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Peel Hall Farm SATURN Modelling

Specification No. TN001	**Client name** Highgate / Satnam	**Client reference** Proforma 2A - 26/06/19 1901 TN03 Draft Scoping Note - Use of WMMTM16_Issue.pdf	**Discipline** Transport Planning
Project name WMMTM 3rd Party Request	**Date** 09 Aug 2019	**Project number** 60566720/M001.106	**Prepared by** Ian Taylor
Approved by Laura Appleton	**Checked by** Frank Mohan	**Verified by** Frank Mohan	

Revision History

Revision	Revision date	Details	Authorised	Position
1.0	09/07/19	DRAFT		
2.1	19/07/19	DRAFT		
2.2	09/08/19	DRAFT		
3.1	22/08/19	DRAFT		
4.1	17/09/19	DRAFT		
4.1	17/02/20	FINAL	L.Appleton	Principal Consultant, AECOM

1. Introduction

Warrington Borough Council (WBC) use a transport model to help estimate and assess future year traffic conditions, inform transport related policy and scheme decision making, as well as informing wider planning decision making.

AECOM were appointed by WBC to build the model in July 2016. The model is referred to as the Warrington Multi Modal Transport Model 2016 (WMMTM16).

The model has been used in a number of ways:

- Its primary purpose is to provide supporting evidence in the development of WBC's Local Plan. The 'Proposed Submission Version Local Plan' (PSVLP) as published in March 2019 is expected to involve substantial development over the next 20 years requiring investment in infrastructure to support both the delivery of this development as well as addressing known congestion issues in the Borough; and
- Be used as a tool by WBC and other 3rd parties who wish to provide supporting modelling evidence as part of the planning application process.

AECOM have been instructed by WBC via the 3rd Party Request proforma to assist with a request for modelling and associated outputs by Highgate Transportation in relation to the Peel Hall Farm development application (**ref. 1901/TN/03, dated June 2019**). The purpose of the modelling is to identify links and junctions on the Warrington network that are impacted by the traffic generated by the development.

This note presents the details of the scope of works and associated modelling assumptions in response to 1901/TN/03.

2. Existing Model

The WMMTM16 has been developed using SATURN modelling software, version 11.3.12U, for highway assignment modelling aspects integrated with EMME 4.29 software for public transport and demand modelling aspects. The following models have been produced:

- A base year highway model for 2016; and
- Two forecast models for 2026 and 2036 based on the Council's Draft Local Plan (as published in March 2019).

Each of these models assess three time periods:

- AM – Average hour 07:45-09:15;
- IP – Average hour 10:00-16:00; and
- PM – Average hour 16:30-18:00.

Agreed Methodology/Approach:

- As this development is not proposing any significant Public Transport improvements, only the highway model is required for assignment.
- As the WMMTM16 is a strategic multi-modal model, a cordoned version of the WMMTM16 will be used in this assessment.
- This assessment will only be looking at the AM and PM peak models.

3. Development Profile & Scenarios

Paragraph 13 of 1901/TN/03 sets out the scenarios to be modelled. In summary, they are:

