Appendix 25
M1 J15 & J15A VISSIM Model Local Model Validation Report

M1 Junction 15 & 15A VISSIM Model – Local Model Validation Report

October, 2016

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M1 Junction 15 & 15A VISSIM Model – Local Model Validation Report

AECOM have been commissioned by Highways England to produce a base model for M1 Junctions 15 and 15A

Quality information

Document name	Ref	Prepared for	Prepared by	Date	Reviewed by
LMVR J15_15a Final Version	00	Highways England	Ashley Hayden & Alexander Prosser	14 September 2016	Irene Echeverria

Revision history

Revision	Revision date	Details	Name	Position
Rev 1	30/09/2016	Check	Irene Echeverria	Graduate Consultant
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Introduction

The purpose of this Local Model Validation Report (LMVR) is to provide a detailed overview of the methodology adopted to revalidate a VISSIM micro-simulation model of the M1 Junction 15 and 15a.

Overview

Highways England (HE) has commissioned AECOM to create this VISSIM model as there is considerable pressure to progress further investigation of future M1 issues around junctions 15 and 15A. This will allow for future tests and options to be determined related to the Northampton Growth Management Scheme (NGMS), improvements to three junctions on the A45 and concerns over the future impact of the proposed Rail Central Strategic Rail Freight Interchange (SRFI) on the A43.

This VISSIM model covers two grade separated junctions on the M1: Junctions 15 and 15A. Junction 15 is a signalised junction and Junction 15A is a priority controlled junction. The objective of the study was to merge two existing validated VISSIM models to obtain a validated model that includes both junctions. The modelled network is illustrated in Figure 1.1

Study Area

The extent of the modelled study area includes:

- M1 Junction 15A (priority controlled):
  - A43/Swan Valley Roundabout;
  - A43/A5123 Roundabout;
  - A43 Roundabout to the south of the M1.
- M1 Junction 15 (signal controlled using MOVA).

In addition, approximately 4.4km of the M1 mainline north and 2.3km south of M1 J15 as well as 2.5km of the A45 north and 1.2km of the A43 South are included in the model.

The following local roads have also been included:

- Approximately 1km of the A5123 approach to A43/ A5123 roundabout;
- Approximately 2.5km of the A508 south approach to M1 Junction 15;
- Approximately 1.6km of the Saxon Avenue approach of M1 J15.

The extents of the model are shown in Figure 1.1

Figure 1.1 Extent of the VISSIM Model
Source: OpenStreetMap

Observed Conditions

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Observed Conditions

Traffic surveys were carried out on Thursday 10 March 2016 by Intelligent Data Collection Limited (IDC).

Observed Data

In order to calibrate and validate the base VISSIM model, the following baseline data was obtained:

- Origin – Destination (O-D) matrices (using Automatic Number Plate Recognition (ANPR) data);
- Manual Classified Count (MCC) data;
- Queue Survey Data;
- TrafficMaster Journey Time data;
- OS Mapping;
- Video Observations.

Traffic Surveys

Traffic surveys were undertaken on Thursday 10th March 2016 by Intelligent Data Collection (IDC) following the traffic survey specification *"160229 60343293 EM1 TSS 001"* as shown **Appendix A**.

Automatic Number Plate Recognition Surveys (ANPR) were collected on Thursday 10 March 2016 at 9 cordon points across the M1 Junction 15a from 06:00 to 09:30hrs and from 15:30 to 19:00hrs, to establish O-D data and to derive journey time estimates. The cordon points are detailed below and further detailed in Figure 2.1

- Site 1 – M1 Mainline;
- Site 2 – M1 Jct15A Off-Slip Eastbound;
- Site 3 – M1 Jct15A On-Slip Westbound;
- Site 4 – Swan Valley Way;
- Site 5 – M1 Jct15A On-Slip Eastbound;
- Site 6 – M1 Jct15A Off-Slip Westbound;
- Site 7 – A5123 Mainline;
- Site 8 – A43 Mainline;
- Site 9 – M1 Mainline.

Manual Classified Counts (MCCs) were collected on Thursday 10 March 2016 at the following locations, which are shown in Figure 2.2 ***AND*** Figure 2.3

M1 Junction 15A

- Site 1 – A43/Un-Named Rd/Swan; Valley Way Roundabout;
- Site 2 – A5123/A43 Roundabout;
- Site 3 – A43 Roundabout to the south of the M1.

M1 Junction 15

- Site 4 – Saxon Ave/M1 Jct15/A45 London Road Roundabout;
- Site 5 – M1 Jct15 Slips/A508 Northampton Road Roundabout.

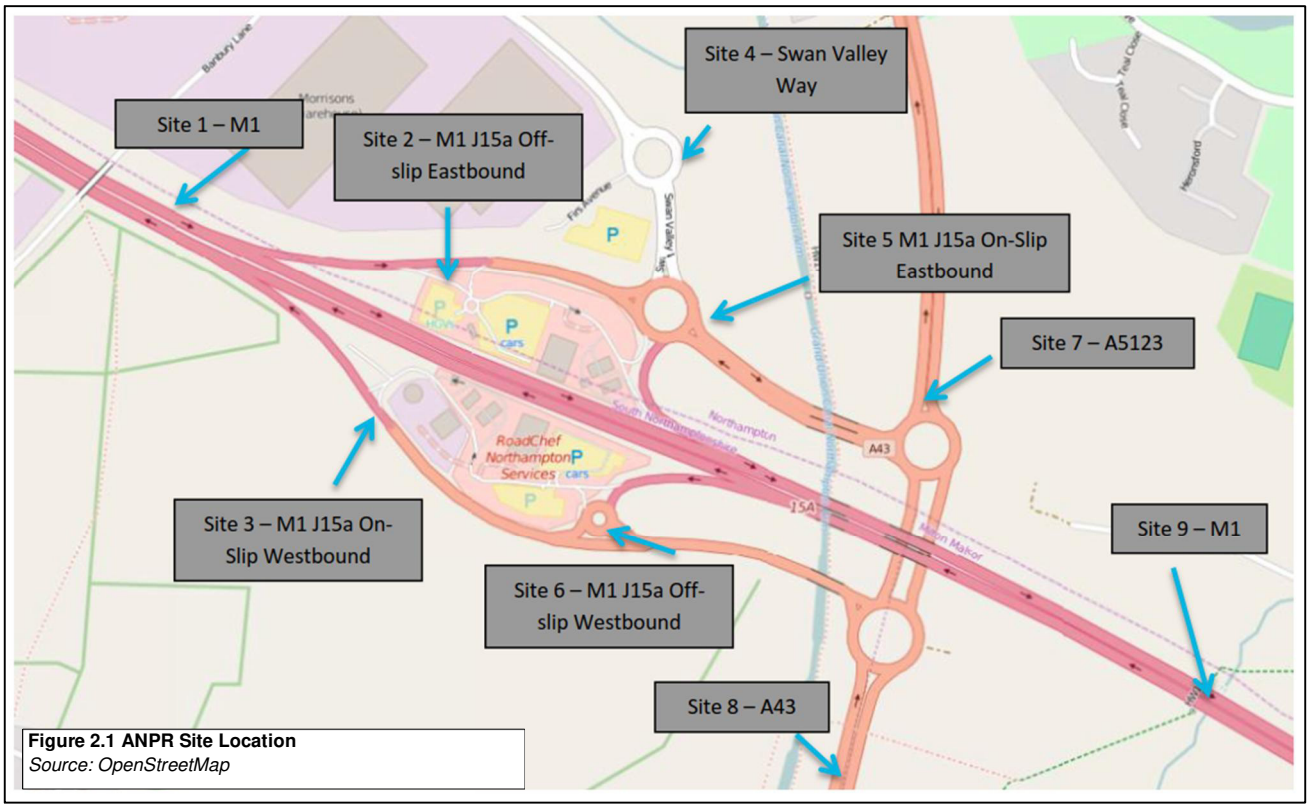

Figure 2.1 ANPR Site Location
Source: OpenStreetMap

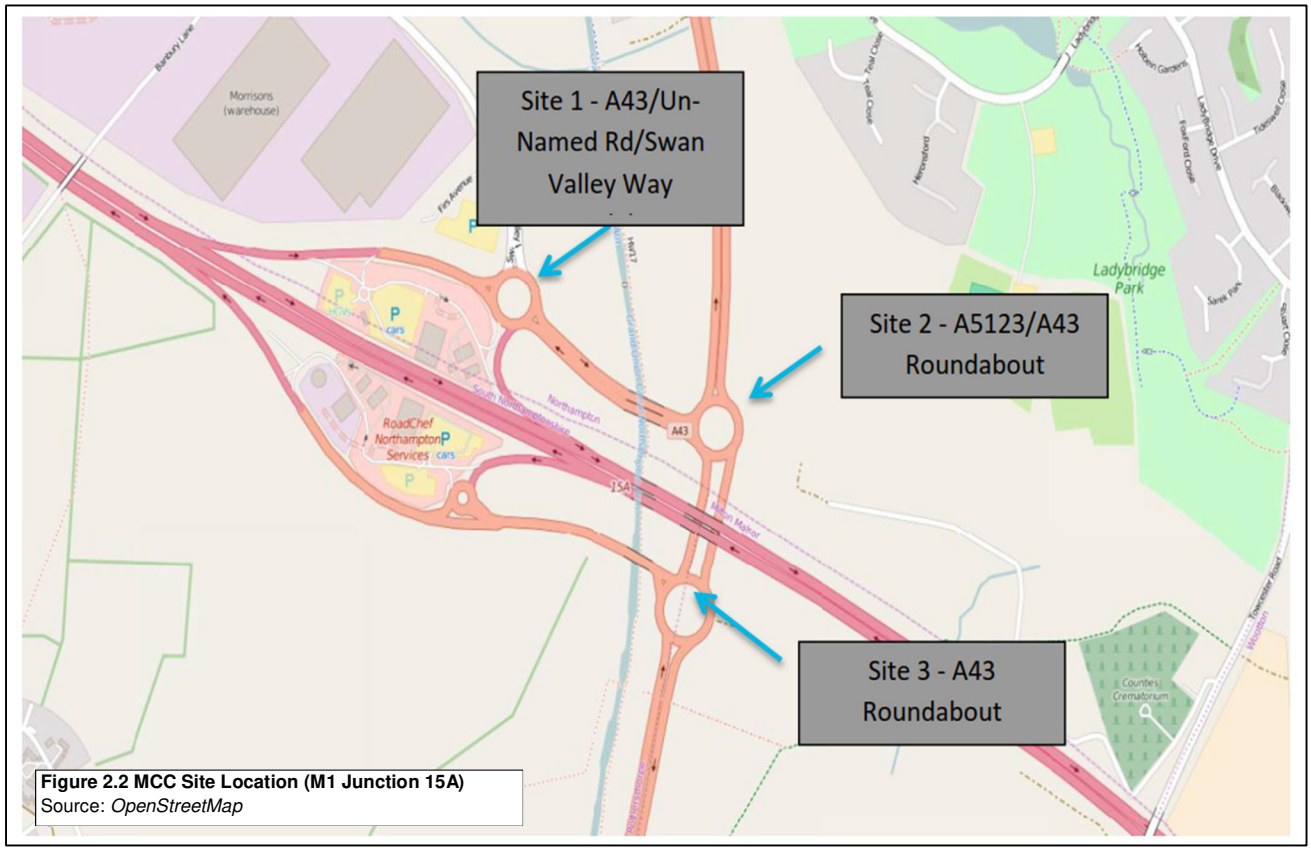

Figure 2.2 MCC Site Location (M1 Junction 15A)
Source: *OpenStreetMap*

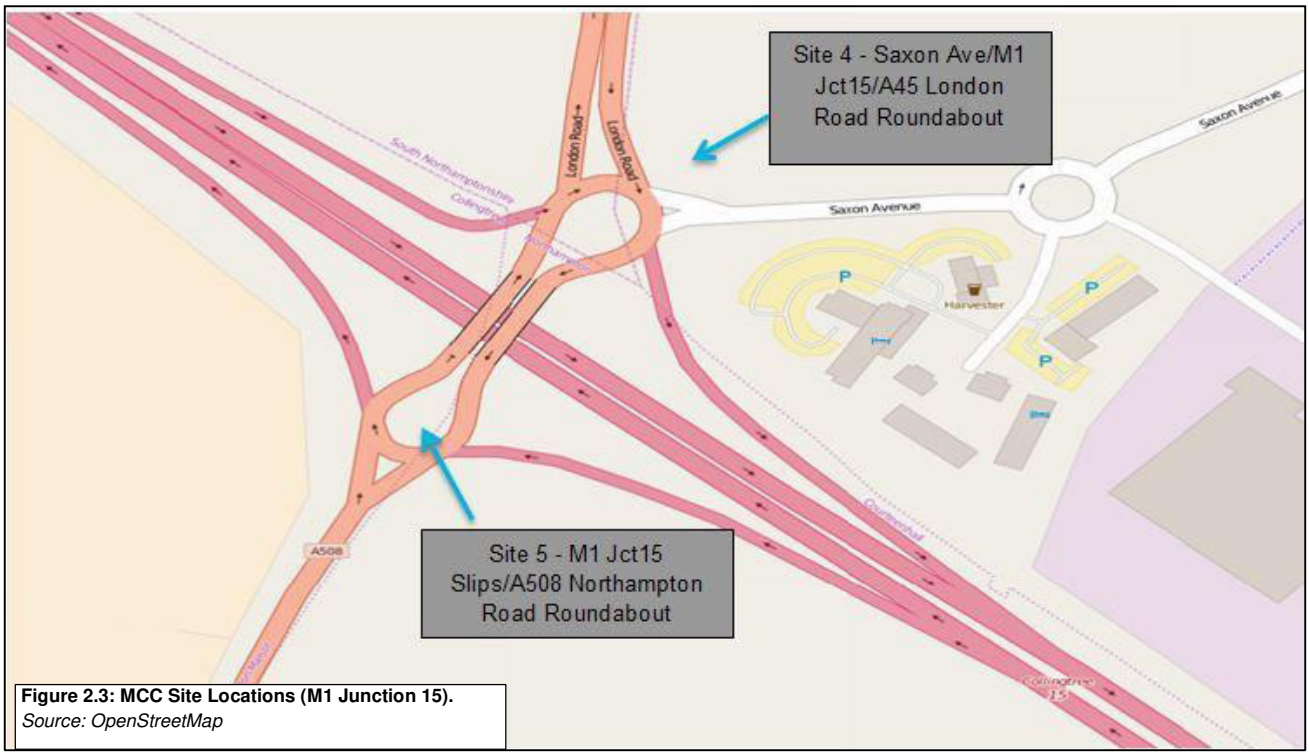

Figure 2.3: MCC Site Locations (M1 Junction 15).
Source: OpenStreetMap

Queue Surveys were undertaken on Thursday 10th March 2016 at 5 locations along the M1 Junction 15 and 15A at every approach. The locations are detailed below and shown in Figure 2.4 – Figure 2.8 Queue Length Site 5
Source: *OpenStreetMap*

Site 1 (A43/Swan Valley Way)

- Lane 1 – A43 East;
- Lane 2 – A43 East;
- Lane 3 – A43 West;
- Lane 4 – A43 West;
- Lane 5 – Swan Valley Way;
- Lane 6 – Swan Valley Way.

Site 2 (A5123/A43)

- Lane 1 – A5123 North;
- Lane 2 – A5123 North;
- Lane 3 – A43 West;
- Lane 4 – A43 West.

Site 3 (A43)

- Lane 1 – A43 South;
- Lane 2 – A43 South;
- Lane 3 – A43 West;

Site 4 (Saxon Ave/M1 J15 Eastbound Slips/A45 London Road)

- Lane 1 – A45 South towards London Road;
- Lane 2 – A45 South towards London Road;
- Lane 3 – A45 South towards London Road;
- Lane 4 – M1 J15 Eastbound Off-Slip;
- Lane 5 – M1 J15 Eastbound Off-Slip;
- Lane 6 – M1 J15 Eastbound Off-Slip;
- Lane 7 – A45 North;
- Lane 8 – A45 North;
- Lane 9 – A45 North.

Site 5 (M1 Jct15 Westbound Slips/Northampton Rd)

- Lane 1 – A45 North towards Northampton Road;
- Lane 2 – A45 North towards Northampton Road;
- Lane 3 – A45 North towards Northampton Road;
- Lane 4 – M1 J15 Westbound Off-Slip;
- Lane 5 – M1 J15 Westbound Off-Slip;
- Lane 6 – M1 J15 Westbound Off-Slip;
- Lane 7 – A508 South;
- Lane 8 – A508 South;
- Lane 9 – A508 South.

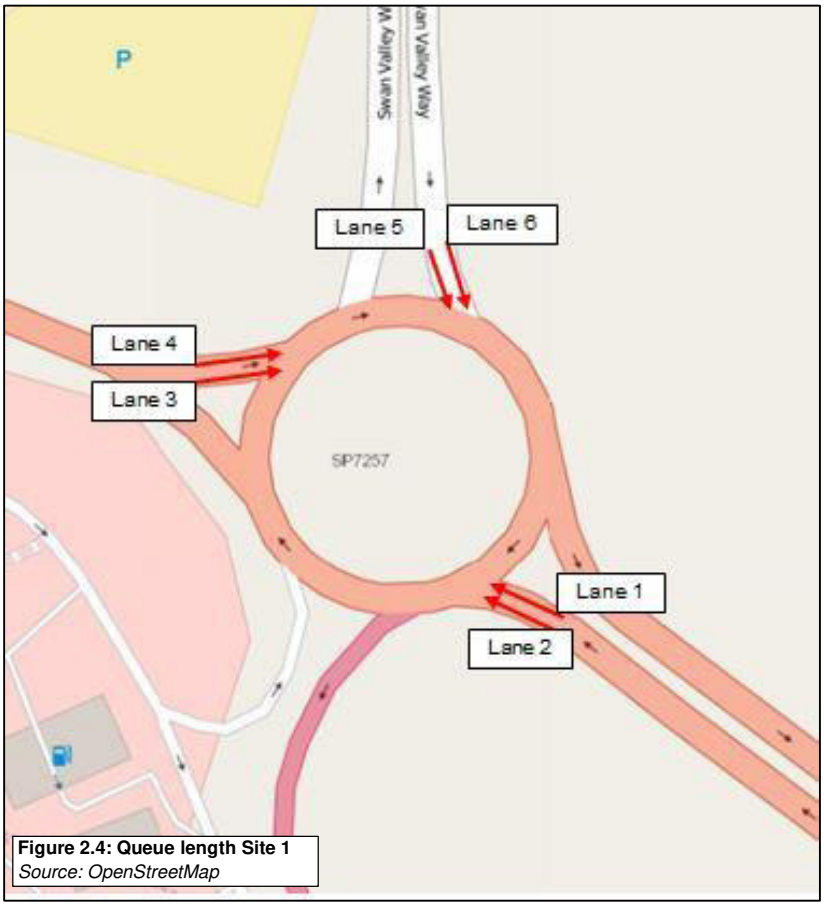

Figure 2.4: Queue length Site 1
Source: OpenStreetMap

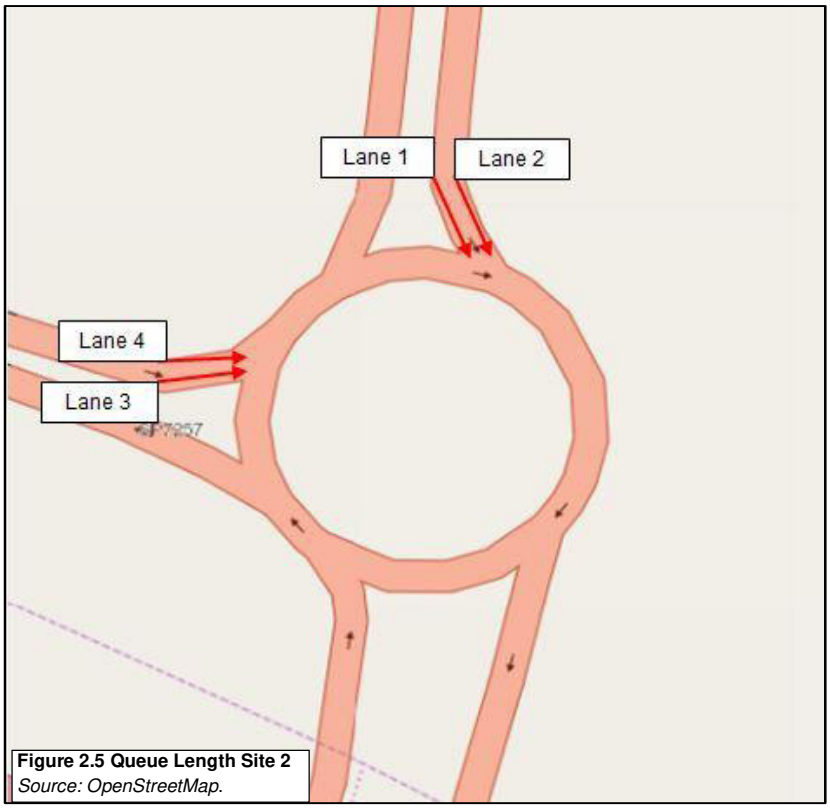

Figure 2.5 Queue Length Site 2
Source: OpenStreetMap.

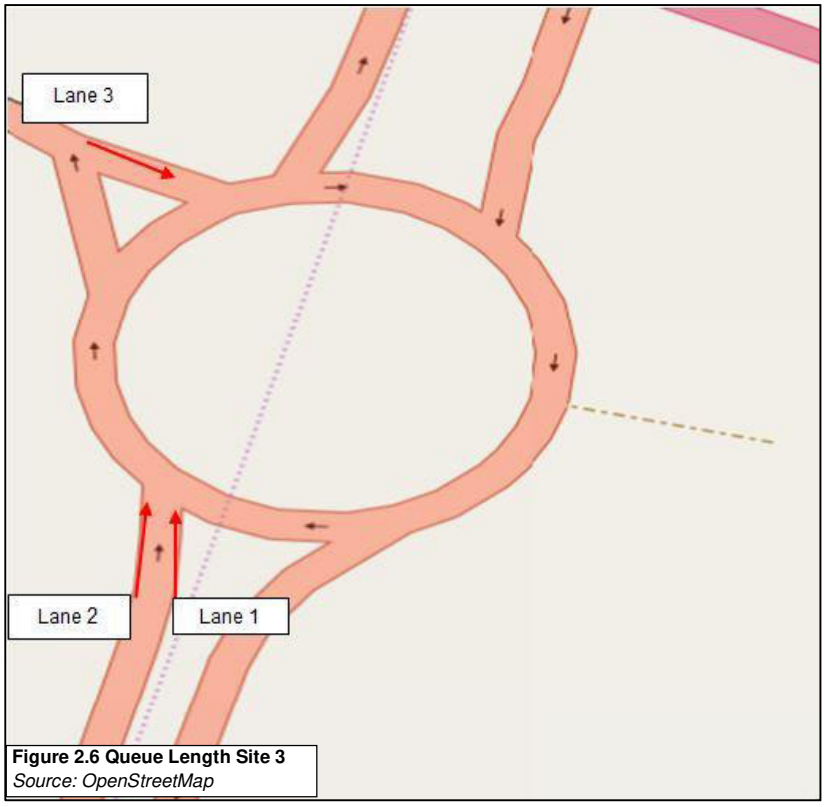

Figure 2.6 Queue Length Site 3
Source: OpenStreetMap

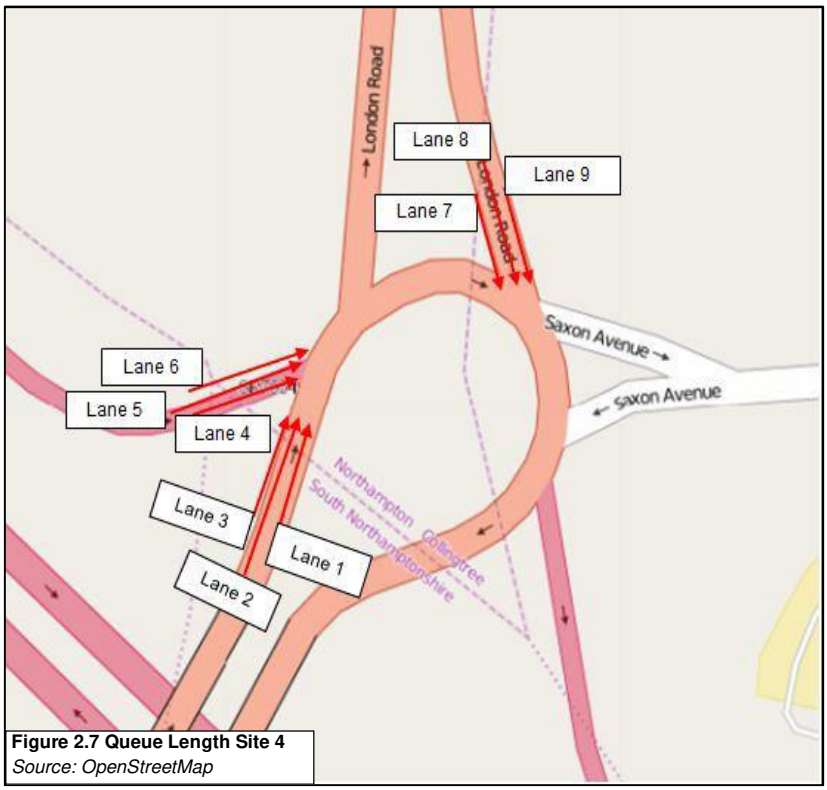

Figure 2.7 Queue Length Site 4
Source: OpenStreetMap

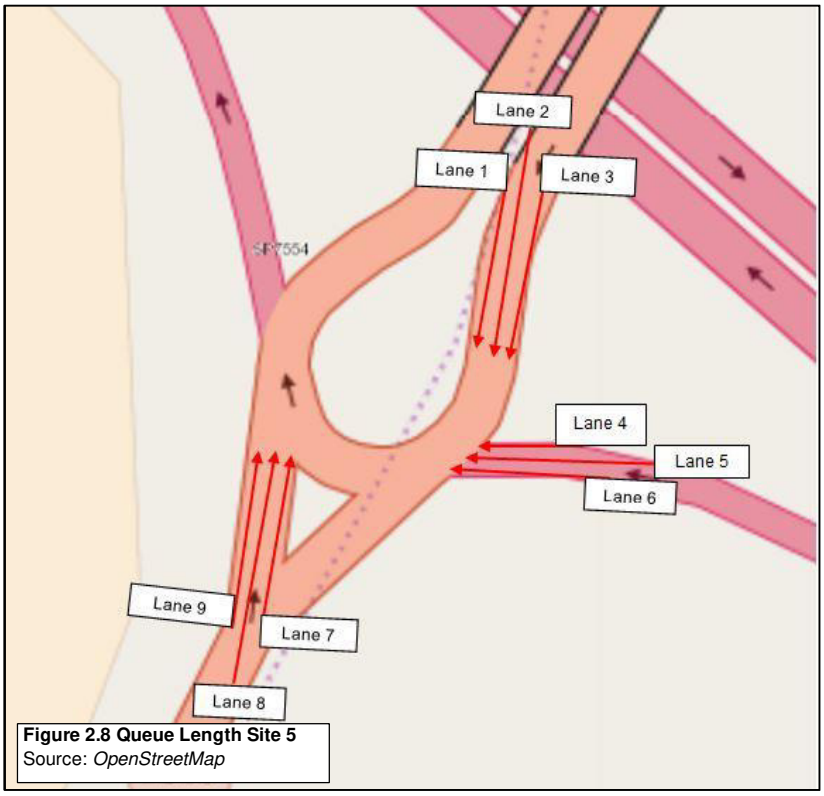

Figure 2.8 Queue Length Site 5
Source: *OpenStreetMap*

TRADS Site data has been used to derive traffic flows on the M1 mainline off-slips at both M1 J15 and J15A. The derive flows have been used as part of a comparison against the MCC data provided by IDC to determine if it provides a fair representation of vehicles entering M1 J15 and 15A. The locations of the TRADS sites used are detailed below and shown in Figure 2.9 – Figure 2.9

A43/Swan Valley Way Rbt

- M1/3044L Southbound;
- M1/3039M Southbound.

