In Parliament – Session 2022 - 2023

HS2

High Speed Rail (Crewe – Manchester)

Supplementary Environmental Statement 2 and Additional Provision 2 Environmental Statement

Volume 5: Appendix TR-005-00000

Traffic and transport

Transport Assessment Part 4 Addendum

S106

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Department for Transport

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Transport Assessment - Overall Structure

Part 3: MA06, MA07 and MA08 (including MA04 and MA05) (TR-003-00006)

Transport Assessment Part 4 Addendum – Route-wide and off-route assessment and TA Addendum Annexes

Part 4: Route-wide and off-route assessment (TR-005-00000)

TA Addendum Annexes C to G (TR-005-00000)

Contents

17 Introduction

17.1.1 A number of changes to the original scheme means that Sections 20 and 21 in Part 4 of the main TA[1] and Section 16 in the SES1 and AP1 ES TA[2] are generally replaced by Sections 18 and 19 in this document.

17.1.2 The terms used in this report to differentiate between the original scheme assessed as part of the main TA and subsequent changes are set out in Part 1 of the SES2 and AP2 ES TA (see SES2 and AP2 ES Volume 5, Appendix: TR-001-00000).

17.1.3 The assessment of impacts during the construction phase, reported in this SES2 and AP2 ES TA, identifies any changes in impacts on the highway and rail network during construction as a result of the SES2 changes and AP2 amendments compared to those reported in the main TA and the SES1 and AP1 ES TA.

17.1.4 The assessment of the impact of changes to train patterns and services during operation was not reported in the SES1 and AP1 ES TA. In this SES2 and AP2 ES TA, the assessment largely replaces the assessment of the original scheme, although it is compared back against the original scheme as reported in the main TA.

17.1.5 The scheme described in this report is referred to as the AP2 revised scheme.

17.1.6 This document provides an overview of the route-wide and off-route traffic and transport impacts for the AP2 revised scheme in construction and operation.

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[1] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Environmental Statement, Transport Assessment Parts 1-4,* Volume 5, Appendices: TR-001 to TR-003 and TR-005. Available online at: https://www.gov.uk/government/collections/hs2-phase2b-crewe-manchester-environmental-statement.

[2] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Supplementary Environmental Statement 1 and Additional Provision 1 Environmental Statement, Transport Assessment Parts 1-4,* Volume 5, Appendices: TR-001 to TR-003 and TR-005. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-supplementary-environmental-statement-1-and-additional-provision-1-environmental-statement.

18 Route-wide assessment

18.1 Introduction and baseline

18.1.1 Section 20 of the main TA and Section 16 of the SES1 and AP1 ES TA set out the route-wide baseline for the original scheme and the AP1 revised scheme respectively. This section of the main TA is unchanged with the exception of a change in the future baseline years from 2038 and 2046 to 2039 and 2051 as reported in Part 1 of the SES2 and AP2 ES TA. However, the AP2 revised scheme includes changes that would change route-wide impacts, as set out in the assessment below.

18.2 Route-wide construction assessment

Impacts on the strategic highway network during construction

18.2.1 The impacts of the original scheme on the strategic highway network during construction are reported in Section 20.2 of the main TA. The impacts of construction traffic are primarily focussed on the road network close to the original scheme, which includes the principal routes for movement of excavated material. These local impacts were considered within the main TA and the SES1 and AP1 ES TA. These assessments consider the impacts of construction activity on roads extending from the original scheme to the strategic road network (SRN).

18.2.2 The AP2 revised scheme results in a net reduction in the total number of construction HGV compared to the main TA of 1.175 million lorry movements. This is an increase of 7% or 0.39 million lorry movements from the AP1 revised scheme but a net reduction of 17% compared to the original scheme as reported in the main TA. The following changes make a particular contribution to the changes in traffic flows:

- Additional land permanently required to reconfigure M56 junction 6 (AP2-006-014);
- Additional land permanently required for changes to design elements managed by the Manchester tunnel north portal main compound (AP2-007-008); and
- Additional land permanently required for modifications to the multi-modal transport hub (AP2-008-003).

18.2.3 Traffic generated by construction on roads from the AP2 revised scheme to the SRN has been assessed in Part 3 of the SES2 and AP2 ES TA for each community area (CA), with measures proposed to mitigate the effect of this traffic (see SES2 and AP2 ES Volume 5, Appendices: TR-003). However, despite the increase in overall HGV movements compared with the AP1 revised scheme, the conclusion from the SES1 and AP1 ES TA for the AP1 revised scheme that the combined impacts across community areas are not considered to represent a substantial route-wide impact is unchanged for the AP2 revised scheme. In addition, the conclusion from the main TA that the impacts outside community areas are not considered likely to result in any substantial route-wide impacts on the SRN is also unchanged.

Impacts on the railway network during construction

18.2.4 The type and number of possessions and blockades required for the original scheme that are of sufficient scale that they could potentially create route-wide disruption and delay to rail passenger and freight services on the West Coast Main Line (WCML) are summarised in Section 20.2 of the main TA. The change in the number of possessions and blockades between the original scheme and the AP1 revised scheme are set out in Table 220-1, Section 16.2 of the SES1 and AP1 ES TA.

18.2.5 The change in the numbers of possessions and blockades between the AP1 revised scheme and the AP2 revised scheme are set out in Table 220-1 of this SES2 and AP2 ES TA. This replaces Table 220-1 of the SES1 and AP1 ES TA. This indicates that there are only minor differences in possessions and blockades as a result of the AP2 revised scheme with a change in the Hough to Walley's Green area (MA01) from a 54 hour to 27 hour possession, and four additional 54 hour possessions: two in the Hulseheath to Manchester Airport area (MA06); one in the Davenport Green to Ardwick area (MA07); and one in the Annandale depot area.

18.2.6 At a route-wide level, there were 154 non-standard possessions and blockades for the original scheme reported in the main TA. For the AP1 revised scheme, this reduced to 120, a reduction of 34 as reported in the SES1 and AP1 TA. For the AP2 revised scheme this is reduced to 116, a further reduction of four.

18.2.7 At a route-wide level, the conclusion of the main TA and the SES1 and AP1 ES TA that the substantial number and extended duration of possessions and blockades will lead to a substantial impact on WCML rail passengers and freight, is unchanged as a result of the AP2 revised scheme.

Table 220-1: Summary of changes to likely route-wide possession and blockade requirements between AP1 and AP2

Route-wide possessions and blockades affecting WCML users with the potential for route-wide impacts	27-hour (difference between AP1 revised scheme and AP2 revised scheme)	54-hour (difference between AP1 revised scheme and AP2 revised scheme)	72-hour (difference between AP1 revised scheme and AP2 revised scheme)	100-hour (difference between AP1 revised scheme and AP2 revised scheme)	Blockades (difference between AP1 revised scheme and AP2 revised scheme)
Hough to Walley's Green area (MA01)	1	-1	-	-	-

Route-wide possessions and blockades affecting WCML users with the potential for route-wide impacts	27-hour (difference between AP1 revised scheme and AP2 revised scheme)	54-hour (difference between AP1 revised scheme and AP2 revised scheme)	72-hour (difference between AP1 revised scheme and AP2 revised scheme)	100-hour (difference between AP1 revised scheme and AP2 revised scheme)	Blockades (difference between AP1 revised scheme and AP2 revised scheme)
Hulseheath to Manchester Airport area (MA06)	-	2	-	-	-
Davenport Green to Ardwick area (MA07)	-	1	-	-	-
Annandale depot	-	1	-	-	-
Total	**1**	**3**	**-**	**-**	**-**

18.3 Route-wide operation assessment

Introduction

18.3.1 The route-wide operational assessment is reported in Section 20.3 of the main TA. SES1 changes, most notably the removal of the HS2 WCML connection (SES1-004-001), along with updates to the Planet Framework Model (PFM) means that Section 20.3 of the main TA is largely replaced by Section 18.3 of this SES2 and AP2 ES TA.

18.3.2 The removal of the HS2 WCML connection as part of the SES1 scheme (SES1-004-001), impacts both journey time savings to destinations on the WCML north of Manchester and passenger demand including the extent of changes in mode share and changes in vehicle and passenger kilometres by mode.

18.3.3 As reported in the main TA, the PLANET Framework Model (PFM)[3] is used to estimate travel by HS2, other rail services and other transport modes. It provides mode share information for rail, car and air travel both without and with HS2. For the assessment of the original scheme, PFM9.6 was used; this has been updated to PFM10a for the assessment of the AP2 revised scheme and reflects the re-estimation of the long-distance demand model using

[3] The PLANET Framework Model (PFM) is the Department for Transport forecasting model which has been used to develop rail demand forecasts for the AP2 revised scheme. PFM has been developed by HS2 Ltd from a suite of models originally developed by the Strategic Rail Authority (SRA). PFM is the most appropriate modelling tool to be used in terms of forecasting the demand impacts of the AP2 revised scheme given its strategic capability, covering all long-distance rail, car and air movements across England, Scotland and Wales. PFM has evolved over a number of years and builds on existing model components.

more recent survey data from the National Travel Survey (NTS) and updated values of travel time savings from the Department for Transport (DfT) 2015 study[4].

18.3.4 Forecasts show increased demands for long distance rail travel in the future. Without HS2 the WCML will become increasingly congested. HS2 will introduce new capacity with accompanying reductions in journey times, enhanced passenger experience and reduced congestion and passenger crowding on the conventional rail network.

18.3.5 The 11 services per hour for the original scheme to and from London Euston comprised: three services per hour London-Birmingham; three services per hour London-Manchester; two service per hour London-Scotland; and three services per hour London-North West (Liverpool, Liverpool/Lancaster and Macclesfield). In addition to these three services per hour London-Birmingham, three further services per hour to and from Birmingham Curzon Street for the original scheme comprised: two services per hour to Manchester and one service per hour to Scotland.

18.3.6 For the original scheme, the two trains to Scotland from Euston split at Carlisle to serve Glasgow and Edinburgh. For the AP2 revised scheme this reduces to one service per hour between London and Glasgow, with no service to Edinburgh. In addition, the Birmingham to Scotland service is removed.

Changes in passenger demand

18.3.7 The impact of increased capacity and improved journey times that will result from the original scheme and the additional services provided to take advantage of released capacity is set out in Section 20.3 of the main TA. For the AP2 revised scheme in combination with HS2 Phase One and HS2 Phase 2a, these improvements will provide an attractive substitute for many users of the long distance rail services that would operate in the absence of the scheme. The improvements will generate new trips and encourage changes in mode share from car and potentially air travel. PFM10a has been used to forecast demand for the AP2 revised scheme for rail, car and air and to establish the extent of changes in mode share. Forecasts for 2039 and 2051 have been considered for the base case and for the AP2 revised scheme.

18.3.8 For the AP2 revised scheme, PFM10a has been used to identify both flows at stations served by HS2 and changes in footfall at other stations, known as off-route stations; the latter are covered under off-route stations in operation. Table 20-4 in the main TA is replaced by Table 20-4 below which sets out the daily HS2 boardings and alightings for the AP2 revised scheme onto and off HS2 trains at all stations served by HS2. A number of stations reported in Table 20-4 of the main TA are not included in Table 20-4 below due to changes in the train service specification for the AP2 revised scheme. This demonstrates the substantial flows into and

[4] Department for Transport (2015), *Values of travel time savings and reliability: final reports*. Available online at: https://www.gov.uk/government/publications/values-of-travel-time-savings-and-reliability-final-reports.

out of London and, to a lesser extent Birmingham and Manchester. Other stations with notable HS2 boarders and alighters are Crewe, Liverpool Lime Street, Preston and Glasgow.

18.3.9 Compared with the forecasts for the original scheme as reported in the main TA, the forecasts for the AP2 revised scheme are lower, with an overall reduction in HS2 boarders and alighters for those stations shown in Table 20-4 of 19% for both 2039 and 2051. However, the reduction in HS2 boardings and alightings in 2051 for the two Manchester stations combined is 4%.

Table 20-4: HS2 boardings and alightings by station, all phases, 2039 and 2051, PFM10a

HS2 station	Total boarders 2039	Total alighters 2039	Total boarders 2051	Total alighters 2051
Manchester Airport High Speed station	7,986	7,915	8,582	8,500
Manchester Piccadilly High Speed station	17,310	17,156	18,618	18,438
Euston	45,439	47,165	47,883	49,707
Old Oak Common	26,648	25,669	28,395	27,368
Birmingham Interchange	11,960	11,966	12,684	12,691
Birmingham Curzon Street	19,315	18,787	20,527	19,975
Stafford	1,566	1,766	1,667	1,881
Stoke-On-Trent	699	683	748	730
Crewe	6,574	6,652	6,917	6,991
Macclesfield	434	435	465	466
Runcorn	3,173	3,049	3,331	3,203
Warrington Bank Quay	1,099	1,032	1,165	1,092
Liverpool Lime Street High Level	5,269	5,209	5,592	5,527
Wigan North Western	1,033	1,043	1,098	1,109
Preston	5,208	5,139	5,519	5,424
Lancaster	1,389	1,542	1,476	1,664
Carlisle	1,495	1,334	1,577	1,408
Glasgow Central	4,231	4,280	4,498	4,554
Total	**160,828**	**160,822**	**170,742**	**170,728**

Impact of journey time savings during operation

18.3.10 Journey time savings for the original scheme are reported in Table 20-5 of the main TA which is replaced by Table 20-5 below for this SES2 and AP2 ES TA. The removal of the HS2 WCML connection (SES1-004-001) as part of the SES1 scheme means that there are changes to journey times to stations north of Manchester on the WCML. The current fastest journey times, the journey times with HS2 Phase One and Phase 2a, the journey times with the original scheme including HS2 Phase One and Phase 2a as reported in the main TA and the journey times with the AP2 revised scheme including HS2 Phase One and Phase 2a are set out in Table 20-5 below. The minor differences between some destinations are a result of reworking of the train service specification associated with the removal of the HS2 WCML connection.

18.3.11 When combined with HS2 Phase One and Phase 2a, the AP2 revised scheme will reduce overall journey time between London and Manchester Piccadilly by 55 minutes (a 44% reduction), and between London and Glasgow Central by 41 minutes (15%). Comparable journey time reductions between Birmingham and Manchester Piccadilly will be 47 minutes (53%), these are consistent with the journey time savings for the original scheme as reported in the main TA. However, journey time reductions from London Euston to Preston are substantially lower than for the original scheme due to the removal of the HS2 WCML connection.

18.3.12 When compared to a baseline containing both HS2 Phase One and Phase 2a, the incremental journey time reductions of the AP2 revised scheme between London Euston and Manchester Piccadilly will be 19 minutes (21%) and between Birmingham Curzon Street and Manchester Piccadilly will be 48 minutes (54%), these are consistent with the journey time savings for the original scheme as reported in the main TA. However, incremental journey time savings between London Euston and Edinburgh Haymarket and between Birmingham Curzon Street and Scotland, which were substantial for the original scheme, are removed for the AP2 revised scheme due to the removal of the HS2 WCML connection as part of the SES1 scheme.

Table 20-5: Journey times between key destinations 'without' and 'with' the AP2 revised scheme in operation

Train origin/ destination	Train destination/ origin	Current fastest standard hour journey time by conventional rail (hours: minutes)	Fastest standard hour journey time with HS2 Phase One and Phase 2a alone (hours: minutes)	Fastest standard hour journey time with the original Phase 2b scheme (including Phase One and Phase 2a) as reported in Volume 3 of the main ES (hours: minutes)	Fastest standard hour journey time with the Phase 2b AP2 revised scheme (including Phase One and Phase 2a) (hours: minutes)
London Euston	Crewe	1:30	0:56	0:56	0:55
	Manchester Airport	2:24 (to conventional rail station)	1:43 (via Manchester Piccadilly High Speed station	1:03 (to Manchester Piccadilly High Speed station)	1:02 (to Manchester Airport High speed station)
	Manchester Piccadilly	2:06	1:30	1.11	1.11
	Preston	2:08	1:31	1.18	1:30
	Liverpool Lime Street	2:14	1:34	1:34	1:34
	Glasgow Central	4:29	3:48	3:46	3:48

Train origin/ destination	Train destination/ origin	Current fastest standard hour journey time by conventional rail (hours: minutes)	Fastest standard hour journey time with HS2 Phase One and Phase 2a alone (hours: minutes)	Fastest standard hour journey time with the original Phase 2b scheme (including Phase One and Phase 2a) as reported in Volume 3 of the main ES (hours: minutes)	Fastest standard hour journey time with the Phase 2b AP2 revised scheme (including Phase One and Phase 2a) (hours: minutes)
Birmingham Curzon Street	Manchester Piccadilly	1:28	1:29	0:41	0:41

Released capacity

18.3.13 Released capacity is reported in Section 20.3 of the main TA. This section of the SES2 and AP2 ES TA is unchanged.

Impact on long distance travel and modal share

18.3.14 Changes in mode share from car and potentially air, together with newly generated rail trips as a result of increased capacity, improved journey times and the additional services provided to take advantage of released capacity, are reported in Section 20.3 of the main TA. Tables 20-6 and Table 20-7 in the main TA report the sources of HS2 demand for the original scheme on a daily and annual basis and are replaced in this document by Table 20-6 and Table 20-7 below for the AP2 revised scheme.

18.3.15 The main TA reported that the combined HS2 Phase One, Phase 2a and original scheme would attract 70m passengers per annum in 2046. This was an increase of 18.2 million passenger per annum compared to HS2 Phase One and Phase 2a alone. The AP2 revised scheme will attract 54.5m passengers per annum in 2051. This is an increase of 5.6m passengers per annum as a result of the AP2 revised scheme compared to Phase One and Phase 2a alone.

18.3.16 With the AP2 revised scheme in combination with Phase One and Phase 2a, 21% of the total demand is newly generated, compared to 20% for Phase One and Phase 2a, due to new journey opportunities, reduced travel times and higher frequencies. The percentage of HS2 demand abstracted from conventional rail reduces slightly compared to previous phases of HS2, from 77% for Phase One and Phase 2a and to 75% for the AP2 revised scheme in combination with Phase One and Phase 2a, corresponding to the increase in newly generated demand. The proportion from car and air remain constant between phases, at around 3% and 1% respectively.

18.3.17 The overall change in rail travel, with a proportion of HS2 trips being generated as new travel, demonstrates the levels of travel suppressed by capacity constraints and journey times. The overall change in rail travel shows the substantial travel opportunities and aspirations that the AP2 revised scheme in combination with HS2 Phase One and Phase 2a and the released capacity services would realise.

18.3.18 The daily and annual forecast numbers of HS2 passenger trips for 2039 and 2051, the numbers of generated new trips and, for the remainder, the mode of travel that they will have transferred from for HS2 Phase One, Phase 2a and the AP2 revised scheme are set out in Table 20-6 and Table 20-7 on a daily and annual basis respectively.

Table 20-6: Number and mode share of HS2 passenger trips – daily (2039 and 2051), PFM10a

Source of HS2 demand	2039 Phase One and Phase 2a	2039 Phase One, Phase 2a and AP2 revised scheme	2051 Phase One and Phase 2a	2051 Phase One, Phase 2a and AP2 revised scheme
Total HS2 trips, of which:	**144,506**	**159,960**	**152,556**	**169,825**
From conventional rail	109,872	119,073	115,002	125,043
From car	3,910	4,939	4,179	5,255
From air	1,107	1,198	1,267	1,381
Newly generated by HS2	29,612	34,745	32,108	38,147

Table 20-7: Number and mode share of HS2 passenger trips – annual (millions) (2039 and 2051), PFM10a

Source of HS2 demand	2038 HS2 Phase One and Phase 2a	2038 HS2 Phase One, Phase 2a and AP2 revised scheme	2051 HS2 Phase One and Phase 2a	2051 HS2 Phase One, Phase 2a and AP2 revised scheme
Total HS2 trips, of which:	**46.2**	**51.3**	**48.9**	**54.5**
From conventional rail	35.7	38.9	37.5	40.9
From car	1.2	1.5	1.3	1.6
From air	0.3	0.4	0.4	0.4
Newly generated by HS2	8.9	10.5	9.7	11.6

18.3.19 The transfer of passengers from the conventional rail network and from mode transfer from car will result in benefits through reducing forecast congestion on both the SRN and the conventional rail network. The extent of reduction in annual vehicle kilometres as a result of the AP2 revised scheme is shown in Table 20-8 below which replaces Table 20-8 in the main TA.

18.3.20 This shows that the impact of the AP2 revised scheme will be a reduction in total annual vehicle travel by car of 240 million kilometres by 2051. In incremental terms, the AP2 revised scheme compared with a baseline containing HS2 Phase One and Phase 2a shows a reduction in annual vehicle kilometres of 30 million vehicle kilometres by 2051. This contributes approximately 13% of the in combination total vehicle kilometre savings of HS2 Phase One, Phase 2a and the AP2 revised scheme.

18.3.21 The biggest reductions in vehicle kilometres are for journeys to and from Scotland. This is a result of the removal of the HS2 WCML connection as part of the SES1 scheme (SES1-004-001) and changes to the Train Service Specification (TSS) which impact these long-distance trips with a consequential impact on highway vehicle kilometres.

Table 20-8: Reduction in vehicle kilometres (millions) resulting from mode shift - AP2 revised scheme compared with HS2 Phase One and Phase 2a, PFM10a, 2051

Trip category	Change in annual vehicle kilometres		
	HS2 Phase One and Phase 2a	AP2 revised scheme	Incremental impact of AP2 revised scheme
Car vehicle kilometres access to long distance rail (including London)	108,137,968	121,357,451	13,219,484
Highway long distance trips vehicle kilometres	-236,603,698	-288,483,675	-51,879,977
Highway local trips vehicle kilometres (from regional models)	-72,318,501	-62,998,696	9,319,805
Air access vehicle kilometres	-8,992,620	-9,747,781	-755,161
Total	**-209,776,851**	**-239,872,701**	**-30,095,849**

Summary of impacts

18.3.22 The main route-wide impacts of the AP2 revised scheme in combination with HS2 Phase One and Phase 2a in operation can be summarised as:

- improved journey times between Manchester, the north of England and the Midlands and the south of England;
- increases to rail capacity, reduced pressure and lower crowding on the conventional rail network enabling the running of additional services and stopping services at more stations; and
- reductions in highway vehicle kilometres due to modal shift from highways to rail.

18.3.23 The AP2 revised scheme is shown to increase demand for rail travel and provide beneficial relief to the conventional rail network as well as beneficial reductions in long distance travel by car. These impacts both for the AP2 revised scheme in isolation and when combined with those provided by HS2 Phase One and Phase 2a are considered to provide substantial benefits.

19 Off-route assessment

19.1 Introduction

19.1.1 The off-route works and assessment was reported in Section 21 of the main TA. With the exception of water treatment works at Annandale depot, there are no changes to the original scheme.

19.1.2 The off-route operation assessment for stations and depots is reported in Section 21.3 of the main TA. The removal of the HS2 WCML connection as part of the SES1 scheme (SES1-004-001), along with the update to the PFM, means that Section 21.3 of the main TA is largely replaced by Section 19 of this SES2 and AP2 ES TA.

19.2 Off-route construction assessment

Introduction

19.2.1 This section provides an assessment of changes to off-route impacts of the SES2 scheme and AP2 revised scheme in relation to works at Annandale depot stabling facilities and changes to the construction programme.

19.2.2 Whilst the assessment years have changed, for Preston Station and Carlisle Station no significant changes to construction activities are anticipated. Consequently, the impacts at these stations are unchanged from those reported in Section 6 of Volume 4, Off-route effects of the main TA. Therefore, only AP2 amendments at Annandale depot have been assessed and are reported in this document.

19.2.3 A number of changes to the original scheme reported in this report mean that Section 21.2 of the main TA is generally replaced by Section 19.2 in this document. Where there is no replacement, the text in the main TA remains valid.

Off-route depot facilities

Annandale depot

19.2.4 The study area for the original scheme is reported in Section 21.2 of the main TA. This section of the main TA is unchanged.

Environmental baseline

19.2.5 The environmental baseline for Annandale depot is reported in Section 21.2 of the main TA.

19.2.6 Since the main TA, additional traffic information has been used in the development of updated baseline and future baseline models for the SES2 scheme and AP2 revised scheme.

19.2.7 In the main TA, future baseline traffic volumes were calculated for 2028, 2038 and 2046. For the SES2 and AP2 ES TA the 2028 and 2038 future baselines have been updated to 2031 and 2039. The 2046 future baseline has been updated to 2051 in order to give the assessment greater resilience to long term growth in travel demand. Consequently, the construction assessment of the AP2 revised scheme has been undertaken for 2031 and the operational assessment has been undertaken for 2039 and 2051.

19.2.8 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 6% by 2031 compared to the baseline year of 2020. Future baseline traffic volumes in the peak hours are forecast to grow by an average of 8% by 2039 compared to the baseline year of 2020. Future baseline traffic volumes in the peak hours are forecast to grow by an average of 12% by 2051 compared to the baseline year of 2020.

AP2 revised scheme construction description

19.2.9 Construction of the AP2 revised scheme at Annandale depot is expected to commence in 2027 with construction activity continuing to 2035. Construction activities have been assessed against 2031 baseline traffic flows, irrespective of when they occur during the construction period.

Construction activities and phasing

19.2.10 Details of the main construction works and the time periods when each compound is operational are summarised in the indicative construction programme. For the construction programme for Annandale depot refer to SES2 and AP2 ES Volume 4, Off-route effects.

19.2.11 Table 21-10 in the main TA summarises the key construction activities, along with their start dates. Table 21-10 below replaces Table 21-10 of the main TA.

Table 21-10: Annandale depot key construction activities

Activity	Start date
Area advance works	2027 Q3
Site preparation and setup	2030 Q1
Station works	2030 Q2
Rail systems installation (depot)	2034 Q4
Rail systems installation (depot connections to NR infrastructure)	2034 Q3
Site reinstatement	2035 Q2

Compounds and construction sites

19.2.12 Table 21-11 in the main TA summarises the expected average and peak workforce (site workers plus staff), at each construction compound in the Annandale area. Table 21-11 below replaces Table 21-11 of the main TA.

Table 21-11: Assumed workforce at construction sites

Compound type	Compound name	Number of site workers (peak)	Number of staff (peak)	Total workforce (site plus staff)	
				Average	Peak
Satellite	Quintinshill Sidings satellite compound	65	15	67	80
Satellite	Cranberry Farm accommodation overbridge satellite compound	95	30	72	125
Main	Annandale depot main compound	225	90	210	315
Satellite	Cove Crossing satellite compound	65	15	67	80

19.2.13 Table 21-12 in the main TA provides details of the compound set up date and the duration of active use. The duration of active use excludes any period where there are no substantial workforce trips or movement of materials to and from the compound. Table 21-12 below replaces Table 21-12 of the main TA.

Table 21-12: Typical vehicle trip generation for construction site compounds in the Annandale depot area

Compound type	Compound name	Indicative start/set up date (years/ quarter)	Estimated duration active of use (years/ months)	Average daily combined two-way car/LGV trips during busy period and within peak month of activity	Average daily combined two-way HGV trips during busy period and within peak month of activity	Estimated duration of busy period (months)
Rail systems	Quintinshill Sidings satellite compound	2034 Q3	9 months	147-147	4-4	6 months
Satellite	Cranberry Farm accommodation overbridge satellite compound	2030 Q2	1 year 11 months	251-268	18-26	17 months
Main	Annandale depot main compound	2030 Q1	4 years 8 months	588-618	445-466	16 months
Rail systems	Cove Crossing satellite compound	2034 Q3	9 months	147-148	4-4	6 months

Overview of impacts – construction

19.2.14 Table 21-14 in the main TA summarises the peak daily HS2 construction traffic flow both in HGV and total vehicles, on roads within the Annandale area that form part of the construction routes. Table 21-14 below replaces Table 21-14 of the main TA.

Table 21-14: Annandale peak daily construction traffic flow

Location	Direction*	Daily peak HGV vehicles	Daily peak all vehicles
B7076 (between Quintinshill sidings satellite compound site access and Gretna service station access)	SB	2	24
	NB	2	24
B7076 (between Gretna Green service station access and Annandale depot site access)	SB	121	174
	NB	121	174
B7076 (between Annandale depot site access and A74(M) junction 21 south-facing slip roads)	SB	121	511
	NB	121	511
B7076 (between A74(M) junction 21 south-facing slip roads and B6357)	SB	1	77
	NB	1	77
B6357 (between B7076 and A74(M) north-facing slip roads)	SB	1	33
	NB	1	33
B7076 (between B6357 and Cove Crossing satellite compound site access)	NB	2	76
	SB	2	76
unnamed road serving Cove Crossing satellite compound	NB	2	76
	SB	2	76

** NB = northbound; SB = southbound.*

Strategic and local road network traffic flows

19.2.15 Table 21-15 and Table 21-16 in the main TA set out the traffic flows for the 2031 future baseline and the original scheme on the roads most affected by construction of the original scheme for the AM and PM peak hour. Table 21-15 and Table 21-16 below replace Table 21-15 and Table 21-16 in the main TA.

Table 21-15: 2031 future baseline and AP2 revised scheme construction traffic (vehicles) - AM peak hour (08:00-09:00)

Location	Direction	2031 future baseline flows		2031 AP2 revised scheme flows		AP2 revised scheme actual flow change from 2031 future baseline		AP2 revised scheme % change from 2031 future baseline	
		All vehicles	HGV	All vehicles	HGV	All vehicles	HGV	All vehicles	HGV
B7076 (between Quintinshill sidings satellite compound site access and Gretna service station access)	SB	94	16	103	16	9	0	10%	0%
	NB	47	10	56	11	9	1	19%	10%
B7076 (between Gretna Green service station access and Annandale depot site access)	SB	76	9	136	21	60	12	79%	133%
	NB	44	12	104	24	60	12	136%	100%
B7076 (between Annandale depot site access and A74(M) junction 21 south-facing slip roads)	SB	115	14	292	26	177	12	154%	86%
	NB	82	22	259	34	177	12	216%	55%
B7076 (between A74(M) junction 21 south-facing slip roads and B6357)	SB	115	14	142	14	27	0	23%	0%
	NB	82	22	108	22	26	0	32%	0%
B6357 (between B7076 and A74(M) north-facing slip roads)	SB	75	11	87	11	12	0	16%	0%
	NB	78	27	90	27	12	0	15%	0%
B7076 (between B6357 and Cove Crossing satellite compound site access)	NB	70	12	96	12	26	0	37%	0%
	SB	110	21	136	21	26	0	24%	0%
unnamed road serving Cove Crossing satellite compound	NB	3	0	30	1	27	1	900%	0%
	SB	5	1	31	1	26	0	520%	0%

Table 21-16: 2031 future baseline and AP2 revised scheme construction traffic (vehicles) - PM peak hour (17:00-18:00)

Location	Direction	2031 future baseline flows		2031 AP2 revised scheme flows		AP2 revised scheme actual flow change from 2031 future baseline		AP2 revised scheme % change from 2031 future baseline	
		All vehicles	HGV	All vehicles	HGV	All vehicles	HGV	All vehicles	HGV
B7076 (between Quintinshill sidings satellite compound site access and Gretna service station access)	SB	92	14	103	14	11	0	12%	0%
	NB	44	4	56	4	12	0	27%	0%
B7076 (between Gretna Green service station access and Annandale depot site access)	SB	57	5	77	18	20	13	35%	260%
	NB	41	5	44	17	3	12	7%	240%
B7076 (between Annandale depot site access and A74(M) junction 21 south-facing slip roads)	SB	70	8	134	21	64	13	91%	163%
	NB	93	12	100	24	7	12	8%	100%
B7076 (between A74(M) junction 21 south-facing slip roads and B6357)	SB	70	8	134	9	64	1	91%	13%
	NB	93	12	100	12	7	0	8%	0%
B6357 (between B7076 and A74(M) north-facing slip roads)	SB	51	9	81	9	30	0	59%	0%
	NB	66	11	84	11	18	0	27%	0%
B7076 (between B6357 and Cove Crossing satellite compound site access)	NB	75	8	96	8	21	0	28%	0%
	SB	73	9	136	9	63	0	86%	0%
unnamed road serving Cove Crossing satellite compound	NB	6	1	30	1	24	0	400%	0%
	SB	5	1	31	1	26	0	520%	0%

Junction performance

19.2.16 Junction capacity analysis has been undertaken for the AM and PM peak hours comparing junction operation in the 2031 future baseline scenario with the AP2 revised scheme.

B7076 / Annandale depot site access

19.2.17 Table 21-17 in the main TA summarises the results of the changes to the performance of the junction as a result of the original scheme. Table 21-17 below replaces Table 21-17 in the main TA and summarises the results of the changes to performance of the junction as a result of the AP2 revised scheme.

Table 21-17: B7076 / depot site access junction 2031 with the AP2 revised scheme junction capacity assessment results

Approach	Flow, PCU/hr	RFC	Q, PCU
08:00-09:00	**2031 AP2 revised scheme**		
B7076 (west) (ahead and left)	192	-	-
Main Compound (left)	29	0.04	0.0
Main Compound (right)	29	0.05	0.1
B7076 (east) (ahead and right)	83	0.05	0.0
17:00-18:00	**2031 AP2 revised scheme**		
B7076 (west) (ahead and left)	77	-	-
Main Compound (left)	32	0.05	0.00
Main Compound (right)	111	0.19	0.00
B7076 (east) (ahead and right)	66	0.04	0.00

19.2.18 The conclusions drawn in paragraph 21.2.97 of the main TA are replaced by:

"The assessment shows that this junction operates well within capacity in 2031 with the AP2 revised scheme."

19.3 Off-route operation assessment

19.3.1 The assessment of off-route operation of stations and depots is reported in Section 21.3 of the main TA. The removal of the HS2 WCML connection as (SES1-004-001) as part of the SES1 scheme, along with the update to the PFM, means that Section 21.3 of the main TA is largely replaced by Section 19.3 of this SES2 and AP2 ES TA.

Summary of off-route stabling facilities impacts in operation

Annandale depot

19.3.2 The Annandale depot operation description for the original scheme is reported in Section 21.3 of the main TA. This section of the main TA is unchanged.

Overview of impacts – operation

19.3.3 The AP2 revised scheme will generate additional vehicle movements due to staff, servicing and operational traffic. However, the weekday peak hour trip generation is anticipated to be low, as the Annandale depot is expected to operate on a shift pattern, with the busiest shift changeovers occurring outside of the morning and evening peak periods on the local road network. Some Annandale depot related traffic would be generated during the peak hours, leading to flow changes on the highway network. Whilst there is uncertainty regarding the timing of the depot being brought into use, the SES2 changes and AP2 amendments do not impact upon the operation of the depot. However, the changes to the assessment years from 2038 to 2039 and 2046 to 2051 mean that Section 21.3 of the main TA is replaced by Section 19.3 in this document. Where there is no replacement the text in the main TA remains valid.

Strategic and local road network traffic flows

19.3.4 Tables 21-22 to 21-25 below replace Tables 21-22 to 21-25 in the main TA and set out the traffic flows on highway links affected by operation of the AP2 revised scheme for the weekday AM peak hour (08:00-09:00) and weekday PM peak hour (17:00-18:00) for the revised assessment years 2039 and 2051 respectively.

19.3.5 The forecast traffic flow tables presented in this report use the following abbreviations for road direction: NB = northbound; SB = southbound; EB = eastbound; and WB = westbound.

Table 21-22: AP2 revised scheme impacted links, 2039 AM peak

Location	Direction	2039 future baseline flows		2039 AP2 revised scheme flows		AP2 revised scheme actual flow change from 2039 future baseline		AP2 revised scheme % change from 2039 future baseline	
		All vehicles	HGV	All vehicles	HGV	All vehicles	HGV	All vehicles	HGV
B7076 (between Gretna Loaning and Quintinshill sidings satellite compound site access)	SB	97	16	97	16	0	0	0%	0%
	NB	49	11	65	11	16	0	33%	0%
B7076 (between Quintinshill sidings satellite compound site access and Gretna service station access)	SB	97	16	97	16	0	0	0%	0%
	NB	49	11	65	11	16	0	33%	0%
B7076 (between Gretna Green service station access and Annandale depot site access)	SB	78	9	78	9	0	0	0%	0%
	NB	45	12	61	12	16	0	36%	0%
B7076 (between Annandale depot site access and A74(M) junction 21 south-facing slip roads)	SB	118	14	179	15	61	1	51%	4%
	NB	84	22	84	22	0	0	0%	0%
B7076 (between A74(M) junction 21 south-facing slip roads and B6357)	SB	118	14	139	14	21	0	18%	0%
	NB	84	22	84	22	0	0	0%	0%

Table 21-23: AP2 revised scheme impacted links, 2051 AM peak

Location	Direction	2051 future baseline flows		2051 AP2 revised scheme flows		AP2 revised scheme actual flow change from 2051 future baseline		AP2 revised scheme % change from 2051 future baseline	
		All vehicles	HGV	All vehicles	HGV	All vehicles	HGV	All vehicles	HGV
B7076 (between Gretna Loaning and Quintinshill sidings satellite compound site access)	SB	101	16	101	16	0	0	0%	0%
	NB	51	11	67	11	16	0	32%	0%

Location	Direction	2051 future baseline flows		2051 AP2 revised scheme flows		AP2 revised scheme actual flow change from 2051 future baseline		AP2 revised scheme % change from 2051 future baseline	
		All vehicles	HGV	All vehicles	HGV	All vehicles	HGV	All vehicles	HGV
B7076 (between Quintinshill sidings satellite compound site access and Gretna service station access)	SB	101	16	101	16	0	0	0%	0%
	NB	51	11	67	11	16	0	32%	0%
B7076 (between Gretna Green service station access and Annandale depot site access)	SB	81	10	81	10	0	0	0%	0%
	NB	46	12	62	12	16	0	34%	0%
B7076 (between Annandale depot site access and A74(M) junction 21 south-facing slip roads)	SB	123	14	183	15	60	1	49%	4%
	NB	87	23	87	23	0	0	0%	0%
B7076 (between A74(M) junction 21 south-facing slip roads and B6357)	SB	123	14	144	14	21	0	17%	0%
	NB	87	23	87	23	0	0	0%	0%

Table 21-24: AP2 revised scheme impacted links, 2039 PM peak

Location	Direction	2039 future baseline flows		2039 AP2 revised scheme flows		AP2 revised scheme actual flow change from 2039 future baseline		AP2 revised scheme % change from 2039 future baseline	
		All vehicles	HGV	All vehicles	HGV	All vehicles	HGV	All vehicles	HGV
B7076 (between Gretna Loaning and Quintinshill sidings satellite compound site access)	SB	94	14	110	14	16	0	17%	0%
	NB	45	4	45	4	0	0	0%	0%
B7076 (between Quintinshill sidings satellite compound site access and Gretna service station access)	SB	94	14	110	14	16	0	17%	0%
	NB	45	4	45	4	0	0	0%	0%

Location	Direction	2039 future baseline flows		2039 AP2 revised scheme flows		AP2 revised scheme actual flow change from 2039 future baseline		AP2 revised scheme % change from 2039 future baseline	
		All vehicles	HGV	All vehicles	HGV	All vehicles	HGV	All vehicles	HGV
B7076 (between Gretna Green service station access and Annandale depot site access)	SB	58	5	74	5	16	0	27%	0%
	NB	42	5	42	5	0	0	0%	0%
B7076 (between Annandale depot site access and A74(M) junction 21 south-facing slip roads)	SB	72	9	73	10	1	1	1%	7%
	NB	95	12	116	12	21	0	23%	0%
B7076 (between A74(M) junction 21 south-facing slip roads and B6357)	SB	72	9	72	9	0	0	0%	0%
	NB	95	12	116	12	21	0	23%	0%

Table 21-25: AP2 revised scheme impacted links, 2051 PM peak

Location	Direction	2051 future baseline flows		2051 AP2 revised scheme flows		AP2 revised scheme actual flow change from 2051 future baseline		AP2 revised scheme % change from 2051 future baseline	
		All vehicles	HGV	All vehicles	HGV	All vehicles	HGV	All vehicles	HGV
B7076 (between Gretna Loaning and Quintinshill sidings satellite compound site access)	SB	97	14	113	14	16	0	16%	0%
	NB	47	4	47	4	0	0	0%	0%
B7076 (between Quintinshill sidings satellite compound site access and Gretna service station access)	SB	97	14	113	14	16	0	16%	0%
	NB	47	4	47	4	0	0	0%	0%
B7076 (between Gretna Green service station access and Annandale depot site access)	SB	60	6	76	6	16	0	26%	0%
	NB	43	5	43	5	0	0	0%	0%

Location	Direction	2051 future baseline flows		2051 AP2 revised scheme flows		AP2 revised scheme actual flow change from 2051 future baseline		AP2 revised scheme % change from 2051 future baseline	
		All vehicles	HGV	All vehicles	HGV	All vehicles	HGV	All vehicles	HGV
B7076 (between Annandale depot site access and A74(M) junction 21 south-facing slip roads)	SB	74	9	74	10	0	1	0%	7%
	NB	98	12	119	12	21	0	22%	0%
B7076 (between A74(M) junction 21 south-facing slip roads and B6357)	SB	74	9	74	9	0	0	0%	0%
	NB	98	12	119	12	21	0	22%	0%

Junction performance

19.3.6 Junction capacity analysis is reported in Section 21.3 of the main TA, which was undertaken for the weekday AM and PM peak hours comparing junction operation in the 2038 and 2046 future baseline with 2038 and 2046 for the original scheme.

19.3.7 Updated junction capacity analysis has been undertaken for the AP2 revised scheme taking account of the revised baseline traffic and changes in traffic flows associated with the SES2 changes and AP2 amendments. Junction capacity analysis has been undertaken for the weekday AM and PM peak hours comparing junction operation in the 2039 and 2051 future baseline with 2039 and 2051 with the AP2 revised scheme.

B7076 / Annandale depot site access

19.3.8 Table 21-26 of the main TA summarises the results of the changes in performance of the junction as a result of the original scheme. Table 21-26 of the main TA is replaced by Table 21-26 below.

Table 21-26: B7076 / depot site access junction 2039 and 2051 with AP2 revised scheme junction capacity assessment

Approach	Flow, PCU/hr	RFC	Q, PCU	Flow, PCU/hr	RFC	Q, PCU
08:00-09:00	**2039 with AP2 revised scheme**			**2051 with AP2 revised scheme**		
B7076 (west) (ahead and left)	137	-	-	141	-	-
Main Compound (left)	0	0	0	0	0	0
Main Compound (right)	0	0	0	0	0	0
B7076 (east) (ahead and right)	63	0.03	0	65	0.03	0
17:00-18:00	**2039 with AP2 revised scheme**			**2051 with AP2 revised scheme**		
B7076 (west) (ahead and left)	45	-	-	47	-	-
Main Compound (left)	16	0.03	0	16	0.03	0
Main Compound (right)	61	0.11	0	61	0.11	0
B7076 (east) (ahead and right)	35	0	0	36	0	0

19.3.9 The conclusions drawn in paragraph 21.3.109 of the main TA are replaced by:

"The assessment shows that this junction operates well within capacity in 2039 and 2051 with the AP2 revised scheme."

Accidents and safety

19.3.10 The impacts on accidents and safety during operation are reported in Section 21.3 of the main TA. This section of the main TA is unchanged.

Public transport

19.3.11 The impacts on local bus routes or rail services during operation are reported in Section 21.3 of the main TA. This section of the main TA is unchanged.

Pedestrian, cyclist and equestrian

19.3.12 The impacts on PRoW or core paths during operation are reported in Section 21.3 of the main TA. This section of the main TA is unchanged.

Off-route stations

19.3.13 In addition to the operational impact of changes to off-route stations to accommodate HS2 services, this section of the report identifies the off-route railway stations across the conventional railway network where operation of the AP2 revised scheme, and the consequent release of capacity elsewhere, will result in changes to passenger numbers. HS2 Phase One stations are included within the assessment. Any change in passengers will lead to changes in the number of access journeys, including, potentially, by car, taxi, walking, cycle, bus and tram. These do not necessarily require any physical works to the station or surrounding area.

Methodology for assessment of passenger demand

19.3.14 The methodology for the assessment of passenger demand is reported in Section 21.3 of the main TA. This section is unchanged from main TA.

Forecast changes in passenger demand

19.3.15 The operation of the AP2 revised scheme, and the consequent use of released rail capacity elsewhere, will result in changes to passenger numbers at off-route railway stations across the conventional railway network. This includes HS2 Phase One stations.

19.3.16 The forecast change in HS2 passenger numbers has been derived from PFM which has been periodically updated by HS2 Ltd during the course of the development of all phases of HS2. For the SES2 and AP2 ES TA, PFM has been updated from PFM9.6 to PFM10a Changes from PFM9.6 to PMF10a reflect the re-estimation of the long-distance demand model using more recent survey data from the National Travel Survey (NTS) and updated values of travel time savings from the DfT 2015 study[5]. In addition, the PFM10a forecasts reflect the removal of the HS2 WCML connection (SES1-004-001) (as part of the SES1 scheme). For the assessment of off-route stations in operation, the forecast year has been updated from 2046 to 2051.

19.3.17 A review has been undertaken to assess the changes to passenger demand forecasts at HS2 Phase One stations (London Euston, Old Oak Common, Birmingham Interchange and

[5] Department for Transport (2015), *Values of travel time savings and reliability: final reports.* Available online at: https://www.gov.uk/government/publications/values-of-travel-time-savings-and-reliability-final-reports.

Birmingham Curzon Street) between PFM9.6 and PFM10a. This review shows that the PFM10a demand used in the analysis undertaken for the AP2 revised scheme, predicts lower demand at London Euston, Old Oak Common, Birmingham Interchange and Birmingham Curzon Street than the PFM9.6 forecasts used for the assessment of the original scheme. Therefore, the conclusion in the main TA that any potential issues arising from increases in use of the stations due to HS2 were appropriately addressed by the HS2 Phase One assessment, is unchanged.

Sifting of stations

19.3.18 The methodology used for sifting of stations for the original scheme is reported in Section 21.3 of the main TA. With the exception of the change in forecast year from 2046 to 2051, this section of the main TA is unchanged.

19.3.19 The stations where the predicted change in footfall meets the criteria of a daily increase in footfall of 10% or 700/1,400 users/day either as a result of the original scheme or due to HS2 Phase One, Phase 2a and the original scheme in combination, are set out in Table 21-19 of the main TA. This is replaced by Table 21-19 below, which outlines both the in combination change of HS2 Phase One, Phase 2a and the AP2 revised scheme together with the incremental change resulting from the AP2 revised scheme assuming the HS2 Phases One and Phase 2a are in operation.

Table 21-19: Increase in passenger demand greater than 10% or 700 trips/day, off-route stations, PFM10a

Station	Change in daily passenger demand due to HS2 Phase One, 2a and the AP2 revised scheme together (2051)	Percentage change in daily passenger demand due to HS2 Phase One, 2a and the AP2 revised scheme together (2051)	Incremental change in daily passenger demand due to the AP2 revised scheme compared with HS2 Phase One and 2a (2051)	Percentage incremental change in daily passenger demand due to the AP2 revised scheme compared with HS2 Phase One and 2a (2051)
Milton Keynes Central	3,128	7%	-71	-0.2%
Crewe	1,067	4%	-464	-1.9%
Preston	2,288	11%	-117	-0.5%
Lancaster	860	10%	7	0.1%
Carlisle	742	8%	-24	-0.3%
Glasgow Central	2,592	3%	121	1.0%

19.3.20 In Table 21-19 of the main TA, six stations were forecast to experience an increase in daily passenger demand greater than 10% or 700/1,400 users/day as a consequence of the original scheme in combination with HS2 Phase One and Phase 2a. The same six stations are forecast to experience an increase in daily passenger demand with the AP2 revised scheme in combination with HS2 Phase One and Phase 2a that meets the 10% or 700/1,400 users/day with no additional stations meeting these criteria and therefore requiring assessment. These increases with the AP2 revised scheme are all lower than those presented in the main TA for the original scheme and therefore the impacts reported in the main TA are reduced. In addition, the incremental changes in footfall for the AP2 revised scheme, compared to a baseline including HS2 Phase One and Phase 2a, are substantially lower than those presented in the main TA, as a result of the removal of the HS2 WCML connection (as part of the SES1 scheme) and therefore the impacts reported in the main TA are reduced. No stations exceed the thresholds of 10% or 700/1,400 users/day for the incremental impact in isolation.

19.3.21 Two stations with an increase greater than 10% or 700 trips/day for all phases of HS2 were scoped out either because the AP2 revised scheme has a limited impact in its own right and so the station has therefore already been considered under the HS2 Phase One and Phase 2a assessments, or there is high rail to rail interchange with limited changes in footfall into and out of the station. This is set out below:

- Runcorn – main impacts in HS2 Phase One and Phase 2a with low impact with AP2 revised scheme; and
- Watford Junction – high rail-rail interchange and dual carriageway highway access.

19.3.22 Table 21-20 of the main TA showed that eleven stations were forecast to experience a reduction in daily passenger demand greater than 10% or 700/1,400 users/day as a consequence of the original scheme in combination with HS2 Phase One and Phase 2a. This is replaced by Table 21-20 below for the AP2 revised scheme. This shows that these stations experience a lower reduction in footfall with the AP2 revised scheme with the exception of Nuneaton, Lichfield Trent Valley and Warrington Bank Quay which, whilst still experiencing small reductions in footfall, now fall below the criteria of 10% or 700/1400 users so are no longer reported. However, with the AP2 revised scheme, Leamington Spa, Solihull, Chester and Wilmslow stations are now forecast to experience a substantial reduction in demand greater than 10% or 700/1400 users/day.

19.3.23 Those stations which are forecast to experience a substantial reduction in footfall with the AP2 revised scheme in combination with HS2 Phase One and Phase 2a are shown in Table 21-20 below along with the incremental change resulting from the AP2 revised scheme. These stations are generally directly impacted by alternative faster HS2 services. Consequently, it is expected that a number of passengers would divert to more convenient, faster HS2 services. This will have the benefit of releasing capacity on the existing rail network, as well as on the traffic and transport network local to the off-route stations. With the exceptions of Leamington Spa, Solihull, Chester and Wilmslow stations which were not reported in the main TA, these reductions are all lower than those presented in the main TA.

Table 21-20: Decrease in passenger demand greater than 10% or 700 trips/day, off-route stations, PFM10a

Station	Change in daily passenger demand due to HS2 Phase One, 2a and the AP2 revised scheme together (2051)	Percentage change in daily passenger demand due to HS2 Phase One, 2a and the AP2 revised scheme together (2051)	Incremental change in daily passenger demand due to the AP2 revised scheme compared with HS2 Phase One and 2a (2051)	Percentage incremental change in daily passenger demand due to the AP2 revised scheme compared with HS2 Phase One and 2a (2051)
London Paddington	-47,341	-20%	184	0.1%
London Kings Cross	-1,632	-2%	NA	NA
London Marylebone	-6,701	-15%	-23	0%
Leamington Spa	-1,271	-6%	-22	-0.1%
Coventry	-5,968	-16%	-74	-0.2%
Birmingham International	-8,330	-21%	-32	-0.3%
Solihull	-1,582	-5%	NA	NA
Birmingham New Street	-19,957	-11%	-3.974	-2.1%
Chester	-1,061	-6%	NA	NA
Manchester Airport	-1,111	-6%	NA	NA
Wilmslow	-1,330	-13%	-2,138	-20.5%
Stockport	-6,521	-14%	-10,370	-21.9%

19.3.24 The largest reductions in passenger demand due to the AP2 revised scheme in combination with HS2 Phase One and Phase 2a are at London and Birmingham stations, most notably London Paddington and Birmingham New Street stations. For Paddington, the reduction is a result of Phase One with the introduction of interchange at Old Oak Common between the Great Western Main Line (GWML) fast services, Elizabeth line and HS2 services. In effect, these are passengers who in the future baseline would have interchanged between GWML (fast) services and the Elizabeth line at Paddington. However, with HS2 Phase One, many of these passengers make the same interchange at Old Oak Common. The reductions at Birmingham New Street Station reflect the proximity to the HS2 station at Birmingham Curzon Street. There are smaller reductions in demand as a result of the AP2 revised scheme in combination with HS2 Phase One and Phase 2a at London Marylebone, Birmingham International and Coventry reflecting diversion to HS2 services at adjacent HS2 stations.

Stage 2 – analysis of impacts

19.3.25 The approach to the Stage 2 analysis of impacts is reported in paragraph 21.3.28 to 21.3.34 of the main TA. This section of the main TA is unchanged.

Methodology

19.3.26 The methodology adopted for the analysis of impacts for the Stage 2 analysis is reported in Section 21.3 of the main TA. This section of the main TA is unchanged with the exception of updating the assessment year from 2046 to 2051.

Summary of impact of changes in demand at off-route stations

Milton Keynes Central Station

19.3.27 Passenger numbers at Milton Keynes Central Station are forecast to increase by approximately 7%, equivalent to 3,128 additional passengers per day by 2051 as a result of the AP2 revised scheme in combination with HS2 Phase One and Phase 2a. This compares to an increase of 10% or 4,450 additional passengers per day for the original scheme in 2046 as reported in the main TA.

Environmental baseline

19.3.28 The environmental baseline for Milton Keynes Central Station is set out in Section 21.3 of the main TA. This section of the main TA is unchanged for the SES2 and AP2 ES TA with the exception of growth to the future baseline of 2051 set out below.

19.3.29 The car park surveys undertaken in May 2019 recorded 1,485 vehicle movements to/from the station in the morning peak hour, and 1,611 in the evening peak hour.

19.3.30 Future baseline traffic volumes are forecast to grow by around 29.7% in the morning peak hour and 28.2% in the evening peak hour by 2051 compared to 2019. As a result, in the future baseline of 2051, it is predicted that the station will attract 1,926 vehicle movements in the morning peak hour and 2,065 in the evening peak hour.

Passenger impacts

19.3.31 Passenger impacts at Milton Keynes Central Station are set out in Section 21.3 of the main TA. The smaller change in use of the station of 7% for the AP2 revised scheme, compared to the change of 10% for the original scheme, is not at a level that would be likely to result in impacts on other station facilities, including car or cycle parking, the local walk network or local bus service facilities.

Crewe Station

19.3.32 Passenger numbers at Crewe Station are forecast to increase by approximately 4%, equivalent to 1,067 additional passengers per day by 2051 as a result of the AP2 revised scheme in combination with HS2 Phase One and Phase 2a. This compares to an increase of 10% or 2,554 additional passengers per day for the original scheme in 2046 as reported in the main TA.

Environmental baseline

19.3.33 The environmental baseline for Crewe Station is set out in Section 21.3 of the main TA. This section of the main TA is unchanged for the SES2 and AP2 ES TA with the exception of growth to the future baseline of 2051 set out below.

19.3.34 The car park surveys undertaken in May 2019 recorded 304 vehicle movements to/from the station in the morning peak hour, and 360 in the evening peak hour.

19.3.35 Future baseline traffic volumes are forecast to grow by around 30.0% in the morning peak hour and 28.1% in the evening peak hour by 2051 compared to 2019. As a result, in the future baseline of 2051, it is predicted that the station will attract 394 vehicle movements in the morning peak hour and 461 in the evening peak hour.

Passenger impacts

19.3.36 Passenger impacts at Crewe station are set out in Section 21.3 of the main TA. The overall change in use of the station for the AP2 revised scheme is not at a level that would be likely to result in impacts on other station facilities, including car or cycle parking, the local walk network or local bus service facilities.

Preston Station

19.3.37 Passenger numbers at Preston Station are forecast to increase by approximately 11%, equivalent to 2,288 additional passengers per day by 2051 as a result of the AP2 revised scheme in combination with HS2 Phase One and Phase 2a. This compares to an increase of 16% or 3,518 additional passengers per day for the original scheme in 2046 as reported in the main TA. In addition, the original scheme included a requirement for daily operation staff including drivers, managers, cleaners and customer service staff at Preston Station; this requirement is reduced for the AP2 revised scheme due to the removal of the HS2 WCML connection (SES1-004-001) as part of the SES1 scheme.

Environmental baseline

19.3.38 The environmental baseline for Preston Station is set out in Section 21.3 of the main TA. This section of the main TA is unchanged for the SES2 and AP2 ES TA with the exception of growth to the future baseline of 2051.

19.3.39 The car park surveys undertaken in March 2017 recorded 307 vehicle movements to/from the station in the morning peak hour, and 412 in the evening peak hour.

19.3.40 Future baseline traffic volumes are forecast to grow by around 28.2% in the morning peak hour and 25.3% in the evening peak hour by 2051 compared to 2017. In the future baseline of 2051, it is forecast that the station will attract 394 vehicle movements in the morning peak hour and 516 in the evening peak hour.

Passenger impacts

19.3.41 Passenger impacts at Preston Station are set out in Section 21.3 of the main TA. The conclusion in the main TA that the overall change in use of the station would be likely to result in impacts on parking demand and drop-off facilities, cycle parking, the local walk network or local bus service facilities is unchanged for the AP2 revised scheme. Bus operators determine the frequency of bus services and can be expected to make adjustments to accommodate any changes in passenger demand when planning future services.

Lancaster Station

19.3.42 Passenger numbers at Lancaster Station are forecast to increase by approximately 10%, equivalent to 860 additional passengers per day by 2051 as a result of the AP2 revised scheme in combination with HS2 Phase One and Phase 2a. This compares to an increase of 15% or 1,276 additional passengers per day for the original scheme in 2046 as reported in the main TA.

Environmental baseline

19.3.43 The environmental baseline for Lancaster station is set out in Section 21.3 of the main TA. This section of the main TA is unchanged for the SES2 and AP2 ES TA with the exception of growth to the future baseline of 2051.

19.3.44 The car park surveys undertaken in July 2019 recorded 304 vehicle movements to/from the station in the morning peak hour, and 281 in the evening peak hour.

19.3.45 Future baseline traffic volumes are forecast to grow by around 24.2% in the morning peak hour and 22.1% in the evening peak hour by 2051 compared to 2019. As a result, in the 2051 future baseline, it is predicted that the station will attract 377 vehicle movements in the morning peak hour and 343 in the evening peak hour.

Passenger impacts

19.3.46 Passenger impacts at Lancaster Station are set out in Section 21.3 of the main TA. The conclusion in the main TA that the overall change in use of the station would be likely to result in impacts on other station facilities, including car or cycle parking, the local walk network or local bus service facilities is unchanged for the AP2 revised scheme. Bus operators determine the frequency of bus services and can be expected to make adjustments to accommodate any changes in passenger demand when planning future services.

Carlisle Station

19.3.47 Passenger numbers at Carlisle Station are forecast to increase by approximately 8%, equivalent to 742 additional passengers per day by 2051 as a result of the AP2 revised scheme in combination with HS2 Phase One and Phase 2a. This compares to an increase of 20% or 1,682 additional passengers per day for the original scheme in 2046 as reported in the main TA. In addition, the original scheme included a requirement for daily operation staff including drivers, managers, cleaners and customer service staff at Carlisle Station; this requirement is removed for the AP2 revised scheme due to the removal of the HS2 WCML connection (SES1-004-001) as part of the SES1 scheme.

Environmental baseline

19.3.48 The environmental baseline for Carlisle Station is set out in Section 21.3 of the main TA. This section of the main TA is unchanged for the SES2 and AP2 ES TA with the exception of growth to the future baseline of 2051.

19.3.49 The car park surveys undertaken in July 2019 recorded 302 vehicle movements to/from the station in the morning peak hour, and 289 in the evening peak hour.

19.3.50 Future baseline traffic volumes are forecast to grow by around 21.1% in both the morning peak hour and 19.2% in the evening peak hour by 2051 compared to 2019. As a result, in the future baseline of 2051, it is predicted that the station will attract 366 vehicle movements in the morning peak hour and 344 in the evening peak hour.

Passenger impacts

19.3.51 Passenger impacts at Carlisle Station are set out in Section 21.3 of the main TA. The conclusion in the main TA that the overall change in use of the station would be likely to result in impacts on parking demand and drop-off facilities is unchanged for the AP2 revised scheme. However, the overall change in use of the station for the AP2 revised scheme, is not at a level that would be likely to result in impacts on other station facilities, including cycle parking, the local walk network or local bus service facilities.

Glasgow Central Station

19.3.52 Passenger numbers at Glasgow Central Station are forecast to increase by approximately 3%, equivalent to 2,592 additional passengers per day by 2051 as a result of the AP2 revised scheme in combination with HS2 Phase One and Phase 2a. This compares to an increase of 6% or 4,854 additional passengers per day for the original scheme in 2046 as reported in the main TA.

Environmental baseline

19.3.53 The environmental baseline for Glasgow Central Station is set out in Section 21.3 of the main TA. This section of the main TA is unchanged for the SES2 and AP2 ES TA with the exception of growth to the future baseline of 2051.

19.3.54 The car park surveys undertaken in May 2019 recorded 273 vehicle movements to/from the station in the morning peak hour, and 279 in the evening peak hour.

19.3.55 Future baseline traffic volumes are forecast to grow by around 26.1% in the morning peak hour and 23.7% in the evening peak hour by 2051 compared to 2019. As a result, in the future baseline of 2051, it is predicted that the station will attract 344 vehicle movements in the morning peak hour and 345 in the evening peak hour.

Passenger impacts

19.3.56 Passenger impacts at Glasgow Central station are set out in Section 21.3 of the main TA. The overall change in use of the station is below the level that would be likely to result in impacts on other station facilities, including car or cycle parking, the local walk network or local bus services.

Annexes

Introduction

The main TA contained seven Annexes which comprised a Framework Travel Plan as Annex A, and six Model Performance Reports (Annexes B–G) covering the performance of the transport models used to inform the assessment of the original scheme. For the SES1 and AP1 ES TA Annexes A, B and C of the main TA were unchanged, while Annexes D–G of the main TA were replaced by Annexes D–G in the SES1 and AP1 ES TA.

For this SES2 and AP2 ES TA, Annexes A and B of the main TA are unchanged with Annex C of the main TA replaced by Annex C in this SES2 and AP2 ES TA. Annexes D-G of the SES1 and AP1 ES TA are replaced by Annexes D-G in this SES2 and AP2 ES TA.

Annex C: Model performance report – Greater Manchester SATURN Model (GMSM)

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Tables

Figures

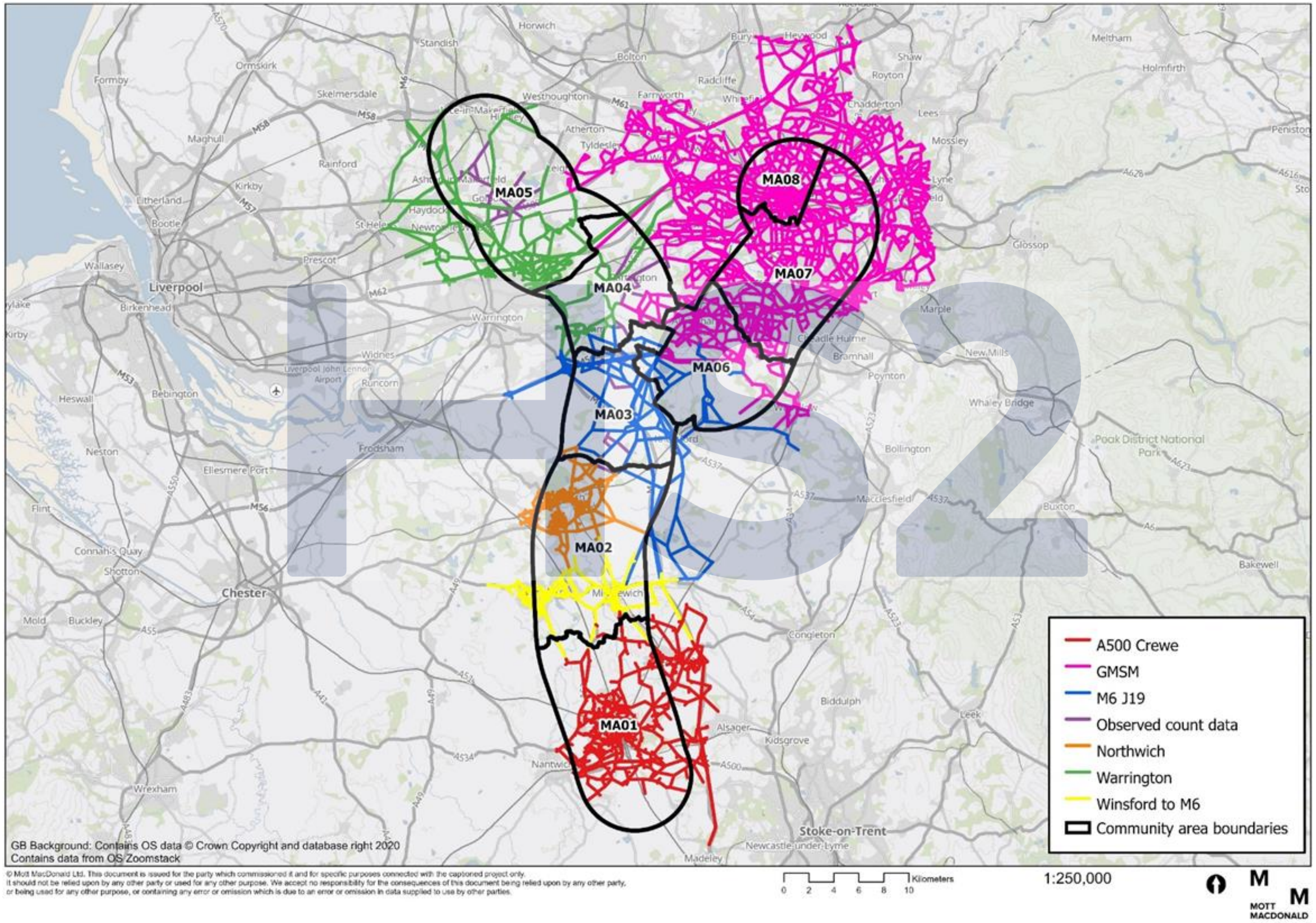
1 Introduction

1.1 Background

1.1.1 For the purpose of assessment, the route of the original scheme is split into a number of geographical areas referred to as Community Areas. The Greater Manchester SATURN Model (GMSM) has been utilised provide an evidence base for the main Transport Assessment (TA) for the Community Areas referred to as Hulseheath to Manchester Airport (MA06), Davenport Green to Ardwick (MA07) and Manchester Piccadilly Station (MA08).

1.1.2 Reference should be made to Figure 1 which shows the geographic coverage of strategic transport models that have been utilised for the TA.

Figure 1: Strategic transport model coverage for the High Speed Rail (Crewe – Manchester) Transport Assessment



1.2 Hybrid Bill and Additional Provision 1 Environmental Statement

1.2.1 Transport for Greater Manchester (TfGM) released copies of the latest available GMSM versions (as of March 2019) to HS2 Ltd, transport consultants, Mott MacDonald WSP Joint Venture (MWJV).

1.2.2 For the main ES, the GMSM Model was updated by MWJV, to include additional network and spatial detail within the local study areas around HS2 Manchester Piccadilly and HS2 Manchester Airport stations. This is described in the Model Performance Report for the GMSM, in the main TA Part 4 Addendum (Volume 5, TR-005-0000, Report 2 of 2).

1.2.3 The GMSM model has been subject to further model updates following the main ES to support the assessment of Additional Provision (AP) that represents amendments and changes to the scheme that include requirements for additional powers in the High Speed Rail (Crewe – Manchester) Bill.

1.2.4 The Additional Provision 1 (AP1) revised scheme focussed on amendments and changes to the scheme covering community areas MA01 to MA05, and the Additional Provision 2 (AP2) revised scheme covers the community areas MA01 to MA08. The GMSM model provides an evidence base to support the transport assessment and environmental statement covering HS2 community areas MA06 to MA08. Therefore, the GMSM model was not subject to a model update for the Supplementary Environmental Statement 1 (SES1) and AP1 Environmental Statement (ES).

1.3 Additional Provision 2 Environmental Statement

1.3.1 Further model development has been undertaken by MWJV for the Additional Provision 2 (AP2) revised scheme. The Baseline model has been updated for the assessment to reflect the use of journey time data in the base model validation, inclusion of additional count data and refinement of network coding to improve model performance.

1.4 Purpose of this report

1.4.1 This report documents the updates made for the AP2 revised scheme and model performance of the HS2 AP2 GMSM.

1.5 Model framework

1.5.1 TfGM's Greater Manchester suite of models comprise the following:

- exogenous forecasting model (EFM);
- variable demand model (GMVDM);
- highway assignment model (GMSM); and
- public transport assignment model (GMPTM).

1.5.2 The GMVDM has been developed within a Cube Voyager model software platform (version 6.4.3) and has a supporting Exogenous Forecasting Model (EFM) that supplies reference case projections of future year changes in land-use trips.

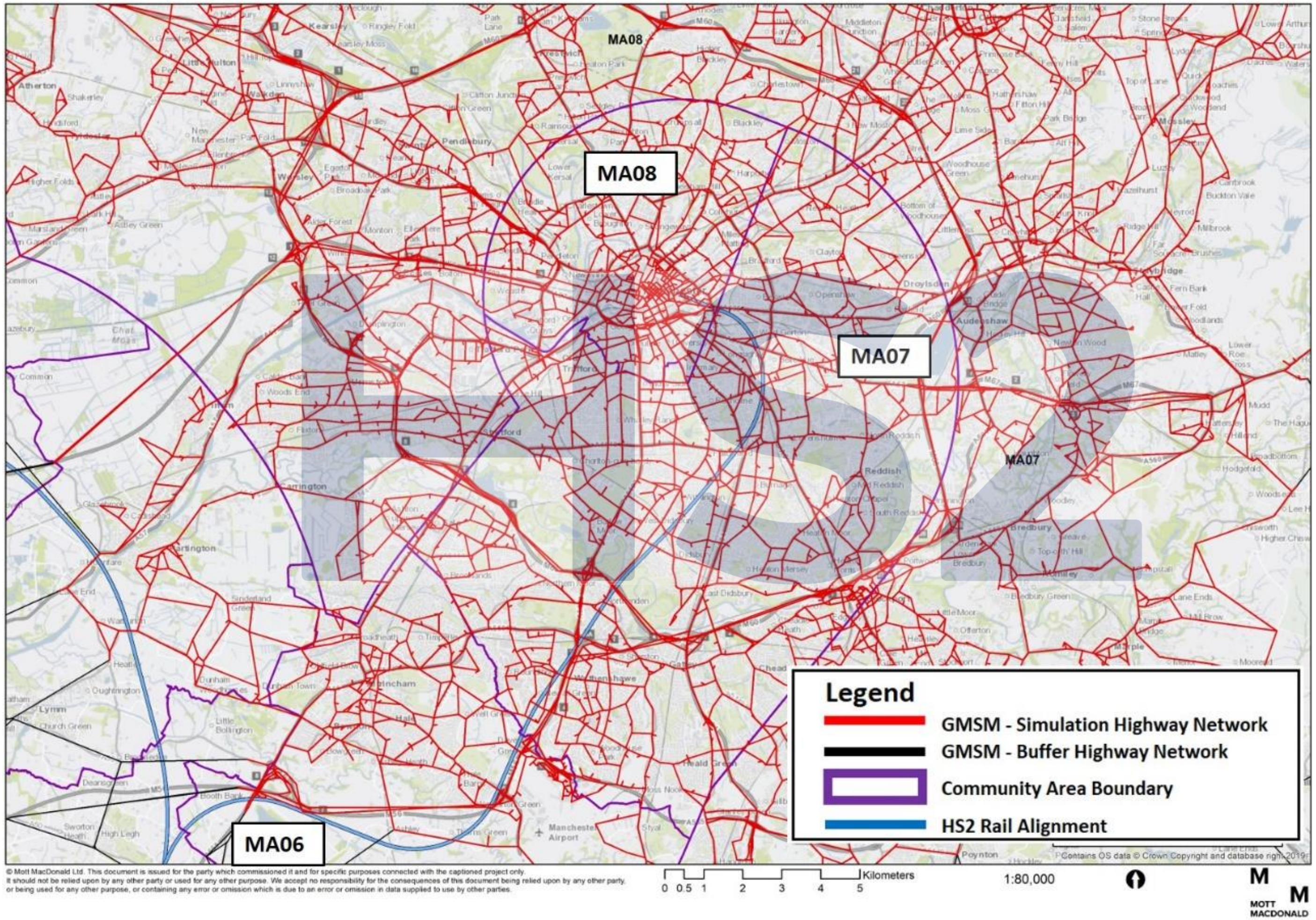
1.5.3 The GMPTM is a public transport assignment model and has also been developed within a Cube Voyager model software platform (version 6.4.3).

1.5.4 The GMSM is a strategic highway model that has been developed within a SATURN model software platform (version 11.3.12).

1.5.5 For the SES2 and AP2 ES TA, the GMSM strategic highway model has been utilised by MWJV to provide an evidence base, and it is the use of this model that is described within this Model Performance Report. The GMPTM has also been used as an evidence base for assessing the scheme operation and patronage forecasts for station access and egress modes, and this is described in a separate report.

1.5.6 The detailed modelled study area for the above models covers the Greater Manchester district and has supporting network and zone system detail to provide representation of external area supply and demand. Reference should be made to Figure 2.

Figure 2: Model study area



1.6 Model development

1.6.1 The TfGM suite of models were subject to a Present Year Validation (PYV) exercise in 2017 to reflect 2017 base year spring transport conditions. This model was also updated to account for changes to local and national planning datasets. This model update was completed by transport consultants working on behalf of TfGM for the Manchester Airport Terminal 2 – Metrolink Extension Strategic Outline Business Case (2017).

1.6.2 The model updates have supported the following primary TfGM model applications:

- Manchester Airport Terminal 2 - Metrolink Extension - Strategic Outline Business Case (2017); and
- Greater Manchester Spatial Framework Strategy (GMSF – 2016 Dataset).

1.6.3 GMVDM04A (version DA_2017) was the latest model version available for release by TfGM and was developed to assess the Greater Manchester Spatial Framework Strategy (2016 Consultation Dataset).

1.7 Model description

1.7.1 The TfGM GMSM strategic highway assignment model has been developed for the following years:

- 2017 base year;
- 2025 first future year; and
- 2040 horizon future year.

1.7.2 The model is representative of the following time periods:

- AM peak hour - 08:00–09:00;
- average inter peak hour - 10:00–16:00; and
- PM peak hour - 17:00–18:00.

1.7.3 The local highway assignment model is comprised of the following demand user-classes:

- car commute;
- car other;
- car employers business;
- light goods vehicles; and
- other goods vehicles.

1.8 Model application objectives

1.8.1 For the assessment of the AP2 revised scheme, the GMSM Strategic Highway Assignment Model provides:

- preliminary traffic data to inform scheme design;
- changes in traffic flows, congestion, and journey times to inform the TA for the AP2 revised scheme;
- traffic data for the construction and operational phases of the AP2 revised scheme on which to base the assessment of significant effects for the Environmental Statement (ES); and
- changes in traffic flows between the base year and forecast scenarios for application to local models.

2 Guidance used

2.1 Introduction

2.1.1 This strategic highway model development makes reference to the following Transport Analysis Guidance (TAG) as published by the Department for Transport (DfT): TAG Unit M3.1 Highway Assignment Modelling (May 2020).

2.2 Highway model guidance

2.2.1 In relation to providing an assessment of model calibration and validation performance, reference has been made to Section 3.2 of TAG Unit M3.1 (Table 1, Table 2, and Table 3).

2.2.2 The criteria for the assessment of model calibration and validation of traffic flows and journey time performance are presented in Table 1, below.

Table 1: DfT-TAG validation criteria

Criteria	Acceptability guideline
Assigned hourly flows	
Individual flows within +/-1.5% for flows 700-2,700 vph	>85% of cases
Individual flows within +/- 100 vph for flows ,700 vph	>85% of cases
Individual flows within +/-400 vph flows >2700 vph	>85% of cases
Screenline flows (normally >5 links) to be within 5%	All or nearly all screenlines
Geoffrey Havers (GEH) statistic	
Individual flows GEH<5	>85% of cases
Journey times	
Modelled journey times within 15% (or 1 minute if higher)	>85% of cases

Credit. Table 1, Table 2, Table 3, DfT TAG Unit M3.1 Highway Assignment Modelling (May 2020)

2.2.3 The criteria for the assessment of highway model assignment convergence is presented in Table 2 below.

Table 2: Summary of convergence measures and base model acceptable values

Measure of convergence	Acceptability guideline
Delta and %GAP	Less than 0.1% or at least stable with convergence fully documented and all other criteria
Percentage of links with flow change (P) <1%	Four consecutive iterations greater than 98%
Percentage of links with cost change (P2) <1%	Four consecutive iterations greater than 98%
Percentage change in total user costs of links with flow change (V) <1%	Four consecutive iterations less than 0.1% (SUE only)

Credit. Table 4,DfT TAG Unit M3.1 Highway Assignment Modelling (May 2020)

3 Data for model development

3.1 Overview

3.1.1 This section of the report presents details of traffic data that has been collected for the purpose of updating model performance within the local study areas of interest for Manchester Piccadilly High Speed station and Manchester Airport High Speed station.

3.1.2 The GMSM covers the whole of the Greater Manchester area. However, in order to inform the TA, the base year validation exercise concentrated on the Manchester Piccadilly High Speed station and Manchester Airport High Speed station areas but with checks also undertaken on the wider model validation.

3.1.3 For the main ES, a subset of the traffic count data described in the following section was used. For the SES2 and AP2 ES, all the available counts described were used, and this includes some additional Webtris data sourced for locations on the Greater Manchester Strategic Road Network.

3.1.4 For the main ES, journey time were validated using existing Trafficmaster data, which was available as part of the parent model validation dataset. For the SES2 and AP2 ES, further Trafficmaster journey time data was collected with a wider coverage on routes in the local study aeras of interest, and this is described in Section 3.3.

3.2 Traffic survey data commission

3.2.1 MWJV commissioned a programme of traffic count surveys in 2017/2018 to support the assessment of the original scheme.

3.2.2 Traffic count surveys have been used from different years and months to update the base year model. The traffic counts have been factored to June 2018 to develop a consistent dataset. Figure 3 shows the location of traffic surveys.

3.2.3 The traffic data used in the MWJV calibration and validation process is from the following data sources and has been collected on behalf of HS2 Ltd:

- MWJV - June 2017 traffic counts (Automatic Traffic Counts, Manual Classified Counts);
- TfGM - May/June 2017 traffic counts (Automatic Traffic Counts); and
- Webtris data (Highways England database).

3.2.4 The location of traffic counts and definition of additional and new MWJV screenlines for the purpose of HS2 transport assessment is discussed below with reference to the local study area.

Manchester Piccadilly High Speed station

3.2.5 The calibration of traffic flows covering the Manchester Piccadilly High Speed station area has been carried out across one cordon (two by direction) incorporating a total of 30 link counts. Reference should be made to Figure 3 which shows the location of the cordon used to calibrate traffic flows.

3.2.6 In addition to the cordon traffic counts, there are also 46 directional link traffic counts from a 2017 traffic count dataset within the Manchester Piccadilly High Speed station area that have also been included in model calibration as individual link counts, these count locations have also been illustrated in Figure 3.

Manchester Airport High Speed station

3.2.7 The calibration of traffic flows for the Manchester Airport High Speed station area was carried out across five screenlines (ten by direction) incorporating a total of 23 counts (46 by direction).

3.2.8 The definition of screenlines is listed below, and reference should be made to Figure 4 which shows their location:

- screenline 1 - East Airport Screenline (five count sites);
- screenline 2 - East of M56 Screenline (six count sites);
- screenline 3 - West of M56 (five count sites);
- screenline 4 - North of A538 Wilmslow Road (three count sites); and
- screenline 5 - Airport Screenline (four count sites).

3.2.9 There are also an additional 43 directional link traffic counts from 2017 traffic surveys within the Manchester Airport High Speed station area included in model calibration, these count locations have also been illustrated in Figure 4.

Manchester wider area

3.2.10 In addition to the two key areas of study, a wider set of counts have been incorporated into the model with 15 screenlines (30 by direction) incorporating a total of 477 counts by direction.

3.2.11 The definition of these screenlines is listed below, and reference should be made to Figure 5 which shows their locations:

- Regional Centre Cordon (40 counts);
- Intermediate Ring Road Cordon (74 counts);
- M60 Inner Cordon (102 counts);
- WIRR Cordon 1 (14 counts);
- WIRR Cordon 2 (16 counts);

- Trafford Centre Cordon (11 counts);
- Rochdale Town Centre Cordon (26 counts);
- Oldham Town Centre Cordon (26 counts);
- Bolton Town Centre Cordon (16 counts);
- Altrincham Screenline (14 counts);
- Walkden to M60 Screenline (10 counts);
- West of Bolton Screenline (20 counts);
- County Boundary (64 counts);
- Stockport Cordon (34 counts); and
- M60 Screenline (10 counts).

3.2.12 These set of counts have been inherited from the parent TfGM parent model and for HS2 purposes, factored to June 2017 levels for model calibration purposes.

3.2.13 In order to extend the data coverage to better represent traffic conditions across the strategic road network around Greater Manchester area, there are also an additional 4 traffic counts (8 by direction) from 2017 Webtris dataset which covers additional locations along M62 and M60 Outer Ring Road. These additional counts are included in model calibration as independent counts and also included in Figure 5.

