CAPITA

South East Blackburn Growth Corridor

Local Model Development and Validation Report
September 2019

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Quality Management

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1. Introduction

1.1 Report Context

Capita Real Estate and Infrastructure Ltd has been commissioned by Blackburn with Darwen Borough Council (BwDBC) to develop a business case for a number of highway improvement measures across south east Blackburn, specifically along the A6077 Haslingden Road and along the B6231 Blackamoor Road around Fishmoor.

As part of the business case development process, an accurate baseline model of traffic flow conditions on the local highway network is required to effectively model and appraise the relative performance of each aspect of the proposed scheme. This report details the model development, calibration and validation process undertaken to ensure the baseline model falls in line with current guidelines, is an accurate reflection of existing traffic flow conditions and can be considered fit for purpose.

1.2 Highway Network Context

1.2.1 The A6077 Haslingden Road

The A6077 Haslingden Road forms a main arterial route across south east Blackburn connecting the town centre to the M65 motorway. Its route takes it south east away from the town centre providing access to RBH and a number of industrial estates before terminating at the M65 Junction 5. Traffic flows along the route have steadily increased since the M65 opened in 1997. The A6077 Haslingden Road and junctions approaching the M65 Junction 5 have been intermittently upgraded and improved over the years as traffic flows have increased.

A clear tidal flow movement along the A6077 Haslingden Road across AM and PM peak travel periods can be identified, with the dominant traffic movement towards Blackburn town centre, RBH and Shadsworth Business Park during the AM peak. The tidal flow reverses during the PM peak period, with the dominant flow outbound from these locations towards guide junction and the M65 Junction 5.

The A6077 Haslingden Road route suffers from congestion and link capacity issues during both AM and PM travel periods in the direction of tidal flow. During the AM peak, traffic is constrained where the route merges from two lanes to a single lane on the north westbound exit from its junction with Lions Drive, as well as at other junctions along the route at Shadsworth Road and the Royal Blackburn Hospital (RBH). During the PM peak, congestions and blocking back

occurs along the entire length of Haslingden Road between the M65 Junction 5 and its junction with Old Bank Lane, suggesting link and junction capacity issues along the route.

1.2.2 The B6231 Blackamoor Road and Roman Road

The Roman Road/ B6231 Blackamoor Road junction forms a four-arm signalised junction to the south west of Haslingden Road. Each approach arm has a single lane, except for the Roman Road approach from the south, which has two lanes. The junction is constrained by the proximity of nearby properties, creating tight vehicle turning radii through the junction and limiting potential options for widening approach arms to increase junction capacity. Extensive queuing and delay frequently occurs during both AM and PM peak travel periods along all approach arms to the junction, notably along the Stopes Brow and Roman Road (southbound) approaches during the AM period, and the Blackamoor Road and Roman Road (southbound) approaches during the PM period.

1.3 Proposed Scheme Aims and Objectives

The proposed scheme aims to alleviate and reduce existing congestion and capacity issues along the A6077 Haslingden Road during peak travel periods, as well as improve traffic flow conditions along Blackamoor Road and at the Roman Road/ Blackamoor Road intersection. It is also expected that the proposed scheme will support housing and employment growth, both locally along the Haslingden Road corridor and more widely across the borough. Specifically, the scheme consists of the following highway interventions across south east Blackburn:

- Widening of the A6077 Haslingden Road between Lions Drive and Shadsworth Road to four lanes with associated geometric improvements at junctions;
- Delivery of the Blackamoor Link Road including two new junctions at Roman Road and Blackamoor Road and associated changes at the existing Roman Road / Blackamoor Road junction; and
- Improvements to the Haslingden Road / Old Bank Lane junction to also include a new access to the Royal Blackburn Teaching Hospital.

Works are proposed to start in early 2020 and be complete by March 2021.

The project will:

- Enable Blackburn with Darwen Borough Councils growth ambitions to be realised without adversely impacting on the existing level of service (congestion) provided by the Haslingden Road corridor and adjoining local highway network;

- Improve air quality at the Blackamoor Road / Roman Road junction to bring nitrogen dioxide levels within the (annual mean) objective as specified in the Air Quality (England) Regulations 2000 (as amended) to enable the revocation of the Blackamoor AQMA;
- Enable further development of employment opportunities by facilitating the delivery of over 47,894sqm of new commercial floorspace creating approximately 3,862 jobs;
- Supporting future housing growth by enabling the delivery of approximately 643 additional houses within the borough; and
- Improve the facilities for walking and cycling along Haslingden Road, providing a safer environment to encourage participation in active travel.

Major transport improvements will act as the catalyst for new housing and commercial development, contributing to the delivery of the Council's adopted Local Plan targets for new housing, businesses and jobs.

In order to meet these aims and help to address the identified issues on the local highway network, the following SMART objectives have been derived:

- **Increase the Capacity along A6077 Haslingden Road -** Haslingden Road currently features two to three lanes between Guide and Royal Blackburn Hospital. The scheme assumes an increase in the number of lanes along Haslingden Road to three and four therefore directly increasing the capacity of the corridor;
- **Aid Optimisation of the Local Road Network** - The scheme is expected to reduce the delays at the Blackamoor Road/ Roman Road junction, therefore reducing total journey times along the A6077 and B6231, additional improvements at junctions along the Haslingden Road corridor will further improve the local road network;
- **Support Future Housing Growth** - The Core Strategy sets out a housing requirement over the plan period 2011-2026 of 9,365 net additional dwellings. Optimising operation of the A6077 Haslingden Road and B6231 Blackamoor Road corridors creates an opportunity to unlock new areas of land for potential developments;
- **Support Development of Employment Opportunities** - Optimising operation of the A6077 Haslingden Road and B6231 Blackamoor Road corridors creates an opportunity to unlock new areas of land for potential development with strong connections to the SRN, boosting the region’s economy; and
- **Improve the Local Air Quality at Blackamoor AQMA** - Reduced vehicle emissions from reduction in delay and queueing on the local highway network shall improve the overall air quality in the area. In addition, construction of Fishmoor Link (and

subsequently rerouting the traffic from Blackamoor Road) is expected to directly tackle the air quality issues in the AQMA No 6 Blackamoor local Air Quality Management Area.

Further details of specific scheme objectives can be found in the main business case document.

1.4 Model Scope and Purpose

Baseline modelling of the improvement scheme has been undertaken using PTV VISSIM. The modelling study area is considered to cover the extent of the direct influence on the highway network expected from each of the proposed interventions, including all approach arms to affected junctions and key highway link sections.

The key routes and junctions forming the local highway network study area across south east Blackburn are detailed as follows:

- **The A6077 Haslingden Road** – From its junction with Old Bank Lane in the north west to its junction with the M65 Junction 5 in the south east. The following junctions with the A6077 Haslingden road along its route have been modelled directly:
    - Old Bank Lane;
    - The Royal Blackburn Hospital (RBH);
    - Shadsworth Road;
    - The Soccerdome and the Eurogarages Petrol Filling Station (PFS);
    - Lions Drive (Beehive Junction);
    - Blackamoor Road/ School Lane (Guide Junction); and
    - The M65 Junction 5, including M65 north east bound and south west bound approach arms.
- **The B6231 Blackamoor Road** – From its junction with Roman Road to the west and its junction with the A6077 Haslingden Road to the east. The following junctions along its route have been modelled directly:
    - Roman Road, including the Stopes Brow approach arm to the junction; and
    - Walker Road.

The baseline modelled network also includes the Newfield drive junction with Roman Road to the north of the Roman Road/ Blackamoor Road junction. A detailed plan view of the study area highway links forming part of the baseline network can be found in Figure 1.1 below.

Figure 1.1 - Modelling Study Area

The model will be used to test the impact of future forecast changes in transport demand and potential options for changes in transport network supply.

From the developed baseline model outlined in this report, relative journey time and vehicle delay changes between intervention options and across future forecast years will be estimated. Journey time savings between modelled scenarios will be used to appraise the proposed highway and junction interventions at various locations across the defined study area. These will inform and guide the development of a business case and economic appraisal of the proposed South East Blackburn Growth Corridor Scheme.

1.5 Report Structure

The remainder of this report will take the following structure:

Chapter 2: Modelling Data Collection
Chapter 3: Model Construction and Development
Chapter 4: Model Calibration and Validation
Chapter 5: Summary and Conclusions

2. Modelling Data Collection

2.1 Traffic Survey Data

Manual Classified Count (MCC) data has been obtained for a number of significant junctions along the A6077 Haslingden Road Corridor. These were undertaken in May 2017 for AM (07:00 – 10:00) and PM (16:00 – 19:00) time periods in support of a local planning application. A total of six junctions along Haslingden Road between the M65 junction 5 to the south and the RBH access junction to the north were surveyed, these are detailed as follows:

- M65 Junction 5 Roundabout (including both M65 mainline off slips);
- Haslingden Road / Blackamoor Road / School Lane (B6321) Junction (Guide);
- Haslingden Road / Lions Drive Roundabout (Beehive Junction);
- Haslingden Road / DW Sports Soccerdome Access Junction;
- Haslingden Road / Shadsworth Road Junction; and
- Haslingden Road / Royal Blackburn Hospital Access Junction.

Additionally, along the A6077 Haslingden Road, in June 2015 an MCC was undertaken at its junction with Old Bank Lane, covering an AM time period between 07:00 – 09:00 and a PM time period between 16:00 – 18:00.

MCC count data has been obtained for the Roman Road/ Blackamoor Road junction, as well as the Walker Road junction with Blackamoor Road. These were undertaken in March 2019 and were undertaken in support of a local planning application along Blackamoor Road. These were also undertaken over an AM time period between 07:00 – 09:00 and a PM time period between 16:00 – 18:00, and recorded two vehicle classes, light vehicles and heavy vehicles.

