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Technical Note

Project:	Solihull Local Plan		
Our reference:	376293	**Your reference:**	-
Prepared by:	ECW	**Date:**	31/05/2019
Approved by:	PO	**Checked by:**	HH
Subject:	PRISM 5.2 Base Year Highway Network Update		

1 Introduction

Mott MacDonald has been commissioned by Solihull Metropolitan Borough Council (SMBC) to update the base year highway network and zones in Solihull, understanding the effect that these updates have on the validation of the network and to check if re-calibration is required.

The purpose of this note is to provide the results of the update to the PRISM base year highway network. The objective is to identify:

- the impact of the updates to the highway network;
- impacts of all updates to the validation of model; and
- whether re-calibration is required.

The data is presented in a series of summary tables with comments in this note, with detail provided in appendices, including bus and rail validation. The appendices are organised as follows:

Appendix A- Bus Validation

Appendix B – Rail Validation

Appendix C - Cordon and Screenline validation

Appendix D - Journey time validation

Appendix E.1 – Highway assignment calibration/validation

Appendix E.2 - Solihull calibration links

Appendix E.3 - Solihull validation links

Note that we recommend that the appendices are printed in A3 landscape or viewed on-screen.

2   Highway network update

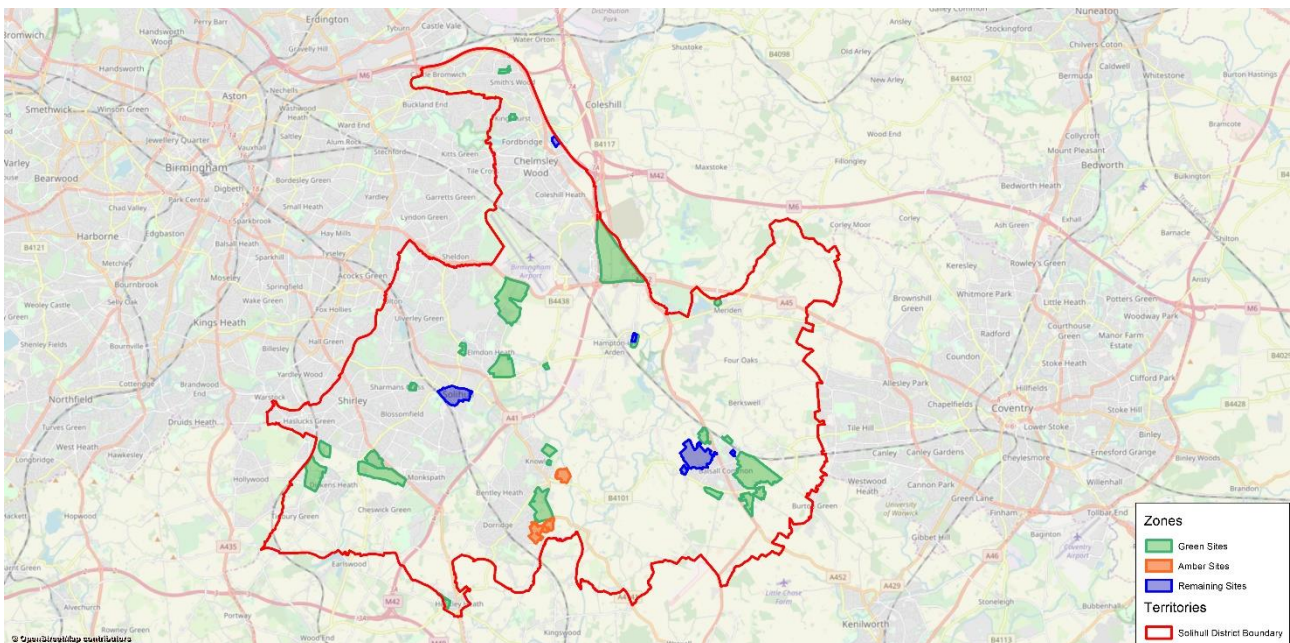## 2.1   Update of links and junctions near proposed developments

A review of the highway network was undertaken to identify if new or modified links and junctions would need to be included to provide additional local detail and to allow suitable access to proposed housing and employment developments. This information was provided in Technical Note 03: Base Year Review (Issued:22/03/2019).

Each Green and Amber site location, (as defined by SMBC), was reviewed in PRISM and compared against the Solihull Local Plan Review Draft Concept Masterplan[1] or Draft Local Plan Supplementary Consultation – Amber sites[2]. These documents were referenced to determine access points to the developments. The Remaining sites were imported, using up-to-date information provided by SMBC, with access either agreed or assumed. See Table 1, Table 2 and Table 3 for details of the updates to the network for each site. Zone IDs have been referenced for easy identification. Following the Base Year Review Workshop (held on 30/04/2019) the following roads have also been coded into PRISM to better represent the route choice available locally and to include roads used by timetabled bus services:

- Holly Lane;
- Fen End Road;
- Honiley Road; and
- Hodgetts Lane.

Figure 1 shows the location of the Green, Amber and Remaining sites within the Solihull boundary.

Figure 1: Location of Green, Amber and Remaining sites

Source: SMBC and Mott MacDonald

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[1] http://www.solihull.gov.uk/Portals/0/Planning/LPR/Solihull-Local-Plan-Review-Draft-Concept-Materplans.pdf

[2] http://www.solihull.gov.uk/Portals/0/Planning/LPR/Draft-Local-Plan-Supplementary-Consultation-Amber-Sites.pdf

Table 1: Additional transport infrastructure coded in PRISM for Green Sites

Zone ID	Site ref	Site Name	Households	Added links or junctions
7620	1	Barretts Farm	900	Meeting House Lane was coded into PRISM. This road could be required as an access point to Barretts Farm, access is assumed from Keeley Lane. This included the coding of two give-way junctions.
7607	2	Frog Lane	110	Frog Lane and Holly Lane were coded into PRISM, with three give-way junctions coded. The entire length of Holly Lane was coded into PRISM to allow all vehicles movements.
7622	3	Windmill Lane - Kenilworth Road	220	Windmill Lane and Hob Lane were coded in PRISM. Including these two roads involved coding four give way junctions.
7600	4	West of Dickens Heath	350	None
7606	6	Meriden Road	100	None
7609	7	Kingshurst Village Centre	100	Gilson Way was coded as a potential access point. Silver Birch Road was coded for completeness.
7602	8	Hampton Road	150	None
7603	8	Hampton Road	150-200	None
7601	9	South of Knowle	600	None
7608	10	West of Meriden	100	Maxstoke Lane East was coded as it is needed as an access point.
7610	11	TRW/The Green	640	None
7623	12	South of Dog Kennel Lane	1000	None
7613	15	Jensen House, Auckland Drive	50	None
7621	16	East of Solihull	600	Lugtrout Lane was coded into PRISM, including the coding of two give way junctions
7612	17	Moat Lane, Vulcan Road	200	None
7611	18	Sharmans Cross Road	100	None
7605	19	UK Central Hub/HS2 interchange	1000	None
7604	20	Land Damson Parkway	0	None
7617	21	Pheasant Oak Farm	100	Windmill Lane and Hob Lane were coded into PRISM as Windmill Lane is an access point. Including these two roads involved coding four give way junctions.
7616	22	Trevallion Stud	300	Wootton Green Lane was coded in PRISM. This road may be needed as an access point. This also included coding two give-way junctions.
7615	23	Lavender Hall Fam	60	None
7618	24	Oak Farm	80	None
7619	25	Land south of School Road	100	School Road may be needed as a future access point so was coded in PRISM.
7614	26	South of Shirley	300	Wootton Green Lane was coded into PRISM, including coding two give-way junctions.

Source: SMBC and Mott MacDonald

Table 2: Additional transport infrastructure coded in PRISM for Amber Sites

Zone ID	Site ref	Site Name	Households	Added links or junctions
-	A1	Land RO 575A-587 Tamworth Lane	36	None
-	A2	Land at Mount Dairy Farm	10	None
-	A3	Land RO Tilehouse Lane	18	None
7700	A4	Golden End Farm	250	Access assumed from Kenilworth Road only.
7701	A5	Land off Blue Lake Road	340	Access assumed from Norton Green Lane, already coded into the PRISM network.
-	A6	Land at Rowood Drive	30	None
-	A7	Land at Widney Manor Road	16	None
-	A8	Land at Widney Manor Road	6	None

Source: SMBC and Mott MacDonald

Table 3: Additional transport infrastructure coded in PRISM for Remaining Sites

| Zone ID	Site Ref	Site Name	Households	Added links or junctions
7801	3	Ridding's Hill	65	Access assumed from Hallmeadow Road only.
7802	8	Meriden Road	110	No additional links were coded into the network, this Remaining site is embedded within the green 'Meriden Road' site listed above (Zone Number 7606). The same access point on Meriden Road is assumed.
7803	9	Solihull Town Centre	861	No additional links were added into the network, with access into the zone assumed to be the same as the full PRISM network.
7800	24	Simon Digby	200	Access assumed to be from Yorkminster Drive, in Chelmsley Wood.
7805	-	Grange Farm	800	Access assumed to be from Balsall Street and Dengate Drive only.

