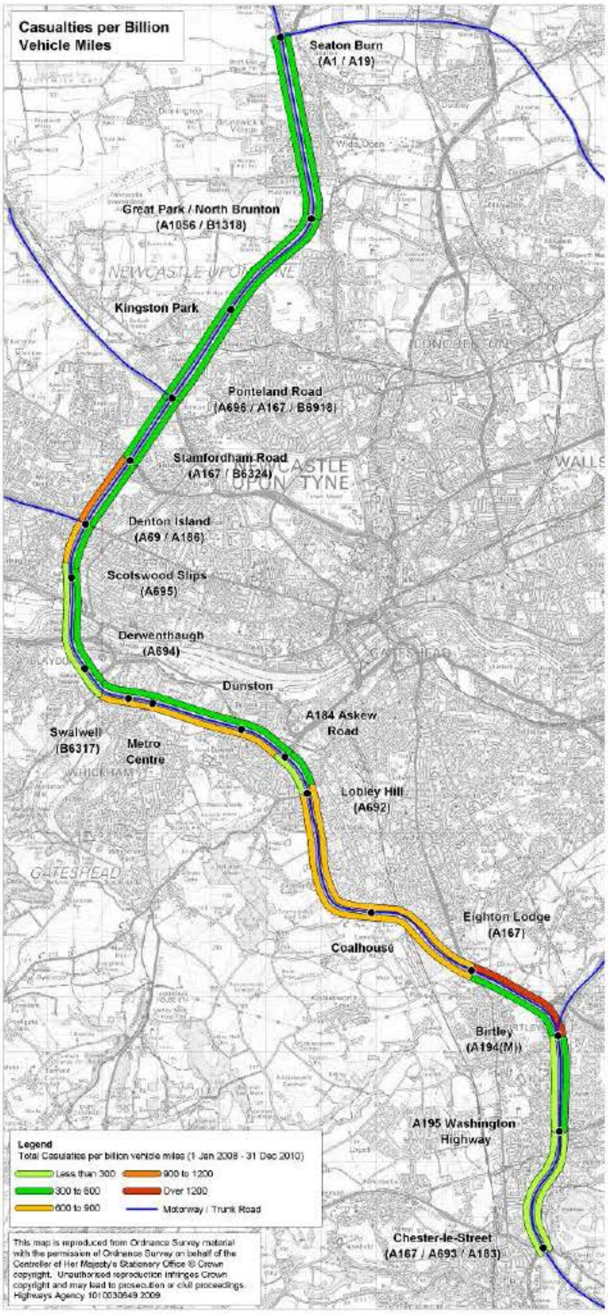


Figure 3-10 Casualties per Billion Vehicle Miles

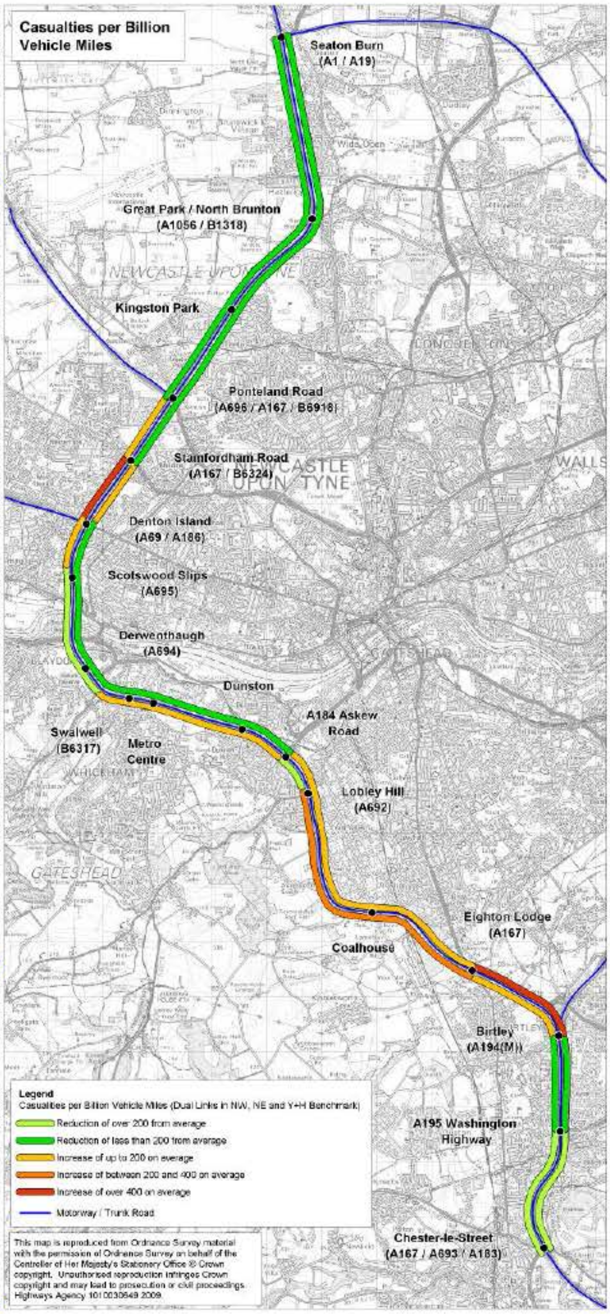
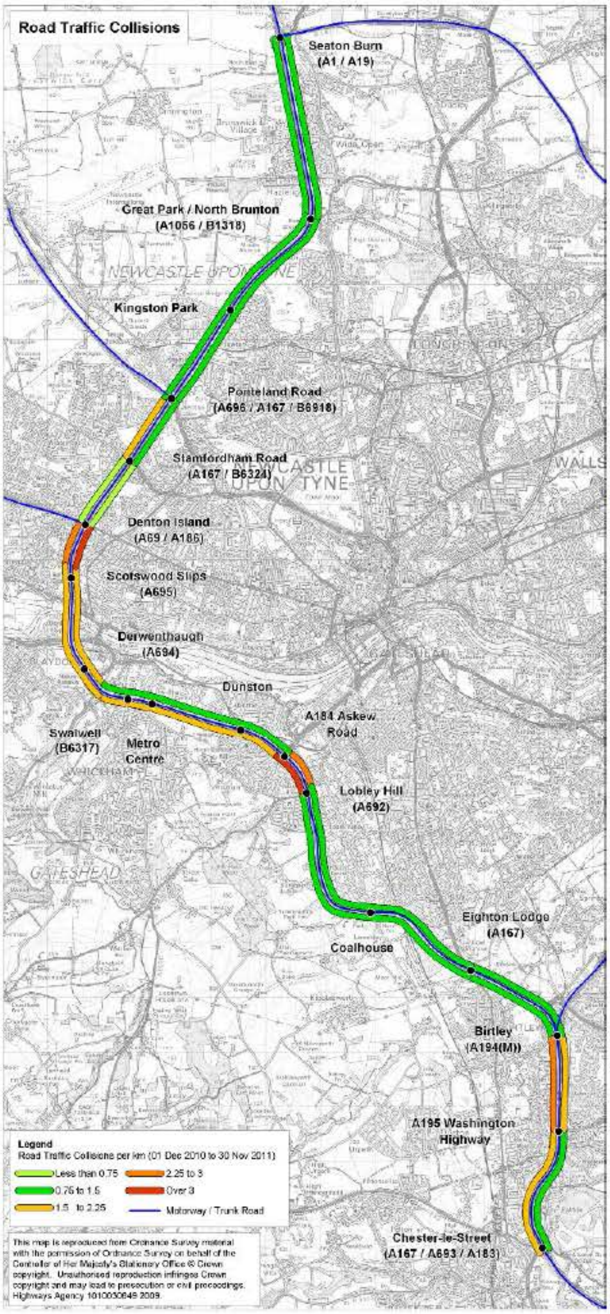


Figure 3-11 …compared to North of England benchmark

3.14 Road Traffic Collisions per kilometre

3.14.1 Including all collisions, this metric highlights the weaving sections between Askew Road and Lobley Hill, and between Scotswood Slips and Denton Island. Notably, these sections were not highlighted in the previous accident data. It is likely that the collisions which occur in these weaving sections are at lower speed, due in part to congestion, and therefore more likely to be damage only collisions, which nevertheless can cause significant disruption and delays. The same stretches of the network are highlighted by the benchmarking, with almost the whole A1 NGWB exceeding the benchmark. The stretch between Lobley Hill and Denton Island performs poorly in general. On the A1(M) section of the study corridor, the section northbound between Junction 64 and Junction 65 has recorded the worst performance.



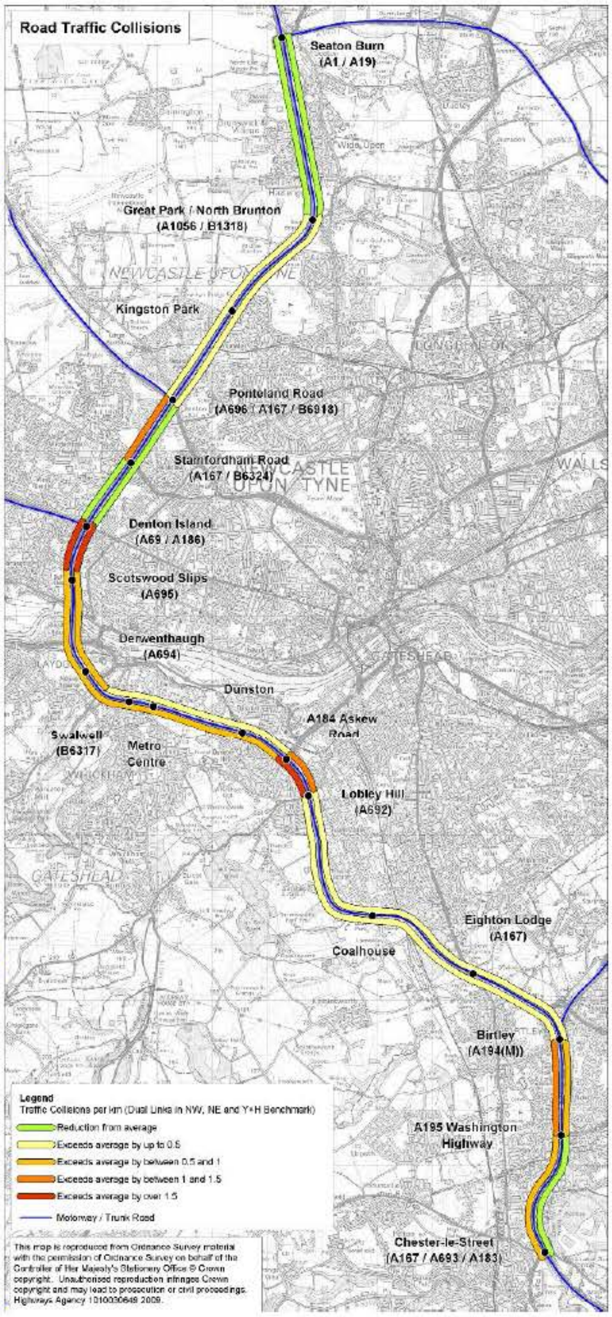


Figure 3-12 Road Traffic Collisions per km

Figure 3-13...compared to North of England benchmark

3.15 Air Quality

3.15.1 The data for Air Quality shows where Nitrogen Dioxide (NO2) emissions are predicted to be higher that the limit set by the European Union (EU), based on the annual limit of 40 µg/m3. The values shown are based on the highest value either on the road link itself, or adjacent to it. This suggests that there are significant stretches of the A1 NGWB where emissions are in excess of these limits.

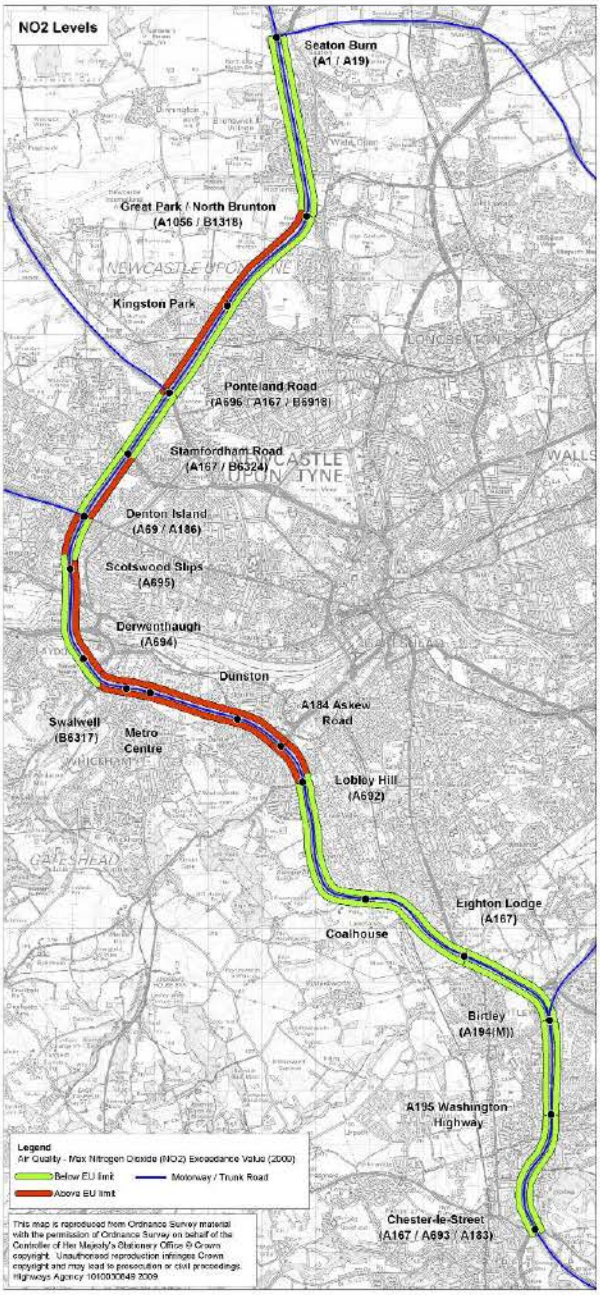


Figure 3-14 Air Quality

3.16 Pedestrian Incidents

3.16.1 The A1 NGWB does not have footpaths and, therefore, the number of pedestrian incidents is of particular concern. They are concentrated on the southbound carriageway of the Gateshead section, between J73 Derwenthaugh and J66 Eighton Lodge in particular. The fact that the southbound section between Derwenthaugh and Askew Road saw the highest number of pedestrian incidents, whereas the adjacent northbound carriageway has zero, suggests that the incidents are not occurring due to pedestrians attempting to cross from one side of the road to the other. These incidents are probably due to people getting out of broken down vehicles, or vehicles involved in incidents and then being hit by other vehicles.

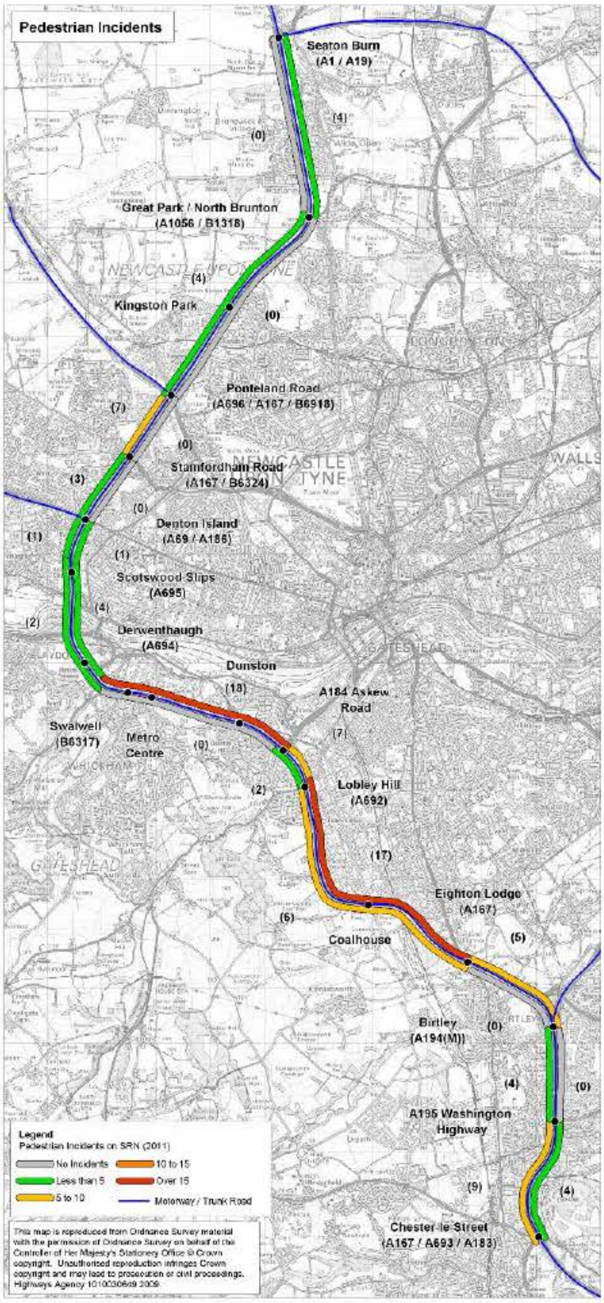


Figure 3-15 Pedestrian Incidents

3.17 Incidents involving a Lane Closure

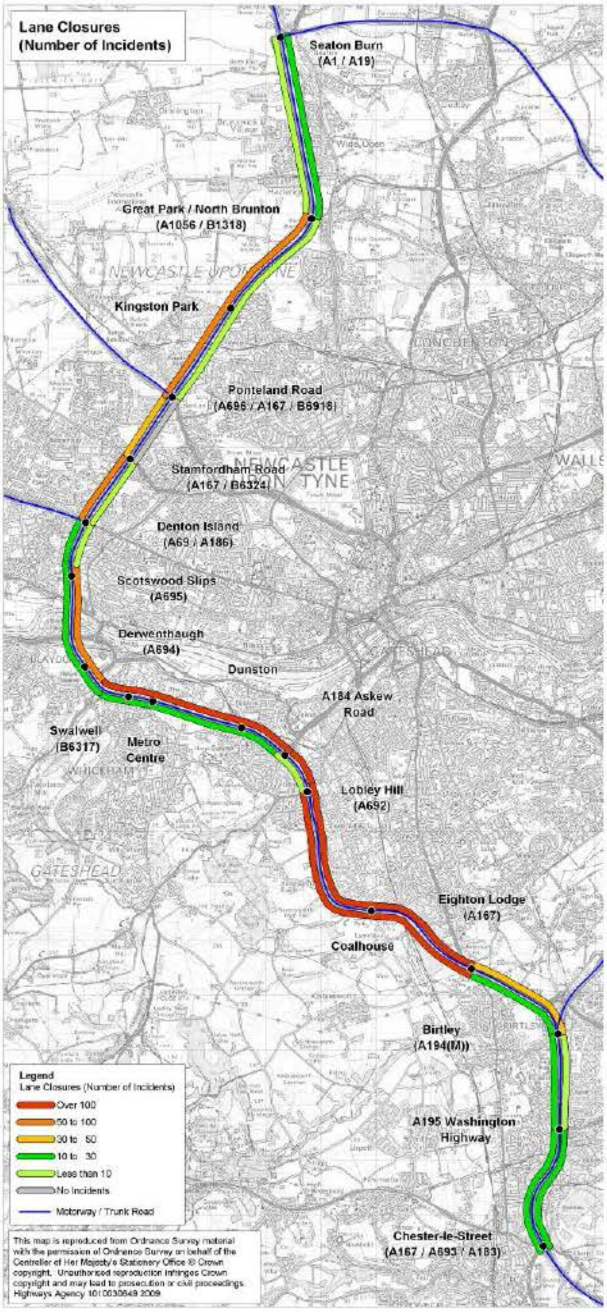


Figure 3-16 Incidents involving a lane closure

3.18 Breakdowns per km

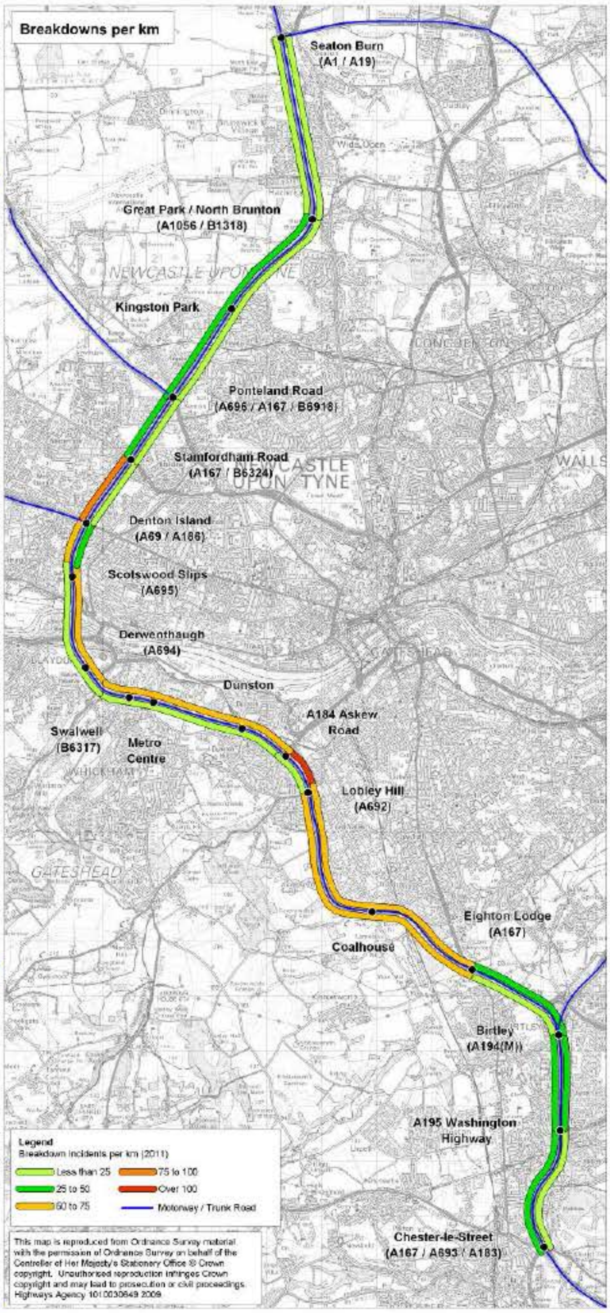


Figure 3-17 Vehicle breakdowns per km

3.18.1 The data for lane closures closely resembles the average hour monthly delay plot, as does that for vehicle breakdowns per km. Given the traffic volumes and the tight cross section of the carriageway, responding to incidents and vehicle breakdowns is difficult. Indeed, the Agency has a Special Retriever deployed in the corridor to aid in vehicle recovery. This is due to, and indicative of, the particular operational issues given the demands on, and configuration of, the corridor.

3.19 Strategic versus local use

3.19.1 The Bluetooth and Automatic Number Plate Recognition surveys undertaken to provide demand information for the mesoscopic model reveal that there is very little through traffic using the A1 NGWB. During the survey periods of 0600-1000 and 1500-1900, the largest proportion of traffic observed passing through Seaton Burn, and subsequently passing Birtley was 4%, in the hour 0600-0700. From Birtley to Seaton Burn, the largest proportion was 2%.This suggests that the use of the A1 NGWB for strategic through trips is limited.

3.20 HGV Proportions

3.20.1 Analysis of TRADS data from October 2012 suggests that the percentage of HGVs in the total traffic volume is in the region of 6-10%. It is noted that this increases to 12% on the A1(M) immediately to the south of the study area.

3.20.2 The national percentage of HGV kilometres on Rural ' 'A' Trunk roads is 9%, and Urban 'A' Trunk roads is 6%. Therefore the A1 NGWB has a proportion of HGVs in line with the national average. The proportion on the motorway section also mirrors the national percentage at 11%, (*Road traffic (vehicle kilometres) by vehicle type and road class in Great Britain 2012)*.

3.21 Rail

Services

3.21.1 The East Coast Mainline runs parallel to the A1 with stations at Durham, Chester-le-Street and Newcastle. Local services are however relatively poor. Whilst there are 4 trains per hour between Durham and Newcastle, three of them depart within 15 minutes of each other due to timetabling issues. Chester-Le-Street is only served by 1 train per hour.

3.21.2 The Tyne Valley Line passes along a section of the corridor. It serves stations at Dunston, Metrocentre and Blaydon as it runs from Newcastle to Hexham and Carlisle. Dunston and Blaydon received much improved rail services from December 2013. Dunston benefits from 31 trains a day Monday – Friday (up from 3), and 21 trains on a Sunday. Blaydon is now served by 20 services per day Monday – Friday (up from 4) and 12 trains on a Sunday. Given the crowding on the Tyne Valley line identified from recent surveys, the capability of these improved services to offer relief during the peak hour would appear limited.

Train Crowding

3.21.3 Information on current rail service crowding has been extracted from 'The Access to the Tyne & Wear City Region Study' which provides information with regards to rail capacity. A survey was conducted by NEXUS in 2009 of crowding levels during AM peak arrivals and PM peak departures from Newcastle Central station. This information is shown in Tables 3.1 and 3.2.

3.21.4 The report found that rail services had some capacity available although crowding is evident on particular services into Newcastle across all time periods, with a greater tendency for trains to be overcrowded in the AM peak. Peak hour Intercity rail services are generally only crowded for sections of their journeys within the North East towards Newcastle in the AM peak, and from Newcastle in the PM peak.

Line	First Station	Time	% Full on Entry
Tyne Valley	Metro centre	08:15	151%
ECML	Durham	08:01	144%
ECML	Durham	07:42	138%
Tyne Valley	Wylam	07:45	120%
ECML	Durham	08:36	118%
ECML	Durham	08:16	100%
ECML	Durham	09:13	100%
Tyne Valley	Metro Centre	08:44	96%
ECML	Morpeth	07:23	93%
ECML	Morpeth	07:50	93%
ECML	Morpeth	08:05	79%
ECML	Durham	07:28	75%
ECML	Durham	08:26	75%
ECML	Durham	09:39	75%
Durham Coast	Heworth	08:43	74%
ECML	Morpeth	08:32	73%
Durham Coast	Heworth	08:07	54%
Durham Coast	Heworth	09:43	54%
ECML	Durham	09:22	50%

Table 3-1: Train Crowding, Newcastle AM Peak Arrivals 2009

Line	Station	Time	% Full on Exit
Durham Coast	Heworth	17:37	119%
ECML	Durham	17:34	114%
Tyne Valley	MetroCentre	18:03	101%
ECML	Morpeth	17:39	100%
Tyne Valley	MetroCentre	16:32	93%
Tyne Valley	MetroCentre	17:21	78%
EMCL	Durham	17:55	75%
Tyne Valley	MetroCentre	17:35	70%
Durham Coast	Heworth	16:38	66%
ECML	Durham	16:48	64%
Durham Coast	Heworth	15:39	57%
Tyne Valley	MetroCentre	15:33	56%
ECML	Chester Le Street	18:31	52%
ECML	Durham	17:09	50%
ECML	Durham	18:23	50%

Table 3-2: Train Crowding, Newcastle PM Peak Departures 2009

Track Capacity

3.21.5 In terms of available track capacity, as reported in the East Coast Route Utilisation Strategy (RUS) and noted previously in Section 2.12, there are capacity constraint issues between Northallerton and Newcastle. Services are flighted, so as to maximise path capacity. This results in poor service spacing for local journeys.

3.21.6 The RUS notes that any increase in freight or passenger services, or optimisation of passenger services to provide a more even spread is likely to exceed capacity.

3.22 Local Road Network

3.22.1 The Local Road Network (LRN), in Newcastle and Gateshead, as with the A1 NGWB, suffers notable peak time congestion. There are particular locations where, on occasion, capacity constraints on the local network impact on the operation of the SRN with queuing back onto the mainline. Locations where this has been observed are:

- A692 Lobley Hill Roundabout; and
- Maingate Roundabout, Team Valley.

3.22.2 This is expected to occur at more locations as further development is implemented and traffic levels grow. Team Valley and, in particular Coalhouse, Lobley Hill and Maingate Roundabouts are of particular concern, with issues in these locations having the potential to reduce markedly any benefits that will accrue from Metrocentre to Lobley Hill scheme.

3.22.3 The major issues are with radial movements to and from the regional centre. Major queues occur in the peaks on many of the LRN approaches to the A1 nodes where these radial movements intersect the SRN.

3.22.4 The A1 NGWB effectively forms part of a ring road around the regional centre, which is continued by the A1056 and the A194(M). There is no road in the LRN hierarchy below the A1 NGWB that performs the same function for orbital movements. The A1056 in particular is under particular pressure, and at times this can affect the operation of Junction 79 Great Park.

3.23 Stakeholder Consultation

3.23.1 The Highways Agency has worked closely with stakeholders in the local area over recent years, in particular with regard to Local Planning Authorities Local Development Framework proposals and their emerging Local Plans.

3.23.2 The Agency has responded to policy proposals and worked with Local Planning Authorities to assist in the identification of realistic and deliverable land use aspirations. It has worked with Local Planning and Highways Authorities to identify the trip making potential of these developments, the impacts at the strategic road network, existing network constraints and issues and the nature of the potential interventions that may be required in order to ensure that the development necessary for economic growth is not prejudiced by, or results in network capacity issues.

3.23.3 This work has resulted in a common consensus as to the issues affecting the area, and on the type and scale of interventions that would be required to alleviate these. In doing so, there was due regard to balancing the imperative to support and foster economic development while taking account of other factors such as environmental impacts, cost and deliverability.

3.23.4 A part of the RBS, a workshop was undertaken with key stakeholders. The list of attendees is shown in Table 3-3 representing both the public and private sector. The key message from the workshop was that the local stakeholders felt that the issues pertaining to the operation of the A1 NGWB were clear and agreed, and that as a result there is a perceived need to deliver additional road capacity within the corridor. The ultimate aim stated was the achievement of a dual three-lane A1 NGWB.

Stakeholder Group
Department for Transport
Newcastle City Council
Newcastle City Council UTMC
Gateshead Council
North East Chamber of Commerce
Highways Agency – Network Services
Newcastle City Council
Durham County Council
North East Local Enterprise Partnership
Newcastle City Council

Table 3-3: RBS Stakeholder Consultees

3.23.5 A further round of consultation has been undertaken as part of this study. This has taken the form of a series of telephone discussions with stakeholders as well as presenting the findings to the stakeholder reference group. Those consulted are listed in Table 3-4.

3.23.6 The stakeholders made clear that the issues and challenges in the corridor were widely known and universally accepted, had been discussed with the Agency on numerous occasions, and had been subject to a number of studies. They confirmed the latest plans and development aspirations for consideration in the study.

3.23.7 Stakeholder engagement by the Agency is ongoing relating to the emerging local plans, and other issues in the area, particularly the traffic implications of developments which continue to come forward.

Stakeholder Group
North Tyneside Council
Gateshead Borough Council
Newcastle City Council
Durham County Council
North East Local Enterprise Partnership
City of Sunderland Council
South Tyneside Council

Table 3-4 Stage 1 Study Consultees

3.24 Current Opportunities and Constraints

This section is concerned with identifying the physical, legal and institutional constraints, and, firstly, the opportunities affecting the study area.

3.25 Opportunities

Stakeholder consensus

3.25.1 The widespread stakeholder support for improvements to the A1 NGWB represents a major opportunity. Potential improvements to the A1 are seen as being a catalyst for growth and economic development in the corridor, and in Tyne and Wear as a whole. This consensus is underpinned by a clear understanding of the issues and the required solutions.

Proof of concept

3.25.2 The recent scheme to provide three lanes through the Dunston interchange, one of the most width constrained structures on the entire bypass has proved that widening is possible, while taking account of current infrastructural constraints in the corridor. This offers the hope that a lower cost scheme than full standard widening might be realistically deliverable in the corridor.

Committed Scheme

3.25.3 The extended Lobley Hill scheme will now see dual three lanes delivered between the Coalhouse and Metrocentre junctions. This represents a major advance towards the goal stated by the LEP, and shared by a broad coalition of stakeholders of a three lane A1 NGWB.

3.26 Constraints

Institutional constraints

3.26.1 Institutional issues relating to funding and deliverability have been the major constraint on improvements in the corridor to date, with numerous schemes developed over recent years, but falling at this hurdle. It is now considered that a full length scheme is unlikely to proceed as a single project, and a pipeline of schemes dealing with discrete sections will be the most effective way of delivering the aim.

Corridor constraints

3.26.2 The corridor itself is physically constrained, with development having occurred in Newcastle up to the reserved corridor for the Newcastle Western Bypass, and development having already occurred along sections of the alignment of the Gateshead Western Bypass. In particular, sections of the Newcastle Western Bypass run through concrete walled cuttings with residential development immediately adjacent, which pose particular constraints and challenges for widening. It is noted that, although the corridor had been reserved, 66 houses were demolished to facilitate its construction to modern standards, and some 1200 houses were provided with noise insulation (CIHT Motorway Archive).

Ownership

3.26.3 The majority of the junctions in the corridor are part of the LRN, and as such not the sole responsibility of the Highway Agency. In particular, it is noted that the Metrocentre to Coalhouse scheme does not involve any amendments to the junctions at the end of slip roads. Modelling suggests that some of these junctions will have difficulty coping with the increased throughput capability of the SRN and/or would be capable of passing addition traffic through from the LRN to the SRN so as to be make full use of the expanded capacity.

3.26.4 The interchanges at which the junctions at the end of the slips form part of the SRN, as opposed to LRN, are those where the A1 interfaces with other SRN routes, namely:

- J65 Birtley ((A194(M) south facing slips only);
- J75 Denton Burn (A69);
- J77 Ponteland Road (A696); and
- J80 Seaton Burn A19.

Structures

3.26.5 The major structures which provide crossings of rivers and rail lines represent major constraints on the aspiration for a three-lane corridor. It is considered that Blaydon Bridge crossing the River Tyne will remain a constraint due to the cost implications of replacement or widening. Derwenthaugh and Allerdene bridges, the former across the River Derwenthaugh, the latter across the East Coast Mainline are also constraints, as are the crossings of the Tees and Team. The River Team was diverted to run in an artificial channel through the centre of Eighton Lodge interchange.

3.26.6 Allerdene in particular is problematic, in that the current structure will need replacement in the near future due to corrosion issues. Replacing this on line, over a live railway line, would be challenging given site and location constraints, the need to maintain access via the A1 and limited possession windows available on the East Coast Mainline.

Environmental and Historical Constraints

3.26.7 Full consideration of potential environmental and historical constraints are provided in the accompanying report *Potential environmental and historical constraints*. A summary is provided below.

3.26.8 **Air Quality:** Recently, the air quality implications of road schemes have been highlighted, with speed limits being introduced where hard shoulder running has been introduced as part of a managed motorway scheme through Luton, and the M60 managed motorway scheme through Trafford being amended to remove hard shoulder running due to potential air quality issues resulting from increased traffic flows. Given that NO2 levels already breach EU legal limits for much of the length of the A1 NGWB, this may constrain future development of the corridor. However, it is noted the M60 corridor in Manchester is an Air Quality Management Area (AQMA), whereas the Western Bypass is not; nor does the corridor pass through any designated area.

3.26.9 Three Air Quality Management Areas are located within 5km of the corridor, the closest being some 3km away.

3.26.10 **Cultural Heritage**: The route crosses Hadrian's Wall World Heritage Site immediately to the south of J75 Denton Burn, with the slip roads being within the site. The designated area of the World Heritage Site stretches approximately 100m either side of the alignment of the wall. Approximately 100 metres to the west of the A1 NGWB is Denton Hall Turret which also forms part of Hadrian's Wall. This is now located within a primarily residential area, where the road names, such as Centurion Close, reflect the Heritage of the area.

3.26.11 The Angel of the North sculpture lies 100 metres to the north east of the A1, to the north of the Eighton Lodge interchange, though it has no formal designation.

3.26.12 There a number of scheduled monuments in the area, three of which adjoin the route:

- Coal mining remains in Mallygill Wood, East of the A1M, approximately 1km north of the route commencement at J62 Carville;
- Site of Ravensworth Coal Mill, to the west of the A1, between J67 Coalhouse and J68 Lobley Hill; and
- Bowes Railway, which traverses the A1 NGWB immediately to the south of J66 Eighton Lodge interchange.

3.26.13 Other heritage assets shown on the 'Constraints' Plans within the report include conservation areas and listed buildings.

3.26.14 **Landscape:** The route passes through two separate Landscape Character Areas, urban and rural. Whilst there are no Special Landscape Areas within the route corridor, given the proximity of residential properties, townscape, rural landscapes, Green Belt and Public Rights of Way the potential exists for beneficial or adverse impacts upon all of these receptors.

3.26.15 **Biodiversity:** Given the extent of the route, it is likely that protected species such as Bats, Badgers and Great Crested Newts may be present in the area. Further detailed studies will be required to support the on-going assessments and design.

3.26.16 High level information obtained to date is detailed below:

- There are no National Nature Reserves along the route; however several Local Nature Reserves adjoin the highway boundary.
- Shibdon Pond Site of Special Scientific Interest (SSSI) abuts the highway boundary to the west, between Swalwell and Derwenthaugh. There are other SSSIs located further from the corridor.
- Two ancient woodlands border the site. Lumley Park Wood crosses the A1(M) to the south of Chester-le-Street interchange. An ancient woodland also lies to the East of the A1 near Coalhouse interchange.

3.26.17 **Noise:** As the route passes through residential areas and community facilities, there is the potential for schemes to adversely affect local people. Residential areas are located close to the road at Chester-le-Street, Birtley, and Lobley Hill through to Dunston.

3.26.18 North of the River Tyne, much of the route is flanked by residential development. The Denton Burn area is particularly vulnerable. A number of Noise Important Areas are identified in the *Potential environmental and historical constraints* report.

3.26.19 **Water:** In addition to the River Tyne floodplain, the route crosses three other locations with a 'High' risk of flooding. In addition it crosses the Rivers Team at Eighton Lodge (which passes through the centre of the interchange in a culvert), Derwenthaugh, south of Derwenthaugh Interchange, and Tees, north of Chester-le-Street.

3.26.20 Potential impacts and solutions for these, and other catchments, and early agreement of acceptable solutions with the Environment Agency (EA), may be a key element in relation to scheme programming.

3.27 Summary and Conclusions

3.27.1 The review of the current situation in the A1 NGWB has shown that:

- National, regional and local policies and strategies consider that the A1 NGWB, and improvements to the route, are fundamental to the economic performance of the region;
- Travel demand data shows that more than 95% of journeys on the A1 NGWB are to, from or within the surrounding area, rather than long-distance trips, emphasising the importance of the route for local and regional journeys;
- The design of the Gateshead Western Bypass between J65 Birtley and J83 Derwentaugh is substandard with varying cross sections. It also has particularly

closely space intersections. The substandard design contributes to the operational challenges for the corridor in terms of resilience, safety and capacity.

- Traffic flows exceed the design capacity of the road, resulting in delays and unreliable journey times, particularly during the peak periods. The Gateshead western bypass in particular performs poorly against benchmarks in terms of safety.
- There are few performance issues to the south of J65 Birtley on the A1(M), and north of J79 Great Park on the A1.
- Public Transport currently plays a relatively minor role, and offers little alternative for the local orbital journeys that utilise the corridor. Local heavy rail use is insignificant compared to the flows on the A1NGWB, with a relatively poor local service.
- A key issue concerns the role of the corridor, the balance between its strategic and local roles, and whether the performance targets and expectations for the corridor are appropriate given the balance between these roles.
- A strong stakeholder consensus exists concerning the issues and challenges in the corridor, and the need for action.
- A number of environmental constraints exist in the corridor including the Hadrian's Wall World Heritage site, and other official safeguarding designations. Much of the corridor is immediately flanked the residential and commercial development.

4 Future Situation

4.1 Introduction

4.1.1 This section provides information on anticipated conditions in the corridor, and issues likely to arise, or be exacerbated. In doing so, it considers:

- Future land use policies;
- Future changes to transport systems; and
- Future travel demands and levels of service.

4.2 Future Land Use Policies

4.2.1 As a result of the ongoing engagement with the Local Authorities in the area, the Highways Agency has developed a thorough understanding of land use policies, and their potential impact on the traffic patterns in the corridor. The Newcastle-Gateshead Local Plan has been considered, as have plans for County Durham and Northumberland.

4.3 Gateshead/Newcastle

4.3.1 The final version of the joint Local Plan, "Planning for the Future Core Strategy and Urban Core Plan for Gateshead and Newcastle upon Tyne" was submitted to the Secretary of State for Communities and Local Government in February 2014. This sets out the vision for the level and distribution of development in the area through to 2030.

4.3.2 In Newcastle, the plan envisages some 21,000 new homes are to be provided during the plan period, with 11,000 in Gateshead. Employment sites are to be provided to support 8,000 new jobs in Gateshead, and 14,000 in Newcastle.

4.3.3 The A1 corridor is the focus of a number of major proposed development sites, both residential and employment.This is clearly shown in Figure 4-1 which is taken from the Local Plan submission. A number of these represent the intensification of existing sites or redevelopment of brownfield sites, while others are green field development.

4.3.4 Most of the "Neighbourhood Growth Area" housing sites are situated to the West of the A1, and will involve crossing and/or use of the A1 to reach the major facilities and employment opportunities located within the urban core.

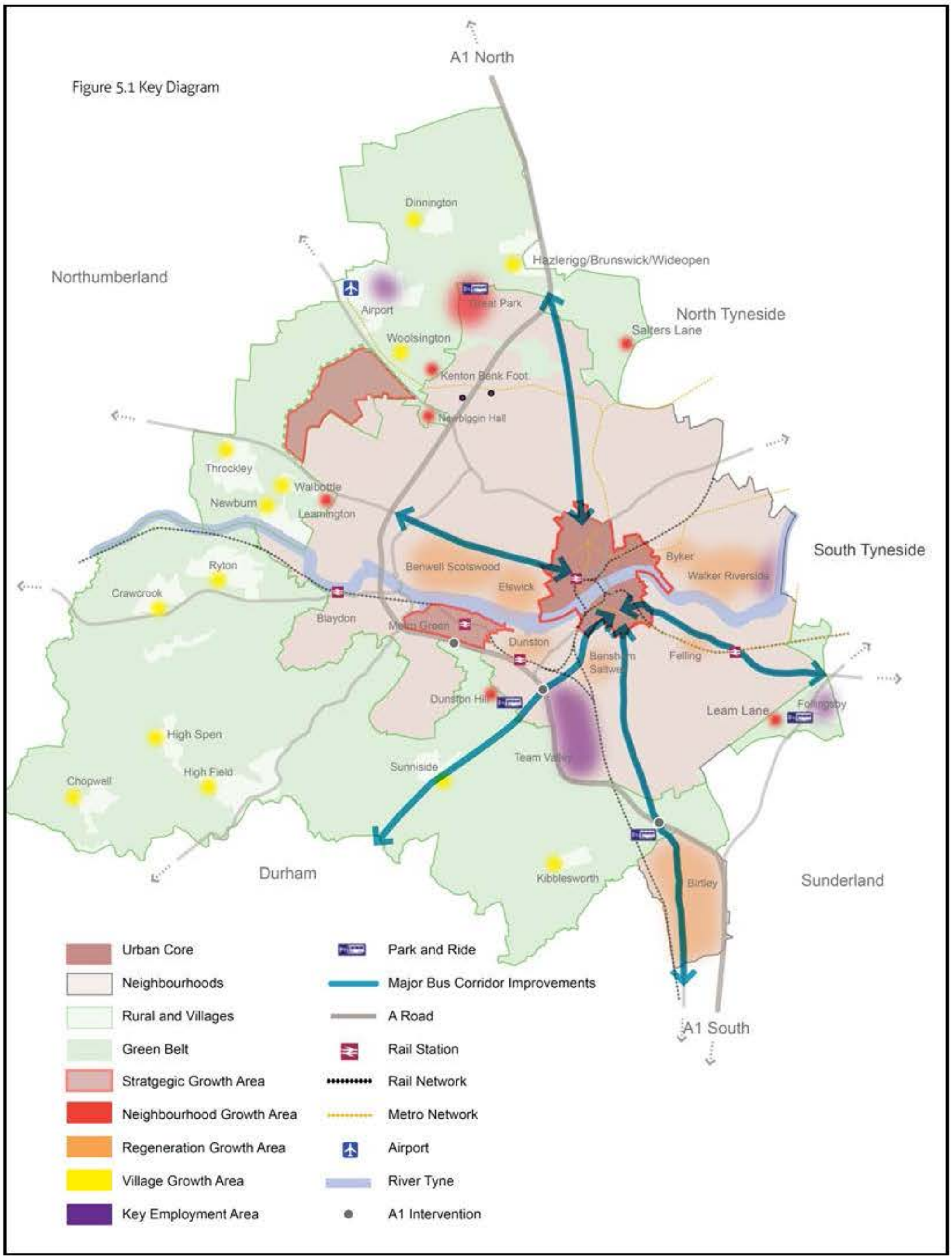


Figure 4-1: Newcastle Gateshead Local Plan Spatial Strategy

4.3.5 The key development sites in Newcastle that are likely to impact on the A1 are:

- Great Park (1,200 dwellings - green field);
- Callerton Park (4,100 dwellings - green field); and
- Newcastle Airport (50 hectares - Key Employment Area – green field).

4.3.6 Key development sites in Gateshead that will impact on the A1 are:

- Metrogreen (850 dwellings, 15,000m2 office, Mixed Use - brown field);

- Dunston Hill (520 dwellings - green field); and
- Team Valley (Key Employment Area - intensification/brown field).

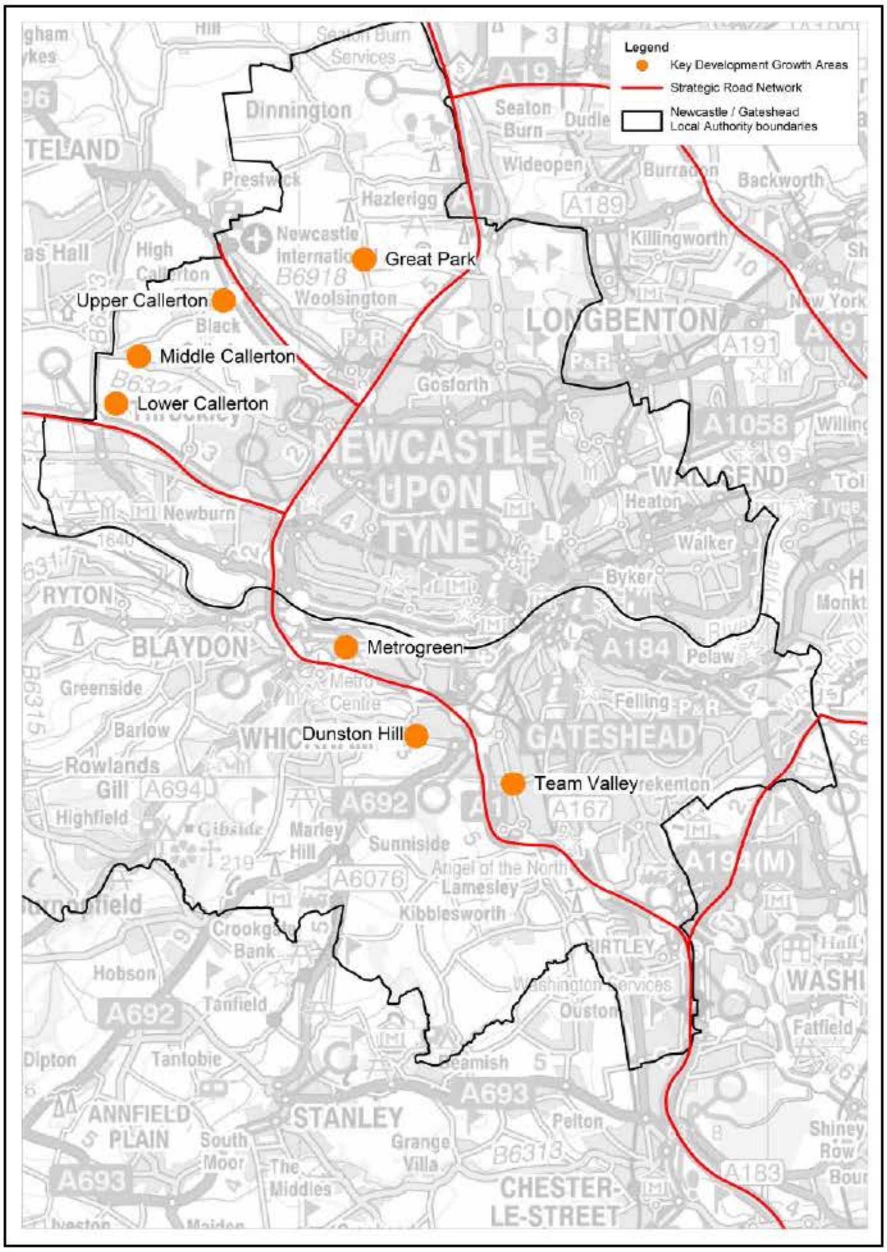


Figure 4-2: Key Development Areas

4.3.7 **Great Park:** much of the Great Park development has extant planning permission, though only a small part has been built out to date. The local plan envisages extending this area significantly, providing some 1,200 homes with capacity for future expansion beyond 2030. This is in addition to existing permissions.

4.3.8 There is a move to migrate the existing permissions from mixed use to a more residential focus. These sites are likely to generate significant additional commuter traffic on the

Newcastle Western bypass in particular, in addition to that from the permitted, but not yet built out allocations.

4.3.9 **Callerton Park:** The Callerton allocations are for residential development in the current green belt, adjoining the current built up area. The sites, as shown in Figure 4.1, lie between the A696(T) and A69(T). They provide sites for some 3,000 homes, with the possibly of further allocations beyond 2030. Nearby allocations at Kingston Park and Newbiggin Hall, lying either side of the A696(T), provide for another 800 and 300 homes respectively.

4.3.10 **Newcastle Airport** is defined as a Key Employment Area, with some 50 acres of land earmarked in the vicinity for airport related and general employment uses. Connecting via the A696(T) to the A1 at Ponteland Road, the development here is expected to generate significant commuter flows on the A696(T), through the Ponteland Road Interchange and onto the A1.

4.3.11 **Metrogreen** will transform a brownfield site lying between the Metrocentre and the River Tyne into a new riverside community. It is planned to provide homes and new business space, with linkages to the leisure, retail and transport facilities at the Metrocentre making this a focal point for the new community. It will encompass 850 homes and 15,000m2 of office space. A new crossing of the River Tyne passing through this development linking the Metrocentre to Scotswood Road is a potential key facilitator of this development.

4.3.12 The entire Metrocentre/Metrogreen area is enclosed by the A1, River Tyne and A184 Askew Road linking to the Tyne Bridge and A695 Dertwenthaugh Road linking to the Scotswood Bridge. The Metrocentre is already a large traffic generator. The Metrogreen development will increase traffic generation in the area, and is expected to have a significant impact on the A1, particularly if a new river crossing is not delivered.

4.3.13 **Dunston Hill** is a greenfield site adjacent to the current built up area. It is designated for some 520 homes. It is located to the west of the A1, and is likely to result in increased traffic in the Lobley Hill corridor, and making the ‘dog-leg’ movement on the A1 between Lobley Hill and Askew Road, as well as increasing pressure on the Lobley Hill and Dunston Road junctions.

4.3.14 **Team Valley** is designated as a key employment site. It is one of the largest trading estates in Europe, and hosts a mix of B1, B2 and B8 uses. It is the largest single employment site in Tyne and Wear, consisting of 6.5 million square feet of development, over 290 hectares. Currently, some 21,000 people are employed on the estate.

4.3.15 There are further opportunities for redevelopment of sections of the site, and a number of plots are currently vacant. Uses proposed would see an intensification of employment on the site, continuing a trend that has seen spatially extensive heavy industrial uses change to more intensive uses such as office and retail. Commuting flows associated with Team Valley already place severe strain on the A1 NGWB and the junctions at Coalhouse and Lobley Hill, this pressure would be further intensified with the intensification and redevelopment.

4.3.16 A further supplementary Local Development Document is to be developed for Team Valley to accompany the Local Plan.

4.3.17 A number of the **Neighbourhood Opportunity Areas** also fall within the sphere of influence of the A1 NGWB corridor. The impact of these in terms of additional trip generation is unclear, insofar as they involve replacement or refurbishment of the existing housing stock, or provision of additional housing over and above that which currently exists.

4.4 County Durham

4.4.1 The Durham Local Plan is at Pre-Submission Draft stage. The areas of Chester-le-Street and North Durham City have strong commuting links with the south of Gateshead and the Urban Core. Housing development in the north of Durham is predicted to generate traffic on the A1(M) and A1 Gateshead bypass in particular.

4.4.2 The construction of the Durham Northern Relief Road will help to facilitate this development. This will run from the A690, immediately to the west of J62 Carrville. It will provide an alternative route from the A1(M) corridor to the north and west of the city centre, and ready access to the A1(M) from the new development areas at North of Amison (1,000 houses) and Sniperley (2,200 houses), as shown in **Error! Reference source not found.**. Sherburn Road housing area, while immediately adjacent to, does not have direct access to the A1 with access to the A1(M) also being via J62 Carrville.

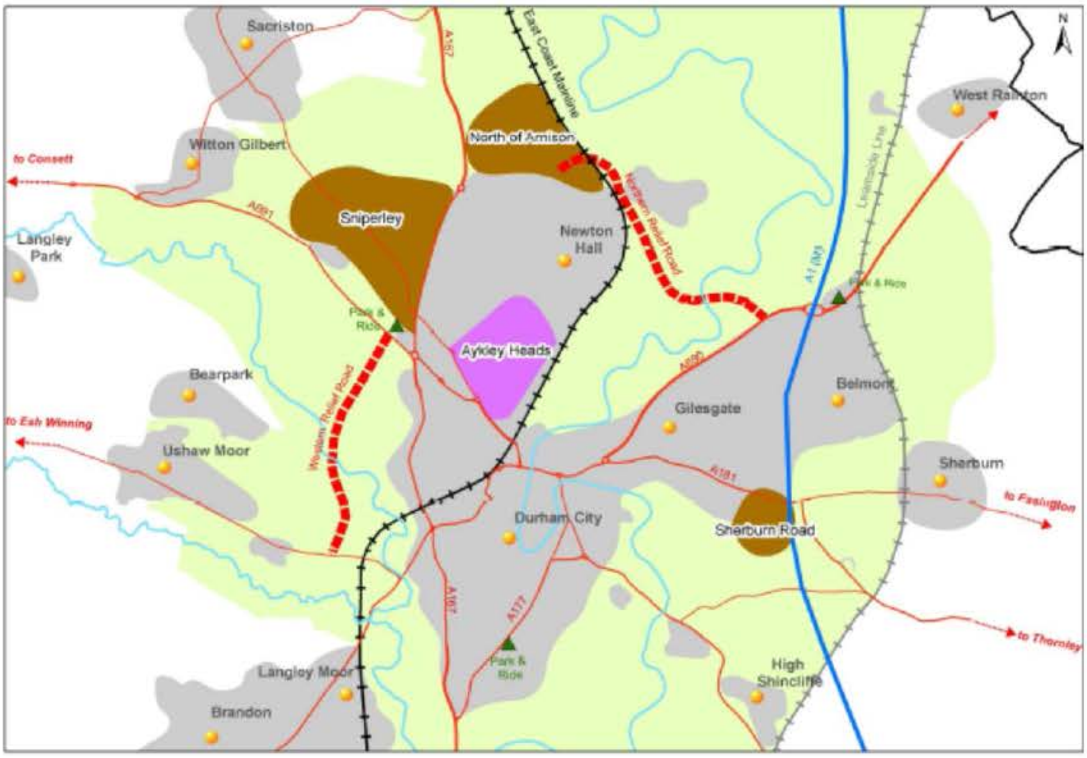


Figure 4-3 Development allocations at Durham City and Durham North and Western Relief Roads (Source: Durham Pre-Submission Draft Local Plan, October 2013)

4.4.3 Aykley Heads is designated as a strategic employment site due to its "excellent road links to the A1(M)", and has the potential to accommodate 6,000 jobs.

4.5 Northumberland

4.5.1 The Northumberland Local Plan is at Core Strategy Preferred Options Consultation Stage 2, with this document being published in October 2013. The development area at Cramlington near to Seaton Burn is of particular importance with regard to potential impacts on the A1 NGWB, with linkages to Morpeth to the north also being significant.

4.5.2 Cramlington is described as being a prime site for inward investment because of the quality of its environment, "and a strategic location for economic development building on is excellent transport links, and ready access to the Tyneside market and labour pool". Some 13 hectares are reserved for a large inward investment, and 19 hectares for general employment use. Some 3,480 houses are scheduled for delivery over the plan period. As shown in Figure 4-4, the allocated site is the south west of the town, close to the Seaton Burn interchange.

4.5.3 The development will increase pressure on the Fisher Lane/Seaton Burn complex, and was considered as a factor in the development of the Seaton Burn Pinch Point scheme. This study found that additional measures would be needed in future to support full build out of the housing and employment allocations at Cramlington.

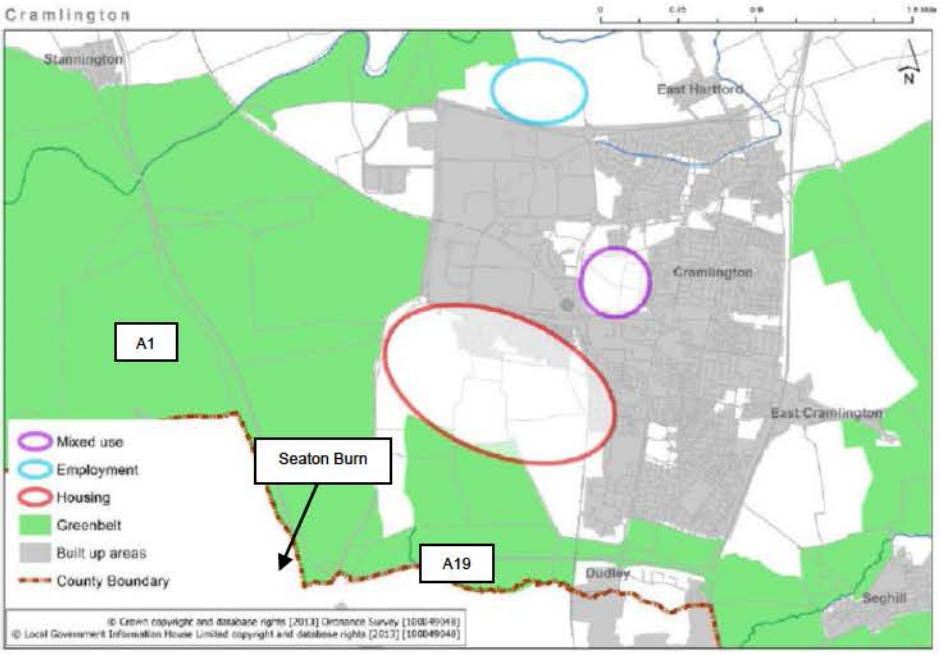


Figure 4-4 Development allocations at Cramlington
(source: Northumberland Local Plan, Consultation Document: October 2013)

4.5.4 Morpeth's linkage with the A1 will be further improved with the construction of the A1 – South East Northumberland Link Road. Sites are identified for the construction of some 1,500 houses over the plan period, with the Morpeth Northern Bypass section of the Link Road being a key facilitator of this development. 18 hectares of land are allocated for employment use, with the A1 Link Road providing access.

4.6 Future Changes to the Transport System

4.6.1 A number of changes to the transport system are either committed or aspired to over the coming years. These are included in various documents, including the Local Transport Plan, the Local Plan, and the draft LEP Transport Strategy.

4.7 Committed Future Highway Schemes

4.7.1 There are two schemes which are committed and will shortly commence construction on the A1 itself in the study area. These are the Lobley Hill to Dunston Improvement Scheme (incorporating extensions to Coalhouse and Metrocentre) and the Seaton Burn Pinch

Point scheme.

4.7.2 The approval of the Lobley Hill to Dunston Improvement Scheme major scheme was announced in the Autumn Statement in 2013. This scheme sees the introduction of collector-distributor roads between the A692 Lobley Hill Road interchange and the A184 Askew Road interchange in both directions. This will mean that traffic making the 'dog-leg' movement between Lobley Hill Road and Askew Road will be separated from through traffic on the A1.

4.7.3 An extension to the scheme was approved in early 2014, meaning that the scheme will provide dual three lanes to the A1 between Metrocentre and Coalhouse interchanges. No enhancements are proposed to the interfaces with the LRN at any of the interchanges along the route, the capacity of which to handle increased levels of traffic flow facilitated by the scheme, and generated by development and background growth is of some concern going forward.

4.7.4 The Seaton Burn Scheme will see an enhancement of the northbound off slip at Seaton Burn, and amendments to the adjacent roundabout at Fisher Lane. This will prevent traffic queuing back onto the A1 northbound and interfering with through traffic.

4.7.5 To the south of the study area, the upgrade of the A1 to A1(M) dual three-lane motorway between Dishforth and Leeming Bar will have increased the attractiveness of the corridor to strategic trips. This will be further enhanced with the recent approval of the upgrade of the 'missing link' between Leeming Bar and Barton. This will connect Tyne and Wear to the National Motorway Network and provide continuous motorway between Tyne and Wear and London. This will further increase the attractiveness of the study corridor for strategic trips, with the motorway terminating at J65 Birtley.

4.7.6 The ongoing introduction of junction numbers on the Western Bypass between J65 Birtley and J80 Seaton Burn, continuing the numbering series from the A1(M) will also further reinforce the impression of the A1 NGWB as a key strategic road. Only a handful of other key dual carriageway all-purpose roads which form part of the SRN have their junctions numbered in this way, such as the A14(T) and A42(T).

4.7.7 On the LRN there is a scheme to improve access for buses through the Maingate Roundabout, which lies to the North of Team Valley Trading Estate, on Lobley Hill Road. Its proximity to the A692 Lobley Hill Interchange makes this a key scheme with regard to the operation of the A692 Lobley Hill Roundabout, and hence the SRN.

4.8 Aspirational Highways Schemes

4.8.1 Among the key aspirational highways schemes on the LRN are a new link road between the A1 at Seaton Burn and the A69 at Throckley. A key facilitator of the proposed development of the 5,300 homes in the north west quadrant encompassing the Callerton Park and Great Park areas is a proposed new dual carriageway link road running between the A1(T) at North Brunton, and the A69(T) at Throckley, connecting with the A696(T) in the vicinity of Newcastle Airport. This is shown in Figure 4.1 as an 'indicative access road'. Envisaged as being at-grade with signal controlled intersections, this road has the potential to change travel patterns in the area, and will greatly enhance access between the developments and the SRN.

4.8.2 A long term aspiration has been the provision of additional river crossing capacity within the urban area. As mentioned above, a corridor has been reserved for provision of a road bridge crossing the River Tyne as part of the Metrogreen development. This will link the

Metrocentre in Gateshead with Scotswood Road in Newcastle. This has the potential to alter traffic patterns crossing the River Tyne and in the surrounding area, including on the A1.

4.8.3 There are a number of potential pinch-point schemes that have been studied on the A1 corridor. These include the signalisation of Coalhouse Roundabout and alterations to the merge arrangements and northbound link between Birtley and Eighton Lodge interchanges.

4.8.4 The key aspiration of local stakeholders, including the LEP and local authorities, is the delivery of additional capacity throughout the A1 NGWB corridor, and as the Draft North Eastern LEP Transport Strategy states, this may involve physical widening of the A1. This is further reinforced in the SEP, with the stated aspiration for a dual three lane A1 NGWB with the exception of the River Tyne crossing.

4.9 Public Transport

4.9.1 A number of public transport schemes are proposed in the Local Transport Plan and the Local Plan which could impact on both rail and bus demand in the corridor.

4.9.2 In terms of heavy rail, and as mentioned previously, the North East LEP commissioned a new study to produce a business case for the reopening of the Leamside Line in April 2014. Network Rail have cited the Leamside Line as a potential freight route to increase capacity in the area to provide improved and more resilient passenger services, on the East Coast Mainline, but that this would be considered post 2019.

4.9.3 Nexus published its Metro Strategy 2030 consultation document in March 2014. This included the possibility of Metro services on part of the Leamside Line. It also included the suggestion of Metro being extended to serve the Metrocentre and Team Valley (Figure 4-5).

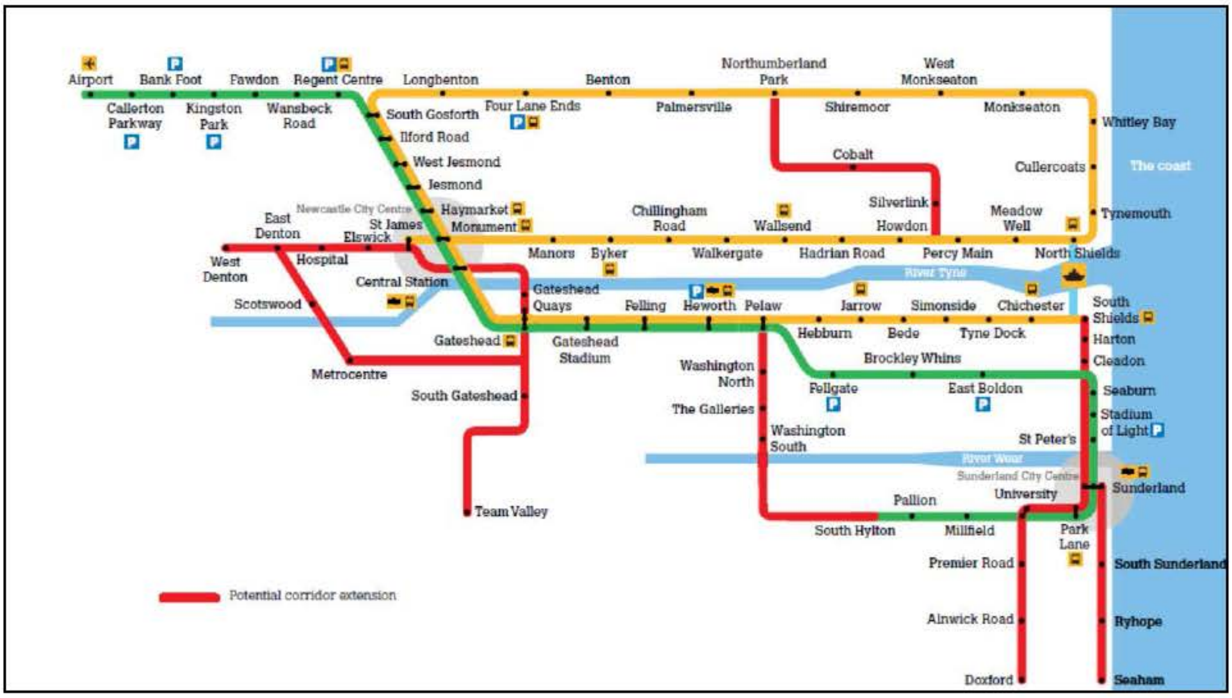


Figure 4-5: Potential Metro Extension to 2030 (Source: Metro Strategy 2030)

4.9.4 In terms of buses, corridor improvements are proposed for four corridors which may potentially impact on the A1 NGWB corridor, as they either parallel or cross the route. These are:

- A692 Corridor (through Lobley Hill interchange and Team Valley North to Urban Core);
- Durham Road (original A1 from Birtley through to the Urban Core);
- West Road (Denton Burn to the Urban Core); and
- Great North Road (original A1 from North Brunton to the Urban Core).

4.9.5 These corridors are shown in Figure 4-1 from the Local Plan. Some parts of these schemes (For example the A692 approach to Lobley Hill Roundabout) have been recently implemented, while others, such as Maingate Roundabout are underway. Others are programmed or currently aspirational.

4.9.6 The bus infrastructure schemes have the potential to encourage modal shift, however depending on the nature and design of the schemes, they may reduce capacity on the LRN. If the reduction in capacity for cars is not met by a commensurate model shift, traffic may be displaced to the SRN. Likewise, reductions in LRN capacity for general traffic at key points, such as the Maingate Roundabout, in favour of buses may directly impact on the SRN due to blocking back.

4.9.7 There are planned park-and-ride sites identified in the Local Plan, associated with these enhanced bus corridors (Figure 4-1). Those relevant to the A1 NGWB are located at Eighton Lodge. While the A692 would intercept traffic before it reaches the A1 NGWB, traffic wishing to reach the Eighton Lodge site would have to negotiate the current congestion at Birtley, though it will provide an intercept for traffic approaching the A1 NGWB on the A167 Durham Road from the south.

4.9.8 The LSTF bid for Newcastle and Gateshead sought funding for a bus service between Washington, Team Valley and Metrocentre, paralleling the A1 Gateshead bypass. Funding for this scheme was not awarded by the DfT. The lack of commercial service on this corridor suggests that either there is little potential for mode shift to bus, or the commercial operators have chosen not to take a risk to grow the market for public transport.

4.10 Future Travel Demands and Levels of Service

4.10.1 It has been noted that development plans for the Newcastle-Gateshead area see a concentration of development in the A1 NGWB corridor. This will increase demand for travel both along the SRN itself, and critically, through the intersecting junctions. The operation of 16 junctions within the 25km bypass is critical to the overall operation of the mainline SRN. Slip roads are, given the tight nature of the corridor, short, and any issues at the intersections at the top of the slips will quickly spill back to impact the mainline.

4.10.2 Much work has been undertaken to date to understand the implications for the future operation of the corridor. This commenced with the Newcastle and Gateshead Infrastructure studies and continued with the A1 West of Newcastle Route Based Strategy. It is continuing to date with an investigation that has been undertaken into the extent to which the LEP aspiration of a dual three-lane route, (with the exception of Blaydon Bridge,) would meet the additional traffic demand that is predicted to be generated by the combination of development and background growth.

4.10.3 This work has indicated that, in the absence of additional measures over and above the committed schemes, the level of service offered by the corridor will decline further. Rather than being the key distributional artery for the area, congestion will increase, and the operational metrics, which already illustrate that levels of service are significantly lower than benchmark, will decline further.

4.10.4 The work has been undertaken using the Tyne and Wear Meso model, and subsequently the extended version, the North East Strategic Mesoscopic Model (NESMM). Traffic from new developments has been generated using generic trip rates, and distributed using the PENELOPE tool. The resultant flows have been cordoned to the Meso extents and assigned to the network.

4.10.5 Background trips have been factored, such that the background growth, when combined with development trips is constrained overall to TEMPRO growth. This process has the effect of reflecting the distribution of development proposals, while maintaining a cap on overall growth.

4.10.6 Tests have been run for the Base Year, 2015, 2020. The scenarios considered so far assumed that a three lane A1 NGWB is in place in 2020. A test with the 2020 demand and 2015 network (as present, with the Lobley Hill and Seaton Burn improvement schemes in place) is pending. The results are shown in Table 5.1 for the A1 Southbound, and Table 5.2 for the A1 Northbound.

4.10.7 The metric reported is Delay Ratio, which is the ratio f of Actual Link Travel Time to Free Flow Link Travel Time. This is reported for mainline links (shaded blue), slip roads and LRN approaches and departures. It is intended as an indicator of predicted conditions. Note that the top green band of 1.0 - 1.2 indicates a journey time between free flow time, and one 20% in excess of the free flow journey time. The black band of >5 indicates a journey time more than five times greater than that experienced during free flow times.

4.10.8 The analysis shows the impact of the Lobley Hill scheme in the PM, with the slow moving sections on the Southbound approach to Lobley Hill eradicated in 2015 when the scheme is in place. Issues are seen to remain, and indeed worsen elsewhere.

4.10.9 The 2020 test, which includes three dual lanes throughout shows a marked improvement for the A1 mainline, showing that the additional capacity has coped with growth and solved many of the issues apparent in the base and 2015 test. However there are numerous other issues pertaining to capacity at junctions, with delays and queues on the local road network in particular. Lobley Hill in particular is affected, with queuing back occurring from Maingate Roundabout at the north of the Team Valley Trading Estate back onto the A1.

4.10.10 This set of tests shows that without intervention, conditions on the A1 NGWB will deteriorate, particularly in the current pinch point areas of Birtley in the AM peak period, and Lobley Hill and Coalhouse in the PM peak period. To the north of the river, conditions in the section between Scotswood and Ponteland Road will also deteriorate.

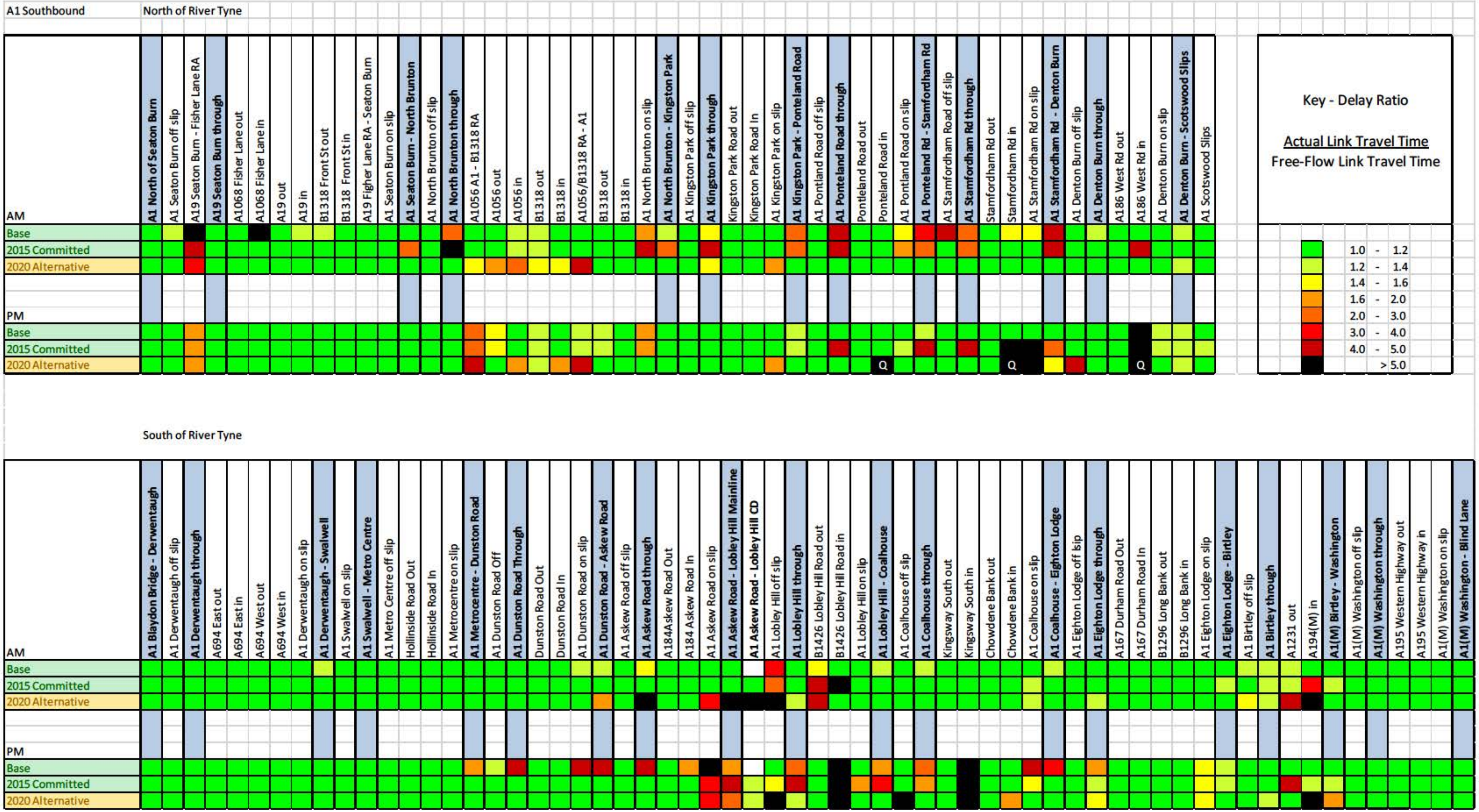
4.10.11 This information has been used to inform the node link analysis in Appendix A, and identify the challenges in the following section.

4.10.12 The review of the future situation in the A1 NGWB corridor has shown that:

- There are significant development plans in Durham, Gateshead, Newcastle and Northumberland which will have an impact on travel demand on the A1 NGWB;
- Developments at Cramlington in Northumberland and in County Durham, particularly in the North of the City of Durham, are likely to load additional traffic at either end of the A1 NGWB corridor;
- There are committed highway schemes, principally the Lobley Hill to Dunston Improvement Scheme and the Seaton Burn Pinch Point Scheme, which will address some of the current and future problems on the A1 NGWB;
- Without intervention, conditions on other parts of the A1 NGWB will deteriorate, particularly south of Coalhouse to Birtley and between Scotswood and Ponteland Road to the north of the river;
- Bus priority schemes on the LRN may displace traffic to the SRN, unless the modal shift achieved is commensurate with the loss of general traffic capacity;
- Consideration is being given to potential major public transport improvements, such as extensions to the Metro system and reopening of the Leamside Line, which could potentially have an impact on travel demand on the A1 NGWB; but
- In general, committed plans for changes to the transport network are not commensurate with the increase in demand expected due to development and background growth.

Table 4.1 Meso Model Results from 2014 A1A1 NGWB Infrastructure study – Delay Ratio on Links - Southbound

Table 4.2 Meso Model Results from 2014 A1A1 NGWB Infrastructure study – Delay Ratio on Links - Northbound


A1 Southbound
North of River Tyne
AM
Base
2015 Committed
2020 Alternative
PM
Base
2015 Committed
2020 Alternative
A1 North of Seaton Burn
A1 Seaton Burn off slip
A19 Seaton Burn - Fisher Lane RA
A19 Seaton Burn through
A1068 Fisher Lane out
A1068 Fisher Lane in
A19 out
A19 in
B1318 Front St out
B1318 Front St in
A19 Figher Lane RA - Seaton Burn
A1 Seaton Burn on slip
A1 Seaton Burn - North Brunton
A1 North Brunton off slip
A1 North Brunton through
A1056 A1 - B1318 RA
A1056 out
A1056 in
B1318 out
B1318 in
A1056/B1318 RA - A1
B1318 out
B1318 in
A1 North Brunton on slip
A1 North Brunton - Kingston Park
A1 Kingston Park off slip
A1 Kingston Park through
Kingston Park Road out
Kingston Park Road In
A1 Kingston Park on slip
A1 Kingston Park - Ponteland Road
A1 Pontland Road off slip
A1 Ponteland Road through
Ponteland Road out
Ponteland Road in
A1 Pontland Road on slip
A1 Ponteland Rd - Stamfordham Rd
A1 Stamfordham Road off slip
A1 Stamfordham Rd through
Stamfordham Rd out
Stamfordham Rd in
A1 Stamfordham Rd on slip
A1 Stamfordham Rd - Denton Burn
A1 Denton Burn off slip
A1 Denton Burn through
A186 West Rd out
A186 West Rd in
A1 Denton Burn on slip
A1 Denton Burn - Scotswood Slips
A1 Scotswood Slips
Q
Key - Delay Ratio
Actual Link Travel Time
Free-Flow Link Travel Time
1.0 - 1.2
1.2 - 1.4
1.4 - 1.6
1.6 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
> 5.0
South of River Tyne
A1 Blaydon Bridge - Derwentaugh
A1 Derwentaugh off slip
A1 Derwentaugh through
A694 East out
A694 East in
A694 West out
A694 West in
A1 Derwentaugh on slip
A1 Derwentaugh - Swalwell
A1 Swalwell on slip
A1 Swalwell - Metro Centre
A1 Metro Centre off slip
Hollinside Road Out
Hollinside Road In
A1 Metrocentre on slip
A1 Metrocentre - Dunston Road
A1 Dunston Road Off
A1 Dunston Road Through
Dunston Road Out
Dunston Road In
A1 Dunston Road on slip
A1 Dunston Road - Askew Road
A1 Askew Road off slip
A1 Askew Road through
A184Askew Road Out
A184 Askew Road In
A1 Askew Road on slip
A1 Askew Road - Lobley Hill Mainline
A1 Askew Road - Lobley Hill CD
A1 Lobley Hill off slip
A1 Lobley Hill through
B1426 Lobley Hill Road out
B1426 Lobley Hill Road in
A1 Lobley Hill on slip
A1 Lobley Hill - Coalhouse
A1 Coalhouse off slip
A1 Coalhouse through
Kingsway South out
Kingsway South in
Chowdene Bank out
Chowdene Bank in
A1 Coalhouse on slip
A1 Coalhouse - Eighton Lodge
A1 Eighton Lodge off lsip
A1 Eighton Lodge through
A167 Durham Road Out
A167 Durham Road In
B1296 Long Bank out
B1296 Long Bank in
A1 Eighton Lodge on slip
A1 Eighton Lodge - Birtley
A1 Birtley off slip
A1 Birtley through
A1231 out
A194(M) in
A1(M) Birtley - Washington
A1(M) Washington off slip
A1(M) Washington through
A195 Western Highway out
A195 Western Highway in
A1(M) Washington on slip
A1(M) Washington - Blind Lane


A1 Northbound
South of River Tyne
AM
Base
2015 Committed
2020 Alternative
PM
A1(M) Blind Lane - Washington
A1(M) Washington off slip
A1(M) Washington through
A195 Western Highway out
A195 Western Highway in
A1(M) Washington on slip
A1(M) Washington - Birtley
A194(M) out
A1 Birtley through
A1231 In
A1 Birtley on slip
A1 Birtley - Eighton Lodge
A1 Eighton Lodge off slip
A1 Eighton Lodge through
A167 Durham Road out
A167 Durham Road in
A1 Eighton Lodge on slip
A1 Eighton Lodge - Coalhouse
A1 Coalhouse off slip
A1 Coalhouse through
Lamesley Lane out
Lamesely Lane in
A1 Coalhouse on slip
A1 Coalhouse - Lobley Hill
A1 Lobley Hill off slip
A1 Lobley Hill through
A692 Lobley Hill Road out
A692 Lobley Hill Road in
A1 Lobley Hill on slip
A1 Lobley Hill - Askew Road
A1 Askew Road off slip
A1 Askew Road through
A1 Askew Road on slip
A1 Askew Road - Dunston Road
A1 Dunston Road Off
A1 Dunston Road Through
Dunston Road Out
Dunston Road In
A1 Dunston Road on slip
A1 Dunston Road - Metrocentre
A1 Metro Centre off slip
Hollinside Road Out
Hollinside Road In
A1 Metrocentre on slip
A1 Metro Centre - Swalwell
A1 Swalwell off slip
A1 Swalwell - Derwentaugh
A1 Derwentaugh off slip
A1 Derwentaugh through
A1 Derwentaugh on slip
A1 Derwentaugh - Blaydon Bridge
Q
North of River Tyne
Blaydon Bridge - Scotswood Slips
A1 Scotswood Slips on
A1 Scotswood Slips - Denton Burn
A1 Denton Burn off slip
A1 Denton Burn through
A69 out
A69 in
A1 Denton Burn on slip
A1 Denton Burn Stamfordham Rd
A1 Stamfordham Road off slip
A1 Stamfordham Rd through
Stamfordham Rd out
Stamfordham Rd in
A1 Stamfordham Rd on slip
A1 Stamfordham Rd - Ponteland Rd
A1 Pontland Road off slip
A1 Ponteland Road through
A696 out
A696 in
Ponteland Road out
Ponteland Road in
A1 Pontland Road on slip
A1 Ponteland Road - Kingston Park
A1 Kingston Park off slip
A1 Kingston Park through
Kingston Park Road out
Kingston Park Road In
A1 Kingston Park on slip
A1 Kingston Park - North Brunton
A1 North Brunton off slip
A1 North Brunton through
Great Park Way out
Great Park Way in
A1 North Brunton on slip
A1 North Brunton - Seaton Burn
A1 Seaton Burn off slip
A1 Seaton Burn through
A1 Seaton Burn on slip
A1 North of Seaton Burn
Key - Delay Ratio
Actual Link Travel Time
Free-Flow Link Travel Time
1.0 - 1.2
1.2 - 1.4
1.4 - 1.6
1.6 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.0
> 5.0

5 Need for Intervention

5.1 Introduction

5.1.1 This section summaries the evidence presented in Chapters 3 and 4, drawing out:

- Current transport-related problems;
- Future transport-related problems; and
- The need for intervention.

5.2 Current transport related problems

5.2.1 The evidence presented in Chapters 3 and 4 presents a compelling case for intervention on the A1 NGWB corridor. The current performance of the corridor is poor, preventing development and employment opportunities coming forward in the area.

5.2.2 The major focus of National Policy is on the promotion of economic growth, however local stakeholders identify the levels of service offered by the A1 NGWB as a major impediment to development and economic growth within Tyne and Wear. Intervention on the corridor is seen as a key priority by the North East LEP, by local authorities and by business groups, in order to unlock the potential of the area and facilitate development.

5.2.3 The highway design and configuration is problematic. Design standards on the Gateshead section are variable, with closely spaced interchanges being an issue. There are 15 junctions in the 21km between Birtley and North Brunton inclusive. This results in weaving issues and driver stress, reduces through capacity and gives rise to a significant number of collisions on key links, though casualty levels on those links where most traffic collisions occur are relatively low, perhaps due to low speeds.

5.2.4 A key aspect of the A1 NGWB is the multifaceted role it plays, in part due to the number of junctions, indeed many of the links play multiple roles in the overall road structure of the area. Between Birtley and Seaton Burn it forms the following roles:

- Strategic (whole length);
- Radial-Arterial (e.g. from South via Askew Road into the Urban Core);
- Local 'Rat-Run'(e.g. Swalwell to Metrocentre);
- Suburban-Distributor (e.g. Denton Burn – Kingston Park and intermediate junctions); and
- Ring Road.

5.2.5 Traffic demand in the corridor currently exceeds the capacity of the infrastructure, with flow breakdown and long delays a daily occurrence at peak times. The indicators consistently highlight the same key links as providing a poor level of service, as well as the same pinch points. These issues are reaffirmed by stakeholders and traffic modelling.

5.2.6 The operational issues pertaining to each link are shown in Appendix A, along with information on the lane configuration. This provides a summary of the information provided in the previous chapters on the current situation. Pertinent issues are highlighted for links and junctions where these are poorly performing on a particular criterion, and these are rated on a red-amber-yellow 'RAY' scale. Only where the link performs particularly poorly on a given criterion are they reported in this table. The link or junction segment is then given an overall red-amber-yellow-green 'RAYG' rating, based on the poorest performing criterion section.

5.2.7 This shows clearly that the most problematic section in operational terms is the Gateshead bypass, particularly the southbound carriageway. The section of the Newcastle Western Bypass between North Brunton and Scotswood is also problematic. The section across Blaydon Bridge, North of North Brunton, and the A1(M) is relatively problem free at present.

5.2.8 The most problematic section of the Gateshead Western Bypass is that covered by the Lobley Hill to Dunston Improvement Scheme. Following implementation of this scheme, the sections between Birtley and Coalhouse, and between Swalwell and Derwenthaugh appear to be most in need of intervention. Should this be a capacity enhancement intervention, then the bridges at Derwenthaugh and Allerdene would represent constraints.

5.2.9 A key problem in the corridor is air quality, with NO_2 levels along much of the corridor in excess of legal limits set by the European Union. Increasing capacity, and hence traffic levels, on the A1 NGWB, is likely to further exacerbate this problem. This issue has come to increased prominence recently with Hard Shoulder running being removed from the plans for the M60 Smart Motorway scheme because of the predicted impact in a corridor where NO_2 levels already breach European limits by 50%. The proximity of existing residential development to the highway boundary makes this a particular area of concern for the A1 NGWB corridor. It is noted however that there is no AQMA designated at any point along the corridor.

5.2.10 The safety record of the corridor as a whole is poor, with most of the route being above benchmark in terms of KSI statistics. The Gateshead bypass section in particular performs poorly on these metrics. Minor shunt type collisions are particularly associated with flow breakdown in the congested areas. Incidents in the corridor cause great disruption given the difficulty of recovery and emergency service access.

5.2.11 There are a significant number of pedestrian incidents for a road with no pedestrian footways. It is unclear whether these are associated with attempts to cross the road or perhaps associated with vehicle breakdowns. There are no at grade facilities for pedestrians to cross the A1 mainline itself. Pedestrian bridges are provided, as are crossings at interchanges, but facilities at junctions vary in quality. As such, the A1 NGWB causes severance issues for pedestrians.

5.2.12 Being an all-purpose dual carriageway, cyclists are permitted on the A1 NGWB, however given the nature and business of the road, few, if any actually use it. The prohibition on slow moving vehicles at peak times prohibits use by cyclists at these times. Traversing the corridor at a number of the junctions is difficult for cyclists. This is particularly the case at the busy roundabouts. Therefore, as is the case for pedestrians, the A1 NGWB represents a barrier to movement for cyclists.

5.2.13 Public transport alternatives are limited for many of the movements facilitated by the corridor. Bus services to cater for key movements which use the A1 NGWB, such as Washington – Team Valley – Metrocentre have been proposed, and funding applied for through the LSTF. In the current institutional environment however, revenue subsidy is unlikely to be available in the long term, and without pump-priming funding (that part of the bid was unsuccessful), potential commercial viability cannot be proven.

5.2.14 The extent to which the problems of the A1 NGWB are an issue for strategic traffic is somewhat debateable. Certainly there is very little through traffic on the A1 between Birtley and Eighton Lodge, and vice versa. Most traffic is either local or has an origin or destination in the area.

5.3 Future transport-related problems

5.3.1 Without intervention, the transport-related problems cited above will worsen. Economic development and growth, already affected by the current performance of the corridor, will be further constrained from its potential trajectory due to congestion on the A1 NGWB.

5.3.2 Whilst the Lobley Hill to Dunston Improvement Scheme will deal with one of the most problematic pinch points on the network, other issues will remain and worsen. Analysis suggests that congestion will occur at the ends of the new dual three-lane section at Coalhouse and at Swalwell. Issues north of the river are not addressed or resolved by the Lobley Hill scheme.

5.3.3 The concentration of development sites adjacent to, and with direct connection to the corridor will increase traffic demand into the future. Access to many of the new jobs and houses to be created in Newcastle and Gateshead will lead to additional trips on or, at least, crossing (and hence interacting with), the corridor. Development planned in County Durham and Northumberland will add to this demand.

5.3.4 The impact of these developments, combined with background growth, has been modelled and shared with stakeholders through the infrastructure studies. Based on current infrastructure, plus the committed schemes, the demand exerted on the network will lead to widespread congestion and delay. Whether this would actually occur is open to argument - it is likely that without intervention, many of the proposed housing and employment developments may not be able to come forward.

5.3.5 Additional transport links, such as an additional Tyne crossing and A69(T) – A696(T) – A1(T) link road are envisaged as key components in facilitating the delivery of development. They could potentially provide relief to some sections of the SRN, and replace some movements. It is noted, however that they also serve to ease access to the A1 corridor, and once traffic reaches the A1 corridor it has to go somewhere; either traversing or joining the A1 NGWB.

5.3.6 Rail is unlikely to be a major contributor in achieving modal shift to relieve demand on the A1 NGWB without major intervention with respect to services, stations and/or line reopening. Even then, the shift that could potentially occur would not provide enough capacity to keep pace with the predicted overall demand for travel.

5.3.7 The proposed key bus priority corridors will need to encourage enough modal shift to bus to cater for the reduction in capacity for general traffic on the LRN. If this is not the case, then traffic demand on the A1 NGWB could increase as a result of the implementation of these schemes. This is a particular concern where the corridors are on parallel routes, i.e. the old A1 corridor (Durham Road to the south, and Great North Road to the North of the urban core).

5.3.8 The strategic role of the A1 NGWB, in terms of catering for through traffic, may increase in future. There are a number of factors which may have a role in this. These include the completion of the 'missing link' motorway between Leeming Bar and Barton, the potential scheme to upgrade the A1 north of Newcastle, and even the continuation of junction numbering from the motorway along the western bypass. Conditions on the bypass then become an increasing concern in the context of providing for strategic national movements.

5.3.9 Table 5-1 details the challenges and issues pertaining to the route arising from the analysis presented, and summarises the need for intervention.

ID	Location	Type	Challenge	Source
1	Whole Route	Network Operation	Journey Time Reliability	A1 West of Newcastle Bypass RBS
2	Whole Route	Asset Condition	Current Pavement condition is below national average.	A1 West of Newcastle Bypass RBS
3	J66 - J68 J66 - J62	Asset Condition	Geotechnical problem areas around the Team Valley - several new defects found in this section following heavy rainfall in 2012. Following this, full detailed inspection of the A1 NGWB was recommended.	A1 West of Newcastle Bypass RBS
4	J66 - J67 J67 - J66	Asset Condition	Allerdene Bridge is a concern for long term serviceability.	A1 West of Newcastle Bypass RBS
5	Whole Route	Network Operation	Only six MS4 variable message signs in the study area.	A1 West of Newcastle Bypass RBS
6	J65 - J80 J80 - J65	Network Resilience	Incident Recovery difficult due to traffic levels and lack of hard shoulder.	A1 West of Newcastle Bypass RBS
7	Whole Route	Environmental; Social; Other Modes	Limited crossing facilities for pedestrians and cyclists; those at junctions are variable in quality. A1 NGWB represents a major barrier to pedestrian and cyclist movement.	Site observations over numerous studies
8	Whole Route	Environmental; Social	Residential development both close, and immediately adjacent, to the corridor including sensitive noise receptors.	
9	J65 - J79 J79 - J65	Safety; Network Operation	Closely spaced junctions result in issues associated with weaving and blocking back. Also results in heavy use for local and very short distance trips. All local roads between J65 and J73, and between J74 and J79 intersect with the A1 at grade separated junctions.	A1 West of Newcastle Bypass RBS; TAMMS.
10	J65 - J79 J79- J65	Network Operation	Conflict in role between strategic and local traffic.	A1 West of Newcastle Bypass RBS
11	Whole Route	Network Operation	Potential increase in strategic traffic due to completion of London - Newcastle Motorway, with A1(M) Leeming Bar to Barton.	A1 West of Newcastle Bypass RBS
12	Whole Route	Other Modes	Parallel East Coast Mainline at capacity; rail services flighted to maximise paths; poor services for local journeys.	
13	Whole Route	Other Modes	Relatively poor bus service alternatives in context of trips using the A1 NGWB.	A1 West of Newcastle Bypass RBS

ID	Location	Type	Challenge	Source
14	Whole Route	Other Modes	Allerdene Bridge is a concern for long term serviceability.	A1 West of Newcastle Bypass RBS
15	Whole Route	Other Modes	Planned Bus Priority Schemes on LRN parallel and traversing routes will reduce capacity for general traffic and may increase demand on the SRN.	A1 West of Newcastle Bypass RBS
16	J80	Network Operation; Key Developments	Peak Queuing at Fisher Lane Roundabout extends back to NB mainline in PM peak. Queuing on other approaches to Roundabout. Issues will be mitigated by Seaton Burn Pinch Point Scheme, but then exacerbated by Cramlington development.	A1 West of Newcastle Bypass RBS; Northumberland Local Plan Seaton Burn PPP Business Case; A1 Adonis Infrastructure Study
17	J80 - J79	Network Operation; Key Developments	Future demand increases expected to result in queuing back onto this section in the AM peak from the J79 merge, and back from the A1056 in the PM peak. Particularly impacted by the Great Park and Cramlington developments.	A1 West of Newcastle Bypass RBS; Northumberland Local Plan; NewcastleGateshed Local Plan; Seaton Burn PPP Business Case; A1 Adonis Infrastructure Study
18	J79	Network Operation; Key Developments	Main junction serving the Great Park development; current queuing to/from A1056. Severe queuing predicted in future to/from A1056 and on approach from Great Park, and back from A1 southbound merge.	A1 West of Newcastle Bypass RBS; NewcastleGateshead Local Plan; A1 Adonis Infrastructure Study
19	J79	Institutional	LRN node	
20	J79 - J78	Network Operation; Key Developments	Flow breakdown occurs at the merge from J79 in the AM Peak. Conditions predicted to deteriorate due to demands from Great Park development.	A1 West of Newcastle Bypass RBS; NewcastleGateshead Local Plan; A1 Adonis Infrastructure Study
21	J78 - J79	Key Developments	Congestion expected in future years due to Great Park Development.	A1 West of Newcastle Bypass RBS; NewcastleGateshed Local Plan
22	J77 - J79	Safety	7 Pedestrian Incidents.	A1 West of Newcastle Bypass RBS
23	J77 - J79	Resilience	60-100 traffic incidents involving a lane closure.	A1 West of Newcastle Bypass RBS
24	J77 - J79	Environmental	NOx levels above EU legal limit.	A1 West of Newcastle Bypass RBS
25	J78	Institutional	LRN node.	
26	J78	Key Developments	Queues on LRN approaches in future years, in part due to demand associated with Great Park Development.	A1 West of Newcastle Bypass RBS; NewcastleGateshead Local Plan; A1 Adonis Infrastructure Study

ID	Location	Type	Challenge	Source
27	J78	Safety/Severance	No footway on Kingston Park Road West; non-controlled crossings only across arms of roundabout where there is a footpath.	
28	J78-J77 J77-J78	Physical Constraint	Fawdon Railway Bridge.	
29	J78-J77	Network Operation	Queues currently in AM Peak, expected to worsen with development.	A1 West of Newcastle Bypass RBS
30	J77	Network Operation; Key Developments	No current issues; Severe queuing is predicted on LRN and A696 approaches associated with Callerton and Airport developments.	A1 West of Newcastle Bypass RBS
31	J77	Safety/ Severance	No cycle facilities. Footpath crossings non-controlled. Challenging for cyclists to traverse.	
32	J76 - J77	Resilience	60 - 100 incidents involving lane closure.	A1 West of Newcastle Bypass RBS
33	J77 - J76	Network Operation	Flow breakdown at merge in AM period; queuing experienced in AM peak period.	A1 West of Newcastle Bypass RBS
34	J76	Institutional	LRN node	
35	J76	Network Operation; Key Developments	No current issues; queuing on A6324 westbound approach predicted in 2020, associated with Callerton Park development.	A1 West of Newcastle Bypass RBS
36	J76	Safety/ Severance	No cycle facilities. Part time signals potentially confusing for pedestrians. Pedestrian crossings uncontrolled.	A1 West of Newcastle Bypass RBS
37	J76 - J75	Network operation	Queuing in both peaks, propagating back from next section; expected to worsen with traffic growth.	A1 West of Newcastle Bypass RBS
39	J75 - J76	Network operation	Queuing in AM peak expected to worsen with traffic growth; large volumes joining at J75 then leaving at J76.	A1 West of Newcastle Bypass RBS
40	J75 - J76	Safety	2 KSI 2008 – 2010.	A1 West of Newcastle Bypass RBS
41	J75	Network Operation; Key Developments	Extensive queue on A69(T) and A186 approach in both peaks, expected to increase with developments at Callerton.	A1 West of Newcastle Bypass RBS
42	J75	Safety/ Severance	No cycle facilities.	
43	J75 - J74	Safety	Over 3 RTC per km, concrete walled cutting, affecting visibility, short weaving section. Flow breakdown at merge in AM Peak. Queuing extends back from across Blaydon Bridge on occasions.	A1 West of Newcastle Bypass RBS
44	J75 - J74	Network Operation	High level of delay.	
45	J74 - J75	Safety	2.25 - 3 RTC per km. Local road joining slip road causes issues.	A1 West of Newcastle Bypass RBS
46	J75 - J74 J74 - J75	Environment	Hadrian's Wall World Heritage site.	English Heritage
47	J75 - J74	Environment	Denton Dene LNR.	

ID	Location	Type	Challenge	Source
48	J74	Network Operation	Queuing back from A695 slip in AM peak. Predicted to worsen in future.	A1 West of Newcastle Bypass RBS; A1 Adonis Infrastructure Study
49	J74	Institutional	LRN node.	A1 West of Newcastle Bypass RBS
50	J74 - J73	Network Operation	7.5 - 10% reduced capacity hours, 4000+ Average Monthly Vehicle Delay per km. Is expected to be improved by Metrocentre - Coalhouse scheme.	A1 West of Newcastle Bypass RBS
51	J74 - J73	Environment	NOx levels above EU legal limit.	A1 West of Newcastle Bypass RBS
52	J74 - J73 J73 - J74	Constraint	Blaydon Bridge.	
53	J73 - J74	Network Operation	2000 - 3000 average monthly vehicle hours delay per km.	A1 West of Newcastle Bypass RBS
54	J73	Institutional	LRN node.	
55	J73 - J72 J72 - J73	Constraint	Derwenthaugh Bridge.	
56	J72 - J73	Constraint	Shibdon Pond SSSI.	DEFRA
57	J73 - J69	Network Operation	7.5 - 10% reduced capacity hours, 4000+ Average Monthly Vehicle Hour Delay per km; is expected to be improved by Metrocentre - Coalhouse scheme; <50% on time reliability.	A1 West of Newcastle Bypass RBS
58	J73 - J69	Safety	18 Pedestrian Incidents 2008 – 2010.	A1 West of Newcastle Bypass RBS
59	J73 - J69	Resilience	100+ incident involving a lane closure. Assumed to be improved by Metrocentre - Coalhouse scheme.	A1 West of Newcastle Bypass RBS
60	J73 - J69	Environment	NOx levels above EU legal limit.	A1 West of Newcastle Bypass RBS
61	J72 - J71 J71 - J72	Network Operation	Very short weaving section.	A1 West of Newcastle Bypass RBS
62	J69 - J73	Network Operation	2000 - 3000 average monthly vehicle hour delay per km. Expected to worsen with development, and Metrocentre - Coalhouse scheme.	A1 West of Newcastle Bypass RBS
63	J71	Network Operation	AM peak queuing on Hollinside Road approach from West. Junction expected to be over capacity in future due to demand from Metrogreen development.	A1 West of Newcastle Bypass RBS
64	J71	Institutional	LRN node.	
65	J70	Network Operation	No current issues. Junction expected to be over capacity in future due to increased demand from Metrogreen development, and increased throughput due to Lobley Hill scheme.	A1 West of Newcastle Bypass RBS
66	J70	Institutional	LRN node.	
67	J69	Network Operation	Queuing back on A184 at peak times.	A1 West of Newcastle Bypass RBS; A1 Adonis Infrastructure Study
68	J69	Institutional	LRN node	

ID	Location	Type	Challenge	Source
69	J69 -J68	Network Operation	4000+ Average Monthly Vehicle Delay per pm; 7.5% to 10% reduced capacity hours. Mitigated by Metrocentre - Coalhouse scheme. In future queuing extends back from Maingate Roundabout in Team Valley Trading Estate, due in part to traffic generated by development in Team Valley.	A1 West of Newcastle Bypass RBS
70	J69 -J68	Air Quality	NOx levels above EU legal limit.	A1 West of Newcastle Bypass RBS
71	J69 -J68	Safety	7 Pedestrian Incidents 2008 - 2010, 23.25 - 3 RTC per km.	A1 West of Newcastle Bypass RBS
72	J69 -J68	Resilience	100+ incidents involving a lane closure.	A1 West of Newcastle Bypass RBS
73	J68	Institutional	LRN node.	A1 West of Newcastle Bypass RBS
74	J68	Network Operation	Extensive queuing on approaches from A692 at peak times, and on B412 in PM peak. Dunston Hill and Team Valley developments will increase pressure on the junction, as will increased throughput from Metrocentre - Coalhouse scheme.	A1 West of Newcastle Bypass RBS; A1 Adonis Infrastructure Study
75	J68- J66	Network Operation	4000+ Average Monthly Vehicle Delay per km; 7.5% to 10% reduced capacity hours. Mitigated by Metrocentre - Coalhouse scheme, though there is likely to be congestion back from the lane drop at the end of the scheme at Coalhouse.	A1 West of Newcastle Bypass RBS
76	J68 - J66	Safety	2 KSI 2008 - 2010; 17 Pedestrian incidents. Likely to be mitigated by the Metrocentre - Coalhouse scheme.	A1 West of Newcastle Bypass RBS
77	J68 - J66	Resilience	100+ incidents involving a lane closure. Likely to be mitigated by the Metrocentre - Coalhouse scheme.	A1 West of Newcastle Bypass RBS
78	J66 - J68	Network Operation	4000+ Average Monthly Vehicle Delay per km.	A1 West of Newcastle Bypass RBS
79	J66 - J68	Safety	2 KSI 2008 - 2010; 6 Pedestrian incidents.	A1 West of Newcastle Bypass RBS
80	J66 - J68	Resilience	100+ incidents involving a lane closure.	A1 West of Newcastle Bypass RBS
81	J67 - J68	Constraint	Scheduled Monument, Ancient Forest.	DEFRA
82	J67	Institutional	LRN node.	
83	J67	Network Operation	Extensive queuing on Kingsway approach in PM peak and Lamesley Lane in AM peak. Will be exacerbated by Team Valley developments. A LMNS scheme has been designed for partial signalisation, changes to the circulatory carriageway and widening of approaches.	A1 West of Newcastle Bypass RBS; A1 Adonis Infrastructure Study
84	J67 - J66	Network Operation	Climbing Lane on Bowes Incline, lost through Eighton Lodge causing congestion.	A1 West of Newcastle Bypass RBS
85	J67 - J66 J66 - J77	Constraint	Allerdene Bridge is a concern for long term serviceability.	A1 West of Newcastle Bypass RBS
86	J66	Institutional	LRN node.	A1 West of Newcastle

ID	Location	Type	Challenge	Source
				Bypass RBS
87	J66	Network Operation	Extensive queuing on approach from Durham Road South in AM peak. Queues are expected to increase. In future, queuing back from AM mainline to the south is predicted to impact on the junction operation.	A1 West of Newcastle Bypass RBS; A1 Adonis Infrastructure Study
88	J66 -J65 J65 - J66	Environment	Bowes Railway Scheduled Monument.	English Heritage
89	J66 - J65	Network Operation	4000+ Average Monthly Vehicle Hour Delay per km. >10% reduced capacity hours. Heavy weaving. Delays expected to increase in future. Queuing back from Lookout Lake roundabout in PM peak.	A1 West of Newcastle Bypass RBS
90	J66 - J65	Safety	2 KSI 2008 to 2010. 9 pedestrian incidents.	A1 West of Newcastle Bypass RBS
91	J65 - J66	Safety	Over 3 KSI 2008 to 2010.	A1 West of Newcastle Bypass RBS
92	J65 - J66	Network Operation	Flow breakdown occurs in the AM at the merge. Demand from A1231 and A1(M) exceed available capacity.	A1 West of Newcastle Bypass RBS; A1 Adonis Infrastructure Study
93	J65	Network Operation	Extensive queues on A1231 in AM peak from merge. Queuing back from A1231 Lookout Lake Roundabout onto mainline in PM peak.	A1 West of Newcastle Bypass RBS; A1 Adonis Infrastructure Study
94	J65 - J64	Network Operation	Merge from A194(M) is predicted to become problematic in future.	A1 West of Newcastle Bypass RBS; A1 Adonis Study
95	J64 - J65	Network Operation	3000-4000 Average Monthly Vehicle Hour Delay per km, with queuing back from merge. County Durham development is likely to increase the issues.	A1 West of Newcastle Bypass RBS
96	J64 - J65	Safety	2.25 - 3 RTC per km.	A1 West of Newcastle Bypass RBS
97	J64	Institutional	LRN node.	
98	J64	Network Operation	Queuing back from Birtley merge extends back onto Washington Highway.	A1 West of Newcastle Bypass RBS; A1 Adonis Infrastructure Study
99	J63 - J64	Network Operation	2000 -3000 Average Monthly Vehicle Hour Delay per km, due to queuing back from Birtley.	A1 West of Newcastle Bypass RBS
100	J63	Institutional	LRN node.	A1 West of Newcastle Bypass RBS
101	J63 - J64	Safety	9 Pedestrian incidents, 2008 - 2009	A1 West of Newcastle Bypass RBS
102	J63	Institutional	LRN node	
103	J63	Network Operation	Queuing on approaches from Chester-le -Street in AM peak	A1 West of Newcastle Bypass RBS; A1 Adonis Infrastructure Study
104	J63 - J62 J62 - J63	Constraints	River Wear	
105	J63 - J62 J62 - J63	Environmental	Lambton Castle Gardens.	A1 West of Newcastle Bypass RBS; A1 Adonis Infrastructure Study

ID	Location	Type	Challenge	Source
106	J62	Institutional	LRN node.	
107	J62	Network Operation	Queuing on approaches from Durham in AM peak. This will be exacerbated by developments in Durham, however a mitigation scheme is proposed for the junction.	A1 West of Newcastle Bypass RBS; A1 Adonis Infrastructure Study

Table 5-1 Route Challenges and Issues

5.4 Underlying cause of problems

5.4.1 The spatial distribution of development and activity chains which give rise to the need to move within the corridor are the fundamental driver of travel demand generally, and hence the ultimate underlying cause of the key issues along the route.

5.4.2 The A1 NGWB, by its very presence, has fostered patterns of activity, development and hence movement on the west side of the Tyne and Wear conurbation which rely upon the accessibility it provides. Although a relatively recent road, with the Newcastle Western Bypass only opening in 1990, these patterns are firmly entrenched. Cutting through the urban area, it was always going to play a variety of roles, from strategic to local, and has come to act as a spine road for new development and largely as a local road.

5.4.3 Population and economic growth in the region requires additional housing and employment land to be identified. Access to the SRN is a key factor in investment decisions, hence the attractiveness of sites along the corridor. The locations which are available and most attractive for such development are located along, or to the west of the corridor, meaning that for many trips to access the key employment areas, and other facilities, people must use, or at least traverse, the corridor, increasing this cycle of dependence.

5.4.4 The imperative for more employment, housing provision and economic growth could serve to reinforce and encourage this pattern of development. It is notable how development locations throughout Tyne and Wear tend to cross the orbital A19/A1/194(M) box. These patterns of development, and hence activity and movement could, without complementary measures, ultimately consume any additional capacity provided. This was the key concern outlined by the Secretary of State in 2003.

5.4.5 Without sensitive design and provision for alternatives to travel by car, or travel at all, for the new developments, the situation will deteriorate. Under these circumstances, and given the level and distribution of development proposed, even if additional capacity were to be provided, the betterment achieved would be short lived. This echoes the concern expressed by the Secretary of State that any additional capacity provided on the A1 NGWB would be taken by local traffic avoiding local congestion issues, and therefore resulting in little benefit for strategic traffic.

5.5 Summary and Conclusions

5.5.1 The review of current and future conditions which will affect the A1 NGWB have led to the summary of specific problems shown in Table 5.1 and Appendix A. In general the conclusions are that:

- Given the current spatial pattern of development, and the demand for travel associated with it, the road in its current form is incapable of meeting the demands placed upon it presently.

- The distribution of future planned development will reinforce these patterns increasing the importance of the A1NGWB as a key *local* artery within the city of Newcastle and Borough of Gateshead.

- Resolving the conflict between the different roles, from local rat-run through to strategic highway is essential to achieving an optimal outcome. Should it be managed as a local road, with a residual strategic function, or should the – comparatively small in number – strategic users be prioritised?

- Problems with the road design exacerbate the problems associated with excess demand.

- It is clear that given the current issues, future development plans and the criticality of the corridor in providing reliable accessibility to enable and foster robust economic growth, that intervention is required.

6 Refined Study Objectives and Area

6.1 Introduction

6.1.1 Chapter 5 summarised the problems experienced in the A1 NGWB corridor and established the need for intervention. Chapter 6 sets out the overall objectives that any such intervention should aim to satisfy.