Figure 3: Manchester Piccadilly High Speed station area – location of traffic counts and cordon

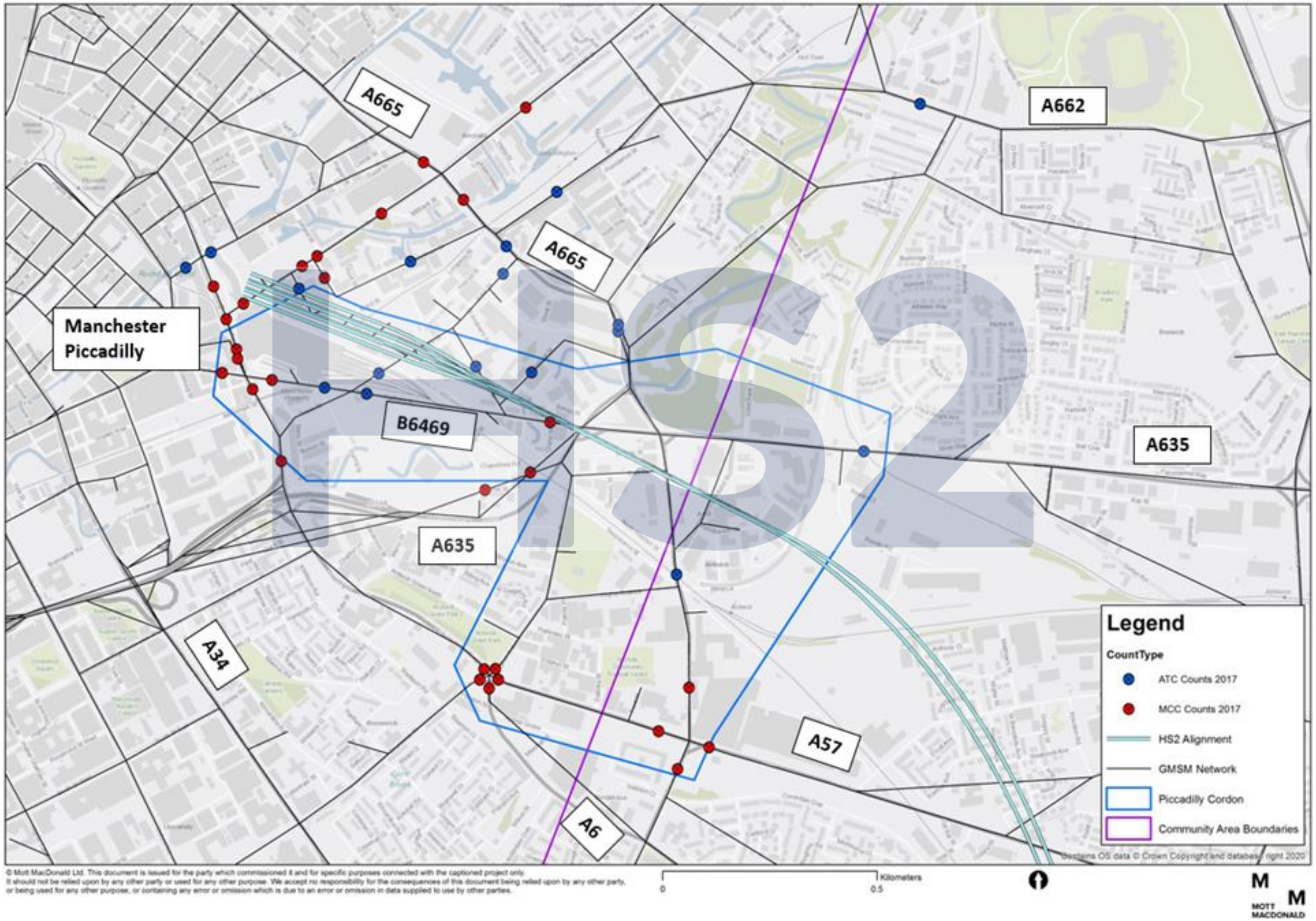


Figure 4: Manchester Airport High Speed station area – location of traffic counts and screenlines

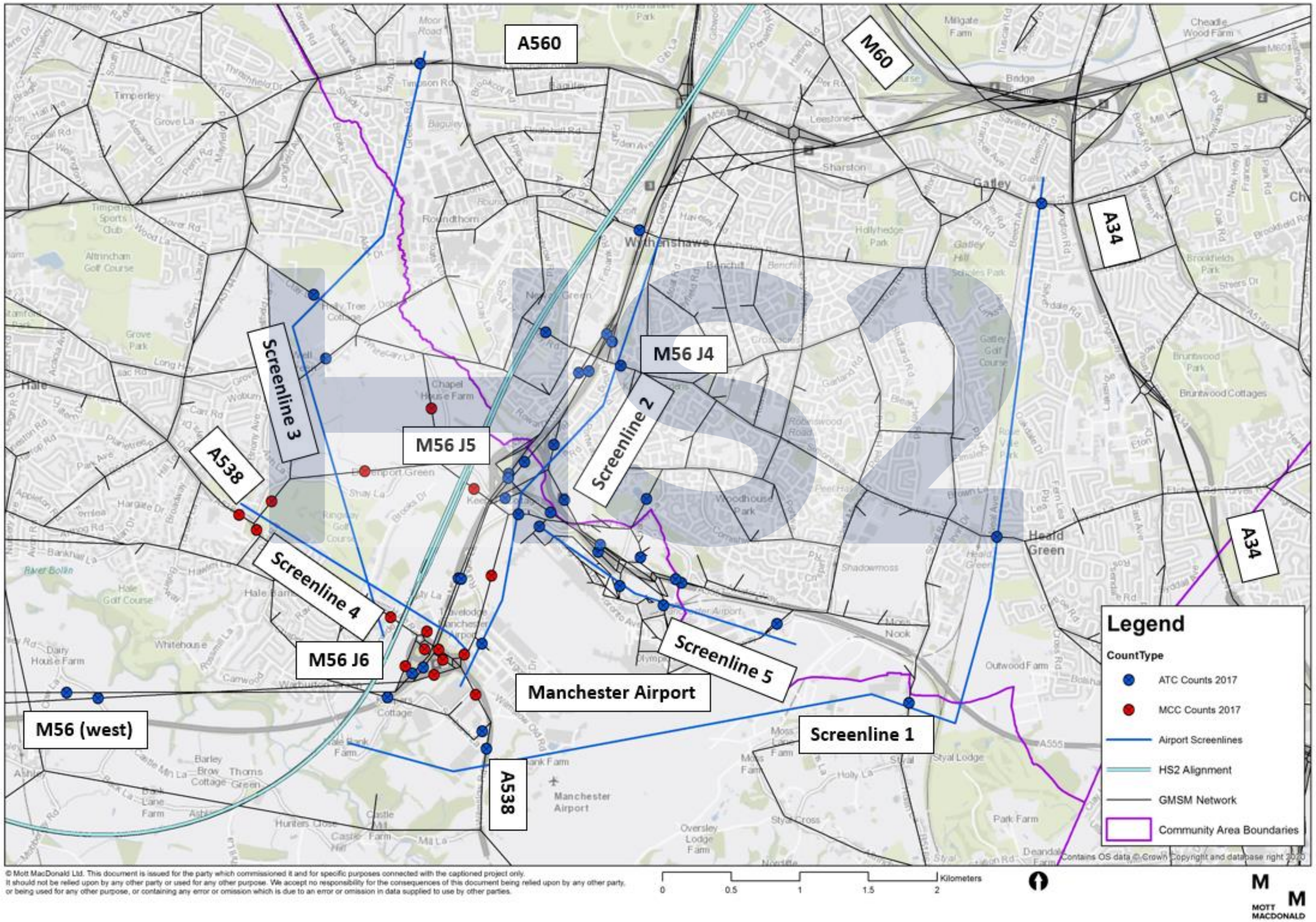
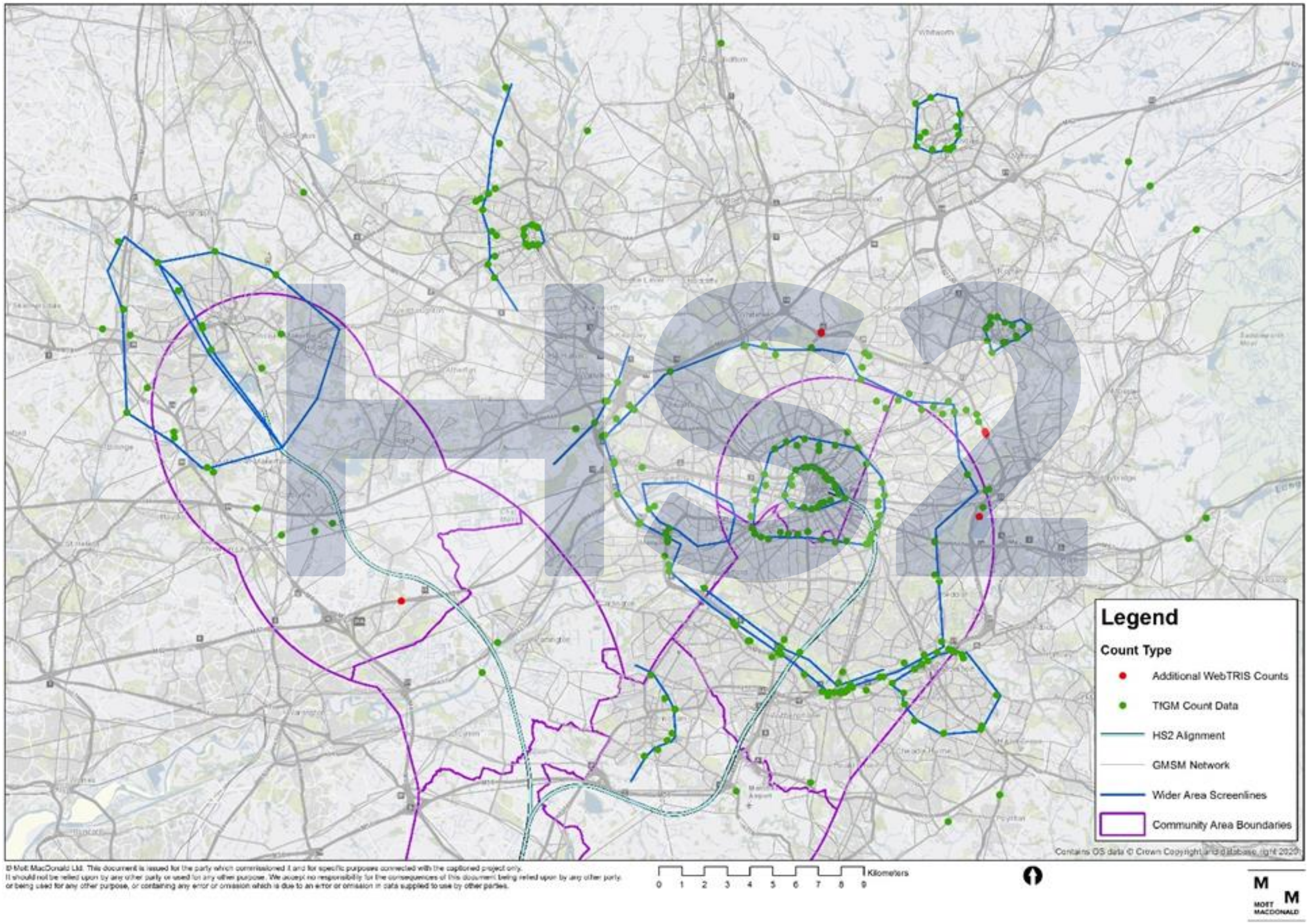


Figure 5: Manchester wider area – location of traffic counts and screenlines

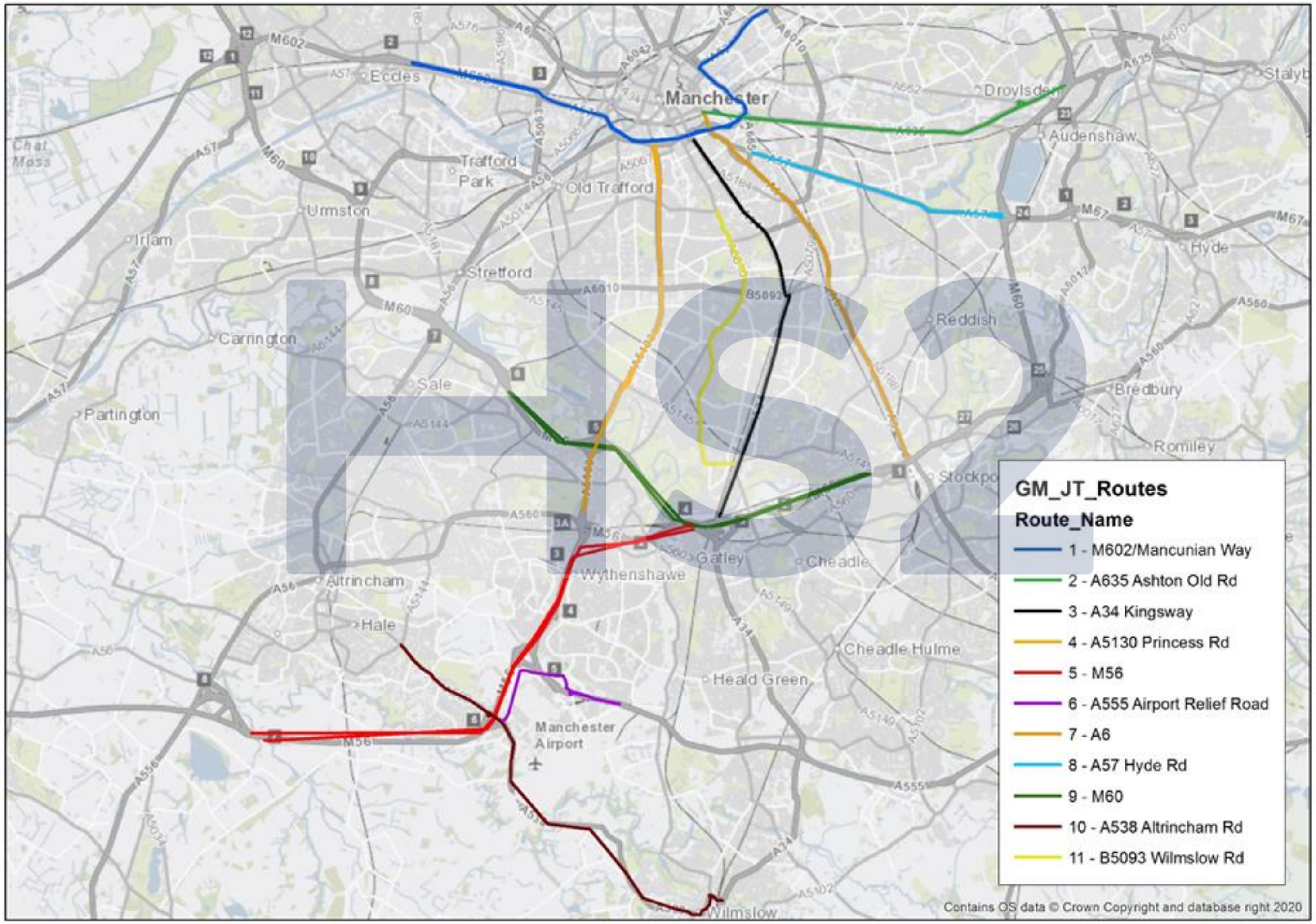


3.3 Journey time data

3.3.1 HS2 requested Trafficmaster journey time data representing June 2017 on behalf of MWJV from the DfT. This was processed by HS2 for MWJV for the journey time routes selected for the AP2 base model validation.

3.3.2 Journey time routes were defined as key routes across the model area of interest. Figure 6 shows the journey time routes chosen.

Figure 6: Location of journey time routes



4 Model development

4.1 Overview

4.1.1 For the main ES, the model was updated by MWJV to include additional network detail and spatial detail within the local study areas of Piccadilly and Manchester Airport to enhance representation of traffic conditions, and to capture the potential effects of both HS2 and Northern Powerhouse Rail (NPR).

4.1.2 For the SES2 and AP2 ES, further localised improvements have now been made following a review of model journey time data covering 11 journey time routes (22 by direction). The AP2 Baseline model update has also included a small number (four traffic count sites, eight by direction) of additional Webtris traffic counts into the model calibration dataset.

4.1.3 The model time periods represent the following peak hours, when the highest traffic volumes and most significant impacts are expected to occur:

- AM peak hour - 08:00–09:00; and
- PM Peak hour - 17:00–18:00.

4.2 Transport supply

4.2.1 For the main ES, a review of highway network detail and attributes were undertaken for the HS2 Manchester Station location areas.

4.2.2 This included checking the following network attributes:

- links: distance, speeds, capacity, bus lanes, traffic regulation orders;
- junctions: type, turn saturation flows, capacity, and lane utilisation;
- traffic signal control: timings, phasing, and staging; and
- routes: minimum cost paths.

4.2.3 The review highlighted that there was a good level of detail across the highway network represented within the scheme areas, but that some additional detail was required particularly in the Manchester Piccadilly High Speed station area. This was applied for the main ES and forms the basis for the further changes for the SES2 and AP2 ES.

4.2.4 For the SES2 and AP2 ES, further network refinements were made to improve model journey times. These involved changes to network free-flow speeds, speed flow relationships, gap acceptance assumptions and signal timings at some locations.

4.2.5 Also, for the SES2 and AP2 ES, a section of Tan Yard Brow, which crossed the bridge structure over Gore Brook has been updated to reflect one-way traffic operation in the southbound direction.

4.2.6 An inventory of highway network improvements is presented below with reference to HS2 Manchester Station areas.

Manchester Piccadilly High Speed station area

4.2.7 The following additional links and junctions were included in the model update for the Manchester Piccadilly High Speed station area:

- Highway Links;
  - Chapeltown Street;
  - Sparkle Street;
  - St Andrew's Street;
  - Helmet Street;
  - Union Street; and
  - Dark Lane.
- Highway Junctions;
  - A665 Great Ancoats Street / Chapeltown Street - three arm priority junction (left in/left out);
  - Sparkle Street / Store Street – three arm priority junction;
  - Travis Street / St Andrew's Street – three arm priority junction;
  - St Andrew's Street / Helmet Street – three arm priority junction;
  - B6469 Fairfield Street / St Andrew's Street – three arm priority junction;
  - A665 Ring Road / Helmet Street – three arm priority junction (left in/left out);
  - A665 Chancellor Lane / Dark Lane – three arm priority junction;
  - A635 Ring Road / North Western Street – three arm priority junction (left in/left out);
  - North Western Street / Dark Lane - three arm priority junction; and
  - Union Street / Higher Ardwick - three arm priority junction.

Manchester Airport High Speed station area

4.2.8 The Manchester Airport High Speed station area comprises a detailed and comprehensive coverage of local highway network.

4.2.9 A review of the highway network identified a limited number of modifications to be made, and these comprised the following:

- M56 Junction 6 western roundabout – inclusion of an access road to the Marriott Hotel; and
- Sunbank Lane – inclusion of intermediate access junctions and modification to zone loading for zone 291.

4.2.10 The generalised cost values (pence per minute (PPM)/pence per kilometre (PPK)) for model assignment have also been updated for the SES2 and AP2 ES to reflect the latest values from the DfT TAG databook (version: July 2020).

4.2.11 In summary, the model includes a sufficiently detailed level of network infrastructure to support the TA.

4.3 Transport demand

4.3.1 This section explains the changes made to the trip demand matrices to improve the detail in the scheme areas of interest.

4.3.2 The following updates were applied for the main ES and retained for the SES and AP2 ES:

- disaggregation of three zones in the Piccadilly area to fifteen zones, with allocated proportions of demand to allow specific locations to be modelled;
- a new zone near Manchester Airport to represent demand to/from the Marriott Hotel; and
- review of the trip matrix demand for the Amazon and DHL warehousing operations (as part of the World Logistics Hub development) on Sunbank Lane.

4.3.3 For the main ES and SES2 and AP2 ES, matrix estimation has been applied using the available count data; and a localised traffic flow calibration exercise has been carried out to improve the correlation between observed and modelled traffic flows within the local areas of interest.

5 Model performance

5.1 Overview

5.1.1 This section of the report focusses on the performance of the 2017 AP2 base model as produced by MWJV against observed traffic flow and journey time data.

5.1.2 The prior trip matrix assignment is the model assignment before matrix estimation is applied. This uses an interpolated parent model matrix adjusted to the HS2 zone system with an updated network that corresponds to HS2 base year. The updated network also includes revisions identified following a network review.

5.1.3 Matrix estimation uses the prior matrix and updated network mentioned above and creates an updated matrix to match count data. The post trip matrix assignment is the model assignment using this updated matrix and the same updated network used in prior assignments.

5.1.4 It is the post matrix assignment that is taken forward and used in the TA.

5.2 Traffic flow

5.2.1 Observed and modelled traffic flows have been compared using count data at the following locations:

- Manchester Piccadilly High Speed station local study area;
- Manchester Airport High Speed station local study area; and
- Greater Manchester wider area.

5.2.2 The counts are categorised as follows:

- cordon or specific screenline counts from the parent model dataset;
- individual counts that have been taken from other cordons or screenline locations in the parent model; and
- supplementary counts that are additional ad-hoc counts to the parent model data set.

Manchester Piccadilly High Speed Station Local Study Area

5.2.3 Observed and modelled traffic flows have been compared for available count site locations within the Manchester Piccadilly High Speed station area, and are presented as:

- Piccadilly cordon performance;
- Piccadilly individual count performance; and
- Piccadilly supplementary count performance.

5.2.4 In total, 76 link counts by direction have been compared, of which 30 are located on one cordon (two by direction) and 46 supplementary count sites.

5.2.5 Table 3 and Table 4 present a summary comparison of cordon flows by total all vehicles and by car vehicle type for the prior matrix assignment. The comparison shows that for the AM period, across both directions, cars and total vehicles, the model performs poorly. For the PM period, cars perform well, while for total vehicles, only one direction is meeting the TAG screenline flow criteria.

Table 3: AP2 GMSM – Piccadilly cordon – total all vehicles – prior

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	2	0	0%
PM peak hour	2	1	50%

Table 4: AP2 GMSM – Piccadilly cordon – car vehicle type – prior

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	2	0	0%
PM peak hour	2	2	100%

5.2.6 Table 5 and Table 6 present a summary comparison of individual link counts by total all vehicles and by car vehicle type for the prior matrix assignment. The comparison shows that the individual flow TAG criteria are not met for either time period, for either car or total vehicle types.

Table 5: AP2 GMSM – Piccadilly individual counts – total all vehicles – prior

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	30	13	43%	15	50%	16	53%
PM peak hour	30	17	57%	15	50%	17	57%

Table 6: AP2 GMSM – Piccadilly individual counts – car vehicle type – prior

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	30	12	40%	12	40%	15	50%
PM peak hour	30	18	60%	15	50%	18	60%

5.2.7 Table 7 and Table 8 present a summary comparison of supplementary counts by total all vehicles and by car vehicle type for the prior matrix assignment. The comparison shows that the individual flow TAG criteria are not met for either time period, for either car or total vehicle types.

Table 7: AP2 GMSM – Piccadilly supplementary counts – total all vehicles – prior

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	46	18	39%	18	39%	21	46%
PM peak hour	46	24	52%	21	46%	25	54%

Table 8: AP2 GMSM – Piccadilly supplementary counts – car vehicle type – prior

Time period	Car Flow Comparison (Vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	46	20	43%	17	37%	22	48%
PM peak hour	46	24	52%	21	46%	25	54%

5.2.8 Figure 7 and Figure 8 show the locations of all the link counts and the respective AM and PM peak hour model performance for the prior matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

Figure 7: AM peak hour – all Piccadilly area counts – traffic flow performance – prior

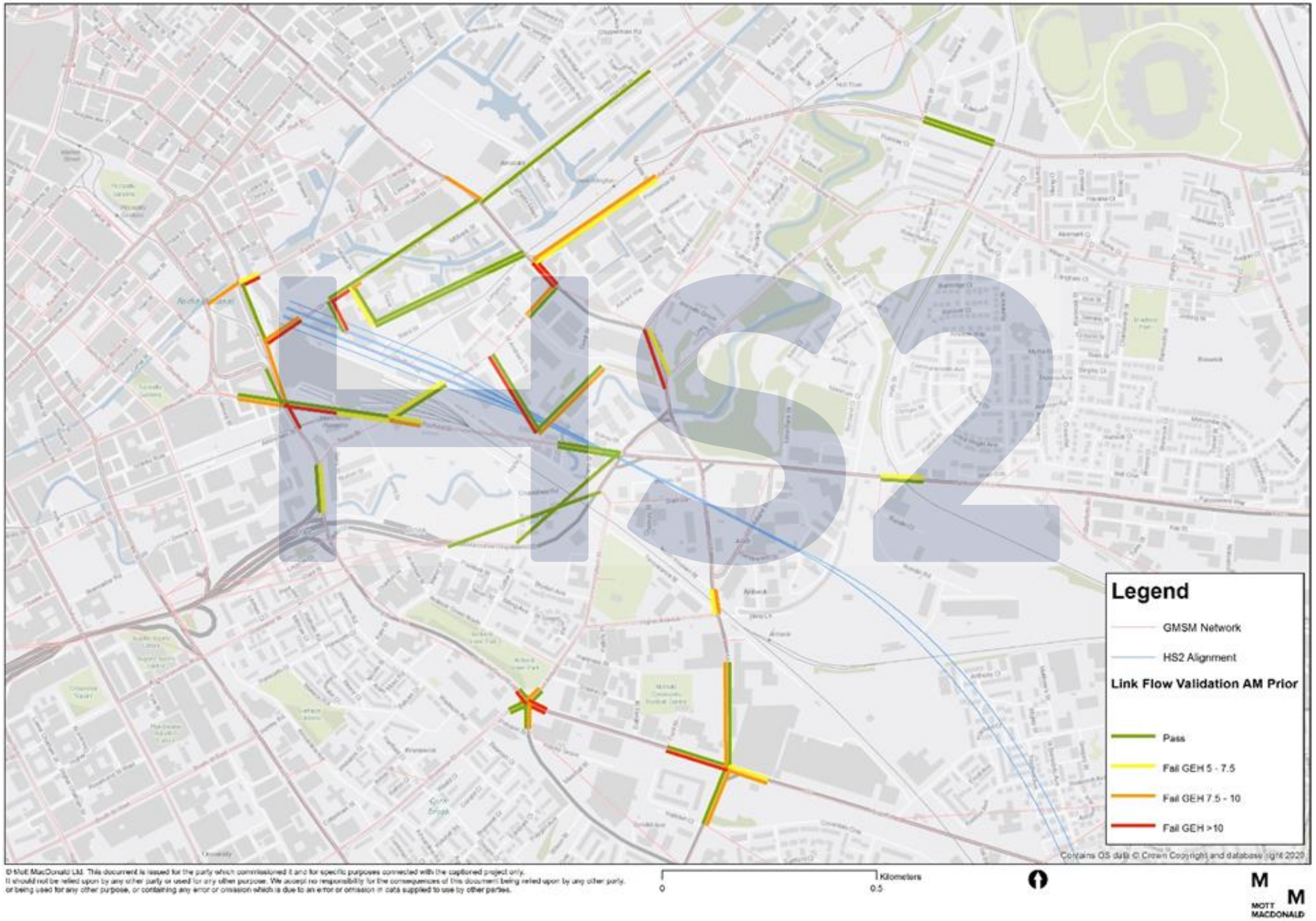
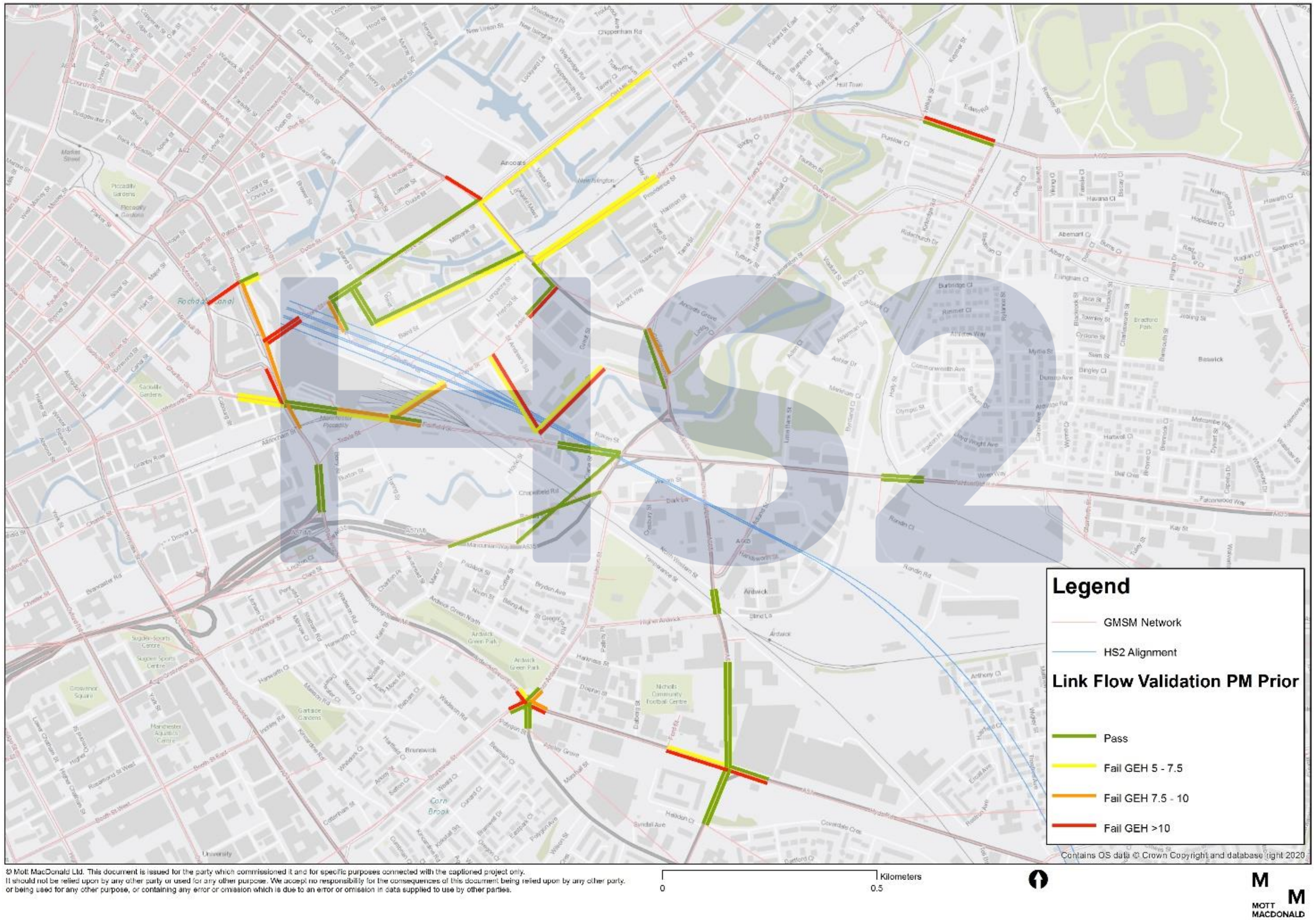


Figure 8: PM peak hour – all Piccadilly area counts – traffic flow performance – prior



5.2.9 Table 9 and Table 10 present a summary comparison of cordon flows by total all vehicles and by car vehicle type for the post matrix assignment. The tables show that across both time periods, for both cars and total vehicles, modelled traffic is meeting the TAG passing criteria.

Table 9: AP2 GMSM – Piccadilly cordon – total all vehicles – post

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	2	2	100%
PM peak hour	2	2	100%

Table 10: AP2 GMSM – Piccadilly cordon – car vehicle type – post

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	2	2	100%
PM peak hour	2	2	100%

5.2.10 Table 11 and Table 12 present a summary comparison of individual link counts by total all vehicles and by car vehicle type for the post matrix assignment. The comparison shows that across both time periods and for both cars and total vehicles, over 90% of counts meet the TAG flow or GEH criteria, which is greater than the 85% recommended by TAG.

Table 11: AP2 GMSM – Piccadilly individual counts – total all vehicles – post

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	30	29	97%	28	93%	29	97%
PM peak hour	30	26	87%	24	80%	27	90%

Table 12: AP2 GMSM – Piccadilly individual counts – car vehicle type – post

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	30	29	97%	28	93%	29	97%
PM peak hour	30	26	87%	24	80%	27	90%

5.2.11 Table 13 and Table 14 present a summary comparison of supplementary counts to total all vehicles and by car vehicle type for the post matrix assignment. The comparison shows that for the AM peak period, both cars and total vehicles have over 85% of sites passing flow or GEH criteria, which meets the TAG threshold. For the PM peak, total vehicles and cars have 80% and 83% of counts passing, which is just under the 85% TAG criteria.

Table 13: AP2 GMSM – Piccadilly supplementary counts – total all vehicles – post

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak our	46	39	85%	39	85%	39	85%
PM peak hour	46	37	80%	35	76%	37	80%

Table 14: AP2 GMSM – Piccadilly supplementary counts – car vehicle type – post

Time period	Car Flow Comparison (Vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	46	39	85%	39	85%	39	85%
PM peak hour	46	37	80%	36	78%	38	83%

5.2.12 Figure 9 and Figure 10 show the locations of all the link counts and the respective AM and PM peak hour model performance for the post matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow of GEH criteria and shown as yellow, orange or red bands, according to GEH value.

Figure 9: AM peak hour – all Piccadilly area counts – traffic flow performance – post

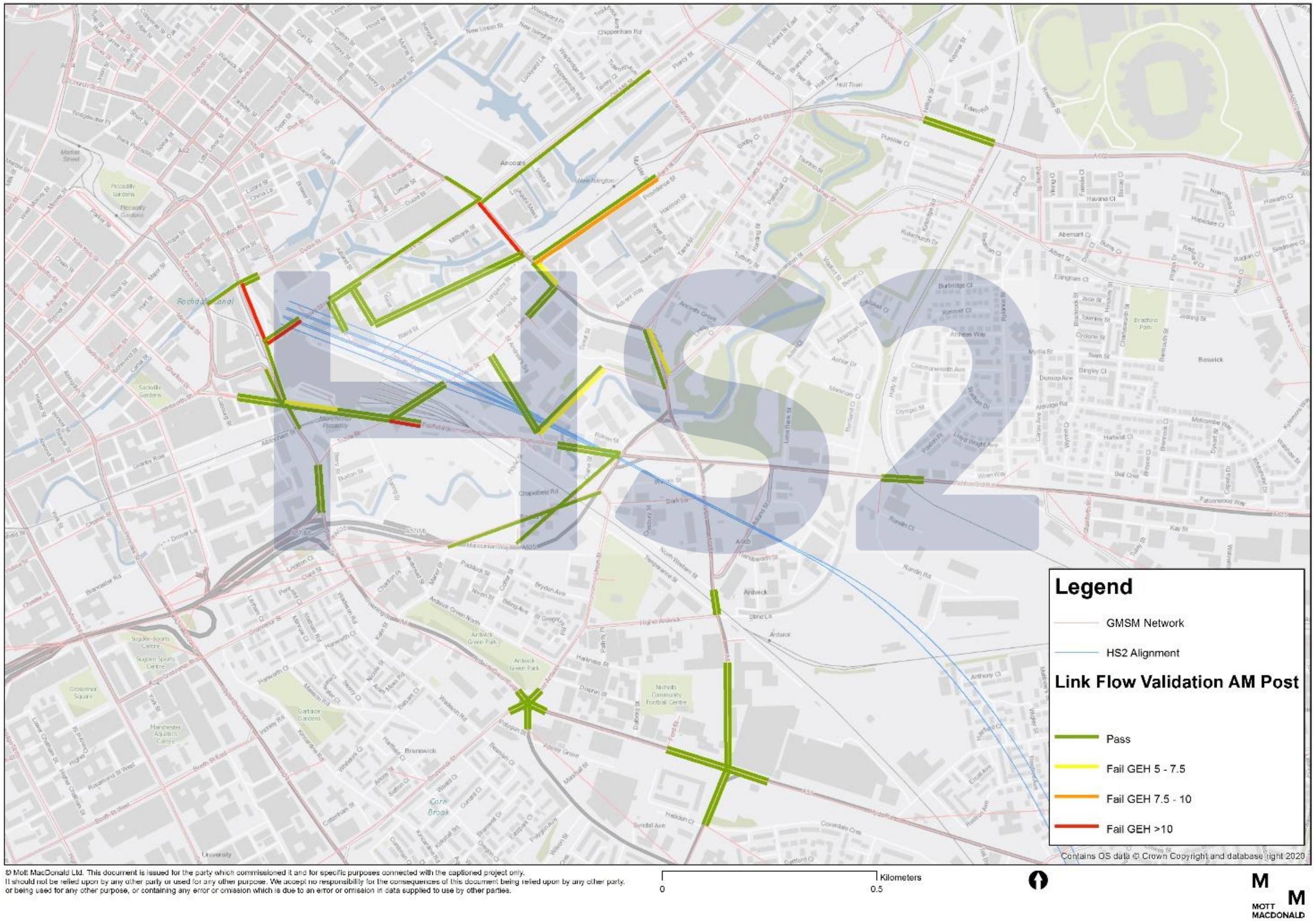
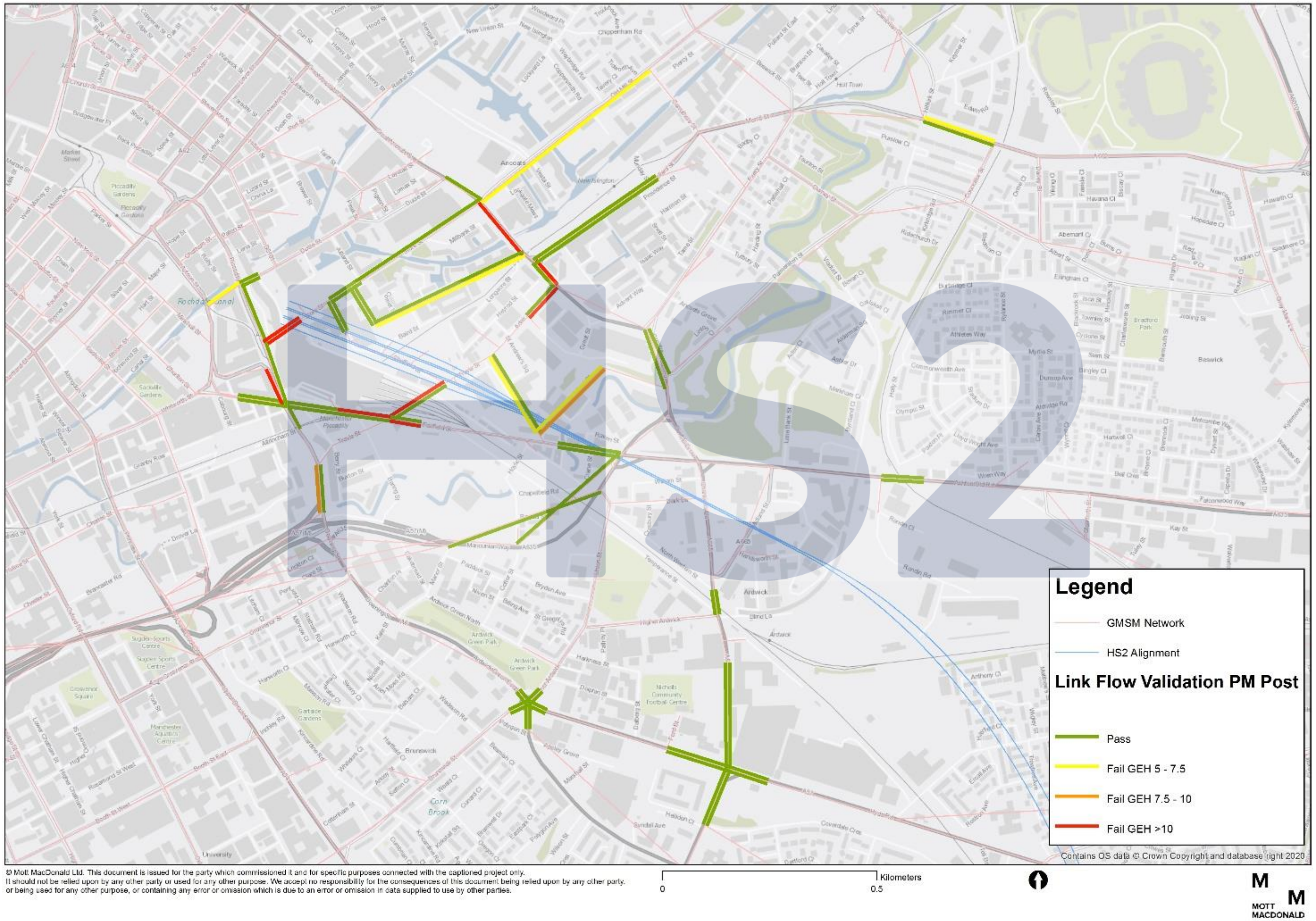


Figure 10: PM peak hour – all Piccadilly area counts – traffic flow performance – post



5.2.13 Reference should also be made to Table 47 and Table 48 in Appendix A, which presents supporting details of the individual link flow performance for each count for the AM and PM time periods, post matrix estimation.

5.2.14 In summary, both the cordon and individual link flow comparisons show a good match, and the supplementary counts a reasonable match, between observed and modelled link flows. This demonstrates that the model provides a good representation of observed traffic flows covering the Manchester Piccadilly High Speed station area.

Manchester Airport High Speed station local study area

5.2.15 Observed and modelled traffic flows have been compared for available count site locations within the Manchester Airport High Speed station area, and are presented as:

- Airport screenline performance;
- Airport individual count performance; and
- Airport supplementary count performance.

5.2.16 In total, 89 link counts by direction have been compared, of which 46 are located on five screenlines (ten by direction) and 43 supplementary count sites which includes M56 motorway counts.

5.2.17 Table 15 and Table 16 present a summary comparison of screenline flows by total all vehicles and by car vehicle type for the prior matrix assignment. The comparison shows that across both time periods and for both car and all vehicles, half or less than half the screenlines are meeting the passing criteria, which does not achieve the TAG criteria of all or nearly all screenlines passing.

Table 15: AP2 GMSM – airport screenline – total all vehicles – prior

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	10	5	50%
PM peak hour	10	5	50%

Table 16: AP2 GMSM – airport screenline – car vehicle type – prior

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	10	4	40%
PM peak hour	10	4	40%

5.2.18 Table 17 and Table 18 present a summary comparison of individual link flows based on the screenline dataset for total all vehicle and by car vehicle type for the prior assignment. The comparison shows that the individual flow TAG criteria are not met for either time period, for either car or total vehicle types.

Table 17: AP2 GMSM – airport individual counts – total all vehicles – prior

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	46	29	63%	32	70%	33	72%
PM peak hour	46	27	59%	28	61%	29	63%

Table 18: AP2 GMSM – airport individual counts – car vehicle type – prior

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	30	12	40%	12	40%	15	50%
PM peak hour	30	18	60%	15	50%	18	60%

5.2.19 Table 19 and Table 20 present a summary comparison of individual link flows based on a supplementary count dataset for total all vehicle and by car vehicle type for the prior assignment. The comparison shows that the individual flow TAG criteria are not met for either time period, for either car or total vehicle types.

Table 19: AP2 GMSM – airport supplementary counts – total all vehicles – prior

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	43	22	51%	20	47%	23	53%
PM peak hour	43	18	42%	20	47%	20	47%

Table 20: AP2 GMSM – airport supplementary counts – car vehicle type – prior

Time period	Car Flow Comparison (Vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	43	19	44%	21	49%	21	49%

Time period	Car Flow Comparison (Vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
PM peak hour	43	22	51%	22	51%	24	56%

5.2.20 Figure 11 and Figure 12 show the locations of all the link counts and respective AM and PM peak hour model performance for the prior matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

Figure 11: AM peak hour – all airport area counts – traffic flow performance – prior

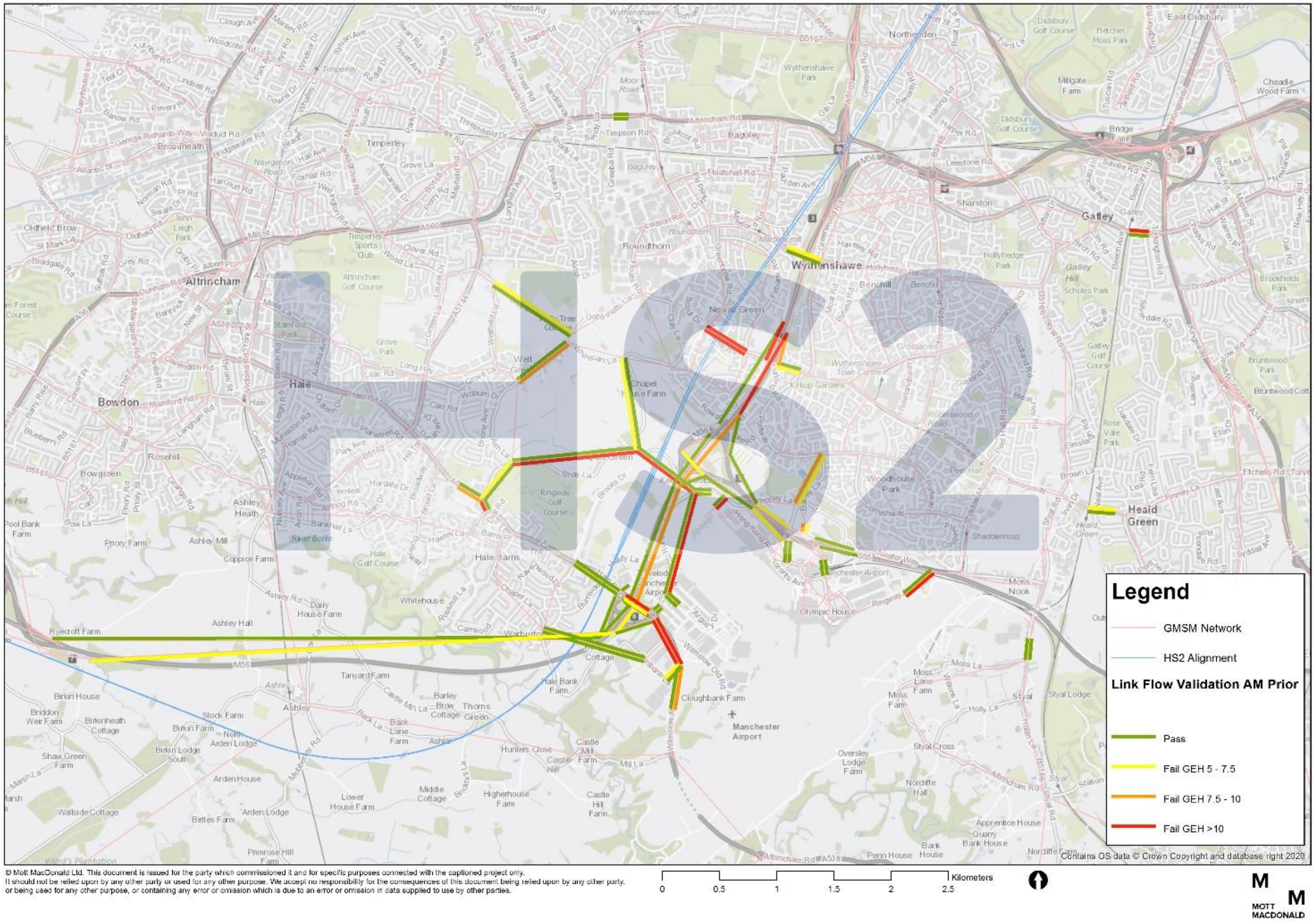
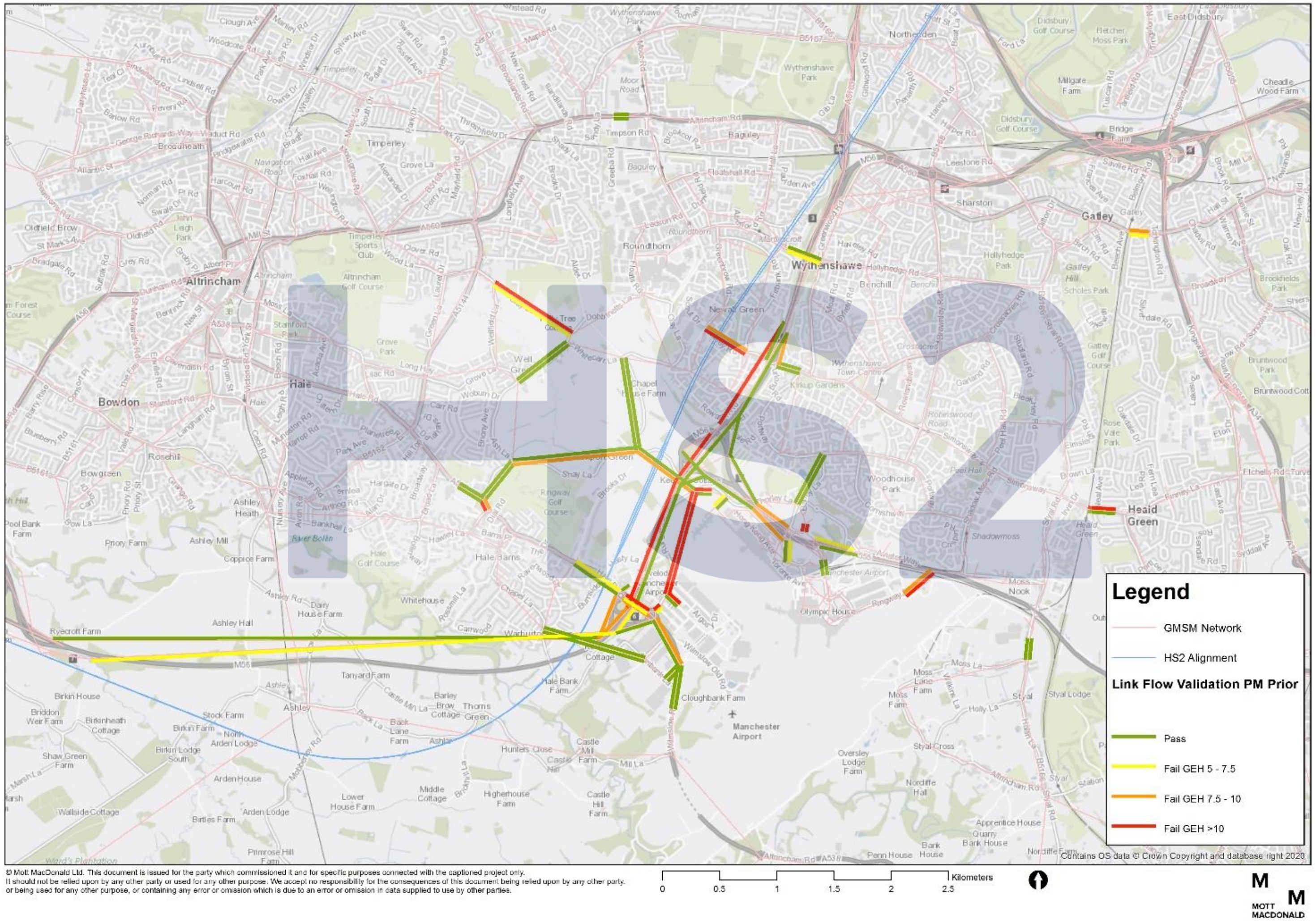


Figure 12: PM peak hour – all airport area counts – traffic flow performance – prior



5.2.21 Table 21 and Table 22 present a summary comparison of screenline flows by total all vehicles and by car vehicle type for the post matrix assignment. The comparison shows that almost all airport screenlines flows are meeting TAG flow criteria.

Table 21: AP2 GMSM – airport screenline – total all vehicles – post

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	10	10	100%
PM peak hour	10	8	80%

Table 22: AP2 GMSM – airport screenline – car vehicle type – post

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	10	9	90%
PM peak hour	10	8	80%

5.2.22 Table 23 and Table 24 present a summary comparison of individual link flows based on the screenline dataset for total all vehicle and by car vehicle type for the post assignment. The comparison shows that for both time periods, and for both car and total vehicles, over 90% of individual screenline counts are passing the flow or GEH criteria, which meets the 85% threshold set out in TAG.

Table 23: AP2 GMSM – airport individual counts – total all vehicles – post

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	46	44	96%	44	96%	44	96%
PM peak hour	46	41	89%	42	91%	42	91%

Table 24: AP2 GMSM – airport individual counts – car vehicle type – post

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	46	44	96%	44	96%	44	96%
PM peak hour	46	41	89%	42	91%	42	91%

5.2.23 Table 25 and Table 26 present a summary comparison of individual link flows based on a supplementary count dataset for total all vehicle and by car vehicle type for the post assignment. The comparison shows that across both time periods and for both car and total vehicles, the percentage of counts passing flow or GEH criteria is above the recommended 85% threshold set out in TAG.

Table 25: AP2 GMSM – airport supplementary counts – total all vehicles – post

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	43	39	91%	39	91%	39	91%
PM peak hour	43	34	79%	37	86%	37	86%

Table 26: AP2 GMSM – airport supplementary counts – car vehicle type – post

Time period	Car Flow Comparison (Vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	43	39	91%	40	93%	40	93%
PM peak hour	43	37	86%	38	88%	38	88%

5.2.24 Figure 13 and Figure 14 show the locations of all the link counts and respective AM and PM peak hour model performance for the post matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

Figure 13: AM peak hour – all airport area counts – traffic flow performance – post

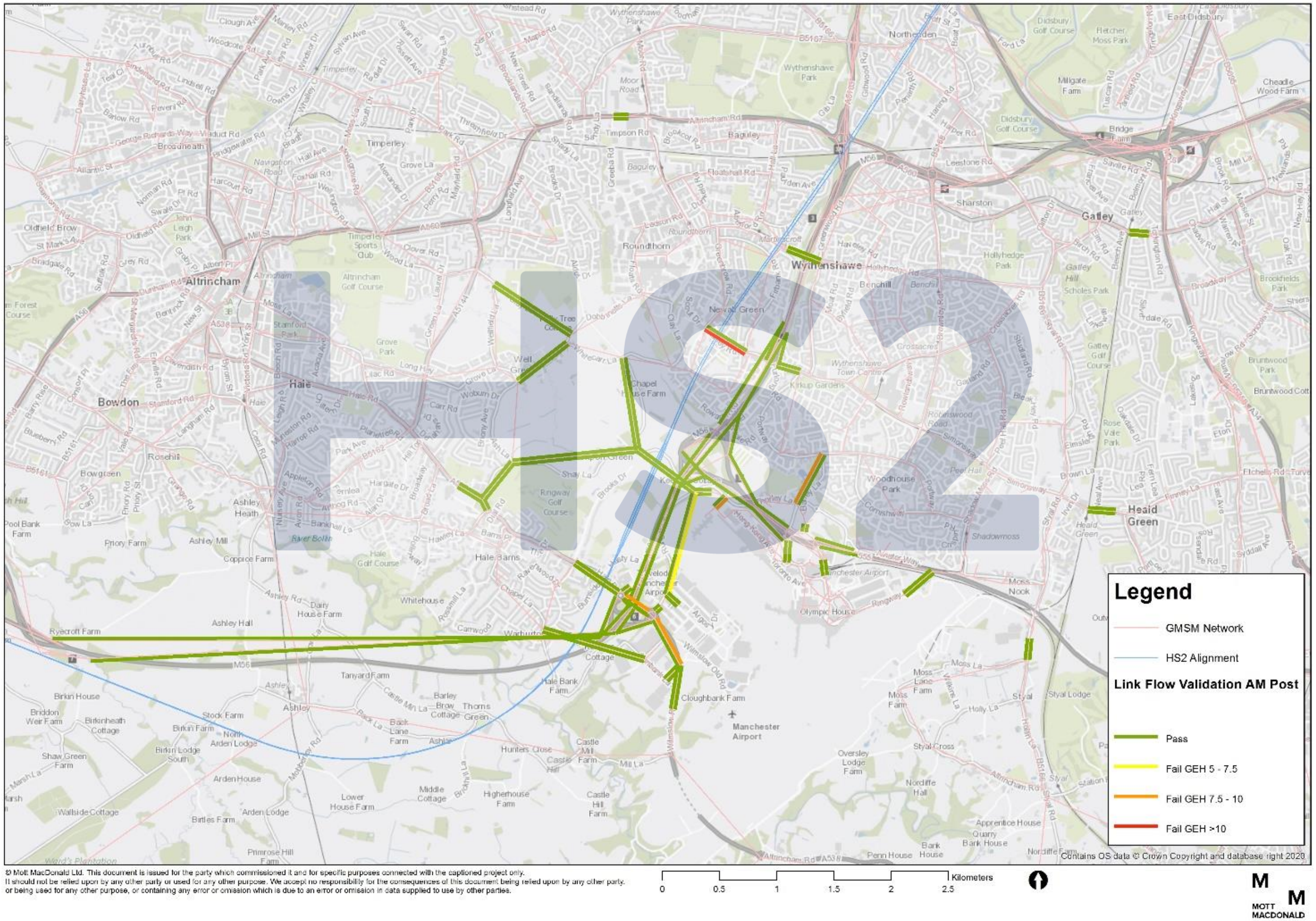
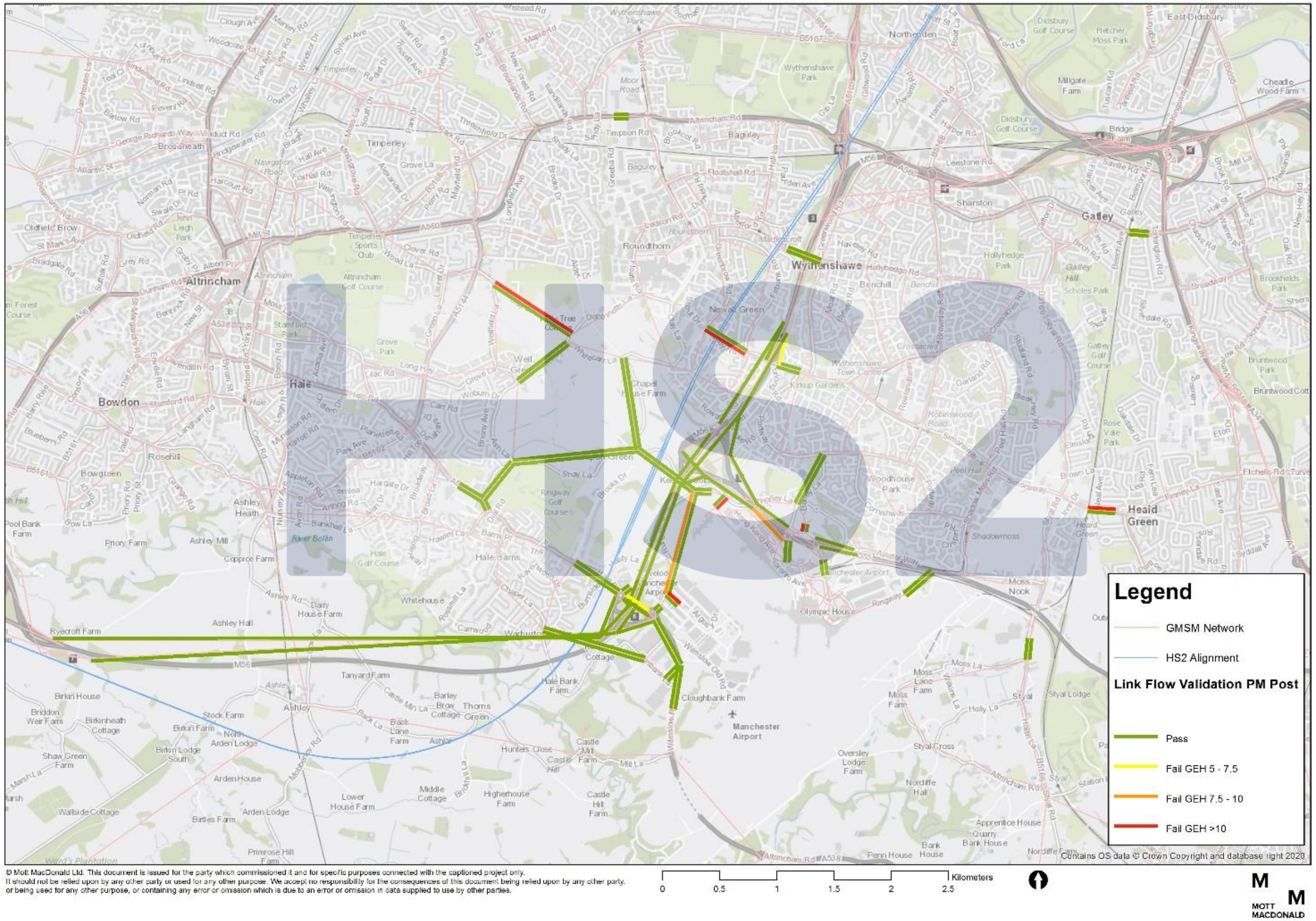


Figure 14: PM peak hour – all airport area counts – traffic flow performance – post



5.2.25 Reference should also be made to Table 49 and Table 50 in Appendix A, which presents supporting details of the individual link flow performance for each count for the AM and PM time periods, post matrix estimation.

5.2.26 In summary, the screenline and the individual link flow comparisons show a good match between observed and modelled links flows covering the Manchester Airport High Speed station area.

Greater Manchester Wider Area

5.2.27 Observed and modelled traffic flows have been compared for available count site locations within the wider area, and are presented as:

- Wide Area screenline performances;
- Wide Area individual count performance; and
- Wide Area supplementary count performance.

5.2.28 In total, 507 individual link counts (of which 477 are screenline counts and 30 as supplementary counts) by direction have been compared.

5.2.29 Table 27 and Table 28 present a summary comparison of screenline flows by total all vehicles and by car vehicle type for the prior matrix assignment. The comparison shows that in the prior assignments, across both time periods and for both car and total vehicles, most screenlines are meeting the TAG criteria.

Table 27: AP2 GMSM – wider area screenline – total all vehicles – prior

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	30	30	100%
PM peak hour	30	26	87%

Table 28: AP2 GMSM – wider area screenline – car vehicle type – prior

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	30	26	87%
PM peak hour	30	26	87%

5.2.30 Table 29 and Table 30 present a summary comparison of individual link counts by total all vehicles and by car vehicle type for the prior matrix assignment. The comparison shows that across both time periods and for both cars and total vehicles that most counts are achieving flow or GEH criteria in the prior assignments.

Table 29: AP2 GMSM – wider area individual counts – total all vehicles – prior

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	477	425	89%	416	87%	432	91%
PM peak hour	477	397	83%	382	80%	402	84%

Table 30: AP2 GMSM – wider area individual counts – car vehicle type – prior

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	477	423	89%	413	87%	428	90%
PM peak hour	477	397	83%	386	81%	405	85%

5.2.31 Table 31 and Table 32 present a summary comparison of supplementary counts by total all vehicles and by car vehicle type for the prior matrix assignment. The comparison shows that across both time periods and for both car and total vehicles the percentage of counts that meet the flow or GEH criteria is lower than the 85% recommended in TAG.

Table 31: AP2 GMSM – wider area supplementary counts – total all vehicles – prior

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	30	25	83%	25	83%	25	83%
PM peak hour	30	22	73%	20	67%	22	73%

Table 32: AP2 GMSM – wider area supplementary counts – car vehicle type – prior

Time period	Car Flow Comparison (Vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	30	23	77%	23	77%	23	77%
PM peak hour	30	21	70%	21	70%	22	73%

5.2.32 Figure 15 and Figure 16 show the locations of all the link counts and the respective AM and PM peak hour model performance for the prior matrix assignment. These show links passing

TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

Figure 15: AM peak hour – all Greater Manchester area counts – traffic flow performance – prior

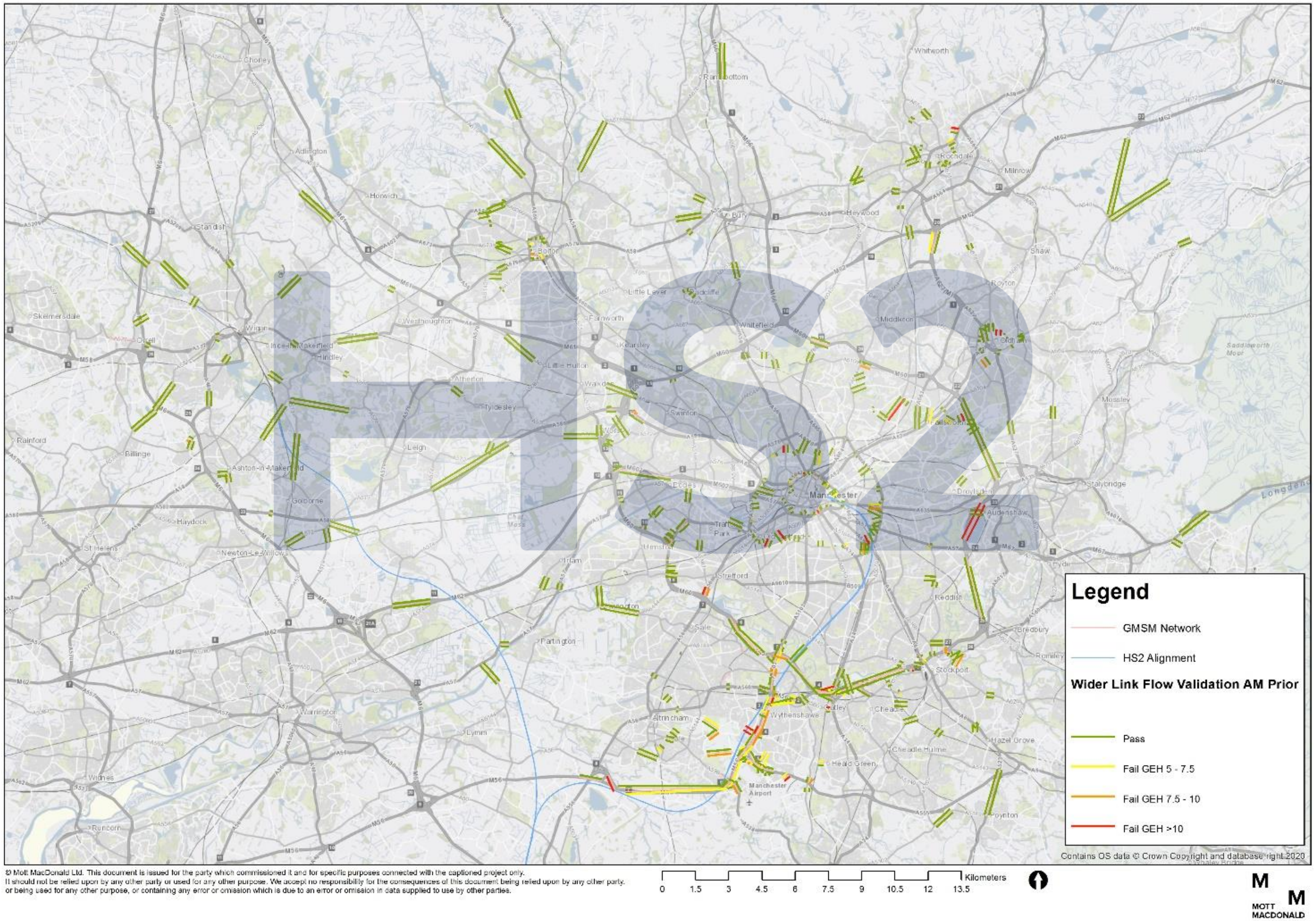
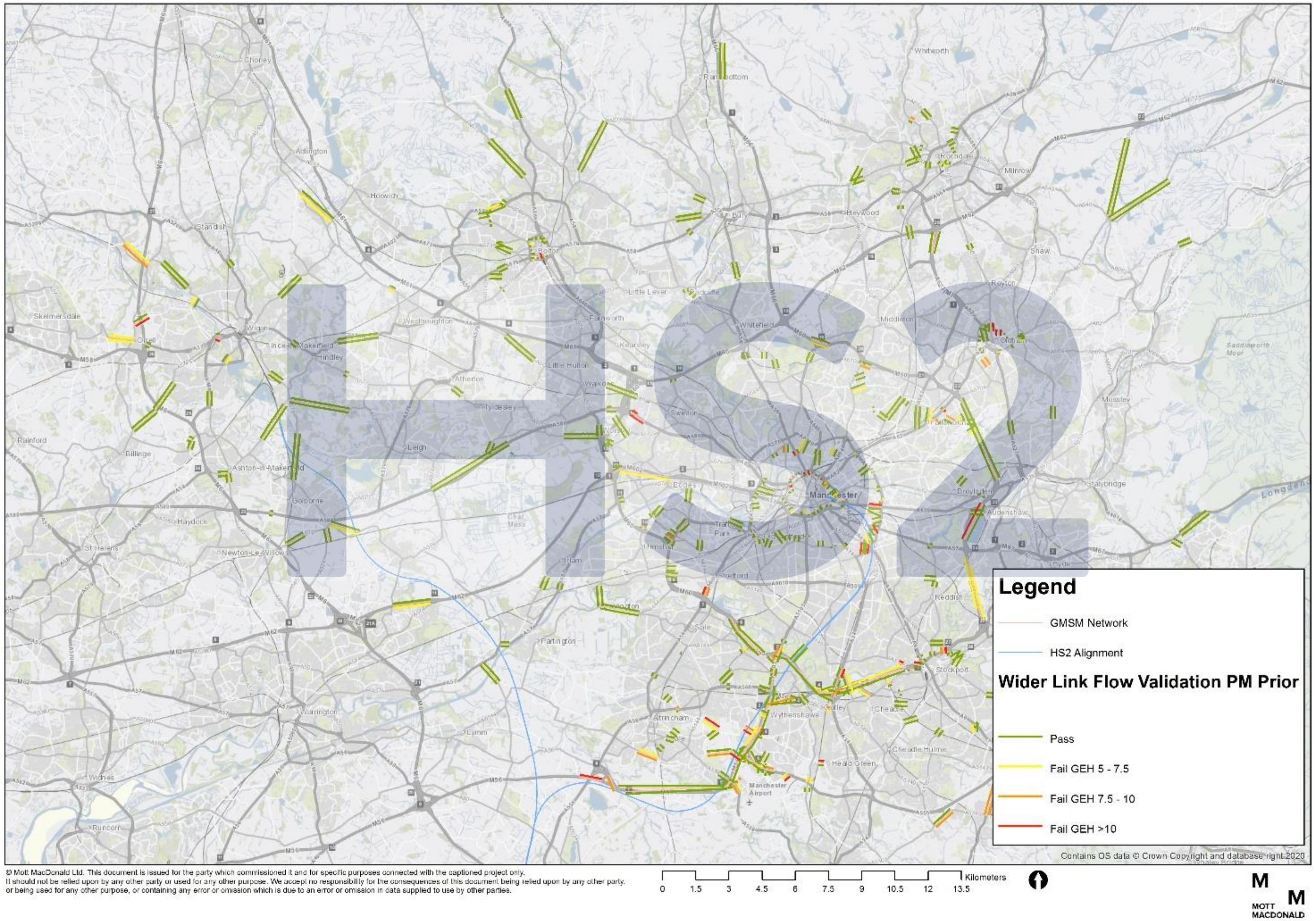


Figure 16: PM peak hour – all Greater Manchester area counts – traffic flow performance – prior



5.2.33 Table 33 and Table 34 present a summary comparison of screenline flows by total all vehicles and by car vehicle type for the post matrix assignment. The comparison shows the compared to the prior assignments, in the post assignments the model performance remains similar where across both time periods most screenlines are meeting the TAG criteria.

Table 33: AP2 GMSM – wider area screenline – total all vehicles – post

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	30	28	93%
PM peak hour	30	26	87%

Table 34: AP2 GMSM – wider area screenline – car vehicle type – post

Time period	Screenline car flow comparison (vehicles)		
	Number of screenlines	TAG screenline flow criteria	
		Number of passing screenlines	Percentage
AM peak hour	30	27	90%
PM peak hour	30	25	83%

5.2.34 Table 35 and Table 36 present a summary comparison of individual link counts by total all vehicles and by car vehicle type for the post matrix assignment. The comparison shows that for the post assignments, across both time periods and for both cars and all vehicles, the percentage of counts meeting the flow or GEH criteria is above the 85% recommended by TAG.

Table 35: AP2 GMSM – wider area individual counts – total all vehicles – post

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	477	445	93%	441	92%	449	94%
PM peak hour	477	442	93%	433	91%	443	93%

Table 36: AP2 GMSM – wider area individual counts – car vehicle type – post

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	477	447	94%	440	92%	451	95%
PM peak hour	477	441	92%	432	91%	443	93%

5.2.35 Table 37 and Table 38 present a summary comparison of supplementary counts by total all vehicles and by car vehicle type for the post matrix assignment. The comparison shows that in the post assignments, across both time periods and for both cars and all vehicles, the percentage of counts meeting the flow or GEH criteria is above the 85% recommended by TAG.

Table 37: AP2 GMSM – wider area supplementary counts – total all vehicles – post

Time period	Total all vehicle flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	30	27	90%	26	87%	27	90%
PM peak hour	30	27	90%	26	87%	27	90%

Table 38: AP2 GMSM – wider area supplementary counts – car vehicle type – post

Time period	Car Flow Comparison (Vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	30	29	97%	28	93%	29	97%
PM peak hour	30	28	93%	28	93%	28	93%

5.2.36 Figure 17 and Figure 18 show the locations of all the link counts and the respective AM and PM peak hour model performance for the post matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

Figure 17: AM peak hour – all Greater Manchester area counts – traffic flow performance – post

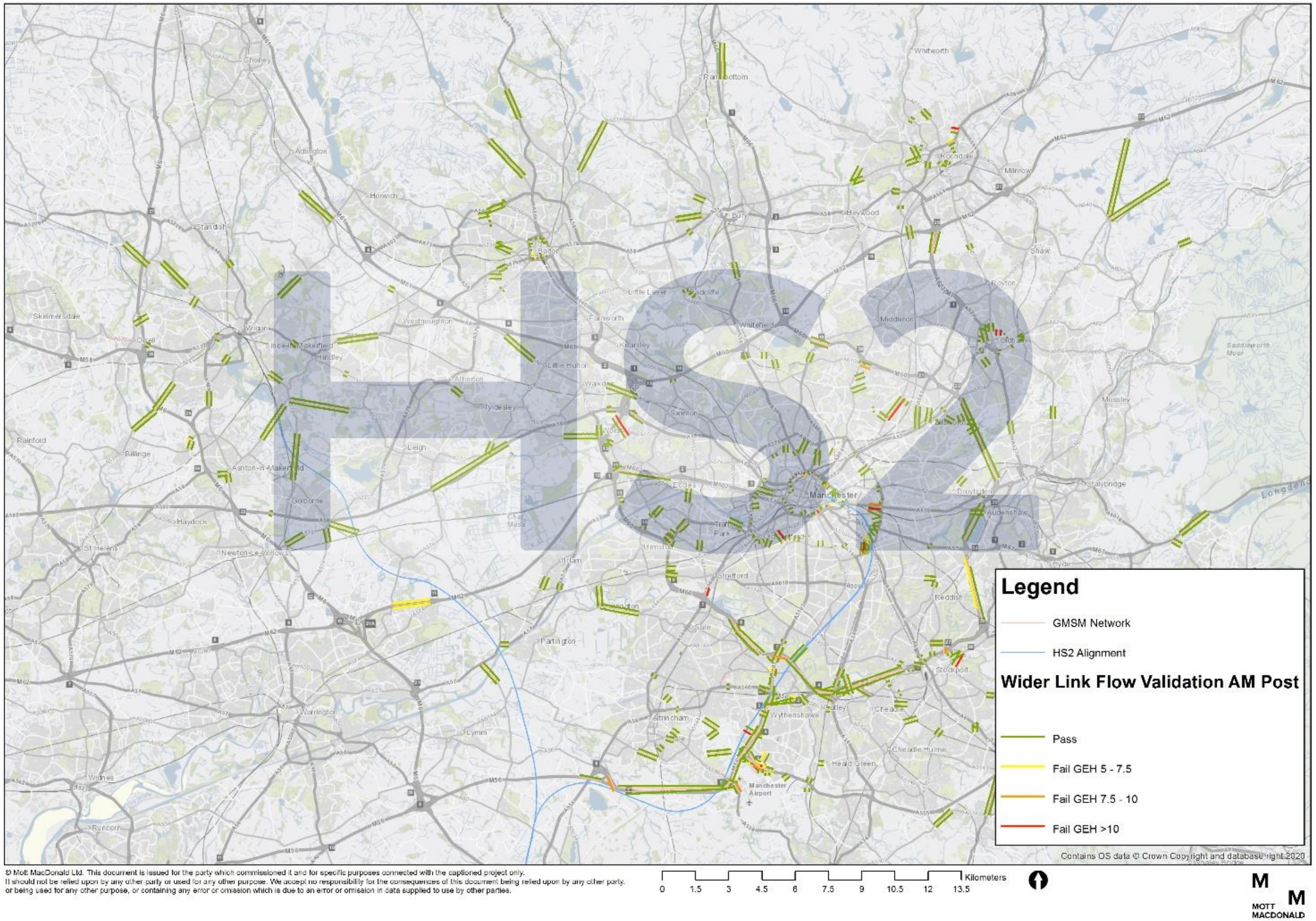
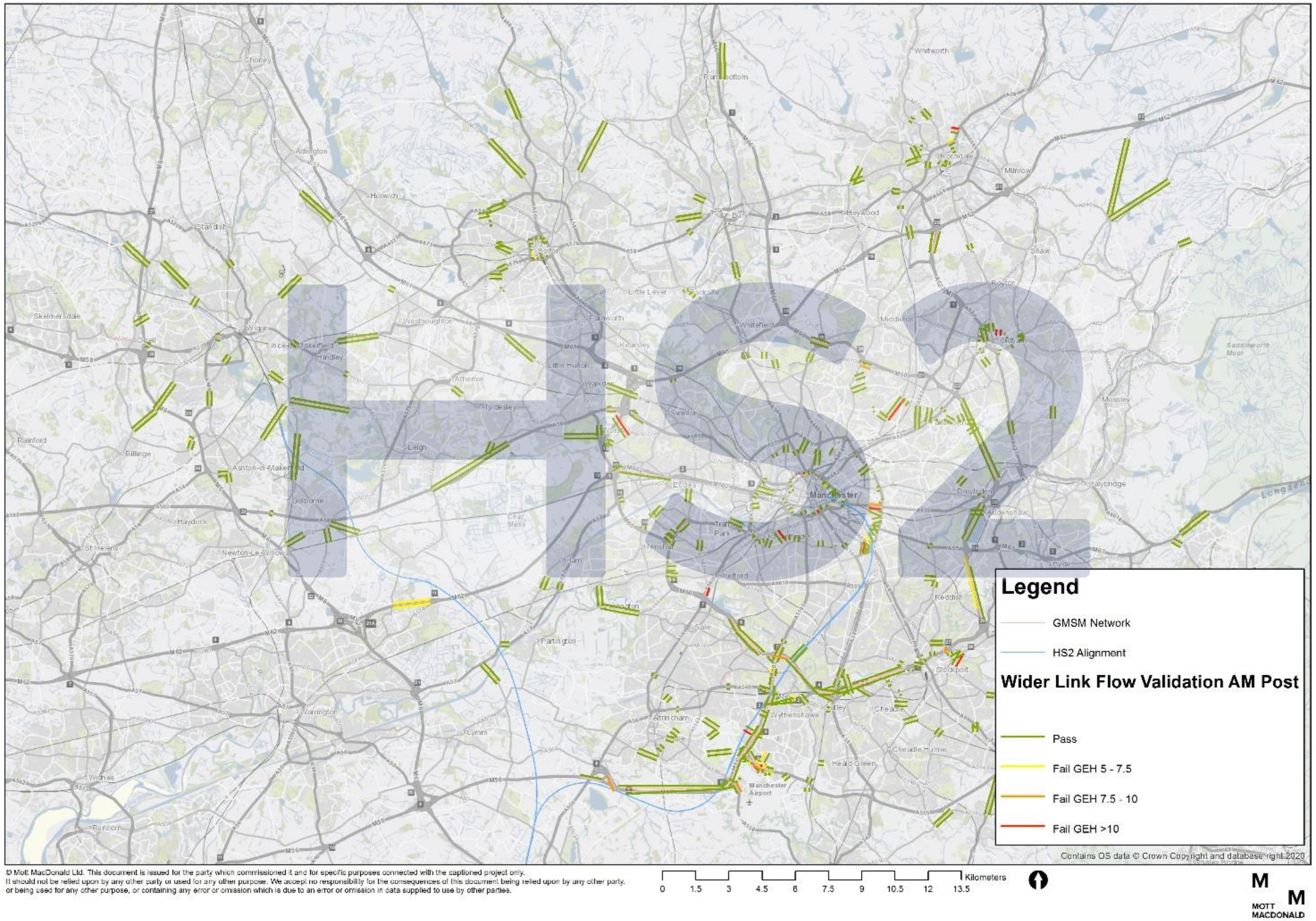


Figure 18: AM peak hour – all Greater Manchester area counts– traffic flow performance – post



5.2.37 In summary, the screenline and the individual link flow comparisons show a good match between observed and modelled links flows across the Greater Manchester wider area.

5.3 Journey time results

5.3.1 Observed and modelled journey times have been compared for 11 (2-way) routes highlighted in Figure 6.

5.3.2 Table 39 summarises the prior journey time results. The table shows that journey times in both time periods fail to meet the DfT TAG journey time guideline of more than 85% of model route times being within 15% of the observed times (or 1 minute, if higher than 15%).

5.3.3 Figure 19 and Figure 20 show the journey time route performance for the prior matrix assignment. These show routes passing TAG criteria as green routes. Routes failing the TAG criteria are shown as orange and red routes, according to time differences.

Table 39: AP2 Greater Manchester SATURN Model – journey time route summary – prior

Time period	Number of routes	TAG journey time criteria	
	Number of screenlines	Number of routes passing	Percentage
AM peak hour	22	15	68%
PM peak hour	22	11	50%

5.3.4 Table 40 summarises the post ME journey time results. The table shows that 77% of journey time routes in the AM model and 50% of journey time routes in the PM model meet the DfT TAG individual route criteria. This is broadly similar to the standard of journey time performance reported at hybrid Bill stage, where data from the parent model validation dataset was used to validate a smaller number of routes.