Source: SMBC and Mott MacDonald

2.2   Changes to the highway zoning system

It was agreed with SMBC that each development site should have their own zone. This is so that trips to and from each specific development can be "tracked". All Green, Amber and Remaining sites have been included as individual zones in the base year highway network update.

The large PRISM zones listed in Technical Note 03, were split using the PT zoning system as a guide. Additional roads and junctions were coded into the highway network after the large PRISM zones were split, for connection purposes. This allows vehicle demand to access the network from each zone.

See Figure 2 for the updated zoning system. The purple lines represent the new highway zone boundaries. As all green, amber and remaining sites with a zone number listed in Table 1, Table 2 and Table 3 are independent zones, and with the highway zones split into the PT zones as suggested in Technical Note 03, there will be approximately 40 new zones. The zoning system is over 1,000 zones for the PRISM highway network.

Figure 2: PRISM Zone map- illustrating zones allocated to specific developments
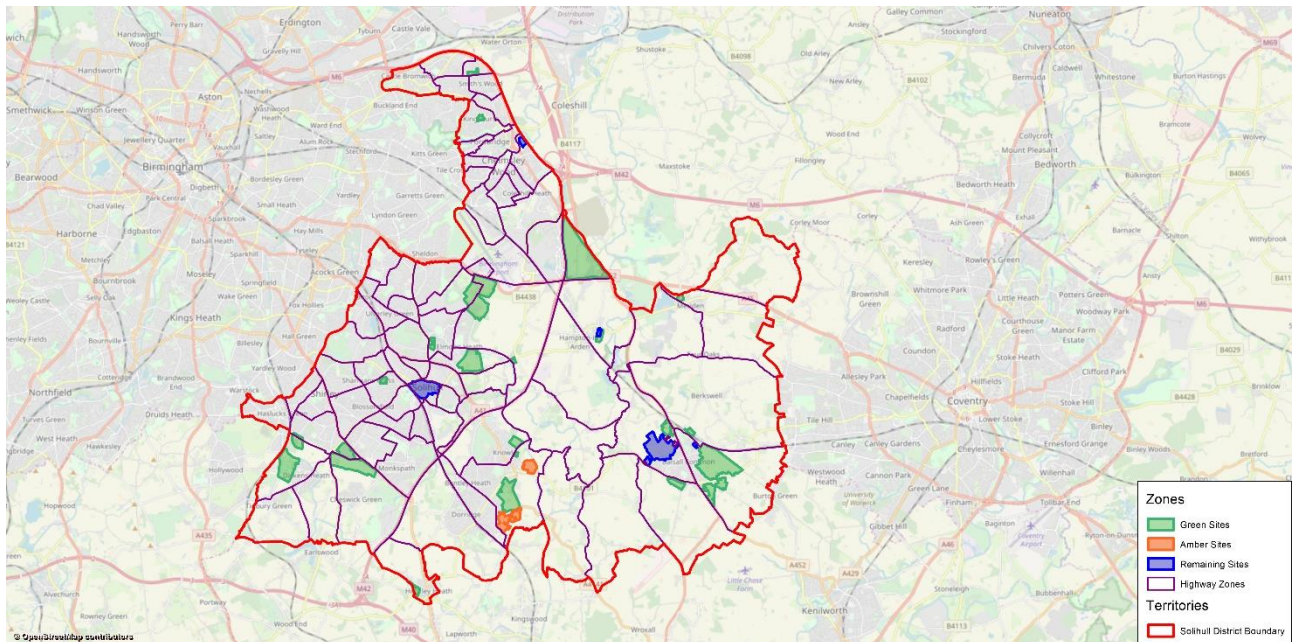
Source: Mott MacDonald

2.3   Count data

As detailed in Table 1,Table 2 and Table 3, there were several links missing from the model which are required as access points to the proposed future developments. Automatic Traffic Counts (ATCs) and Junction Turning Counts (JTCs) are included in the network, which were available from a previous Balsall Common Transport Study undertaken by Mott MacDonald. The count data will be used during a re-validation of the base model and potentially to aid re-calibration if required.

2.4   Uncertainty Log

The base year planning data (2016) has been reviewed and approved by SMBC (in the meeting held on Friday 24th May 2019), this will be followed by a detailed review of the Uncertainty log (which has been provided to SMBC) prior to forecasting.

3   Highway Validation

3.1   GEH

The GEH Statistic is a formula which incorporates both absolute and relative difference in values. It is commonly used in traffic modelling where it's desirable to compare differences in both low and high-volume links using the same measure. It is as follows, where M is modelled flow and C is observed flow:

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

A pass GEH indicates a GEH of less than 4 between the observed and modelled flows as prescribed in WebTAG unit M3.1 paragraph 3.2.8.

3.2 Screenlines

In the PRISM 5.2 MVR, the traffic count data was organised into screenlines with the following hierarchy:

- Type 1: Screenlines forming cordons around the urban areas
- Type 2: Screenlines forming cordons around the 7 Districts in the Area of Detailed Modelling
- Type 3: Smaller screenlines capturing corridors of movements within the areas defined by the other 3 types
- Type 4: Screenlines splitting the areas defined by Type 1 and Type 2

The acceptability criteria are shown in Table 4 below.

Table 4: WebTAG screenline validation criteria

Criteria	Acceptability guideline
Differences between modelled flows should be less than 5% of the counts	All or nearly all screenlines
The modelled flows should have less than 4 GEH	

Source: Mott MacDonald

For some of the smaller screenlines with low flows, measuring model performance using percentage difference is not appropriate as a small difference in flows can result in a large percentage difference. We have therefore also measured performance using older WebTAG guidelines that recommended that the modelled flows should be less than 4 GEH of the counts across screenlines.

Table C.1 in Appendix C shows this adjusted criterion, as described above, which has been used for the validation of screenlines in PRISM 5.2. Tables C.2 to C.4 in Appendix C show the validation results for the screenlines that pass through the Solihull district. Table 5 below shows a summary of these results, with screenlines which pass either of the criteria above.

Table 5: Summary of Screenline Validation in Solihull

Time Period	Number of screenlines	Number that pass	Percentage Pass
AM	22	19	86%
IP	22	18	82%
PM	22	17	77%

Source: Mott MacDonald

The screenlines are designed to capture the main traffic movements to/from/within the Area of Detailed Modelling. Type 1, 2 and 4 join up to create water-tight sectors that have been used in the trip matrix development.

Figures C.1 to C.3 illustrate the results for the screenlines that enter the Solihull district, and the results of the relevant screenlines are shown in Tables C.2 to C.4. Overall across the relevant screenlines, 86% pass the WebTAG criteria in the AM and 82% pass in the IP and 77% in the PM. When the WebTAG criteria is adjusted to a GEH of less than 5 then the pass rate increases to 100%, 86% and 91% respectively, which shows that many of the screenlines are close to passing in the first instance.

The screenlines that fail within Solihull could be addressed during a re-calibration of the base year model but overall, the pass rates are acceptable within the area.

3.3 Journey Times

For journey time validation, the measure used is the percentage difference between modelled and observed journey times, subject to an absolute maximum difference.

PRISM 5 includes a tiered approach which means that validation targets are in line with WebTAG guidelines for the important Tier 1 routes (i.e. modelled time to be within 15% of observed time or within 1 minute) but were relaxed for the Tier 2 and Tier 3 routes to 25% and 35%, respectively. The validation criteria are described in Table 6. The relaxation in the criteria was considered appropriate for a strategic model, however for the purposes of the local plan, the criteria that is most relevant is the tier 1 criteria (WebTAG).

Table 6: Journey time validation criteria

Tier	Passing Criteria
Tier 1	Less than 60 seconds, or less than 15% difference (same as WebTAG)
Tier 2	Less than 60 seconds, or less than 25% difference
Tier 3	Less than 60 seconds, or less than 35% difference

Source: WebTAG/Mott MacDonald

Modelled journey times have been compared against the observed journey times for the routes considered to be relevant to Solihull. Below is a summary of journey time routes in or near Solihull. Table E.1 in Appendix E shows the performance of each journey time route within the Solihull district and Figure E.1 illustrates the locations of the journey time routes.

Table 7: Journey time route summary

Time Period	Total Number	Number that pass Tier 1	Percentage pass Tier 1	Number that pass Tier 1, 2 or 3	Percentage Pass 1, 2 or 3
AM	24	22	92%	24	100%
IP	24	24	100%	24	100%
PM	24	17	71%	22	92%

Source: Mott MacDonald

In the AM, 92% of journey time routes pass the WebTAG criteria, 100% pass in the IP and 71% in PM. For those that do not pass the 15% criteria, most are within 20% or 30% of the observed times, and there is a reasonably even spread of routes that are either too fast or too slow, indicating that there are no major issues with the model speeds within the Solihull district. The route with the poorest performance is the M42 J5 - J3A in the southbound direction where modelled speeds are higher than observed in the PM peak period.

3.4 Calibration and validation links

In addition to the counts on screenlines, a set of individual link counts were used that cover the motorways and locations on the Key Route Network and other main roads not captured by the screenlines. Due to the nature of PRISM 5.2 as a strategic model, individual link counts on most minor roads were excluded, unless they formed part of a screenline. Table 8 shows the WebTAG calibration and validation criteria for links.