Saxon Ave/M1 J15 Eastbound Slips/A45 London Road

- M1/3001L Southbound;
- M1/2996M Southbound.

M1 Jct15 Westbound Slips/Northampton Rd

- M1/3002K Northbound;
- M1/2995J

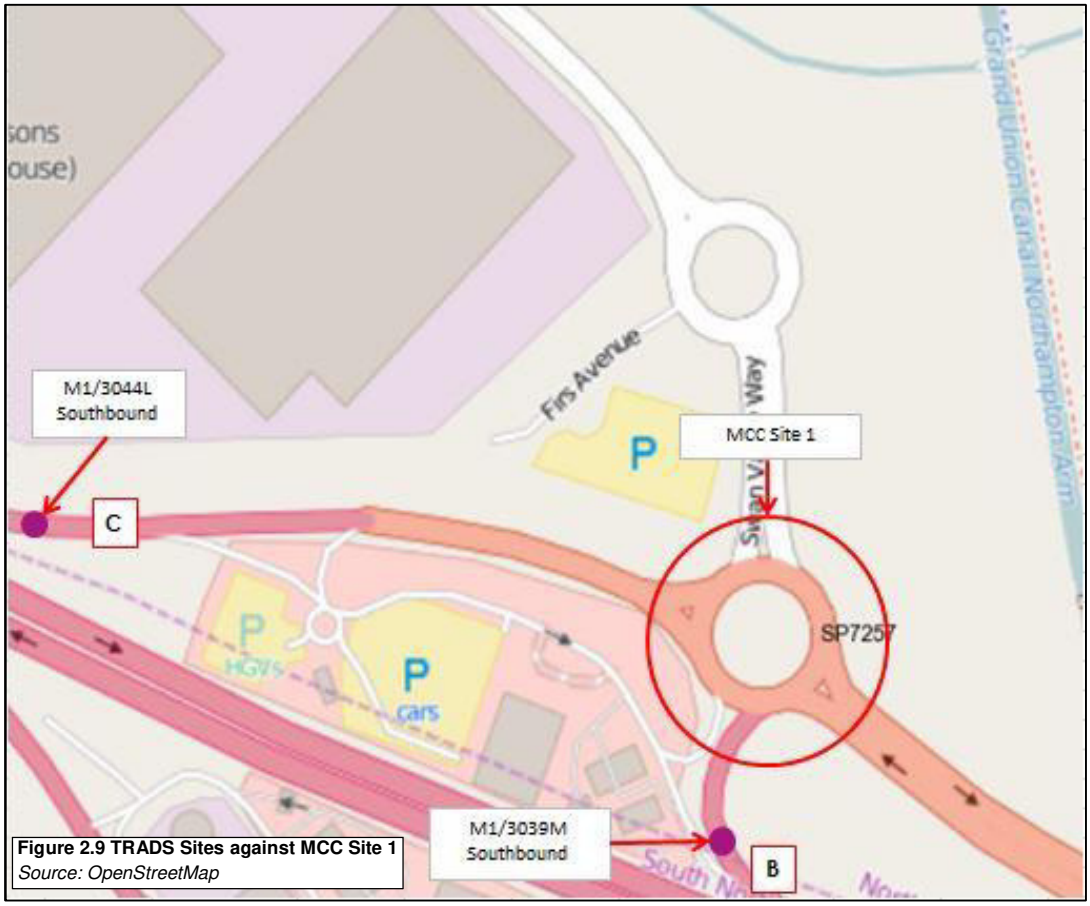

Figure 2.9 TRADS Sites against MCC Site 1
Source: OpenStreetMap

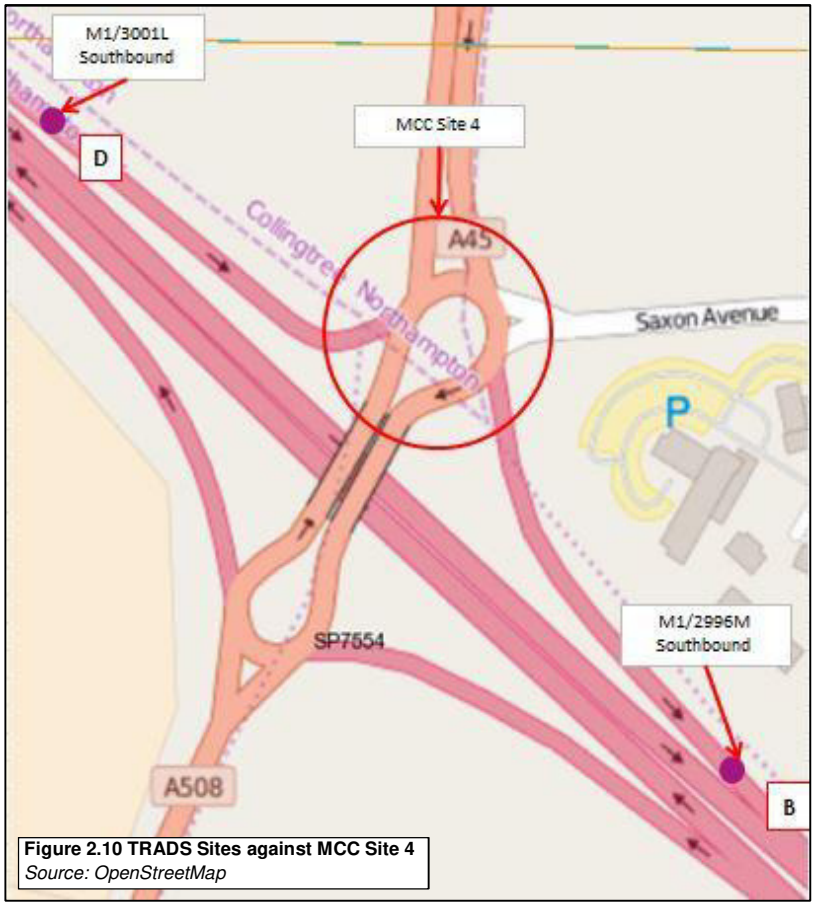

Figure 2.10 TRADS Sites against MCC Site 4
Source: OpenStreetMap

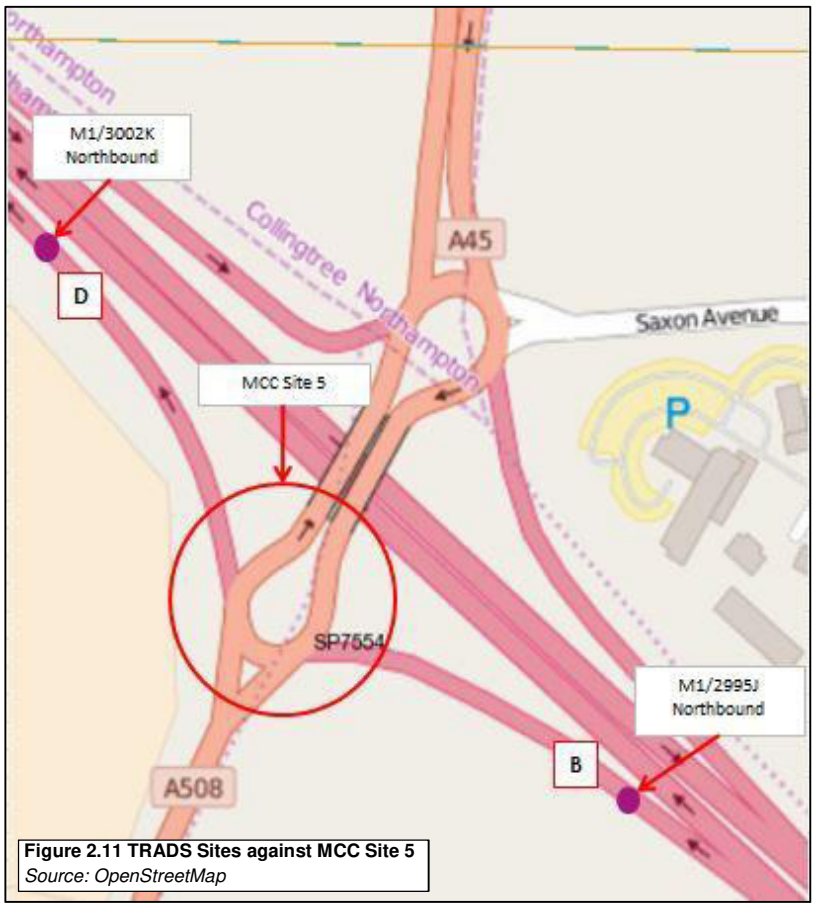

Figure 2.11 TRADS Sites against MCC Site 5
Source: OpenStreetMap

Bus Information

Public transport stops and routes were obtained in order to include all information regarding public transport lines in the model. The Traveline East Midlands website (http://www.travelineeastmidlands.co.uk) provides information on the bus services throughout Northampton. This source has been used to identify:

- The bus routes that fall within the extent of the modelled network;
- The timetables for the relevant bus services and;
- The number of buses using the modelled network during the AM and PM peak periods (0645 to 0845hrs and 1615 to 1815hrs respectively).

The collation of this information has allowed for the following routes to be coded into the model:

- 33 Central Milton Keynes to Northampton;
- 33A Central Milton Keynes to Northampton;
- 801 Bletchley to Kings Heath;
- X4 Milton Keynes to Peterborough;
- X7 Milton Keynes to Leicester;
- 302 Bristol to Northampton;
- 455 London to Corby;
- 707 Northampton to Gatwick Airport;
- C15 Luton to Creamfields;
- 7 Moulton Park to Grange Park.

Base Mapping

In order to construct the network, Mastermap topographical mapping was obtained from Highways England GeoStores for the areas around M1 Junction 15 and 15A including the M1 mainline and all of the above roundabouts and off-slip roads. This therefore allowed for the network to be constructed on mapping to the correct scale and extents.

Site Observations

No site observations have been undertaken by AECOM.

Video Observations

Video footage was obtained for the survey day, collected by IDC as part of the survey specification agreement. The videos were obtained on Thursday 10 March 2016 from 0500hrs until 2200hrs.

The footage has been used to check the operation of the modelled network and to observe driver behaviour. This has been used to identify the gap times which were subsequently used to code priority rules within the model. These have also been used to identify where extensive queues are located and to what lengths.

The video cameras were located at all of the approaches at M1 Junction 15. ANPR cameras were set up at the entry and exit locations along the M1 Junction 15A.

Review of Observed Data

To verify the suitability of the observed data, a series of checks were made to identify any potential issues which may have led to difficulties calibrating and validating the VISSIM model. The *Technical Note 60343293* Survey Data Review dated 1 April 2016, describes these checks in further detail, refer further to **Appendix B**. This note concluded that the data collected by IDC was suitable to create origin-destination matrices.

Peak Determination

Once the survey data had been reviewed, the AM and PM peak periods were determined based on the obtained flows for each junction.

From this analysis it was found that the overall peak hour periods were:

- AM Peak: 0715 – 0815hrs;
- PM Peak: 1645 – 1745hrs.

Signal Specification

The signal specification included in the model is detailed in Table 1: Signal Data Received

Table 1: Signal Data Received

Location	Data Type	Name	Description	Date	Received From
M1 J15	Mova Dataset	M1J15.MDS	M1 J15	May 2016	Aone+
	Mova Drawing	M1J15.Link,Lane,Final-Issue	M1 J15 Gyratory, Northampton	August 2010	Aone+
	Signal Details	M1 J15 Traffic Signal	M1 J15	January 2014	Aone+
	Signal Specifications Form	E84018 Issue 2	M1 J15	September 2015	Aone+
	Signal Specifications Form	E84018 Issue 3	M1 J15	September 2015	Aone+

Modelling Approach

03

Approach Overview

A VISSIM micro-simulation model has been created with the merge of two existing validated models of M1 J15 and J15A with the purpose of allowing future testing at these locations.

Approach Overview

VISSIM is a microscopic, behaviour-based multi-purpose traffic simulation program developed by PTV. The model uses the psycho-physical car-following model developed by Wiedemann and a related lane-changing model originally designed by Sparmann.

VISSIM has been used to update the existing M1 Junction 15 and 15A models as the program can analyse various typical traffic operations including scenarios of merging/diverging traffic under congested and free flow conditions, with constraints such as lane configuration, traffic composition and priority control. Complex signalised junctions can also be modelled in VISSIM with a reasonable degree of accuracy when combined with external software such as VAP (Vehicle Actuated Program) and more recently PC MOVA.

The wide range of tools combined with the ability to assess interaction between consecutive junctions makes VISSIM an extremely useful tool for the evaluation of the base year performance and any future year testing of a network.

Another benefit of VISSIM is its graphical interface that allows the user to add traffic and signal data to existing base maps or aerial photographs of intersections and road layouts. The capability dramatically improves the quality of animation of traffic operations providing an important graphical interface to aid in presentation of the outcome.

The simulation can be calibrated and validated using local traffic counts, queue lengths and journey time information. This allows the production of a site-specific base model that can accurately reflect the behaviour of traffic in the study area.

Model Coverage

The M1 Junction 15 and 15A Study VISSIM model includes the following junctions:

M1 Junction 15A:

- Site 1 – A43/Un-Named Rd/Swan Valley Way Roundabout;
- Site 2 – A5123/A43 Roundabout;
- Site 3 – A43 Roundabout to the south of the M1.

M1 Junction 15:

- Site 4 – Saxon Ave/M1 Jct15/A45 London Road Roundabout;
- Site 5 – M1 Jct15 Slips/A508 Northampton Road Roundabout.

The extent of the VISSIM model can be seen in Figure 3.1

Figure 3.1 Extent of M J15 and 15a VISSIM Model

Model Specifications

M1 Junction 15 and 15A VISSIM model has been developed using the following specifications

Table 2: Modelling Parameters

Modelling Parameters		
Assessment Year	2016	
Assessment Scenarios	AM Period	0645-0915hrs
	AM Build-Up Period	0645-0745hrs
	AM Peak Period	0745-0845hrs
	AM Cool-Down Period	0845-0915hrs
	PM Period	1530-1800hrs
	PM Build-Up Period	1530-1630hrs
	PM Peak Period	1630-1730hrs
	PM Cool-Down Period	1730-1800hrs
Evaluation Periods	AM Peak Period	0745-0845hrs
	PM Peak Period	1630-1730hrs
Vehicle Types	Light Vehicles (comprising cars and light goods vehicles)	
	Heavy Vehicles (comprising OGV1 and OGV2)	
	Public Service Vehicles (comprising of school / day trip buses and coaches)	
	Buses (comprising of buses only with specified routing, timetables and bus stops for each bus service number).	
VISSIM Version	5.40.06	
PC MOVA Version	PC MOVA 7	

Network Development

04

Network Development

Network development has been undertaken in accordance with guidance in both *DMRB Volume 12a* and *Interim Advice Note 36-01 'The use and application of micro-simulation models'*

Network Development Introduction

This section describes how the model network has been built and provides a brief overview of the data used. It then outlines the data entry checks undertaken. The model has been developed in accordance with guidance in both *DMRB Volume 12a* and *Interim Advice Note 36-01 'The use and application of micro-simulation models'.*

The network was built by merging together two existing VISSIM models. One of these models was validated in 2007 and included M1 Junctions 15, 15A and 16, however only M1 J15a was used in this combined network. The other model only replicated the operation of the M1 Junction 15 and was validated in 2014. The combined model layout is shown in Figure 3.1

The VISSIM network is made up of a series of links joined together by connectors. A link is a unidirectional representation of a section of highway. A connector is a unidirectional section of highway that joins two links. The information required for each link is:

- Lane width;
- Link Length;
- Number of Lanes.

Traffic enters and exits the network by external points known as parking lots in VISSIM; a practice referred to as zone or zone loading in more traditional traffic modelling.

This is a collection of links and connectors that form a significant traffic route decision is referred to as a node.

A summary of the modelled network is as follows:

- 12 Model Zones (22 Parking Lots);
- 23 Nodes (significant areas of route decisions – junctions);
- 295 Links and Connectors.

Vehicular Parameters

After checking the physical characteristics of the network, vehicular parameters were reviewed in order to make the model reflect existing site conditions as accurately as possible.

VISSIM has a set of default values for various vehicle characteristics, for example, range of vehicular lengths, standard weights and power distributions, maximum or minimum acceleration values. As changes in gradient have not been used within this model, these default settings were deemed appropriate and have been applied.

Signal Control

As outlined in Signal Specification, four signal controllers and 22 signal heads have been included in the model in order to replicate signal conditions at M1 Junction 15.

The datasets used for the signal control remain unchanged from the ones included in the M1 J15 existing model. The most recent signal data for this junction was received which confirmed the suitability of the existing datasets.

Desired Speed Decisions & Distributions Profiles

Desired speed decisions, which determine the speed distribution profile, are placed along a link in the VISSIM model to ensure that once a vehicle passes through a marker, it adopts the speed distributions profile associated with that marker. This allows on-site speed to be modelled. The locations of any desired speed decision in the VISSIM model were identified from the recorded video footage obtained during the AM and PM modelling periods.

Speed distribution profiles used in the model have been derived from two sources:

- Department for Transport (DfT) National vehicle free-flow speed statistics data – 2015;
- VISSIM default speed distributions.

The parameters used are detailed in Table 3.

Table 3: Desired Speed Decisions and Distribution Profiles

No	Location	Source	Vehicle Class	Speed Distribution
M1 Junction 15A (A43/Swan Valley Way Rbt)				
245, 246, 247	M1 Mainline EB	DfT	LVs	Motorways - Car
			HVs	Motorways - Heavies
27	M1 Jct15 EB On - Slip	DfT	LVs	Motorways - Car
			HVs	Motorways - Heavies
102, 265	M1 EB Off - Slip	DfT	LVs	Single Carriageways - Cars
			HVs	Single Carriageways - Heavies
99	M1 EB Service Area Entry	DfT	LVs	20 MPH - Cars
			HVs	20 MPH - Heavies
			Buses	20 MPH - PSVs
103	A43 Mainline EB	DfT	LVs	40 Mph Cars
			HVs	40 mph Heavies
			Buses	40 mph PSVs
100	A43 WB Service Area Entry	DfT	LVs	20 MPH - Cars
			HVs	20 MPH - Heavies
			Buses	20 MPH - PSVs
164, 165	A43 West EB Entry	DfT	LVs	50
			HVs	40
240	Swan Valley Way North NB	DfT	LVs	40 Mph Cars
			HVs	40 mph Heavies
			Buses	40 mph PSVs
166, 167	Swan Valley Way North SB	DfT	LVs	50
			HVs	40
260	A43 East EB Exit	DfT	LVs	40 Mph Cars
			HVs	40 mph Heavies
			Buses	40 mph PSVs
168, 169	A43 East WB Entry	DfT	LVs	50
			HVs	40
170, 171	EB Service Area Exit	DfT	LVs	50
			HVs	40
118	EB Service Area Exit	DfT	LVs	5 (25.0, 50.0)
			HVs	6 (20.0, 50.0)
119	A43/Swan Valley Way SB Exit	DfT	LVs	5 (25.0, 50.0)
			HVs	6 (20.0, 50.0)

No	Location	Source	Vehicle Class	Speed Distribution
Swan Valley Way Roundabout				
145, 146	Swan Valley Way Rbt South NB Entry	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
			Buses	30 mph PSVs
147, 148	Swan Valley Way Rbt North SB Entry	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
			Buses	30 mph PSVs
241, 242	Swan Valley Way Rbt North NB Exit	DfT	LVs	40 Mph Cars
			HVs	40 mph Heavies
			Buses	40mph PSVs
243, 244	Swan Valley Way Rbt South SB Exit	DfT	LVs	40 Mph Cars
			HVs	40 mph Heavies
			Buses	40mph PSVs
M1 Junction 15A (A43/A5123 Rbt)				
160, 161	A43 West EB Entry	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
			Buses	30 mph PSVs
261, 262	A43 West WB Exit	DfT	LVs	40 Mph Cars
			HVs	40 mph Heavies
			Buses	40mph PSVs
67, 253	A5123 North NB Exit	DfT	LVs	Dual carriageways – cars
			HVs	Dual carriageways - Heavies
			Buses	Dual carriageways - PSVs
258, 259	A5123 North SB Entry	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
			Buses	30 mph PSVs
254, 255	A43 South SB Exit	DfT	LVs	Dual carriageways – cars
			HVs	Dual carriageways - Heavies
			Buses	Dual carriageways - PSVs
256, 257	A43 South NB Entry	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
			Buses	30 mph PSVs
251, 252	A5123 Mainline SB	DfT	LVs	Dual carriageways – cars
			HVs	Dual carriageways - Heavies
			Buses	Dual carriageways - PSVs
M1 Junction 15A (A43 Rbt)				
266	A43 West EB Entry	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies

No	Location	Source	Vehicle Class	Speed Distribution
107	A43 West WB Exit	DfT	LVs	Single carriageways – cars
			HVs	Single Carriageways - heavies
88, 89	A43 North NB Exit	DfT	LVs	1 (55.0, 90.0)
			HVs	2 (50.0, 70.0)
156, 157	A43 North SB Entry	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
84, 85	A43 South SB Exit	DfT	LVs	Dual carriageways – cars
			HVs	Dual Carriageways – Heavies
			Buses	Dual Carriageways - PSVs
267, 268	A43 South NB Entry	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
269, 270	A43 South Mainline NB	DfT	LVs	Dual carriageways – cars
			HVs	Dual Carriageways – Heavies
M1 Junction 15A (A43/WB Service Area)				
9	M1 Jct15a WB Off – Slip	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
96	M1 Jct15a WB Off – Slip (Entry into Services Area)	DfT	LVs	20 MPH – Cars
			HVs	20 MPH - Heavies
213	A43 EB (Exiting WB Services Rbt)	DfT	LVs	5 (25.0, 50.0)
			HVs	6 (20.0, 50.0)
263	A43 WB (Entering WB Services Rbt)	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
264	A43 EB (Entering WB Services Rbt)	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
95	A43 NB (Towards WB Services Area)	DfT	LVs	20 MPH – Cars
			HVs	20 MPH - Heavies
212	WB Service Area Exit (Towards A43 EB)	DfT	LVs	Single carriageways - cars
			HVs	Single Carriageways - Heavies
45, 46	A43 WB (Towards M1 Jct15a On - Slip)	DfT	LVs	Dual carriageways – cars
			HVs	Dual Carriageways – Heavies
26	M1 Jct15a WB On – Slip	DfT	LVs	Motorways – cars
			HVs	Motorways - Heavies
M1 Junction 15				
237, 238, 239	M1 Jct15 EB Off - Slip	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
			Buses	30 mph PSVs

No	Location	Source	Vehicle Class	Speed Distribution
214, 215	A45 London Rd North NB Exit	DfT	LVs	Dual carriageways – cars
			HVs	Dual Carriageways – Heavies
			Buses	Dual Carriageways - PSVS
216, 217	A45 London Rd SB Mainline	DfT	LVs	Dual carriageways – cars
			HVs	Dual Carriageways – Heavies
			Buses	Dual Carriageways - PSVS
276, 277, 278	A45 London Rd North SB Entry	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
			Buses	30 mph PSVS
218, 219	Saxon Avenue EB Exit	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
			Buses	30 mph PSVS
274, 275	Saxon Avenue WB Entry	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
			Buses	30 mph PSVS
220, 221	M1 Jct15 On – Slip Exit from Jct15	DfT	LVs	40 Mph Cars
			HVs	40 mph Heavies
			Buses	40 mph PSVS
222, 223	M1 Jct15 EB On – Slip onto M1 Mainline SB	DfT	LVs	Motorways – cars
			HVs	Motorways - Heavies
			Buses	Motorways - Heavies
227, 228	M1 Jct15 EB On – Slip onto M1 Mainline SB	DfT	LVs	Dual carriageways – cars
			HVs	Dual Carriageways – Heavies
			Buses	Dual Carriageways - PSVS
229, 230, 231	M1 Jct15 WB Entry into Jct	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
			Buses	30 mph PSVS
232	A508 Northampton Rd SB Exit	DfT	LVs	Single carriageways - cars
			HVs	Single Carriageways - heavies
			Buses	Single Carriageways PSVS
271, 272, 273	A508 Northampton Rd NB Entry	DfT	LVs	30 mph Cars
			HVs	30 Mph Heavies
			Buses	30 mph PSVS
233	A508 Northampton Rd NB Mainline	DfT	LVs	Single carriageways - cars
			HVs	Single Carriageways - heavies
			Buses	Single Carriageways PSVS

Priority Markers and Gap Times

Priority rules inform a vehicle to wait at a junction unless the gap time is large enough for it to pull out safely and continue on its journey. The priority rules have been placed in the vicinity of all junctions within the model. The gap times were initially based on theoretical default values of 3.0 seconds for Light Vehicles (LVs) including cars where 3.5 seconds were applied for Heavy Vehicles (HVs) including buses. However, a review of the observed video footage from the traffic surveys undertaken by IDC resulted in changes to some of these values. As part of the calibration process, these have been adjusted to suit the level of queuing and journey times observed. The gap times used below are all within the normal variance adopted in VISSIM.