2.2 Journey Time, Speed and Congestion Data

Traffic journey time and speed data across a number of key links across the study area has been obtained from TomTom for the month of April 2019. These Routes are detailed below and highlighted in Figure 2.1 overleaf:

- **A6077 Haslingden Road:** Between its junction with Grimshaw Park to the north and the M65 Junction 5 to the south (defined in red);
- **B6231 Blackamoor Road:** Between its junction with Haslingden Road to the east and its junction with Roman Road to the west (defined in blue); and
- **Roman Road:** Between its junction with Grimshaw Park to the north and its junction with Blackamoor Road to the south (defined in yellow).

Data has been obtained for both directions along specified routes, providing journey time and speed data for all passenger vehicles traveling along the defined route with an active TomTom device. Data is averaged across a three-day (Tuesday - Thursday) period, providing weekday average speeds for various intra-day time intervals as defined below:

- 07:00 – 08:00;
- 08:00 – 09:00;
- 09:00 – 10:00;
- 10:00 – 16:00;
- 16:00 – 17:00; and
- 17:00 – 18:00.

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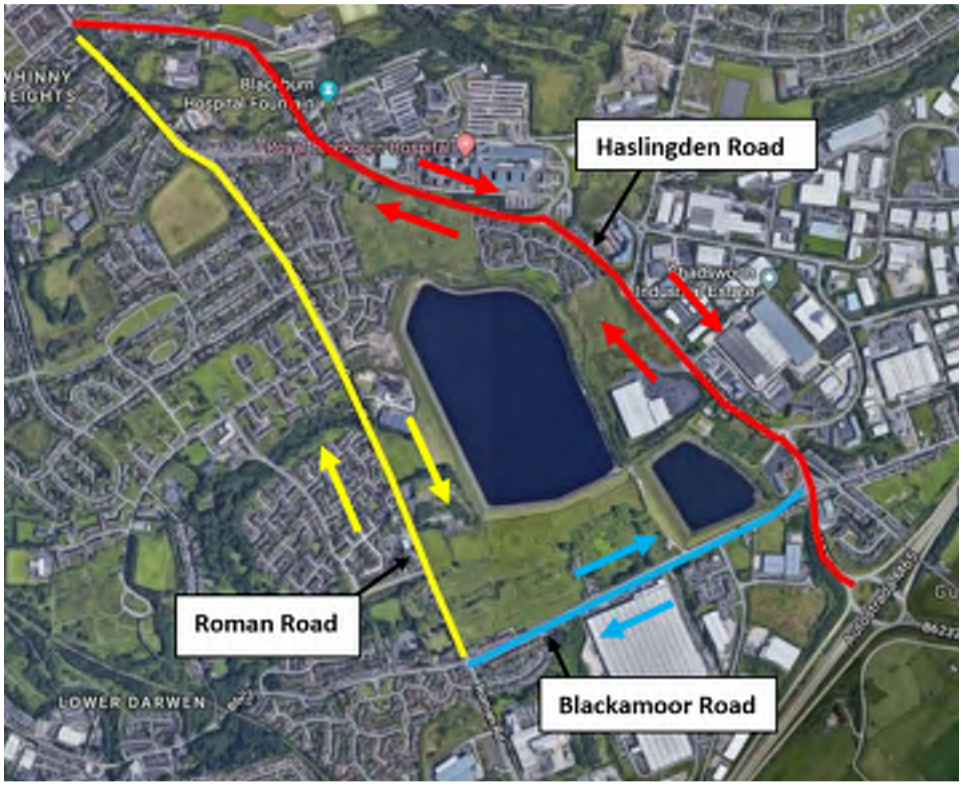
Figure 2.1 - TomTom Data Routes



TomTom journey time data will be used during model validation to ensure the relative delay along key modelled link sections is representative and falls in line with observed baseline conditions.

2.3 Site Visits

Several site visits and site drive-throughs have been undertaken during peak travel periods to ensure network characteristics, network layout and driver behaviour are accurate and reflective

of baseline network conditions. On-site observations informed calibration of site-specific driver behaviours at certain locations. A number of other historical site visits to Haslingden Road have been undertaken over recent years to aid model development of the M65 Junction 5 VISSIM model also developed by Capita.

2.4 Public Transport Service Data

A review of bus routes along the Haslingden Road corridor and across the wider south east Blackburn study area concluded that there are not sufficient levels of bus provision to warrant explicit modelling of timetabled bus services through the network. Any Personal Service Vehicles (PSVs) identified in MCC counts have been included in the vehicle composition as a proportion of HGV traffic at each vehicle input.

2.5 Traffic Signal Data

Baseline traffic signal specifications have been obtained from the Blackburn with Darwen Local Authority for all significant signalised junctions across the study area, including:

- Roman Road/ Blackamoor Road junction;
- Blackamoor Road/ Walker Road junction;
- Haslingden Road/ Blackamoor Road/ School Lane (Guide) junction; and
- Part time signals at the M65 Junction 5 roundabout, operating during AM and PM peak periods on the following approach arms:
    - The A6077 Haslingden Road approach
    - The north east bound M65 off-slip; and
    - The south west bound M65 off-slip.

3. Model Construction and Development

3.1 Modelling Software

Microsimulation modelling software VISSIM v11.00-09 was used to develop the baseline model across the defined study area around the proposed highway intervention. VISSIM software is part of PTV Vision transport modelling suite. PTV state that "*the VISSIM software offers flexibility in several respects: the concept of links and connectors allows users to model geometries with any level of complexity. Attributes for driver and vehicle characteristics enable individual parameterisation. Furthermore, a large number of interfaces provide seamless integration with other systems for signal controllers, traffic management or emissions models*". In Addition, Transport for London (TfL) modelling guidelines[1] state that VISSIM is appropriate for use when "*over-saturated conditions exist, and particularly where exit-blocking occurs or where queues interact with other facilities*".

Therefore, VISSIM is considered to be the most appropriate tool available for baseline modelling of the defined highway network, as well as the relative congestion and blocking back identified at a number of locations across the study area during peak travel periods. The model has been developed in accordance with current best practice guidance on micro-simulation modelling and guidelines provided in the VISSIM manual.

3.2 Network Construction and Development

The base network of the existing highway layout has been constructed based on default background mapping and satellite imagery within VISSIM. The extent of the VISSIM network is shown in Figure 3.1 overleaf.

Checks undertaken on site visits have been made to ensure the network layout, positioning, lane numbers and lane lengths defined within VISSIM are in line with the existing conditions in the base year. The locations of stop lines and give-way lines have also been positioned in accordance with default background mapping and on-site observations.

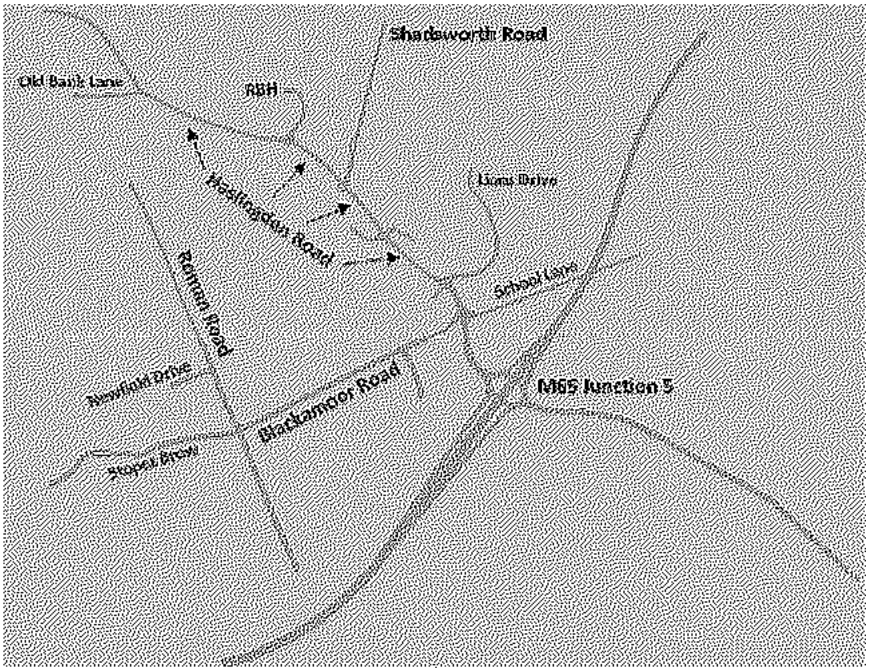
A combination of conflict areas and priority rules were used at different locations across the network where traffic is required to give way. The relative use of each was dependent on

Site specific requirements and driver behaviour. Both conflict areas and priority rules were coded in accordance with guidance provided in the VISSIM manual, with adjustments made to

[1] http://content.tfl.gov.uk/traffic-modelling-guidelines.pdf

each during the model calibration process to ensure they provided an accurate reflection of driver behaviour (see Section 4.2).

Figure 3.1 - Extent of VISSIM Road Network



3.3 Base Year and Modelled Time Periods

The developed south east Blackburn baseline VISSIM model has been calibrated and validated to a 2019 base year.

Weekday morning (AM) and evening (PM) periods have been assessed, taken as 07:00 to 09:00 and 16:00 to 18:00 respectively. Each 7200 second assessment period covers an AM peak hour (07:30 – 08:30) and PM peak hour (16:30 – 17:30). Peak hours within each modelled period were established following a review of cumulative model input totals across hour periods within each modelled peak. These are summarised in Table 3.1 overleaf.

For the AM period, a clear peak hour between 07:30 – 08:30 can be identified, which contains the greatest vehicle input total to the network. For the PM period, both 16:15 – 17:15 and 16:30 – 17:30 hour periods give relatively similar peak vehicle input totals. 16:30 – 17:30 has been selected as the modelled peak hour to allow for a sufficient warm up period prior to assessment within each model run.