6.1.2 Along with identified issues these objectives will guide the sifting and assessment of options during Stage 2 of the study.

6.2 Setting the objectives

6.2.1 It is clear from the national policy context through to the concerns of local stakeholders that the key overriding concern for the region is supporting economic growth. Also highlighted in the issues and challenges are those related to other strategic objectives, such as the environment, and national policy objectives related to the social and distributional impacts of interventions.

6.2.2 The next level of objectives, termed intermediate objectives, relate to how the strategic objectives might be delivered, and provide building blocks for them.

6.2.3 Supporting all these objectives are the operational objectives related to the performance of the A1 NGWB itself, informed by the current performance of the corridor. This issue is seen, in particular, by stakeholders as being a major constraint on economic development in the area. More specifically, the current operational issues associated with the A1 NGWB are currently seen as an impediment to development proposals that would bring jobs to the area, and provide additional housing stock: a situation that is likely to deteriorate with predicted traffic growth, itself generated by the proposed developments.

6.2.4 It is in this context that the high level objectives for the study have been established. These are shown in Table 6.1

Objective Type	Objective	Description
Strategic	Facilitating Economic Growth – Jobs	Supporting the role of the A1 NGWB in facilitating job creation and the attractiveness and delivery of current and potential employment locations in the corridor and wider region. In line with SEP – "More and Better Jobs".
	Facilitating Economic Growth – Housing	Supporting the role played by A1 NGWB in facilitating housing developments in the corridor and wider region.
	Facilitating Economic Growth – Freight	Maintaining and enhancing the role of corridor in facilitating the movement of goods, and access to transport hubs, in particular ports and airports.

	Social and Distributional – Air Quality	Maintaining air quality with regard to European legal standards.
	Social and Distributional – Accessibility	Maintaining and improving accessibility to jobs, housing and key services, with due regard to the needs of non-car users.
	Social and Distributional – Disadvantage, Diversity and Equality	Actively challenging patterns of disadvantage and ensuring that interventions take account of the needs of protected groups in potentially affected communities in line with Highways Agency Public Sector Equality objectives.
	Environment	Any interventions must be cognisant of the urban and rural environment the corridor passes through and its special features, as well as national environmental objectives and imperatives.
Intermediate	Release of Development sites	Mitigation of the constraints placed on specific sites by issues of accessibility and transport system capability.
	Optimal targeting of resources	Ensuring that any proposed interventions are targeted to best contribute to the strategic objectives, optimising the benefit from any allocation of scarce resources.
	Integration with the Local Road Network	Ensure that interventions on the SRN work in concert with interventions on the LRN, to achieve the best possible outcomes for all.
	Multimodal Optimisation	Meeting the derived demand for transport within and traversing the corridor in the optimal way, maximising the use of alternatives to the private car, so as to improve the balance of demand for roadspace and the available supply.
	Strategic versus Local Road	Have due regard to the role that the corridor plays in terms of Local versus Strategic link versus connectivity, considering priorities and appropriateness of intervention accordingly.
Operational	Reduce Delay	Reduction in delays that occur in the corridor towards benchmark levels.
	Improve Safety	Reduction in collisions, in particular incidents involving pedestrians.

	Increase Resilience	Reduction in the impact that perturbations of any kind cause to the transport system. Maintain the condition of the asset.
	Increase Reliability	Reduction in the variability in journey times in the corridor.

Table 6-1: Initial Study Objectives

6.2.5 These objectives are subject to review following stakeholder consultation. In particular, it is noted that ‘capacity’ is not an objective, as this would at this stage pre-empt the consideration of interventions that will be considered in Stage 2 of the study.

6.3 Geographic Area

6.3.1 The proposed geographical extent for Stage 2 of the study encompasses the road corridor itself, between J62 Carrville and J80 at Seaton Burn, as well as the local road approaches. Also proposed for inclusion are the two key trip generators adjacent to the corridor, namely Team Valley and the Metrocentre, and the Tyne Crossing at Scotswood Bridge, as this has an important symbiotic relationship with the A1 Blaydon Bridge, in terms of trip tidality and route choice.

6.3.2 The study at this stage will concentrate on the road corridor itself, however, should large scale schemes be identified as possibilities, it will be required under Webtag guidance to consider the wider impacts, as well as redistribution and generations, which would require the use of a strategic level analysis and model.

6.3.3 It is noted that the vast majority of journeys using the A1 NGWB are local or regional trips, with only 2% of vehicles passing through J65 Birtley continuing through to J80 Seaton Burn.

6.3.4 It is necessary to take an integrated corridor approach, rather than looking individually at nodes and links, as given the short distance between interchanges, interventions in one section will impact both upstream and downstream as well as the LRN. For example, the slips and merge/diverges at Askew Road would work effectively were it not for the proximity of the Lobley Hill interchange.

7 Conclusions and Recommendations

7.1 Introduction

7.1.1 This report represents the culmination of the first stage of a three stage process to develop proposals to mitigate issues and challenges identified along the A1 GNWB, which runs between J65 at Birtley, through to J80 at Seaton Burn. The study also considers the A1(M) immediately to the south, through to J62 at Carville.

7.1.2 This report has identified the issues and challenges experienced along the corridor which, if mitigated or resolved, could potentially unlock opportunities for economic development and growth. This is considered in terms of potential sites for commercial and housing development. It has done this by looking at the historical context, current situation and potential future circumstances.

7.1.3 These have been drawn together to identify the need for intervention, and subsequently set the objectives for any proposed interventions that are identified in the identification, sift and assessment of options in the next stage of the study.

7.2 Stage 1 Conclusions

7.2.1 The corridor has been the subject of a number of studies over recent years, and a number are ongoing. These studies have established the importance of the A1 NGWB in assisting the economic performance of the region and led to a number of potential improvements to the highway network, particularly the A1 Lobley Hill to Dunston Scheme (incorporating extensions to Coalhouse and Metrocentre), which commenced construction in August 2014.

7.2.2 The conclusions from the Stage 1 review of the current and future situation in areas relevant to the A1 NGWB are that:

- National, regional and local policies and strategies consider that the A1 NGWB, and improvements to the route, are fundamental to the economic performance of the region;
- Travel demand data shows that more than 95% of journeys on the A1 NGWB are to, from or within the surrounding area, rather than long-distance trips, emphasising the importance of the route for local and regional journeys;
- Given the current spatial pattern of development, and the demand for travel associated with it, the road in its current form is incapable of meeting the demands placed upon it presently;
- There are significant development plans in Durham, Gateshead, Newcastle and Northumberland which will have an impact on travel demand on the A1 NGWB;
- There are committed highway schemes, principally the Lobley Hill to Dunston Improvement Scheme and the Seaton Burn Pinch Point Scheme, which will address some of the current and future problems on the A1 NGWB;

- Without intervention, conditions on other parts of the A1 NGWB will deteriorate, particularly south of Coalhouse to Birtley and between Scotswood and Ponteland Road to the north of the river;
- Consideration is being given to potential major public transport improvements, such as extensions to the Metro system and reopening of the Leamside Line, which could potentially have an impact on travel demand on the A1 NGWB; but
- In general, committed plans for changes to the transport network are not commensurate with the increase in demand expected due to development and background growth.

7.2.3 It is clear, therefore, that given the current issues, future development plans and criticality of the corridor in providing reliable access to enable and foster robust economic growth, that intervention is required.

7.3 Recommendations

7.3.1 This report, details the first stage of this study, and is commensurate with Transport Appraisal Process Steps 1- 5. It has summarised the challenges and issues pertaining to the corridor, and set objectives by which potential interventions can be assessed.

7.3.2 The recommendations for the next steps are that:

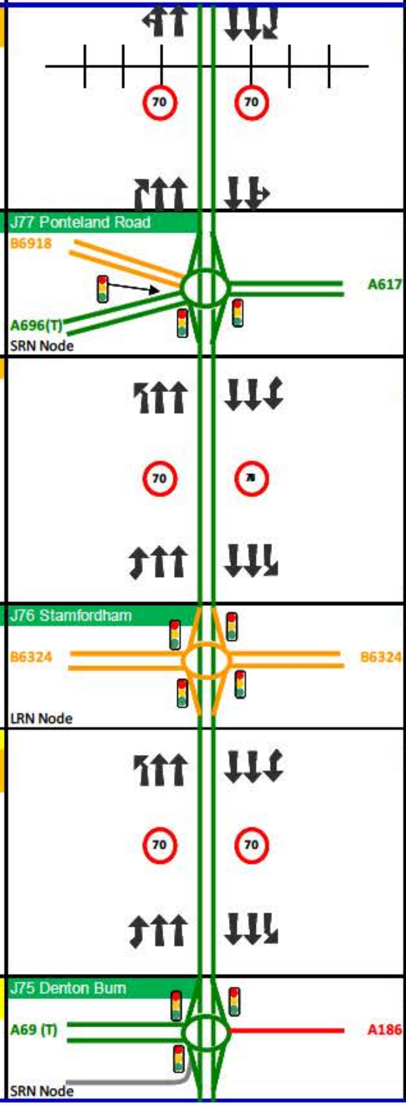
- The issues and problems identified in Chapter 5, and supported by Table 5.1 and Appendix A, are considered in drawing up a long list of options/interventions in Stage 2 of the study; and
- That the resultant long list of options is assessed against the identified issues/problems and the objectives presented in Chapter 6 of this report.

Appendix A

Node & Link Summary

- No/Minor Issue
- Historic/Environmental Constraint
- Moderate Issue
- Committed Scheme
- Major Issue

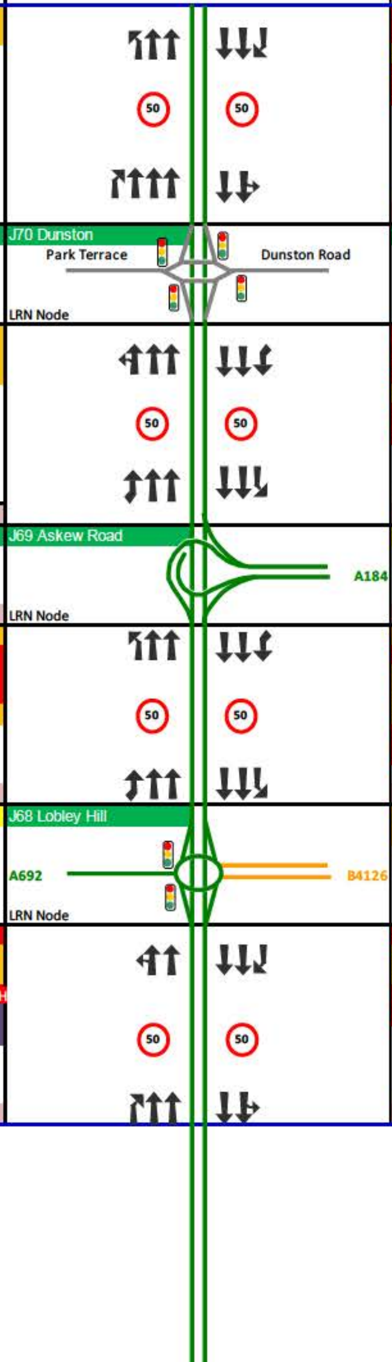
Northbound - 2020 committed	Northbound - Current		Southbound - Current	Southbound - 2020 committed
No notable issues	No notable issues		No notable issues	No notable issues
Additional demand to Cramlington - negating pinch point gain	Peak Queuing back from Roundabout onto mainline *Seaton Burn Pinch Point Scheme*	J80 Seaton Burn A19 (T) SRN Node	Congestion at Fisher Lane Roundabout *Seaton Burn Pinch Point Scheme*	Additional demand from Cramlington - negating pinch point gain
No notable issues	No notable issues AADT 27500	70 70	No notable issues AADT 27200	Affected by traffic volume and queuing back from North Brunton Merge in AM peak; Traffic queuing back from A1056 in PM peak
Increased traffic to/from Great Park dev. Roundabout and slip affected by queuing back from A1056 in PM peak	No notable issues	J79 North Brunton A1056 B1318 LRN Node	Queuing back from A1056 in PM Peak	Queue back from A1056 expected to impact roundabout at North Brunton
Delays likely to increase due to development traffic Large volumes leaving to Great Park	Poor Air Quality 7 Pedestrian Incidents 60-100 incidents involving a lane closure AADT 37300 (RIU sector is J77-J79)	70 70	2000 - 3000 Average Monthly Vehicle Hour Delay Flow Breakdown at Merge in AM Peak AADT 36600 (RIU sector is J77-J79)	Delay likely to increase to next threshold level Flow breakdown in AM likely to propagate back to next link
Queues on approaches in peak		J78 Kingston Park Kingston Park Road Kingston Park Road LRN Node	No notable issues	Queues on approaches in peak



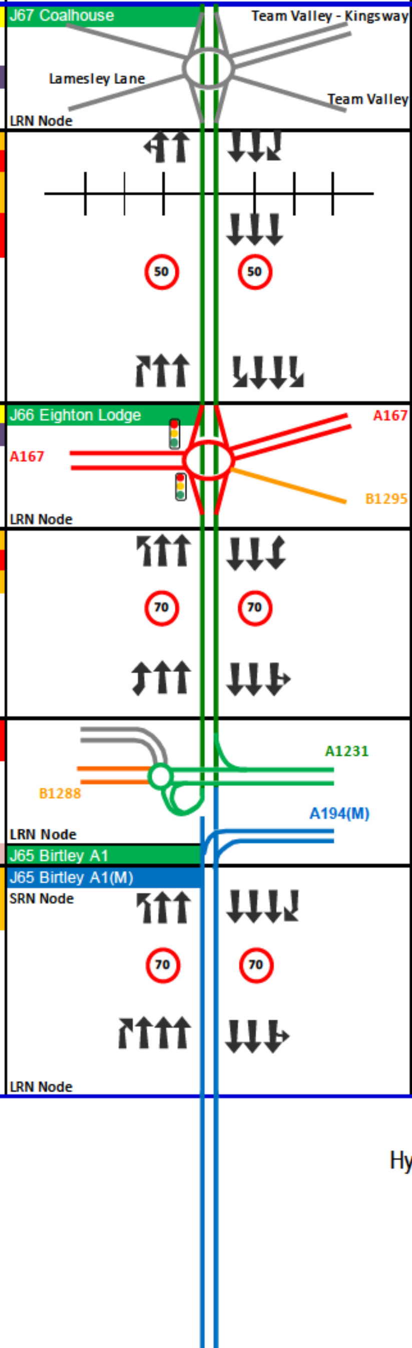
Northbound - 2020 committed	Northbound - Current	Southbound - Current	Southbound - 2020 committed
Development likely to increase delay to next threshold level	Poor Air Quality 60-100 incidents involving a lane closure Fawdon Metro Bridge AADT 37300 (RIU sector is J77-J79)	2000 - 3000 Average Monthly Vehicle Hour Delay per km Flow Breakdown at Merge in AM Peak Fawdon Metro Bridge AADT 36600 (RIU sector is J77-J79)	Delay likely to increase to next threshold level
Severe queuing on approach from A696 in both peaks related to Callerton and Airport Developments	No notable issues	No notable issues	Severe queuing on approach from City in PM peak related to Callerton and Airport Developments
Increased demand at developments on A696	60-100 incidents involving a lane closure 42700 AADT (RIU sector is J76 - J77)	2000 - 3000 Average Monthly Vehicle Hour Delay per km Flow Breakdown at Merge in AM Peak 41700 AADT (RIU sector is J76 - J77)	Delay likely to increase to next threshold level increase demand from developments from A696
No notable issues	No notable issues	No notable issues	Queuing in PM in approach
Delay likely to increase to next threshold level	2000 - 3000 Average Monthly Vehicle Hour Delay per km 2 KSI 2008-2010 Flow Breakdown at Merge in AM Peak 47100 (AADT RIU sector is J75 -- J76)	2000 - 3000 Average Monthly Vehicle Hour Delay per km Poor Air Quality 46300 AADT (RIU sector is J75- J76)	Delay likely to increase, propagating back from next section
Extensive queuing on A69 - extending further Impacted by development at Callerton	Extensive queue on A69 in both peaks Safety issue with very minor road joining slip road	Extensive queue on A186 in both peaks	Extensive queuing on A186 - extending further Impacted by development at Callerton

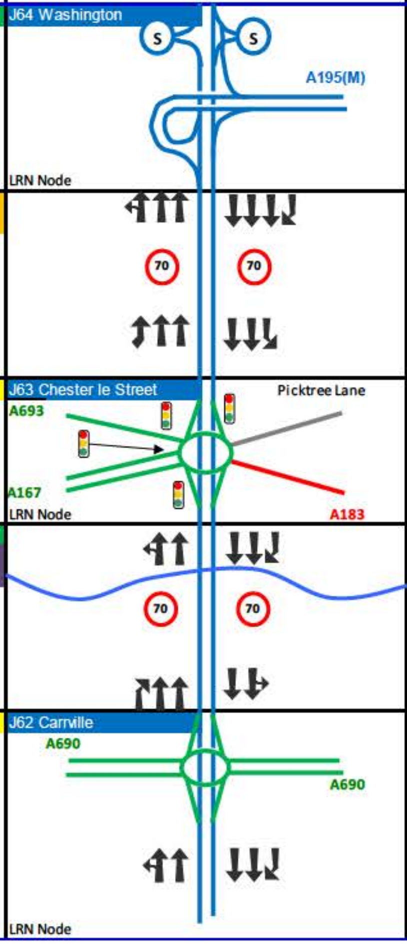
Northbound - 2020 committed	Northbound - Current		Southbound - Current	Southbound - 2020 committed
Delay likely to increase to next threshold level conditions related to incidents remain	2000 - 3000 Average Monthly Vehicle Hour Delay per km 2.25 - 3 RTC per km Poor Air Quality 60-100 incidents involving a lane closure Short weaving section on curved alignment Concrete walled cutting Hadrian's Wall World Heritage Site 46700 (RIU sector is J74 - J75)	70 70	3000 - 4000 Average Monthly Vehicle Hour Delay Over 3 RTC per km Short weaving section, on curved alignment Concrete walled cutting - affects visibility Flow Breakdown at Merge in AM Peak Hadrian's Wall World Heritage Site Denton Dene LNR 45200 AADT (RIU sector is J74 - J75)	Delay likely to increase to next threshold level
Queuing back from merge/weaving section Likely to increase to next threshold level	No notable issues	J74 Scotswood A695 A6085 LRN node	Queuing back from A695 slip AM peak	Queuing back from slip - extending back to mainline
Delay propagating from merge at Spotswood Likely to increase to next threshold level	2000 - 3000 Average Monthly Vehicle Hour Delay per km Blaydon Bridge - River Tyne AADT 43000 (RIU sector is J73 - J74)	70 70	4000+ Average Monthly Vehicle Hour Delay 7.5-10% reduced capacity hours Poor Air Quality Blaydon Bridge - River Tyne AADT drop compared to NB suggests behavior to avoid worse congestion on SB carriageway. AADT 34800 (RIU sector is J73 - J74)	Average Monthly Vehicle Hour Delay decreases due to Metrocentre - Coalhouse scheme
No notable issues	No notable issues	J73 Derwenthaugh A694 LRN Node A694	No notable issues AADT drop compared to NB suggests behavior to avoid worse congestion on SB carriageway.	No notable issues
Delay propagating from merge at Spotswood Likely to increase to next threshold level	2000 - 3000 Average Monthly Vehicle Hour Delay per km Shibdon Pond SSSI Derwenthaugh Bridge - River Derwenthaugh AADT 48500 (RIU sector is J69 - J73)	50 50	4000+ Average Monthly Vehicle Hour Delay 7.5-10% reduced capacity hours Poor Air Quality 18 Pedestrian Incidents Derwenthaugh - Askew Road 60-100 incidents involving a lane closure Derwenthaugh Bridge - River Derwenthaugh AADT 42100 (RIU sector is J69 - J73	Average Monthly Vehicle Hour Delay decreases due to Metrocentre - Coalhouse scheme Pedestrian issues assumed to be mitigated by Metrocentre - Coalhouse scheme
No notable issues	No notable issues	J72 Swalwell B6317 LRN Node	No notable issues	No notable issues
Lane drop at Swalwell causing congestion. more traffic allowed through to this point by Lobley Hill scheme	2000 - 3000 Average Monthly Vehicle Hour Delay per km Very High Flows v. benchmark Poor Air Quality AADT 48500 (RIU sector is J69 - J73)	50 50	4000+ Average Monthly Vehicle Hour Delay 10%+ Reduced Capacity Hours <50% On-time reliability Poor Air Quality 18 Pedestrian Incidents Derwenthaugh - Askew Road 100+ incidents involving a lane closure AADT 42100 (RIU sector is J69 - J73)	Average Monthly Vehicle Hour Delay decreases due to Lobley Hill scheme Safety issues assumed to be mitigated by Metrocentre - Coalhouse scheme
AM increased queuing on Hollinside Road	AM Peak Queuing on Hollinside Road	J71 Metrocentre Hollingside Road LRN Node	No notable issues	Junction over capacity increase demand due to Metrogreen

Northbound - 2020 committed	Northbound - Current		Southbound - Current	Southbound - 2020 committed
Delays propagating from lane drop at Swalwell	V High Flows v. benchmark 2000 - 3000 Average Monthly Vehicle Hour Delay AADT 48500 (RIU sector is J69 - J73)		4000+ Average Monthly Vehicle Hour Delay 10%+ Reduced Capacity Hours Poor Air Quality 18 Pedestrian Incidents Derwenthaugh - Askew Road 100+ incidents involving a lane closure AADT 42100 (RIU sector is J69 - J73) *Metrocentre - Coalhouse Scheme*	Average Monthly Vehicle Hour Delay decreases due to Metrocentre - Coalhouse scheme Safety issues assumed to be mitigated by Metrocentre - Coalhouse scheme
Junction over capacity	No notable issues Recent Scheme provided 3 narrow through lanes	J70 Dunston Park Terrace Dunston Road LRN Node	No notable issues	Increased demand and queues related to Metrogreen on Dunston Road
Delays propagating from lane drop at Swalwell	V High Flows v. benchmark 2000 - 3000 Average Monthly Vehicle Hour Delay Poor Air Quality AADT 48500 (RIU sector is J69 - J73) *Metrocentre - Coalhouse Scheme*		4000+ Average Monthly Vehicle Hour Delay 10%+ Reduced Capacity Hours <50% On-time reliability Poor Air Quality 18 Pedestrian Incidents Derwenthaugh - Askew Road 100+ incidents involving a lane closure AADT 42100 (RIU sector is J69 - J73) *Metrocentre - Coalhouse Scheme*	Queuing back from Maingate Roundabout impact Askew Road - Development at Team Valley Safety issues assumed to be mitigated by Metrocentre - Coalhouse scheme
No notable issues	No notable issues *Metrocentre - Coalhouse Scheme*	J69 Askew Road A184 LRN Node	Queuing back on A184 at peak times *Metrocentre - Coalhouse Scheme*	Queuing back from Maingate Roundabout impact Askew Road - Development at Team Valley
Monthly Delay reduced due to Coalhouse - Metrocentre scheme	Very High Flows 4000+ Average Monthly Vehicle Hour Delay <50% On-time reliability Over 3 RTC per km Poor Air Quality AADT 52500 (RIU sector is J68 - J69) *Metrocentre - Coalhouse Scheme*		Very High Flows 4000+ Average Monthly Vehicle Hour Delay 7.5-10% reduced capacity hours 2.25-3 RTC per km Poor Air Quality 7 Pedestrian Incidents 100+ incidents involving a lane closure AADT 55100 (RIU sector is J68 - J69) *Metrocentre - Coalhouse Scheme*	Queuing back from Maingate Roundabout impacting on mainline - Development at Team Valley Overspill queue has safety implications
Queuing back through roundabout from Maingate	Extensive queuing on A692 at peak times Recently signalised - bus priority scheme	J68 Lobley Hill A692 B4126 LRN Node	Extensive queuing to/from B4126 at peak times - Queuing from Maingate Roundabout in Team Valley Recently signalised - bus priority scheme	Roundabout over capacity, Queuing back through roundabout from Maingate Roundabout
Monthly Delay reduced due to Coalhouse - Metrocentre scheme	4000+ Average Monthly Vehicle Hour Delay 2 KSI 2008-2010 Eighton Lodge - Lobley Hill 6 Pedestrian Incidents Eighton Lodge - Lobley Hill 100+ incidents involving a lane closure Eighton Lodge - LH Scheduled Monument - Ravensworth Coal Mill Grade II Listed Building - South Lodge AADT 44300 (RIU sector is J66 - J68) *Metrocentre - Coalhouse Scheme*		4000+ Average Monthly Vehicle Hour Delay 7.5-10% reduced capacity hours 2 KSI 2008-2010 17 Pedestrian Incidents Lobley Hill - Eighton Lodge 100+ incidents involving a lane closure AADT 46100 (RIU sector is J66 - J68) *Metrocentre - Coalhouse Scheme*	Queuing back from lane drop at Coalhouse



Northbound - 2020 committed	Northbound - Current	Junction / Link	Southbound - Current	Southbound - 2020 committed
Queuing on Lamesley Lane increases	Extensive Queue on Lamesley Lane in AM LNMS scheme for partial part time signalisation has been designed River Team	J67 Coalhouse LRN Node	Extensive queuing on Kingsway in PM peak LNMS scheme for partial part time signalisation has been designed River Team	Queuing on Kingsway increase - development at Team Valley. LNMS scheme not committed
Monthly Delay reduced due to Coalhouse - Metrocentre scheme	V High Flows v. Benchmark 4000+ Average Monthly Vehicle Hour Delay 2 KSI 2008-2010 Eighton Lodge - Lobley Hill 6 Pedestrian Incidents Eighton Lodge - Lobley Hill 100+ incidents involving a lane closure EL -LH Allerdene Bridge maintenance/replacement issue AADT 44300 (RIU sector is J66 - J68)		4000+ Average Monthly Vehicle Hour Delay 7.5-10% reduced capacity hours 2 KSI 2008-2010 17 Pedestrian Incidents Lobley Hill - Eighton Lodge 100+ incidents involving a lane closure Allerdene Bridge maintenance/replacement issue Climbing Lane Gain and drop AADT 44300 (RIU sector is J66 - J68)	Monthly Hour Delay increases
Queues on Durham Road increase markedly	Extensive queuing on Durham Road in AM Park - RA west Scheduled Monument - Bowes Railway	J66 Eighton Lodge LRN Node	No notable issues - roundabout east Mainline Lane Drop through junction causes issues Scheduled Monument - Bowes Railway RA RA ML ML	Queuing now occurs through to Durham Road
Weaving, and hence safety issues remain	Very High Flows v. Benchmark Over 3 KSI 2008-2010 Heavy Weaving AADT 51200 (RIU sector is J65 - J66)		Very High Flows v. Benchmark 4000+ Average Monthly Vehicle Hour Delay 10%+ Reduced Capacity Hours 2 KSI 2008-2010 9 Pedestrian Incidents Heavy Weaving AADT 47300 (RIU sector is J65- J66)	Monthly Hour Delay increases
Problematic Merge remains associated issues worsen	Problematic Merge AM Peak queuing back onto Sunderland Highway *Merge configuration currently being investigated*	LRN Node J65 Birtley A1	PM queuing back from Sunderland Highway Turbulence on merge from A194(M)	Queuing back from Sunderland Highway affecting mainline
Queuing back from Birtley Merge increases	3000 - 4000 Average Monthly Vehicle Hour Delay 2.25-3 RTC 2008 - 2010 Extensive queue in AM peak from Birtley Merge AADT 38500 (RIU sector is J64 - J65)	J65 Birtley A1(M) SRN Node LRN Node	No notable issues AADT 42900 (RIU sector is J64 - J65)	Increased turbulence on section, merge from A194(M) becomes problematic





Northbound - 2020 committed	Northbound - Current		Southbound - Current	Southbound - 2020 committed
Queuing back from Birtley merge impact on Washington Highway	No notable issues	J64 Washington A195(M) LRN Node	No notable issues	No notable issues
Queuing back from Birtley Merge increases	2000 - 3000 Average Monthly Vehicle Hour Delay 9 Pedestrian Incidents AADT 40200 (RIU sector is J63 - J64	70 70	No notable issues AADT 41500 (RIU sector is J63 - J64	No notable issues
Increased Development in Chester-le-Street	Queuing on approaches AM peak	J63 Chester le Street Picktree Lane A693 A167 A183 LRN Node	No notable issues	No notable issues
No notable issues	No notable issues Grade II listed - Lambton Castle Gardens River Wear No RIU data available	70 70	No notable issues Grade II listed - Lambton Castle Gardens Lindly Wood Remains of Coal Workings River Wear No RIU data available	No notable issues
Residential biased development in Durham increases commuter flows to Regional Centre	Queuing on approaches AM peak	J62 Carrville A690 A690 LRN Node	No notable issues	No notable issues

Appendix D

WALKING, CYCLING AND HORSE RIDING ASSESSMENT REVIEW

A1

Birtley to Coal House Scheme

PCF Stage 3

Walking, Cycling and Horse Riding Assessment and Review

Registered office Bridge House, 1 Walnut Tree Close, Guildford, GU1 4LZ
Highways England Company Limited registered in England and Wales number 09346363

November 2018

A1 BIRTLEY TO COALHOUSE SCHEME

PCF STAGE 3 (PRELIMINARY DESIGN)

WALKING, CYCLING AND HORSE RIDING ASSESSMENT AND REVIEW

Highways England

Date: November 2018

Project no:

HE PIN: 551462
WSP Ref: 70041947

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QUALITY MANAGEMENT

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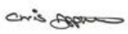
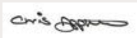
Signature				
Checked by	Simon Pratt	Simon Pratt		
Signature				
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Signature				
Project number	PIN: 551462 WSP ref: 70015226			
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File reference	70041947			

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APPENDICES

1. INTRODUCTION

1.1 OVERVIEW AND DOCUMENT STRUCTURE

WSP have been appointed by Highways England to act as a supplier for the Project Control Framework (PCF) Stage 3 (Preliminary Design) of the proposed A1 Birtley to Coalhouse scheme to undertake a walking, cycling and horse-riding assessment for the scheme.

The Design Manual for Roads and Bridges (DMRB) Volume 5, Section 2, Part 5 (HD42/17) sets out current national guidance on the procedures required to implement Walking, Cycling & Horse-Riding Assessment and Review (WCHAR) for highway schemes on the motorway and all-purpose trunk road network. The advice was updated in May 2017 following introduction of the Highways England Strategic Business Plan and Road Investment Strategy (RIS) in addition to the Infrastructure Act 2015 formally coming into force. These policy changes informed the development of HD42/17 which now fully reflects Government desire to encourage walking, cycling and horse-riding in order to support the promotion of sustainable travel modes. This document also sets out the necessary structure for WCHAR reports.

1.2 DOCUMENT PURPOSE, SCOPE AND VERSIONS

The purpose of a WCHAR is to facilitate the inclusion of all walking, cycling & horse-riding modes within the highway scheme design process from an early stage, enabling the design team to identify opportunities for improved facilities and integration with local, regional or national networks through the design process.

HD42/17 has formally superseded the assessment process previously established within DMRB Volume 5, Section 2, Part 5 (HD42/05) Non-Motorised User Audit and the subsequent Interim Advice Note 143/11: Supplementary Advice and Requirements for the provision for Non-Motorised Users and Accessibility during Planning, Construction and Handover of Improvement Schemes.

The proposed scheme has been assessed and it is considered that it will have a significant impact on the future operation of the strategic and local highway networks. The application of HD 42/17 Walking, Cycling & Horse-Riding Assessment and Review is, therefore, appropriate with the A1 Birtley to Coalhouse widening proposal qualifying as a ‘large’ scheme in accordance with the definition below (from Paragraph 2.7 of HD 42/17):

A large scheme – highway schemes comprising new road construction (including new motorways where applicable), significant changes to an existing all-purpose trunk road or significant changes to an urban environment consisting of both the trunk road network and local highway network. In addition, any scheme aimed principally at providing a dedicated facility for pedestrians, cyclists or equestrians or a scheme which includes such a facility as part of the original scope of works, shall be deemed to be a large scheme in the context of this process”.

Therefore the scheme will be subject to a Walking, Cycling & Horse-Riding Assessment (this document) during the preliminary design stage of the proposed highway scheme; this will then be followed by Walking, Cycling & Horse-Riding Reviews at the detailed design stages.

The A1 was designated in 1921 by the Ministry of Transport as part of the Great Britain Road numbering system, providing a strategic link between the cities of London and Edinburgh. The A1 is a major north-south route and forms part of the Highways England maintained Strategic Road

Network (SRN). It provides regional connectivity between Newcastle, Durham, Darlington (in the northeast), Wetherby, York and Leeds (in Yorkshire).

This is the first issue of the Walking, Cycling & Horse-Riding Assessment, issued at the beginning of PCF Stage 3 (Preliminary Design) of the A1 Birtley to Coalhouse scheme.

1.3 PROPOSED HIGHWAY SCHEME

The scheme forms part of the A1 Newcastle/Gateshead Western Bypass (NGWB), which is located on the A1 between J65 (Birtley) and J80 (Seaton Burn). It forms part of Highways England's strategic road network serving the metropolitan area of Tyne and Wear. The proposed scheme will be implemented between J65 (Birtley) and J67 (Coalhouse), which consists of approximately 4.2km of highway. The existing carriageways comprise:

- Northbound: Two lanes with a lane gain/lane drop between J65 (Birtley) and J66 (Eighton Lodge) and two lanes between J66 (Eighton Lodge) and J67 (Coalhouse). The existing speed limit is 50 mph throughout.
- Southbound: Two lanes between J67 (Coalhouse) and J66 (Eighton Lodge) with an additional climbing lane between Smithy Lane Overbridge and J66 (Eighton Lodge) and three lanes between J66 (Eighton Lodge) and J65 (Birtley). The existing speed limit is 50 mph between J67 (Coalhouse) and Smithy Lane Overbridge and 70 mph thereafter.

The A1 NGWB is one of the most congested highway links in the North-East Region with more than 110,000 vehicles using the route every day on the busiest section. As a result of this travel demand on the route there are a number of issues relating to: journey time delays; journey time reliability; route resilience; safety; environmental impacts and development pressures.

Improvements to the A1 NGWB have long been acknowledged as a requirement for economic growth in the region within both local and national policy documents and reflected in the consensus of opinion amongst regional stakeholders that something needs to be done to address the issues to facilitate the economic growth of the region. The route has been identified as a 'hot-spot' requiring Government investment to deliver infrastructure improvements.

Traffic in the region is forecast to grow in the future, largely due to a number of proposed development sites to be delivered through the Newcastle Approved Plan. This additional traffic demand will further exacerbate the issues on the A1 NGWB with traffic modelling work indicating the likely extent of the impacts.

In an attempt to fully understand and address the issues a number of studies have been undertaken in recent years and these include:

- TAMMS Multi Modal Study (2002);
- Access to Tyne and Wear DaSTS study (2010);
- North East DaSTS Strategic Connectivity Study Report (2010);
- Newcastle City Deal (2012);
- HA Pilot Based Strategy Report (2013);
- A1 Newcastle and Gateshead Western Bypass – Exploration of Dual 3-Lane Provisions Initial Infrastructure Report (2013);
- DRAFT Route-based strategy: Evidence Report London to Scotland East (February 2014);
- The Gateshead and Newcastle Council Core Strategy & Urban Core AAP Draft Infrastructure Delivery Plan has also been used, as well as the Appraisal Specification Report (ASR) for this feasibility study; and

- A1 Newcastle/Gateshead Western Bypass Feasibility Study (2014).

The Feasibility Study undertaken in 2014 followed Steps 1 to 10 of the Transport Appraisal Process (TAP) from the Transport Appraisal Guidance (TAG). Stage 1 of the Feasibility Study (Steps 1 to 4 of the TAP) included a comprehensive review of all of the previous studies outlined above to determine the existing issues on the route and prioritise the sections which most urgently needed attention.

Following the prioritisation of sections, Stage 2 (Steps 5 to 9 of the TAP) looked at developing interventions to address the issues highlighted in Stage 1. Interventions were processed through the Early Appraisal Sifting Tool (EAST) and the best performing interventions were put forward through the Options Appraisal Process and scheme cost estimates were produced by the Highways England Commercial Team.

At Stage 3 of the process (Step 10), a Strategic Outline Business Case (SOBC) was produced for the options which performed well at the Options Assessment Stage.

Stages 1 & 2 of the Feasibility Study identified the following sections of the route which should be given priority:

- J65 – J67 A1 Birtley to Coalhouse (including Allerdene Railway Bridge);
- J71 – J73 A1 Metrocentre to Derwenthaugh; and
- J74 – J79 A1 Scotswood to North Brunton.

At Stage 3, SOBC's were produced for the following schemes:

- J65 – J67 A1 Birtley to Coalhouse (including Allerdene Railway Bridge); and
- J74 – J79 A1 Scotswood to North Brunton.

Both schemes were announced in the Autumn Statement in December 2014 as schemes that should be taken forward into the Roads Investment Strategy (RIS).

The completion of the Feasibility Study concluded PCF Stage 0 (Strategy, Shaping and Prioritisation) for both schemes.

The A1 Birtley to Coalhouse scheme concluded PCF Stage 1 (Option Identification) in April 2016 and two options were considered at PCF Stage 2 (Option Selection). PCF Stage 2 (Option Selection) concluded in the July 2017 that "Option 1a with the offline replacement of Allerdene Bridge should be the recommended route" [2].

The proposed scheme involves online widening of the A1 within the study area to provide at least one additional lane in both carriageways to increase capacity. Under the proposals, Allerdene Railway Bridge will also be replaced approximately 60m south of its current location, continuing to use the existing structure to maintain two lanes of traffic while the new bridge is constructed. The height of which will be raised to meet current standards. Kingsway Viaduct will also be widened but no changes will be made at J67 (Coalhouse).

The scheme objectives will also ensure that conditions are improved (where practicable to do so) for active travel modes. Current crossing opportunities and associated infrastructure is fully appraised within this Walking, Cycling & Horse-Riding Assessment.

1.4 STUDY AREA

The extents of the study area considered within this report have been established by the Lead Assessor as shown in Appendix A. The assessment area broadly comprises the crossing opportunities over the A1 between J65 (Birtley) and J67 (Coalhouse), with the principal pedestrian, cycle and equestrian routes considered between these locations for completeness.

The overall study area has been sub-divided into the following sections, as shown in Appendix B, in order to facilitate detailed appraisal of the various routes and infrastructure available to pedestrians, cyclists and equestrians:

- Section 1 - Northside Overbridge
- Section 2 – Northside to North Dene Footway and the North Dene Footbridge
- Section 3 - North Dene to Longbank Footway and the Longbank Bridleway underbridge
- Section 4 - Longbank to Eighton Lodge Footway and the Eighton Lodge Interchange
- Section 5 - Smithy Lane overbridge and the Angel Cycleway/Chowdene Bank Bridge
- Section 6 - Coalhouse Interchange

The routes, connections, facilities, infrastructure, etc, that are available at each of these locations, are considered in detail within Section 2.8 Existing Pedestrian, Cyclist and Equestrian Facilities within the Local Area and Links to the Strategic Network.

2. PROJECT BACKGROUND

2.1 REVIEW OF WALKING, CYCLING & HORSE-RIDING POLICIES AND STRATEGIES

In order to inform the preparation of this Walking, Cycling and Horse-Riding Assessment, the following local and national policy/advice notes have been considered:

Local Policy and Advice Notes

- Tyne & Wear Local Transport Plan 3
- Gateshead Local Plan to 2030
- Planning for the Future - Core Strategy and Urban Core Plan for Gateshead and Newcastle upon Tyne 2010-2030'
- Gateshead Unitary Development Plan (UDP) - Remaining Saved Policies
- Making Spaces for Growing Places
- Gateshead Cycling Strategy

National Policy and Advice Notes

- Horses and Highway Surfacing – A Guidance Note for Highway Authorities
- DMRB Volume 2, Section 2, Part 8 (BD29/17) Design Criteria for Footbridges
- DMRB Volume 5, Section 2, Part 5 (HD42/17) Walking, Cycling & Horse-Riding Assessment and Review
- DMRB Volume 6, Section 3, Part 5 (TA90/05) The Geometric Design of Pedestrian, Cycle & Equestrian Routes

2.2 COLLISION DATA

Personal Injury Collision (PIC) data has been provided by Gateshead Council for strategic highway network and the local highway network within the extents of the study area, for the period 30th November 2012 to 1st December 2017, as shown in Appendix C. A review of the records has indicated that a total of 152 collisions were recorded of which:

- 0 was documented as being fatal in severity;
- 12 were documented as being serious in severity; and
- 140 were documented as being slight in severity.

A summary of the collisions statistics is presented at Table 1 below.

Table 1 - Collisions Summary (November 2012 - December 2017)

Table 1		Year							
		2012*	2013	2014	2015	2016	2017**	TOTAL	PERCENTAGE
Severity	Fatal	0	0	0	0	0	0	0	0%
	Serious	0	2	5	2	1	2	12	8%
	Slight	1	36	28	30	24	21	140	92%
TOTAL		1	38	33	32	25	23	152	100%

Gateshead Council

*Only one month worth of data.

**Only eleven months' worth of data.

The number of collisions during the 5 year period for the area extent shown is low. Across the study area a total of 152 PICs have been recorded, equating to an average of approximately 30 collisions per year. Table 1 demonstrates that 140 (92%) of the collisions were classified as slight in severity and the remaining 12 (8%) were classified as serious. There were no reported fatalities recorded over the preceding five year period under consideration.

Table 1, also, demonstrates that between 2012 and 2017 (for the full year periods) there has been an overall decline year on year for the number of collisions.

Furthermore, a breakdown showing collisions involving non-motorised users is outlined below:

- 5 were documented as involving pedestrians;
- 11 were documented as involving cyclists; and
- 0 were documented as involving horse-riders.

Coalhouse Interchange

At this junction, there has been a total of 3 incidents, which were classified as slight in severity. The incidents comprised of the following:

- Incident ref P396914: occurred during daylight and in wet/damp conditions, when a vehicle clipped a pedestrian walking eastward along Banesley Lane towards the A1, which caused them to stumble and fall over. Careless, reckless or in a hurry was cited as the main contributory factor.
- Incident ref 0056024: occurred during daylight and in dry conditions, when a vehicle cut in front of a cyclist at the A1 southbound slip road arm of the roundabout, causing the cyclist to fall from the bike. Both the driver and rider had entered the roundabout from Kingsway South with the cyclist intending to continue south whilst the motorist intended on going to the A1 southbound slip road. The main contributory factors which were attributed at the driver of the vehicle, included: Careless, reckless or in a hurry and poor turn or manoeuvre.
- Incident ref 0147102: occurred during darkness, where street lights were present and lit, along with wet/damp conditions, when a cyclist fails to see an overtaking vehicle and attempts to turn right. The nearside of the vehicle collides with the cyclist causing the rider to fall off and sustain injury. The riders' failure to look properly was listed as the main contributory factor.

St Andrew's Drive/Berkdale Road

At this junction, there has been a total of 1 incident, which was classified as serious in severity. The incident comprised of the following:

- Incident ref P641715: occurred during daylight and in dry conditions, when a pedestrian was struck by a vehicle reversing out of a driveway. Vehicles blind spot and failure to judge vehicle's path or speed were cited as the main contributory factors.

Hertford/ Trafford Mini Roundabout

At this junction, there has been a total of 1 incident, which was classified as slight in severity. The incident comprised of the following:

- Incident ref P691213: occurred during daylight and in dry conditions, when a pedestrian stepped into the path of a vehicle that had just turned left from Hertford. The contributory factor indicates that the pedestrian was careless, reckless or in a hurry.

A167 Durham Road

At this junction, there have been a total of 2 collisions, of which 1 was classified as serious and 1 was classified as slight in severity. The collisions comprised of the following:

- Incident ref P786415: occurred during darkness, where no street lighting was present, and in wet/damp conditions, when an intoxicated pedestrian stepped into the path of a vehicle which resulted in a collision. The main contributory factors indicate that the pedestrians; were wearing dark clothing at night, failed to judge the vehicle's path or speed and failed to look properly.
- Incident ref 0219733: occurred during daylight and in dry conditions, when two pedestrians jumped over the central reservation and ran into the road, directly into the path of a vehicle travelling south on the A167 Durham Road. The main contributory factors indicate that the pedestrians; failed to judge the vehicle's path or speed, carried out a dangerous action in carriageway and were careless, reckless or in a hurry.

Eighton Lodge Interchange

At this junction, there have been a total of 3 collisions, all of which were classified as slight in severity. The collisions comprised of the following:

- Incident ref P432913: occurred during daylight and in dry conditions, when a cyclist collided with a vehicle on the roundabout after the vehicle had pulled out from the A1 southbound slip exit. The driver's failure to look properly and to judge another vehicle's path or speed were cited as the main contributory factors.
- Incident ref P511414: occurred during daylight and in dry conditions, when a cyclist collided with a vehicle on the roundabout after the vehicle had pulled out from the A1 southbound slip exit. The main contributory factor cited was that the driver's vision was impaired by the glare from the sun.
- Incident ref 0199559: occurred during daylight and in dry conditions, when a cyclist collided with a vehicle on the roundabout after the vehicle had pulled out from the A1 southbound slip exit. The driver's failure to look properly was cited as the main contributory factor.

A167 Newcastle Bank

On this road, there have been a total of 2 collisions, all of which were classified as slight in severity. The incident comprised of the following:

- Incident ref P134415: occurred during daylight and in dry conditions, when a cyclist had been travelling south along the A167 Newcastle Bank, however the bike has skidded which resulted in the rider falling off. The rider being impaired by drugs (illicit or medicinal) was cited as the main contributory factor.
- Incident ref P799015: occurred during darkness, where street lights were present and lit, along with wet/damp conditions, when a vehicle turned right from Lamesley Road onto the A167 Newcastle Bank into the path of an oncoming cyclist which resulted in a collision. The driver's failure to look properly was cited as the main contributory factor.

A167 Newcastle Bank/Highfield

At this junction, there have been a total of 4 collisions, all of which were classified as slight in severity. The incident comprised of the following:

- Incident ref P640113: occurred during darkness, where street lights were present and lit, along with wet/damp conditions, when both a cyclist and a vehicle were travelling south on A167 Newcastle Bank. The vehicle passed the cyclist and turned left into Highfield, which resulted in the cyclist colliding with the nearside of the vehicle. Failed to look properly, failed to judge other person's path or speed, adverse weather conditions and a poor turn of manoeuvre are listed as the main contributory factors.
- Incident ref P639314: occurred during daylight and in dry conditions, when both a cyclist and a vehicle were travelling south on A167 Newcastle Bank. The vehicle passed the cyclist and turned left into Highfield, which resulted in the cyclist colliding with the nearside of the vehicle. A poor turn or manoeuvre, failed to look properly, distraction in vehicle and careless, reckless or in a hurry are listed as the main contributory factors.
- Incident ref 0073397: occurred during daylight and in dry conditions, when both a cyclist and a vehicle were travelling south on A167 Newcastle Bank. The vehicle passed the cyclist and turned left into Highfield, which resulted in the cyclist colliding with the nearside of the vehicle. A poor turn or manoeuvre, failed to look properly and passing too close to cyclist, horse riser or pedestrian are listed as the main contributory factors.
- Incident ref 0100328: occurred during daylight and in a dry conditions, when both a cyclist and a vehicle were travelling south on A167 Newcastle Bank. The vehicle passed the cyclist and turned left into Highfield, which resulted in the cyclist colliding with the nearside of the vehicle. The driver failing to look properly was cited as the main contributory factor.

The PIC records clearly demonstrate that the majority of collisions were caused as a result of driving with undue care and attention similarly cannot be attributed to inadequate highway design.

2.3 PUBLIC TRANSPORT SERVICES AND INTERCHANGE INFORMATION

Following a thorough review of the existing public transport services that are available within the study area, it is apparent that the key bus services set out at Table 2 are accessible to commuters.

Table 2 - Bus Services Accessible within the Study Area

Service Number	Accessible From	Service Origin	Service Destination
21 / N21 Angel	Birtley, Eighton Lodge	Newcastle	Durham
23 / 29	Birtley, Eighton Lodge, Gateshead, Team Valley	Washington/Gateshead	Birtley
90	Team Valley	Team Valley	Winlaton
92	Gateshead, Team Valley	Team Valley	Wardley
933	Team Valley	Team Valley	Winlaton
937	Birtley, Team Valley	Team Valley	Chester-Le-Street
939	Team Valley	Team Valley	Sunderland
Castle Express X21	Eighton Lodge	Newcastle	Bishop Auckland
Coaster 1 / 1A	Gateshead, Team Valley	Whitley Bay	Kibblesworth
GC1	Team Valley	Team Valley	Bensham
IndiGo 82	Birtley	Washington	Birtley
Loop 93 / 94 / 94A	Team Valley	Team Valley	Gateshead
Max X12	Birtley	Newcastle	Middlesbrough
TB14	Birtley	Birtley Circular	
Waggonway 28 / 28A / 28B	Birtley, Eighton Lodge, Team Valley	Newcastle	Chester-Le-Street
X22	Birtley, Team Valley	Metro Centre	Durham
X25	Birtley	Newcastle	Langley Park

2.4 KEY TRIP GENERATORS AND LOCAL AMENITIES

Within the extents of the study area under consideration, there are a number of key trip generators and local amenities which have been identified during the preparation of this Walking, Cycling and Horse-Riding Assessment, that could be attractive to non-motorised users. These facilities are set out below:

Key Trip Generators and Local Amenities

1) Parsons Industrial Estate
2) Armstrong Industrial Estate
3) Crowther Industrial Estate
4) Portobello Industrial Estate
5) Durham Road Trading Estate
6) Bowes Incline Hotel
7) Bowes Lake and Bassetts Pond
8) Bowes Manor Equestrian Centre
9) Angel of the North Livery Yard
10) Birtley Neighbourhood Retail Facilities on A167 Newcastle Bank
11) The Angel View Hotel
12) Angel of the North
13) Horse World
14) Sainsbury's and Argos
15) Team Valley Retail Park
16) Team Valley Industrial Park

Educational Facilities

P) Primary Schools
S) Secondary Schools

The plan in Appendix D shows the location of these attractors relative to the local and strategic highway network, within the study area considered by this Walking, Cycling and Horse-Riding Assessment.

2.5 SITE VISIT

A comprehensive site visit was undertaken by Simon Pratt (Lead Assessor), Chris Appleton (Assessor) and Ben Handley (Assessor) on Thursday 19th October 2017 between 10:00 and 20:00 during daylight conditions and also the hours of darkness. An assessment of the available facilities was made, whilst walking along the various pedestrian, cycle and equestrian routes available within the extents of the study area.

Other walking, cycling & horse-riding routes within the vicinity of the scheme, including National Cycle Network (NCN) Route 11 and 725, the Angel Cycleway, etc, were also visited during the course of the site visit. The level of use by each mode of travel and the general condition of the route (or specific piece of infrastructure) were recorded, with the potential for improvement, upgrade or new connections noted in relation to the study.

During the course of the site visit, weather conditions were dry and bright, with light winds noted and temperatures typically between 7 and 12 degrees Celsius. The road and foot/cycleway surfaces surveyed were all noted to be dry and clear (however off-road conditions on Route 11 of the NCN along the Great North Forest Heritage Trail were damp following rainfall which had occurred over night). The weather conditions were generally assessed as being suitable for pedestrians, cyclists and equestrians.

A summary of the key findings from the site are provided below, with full details contained at Section 2.8 Existing Pedestrian, Cyclist and Equestrian Facilities within the Local Area:

Section 1 – Northside Overbridge

- The footway provision on the approach the A1231 Northside Overbridge is substandard in width (on both the eastern and western sides).
- The condition of the pavement surface of the footway provision on both the eastern and western approaches to the A1231 Northside Overbridge is poor.
- Vegetation on the western verges encroaches onto the existing footway, reducing the usable width of the infrastructure and its effectiveness for less abled bodied pedestrians.
- No lighting is available on the approach the A1231 Northside Overbridge (on both the eastern and western sides).
- The condition of the concrete post and tubular pole fencing on both the eastern and western approaches to the A1231 Northside Overbridge is poor.
- No directional signage is available on either side of the A1231 Northside Overbridge.
- No dedicated cycle facilities available, despite the A1231 having being a derestricted dual-carriageway, two-way road at this location. A modest number of on carriageway cycle trips were recorded during the video non-motorised user surveys.

Section 2 – Northside to North Dene Footway and the North Dene Footbridge

- There is no boundary fence treatment between the Northside Footway and the A1 mainline.
- The Northside to North Dene Footway (for the 65m stretch south of North Dene Footbridge), which is designated on ‘a traffic free path’ on the Gateshead Cycle Map, is substandard in width.
- No lighting is available on the Northside to North Dene Footway.
- The North Dene Footbridge deck and ramp is substandard in width (on both the eastern and western sides) in light of its use by both pedestrians and cyclists, it is designated as ‘a path or footway where you should walk your bike’ on the Gateshead Cycle Map.
- North Dene Footbridge is accessed via a stepped ramp with a single landing, which features a 1 in 6 gradient between ground level and the bridge deck.
- The bridge deck and ramp landings on either side do not currently benefit from tactile paving provisions.
- No directional signage is available on either side of the North Dene Footbridge.
- To the eastern side of North Dene Footbridge the public right of way takes the form of an unmade footpath.
- To the eastern side of North Dene Footbridge the public right of way passes through a ‘kissing gate’ that is only suitable for pedestrian access.

Section 3 – North Dene to Longbank Footpath and the Longbank Bridleway underbridge

- The North Dene to Longbank Footpath, which is designated on 'a traffic free path' on the Gateshead Cycle Map, is substandard in width.
- No lighting is available on the North Dene to Longbank Footpath.
- Vegetation in the verges encroaches onto the existing footpath, reducing the usable width of the infrastructure and its effectiveness for less abled bodied pedestrians.
- The condition of the concrete post and wire-mesh fencing between the North Dene to Longbank Footpath and the A1 mainline is poor.
- No directional signage is available on either end of the North Dene to Longbank Footpath.
- Pedestrian access to the Longbank Bridleway underbridge is provided by means of an informal and unmade ramp, leading to a flight of steps (constructed of wood, with a loose paved tread surface and wooden handrails to aid ascent/decent).
- Cycle access to the Longbank Bridleway underbridge, which is designated as 'a National Cycle Network off-road cycle path' and is identified as Route 11 a 'Regional Cycle Network' on the Gateshead Cycle Map, is only available by means of an at-grade ramp located approximately 200.0m southwest, where the route meets the A167 Newcastle Bank.
- The Longbank Bridleway underbridge is an unlit 80.0m long, domed corrugated-steel lined structure, which is intimidating to pedestrians and cyclists.
- To the northern side of the Longbank Bridleway underbridge, the surface is loose/coarse paved in nature to aid equestrians and to the southern side a concrete drainage channel provides a formal made surface for pedestrians/cyclists.
- During heavy rain-fall, the bridleway is susceptible to flooding, with the loose/coarse surface treatment being known to either wash away completely or being overrun with earth which encroaches from the adjacent cutting slopes.
- To the eastern side of the structure, an informal and unmade ramp provides a raised link for cyclists/equestrians to the eastern headwall of the Longbank Bridleway underbridge).
- The eastern headwall of the Longbank Bridleway underbridge passes between a brick built parapet wall and 2.0m high wooden close-board fence treatment, with the available width varying between approximately 1.5m and 3.0m.
- At both entry points to the underpass there are horse-rider dismounting points which Equestrians use before travelling through.

Section 4 – Longbank to Eighton Lodge Footpath and the Eighton Lodge Interchange

- The Longbank to Eighton Lodge Footpath, which is designated on 'a traffic free path' on the Gateshead Cycle Map, is substandard in width.
- No lighting is available on the Longbank to Eighton Lodge Footpath.
- Vegetation in the verges encroaches onto the existing footpath, reducing the usable width of the infrastructure and its effectiveness for less abled bodied pedestrians.
- The condition of the concrete post and wire-mesh fencing between the Longbank to Eighton Lodge Footpath and the A1 mainline is poor.
- No directional signage is available on either end of the Longbank to Eighton Lodge Footpath.
- The shared footway/cycleway provisions Eighton Lodge Interchange, which are designated as part of the NCN Route 725, are substandard in width.

- Crossing provisions are uncontrolled in nature and require users to accept gaps between the conflicting traffic streams (some of which are under part-time signal control) in order to pass over the various sections of carriageway.
- Crossing opportunities were complicated by the horizontal alignment of entry-arms and the location/height of traffic signage on the approach to the junction, which often acted as a sight-screen prohibiting visibility for pedestrians.

Section 5 – Smithy Lane overbridge and the Angel Cycleway/Chowdene Bank Bridge

- The footway provision on the approach the Smithy Lane overbridge is generally substandard in width (on both the eastern and western sides). Significant level differences and lack of infrastructure limit access to the A1 mainline.
- No lighting is available on the approach the Smithy Lane overbridge (on both the eastern and western sides).

Section 6 – Coalhouse Interchange

- The footway provisions around the Coalhouse Interchange are generally substandard in width.
- No dedicated cycle facilities are available around the Coalhouse Interchange.
- The six arms of the roundabout currently have varying degrees of physical pedestrian infrastructure at crossing points.
- Crossing provisions are uncontrolled in nature and require users to accept gaps between the conflicting traffic streams (some of which are under part-time signal control) in order to pass over the various sections of carriageway.
- No directional signage is available around the Coalhouse Interchange.
- No formal crossing provisions adjacent to the Sainsbury's and Argos store access and the primary desire line encourages pedestrians to cross the road between two bus lay-bys (on either side of Chowdene Bank).

Evidence of the findings presented above is available in the photographs at Appendix E to the rear of this Walking, Cycling and Horse-Riding Assessment.

2.6 CONSULTATION WITH KEY STAKEHOLDERS

A meeting between Gateshead Council, Highways England and WSP was held on Tuesday 5th September 2017 at the Gateshead Council office to discuss NMU's in the area of the scheme. Additionally, a discussion on non-motorised users was held the following day with Sunderland Council, after which information was distributed out via email in which WSP has received no response.

The operation of existing pedestrian, cycle and equestrian facilities within the study area and the vicinity of the proposed scheme were discussed and documented by Highways England. Additionally the stakeholder meeting was also used as an opportunity to discuss planned and aspirational routes, connections, facilities, infrastructure, etc, that the Local Authorities have previously identified to improve pedestrian, cycle and equestrian routes within the area.

The information gathered during the stakeholder meeting has been incorporated into this Walking, Cycling and Horse-Riding Assessment report, with the minutes of the meeting archived on the project file in order to record the specific topics discussed. A summary of the key points are provided below:

- NMU provision is high profile in Gateshead.
- The usage of Longbank Bridleway has decreased significantly in recent years.
- NCN Route 11 has become overgrown and suffers from flood water issues. The route has been legally closed in the past due to flooding, as water flows down from the fields to the north of the A1 onto the bridleway and has washed 270 tonnes of surface material away, but the decision received public opposition.
- Measures have been taken to repair the damage caused, but it is unlikely that the route will be restored to previous standards due to issues with flood water and drainage.
- A concrete dish wash implemented by Gateshead Council to direct excess water away from the route, which has helped minimise further damage, but is not seen as a solution to the flooding issues.
- There are no known collision issues involving NMU routes in the vicinity of Eighton Lodge Interchange.
- NMUs are aware that Eighton Lodge is not the safest route available within the local area, as it is not fully signalised.
- There is growing demand along the NCN Route 725 and the Eighton Lodge Interchange will need to be considered for upgrade over the coming years. It is considered that NMU facilities are less suitable than the standard set throughout the remainder of Gateshead.
- Introduction of part-time traffic signal control has helped to some extent, but concerns still remain for pedestrians and cyclists crossing at the Eighton Lodge Interchange.
- Usage of North Dene Footbridge is expected to increase in the future.
- Highways England (with a financial contribution from Gateshead Council) recently replaced the bridge deck and introduced a bike rail to assist cyclists crossing the infrastructure.
- The Gateshead Council Cycling Champion has raised concerns over the provisions at the Coalhouse Interchange.
- Pedestrians originating from the Lady Park area of Gateshead, wishing to access local bus routes and supermarket provisions in Team Valley are concerned about walking routes/crossing opportunities around the Coalhouse Interchange.
- On-street parking throughout local industrial estates has been removed and replaces with dedicated cycle routes with great success.
- Gateshead Council is not aware that NMUs are using the A1 for commuting purposes, however, pedestrians in Northside utilise the embankment as a walking route despite the lack of a boundary fence.
- There is potential for a cycling route from the Eighton Lodge Interchange running parallel to the A1 mainline, which would be unlikely to affect the A1 Birtley to Coalhouse widening scheme.
- Consideration should be given to the mitigation of adverse impacts of increased traffic demand (created by the A1 Birtley to Coalhouse widening scheme) on the local highway network.

2.7 CONSULTATION WITH LOCAL USER GROUPS AND WIDER PUBLIC

A series of public consultation events were held during February 2018 and, as such, no specific events were organised as part of the preparation of this Walking, Cycling and Horse-Riding Assessment.

This stakeholder engagement exercise effectively captured the opinions and views of various non-motorised user groups (including, but not limited to local resident walking representatives, local resident cycling representatives and Cycling UK). A summary of the key points are provided at Appendix G.

2.8 EXISTING PEDESTRIAN/CYCLE/EQUESTRIAN FACILITIES WITHIN THE LOCAL AREA AND LINKS TO THE STRATEGIC NETWORK

During the aforementioned site visit, an assessment was made of the facilities available to pedestrians, cyclists and equestrians within each section of the overall study area. The routes, connections, infrastructure, etc, that were identified by the Lead Assessor are set out in detail below.

Cycle Maps for Gateshead North, Gateshead South and South Tyneside South are illustrated in Appendix F, which cover the extents of the study area and will be referred to throughout the remainder of this Walking, Cycling and Horse-Riding Assessment.

Section 1 - Northside Overbridge

The 'Northside Overbridge' is located at Junction 65 of the A1 (the Bowes Incline Interchange) to the southern extent of the A1 NGWB, and facilitates the crossing of A1231 over the trunk road network between the Armstrong area of Washington (to the east) and Birtley (to the west). The interchange is grade-separated in nature and provides:

- Access to the A1 for the northbound traffic stream
- Egress from the A1 for the southbound traffic stream

The A1231 at this location is a derestricted dual-carriageway, two-way road, which is a relatively highly trafficked section of the local highway network owing to its function as an inner-urban route, which provides essential linkage between Washington (plus its surrounding towns/villages) and major employment centres within Teesside, Durham, Sunderland, Gateshead and Newcastle.

The A1231 forms part of the local highway network and, as such, Gateshead and Sunderland Councils are the Authorities responsible for maintaining the carriageway/footway/verges.

The 'Northside Overbridge' is approximately 22.3m wide (consisting of two 7.3m wide carriageways separated by a 5.0m kerbed central island and a 2.9m wide footway over the western side of the 70.0m long bridge-deck) with a 1.0m high parapet fence to protect crossing pedestrians.

This unlit pedestrian footway is variable in terms of standard and width on both approaches to the 'Northside Overbridge' itself. The gradient is generally around 1 in 12 on the western side, however, the substandard footway width varies between 0.6m and 1.0m (with a marginal 1.2m to 1.5m wide grass verge on either side of the footway to separate the pedestrian facilities from the carriageway and a short additional section of tension corrugated safety barrier prior to the bridge deck). A 1.0m high concrete post and metal rail fence separates the footway from the embankment along the western approach to the bridge deck, however, on-site observations noted dilapidation at certain locations which presents a potential safety concern for users.

An additional unlit, 1.8m wide footway link has also been provided between the Northside residential estate road and the 'Northside Overbridge' which experiences a gradient in excess of 1 in 5 for a length of around 80.0m in total and provides access to a bus stop on the A1231 which facilitates onward travel by means of the Service X25 between Newcastle upon Tyne and Langley Park. A 1.0m high concrete post/metal rail fence also separates this footway from the bridge embankment and on site observations noted similar levels of dilapidation.

The aforementioned stop benefits from a post and schedule information board, however, buses must currently stop on a 70mph section of road. Additionally, patrons are required to walk across the marginal grass verge in order to access the services provided by local bus operators, with no raised kerbs or bituminous surfacing to aid access.

On the eastern side of the bridge the gradient is reasonably level, however, a similar substandard footway width and 1.0m high concrete post/metal rail fence is present up to the signal controlled intersection between the A1231 and the A1 southbound off-slip road. At this location an advisory crossing point over the A1 southbound off-slip road is available, which benefits from dropped kerbs, tactile paving and 'Look Left/Look Right' white lining on the carriageway to assist pedestrians navigate the highway during breaks in the traffic flow of approximately 15 seconds (i.e. whilst the A1231 mainline receives a green signal).

Running along the eastern side of the A1 southbound off-slip road, is an unlit 1.5m wide footway (with a marginal 1.5m to 2.0m wide grass verge on either side of the footway to separate the pedestrian facilities from the carriageway) which passes through a 'kissing gate' approximately 150.0m north of the intersection with the A1231. The route provides access to an unnamed bridleway (that runs past Bassetts Pond, Bowes Lake and the Angel of the North Livery Yard) to the north and the Bowes Incline Hotel (leading to the North Dene Footbridge) to the west.

Fully classified surveys using video cameras were conducted at this location (over 24 hour periods) on Thursday 9th and Saturday 11th November 2017 in order to establish existing usage levels for all non-motorised user modes of travel. The results associated with the 'Northside Overbridge' are presented at Table 3:

Table 3 - Total NMU Usage Levels at the Northside Overbridge

	Thursday 9th November 2017			Saturday 11th November 2017		
Travel Mode	**AM Peak (09:00-10:00)**	**PM Peak (16:00-17:00)**	**Daily (00:00-24:00)**	**AM Peak (08:00-09:00)**	**PM Peak (14:00-15:00)**	**Daily (00:00-24:00)**
Pedestrians	4	5	45	4	6	30
Cycles	3	6	24	0	2	11
Electric Cycles	0	0	1	0	0	0
Non-motorised Scooters	0	0	0	0	0	0
Equestrians	0	0	0	0	0	0
Powered Wheelchairs	0	0	0	0	0	0
Total	**7**	**11**	**70**	**4**	**8**	**41**

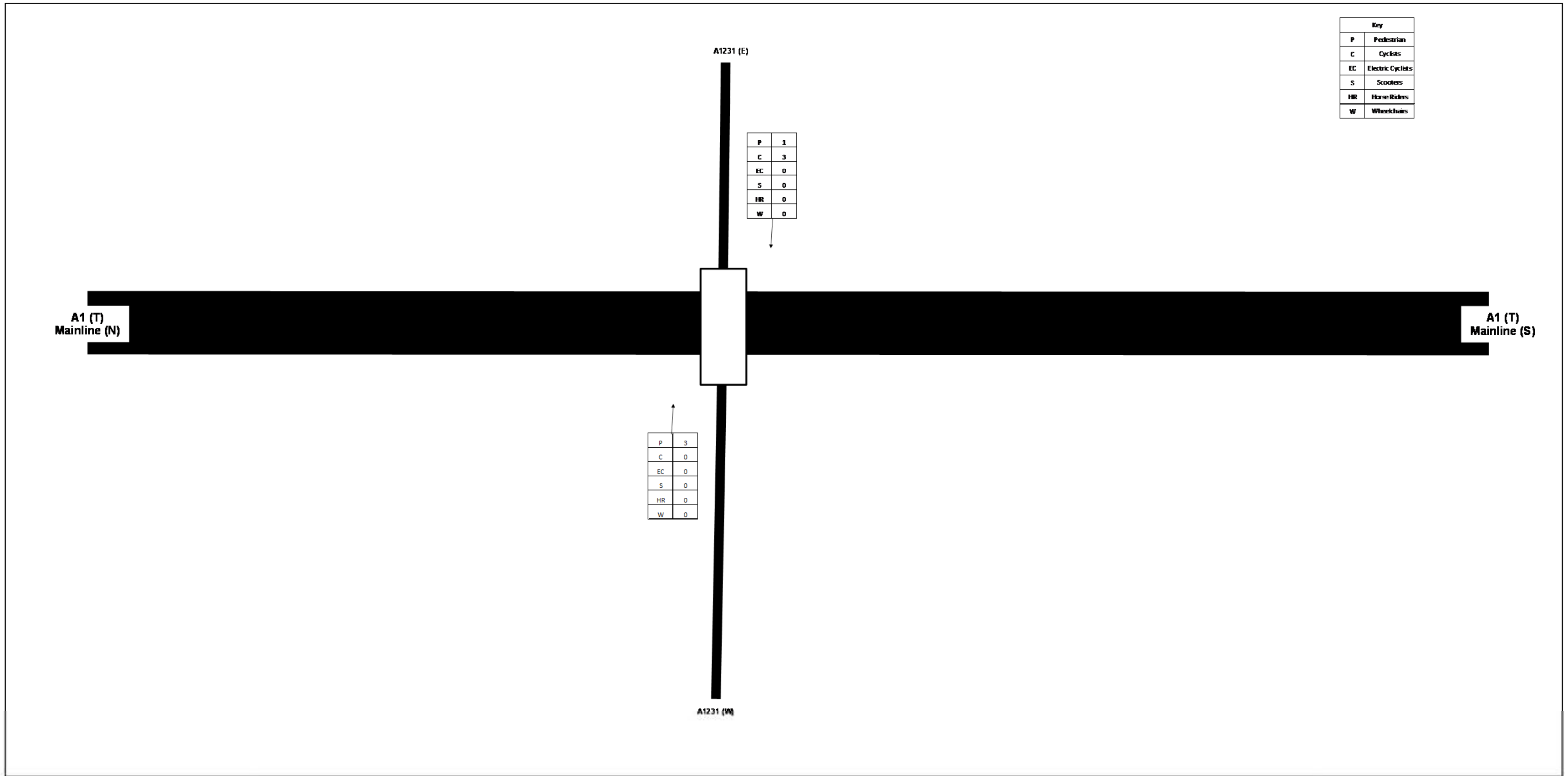
The results tabulated above clearly demonstrate that the route currently attracts a modest level of pedestrian and cycle movements during both peak periods and across the daily total (i.e. a maximum average of one movement every 5-6 minutes during the most intensive period of usage).

The Cycle Maps in Appendix F clearly show that the Northside Overbridge is designated as a 'path or footway where you should walk your bike'. This indicates that the Local Highway Authority currently encourage cycling along this particular section of the network, although particularly low usage levels were demonstrated in the table previously.

The flow diagrams presented on the following pages of this report set out the specific non-motorised user flow profile recorded at this location during both the AM and PM peak period, in addition to the daily totals associated with each mode of travel.

There is an alternative route from Birtley over the A1 mainline for NMU's, in the form of an Overbridge which is located north of Washington service area and is accessible from Penshaw View on the eastern side of the A1 and Crowther Road on the western side. However, this route is not as direct as the 'Northside Overbridge' to the employment areas that are located on the east side of the A1; therefore it is considered that the majority of non-motorised user usage would be from 'Northside Overbridge'.

Figure 1 - Weekday AM Peak Period NMU Flows at the Northside Overbridge



wsp

Non-Motorised Users Two-way flow survey on the A1231 overbridge
(Thursday 9th 2017 - AM Peak: 09:00 - 10:00)

Figure 2 – Weekday PM Peak Period NMU Flows at the Northside Overbridge

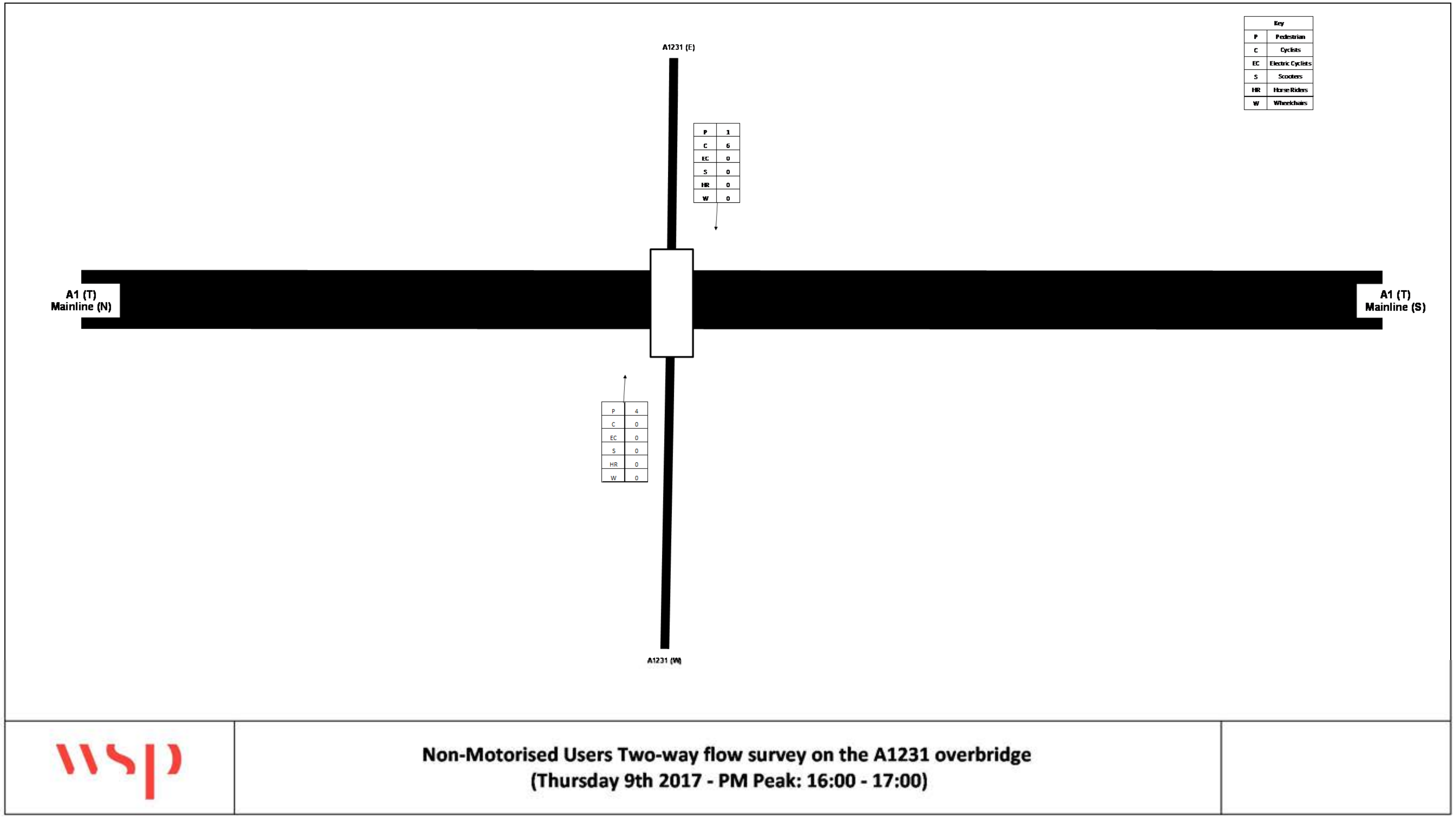
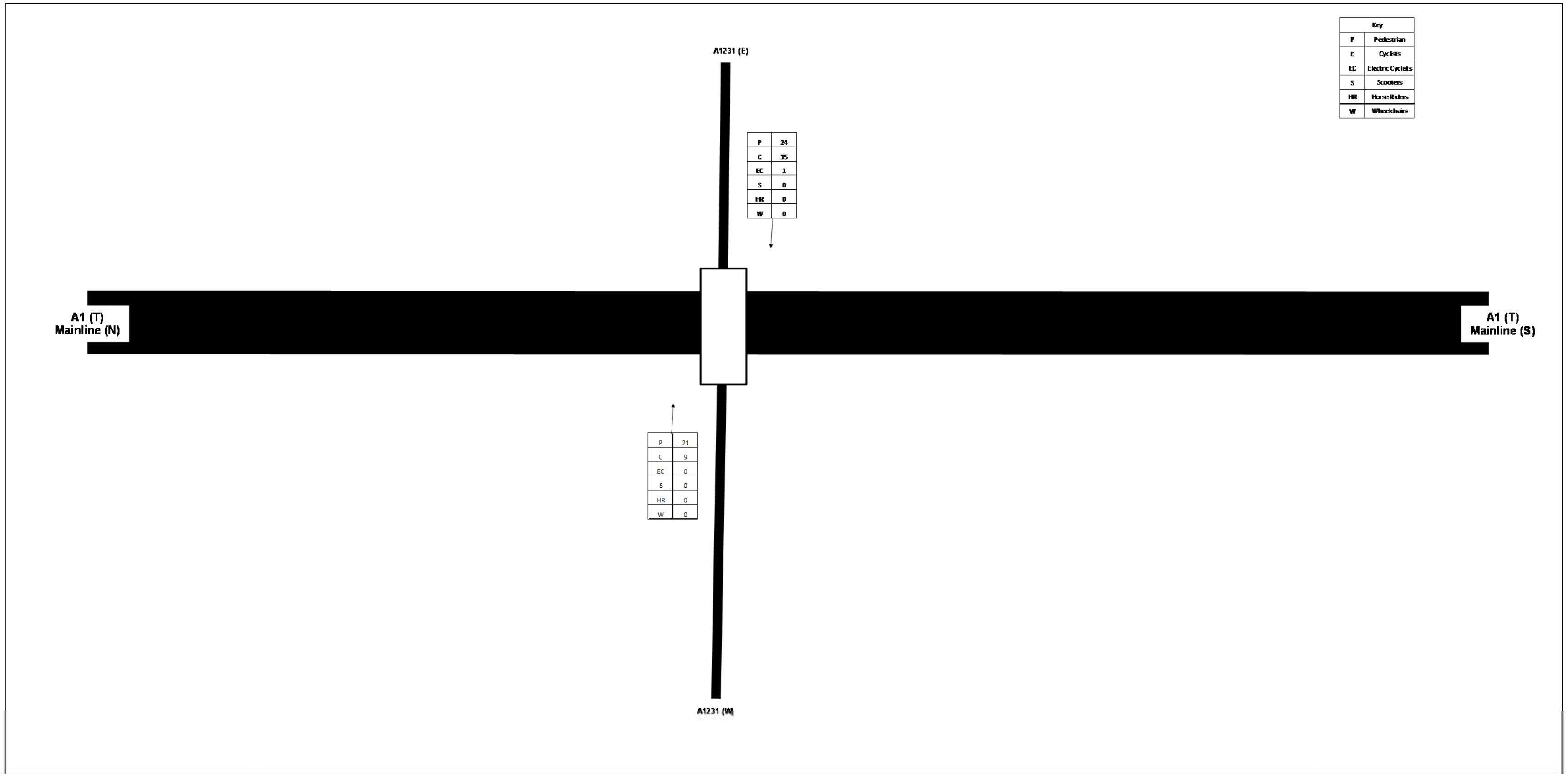
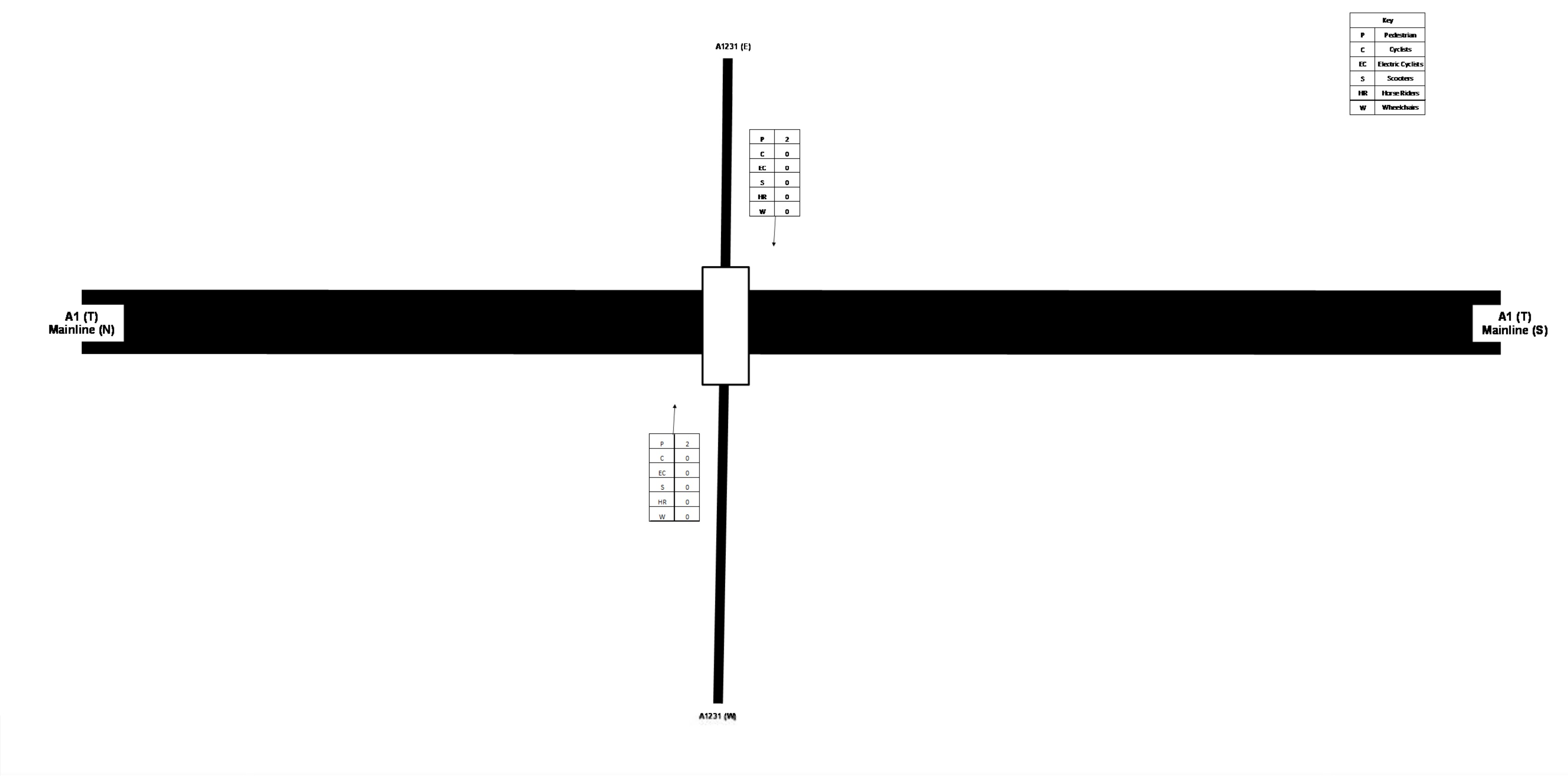


Figure 3 - Weekday Daily NMU Flows at the Northside Overbridge



Non-Motorised Users Two-way flow survey on the A1231 overbridge (Thursday 9th 2017 - 24 Hour)

Figure 4 – Weekend AM Peak Period NMU Flows at the Northside Overbridge



Non-Motorised Users Two-way flow survey on the A1231 overbridge
(Saturday 11th 2017 - AM Peak: 08:00 - 09:00)

Figure 5 – Weekend PM Peak Period NMU Flows at the Northside Overbridge

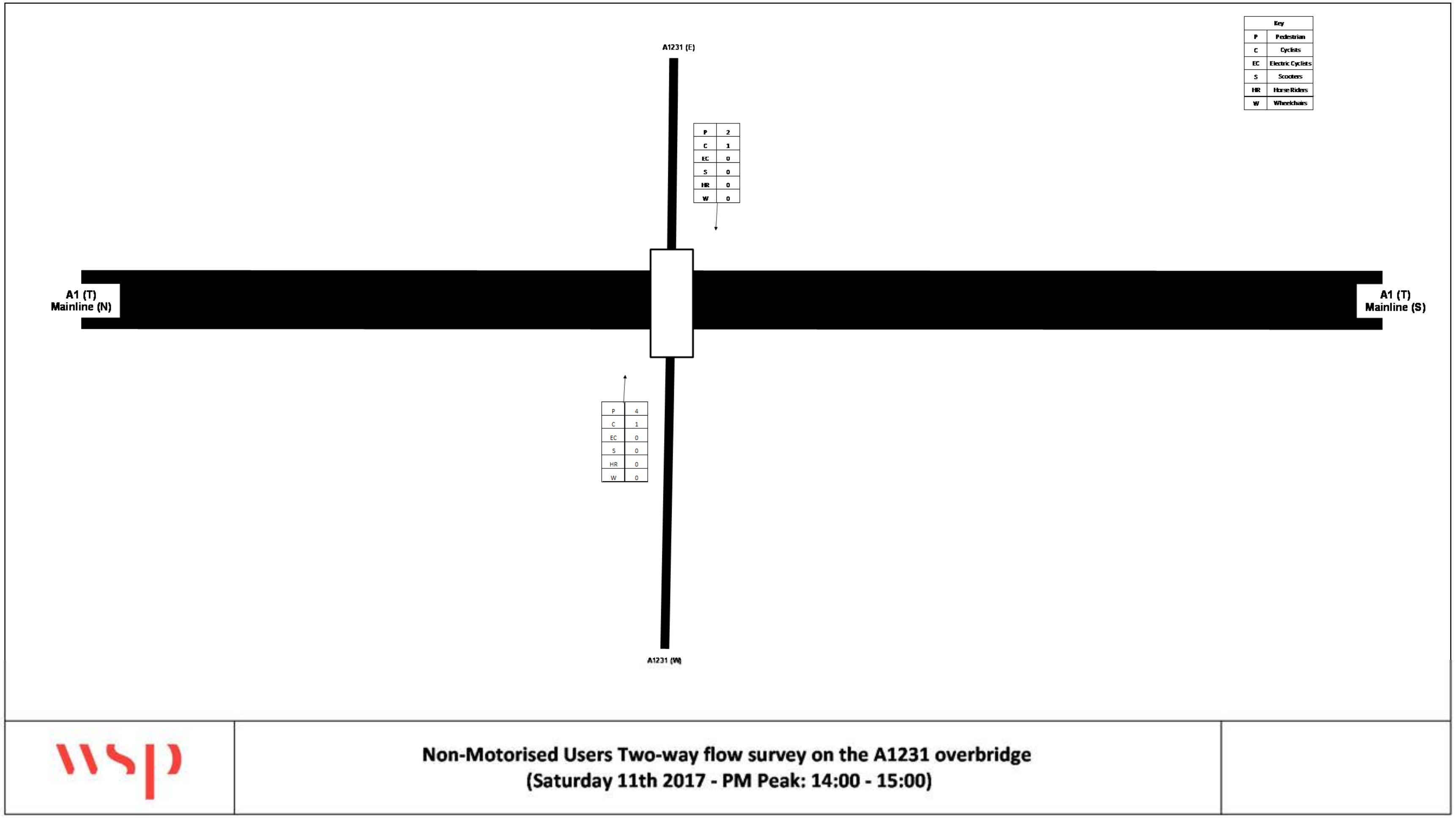
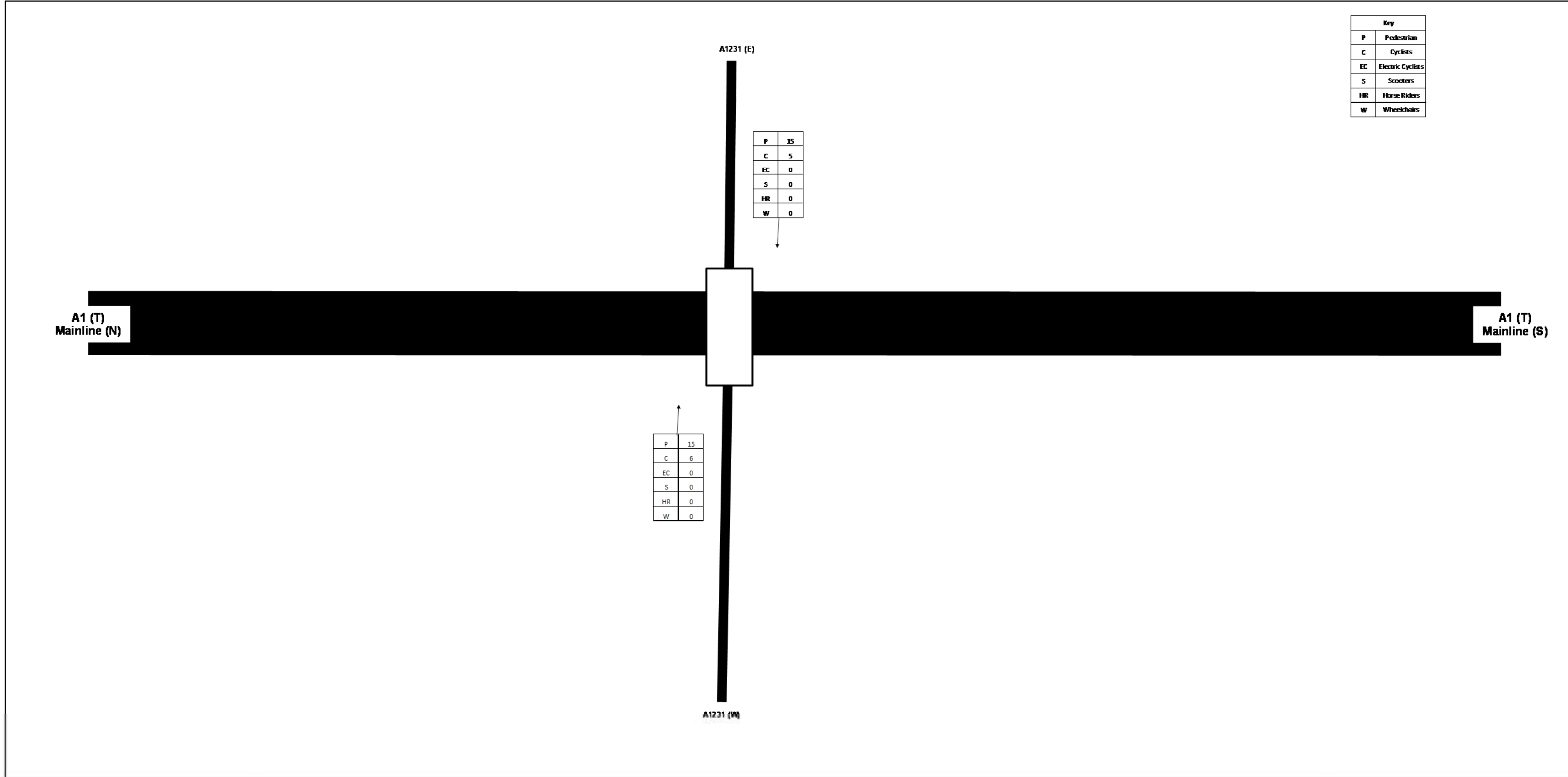


Figure 6 – Weekend Daily NMU Flows at the Northside Overbridge



Non-Motorised Users Two-way flow survey on the A1231 overbridge
(Saturday 11th 2017 - 24 Hour)

Section 2 – Northside to North Dene Footway and the North Dene Footbridge

The Northside to North Dene Footway is an informal and unmade pedestrian route, which follows an alignment broadly adjacent to the A1 mainline (approximately 18.0-20.0m to the west of the trunk road network) for a length of 425.0m between the boundary of the Northside residential street and North Dene Footbridge.

This unmade track (which runs along the top of an earth-mound embankment which forms a barrier between the Northside residential estate and the northbound carriageway of the A1) is not a formal pedestrian route and, hence, is not the responsibility of either Highways England or Gateshead Council to maintain. Its informal use by pedestrians as an attractive dog walking route (for locals originating from the adjacent residential estate) is, however, a concern due to the complete lack of any boundary fence treatment to restrict access to the northbound carriageway of the A1 mainline.

Approximately 65m south of the North Dene Footbridge, the route becomes formal in nature (and becomes the responsibility of Gateshead Council to maintain) with an unlit 1.5m wide footway providing access to the residential street of Crathie and continuing north for approximately 900.0m to the Eighton Lodge Interchange (as described in greater detail in the following section of this report).

North Dene Footbridge is located between Junction 65 (Birtley) and Junction 66 (Eighton Lodge) of the A1, providing a formal public right of way footpath route between Northside Farm/Bowes Incline Hotel (to the east) and the Northside residential estate (to the west).

Access to the structure from Crathie is provided by means of a 2.0m wide stepped ramp with a single landing (each step change measuring 120mm in height and spanning 1.7m in length) which features a 1 in 6 gradient between ground level and the bridge deck. Cyclists using the facility are currently required to dismount and use a 100.0mm wide runner-rail style ramp feature, which allows cycles to be pushed up the steps.

A modern 2.0m wide bridge deck runs for approximately 45.0m in length, benefitting from a high friction surface treatment and 1.4m high parapet fences to either side in order to protect both pedestrians/cyclists whilst crossing the structure.

To the eastern side of North Dene Footbridge the public right of way takes the form of an unmade footpath, which passes through a ‘kissing gate’ that is only suitable for pedestrian access, before providing access to Northside Farm and an unnamed local road which serves the Bowes Incline Hotel (approximately 250.0m to the southeast). From this point onwards the network joins the previously described bridleway (at Bowes Lake) and the unlit 1.5m wide footway which runs along the eastern side of the A1 southbound off-slip road to the intersection with the A1231 at Northside Overbridge.

With regards to bullet point 10 in Section 2.6, WSP have reviewed the Local Authority development aspirations for the area, as set out within ‘Planning for the future – Core Strategy and Urban Core Plan for Gateshead and Newcastle upon Tyne 2010-2030’. The parcels of land immediately to the north of the A1 (adjacent to North Dene footbridge) currently form part of the existing green-belt and have not been identified for development purposes prior to 2030. Conversations between WSP and representatives of the Spatial Planning and Environment team at Gateshead Council have confirmed that “as housing need no longer provides exceptional circumstances for greenfield Green Belt land to be allocated for residential use in Gateshead, our emerging Land Allocations and DM policies document (MSGP) is not considering the development potential of such sites”. WSP would, therefore, not envisage that NMU movements over the North Dene footbridge will materially increase over existing usage levels during this period.

As discussed previously, an intensification of NMU movements over the bridge is not forecast prior to 2030 and, as such, it must be considered that there may be no absolute need to construct a new 1 in 12 ramp as part of the A1 Birtley to Coalhouse scheme (unless existing issues have been raised with the Highway Authority by users of the bridge).

Should the parcels of land immediately to the north of the A1 (adjacent to North Dene footbridge) ever be identified for development purposes in future revisions of the Gateshead Local Plan, resulting in an intensification of use, it would be advisable to ensure that consultation with developers is held to ensure that financial contributions are secured towards the provision of a new fully compliant ramp.

Fully classified surveys using video cameras were conducted at this location (over 24 hour periods) on Thursday 9th and Saturday 11th November 2017 in order to establish existing usage levels for all non-motorised user modes of travel. The results associated with the 'North Dene Footbridge' are presented at Table 4:

Table 4 – Total NMU Usage Levels at the North Dene Footbridge

	Thursday 9th November 2017			Saturday 11th November 2017		
Travel Mode	**AM Peak (08:00-09:00)**	**PM Peak (17:00-18:00)**	**Daily (00:00-24:00)**	**AM Peak (11:00-12:00)**	**PM Peak (12:00-13:00)**	**Daily (00:00-24:00)**
Pedestrians	5	2	38	10	8	49
Cycles	2	4	21	0	0	3
Electric Cycles	0	0	0	0	0	0
Non-motorised Scooters	0	0	0	0	0	0
Equestrians	0	0	0	0	0	0
Powered Wheelchairs	0	0	0	0	0	0
Total	**7**	**6**	**59**	**10**	**8**	**52**

The results tabulated above clearly demonstrate that the route currently attracts a modest level of pedestrian and cycle movements during both peak periods and across the daily total (i.e. a maximum average of one movement every 6 minutes during the most intensive period of usage).

The Cycle Maps in Appendix F clearly show that the North Dene Footbridge is designated as a 'path or footway where you should walk your bike'. This indicates that the Local Highway Authority currently encourage cycling along this particular section of the network, although particularly low usage levels were demonstrated in the table previously. Within the immediate vicinity of this section of the study area, the B1288 and adjacent residential area are designated as proving a 'traffic-free path' with some lengths classified as forming a 'sign-posted on road cycle route'.

The flow diagrams presented on the following pages of this report set out the specific non-motorised user flow profile recorded at this location during both the AM and PM peak period, in addition to the daily totals associated with each mode of travel.

Figure 7 – Weekday AM Peak Period NMU Flows at the North Dene Footbridge

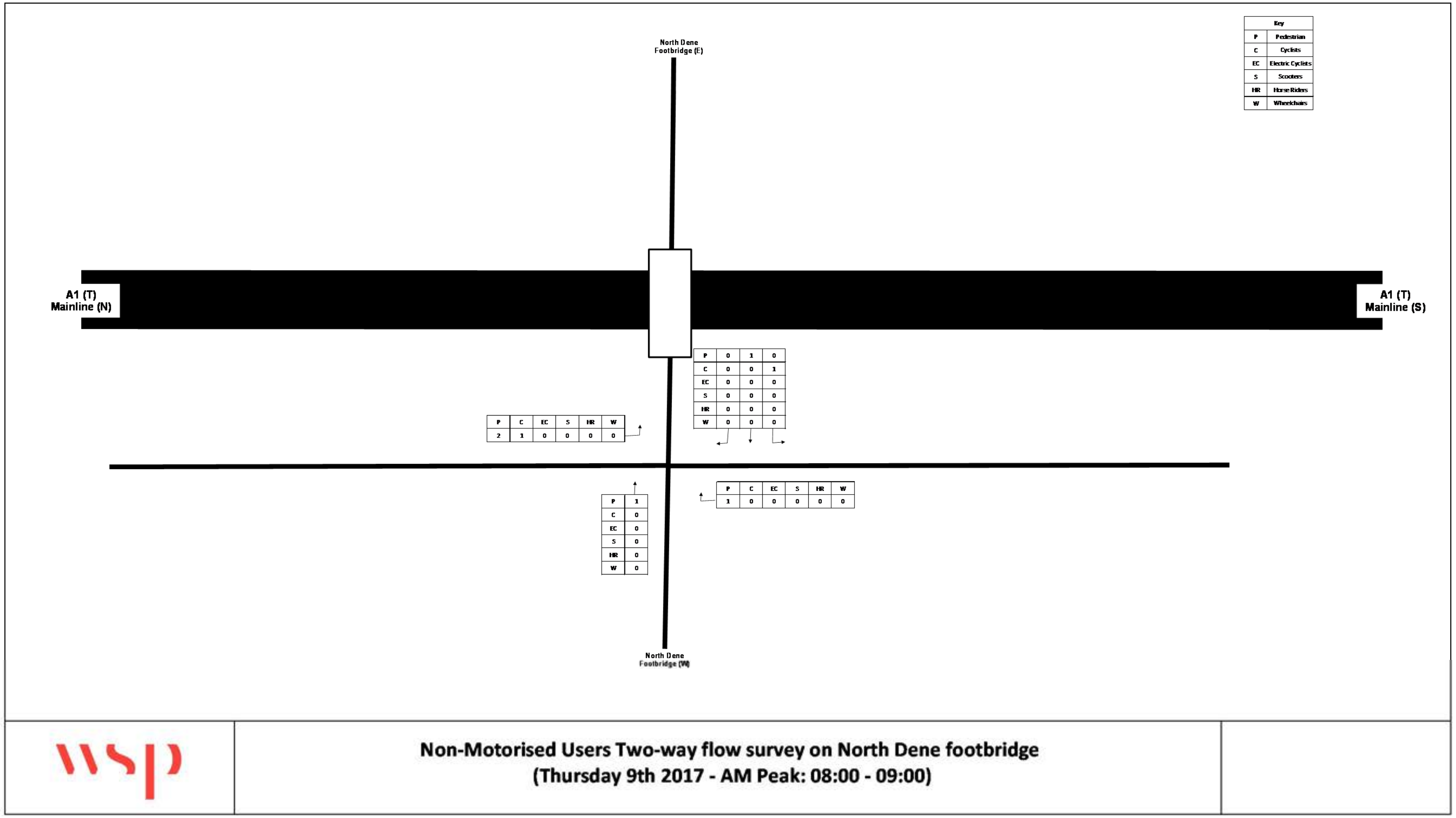


Figure 8 - Weekday PM Peak Period NMU Flows at the North Dene Footbridge

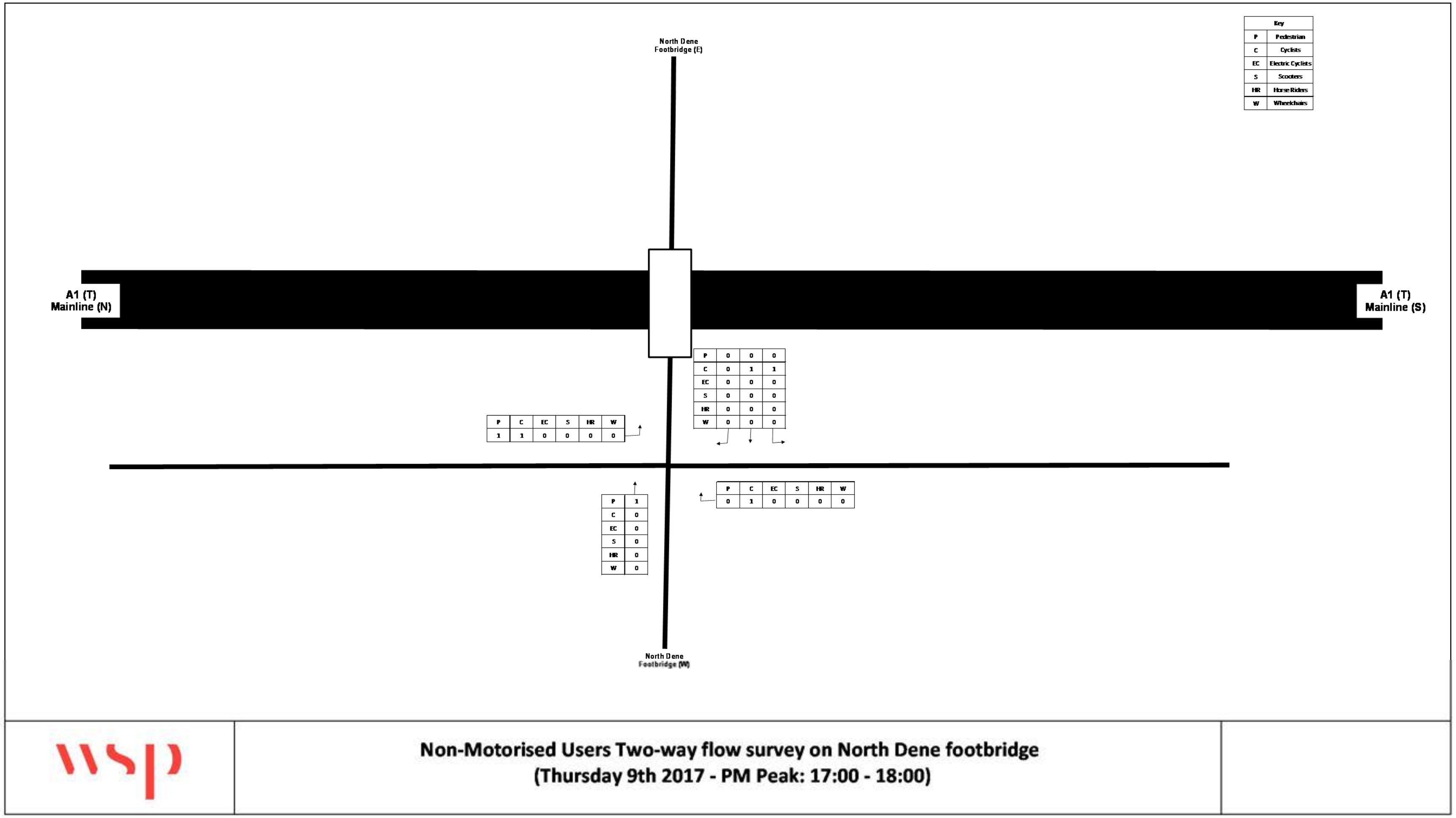


Figure 9 – Weekday Daily NMU Flows at the North Dene Footbridge

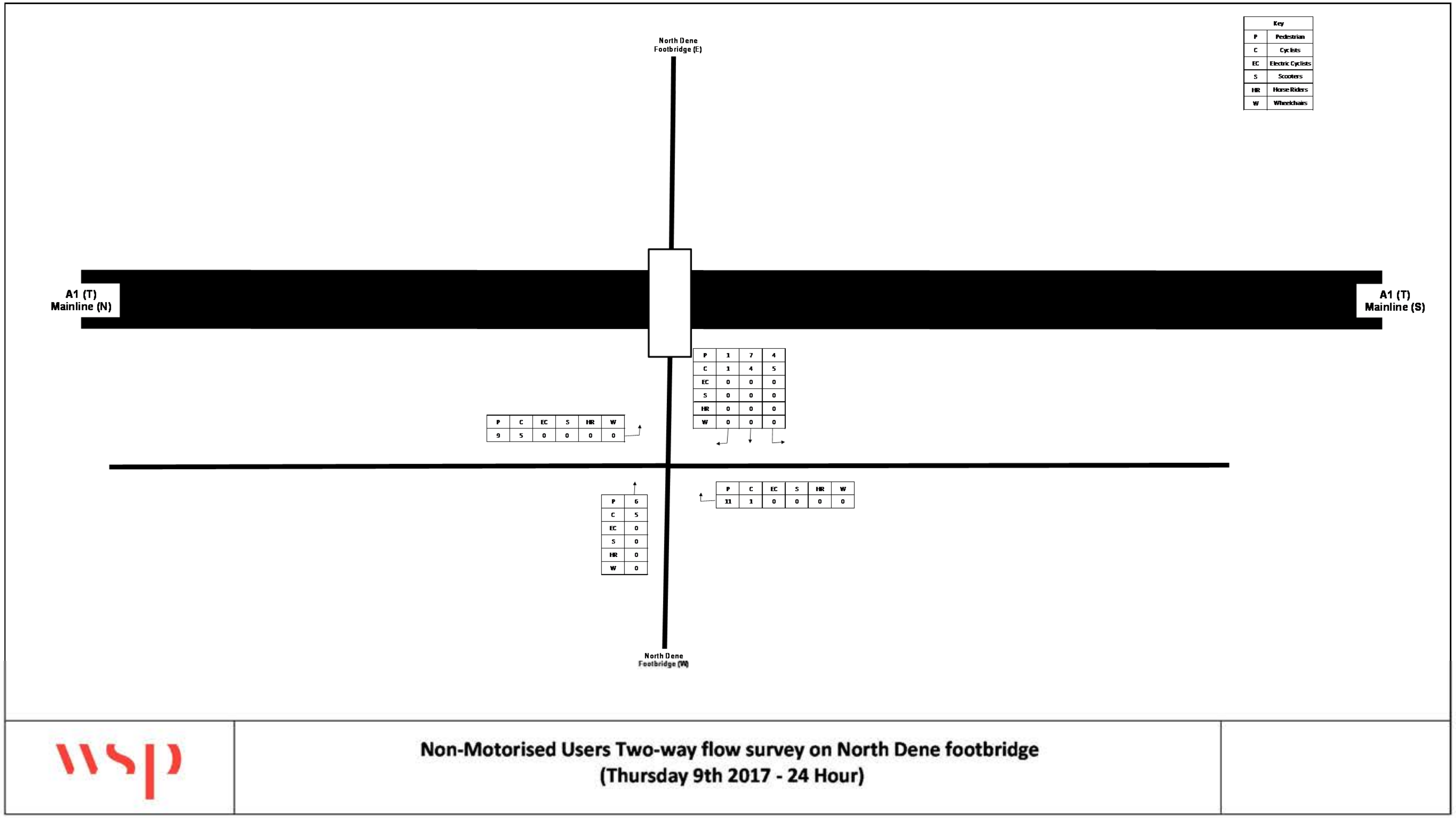
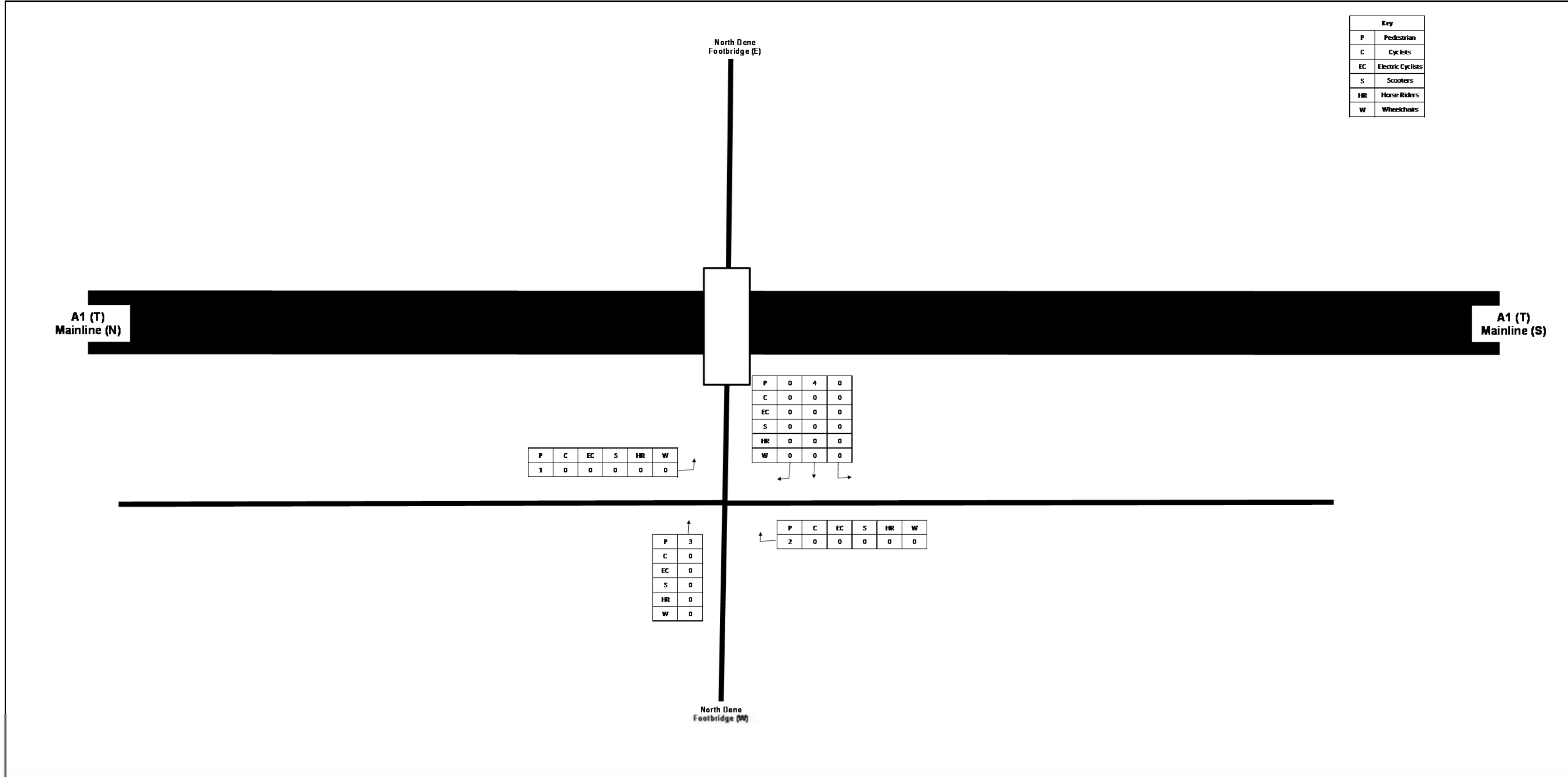


Figure 10 – Weekend AM Peak Period NMU Flows at the North Dene Footbridge



Non-Motorised Users Two-way flow survey on North Dene footbridge
(Saturday 11th 2017 - AM Peak: 11:00 - 12:00)

Figure 11 – Weekend PM Peak Period NMU Flows at the North Dene Footbridge

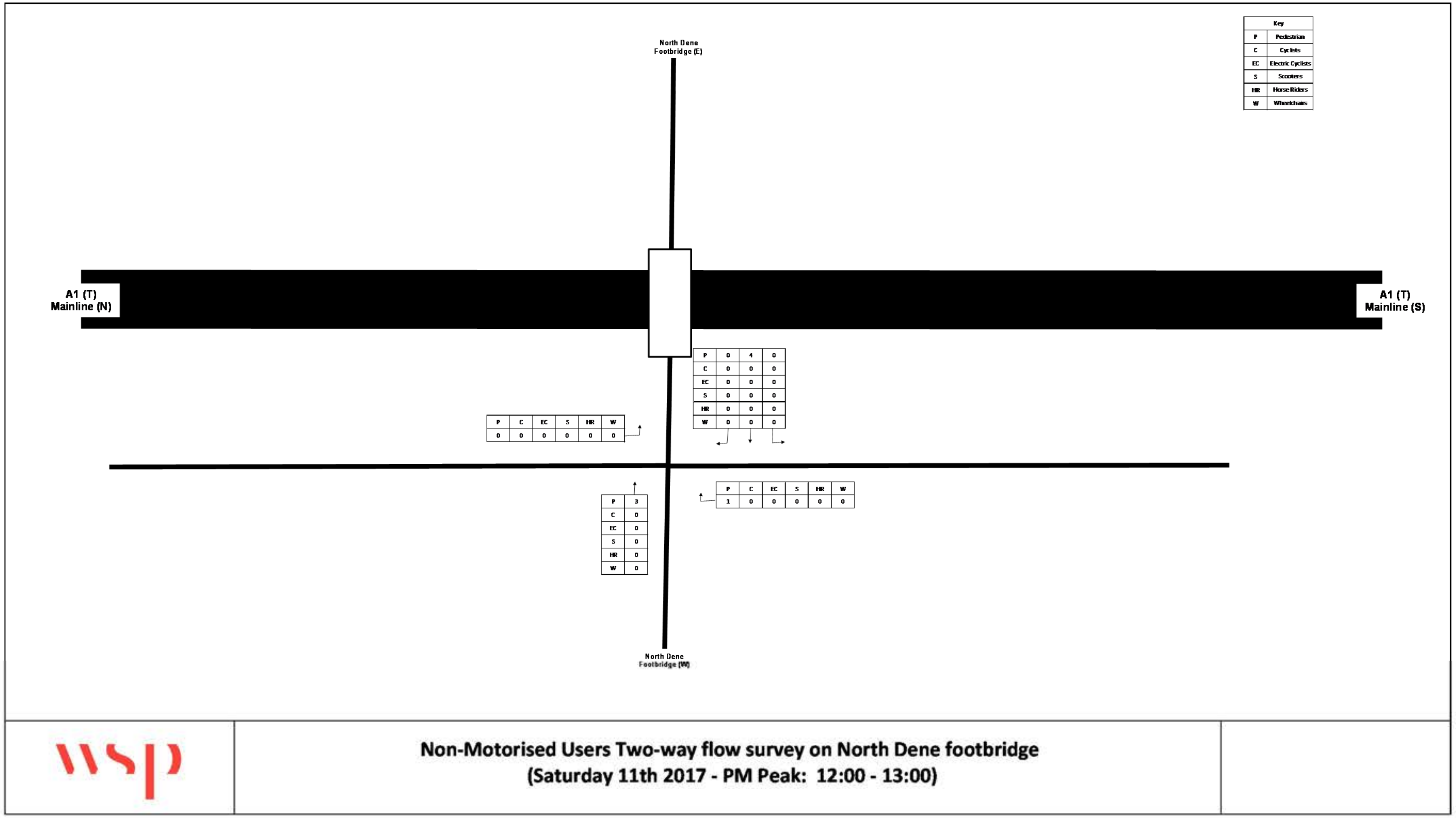
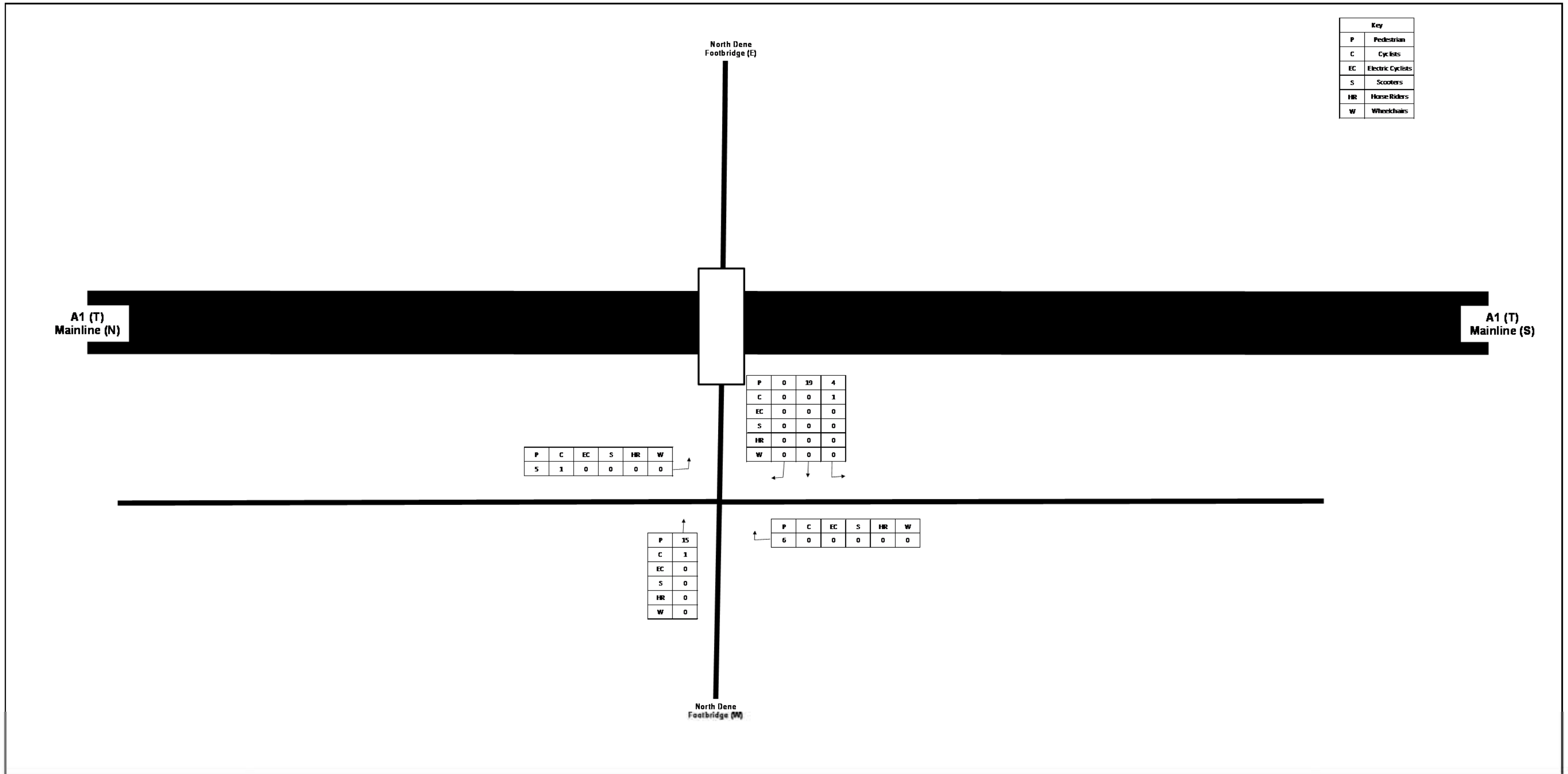


Figure 12 – Weekend Daily NMU Flows at the North Dene Footbridge



Non-Motorised Users Two-way flow survey on North Dene footbridge
(Saturday 11th 2017 - 24 Hour)

Section 3 - North Dene to Longbank Footpath and the Longbank Bridleway Underbridge

To the northern side of the North Dene Footbridge, the previously described unlit 1.5m wide footway continues to the Longbank Bridleway underbridge and is a formal pedestrian route which is the responsibility of Gateshead Council to maintain. The route is primarily used by pedestrians and is segregated from the northbound carriageway of the A1 mainline (which runs parallel to the route at a variable distance between 2.0m and 10.0m to the east) by a marginal grass verge/concrete post and mesh-wire boundary fence treatment. On the western side of the footway a wooden post and rail fence restricts access to an area of dense vegetation (which overhangs the footway at certain locations resulting in potentially hazardous conditions for non-motorised users) and grass verges, which segregate the pedestrian route from the adjacent residential estate.