The final gap times used for the relevant priority approach are detailed below in Table 4.

Table 4: Gap Times used in VISSIM Model

Approach	Vehicle Type	AM &PM Circulatory		
		Lane 1	Lane 2	Lane 3
A43/Swan Valley Way Rbt (M1 J15A)				
A43 West Lane 1	Car/LVs	3.0s	3.0s	-
	HVs	3.4s	3.2s	-
A43 West Lane 2	Car/LVs	3.2s	3.2s	-
	HVs	3.4s	3.2s	-
Swan Valley Way Lane 1	Car/LVs	3.2s	3.0s	-
	HVs	3.4s	3.2s	-
Swan Valley Way Lane 2	Car/LVs	3.2s	3.0s	-
	HVs	3.4s	3.2s	-
A43 East Lane 1	Car/LVs	3.2s	3.0s	-
	HVs	3.4s	3.2s	-
A43 East Lane 2	Car/LVs	2.8s	3.0s	-
	HVs	3.4s	3.2s	-
WB Services South Lane 1	Car/LVs	3.2s	3.0s	-
	HVs	3.4s	3.2s	-
WB Services South Lane 2	Car/LVs	3.2s	3.0s	-
	HVs	3.4s	3.2s	-
A43/A5123 Rbt (J15A)				
A43 West Lane 1	Car/LVs	3.1s	3.2s	-
	HVs	3.8s	4.0s	-
A43 West Lane 2	Car/LVs	3.1s	3.4s	-
	HVs	3.8s	3.8s	-
A5123 North Lane 1	Car/LVs	3.2s	3.0s	-
	HVs	3.7s	3.6s	-
A5123 North Lane 2	Car/LVs	2.8s	3.0s	-
	HVs	3.7s	3.6s	-
A43 South Lane 1	Car/LVs	2.8s	2.6s	-
	HVs	3.7s	3.6s	-

Approach	Vehicle Type	AM &PM Circulatory		
		Lane 1	Lane 2	Lane 3
A43 South Lane 2	Car/LVs	2.8s	3.0s	-
	HVs	3.7s	3.6s	-
A43 Rbt (M1 J15A)				
A43 North Lane 1	Car/LVs	3.2s	3.0s	-
	HVs	3.7s	3.6s	-
A43 North Lane 2	Car/LVs	2.8s	3.0s	-
	HVs	3.7s	3.6s	-
A43 South Lane 1	Car/LVs	3.2s	3.0s	-
	HVs	3.5s	3.2s	-
A43 South Lane 2	Car/LVs	2.8s	3.0s	-
	HVs	3.5s	3.2s	-
A43 West	Car/LVs	2.8s	2.6s	-
	HVs	3.5s	3.4s	-
Eastbound Services Rbt (M1 J15A)				
M1 off-slip into Rbt	Car/LVs	2.6s	-	-
	HVs	3.6s	-	-
A43 East	Car/LVs	1.8s	-	-
	HVs	3.6s	-	-
A43 Southwest	Car/LVs	2.6s	-	-
	HVs	3.6s	-	-
M1 off-slip into services	All Vehicles	3.0s	-	-
Saxon Avenue Entry into M1 J15				
Saxon Av Lane 1	All Vehicles	3.0s	3.0s	3.0s
Saxon Av Lane 2	All Vehicles	3.0s	3.0s	3.0s
Saxon Avenue Rbt				
Saxon Avenue West	All Vehicles	3.0s	-	-
Saxon Avenue NE	All Vehicles	3.0s	-	-
A508 Entry into M1 J15				
A508 Lane 1	All Vehicles	3.7s	3.7s	3.7s
A508 Lane 2	All Vehicles	3.7s	3.7s	3.7s
A508 Lane 3	All Vehicles	-	3.7s	3.7s

Reduced Speed Areas

Reduced speed areas (RSAs) have been inserted before a junction in order to slow vehicles down on the approaches, where the speed limit reduces, or where the layout results in drivers having to slow down. RSAs have to be applied to each lane of a link and the parameters set for Light Vehicles (LVs) and Heavy Vehicles (HVs).

The speed distributions for the reduced speed areas at the junctions above differ for the AM and PM peak periods in order to reflect on site conditions.

The extent of the reduced speeds areas are detailed below:

- A43/Swan Valley Way Roundabout - Speed distribution set at 30mph;
- A43/A6123 - Speed distribution set to 30mph (North) & 20 mph (south);
- A43 roundabout - Speed distribution set at 30mph;
- M1 Junction 15A Service Roundabout (northbound) – Speed distribution set at 30mph;
- Swan Valley Way Roundabout - Speed distribution set to 30mph;
- M1 Junction 15 (North) - Speed distribution set to 30mph (North) and 20 mph (south);
- Saxon Avenue - Speed distribution set at 30mph;
- M1 Junction 15 (south) - Speed distribution set to 30mph (approaching junction) and 20mph (circulatory).

Routing Decisions

A number of routing decisions were removed from the junctions because they were either redundant or a circular route. 'U' turns around the junctions have also been removed from the model where no vehicles have been recorded doing that movement.

Redundant routes included those which did not follow the correct lane markings and allocations around the junction. This allowed the model to better replicate lane choice and routing both on the approaches and around the circulatory.

Public Transport

There are nineteen bus routes identified that travel through the model network but only ten of these were coded into the VISSIM model. The nine bus routes that were not included in the model were either school holiday bus routes only or their timetables did not distribute vehicles through the modelled network during the modelled AM and PM peak periods. The bus routes were found in Google Maps and then the timetables were sourced from the Traveline East Midlands website. These were then checked for confirmation against the bus operators' timetables.

Driving Behaviour Parameters

VISSIM has a default set of driving behaviours contained in a complex array of parameters which can be edited to more accurately reflect site specific conditions. These parameters affect the car following and lane change models of vehicles, lateral behaviour and vehicular reaction to traffic signals. These sets of parameters are associated with link types so that all vehicles travelling along a specific link will display the same driving behaviour properties.

The driver behaviour profiles have been used on a variety of different links, depending on their location within the VISSIM model.

The following driving behaviours that have been included in the model:

- Urban (Motorised) default;
- Right-side rule (motorised);
- Merges;
- Urban (motorised)
- Motorway – found only on the M1 mainline.

The above driving behavior parameters have been updated to represent the driving behaviour within the area of the model.

The "Merge" driver behaviour type has been used for the VISSIM model to achieve a better representation of reality in the areas where merging is occurring. This has been amended for Junction 15A in order to represent on site conditions observed from the video footage.

The "Urban "motorised)" behaviour was also updated at this location, using the existing as a template, and, adjusting some of the parameters to replicate the observed behaviour. A further breakdown of driving behaviours used for the VISSIM model is shown in Appendix C.

Conflict Areas

Conflict areas are inserted into VISSIM models as a method of preventing vehicles from overlapping when the model is in operation. This helps to better simulate site conditions. As separate models, both the M1 J15a and M1 J15 were coded with conflict areas. Two conflict areas were included into the M1 J15A model and another five conflict areas were coded into the M1 J15 model. When the models were merged together these conflict areas were unchanged.

Lane Change Decisions

The Lane change decision distance governs how far in advance a vehicle will alter its path of travel to more from one link to another link via a connector. The default lane change decision distance in VISSIM is 200m. When the M1 J15A and M1 J15 models were merged together the lane change decisions were unchanged.

Matrix Development

05

Traffic Modelling Zoning System

The VISSIM models were built using a dynamic (matrix based) demand assignment in which vehicles choose their route through the network based on calculated cost paths.

This section describes the development of the demand matrices used in the dynamic assignment of vehicles in the VISSIM micro-simulation model.

The VISSIM models were built using a dynamic (matrix based) demand assignment in which vehicles choose their route through the network based on calculated cost paths. A dynamic assignment was chosen because of data availability and the ease of amending a dynamic model for future scenarios. The nature of the network is also best replicated by a dynamic assignment due to the lane changing characteristics, which are catered for by forward thinking route choice rather than a static set of paths.

The zoning system, on which dynamic assignments are based, provides a series of vehicular entry and exit points on the network. The inter-zone movements, which are generated by the assignment process, provide a representation of the vehicle paths and driver behavior between the origins and destinations in the model network.

The zoning system for the VISSIM model is shown in Figure 5.1 – Figure 5.2 including the traffic entry and exit points, which are as follows:

- Zone 1 – A508 Northampton Rd;
- Zone 2 – M1 Southeast;
- Zone 3 – Saxon Avenue;
- Zone 4 – A45 North;
- Zone 5 – A43 South;
- Zone 6 – A5123 North;
- Zone 7 – EB Services Area – Model Entry;
- Zone 8 – EB Services Area – Model Exit;
- Zone 9 – WB Services Area – Model Entry;
- Zone 10 – WB Services Area – Model Exit;
- Zone 11 – Swan Valley Way;
- Zone 12 – M1 Northwest.

Types of Traffic Flow Input Files Used

For this model, Origin Destination matrices were created and used to distribute traffic around the network. ANPR and MCC survey data was used to produce the matrices for the network extents. TRADS data obtained from the Highways England Traffic Information Database was used to carry out a quality check of the M1 mainline flows.

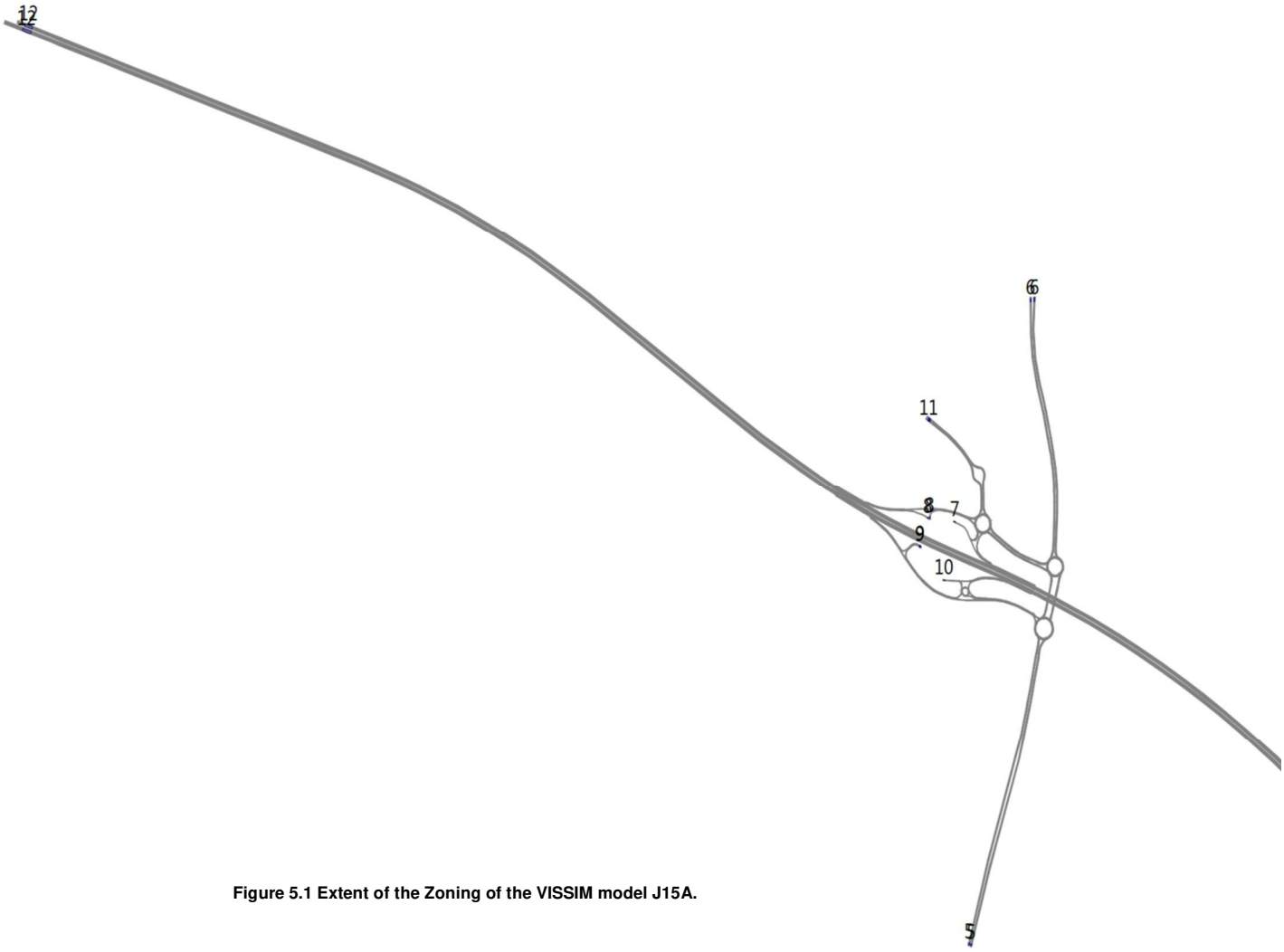

Figure 5.1 Extent of the Zoning of the VISSIM model J15A.

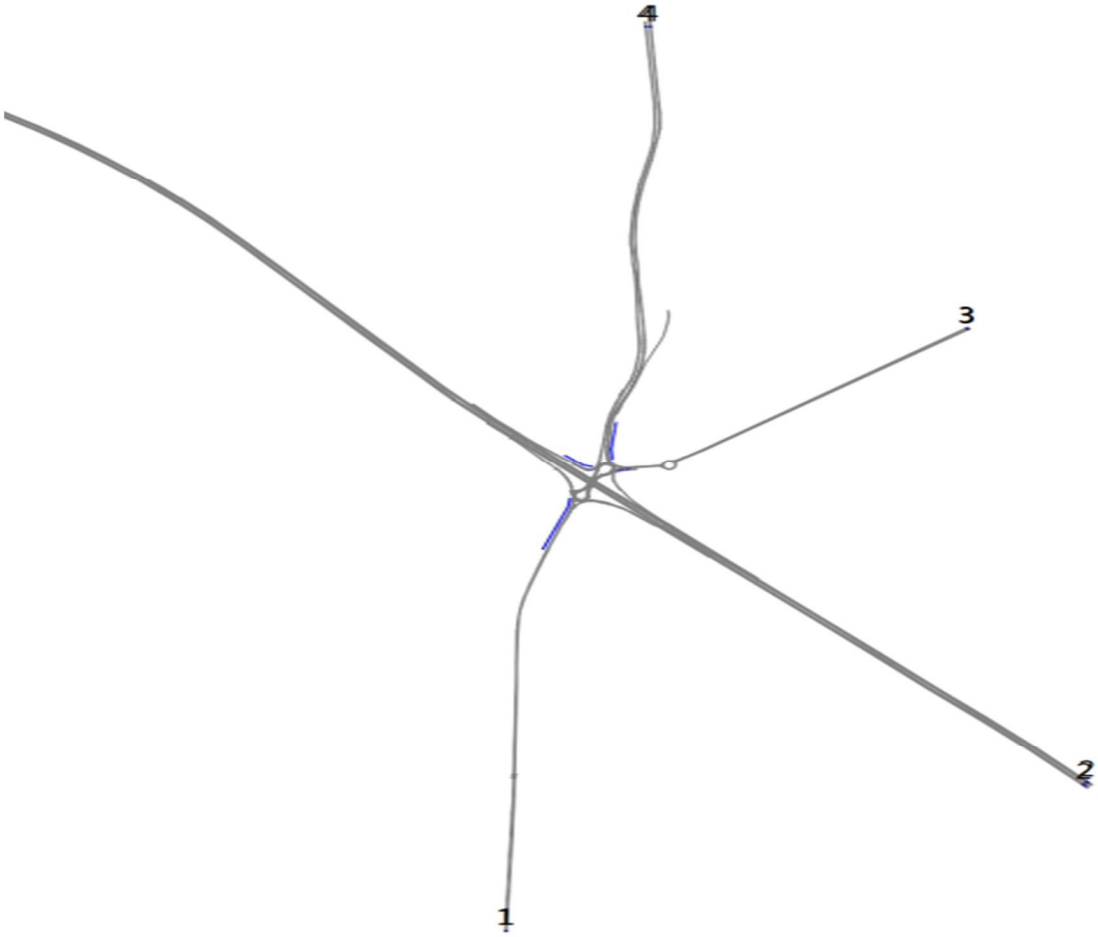

Figure 5.2 Extent of the Zoning of the VISSIM model J15.

Matrix Development

O-D matrices have been developed using the ANPR and MCC data. The section below outlines the methodology employed.

The matrices used in the model have been derived through the collection, analysis and subsequent assembly of ANPR and MCC data recorded for a cordon around M1 Junction 15 and 15A.

Section 2 details the traffic surveys used in matrix development.

The matrix construction for the AM and PM VISSIM models was undertaken using three different methodologies. Each one of these methodologies is used to estimate a specific part of the final O-D matrix as it can be seen in ***Table*** 5**.**

These are listed and explained below:

- MCC Turning Factors (highlighted in red);
  - Trips between Zones 1 – 4;
- ANPR + MCC Growth Factors (highlighted in orange);
  - Trips between Zones 5 – 12;
- MCC Turning Factors + Balancing Factors (highlighted in blue);
  - Rest of the O-D matrix.

MCC Turning Factors

Due to the lack of ANPR data at the M1 Junction 15, trips between zones 1 - 4 were estimated using MCC data collected at two of roundabouts which form the dumbbell interchange.

O - D flows were estimated applying MCC turning factors to the total flow at the origin zone entering the model.

A total of up to two or three MCC turning factors were applied in order to estimate O - D traffic flows for those trips using routes passing through the two roundabouts.

The following mathematical expression can be used to calculate O - D flows within these zones:

$$T_{ij} = MCC_i(F_1, F_2, \dots, F_n);$$

where T_{ij} is the number of trips with origin zone *i* and destination zone *j*, MCC_i is the total flow entering the model using zone *i*, *F* is a turning factor and *n* is the number of turning movements within the route from zone *i* to zone *j*.

ANPR + MCC Growth Factors

This method was implemented to estimate O-D flows between zones 5 - 12 and was divided in two main stages.

A comparison of the ANPR and MCC data collected at the M1 Junction 15A has been carried out. A difference percentage factor was calculated and then applied to

Table 5: Matrices Applied to the Model

	1	2	3	4	5	6	7	8	9	10	11	12
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												

growth ANPR flows to match the data obtained from the MCC to ensure that all vehicles that travelled through this part of the network are included within the model.

MCC Turning Factors + Balancing Factors

In order to estimate the O - D flows for the routes with origin and destination zones located in different junctions, MCC turning factors were applied to the ANPR internal zone. This internal zone allowed an estimation of O - D flows between junctions.

Additionally, this method was constrained using balancing factors, in the sense that the total number of trips to the ANPR internal zone equals the total number of trips within origin zones 5 - 12 and destination zones 1 - 4. Similarly, the total number of trips from the ANPR internal zone equals the total number of trips within origin zones 1 - 4 and destination zones 5 - 12.

The following mathematical expression can be used to calculate O-D flows using this method:

$$T_{ij} = \begin{cases} ANPR_i(F_1, F_2, \dots, F_n) f_b, & i < 5 \\ ANPR_j(F_1, F_2, \dots, F_n) f_b, & i \geq 5 \end{cases}$$

Where $ANPR_i$ is the total flow with the ANPR internal zone as origin zone, $ANPR_j$ is the total flow with the ANPR internal zone as destination zone and f_b is the balancing factor.

In total, for each of the AM and PM peak models, three O - D matrices were constructed for each vehicle type, Light Vehicles (LVs) and Heavy Vehicles (HVs):

- AM period (0615-0845hrs)
  - Build Up Period: 0615-0715hrs
  - Peak Period: 0715-0815hrs
  - Cool Down Period: 0815-0845hrs
- PM period (1545-1815hrs)
  - Build Up Period: 1545-1645hrs
  - Peak Period: 1645-1745hrs
  - Cool Down Period: 1745-1815hrs

Once the O-D matrices were complete, they were entered into the VISSIM model and it was run a number of times to ensure that all of the elements operated correctly. Any errors that were shown in the error files were corrected before the modelling process was taken any further. The final matrices are detailed in **Appendix D**.

Model Convergence

06

Model Convergence

DMRB (Volume 12, Section 2, Part 1, Chapter 4) and TfL's Traffic Modelling Guidelines: TfL Traffic Manager and Network Performance Best Practice. Version 3.0" have been used to assess the convergence of the M1 J15 and 15A model.

The VISSIM model has been run using the Dynamic Assignment Module, in which a series of iterated simulations are used to determine the route of a vehicle through the network based on a total travel cost. As a result of this, there is a need to assess the convergence of the model to establish that the travel times and volumes do not change significantly from one iteration to the next, enabling the model to be deemed stable and results to be analysed in confidence.

DMRB (Volume 12, Section 2, Part 1, Chapter 4) and TfL's Traffic Modelling Guidelines: TfL Traffic Manager and Network Performance Best Practice. Version 3.0" provides a series of convergence criteria that should be used to assess the convergence and stability of traffic models. The following convergence criteria can be assessed within the context of VISSIM:

- 95% of all path traffic volumes change by less than 5% for at least four consecutive iterations;
- 95% of the travel times on all paths change by less than 20% for at least four consecutive iterations;
- The percentage change in user costs or time spent within the network (V) should be less than 1% for four consecutive iterations.

Convergence Results

The AM and PM models were initially run for a single simulation using random seed 42 to establish the initial costs (BEW files) and paths (WEG files) within the network. Using the node evaluation window, the paths through the network were reviewed and any paths that were deemed incorrect or unfeasible were closed.

A batch run of each scenario was then undertaken, using random seed 42 and running the models for 10 simulations, using the same random seed in order to assess the convergence of the model. Very high levels of convergence have been achieved for both the AM and PM models. Table 6 ***TO*** Table 9 shows the results of the convergence evaluation.

Table 6 ***AND*** Table 7 indicate that path convergence is achieved in both the AM and PM peak periods. The percentage differences between seeds are lower than 1% for all simulation runs and are well over the 90% path convergence criteria required.