5.3.5 Where model journey time routes have not met the TAG criteria against the observed data, this has been due to the limiting nature of the strategic model in its ability to replicate both flow and speed at urban over capacity conditions. The speed-flow relationship calculated in the strategic model software is more complicated in reality, particularly where flow breakdown occurs and there are very slow speeds. This is despite network capacities and traffic flows being well represented. Under these circumstances the usual practice is to achieve flow calibration.

5.3.6 There is a balance between achieving both model flow and journey time performance, and despite some routes not having met the TAG journey time criteria, it is important to note that the link flow results presented earlier in this chapter show a good standard has been achieved.

5.3.7 Figure 21 and Figure 22 show the journey time route performance for the post ME assignment. These show routes passing TAG criteria as green routes. Routes failing the TAG criteria are shown as orange and red routes, according to time differences.

Table 40: AP2 Greater Manchester SATURN Model – journey time route summary – post

Time period	Number of routes	TAG journey time criteria	
	Number of screenlines	Number of routes passing	Percentage
AM peak hour	22	17	77%
PM peak hour	22	11	50%

5.3.8 Reference should also be made to Table 51 and Table 52 in Appendix A, which presents supporting details of the individual route performance for the AM and PM time periods post matrix estimation. For routes where model times are outside of the DfT criteria guideline. further details are provided on why this is the case.

5.3.9 Overall, the traffic flow and journey time results collectively show evidence of a good standard which is not undermined by the performance of any individual counts or routes.

Figure 19: AM peak hour – journey time performance – prior

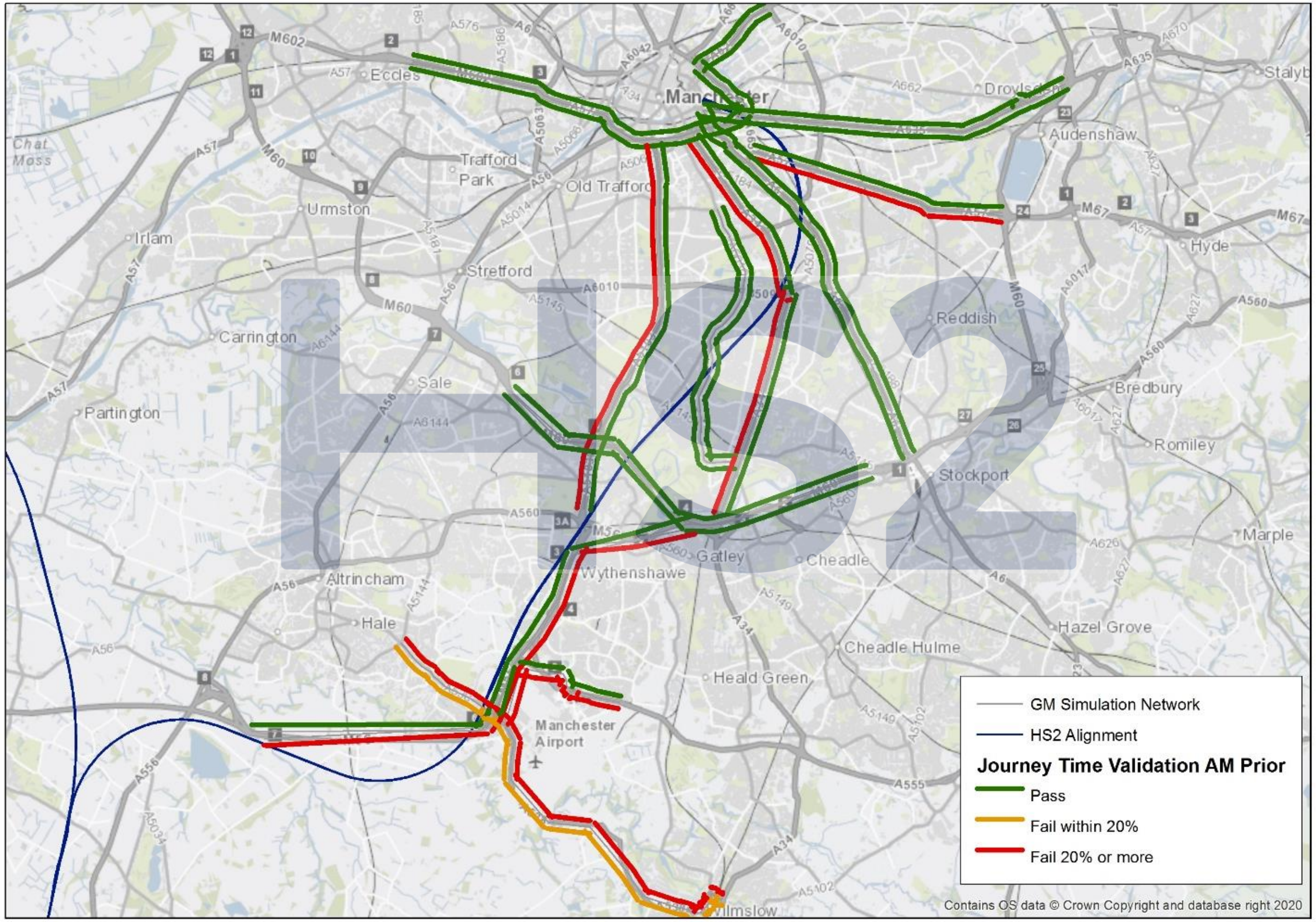


Figure 20: PM peak hour – journey time performance – prior

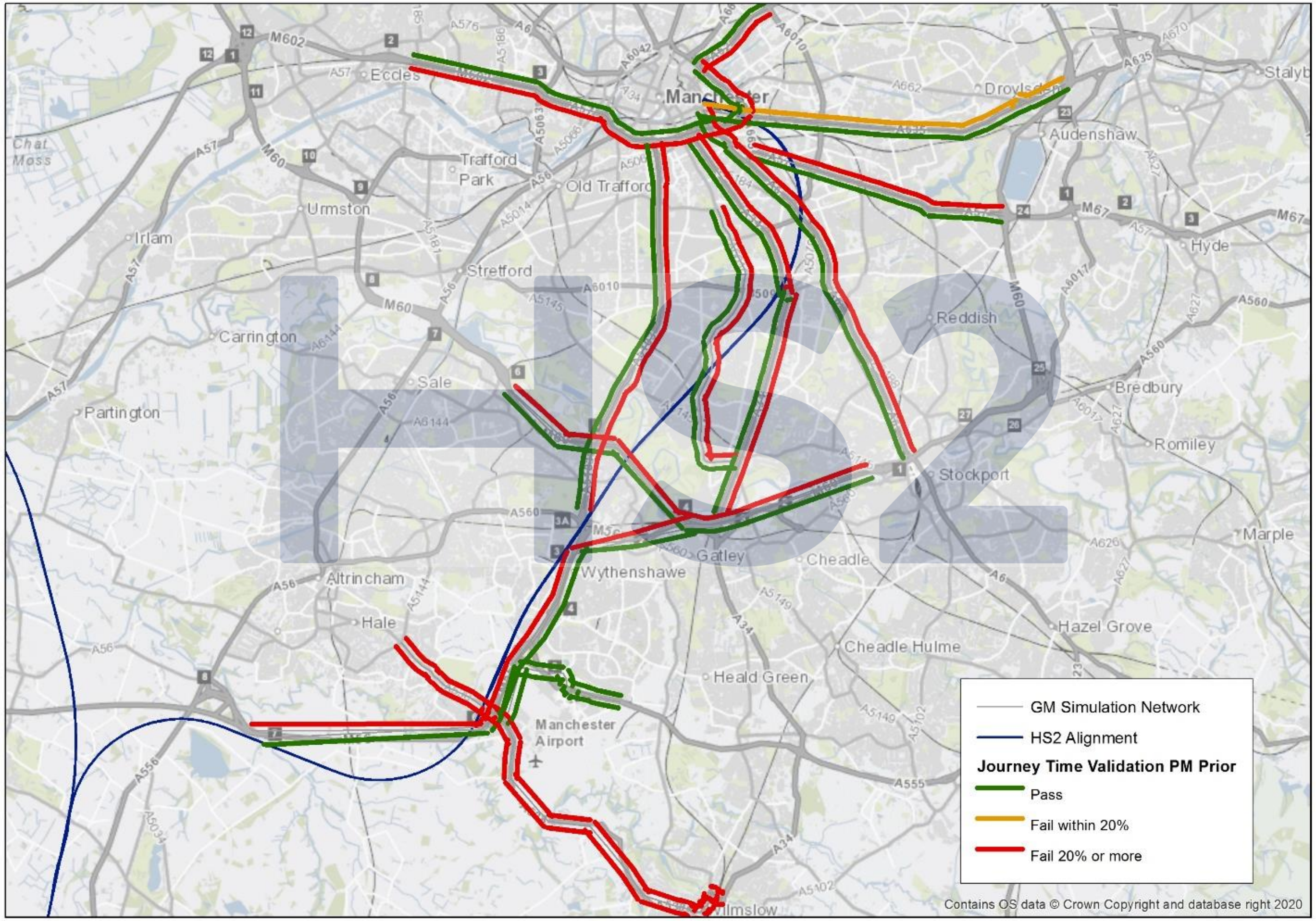


Figure 21: AM peak hour – journey time performance – post

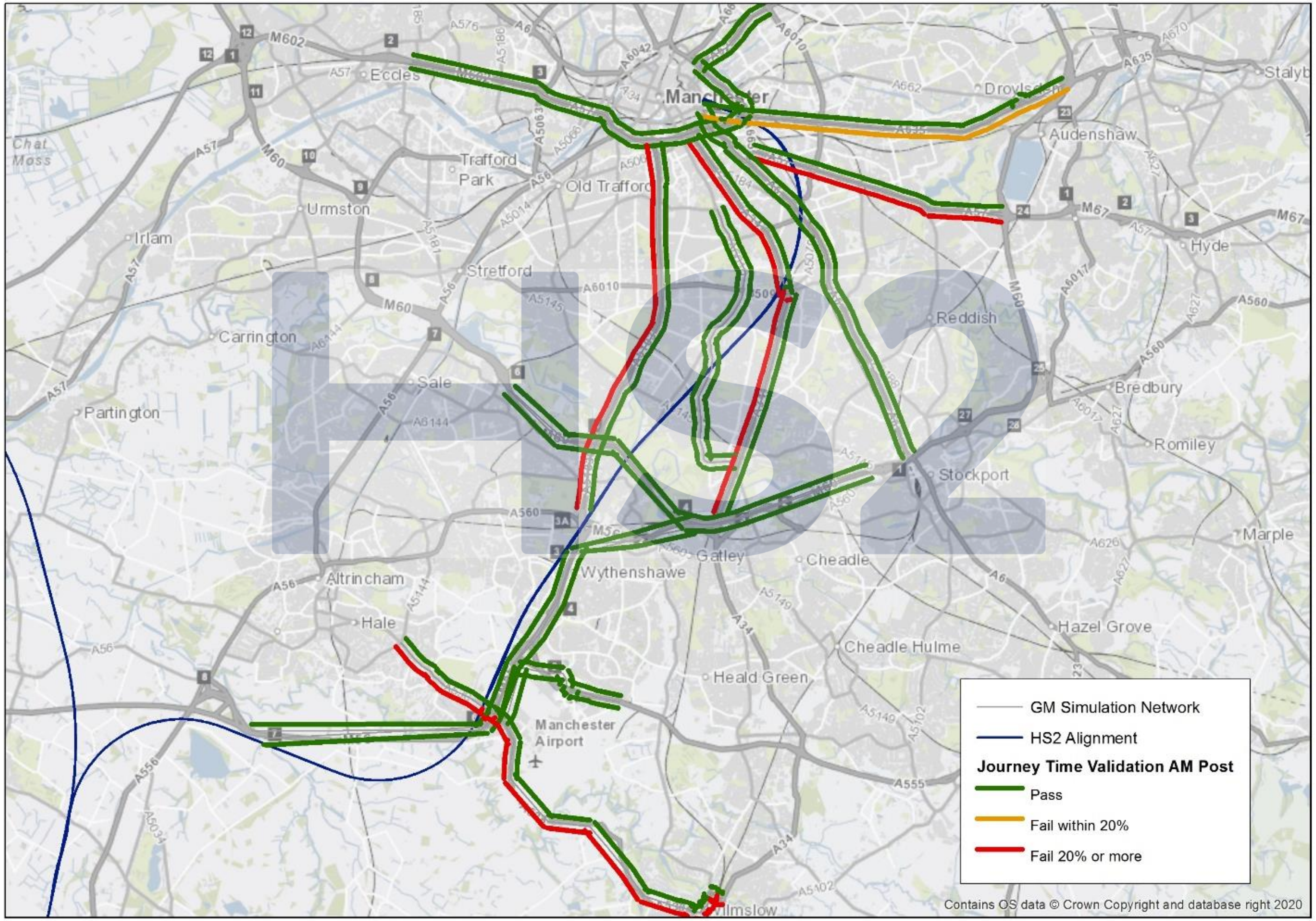
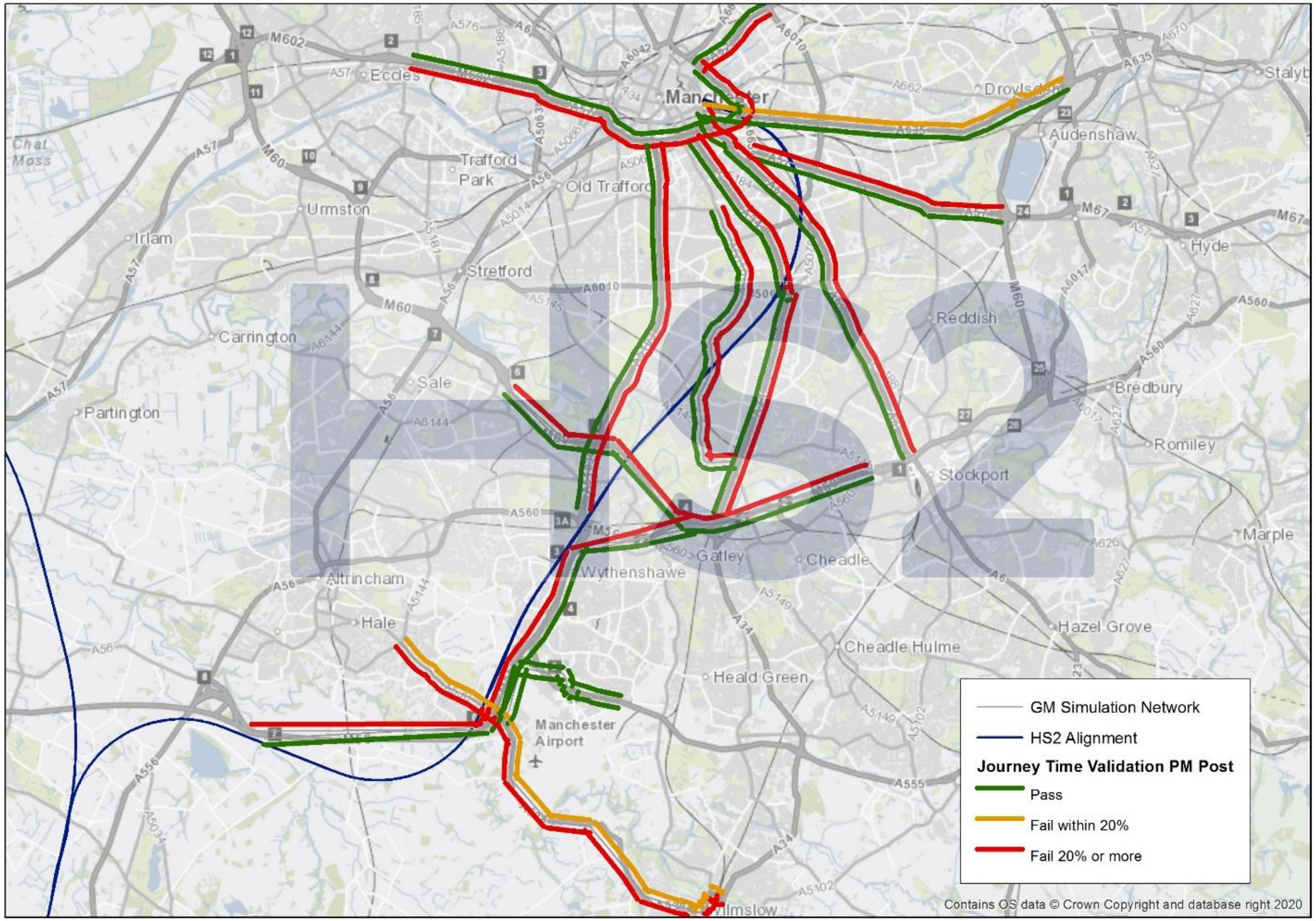


Figure 22: PM peak hour – journey time performance – post



6 Model convergence

6.1.1 Achieving a suitable level of model convergence is necessary to provide stable, consistent, and robust model results and to differentiate between real changes and those associated with differing degrees of convergence.

6.1.2 DfT TAG provides guidance on highway model convergence with recommendations on acceptable variations in link flows and costs between iterations helping to ensure the model is sufficiently stable.

6.1.3 Table 41 presents a summary of the 2017 base year highway model convergence statistics for the AP2 revised scheme by time period. Both models achieve a satisfactory level of convergence.

Table 41: AP2 GMSM Model 2017 baseline model convergence

Criteria	Loop	Target	AM	PM
Flow change	N-3	> 98%	98.2	98.1
	N-2		98.4	98.2
	N-1		98.4	98.4
	N		98.5	98.5
Delays change	N-3	> 98%	99.2	99.1
	N-2		99.2	99.1
	N-1		99.3	99.1
	N		99.3	99.2
Delta		< 0.1%	0.0023/16	0.0095/15
% GAP		< 0.1%	0.0079	0.026

7 Summary and conclusions

7.1.1 For the assessment of the AP2 revised scheme, the 2017 base year model, supplied by TfGM has been further developed at AP2 with additional localised updates to improve model performance in key areas of interest, strengthening the validation with some additional counts, and a wider journey time data set coverage.

7.1.2 Presented below is a summary of the individual link flow model performance (combined and supplementary counts) for all modelled time periods for the SES2 and AP2 ES, post matrix estimation, for the Piccadilly, Airport and Wider Areas. The comparison shows that both time periods exceed the 85% threshold of individual links meeting either the DfT TAG flow range or GEH less than five criteria, apart from the Piccadilly area in the PM model where 84% of links meet the criteria.

Table 42: AP2 Greater Manchester Model – Piccadilly area - individual and supplementary link flow – total all vehicles - post

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	76	68	89%	67	88%	68	89%
PM peak hour	76	63	83%	59	78%	64	84%

Table 43: AP2 Greater Manchester Model – airport area - individual and supplementary link flow – total all vehicles - post

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	89	83	93%	83	93%	83	93%
PM peak hour	89	75	84%	79	89%	79	89%

Table 44: AP2 Greater Manchester Model – wider area - individual and supplementary link flow – total all vehicles - post

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	507	472	93%	467	92%	476	94%
PM peak hour	507	469	93%	459	91%	470	93%

7.1.3 Presented below is a summary of the journey time route performance for all modelled time periods for the AP2 revised scheme, post matrix estimation. The comparison shows that 77% of journey time routes in the AM model and 50% of journey time routes in the PM model meet the DfT TAG individual route criteria. This is broadly similar to the standard of journey time performance reported at hybrid Bill stage, where data from the parent model validation dataset was used to validate a smaller number of routes.

7.1.4 Where model journey time routes have not met the TAG criteria against the observed data, this has been due to the limiting nature of the strategic model in its ability to replicate both flow and speed at urban over capacity conditions.

7.1.5 There is a balance between achieving both model flow and journey time performance, and despite some routes not having met the TAG journey time criteria, it is important to note that the link flow results presented earlier in this chapter show a good standard has been achieved.

7.1.6 Overall, the traffic flow and journey time results collectively show evidence of a good standard which is not undermined by the performance of any individual counts or routes.

7.1.7 Presented below is a summary of the journey time route performance for all modelled time periods for the SES2 and AP2 ES, post matrix estimation. The comparison shows that 90% of journey time routes in the AM model, and all journey time routes in the PM model, meet the DfT TAG individual route criteria and achieve the 85% acceptability guideline.

Table 45: AP2 Northwich Traffic Model - journey time route summary – post

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM peak hour	22	17	77%
PM peak hour	22	11	50%

7.1.8 Both the AM and PM models converge satisfactorily.

7.1.9 In conclusion, the updated GMSM provides a reliable forecasting base and forms a suitable tool for the assessment of HS2 construction and operational impacts within the Manchester Station areas, and also across the wider area of Greater Manchester.

8 List of acronyms

Table 46: List of acronyms

Acronym	Description
ATC	Automatic traffic count
CDES	Civil Design and Engineering Services (Consultant)
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
ES	Environmental Statement
GEH	Geoffrey Havers (statistic)
GMPTM	Greater Manchester Public Transport Model
GMSM	Greater Manchester SATURN Model
GMVDM	Greater Manchester Variable Demand Model
JTC	Junction turning count
LMVR	Local Model Validation Report
MCC	Manual Classified count
MPR	Model Performance Report
PYV	Present Year Validation
TA	Transport Assessment

9 References

AECOM (2017), *Greater Manchester SATURN Model - 2017 Local Model Validation Report Addendum*.

Department for Transport (2020), *TAG unit M1.2 Data Sources and Surveys*. Public Transport Assignment. Available online at: https://www.gov.uk/government/publications/webtag-tag-unit-m1-2-data-sources-and-surveys.

Department for Transport (2020), *TAG unit M3.1 Highway Assignment Modelling*. Public Transport Assignment. Available online at: https://www.gov.uk/government/publications/webtag-tag-unit-m3-1-highway-assignment-modelling.

Department for Transport (2020), *TAG unit M3.2 Public Transport Assignment Modelling*. Public Transport Assignment. Available online at: https://www.gov.uk/government/publications/webtag-tag-unit-m3-2-public-transport-assignment-modelling.

Department for Transport (2020), *TAG unit M3.2 Variable Demand Modelling*. Public Transport Assignment. Available online at: https://www.gov.uk/government/publications/tag-unit-m2-1-variable-demand-modelling.

Transport for Greater Manchester (2014), *Greater Manchester SATURN Model - 2014 Local Model Validation Report*.

10 Appendix A – Model performance

Individual link flow performance – Piccadilly area

Table 47: AP2 GMSM – Piccadilly area - individual and supplementary link flow detailed results – post – AM peak hour

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A6 London Road	South of Store Street	NB	521	35	11	567	539	36	8	583	16	3%	0.66	✓	✓	✓
Boad Street	South of Store Street	NB	57	6	2	65	86	6	2	94	29	44%	3.21	✓	✓	✓
Sparkle Street	South of Store Street	NB	18	2	0	20	7	1	0	8	-12	-61%	3.26	✓	✓	✓
A665 Great Ancoats Street	South of Store Street	NB	1506	139	45	1690	1157	109	22	1288	-402	-24%	10.41	×	×	×
A6 London Road	South of Store Street	SB	410	72	18	500	462	57	11	530	30	6%	1.33	✓	✓	✓
Boad Street	South of Store Street	SB	106	12	3	120	123	13	3	138	18	15%	1.60	✓	✓	✓
Sparkle Street	South of Store Street	SB	7	1	0	8	0	0	0	0	-8	-100%	4.00	✓	✓	✓
Store Street	East of Sheffield Street	EB	69	8	3	80	69	11	2	82	2	3%	0.22	✓	✓	✓
Travis Street	East of Sheffield Street	EB	192	21	6	219	154	18	5	177	-42	-19%	2.99	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Store Street	East of Sheffield Street	WB	376	24	4	404	395	23	5	424	20	5%	0.98	✓	✓	✓
Travis Street	East of Sheffield Street	WB	403	44	12	459	408	44	15	467	8	2%	0.37	✓	✓	✓
A635 Ring Road	South of North Western Street	NB	1229	161	61	1451	1220	158	52	1430	-21	-1%	0.55	✓	✓	✓
A665 Chancellor Lane	North of Higher Ardwick	NB	777	85	24	886	739	78	15	832	-53	-6%	1.81	✓	✓	✓
A6 London Road	South of Fairfield Street	SB	343	47	16	406	422	59	11	492	86	21%	4.07	✓	✓	✓
A635 Ring Road	South of North Western Street	SB	1728	252	26	2006	1658	256	56	1970	-36	-2%	0.81	✓	✓	✓
A665 Chancellor Lane	North of Higher Ardwick	SB	803	88	24	916	743	67	20	830	-86	-9%	2.91	✓	✓	✓
A6 London Road	South of Travis Street	NB	658	50	10	718	672	61	8	741	23	3%	0.86	✓	✓	✓
B6469 Fairfield Street	West of A635	NWB	265	29	8	302	258	29	11	299	-3	-1%	0.17	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A665 Pin Mill Brow	South of Helmet Street	NB	1489	163	45	1697	1408	162	40	1610	-87	-5%	2.14	✓	✓	✓
A6 London Road	South of Travis Street	SB	556	83	19	658	584	81	15	679	21	3%	0.83	✓	✓	✓
B6469 Fairfield Street	West of A635	SEB	110	12	3	126	108	15	3	125	-1	0%	0.05	✓	✓	✓
A665 Pin Mill Brow	South of Helmet Street	SB	1283	140	39	1462	1556	159	38	1754	292	20%	7.27	×	×	×
St Andrew's Street	South of Travis Street	NB	98	11	3	112	145	11	5	161	49	43%	4.17	✓	✓	✓
St Andrew's Street	South of Travis Street	SB	84	9	3	95	90	12	2	103	8	8%	0.80	✓	✓	✓
Devonshire Street	-	-	718	43	9	770	682	42	7	731	-39	-5%	1.44	✓	✓	✓
Devonshire Street North	-	-	472	49	16	537	458	57	15	529	-8	-1%	0.33	✓	✓	✓
Hyde Road (E)	-	-	846	108	35	989	912	111	33	1055	66	7%	2.08	✓	✓	✓
Hyde Road (W)	-	-	244	52	29	325	249	54	27	331	6	2%	0.32	✓	✓	✓
Brunswick Street	-	-	300	39	13	352	299	39	11	348	-4	-1%	0.20	✓	✓	✓
Ardwick Green South	-	-	470	76	44	590	472	76	38	586	-4	-1%	0.18	✓	✓	✓
Higher Ardwick	-	-	323	59	14	396	324	58	13	395	-1	0%	0.05	✓	✓	✓
Hyde Road	-	-	546	78	25	649	592	79	27	699	50	8%	1.92	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Stockport Road	-	-	537	54	10	601	556	51	9	616	15	2%	0.61	✓	✓	✓
Fairfield Street (E)	-	-	404	48	12	464	468	49	12	530	66	14%	2.96	✓	✓	✓
Fairfield Street (W)	-	-	275	23	5	303	275	18	4	297	-6	-2%	0.34	✓	✓	✓
London Road (N)	-	-	355	62	17	434	208	31	9	248	-186	-43%	10.05	×	×	×
Store Street	-	-	137	15	6	158	316	35	5	356	198	125%	12.34	×	×	×
Store Street (E)	-	-	363	25	4	392	388	22	5	416	24	6%	1.20	✓	✓	✓
Store Street	-	-	67	8	3	78	69	11	2	82	4	5%	0.45	✓	✓	✓
Great Ancoats Street (N)	-	-	1114	135	45	1294	1069	122	35	1226	-68	-5%	1.92	✓	✓	✓
Old Mill Street	-	-	547	46	7	600	541	34	3	577	-23	-4%	0.95	✓	✓	✓
Devonshire Street	-	-	518	46	16	580	517	48	14	580	0	0%	0.02	✓	✓	✓
Devonshire Street North	-	-	827	54	11	892	781	66	10	857	-35	-4%	1.18	✓	✓	✓
Hyde Road (E)	-	-	383	77	35	495	401	74	31	505	10	2%	0.46	✓	✓	✓
Hyde Road (W)	-	-	552	75	27	654	601	76	27	704	50	8%	1.93	✓	✓	✓
Brunswick Street	-	-	528	59	10	597	517	59	8	584	-13	-2%	0.55	✓	✓	✓
Ardwick Green South	-	-	833	125	38	996	911	122	37	1070	74	7%	2.30	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Higher Ardwick	-	-	271	34	11	316	269	34	9	312	-4	-1%	0.22	✓	✓	✓
Hyde Road	-	-	267	52	30	349	313	55	29	397	48	14%	2.50	✓	✓	✓
Stockport Road	-	-	277	36	17	330	233	34	14	281	-49	-15%	2.81	✓	✓	✓
Fairfield Street (E)	-	-	240	19	2	261	345	16	4	365	104	40%	5.89	×	×	×
Fairfield Street (W)	-	-	562	89	16	667	571	74	13	658	-9	-1%	0.35	✓	✓	✓
Store Street	-	-	59	3	2	64	63	8	3	74	10	16%	1.23	✓	✓	✓
London Road (S)	-	-	433	74	21	528	462	57	11	530	2	0%	0.10	✓	✓	✓
Store Street (E)	-	-	67	10	3	80	69	11	2	82	2	3%	0.22	✓	✓	✓
Chapeltown Street	-	-	9	1	0	10	0	0	0	0	-10	-100%	4.42	✓	✓	✓
Chapeltown street	-	-	26	3	1	29	7	1	0	8	-21	-73%	4.95	✓	✓	✓
Helmet Street	-	-	4	0	0	5	0	0	0	0	-5	-100%	3.17	✓	✓	✓
Helmet Street	-	-	16	2	0	19	0	0	0	0	-19	-100%	6.11	×	✓	✓
ATC2_10_09_Ashton Old Road	-	EB	481	77	27	584	495	87	37	620	36	6%	1.46	✓	✓	✓
ATC2_10_09_Ashton Old Road	-	WB	1012	162	56	1229	964	161	52	1178	-51	-4%	1.48	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Ashton New Rd (A662)	130m W of Hillkirk St, Manchester (ATC)	EB	240	26	7	273	241	42	7	290	16	6%	0.98	✓	✓	✓
Ashton New Rd (A662)	130m W of Hillkirk St, Manchester (ATC)	WB	791	87	24	902	820	79	10	908	7	1%	0.22	✓	✓	✓
(North) Travis Street	-	SWB	407	51	10	468	391	50	10	451	-17	-4%	0.81	✓	✓	✓
(North) Travis Street	-	NEB	181	16	2	199	179	13	3	195	-4	-2%	0.28	✓	✓	✓
(East) B6469 Fairfield Street	-	WB	310	44	14	368	156	21	6	184	-184	-50%	11.10	×	×	×
(East) B6469 Fairfield Street	-	EB	112	9	0	121	93	3	1	97	-24	-20%	2.29	✓	✓	✓
(West) B6469 Fairfield Street	-	EB	363	2	19	384	364	16	4	384	0	0%	0.02	✓	✓	✓
(West) B6469 Fairfield Street	-	WB	465	48	14	527	478	49	12	539	12	2%	0.54	✓	✓	✓
Ducie Street	-	SWB	104	16	5	125	145	23	6	174	49	39%	4.03	✓	✓	✓
Ducie Street	-	NEB	188	32	7	227	251	33	7	291	64	28%	3.98	✓	✓	✓
Auburn Street	-	NEB	281	39	10	330	314	41	10	365	35	11%	1.88	✓	✓	✓
Pollard Street	-	SWB	511	40	9	560	327	41	9	377	-183	-33%	8.47	×	×	×

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Pollard Street	-	NEB	171	25	6	202	174	25	6	205	3	1%	0.18	✓	✓	✓
(South) Great Ancoats Street	-	NWB	1215	114	32	1361	1167	111	24	1302	-59	-4%	1.62	✓	✓	✓
(South) Great Ancoats Street	-	SEB	1456	172	37	1665	1208	140	36	1383	-282	-17%	7.22	×	×	×

Table 48: AP2 GMSM – Piccadilly area - individual and supplementary link flow detailed results – post – PM peak hour

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A6 London Road	South of Store Street	NB	265	14	0	279	87	0	0	87	-192	-69%	14.20	×	×	×
Boad Street	South of Store Street	NB	98	6	1	105	150	6	1	157	52	49%	4.54	✓	✓	✓
Sparkle Street	South of Store Street	NB	9	0	0	9	1	0	0	2	-7	-83%	3.26	✓	✓	✓
A665 Great Ancoats Street	South of Store Street	NB	1699	121	24	1844	1327	84	12	1423	-421	-23%	10.41	×	×	×
A6 London Road	South of Store Street	SB	554	29	3	586	576	26	5	606	20	3%	0.81	✓	✓	✓
Boad Street	South of Store Street	SB	90	6	1	97	115	6	1	122	25	26%	2.38	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Sparkle Street	South of Store Street	SB	25	0	1	26	32	0	0	32	6	24%	1.14	✓	✓	✓
Store Street	East of Sheffield Street	EB	216	10	0	226	241	10	1	252	26	11%	1.65	✓	✓	✓
Travis Street	East of Sheffield Street	EB	346	23	4	373	375	19	3	397	24	6%	1.23	✓	✓	✓
Store Street	East of Sheffield Street	WB	179	8	0	187	185	8	3	196	9	5%	0.67	✓	✓	✓
Travis Street	East of Sheffield Street	WB	222	14	2	238	61	14	2	76	-162	-68%	12.94	×	×	×
A635 Ring Road	South of North Western Street	NB	1690	191	30	1911	1660	167	22	1849	-62	-3%	1.43	✓	✓	✓
A665 Chancellor Lane	North of Higher Ardwick	NB	878	57	10	945	870	56	9	935	-10	-1%	0.34	✓	✓	✓
A6 London Road	South of Fairfield Street	SB	649	23	4	676	717	26	6	750	74	11%	2.76	✓	✓	✓
A635 Ring Road	South of North Western Street	SB	1196	93	22	1311	1182	95	20	1298	-13	-1%	0.37	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A665 Chancellor Lane	North of Higher Ardwick	SB	608	40	7	655	607	40	6	653	-2	0%	0.08	✓	✓	✓
A6 London Road	South of Travis Street	NB	416	19	2	437	244	13	2	259	-178	-41%	9.57	×	×	×
B6469 Fairfield Street	West of A635	NWB	217	14	2	234	303	10	2	315	81	35%	4.91	✓	✓	✓
A665 Pin Mill Brow	South of Helmet Street	NB	1734	113	19	1867	1552	118	18	1687	-180	-10%	4.26	✓	✓	✓
A6 London Road	South of Travis Street	SB	958	37	8	1003	909	39	10	958	-45	-5%	1.44	✓	✓	✓
B6469 Fairfield Street	West of A635	SEB	276	18	3	297	229	17	3	249	-49	-16%	2.94	✓	✓	✓
A665 Pin Mill Brow	South of Helmet Street	SB	1314	86	15	1414	1332	88	12	1432	18	1%	0.47	✓	✓	✓
St Andrew's Street	South of Travis Street	NB	160	10	2	173	243	12	2	256	83	48%	5.70	×	✓	✓
St Andrew's Street	South of Travis Street	SB	92	6	1	99	144	9	1	154	55	55%	4.86	✓	✓	✓
Devonshire Street	-	-	644	43	9	696	637	42	6	685	-11	-2%	0.42	✓	✓	✓
Devonshire Street North	-	-	501	37	9	547	551	37	7	594	47	9%	1.98	✓	✓	✓
Hyde Road (E)	-	-	449	35	14	498	455	43	11	508	10	2%	0.45	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Hyde Road (W)	-	-	938	76	16	1030	947	76	15	1038	8	1%	0.24	✓	✓	✓
Brunswick Street	-	-	676	50	7	733	704	50	6	760	27	4%	0.98	✓	✓	✓
Ardwick Green South	-	-	866	76	22	964	888	77	21	986	22	2%	0.71	✓	✓	✓
Higher Ardwick	-	-	420	35	1	456	405	34	1	440	-16	-3%	0.75	✓	✓	✓
Hyde Road	-	-	259	29	11	299	286	29	11	326	27	9%	1.52	✓	✓	✓
Stockport Road	-	-	405	40	4	449	411	42	4	456	7	2%	0.35	✓	✓	✓
Fairfield Street (E)	-	-	375	12	4	391	376	12	2	391	0	0%	0.02	✓	✓	✓
Fairfield Street (W)	-	-	610	14	5	629	494	14	4	512	-117	-19%	4.91	✓	×	✓
London Road (N)	-	-	480	19	4	503	402	16	3	421	-82	-16%	3.83	✓	✓	✓
Store Street	-	-	115	9	0	124	325	14	3	342	218	176%	14.28	×	×	×
Store Street (E)	-	-	192	8	1	201	184	8	3	195	-6	-3%	0.44	✓	✓	✓
Store Street	-	-	218	17	0	235	209	10	1	219	-16	-7%	1.04	✓	✓	✓
Great Ancoats Street (N)	-	-	1508	97	14	1619	1389	95	9	1494	-125	-8%	3.18	✓	✓	✓
Old Mill Street	-	-	199	20	1	220	136	6	1	144	-76	-34%	5.62	×	✓	✓
Devonshire Street	-	-	416	23	7	446	415	23	6	444	-2	-1%	0.11	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Devonshire Street North	-	-	613	42	9	664	659	41	7	707	43	7%	1.66	✓	✓	✓
Hyde Road (E)	-	-	1254	102	23	1379	1263	109	16	1388	9	1%	0.25	✓	✓	✓
Hyde Road (W)	-	-	249	24	9	282	252	24	9	285	3	1%	0.20	✓	✓	✓
Brunswick Street	-	-	295	30	3	328	295	30	3	327	-1	0%	0.05	✓	✓	✓
Ardwick Green South	-	-	492	43	10	545	550	45	11	605	60	11%	2.52	✓	✓	✓
Higher Ardwick	-	-	423	46	10	479	424	46	9	479	0	0%	0.02	✓	✓	✓
Hyde Road	-	-	907	75	15	997	916	75	15	1006	9	1%	0.28	✓	✓	✓
Stockport Road	-	-	509	36	7	552	509	36	6	551	-1	0%	0.05	✓	✓	✓
Fairfield Street (E)	-	-	519	13	4	536	483	14	2	499	-37	-7%	1.64	✓	✓	✓
Fairfield Street (W)	-	-	409	20	6	435	403	25	4	431	-4	-1%	0.17	✓	✓	✓
Store Street	-	-	41	2	0	43	153	4	1	158	115	267%	11.47	×	×	×
London Road (S)	-	-	554	26	4	584	576	26	5	606	22	4%	0.90	✓	✓	✓
Store Street (E)	-	-	213	10	0	223	209	10	1	219	-4	-2%	0.24	✓	✓	✓
CHAPELTOWN STREET	-	-	27	2	0	29	32	0	0	32	3	10%	0.51	✓	✓	✓
CHAPELTOWN STREET	-	-	24	2	0	26	1	0	0	2	-24	-94%	6.59	×	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
HELMET STREET	-	-	21	1	0	22	0	0	0	0	-22	-100%	6.64	×	✓	✓
HELMET STREET	-	-	11	1	0	12	64	6	0	70	58	498%	9.13	×	✓	✓
ATC2_10_09_Ashton Old Road	-	EB	1273	108	13	1394	1197	108	11	1315	-79	-6%	2.14	✓	✓	✓
ATC2_10_09_Ashton Old Road	-	WB	523	44	5	572	528	43	6	577	5	1%	0.19	✓	✓	✓
Ashton New Rd (A662)	130m W of Hillkirk St, Manchester (ATC)	EB	627	41	7	675	740	71	6	817	143	21%	5.22	×	×	×
Ashton New Rd (A662)	130m W of Hillkirk St, Manchester (ATC)	WB	298	19	3	320	297	19	1	317	-4	-1%	0.21	✓	✓	✓
(North) Travis Street	-	SWB	373	19	5	397	402	20	5	428	31	8%	1.51	✓	✓	✓
(North) Travis Street	-	NEB	283	14	2	299	135	8	0	144	-155	-52%	10.45	×	×	×
(East) B6469 Fairfield Street	-	WB	291	16	0	307	147	5	0	152	-155	-50%	10.20	×	×	×
(East) B6469 Fairfield Street	-	EB	155	7	1	163	128	5	2	136	-27	-17%	2.25	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
(West) B6469 Fairfield Street	-	EB	468	14	2	484	263	14	2	279	-205	-42%	10.49	×	×	×
(West) B6469 Fairfield Street	-	WB	357	15	2	374	358	12	2	372	-2	-1%	0.12	✓	✓	✓
Ducie Street	-	SWB	118	11	0	129	135	0	0	135	6	5%	0.52	✓	✓	✓
Ducie Street	-	NEB	268	19	0	287	271	22	1	293	6	2%	0.38	✓	✓	✓
Auburn Street	-	NEB	362	23	1	386	517	27	2	545	159	41%	7.39	×	×	×
Pollard Street	-	SWB	161	10	1	172	155	13	1	168	-4	-2%	0.28	✓	✓	✓
Pollard Street	-	NEB	523	38	3	564	532	36	3	570	6	1%	0.27	✓	✓	✓
(South) Great Ancoats Street	-	NWB	1317	90	12	1419	1445	85	12	1542	123	9%	3.19	✓	✓	✓
(South) Great Ancoats Street	-	SEB	1309	68	5	1382	952	63	5	1020	-362	-26%	10.43	×	×	×

Individual link flow performance – Airport area

Table 49: AP2 GMSM – airport area - individual and supplementary link flow detailed results – post – AM peak hour

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Thorley Lane	East of Roaring Gate Lane	NWB	309	20	0	329	304	21	6	331	2	1%	0.10	✓	✓	✓
Thorley Lane	East of Roaring Gate Lane	SEB	440	23	4	467	359	31	4	394	-73	-16%	3.51	✓	✓	✓
Hale Road (E)	-	-	823	91	23	937	824	87	9	919	-18	-2%	0.59	✓	✓	✓
Hale Road (W)	-	-	491	35	13	539	494	36	5	534	-5	-1%	0.20	✓	✓	✓
Roaring Gate Lane	-	-	293	23	4	320	308	30	3	341	21	7%	1.15	✓	✓	✓
Runger Lane	-	-	412	37	10	459	382	18	13	414	-45	-10%	2.15	✓	✓	✓
Hale Road (E)	-	-	538	43	13	594	534	38	4	576	-18	-3%	0.74	✓	✓	✓
Hale Road (W)	-	-	722	82	21	825	722	83	10	815	-10	-1%	0.36	✓	✓	✓
Roaring Gate Lane	-	-	226	16	1	243	304	16	5	324	81	33%	4.83	✓	✓	✓
Runger Lane	-	-	538	41	12	591	437	27	8	472	-119	-20%	5.14	×	×	×
M56	-	-	1097	166	55	1318	1081	167	52	1300	-18	-1%	0.50	✓	✓	✓
Wilmslow Road (W)	-	-	1242	155	55	1452	982	101	53	1136	-316	-22%	8.80	×	×	×
M56	-	-	425	58	22	505	510	58	23	591	86	17%	3.68	✓	✓	✓
Wilmslow Road (W)	-	-	1156	190	61	1407	1160	193	56	1409	2	0%	0.05	✓	✓	✓
Hotel Access	-	-	77	2	0	79	77	2	0	79	0	0%	0.01	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
M56	-	-	701	102	35	838	742	98	53	892	54	6%	1.85	✓	✓	✓
Hotel Access	-	-	93	5	1	99	93	5	1	99	0	0%	0.04	✓	✓	✓
M56	-	-	1007	108	42	1157	1006	110	39	1155	-2	0%	0.07	✓	✓	✓
M56 J5 SB off-slip	-	-	1213	160	55	1428	1192	183	74	1449	21	1%	0.56	✓	✓	✓
M56 J5 SB on-slip	-	-	787	104	35	927	776	104	26	905	-22	-2%	0.72	✓	✓	✓
M56 J5 NB on-slip	-	-	822	109	37	967	820	109	35	964	-3	0%	0.10	✓	✓	✓
M56 J4 NB on-slip	-	-	474	63	21	558	460	48	104	613	55	10%	2.27	✓	✓	✓
M56 J4 to J5 SB	-	-	4776	631	215	5622	4763	659	240	5661	39	1%	0.53	✓	✓	✓
M56 J4 to J5 NB	-	-	4399	582	198	5179	4311	582	280	5173	-6	0%	0.08	✓	✓	✓
M56 J4 SB off-slip	-	-	849	112	38	999	867	164	79	1110	111	11%	3.42	✓	✓	✓
M56 J5 mainline - mid junction SB	-	-	3572	472	161	4204	3571	475	166	4212	8	0%	0.12	✓	✓	✓
M56 J5 mainline - mid junction NB	-	-	3497	462	157	4117	3490	473	245	4208	91	2%	1.42	✓	✓	✓
M56 J6 to J7 EB	-	-	4239	560	191	4990	4256	575	265	5096	107	2%	1.50	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
M56 J6 to J7 WB	-	-	3767	498	169	4434	3775	470	163	4408	-26	-1%	0.39	✓	✓	✓
M56 J6 mainline - mid junction NEB	-	-	3541	468	159	4169	3514	477	212	4204	35	1%	0.54	✓	✓	✓
M56 J6 mainline - mid junction SWB	-	-	3335	441	150	3925	3266	412	139	3817	-108	-3%	1.74	✓	✓	✓
Ringway Road West (Between Terminal 1 and 3 Roundabout and Aviator Way)	-	EB	885	97	27	1009	890	100	24	1014	5	0%	0.15	✓	✓	✓
Ringway Road West (Between Terminal 1 and 3 Roundabout and Aviator Way)	-	WB	689	75	21	785	672	62	19	752	-32	-4%	1.17	✓	✓	✓
Tuffley Road (Between Firbank Road	-	EB	404	44	12	460	400	34	16	450	-10	-2%	0.49	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
and Wrekin Avenue)																
Tuffley Road (Between Firbank Road and Wrekin Avenue)	-	WB	276	30	8	315	86	17	1	104	-211	-67%	14.55	×	×	×
Thornley Lane (Between Outwood Lane West and Bailey Lane)	-	NB	850	93	26	969	853	92	18	963	-6	-1%	0.19	✓	✓	✓
Thornley Lane (Between Outwood Lane West and Bailey Lane)	-	SB	646	71	20	736	656	71	13	740	4	1%	0.15	✓	✓	✓
Bailey Lane (Between Thornley Lane and Hilary Road)	-	NB	281	31	9	320	426	53	8	487	167	52%	8.30	×	×	×
Bailey Lane (Between Thornley Lane and Hilary Road)	-	SB	319	35	10	363	344	34	10	387	24	7%	1.25	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Terminal 2 Roundabout (Top of Airport Spur Off Slip)	-	EB	1211	132	37	1380	1161	133	33	1328	-53	-4%	1.43	✓	✓	✓
Terminal 2 Roundabout (Top of Airport Spur Off Slip)	-	WB	751	82	23	857	696	82	21	798	-58	-7%	2.03	✓	✓	✓
B5166 Styal Road	-	-	689	75	21	785	734	36	18	788	3	0%	0.12	✓	✓	✓
Finney Lane	-	-	1075	18	29	1122	1061	19	28	1108	-14	-1%	0.41	✓	✓	✓
A560 Gatley Road	-	-	588	12	29	629	596	12	29	638	9	1%	0.34	✓	✓	✓
A538 Wilmslow Road	South of Sunbank Lane	NWB	840	92	26	958	863	119	39	1021	63	7%	2.02	✓	✓	✓
Sunbank Lane	South of M56	NWB	4	0	0	5	1	1	0	2	-3	-61%	1.60	✓	✓	✓
B5166 Styal Road	-	-	581	64	18	663	597	58	7	662	-1	0%	0.02	✓	✓	✓
Finney Lane	-	-	823	13	17	853	776	13	12	800	-53	-6%	1.84	✓	✓	✓
A560 Gatley Road	-	-	549	16	16	581	555	47	19	621	40	7%	1.62	✓	✓	✓
A538 Wilmslow Road	South of Sunbank Lane	SEB	948	104	29	1080	944	101	50	1095	15	1%	0.46	✓	✓	✓
Sunbank Lane	South of M56	SEB	15	2	0	17	25	2	0	27	10	59%	2.15	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Hollyhedge Road	-	-	585	26	6	617	599	34	9	643	26	4%	1.03	✓	✓	✓
Simonsway	-	-	838	92	26	955	848	79	23	950	-5	-1%	0.17	✓	✓	✓
M56 Airport Spur EB	-	EB	2255	298	101	2654	2221	298	80	2599	-55	-2%	1.08	✓	✓	✓
Thorley Lane (N)	-	-	549	37	11	597	568	41	10	620	23	4%	0.93	✓	✓	✓
Avro Way (Between Runger Lane and Viscount Drive)	-	SB	446	49	14	509	446	72	15	533	24	5%	1.06	✓	✓	✓
Wilmslow Road (E)	-	SEB	1250	158	65	1473	979	132	57	1168	-305	-21%	8.40	×	×	×
Hollyhedge Road	-	-	964	37	18	1019	957	36	18	1010	-9	-1%	0.28	✓	✓	✓
Simonsway	-	-	563	62	17	642	543	50	11	604	-38	-6%	1.52	✓	✓	✓
M56 Airport Spur WB	-	WB	1609	213	72	1894	1596	212	61	1869	-25	-1%	0.58	✓	✓	✓
Thorley Lane (N)	-	-	552	38	9	599	569	39	7	615	16	3%	0.65	✓	✓	✓
Avro Way (Between Runger Lane and Viscount Drive)	-	NB	131	14	4	149	131	32	6	169	20	14%	1.60	✓	✓	✓
Wilmslow Road (E)	-	NWB	999	145	45	1189	907	147	45	1100	-89	-8%	2.65	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Hale Road	-	SEB	804	46	11	861	785	46	10	841	-20	-2%	0.68	✓	✓	✓
Shay Lane	-	-	138	3	1	142	140	3	1	144	2	1%	0.14	✓	✓	✓
Clay Lane (Between Whitecarr Lane and Canterbury Road)	-	NB	388	42	12	442	412	36	8	456	14	3%	0.68	✓	✓	✓
Clay Lane	-	-	548	15	3	566	484	14	3	500	-66	-12%	2.84	✓	✓	✓
A560 Altrincham Road	-	-	942	54	74	1070	914	60	77	1051	-19	-2%	0.59	✓	✓	✓
Hale Road	-	NWB	683	122	30	835	682	124	27	832	-3	0%	0.09	✓	✓	✓
Shay Lane	-	-	93	6	0	99	90	6	1	97	-2	-2%	0.21	✓	✓	✓
Clay Lane (Between Whitecarr Lane and Canterbury Road)	-	SB	211	23	6	241	228	23	6	257	16	7%	1.03	✓	✓	✓
Clay Lane	-	-	821	23	6	850	791	23	2	816	-34	-4%	1.18	✓	✓	✓
A560 Altrincham Road	-	-	777	57	40	874	811	58	28	897	23	3%	0.79	✓	✓	✓
Shay Lane	North of A538 Hale Road	NB	245	12	4	261	246	12	1	259	-2	-1%	0.12	✓	✓	✓
M56	Between J5 and J6	NB	4554	602	205	5361	4521	587	251	5359	-2	0%	0.03	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Runger Lane	North of A538 Wilmslow Road	NB	842	112	42	996	743	81	28	852	-144	-14%	4.75	✓	✓	✓
Sydney Avenue (Between Thorley Lane and Melbourne Avenue)	-	SB	181	20	6	206	345	16	1	361	155	75%	9.19	×	×	×
World Way (Between M56 Junction and Chicago Avenue)	-	SB	558	61	17	636	560	62	15	637	1	0%	0.05	✓	✓	✓
Outwood Lane (Between M56 Roundabout and Terminal Road North)	-	SB	876	96	27	999	868	94	24	986	-13	-1%	0.40	✓	✓	✓
Ringway Road (South of the Railway line and junction with Ringway Road West)	-	SB	304	33	9	347	303	1	0	304	-43	-12%	2.38	✓	✓	✓
Sydney Avenue	-	NB	163	18	5	186	163	18	4	185	-1	0%	0.04	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
(Between Thorley Lane and Melbourne Avenue)																
World Way (Between M56 Junction and Chicago Avenue)	-	NB	392	43	12	447	411	43	9	463	16	4%	0.74	✓	✓	✓
Outwood Lane (Between M56 Roundabout and Terminal Road North)	-	NB	802	88	24	915	805	88	22	915	0	0%	0.00	✓	✓	✓
Ringway Road (South of the Railway line and junction with Ringway Road West)	-	NB	191	21	6	217	187	0	1	188	-29	-13%	2.04	✓	✓	✓
(West) Sunbank Lane	-	EB	29	11	6	46	49	30	6	85	39	85%	4.81	✓	✓	✓
(West) Sunbank Lane	-	WB	37	26	5	68	40	33	7	80	12	17%	1.35	✓	✓	✓

Table 50: AP2 GMSM – airport area - individual and supplementary link flow detailed results – post – PM peak hour

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Thorley Lane	East of Roaring Gate Lane	NWB	368	31	1	400	364	31	2	396	-4	-1%	0.19	✓	✓	✓
Thorley Lane	East of Roaring Gate Lane	SEB	339	18	1	358	378	23	2	404	46	13%	2.33	✓	✓	✓
Hale Road (E)	-	-	732	41	4	777	721	41	3	764	-13	-2%	0.46	✓	✓	✓
Hale Road (W)	-	-	579	39	5	623	578	34	2	614	-9	-2%	0.38	✓	✓	✓
Roaring Gate Lane	-	-	281	17	0	298	335	21	1	357	59	20%	3.26	✓	✓	✓
Runger Lane	-	-	694	68	5	767	526	34	7	568	-199	-26%	7.72	×	×	×
Hale Road (E)	-	-	672	44	6	722	656	33	1	690	-32	-4%	1.19	✓	✓	✓
Hale Road (W)	-	-	688	34	3	725	690	32	3	726	1	0%	0.02	✓	✓	✓
Roaring Gate Lane	-	-	267	27	0	294	269	30	1	300	6	2%	0.37	✓	✓	✓
Runger Lane	-	-	539	45	14	598	463	23	3	489	-109	-18%	4.66	✓	×	✓
M56	-	-	1080	79	23	1182	1093	79	21	1193	11	1%	0.32	✓	✓	✓
Wilmslow Road (W)	-	-	1264	96	21	1381	1017	92	23	1131	-250	-18%	7.04	×	×	×
M56	-	-	681	55	20	756	673	55	26	753	-3	0%	0.10	✓	✓	✓
Wilmslow Road (W)	-	-	1230	59	12	1301	1231	59	11	1301	0	0%	0.01	✓	✓	✓
Hotel Access	-	-	158	2	0	160	160	2	0	162	2	1%	0.15	✓	✓	✓
M56	-	-	771	80	21	872	764	75	21	859	-13	-1%	0.43	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Hotel Access	-	-	83	2	0	85	83	1	0	84	-1	-1%	0.11	✓	✓	✓
M56	-	-	814	60	10	884	827	60	9	896	12	1%	0.41	✓	✓	✓
M56 J5 SB off-slip	-	-	979	74	17	1070	980	81	23	1084	14	1%	0.44	✓	✓	✓
M56 J5 SB on-slip	-	-	1180	89	21	1289	1192	95	18	1304	15	1%	0.42	✓	✓	✓
M56 J5 NB on-slip	-	-	1183	89	21	1293	1187	89	20	1296	3	0%	0.10	✓	✓	✓
M56 J4 NB on-slip	-	-	634	48	11	693	642	80	93	816	123	18%	4.48	✓	×	✓
M56 J4 to J5 SB	-	-	5439	408	95	5943	5437	420	104	5960	17	0%	0.22	✓	✓	✓
M56 J4 to J5 NB	-	-	4077	306	71	4454	4132	308	114	4554	99	2%	1.48	✓	✓	✓
M56 J4 SB off-slip	-	-	742	56	13	811	736	227	26	989	178	22%	5.93	×	×	×
M56 J5 mainline - mid junction SB	-	-	4482	337	78	4897	4456	339	81	4876	-21	0%	0.30	✓	✓	✓
M56 J5 mainline - mid junction NB	-	-	2874	216	50	3140	2944	218	95	3257	117	4%	2.07	✓	✓	✓
M56 J6 to J7 EB	-	-	3529	265	62	3855	3560	282	114	3956	100	3%	1.60	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
M56 J6 to J7 WB	-	-	5253	394	92	5739	5228	409	103	5740	1	0%	0.01	✓	✓	✓
M56 J6 mainline - mid junction NEB	-	-	2772	208	48	3028	2796	208	92	3096	68	2%	1.23	✓	✓	✓
M56 J6 mainline - mid junction SWB	-	-	4541	341	79	4961	4555	354	78	4987	26	1%	0.37	✓	✓	✓
Ringway Road West (Between Terminal 1 and 3 Roundabout and Aviator Way)	-	EB	678	44	8	730	666	41	7	713	-16	-2%	0.61	✓	✓	✓
Ringway Road West (Between Terminal 1 and 3 Roundabout and Aviator Way)	-	WB	1025	67	11	1104	1021	68	16	1104	0	0%	0.01	✓	✓	✓
Tuffley Road (Between Firbank Road	-	EB	546	36	6	588	654	42	14	710	122	21%	4.78	✓	×	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
and Wrekin Avenue)																
Tuffley Road (Between Firbank Road and Wrekin Avenue)	-	WB	334	22	4	359	62	16	0	78	-281	-78%	19.01	×	×	×
Thornley Lane (Between Outwood Lane West and Bailey Lane)	-	NB	1250	82	14	1346	884	51	12	947	-399	-30%	11.79	×	×	×
Thornley Lane (Between Outwood Lane West and Bailey Lane)	-	SB	857	56	10	922	863	61	8	932	10	1%	0.32	✓	✓	✓
Bailey Lane (Between Thornley Lane and Hilary Road)	-	NB	621	41	7	668	578	40	6	625	-43	-7%	1.71	✓	✓	✓
Bailey Lane (Between Thornley Lane and Hilary Road)	-	SB	352	23	4	379	354	54	4	412	33	9%	1.66	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Terminal 2 Roundabout (Top of Airport Spur Off Slip)	-	EB	1045	68	12	1125	959	68	17	1043	-81	-7%	2.47	✓	✓	✓
Terminal 2 Roundabout (Top of Airport Spur Off Slip)	-	WB	1032	67	11	1111	787	69	7	864	-248	-22%	7.88	×	×	×
B5166 Styal Road	-	-	531	35	6	571	517	35	7	559	-12	-2%	0.49	✓	✓	✓
Finney Lane	-	-	907	14	12	933	912	14	12	938	5	1%	0.16	✓	✓	✓
A560 Gatley Road	-	-	560	8	24	592	560	9	24	593	1	0%	0.06	✓	✓	✓
A538 Wilmslow Road	South of Sunbank Lane	NWB	892	58	10	960	894	69	15	978	18	2%	0.58	✓	✓	✓
Sunbank Lane	South of M56	NWB	8	1	0	9	1	0	0	1	-8	-87%	3.43	✓	✓	✓
B5166 Styal Road	-	-	677	44	8	729	665	37	5	707	-22	-3%	0.81	✓	✓	✓
Finney Lane	-	-	898	10	21	929	590	10	8	608	-321	-35%	11.59	×	×	×
A560 Gatley Road	-	-	637	17	14	668	647	33	13	693	25	4%	0.96	✓	✓	✓
A538 Wilmslow Road	South of Sunbank Lane	SEB	1026	67	11	1104	1175	80	21	1277	172	16%	4.99	✓	×	✓
Sunbank Lane	South of M56	SEB	8	1	0	8	8	1	0	9	1	9%	0.26	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Hollyhedge Road	-	-	821	23	11	855	781	22	11	813	-42	-5%	1.44	✓	✓	✓
Simonsway	-	-	868	57	10	934	906	58	15	979	45	5%	1.45	✓	✓	✓
M56 Airport Spur EB	-	EB	1739	131	30	1900	1660	130	29	1819	-81	-4%	1.87	✓	✓	✓
Thorley Lane (N)	-	-	743	53	6	802	724	36	8	767	-35	-4%	1.24	✓	✓	✓
Avro Way (Between Runger Lane and Viscount Drive)	-	SB	119	8	1	128	255	44	9	308	180	140%	12.16	×	×	×
Wilmslow Road (E)	-	SEB	1422	122	27	1571	1283	118	26	1428	-143	-9%	3.69	✓	✓	✓
Hollyhedge Road	-	-	607	26	6	639	615	25	6	646	7	1%	0.27	✓	✓	✓
Simonsway	-	-	752	49	8	810	761	49	23	832	22	3%	0.78	✓	✓	✓
M56 Airport Spur WB	-	WB	2363	177	42	2582	2379	184	38	2601	19	1%	0.37	✓	✓	✓
Thorley Lane (N)	-	-	604	43	15	662	646	31	4	682	20	3%	0.76	✓	✓	✓
Avro Way (Between Runger Lane and Viscount Drive)	-	NB	407	27	5	438	407	27	7	441	3	1%	0.15	✓	✓	✓
Wilmslow Road (E)	-	NWB	1025	90	23	1138	1014	89	25	1128	-10	-1%	0.29	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Hale Road	-	SEB	565	43	6	614	578	45	4	628	14	2%	0.56	✓	✓	✓
Shay Lane	-	-	68	3	1	72	65	4	1	70	-2	-2%	0.19	✓	✓	✓
Clay Lane (Between Whitecarr Lane and Canterbury Road)	-	NB	276	18	3	297	313	19	3	336	39	13%	2.19	✓	✓	✓
Clay Lane	-	-	737	17	1	755	483	16	1	500	-255	-34%	10.18	×	×	×
A560 Altrincham Road	-	-	853	42	38	933	857	42	38	937	4	0%	0.12	✓	✓	✓
Hale Road	-	NWB	805	27	6	838	807	27	4	838	0	0%	0.01	✓	✓	✓
Shay Lane	-	-	122	4	1	127	117	2	1	120	-7	-6%	0.64	✓	✓	✓
Clay Lane (Between Whitecarr Lane and Canterbury Road)	-	SB	296	19	3	318	296	19	3	318	0	0%	0.02	✓	✓	✓
Clay Lane	-	-	474	16	2	492	486	19	2	508	16	3%	0.71	✓	✓	✓
A560 Altrincham Road	-	-	1187	29	64	1280	1182	29	15	1226	-54	-4%	1.52	✓	✓	✓
Shay Lane	North of A538 Hale Road	NB	184	15	1	200	180	13	1	193	-7	-3%	0.47	✓	✓	✓
M56	Between J5 and J6	NB	3572	268	62	3903	3624	268	101	3993	90	2%	1.43	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Runger Lane	North of A538 Wilmslow Road	NB	748	77	21	846	633	77	16	726	-120	-14%	4.27	✓	✓	✓
Sydney Avenue (Between Thorley Lane and Melbourne Avenue)	-	SB	233	13	1	247	228	3	1	231	-16	-6%	1.01	✓	✓	✓
World Way (Between M56 Junction and Chicago Avenue)	-	SB	5695	428	100	6222	5648	433	99	6180	-42	-1%	0.53	✓	✓	✓
Outwood Lane (Between M56 Roundabout and Terminal Road North)	-	SB	712	48	13	773	698	48	10	756	-17	-2%	0.62	✓	✓	✓
Ringway Road (South of the Railway line and junction with Ringway Road West)	-	SB	124	8	1	134	272	8	1	280	146	109%	10.17	×	×	×
Sydney Avenue	-	NB	394	26	4	424	395	26	4	425	1	0%	0.03	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
(Between Thorley Lane and Melbourne Avenue)																
World Way (Between M56 Junction and Chicago Avenue)	-	NB	715	47	8	770	727	43	8	777	7	1%	0.26	✓	✓	✓
Outwood Lane (Between M56 Roundabout and Terminal Road North)	-	NB	339	22	4	365	310	11	0	321	-44	-12%	2.37	✓	✓	✓
Ringway Road (South of the Railway line and junction with Ringway Road West)	-	NB	142	9	2	153	142	9	2	153	0	0%	0.03	✓	✓	✓
(West) Sunbank Lane	-	EB	461	30	5	496	500	30	1	531	35	7%	1.55	✓	✓	✓
(West) Sunbank Lane	-	WB	1033	67	11	1112	1009	54	14	1077	-34	-3%	1.04	✓	✓	✓

Individual route journey time performance

Table 51: AP2 GMSM Model - individual route journey time detailed results – post – AM peak hour

Route name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
M602/Mancunian Wy	EB	10,966	1764	1536	-227	-12.9%	✓	
M602/Mancunian Wy	WB	10,979	1409	1403	-7	-0.5%	✓	
A635 Aston Old Rd	EB	7,933	1234	1362	128	10.4%	✓	
A635 Aston Old Rd	WB	7,817	1679	1389	-290	-17.3%	×	Unable to reflect delays between A662 and Audenshaw Road
A34 Kingsway	NB	8,812	1493	1156	-337	-22.6%	×	Unable to reflect slow speeds along A34 north of A6010
A34 Kingsway	SB	8,712	1332	1353	21	1.6%	✓	
A5130 Princess Rd	NB	8,033	1498	878	-620	-41.4%	×	Unable to reflect slow speeds in the first half of the route
A5130 Princess Rd	SB	8,044	897	835	-62	-6.9%	✓	
M56	NB	12,001	921	844	-77	-8.3%	✓	
M56	SB	11,781	503	572	69	13.8%	✓	
A555 Airport Relief Road	EB	3,707	458	404	-54	-11.8%	✓	
A555 Airport Relief Road	WB	3,690	355	407	51	14.5%	✓	
A6	NB	8,667	1705	1534	-171	-10.1%	✓	
A6	SB	8,667	1764	1597	-167	-9.5%	✓	
A57 Hyde Rd	EB	5,421	682	753	71	10.5%	✓	
A57 Hyde Rd	WB	5,453	1113	797	-316	-28.4%	×	Unable to reflect delays from beginning of route to Gorton area

Route name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
M60	WB	9,082	482	454	-28	-5.9%	✓	
M60	EB	8,974	484	495	11	2.3%	✓	
A538 Altrincham Rd	NB	10,375	1604	1193	-411	-25.6%	×	Unable to reflect slow speeds along Wilmslow Road through Manchester Airport
A538 Altrincham Rd	SB	10,413	1500	1352	-148	-9.9%	✓	
B5093 Wilmslow Rd	NB	6,404	1202	1129	-73	-6.1%	✓	
B5093 Wilmslow Rd	SB	6,404	1235	1076	-159	-12.9%	✓	

Table 52: AP2 GMSM Model - individual route journey time detailed results – post – PM peak hour

Route name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
M602/Mancunian Wy	EB	10,966	1618	1385	-234	-14.4%	✓	
M602/Mancunian Wy	WB	10,979	1849	1382	-467	-25.3%	×	Unable to reflect slow speeds along Mancunian Way section from Pin Mill Brow to Regent Road
A635 Aston Old Rd	EB	7,933	1697	1407	-290	-17.1%	×	Unable to reflect delays near Cornwall Street
A635 Aston Old Rd	WB	7,817	1106	1191	85	7.7%	✓	
A34 Kingsway	NB	8,812	1139	1091	-48	-4.2%	✓	
A34 Kingsway	SB	8,712	1563	1114	-449	-28.7%	×	Unable to reflect slow speeds along A34 north of A6010
A5130 Princess Rd	NB	8,033	883	897	14	1.6%	✓	
A5130 Princess Rd	SB	8,044	1288	856	-432	-33.6%	×	Unable to reflect slow speeds from beginning of route to A6010

Route name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
M56	NB	12,001	1382	563	-818	-59.2%	×	Unable to reflect very slow observed speeds starting from M56 Junction 6
M56	SB	11,781	693	657	-36	-5.2%	✓	
A555 Airport Relief Road	EB	3,707	528	526	-3	-0.5%	✓	
A555 Airport Relief Road	WB	3,690	492	446	-46	-9.3%	✓	
A6	NB	8,667	1402	1387	-15	-1.1%	✓	
A6	SB	8,667	2079	1315	-764	-36.8%	×	Unable to replicate the slower speeds along the majority of the route
A57 Hyde Rd	EB	5,421	1338	978	-360	-26.9%	×	Unable to reflect slow speeds between A6010 and Gorton
A57 Hyde Rd	WB	5,453	713	754	41	5.7%	✓	
M60	WB	9,082	408	412	4	1.0%	✓	
M60	EB	8,974	973	731	-242	-24.9%	×	Unable to replicate very slow observed speeds across majority of route
A538 Altrincham Rd	NB	10,375	1728	1045	-683	-39.5%	×	Unable to reflect slow speeds along Wilmslow Road through Manchester Airport
A538 Altrincham Rd	SB	10,413	1645	1329	-316	-19.2%	×	Unable to reflect delays along final section through Wilmslow
B5093 Wilmslow Rd	NB	6,404	1162	1007	-155	-13.3%	✓	
B5093 Wilmslow Rd	SB	6,404	1423	1009	-414	-29.1%	×	Unable to replicate slower observed speeds across majority of route

Annex D: Model performance report – M6 Junction 19 Model

Contents

Tables

Figures

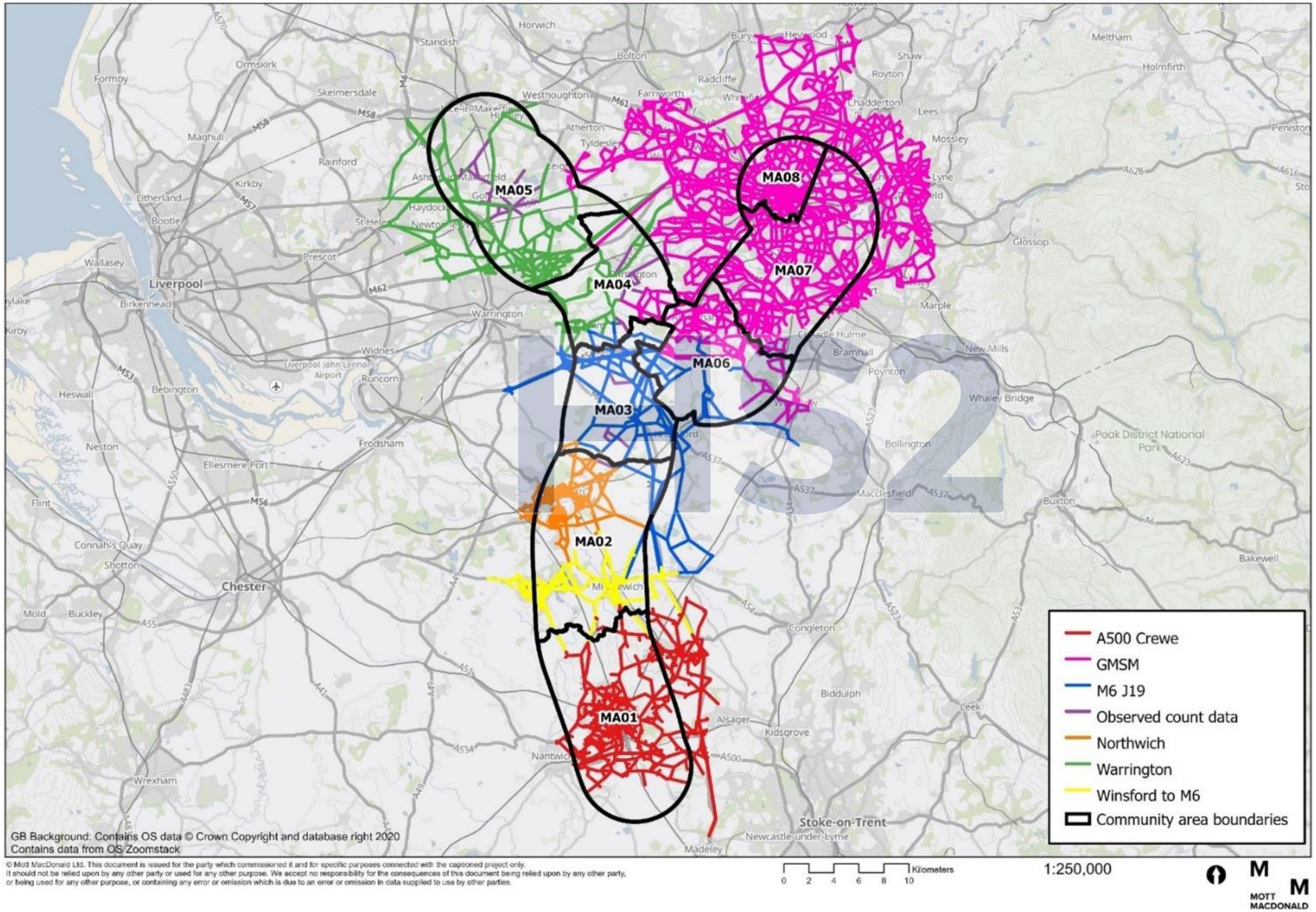
1 Introduction

1.1 Background

1.1.1 For the purpose of assessment, the route of the original scheme is split into a number of geographical areas referred to as Community Areas. The M6 Junction 19 Model has been utilised to provide an evidence base for the main Transport Assessment (TA) for the community areas referred to as Pickmere to Agden and Hulseheath (MA03) community area, and Hulseheath to Manchester Airport (MA06) community area. National Highways released copies of the latest available M6 Junction 19 Model versions (as of January 2017) to HS2 Ltd.

1.1.2 Reference should be made to Figure 1 which shows the geographic coverage of strategic transport models that have been utilised for the TA.

Figure 1: Strategic transport model coverage for the High Speed Rail (Crewe – Manchester) Transport Assessment



1.2 Hybrid Bill and Additional Provision 1 Environmental Statement

1.2.1 The M6 Junction 19 Model was updated by HS2 Ltd transport consultants, Mott MacDonald WSP Joint Venture (MWJV), to include localised improvements within the original scheme area of interest. This is described in the Model Performance Report for the M6 Junction 19 Model, in the main TA Part 4 Addendum (Volume 5, Appendix: TR-005-0000, Report 2 of 2).

1.2.2 Additional Provision (AP) amendments are changes to the scheme that include requirements for additional powers in the High Speed Rail (Crewe – Manchester) Bill. At Additional Provision 1 (AP1) further model development work was undertaken which is described in the AP1 Model Performance Report for the M6 Junction 19 Model, in the Supplementary Environmental Statement 1 (SES1) and AP1 ES TA Part 4 Addendum (SES1 and AP1 ES Volume 5, Appendix: TR-005-00000).

1.3 Additional Provision 2 Environmental Statement

1.3.1 Further model development has been undertaken by MWJV for the Additional Provision 2 (AP2) revised scheme. The Baseline model has been updated for the assessment to reflect the use of journey time data in the base model validation, and refinement of network coding to improve model performance.

1.4 Purpose of this report

1.4.1 This report documents the updates made for the AP2 revised scheme and model performance of the HS2 AP2 M6 Junction 19 Model.

1.5 Model framework

1.5.1 The M6 Junction 19 Model consists of the following:

- Variable Demand Model (DIADEM); and
- Strategic Highway Assignment Model (SATURN).

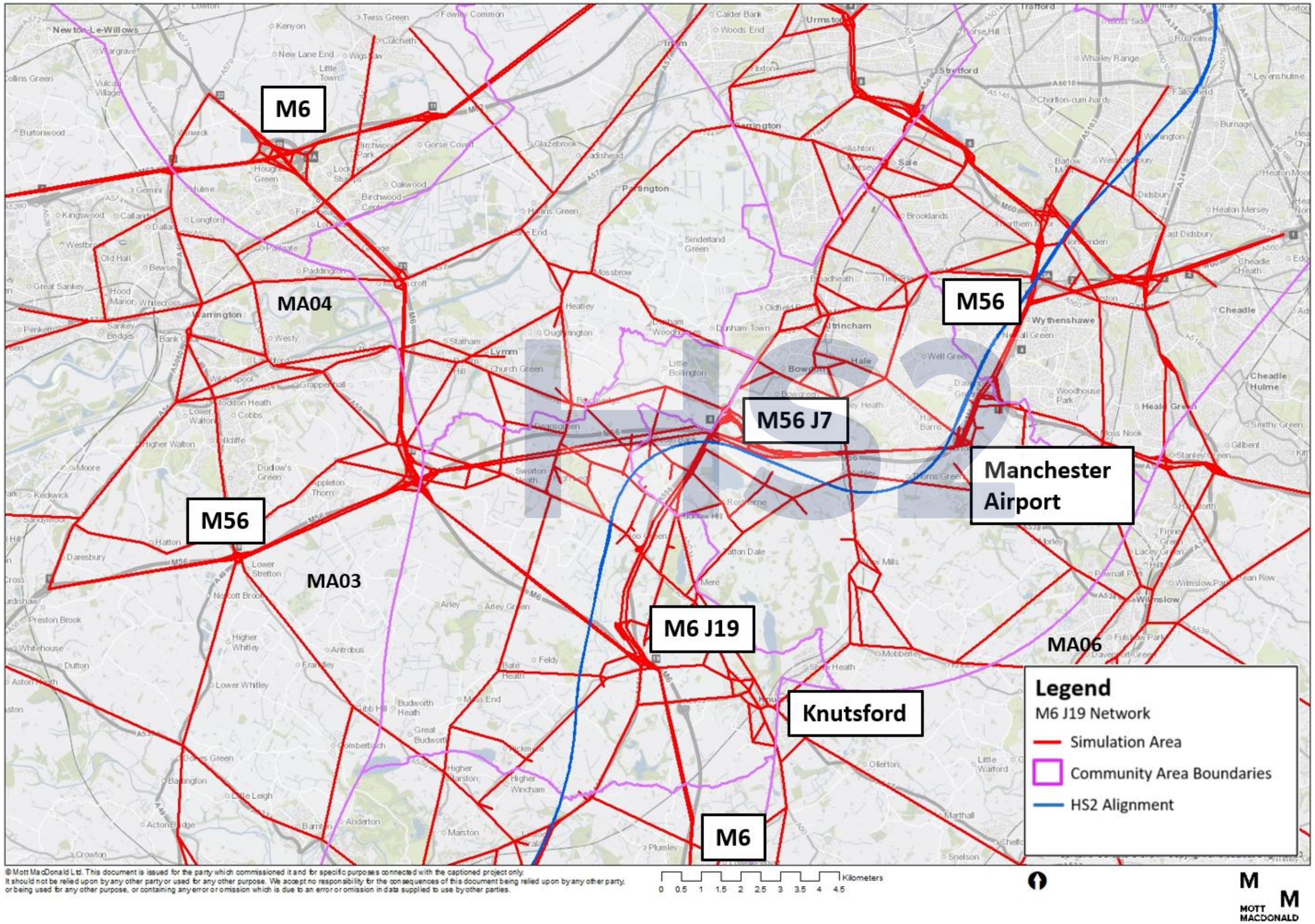
1.5.2 Only the strategic highway assignment model has been utilised by MWJV to provide an evidence base.

1.5.3 The M6 Junction 19 Model is a strategic highway assignment model that was developed within the SATURN model software platform (version 11.3.12).

1.5.4 The detailed modelled study area covers the M6/M56/A556 triangle and surrounding areas. There is supporting network and zone system detail to provide a representation of the external area supply and demand. Reference should be made to Figure 2.

1.5.5 The original M6 Junction 19 Model is representative of 2015 base year transport conditions.

Figure 2: Model study area



1.6 Model development

1.6.1 The M6 Junction 19 Model was developed by National Highways appointed transport consultants to provide an evidence base to support the business case for the M6 Junction 19 improvement scheme.

1.7 Model description

1.7.1 The original M6 Junction 19 Model has been developed with the following years:

- 2015 base year;
- 2021 first future year;
- 2036 second future year; and
- 2051 horizon future year.

1.7.2 The model is representative of the following time periods:

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

1.7.3 The model is comprised of the following demand user-classes:

- car commute;
- car employers business;
- car other;
- light goods vehicles; and
- other goods vehicles.

1.8 Model application objectives

1.8.1 For the assessment of the AP2 revised scheme, the M6 Junction 19 Model provides:

- preliminary traffic data to inform scheme design;
- changes in traffic flows, congestion, and journey times to inform the TA for the AP2 revised scheme;
- traffic data for the construction and operational phases of the AP2 revised scheme on which to base the assessment of significant effects for the Environmental Statement (ES); and
- changes in traffic flows between the base year and forecast scenarios for application to local models.

2 Guidance used

2.1 Introduction

2.1.1 This strategic highway model development makes reference to the following Transport Analysis Guidance (TAG) as published by the Department for Transport (DfT): TAG Unit M3.1 Highway Assignment Modelling (May 2020).

2.2 Highway model guidance

2.2.1 In relation to providing an assessment of model calibration and validation performance, reference has been made to Section 3.2 of TAG Unit M3.1 (Table 1, Table 2, and Table 3).

2.2.2 The criteria for the assessment of model calibration and validation of traffic flows and journey time performance are presented in Table 1, below.

Table 1: DfT - TAG validation criteria

Criteria	Acceptability guideline
Assigned hourly flows	
Individual flows within +/-15% for flows 700-2,700 vph	>85% of cases
Individual flows within +/-100 vph for flows <700 vph	>85% of cases
Individual flows within +/-400 vph for flows >2,700 vph	>85% of cases
Screenline flows (normally >5 links) to be within 5%	All or nearly all screenlines
Geoffrey Havers (GEH) statistic	
Individual flows GEH <5	>85% of cases
Journey times	
Modelled journey times within 15% (or 1 minute if higher)	>85% of cases

Credit. Table 1, Table 2, Table 3, DfT TAG Unit M3.1 Highway Assignment Modelling (May 2020)

2.2.3 The criteria for the assessment of highway model assignment convergence is presented in Table 2, below.

Table 2: Summary of convergence measures and base model acceptable values

Measures of convergence	Acceptability guideline
Delta and %GAP	Less than 0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with flow change (P) <1%	Four consecutive iterations greater than 98%
Percentage of links with cost change (P2) <1%	Four consecutive iterations greater than 98%
Percentage change in total user costs of links with flow change (V) <1%	Four consecutive iterations less than 0.1% (SUE only)

Credit. Table 4, DfT TAG Unit M3.1 Highway Assignment Modelling (May 2020)

3 Data for model development

3.1 Overview

3.1.1 This section of the report presents details of traffic data that has been used for the purpose of updating the M6 Junction 19 Model study area.