Table 3.1 - Peak Hour Identification Summary

AM		PM	
Hour Period	**Total Vehicle Input**	**Hour Period**	**Total Vehicle Input**
07:00 – 08:00	7145	**16:00 – 17:00**	7420
07:15 – 08:15	7610	**16:15 – 17:15**	7523
07:30 – 08:30	7834	**16:30 – 17:30**	7519
07:45 – 08:45	7684	**16:45 – 17:45**	7170
08:00 – 09:00	7396	**17:00 – 18:00**	6803

Model outputs for both time periods have been assessed based on the defined peak hour.

Models for both time periods have a 30-minute warm up period prior to the assessed peak hour and a 30-minute warm down period immediately after the assessed peak hour.

The network has been modelled under scenario management, with separate scenarios for AM and PM peak periods.

3.4 Traffic Modelling

3.4.1 Vehicle Inputs

Traffic is added to the network through vehicle inputs at each of the following locations:

1. The A6077 Haslingden Road (southbound)
2. Royal Blackburn Hospital
3. Shadsworth Road
4. Petrol Filling Station access
5. Lions Drive
6. School Lane
7. M65 South West Bound Off-slip
8. B6232 Haslingden Road
9. M65 North East Bound Off-slip
10. Roman Road South (northbound)
11. Stopes Brow
12. Newfield Drive
13. Roman Road North (southbound)
14. Willows Public House Access
15. Soccerdome Access Road
16. Old Bank Lane
17. Walker Road

MCC data at relevant junctions has been used to inform vehicle inputs to the network along appropriate approach arms.

For junctions not surveyed in 2019, a TEMPro growth factor for the Blackburn with Darwen authority area has been applied to MCC movements to growth values up to a 2019 base year. No significant traffic generating developments have been completed along Haslingden Road between 2017 and 2019 that would significantly alter the traffic distribution and movements along the route and across the wider network. As a result, a TEMPro growth factor between the survey year and the base year is considered sufficient to capture growth in baseline traffic.

Model validation has been undertaken against MCC data at each junction independently, growthed to a 2019 base year. A traffic flow diagram indicating Base year flows from MCC counts and relative flow constancy between junctions and individual MCCs can be found in Appendix A. This indicates a relatively strong level of flow consistency between counts across the identified study area, and as a result, there has been no requirement to adjust vehicle input demand at specific locations to account for disparity between count sites.

No MCC or traffic count data is available for Newfield Drive. Newfield drive forms a relatively minor residential access road giving a local social housing estate access to the wider highway network, with a relatively low number of traffic movements. Baseline vehicle input data for Newfield drive has been inferred from TRICS trip generation values derived for affordable housing and applied to the number of dwellings likely to gain access from to the wider highway network from Newfield Drive. The resulting traffic levels generated within the model are in line with levels of traffic observed on visits to the site. Relative flows into Newfield Drive have been derived using a similar methodology.

MCC values, recorded in 15-minute intervals have been converted into a vehicle per hour rate for input into VISSIM.

Within the modelled area, significant queueing and delay is known to occur, particularly along Haslingden Road (southbound) and Roman Road (southbound) during the PM peak period. To ensure accurate model validation in the PM model, the relative vehicle input demand from certain approach arms has been profiled to allow sufficient congestion to build within the 1800 second warm up period (16:00 – 16:30). Factors applied to vehicle inputs across each 15-minute interval can be found in Table 3.2 below.

Table 3.2 - PM Vehicle Input Profile Adjustment Factors

Vehicle Input	Model Time Interval							
			Assessed Peak Hour					
	0	900	1800	2700	3600	4500	5400	6300
The A6077 Haslingden Road (southbound)	1.10	1.20	1.20	1.10	0.90	0.90	0.90	0.80
Shadsworth Road	1.10	1.05	1.00	1.00	1.00	1.00	0.95	0.90
Roman Road North (southbound)	1.10	1.05	1.00	1.00	1.00	1.00	0.95	0.90

3.4.2 Relative Vehicle Composition

VISSIM models individual vehicles that are grouped into vehicle types and then vehicle classes. Two vehicle types, Car and Heavy Goods Vehicle (HGV) have been included within baseline modelling. Cars and Light Goods Vehicles (LGVs) have been modelled as a car vehicle class. As mentioned in Section 2.5, bus movements are low across the study area, and have been included as a proportion of the HGV vehicle composition at each vehicle input.

Relative vehicle compositions for cars and HGV classes for each vehicle input have been informed by MCC vehicle type splits. An average Car/ HGV proportion for the AM peak hour (07:30 – 08:30) and PM peak hour (16:30 - 17:30) was derived and applied to each vehicle input to the network.

3.4.3 Model Relative Flows

Static route choices at each junction have been used to determine relative flows and turning proportions across the network. These have been defined from MCC data available at each junction Static assignment is when vehicles are input directly and routes between origins and destinations are determined manually by the user.

A review of MCC data revealed no significant differences in turning proportions between car and HGV vehicle classes, so identical routing proportions have been used for both classes. Relative flow proportions have been determined for the established AM and PM peak hours within each modelled period, with relative flows applied across each 7200 second modelled period.

Slight adjustments were made to turning proportions across the network to ensure model calibration and validation with observed MCC data.

3.4.4 Traffic Signals

Traffic signal specifications of baseline conditions were obtained for all signalised junctions within the model defined in Section 2.5. Signal specifications, including phasing and staging plan, cycle times and inter-green times were coded into LinSig models of each signalised junction.

LinSig models optimised for Practical Reserve Capacity (PRC) to provide green times and timing offsets for signal heads across the VISSIM network. Part-time signals at the M65 Junction 5 were modelled under a single controller with multiple stage streams to provide co-ordinated signal timings around the junction. Slight adjustments were made to green times during the model calibration process to ensure delay and queueing matched observed and measured conditions.

3.4.5 Model Outputs and Analysis

A total of 10 nodes have been added to the VISSIM network at the locations detailed in Figure 3.2 overleaf and summarised as follows:

- 1) Haslingden Road/ Lions Drive Junction
- 2) Guide Junction
- 3) M65 Junction 5
- 6) Haslingden Road/ Old Bank Lane Junction
- 7) Haslingden Road/ RBH Junction
- 8) Haslingden Road/ Shadsworth Road Junction
- 11) Haslingden Road/ Soccerdome Junction
- 13) Roman Road/ Blackamoor Road Junction
- 15) Roman Road/ Newfield Drive Junction
- 16) Blackamoor Road/ Walker Road Junction

These will be used assess the relative performance of junctions across the network, including junction turning count validation and an estimate of delay on approach arms.

Figure 3.2 - Node Locations

Vehicle travel time counters were added to the VISSIM network along a number of routes to assess the relative modelled journey time as compared to analysed TomTom data. Further details can be found in Section 4.4.

4. Model Calibration and Validation

4.1 Introduction

It is necessary to calibrate and validate the base model to confirm that the model is fit for purpose for the evaluation and appraisal of the proposed scheme. Calibration involves changing the model set-up and behavioural characteristics to achieve a match between observed and modelled data. Model validation assesses the accuracy of the model by comparing traffic data from the model with other sources of traffic data that were not used during model development or calibration.

4.2 Model Calibration Process

4.2.1 Random Seed

Due to the stochastic nature of VISSIM, the model was run for 20 random seeds across both AM and PM modelled periods to account for natural random variation in traffic input profiles, driver behaviour and interactions between vehicles. TfL guidance on micro-simulation[2] states that "*random fluctuations occur in the results of the individual simulation runs. A more reliable assertion is only reached through averaging the results of enough simulation runs with different random seeds*" and "*Twenty seed runs are required in order to measure the Journey Time Reliability (JTR) of routes in the model*". Details of the random seeds used in modelling can be found in Table 4.1 below.

Table 4.1 - Random Seed Details

Initial Random Seed	5
Random Seed Increment	5
Number of Model Runs	20

4.2.2 Driver Behaviour and Link Types

The majority of links across the modelled area have been set to 'Urban (Motorised)', the default link behaviour type set in VISSIM. A number of link sections at the edge of the model forming the M65 Mainline have been set to 'Freeway (free lane section)'. The driver behaviour on a number of links approaching junctions where the route flares to multiple lanes have been

[2] http://content.tfl.gov.uk/map-v3-5-engineer-guide.pdf

adjusted following the advice at the link below3. This alters the driver behaviour on the given link to be more representative of vehicle movements on flared link sections.

4.2.3 *Vehicle Speeds and Reduced Speed Areas*

Desired Speed decisions were added to the network after each vehicle input, with desired speed distributions assigned based on the on-site observations of vehicle speeds and the speed limit of a given link section. Speed decision markers were also placed at other locations within the model to reflect a change of speed limit.

Reduced speed areas need to be used to model an area where speed is reduced, for example a bend or on approach to a junction to check it is safe to proceed. Reduced speed areas were applied to all relevant turns throughout the network, along turning movements through signalised junctions and on circulatory links at roundabouts. The desired speed distribution assigned to each reduced speed area was reflective of on-site observations of driver behaviour and the relative turning radii of each movement.

4.2.4 *Conflict Areas and Priority Rules*

A combination of conflict areas and priority rules were used at different locations across the network where traffic is required to give way. The relative use of each was dependent on-site specific requirements and driver behaviour. Both conflict areas and priority rules were coded following guidance provided in the VISSIM manual.

Driver behaviour during congested conditions has been informed by on site observations, with adjustments made to gap acceptance values and headway distances at give way lines to accommodate site specific behaviours (for example, lower gap acceptance values to represent more aggressive driver behaviour during congested conditions).