Table 6: Convergence Evaluation Files for Seed 42 – Volume on Edges and Paths – AM Peak

Run Number	% Edges with Volume difference ≤ 5 Vehicles	Difference from previous run	Paths Convergence Figure	Difference from previous run
1	97%		87%	
2	97%	-0.03%	87%	0.00%
3	96%	-0.41%	87%	0.00%
4	96%	0.26%	87%	0.00%
5	96%	0.00%	87%	0.00%
6	96%	0.06%	87%	0.00%
7	96%	-0.46%	85%	-1.50%
8	100%	4.03%	85%	0.00%
9	100%	0.00%	85%	0.00%
10	97%	-3.45%	85%	0.00%

Table 7: Convergence Evaluation Files for Seed 42 – Volume on Edges and Paths – PM Peak

Run Number	% Edges with Volume difference ≤ 5 Vehicles	Difference from previous run	Paths Convergence Figure	Difference from previous run
1	75%		81%	
2	96%	21.45%	81%	0.00%
3	96%	-0.52%	81%	0.00%
4	96%	0.35%	81%	0.00%
5	96%	0.35%	81%	0.00%
6	96%	-0.64%	81%	0.06%
7	96%	0.35%	79%	-1.99%
8	96%	0.23%	79%	0.00%
9	96%	0.20%	79%	0.00%
10	96%	-0.06%	79%	0.00%

Table 8: Convergence Evaluation Files for Seed 42 – Travel Time on Edges and Paths – AM Peak

Run Number	% Edges with Travel Time difference ≤ 20%	Difference from previous run	Paths Convergence Figure	Difference from previous run
1	100%		100%	
2	100%	-0.03%	100%	0.00%
3	100%	0.03%	100%	0.00%
4	100%	0.00%	100%	0.00%
5	100%	0.00%	100%	0.00%
6	100%	0.00%	100%	0.00%
7	100%	0.00%	100%	0.00%
8	100%	0.00%	100%	0.00%
9	100%	0.00%	100%	0.00%
10	100%	0.00%	100%	0.00%

Table 9: Convergence Evaluation Files for Seed 42 – Travel Time on Edges and Paths – PM Peak

Run Number	% Edges with Travel Time difference ≤ 20%	Difference from previous run	Paths Convergence Figure	Difference from previous run
1	100%		100%	
2	100%	0.03%	100%	0.12%
3	100%	0.00%	100%	0.00%
4	100%	0.00%	100%	0.00%
5	100%	0.00%	100%	0.00%
6	100%	0.00%	100%	0.00%
7	100%	0.00%	100%	0.00%
8	100%	0.00%	100%	0.00%
9	100%	0.00%	100%	0.00%
10	100%	0.00%	100%	0.00%

Table 6 and ***TABLE 7***indicate that the AM and PM models fulfil convergence criteria for travel times on edges and paths. Thus, it is deemed to have suitably converged.

The total travel times in the network have also been extracted from the NPE files and the results of this analysis are presented in Table 8 and ***TABLE 9***

With regards to the travel times, AM and PM models suitably meet all required criteria.

These models are therefore considered converged to an appropriate level and to provide a suitable platform in order to extract results for validation against other data sources.

Model Calibration

07

Model Calibration

As part of the calibration process, several checks were undertaken. These checks include coding of the network, O-D matrix flows and signal operation and queues.

The AM and PM VISSIM models have been subject to model calibration, to ensure that the inputs into the model are representative of on-site conditions. Refer to **Appendix E** for a further breakdown of calibration of the entry flows.

In order to check calibration levels, the model was multi-run to produce a set average of traffic flow results. The VISSIM model was run using 10 different random seeds, starting with random seed 10 and with a random seed increment of 10.

To enable a robust assessment, the results used in the model calibration process represent an average of the 10 simulation runs for each of the AM and PM peaks.

In order to correctly model on-site behaviour, a number of factors have been considered as listed below:

- Traffic patterns in the area are modelled accurately;
- Key junctions in the area are modelled accurately;
- The correct level of traffic is getting through the network and equally the right levels are being suppressed;
- Traffic volumes on side roads and alternative routes are modelled accurately.

Calibration is an iterative process in which the model is continually revised to ensure that the most accurate replications of the base year conditions are represented. This includes:

- Checking the coding of network elements;
- Refining and adjustments of the trip matrices.

Calibration Checks

The following calibration checks were undertaken for each model period using the previously identified elements of the survey database.

Checking the Coding of the Network

The addition of O - D matrix flows into the base models allows a visual check of the model to be undertaken. This allows the construction of the network to be checked, as well as highlighting any program error files that may require addressing. The checked network elements include priority rules, speed decisions marker locations and lengths, and alignments of the roads to ensure that they replicated on-street conditions. Any identified errors were subsequently corrected.

In addition, modelled queue lengths were compared against surveyed queues.

Checking O-D Matrix Flows

To demonstrate that the correct flows enter the model, comparisons were made between the O - D matrix and VISSIM model entry flows. To test the robustness of the models, results were extracted for 10 different seeds and corresponding average values were used Table 10 *TO* Table 11 indicate the results of the entry flow comparisons for the AM and PM peak periods.

Table 10: Entry Flow Calibration – Total Vehicles – AM Peak

Entry Zone		0745-0845		Difference		
Zone	**Location**	**Matrix**	**Modelled**	**Absolute**	**%**	**<5%?**
1	A508 South	986	991	5	1%	Y
2	M1 South East	3639	3638	-1	0%	Y
3	Saxon Avenue North East	662	664	2	0%	Y
4	A45 North	2527	2527	0	0%	Y
5	A43 South	1285	1272	-13	-1%	Y
6	A5123 North	1701	1679	-21	-1%	Y
7	EB Services Area Exit	33	34	1	3%	Y
9	WB Services Area Exit	17	17	0	0%	Y
11	Swan Valley Way NW	127	123	-4	-3%	Y
12	M1 North West	4475	4467	-8	0%	Y

Table 11: Entry Flow Calibration – Total Vehicles – PM Peak

Entry Zone		0745-0845		Difference		
Zone	**Location**	**Matrix**	**Modelled**	**Absolute**	**%**	**<5%?**
1	A508 South	886	892	6	1%	Y
2	M1 South East	4530	4529	-1	0%	Y
3	Saxon Avenue North East	726	727	1	0%	Y
4	A45 North	2286	2287	1	0%	Y
5	A43 South	1668	1643	-25	-1%	Y
6	A5123 North	1036	1024	-12	-1%	Y
7	EB Services Area Exit	30	29	-1	3%	Y
9	WB Services Area Exit	24	24	0	0%	Y
11	Swan Valley Way NW	158	151	-7	-3%	Y
12	M1 North West	4162	4160	-2	0%	Y

These results show that high levels of calibration have been achieved for both peak periods. This indicates that the model has an acceptable amount of traffic entering the model from the correct zone locations.

A difference of less than 5% has been achieved for all entry zones during both AM and PM peak periods. Thus the entry flow calibration is considered acceptable.

Model Validation

08

Model Validation Criteria

DMRB standards have been used to assess the validation of the M1 J15 and 15A VISSIM model.

Following on from the model calibration, the VISSIM model was taken forward for model validation. This process involves comparing model outputs against independent data to ensure that the model is correctly calibrated.

As stated in the Model Calibration section of this report, in order to determine the validation levels, the models were multi-run in order to produce a set of journey time results. Network validation has been carried out in accordance with DMRB Volume 12, Section 2, Part 1, Chapter 4. Current advice on micro-simulation modelling is also contained in HE's Interim Advice Note 36-01 'The Use and Application of Micro-Simulation Models'. A summary of the acceptable criteria is shown in Table 12

In order to demonstrate that the developed models provide a rigorous platform for future testing, they were validated against average Journey Times and exit flows.

Table 12: Summary of Assignment Validation: Acceptability Guidelines

Criteria and Measures	Acceptability Guideline
Assigned Hourly Flows* compared with observed flows. 1. Individual flows within 15% for flows 700-2700 vph 2. Individual flows within 100 vph for flows < 700 vph 3. Individual flows within 400 vph for flows < 2700 vph 4. Total screenline flows (normally >5 links) to be within 5% 5. GEH Statistic i. Individual flows: GEH < 5 ii. Screenline** totals: GEH < 4 Notes: * link flows or turning movements **Screenlines containing high flow routes such as motorways should be presented both including and excluding such routes.	All (or nearly all) screenlines Greater than 85% of all cases
Modelled journey times compared with observed times 6. Times within 15% (or 1 minute if higher)	> 85% of routes

DMRB Volume 12, Section 2 Part 1 Chapter 4

Average Journey Time Validation

95% and 85% of the selected routes for validation purposes fulfil DMRB Journey Time criteria for both AM and PM peak periods.

As explained in Traffic Surveys, journey time estimations were undertaken using ANPR data for all routes within the modelled area to assist with the validation of the VISSIM model. Traffic Master Data was also used to obtain journey times for the whole network. The level of accuracy of the Traffic Master data is shown in the table below Table 13.

Table 13: Accuracy of Traffic Master Data

Data	*AM*	*PM*
No. of links within 10% accuracy	*110*	*101*
No. of links greater than 10% accuracy	*8*	*17*

DMRB (Volume 13, Section 1, Part 5, Chapter 11) recommends aiming for an accuracy of ±10% in the estimation of journey time on the exiting route, at the 95% confidence level. This level of accuracy, A, is defined as:

$$A = t\frac{s}{m\sqrt{n}}$$

Where m, s and n are the mean, the standard deviation and number of measurements of the journey time sample and the value of t depends on the number of degrees of freedom and the confidence level according to the Student's t-distribution.

The journey times routes used in the validation were identified by choosing routes that covered the modelled network to ensure network validation. In total, 20 routes were identified. Furthermore Traffic Master Data was used to confirm there was a sufficient source of data for the selected routes.

The observed average journey times for these 20 routes have been compared to the modelled average journey times in accordance with the criteria outlined in Table 12.

Table 14 – Table 15 present the observed journey time results. A further detailed breakdown of the journey time validation can be seen in Table 16 – Table 17 and **Appendix F.**

The validation criteria used is highlighted in the model validation summary tables below. The initial step was to check that the average journey times from the model were within 15% of those observed. Following that, a check of the modelled journey times being within 60 seconds of those observed was undertaken.

Table 14: Summary of Journey Time Validation – AM Peak

DMRB Journey Time Validation Criteria	No. Within	Total	Percentage
Percentage of Times within 15%	19	20	95%
Percentage of Times within 60 seconds	20	20	100%
Percentage of journey times sections within min/ Max modelled range	20	20	100%

Table 15: Summary of Journey Time Validation – PM Peak

DMRB Journey Time Validation Criteria	No. Within	Total	Percentage
Percentage of Times within 15%	17	20	85%
Percentage of Times within 60 seconds	17	20	85%
Percentage of journey times sections within min/ Max modelled range	20	20	100%

Table 16: Journey Time Validation – AM Peak

From	To	0715 – 0815			Difference		
		Observed	Modelled	%	Validated	Abs.	Validated
A508 Northampton Rd South	M1 Mainline South	219	220	0%	Y	1	Y
	A45 London Road North	165	168	2%	Y	3	Y
	A43 South	349	398	14%	Y	49	Y
M1 Mainline South	A45 London Road North	189	201	6%	N	12	Y
	A43 South	320	363	14%	Y	43	Y
	A5123 North	318	356	12%	Y	38	Y
	M1 Mainline North	271	305	13%	Y	34	Y
A45 London Road North	A508 Northampton Road South	145	111	-24%	N	-34	Y
	M1 Mainline North	353	330	-7%	Y	-23	Y
A43 South	A508 Northampton Road South	385	390	1%	Y	5	Y
	M1 Mainline South	367	364	-1%	Y	-3	Y
	A5123 North	121	122	1%	Y	1	Y
	M1 Mainline North	146	159	9%	Y	13	Y
A5123 North	A43 South	143	137	-4%	Y	-6	Y
EB Service Area	M1 Mainline South	255	254	0%	Y	0	Y
Swan Valley Way North	M1 Mainline South	274	269	-2%	Y	-4	Y
	A43 South	135	129	-4%	Y	-6	Y
M1 Mainline North	M1 Mainline South	362	360	-1%	Y	-2	Y
	A45 London Road North	374	352	-6%	Y	-21	Y
	A43 South	258	260	1%	Y	3	Y

Table 17: Journey Time Validation – PM Peak

From	To	1645 – 1745			Difference		
		Observed	Modelled	%	Validated	Abs.	Validated
A508 Northampton Rd South	M1 Mainline South	287	215	-25%	N	-72	N
	A45 London Road North	247	181	-27%	N	-66	N
	A43 South	463	415	-10%	Y	-48	Y
M1 Mainline South	A45 London Road North	269	196	-27%	N	-74	Y
	A43 South	373	367	-2%	Y	-6	Y
	A5123 North	373	364	-3%	Y	-10	Y
	M1 Mainline North	323	309	-4%	Y	-14	Y
A45 London Road North	A508 Northampton Road South	114	102	-11%	Y	-12	Y
	M1 Mainline North	362	336	-7%	Y	-26	Y
A43 South	A508 Northampton Road South	389	381	-2%	Y	-8	Y
	M1 Mainline South	351	358	2%	Y	7	Y
	A5123 North	122	124	1%	Y	1	Y
	M1 Mainline North	163	163	0%	Y	0	Y
A5123 North	A43 South	122	123	1%	Y	1	Y
EB Service Area	M1 Mainline South	237	247	4%	Y	11	Y
Swan Valley Way North	M1 Mainline South	256	261	2%	Y	5	Y
	A43 South	151	154	2%	Y	3	Y
M1 Mainline North	M1 Mainline South	335	349	4%	Y	13	Y
	A45 London Road North	358	348	-3%	Y	-9	Y
	A43 South	267	284	6%	Y	17	Y

In summary, the model has been validated at 95% and 85% for average journey times, which are within a 15% difference of the observed.

As can be seen in Table 16 ***AND*** Table 17 A508 Northampton Rd South to M1 Mainline South and A45 London Road North validated in the AM Peak but not in the PM Peak. This may be due to the influence of the MOVA controlled signals at this location.

Exit Flow Vehicle Validation

100% of the exit flows have been achieved to be within a GEH Statistic of 5 for both the AM and PM peak periods.

In order to further prove the validation of the VISSIM model, vehicle exit flows were analysed. These have been used to demonstrate that the correct flows are leaving the model within the peak period and that the correct level of traffic is also reaching and using the junctions within the peak periods.

As identified above*, DMRB (Volume 12, Section 2, Part 1, Chapter 4)* recommends an individual flow GEH statistic of less than 5 is achieved.

The standard method used to compare modelled values against observations on a link therefore involves the calculation of the Geoff Havers (GEH) statistic, which is a form of the Chi-squared statistic, incorporating both the relative and the absolute errors. The GEH statistic is defined as

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

Where C and M are observed and modelled flows respectively.

The GEH statistic for the modelled exit flows at each junction was calculated in accordance with the above criteria. The results are summarised below and full results can be found in tables 18 and 19.

Table 18: Journey Time Validation – PM Peak

DMRB Link Flows (Exit Flows) Criteria	% Within
Percentage of flows within a statistic of 5 GEH	100
Percentage of flows satisfying individual flows criteria	100

Table 19: Summary of Entry Flow Validation – AM Peak

				Difference		GEH		DMRB
Zone	**Location**	**Observed**	**Modelled**	**Value**	**Percentage**	**Value**	**<5?**	**Individual Flows**
1	A508 Northampton Road	1203	1142	-62	-5%	1.8	Y	OK
2	M1 South-East	4639	4516	-123	-3%	1.8	Y	OK
3	Saxon Avenue	243	222	-21	-9%	1.4	Y	OK
4	A45 London Road	2856	2696	-160	-6%	3.0	Y	OK
5	A43 South	1748	1742	-6	0%	0.2	Y	OK
6	A5123 North	712	691	-21	-3%	0.8	Y	OK
8	Services	51	50	-1	-2%	0.2	Y	OK
10	Services	155	152	-3	-2%	0.3	Y	OK
11	Swan Valley Way	141	134	-8	-5%	0.6	Y	OK
12	M1 North-West	3675	3611	-64	-2%	1.1	Y	OK
Level of Validation Achieved							100%	100%

Table 20: Summary of Entry Flow Validation – PM Peak

				Difference		GEH		DMRB
Zone	**Location**	**Observed**	**Modelled**	**Value**	**Percentage**	**Value**	**<5?**	**Individual Flows**
1	A508 Northampton Road	845	853	8	1%	0.3	Y	OK
2	M1 South-East	4049	4020	-29	-1%	0.5	Y	OK
3	Saxon Avenue	373	375	2	1%	0.1	Y	OK
4	A45 London Road	2956	2959	3	0%	0.1	Y	OK
5	A43 South	1427	1411	-16	-1%	0.4	Y	OK
6	A5123 North	1048	1029	-19	-2%	0.6	Y	OK
8	Services	32	32	0	-1%	0.1	Y	OK
10	Services	162	158	-4	-2%	0.3	Y	OK
11	Swan Valley Way	97	95	-2	-2%	0.2	Y	OK
12	M1 North-West	4489	4508	19	0%	0.3	Y	OK
Level of Validation Achieved							100%	100%

Summary & Conclusions

09

Traffic Model Calibration and Validation

The M1 J15 and 15A VISSIM model has been validated successfully.

A 2016 base VISSIM model of the M1 Junction 15 and 15A has been produced to allow the testing of future scenarios. AM and PM peak scenarios have been created.

Traffic data was collected on Wednesday 10th March 2016 to gather information about the traffic conditions at the site. The VISSIM model has been constructed, calibrated and validated successfully with a summary of the results detailed in the following sections below.

Convergence

The VISSIM model was successfully converged for the AM and PM peak periods, meeting the requirements of the DMRB and TfL's Convergence criteria, demonstrating a high level of stability.

Traffic Flow Calibration

The VISSIM model was successfully calibrated for the AM and PM peak periods. There are minor differences in the number of vehicles between the modelled averages and the matrices. These differences are however negligible and therefore the calibration levels were deemed acceptable.

Journey Time Validation

The VISSIM model in the AM peak has met the required 85% DMRB criteria, with 95% of the routes being within 15% of the observed journey times and 100% of the routes being within 60 seconds. The VISSIM model in the PM peak met the required 85% DMRB criteria, with 85% of the routes being within 15% of the observed journey times and 85% being within 60 seconds. As a result, both models are considered to represent network conditions appropriately.

Exit Flow Validation

The VISSIM model has met the DMRB requirement of validating for flows in less than a 5 GEH statistic value for all zone exits in both the AM and PM peak periods. The DMRB requirement as identified in table 12 for individual flows has also been met for both peak periods and therefore the model has satisfied the DMRB criteria for link flows appropriately.

Overall Conclusion

The 2016 M1 J15 and 15A base VISSIM model is considered a suitable tool for future year testing.

Overall, the 2016 M1 J15 and 15a base VISSIM model is considered to be an appropriate representation of the network conditions, since good levels of validation have been reached in accordance with DMRB requirements. The base model has been able to achieve validation against Journey Time data and is considered an acceptable tool for undertaking future year testing and option testing.

Appendices

Appendix A – *160229-60343293-EM1-TSS-001* – Traffic Survey Specification

Traffic Survey Specification – M1 J15 and M1 J15a

Project:	**60343293 - Highways England Spatial Planning Arrangement**	HE Ref:	**EM1 15/16**
Subject:	**M1 J15 and M1 J15a Traffic Surveys**	Date:	**29th February 2016**
Doc No:	**160229 60343293 EM1 TSS 001**	Task:	**EM1**
Rev No:	**-**		

1. Introduction

This specification outlines AECOM's requirements for the collection, and subsequent analysis of the following survey data:

1) Video Surveys to provide Fully Classified Turning Counts;
2) Automatic Number Plate Recognition (ANPR) surveys; and
3) Queue Surveys.

Tenderers should read this specification and the attached Sub-Consultancy Agreement in full to ensure that they are able to fulfil all requirements within the required timescales. Failure to fulfil all the requirements within the stated timescales and/or failure to meet the specification in any respect will be considered a breach of this agreement and may result in either termination of this agreement and/or a partial or total non-payment of fees due.

2. Quotes

You are invited to provide a quote for undertaking the work described in this survey specification. The work will need to be undertaken in accordance with AECOM's Sub Consultancy Agreement which is attached for your reference. All quoted prices shall:

- Include for complying with the sub-consultancy agreement and insurance requirements contained therein;
- Include for compliance with the terms and conditions as set out in the Highways England Spatial Planning Arrangement contract (attached);
- Be inclusive of all costs incurred by the survey company in order to satisfy the survey requirements detailed in this traffic survey specification and for any materials and work which may not be expressly specified but which are implied and necessary for the satisfactory completion of the work; and
- Be exclusive of VAT.

The contact for any queries to this tender is **Darren Abberley** (Tel: 0121 262 1954; email: darren.abberley@aecom.com).

All quotes should be submitted by **1700hrs on Friday 19th February 2016**. Quotes received after this time may not be considered. AECOM will contact all companies to indicate whether they have been successful by **1700hrs on Tuesday 23rd February 2016.**

Please note that all camera locations and fields of view must be confirmed with AECOM on-site prior to the start of the survey. Therefore an on-site meeting will be necessary. **It is expected that this meeting**

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would be held on the day prior to the survey taking place, therefore meaning that the equipment should be installed in advance of this meeting take place.

If, on receipt of this specification, you wish to quote for this work please contact AECOM by responding to the email which you have received, to confirm that you are able to respond within the specified timescales.

3. Surveys

3.1 Location and Date

The junctions for the collection of the survey data include;

- M1 Junction 15; and
- M1 Junction 15a.

The locations of these sites are shown in **Figure 1** and **Figure 2.**

Survey dates shall be confirmed with AECOM prior to the survey being undertaken. It is expected that all surveys shall be undertaken on **Thursday 10th March 2016**. All data shall be collected outside local school holidays when the operations of the network are typical.

3.2 Survey Requirements

Tenderers shall set out their survey methodology in their tender response. The methodology should include a marked up plan indicating the anticipated locations of equipment.

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3.2.1 Fully Classified Turning Count Video Surveys

AECOM encourages the survey company to consider the most appropriate methodology for obtaining reliable turning count data. However the following requirements are expected to be adhered to:

- All turning counts are to be carried out on Thursday 10th March 2016 (or other neutral day, as agreed at AECOM's discretion);
- The survey period is 0600 – 1900hrs;
- Turning counts are required for all arms at the two sites indicated in **Figure 1** and **Figure 2**;
- Each camera is to be positioned in such a way as to provide a clear field of view of the junction, the traffic stopline and where applicable, the traffic signals (this would preferably mean that the camera is positioned approximately 30m back from the stopline, looking towards the junction and at a reasonable height); and
- All cameras used for this survey shall be digital and synchronised to GMT.

If any of the above cannot be achieved, please liaise with AECOM in advance of providing a quote.

3.2.1.1 Analysis and Outputs

The video data shall be analysed using the vehicle classifications shown in **Table 1** in accordance with DMRB vehicle class standards (DMRB 13.1.4).

Class	Car / Taxi	LGV	OGV1	OGV2 / HGV	Bus	Motorcycle	Cycle

Table 1: Vehicle Classifications

No interpolation or extrapolation of data, nor infilling of results shall be included in the turning count without the prior approval of AECOM.

The video data analysis shall be of the entire survey period (0600-1900hrs) and shall populate an Excel spreadsheet in 15 minute intervals.

3.2.2 Automatic Number Plate Recognition (ANPR) for Origin – Destination (O-D) data

AECOM encourages the survey company to consider the most appropriate methodology for obtaining reliable Origin – Destination data. However the following requirements are expected to be adhered to:

- All ANPR data is to be collected on Thursday 10th March 2016 (or other neutral day, as agreed at AECOM's discretion);
- The survey period is broken down into the two peak periods; 0600-0930 in the AM and 1530-1900 in the PM;
- The Origin – Destination cordon is indicated in **Figure 1**; and
- All cameras used for this survey shall be synchronised to GMT.

If any of the above cannot be achieved, please liaise with AECOM in advance of providing a quote.

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The data capture should record the vehicle registration number and the vehicle classification, the time and a site number where the vehicle crossed the entry cordon and (for matched registrations) the time and a site number where the vehicle crossed the exit cordon.

3.2.2.1 Analysis and Outputs

The data obtained from the analysis of the ANPR surveys shall be processed to provide O-D matrices. Registration matching techniques shall be used to determine O-Ds between all of the nominated entries and exits.

The analysis shall be of the full AM peak period (0600-0930hrs) and PM peak period (1530-1900hrs) and shall use the vehicle classifications as stated in **Table 2**.

Class	Car / Taxi	LGV	OGV1	OGV2 / HGV	Bus	Motorcycle	Cycle

Table 2: Vehicle Classifications

The capture rate that is likely to be achieved should be stated as part of the quote, with an anticipated minimum of 75% of the vehicles crossing the screen line expected to be recorded to achieve the desired minimum of 50% matching of vehicles in each 15 minute period.

The outputs of the O-D processing shall be as follows:

- The Raw Data capture, as described in 3.2.2
- The Processed Data, including:
    - An O-D matrix derived from matched registrations for each class for each 15 minute period by time of entry; and
    - A summary table of the proportion of matched registrations at each entry screen-line, for each 15 minute period.

Please note that a minimum of 50% matched vehicles is required at the Cordon Entry and Exit points.

Failure to achieve a 50% match may result in non-payment of survey fees, in accordance with the AECOM Sub Consultancy Agreement.

3.2.3 Queue Surveys

AECOM encourages the survey company to consider the most appropriate methodology for obtaining reliable Queue Survey data.