3.1.2 The same MWJV commissioned programme of traffic counts collected in 2017/2018 was used for the main ES, SES1 and AP1 ES and the SES2 and AP2 ES for model calibration, but with the opportunity taken to also use some additional counts for the SES1 and AP1 ES and the SES2 and AP2 ES. These additional counts were sourced from the National Highways programme of traffic surveys in 2020 (prior to COVID-19) and WebTRIS data. The traffic count data is described in the following section.

3.1.3 The journey time data has been used to inform the assessment of the AP2 revised scheme only and was not available to use for the original scheme or AP1 revised scheme. The journey time data is described in Section 3.3. For the main ES and SES1 and AP1 ES the focus for model development was to improve localised traffic flow performance.

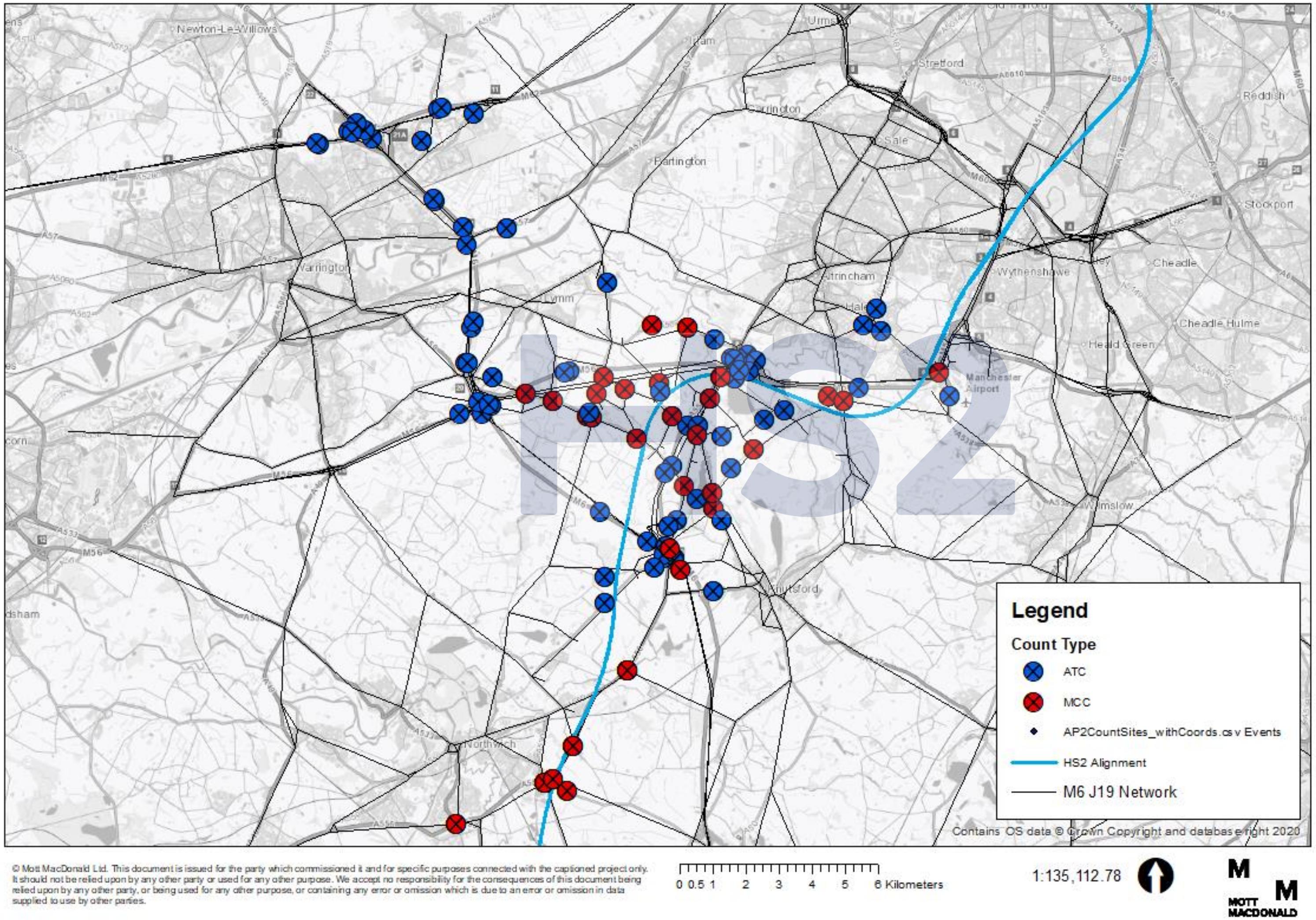
3.2 Traffic survey data commission

3.2.1 MWJV commissioned a programme of traffic count surveys in 2017/2018 to support the assessment of the original scheme. This was also supported by further traffic surveys in 2020 that were completed prior to the on-set of COVID-19 restrictions.

3.2.2 Traffic count data has also been sourced from the National Highways programme of traffic surveys in 2020 (prior to COVID-19) and WebTRIS data for motorway and trunk road links within the local study area.

3.2.3 Traffic count surveys have been used from different years and months to update the base year model. The traffic counts have been factored to June 2018 to develop a consistent dataset. Figure 3 shows the location of traffic counts.

Figure 3: Location of traffic counts (MWJV Survey Commission)

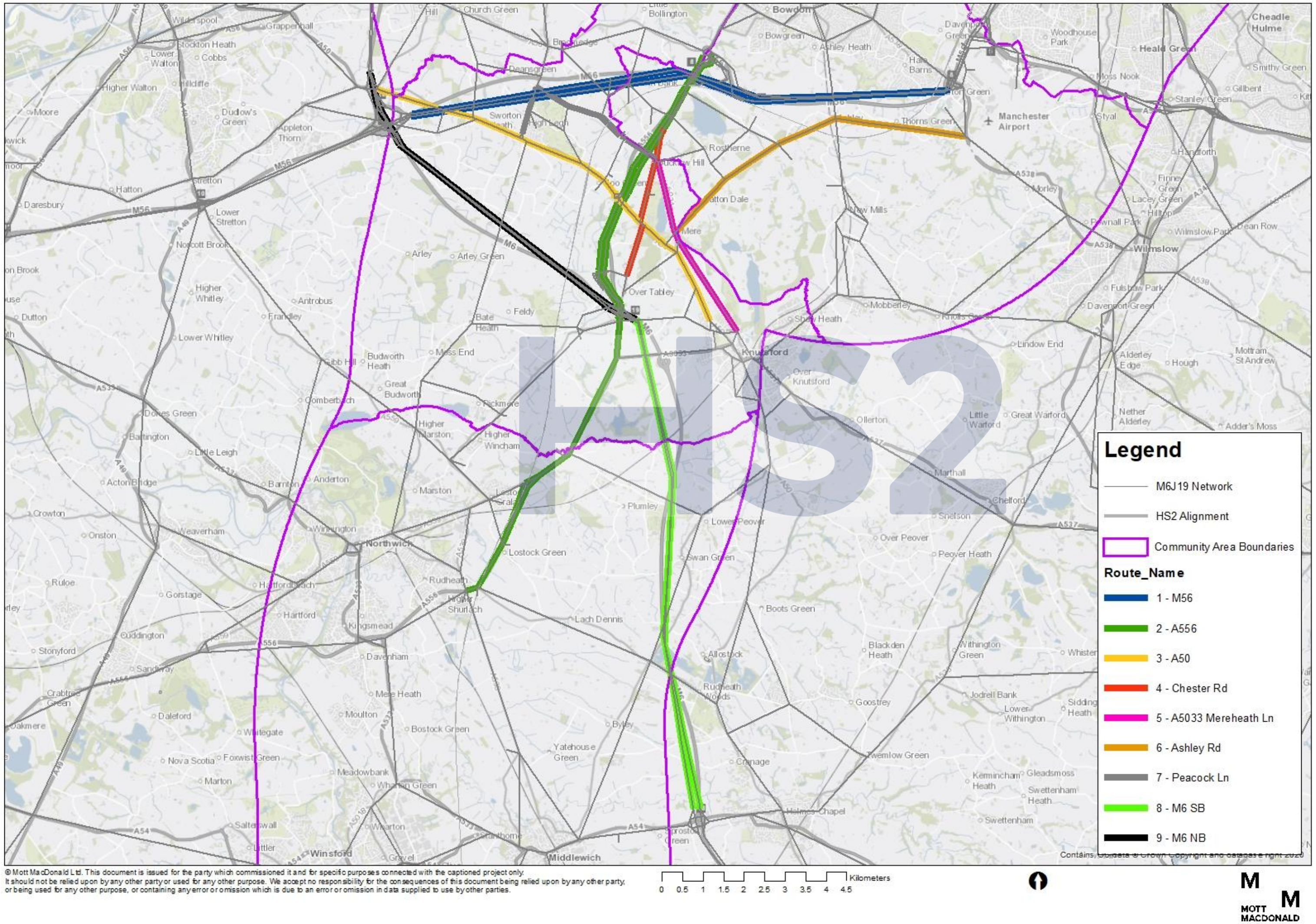


3.3 Journey time data

3.3.1 HS2 requested Trafficmaster journey time data representing June 2018 on behalf of MWJV from the DfT. This was processed by HS2 for the journey time routes selected to update the Base model validation.

3.3.2 Journey time routes were defined as key routes across the model area of interest. Figure 4 shows the journey time routes chosen.

Figure 4: Location of journey time routes



4 Model development

4.1 Overview

4.1.1 For the main ES, the SES1 and AP1 ES and the SES2 and AP2 ES, the 2015 base year model was updated to a 2018 (June) base year model by MWJV using local growth factors and traffic count survey data that was collected between November 2017 and March 2020 (prior to COVID-19). Traffic count data has been normalised to June 2018 traffic conditions using local count data.

4.1.2 For the SES1 and AP1 ES, a review of base year model traffic flows identified that there was scope to undertake some localised improvements to the traffic model in order to provide a more robust assessment in the AP1 revised scheme area of interest. For the SES2 and AP2 ES, further localised improvements were made following review of model journey time data.

4.1.3 A widened area of interest has been applied for the SES2 and AP2 ES by extending the model from north of M6 J20 up to M6 J21a, with additional counts used to support model performance in this area. This was to support assessment of impacts, particularly for air quality in this wider area.

4.1.4 The model time periods represent the following peak hours, when the highest traffic volumes and most significant impacts are expected to occur:

- AM peak hour - 08:00–9:00; and
- PM peak hour - 17:00–18:00.

4.1.5 The model time periods were converted from an average hour to a peak hour by using local traffic data.

4.2 Transport supply

4.2.1 The original M6 Junction 19 Model future year networks supplied by National Highways include the new A556 Knutsford to Bowdon Improvement Scheme which was opened to traffic in March 2017. This scheme is included in the main ES, SES1 and AP1 ES and SES2 and AP2 ES baseline models, which are based upon the year 2018.

4.2.2 For the main ES, a review of highway network detail and attributes was undertaken for the model area that is included in the MA03 to MA06 community areas.

4.2.3 The following network attributes have been reviewed and checked:

- links: distance, speeds, capacity, bus lanes, traffic regulation orders;
- junctions: type, turn saturation flows, capacity, and lane utilisation;
- traffic signal control: timings, phasing, and staging; and
- routes: minimum cost paths.

4.2.4 The review highlighted that there is a good level of detailed highway network representation within the study areas, and that this compared well with local datasets.

4.2.5 Network coding changes were implemented for the SES1 and AP1 ES to improve model representation. These included:

- some capacity refinements at locations along the M6, M56 and A556;
- improved junction representation for Chester Road/Mereside Road/Chapel Lane and A50/Chester Road junction; and
- more accurate network free flow speeds for Wrenshot Lane and Pickmere Lane.

4.2.6 For the SES2 and AP2 ES, further network refinements have been made to improve model journey times. These involved changes to network free flow speeds and capacities at some locations.

4.2.7 The generalised cost values (pence per minute (PPM)/pence per kilometre (PPK)) for model assignment were updated for the SES1 and AP1 ES to reflect the latest values from the DfT TAG databook (version: July 2020). This has been retained for the SES2 and AP2 ES.

4.2.8 In summary, the model includes a sufficiently detailed level of network infrastructure to support TA.

4.3 Transport demand

4.3.1 The original M6 Junction 19 Model includes a detailed representation of spatial demand. The model zone system contains 275 model zones and accounts for future land-use development zones.

4.3.2 For the SES1 and AP1 ES, adjacent to the A556, two zones were disaggregated into four zones to better represent traffic flow distribution on the minor rural roads in Moston, Bucklow Hill, Mere and Rostherne areas. These have been retained for the SES2 and AP2 ES.

4.3.3 For the main ES, the demand matrices were adjusted from 2015 to 2018 by carrying out an interpolation between base and 2021 future year matrices. For the main ES, SES1 and AP1 ES and SES2 and AP2 ES this interpolated 2018 matrix has then been subject to matrix estimation using the available 2018 count data; and a localised traffic flow calibration exercise has been carried out to improve the correlation between observed and modelled traffic flows within the local areas of interest.

4.3.4 The count data has been applied in matrix estimation in the same way for the main ES, SES1 and AP1 ES and SES2 and AP2 ES, but with the additional WebTRIS and ATC data in the extended area of interest also included at AP2.

5 Model performance

5.1 Overview

5.1.1 This section of the report focusses on the performance of the 2018 AP2 base model as produced by MWJV against observed traffic flow data.

5.1.2 The prior trip matrix assignment is the model assignment before matrix estimation is applied. This uses an interpolated parent model matrix adjusted to the HS2 zone system with an updated network that corresponds to HS2 base year. The updated network also includes revisions identified following a network review.

5.1.3 Matrix estimation uses the prior matrix and updated network mentioned above and creates an updated matrix to match count data. The post trip matrix assignment is the model assignment using this updated matrix and the same updated network used in prior assignments.

5.1.4 It is the post matrix assignment that is taken forward and used in the SES2 and AP2 ES TA.

5.2 Traffic flow

5.2.1 Observed and modelled traffic flows have been compared for the count site locations within the scheme area of interest (MA03 and MA06 community area). In total, 197 individual link counts by direction have been compared.

5.2.2 Table 3 and Table 4 present a summary comparison of individual link flows for all vehicles and by the car vehicle type for the prior matrix assignment. The comparison shows that both time periods fall below the DfT TAG individual link count criteria of greater than 85% of comparisons achieving the flow or GEH criteria.

Table 3: AP2 M6 Junction 19 Model - individual link flow - total all vehicle - prior

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	197	117	59%	86	44%	119	60%
PM peak hour	197	103	52%	79	40%	104	53%

Table 4: AP2 M6 Junction 19 Model - individual link flow - car vehicle type – prior

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	197	113	57%	87	44%	115	58%
PM peak hour	197	105	53%	79	40%	109	55%

5.2.3 Figure 5 and Figure 6 show the locations of the link counts and the respective AM and PM peak hour model performance for the prior matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

5.2.4 Table 5 and Table 6 present a summary comparison of individual link flows for all vehicles and by the car vehicle type for the post matrix estimation assignment. The comparison shows that both time periods meet the DfT TAG individual link count criteria of greater than 85% of comparisons achieving flow or GEH criteria.

5.2.5 The results show a similar level of performance compared to the main ES and SES1 and AP1 ES. These AP2 results include the additional counts in the extended area of interest.

Table 5: AP2 M6 Junction 19 Model - individual link flow - total all vehicle – post

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	197	171	87%	157	80%	171	87%
PM peak hour	197	170	86%	161	82%	170	86%

Table 6: AP2 M6 Junction 19 Model - individual link flow - car vehicle type - post

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	197	172	87%	159	81%	172	87%
PM peak hour	197	173	88%	163	83%	173	88%

5.2.6 Figure 7 and Figure 8 show the locations of the link counts and the respective AM and PM peak hour model performance for the post matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

5.2.7 Reference should be made to Table 13 and Table 14 which presents supporting details of the individual link flow performance for AM and PM time periods, post matrix estimation.

Figure 5: AM peak hour - traffic flow performance - prior

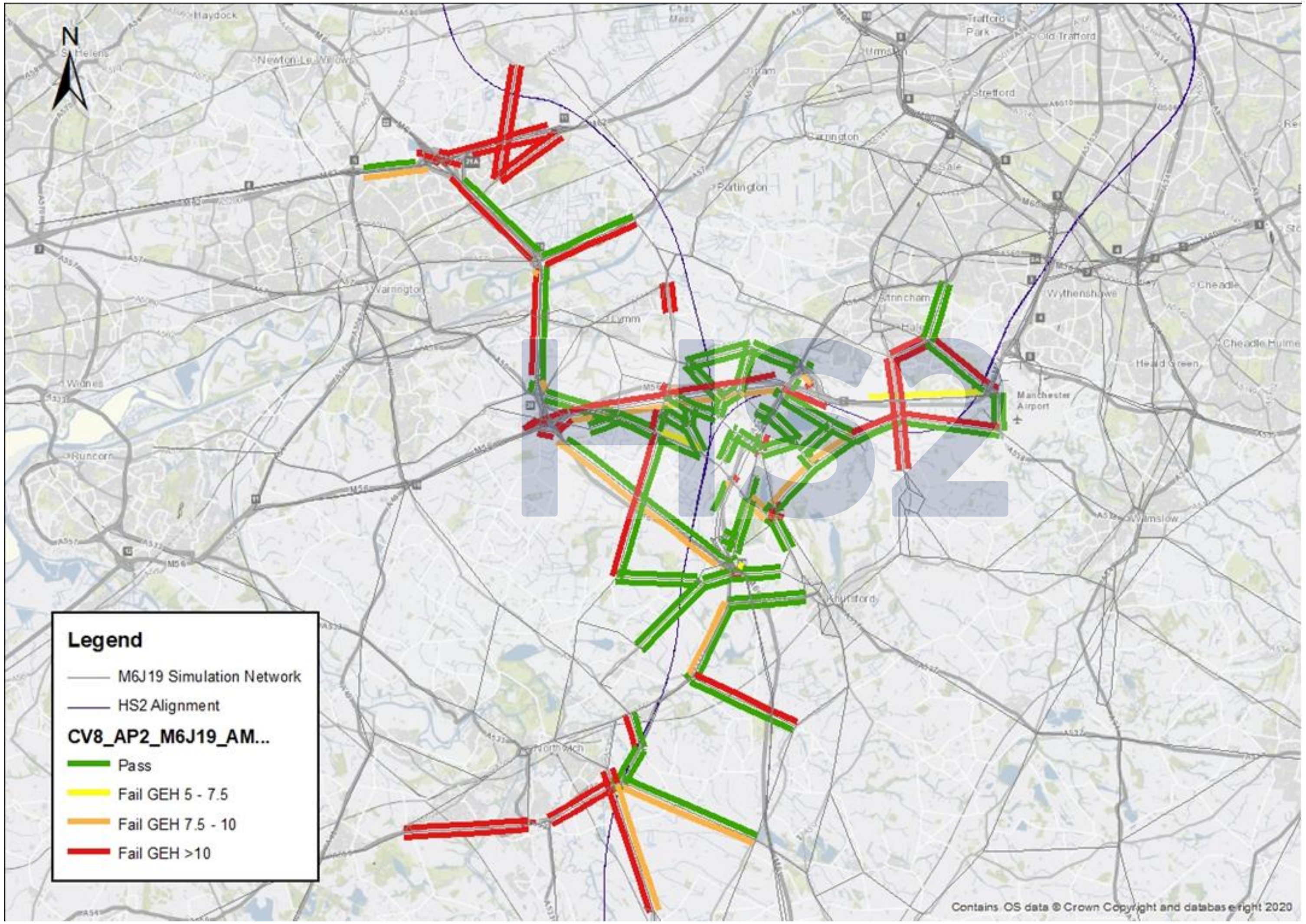


Figure 6: PM peak hour - traffic flow performance - prior

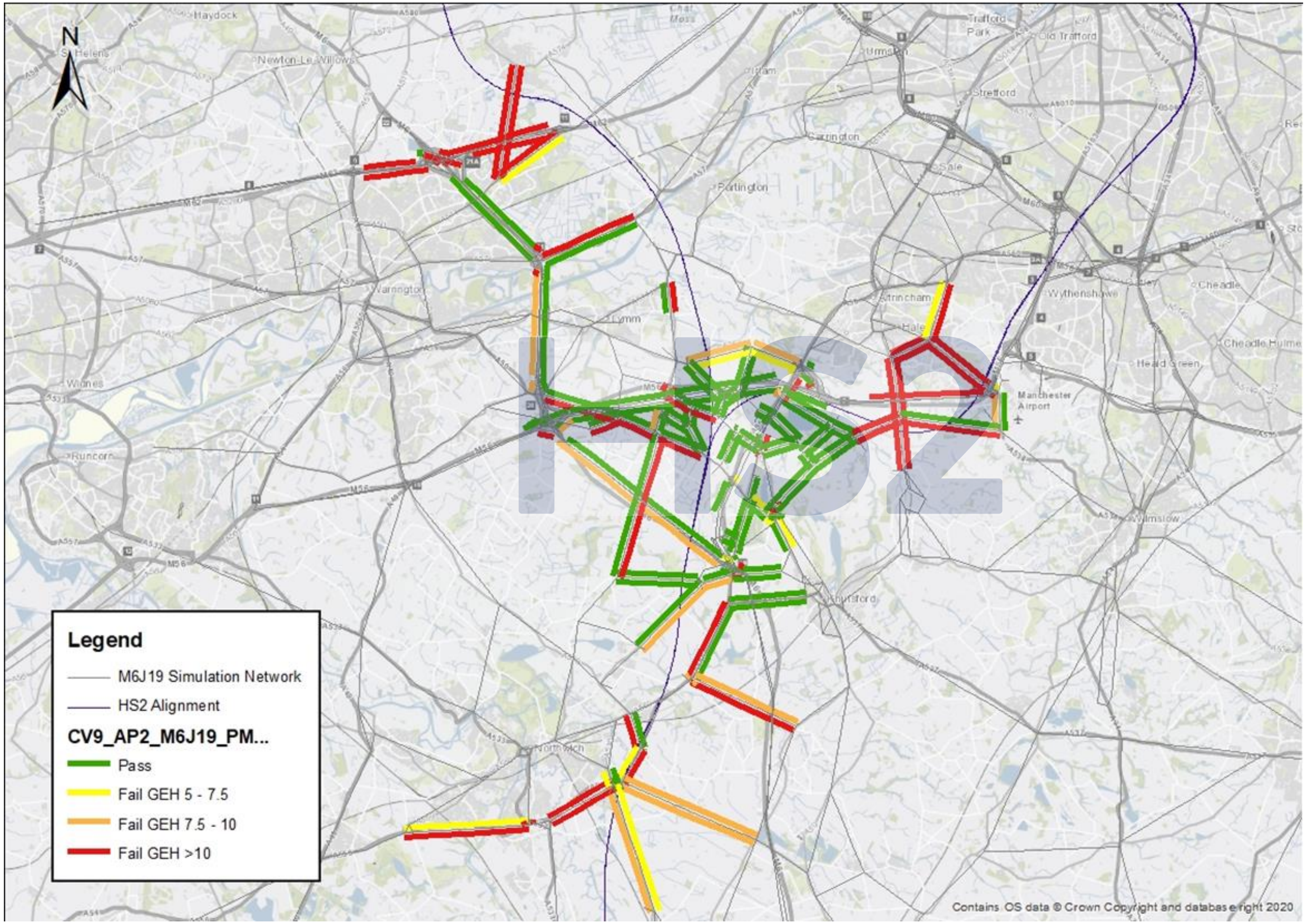


Figure 7: AM peak hour - traffic flow performance - post

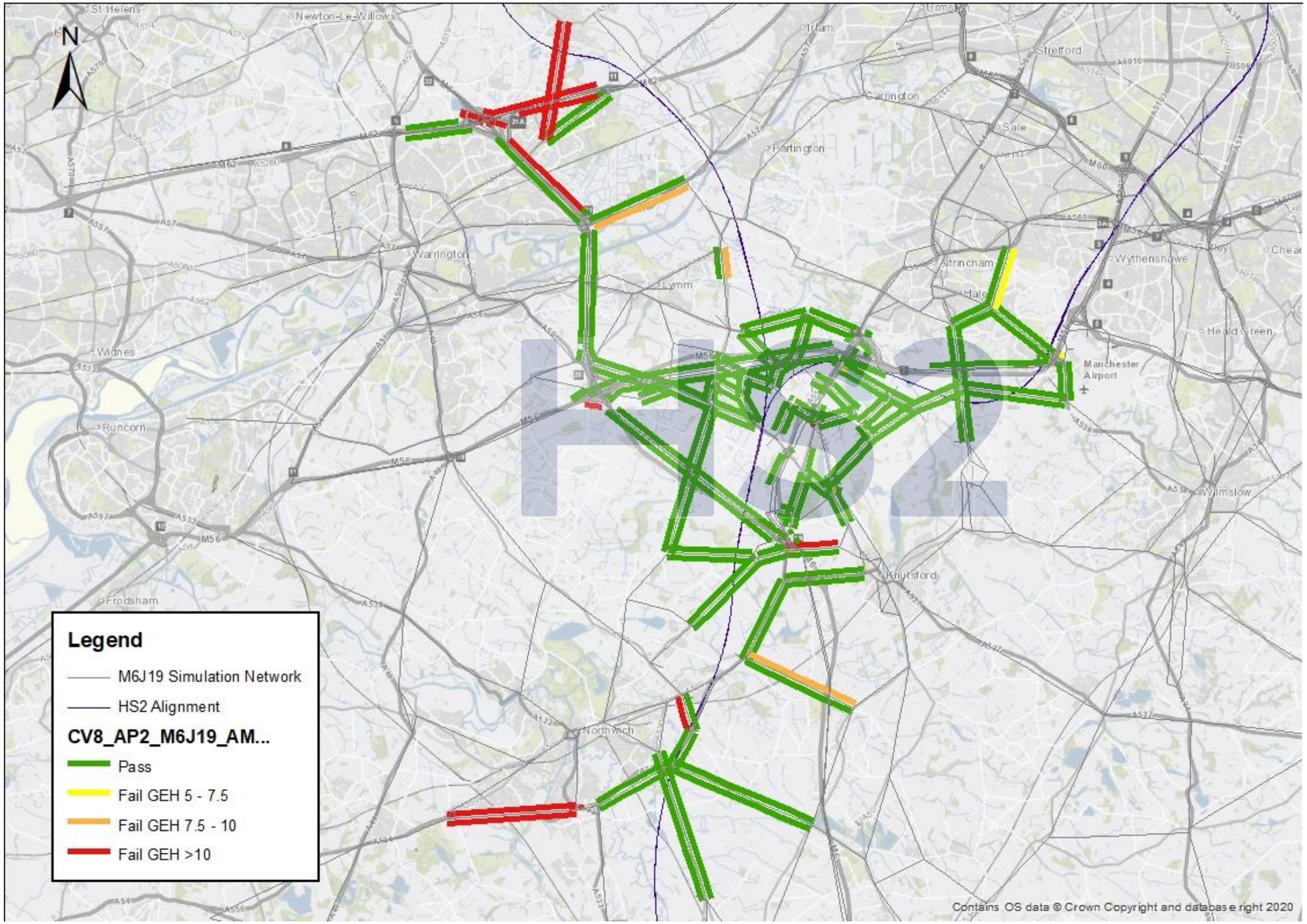
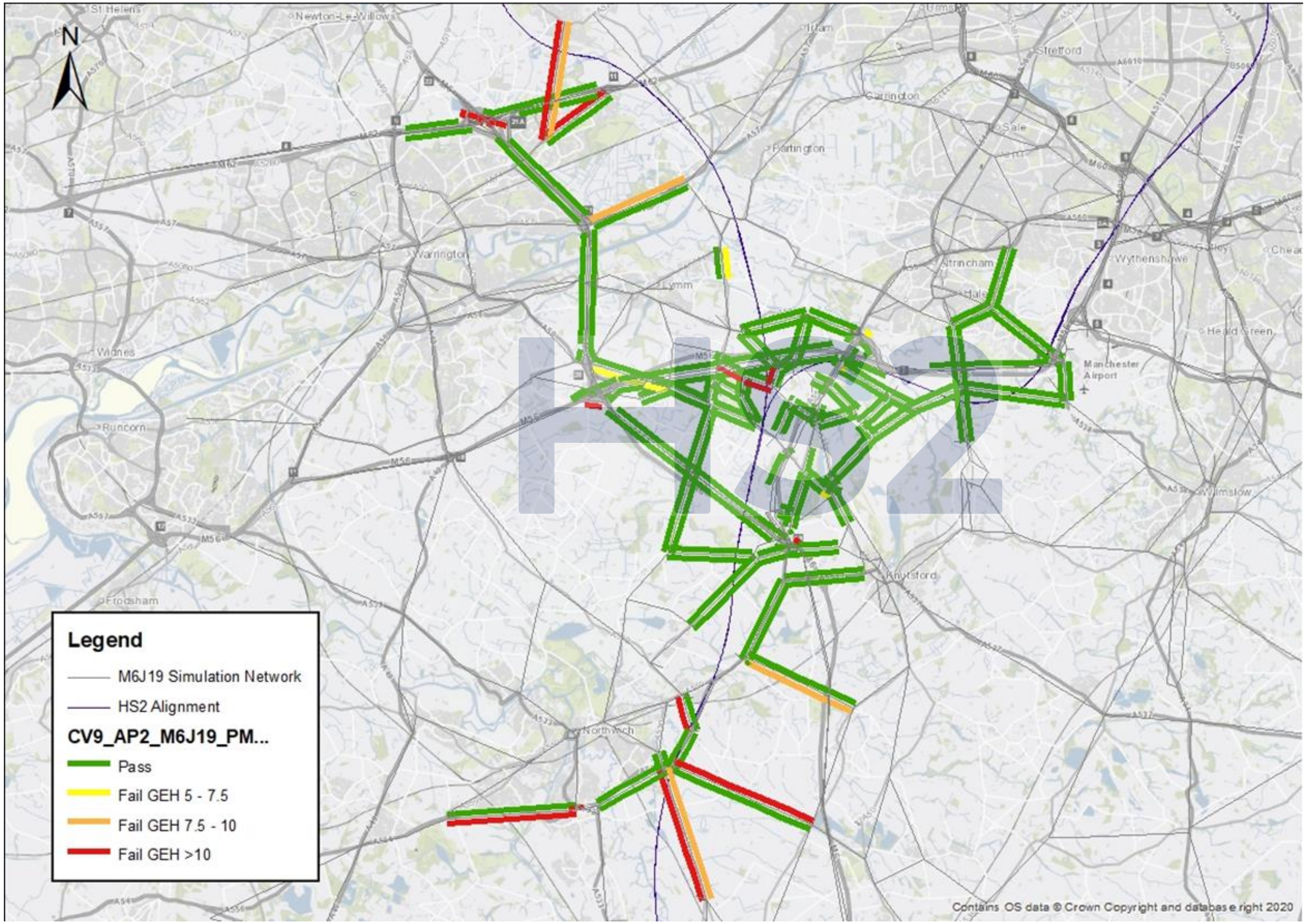


Figure 8: PM peak hour - traffic flow performance - post



5.3 Journey time results

5.3.1 Observed and modelled journey times have been compared for nine (2-way) routes highlighted in Figure 4.

5.3.2 Table 7 summarises the prior journey time results. The table shows that journey times in both time periods fail to meet the DfT TAG journey time guideline of more than 85% of model route times being within 15% of the observed times (or 1 minute, if higher than 15%).

5.3.3 Figure 8 and Figure 9 show the journey time route performance for the prior matrix assignment. These show routes passing TAG criteria as green routes. Routes failing the TAG criteria are shown as orange and red routes, according to time differences.

Table 7: AP2 M6 Junction 19 Model – journey time route summary – prior

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM peak hour	18	13	72%
PM peak hour	18	15	83%

5.3.4 Table 8 summarises the post ME journey time results. The table shows that most journey time routes in the AM and PM model meet the DfT TAG individual route criteria and achieve the 85% acceptability guideline.

5.3.5 Where model journey time routes have not met the TAG criteria against the observed data, this has been due to the limiting nature of the strategic model in its ability to replicate both flow and speed at urban over capacity conditions. The speed-flow relationship calculated in the strategic model software is more complicated in reality, particularly where flow breakdown occurs and there are very slow speeds. This is despite network capacities and traffic flows being well represented. Under these circumstances the usual practice is to achieve flow calibration.

5.3.6 There is a balance between achieving both model flow and journey time performance, and despite some routes not having met the TAG journey time criteria, it is important to note that the link flow results presented earlier in this chapter show a good standard has been achieved.

5.3.7 Figure 11 and Figure 12 show the journey time route performance for the post ME assignment. These show routes passing TAG criteria as green routes. Routes failing the TAG criteria are shown as orange and red routes, according to time differences.

Table 8: AP2 M6 Junction 19 Model – journey time route summary – post

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM peak hour	18	16	89%
PM peak hour	18	17	94%

5.3.8 Reference should also be made to Table 15 and Table 16 which presents supporting details of the individual route performance for the AM and PM time periods post matrix. For routes where model times are outside of the DfT criteria guideline, further details are provided on why this is the case.

5.3.9 Overall, the traffic flow and journey time results collectively show evidence of a good standard which is not undermined by the performance of any individual counts or routes.

Figure 9: AM peak hour – journey time performance – prior

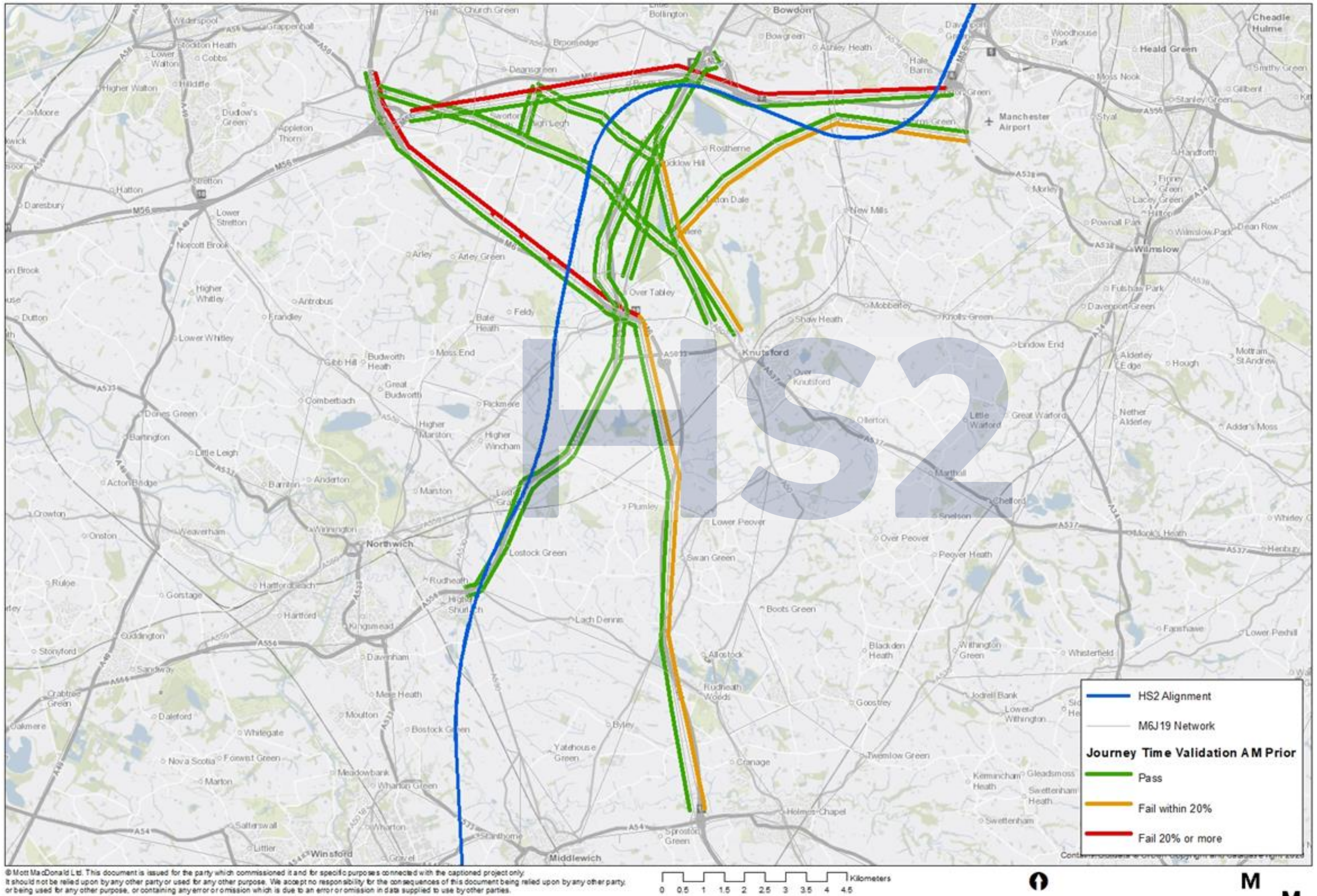


Figure 10: PM peak hour – journey time performance – prior

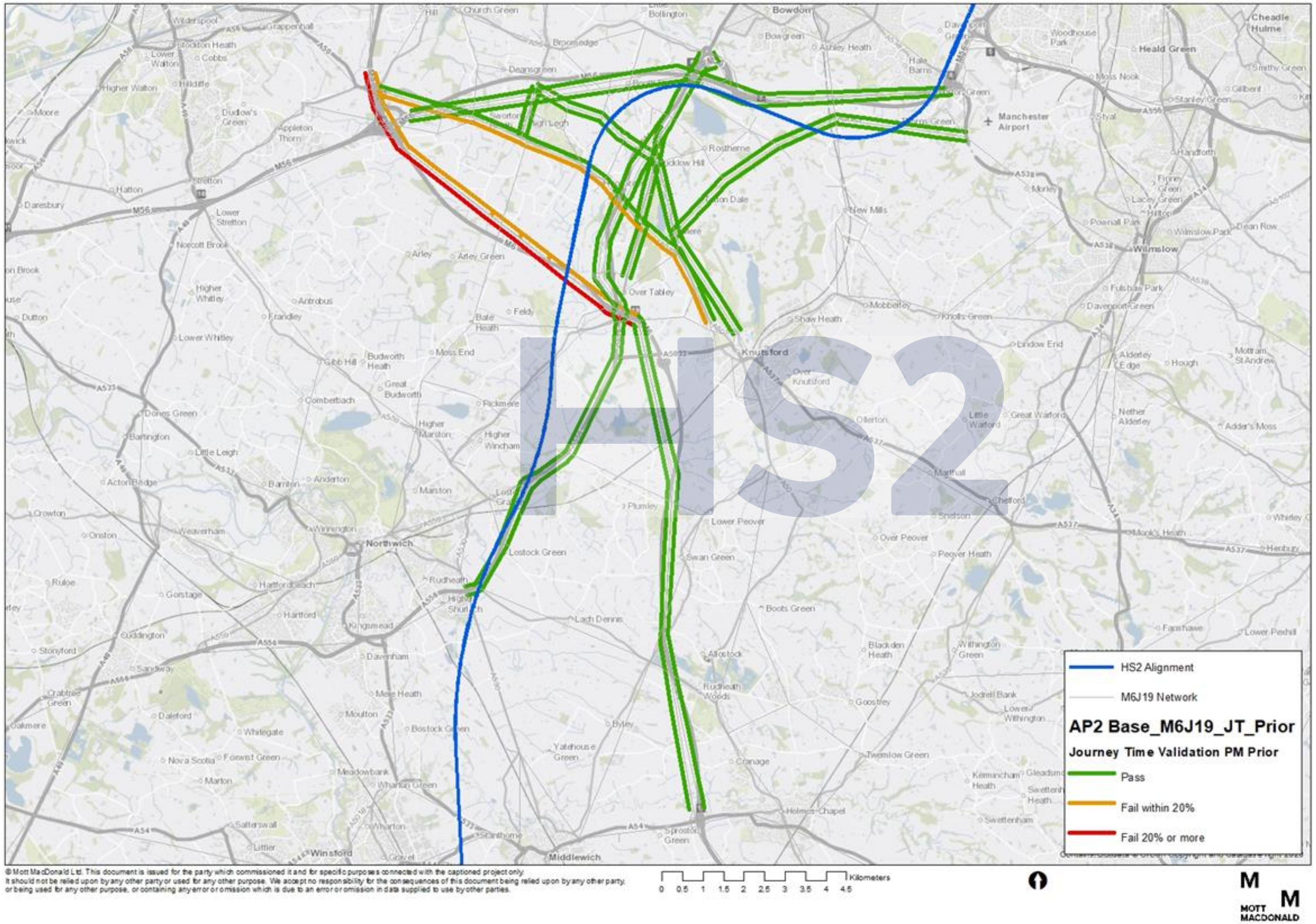


Figure 11: AM peak hour – journey time performance – post

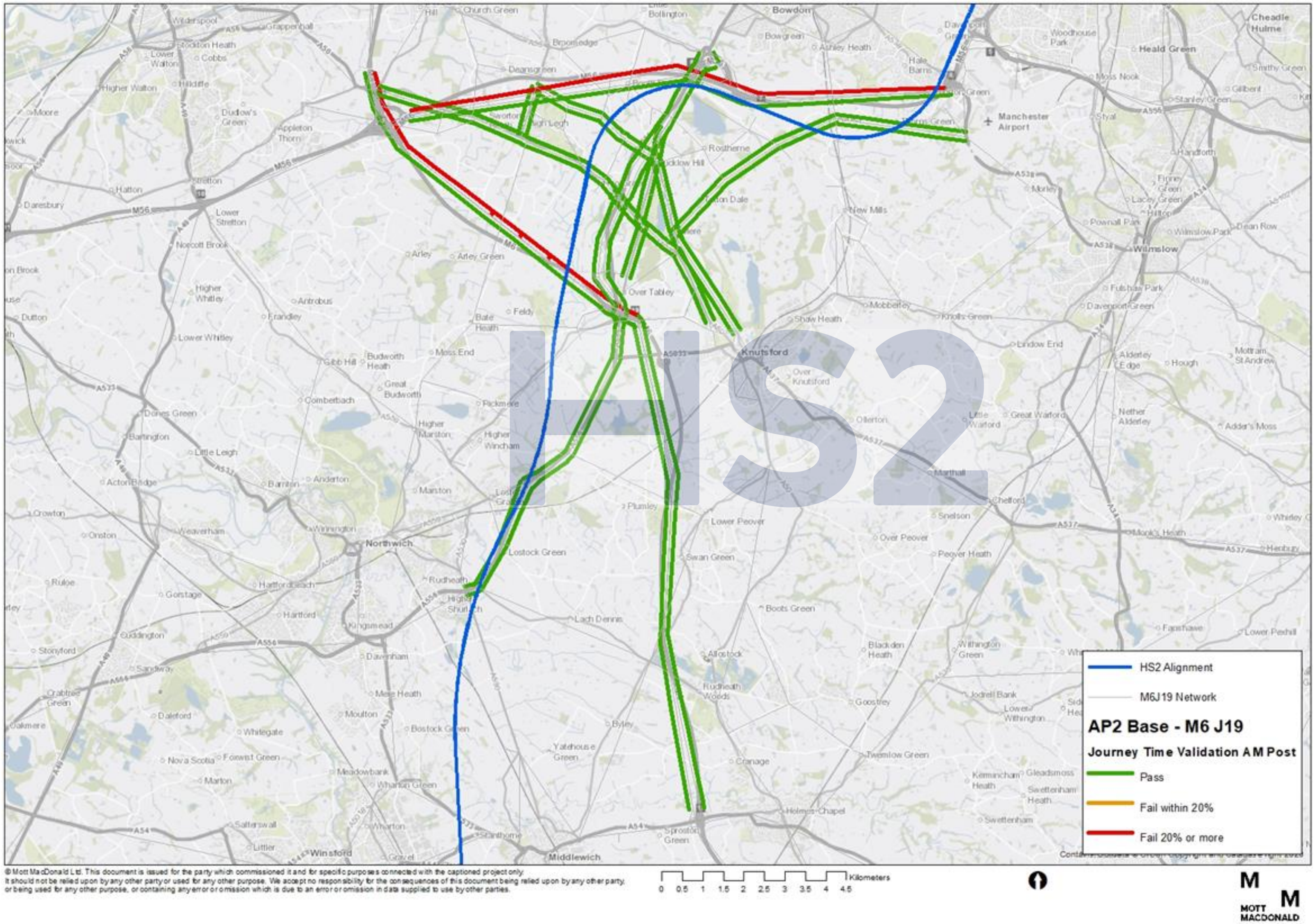
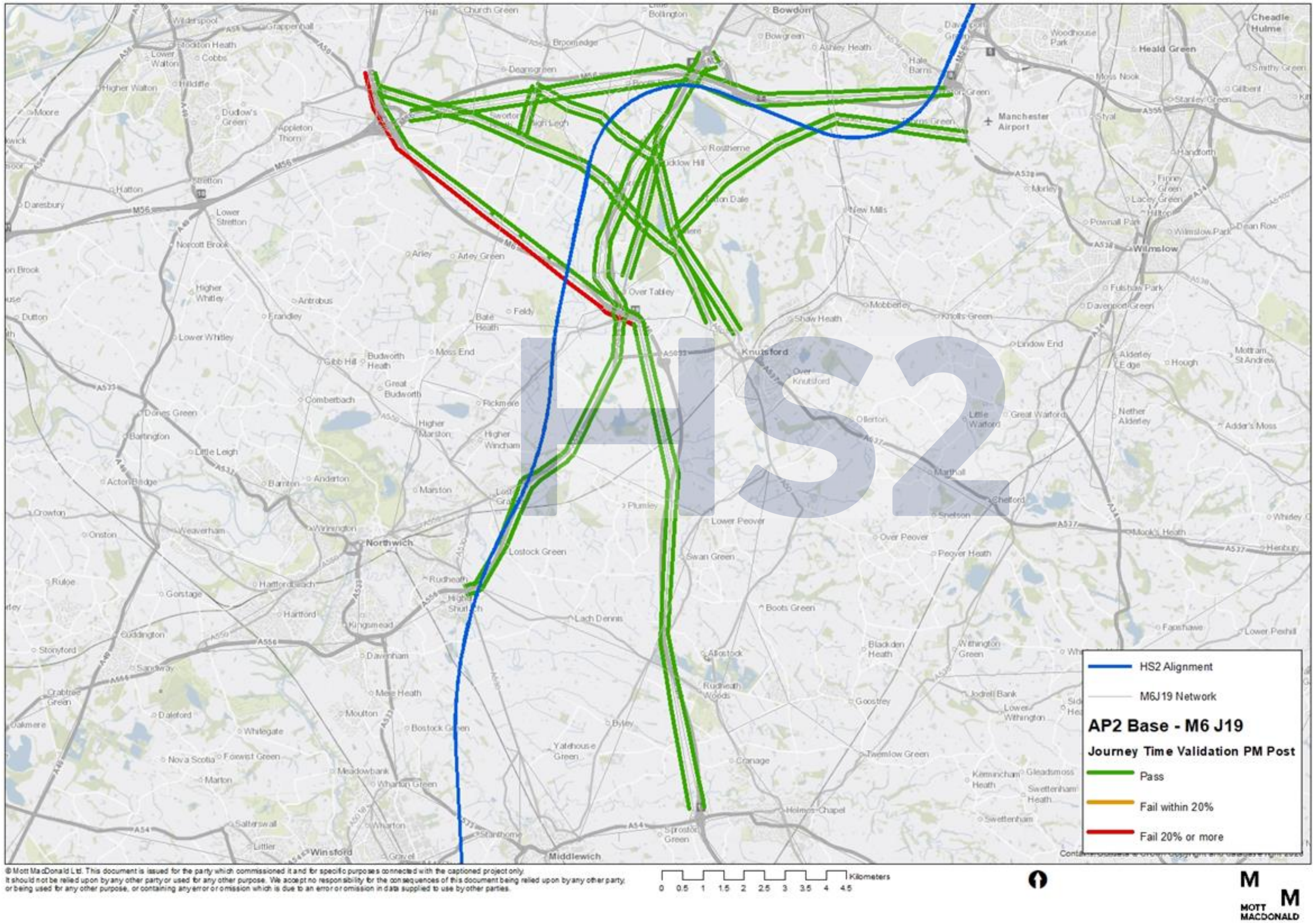


Figure 12: PM peak hour – journey time performance – post



6 Model convergence

6.1.1 Achieving a suitable level of model convergence is necessary to provide stable, consistent, and robust model results and to differentiate between real changes and those associated with differing degrees of convergence.

6.1.2 DfT TAG provides guidance on highway model convergence with recommendations on acceptable variations in link flows and costs between iterations helping to ensure the model is sufficiently stable.

6.1.3 Table 9 presents a summary of the 2018 base year highway model convergence statistics for the AP2 revised scheme by time period. Both models converge satisfactorily.

Table 9: AP2 M6 Junction 19 Model 2018 baseline model convergence

Criteria	Loop	Target	AM	PM
Flow change	N-3	> 98%	98.20	99.90
	N-2		98.30	98.70
	N-1		99.90	98.80
	N		98.20	98.60
Delays change	N-3	> 98%	99.30	99.50
	N-2		99.20	99.20
	N-1		99.40	99.60
	N		99.40	99.30
Delta		< 0.1%	0.0031/13	0.0051/19
% GAP		< 0.1%	0.0047	0.0057

7 Summary and conclusions

7.1.1 For the assessment of the AP2 revised scheme, the M6 Junction 19 Model highway assignment 2015 base year, supplied by National Highways, has been further developed for the SES2 and AP2 ES. This includes refinement of the network coding to improve model performance in key areas of interest and inclusion of some additional count data to support a widened model area of interest.

7.1.2 Presented below is a summary of the individual link flow model performance for all modelled time periods for the SES2 and AP2 ES, post matrix estimation. The comparison shows that both time periods exceed the 85% threshold of individual links meeting either the DfT TAG flow range or GEH less than five criteria.

Table 10: AP2 M6 Junction 19 Model - individual link flow - total all vehicle – post

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	197	171	87%	157	80%	171	87%
PM peak hour	197	170	86%	161	82%	170	86%

7.1.3 Presented below is a summary of the journey time route performance for all modelled time periods for the SES2 and AP2 ES, post matrix estimation. The comparison shows that most journey time routes in the AM and PM model meet the DfT TAG individual route criteria and achieve the 85% acceptability guideline.

Table 11: AP2 M6 Junction 19 Model – journey time route summary – post

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM peak hour	18	16	89%
PM peak hour	18	17	94%

7.1.4 Both the AM and PM models converge satisfactorily.

7.1.5 In conclusion, the updated M6 Junction 19 Model for the SES2 and AP2 ES provides a reliable forecasting base and forms a suitable tool for the assessment of HS2 construction and operational impacts within the scheme area of interest.

8 List of acronyms

Table 12: List of acronyms

Acronym	Description
ATC	Automatic traffic count
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
ES	Environmental Statement
GEH	Geoffrey Havers (statistic)
JTC	Junction turning count
LMVR	Local Model Validation Report
MCC	Manual Classified count
MPR	Model Performance Report
SMP	Smart Motorway Programme
TA	Transport Assessment

9 References

Department for Transport (2020), *TAG unit M1.2 Data Sources and Surveys*. Public Transport Assignment Available online at: https://www.gov.uk/government/publications/webtag-tag-unit-m1-2-data-sources-and-surveys.

Department for Transport (2020), *TAG unit M3.1 Highway Assignment Modelling*. Public Transport Assignment. Available online at: https://www.gov.uk/government/publications/webtag-tag-unit-m3-1-highway-assignment-modelling.

Appendix A – Model performance

Individual link flow performance

Table 13: AP2 M6 Junction 19 Model – AM peak hour – individual link flows

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
M6 NB off slip to M62 EB	M6 J21a	NB	897	180	107	1183	0	0	0	0	-1,183	-100%	48.64	×	×	×
M6 NB off slip	M6 J21	NB	1,238	248	148	1,633	1,209	239	79	1,528	-105	-6%	2.64	✓	✓	✓
M6 SB off slip	M6 J21	SB	255	51	30	336	251	50	17	318	-18	-5%	1.00	✓	✓	✓
M6 SB off slip to M62 WB	M6 J21a	SB	248	50	30	327	113	50	0	164	-164	-50%	10.45	×	×	×
M6 SB off slip to M62 EB	M6 J21a	SB	927	186	111	1,223	0	0	0	0	-1223	-100%	49.45	×	×	×
M62 WB slip to M6 NB	M6 J21a	WB	375	75	45	495	0	0	0	0	-495	-100%	31.46	×	×	×
M62 EB slip to M6 NB	M6 J21a	EB	298	60	36	393	176	4	0	180	-213	-54%	12.58	×	×	×
M6 NB	J21 to J21A	NB	3,719	945	1,291	5,965	3,698	942	1,279	5,919	-47	-1%	0.61	✓	✓	✓
M6 SB	J21 to J21A	SB	3,817	970	1,326	6,124	2,980	856	1,292	5,128	-996	-16%	13.27	×	×	×
M62 WB	J9 to J10	WB	2,634	670	914	4,225	2,582	671	908	4,161	-63	-1%	0.98	✓	✓	✓
M62 EB	J9 to J10	EB	2,434	619	845	3,904	2,333	580	850	3,763	-140	-4%	2.27	✓	✓	✓
M62 WB	J10 to J11	WB	2,468	627	857	3,958	1,978	509	828	3,315	-643	-16%	10.67	×	×	×
M62 EB	J10 to J11	EB	2,942	748	1,021	4,719	1,818	460	753	3,031	-1,688	-36%	27.12	×	×	×

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Mill Lane	Stage Lane-Birch Brook Road	NB	176	15	3	195	176	15	0	191	-4	-2%	0.32	✓	✓	✓
Mill Lane	Stage Lane-Birch Brook Road	SB	194	20	4	219	97	20	0	117	-103	-47%	7.91	×	×	×
A57 Manchester Road	Warburton Bridge Road-M6	EB	458	95	46	599	416	155	48	619	19	3%	0.79	✓	✓	✓
A57 Manchester Road	Warburton Bridge Road-M6	WB	593	180	53	829	473	126	23	622	-207	-25%	7.68	×	×	×
Birchwood Way	Birchwood Park Avenue-M62	EB	889	162	59	1,110	1,002	76	12	1,090	-20	-2%	0.62	✓	✓	✓
Birchwood Way	Birchwood Park Avenue-M62	WB	1,106	119	44	1270	1,108	110	42	1,261	-9	-1%	0.26	✓	✓	✓
A574 Birchwood Park Avenue	Birchwood Way-B5207	NB	639	41	4	685	794	203	90	1,086	401	58%	13.46	×	×	×
A574 Birchwood Park Avenue	Birchwood Way-B5207	SB	502	39	4	549	639	153	27	819	269	49%	10.30	×	×	×
A50 Warrington Road	Chester Road-Clamhunger Lane	WB	357	40	17	415	359	39	17	415	0	0%	0.02	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5569 Chester Road	South of A50	NB	84	14	6	105	167	14	6	187	82	78%	6.76	×	✓	✓
A50 Warrington Road	Chester Road-Clamhunger Lane	EB	362	56	16	435	379	55	15	449	14	3%	0.66	✓	✓	✓
Clamhunger Lane	A50-A5034	SB	25	4	1	30	28	2	1	31	1	2%	0.11	✓	✓	✓
A50 Warrington Road	Clamhunger Lane-Mereside Road	WB	403	41	19	464	332	37	16	385	-80	-17%	3.87	✓	✓	✓
A50 Warrington Road	Clamhunger Lane-Mereside Road	EB	423	42	31	497	320	42	12	374	-122	-25%	5.85	×	×	×
A5034 Mereside Road	A50-Mereheath Lane	SB	583	52	26	666	541	54	14	610	-57	-8%	2.24	✓	✓	✓
Clamhunger Lane	A50-A5034	NB	53	9	3	65	58	14	3	75	9	14%	1.13	✓	✓	✓
A5034 Mereside Road	A50-Mereheath Lane	NB	182	25	10	217	182	24	3	209	-8	-3%	0.52	✓	✓	✓
B5569 Chester Road	South of A50	SB	51	14	5	70	68	12	7	87	18	25%	1.98	✓	✓	✓
A50	A556-Chester Road	WB	368	43	19	432	396	45	21	462	30	7%	1.42	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A50	A556-Chester Road	EB	355	56	15	428	365	56	16	437	8	2%	0.41	✓	✓	✓
A50 Cliff Lane	East of M6	WB	214	29	14	257	217	30	14	261	4	2%	0.27	✓	✓	✓
B5159 West Lane	Beechtree Lane-Beechtree Farm Close	SB	267	32	5	305	187	29	5	221	-84	-28%	5.20	×	✓	✓
A50	Swineyard Lane-Mag Lane	EB	399	79	21	500	377	65	19	461	-39	-8%	1.77	✓	✓	✓
A50	Mag Lane-Heath Lane	WB	197	21	15	232	175	22	14	211	-20	-9%	1.36	✓	✓	✓
A50 Cliff Lane	East of M6	EB	376	74	16	468	391	73	18	483	15	3%	0.67	✓	✓	✓
A56 Lymm Road	Dunham Road-Reddy Lane	WB	224	41	6	272	214	36	5	255	-17	-6%	1.06	✓	✓	✓
A50	Mag Lane-Heath Lane	EB	377	87	20	486	377	65	18	460	-26	-5%	1.18	✓	✓	✓
A50	Swineyard Lane-Mag Lane	WB	207	24	14	244	201	24	14	239	-6	-2%	0.36	✓	✓	✓
West Lane	Beechtree Lane-Beechtree Farm Close	NB	306	39	4	350	306	35	4	345	-5	-2%	0.29	✓	✓	✓
Ashley Road	Rostherne Lane-	WB	123	11	1	135	61	9	3	73	-63	-46%	6.13	×	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
	Mereside Road															
Ashley Road	Rostherne Lane-Mereside Road	EB	251	23	3	277	233	25	5	263	-14	-5%	0.87	✓	✓	✓
A56 Lymm Road	Dunham Road-Reddy Lane	EB	634	57	5	697	634	57	5	696	-1	0%	0.04	✓	✓	✓
Wrenshot Lane	West Lane-Renshèrds Place	EB	51	6	0	57	0	0	0	0	-57	-100%	10.65	×	✓	✓
A5034 Mereside Road	A50-Mereheath Lane	NB	194	21	10	225	163	12	3	179	-46	-21%	3.27	✓	✓	✓
Rostherne Lane	Marsh Lane-Ashley Road	SB	20	6	0	26	20	2	2	24	-2	-7%	0.37	✓	✓	✓
Rostherne Lane	Chester Road-New Road	SB	9	5	1	14	3	1	0	4	-9	-70%	3.18	✓	✓	✓
Chester Road	A556 SB Offslip-Millington Lane	NB	38	15	5	57	28	9	0	37	-20	-36%	2.96	✓	✓	✓
Millington Lane	Chester Road-Millington Hall Lane	WB	12	7	2	20	20	8	0	28	8	38%	1.55	✓	✓	✓
Rostherne Lane	Marsh Lane-Ashley Road	NB	5	4	0	9	4	4	1	9	0	0%	0.00	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Rostherne Lane	Chester Road-New Road	NB	3	1	1	4	0	0	0	0	-4	-100%	2.83	✓	✓	✓
Budworth Road	Cann Lane-Old Hall Lane	WB	15	13	1	30	15	5	1	21	-9	-31%	1.86	✓	✓	✓
Agden Lane	Thowler Lane-Agden Park Lane	NB	12	2	1	14	12	2	0	14	0	2%	0.07	✓	✓	✓
Boothbank Lane	Thowler Lane-Boothbank Lane	WB	12	4	1	16	12	4	0	16	1	6%	0.23	✓	✓	✓
Reddy Lane	Millington Lane-Lymm Road	NB	23	7	1	31	23	7	0	30	0	-1%	0.05	✓	✓	✓
Reddy Lane	Millington Lane-Lymm Road	SB	20	5	1	25	3	2	0	6	-19	-76%	4.87	✓	✓	✓
Boothbank Lane	Thowler Lane-Boothbank Lane	EB	16	4	1	21	22	4	0	27	6	30%	1.27	✓	✓	✓
Agden Lane	Thowler Lane-Agden Park Lane	SB	15	3	1	18	14	3	0	17	0	-2%	0.08	✓	✓	✓
Budworth Road	Cann Lane-Old Hall Lane	EB	21	20	1	42	6	2	0	8	-34	-81%	6.81	×	✓	✓
Millington Lane	Chester Road-Millington Hall Lane	EB	4	3	2	9	10	3	0	13	4	50%	1.30	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Wrenshot Lane	Broad Oak Lane-A50	NB	3	3	0	6	0	0	0	0	-6	-97%	3.34	✓	✓	✓
Broadoak Lane	Peacock Lane-Wrenshot Lane	NB	8	1	0	9	0	0	0	0	-8	-98%	4.02	✓	✓	✓
Peacock Lane	Broadoak Lane-West Lane	WB	23	3	1	27	12	3	1	16	-11	-41%	2.41	✓	✓	✓
Peacock Lane	Broadoak Lane-West Lane	EB	67	5	0	73	67	5	0	72	-1	-1%	0.09	✓	✓	✓
Broadoak Lane	Peacock Lane-Wrenshot Lane	SB	7	1	0	8	0	0	0	0	-7	-97%	3.71	✓	✓	✓
Wrenshot Lane	Broad Oak Lane-A50	SB	3	1	0	3	0	0	0	0	-3	-92%	2.19	✓	✓	✓
A5034 Mereside Road	A50-Mereheath Lane	SB	226	26	21	275	193	33	14	240	-35	-13%	2.18	✓	✓	✓
A56 Lymm Road	Agden Park Lane-Reddy Lane	EB	579	50	5	637	611	50	5	666	29	5%	1.14	✓	✓	✓
A56 Lymm Road	Agden Park Lane-Reddy Lane	WB	231	35	4	271	210	34	5	249	-22	-8%	1.37	✓	✓	✓
Birches Lane	A556-A559	WB	130	23	3	155	0	0	3	3	-152	-98%	17.17	×	×	×
A556	Penny's Lane-Birches Lane	NB	989	118	67	1175	982	143	59	1184	9	1%	0.27	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A556	Penny's Lane-Birches Lane	SB	836	141	94	1075	828	146	82	1056	-18	-2%	0.56	✓	✓	✓
A556	A530-Penny's Lane	EB	1312	168	74	1556	1333	190	78	1601	45	3%	1.13	✓	✓	✓
A530	Middlewich Road-A556	SB	624	108	27	759	629	112	31	773	13	2%	0.47	✓	✓	✓
A556	A530-Penny's Lane	WB	1133	167	90	1397	1151	179	91	1421	24	2%	0.63	✓	✓	✓
A530	Middlewich Road-A556	NB	330	62	15	409	341	64	27	432	24	6%	1.15	✓	✓	✓
Mobberley Road	Ashley Road-Breach House Lane	NB	450	39	2	490	363	33	1	397	-93	-19%	4.42	✓	✓	✓
Mobberley Road	Ashley Road-Breach House Lane	SB	326	35	2	362	331	25	2	358	-4	-1%	0.20	✓	✓	✓
M56 J7/8 - slip road from M56 WB to A556 SB	M56 J7/8	SB	1280	256	153	1692	1288	238	139	1666	-27	-2%	0.65	✓	✓	✓
M56 J7/8 - slip road from A556 NB to Bowdon Rbt	M56 J7/8	NB	433	87	52	573	408	63	20	492	-81	-14%	3.51	✓	✓	✓
M56 J7/8 - slip road from Bowdon Rbt to A556 SB	M56 J7/8	SB	734	147	88	971	742	136	85	963	-8	-1%	0.26	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A556 NB mainline	M6 J19-A50	NB	1214	309	421	1947	1343	309	203	1855	-92	-5%	2.11	✓	✓	✓
M6 J20 to J19 SB mainline	M6 J19-J20	SB	2138	543	742	3429	2121	536	836	3493	64	2%	1.09	✓	✓	✓
M56 J7/8 - slip road from Bowdon Rbt to M56 EB	M56 J7/8	EB	1639	328	195	2167	1561	325	195	2081	-87	-4%	1.88	✓	✓	✓
M56 J7/8 - slip road M56 WB to Bowdon Rbt	M56 J7/8	EB	315	63	38	417	323	13	4	340	-77	-18%	3.96	✓	✓	✓
M56 EB mainline	M56 J7/8-J6	EB	3240	824	1125	5196	3170	810	885	4865	-331	-6%	4.67	✓	✓	✓
B5569	Chester Road-A556	EB	188	24	7	219	188	17	6	210	-9	-4%	0.59	✓	✓	✓
B5569	Chester Road-A556	WB	79	10	8	98	77	13	8	98	0	0%	0.03	✓	✓	✓
B5391 Pickmere Lane	Budworth Lane-Park Lane	NB	91	19	3	113	66	31	5	102	-11	-9%	1.03	✓	✓	✓
B5391 Pickmere Lane	Budworth Lane-Park Lane	SB	56	13	4	73	52	13	4	69	-4	-5%	0.47	✓	✓	✓
Chapel Lane	Hulseheath Lane-Chester Road	EB	43	6	1	50	43	6	0	49	-1	-2%	0.11	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Chapel Lane	Hulseheath Lane-Chester Road	WB	21	3	1	26	26	7	0	32	7	26%	1.22	✓	✓	✓
Ashley Road	Rostherne Lane-Mereside Road	NB	218	52	7	276	217	28	6	251	-25	-9%	1.54	✓	✓	✓
Ashley Road	Rostherne Lane-Mereside Road	SB	61	10	4	75	61	10	5	76	1	1%	0.07	✓	✓	✓
A50 Manchester Road	Moss Lane-Green Lane	NB	482	42	19	545	495	49	19	564	19	3%	0.79	✓	✓	✓
A50 Manchester Road	Moss Lane-Green Lane	SB	476	60	24	561	514	74	26	614	53	9%	2.19	✓	✓	✓
A5034 Chester Road	Millington Hall Lane-Chapel Lane	NB	14	5	3	21	21	6	0	28	6	31%	1.32	✓	✓	✓
A5034 Chester Road	Millington Hall Lane-Chapel Lane	SB	500	37	15	554	510	52	14	576	21	4%	0.90	✓	✓	✓
Cherry Tree Lane	Millington Lane-Ashley Road	EB	11	2	0	13	10	2	0	11	-1	-11%	0.40	✓	✓	✓
Cherry Tree Lane	Millington Lane-Ashley Road	WB	1	1	0	3	4	1	0	5	2	90%	1.23	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A556 NB mainline	north of M6 J19	NB	1568	329	209	2105	1528	325	208	2061	-45	-2%	0.98	✓	✓	✓
A556 SB mainline	north of M6 J19	SB	1254	258	238	1750	1261	259	162	1681	-69	-4%	1.67	✓	✓	✓
M6 J19 EB onslip merge	M6 J19	EB	756	263	99	1117	735	139	96	971	-146	-13%	4.53	✓	✓	✓
M6 J19 WB offslip diverge	M6 J19	WB	1147	164	127	1438	846	146	125	1117	-321	-22%	8.99	×	×	×
M6 J19 WB onslip merge	M6 J19	WB	340	90	22	452	343	97	22	463	10	2%	0.49	✓	✓	✓
M6 J19 EB offslip diverge	M6 J19	EB	555	123	111	789	551	124	42	718	-72	-9%	2.60	✓	✓	✓
B5569 Chester Road	north of A50	SB	121	18	12	151	76	16	6	98	-52	-35%	4.69	✓	✓	✓
A5034 Mereside Road	Ashley Road-Chester Road	NB	32	10	5	47	23	10	0	33	-14	-30%	2.21	✓	✓	✓
A5034 Mereside Road	Ashley Road-Chester Road	SB	527	51	22	605	508	47	11	565	-40	-7%	1.64	✓	✓	✓
A50	West Lane-Swineyard Lane	NB	246	27	15	288	251	30	16	297	10	3%	0.56	✓	✓	✓
A50	West Lane-Swineyard Lane	SB	478	71	34	582	485	69	21	576	-6	-1%	0.25	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Thowler Lane	Peacock Lane-Boothbank Lane	NB	5	5	1	10	68	10	1	79	68	654%	10.22	×	✓	✓
Thowler Lane	Peacock Lane-Boothbank Lane	SB	5	5	1	11	31	7	1	39	28	264%	5.66	×	✓	✓
A556	Northwich Road-Plumley Moor Road	NB	1109	136	70	1315	1172	195	85	1453	138	10%	3.71	✓	✓	✓
A556	Northwich Road-Plumley Moor Road	SB	989	182	89	1263	1008	188	103	1299	36	3%	1.00	✓	✓	✓
Plumley Moor Road	A556-B5081	EB	337	48	6	392	228	5	2	235	-157	-40%	8.88	×	×	×
Plumley Moor Road	A556-B5081	WB	220	32	7	259	183	15	2	199	-60	-23%	3.96	✓	✓	✓
A556	Plumley Moor Road-A556	SB	1059	185	92	1340	1064	185	103	1352	12	1%	0.32	✓	✓	✓
A556	Plumley Moor Road-A556	NB	1296	156	72	1524	1322	181	84	1587	62	4%	1.58	✓	✓	✓
B5569 Chester Road	Bentleyhurst Lane-B5569	NB	10	5	1	15	10	3	0	13	-1	-8%	0.33	✓	✓	✓
B5569 Chester Road	Bentleyhurst Lane-B5569	SB	22	4	2	27	22	4	0	26	0	-1%	0.03	✓	✓	✓
Halliwells Brow	A50-Budworth Road	SB	110	18	1	129	108	18	9	135	7	5%	0.60	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Halliwells Brow	A50-Budworth Road	NB	132	19	3	153	121	16	2	139	-13	-9%	1.10	✓	✓	✓
Hulseheath Lane	Chapel Lane-Bucklowhill Lane	SB	20	3	1	24	0	0	0	0	-23	-99%	6.80	×	✓	✓
Hulseheath Lane	Chapel Lane-Bucklowhill Lane	NB	20	5	1	25	0	0	0	0	-25	-100%	7.06	×	✓	✓
Chapel Lane	Hulseheath Lane-Back Lane	WB	65	7	1	72	26	7	0	32	-40	-56%	5.56	×	✓	✓
Chapel Lane	Hulseheath Lane-Back Lane	EB	72	6	1	78	43	6	0	49	-29	-37%	3.67	✓	✓	✓
Wrenshot Lane	West Lane-Rensherds Pl	WB	48	8	0	56	0	0	0	0	-56	-100%	10.55	×	✓	✓
Peacock Lane	Broadoak Lane-Back Lane	EB	68	7	1	75	67	5	1	73	-3	-4%	0.31	✓	✓	✓
Peacock Lane	Broadoak Lane-Back Lane	WB	27	3	1	31	12	3	1	16	-15	-48%	3.03	✓	✓	✓
A5144	Hale Road-A560	NB	384	34	9	429	430	33	12	476	47	11%	2.19	✓	✓	✓
A5144	Hale Road-A560	SB	507	61	17	593	665	67	27	759	166	28%	6.37	×	×	×

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A538 Hale Road	B5162-M56 J6	EB	589	46	21	673	651	50	18	720	47	7%	1.77	✓	✓	✓
A538 Hale Road	B5162-M56 J6	WB	657	74	21	760	602	73	11	686	-74	-10%	2.76	✓	✓	✓
B5162 Park Road	A538-Ashley Road	SB	285	49	9	345	305	14	1	321	-24	-7%	1.34	✓	✓	✓
B5162 Park Road	A538-Ashley Road	NB	349	16	4	372	355	22	3	379	7	2%	0.38	✓	✓	✓
A538 Wilmslow Road	Hale Four Seasons Rbout-Runger Lane	WB	1193	209	71	1487	1107	160	35	1302	-185	-12%	4.96	✓	✓	✓
A538 Wilmslow Road	Hale Four Seasons Rbout-Runger Lane	EB	863	142	63	1077	1016	141	93	1250	173	16%	5.08	×	×	×
A556 NB mainline	M56 J7/8-Cherry Tree Lane	NB	1539	231	166	1940	1563	335	209	2107	167	9%	3.72	✓	✓	✓
A556 SB mainline	M56 J7/8-Cherry Tree Lane	SB	1469	239	143	1859	1693	297	169	2159	300	16%	6.69	×	×	×
Cicely Mill Road	Mereside Road-Rostherne Lane	EB	4	4	2	10	16	1	0	17	7	73%	1.95	✓	✓	✓
Cicely Mill Road	Mereside Road-	WB	5	7	1	13	0	0	0	0	-13	-100%	5.14	×	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
	Rostherne Lane															
Marsh Lane	Rostherne Lane-Birkinheath Lane	EB	2	3	2	7	4	4	1	9	3	40%	0.94	✓	✓	✓
Marsh Lane	Rostherne Lane-Birkinheath Lane	WB	4	4	2	9	1	1	2	3	-6	-69%	2.59	✓	✓	✓
Birkinheath Lane	Cherry Tree Lane-Ashley Road	EB	10	9	2	21	10	5	0	15	-6	-27%	1.33	✓	✓	✓
Birkinheath Lane	Cherry Tree Lane-Ashley Road	WB	3	3	2	8	4	3	0	7	-1	-9%	0.26	✓	✓	✓
A5034 Mereside Road	Chester Road-Cicely Mill Lane	EB	562	59	11	636	524	47	11	582	-54	-9%	2.21	✓	✓	✓
A5034 Mereside Road	Chester Road-Cicely Mill Lane	WB	117	17	3	137	23	10	0	33	-105	-76%	11.37	×	×	×
B5569 Chester Road	Mereside Road-A50	SB	55	14	7	75	45	11	4	60	-15	-20%	1.84	✓	✓	✓
B5569 Chester Road	Mereside Road-A50	NB	50	9	7	65	40	4	0	44	-21	-32%	2.80	✓	✓	✓
London Road	A533-A556	NB	1015	81	17	1129	262	18	4	284	-845	-75%	31.81	×	×	×
London Road	A533-A556	SB	1298	120	50	1477	447	69	26	542	-934	-63%	29.41	×	×	×

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A556 Chester Road	London Road-A559	WB	826	123	38	992	581	81	17	680	-312	-31%	10.80	×	×	×
A556 Chester Road	London Road-A559	EB	1531	112	38	1687	1031	84	38	1153	-535	-32%	14.19	×	×	×
A530	A556-King St	SB	478	83	53	616	477	93	53	622	7	1%	0.27	✓	✓	✓
A530	A556-King St	NB	503	67	34	605	559	96	41	697	91	15%	3.57	✓	✓	✓
A556	A533-A530	WB	1257	141	57	1460	1047	144	58	1248	-211	-14%	5.74	×	✓	✓
A556	A533-A530	EB	1106	121	57	1285	1140	122	58	1319	34	3%	0.94	✓	✓	✓
B5082	A556-Byley Road	SB	360	48	7	417	351	47	19	417	0	0%	0.01	✓	✓	✓
B5082	A556-Byley Road	NB	321	32	9	367	325	32	9	366	-1	0%	0.07	✓	✓	✓
Birches Lane	A556-A559	EB	1	4	3	7	0	0	0	0	-7	-100%	3.75	✓	✓	✓
Cow Lane	Back Lane-Castle Mill Lane	NB	486	47	3	536	428	42	3	473	-63	-12%	2.81	✓	✓	✓
Cow Lane	Back Lane-Castle Mill Lane	SB	348	26	3	377	364	27	3	393	16	4%	0.82	✓	✓	✓
Back Lane	Cow Lane-Tanyard Lane	EB	222	21	3	246	203	21	3	227	-19	-8%	1.24	✓	✓	✓
Back Lane	Cow Lane-Tanyard Lane	WB	61	16	2	79	62	8	1	71	-8	-10%	0.88	✓	✓	✓
Ashley Road	Cow Lane-Lamb Lane	WB	123	15	2	140	125	15	2	142	2	1%	0.13	✓	✓	✓
Ashley Road	Cow Lane-Lamb Lane	EB	298	37	2	337	297	37	5	339	2	0%	0.09	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A538 Wilmslow Road	Mill Lane-M56 J6	NB	843	92	26	961	852	89	25	966	5	1%	0.17	✓	✓	✓
A538 Wilmslow Road	Mill Lane-M56 J6	SB	951	104	29	1084	1018	108	30	1155	72	7%	2.14	✓	✓	✓
M6 NB mainline	M56 J20-J21	NB	4353	1107	1511	6983	4541	1092	1344	6977	-6	0%	0.07	✓	✓	✓
M6 SB mainline	M56 J21-J20	SB	3939	1001	1368	6319	3826	986	1346	6158	-161	-3%	2.04	✓	✓	✓
M56 EB mainline	M56 J9	EB	1065	271	370	1708	1064	271	370	1705	-3	0%	0.06	✓	✓	✓
M56 WB mainline	M56 J9	NB	2326	466	277	3069	2319	468	279	3065	-4	0%	0.07	✓	✓	✓
M6 NB offslip	M6 J20	WB	551	110	66	728	269	35	14	319	-409	-56%	17.88	×	×	×
M56 WB mainline	M56 J7/8-J9	WB	2047	520	711	3284	2063	503	662	3229	-55	-2%	0.97	✓	✓	✓
M56 EB mainline	M56 J9-J7/8	EB	1983	504	688	3180	1931	498	694	3123	-57	-2%	1.01	✓	✓	✓
M56 J9 WB offslip	M56 J9	WB	1195	239	142	1577	1200	224	140	1564	-13	-1%	0.33	✓	✓	✓
M6 NB onslip from M56 J9 WB loop	M56 J9/M6 J20	NB	965	193	115	1273	968	178	127	1273	0	0%	0.01	✓	✓	✓
M6 NB onslip from A50 Cliff Lane	M6 J20	NB	377	75	45	497	376	76	45	497	0	0%	0.02	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
M6J20 SB offslip to A50	M6 J20	SB	627	125	75	827	589	124	94	807	-19	-2%	0.68	✓	✓	✓
M56 J9 WB onslip from M6J20 North	M56 J9/M6 J20	WB	1648	330	197	2175	1587	326	195	2108	-67	-3%	1.46	✓	✓	✓
M56 J8 WB mainline	M56 J7/8	WB	1691	430	587	2713	1726	427	606	2759	46	2%	0.88	✓	✓	✓
M6 J20 to J19 NB mainline	M6 J19-J20	NB	2076	528	721	3331	2070	522	907	3500	169	5%	2.89	✓	✓	✓
Swineyard Lane	Heath Lane-A50	NB	111	18	2	131	109	4	2	115	-16	-12%	1.41	✓	✓	✓
Swineyard Lane	Heath Lane-A50	SB	49	6	2	57	50	6	2	58	1	2%	0.16	✓	✓	✓
A50	Wrenshot Lane-Halliwell's Bow	WB	198	23	15	236	203	24	15	242	6	3%	0.39	✓	✓	✓
A50	Wrenshot Lane-Halliwell's Bow	EB	424	68	18	511	432	70	17	520	9	2%	0.39	✓	✓	✓
West Lane	A50-Wrenshot Lane	NB	243	0	15	258	243	25	3	271	13	5%	0.81	✓	✓	✓
West Lane	A50-Wrenshot Lane	SB	225	0	15	240	224	34	8	267	27	11%	1.67	✓	✓	✓
B5391 Pickmere Lane	A556-Budworth Road	EB	73	57	5	136	73	57	5	135	-1	-1%	0.08	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5391 Pickmere Lane	A556-Budworth Road	WB	57	43	5	105	56	24	5	86	-19	-18%	1.98	✓	✓	✓
Tabley Hill Lane	A556-Green Lane	EB	253	39	5	297	95	41	0	136	-161	-54%	10.96	×	×	×
Tabley Hill Lane	A556-Green Lane	WB	77	19	3	99	4	2	0	6	-93	-94%	12.87	×	✓	✓
A5033 Northwich Road	A556-Ladies Mile	EB	482	0	48	530	501	19	3	523	-7	-1%	0.30	✓	✓	✓
A5033 Northwich Road	A556-Ladies Mile	WB	429	0	45	474	429	64	24	517	43	9%	1.92	✓	✓	✓

Table 14: AP2 M6 Junction 19 Model – individual link flow detailed results – post – PM peak hour

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
M6 NB offslip to M62 EB	M6 J21a	NB	930	85	41	1056	0	0	0	0	-1056	-100%	45.95	×	×	×
M6 NB offslip	M6 J21	NB	921	84	41	1046	936	85	40	1062	15	1%	0.47	✓	✓	✓
M6 SB offslip	M6 J21	SB	166	15	7	189	201	15	7	224	35	18%	2.43	✓	✓	✓
M6 SB offslip to M62 WB	M6 J21a	SB	430	39	19	489	686	88	23	796	307	63%	12.13	×	×	×
M6 SB offslip to M62 EB	M6 J21a	SB	455	42	20	517	390	42	43	476	-41	-8%	1.84	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
M62 WB slip to M6 NB	M6 J21a	WB	791	72	35	898	499	73	25	597	-302	-34%	11.03	×	×	×
M62 EB slip to M6 NB	M6 J21a	EB	431	39	19	489	223	0	0	223	-266	-54%	14.11	×	×	×
M6 NB	J21 to J21A	NB	4503	676	1094	6273	4482	672	1087	6241	-32	-1%	0.40	✓	✓	✓
M6 SB	J21 to J21A	SB	4202	631	1021	5854	4248	628	1018	5894	41	1%	0.53	✓	✓	✓
M62 WB	J9 to J10	WB	3882	583	943	5409	3882	580	939	5402	-7	0%	0.10	✓	✓	✓
M62 EB	J9 to J10	EB	3364	505	817	4687	3377	496	816	4689	2	0%	0.04	✓	✓	✓
M62 WB	J10 to J11	WB	3716	558	903	5177	3757	559	813	5128	-48	-1%	0.68	✓	✓	✓
M62 EB	J10 to J11	EB	2810	422	683	3915	2812	415	678	3906	-9	0%	0.14	✓	✓	✓
Mill Lane	Stage Lane-Birch Brook Road	NB	120	13	2	134	135	13	0	148	14	11%	1.20	✓	✓	✓
Mill Lane	Stage Lane-Birch Brook Road	SB	245	17	2	264	150	13	0	163	-102	-38%	6.96	×	×	×
A57 Manchester Road	Warburton Bridge Road-M6	EB	791	141	53	985	708	29	16	752	-233	-24%	7.89	×	×	×
A57 Manchester Road	Warburton Bridge Road-M6	WB	609	57	23	690	563	60	15	638	-51	-7%	1.99	✓	✓	✓
Birchwood Way	Birchwood Pk Avenue-M62	EB	1626	69	24	1720	572	75	25	673	-1047	-61%	30.27	×	×	×
Birchwood Way	Birchwood Pk Avenue-M62	WB	593	75	34	702	591	73	24	688	-13	-2%	0.50	✓	✓	✓
A574 Birchwood Pk Avenue	Birchwood Way-B5207	NB	453	26	4	483	790	71	38	899	416	86%	15.82	×	×	×