Priority rules were also added to circulatory links at certain locations at roundabouts to replicate traffic giving way to entering vehicles during congested conditions. These were added following onsite observations of queuing vehicles leaving gaps in traffic when stationary.

4.2.5 *Traffic Signals*

Traffic signal specifications for all signalised junctions across the modelled area have been provided by BwDBC as the local highway authority, including part time signals on specific approach arms the M65 Junction 5 roundabout. Signalised junctions optimised for capacity using LinSig, with green times from LinSig model outputs added into VISSIM. Slight adjustments were made to phase green times on a number of approach arms during the model

[3] https://www.multimodaluk.com/multimodal-technical-blog/2018/5/3/urban-flare-urban-merging-driver-behaviour

calibration process to ensure the model provided an accurate reflection of capacity, queueing and delay.

4.3 Model Validation – Vehicle Turning Flows

4.3.1 Turning Flow Validation Methodology

Model validation against turning flows at key junctions will be assessed against turning movements through each of the nodes identified in Figure 3.2. This will be undertaken during both AM and PM time periods against MCC count data available at each location. Validation has not been undertaken at Node 15, as no MCC data is available for Newfield Drive.

Across both time periods, where both modelled and MCC turning flows are zero, this movement has not been included in turning count validation statistics. Model turning flow values will be averaged across the 20 model runs within each peak period, within the defined AM and PM peak hours.

4.3.2 Turning Flow Validation Criteria

WebTAG does not provide explicit guidance for the calibration and validation of micro-simulation models, however the overall principles and criteria outlined for highway assignment modelling can be applied.

For vehicle turning flows the GEH statistic has been used to measure the effectiveness of the model calibration process. The GEH statistic is a form of the Chi-squared statistic that incorporates both relative and absolute errors. This is defined as follows:

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

Where: GEH is the GEH statistic;
M is the modelled flow; and
C is the observed flow.

As detailed in WebTAG Unit M3.1 Highway Assignment Modelling, acceptability guidelines for flows calibrated using the GEH statistic as GEH values < 5 in more than 85% of cases.

4.3.3 Turning Flow Validation Results

Overall network performance results for both time periods can be found in Appendix B. The results of model turning flow validation can be found in Appendix C and the AM and PM peak summaries in Table 4.2 for the AM assessment period and Table 4.3 for the PM assessment

period on the following pages. Both Table 4.2 and Table 4.3 highlight information on modelled and observed flow differences, the relative and absolute differences between modelled flows and MCC flows, as well as the GEH statistic for each movement.

The AM peak hour (Table 4.2) gives a total of 80 turning movements through all nodes across the network. All 80 movements have a GEH value below 5.0, giving 100% turning flow validation across the network. This meets the guideline 85% criteria outlined in WebTAG Unit M3.1. The greatest GEH value across turning movements within the network is 2.0, which indicates excellent turning flow validation during the AM peak model. This includes turning movements through key junctions where interventions are likely to take place, including the Roman Road/ Blackamoor Junction, as well as junctions along the A6077 Haslingden Road.

The PM peak hour (Table 4.3) gives a total of 81 turning movements through all nodes across the network. All 81 movements have a GEH value below 5.0, giving 100% turning flow validation across the network. This meets the guideline 85% criteria outlined in WebTAG Unit M3.1. The greatest GEH value across turning movements within the network is 3.6, which indicates excellent turning flow validation during the PM peak model. This includes turning movements through key junctions where interventions are likely to take place, including the Roman Road/ Blackamoor Junction, as well as junctions along the A6077 Haslingden Road.

Table 4.2 - AM Turning Count Validation Results Summary

Summary	**Total Movements**	80
	Total Within Criteria	80
	% Within Criteria	100%

Table 4.3 - PM Turning Count Validation Results Summary

Summary	**Total Movements**	81
	Total Within Criteria	81
	% Within Criteria	100%

4.4 Model Validation – Vehicle Travel Times

4.4.1 Vehicle Travel Time Validation Methodology

As detailed in Section 2.2, TomTom journey time data has been obtained along a number of key routes across south east Blackburn study area, as defined in Figure 2.1. Along each route, travel time data is disaggregated into short link segments, allowing a cumulative journey time along defined sections of the route to be calculated.

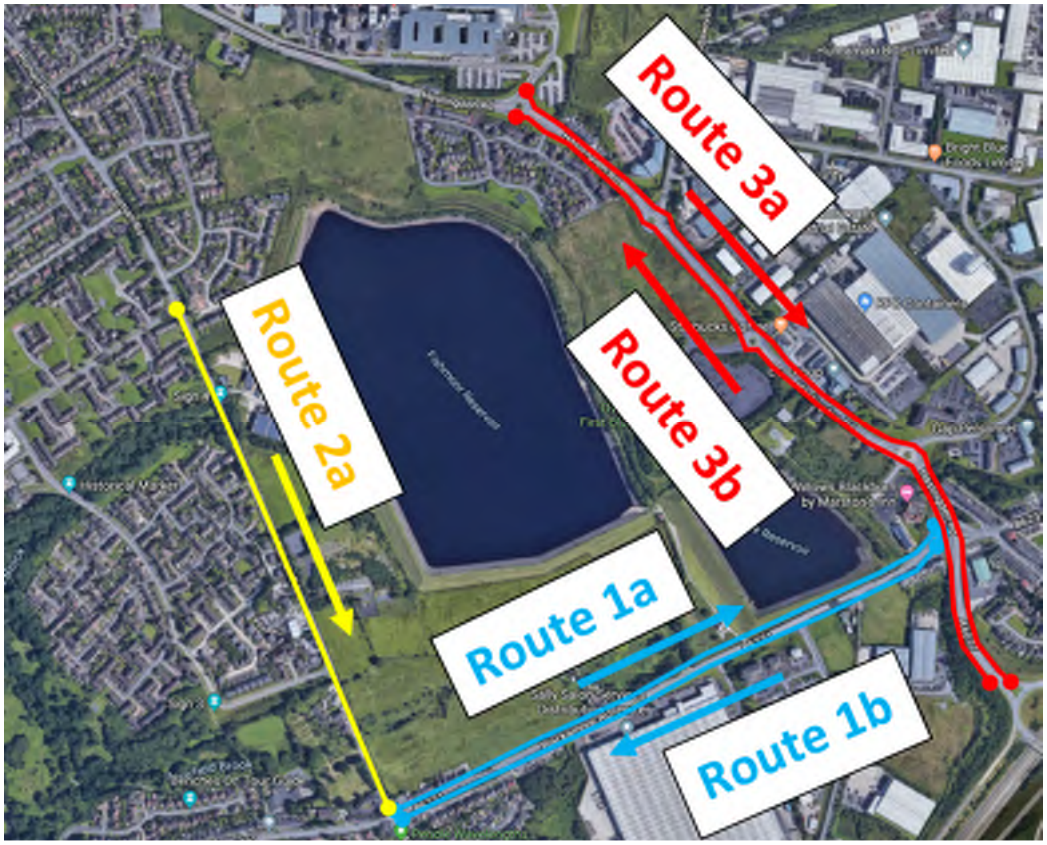
Within each of the TomTom travel time routes, a total of five journey time validation routes have been defined. These are shown below in Figure 4.1 overleaf and summarised as follows:

- **Route 1a – Blackamoor Road Eastbound** (between its junctions with Roman Road and the A6077 Haslingden Road);
- **Route 1b – Blackamoor Road Westbound** (between its junctions with the A6077 Haslingden Road and Roman Road);
- **Route 2a – Roman Road Southbound** (between its junctions with Fishmoor Drive and Blackamoor Road);
- **Route 3a – A6077 Haslingden Road South East Bound** (between its junction with RBH and the M65 Junction 5);
- **Route 3b – A6077 Haslingden Road North West Bound** (between the exit from the M65 Junction 5 and its junction with RBH);

These routes are considered to cover the critical link sections within the modelled study area where users experience the most significant delay, as well as the routes where proposed highway interventions are most likely to have a significant impact on journey times across both AM and PM time periods.

Traffic flow conditions northbound along Roman Road fall outside of the required scope and extent of baseline modelling and forms an unrestricted route, with free-flowing traffic exiting the model north of the Newfield Drive junction. As a result, modelled flow conditions are not representative of observed baseline conditions and journey time validation has not been undertaken northbound along Roman Road.

Figure 4.1 - TomTom Journey Time Validation Routes



Within VISSIM, vehicle travel time measurement markers were used to assess travel times along each of the defined routes. Journey times of each vehicle traveling on the entire route within VISSIM are recorded, with journey times averaged both within each assessed peak hour and across each of the 20 model runs. Averaged values are compared to observed journey time values for a matching route obtained from TomTom data.

4.4.2 Vehicle Travel Time Validation Criteria

WebTAG Unit M3.1 outlines the acceptance criteria of modelled journey times as within ±15% or 1 minute (5km plus routes) of surveyed journey times for 85% of routes. None of the defined routes above are greater than 5km. Modelled journey times are taken from an average of 20 model runs undertaken using the same random seed profile detailed in Table 4.1.

4.4.3 Journey Time Validation Results

The results of model validation against TomTom journey time routes can be found in Table 4.4 below. In relation to the AM peak hour, all five modelled journey time routes are within 15% of journey times calculated from TomTom data. Modelled journey times along Route 1b and 2a

approaches to the Roman Road/ Blackamoor Road junction are both approximately 6% slower than the TomTom journey time, well within the guideline criteria.

During the AM peak hour, the direction of tidal flow along Haslingden Road flows north west bound away from Junction 5 towards Blackburn Town Centre, as highlighted by the relative number of vehicles flowing through Route 3b. Average modelled journey times are shown to be near identical to TomTom travel time data for Route 3b, indicating strong model validation to observed baseline conditions during the AM peak hour along this key route.