- All ANPR data is to be collected on Thursday 10th March 2016 (or other neutral day, as agreed at AECOM's discretion);
- The survey period is broken down into the two peak periods; 0600-0930 in the AM and 1530-1900 in the PM;
- The sites are indicated in **Figure 1** and **Figure 2**;

3.2.3.1 Analysis and Outputs

The data analysis shall populate an Excel spreadsheet per priority controlled approach such that the following data is available:

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- Queue counts by lane recorded at intervals of five minutes;
- Maximum queue observed by lane recorded in PCU equivalents at intervals of five minutes;
- Hourly maximum and average queue lengths in PCU equivalents; and
- Full survey period maximum and average queue lengths in PCU equivalents.

A workbook shall be provided for the survey and each spreadsheet shall clearly identify the survey date and time and contain a diagram clearly identifying the survey location, and queues recorded.

If any of the above cannot be achieved, please liaise with AECOM in advance of providing a quote.

4. Deliverables

All deliverables shall be provided to AECOM by 5pm on **Friday 8th April 2016**. AECOM will review the deliverables on receipt. Any errors or omissions identified shall be resolved to AECOM's satisfaction and failure to resolve errors or emissions will result in non-payment of survey fees, in accordance with the AECOM sub consultancy agreement.

The following shall be supplied to AECOM following analysis of the survey data.

Format of data to be delivered

All data shall be provided as follows:

- Soft copy data shall be in the originating format (.doc /.xls/etc.) and each file shall be for an individual site (for turning counts and queue surveys). The documents shall clearly identify the survey date, time and weather and contain a diagram clearly identifying the survey location and data recorded. The documents also must be provided in an 'unprotected' state and with unrestricted access;
- All video data collected in the undertaking of the surveys shall be provided on an External Hard Drive and provided with relevant site numbers.

Site Report

A few paragraphs shall be provided that give a record of the surveys undertaken with a commentary on prevailing site conditions and any additional information or situations arising during the survey that may, in the opinion of the surveyor, have affected the accuracy or reliability of the survey data.

Output Data

Output data should be provided to AECOM as specified in sections 3.2.1.1, 3.2.2.1 and 3.2.3.1.

5. Health and Safety

Upon appointment and to ensure that safe working practices are being followed, the winning contractor would be expected to submit the following to AECOM:

- A risk assessment identifying and assessing the risks associated with carrying out the surveys and setting out appropriate mitigation; and

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- Written confirmation that all equipment can be installed/removed at each location in 15 minutes or less and that a safety zone of at least 1.2m can be maintained at all times between the live carriageway and personnel installing the equipment. If this cannot be achieved, please liaise with AECOM in advance of providing a quote.

The winning contractor would also be expected to contact and gain approval from the local Highway Authority to work on their network before commencement of the survey works.

Contractors shall obtain authorisation for the method of working and written confirmation for any equipment installed in the carriageway. Failure to abide by these Health and Safety requirements will be considered a serious breach of contract and may result in termination of the contract without payment.

Prepared by: [redacted]
Emma Luckman
Trainee Technician

Checked by: [redacted]
Darren Abberley
Consultant

Approved by: [redacted]
Graham Fry
Associate Director

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FIGURE 1

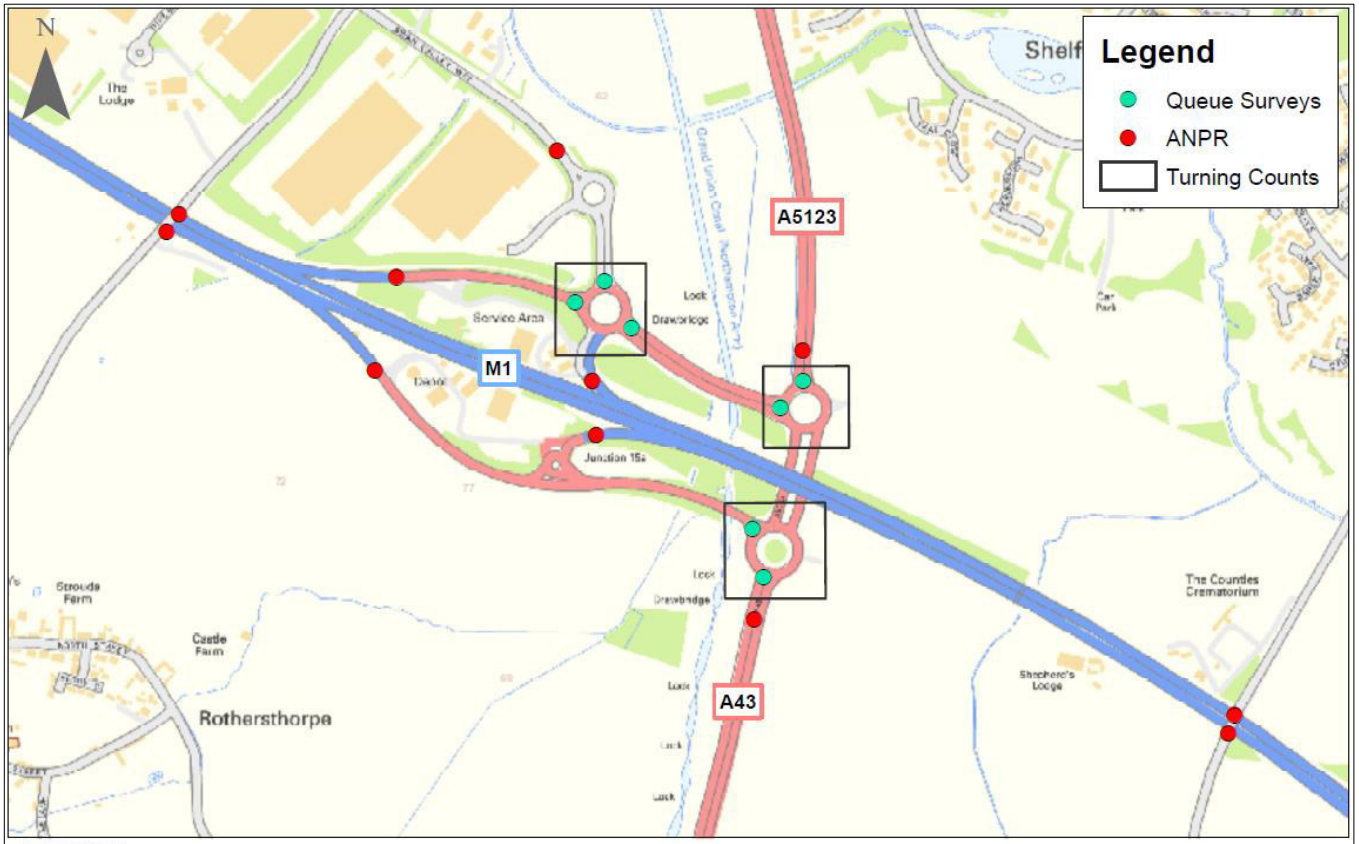

Figure 1
Survey Specification - Location of Data Colllection Points - Queue Survey Locations, ANPR Locations & Turning Counts - Site 1 Junction 15A M1/A5123/A43

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FIGURE 2

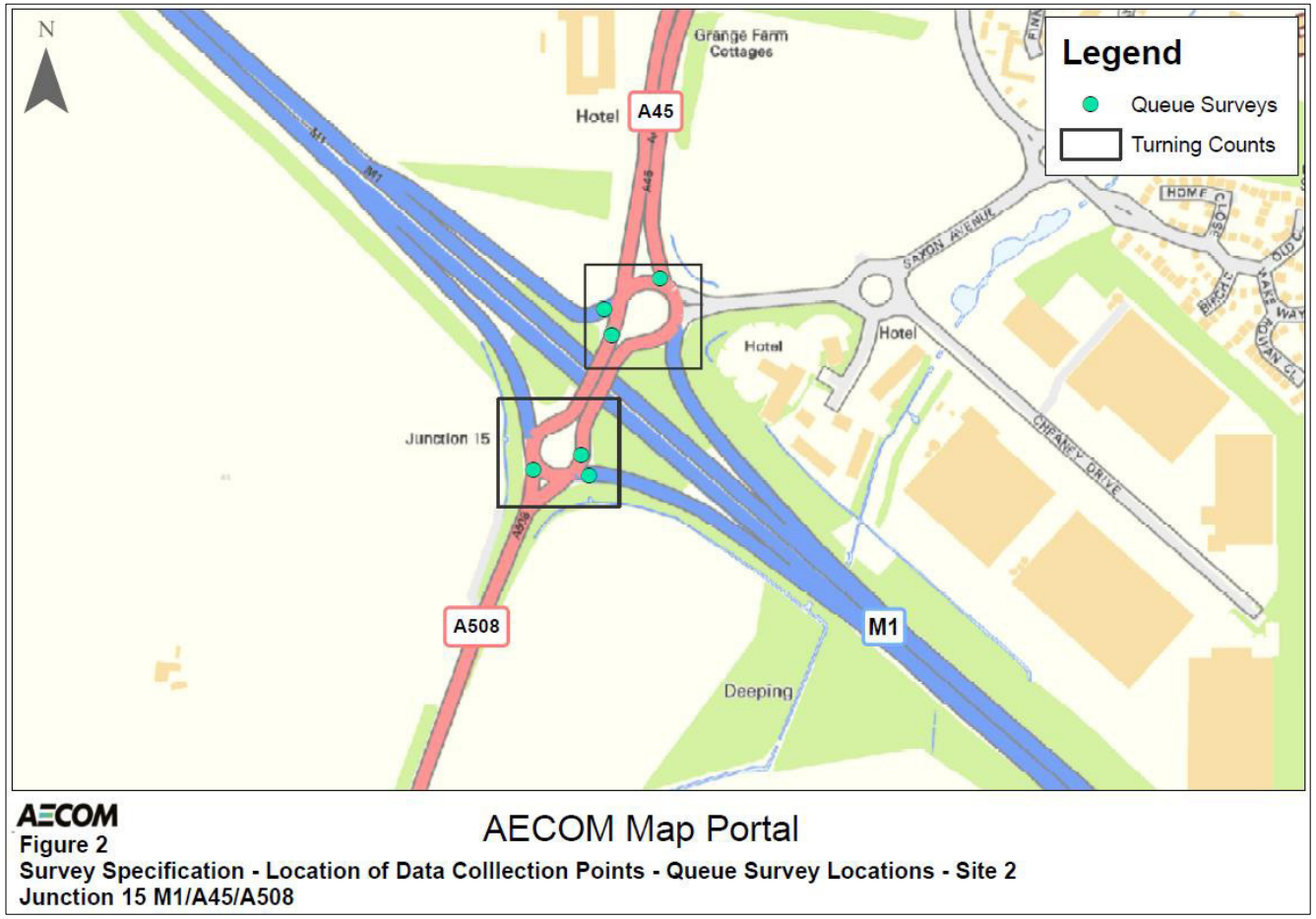

Figure 2
Survey Specification - Location of Data Colllection Points - Queue Survey Locations - Site 2
Junction 15 M1/A45/A508

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THIS AGREEMENT is made the 29 day of February 2016

BETWEEN **1. AECOM LTD**
Colmore Plaza
Colmore Circus Queensway
Birmingham
B4 6AT

("AECOM")

And

2. Intelligent Data Collection
Unit 1, Cordwallis House,
Cordwallis Street,
Maidenhead,
Berkshire
SL6 7BE

("Sub-Consultant")

Together referred to as the "parties"

BACKGROUND

A. AECOM has entered into or intends to enter into a consultancy agreement with its client(s) to carry out various consultancy services.

B. AECOM wishes to appoint the Sub-Consultant to carry out the sub-consultancy services under the terms and conditions in this Agreement.

IT IS HEREBY AGREED that:-

1.0 **Definitions** In this Agreement, the following definitions shall apply:-

'Client'	means the entity with whom AECOM has entered into or intends to enter into the Main Contract.
"Confidential Information"	means collectively and individually all or any information of whatsoever nature, disclosed in any form, whether oral, visual, written or in electronic form (including, without limitation, any documentation, reports, drawings, calculations, processes, methodologies, models, manuals and software) together with all records or copies or extracts thereof which is received by the Sub-Consultant under or pursuant to this Agreement.
'Fee'	means the amount in Schedule B payable for the performance of the Sub-Consultancy Services plus any additional fees agreed arising from an Authorised Variation.
'Main Contract'	means the contract between AECOM and the Client attached in Schedule E.
'Materials'	means drawings, reports, models, specifications, bills of quantities, calculations and such other documents and information prepared by or on behalf of the Sub-Consultant pursuant to this Agreement.

'Official'	any official or employee of any government, state-owned enterprise, international organization or any subdivisions, agents or advisors thereto, whether paid or unpaid.
'Sub-Consultancy Services'	means the services to be provided by the Sub-Consultant under this Agreement, as described in Schedule A, including an Authorised Variation (if any).
'Authorised Variation'	means the additional, omitted or modified services to be provided by the Sub-Consultant as may be instructed in writing by AECOM from time to time.
	'Statutory Requirements' means all requirements of all Acts of Parliament, statutory instruments, court orders, regulations, directives, European Community decisions (insofar as legally binding), bye-laws, treaties, regulatory requirements and codes of practice relevant to the Sub-Consultant's business from time to time in force which are or may become applicable to the Sub-Consultancy Services.

2.0 General Obligations

In performing the Sub-Consultancy Services, the Sub-Consultant shall:-

(a) exercise the standard of reasonable skill, care and diligence of an appropriately qualified consultant in the discipline relating to the Sub-Consultancy Services in connection with a project of a size, scope and complexity similar to that of the project/works described in the Main Contract and/or to which the Sub-Consultancy Services otherwise relates;

(b) comply with all Statutory Requirements;

(c) perform the Sub-Consultancy Services to the reasonable satisfaction of AECOM;

(d) perform the Sub-Consultancy Services so that no act, omission or default by the Sub-Consultant in relation thereto shall constitute, cause or contribute to any breach by AECOM of any of its obligations under the Main Contract, a copy of which the Sub-Consultant acknowledges it has received (excluding fee information);

(e) immediately notify AECOM of any commercial interests of the Sub-Consultant which are likely to conflict with the Sub-Consultancy Services or the obligations of the Sub-Consultant under this Agreement; and

(f) supply AECOM with suitable and sufficient information regarding the management by the Sub-Consultant of any environmental, health and safety risks arising from the Sub-Consultancy Services prior to their commencement.

3.0 Instructions, Directions and Staffing

3.1 The Sub-Consultant shall only take instructions and directions in relation to the Sub-Consultancy Services and/or this Agreement from AECOM. The Sub-Consultant shall only commence the Sub-Consultancy Services upon the written instruction of AECOM.

3.2 The Sub-Consultant shall not comply with any instructions or directions which are directly received by it from the Client. If the Sub-Consultant receives any such instructions or directions, it shall immediately inform AECOM and supply AECOM with a copy of them.

3.3 AECOM may instruct the Sub-Consultant in writing to undertake an Authorised Variation by way of addition, omission or modification to the Sub-Consultancy Services. Under no circumstances shall the Sub-Consultant make any addition, omission or modification to the Sub-Consultancy Services without an Authorised Variation from AECOM.

3.4 The Sub-Consultant may not replace any staff performing the Sub-Consultancy Services without the prior and written consent of AECOM (not to be unreasonably withheld). The Sub-Consultant shall replace any member of staff where, in the reasonable opinion of AECOM, they are not performing the Sub-Consultancy Services in accordance with this Agreement. Any replacement staff shall be procured at the sole cost of the Sub-Consultant and shall be of equivalent competence and experience.

3.5 Neither party intends there to be any mutuality of obligation between one another during this Agreement or in the event of its termination (for whatever reason). AECOM is under no obligation to offer future work to the Sub-Consultant nor is the Sub-Consultant obliged to accept such an offer.

4.0 Programme of Work

4.1 The Sub-Consultant shall complete the Sub-Consultancy Services or any section thereof within the period specified in Schedule C or within any extended time granted by AECOM. Where there is no such programme the Sub-Consultant shall complete the Sub-Consultancy Services as may be reasonably directed by AECOM.

5.0 Terms of Payment

5.1 AECOM shall pay to the Sub-Consultant the Fee as full remuneration for the performance of the Sub-Consultancy Services and the Fee shall be deemed to be inclusive payment of all costs, expenses and overheads of every kind incurred in the performance of the Sub-Consultancy Services, except those described in Schedule B (if any).

5.2 The value of any Authorised Variation shall be determined by AECOM after consultation with the Sub-Consultant. The value shall be either an agreed lump sum fee or ascertained by reference to the hourly rates specified in Schedule B for similar work. If a lump sum fee cannot be agreed and if such hourly rates are considered by AECOM to be inapplicable, the value shall be determined by AECOM such as is fair and reasonable in all the circumstances.

5.3 At the time of invoicing the Sub-Consultant shall submit to AECOM a written statement of amounts due and calculated in accordance with Schedule B. Invoices must set out the period to which the invoice relates, the amount of the instalment due and the basis of its calculation. All invoices must be accompanied by such supporting documentation as AECOM may reasonably require.

5.4.1 In the event that the Housing Grants Construction and Regeneration Act 1996 ("HGCRA"), incorporating amendments in the Local Democracy, Economic Development and Construction Act 2009 ("LDEDCA") applies to this Agreement:-

(a) The Sub-Consultant is required to give notice of payment to AECOM, specifying the amount that the Sub-Consultant considers to be due and the basis on which the sum is calculated.
The due date for payment is the date of receipt by AECOM of the Sub-Consultant's invoice, which, for the purpose of this Agreement, is the payment notice.

(b) The final date for payment is 30 days after the due date.

(c) If AECOM wishes to pay less than the sum stated in the invoice, it shall issue a pay less notice no later than 7 days before the final date for payment, stating the sum due and how it is calculated.

(d) In the event that payment is not made by the final date and no pay less notice is given by AECOM, the notice required for the suspension of performance of Sub-Consultancy Services is 21 days.

(e) AECOM shall be relieved of all obligations to make any further payments under this Agreement to the Sub-Consultant if the Client is insolvent within the meaning of Section 113 (2), (3), (4) or (5) of the HGCRA.

5.4.2 In the event that the HGCRA does not apply to this Agreement, payment shall be made by AECOM within 14 days receipt of the corresponding payment from the Client under the Main Contract in respect of the Sub-Consultancy Services and clause 5.4.1 shall not be applicable.

5.5 Any sums remaining unpaid after the final date for payment under clause 5.4.1 or 5.4.2 (as applicable) shall accrue simple interest thereafter, such interest to accrue daily at the rate of 2% above the Bank of England Base Rate. The interest shall be calculated from the final date for payment until the day on which payment is actually made. The parties agree that this clause shall constitute a 'substantial remedy' under the Late Payment of Commercial Debts (Interest) Act 1998.

6 Taxation

6.1 Nothing in this Agreement will render the Sub-Consultant an employee, agent or partner of the AECOM by virtue of the provision of the Sub-Consultancy Services and the Sub-Consultant shall be responsible for making appropriate deductions for tax and national insurance contributions from the remuneration paid to the Sub-Consultant's personnel and for the payment of all other taxes including (without limitation) corporation, income tax and VAT.

6.2 The Sub-Consultant shall provide AECOM with any evidence reasonably required by AECOM to demonstrate the compliance of the Sub-Consultant with this clause 6.

7.0 Insurance and Liability

7.1 Without prejudice to its obligations under this Agreement or otherwise at law, the Sub-Consultant shall obtain and maintain, for so long as may be necessary to cover his obligations and liabilities in connection with this Agreement, Employers Liability, Professional Indemnity and Public Liability insurance in the sums stated in Schedule D or the sums stated in the Main Contract (whichever is the higher) with insurers of good repute, provided always that such insurance is available at commercially reasonable rates. In the event that such insurance ceases to be available, the Sub-Consultant shall immediately notify AECOM and the parties shall use all reasonable endeavours to agree alternative arrangements to protect their respective positions.

7.2 The Sub-Consultant shall produce for inspection documentary evidence that the insurances required under Clause 7.1 are being properly maintained whenever requested by AECOM.

7.3 Should the Sub-Consultant be in breach of his obligations under Clauses 7.1 or 7.2, AECOM may insure against any risk in respect of which the breach may occur and deduct a sum equivalent to the amount paid or payable in respect of premiums from any monies due or to become due to the Sub-Consultant under this Agreement or recover them from the Sub-Consultant as a debt.

7.4 The Sub-Consultant shall indemnify AECOM against all claims, demands, proceedings, damages, costs, and expenses sustained, incurred or payable by AECOM arising by or because of (a) any negligence, omission or default by the Sub-Consultant in the performance of its obligations under this Agreement and/or (b) any breach of this Agreement.

8.0 Termination

8.1 AECOM may by notice terminate this Agreement immediately for any of the following reasons:-

(a) for convenience.
(b) where the Sub-Consultant has breached any term of this Agreement which is capable of remedy and failed to remedy such breach within 7 days notice from AECOM.
(c) where the Sub-Consultant has breached any term of this Agreement which is not capable of remedy.
(d) where the Sub-Consultant has a bankruptcy order made against it or makes an arrangement or composition with its creditors, or enters into liquidation (whether voluntary or compulsory) or if any proceedings are commenced relating to its insolvency or possible insolvency.

8.2 In the event of termination under clause 8.1(a) AECOM shall, in accordance with Clause 5, pay to the Sub-Consultant a fair and reasonable proportion of the Fee in respect of the Sub-Consultancy Services which have been performed up until the date of termination.

8.3 In the event of termination under clauses 8.1(b), 8.1(c) or 8.1(d), AECOM shall set off any claim for damages arising out of such breach from any Fees due to the Sub-Consultant.

8.4 Upon any termination of this Agreement, the Sub-Consultant shall take immediate steps to bring to an end the Sub-Consultancy Services in an orderly manner, but with all reasonable speed and

economy. The Sub-Consultant shall also deliver to AECOM within 7 days of any such termination all of the materials prepared or being prepared by the Sub-Consultant or in the Sub-Consultant's possession relating to the Sub-Consultancy Services.

8.5 No termination of the Sub-Consultant's engagement under this Agreement (howsoever arising) shall make AECOM liable for any claim for loss of profit, loss of fees or other similar losses.

8.6 The provisions of this Agreement shall continue to bind each party insofar as and for as long as it may be necessary to give effect to their respective rights and obligations hereunder. Termination shall be without prejudice to the rights and remedies of AECOM which have accrued prior to such termination.

9.0 Intellectual Property Rights and Confidentiality

9.1 If the Main Contract contains provisions in relation to the intellectual property rights of any Materials, the Sub-Consultant shall comply with such provisions mutatis mutandis. If the Main Contract contains no such provisions, the copyright in the Materials shall remain vested in the Sub-Consultant and the Sub-Consultant hereby grants AECOM and the Client a licence to reproduce the Materials for any purpose related to this Agreement and the Main Contract, provided always that the Sub-Consultant shall not be liable for any use of the Materials other than their originally intended purpose.

9.2 If the Main Contract contains provisions in relation to the usage of Confidential Information, the Sub-Consultant shall comply with such provisions mutatis mutandis. If the Main Contract imposes no such provisions, the Sub-Consultant shall not during this Agreement and any time thereafter disclose Confidential Information without the prior written consent of AECOM, provided that this restriction shall not apply to Confidential Information which the Sub-Consultant can demonstrate:-

(a) is in or subsequently enters the public domain for any reason other than a breach of this Agreement by the Sub-Consultant;

(b) was lawfully known by the Sub-Consultant prior to its receipt; or

(c) the Sub-Consultant is required to disclose by reason of a binding order issued by a competent court or regulatory authority (in which case the Sub-Consultant shall immediately notify AECOM upon receipt of such order, unless notification is itself prohibited by law).

9.3 The Sub-Consultant shall not publish articles, photographs or other materials relating to the project to which the Sub-Consultancy Services relates without the prior approval of AECOM.

10.0 Notices

Any notice under this Agreement shall be in writing and sent to the other party using the address stipulated at the beginning of this Agreement. Notices shall take effect when they have been received by the other party (subject to proof of delivery).

11.0 Assignment and Sub-letting

The Sub-Consultant shall not assign the benefits or liabilities of this Agreement nor sub-let the Sub-Consultancy Services or any part thereof without the prior written consent of AECOM.

12.0 Warranties

The Sub-Consultant shall comply with any provision under the Main Contract which requires the provision of collateral warranties by the Sub-Consultant to third parties.

13.0 Entire Agreement

13.1 Any failure by a party to enforce a term of this Agreement shall not prevent that party from subsequently enforcing it.

13.2 This Agreement, the Main Contract and the attached Schedules represent the entire agreement between the parties and supersedes any other agreements, undertakings or arrangements between them (whether written or oral) concerning any of the subject matter of this Agreement.

14.0 Third Party Rights

No person or entity shall have any rights in relation to this Agreement whether as third parties under the Contracts (Rights of Third Parties) Act 1999 or otherwise save the parties to this

Agreement.

15.0 Improper Conduct

15.1 Neither party to this Agreement shall, whether directly or indirectly, undertake nor cause nor permit to be undertaken any activity which is:

(a) illegal under any applicable laws or regulations, or;

(b) would have the effect of causing AECOM or its subsidiaries or affiliates to be in violation of the United States Foreign Corrupt Practices Act 1977, the United Kingdom Bribery Act 2010 or any other similar legislation in any other jurisdiction in which AECOM carries on business.