Approximately 500.0m to the north of the previously discussed foot-bridge over the A1, this footway runs adjacent to the western headwall of the Longbank Bridleway underbridge and passes between a brick built parapet wall and a concrete post/wire-mesh boundary fence treatment. Pedestrian access to the Underpass from this footpath is provided by means of an informal and unmade ramp, leading to a flight of steps (constructed of wood, with a loose paved tread surface and wooden handrails to aid ascent/decent). Cycle access can be achieved via an at-grade ramp located approximately 200.0m southwest, where the route meets the A167 Newcastle Bank.

Longbank Bridleway underbridge runs beneath the A1 mainline on a skewed northeast to southwest alignment, between Junction 65 (Birtley) and Junction 66 (Eighton Lodge), providing a bridleway function and forming part of the 65 mile long Great North Forest Heritage Trail. The path follows the route of the former Bowes Incline Rope Railway Line, which was designed in the early part of the 19th Century by George Stephenson and now forms part of an English Heritage site with designated scheduled monument status.

The underpass itself takes the form of an unlit 80.0m long, domed corrugated-steel lined structure, which is 4.7m wide and 3.5m high along the centre line of the tunnel (to facilitate safe passage for dismounted equestrians). To the northern side of route, the surface is loose/coarse paved in nature to facilitate the movement of equestrians and to the southern side a concrete drainage channel has been installed, which provides a formal made surface for pedestrians/cyclists. Equestrian mounting blocks are located either side of the Longbank Bridleway underbridge, with signage advising riders to dismount prior to entering the structure.

Consultation with stakeholders has revealed that owing to gradient and general alignment of the route, it frequently acts as a funnel during extreme weather events, channelling surface water run-off in a downhill westerly direction towards Birtley. During heavy periods of rain-fall, the bridleway is particularly susceptible to flooding, with the loose/coarse surface treatment being known to either wash away completely or being overrun with earth which encroaches from the adjacent cutting slopes.

To the eastern side of the structure, an informal and unmade ramp provides a raised link for cyclists/equestrians to the eastern headwall of the Longbank Bridleway underbridge, and passes between a brick built parapet wall and 2.0m high wooden close-board fence treatment (although the available width varied considerably between approximately 1.5m and 3.0m). Additional pedestrian access can also be achieved by means of a similar flight of steps (constructed of wood, with a loose paved tread surface and wooden handrails to aid ascent/decent).

Fully classified surveys using video cameras were conducted at this location (over 24 hour periods) on Thursday 9th and Saturday 11th November 2017 in order to establish existing usage levels for all non-motorised user modes of travel. The results associated with the 'Longbank Bridleway underbridge' are presented at Table 5 below:

Table 5 – Total NMU Usage Levels at the Longbank Bridleway Underbridge

	Thursday 9th November 2017			Saturday 11th November 2017		
Travel Mode	**AM Peak (11:00-12:00)**	**PM Peak (12:00-13:00)**	**Daily (00:00-24:00)**	**AM Peak (11:00-12:00)**	**PM Peak (12:00-13:00)**	**Daily (00:00-24:00)**
Pedestrians	4	5	24	5	5	40
Cycles	0	1	2	0	2	6
Electric Cycles	0	0	0	0	0	0
Non-motorised Scooters	0	0	0	0	0	0
Equestrians	0	0	0	2	0	2
Powered Wheelchairs	0	0	0	0	0	0
Total	**4**	**6**	**26**	**7**	**7**	**48**

The results tabulated above clearly demonstrate that the route currently attracts a modest level of pedestrian, cycle and equestrian movements during both peak periods and across the daily total (i.e. a maximum average of one movement every 8-9 minutes during the most intensive period of usage).

The Cycle Maps in Appendix F clearly show that the North Dene to Longbank Footway is designated as a 'traffic-free path' (although poor horizontal alignment in certain locations may cause difficulty for cyclists) and the Longbank Bridleway underbridge itself forms part of the National Cycle Network Route 11. This indicates that the Local Highway Authority currently encourage cycling along this particular section of the network, although particularly low usage levels were demonstrated in the table previously (with a similar level of equestrian activity recorded).

The flow diagrams presented on the following pages of this report set out the specific non-motorised user flow profile recorded at this location during both the AM and PM peak period, in addition to the daily totals associated with each mode of travel.

Figure 13 – Weekday AM Peak Period NMU Flows at the Longbank Bridleway Underbridge

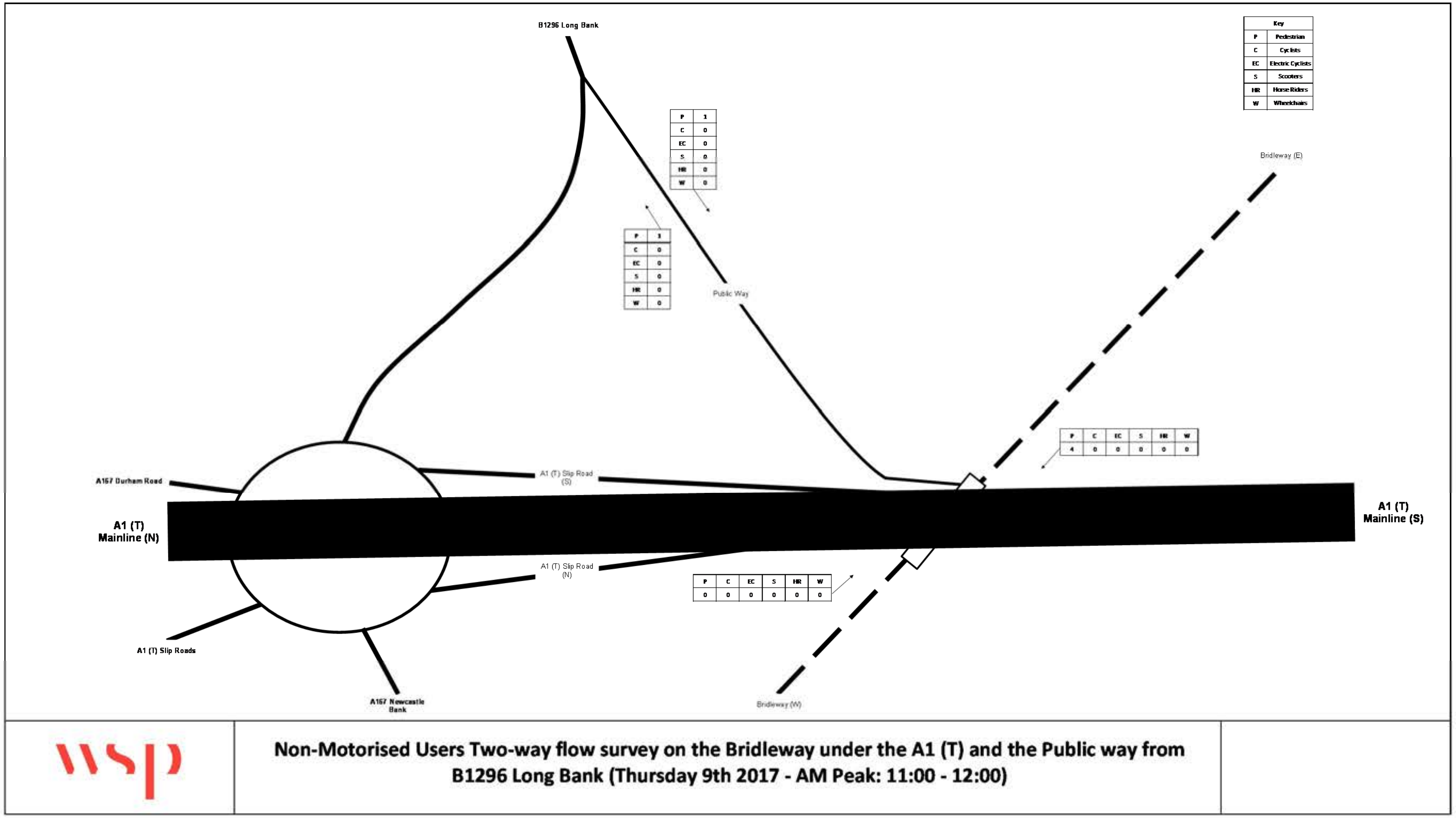
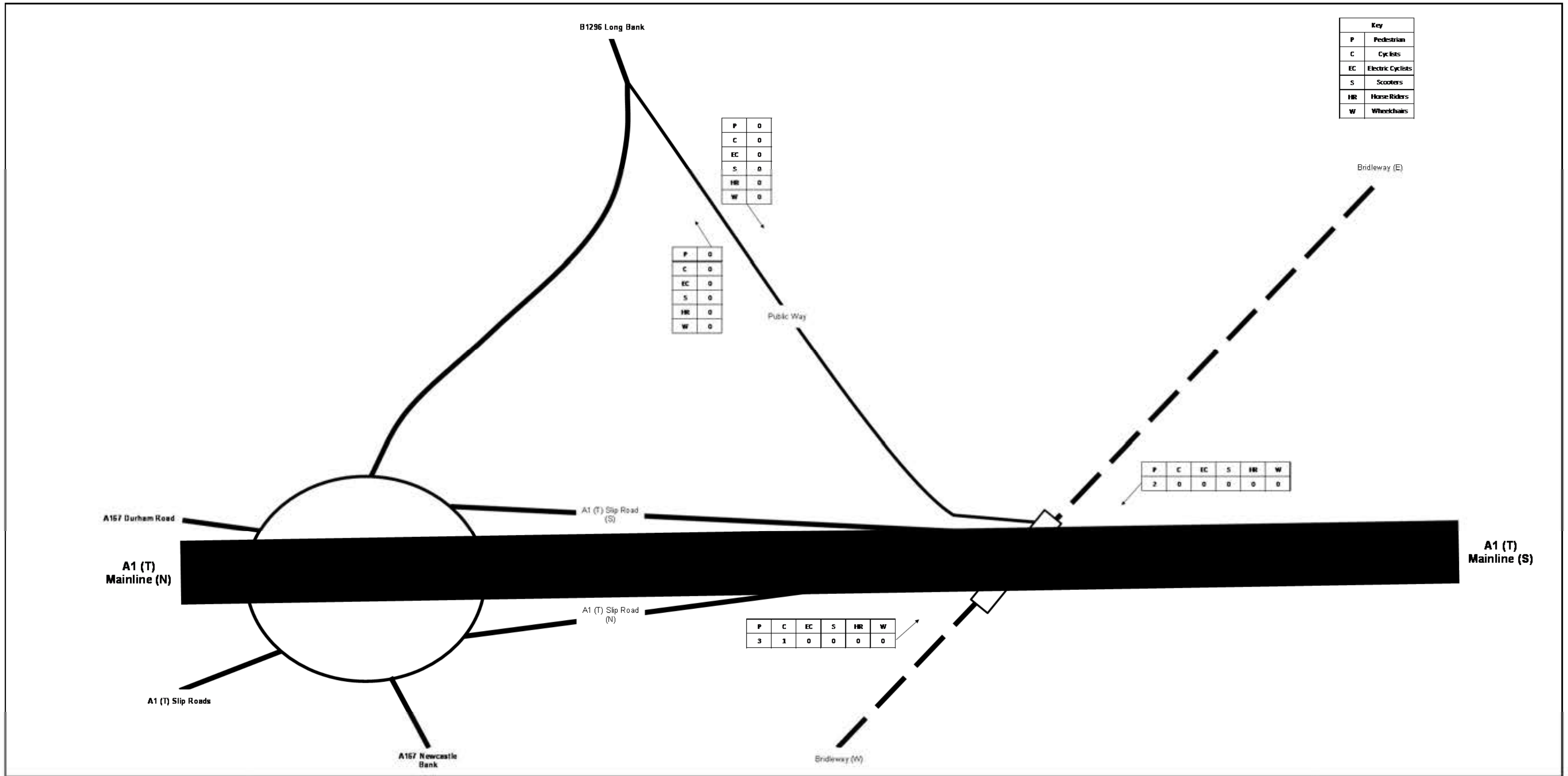
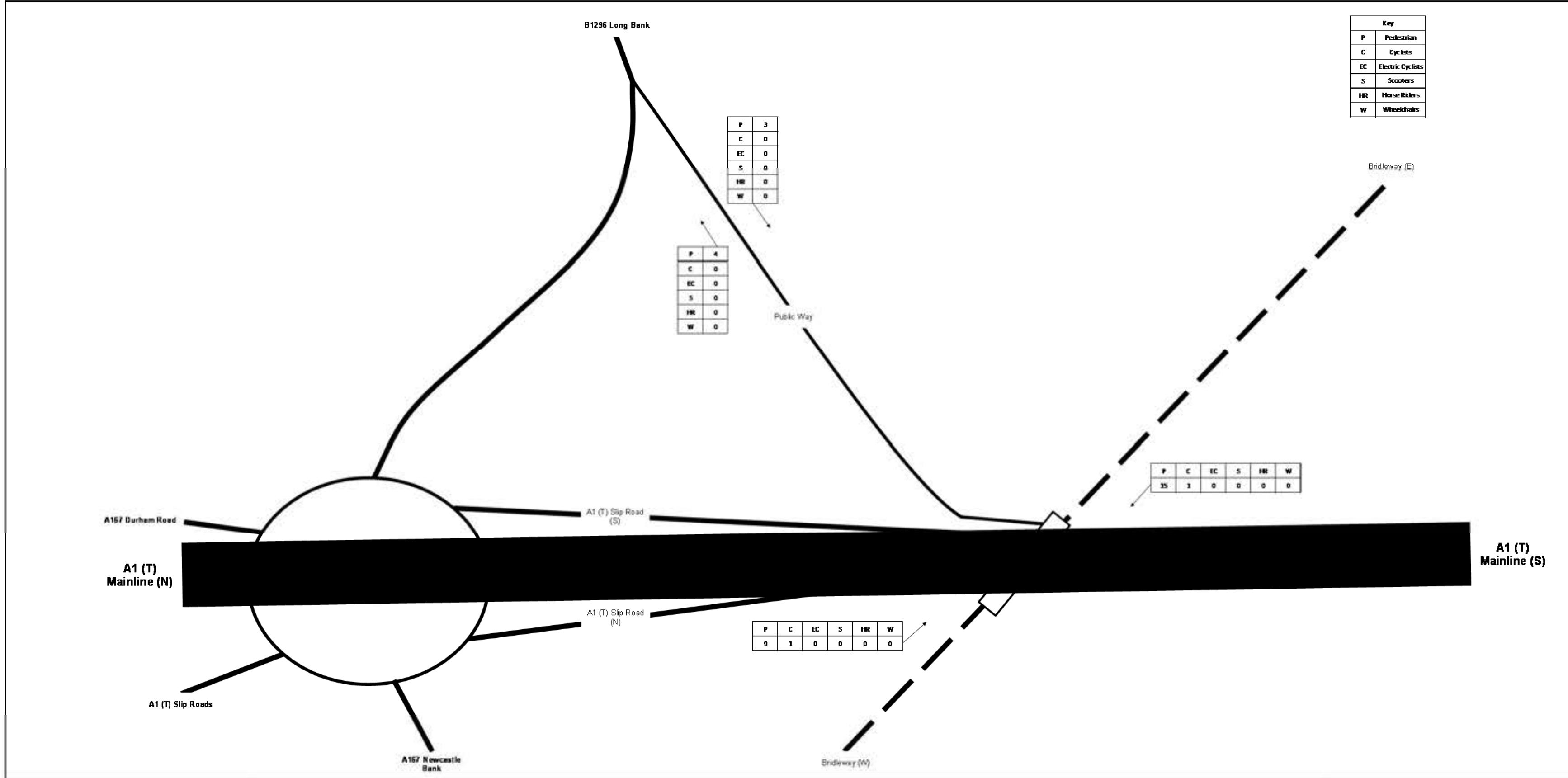


Figure 14 – Weekday PM Peak Period NMU Flows at the Longbank Bridleway Underbridge



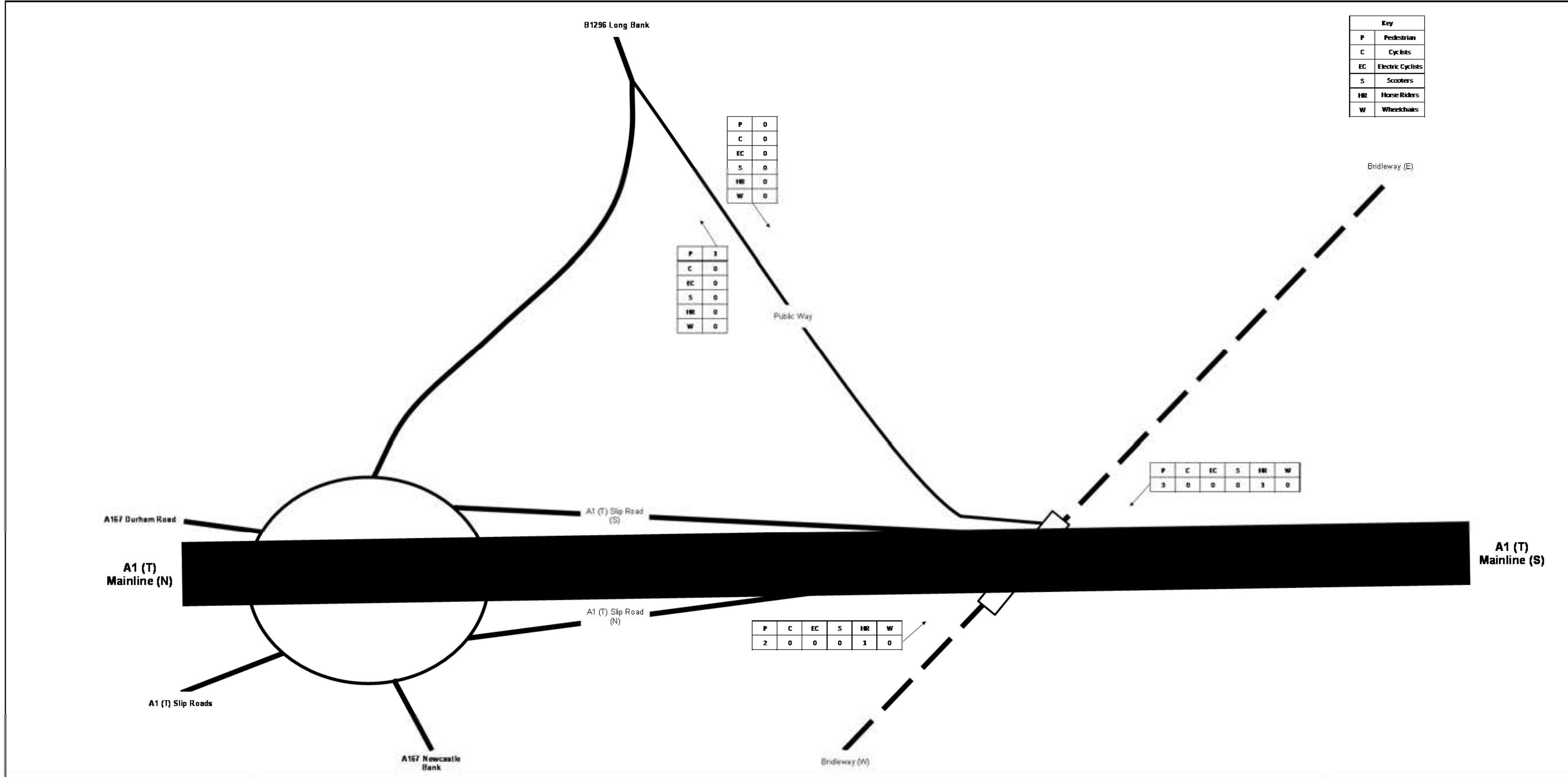
Non-Motorised Users Two-way flow survey on the Bridleway under the A1 (T) and the Public way from B1296 Long Bank (Thursday 9th 2017 - PM Peak: 12:00 - 13:00)

Figure 15 – Weekday Daily NMU Flows at the Longbank Bridleway Underbridge



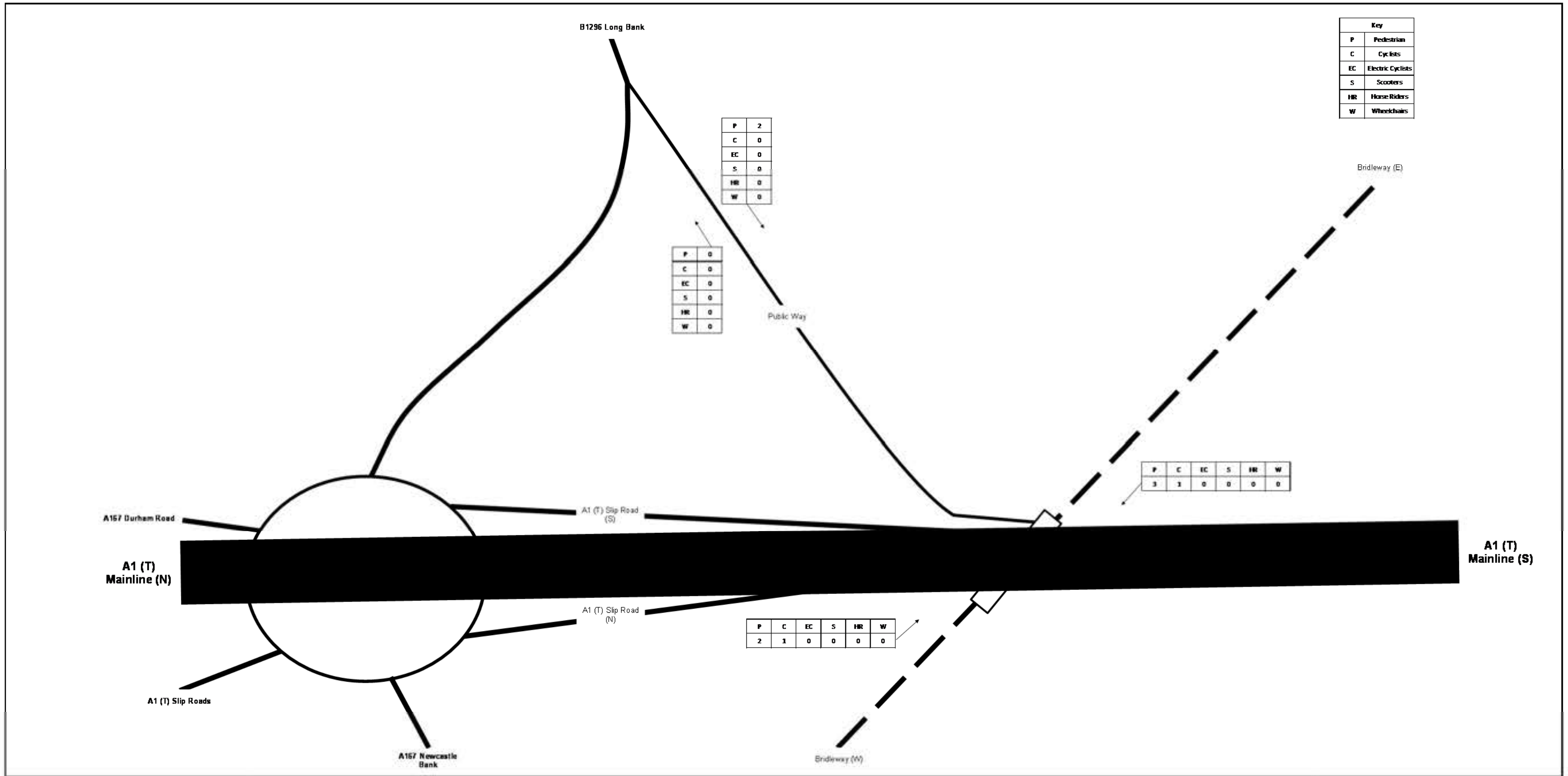
Non-Motorised Users Two-way flow survey on the Bridleway under the A1 (T) and the Public way from B1296 Long Bank (Thursday 9th 2017 - 24 Hour)

Figure 16 – Weekend AM Peak Period NMU Flows at the Longbank Bridleway Underbridge



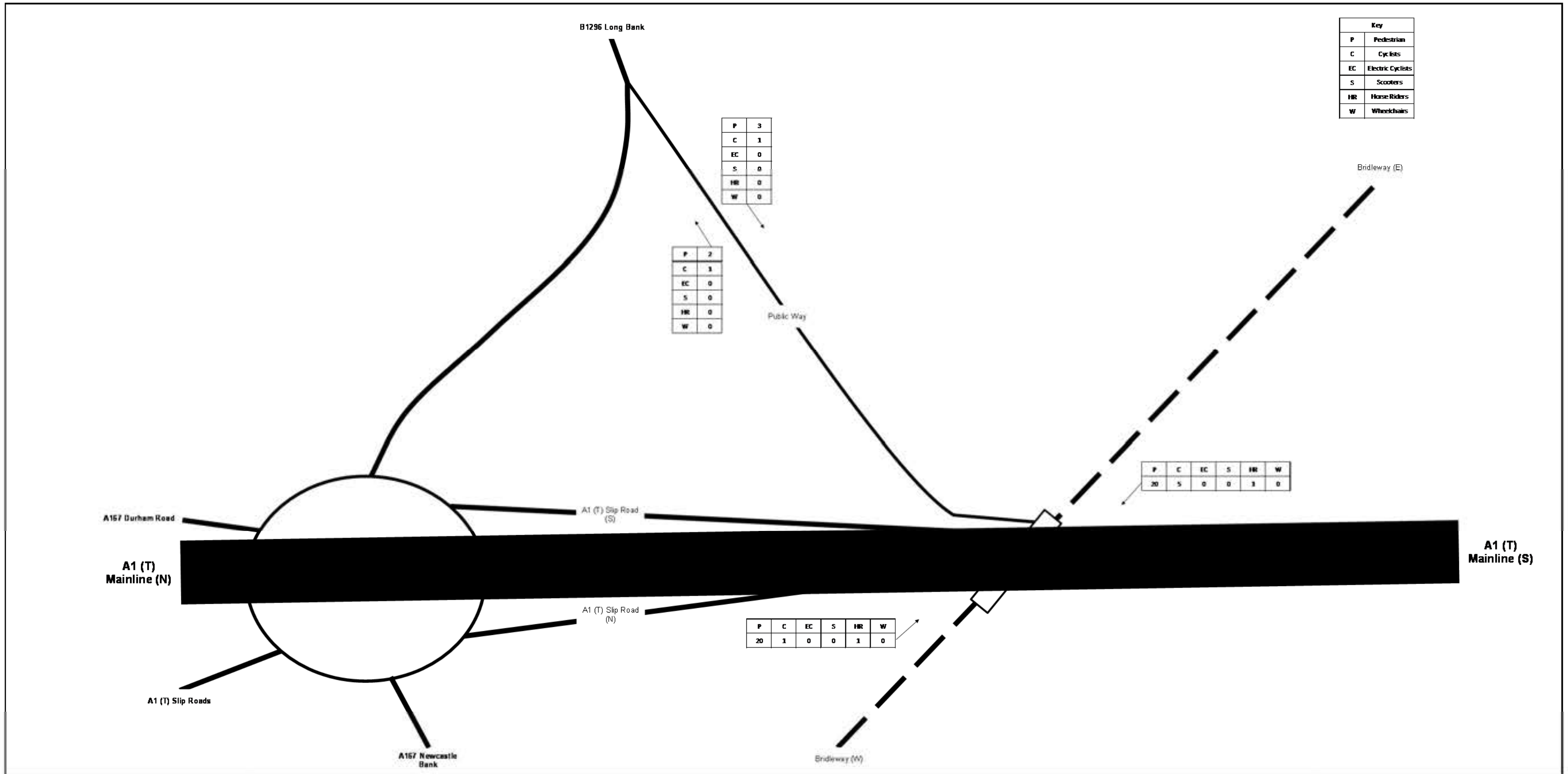
Non-Motorised Users Two-way flow survey on the Bridleway under the A1 (T) and the Public way from B1296 Long Bank (Saturday 11th 2017 - AM Peak: 11:00 - 12:00)

Figure 17 – Weekend PM Peak Period NMU Flows at the Longbank Bridleway Underbridge



Non-Motorised Users Two-way flow survey on the Bridleway under the A1 (T) and the Public way from B1296 Long Bank (Saturday 11th 2017 - PM Peak: 12:00 - 13:00)

Figure 18 – Weekend Daily NMU Flows at the Longbank Bridleway Underbridge



Non-Motorised Users Two-way flow survey on the Bridleway under the A1 (T) and the Public way from B1296 Long Bank (Saturday 11th 2017 - 24 Hour)

Section 4 - Longbank to Eighton Lodge Footpath and Eighton Lodge Interchange

To the northern side of the Longbank Bridleway underbridge, the previously described unlit 1.5m wide footpath continues to the Eighton Lodge Interchange (A1 Junction 66) Longbank Bridleway underbridge and is a formal pedestrian route which is the responsibility of Gateshead Council to maintain. The route is primarily used by pedestrians and is segregated from the northbound carriageway of the A1 mainline (which runs parallel to the route at a variable distance between 10.0m and 15.0m to the east) by a tension corrugated safety barrier/marginal grass verge with mature vegetation/concrete post and mesh-wire boundary fence treatment. On the western side of the footway there is a triangular shaped parcel of agricultural land which segregates the pedestrian route from the adjacent A167 Newcastle Bank.

Approximately 370.0m to the north of the Longbank Bridleway underbridge, the Eighton Lodge Interchange forms a full-movement five-arm, grade-separated roundabout (with part-time signal control on certain arms) between:

- The A1 (North) - Permanent priority control
- A167 Durham Road - Permanent priority control
- B1296 Longbank - Permanent priority control
- A1 (South) - Part-time traffic signal control during peak periods of operation
- A167 Newcastle Bank - Part-time traffic signal control during peak periods of operation

The roundabout has an ovular circulatory carriageway, with an ICD of approximately 140.0m (on the North-South alignment) and 165.0m (on the East-West alignment), which passes beneath two bridge structures where the A1 mainline passes over the interchange.

Either side of the junction, dedicated on-carriageway cycle facilities are provided on the A167 Durham Road and Newcastle Bank (by means of a combination of high quality bus and cycle lanes). Continuous off-carriageway dedicated non-motorised user provisions are available around the Eighton Lodge Interchange, with all five arms featuring street lighting, signage, a substandard variable width 1.0m to 1.5m shared footway/cycleway (which widens to approximately 2.5 metres beneath the bridge deck), central splitter islands, dropped kerbs with tactile blister-paving and cycleway white-lining on the bituminous pavement surface.

Pedestrian/cyclist crossing provisions are uncontrolled in nature and require users to accept gaps between the conflicting traffic streams in order to pass over the various sections of carriageway. On-site observations revealed that this is generally acceptable on receptors with lower vehicular approach speeds (i.e. typically the arms forming part of the local highway network), however, the process is considerably more complicated on entry-arms with higher vehicular approach speeds (i.e. the A1 off-slip roads) and the five exit-arms where traffic typically departs the circulatory carriageway of the roundabout at higher average speeds. It was noted that ‘Pedestrian Crossing’ signs were present on the two A1 off-slip roads on the approach to the junction, in order to provide advanced warning to motorists.

Crossing opportunities were noted to be further complicated by the horizontal alignment of the five entry-arms and the location/height of traffic signage intended for vehicles on the approach to the junction, which often acted as a sight-screen prohibiting egress visibility for pedestrians attempting to pick a gap in approaching traffic streams to the right (i.e. those travelling around the junction in an anti-clockwise direction). The exception was on A167 Durham Road and Newcastle Bank, where traffic signage had been raised in excess of 2.0m above ground level, which improved the visibility sight-lines for pedestrians and resulted in increased levels of road safety for non-motorised users.

The part time signal controlled nature of junction also resulted in issues for crossing pedestrians/cyclists, which (during periods of priority control) required them to travel in front of vehicles that were attempting to pick a gap in the circulatory traffic stream to the off-side. In such instances, non-motorised users located to the near-side kerb-line or crossing the carriageway in front of a vehicle (i.e. those travelling around the junction in an anti-clockwise direction) were typically not located within the driver's peripheral field of vision.

When the traffic signals were operational and drivers were typically looking directly ahead at the aspect/post, the presence of pedestrians/cyclists located to the near-side kerb-line or crossing the carriageway in front of a vehicle was more apparent, which resulted in increased levels of road safety for non-motorised users.

Fully classified surveys using video cameras were conducted at this location (over 24 hour periods) on Thursday 9th and Saturday 11th November 2017 in order to establish existing usage levels for all non-motorised user modes of travel. The results associated with the 'Eighton Lodge Interchange' are presented at Table 6 below:

Table 6 – Total NMU Usage Levels at the Eighton Lodge Interchange

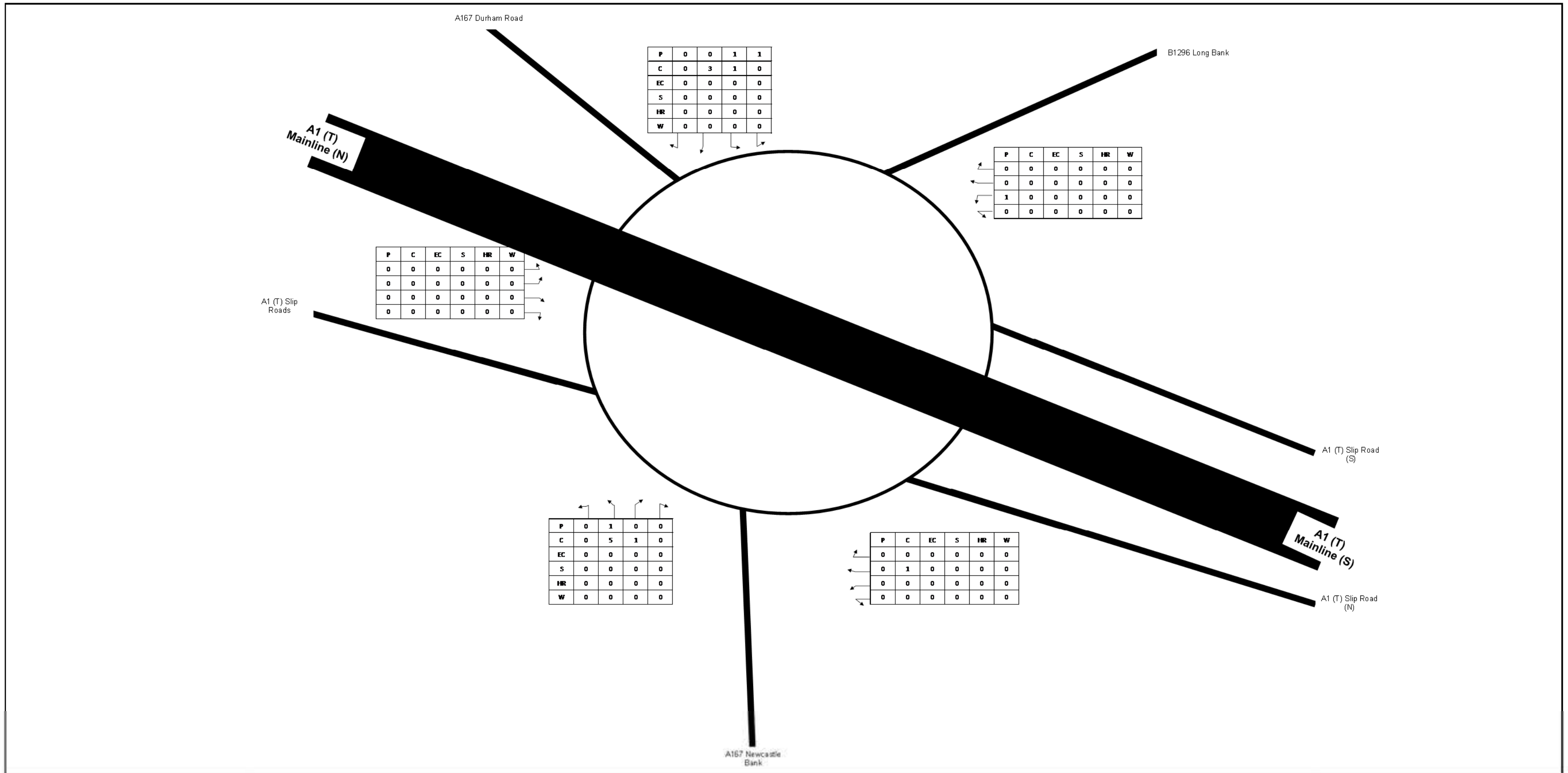
	Thursday 9th November 2017			Saturday 11th November 2017		
Travel Mode	**AM Peak (08:00-09:00)**	**PM Peak (17:00-18:00)**	**Daily (00:00-24:00)**	**AM Peak (10:00-11:00)**	**PM Peak (13:00-14:00)**	**Daily (00:00-24:00)**
Pedestrians	4	44	167	11	12	136
Cycles	11	1	82	3	7	44
Electric Cycles	0	0	0	0	0	0
Non-motorised Scooters	0	0	0	0	0	0
Equestrians	0	0	0	0	0	0
Powered Wheelchairs	0	0	0	0	0	0
Total	**15**	**45**	**249**	**14**	**19**	**180**

The results tabulated above clearly demonstrate that the route currently attracts a higher level of pedestrian and cycle movements during both peak periods and across the daily total (i.e. a maximum average of one movement every 1-2 minutes during the most intensive period of usage) than other sections in the study area.

The Cycle Map in Appendix F clearly show that the Longbank to Eighton Lodge Footpath is designated as a 'traffic-free path' with Eighton Lodge Interchange forming part of the NCN Route 725 'Great North Cycleway' (which follows the alignment of the A167, running locally from Chester-Le-Street to Gateshead and onto Newcastle upon Tyne). This indicates that the Local Highway Authority currently encourage cycling along this particular section of the network. To the northwest of the Eighton Lodge Interchange, the National Cycle Network Route 725 connects with the local Angel Cycleway, which provides a 'traffic free path' from the Angel of the North to Smithy Lane.

The flow diagrams presented on the following pages of this report set out the specific non-motorised user flow profile recorded at this location during both the AM and PM peak period, in addition to the daily totals associated with each mode of travel.

Figure 19 – Weekday AM Peak Period NMU Flows at the Eighton Lodge Interchange



P	0	0	1	1
C	0	3	1	0
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
1	0	0	0	0	0
0	0	0	0	0	0

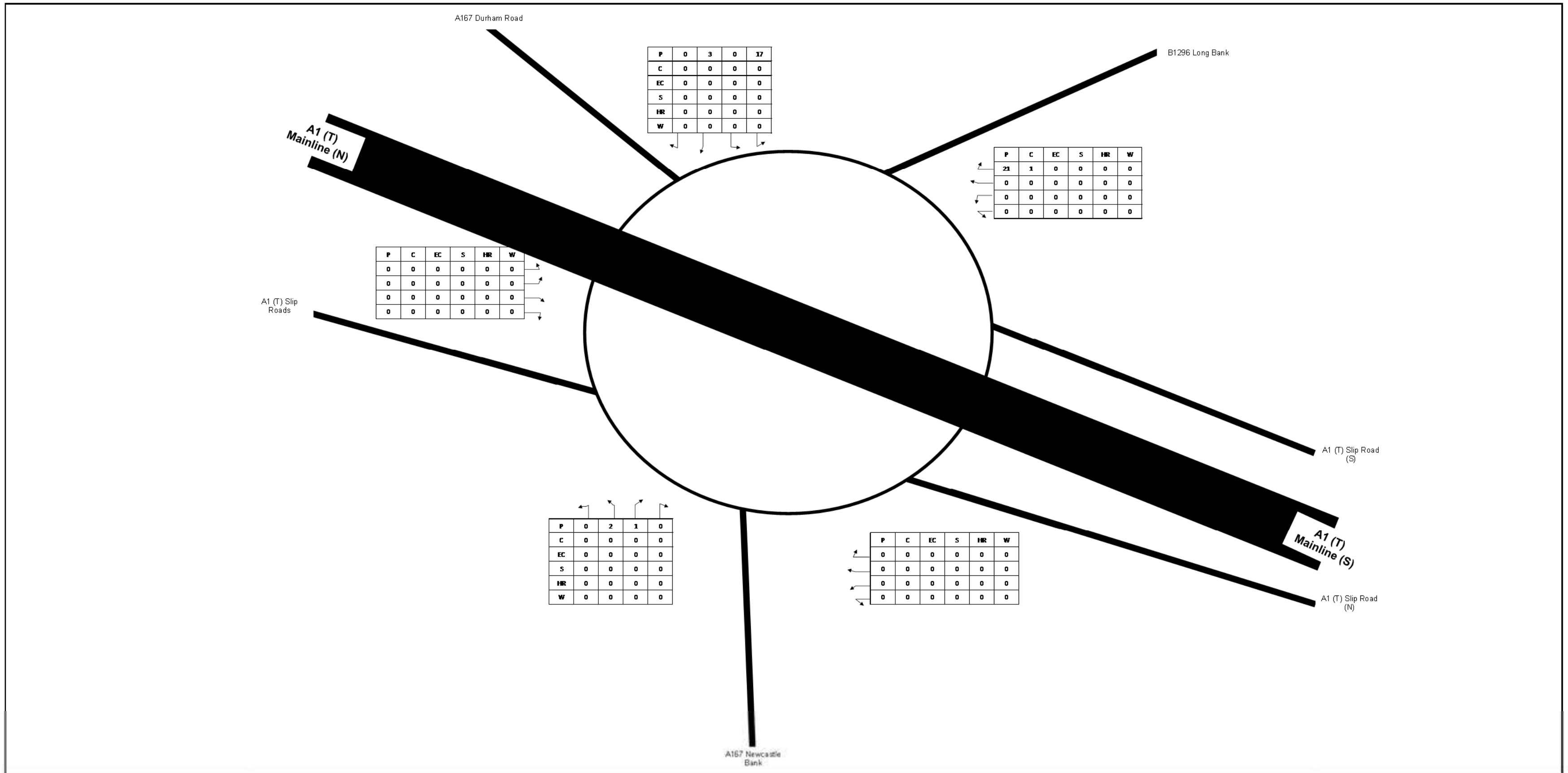
P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

P	0	1	0	0
C	0	5	1	0
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
0	0	0	0	0	0
0	1	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

Non-Motorised Users Origin to Destrination survey on the arms of Eighton Lodge roundabout
(Thursday 9th 2017 - AM Peak: 08:00 - 09:00)

Figure 20 – Weekday PM Peak Period NMU Flows at the Eighton Lodge Interchange



P	0	3	0	17
C	0	0	0	0
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
21	1	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

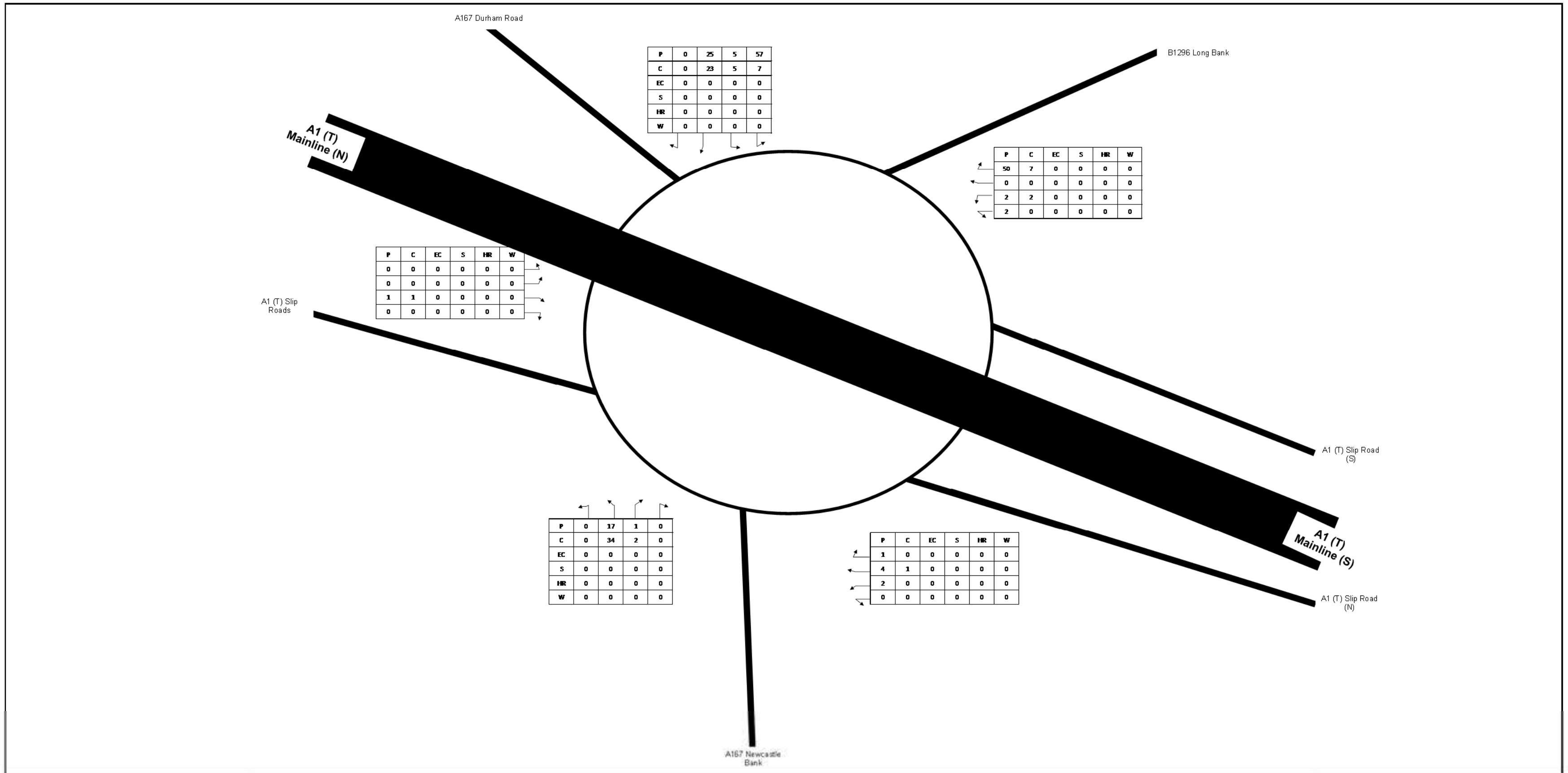
P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

P	0	2	1	0
C	0	0	0	0
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

Non-Motorised Users Origin to Destrination survey on the arms of Eighton Lodge roundabout
(Thursday 9th 2017 - PM Peak: 19:00 - 20:00)

Figure 21 – Weekday Daily NMU Flows at the Eighton Lodge Interchange



P	0	25	5	57
C	0	23	5	7
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
50	7	0	0	0	0
0	0	0	0	0	0
2	2	0	0	0	0
2	0	0	0	0	0

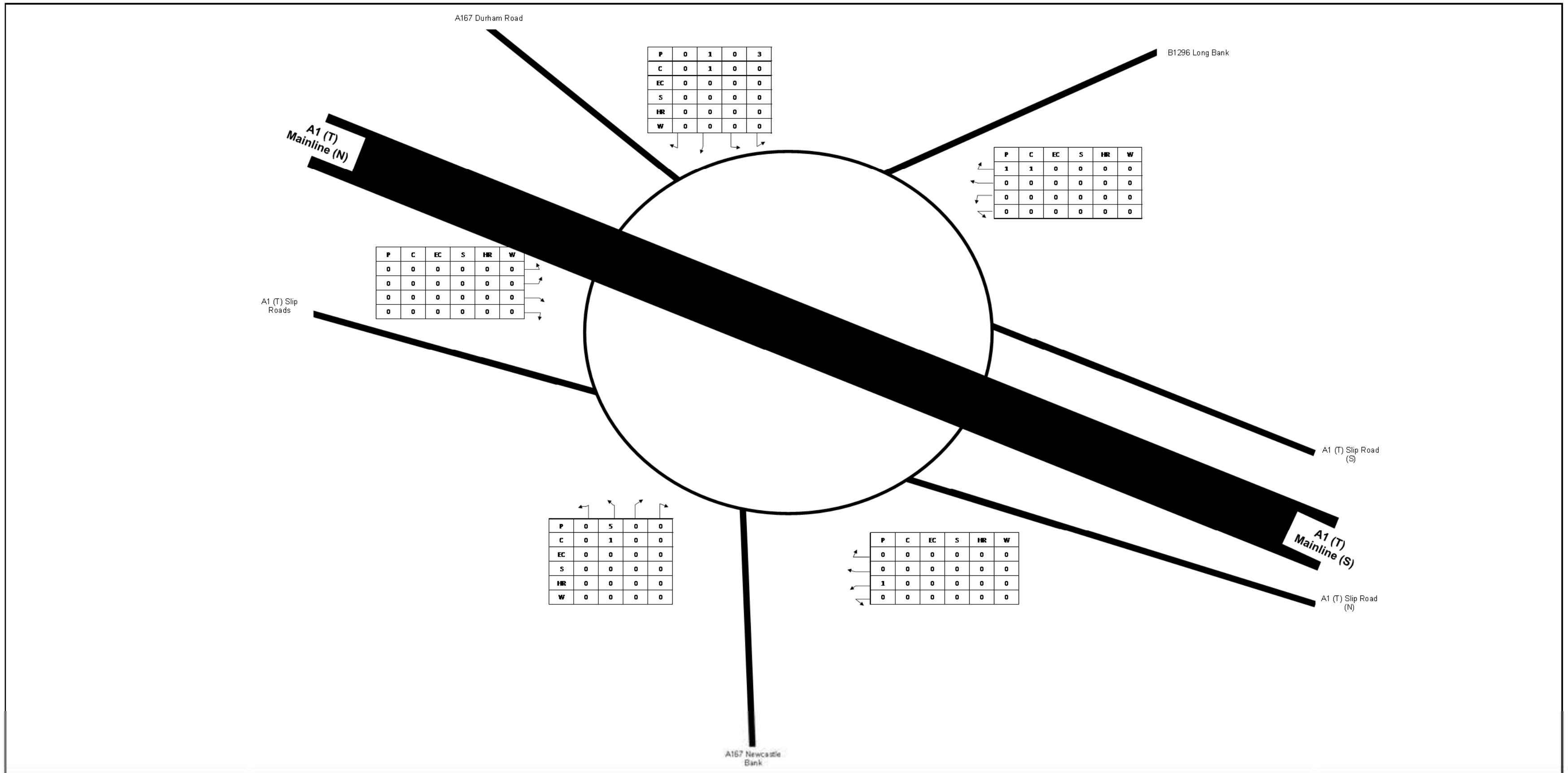
P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
1	1	0	0	0	0
0	0	0	0	0	0

P	0	17	1	0
C	0	34	2	0
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
1	0	0	0	0	0
4	1	0	0	0	0
2	0	0	0	0	0
0	0	0	0	0	0

Non-Motorised Users Origin to Destrination survey on the arms of Eighton Lodge roundabout (Thursday 9th 2017 - 24 Hour)

Figure 22– Weekend AM Peak Period NMU Flows at the Eighton Lodge Interchange



P	0	1	0	3
C	0	1	0	0
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
1	1	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

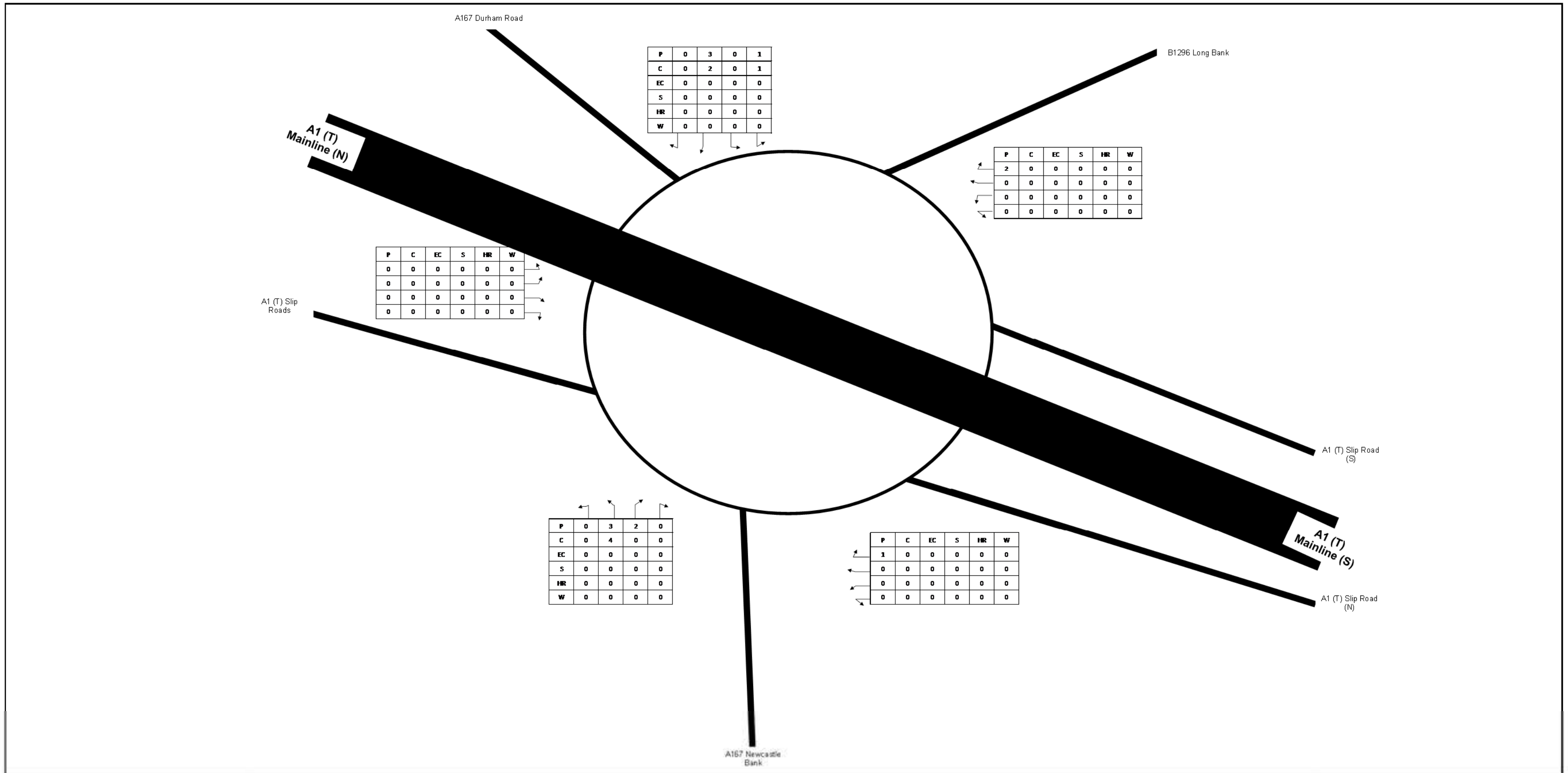
P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

P	0	5	0	0
C	0	1	0	0
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
1	0	0	0	0	0
0	0	0	0	0	0

Non-Motorised Users Origin to Destrination survey on the arms of Eighton Lodge roundabout
(Saturday 11th 2017 - AM Peak: 10:00 - 11:00)

Figure 23 – Weekend PM Peak Period NMU Flows at the Eighton Lodge Interchange



P	0	3	0	1
C	0	2	0	1
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
2	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

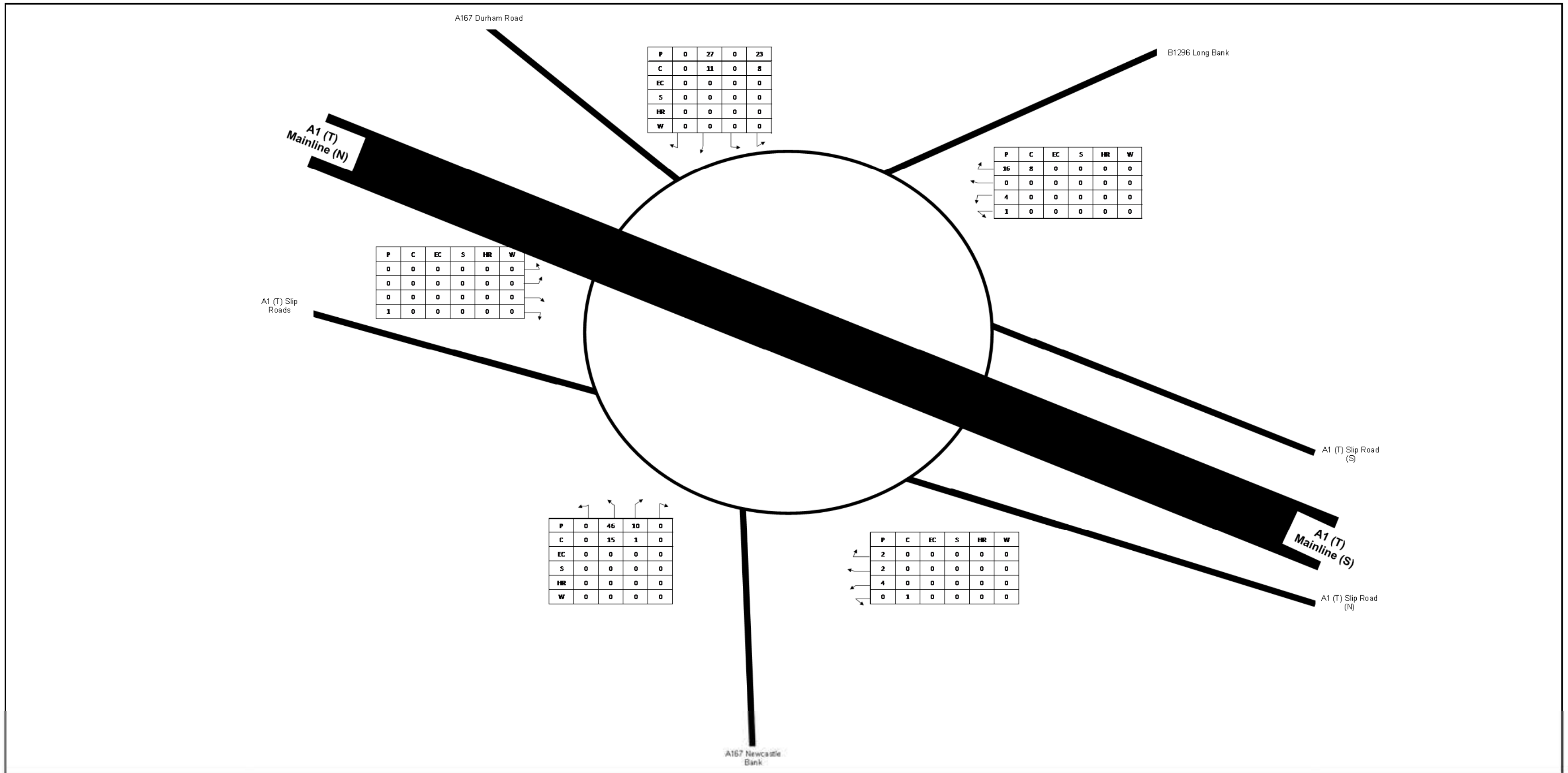
P	0	3	2	0
C	0	4	0	0
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
1	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

wsp

Non-Motorised Users Origin to Destrination survey on the arms of Eighton Lodge roundabout
(Saturday 11th 2017 - PM Peak: 14:00 - 15:00)

Figure 24 – Weekend Daily NMU Flows at the Eighton Lodge Interchange



P	0	27	0	23
C	0	11	0	8
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
16	8	0	0	0	0
0	0	0	0	0	0
4	0	0	0	0	0
1	0	0	0	0	0

P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
1	0	0	0	0	0

P	0	46	10	0
C	0	15	1	0
EC	0	0	0	0
S	0	0	0	0
HR	0	0	0	0
W	0	0	0	0

P	C	EC	S	HR	W
2	0	0	0	0	0
2	0	0	0	0	0
4	0	0	0	0	0
0	1	0	0	0	0

Non-Motorised Users Origin to Destrination survey on the arms of Eighton Lodge roundabout (Saturday 11th 2017 - 24 Hour)

Section 5 - Smithy Lane overbridge and the Angel Cycleway/Chowdene Bank Bridge

The 'Smithy Lane overbridge' is located between Junction 66 (Eighton Lodge) and Junction 67 (Coalhouse) of the A1, midway along the A1 NGWB, and facilitates the crossing of Smithy Lane over the trunk road network between the Harlow Green area of Gateshead (to the east) and Lamesley (to the west).

Smithy Lane at this location is a derestricted single-carriageway, two-way road, which is a relatively lightly trafficked section of the local highway network. Smithy Lane provides a linkage between rural villages such as Sunniside, Ravensworth, Lamesley, etc., and the urban conurbation of Gateshead to the east. Smithy Lane forms part of the local highway network and, as such, Gateshead Council is the Authority responsible for maintaining the carriageway/footway.

The 'Smithy Lane overbridge' is approximately 11.3m wide (consisting of a 7.3m wide carriageway, a 1.5m wide nominal footway over the northern side and a 2.5m wide footway over the southern side of the 85.0m long bridge-deck) with a 1.0m high parapet fence to protect crossing pedestrians. Significant level differences and lack of infrastructure limit access to the A1 mainline.

The unlit pedestrian footway on the southern side which continues either side of the bridge is variable in terms of both standard and width on both approaches to the 'Smithy Lane overbridge' itself. The gradient is reasonably level, however, the substandard footway width varies between 1.0m and 1.5m (with a marginal 1.0m to 1.5m wide grass verge on either side of the footway to separate the pedestrian facilities from the carriageway and a short additional section of tension corrugated safety barrier prior to the bridge deck on the eastern side).

Fully classified surveys using video cameras were conducted at this location (over 24 hour periods) on Thursday 9th and Saturday 11th November 2017 in order to establish existing usage levels for all non-motorised user modes of travel. The results associated with the 'Smithy Lane overbridge' are presented at Table 7 below:

Table 7 – Total NMU Usage Levels at the Smithy Lane overbridge

	Thursday 9th November 2017			Saturday 11th November 2017		
Travel Mode	**AM Peak (10:00-11:00)**	**PM Peak (12:00-13:00)**	**Daily (00:00-24:00)**	**AM Peak (08:00-09:00)**	**PM Peak (20:00-21:00)**	**Daily (00:00-24:00)**
Pedestrians	12	12	35	3	9	44
Cycles	0	0	2	0	0	2
Electric Cycles	0	0	0	0	0	0
Non-motorised Scooters	0	0	0	0	0	0
Equestrians	0	0	0	0	0	0
Powered Wheelchairs	0	0	0	0	0	0
Total	**12**	**12**	**37**	**3**	**9**	**46**

The results tabulated above clearly demonstrate that the route currently attracts a modest level of pedestrian and cycle movements (on carriageway) during both peak periods and across the daily total (i.e. a maximum average of one movement every 5 minutes during the most intensive period of usage).

The Cycle Maps in Appendix F clearly show that the Smithy Lane overbridge is not designated as a formal route, which is borne out by the numbers in the table above. However, the Local Highway Authority would not discourage cycling along this particular section of the network.

The flow diagrams presented on the following pages of this report set out the specific non-motorised user flow profile recorded at this location during both the AM and PM peak period, in addition to the daily totals associated with each mode of travel.

Figure 25 – Weekday AM Peak Period NMU Flows at the Smithy Lane overbridge

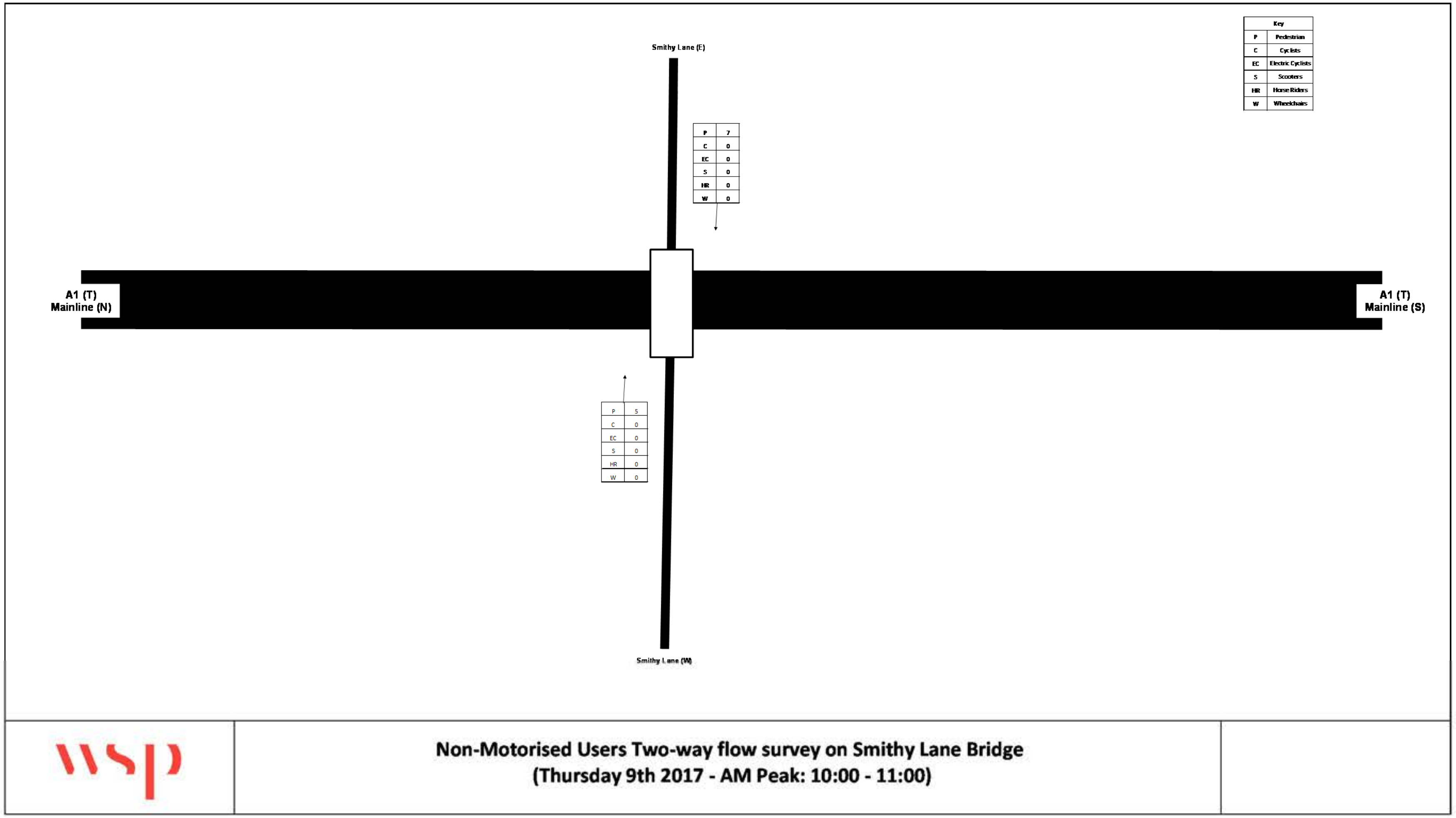


Figure 26 – Weekday PM Peak Period NMU Flows at the Smithy Lane overbridge

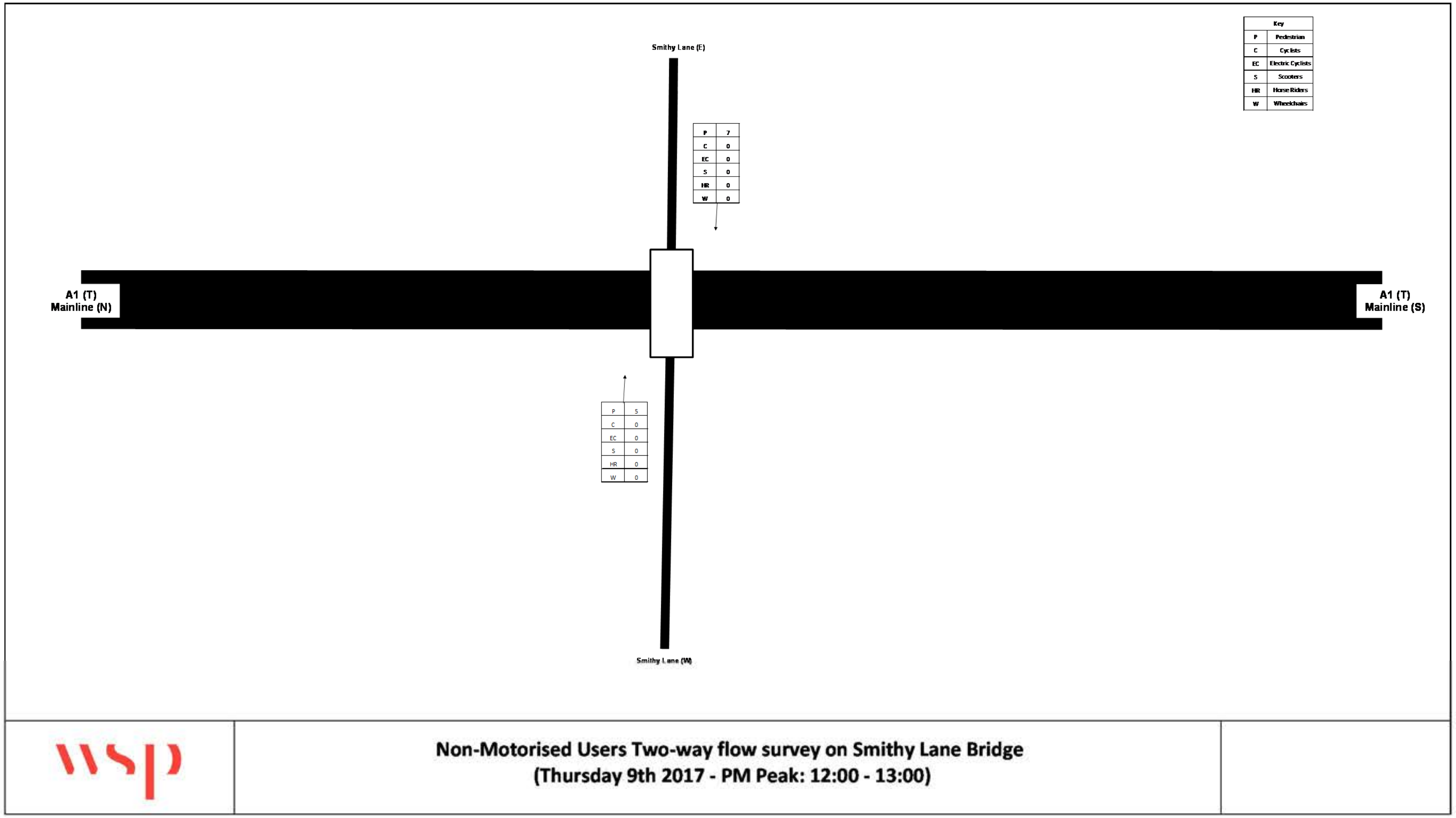


Figure 27 – Weekday Daily NMU Flows at the Smithy Lane overbridge

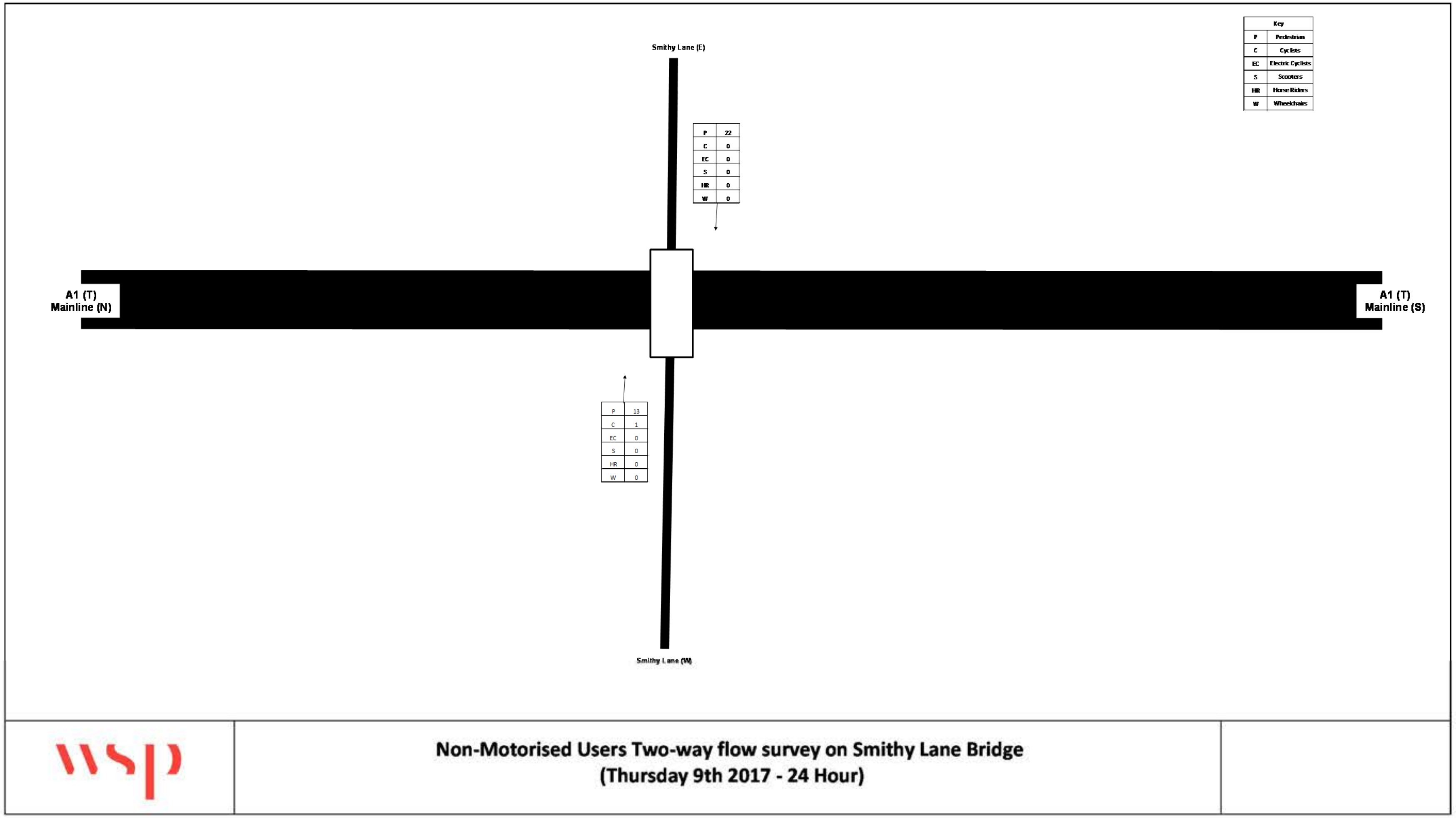


Figure 28 – Weekend AM Peak Period NMU Flows at the Smithy Lane overbridge

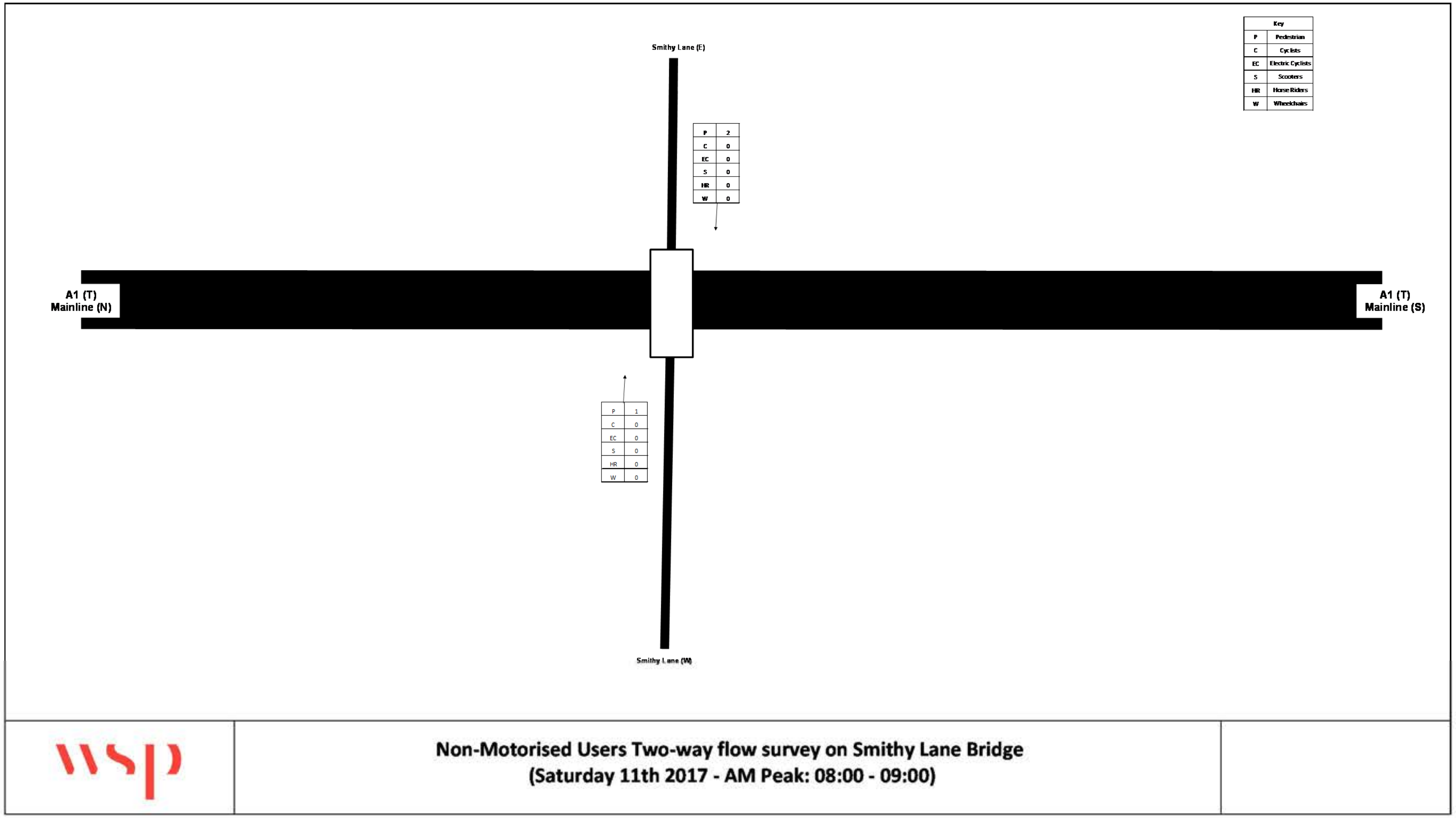


Figure 29 – Weekend PM Peak Period NMU Flows at the Smithy Lane overbridge

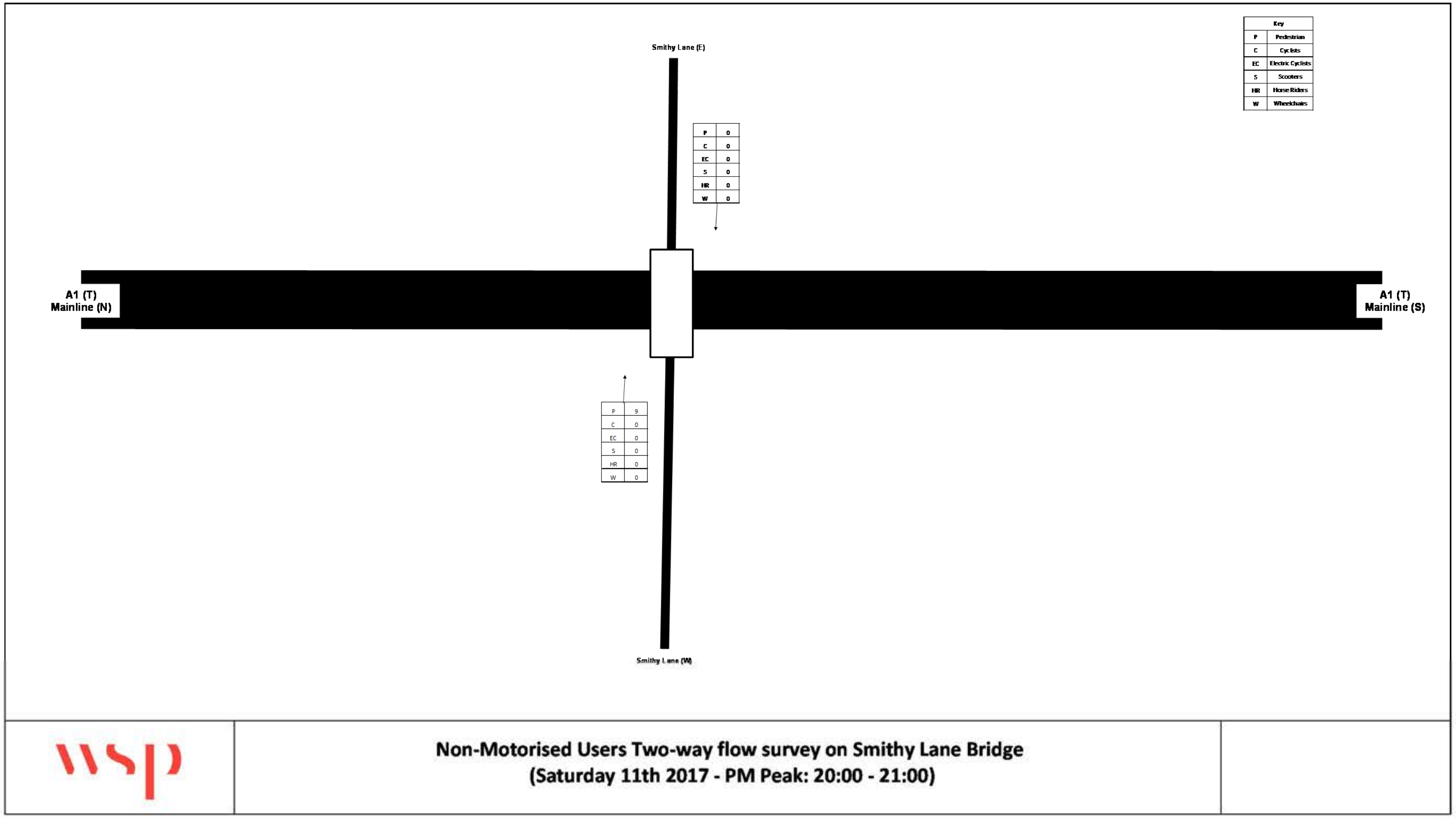
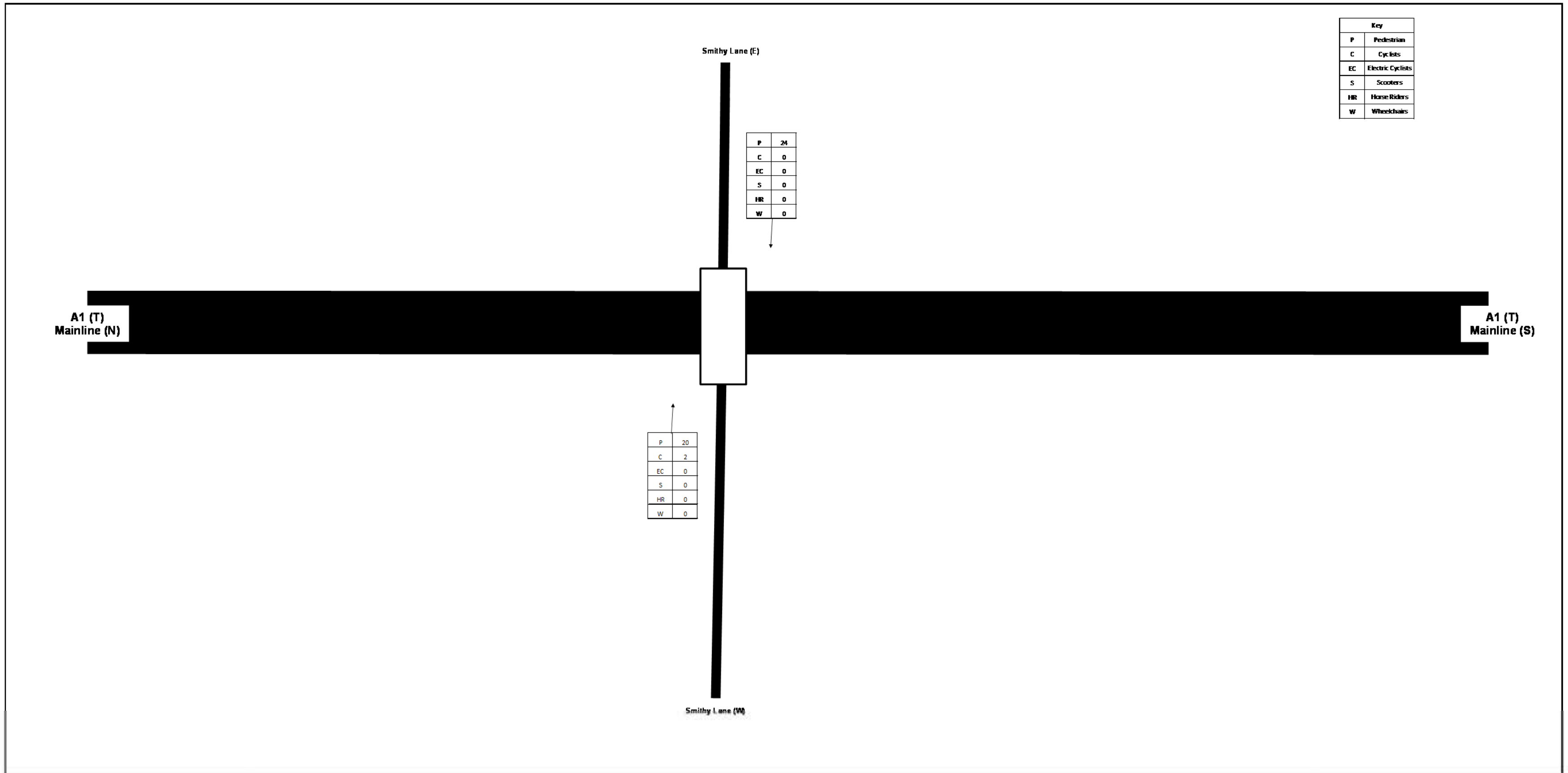


Figure 30 – Weekend Daily NMU Flows at the Smithy Lane overbridge



Non-Motorised Users Two-way flow survey on Smithy Lane Bridge
(Saturday 11th 2017 - 24 Hour)

To the eastern side of the 'Smithy Lane overbridge' the previously described Angel Cycleway joins the local highway network adjacent to Smithy Lane. This lit 3.5m wide pedestrian/cycleway, which is maintained by Gateshead Council, provides a 'traffic free path' up to the residential area of Salcombe Gardens in Allerdene. Beyond this point it becomes a 'sign-posted on road cycle route' crossing Chowdene Bank Bridge which is approximately 7.0m wide (consisting of a 5.5m wide carriageway and a 1.5m wide footway over the northern side of the 80.0m long bridge-deck) with a 2.0m high parapet wall. To the west of the bridge the footway width increases to 2.0m and provides a street-lit, continuous direct link to the Coalhouse Interchange, the Team Valley Industrial and Retail Parks.

Fully classified surveys using video cameras were also conducted at this location in order to establish existing usage levels for all non-motorised user modes of travel. The results associated with the 'The Angel Cycleway/Chowdene Bank Bridge' are presented at Table 8 and Table 9 below:

Table 8 – Total NMU Usage Levels at the Angel Cycleway

	Thursday 9th November 2017			Saturday 11th November 2017		
Travel Mode	**AM Peak (08:00-09:00)**	**PM Peak (16:00-17:00)**	**Daily (00:00-24:00)**	**AM Peak (10:00-11:00)**	**PM Peak (13:00-14:00)**	**Daily (00:00-24:00)**
Pedestrians	7	5	66	7	12	86
Cycles	1	0	3	1	0	4
Electric Cycles	0	0	0	0	0	0
Non-motorised Scooters	0	0	0	0	0	0
Equestrians	0	0	0	0	0	0
Powered Wheelchairs	0	0	0	0	0	0
Total	**8**	**5**	**69**	**8**	**12**	**90**

Table 9 – Total NMU Usage Levels at the Chowdene Bank Bridge

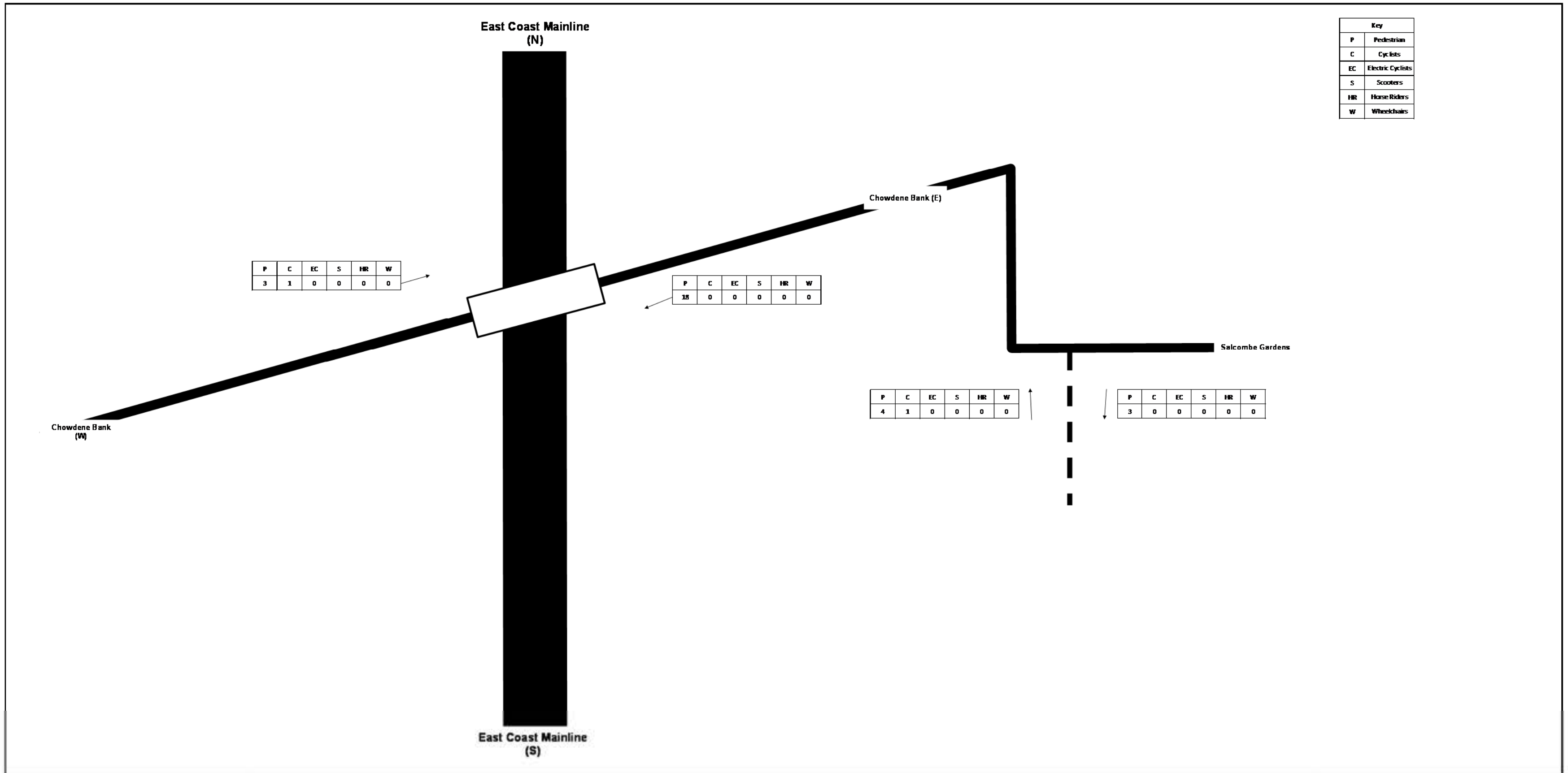
	Thursday 9th November 2017			Saturday 11th November 2017		
Travel Mode	**AM Peak (08:00-09:00)**	**PM Peak (16:00-17:00)**	**Daily (00:00-24:00)**	**AM Peak (10:00-11:00)**	**PM Peak (13:00-14:00)**	**Daily (00:00-24:00)**
Pedestrians	21	40	252	29	36	278
Cycles	1	4	25	0	0	11
Electric Cycles	0	0	0	0	0	0
Non-motorised Scooters	0	0	0	0	0	0
Equestrians	0	0	0	0	0	0
Powered Wheelchairs	0	0	0	0	0	0
Total	**22**	**44**	**277**	**29**	**36**	**289**

The results tabulated above for Chowdene Bank Bridge clearly demonstrate that the route currently attracts a higher level of pedestrian and cycle movements during both peak periods and across the daily total than other sections in the study area.

The results tabulated above show a maximum average of one movement every 5 minutes on the Angel Cycleway and one every minute over Chowdene Bank Bridge during the most intensive period of usage.

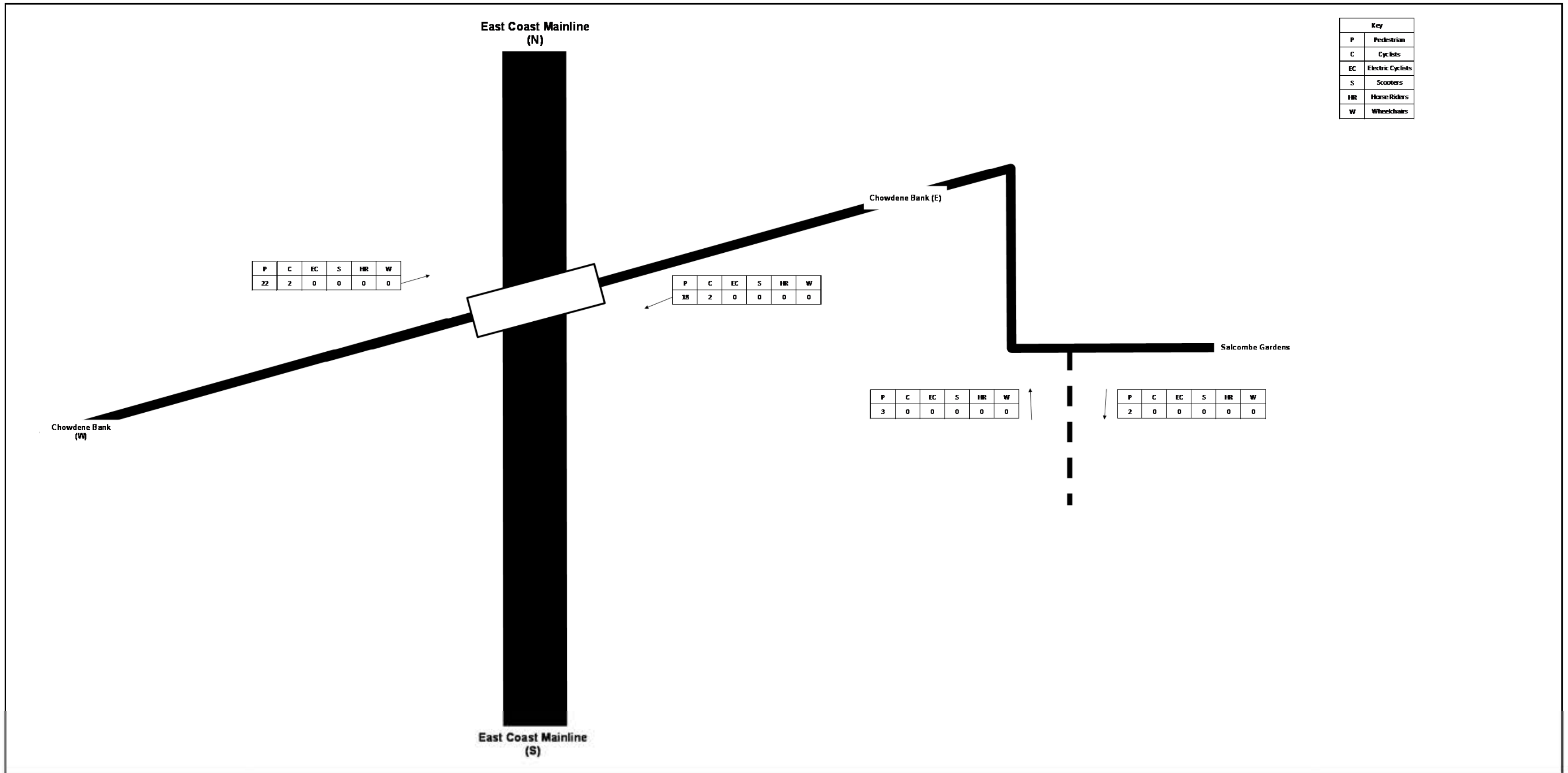
The flow diagrams presented on the following pages of this report set out the specific non-motorised user flow profile recorded at this location during both the AM and PM peak period, in addition to the daily totals associated with each mode of travel.