In relation to the PM peak hour, Table 4.4 again shows all five modelled journey time routes are within 15% of journey times calculated from TomTom data. During the PM peak, significant queuing and congestion is known to occur along Roman Road Southbound (Route 2a), as highlighted by the extended journey time recorded in TomTom data. Average modelled travel times along this route is shown to validate within 5% of TomTom travel time data, well within guideline criteria.

In a reverse of the AM peak period, the direction of tidal flow along Haslingden Road travels south east bound during the PM period. Average modelled journey times along Route 3a during the PM peak are shown as being within 3% of TomTom journey times, indicating strong model validation along this route in the PM model.

Table 4.4 - TomTom Journey Time Validation Results

Route	Time Period	Veh*	TomTom Time (s)	Modelled Time (s)	Diff (s)	%Diff	Criteria
R1a – Blackamoor Road EB	**AM**	299	152.3	144.1	-8.2	-5.4%	✓
R1b - Blackamoor Road WB		429	135.6	144.0	8.4	6.2%	✓
R2a – Roman Road SB		407	163.3	173.1	9.8	6.0%	✓
R3a – Haslingden Road SEB		256	176.0	158.2	-17.8	-10.1%	✓
R3b – Haslingden Road NWB		673	172.1	171.0	-1.1	-0.6%	✓
R1a – Blackamoor Road EB	**PM**	374	159.5	147.7	11.8	8.0%	✓
R1B - Blackamoor Road WB		412	215.4	194.8	20.6	10.6%	✓
R2a – Roman Road SB		423	358.2	375.5	-17.3	-4.6%	✓
R3a – Haslingden Road SEB		491	299.4	291.6	7.8	2.7%	✓
R3b – Haslingden Road NWB		300	160.0	174.0	-14.1	-8.1%	✓

***** Average number of vehicles recorded traversing the entire journey time route per model run

4.5 Additional Validation – Typical Congestion Data

Typical traffic delay data made available online via Google has been identified for the modelled network study area. This gives an estimate of the general level of traffic and delay along specific link sections for a given time period. Typical conditions within the modelled area for the typical weekday conditions at 08:00 (Figure 4.2) and 17:00 (Figure 4.3) shown overleaf give an indication of the level and extent of congestion across the south east Blackburn study area. These highlight the level of typical congestion in areas of the model where congestion and journey time data is not available.

Figure 4.2 for the AM peak indicates a typical pattern of congestion in line with that observed during modelling. In relation to the M65 Junction 5, modelled queueing and congestion generally matches that seen in Figure 4.2, particularly the M65 NEB Off-slip and the B6232. This also highlights the slow-moving traffic away from the M65 Junction 5 along Haslingden

Road to its junction with RBH, matching the reduced vehicle flow speeds observed during modelling.

Figure 4.2 - AM Peak (08:00) Typical Flow Congestion

Figure 4.3 for the PM peak also indicates a general pattern of congestion observed in modelling, with high levels of delay along Roman Road southbound, as well as blocking back along Haslingden Road south east bound towards the M65 Junction 5. This also shows queuing levels on M65 approach arms to be roughly in line with levels observed during model runs.

Figure 4.3 - PM Peak (17:00) Typical Flow Congestion

5. Summary and Conclusions

5.1 Report Summary

A micro-simulation model has been developed for a defined highway network across an area of south east Blackburn using VISSIM 11.00-09, focusing on the A6077 Haslingden Road, the B6231 Blackamoor Road and Roman Road. This has been developed in support of a business case for a number of highway and junction interventions across the study area, including widening of the A6077 Haslingden Road to between 3 and 4 lanes, as well as construction of a new 'Fishmoor Link Road', with changes to the Roman Road/ Blackamoor Road junction. The local network is known to suffer from heavy congestion during both peak periods, particularly on approaches to the Roman Road/ Blackamoor Road junction and along the A6077 Haslingden Road.

Traffic data has been obtained from a number of sources, including MCC data from local planning applications, journey time data calculated from TomTom travel time data, as well as information provided by the local authority and site drive throughs.

A model calibration process has been undertaken to ensure the developed baseline VISSIM model matched baseline traffic flow, delay and congestion conditions observed during both peak periods. Consideration was made to local driver behaviour and vehicle movements to ensure the model provided an accurate reflection of observed traffic flow conditions.

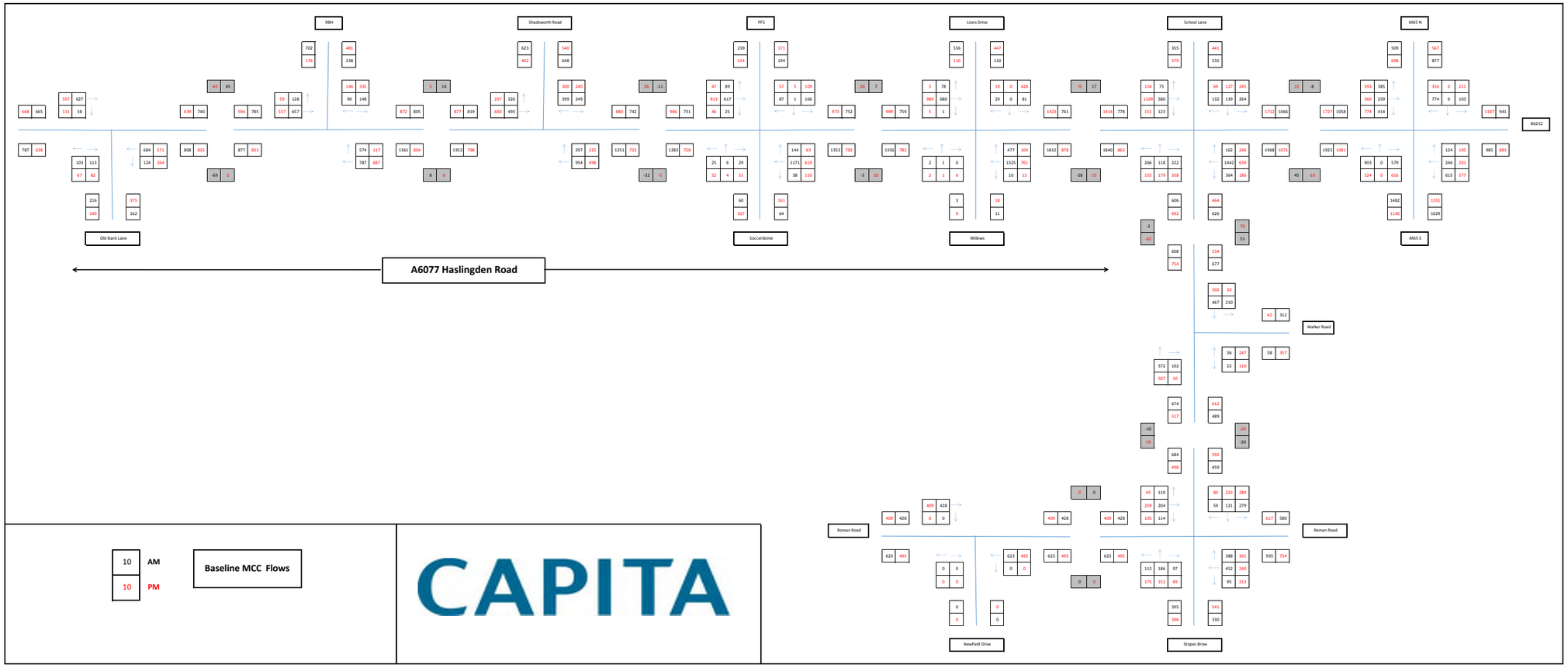
Model calibration has been undertaken against MCC data collected at a number of key junctions across the study area. Results from model turning flow calibration showed traffic flows across the network to be well within guideline criteria in both AM and PM modelled time period, with 100% of model turning flows giving a GEH statistic lower the five as compared to observed flows.

Model validation has also been undertaken against TomTom journey time data. Key routes within the network, including Roman Road Southbound, Blackamoor Road (both directions) and the A6077 Haslingden Road (both directions) have been validated against observed baseline journey times. Overall journey times across the network are well within the available guideline criteria, with all modelled travel time routes within 15% of recorded journey times across both time periods. The model is considered to be an accurate representation of the level of queueing and delay on the local highway network in the context of heavy congestion observed during peak periods.

5.2 Conclusions

Taking into consideration the level of congestion and delay within the study area, as well as the scale of the proposed scheme and the likely benefits, this model is considered to provide a strong representation of traffic and travel conditions on the local highway network across south east Blackburn. It is deemed fit for the purpose of informing forecasting models to test design options within the modelled study area for the proposed scheme.