15.2 In connection with this Agreement, neither party shall give, offer, promise, or authorize, directly or indirectly, anything of value to:

(a) any person or entity with the intention of inducing them to perform a relevant function or activity improperly or to reward that person or entity for so doing;

(b) any person or entity with the intention of inducing that person or entity to obtain or retain business for AECOM or to retain an advantage in the conduct of business for AECOM;

(c) any Official, including the government(s) of the territories in which Sub-Consultancy Services will be performed hereunder;

(d) any person or entity while knowing or having reason to know that such thing of value is to be given, offered or promised to an Official in order to:

i. influence any official act or decision, or;

ii. induce an Official to use his or her influence to affect a decision of any government or international organization, or;

iii. assist the parties hereto in obtaining or retaining business, or in directing business to any person, or;

iv. to obtain an unfair advantage for the parties in any respect.

15.3 In connection with this Agreement, neither party has requested, agreed to receive or accepted a financial or other advantage with the intention that a relevant function is performed improperly or to reward them for so doing knowing or believing that the request, agreement or acceptance itself constitutes the improper performance of a relevant function or activity.

15.4 In connection with this Agreement, neither party shall make a contribution to any political party or candidate for office on behalf of or associated with the parties or in connection with the purpose of this Agreement.

15.5 The Sub-Consultant shall not retain or engage a third party to carry out sales or marketing obligations in connection with the scope of this Agreement without obtaining AECOM's prior written consent. AECOM reserves the right in its sole discretion to reject a request to engage or retain any such third party.

15.6 The Sub-Consultant hereby covenants that no officer, director, owners, principal shareholder, family members thereof, agent, representative or employee of the Sub-Consultant is an Official and that the Sub-Consultant shall not employ any Official during the term of this Agreement. The Sub-Consultant further covenants that no Official is deriving any benefit, directly or indirectly, from this Agreement.

15.7 In no case shall AECOM be obligated to take any action or make any payment to the Sub-Consultant that would cause AECOM to suffer a penalty or contravene applicable laws or regulations, including but not limited to the laws of the territories in which work will be performed, those of the United States and those of the United Kingdom.

15.8 If the Sub-Consultant breaches any of the covenants contained in this section, AECOM shall have the right to immediately terminate this Agreement without penalty or further payment of any sums due and owing or claimed by the Sub-Consultant hereunder. In such instance, the Sub-Consultant

shall indemnify AECOM for any penalties, losses and expenses resulting from such breach of the provisions of this clause.

16.0 Dispute Resolution

16.1 Subject always to Clause 16.2, any dispute arising under the Agreement which cannot be resolved amicably between the parties shall be decided by adjudication in accordance with the Construction Industry Council Model Adjudication Procedure current at the date the dispute arises subject to the following revision: The adjudicator shall be appointed by the Construction Industry Council. The adjudication shall be conducted in English and held in London or such other alternative venue as may be agreed mutually between the parties.

16.2 In the event that any dispute between the parties under this Agreement relates to a dispute between AECOM and the Client under the Main Contract, AECOM may elect that such dispute between the parties is resolved jointly with the dispute under the Main Contract and/or using the dispute resolution procedure contained in the Main Contract.

16.3 The performance of the Sub-Consultancy Services shall not stop or be delayed or be interrupted during any such resolution of disputes or differences.

16.4 This Agreement shall be governed by and construed in accordance with English law under the jurisdiction of the English Courts.

EXECUTED and DELIVERED as a DEED by AECOM Limited acting by:

Director

Director/Company Secretary

EXECUTED and DELIVERED as a DEED by Intelligent Data Collection acting by:

Director

Director/Company Secretary

SCHEDULE A- SUB-CONSULTANCY SERVICES

A.1 The Sub-Consultancy Services are:

As detailed in the attached AECOM specification 'M1 J15 and J15a – Traffic Survey Specifications' document, number *'160229-60343293-EM1-TSS-001'*.

*All cameras must be set up at least 1.2m away from the carriageway and installation should take no longer than 15 minutes per camera.

SCHEDULE B- FEE AND PAYMENT

B.1 The Fee shall be exclusive of VAT but inclusive of any other tax whether imposed in or outside of the United Kingdom.

B.2 The Fee for the Sub-Consultancy Services shall be:

-£10,270.00

B.3 The Sub-Consultant shall be entitled to reimbursement of the following expenses which shall be paid without any addition to the actual cost:

-None

B.4 Not applicable.

B.5 AECOM shall be entitled to deduct a percentage 0% from the Fee due to the Sub-Consultant to allow for AECOM's administration and co-ordination.

B.6 AECOM shall retain a percentage of 0% as a retention on each payment due to the Sub-Consultant. The retention money shall be paid to the Sub-Consultant upon the satisfactory completion of the Sub-Consultancy Services and Authorised Variations to the approval of AECOM.

B.7 The satisfactory execution of warranties pursuant to Clause 11 (if applicable) shall be a condition precedent to the payment of any of the Fee.

SCHEDULE C- PROGRAMME

Dates which are of essence to the contract are detailed in the attached AECOM Specification 'M1 J15 and J15a – Traffic Survey Specifications' document, number *''160229-60343293-EM1-TSS-001'*. (see Schedule A).

SCHEDULE D- INSURANCE

Professional Indemnity insurance- minimum of £5,000,000 per claim or per occurrence.

Public Liability insurance- minimum of £5,000,000 per claim or per occurrence.

Employer's Liability insurance- statutory minimum or more.

SCHEDULE E- Main Contract

See attached ‘National Spatial Planning Arrangement 2010 Contract Data’ v1.1 August 2010.

National Spatial Planning Arrangement 2010

Contract Data

August 2010

Contents amendment sheet

Amend. No.	Issue Date	Amendments	Initials	Date
0	June 2010	Issue 1 revision 0		
1	August 2010	Issue 1 revision 1 Clause Z22 deleted and replaced with new Clause Z22	LB	31/08/10

Part one – Data provided by the *Employer*

1 General

- The *conditions of contract* are the core clauses and the clauses for the main Option G, dispute resolution Option W1 and secondary Options X1, X2, X4 X7, X9, , X20,, Y(UK)3 and Z of the NEC3 Professional Services Contract June 2005 (with amendments June 2006).
- The *Employer* is the Secretary of State for Transport of Great Minster House, 76 Marsham Street, London SW1P 4DR, who is represented on this contract by the Highways Agency.
- The *Adjudicator* is the person chosen by the Parties from the list of Adjudicators published by the *Chartered Institute of Arbitrators.*
- The *services* are advice to the Highways Agency on spatial planning issues including proposals affecting motorways and trunk roads nationally
- The Scope is in the document titled "Scope"
- The *language of this contract* is English
- The *law of the contract* is the law of England and Wales, subject to the jurisdiction of the Courts of England and Wales
- The *period for reply* is two weeks
- The *period for retention* is 12 years following Completion or earlier termination.
- The following matters will be included in the Risk Register

  None identified
- The *Adjudicator nominating body* is the *Chartered Institute of Arbitrators*
- The *tribunal* is arbitration
- The *arbitration procedure* is the *Chartered Institute of Arbitrators' Arbitration Rules (2000)*
- The place where arbitration is to be held is to be decided on a case by case basis
- The person or organisation who will choose an arbitrator
  - if the Parties cannot agree a choice or
  - if the arbitration procedure does not state who selects an arbitrator

  is the *President or Vice President of the Chartered Institute of Arbitrators*

2 The Parties' main responsibilities

- The *Consultant* prepares forecasts of the total Time Charge and *expenses* at intervals no longer than 4 weeks.

3 Time

- *The starting date* is 2 weeks after the Contract Date
- The *Consultant* is to submit a first programme for acceptance within 2 weeks of the Contract Date.
- The *Consultant* submits revised programmes at intervals no longer than one month
- The *completion date* for the whole of the *services* is 4 years after the Contract Date

4 Quality

- The quality policy statement and quality plan are provided within 12 weeks of the Contract Date.
- The *defects date* is 13 weeks after Completion of the whole of the *services.*

5 Payment

- The *task schedule* is the document entitled “Task Schedule”
- The *staff rates* are the rates calculated using the method set out in the document entitled “Schedule of Cost Components”
- The assessment interval is 1 month
- The *expenses* stated by the *Employer* are

Item	**amount**
Travel and Subsistence	Payment in accordance with the Highways Agency scale

- The period within which payments are made is thirty days after receipt of the *Consultant’s* invoice
- The *currency of this contract* is the pound sterling (£)

“Applies if the *Employer* notifies the *Consultant* that the total of the Prices be treated as a target price”

- The *Consultant’s share percentages* and the *share ranges* are

share range	*Consultant’s share percentage*
less than 80 %	25%
from 80 % to 100 %	50%
from 100% to 120 %	50 %
greater than 120%	25 %

- The *interest rate* is, unless the provisions of the Late Payment of Commercial Debts (Interest) Act 1998 otherwise require, 3% per annum above the Bank of England base rate in force from time to time.

8 Indemnity, insurance and liability

- The amounts of insurance and the periods for which the *Consultant* maintains insurance are

event	cover	period
failure of the *Consultant* to use the skill and care normally used by professionals providing services similar to the *services*	£5 million in respect of each claim, without limit to the number of claims except for claims arising out of pollution or contamination, where the minimum amount of cover applies in the aggregate in any one period of insurance	from the *starting date* until 6 years following completion of the whole of the *services* or earlier termination
death of or bodily injury to a person (not an employee of the *Consultant*) or loss of or damage to property resulting from an action or failure to take action by the *Consultant*	£10 million or as required by Statute which ever is the higher in respect of each claim, without limit to the number of claims	from the *starting date* until all notified Defects have been corrected or earlier termination
death of or bodily injury to employees of the *Consultant* arising out of and in the course of their employment in connection with this contract	£10 million or as required by Statute which ever is the higher in respect of each claim, without limit to the number of claims	from the *starting date* until all notified Defects have been corrected or earlier termination

- The *Consultant*'s total liability to the *Employer* for all matters arising under or in connection with this contract, other than the excluded matters, is unlimited

Option X1

- The *index* is the Harmonised Indices of Consumer Prices (HICPs) - International comparisons : EU countries :United Kingdom as published in Table 18.6 of the Central Statistical Office publication “Monthly Digest of Statistics”.

Option X2

- The law of the project is the law of England and Wales, subject to the jurisdiction of the Courts of England and Wales

Option X20

- The *incentive schedule* for Key Performance Indicators is in motivating success toolkit
- A report of performance against each Key Performance Indicator is provided at intervals of 1 month.

Option Y(UK)3

term	person or organisation
None	None

Option Z

- The additional conditions of contract are clauses Z1 to Z24

Clause Z1 Corrupt practices

Z1.1 The *Consultant* does not

- offer or give to any person in the service of the *Employer* any gift or consideration of any kind as an inducement or reward in relation to the obtaining or execution of this contract or any other contract with the *Employer* or for showing favour or disfavour to any person in relation to this contract or any other contract with the *Employer*, or
- enter into this contract or any other contract with the *Employer* if, in connection with this contract or any such other contract, commission has been paid or an agreement for the payment of commission has been made by him or on his behalf or to his knowledge.

Z1.2 A failure to comply with this condition is treated as a substantial failure by the *Consultant* to comply with his obligations.

Clause Z2 Euro (€) functionality

Z1.1 The *Consultant* Provides the Services in such a way that the *services*

- would not be prejudiced by the implementation of the Euro,
- comply with all legal requirements applicable to the Euro in the United Kingdom, including, but without limitation, the rules on conversion and rounding set out in the EC Regulation 1103/97;
- are capable of utilising all symbols and codes adopted by the EU Commission in relation to the Euro; and
- are in accordance with the *Employer's* requirements both for Sterling and for the Euro.

Clause Z3 Recovery of sums due from *Consultant*

Z3.1 When under the contract any sum of money is recoverable from or payable by the *Consultant* such sum may be deducted from or reduced by the amount of any sum or sums then due or which at any time after may become due to the *Consultant* under this contract or any other contract with any Department or Office of Her Majesty's Government.

Clause Z4 Assignment

Z4.1 The *Consultant* does not assign, transfer or charge the benefit of this contract or any part of it or any benefit or interest under it without the prior agreement of the *Employer.*

Clause Z5 Discrimination

Z5.1 The *Consultant* does not discriminate directly or indirectly or by way of victimisation or harassment against any person contrary to the Race Relations Act 1976, the Sex Discrimination Act 1975 or the Disability Discrimination Act 1995 and 2005 or any amendment or re-enactment of them from time to time (the “Discrimination Acts”).

Z5.2 Where possible in Providing the Services, the *Consultant* co-operates with and assists the *Employer* to satisfy its duty under the Discrimination Acts to eliminate unlawful discrimination and to promote equality of opportunity between persons of different racial groups and between disabled people and other people.

Z5.3 Where any employee or Sub*Consultant* employed by the *Consultant* is required to carry out any activity alongside the *Employer*'s employees in any premises, the *Consultant* ensures that each such employee or Sub*Consultant* complies with the *Employer*'s employment policies and codes of practice relating to discrimination and equal opportunities.

Z5.4 The *Consultant* notifies the *Employer* in writing as soon as he becomes aware of any investigation or proceedings brought against the *Consultant* under the Discrimination Acts in connection with this contract and

- provides any information requested by the investigating body, court or tribunal in the timescale allotted,
- attends (and permits a representative from the *Employer* to attend) any associated meetings,
- promptly allows access to any relevant documents and information and
- cooperates fully and promptly with the investigatory body, court or tribunal

Z5.5 The *Consultant* indemnifies the *Employer* against all costs, charges, expenses (including legal and administrative expenses) and payments made by the *Employer* arising out of or in connection with any investigation or proceedings under the Discrimination Acts resulting from any act or omission of the *Consultant*.

Z5.6 The *Consultant* includes in the conditions of contract for each Sub*Consultant* obligations substantially similar to those set out above.

Clause Z6 Disclosure of information

Z6.1 The *Consultant* acknowledges that the *Employer* may receive Disclosure Requests and that the *Employer* may be obliged (subject to the application of any relevant exemption and, where applicable, the public interest test) to disclose information (including commercially sensitive information) pursuant to a Disclosure Request. Where practicable, the *Employer* consults with the *Consultant* before doing so in accordance with the relevant Code of Practice. The *Consultant* uses its best endeavours to respond to any such consultation promptly and within any deadline set by the *Employer* and acknowledges that it is for the *Employer* to determine whether or not such information should be disclosed.

Z6.2 When requested to do so by the *Employer*, the *Consultant* promptly provides information in its possession relating to this contract and assists and co-operates with the *Employer* to enable the *Employer* to respond to a Disclosure Request within the time limit set out in the relevant legislation.

Z6.3 The *Consultant* promptly passes any Disclosure Request which it receives to the *Employer*. The *Consultant* does not respond directly to a Disclosure Request unless instructed to do so by the *Employer*.

Z6.4 A Disclosure Request is a request for information relating to this contract received by the *Employer* pursuant to the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or otherwise.

Clause Z7 Conflict of interest

Z7.1 The *Consultant* does not take an action which would cause a conflict of interest to arise in connection with this contract. The *Consultant* notifies the *Employer* if there is any uncertainty about whether a conflict of interest may exist or arise.

Clause Z8 Official secrets acts

Z8.1 The *Consultant* advises his employees and Sub*Consultant*s of how the Official Secrets Acts 1911 to 1989 apply to them during and after performance of the s*ervices*.

Z8.2 A failure to comply with this condition is treated as a substantial failure by the *Consultant* to comply with his obligations.

Clause Z9 Subconsulting

Z9.1 The *Consultant* includes in the contract for each subcontract a period for payment to the Sub*Consultant* which is no greater than 30 days from receipt of an invoice issued in accordance with that contract.

Clause Z10 Data protection

Z10.1 (1) The Data Protection Acts are the Data Protection Act 1998 (as amended) and any other laws or regulations relating to privacy or personal data.

(2) Personal Data is information collected by the *Consultant* on behalf of the *Employer* in relation to this contract, which relates to living individuals who can be identified

- from that information or
- from that information combined with other details in (or likely to come into) the possession of the *Employer*.

Z10.2 For the purposes of this contract and the Data Protection Acts

- the *Employer* is the Data Controller and
- the *Consultant* is the Data Processor.

Z10.3 The *Consultant* processes the Personal Data in accordance with (and so as not to put the *Employer* in breach of) the Data Protection Acts and only to the extent necessary for the purpose of performing its obligations under this contract.

Z10.4 The *Consultant* has in place for as long as it holds the Personal Data

- appropriate technical and organisational measures (having regard to the nature of the Personal Data) to protect the Personal Data against accidental, unauthorised or unlawful processing, destruction, loss, damage, alteration or disclosure and
- adequate security programmes and procedures to ensure that unauthorised persons do not have access to the Personal Data or to any equipment used to process the Personal Data.

Z10.5 The *Consultant* immediately notifies the *Employer* if it receives

- a request from any person whose Personal Data it holds to access his Personal Data or
- a complaint or request relating to the *Employer*'s obligations under the Data Protection Acts.

Z10.6 The *Consultant* assists and co-operates with the *Employer* in relation to any complaint or request received, including

- providing full details of the complaint or request,
- complying with the request within the time limits set out in the Data Protection Acts and in accordance with the instructions of the *Employer* and
- promptly providing the *Employer* with any Personal Data and other information requested by him.

Z10.7 The *Consultant* complies with the requirements of the *Employer* in relation to the storage, dispatch and disposal of Personal Data in any form or medium.

Z10.8 The *Consultant* immediately notifies the *Employer* on becoming aware of any breach of this clause or of the Data Protection Acts.

Z10.9 The *Consultant* does not process the Personal Data outside the European Economic Area without the agreement of the *Employer*. Where the *Employer* agrees, the *Consultant* complies with the instructions of the *Employer* and provides an adequate level of protection to any Personal Data in accordance with the eighth data protection principle set out in Schedule 1 to the Data Protection Act 1998..

Clause Z11 Transfer of Undertakings (Protection of Employment) Regulations 2006 ("TUPE")

Z11.1 The *Consultant* provides to the *Employer* within 10 days of the *Employer's* request such information in connection with TUPE as the *Employer* may require. The *Consultant* promptly notifies the *Employer* of any later change to information provided by it.

Z11.2 The *Consultant* acknowledges that the *Employer* may disclose information provided by the *Consultant* to

- any replacement provider of services similar to the *services* and
- any person tendering to become a replacement provider.

The *Employer* obtains undertakings from any person to whom the information is disclosed not to disclose it to any other person (unless required to do so by law).

Z11.3 During the 8 month period immediately prior to the Completion Date, the *Consultant* submits for the acceptance of the *Employer* any proposals to

- materially amend the terms and conditions of employment of any employee whose work, wholly or mainly falls within the scope of this contract,
- materially increase the number of employees whose work (or any part of it) is work undertaken for the purposes of this contract or
- move or deploy any key person away from the performance of the *services*.

The *Employer* may withhold acceptance if the proposal would increase the cost to the *Employer* of this or any future contract for the *services*.

Z11.4 The *Consultant* does not do anything which may adversely affect the orderly transfer of responsibility for provision of the *services*.

Z11.5 The *Consultant* complies with, and ensures that any Sub*Consultant* complies with, the Code of Practice on Workforce Matters in Local Customer Service Contracts (as currently contained in COPM Circular 3/03, Annex O) or any similar code applicable to persons engaged on service contracts for any

department or office of Her Majesty's Government.

Clause Z12 Merger, take-over or change of control

Z12.1 The *Consultant* notifies the *Employer* if a Change of Control of the *Consultant* has occurred or is expected to occur. The *Employer* may treat the Change of Control as a substantial failure by the *Consultant* to comply with his obligations if the Change of Control will not allow the *Consultant* to Provide the Services.

Change of Control means an event where any single person, or group of persons acting in concert, acquires control of the *Consultant* or any direct or indirect interest in the relevant share capital of the *Consultant*, as a result of which that person or group of persons has a direct or indirect interest in more than 25% of the relevant share capital of the *Consultant*.

Z12.2 The *Consultant* notifies the *Employer* immediately of

- any material change to the direct or indirect legal or beneficial ownership of any shareholding in the *Consultant*. A change is material if it relates directly or indirectly to a change of 3% or more of the issued share capital of the *Consultant*, or
- any material change in the composition of the *Consultant's* partnership. A change in the composition of the partnership is material if it directly or indirectly affects the performance of this contract by the *Consultant*.

Z12.3 The *Consultant* notifies the *Employer* of any change, or proposed change in the name of or status of the *Consultant*.

Clause Z13 Audit by Comptroller and Auditor General

Z13.1 The *Consultant* permits the Comptroller and Auditor General to examine documents held or controlled by the *Consultant* or any Sub*Consultant*.

Z13.2 The *Consultant* provides such oral or written explanations as the Comptroller and Auditor General considers necessary.

Z13.3 This clause does not constitute a requirement or agreement for the purposes of section 6(3)(d) of the National Audit Act 1983 for the examination, certification or inspection of the accounts of the *Consultant.*

Clause Z14 Appointment of *Adjudicator*

Z14.1 The *Adjudicator's* appointment under the NEC3 Adjudicator's Contract (June 2005) includes the following additional condition of contract

"The *Adjudicator* complies, and takes all reasonable steps to ensure that any persons advising or aiding him comply, with the Official Secrets Act 1989. Any information concerning the Contract obtained either by the *Adjudicator* or any person advising or aiding him is confidential, and may not be used or disclosed by the *Adjudicator* or any such person except for the purposes of this Agreement."

Clause Z15 Quality Management Points

Z15.1 Quality Management Points are points accrued by the *Consultant* in accordance with the Quality Table. Quality Management Points accrue for the failures listed on the Quality Table whether arising from an audit by the *Consultant*, the *Employer* or the relevant accreditation body:

Z15.2 If the *Consultant* fails to comply with his quality management system, the *Consultant* accrues Quality Management Points from the date when the failure is identified in accordance with the Quality Table. The number of Quality Management Points is reduced in accordance with the Quality Table.

Z15.3 The *Consultant* maintains a register of the number of Quality Management Points in effect, showing when Quality Management Points accrue and are removed.

Z15.4 If the number of Quality Management Points in effect at any time is more than 25 points, the *Consultant* and the *Employer* meet within one week to consider ways of reducing the number of Quality Management Points in effect to 25 or less and to avoid accruing further Quality Management Points. The *Consultant* submits a report to the *Employer* within one week of the meeting setting out

- the actions agreed at the meeting and
- any other actions which the *Consultant* proposes to take immediately to reduce the number of Quality Management Points in effect to 25 or less and to avoid accruing further Quality Management Points.

Z15.5 If the *Employer* does not accept the *Consultant*'s proposals or the *Consultant* does not take the agreed actions, the *Employer* serves a quality warning notice on the *Consultant*. Within one week of receipt of the quality warning notice, the *Consultant* submits a report to the *Employer* setting out the actions which the *Consultant* has taken and what further or alternative actions he proposes to take to reduce the number of Quality Management Points in effect to 25 or less.

Z15.6 Until the number of Quality Management Points in effect is reduced to 25 or less, the *Consultant* takes the actions detailed in his reports and submits weekly up date reports to the *Employer* setting out the actions he has taken, the results of those actions and the actions which are still to be taken by him.

Z15.7 Failure to take actions to reduce the number of Quality Management Points in effect to 25 or less is treated as a substantial failure by the *Consultant* to comply with his obligations.

Quality Table

Failure	Quality Management Points	Period of effect
Failure to have a complete Quality Plan in place and operating	25	Until audit confirms that Quality Plan complete and operating
The Quality Plan does not comply with the requirements of this contract	10 per failure	Until audit confirms that Quality Plan complies
Failure to raise a Non-Conformity report	5 per Non-Conformity	6 months
Failure to raise a corrective action report	5 per Non-Conformity	6 months
Failure to correct Quality Plan in manner set out in a corrective action report *(see note 1 below)*	10 per failure	Until failure corrected
Failure to implement recommendations in audit report *(see note 1 below)*	5 per recommendation	Until audit confirms that recommendation implemented
Failure to carry out internal audit	25 per audit	Until audit carried out
Carrying out work without release of hold point	10 per item	6 months
Failure to make records available for inspection by the *Employer*	10 per failure	Until the records are made available
Failure to allow access for *Employer* audits	10 per failure	Until *Employer* audit is carried out
Failure by *Consultant* to accrue Quality Management Points that should have been accrued	The number of Points that should have been accrued	Applicable to the failure that should have accrued Points
	plus an additional number of Points equivalent to the Points that should have been accrued	6 months
Note 1: For these failures additional Points are accrued at each audit until an audit confirms that rectification/correction/implementation/action has taken place.		

Clause Z16 Staff vetting and training

Z16.1 The *Consultant* complies with the staff vetting and training requirements stated in the Scope.

Clause Z17 Confidentiality

Z17.1 Clause 70.3 is deleted and replaced by the following.

The *Consultant* keeps (and ensures that its employees and Sub*Consultant*s

keep) confidential and does not disclose to any person

- the terms of this contract and
- any confidential or proprietary information (including Personal Data) provided to or acquired by the *Consultant* in the course of Providing the Services

except that the *Consultant* may disclose information

- to its legal or other professional advisers,
- to its employees and Sub*Consultant*s as needed to enable the *Consultant* to Provide the Services,
- where required to do so by law or by any professional or regulatory obligation or by order of any court or governmental agency, provided that prior to disclosure the *Consultant* consults the *Employer* and takes full account of the *Employer*'s views about whether (and if so to what extent) the information should be disclosed,
- which it receives from a third party who lawfully acquired it and who is under no obligation restricting its disclosure,
- which is in the public domain at the time of disclosure other than due to the fault of the *Consultant* or
- with the consent of the *Employer.*

Clause Z18 Retention of information

Z18.1 The *Consultant* retains information obtained or prepared for this contract for the period stated in the Contract Data. When requested by the *Employer*, the *Consultant* makes this information available for inspection by the *Employer* or Others.