Figure 31 – Weekday AM Peak Period NMU Flows at the Angel Cycleway and Chowdene Bank Bridge



Non-Motorised Users Two-way flow survey on Chowdene Bank Bridge and Salcombe Gardens
(Thursday 9th 2017 - AM Peak: 08:00 - 09:00)

Figure 32 – Weekday PM Peak Period NMU Flows at the Angel Cycleway and Chowdene Bank Bridge



Non-Motorised Users Two-way flow survey on Chowdene Bank Bridge and Salcombe Gardens
(Thursday 9th 2017 - PM Peak: 16:00 - 17:00)

Figure 33 – Weekday Daily NMU Flows at the Angel Cycleway and Chowdene Bank Bridge

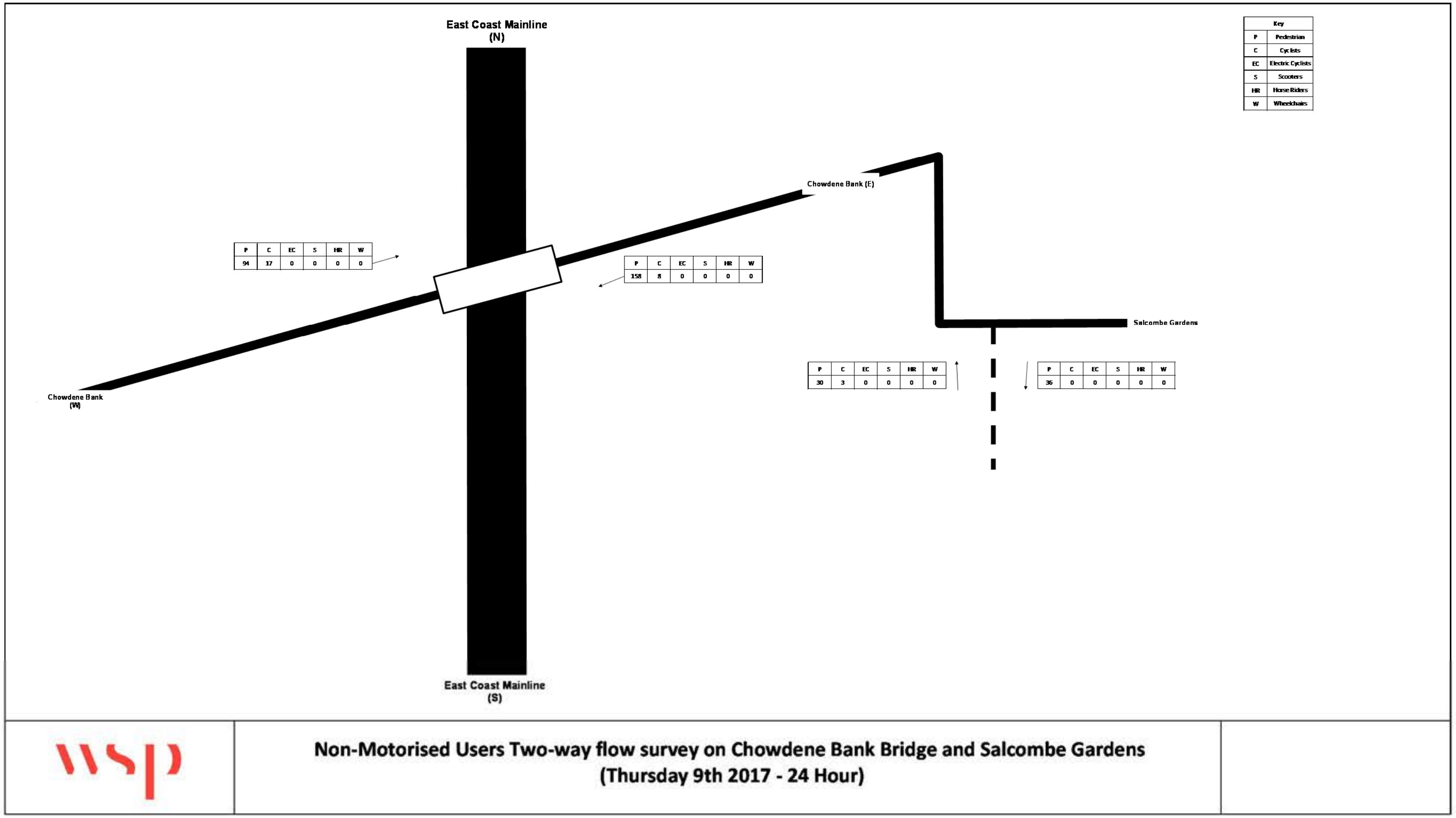
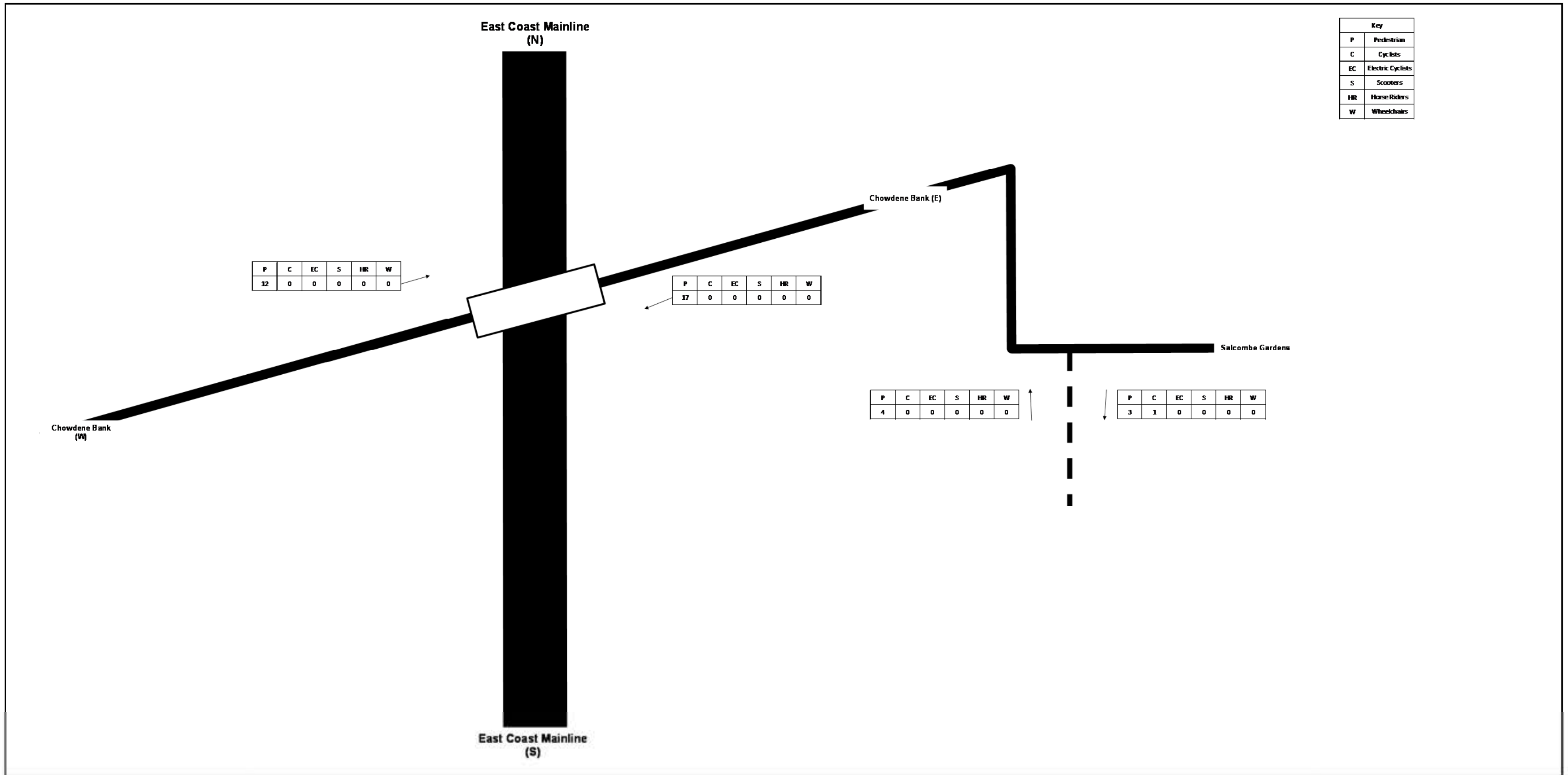


Figure 34 – Weekend AM Peak Period NMU Flows at the Angel Cycleway and Chowdene Bank Bridge



Non-Motorised Users Two-way flow survey on Chowdene Bank Bridge and Salcombe Gardens
(Saturday 11th 2017 - AM Peak: 10:00 - 11:00)

Figure 35 – Weekend PM Peak Period NMU Flows at the Angel Cycleway and Chowdene Bank Bridge

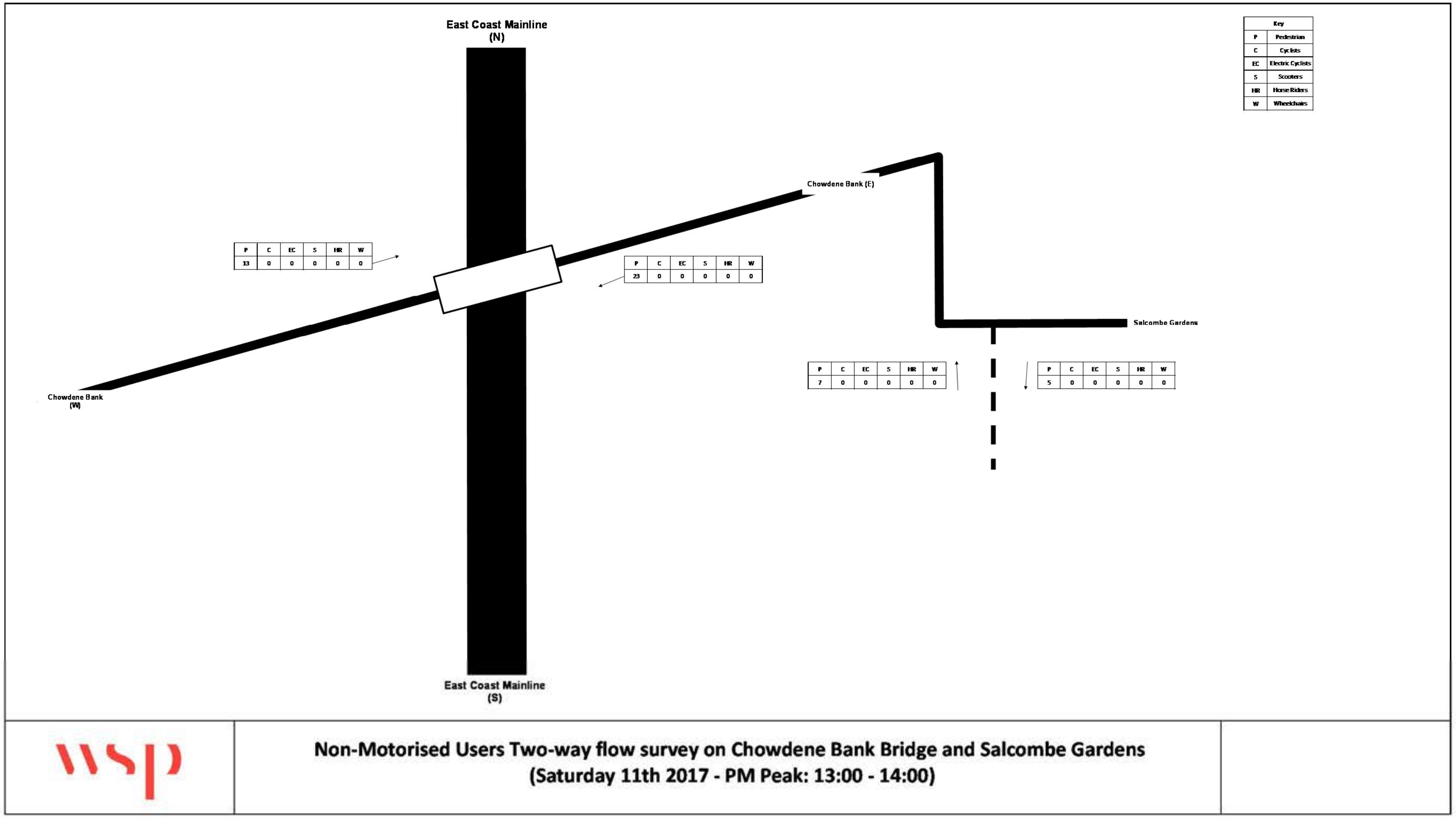
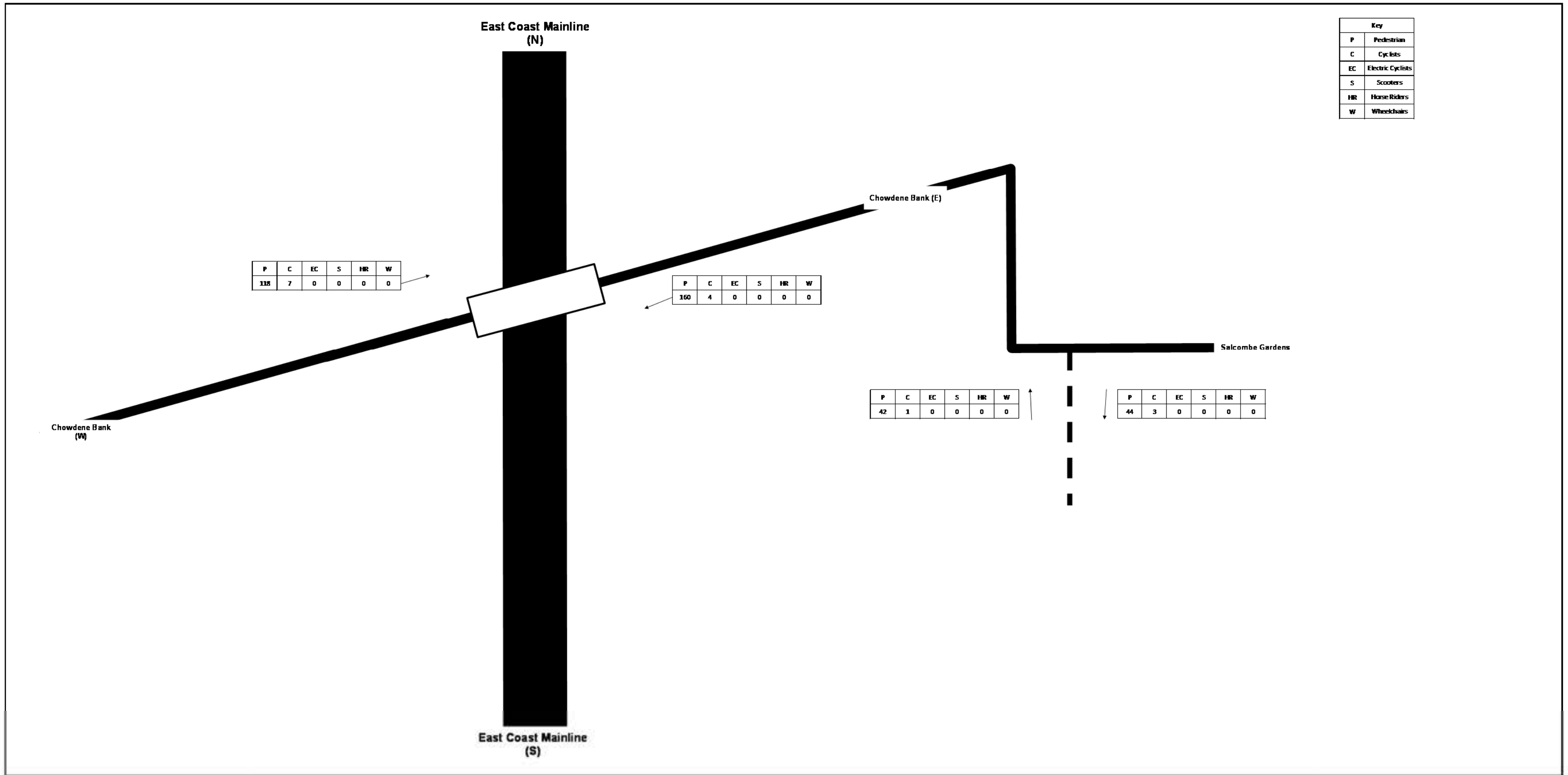


Figure 36 – Weekend Daily NMU Flows at the Angel Cycleway and Chowdene Bank Bridge



P	C	EC	S	HR	W
118	7	0	0	0	0

P	C	EC	S	HR	W
160	4	0	0	0	0

P	C	EC	S	HR	W
42	1	0	0	0	0

P	C	EC	S	HR	W
44	3	0	0	0	0

wsp

Non-Motorised Users Two-way flow survey on Chowdene Bank Bridge and Salcombe Gardens
(Saturday 11th 2017 - 24 Hour)

Section 6 – Coalhouse Interchange

To the west side of the Chowdene Bank Bridge, the previously described lit 2.0m wide footway continues for approximately 450.0m to the Coalhouse Interchange at Junction 67 on the A1, which forms a full-movement six-arm, grade-separated roundabout (with part-time signal control on certain arms) between:

- The A1 (West) - Permanent priority control
- Kingsway South - Part-time traffic signal control during peak periods of operation
- Chowdene Bank - Permanent priority control
- A1 (East) - Part-time traffic signal control during peak periods of operation
- Lamesley Road - Permanent priority control
- Banesley Lane - Permanent priority control

The roundabout has an ovular circulatory carriageway, with an ICD of approximately 140.0m (on the North-South alignment) and 125.0m (on the East-West alignment), which passes beneath two bridge structures where the A1 mainline passes over the interchange.

Kingsway South is a dual-carriageway two-way road that provides direct access to the Team Valley Industrial and Retail Parks. Chowdene Bank is a single-carriageway two-way road which serves the Sainsbury's and Argos development in addition to the residential areas to the east. Both of these routes provide access to major employment and retail opportunities in the local area, which are trip attractors for both vehicular and non-motorised modes of travel. Lamesley Road is also a single-carriageway two-way road which serves Horse World; an equestrian centre that also sells equipment and supplies to the general public, and further afield continues to Birtley. Banesley Lane is a single-carriageway two-way road which serves a number of residential units.

Continuous off-carriageway dedicated non-motorised user provisions are available around the Coalhouse Interchange, with all six arms featuring street lighting, a variable width 2.0m to 2.5m footway and central splitter islands. Various arms also benefit from dropped kerbs with tactile blister-paving and dashed white-lining to provide indicative pedestrian crossing routes over the traffic lanes.

Pedestrian/cyclist crossing provisions are uncontrolled in nature and require users to accept gaps between the conflicting traffic streams in order to pass over the various sections of carriageway. On-site observations revealed that this is generally acceptable on receptors with lower vehicular approach speeds (i.e. typically the arms forming part of the local highway network), however, the process is considerably more complicated on entry-arms with higher vehicular approach speeds (i.e. the A1 off-slip roads) and the five exit-arms where traffic typically departs the circulatory carriageway of the roundabout at higher average speeds. It was noted that 'Pedestrian Crossing' signs were present on the two A1 off-slip roads on the approach to the junction, in order to provide advanced warning to motorists. The signage strategy is, however, inconsistent, with the northbound off-slip benefiting from a 'Zebra Crossing Ahead' sign (despite the crossing being uncontrolled in nature and the southbound off-slip has an 'Other Danger Ahead' sign with an accompanying 'Nature of Danger' sign located beneath which advises of 'Pedestrians Crossing'.

Crossing opportunities were noted to be further complicated by the horizontal alignment of the five entry-arms and part time signal controlled nature of junction, which (during periods of priority control) required pedestrians to walk in front of vehicles that were attempting to pick a gap in the circulatory traffic stream to the off-side. In such instances, pedestrians located to the near-side kerb-line or crossing the carriageway in front of a vehicle (i.e. those travelling around the junction in an anti-clockwise direction) were typically not located within the driver's peripheral field of vision.

When the traffic signals were operational and drivers were typically looking directly ahead at the aspect/post, however, the presence of pedestrians located to the near-side kerb-line or crossing the carriageway in front of a vehicle was more apparent, which resulted in increased levels of road safety for non-motorised users.

Additionally, site observations also revealed that the Sainsbury's and Argos site acts as a local trip attractor, with pedestrians originating from the south of the Coalhouse Interchange (i.e. those travelling around the junction in an anti-clockwise direction) generally approaching on the southern side of Chowdene Bank and crossing a heavily trafficked stretch of the local highway network in order to reach the main pedestrian access on the northern side of Chowdene Bank. There are currently no formal crossing provisions adjacent to the store access and the primary desire line actively encourages pedestrians to cross the road between two bus lay-bys (on either side of Chowdene Bank) resulting in road safety concerns for non-motorised users.

Fully classified surveys using video cameras were conducted at this location (over 24 hour periods) on Thursday 9th and Saturday 11th November 2017 in order to establish existing usage levels for all non-motorised user modes of travel. The results associated with the 'Coalhouse Interchange' are presented at Table 10 below:

Table 10 – Total NMU Usage Levels at the Coalhouse Interchange

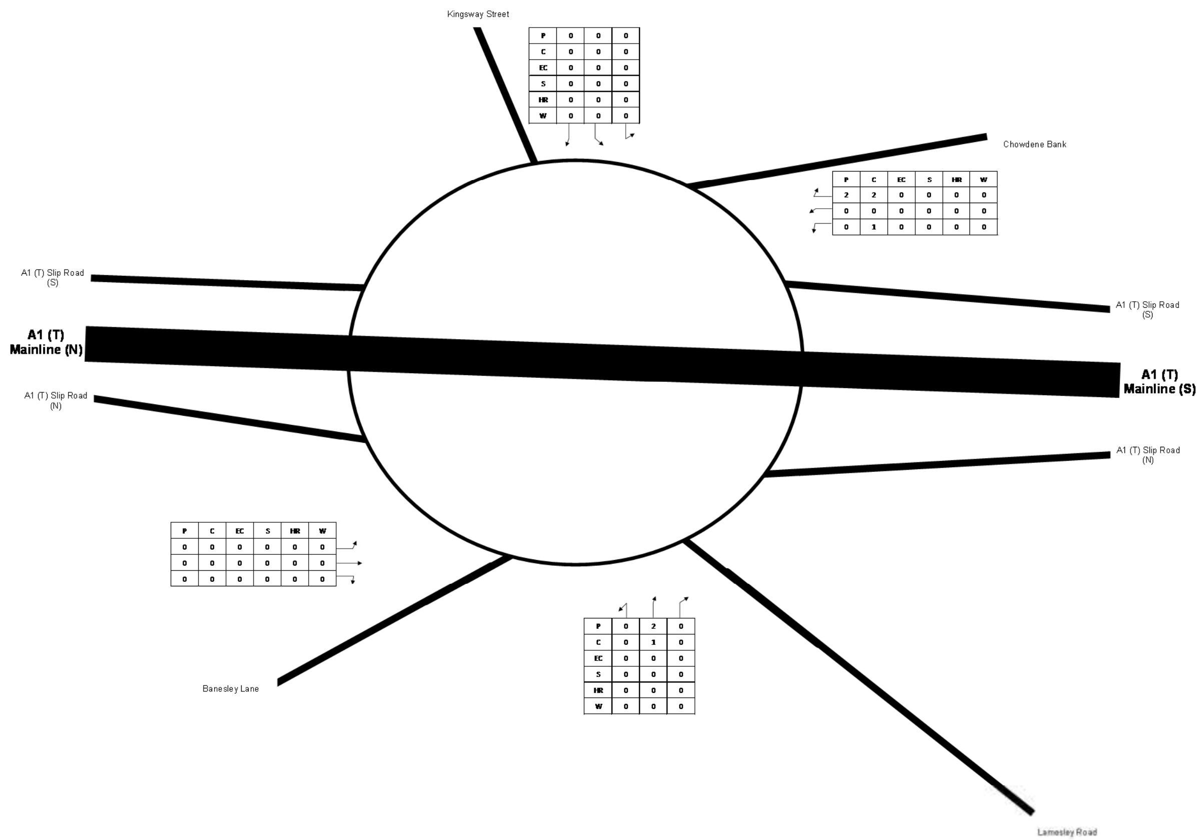
	Thursday 9th November 2017			Saturday 11th November 2017		
Travel Mode	**AM Peak (08:00-09:00)**	**PM Peak (16:00-17:00)**	**Daily (00:00-24:00)**	**AM Peak (08:00-09:00)**	**PM Peak (13:00-14:00)**	**Daily (00:00-24:00)**
Pedestrians	4	8	64	4	14	77
Cycles	4	6	22	2	2	27
Electric Cycles	0	0	0	0	0	0
Non-motorised Scooters	0	0	0	0	0	0
Equestrians	0	0	0	0	0	0
Powered Wheelchairs	0	0	0	0	0	0
Total	**8**	**14**	**86**	**6**	**16**	**104**

The results tabulated above clearly demonstrate that the route currently attracts a modest level of pedestrian and cycle movements during both peak periods and across the daily total (i.e. a maximum average of one movement every 3-4 minutes during the most intensive period of usage).

The Cycle Maps in Appendix F clearly show that the Coalhouse Interchange is designated as a 'path or footway where you should walk your bike', although it is not a designated cycle route cyclists are the predominant user. The table previously demonstrates low usage levels at this section. Within the immediate vicinity of this section of the study area, much of the Team Valley Trading Estate is designated as proving either a 'traffic-free path' or a 'sign-posted on road cycle route'.

The flow diagrams presented on the following pages of this report set out the specific non-motorised user flow profile recorded at this location during both the AM and PM peak period, in addition to the daily totals associated with each mode of travel.

Figure 37 – Weekday AM Peak Period NMU Flows at the Coalhouse Interchange



Kingsway Street:

P	0	0	0
C	0	0	0
EC	0	0	0
S	0	0	0
HR	0	0	0
W	0	0	0

Chowdene Bank:

P	C	EC	S	HR	W
2	2	0	0	0	0
0	0	0	0	0	0
0	1	0	0	0	0

Banesley Lane:

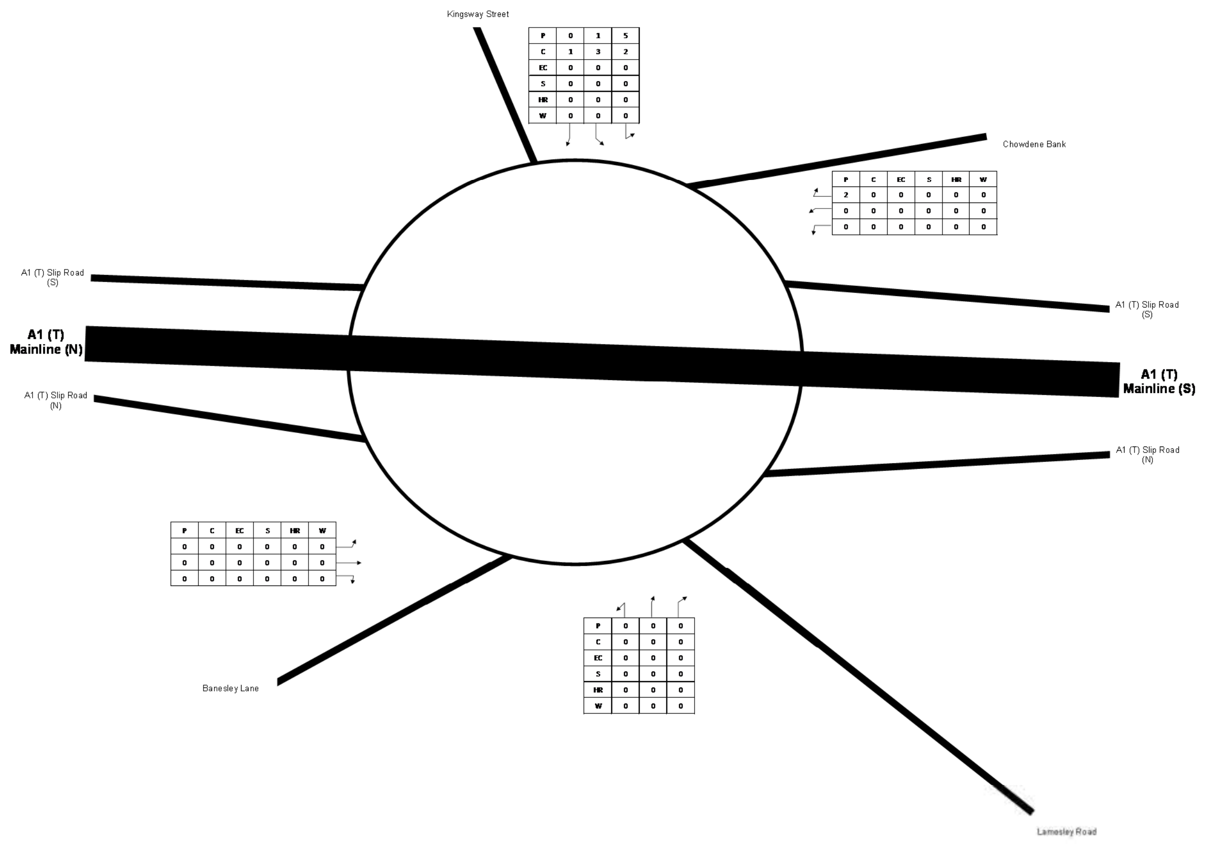
P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

Lamesley Road:

P	0	2	0
C	0	1	0
EC	0	0	0
S	0	0	0
HR	0	0	0
W	0	0	0

Non-Motorised Users Origin to Destination survey on the arms of Coal-House roundabout
(Thursday 9th 2017 - AM Peak: 08:00 - 09:00)

Figure 38 – Weekday PM Peak Period NMU Flows at the Coalhouse Interchange



Kingsway Street:

P	0	1	5
C	1	3	2
EC	0	0	0
S	0	0	0
HR	0	0	0
W	0	0	0

Chowdene Bank:

P	C	EC	S	HR	W
2	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

Banesley Lane:

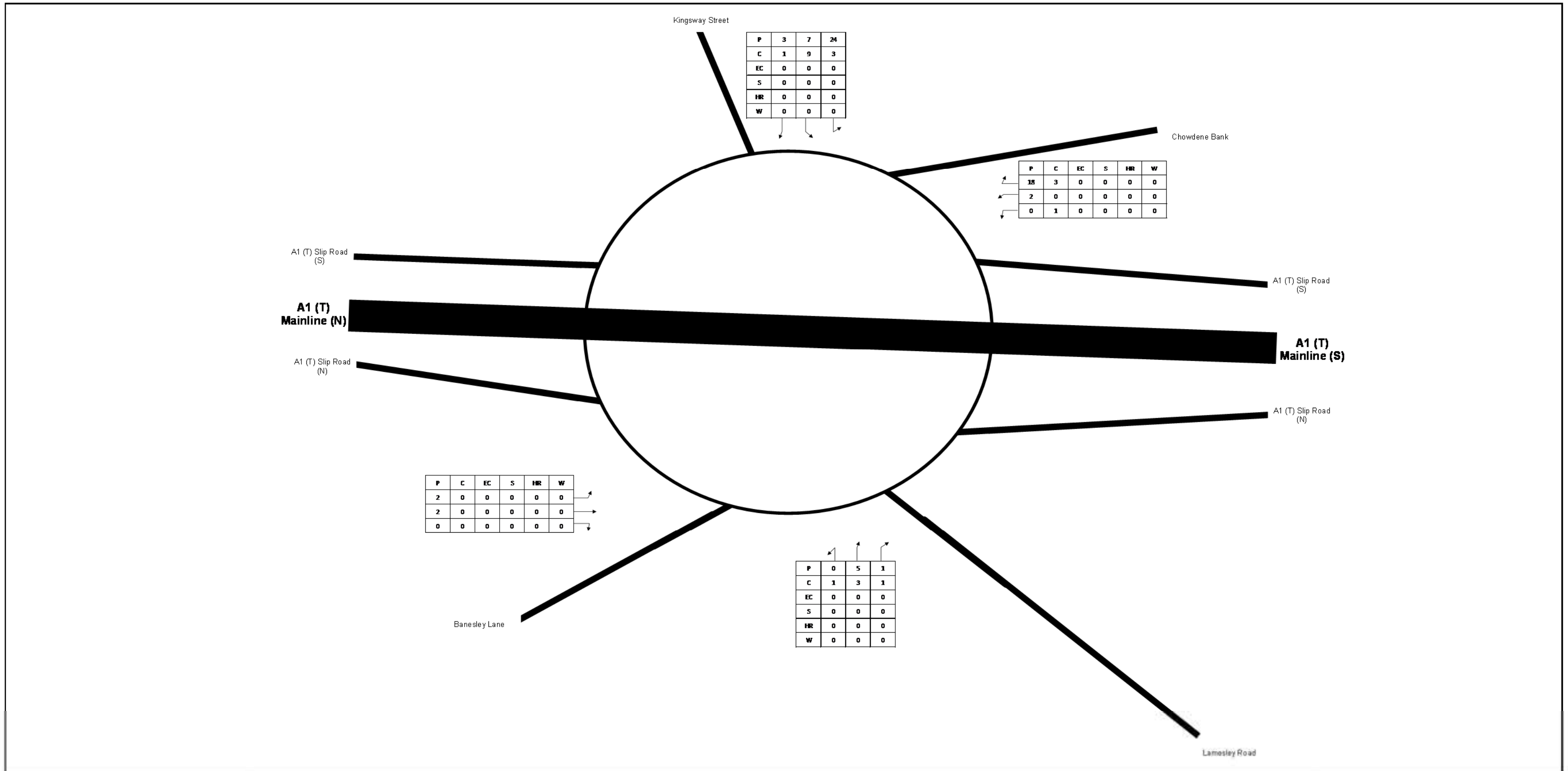
P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

Lamesley Road:

P	0	0	0
C	0	0	0
EC	0	0	0
S	0	0	0
HR	0	0	0
W	0	0	0

Non-Motorised Users Origin to Destination survey on the arms of Coal-House roundabout
(Thursday 9th 2017 - PM Peak: 17:00 - 18:00)

Figure 39 – Weekday Daily NMU Flows at the Coalhouse Interchange



Kingsway Street:

P	3	7	24
C	1	9	3
EC	0	0	0
S	0	0	0
HR	0	0	0
W	0	0	0

Chowdene Bank:

P	C	EC	S	HR	W
18	3	0	0	0	0
2	0	0	0	0	0
0	1	0	0	0	0

Banesley Lane:

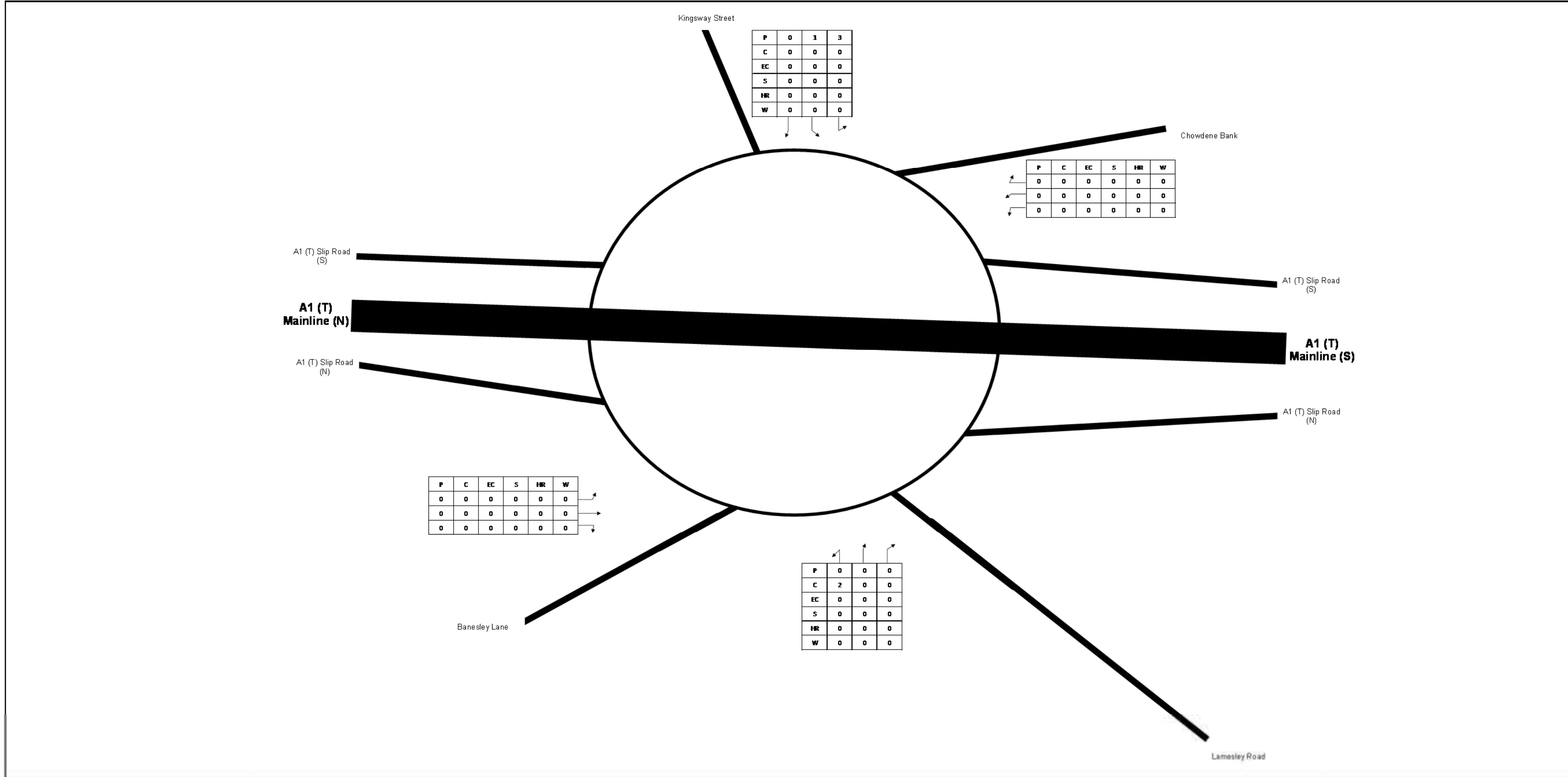
P	C	EC	S	HR	W
2	0	0	0	0	0
2	0	0	0	0	0
0	0	0	0	0	0

Lamesley Road:

P	0	5	1
C	1	3	1
EC	0	0	0
S	0	0	0
HR	0	0	0
W	0	0	0

Non-Motorised Users Origin to Destination survey on the arms of Coal-House roundabout (Thursday 9th 2017 - 24 Hour)

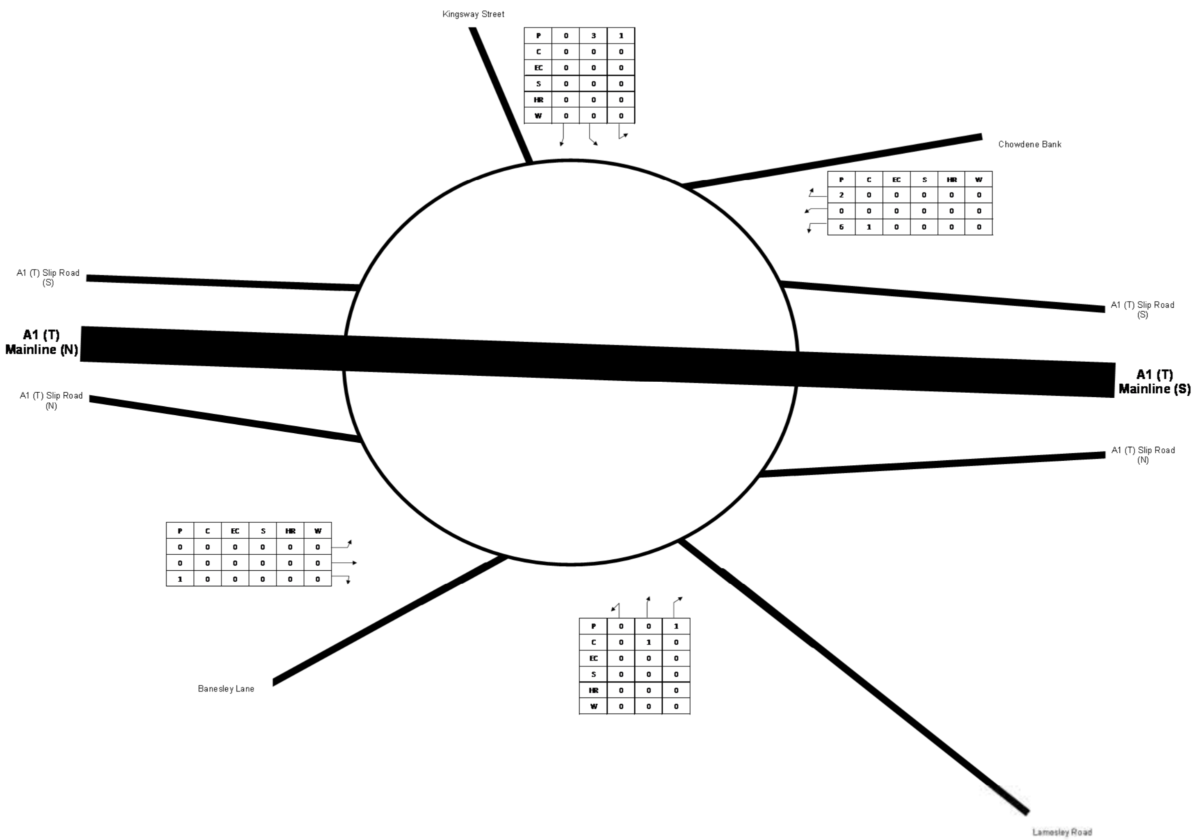
Figure 40 – Weekend AM Peak Period NMU Flows at the Coalhouse Interchange



wsp

Non-Motorised Users Origin to Destination survey on the arms of Coal-House roundabout
(Saturday 11th 2017 - AM Peak: 10:00 - 11:00)

Figure 41 – Weekend PM Peak Period NMU Flows at the Coalhouse Interchange



P	0	3	1
C	0	0	0
EC	0	0	0
S	0	0	0
HR	0	0	0
W	0	0	0

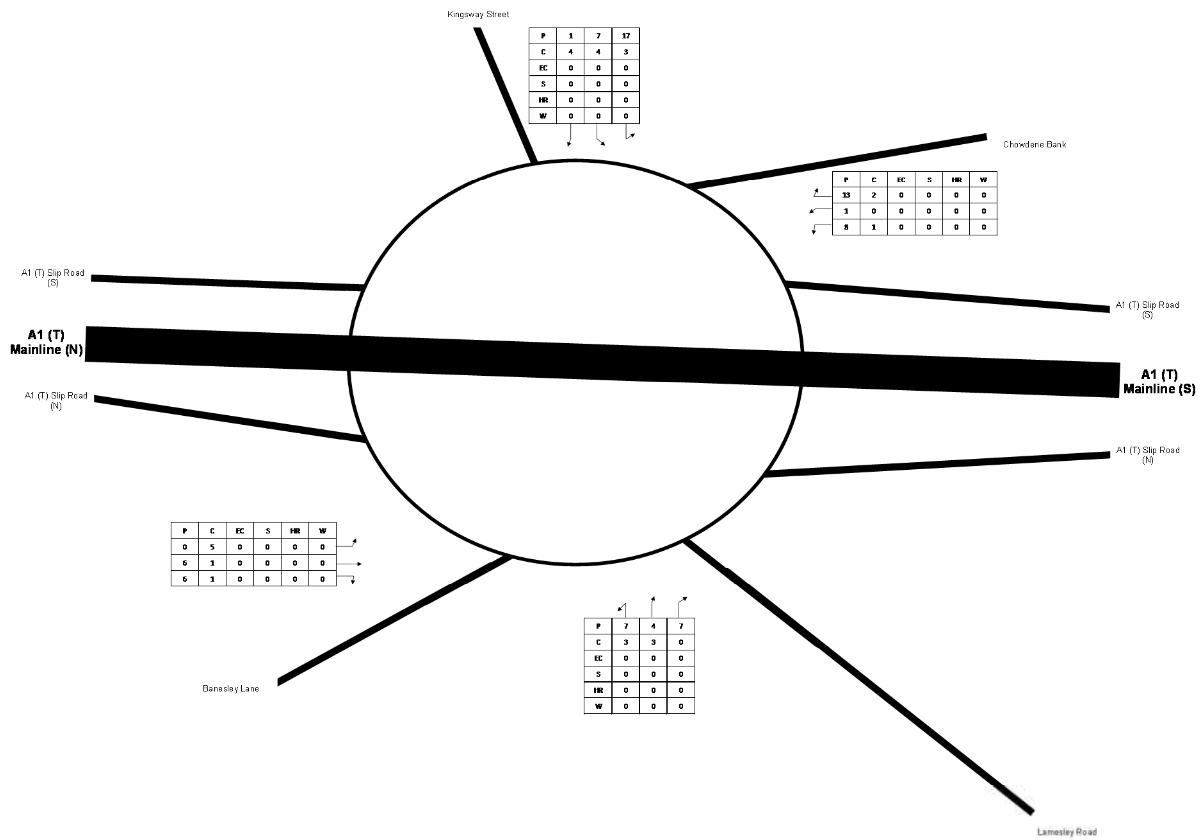
P	C	EC	S	HR	W
2	0	0	0	0	0
0	0	0	0	0	0
6	1	0	0	0	0

P	C	EC	S	HR	W
0	0	0	0	0	0
0	0	0	0	0	0
1	0	0	0	0	0

P	0	0	1
C	0	1	0
EC	0	0	0
S	0	0	0
HR	0	0	0
W	0	0	0

Non-Motorised Users Origin to Destination survey on the arms of Coal-House roundabout
(Saturday 11th 2017 - PM Peak: 13:00 - 14:00)

Figure 42 – Weekend Daily NMU Flows at the Coalhouse Interchange



P	1	7	17
C	4	4	3
EC	0	0	0
S	0	0	0
HR	0	0	0
W	0	0	0

P	C	EC	S	HR	W
13	2	0	0	0	0
1	0	0	0	0	0
8	1	0	0	0	0

P	C	EC	S	HR	W
0	5	0	0	0	0
6	1	0	0	0	0
6	1	0	0	0	0

P	7	4	7
C	3	3	0
EC	0	0	0
S	0	0	0
HR	0	0	0
W	0	0	0

Non-Motorised Users Origin to Destination survey on the arms of Coal-House roundabout
(Saturday 11th 2017 - 24 Hour)

3. USER OPPORTUNITIES

3.1 IDENTIFIED ISSUES AND CORRESPONDING USER OPPORTUNITIES

Following detailed consideration of the existing routes, connections, facilities, infrastructure, etc, that are available at each of the locations within the overall study area, the opportunities discussed within this section of the report has highlighted potential improvements which are relevant to the A1 Birtley to Coalhouse scheme.

These opportunities should be considered by the wider design team throughout the progression of the scheme design, in addition to any further opportunities that may arise through the ongoing development of the design phase(s).

Whilst some of the improvements identified are associated with infrastructure that Gateshead Council are responsible for maintaining, it is considered that Highways England should work in a collaborative manner with the Local Highway Authority to ensure that the impact of the A1 Birtley to Coalhouse scheme is suitably mitigated.

Table 11 – Opportunities at the Northside Overbridge

	Section 1 - Walking, Cycling and Horse-Riding Opportunities for Improvement	Responsibility	
		HE	GC
Identified Issue 1	The footway provision on the approach the A1231 Northside Overbridge is substandard in width (on both the eastern and western sides).		✓
Corresponding Opportunity 1	Provision of a 2.0m (acceptable minimum) to 2.6m (preferred width) pedestrian only route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).		✓
Identified Issue 2	The condition of the pavement surface of the footway provision on both the eastern and western approaches to the A1231 Northside Overbridge is poor.		✓
Corresponding Opportunity 2	Re-surface the footway pavement to provide a higher quality bituminous material for non-motorised users.		✓
Identified Issue 3	Vegetation on the western verges encroaches onto the existing footway, reducing the usable width of the infrastructure and its effectiveness for less abled bodied pedestrians.		✓
Corresponding Opportunity 3	Removal of vegetation from the boundary of the footway provision to reinstate its full usable width and avoid the presence of tripping hazards.		✓
Identified Issue 4	No lighting is available on the approach to the A1231 Northside Overbridge (on both the eastern and western sides).		✓
Corresponding Opportunity 4	Provide an appropriate level of street lighting to ensure safe usage for non-motorised users during hours of darkness.		✓
Identified Issue 5	The condition of the concrete post and tubular pole fencing on both the eastern and western approaches to the A1231 Northside Overbridge is poor.		✓
Corresponding Opportunity 5	Provide an upgraded fence treatment to protect non-motorised users.		✓
Identified Issue 6	No directional signage is available on either side of the A1231 Northside Overbridge.		✓
Corresponding Opportunity 6	Implement directional signage to advise non-motorised users of available routes or destinations.		✓
Identified Issue 7	No dedicated cycle facilities available, despite the A1231 being a derestricted dual-carriageway, two-way road at this location. The 1.0m high parapet fence to protect crossing pedestrians is insufficient.	✓	✓
Corresponding Opportunity 7	Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route (with a 1.4m high parapet fence) in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).	✓	✓
Identified Issue 8	Only uncontrolled pedestrian crossing facilities over the A1 southbound off-slip road are available (i.e. dropped kerbs, tactile paving and 'Look Left/Look Right' white lining on the carriageway) at the signal controlled intersection between the A1231 and the A1 southbound off-slip road.		✓
Corresponding Opportunity 8	Provision of formal signal control to assist pedestrians crossing the A1 southbound off-slip road during breaks in the traffic flow of approximately 15 seconds (i.e. whilst the A1231 mainline receives a green signal).		✓

Table 12 – Opportunities at the Northside to North Dene Footway and North Dene Footbridge

	Section 2 - Walking, Cycling and Horse-Riding Opportunities for Improvement	Responsibility	
		HE	GC
Identified Issue 1	There is no boundary fence treatment between the Northside Footway and the A1 mainline.	✓	
Corresponding Opportunity 1	Installation of a fence to restrict access to the northbound carriageway for pedestrians and animals.	✓	
Identified Issue 2	The Northside to North Dene Footway (for the 65m stretch south of North Dene Footbridge), which is designated on 'a traffic free path' on the Gateshead Cycle Map, is substandard in width.		✓
Corresponding Opportunity 2	Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).		✓
Identified Issue 3	No lighting is available on the Northside to North Dene Footway.		✓
Corresponding Opportunity 3	Provide an appropriate level of street lighting to ensure safe usage for non-motorised users during hours of darkness.		✓
Identified Issue 4	The North Dene Footbridge deck and ramp is substandard in width (on both the eastern and western sides) in light of its use by both pedestrians and cyclists. North Dene Footbridge is designated as 'a National Cycle Network off-road cycle path' and is identified as Route 11 a 'Regional Cycle Network' on the Gateshead Cycle Map.	✓	
Corresponding Opportunity 4	Provision of a 3.5m (unsegregated) pedestrian/cycle path over the bridge deck (with a 1.4m high parapet fence) and ramp in accordance with the recommendations of DMRB Volume 2, Section 2, Part 8 (BD29/17) Design Criteria for Footbridges.	✓	
Identified Issue 5	North Dene Footbridge is accessed via a stepped ramp with a single landing, which features a 1 in 6 gradient between ground level and the bridge deck.	✓	
Corresponding Opportunity 5	Provision of a 1 in 12 (minimum) gradient ramp to provide improved access for non-motorised users.	✓	
Identified Issue 6	The bridge deck and ramp landings on either side do not currently benefit from tactile paving provisions.	✓	
Corresponding Opportunity 6	Installation of corduroy tactile paving to aid the movement of partially sighted non-motorised users.	✓	
Identified Issue 7	No directional signage is available on either side of the North Dene Footbridge.	✓	
Corresponding Opportunity 7	Implement directional signage to advise non-motorised users of available routes or destinations.	✓	
Identified Issue 8	To the eastern side of North Dene Footbridge the public right of way takes the form of an unmade footpath.		✓
Corresponding Opportunity 8	Re-surface the footway pavement to provide a higher quality bituminous material for non-motorised users.		✓
Identified Issue 9	To the eastern side of North Dene Footbridge the public right of way passes through a 'kissing gate' that is only suitable for pedestrian access.		✓
Corresponding Opportunity 9	Replace with access control barriers that are appropriate for all non-motorised users.		✓

Table 13 – Opportunities at the North Dene to Longbank Footpath and Longbank Bridleway

	Section 3 - Walking, Cycling and Horse-Riding Opportunities for Improvement	Responsibility	
		HE	GC
Identified Issue 1	The North Dene to Longbank Footpath, which is designated on 'a traffic free path' on the Gateshead Cycle Map, is substandard in width and suffers from poor horizontal alignment in certain locations.		✓
Corresponding Opportunity 1	Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05) with improved alignment.		✓
Identified Issue 2	No lighting is available on the North Dene to Longbank Footpath.		✓
Corresponding Opportunity 2	Provide an appropriate level of street lighting to ensure safe usage for non-motorised users during hours of darkness.		✓
Identified Issue 3	Vegetation in the verges encroaches onto the existing footpath, reducing the usable width of the infrastructure and its effectiveness for less abled bodied pedestrians.		✓
Corresponding Opportunity 3	Removal of vegetation from the boundary of the footpath provision to reinstate its full usable width and avoid the presence of tripping hazards.		✓
Identified Issue 4	The condition of the concrete post and wire-mesh fencing between the North Dene to Longbank Footpath and the A1 mainline is poor.	✓	
Corresponding Opportunity 4	Installation of a fence to restrict access to the northbound carriageway for pedestrians and animals.	✓	
Identified Issue 5	No directional signage is available on the North Dene to Longbank Footpath.		✓
Corresponding Opportunity 5	Implement directional signage to advise non-motorised users of available routes or destinations.		✓
Identified Issue 6	Pedestrian access to the Longbank Bridleway underbridge is provided by means of an informal and unmade ramp, leading to a flight of steps (constructed of wood, with a loose paved tread surface and wooden handrails to aid ascent/decent).		✓
Corresponding Opportunity 6	Provide a ramp with a bituminous material and upgraded steps for non-motorised users.		✓
Identified Issue 7	Cycle access to the Longbank Bridleway underbridge is only available via an at-grade ramp 200.0m southwest, where the route meets the A167 Newcastle Bank.		✓
Corresponding Opportunity 7	Provide a formal ramp with a high quality bituminous material or provide an upgraded flight of steps for non-motorised users with a 100.0mm wide runner-rail style ramp feature to allow cycles to be pushed up/down the steps.		✓
Identified Issue 8	The Longbank Bridleway underbridge is an unlit 80.0m long, domed corrugated-steel lined structure, which is intimidating to pedestrians and cyclists.	✓	
Corresponding Opportunity 8	Provide an appropriate level of street lighting to ensure safe usage for non-motorised users.	✓	
Identified Issue 9	During heavy rain-fall, the bridleway is susceptible to flooding, with the loose/coarse surface treatment being known to either wash away completely or being overrun with earth which encroaches from the adjacent cutting slopes.		✓
Corresponding Opportunity 9	Re-surface the footpath pavement to provide a higher quality bituminous and improve the available drainage channel.		✓
Identified Issue 10	The eastern headwall of the Longbank Bridleway underbridge passes between a brick built parapet wall and 2.0m high wooden close-board fence treatment, with the available width varying between approximately 1.5m (substandard) and 3.0m.	✓	
Corresponding Opportunity 10	Provide a higher wooden close-board fence treatment to ensure that horses are not exposed to oncoming traffic and ensure a standard 3.0m wide passage is available across the entire width of the headwall.	✓	

Table 14 - Opportunities at the Longbank to Eighton Lodge Footpath and Eighton Lodge Interchange

	Section 4 - Walking, Cycling and Horse-Riding Opportunities for Improvement	Responsibility	
		HE	GC
Identified Issue 1	The Longbank to Eighton Lodge Footpath, which is designated on 'a traffic free path' on the Gateshead Cycle Map, is substandard in width.		✓
Corresponding Opportunity 1	Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).		✓
Identified Issue 2	No lighting is available on the Longbank to Eighton Lodge Footpath.		✓
Corresponding Opportunity 2	Provide an appropriate level of street lighting to ensure safe usage for non-motorised users during hours of darkness.		✓
Identified Issue 3	Vegetation in the verges encroaches onto the existing footpath, reducing the usable width of the infrastructure and its effectiveness for less abled bodied pedestrians.		✓
Corresponding Opportunity 3	Removal of vegetation from the boundary of the footpath provision to reinstate its full usable width and avoid the presence of tripping hazards.		✓
Identified Issue 4	The condition of the concrete post and wire-mesh fencing between the Longbank to Eighton Lodge Footpath and the A1 mainline is poor.	✓	
Corresponding Opportunity 4	Installation of a fence to restrict access to the northbound carriageway for pedestrians and animals.	✓	
Identified Issue 5	No directional signage is available on either end of the Longbank to Eighton Lodge Footpath.		✓
Corresponding Opportunity 5	Implement directional signage to advise non-motorised users of available routes or destinations.		✓
Identified Issue 6	The shared footway/cycleway provisions at Eighton Lodge Interchange, which are designated as part of the NCN Route 725, are substandard in width.		✓
Corresponding Opportunity 6	Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).		✓
Identified Issue 7	Crossing provisions are uncontrolled in nature and require users to accept gaps between the conflicting traffic streams (some of which are under part-time signal control) in order to pass over the various sections of carriageway.		✓
Corresponding Opportunity 7	Provide full time signalisation at the interchange and provide signal controlled crossing facilities with dedicated pedestrian phases and look left/look right white lining. Responsibility for this improvement will be reviewed following finalisation of the scheme design proposal.		✓
Identified Issue 8	Crossing opportunities were complicated by the horizontal alignment of entry-arms and the location/height of traffic signage on the approach to the junction, which often acted as a sight-screen prohibiting visibility for pedestrians.	✓	
Corresponding Opportunity 8	Relocate traffic signage and increase the height to in excess of 2.0m above ground level, in order to improve the visibility sight-lines for pedestrians (thus increasing road safety for non-motorised users).	✓	

Table 15 – Opportunities at the Smithy Lane overbridge and Angel Cycleway/Chowdene Bank Bridge

	Section 5 - Walking, Cycling and Horse-Riding Opportunities for Improvement	Responsibility	
		HE	GC
Identified Issue 1	The footway provision on the approach to Smithy Lane overbridge is generally substandard in width (on both the eastern and western sides).		✓
Corresponding Opportunity 1	Provision of a 2.0m (acceptable minimum) to 2.6m (preferred width) pedestrian only route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).		✓
Identified Issue 2	No lighting is available on the approach the Smithy Lane overbridge (on both the eastern and western sides).		✓
Corresponding Opportunity 2	Provide an appropriate level of street lighting to ensure safe usage for non-motorised users during hours of darkness (especially during winter months).		✓
Identified Issue 3	Chowdene Bank Bridge is unsuitable for the high level of use by pedestrians and cyclists.		✓
Corresponding Opportunity 3	Provide a new bridge for pedestrians and cyclists adjacent to the south side of the existing bridge. Additionally, introduce a crossing facilitate so pedestrians can access the 2.0m wide footway on the northern side of Chowdene Bank.		✓

Table 16 – Opportunities at the Coalhouse Interchange

	Section 6 - Walking, Cycling and Horse-Riding Opportunities for Improvement	**Responsibility**	
		HE	**GC**
Identified Issue 1	The footway provisions around the Coalhouse Interchange are generally substandard in width. There are no dedicated cycle facilities available around the junction.		✓
Corresponding Opportunity 1	Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).		✓
Identified Issue 2	The six arms of the roundabout currently have varying degrees of physical pedestrian infrastructure at crossing points.	✓	
Corresponding Opportunity 2	Temporary works associated with the scheme will cause disruptions to this infrastructure. Once they are finalised, Highways England will replace substandard infrastructure with improved dropped-kerbs, tactile paving and look left/look right white lining at all crossing points.	✓	
Identified Issue 3	Crossing provisions are uncontrolled in nature and require users to accept gaps between the conflicting traffic streams (some of which are under part-time signal control) in order to pass over the various sections of carriageway.		✓
Corresponding Opportunity 3	Provide full time signalisation at the interchange and provide signal controlled crossing facilities with dedicated pedestrian phases. Responsibility for this improvement will be reviewed following finalisation of the scheme design proposal.		✓
Identified Issue 4	No directional signage is available around the Coalhouse Interchange.		✓
Corresponding Opportunity 4	Implement directional signage to advise non-motorised users of available routes or destinations.		✓
Identified Issue 5	No formal crossing provisions adjacent to the Sainsbury's and Argos store access and the primary desire line encourages pedestrians to cross the road between two bus lay-bys (on either side of Chowdene Bank).		✓
Corresponding Opportunity 5	Implementation of dropped-kerbs, tactile paving and look left/look right white lining at a location west of the bus lay-bys to improve road safety for non-motorised users.		✓
Identified Issue 6	Pedestrian Crossing signs are present on the two A1 off-slip roads on the approach to the junction, in order to provide advanced warning to motorists. The signage strategy is, however, inconsistent, with the northbound off-slip benefiting from a 'Zebra Crossing Ahead' sign (despite the crossing being uncontrolled in nature and the southbound off-slip has an 'Other Danger Ahead' sign with an accompanying 'Nature of Danger' sign located beneath which advises of 'Pedestrians Crossing'.	✓	
Identified Issue 6	Provide consistent signage strategy to replace the existing northbound off-slip 'Zebra Crossing Ahead' sign with an 'Other Danger Ahead' sign and an accompanying 'Nature of Danger' sign located beneath which advises of 'Pedestrians Crossing'.	✓	

4. WALKING, CYCLING & HORSE-RIDING ASSESSMENT TEAM STATEMENT

4.1 ASSESSMENT TEAM STATEMENT

As Lead Assessor, I confirm that this Walking, Cycling & Horse-Riding Assessment Report has been compiled in accordance with DMRB HD 42/17 and thus contains the appropriate information for the wider design team. The Walking, Cycling & Horse-Riding Assessment was undertaken by the following Assessment and Review Team:

Walking, Cycling & Horse-Riding Lead Assessor WSP

Simon Pratt — Signed:

Director — Date: 09/03/2018

Walking, Cycling & Horse-Riding Assessor WSP

Chris Appleton — Signed: Chris Appleton

Principal Engineer — Date: 09/03/2018

Walking, Cycling & Horse-Riding Assessor WSP

Ben Handley — Signed: B. Handley

Graduate Transport Planner — Date: 09/03/2018

4.2 DESIGN TEAM STATEMENT

As Design Team Leader, I confirm that the assessment has been undertaken at the appropriate stage of the scheme development and that the wider design team has been involved in the process.

I confirm that in my professional opinion the appointed Lead Assessor has the appropriate experience for the role making reference to the expected competencies contained in HD 42/17.

Design Team Leader WSP

Nigel Rawcliffe — Signed:

Associate Director — Date: 09/03/2018

5. REVIEW OF WALKING, CYCLING AND HORSE-RIDING ASSESSMENT OPPORTUNITIES

5.1 INTRODUCTION

This chapter provides a summary of the opportunities identified as part of the original Walking, Cycling and Horse-Riding Assessment and the resulting actions taken by the design team or related outcomes from the preliminary design phase of the A1 Birtley to Coalhouse scheme. For consistency, the identified opportunities are presented in the same format as those contained at Section 3 of this report.

The purpose of conducting this Walking, Cycling & Horse-Riding Review are to:

- Review proposals for pedestrians, cyclists and equestrians throughout the highway scheme design process.
- Review the potential impact of the proposed highway scheme on users in the area and on existing facilities.
- Identify new opportunities for improvement for users that may arise from the development of the highway scheme that were not evident during the Assessment phase.

In order to ensure that this phase of the process is meaningful and constructive, the Walking, Cycling and Horse-Riding Review has been undertaken following the initial Assessment phase and once the design team has had the opportunity to consider/incorporate the findings from this report into the highway scheme design. This chapter, also, takes into consideration the consultations outlined in section 2.6 and 2.7.

The identification of opportunities for improving existing Walking, Cycling & Horse-Riding facilities or for creating new ones has not been restricted to those that can be delivered within the context of the highway scheme. Recording details of these opportunities is presented within this review in order to inform the ongoing maintenance and management of the A1 within the study area and can be shared with key stakeholders such as Gateshead Council.

The Walking, Cycling and Horse-Riding Assessment report has been considered prior to this review being conducted to ensure that the previously identified opportunities for improvement are considered during Review phase. It is intended that this preliminary design stage Review report will be considered further during the subsequent detailed design stage Review.

The highway scheme design drawings and associated information have been reviewed with a specific emphasis on:

- Ensuring that previously identified opportunities at the Assessment phase have been considered and implemented where appropriate.
- Identifying opportunities for improvement for pedestrians, cyclists and equestrians as a result of the developing highway scheme design.

Once again, the impact on all modes (and user groups) has been reviewed both in isolation and within the context of the various other user groups (i.e. how proposed facilities for pedestrians will impact cyclists and horse-riders, etc).

5.2 TRAFFIC FLOWS

The strategic macro-simulation area wide traffic model has been utilised to extract forecast flows associated with the 2038 design year with and without the proposed A1 Birtley to Coalhouse scheme.

The relative potential impact of the proposal upon non-motorised users (at the various locations considered within this WCHAR) has been considered and forms the basis of the 'Assessor Comments' provided in Section 5.4 of this review.

5.3 PRELIMINARY DESIGN STAGE WALKING CYCLING & HORSE-RIDING REVIEW OPPORTUNITIES

Following detailed consideration of the existing routes, connections, facilities, infrastructure, etc, that are available at each of the locations within the overall study area, the opportunities discussed within Section 3 of the Walking, Cycling and Horse-Riding Assessment report highlighted potential improvements which are relevant to the A1 Birtley to Coalhouse scheme.

These opportunities were considered by the wider design team throughout the progression of the scheme design, in addition to any further opportunities that may arise through the ongoing development of the various design phase(s).

Whilst some of the improvements identified are associated with infrastructure that Gateshead Council are responsible for maintaining, it is considered that Highways England should work in a collaborative manner with the Local Highway Authority to ensure that the impact of the A1 Birtley to Coalhouse scheme is suitably mitigated.

The tables presented below provide a summary of the opportunities identified as part of the previous assessment and the resulting actions taken by the design team or related outcomes from the preliminary design phase of the A1 Birtley to Coalhouse scheme. For ease of reference the 'Assessor Comments' within these tables are marked with either a:

(✓) Which signifies that design action is required by Highways England; or

(✗) Which signifies that no design action is required by Highways England.

Table 17 – Opportunities at the Northside Overbridge

	Section 1 - Walking, Cycling and Horse-Riding Opportunities for Improvement	Responsibility	
		HE	GC
Identified Issue 1	The footway provision on the approach the A1231 Northside Overbridge is substandard in width (on both the eastern and western sides).		✓
Corresponding Opportunity 1	Provision of a 2.0m (acceptable minimum) to 2.6m (preferred width) pedestrian only route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).		✓
Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 2	The condition of the pavement surface of the footway provision on both the eastern and western approaches to the A1231 Northside Overbridge is poor.		✓
Corresponding Opportunity 2	Re-surface the footway pavement to provide a higher quality bituminous material for non-motorised users.		✓
Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 3	Vegetation on the western verges encroaches onto the existing footway, reducing the usable width of the infrastructure and its effectiveness for less abled bodied pedestrians.		✓
Corresponding Opportunity 3	Removal of vegetation from the boundary of the footway provision to reinstate its full usable width and avoid the presence of tripping hazards.		✓
Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 4	No lighting is available on the approach to the A1231 Northside Overbridge (on both the eastern and western sides).		✓
Corresponding Opportunity 4	Provide an appropriate level of street lighting to ensure safe usage for non-motorised users during hours of darkness.		✓
Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 5	The condition of the concrete post and tubular pole fencing on both the eastern and western approaches to the A1231 Northside Overbridge is poor.		✓
Corresponding Opportunity 5	Provide an upgraded fence treatment to protect non-motorised users.		✓
Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 6	No directional signage is available on either side of the A1231 Northside Overbridge.		✓
Corresponding Opportunity 6	Implement directional signage to advise non-motorised users of available routes or destinations.		✓

	Section 1 - Walking, Cycling and Horse-Riding Opportunities for Improvement	Responsibility	
		HE	GC
Assessor Comment: No design action required by Highways England (✗). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 7	No dedicated cycle facilities available, despite the A1231 being a derestricted dual-carriageway, two-way road at this location. The 1.0m high parapet fence to protect crossing pedestrians is insufficient.	✓	✓
Corresponding Opportunity 7	Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route (with a 1.4m high parapet fence) in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).	✓	✓
Assessor Comment: No design action required by Highways England (✗). The identified improvement is associated with infrastructure that Gateshead Council/Highways England are responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 8	Only uncontrolled pedestrian crossing facilities over the A1 southbound off-slip road are available (i.e. dropped kerbs, tactile paving and 'Look Left/Look Right' white lining on the carriageway) at the signal controlled intersection between the A1231 and the A1 southbound off-slip road.		✓
Corresponding Opportunity 8	Provision of formal signal control to assist pedestrians crossing the A1 southbound off-slip road during breaks in the traffic flow of approximately 15 seconds (i.e. whilst the A1231 mainline receives a green signal).		✓
Assessor Comment: Design action required by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible and the A1 Birtley to Coalhouse scheme will result in significant levels of additional vehicular trips using this part of the network, which may result in a negative adverse impact upon non-motorised users at this location. The identified opportunity is located within the DCO redline boundary and it is considered necessary that Highways England mitigate this impact through the introduction of formal signal control to assist pedestrians crossing the A1 southbound off-slip road and it is advised that this is introduced as part of the scheme design (ensuring co-ordination with Highways England Area 14 proposals for the traffic signals).			

Table 18 – Opportunities at the Northside to North Dene Footway and North Dene Footbridge

	Section 2 - Walking, Cycling and Horse-Riding Opportunities for Improvement	**Responsibility**	
		HE	**GC**
Identified Issue 1	There is no boundary fence treatment between the Northside Footway and the A1 mainline.	✓	
Corresponding Opportunity 1	Installation of a fence to restrict access to the northbound carriageway for pedestrians and animals.	✓	
Assessor Comment: Design action required by Highways England (✓). The identified improvement is associated with infrastructure that the local landowner is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that its customers are protected and the A1 Birtley to Coalhouse scheme will result in significant levels of additional vehicular trips using the A1 mainline adjacent to this part of the network, which may result in a negative adverse impact upon non-motorised users at this location. The identified opportunity is located within the DCO redline boundary and Highways England propose to mitigate this impact through the installation of a boundary fence to restrict access to the Strategic Road Network for pedestrians and animals. The strategy involves the replacement of existing substandard fencing and the installation of new post and rail fencing where gaps currently exist.			
Identified Issue 2	The Northside to North Dene Footway (for the 65m stretch south of North Dene Footbridge), which is designated on 'a traffic free path' on the Gateshead Cycle Map, is substandard in width.		✓
Corresponding Opportunity 2	Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).		✓
Assessor Comment: No design action required by Highways England (✗). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 3	No lighting is available on the Northside to North Dene Footway.		✓
Corresponding Opportunity 3	Provide an appropriate level of street lighting to ensure safe usage for non-motorised users during hours of darkness.		✓
Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible. Highways England propose to mitigate any scheme impact through the installation of street lighting along the North Dene Footway. This will necessitate a Highways England Designated Funds study (independent of the A1 Birtley to Coalhouse scheme) to further investigate the impact of the proposals, with a subsequent funding application progressed in order to facilitate the design of an appropriate mitigation scheme.			
Identified Issue 4	The North Dene Footbridge deck and ramp is substandard in width (on both the eastern and western sides) in light of its use by both pedestrians and cyclists. North Dene Footbridge is designated as 'a National Cycle Network off-road cycle path' and is identified as Route 11 a 'Regional Cycle Network' on the Gateshead Cycle Map.	✓	
Corresponding Opportunity 4	Provision of a 3.5m (unsegregated) pedestrian/cycle path over the bridge deck (with a 1.4m high parapet fence) and ramp in accordance with the recommendations of DMRB Volume 2, Section 2, Part 8 (BD29/17) Design Criteria for Footbridges.	✓	
Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Highways England is responsible for maintaining. The identified opportunity is located within the DCO redline boundary and Highways England propose to mitigate any scheme impact through the installation of a 3.5m (unsegregated) pedestrian/cycle path over the bridge deck (with a 1.4m high parapet fence) and ramp in accordance with the recommendations of DMRB Volume 2, Section 2, Part 8 (BD29/17) Design Criteria for Footbridges.			
Identified Issue 5	North Dene Footbridge is accessed via a stepped ramp with a single landing, which features a 1 in 6 gradient between ground level and the bridge deck.	✓	
Corresponding Opportunity 5	Provision of a 1 in 12 (minimum) gradient ramp to provide improved access for non-motorised users.	✓	
Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a			

	Section 2 - Walking, Cycling and Horse-Riding Opportunities for Improvement	**Responsibility**	
		HE	**GC**
collaborative manner to ensure that the Local Highway Authority may improve its network where possible. The identified opportunity is located within the DCO redline boundary and Highways England propose to mitigate any scheme impact through the installation of a 1 in 12 gradient ramp.			
Identified Issue 6	The bridge deck and ramp landings on either side do not currently benefit from tactile paving provisions.	✓	
Corresponding Opportunity 6	Installation of corduroy tactile paving to aid the movement of partially sighted non-motorised users.	✓	
Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible. The identified opportunity is located within the DCO redline boundary and Highways England propose to mitigate any scheme impact through the installation of corduroy tactile paving.			
Identified Issue 7	No directional signage is available on either side of the North Dene Footbridge.	✓	
Corresponding Opportunity 7	Implement directional signage to advise non-motorised users of available routes or destinations.	✓	
Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible. Highways England propose to mitigate any scheme impact through the installation of directional signage to advise non-motorised users of available routes or destinations. This will necessitate a Highways England Designated Funds study (independent of the A1 Birtley to Coalhouse scheme) to further investigate the impact of the proposals, with a subsequent funding application progressed in order to facilitate the design of an appropriate mitigation scheme.			
Identified Issue 8	To the eastern side of North Dene Footbridge the public right of way takes the form of an unmade footpath.		✓
Corresponding Opportunity 8	Re-surface the footway pavement to provide a higher quality bituminous material for non-motorised users.		✓
Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 9	To the eastern side of North Dene Footbridge the public right of way passes through a 'kissing gate' that is only suitable for pedestrian access.		✓
Corresponding Opportunity 9	Replace with access control barriers that are appropriate for all non-motorised users.		✓
Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			

Table 19 – Opportunities at the North Dene to Longbank Footpath and Longbank Bridleway

<table>
<tr><th rowspan="2"></th><th rowspan="2">Section 3 - Walking, Cycling and Horse-Riding Opportunities for Improvement</th><th colspan="2">Responsibility</th></tr>
<tr><th>HE</th><th>GC</th></tr>
<tr><td>Identified Issue 1</td><td>The North Dene to Longbank Footpath, which is designated on ‘a traffic free path’ on the Gateshead Cycle Map, is substandard in width and suffers from poor horizontal alignment in certain locations.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 1</td><td>Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05) with improved alignment.</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.</td></tr>
<tr><td>Identified Issue 2</td><td>No lighting is available on the North Dene to Longbank Footpath.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 2</td><td>Provide an appropriate level of street lighting to ensure safe usage for non-motorised users during hours of darkness.</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible. Highways England propose to mitigate any scheme impact through the installation of street lighting along the North Dene to Longbank Footpath. This will necessitate a Highways England Designated Funds study (independent of the A1 Birtley to Coalhouse scheme) to further investigate the impact of the proposals, with a subsequent funding application progressed in order to facilitate the design of an appropriate mitigation scheme.</td></tr>
<tr><td>Identified Issue 3</td><td>Vegetation in the verges encroaches onto the existing footpath, reducing the usable width of the infrastructure and its effectiveness for less abled bodied pedestrians.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 3</td><td>Removal of vegetation from the boundary of the footpath provision to reinstate its full usable width and avoid the presence of tripping hazards.</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.</td></tr>
<tr><td>Identified Issue 4</td><td>The condition of the concrete post and wire-mesh fencing between the North Dene to Longbank Footpath and the A1 mainline is poor.</td><td>✓</td><td></td></tr>
<tr><td>Corresponding Opportunity 4</td><td>Installation of a fence to restrict access to the northbound carriageway for pedestrians and animals.</td><td>✓</td><td></td></tr>
<tr><td colspan="4">Assessor Comment: Design action required by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that its customers are protected. The identified opportunity is located within the DCO redline boundary and Highways England propose to mitigate this impact through the installation of a noise barrier (between North Dene Footbridge - Longbank Bridleway) and boundary fence to restrict access to the Strategic Road Network for pedestrians and animals.</td></tr>
<tr><td>Identified Issue 5</td><td>No directional signage is available on the North Dene to Longbank Footpath.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 5</td><td>Implement directional signage to advise non-motorised users of available routes or destinations.</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible. Highways England propose to mitigate any scheme impact through the installation of directional signage to advise non-motorised users of available routes or destinations. This will necessitate a Highways England Designated Funds study (independent of the A1 Birtley to Coalhouse scheme) to further investigate the impact of the proposals, with a subsequent funding application progressed in order to facilitate the design of an appropriate mitigation scheme.</td></tr>
</table>

	Section 3 - Walking, Cycling and Horse-Riding Opportunities for Improvement	Responsibility	
		HE	GC
Identified Issue 6	Pedestrian access to the Longbank Bridleway underbridge is provided by means of an informal and unmade ramp, leading to a flight of steps (constructed of wood, with a loose paved tread surface and wooden handrails to aid ascent/decent).		✓
Corresponding Opportunity 6	Provide a ramp with a bituminous material and upgraded steps for non-motorised users.		✓
Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible. Highways England propose to mitigate any scheme impact through the installation of a ramp with a bituminous material and upgraded steps for non-motorised users. This will necessitate a Highways England Designated Funds study (independent of the A1 Birtley to Coalhouse scheme) to further investigate the impact of the proposals, with a subsequent funding application progressed in order to facilitate the design of an appropriate mitigation scheme.			
Identified Issue 7	Cycle access to the Longbank Bridleway underbridge is only available via an at-grade ramp 200.0m southwest, where the route meets the A167 Newcastle Bank.		✓
Corresponding Opportunity 7	Provide a formal ramp with a high quality bituminous material or provide an upgraded flight of steps for non-motorised users with a 100.0mm wide runner-rail style ramp feature to allow cycles to be pushed up/down the steps.		✓
Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 8	The Longbank Bridleway underbridge is an unlit 80.0m long, domed corrugated-steel lined structure, which is intimidating to pedestrians and cyclists.	✓	
Corresponding Opportunity 8	Provide an appropriate level of street lighting to ensure safe usage for non-motorised users.	✓	
Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible. The identified opportunity is located within the DCO redline boundary and Highways England propose to mitigate any scheme impact through the installation of appropriate lighting to ensure safe usage for non-motorised users (although this is currently being considered by Gateshead Council, with the impact upon bats being considered).			
Identified Issue 9	During heavy rain-fall, the bridleway is susceptible to flooding, with the loose/coarse surface treatment being known to either wash away completely or being overrun with earth which encroaches from the adjacent cutting slopes.		✓
Corresponding Opportunity 9	Re-surface the footpath pavement to provide a higher quality bituminous and improve the available drainage channel.		✓
Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 10	The eastern headwall of the Longbank Bridleway underbridge passes between a brick built parapet wall and 2.0m high wooden close-board fence treatment, with the available width varying between approximately 1.5m (substandard) and 3.0m.	✓	
Corresponding Opportunity 10	Provide a higher wooden close-board fence treatment to ensure that horses are not exposed to oncoming traffic and ensure a standard 3.0m wide passage is available across the entire width of the headwall.	✓	
Assessor Comment: Design action required by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that its customers are protected. The identified opportunity is located within the DCO redline boundary and Highways England propose to mitigate this impact through the installation of a 2.5m high close-board fence treatment, with a standard 3.0m wide passage across the entire width of the headwall (which will be 1.8m high as the link forms part of a bridleway).			

Table 20 - Opportunities at the Longbank to Eighton Lodge Footpath and Eighton Lodge Interchange

<table>
<tr><th rowspan="2"></th><th rowspan="2">Section 4 - Walking, Cycling and Horse-Riding Opportunities for Improvement</th><th colspan="2">Responsibility</th></tr>
<tr><th>HE</th><th>GC</th></tr>
<tr><td>Identified Issue 1</td><td>The Longbank to Eighton Lodge Footpath, which is designated on ‘a traffic free path’ on the Gateshead Cycle Map, is substandard in width.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 1</td><td>Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.</td></tr>
<tr><td>Identified Issue 2</td><td>No lighting is available on the Longbank to Eighton Lodge Footpath.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 2</td><td>Provide an appropriate level of street lighting to ensure safe usage for non-motorised users during hours of darkness.</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible. Highways England propose to mitigate any scheme impact through the installation of street lighting along the Longbank to Eighton Lodge Footpath. This will necessitate a Highways England Designated Funds study (independent of the A1 Birtley to Coalhouse scheme) to further investigate the impact of the proposals, with a subsequent funding application progressed in order to facilitate the design of an appropriate mitigation scheme.</td></tr>
<tr><td>Identified Issue 3</td><td>Vegetation in the verges encroaches onto the existing footpath, reducing the usable width of the infrastructure and its effectiveness for less abled bodied pedestrians.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 3</td><td>Removal of vegetation from the boundary of the footpath provision to reinstate its full usable width and avoid the presence of tripping hazards.</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: No design action required by Highways England (×). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.</td></tr>
<tr><td>Identified Issue 4</td><td>The condition of the concrete post and wire-mesh fencing between the Longbank to Eighton Lodge Footpath and the A1 mainline is poor.</td><td>✓</td><td></td></tr>
<tr><td>Corresponding Opportunity 4</td><td>Installation of a fence to restrict access to the northbound carriageway for pedestrians and animals.</td><td>✓</td><td></td></tr>
<tr><td colspan="4">Assessor Comment: Design action required by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that its customers are protected and the A1 Birtley to Coalhouse scheme will result in significant levels of additional vehicular trips using the A1 mainline adjacent to this part of the network, which may result in a negative adverse impact upon non-motorised users at this location. The identified opportunity is located within the DCO redline boundary and Highways England propose to mitigate this impact through the installation of a boundary fence to restrict access to the Strategic Road Network for pedestrians and animals. The strategy involves the replacement of existing substandard fencing and the installation of new post and rail fencing where gaps currently exist.</td></tr>
<tr><td>Identified Issue 5</td><td>No directional signage is available on either end of the Longbank to Eighton Lodge Footpath.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 5</td><td>Implement directional signage to advise non-motorised users of available routes or destinations.</td><td></td><td>✓</td></tr>
</table>

	Section 4 - Walking, Cycling and Horse-Riding Opportunities for Improvement	Responsibility	
		HE	**GC**
Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible. Highways England propose to mitigate any scheme impact through the installation of directional signage to advise non-motorised users of available routes or destinations. This will necessitate a Highways England Designated Funds study (independent of the A1 Birtley to Coalhouse scheme) to further investigate the impact of the proposals, with a subsequent funding application progressed in order to facilitate the design of an appropriate mitigation scheme.			
Identified Issue 6	The shared footway/cycleway provisions at Eighton Lodge Interchange, which are designated as part of the NCN Rote 725, are substandard in width.		✓
Corresponding Opportunity 6	Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).		✓
Assessor Comment: No design action required by Highways England (✗). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 7	Crossing provisions at the interchange are uncontrolled in nature and require users to accept gaps between the conflicting traffic streams (some of which are under part-time signal control) in order to pass over the various sections of carriageway.		✓
Corresponding Opportunity 7	Provide full time signalisation at the interchange and provide signal controlled crossing facilities with dedicated pedestrian phases and look left/look right white lining. Responsibility for this improvement will be reviewed following finalisation of the scheme design proposal.		✓
Assessor Comment: Design action required by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible and the A1 Birtley to Coalhouse scheme will result in significant levels of additional vehicular trips using this part of the network, which may result in a negative adverse impact upon non-motorised users at this location. The identified opportunity is located within the DCO redline boundary and it is considered necessary that Highways England mitigate this impact through the introduction of formal priority control to assist pedestrians crossing the various approach/exit arms at the roundabout. This will necessitate a Highways England Designated Funds study (independent of the A1 Birtley to Coalhouse scheme) to further investigate the impact of the proposals, with a subsequent funding application progressed in order to facilitate the design of an appropriate mitigation scheme.			
Identified Issue 8	Crossing opportunities were complicated by the horizontal alignment of entry-arms and the location/height of traffic signage on the approach to the junction, which often acted as a sight-screen prohibiting visibility for pedestrians.	✓	
Corresponding Opportunity 8	Relocate traffic signage or increase the height to in excess of 2.0m above ground level, in order to improve the visibility sight-lines for pedestrians (thus increasing road safety for non-motorised users).	✓	
Assessor Comment: Design action required by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible and the A1 Birtley to Coalhouse scheme will result in significant levels of additional vehicular trips using this part of the network, which may result in a negative adverse impact upon non-motorised users at this location. The identified opportunity is located within the DCO redline boundary and it is considered necessary that Highways England mitigate this impact through the introduction of relocated traffic signage (with increased height in excess of 2.0m above ground level) to improve visibility sight-lines for pedestrians and it is advised that this is introduced as part of the scheme at the detailed design stage.			

Table 21 – Opportunities at the Smithy Lane overbridge and Angel Cycleway/Chowdene Bank Bridge

<table>
<tr><th rowspan="2"></th><th rowspan="2">Section 5 - Walking, Cycling and Horse-Riding Opportunities for Improvement</th><th colspan="2">Responsibility</th></tr>
<tr><th>HE</th><th>GC</th></tr>
<tr><td>Identified Issue 1</td><td>The footway provision on the approach to Smithy Lane overbridge is generally substandard in width (on both the eastern and western sides).</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 1</td><td>Provision of a 2.0m (acceptable minimum) to 2.6m (preferred width) pedestrian only route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: No design action required by Highways England (✗). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.</td></tr>
<tr><td>Identified Issue 2</td><td>No lighting is available on the approach the Smithy Lane overbridge (on both the eastern and western sides).</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 2</td><td>Provide an appropriate level of street lighting to ensure safe usage for non-motorised users during hours of darkness (especially during winter months).</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: No design action required by Highways England (✗). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.</td></tr>
<tr><td>Identified Issue 3</td><td>Chowdene Bank Bridge is unsuitable for the high level of use by pedestrians and cyclists.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 3</td><td>Provide a new bridge for pedestrians and cyclists adjacent to the south side of the existing bridge. Additionally, introduce a crossing facilitate so pedestrians can access the 2.0m wide footway on the northern side of Chowdene Bank.</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: No design action required by Highways England (✗). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.</td></tr>
</table>

Table 22 – Opportunities at the Coalhouse Interchange

<table>
<tr><th rowspan="2"></th><th rowspan="2">Section 6 - Walking, Cycling and Horse-Riding Opportunities for Improvement</th><th colspan="2">Responsibility</th></tr>
<tr><th>HE</th><th>GC</th></tr>
<tr><td>Identified Issue 1</td><td>The footway provisions around the Coalhouse Interchange are generally substandard in width. There are no dedicated cycle facilities available around the Coalhouse Interchange.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 1</td><td>Provision of a 3.0m (acceptable minimum) to 5.0m (preferred width) off-carriageway shared pedestrian/cycle route in accordance with the recommendations of DMRB Volume 6, Section 3, Part 5 (TA90/05).</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: Design action required by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible and the A1 Birtley to Coalhouse scheme will result in significant levels of additional vehicular trips using this part of the network, which may result in a negative adverse impact upon non-motorised users at this location. The identified opportunity is located within the DCO redline boundary and Highways England proposes to mitigate this impact through the introduction of an improved standard width foot/cycleway provision.

Note: Paragraph 7.34 of 'Local Transport Note 1/12: Shared Use Routes for Pedestrians and Cyclists' advises that "a width of 3 metres should generally be regarded as the preferred minimum on an unsegregated route, although in areas with few cyclists or pedestrians a narrower route might suffice." A total of 86 non-motorised users were recorded during the 24 hour weekday survey (of which 64 were pedestrians / 22 were cyclists) and a total of 104 non-motorised users were recorded during the 24 hour weekend survey (of which 77 were pedestrians / 27 were cyclists).</td></tr>
<tr><td>Identified Issue 2</td><td>The six arms of the roundabout currently have varying degrees of physical pedestrian infrastructure at crossing points.</td><td>✓</td><td></td></tr>
<tr><td>Corresponding Opportunity 2</td><td>Temporary works associated with the scheme will cause disruptions to this infrastructure. Once they are finalised, Highways England will replace substandard infrastructure with improved dropped-kerbs, tactile paving and look left/look right white lining at all crossing points.</td><td>✓</td><td></td></tr>
<tr><td colspan="4">Assessor Comment: Design action required by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible and the A1 Birtley to Coalhouse scheme will result in significant levels of additional vehicular trips using this part of the network, which may result in a negative adverse impact upon non-motorised users at this location. The identified opportunity is located within the DCO redline boundary and Highways England proposes to mitigate this impact through the introduction of improved dropped-kerbs, tactile paving and look left/look right white lining at all crossing points.</td></tr>
<tr><td>Identified Issue 3</td><td>Crossing provisions at the interchange are uncontrolled in nature and require users to accept gaps between the conflicting traffic streams (some of which are under part-time signal control) in order to pass over the various sections of carriageway.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 3</td><td>Provide full time signalisation at the interchange and provide signal controlled crossing facilities with dedicated pedestrian phases. Responsibility for this improvement will be reviewed following finalisation of the scheme design proposal.</td><td></td><td>✓</td></tr>
<tr><td colspan="4">Assessor Comment: Design action required by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible and the A1 Birtley to Coalhouse scheme will result in significant levels of additional vehicular trips using this part of the network, which may result in a negative adverse impact upon non-motorised users at this location. The identified opportunity is located within the DCO redline boundary and it is considered necessary that Highways England mitigate this impact through the introduction of formal priority control to assist pedestrians crossing the various approach/exit arms at the roundabout. This will necessitate a Highways England Designated Funds study (independent of the A1 Birtley to Coalhouse scheme) to further investigate the impact of the proposals, with a subsequent funding application progressed in order to facilitate the design of an appropriate mitigation scheme.</td></tr>
<tr><td>Identified Issue 4</td><td>No directional signage is available around the Coalhouse Interchange.</td><td></td><td>✓</td></tr>
<tr><td>Corresponding Opportunity 4</td><td>Implement directional signage to advise non-motorised users of available routes or destinations.</td><td></td><td>✓</td></tr>
</table>

	Section 6 - Walking, Cycling and Horse-Riding Opportunities for Improvement	Responsibility	
		HE	**GC**
Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible and the A1 Birtley to Coalhouse scheme will result in significant levels of additional vehicular trips using the A1 mainline adjacent to this part of the network. Highways England propose to mitigate any scheme impact through the installation of directional signage to advise non-motorised users of available routes or destinations. This will necessitate a Highways England Designated Funds study (independent of the A1 Birtley to Coalhouse scheme) to further investigate the impact of the proposals, with a subsequent funding application progressed in order to facilitate the design of an appropriate mitigation scheme.			
Identified Issue 5	No formal crossing provisions adjacent to the Sainsbury's and Argos store access and the primary desire line encourages pedestrians to cross the road between two bus lay-bys (on either side of Chowdene Bank).		✓
Corresponding Opportunity 5	Implementation of dropped-kerbs, tactile paving and look left/look right white lining at a location west of the bus lay-bys to improve road safety for non-motorised users.		✓
Assessor Comment: No design action required by Highways England (✗). The identified improvement is associated with infrastructure that Gateshead Council is responsible for maintaining. Highways England is committed to working in a collaborative manner to ensure that the Local Highway Authority may improve its network where possible, however, the A1 Birtley to Coalhouse scheme will not directly result in a negative adverse impact upon non-motorised users at this location. It is not considered necessary for Highways England to provide mitigation associated with this infrastructure.			
Identified Issue 6	Pedestrian Crossing signs are present on the two A1 off-slip roads on the approach to the junction, in order to provide advanced warning to motorists. The signage strategy is, however, inconsistent, with the northbound off-slip benefiting from a 'Zebra Crossing Ahead' sign (despite the crossing being uncontrolled in nature and the southbound off-slip has an 'Other Danger Ahead' sign with an accompanying 'Nature of Danger' sign located beneath which advises of 'Pedestrians Crossing'.	✓	
Identified Issue 6	Provide consistent signage strategy to replace the existing northbound off-slip 'Zebra Crossing Ahead' sign with an 'Other Danger Ahead' sign and an accompanying 'Nature of Danger' sign located beneath which advises of 'Pedestrians Crossing'.	✓	
Assessor Comment: Design action identified by Highways England (✓). The identified improvement is associated with infrastructure that Highways England is responsible for maintaining. The identified opportunity is located within the DCO redline boundary and Highways England propose to mitigate any scheme impact through the installation of a an 'Other Danger Ahead' sign and an accompanying 'Nature of Danger' sign located beneath which advises of 'Pedestrians Crossing' in accordance with the recommendations of The Traffic Signs Manual Chapter 4 - Warning Signs.			

5.4 ROAD SAFETY AUDIT

A stage 1 Road Safety Audit of the proposed A1 Birtley to Coalhouse scheme was conducted on 10th August 2018 and initial comments raised the following points in relation to non-motorised users:

- Location – A1 Junction 66 – northbound off-slip

  Summary – All Footway users have insufficient visibility sight-line to observe approaching traffic – possible Ped/cyclist conflict with vehicle

  Recommendation – Raise all signs and cut back vegetation.

- Location – Longbank Bridleway east side of A1

  Summary – Wooden fencing separating bridleway from southbound carriageway is poor condition – fast moving traffic could spook horse.

  Recommendation – Installation of appropriate fencing to ensure safety of equestrians passing close to carriageway

- Location – Footpath over the Longbank Bridleway bridge on western side of A1 between Longbank and Eighton Roundabout

  Summary – Existing fencing separating northbound carriageway from footpath is in poor condition – fence could fail resulting is direct access to live traffic lane

  Recommendation – Provision of adequate fencing to ensure safety of all footpath users.

- Location – M1 J67, J66 and J65 all NMU Routes

  Summary – None of the existing uncontrolled NMU routes around the existing roundabout junctions are being improved – potential conflict between a shared-use footway user and vehicle at each crossing point

  Recommendation – Install appropriate measures that would establish a safer passage for all shared-use footway users to access local facilities.

All of the points raised within the Stage 1 Road Safety Audit have been adequately addressed within this Walking, Cycling & Horse-Riding Assessment and Review (WCHAR) for the proposed A1 Birtley to Coalhouse scheme.

6. WALKING, CYCLING & HORSE-RIDING ASSESSMENT AND REVIEW TEAM STATEMENT

6.1 ASSESSMENT TEAM STATEMENT

As Lead Assessor, I confirm that this Walking, Cycling & Horse-Riding Assessment and Review Report has been compiled in accordance with DMRB HD 42/17 and thus contains the appropriate information for the wider design team. The Walking, Cycling & Horse-Riding Assessment and Review was undertaken by the following Assessment and Review Team:

Walking, Cycling & Horse-Riding Lead Assessor WSP

Simon Pratt — Signed:

Director — Date: 15/11/2018

Walking, Cycling & Horse-Riding Assessor WSP

Chris Appleton — Signed:

Principal Engineer — Date: 15/11/2018

Walking, Cycling & Horse-Riding Assessor WSP

Ben Handley — Signed: B. Handley

Graduate Transport Planner — Date: 15/11/2018

6.2 DESIGN TEAM STATEMENT

As Design Team Leader, I confirm that the assessment has been undertaken at the appropriate stage of the scheme development and that the wider design team has been involved in the process.

I confirm that in my professional opinion the appointed Lead Assessor has the appropriate experience for the role making reference to the expected competencies contained in HD 42/17.

Design Team Leader WSP

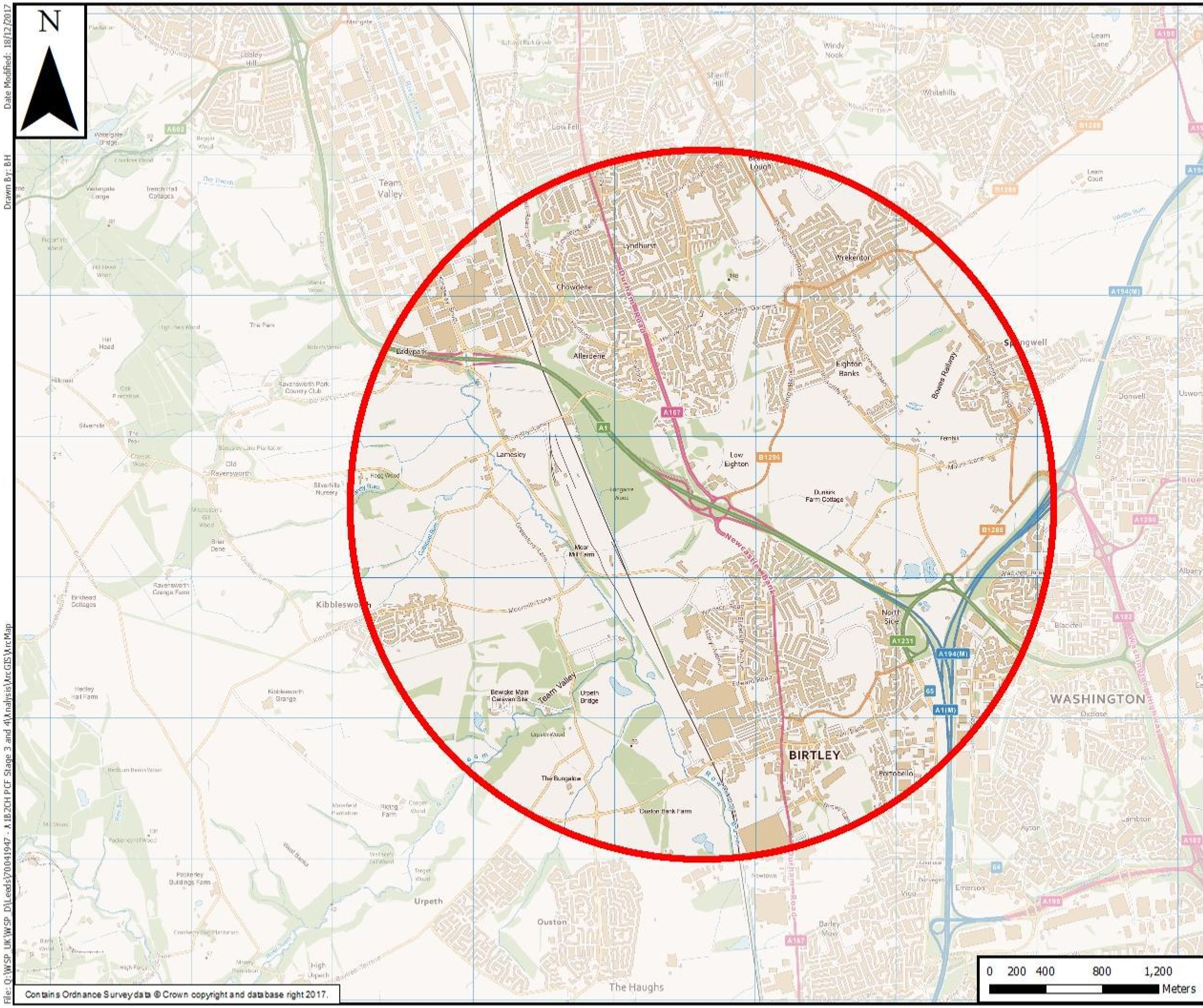
Nigel Rawcliffe — Signed:

Associate Director — Date: 15/11/2018

Appendix A

STUDY AREA

Date Modified: 18/12/2017
Drawn By: BH
File: Q:\WSP_UK\WSP_D\Leeds\70041947 - A1B2CH PCF Stage 3 and 4\Analysis\ArcGIS\ArcMap



Key

Study Area

wsp

PROJECT:
A1 - Birtley to Coal House Widening

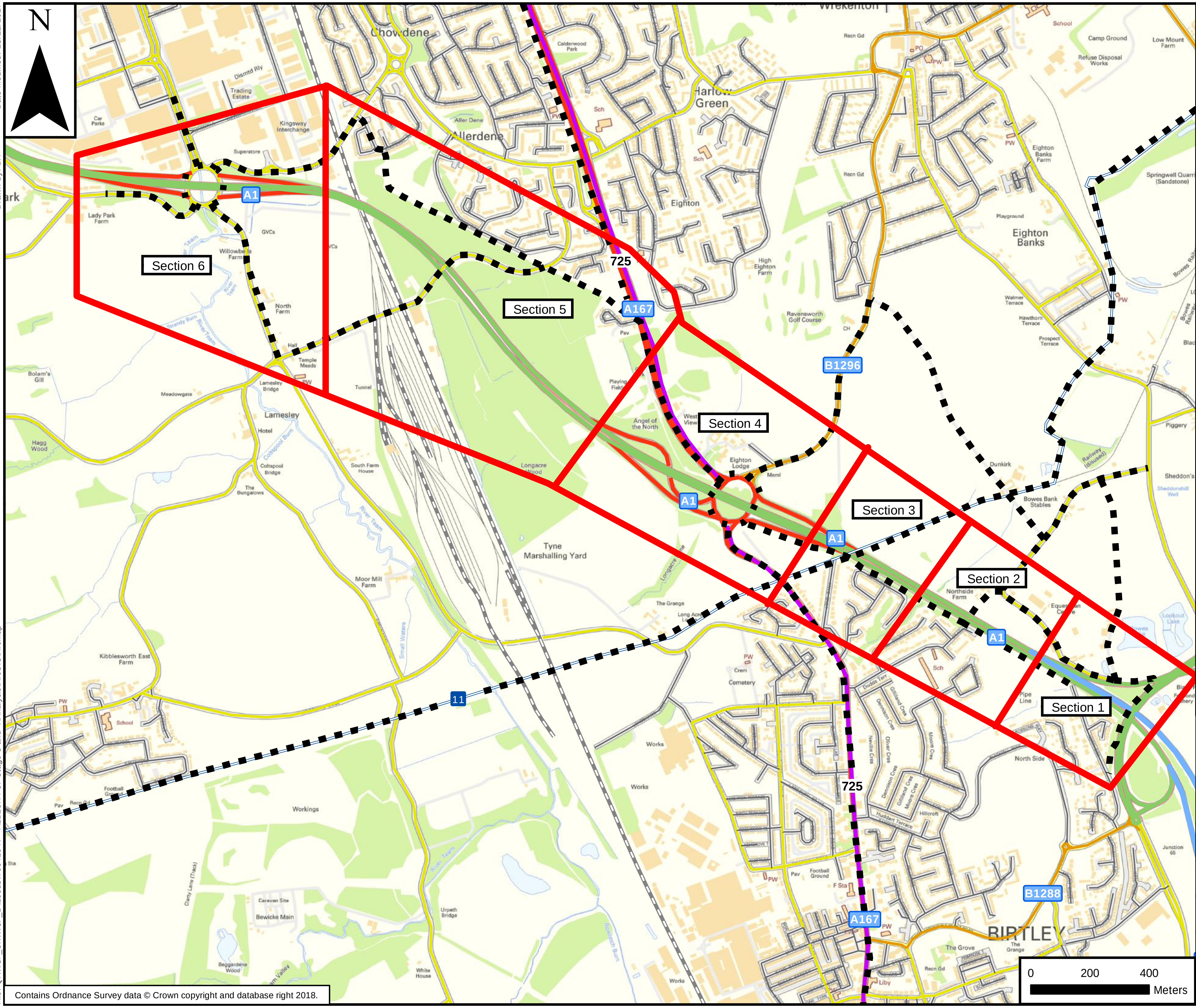
TITLE:
Study Area

FIGURE No:
Appendix A

Appendix B

STUDY SECTIONS

Date Modified: 18/12/2017
Drawn By: BH
File: Q:\WSP_UK\WSP_D\Leeds\70041947 - A1B2CH PCF Stage 3 and 4\Analysis\ArcGIS\ArcMap



Key

- WCH Assessment Routes

Sustrans Regional Route

- Regional Route (off road)

National Cycling Network

- Local Route (off road)
- Cycle Route 725

Road Network

- Motorway
- Primary Road
- A Road
- B Road
- Minor Road
- Local Street

Railway Line

- Railway Line

wsp

PROJECT:
A1 - Birtley to Coal House Widening

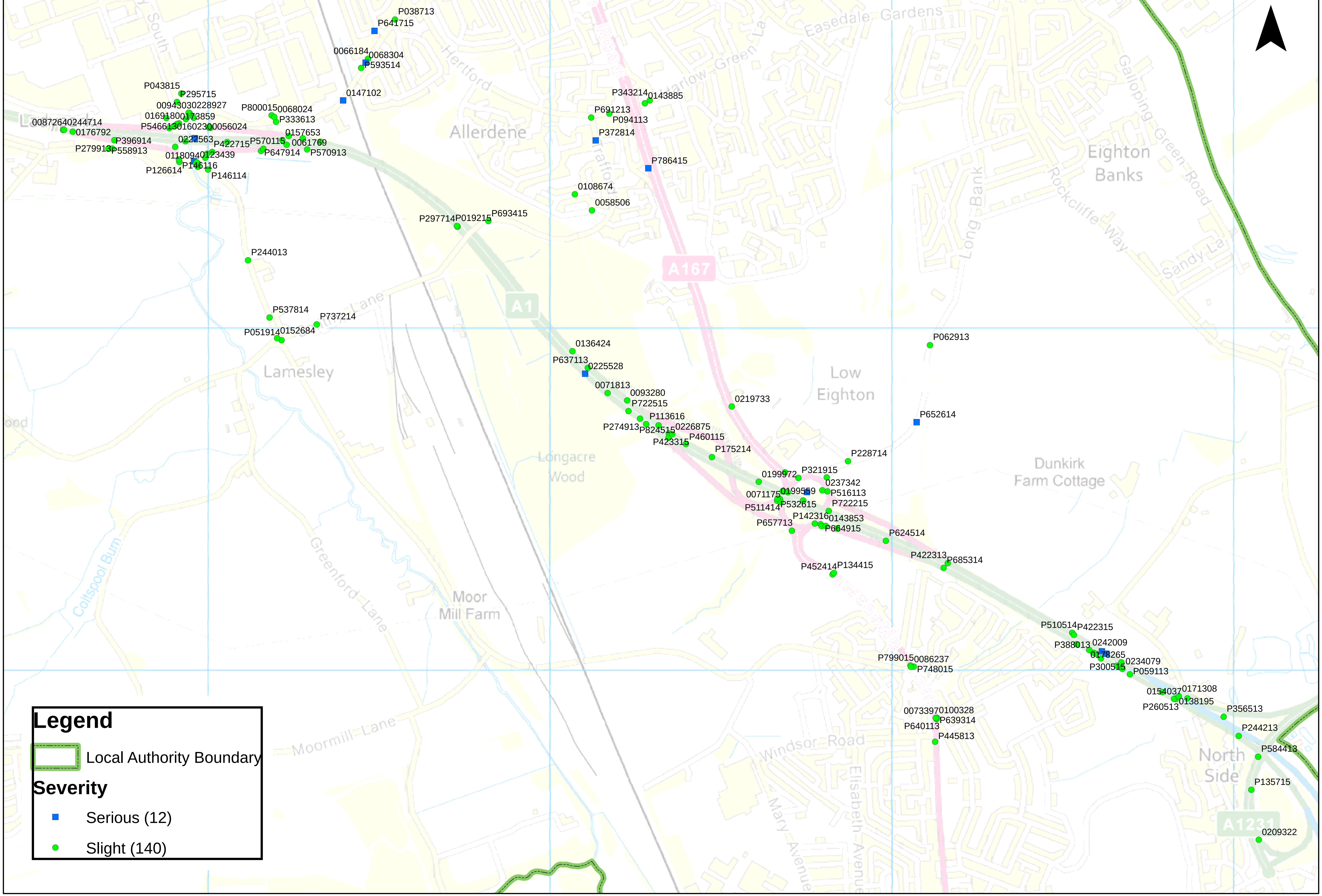
TITLE:
Study Sections

FIGURE No:
Appendix B

Appendix C

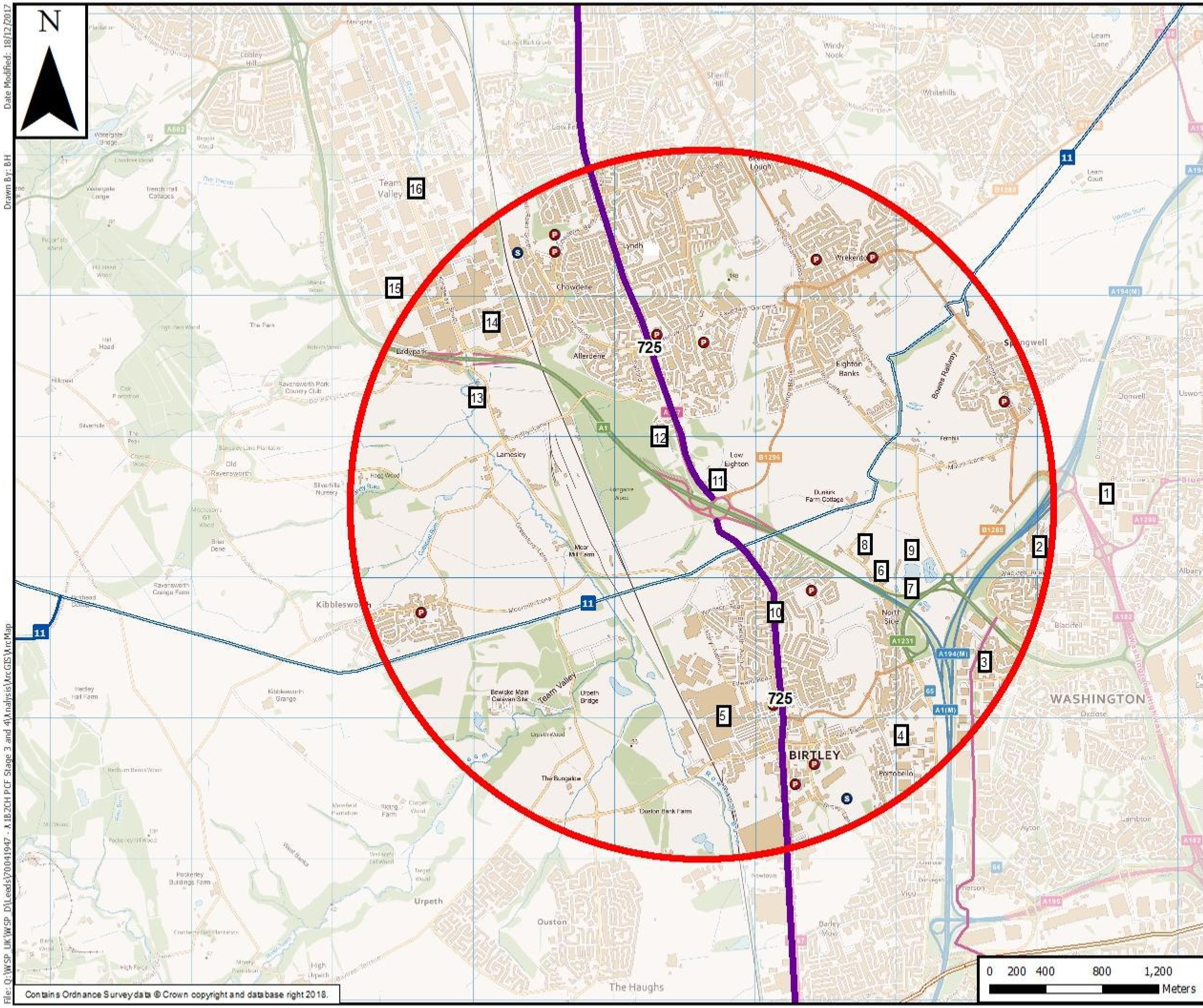
ACCIDENT DATA PLOT

Collisions between 30/11/12 and 01/12/2017



Appendix D

KEY TRIP GENERATORS AND LOCAL AMENITIES



File: Q:\WSP_UK\WSP_D\Leeds\70041947 - A1 B2CH PCF Stage 3 and 4\Analysis\ArcGIS\ArcMap

Key

Study Area

SchoolType

- P Primary
- S Secondary

wsp

PROJECT:
A1 - Birtley to Coal House Widening

TITLE:
Key Trip Generators and Local Amenitites

FIGURE No:
Appendix D

Appendix E

PHOTOGRAPHS

Section 1 – A1231 Northside Overbridge

F.1 – A photo from the western side looking eastwards

F.2 – A photo from the eastern side looking eastwards

In the foreground of both photos, it is shown that the footway provision is substandard in width and the condition of the pavement surface is poor. On the left-hand side of photo F.1, the vegetation on the verge encroaches onto the existing footway. Both photos show that no lighting, no directional signage and no dedicated cycle facilities are available along this route.

F.3 – A photo focusing in on the fencing on the western side

F.4 – A photo with a zoomed extent of the fencing

Photos F.3 and F.4 were taken to highlight the poor condition of the current concrete post and tubular pole fencing.

F.5 – A photo showing the passage way from Northside Road to the A1231

Section 2 – Northside to North Dene Footway and the North Dene Footbridge

F.6 – A photo looking south (west of the A1 mainline) along Northside Footway

F.7 – A photo taken on the western side of North Dene Footbridge

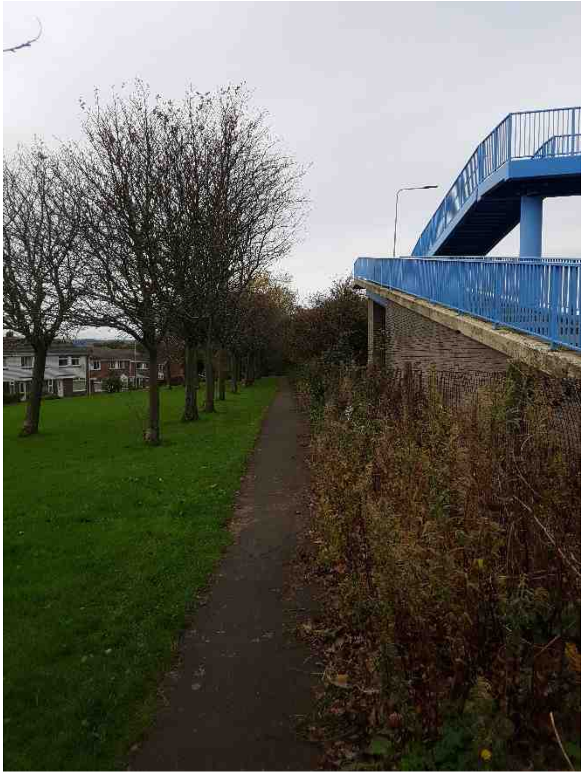
Photo F.6 demonstrates that Northside Footway is unlit as well as there being no physical fence that would prevent people and animals accessing the A1 mainline. The deck and ramp shown in the foreground of photo F.7 is substandard in width.

F.8 – A photo taken from North Dene Footbridge looking eastwards

F.9 – The ‘Kissing Gate’ and unmade footpath on the eastern side of North Dene Footbridge

Photo F.8 further highlights the substandard width of the deck and ramp on North Dene Footbridge and no tactile paving is provided. Photo F.9 shows the unmade footpath and a ‘kissing gate’ which is unsuitable for cyclists. No directional signage is provided in any of the four above pictures.

Section 3 – North Dene to Long Bank Footway and the Long Bank Underpass

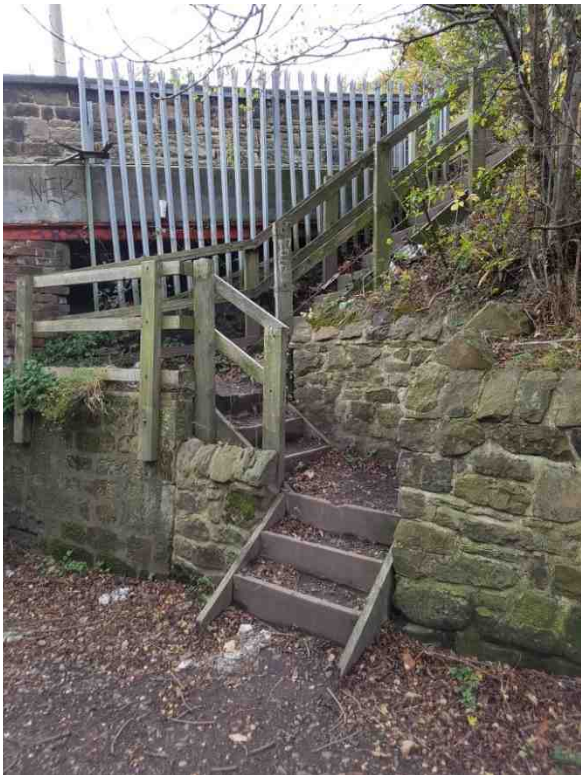


F.10 – A photo looking north from North Dene Footbridge to Longbank Footway

F.11 – A photo looking north and on the western side of the A1 mainline of Longbank Footway

In the foreground of both photos it is shown that footway provision is substandard in width for the usage from cyclists and it can also be seen that vegetation in the verges encroaches onto the existing footway. Both photos show that this footway is unlit with no directional signage. Photo F.11 highlights the poor outdated condition of the concrete post and wire-mesh fencing which acts as a barrier to the A1 mainline.