Table 8: WebTAG calibration and validation criteria

Criteria	Description of criteria	Acceptability guideline
1	Individual flows within 100 vehicles/hour of counts for flows less than 700 vehicles/hour	>85% of cases
	Individual flows within 15% of counts for flows from 700 to 2700 vehicles/hour	>85% of cases
	Individual flows within 400 vehicles/hour of counts for flows more than 2,700 vehicles/hour	>85% of cases
2	GEH < 5 for individual flows	>85% of cases

Source: WebTAG

For a strategic model it is difficult to accurately match the observed count on low-flow minor roads, as the level of detail that would be needed in the road network, zone system and zone connectors is not feasible across the West Midlands conurbation (without significantly increasing model run times and potentially affecting model convergence). Therefore, we also present link flow validation against adjusted criteria in which low flow roads (defined as having an observed traffic flow of less than 250 vehicles/hour) are considered to pass if the modelled flow is less than 350. This is shown in Table 9.

Table 9: Adjusted calibration and validation criteria

Criteria	Description of criteria	Acceptability guideline
1	Passes WebTAG criteria	>85% of cases
2	Count less than 250 vehicles an hour and modelled flow less than 350 vehicles	>85% of cases

Source: Mott MacDonald

Table 10 and Table 11 show the assignment validation for links within the Solihull district. The proportion of calibration links passing WebTAG criteria is between 77% and 83%, with the all time periods falling short of the target 85%. The proportion of validation links passing WebTAG criteria is between 62% and 72%.

Table 10: Link Calibration results in the Solihull District (WebTAG Criteria)

Time Period	Number of counts	Number of passes	Percentage Pass
AM	166	133	80%
IP	166	138	83%
PM	166	128	77%

Source: Mott MacDonald

Table 11: Link Validation results in the Solihull District (WebTAG Criteria)

Time Period	Number of counts	Number of passes	Percentage Pass
AM	29	21	72%
IP	29	20	69%
PM	29	18	62%

Source: Mott MacDonald

When compared against the adjusted criteria, the pass rate for validation and calibration doesn't change. Extending the GEH range to GEH<10 captures between 86% and 93% of validation links, demonstrating that most links within the Solihull district are not too far from the target of GEH<5. Extending the GEH range to GEH <7.5 captures 87% to 89% of calibration links, indicating that most calibration links within Solihull are not too far from the target GEH <5. This can be seen in Tables E.5 and E.6 in Appendix E.1.

Figures E.1 to E.3 show that there is no obvious pattern of link flows being too low or too high, indicating that the model flows are reasonably balanced across the district.

Balsall Common counts were added into the highway model, available from a transport study undertaken by Mott MacDonald in 2017. Table 12 shows the assignment validation for those specific links. The proportion of links passing WebTAG criteria is between 56% and 80%, with all three time periods falling short of the 85% target.

Table 12: Link Validation results for Balsall Common Count Links

Time Period	Number of Counts	Number of Passes	Percentage Pass
AM	54	30	56%
IP	54	48	80%
PM	54	30	56%

Source: Mott MacDonald

The Balsall Common link validation results have been analysed separately to the Solihull Area link validation, as they were an independent set of counts. The link validation results are unsatisfactory and in order to rectify this, a calibration exercise would be required. Extending the GEH<10 doesn't improve the percentage pass rate, indicating that links within Balsall Common are not close to meeting the WebTAG criteria. This reflects the fact that a better representation of the local transport network demand and supply is necessary as it is currently "skeletal" and on the edge of the model.

Traffic flows on motorways are presented separately below. The northbound through-movement at M42 Junction 6 and the southbound movement on the M42 between Junction 6 and Junction 5 fail against WebTAG criteria. However, the M42 north of J6 and south of J5 pass the WebTAG criteria. See Table 13 below for validation results for these sections on the M42.

Table 13: M42 Validation Pass/Fail rates

Section of M42	AM				IP				PM			
	Mod Flow	Obs Flow	GEH	Pass?	Mod Flow	Obs Flow	GEH	Pass?	Mod Flow	Obs Flow	GEH	Pass?
SB J7-J6	5631	5789	2.1	✔	4276	4442	2.5	✔	4783	4760	0.3	✔
SB J6-J5	5115	5622	6.9	✘	4041	4454	6.3	✘	4639	5185	7.8	✘
SB J5-J4	5286	5659	5.0	✔	4301	4547	3.7	✔	4993	5284	4.1	✔
NB J4-J5	5223	5090	1.9	✔	4389	4511	1.8	✔	4918	4957	0.6	✔
NB J5-J6	5167	5164	0	✔	4300	4508	3.1	✔	4883	5016	1.9	✔
NB J6-J7	4361	4606	3.7	✔	4161	4498	5.1	✔	5388	5651	3.5	✔

Source: Mott MacDonald

The northbound movement at M6 Junction 4-4a fails against WebTAG criteria. However, all southbound movements pass the WebTAG criteria. See Table 14 below for validation results on these sections of the M6.

Table 14: M6 Validation Pass/Fail Rates

Section of M6	AM				IP				PM			
	Mod Flow	Obs Flow	GEH	Pass?	Mod Flow	Obs Flow	GEH	Pass?	Mod Flow	Obs Flow	GEH	Pass?
SB J5-4a	4914	5145	3.3	✔	4079	4372	4.5	✔	4779	5042	3.8	✔
SB J4a-4	2957	2928	0.5	✔	2383	2369	0.3	✔	2681	2669	0.2	✔
NB J4-4a	3469	3982	8.4	✘	3351	3805	7.6	✘	3959	4368	6.3	✘
NB J4a-5	5740	5521	2.9	✔	5080	4872	2.9	✔	5840	5483	4.7	✔

Source: Mott MacDonald

See Appendix E.2 and E.3 for more detailed tables of the calibration and validation links in the Solihull district.

4   PT Validation

The PRISM 5.2 PT network was updated during this work commissioned by SMBC. As a result of this update, the PT network validation was re-reviewed and updated following the issue of Technical Note 03.

4.1   Bus Validation

The PRISM 5.2 bus demand has been validated using count data assembled into cordons around local centres. Pass rates are determined by whether modelled flows are within 25% of observed counts where counts are above 150, or with an absolute difference less than 50 where observed counts are below 150. This is in line with WebTAG guidance and all the data in the AM and PM, with 90% in the IP passes on this requirement.

Table 15 below shows the overall summary of bus cordon counts in Solihull.

Table 15: Bus Cordon Count Summary

Time Period	Number of Stops	Number that pass	Percentage Pass
AM	10	10	100%
IP	10	9	90%
PM	10	10	100%

Source: Mott MacDonald

Tables A.1 to A.3 in Appendix A shows the overall validation statistics for Solihull centres, where table A.4 shows the statistics for the Solihull cordon in more detail. From these tables, it can be seen that the overall Solihull cordon passes the WebTAG criteria in all time periods and 100% of individual sites in Solihull, for AM and PM periods, also pass. In the IP period, 90% of sites pass this criterion.

The bus demand has also been validated against boarders and alighters at aggregated bus stops across the network. We were unable to validate the network per service due to the limitations of the observed data but were able to validate to geographical areas. Table 16 shows a summary of the bus stop areas in the Solihull Area.

Table 16: Bus Boarding and Alighting Summary

Time Period	Boarding/Alighting	Number of Stops	Number that pass	Percentage Pass
AM	Boarding	6	5	83%
IP	Boarding	6	6	100%
PM	Boarding	6	4	67%
AM	Alighting	6	5	83%
IP	Alighting	6	6	100%
PM	Alighting	6	5	83%

Source: Mott MacDonald

Table A.5 in Appendix A shows the results for those stop areas (groups of bus stops) that fall within the Solihull district boundary. In the IP assignments, 100% of these stops pass the WebTAG criteria. In the PM, only 2 stops areas do not meet the criteria for boarding and 1 stop area for alighting. In the AM, 1 stop does not meet the criteria for boarding, and one for alighting.

The stop area validation at Olton does not meet the criteria for both boarding and alighting due to one stop within the area having insufficient observed data. If this stop is removed from the stop area, it would meet the criteria overall. The stop area at Chelmsley Road has an average difference between observed and modelled flow of 57 which is very close to the passing criteria of less than 50 difference.

The Figures in Appendix A show the locations of the individual bus stops used for the aggregated stop area validation.

Currently, we do not hold any observed boarding and alighting information for bus stops on the East side of the M42, and in Balsall Common. If observed data could be obtained, this could be used to check the level of model validation in this area.

4.2 Local Rail Validation

Local rail demand has been validated against boarding and alighting counts at each rail station in the Solihull district. The pass rate is very high with an average pass rate of 94% across all three time periods. See Table 17 below for a summary of rail validation in the Solihull area.

Table 17: Rail Validation Summary in Solihull

Time Period	Boarding/Alighting	Number of Stops	Number that pass	Percentage Pass
AM	Boarding	11	11	100%
IP	Boarding	11	10	91%
PM	Boarding	11	11	100%
AM	Alighting	11	10	91%
IP	Alighting	11	11	100%
PM	Alighting	11	9	82%

Source: Mott MacDonald

Figures B.1 to B.6 in Appendix B show maps of sites and matrix validation or assignment validation results for each site in the FMA. Table B.1 shows the boarding and alighting statistics for all stations which lie within the Solihull district boundary.