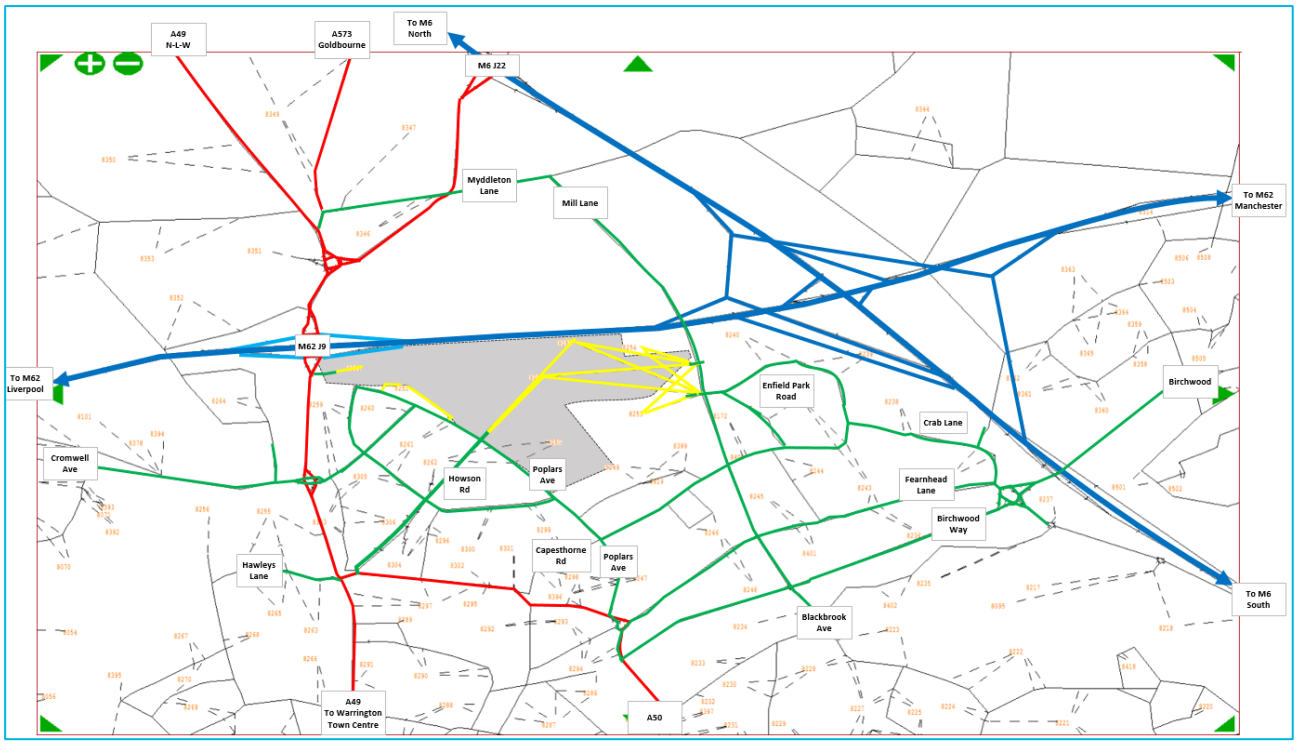
- Existing 2016 Base Model
- 2018 baseline model (no development)
- Opening Year 2022
  - Access Strategy A & B
  - No development, partial development (120), full development
- 5 year after opening 2027
  - Access Strategy A & B
  - No development, partial development (600)
- 10 year after opening 2032
  - Access Strategy A & B
  - No development, full development

Each scenario will be run for the AM and PM peak time periods. Highgate and WBC have confirmed that an Inter-peak model is no longer required. Excluding the 2016 base model runs, as this scenario is already assigned, this is a total of 24 model runs.

4. Study Area

Figure 1 shows the existing 2016 base model network. This has been signed off by WBC on 27/06/19. This image is a confirmation of the proposed study area noted in 1901/TN/03, Appendix 4. All links and junctions highlighted are present in the 2016 WMMTM base model.