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A574 Birchwood Pk Avenue	Birchwood Way-B5207	SB	644	23	4	671	803	64	37	905	233	35%	8.30	×	×	×
A50 Warrington Road	Chester Road-Clamhunger Lane	WB	724	45	13	782	693	45	20	758	-24	-3%	0.87	✓	✓	✓
B5569 Chester Road	South of A50	NB	126	7	5	139	117	11	4	132	-7	-5%	0.62	✓	✓	✓
A50 Warrington Road	Chester Road-Clamhunger Lane	EB	257	10	6	273	261	13	5	279	5	2%	0.32	✓	✓	✓
Clamhunger Lane	A50-A5034	SB	47	6	0	53	46	7	1	53	0	0%	0.01	✓	✓	✓
A50 Warrington Road	Clamhunger Lane-Mereside Road	WB	798	49	14	861	647	39	19	705	-156	-18%	5.58	×	×	×
A50 Warrington Road	Clamhunger Lane-Mereside Road	EB	259	12	7	278	239	10	4	253	-25	-9%	1.51	✓	✓	✓
A5034 Mereside Road	A50-Mereheath Lane	SB	389	20	6	415	361	19	2	382	-33	-8%	1.64	✓	✓	✓
Clamhunger Lane	A50-A5034	NB	22	3	0	25	22	3	0	25	1	3%	0.14	✓	✓	✓
A5034 Mereside Road	A50-Mereheath Lane	NB	195	13	3	211	167	11	2	181	-29	-14%	2.10	✓	✓	✓
B5569 Chester Road	South of A50	SB	81	9	2	92	89	10	2	100	8	9%	0.85	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A50	A556-Chester Road	WB	892	64	16	972	851	61	24	936	-36	-4%	1.15	✓	✓	✓
A50	A556-Chester Road	EB	275	9	6	290	276	17	5	298	8	3%	0.49	✓	✓	✓
A50 Cliff Lane	East of M6	WB	599	64	16	679	460	50	25	534	-144	-21%	5.86	×	×	×
B5159 West Lane	Beechtree Lane-Beechtree Farm Close	SB	312	19	4	335	221	18	1	241	-95	-28%	5.57	×	✓	✓
A50	Swineyard Lane-Mag Lane	EB	300	24	7	332	282	18	7	307	-24	-7%	1.36	✓	✓	✓
A50	Mag Lane-Heath Lane	WB	569	57	20	646	442	45	25	512	-133	-21%	5.54	×	×	×
A50 Cliff Lane	East of M6	EB	260	17	6	283	345	22	7	373	91	32%	5.02	×	✓	✓
A56 Lymm Road	Dunham Road-Reddy Lane	WB	629	30	5	664	635	30	3	669	5	1%	0.20	✓	✓	✓
A50	Mag Lane-Heath Lane	EB	286	25	8	319	282	18	6	307	-12	-4%	0.67	✓	✓	✓
A50	Swineyard Lane-Mag Lane	WB	579	48	20	647	490	46	27	563	-84	-13%	3.41	✓	✓	✓
West Lane	Beechtree Lane-Beechtree Farm Close	NB	366	23	0	388	384	23	3	410	22	6%	1.09	✓	✓	✓
Ashley Road	Rostherne Lane-Mereside Road	WB	136	6	1	142	137	12	1	149	7	5%	0.62	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Ashley Road	Rostherne Lane-Mereside Road	EB	157	5	0	162	101	6	2	110	-51	-32%	4.42	✓	✓	✓
A56 Lymm Road	Dunham Road-Reddy Lane	EB	238	18	4	259	238	26	2	265	6	2%	0.38	✓	✓	✓
Wrenshot Lane	West Lane-Rensherds Pl	EB	45	2	1	48	0	0	0	0	-48	-100%	9.81	×	✓	✓
A5034 Mereside Road	A50-Mereheath Lane	NB	120	6	2	128	117	5	2	124	-4	-3%	0.36	✓	✓	✓
Rostherne Lane	Marsh Lane-Ashley Road	SB	7	2	0	9	11	2	0	13	4	41%	1.12	✓	✓	✓
Rostherne Lane	Chester Road-New Road	SB	3	0	0	3	3	0	0	3	0	-4%	0.07	✓	✓	✓
Chester Road	A556 SB Offslip-Millington Lane	NB	44	1	1	46	32	2	0	34	-12	-26%	1.86	✓	✓	✓
Millington Lane	Chester Road-Millington Hall Lane	WB	14	1	0	14	25	3	0	28	14	99%	3.03	✓	✓	✓
Rostherne Lane	Marsh Lane-Ashley Road	NB	5	2	0	7	5	2	0	7	0	4%	0.10	✓	✓	✓
Rostherne Lane	Chester Road-New Road	NB	6	1	1	7	0	0	0	0	-7	-100%	3.75	✓	✓	✓
Budworth Road	Cann Lane-Old Hall Lane	WB	52	28	4	83	52	10	0	63	-21	-25%	2.43	✓	✓	✓
Agden Lane	Thowler Lane-Agden Park Lane	NB	40	1	0	40	87	5	0	92	52	130%	6.40	×	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LG Vs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Boothbank Lane	Thowler Lane-Boothbank Lane	WB	50	2	0	52	28	2	1	30	-21	-41%	3.34	✓	✓	✓
Reddy Lane	Millington Lane-Lymm Road	NB	22	6	1	28	6	1	0	7	-20	-73%	4.83	✓	✓	✓
Reddy Lane	Millington Lane-Lymm Road	SB	13	4	1	17	13	0	0	14	-3	-20%	0.85	✓	✓	✓
Boothbank Lane	Thowler Lane-Boothbank Lane	EB	6	1	0	7	8	1	0	9	3	43%	0.99	✓	✓	✓
Agden Lane	Thowler Lane-Agden Park Lane	SB	8	2	0	9	8	2	0	10	1	11%	0.32	✓	✓	✓
Budworth Road	Cann Lane-Old Hall Lane	EB	14	8	1	24	9	1	0	10	-13	-57%	3.25	✓	✓	✓
Millington Lane	Chester Road-Millington Hall Lane	EB	13	0	0	13	13	4	0	17	4	33%	1.09	✓	✓	✓
Wrenshot Lane	Broad Oak Lane-A50	NB	4	1	0	5	0	0	0	0	-4	-95%	2.81	✓	✓	✓
Broadoak Lane	Peacock Lane-Wrenshot Lane	NB	3	0	0	3	0	0	0	0	-2	-92%	1.98	✓	✓	✓
Peacock Lane	Broadoak Lane-West Lane	WB	131	11	0	142	11	3	0	14	-128	-90%	14.46	×	×	×
Peacock Lane	Broadoak Lane-West Lane	EB	20	1	1	23	21	1	1	23	0	1%	0.06	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Broadoak Lane	Peacock Lane-Wrenshot Lane	SB	10	1	0	10	0	0	0	0	-10	-97%	4.30	✓	✓	✓
Wrenshot Lane	Broad Oak Lane-A50	SB	4	1	0	5	0	0	0	0	-4	-94%	2.74	✓	✓	✓
A5034 Mereside Road	A50-Mereheath Lane	SB	277	15	7	299	233	16	2	251	-48	-16%	2.90	✓	✓	✓
A56 Lymm Road	Agden Park Lane-Reddy Lane	EB	231	29	3	262	232	25	2	258	-4	-2%	0.26	✓	✓	✓
A56 Lymm Road	Agden Park Lane-Reddy Lane	WB	612	38	6	655	622	30	3	655	0	0%	0.00	✓	✓	✓
Birches Lane	A556-A559	WB	165	15	0	180	0	0	16	16	-164	-91%	16.53	×	×	×
A556	Penny's Lane-Birches Lane	NB	1010	75	50	1135	843	89	42	973	-162	-14%	4.99	✓	✓	✓
A556	Penny's Lane-Birches Lane	SB	1357	107	34	1498	1285	107	33	1426	-72	-5%	1.89	✓	✓	✓
A556	A530-Penny's Lane	EB	1261	106	52	1419	1290	121	47	1458	40	3%	1.04	✓	✓	✓
A530	Middlewich Road-A556	SB	549	59	16	624	583	55	22	661	37	6%	1.46	✓	✓	✓
A556	A530-Penny's Lane	WB	1654	147	37	1838	1634	149	37	1821	-17	-1%	0.39	✓	✓	✓
A530	Middlewich Road-A556	NB	603	71	9	684	554	74	22	650	-34	-5%	1.30	✓	✓	✓
Mobberley Road	Ashley Road-Breach House Lane	NB	351	23	2	375	329	23	1	354	-21	-6%	1.09	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LG Vs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Mobberley Road	Ashley Road-Breach House Lane	SB	355	18	1	374	291	19	1	311	-63	-17%	3.41	✓	✓	✓
M56 J7/8 - slip road from M56 WB to A556 SB	M56 J7/8	SB	1564	143	75	1782	1441	140	67	1648	-134	-8%	3.23	✓	✓	✓
M56 J7/8 - slip road from A556 NB to Bowdon Rbt	M56 J7/8	NB	649	59	31	739	613	59	29	700	-39	-5%	1.45	✓	✓	✓
M56 J7/8 - slip road from Bowdon Rbt to A556 SB	M56 J7/8	SB	1019	93	48	1160	1057	88	45	1190	30	3%	0.86	✓	✓	✓
A556 NB mainline	M6 J19-A50	NB	1229	184	298	1712	1405	154	97	1656	-55	-3%	1.35	✓	✓	✓
M6 J20 to J19 SB mainline	M6 J19-J20	SB	2331	350	567	3249	2329	353	567	3249	1	0%	0.01	✓	✓	✓
M56 J7/8 - slip road from Bowdon Rbt to M56 EB	M56 J7/8	EB	1595	145	76	1816	1306	141	71	1518	-298	-16%	7.30	×	×	×
M56 J7/8 - slip road M56 WB to Bowdon Rbt	M56 J7/8	EB	467	42	23	532	454	17	7	479	-53	-10%	2.36	✓	✓	✓
M56 EB mainline	M56 J7/8-J6	EB	2998	450	728	4176	3032	445	728	4206	29	1%	0.45	✓	✓	✓
B5569	Chester Road-A556	EB	90	11	3	104	116	11	4	131	28	27%	2.56	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LG Vs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5569	Chester Road-A556	WB	138	12	4	154	101	13	2	116	-38	-25%	3.28	✓	✓	✓
B5391 Pickmere Lane	Budworth Lane-Park Lane	NB	51	12	1	65	31	12	1	45	-20	-31%	2.72	✓	✓	✓
B5391 Pickmere Lane	Budworth Lane-Park Lane	SB	154	18	1	173	109	24	5	139	-34	-20%	2.70	✓	✓	✓
Chapel Lane	Hulseheath Lane-Chester Road	EB	16	2	0	18	18	2	0	20	2	9%	0.37	✓	✓	✓
Chapel Lane	Hulseheath Lane-Chester Road	WB	54	5	0	59	90	6	0	96	37	63%	4.20	✓	✓	✓
Ashley Road	Rostherne Lane-Mereside Road	NB	68	16	1	85	94	7	2	103	18	21%	1.86	✓	✓	✓
Ashley Road	Rostherne Lane-Mereside Road	SB	112	12	1	125	135	12	1	148	23	19%	1.99	✓	✓	✓
A50 Manchester Road	Moss Lane-Green Lane	NB	762	35	10	807	772	44	22	838	32	4%	1.10	✓	✓	✓
A50 Manchester Road	Moss Lane-Green Lane	SB	431	39	7	476	471	27	7	504	28	6%	1.28	✓	✓	✓
A5034 Chester Road	Millington Hall Lane-Chapel Lane	NB	15	3	0	18	17	2	0	19	1	3%	0.14	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A5034 Chester Road	Millington Hall Lane-Chapel Lane	SB	318	23	3	344	333	19	2	354	10	3%	0.53	✓	✓	✓
Cherry Tree Lane	Millington Lane-Ashley Road	EB	9	2	0	11	10	0	0	10	0	-4%	0.14	✓	✓	✓
Cherry Tree Lane	Millington Lane-Ashley Road	WB	3	1	0	5	5	1	1	7	2	40%	0.80	✓	✓	✓
A556 NB mainline	North of M6 J19	NB	1768	158	102	2028	1520	165	101	1786	-242	-12%	5.54	×	✓	✓
A556 SB mainline	North of M6 J19	SB	1825	218	129	2172	1797	192	85	2073	-99	-5%	2.15	✓	✓	✓
M6 J19 EB onslip merge	M6 J19	EB	1438	106	13	1557	962	98	45	1105	-452	-29%	12.39	×	×	×
M6 J19 WB offslip diverge	M6 J19	WB	1091	100	54	1245	1089	99	53	1241	-4	0%	0.12	✓	✓	✓
M6 J19 WB onslip merge	M6 J19	WB	472	39	2	513	495	52	23	570	57	11%	2.45	✓	✓	✓
M6 J19 EB offslip diverge	M6 J19	EB	467	41	44	551	445	43	9	496	-55	-10%	2.40	✓	✓	✓
B5569 Chester Road	North of A50	SB	179	11	2	192	177	15	2	195	3	1%	0.18	✓	✓	✓
A5034 Mereside Road	Ashley Road-Chester Road	NB	101	10	2	113	96	8	0	103	-9	-8%	0.88	✓	✓	✓
A5034 Mereside Road	Ashley Road-Chester Road	SB	268	14	3	285	272	13	1	287	2	1%	0.14	✓	✓	✓
A50	West Lane-Swineyard Lane	NB	609	62	21	691	647	61	29	737	46	7%	1.73	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A50	West Lane-Swineyard Lane	SB	342	25	11	377	342	23	8	373	-4	-1%	0.21	✓	✓	✓
Thowler Lane	Peacock Lane-Boothbank Lane	NB	3	6	1	10	103	7	1	111	100	968%	12.89	×	×	×
Thowler Lane	Peacock Lane-Boothbank Lane	SB	4	3	1	8	22	4	1	27	19	250%	4.59	✓	✓	✓
A556	Northwich Road-Plumley Moor Road	NB	935	94	52	1081	1051	114	48	1213	132	12%	3.89	✓	✓	✓
A556	Northwich Road-Plumley Moor Road	SB	1480	121	38	1639	1449	116	38	1603	-36	-2%	0.90	✓	✓	✓
Plumley Moor Road	A556-B5081	EB	186	16	1	203	184	16	1	200	-3	-1%	0.20	✓	✓	✓
Plumley Moor Road	A556-B5081	WB	373	35	3	410	264	4	1	269	-141	-34%	7.63	×	×	×
A556	Plumley Moor Road-A556	SB	1757	143	39	1939	1665	119	38	1822	-118	-6%	2.71	✓	✓	✓
A556	Plumley Moor Road-A556	NB	1025	98	51	1174	1011	112	48	1171	-3	0%	0.10	✓	✓	✓
B5569 Chester Road	Bentleyhurst Lane-B5569	NB	32	0	1	33	23	4	0	27	-5	-16%	0.94	✓	✓	✓
B5569 Chester Road	Bentleyhurst Lane-B5569	SB	10	1	1	12	10	1	0	11	0	-1%	0.04	✓	✓	✓
Halliwells Brow	A50-Budworth Road	SB	229	23	1	253	220	18	4	242	-10	-4%	0.66	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LG Vs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Halliwells Brow	A50-Budworth Road	NB	136	12	1	148	140	11	0	152	4	3%	0.36	✓	✓	✓
Hulseheath Lane	Chapel Lane-Bucklowhill Lane	SB	28	5	0	32	1	0	0	1	-31	-97%	7.63	×	✓	✓
Hulseheath Lane	Chapel Lane-Bucklowhill Lane	NB	4	1	0	5	0	0	0	0	-4	-99%	2.97	✓	✓	✓
Chapel Lane	Hulseheath Lane-Back Lane	WB	89	6	0	95	89	6	0	95	0	0%	0.03	✓	✓	✓
Chapel Lane	Hulseheath Lane-Back Lane	EB	18	4	1	23	18	2	0	20	-3	-14%	0.70	✓	✓	✓
Wrenshot Lane	West Lane-Renshaw Pl	WB	31	3	0	34	0	0	0	0	-34	-100%	8.20	×	✓	✓
Peacock Lane	Broadoak Lane-Back Lane	EB	24	0	1	25	21	1	1	23	-1	-6%	0.31	✓	✓	✓
Peacock Lane	Broadoak Lane-Back Lane	WB	144	10	0	154	11	3	1	14	-139	-91%	15.18	×	×	×
A5144	Hale Road-A560	NB	559	32	11	602	560	31	7	597	-5	-1%	0.19	✓	✓	✓
A5144	Hale Road-A560	SB	432	26	6	464	414	32	2	448	-16	-3%	0.73	✓	✓	✓
A538 Hale Road	B5162-M56 J6	EB	569	29	7	605	564	33	4	601	-4	-1%	0.17	✓	✓	✓
A538 Hale Road	B5162-M56 J6	WB	692	32	12	736	692	50	10	752	16	2%	0.59	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LG Vs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5162 Park Road	A538-Ashley Road	SB	278	13	5	296	284	14	0	298	2	1%	0.13	✓	✓	✓
B5162 Park Road	A538-Ashley Road	NB	358	24	6	388	357	21	4	382	-6	-1%	0.28	✓	✓	✓
A538 Wilmslow Road	Hale Four Seasons Rbout-Runger Lane	WB	1327	99	29	1455	1330	99	18	1447	-8	-1%	0.21	✓	✓	✓
A538 Wilmslow Road	Hale Four Seasons Rbout-Runger Lane	EB	937	82	25	1044	959	81	25	1065	21	2%	0.65	✓	✓	✓
A556 NB mainline	M56 J7/8-Cherry Tree Lane	NB	1762	94	100	1956	1753	170	99	2022	66	3%	1.48	✓	✓	✓
A556 SB mainline	M56 J7/8-Cherry Tree Lane	SB	1829	59	89	1978	2034	194	85	2313	336	17%	7.25	×	×	×
Cicely Mill Road	Mereside Road-Rostherne Lane	EB	4	4	1	9	6	0	0	6	-3	-30%	0.98	✓	✓	✓
Cicely Mill Road	Mereside Road-Rostherne Lane	WB	3	4	1	8	3	1	0	4	-4	-47%	1.56	✓	✓	✓
Marsh Lane	Rostherne Lane-Birkinheath Lane	EB	2	1	1	4	1	1	0	2	-2	-47%	1.12	✓	✓	✓
Marsh Lane	Rostherne Lane-	WB	5	3	1	10	2	1	0	4	-6	-64%	2.40	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
	Birkinheath Lane															
Birkinheath Lane	Cherry Tree Lane-Ashley Road	EB	14	8	2	23	14	4	1	19	-5	-20%	1.01	✓	✓	✓
Birkinheath Lane	Cherry Tree Lane-Ashley Road	WB	3	3	1	7	8	3	0	12	5	67%	1.53	✓	✓	✓
A5034 Mereside Road	Chester Road-Cicely Mill Lane	EB	273	20	3	295	278	14	1	293	-2	-1%	0.13	✓	✓	✓
A5034 Mereside Road	Chester Road-Cicely Mill Lane	WB	116	15	1	131	99	9	0	108	-23	-18%	2.12	✓	✓	✓
B5569 Chester Road	Mereside Road-A50	SB	90	8	2	100	81	8	1	90	-9	-9%	0.96	✓	✓	✓
B5569 Chester Road	Mereside Road-A50	NB	33	2	1	35	16	1	0	17	-18	-52%	3.54	✓	✓	✓
London Road	A533-A556	NB	1015	67	6	1088	312	33	1	346	-742	-68%	27.71	×	×	×
London Road	A533-A556	SB	1057	80	19	1155	501	37	5	544	-612	-53%	20.99	×	×	×
A556 Chester Road	London Road-A559	WB	1524	86	17	1627	889	74	9	972	-655	-40%	18.18	×	×	×
A556 Chester Road	London Road-A559	EB	984	106	18	1108	1049	87	18	1154	46	4%	1.35	✓	✓	✓
A530	A556-King St	SB	728	69	30	827	989	81	25	1095	269	33%	8.67	×	×	×
A530	A556-King St	NB	670	75	35	779	948	107	39	1094	315	40%	10.30	×	×	×
A556	A533-A530	WB	1405	118	31	1554	1543	112	29	1685	131	8%	3.26	✓	✓	✓
A556	A533-A530	EB	1158	81	33	1272	1204	73	22	1298	26	2%	0.73	✓	✓	✓
B5082	A556-Byley Road	SB	262	20	2	283	447	32	6	486	203	71%	10.33	×	×	×

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5082	A556-Byley Road	NB	329	30	3	361	349	43	5	396	35	10%	1.81	✓	✓	✓
Birches Lane	A556-A559	EB	1	1	0	2	0	0	0	0	-2	-100%	1.73	✓	✓	✓
Cow Lane	Back Lane-Castle Mill Lane	NB	417	29	0	446	428	29	4	461	15	3%	0.73	✓	✓	✓
Cow Lane	Back Lane-Castle Mill Lane	SB	375	26	0	400	320	24	1	344	-56	-14%	2.90	✓	✓	✓
Back Lane	Cow Lane-Tanyard Lane	EB	113	10	2	124	64	7	1	72	-52	-42%	5.29	×	✓	✓
Back Lane	Cow Lane-Tanyard Lane	WB	191	15	1	206	181	15	1	197	-9	-4%	0.62	✓	✓	✓
Ashley Road	Cow Lane-Lamb Lane	WB	238	24	0	262	239	24	1	264	2	1%	0.15	✓	✓	✓
Ashley Road	Cow Lane-Lamb Lane	EB	208	17	0	225	191	17	4	212	-12	-5%	0.83	✓	✓	✓
A538 Wilmslow Road	Mill Lane-M56 J6	NB	895	58	10	963	904	59	10	974	10	1%	0.34	✓	✓	✓
A538 Wilmslow Road	Mill Lane-M56 J6	SB	1029	67	11	1108	1024	67	11	1103	-5	0%	0.16	✓	✓	✓
M6 NB mainline	M56 J20-J21	NB	4741	712	1152	6605	5045	708	1119	6871	266	4%	3.24	✓	✓	✓
M6 SB mainline	M56 J21-J20	SB	4700	706	1142	6548	4742	700	1062	6504	-44	-1%	0.55	✓	✓	✓
M56 EB mainline	M56 J9	EB	1251	188	304	1743	1247	186	303	1736	-7	0%	0.17	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
M56 WB mainline	M56 J9	NB	2303	210	103	2616	2267	196	133	2596	-20	-1%	0.38	✓	✓	✓
M6 NB offslip	M6 J20	WB	547	50	24	622	250	16	11	278	-344	-55%	16.22	×	×	×
M56 WB mainline	M56 J7/8-J9	WB	3144	472	764	4380	3229	470	697	4395	15	0%	0.23	✓	✓	✓
M56 EB mainline	M56 J9-J7/8	EB	2133	320	518	2972	2155	321	675	3152	180	6%	3.24	✓	✓	✓
M56 J9 WB offslip	M56 J9	WB	1794	164	80	2038	1853	162	81	2096	58	3%	1.28	✓	✓	✓
M6 NB onslip from M56 J9 WB loop	M56 J9/M6 J20	NB	1321	120	59	1500	1370	130	73	1574	74	5%	1.89	✓	✓	✓
M6 NB onslip from A50 Cliff Lane	M6 J20	NB	549	50	24	623	527	103	42	672	49	8%	1.92	✓	✓	✓
M6J20 SB offslip to A50	M6 J20	SB	908	83	40	1031	815	81	201	1096	65	6%	2.01	✓	✓	✓
M56 J9 WB onslip from M6J20 North	M56 J9/M6 J20	WB	1954	178	87	2219	1976	177	99	2253	34	2%	0.72	✓	✓	✓
M56 J8 WB mainline	M56 J7/8	WB	2737	411	665	3814	2772	435	667	3874	60	2%	0.98	✓	✓	✓
M6 J20 to J19 NB mainline	M6 J19-J20	NB	2065	310	501	2876	2096	322	850	3268	392	14%	7.07	×	✓	✓
Swineyard Lane	Heath Lane-A50	NB	85	9	2	95	87	6	1	95	-1	-1%	0.07	✓	✓	✓
Swineyard Lane	Heath Lane-A50	SB	228	24	1	252	185	16	2	202	-49	-20%	3.28	✓	✓	✓
A50	Wrenshot Lane-	WB	741	49	14	804	709	49	23	781	-23	-3%	0.80	✓	✓	✓

Road name	Location	Direction	Observed Flow (Vehicles)				Modelled Flow (Vehicles)				Total Flow Comparison					
			Cars	LGVs	HGVs	Total	Cars	LGVs	HGVs	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
	Halliwell's Bow															
A50	Wrenshot Lane-Halliwell's Bow	EB	287	22	6	315	313	20	5	338	24	7%	1.30	✓	✓	✓
West Lane	A50-Wrenshot Lane	NB	265	0	8	273	281	19	4	304	31	11%	1.82	✓	✓	✓
West Lane	A50-Wrenshot Lane	SB	222	0	10	232	268	36	10	314	82	35%	4.95	✓	✓	✓
B5391 Pickmere Lane	A556-Budworth Road	EB	44	33	2	79	50	23	2	74	-5	-6%	0.52	✓	✓	✓
B5391 Pickmere Lane	A556-Budworth Road	WB	144	74	7	225	138	38	5	182	-43	-19%	3.02	✓	✓	✓
Tabley Hill Lane	A556-Green Lane	EB	82	15	1	97	55	2	0	57	-40	-42%	4.59	✓	✓	✓
Tabley Hill Lane	A556-Green Lane	WB	95	16	1	111	105	14	0	120	8	8%	0.78	✓	✓	✓
A5033 Northwich Road	A556-Ladies Mile	EB	445	0	26	471	432	13	2	447	-24	-5%	1.10	✓	✓	✓
A5033 Northwich Road	A556-Ladies Mile	WB	715	0	47	762	710	22	20	753	-9	-1%	0.34	✓	✓	✓

Individual route journey time performance

Table 15: AP2 M6 Junction 19 Model – individual route journey time detailed results – post – AM peak hour

Route name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
M56	EB	13,182	753	492	-261	-34.7%	×	Unable to reflect delays along M56 J7 and 8.
M56	WB	13,333	443	488	45	10.2%	✓	
A556	NB	15,193	902	771	-131	-14.5%	✓	
A556	SB	15,169	834	859	25	3.0%	✓	
A50	NB	10,593	590	572	-18	-3.1%	✓	
A50	SB	10,593	591	563	-29	-4.8%	✓	
Chester Road	NB	3,601	248	242	-6	-2.3%	✓	
Chester Road	SB	3,601	238	225	-13	-5.4%	✓	
A5033 Mereheath Lane	NB	5,520	334	355	21	6.3%	✓	
A5033 Mereheath Lane	SB	5,520	399	340	-60	-14.9%	✓	
Ashley Road	EB	8,873	675	588	-88	-13.0%	✓	
Ashley Road	WB	8,873	671	572	-99	-14.8%	✓	
Peacock Lane	WB	4,619	319	316	-2	-0.8%	✓	
Peacock Lane	EB	4,619	307	318	11	3.6%	✓	
M6 J18-19	NB	12,185	837	730	-107	-12.8%	✓	
M6 J18-19	SB	12,179	574	660	86	15.0%	✓	
M6 J19-20	NB	9,586	378	392	14	3.8%	✓	
M6 J19-20	SB	9,572	456	362	-94	-20.6%	×	Unable to fully reflect speeds accurately.

Table 16: AP2 M6 Junction 19 Model – individual route journey time detailed results – post – PM peak hour

Route name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
M56	EB	13,182	514	478	-36	-7.0%	✓	
M56	WB	13,333	542	597	55	10.2%	✓	
A556	NB	15,193	819	805	-14	-1.7%	✓	
A556	SB	15,169	884	871	-14	-1.5%	✓	
A50	NB	10,593	703	700	-4	-0.5%	✓	
A50	SB	10,593	580	550	-30	-5.2%	✓	
Chester Road	NB	3,601	242	241	-1	-0.3%	✓	
Chester Road	SB	3,601	263	231	-32	-12.1%	✓	
A5033 Mereheath Lane	NB	5,520	358	353	-5	-1.5%	✓	
A5033 Mereheath Lane	SB	5,520	348	330	-18	-5.3%	✓	
Ashley Road	EB	8,873	638	575	-63	-9.8%	✓	
Ashley Road	WB	8,873	625	575	-50	-7.9%	✓	
Peacock Lane	WB	4,619	313	321	8	2.4%	✓	
Peacock Lane	EB	4,619	302	315	14	4.5%	✓	
M6 J18-19	NB	12,185	674	692	18	2.7%	✓	
M6 J18-19	SB	12,179	706	637	-68	-9.7%	✓	
M6 J19-20	NB	9,586	1,133	372	-761	-67.2%	×	Unable to reflect delays approaching M6 J20.
M6 J19-20	SB	9,572	411	351	-60	-14.7%	✓	

Annex E: Model performance report – Winsford and Middlewich Model

Contents

Tables

Figures

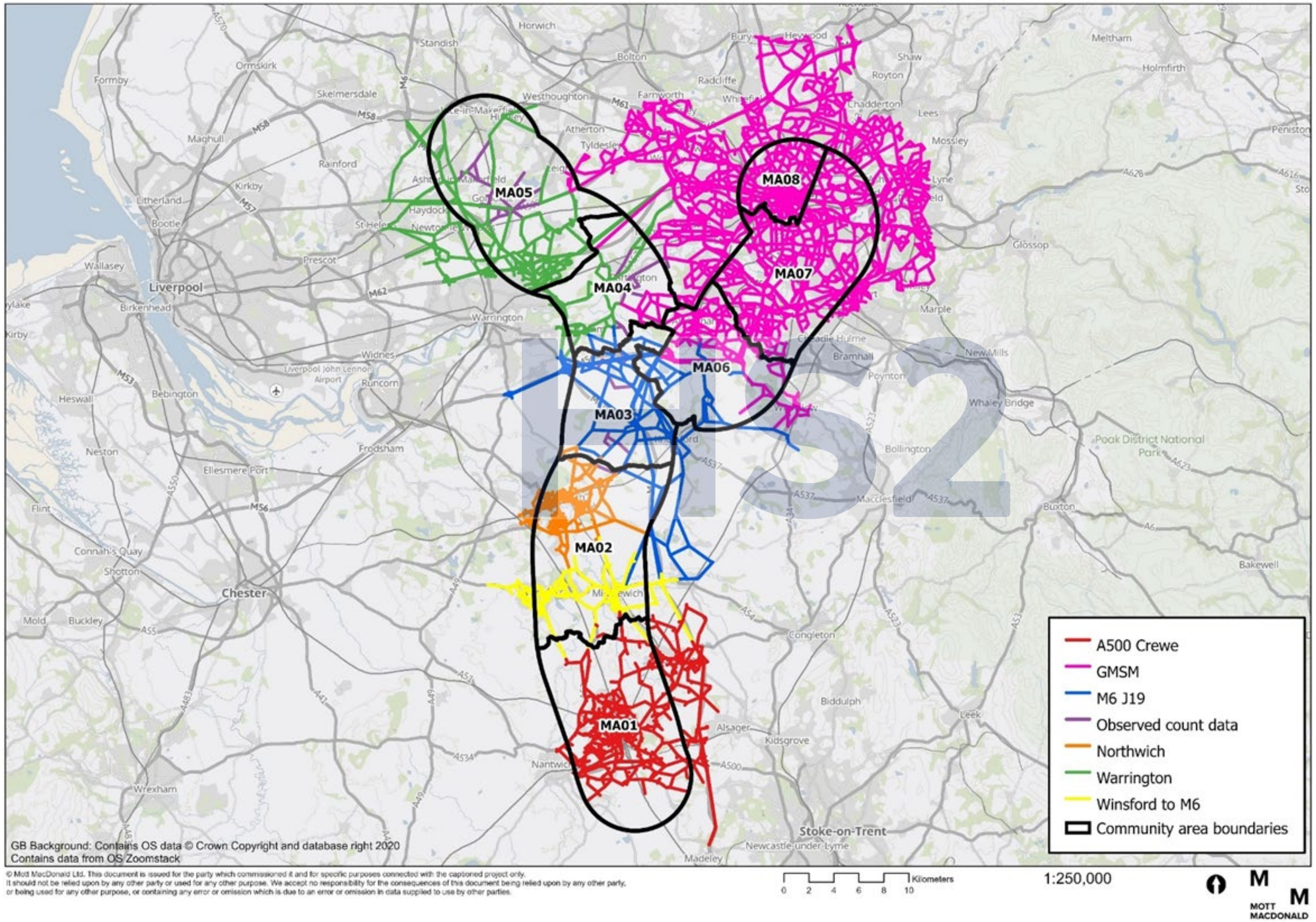
1 Introduction

1.1 Background

1.1.1 For the purpose of assessment, the route of the original scheme is split into a number of geographical areas referred to as Community Areas. The Winsford and Middlewich Model has been utilised to provide an evidence base for the main Transport Assessment (TA) for the south part of the community area referred to as Wimboldsley to Lostock Gralam (MA02). Cheshire West and Chester Council (CWaC) released copies of the latest available Winsford and Middlewich Model versions (as of January 2019) to HS2 Ltd.

1.1.2 Reference should be made to Figure 1 which shows the geographic coverage of strategic transport models that have been utilised for the TA.

Figure 1: Strategic transport model coverage for the High Speed Rail (Crewe – Manchester) Transport Assessment



1.2 Hybrid Bill and Additional Provision 1 Environmental Statement

1.2.1 The Winsford and Middlewich Model was updated by HS2 Ltd's transport consultants, Mott MacDonald WSP Joint Venture (MWJV), to include localised improvements within the original scheme area of interest. This is described in the Model Performance Report for the Winsford and Middlewich Model, in the main TA Part 4 Addendum (Volume 5, Appendix: TR-005-0000, Report 2 of 2).

1.2.2 Additional Provision (AP) amendments are changes to the scheme that include requirements for additional powers in the High Speed Rail (Crewe-Manchester) Bill. At Additional Provision 1 (AP1) further model development work was undertaken which is described in the AP1 Model Performance Report for the Winsford and Middlewich Model, in the Supplementary Environmental Statement 1 (SES1) and AP1 ES Transport Assessment Part 4 Addendum (SES1 and AP1 ES Volume 5, Appendix: TR-005-00000, Report 2 of 2).

1.3 Additional Provision 2 Environmental Statement

1.3.1 Further model development has been undertaken by MWJV for the Additional Provision 2 (AP2) revised scheme. The Baseline model has been updated for the assessment to reflect the use of journey time data in the base model validation, and refinement of network coding to improve model performance.

1.4 Purpose of this report

1.4.1 This report documents the updates made for the AP2 revised scheme and model performance of the HS2 AP2 Winsford and Middlewich Model.

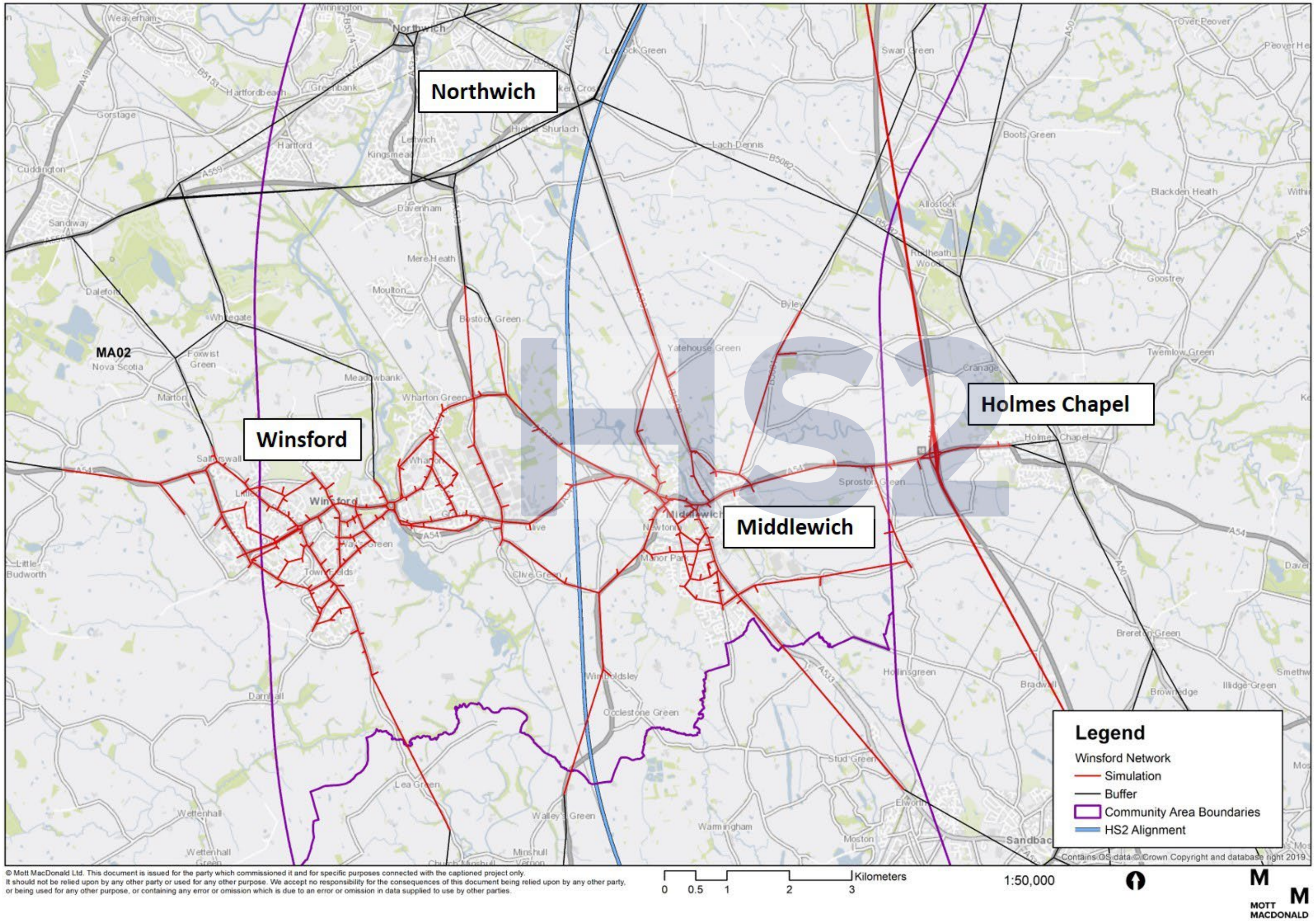
1.5 Model framework

1.5.1 The Winsford and Middlewich Model is a local highway model that was developed within a SATURN model software platform (originally version 11.3.1oe).

1.5.2 The detailed modelled study area covers Winsford, Middlewich and surrounding areas. There is supporting network and zone system detail to provide a representation of the external area supply and demand. Reference should be made to Figure 2.

1.5.3 The Winsford and Middlewich Model is representative of 2014 base year transport conditions.

Figure 2: Model study area



1.6 Model development

1.6.1 The Winsford and Middlewich Model was developed by CWAC's appointed transport consultants to provide an evidence base to support the Winsford transport strategy study.

1.7 Model description

1.7.1 The original Winsford and Middlewich Model was developed for the following years:

- 2014 base year; and
- 2030 future year.

1.7.2 The model is representative of the following time periods:

- AM peak hour - 07:45–08:45;
- average inter peak hour - 10:00–16:00; and
- PM peak hour - 17:00–18:00.

1.7.3 The model is comprised of the following demand user-classes:

- car commute;
- car employers business;
- car other
- light goods vehicles; and
- other goods vehicles.

1.8 Model application objectives

1.8.1 For the assessment of the AP2 revised scheme, the Winsford and Middlewich Model provides:

- preliminary traffic data to inform scheme design;
- changes in traffic flows, congestion, and journey times to inform the TA for the AP2 revised scheme;
- traffic data for the construction and operational phases of the AP2 revised scheme on which to base the assessment of significant effects for the Environmental Statement (ES); and
- changes in traffic flows between the base year and forecast scenarios for application to local models.

2 Guidance used

2.1 Introduction

2.1.1 This strategic highway model development makes reference to the following Transport Analysis Guidance (TAG) as published by the Department for Transport (DfT): TAG Unit M3.1 Highway Assignment Modelling (May 2020).

2.2 Highway model guidance

2.2.1 In relation to providing an assessment of model calibration and validation performance, reference has been made to Section 3.2 of TAG Unit M3.1 (Table 1, Table 2, and Table 3).

2.2.2 The criteria for the assessment of model calibration and validation of traffic flows and journey time performance are presented in Table 1, below.

Table 1: DfT – TAG validation criteria

Criteria	Acceptability guideline
Assigned hourly flows	
Individual flows within +/-15% for flows 700-2,700 vph	>85% of cases
Individual flows within +/-100 vph for flows <700 vph	>85% of cases
Individual flows within +/-400 vph for flows >2,700 vph	>85% of cases
Screenline flows (normally >5 links) to be within 5%	All or nearly all screenlines
Geoffrey Havers (GEH) statistic	
Individual flows GEH <5	>85% of cases
Journey times	
Modelled journey times within 15% (or 1 minute if higher)	>85% of cases

Credit. Table 1, Table 2, Table 3, DfT TAG Unit M3.1 Highway Assignment Modelling (May 2020)

2.2.3 The criteria for the assessment of highway model assignment convergence is presented in Table 2, below.

Table 2: Summary of convergence measures and base model acceptable values

Measures of convergence	Acceptability guideline
Delta and %GAP	Less than 0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with flow change (P) <1%	Four consecutive iterations greater than 98%
Percentage of links with cost change (P2) <1%	Four consecutive iterations greater than 98%
Percentage change in total user costs of links with flow change (V) <1%	Four consecutive iterations less than 0.1% (SUE only)

Credit. Table 4, DfT TAG Unit M3.1 highway assignment modelling (May 2020)

3 Data for model development

3.1 Overview

3.1.1 This section of the report presents details of traffic data that has been used for the purpose of updating the Winsford and Middlewich Model study area.

3.1.2 The same traffic count data set was used for the main ES, SES1 and AP1 ES, and SES2 and AP2 ES. This is described in the following section.

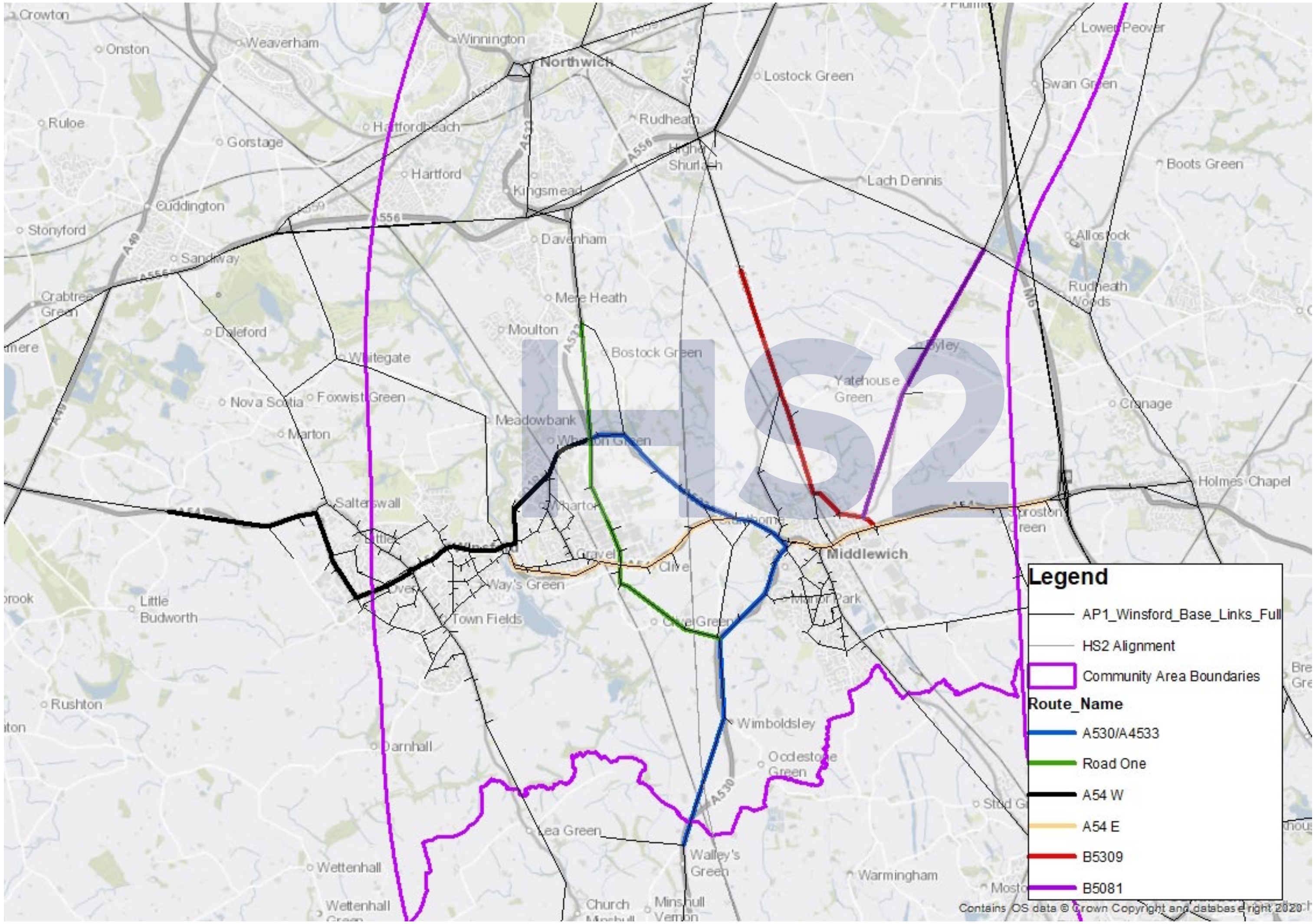
3.1.3 The journey time data has been used to inform the assessment of the AP2 revised scheme only and was not available to use for the original scheme or AP1 revised scheme. The journey time data is described in Section 3.3. For the main ES and AP1 the focus for model development was to improve localised traffic flow performance.

3.2 Traffic survey data commission

3.2.1 MWJV commissioned a programme of traffic count surveys in 2017/2018 to support the assessment of the original scheme.

3.2.2 Traffic count surveys have been used from different years and months to update the base year model. The traffic counts have been factored to June 2018 to develop a consistent dataset. Figure 3 shows the location of traffic surveys.

Figure 3: Location of traffic counts (MWJV survey commission)

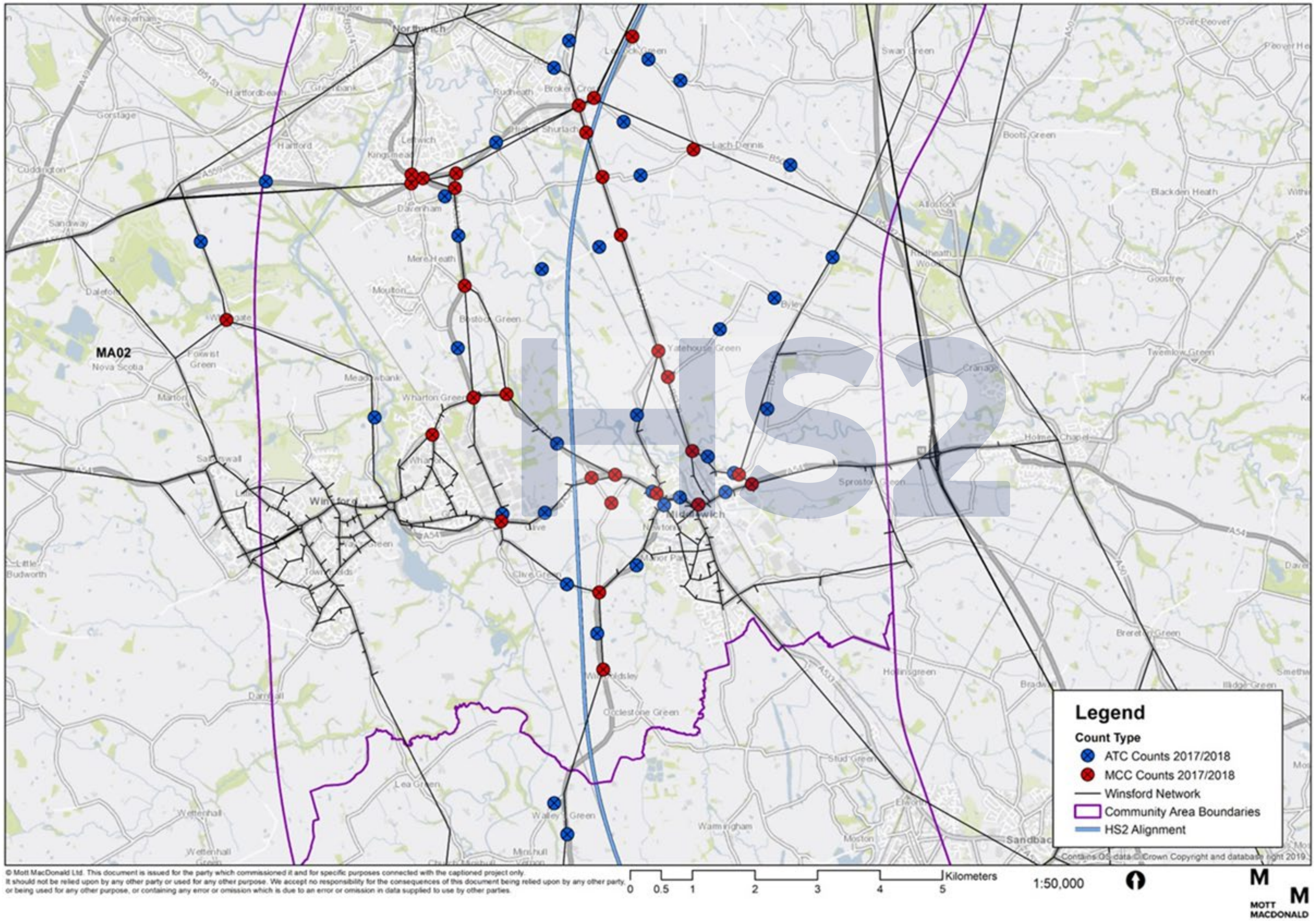


3.3 Journey time data

3.3.1 HS2 requested Trafficmaster journey time data representing June 2018 on behalf of MWJV from the DfT. This was processed by HS2 for MWJV for the journey time routes selected for the AP2 base model validation.

3.3.2 Journey time routes were defined as key routes across the model area of interest. Figure 4 shows the journey time routes chosen.

Figure 4: Location of journey time routes



4 Model development

4.1 Overview

4.1.1 For the main ES, the SES1 and AP1 ES, and the SES2 and AP2 ES, the 2014 base year model was updated to a 2018 (June) base year model by MWJV using local growth factors and the traffic count survey data that was collected between November 2017 and March 2020 (prior to COVID-19). Traffic count data has been normalised to June 2018 traffic conditions using local count data.

4.1.2 For the SES1 and AP1 ES, a review of base year model traffic flows identified that there was scope to undertake some localised improvements to the traffic model in order to provide a more robust assessment in the scheme area of interest. For the SES2 and AP2 ES, further localised improvements were made following review of model journey time data.

4.1.3 The model time periods represent the following peak hours, when the highest traffic volumes and most significant scheme impacts are expected to occur:

- AM peak hour - 08:00–09:00; and
- PM peak hour - 17:00–18:00.

4.2 Transport supply

4.2.1 For the main ES, a review of highway network detail and attributes was undertaken for the model area that is included in the Wimboldsley to Lostock Gralam area (MA02) community area.

4.2.2 This included checking the following network attributes:

- links: distance, speeds, capacity, bus lanes, traffic regulation orders;
- junctions: type; turn saturation flows, capacity, and lane utilisation;
- traffic signal control: timings, phasing, and staging; and
- routes: minimum cost paths.

4.2.3 The review highlighted that there was a good level of detailed highway network representation within the scheme area, and that this compared well with local datasets.

4.2.4 Network coding changes were implemented for the AP2 revised scheme for some roundabout junctions in the model simulation area to improve representation of junction queues and delays. This was at the locations listed below:

- A54 Holmes Chapel Road/Pochin Way;
- A533 Booth Lane/Middlewich Eastern Bypass (affects future year only);
- A533 Bostock Road/Road One; and
- B5309 Centurion Way/Pennymoor Drive.

4.2.5 In addition, for the SES1 and AP1 ES, Coalpit Lane was included in the model network in order to provide additional information on likely scheme impacts.

4.2.6 For the SES2 and AP2 ES, some further network refinements have been made to improve model journey times. These involved changes to network speed flow relationships, gap acceptance assumptions and signal timings at some locations.

4.2.7 The generalised cost values (pence per minute (PPM)/pence per kilometre (PPK)) for model assignment were updated for the SES1 and AP1 ES to reflect the latest values from the DfT TAG databook (version: July 2020). This has been retained for the SES2 and AP2 ES.

4.2.8 In summary, the model includes a sufficiently detailed level of network infrastructure to support the TA.

4.3 Transport demand

4.3.1 The original Winsford and Middlewich Model includes a detailed representation of spatial demand. The model zone system contains 207 model zones and accounts for future land-use development zones.

4.3.2 To account for the Clive Green Rolling Stock Depot, an additional zone was added to enable a more accurate representation of future demand.

4.3.3 For the main ES, the demand matrices were adjusted from 2014 to 2018 by carrying out an interpolation between base and 2030 future year matrices. For the main ES, SES1 and AP1 ES and SES2 and AP2 ES, this interpolated 2018 matrix has then been subject to matrix estimation using the available 2018 count data; and a localised traffic flow calibration exercise has been carried out to improve the correlation between observed and modelled traffic flows within the local areas of interest.

4.3.4 The count data collected from the traffic survey data commission in 2017/2018 has been applied in matrix estimation in the same way for the main ES, SES1 and AP1 ES and SES2 and AP2 ES, but with an additional count included on Coalpit Lane for the SES1 and AP1 ES and SES2 and AP2 ES.

5 Model performance

5.1 Overview

5.1.1 This section of the report focusses on the performance of the 2018 AP2 base model as produced by MWJV against observed traffic flow and journey time data.

5.1.2 The prior trip matrix assignment is the model assignment before matrix estimation is applied. This uses an interpolated parent model matrix adjusted to the HS2 zone system with an updated network that corresponds to HS2 base year. The updated network also includes revisions identified following a network review.

5.1.3 Matrix estimation uses the prior matrix and updated network mentioned above and creates an updated matrix to match count data. The post trip matrix assignment is the model assignment using this updated matrix and the same updated network used in prior assignments.

5.1.4 It is the post matrix assignment that is taken forward and used in the SES2 and AP2 ES TA.

5.2 Traffic flow

5.2.1 Observed and modelled traffic flows have been compared for the count site locations within the scheme area of interest (MA02). In total, 121 individual link counts by direction have been compared.

5.2.2 Table 3 and Table 4 present a summary comparison of individual link flows for all vehicles and by the car vehicle type for the prior matrix assignment. The comparison shows that both time periods fall well below the DfT TAG individual link count criteria of greater than 85% of comparisons achieving the flow or GEH criteria.

Table 3: AP2 Winsford and Middlewich Model - individual link flow - total all vehicle - prior

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	121	62	51%	53	44%	65	54%
PM peak hour	121	65	54%	55	45%	67	55%

Table 4: AP2 Winsford and Middlewich Model - individual link flow - car vehicle type - prior

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	121	64	53%	61	50%	68	56%
PM peak hour	121	65	54%	51	42%	66	55%

5.2.3 Figure 5 and Figure 6 show the locations of the link counts and the respective AM and PM peak hour model performance for the prior matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

5.2.4 Table 5 and Table 6 present a summary comparison of individual link flows for all vehicles and by the car vehicle type for the post matrix estimation assignment. The comparison shows that both time periods meet the DfT TAG individual link count criteria of greater than 85 percent of comparisons achieving the flow or GEH criteria.

5.2.5 The results show an overall improvement on the results from the main ES and are similar to the SES1 and AP1 ES results.

Table 5: AP2 Winsford and Middlewich Model - individual link flow - total all vehicle – post

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	121	107	88%	106	88%	108	89%
PM peak hour	121	110	91%	105	87%	112	93%

Table 6: AP2 Winsford and Middlewich Model - individual link flow - car vehicle type - post

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	121	107	88%	105	87%	108	89%
PM peak hour	121	109	90%	105	87%	111	92%

5.2.6 Figure 7 and Figure 8 show the locations of the link counts and the respective AM and PM peak hour model performance for the post matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

5.2.7 Reference should also be made to Table 13 and Table 14, Appendix A, which presents supporting details of the individual link flow performance for each count for the AM and PM time periods, post matrix estimation.

Figure 5: AM peak hour - traffic flow performance - prior

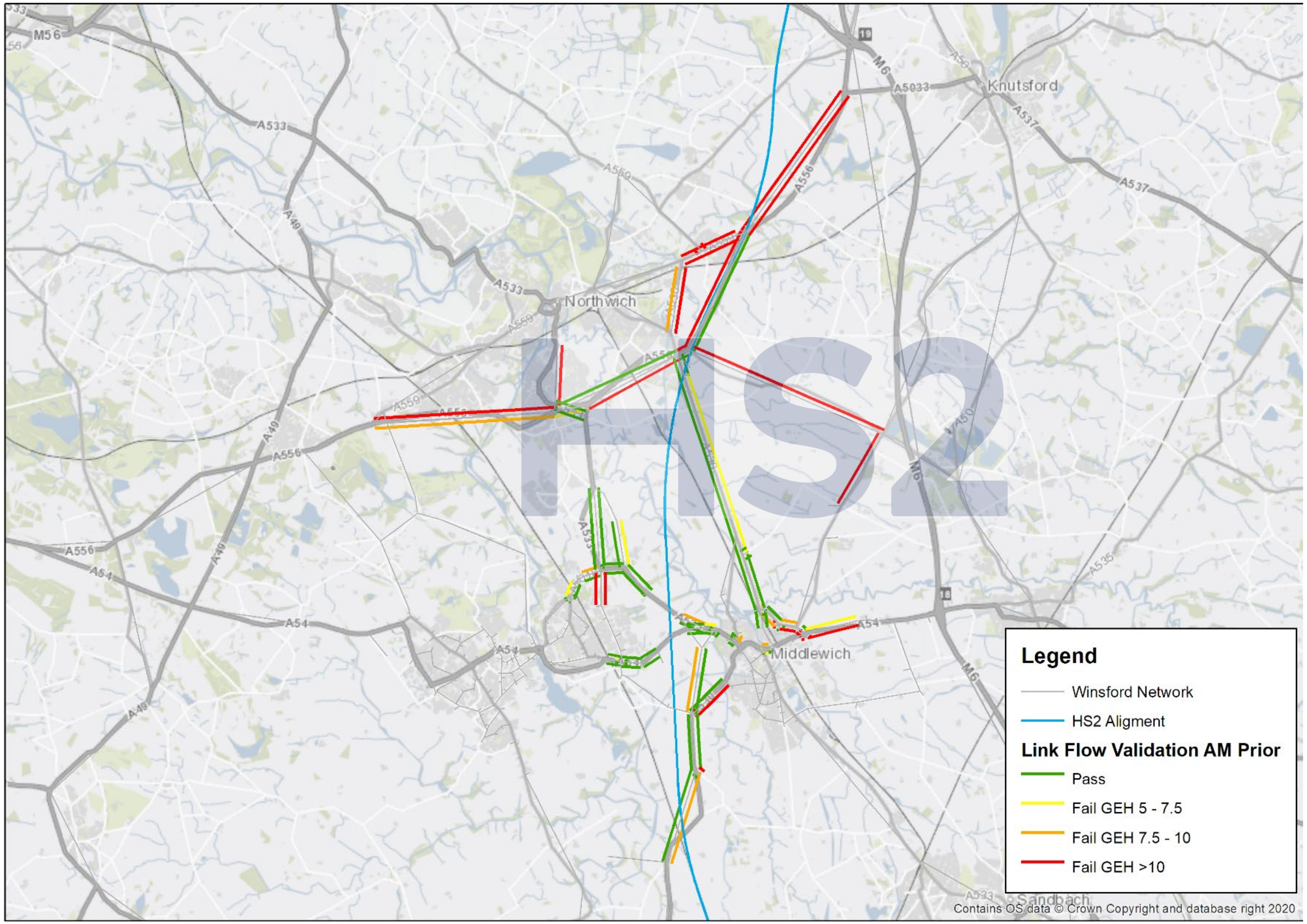


Figure 6: PM peak hour - traffic flow performance - prior

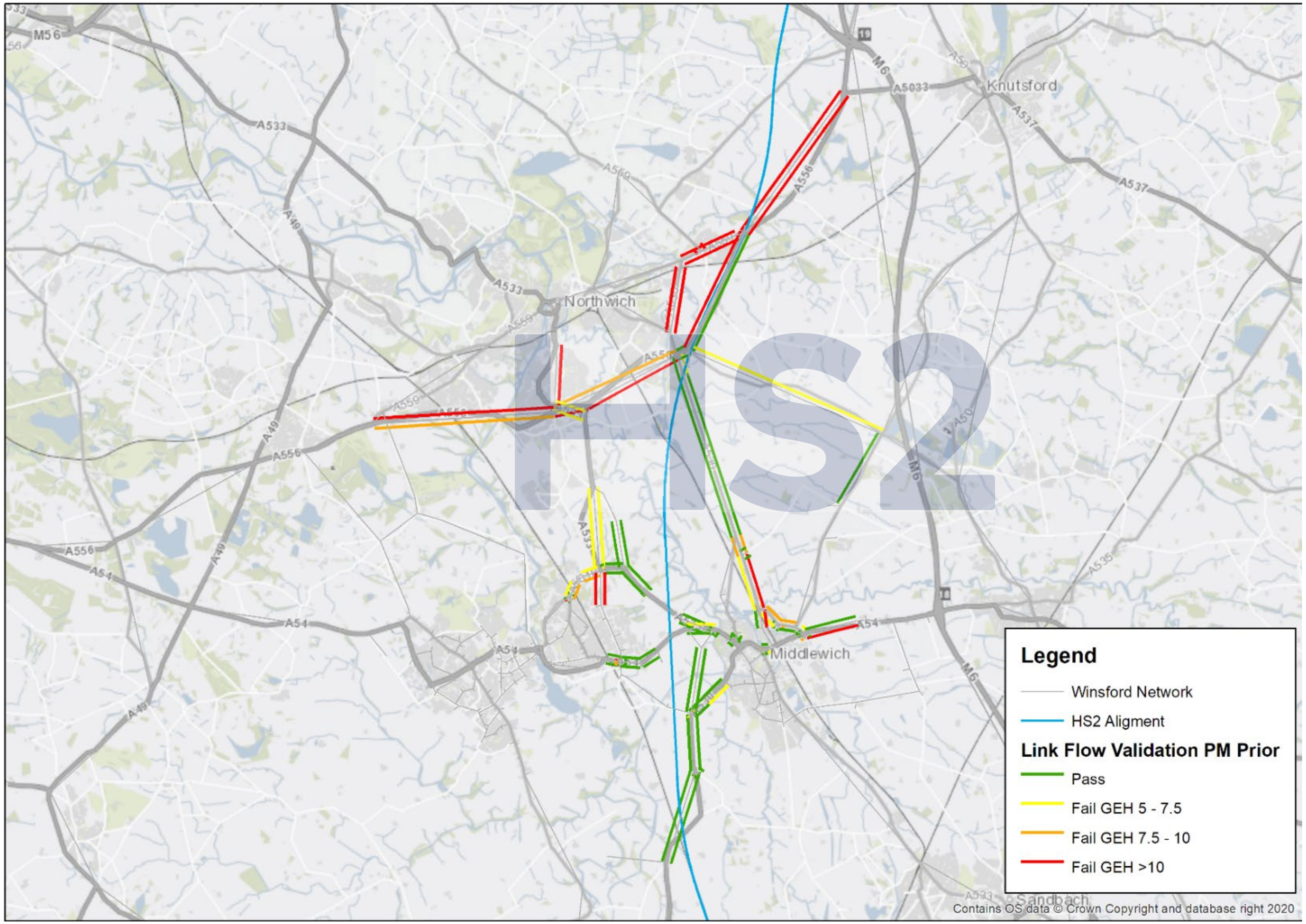


Figure 7: AM peak hour - traffic flow performance – post

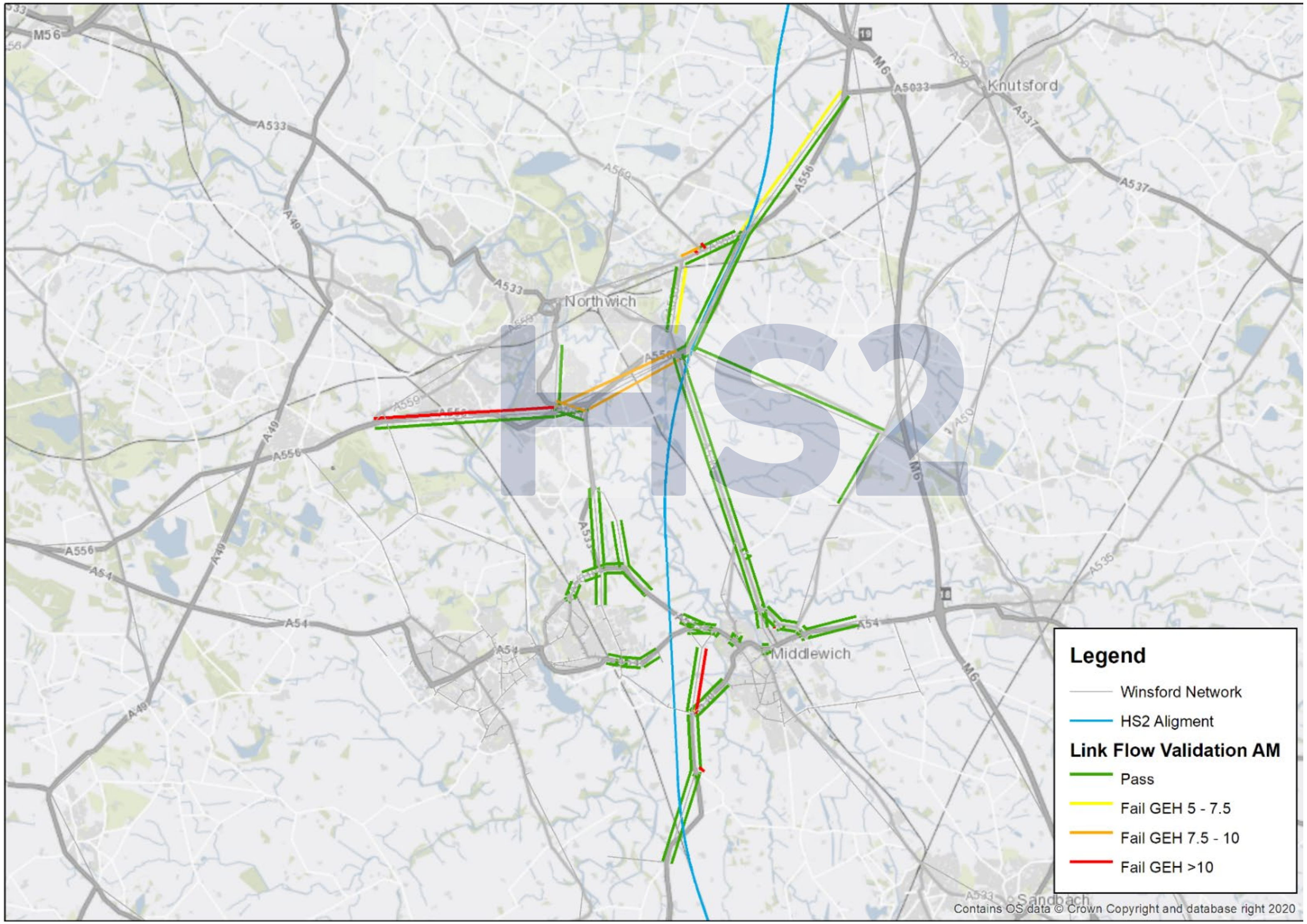
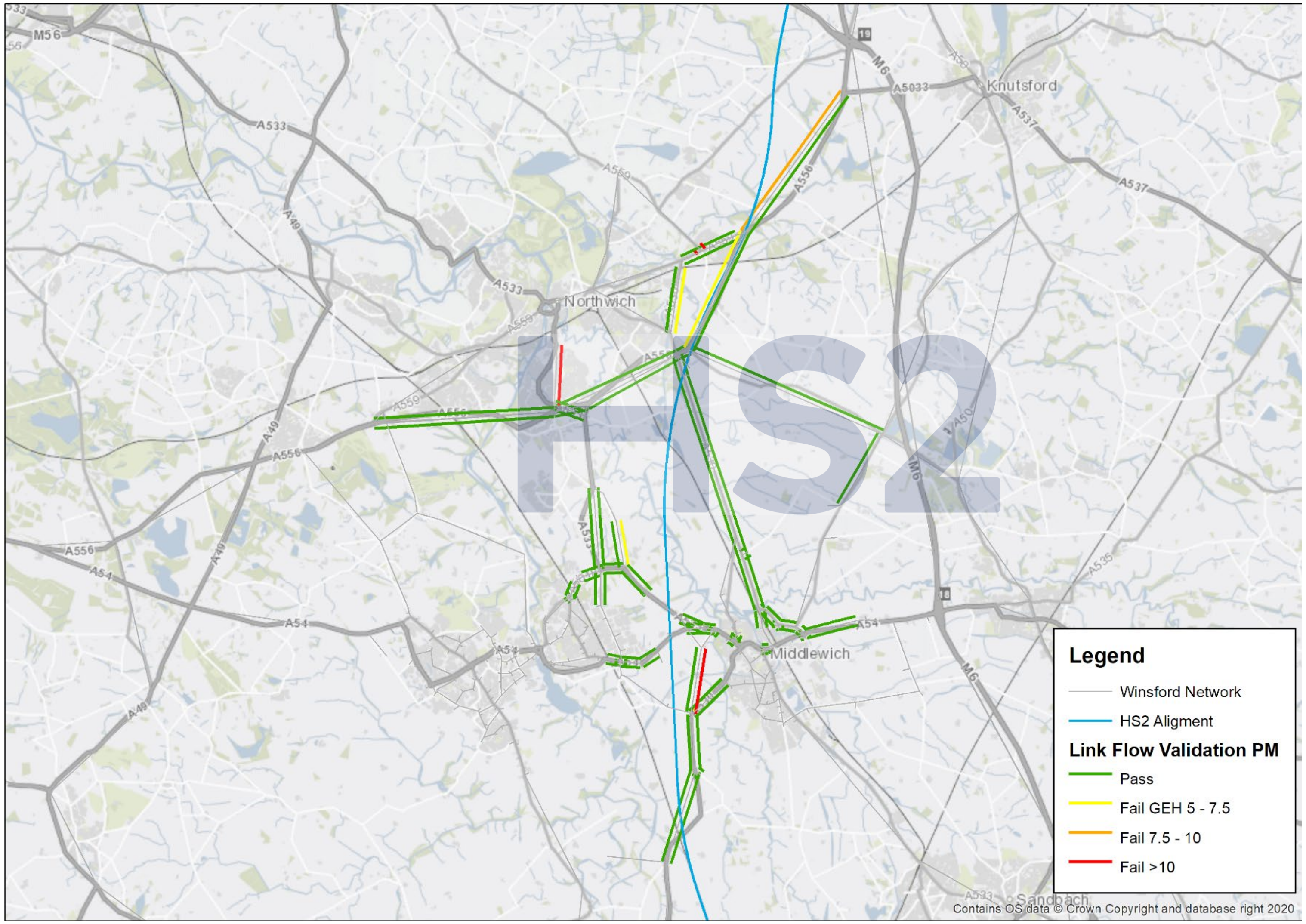


Figure 8: PM peak hour - traffic flow performance - post



5.3 Journey time results

5.3.1 Observed and modelled journey times have been compared for 6 (2-way) routes highlighted in Figure 4.

5.3.2 Table 7 summarises the prior journey time results. The table shows that journey times in both time periods fail to meet the DfT TAG journey time guideline of more than 85 percent of model route times being within 15% of the observed times (or 1 minute, if higher than 15%).

5.3.3 Figure 9 and Figure 10 show the journey time route performance for the prior matrix assignment. These show routes passing TAG criteria as green routes. Routes failing the TAG criteria are shown as orange and red routes, according to time differences.

Table 7: AP2 Winsford and Middlewich Model – journey time route summary – prior

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM peak hour	12	7	58%
PM peak hour	12	4	33%

5.3.4 Table 8 summarises the post ME journey time results. The table shows that 58% of journey time routes in the AM model and 67% of journey time routes in the PM model meet the DfT TAG individual route criteria. Several routes are also close to the individual route criteria, and there is a clear improvement on the prior matrix assignment validation in the PM period.

5.3.5 Where model journey time routes have not met the TAG criteria against the observed data, this has been due to the limiting nature of the strategic model in its ability to replicate both flow and speed at urban over capacity conditions. The speed-flow relationship calculated in the strategic model software is more complicated in reality, particularly where flow breakdown occurs and there are very slow speeds. This is despite network capacities and traffic flows being well represented. Under these circumstances the usual practice is to achieve flow calibration.

5.3.6 There is a balance between achieving both model flow and journey time performance, and despite some routes not having met the TAG journey time criteria, it is important to note that the link flow results presented earlier in this chapter show a good standard has been achieved.

5.3.7 Figure 11 and Figure 12 show the journey time route performance for the post ME assignment. These show routes passing TAG criteria as green routes. Routes failing the TAG criteria are shown as orange and red routes, according to time differences.

Table 8: AP2 Winsford and Middlewich Model – journey time route summary – post

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM peak hour	12	7	58%
PM peak hour	12	8	67%

5.3.8 Reference should be made to Table 15 and Table 16 in Appendix A, which presents supporting details of the individual route performance for the AM and PM time periods post matrix estimation. For routes where model times are outside of the DfT criteria guideline. further details are provided on why this is the case.

5.3.9 Overall, the traffic flow and journey time results collectively show evidence of a good standard which is not undermined by performance of any individual counts or routes.