Appendix A - MCC Traffic Flows



10 AM

10 PM

Baseline MCC Flows

CAPITA

Appendix B – Network Performance Statistics

MODEL RUN - AM	TIMEINT	DELAYAVG	STOPSAVG	SPEEDAVG	DELAYSTOPAVG	DISTTOT	TRAVTMTOT	DELAYTOT	STOPSTOT	DELAYSTOPTOT	VEHACT	VEHARR	DELAYLATENT	DEMANDLATENT
1	1800-5400	84.86	2.97	37.98	49.7	20229.7	1917352.9	704051.63	24615	412325.5	527	7770	1301.8	0
2	1800-5400	120.31	4.26	32.74	72.83	20626.31	2267818	1025912.98	36339	621057.7	733	7794	21690.3	71
3	1800-5400	136.6	5.17	30.92	81.53	20743.03	2414880.5	1166190.14	44130	696025.68	713	7824	78138.7	77
4	1800-5400	124.04	5.19	32.45	68.44	20855.15	2313780.6	1059343.34	44313	584486.35	662	7878	22724	6
5	1800-5400	117.48	4.21	33.13	70.33	20745.61	2254405.4	1006445.47	36071	602521.94	760	7807	7106.2	9
6	1800-5400	118.76	4.05	32.9	74.43	20927.57	2289909.1	1027414.51	34994	643911.41	724	7927	1354.7	0
7	1800-5400	117.14	4.12	33.19	72.15	20391.82	2211770.5	985859.69	34667	607218.7	715	7701	28433.5	8
8	1800-5400	107.24	3.71	34.35	65.59	20349.19	2132686.3	907926.15	31443	555310.39	768	7698	2048.8	5
9	1800-5400	106.28	3.69	34.74	64.73	20674.84	2142220.1	898661.42	31189	547391.91	740	7716	1376.6	3
10	1800-5400	76.67	2.64	39.22	42.87	20313.08	1864485.6	640548.2	22025	358138.62	584	7771	1367.7	0
11	1800-5400	75.34	2.72	39.51	41.3	20397.19	1858392	629741.83	22744	345249.06	531	7828	1324.5	0
12	1800-5400	131.5	5.3	31.36	77.08	20523.84	2355823.4	1121296.48	45172	657278.74	767	7760	6859.5	0
13	1800-5400	113.38	4.1	33.54	68.8	20415.58	2191050.1	961665.07	34767	583538.93	714	7768	21639.9	31
14	1800-5400	112.81	3.91	33.78	68.59	20916.42	2229126.9	966933.06	33482	587849.64	644	7927	2167.9	0
15	1800-5400	84.75	2.98	37.93	47.89	20396.58	1935988	709614.81	24912	400986.49	636	7737	1326.4	2
16	1800-5400	91.79	3.5	36.97	49.81	20602.51	2006358.1	771206.69	29400	418471.34	590	7812	23840.6	31
17	1800-5400	105.86	3.67	34.79	65.14	20473.23	2118570.1	890452.3	30842	547971.06	663	7749	45057.4	79
18	1800-5400	83.02	2.76	38.22	48.22	20380.41	1919874.2	693366.61	23085	402737.64	560	7792	1428.9	0
19	1800-5400	110.99	4.28	34.12	64.05	20989.67	2214823.7	953641.67	36767	550276.4	666	7926	4886.9	0
20	1800-5400	99.21	3.42	35.51	59.91	20282.71	2056247.9	832689.97	28729	502810.23	643	7750	7648.3	16
AVG	1800-5400	105.9	3.83	34.87	62.67	20561.72	2134778.17	897648.1	32484	531277.89	667	7797	14086.13	16.9
STDDEV	1800-5400	17.97	0.8	2.59	11.92	235.75	169401.88	159938.9	7037	105285.28	77	71	19468.05	27.04
MIN	1800-5400	75.34	2.64	30.92	41.3	20229.7	1858392	629741.83	22025	345249.06	527	7698	1301.8	0
MAX	1800-5400	136.6	5.3	39.51	81.53	20989.67	2414880.5	1166190.14	45172	696025.68	768	7927	78138.7	79

MODEL RUN - PM	TIMEINT	DELAYAVG	STOPSAVG	SPEEDAVG	DELAYSTOPAVG	DISTTOT	TRAVTMTOT	DELAYTOT	STOPSTOT	DELAYSTOPTOT	VEHACT	VEHARR	DELAYLATENT	DEMANDLATENT
1	1800-5400	117.33	4.06	33.35	75.86	19211.62	2073888.5	934403.26	32364	604129.93	580	7384	2297	0
2	1800-5400	153.41	5.63	28.85	98.77	19620.36	2448141.3	1278560.04	46923	823121.1	734	7600	4075.5	0
3	1800-5400	168.87	6.96	27.5	106.29	19906.67	2605824.9	1420019.34	58534	893802.71	709	7700	181519.8	48
4	1800-5400	168.99	7.31	27.55	102.94	19786.13	2585897.6	1406194.44	60804	856601.37	659	7662	214003.6	115
5	1800-5400	171.8	6.21	27.32	114.33	19837.27	2613589.9	1438825.47	52027	957524.13	767	7608	3756.3	18
6	1800-5400	213.73	9.48	23.93	133.82	19670.91	2958816.8	1789999.44	79372	1120762.31	821	7554	89329.3	27
7	1800-5400	176.61	6.98	26.84	113.47	19419.78	2605171.3	1452247.12	57375	933079.85	720	7503	96550.7	55
8	1800-5400	169.5	6.52	27.6	108.35	19552.88	2550187.4	1390273.91	53507	888692.59	705	7497	127506.2	78
9	1800-5400	161.25	5.88	28.32	105.08	19823.63	2520029.5	1342921.83	48976	875091.86	777	7551	53942	40
10	1800-5400	181.34	7.69	26.43	112.52	19168.05	2610672.4	1471424.76	62401	912953.27	727	7387	64645.7	55
11	1800-5400	147.88	5.11	29.67	97.67	19394.22	2352894.8	1204951.5	41670	795830.05	640	7508	1082.8	0
12	1800-5400	154.04	5.03	28.78	105.72	19560.88	2446963.6	1283496.45	41891	880887.93	862	7470	10215.4	0
13	1800-5400	129.91	4.65	31.57	82.85	19434.71	2215855.8	1057474.67	37880	674425.04	594	7546	1220.9	0
14	1800-5400	161.55	5.83	28.16	106.94	19650.54	2512462.1	1341173.07	48406	887835.99	773	7529	4534.9	8
15	1800-5400	114.73	4.13	33.67	73.27	19608.53	2096379	933868.92	33583	596392.26	557	7583	6348.9	0
16	1800-5400	140.68	5.46	30.41	88.68	19542.88	2313149.6	1151569.74	44698	725970.37	582	7604	59945.7	60
17	1800-5400	150.34	5.15	29.41	98.33	19583.89	2397251.3	1234869.98	42316	807648.74	692	7522	1141	0
18	1800-5400	123.16	4.11	32.62	79.4	19720.11	2176400.7	1003723.65	33517	647112.35	545	7605	2003	0
19	1800-5400	194.89	8.27	25.36	122.6	19680.98	2794031.3	1624818.56	68948	1022135.18	806	7531	136152.9	87
20	1800-5400	150.16	5.76	29.27	95.38	19101.71	2348974.4	1210293.1	46428	768728.98	684	7376	147952.4	84
AVG	1800-5400	157.51	6.01	28.83	101.11	19563.79	2461329.11	1298555.46	49581	833636.3	697	7536	60411.2	33.75
STDDEV	1800-5400	25.16	1.44	2.55	15.51	221.59	223639.71	219229.51	12311	135857.22	92	87	69067.22	36.87
MIN	1800-5400	114.73	4.06	23.93	73.27	19101.71	2073888.5	933868.92	32364	596392.26	545	7376	1082.8	0
MAX	1800-5400	213.73	9.48	33.67	133.82	19906.67	2958816.8	1789999.44	79372	1120762.31	862	7700	214003.6	115

Appendix C – AM and PM Turning Count Validation Results

AM Peak

Junction Number	Junction Name	Description	From	To	Ref	Model (Veh)	Count (Veh)	Abs Diff	%Diff	GEH	GEH Accept
S0	Old Bank Lane Junction	Haslingden Road East Left to Old Bank Lane	A	B	S0_A_B	135	127	8	6.5%	0.7	✓
S0		Haslingden Road East Ahead to Haslingden Road West	A	C	S0_A_C	745	699	46	6.6%	1.7	✓
S0		Old Bank Lane Right to Haslingden Road East	B	A	S0_B_A	112	115	-3	-3.0%	0.3	✓
S0		Old Bank Lane Left to Haslingden Road West	B	C	S0_B_C	98	105	-7	-6.9%	0.7	✓
S0		Haslingden Road West ahead to Haslingden Road East	C	A	S0_C_A	646	641	5	0.8%	0.2	✓
S0		Haslingden Road West Right to Old Bank Lane	C	B	S0_C_B	41	39	2	5.6%	0.3	✓
S4	RBH Junction	RBH Right to Haslingden Road West	A	B	S4_A_B	94	92	2	2.2%	0.2	✓
S4		RBH Left to Haslingden Road East	A	C	S4_A_C	152	151	1	0.5%	0.1	✓
S4		Haslingden Road West Left to RBH	B	A	S4_B_A	124	131	-7	-5.2%	0.6	✓
S4		Haslingden Road West ahead to Haslingden Road East	B	C	S4_B_C	626	671	-45	-6.8%	1.8	✓
S4		Haslingden Road East Right to RBH	C	A	S4_C_A	575	587	-12	-2.0%	0.5	✓
S4		Haslingden Road East Ahead to Haslingden Road West	C	B	S4_C_B	790	804	-14	-1.8%	0.5	✓
S2	Shadsworth Road Junction	Shadsworth Road Right to Haslingden Road West	A	B	S2_A_B	407	408	-1	-0.2%	0.0	✓
S2		Shadsworth Road Left to Haslingden Road East	A	C	S2_A_C	255	254	1	0.2%	0.0	✓
S2		Haslingden Road West Left to Shadsworth Road	B	A	S2_B_A	311	333	-22	-6.6%	1.2	✓
S2		Haslingden Road West Ahead to Haslingden Road East	B	C	S2_B_C	466	504	-38	-7.5%	1.7	✓
S2		Haslingden Road East Right to Shadsworth Road	C	A	S2_C_A	302	303	-1	-0.5%	0.1	✓
S2		Haslingden Road East ahead to Haslingden Road West	C	B	S2_C_B	960	975	-15	-1.5%	0.5	✓
S1	PFS/ Soccerdome Junction	Haslingden Road West Right to Soccerdome	A	B	S1_A_B	27	26	1	5.7%	0.3	✓
S1		Haslingden Road West ahead to Haslingden Road East	A	C	S1_A_C	606	630	-24	-3.9%	1.0	✓
S1		Haslingden Road Left to PFS	A	D	S1_A_D	87	91	-4	-4.3%	0.4	✓
S1		Soccerdome Left to Haslingden Road West	B	A	S1_B_A	24	26	-2	-6.0%	0.3	✓
S1		Soccerdome Right to Haslingden Road East	B	C	S1_B_C	30	30	0	1.2%	0.1	✓
S1		Soccerdome Ahead to PFS	B	D	S1_B_D	6	6	0	-2.1%	0.1	✓
S1		Haslingden Road East ahead to Haslingden Road East West	C	A	S1_C_A	1153	1197	-44	-3.6%	1.3	✓
S1		Haslingden Road East Left to Soccerdome	C	B	S1_C_B	37	39	-2	-4.7%	0.3	✓
S1		Haslingden Road East Right to PFS	C	D	S1_C_D	143	147	-4	-2.8%	0.3	✓
S1		PFS Right to Haslingden Road West	D	A	S1_D_A	89	89	0	0.1%	0.0	✓