F.12 – A photo of an informal and unmade ramp



F.13 – A photo of the flight of wooden steps that lead to Longbank Bridleway

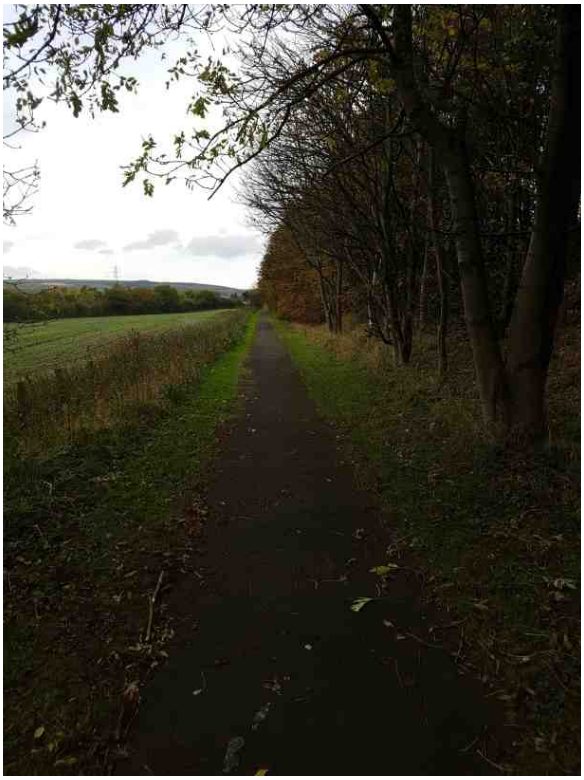
F.14 – A photo taken from Longbank Bridleway looking westwards highlighting the A167 Newcastle Bank access

F.15 – A photo taken from Longbank Bridleway looking westwards under the A1 mainline

F.16 – A photo on the eastern side of the A1 mainline looking north

The A1 mainline southbound is behind the 2.0m high wooden close-board fence on the left of photo F.16.

Section 4 – Long Bank to Eighton Lodge Footway and the Eighton Lodge Interchange



F.17 – The Footway from Longbank to Eighton Lodge taken looking north

F.18 – The concrete post and wire-mesh fencing on the western side of the A1 mainline on the Footway from Longbank to Eighton Lodge

F.19 – Shared Footway/Cycleway provision taking facing north on the A167 Durham Road

F.20 – This photo was taken from the crossing point looking southwards up the A1 northbound slip road

F.21 – A photo taken looking eastwards from the crossing point on the B1296 Long Bank

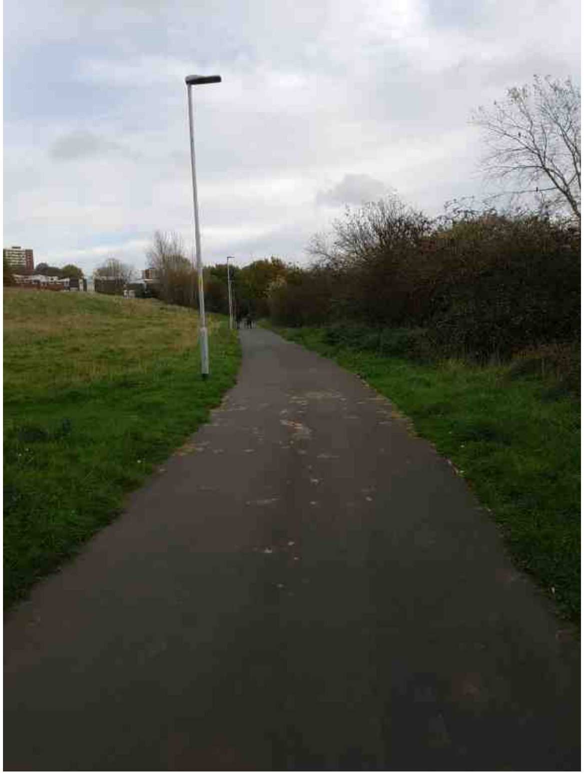
Photos F.20 and F.21 both demonstrate the impact the signage has on the visibility for people crossing the roads.

Section 5 – Smithy Lane Over-bridge and the Angel Cycleway/Chowdene Bank Bridge

F.22 – Western side of Smithy Lane Bridge

F.23 – Eastern side of Smithy Lane Bridge

Photo F.22 was taken looking north-east along Smithy Lane on the approach to the Bridge, this photo is a good example of firstly the narrow footway and secondly how motorists park indiscriminately along this part of the road, which reduces the width further. Photo F.23 further supports this argument of a narrow footway. Both photos are unlit.



F.24 – The Angel Cycleway

F.25 – South-westerly for Chowdene Bank Bridge

Photo F.24 was taken walking south along The Angel Cycleway, as shown in the photo the cycleway is well lit with a well maintained pavement surface. Photo F.25 is looking south-west down Chowdene Bank Bridge, in the forefront of the photo is a narrow footway which is only on one side of the bridge.

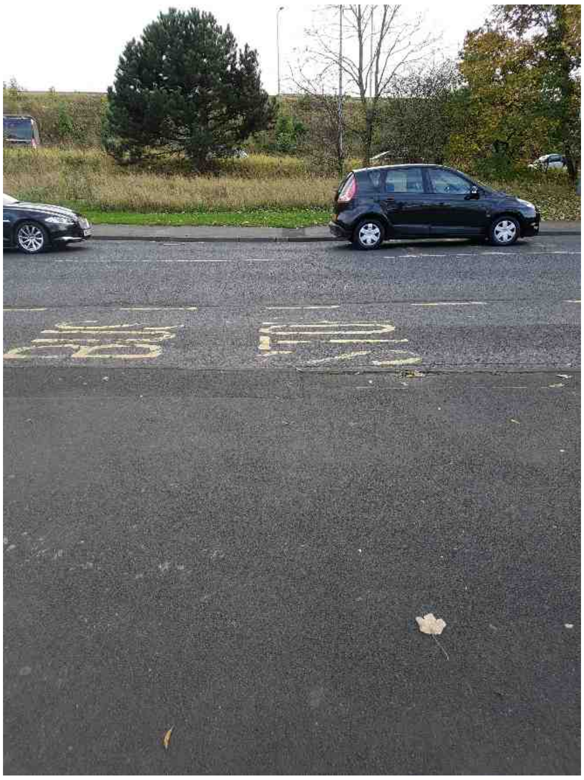
Section 6 – Lamesley Roundabout

F.26 – Western view from Chowdene Bank to Kingsway

F.27 – Crossing facilities at the Banesley Lane Arm of Lamesley Roundabout

Photo F.26 was taken looking west across the Kingsway Arm of Lamesley Roundabout, this photo in particularly highlights that footway provision is substandard in width and this is a reoccurring theme around the roundabout. Photo F.27 was taken at the crossing point on Banesley Lane Arm of Lamesley Roundabout and is a typical example of how there is a varying degree of physical pedestrian infrastructure at crossing points. In this photo there are dropped kerbs and white line markings however there is no tactile paving.

F.28 – A1 northbound slip road crossing point

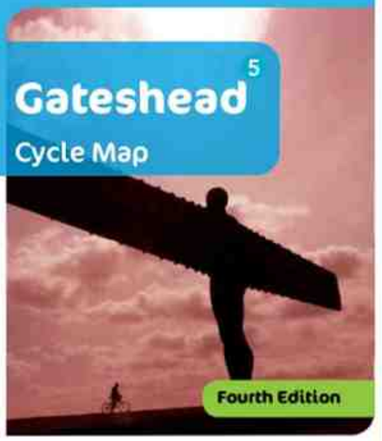


F.29 – Southern view from Sainsbury's Pedestrian access over Chowdene Bank

Photo F.28 was taken at the crossing point on the A1 northbound slip road to Lamesley Roundabout, this photo depicts the conflict between non-motorised users and vehicles as well as the difficulties non-motorised users face when crossing. Photo F.29 was taken at the southern entrance point into the Sainsbury's and Argos store park overlooking Chowdene Bank, this photo shows a bus lay-by in the primary pedestrian desired line.

Appendix F

CYCLE MAPS



Go Smarter

Gateshead Council

Double sided map with hundreds of miles of routes

5 Gateshead

This map series covers the areas of:

1. South East Northumberland **Tel: 0345 600 6400**
2. North Tyneside **Tel: 0191 643 6086**
3. South Tyneside **Tel: 0191 424 7665**
4. Sunderland **Tel: 0191 561 2450**
5. Gateshead **Tel: 0191 4333106**
6. Newcastle upon Tyne **Tel: 0191 277 8958**

Please cycle responsibly, according to the Highway Code.

The Councils of Tyne and Wear and Northumberland are developing a network of cycle routes to all local areas, linking homes to employment, shops, education, recreation and medical facilities. For more information and ideas about cycling visit:

- www.northumberland.gov.uk
- www.northtyneside.gov.uk
- www.newcastle.gov.uk
- www.sustrans.org.uk
- www.southtyneside.info
- www.gateshead.gov.uk
- www.sunderland.gov.uk/cycling
- www.ctc.org.uk
- www.gosmarter.co.uk

Welcome to the Gateshead cycle map, and its surrounding area. This map is one of six in total, covering the whole of Tyne and Wear and South East Northumberland.
The other five maps are

- **North Tyneside**
- **South Tyneside**
- **Newcastle upon Tyne**
- **Sunderland**
- **South East Northumberland**

Whether you are cycling for business or pleasure, we trust that this map will help you to travel from A to B by bike safely and efficiently, using our ever expanding network of on- and off-road cycle routes.

5 Gateshead

Gateshead has so much to offer the cyclist. It has everything that you'll need whether you're shopping, paying a bill or just out for a ride.

Cyclists have easy access to the borough's natural and industrial heritage. You can enjoy some of the area's most scenic countryside along the Tyne, through the Derwent Valley and across the west of the borough. You can also experience the area's industrial heritage at Blaydon Burn, re-visit the age of steam at the Tanfield Railway and see a working water wheel at Path Head Water Mill.

If you have more cultural pursuits in mind, Gateshead Quays offers world famous contemporary arts and music venues at BALTIC and the Sage Gateshead. Cyclists can enjoy Gibside Park and Chapel, the Shipley Art Gallery, the Riverside Sculpture Park and the numerous art installations across the borough. Perhaps best of all, you can have direct access to the region's most famous artwork – the Angel of the North. Cycle parking is provided across the town centre and at many of the local centres across the borough, allowing cyclists access to the full range of shops and services on offer. In addition, there is now vastly improved cycle parking and cycle routes around the MetroCentre.

For those wanting to travel further afield, Gateshead Interchange offers secure cycle parking and access to a network of bus and metro services that cover much of the region. These services also provide frequent connections to the National Rail Network.

And we haven't even mentioned the Gateshead Millennium Bridge!

If you have any questions or ideas about cycling in Gateshead please contact:

Neil Frier
Team Leader Traffic Solutions
Tel: 0191 433 3100
Email: neilfrier@gateshead.gov.uk

Go Smarter

Go Smarter is the sustainable transport programme for Tyne and Wear. Go Smarter encourages people to travel sustainably on their daily journeys to school and work. Go to **www.gosmarter.co.uk** for more information and to use the Go Smarter journey planner.

Map Key

- National Cycle Network off-road cycle path
- National Cycle Network on-road routes
- Traffic-free path
- Path or footway where you should walk your bike
- Bridleway / Rough track
- Signposted on-road cycle route
- Road Links
- Cycle lane
- Bus lane
- Other roads
- One way street (shown on road links only)
- Steep hill (arrow points down hill)
- Council boundary line
- 7 National Cycle Network
- 11 Regional Cycle Network
- Cycle parking
- Toucan crossing
- Pedestrian crossing
- Railway station
- Level crossing
- Metro station
- Tourist Information Centre
- Bus station
- Library
- Buildings
- School, college or university

Traffic Signs

Some traffic signs that you may come across when you are cycling through the area

- No entry
- Motor vehicles prohibited (cycles permitted)
- No cycling
- Shared route for cyclists & pedestrians
- Route to be used by cyclists only
- Segregated cycle & pedestrian route
- Buses & cycles only
- Signposted on-road cycle route
- With-flow bus & cycle lanes
- With-flow cycle lanes
- City Centre 3 — Signposted on-road cycle route to place shown

Gateshead Town Centre

Places of Interest

1. Angel of The North
2. BALTIC Centre for Contemporary Art
3. Birkheads Secret Gardens
4. Causey Arch
5. Chopwell Woods
6. Derwent Walk Country Park
7. Gateshead Heritage @ St Mary's
8. Gateshead Leisure Centre
9. Gateshead Millennium Bridge
10. Gateshead Old Town Hall
11. Gibside
12. Path Head Water Mill
13. Riverside Park
14. Ryton Willows Local Nature Reserve
15. Saltwell Park
16. Shipley Art Gallery
17. Swalwell Visitor Centre
18. Tanfield Railway
19. The Sage Gateshead
20. Thornley Woodlands Centre
21. Watergate Forest Park
22. Whickham Thorns Outdoor Activity Centre

Tourist Information Centres

Gateshead Tourist Information Centres will help you make the most of your stay. They can advise on a whole host of things to do and see in NewcastleGateshead. Whether it's comedy, live music or special events, they'll be only too pleased to help. You can book your accommodation, buy tickets for walking tours, bus tours and river cruises and pick up great gifts, souvenirs and What's On guides too.

St Mary Heritage Centre
St Marys Square, Oakwellgate,
Gateshead NE8 2AU
Tel: 0191 433 4699
Email: heritage@gateshead.gov.uk

Gateshead Central Library
Prince Consort Road,
Gateshead NE8 4LN
Tel: 0191 433 8420
Minicom: 0191 478 2020
Email: enquiries@gateshead.gov.uk
Open Weekdays 9am-7pm (closes 5pm Wednesday); Saturday 9am-1pm

Need accommodation?
If you are planning a trip to NewcastleGateshead and you need to find a place to stay call the accommodation booking line on **0906 680 6805** (25p per minute) Or visit, call, email or write to our Tourist Information Centres

Map Key

- National Cycle Network off-road cycle path
- National Cycle Network on-road routes
- Traffic-free path
- Path or footway where you should walk your bike
- Bridleway / Rough track
- Signposted on-road cycle route
- Road Links
- Cycle Lane
- Bus lane
- Other roads
- One way street
- Steep hill
- Council boundary line
- 1 National Cycle Network
- 11 Regional Cycle Network
- Cycle shop
- Cycle parking
- Toucan crossing
- Pedestrian crossing
- Railway station
- Level crossing
- Metro station
- Tourist Information Centre
- Bus station
- Library
- Buildings
- Schools, college or university
- Community Associations

Traffic Signs

Some traffic signs that you may come across when you are cycling through the area

- No entry
- Motor vehicles prohibited (cycles permitted)
- No cycling
- Shared route for cyclists & pedestrians
- Route to be used by cyclists only
- Segregated cycle & pedestrian route
- Buses & cycles only
- Signposted on-road cycle route
- With-flow bus & cycle lanes
- With-flow cycle lanes
- Signposted on-road cycle route to place shown

South Shields

Bike Shops

1. **A-S Cycles**
44 St. Aidan's Road,
South Shields NE33 2HD
Tel: 0191 456 3133

2. **Barrie Hopkirk's Cycle Centre**
248 Shields Road,
Byker, Newcastle NE6 1DX
Tel: 0191 265 1472

3. **Conway Cycles**
12 Salem Street,
South Shields NE33 1HH
Tel: 0191 455 3129

4. **Cycle World**
118 High Street West,
Sunderland SR1 1TR
Tel: 0191 565 8188 or 514 1974

5. **Halfords**
Station Road,
Millbank, South Shields NE33 1ED
Tel: 0191 427 1600

6. **Halfords**
Unit H, Silverlink Business Park,
Coast Road, Wallsend NE28 9ND
Tel: 0191 262 8833

7. **Halfords Bike Hut**
Unit 3 Trimdon Street,
Sunderland
Tel: 0191 514 0843

8. **Hardisty Cycles**
5-7 Union Road,
Byker, Newcastle NE6 1DH
Tel: 0191 265 8619

9. **Pedal Inn**
172 Albert Road,
Jarrow NE32 5JA
Tel: 0191 428 6190

10. **Peter Darke Cycles**
1-2 John Street,
Sunderland SR1 1DX
Tel: 0191 510 8155
www.darkecycles.com

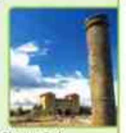
11. **Spokes**
39 Nile Street,
North Shields NE29 0DB
Tel: 0191 296 2840

12. **Sports Recycler**
TEDCO Business Park,
Henry Robson Way,
South Shields NE33 1RF
Tel: 0845 270 0535

Places of Interest

1. **Arbeia Roman Fort**
Baring Street, South Shields NE33 2BB
Tel: 0191 456 1369

2. **Bede's World**
Bede's World, Church Bank, Jarrow,
Tyne and Wear NE32 3DY
Tel: 0191 489 2106



3. **Customs House**
Mill Dam, South Shields NE33 1ES
Tel: 0191 454 1234

4. **Hebburn Leisure Centre**
Campbell Park Road, Hebburn NE31 2SN
Tel: 0191 483 3163

5. **Monkton Stadium**
Dene Terrace, Jarrow NE32 5NJ
Tel: 0191 489 1283

6. **Ocean Beach Pleasure Park**
Middle Arcade, Sea Road,
South Shields NE33 2LD
Tel: 0191 456 1617

7. **Souter Lighthouse**
Coast Road, Whitburn, Sunderland,
Tyne and Wear SR6 7NH
Tel: 01670 773966

8. **South Shields Museum & Art Gallery**
Ocean Road, South Shields NE33 2JA
Tel: 0191 456 8740

9. **Temple Park Leisure Centre**
John Reid Road, South Shields,
Tyne and Wear NE34 8QN
Tel: 0191 456 8119

10. **The Leas & Marsden Rock**

11. **Haven Point Leisure Centre**
Pier Parade,
South Shields,
Tyne and Wear,
NE33 2JS
Tel: 0191 424 7600

Tourist Information Centres

Tourist Information Centre
Museum and Gallery
Ocean Road, South Shields
Tyne and Wear NE33 2HZ
Tel: 0191 454 6612
Email:
museum.tic@southtyneside.gov.uk

Tourist Information Centre
Amphitheatre, Seafront
South Shields,
Tyne and Wear NE33 2RL
Email:
museum.tic@southtyneside.gov.uk
(Seasonal opening)

Appendix G

PUBLIC CONSULTATION FEEDBACK

Theme	Issue raised	Response No	Contact	ENV team response (2018 consultation)	Design Team response (2018 consultation)	NC Comments	Env updated response
WCH/ Heritage/ Landscape	Concerns about disruption to recreation, heritage and wildlife at Bowes railway line.	(2016): 80	Chris Appleton/ Alison Plummer/ Sarah Proctor	N/A	N/A	Pls can you review and provide a response on the mitigation in place for impacts on recreation, heritage and wildlife at Bowes railway?	ALISON COMMENTS: We have had consultation with Historic England and the conservation officer as to the work affecting Bowes Railway and have agreed an appropriate proportionate form of investigation and recording.
WCH	A number of comments received asking about pedestrian facilities in place for pedestrians at J67 crossing between Lady Park/Kibblesworth and Sainsburys *Asked for crossing points further up the slip road on north and southbound lanes to increase safety. *Wants full time traffic lights on junction 67/pedestrian crossings *Asked for zebra crossings *Very little pedestrian provision -more needed	(2016): 69; (2018): 22,74,183,237,246,255,268,269, O19,O64	Chris Appleton	N/A	N/A	Pls can you review and advise what pedestrian crossings/facilities are being considered during construction and operation at J67?	As part of the scheme the crossing points will be up-graded so that they are consistent around the roundabout and provide tactile paving. Crossing points further up the slip roads is nota safer option as vehicle speeds become faster, although we are looking at option at the junction itself which may be funde d via the designated funds route, this option would investigate the full time provision of signals. Zebra crossing are not suitable for loctions such as this as they give priority to pedestrians at the crossing and so if a regular flow of pedestrians it could cause issues on the SRN with traffic blocking back.
WCH/ Structures	Wants to improve Smithy Lane Overbridge for use by horses (increase parapets and infill at bottom) -links to bridleway.	(2016):88	Chris Appleton/Imitiaz	N/A	N/A	Pls can you review comments on Smithy Lane bridge - Not sure what they mean or if this is achievable?	IMMITIAZ COMMENTS: We have NO planned works to Smithy Lane Bridge as part of the scheme. Any improvement (i.e. provision for horse riders) should be made through designated funds? Simon Pratt to provide further details if required. SIMON PRATT COMMENTS: But just to confirm that there is no bridleway on Smithy Lane but as a public road all users even horses can use the route.
WCH	Requested safe cycle lane separate from highway to encourage people to cycle to work.	(2018):12	Chris Appleton	N/A	N/A	Is this being considered? Reasons for not including in scheme?	was this for a specific location? As a number of cycle routes exist off carriageway in the area, although due to land constraints some routes need to be on road. Although nothing new is planned as part of this scheme.
WCH	Requested improved tourist facilities around Angel of North and better signage for such facilities on A1.	(2018): 49,50	Chris Appleton	N/A	N/A	Do we have any plans to upgrade PRoW or have more signage in this area for tourism facilities?	Additional signage is to be provided through the designated fund route.
WCH	Wants to know impact of new North Dene footbridge on residents.	(2018): 66	Hitan Mistry	N/A	N/A	PLs can you review and advise in bridge impacts compared to existing (will it be taller, will any trees be cut down, additional lighting etc?)	The design was undertaken by the bridges section and so they will be able to advise better
WCH	Wants improvements to Longbank bridleway between A167 and Kibblesworth/Lamesley marshes	(2018): 89,209	Chris Appleton	N/A	N/A	Pls can you review and provide some text on proposed improvements. Will this be subject to designated funds?	No improvements proposed as the A1 scheme does not affect this section of bridleway
WCH	Wants no loss of pedestrian/cyclist /equestrian facilities -crossing access improved or at least not lessened. A1 already represents a division and major barrier for pedestrians in the area	(2018): 91,134,140,168,176	Chris Appleton	N/A	N/A	Will WCH facilities be lost as result of scheme? Are we adding in more? Pls can you review and advise on wording.	no loss of facilities will occur as a result of the scheme, although routes will be closed temporarily while construction works take place.
WCH/Design	Concerns over footpath safety during construction	(2018):116	Irfan	N/A	N/A	Pls can you review and advise on arrangements for affected footpaths during construction.	to be advied by other members of the team
WCH/Design	Wants to improve pedestrian safety on the railway between the gold medal restaurant and the coal house roundabout (think they mean where Chowdene Bank crosses the ECML). Says narrow path is dangerous for pedestrians accessing Sainsbury's and Team Valley (close to traffic). Suggests 2 improvements: 1) Wants footbridge on both sides of gold medal/coal house bridge (Chowdene Bank over ECML?); 2) Widen this road bridge by removing path on north side.	(2018):152	Chris Appleton / Irfan	N/A	N/A	Is this outside scope of scheme? Pls can you review and advise what is being done in this section?	The A1 scheme doesn't affect this route and so no proposals are suggested. I agree a footbridge adjacent to the existing bridge would be a good idea but I'm not sure if the designated funds route would provide the £1m to provide it.
WCH	Wants safe cycle connection through J67 roundabout (Team Valley to Lamesley).	(2018): 185	Chris Appleton	N/A	N/A	Pls can you review and advise what is being done for cyclists at this roundabout?	Current facilities will be improved at the crossing points, further facilities may be provided through the designated funds route.
WCH	Comments on the well used footpath on Birtley side of North Dene Footbridge that is now blocked by a large earth mound. Asked if the footpath can be replaced./ A North Side resident asked for no loss of footpath adjacent to road.	(2018):205, O15	Chris Appleton	N/A	N/A	Pls can you review and advise on a response. Is our scheme affecting this footpath? Is this housing developer issue?	As part of the A1 scheme there will be no loss of footpath. The earth mound may be to one next to the new housing which I belive acts as a noise barrier, this would be an issue for the local authority to deal with.
WCH	Wants safer pedestrian and cycle access across the angel roundabout J66 from Birtley to Low Fell. Dangerous to cross/fast traffic.	(2018): 215,O22	Chris Appleton	N/A	N/A	Pls can you review and advise what measures are in place here?	This is something that is being reviewed and would be undertaken through the designated funds route.
WCH	Wants better cycle lanes for wider area and onto Team Valley.	(2018): 230	Chris Appleton	N/A	N/A	Outside remit of scheme? Or can this be done under designated funds?	Not sure where but routes into team valley would be co-ordianted by the local authority.
WCH	Says road widening will affect equestrian access to Longbank Bridleway. Wants alternative connection on south of A1 underpass to give connectivity from Eighton Lodge stables. Wants disused longbank section set up as a bridleway (at the point where soil deposited). Wants further improvements at junctions of Smithy Lane, Hunerby Road (horse warning sign) during construction due to increased traffic volumes. Other comments ask that we do not close Longbank Bridleway.	(2018): 276,O55	Chris Appleton	N/A	N/A	Pls can you review and provide wording for consultation report. What measures are in place for equestrians at these locations?	Access to Longbank Bridleway will not be affected by the scheme, extending the underpass will be undertaken on the north side of the A1 I understand and the access ramp will be retained. In additiona the route of the top of the bridleway on the north side of the A1 will be widened to allow better passage for equestrians. Not sure where Hunerby Road is?
WCH	A number of comments received from horseriders who use Angel Fishing Lakes Stables/Local Riding Schools concerned about access during construction: *Concerns that horse riders will be forced onto main roads during construction works, safety issues. *Wants to retain bridlepath for riding- safer than roads and for less confident riders. *The bridlepath from North Side to Kibblesworth will be affected, but there is also a track that runs alongside the the A1 over the top of the bridlepath, that allows access from Longbank. Wants a suitable safe alternative provided if this access removed. *Concerns about bridleway access linking Long Bank and Bowes path during construction. Says proposed diversion route is unacceptable to horse riders as it uses busy public roads and a major roundabout.	(2018): O51,O52,O53,O57	Irfan	N/A	N/A	What proposals are in place for riders using local stables/riding schools during construction?	Access during construction is not something we have been dealing with and so this would need to be dealt with by others, but I am aware of a plan showing diversion routes which may assist.

Appendix E

NORTHERN REGIONAL TRANSPORT MODEL – MODEL VALIDATION REPORT

North Regional Model
Model Validation Report

March 2017

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Approvals

Name	Signature	Title	Date of Issue	Version
Roger Himlin		Senior Responsible Owner		

This report is presented to Highways England in respect of North Regional Model and may not be used or relied on by any other person. It may not be used by Highways England in relation to any other matters not covered specifically by the agreed scope of this Report.

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List of Abbreviations

Abbreviation	Name
AAWT	Annual Average Weekday Traffic
Area 13	The Highways England network within Cumbria and North Lancashire
Area 14	The Highways England network within the North East
ATC	Automatic Traffic Count
ATCO	Association of Transport Co-ordinating Offices
BC	Borough Council
BRES	Business Register and Employment Survey
BYFM	Base Year Freight Matrix
CAA	Civil Aviation Authority
CC	County Council (or City Council for Newcastle only)
CSRGT	Continuing Survey of Road Goods Transport
DfT	Department for Transport
DIADEM	Dynamic Integrated Assignment and Demand Modelling (software)
HGV	Heavy Goods Vehicle
ITN	Integrated Transport Network
LA	Local Authority
LENNON	Latest Earnings Nationally Networked Over-Night (rail fares data)
LGV	Light Goods Vehicle
LSOA	Lower Super Output Area
MCC	Manual Classified Count
MCTC	Manual Classified Turning Count
MNO	Mobile Network Operator
MOIRA	Model of Inter Regional Activities (rail services)
MPOD	Mobile Phone Origin-Destination
MSOA	Middle Super Output Area
MSR	Model Specification Report
NAPALM	National Air Passenger Allocation Model
NRM	North Regional Transport Model
NRTS	National Rail Travel Survey
NTEM	National Trip End Model
NTM	National Transport Model
NTS	National Travel Survey
OBA	Origin Based Assignment
OFCOM	Office of Communications
OGV	Other Goods Vehicle
ONS	Office for National Statistics
ORR	Office of Rail Regulation
OS	Ordnance Survey

PDFH	Passenger Demand Forecasting Handbook
PT	Public Transport
RIS	Road Investment Strategy
RoF	Region of Focus (model study area)
RSI	Roadside Interview
RTM	Regional Traffic Model (suffix for all five model names)
SATURN	Simulation and Assignment of Traffic in Urban Road Networks (software)
SRN	Strategic Road Network
STATS 19	DfT Statistics on road safety in Great Britain based on injury accidents reported to the police.
TADU	Traffic Accident Data Unit (covering Tyne and Wear)
TAG	Transport Analysis Guidance
TAME	Traffic Appraisal, Modelling and Economics
TCG	Technical Consistency Group
TechMAC	Technology Managing Agent Contractor
TEMPRO	Trip End Model Presentation Program
TIS	Trip Information System
T-PSM	Trans-Pennine South Transport Model
TRADS	Traffic Accident Data System
VDM	Variable Demand Modelling
VOC	Vehicle Operating Cost
VOT	Value of Time

Executive Summary

The Model Validation Report presents a summary of the highway model and variable demand model development, calibration and validation for the base model of the North Region Model, one of five Regional Models currently being developed for Highways England to cover the whole of the country. The report covers:

- Purpose of the model;
- Model Description and Specification;
- Standards and Objectives;
- Summary of Data Collation;
- Highway Model Development: Zoning, Network and Matrices;
- Highway Model Calibration;
- Highway Model Validation;
- Variable Demand Model; and
- Summary of Model Performance.

The report confirms that the model has been diligently developed. The scale and scope of the model is such that modified target standards have been employed to suit the input data and intended application.

The model meets the target objectives for the Highway Calibration and validation. The variable demand model is suitably specified and meets the target objectives.

The model is generally fit for purpose but would benefit from a review of intended use prior to each application.

1 Study Overview

1.1 Background to Regional Traffic Models

In summer 2015 Highways England commissioned a team led by Mouchel to build a transport model of the North region of England. This is in response to the need for Highways England to progress a range of road schemes throughout England identified in the Road Investment Strategy (RIS) within the first Road Period (2015-2020) and for developing subsequent RIS periods. A significant amount of modelling and appraisal work is required to progress these plans and a 'Traffic Modelling Strategy' was developed for Highways England by the Traffic Appraisal, Modelling and Economics (TAME) group. This document identified the creation of five 'regional' models as one of the components with the greatest potential to increase the speed of future delivery of schemes.

1.2 Regional Model Objectives

The requirement for the Regional Traffic Models, as set out in the initial Highways England scope, is to help progress the schemes identified in the Road Investment Strategy (RIS) within the first Road Period (2015-2020) for which a significant amount of modelling and appraisal work will be required.

By implication, the nature of the Regional Traffic Models will differ from most conventional models in that there is no single geographic area of focus around which the model is constructed. For the Regional Models, the aim is to be a base for a large number of separate schemes. This will therefore give a more uneven spread of detail with the main focus on the SRN.

The regional models have a clear set of high level objectives, namely:

- To provide a multi-modal platform for transport scheme assessment;
- To ensure that a common approach is employed using common data sources and software to ensure consistent outcomes between regional models; and
- To provide the basis for the development and appraisal of RIS schemes.

Furthermore, consideration needs to be given for using the models to go beyond the immediate RIS schemes and to be used as a tool to help identify and potentially appraise the next tranche of interventions, what has been referred to as "RIS2". This would require detail to be included in the model for areas where schemes have not yet been identified. This wider functionality presents an extra challenge as, to some extent, network problems will be more apparent where there is greater network detail. However, Highways England are concerned with the Strategic Road Network (SRN) rather than all the road network. As a result the potential areas for new schemes to be identified will be limited to very specific parts of the network.

Taking this into account, the model will have additional detail along the SRN that is not just concentrated around the current RIS schemes. This should have the additional benefit of allowing the model to be used on a wider range of schemes where forecasting would be required but no current model is available. For many small scale schemes (for example a single junction operation) it is easy to obtain traffic counts to assess the baseline but providing a forecast of future flows is a common problem. Applying previous growth rates can lead to overestimation of flows. The Regional Models will provide these forecasts. In such cases the Regional Model may not itself be closely validated at a particular junction but the model should be able to provide growth factors to apply to new counts, to give more reliable forecast flows.

The Regional Models therefore provide the opportunity for improving the availability of traffic forecasts. However it is important to understand the limitations of such a model. By allowing for a wider geographical scope of the model, this can only come at a price of reduced accuracy at any single location.

The RTMs will provide a quicker start up at the early stages and would therefore still provide a significant advantage to Highways England. It will therefore be important to consider not whether a specific scheme can be modelled within the RTM, but rather whether a specific scheme in a specific part of the development process can be modelled within the RTM.

The model also offers further opportunities for subsequent development, including the addition of more detail in specific areas, the reduction of detail elsewhere (what could be termed a compression of the model) or even a cordon of a smaller area (e.g. for more local operational assessment and possibly feeding demands into a more detailed micro-simulation model.

As a consequence the RTMs should provide a versatile starting point for modelling, although are will always be needed to ensure the correct use is made of it, taking into account the nature of the scheme, and the context of the study.

1.3 Regional Model Application

It is currently proposed to undertake two main scenarios, a Do Minimum / Reference case, and a “Do All” case. The Reference will include all committed schemes but not the current RIS schemes. The “Do All” will then be based on the Reference but with all the current RIS schemes included.

For downstream application of the models the current assumption is that all interventions tested will be in the form of additional road capacity, which may include junction improvements, road widening or even new links.

It is currently not considered that interventions such as road user charging would be included, or toll regime testing. This would require the model to include some differentiation of “willingness to pay” within the user classes and would be expected to make the model building more complex and lengthier.

High level multi-modal interventions, such as the impact of High Speed 2, will be able to be tested through the variable demand model (VDM) process. It should be emphasized that this is a “passive” ability of the model to gauge the impact of cost changes of rail on demand for highway capacity, rather than detailed forecasts of rail patronage in its own right.

1.4 Technical Consistency Groups

To ensure that the consistency element of the high level objectives is adhered to the regional models will operate to a common format to be established by the Technical Consistency Groups (TCG), with representatives from the client organisation and consultancies involved in each of the geographical regions. At the highest level these groups were formed to advise on:

- Modelled platform;
- Data consistency;
- Network development;
- Demand Matrix development;
- Calibration and validation (CalVal);
- Variable demand modelling;
- Forecasting process; and
- Model handover

The TCG's have produced a body of guidance that was used for a range of model development topics. This guidance was consolidated into a central document referred to as the RTM Technical Guidance (RTMTG) reflecting the TCGs as follows:

- RTMTG – Chapter 1 - Model Platform.
- RTMTG – Chapter 2 – Data Consistency.
- RTMTG – Chapter 3 – Matrix Development.
- RTMTG – Chapter 4 – Network Development
- RTMTG – Chapter 5 – Calibration / Validation.
- RTMTG – Chapter 6 – Variable Demand Modelling.
- RTMTG – Chapter 7 – Traffic Forecasting.

This information is available on the[1] Highways England Sharepoint site and references to the content are also provided throughout this document.

1.5 Purpose and Structure of the Report

The main purpose of this Model Development Report is to document the development of the North Regional Model and to establish Fitness for purpose.

This Model Development Report has been developed in accordance with discussions held by the TCGs. A standard template has been developed to be followed by all regions. These take account of the Highways England documents such as the Interim Advice Note 106/08 and the PCF product description for the Local Model Validation Report (LMVR).

[1] https://extranet.aecom.com/sites/highwaysenglandregionalmodels/SitePages/Home.aspx

The remainder of this report covers:

- Chapter 2 - Model Description and Specification;
- Chapter 3 - Standards and Objectives;
- Chapter 4 - Summary of Data Collation;
- Chapter 5 - Highway Model Development - Networks;
- Chapter 6 - Highway Model Development - Matrices;
- Chapter 7 - Highway Model Calibration;
- Chapter 8 - Highway Model Validation; and
- Chapter 9 - Variable Demand Model;

The report concludes with a summary of the process and statement on the fitness for purpose of the model.

2 Model Description/Specification

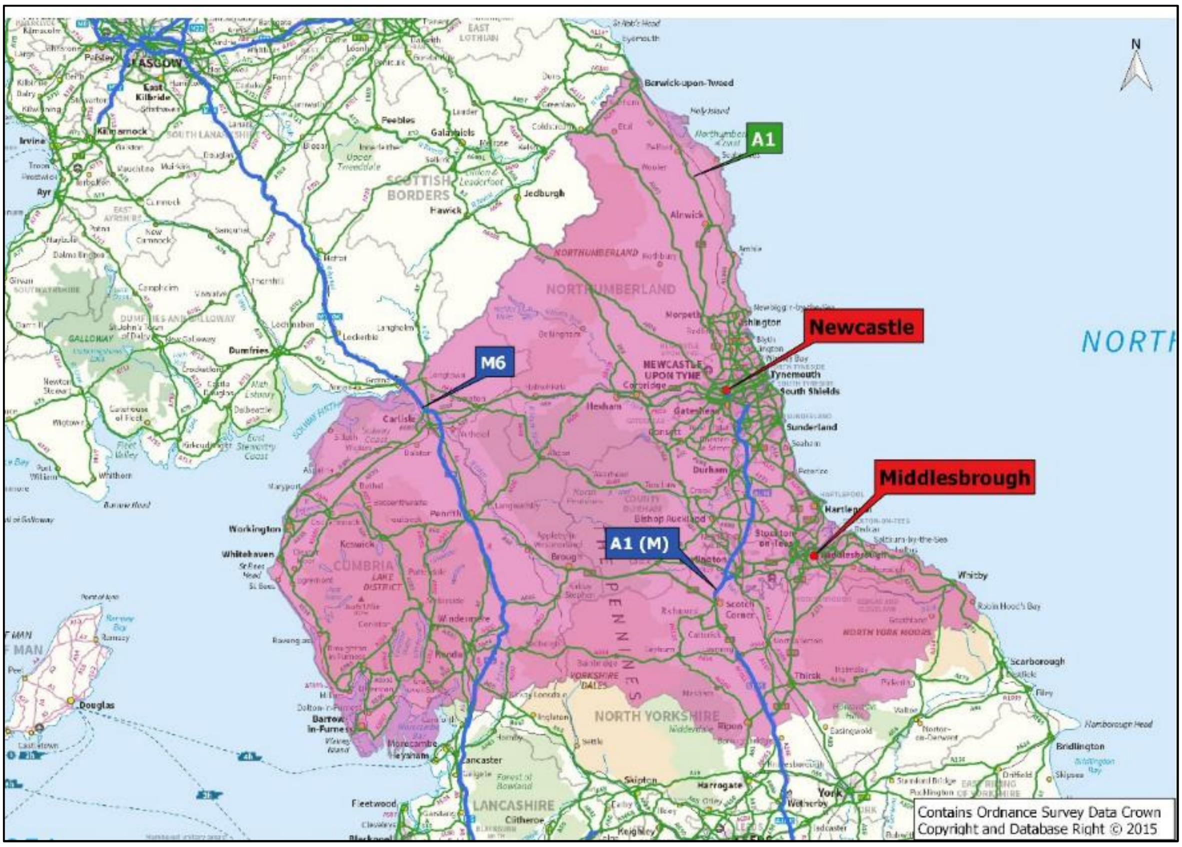
2.1 Introduction

This chapter provides a description of the North Regional Model. This includes a summary of the spatial coverage, the model specification, base year and time periods modelled. The chapter also explains how the elements of the NRM interface, such as how the highway model relates to the other components such as the demand model. The final section of this chapter also outlines the software packages adopted.

2.2 North Region Model Area

The general area of coverage for the North Regional Model is as shown in Figure 2-1. Specifically the model covers the whole of the North East Region, the County of Cumbria from the North West region and northern districts of North Yorkshire where travel patterns are more closely aligned with Teesside. The remaining areas of the North West and Yorkshire & Humberside are included within the Trans Pennine South Model, immediately adjacent to the North Region.

Figure 2-1 NRM Model Area



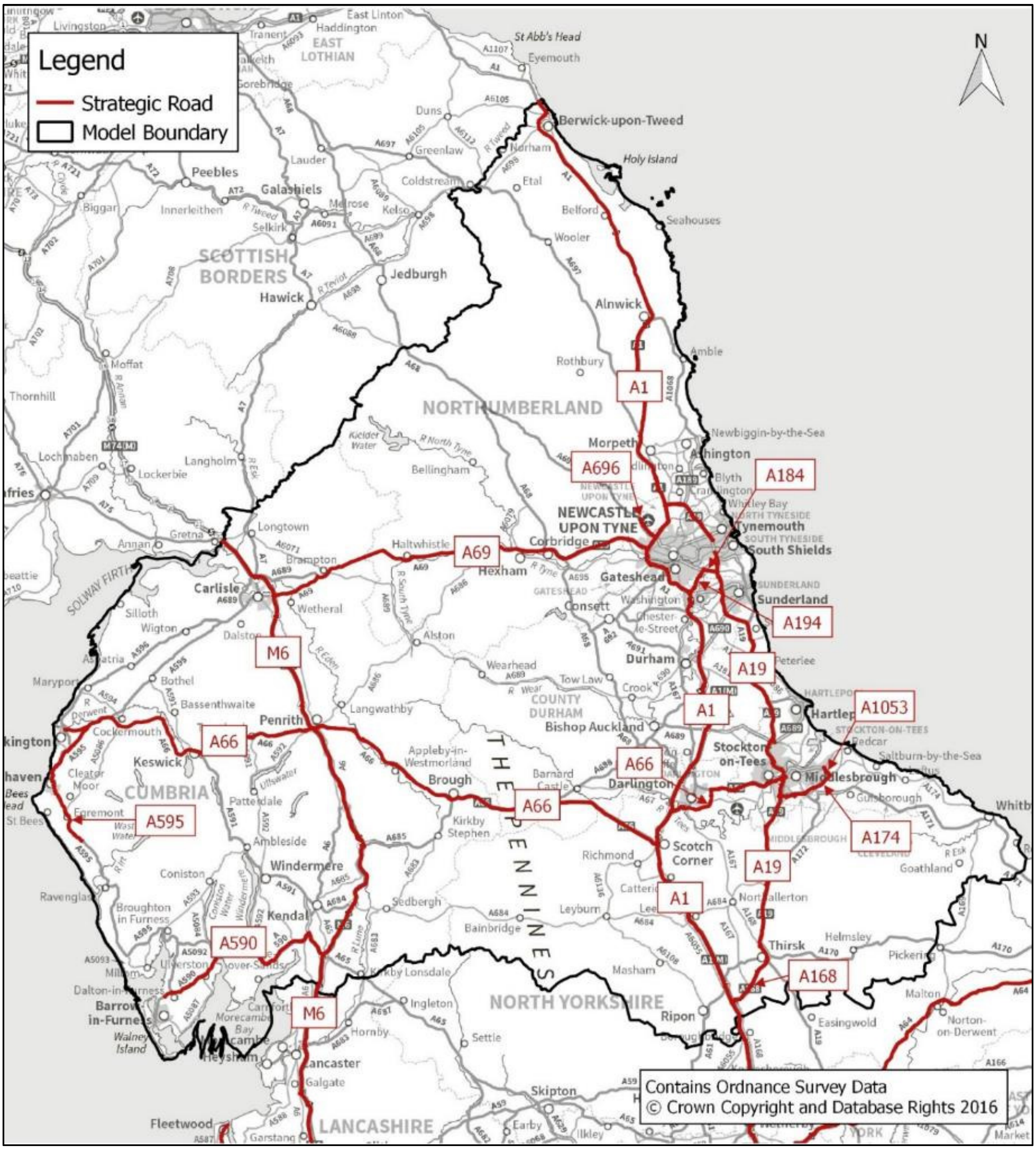
The larger centres of population and economic activity are on the eastern side of the region; the largest of these being the metropolitan county of Tyne and Wear with a population of around 1.1 million. Cities on Tyneside and Teesside dominate the population of the region. Key settlements within the modelled area include:

- Newcastle;
- Middlesbrough;
- Sunderland;
- Gateshead;
- Stockton;
- Darlington;
- Hartlepool;
- Carlisle;
- Workington; and
- Barrow

In developing strategic traffic models the common practice is to define the main modelled area (i.e. the area within which the model will be calibrated and validated and for which it can provide reliable forecasts) together with a less detailed area that has a more skeletal road network used to ensure that the longer distance trips beyond the model area are assigned to the correct corridors. The zonal boundaries are defined according to administrative boundaries at County, or possibly District level.

Figure 2-2 shows the Strategic Road Network (SRN) which reflect Highways England assets within the region. The network is dominated by the M6 and A1 north-south routes and the A66 and A69 east-west Routes. The A19 provides additional north-south capacity between Teesside and Tyne and Wear. A number of shorter spurs provide access to and from strategically important locations.

Figure 2-2 Strategic Road Network in NRM Region



2.3 Description of the Modelling System

Chapter 1 outlined the purpose of developing the NRM to support the development of the Road Investment Strategy within the North of England.

As such the model needs to be able to predict the impact of the strategy as a whole as well as providing a starting point for assessing individual schemes. These are treated as Type A or Type B schemes depending on how the model is used.

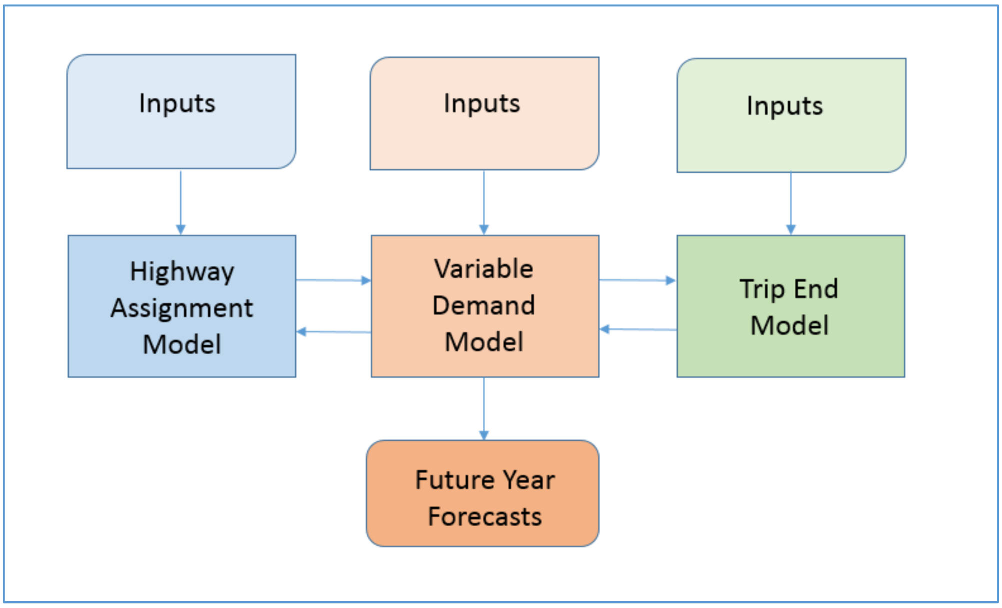
- Type A usage – a scheme will be coded into the new regional model and the model will be capable of producing all the economic and environmental outputs; or
- Type B usage – for some smaller schemes the model will be used to generate a cordon area to enable the required outputs to be generated.

Notwithstanding the specific requirements of Type B usage the Regional Traffic Modelling system is based on a WebTAG based approach, with the following components:

- A trip end model – used for estimating the number of trips generated / attracted by a specific zone.
- A highway assignment model – used for estimating travel costs and identifying the routes travellers may choose through the road network.
- A demand model – used for estimating how travellers will respond to changes in their travel costs

The principles of this approach are shown in Figure 2-3.

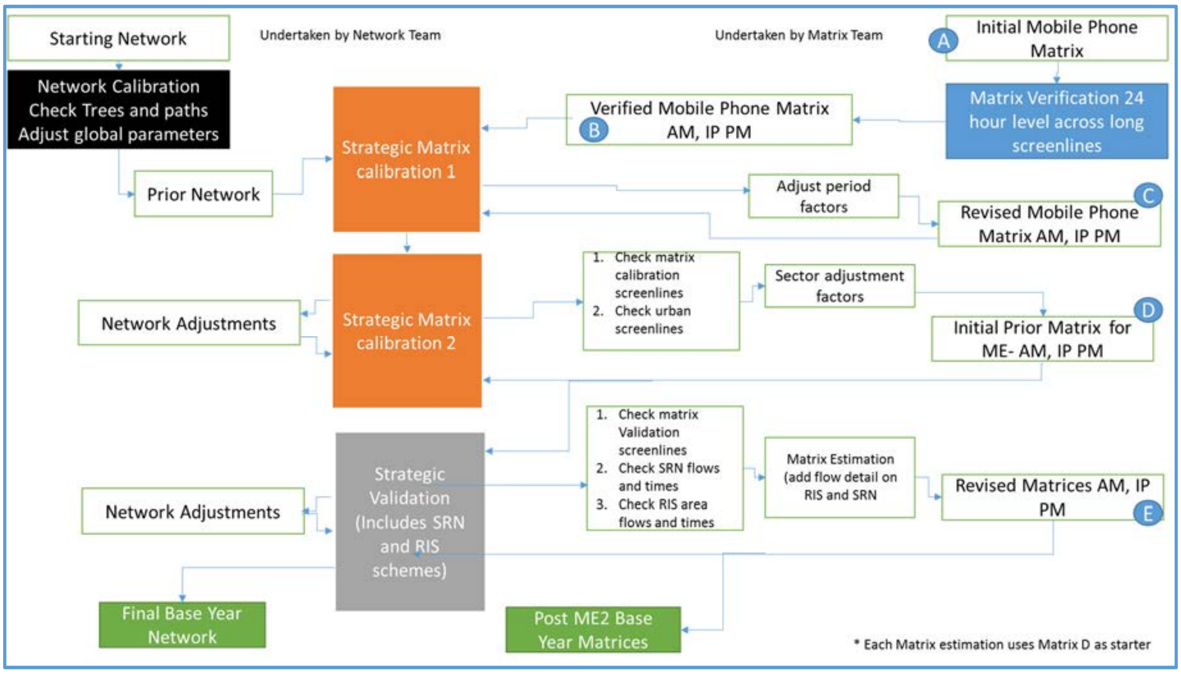
Figure 2-3 NRM Modelling System



The NRM has been based on the development of a highway model with attendant components designed to evaluate the impact of strategic infrastructure. The calibration has blended network based supply data and mobile phone based demand data to deliver a model subject to various checks and verifications at each stage of the development. The development was separated into calibration (adjustment) and validation (verification) processes and resulted in a set of networks which represent the available travel choices and travel demands which reflect the propensity to travel.

Figure 2-4 shows the process leading to the completion of the highway model.

Figure 2-4 NRM Calibration/Validation Process



A highway model in isolation is not sufficient to deliver the requirements of the project, and variable demand component is therefore required. Variable demand modelling reflects the expectation that infrastructure adjustments or additional travel demands will impact on the wider propensity to travel.

The VDM process will be controlled by DIADEM and is based on a Production Attraction (P-A) demand model with cost changes from incremental differences between base and test scenario operated using a pivot point approach. The structure is referenced in Figure 2-5 below.

2.4 Software Packages Used

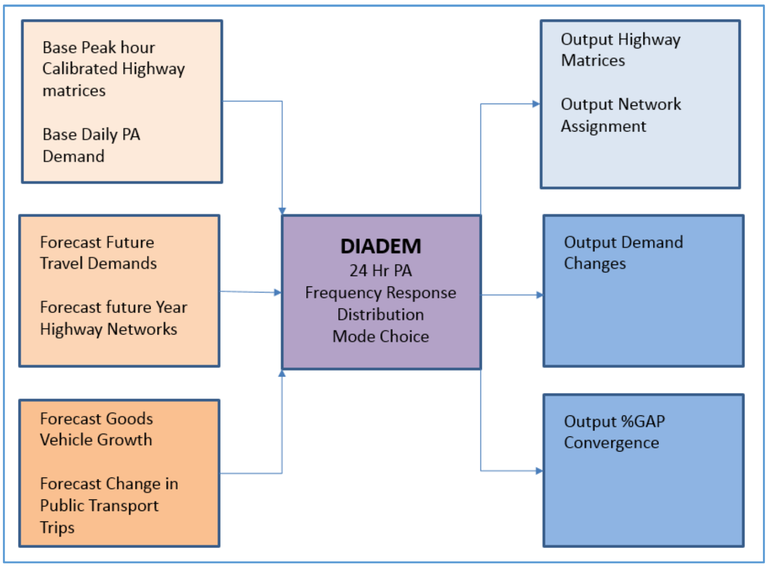
As part of the initial Technical Group decisions SATURN was identified as the most appropriate tool for building the Regional Transport Models, in conjunction with DIADEM Variable Demand Modelling and a bespoke model control mechanism

SATURN operates as a static equilibrium highway assignment model which incorporates both simulation and assignment loops. SATURN is jointly developed by the Institute for Transport Studies, University of Leeds and Atkins. As a “conventional” traffic assignment model it can deal with local, large conurbation, regional or even national models thus making it appropriate for the North Region Model. SATURN Software Version 11.3.12 has been used for this model.

DIADEM (Dynamic Integrated Assignment and DEmand Modelling) is software designed to enable practitioners to easily set up variable demand models. DIADEM provides a user-friendly method for setting up a multi-stage transport demand model and finding equilibrium between demand and supply, using the SATURN package as the supply model. The process iterates between demand calculations and assignments until a converged solution is reached.

HEIDI (Highways England Integrated Demand Interface) is a bespoke programme developed to assemble trip end data and to organise and implement forecast model runs. HEIDI invokes a DIADEM run which in turn invokes SATURN.

Figure 2-5 DIADEM Demand Model Process



2.5 *Key Features of the Model*

The base year model represents an average March weekday in 2015 to coincide with the mobile phone origin destination (OD) dataset made available for the project.

A TRADS traffic count dataset for March 2015 was obtained by Highways England. Further information has been collected for use in this study and converted to March 2015, which is a neutral month for traffic flow purposes.

Further features of the model include:

- Modelled Time periods:
    - AM average hour: 0700-1000;
    - Inter-peak average hour: 1000-1600; and
    - PM average hour: 1600-1900.
- Modelling of the following forecast years:
    - 2021;
    - 2031;
    - 2041; and
    - 2051

Based on the latest NTEM 7 horizon 2051 has been recently added.

The model zone structure is based on aggregations of the 2011 Census Output Areas. The zoning system was designed to be sufficiently detailed spatially to enable trips to load onto the network and follow representative routes. It has been aggregated to respect administrative boundaries so that zone based outputs can be reported at District, County and Regional levels. There are1550 zones.

The following assignment vehicle and purpose classes are included in the highway and demand models:

- Car – Employer's Business.
- Car – Commuting.
- Car – Other.
- Rail – Commuting
- Rail – Other
- Rail – Employer's Business

Light Good Vehicles (LGV) and Heavy Goods Vehicle (HGV) classes are included in the Highway model only.

2.6 Overview of Data Used

The following data were employed to develop the NRM base year model.

- Network database:
  - Integrated Transport Network (ITN) were used to provide a skeletal network for the Regional Transport models. The ITN network, as agreed with HE, was provided in a form of: Motorways, A Roads and B Roads
  - The information such as speed limit, number of lanes, road types were subsequently obtained from various sources for the purpose of network development.
- Traffic Count Data:
  - Majority of traffic data were collated from TRADS database;
  - Where TRADS data is not available, other sources such as DfT count and local authority counts were collated; and
  - Additional counts commissioned to fill the gap within the key simulation areas where no form of observed data is available.
- Traffic Signal data:
  - Observed signal data collated from number of local authorities within the study region were used for key junctions (junctions on SRN network, key junctions that potentially affects routeing to SRN networks);
  - For minor roads or road distance from SRN, the proposed template signal coding were adopted
- Trafficmaster Journey Time (JT) and Origin/Destination (OD) Data:

- Trafficmaster JT data were used to derive fixed speed for the external road network and as a form to validate journey time routes during the base year model validation process; and
- Trafficmaster OD data were used to derive a prior matrices for LGV.

- Existing models:
  - Existing traffic models within the study regions were used to assist the base year model development
- Census Data:
  - A variety of datasets from the UK census 2011 were used as part of the matrix development stage. This included population, household composition and car availability, census journey to work and employment by industrial type
- Mobile Phone Origin/Destination Data (MPODD):
  - The MPOD data was developed by Telefónica to cover a national series of movements inferred between MSOA's or larger aggregations thereof, segmented by time or purpose.
- National Travel Survey (NTS) Data:
  - NTS contains travel diary information for journeys from a sample of the UK households. For the NRM, information such as mode shares, trip length distribution, purpose splits and time period splits were used as part of the matrix development
- Public Transport (PT) data:
  - Public transport data from LENNON/MOIRA were used. This was supplemented with Nation Rail Travel Survey data to apportion purposes and other attributes to rail travel data.
- Forecast data:
  - TEMPRO7

2.7 Software Packages Used

The following software versions have been used:

- SATURN highways assignment model – *v11.3.12U*
- DIADEM variable demand model – v6.2

3 Model Standards and Objectives

3.1 *Overview*

Guidance on the calibration and validation of Regional Models was developed by the CalVal and matrix TCGs. Although this guidance has been developed from that contained in *TAG Unit M3.1 Highway Assignment Modelling,* there are a couple of new or unique circumstances, which are not well served by existing guidance, these being:

- **Sources of data:** Current TAG guidance is typically based on matrices produced from roadside interview surveys and synthetic approaches. The data sources for the RTMs include ITN networks for the supply side and mobile phone records for demand information. The latter provide different challenges for calibration. In advance of published DfT guidance on best practice (which will in part be based on experiences within this project), the data standards associated with the project have been discussed and confirmed with the Technical Consistency Group Board. They are described in more detail in the following sections and in the Model Specification Report.

- **The scale of the model and spread of schemes which are likely to be tested in the future:** The nature of the Regional Traffic Models differs from most conventional models in that there is no single geographic area of focus around which the model is constructed; rather the aim is to be a base for a large number of separate schemes throughout the model area. This produces a more uneven spread of detail, with the main focus on the SRN. In recognition of this fact, calibration and validation efforts were initially concentrated on the SRN.

The CalVal and matrix TCGs produced chapters of the RTMTG where this decision making process is documented, as well as case studies of best practice on other large models.

3.2 *Count Data Verification Standards*

Count data was collected from a range of sources. In order to ensure quality and accuracy of these counts a set of minimum standards were agreed within the Data Consistency TCG. This created a hierarchy of desirable attributes as outlined below:

- Use of permanent automatic traffic count (ATC) for total flow data (full time March 2015) and full time March 2015 manual classified count (MCC) for classification.
- Use of at least 2 weeks March 2015 ATC and 1 day MCC.
- Use of at least 2 weeks ATC data in another 2015 month and 1 day MCC.
- Use of previous years ATC and 1 day MCC.
- Use of ATC and generic classification factor derived from DfT national data.
- Reliance on MCC for total flow and classification.

Following collation of data a series of cleaning and checking tasks were undertaken including:

- Removal of bank holidays and outliers (greater than 2 standard deviations from the mean);
- Review of comments included with count data highlighting any data collection error (human or equipment);
- Day-to-day variations in flow;
- Variations in flows by week;
- Hourly flow profiles – this can be used to identify unusual peak hours or inconsistent tidal flows;

Each count was then assigned quality scores based on the attributes outlined in Table 3-1. The final 'health check' score for each count being the sum of these attribute scores.

Table 3-1 Count 'Health Check' Scoring Criteria

	Attribute			
Score	**Type**	**Duration**	**Year**	**Month**
5 (High Confidence)	Permanent ATC (inductive loop)	Full month	2015	March (base month)
4		2 – 4 weeks	2014 or 2016	
3	Temporary ATC (tubes)	6 – 9 weekdays	2012 or 2013	Neutral month
2		2 – 5 weekdays		
1 (Lower confidence)	Manual	Single weekday	< 2012	Non-neutral month

3.3 Network Verification Standards

A set of network verification tests were agreed with the network TCG and were completed on the NRM network prior to the commencement of the calibration/validation. Six tests were undertaken:

- Test 1 – Completeness Check: ensures that the network produced is complete according to the Model Specification Report (MSR)
- Test 2 – SATURN Compilation Check: ensures that all the errors/warnings produced by SATNET have been reviewed and checked.
- Test 3 – Inspection of Key Junctions: ensures that all the key junctions within the influence area of the SRN network are coded correctly
- Test 4 – Network Routeing: ensures that routeings on the network appear realistic;
- Test 5 – Link Consistency Tests: ensures that link type, distance, speed limit, etc. are consistent between directions and up/downstream; and
- Test 6 – Flat Matrix Assignment Test: ensures that model assignment with a flat matrix produces a plausible set of routeings and also to investigate whether or not locations with excessively high delays are as a result of significant flows or due to coding error.

These checks are designed to provide reassurance that:

- The network building is complete to the agreed specification;
- The network and inputs have been appropriately checked, the SATURN warnings have been reviewed and formal testing has been carried out against a list of potential errors; and
- The network coding is satisfactory, as far as can be determined, before commencement of the calibration/validation stage.

3.4 Matrix Verification Standards

Travel demand matrix data for RTMs originate from Telefónica (O2) UK. The data, is Provisional on the basis that continued refinements of the high level processing is being undertaken under a separate consultancy contract between Highways England and the mobile phone data providers.

In response to the provisional nature of data the Matrix TCG developed a guidance document that sets out the key considerations for the RTM matrix development. Mobile Phone Origin Destination data (MPOD) is new technology with little guidance.

The approach developed by the Regional Model programme has been to compare MPOD against existing data sources to establish the resolution level at which the data can be applied and the supplementary enhancement which may need to be introduced.

Verification standards have been developed to ensure consistency between the RTMs. In particular, the following key aspects of the Provisional mobile phone data are reviewed and verified through comparisons with independent data sources:

- Trip-ends;

- Symmetry of the matrix;
- Trip rates;
- Trip distribution pattern;
- Trip length profile;
- Trip purpose allocation;
- Daily profile of trips; and
- Flow volume.

The initial mobile phone matrices have been subject to a set of initial verification checks to assess the overall levels of demand are appropriate, through an initial assignment on the starting network. This verification check assesses the daily traffic flow across 'high level' long screenlines to verify demands. The approach to this was supplied in Technical Note 14 "Consistent Approach Towards Using Provisional Data for Regional Model Matrix Development".

3.5 Count and Screenline Calibration and Validation Criteria

An agreement was reached within the CalVal and Matrix TCGs on the approach to model calibration and the validation criteria to be adopted for RTMs.

The following criteria were set out and used at different steps of model calibration and validation:

- Prior matrix acceptability criteria:
    - Screenline and model boundary checks;
    - Matrix comparison to other RTMs;
    - Matrix symmetry between Government Regions
- Calibration and validation criteria
    - Screenline and mini-screenline validation divided into 'core' and 'non-core';
    - Individual counts divided into 'SRN' and 'non-SRN'.

TAG criteria have been adopted for the SRN, on the non-SRN some deviations from these standards have been agreed to reflect the lesser importance of these locations. Results are presented in chapters 8 and 9 of this report separately and as totals for these sets of count sets.

The acceptability criteria for the prior matrix are shown in Table 3-2 below.

Table 3-2 Summary Of Criteria for Prior Matrix

Element	Criteria	Time period	Vehicle Type
Boundary	Flows to be within 5% of observed counts	12hr and all time periods	All vehicle classes separately

Long Screenlines	Flows to be within 5% of observed flows	12hr and all time periods	Cars
Other screenlines	Flows to be within 20% of observed flows	12hr and all time periods	Cars
RTM model-model flows	Matrix movements to be within 10% of average RTM	All day level	Cars
Matrix symmetry between Government regions	Within 1000 vehicles or 10%, or within 1500 people or 10%	All day level	Cars

The acceptability calibration and validation criteria are shown in Table 3-3 below.

Table 3-3 Summary of Count Calibration/Validation Criteria

Element	Criteria	Time period	Vehicle Type
Screenlines			
Boundary – cross boundary between models	Within 5%	All time periods	All vehicle classes separately
Screenlines	Within 10%	All time periods	All vehicle classes separately
Mini Screenlines – core routes	To be treated as ad hoc sites within the dashboard (if individual links then use TAG flow criteria)	All time periods	All vehicle classes separately
Mini Screenlines – non core	Within 10%	All time periods	All vehicle classes separately
Individual Links			
SRN roads with flows>2700	Adopt TAG criteria (+/-400)	All time periods	Car and Total Flow
SRN roads with flows between 700-2700	Adopt TAG criteria (+/-15%)	All time periods	Car and Total Flow
SRN roads with flows <700	Adopt TAG criteria (+/-100)	All time periods	Car and Total Flow
SRN roads	Use GEH of <5	All time periods	Car and Total Flow

Element	Criteria	Time period	Vehicle Type
Non SRN roads with flows>2700	Adopt TAG criteria (+/-400)	All time periods	Car and Total Flow
Non SRN roads with flows between 2000-2700	Deviation from TAG: Within +/- 15%	All time periods	Car and Total Flow
Non SRN roads with flows <2000	Deviation from TAG: Within +/- 300 vehicles	All time periods	Car and Total Flow
Non SRN roads	Report sliding proportion of GEH values	All time periods	Car and Total Flow

3.6 *Journey Time Validation Standards*

TAG guidance on journey time validation has been adopted from the RTMs and is shown in Table 3-4 below:

Table 3-4 Summary of Journey Time Validation Acceptability Criteria

Element	Criteria	Time period	Vehicle Type
Journey Times			
Journey Times Routes	TAG criteria within 15% or 1 minute	All time periods	Total Flow
Journey Times Segments	TAG criteria for the SRN links within 15% or 1 minute	All time periods	Total Flow

3.7 *Assignment Method and Convergence Criteria Used*

The assignment procedure adopted for the highway model is based on an equilibrium assignment with multiple demand segments for a typical hour in the morning peak, inter-peak and evening peak, within the constraints of the convergence criteria set out in this chapter.

As agreed by the Network / CalVal TCG, the following assignment methodology was implemented:

- Path-based algorithm were employed;
- Blocking back were included; and
- Modelling of each time period as a stand-alone model, no interaction with previous time period (i.e. no PASSQ from previous time period)

Before the results of any traffic assignment are used to influence decisions, the stability (degree of convergence) of the assignment must be confirmed. This is set at an appropriate level in order to provide stable, consistent and robust model results for the task in hand.

The convergence indicators provided by different software packages vary, as does the availability of a facility for the user to control the assignment process to ensure a given level of convergence. Care must be taken to distinguish between convergence and stability. Stability can often be achieved without there necessarily being convergence to a solution.

WebTAG Unit M3.1 Table 4 provides suggested convergence measures of proximity and stability. This guidance has been adopted for the development of the NRM making use of the %GAP and P<1% measures and is presented in Table 3-5.

Table 3-5 Summary of Acceptability Criteria - Convergence

Element	Criteria	Time period	Vehicle Type
Convergence Gap	Adopt TAG criteria 0.1%	All time periods	Total Flow
P<1% - percentage of link flows changing by <1%	Adopt TAG criteria – 4 iterations >98%	All time periods	Total Flow

4 Summary of Data Collation

4.1 Introduction

In building this model there was a requirement to collect and process data which feeds into the various steps of building the base year model, including:

- Network development;
- Demand matrix development;
- Traffic model calibration and validation; and
- Variable demand modelling.

NRM is one of five regional models currently being developed across the country. In order to ensure consistency and inter-operability across the regions Technical Consistency Groups (TCGs) were formed by Highways England with representatives from each region. TCGs were organised for each of the areas listed in the bullet points above as well as a separate group for data consistency with the objective agreeing standard approaches to data management and processing.

Full details of the data requirements and data sources, the data checking, cleaning and processing are included in the Traffic Data Collection Report (TDCR). A summary of the main data sources and units is included below, including surveys, existing models, national databases and a description of the data used for the calibration and validation processes.

4.2 Network Development Data

4.2.1 Mapping

The initial network structure was developed using an automated process which took the Ordnance Survey's (OS) ITN layer and converted to a SATURN buffer network. In addition to that, OS data further mapping was downloaded from Highways England's GeoStore and was used for various tasks including network refinement.

4.2.2 Existing Models

Existing strategic and microsimulation models were a potential source of data for NRM. Existing models which cover substantial areas in the NRM area were identified through the data collection process, as provided in Table 4-1 below.

Within the NRM base model build, counts undertaken for previous model builds have been used as well as signal timings in some locations. Information from existing model uncertainty logs will also be used in forecasting.

Table 4-1 Reviewed Models

Model	Software	Base Year	Regions Covered
Tees Valley Multi Modal Model (TVMMM)	CUBE TRIPS (updates from Voyager)	2005	Middlesbrough, Redcar and Cleveland
West Cumbria Multi-Model Transport Model (WCTM)	SATURN/ VISUM	2011	Cumbria
Kendal Transport Model	SATURN	2011	Cumbria
Penrith Transport Model	SATURN	2012	Cumbria
Carlisle Transport Model	SATURN, VISUM, DIADEM	2008	Cumbria
Barrow-in-Furness Transport Model	SATURN	2009	Cumbria
Ulverston Model	S-Paramics	2014	Cumbria
North of Newcastle A1 Model	SATURN		Tyne & Wear, Northumberland
A1Gateshead Newcastle Western Bypass	SATURN	2013	Tyne & Wear
A19 Highway Assignment Model for the A19/ A1058 Coast Road junction and A184 Testos Roundabout	SATURN	2012	Tyne & Wear

4.2.3 Traffic Signal Timings

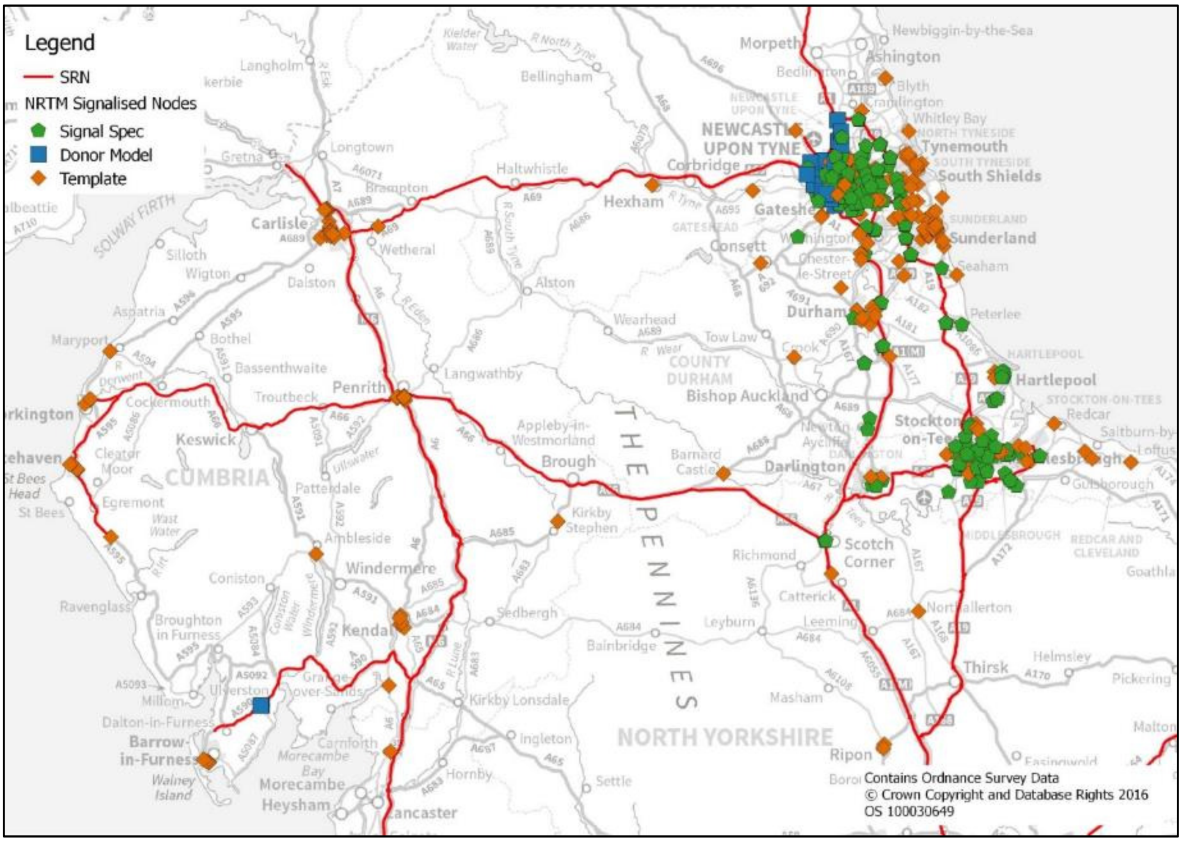
Detailed traffic signal data was collected in order to code signalised junctions in the model simulation area. The information was collected from the relevant Local Authorities and one of the Highways England TechMAC. In addition, the following donor models have been obtained to provide signal data for additional junctions

- West of Newcastle A1 Corridor SATURN model; and
- Ulverston S-Paramics model.

Where observed or previously modelled signal timings could not be collected, a “template approach” to signal timings was adopted, as agreed by the network TCG.

The source of signal data for each signalised junction is presented in Figure 4-1.

Figure 4-1 Source of Signal Timing Data



4.2.4 Journey Time and Speed Data

Trafficmaster data was used to code fixed speed buffer links in the network. The data was also employed to validate journey time routes in the model. Average travel times by links were formed into routes and compared to modelled journey times. This approach was agreed in the calibration-validation TCG.

Trafficmaster data was not available from DfT for Scotland. Contact was made with Transport Scotland to investigate alternative sources of journey time and speed data. The LATIS model which covers all of Scotland and contains base and forecast year speeds was identified as an alternative source of journey time and speed information. Following a request to Transport Scotland this data was made available to the Regional Model teams.

4.3 Matrix Development Data

Development of a highway assignment model required a set of trip matrices to be produced. It was unfeasible to use RSI data to develop trip matrices for a model of the size of the NRM and therefore Highways England was instrumental in sourcing mobile phone data in the form of person trip matrices.

On closer inspection numerous biases were identified in the dataset. In particular, there was limited confidence in the short distance trips within the MPOD matrices. The Matrix TCG agreed that a set of synthetic matrices would be developed by each region. These have been used to replace MPOD short distance trips – specifically intra-MPOD sector trips – within the dataset.

Independent sources were also required for the verification checks.

The synthetic matrix build process required planning data from the census to generate the trip ends plus generalised costs and observed trip distributions for the gravity modelling process. Further datasets were also required to develop separate LGV, HGV and rail matrices plus air travel profiles.

A high level summary of the datasets used in the matrix development process is given in Table 4-2.

Table 4-2 Summary of Demand Data Sources

Data Set	Source	Year(s)	Usage in NRM
MPOD Provisional Dataset	Telefónica	2015	Car origin-destination trip matrices
National Travel Survey (NTS)	DfT via UK Data Service	2009 - 2014	Observed trip length distributions, trip rates and trip purpose splits by various variables
Media Use and Attitudes Report 2015	OFCOM	2014 - 2015	Mobile phone ownership by age and socio-economic group
UK Census Data	NOMIS	2011	Planning data inputs for CTripEnd
Mid-Year Population Estimates	ONS	2011 - 2014	Generate factors for census population data to base year
Business Register Employment Survey	ONS	2011 - 2014	Generate factors for census employment data to base year
Households and Families Survey	ONS	2011 - 2014	Generate factors for census household data to base year
TEMPRO	DfT	2015	Trip ends for Scotland
WebTAG	DfT	2014, 2015	VOC, VOT and occupancy values
TrafficMaster	DfT	2015	LGV origin-destination trip movements
Base Year Freight Matrix (BYFM)	DfT	2006	HGV origin-destination trip movements
Continuing Survey of Road Goods Transport	DfT	2006 - 2014	Generate factors for BFYM values to base year
MOIRA	ATOC	2015	Rail fares, generalised costs and base year rail demand
National Rail Transport Survey	DfT	2007	Derive zone to zone movements from data extracted from MOIRA
NAPALM	DfT	2015 and forecast years	Modelled air travel passenger demand for forecasting

Data Set	Source	Year(s)	Usage in NRM
Civil Aviation Authority Passenger Surveys	DfT	2014	Overlay airport demand distributions onto MPOD data

4.4 Journey Time Validation Data

Trafficmaster journey time data was used for the validation of the NRM SATURN model. Journey Time data was extracted separately for the modelled time periods, along 43 bi-directional routes, as presented in Table 4-3Table 4-3 below. All routes were in line with the criteria set out by the calibration-validation TCG. A detailed description of the Trafficmaster data processing exercise is presented in TN26 'Trafficmaster Journey Time Data Methodology'.

Each journey time route was then assigned a route class as required in the Dashboard. The routes were assigned one of the following route classes below.

- Motorway;
- SRN;
- Non-SRN Urban; and
- Non-SRN Rural.

Figure 4-2 presents the journey time routes as disaggregated by SRN and non-SRN.

Table 4-3 Journey Time Routes

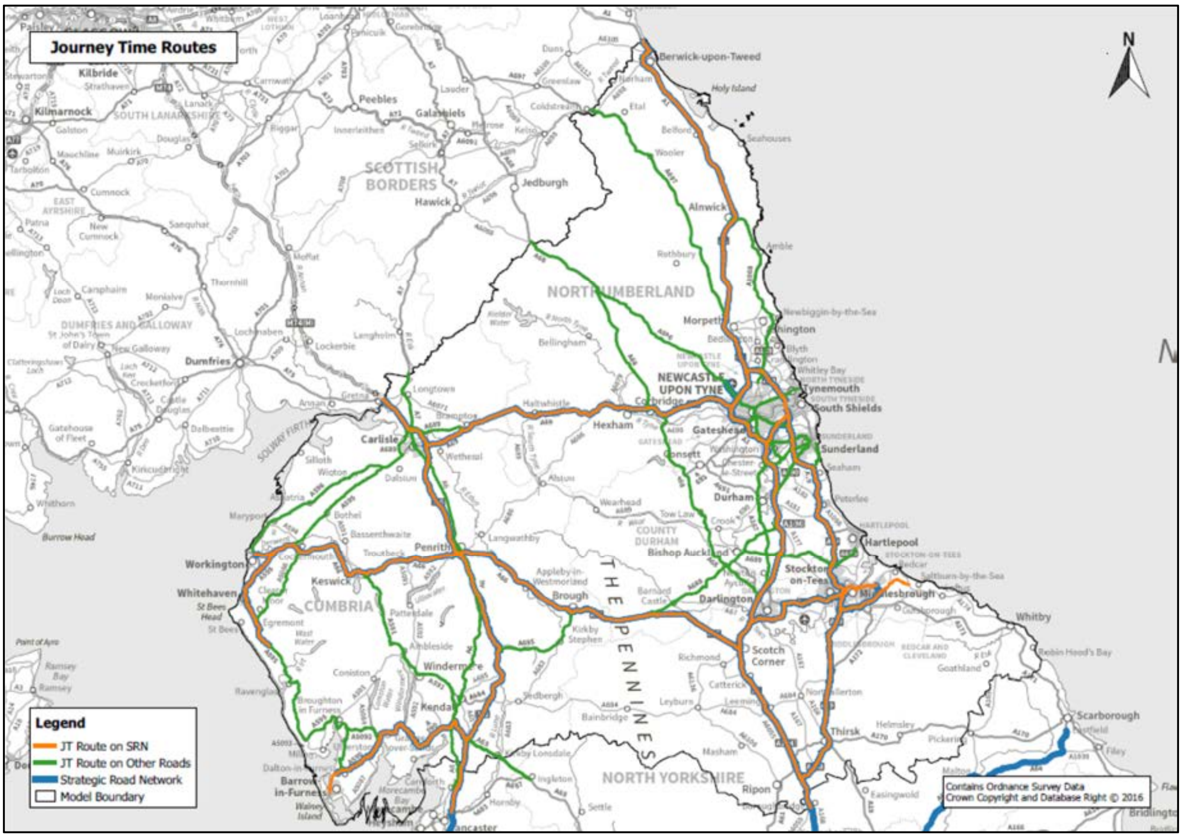
Route ID	Description	Route Class
Route_01_NB	A19: from A1(M) J45 to junction with A689	SRN
Route_01_SB	A19: from junction with A689 to A1(M) J45	SRN
Route_02_NB	A19: from junction with A689 to junction with A1	SRN
Route_02_SB	A19: from junction with A1 to junction with A689	SRN
Route_03_EB	A66: from junction with A596 to junction with M6	SRN
Route_03_WB	A66: from junction with M6 to junction with A596	SRN
Route_04_EB	A66: from junction with M6 to junction with A1	SRN
Route_04_WB	A66: from junction with A1 to junction with M6	SRN
Route_05_EB	A66: from junction with A1 to junction with …	SRN
Route_05_WB	A66: from junction with A1085 to junction with A1	SRN
Route_06_NB	M6: from junction with A683 to junction with A66	Motorway
Route_06_SB	M6: from junction with A66 to junction with A683	Motorway

Route ID	Description	Route Class
Route_07_NB	M6: from junction with A66 to A74(M) off-slip	Motorway
Route_07_SB	M6: from A74(M) to junction with A66	Motorway
Route_08_NB	A1: from A1(M)/A6055 to junction with A689	SRN
Route_08_SB	A1: from junction with A689 to A1(M)/A6055	SRN
Route_09_NB	A1: from junction with A689 to Shotton Interch	SRN
Route_09_SB	A1: from Shotton Interch to junction with A689	SRN
Route_10_NB	A1: from Shotton Interch to Scottish border	SRN
Route_10_SB	A1: from Scottish border to Shotton Interch	SRN
Route_11_NB	A68: from A68/A1(M) to junction with A69	Non-SRN Rural
Route_11_SB	A68: from junction with A69 to A68/A1(M)	Non-SRN Rural
Route_12_NB	A68: from junction with A69 to Scottish border	Non-SRN Rural
Route_12_SB	A68: from Scottish border to junction with A69	Non-SRN Rural
Route_13_NB	A167: from A1S to junction with A1N	Non-SRN Rural
Route_13_SB	A167: from junction with A1N to A1S	Non-SRN Rural
Route_14_EB	A183: from A1 (M) J63 to A183 Chester Rd/Western Hill J	Non-SRN Urban
Route_14_WB	A183: from Chester Rd/Western Hill J to A1 (M) J63	Non-SRN Urban
Route_15_EB	A174: from A19/A174 to A174/A1085	SRN
Route_15_WB	A174: from A174/A1085 to A19/A174	SRN
Route_16_NB	A697: from A697/A1 to A697/A6112	Non-SRN Rural
Route_16_SB	A697: from A697/A6112 to A697/A1	Non-SRN Rural
Route_17_NB	A697: from A1(M) J62 to A690 Burn Park Rd	Non-SRN Urban
Route_17_SB	A697: from A690 Burn Park Rd to A1(M) J62	Non-SRN Urban
Route_18_EB	A184: from A184/A1 to A184/A19	Non-SRN Urban
Route_18_WB	A184: from A184/A19 rb to A184/A1	Non-SRN Urban
Route_19_NB	A696: from A696/A1 to A696/A68 junction	Non-SRN Rural
Route_19_SB	A696: from A696/A68 junction to A696/A1	Non-SRN Rural
Route_20_NB	A591: from A590 on-slip to A591/A5271	Non-SRN Rural
Route_20_SB	A591: from A591/A5271 to A590 on-slip	Non-SRN Rural
Route_21_NB	A595: from A595/North Dr junction to A595/A66	SRN
Route_21_SB	A595: from A595/A66 junction to A595/North Dr	SRN
Route_22_EB	A69: from M6 J43 to A1/A69	SRN
Route_22_WB	A69: from A1/A69 to M6 J43	SRN
Route_23_EB	A1231: from rb with B1288 to A183	Non-SRN Urban
Route_23_WB	A1231: from A183 to rb with B1288	Non-SRN Urban

Route ID	Description	Route Class
Route_24_NB	A182: from rb with A183/B1519 to A194(M)/A182	Non-SRN Urban
Route_24_SB	A182: from rb with A183/B1519 to A194(M)/A182	Non-SRN Urban
Route_25_NB	A1018: from off-slip: from A19 to junction with A1231	Non-SRN Urban
Route_25_SB	A1018: from off-slip: from A19 to junction with A1231	Non-SRN Urban
Route_26_NB	A194: from A1(M) J65 to A194/A19	SRN
Route_26_SB	A194: from A194/A19 to A1(M) J65	SRN
Route_27_EB	A1058: from A167(M) to A1058/A193	Non-SRN Urban
Route_27_WB	A1058: from A1058/A193 to A167(M)	Non-SRN Urban
Route_28_NB	A590: from A590/A5087 to M6 J36	SRN
Route_28_SB	A590: from M6 J36 to A590/A5087	SRN
Route_29_NB	A595: from A66 to M6	SRN
Route_29_SB	A595: from M6 to A66	SRN
Route_30_EB	A689: from A688 to Brierton Ln	Non-SRN Rural
Route_30_WB	A689: from Brierton Ln to A688	Non-SRN Rural
Route_31_NB	A189/1068: from A1056 to B6346	Non-SRN Rural
Route_31_SB	A189/1068: from B6346 to A1056	Non-SRN Rural
Route_32_NB	A167_2: from A1(M) Junction 59 to A1(M) Junction 63	Non-SRN Rural
Route_32_SB	A167_2: from A1(M) Junction 63 to A1(M) Junction 59	Non-SRN Rural
Route_33_NB	A595_3: from A590 to Calder Bridge	SRN
Route_33_SB	A595_3: from A590 to Calder Bridge	SRN
Route_34_NB	A6_1: from Carnforth to Penrith	Non-SRN Rural
Route_34_SB	A6_1: from Penrith to Carnforth	Non-SRN Rural
Route_35_NB	A6_2: from Penrith to M6 Junction 44	Non-SRN Rural
Route_35_SB	A6_2: from M6 Junction 44 to Penrith	Non-SRN Rural
Route_36_EB	A685: from M6 Junction 38 to A66	Non-SRN Rural
Route_36_WB	A685: from A66 to M6 Junction 38	Non-SRN Rural
Route_37_EB	A688: from A66 to A1(M) Junction 61	Non-SRN Rural
Route_37_WB	A688: from A1(M) Junction 61 to A66	Non-SRN Rural
Route_38_NB	A5086: from A595 to A66	Non-SRN Rural
Route_38_SB	A5086: from A66 to A595	Non-SRN Rural
Route_39_EB	A5092: from A595 to A590	Non-SRN Rural
Route_39_WB	A5092: from A590 to A595	Non-SRN Rural
Route_40_EB	A596: from Workington to A595	Non-SRN Rural
Route_40_WB	A596: from A595 to Workington	Non-SRN Rural

Route ID	Description	Route Class
Route_41_EB	A65: from M6 Junction 36 to Ingleton	Non-SRN Rural
Route_41_WB	A65: from Ingleton to M6 Junction 36	Non-SRN Rural
Route_42_EB	A689_2: from M6 Junction 44 to A69	Non-SRN Rural
Route_42_WB	A689_2: from A69 to M6 Junction 44	Non-SRN Rural
Route_43_NB	A7: from M6 Junction 44 to Scottish Border	Non-SRN Rural
Route_43_SB	A7: from M6 Junction 44 to Scottish Border	Non-SRN Rural

Figure 4-2 Journey Time Routes



4.5 Traffic Count Data

4.5.1 Traffic Count Data

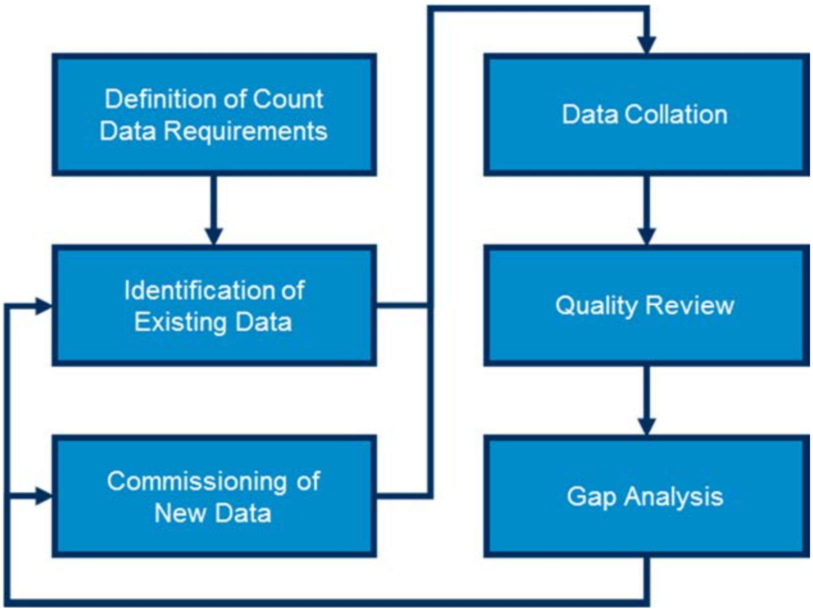
Traffic count data has been collected for two main purposes:

- Matrix calibration and validation; and
- Network assignment calibration and validation.

A technical specification for use of this data was agreed in the Data Consistency Technical Group based on guidance contained in WebTAG Unit M1.2.

A period of count data collation was undertaken between August 2015 and March 2016. This included several iterations of data collation, designed to maximise the use of existing data, thus reducing the requirement for additional data collection. This process is illustrated in Figure 4-3 below:

Figure 4-3 Count Data Collation Process



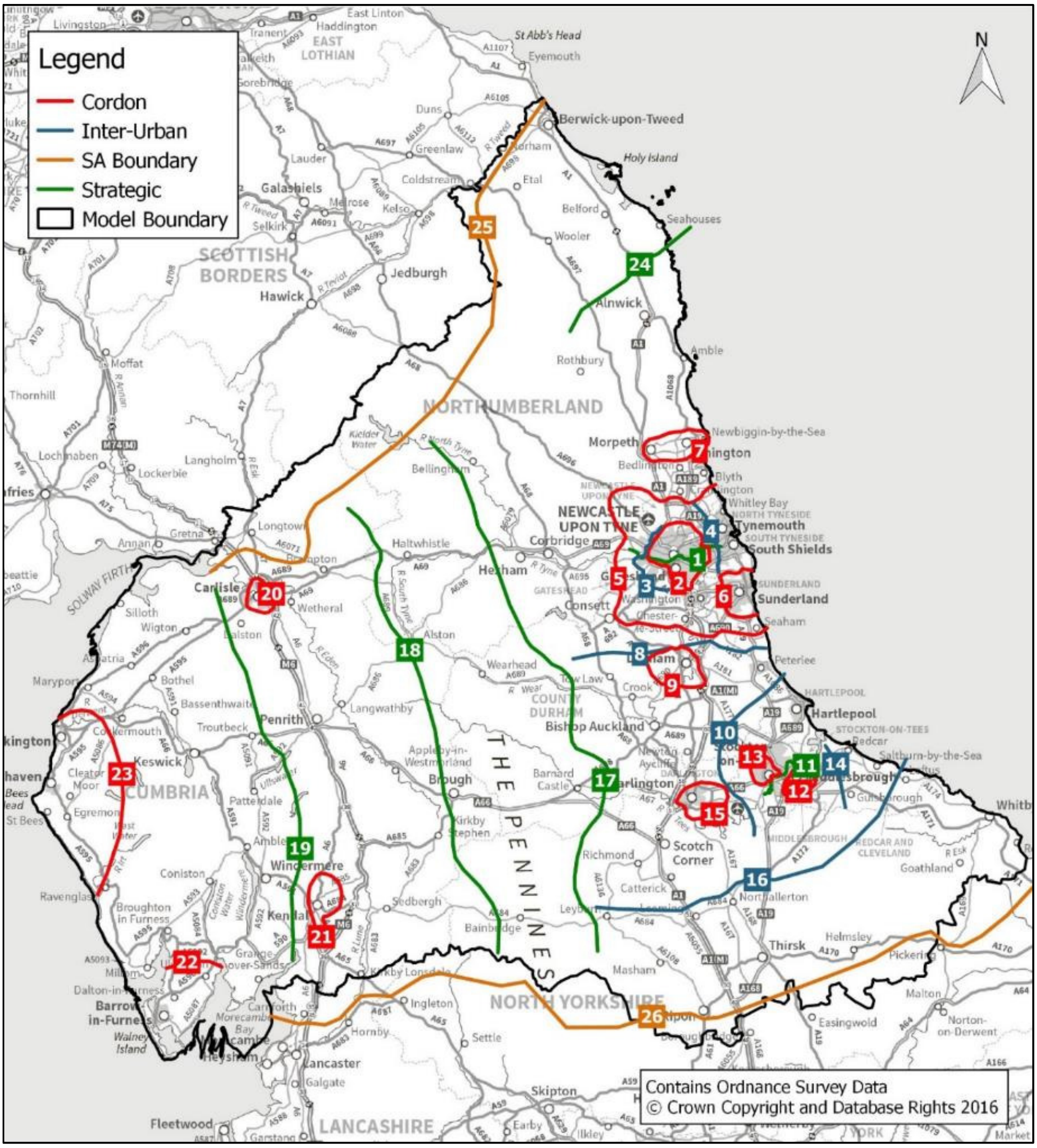
4.5.2 Definition of Count Data Requirements

The selection of counts and commissioning of further counts are based on the screenlines. These were defined in line with the guidance set out by the Cal/Val Technical Consistency Group and can be divided into four categories:

- Boundary: Provided full coverage of model boundaries which were shared with neighbouring regions. The NRM shares a boundary with the Trans-Pennine South region – a common screenline has been agreed with the Trans-Pennine South Model. The northern boundary of the model is with Scotland.
- Inter-urban: Covered key inter-regional movements between adjacent conurbations within the study area. These are predominately on the eastern side of the region and have been defined between all neighbouring counties.
- Strategic: Tracked long distance movements across the study area – such as the Trans Pennine routes – and where route choice is restricted by a physical feature such as the River Tyne.
- Cordon: Defined around all major towns, cities within the study area as a check on the quality of the trip matrices to validate the quantity of trips entering and leaving that sector. An additional larger cordon has been defined for the Tyne and Wear region.

The screenlines for NRM are shown in Figure 4-4.

Figure 4-4 NRM Study Area Screenlines



Locations at which counts were required were identified by creating a list of points at which the modelled network intersects these screenlines. In addition to screenline counts it was also agreed that the model should be calibrated and validated against a number of counts on the Strategic Network which do not form part of a screenline.

4.5.3 Existing Data Sources

Existing counts were identified by contacting all Local Authorities and consultants currently working on RIS models in the region. In the model region, there are a large number of permanent traffic counts locations where traffic flow data is collected on an ongoing basis. In addition to permanent sites there are also temporary counts undertaken by various authorities (including Highways England and Local Authorities) which are used for a range of purposes.

4.5.4 Commissioned Counts

To provide missing count locations for number of screenlines/cordons within the study area, 36 ATCs were commissioned and undertaken over a 2 week period between 21st November and 4th December. Following a second round of gap analysis, a further 25 counts were commissioned and took place between 19th February 2016 and 7th March 2016. This was supplemented by DfT counts located in the proximity of the original counts.

4.6 Description of Calibration Data

Agreement was reached within the CalVal TCG on the requirements for screenlines for matrix calibration and validation. The identification of calibration screenlines needed to reflect the key two stages of matrix calibration:

- initial global matrix adjustment; followed by
- more detailed refinement of the matrix using matrix estimation.

Screenlines 3, 8, 10, 11, 16 and 24 were identified for validation; the remainder were chosen as calibration screenlines.

The locations of the calibration counts are shown in Figure 4-5 below.

Figure 4-5 Calibration Counts

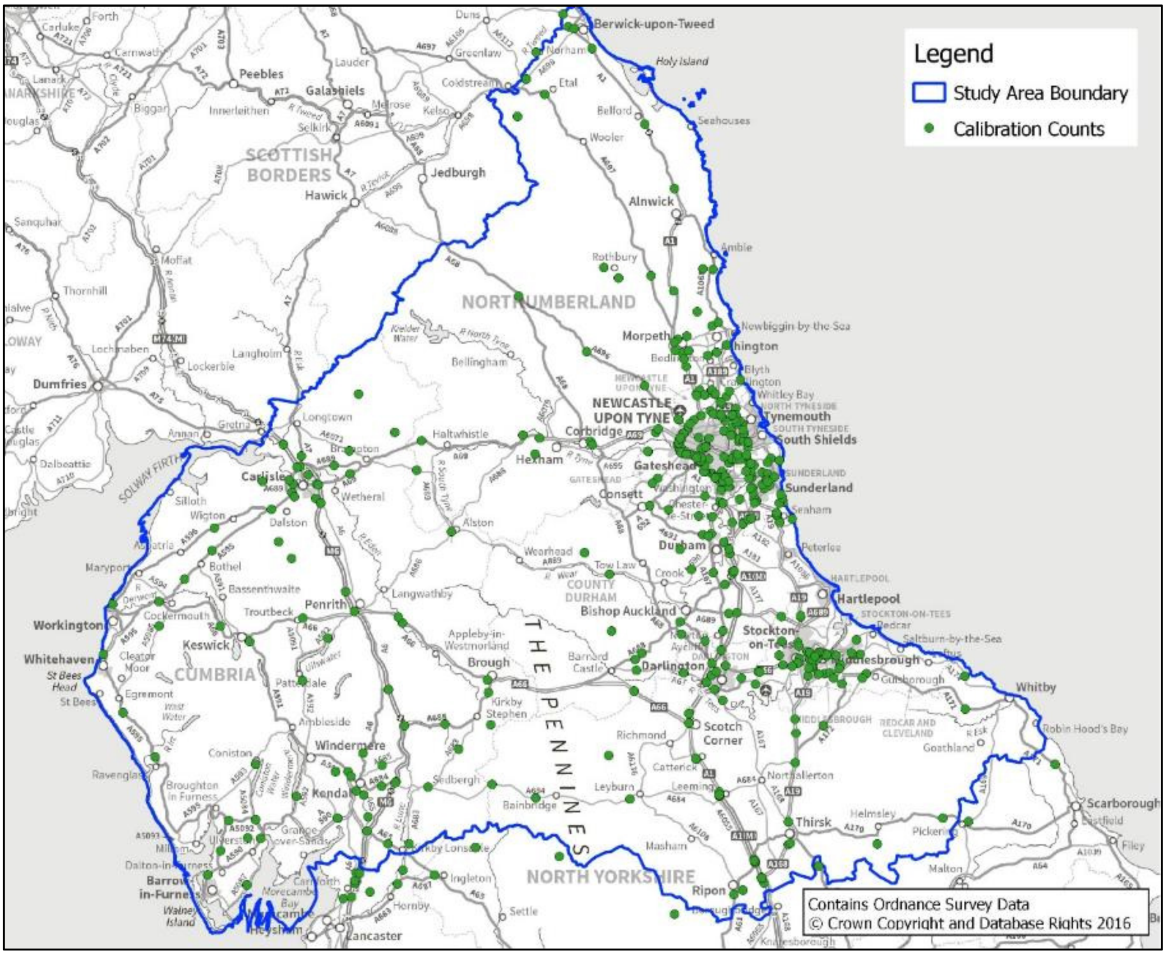
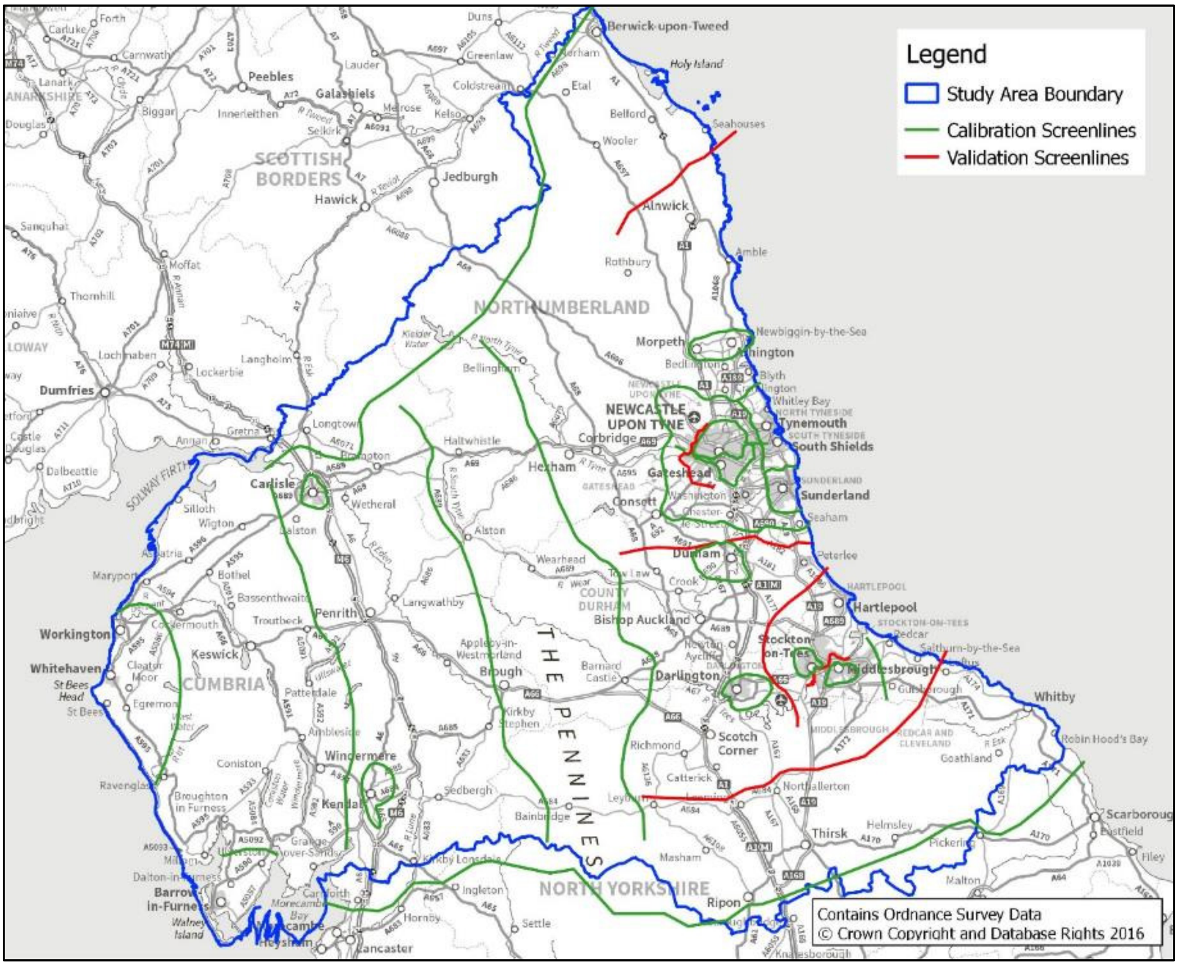


Figure 4-6 shows the screenlines with final classification as either calibration or validation.

Figure 4-6 Definitions of Calibration and Validation Screenlines



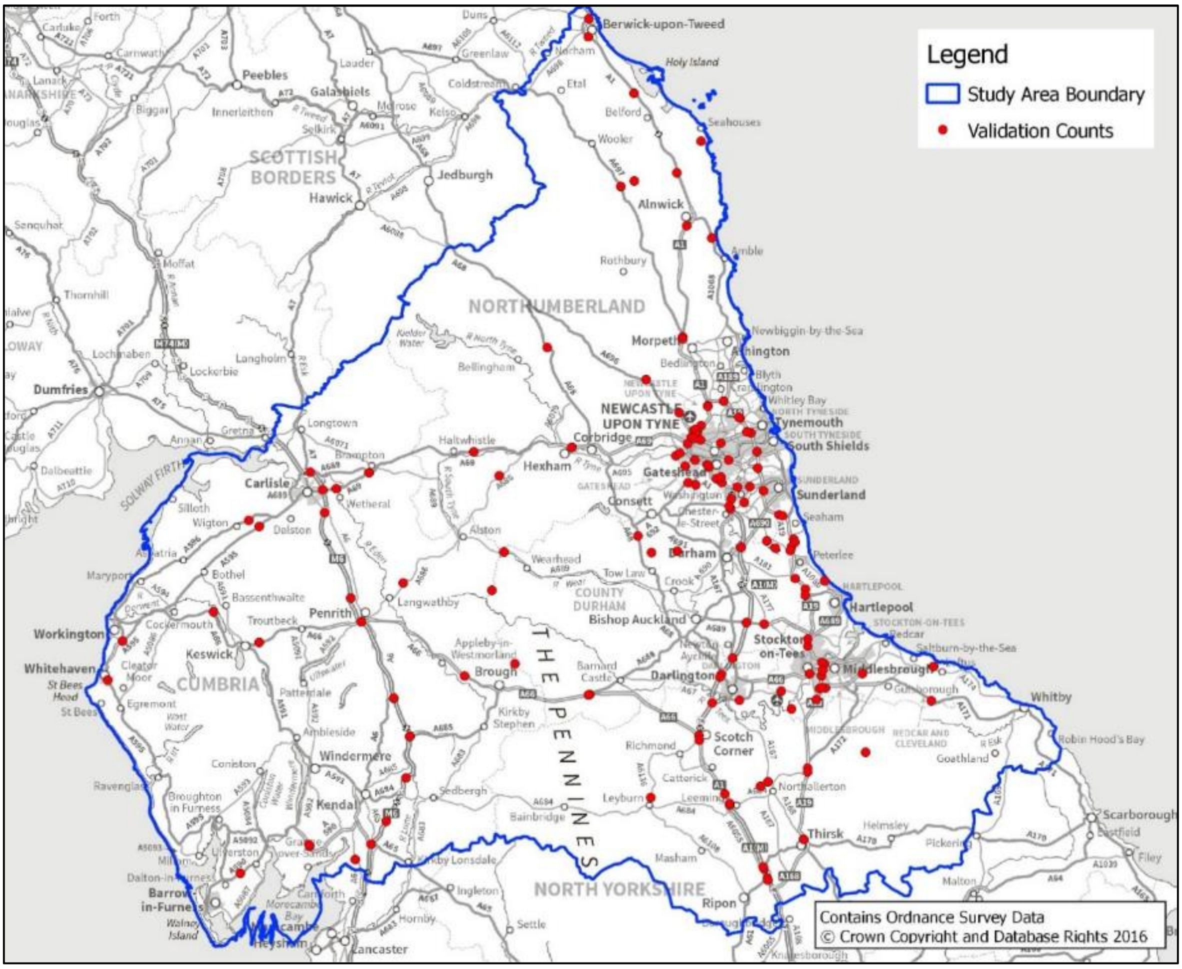
4.7 Description of Validation Data

A subset of independent cordons and screenlines were defined for assignment validation. The following examples of appropriate locations for these screenlines were drawn up by the CalVal TCG and were considered when defining NRM validation screenlines. These included:

- Cordons around conurbations and individual towns and cities within conurbations;
- Screenlines between major settlements in conurbations;
- Cordons around towns and cities;
- Screenlines adjacent to major features e.g. rivers, motorways;
- Although not a cordon or screenline, consideration needs to be given to validation on key links in the highway network – for example is a section by section validation of the motorway network desirable; and
- Noting the need to respect zonal boundaries.

The location of the independent 'validation counts' are shown in Figure 4-7.

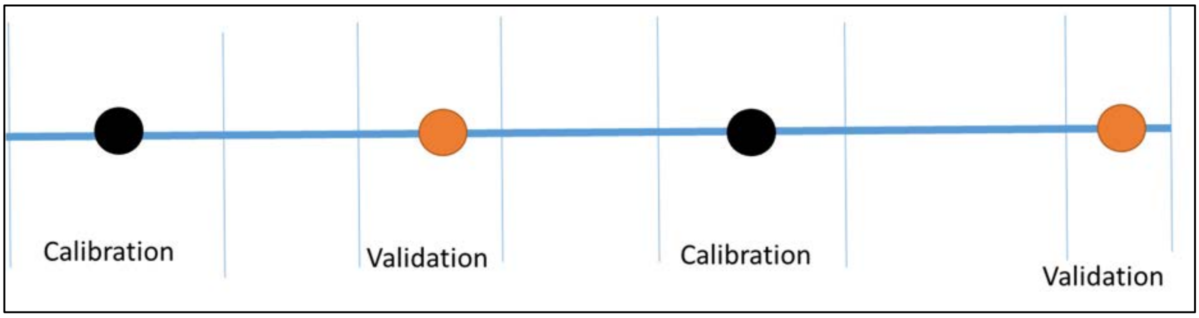
Figure 4-7 Validation Counts



As well as defining validation screenlines, it was also considered important that additional validation took place on the SRN. Where additional count data was available beyond the defined screenlines sections of the SRN were included in the calibration and validation datasets.

For calibration and validation purposes the SRN was split into a series of corridors, and each corridor subdivided into sections, usually between key junctions. The TAG unit M3-1 suggests that two major junctions should be located between validation or calibration points. For the NRM, the type of count generally alternated between validation and calibration with one route section between each calibration and validation site where data availability permitted, as shown diagrammatically by Figure 4-8.