There is one stop in the AM and two in the PM which do not meet the criteria. Earlswood station does not meet the criteria in the PM. This station has very low observed flows and is on the very edge of the Solihull district boundary. Dorridge station does not meet the validation criteria in both the AM and PM model for alighters. This station can be revisited and discussed with SMBC before deciding on a course of action.

4.3 Changes in PT validation

Compared with the results presented in Technical Note 03, the level of PT validation (bus and rail only) in Solihull has decreased slightly. However, the percentage of bus borders which pass has increased, with the alighters decreasing. Rail validation has decreased for both borders and alighters, but both modes are still at acceptable levels.

5 Conclusion and recommendations

The validation statistics for the PRISM 5.2 Highway model in Solihull, post base year update, do not meet WebTAG criteria. The screenline validation is reasonable in AM and IP but should be improved in the PM period where 77% of the screenlines pass. Similarly, the journey time validation in the AM and the IP is good, but falls short in the PM, where 71% pass the WebTAG criteria.

The level of calibration on highway links within the Solihull area are generally fine but fall short of the WebTAG criteria of 85% pass. The percentage pass rate for the validation links ranges from 62% to 72% across the three time periods. When comparing the modelled flows against the observed data from the Balsall common traffic study, the pass rate is poor with only 56% of links passing in the AM and PM periods.

This suggests that the highway validation in the Solihull area should be improved, especially in the Balsall Common area. It is recommended that for the Solihull Local Plan PRISM the base year model undergoes a calibration and validation exercise. This should improve the link count validation statistics and provide a more robust base network before continuing with forecasting.

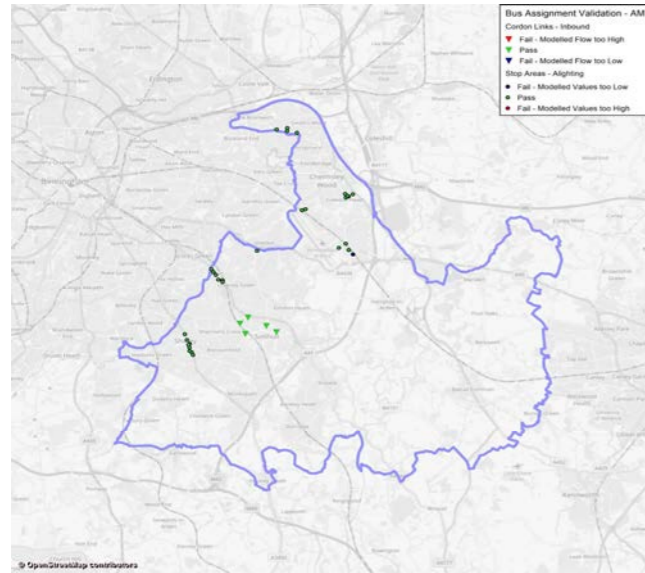# Appendix A - Public Transport - Relevant bus cordon counts
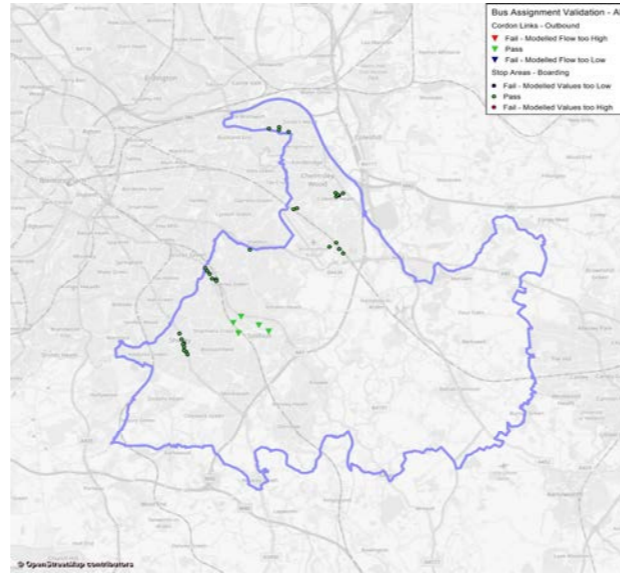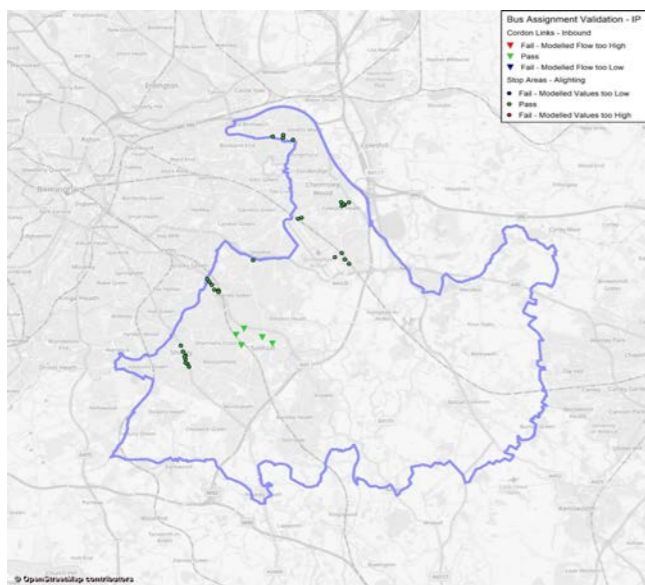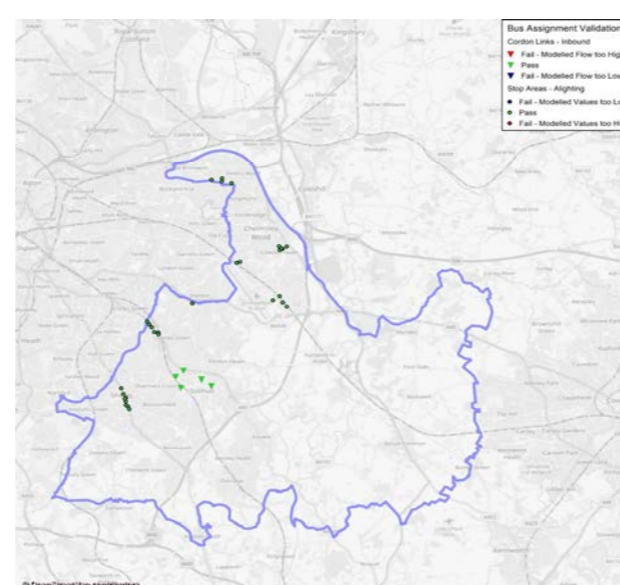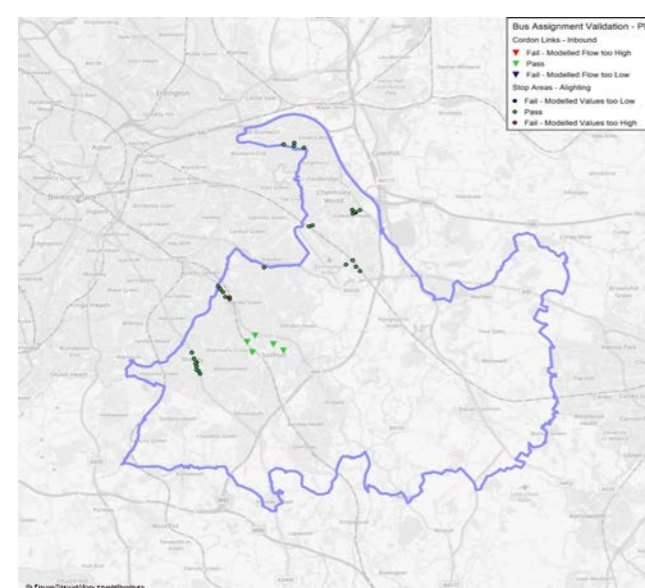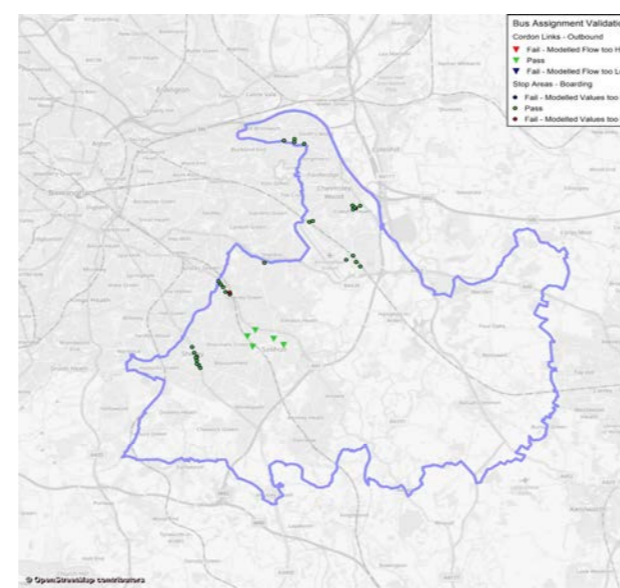
Table A.1: Relevant bus cordon counts - AM

Cordon	Dir'n	Obs	Mod	%Diff	GEH Diff	Pass
Solihull	In	2736	2727	0%	0.16	Pass
Solihull	Out	1854	1641	-11%	5.04	Pass
						100%