S1		PFS ahead to Soccerdome	D	B	S1_D_B	1	1	0	-2.1%	0.0	✓
S1		PFS Left to Haslingden Road East	D	C	S1_D_C	105	108	-3	-3.1%	0.3	✓
S3	Lions Drive (Beehive) Junction	Haslingden Road West Left to Willows Public House	A	B	S3_A_B	1	1	0	-2.1%	0.0	✓
S3		Haslingden Road West Ahead to Haslingden Road East	A	C	S3_A_C	662	695	-33	-4.7%	1.3	✓
S3		Haslingden Road West Right to Lions Drive	A	D	S3_A_D	77	80	-3	-3.4%	0.3	✓
S3		Willows Public House Left to Haslingden Road West	B	A	S3_B_A	2	2	0	-2.1%	0.0	✓
S3		Willows Public House Right to Haslingden Road East	B	C	S3_B_C	0	0	0			
S3		Willows Public House ahead to Lions Drive	B	D	S3_B_D	1	1	0	-2.1%	0.0	✓
S3		Haslingden Road East Ahead to Haslingden Road West	C	A	S3_C_A	1306	1354	-48	-3.5%	1.3	✓
S3		Haslingden Road East Left to Willows Public House	C	B	S3_C_B	8	10	-2	-21.7%	0.7	✓
S3		Haslingden Road East Right to Lions Drive	C	D	S3_C_D	470	487	-17	-3.6%	0.8	✓
S3		Lions Drive Right to Haslingden Road West	D	A	S3_D_A	30	30	0	1.2%	0.1	✓
S3		Lions Drive Ahead to Willows Public House	D	B	S3_D_B	0	0	0			
S3		Lions Drive Left to Haslingden Road East	D	C	S3_D_C	81	83	-2	-2.1%	0.2	✓
S5	Guide Junction	Haslingden Road North Right to Blackamoor Road	A	B	S5_A_B	120	126	-6	-4.5%	0.5	✓
S5		Haslingden Road North ahead to Haslingden Road South	A	C	S5_A_C	546	593	-47	-7.9%	2.0	✓
S5		Haslingden Road North Left to School Lane	A	D	S5_A_D	72	77	-5	-6.0%	0.5	✓
S5		Blackamoor Road Left to Haslingden Road North	B	A	S5_B_A	243	272	-29	-10.6%	1.8	✓
S5		Blackamoor Road Right to Haslingden Road South	B	C	S5_B_C	207	227	-20	-8.7%	1.3	✓
S5		Blackamoor Road Ahead to School Lane	B	D	S5_B_D	110	121	-11	-8.8%	1.0	✓
S5		Haslingden Road South Ahead to Haslingden Road North	C	A	S5_C_A	1415	1473	-58	-4.0%	1.5	✓
S5		Haslingden Road South Left to Blackamoor Road	C	B	S5_C_B	355	372	-17	-4.6%	0.9	✓
S5		Haslingden Road South Right to School Lane	C	D	S5_C_D	159	166	-7	-3.9%	0.5	✓
S5		School Lane Right to Haslingden Road North	D	A	S5_D_A	135	135	0	0.1%	0.0	✓
S5		School Lane Ahead to Blackamoor Road	D	B	S5_D_B	142	142	0	0.0%	0.0	✓
S5		School Lane Left to Haslingden Road South	D	C	S5_D_C	271	270	1	0.5%	0.1	✓
S7	M65 Junction 5	SWB Off-slip Right to Haslingden Road West	A	B	S7_A_B	773	791	-18	-2.3%	0.6	✓
S7		SWB Off-slip Ahead to SWB On-slip	A	C	S7_A_C	0	0	0			
S7		SWB Off-slip Left to B6232	A	D	S7_A_D	102	105	-3	-3.1%	0.3	✓
S7		Haslingden Road West Left to NEB On-slip	B	A	S7_B_A	363	393	-30	-7.7%	1.6	✓
S7		Haslingden Road West Right to SWB On-Slip	B	C	S7_B_C	401	423	-22	-5.2%	1.1	✓
S7		Haslingden Road West Ahead onto B6232	B	D	S7_B_D	243	265	-22	-8.2%	1.4	✓
S7		NEB Off-Slip Ahead to NEB On-Slip	C	A	S7_C_A	0	0	0			
S7		NEB Off-Slip Left to Haslingden Road West	C	B	S7_C_B	912	923	-11	-1.2%	0.4	✓
S7		NEB Off-Slip Right to B6232	C	D	S7_C_D	593	592	1	0.2%	0.1	✓
S7		B6232 Right to NEB On-Slip	D	A	S7_D_A	134	127	7	5.8%	0.6	✓

S7		B6232 Ahead to Haslingden Road	D	B	S7_D_B	256	251	5	1.8%	0.3	✓
S7		B6232 Left to SWB On-Slip	D	C	S7_D_C	635	628	7	1.0%	0.3	✓
J2	Walker Road Junction	Blackamoor East Left to Walker Road	A	B	J2_A_B	188	210	-22	-10.5%	1.6	✓
J2		Blackamoor East Ahead to Blackamoor West	A	C	J2_A_C	430	467	-37	-7.9%	1.7	✓
J2		Walker Road Right to Blackamoor East	B	A	J2_B_A	36	36	0	0.0%	0.0	✓
J2		Walker Road Left to Blackamoor West	B	C	J2_B_C	22	22	0	0.0%	0.0	✓
J2		Blackamoor West Ahead to Blackamoor East	C	A	J2_C_A	538	572	-34	-5.9%	1.4	✓
J2		Blackamoor West Right to Walker Road	C	B	J2_C_B	94	102	-8	-7.8%	0.8	✓
J1	Roman/ Blackamoor Road Junction	Roman Road North Left to Blackamoor	A	B	J1_A_B	109	110	-1	-0.9%	0.1	✓
J1		Roman Road North Ahead to Roman Road South	A	C	J1_A_C	211	205	6	2.9%	0.4	✓
J1		Roman Road North Right to Stopes Brow	A	D	J1_A_D	115	114	1	0.9%	0.1	✓
J1		Blackamoor Right to Roman Road North	B	A	J1_B_A	59	59	0	0.0%	0.0	✓
J1		Blackamoor Left to Roman Road South	B	C	J1_B_C	275	279	-4	-1.4%	0.2	✓
J1		Blackamoor Ahead to Stopes Brow	B	D	J1_B_D	117	121	-4	-3.3%	0.4	✓
J1		Roman Road South Ahead to Roman Road North	C	A	J1_C_A	420	452	-32	-7.1%	1.5	✓
J1		Roman Road South Right to Blackamoor	C	B	J1_C_B	360	388	-28	-7.2%	1.4	✓
J1		Roman Road South to Left to Stopes Brow	C	D	J1_C_D	89	95	-6	-6.3%	0.6	✓
J1		Stopes Brow Left to Roman Road North	D	A	J1_D_A	99	112	-13	-11.6%	1.3	✓
J1		Stopes Brow Ahead to Blackamoor	D	B	J1_D_B	164	186	-22	-11.8%	1.7	✓
J1		Stopes Brow Right to Roman Road South	D	C	J1_D_C	84	97	-13	-13.4%	1.4	✓