Figure 1 2016 WMMTM Base Model Study Area – Existing Network & Zoning

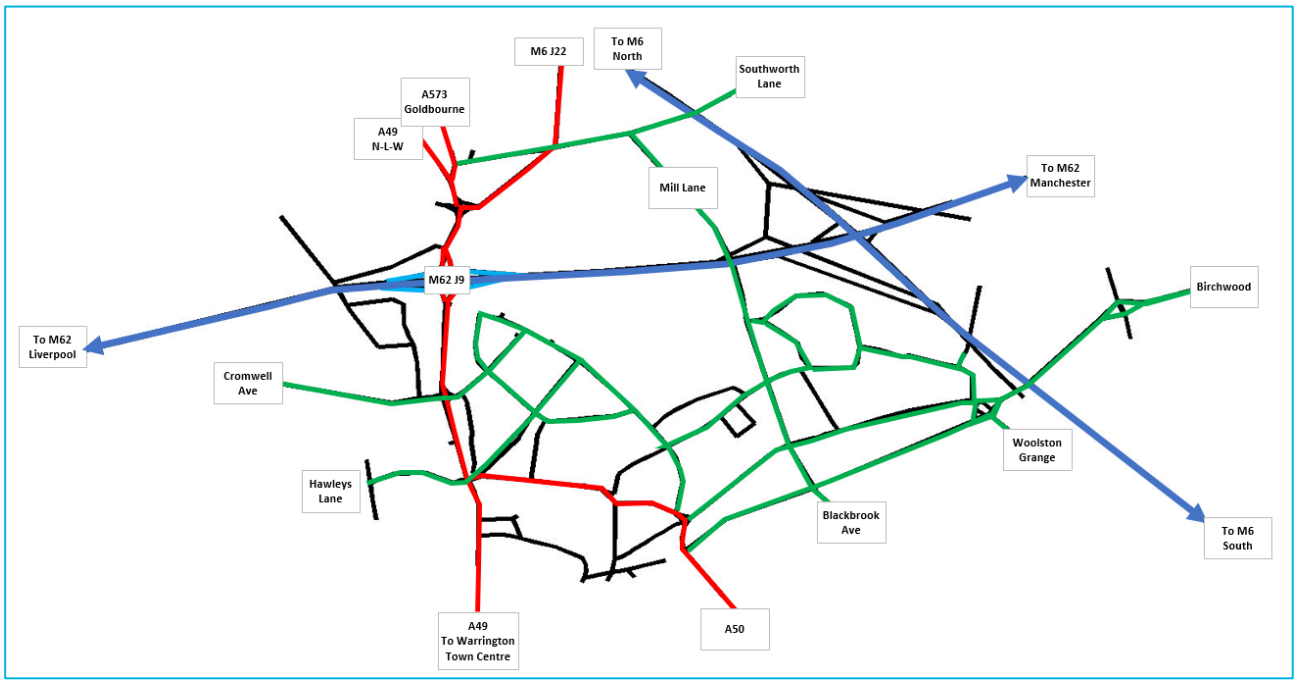


Source: WMMTM16 Base Model Network

5. Model Cordon & Proposed Model Network

The full WMMTM16 model is to be cordoned in line with the extent of the study area shown in **Figure 1** and matches the cordon plans provided by WSP and Highgate on 18/06/19. This cordon matches the structure that has been used in earlier modelling work for the Peel Hall Farm development site. The resulting model network proposed for use in this assessment is shown in **Figure 2**. Based on what has been provided, and known future year committed development locations that need to be considered in this assessment, the extent of this cordon does not currently include all of the Parkside local network.

Figure 2 Extent of Cordoned Model Network (Based on Existing WMMTM 2016 Base Model Network)



Source: WMMTM16 Base Model Network

Agreed Methodology/Approach:

The assumption at this stage is to load southbound Parkside development demand that is deemed to impact on the cordon network directly onto the A49 at Newton-le-Willows. Highgate has confirmed that the cordon network is not required to be extended to include Parkside local network and demand can be loaded directly onto the A49.

Following feedback on the 2016 base model network shown in **Figure 1**, one additional link and updates to the zone structure within the development area was required to be included in the network for this assessment. The revised changes, including network coding for Access Strategy A and B are shown in **Figure 3** for Option A and **Figure 4** for Option B.