Clause Z19 Project Bank Account

Defined terms Z19.1 (1) The Authorisation is a document authorising the project bank to make payments to the *Consultant* and Named Suppliers.

(2) Named Suppliers are *named suppliers* unless later changed in accordance with this contract.

(3) Project Bank Account is the account used to receive payments from the *Employer* and make payments to the *Consultant* and Named Suppliers.

(4) A Supplier is a person or organisation who has a contract with the *Consultant* to provide part of the *services*.

(5) Trust Deed is an agreement between the *Employer*, the *Consultant* and Named Suppliers which contains provisions for administering the Project Bank Account.

Project Bank Account

Z19.2 The *Consultant* establishes the Project Bank Account with the project bank within one week of the Contract Date.

Z19.3 Unless stated otherwise in the Contract Data, the *Consultant* pays any charges and is paid any interest made by the project bank.

Z19.4 The *Consultant* submits to the *Employer* for acceptance details of the banking arrangements for the Project Bank Account. A reason for not accepting the banking arrangements is that they do not provide for payments to be made in accordance with this contract. The *Consultant* provides to the *Employer* copies of communications with the project bank in connection with the Project Bank Account.

Named Suppliers

Z19.5 The *Consultant* includes in his contracts with Named Suppliers the arrangements in this contract for the operation of the Project Bank Account and Trust Deed. The *Consultant* notifies the Named Suppliers of the details of the Project Bank Account and the arrangements for payment of amounts due under their contracts.

Z19.6 The *Consultant* submits proposals for adding a Supplier to the Named Suppliers to the *Employer* for acceptance. A reason for not accepting is that the addition of the Supplier does not comply with the Works Information.

Payments

Z19.7 In assessing the amount due at each assessment date, the *Consultant* deducts the amount due to Named Suppliers. The *Consultant* includes with his invoice for payment a statement of the amounts due to Named Suppliers in accordance with their contracts and an invoice from each Named Supplier

Z19.8 No later than one week before the expiry of the period within which payment is to be made, the *Employer* makes payment to the Project Bank Account of the amount which he assesses is due to be paid to the *Consultant*.

Z19.9 The *Consultant* makes payment to the Project Bank Account of

- any amount not paid by the *Employer* and
- any amount required to make payment in full to Named Suppliers.

Z19.10 The *Consultant* prepares the Authorisation, setting out the sums due to Named Suppliers as assessed by the *Consultant* and to the *Consultant* for the balance of the certified payment. After signing the Authorisation, the *Consultant* submits it to the *Employer* for signature and submission to the project bank.

Z19.11 The *Consultant* and Named Suppliers receive payment from the Project Bank Account of the sums set out in the Authorisation as soon as practicable after the Project Bank Account receives payment.

Z19.12 A payment which is due from the *Consultant* to the *Employer* is not made through the Project Bank Account.

Effect of payment

Z19.13 Payments made from the Project Bank Account are treated as payments from the *Employer* to the *Consultant* in accordance with this contract or from the *Consultant* or Sub*Consultant* to Named Suppliers in accordance

with their contracts as applicable.

Trust Deed Z19.14 The *Employer*, the *Consultant* and Named Suppliers sign the Trust Deed before the first assessment date.

Termination Z19.15 If the *Employer* issues a termination certificate, no further payment are made into the Project Bank Account.

Trust Deed

This agreement is made between the *Employer,* the *Consultant* and the Named Suppliers.

Terms in this deed have the meanings given to them in the contract between ……. and …….. for ……. (the *works*).

Background

The *Employer* and the *Consultant* have entered into a contract for the *works.*

The Named Suppliers have entered into contracts with the *Consultant* or a Sub*Consultant* in connection with the *works*.

The *Employer* and the *Consultant* have established a Project Bank Account to make provision for payment to the *Consultant* and the Named Suppliers.

Agreement

The parties to this deed agree that

- sums due to the *Consultant* and Named Suppliers and set out in the Authorisation are held in trust in the Project Bank Account for distribution to the Named Suppliers in accordance with the banking arrangements applicable to the Project Bank Account,
- further Named Suppliers may be added as parties to this deed with the agreement of the *Employer* and *Consultant.* The agreement of the *Employer* and *Consultant* is treated as agreement by the Named Suppliers,
- this deed is subject to the law of the contract for the *works*,
- the benefits under this deed may not be assigned.

Executed as a deed on ……..

by

……. (*Employer*)

……. (*Consultant*)

……..

……..

……..

……..
(Named Suppliers)

Joining Deed

This agreement is made between the *Employer,* the *Consultant* and …… (the Additional Supplier).

Terms in this deed have the meanings given to them in the contract between ……. and …….. for ……. (the *works*).

Background

The *Employer* and the *Consultant* have entered into a contract for the *works.*

The Named Suppliers have entered into contracts with the *Consultant* or a Sub*Consultant* in connection with the *works*.

The *Employer* and the *Consultant* have established a Project Bank Account to make provision for payment to the *Consultant* and the Named Suppliers.

The *Employer,* the *Consultant* and the Named Suppliers have entered into a deed as set out in Annex 1 (the Trust Deed), and have agreed that the Additional Supplier may join that deed.

Agreement

The Parties to this deed agree that

- the Additional Supplier becomes a party to the Trust Deed from the date set out below,
- this deed is subject to the law of the contract for the *works*,
- the benefits under this deed may not be assigned.

Executed as a deed on ……

by

……. (*Employer*)

……. (*Consultant*)

…….. (Additional Supplier)

Clause Z20 Change to the Completion Date

Z20.1 On each anniversary of the Contract Date, the *Employer* assesses the performance of the *Consultant* and classifies it as

- good if the *Consultant* has
  - incurred no more than 40 Quality Points in the relevant year and
  - achieved a Performance Measurement Score of 8.0 or more
- poor if the *Consultant* has
  - incurred more than 80 Quality Points in the relevant year or
  - achieved a Performance Measurement Score of less than 6.0
- neutral in all other cases.

Z20.2 The *Employer* notifies the *Consultant* of the classification and of the following actions to be taken as a result of the classification.

- If the performance of the *Consultant* is classified as good and the Completion Date is earlier than the completion date, the Completion Date is delayed by six months
- If the performance of the *Consultant* is classified as good and the Completion Date is not earlier than the completion date, a potential extension to the Completion Date of six months is earned
- If the performance of the *Consultant* is classified as poor the Completion Date is brought forward by six months.

Z20.3 No later than 11 months before the Completion Date, the *Employer* may notify the *Consultant* that the Completion Date is delayed by an amount not exceeding the potential extension. The amount of the potential extension is reduced by the amount of the delay notified.

Z20.4 The Completion Date is not delayed by more than 12 months in aggregate.

Z20.5 A delay to or bringing forward of the Completion Date notified by the *Employer* is not a compensation event.

Z20.6 The Performance Measurement Score is the average Performance Indicator score measured in accordance with the Highways Agency Motivating Success Toolkit. The average score is calculated from the monthly scores of all indicators during the relevant year.

Clause Z21 Termination by the *Employer*

Z21.1 The *Employer* may terminate the *Consultant*'s obligation to Provide the Services for a reason not stated in this contract by notifying the *Consultant*.
Z21.2 If the *Employer* terminates for a reason not stated in this contract, an

additional amount is due on termination which is 5% of the difference between

- the forecast of the final total of the Prices for Tasks instructed by the *Employer* in the absence of termination and
- the amount due on termination for the services in Task Orders instructed by the *Employer* excluding the additional amount.

Clause Z22 Payment options

Z22.1 The *Employer* may notify the *Consultant* that the total of the Prices for a proposed Task Order be treated as a lump sum or target price.

Z22.2 If the *Employer* notifies the *Consultant* that the total of the Prices for a proposed Task Order be treated as a target price,

- If the effect of a compensation event is to reduce the total Time Charge and the event is a change to the Task, other than a change to the Task which the *Consultant* proposed and the *Employer* has accepted, the Prices are reduced.
- The *Employer* assesses the *Consultant's* share of the difference between the total of the Prices and the Time Charge for the Task. The difference is divided into increments falling within each of the share ranges. The limits of a share range are the Time Charge divided by the total of the Prices, expressed as a percentage. The *Consultant's* share equals the sum of the products of the increment within each share range and the corresponding *Consultant's* share percentage.
- If the Time Charge is less than the total of the Prices, the *Consultant* is paid his share of the saving. If the Time Charge is greater than the total of the Prices, the *Consultant* pays his share of the excess.
- The *Employer* makes a preliminary assessment of the *Consultant's* share at Completion of the whole of the services in the Task Order using his forecasts of the final Time Charge and the final total of the Prices. This share is included in the amount due following Completion of the whole of the services in the Task Order.
- The *Employer* makes a final assessment of the *Consultant's* share using the final Time Charge and the final total of the Prices. This share is included in the final amount due for the services in the Task Order.
- If there is a termination, the *Employer* assesses the *Consultant's* share. His assessment uses the total of the Time Charge which the *Consultant* has paid and which he is committed to pay for work done before termination and a proportion of the total of the Prices which is the proportion of the work which has been completed. The *Employer's* assessment of the *Consultant's* share is added to the amount due to the *Consultant* on termination if there has been a saving or deducted if there has been an excess.

Clause Z23 Transfer of work

Z23.1 If the *Employer* wishes to have work carried out within the Scope and

- the *Employer* is unable to issue a Task Order to the *Consultant* due to a conflict of interest,
- the *Consultant* has more than 25 Quality Management Points in effect,
- the *Consultant's* average monthly Project Performance Indicator score has been below six for a period of three months or more,
- the *Consultant's* proposals for improvement have not been accepted or
- the *Employer* does not accept the *Consultant's* resources or the *Consultant's* forecast of the Prices for a proposed Task,

the *Employer* may issue a Task Order for the work to another *Consultant*.

Clause Z24 Payment for subcontracted services

Z24.1 In assessing the amount due at an assessment date, the Time Charge for services provided by a Subconsultant (other than a Named Supplier), is retained from the Consultant unless, at the assessment date, the Consultant has paid the Subconsultant for the services.

Z24.2 An amount retained is included in the amount due at the assessment date after the Consultant has paid the Subconsultant for the services.

Z24.3 When submitting an invoice, the Consultant demonstrates that payment has been made for the Time Charge included in the invoice in respect of services provided by a Subconsultant.

Part two – Data provided by the *Consultant*

1 General

- The *Consultant* is

  Name […]

  Address […]

- The following matters will be included in the Risk Register

  […]

2 The Parties' main responsibilities

- The *key people* are the people listed in the *key people schedule*

4 Quality

- The Quality Statement is […]

5 Payment

- The *expenses* stated by the *Consultant* are

item	amount
[list expenses for which prices are to be tendered]	

- The resource cost schedule is […]
- The *task schedule* is […]
- The project bank is […]
- The named suppliers are […]

Appendix B – *60343293 EM50 15/16 TN1* – Survey Data Check

Project:	**Highways England Spatial Planning Arrangement**	Job No:	**60343293**
Subject:	**M1 J15 and J15a – Traffic Survey Data Check**	Date:	**01 April 2016**
HE ref:	**EM 50 15/16**	Task:	**EM50**

1. Introduction

On behalf of Highways England, AECOM commissioned Intelligent Data Collection Limited to conduct traffic surveys at the following junctions in Northampton:

- M1 Junction 15; and
- M1 Junction 15a.

The surveys were to be conducted in line with the details set out in document number **160229 60343293 EM1 TSS 001**, titled *'Traffic Survey Specification – M1 J15 and J15a',* dated 29th February 2016. This note is a check of the data received against the Intelligent Data Collection Limited data**.**

The surveys and dates carried out are detailed as follows:

- MCC surveys;
- Automatic Number Plate Recognition (ANPR) surveys; and
- Queue Surveys.

The traffic survey data submitted by Intelligent Data Collection Limited Data has been uploaded to the project network in the following location: F:\TP\PROJECT\Traffic - HASPA - 15\EM Studies\EM50 M1 J15 and 15a Traffic survey\03 EXECUTION\06 Tech Info Rcvd

2. MCC Survey Data

Item	Requirements Met?	Comments
Were the turning counts carried out on Thursday 10th March 2016?	Yes	
Were the turning counts carried out between 0600 to 1900hrs (13hrs)?	Yes	
Were 2 turning count sites used?	Yes	
Was the turning counts survey conducted with classified vehicle counts?	Yes	
Has turning count data been provided by vehicle class every 15 minutes?	Yes	
Have 15 minute vehicle totals and movements been provided?	Yes	
Have hourly vehicle totals by class and movement (direction) been provided?	No	
Has a full analysis period totals by class and movement (direction) been provided?	Yes	
Have all sites recorded data fully without any failure?	Yes	

Table 1: MCC Data Check against TSS

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Birmingham B4 6AT

Table 1 indicates that the MCC data has been collected in accordance with the survey specifications. AECOM noted that at Site 5 there was an unusually high amount of vehicles making A-A movements. This query was raised with Intelligent Data Collection Limited, who carried out a series of checks on this particular set of data and confirmed that the data was accurate and the high number of U turning movements was solely down to the layout of the junction. Use of the MCC data should take this situation into account and be subject to further checks to ensure that it is appropriate to the assessment being undertaken.

3. ANPR Survey Data

Item	Requirements Met?	Comments
Have the ANPR surveys been carried out on the date specified – Thursday 10th March 2016?	Yes	
Have the ANPR surveys been undertaken between 0600 - 0930 and 1530 - 1900?	Yes	
Have the ANPR surveys been set up as per the ANPR layout in the specification?	Yes	
Have vehicles been classified within the survey?	Yes	Vehicles have been classified in the Trip Chain Report but not in the OD Report or ANPR Sample Rate document.
Has a 50% total screen line matching of vehicles been achieved?	Yes	
Have ANPR network O-D matrices been provided for each class and 15 minute intervals?	Yes	A set of summary matrices has been provided which shows trip times for all sites and classes.

Table 2: ANPR Check against TSS

Table 2 indicates that ANPR data has been collected in accordance with the survey specifications. All data was collected correctly and presented clearly. All average matched rates were above 50% with a highest and lowest match rate of 95% & 71% respectively. Use of the ANPR data should take this position into account and be subject to further checks to ensure that it is appropriate to the assessment being undertaken.

4. Queue Survey Data

Item	Requirements Met?	Comments
Were the Queue surveys carried out on the date specified – Thursday 10th March 2016?	Yes	
Were the Queue surveys been undertaken between 0600 - 0930 and 1530 - 1900?	No	Queue surveys have been undertaken between 0600-0930 and 1500-190, thirty minutes longer than stated in the specification.
Have the Queue surveys been set up as per the Queue survey layout in the specification?	Yes	
Have vehicles been classified within the	Yes	Vehicles have been classified as 'Lights

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survey?		and Heavies' as the queue lengths are determined in metres. The data was collected on the assumption that a 'light' vehicle would account for 6 metres for a queue and a 'heavy' vehicle 15 metres.

Table 3: Queue Survey Check against TSS

Table 3 indicates that Queue Survey data has been collected largely in accordance with the survey specifications. AECOM has noted that Queue Survey data was collected for thirty minutes longer than stated in the traffic survey specification; however this is not an issue as all the required data has been given to AECOM. The data was submitted to AECOM before the given date in the traffic survey specification.

5. Conclusions

Overall, the survey data submitted by Intelligent Data Collection Limited is satisfactory, with all issues being successfully resolved.

The checks on the M1 J15 & J15a traffic survey data referred to in this note are focused on ensuring that the data requested in the traffic survey specification have been fully provided. Use of the survey data should be subject to further checks to ensure that it is being used appropriately in each specific case.

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Appendix C – VISSIM Driving Behaviours

Driving Behaviour	Urban (motorized)		Right-side Rule (motorized)		Merges	
Car following model	Wiedemann 74		Wiedemann 99		Wiedemann 99	
Look ahead distance (min,max)	0.00m, 250.00m		0.00m, 250.00m		0.00m, 250.00m	
No. of observed vehicles	4		2		2	
Look back distance (min,max)	0.00m, 150.00m		0.00m, 150.00m		0.00m, 150.00m	
Average standstill distance	1.20m		-		-	
Addictive part of safety distance	2.00m		-		-	
Multiplic part of safety distance	3.00m		-		-	
CC0 (Standstill Distance)	-		1.50m		1.50m	
CC1 (Headway Time)	-		0.90s		0.90s	
CC2 ('Following' Variation)	-		4.00m		4.00m	
CC3 (Threshold for entering 'following')	-		-8.00		-8.00	
CC4 (Negative 'following' threshold)	-		-0.35		-0.35	
CC5 (Positive 'following' threshold)	-		0.35		0.35	
CC6 (Speed dependency of oscillation)	-		11.44		11.44	
CC7 (Oscillation acceleration)	-		0.25 m/s^2		0.25 m/s^2	
CC8 (Standstill acceleration)	-		3.50 m/s^2		3.50 m/s^2	
CC9 (Acceleration at 50mph)	-		1.50 m/s^2		1.50 m/s^2	
General Behaviour	Free Lane Selection		Left-Side Rule		Free Lane Selection	
	Own	Trailing - Vehicle	Own	Trailing Vehicle	Own	Trailing Vehicle
Maximum deceleration	-4.00 m/s^2	-3.00 m/s^2	-4.00 m/s^2	-3.00 m/s^2	-4.00 m/s^2	-4.00 m/s^2
-1 m/s^2 per distance	100.00m	100.00m	200.00m	200.00m	100.00m	100.00m
Accepted deceleration	-1.00 m/s^2	-1.00 m/s^2	-1.00 m/s^2	-0.50 m/s^2	-1.00 m/s^2	-1.50 m/s^2
Waiting time before diffusion	60.00s		60.00s		60.00s	
Min. Headway (front/rear)	0.50m		0.50m		0.50m	
To slower lane if collision time above	-		11.00s		-	
Safety distance reduction factor	0.60		0.60		0.10	
Maximum deceleration for cooperative braking	-3.00 m/s^2		-3.00 m/s^2		-9.00m/s^2	
Advanced merging	N		N		Y	
Cooperative Lane Change?	N		N		Y	
Maximum speed distance	-		-		6.71 mph	
Maximum collision time	-		-		10.00s	

Driving Behaviour	M1 J15A Merges		Urban (motorized) - More Agressive lane change		Urban (motorized)- Shorter Standstill (1.2m)	
Car following model	Wiedemann 99		Wiedemann 99		Wiedemann 74	
Look ahead distance (min,max)	0.00m, 250.00m		0.00m, 250.00m		0.00m, 250.00m	
No. of observed vehicles	2		4		4	
Look back distance (min,max)	0.00m, 150.00m		0.00m, 150.00m		0.00m, 150.00m	
Average standstill distance	-		-		1.20m	
Addictive part of safety distance	-		-		2.00m	
Multiplic part of safety distance	-		0.50m		3.00m	
CC0 (Standstill Distance)	1.50m		1.50 m		-	
CC1 (Headway Time)	0.90s		0.90s		-	
CC2 ('Following' Variation)	4.00m		6.00m		-	
CC3 (Threshold for entering 'following')	-8.00		-8.00		-	
CC4 (Negative 'following' threshold)	-0.35		-0.35		-	
CC5 (Positive 'following' threshold)	0.35		0.35		-	
CC6 (Speed dependency of oscillation)	11.44		11.44		-	
CC7 (Oscillation acceleration)	0.25 m/s^2		0.25 m/s^2		-	
CC8 (Standstill acceleration)	3.50 m/s^2		3.50 m/s^2		-	
CC9 (Acceleration at 50mph)	1.50 m/s^2		1.50 m/s^2		-	
General Behaviour	Free Lane Selection		Free Lane Selection		Free Lane Selection	
	Own	Trailing - Vehicle	Own	Trailing Vehicle	Own	Trailing Vehicle
Maximum deceleration	-4.00 m/s^2	-3.00 m/s^2	-4.00 m/s^2	-3.00 m/s^2	-4.00 m/s^2	-3.00 m/s^2
-1 m/s^2 per distance	100.00m	100.00m	100.00m	100.00m	100.00m	100.00m
Accepted deceleration	-1.00 m/s^2	-2.00 m/s^2	-1.00 m/s^2	-1.00 m/s^2	-1.00 m/s^2	-1.00 m/s^2
Waiting time before diffusion	60.00s		60.00s		60.00s	
Min. Headway (front/rear)	0.50 m		0.50 m		0.50m	
To slower lane if collision time above	-		-		-	
Safety distance reduction factor	0.07		0.10		0.60	
Maximum deceleration for cooperative braking	-7.00 m/s^2		-9.00 m/s^2		-3.00 m/s^2	
Advanced merging	Y		N		N	
Cooperative Lane Change?	N		N		N	
Maximum speed distance	-		-		-	
Maximum collision time	-		-		-	

Driving Behaviour	Urban (motorized)-change of lane change parameters		Motorway	
Car following model	Wiedemann 74		Wiedemann 74	
Look ahead distance (min,max)	0.00m, 250.00m		0.00m, 250.00m	
No. of observed vehicles	4		2	
Look back distance (min,max)	0.00m, 150.00m		0.00m, 150.00m	
Average standstill distance	1.20m		2.00m	
Addictive part of safety distance	2.00m		2.00m	
Multiplic part of safety distance	3.00m		3.00m	
CC0 (Standstill Distance)	-		-	
CC1 (Headway Time)	-		-	
CC2 ('Following' Variation)	-		-	
CC3 (Threshold for entering 'following')	-		-	
CC4 (Negative 'following' threshold)	-		-	
CC5 (Positive 'following' threshold)	-		-	
CC6 (Speed dependency of oscillation)	-		-	
CC7 (Oscillation acceleration)	-		-	
CC8 (Standstill acceleration)	-		-	
CC9 (Acceleration at 50mph)	-		-	
General Behaviour	Free Lane Selection		Free Lane Selection	
	Own	Trailing Vehicle	Own	Trailing Vehicle
Maximum deceleration	-4.00 m/s^2	-3.00 m/s^2	-4.00 m/s^2	-3.00 m/s^2
-1 m/s^2 per distance	100.00m	100.00m	100.00m	100.00m
Accepted deceleration	-1.00 m/s^2	-1.00 m/s^2	-1.00 m/s^2	-1.00 m/s^2
Waiting time before diffusion	60.00s		60.00s	
Min. Headway (front/rear)	0.50m		0.50m	
To slower lane if collision time above	-		-	
Safety distance reduction factor	0.20		0.60	
Maximum deceleration for cooperative braking	-8.00 m/s^2		-9.00 m/s^2	
Advanced merging	N		Y	
Cooperative Lane Change?	N		N	
Maximum speed distance	-		-	
Maximum collision time	-		-	

Appendix D – Final O-D Matrices

M1 J15a VISSIM Validation - AM O-D Matrix

AECOM

Project Name: HESPA M12 M1 J15a and J15 Study
Subject: M1 J15&15a AM O-D Matrices
Date: 01/07/2016

LGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**13**	**7**	**279**	21	6	0	0	1	3	2	231
2	**15**	**16**	**9**	**362**	134	38	0	0	4	20	12	1465
3	**58**	**63**	**0**	**4**	24	7	0	0	1	4	2	262
4	**596**	**1068**	**50**	**40**	19	5	0	0	1	3	2	210
5	3	64	1	17	0	210	18	0	21	0	8	165
6	7	182	3	49	791	1	60	0	8	0	10	110
7	0	7	0	2	0	0	0	0	0	0	0	0
8	0	0	0	0	0	3	4	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	9
10	0	0	0	0	2	0	0	0	0	0	0	1
11	1	19	0	5	22	1	2	0	1	0	0	2
12	59	1458	21	390	296	19	11	29	0	0	11	0

ANPR
From Internal Zone, applying ANPR proportions
To Internal Zone, applying ANPR proportions
TCs

HGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**0**	**1**	**12**	7	1	0	0	1	1	2	61
2	**1**	**5**	**4**	**79**	54	6	0	0	5	9	14	459
3	**3**	**2**	**0**	**0**	7	1	0	0	1	1	2	58
4	**43**	**140**	**8**	**4**	4	1	0	0	0	1	1	37
5	0	28	0	6	0	10	0	0	13	0	3	45
6	0	20	0	4	90	0	3	0	0	0	1	8
7	0	4	0	1	0	0	0	0	0	0	0	0
8	0	1	0	0	2	1	1	0	0	0	1	0
9	0	0	0	0	0	0	0	0	0	0	0	4
10	0	0	0	0	0	0	0	0	1	0	1	0
11	0	10	0	2	2	0	1	0	0	0	0	0
12	8	606	3	118	108	2	2	17	2	0	8	3

Please Note: Vehicles have been re-assigned to zone 10 in the model as zone 9 is a model entry only and does not allow vehicles to exit the network.