Figure 9: AM peak hour – journey time performance – prior

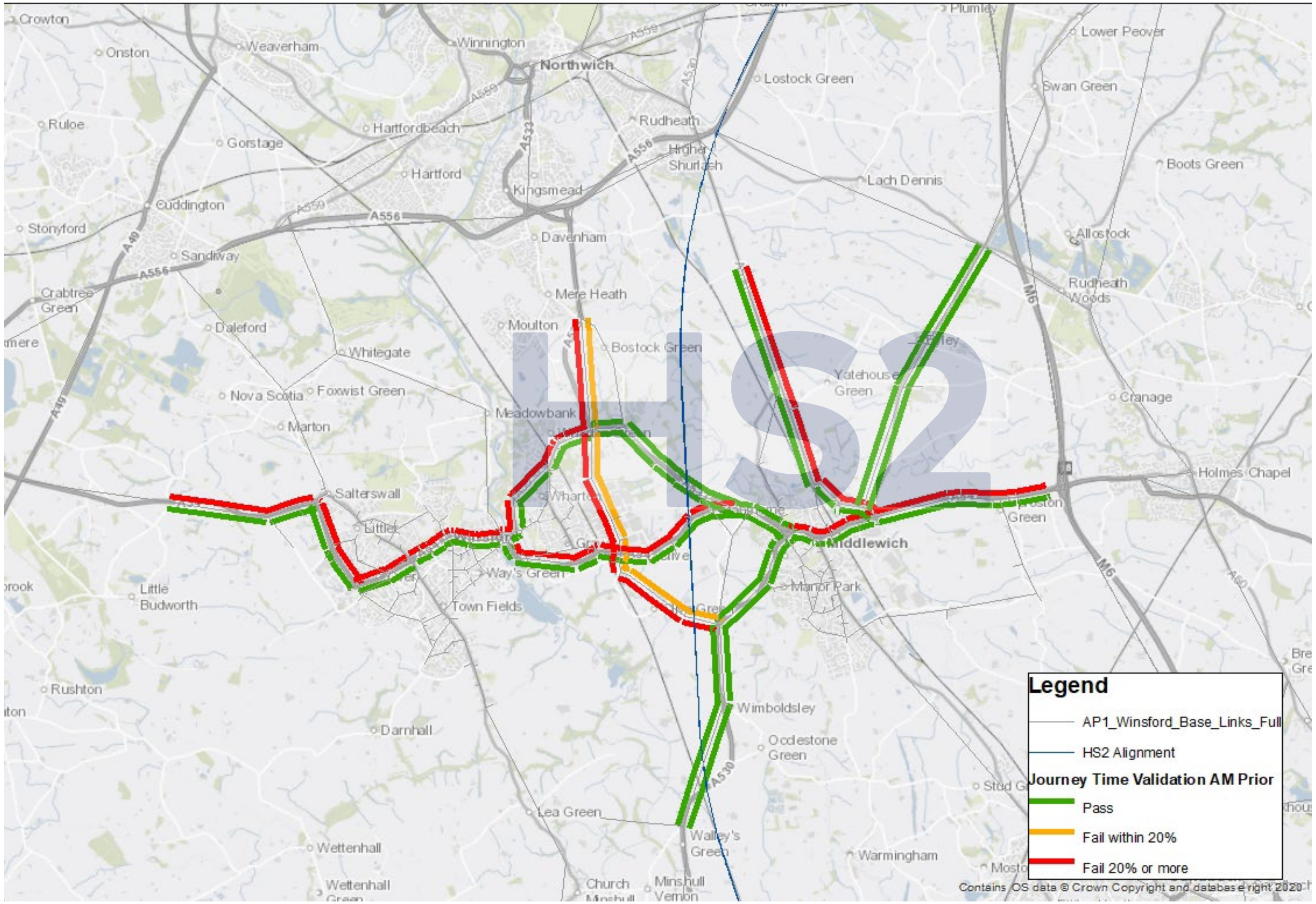


Figure 10: PM peak hour – journey time performance – prior

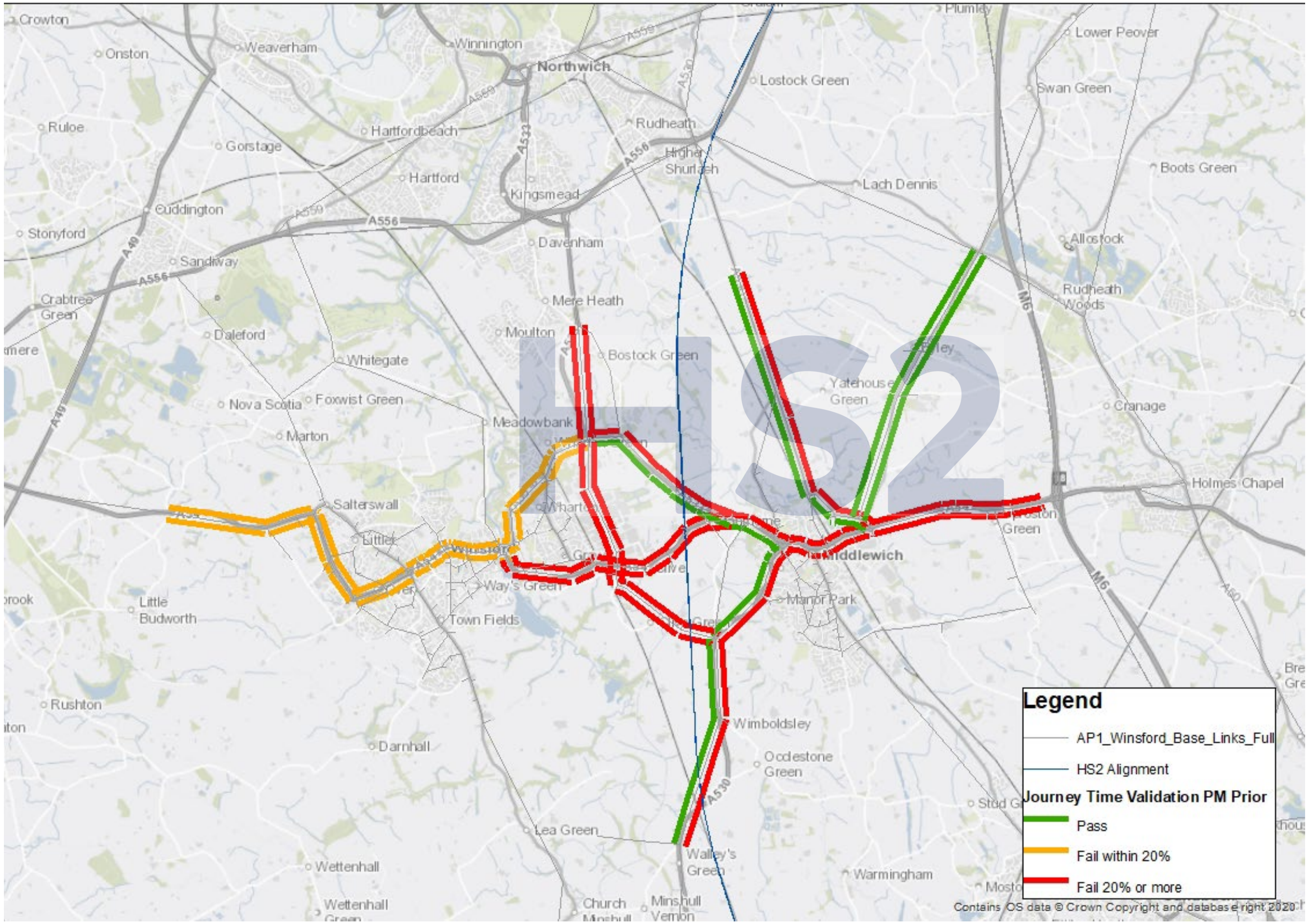


Figure 11: AM peak hour – journey time performance – post

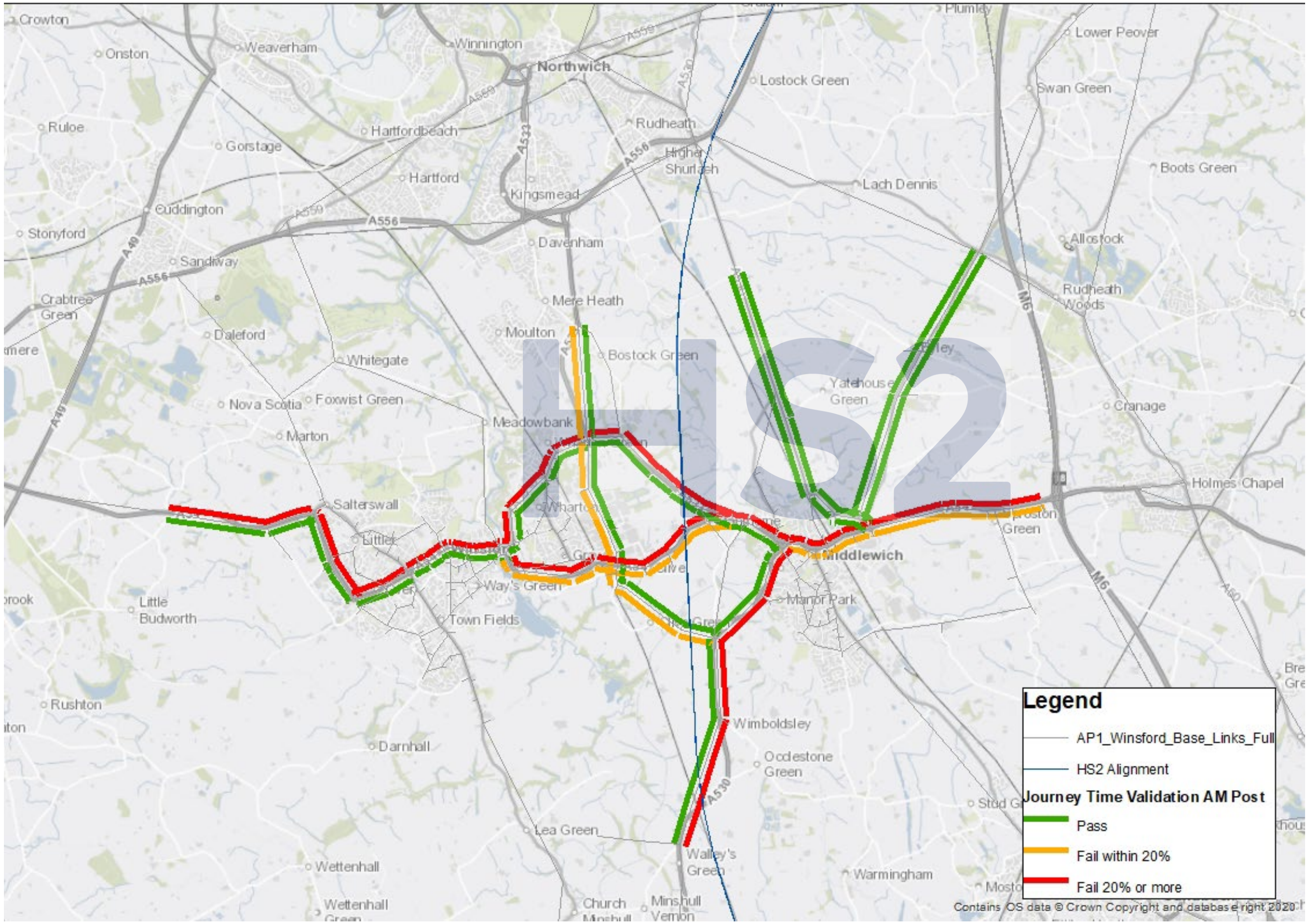
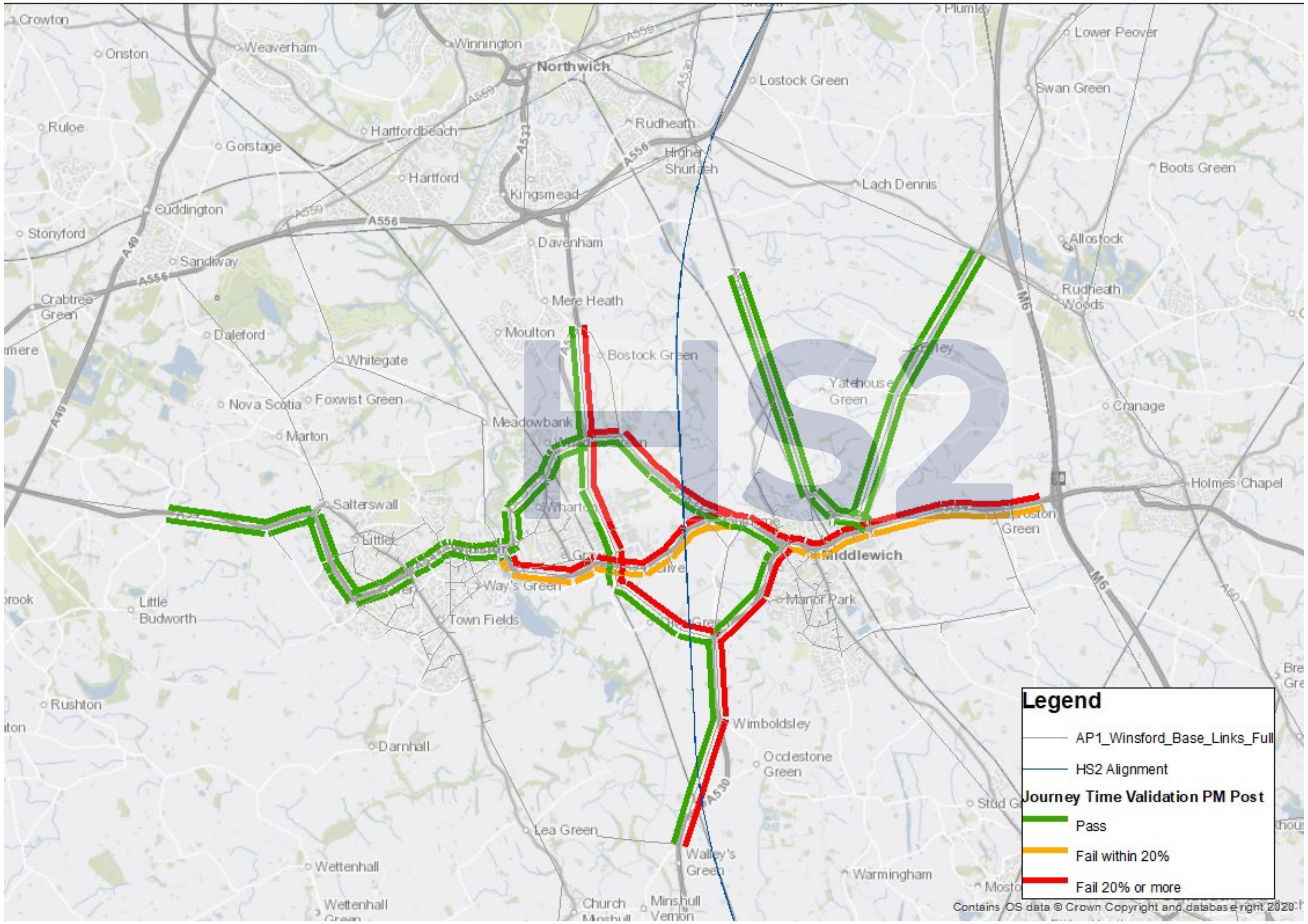


Figure 12: PM peak hour – journey time performance – post



6 Model convergence

6.1.1 Achieving a suitable level of model convergence is necessary to provide stable, consistent, and robust model results and to differentiate between real changes and those associated with differing degrees of convergence.

6.1.2 DfT TAG provides guidance on highway model convergence with recommendations on acceptable variations in link flows and costs between iterations helping to ensure the model is sufficiently stable.

6.1.3 Table 9 presents a summary of the 2018 base year highway model convergence statistics for the AP2 revised scheme by time period. Both models converge well in 50 loops or less.

Table 9: AP2 Winsford and Middlewich Model 2018 baseline model convergence

Criteria	Loop	Target	AM	PM
Flow change	N-3	> 98%	98.6	99.2
	N-2		98.6	99.5
	N-1		98.6	99.6
	N		98.8	99.7
Cost change	N-3	> 98%	99.8	99.7
	N-2		99.6	99.8
	N-1		99.7	99.8
	N		99.9	99.8
Delta		< 0.1%	0.0302/20	0.0440/20
%GAP		< 0.1%	0.046	0.043

7 Summary and conclusions

7.1.1 For the assessment of the AP2 revised scheme, the Winsford and Middlewich Model 2016 base year local highway model as supplied by CWaC has been further developed for the SES2 and AP2 ES with additional localised updates to improve model journey time performance in key areas of interest.

7.1.2 Presented below is a summary of the individual link flow model performance for all modelled time periods for the SES2 and AP2 ES, post matrix estimation. The comparison shows that both time periods exceed the 85 percent threshold of individual links meeting either the DfT TAG flow range or GEH less than five criteria.

Table 10: AP2 Winsford and Middlewich Model - individual link flow - total all vehicle – post

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	121	107	88%	106	88%	108	89%
PM peak hour	121	110	91%	105	87%	112	93%

7.1.3 Presented below is a summary of the journey time route performance for all modelled time periods at AP2, post matrix estimation. The comparison shows that 58% of journey time routes in the AM model and 67% of journey time routes in the PM model meet the DfT TAG individual route criteria. Several routes are also close to the individual route criteria, and there is a clear improvement on the prior matrix assignment validation in the PM time period.

7.1.4 Where model journey time routes have not met the TAG criteria against the observed data, this has been due to the limiting nature of the strategic model in its ability to replicate both flow and speed at urban over capacity conditions.

7.1.5 There is a balance between achieving both model flow and journey time performance, and despite some routes not having met the TAG journey time criteria, it is important to note that the link flow results presented earlier in this chapter show a good standard has been achieved.

7.1.6 Overall, the traffic flow and journey time results collectively show evidence of a good standard which is not undermined by the performance of any individual counts or routes.

Table 11: AP2 Winsford and Middlewich Model - journey time route summary – post

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM peak hour	12	7	58%
PM peak hour	12	8	67%

7.1.7 Both the AM and PM models converge satisfactorily.

7.1.8 In conclusion, the updated Winsford and Middlewich Model for the SES2 and AP2 ES provides a reliable forecasting base and forms a suitable tool for the assessment of HS2 construction and operational impacts within the scheme area of interest.

8 List of acronyms

Table 12: List of acronyms

Acronym	Description
ATC	Automatic traffic count
CWaC	Cheshire West and Chester Council
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
ES	Environmental Statement
GEH	Geoffrey Havers (statistic)
JTC	Junction turning count
LMVR	Local Model Validation Report
MCC	Manual Classified count
MPR	Model Performance Report
TA	Transport Assessment

9 References

Department for Transport (2020), *TAG unit M1.2 Data Sources and Surveys*. Public Transport Assignment. Available online at: https://www.gov.uk/government/publications/webtag-tag-unit-m1-2-data-sources-and-surveys.

Department for Transport (2020), *TAG unit M3.1 Highway Assignment Modelling*. Public Transport Assignment. Available online at: https://www.gov.uk/government/publications/webtag-tag-unit-m3-1-highway-assignment-modelling.

10 Appendix A – Model performance

Individual link flow performance

Table 13: AP2 Winsford and Middlewich Model – individual link flow detailed results – post – AM peak hour

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5039 / Centurion Way / White Park Close / Pennymoor Drive Roundabout	Pennymoor Drive Entry (VEH)	EB	69	0	0	69	151	7	3	161	92	134%	8.59	×	✓	✓
B5039 / Centurion Way / White Park Close / Pennymoor Drive Roundabout	White Park Close Exit (VEH)	SB	52	5	0	57	70	10	12	93	36	63%	4.17	✓	✓	✓
Kingsmead - London Road	London Road (N), Arm A Approach	SB	409	34	4	450	475	53	28	556	106	24%	4.73	✓	×	✓
Station Road - Hall Lane	A559 Manchester Road (W), Arm D Approach	EB	492	89	15	597	666	89	50	805	208	35%	7.85	×	×	×
A559 - A556	A559 Manchester	EB	1239	159	72	1472	1429	178	131	1738	266	18%	6.64	×	×	×

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
	Road (E), Arm A Exit															
Pochin Way	South of Centurion Wat	SB	188	29	16	233	210	17	20	246	14	6%	0.90	✓	✓	✓
A530 Nantwich Road	South of Clivegreen Lane	SB	571	73	18	667	581	75	51	707	40	6%	1.53	✓	✓	✓
A533 Bostock Road	East of Road One	EB	98	24	13	135	99	19	21	138	4	3%	0.30	✓	✓	✓
A559 - A556	A559 Manchester Road (E), Arm A Approach	WB	1105	204	93	1407	1234	206	159	1599	191	14%	4.93	✓	✓	✓
Chester Road	Birches Lane (S) to A556 Manchester Road (N)	NB	941	105	69	1116	997	137	111	1245	129	12%	3.75	✓	✓	✓
Nantwich Road	West of Brynlow Drive	NB	454	64	8	527	449	73	37	559	33	6%	1.40	✓	✓	✓
Bostock Road	East of Road One	EB	93	23	13	129	81	19	21	120	-9	-7%	0.79	✓	✓	✓
Clive Lane	South of A54	NB	367	46	23	436	387	62	44	493	57	13%	2.66	✓	✓	✓
A530_Clive Green Lane	Clive Green Lane (W), Arm C Exit	WB	453	53	23	529	457	69	47	573	44	8%	1.89	✓	✓	✓
Nantwich Road	East of Clivegreen Lane	WB	494	57	4	560	532	78	41	651	91	16%	3.71	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A530 Croxton Lane	North of A54	NB	250	36	4	290	243	32	21	296	6	2%	0.38	✓	✓	✓
A530 King Street	North of Croxton Lane	SB	472	65	30	568	483	85	59	628	59	10%	2.43	✓	✓	✓
A54 Middlewich Road	West of Clive Lane	EB	564	70	28	665	553	101	59	713	48	7%	1.81	✓	✓	✓
Clive Lane	South of A54	SB	169	26	20	216	169	27	26	223	7	3%	0.44	✓	✓	✓
B5309 Centurion Way	East of King Street	SB	202	36	10	249	201	34	30	266	17	7%	1.03	✓	✓	✓
Nantwich Road	West of Brynlow Drive	SB	499	62	7	572	529	83	43	655	83	15%	3.36	✓	✓	✓
A530_Clive Green Lane	Clive Green Lane (W), Arm C Approach	EB	286	40	18	345	155	37	30	222	-123	-36%	7.31	×	×	×
A530 - Davenham Road - Crowder's Lane	A530 (S), Arm C Exit	SB	455	83	32	572	476	85	59	620	48	8%	1.96	✓	✓	✓
Bostock Road	North of Wharton Road	NB	880	124	35	1045	893	124	80	1097	52	5%	1.60	✓	✓	✓
A533 Bostock Road	South of London Road	SB	378	41	15	436	301	39	30	369	-67	-15%	3.33	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Nantwich Road	East of Clivegreen Lane	EB	481	59	6	546	450	72	36	557	11	2%	0.48	✓	✓	✓
A556 London Road	A556 (E), Arm B Approach	WB	423	88	31	547	493	88	61	643	96	18%	3.93	✓	✓	✓
A533 Bostock Road	East of Road One	WB	114	22	13	151	113	22	19	154	4	2%	0.30	✓	✓	✓
A54 Chester Road	East of Croxton Lane	NWB	795	119	40	959	774	112	90	976	17	2%	0.53	✓	✓	✓
A556 - B5082 Penny's Lane	B5082 Penny's Lane (S), Arm B Exit	SB	368	49	7	426	370	54	30	454	28	7%	1.33	✓	✓	✓
London Road	North of A533	SB	295	22	3	322	258	21	9	288	-34	-11%	1.95	✓	✓	✓
A530 Nantwich Road	South of Clivegreen Lane	NB	725	97	24	846	720	106	64	890	43	5%	1.47	✓	✓	✓
A5018_B5356 Roundabout	Collingtree Avenue (N), Arm A Approach	SB	140	19	1	160	140	16	7	162	2	1%	0.16	✓	✓	✓
A530 - Davenham Road - Crowder's Lane	A530 (N), Arm A Exit	NB	519	77	35	632	517	98	66	681	49	8%	1.92	✓	✓	✓
King Street	North of B5309	SB	227	38	24	290	252	39	39	330	40	14%	2.27	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Bostock Road	East of Road One	WB	111	22	14	148	138	21	19	178	30	20%	2.34	✓	✓	✓
A54 Kinderton Street	East of Leadsmithy Street	WB	413	101	58	576	433	106	90	630	53	9%	2.16	✓	✓	✓
A54 St Michaels Way	West of Leadsmithy Street	EB	754	131	59	952	713	123	90	926	-26	-3%	0.84	✓	✓	✓
Station Road - Hall Lane	A559 Manchester Road (W), Arm D Exit	WB	569	78	15	665	569	78	45	692	27	4%	1.03	✓	✓	✓
A5018_B5356 Roundabout	B5355 Wharton Road (S), Arm C Approach	NB	253	40	4	302	252	40	20	313	10	3%	0.58	✓	✓	✓
Station Road - Hall Lane	A559 Manchester Road (E), Arm B Approach	WB	329	48	27	408	329	50	48	426	19	5%	0.91	✓	✓	✓
A533 Bostock Road	South of London Road	NB	382	49	15	447	389	49	31	468	21	5%	0.98	✓	✓	✓
B5081 / Moss Lane / Drakelow Lane	B5081 (N) Exit (VEH)	NB	236	26	7	269	236	21	16	272	3	1%	0.18	✓	✓	✓
A5018_B5356 Roundbout	A5018 Wharton Park Road (W),	EB	619	84	28	731	618	83	59	760	29	4%	1.07	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
	Arm D Approach															
B5309	South of King Street	EB	261	34	24	320	260	34	37	330	10	3%	0.57	✓	✓	✓
Chester Road	A556 Manchester Road (N) to Birches Lane (S)	SB	940	154	85	1183	950	156	131	1237	54	5%	1.57	✓	✓	✓
London Road	North of A533	NB	281	31	2	314	288	28	12	329	15	5%	0.83	✓	✓	✓
Nantwich Road	South of Clivegreen Lane	NB	787	105	31	924	783	113	69	964	40	4%	1.30	✓	✓	✓
Kingsmead - London Road	A553 (E), Arm B Approach	WB	875	114	52	1044	871	118	96	1085	41	4%	1.27	✓	✓	✓
Centurion Way	North of Pochin Way	WB	500	76	50	628	503	72	72	647	18	3%	0.73	✓	✓	✓
A54 Middlewich Road	West of Bostock Road	EB	272	56	33	365	262	65	53	380	15	4%	0.80	✓	✓	✓
A533 Bostock Road	North of A54	NB	285	39	13	339	291	39	27	357	18	5%	0.94	✓	✓	✓
A533	North of Bostock Road	SB	701	98	44	849	697	107	80	883	33	4%	1.13	✓	✓	✓
A54 Chester Road	East of Croxton Lane	SEB	925	148	55	1137	924	149	102	1176	38	3%	1.12	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A54 Chester Road	East of Bostock Road	EB	550	99	50	705	554	99	80	732	28	4%	1.03	✓	✓	✓
A54 St Michaels Way	West of Leadsmithy Street	WB	586	92	49	735	586	91	72	750	15	2%	0.56	✓	✓	✓
Coal Pit Lane	Coal Pit Lane	NB	104	9	3	117	105	10	4	119	2	2%	0.20	✓	✓	✓
A5018_B5356 Roundabout	A5018 Wharton Park Road (W), Arm D Exit	WB	479	83	28	591	475	83	54	611	20	3%	0.82	✓	✓	✓
A556 - A530 Roundabout	A556 (E), Arm B Approach	WB	1157	170	92	1427	1155	172	140	1466	39	3%	1.03	✓	✓	✓
A556 - A530 Roundabout	A556 (E), Arm B Exit	EB	1340	172	76	1589	1328	185	136	1650	60	4%		✓	✓	✓
Road One	North of A54	NB	507	70	29	607	509	56	65	630	23	4%		✓	✓	✓
Middlewich Road	North of Beckett Avenue	WB	215	168	35	421	329	43	43	416	-5	-1%		✓	✓	✓
A54 Chester Road	West of Croxton Lane	SEB	623	102	53	785	611	101	81	794	8	1%		✓	✓	✓
B5309	South of King Street	WB	243	37	34	316	247	47	48	342	26	8%		✓	✓	✓
A5018 Bostock Road	West of Road one	WB	595	97	27	723	589	95	61	745	22	3%	0.81	✓	✓	✓
A533 Bostock Road	North of A54	SB	279	43	17	341	291	33	27	352	11	3%	0.58	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Holmes Chapel Road	North of Pochin Way	WB	387	86	66	542	386	86	79	551	9	2%	0.39	✓	✓	✓
A530 - Davenham Road - Crowder's Lane	A530 (N), Arm A Approach	SB	457	84	43	586	469	86	57	611	26	4%	1.05	✓	✓	✓
A533	North of Bostock Road	NB	730	120	46	903	726	112	89	927	24	3%	0.80	✓	✓	✓
A530 - Davenham Road - Crowder's Lane	A530 (S), Arm C Approach	NB	611	94	37	744	601	97	69	767	23	3%	0.83	✓	✓	✓
Holmes Chapel Road	North-east of Pochin Way	WB	433	92	94	623	429	92	110	630	8	1%	0.32	✓	✓	✓
Coal Pit Lane	Coal Pit Lane	SB	110	6	2	118	2	6	3	11	-107	-91%	13.35	×	×	×
A530 King Street	North of Croxton Lane	NB	632	89	44	765	622	97	69	788	23	3%	0.82	✓	✓	✓
A54 Middlewich Road	West of Clive Lane	WB	473	87	28	590	477	78	38	593	3	0%	0.11	✓	✓	✓
Griffiths Road	Cottage Close (S) to A559 Manchester Road (N)	NB	238	43	13	296	238	38	16	292	-4	-1%	0.21	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A530 Croxton Lane	North of A54	SB	388	59	8	458	402	49	21	472	14	3%	0.65	✓	✓	✓
A5018 Bostock Road	West of Road one	EB	955	117	26	1103	902	117	76	1095	-7	-1%	0.22	✓	✓	✓
Centurion Way	North of Pochin Way	EB	404	43	50	500	403	43	56	502	1	0%	0.07	✓	✓	✓
Yatehouse Lane	East of King Street	EB	24	5	1	30	24	1	1	25	-5	-16%	0.89	✓	✓	✓
A54 Chester Road	West of Croxton Lane	NWB	632	96	42	775	619	81	69	769	-6	-1%	0.21	✓	✓	✓
Holmes Chapel Road	North-east of Pochin Way	EB	599	114	110	826	586	112	122	819	-7	-1%	0.23	✓	✓	✓
A54 Kinderton Street	East of Leadsmithy Street	EB	949	133	68	1155	932	133	109	1174	19	2%	0.56	✓	✓	✓
A54 Chester Road	East of Bostock Road	WB	631	98	46	779	619	82	70	772	-8	-1%	0.28	✓	✓	✓
Station Road - Hall Lane	A559 Manchester Road (E), Arm B Exit	EB	433	71	29	533	433	58	47	538	4	1%	0.18	✓	✓	✓
King Street	North of B5309	NB	398	59	35	492	401	63	55	519	27	5%	1.20	✓	✓	✓
Nantwich Road	South of Clivegreen Lane	SB	667	86	25	784	556	85	56	697	-87	-11%	3.18	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A54 Middlewich Road	East of Clive Lane	EB	281	61	33	378	257	65	53	375	-3	-1%	0.16	✓	✓	✓
B5309 King Street	South of Croxton Lane	SB	261	39	24	325	273	39	39	352	27	8%	1.45	✓	✓	✓
A54 Middlewich Road	East of Clive Lane	WB	369	63	32	467	340	47	45	432	-35	-8%	1.66	✓	✓	✓
Leadsmithy Street	South of A54	SB	319	79	34	437	314	74	44	431	-6	-1%	0.27	✓	✓	✓
A54 Middlewich Road	West of Bostock Road	WB	347	58	33	442	328	43	43	415	-27	-6%	1.30	✓	✓	✓
Bostock Road	North of Wharton Road	SB	563	113	32	714	557	84	56	696	-18	-2%	0.66	✓	✓	✓
B5309 King Street	South of Croxton Lane	NB	442	63	36	542	438	63	55	555	14	3%	0.59	✓	✓	✓
B5309 Centurion Way	East of King Street	NB	306	64	36	408	310	47	50	407	0	0%	0.02	✓	✓	✓
Holmes Chapel Road	North of Pochin Way	EB	822	150	83	1056	767	122	115	1003	-53	-5%	1.64	✓	✓	✓
B5309_King Street	King Street (S), Arm C Approach	NB	244	28	1	273	237	23	10	270	-3	-1%	0.18	✓	✓	✓
Leadsmithy Street	South of A54	NB	688	72	33	798	686	69	45	800	2	0%	0.05	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5309_King Street	King Street (S), Arm C Exit	SB	51	12	3	66	75	12	5	93	27	40%	2.98	✓	✓	✓
Road One	South of Bostock Road	SB	499	67	23	589	476	35	29	540	-49	-8%	2.04	✓	✓	✓
Yatehouse Lane	East of King Street	WB	39	5	0	45	39	1	0	40	-5	-11%	0.77	✓	✓	✓
A556 London Road	A556 (W), Arm D Exit	WB	844	126	39	1013	773	126	88	987	-26	-3%	0.82	✓	✓	✓
Coalpit Lane	South of Chester Road	NB	25	3	1	28	27	0	0	27	-1	-4%	0.22	✓	✓	✓
B5039 / Centurion Way / White Park Close / Pennymoor Drive Roundabout	Centurion Way Entry (VEH)	WB	374	90	52	519	363	57	62	481	-37	-7%	1.67	✓	✓	✓
School Lane	North of Lea Drive	WB	95	12	1	109	95	7	5	107	-1	-1%	0.12	✓	✓	✓
Middlewich Road	North of Beckett Avenue	EB	313	104	24	444	264	66	53	383	-61	-14%	3.01	✓	✓	✓
Coalpit Lane	South of Chester Road	SB	6	2	0	7	6	0	0	6	-1	-14%	0.39	✓	✓	✓
Kingsmead - London Road	A553 (E), Arm B Exit	EB	608	63	22	695	394	44	24	461	-234	-34%	9.75	×	×	×

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5039 / Centurion Way / White Park Close / Pennymoor Drive Roundabout	Centurion Way Exit (VEH)	EB	410	45	14	470	334	40	33	408	-62	-13%	2.97	✓	✓	✓
Road One	North of A54	SB	130	65	34	230	131	17	34	182	-48	-21%	3.32	✓	✓	✓
A556 London Road	A556 (E), Arm B Exit	EB	1471	131	61	1664	1133	136	99	1368	-297	-18%	7.62	×	×	×
A5018_B5356 Roundabout	B5355 Wharton Road (S), Arm C Exit	SB	178	36	5	224	161	15	8	185	-40	-18%	2.78	✓	✓	✓
A5018_B5356 Roundabout	Collingtree Avenue (N), Arm A Exit	NB	38	12	1	51	38	0	0	39	-13	-25%	1.90	✓	✓	✓
Griffiths Road	A559 Manchester Road (N) to Cottage Close (S)	SB	310	47	16	375	220	26	11	258	-118	-31%	6.62	×	×	×
Road One	South of Bostock Road	NB	179	77	31	287	179	15	25	219	-69	-24%	4.32	✓	✓	✓
A556 - A530 Roundabout	A556 (W), Arm D Exit	WB	1284	144	58	1491	899	144	110	1152	-339	-23%	9.31	×	×	×
A556 London Road	A556 (W), Arm D Approach	EB	1564	114	38	1723	1087	88	59	1235	-488	-28%	12.69	×	×	×

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
School Lane	North of Lea Drive	EB	122	13	1	136	7	11	5	23	-113	-83%	12.69	×	×	×
Station Road - Hall Lane	A559 Hall Lane (N), Arm A Exit	NB	272	56	26	354	0	0	0	0	-354	-100%	26.61	×	×	×
Station Road - Hall Lane	A559 Hall Lane (N), Arm A Approach	SB	392	64	32	487	0	0	0	0	-487	-100%	31.22	×	×	×
B5039 / Centurion Way / White Park Close / Pennymoor Drive Roundabout	White Park Close Entry (VEH)	NB	214	5	0	218	0	0	0	0	-218	-100%	20.90	×	×	×

Table 14: AP2 Northwich Traffic Model – individual link flow detailed results – post – PM peak hour

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5039 / Centurion Way / White Park Close / Pennymoor Drive Roundabout	Pennymoor Drive Exit (VEH)	WB	18	1	0	19	0	0	0	0	-19	-100%	6.16	×	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A54 Middlewich Road	West of Clive Lane	WB	784	75	15	877	755	75	33	862	-15	-2%	0.50	✓	✓	✓
Bostock Road	North of Wharton Road	SB	948	89	10	1052	962	85	47	1093	42	4%	1.27	✓	✓	✓
Bostock Road	North of Wharton Road	NB	623	57	10	695	616	55	31	702	7	1%	0.25	✓	✓	✓
A5018 Bostock Road	West of Road one	WB	929	86	21	1039	943	85	54	1083	44	4%	1.35	✓	✓	✓
A5018 Bostock Road	West of Road one	EB	622	63	10	700	617	63	35	715	16	2%	0.58	✓	✓	✓
A533	North of Bostock Road	SB	767	61	20	851	732	61	43	836	-15	-2%	0.51	✓	✓	✓
A533 Bostock Road	East of Road One	WB	98	13	10	120	100	5	10	115	-5	-4%	0.49	✓	✓	✓
Road One	South of Bostock Road	NB	597	45	16	661	601	44	31	676	14	2%	0.55	✓	✓	✓
A533 Bostock Road	East of Road One	EB	135	9	7	152	134	10	10	154	2	1%	0.16	✓	✓	✓
Bostock Road	East of Road One	WB	93	11	10	114	73	5	10	88	-26	-23%	2.60	✓	✓	✓
Road One	South of Bostock Road	SB	196	26	8	231	184	20	14	218	-12	-5%	0.81	✓	✓	✓
Road One	North of A54	NB	240	24	25	291	214	9	21	244	-47	-16%	2.84	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Road One	North of A54	SB	452	37	12	502	417	36	28	480	-21	-4%	0.96	✓	✓	✓
A54 Middlewich Road	East of Clive Lane	WB	330	40	15	387	356	40	22	418	31	8%	1.57	✓	✓	✓
Clive Lane	South of A54	NB	455	46	19	524	396	34	28	458	-66	-13%	2.96	✓	✓	✓
A54 Middlewich Road	West of Clive Lane	EB	427	44	16	492	436	43	22	501	9	2%	0.39	✓	✓	✓
Bostock Road	East of Road One	EB	133	10	7	151	133	10	10	152	1	1%	0.11	✓	✓	✓
London Road	North of A533	SB	358	17	2	378	224	17	7	248	-129	-34%	7.31	×	×	×
A533 Bostock Road	South of London Road	NB	433	48	10	492	411	42	26	479	-13	-3%	0.58	✓	✓	✓
A533 Bostock Road	South of London Road	SB	468	27	9	506	356	27	17	400	-105	-21%	4.95	✓	×	✓
A533 Bostock Road	North of A54	NB	282	42	9	333	260	33	22	315	-18	-5%	0.99	✓	✓	✓
A533 Bostock Road	North of A54	SB	278	21	8	309	304	26	17	347	38	12%	2.10	✓	✓	✓
A54 Chester Road	East of Bostock Road	WB	588	76	22	688	592	74	43	709	22	3%	0.82	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A54 Middlewich Road	West of Bostock Road	EB	263	30	17	315	290	43	31	363	48	15%	2.63	✓	✓	✓
A54 Chester Road	East of Bostock Road	EB	541	51	25	623	593	69	48	710	88	14%	3.39	✓	✓	✓
Coalpit Lane	South of Chester Road	NB	21	3	1	25	15	0	0	15	-9	-38%	2.08	✓	✓	✓
Coalpit Lane	South of Chester Road	SB	4	0	2	6	4	0	0	4	-2	-29%	0.75	✓	✓	✓
A54 Middlewich Road	West of Bostock Road	WB	307	35	14	357	333	40	22	395	38	11%	1.96	✓	✓	✓
Middlewich Road	North of Beckett Avenue	WB	179	153	14	348	374	42	22	438	90	26%	4.53	✓	✓	✓
A54 Middlewich Road	East of Clive Lane	EB	382	42	18	447	349	41	31	421	-26	-6%	1.25	✓	✓	✓
Nantwich Road	East of Clivegreen Lane	WB	450	45	2	498	406	40	19	466	-32	-6%	1.45	✓	✓	✓
Nantwich Road	South of Clivegreen Lane	NB	946	55	13	1022	941	82	51	1073	51	5%	1.58	✓	✓	✓
Nantwich Road	East of Clivegreen Lane	EB	555	48	2	609	548	38	18	604	-5	-1%	0.22	✓	✓	✓
Nantwich Road	West of Brynlow Drive	SB	456	24	2	483	405	41	20	466	-17	-3%	0.77	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Nantwich Road	South of Clivegreen Lane	SB	674	30	7	712	556	61	30	648	-64	-9%	2.47	✓	✓	✓
School Lane	North of Lea Drive	WB	90	14	2	105	40	3	2	46	-59	-56%	6.81	×	✓	✓
A530 Nantwich Road	South of Clivegreen Lane	NB	869	73	19	969	915	80	49	1044	75	8%	2.36	✓	✓	✓
School Lane	North of Lea Drive	EB	85	11	1	96	39	8	3	50	-46	-48%	5.39	×	✓	✓
Middlewich Road	North of Beckett Avenue	EB	311	137	20	471	296	43	31	371	-100	-21%	4.89	✓	×	✓
A54 Chester Road	West of Croxton Lane	NWB	588	67	11	669	598	76	44	719	50	7%	1.90	✓	✓	✓
A54 Chester Road	West of Croxton Lane	SEB	612	72	24	714	600	70	48	719	5	1%	0.17	✓	✓	✓
A530 Croxton Lane	North of A54	SB	448	51	4	503	474	24	12	510	7	1%	0.31	✓	✓	✓
A54 Chester Road	East of Croxton Lane	NWB	860	86	15	966	821	100	55	976	10	1%	0.32	✓	✓	✓
A530 Croxton Lane	North of A54	NB	352	28	5	386	345	24	11	380	-7	-2%	0.34	✓	✓	✓
A530 King Street	North of Croxton Lane	SB	632	48	20	701	643	63	42	747	46	7%	1.73	✓	✓	✓
B5309 King Street	South of Croxton Lane	NB	603	56	43	702	654	50	43	747	45	6%	1.68	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A54 Chester Road	East of Croxton Lane	SEB	980	114	27	1128	952	93	61	1106	-22	-2%	0.65	✓	✓	✓
Nantwich Road	West of Brynlow Drive	NB	550	33	2	590	547	40	19	607	17	3%	0.70	✓	✓	✓
A54 St Michaels Way	West of Leadsmithy Street	EB	691	53	21	776	657	55	44	756	-20	-3%	0.71	✓	✓	✓
A54 Kinderton Street	East of Leadsmithy Street	WB	656	72	21	750	614	72	46	732	-18	-2%	0.66	✓	✓	✓
Leadsmithy Street	South of A54	NB	566	52	11	634	597	47	23	667	33	5%	1.29	✓	✓	✓
Leadsmithy Street	South of A54	SB	553	48	14	622	529	50	33	611	-10	-2%	0.42	✓	✓	✓
A54 Kinderton Street	East of Leadsmithy Street	EB	619	55	26	705	645	55	39	740	35	5%	1.31	✓	✓	✓
Holmes Chapel Road	North of Pochin Way	WB	326	41	29	396	308	41	39	388	-8	-2%	0.42	✓	✓	✓
Holmes Chapel Road	North of Pochin Way	EB	592	70	34	699	582	70	48	700	1	0%	0.06	✓	✓	✓
Centurion Way	North of Pochin Way	EB	326	43	25	395	324	39	36	399	4	1%	0.20	✓	✓	✓
Holmes Chapel Road	North-east of Pochin Way	WB	385	48	58	491	371	51	60	482	-10	-2%	0.44	✓	✓	✓
Centurion Way	north of Pochin Way	WB	474	43	17	536	493	43	40	575	39	7%	1.65	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Holmes Chapel Road	Northeast of Pochin Way	EB	639	83	57	782	636	83	78	798	16	2%	0.56	✓	✓	✓
Pochin Way	South of Centurion Wat	SB	36	7	22	66	58	7	3	68	3	4%	0.32	✓	✓	✓
B5309 Centurion Way	East of King Street	SB	244	22	14	281	244	22	25	291	10	4%	0.60	✓	✓	✓
B5309 Centurion Way	East of King Street	NB	370	31	10	411	375	37	31	443	32	8%	1.57	✓	✓	✓
B5309	South of King Street	EB	216	26	20	263	212	23	24	259	-4	-2%	0.26	✓	✓	✓
King Street	North of B5309	SB	276	39	17	332	275	39	32	346	13	4%	0.72	✓	✓	✓
B5309	South of King Street	WB	393	38	15	447	399	38	38	475	27	6%	1.28	✓	✓	✓
B5309 King Street	South of Croxton Lane	SB	260	40	14	315	260	39	31	331	16	5%	0.89	✓	✓	✓
Yatehouse Lane	East of King Street	WB	110	10	1	120	110	0	0	110	-10	-8%	0.90	✓	✓	✓
King Street	North of B5309	NB	501	50	29	581	575	50	43	668	87	15%	3.46	✓	✓	✓
Yatehouse Lane	East of King Street	EB	40	4	1	44	15	0	0	16	-28	-64%	5.17	×	✓	✓
King Street	North of B5309	SB	276	39	17	332	275	39	32	346	13	4%	0.72	✓	✓	✓
A54 St Michaels Way	West of Leadsmithy Street	WB	741	74	13	833	664	66	39	769	-64	-8%	2.25	✓	✓	✓
Clive Lane	South of A54	SB	259	27	3	289	272	26	14	312	23	8%	1.31	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A530 Nantwich Road	South of Clivegreen Lane	SB	537	53	4	595	532	55	28	614	19	3%	0.78	✓	✓	✓
London Road	North of A533	NB	363	37	1	401	338	37	16	391	-9	-2%	0.47	✓	✓	✓
A533	North of Bostock Road	NB	797	54	15	871	789	58	41	887	17	2%	0.57	✓	✓	✓
A530 King Street	North of Croxton Lane	NB	783	60	50	895	801	69	51	921	27	3%	0.88	✓	✓	✓
B5309_King Street	King Street (S), Arm C Exit	SB	164	22	0	187	99	19	8	127	-59	-32%	4.73	✓	✓	✓
B5309_King Street	King Street (S), Arm C Approach	NB	163	24	1	189	212	15	7	233	45	24%	3.08	✓	✓	✓
A5018_B5356 Roundabout	Collingtree Avenue (N), Arm A Exit	NB	128	19	0	147	128	2	1	130	-16	-11%	1.37	✓	✓	✓
A5018_B5356 Roundabout	Collingtree Avenue (N), Arm A Approach	SB	67	9	1	77	67	6	2	75	-2	-3%	0.23	✓	✓	✓
A5018_B5356 Roundabout	B5355 Wharton Road (S), Arm C Exit	SB	309	35	0	349	264	35	16	315	-34	-10%	1.88	✓	✓	✓
A5018_B5356 Roundabout	B5355 Wharton Road (S), Arm C Approach	NB	204	23	0	232	201	17	12	230	-1	-1%	0.09	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A5018_B5356 Roundabout	A5018 Wharton Park Road (W), Arm D Exit	WB	678	54	10	743	691	56	32	780	37	5%	1.33	✓	✓	✓
A5018_B5356 Roundabout	A5018 Wharton Park Road (W), Arm D Approach	EB	519	44	10	573	516	44	22	582	9	2%	0.37	✓	✓	✓
A556 London Road	A556 (E), Arm B Exit	EB	1052	98	29	1181	1046	83	58	1188	7	1%	0.21	✓	✓	✓
A556 London Road	A556 (E), Arm B Approach	WB	1499	86	12	1598	1244	73	41	1359	-239	-15%	6.21	×	✓	✓
A556 London Road	A556 (W), Arm D Exit	WB	1557	88	15	1662	1532	88	48	1668	6	0%	0.15	✓	✓	✓
A556 London Road	A556 (W), Arm D Approach	EB	1005	109	18	1132	953	89	52	1094	-38	-3%	1.13	✓	✓	✓
A530 - Davenham Road - Crowder's Lane	A530 (N), Arm A Exit	NB	678	75	27	782	697	74	50	821	39	5%	1.37	✓	✓	✓
A530 - Davenham Road - Crowder's Lane	A530 (N), Arm A Approach	SB	731	65	25	823	642	67	43	752	-71	-9%	2.54	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A530 - Davenham Road - Crowder's Lane	A530 (S), Arm C Exit	SB	696	65	22	785	681	63	42	786	1	0%	0.02	✓	✓	✓
A530 - Davenham Road - Crowder's Lane	A530 (S), Arm C Approach	NB	755	78	22	857	768	69	52	888	31	4%	1.06	✓	✓	✓
Kingsmead - London Road	London Road (N), Arm A Approach	SB	250	17	1	270	625	25	15	665	395	146%	18.27	×	×	×
Kingsmead - London Road	A553 (E), Arm B Exit	EB	513	40	4	558	517	40	22	579	21	4%	0.87	✓	✓	✓
Kingsmead - London Road	A553 (E), Arm B Approach	WB	944	83	13	1045	916	83	46	1045	0	0%	0.01	✓	✓	✓
A556 - A530 Roundabout	A556 (E), Arm B Exit	EB	1288	108	51	1449	1278	115	88	1481	32	2%	0.83	✓	✓	✓
A556 - A530 Roundabout	A556 (E), Arm B Approach	WB	1689	150	36	1877	1678	152	93	1923	46	2%	1.07	✓	✓	✓
A556 - A530 Roundabout	A556 (W), Arm D Exit	WB	1435	121	29	1587	1433	121	74	1629	42	3%	1.04	✓	✓	✓
A556 - B5082 Penny's Lane	B5082 Penny's Lane (S), Arm B Exit	SB	267	20	2	289	271	20	13	304	14	5%	0.83	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Station Road - Hall Lane	A559 Hall Lane (N), Arm A Exit	NB	431	48	9	489	0	0	0	0	-489	-100%	31.27	×	×	×
Station Road - Hall Lane	A559 Hall Lane (N), Arm A Approach	SB	308	33	7	349	0	0	0	0	-349	-100%	26.42	×	×	×
Station Road - Hall Lane	A559 Manchester Road (E), Arm B Exit	EB	348	37	8	396	318	37	24	379	-16	-4%	0.83	✓	✓	✓
Station Road - Hall Lane	A559 Manchester Road (E), Arm B Approach	WB	523	36	11	571	449	36	26	511	-60	-11%	2.60	✓	✓	✓
Station Road - Hall Lane	A559 Manchester Road (W), Arm D Exit	WB	709	57	7	775	709	57	30	796	21	3%	0.75	✓	✓	✓
Station Road - Hall Lane	A559 Manchester Road (W), Arm D Approach	EB	541	60	6	609	541	60	30	631	22	4%	0.87	✓	✓	✓
A559 - A556	A559 Manchester Road (E), Arm A Exit	EB	1115	105	50	1272	1384	130	94	1607	335	26%	8.84	×	×	×
A559 - A556	A559 Manchester Road (E), Arm A Approach	WB	1818	139	39	1998	1806	141	91	2038	40	2%	0.89	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Griffiths Road	Cottage Close (S) to A559 Manchester Road (N)	NB	254	17	11	283	239	21	9	269	-14	-5%	0.85	✓	✓	✓
Griffiths Road	A559 Manchester Road (N) to Cottage Close (S)	SB	413	19	12	445	277	20	9	305	-140	-31%	7.21	×	×	×
Chester Road	Birches Lane (S) to A556 Manchester Road (N)	NB	895	77	51	1024	1050	95	80	1225	201	20%	6.00	×	×	×
Chester Road	A556 Manchester Road (N) to Birches Lane (S)	SB	1405	85	36	1527	1393	107	72	1572	45	3%	1.14	✓	✓	✓
B5081 / Moss Lane / Drakelow Lane	B5081 (N) Exit (VEH)	NB	67	5	3	75	71	10	7	88	13	17%	1.43	✓	✓	✓
B5039 / Centurion Way / White Park Close / Pennymoor Drive Roundabout	Centurion Way Exit (VEH)	EB	233	18	13	264	195	18	25	237	-27	-10%	1.70	✓	✓	✓
B5039 / Centurion	Centurion Way Entry (VEH)	WB	514	38	11	563	487	38	32	556	-7	-1%	0.28	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Way / White Park Close / Pennymoor Drive Roundabout																
B5039 / Centurion Way / White Park Close / Pennymoor Drive Roundabout	White Park Close Exit (VEH)	SB	140	5	0	145	190	19	8	217	72	50%	5.37	×	✓	✓
B5039 / Centurion Way / White Park Close / Pennymoor Drive Roundabout	White Park Close Entry (VEH)	NB	73	2	0	75	0	0	0	0	-75	-100%	12.23	×	✓	✓
B5039 / Centurion Way / White Park Close / Pennymoor Drive Roundabout	Pennymoor Drive Exit (VEH)	WB	48	3	0	51	0	0	0	0	-51	-100%	10.09	×	✓	✓
B5039 / Centurion Way / White Park Close / Pennymoor	Pennymoor Drive Entry (VEH)	EB	25	1	0	26	28	14	9	51	25	96%	4.02	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Drive Roundabout																
Coal Pit Lane	Coal Pit Lane	SB	143	6	0	148	4	1	1	6	-142	-96%	16.16	×	×	×
Coal Pit Lane	Coal Pit Lane	NB	114	7	1	122	152	11	5	168	46	38%	3.83	✓	✓	✓
A530_Clive Green Lane	Clive Green Lane (W), Arm C Exit	WB	564	58	18	643	473	49	35	557	-86	-13%	3.51	✓	✓	✓
A530_Clive Green Lane	Clive Green Lane (W), Arm C Approach	EB	339	42	3	383	239	26	14	279	-104	-27%	5.72	×	×	×

Individual route journey time performance

Table 15: AP2 Winsford and Middlewich Model – individual route journey time detailed results – post – AM peak hour

Route Name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
A530/A4533	NB	9,125	650	673	23	3.5%	✓	
A530/A4533	SB	9,186	807	629	-178	-22.1%	×	Unable to replicate slow observed speeds in Middlewich turning right from A54 to the A530.
Road One	NB	6,203	519	424	-96	-18.4%	×	Unable to replicate slow speeds where Road One intersects Bostock Road.
Road One	SB	6,201	701	710	9	1.3%	✓	
A54 W	EB	8,764	740	562	-178	-24.1%	×	Unable to replicate slow speed where Bostock Road meets Road One.

Route Name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
A54 W	WB	8,887	672	585	-87	-12.9%	✓	
A54 E	EB	9,210	1,042	752	-289	-27.8%	×	Unable to represent delays on the A45 at Winsford Bridge roundabout.
A54 E	WB	9,328	988	832	-156	-15.8%	×	Unable to replicate slow speeds through Middlewich centre.
B5309	NB	4,823	296	303	7	2.5%	✓	
B5309	SB	4,778	275	262	-13	-4.9%	✓	
B5081	NB	2,898	150	132	-17	-11.6%	✓	
B5081	SB	2,898	140	143	4	2.6%	✓	

Table 16: AP2 Winsford and Middlewich Model – individual route journey time detailed results – post – PM peak hour

Route Name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
A530/A4533	NB	9,125	637	620	-17	-2.6%	✓	
A530/A4533	SB	9,186	882	593	-289	-32.7%	×	Unable to replicate slow observed speeds in Middlewich turning right from A54 to the A530.
Road One	NB	6,203	583	536	-47	-8.0%	✓	
Road One	SB	6,201	1,034	813	-221	-21.4%	×	Unable to replicate a very slow speeds where Clive Green Lane meets A530.
A54 W	EB	8,799	638	545	-93	-14.5%	✓	
A54 W	WB	8,926	716	701	-14	-2.0%	✓	
A54 E	EB	9,210	1,090	732	-358	-32.8%	×	Unable to represent delays on the A45 at Winsford Bridge roundabout.

Route Name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
A54 E	WB	9,328	1,219	1,005	-214	-17.6%	×	Unable to replicate slow speeds through Middlewich centre.
B5309	NB	4,823	282	327	45	15.9%	✓	
B5309	SB	4,778	371	320	-51	-13.7%	✓	
B5081	NB	2,898	155	130	-25	-16.0%	✓	
B5081	SB	2,898	151	140	-12	-7.8%	✓	

Annex F: Model performance report – A500 Crewe Model

Contents

Tables

Figures

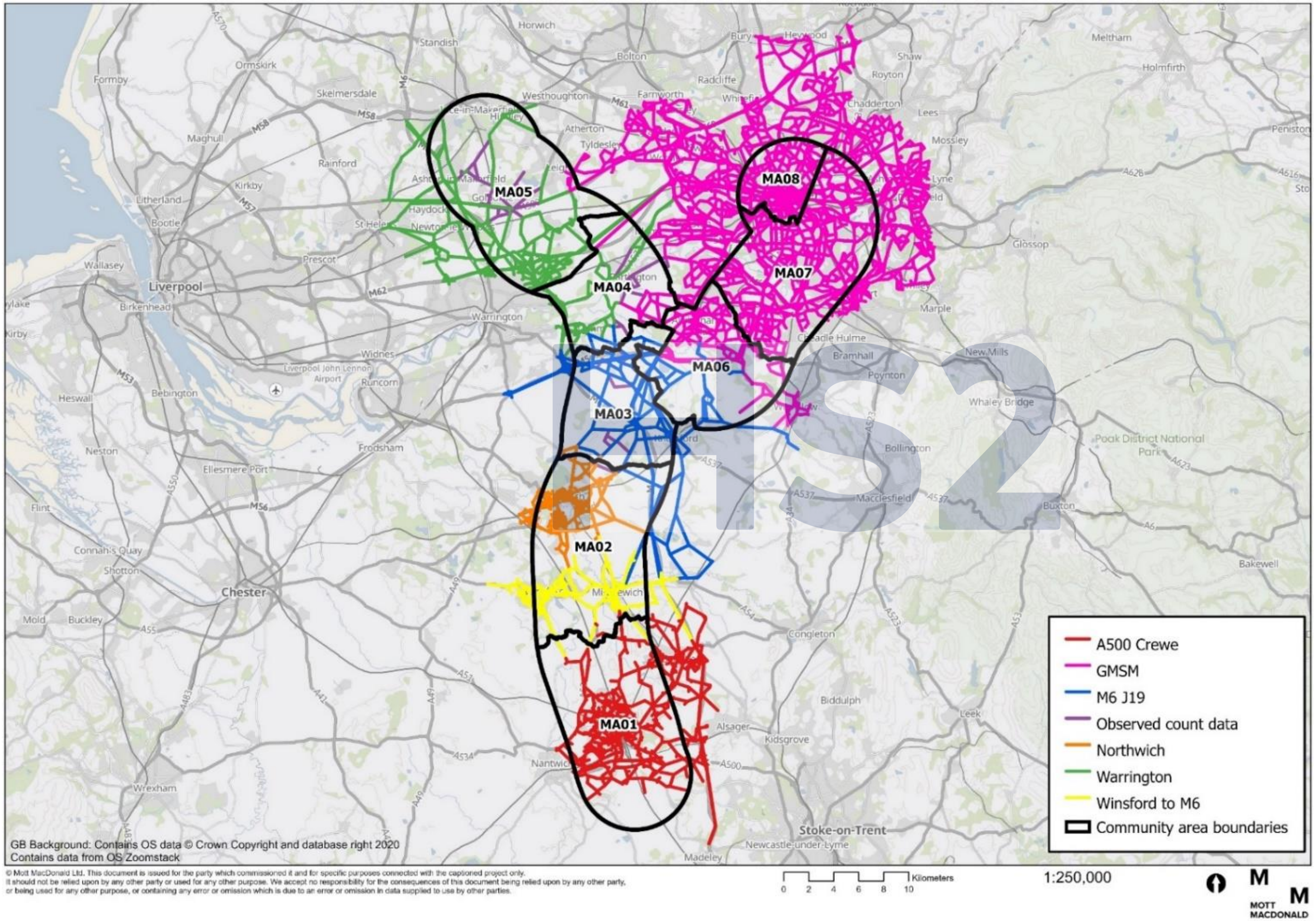
1 Introduction

1.1 Background

1.1.1 For the purpose of assessment, the route of the original scheme is split into a number of geographical areas referred to as Community Areas. The A500 Crewe Model, has been utilised to provide an evidence base for the scheme Transport Assessment (TA) for the Community Area referred to as MA01 Hough to Walley's Green area (MA01). Cheshire East Council (CEC) released copies of the latest available A500 Crewe Model versions (as of June 2020) to HS2 Ltd.

1.1.2 Reference should be made to Figure 1 which shows the geographic coverage of strategic transport models that have been utilised for the TA.

Figure 1: Strategic transport model coverage for the High Speed Rail (Crewe – Manchester) Transport Assessment



1.2 Hybrid Bill and Additional Provision 1 Environmental Statement

1.2.1 The A500 Crewe Model was updated by HS2 Ltd's transport consultants, Mott MacDonald WSP Joint Venture (MWJV), to include localised improvements within the original scheme area of interest. This is described in the Model Performance Report for the A500 Crewe Model, in the main TA Part 4 Addendum (Volume 5, Appendix: TR-005-00000, Report 2 of 2).

1.2.2 Additional Provision (AP) amendments are changes to the scheme that include requirements for additional powers in the High Speed Rail (Crewe – Manchester) Bill. At Additional Provision 1 (AP1) further model development work was undertaken which is described in the AP1 Model Performance Report for the A500 Crewe Model, in the SES1 and AP1 ES Transport Assessment Part 4 Addendum (SES1 and AP1 ES Volume 5, Appendix: TR-005-00000).

1.3 Additional Provision 2 Environmental Statement

1.3.1 Further model development has been undertaken by MWJV for Additional Provision 2 (AP2). The Baseline model has been updated for the assessment to reflect the use of journey time data in the base model validation, and refinement of network coding to improve model performance.

1.4 Purpose of this report

1.4.1 This report documents the updates made for the AP2 revised scheme and model performance of the HS2 AP2 A500 Crewe Model.

1.5 Model framework

1.5.1 The A500 Crewe model framework is comprised of the following models:

- Variable Demand Model (DIADEM);
- Strategic Highway Assignment Model (SATURN); and
- Strategic Rail Assignment Model (VISUM).

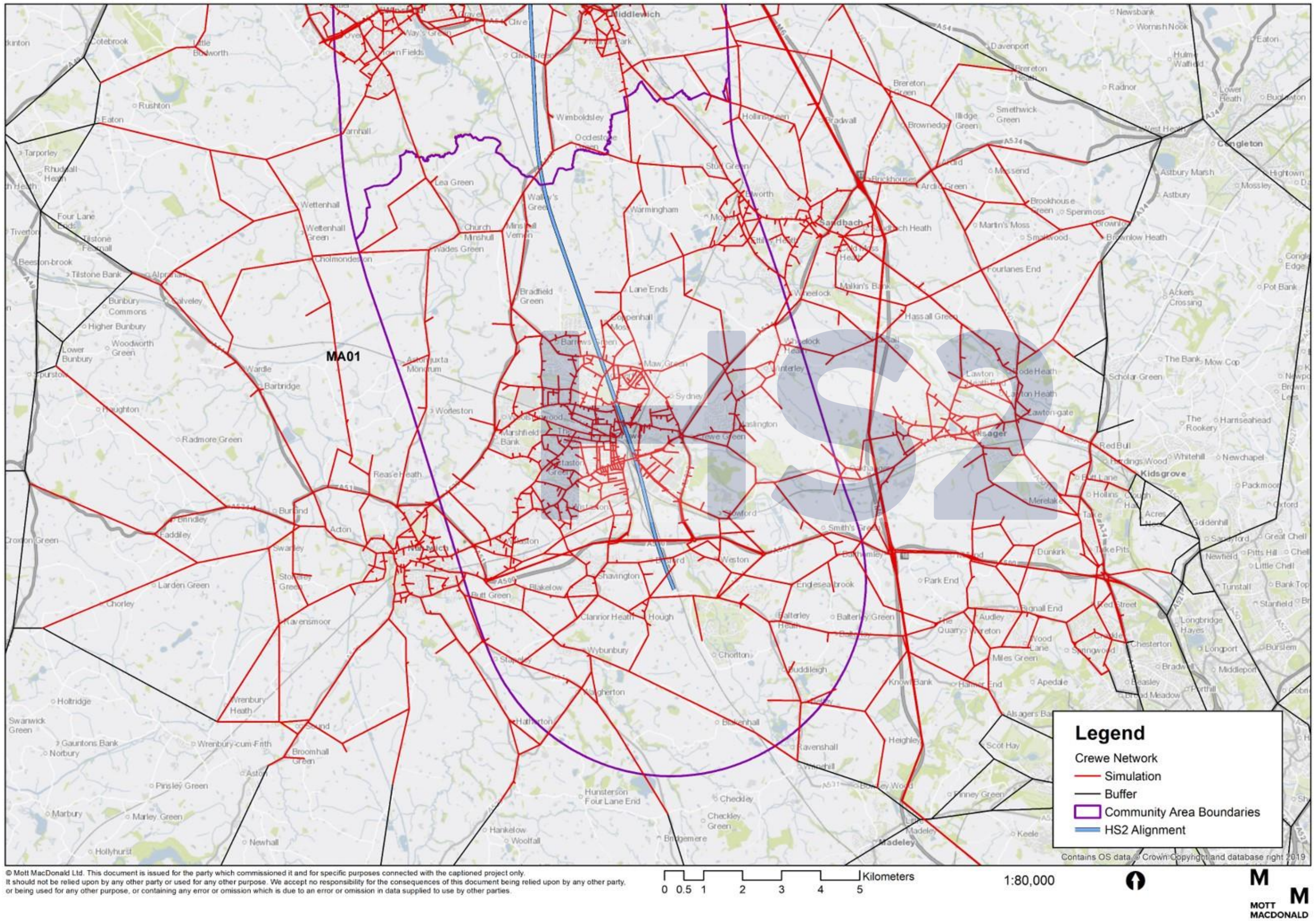
1.5.2 Only the strategic highway assignment model has been utilised by MWJV to provide an evidence base.

1.5.3 The A500 Crewe Strategic Highway Assignment Model was developed within the SATURN model software platform (version: 11.4.06D).

1.5.4 The detailed modelled study area covers A500 Crewe and surrounding areas. There is supporting network and zone system detail to provide a representation of the external area supply and demand. Reference should be made to Figure 2.

1.5.5 The A500 Crewe Model is representative of 2017 base year transport conditions.

Figure 2: Model study area



1.6 Model development

1.6.1 The A500 Crewe Model was developed by CEC transport consultants to provide an evidence base to support the business case for the A500 upgrade scheme between Meremoor Moss roundabout and M6 junction 16 to dual carriageway standard.

1.7 Model description

1.7.1 The original A500 Crewe Strategic Highway Assignment Model was developed for the following years:

- 2017 base year;
- 2021 future year; and
- 2036 horizon year.

1.7.2 The model is representative of the following time periods:

- AM peak hour - 08:00–09:00;
- average inter peak hour - 10:00–16:00; and
- PM peak hour - 17:00–18:00.

1.7.3 The model is comprised of the following demand user-classes:

- car commute;
- car other;
- car employers business;
- light goods vehicles; and
- other goods vehicles.

1.8 Model application objectives

1.8.1 For the assessment of the AP2 revised scheme, the A500 Crewe Strategic Highway Assignment Model provides:

- preliminary traffic data to inform scheme design;
- changes in traffic flows, congestion, and journey times to inform the TA for the AP2 revised scheme;
- traffic data for the construction and operational phases of the scheme on which to base the assessment of significant effects for the Environmental Statement; and
- changes in traffic flows between the base year and forecast scenarios for application to local models.

2 Guidance used

2.1 Introduction

2.1.1 This strategic highway model development makes reference to the following Transport Analysis Guidance (TAG) as published by the Department for Transport (DfT): TAG Unit M3.1 Highway Assignment Modelling (May 2020).

2.2 Highway model guidance

2.2.1 In relation to providing an assessment of model calibration and validation performance, reference has been made to Section 3.2 of TAG Unit M3.1 (Table 1, Table 2, and Table 3).

2.2.2 The criteria for the assessment of model calibration and validation of traffic flows and journey time performance are presented in Table 1 below.

Table 1: DfT - TAG validation criteria

Criteria	Acceptability guideline
Assigned hourly flows	
Individual flows within +/-15% for flows 700-2,700 vph	>85% of cases
Individual flows within +/-100 vph for flows <700 vph	>85% of cases
Individual flows within +/-400 vph for flows >2,700 vph	>85% of cases
Screenline flows (normally >5 links) to be within 5%	All or nearly all screenlines
Geoffrey Havers (GEH) statistic	
Individual flows GEH <5	>85% of cases
Journey times	
Modelled journey times within 15% (or 1 minute if higher)	>85% of cases

Credit: Table 1, Table 2, Table 3, DfT TAG Unit M3.1 Highway Assignment Modelling (May 2020)

2.2.3 The criteria for the assessment of highway model assignment convergence is presented in Table 2, below.

Table 2: Summary of convergence measures and base model acceptable values

Measures of convergence	Acceptability guideline
Delta and %GAP	Less than 0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with flow change (P) <1%	Four consecutive iterations greater than 98%
Percentage of links with cost change (P2) <1%	Four consecutive iterations greater than 98%
Percentage change in total user costs of links with flow change (V) <1%	Four consecutive iterations less than 0.1% (SUE only)

Credit. Table 4, DfT TAG Unit M3.1 Highway Assignment Modelling (May 2020)

3 Data for model development

3.1 Overview

3.1.1 This section of the report presents details of traffic data that has been collected for the purpose of updating the A500 Crewe Model study area.

3.1.2 The same traffic count data set was used for the main ES, SES1 and AP1 ES and SES2 and AP2 ES. This is described in the following section.

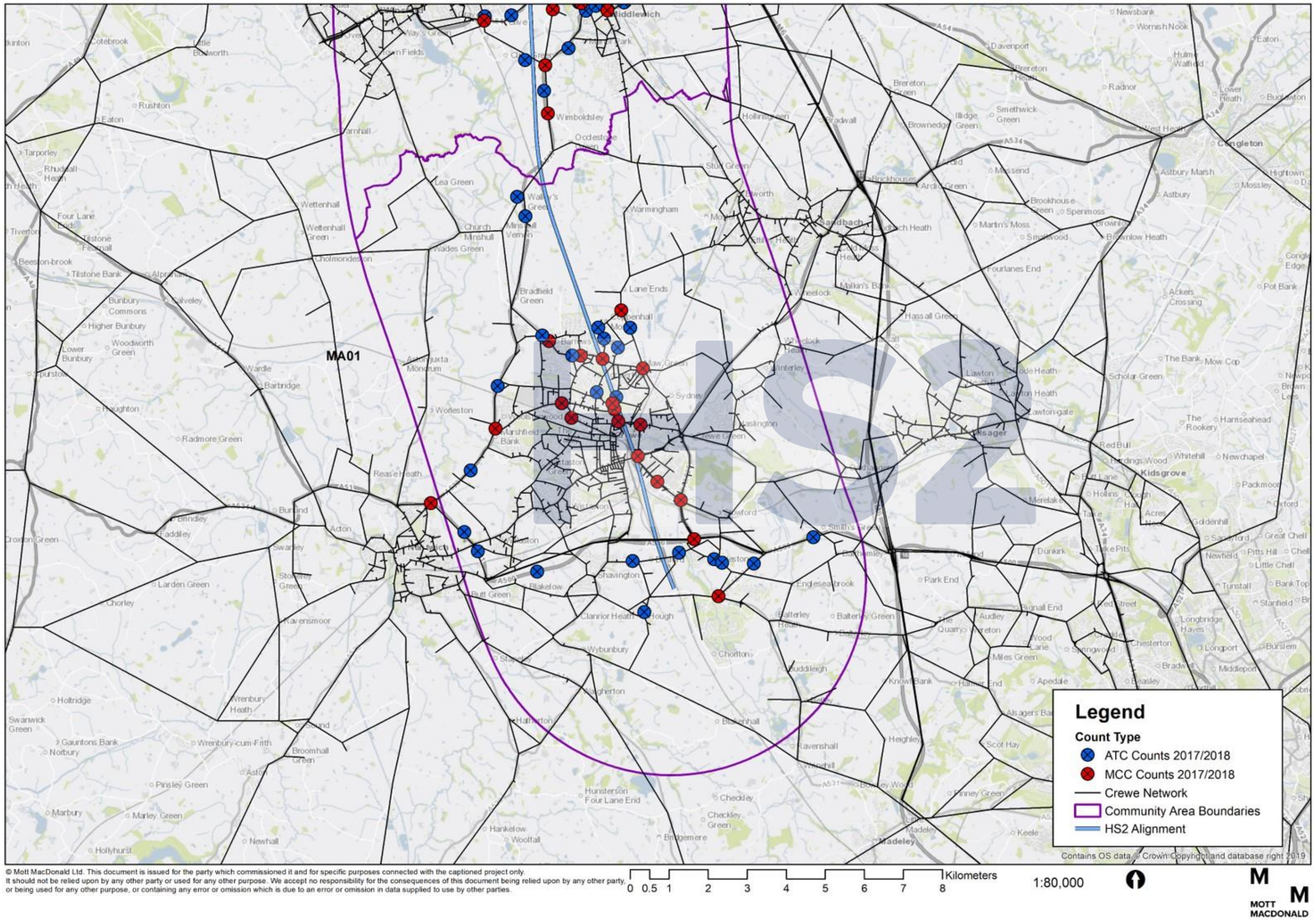
3.1.3 The journey time data has been used to inform the assessment of the AP2 revised scheme only and was not available to use for the original scheme or AP1 revised scheme. The journey time data is described in Section 3.3. For the main ES and AP1 the focus for model development was to improve localised traffic flow performance.

3.2 Traffic survey data commission

3.2.1 MWJV commissioned a programme of traffic count surveys in 2017/2018 to support the assessment of the original scheme.

3.2.2 Traffic count surveys have been used from different years and months to update the base year model. The traffic counts have been factored to June 2018 to develop a consistent dataset. Figure 3 shows the location of traffic counts.

Figure 3: Location of traffic counts (MWJV survey commission)

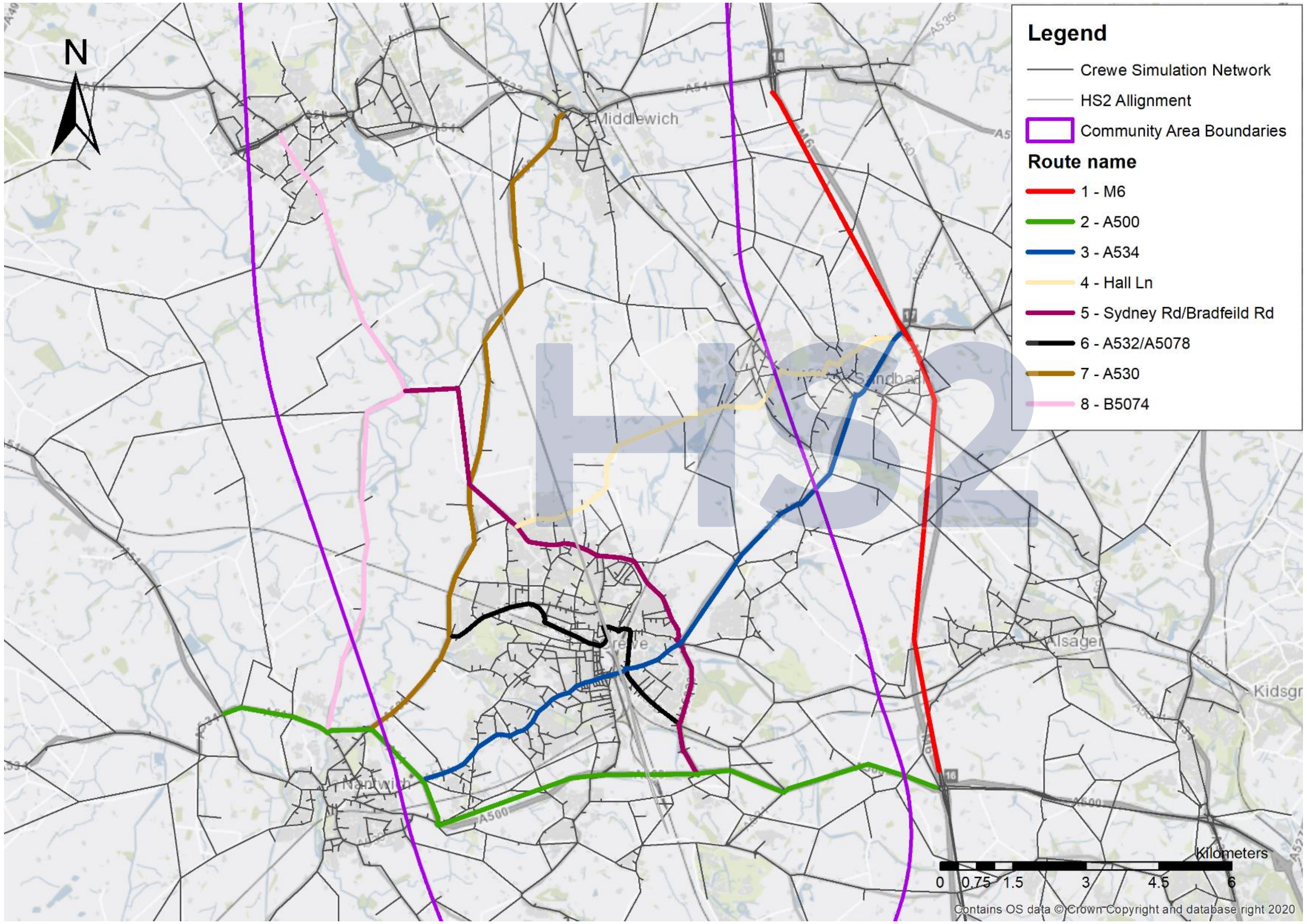


3.3 Journey time data

3.3.1 HS2 requested Trafficmaster journey time data representing June 2018 on behalf of MWJV from the DfT. This was processed by HS2 for MWJV for the journey time routes selected for the AP2 base model validation.

3.3.2 Journey time routes were defined as key routes across the model area of interest. Figure 4 shows the journey time routes chosen.

Figure 4: Location of journey time routes



4 Model development

4.1 Overview

4.1.1 For the main ES, the SES1 and AP1 ES, and the SES2 and AP2 ES, the 2017 base year model was updated to a 2018 (June) base year model by MWJV using local growth factors and the traffic count survey data that was collected between November 2017 and March 2020 (prior to COVID-19). Traffic count data has been normalised to June 2018 traffic conditions using local count data.

4.1.2 For the SES1 and AP1 ES, a review of base year model traffic flows identified that there was scope to undertake some localised improvements to the traffic model in order to provide a more robust assessment in the AP1 revised scheme area of interest. For the SES2 and AP2 ES, further localised improvements were made following review of model journey time data.

4.1.3 The model time periods represent the following peak hours, when the highest traffic volumes and most significant scheme impacts are expected to occur:

- AM peak hour - 08:00–09:00; and
- PM peak hour - 17:00–18:00.

4.2 Transport supply

4.2.1 For the main ES, a review of highway network detail and attributes was undertaken for the model area that is included in the Hough to Walley's Green (MA01) area.

4.2.2 The following network attributes have been reviewed and checked:

- links: distance, speeds, capacity, bus lanes, traffic regulation orders;
- junctions: type; turn saturation flows, capacity, and lane utilisation;
- traffic signal control: timings, phasing, and staging; and
- routes: minimum cost paths.

4.2.3 The review highlighted that there is a good level of detailed highway network representation within the scheme area, and that this compared well with local datasets.

4.2.4 Although, the Crewe Green Roundabout improvement scheme was opened in autumn 2018, the base year model reflects 2018 traffic conditions prior to the opening of this scheme. This scheme has therefore only been included in the future year forecast models.

4.2.5 The Smart Motorway Programme (SMP) roadworks on the M6 between junctions 16 and 19 were not included in the parent model provided by CEC. This scheme was included in the SES1 and AP1 ES, and the SES2 and AP2 ES model network. For the SES1 and AP1 ES, and the SES2 and AP2 ES base models, the SMP scheme construction is represented by reducing capacity and reducing speeds to 50 mph to reflect this intervention.

4.2.6 For the SES1 and AP1 ES, some network refinements were made to improve model performance, and for the SES2 and AP2 ES some further network changes have also been made to improve representation against journey times. These involved changes to network speed flow relationships, gap acceptance assumptions and signal timings at some locations.

4.2.7 The generalised cost values (pence per minute (PPM)/pence per kilometre (PPK)) for model assignment were updated for the SES1 and AP1 ES to reflect the latest values from the DfT TAG databook (version: July 2020). This has been retained at SES2 and AP2 ES.

4.2.8 In summary, the model includes a sufficiently detailed level of network infrastructure to support the TA.

4.3 Transport demand

4.3.1 The original A500 Crewe Model includes a detailed representation of spatial demand. The model zone system contains 671 model zones and accounts for future land-use development zones.

4.3.2 To account for the Clive Green Rolling Stock Depot, an additional zone was added to enable a more accurate representation of future demand.

4.3.3 For the main ES, the demand matrices were adjusted from 2017 to 2018 by carrying out an interpolation between base and 2030 future year matrices. For the main ES, at SES1 and AP1 ES, and the SES2 and AP2 ES, this interpolated 2018 matrix has then been subject to matrix estimation using the available 2018 count data; and a localised traffic flow calibration exercise has been carried out to improve the correlation between observed and modelled traffic flows within the local areas of interest.

4.3.4 The count data collected from the traffic survey data commission in 2017/2018 has been applied in matrix estimation in the same way for the main ES, at SES1 and AP1 ES, and the SES2 and AP2 ES.

5 Model performance

5.1 Overview

5.1.1 This section of the report focusses on the performance of the 2018 AP2 revised scheme base model as produced by MWJV against observed traffic flow and journey time data.

5.1.2 The prior trip matrix assignment is the model assignment before matrix estimation is applied. This uses an interpolated parent model matrix adjusted to the HS2 zone system with an updated network that corresponds to HS2 base year. The updated network also includes revisions identified following a network review.

5.1.3 Matrix estimation uses the prior matrix and updated network mentioned above and creates an updated matrix to match count data. The post trip matrix assignment is the model assignment using this updated matrix and the same updated network used in prior assignments.

5.1.4 It is the post matrix assignment that is taken forward and used in the SES2 and AP2 ES TA.

5.2 Traffic flow

5.2.1 Observed and modelled traffic flows have been compared for the count site locations within the scheme area of interest (MA01). In total, 138 individual link counts by direction have been compared.

5.2.2 Table 3 and Table 4 present a summary comparison of individual link flows for all vehicles and by the car vehicle type for the prior matrix assignment. The comparison shows that both time periods fall below the DfT TAG individual link count criteria of greater than 85% of comparisons achieving the flow or GEH criteria.

Table 3: AP2 A500 Crewe Model - individual link flow - total all vehicle - prior

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM Peak hour	138	67	49%	65	47.1%	70	51%
PM Peak hour	138	74	54%	74	53.6%	79	57%

Table 4: AP2 A500 Crewe Model - individual link flow - car vehicle type - prior

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM Peak hour	138	69	50%	71	51.4%	76	55%
PM Peak hour	138	77	56%	73	52.9%	80	58%

5.2.3 Figure 5 and Figure 6 show the locations of the link counts and the respective AM and PM peak hour model performance for the prior matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

5.2.4 Table 5 and Table 6 present a summary comparison of individual link flows for all vehicles and by the car vehicle type for the post matrix estimation assignment. The comparison shows that both time periods meet the DfT TAG individual link count criteria of greater than 85 percent of comparisons achieving the flow or GEH criteria.

5.2.5 The results show an overall improvement on the results from the main ES and are similar to the SES1 and AP1 ES results.

Table 5: AP2 A500 Crewe Model - individual link flow - total all vehicle – post

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM Peak hour	138	132	96%	132	95.7%	133	96%
PM Peak hour	138	136	99%	137	99.3%	137	99%

Table 6: AP2 A500 Crewe Model - individual link flow - car vehicle type - post

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM Peak hour	138	132	96%	132	95.7%	133	96%
PM Peak hour	138	136	99%	137	99.3%	137	99%

5.2.6 Figure 7 and Figure 8 show the locations of the link counts and the respective AM and PM peak hour model performance for the post matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

5.2.7 Reference should also be made to Table 13 and Table 14, Appendix A, which presents supporting details of the individual link flow performance for each count for the AM and PM time periods, post matrix estimation.