Figure 4-8 Calibration / Validation process for the SRN



5 Highway Model Development – Network

5.1 Introduction

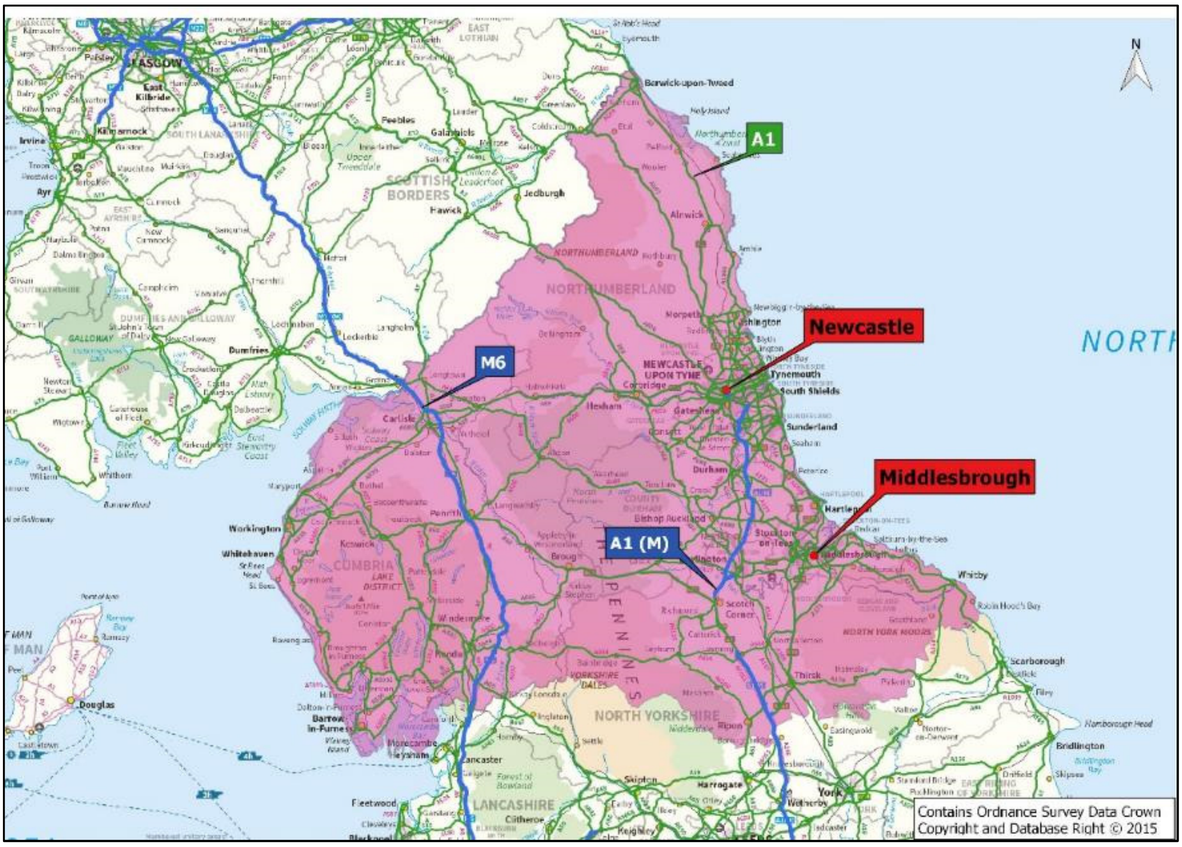
This section of the report describes the steps that have been undertaken to develop the NRM highway model network. A number of technical notes have also been produced which describe various aspects of the network development process and are referenced in this chapter.

5.2 Network Structure

The NRM covers the northernmost region of England. It is roughly bounded by an area north of Lancaster and York through to the Scottish Border. A map of the NRM model area is shown in Figure 5-1, and covers the following counties:

- Northumberland;
- Tyne & Wear;
- County Durham;
- Cumbria; and
- part of North Yorkshire.

Figure 5-1 NRM Model Area



The southern extent of the model area forms the boundary with the Northern Powerhouse model. The original boundary contained in the Highways England brief was revised following a meeting between the Northern and Northern Powerhouse model teams on 28th October 2015. The rationale behind boundary revision are presented in *Appendix A: Model Boundary Revision.*

An important component of the model is the SATURN highway network. The network needs to provide sufficient detail and a delay function to offer accurate route choice, whilst at the same time there is a recognition that the model is a representation of reality.

Much of the detail relating to network density was agreed at a national level, and includes motorways, A and B roads in the study area. An automated process was created by Atkins which converted an Ordnance Survey ITN layer to a SATURN buffer network consisting of these links. Following on from this, 'C' or ungraded roads that play an important role in allowing development traffic to access the rest of the network were also added.

Simulation junction coding was then added by the Northern model team to reproduce the effects of traffic queuing and delays at junctions. The level of simulation detail required in the network was based on:

- Model purpose. The model will be focused on the Strategic Road Network (SRN), but it was also important that alternative routes and routes feeding into the SRN were adequately modelled to represent realistic journey times; and
- Data availability

The rationale behind the extent of the simulation area is presented in *Appendix B: Extent of Simulation Area*.

The modelled network provides an accurate representation of the existing highway network within the study area. It also ensures the routing of longer distance traffic to and from the study area is properly represented, as well as through traffic between Scotland and the regions to the south of NRM.

The NRM SATURN model network coverage is presented in Figure 5-2. It shows that the network covers the whole of England, with detailed simulation junction coding (highlighted in colour) within the NRM study area. Figure 5-3 shows the network coverage of the simulation area. The entire NRM study area has been coded in simulation, with the Tyneside and Teesside areas being the most dense areas of coding within the region.

Figure 5-2 NRM SATURN Network Coverage

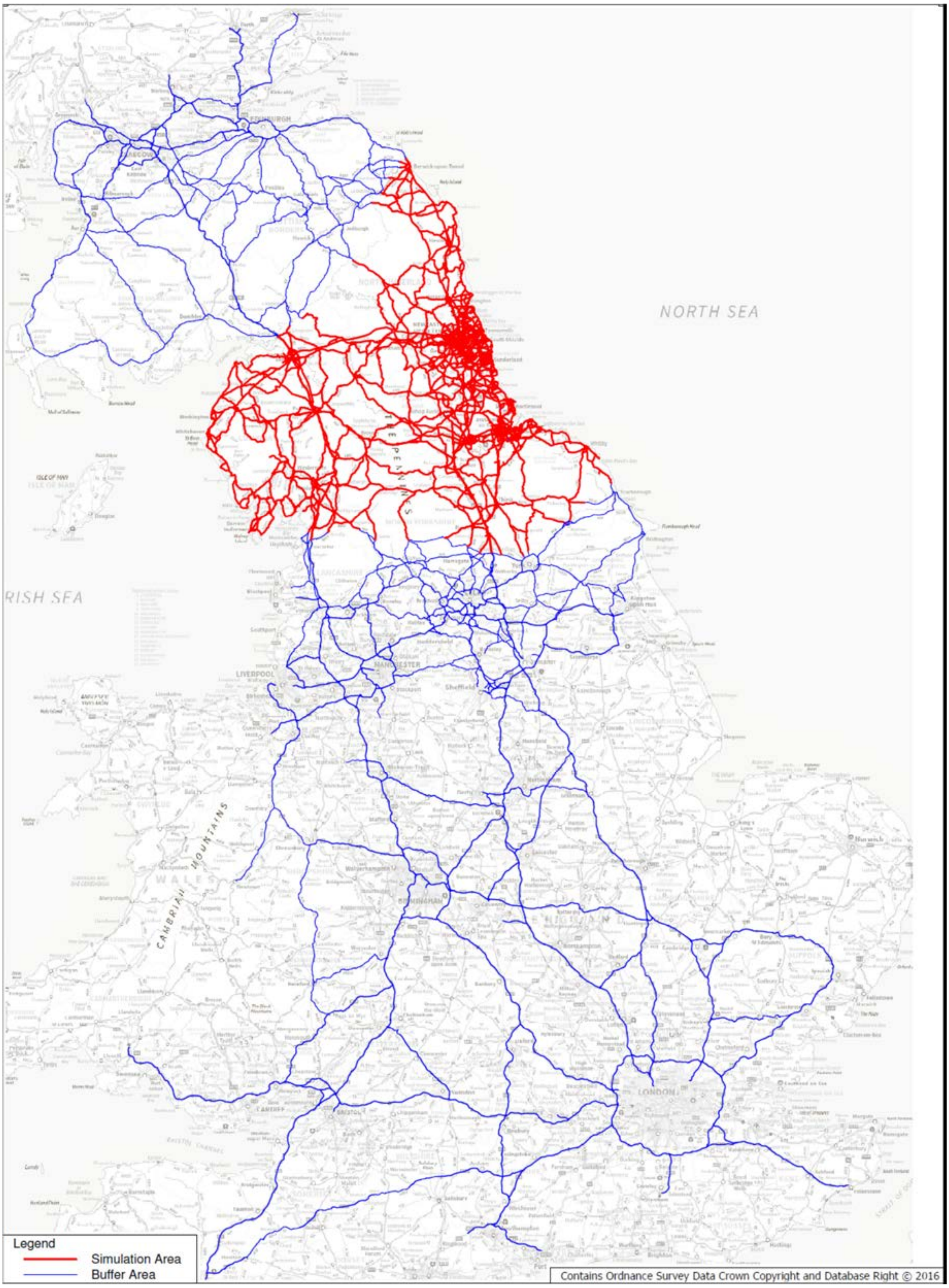
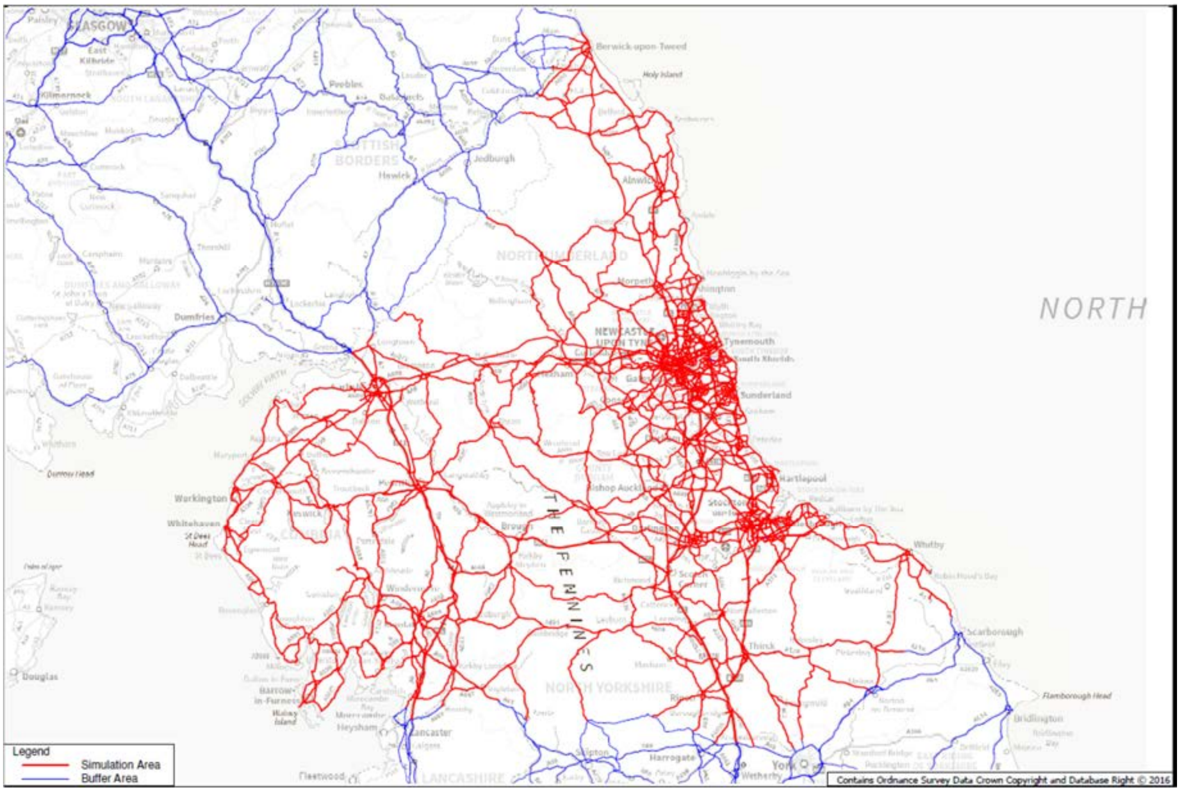


Figure 5-3 NRM Simulation Area



5.3 *Network Coding Manual*

An RTM Network Coding Manual was developed by the Technical Consistency Group. This sets out the methodology and assumptions to be applied during the development of the five regional traffic models. Modifications required in order to provide a better fit to the local circumstances of the NRM, as identified during the calibration process, are described in subsequent chapters of this LMVR.

As a basic principle, a tiered approach to coding was agreed as set out in Table 5-1 below. In summary, it states that rural areas beyond the Strategic Road Network (SRN) should be coded by junction type using standard template coding as described in the manual. This method of coding reduces the potential of trips routing through rural areas to avoid congestion near SRN. In urban areas outside the influence of the SRN and RIS schemes, network detail will be reduced, only including key routes and maintaining zone connectivity.

Table 5-1 Principles of Network Coding

	Area Type 1	Area Type 2	Area Type 3	External
Coverage	• SRN • Roads connected to/parallel with SRN	• Rural roads that are not connected to SRN	• Urban areas outside the influence area of RIS schemes and	• Roads outside the region of focus (e.g. neighbouring regions,

	Area Type 1	Area Type 2	Area Type 3	External
	• Roads considered important to RIS scheme appraisal		the SRN network	Scotland, Wales)
Level of Coding	• Detailed junction coding (accurate layout, sat flow, signal timing)	• Template signalised junction coding • Less detailed junction coding (e.g. flare lanes may not need to be considered, etc.)	• Dummy Nodes	• Buffer Network
Speed Flows Curves	• Links with greater than 1km for rural roads	• Links greater than 1 km	• No	• No
Fixed Speeds	• In urban area (from Trafficmaster)	• No - free-flow speed taken from speed-flow curve	• Yes - taken from Trafficmaster JT data	• Yes, taken from Trafficmaster JT Data

The coding of junctions adopted the principles described above. As part of the calibration and validation of key junctions, junction coding was checked and refined to ensure that the model provided sufficient route choice as well as flows and journey time validation.

Speed-flow curves based on the adjusted COBA speed/flow curve (provided by TAME) were adopted across the five regional models and have been applied for all the links (Motorways, A-roads and B-roads) within the buffer area. Within the simulation area, all the links of the SRN network, links in the area of influence of the SRN and RIS schemes have also had appropriate speed-flow curves applied. This ensured that delays and speeds on the network were appropriate for calibration/validation purposes, and for forecasting, where the impact of increased travel demands on network speed was critical.

Within urban areas, the travel speed on links of less than 200m is primarily determined by delays at junctions. Fixed speeds have been applied and detailed junction coding used to reflect appropriately level of delays within the network. Fixed speeds were derived from Trafficmaster JT data for each respective modelled time period.

5.4 ITN layer

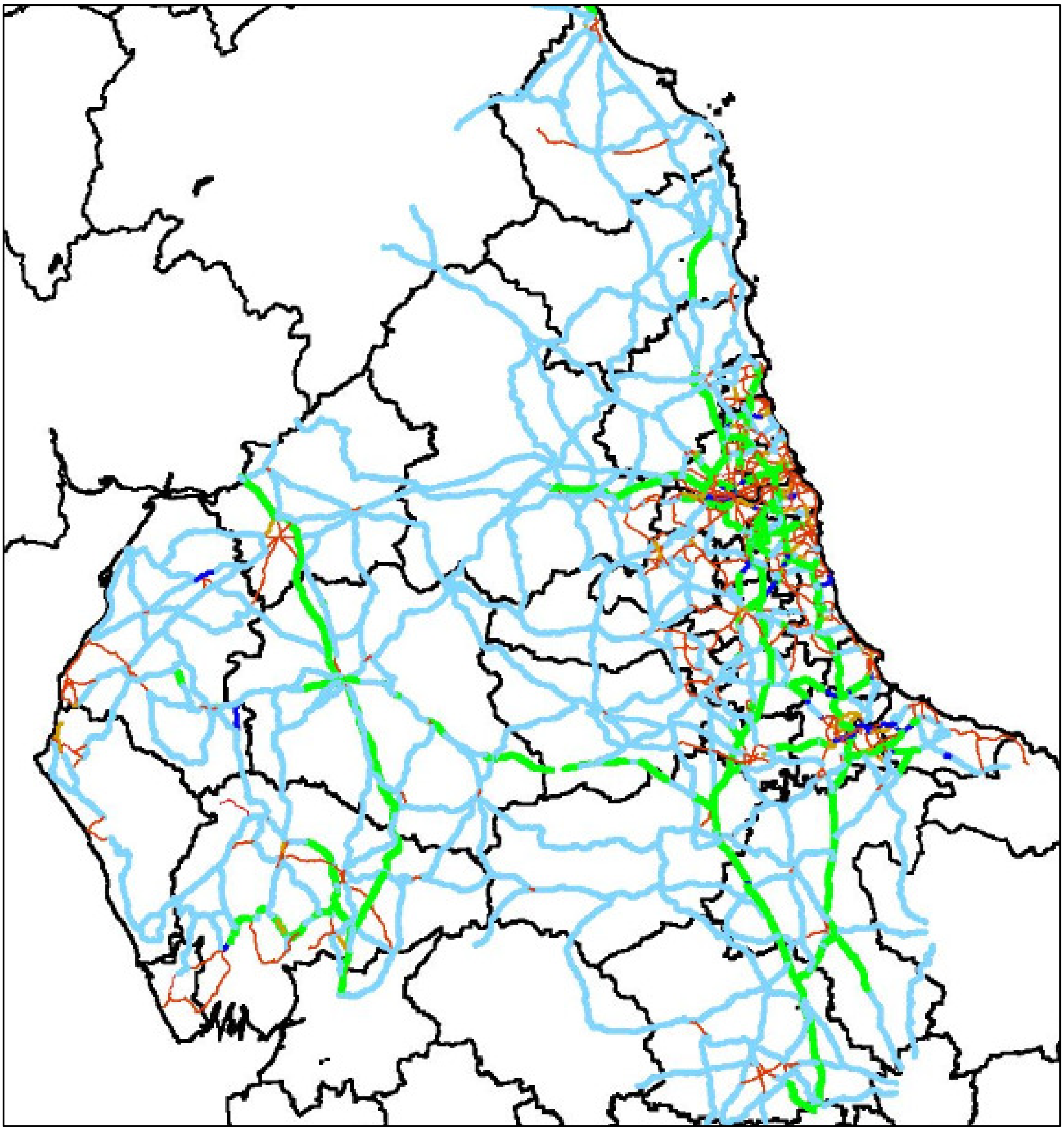
An Integrated Transport Network (ITN) network was used to provide a skeletal network for the NRM model. Atkins provided the ITN network which covered all the motorways, A roads and B roads for the whole of England. The ITN network was provided in the following form:

- A node;
- B node;
- Link length; and
- Road class category

The ITN layer for the NRM model is presented in Figure 5-4.

The link lengths provided from the ITN2SATURN process were checked against crow-fly distances.

Figure 5-4 ITN Layer for NRM Model



In addition to the information provided from the ITN layer, the following were obtained from mapping, satellite images (including Google Street maps) and other sources such as STATS19 data during the network development process, in line with guidance in the national coding manual:

- Road Type (Single or Dual carriageway)
- Speed limit;
- Number of Lanes on the roads; and
- Junction layouts such as lanes on approaches, junction types, lane markings.

This information allowed for the process of junction coding and determination of the appropriate speed flow curves to be applied for the network.

5.5 Speed Limits

Evidence on the speed limit and road class were obtained from the STATS19 database, they were then refined during the network development stage for urban areas such as Newcastle, Carlisle, Middlesbrough and Darlington using Google satellite images.

5.6 Fixed Speeds and Speed Flow Curves

For the NRTM, it was agreed that due to the nature of the network, fixed speed were not applied within the study boundary. Instead speed-flow curves with accurate representation of junction coding were used for rural and urban road networks to allow more accurate route choice to be modelled within the network. Exceptions were used with links between two junctions of less than 200 metres and within the urban area. Where speed-flow curves were not used, free-flow speed and detailed junction coding were modelled.

Outside the study boundary, fixed speed were used derived from Trafficmaster journey time database and from LATIS data for England/Wales and Scotland networks respectively.

5.7 Junction Operation Data

Within the Northern Region Model, it was agreed with the Network Development Technical Consistency Group that the network in the vicinity of the Strategic Road Network (SRN) and some of the larger urban areas such as Newcastle, Gateshead and the Tees Valley would be coded using Area Type 1 coding. Signalised junctions within Area 1 were identified on a GIS layer. Data for junction coding was then sourced from Local Authorities wherever possible.

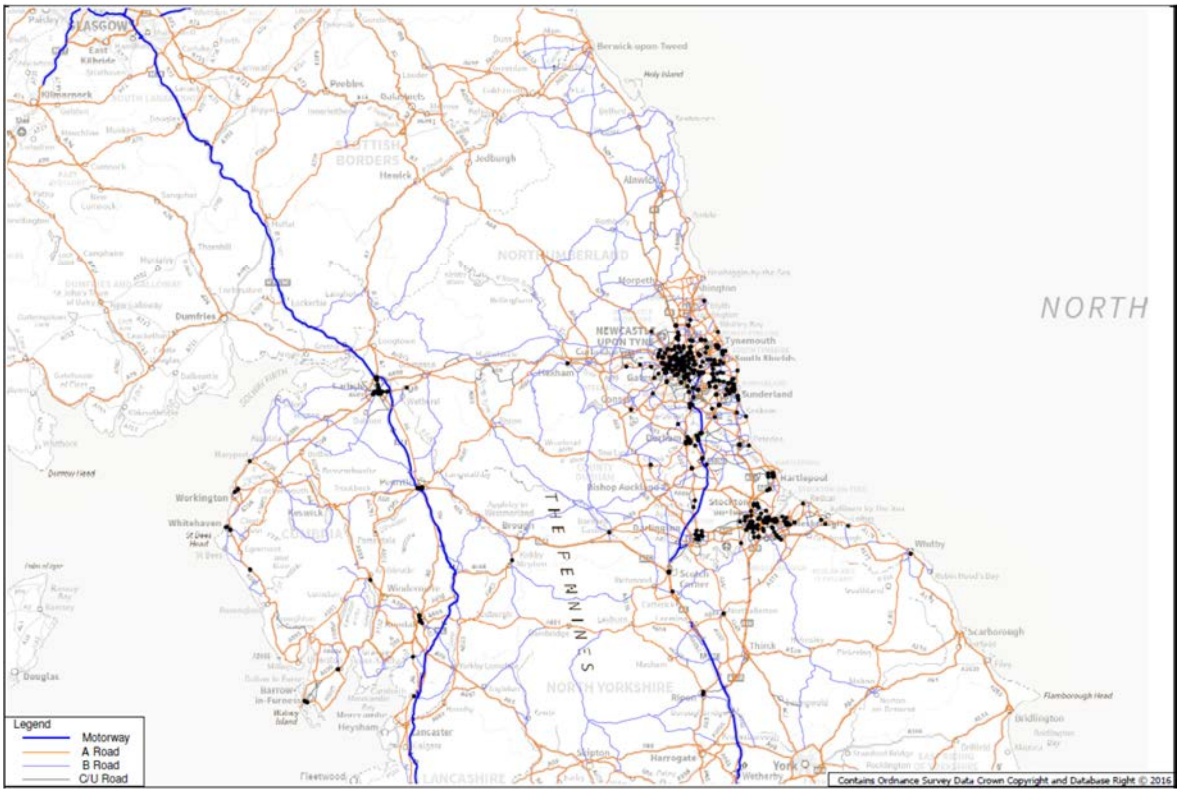
The majority of signal installations in the Tees Valley and Newcastle upon Tyne are controlled and monitored via Urban Traffic Control (UTC). The signalised nodes identified from the initial exercise were cross-checked against UTC records of all signal installations, and additional nodes and links incorporated to ensure the model includes formal diversion routes for the SRN and sufficient detail within urban areas to accurately reflect origin-destination movements from key zones.

Signal data was also obtained from Amey for the Highways England controlled junctions in Area 14 and from Durham County Council. In addition, the following donor models were obtained to provide signal data for additional junctions

- West of Newcastle A1 Corridor SATURN Model;
- North of Newcastle A1 Model; and
- Ulverston S-Paramics Model.

In summary, the Northern Regional Model SATURN network contains a total of 557 signalised nodes. A detailed description of the signal data collection process, and data interpretation and processing are presented in *Appendix C: Traffic Signal Data*. Figure 5-5 shows all the signalised junctions that have been coded in the RTM Base Year model.

Figure 5-5 Signalised Junctions Coded



Estimates of gaps at roundabouts were based on the guidance presented in the Network Coding Manual.

5.8 PCU Conversion Factors

Following the discussion by the Calibration/Validation Technical Consistency group in April 2016, that: a) the scope of the RTM focus on the motorways and SRN road networks; and b) observed count database from the RTM teams showed that overall OGV1/OGV2 split for motorways and SRN networks is about 40/60 respectively. It was therefore agreed by all the RTMs to adopt the average PCU factor for each of the three vehicle types as below:

- Car = 1.0;
- LGV = 1.0;
- HGV = 2.5;

5.9 Public Transport Services and Bus Priority

Bus routes are generally defined in SATURN using fixed demand and routes. Given the urban areas in the Regional Models will be coded in less detail and the level of bus services using the SRN (the main area of interest) is small, the preferred approach is not to model fixed route buses. Where bus lanes exist within the simulation area these have been taken into account in order to provide an accurate representation of link capacity.

5.10 Representation of Tolls

Tolls have been coded for the Tyne Tunnel along the A19 to the east of Newcastle, to ensure a realistic calculation of generalised cost for trips using this link. The toll values used are presented in Table 5-2.

Table 5-2 A19 Tyne Tunnel Toll Prices used in Assignment

Car – UC1	Car – UC2	Car – UC3	LGV – UC4	HGV – UC5
£1.23	£1.47	£1.47	£1.26	£2.47

The current toll price for cars and LGVs is £1.60 per vehicle and for HGV is £3.20 per vehicle. This was then converted to 2010 perceived cost using the GDP deflator as provided from the WebTAG Databook Dec 2015 prior to inclusion in the model. It is noted that the costs used for the assignment purpose are in 2010 perceived prices (i.e. without taxation), the toll charges for the User Class 1 (employers' business) is therefore lower than that for the Commuting and Others (UC2 and UC3). Furthermore, the toll charges for the LGV were calculated as a weighted average of personal and freight trips and are therefore lower than costs for Commuting and Others.

5.11 Generalised Cost

Generalised costs are essential to highway model as they affect traffic routeing on the road networks. The generalised cost parameters are presented in a form of

*G.Cost = Time + PPK/PPM*Distance + Toll*

where PPM is Pence Per Metre and

PPK is Pence Per Kilometre

As agreed with Highways England, the latest WebTAG Databook November 2016 dataset were used to produce the PPM and PPK values for all five regional traffic models.

Following discussion with the CalVal TCG, it was agreed that the main purpose of the RTM is to focus on the motorway and SRN road networks and with the observed data showing that the percentage split for the OGV1 and OGV2 is 40:60. This was used to determine average PCU factors and PPK for HGV.

As stated in paragraph 2.8.8 of the *TAG Unit M3.1 - Highway Assignment Modelling*, the value of time given in the TAG databook for HGVs relates to the driver's time and does not take into account the influence of owners on the routeing of these vehicles. On these ground, it may be considered to be more appropriate to use a value of time around twice the Databook's values.

The *Advice on Modelling of Congestion Charging or Tolling Options for Multimodal Studies, ITEA division January 2002*, which is based on the report *The Value of Time on UK roads – 1996* produced by Accent Marketing and Hague Consulting Group, shows that an average factor of 2.3 should be applied to the Databook's values to reflect a cost that freight operators would be prepared to pay. Since no further analysis has been conducted, these factors were used for the purpose of the calculation of the PPM values for HGVs.

Table 5-3 and Table 5-4 provide the PPM and PPK values for each of the three modelled periods and by user classes.

Table 5-3 NRM Generalised Cost Parameters – PPM (Final)

Vehicle Type	User Class	AM Peak	Inter Peak	PM Peak
Car	Employer Business	29.82	30.56	30.25
	Commuting	20.00	20.32	20.07
	Other	13.80	14.70	14.45
LGV	LGV	21.08	21.08	21.08
HGV	OGV1	49.22	49.22	49.22
	OGV2	49.22	49.22	49.22
	Average OGV	49.22	49.22	49.22

Note: All figures quoted in 2010 price base.

Table 5-4 NRM Generalised Cost Parameters – PPK (Final)

Vehicle Type	User Class	AM Peak	Inter Peak	PM Peak
Car	Employer Business	12.19	12.19	12.19
	Commuting	5.66	5.66	5.66
	Other	5.66	5.66	5.66
LGV	LGV	12.67	12.67	12.67
HGV	OGV1 (40%)	30.88	30.88	30.88
	OGV2 (60%)	56.23	56.23	56.23
	Average HGV	46.09	46.09	46.09

Note: All figures quoted in 2010 price base

6 Highway Model Development – Matrices

6.1 Introduction

This chapter describes principles involved in creating the Model zoning system and the matrix development process.

Firstly the principles behind the creation of Model zones are described along with a description of the zone structure. A case study of Newcastle-upon Tyne (the largest city in the North region) is included.

The chapter then outlines the process undertaken to obtain a set of prior matrices by mode. The process has been undertaken in line with the guidelines set out by the Technical Consistency Group set up for matrix development (MTCG). An overview of the matrix building process is presented in Section 6.3 (Matrix Build Overview). Following this the matrix user classes are summarised in 6.4, and the sources of data required for the matrix build (along with details of their application) are described in 6.5. Section 6.6 describes the development of the Synthetic Matrices that go alongside the Mobile Phone Origin Destination (MPOD) data. The verification and subsequent prior matrix development processes are then described in more detail (6.6 and 6.7 respectively), the latter being broken down into a step-by-step format, explaining how MPOD and Synthetic matrices are brought together.

It should be noted that there is no established practice or indeed complete technical appreciation of the issues associated with using mobile phone data to develop trip matrices and as such the approach carries significant risk. The intent of the MTCG, set up by Highways England, was therefore to set out good practice on how to approach the matrix development task and thus moderate this risk. The MTCG also aimed to ensure that all elements of the work were undertaken in a consistent manner by all matrix development teams across the RTM programme.

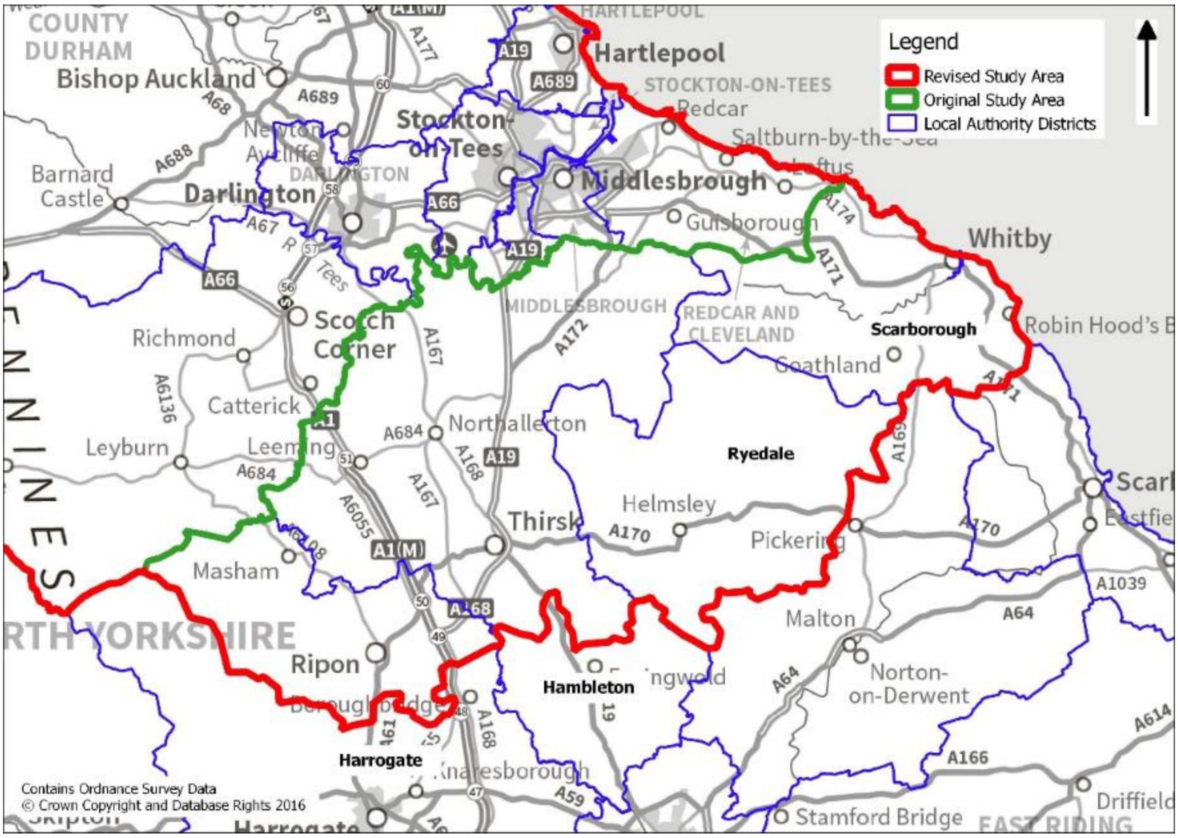
North Transport Model TN14 ‘Matrix Development’ describes the development of the prior matrices in comprehensive detail.

6.2 Zoning

6.2.1 Principles and Methodology

The original NRM boundary with the Trans Pennine South RTM dissected the RIS 1 Scheme no.3 from Leeming to Barton on the A1. It was agreed between the two modelling teams that the NRM study area would be extended to fully model this scheme, including the A19 parallel to this section. The revised boundary was drawn along MOSA/LSOA boundaries in accordance with the rationale set out in *Appendix A: Model Boundary*. This is shown in Figure 6-1 below.

Figure 6-1 Extension to NRM Study Area



Network density for all regional models has been agreed at a national level through the Network Technical Consistency Group. The zoning system for the study area has been developed following an agreed set of principles including the following guidance from TAG unit M3.1:

- The building blocks should be census or administrative boundaries – core statistics are readily available for these boundaries. The NRM uses the output areas as the starting point;
- Aggregation of the building blocks should consider the local network topography and land use. The respective demographics should also be considered; and
- Natural boundaries such as rivers should be exploited – the River Tyne, River Tees and River Eden intersect three of the main urban areas in the NRM area.

6.2.2 Description of Zone Structure

There are a number of considerations that should be taken into account when developing a zone structure. One of these is the makeup of the study area – for the North Regional Model this can be broadly categorised into three groups:

- The sizeable urban areas in the east of the region, including Newcastle, Middleborough, Sunderland, Darlington and Stockton plus the city of Carlisle in Cumbria. These are all serviced by the SRN.
- The larger Cumbrian towns including as Barrow in the south west peninsula, Workington and Whitehaven on the west coast plus Kendal and Penrith. These are all located on or next to the SRN.
- The more rural areas in the Lake District, Northumberland and the North Pennines. The network is very sparse in these areas with little or no route choice but some SRN route intersecting

In the study area all motorways, A roads and B roads were included in the network. This was taken into account when considering the zoning system.

It is important that the network was not too dense relative to the zones – if zones were too large and included several junctions or entry/exit points onto key routes this could lead to competing route choices within a zone and difficulty in defining the zone loading point on to the network. Consequently the distribution of trips and movements within the model would not be reflective of on the ground behaviour which could lead to problems later with validation.

Conversely the zones cannot be too small relative to the network and population density. If the zones are too small in the rural areas, there could be a very small population within the zones and none of the Atkins network intersecting or bounding part of the zone. This could lead to zones having no demand.

As the travel demand data will be supplied to the regional models at MSOA level, this been used as a starting point. In the NRM study area there are 410 MSOAs and this would represent too spares a zoning system. It has therefore been agreed nationally that LSOAs will be used as the starting point for the zoning system. There are 2012 LSOAs in the study area, and these have been considered individually for aggregation with adjacent LSOAs, in some cases up to MSOA level.

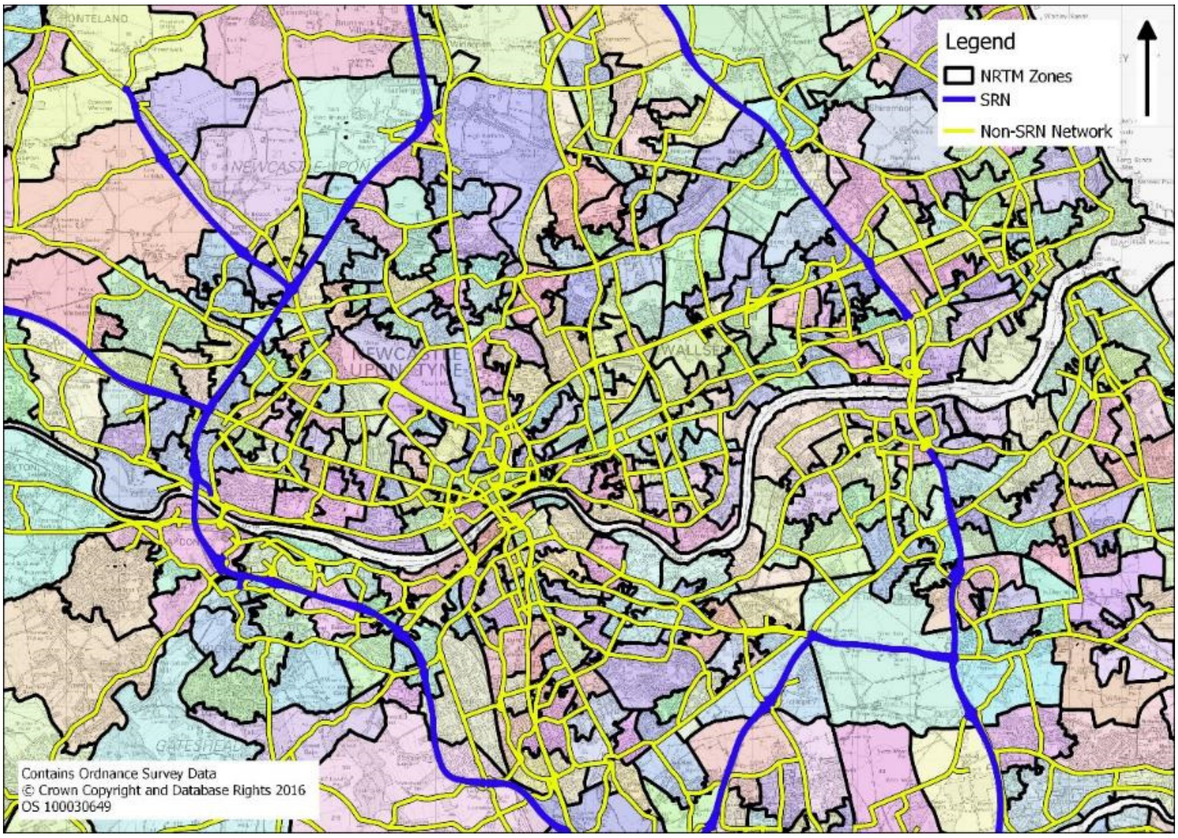
6.2.3 Case Study: Newcastle-upon-Tyne

Newcastle-upon-Tyne is the largest urban area in the NRM region – the city has population of 289,835 and is intersected by the River Tyne which is a natural boundary for zones.

- There are SRN routes bypassing the city on both sides – the A19 to the east and the A1 to the west.
- Both of these corridors provide a competing route choice for northbound trips. However there are several competing local road choices in the city centre. Several are good quality, fast and high capacity routes including the city centre motorway.
- There are frequent junctions on the SRN routes near to the city. In order to model local trips which use these routes there must be a high level of zoning detail to permit trips to access and egress the SRN at the correct points on the network.

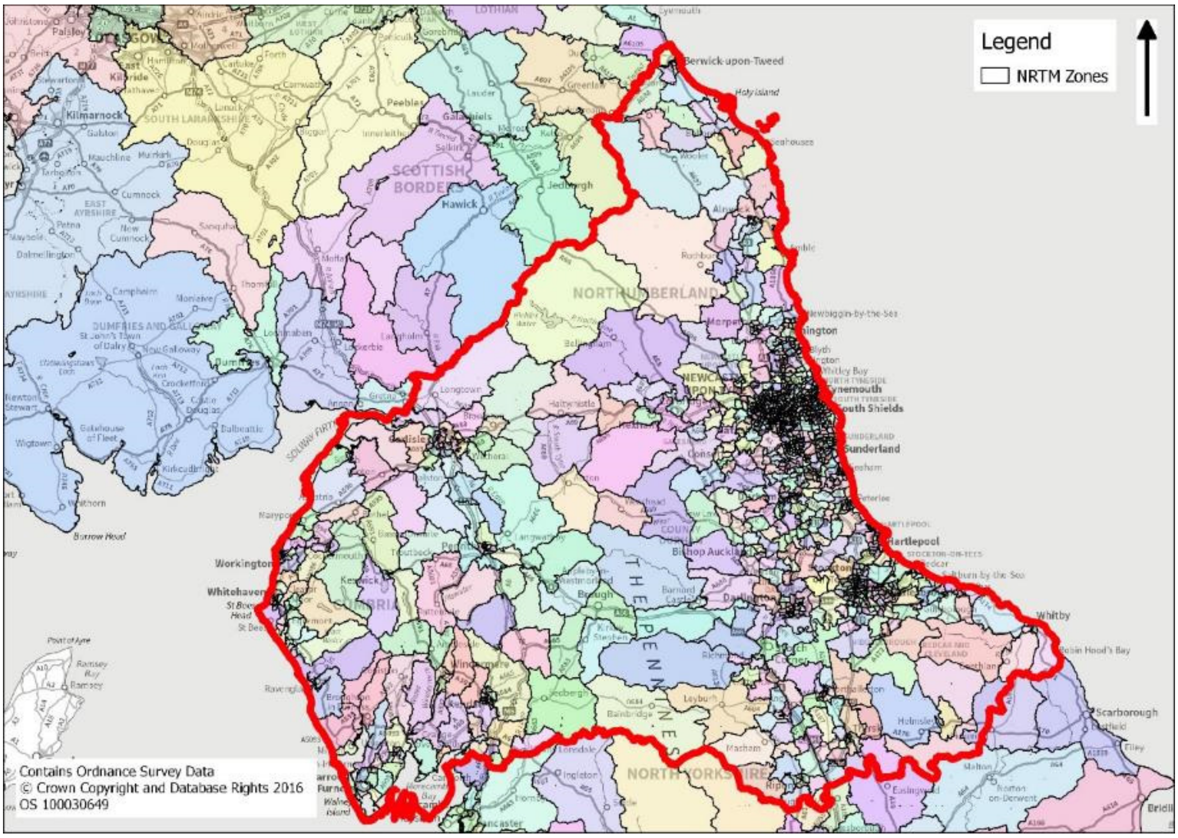
- In achieving this high level of detail there has been minimal aggregation of LSOAs in the city. Many LSOAs were retained due to the amount of network density and competing routes within the city.

Figure 6-2 Newcastle Upon Tyne Zoning



Full details of the process, including additional case studies, are documented in *Appendix D: Zoning Proposal*. Figure 6-3 below shows the NRM zoning system.

Figure 6-3 NRM Zones

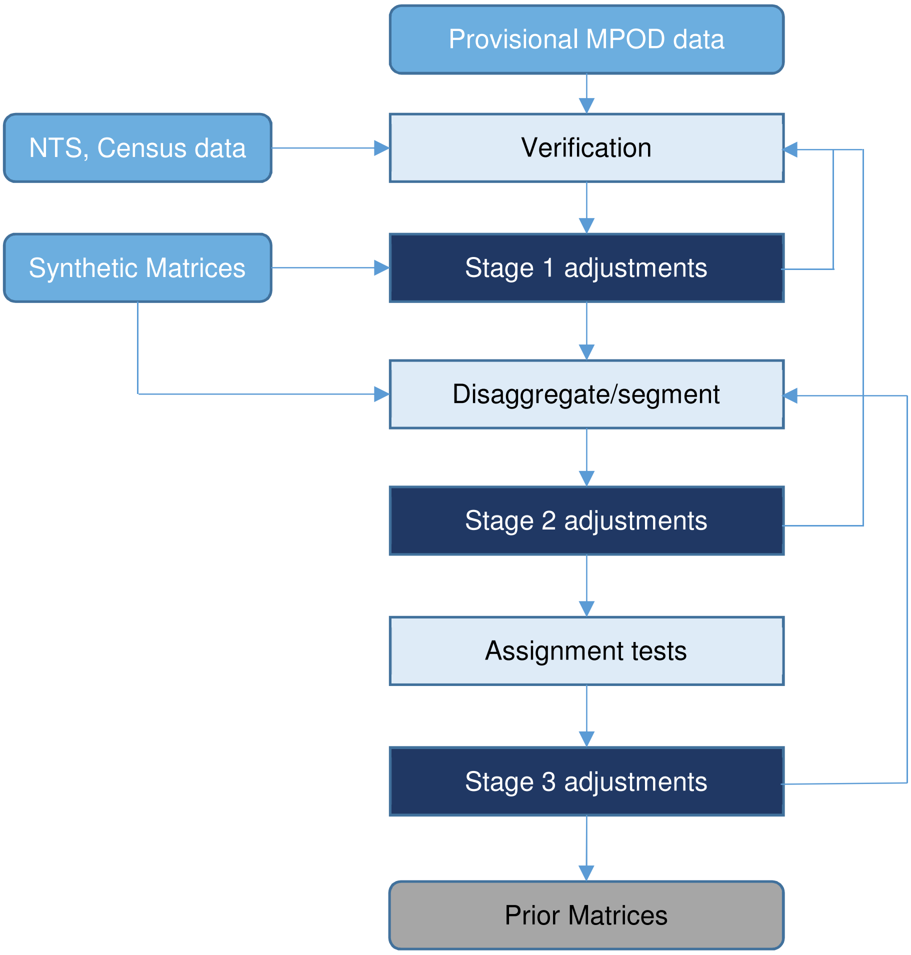


6.3 Matrix Build Overview

Data from a number of sources have been combined to produce a set of trip matrices for cars, Light Goods Vehicles and Heavy Goods Vehicles. The bulk of the data come from Mobile Phone Origin Destination (MPOD) data, which formed the basis for car trips. MPOD data contained trips across a number of modes, so additional sources of data were used to extract and exclude non-car trips. Additionally synthetic matrices were developed to compliment the MPOD car trips and provide some additional detail not present in MPOD.

Broadly three stages were involved in producing the prior trip matrices. The synthetic matrices were used to split MPOD data into Model Zones and to further segment the purpose split, with LGV and HGV data from TrafficMaster and Base Year Freight Matrices (BYFM) sources respectively. In Stage 1 the provisional MPOD matrices/synthetic were reviewed through verification against independent data sources, with adjustments sought to correct for known, quantified biases in MPOD if necessary. Stage 2 involved further review of the matrices against independent sources, with the objective of producing broadly correct traffic volume within the North region and achieving consistency across regions with matrices from other RTMs. In Stage 3 final adjustments were made to further reconcile boundary screenlines, to within 5% of observed counts. Evidence based adjustments in agreement with the MTCG were made where necessary to the MPOD data and to the combined MPOD/synthetic matrices throughout stages 1, 2 and 3.

Figure 6-4 Overview of Matrix Verification and Build



6.4 *Highway Matrix Build Specification/Requirements*

Five highway user classes have been modelled within the NRM as follows;

- Cars – employer business;
- Cars – commute;
- Cars – other;
- Light Goods Vehicles (LGVs); and
- Heavy Goods Vehicles (HGVs).

6.5 *Data Sources and Applications*

Data sources used in the development of the matrices were as follows:

6.5.1 Mobile Phone Data

Provisional Mobile Phone Origin-Destination (MPOD) data were provided to Mouchel from Telefónica (O2) UK. These comprised trips between bespoke sectors (based on MSOAs in England and Wales and Intermediate zones in Scotland), as devised by Mouchel. The bespoke mobile phone sector system is presented in Figure 6-5, which shows increasing spatial aggregation away for the North region.

MPOD data were provided for Home Based trips by purpose and direction (outbound and inbound) separately on an O-D basis. For the development of Highway Model assignment matrices all processing was conducted on both outbound and inbound datasets, corresponding to an Origin - Destination based process. For other processes including the demand this was used as a proxy for production/attraction. For example a person who makes an outbound trip to work in the morning is likely to make a return trip later that same day as they return home (home acts as a production, and the workplace is an attraction). The outbound and return trips were assumed to be included in the MPOD data as separate trips, recorded as Home Based Work Outbound and Home Based Work Inbound trips respectively, at the times the trips were made.

All slow-mode trips (walking and cycling) had been removed from the data, along with air trips. Originally the MPOD data were provided exclusive of rail trips. An additional cut of the data was subsequently provided at a later date with rail trips retained, as verification checks suggested that rail trips were still erroneously present in the earlier dataset.

A number of issues related to the principles of MPOD data are evident:

- Historically processes to develop prior trip matrices are subject to varied sources of error. These include both the sampling related errors from household and road side interview (RSI) surveys, and the modelling errors of gravity and trip end models used to synthesise unobserved trips. For travel demand purposes the large sample involved in the mobile phone data should result in a significantly smaller scale of sampling error. The difference in error being such that applying statistical data fusion methods to integrate existing data sources would make a negligible change due to significantly smaller variance in mobile data; and hence, significantly larger proportion of the data used. On the other hand if the mobile data are not reliable at any level, then it would be inappropriate to make use of them. The approach therefore heavily relies on verifying data suitability.
- The rate of recording of events from mobile phones depends on the network available, with 3G and 4G typically generating more events than 2G. Network coverage is poorer in the North Region compared to other more populated regions, broadly similar to the South West region, particularly for 3G and 4G. The impact of the network coverage is unclear when considering the outturn demands.
- The allocation of a Mobile Phone event location to a specific MSOA depends on the size of the mast's cell relative to the MSOA. In rural areas with poor

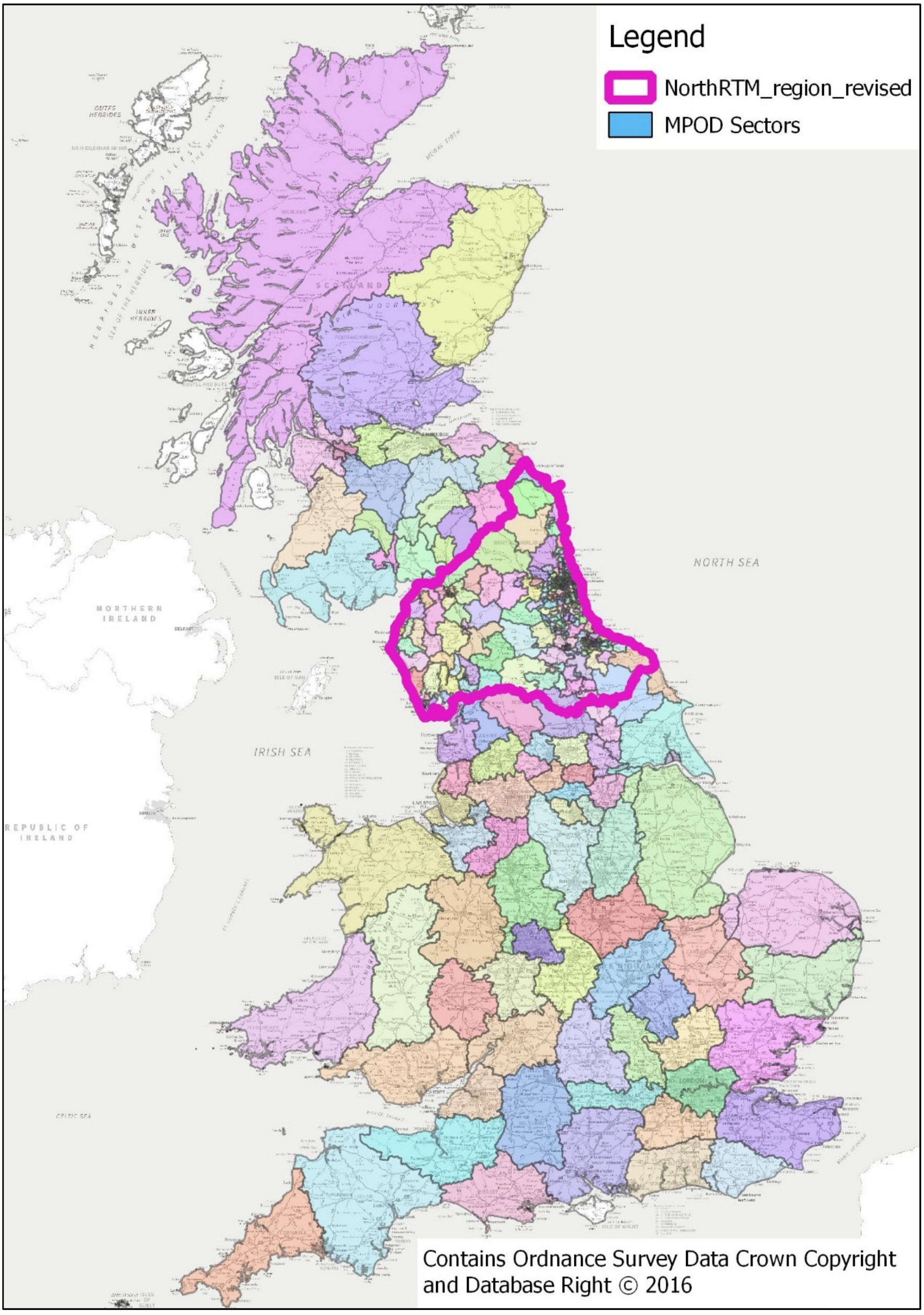
coverage, where active events are limited, there is a risk that a mobile phone mast's cell is larger than an MSOA. If the event is a trip origin or destination, the allocation of the trip end to the MSOA would only be an approximate location. Further, in mountainous areas cell coverage may be distorted by topography.

- The longer a trip is, the more likely it is to generate events, either active or passive. Short trips may potentially not all be detected. The length of an undetected trip could potentially increase in areas with poor coverage. The lack of coverage and rural nature of much of the North region suggests a potential lack of short trips in the data. Data are therefore likely to be biased therefore towards longer trips.
- A home location is identified as where the device typically is overnight. This identifies the home end of a home based trip. However for people who typically work night shifts, their device will be located at their place of work overnight, potentially presenting a challenge in allocating home and work ends of trips. The North region includes a Nuclear Power Plant in Sellafield and Teesport, one of the largest ports in Great Britain, which are likely to employ a significant number of night shift workers.

To overcome some of the limitations described above, the prior MPOD matrices were supplemented with synthetic matrices, as described in Section 6.6.

The subsequent section gives an overview of data used and the manner in which it was used. Further refinements to this general principle are considered later in the chapter.

Figure 6-5 Mobile Phone Sector System for Great Britain



6.5.2 LGV Data

DfT TrafficMaster Origin Destination data have been used to provide LGV matrices. Data were received at LSOA level.

The TrafficMaster sample of LGVs represents approximately 3% of the total fleet. The data therefore needed scaling up from the sample to the whole fleet. Scaling factors were derived by comparing the TrafficMaster LGV trips with the number of LGVs at adjacent count sites at various locations. LGV data were allocated to Commute, other and employers business according to NTS data.

LGV Data were subtracted from the overall MPOD matrix

6.5.3 HGV Data

DfT Base Year Freight Matrices (BYFM) were used to provide HGV matrices for each of the regions. These comprise daily movements of Heavy Goods Vehicles at a Local Authority level.

The most recent available matrices were from 2006. In order to scale up to 2015, Mouchel requested statistics from DfT relating to total HGV trips yearly from 2006 onwards. The total number of HGV trips undertaken in Great Britain were provided from 2004 up to 2014, based on the Continuing survey of Road Goods Transport. An extrapolation of the trend from 2010 to 2014 was then undertaken (as HGV trips dipped in 2009 likely because of recession) to ascertain an estimated total number of HGV trips for 2015. The trips for 2015 divided by 2006 formed a scaling factor of -0.36 to be applied to all trips in the BYFM matrices.

LGV Data were subtracted from the overall MPOD matrix for the Employers Business segment only.

6.5.4 Rail Data

For the North, MOIRA data, based on ticket sales, was used to establish Origin Destination matrices between Model Zones, based on the ultimate origin and destination of the trip (i.e. not just station to station). The data were subsequently controlled at an aggregate level to National Rail Travel Survey data. This is a reliable source of data in which trip details are recorded in a travel diary. Rail trips were provided by purpose (Home Based Work, Home Based Other, Home Based Employers Business, Non-Home Based Other and Non-Home Based Employers Business).

HGV data were subtracted from the overall matrix.

6.5.5 Bus and Other PT Trips - Census Journey To Work Data

Census Journey To Work data were available at MSOA level in England and Wales, and at Intermediate zone level in Scotland. They represented the number of commuting trips made by the whole population on a typical weekday. Total number of trips, broken down by mode, are provided between MSOAs in England and Wales, and between Intermediate zones in Scotland.

Bus, LRT and 'Other' modes were removed from the Mobile Phone matrices using 2011 Census Journey To Work data. A proportional split of trips by mode was created between model zones and applied to remove bus, LRT and 'Other' modes. Rail data had already been removed absolutely. For zone to zone movements where no Journey To Work trips are made, global modal splits (for removal of bus, LRT and Other) were applied. For other trip purposes (Other and Employers business) the mode shares implicit with NTS datasets was applied.

6.5.6 Synthetic Demands form Census ONS Data, NTS Data

Synthetic infill data was created in the following manner. Localised land use data from Census ONS population and employment databases was plugged into DfT Programme CTRIPEND 6.2. An uplift of data from 2011 to 2014 using ONS 2014 Mid year estimates and BRESS Employment by LA was applied. NTS trip lengths were applied to a doubly constrained distribution model using a log-normal function. Overall trip rates were compared against NTS trends and a modest downlift in trip rates was applied to account for changes in travel propensity over recent years. Technical Note 22A 'Synthetic Matrix Development' has been written to document this process in further detail.

This data were used to infill shorter distance trips missing from MPOD, to disaggregate MPOD trips from MSOA to Model Zone and to further segment trip purpose in MPOD.

The next section (6.6) describes how the Synthetic Matrices are developed. Following this, 6.7 outlines the Matrix Verification process, before subsequent chapters describe the different stages of the Prior Matrix Development.

6.6 Synthetic Matrix Development

The synthetic matrices were developed using a gravity model with a log normal distribution deterrence function. The number of trips from zone i to zone j in the gravity model was given by

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

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 log-normal function with some fitted parameters time period and purpose specific parameters μ and σ:

$$F_{ij} = \frac{1}{x\sigma\sqrt{2\pi}} exp\left[-\frac{(lnx-\mu)^2}{2\sigma^2}\right],\ x > 0$$

The gravity model application required three data inputs.

- Trip Ends

These were generated using the DfT software package CTripEnd 6.2 which is based on the trip rate and planning data within TEMPRO 6.2 However, unlike TEMPRO, it could be rezoned at the input stage to a bespoke zone system.

- Generalised Cost Skims

Distance and time skims were extracted from the fixed speed networks developed by the Network team in line with the agreed Matrix TCG methodology. Intra-zonal values were defined as half of the minimum value observed to an adjacent zone. (These were capped for a small number of large zones in southern England). The VOT and VOC values were taken from the most recent TAG databook to calculate the generalised cost skim for each zone pair:

$$x = \frac{Skim\ Time}{60} + \frac{Skim\ Distance}{1000} \times \frac{VOC}{VOT}$$

- Observed Trip Length Distributions

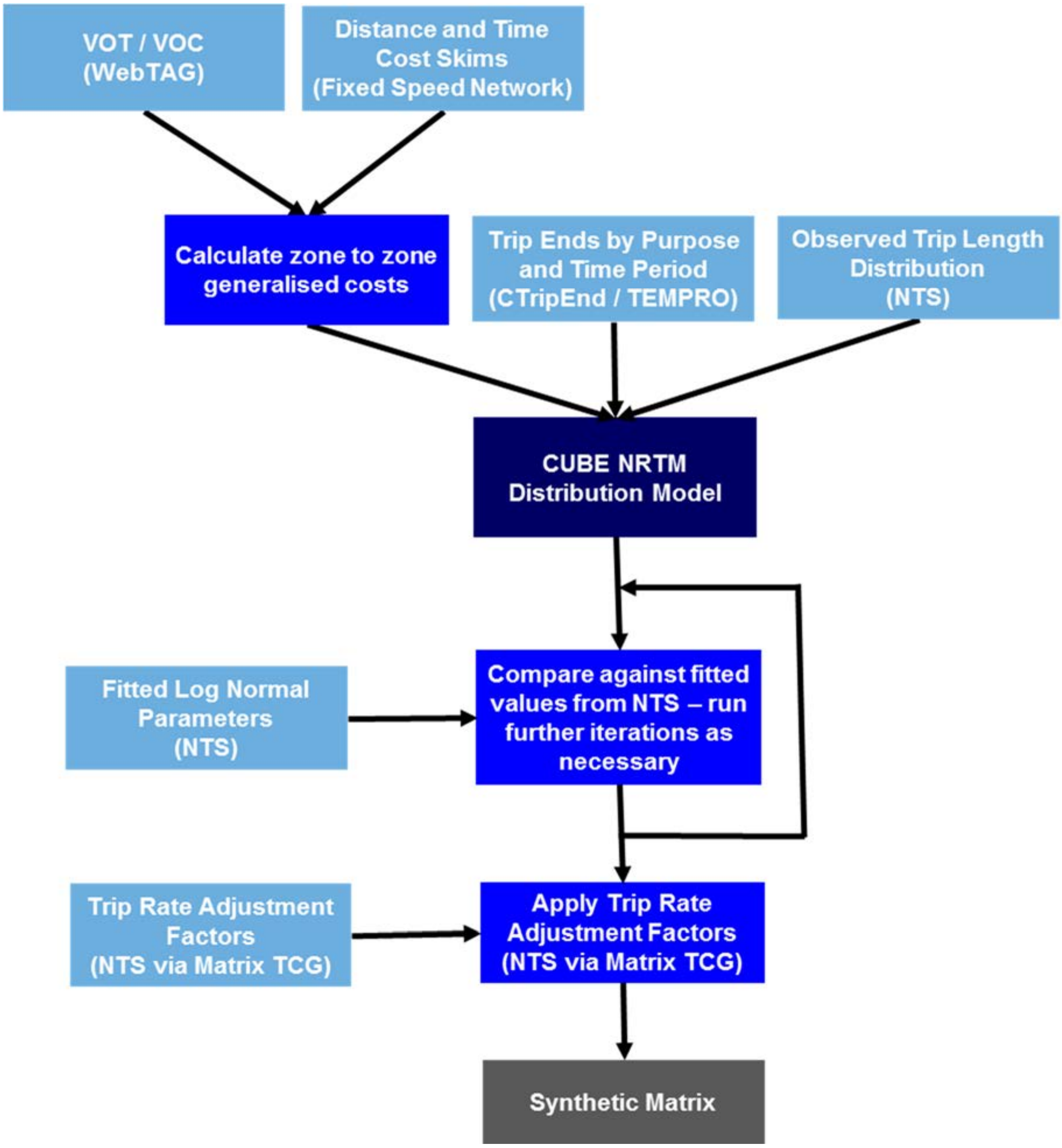
The observed distance profiles were derived from NTS using data from 2009 to 2012 as the most recent study years available. Only households within the NRM study area were considered to reflect local trip behaviour more accurately and these were split by purpose and time period.

When the synthetic matrices had been developed, investigations found that the trip rates were too high. CTripEnd 6.2 was last calibrated using NTS data up to 2006. However, recent NTS documentation has reported a high level national decline in trip rates. There was no scope to recalculate the trip rates for NRM; instead standard adjustment factors for all RTMs calculated by the Matrix TCG were applied to the developed synthetic matrices. These are listed in Table 6-1. The calculation process described is illustrated in Figure 6-6.

Table 6-1 Synthetic Matrix Trip Rate Adjustment Factors

Region	HB Work	HB EB	HB Other	NHB EB	NHB Other
East Midlands	0.75	0.8	0.94	0.66	1.05
East of England	0.73	0.88	0.85	0.66	0.93
London	0.46	0.47	0.61	0.29	0.53
North East	0.79	0.75	0.85	0.88	0.88
North West	0.74	0.75	0.87	0.59	0.94
Scotland	0.78	0.88	0.86	1.09	0.98
South East	0.69	0.91	0.89	0.61	0.99
South West	0.68	1.05	0.92	0.73	1.05
Wales	0.91	1.09	0.86	1.11	1.14
West Midlands	0.78	1.01	0.87	0.73	1.06
Yorks & Humber	0.74	0.98	0.92	0.88	0.99

Figure 6-6 Synthetic Matrix Development Methodology



This created the outbound matrices. For the home based purposes, the inbound matrices were generated by apply time period trip return probabilities calculated from NTS data.

A complete description of the synthetic matrix development including reporting of sector matrices and trip length distributions is included in TN22A 'Synthetic Matrix Development'.

6.7 Matrix Verification Process

A series of checks were undertaken to see how the MPOD data compared with other relevant sources of information such as Census Journey to Work data and Census population statistics, using the MPOD dataset received with rail trips retained. The verification checks described in this section are in line with the process that was agreed with the Technical Consistency Group in January 2016. The principles of this are included in *Appendix F: Consistent Approach towards Using Provisional Data*.

For these verification checks, public transport trips (rail and bus) were derived using Census Journey To Work data, and removed to leave car matrices. A global reduction factor of 17% was applied to Non-Home Based Trips to remove LGVs and HGV. These assumptions were made in advance of more detailed treatment of the user classes at later stages of the build process.

6.7.1 MPOD Data Received

Table 6-2 presents the number of trips recorded. Compared with the earlier rail trips removed dataset an additional four million trips were in the revised dataset with rail trips retained, although there are only approximately 15,000 additional trips in the North region.

Table 6-2 Number of Trips from MPOD Data

Start	End	Home Based Work Outbound	Home Based Work Inbound	Home Based Other Outbound	Home Based Other Inbound	Non Home Based	Total
Internal	**Internal**	**1,077,903.0**	**1,077,869.5**	**2,564,070.5**	**2,535,227.5**	**1,611,952.5**	**8,206,361.0**
Internal	Ext-North	4,429.5	6,992.0	9,319.0	10,076.5	18,734.5	33,283.5
Internal	Ext-South	28,169.5	21,770.5	50,667.5	39,766.5	65,643.5	140,136.0
Ext-North	Internal	7,220.0	4,266.5	11,814.0	7,862.0	18,576.5	34,129.0
Ext-North	Ext-North	1,705,220.5	1,685,053.0	4,030,651.0	3,966,810.0	2,939,365.5	14,326,276.5
Ext-North	Ext-South	1,406.5	1,340.0	9,036.0	8,994.0	19,868.0	36,128.5
Ext-South	Internal	22,868.0	26,416.5	47,822.5	43,135.5	68,523.0	143,111.5
Ext-South	Ext-North	1,400.0	1,275.0	10,494.0	8,177.0	21,421.5	37,675.0
Ext-South	Ext-South	18,564,010.5	17,892,510.0	39,746,097.5	39,148,041.0	28,175,309.0	143,516,733.0
Total		21,412,627.5	20,717,493.0	46,479,972.0	45,768,090.0	32,939,394.0	166,473,834.0

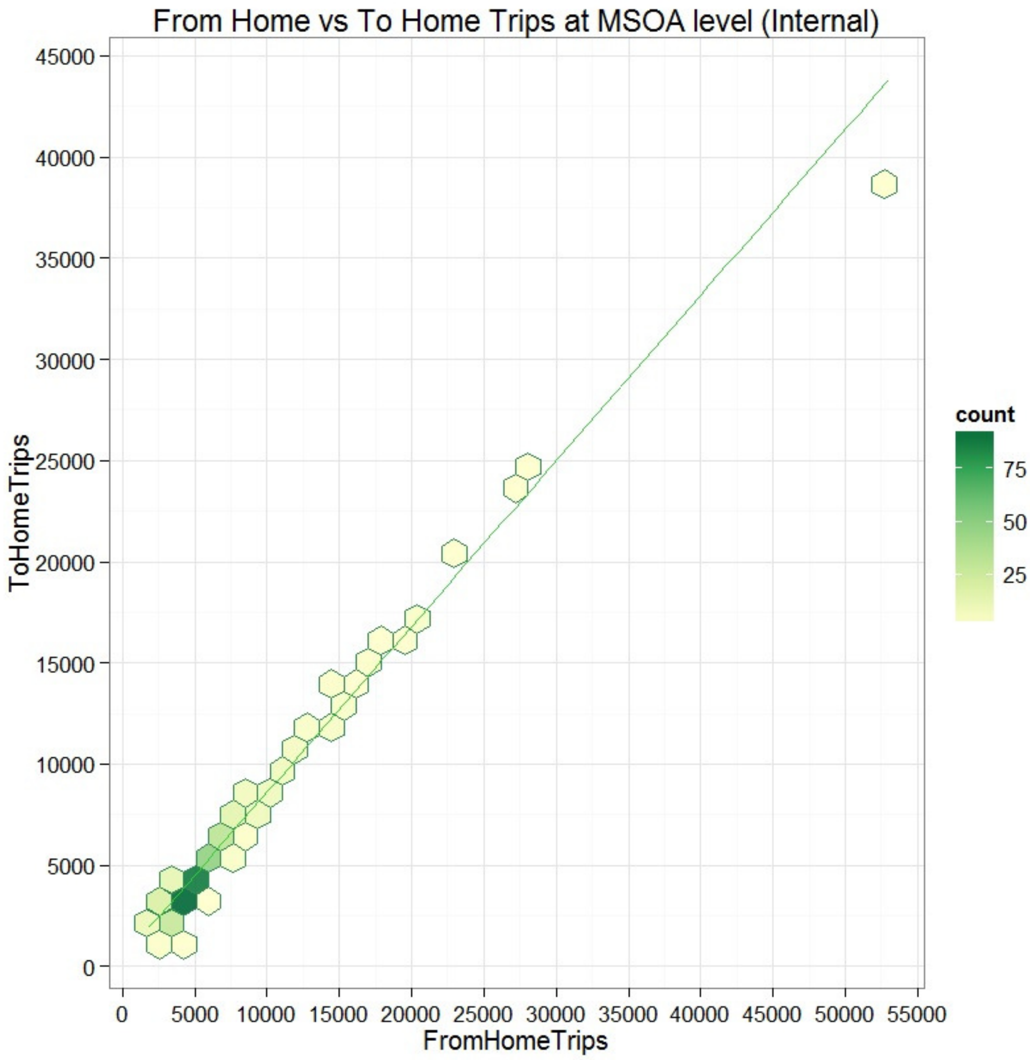
A set of Matrix verification checks were conducted and shared amongst the MTCG members salient outcomes are presented in the sections below.

6.7.2 Consistency of Data

The data were checked for internal consistency. For each MSOA, the total number of trips departing within 24 hours should approximately equal the total number of trips arriving in that same 24 hours.

The data show a high level of internal consistency (R squared = 0.978 at MSOA level and 0.997 at District level), with few outliers, as presented in Figure 6-7. This gave confidence that a coherent dataset had been received.

Figure 6-7 Number of Home to Home Trips at MOSA level



6.7.3 Trip End Checks

The number of trips in the Telefónica data departing and entering an individual MSOA were compared against 2011 Census population data. The origin of an outbound From Home trip can be compared to Census population for that MSOA, as can the destination of an inbound From Home trip. If there are large discrepancies between Census population and equivalent Telefónica data, the comparisons can be made at a more aggregated level.

At MSOA level there was weak correlation between Mobile Phone data and Census Population. The R squared for From Home Origins vs Population was 0.201, and R squared for To Home Destinations vs Population was 0.15 (for all purposes combined). For Home Based Work trips though, R squared was slightly higher for outbound trips (0.26) and lower for inbound trips (0.12). Correlation was higher at Local Authority District level (0.67 outbound and 0.68 inbound).

The trip rate pattern varied depending on land type (urban/rural). The level of correlation increased when looking at only urban MSOAs. The urban/rural classification is provided from 2011 Census data.

These figures provided relatively low correlation rates, even at greater levels of aggregation. There was no single explanation for this. Several probable reasons are indicated below

- Given the potential lack of Mobile Phone coverage in some of the rural locations in the North region, it may be more difficult for the MPOD data to accurately record trip movements in the rural locations. Trip rates were higher for rural locations than for urban, most likely because of higher car ownership and propensity to use.

- Certain rural locations can also contain large industrial sites, such as in Sellafield Nuclear site in Copeland. The trip rates for rural MSOAs was slightly higher than that for urban, but the R squared was greater for urban trips. The possible lack of coverage in rural areas of the North region, and the low R squared, suggest a potential reliability issue for data related to rural locations.

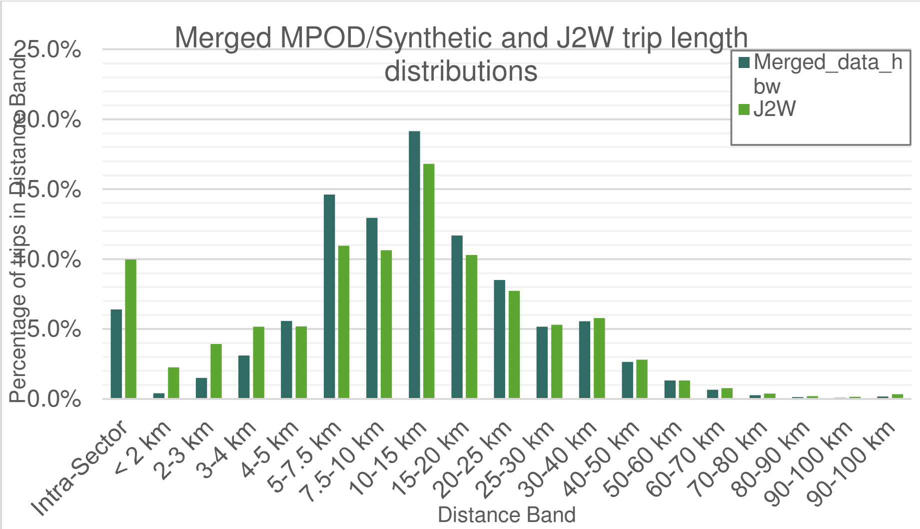
- Mast density and location in urban areas was also a possible explanation where phones (trips) are not necessarily registered to the most local cell on commencement of a trip because of geographical coverage or mast signal loading constraints.

6.7.4 Trip Length Distribution

The distribution of trips from the MPOD/Synthetic data were compared with Census Journey To Work (JTW) data and National Travel Survey (NTS) information. Data was disaggregated from MSOA to model zone in order to facilitate this comparison. Distance bands were allocated and the number of trips in each band were compared against the equivalent distance bands in Census Journey To Work and NTS data.

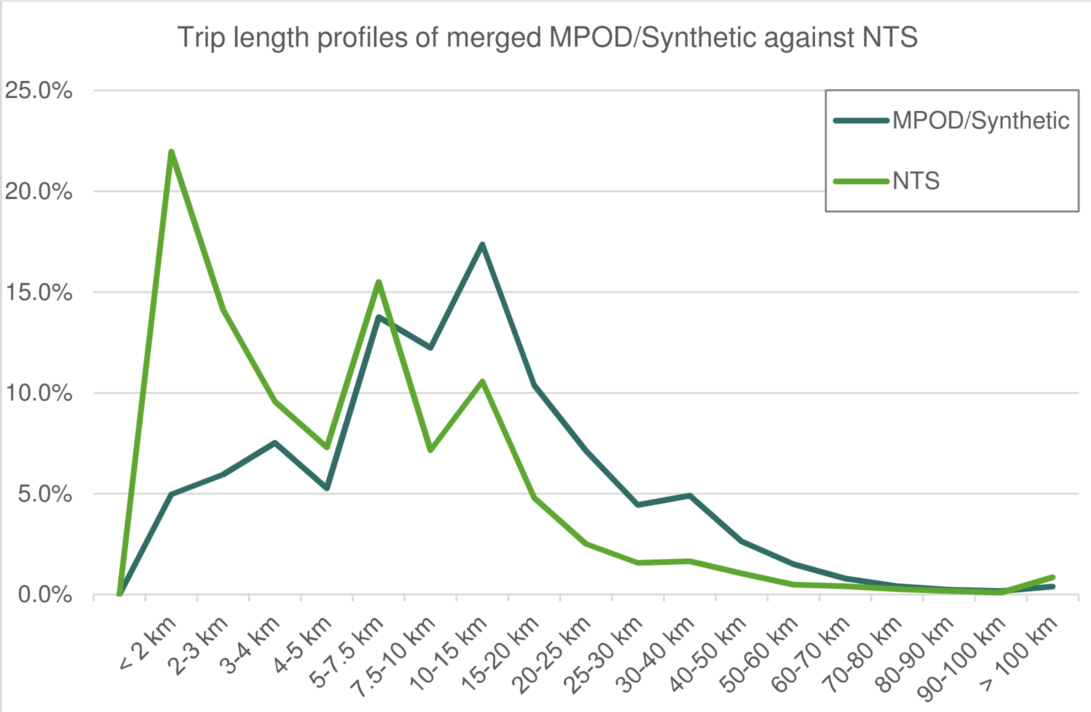
This process showed that the MPOD data had under detected short distance trips due to coverage limitations. This suggested a bias in MPOD data towards longer trips, up to 20km, albeit less of a bias than had been found in other RTM regions. For trips greater than 20km, the merged data broadly overlaps with JTW data. A comparison of trip length distributions of merged MPOD/synthetic and JTW data is shown in Figure 6-8.

Figure 6-8 Merged MPOD/Synthetic and J2W Trip Length Distributions



Merged MPOD/synthetic data were also compared with NTS data for each purpose. The NTS data are only available at County and Unitary Authority level, so no intra request sector trips can be identified from the NTS dataset. Therefore for the purpose of comparison with NTS, in the merged MPOD/synthetic dataset, intra-zone trips were redistributed. An assumption was made that intra zone trips could be between 2 and 5 km for urban Zone to Zone movements, and up to 20km for rural. Intra zone trips were evenly distributed amongst the corresponding bands depending on land type (urban/rural). Figure 6-9 illustrates trip length distributions for the merged data and the NTS data.

Figure 6-9 Merged MPOD/Synthetic and NTS Trip Length Distributions



NTS data contain more short distance trips than in the merged MPOD/synthetic data. This was consistent across purposes, but particularly so for home based work trips. This could indicate a bias towards longer trips in the merged dataset (indeed longer trips are more likely to be recorded due to the increased chance of an event being registered).

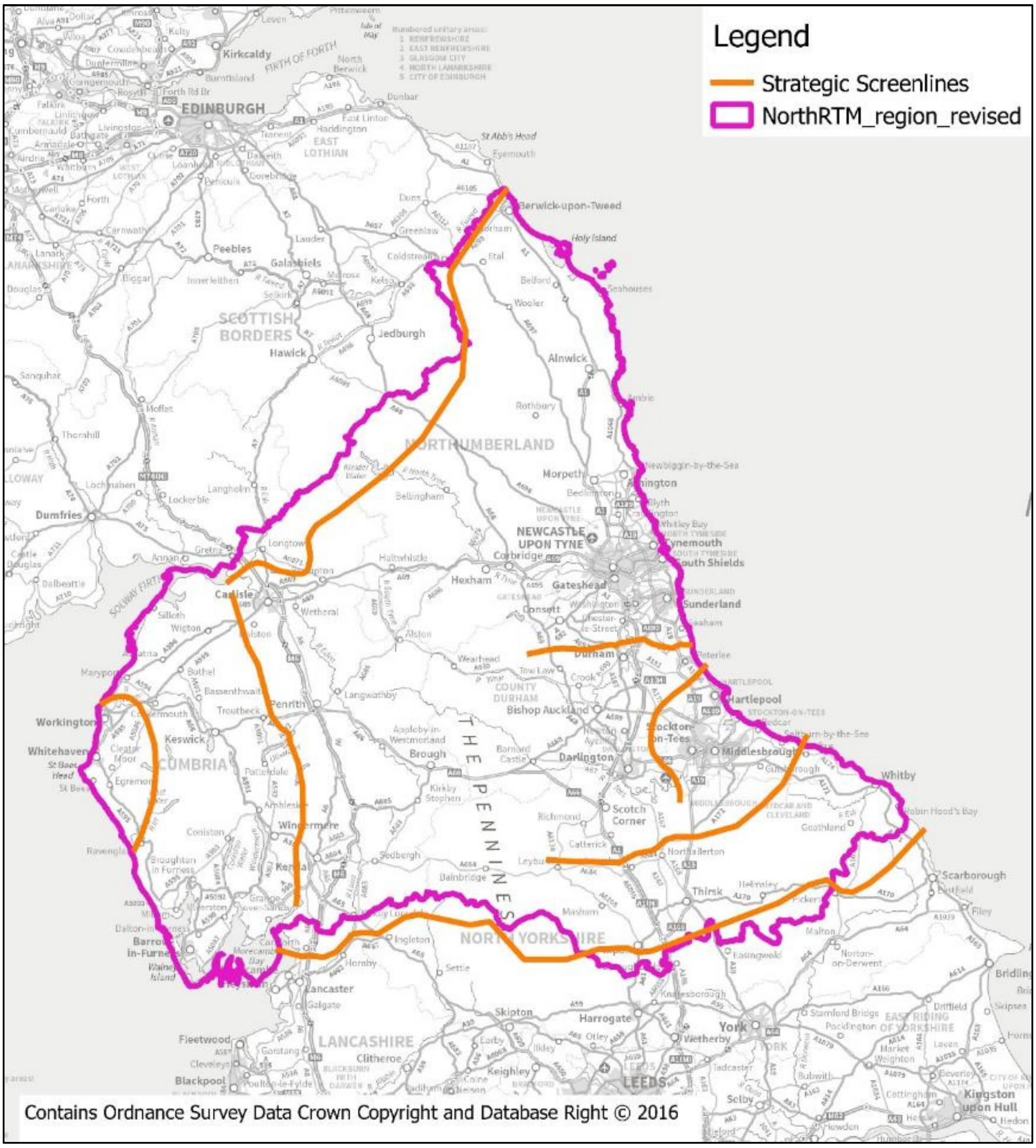
Later in the build process the trip length distributions would be refined to a more appropriate profile.

6.7.5 Results of Verification Assignment

The merged MPOD/Synthetic data were assigned to a fixed speed network to gain an overall picture of the data compared to observed counts. Total MPOD/Synthetic movements were compared with count data for screenlines in the North region. These screenlines cover broad sector to sector movements, some of which stretch across the full length or width of the region.

Whilst route choice was not fully enabled in the assignment, total daily modelled trips across long screenlines should be verifiable and comparable with counts. Figure 6-10 shows the locations of the screenlines used in this assignment test.

Figure 6-10 North Region Screenlines used in Assignment Test



The assignment revealed that, across the screenline totals, the modelled data were 35% higher than the counts with the Scottish Border screenline showing the worst performance. This is demonstrated in Table 6-3.

As mentioned previously, trip length distribution verification checks against Census Journey To Work and NTS data suggested a bias towards too many longer trips. The assignment results corroborated this finding.

Table 6-3 Modelled vs Observed Flows Across Long Screenlines

Screenline	Direction	Observed	Model	M/O	Percent
Durham to coast	Northbound	92,230	114,878	1.246	25%
	Southbound	92,289	112,246	1.216	22%
Teesside North&West	Inbound	54,836	68,430	1.248	25%
	Outbound	55,659	70,108	1.260	26%
Teesside South	Northbound	48,742	78,665	1.614	61%
	Southbound	49,624	80,544	1.623	62%
Lakes	Eastbound	36,119	45,518	1.260	26%
	Westbound	34,213	42,953	1.255	26%
West Lakes	Inbound	19,067	20,274	1.063	6%
	Outbound	19,700	22,974	1.166	17%
SUM internal screenlines		**502,479**	**656,590**	**1.307**	**31%**
Scottish Border	Northbound	28,114	49,731	1.769	77%
	Southbound	29,593	50,971	1.722	72%
TPS Border	Northbound	130,942	176,965	1.351	35%
	Southbound	132,941	178,502	1.343	34%
SUM total screenlines		**824,069**	**1,112,759**	**1.350**	**35%**

The results from the initial verification checks across all RTM areas led the Matrix Development TCG to investigate possible biases in data that would result in too much modelled traffic resultant from too many modelled trips. This is discussed in subsequent sections.

6.8 Prior Matrix Development

Overview

This section describes the detailed process of building prior matrices from the original Mobile Phone data. The process was agreed by the Matrix Development Technical Consistency Group. It follows from the data descriptions included in Section 6.5. The process built upon the results of the initial verification tests, leading to adjustments in the methods for removing non-car modes, and to adjustments relating to the total magnitude of trips.

Mobile Phone data were split into different modes, aggregated to time periods (from individual hours), and split into zone movements and purposes provided by the synthetic matrices. Note the Mobile Phone data were split into five categories, but the final prior matrices are split across eight purposes, as summarised in Table 6-4 below.

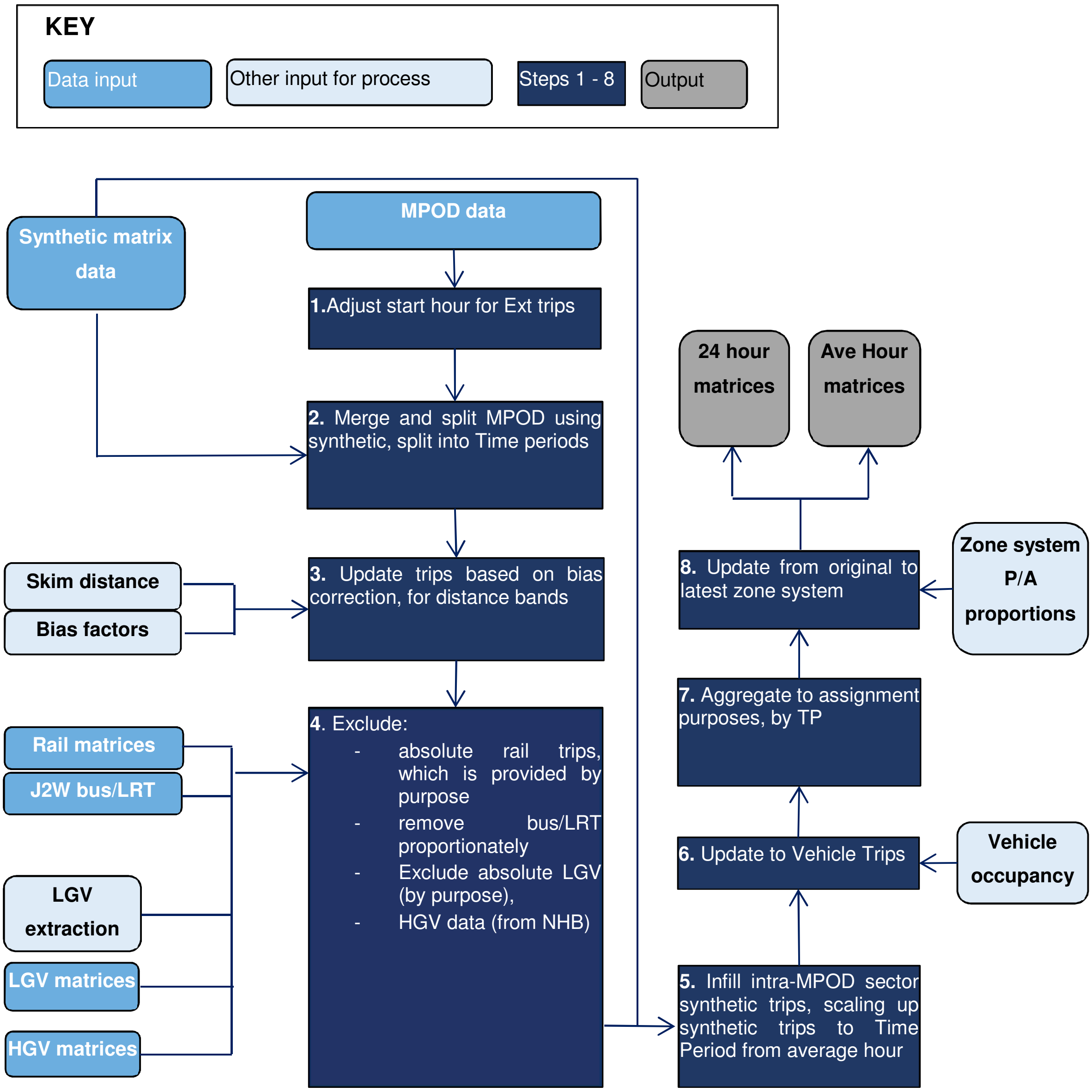
Table 6-4 Matrix Build and MPOD Data Trip Purpose

Matrix Purpose	MPOD Purpose Used
Home To Work	Home Based Work outbound
Work To Home	Home Based Work inbound
Home To Other	Home Based Other outbound
Other To Home	Home Based Other inbound
Home to Employers Business	Home Based Other outbound
Employers Business To Home	Home Based Other inbound
Non-home based Other	Non-Home Based
Non-home based Employers Business	Non-Home Based

Figure 6-11 illustrates the overall matrix building process, from the original MPOD data to the resulting assignment matrices. Each step is described below the flow-chart in detail. In the diagram, the dark blue boxes indicate the steps undertaken. The following steps were undertaken:

1. Adjust start time for trips that start outside the North region but which travel to the region, adding the time it takes to reach the region.
2. Split MPOD into Model Zones using synthetic matrices
3. Adjust for bias in expanding to total population
4. Remove non-car modes (rail, bus then LGV and HGV)
5. Infill with synthetic trips for short distances
6. Update from person to vehicle trips
7. Aggregate over direction and Home/Non-Home to form matrices that will be assigned to the network
8. Update to latest zone system in the model

Figure 6-11 Outline of Matrix Building Process

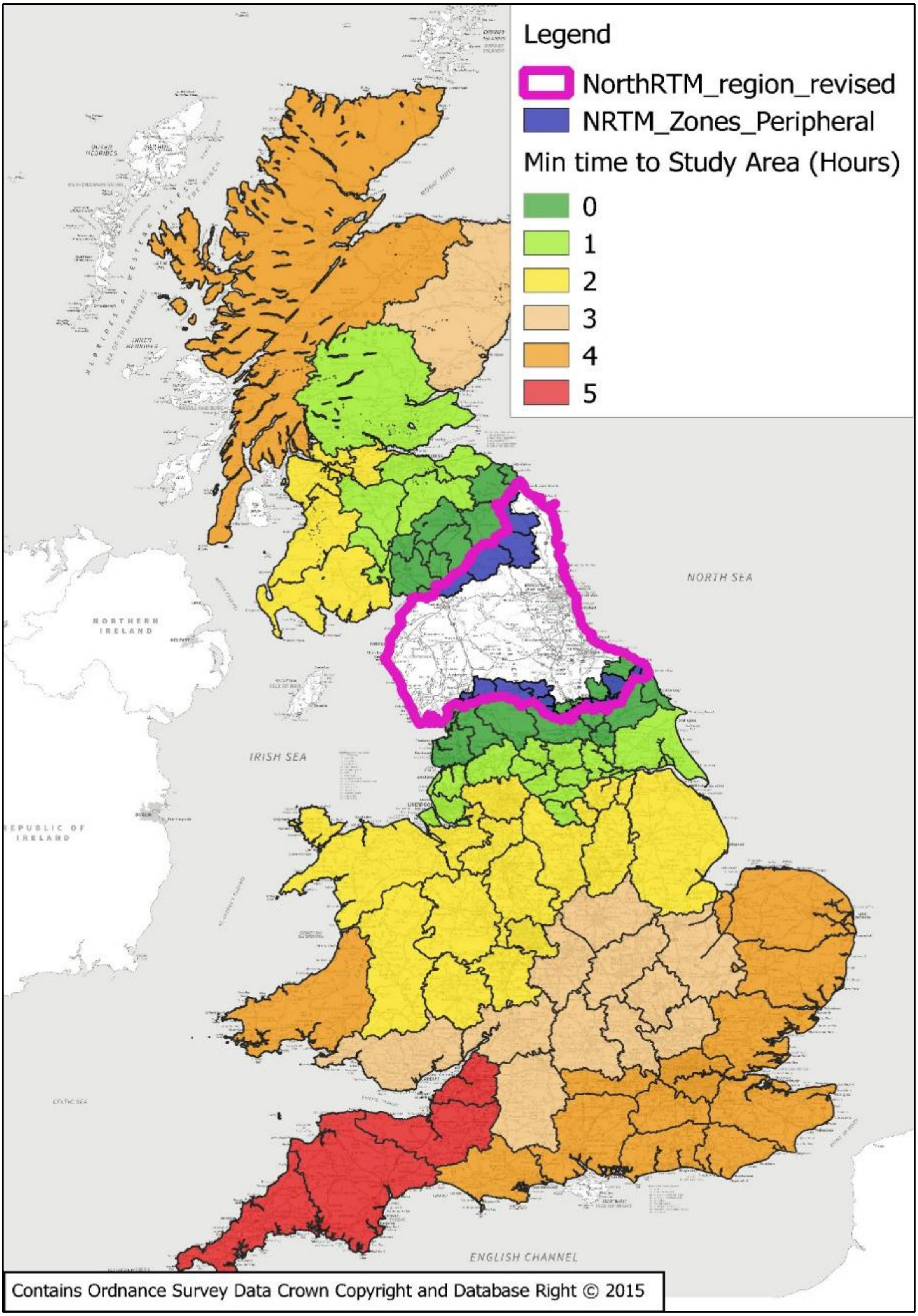


6.8.1 Step 1: Adjusting Start Hour

For trips commencing outside the North region, the start times of the trip were adjusted to take account of the time that that trip reaches the North region. This is because an assignment period is for an average hour, so a trip that takes longer than this to reach the North region would not be represented in any assignment period without adjusting the start time. An offset time (in hours) is required, to represent the time taken to travel from outside the North region to the North region itself. This was then added to the start hour.

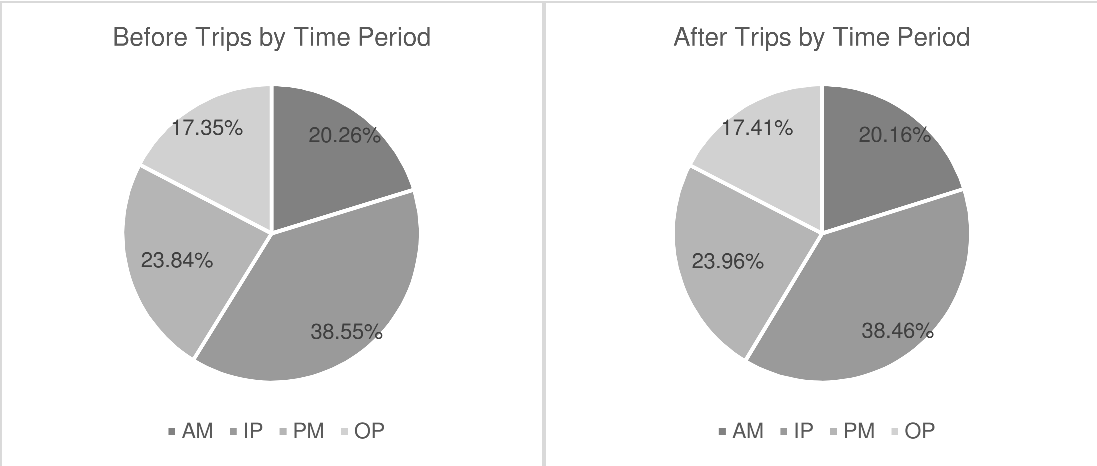
Figure 6-12 shows the offset time for trips from each Mobile Phone sector outside the North Region. Some Mobile Phone sectors straddle the North region boundary – the offset time from trips from these sectors (to reach the North region) is set to zero.

Figure 6-12 Minimum Time to Reach the North Region in the AM Period



Adjusting the start hour of the trips resulted in a change in the number of trips in each time period, and implicitly the trip purpose mix. There are now marginally more trips in the Off-peak and PM periods compared to before, and fewer in the AM and Inter-peak periods. These are highlighted in Figure 6-13 below.

Figure 6-13 Proportion of Trips After Adjusting the Start Hour



6.8.2 Step 2: Disaggregating MPOD Data into Model Zones and Segmenting Purpose

As described previously, MPOD data were collected at a bespoke Mobile Phone sector level based on MSOA. This was the most detailed spatial level available for the MPOD data, as an event could not be accurately assigned to a location any more precise than this. The MPOD trips with rail, bus/LRT, LGV and HGV removed were then split from Mobile Phone Sectors to Model Zones. Model Zones represented a more detailed breakdown of land and typically many Model Zones nested within a Mobile Phone sector. Splitting factors were therefore derived for the conversion of data from Mobile Phone sector to Model Zone.

Furthermore ‘Other’ and ‘Employer Business’ were required as separate purposes in the trip matrices. Both were subsumed within ‘Other’ in the MPOD data. Synthetic matrices are therefore also used to segment ‘Other’ MPOD trip into both ‘Other’ and ‘Employer Business’, taking the relative split of each of these purposes from the synthetic matrices at a zonal level.

6.8.3 Step 3: Applying Population Expansion Adjustment Factors

MPOD data provided by Telefónica was expanded from a sample of mobile phone users to the whole Great Britain population. Verification tests outlined earlier in the chapter suggest that there were biases in the data relating to the number of trip ends and the trip length distribution. Evidence suggested trip rates were lower amongst children and adults in lower income groups; expansion to the total population therefore resulted in an overestimation of total trip ends. Short trips were not always detected, and trips made by people with multiple devices (and therefore more likely to be in the Telefónica dataset) were typically longer, resulting in a bias towards longer trips.

It was agreed with the regions and with Highways England that adjustment factors should be applied to account for biases in trip making patterns resulting from a lack of detection of short trips and from expanding the MPOD data up to the whole Great Britain population. The adjustment factors presented in Table 6-5 were derived and adopted by each Region. The MPOD data were adjusted using these factors prior to excluding non-car modes

Table 6-5 - Bias Adjustment Factors Applied by Distance band

Distance Band (km)	Expansion Factor
0-5	1.034
5-10	0.898
10-15	0.864
15-20	0.846
20 – 30	0.832
30 – 40	0.819
40 – 50	0.811
50 – 100	0.801
100 – 300	0.789
300+	0.797

6.8.4 Step 4: Revised Trip Removal Process

After adjusting the MPOD trips to take account of bias (in the expansion to the whole population), freight and public transport trips needed to be extracted and removed from the MPOD trips in order to yield car matrices. Where possible, reliable alternative sources of data were used to build matrices for the other modes that were then removed from the MPOD data.

Rail matrices were derived using National Rail Travel Survey and MOIRA data and removed

Bus and light rail/underground/tram (referred to in this section as Bus) did not have separate matrices prepared and extracted from MPOD data. Census JTW data and NTS data were used to develop this and remove a proportion of trips implicit from the zonal mode share.

TrafficMaster Origin Destination data were used to provide LGV matrices, and these were scaled up to the fleet size based on count data in the region.

HGV data from the Base Year Freight Matrix (BYFM) were scaled from the provided year (2006) to 2015. Matrices were disaggregated from Local Authority to Model Zones.

In total the following number of trips were removed from each mode as presented in Table 6-6.

Table 6-6 Total Non-Car Trips Removed for all of Great Britain

Mode	Total Trips removed from NRM
Rail	3,083,314
Bus	28,759,648
LGV (vehicle trips)	7,890,504
HGV (vehicle trips)	1,440,340

6.8.5 Step 5: Infilling with Synthetic Data

Synthetic matrices have been developed to provide additional purpose segmentation to MPOD and to disaggregate MPOD from MSOA into Model Zones. Synthetic trips involve generating the likely number of trip productions from a given zone (based on data such as population statistics), and distributing them to appropriate zones based on a measure of cost (ostensibly distance from the origin).

In addition to segmentation/disaggregation, a number of MPOD trips were directly replaced by synthetic where there is greater confidence in the latter. As described earlier, in order for a trip to be present in the MPOD data, Mobile Phone events need to be generated from the trip. The longer a trip is, the more likely it is to generate an event. It is likely therefore that some short trips were not detected in the MPOD data. The trip length distribution of the MPOD data was compared to that of NTS to ascertain the extent to which short trips are missing.

The comparison indicated a cut-off point where the trip length distribution of MPOD matched that of NTS. Trips shorter than this cut-off point were removed and directly replaced by the number of synthetic trips, based on the skimmed distance between the Zones in the network. Trips longer than this were retained from MPOD, and the synthetic matrices were used to split the absolute number of MPOD trips into a Model Zone. The cut-off point derived for replacing MPOD trips with Synthetic trips are presented in Table 6-7.

Table 6-7 Cut-off Point (km) for Replacing MPOD with Synthetic Trips

	Urban	Rural
HBW	5	20
HBO	5	5
NHB	20	25

Intra-Mobile Phone sector trips were also replaced by synthetic trips, as it was assumed such a trip would not exceed the cut-off point identified in the table above. After infilling synthetic trips, approximately two thirds of the trips to and from the North region were from MPOD and one third from the Synthetic matrices, as shown in Table 6-8 below. This varied by purpose, with the highest percentage of Synthetic trips occurring for Non-Home Based trips (although Non-Home Based trips formed only a small proportion of the total trips).

Table 6-8 MPOD / Synthetic trip composition by purpose

Purpose	% MPOD	% Synthetic
HBW	72%	28%
HBO	70%	30%
HBEB	79%	21%
NHBO	18%	82%
NHBEB	57%	43%
All	**65%**	**35%**

6.8.6 Step 6: Updating to Vehicle Trips

MPOD and Synthetic matrices were produced at a person trip level. In order to assign these trips onto the model network, the matrices were converted to vehicle trips. An approach was agreed through the Matrix Technical Consistency Group. The group analysed occupancy by trip purpose, land type (urban/rural, with a separate category for London) and distance from NTS data, using a Poisson regression model. For each purpose / land type combination, occupancy varied by distance. However the variation by distance was only statistically significant for 'Other' trips.

For Commute and Employer Business trips a set of occupancy factors were adopted by each RTM, based on average occupancy from NTS. For 'Other' trips, occupancy was applied through the Poisson function based on distance, with separate parameters for urban/rural/London (the last of which only was applicable to SERTM). The function took the following form:

$$O = EXP(\alpha_i + \beta_i * D)$$

Where *O* is occupancy, *D* is distance (km) and α_i and β_i are parameters to be estimated, for purpose/land type combination *i* (e.g. Home Based Other urban).

Table 6-9 shows the occupancy factors adopted for HBW, Home Based Employer Business and Non-Home Based Employer Business trips, and the parameter estimates for Home Based Other and Non-Home Based Other trips.

Table 6-9 Occupancy Factors/Parameters Depending on Purpose

Purpose	Occupancy Factor	Occupancy Function Parameters	
		α	β
HBW	1.10		
HBEB	1.11		
NHBEB	1.18		
HBO urban		0.524	0.00113
HBO rural		0.482	0.00113
NHBO		0.418	0.00108

6.8.7 Step 7: Generating Assignment Matrices

The merged Mobile Phone data for the eight matrix purposes was aggregated into commute, other and employers business for the purposes of assignment, as summarised in Table 6-10 below. This was conducted for AM, IP and PM data respectively.

Table 6-10 Aggregation of Trip Purpose

Assignment Purpose	Matrix Purpose
Commute	Home Based Work outbound + Home Based Work inbound
Other	Home Based Other outbound + Home Based Other inbound + Non-Home Based Other
Employers Business	Home Based Employers Business outbound + Home Based Employers Business inbound + Non-Home Based Employers Business

6.8.8 Step 8: Update to Latest Zoning System

As focus had been placed on areas of increasing spatial detail throughout the model build, a number of changes to the model zoning system were made. Each time zone changes were made, trip matrices needed to be updated accordingly. Having undergone a lengthy process of bias correction, removal of non-car trips and disaggregation/segmentation from synthetic matrices, it was considered more practical to split trips between zones using bespoke splitting factors than to repeat the entire matrix development process. Splitting factors based on population, employment and land use were used to split resulting trip ends (origins and destinations) where a zone was split.

6.8.9 Prior Matrix Totals

Undertaking the steps described in this section yielded car matrices adjusted for known biases, for 24 hours. In total, there were approximately 100 million trips in the daily MPOD/Synthetic matrices after applying the agreed steps. This is approximately equal to the pure synthetic matrices constructed using NTEM inputs, which contains 99 million. However for trips in the North region itself, there were fewer trips in the MPOD/Synthetic matrices compared to the pure synthetic matrices, particularly for Home Based Other trips. The total daily trip ends by purpose, for GB as a whole and the North region are presented in Table 6-11.

Table 6-11 Total Daily Trip Ends by Purpose

Purpose	MPOD/Synthetic	NTEM Synthetic	% Dif
HBW Out	839,891	923,003	-10%
HBW In	854,725	865,784	-1%
HBO Out	887,008	1,390,009	-57%
HBO In	795,572	1,349,091	-70%
NHB	770,641	714,411	7%
All	**4,147,838**	**5,242,299**	**-26%**

Table 6-12 summarises the total number of trips by purpose at various stages of the Prior Matrix development.

Table 6-12 Total Daily Trips by Purpose

Stage	MPOD Purposes			Assignment Purposes		
	HBW	HBO	NHB	HBW	Other	EB
Provisional MPOD	42,130,121	92,248,062	32,939,394	42,130,121		
Synthetic				30,783,672	65,104,363	5,546,533
Disaggregated/ segmented MPOD				35,352,014	82,395,396	16,451,642
MPOD - Bias corrected				34,640,665	83,884,907	15,014,452
MPOD - Non-car removed				25,619,211	75,441,269	12,182,523
Prior Matrix Person Trips (post Synthetic infill)				34,123,418	47,858,930	6,384,024
Prior Matrix Vehicle Trips				29,487,656	38,959,906	8,372,361

6.9 *Prior Matrix Development – Stage 2 Adjustments*

The Initial bias adjustments were applied to account for how the MPOD data are expanded to GB population. However it was still perceived by the MTCG that biases remained in the data, resulting in too trips that were also biased towards longer distances. At the TCG forum it was agreed that a separate set of steps were required to address unquantified biases in the data relating to the number of trip ends and the trip length distributions. The target of further adjustments was to broadly establish the correct flow of traffic across the long strategic screenlines of each model region.

Two sets of adjustments were involved in Stage 2 – controlling to total NTEM trip ends at a Government Office Region (GOR) level, and adjusting trip length distribution to match NTS.

6.9.1 Step 1: Controlling Trip Ends to NTEM

It was agreed within the MTCG that NTEM represents a reliable indicator of total trip ends at a broad level. The trip ends in the merged MPOD/Synthetic data were controlled to NTEM at a modification of the Government Region (GOR) level. Since the North West and North Yorkshire regions straddle the North region, they were each split into two (Cumbria and North West outside North region, and North Yorkshire within/outside North region respectively); referred to as Modified Government Regions in this report. Cumbria for example is likely to have very different trip making patterns from the rest of the North West region, so it was considered appropriate to treat them separately when making adjustments to total trip ends. The number of trips and distribution of trips between Modified Government

Regions is aggregate enough to be reliably calculated using synthetic matrices; whilst some subtle aspects trip making patterns are not picked up by NTEM, this is not an issue at such an aggregate level. This process retains the distribution of trips (at an MSOA to MSOA level) within Modified Government regions from the MPOD data.

Compared to NTEM, the MPOD/Synthetic matrices had fewer trips within the North region, but more outside of it and crossing it, as shown in Table 6-13. For example, for movements within Cumbria, the MPOD/Synthetic matrices had 30% fewer trips than in NTEM.

Table 6-13 MPOD/Synthetic Post Stage 1 vs NTEM

Modified GOR	Cumbria	North-East	North-Yorks	Rest of England/Wales	Scotland
Cumbria	-30%	44%	-18%	55%	31%
North-East	44%	-28%	-55%	78%	-13%
North-Yorks	-15%	-48%	-8%	26%	91%
Rest of England/Wales	55%	78%	27%	7%	94%
Scotland	1%	-32%	78%	86%	2%

Adjustment factors were derived to match the MPOD/Synthetic trip totals to NTEM by time period and trip purpose (Home Based Work, Home Based Other and Non-Home Based), aggregated over direction.

After controlling to NTEM at the modified GOR, trip ends of the MPOD/Synthetic data closely matched NTEM for Great Britain as well as the North region, as shown in Table 6-14.

Table 6-14 Total Daily Trip Ends by Purpose Compared to NTEM

Purpose	GB			North Region		
	MPOD/ Synthetic	NTEM Synthetic	% Dif	MPOD/ Synthetic	NTEM Synthetic	% Dif
HBW Out	17,964,670	16,775,811	7%	953,278	923,009	3%
HBW In	14,854,982	15,523,073	-4%	833,216	865,790	-4%
HBO Out	27,696,227	27,118,594	2%	1,409,395	1,390,014	1%
HBO In	25,743,878	26,121,087	-1%	1,292,945	1,349,097	-4%
NHB	14,301,071	14,265,332	0%	716,973	714,417	0%
All	**100,560,828**	**99,803,897**	**1%**	**5,205,806**	**5,242,327**	**-1%**

6.9.2 Step 2: Adjusting Trip Length Distribution to NTS

After applying adjustments to trip ends, there was still a bias towards longer trip lengths compared to NTS for the North region. The extent of the bias varied by purpose and land type (urban/rural), with the most marked trip length bias occurring for Non-Home Based trips. This resulted in too much traffic across the network, as the bias towards longer trip length means more vehicles reach the Strategic Road Network. The perceived bias towards longer trip lengths is thought likely to be due to the difficulty of detecting short MPOD trips.

Table 6-15 indicates the differences in mean trip length between the MPOD/Synthetic matrices and NTS after Stage 2 trip end adjustments.

Table 6-15 Trip Length Distribution Against NTS Post Stage 2 Trip End Adjustments

Purpose	Urban		Rural	
	MPOD/Synthetic	NTS	MPOD/Synthetic	NTS
HBW	15.4	11.7	16.5	17.3
HBO	13.8	11.1	22.6	17.9
NHB	17.1	12.3	24.4	17.3

Adjustment factors were calculated to address biases in trip length (Table 6-16). Trips were grouped into a number of distance bands, split by purpose and land type. Each distance band was based on a suitable number of observations of NTS trips, ideally at least 300 in each category. The target of 300 NTS sample points was achieved in all but the over 50km group for Home Based Work and Non-Home Based.

Table 6-16 Trip Length Distribution Adjustment Factors

Distance (km)	Urban			Rural		
	HBW	HBO	NHB	HBW	HBO	NHB
<5	1.94	2.45	3.16	0.80	2.15	7.56
5-10	0.72	0.58	0.90	1.66	2.08	1.67
10-25	0.78	0.61	0.61	0.98	0.70	0.68
25-50	0.78	0.61	0.55	0.83	0.45	0.64
50+	0.57	0.67	0.37	1.42	0.67	0.36

Following application of the adjustment factors a mean trip length distribution was achieved that more closely matched NTS, as shown in Table 6-17.