Prepared by:	Irene Echeverria	01/07/2016
Checked by:	Marino Gonzalez	07/07/2016

M1 J15a VISSIM Validation - AM O-D Matrix

AECOM

Project Name: HESPA M12 M1 J15a and J15 Study
Subject: M1 J15&15a AM O-D Matrices
Date: 01/07/2016

LGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**17**	**31**	**609**	18	10	0	0	1	4	3	222
2	**25**	**24**	**43**	**843**	149	82	0	0	7	30	26	1808
3	**116**	**111**	**0**	**10**	26	14	0	0	1	5	5	314
4	**801**	**1129**	**56**	**66**	22	12	0	0	1	4	4	264
5	14	181	6	77	1	524	11	0	42	0	28	295
6	23	301	11	128	915	1	18	0	26	0	15	134
7	1	18	1	8	0	0	0	0	0	0	0	0
8	0	0	0	0	5	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	13
10	0	0	0	0	1	2	0	0	0	0	1	1
11	3	34	1	15	50	1	3	0	1	0	1	1
12	159	2079	74	885	292	45	6	34	0	0	27	5

ANPR
From Internal Zone, applying ANPR proportions
To Internal Zone, applying ANPR proportions
TCs

HGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**0**	**1**	**16**	5	1	0	0	1	1	1	46
2	**9**	**1**	**3**	**70**	51	6	0	0	5	8	14	434
3	**4**	**5**	**0**	**1**	5	1	0	0	0	1	1	42
4	**39**	**66**	**12**	**8**	4	0	0	0	0	1	1	36
5	0	28	0	5	0	10	0	0	13	0	3	45
6	0	21	0	4	92	0	4	0	0	0	1	8
7	0	5	0	1	0	0	0	0	0	0	0	0
8	0	1	0	0	2	1	1	0	0	0	1	0
9	0	0	0	0	0	0	0	0	0	0	0	4
10	0	0	0	0	0	0	0	0	1	0	1	0
11	0	11	0	2	3	0	1	0	0	0	0	0
12	9	607	4	108	107	2	2	17	2	0	8	3

Please Note: Vehicles have been re-assigned to zone 10 in the model as zone 9 is a model entry only and does not allow vehicles to exit the network.

Prepared by:	Irene Echeverria	01/07/2016
Checked by:	Marino Gonzalez	07/07/2016

M1 J15a VISSIM Validation - AM O-D Matrix

AECOM

Project Name: HESPA M12 M1 J15a and J15 Study
Subject: M1 J15&15a AM O-D Matrices
Date: 01/07/2016

LGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**5**	**17**	**277**	8	4	0	0	0	2	2	72
2	**8**	**6**	**21**	**341**	63	31	0	0	2	18	13	591
3	**62**	**28**	**1**	**11**	14	7	0	0	1	4	3	135
4	**319**	**411**	**45**	**54**	10	5	0	0	0	3	2	95
5	4	67	4	34	4	267	2	0	16	0	14	146
6	6	96	6	48	446	2	5	0	1	0	8	61
7	0	4	0	2	0	0	0	0	0	0	0	0
8	0	2	0	1	2	1	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	2
10	0	0	0	0	0	1	0	0	0	0	0	0
11	2	23	1	11	22	3	0	0	0	0	0	0
12	58	867	55	438	160	38	1	24	0	0	12	1

ANPR
From Internal Zone, applying ANPR proportions
To Internal Zone, applying ANPR proportions
TCs

HGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**0**	**1**	**13**	3	0	0	0	0	0	1	25
2	**0**	**0**	**1**	**16**	60	7	0	0	6	10	16	509
3	**5**	**3**	**0**	**1**	2	0	0	0	0	0	1	19
4	**35**	**34**	**2**	**4**	2	0	0	0	0	0	1	16
5	1	30	0	3	0	10	0	0	13	0	3	44
6	0	23	0	2	93	0	4	0	0	0	1	8
7	0	5	0	0	0	0	0	0	0	0	0	0
8	0	1	0	0	2	1	1	0	0	0	1	0
9	0	0	0	0	0	0	0	0	0	0	0	4
10	0	0	0	0	0	0	0	0	1	0	1	0
11	0	12	0	1	3	0	1	0	0	0	0	0
12	12	656	1	56	107	2	2	17	2	0	8	3

Please Note: Vehicles have been re-assigned to zone 10 in the model as zone 9 is a model entry only and does not allow vehicles to exit the network.

Prepared by:	Irene Echeverria	01/07/2016
Checked by:	Marino Gonzalez	07/07/2016

M1 J15a VISSIM Validation - PM O-D Matrix

AECOM

Project Name: HESPA M12 M1 J15a and J15 Study
Subject: M1 J15&15a AM O-D Matrices
Date: 01/07/2016

LGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**7**	**35**	**508**	14	11	0	0	0	3	2	262
2	**31**	**14**	**74**	**1071**	132	107	0	0	5	27	15	2540
3	**107**	**46**	**2**	**29**	23	19	0	0	1	5	3	441
4	**612**	**913**	**136**	**166**	16	13	0	0	1	3	2	307
5	5	159	8	68	2	544	17	0	48	0	14	427
6	4	135	7	57	549	4	13	0	6	0	7	57
7	1	25	1	11	0	0	0	0	0	0	0	0
8	0	1	0	1	7	2	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	28
10	0	0	0	0	2	2	0	0	1	0	1	2
11	1	40	2	17	30	22	5	0	3	0	1	18
12	61	1909	93	813	367	54	3	22	0	0	7	1

ANPR
From Internal Zone, applying ANPR proportions
To Internal Zone, applying ANPR proportions
TCs

HGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**0**	**1**	**19**	2	0	0	0	0	1	1	22
2	**3**	**2**	**4**	**59**	30	5	1	0	2	13	9	376
3	**2**	**2**	**0**	**1**	3	1	0	0	0	1	1	40
4	**17**	**49**	**7**	**10**	2	0	0	0	0	1	1	30
5	0	34	0	11	1	25	6	1	11	0	5	59
6	0	9	0	3	41	0	1	0	1	0	1	5
7	0	4	0	1	0	0	0	0	0	0	0	0
8	0	1	0	0	1	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	7
10	0	0	0	0	1	1	0	0	1	0	0	1
11	0	11	0	3	3	1	3	0	0	0	0	1
12	2	337	2	109	68	0	0	0	0	0	0	0

Please Note: Vehicles have been re-assigned to zone 10 in the model as zone 9 is a model entry only and does not allow vehicles to exit the network.

Prepared by:	Irene Echeverria	01/07/2016
Checked by:	Marino Gonzalez	07/07/2016

M1 J15a VISSIM Validation - PM O-D Matrix

AECOM

Project Name: HESPA M12 M1 J15a and J15 Study
Subject: M1 J15&15a AM O-D Matrices
Date: 01/07/2016

LGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**7**	**35**	**508**	14	16	0	0	1	4	2	255
2	**31**	**14**	**74**	**1071**	136	155	0	0	6	37	22	2493
3	**107**	**46**	**2**	**29**	23	27	0	0	1	6	4	429
4	**612**	**913**	**136**	**166**	16	19	0	0	1	4	3	298
5	6	226	10	83	1	687	19	0	60	0	19	404
6	5	181	8	67	621	6	14	0	11	0	12	51
7	0	17	1	6	0	0	0	0	0	0	0	0
8	0	1	0	0	7	0	3	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	17
10	0	0	0	0	2	2	0	0	1	0	0	2
11	1	44	2	16	48	13	4	0	0	0	1	8
12	59	2156	91	794	408	90	3	31	0	0	16	1

ANPR
From Internal Zone, applying ANPR proportions
To Internal Zone, applying ANPR proportions
TCs

HGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**0**	**1**	**19**	2	0	0	0	0	1	1	22
2	**3**	**2**	**4**	**59**	29	5	1	0	2	12	9	365
3	**2**	**2**	**0**	**1**	3	1	0	0	0	1	1	40
4	**17**	**49**	**7**	**10**	2	0	0	0	0	1	1	31
5	0	34	0	11	1	25	6	1	11	0	5	59
6	0	9	0	3	41	0	1	0	1	0	1	5
7	0	4	0	1	0	0	0	0	0	0	0	0
8	0	1	0	0	1	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	7
10	0	0	0	0	1	1	0	0	1	0	0	1
11	0	10	0	3	3	1	3	0	0	0	0	1
12	2	333	2	109	68	0	0	0	0	0	0	0

Please Note: Vehicles have been re-assigned to zone 10 in the model as zone 9 is a model entry only and does not allow vehicles to exit the network.

Prepared by:	Irene Echeverria	01/07/2016
Checked by:	Marino Gonzalez	07/07/2016

M1 J15a VISSIM Validation - PM O-D Matrix

AECOM

Project Name: HESPA M12 M1 J15a and J15 Study
Subject: M1 J15&15a AM O-D Matrices
Date: 01/07/2016

LGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**7**	**35**	**508**	14	16	0	0	1	4	2	255
2	**31**	**14**	**74**	**1071**	136	155	0	0	6	37	22	2493
3	**107**	**46**	**2**	**29**	23	27	0	0	1	6	4	429
4	**612**	**913**	**136**	**166**	16	19	0	0	1	4	3	298
5	6	226	10	83	1	687	19	0	60	0	19	404
6	5	181	8	67	621	6	14	0	11	0	12	51
7	0	17	1	6	0	0	0	0	0	0	0	0
8	0	1	0	0	7	0	3	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	17
10	0	0	0	0	2	2	0	0	1	0	0	2
11	1	44	2	16	48	13	4	0	0	0	1	8
12	59	2156	91	794	408	90	3	31	0	0	16	1

ANPR
From Internal Zone, applying ANPR proportions
To Internal Zone, applying ANPR proportions
TCs

HGVs	1	2	3	4	5	6	7	8	9	10	11	12
1	**0**	**0**	**1**	**19**	2	0	0	0	0	1	1	22
2	**3**	**2**	**4**	**59**	29	5	1	0	2	12	9	365
3	**2**	**2**	**0**	**1**	3	1	0	0	0	1	1	40
4	**17**	**49**	**7**	**10**	2	0	0	0	0	1	1	31
5	0	34	0	11	1	25	6	1	11	0	5	59
6	0	9	0	3	41	0	1	0	1	0	1	5
7	0	4	0	1	0	0	0	0	0	0	0	0
8	0	1	0	0	1	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	7
10	0	0	0	0	1	1	0	0	1	0	0	1
11	0	10	0	3	3	1	3	0	0	0	0	1
12	2	333	2	109	68	0	0	0	0	0	0	0

Please Note: Vehicles have been re-assigned to zone 10 in the model as zone 9 is a model entry only and does not allow vehicles to exit the network.

Prepared by:	Irene Echeverria	01/07/2016
Checked by:	Marino Gonzalez	07/07/2016

Appendix E – Final Calibration

Calibration - Entry Flows - M1 Jct15 & 15a Study AM Peak

AECOM

Project Name: Highways England Spatial Planning Arrangement
Project Number: 60504781
Subject: M1 Jct15 & 15a - Calibration Entry Flows
Date: Aug-16

M1 Jct15 & 15a Study

Matrix Value Reference
Reference: \\Ukbhm2fp002\ukbhm2fp001-v1tp\TP\PROJECT\Traffic - HESPA - 16\Studies\M12. M1 J15 & 15A Study\03 EXECUTION\09 Calculations\02 O-D Matrices
Spreadsheet: AM OD Matrices - Peak
Tab: 1. AM Summary

AM Peak - LGVs

Parking Lot	Entry Zone		Entry Flow 0730-0830		Difference		
	Zone	Location	Matrix	Modelled	Value	%	< 5%?
1	1	A508 South	915	915	0	0%	Y
3	2	M1 South East	3038	3037	-1	0%	Y
5	3	Saxon Avenue NE	602	602	0	0%	Y
7	4	A45 North	2359	2374	15	1%	Y
10	5	A43 South	1180	1168	-12	-1%	Y
111	6	A5123 North	1572	1552	-19	-1%	Y
13	7	EB Services Area - Model Entry	27	28	1	2%	Y
16 & 17	9	WB Services Area Exit	13	13	0	-3%	Y
20	11	Swan Valley Way NW	110	107	-3	-3%	Y
22	12	M1 North West	3605	3600	-4	0%	Y
Level of Calibration Achieved =					Difference < 5% = 10 Difference > 5% = 0 10		**100.00%**

AM Peak - HGVs

Parking Lot	Entry Zone		Entry Flow 0730-0830		Difference		
	Zone	Location	Matrix	Modelled	Value	%	< 5%?
1	1	A508 South	71	72	1	1%	Y
3	2	M1 South East	602	601	-1	0%	Y
5	3	Saxon Avenue NE	60	60	0	1%	Y
7	4	A45 North	168	167	-1	-1%	Y
10	5	A43 South	105	104	-1	-1%	Y
111	6	A5123 North	129	126	-3	-3%	Y
13	7	EB Services Area Exit	6	6	0	0%	Y
16 & 17	9	WB Services Area Exit	4	4	0	0%	Y
20	11	Swan Valley Way NW	16	16	0	-2%	Y
22	12	M1 North West	871	867	-4	0%	Y
Level of Calibration Achieved =					Difference < 5% = 10 Difference > 5% = 0 10		**100.00%**

AM Peak - All Vehicles

Parking Lot	Entry Zone		Entry Flow 0730-0830		Difference		
	Zone	Location	Matrix	Modelled	Value	%	< 5%?
1	1	A508 South	986	991	5	1%	Y
3	2	M1 South East	3639	3638	-1	0%	Y
5	3	Saxon Avenue NE	662	664	2	0%	Y
7	4	A45 North	2527	2527	0	0%	Y
10	5	A43 South	1285	1272	-13	-1%	Y
111	6	A5123 North	1701	1679	-21	-1%	Y
13	7	EB Services Area Exit	33	34	1	3%	Y
16 & 17	9	WB Services Area Exit	17	17	0	0%	Y
20	11	Swan Valley Way NW	127	123	-4	-3%	Y
22	12	M1 North West	4475	4467	-8	0%	Y
Level of Calibration Achieved =					Difference < 5% = 10 Difference > 5% = 0 10		**100.00%**

Prepared by:	**Matthew Rainsford**	09/08/2016
Checked by:	**Irene Echeverria**	15/08/2016

Calibration - Entry Flows - M1 Jct15 & 15a Study PM Peak

AECOM

Project Name: Highways England Spatial Planning Arrangement
Project Number: 60504781
Subject: M1 Jct15 & 15a - Calibration Entry Flows
Date: Aug-16

M1 Jct15 & 15a Study

Matrix Value Reference
Reference: \\Ukbhm2fp002\ukbhm2fp001-v1tp\TP\PROJECT\Traffic - HESPA - 16\Studies\M12. M1 J15 & 15A Study\03 EXECUTION\09 Calculations\02 O-D Matrices
Spreadsheet: PM OD Matrices - Peak
Tab: 1. PM Summary

PM Peak - LGVs

Parking Lot	Entry Zone		Entry Flow 1645-1745		Difference		
	Zone	Location	Matrix	Modelled	Value	%	< 5%?
	1	A508 South	841	842	2	0%	Y
	2	M1 South East	4040	4039	-1	0%	Y
	3	Saxon Avenue NE	674	674	0	0%	Y
	4	A45 North	2168	2168	0	0%	Y
	5	A43 South	1515	1496	-19	-1%	Y
	6	A5123 North	975	962	-13	-1%	Y
	7	SB Exit out of Northampton Roadchef Service Area	25	24	-1	-3%	Y
	9	NB Exit out of Northampton Roadchef Service Area	17	17	0	2%	Y
	11	Swan Valley Way NW	137	133	-4	-3%	Y
	12	M1 North West	3648	3646	-2	0%	Y
Level of Calibration Achieved =					Difference < 5% =	10	**100.00%**
					Difference > 5% =	0	
						10	

PM Peak - HGVs

Parking Lot	Entry Zone		Entry Flow 1645-1745		Difference		
	Zone	Location	Matrix	Modelled	Value	%	< 5%?
	1	A508 South	46	46	0	1%	Y
	2	M1 South East	490	490	0	0%	Y
	3	Saxon Avenue NE	51	51	0	-1%	Y
	4	A45 North	119	118	-1	0%	Y
	5	A43 South	153	147	-6	-4%	Y
	6	A5123 North	61	60	-1	-1%	Y
	7	SB Exit out of Northampton Roadchef Service Area	5	5	0	-8%	N
	9	NB Exit out of Northampton Roadchef Service Area	7	7	0	-2%	Y
	11	Swan Valley Way NW	21	18	-3	-15%	N
	12	M1 North West	514	514	0	0%	Y
Level of Calibration Achieved =					Difference < 5% =	8	**80.00%**
					Difference > 5% =	2	
						10	

PM Peak - All Vehicles

Parking Lot	Entry Zone		Entry Flow 1645-1745		Difference		
	Zone	Location	Matrix	Modelled	Value	%	< 5%?
	1	A508 South	886	892	6	1%	Y
	2	M1 South East	4530	4529	-1	0%	Y
	3	Saxon Avenue NE	726	727	1	0%	Y
	4	A45 North	2286	2287	1	0%	Y
	5	A43 South	1668	1643	-25	-2%	Y
	6	A5123 North	1036	1024	-12	-1%	Y
	7	SB Exit out of Northampton Roadchef Service Area	30	29	-1	-4%	Y
	9	NB Exit out of Northampton Roadchef Service Area	24	24	0	1%	Y
	11	Swan Valley Way NW	158	151	-7	-4%	Y
	12	M1 North West	4162	4160	-2	0%	Y
Level of Calibration Achieved =					Difference < 5% =	10	**100.00%**
					Difference > 5% =	0	
						10	

Summary
From the tables above we can see that we achieved a 100% level of calibration between the averaged VISSIM model outputs and the Matrices inputted into the AM VISSIM model.

Prepared by:	**Matthew Rainsford**	10/08/2016
Checked by:	**Irene Echeverria**	15/08/2016

Appendix F – Journey Time Validation

AM Journey Time Model Validation - M1 Jct15 & 15a Study

AECOM

Project: HESPA - M1 Jct15 & 15a Study
Subject: AM Journey Time Validation
Job Number: 60504781
HA Reference: M12
Date: Aug-16

M1 Jct15 & 15a VISSIM Model

AM Peak Observed Data Source: \\Ukbhm2fp002\ukbhm2fp002-v1\p\TP\PROJECT\Traffic - HESPA - 16\Studies\M12_M1 J15 & 15A Study\03 EXECUTION\08 Modelling\03 VISSIM\01 Base Year\02 Inputs\08 Journey Times\2. Data Analysis\Step 3. Data Analysis & Routes\3. M1 J15 JT Routes.xlsx

AM Peak - All Vehicles

JT Marker Number	Site				Journey Time (s) 0715-0815			Difference			Car Journey Time (s) 0730 - 0830		Modelled within Min/Max
	From		To		Observed	Modelled Avg	Percentage	Validated	Absolute	Validated	Observed Min	Observed Max	
1	Zone 1	A508 Northampton Rd South	Zone 2	M1 Mainline South	219	220	0%	Y	1	Y	112	488	Y
2			Zone 4	A45 London Rd North	165	168	2%	Y	3	Y	81	379	Y
3			Zone 5	A43 South	349	398	14%	Y	49	Y	208	599	Y
4	Zone 2	M1 Mainline South	Zone 4	A45 London Rd North	189	201	6%	Y	12	Y	116	384	Y
5			Zone 5	A43 South	320	363	14%	Y	43	Y	227	495	Y
6			Zone 6	A5123 North	318	356	12%	Y	38	Y	229	515	Y
7			Zone 12	M1 Mainline North	271	305	13%	Y	34	Y	205	403	Y
8	Zone 4	A45 London Rd North	Zone 1	A508 Nothampton Rd South	145	111	-24%	N	-34	Y	54	289	Y
9			Zone 12	M1 Mainline North	353	330	-7%	Y	-23	Y	207	598	Y
10	Zone 5	A43 South	Zone 1	A508 Nothampton Rd South	385	390	1%	Y	5	Y	235	815	Y
11			Zone 2	M1 Mainline South	367	364	-1%	Y	-3	Y	254	769	Y
12			Zone 6	A5123 North	121	122	1%	Y	1	Y	85	229	Y
13			Zone 12	M1 Mainline North	146	159	9%	Y	13	Y	109	241	Y
14	Zone 6	A5123 North	Zone 5	A43 South	143	137	-4%	Y	-6	Y	88	219	Y
15	Zone 7	EB Service Area	Zone 2	M1 Mainline South	255	254	0%	Y	0	Y	177	546	Y
16	Zone 11	Swan Valley Way North	Zone 2	M1 Mainline South	274	269	-2%	Y	-4	Y	191	573	Y
17			Zone 5	A43 South	135	129	-4%	Y	-6	Y	78	234	Y
18	Zone 12	M1 Mainline North	Zone 2	M1 Mainline South	362	360	-1%	Y	-2	Y	251	801	Y
19			Zone 4	A45 London Rd North	374	352	-6%	Y	-21	Y	244	843	Y
20			Zone 5	A43 South	258	260	1%	Y	3	Y	162	505	Y

Validation Summary

AM Peak - All

Percentage of journeytimes within 15% =	19 1	95%
Percentage of journeytimes within 60 seconds =	20 0	100%
Percentage of journeytimes sections within min/max modelled range =	20 0	100%

Summary

We have run the AM model for Journey Time Validation and compared them to journey times collected from the site. Form the results collected above we can see that the AM model has achieved the DMRB critieria for the journey time difference within 15% and difference within 60 seconds of the observed journey times. Based on this the AM model has validated.

Prepared By:	Matthew Rainsford	10/08/2016
Checked By:	Irene Echeverria	15/08/2016

PM Journey Time Model Validation - M1 Jct15 & 15a Study

AECOM

Project: HESPA - M1 Jct15 & 15a Study
Subject: PM Journey Time Validation
Job Number: 60504781
HA Reference: M12
Date: Aug-16

M1 Jct15 & 15a VISSIM Model

PM Peak Observed Data Source: \\Ukbhm2fp002\ukbhm2fp002-v1\p\TP\PROJECT\Traffic - HESPA - 16\Studies\M12_M1 J15 & 15A Study\03 EXECUTION\08 Modelling\03 VISSIM\01 Base Year\02 Inputs\08 Journey Times\2. Data Analysis\Step 3. Data Analysis & Routes\3. M1 J15 JT Routes for Validation.x

PM Peak - All Vehicles

JT Marker Number	Site				Journey Time (s) 1645-1745			Difference			Journey Time (s) 1645-1745		Modelled within Min/Max
	From		To		Observed	Modelled Avg	Percentage	Validated	Absolute	Validated	Observed Min	Observed Max	
1	Zone 1	A508 Northampton Rd South	Zone 2	M1 Mainline South	287	215	-25%	N	-72	N	109	521	Y
2			Zone 4	A45 London Rd North	247	181	-27%	N	-66	N	83	459	Y
3			Zone 5	A43 South	463	415	-10%	Y	-48	Y	222	913	Y
4	Zone 2	M1 Mainline South	Zone 4	A45 London Rd North	269	196	-27%	N	-74	N	130	564	Y
5			Zone 5	A43 South	373	367	-2%	Y	-6	Y	237	759	Y
6			Zone 6	A5123 North	373	364	-3%	Y	-10	Y	235	784	Y
7			Zone 12	M1 Mainline North	323	309	-4%	Y	-14	Y	214	688	Y
8	Zone 4	A45 London Rd North	Zone 1	A508 Nothampton Rd South	114	102	-11%	Y	-12	Y	55	239	Y
9			Zone 12	M1 Mainline North	362	336	-7%	Y	-26	Y	217	776	Y
10	Zone 5	A43 South	Zone 1	A508 Nothampton Rd South	389	381	-2%	Y	-8	Y	245	797	Y
11			Zone 2	M1 Mainline South	351	358	2%	Y	7	Y	259	665	Y
12			Zone 6	A5123 North	122	124	1%	Y	1	Y	84	221	Y
13			Zone 12	M1 Mainline North	163	163	0%	Y	0	Y	106	307	Y
14	Zone 6	A5123 North	Zone 5	A43 South	122	123	1%	Y	1	Y	82	185	Y
15	Zone 7	EB Service Area	Zone 2	M1 Mainline South	237	247	4%	Y	11	Y	177	452	Y
16	Zone 11	Swan Valley Way North	Zone 2	M1 Mainline South	256	261	2%	Y	5	Y	191	487	Y
17			Zone 5	A43 South	151	154	2%	Y	3	Y	78	265	Y
18	Zone 12	M1 Mainline North	Zone 2	M1 Mainline South	335	349	4%	Y	13	Y	254	662	Y
19			Zone 4	A45 London Rd North	358	348	-3%	Y	-9	Y	249	732	Y
20			Zone 5	A43 South	267	284	6%	Y	17	Y	166	488	Y

Validation Summary

PM Peak - All

Percentage of journey times within 15% =	17 3	85%
Percentage of journey times within 60 seconds =	17 3	85%
Percentage of journey times sections within min/max modelled range =	20 0	100%

Summary

We have run the PM model for Journey Time Validation and compared them to journey times collected from the site. Form the results collected above we can see that the PM model has achieved the DMRB critieria for the journey time difference within 15% and difference within 60 seconds of the observed journey times. Based on this the PM model has validated.

Prepared By:	Matthew Rainsford	10/08/2016
Checked By:	Irene Cruchaga	15/08/2016

About AECOM

AECOM (NYSE: ACM) is built to deliver a better world. We design, build, finance and operate infrastructure assets for governments, businesses and organizations in more than 150 countries.

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