Table A.2: Relevant bus cordon counts - IP

Cordon	Dir'n	Obs	Mod	%Diff	GEH Diff	Pass
Solihull	In	2326	2110	-9%	4.58	Pass
Solihull	Out	1548	1492	-4%	1.45	Pass
						100%

Table A.3: Relevant bus cordon counts - PM

Cordon	Dir'n	Obs	Mod	%Diff	GEH Diff	Pass
Solihull	In	1679	1700	1%	0.51	Pass
Solihull	Out	3816	3530	-7%	4.72	Pass
						100%

Table A.4: Relevant bus cordon counts (individual) - AM, IP, PM

Site	Cordon	Dir'n	Obs	Mod	%Diff	GEH Diff	Pass	Obs	Mod	%Diff	GEH Diff	Pass	Obs	Mod	%Diff	GEH Diff	Pass
			AM					IP					PM				
site 401	Solihull	In	155	162	5%	0.56	Pass	171	152	-11%	1.50	Pass	95	100	5%	0.50	Pass
site 402	Solihull	In	388	357	-8%	1.63	Pass	460	325	-29%	6.83	Fail	238	227	-5%	0.75	Pass
site 403	Solihull	In	1329	1307	-2%	0.60	Pass	936	903	-3%	1.08	Pass	815	794	-3%	0.75	Pass
site 404	Solihull	In	158	176	11%	1.37	Pass	226	221	-2%	0.32	Pass	97	124	28%	2.56	Pass
site 407	Solihull	In	705	725	3%	0.73	Pass	533	509	-5%	1.05	Pass	433	455	5%	1.05	Pass
site 401	Solihull	Out	105	105	0%	0.00	Pass	114	123	8%	0.84	Pass	216	223	3%	0.47	Pass
site 402	Solihull	Out	263	216	-18%	3.05	Pass	306	276	-10%	1.79	Pass	542	444	-18%	4.41	Pass
site 403	Solihull	Out	900	707	-21%	6.82	Pass	623	605	-3%	0.72	Pass	1853	1661	-10%	4.59	Pass
site 404	Solihull	Out	107	127	18%	1.83	Pass	150	159	6%	0.70	Pass	221	232	5%	0.75	Pass
site 407	Solihull	Out	478	486	2%	0.37	Pass	355	329	-7%	1.40	Pass	984	970	-1%	0.45	Pass
Percentage of cordons which pass							100.0%					90.0%					100.0%

Table A.5: Relevant bus stop area counts - AM, IP, PM

Site	B/A	Obs	Mod	%Diff	GEH Diff	Pass	Obs	Mod	%Diff	GEH Diff	Pass	Obs	Mod	%Diff	GEH Diff	Pass
		AM					IP					PM				
Olton	A	62	83	34%	2.47	Pass	83.6	102	22%	1.91	Pass	126	221	75%	7.21	Fail
Marston Green Tavern	A	78	103	32%	2.63	Pass	55.2	59	7%	0.50	Pass	79	67	-15%	1.40	Pass
Solihull Road	A	245	240	-2%	0.32	Pass	518	497	-4%	0.93	Pass	420	412	-2%	0.39	Pass
Chester Road	A	100	113	13%	1.26	Pass	177.2	195	10%	1.30	Pass	234	257	10%	1.47	Pass
Birmingham Airport	A	378	312	-17%	3.55	Pass	183.2	201	10%	1.28	Pass	379	374	-1%	0.26	Pass
Chelmsley Road	A	115	44	-62%	7.96	Fail	41.6	29	-30%	2.12	Pass	106	70	-34%	3.84	Pass
Olton	B	117	121	3%	0.37	Pass	87.6	99	13%	1.18	Pass	73	131	79%	5.74	Fail
Marston Green Tavern	B	83	88	6%	0.54	Pass	60	69	15%	1.12	Pass	75	107	43%	3.35	Pass
Solihull Road	B	335	353	5%	0.97	Pass	507.6	448	-12%	2.73	Pass	322	309	-4%	0.73	Pass
Chester Road	B	229	211	-8%	1.21	Pass	200	155	-23%	3.38	Pass	154	142	-8%	0.99	Pass
Birmingham Airport	B	344	385	12%	2.15	Pass	196.4	211	7%	1.02	Pass	356	325	-9%	0.67	Pass
Chelmsley Road	B	148	75	-49%	6.91	Fail	63.6	32	-50%	4.57	Pass	112	26	-77%	10.35	Fail
Percentage of cordons which pass							83.3%					100.0%					75.0%

Appendix B - Public Transport - Local rail passenger counts

Table B.1: Rail boarding and alighting statistics

Site	Area	B/A	AM					IP					PM				
			Obs	Mod	%Diff	GEH Diff	Pass	Obs	Mod	%Diff	GEH Diff	Pass	Obs	Mod	%Diff	GEH Diff	Pass
Berkswell	Coventry	B	141	148	5%	0.58	Pass	33	72	120%	5.42	Pass	52	53	2%	0.14	Pass
Marston Green	Birmingha	B	413	417	1%	0.20	Pass	77	118	54%	4.17	Pass	92	115	25%	2.26	Pass
Birmingham International	Solihull	B	1478	1422	-4%	1.47	Pass	990	1041	5%	1.60	Pass	1569	1468	-6%	2.59	Pass
Dorridge	Solihull	B	398	379	-5%	0.96	Pass	113	132	17%	1.70	Pass	91	112	23%	2.08	Pass
Earlswood	Solihull	B	18	21	17%	0.68	Pass	4	9	105%	1.78	Pass	3	9	200%	2.45	Pass
Hampton in Arden	Solihull	B	145	157	8%	0.98	Pass	23	79	246%	7.88	Fail	18	43	139%	4.53	Pass
Olton	Solihull	B	599	611	2%	0.49	Pass	61	83	37%	2.62	Pass	57	75	32%	2.22	Pass
Shirley	Solihull	B	261	260	0%	0.06	Pass	37	61	66%	3.46	Pass	38	58	53%	2.89	Pass
Solihull	Solihull	B	817	807	-1%	0.35	Pass	349	363	4%	0.75	Pass	848	830	-2%	0.62	Pass
Whitlocks End	Solihull	B	293	270	-8%	1.37	Pass	24	30	23%	1.07	Pass	13	13	0%	0.00	Pass
Widney Manor	Solihull	B	350	368	5%	0.95	Pass	35	49	39%	2.13	Pass	46	51	11%	0.72	Pass
Berkswell	Coventry	A	17	41	141%	4.46	Pass	14	38	179%	4.80	Pass	109	126	16%	1.57	Pass
Marston Green	Birmingha	A	87	131	51%	4.21	Pass	68	97	43%	3.19	Pass	335	355	6%	1.08	Pass
Birmingham International	Solihull	A	1515	1461	-4%	1.40	Pass	810	801	-1%	0.32	Pass	1226	1244	1%	0.51	Pass
Dorridge	Solihull	A	49	202	312%	13.66	Fail	85	113	33%	2.79	Pass	355	498	40%	6.92	Fail
Earlswood	Solihull	A	2	15	650%	4.46	Pass	4	13	195%	2.92	Pass	3	79	2533%	11.87	Fail
Hampton in Arden	Solihull	A	22	45	105%	3.97	Pass	18	37	106%	3.62	Pass	112	132	18%	1.81	Pass
Olton	Solihull	A	24	57	138%	5.19	Pass	53	64	21%	1.47	Pass	455	483	6%	1.29	Pass
Shirley	Solihull	A	15	54	260%	6.64	Pass	47	66	41%	2.56	Pass	217	235	8%	1.20	Pass
Solihull	Solihull	A	867	866	0%	0.03	Pass	356	356	0%	0.00	Pass	678	716	6%	1.44	Pass
Whitlocks End	Solihull	A	6	19	217%	3.68	Pass	20	27	32%	1.36	Pass	336	320	-5%	0.88	Pass
Widney Manor	Solihull	A	20	52	160%	5.33	Pass	33	44	33%	1.74	Pass	241	258	7%	1.08	Pass
Percentage of counts which pass							95%					95%					91%

Appendix C - Highway - Matrix validation (cordons and screenlines)

Table C.1: Acceptability guidelines for trip matrix validation

Criteria	Acceptability guideline
Differences between modelled flows should be less than 5% of the counts	All or nearly all screenlines
The modelled flows should be less than 4 GEH	