Table 6-17 Trip Length Distribution Against NTS Post Stage 2 Trip Length Distribution Adjustments

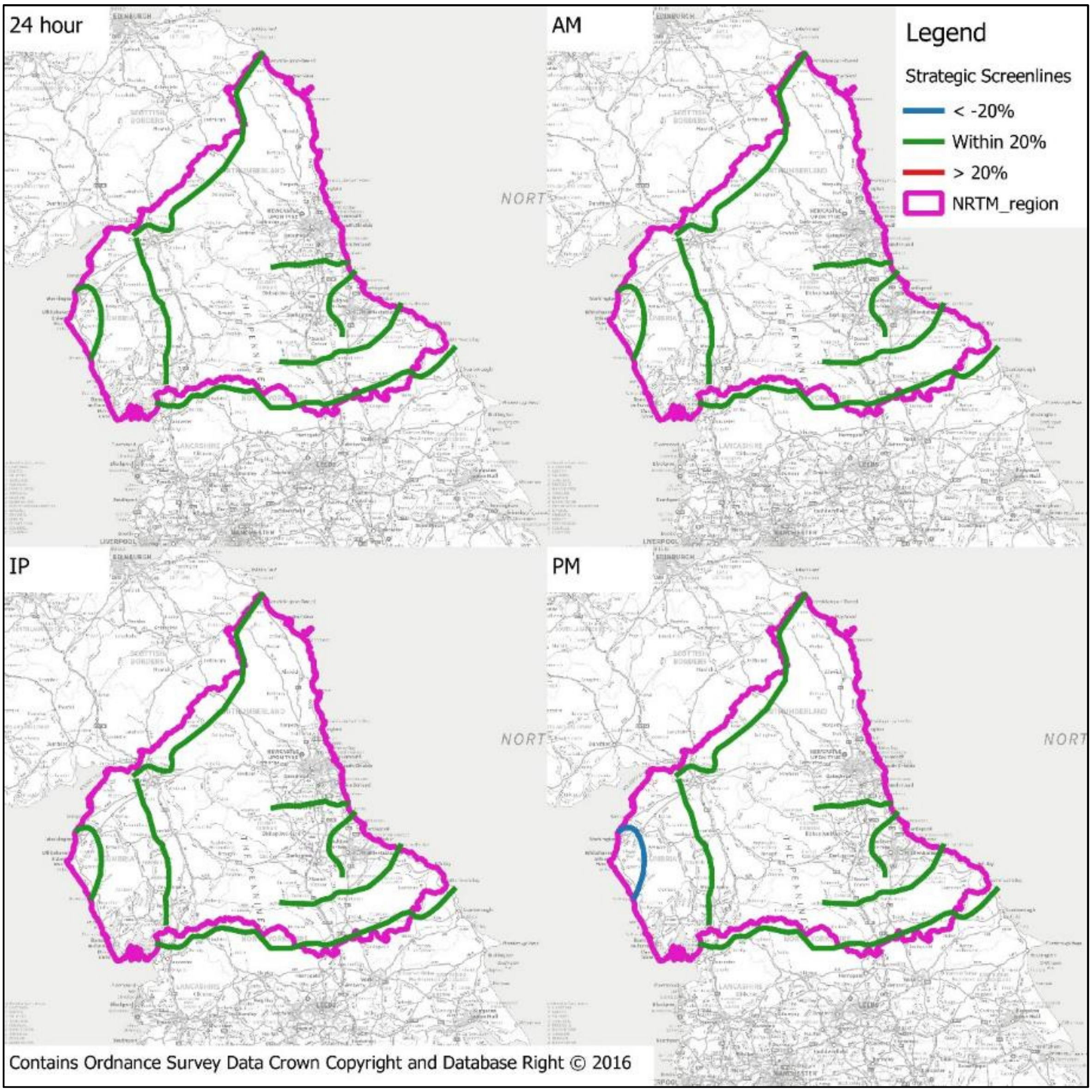
Purpose	Urban		Rural	
	MPOD/Synthetic	NTS	MPOD/Synthetic	NTS
HBW	12.0	11.7	16.4	17.3
HBO	12.0	11.1	18.2	17.9
NHB	11.7	12.3	19.6	17.3

6.9.3 Results of Stage 2 Adjustments

These further adjustments helped to correct for the right amount of traffic for long screenlines, particularly for boundary screenlines and East/West screenlines that carry traffic into, out of and through the Study Area (trips from Manchester to Newcastle or Manchester to Edinburgh for example). The adjustments were less effective for screenlines that carry purely internal trips, say from Cumbria to Newcastle.

Following the Stage 2 adjustments, the total volume of modelled traffic across the network broadly matched the observed flows. Figure 6-14 shows the total modelled flows vs the observed flows across the strategic 'long' screenlines, for 24 hour and AM, IP and PM periods. It shows that the modelled flows are generally within 20% of the observed flows across all screenlines.

Figure 6-14 Modelled vs Observed Flows Across Strategic Screenlines



Directionality biases (for daily flows) and inter regional flow volumes have also been reconciled between regional models. The former requires outturn directional biases not to exceed those originally supplied by the original MPOD data. The latter require models inter regional calibrated flows to be sufficiently close to each other to ensure communality of traffic patterns. It was agreed with the MTCG that consistency should be achieved between RTMs in inter-regional trips before local adjustments were made through Stage 3.

6.10 Inter-Regional Reconciliation

Following stage 2 adjustments consistency was achieved in GOR-GOR flows with other RTMs. Table 6-18 summarises trips between GORs in each RTM. Since the borders of North West, North East and Yorkshire and the Humber GORs do not coincide with NRM and TPSRM regions, these three GORs are aggregated for reporting purposes. The 'target' flows are the average of regions that have been in a suitable position to calibrate the movement (e.g. for South-East to South-West movements, the 'target' would comprise the average from the SWRM and SERM). Values in grey text are excluded from the average for the 'target' flows.

Table 6-18 Total Daily Trips Between GORs from NRM compared to other RTMs (Northern GORs aggregated)

	RTM:						
GOR / Sector	SE	SW	Mid	TPS	North	Target	North Target Dif
North-North	16,340,598	16,340,877	16,340,876	16,184,513	16,674,878	**16,429,695**	1%
Mid-Mid	11,961,011	11,961,135	12,041,826	11,959,262	12,529,313	**12,041,826**	4%
SE-SE	21,642,085	21,626,518	21,641,753	21,641,781	22,537,809	**21,642,085**	4%
SW-SW	6,758,823	6,757,623	6,758,627	6,758,742	7,068,953	**6,757,623**	5%
Midlands - North	474,602	474,597	466,470	471,227	464,908	**467,535**	-1%
SE - North	38,546	38,610	38,999	44,010	42,313	**41,623**	2%
SW-North	9,620	9,376	10,005	9,590	10,272	**9,746**	5%
Midlands - SW	108,925	105,447	97,877	108,914	106,531	**101,662**	5%
Midlands - SE	393,133	400,176	353,386	400,542	389,273	**373,259**	4%
SE - SW	244,398	264,718	254,195	254,186	266,435	**254,558**	5%
North - Wales	143,405	143,462	143,660	134,245	156,070	**145,157**	8%
Mid - Wales	70,063	70,210	60,152	70,042	62,347	**60,152**	4%
SW - Wales	67,811	67,415	67,870	67,810	70,599	**67,415**	5%
SE - Wales	12,991	12,912	12,894	12,887	13,576	**12,991**	5%
North - Scotland	43,405	43,404	43,404	44,903	39,229	**42,066**	-7%
Mid - Scotland	4,404	4,404	4,670	4,400	4,371	**4,670**	-6%
SW - Scotland	746	740	766	746	709	**740**	-4%
SE - Scotland	5,052	5,006	5,027	5,011	4,776	**5,052**	-5%

Criteria for target symmetry were agreed and applied to relevant GOR-GOR movements for each RTM. Where reasonable symmetry existed in the provisional Telefónica data, vehicle trips were expected to vary by less than 10% or 1000 absolute trips by direction. Symmetry by direction was achieved for each GOR-GOR movement within, to and from the North region.

Table 6-19 Symmetry between GORs within, to and from the North Region

GOR / Sector	North East	North West	Yorkshire and The Humber	East Midlands	West Midlands	East of England	London	South East	South West	Scotland	Wales
North East		3%	-4%	15%	12%	5%	14%	16%	13%	-4%	12%
North West			0%	2%	2%	0%	-14%	0%	-8%	4%	1%
Yorkshire and The Humber				2%	2%	-1%	-12%	3%	-2%	2%	-2%
East Midlands					-1%	-2%	-25%	-3%	-8%	-8%	-4%
West Midlands						-1%	-21%	-6%	-2%	-12%	2%
East of England							-8%	-2%	-7%	-6%	-1%
London								7%	20%	-18%	17%
South East									5%	-14%	4%
South West										-21%	6%
Scotland											16%
Wales											

6.11 *Prior Matrix Development – Stage 3 Adjustments*

A final set of adjustments were required to reconcile the boundary screenlines flows to within 5% of counts.

Adjustments were made at Local-Authority level within the Study Area (and aggregations thereof externally), whilst GOR distribution of trips were constrained to ensure national consistency is retained with other RTM teams. Trips between Longtown (immediately north of the northern boundary screenline but within England) and Carlisle were analysed to ensure the proportion of local and long distance trips was retained. Boundary screenline counts within 5% of counts were achieved through these adjustments. Table 6-20 summarises screenline performance (modelled flows / observed counts) post Stage 3 adjustments.

Table 6-20 Long screenline performance post Stage 3 adjustments

Screenline	Direction	Mod/Obs AM	IP	PM
Durham to Coast	Northbound	-2%	6%	-6%
	Southbound	-10%	4%	-2%
Teesside North&West	Inbound	8%	12%	4%
	Outbound	11%	14%	7%
Teesside South	Northbound	0%	4%	8%
	Southbound	2%	-2%	-5%
Lakes	Eastbound	38%	37%	11%
	Westbound	17%	25%	26%
West Lakes	Inbound	-9%	-16%	-23%
	Outbound	-16%	-14%	-12%
Scottish Border	Northbound	1%	1%	-1%
	Southbound	2%	-1%	-3%
TPS Border	Northbound	5%	-2%	1%
	Southbound	3%	-4%	0%

Whilst not every screenline was limited to 5% difference those presenting greater disparity were considered suitable for further calibration adjustment at a more detailed level. The outcome of these adjustments provided an appropriate local highway trip matrix suitable for ongoing calibration work which was also consistent at a Regional and National level.

6.12 Summary

Mobile Phone Origin Destination data have been used by Mouchel to build prior matrices for the North region of Highways England's regional models. A number of limitations with the data have led to these being supplemented with synthetic matrices, such as for short trips where there is a lack of detection of trips in the mobile Phone data. A number of other data sources have also been used, including 2011 Census Journey To Work Data.

Verification of the data against independent sources (such as National Travel Survey data) has been conducted throughout the process. An agreed set of steps has been outlined by the regions through the Matrix Development Technical Consistency Group, and adhered to by Mouchel in building the prior matrices in the North regions. A series of adjustments have been made to the data based on results of verifications tests, including adjustments to trip length due to a bias towards longer trips in the Mobile Phone data. Controlling total trip ends and trip length distribution by purpose to NTS at an aggregate level (essentially Government Official Region with a modification to reflect trip making patterns in and adjacent to the North region) results in a total volume of traffic that satisfies target criteria outlined by the Technical Consistency Group.

7 Highway Model Calibration

7.1 Calibration and Validation Process

This chapter outlines the calibration process undertaken for the NRM base year models. Standard techniques and best practice from TAG have been used to employ data from three of the workstreams to produce the calibrated base year highway models and validate these against existing data sources.

The calibration and validation process involved three sources of information.

- Traffic count ATC and journey time data collated and processed in accordance to the methodology set out in Chapter 4;
- Initial SATURN networks for each time period (AM peak, inter peak and PM peak) developed in accordance to the methodology set out in Chapter 5; and
- Initial trip matrices for each time period (AM peak, inter peak and PM peak) developed in accordance to the methodology set out in Chapter 6

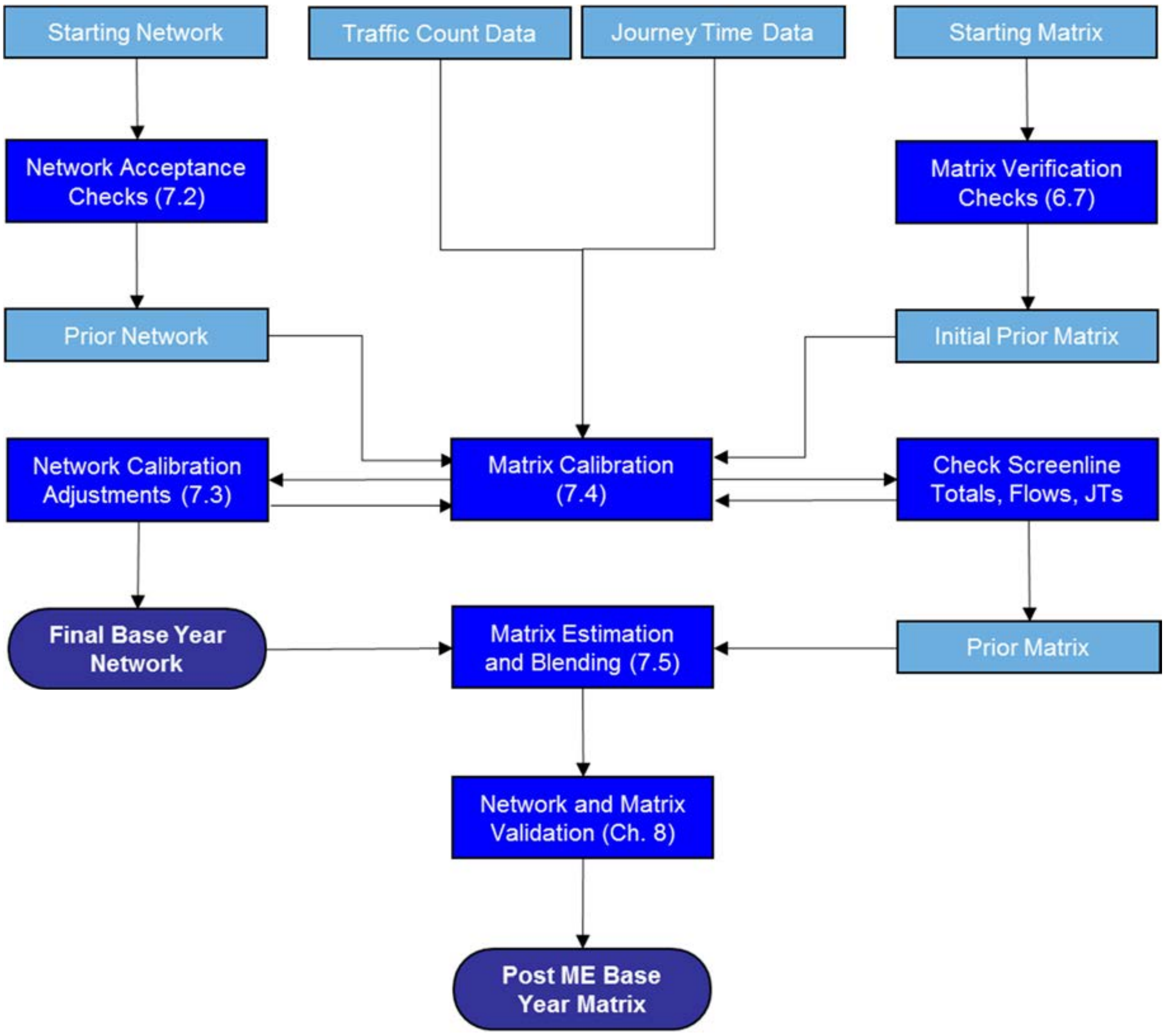
The process for calibrating the base year highway models is described in this chapter, including details of:

- Network calibration and checking;
- Local adjustments for matrix calibration;
- Prior matrix assignment reporting;
- The methodology for an application of matrix estimation within SATURN; and
- The impacts of matrix estimation against TAG criteria.

The highway model validation is covered in Chapter 8.

An outline of the calibration and validation process is presented in Figure 7-1.

Figure 7-1 Calibration and Validation Process



7.2 *Network Calibration – Acceptance Tests*

The initial networks originated from the SATURN buffer network for the ITN layer which was supplied to each RTM team alongside the RTM Coding Manual to assure consistency between the different regions.

Quality and calibration checks have been carried out on the networks, in line with the Network TCG guidance, on completion of network coding and are designed to assess the network suitability before moving into full calibration tasks. The rationale for the tests has been described previously in Section 3.3.

Detailed reporting of these checks can be found in *Appendix E: Network Acceptance Checks* including tabulations and P1X outputs.

The summary results are presented below.

7.2.1 Test 1: Completeness Check

The network was complete to the specification agreed in the MSR for the study area. All roads within the study area had been coded in the simulation network and roads outside the study area had been coded as buffer network.

7.2.2 Test 2: SATURN Compilation Check

There were 4,531 *total warnings* produced by SATNET – these broke down into 1,510 *warnings*, 3,020 *serious warnings* and 1 *non-fatal error (NAFF)*. These were reviewed and adjusted if necessary.

There was no action required for the NAFF error – *"Number of possible U-turns at external simulation nodes exceeds number allowed for checking in SATALL".*

7.2.3 Test 3: Inspection of Key Junctions

Junction coding was based on Google Maps for junction type and junction layout characteristics for simulation nodes to the specifications set out in the RTM Network Coding Manual. For signalised junctions, signal timings were obtained were possible from Local Authorities or donor models.

The following checks were completed:

- All junctions had the correct definitions;
- All junctions had consistent and appropriate representations based on the available data sources;
- Signalised junctions had correct timings based on the data available;
- Times to circle roundabouts were consistent and appropriate based on the data available; and
- Right turn on major arm definitions for priority junctions were applied consistently.

7.2.4 Test 4: Network Routeing

A set of 15 key strategic places for NRM were identified and used as a basis to test 12 strategic route options. These included:

- Strategic routes within the study area – for example Middlesbrough to Newcastle and Sunderland to Barrow;
- Strategic routes into/out of the study area – for example Manchester to Newcastle and Preston to Newcastle; and
- Strategic trips through the NRM study area – e.g. London to Glasgow and Birmingham to Edinburgh.

All of the routes appeared plausible with traffic using the SRN and taking the most obvious route in all cases.

7.2.5 Test 5: Link Consistency Tests

It was verified against the agreed acceptance criteria that:

- There was no change in link type between directions unless there is a specific justification such as a difference in speed limit or number of lanes;
- Dual carriageways had the same link type in both directions except where indicated by a difference such as speed limit or number of lanes; and
- The change in link type was consistent providing changes in speed limit when moving between urban and rural areas.

The percentage difference between the coded links lengths from SATURN and the crow-fly distances were checked for consistency.

7.2.6 Test 6: Flat Matrix Assignment Test

The flat matrix assignment was checked against various measures:

- Routing between OD pairs (using a subset of those pairs from Test 4) appeared plausible with traffic using the SRN and taking the most obvious route in all cases;
- Bandwidths plots for actual flow showed a correct magnitude of difference between traffic on the strategic links and the minor roads; and
- Node delay plots for Tyne and Wear and Teesside showed delay occurring at expected locations on key links in and around the city centres.

7.3 Network Calibration – Local Adjustments

As part of the calibration process, preliminary assignments were carried out using different iterations of the trip matrices to assist with debugging the networks. This needed to be carried out prior to running matrix estimation to prevent the matrix calibration from causing issues through compensating for network errors.

7.3.1 Delays and Flows

A series of network checks were undertaken as part of the calibration including

- Capacities versus observed counts;
- Modelled delays versus observed delays; and
- Modelled flows versus observed flows.

Where issues with the initial networks were identified, the parameters defining the capacity of movements were reviewed. The loading of zone connectors were reviewed and refined accordingly to represent more accurate loading of the traffic on to the network and to avoid issues with delays at major junctions due to loading directly to junctions.

It was agreed by the Network TCG that there may be requirements to deviate from the RTM Coding Manual for specific local issues. Such adjustments were only made where modelled delays or modelled flows were unacceptably lower than the observed delays or observed flows respectively.

7.3.2 Signalised Junctions

A varied range of source data was used to code signalised junctions. The primary source of data was signal survey specifications from local authorities. However, these plans will only provide the maximum / minimum green times. For urban areas in particular, traffic signals will use operations such as SCOOT or MOVA to optimise the timings to reflect the live traffic conditions. A limitation of SATURN is that it can only operate with fixed signal timings. Where signal timing data was not available, template coding has been used.

The initial assignments were reviewed to check that the levels of delay at signalised nodes was reasonable and to find the worst converged nodes. For the problem areas, local signal optimisation was used as a proxy to represent varying signal timings under maximum / minimum green times. However, before being adopted into the networks the outturn timings were examined to assure the outturn was sensible for that particular junction and the hierarchy of routes into it.

7.4 Matrix Calibration – Local Adjustments

7.4.1 Requirements for Local Adjustments

The initial prior matrices had been developed for the base year using the methodology described throughout Chapter 6. In summary, they were developed using MPOD data with short distance trips infilled from synthetic matrices and then constrained at a high level to two independent sets, NTEM and NTS, which was referred to as Stage 2 in Chapter 6. The regional reconciliation factors were applied and the outturn was that all model boundary screenlines had been resolved to within 5% of the observed counts.

The purpose of this process was to generate an strategic prior matrix whereby all or nearly of the long screenlines were within 10% of the observed counts. However, the high level adjustments applied at Stage 2 overlooked the local details which necessitated further adjustments as part of the matrix calibration process.

Note that for the purposes of these calibration steps, any trips to/from external zones were frozen, with the boundaries having already been reconciled.

7.4.2 Inter-urban Screenlines

Adjustments were made across long inter-urban screenlines at local authority level for purely internal trips. At stage 2, the trip rates were controlled to NTEM at Government Region level. However, this overlooks the local detail within those large reporting areas.

The major Government Region in the NRM study area is the North East. This encompasses a large area including metropolitan Tyne and Wear, urban Teesside and the rural counties Northumberland and County Durham. Whilst the strategic matrix was improved by controlling the trip rates for the North East as a whole, there was a requirement to adjust the internal matrix to account for the variation in trip rates for those different areas within the North East.

Further, the trip length constraints during stage 2 were applied using the observed trip length distribution for the study area, separately for urban and rural areas. At the local level, this overlooks factors such as urban density, proximity to employment areas and differing access to public transport for local trips (e.g. Metrolink across Tyne and Wear) which may impact the short distance trip length profile.

The outturn of this was that the target inter-urban screenlines were resolved to within 5% of the observed counts with the exception of the Cumbrian eastern boundary (Screenline 18). Investigation of this screenline showed higher modelled flow along one link with poor count confidence to be the causation.

7.4.3 Short Screenlines and Cordons

Following the inter-urban screenline calibration, the trip matrix was adjusted at a very local level for movements within the major urban conurbations:

- inter-Tyne and Wear;
- inter-Teesside; and
- inter-Cumbria.

This was due to three key issues which had been identified with trip allocation for adjacent and inter-Local Authority District trips.

The modelled flow over the River Tyne was far in excess of the observed counts whereas the Newcastle cordon was low against the observed counts. Consideration of trip rates, land use indicators and SLA in SATURN suggested misallocation of trips in the MPOD data between Newcastle/Gateshead and North/South Tyneside across the River Tyne. This was consistent with other RTM regions which also identified issues of trip allocation within MPOD data around estuaries and rivers.

Aside from the estuary issue, there were further unknowns around the quality of the MPOD data for areas with a higher density of MOSAs due to stochastic rounding. This was evidenced by trip rate analysis at a zonal level.

Also, localised issues or distributions cannot be replicated easily within synthetic matrices, especially for such a large area and with no use of K factors. For example, the Metro Centre is a major attractor and will have a wider catchment area than other shopping areas. The shift start time for Sellafield begins outside of the modelled AM peak period however this specific detail is not captured using CTripEnd.

These adjustments were only undertaken were there was evidence to suggest localised issues with trip rates and/or trip distribution. Inter-County Durham was not considered for this reason since the inter-urban adjustments had led to a satisfactory outcome for the prior matrix.

The outturn was that all screenlines were resolved to within 10% of observed counts with the exception of the Cumbria eastern boundary (Screenline 18) in specific cases and the Carlisle cordon inbound in the AM (Screenline 20).

These were the prior matrices for matrix estimation. The summary assignment results are presented in Table 7-1 and Table 7-2.

Table 7-1 Prior Matrix Screenline Validation

Performance Measure	AM Peak	Inter-Peak	PM Peak
All screenlines or cordons within 5% of observed flows	81%	65%	77%
All screenlines or cordons within 10% of observed flows	96%	92%	94%

Table 7-2 Link Flow Validation Summary – Prior Matrices

Performance Measure	AM Peak	Inter Peak	PM Peak
All NRM Links			
- within GEH of 5.0	66%	67%	68%
- within GEH of 7.5	81%	81%	80%
- pass cal/val guidance link criterion	88%	87%	87%
By Calibration/Validation			
Calibration Counts (777)			
- within GEH of 5.0	65%	66%	66%
- within GEH of 7.5	81%	81%	80%
- pass cal/val guidance link criterion	88%	89%	87%
Validation Counts (245)			
- within GEH of 5.0	70%	71%	72%
- within GEH of 7.5	84%	83%	83%
- pass cal/val guidance link criterion	87%	87%	86%
By Road Type			
SRN link Counts (332)			
- within GEH of 5.0	73%	74%	79%
- within GEH of 7.5	88%	88%	87%
- pass cal/val guidance link criterion	82%	84%	85%
Non-SRN link Counts (690)			
- within GEH of 5.0	63%	63%	62%
- within GEH of 7.5	79%	79%	77%
- pass cal/val guidance link criterion	91%	90%	88%

7.5 Matrix Calibration – Methodology for Matrix Estimation

The principle for matrix estimation for the RTMs was that it should not excessively distort the prior demand but allow sufficient scope to reasonably improve the screenline validation. A more detailed breakdown of these results is included in *Appendix G: Effects of Matrix Estimation*.

7.5.1 Definition of Matrix Estimation Screenlines

Matrix estimation was undertaken following finalisation of the prior matrices and networks. A set of principles for matrix estimation was agreed by all regions to assure a consistent approach to the matrix estimation process.

TAG Unit M3-1 recommends the use of grouped counts at a short screenline level to avoid inaccuracies for individual counts distorting the prior matrices. The screenlines chosen for calibration – see Section 4.6 – were split into 'mini-screenlines' for the matrix estimation process. It was agreed by the CalVal TCG that, since the focus of the RTMs is the SRN, the SRN links should be represented as individual 'mini-screenlines'. That is, a single SRN links was defined as a 'mini-screenline'.

In total, the 26 bi-directional screenlines in NRM were split into 107 bi-directional 'mini-screenlines'. Of these, there were 32 bi-directional SRN 'mini-screenlines' and 75 bi-directional Non-SRN 'mini-screenlines'.

7.5.2 Matrix Estimation by Vehicle Type

It was agreed by the CalVal TCG that the matrix estimation process should acknowledge the differing levels of confidence around the various datasets used in the matrix build.

The car matrices have been developed from mobile phone data with short distance trips infilled using synthetic matrices. These matrices have subsequently been controlled at a high level to NTEM trip rates and NTS trip length distributions with a focus on longer distance strategic trips. The shorter distance synthetic trips will have been less susceptible to the high level adjustments

The LGV and HGV matrices have been derived from Trafficmaster and BYFM respectively. Due to their respective limitations, which are documented in the TDCR, it was agreed by the CalVal TCG that there was greater scope for these to be adjusted by the matrix estimation process.

7.5.3 Blending Process for Matrix Estimation

The agreed methodology for all RTMs was that the calibrated matrix would consist of a blend from two distinct runs of matrix estimation.

Run 1: Fully Unconstrained

- Fully unconstrained matrix estimation for all OD pairs for all vehicle classes, subject to the XAMAX constraints (see Section 7.5.4).

Run 2: Long Distance Constrained

- Constrained matrix estimation for the car demand by freezing all OD pairs with a skim distance of greater than 20km (see Section 7.5.4); and
- Unconstrained matrix estimation for the GV demand; i.e. no frozen cells.

Calibrated Matrix – Blend of Run 1 and Run 2

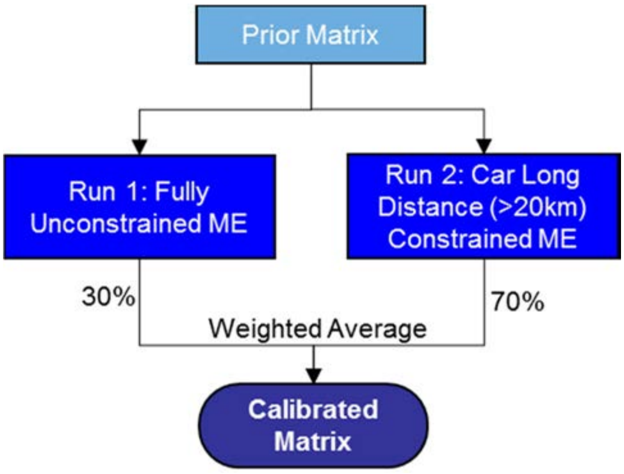
- The outturn calibrated matrix was calculated as the weighted average of Run 1 and Run 2, whereby greater confidence was to be given to Run 2 in the choice of factors.

It was investigated which combination of weighting factors should be used for NRM. The outturn for a 20:80 split and a 30:70 split were considered. The assignment performance, in terms of link validation and journey time validation, showed no significant difference between the two options.

However, reviewing the sector changes demonstrated that the 20:80 blend had a greater negative impact against the sector changes criteria set out in TAG.

Following this analysis, it was decided that a 30:70 split for Run 1 / Run 2 respectively would be used for NRM. For consistency, the same weighting factors were applied to car and GV demand. This process is summarised in Figure 7-2.

Figure 7-2 Matrix Estimation Blending Process



7.5.4 Application of Matrix Estimation within SATURN

The matrix estimation process used an iterative approach to generate a matrix with improved calibration and validation in the model. It was agreed by the CalVal TCG that six iterations would be used, whereby the PIJA factors are taken from the previous iteration but the original prior matrix is always used for the demand. This process is shown in Figure 7-3.

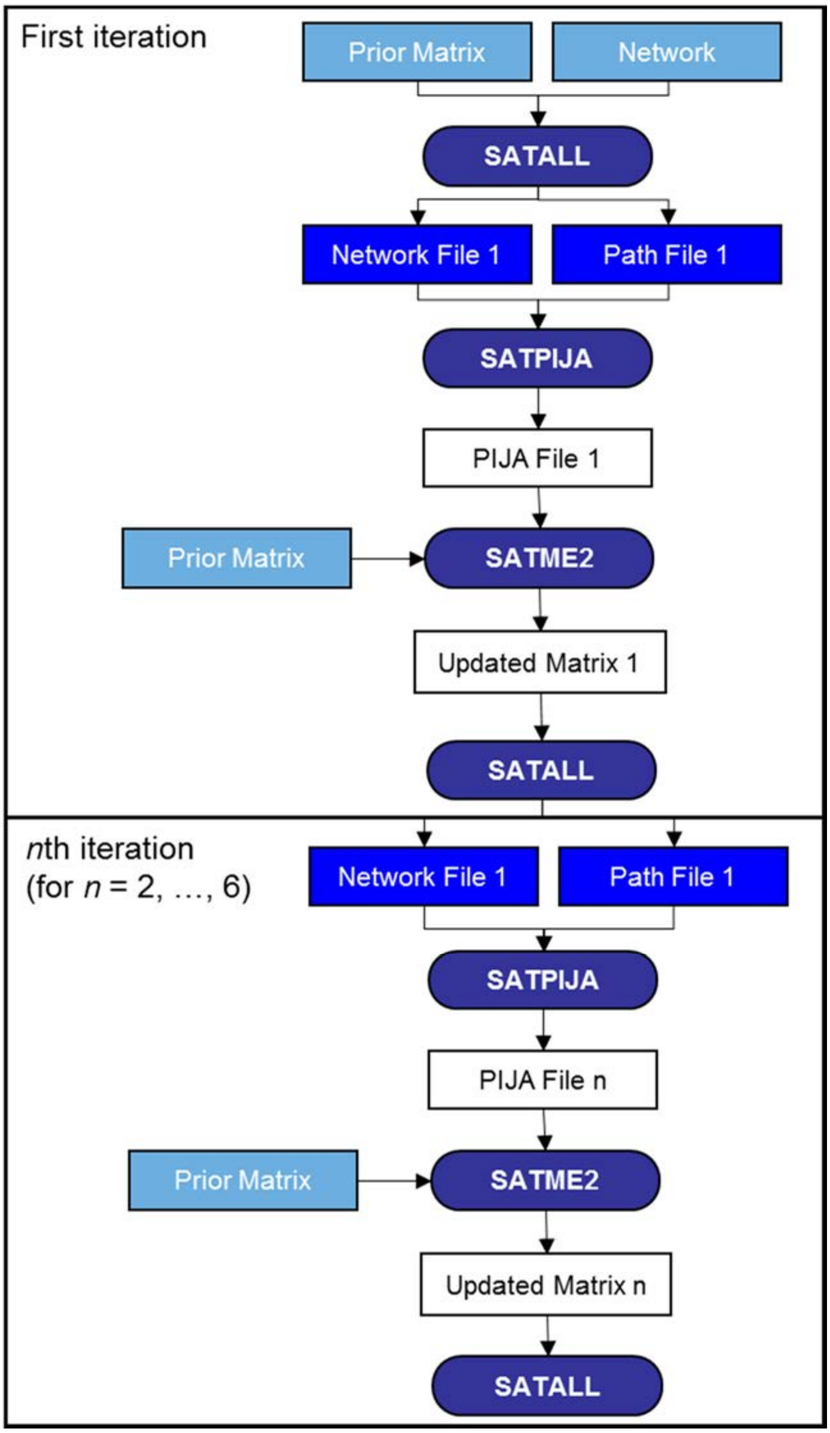
There are several parameters within SATURN that permit the user to control the extent of change that will be caused by the matrix estimation. The NRM process adopted the values recommended in the RTM CalVal Guidance Document which are summarised in Table 7-3.

Table 7-3 SATURN Constraints for Matrix Estimation

Parameter	Description	NRM 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)	Max value: Car: 2 LGV/HGV: 5
EPSILN	The convergence criteria for the difference between individual observed counts and their respective model flow.	0.001
ITERMX	The maximum number of iterations that will be run to achieve convergence.	99

A benefit of using mobile phone data is that it provides complete national coverage. Combined with the synthetic matrices infilling short distance trips there was no expectation of unobserved movements in the demand data. Therefore a SEED value was not used. The higher XAMAX value for the GV matrices reflects the lower confidence in the demand data used to derive those matrices.

Figure 7-3 Matrix Estimation Process in SATURN



7.6 *Matrix Estimation – Results*

The blended post matrix estimation matrix has been checked against the significance criteria set out in TAG Unit M3-1. This is summarised in Table 7-4 below.

Note that as agreed by the CalVal TCG, the reporting below excludes intra-zonal trips and all external trips which do not pass through the study area. This was to provide greater transparency on the effects of the matrix estimation; the two excluded categories of trip aforementioned are unaffected by matrix estimation so including those in the reporting will mask some of the true impacts. For this reason, some of the zonal trip end values for car demand fall narrowly outside of the TAG guidance.

The greater maximum balancing factor for GV has allowed more sustainable changes for those matrices. This was to compensate for limitations in the primary datasets used to generate the prior GV matrices. They were not adjusted prior to matrix estimation therefore it was expected that the changes due to matrix estimation would be more significant.

The LGV matrix was developed from a Trafficmaster OD dataset. This was a sample data for an unknown proportion of the LGV population. For this reason it was expected the matrix estimation may have a more significant impact on the magnitude and distribution of the LGV matrix.

The HGV matrix was developed from the BYFM which has very large zones in the NRM study area. There was no substantial data to generate a distribution for splitting the intra-BYFM zonal trips into inter-NRM zonal trips therefore these trips will have been more susceptible to matrix estimation, hence the more significant differences between the post and the calibrated matrix.

The agreed reporting spatial level for the sector changes is county level. There are 11 internal sectors and 10 external sectors for NRM – these are shown in the following two figures for the study area and for all of Great Britain.

Detailed reporting for the effects of matrix estimation is included in *Appendix G: Effects of Matrix Estimation*. This contains complete tabulations and plots for all four of the TAG criteria below for the calibrated matrix plus the unconstrained and fully constrained matrices to demonstrate their impact within the final blended matrix.

Table 7-4 Impacts of Matrix Estimation – Blended Matrix

Measure	TAG Significance Criteria	Blended Matrix (30:70)		
		Car	LGV	HGV
Matrix zonal cell values	Slope within 0.98 and 1.02; Intercept near zero; $R^2 > 0.95$	Pass for all car purposes	R^2 range from 0.911 to 0.936	R^2 range from 0.7 to 0.779

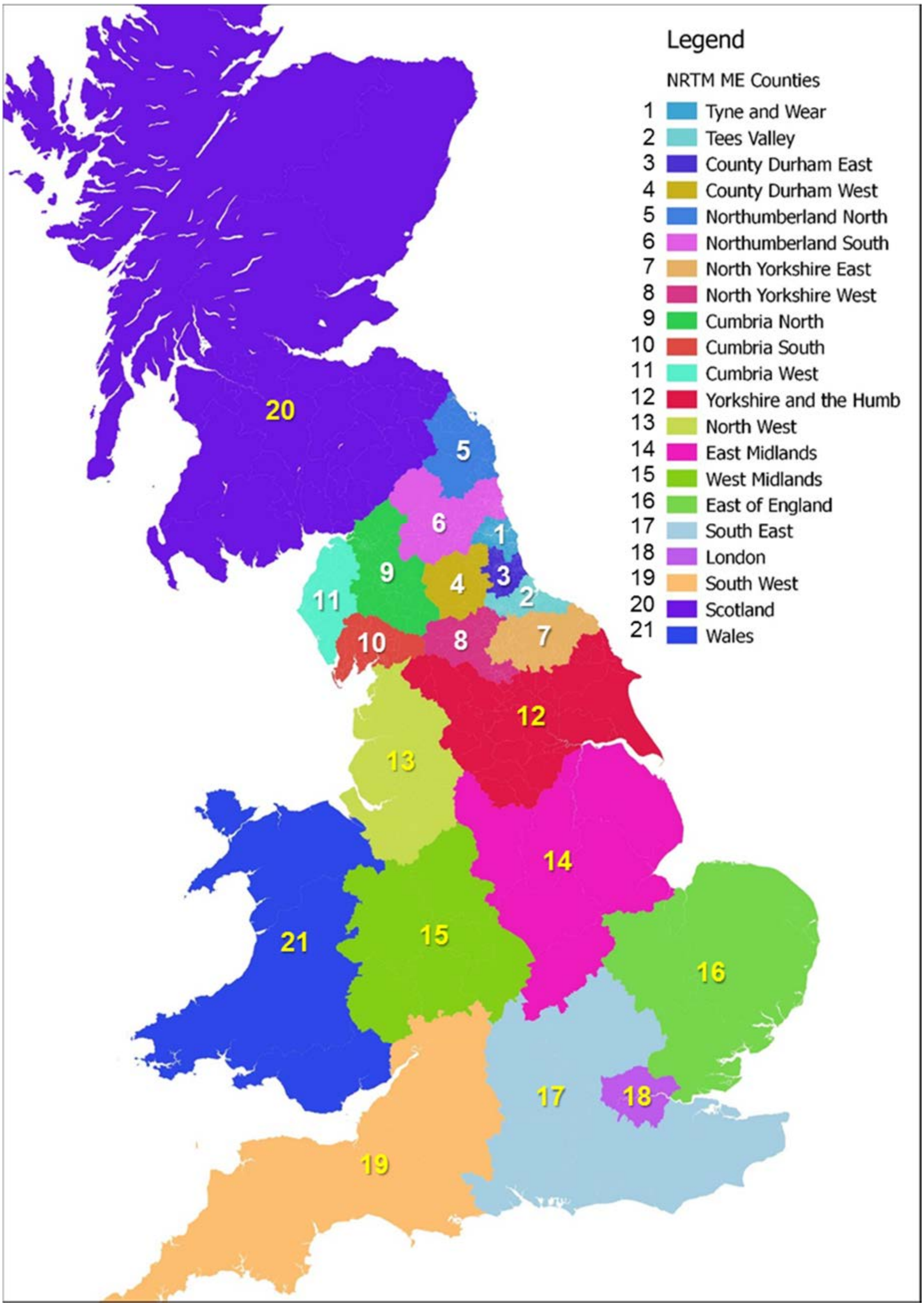
Matrix zonal trip ends	Slope within 0.99 and 1.01; Intercept near zero; $R^2 > 0.98$	$R^2 > 0.98$ for 7/18 cases; $R^2 > 0.97$ for 17/18 cases	R^2 range from 0.939 to 0.971; all slope values within 0.05 of 1	R^2 range from 0.92 to 0.95; slope values generally >0.90
Trip length distributions	Means within 5%; Standard Deviations within 5%	Pass	Pass	Outside criteria: differences range from -16.9% to-4.5%
Sector to sector matrices	Differences within 5%	Considered flow and GEH due to very low flows in several cells; met in nearly all cases (using GEH of 4 for low flow cells). Is not met for isolated cells in certain segments		

The criteria have also been checked for the constrained and fully unconstrained matrices to understand their respective impact within the blended matrix. This is summarised in the Table 7-5. This further illustrates the rationale for using the 30:70 split, as opposed to 20:80 which was raised in Section 7.5.3.

Table 7-5 Impacts of Matrix Estimation – Run 1 and Run 2

Measure	TAG Significance Criteria	Constrained ME	Unconstrained ME
Matrix zonal trip ends	Slope within 0.99 and 1.01; Intercept near zero; $R^2 > 0.98$	$R^2 > 0.98$ for car in 6/18 cases. $R^2 > 0.97$ for car in 17/18 cases. No LGV or HGV time periods satisfy criteria.	$R^2 > 0.98$ for car in 1/18 cases. $R^2 > 0.97$ for car in 14/18 cases. No LGV or HGV time periods satisfy criteria.
Trip length distributions	Means within 5%; Standard Deviations within 5%	All cases pass both criteria for Car and LGV. No HGV time periods satisfy criteria.	AM Business does not meet either criteria; all other cases for Car and LGV are ok. No HGV time periods satisfy criteria.
Sector to sector matrices	Differences within 5%	Restricted impact to sector pairs of close enough proximity to have unfrozen trips. As per the 'blended', some large flow differences due to small flows which are reasonable GEH.	As per the 'blended', some large flow differences due to small flows which are reasonable GEH. In most cells greater change than the 'blended' as expected.

Figure 7-4 Matrix Estimation Sectors



8 Highway Model Validation

8.1 Model Validation Process

This chapter describes the validation of the NRM base year models. An overview of the calibration and validation process is provided in Figure 7-1.

The results of this process are reported here, including:

- Trip matrix validation;
- Link flow validation; and
- Route choice validation.

The validation of the base year models has utilised two key sources of data.

8.1.1 Traffic Counts

A subset of the traffic counts have been defined which are independent from those used for calibration – see Section 4.6. This is in accordance with the guidance set out in TAG Unit M3-1 relating to use of traffic counts for calibration and validation.

8.1.2 Journey Time Routes

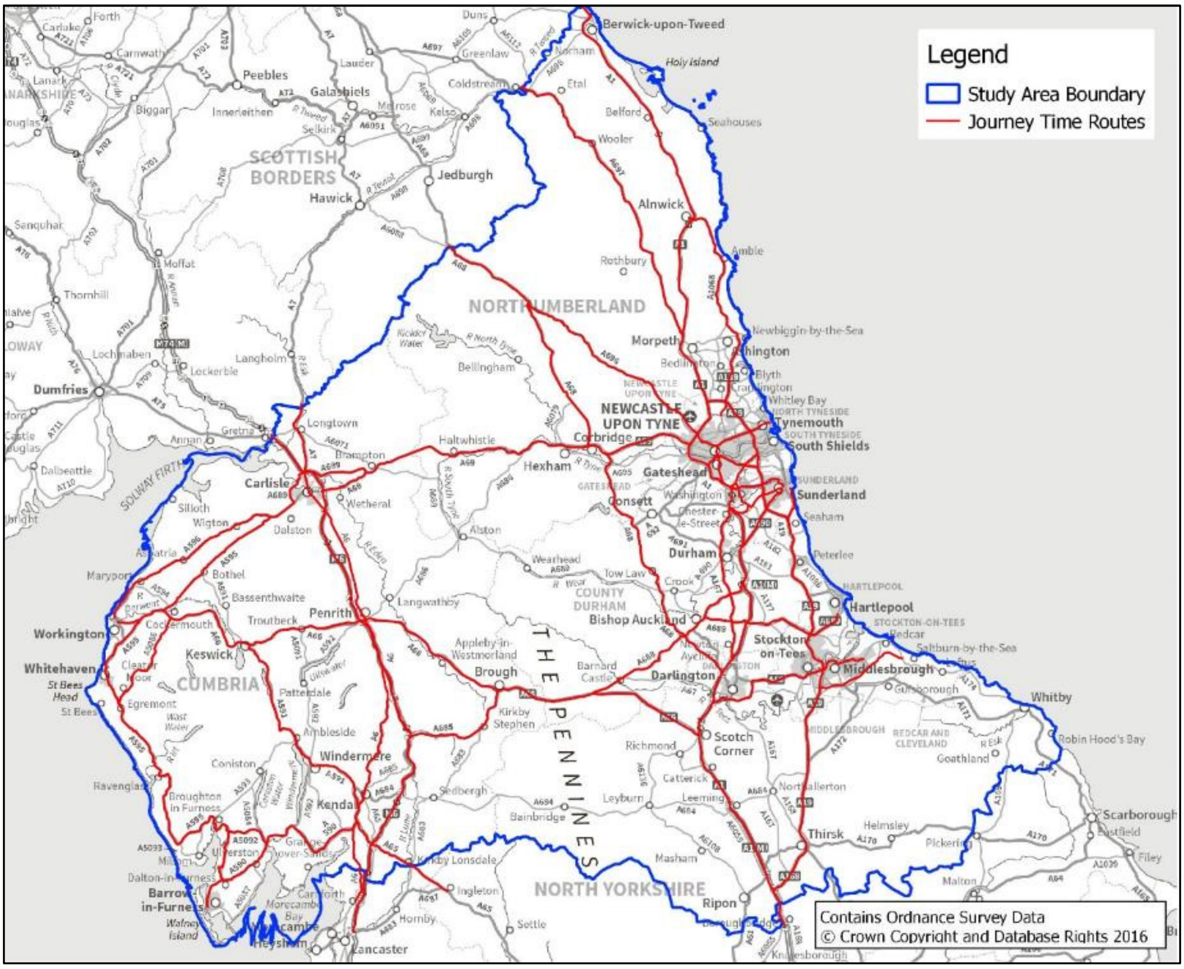
The journey time routes for validation have been defined in accordance to three principles set out for the RTMs:

- SRN Routes – full coverage of SRN links within the model boundary was required for journey time validation;
- Access routes to the SRN – any main access routes to the SRN should also be included for journey time validation; and
- Competing routes – any routes which provide key alternatives to the SRN including parallel routes and 'rat-runs' in the rural areas.

The guidance in TAG is that routes should be between 3km and 15km. However, due to the length of the SRN and other chosen routes this would require hundreds of routes to be assessed for each RTM. It was agreed by the CalVal TCG that, since the RTMs are modelling average hour rather than peak hour, the routes can be of greater length. Instead, routes should be defined as sections between key urban areas or sections between key feeder routes to the SRN.

These are shown in Figure 8-1.

Figure 8-1 Validation Journey Time Routes



8.2 *Assignment Process within SATURN*

Three parameters in SATURN correspond to the highway model convergence criteria in TAG Unit M3-1. The values adopted for SATURN stopping criteria in NRM are reported in Table 8-1 below.

Note that within SATURN, a value of 99 for ISTOP is treated as 98.5 due to rounding. This criteria is stricter than the TAG acceptance criteria. The values for PCNEAR and NISTOP follow the acceptability guidelines in TAG.

Table 8-1 SATURN Constraints for Convergence

Parameter	Description	NRM Value
ISTOP	The percentage of links which change by less that the values defined by PCNEAR	99
PCNEAR	Defines the threshold maximum percentage flow change (for ISTOP% of links)	1.00
NISTOP	Number of successive loops for the criteria to be met	4

The convergence statistics for the prior and calibrated assignments are reported in Table 8-2 and

Table 8-3 respectively.

Table 8-2 Prior Assignment Statistics

AM Peak			Inter-Peak			PM Peak		
Loop	%Flow	%GAP	Loop	%Flow	%GAP	Loop	%Flow	%GAP
30	98.8	0.0007	17	98.9	0.0004	30	98.9	0.0011
31	98.9	0.0006	18	99.0	0.0008	31	98.7	0.0008
32	98.8	0.0005	19	99.3	0.0003	32	99.3	0.0006
33	98.7	0.0011	20	99.2	0.0003	33	99.5	0.0011

Table 8-3 Calibrated Assignment Statistics

AM Peak			Inter-Peak			PM Peak		
Loop	%Flow	%GAP	Loop	%Flow	%GAP	Loop	%Flow	%GAP
22	98.5	0.0010	21	98.6	0.0005	26	99.0	0.0012
23	98.9	0.0005	22	99.0	0.0004	27	98.7	0.0009
24	99.0	0.0007	23	99.1	0.0005	28	98.8	0.0012
25	99.1	0.0005	24	98.8	0.0006	29	98.8	0.0007

A stress test was undertaken using a universal 20% growth applied to the calibrated base year demand matrices to check the stability of the assignment and to investigate the robustness of the networks ahead of forecasting. The convergence statistics are reported in Table 8-4. All three time periods achieved convergence within 45 iterations or less.

Table 8-4 Calibrated Assignment – 20% Stress Test Statistics

AM Peak			Inter-Peak			PM Peak		
Loop	%Flow	%GAP	Loop	%Flow	%GAP	Loop	%Flow	%GAP
42	98.9	0.0024	29	98.7	0.0011	37	98.8	0.0022
43	99.2	0.0025	30	98.3	0.0008	38	98.5	0.0019
44	98.9	0.0019	31	99.3	0.0008	39	98.6	0.0017
45	98.5	0.0031	32	99.0	0.0017	40	98.9	0.0020

8.3 Trip Matrix Validation

The trip matrix validation has been reported for full screenlines in line with the RTM reporting guidance. The guidance from the CalVal TCG is that boundary screenlines should be within 5% of observed flows; all other screenlines and cordons should be within 10% of observed flows. This is because a majority of screenlines, in particular urban cordons, have a large proportion of non-SRN counts.

The NRM high level results are presented in Table 8-5; they are also presented as thematic maps in Figure 8-2, Figure 8-3 and Figure 8-4.

The NRM boundary screenlines achieve this target with one exception. The only screenline to fall outside of the 10% guideline is Screenline 18 in the PM peak. This screenline traverses the study area north to south through the North Pennines crossing the SRN on the A69 near Haltwhistle and the A66 at Brough. There are low flows on most of links due to its locality.

However, Screenline 17 immediately east of 18 has good validation so this can be linked to quality of data (both demand and ATC) in the rural areas and it has not affected the SRN in the North East corridor. Likewise, the M6 to the west has good validation at a link level.

Table 8-5 Calibrated Matrix Screenline Validation

Performance Measure	AM Peak	Inter-Peak	PM Peak
All screenlines and cordons within 5% of observed flows	83%	87%	92%
All Screenlines and cordons within 10% of observed flows	100%	100%	98%

Figure 8-2 Screenline Performance - AM Peak

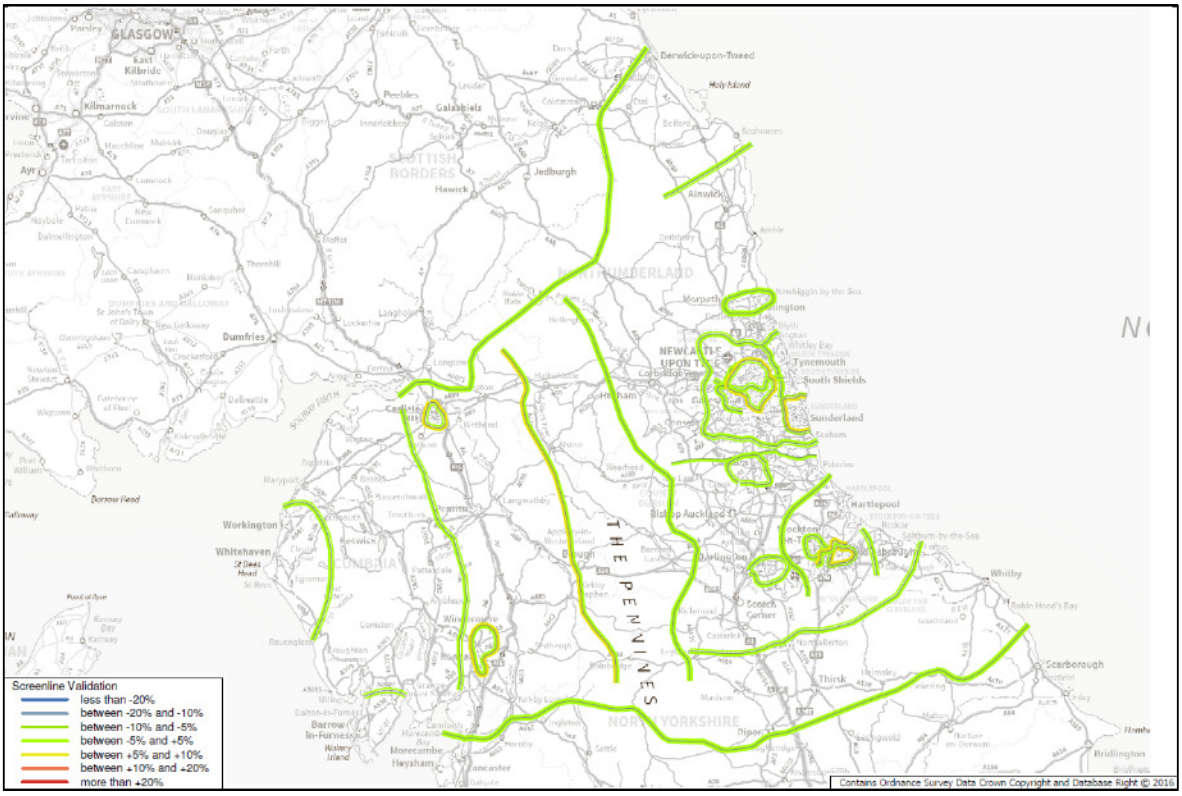


Figure 8-3 Screenline Performance - Inter Peak

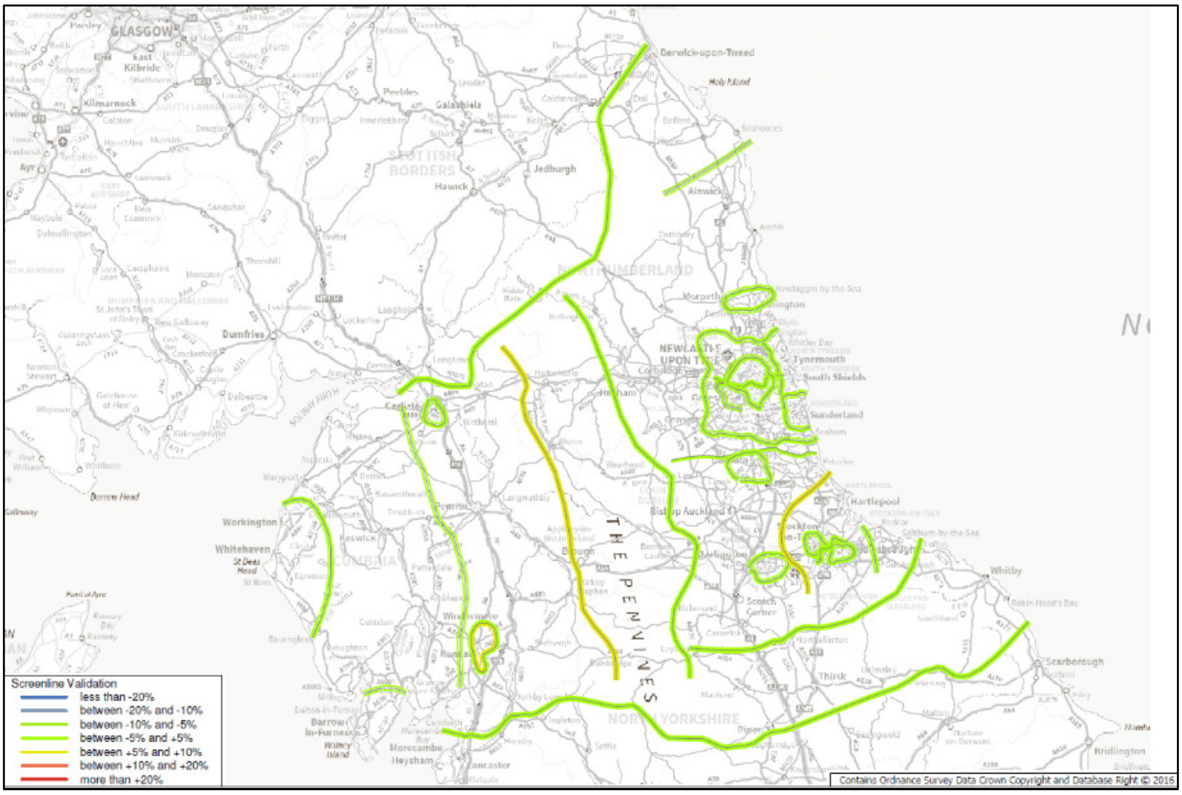
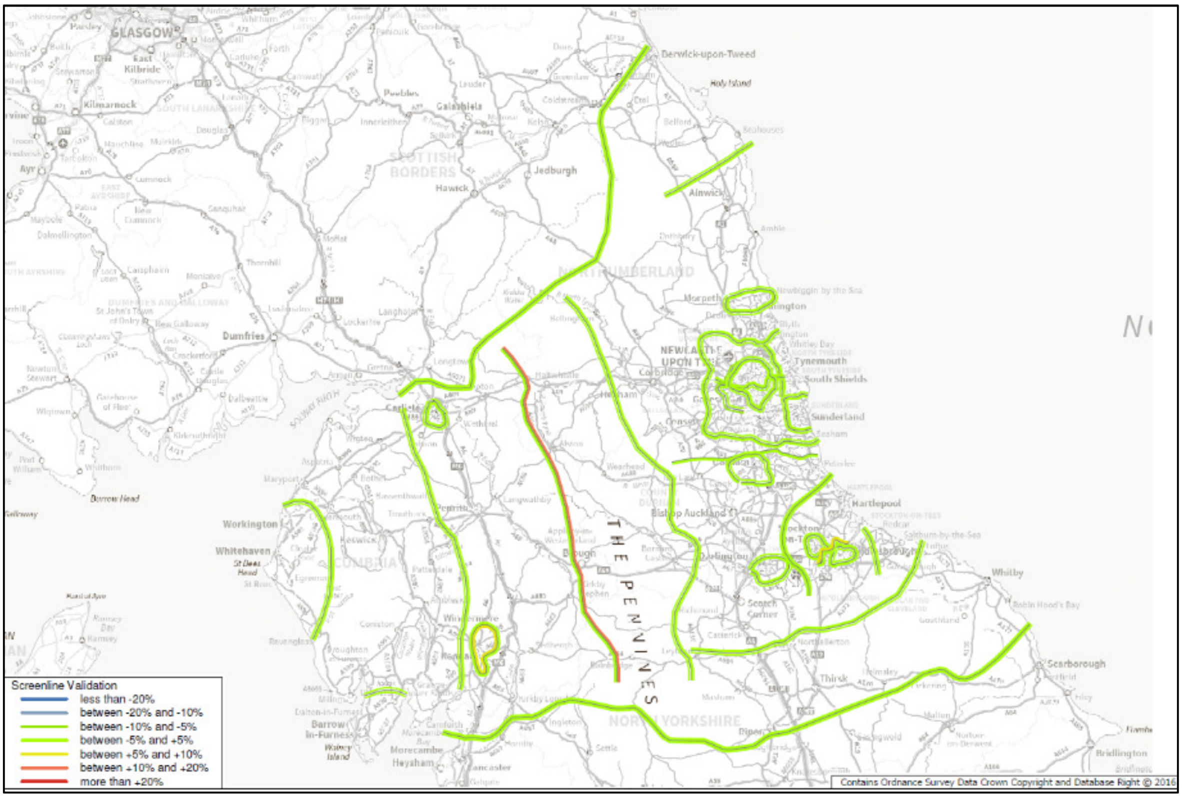


Figure 8-4 Screenline Performance - PM Peak



A complete set of reporting of the trip matrix validation for the calibrated models is included in *Appendix H: Screenline Performance*. This includes summary tabulations of the screenline performance by time period by vehicle class and larger versions of the maps presented below.

8.4 Link Flow Validation

The summary statistics for the link flow validation in the calibrated models are presented in Table 8-6. It was agreed within the CalVal TCG that SRN links should be validated to TAG criteria and a revised criteria would be applied for non-SRN links. This reflects the relative importance of the SRN and the fact that Regional Models will not be used in the testing of local schemes, nor could they be expected to fully model all urban areas.

Table 8-6 Link Flow Validation Summary – Calibrated Matrices

Performance Measure	AM Peak	Inter Peak	PM Peak
All NRM Links			
- within GEH of 5.0	80%	80%	79%
- within GEH of 7.5	89%	91%	89%
- pass cal/val guidance link criterion	94%	94%	94%
By Calibration/Validation			
Calibration Counts (777)			
- within GEH of 5.0	81%	82%	80%

- within GEH of 7.5	89%	92%	89%
- pass cal/val guidance link criterion	95%	96%	95%
Validation Counts (245)			
- within GEH of 5.0	76%	73%	78%
- within GEH of 7.5	89%	87%	91%
- pass cal/val guidance link criterion	91%	91%	91%
By Road Type			
SRN link Counts (332)			
- within GEH of 5.0	90%	87%	91%
- within GEH of 7.5	96%	95%	97%
- pass cal/val guidance link criterion	94%	94%	94%
Non-SRN link Counts (690)			
- within GEH of 5.0	75%	77%	73%
- within GEH of 7.5	86%	89%	85%
- pass cal/val guidance link criterion	94%	95%	94%

The calibrated NRM model achieve the required link validation criteria set out by the CalVal TCG. Further, when considering SRN links in insolation the NRM achieves the TAG criteria of GEH <5 in more than 85% of cases.

The results show that the flows on the SRN have been modelled to a high degree of accuracy. The NRM will provide a solid basis for modelling of schemes in these locations. As can be seen on the thematic plots below, the validation is particularly strong on the key strategic corridors across including the M6, A1, A19 and Trans Pennine trips using the A66 and the A69.

The areas with weaker flow validation are generally on local routes within urban centres. The trip matrix validation shows that the demand into and out of the cordons for Newcastle, Stockton, Middlesbrough and Darlington is close to the observed counts. However, the route choice on the local network within these areas is less well modelled. This is the result of complicated travel patterns and high levels of congestion in these areas. The Regional Models are specified to model the SRN and surrounding corridors and as such less detail (zone and network) is available in densely populated urban areas.

For example, the A1 and the A19 Tyne crossings both pass the link flow criteria but there are route choice issues for the city centre bridges (Tyne Bridge, Redheugh Bridge and Bridge Street). These links carry a large volume of local trips between Gateshead and Newcastle and route choice will not necessarily be reflected accurately for all movements.

The link validation is displayed thematically in Figure 8-5, Figure 8-6 and Figure 8-7. A complete set of reporting of the link flow validation for the calibrated models is included in *Appendix I: Link Flow Validation*. This includes summary tabulations by time period by vehicle class for each link plus larger versions of the maps presented below.

Figure 8-5 Link Flow Validation - AM Peak

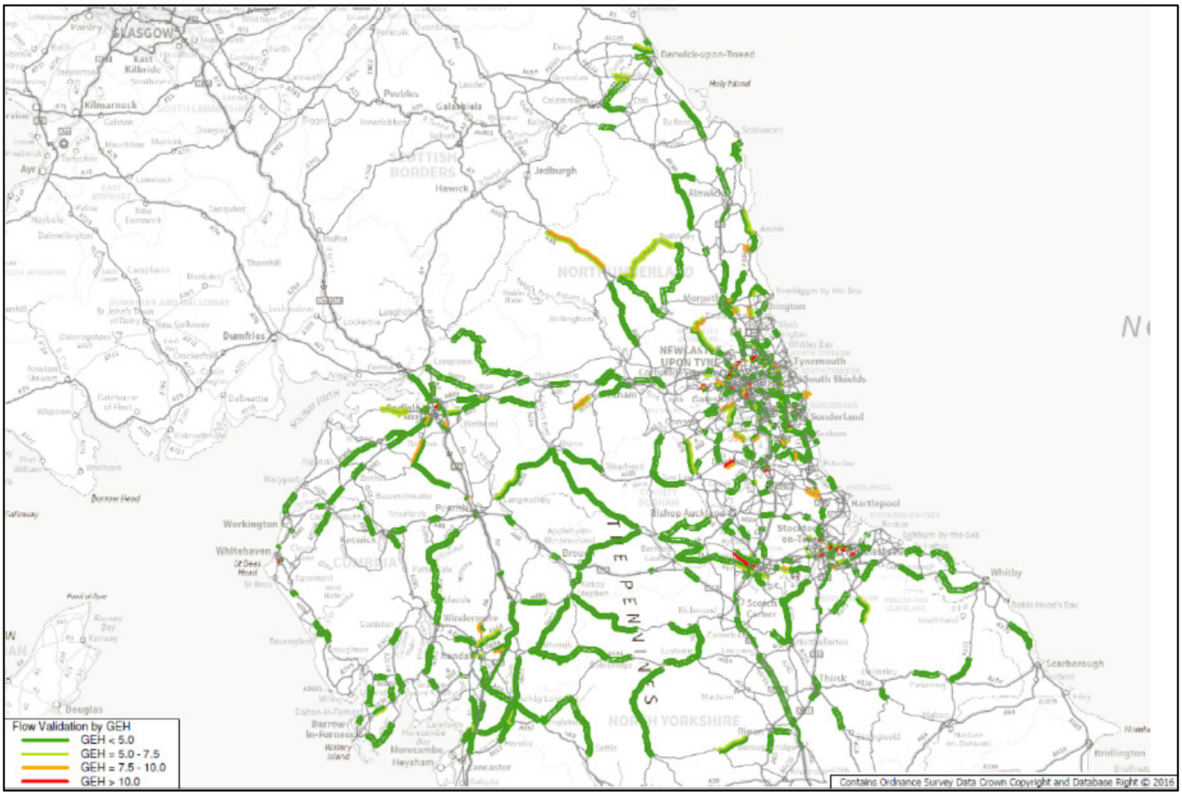


Figure 8-6 Link Flow Validation - Inter Peak

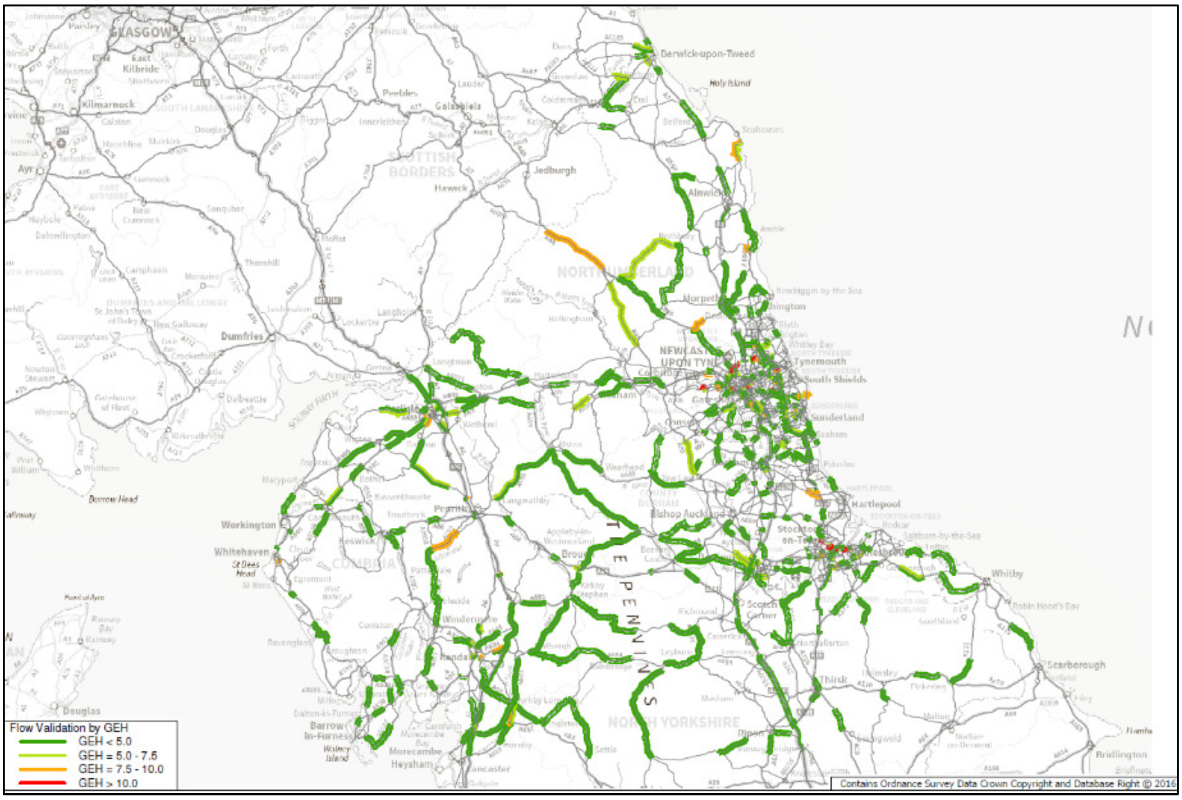
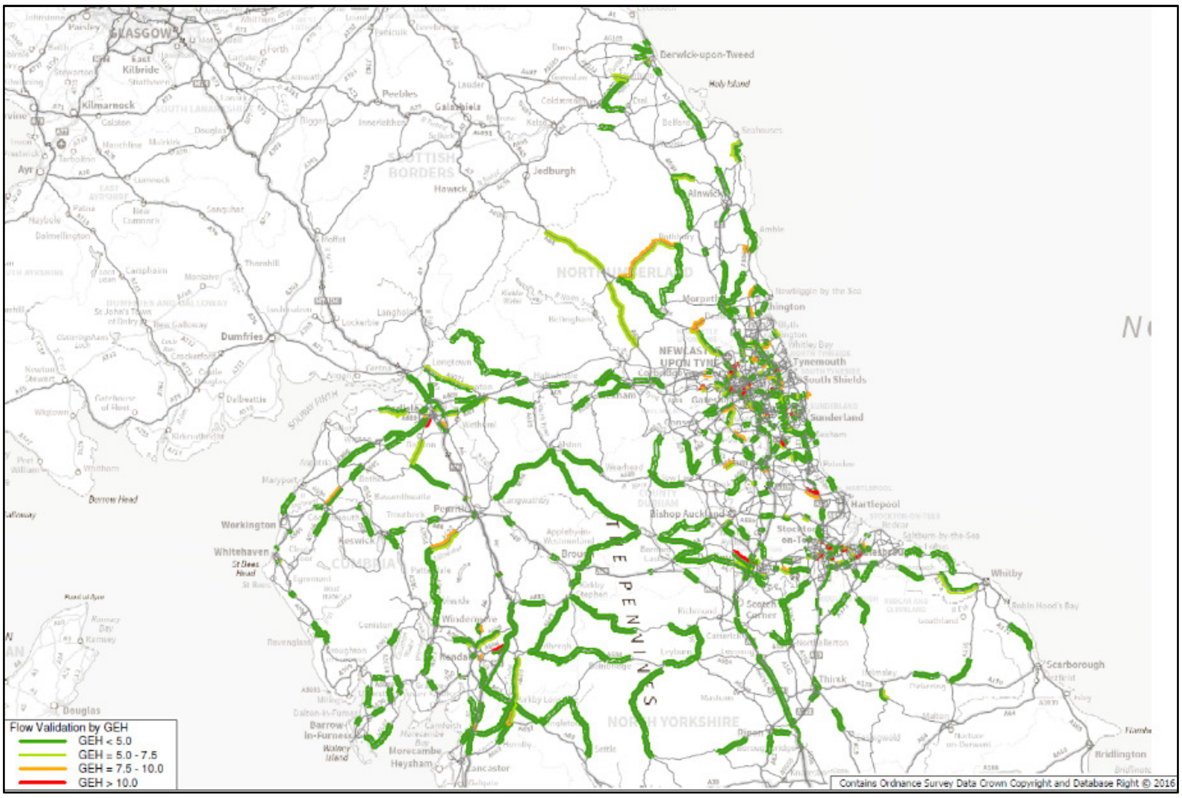


Figure 8-7 Link Flow Validation - PM Peak



8.5 Journey Time Validation

The summary statistics for the journey time validation in the calibrated models are presented in Table 8-7. The criteria set out in TAG Unit M3-1 have been achieved for all time periods. The statistics by segment have also been reported.

The same reporting statistics have been produced for SRN routes only and appended to Table 8-7; this is in line with the RTM reporting guidelines.

Table 8-7 Journey Time Validation Summary

Performance Measure	AM Peak	Inter-Peak	PM Peak
All Journey Time Routes			
Routes within 15% or 1 min of Observed Times	97%	93%	97%
Segments within 15% of Observed Times	77%	81%	76%
SRN Journey Time Routes			
Routes within 15% or 1 min of Observed Times	97%	100%	97%
Segments within 15% of Observed Times	83%	90%	82%

The statistics are improved, in particular for individual segments. The validation is very good on the M6, which is split into two routes, with both directions in all time periods having a difference against the observed data of less than 5%.
The A1 and the A19 also have good validation, split into three and two routes respectively, with only the A1 Section 2 Southbound in the PM having an absolute difference of greater than 7% from the observed data.

The areas where SRN segments do not meet the 15% (or 1 minute) threshold are isolated segments, often for a single direction, within otherwise validated routes. This can be seen in the thematic maps presented in Figure 8-8, Figure 8-9 and Figure 8-10.

There are some areas of weaker validation. In particular, the A167 through urban Gateshead up to the River Tyne crossing and the A1231 / A184 within Sunderland city centre. However, it is not intended that the NRM will be used to model urban or local schemes.

A complete set of reporting of the journey time validation for the calibrated models is included in *Appendix J: Journey Time Validation*. This includes summary tabulations of the journey time validation by time period by route, larger versions of the maps presented below and time series graphs showing the observed vs modelled time by segment by time period.

Figure 8-8 Journey Time Validation - AM Peak

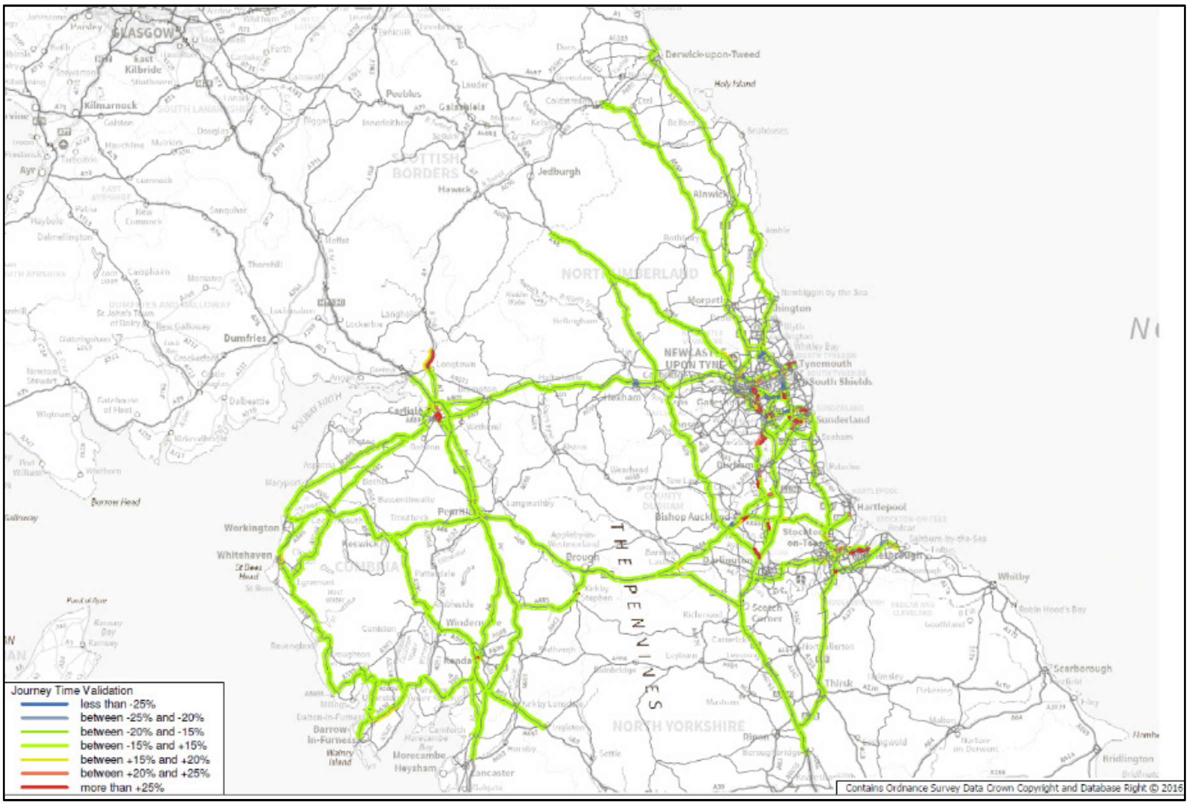


Figure 8-9 Journey Time Validation - Inter Peak

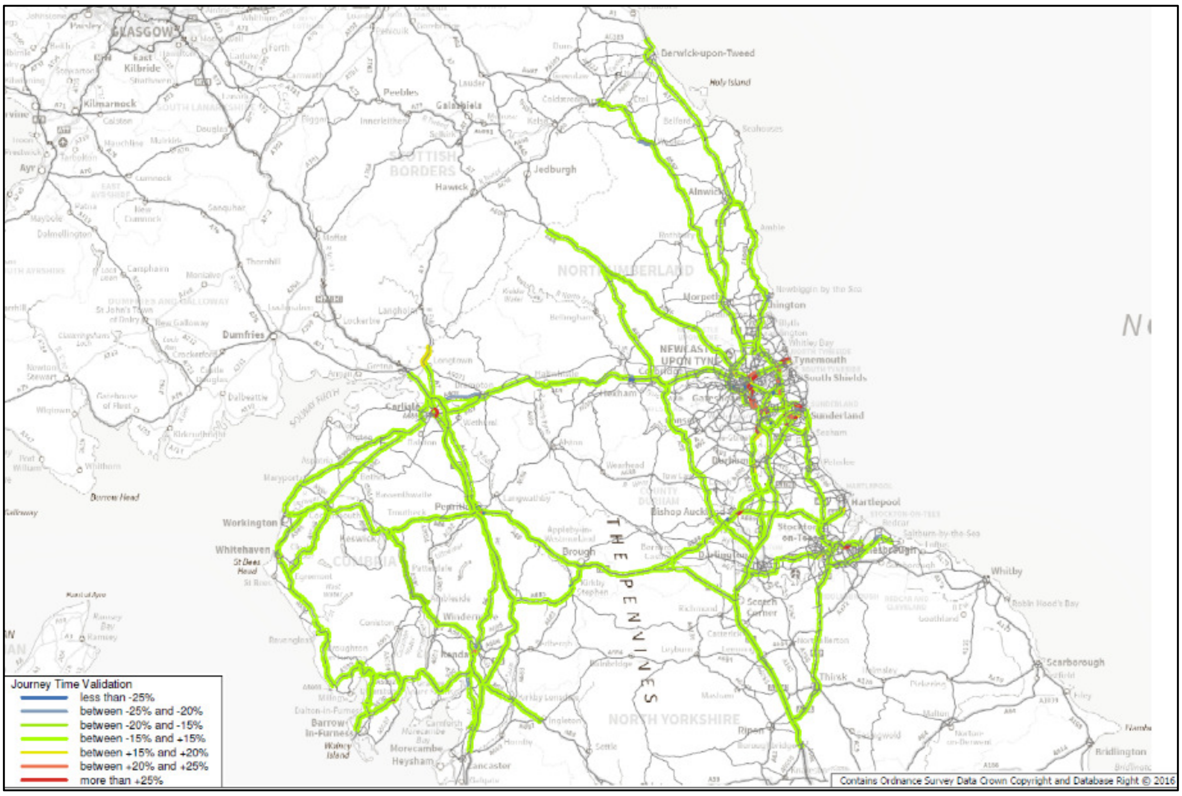
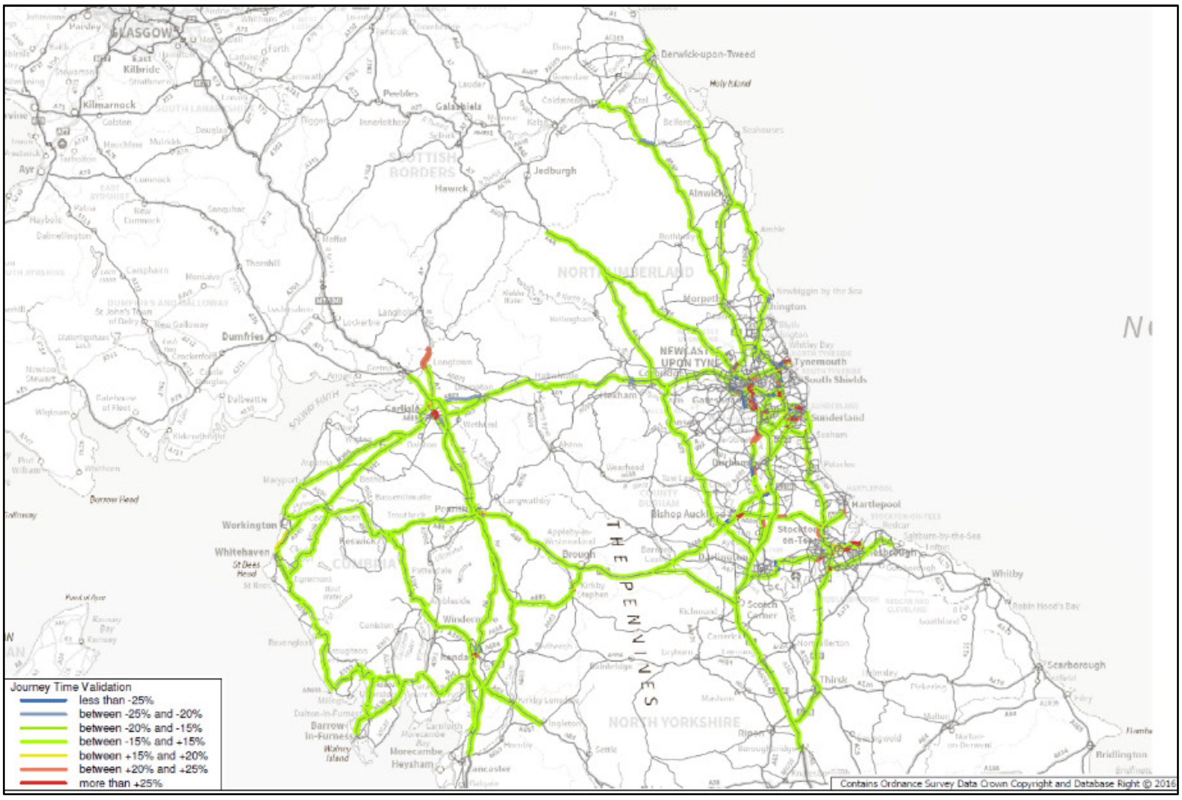


Figure 8-10 Journey Time Validation - PM Peak



8.6 *Base Minus Comparison*

8.6.1 Requirement for 'Base Minus'

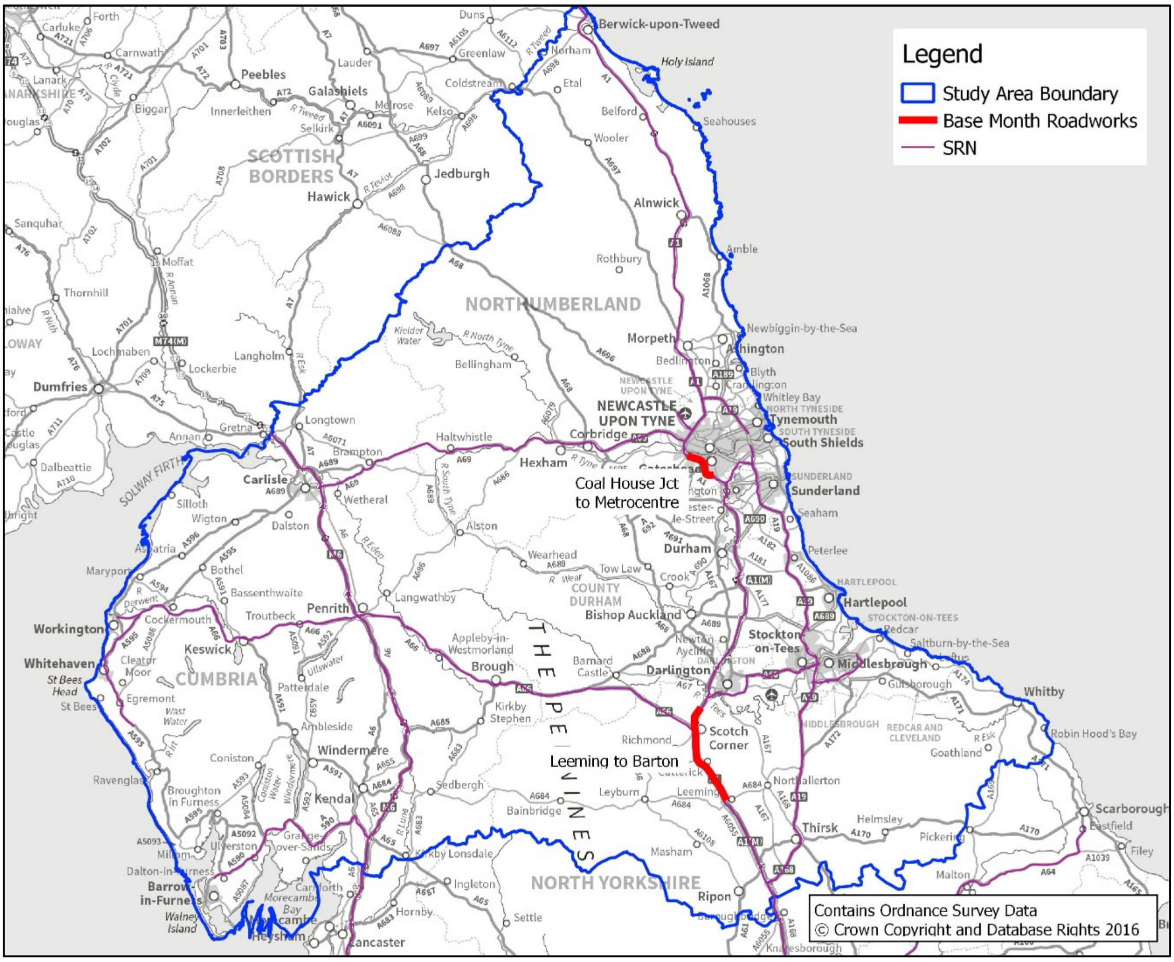
The NRM has been calibrated and validation for a base month of March 2015, during which there were two major roadworks schemes within the NRM study area, on:

- The A1 between Leeming and Barton; and
- The A1 between Coal House Junction and the Metro Centre.

These locations are shown in Figure 8-11.

The presence of these roadworks may have significant impacts on routeing and user costs in the model. This would create an issue for forecasting since the base network is not representative of 'average conditions' in proximity to the roadworks and therefore an unsuitable pivot base for the VDM.

Figure 8-11 Locations of Base Month Roadworks



8.6.2 Data Collection for ‘Base Minus’

A version of the base year model was created with the two aforementioned sets of roadworks removed – this is referred to as the ‘base minus’ model. A test was carried out to assign the calibrated matrices to the ‘base minus’ networks to verify that without the roadworks, the network performance is satisfactory in terms of flow validation and traffic rerouting.

Traffic count data for March 2014 (or if not available, March 2013) was collected for 92 counts on the modelled routes which were impacted by the roadworks:

- The A1/A1(M) and A19 as the main route choice impacted by the roadworks;
- Links in Tyne and Wear in proximity to the Metro Centre; and
- Links in Tyne and Wear offering connectivity between the A1 and the A19.

The counts were factored to 2015 using the values derived for the main NRM data collection process. No suitable journey time data was available therefore only the flow validation was considered.

8.6.3 'Base Minus' Assignment Results

The main impact of removing the A1 roadworks was to reroute traffic from the A19 onto the A1. The Leeming to Barton roadworks have a 50mph speed restriction in place so this is not unexpected. This is demonstrated by Figure 8-12, which shows the flow difference plot from P1X for the 'base minus' assignment versus the calibrated base model in the AM peak for the NRM study area.

There was also a significant impact between the A184 Junction and Swalwell at Gateshead. In particular, there was a large re-assignment of traffic onto the A1 between the Coal House Roundabout and Gateshead with a significant amount of traffic re-assigning from Kingsway in the Team Valley Trading Estate. This is demonstrated by Figure 8-13, which shows the flow difference plot from P1X for the 'base minus' assignment versus the calibrated base model in the AM peak focussed on Tyneside.

The traffic flows in the 'base minus' assignment were compared against the 'pre-roadworks' traffic count data described above. The majority of links and screenlines meet the GEH, flow difference and journey time difference criteria for all of the time periods.

In summary, the 'base minus' assignments are suitable as a basis for the Variable Demand Modelling of future year forecasts.

Figure 8-12 Flow Difference for 'Base Minus' vs Calibrated Base – Study Area

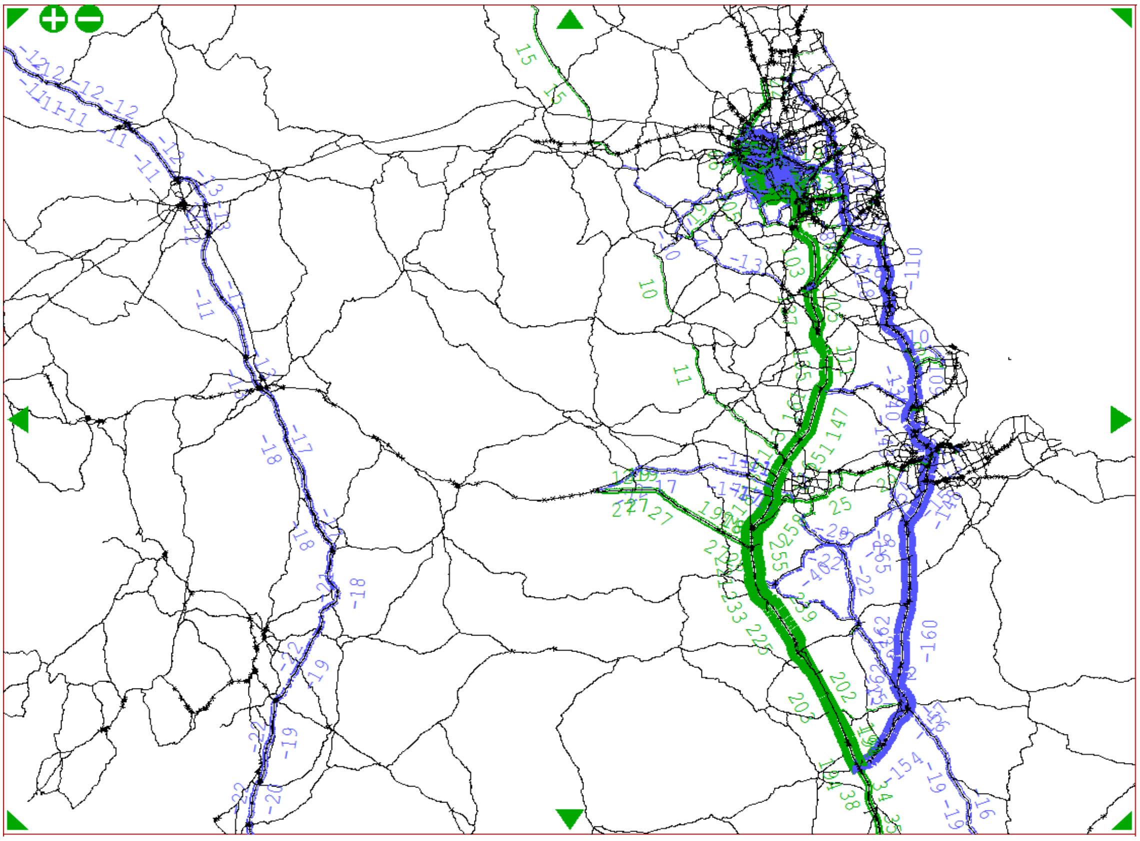


Figure 8-13 Flow Difference for 'Base Minus' vs Calibrated Base – Tyneside

9 Variable Demand Model

This Chapter discusses the development, calibration and validation of the Variable Demand Model (VDM) and Public Transport (PT) aspects of the Regional Transport Models (RTMs). Given the inter-regional nature of much of the SRN travel demand the approach taken is common across all models. Hence this section refers not only to the NRM but also draws on the experience of the wider study programme conducted via a Technical Consistency Group (TCG) tasked with delivering a common VDM approach.

9.1 Model Development

9.1.1 Basis of whether to include variable demand in the model

A key objective of the RTM's is to provide a multi-modal platform for transport scheme assessment. The scale and spatial coverage of transport schemes to be assessed by the RTMs is significant. Furthermore, many of the schemes to be considered will be in sections of the Strategic Road Network (SRN) that are subject to congestion. Any scheme which is demonstrated to afford congestion relief is required to incorporate variable demand modelling.

As a consequence, a VDM approach has been developed which adheres to WebTAG guidance[2] where appropriate and models the key traveller choices of; route, mode, destination and time of day.

9.1.2 Model Form

In order to ensure consistency between all regional models with respect to approach to VDM, it was agreed (with Highways England) that DfT's DIADEM (Dynamic Integrated Assignment and DEmand Modelling) software would be used.

DIADEM is software designed to enable practitioners to easily set up variable demand models. It provides a user-friendly method for setting up a multi-stage transport demand model and finding equilibrium between demand and supply, using the SATURN package as the supply model. The process iterates between demand calculations and highway assignments until a converged solution is reached.

DIADEM is also compliant with webTAG guidance with respect to model form, most notably model hierarchy and incremental nature of the model. The approach makes

[2] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/542504/webtag-unit-m2-variable-demand-modelling-forthcoming-change-november-2016.pdf

use of cost changes from incremental differences between base and test scenario operated using a pivot point approach.

DIADEM inputs and outputs are entirely based in text files which have prescribed file names. While DIADEM provides a user interface to control model runs, a bespoke software tool HEIDI (Highways England Integrated Demand Interface) was developed as part of the RTM development programme to:

- Control the application of DIADEM;
- enable consistent application of DIADEM across all RTM's;
- to simplify file management;
- organise and implement forecast model runs;
- assemble trip ends;
- undertake multiple model runs; and
- prepare 'template' reporting of VDM runs

HEIDI is a combination of a C#-based Graphical User Interface which interrogates a SQL database containing model inputs. This approach simplifies the overall model flow, where HEIDI controls DIADEM which in turn controls the SATURN assignments within internal loops of supply\demand calculations until convergence is reached. Further information relating to HEIDI can be found in the RTMTG documents.

9.1.3 Model area and zone size

The model area is shown in Figure 2-1.

The zonal dimensions of the model are provided in Table 9-1 below:

Table 9-1 Zones by Region

Zones	North
Simulation Zones	1,252
Buffer Zones	298
Total Zones	1,550

9.1.4 Model Parameters

A wide range of model parameters and inputs to DIADEM have been prepared. Table 9-2 below contains a list of those applied to the VDM Model.

Table 9-2 VDM Parameters

<table>
<tr><th>Parameter/Setting</th><th colspan="2">Data Source</th><th>Notes</th></tr>
<tr><td colspan="4">Segmentation</td></tr>
<tr><td>Modelled time slices</td><td colspan="2">AM 07:00-10:00, IP 10:00-16:00, PM 16:00-19:00 hours, OP 19:00-07:00</td><td>AM, IP, PM travel costs derived from average peak hour calibrated assignments.
OP travel costs derived from uncalibrated assignment of MPD derived OP matrix to IP network to represent freeflow conditions.</td></tr>
<tr><td>Time period factors</td><td colspan="2">AM=3, IP=6, PM=3, OP=12</td><td>Simple calculation consistent across all movements and purposes as average peak hours modelled:</td></tr>
<tr><td>Assigned User classes</td><td colspan="2">From assignment models:
Car Employers Business,
Car Commute,
Car Other,
Light Good Vehicles,
Heavy Good Vehicles</td><td></td></tr>
<tr><td rowspan="8">VDM Segments</td><td>Segment</td><td>Car Available</td><td rowspan="8">Fixed elements relate to ‘special zones’ which include unique travel patterns that are not subject to VDM response.
This may be a port or airport where ‘Other’ (passengers) and Employers Business are not subject to VDM responses.</td></tr>
<tr><td>Home Based Employers Business</td><td>1</td></tr>
<tr><td>Home Based Commute</td><td>2</td></tr>
<tr><td>Home Based Other</td><td>3</td></tr>
<tr><td>Non Home Based Employers Business</td><td>4</td></tr>
<tr><td>Non Home Based Other</td><td>5</td></tr>
<tr><td>Fixed – Employers Business</td><td>6</td></tr>
<tr><td>Fixed – Commute</td><td>7</td></tr>
</table>

Parameter/Setting	Data Source		Notes
	Fixed - Other	8	
	Light Good Vehicles	9	
	Heavy Good Vehicles	10	
Sectors	13 sectors defined for North Model. 9 Internal and 4 External.		
Model Parameters			
Model type	Home Based	Incremental PA	
	Non Home Base	Incremental OD	
	Goods	Fixed	
	Special Generators	Fixed	
Model responses and hierarchy	(Macro) Time of Day Choice Mode Choice Distribution		Distribution is singly constrained for Employers Business and Other, doubly constrained for Commute.
Logit parameters: lambda, theta	Median WebTAG		
Distribution Intra-zonal cost calculation	DIADEM Default values (ρ=0.5, minimum cost=5)		
Cost co-efficients (VOTs etc)	WebTAG with distance based VOT		
Cost damping parameters and specification	Damped utility by function of cost		
Occupancy factors	WebTAG		

Parameter/Setting	Data Source		Notes
Demand Matrices			
Road Matrices	Home-based (24hr PA)	Calibrated assignment matrices split using MPOD data and transposed then aggregated to 24-hour using PA Outbound and Return proportions (see below)	
	Non-home-based (hourly OD)	Calibrated assignment matrices split using MPOD data	
	Goods (hourly OD)	Calibrated assignment matrices	
	Special Generators	Calibrated assignment matrices with extraction of demand for specific zones and demand segments	
Public transport	Combination of Moira and NRTS assigned to demand segments (see following section)		
Cost Matrices			
Reference SATURN UFS files			Extracted from SATURN road assignment.
Rail costs skims for reference and forecast	Base	VISUM Time Skims	Extracted from National Rail network and then compressed to North Model zone system.
	Forecast		
Rail fare skims for reference and forecast	Base	VISUM In Vehicle Time Skim applied to distance-based fare function	
	Forecast		

Parameter/Setting	Data Source	Notes
PA Data		
Outbound proportions Return proportions (by time period for each demand segment, sector movement, and mode)	DIADEM Manual (from NTS) Proportions applied for Employers Business for all sectors MPOD derived proportions used for Work and Other for 13 sectors based on origin trip ends Proportions adjusted to reflect assignment matrix proportions with outbound/return split based on initial values for each time period	
Tour proportions	Default values provided in DIADEM from NTS data, which are then furnessed within DIADEM application to match defined Outbound and Return proportions (see above)	
DIADEM Parameters		
Algorithm	Fixed Step Length (0.5 during base model calibration)	
Convergence	Target GAP of 0.1% for entire model and 0.2% for simulation area	

9.1.5 Representation of public transport supply and demand (Note variation between models)

A representation of Public Transport (PT) demand and supply data was required for the VDM. With the RTM's focussing on Inter-urban travel, and the need for a proportionate approach to representing PT, it was deemed that rail travel was the main competitor to car travel and that bus\coach need not be represented. The following approach to representing rail within the VDM was undertaken:

Derivation of Base Year Public Transport Demand

- MOIRA2 data was used to derive weekday station-to-station matrices for the year up to March 2015.
- This was converted to an average single weekday, based on the number of weekdays in a year, with no adjustment for seasonality.

- Combined weekday, Saturday and Sunday data set was compared to ORR Station Usage data at the annual level to check correlation.
- National Rail Travel Survey (NRTS) data was expanded to match MOIRA time period weekday station-to-station volumes deriving the following segmentation:
  - true origin-destination;
  - access/egress mode;
  - modelled time period; and
  - journey purpose.
- Where NRTS data was not available for specific station-pairs, or the expansion factor was considered too high then aggregate origin-station or destination-station data was applied to estimate the above segmentation. This was only for a small sample of journeys with a relatively low proportion of overall travel volumes.
- Where there were new stations in the MOIRA2 dataset that were not included in NRTS, then true origin-destination data was estimated using gravity model techniques. Other segmentation was estimated based on the paired station or aggregate data for all stations.

Derivation of Base Year Public Transport Supply

A representation of the UK rail network (including Scotland, England and Wales, but excluding Northern Ireland) was prepared using timetable and network data obtained from the Traveline National Dataset, a detailed database of UK rail timetables as well as data from the Association of Train Operating Companies (ATOC). In addition to this the National Public Transport Access Nodes (NaPTAN) provided data on the locations of UK railway stations.

CIF files for April 2016 were downloaded using Basemap Datacutter. These were converted into General Transit Feed Specification (GTFS) format using Basemap TRACC software. These GTFS files were then imported into VISUM, to produce links, nodes, line routes, etc.

The resultant rail network was aligned to a newly developed National Zoning system. This zone system was developed using the finest level of detail from each of the five regional models. A total of 8,049 zones were identified.

After the preparation of the GTFS data and Zone system into VISUM, a number of additional stages were required before cost skims could be produced as follows:

- Connectors were added to connect zones to stop nodes. A filter was placed on the nodes, so as only rail and light rail/underground stop nodes were active. The first iterations of this was:

i) Connectors added to the closest five nodes to the zone centroid, which are less than 1.6km (1 mile) from the centroid with mode set to “walk”. Journey time determined by a walk speed of 3 miles per hour.
ii) For zones with less than two connectors after Stage A, connectors were added to the closest Nodes with mode set to “other”. This is to represent a combination of walking, bus and other modes which could be used to reach these railway stations. Journey time determined by assuming a speed of 3 miles per hour for the first mile, then 30 miles per hour for all remaining distance.

- Major rivers and inlets were reviewed to identify possible inappropriate connectors where crossing points are not available. Inappropriate connectors were deleted and, where possible, replacement zone connectors were added.

- The resultant network was assigned a ‘flat’ demand matrix (of 1’s) to identify errors and highlight areas where connectivity was limited or broken.

The skim tool is currently configured to produce skim matrices for Perceived Journey Time (PJT) and In Vehicle Distance (IVD). The perceived generalised journey time for public transport are calculated as follows:

- In-vehicle time (actual from timetable)

- Access/Egress time (from distance based connectors described above)

- Transfer walk time (from distance based connectors at key interchange locations)

- Transfer wait time (from timetable)

- Number of Transfers × 10 minutes

It should be noted that there is no weighting applied to the walk or weight times. Using the VISUM timetable based assignment method there are also no initial wait times included. In general, it’s important to note that the rail skim tool is not intended to be a PT model and is simply a method of extracting comparable PT costs for the demand modelling with a focus on determining change in rail journey times in forecast scenario(s). Therefore, the in-vehicle time is the most important skim component, unless station choice becomes more of a critical aspect, in which case access/egress may also feature more strongly in terms of change.

Some further key features of the rail skim tool:

- **Time Periods:** The process represents AM Peak (07:00-10:00) only. Following analysis of IP and PM data, it was shown that, although there were differences between the time periods, the effort of preparing three forecast time periods and the context of the RTM’s (with respect to PT representation) suggested that the pragmatic approach is to focus on AM Peak only service representation.

- **Journey Purpose:** The process is configured to represent an average of all rail journeys regardless of journey purpose. Given the absence of fares, with differences in the value of time by purpose, it is not considered that route choice would vary greatly and segmentation would significantly increase the skim tool run times

- **Modes:** The following modes are included in the skim tool:
    - Rail
    - Light Rail/Tram (Trams in Sheffield, Manchester, etc. plus Tyne and Wear Metro)
    - London Underground
    - Ferries

For simplicity, all modes are represented with no capacity restraint on services. Buses are not considered in this skim tool.

Walking is considered with regards to connections to, from and between public transport stations. In addition, a proxy “Other” mode is used to represent travellers accessing rail stations by modes such as bus, car, etc where the average speed is greater than walk.

From the resultant National rail skim, individual regional model skims are derived using demand weighted aggregation.

Rail Fares

To calculate rail fares, MOIRA data (total Revenue and total Demand between any two UK train stations with non-zero demand between them) was analysed to model the relationship between distance travelled on the railways and fares.

Data was obtained from the National Rail Travel Survey, which specified the “distance on network” (In Vehicle Distance) for passengers travelling between stations on the National Rail Network.

Combining these sources of data enabled both average fare and IVD for travellers between different stations on the National Rail Network to be calculated. Using this analysis, Regression Analysis was then performed to model the relationship between IVD and average fare. This analysis was tested using a power function.

The power function produced was:

$$F = 0.28d^{0.9}$$

Where F is the fare in pounds sterling and d is the IVD in km. This relationship described the variance in the fares with an R^2 value of 0.91.

9.1.6 *Software used*

The software required to run the VDM includes:

- SATURN Version 11.3.12 — *Highway Assignment Software*
- DIADEM Version 6.3.3 — *VDM Software*
- HEIDI Version 6.4 — *C# Graphical User Interface to control DIADEM*
- SQL Server 2016 SP1 Express — *Model Database*
- VISUM 15 — *Development of rail skims*

9.2 *Calibration*

9.2.1 Calibration of variable demand model

The source of demand data for highway and rail is, respectively explained in Sections 6.5.1 and 6.5.4. These data were assembled for model application and do not provide a structured data source of sufficient standard directly to estimate the demand model coefficients, although the highway matrix development did consider trip distribution, as discussed further below.

Accordingly, the approach taken to determine demand model coefficients and structure followed WebTAG M2[3] Section 5.6. The research evidence from which the guidance is derived is based on the calibration of a selection of urban models. The main considerations related therefore to extrapolation of this evidence to the relatively long distance range of trips using the Strategic Road Network represented in the RTMs. The estimation of long distance UK travel behaviour most recently undertaken by RAND[4] was limited to trips longer than 50 miles and is not directly applicable. Nevertheless, it demonstrates the same mode/destination choice structure recommended in guidance and the lower generalised cost sensitivity is consistent with guidance on cost damping.

9.2.2 Choice of model parameters and comparison against published values

Model Structure and Sensitivity

Mode, destination and (macro) time period choices are represented in the demand model. The assumed logit choice parameters have been drawn from Median

[3] An update to WebTAG unit M2 was published for consultation during July 2016 and references are made to this ‘draft for consultation’; Hereafter where the draft guidance differs from previous 2014 guidance specific note is made and the section references are distinguished by ‘(M2-2014)’.

[4] Modelling Longer Distance Demand for Travel Phase 2, Final Report, Scott Wilson Ltd, August 2009

illustrative values set out in WebTAG unit M2, as summarised (in units of generalised minutes) in Table 9-3.

Table 9-3 Selected Logit Parameters

Purpose	Car		Rail	
	Destination	Mode, time	Destination	Mode, time
Home based work	-0.065	0.68	-0.033	0.68
Home based employer's business	-0.067	0.45	-0.036	0.45
Home based other	-0.090	0.53	-0.036	0.53
Non home based employer's business	-0.081	0.73	-0.042	0.73
Non home based other	-0.077	0.81	-0.033	0.81

Source: Destination- Table 5.1, Mode, Time – Table 5.2

Demand for non-car available segments is not represented in the variable demand model. Demand by air passengers to airports and freight demand and in forecasts for selected developments is assumed to be modelled separately and therefore held fixed within the RTM. The RTM user can decide whether demand for new developments is distinct and should be modelled separately or is to be included (with suitable seeding of reference demand) within the five purposes represented by the VDM.

Car Occupancy

In developing the highway trip matrices an analysis was undertaken of NTS data to review car occupancy assumptions reflecting the wide coverage and range of trips represented in the RTMs. The car occupancy is covered in the Matrix Development Chapter 6, Section 6.8.6.

9.2.3 Description of any cost damping mechanisms used

Value of Time

WebTAG M2 Section 3.3.6 sets out guidance on the variation of values of time with distance. Accordingly, the approach taken to interpret values of time for the RTM VDMs was applied consistently using national evidence to:

- consider options for a distance cut-off to define d_c

- estimate a value for d_0 using the distance elasticities (η) defined in WebTAG M2 (July 2016 draft) para 3.3.8 that reproduces average distance weighted values of time set out in the WebTAG data book (July 16, release 1.6, Table A1.3.2), taking 2015 values and 2010 prices.

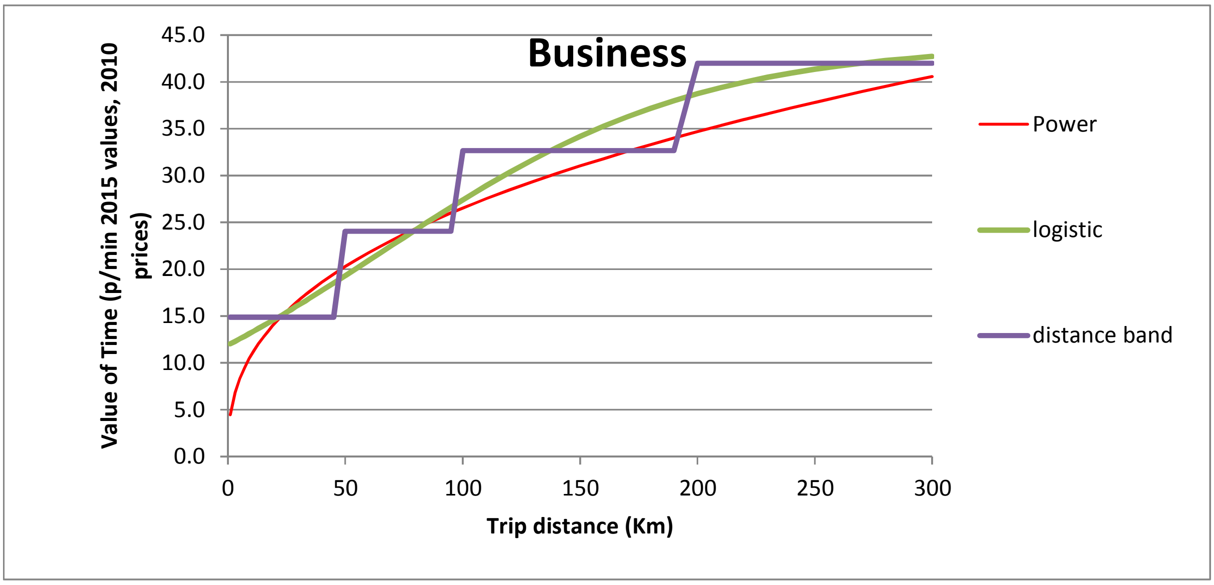
$$VOT_d = VOT.\left(\frac{\max(d, d_c)}{d_0}\right)^{n_c}$$

Where d is minimum trip distance, defined from an interpeak base year highway network assignment (with allowance for travel distance to access the modelled transport network based on the radius of the zone area),

The DfT have also estimated a logistic value of time for appraisal of employers' business travel time saving (consultation draft guidance July 2016 unit A1-3, section 4.2.9). This option is not available in DIADEM and the functional form is not estimated for non-business purposes. Accordingly, the logistic function was used only for verification purposes.

As Illustrated below the material differences between the power and logistic functions (when calibrated to reproduce the same distance weighted average value of time) relate to relatively short distance trips, with the (red) power curve showing lower values of time than the (green) logistic curve for employers' business trips up to about 15 Km.