Figure 5: AM peak hour – traffic flow performance - prior

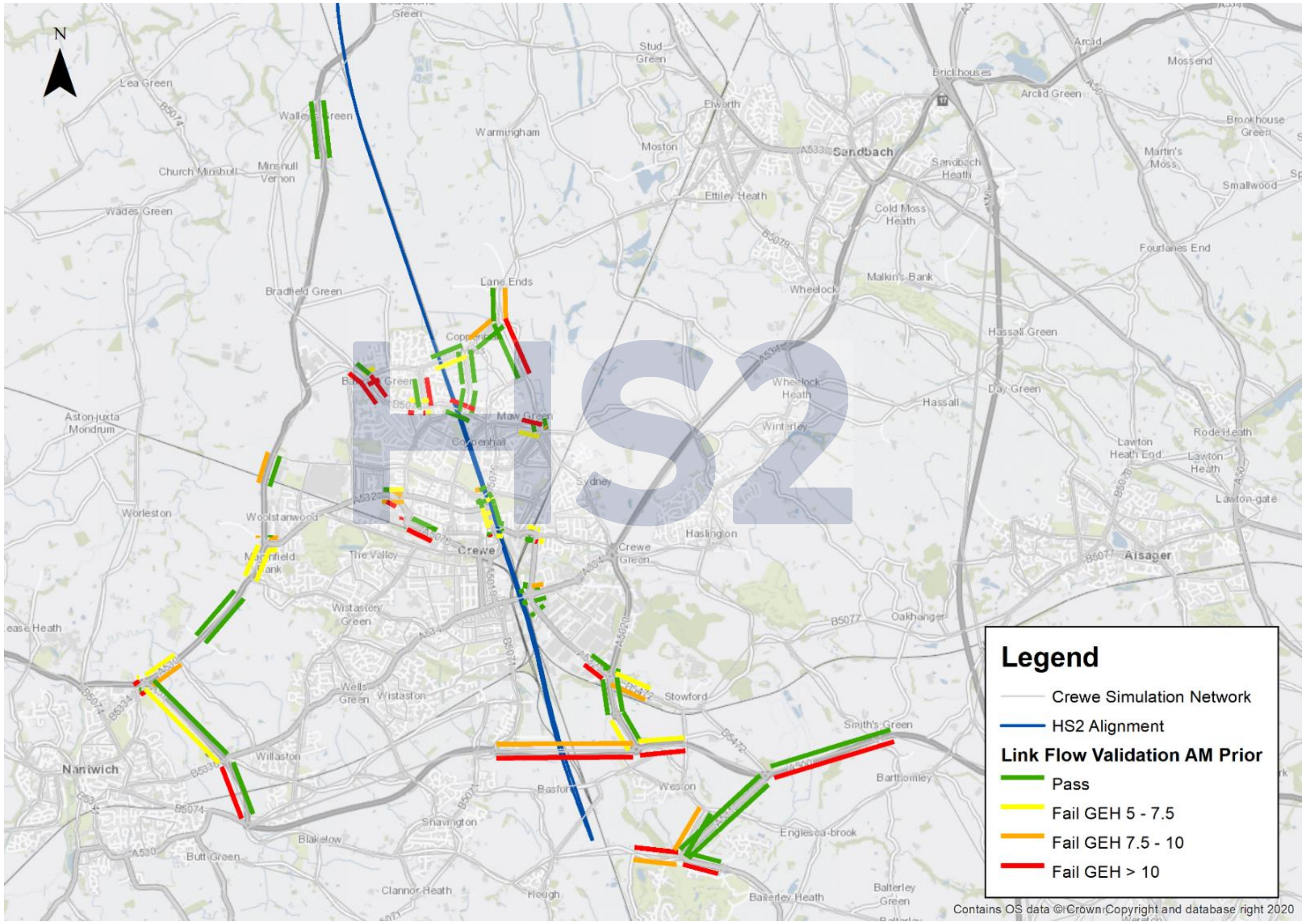


Figure 6: PM peak hour - traffic flow performance - prior

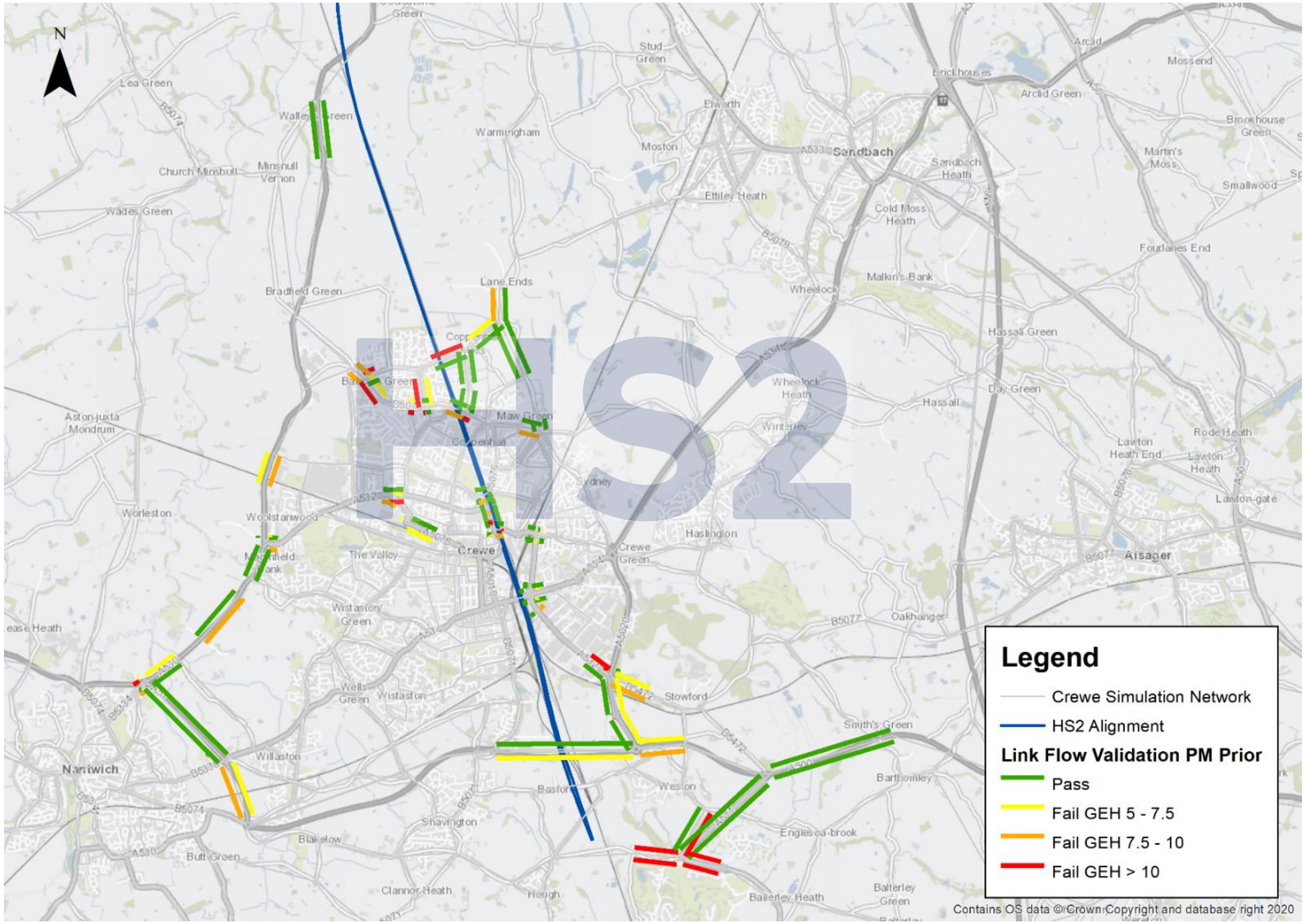


Figure 7: AM peak hour - traffic flow performance - post

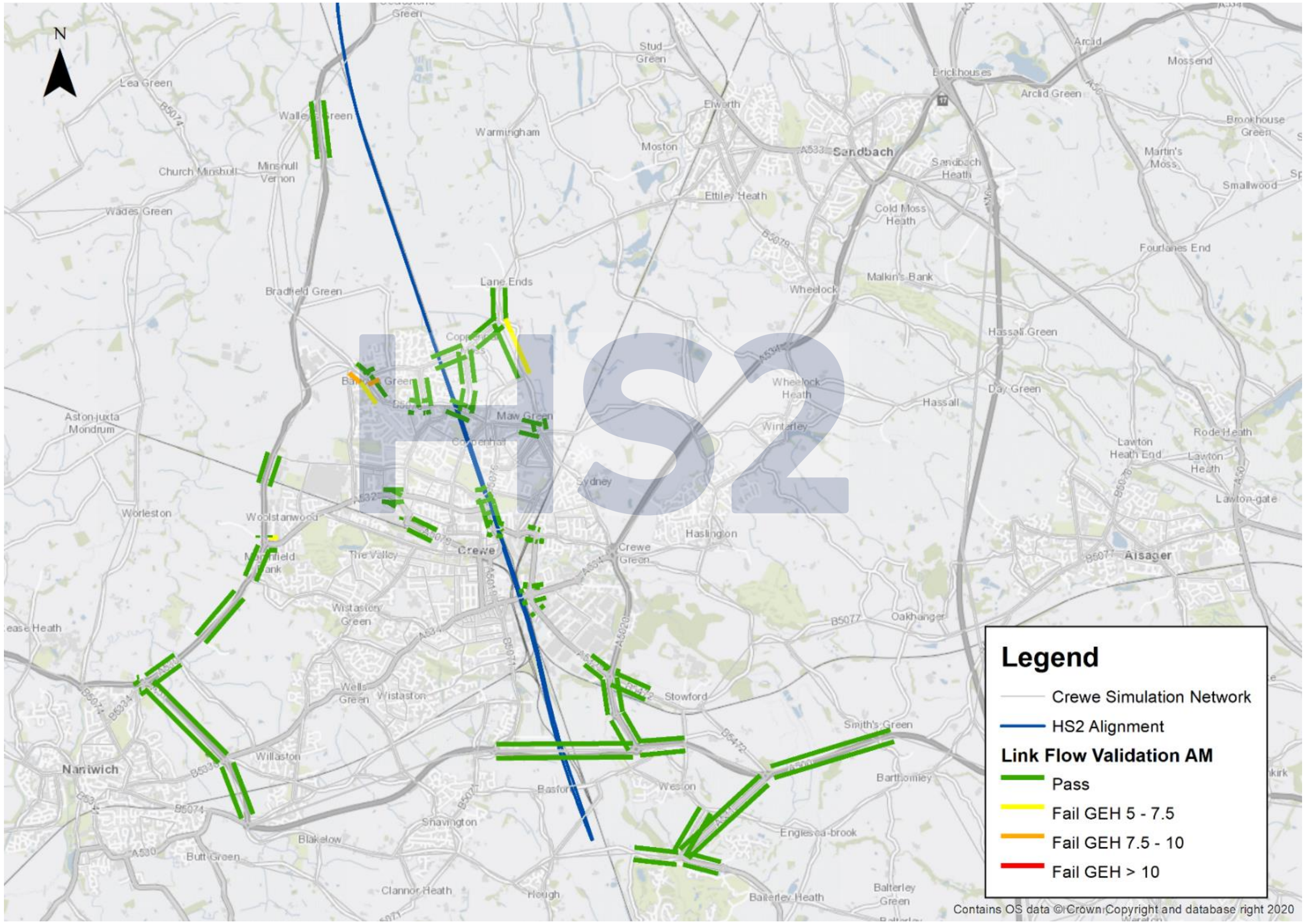
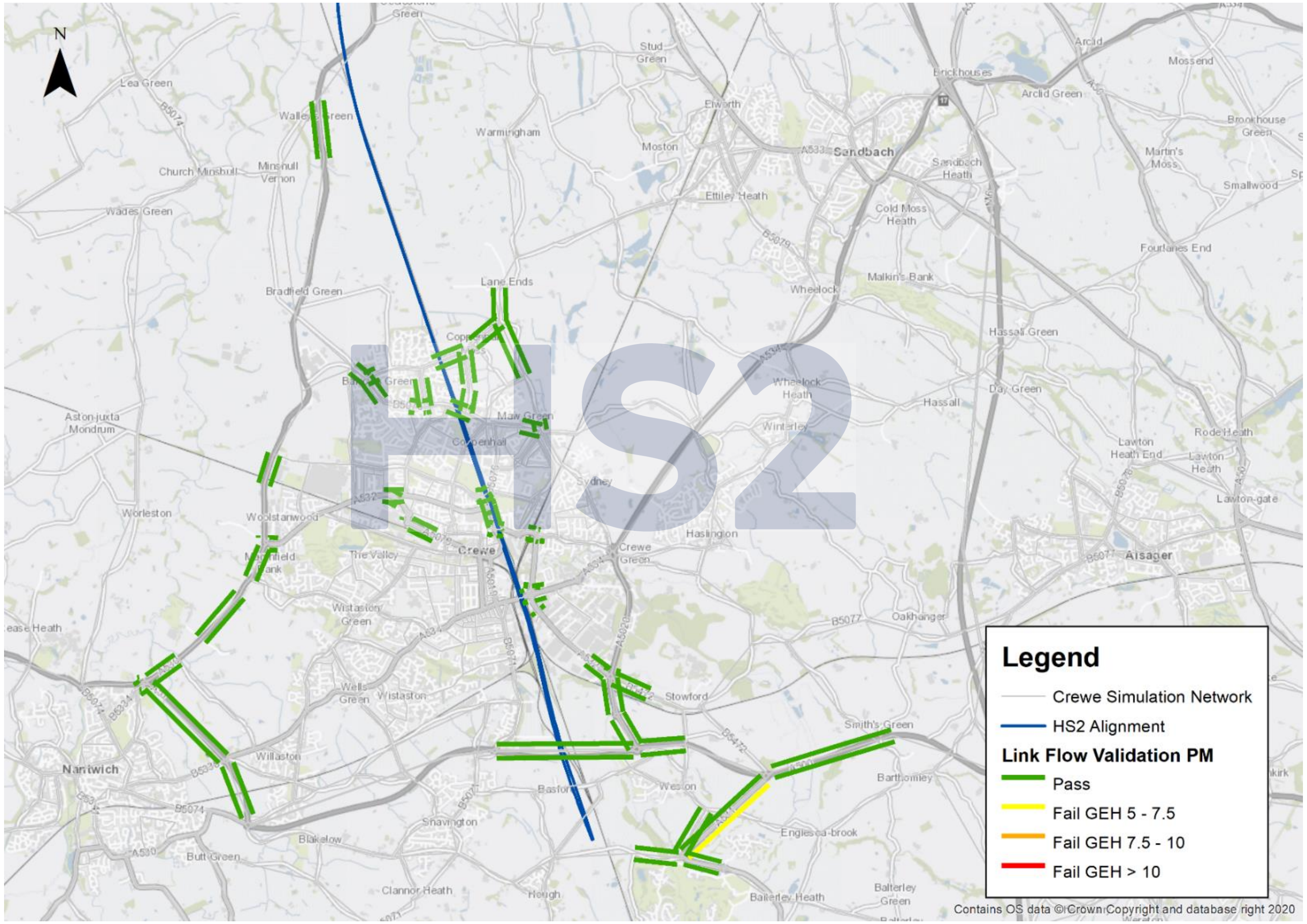


Figure 8: PM peak hour - traffic flow performance - post



5.3 Journey time results

5.3.1 Observed and modelled journey times have been compared for 8 (2-way) routes highlighted in Figure 4.

5.3.2 Table 7 summarises the prior journey time results. The table shows that journey times in both time periods fail to meet the DfT TAG journey time guideline of more than 85 percent of model route times being within 15 percent of the observed times (or 1 minute, if higher than 15%).

5.3.3 Figure 9 and Figure 10 show the journey time route performance for the prior matrix assignment. These show routes passing TAG criteria as green routes. Routes failing the TAG criteria are shown as orange and red routes, according to time differences.

Table 7 AP2 A500 Crewe Model – journey time route summary – prior

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM Peak hour	16	10	63%
PM Peak hour	16	11	69%

5.3.4 Table 8 summarises the post ME journey time results. The table shows that 81% of journey time routes in the AM model and 75% of journey time routes in the PM model meet the DfT TAG individual route criteria.

5.3.5 Where model journey time routes have not met the TAG criteria against the observed data, this has been due to the limiting nature of the strategic model in its ability to replicate both flow and speed at urban over capacity conditions. The speed-flow relationship calculated in the strategic model software is more complicated in reality, particularly where flow breakdown occurs and there are very slow speeds. This is despite network capacities and traffic flows being well represented. Under these circumstances the usual practice is to achieve flow calibration.

5.3.6 There is a balance between achieving both model flow and journey time performance, and despite some routes not having met the TAG journey time criteria, it is important to note that the link flow results presented earlier in this chapter show a good standard has been achieved.

5.3.7 Figure 11 and Figure 12 show the journey time route performance for the post ME assignment. These show routes passing TAG criteria as green routes. Routes failing the TAG criteria are shown as orange and red routes, according to time differences.

Table 8: AP2 A500 Crewe Model – journey time route summary – post

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM Peak hour	16	13	81%
PM Peak hour	16	12	75%

5.3.8 Reference should also be made to Table 15 and Table 16 in Appendix A, which presents supporting details of the individual route performance for the AM and PM time periods post matrix estimation. For routes where model times are outside of the DfT criteria guideline. Further details are provided on why this is the case.

5.3.9 Overall, the traffic flow and journey time results collectively show evidence of a good standard which is not undermined by the performance of any individual counts or routes.

Figure 9: AM peak hour – journey time performance – prior

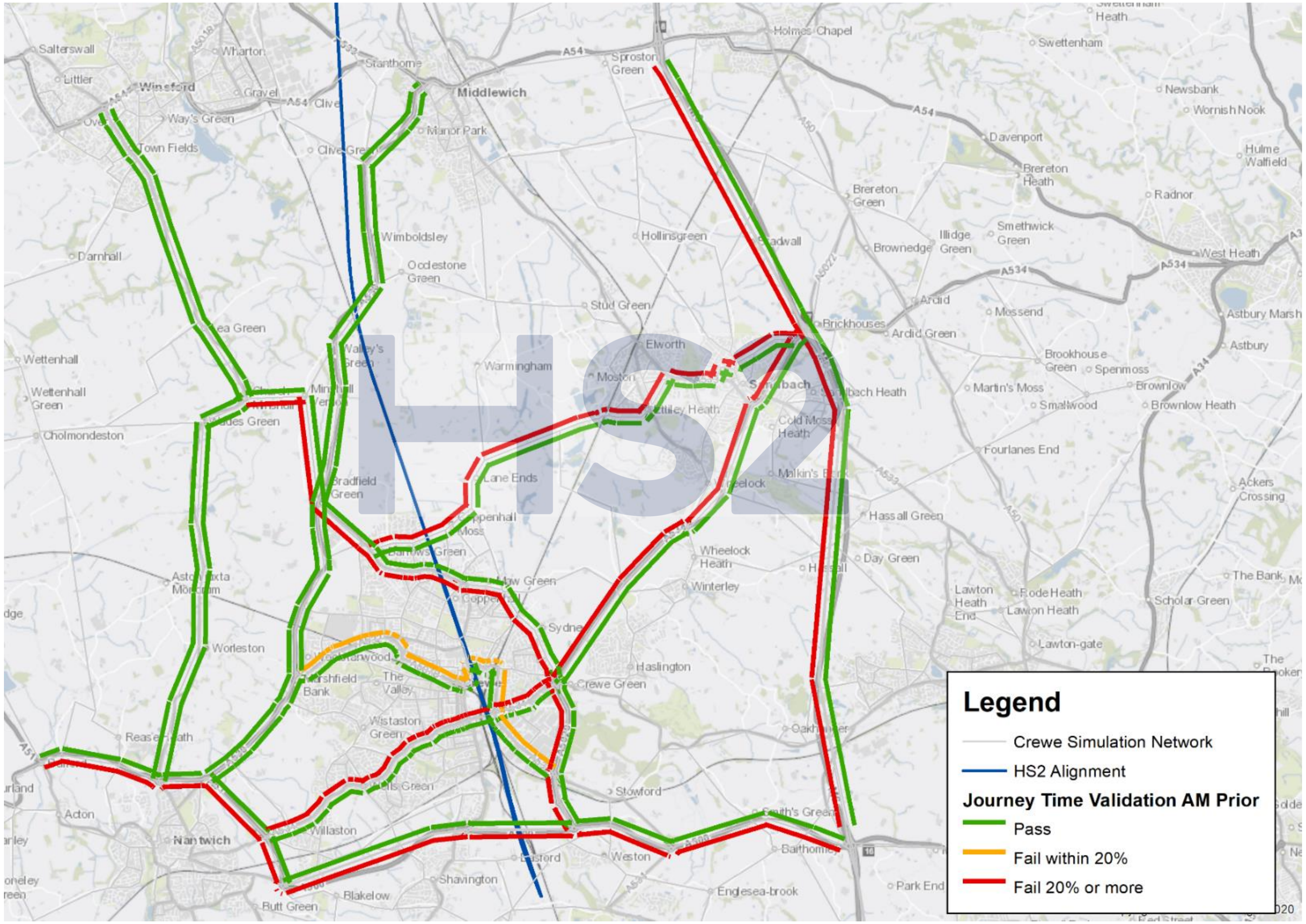


Figure 10: PM peak hour – journey time performance – prior

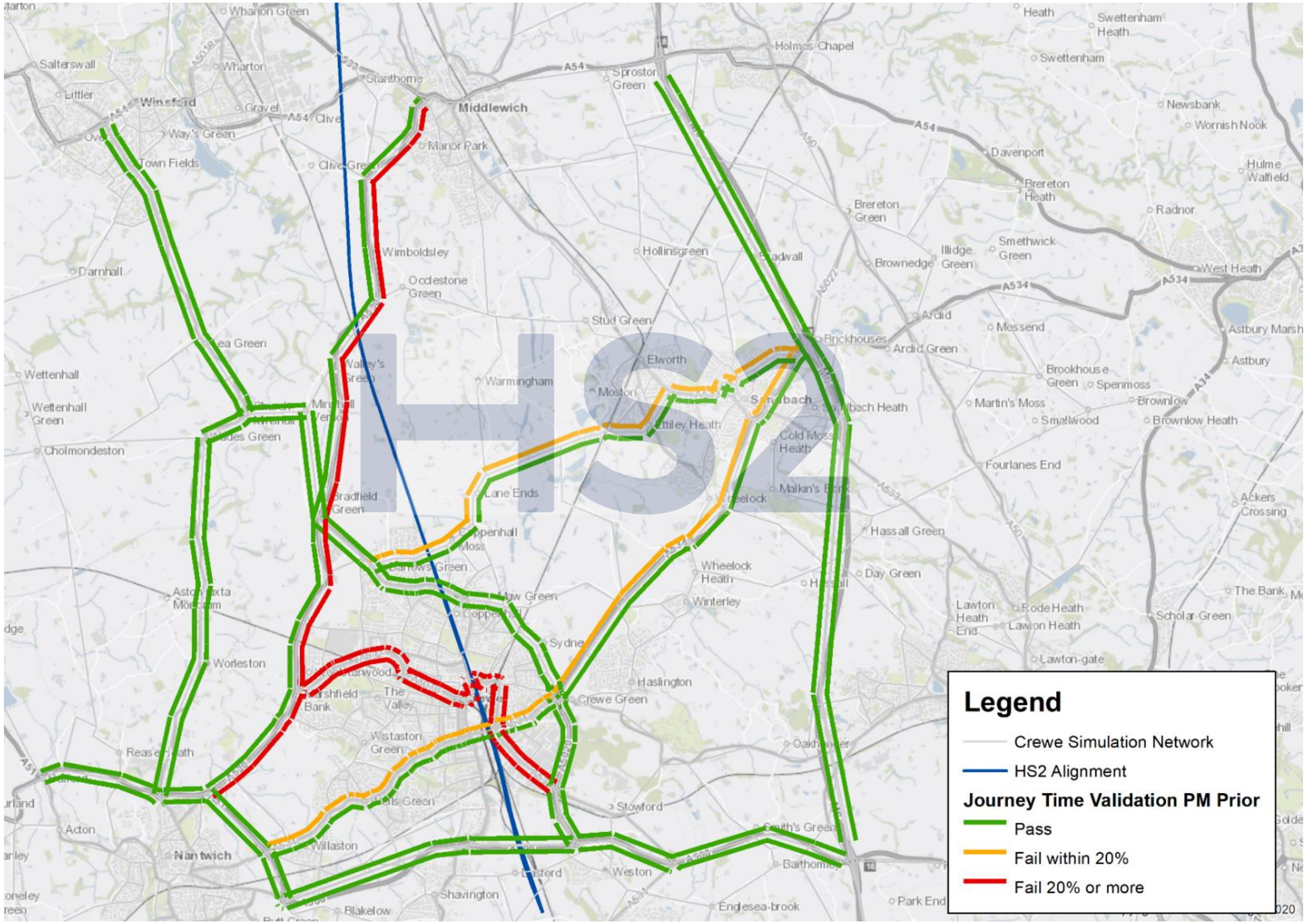


Figure 11: AM peak hour – journey time performance – post

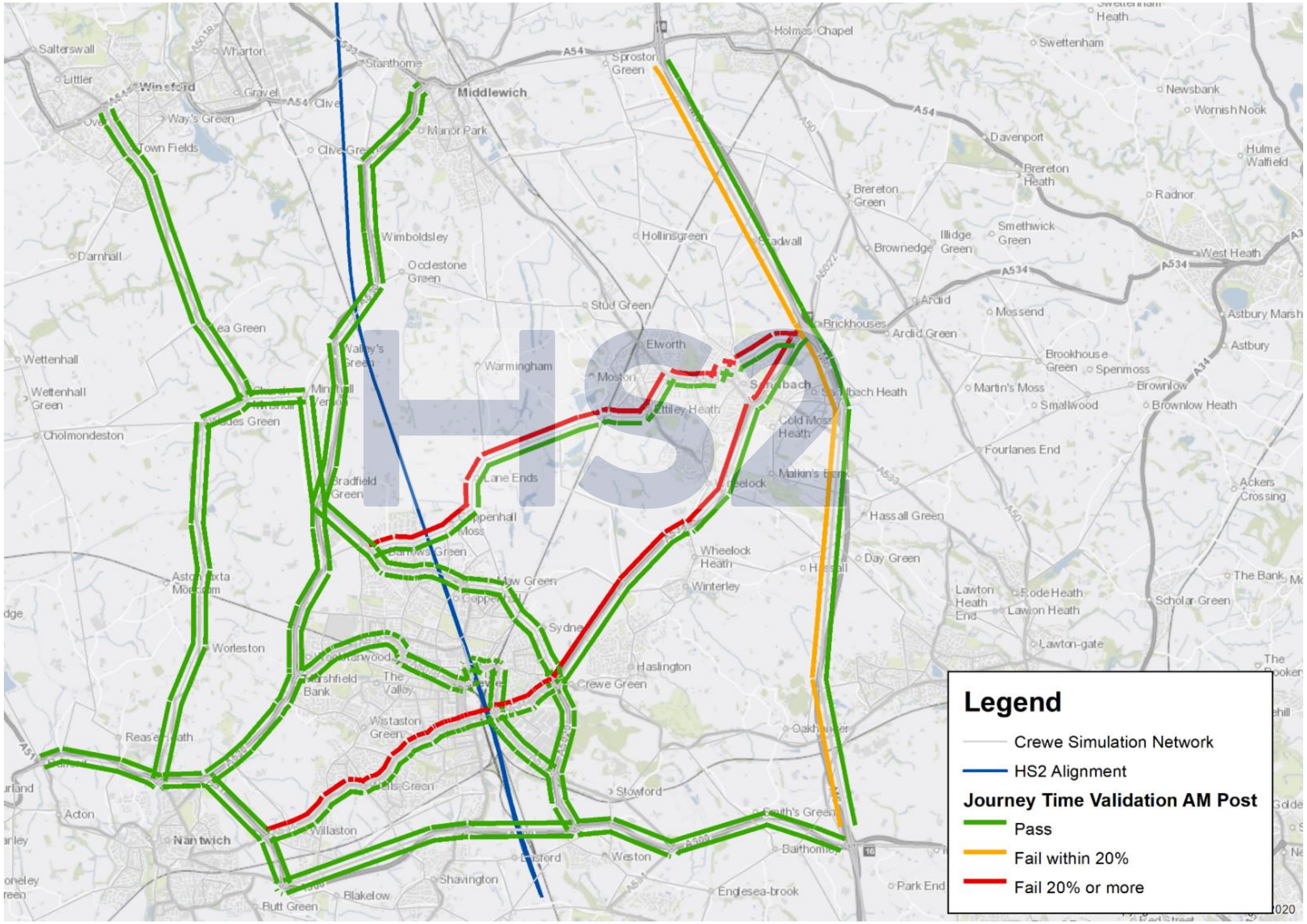
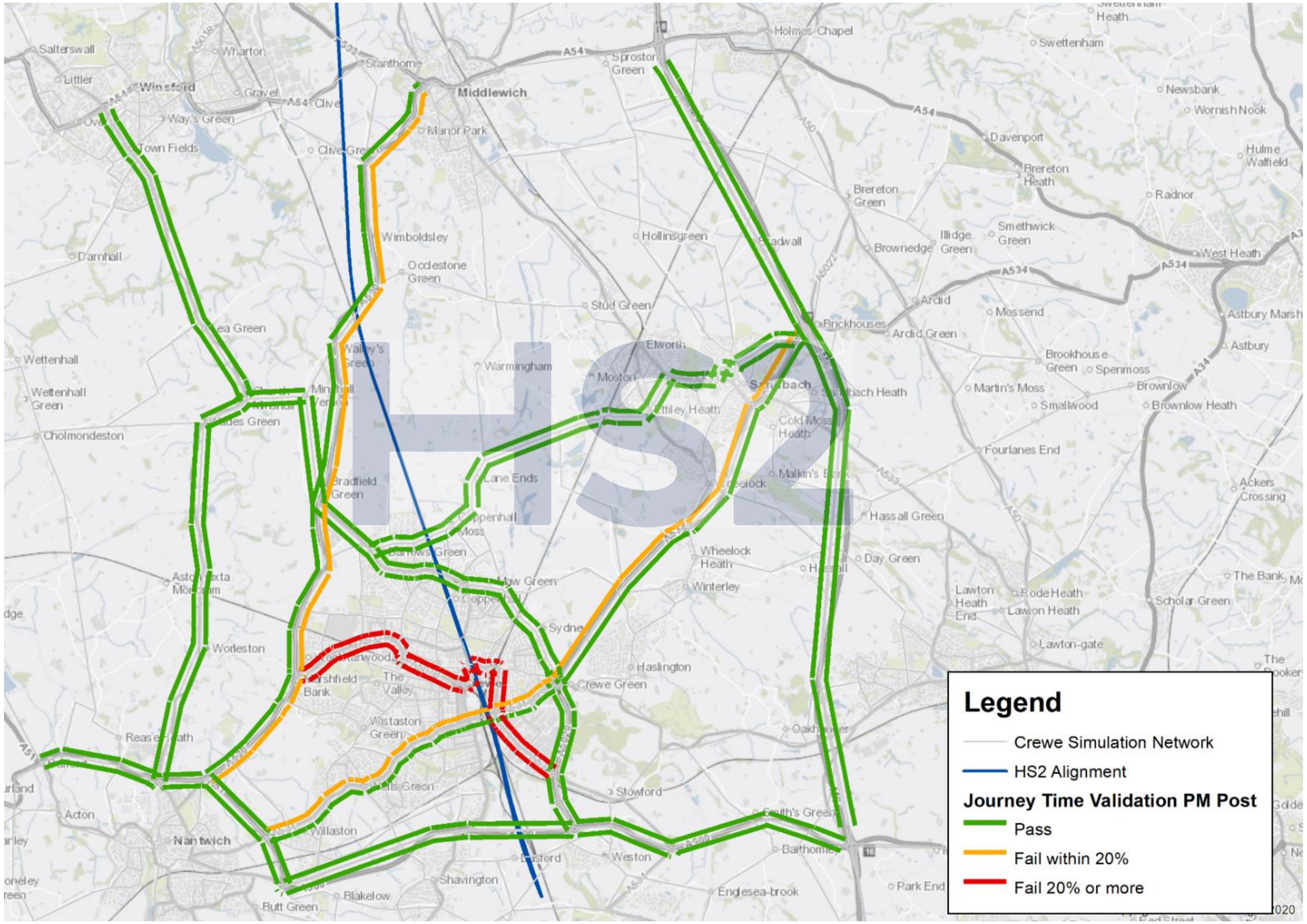


Figure 12: PM peak hour – journey time performance – post



6 Model convergence

6.1.1 Achieving a suitable level of model convergence is necessary to provide stable, consistent, and robust model results and to differentiate between real changes and those associated with differing degrees of convergence.

6.1.2 DfT TAG provides guidance on highway model convergence with recommendations on acceptable variations in link flows and costs between iterations helping to ensure the model is sufficiently stable.

6.1.3 Table 9 presents a summary of the 2018 base year highway model convergence statistics for the AP2 revised scheme by time period. Both models achieve a satisfactory level of convergence.

Table 9: AP2 A500 Crewe Model 2018 baseline model convergence

Criteria	Loop	Target	AM	PM
Flow Change	N-3	> 98%	98.20	98.40
	N-2		98.80	98.50
	N-1		99.20	99.10
	N		98.60	98.80
Delays Change	N-3	> 98%	99.50	99.90
	N-2		99.70	99.90
	N-1		99.60	99.90
	N		99.60	99.80
Delta		< 0.1%	0.0023/16	0.0004/18
% GAP		< 0.1%	0.0079	0.0024

7 Summary and conclusions

7.1.1 For the assessment of the AP2 revised scheme, the A500 Crewe Model highway assignment 2017 base year model, supplied by CEC has been further developed for the AP2 revised scheme with additional localised updates to improve model journey time performance in key areas of interest.

7.1.2 Presented below is a summary of the individual link flow model performance for all modelled time periods the AP2 revised scheme, post matrix estimation. The comparison shows that both time periods exceed the 85 percent threshold of individual links meeting either the DfT TAG flow range or GEH less than five criteria.

Table 10: AP2 A500 Crewe Model - individual link flow - total all vehicle – post

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of Counts	Percentage
AM peak hour	138	132	96%	132	95.7%	133	96%
PM peak hour	138	136	99%	137	99.3%	137	99%

7.1.3 Presented below is a summary of the journey time route performance for all modelled time periods at AP2, post matrix estimation. The comparison shows that 81% of journey time routes in the AM model and 75% of journey time routes in the PM model meet the DfT TAG individual route criteria.

7.1.4 Where model journey time routes have not met the TAG criteria against the observed data, this has been due to the limiting nature of the strategic model in its ability to replicate both flow and speed at urban over capacity conditions.

7.1.5 There is a balance between achieving both model flow and journey time performance, and despite some routes not having met the TAG journey time criteria, it is important to note that the link flow results presented earlier in this chapter show a good standard has been achieved.

7.1.6 Overall, the traffic flow and journey time results collectively show evidence of a good standard which is not undermined by the performance of any individual counts or routes.

Table 11: AP2 A500 Crewe Model - journey time route summary – post

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM peak hour	16	13	81%
PM peak hour	16	12	75%

7.1.7 Both the AM and PM models converge satisfactorily.

7.1.8 In conclusion, the updated A500 Crewe Model the AP2 revised scheme provides a reliable forecasting base and forms a suitable tool for the assessment of HS2 construction and operational impacts within the scheme area of interest.

8 List of acronyms

Table 12: List of acronyms

Acronym	Description
ATC	Automatic traffic count
CEC	Cheshire East Council
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
ES	Environmental Statement
GEH	Geoffrey Havers (statistic)
JTC	Junction turning count
LMVR	Local Model Validation Report
MCC	Manual Classified count
MPR	Model Performance Report
TA	Transport Assessment

9 References

Department for Transport (2020), *TAG unit M1.2 Data Sources and Surveys*. Public Transport Assignment. Available online at: https://www.gov.uk/government/publications/webtag-tag-unit-m1-2-data-sources-and-surveys.

Department for Transport (2020), *TAG unit M3.1 Highway Assignment Modelling*. Public Transport Assignment. Available online at: https://www.gov.uk/government/publications/webtag-tag-unit-m3-1-highway-assignment-modelling.

10 Appendix A – Model performance

Individual link flow performance

Table 13: AP2 A500 Crewe Model – Individual link flow detailed results – post – AM peak hour

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Badger Avenue	West of Vernon Way	EB	362	27	4	394	318	25	4	347	-47	-12%	2.45	✓	✓	✓
A500	West of David Whitby Way	EB	1130	121	80	1339	1133	127	80	1341	2	0%	0.05	✓	✓	✓
Nantwich Bypass	South of Nantwich Bypass NB	NB	712	89	80	895	712	89	78	880	-16	-2%	0.53	✓	✓	✓
A530 Middlewich Road	South of Pyms Lane	SB	686	65	20	774	672	65	20	757	-17	-2%	0.62	✓	✓	✓
B5472 Weston Road	East of David Whitby Way	EB	323	66	32	423	350	93	25	468	45	11%	2.14	✓	✓	✓
A500	West of David Whitby Way	WB	782	217	91	1097	781	217	91	1089	-8	-1%	0.25	✓	✓	✓
Nantwich Bypass	South of Nantwich Bypass SB	SB	490	65	60	622	480	68	62	610	-12	-2%	0.49	✓	✓	✓
A530 Middlewich Road	South of Pyms Lane	NB	799	70	26	899	762	69	26	857	-41	-5%	1.40	✓	✓	✓
West Street	West of A532 West Street WB	WB	363	46	9	420	364	47	15	427	6	1%	0.30	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
West Street	East of A532 West Street WB	WB	234	30	4	269	181	31	5	216	-53	-20%	3.40	✓	✓	✓
Dunwoody Way	North of Dunwoody way NB	WB	245	31	6	283	245	32	10	287	3	1%	0.19	✓	✓	✓
Bessemer Way	North of Bessemer Way SB	NB	47	0	0	47	47	2	1	50	3	7%	0.46	✓	✓	✓
West Street	West of A532 West Street EB	EB	539	61	7	610	554	62	13	629	18	3%	0.74	✓	✓	✓
Bessemer Way	North of Bessemer Way NB	SB	21	1	0	22	21	2	1	23	2	8%	0.39	✓	✓	✓
Dunwoody Way	North of Dunwoody way SB	EB	396	39	4	440	345	39	9	392	-48	-11%	2.35	✓	✓	✓
West Street	East of A532 West Street EB	EB	285	37	4	327	295	38	5	339	12	4%	0.65	✓	✓	✓
Dunwoody Way	A5078 Dunwoody Way SB	SB	303	34	5	344	305	35	11	350	6	2%	0.35	✓	✓	✓
Dunwoody Way	A5078 Dunwoody Way NB	NB	245	37	9	291	245	39	14	297	6	2%	0.34	✓	✓	✓
Bradfield Road	East of Bradfield Road WB	WB	358	133	19	511	357	58	20	435	-77	-15%	3.52	✓	✓	✓
Bradfield Road	East of Bradfield Road EB	EB	222	121	12	356	226	47	14	287	-69	-19%	3.87	✓	✓	✓
Mablins Lane	South of Mablins Lane NB	NB	117	17	7	144	119	17	16	152	8	6%	0.68	✓	✓	✓
Bradfield Road	East of B5076 Bradfield Road EB	WB	406	49	26	492	408	51	35	494	1	0%	0.06	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Bradfield Road	West of B5076 Bradfield Road EB	EB	292	39	16	351	228	39	15	281	-70	-20%	3.95	✓	✓	✓
Mablins Lane	South of Mablins Lane SB	SB	145	14	3	164	208	24	12	244	79	48%	5.55	×	✓	✓
Dunwoody Way	East of A5078 Dunwoody Way WB	WB	245	38	9	293	245	39	11	295	1	0%	0.08	✓	✓	✓
Bradfield Road	East of B5076 Bradfield Road WB	EB	387	46	15	455	369	45	25	440	-16	-3%	0.74	✓	✓	✓
Dunwoody WayA	East of A5078 Dunwoody Way EB	EB	301	35	6	343	305	35	8	348	5	1%	0.24	✓	✓	✓
Bradfield Road	West of Broughton Road	WB	461	57	17	541	466	57	24	547	6	1%	0.25	✓	✓	✓
Bradfield Road	East of Broughton Road	WB	466	62	18	553	471	62	26	559	6	1%	0.26	✓	✓	✓
Bradfield Road	West of Broughton Road	EB	446	57	13	520	428	57	18	503	-17	-3%	0.76	✓	✓	✓
Broughton Road	North of Bradfield Road	SB	121	16	2	140	121	16	3	140	0	0%	0.02	✓	✓	✓
Parkers Road	West of Broughton Road	EB	330	117	4	453	331	47	6	384	-69	-15%	3.38	✓	✓	✓
Badger Avenue	West of Vernon Way	WB	232	30	5	266	189	29	4	222	-45	-17%	2.87	✓	✓	✓
A532 West Street	West of Vernon Way	WB	248	32	4	284	264	32	4	299	15	5%	0.90	✓	✓	✓
Market Close	Market close NB	NB	3	1	0	3	3	6	0	9	6	212%	2.56	✓	✓	✓
Middlewich Street	North of Vernon Way NB	WB	525	52	4	583	442	50	2	494	-90	-15%	3.86	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Vernon Way	North of Vernon Way NB	NB	265	45	4	316	258	46	4	307	-8	-3%	0.47	✓	✓	✓
Vernon Way	North of Vernon Way SB	SB	631	57	6	697	535	55	6	596	-101	-14%	3.96	✓	×	✓
Vernon Way	South of Vernon Way NB	NB	282	44	5	332	261	44	4	310	-22	-6%	1.20	✓	✓	✓
Warmingham Road	South of Groby Rod	SB	375	35	6	419	376	34	6	416	-3	-1%	0.16	✓	✓	✓
Earle Street	West of Earles Street WB	WB	221	16	1	240	222	16	15	253	13	5%	0.83	✓	✓	✓
Middlewich Street	West of Middlewich Street NB	EB	289	37	2	329	287	38	0	324	-5	-1%	0.25	✓	✓	✓
Vernon Way	South of Vernon Way SB	SB	613	58	6	679	524	56	7	587	-92	-14%	3.65	✓	✓	✓
A532 Veron Way	South of West Street	NB	364	57	7	429	368	57	7	432	3	1%	0.15	✓	✓	✓
A532 West Street	West of Vernon Way	EB	211	29	5	246	235	33	5	273	27	11%	1.68	✓	✓	✓
Earle Street	West of Earles Street EB	EB	161	22	1	188	178	25	6	208	21	11%	1.48	✓	✓	✓
A532 Veron Way	South of West Street	SB	649	70	10	733	602	69	12	683	-50	-7%	1.88	✓	✓	✓
Vernon Way	South of Vernon Way NB	NB	470	53	4	528	466	53	4	523	-5	-1%	0.22	✓	✓	✓
Earle Street	Earle Street WB	WB	654	85	10	750	675	86	22	782	32	4%	1.17	✓	✓	✓
Warmingham Road	North of Groby Road	SB	631	51	6	692	535	51	8	594	-98	-14%	3.86	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Warmingham Road	South of Groby Rod	NB	272	27	3	305	274	27	5	306	1	0%	0.05	✓	✓	✓
Earle Street	Earle Street EB	EB	783	85	10	885	800	86	15	900	15	2%	0.52	✓	✓	✓
Tommy's Lane	South of Tommys Lane NB	WB	82	21	2	105	82	21	2	105	0	0%	0.01	✓	✓	✓
A534 Nantwich Road	West of A532 Weston Road	EB	736	90	22	859	732	89	26	846	-13	-2%	0.44	✓	✓	✓
A532 Manchester Bridge	West of Macon Way	WB	650	96	11	758	650	96	23	770	12	2%	0.42	✓	✓	✓
Tommy's Lane	South of Tommys Lane SB	EB	50	11	0	60	50	11	2	63	3	5%	0.40	✓	✓	✓
A532 Weston Road	South of A534 Nantwich Road	NB	571	107	24	707	571	108	25	704	-3	0%	0.11	✓	✓	✓
A532 Macon Way	North of A534 Nantwich Road	SB	593	82	14	693	584	82	14	680	-13	-2%	0.49	✓	✓	✓
A532 Macon Way	North of A534 Nantwich Road	NB	469	75	12	557	468	76	12	555	-1	0%	0.06	✓	✓	✓
A534 Crewe Road	East of A532 Weston Road	WB	417	75	24	527	418	75	27	519	-7	-1%	0.32	✓	✓	✓
A532 Manchester Bridge	West of Macon Way	EB	925	114	14	1059	930	110	19	1059	-1	0%	0.02	✓	✓	✓
A532 Macon Way	South of A532 Manchester Bridge	SB	649	84	10	746	596	80	14	690	-56	-7%	2.08	✓	✓	✓
A532 Macon Way	South of A532 Manchester Bridge	NB	319	83	11	413	318	84	12	413	0	0%	0.00	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Hungerford Road	East of A532 Macon Way	WB	497	52	2	552	455	52	14	522	-30	-6%	1.31	✓	✓	✓
Groby Road	North of Sydney Road	NB	101	14	7	123	103	14	5	122	-1	-1%	0.10	✓	✓	✓
Hungerford Road	East of A532 Macon Way	EB	442	68	6	521	456	70	8	534	13	2%	0.56	✓	✓	✓
Remer Street	West of Groby Road	EB	307	40	10	359	314	40	10	363	4	1%	0.22	✓	✓	✓
Groby Road	North of Sydney Road	SB	240	22	8	272	237	22	7	266	-6	-2%	0.36	✓	✓	✓
Sydney Road	South of Groby Road	NB	450	47	18	520	448	46	20	514	-5	-1%	0.24	✓	✓	✓
Sydney Road	South of Groby Road	SB	520	59	16	599	528	59	16	603	4	1%	0.17	✓	✓	✓
Savoy Road	East of Savoy Road WB	WB	114	11	18	143	114	0	10	124	-19	-13%	1.61	✓	✓	✓
Savoy Road	East of Savoy Road EB	EB	15	6	16	36	15	6	14	35	-1	-2%	0.15	✓	✓	✓
A532 Weston Road	West of A5020 University Way	SB	277	71	54	403	270	71	55	396	-7	-2%	0.36	✓	✓	✓
A5020 David Whitby Way	South of A532	NB	643	66	38	747	648	69	38	756	8	1%	0.30	✓	✓	✓
A5020 University Way	North of Weston Road	SB	398	62	28	491	397	62	28	487	-3	-1%	0.15	✓	✓	✓
A5020 University Way	North of Weston Road	NB	423	62	26	515	425	61	24	510	-5	-1%	0.22	✓	✓	✓
B5472 Weston Road	East of David Whitby Way	WB	892	90	45	1033	889	86	22	997	-36	-4%	1.14	✓	✓	✓
A5020 David Whitby Way	North of A500	SB	649	68	36	754	656	73	36	764	10	1%	0.38	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Parkers Road	West of Broughton Road	WB	286	132	8	428	308	43	4	355	-72	-17%	3.65	✓	✓	✓
A534 Nantwich Road	West of A532 Weston Road	WB	565	109	28	715	566	119	34	719	3	0%	0.13	✓	✓	✓
A534 Crewe Road	East of A532 Weston Road	EB	740	89	22	865	730	88	24	842	-23	-3%	0.80	✓	✓	✓
A532 Weston Road	South of A534 Nantwich Road	NB	511	71	21	604	509	61	22	593	-11	-2%	0.47	✓	✓	✓
Market Close	Market close NB	NB	3	1	0	4	2	5	0	7	3	88%	1.38	✓	✓	✓
Vernon Way	South of Vernon Way SB	SB	557	74	7	639	531	74	7	611	-28	-4%	1.12	✓	✓	✓
Remer Street	West of Groby Road	EB	371	35	13	423	368	35	16	419	-3	-1%	0.17	✓	✓	✓
Bradfield Road	East of Broughton Road	EB	510	68	13	596	491	68	20	579	-17	-3%	0.72	✓	✓	✓
Bradfield Road	West of B5076 Bradfield Road WB	WB	343	39	22	413	356	51	20	427	14	3%	0.67	✓	✓	✓
Broughton Road	North of Bradfield Road	NB	62	10	4	76	62	10	4	76	0	0%	0.02	✓	✓	✓
A532 Weston Road	West of A5020 University Way	NB	1157	107	67	1335	1115	90	61	1267	-69	-5%	1.91	✓	✓	✓
A530 Middlewich Road	South of Brookhouse Lane	NB	557	55	10	628	529	54	11	595	-33	-5%	1.34	✓	✓	✓
A530 Middlewich Road	South of Brookhouse Lane	SB	461	63	21	552	464	63	22	548	-3	-1%	0.13	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A530 Middlewich Road	South of Wistaston Green Road	NB	833	92	32	961	896	107	40	1042	81	8%	2.56	✓	✓	✓
A530 Middlewich Road	South of Wistaston Green Road	SB	701	98	31	832	703	98	34	834	3	0%	0.09	✓	✓	✓
Warmingham Road	North of Groby Road	NB	287	33	5	327	290	45	8	343	16	5%	0.88	✓	✓	✓
A5020 David Whitby Way	South of A532	SB	207	50	37	294	215	50	37	302	8	3%	0.45	✓	✓	✓
Newcastle Road	North of Chorlton Lane	WB	293	75	10	381	296	75	9	380	-2	0%	0.08	✓	✓	✓
A5020 David Whitby Way	North of A500	SB	210	53	38	301	210	53	38	301	-1	0%	0.04	✓	✓	✓
A500	East of David Whitby Way	WB	784	203	90	1083	788	201	90	1079	-3	0%	0.10	✓	✓	✓
Newcastle Road	North of Chorlton Lane	EB	370	46	11	429	278	42	13	333	-96	-22%	4.93	✓	✓	✓
Main Road	South of Snape Lane	NB	174	39	7	221	174	39	8	221	0	0%	0.01	✓	✓	✓
A531	South of A500	SB	190	42	16	248	193	38	11	242	-6	-2%	0.37	✓	✓	✓
Newcastle Road	Between A531 roundabout and Abbey Park Way roundabout	WB	742	75	11	835	742	75	12	829	-6	-1%	0.22	✓	✓	✓
A500	East of David Whitby Way	EB	692	91	82	872	695	91	81	867	-4	-1%	0.15	✓	✓	✓
Main Road	South of Snape Lane	SB	362	29	7	402	373	29	10	412	11	3%	0.52	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Newcastle Road	Between A531 roundabout and Abbey Park Way roundabout	EB	440	65	12	522	440	65	13	518	-4	-1%	0.17	✓	✓	✓
A531	South of A500	NB	278	26	9	315	278	26	11	315	0	0%	0.01	✓	✓	✓
A500	East of B5472	WB	987	261	153	1407	989	261	103	1353	-54	-4%	1.45	✓	✓	✓
A500	East of B5472	EB	919	146	126	1195	921	146	127	1195	0	0%	0.00	✓	✓	✓
Broughton Road	Bradfield Road (S) to Parkers Road (N)	NB	45	33	5	83	40	19	3	61	-22	-26%	2.59	✓	✓	✓
Broughton Road	Parkers Road (N) to Bradfield Road (S)	SB	67	49	3	120	67	29	2	98	-22	-18%	2.08	✓	✓	✓
A51 - A530	A51 Nantwich Bypass (S), Arm C Exit	SB	491	101	76	677	481	98	65	644	-33	-5%	1.27	✓	✓	✓
A51 - A531	A51 Nantwich Bypass (S), Arm C Approach	NB	677	124	68	877	686	125	68	878	1	0%	0.04	✓	✓	✓
Weston Road	Unnamed Road (S) to Weston Road Service Road (N)	NB	566	100	24	695	566	101	25	692	-2	0%	0.09	✓	✓	✓
Weston Road	Weston Road Service Road (N) to Unnamed Road (S)	SB	324	59	12	397	322	61	17	400	4	1%	0.18	✓	✓	✓
Warmingham Road / Groby Road	Groby Road (E), Arm B Exit	EB	360	29	1	393	243	17	2	262	-130	-33%	7.21	×	×	×
Warmingham Road / Groby Road	Groby Road (E), Arm B Approach	WB	119	20	3	143	100	18	3	121	-21	-15%	1.86	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Marshfield Bank	Marshfield Bank NB	NB	354	49	10	413	354	49	4	408	-5	-1%	0.26	✓	✓	✓
Marshfield Bank	Marshfield Bank SB	SB	63	41	10	114	63	41	3	107	-7	-6%	0.62	✓	✓	✓
A530 Middlewich Road	North of A532 Coppenhall Lane	NB	806	87	38	935	769	82	32	883	-52	-6%	1.73	✓	✓	✓
A530 Middlewich Road	North of A532 Coppenhall Lane	SB	650	84	25	760	646	84	22	752	-9	-1%	0.32	✓	✓	✓
A530 Middlewich Road	North of Wistaston Green Road	SB	696	97	31	826	814	100	35	949	123	15%	4.13	✓	✓	✓
A530 Middlewich Road	North of Wistaston Green Road	NB	1017	112	39	1174	991	111	41	1143	-31	-3%	0.91	✓	✓	✓
Coppenhall Lane	West of A532 Coppenhall Lane WB	WB	536	55	15	608	530	55	19	604	-4	-1%	0.15	✓	✓	✓
Coppenhall Lane	West of A532 Coppenhall Lane EB	EB	410	59	10	483	294	59	14	366	-116	-24%	5.63	×	×	×
Middlewich Road	South of Nantwich Road SB	WB	727	98	24	849	638	98	26	761	-88	-10%	3.09	✓	✓	✓
Middlewich Road	South of Nantwich Road NB	EB	810	103	40	958	759	102	43	904	-54	-6%	1.78	✓	✓	✓
Middlewich Road	North of B5334 NB	EB	507	82	9	600	501	80	12	593	-7	-1%	0.29	✓	✓	✓
Middlewich Road	North of B5334 SB	WB	518	90	7	616	468	90	15	572	-43	-7%	1.77	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A51	South of Nantwich Tennis Club	EB	640	107	81	839	672	109	81	862	23	3%	0.80	✓	✓	✓
A51	South of Nantwich Tennis Club	WB	628	115	60	810	652	114	59	825	15	2%	0.52	✓	✓	✓
Unnamed Road	Near to Alvaston Business Park	EB	13	4	1	17	14	4	1	19	2	11%	0.43	✓	✓	✓
Unnamed Road	Near to Alvaston Business Park	WB	117	6	0	122	117	6	2	125	3	2%	0.25	✓	✓	✓
Parkers Road	East of Bradfield Road	WB	560	44	10	618	359	39	16	414	-204	-33%	8.97	×	×	×
Bradfield Road	South of Parkers Lane	NB	529	65	12	612	405	61	16	482	-130	-21%	5.57	×	×	×
Bradfield Road	South of Parkers Lane	SB	337	47	11	399	261	37	13	310	-89	-22%	4.73	✓	✓	✓
Bradfield Road - Parkers Road	B5076 Bradfield Road (NW), Arm C Exit	NW	987	98	19	1114	729	99	31	859	-255	-23%	8.12	×	×	×
Bradfield Road - Parkers Road	B5076 Bradfield Road (NW), Arm C Approach	SE	483	66	22	578	478	66	33	577	-1	0%	0.05	✓	✓	✓
Parkers Road	East of Bradfield Road	EB	248	30	14	295	247	30	21	298	2	1%	0.13	✓	✓	✓

Table 14: AP2 A500 Crewe Model – individual link flow detailed results – post – PM peak hour

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Badger Avenue	West of Vernon Way	EB	342	25	1	368	340	24	0	365	-3	-1%	0.14	✓	✓	✓
A500	West of David Whitby Way	EB	933	126	62	1128	944	126	60	1129	1	0%	0.02	✓	✓	✓
Nantwich Bypass	South of Nantwich Bypass NB	NB	784	59	39	886	781	59	39	878	-8	-1%	0.26	✓	✓	✓
A530 Middlewich Road	South of Pyms Lane	SB	817	58	12	887	760	58	5	822	-65	-7%	2.22	✓	✓	✓
B5472 Weston Road	East of David Whitby Way	EB	941	68	9	1019	927	69	6	1002	-18	-2%	0.56	✓	✓	✓
A500	West of David Whitby Way	WB	1403	118	52	1574	1413	127	52	1592	18	1%	0.45	✓	✓	✓
Nantwich Bypass	South of Nantwich Bypass SB	SB	713	72	44	843	714	71	44	829	-14	-2%	0.47	✓	✓	✓
A530 Middlewich Road	South of Pyms Lane	NB	575	37	9	622	569	37	9	614	-8	-1%	0.32	✓	✓	✓
West Street	West of A532 West Street WB	WB	608	52	3	666	606	52	13	671	5	1%	0.21	✓	✓	✓
West Street	East of A532 West Street WB	WB	287	29	1	317	237	29	3	270	-47	-15%	2.75	✓	✓	✓
Dunwoody Way	North of Dunwoody way NB	WB	580	38	2	624	578	38	9	626	2	0%	0.09	✓	✓	✓
Bessemer Way	North of Bessemer Way SB	NB	22	2	0	24	29	2	1	31	8	33%	1.48	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
West Street	West of A532 West Street EB	EB	554	37	4	598	599	38	14	650	52	9%	2.09	✓	✓	✓
Bessemer Way	North of Bessemer Way NB	SB	31	3	0	34	31	3	0	34	0	0%	0.02	✓	✓	✓
Dunwoody Way	North of Dunwoody way SB	EB	420	28	2	453	418	28	9	456	3	1%	0.13	✓	✓	✓
West Street	East of A532 West Street EB	EB	384	23	2	409	388	24	4	416	7	2%	0.35	✓	✓	✓
Dunwoody Way	A5078 Dunwoody Way SB	SB	349	22	1	372	344	22	8	375	2	1%	0.12	✓	✓	✓
Dunwoody Way	A5078 Dunwoody Way NB	NB	480	23	1	505	481	24	8	513	8	2%	0.35	✓	✓	✓
Bradfield Road	East of Bradfield Road WB	WB	293	121	10	425	325	32	6	363	-62	-15%	3.13	✓	✓	✓
Bradfield Road	East of Bradfield Road EB	EB	346	161	10	519	384	47	10	441	-78	-15%	3.55	✓	✓	✓
Mablins Lane	South of Mablins Lane NB	NB	201	16	1	219	203	16	6	225	6	3%	0.40	✓	✓	✓
Bradfield Road	East of B5076 Bradfield Road EB	WB	528	38	4	579	529	38	12	579	0	0%	0.00	✓	✓	✓
Bradfield Road	West of B5076 Bradfield Road EB	EB	438	42	8	493	394	42	10	446	-47	-10%	2.17	✓	✓	✓
Mablins Lane	South of Mablins Lane SB	SB	136	7	2	146	136	10	9	156	10	7%	0.82	✓	✓	✓
Dunwoody Way	East of A5078 Dunwoody Way WB	WB	482	24	1	507	481	24	3	508	1	0%	0.04	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Bradfield Road	East of B5076 Bradfield Road WB	EB	532	48	9	596	522	48	19	589	-7	-1%	0.30	✓	✓	✓
Dunwoody Way	East of A5078 Dunwoody Way EB	EB	341	22	1	365	344	22	3	370	4	1%	0.23	✓	✓	✓
Bradfield Road	West of Broughton Road	WB	613	45	3	664	612	45	3	659	-5	-1%	0.20	✓	✓	✓
Bradfield Road	East of Broughton Road	WB	655	50	3	711	654	50	4	708	-4	-1%	0.14	✓	✓	✓
Bradfield Road	West of Broughton Road	EB	547	31	7	586	546	31	10	587	0	0%	0.02	✓	✓	✓
Broughton Road	North of Bradfield Road	SB	67	7	1	77	67	7	0	74	-3	-4%	0.34	✓	✓	✓
Parkers Road	West of Broughton Road	EB	347	114	6	468	349	32	6	387	-81	-17%	3.92	✓	✓	✓
Badger Avenue	West of Vernon Way	WB	361	24	1	386	352	24	1	377	-9	-2%	0.46	✓	✓	✓
A532 West Street	West of Vernon Way	WB	301	25	3	331	261	24	3	288	-43	-13%	2.47	✓	✓	✓
Market Close	Market close NB	SB	8	0	0	8	6	7	0	13	6	74%	1.73	✓	✓	✓
Middlewich Street	North of Vernon Way NB	WB	368	34	0	404	340	31	15	387	-18	-4%	0.89	✓	✓	✓
Vernon Way	North of Vernon Way NB	NB	613	39	1	652	610	37	13	661	9	1%	0.33	✓	✓	✓
Vernon Way	North of Vernon Way SB	SB	393	33	1	429	379	30	15	424	-5	-1%	0.23	✓	✓	✓
Vernon Way	South of Vernon Way NB	NB	600	35	2	637	601	35	14	650	13	2%	0.51	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Warmingham Road	South of Groby Rod	SB	266	29	2	298	255	29	4	288	-11	-4%	0.62	✓	✓	✓
Earle Street	West of Earles Street WB	WB	215	14	1	230	211	14	27	251	22	9%	1.39	✓	✓	✓
Middlewich Street	West of Middlewich Street NB	EB	571	41	1	613	565	41	12	618	5	1%	0.22	✓	✓	✓
Vernon Way	South of Vernon Way SB	SB	404	33	1	439	385	30	16	431	-8	-2%	0.39	✓	✓	✓
A532 Veron Way	South of West Street	NB	673	44	3	720	680	44	16	739	19	3%	0.69	✓	✓	✓
A532 West Street	West of Vernon Way	EB	386	27	3	416	335	28	3	365	-51	-12%	2.59	✓	✓	✓
Earle Sreet	West of Earles Street EB	EB	240	15	1	257	237	15	18	270	13	5%	0.80	✓	✓	✓
A532 Veron Way	South of West Street	SB	555	44	3	602	538	43	18	598	-4	-1%	0.16	✓	✓	✓
Vernon Way	South of Vernon Way NB	NB	695	43	1	739	697	43	1	741	2	0%	0.09	✓	✓	✓
Earle Street	Earle Street WB	WB	893	56	3	952	890	57	14	962	10	1%	0.31	✓	✓	✓
Warmingham Road	North of Groby Road	SB	372	39	2	416	374	44	4	421	5	1%	0.25	✓	✓	✓
Warmingham Road	South of Groby Road	NB	321	14	0	339	323	14	7	344	6	2%	0.30	✓	✓	✓
Earle Street	Earle Street EB	EB	860	61	3	926	851	61	8	920	-6	-1%	0.19	✓	✓	✓
Tommy's Lane	South of Tommys Lane NB	WB	79	6	0	84	79	6	0	85	1	1%	0.07	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A534 Nantwich Road	West of A532 Weston Road	EB	672	47	6	732	675	47	13	734	2	0%	0.09	✓	✓	✓
A532 Manchester Bridge	West of Macon Way	WB	1006	63	3	1072	1003	63	14	1080	8	1%	0.24	✓	✓	✓
Tommy's Lane	South of Tommys Lane SB	EB	71	6	1	78	71	3	0	74	-3	-4%	0.40	✓	✓	✓
A532 Weston Road	South of A534 Nantwich Road	NB	627	38	6	672	632	39	8	680	8	1%	0.30	✓	✓	✓
A532 Macon Way	North of A534 Nantwich Road	SB	576	38	3	617	572	39	5	616	-1	0%	0.03	✓	✓	✓
A532 Macon Way	North of A534 Nantwich Road	NB	668	38	4	709	667	36	4	707	-2	0%	0.08	✓	✓	✓
A534 Crewe Road	East of A532 Weston Road	WB	567	31	9	609	576	31	13	620	11	2%	0.43	✓	✓	✓
A532 Manchester Bridge	West of Macon Way	EB	894	66	4	966	972	66	9	1047	81	8%	2.54	✓	✓	✓
A532 Macon Way	South of A532 Manchester Bridge	SB	466	39	3	508	461	38	6	505	-3	-1%	0.13	✓	✓	✓
A532 Macon Way	South of A532 Manchester Bridge	NB	795	37	3	835	710	37	3	750	-85	-10%	3.02	✓	✓	✓
Hungerford Road	East of A532 Macon Way	WB	499	50	1	550	496	49	12	557	7	1%	0.32	✓	✓	✓
Groby Road	North of Sydney Road	NB	168	12	0	180	199	15	0	215	34	19%	2.44	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Hungerford Road	East of A532 Macon Way	EB	717	51	1	771	715	51	3	769	-2	0%	0.06	✓	✓	✓
Remer Street	West of Groby Road	EB	420	34	7	462	419	34	7	460	-1	0%	0.06	✓	✓	✓
Groby Road	North of Sydney Road	SB	181	13	0	194	180	14	0	194	0	0%	0.00	✓	✓	✓
Sydney Road	South of Groby Road	NB	495	45	2	545	519	46	17	582	37	7%	1.57	✓	✓	✓
Sydney Road	South of Groby Road	SB	583	47	7	637	580	47	7	634	-3	0%	0.12	✓	✓	✓
Savoy Road	East of Savoy Road WB	WB	12	1	5	18	15	0	4	20	2	13%	0.53	✓	✓	✓
Savoy Road	East of Savoy Road EB	EB	118	5	4	127	118	5	2	126	-2	-1%	0.16	✓	✓	✓
A532 Weston Road	West of A5020 University Way	SB	1208	85	21	1316	1198	74	20	1292	-24	-2%	0.67	✓	✓	✓
A5020 David Whitby Way	South of A532	NB	279	36	29	349	282	36	29	347	-1	0%	0.08	✓	✓	✓
A5020 University Way	North of Weston Road	SB	579	55	11	647	577	55	11	644	-3	0%	0.12	✓	✓	✓
A5020 University Way	North of Weston Road	NB	445	47	10	503	446	47	9	503	-1	0%	0.03	✓	✓	✓
B5472 Weston Road	East of David Whitby Way	WB	401	41	27	470	404	41	7	451	-19	-4%	0.87	✓	✓	✓
A5020 David Whitby Way	North of A500	SB	284	28	32	348	287	28	32	347	-1	0%	0.05	✓	✓	✓
Parkers Road	West of Broughton Road	WB	219	108	5	333	219	43	4	266	-67	-20%	3.85	✓	✓	✓
A534 Nantwich Road	West of A532 Weston Road	WB	743	46	6	798	761	55	15	832	34	4%	1.19	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A534 Crewe Road	East of A532 Weston Road	EB	431	27	3	467	433	27	7	467	0	0%	0.01	✓	✓	✓
A532 Weston Road	South of A534 Nantwich Road	NB	592	43	12	649	584	35	14	633	-16	-2%	0.64	✓	✓	✓
Market Close	Market close NB	NB	4	0	0	4	0	5	0	6	2	41%	0.75	✓	✓	✓
Vernon Way	South of Vernon Way SB	SB	628	40	1	668	621	39	0	661	-7	-1%	0.28	✓	✓	✓
Remer Street	West of Groby Road	EB	340	32	2	376	339	32	17	388	12	3%	0.59	✓	✓	✓
Bradfield Road	East of Broughton Road	EB	576	33	8	621	575	33	10	618	-2	0%	0.09	✓	✓	✓
Bradfield Road	West of B5076 Bradfield Road WB	WB	376	26	4	411	335	26	6	367	-44	-11%	2.25	✓	✓	✓
Broughton Road	North of Bradfield Road	NB	80	10	0	90	80	10	1	91	1	1%	0.11	✓	✓	✓
A532 Weston Road	West of A5020 University Way	NB	321	42	51	417	323	33	32	388	-29	-7%	1.45	✓	✓	✓
A530 Middlewich Road	South of Brookhouse Lane	NB	649	44	3	702	643	43	7	693	-9	-1%	0.33	✓	✓	✓
A530 Middlewich Road	South of Brookhouse Lane	SB	493	33	2	533	493	33	5	531	-2	0%	0.09	✓	✓	✓
A530 Middlewich Road	South of Wistaston Green Road	NB	618	54	10	684	738	54	15	807	123	18%	4.49	✓	×	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A530 Middlewich Road	South of Wistaston Green Road	SB	585	32	2	620	645	35	8	689	69	11%	2.69	✓	✓	✓
Warmingham Road	North of Groby Road	NB	476	26	0	505	481	27	7	515	10	2%	0.42	✓	✓	✓
A5020 David Whitby Way	South of A532	SB	868	64	18	952	867	62	18	948	-4	0%	0.13	✓	✓	✓
Newcastle Road	North of Chorlton Lane	WB	386	31	0	417	386	31	3	420	2	1%	0.12	✓	✓	✓
A5020 David Whitby Way	North of A500	SB	879	64	18	963	831	62	18	911	-52	-5%	1.70	✓	✓	✓
A500	East of David Whitby Way	WB	848	85	66	1000	844	72	68	984	-16	-2%	0.50	✓	✓	✓
Newcastle Road	North of Chorlton Lane	EB	318	33	2	355	318	33	2	353	-2	-1%	0.11	✓	✓	✓
Main Road	South of Snape Lane	NB	371	25	1	399	364	25	3	393	-6	-2%	0.32	✓	✓	✓
A531	South of A500	SB	270	24	3	299	378	24	3	405	106	35%	5.64	×	×	×
Newcastle Road	Between A531 roundabout and Abbey Park Way roundabout	WB	445	27	1	475	445	27	5	477	2	0%	0.10	✓	✓	✓
A500	East of David Whitby Way	EB	973	130	61	1170	920	105	61	1085	-84	-7%	2.51	✓	✓	✓
Main Road	South of Snape Lane	SB	172	14	1	189	172	14	4	191	2	1%	0.12	✓	✓	✓
Newcastle Road	Between A531 roundabout and	EB	775	51	2	832	776	47	4	828	-4	-1%	0.16	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
	Abbey Park Way roundabout															
A531	South of A500	NB	171	17	2	192	171	17	1	189	-3	-2%	0.24	✓	✓	✓
A500	East of B5472	WB	1213	106	79	1398	1209	106	71	1387	-11	-1%	0.31	✓	✓	✓
A500	East of B5472	EB	1116	147	61	1330	1116	147	61	1324	-6	0%	0.17	✓	✓	✓
Broughton Road	Bradfield Road (S) to Parkers Road (N)	NB	54	27	2	85	54	16	2	71	-14	-16%	1.58	✓	✓	✓
Broughton Road	Parkers Road (N) to Bradfield Road (S)	SB	41	39	3	84	41	11	0	52	-32	-38%	3.87	✓	✓	✓
A51 - A530	A51 Nantwich Bypass (S), Arm C Exit	SB	701	90	35	829	702	89	35	827	-2	0%	0.08	✓	✓	✓
A51 - A531	A51 Nantwich Bypass (S), Arm C Approach	NB	682	76	42	801	680	76	42	798	-3	0%	0.12	✓	✓	✓
Weston Road	Unnamed Road (S) to Weston Road Service Road (N)	NB	485	32	6	525	490	36	9	535	10	2%	0.43	✓	✓	✓
Weston Road	Weston Road Service Road (N) to Unnamed Road (S)	SB	608	35	10	656	599	35	12	647	-9	-1%	0.35	✓	✓	✓
Warmingham Road / Groby Road	Groby Road (E), Arm B Exit	EB	212	19	0	234	172	15	0	187	-46	-20%	3.18	✓	✓	✓
Warmingham Road / Groby Road	Groby Road (E), Arm B Approach	WB	262	21	0	282	211	13	0	224	-58	-20%	3.63	✓	✓	✓
Marshfield Bank	Marshfield Bank NB	NB	86	12	4	101	86	12	3	101	0	0%	0.01	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Marshfield Bank	Marshfield Bank SB	SB	351	11	2	364	351	11	2	363	-1	0%	0.05	✓	✓	✓
A530 Middlewich Road	North of A532 Coppenhall Lane	NB	567	39	9	616	562	39	9	609	-7	-1%	0.26	✓	✓	✓
A530 Middlewich Road	North of A532 Coppenhall Lane	SB	821	49	5	875	820	49	5	875	0	0%	0.01	✓	✓	✓
A530 Middlewich Road	North of Wistaston Green Road	SB	1055	57	4	1118	1052	57	9	1118	0	0%	0.01	✓	✓	✓
A530 Middlewich Road	North of Wistaston Green Road	NB	669	58	11	740	670	58	16	744	4	1%	0.14	✓	✓	✓
Coppenhall Lane	West of A532 Coppenhall Lane WB	WB	378	22	1	403	375	22	6	403	1	0%	0.03	✓	✓	✓
Coppenhall Lane	West of A532 Coppenhall Lane EB	EB	510	33	3	547	517	33	8	558	10	2%	0.44	✓	✓	✓
Middlewich Road	South of Nantwich Road SB	WB	646	38	4	690	640	38	9	687	-3	0%	0.11	✓	✓	✓
Middlewich Road	South of Nantwich Road NB	EB	770	68	11	850	745	65	16	825	-25	-3%	0.86	✓	✓	✓
Middlewich Road	North of B5334 NB	EB	632	52	3	689	630	52	8	690	1	0%	0.04	✓	✓	✓
Middlewich Road	North of B5334 SB	WB	617	40	2	660	616	40	7	663	2	0%	0.10	✓	✓	✓
A51	South of Nantwich Tennis Club	EB	760	100	39	901	767	99	39	905	4	0%	0.12	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A51	South of Nantwich Tennis Club	WB	712	74	39	826	712	74	39	825	-1	0%	0.03	✓	✓	✓
Unnamed Road	Near to Alvaston Business Park	EB	109	8	1	117	109	8	0	117	0	0%	0.01	✓	✓	✓
Unnamed Road	Near to Alvaston Business Park	WB	30	3	1	34	30	3	0	33	0	-1%	0.06	✓	✓	✓
Parkers Road	East of Bradfield Road	WB	226	22	1	250	226	22	8	256	6	2%	0.36	✓	✓	✓
Bradfield Road	South of Parkers Lane	NB	437	28	2	472	435	28	5	467	-5	-1%	0.23	✓	✓	✓
Bradfield Road	South of Parkers Lane	SB	514	36	3	558	508	36	6	550	-8	-1%	0.35	✓	✓	✓
Bradfield Road - Parkers Road	B5076 Bradfield Road (NW), Arm C Exit	NW	569	38	3	615	566	38	13	617	2	0%	0.09	✓	✓	✓
Bradfield Road - Parkers Road	B5076 Bradfield Road (NW), Arm C Approach	SE	918	62	4	992	912	62	17	991	-1	0%	0.04	✓	✓	✓
Parkers Road	east of Bradfield Road	EB	498	38	2	542	498	38	11	547	6	1%	0.24	✓	✓	✓

Individual route journey time performance

Table 15: AP2 A500 Crewe Model – individual route journey time detailed results – post – AM peak hour

Route Name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
M6	NB	14,863	951	763	-188	-19.8%	×	No count data on the M6 so difficult to reflect flow and journey times in the model.
M6	SB	14,963	718	779	61	8.5%	✓	
A500	WB	16,780	1,321	1,135	-186	-14.1%	✓	
A500	EB	16,657	1,048	1,026	-22	-2.1%	✓	
A534	NB	14,380	2,230	1,481	-749	-33.6%	×	Unable to replicate very slow observed speeds near Crewe rail station while maintaining suitable traffic flow levels.
A534	SB	14,462	1,522	1,343	-179	-11.8%	✓	
Hall Lane	EB	10,051	1,356	973	-382	-28.2%	×	No count data in Sandbach area so difficult to reflect flow and journey times in the model.
Hall Lane	WB	10,077	1,116	1,121	5	0.4%	✓	
Sydney Road/Bradfield Road	NB	12,120	1,450	1,295	-155	-10.7%	✓	
Sydney Road/Bradfield Road	SB	12,065	1,287	1,261	-26	-2.0%	✓	
A532/A5078	NB	7,150	805	859	53	6.6%	✓	
A532/A5078	SB	7,161	1,042	887	-156	-15.0%	✓	
A530	NB	14,383	1,046	1,194	147	14.1%	✓	
A530	SB	14,446	1,187	1,288	101	8.5%	✓	

Route Name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
B5074	NB	13,796	971	1,060	89	9.1%	✓	
B5074	SB	13,796	986	1,028	42	4.2%	✓	

Table 16: AP2 A500 Crewe Model – individual route journey time detailed results – post – PM peak hour

Route Name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
M6	NB	14,863	768	729	-38	-5.0%	✓	
M6	SB	14,963	750	816	66	8.9%	✓	
A500	WB	16,780	1,216	1,133	-83	-6.8%	✓	
A500	EB	16,657	1,172	1,038	-134	-11.4%	✓	
A534	NB	14,380	1,679	1,355	-323	-19.3%	×	Unable to replicate very slow observed speeds near Crewe rail station while maintaining suitable traffic flow levels.
A534	SB	14,462	1,732	1,537	-194	-11.2%	✓	
Hall Lane	EB	10,051	1,156	989	-167	-14.4%	✓	
Hall Lane	WB	10,077	1,062	1,020	-42	-4.0%	✓	
Sydney Road/Bradfield Road	NB	12,120	1,425	1,253	-172	-12.1%	✓	
Sydney Road/Bradfield Road	SB	12,065	1,216	1,220	4	0.4%	✓	
A532/A5078	NB	7,150	1,271	882	-389	-30.6%	×	Unable to replicate very slow observed speeds near Crewe rail station while maintaining suitable traffic flow levels.

Route Name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
A532/A5078	SB	7,161	1,499	933	-566	-37.8%	×	Unable to replicate very slow observed speeds near Crewe rail station while maintaining suitable traffic flow levels.
A530	NB	14,383	1,268	1,190	-77	-6.1%	✓	
A530	SB	14,446	1,514	1,237	-278	-18.3%	×	Unable to replicate slow observed speeds approaching Alvaston Roundabout while maintaining suitable traffic flow levels.
B5074	NB	13,796	908	980	72	8.0%	✓	
B5074	SB	13,796	985	959	-26	-2.6%	✓	

Annex G: Model performance report – Northwich Traffic Model

Contents

Tables

Figures

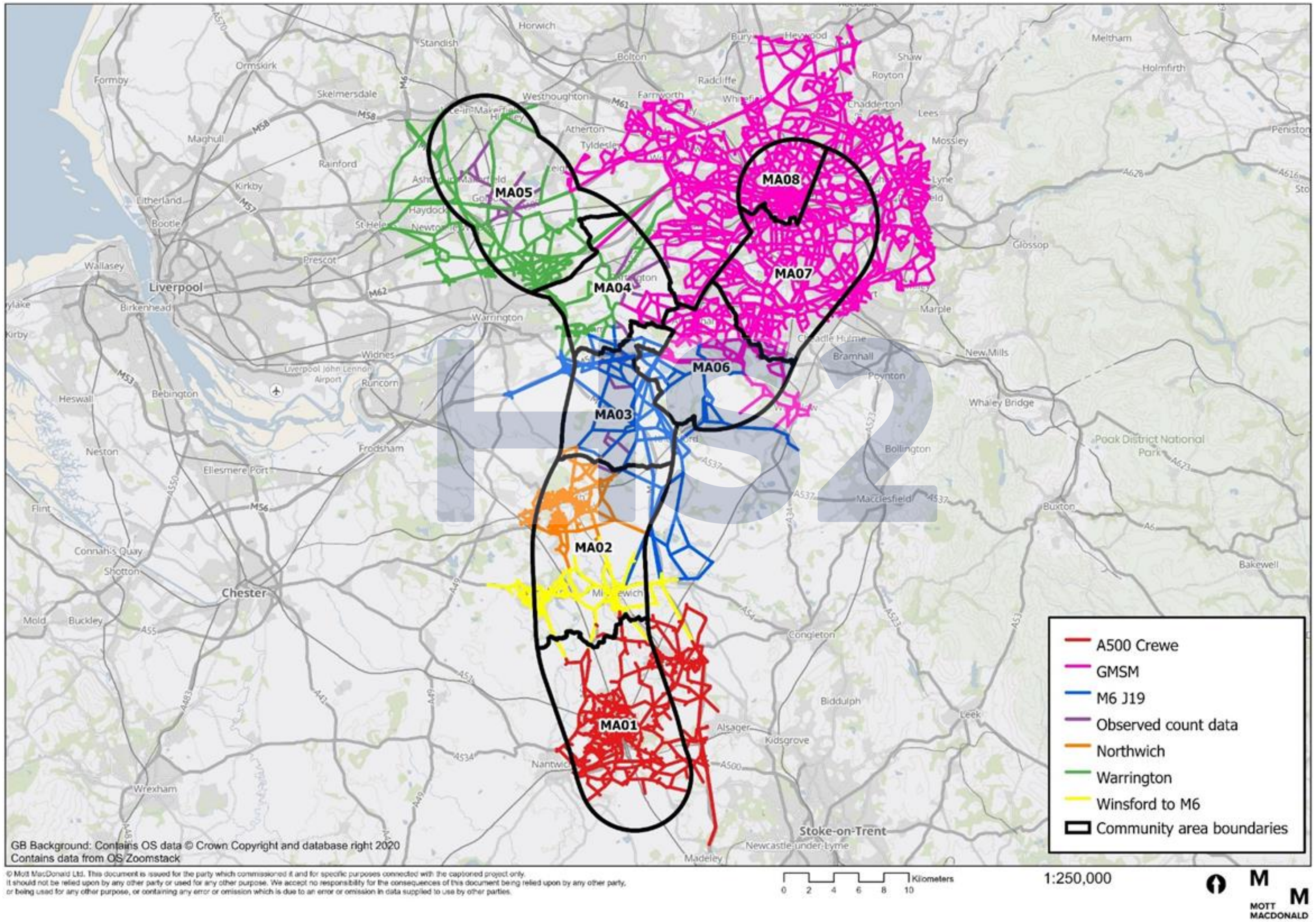
1 Introduction

1.1 Background

1.1.1 For the purpose of assessment, the route of the original scheme is split into a number of geographical areas referred to as Community Areas. The Northwich Traffic Model has been utilised to provide an evidence base for the main Transport Assessment (TA) for the north part of the community area referred to as Wimboldsley to Lostock Gralam (MA02). Cheshire West and Chester Council (CWaC) released copies of the latest available Northwich Traffic Model versions (as of January 2019) to HS2 Ltd.

1.1.2 Reference should be made to Figure 1 which shows the geographic coverage of strategic transport models that have been utilised for the TA.

Figure 1: Strategic transport model coverage for the High Speed Rail (Crewe – Manchester) Transport Assessment



1.2 Hybrid Bill and Additional Provision 1 Environmental Statement

1.2.1 The Northwich Traffic Model was updated by HS2 Ltd's transport consultants, Mott MacDonald Joint Venture (MWJV), to include localised improvements within the original scheme area of interest. This is described in the Model Performance Report for the Northwich Traffic, in the main TA Part 4 Addendum (Volume 5, Appendix: TR-005-00000, Report 2 of 2).

1.2.2 Additional Provision (AP) amendments are changes to the scheme that include requirements for additional powers in the High Speed Rail (Crewe-Manchester) Bill. At Additional Provision 1 (AP1) further model development work was undertaken which is described in the AP1 Model Performance Report for the Northwich Traffic Model, in the Supplementary Environmental Statement 1 (SES1) and AP1 ES TA Part 4 Addendum (SES1 and AP1 ES Volume 5, Appendix: TR-005-00000).

1.3 Additional Provision 2 Environmental Statement

1.3.1 Further model development has been undertaken by MWJV for the Additional Provision 2 (AP2) revised scheme. The Baseline model has been updated for the assessment to reflect the use of journey time data in the base model validation, and refinement of network coding to improve model performance.

1.4 Purpose of this report

1.4.1 This report documents the updates made for the AP2 revised scheme and model performance of the HS2 AP2 Northwich Traffic Model.