Table C.2: Relevant screenline and cordon validation - AM

	Area	Direction	Type	Cal/Val	Total Observed Traffic Flow (Vehicles)	Total Model Traffic Flow (Vehicles)	% Difference	GEH	Pass?
1	Solihull North Cordon	I	1	C	2809	2777	1%	0.61	Pass
	Solihull North Cordon	O	1	C	2619	2620	0%	0.02	Pass
2	Solihull South Cordon	I	1	C	3861	3802	2%	0.95	Pass
	Solihull South Cordon	O	1	C	3339	3159	6%	3.16	Pass
3	Birmingham Box East	I	2	C	9255	9444	2%	1.95	Pass
	Birmingham Box East	O	2	C	7819	7774	1%	0.51	Pass
4	Coventry & Solihull South West	I	2	C	1103	1079	2%	0.73	Pass
	Coventry & Solihull South West	O	2	C	1014	1069	5%	1.70	Pass
5	Coventry & Solihull West	I	2	C	6777	6456	5%	3.95	Pass
	Coventry & Solihull West	O	2	C	7007	6638	6%	4.47	Fail
6	*Birmingham Airport	I	3	C	2156	2130	1%	0.56	Pass
	*Birmingham Airport	O	3	C	1577	1596	1%	0.48	Pass
7	*Birmingham Box North East	I	4	C	2334	2378	2%	0.91	Pass
	*Birmingham Centre to East	O	4	C	789	922	14%	4.55	Fail
8	*Birmingham Box North East	O	4	C	1868	1850	1%	0.42	Pass
	*Birmingham Centre to East	I	4	C	1997	2081	4%	1.86	Pass
9	*Solihull South East	I	3	V	712	606	17%	4.13	Fail
	*Solihull South East	O	3	V	1175	1198	2%	0.67	Pass
10	*Solihull Box East	O	4	V	3922	3798	3%	2.00	Pass
	*Coventry & Far East Solihull	I	4	V	946	736	29%	7.24	Fail
11	*Solihull Box East	I	4	V	3517	3518	0%	0.02	Pass
	*Coventry & Far East Solihull	O	4	V	556	440	26%	5.20	Fail

Table C.3: Relevant screenline and cordon validation - IP

Area	Direction	Type	Cal/Val	Total Observed Traffic Flow (Vehicles)	Total Model Traffic Flow (Vehicles)	% Difference	GEH	Pass?
Solihull North Cordon	I	1	C	2393	2352	2%	0.84	Pass
Solihull North Cordon	O	1	C	2645	2594	2%	1.00	Pass
Solihull South Cordon	I	1	C	3066	2908	5%	2.89	Pass
Solihull South Cordon	O	1	C	3225	3027	7%	3.54	Pass
Birmingham Box East	I	2	C	6196	6058	2%	1.76	Pass
Birmingham Box East	O	2	C	6465	6381	1%	1.05	Pass
Coventry & Solihull South West	I	2	C	959	847	13%	3.73	Pass
Coventry & Solihull South West	O	2	C	904	803	13%	3.46	Pass
Coventry & Solihull West	I	2	C	4963	4675	6%	4.15	Fail
Coventry & Solihull West	O	2	C	4626	4455	4%	2.54	Pass
*Birmingham Airport	I	3	C	1483	1477	0%	0.16	Pass
*Birmingham Box North East	I	4	C	1775	1828	3%	1.25	Pass
*Birmingham Centre to East	O	4	C	898	960	6%	2.03	Pass
*Birmingham Box North East	O	4	C	1814	1866	3%	1.21	Pass
*Birmingham Centre to East	I	4	C	1082	1171	8%	2.65	Pass
*Solihull South East	I	3	V	603	527	14%	3.20	Pass
*Solihull South East	O	3	V	539	426	27%	5.14	Fail
*Solihull Box East	O	4	V	3213	3023	6%	3.40	Pass
*Coventry & Far East Solihull	I	4	V	341	156	119%	11.74	Fail
*Solihull Box East	I	4	V	3621	3684	2%	1.04	Pass
*Coventry & Far East Solihull	O	4	V	415	438	5%	1.11	Pass

Table C.4: Relevant screenline and cordon validation - PM

| Area	Direction	Type	Cal/Val	Total Observed Traffic Flow (Vehicles)	Total Model Traffic Flow (Vehicles)	% Difference	GEH	Pass?
Solihull North Cordon	I	1	C	2790	2763	1%	0.51	Pass
Solihull North Cordon	O	1	C	3221	3182	1%	0.69	Pass
Solihull South Cordon	I	1	C	3595	3667	2%	1.19	Pass
Solihull South Cordon	O	1	C	4613	4508	2%	1.55	Pass
Birmingham Box East	I	2	C	8076	8258	2%	2.01	Pass
Birmingham Box East	O	2	C	9337	9656	3%	3.27	Pass
Coventry & Solihull South West	I	2	C	1244	1218	2%	0.74	Pass
Coventry & Solihull South West	O	2	C	1304	1136	15%	4.81	Fail
Coventry & Solihull West	I	2	C	6733	6399	5%	4.12	Fail
Coventry & Solihull West	O	2	C	6796	6843	1%	0.57	Pass
*Birmingham Airport	I	3	C	1815	1819	0%	0.09	Pass
*Birmingham Airport	O	3	C	2017	2094	4%	1.70	Pass
*Birmingham Box North East	I	4	C	1973	1999	1%	0.58	Pass
*Birmingham Centre to East	O	4	C	1476	1674	12%	4.99	Fail
*Birmingham Box North East	O	4	C	2433	2442	0%	0.18	Pass
*Birmingham Centre to East	I	4	C	1093	1180	7%	2.58	Pass
*Solihull South East	I	3	V	1102	1073	3%	0.88	Pass
*Solihull South East	O	3	V	664	625	6%	1.54	Pass
*Solihull Box East	O	4	V	3930	3814	3%	1.86	Pass
*Coventry & Far East Solihull	I	4	V	340	144	136%	12.00	Fail
*Solihull Box East	I	4	V	4163	4416	6%	3.86	Pass
*Coventry & Far East Solihull	O	4	V	654	700	7%	1.77	Pass

Figure C.1: Screenlines – AM
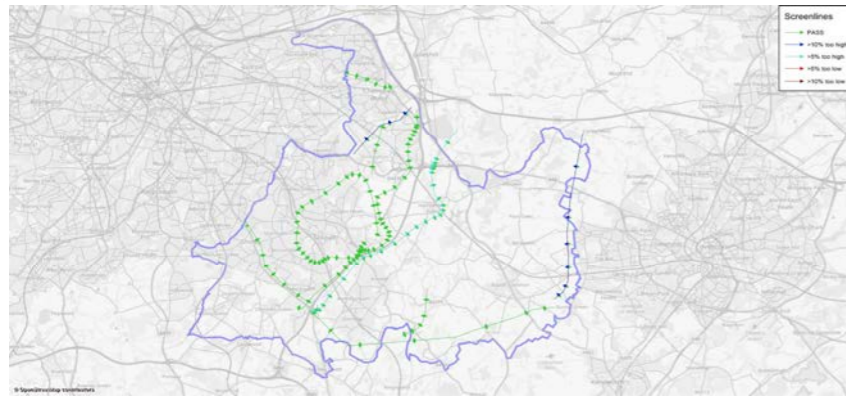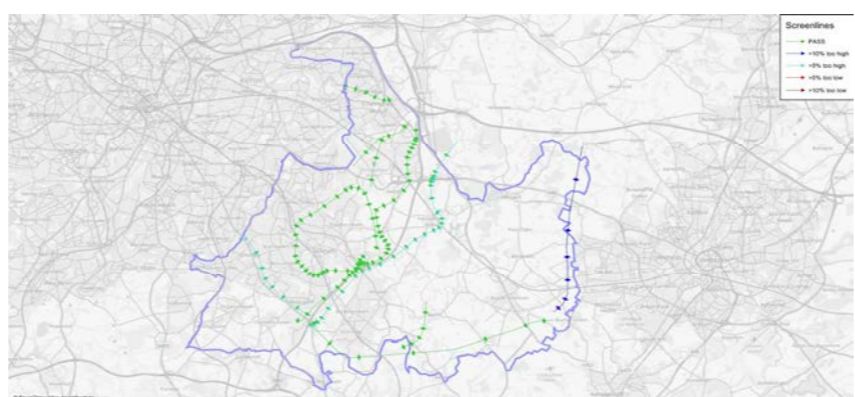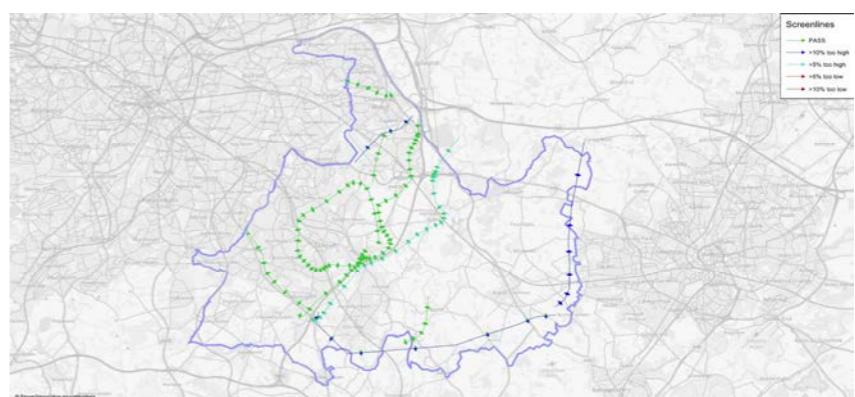