Summary		
	Total Movements	80
	Total Within Criteria	80
	% Within Criteria	100%

PM Peak

Junction Number	Junction Name	Description	From	To	Ref	Model (Veh)	Count (Veh)	Abs Diff	%Diff	GEH	GEH Accept
S0	Old Bank Lane Junction	Haslingden Road East Left to Old Bank Lane	A	B	S0_A_B	263	264	-1	-0.4%	0.1	✓
S0		Haslingden Road East Ahead to Haslingden Road West	A	C	S0_A_C	579	571	8	1.4%	0.3	✓
S0		Old Bank Lane Right to Haslingden Road East	B	A	S0_B_A	83	82	1	1.2%	0.1	✓
S0		Old Bank Lane Left to Haslingden Road West	B	C	S0_B_C	68	67	1	1.5%	0.1	✓
S0		Haslingden Road West ahead to Haslingden Road East	C	A	S0_C_A	592	557	35	6.3%	1.5	✓
S0		Haslingden Road West Right to Old Bank Lane	C	B	S0_C_B	121	111	10	9.0%	0.9	✓
S4	RBH Junction	RBH Right to Haslingden Road West	A	B	S4_A_B	153	146	7	4.8%	0.6	✓
S4		RBH Left to Haslingden Road East	A	C	S4_A_C	342	335	7	2.1%	0.4	✓
S4		Haslingden Road West Left to RBH	B	A	S4_B_A	69	59	10	16.9%	1.3	✓
S4		Haslingden Road West ahead to Haslingden Road East	B	C	S4_B_C	609	537	72	13.4%	3.0	✓
S4		Haslingden Road East Right to RBH	C	A	S4_C_A	118	117	1	0.9%	0.1	✓
S4		Haslingden Road East Ahead to Haslingden Road West	C	B	S4_C_B	689	687	2	0.3%	0.1	✓
S2	Shadsworth Road Junction	Shadsworth Road Right to Haslingden Road West	A	B	S2_A_B	309	300	9	3.0%	0.5	✓
S2		Shadsworth Road Left to Haslingden Road East	A	C	S2_A_C	252	240	12	5.0%	0.8	✓
S2		Haslingden Road West Left to Shadsworth Road	B	A	S2_B_A	260	237	23	9.7%	1.5	✓
S2		Haslingden Road West Ahead to Haslingden Road East	B	C	S2_B_C	698	640	58	9.1%	2.2	✓
S2		Haslingden Road East Right to Shadsworth Road	C	A	S2_C_A	218	225	-7	-3.1%	0.5	✓
S2		Haslingden Road East ahead to Haslingden Road West	C	B	S2_C_B	498	498	0	0.0%	0.0	✓
S1	PFS/ Soccerdome Junction	Haslingden Road West Right to Soccerdome	A	B	S1_A_B	48	46	2	4.3%	0.3	✓
S1		Haslingden Road West ahead to Haslingden Road East	A	C	S1_A_C	857	813	44	5.4%	1.5	✓
S1		Haslingden Road Left to PFS	A	D	S1_A_D	51	47	4	8.5%	0.6	✓
S1		Soccerdome Left to Haslingden Road West	B	A	S1_B_A	52	52	0	0.0%	0.0	✓
S1		Soccerdome Right to Haslingden Road East	B	C	S1_B_C	51	51	0	0.0%	0.0	✓
S1		Soccerdome Ahead to PFS	B	D	S1_B_D	4	4	0	0.0%	0.0	✓
S1		Haslingden Road East ahead to Haslingden Road East West	C	A	S1_C_A	606	619	-13	-2.1%	0.5	✓
S1		Haslingden Road East Left to Soccerdome	C	B	S1_C_B	105	110	-5	-4.5%	0.5	✓
S1		Haslingden Road East Right to PFS	C	D	S1_C_D	60	63	-3	-4.8%	0.4	✓
S1		PFS Right to Haslingden Road West	D	A	S1_D_A	58	57	1	1.8%	0.1	✓
S1		PFS ahead to Soccerdome	D	B	S1_D_B	6	5	1	20.0%	0.4	✓
S1		PFS Left to Haslingden Road East	D	C	S1_D_C	109	109	0	0.0%	0.0	✓
S3	Lio ns Dri	Haslingden Road West Left to Willows Public House	A	B	S3_A_B	6	5	1	20.0%	0.4	✓

S3		Haslingden Road West Ahead to Haslingden Road East	A	C	S3_A_C	1005	989	16	1.6%	0.5	✓
S3		Haslingden Road West Right to Lions Drive	A	D	S3_A_D	5	5	0	0.0%	0.0	✓
S3		Willows Public House Left to Haslingden Road West	B	A	S3_B_A	2	2	0	0.0%	0.0	✓
S3		Willows Public House Right to Haslingden Road East	B	C	S3_B_C	7	6	1	16.7%	0.4	
S3		Willows Public House ahead to Lions Drive	B	D	S3_B_D	1	1	0	0.0%	0.0	✓
S3		Haslingden Road East Ahead to Haslingden Road West	C	A	S3_C_A	751	761	-10	-1.3%	0.4	✓
S3		Haslingden Road East Left to Willows Public House	C	B	S3_C_B	13	13	0	0.0%	0.0	✓
S3		Haslingden Road East Right to Lions Drive	C	D	S3_C_D	106	104	2	1.9%	0.2	✓
S3		Lions Drive Right to Haslingden Road West	D	A	S3_D_A	16	19	-3	-15.8%	0.7	✓
S3		Lions Drive Ahead to Willows Public House	D	B	S3_D_B	0	0	0			
S3		Lions Drive Left to Haslingden Road East	D	C	S3_D_C	359	428	-69	-16.1%	3.5	✓
S5	Guide Junction	Haslingden Road North Right to Blackamoor Road	A	B	S5_A_B	147	151	-4	-2.6%	0.3	✓
S5		Haslingden Road North ahead to Haslingden Road South	A	C	S5_A_C	1075	1109	-34	-3.1%	1.0	✓
S5		Haslingden Road North Left to School Lane	A	D	S5_A_D	145	154	-9	-5.8%	0.7	✓
S5		Blackamoor Road Left to Haslingden Road North	B	A	S5_B_A	161	155	6	3.9%	0.5	✓
S5		Blackamoor Road Right to Haslingden Road South	B	C	S5_B_C	383	358	25	7.0%	1.3	✓
S5		Blackamoor Road Ahead to School Lane	B	D	S5_B_D	188	179	9	5.0%	0.7	✓
S5		Haslingden Road South Ahead to Haslingden Road North	C	A	S5_C_A	640	639	1	0.2%	0.0	✓
S5		Haslingden Road South Left to Blackamoor Road	C	B	S5_C_B	182	186	-4	-2.2%	0.3	✓
S5		Haslingden Road South Right to School Lane	C	D	S5_C_D	245	246	-1	-0.4%	0.1	✓
S5		School Lane Right to Haslingden Road North	D	A	S5_D_A	70	69	1	1.4%	0.1	✓
S5		School Lane Ahead to Blackamoor Road	D	B	S5_D_B	127	127	0	0.0%	0.0	✓
S5		School Lane Left to Haslingden Road South	D	C	S5_D_C	250	245	5	2.0%	0.3	✓
S7	M65 Junction 5	SWB Off-slip Right to Haslingden Road West	A	B	S7_A_B	358	356	2	0.6%	0.1	✓
S7		SWB Off-slip Ahead to SWB On-slip	A	C	S7_A_C	0	0	0			
S7		SWB Off-slip Left to B6232	A	D	S7_A_D	213	211	2	0.9%	0.1	✓
S7		Haslingden Road West Left to NEB On-slip	B	A	S7_B_A	574	593	-19	-3.2%	0.8	✓
S7		Haslingden Road West Right to SWB On-Slip	B	C	S7_B_C	771	774	-3	-0.4%	0.1	✓
S7		Haslingden Road West Ahead onto B6232	B	D	S7_B_D	357	360	-3	-0.8%	0.2	✓
S7		NEB Off-Slip Ahead to NEB On-Slip	C	A	S7_C_A	0	0	0			
S7		NEB Off-Slip Left to Haslingden Road West	C	B	S7_C_B	518	524	-6	-1.1%	0.3	✓
S7		NEB Off-Slip Right to B6232	C	D	S7_C_D	584	616	-32	-5.2%	1.3	✓
S7		B6232 Right to NEB On-Slip	D	A	S7_D_A	104	105	-1	-1.0%	0.1	✓
S7		B6232 Ahead to Haslingden Road	D	B	S7_D_B	200	201	-1	-0.5%	0.1	✓
S7		B6232 Left to SWB On-Slip	D	C	S7_D_C	575	577	-2	-0.3%	0.1	✓
J2	Walker Road	Blackamoor East Left to Walker Road	A	B	J2_A_B	27	32	-5	-15.6%	0.9	✓

J2		Blackamoor East Ahead to Blackamoor West	A	C	J2_A_C	425	502	-77	-15.3%	3.6	✓
J2		Walker Road Right to Blackamoor East	B	A	J2_B_A	252	247	5	2.0%	0.3	✓
J2		Walker Road Left to Blackamoor West	B	C	J2_B_C	110	110	0	0.0%	0.0	✓
J2		Blackamoor West Ahead to Blackamoor East	C	A	J2_C_A	481	507	-26	-5.1%	1.2	✓
J2		Blackamoor West Right to Walker Road	C	B	J2_C_B	9	10	-1	-10.0%	0.3	✓
J1	Roman/ Blackamoor Road Junction	Roman Road North Left to Blackamoor	A	B	J1_A_B	49	45	4	8.9%	0.6	✓
J1		Roman Road North Ahead to Roman Road South	A	C	J1_A_C	286	259	27	10.4%	1.6	✓
J1		Roman Road North Right to Stopes Brow	A	D	J1_A_D	114	105	9	8.6%	0.9	✓
J1		Blackamoor Right to Roman Road North	B	A	J1_B_A	72	80	-8	-10.0%	0.9	✓
J1		Blackamoor Left to Roman Road South	B	C	J1_B_C	252	289	-37	-12.8%	2.2	✓
J1		Blackamoor Ahead to Stopes Brow	B	D	J1_B_D	193	223	-30	-13.5%	2.1	✓
J1		Roman Road South Ahead to Roman Road North	C	A	J1_C_A	240	240	0	0.0%	0.0	✓
J1		Roman Road South Right to Blackamoor	C	B	J1_C_B	300	301	-1	-0.3%	0.1	✓
J1		Roman Road South to Left to Stopes Brow	C	D	J1_C_D	212	213	-1	-0.5%	0.1	✓
J1		Stopes Brow Left to Roman Road North	D	A	J1_D_A	166	175	-9	-5.1%	0.7	✓
J1		Stopes Brow Ahead to Blackamoor	D	B	J1_D_B	144	152	-8	-5.3%	0.7	✓
J1		Stopes Brow Right to Roman Road South	D	C	J1_D_C	62	69	-7	-10.1%	0.9	✓

Summary		
	Total Movements	81
	Total Within Criteria	81
	% Within Criteria	100%

CAPITA

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