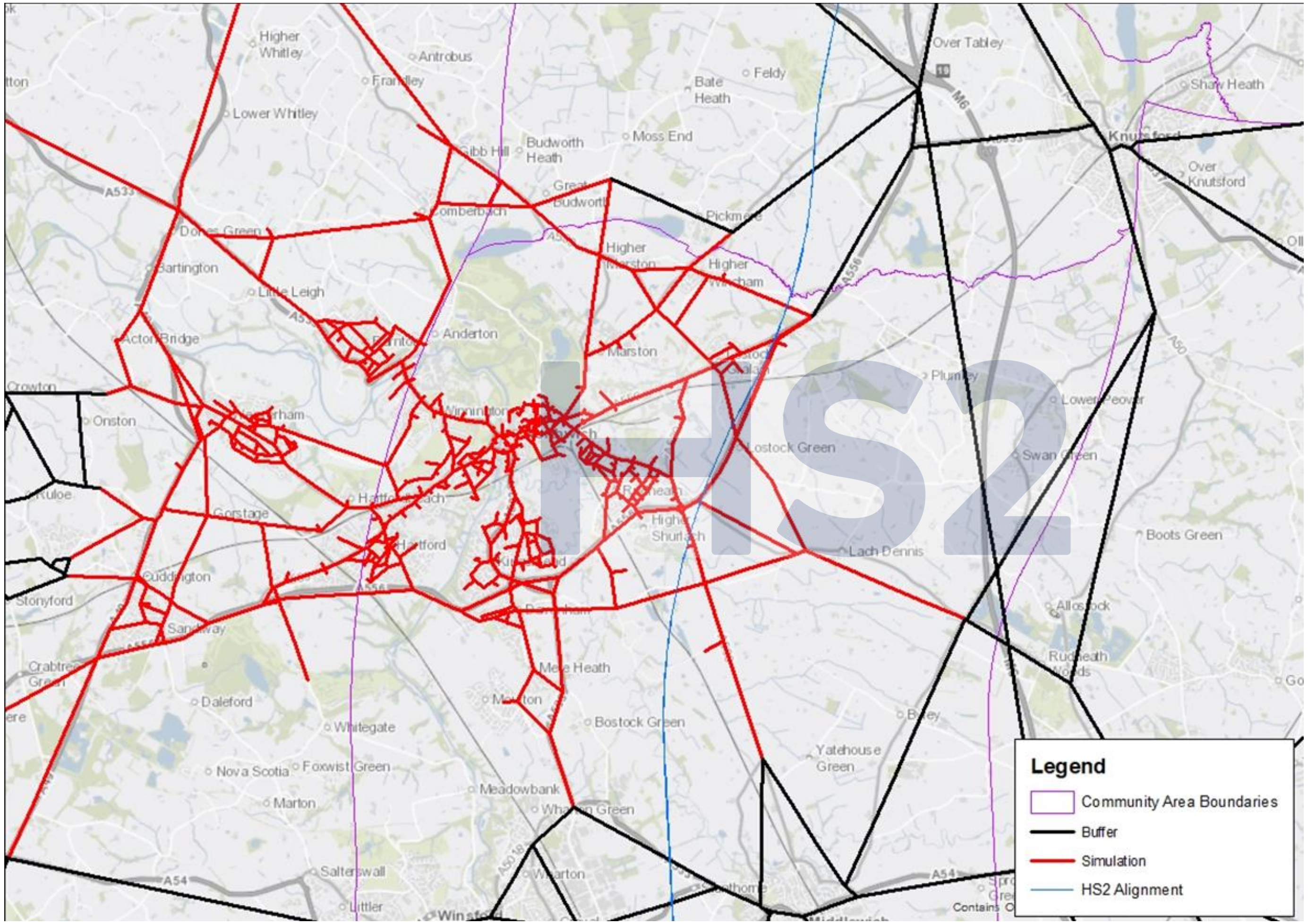
1.5 Model framework

1.5.1 The Northwich Traffic Model is a local highway model that was developed within a SATURN model software platform (version 11.3.12u).

1.5.2 The detailed modelled study area covers Northwich and surrounding areas. There is supporting network and zone system detail to provide a representation of the external area supply and demand. Reference should be made to Figure 2.

1.5.3 The Northwich Traffic Model is representative of 2016 base year transport conditions.

Figure 2: Model study area



1.6 Model development

1.6.1 The Northwich Traffic Model was developed by CWaC's appointed transport consultants to support the Northwich Transport Strategy.

1.7 Model description

1.7.1 The original Northwich Traffic Model has been developed for the following years:

- 2016 base year; and
- 2030 future year.

1.7.2 The model is representative of the following time periods:

- AM peak hour - 08:00–09:00;
- average inter peak hour - 10:00–16:00; and
- PM peak hour - 17:00–18:00.

1.7.3 The model is comprised of the following demand user-classes:

- car commute;
- car other;
- car employers business;
- light goods vehicles; and
- other goods vehicles.

1.8 Model application objectives

1.8.1 For the assessment of the AP2 revised scheme, the Northwich Traffic Model provides:

- preliminary traffic data to inform scheme design;
- changes in traffic flows, congestion, and journey times to inform the TA for the AP2 revised scheme;
- traffic data for the construction and operational phases of the AP2 revised scheme on which to base the assessment of significant effects for the Environmental Statement (ES); and
- changes in traffic flows between the base year and forecast scenarios for application to local models.

2 Guidance used

2.1 Introduction

2.1.1 This strategic highway model development makes reference to the following Transport Analysis Guidance (TAG) as published by the Department for Transport (DfT): TAG Unit M3.1 Highway Assignment Modelling (May 2020).

2.2 Highway model guidance

2.2.1 In relation to providing an assessment of model calibration and validation performance, reference has been made to Section 3.2 of TAG Unit M3.1 (Table 1, Table 2, and Table 3).

2.2.2 The criteria for the assessment of model calibration and validation of traffic flows and journey time performance are presented in Table 1, below.

Table 1: DfT - TAG validation criteria

Criteria	Acceptability guideline
Assigned hourly flows	
Individual flows within +/-15% for flows 700-2,700 vph	>85% of cases
Individual flows within +/-100 vph for flows <700 vph	>85% of cases
Individual flows within +/-400 vph for flows >2,700 vph	>85% of cases
Screenline flows (normally >5 links) to be within 5%	All or nearly all screenlines
Geoffrey Havers (GEH) statistic	
Individual flows GEH <5	>85% of cases
Journey times	
Modelled journey times within 15% (or 1 minute if higher)	>85% of cases

Credit. Table 1, Table 2, Table 3, DfT TAG Unit M3.1 Highway Assignment Modelling (May 2020)

2.2.3 The criteria for the assessment of highway model assignment convergence is presented in Table 2, below.

Table 2: Summary of convergence measures and base model acceptable values

Measures of convergence	Acceptability guideline
Delta and %GAP	Less than 0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with flow change (P) <1%	Four consecutive iterations greater than 98%
Percentage of links with cost change (P2) <1%	Four consecutive iterations greater than 98%
Percentage change in total user costs of links with flow change (V) <1%	Four consecutive iterations less than 0.1% (SUE only)

Credit. Table 4, DfT TAG Unit M3.1 Highway Assignment Modelling (May 2020)

3 Data for model development

3.1 Overview

3.1.1 This section of the report presents details of traffic data that has been used for the purpose of updating the Northwich Traffic Model study area.

3.1.2 The same traffic count data set was used for the main ES, SES1 and AP1 ES, and SES2 and AP2 ES. This is described in the following section.

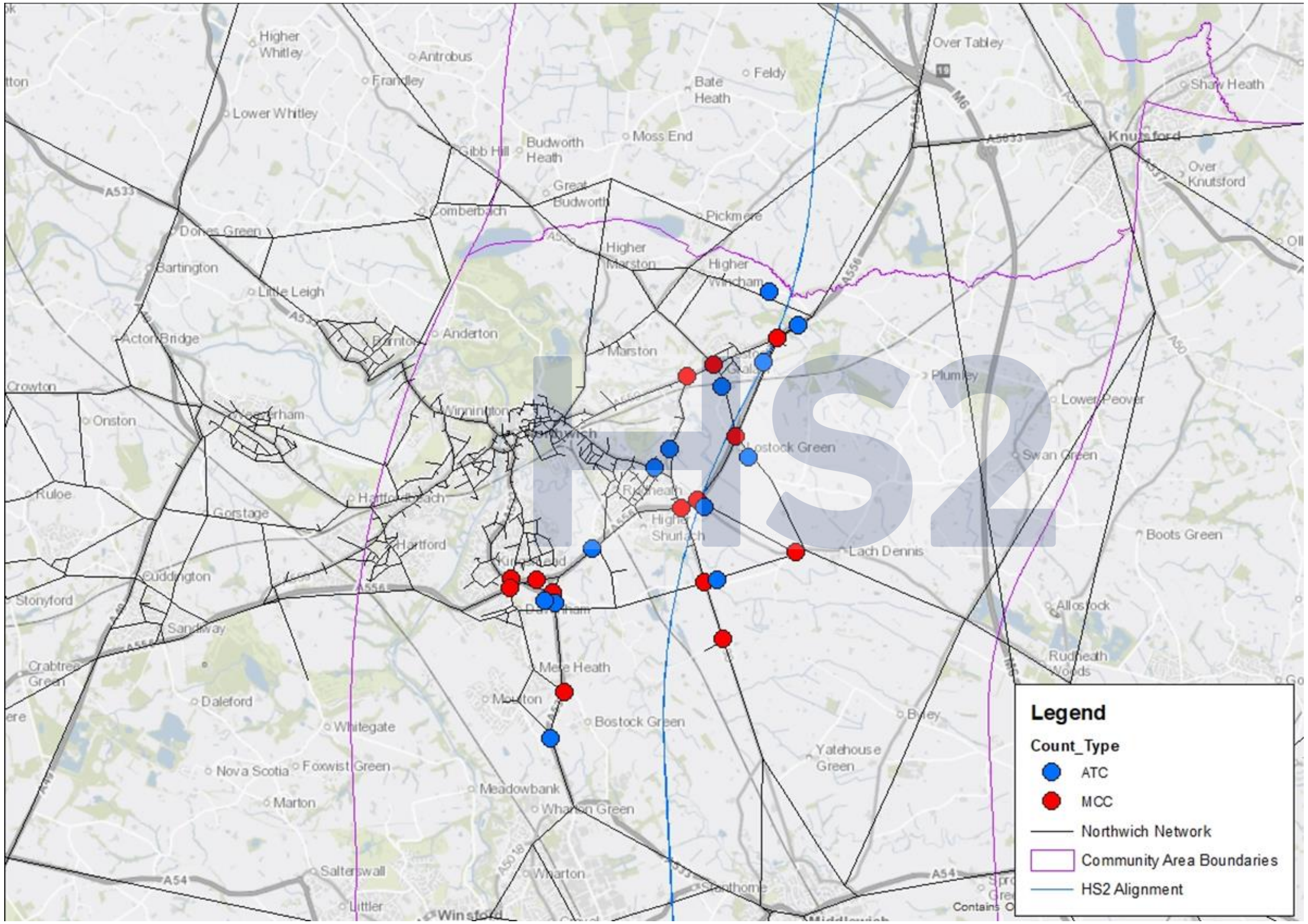
3.1.3 The journey time data has been used to inform the assessment of the AP2 revised scheme only and was not available to use for the original scheme or AP1 revised scheme. The journey time data is described in section 3.3. For the main ES and AP1 the focus for model development was to improve localised traffic flow performance.

3.2 Traffic survey data commission

3.2.1 MWJV commissioned a programme of traffic count surveys in 2017/2018 to support the assessment of the original scheme.

3.2.2 Traffic count surveys have been used from different years and months to update the base year model. The traffic counts have been factored to June 2018 to develop a consistent dataset. Figure 3 shows the location of traffic counts.

Figure 3: Location of traffic counts (MWJV survey commission)

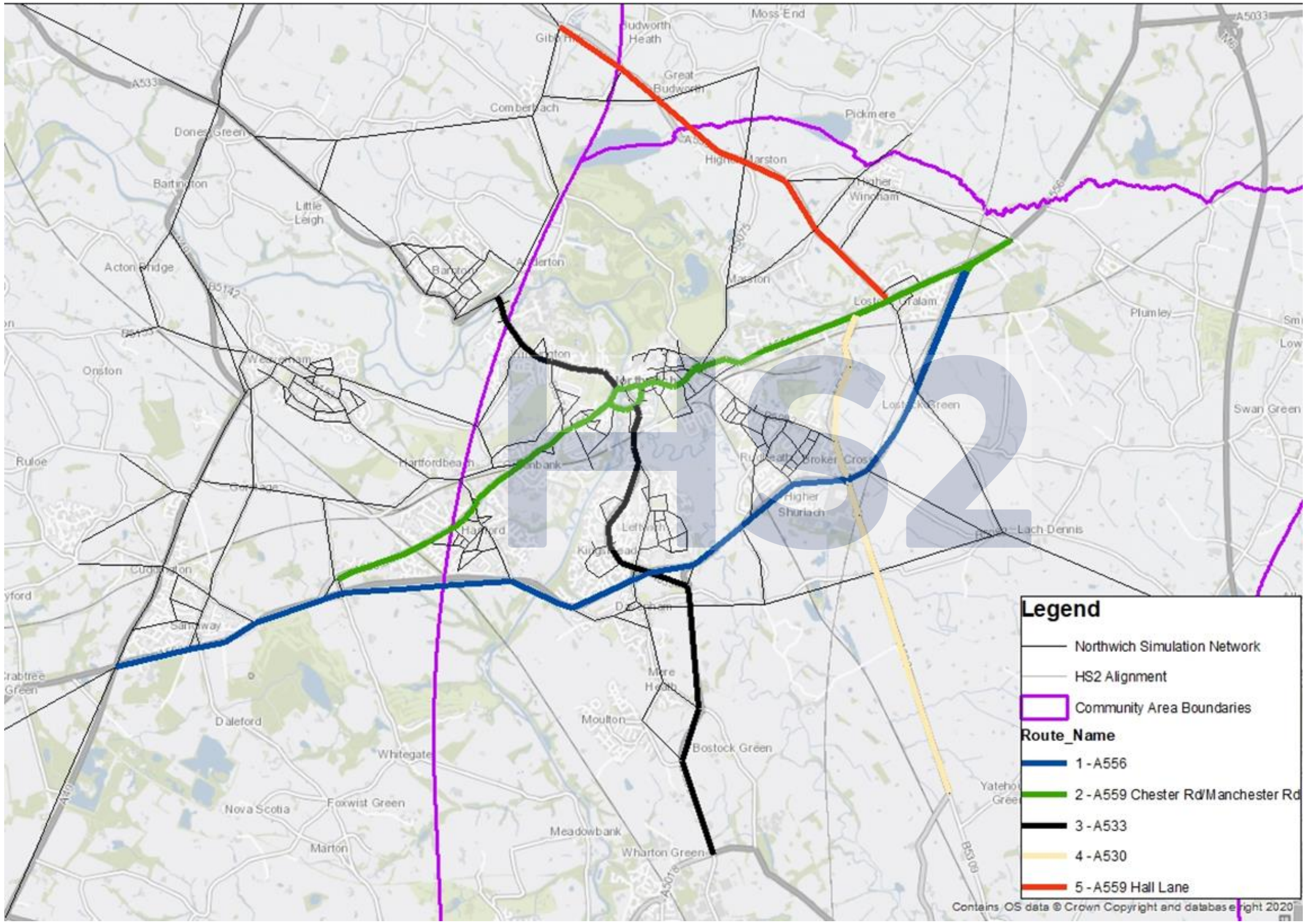


3.3 Journey time data

3.3.1 HS2 requested Trafficmaster journey time data representing June 2018 on behalf of MWJV from the DfT. This was processed by HS2 for MWJV for the journey time routes selected for the AP2 base model validation.

3.3.2 Journey time routes were defined as key routes across the model area of interest. Figure 4 shows the journey time routes chosen.

Figure 4: Location of journey time routes



4 Model development

4.1 Overview

4.1.1 For the main ES, the SES1 and AP1 ES, and the SES2 and AP2 ES, the 2016 base year model was updated to a 2018 (June) base year model by MWJV using local growth factors and the traffic count survey data that was collected between November 2017 and March 2020 (prior to COVID-19). Traffic count data has been normalised to June 2018 traffic conditions using local count data.

4.1.2 For the SES1 and AP1 ES, a review of base year model traffic flows identified that there was scope to undertake some localised improvements to the traffic model in order to provide a more robust assessment in the AP1 revised scheme area of interest. For the SES2 and AP2 ES, further localised improvements were made following review of model journey time data.

4.1.3 The model time periods represent the following peak hours, when the highest traffic volumes and most significant impacts are expected to occur:

- AM peak hour - 08:00–09:00; and
- PM peak hour - 17:00–18:00.

4.2 Transport supply

4.2.1 For the main ES, a review of highway network detail and attributes was undertaken for the model area that is included in the Wimboldsley to Lostock Gralam (MA02) community area.

4.2.2 The following network attributes have been reviewed and checked:

- links: distance, speeds, capacity, bus lanes, traffic regulation orders;
- junctions: type, turn saturation flows, capacity, and lane utilisation;
- traffic signal control: timings, phasing, and staging; and
- routes: minimum cost paths.

4.2.3 The review highlighted that there is a good level of detailed highway network representation within the study area, and that this compared well with local datasets.

4.2.4 A network coding change was applied to the Gadbrook roundabout, refining the network to improve representation in the model for the SES1 and AP1 ES.

4.2.5 For the SES2 and AP2 ES, further network refinements have been made to improve model journey times. These involved some network speeds and signal timing refinements to better reflect traffic conditions.

4.2.6 The generalised cost values (pence per minute (PPM)/pence per kilometre (PPK)) for model assignment were updated for the SES1 and AP1 ES to reflect the latest values from the DfT TAG data book (version: July 2020). This has been retained for the SES2 and AP2 ES.

4.2.7 In summary, the model includes a sufficiently detailed level of network infrastructure to support the TA.

4.3 Transport demand

4.3.1 The original Northwich Traffic Model includes a detailed representation of spatial demand. The model zone system contains 220 model zones and accounts for future land-use development zones.

4.3.2 For the main ES, the demand matrices were adjusted from 2016 to 2018 by carrying out an interpolation between base and 2030 future year matrices. These uplifted matrices were then applied directly in model assignment without matrix estimation.

4.3.3 For the SES1 and AP1 ES and SES2 and AP2 ES, this interpolated 2018 matrix has been subject to matrix estimation using the available 2018 count data; and a localised traffic flow calibration exercise carried out to improve the correlation between observed and modelled traffic flows within the local area of interest.

4.3.4 The count data collected from the traffic survey data commission in 2017/2018 has been applied in matrix estimation in the same way for both the SES1 and AP1 ES and SES2 and AP2 ES.

5 Model performance

5.1 Overview

5.1.1 This section of the report focusses on the performance of the 2018 AP2 revised scheme base model as produced by MWJV against observed traffic flow and journey time data.

5.1.2 The prior trip matrix assignment is the model assignment before matrix estimation is applied. This uses an interpolated parent model matrix adjusted to the HS2 zone system with an updated network that corresponds to HS2 base year. The updated network also includes revisions identified following a network review.

5.1.3 Matrix estimation uses the prior matrix and updated network mentioned above and creates an updated matrix to match count data. The post trip matrix assignment is the model assignment using this updated matrix and the same updated network used in prior assignments.

5.1.4 It is the post matrix assignment that is taken forward and used in the SES2 and AP2 ES TA.

5.2 Traffic flow

5.2.1 Observed and modelled traffic flows have been compared for the count site locations within the scheme area of interest (Wimboldsley to Lostock Gralam (MA02) community area). In total, 78 individual link counts by direction have been compared.

5.2.2 Table 3 and Table 4 present a summary comparison of individual link flows for all vehicles and by the car vehicle type for the prior matrix assignment. The comparison shows that both time periods fall below the DfT TAG individual link count criteria of greater than 85% of comparisons achieving the flow or GEH criteria.

Table 3: AP2 Northwich traffic model - individual link flow - total all vehicle - prior

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	78	47	60%	39	50%	49	63%
PM peak hour	78	52	67%	49	63%	52	67%

Table 4: AP2 Northwich traffic model - individual link flow - car vehicle type - prior

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	78	49	63%	45	58%	50	64%
PM peak hour	78	55	71%	51	65%	56	72%

5.2.3 Figure 5 and Figure 6 show the locations of the link counts and the respective AM and PM peak hour model performance for the prior matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

5.2.4 Table 5 and Table 6 present a summary comparison of individual link flows for all vehicles and by the car vehicle type for the post matrix estimation assignment. The comparison shows that both time periods meet the DfT TAG individual link count criteria of greater than 85% of comparisons achieving the flow or GEH criteria.

5.2.5 The results show an overall improvement on the results from the main ES and are similar to the SES1 and AP1 ES results.

Table 5: AP2 Northwich traffic model - individual link flow - total all vehicle – post

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	78	72	92%	64	82%	72	92%
PM peak hour	78	72	92%	70	90%	74	95%

Table 6: AP2 Northwich traffic model - individual link flow - car vehicle type - post

Time period	Car flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	78	71	91%	66	85%	71	91%
PM peak hour	78	71	91%	73	94%	75	96%

5.2.6 Figure 7 and Figure 8 show the locations of the link counts and the respective AM and PM peak hour model performance for the post matrix assignment. These show links passing TAG flow or GEH criteria as green bands. Links failing the TAG flow or GEH criteria are shown as yellow, orange or red bands, according to GEH value.

5.2.7 Reference should also be made to Table 13 and Table 14, Appendix A, which presents supporting details of the individual link flow performance for each count for the AM and PM time periods, post matrix estimation.

Figure 5: AM peak hour - traffic flow performance - prior

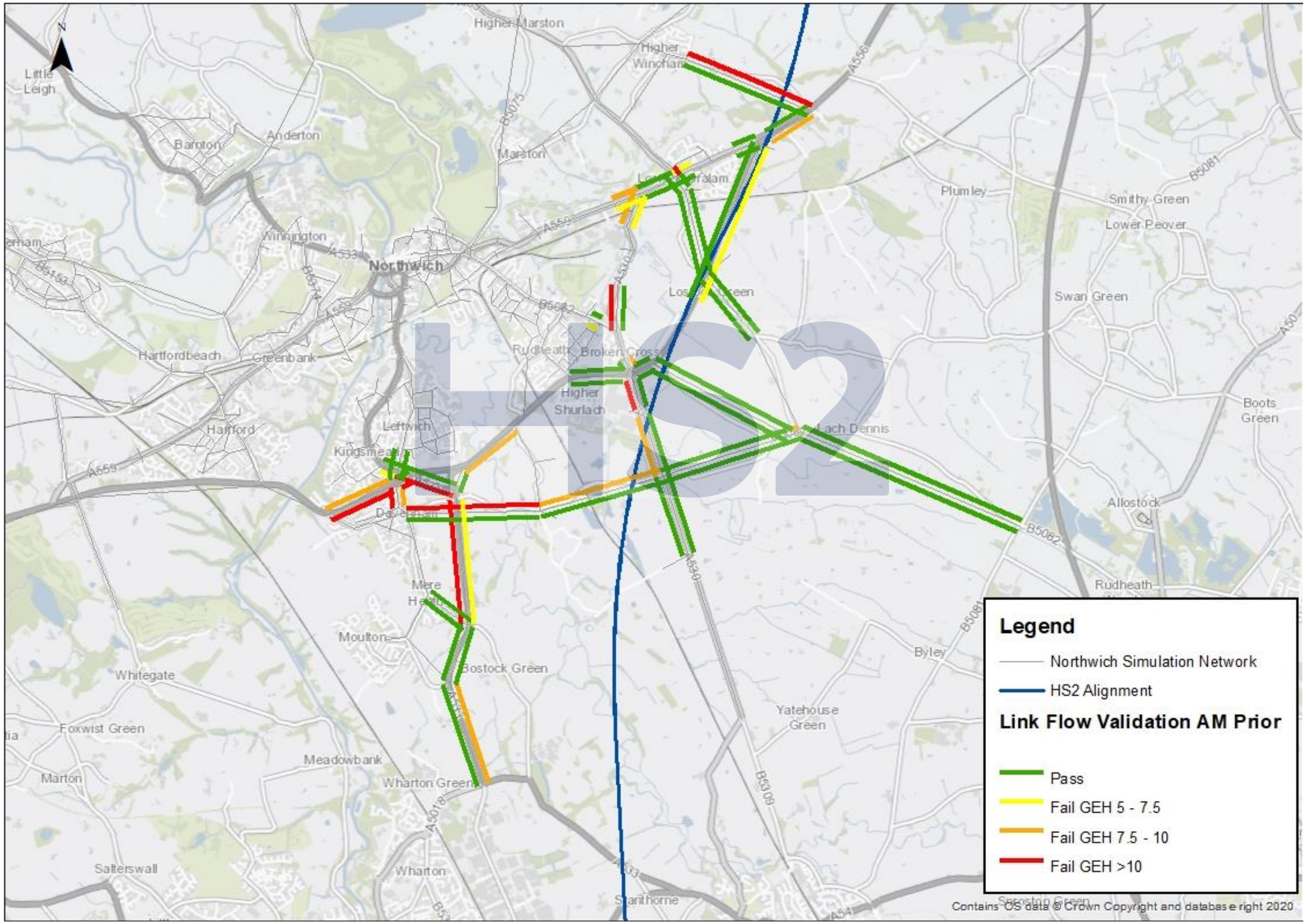


Figure 6: PM peak hour - traffic flow performance - prior

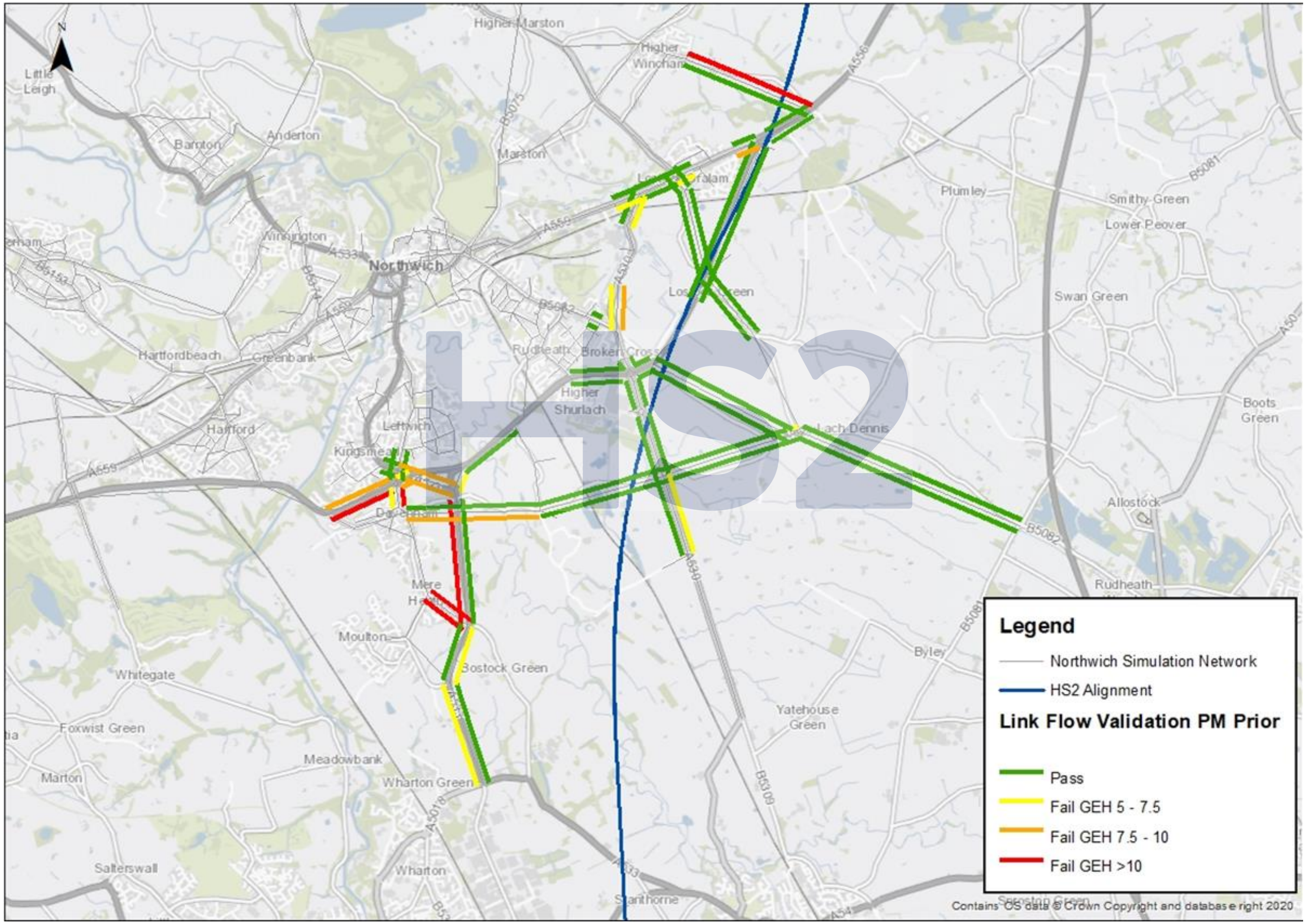


Figure 7: AM peak hour - traffic flow performance - post

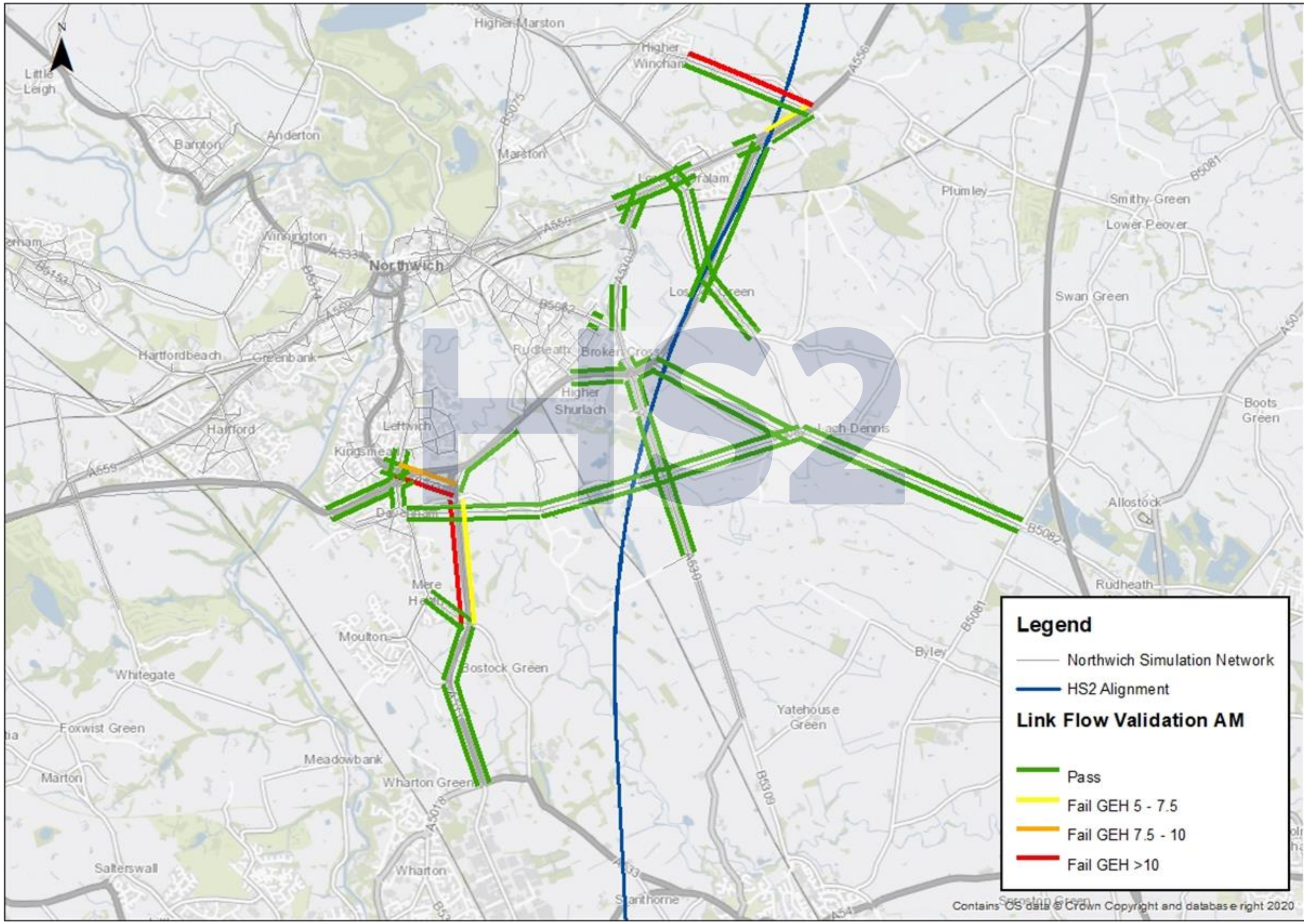
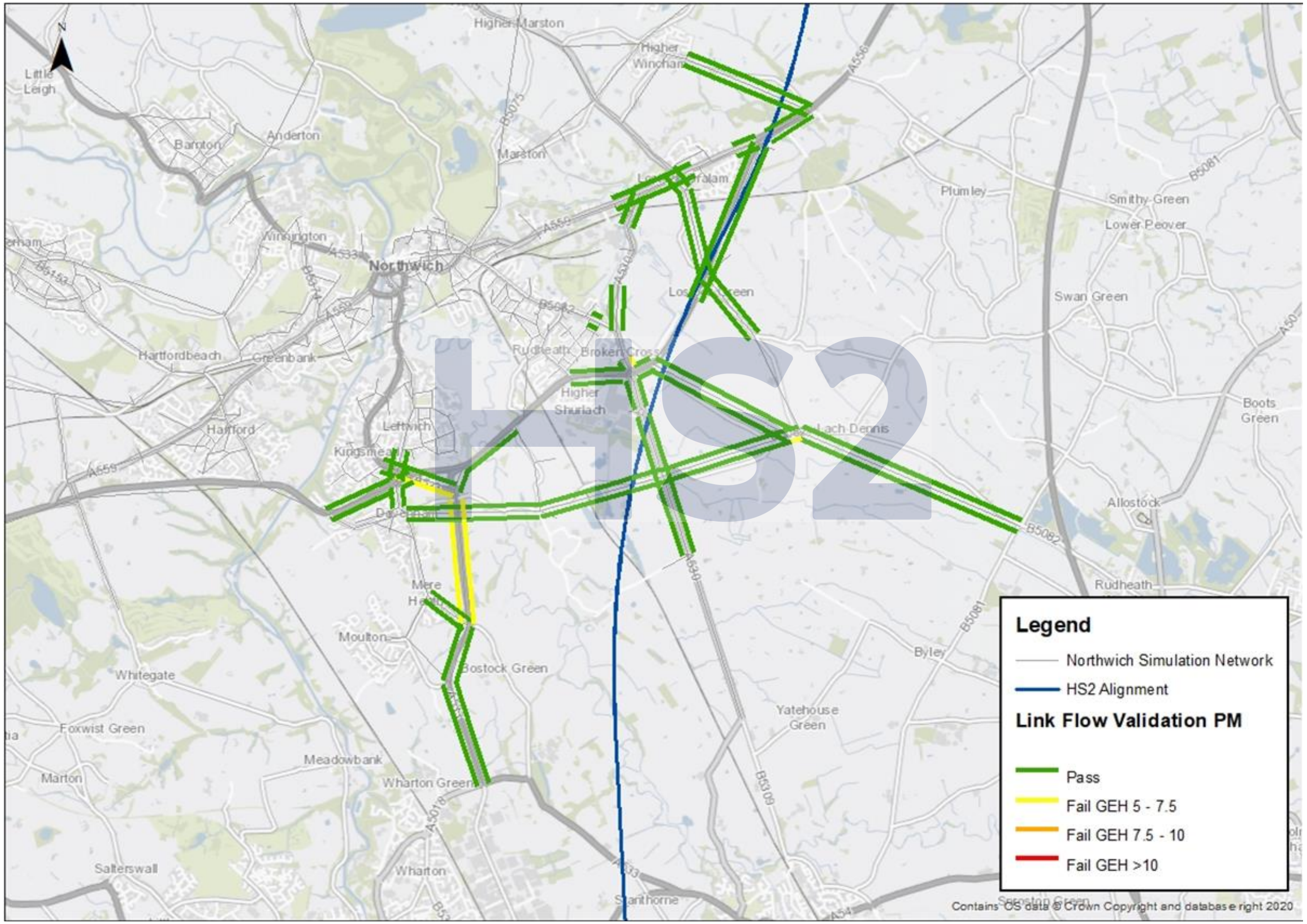


Figure 8: PM peak hour - traffic flow performance - post



5.3 Journey time results

5.3.1 Observed and modelled journey times have been compared for five (2-way) routes highlighted in Figure 4.

5.3.2 Table 7 summarises the prior journey time results. The table shows that journey times in both time periods fail to meet the DfT TAG journey time guideline of more than 85% of model route times being within 15% of the observed times (or 1 minute, if higher than 15%).

5.3.3 Figure 9 and Figure 10 show the journey time route performance for the prior matrix assignment. These show routes passing TAG criteria as green routes. Routes failing the TAG criteria are shown as orange and red routes, according to time differences.

Table 7: AP2 Northwich traffic model – journey time route summary – prior

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM peak hour	10	8	80%
PM peak hour	10	8	80%

5.3.4 Table 8 summarises the post ME journey time results. The table shows that 90% of journey time routes in the AM model, and all journey time routes in the PM model, meet the DfT TAG individual route criteria and achieve the 85% acceptability guideline.

5.3.5 Where model journey time routes have not met the TAG criteria against the observed data, this has been due to the limiting nature of the strategic model in its ability to replicate both flow and speed at urban over capacity conditions. The speed-flow relationship calculated in the strategic model software is more complicated in reality, particularly where flow breakdown occurs and there are very slow speeds. This is despite network capacities and traffic flows being well represented. Under these circumstances the usual practice is to achieve flow calibration.

5.3.6 There is a balance between achieving both model flow and journey time performance, and despite some routes not having met the TAG journey time criteria, it is important to note that the link flow results presented earlier in this chapter show a good standard has been achieved.

5.3.7 Figure 11 and Figure 12 show the journey time route performance for the post ME assignment. These show routes passing TAG criteria as green routes. Routes failing the TAG criteria are shown as orange and red routes, according to time differences.

Table 8: AP2 Northwich traffic model – journey time route summary – post

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM peak hour	10	9	90%
PM peak hour	10	10	100%

5.3.8 Reference should also be made to Table 15 and Table 16 in Appendix A, which presents supporting details of the individual route performance for the AM and PM time periods post matrix estimation. For routes where model times are outside of the DfT criteria guideline. further details are provided on why this is the case.

5.3.9 Overall, the traffic flow and journey time results collectively show evidence of a good standard which is not undermined by the performance of any individual counts or routes.

Figure 9: AM peak hour – journey time performance – prior

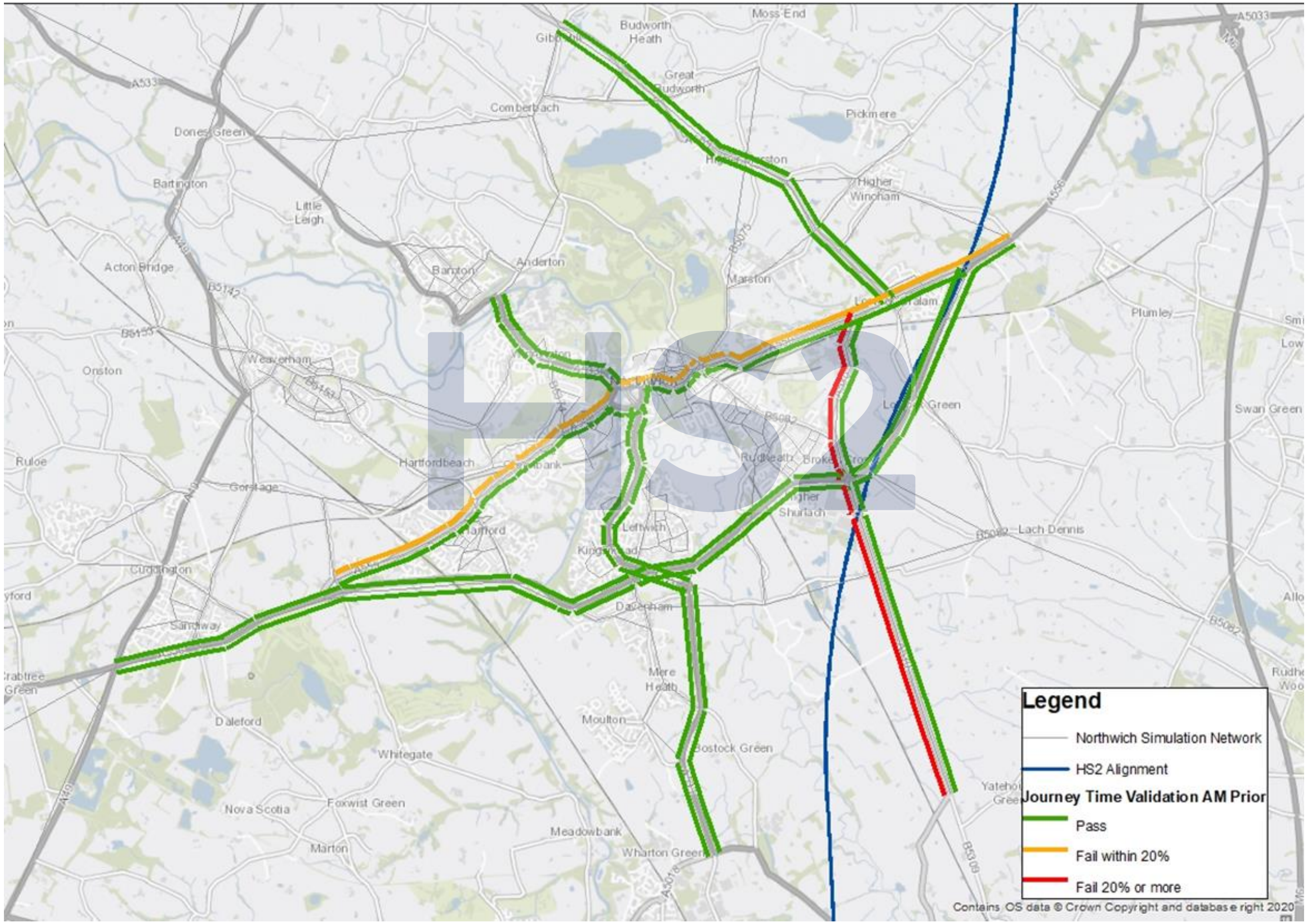


Figure 10: PM peak hour – journey time performance – prior

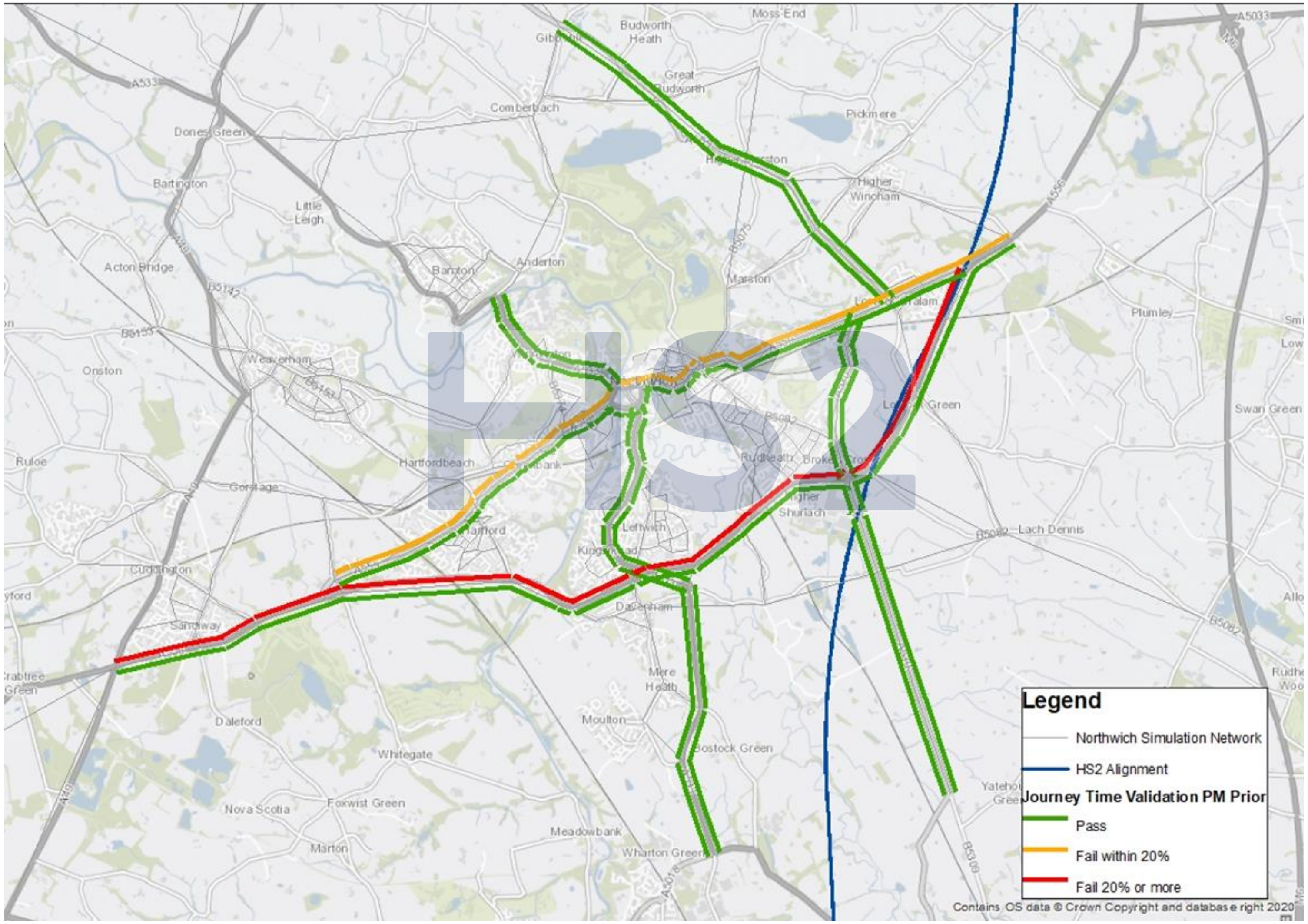


Figure 11: AM peak hour – journey time performance – post

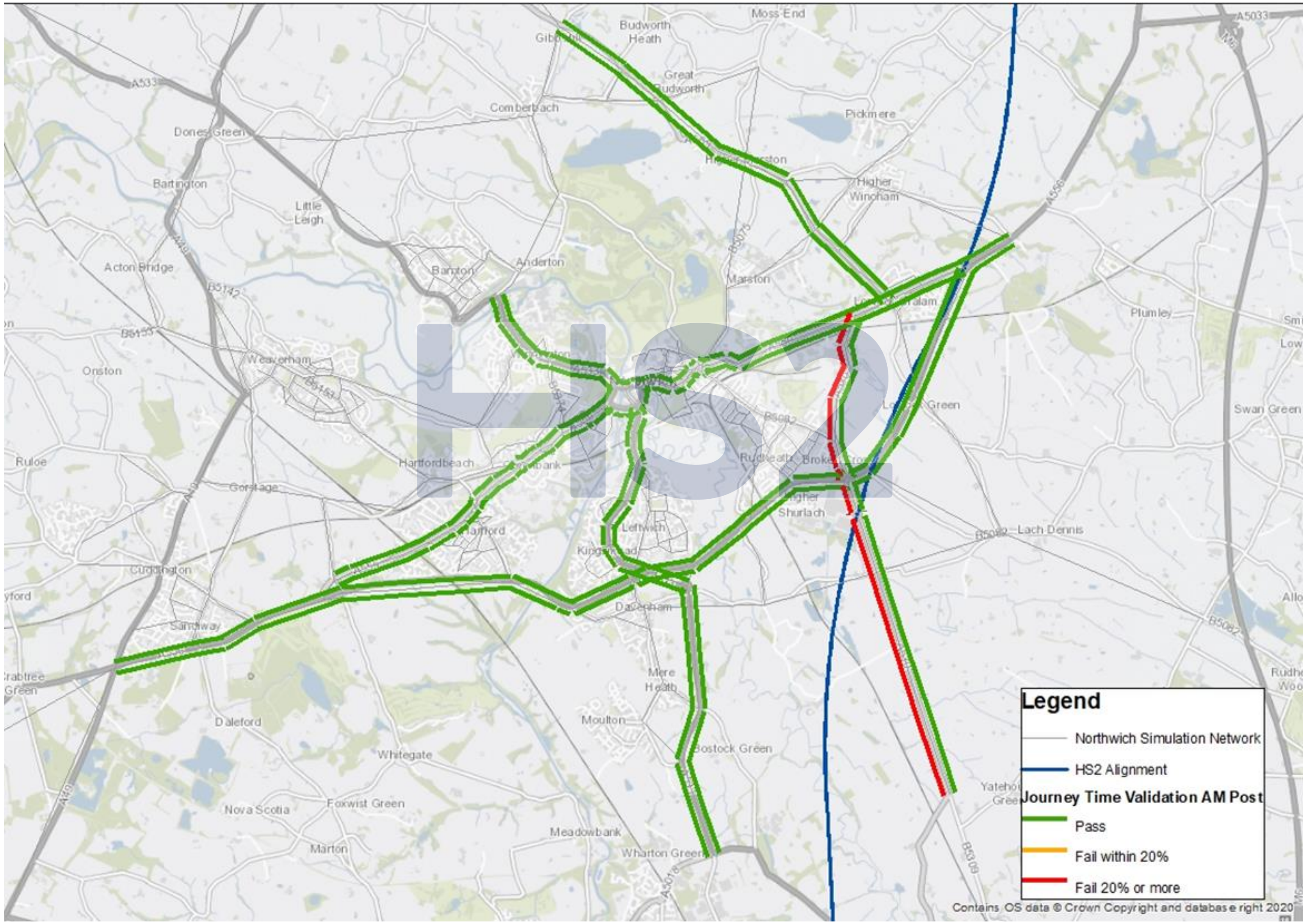
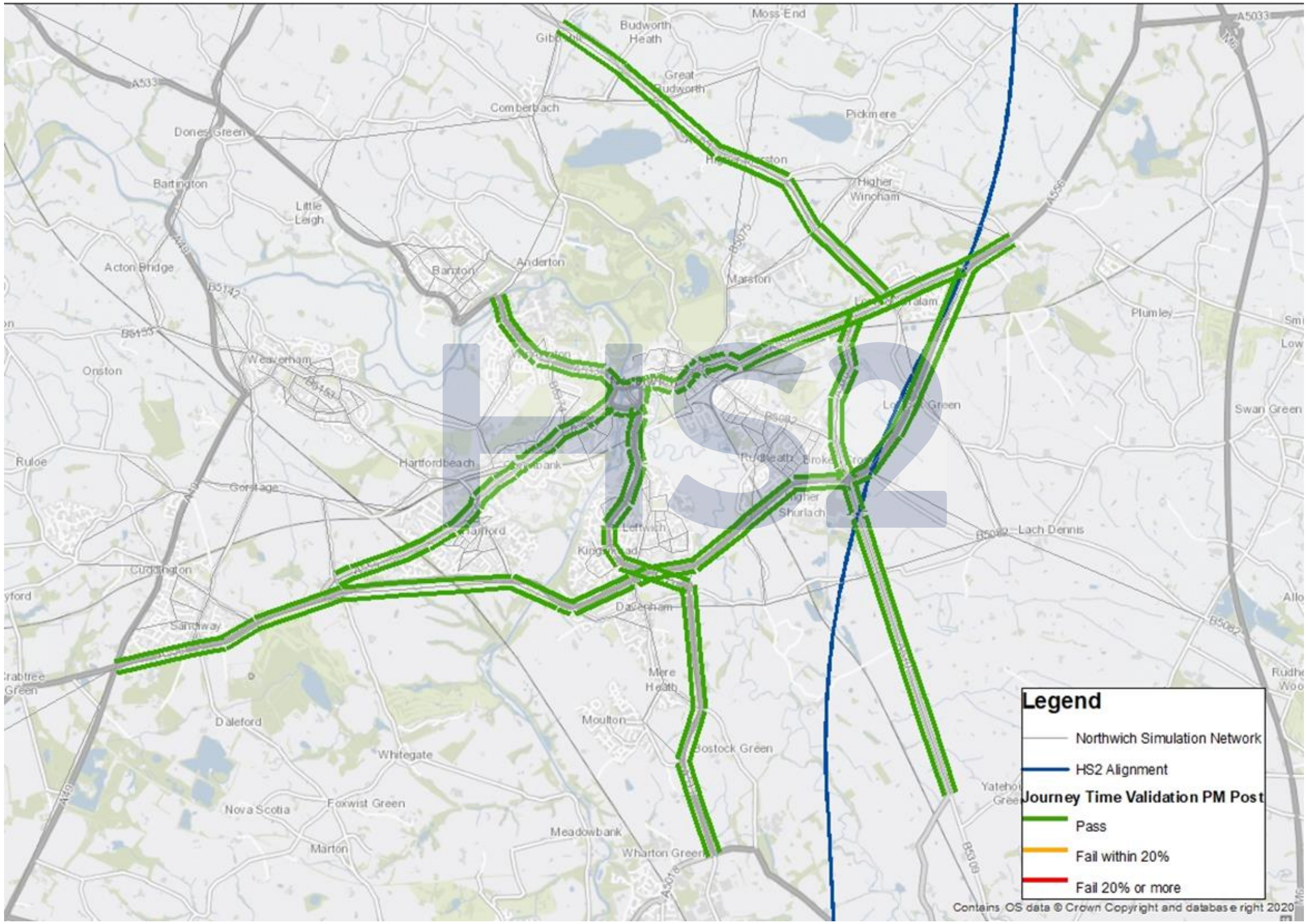


Figure 12: PM peak hour – journey time performance – post



6 Model convergence

6.1.1 Achieving a suitable level of model convergence is necessary to provide stable, consistent, and robust model results and to differentiate between real changes and those associated with differing degrees of convergence.

6.1.2 DfT TAG provides guidance on highway model convergence with recommendations on acceptable variations in link flows and costs between iterations helping to ensure the model is sufficiently stable.

6.1.3 Table 9 presents a summary of the 2018 base year highway model convergence statistics for the AP2 revised scheme by time period. Both models achieve a satisfactory level of convergence.

Table 9: AP2 Northwich traffic model 2018 baseline model convergence

Criteria	Loop	Target	AM	PM
Flow change	N-3	> 98%	97.50	99.10
	N-2		97.90	99.20
	N-1		97.70	99.30
	N		98.00	99.30
Delays change	N-3	> 98%	99.60	99.70
	N-2		99.50	99.70
	N-1		99.40	99.90
	N		99.60	99.70
Delta		< 0.1%	0.0398/20	0.0556/20
% GAP		< 0.1%	0.039	0.042

7 Summary and conclusions

7.1.1 For the assessment of the AP2 revised scheme, the Northwich Traffic Model 2016 base year local highway model as supplied by CWaC has been further developed for the SES2 and AP2 ES with additional localised updates to improve model journey time performance in key areas of interest.

7.1.2 Presented below is a summary of the individual link flow model performance for all modelled time periods for the SES2 and AP2 ES, post matrix estimation. The comparison shows that both time periods exceed the 85% threshold of individual links meeting either the DfT TAG flow range or GEH less than five criteria.

Table 10: AP2 Northwich traffic model - individual link flow - total all vehicle – post

Time period	Total flow comparison (vehicles)						
	Number of sites	TAG flow criteria		TAG GEH criteria		TAG flow or GEH criteria	
		Number of counts	Percentage	Number of counts	Percentage	Number of counts	Percentage
AM peak hour	78	72	92%	64	82%	72	92%
PM peak hour	78	72	92%	70	90%	74	95%

7.1.3 Presented below is a summary of the journey time route performance for all modelled time periods for the SES2 and AP2 ES, post matrix estimation. The comparison shows that 90% of journey time routes in the AM model, and all journey time routes in the PM model, meet the DfT TAG individual route criteria and achieve the 85% acceptability guideline.

Table 11: AP2 Northwich traffic model - journey time route summary – post

Time period	Number of routes	TAG journey time criteria	
		Number of routes passing	Percentage
AM peak hour	10	9	90%
PM peak hour	10	10	100%

7.1.4 Both the AM and PM models converge satisfactorily.

7.1.5 In conclusion, the updated Northwich Traffic Model for the SES2 and AP2 ES provides a reliable forecasting base and forms a suitable tool for the assessment of HS2 construction and operational impacts within the area of interest of the AP2 revised scheme.

8 List of acronyms

Table 12: List of acronyms

Acronym	Description
ATC	Automatic traffic count
CWaC	Cheshire West and Chester Council
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
ES	Environmental Statement
GEH	Geoffrey Havers (statistic)
JTC	Junction turning count
LMVR	Local Model Validation Report
MCC	Manual Classified count
MPR	Model Performance Report
TA	Transport Assessment

9 References

Department for Transport (2020), *TAG unit M1.2 Data Sources and Surveys*. Public Transport Assignment. Available online at: https://www.gov.uk/government/publications/webtag-tag-unit-m1-2-data-sources-and-surveys.

Department for Transport (2020), *TAG unit M3.1 Highway Assignment Modelling*. Public Transport Assignment. Available online at: https://www.gov.uk/government/publications/webtag-tag-unit-m3-1-highway-assignment-modelling.

10 Appendix A – Model performance

Individual link flow performance

Table 13: AP2 Northwich traffic model – individual link flow detailed results – post – AM peak hour

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A533	Between Bostock Road and Jack Lane	NB	712	117	52	881	802	115	25	942	61	7%	2.02	✓	✓	✓
A559 Manchester Road	Between Station Road and Lodge Lane	EB	423	69	29	521	423	69	13	506	-15	-3%	0.65	✓	✓	✓
A559 Manchester Road	Between Cheshire Business Park and A556	EB	478	75	33	586	480	75	14	569	-17	-3%	0.70	✓	✓	✓
A556	Between Birches Lane and A559 Manchester Road	EB	918	102	69	1089	914	102	27	1043	-46	-4%	1.42	✓	✓	✓
A559 Hall Lane	Between A559 Manchester Road and Townshend Road	NB	265	55	26	346	265	55	7	327	-18	-5%	0.99	✓	✓	✓
A559 Manchester Road	Between A530 Griffiths Road and Station Road	EB	480	87	16	583	481	85	17	583	0	0%	0.01	✓	✓	✓
A559 Hall Lane	Between Townshend Road	SB	383	62	31	476	364	62	2	428	-47	-10%	2.22	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
	and A559 Manchester Road															
A559 Manchester Road	Between Lodge Lane and Station Road	WB	322	47	30	398	330	41	14	385	-13	-3%	0.66	✓	✓	✓
Station Road	Between School Lane and A559 Manchester Road	NB	140	18	2	159	76	13	3	92	-67	-42%	5.94	×	✓	✓
A530 King Street	Between A556 and Cookes Lane	NB	329	62	17	408	330	77	13	421	14	3%	0.66	✓	✓	✓
A559 Manchester Road	Between Stanley Grove and A530 Griffiths Road	EB	423	76	5	504	469	77	17	562	59	12%	2.55	✓	✓	✓
A559 Manchester Road	Between Station Road and A530 Griffiths Road	WB	555	77	18	649	562	78	16	655	6	1%	0.25	✓	✓	✓
A530 Griffiths Road	Between A530 Griffiths Road and A559	NB	199	45	5	249	200	45	0	245	-4	-1%	0.24	✓	✓	✓
A530 King Street	Between Morrisons and Crowders Lane	SB	415	82	34	530	418	85	15	519	-11	-2%	0.50	✓	✓	✓
Crowder's Lane	--	WB	40	27	4	72	25	1	0	26	-46	-64%	6.57	×	✓	✓
A530 King Street	Between Whatcroft Hall Lane and Crowder's Lane	NB	619	88	43	750	558	88	16	663	-87	-12%	3.27	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
Davenham Road	Between Shurlach Lane and A530 King Street	EB	156	20	1	176	160	29	0	189	13	7%	0.98	✓	✓	✓
A530 Griffiths Road	Between A530 Griffiths Road and B5082 Middlewich Road	SB	302	46	18	366	301	57	3	361	-5	-1%	0.28	✓	✓	✓
A533 Kingsmead	Between London Road and Regency Way	WB	955	79	25	1059	983	53	11	1047	-12	-1%	0.36	✓	✓	✓
A533 Kingsmead	Between Regency Way and London Road	EB	961	75	17	1053	1021	92	10	1123	70	7%	2.13	✓	✓	✓
London Road	Between Dunham Road and A533	SB	399	33	7	439	454	36	7	497	58	13%	2.69	✓	✓	✓
A533 Kingsmead	Between A533 and London Road	WB	854	112	54	1020	493	65	0	558	-462	-45%	16.44	×	×	×
London Road	Between Davenham Road Roundabout and A533 Kingsmead	NB	1012	81	34	1126	1033	56	17	1107	-19	-2%	0.56	✓	✓	✓
A556	Between Davenham Road Roundabout and A556	EB	1769	135	64	1968	1759	136	27	1922	-46	-2%	1.03	✓	✓	✓
A556 Slip Road	Between A556 and A533 Kingsmead	SB	222	69	28	319	238	44	13	295	-24	-7%	1.36	✓	✓	✓
A533 Kingsmead	Between London Road and A533	EB	594	62	24	680	451	34	3	488	-192	-28%	7.93	×	×	×

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A556	Between Shurlach Lane and A533 Exit	WB	663	132	72	867	664	129	29	823	-44	-5%	1.51	✓	✓	✓
A533	Between Peckmill Roundabout and A533 Kingsmead	NB	856	112	48	1016	493	65	0	558	-458	-45%	16.31	×	×	×
A556	Between Davenham Road Roundabout and Hartford Road	WB	824	123	43	989	813	123	20	956	-33	-3%	1.05	✓	✓	✓
B5082 Penny's Lane	Between Crowder's Lane and A556	WB	168	66	12	246	273	45	7	324	78	32%	4.64	✓	✓	✓
A556	Between A530 King Street and B5082 Penny's Lane	EB	1319	161	76	1555	1330	166	34	1530	-25	-2%	0.64	✓	✓	✓
A556	Between A530 King Street and Gadbrook Road	WB	1253	141	62	1455	1257	137	32	1426	-29	-2%	0.76	✓	✓	✓
Lostock Green	Between Lostock Hollow and Birches Lane	SB	8	5	1	14	0	0	0	0	-14	-100%	5.35	×	✓	✓
A556	Between A559 Manchester Road and Birches Lane	WB	917	150	87	1154	915	151	39	1104	-50	-4%	1.48	✓	✓	✓
Birches Lane	Between Hangman's Lane and A556	NB	8	17	3	27	0	0	0	0	-27	-100%	7.36	×	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A556	Between Truck Stop and Birches Lane	EB	997	119	67	1182	1016	123	31	1169	-13	-1%	0.38	✓	✓	✓
B5569 Chester Road	Between A556 and Linnards Lane	EB	1311	0	189	1500	1104	116	39	1259	-241	-16%	6.49	×	×	×
Linnards Lane	Between Keats Lane and B5569 Chester Road	EB	73	0	5	78	166	23	13	203	125	161%	10.55	×	×	×
B5082 Middlewich Road	Between West Avenue and East Avenue	EB	315	0	23	338	307	51	14	372	34	10%	1.81	✓	✓	✓
B5082 Middlewich Road	Between East Avenue and West Avenue	WB	306	0	20	326	309	44	8	362	36	11%	1.94	✓	✓	✓
B5082 Penny's Lane	Between Crowder's Lane and Birches Lane	EB	498	69	11	578	434	71	3	507	-70	-12%	3.02	✓	✓	✓
London Road	Between A533 and Dunham Road	NB	375	32	5	412	342	67	6	416	4	1%	0.18	✓	✓	✓
London Road	Between A556 and Green Lane	SB	338	42	11	391	329	54	9	391	1	0%	0.05	✓	✓	✓
Lostock Green	Between Birches Lane and Lostock Hollow	NB	120	38	2	160	102	21	3	126	-34	-21%	2.81	✓	✓	✓
Station Road	Between A559 Manchester Road and School Lane	SB	81	14	1	95	0	0	0	0	-95	-100%	13.78	×	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A556	Between Birches Lane and Truck Stop	WB	845	140	100	1084	860	125	36	1021	-63	-6%	1.95	✓	✓	✓
B5082 Penny's Lane	Between Birches Lane and Crowder's Lane	WB	337	44	17	398	297	46	7	350	-47	-12%	2.45	✓	✓	✓
Crowder's Lane	Between and	EB	129	51	3	183	119	27	0	146	-36	-20%	2.81	✓	✓	✓
B5082 Penny's Lane	Between A556 and Crowder's Lane	EB	245	99	7	351	314	44	3	361	10	3%	0.51	✓	✓	✓
Davenham Road	Between A530 King Street and Shurlach Lane	WB	108	22	2	132	55	22	0	77	-55	-42%	5.38	×	✓	✓
Shipbrook Road	Between Shurlach Lane and London Road	WB	24	0	2	26	26	17	0	43	17	64%	2.85	✓	✓	✓
Birches Lane	Between A556 and Hangman's Lane	SB	50	42	7	98	55	26	3	84	-14	-14%	1.48	✓	✓	✓
Shipbrook Road	Between London Road and Shurlach Lane	EB	96	0	4	100	161	30	0	191	91	91%	7.55	×	✓	✓
London Road	Between A533 and Jack Lane	NB	269	44	4	317	290	48	21	360	43	14%	2.36	✓	✓	✓
A533	Between London Road and Jack Lane	SB	753	103	44	900	758	99	21	878	-22	-2%	0.74	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A533	Between Jack Lane and Jack Lane	SB	684	96	50	829	775	100	24	899	70	8%	2.38	✓	✓	✓
A533	Between Jack Lane and London Road	NB	804	114	48	966	773	112	21	907	-59	-6%	1.92	✓	✓	✓
London Road	Between Jack Lane and A533	SB	180	19	6	204	79	23	4	106	-98	-48%	7.89	×	✓	✓
A533	Between A533 Kingsmead and London Road	SB	832	118	50	1000	689	78	16	783	-217	-22%	7.27	×	×	×
A559 Manchester Road	Between A530 Griffiths Road and Stanley Grove	WB	362	66	10	437	448	66	16	530	93	21%	4.25	✓	✓	✓
A530 Griffiths Road	Between A559 and A530 Griffiths Road	SB	341	48	7	396	301	48	0	349	-46	-12%	2.39	✓	✓	✓
A530 Griffiths Road	Between B5082 Middlewich Road and A530 Griffiths Road	NB	233	42	14	289	184	42	6	231	-58	-20%	3.58	✓	✓	✓
A530 King Street	Between A556 and Morrisons	SB	477	83	55	614	456	86	17	559	-54	-9%	2.23	✓	✓	✓
A530 King Street	Between Crowder's Lane and Morrisons	NB	512	83	36	630	527	68	17	611	-19	-3%	0.74	✓	✓	✓
B5569 Chester Road	Between Linnards Lane and A556	WB	950	0	204	1154	957	116	49	1123	-31	-3%	0.93	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A556	Between A556 and Davenham Road Roundabout	WB	413	86	35	534	426	86	16	528	-5	-1%	0.23	✓	✓	✓
London Road	Between A533 Kingsmead and Davenham Road Roundabout	SB	1294	120	58	1472	1226	95	14	1334	-138	-9%	3.68	✓	✓	✓
London Road	Between Green Lane and Davenham Road Roundabout	NB	709	62	14	785	774	80	23	878	93	12%	3.21	✓	✓	✓
A556	Between Hartford Road and Davenham Road Roundabout	EB	1526	112	45	1682	1508	109	19	1636	-46	-3%	1.13	✓	✓	✓
A556	Between Gadbrook Road and A530 King Street	EB	1102	121	59	1281	1117	123	25	1265	-16	-1%	0.46	✓	✓	✓
A530 King Street	Between Morrisons and A556	NB	501	67	36	604	527	68	16	611	7	1%	0.30	✓	✓	✓
A556	Between A530 King Street and B5082 Pennys Lane	WB	1128	169	107	1403	1133	170	42	1345	-58	-4%	1.57	✓	✓	✓
A530 King Street	Between Cookes Lane and A556	SB	622	108	28	757	597	106	13	716	-41	-5%	1.51	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A559 Manchester Road	Between A556 and Cheshire Business Park	WB	363	52	30	444	338	52	13	403	-41	-9%	1.99	✓	✓	✓
A530 King Street	Between Crowder's Lane and Whatcroft Hall Lane	SB	463	64	31	558	460	87	15	562	4	1%	0.19	✓	✓	✓
Linnards Lane	Between B5569 Chester Road and Keats Lane	WB	32	0	2	33	36	11	5	51	18	54%	2.76	✓	✓	✓
Holmes Chapel Road	Between Common Lane and Highfield Farm	EB	488	0	34	522	489	96	6	591	69	13%	2.92	✓	✓	✓
Holmes Chapel Road	Between Highfield Farm and Common Lane	WB	285	0	69	354	297	46	7	350	-4	-1%	0.20	✓	✓	✓

Table 14: AP2 Northwich traffic model – individual link flow detailed results – post – PM peak hour

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A533	Between Bostock Road and Jack Lane	NB	777	53	20	850	871	69	13	953	103	12%	3.45	✓	✓	✓
A559 Manchester Road	Between Station Road and Lodge Lane	EB	340	37	10	386	339	37	5	381	-5	-1%	0.27	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A559 Manchester Road	Between Cheshire Business Park and A556	EB	396	29	8	432	466	28	4	498	66	15%	3.06	✓	✓	✓
A556	Between Birches Lane and A559 Manchester Road	EB	873	75	51	999	878	69	19	966	-33	-3%	1.04	✓	✓	✓
A559 Hall Lane	Between A559 Manchester Road and Townshend Road	NB	421	47	10	477	399	47	3	448	-29	-6%	1.35	✓	✓	✓
A559 Manchester Road	Between A530 Griffiths Road and Station Road	EB	528	59	9	595	545	59	6	610	15	3%	0.63	✓	✓	✓
A559 Hall Lane	Between Townshend Road and A559 Manchester Road	SB	301	33	8	341	306	35	1	342	1	0%	0.07	✓	✓	✓
A559 Manchester Road	Between Lodge Lane and Station Road	WB	511	35	12	558	431	36	5	472	-85	-15%	3.76	✓	✓	✓
Station Road	Between School Lane and A559 Manchester Road	NB	152	18	1	170	146	12	2	160	-10	-6%	0.75	✓	✓	✓
A530 King Street	Between A556 and Cookes Lane	NB	602	71	9	682	636	70	8	714	32	5%	1.22	✓	✓	✓
A559 Manchester Road	Between Stanley Grove and A530 Griffiths Road	EB	526	45	5	576	543	47	6	596	20	3%	0.83	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A559 Manchester Road	Between Station Road and A530 Griffiths Road	WB	692	56	9	756	691	57	7	755	-1	0%	0.04	✓	✓	✓
A530 Griffiths Road	Between A530 Griffiths Road and A559	NB	256	30	4	290	258	30	0	288	-2	-1%	0.12	✓	✓	✓
A530 King Street	Between Morrisons and Crowders Lane	SB	700	59	24	783	690	47	9	746	-37	-5%	1.35	✓	✓	✓
Crowder's Lane	Between and	WB	66	63	3	132	97	7	0	104	-28	-21%	2.59	✓	✓	✓
A530 King Street	Between Whatcroft Hall Lane and Crowder's Lane	NB	765	59	50	874	751	75	15	840	-33	-4%	1.13	✓	✓	✓
Davenham Road	Between Shurlach Lane and A530 King Street	EB	9	7	0	15	15	8	0	23	8	54%	1.84	✓	✓	✓
A530 Griffiths Road	Between A530 Griffiths Road and B5082 Middlewich Road	SB	404	18	13	434	348	18	5	372	-63	-14%	3.11	✓	✓	✓
A533 Kingsmead	Between London Road and Regency Way	WB	1054	60	5	1119	1020	69	3	1093	-26	-2%	0.78	✓	✓	✓
A533 Kingsmead	Between Regency Way and London Road	EB	745	47	5	797	822	64	1	886	89	11%	3.07	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
London Road	Between Dunham Road and A533	SB	244	17	4	265	240	27	7	273	8	3%	0.52	✓	✓	✓
A533 Kingsmead	Between A533 and London Road	WB	922	81	17	1020	816	45	1	862	-158	-16%	5.16	×	×	×
London Road	Between Davenham Road Roundabout and A533 Kingsmead	NB	1012	67	6	1085	956	55	7	1018	-66	-6%	2.04	✓	✓	✓
A556	Between Davenham Road Roundabout and A556	EB	900	111	27	1037	896	111	19	1025	-12	-1%	0.36	✓	✓	✓
A556 Slip Road	Between A556 and A533 Kingsmead	SB	571	47	17	635	463	50	9	522	-113	-18%	4.69	✓	×	✓
A533 Kingsmead	Between London Road and A533	EB	501	39	5	545	451	29	0	480	-65	-12%	2.88	✓	✓	✓
A556	Between Shurlach Lane and A533 Exit	WB	1967	136	35	2138	1890	130	14	2034	-104	-5%	2.28	✓	✓	✓
A533	Between Peckmill Roundabout and A533 Kingsmead	NB	900	65	20	986	731	40	0	771	-214	-22%	7.24	×	×	×
A556	Between Davenham Road Roundabout and Hartford Road	WB	1519	86	17	1622	1494	79	5	1578	-43	-3%	1.09	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5082 Penny's Lane	Between Crowder's Lane and A556	WB	113	47	4	163	203	39	2	243	80	49%	5.60	×	✓	✓
A556	Between A530 King Street and B5082 Penny's Lane	EB	1244	102	50	1396	1246	106	22	1374	-22	-2%	0.59	✓	✓	✓
A556	Between A530 King Street and Gadbrook Road	WB	1400	118	31	1549	1481	99	14	1594	45	3%	1.14	✓	✓	✓
Lostock Green	Between Lostock Hollow and Birches Lane	SB	5	2	1	8	0	0	0	0	-8	-100%	3.88	✓	✓	✓
A556	Between A559 Manchester Road and Birches Lane	WB	1371	83	37	1490	1393	106	15	1514	24	2%	0.62	✓	✓	✓
Birches Lane	Between Hangman's Lane and A556	NB	36	54	5	95	40	0	0	40	-55	-58%	6.70	×	✓	✓
A556	Between Truck Stop and Birches Lane	EB	1016	68	50	1133	1032	90	21	1143	10	1%	0.29	✓	✓	✓
B5569 Chester Road	Between A556 and Linnards Lane	EB	1103	0	97	1200	1012	80	24	1116	-83	-7%	2.45	✓	✓	✓
Linnards Lane	Between Keats Lane and B5569 Chester Road	EB	36	0	2	37	54	31	3	88	51	135%	6.39	×	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5082 Middlewich Road	Between West Avenue and East Avenue	EB	326	0	17	343	337	29	6	372	29	8%	1.53	✓	✓	✓
B5082 Middlewich Road	Between East Avenue and West Avenue	WB	399	0	12	411	435	52	3	490	79	19%	3.73	✓	✓	✓
B5082 Penny's Lane	Between Crowder's Lane and Birches Lane	EB	298	19	3	319	233	18	1	252	-67	-21%	3.99	✓	✓	✓
London Road	Between A533 and Dunham Road	NB	324	32	3	359	309	31	5	345	-14	-4%	0.73	✓	✓	✓
London Road	Between A556 and Green Lane	SB	420	35	5	460	447	36	5	488	28	6%	1.29	✓	✓	✓
Lostock Green	Between Birches Lane and Lostock Hollow	NB	134	49	4	187	154	21	2	176	-10	-5%	0.76	✓	✓	✓
Station Road	Between A559 Manchester Road and School Lane	SB	39	4	1	43	0	0	0	0	-43	-100%	9.27	×	✓	✓
A556	Between Birches Lane and Truck Stop	WB	1351	102	34	1487	1391	98	15	1504	17	1%	0.44	✓	✓	✓
B5082 Penny's Lane	Between Birches Lane and Crowder's Lane	WB	456	27	3	485	299	46	2	347	-138	-28%	6.77	×	×	×
Crowder's Lane	Between and	EB	33	9	2	45	19	1	0	21	-24	-53%	4.17	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
B5082 Penny's Lane	Between A556 and Crowder's Lane	EB	165	65	3	233	214	16	1	231	-3	-1%	0.17	✓	✓	✓
Davenham Road	Between A530 King Street and Shurlach Lane	WB	194	11	0	205	185	16	0	201	-4	-2%	0.26	✓	✓	✓
Shipbrook Road	Between Shurlach Lane and London Road	WB	142	0	6	148	178	15	0	193	45	31%	3.46	✓	✓	✓
Birches Lane	Between A556 and Hangman's Lane	SB	37	31	2	70	41	8	1	50	-20	-29%	2.61	✓	✓	✓
Shipbrook Road	Between London Road and Shurlach Lane	EB	16	0	1	17	11	7	0	19	2	10%	0.42	✓	✓	✓
London Road	Between A533 and Jack Lane	NB	258	29	3	289	239	32	9	280	-9	-3%	0.52	✓	✓	✓
A533	Between London Road and Jack Lane	SB	856	80	25	961	848	79	10	936	-24	-3%	0.79	✓	✓	✓
A533	Between Jack Lane and Jack Lane	SB	748	59	23	831	878	79	13	969	139	17%	4.63	✓	×	✓
A533	Between Jack Lane and London Road	NB	822	68	29	918	832	68	9	909	-9	-1%	0.28	✓	✓	✓
London Road	Between Jack Lane and A533	SB	126	15	2	143	159	7	2	168	25	18%	2.03	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
A533	Between A533 Kingsmead and London Road	SB	1058	79	23	1161	823	77	9	909	-251	-22%	7.81	×	×	×
A559 Manchester Road	Between A530 Griffiths Road and Stanley Grove	WB	583	48	7	638	575	48	7	630	-8	-1%	0.31	✓	✓	✓
A530 Griffiths Road	Between A559 and A530 Griffiths Road	SB	358	32	3	393	371	28	0	399	6	2%	0.32	✓	✓	✓
A530 Griffiths Road	Between B5082 Middlewich Road and A530 Griffiths Road	NB	248	17	12	276	256	23	5	283	7	3%	0.42	✓	✓	✓
A530 King Street	Between A556 and Morrisons	SB	726	69	30	824	687	47	9	743	-81	-10%	2.90	✓	✓	✓
A530 King Street	Between Crowder's Lane and Morrisons	NB	656	71	23	750	660	69	15	743	-6	-1%	0.22	✓	✓	✓
B5569 Chester Road	Between Linnards Lane and A556	WB	1570	0	145	1716	1589	133	20	1742	26	2%	0.64	✓	✓	✓
A556	Between A556 and Davenham Road Roundabout	WB	1463	84	13	1559	1427	80	5	1512	-47	-3%	1.20	✓	✓	✓
London Road	Between A533 Kingsmead and	SB	1054	80	19	1152	1053	61	8	1121	-30	-3%	0.90	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
	Davenham Road Roundabout															
London Road	Between Green Lane and Davenham Road Roundabout	NB	354	29	5	387	330	36	15	381	-6	-1%	0.29	✓	✓	✓
A556	Between Hartford Road and Davenham Road Roundabout	EB	981	106	18	1105	978	107	9	1094	-11	-1%	0.33	✓	✓	✓
A556	Between Gadbrook Road and A530 King Street	EB	1155	81	33	1268	1130	81	14	1225	-43	-3%	1.22	✓	✓	✓
A530 King Street	Between Morrisons and A556	NB	668	75	35	777	670	69	15	754	-22	-3%	0.81	✓	✓	✓
A556	Between A530 King Street and B5082 Pennys Lane	WB	1669	140	35	1843	1588	136	16	1741	-102	-6%	2.41	✓	✓	✓
A530 King Street	Between Cookes Lane and A556	SB	547	59	16	622	651	43	9	703	81	13%	3.13	✓	✓	✓
A559 Manchester Road	Between A556 and Cheshire Business Park	WB	541	44	10	594	529	44	4	577	-17	-3%	0.70	✓	✓	✓
A530 King Street	Between Crowder's Lane	SB	617	46	20	683	688	51	9	748	65	10%	2.44	✓	✓	✓

Road name	Location	Direction	Observed flow (vehicles)				Modelled flow (vehicles)				Total flow comparison					
			Cars	LGV	HGV	Total	Cars	LGV	HGV	Total	Dif	% Dif	GEH	GEH <5	Flow	GEH or Flow
	and Whatccroft Hall Lane															
Linnards Lane	Between B5569 Chester Road and Keats Lane	WB	65	0	3	68	64	8	2	74	6	9%	0.73	✓	✓	✓
Holmes Chapel Road	Between Common Lane and Highfield Farm	EB	343	0	24	367	275	25	2	301	-66	-18%	3.59	✓	✓	✓
Holmes Chapel Road	Between Highfield Farm and Common Lane	WB	369	0	53	422	339	46	2	387	-35	-8%	1.76	✓	✓	✓

Individual route journey time performance

Table 15: AP2 Northwich traffic model – individual route journey time detailed results – post – AM peak hour

Route name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
A556	EB	13,063	913	882	-31	-3.4%	✓	
A556	WB	13,049	802	756	-46	-5.8%	✓	
A559 Chester Road/Manchester Road	EB	9,866	1,765	1,501	-263	-14.9%	✓	
A559	WB	9,984	1,278	1,255	-23	-1.8%	✓	
A533	NB	9,181	1,239	1,097	-142	-11.5%	✓	
A533	SB	9,168	863	856	-7	-0.8%	✓	

Route name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
A530	NB	6,385	642	499	-144	-22.4%	*	Unable to replicate slow speed in the model on the A530 near the A556.
A530	SB	6,395	531	476	-55	-10.4%	✓	
A559 Hall Lane	NB	5,607	397	351	-46	-11.6%	✓	
A559 Hall Lane	SB	5,607	454	405	-49	-10.8%	✓	

Table 16: AP2 Northwich traffic model – individual route journey time detailed results – post – PM peak hour

Route name	Direction	Route length (m)	Observed time (s)	Modelled time (s)	Difference (s)	% Difference	Journey time criteria	Details
A556	EB	13,063	755	821	66	8.7%	✓	
A556	WB	13,049	837	879	42	5.0%	✓	
A559 Chester Road/Manchester Road	EB	9,866	1,161	1,335	174	15.0%	✓	
A559	WB	9,984	1,263	1,301	38	3.0%	✓	
A533	NB	9,181	924	1,012	88	9.5%	✓	
A533	SB	9,168	859	932	73	8.5%	✓	
A530	NB	6,385	568	515	-53	-9.3%	✓	
A530	SB	6,395	509	458	-52	-10.1%	✓	
A559 Hall Lane	NB	5,607	375	350	-25	-6.6%	✓	
A559 Hall Lane	SB	5,607	457	396	-61	-13.4%	✓	
A533	SB	9,168	859	932	73	8.5%	✓	

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