Figure C.2: Screenlines – IP

Figure C.3: Screenlines – PM

Appendix D - Highway - Journey time validation

Table D.1: Relevant journey time validation

Route Number	Route Name	Direction	Route Rank	AM Observed Time	AM Modelled Time	AM Time Difference	AM Percentage Difference	AM Pass Tier X Criteria	AM Pass WebTAG criteria	IP Observed Time	IP Modelled Time	IP Time Difference	IP Percentage Difference	IP Pass Tier X Criteria	IP Pass WebTAG criteria	PM Observed Time	PM Modelled Time	PM Time Difference	PM Percentage Difference	PM Pass Tier X Criteria	PM Pass WebTAG criteria
2	A45 Stonebridge Island - Bordesley Circus	WB	1	1283	1168	115	9%	✓	✓	1172	1259	-87	-7%	✓	✓	1415	1208	207	15%	✓	✓
2	A45 Stonebridge Island - Bordesley Circus	EB	1	1395	1221	174	12%	✓	✓	1274	1166	108	8%	✓	✓	1382	1197	185	13%	✓	✓
3	A41 Warwick Road	NB	1	1335	1466	-132	-10%	✓	✓	1267	1364	-98	-8%	✓	✓	1501	1462	39	3%	✓	✓
3	A41 Warwick Road	SB	1	1411	1336	75	5%	✓	✓	1238	1330	-92	-7%	✓	✓	1368	1423	-54	-4%	✓	✓
4	A34 Stratford Road	NB	1	1666	1598	68	4%	✓	✓	1678	1520	157	9%	✓	✓	1810	1602	208	11%	✓	✓
4	A34 Stratford Road	SB	1	1597	1515	82	5%	✓	✓	1688	1558	130	8%	✓	✓	1860	1733	127	7%	✓	✓
20	A452 Chester Road	NB	1	869	979	-110	-13%	✓	✓	890	937	-47	-5%	✓	✓	1077	1035	42	4%	✓	✓
20	A452 Chester Road	SB	1	935	995	-61	-7%	✓	✓	851	879	-29	-3%	✓	✓	992	922	70	7%	✓	✓
1	A45 Stivchall Interchange - Stonebridge Island	WB	2	1040	1040	1	0%	✓	✓	879	946	-66	-8%	✓	✓	896	993	-97	-11%	✓	✓
1	A45 Stivchall Interchange - Stonebridge Island	EB	2	1058	956	103	10%	✓	✓	900	915	-15	-2%	✓	✓	1101	980	121	11%	✓	✓
21	B4128 Bordesley Green East	EB	2	1237	1310	-73	-6%	✓	✓	1336	1384	-48	-4%	✓	✓	1438	1485	-46	-3%	✓	✓
21	B4128 Bordesley Green East	WB	2	1398	1435	-37	-3%	✓	✓	1354	1340	15	1%	✓	✓	1362	1430	-67	-5%	✓	✓
83	A446 Lichfield Road/Stonebridge Road	NB	2	665	822	-157	-24%	✓	✗	645	647	-2	0%	✓	✓	795	755	40	5%	✓	✓
83	A446 Lichfield Road/Stonebridge Road	SB	2	778	699	79	10%	✓	✓	620	554	66	11%	✓	✓	655	572	83	13%	✓	✓
1002	M6 J6 - J3a	NB	2	802	602	200	25%	✓	✗	621	663	-42	-7%	✓	✓	731	587	144	20%	✓	✗
1002	M6 J6 - J3a	SB	2	659	592	67	10%	✓	✓	585	604	-19	-3%	✓	✓	625	589	36	6%	✓	✓
1004	M6 - M42 J5	NB	2	359	323	36	10%	✓	✓	351	391	-41	-12%	✓	✓	433	332	101	23%	✓	✗
1004	M6 - M42 J5	SB	2	491	476	15	3%	✓	✓	428	454	-25	-6%	✓	✓	559	409	150	27%	✗	✗
1015	M42 J5 - J3A	NB	2	335	307	28	8%	✓	✓	333	368	-35	-10%	✓	✓	395	300	95	24%	✓	✗
1015	M42 J5 - J3A	SB	2	341	291	50	15%	✓	✓	315	311	4	1%	✓	✓	515	286	230	45%	✗	✗
39	Damson Parkway/Streetsbrook Road	NB	3	1111	1073	38	3%	✓	✓	899	1025	-127	-14%	✓	✓	932	1137	-205	-22%	✓	✗
39	Damson Parkway/Streetsbrook Road	SB	3	1058	1106	-49	-5%	✓	✓	982	1126	-144	-15%	✓	✓	1161	1355	-194	-17%	✓	✗
64	Kings Norton to Shirley	WB	3	890	859	31	3%	✓	✓	850	840	10	1%	✓	✓	930	900	30	3%	✓	✓
64	Kings Norton to Shirley	EB	3	886	876	10	1%	✓	✓	845	849	-4	0%	✓	✓	912	960	-48	-5%	✓	✓

Figure D.1: Relevant journey time routes

Journey Time Routes
- Route 1 - A45 Stivchall Interchange - Stonebridge Island
- Route 2 - A45 Stonebridge Island - Bordesley Circus
- Route 3 - A41 Warwick Road
- Route 4 - A34 Stratford Road
- Route 20 - A452 Chester Road
- Route 21 - B4128 Bordesley Green East
- Route 39 - Damson Parkway/Streetsbrook Road
- Route 64 - Kings Norton to Shirley
- Route 83 - A446 Lichfield Road/Stonebridge Road
- Route 1002 - M6 J6 - J3a
- Route 1004 - M6 - M42 J5
- Route 1015 - M42 J5 - J3a
- Solihull District

Table D.2: Tier X Passing Criteria

	Passing Criteria	Number of Routes	Percentage Pass AM	IP	PM
Tier 1	Less than 60 seconds, or less than 15% difference (same as WebTAG)	8	100%	100%	100%
Tier 2	Less than 60 seconds, or less than 25% difference	12	100%	100%	83%
Tier 3	Less than 60 seconds, or less than 35% difference	4	100%	100%	100%

Appendix E.1 - Highway - Assignment validation

Table E.1: WebTAG calibration and validation criteria

Criteria		Description of criteria	Acceptability guideline
	1	Individual flows within 100 vehicles/hour of counts for flows less than 700 vehicles/hour	>85% of cases
		Individual flows within 15% of counts for flows from 700 to 2700 vehicles/hour	>85% of cases
		Individual flows within 400 vehicles/hour of counts for flows more than 2,700 vehicles/hour	>85% of cases
	2	GEH < 5 for individual flows	>85% of cases

Table E.2: Adjusted calibration and validation criteria

Criteria		Description of criteria	Acceptability
	1	Passes WebTAG criteria	>85% of cases
	2	Count less than 250 vehicles an hour and modelled flow less than 350 vehicles	>85% of cases

Table E.3: Link Calibration results in the Solihull District(WebTAG Criteria)

Time Period	Number of counts	Number of passes	Percentage Pass
AM	166	133	80%
IP	166	138	83%
PM	166	128	77%

Table E.4: Link Validation results in theSolihull District (WebTAG Criteria)

Time Period	Number of counts	Number of passes	Percentage Pass
AM	29	21	72%
IP	29	20	69%
PM	29	18	62%

Table E.5: Link Calibration results in the Solihull District (Adjusted Criteria)

Time Period	Number of counts	% Pass Adjusted	% Pass <7.5 GEH	% Pass <10 GEH
AM	166	80%	89%	96%
IP	166	83%	88%	95%
PM	166	77%	87%	93%

Table E.6: Link Validation results in the Solihull District (Adjusted Criteria)

Time Period	Number of counts	% Pass Adjusted	% Pass <7.5 GEH	% Pass <10 GEH
AM	29	72%	86%	93%
IP	29	69%	83%	86%
PM	29	62%	79%	86%

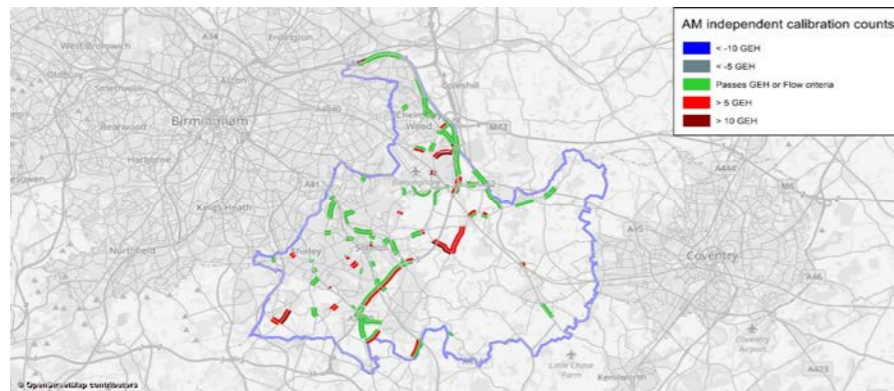Figure E.1: Area of Influence calibration links – AM

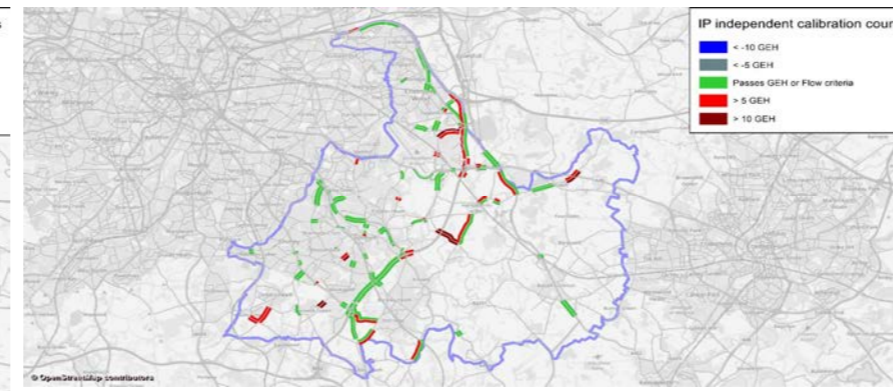Figure E.2: Area of Influence calibration links – IP