Figure 9-1 Value of Time by Distance Functions

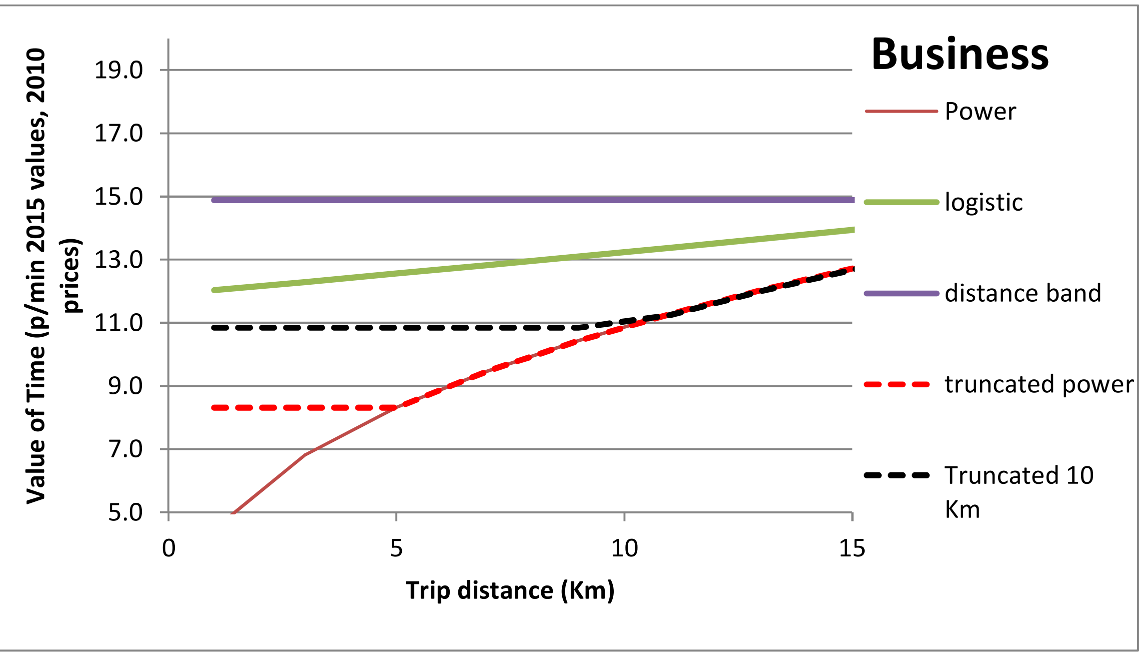


The argument for imposing a distance cut off relates to the relatively high sensitivity implied for short trips where the power function results in a low value of time5. The RTMs have zones based on MSOA geography and will not therefore provide reliable trip length estimates for trips substantially less than about 5Km in length. There are also instances where centroid connectors from adjacent zones have been coded on adjacent network links such that the network distance skims are zero or small. Imposing a cut off will assist stability of the RTMs.

The reasons for recommending the logistic function for appraisal relate to the stability of extrapolation of evidence to very short and very long distance trips, and not whether he logistic or power function fits the observed data better. There are less than 0.3% of business trips recorded in NTS greater than 400Km where the power function has a value of time of about 47p/min, or about 7% larger than the logistic function of 44 p/minute. There are too few extremely long trips to be material for the RTMs and the potential issues about extrapolation concern short trips.

The following figure compares the values of time of short distance trips: the distance banded (purple) and logistic function (green) have higher values than the power function and two variants (dotted lines) where the distance has been truncated at 5 and 10 Km (and the overall value of time calibrated to the same distance weighted average).

Figure 9-2 Value of Time by Short Distance Trips

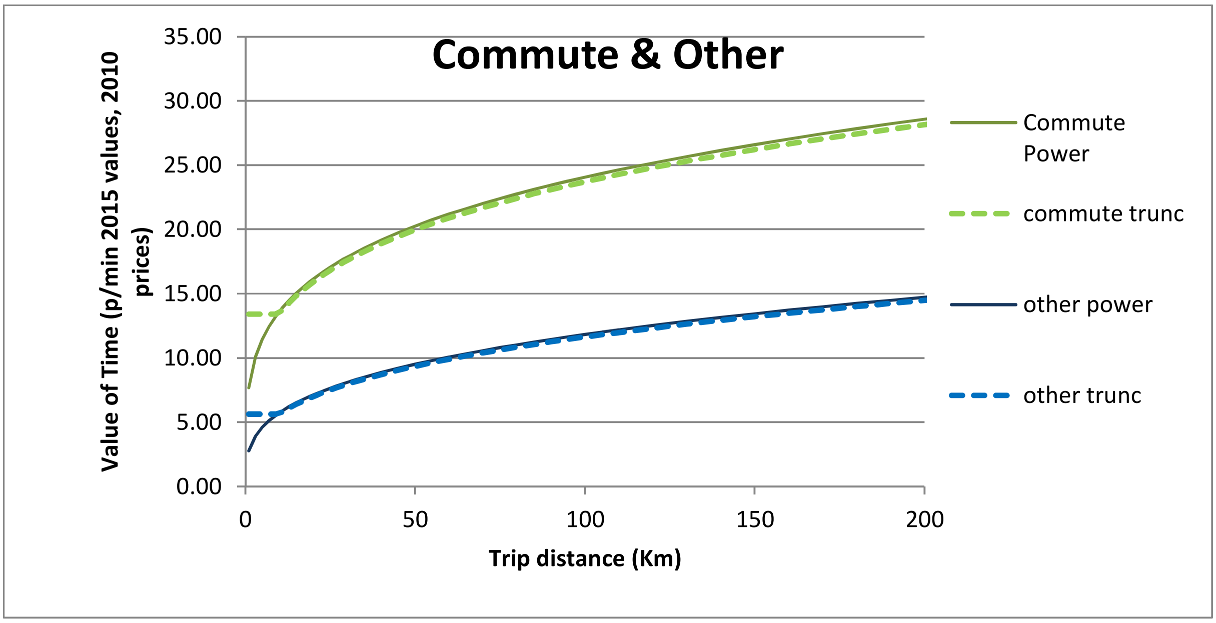


[5] 5 GC (min) = time(min) + cost(p) / VOT(p/min), so lower VOTs give rise to larger generalised cost changes.

There is limited practical difference imposing a lower bound of 8.3 or 10.9 p/min. A 10Km cut off (dc) was therefore adopted as an acceptable compromise that better reflects the logistic function.

For reasons of consistency, this same distance cut off assumption was applied for other purposes. The resulting distribution of values of time are illustrated below.

Figure 9-3 Value of Time by Trip Distance - Commute and Other Purposes



Separate elasticities are not provided for non-home based purpose, nor is there a substantial difference in trip lengths between home base and non-home based average trip lengths for business and other purposes. The same value of time distributions have been assumed for the non-home based employers business and non-home based other purposes as for their home-based equivalents.

Estimating D0 to reproduce distance weighted average values of time yields the following parameters. (Note that the values for D0 set out here are calibrated to reproduce distance weighted average values of time set out in the WebTAG databook (November 2016 Draft) and are accordingly much larger than would be implied if the functions were calibrated to a trip weighted average value of time.)

Table 9-4 Value of Time Weighted by Distance

Parameter	Home Based Employers Business - car	Home Based Employers Business - Rail	Home Based Work	Home Based Other
VoT (p/min 2015 values, 2010 prices)	26.38	43.51	17.66	8.06
Dc (Km)	10	10	10	10
Do (Km)	99.5	165.5	30.5	31.2
η	0.387	0.435	0.248	0.315

Damping Generalised Cost as a Function of Distance

Work was undertaken to establish synthetic car demand matrices as part of the task to develop prior highway demand matrices (see section 6.3 of this report) For this task a lognormal function was adopted to reflect the observed distribution of travel demand with distance. The parameters estimated provide direct evidence on how the sensitivity of demand to generalised cost varies with distance.

The original intent was therefore to implement the VDM using the same functional form. Delivery programme time constraints together with software implementation issues introducing this function in DIADEM resulted in an approach that adopted a form of cost dampening set out in WebTAG unit M2 (Section 3.3). This was however verified against the evidence from the highway matrix development. The following paragraphs therefore first briefly introduce the lognormal function and then explain how this was used to inform the choice for damping generalised costs in the RTMs.

For the purposes of establishing highway matrices, a number of simplifications were adopted in defining generalised costs: a single value of time and cost per Km was adopted in generating generalised costs. The lognormal functional form is not amenable to direct post estimation adjustment to derive parameters consistent with the generalised cost formulation adopted for the VDM. However, limited sensitivity analysis indicated that the effect on the estimated coefficients would be modest.

A second area of concern arose from a review of the iterative procedures applied to establish the synthetic matrices. This confirmed that, while estimated trip length distribution had adequately converged, the estimated coefficients were not stable between iterations. A pooled estimate of coefficients across all time periods and RTMs was adopted to reduce uncertainty about central coefficient values.

The indicative coefficients and their standard deviations (based on variation between models and time periods) are set out in Table 9-5, based on the standard log-normal distribution function:

$$\frac{1}{C_i\sigma\sqrt{2\pi}} exp\left(\frac{-(lnC_i - \mu)^2}{2\sigma^2}\right)$$

WhereC is the generalised cost, and

σ and μ are the fitted distribution parameters.

Table 9-5 Averaged Lognormal Parameters from all RTM highway matrix syntheses

	HBW		HBEB		HBO	
	μ	σ	μ	σ	μ	σ
mean	2.7	0.70	2.5	0.92	2.21	0.67
(st. dev)	0.43	0.11	0.63	0.22	0.46	0.25

Two common approaches to cost damping are set out in WebTAG:

- varying cost as a function of distance, with common cost damping parameters are set out related to the distance function (WebTAG M2 para 3.3.15); and
- a power function of utility, for which common cost damping assumptions referred (WebTAG M2, para 3.3.18), for which a beta value of 0.75 (centre of range) was assumed and a value for mu estimated to set the mean generalised cost.

A spreadsheet based approach was adopted using NTS trip length distributions, assumed generalised cost distributions and the lognormal, distance based and power based cost dampening alternatives.

The following figures illustrate the forecast change in trip length arising from an increase in fuel cost implied by different distribution functions represented in the spreadsheet. Overall elasticities are summarised in Table 9-6**Error! Reference source not found.** which covers trips of all lengths. (It should be noted that the spreadsheet tool did not include constraints in trip attractions and the purpose was merely to understand the behaviour of different functions, not to indicate or provide a comparison for the individual RTMs. The figures focus on the 20-200 Km trip length that will be of most relevance to the SRN forecast traffic, showing on the left the cumulative proportion of trips against distance and on the right the cumulative trip kilometres against distance, and setting out:

- the NTS trip length distribution (base - black),
- the effect of applying a standard logit function with fixed values of time (dotted),
- a standard logit function with values of time increasing with distance (thin red line),
- logit with value of time increasing with distance using distance based cost damping (thick dark brown line),
- logit with value of time increasing with distance using power based cost damping (thick light brown line), and
- lognormal (thick green line).

Over the distances illustrated the figures indicate little difference between the two cost damping and log-normal functions – the forecast change in trip length distribution to a change in fuel cost appears similar. (The figures do however demonstrate substantial and material differences where no cost damping or only a variation in value of time with distance is represented.) The lognormal function behaves differently for short distance trips and the elasticities shown in Table 9-6 are influenced by that difference. The effect of the power function appears to have a more consistent influence on elasticity between business and other purposes whereas the distance based function results in a larger reduction in business related elasticity.

Table 9-6 Implied Fuel Elasticity

Function assumed	HBW	HBEB	HBO
Standard logit, fixed Value of time	-0.59	-0.57	-0.49
Logit, value of time increases with distance	-0.44	-0.39	-0.44
Logit, value of time increases with distance, distance based cost damping	-0.26	-0.13	-0.32
Logit, value of time increases with distance, power function cost damping	-0.25	-0.21	-0.24
Lognormal, value of time increases with distance	-0.33	-0.10	-0.36

Figure 9-4 Illustrative HBW Responsiveness

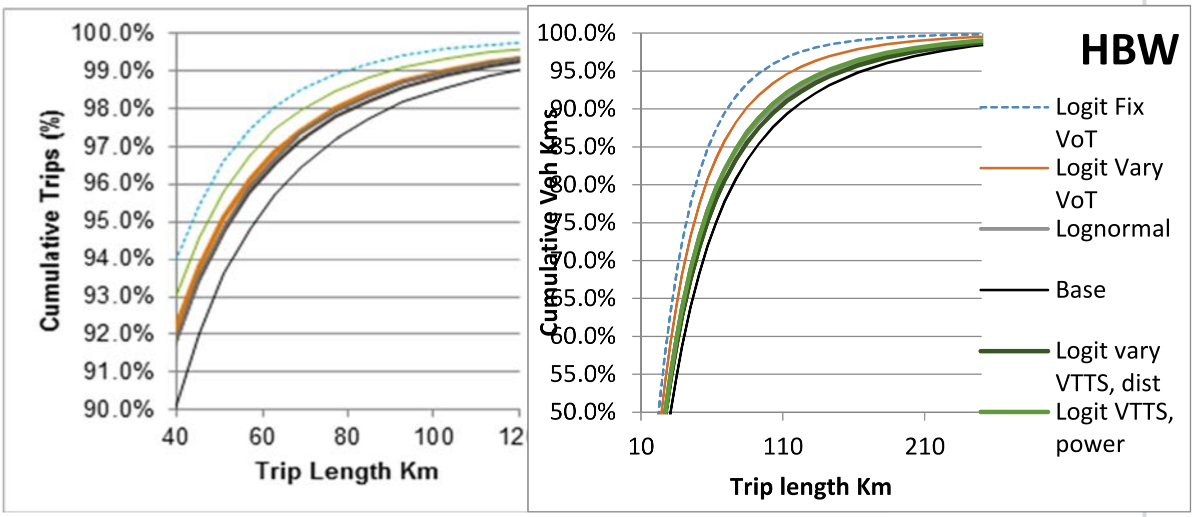


Figure 9-5 Illustrative HBEB Responsiveness

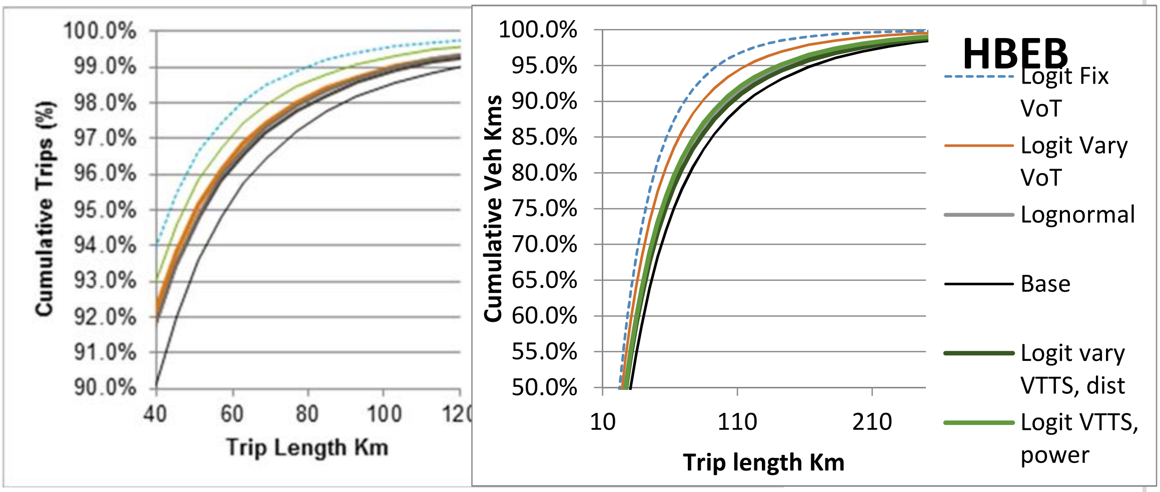
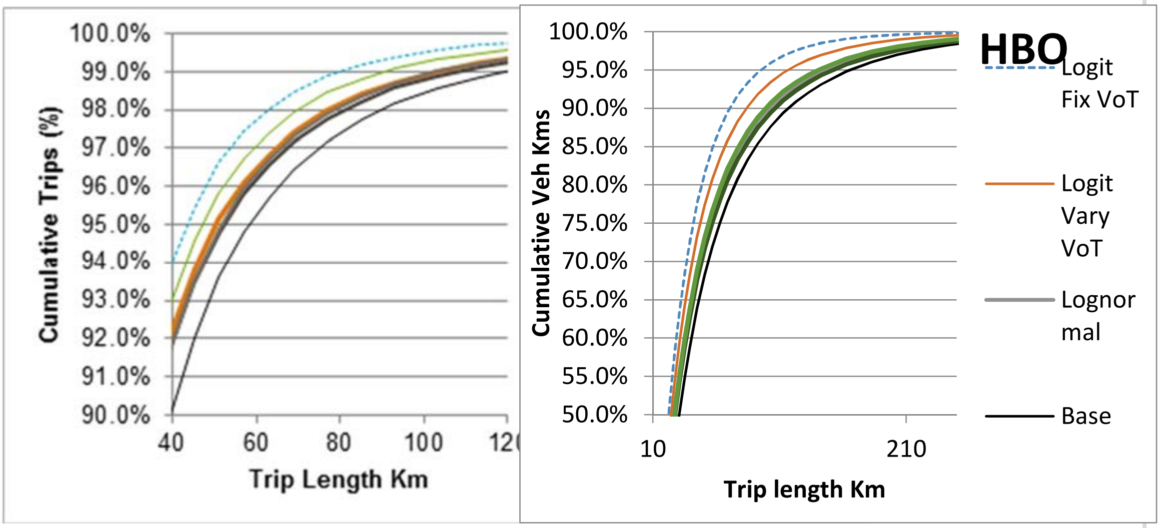


Figure 9-6 Illustrative HBO Responsiveness



Both the power based and distance based cost dampening approaches (with an assumption also that values of time increase with distance) result in similar forecasts of the change in trip length distribution for a change in fuel cost. These are similar to the forecasts that arise from the log-normal function using parameters implied from the RTM trip matrix estimation.

Given that the distance based deterrence function appears to result in a more plausible balance between business and non-business fuel price elasticity this form was selected. As previously noted the common assumptions set out in WebTAG were adopted.

$$\acute{G} = max\left(1, \left(\frac{d}{k}\right)^{-\alpha}\right)G$$

WhereG is the generalised cost combining time and monetary cost

d is the trip distance

k is a distance cut off, 30Km

α is a parameter, 0.5

9.2.4 Description of model convergence

All variable demand models need to iterate between the demand model and the assignment (or supply) model. This is because the volume of demand affects travel times, which in turn affect the volume of demand and so on.

As in any such modelling system it is important to monitor the convergence of this iterative process. Poor convergence causes noise in the model outputs, which in turn introduces errors into subsequent analyses such as economic appraisal, noise and air quality.

WebTAG requirements for VDM convergence are set out in section 6.3 of TAG Unit M2. This defines the demand/supply gap as the preferred measure of convergence and states that:

> 'Tests indicate that gap values of less than 0.1% can be achieved in many cases, although in more problematic systems this may be nearer to 0.2%. Where the convergence level, as measured by the %GAP, is over 0.2% remedial steps should be taken to improve the convergence, by increasing the assignment accuracy.'

WebTAG also states that 'ideally the user benefits, as a percentage of network costs, should be at least 10 times the % Gap achieved in the Without-Scheme and With-Scheme scenarios.' However, this relates to economic appraisal and forecasting and cannot be applied to base year realism testing.

One of the new features introduced into version 6 of DIADEM for the RTMs is the ability to calculate the demand/supply gap over a subset of matrix cells. This feature was requested because of a concern that the whole-model gap would be dominated by external zones with very high flows, and may give a misleading picture of convergence within the region of focus (RoF).

The gap calculated over a subset of matrix cells is referred to the 'subarea gap'. The subarea has been defined as all internal to internal movements within the RoF.

Based on WebTAG guidance, and on practical experience in terms of what is achievable with the RTMs, the stopping criteria in DIADEM were set as:

Whole-model gap < 0.1% AND subarea gap<0.2%.

The gap values achieved during realism testing, along with the number of demand-assignment loops required, were as follows:

Table 9-7 Gap Values from Realism Tests

Attribute	Whole model gap	Subarea gap	Number of loops
Fuel cost realism test	0.06%	0.09%	3
Rail fare realism test	0.04%	0.09%	3

9.2.5 Discussion of where the model is less robust with statement on how this impacts on the model's performance

The focus and associated strength of the RTMs is the representation of highway demand making inter-urban movements. Inter-urban rail demand is represented. There is no representation of inter-urban coach or air modes, however these generally have niche markets and may be of relevance therefore only in particular exceptional contexts.

There are simplifications to the highway network using fixed speeds in the largest conurbations (not relevant to NRM), the zones are relatively large with a correspondingly coarse treatment of short (intra-zonal) demand and no representation of travel by active modes, bus or park and ride. The VDM implemented for the RTMs will not therefore provide a reliable basis to forecast the effect of transport interventions on changes intra-urban travel behaviour. The main concerns would be for the appraisal of schemes on the periphery of urban areas where local mode choice or local trip redistribution could affect a material proportion of traffic using the SRN and of relevance therefore for assessing the impact of interventions on or adjacent to the SRN.

With respect to longer distance travel demand - the main focus of the RTMs - care has been taken to implement a model that reflects available evidence representing variations in sensitivity with distance. The approach taken in the RTMs will represent a significant change from existing practice where the sensitivity (fuel cost elasticity) of individual scheme demand models has been constrained to reproduce the same national average value, largely irrespective of the nature of travel within the modelled area. While this aligns better with the research evidence available, the consequence will be that in using the model there will be some schemes for which the demand modelling responses are larger than would be evident from previous (local) modelling and also others where a smaller demand response will be forecast.

This variation in response will require consideration particularly if an approach is taken to develop local models drawing on the RTMs in the assessment of individual schemes.

9.3 Validation

9.3.1 Realism testing

Realism testing has been undertaken for the five RTMs following the guidance set out in Section 6.4 of TAG Unit M2. Specifically, demand elasticities have been calculated using the formula specified in the guidance:

$$e = \frac{\log(T^1) - \log(T^0)}{\log(C^1) - \log(C^0)} \quad (1)$$

where: T^1 and T^0 indicate values of demand in the test and base runs

C^1 and C^0 indicate levels of cost in the test and base runs

Given that the RTMs are designed to evaluate schemes on the strategic highway network, most of the focus in the VDM group discussions has been around the fuel cost kilometre elasticities. However, the realism of the rail fare elasticities has also been assessed.

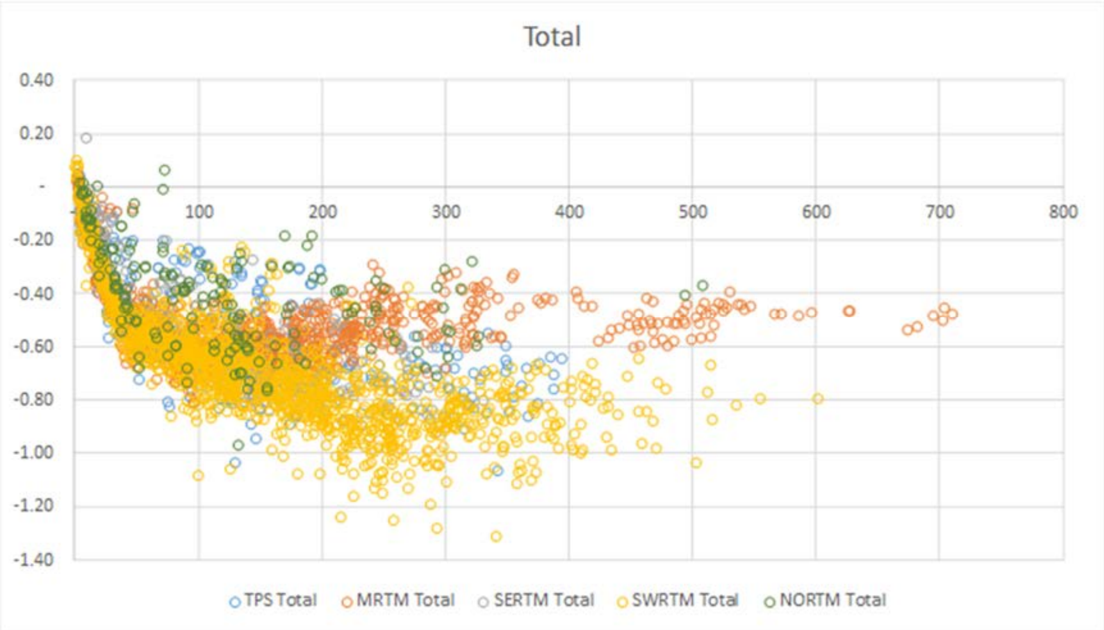
Fuel cost elasticities

The Section 6.4 TAG Unit M2 guidance on fuel cost elasticities is that the overall annual fuel cost elasticity *across purposes* should lie in the range -0.25 to -0.35. Guidance around expected purpose variation is also provided:

- values for business travel expected to be in the region of -0.1
- values for commuting and education expected to be in the region of the -0.3 average
- values for discretionary travel expected to be closer to -0.4.

Fuel cost elasticities would be expected to increase with distance, and analysis of the RTMs has confirmed that all five models exhibit a strong variation in elasticity with distance. Figure 9-7 scatters, for each region, distance in kilometres and fuel cost elasticity.

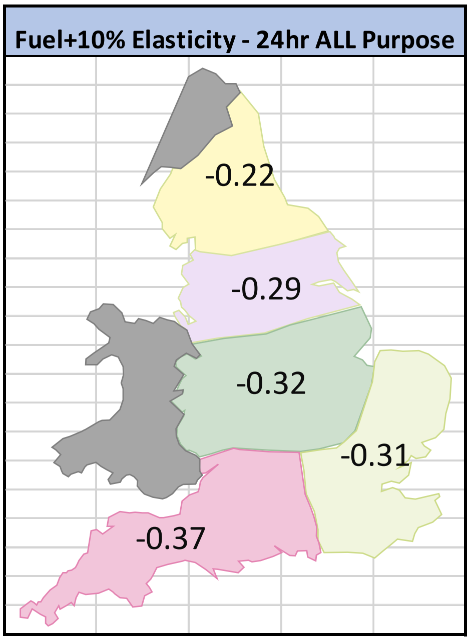
Figure 9-7 Variation in Fuel Cost Elasticity with Distance



For all five regions there is a strong relationship between fuel cost elasticity and distance, with broadly similar shaped curves that increase rapidly for the first 100km, and level off after 300km. However, there are differences between the regions: in particular, for a given trip distance the elasticities in South West are stronger than those for other regions, and those for North weakest and in a few cases positive (these cases are explained in Section (b) below).

The fuel cost elasticities that have been obtained from the RTM models are also summarised in the figure below.

Figure 9-8 Fuel cost elasticity by region



A simple mean of the five elasticity values is -0.30, and so overall the fuel cost elasticities remain in line with current WebTAG guidance. However, there is intra-regional variation, in particular North is weak whereas South West is strong.

To investigate factors that might explain the inter-regional variation in elasticity the mean trip lengths (in kms) by region and purpose are presented in Table 9-8 below.

Table 9-8 Mean trip length by purpose and region (km)

	North	South West	TPS	South East	Midlands
Business	40.0	29.3	28.9	24.1	41.0
Commute	12.5	14.4	15.4	17.1	14.2
Other	10.5	10.1	7.6	12.4	8.2

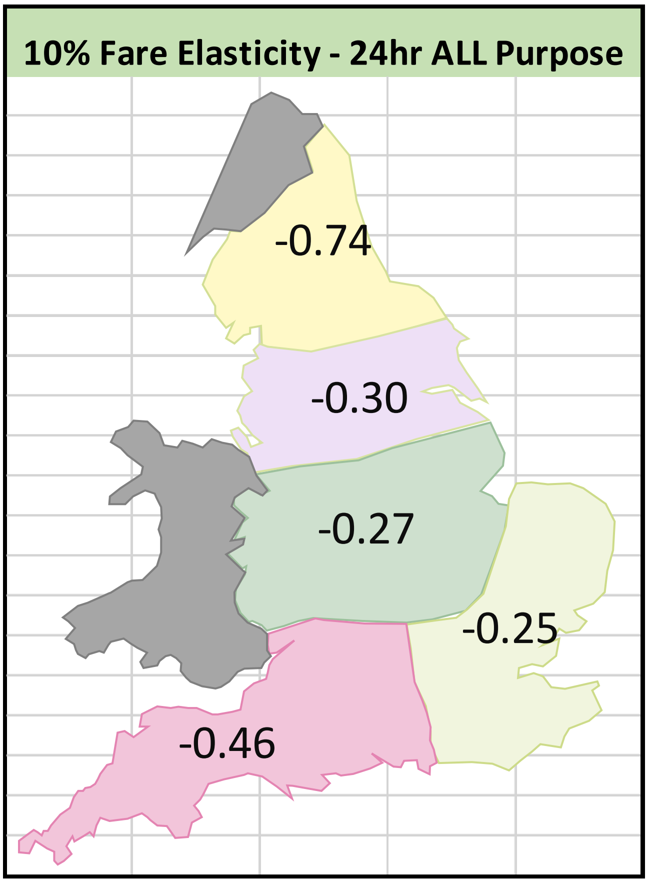
Shorter trips are associated with lower fuel cost elasticities, but there is no evidence from the table that trip lengths in the North are lower than average (apart from for commute) which might explain the low fuel cost elasticity. Similarly, trip lengths in the South West are no higher than average. Figure 9-7 above also suggests that there are intra-regional differences in elasticity over and above what is explained by distance.

Differences in the purpose mix between regions would be expected to contribute to differences in the fuel cost elasticity, with a higher than average business share leading to a weaker overall elasticity and a higher than average discretionary travel share leading to a stronger overall elasticity. For example a higher than average discretionary travel share is a plausible explanation of the high overall fuel cost elasticity in the South West.

Public transport fare elasticities

WebTAG quotes a public transport fare elasticity range of -0.2 to -0.9, i.e. a relatively wide range of values, based on 2004 TRL work. The following figure summarises the PT fare elasticities obtained in each of the five regional models.

Figure 9-9 PT fare elasticity by region



It can be seen that while the values range considerably between regions, all of the values lie within the -0.2 to -0.9 range outlined in WebTAG. The South East presents the lowest value. Higher mean incomes, and the lack of a realistic mode choice alternative for those commuting into Central London by rail, are factors that will contribute the low rail fare elasticity. Conversely the NRM area provides a relatively high elasticity for opposite reasons.

9.3.2 Model limitations and impacts on performance

Section 9.3.1 above discusses the comparison between all five RTMs of their top-line realism responses (car fuel cost and PT fare own-price elasticities) and their relationship to the indicative ranges provided by WebTAG. This section describes the differences between model responses in more detail. We examine the fuel cost realism responses by purpose and consider further the differences in the transport characteristics between the regions and how these might be expected to influence these. Finally, we discuss the limitations in model implementation (generic across all the RTMs) which might be expected to modify responses with respect to those typically found in more urban-centric multimodal transport models.

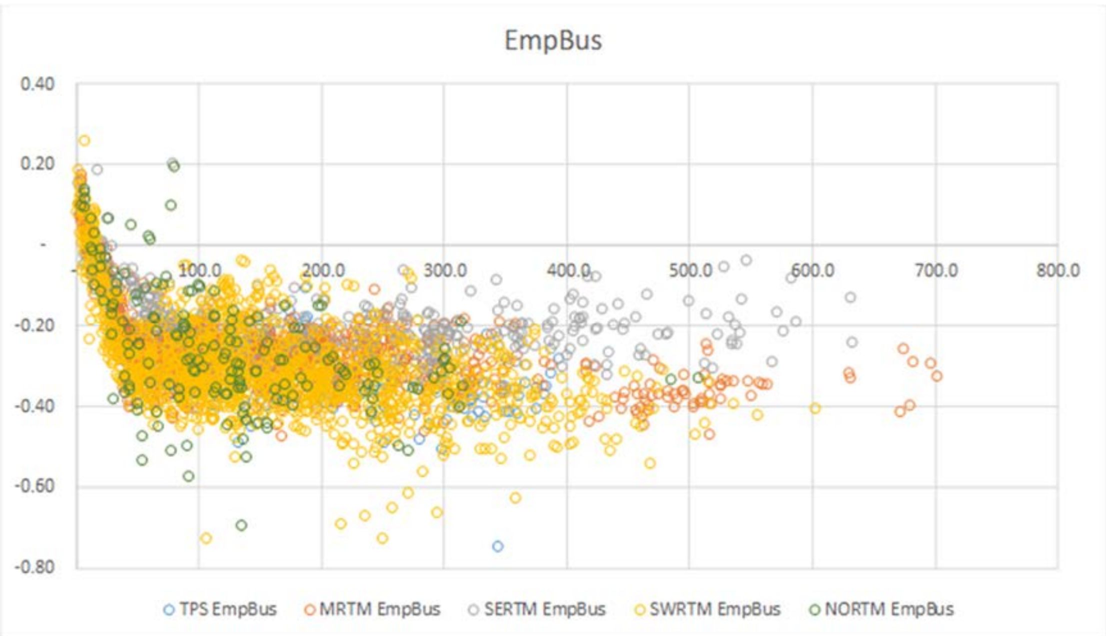
Table 9-9 below shows the individual car fuel cost elasticities by purpose and model.

Table 9-9 24-hr car fuel cost elasticity by region and purpose (matrix-based, Internal to All)

Purpose	North	TPS	Midlands	South East	South West
Business	-0.21	-0.21	-0.22	-0.11	-0.22
Commute	-0.16	-0.17	-0.20	-0.13	-0.19
Other	-0.29	-0.45	-0.43	-0.41	-0.54
Total	**-0.22**	**-0.29**	**-0.32**	**-0.27**	**-0.37**

The employer's business fuel cost elasticity is consistent between four of the models (near -0.21) with only the South East model being an outlier with a significantly weaker value of -0.11.

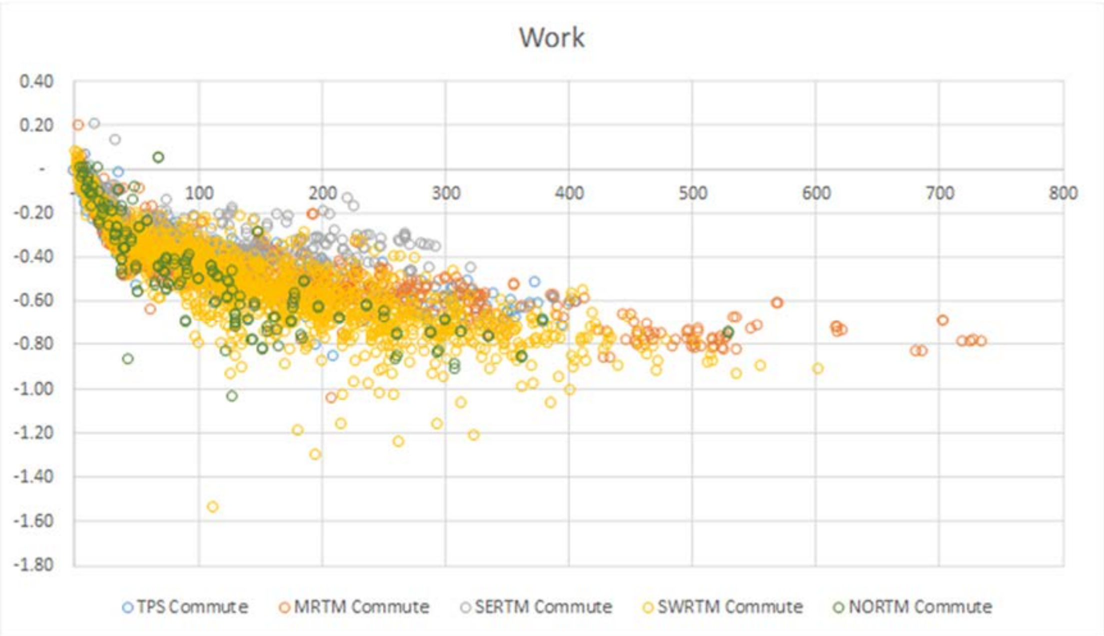
Figure 9-10 Variation in fuel cost elasticity with distance – Employer's business



The chart in Figure 9-10 above is analogous to that in Figure 9-7 but shows the scatter plot of sector-sector elasticities colour-coded by model for the employer's business (EB) purpose only. It can be seen that the South East (grey circles) elasticity with respect to distance tends to lie on the weaker side of the scatter with respect to distance. This is coupled with the lowest average distance for EB being in SERTM, and lower distances tend to correspond to weaker elasticities (as can be seen in all these scatter plots). Higher mean incomes in the South East may also lead to reduced fuel cost elasticities. Together these effects provide an explanation for the weaker EB fuel cost elasticity reported for SERTM. It should be noted that it is only this SERTM elasticity which accords well with TAG Unit M2 guidance for the expected value for business travel of -0.1 (as mentioned above), but this will be discussed further below.

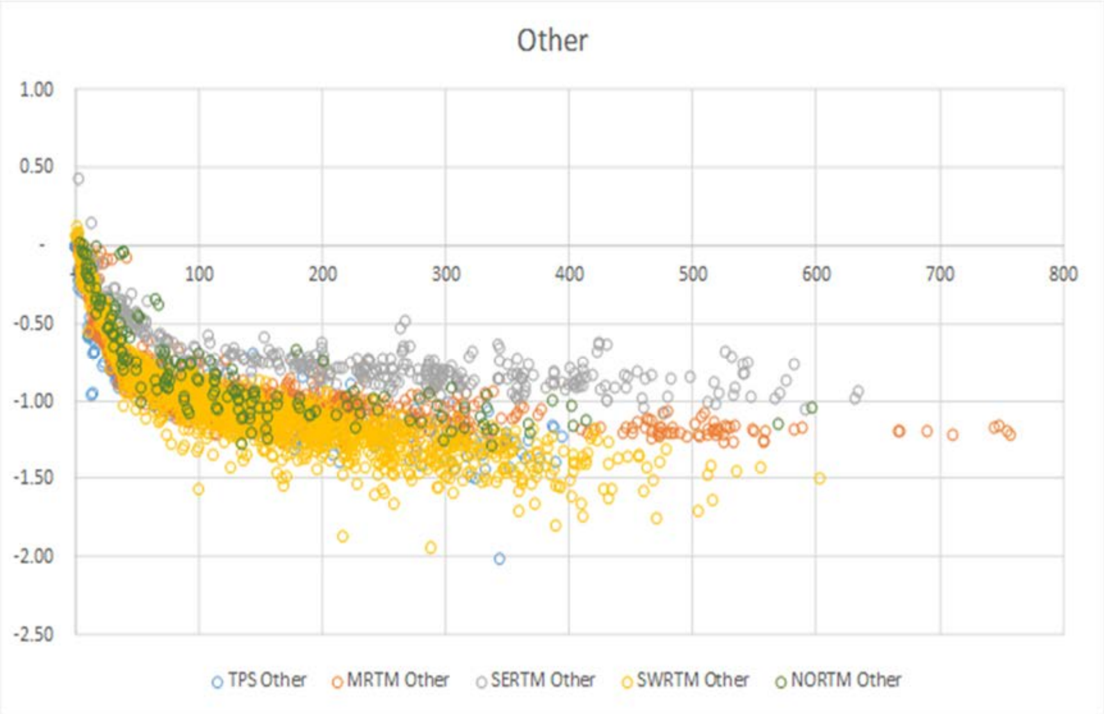
The commuting fuel cost elasticities show more variation between the models in general but across a narrower range, so while South East is again weakest at -0.13, and Midlands is again strongest at -0.20 the relative differences are lower. In this case, though, SERTM has the highest average distance for this purpose (17 km), but the scatter plot for commuting elasticity with distance (Figure 9-11) again indicates that the SERTM elasticities tend to the weaker end of the range.

Figure 9-11 Variation in fuel cost elasticity with distance – Commuting



For the Other purpose, three models show relatively consistent elasticities in the range -0.41 to -0.45, with a stronger elasticity of -0.54 for the South West and a significantly weaker elasticity of -0.29 for North. The scatter plot of other purpose elasticity with respect to distance (Figure 9-12) again shows that South East and perhaps North have values at the weaker end of the range. In the case of SERTM this is compensated for by the largest average distance for this purpose (12.4 km). This may not seem much greater than those for the other models but it should be noticed that the other elasticity increases in absolute value most quickly with distance, thus magnifying the impact of differences in average trip length.

Figure 9-12 Variation in fuel cost elasticity with distance – Other



Trip Length Distributions and Purpose Split

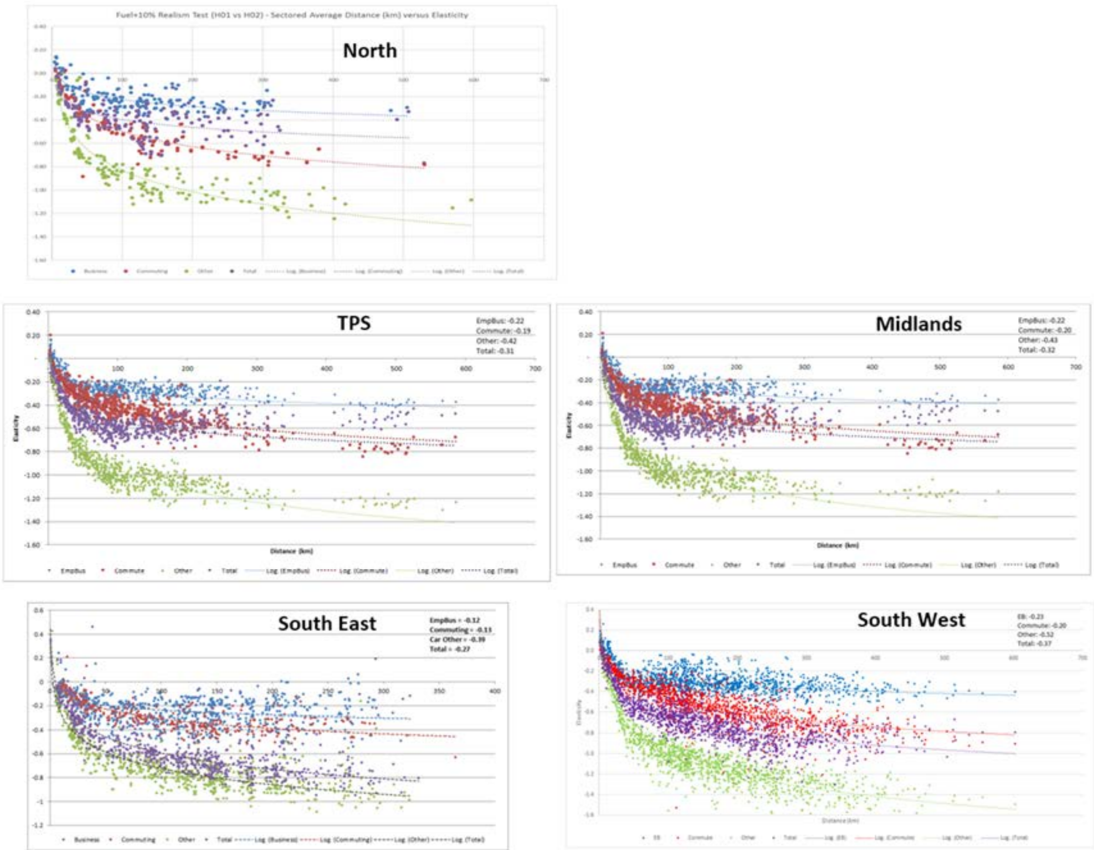
The elasticity profiles by purpose with distance are relatively similar between the models, but it is clear that these profiles and the associated average trip lengths do not fully explain the differences in outturn elasticities between them. In fact, the trip length distribution (TLD) interacts with the elasticity profile to produce the eventual average elasticity of response. For instance, if a TLD has a long tail then this will correspond to much stronger elasticities at distance and lead to a much stronger average; whereas a bias towards short trips might correspond to very weak or even positive[6] elasticities and thus lead to a weaker average elasticity.

Figure 9-13 shows a set of plots of elasticity profiles by purpose with one for each model. Note that it is not intended to examine these plots in great detail; the information has already been presented by purpose above. The intention is to look at the relative behaviour of the elasticities by purpose and the totals and consider the implications for trip length distributions. All the plots use the same ranges (elasticity from -1.6 to +0.4, distance from 0 – 700 km) except South East which

[6] Positive elasticities are possible, especially at shorter distances, because the demand model hierarchy leads to redistribution being a much stronger effect than mode choice. For a fuel price increase this means that longer trips redistribute to shorter distance movements; and fuel price is a relatively greater share of generalised cost for longer distance movements than shorter. This is why the elasticity profiles become stronger with distance. The net effect at short distances is an increase in car trips, and thus a positive elasticity of response for those movements.

uses and elasticity range of -1.2 to +0.6 and a much shorter distance range of 0 – 400 km. The first point to notice is the relative similarity of the distance profiles of elasticity by purpose for employer's business (blue, weakest), commuting (red, intermediate but closer to EB) and other (green, strongest). This consistency has been noted in the discussion of Figures 9-8 to 9-10 above, and indicates a broad similarity in response between the models by distance.

Figure 9-13 Variation in fuel cost elasticity with distance and purpose by Model



The important point to observe in Figure 9-13 is the relationship between the total (trip weighted average) elasticity (purple) and the other purposes. For North, the total elasticity is already weaker than commuting at 100 km and rapidly approaches that of EB above 2-300 km. This means that EB trips dominate at longer distances even from 100 km and there cannot be a ‘long tail’ of other trips representing a significant share of highway trips at long distance. This means that the overall other purpose elasticity is likely to be weak for North despite its reasonably high average trip length because it is the tail of longer distance other purpose trips (at strong elasticities) which preferentially dominate the average (at least, in all the other models). This provides a final explanation for the observed overall weaker other purpose elasticity for the North model, and therefore the weakest total average elasticity (Figure 9-8) given that the other purpose represents the greatest fraction of all trips.

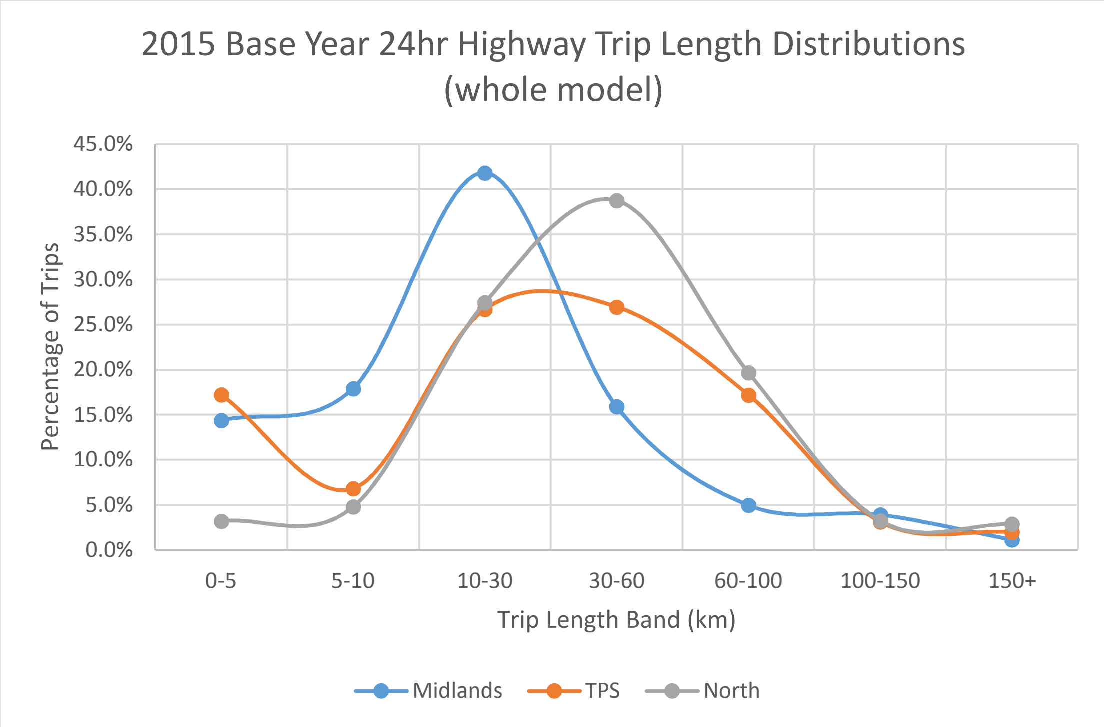
TPS and Midlands show similar behaviour to each other, with EB starting to dominate over other in the total average elasticity beyond 150-200 km and strongly dominant over 300km. South West on the other hand shows that other purpose trips dominate EB out to ~500km, and the implied long tail leads to the strongest other purpose elasticity, and therefore the strongest total average elasticity (Figure 9-8) given that the other purpose represents the greatest fraction of all trips.

Finally, for SERTM, it is clear that the other purpose trips dominate EB in their influence on the total out beyond 300km and more closely so at all distances than the other models. This in turn implies a short tail for EB trips and we observe this in the lowest average trip length for that purpose. Noting that this analysis is focussed only on highway trips, this relative shortness of EB trips is perhaps because longer trips are more likely to be made by rail in the SE given the levels of highway congestion and that rail is often the best bet for central London destinations where many of these trips are attracted to. Conversely this implies a long tail for other purpose (highway) trips which we again observe as the highest average trip length. This in turn causes the other purpose average elasticity to be stronger than North and close to Midlands, even though SERTM shows the weakest elasticity profiles with distance of the models for all purposes. Since the relatively stronger other purpose elasticities dominate the total elasticity across the distance range, SERTM attains an overall average fuel elasticity stronger than North and close to TPS.

The distance profiles discussed above relate to the movements under consideration for the elasticity determination which are, by agreement, internal to all[7] only. The corresponding TLDs and their differences between models are only deduced indirectly from the elasticity profiles with distance. Direct evidence of TLDs is available from the Midlands, TPS and North models and these also demonstrate that there are differences in TLDs between models. Note that these TLDs are for all purposes and all movements (including external➔external) and therefore imply longer average trip lengths than might be anticipated from Table 9-8.

[7] i.e. internal➔internal plus internal➔external but excluding external➔internal and external➔external

Figure 9-14 Trip length distribution for Midlands, TPS and North models (whole model)



Differences in mode shares between the models (especially for the relevant subset of movements) will also have an influence on the top-line outturn elasticities (Figure 9-8) as these will change the relative weights of the individual purpose-specific elasticities.

Figure 9-15 Trips by purpose Midlands, TPS and North models (24hr, whole model)

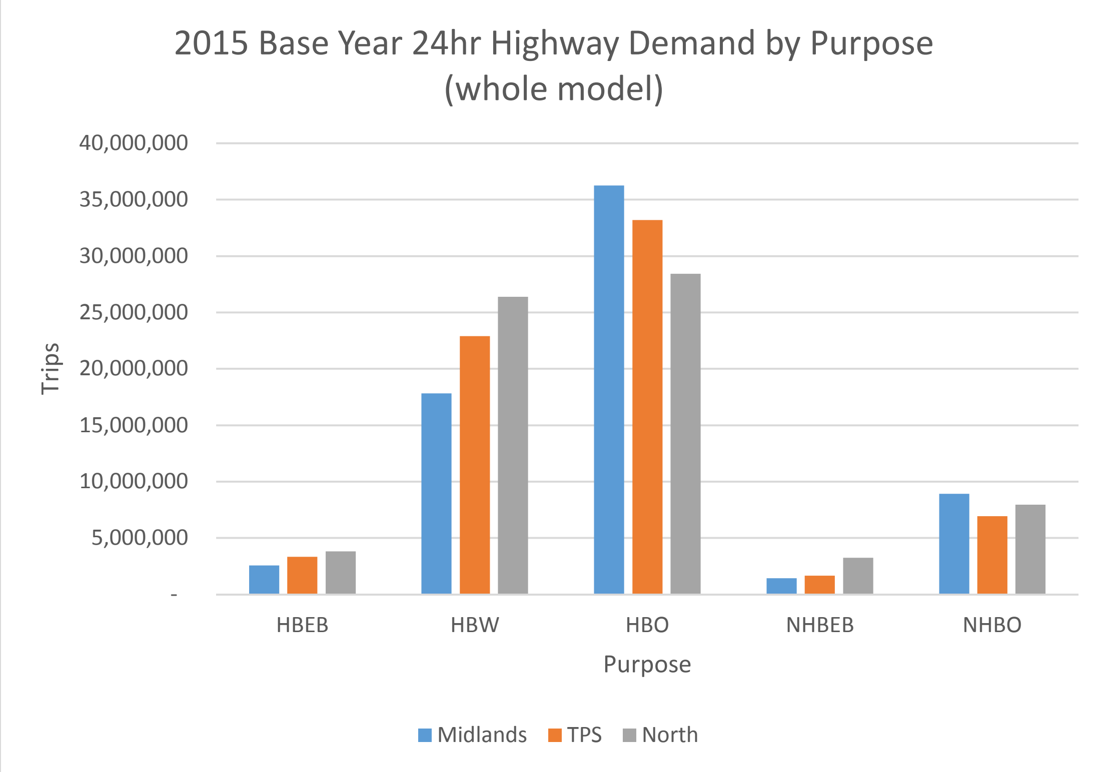


Figure 9-15 shows the absolute numbers of trips by purpose for the Midlands, TPS and North models. While these shares are for the whole model (all movements), if we assume the relative proportions are maintained for the internal→all movements used to calculate elasticities then we can immediately see that North has a much greater fraction of less elastic EB and commuting trips with respect to (more elastic) other purpose trips than Midlands. We would therefore expect a significantly weaker overall elasticity for North (c.f. Midlands) on this basis alone notwithstanding the TLD discussion above. TPS lies between Midlands and North so again we might expect TPS to have a weaker overall fuel cost elasticity than Midlands on this basis alone, and this is indeed what is observed.

The above discussion demonstrates that the interactions of model-specific (but relatively consistent) elasticity profiles with local purpose shares and trip length distributions can make significant inroads into explaining the observed differences between the models in terms of (relative) fuel cost elasticities by purpose and overall.

Differences from WebTAG fuel cost elasticity recommended values

The relative fuel cost elasticities are well explained by considerations discussed above, and the top-line total fuel cost elasticities are broadly in line with WebTAG's indicated range of -0.25 – -0.35, with only North falling on the weaker side at -0.22 and South West on the stronger side at -0.37 (and these in turn explainable by the characteristics of their highway matrices in terms of trip length distribution by purpose). However, there is a clear difference between the RTM elasticities by purpose and those suggested by guidance:

- The RTM business elasticities are approximately twice as strong as guidance at approx. -0.2 rather than -0.1;
- The RTM commuting elasticities are nearly half as weak as guidance being -0.2 or weaker rather than -0.3; and
- The RTM other purpose elasticities were nearly all somewhat stronger than the -0.4 suggested in WebTAG.

Basic modelling considerations tell us that the influence a monetary cost component (such as fuel cost) will have on the overall generalised cost will depend on the value of time applied to convert that money cost into units of (generalised) time. Therefore, an increase in value of time by a given factor would be expected (at first approximation) to reduce the elasticity of a money-cost related policy test by the same factor. The RTMs use new values of time from recent DfT research and these represent a significant step change from those which preceded them.

Table 9-10 TAG November 2016 vs TAG July 2016 perceived Values of Time (£/hr 2010 prices & values)

Purpose	July 2016	November 2016	Factor
Business	22.75	16.19	0.71
Commute	6.81	9.95	1.46
Other	6.04	4.54	0.75

The factor for Business travel is complicated by a new distance-dependent component which further reduces the new perceived VoT for car trips under 50km to £8.42/hr so that over most of the range 0-100km (where the majority of car trips take place) the factor to be applied is ~0.5 or less. These factors in themselves are sufficient to explain the differences between the RTM purpose-specific elasticities and those indicated in TAG Unit M2. Indeed, we might expect the RTM other purpose elasticities to be stronger than they are (in the region of -0.53), but it should be noticed that the RTM “other” purpose includes education trips which are indicated as having a weaker elasticity.

In addition to the changes in VoT which have occurred during 2016 as a result of new research, there are other effects which need to be considered which might influence the anticipated fuel cost elasticities.

WebTAG unit M2, para 6.4.14 states that '*the annual average fuel cost elasticity should lie within the range **-0.25 to -0.35** (overall, across all purposes)*', and indicates that income and trip length distribution should be considered to indicate the appropriate sensitivity in this range. There is also guidance (Para 6.4.17) on the relative sensitivity of business, commuting and other trip purposes.

The guidance is based primarily on research undertaken in 2002.

WebTAG unit M2 sets out variable demand modelling methodology following the principle that a fixed function is used to forecast how changes in travel costs affect travel choices. Default parameters for this function are expressed in units of in-vehicle time, implying that sensitivity to travel time should be assumed not to change in forecasting. The implication is that in forecast years, after allowing for assumed changes in travel costs and in values of time, the marginal sensitivity (i.e. elasticity) of models will change from those used to verify the model calibration in the base year.

Fourteen years have elapsed since the published research. The question arises whether there have been changes in price elasticities. That is, whether it remains appropriate to verify that demand models have a base year elasticity of about -0.3. Since 2002 changes to the relevant factors (prior to the introduction of new VoTs discussed above) have been as follows:

Source of Change	Change	Source and Assumptions
Car fuel efficiency	-15%	WebTAG 3.5.6 Table 13 (2007), and WebTAG databook A1.3.10, December 2015. Note efficiency for petrol car used, and the increase use of more cost efficient diesel cars is not included, and 0 change assumed for 2005-2006 which is missing from these two sources.
Fuel pump price	13%	AA Fuel price report , 2002 average (73.3p); DECC weekly statistics[8] average petrol pump price average 2015 (111.0p); deflated using CP index
Value of time	+13%	WebTAG databook Annual Parameters, December 2015, Average GDP/person, historic

[8] https://www.gov.uk/government/statistical-data-sets/oil-and-petroleum-products-weekly-statistics

		data between 2002 and 2014 and forecast for 2015

In combination, the increase in fuel efficiency has offset the increase in pump price (although the comparison here excludes the increased use of more efficient diesel vehicles). Allowing for real increases in values of time, perceived costs have reduced by about 15%. If this is applied to update the 2002 evidence it could imply that the RTMs should demonstrate a vehicle-km elasticity to fuel price in the range between -0.21 and -0.30.

PT Fare Elasticities

Since the focus of the RTMs is on highway scheme testing and PT comprises only a single mode (rail) with small share except in South-East England, we do not propose to discuss its elasticities model by model in further detail beyond the top-line values discussed above. Almost all the elasticities fall within the acceptable range.

However, the PT fare elasticity for SERTM is weaker than the range specified in WebTAG. The SE model team have provided further evidence for the breakdown of these elasticities by purpose including the relevant demand, as shown in Table 9-11.

Table 9-11 SERTM PT Fare Base and Test trips and own-price elasticities by purpose

Purpose	Base Trips	Test Trips	PT Fare Elasticity
Business	62,741	61,341	-0.24
Commute	407,090	404,102	-0.08
Other	54,921	53,526	-0.27
Total	524,752	518,969	-0.12

It is clear that the overall elasticity is brought outside the WebTAG range on the weaker side due to the very weak commuting elasticity and the extremely high share of rail trips represented by the commuting purpose. The high share is the consequence of the uniquely rail-oriented commuting pattern into London, and the lack of viable car alternatives to those rail journeys when operating under double constraint will act to curtail the elasticity of response for the commuting purpose.

Therefore, the only egregious PT fare elasticity of significant note among the RTMs can be explained by the unique circumstances for rail travel in London and the South East.

9.4 Model Limitations and Robustness

In conclusion, there are several model characteristics which should be expected to influence elasticities (the first three of which have been discussed in detail above):

- **changes to values of time** – these should have a significant impact on elasticities resulting from tests related to money cost such as the standard fuel price and PT fare sensitivity tests.
- **changes in factors affecting fuel cost over time** – these would also be expected to lead to revisions in WebTAG indicative elasticities.
- **differences in regional travel characteristics** – differences in urban density; the geographical distribution of major generators and natural barriers; trip length distributions; generalised travel costs; and base year mode and purpose shares and matrix structure all have an impact.
- **income differences by region** – these may also be having an effect, for instance higher mean incomes in the South East may lead to reduced fuel cost elasticities.
- **limited substitution options** – the model only represents variable passenger demand in the form of car and rail modes. This means that options to switch modes is limited especially over the shorter distance ranges where bus and active mode shares are most significant. This is understandable due to the ex-urban and longer distance focus of the schemes to be tested, but will influence outturn elasticities so that we would not expect them to be identical to those described in WebTAG (largely derived from urban multimodal models which did include those other modes). It should also be noted that the particular characteristics of the South East mean that car and rail substitution patterns will be different from those in the other four regions.
- **restrictions to the operation of capacity restraint** – capacity restraint is only considered on the portions of the highway network where fixed speeds are not applied. There is no crowding representation on rail.

As an example of the impact of limited substitution options, our experience with urban multimodal models suggests that, as an approximate rule of thumb, about 75-80% of the fuel cost elasticity lies in the distance change (redistribution) with only 20-25% taking the form of mode shift (to PT modes including bus and rail, and to active modes). Since rail has a much lower national mode share than bus and very much lower than active modes, it is reasonable to expect that models such as the RTMs (which only have rail as an alternative to car) will experience more restricted mode switching away from car. This is demonstrated in practice in Table 9-12and Table 9-13 below (from the MRTM) which show that the highway trip own-price elasticity with respect to fuel cost change is almost negligible by purpose time period and overall.

Table 9-12 Midlands highway trip own-price elasticity wrt highway fuel cost change

HY Trips	EmpBus	Work	Other	Total
AM	- 0.004	- 0.003	- 0.003	- 0.003
IP	- 0.009	- 0.005	0.002	0.000
PM	0.007	- 0.001	0.002	0.001
OP	- 0.017	- 0.012	- 0.006	- 0.007
24hr	- 0.002	- 0.003	0.000	**- 0.001**

The implication is that a highway scheme test (or PT scheme test) within the RTMs (with the possible exception of South East) is unlikely to produce a significant impact on highway mode share. This is because the car share is so much greater than the rail share nationally and in most of the regions. The model does respond as shown by the PT (rail) cross elasticity in Table 9-13**Error! Reference source not found.**. The point is that it would take a very large change in PT (rail) trips to translate into any significant change in car trips due to the huge disparity in the initial mode shares.

Table 9-13 Midlands PT trip cross-elasticity wrt highway fuel cost change

PT Trips	EmpBus	Work	Other	Total
AM	0.068	0.054	0.114	0.066
IP	0.083	0.048	0.132	0.104
PM	0.082	0.040	0.151	0.067
OP	0.073	0.049	0.151	0.079
24hr	0.076	0.047	0.135	**0.071**

The discussion in this section is designed to explain why one should expect differences between realism responses in the RTMs with respect to those indicated in WebTAG (due to designed limitations in modal representation and significant changes in relevant input factors), and also between models due to local travel characteristics.

Nevertheless, the models have been consistently calibrated using identical or very similar inputs and have all produced acceptable realism responses (subject to the caveats previously noted). The North Region model in particular lies towards the lower end of the fuel elasticity spectrum and towards the upper end of the PT fare elasticity continuum. Given the characteristics of the region in question, an area with relatively low levels of urbanisation and limited rail network, this is unsurprising. Of equal importance it is consistent with the scale of output demonstrated in other models under the RTM programme.

The differences between the model results have been examined and explained: "*many a mickle makes a muckle*". There is no reason why the variable demand component of the Highways England Regional Transport Models should not perform acceptably within the intended remit of the schemes to be tested.

10 Conclusion

10.1 Summary

Mouchel was appointed by Highways England to develop the North Regional Model. The aim of this report has been to document the development of the 2015 base year. This model update has been undertaken in accordance with modified version of WebTAG standards, designed to reflect the data sources, model extent and application.

10.2 Key Features of the Model

10.2.1 Survey Data

Data collation from various sources and bespoke data collection of missing elements has been conducted. ATC and MCC data has been sourced in this manner. The information was used in the calibration and validation process. All survey locations were strategically chosen to capture the main sector to sector movements across the North Region and to provide assurance of SRN flow volumes, either directly or via parallel or feeder routes.

10.2.2 Network Definition

As part of the model development the highway network was developed from first principles including:

- Establishment of a network layer from GIS sources;
- Definition of coding detail including geometry and signalisation.

10.2.3 Matrix Development

Matrix developed from Mobile Phone records (MPOD) supplied by Telefónica

Verification of trip patterns established. Identified requirements for short distance trip infill and subsequent control to high level trip rates and trip lengths from NTEM. Reconciliation of movements between Government regions and adjacent regional models. Refinement of localised movements to adhere to long screenline targets, both at daily and time period level.

10.2.4 Network Development

A validation of the highway network was undertaken by comparing model flowed against the observed counts using modification of WebTAG guidance M3.1.

10.2.5 Target Standards

Target standard criteria have been modified based on whether network reflects SRN or other traffic significant roads.

10.2.6 Highway Model Calibration and Validation

The matrix was calibrated using a matrix estimation process.

The results achieved with the prior matrix show a high number of screenlines and counts achieving the modified WebTAG criteria and therefore, the decision was taken to apply matrix estimation to improve the goodness of fit of the model compared with the observed counts.

Matrix estimation monitoring was undertaken in accordance with WebTAG M3.1. Comparisons made between prior and estimated matrix show that the differences are relatively small but do not achieve WebTAG criteria in some cases. Modified criteria were proposed based on the scale of the model and the provenance of the input data.

Runs with estimated matrices show that flows reproduce the observed counts in the majority of cases and also demonstrate that the best results are achieved including a greater number of validation screenlines in matrix estimation.

10.2.7 Variable Demand Model Development

The Variable Demand Modelling has been conducted on a common basis with other RTM's. The package selected for this was DIADEM. The modelled approach was undertaken in accordance with WebTAG Unit M2. Outturn elasticities approached anticipated ranges, given the dated guidance on responses, specific facets of the Regional Models and variations in Value of Time recently introduced.

10.3 Assessment of Fitness for Purpose

The North RTM covers a significant area and has been built as a general purpose traffic model with a focus on Highways England infrastructure. Consequently a higher level of calibration, validation and zonal detail has been achieved on the SRN compared to other areas, Localised traffic route choice and OD assignment has been improved to the maximum extent of the existing model configuration. Variable Demand functionality is considered sufficiently robust for significant strategic network infrastructure and development interventions.

For subsequent updates it is recommended that a number of specific enhancements should be considered

- Greater use of observed signal timing data in the event that more of this information can be obtained from Highways England and other authorities. This would reduce the impact of template coding for the SRN and optimisation subject to min and max criteria within urban areas
- Development of travel demand matrices from final Telefónica final dataset rather than provisional dataset limiting the need for control to synthetic values
- Specific areas of the model that require further attention are identified below
    - Review and respecification of poor quality DfT count on Screenline 18 affecting flow adherence on A66 Trans Pennine route
    - Further refinement of Newcastle flow volumes based on potential matrix issues and relatively poor adherence to expected flow volumes within certain parts of the urban area.
    - Journey time adherence on local (non SRN routes in vicinity of Sunderland and A167 Gateshead crossing the River Tyne and approaching the Central Motorway
- Review of demand responses in parts of the study area where concomitant strategic model limitations give rise to outturn changes beyond the bounds of those considered acceptable at the strategic level.

For schemes that are impacted by these limitations it is recommended that the model's fitness for purpose should be demonstrated through careful analysis of model outputs on a case-by-case basis.

10.4 Conclusions

This report has demonstrated the processes undertaken to develop the model according to the proposed uses and the target standards outlined.

The quality of calibration/validation of the model is set out and demonstrates that the model meets the required targets and is therefore generally fit for purpose.

Specific applications of the model are encouraged to review detailed fitness for purpose prior to application.

Appendix F

WALKING CYCLING & HORSE RIDING

SURVEYS

Gateshead NMU, Saturday 11th November 2017

Produced by Road Data Services Ltd.

	Overbridge														
	Westbound							Eastbound							
TIME	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	TOTAL
0000 - 0015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0015 - 0030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0030 - 0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0045 - 0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0100 - 0115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0115 - 0130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0400 - 0415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0430 - 0445	0	1	0	0	0	0	1	0	0	0	0	0	0	0	
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	1
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0515 - 0530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0530 - 0545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0545 - 0600	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	1
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0615 - 0630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0630 - 0645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0645 - 0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0700 - 0715	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
0715 - 0730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0730 - 0745	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
0745 - 0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**2**	2
0800 - 0815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0815 - 0830	2	0	0	0	0	0	2	1	0	0	0	0	0	1	
0830 - 0845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0845 - 0900	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
Hourly Total	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	4
0900 - 0915	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
0915 - 0930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0930 - 0945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0945 - 1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	1
1000 - 1015	1	0	0	0	0	0	1	1	0	0	0	0	0	1	
1015 - 1030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1030 - 1045	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
1045 - 1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**2**	3
1100 - 1115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1115 - 1130	0	1	0	0	0	0	1	0	0	0	0	0	0	0	
1130 - 1145	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1145 - 1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**1**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	2
1200 - 1215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1215 - 1230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1230 - 1245	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
1245 - 1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	1
1300 - 1315	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1315 - 1330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1330 - 1345	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
1345 - 1400	1	0	0	0	0	0	1	1	0	0	0	0	0	1	
Hourly Total	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**1**	**0**	**0**	**0**	**0**	**2**	4
1400 - 1415	0	0	0	0	0	0	0	2	1	0	0	0	0	3	
1415 - 1430	1	0	0	0	0	0	1	1	0	0	0	0	0	1	
1430 - 1445	0	1	0	0	0	0	1	1	0	0	0	0	0	1	
1445 - 1500	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
Hourly Total	**2**	**1**	**0**	**0**	**0**	**0**	**3**	**4**	**1**	**0**	**0**	**0**	**0**	**5**	8
1500 - 1515	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1515 - 1530	0	0	0	0	0	0	0	2	0	0	0	0	0	2	
1530 - 1545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1545 - 1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	3
1600 - 1615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1615 - 1630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1630 - 1645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1645 - 1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
1700 - 1715	1	1	0	0	0	0	2	0	0	0	0	0	0	0	
1715 - 1730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1730 - 1745	0	0	0	0	0	0	0	2	0	0	0	0	0	2	
1745 - 1800	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
Hourly Total	**1**	**1**	**0**	**0**	**0**	**0**	**2**	**2**	**1**	**0**	**0**	**0**	**0**	**3**	5
1800 - 1815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1815 - 1830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1830 - 1845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1845 - 1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
1900 - 1915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1915 - 1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1930 - 1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1945 - 2000	0	1	0	0	0	0	1	0	0	0	0	0	0	0	
Hourly Total	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	1
2000 - 2015	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
2015 - 2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2030 - 2045	2	0	0	0	0	0	2	1	0	0	0	0	0	1	
2045 - 2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**4**	**0**	**0**	**0**	**0**	**0**	**4**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	5
2100 - 2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2115 - 2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2130 - 2145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2145 - 2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
2200 - 2215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2215 - 2230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2230 - 2245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2245 - 2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
2300 - 2315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2315 - 2330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2330 - 2345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2345 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
TOTAL	**15**	**5**	**0**	**0**	**0**	**0**	**20**	**15**	**6**	**0**	**0**	**0**	**0**	**21**	

Gateshead NMU, Saturday 11th November 2017

Produced by Road Data Services Ltd.

From Overbridge

TIME	Left Turn							Ahead							Right Turn						
	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL
0000 - 0015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0015 - 0030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0030 - 0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0045 - 0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 - 0115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0115 - 0130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400 - 0415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0430 - 0445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0515 - 0530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0530 - 0545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0545 - 0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0615 - 0630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0630 - 0645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0645 - 0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700 - 0715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0715 - 0730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0730 - 0745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0745 - 0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0800 - 0815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0815 - 0830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0830 - 0845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0845 - 0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0900 - 0915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0915 - 0930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0930 - 0945	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
0945 - 1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
1000 - 1015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1015 - 1030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1030 - 1045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1045 - 1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1100 - 1115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1115 - 1130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130 - 1145	0	0	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0
1145 - 1200	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0
1200 - 1215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1215 - 1230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1230 - 1245	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
1245 - 1300	0	0	0	0	0	0	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0
1300 - 1315	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	2
1315 - 1330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1330 - 1345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1345 - 1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	2
1400 - 1415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1415 - 1430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1430 - 1445	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
1445 - 1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
1500 - 1515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1515 - 1530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1530 - 1545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1545 - 1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1600 - 1615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1615 - 1630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1630 - 1645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1645 - 1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1700 - 1715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715 - 1730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1730 - 1745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1745 - 1800	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0
1800 - 1815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1815 - 1830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1830 - 1845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1845 - 1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1900 - 1915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1915 - 1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1930 - 1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1945 - 2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000 - 2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015 - 2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030 - 2045	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0
2045 - 2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0
2100 - 2115	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0
2115 - 2130	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
2130 - 2145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2145 - 2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0
2200 - 2215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2215 - 2230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2230 - 2245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2245 - 2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2300 - 2315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2315 - 2330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2330 - 2345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2345 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	19	0	0	0	0	0	19	4	1	0	0	0	0	5

To Overbridge

TIME	Left to Overbridge							Ahead to Overbridge							Right to Overbridge							TOTAL
	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	
0000 - 0015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0015 - 0030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0030 - 0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0045 - 0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 - 0115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0115 - 0130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400 - 0415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0430 - 0445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0515 - 0530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0530 - 0545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0545 - 0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0615 - 0630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0630 - 0645	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	
0645 - 0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1
0700 - 0715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0715 - 0730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0730 - 0745	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0745 - 0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
Hourly Total	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	3
0800 - 0815	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0815 - 0830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0830 - 0845	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0845 - 0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	2	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
0900 - 0915	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0915 - 0930	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
0930 - 0945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0945 - 1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
Hourly Total	1	0	0	0	0	0	1	2	0	0	0	0	0	2	1	0	0	0	0	0	1	5
1000 - 1015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1015 - 1030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1030 - 1045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1045 - 1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1100 - 1115	0	0	0	0	0	0	0	2	0	0	0	0	0	2	1	0	0	0	0	0	1	
1115 - 1130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
1130 - 1145	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1145 - 1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	1	0	0	0	0	0	1	3	0	0	0	0	0	3	2	0	0	0	0	0	2	10
1200 - 1215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1215 - 1230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1230 - 1245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1245 - 1300	0	0	0	0	0	0	0	3	0	0	0	0	0	3	1	0	0	0	0	0	1	
Hourly Total	0	0	0	0	0	0	0	3	0	0	0	0	0	3	1	0	0	0	0	0	1	8
1300 - 1315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1315 - 1330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1330 - 1345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1345 - 1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
1400 - 1415	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1415 - 1430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1430 - 1445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1445 - 1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2
1500 - 1515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1515 - 1530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1530 - 1545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
1545 - 1600	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	2	0	0	0	0	0	2	1	0	0	0	0	0	1	3
1600 - 1615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1615 - 1630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1630 - 1645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1645 - 1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1700 - 1715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1715 - 1730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1730 - 1745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1745 - 1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1800 - 1815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1815 - 1830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1830 - 1845	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
1845 - 1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	2
1900 - 1915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1915 - 1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1930 - 1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1945 - 2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000 - 2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2015 - 2030	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
2030 - 2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2045 - 2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	4
2100 - 2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2115 - 2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2130 - 2145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2145 - 2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
2200 - 2215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2215 - 2230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2230 - 2245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2245 - 2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2300 - 2315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2315 - 2330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2330 - 2345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2345 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	5	1	0	0	0	0	6	15	1	0	0	0	0	16	6	0	0	0	0	0	6	

Gateshead NMU, Saturday 11th November 2017

Produced by Road Data Services Ltd.

	Northern Site														Southern Site (under the bridge)														
	Northbound							Southbound							Northbound							Southbound							
TIME	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	TOTAL
0000 - 0015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0015 - 0030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0030 - 0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0045 - 0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0100 - 0115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0115 - 0130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400 - 0415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0430 - 0445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0515 - 0530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0530 - 0545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0545 - 0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0615 - 0630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0630 - 0645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0645 - 0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0700 - 0715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0715 - 0730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
0730 - 0745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0745 - 0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
0800 - 0815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0815 - 0830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	
0830 - 0845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0845 - 0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	2
0900 - 0915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
0915 - 0930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
0930 - 0945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
0945 - 1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	2	4
1000 - 1015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
1015 - 1030	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1030 - 1045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1045 - 1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	1	0	0	0	0	0	1	3	0	0	0	0	0	3	0	0	0	0	0	0	0	4
1100 - 1115	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1115 - 1130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	
1130 - 1145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	1	0	0	0	1	0	2	
1145 - 1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
Hourly Total	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	1	0	3	3	0	0	0	1	0	4	8
1200 - 1215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	
1215 - 1230	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1230 - 1245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2	0	0	0	0	0	2	
1245 - 1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
Hourly Total	0	0	0	0	0	0	0	2	0	0	0	0	0	2	2	1	0	0	0	0	3	3	1	0	0	0	0	4	9
1300 - 1315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1315 - 1330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
1330 - 1345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	4	
1345 - 1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	0	0	0	7	7
1400 - 1415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1415 - 1430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
1430 - 1445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1445 - 1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	4	0	0	0	0	0	0	0	4
1500 - 1515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
1515 - 1530	0	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1530 - 1545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1545 - 1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
Hourly Total	0	1	0	0	0	0	1	0	1	0	0	0	0	1	2	0	0	0	0	0	2	0	1	0	0	0	0	1	5
1600 - 1615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	0	0	0	0	0	2	
1615 - 1630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1630 - 1645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	
1645 - 1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	5	0	0	0	0	0	5	6
1700 - 1715	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1715 - 1730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1730 - 1745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1745 - 1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2
1800 - 1815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1815 - 1830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1830 - 1845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
1845 - 1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
1900 - 1915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1915 - 1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
1930 - 1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1945 - 2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	2
2000 - 2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2015 - 2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2030 - 2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2045 - 2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2100 - 2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2115 - 2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2130 - 2145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2145 - 2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2200 - 2215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2215 - 2230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2230 - 2245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2245 - 2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2300 - 2315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2315 - 2330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2330 - 2345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2345 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	1	0	0	0	0	3	3	1	0	0	0	0	4	20	1	0	0	1	0	22	20	5	0	0	1	0	26	

Gateshead NMU, Saturday 11th November 2017

Produced by Road Data Services Ltd.

Arm A		Arm B	Arm C	Arm D	Arm E
Northbound	Southbound	[illegible]	[illegible]	[illegible]	[illegible]

Gateshead NMU, Saturday 11th November 2017

Produced by Road Data Services Ltd.

	Overbridge														
	Westbound							Eastbound							
TIME	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	TOTAL
0000 - 0015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0015 - 0030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0030 - 0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0045 - 0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0100 - 0115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0115 - 0130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0400 - 0415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0430 - 0445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0515 - 0530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0530 - 0545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0545 - 0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0615 - 0630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0630 - 0645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0645 - 0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
0700 - 0715	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
0715 - 0730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0730 - 0745	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
0745 - 0800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	3
0800 - 0815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0815 - 0830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0830 - 0845	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
0845 - 0900	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
Hourly Total	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	3
0900 - 0915	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
0915 - 0930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0930 - 0945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0945 - 1000	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
Hourly Total	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	2
1000 - 1015	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
1015 - 1030	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
1030 - 1045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1045 - 1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	3
1100 - 1115	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1115 - 1130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1130 - 1145	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
1145 - 1200	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
Hourly Total	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	3
1200 - 1215	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
1215 - 1230	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
1230 - 1245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1245 - 1300	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
Hourly Total	**3**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	4
1300 - 1315	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
1315 - 1330	0	0	0	0	0	0	0	2	0	0	0	0	0	2	
1330 - 1345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1345 - 1400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**3**	3
1400 - 1415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1415 - 1430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1430 - 1445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1445 - 1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
1500 - 1515	3	0	0	0	0	0	3	0	0	0	0	0	0	0	
1515 - 1530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1530 - 1545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1545 - 1600	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
Hourly Total	**5**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	5
1600 - 1615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1615 - 1630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1630 - 1645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1645 - 1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
1700 - 1715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1715 - 1730	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1730 - 1745	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1745 - 1800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
1800 - 1815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1815 - 1830	5	0	0	0	0	0	5	0	0	0	0	0	0	0	
1830 - 1845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1845 - 1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**5**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	5
1900 - 1915	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
1915 - 1930	2	0	0	0	0	0	2	0	0	0	0	0	0	0	
1930 - 1945	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
1945 - 2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**1**	**1**	**0**	**0**	**0**	**0**	**2**	4
2000 - 2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2015 - 2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2030 - 2045	0	0	0	0	0	0	0	5	0	0	0	0	0	5	
2045 - 2100	0	0	0	0	0	0	0	4	0	0	0	0	0	4	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**0**	**0**	**0**	**0**	**0**	**9**	9
2100 - 2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2115 - 2130	0	0	0	0	0	0	0	2	0	0	0	0	0	2	
2130 - 2145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2145 - 2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	2
2200 - 2215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2215 - 2230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2230 - 2245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2245 - 2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
2300 - 2315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2315 - 2330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2330 - 2345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2345 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	0
TOTAL	**24**	**0**	**0**	**0**	**0**	**0**	**24**	**20**	**2**	**0**	**0**	**0**	**0**	**22**	

Gateshead NMU, Saturday 11th November 2017

Produced by Road Data Services Ltd.

Western Site (Overbridge)

	Northbound							Southbound						
TIME	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL
0000 - 0015	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0015 - 0030	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0030 - 0045	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0045 - 0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0100 - 0115	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0115 - 0130	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0230 - 0245	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400 - 0415	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0430 - 0445	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500 - 0515	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0515 - 0530	1	0	0	0	0	0	1	2	0	0	0	0	0	2
0530 - 0545	0	0	0	0	0	0	0	1	2	0	0	0	0	3
0545 - 0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	1	0	0	0	0	0	1	4	2	0	0	0	0	6
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0615 - 0630	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0630 - 0645	0	0	0	0	0	0	0	1	1	0	0	0	0	2
0645 - 0700	1	0	0	0	0	0	1	4	0	0	0	0	0	4
Hourly Total	1	0	0	0	0	0	1	6	1	0	0	0	0	7
0700 - 0715	1	0	0	0	0	0	1	0	0	0	0	0	0	0
0715 - 0730	1	0	0	0	0	0	1	3	0	0	0	0	0	3
0730 - 0745	1	0	0	0	0	0	1	1	0	0	0	0	0	1
0745 - 0800	0	0	0	0	0	0	0	2	0	0	0	0	0	2
Hourly Total	3	0	0	0	0	0	3	6	0	0	0	0	0	6
0800 - 0815	1	0	0	0	0	0	1	4	0	0	0	0	0	4
0815 - 0830	0	0	0	0	0	0	0	2	0	0	0	0	0	2
0830 - 0845	1	0	0	0	0	0	1	10	0	0	0	0	0	10
0845 - 0900	2	0	0	0	0	0	2	0	0	0	0	0	0	0
Hourly Total	4	0	0	0	0	0	4	16	0	0	0	0	0	16
0900 - 0915	2	0	0	0	0	0	2	1	0	0	0	0	0	1
0915 - 0930	4	0	0	0	0	0	4	1	0	0	0	0	0	1
0930 - 0945	1	0	0	0	0	0	1	5	0	0	0	0	0	5
0945 - 1000	3	0	0	0	0	0	3	4	0	0	0	0	0	4
Hourly Total	10	0	0	0	0	0	10	11	0	0	0	0	0	11
1000 - 1015	1	0	0	0	0	0	1	1	0	0	0	0	0	1
1015 - 1030	3	0	0	0	0	0	3	6	0	0	0	0	0	6
1030 - 1045	3	0	0	0	0	0	3	4	0	0	0	0	0	4
1045 - 1100	5	0	0	0	0	0	5	6	0	0	0	0	0	6
Hourly Total	12	0	0	0	0	0	12	17	0	0	0	0	0	17
1100 - 1115	1	0	0	0	0	0	1	2	0	0	0	0	0	2
1115 - 1130	2	0	0	0	0	0	2	2	0	0	0	0	0	2
1130 - 1145	6	0	0	0	0	0	6	5	0	0	0	0	0	5
1145 - 1200	1	0	0	0	0	0	1	4	0	0	0	0	0	4
Hourly Total	10	0	0	0	0	0	10	13	0	0	0	0	0	13
1200 - 1215	2	1	0	0	0	0	3	8	0	0	0	0	0	8
1215 - 1230	0	0	0	0	0	0	0	3	0	0	0	0	0	3
1230 - 1245	4	0	0	0	0	0	4	0	0	0	0	0	0	0
1245 - 1300	2	0	0	0	0	0	2	3	0	0	0	0	0	3
Hourly Total	8	1	0	0	0	0	9	14	0	0	0	0	0	14
1300 - 1315	2	0	0	0	0	0	2	7	0	0	0	0	0	7
1315 - 1330	3	0	0	0	0	0	3	2	0	0	0	0	0	2
1330 - 1345	4	0	0	0	0	0	4	5	0	0	0	0	0	5
1345 - 1400	4	0	0	0	0	0	4	9	0	0	0	0	0	9
Hourly Total	13	0	0	0	0	0	13	23	0	0	0	0	0	23
1400 - 1415	3	0	0	0	0	0	3	1	0	0	0	0	0	1
1415 - 1430	2	1	0	0	0	0	3	5	0	0	0	0	0	5
1430 - 1445	3	0	0	0	0	0	3	0	0	0	0	0	0	0
1445 - 1500	3	0	0	0	0	0	3	2	1	0	0	0	0	3
Hourly Total	11	1	0	0	0	0	12	8	1	0	0	0	0	9
1500 - 1515	1	0	0	0	0	0	1	4	0	0	0	0	0	4
1515 - 1530	6	0	0	0	0	0	6	1	0	0	0	0	0	1
1530 - 1545	0	0	0	0	0	0	0	3	0	0	0	0	0	3
1545 - 1600	1	0	0	0	0	0	1	6	0	0	0	0	0	6
Hourly Total	8	0	0	0	0	0	8	14	0	0	0	0	0	14
1600 - 1615	3	0	0	0	0	0	3	1	0	0	0	0	0	1
1615 - 1630	3	3	0	0	0	0	6	1	0	0	0	0	0	1
1630 - 1645	1	0	0	0	0	0	1	0	0	0	0	0	0	0
1645 - 1700	3	1	0	0	0	0	4	4	0	0	0	0	0	4
Hourly Total	10	4	0	0	0	0	14	6	0	0	0	0	0	6
1700 - 1715	1	0	0	0	0	0	1	3	0	0	0	0	0	3
1715 - 1730	5	0	0	0	0	0	5	1	0	0	0	0	0	1
1730 - 1745	4	0	0	0	0	0	4	0	0	0	0	0	0	0
1745 - 1800	0	0	0	0	0	0	0	3	0	0	0	0	0	3
Hourly Total	10	0	0	0	0	0	10	7	0	0	0	0	0	7
1800 - 1815	1	0	0	0	0	0	1	0	0	0	0	0	0	0
1815 - 1830	1	0	0	0	0	0	1	1	0	0	0	0	0	1
1830 - 1845	2	0	0	0	0	0	2	3	0	0	0	0	0	3
1845 - 1900	3	0	0	0	0	0	3	3	0	0	0	0	0	3
Hourly Total	7	0	0	0	0	0	7	7	0	0	0	0	0	7
1900 - 1915	1	0	0	0	0	0	1	0	0	0	0	0	0	0
1915 - 1930	0	0	0	0	0	0	0	3	0	0	0	0	0	3
1930 - 1945	2	0	0	0	0	0	2	1	0	0	0	0	0	1
1945 - 2000	4	0	0	0	0	0	4	1	0	0	0	0	0	1
Hourly Total	7	0	0	0	0	0	7	5	0	0	0	0	0	5
2000 - 2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015 - 2030	0	1	0	0	0	0	1	0	0	0	0	0	0	0
2030 - 2045	1	0	0	0	0	0	1	0	0	0	0	0	0	0
2045 - 2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	1	1	0	0	0	0	2	0	0	0	0	0	0	0
2100 - 2115	1	0	0	0	0	0	1	0	0	0	0	0	0	0
2115 - 2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2130 - 2145	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2145 - 2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	1	0	0	0	0	0	1	0	0	0	0	0	0	0
2200 - 2215	0	0	0	0	0	0	0	1	0	0	0	0	0	1
2215 - 2230	1	0	0	0	0	0	1	0	0	0	0	0	0	0
2230 - 2245	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2245 - 2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	1	0	0	0	0	0	1	1	0	0	0	0	0	1
2300 - 2315	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2315 - 2330	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2330 - 2345	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2345 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	118	7	0	0	0	0	125	160	4	0	0	0	0	164

Eastern Site

	Northbound							Southbound							
TIME	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	TOTAL
0000 - 0015	0	1	0	0	0	0	1	1	0	0	0	0	0	1	
0015 - 0030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0030 - 0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0045 - 0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	1	0	0	0	0	1	1	0	0	0	0	0	1	3
0100 - 0115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0115 - 0130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0400 - 0415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0430 - 0445	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0515 - 0530	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0530 - 0545	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0545 - 0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0615 - 0630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0630 - 0645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0645 - 0700	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
Hourly Total	1	0	0	0	0	0	1	0	0	0	0	0	0	0	9
0700 - 0715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0715 - 0730	1	0	0	0	0	0	1	2	0	0	0	0	0	2	
0730 - 0745	1	0	0	0	0	0	1	3	0	0	0	0	0	3	
0745 - 0800	1	0	0	0	0	0	1	1	0	0	0	0	0	1	
Hourly Total	3	0	0	0	0	0	3	6	0	0	0	0	0	6	18
0800 - 0815	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0815 - 0830	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0830 - 0845	3	0	0	0	0	0	3	2	0	0	0	0	0	2	
0845 - 0900	2	0	0	0	0	0	2	3	0	0	0	0	0	3	
Hourly Total	5	0	0	0	0	0	5	5	0	0	0	0	0	5	30
0900 - 0915	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
0915 - 0930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0930 - 0945	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
0945 - 1000	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
Hourly Total	3	0	0	0	0	0	3	0	0	0	0	0	0	0	24
1000 - 1015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1015 - 1030	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
1030 - 1045	1	0	0	0	0	0	1	1	0	0	0	0	0	1	
1045 - 1100	3	0	0	0	0	0	3	2	0	0	0	0	0	2	
Hourly Total	4	0	0	0	0	0	4	3	1	0	0	0	0	4	37
1100 - 1115	1	0	0	0	0	0	1	5	0	0	0	0	0	5	
1115 - 1130	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
1130 - 1145	1	0	0	0	0	0	1	0	1	0	0	0	0	1	
1145 - 1200	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
Hourly Total	3	0	0	0	0	0	3	6	1	0	0	0	0	7	33
1200 - 1215	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
1215 - 1230	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1230 - 1245	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1245 - 1300	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
Hourly Total	3	0	0	0	0	0	3	1	0	0	0	0	0	1	27
1300 - 1315	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1315 - 1330	1	0	0	0	0	0	1	1	0	0	0	0	0	1	
1330 - 1345	4	0	0	0	0	0	4	1	0	0	0	0	0	1	
1345 - 1400	1	0	0	0	0	0	1	3	0	0	0	0	0	3	
Hourly Total	7	0	0	0	0	0	7	5	0	0	0	0	0	5	48
1400 - 1415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1415 - 1430	0	0	0	0	0	0	0	2	0	0	0	0	0	2	
1430 - 1445	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
1445 - 1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	3	0	0	0	0	0	3	24
1500 - 1515	1	0	0	0	0	0	1	1	0	0	0	0	0	1	
1515 - 1530	0	0	0	0	0	0	0	2	0	0	0	0	0	2	
1530 - 1545	1	0	0	0	0	0	1	2	0	0	0	0	0	2	
1545 - 1600	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
Hourly Total	3	0	0	0	0	0	3	5	0	0	0	0	0	5	30
1600 - 1615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1615 - 1630	1	0	0	0	0	0	1	1	0	0	0	0	0	1	
1630 - 1645	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1645 - 1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	1	0	0	0	0	0	1	1	0	0	0	0	0	1	22
1700 - 1715	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1715 - 1730	1	0	0	0	0	0	1	1	0	0	0	0	0	1	
1730 - 1745	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1745 - 1800	0	0	0	0	0	0	0	3	0	0	0	0	0	3	
Hourly Total	2	0	0	0	0	0	2	4	0	0	0	0	0	4	23
1800 - 1815	3	0	0	0	0	0	3	0	0	0	0	0	0	0	
1815 - 1830	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
1830 - 1845	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1845 - 1900	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
Hourly Total	4	0	0	0	0	0	4	1	0	0	0	0	0	1	19
1900 - 1915	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1915 - 1930	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
1930 - 1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1945 - 2000	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
Hourly Total	0	0	0	0	0	0	0	1	1	0	0	0	0	2	14
2000 - 2015	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
2015 - 2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2030 - 2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2045 - 2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	1	0	0	0	0	0	1	0	0	0	0	0	0	0	3
2100 - 2115	0	0	0	0	0	0	0	1	0	0	0	0	0	1	
2115 - 2130	1	0	0	0	0	0	1	0	0	0	0	0	0	0	
2130 - 2145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2145 - 2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	1	0	0	0	0	0	1	1	0	0	0	0	0	1	3
2200 - 2215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2215 - 2230	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2230 - 2245	1	0	0	0	0	0	1	1	0	0	0	0	0	1	
2245 - 2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	1	0	0	0	0	0	1	1	0	0	0	0	0	1	4
2300 - 2315	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2315 - 2330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2330 - 2345	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2345 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	42	1	0	0	0	0	43	44	3	0	0	0	0	47	

Gateshead NMU, Saturday 11th November 2017

Produced by Road Data Services Ltd.

	Arm A		Arm B		Arm C		Arm D		Arm E	
	Northbound	Southbound								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Arm F

Westbound				Eastbound						

Gateshead NMU, Saturday 11th November 2017

Produced by Road Data Services Ltd.

	Lamesley Road													
	Northbound							Southbound						
TIME	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL	Pedestrians	Cyclists	Electric Cyclists	Scooters	Horse Riders	Wheelchairs	TOTAL
0000 - 0015	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0015 - 0030	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0030 - 0045	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0045 - 0100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0100 - 0115	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0115 - 0130	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0130 - 0145	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0145 - 0200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0200 - 0215	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0215 - 0230	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0230 - 0245	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0245 - 0300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0300 - 0315	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0315 - 0330	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0330 - 0345	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0345 - 0400	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0400 - 0415	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0415 - 0430	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0430 - 0445	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0445 - 0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0500 - 0515	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0515 - 0530	1	0	0	0	0	0	1	0	0	0	0	0	0	0
0530 - 0545	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0545 - 0600	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0600 - 0615	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0615 - 0630	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0630 - 0645	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0645 - 0700	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**
0700 - 0715	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0715 - 0730	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0730 - 0745	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0745 - 0800	1	0	0	0	0	0	1	1	0	0	0	0	0	1
Hourly Total	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**1**
0800 - 0815	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0815 - 0830	0	1	0	0	0	0	1	0	0	0	0	0	0	0
0830 - 0845	2	0	0	0	0	0	2	0	0	0	0	0	0	0
0845 - 0900	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**2**	**1**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
0900 - 0915	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0915 - 0930	0	0	0	0	0	0	0	1	0	0	0	0	0	1
0930 - 0945	1	0	0	0	0	0	1	1	0	0	0	0	0	1
0945 - 1000	1	0	0	0	0	0	1	1	0	0	0	0	0	1
Hourly Total	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**0**	**0**	**0**	**0**	**0**	**3**
1000 - 1015	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1015 - 1030	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1030 - 1045	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1045 - 1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1100 - 1115	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1115 - 1130	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130 - 1145	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1145 - 1200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1200 - 1215	1	0	0	0	0	0	1	0	0	0	0	0	0	0
1215 - 1230	0	0	0	0	0	0	0	3	0	0	0	0	0	3
1230 - 1245	5	0	0	0	0	0	5	0	0	0	0	0	0	0
1245 - 1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**6**	**0**	**0**	**0**	**0**	**0**	**6**	**3**	**0**	**0**	**0**	**0**	**0**	**3**
1300 - 1315	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1315 - 1330	0	0	0	0	0	0	0	1	0	0	0	0	0	1
1330 - 1345	0	0	0	0	0	0	0	5	0	0	0	0	0	5
1345 - 1400	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**0**	**7**
1400 - 1415	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1415 - 1430	1	0	0	0	0	0	1	0	0	0	0	0	0	0
1430 - 1445	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1445 - 1500	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1500 - 1515	3	0	0	0	0	0	3	0	0	0	0	0	0	0
1515 - 1530	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1530 - 1545	0	0	0	0	0	0	0	0	1	0	0	0	0	1
1545 - 1600	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**3**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**1**
1600 - 1615	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1615 - 1630	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1630 - 1645	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1645 - 1700	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1700 - 1715	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1715 - 1730	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1730 - 1745	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1745 - 1800	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**1**
1800 - 1815	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1815 - 1830	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1830 - 1845	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1845 - 1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
1900 - 1915	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1915 - 1930	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1930 - 1945	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1945 - 2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2000 - 2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015 - 2030	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2030 - 2045	0	0	0	0	0	0	0	1	0	0	0	0	0	1
2045 - 2100	0	0	0	0	0	0	0	2	0	0	0	0	0	2
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**	**3**
2100 - 2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2115 - 2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2130 - 2145	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2145 - 2200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2200 - 2215	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2215 - 2230	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2230 - 2245	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2245 - 2300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2300 - 2315	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2315 - 2330	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2330 - 2345	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2345 - 2400	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hourly Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL	**16**	**1**	**0**	**0**	**0**	**0**	**17**	**19**	**1**	**0**	**0**	**0**	**0**	**20**

Appendix G

TECHNICAL NOTE BTN 20

TECHNICAL NOTE – BTN 20

PROJECT NUMBER	70039571
PROJECT NAME	A1 Birtley to Coal House PCF 3
CLIENT	Highways England
PREPARED BY	Tom Randall
CHECKED BY	Paul Byron
AUTHORISED BY	Paul Byron

TRAFFIC MASTER JOURNEY TIME DATASET

1.0 INTRODUCTION

1.1 WSP has been appointed by Highways England as transport consultants to provide technical support on the proposed widening and realignment of the A1 between junctions 65 and 80, to the west of Newcastle. This forms the A1 Gateshead Newcastle Western Bypass (GNWB).

1.2 The GNWB improvement includes two schemes, namely:

- A1 Birtley to Coal House Improvement Scheme (A1-BCH), J65 – J67
- A1 Scotswood to North Brunton Improvement Scheme (A1-SNB), J74 – J79

1.3 A single model is to be developed for use in assessing both schemes for PCF stage 3. The basis of the model to be developed is the North Region Transport Model (NRTM). This report outlines the issues found with the DfT supplied Traffic Master journey time data set used as part of the model validation.

2.0 DATASET RECEIVED

2.1 Traffic Master data was received from DfT for the months of March to June 2017 covering all days. The raw data included a record of Traffic Master vehicle observations by type for each 15 minute period in the day, for each Integrated Transport Network (ITN) link within the Tyne and Wear area. The average journey time is given for each link based on the number of observations of that vehicle type within the 15 minute period of the day.

2.2 The ITN links included within the journey time routes to be used in model validation were extracted from the dataset received from DfT; these were then aggregated to give average journey times for each modelled time period.

2.3 The ITN link data was then aggregated to form journey times for routes that cross the area which is most important for the scheme appraisal, namely the Gateshead and Newcastle urban areas, A1 and A19.

3.0 INITIAL OBSERVATIONS

3.1 Initial comparison of the modelled and observed journey times showed that the observed journey times (taken from the Traffic Master data) were slower than those in the model in all cases. This was deemed to be suspect and therefore further analysis was undertaken.

3.2 The base modelling exercise expected little change in both flows and journey times given the short period of time between the NRTM 2015 base and 2017. A comparison was therefore undertaken of journey times and is shown in table 3-1 below.

Table 3-1 - Initial comparison of 2015 and 2017 observed journey times

Route	Direction	Journey time (mins)						% change			Notes	Road
		AM 2015	IP 2015	PM 2015	AM 2017	IP 2017	PM 2017	AM change	IP change	PM change		
Route_02	NB	26.17	18.9	22.92	31.89	22.71	28.52	22%	20%	24%	Roadworks	A19
Route_02	SB	21.17	19.6	23.65	30.01	25.01	29.90	42%	28%	26%	Roadworks	A19
Route_09	NB	35.58	32.28	35.25	37.46	28.43	32.52	5%	-12%	-8%		A1
Route_09	SB	31.57	30.90	34.43	30.77	26.81	35.81	-3%	-13%	4%		A1
Route_13	NB	21.07	16.85	18.52	26.09	19.50	23.88	24%	16%	29%		A167
Route_13	SB	18.48	17.37	22.77	23.39	20.35	28.43	27%	17%	25%		A167
Route_18	EB	17.85	19.7	18.47	24.44	17.84	22.09	37%	-9%	20%		A184
Route_18	WB	18.95	15.57	16.88	26.68	16.15	16.66	41%	4%	-1%		A184
Route_23	EB	13.53	13.12	12.93	17.08	16.36	16.49	26%	25%	28%	Roadworks	A1231
Route_23	WB	13.53	13.82	15.92	15.64	15.25	18.57	16%	10%	17%	Roadworks	A1231
Route_24	NB	4.62	4.7	4.47	4.65	4.73	4.47	1%	1%	0%		A182
Route_24	SB	4.73	4.83	4.68	4.84	4.85	4.80	2%	0%	3%		A182
Route_26	NB	8.9	7.03	8.1	9.12	13.67	9.38	2%	94%	16%	Roadworks	A194
Route_26	SB	6.98	6.83	6.87	8.01	7.08	6.94	15%	4%	1%	Roadworks	A194
Route_27	EB	11.85	11.72	14.62	15.77	15.40	19.37	33%	31%	33%	Roadworks	A1058
Route_27	WB	14.78	12.27	13.25	22.01	17.39	19.84	49%	42%	50%	Roadworks	A1058

3.3 It can be seen that in the majority of cases there are large increases in journey time seen between 2015 and 2017. These are of a magnitude that would not be expected given the minimal change in traffic conditions between the two years. Comparable traffic count data on the routes used for journey time validation between the two years is shown below in Table 3-2. However, this does not show a clear pattern of increases which matches the increases seen for the journey time data.

3.4 Table 3-1 also shows that four of the journey time routes have been affected by ongoing roadworks during the Spring of 2017, these include the A19 Coast Road scheme (Routes 02 and 27) and Lindisfarne roundabout (Route 26).

Table 3-2 - Change in traffic volumes on the journey time routes

Count data								2017 - 2015			% (2017 - 2015)		
Base_Count_data		2015			2017								
Link_ID	Road_Name	AM	IP	PM	AM	IP	PM	AM	IP	PM	AM	IP	PM
91165-91166	A1	1297	783	818	1333	792	868	36	9	51	3%	1%	6%
90868-90836	A1	2460	1985	2317	2086	1728	1925	-374	-257	-392	-15%	-13%	-17%
93967-93748	A1058	2647	1704	2139	3014	1930	2475	367	226	336	14%	13%	16%
93747-93750	A1058	2144	1779	2650	2368	2002	2917	224	222	267	10%	12%	10%
91437-91438	A167	359	363	376	556	450	475	197	86	99	55%	24%	26%
91437-91507	A167	2318	1602	2114	2306	1667	2161	-12	66	47	-1%	4%	2%
91508-91459	A167	1245	1415	1300	1717	1593	1623	472	177	324	38%	13%	25%
92660-91459	A167	258	308	418	383	332	560	126	24	142	49%	8%	34%
90788-93617	A167	776	551	773	891	598	850	115	47	77	15%	9%	10%
93620-90789	A167	742	644	966	811	686	1018	69	43	52	9%	7%	5%
93935-90884	A182	482	404	448	479	390	421	-3	-14	-27	-1%	-3%	-6%
90884-93935	A182	395	438	598	382	426	557	-13	-11	-42	-3%	-3%	-7%
91319-91336	A184	1507	1028	1097	1302	832	753	-205	-196	-343	-14%	-19%	-31%
91337-91320	A184	1308	1491	2241	1214	1364	1802	-94	-127	-439	-7%	-9%	-20%
91537-92898	A184	1244	1175	1560	1216	997	1523	-28	-178	-38	-2%	-15%	-2%
91539-91536	A184	1870	1204	1679	1792	1098	1631	-78	-106	-48	-4%	-9%	-3%
92682-92696	A19	2427	1265	2036	2642	1419	2347	216	154	311	9%	12%	15%
92670-92683	A19	2095	1419	2416	2386	1538	2601	290	119	186	14%	8%	8%
92864-92625	A19	1642	1196	1829	1440	990	1588	-202	-206	-242	-12%	-17%	-13%
90984-91781	A19	2516	1716	2446	2652	1694	2532	135	-22	87	5%	-1%	4%
91919-92984	A19	1610	1299	1657	1745	1325	1824	135	26	167	8%	2%	10%
90939-90930	A19	3082	2226	3011	3086	2213	3130	4	-13	119	0%	-1%	4%
92898-91575	A19	1589	1243	1838	1620	1162	1929	32	-81	91	2%	-7%	5%
92986-91909	A19	1387	1082	1225	1347	926	1171	-40	-156	-54	-3%	-14%	-4%
91757-91920	A19	1756	1484	2113	2074	1676	2492	318	192	378	18%	13%	18%
91740-94130	A19	1539	1272	1451	2238	1539	2172	699	267	722	45%	21%	50%
91568-94129	A19	1976	1324	1864	2256	1426	2103	279	101	239	14%	8%	13%
92983-91918	A19	1959	1324	1708	2217	1360	1740	258	36	32	13%	3%	2%

91782-90985	A19	2472	1740	2621	2597	1824	2614	125	84	-7	5%	5%	0%
90929-90932	A19	2934	2208	3102	2855	2176	2990	-78	-32	-112	-3%	-1%	-4%
92938-94132	A19	1943	1345	1946	2009	1347	1971	65	2	25	3%	0%	1%
92625-92761	A19	1425	1009	1528	1253	835	1319	-172	-173	-209	-12%	-17%	-14%
91922-91754	A19	2269	1496	1902	2782	1694	2175	513	197	273	23%	13%	14%
91776-91742	A19	1836	1446	1971	2414	1640	2254	578	194	283	31%	13%	14%
92680-91569	A19	2055	1564	2416	2287	1651	2588	232	87	172	11%	6%	7%
92624-92865	A19	1691	1211	1416	1644	1023	1308	-47	-187	-108	-3%	-15%	-8%
90868-90870	A194(M)	952	639	989	963	658	963	11	19	-26	1%	3%	-3%

3.6 The patterns shown by the comparison of the 2015 and 2017 journey time data were discussed with the team that worked on the NRTM base year model. This revealed that the Traffic Master data used in 2015 was pre-cleaned by DfT and also supplied as a median average journey time, rather than a mean average, following discussions within the technical group looking at the regional models. This was described in a technical note from October 2015 and covered the appropriate average to use under the following extract:

Consideration has been given to the use of Mean or Median Journey times supplied by Trafficmaster. The key points to note are as follows:

Mean Journey Times – Consideration of a sample of mean journey times and the Standard Deviations (SD) associated with these datasets has highlighted that in many cases the SD can be extremely high. This is caused in part to a 'long tail' associated with random events etc. that cause significant delays for a relatively small number of observations. This has the potential to increase the mean journey times and hence may cause an issue in the model validation and calibration, as these 'outlying' journey times will not necessarily be reflected by the traffic counts.

Median Journey Times – The median journey times have recently been used for the calibration and validation of the A14 transport model and were adopted for the same issues as highlighted above. As this model is currently going through the DCO stage it is considered appropriate to apply a consistent approach between the models.

4.0 DETAILED OBSERVATIONS

4.1 As a demonstration of the issues seen from using the mean average as supplied, examination of the ITN link values for the journey time routes to be used in the model has been undertaken. The 124 ITN links that form the A1 route southbound (covering the entire Western Bypass) have been examined and the statistics are shown below for the aggregated data:

Table 4-1 - A1 southbound Traffic Master Data Summary

Time period	Average speed (mph)	Max speed (mph)	Min speed (mph)
AM (7-10)	48	65	23
IP (10-16)	54	67	45
PM (16-19)	44	68	13

4.2 Given the nature of the A1 as part of the SRN, with grade separated junctions, it is not deemed plausible that sections are running consistently at speeds of 23mph and 13mph over the 3hr peak periods.

4.3 WebTRIS speed data has been examined for the A1 near to the ITN links that show the minimum speeds in table 4-1. The WebTRIS data shows a minimum speed of 20mph for June over the PM peak period. This gives further weight to the argument that the Trafficmaster data is not representative of "average" conditions.

5.0 CLEANING

Following advice from the team that worked on the NRTM dataset, their recommendation is to undertake a cleaning exercise to remove the values with extremely slow speeds. These are typically associated with events such as parking/waiting or unusual events such as accidents. This has been done, with the removal of records below 3kph, and the revised journey times are shown below.

Table 5-1 –Change in journey times with application of cleaning

Route	Direction	Original			Post-cleaning			% change			
		AM	IP	PM	AM	IP	PM	AM change	IP change	PM change	Road
Route_02	NB	31.89	22.71	28.52	24.19	20.98	23.58	-24%	-8%	-17%	A19
Route_02	SB	30.01	25.01	29.90	23.78	22.01	24.24	-21%	-12%	-19%	A19
Route_09	NB	37.46	28.43	32.52	31.74	27.65	30.63	-15%	-3%	-6%	A1
Route_09	SB	30.77	26.81	35.81	27.79	25.69	31.61	-10%	-4%	-12%	A1
Route_13	NB	26.09	19.50	23.88	18.29	17.48	21.62	-30%	-10%	-9%	A167
Route_13	SB	23.39	20.35	28.43	18.78	17.22	19.86	-20%	-15%	-30%	A167
Route_18	EB	24.44	17.84	22.09	15.48	14.63	16.62	-37%	-18%	-25%	A184
Route_18	WB	26.68	16.15	16.66	15.90	14.14	14.82	-40%	-12%	-11%	A184
Route_23	EB	17.08	16.36	16.49	14.90	14.79	15.06	-13%	-10%	-9%	A1231
Route_23	WB	15.64	15.25	18.57	14.40	14.53	16.39	-8%	-5%	-12%	A1231
Route_24	NB	4.65	4.73	4.47	4.65	4.70	4.40	0%	-1%	-2%	A182
Route_24	SB	4.84	4.85	4.80	4.80	4.80	4.74	-1%	-1%	-1%	A182
Route_26	NB	9.12	13.67	9.38	7.92	8.03	8.03	-13%	-41%	-14%	A194
Route_26	SB	8.01	7.08	6.94	7.41	6.95	6.87	-7%	-2%	-1%	A194
Route_27	EB	15.77	15.40	19.37	13.95	14.32	16.27	-11%	-7%	-16%	A1058
Route_27	WB	22.01	17.39	19.84	16.18	14.70	15.92	-26%	-15%	-20%	A1058

5.1 It can be seen from Table 5-1 that the removal of the slowest observations has had a marked effect on the time taken for most of the journey time routes.

5.2 The change in numbers of observations has been checked and shows that only 1.6% of observations have been removed.

6.0 NEXT STEPS

6.1 Following consultation with DfT, it is not possible to produce a median figure for the 2017 data and replicate the process used for the original NRTM model validation.

6.2 It is therefore deemed appropriate to undertake the PCF stage 3 model validation using the cleaned data as shown in Table 5-1.

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