Figure E.3: Area of Influence calibration links – PM
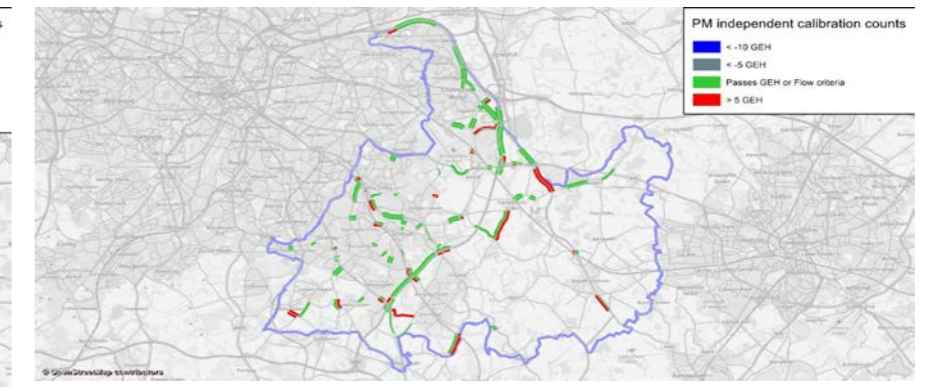
Figure E.4: Area of Influence validation links – AM
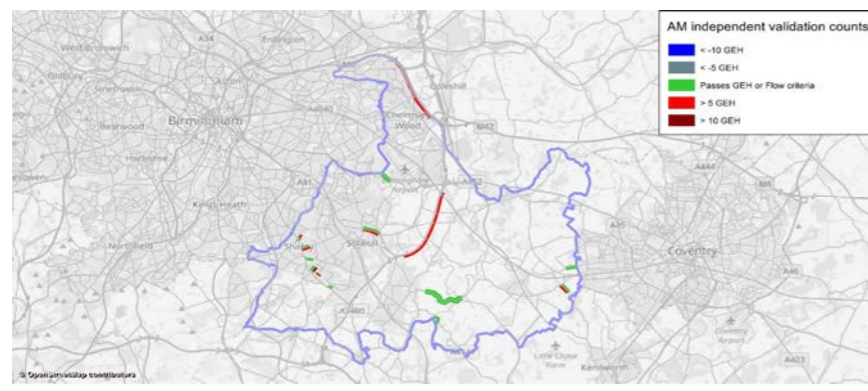
Figure E.5: Area of Influence validation links – IP
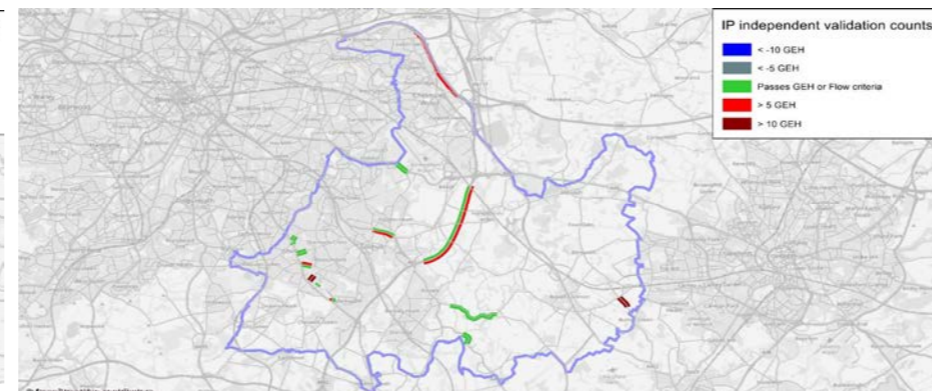
Figure E.6: Area of Influence validation links – PM

Appendix E.2 - Highway - Assignment calibration links in the Solihull District

Table E.7: Calibration - AM

Link Number	From Node	To Node	Total Modelled Flow	Total Observed Flow	GEH	Pass?

Table E.8: Calibration - IP

Link Number	From Node	To Node	Total Modelled Flow	Total Observed Flow	GEH	Pass?

Table E.9: Calibration - PM

Link Number	From Node	To Node	Total Modelled Flow	Total Observed Flow	GEH	Pass?

Appendix E.3 - Highway - Assignment validation links in the Solihull District

Link Number	From Node	To Node	Total Modelled Flow	Total Observed Flow	GEH	Pass?
108884	107439	107601	1272	1418	3.98	✔
108884	107601	107439	1736	1764	0.67	✔
111770	109655	109605	3469	3982	8.40	✖
111801	109668	109667	5115	5622	6.92	✖
111804	109670	107447	5167	5164	0.04	✔
113635	110668	115373	616	473	6.13	✖
113635	115373	110668	460	467	0.33	✔
119855	110889	114660	1101	993	3.34	✔
119855	114660	110889	1227	1136	2.65	✔
121747	103786	103824	654	756	3.84	✔
121747	103824	103786	452	614	7.02	✖
510021	106783	510389	81	119	3.80	✔
510021	510389	106783	168	174	0.46	✔
510878	115370	510542	927	1010	2.67	✔
510878	510542	115370	878	764	3.98	✔
513780	510531	510550	397	463	3.18	✔
513780	510550	510531	199	414	12.28	✖
514209	113320	510535	394	390	0.20	✔
514209	510535	113320	350	399	2.53	✔
514265	103571	510545	289	277	0.71	✔
514265	510545	103571	263	365	5.76	✖
517330	107899	510377	361	345	0.85	✔
517330	510377	107899	211	106	8.34	✖
517354	510399	510404	350	348	0.11	✔
517354	510404	510399	277	251	1.60	✔
517630	510500	520263	142	232	6.58	✖
517630	520263	510500	351	603	11.54	✖
630275	510410	5100314	190	230	2.76	✔
630275	5100314	510410	251	279	1.72	✔

Link Number	From Node	To Node	Total Modelled Flow	Total Observed Flow	GEH	Pass?
108884	107439	107601	1282	1216	1.87	✔
108884	107601	107439	1253	1216	1.05	✔
111770	109655	109605	3351	3805	7.59	✖
111801	109668	109667	4041	4454	6.34	✖
111804	109670	107447	4300	4508	3.13	✔
113635	110668	115373	558	450	4.81	✔
113635	115373	110668	499	461	1.73	✔
119855	110889	114660	860	760	3.51	✔
119855	114660	110889	902	732	5.95	✖
121747	103786	103824	518	537	0.83	✔
121747	103824	103786	397	543	6.73	✖
510021	106783	510389	89	89	0.00	✔
510021	510389	106783	100	97	0.30	✔
510878	115370	510542	845	896	1.73	✔
510878	510542	115370	808	844	1.25	✔
513780	510531	510550	394	686	12.57	✖
513780	510550	510531	226	677	21.22	✖
514209	113320	510535	383	283	5.48	✖
514209	510535	113320	455	381	3.62	✔
514265	103571	510545	308	264	2.60	✔
514265	510545	103571	296	338	2.36	✔
517330	107899	510377	209	81	10.63	✖
517330	510377	107899	228	88	11.14	✖
517354	510399	510404	250	217	2.16	✔
517354	510404	510399	244	225	1.24	✔
517630	510500	520263	244	314	4.19	✔
517630	520263	510500	207	277	4.50	✔
630275	510410	5100314	153	175	1.72	✔
630275	5100314	510410	156	150	0.49	✔

Link Number	From Node	To Node	Total Modelled Flow	Total Observed Flow	GEH	Pass?
108884	107439	107601	1826	1797	0.68	✔
108884	107601	107439	1356	1393	1.00	✔
111770	109655	109605	3959	4368	6.34	✖
111801	109668	109667	4639	5185	7.79	✖
111804	109670	107447	4883	5016	1.89	✔
113635	110668	115373	673	508	6.79	✖
113635	115373	110668	617	543	3.07	✔
119855	110889	114660	1212	1031	5.40	✖
119855	114660	110889	1151	829	10.23	✖
121747	103786	103824	678	630	1.88	✔
121747	103824	103786	462	742	11.41	✖
510021	106783	510389	139	133	0.51	✔
510021	510389	106783	129	158	2.42	✔
510878	115370	510542	887	955	2.24	✔
510878	510542	115370	933	915	0.59	✔
513780	510531	510550	443	670	9.62	✖
513780	510550	510531	301	645	15.82	✖
514209	113320	510535	435	345	4.56	✔
514209	510535	113320	514	543	1.26	✔
514265	103571	510545	287	326	2.23	✔
514265	510545	103571	350	434	4.24	✔
517330	107899	510377	243	90	11.86	✖
517330	510377	107899	370	242	7.32	✖
517354	510399	510404	311	285	1.51	✔
517354	510404	510399	429	418	0.53	✔
517630	510500	520263	454	501	2.15	✔
517630	520263	510500	222	327	6.34	✖
630275	510410	5100314	172	276	6.95	✖
630275	5100314	510410	202	234	2.17	✔