Figure 3 Option A SATURN Network Coding & Zone Layout

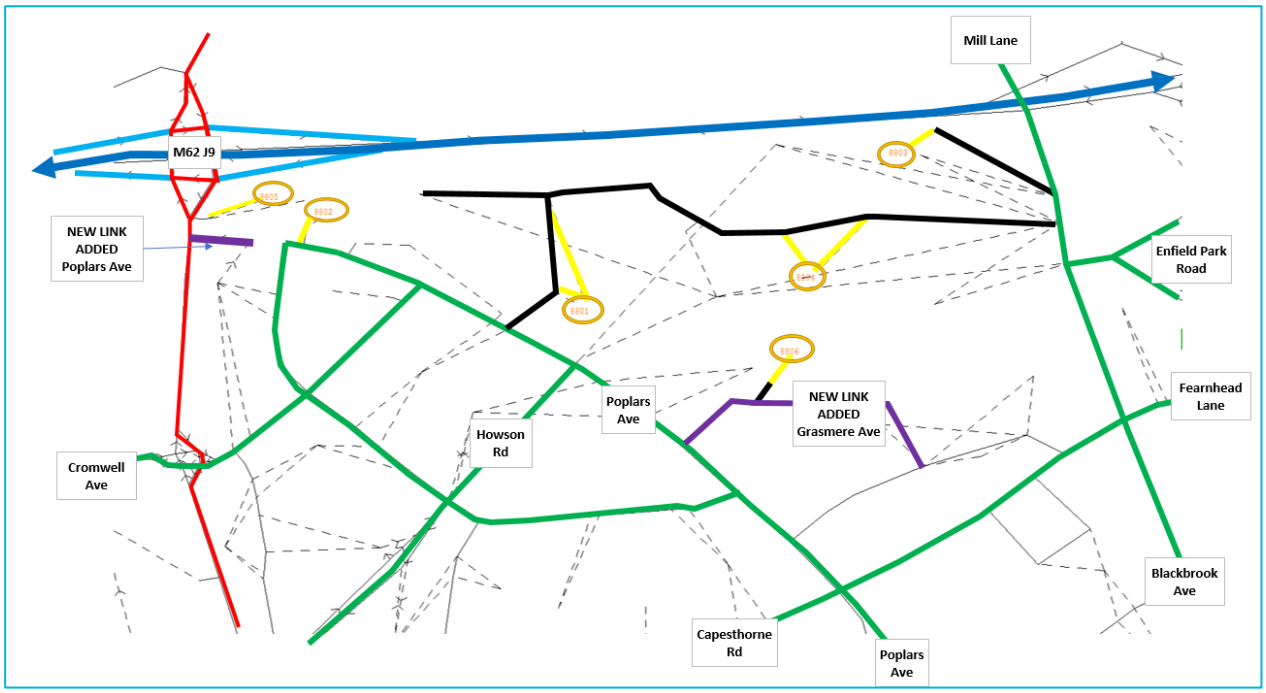
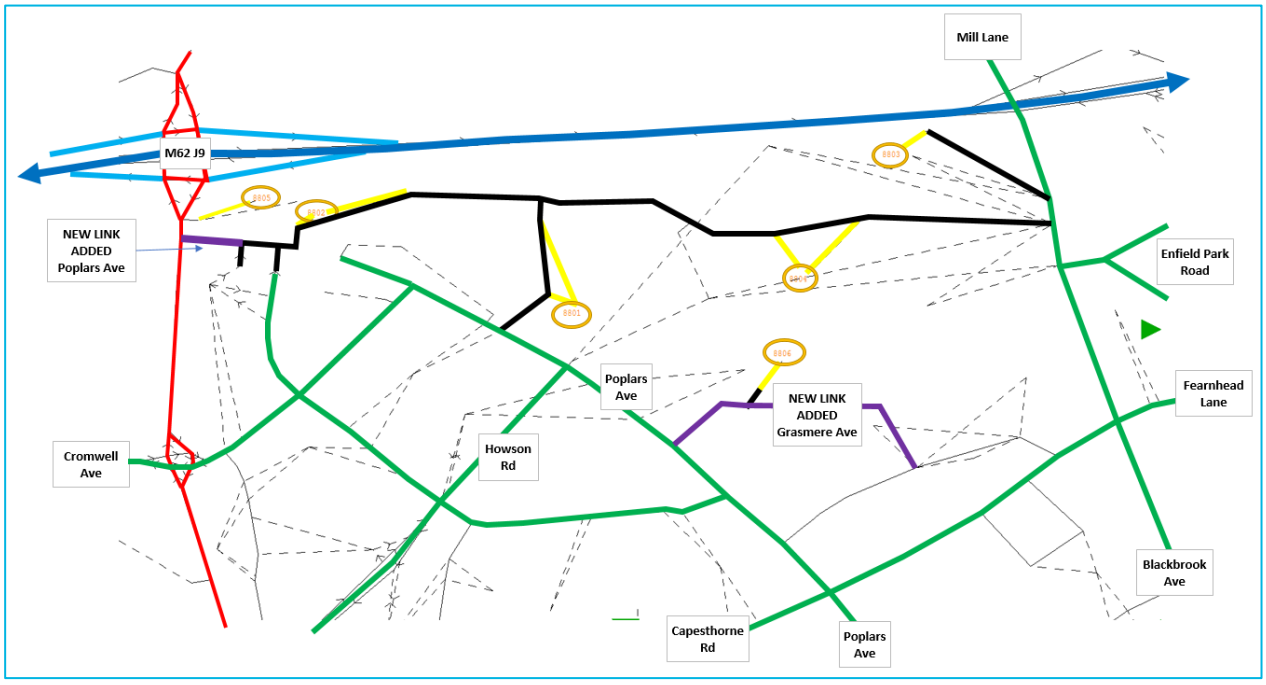


Figure 4 Option B SATURN Network Coding & Zone Layout



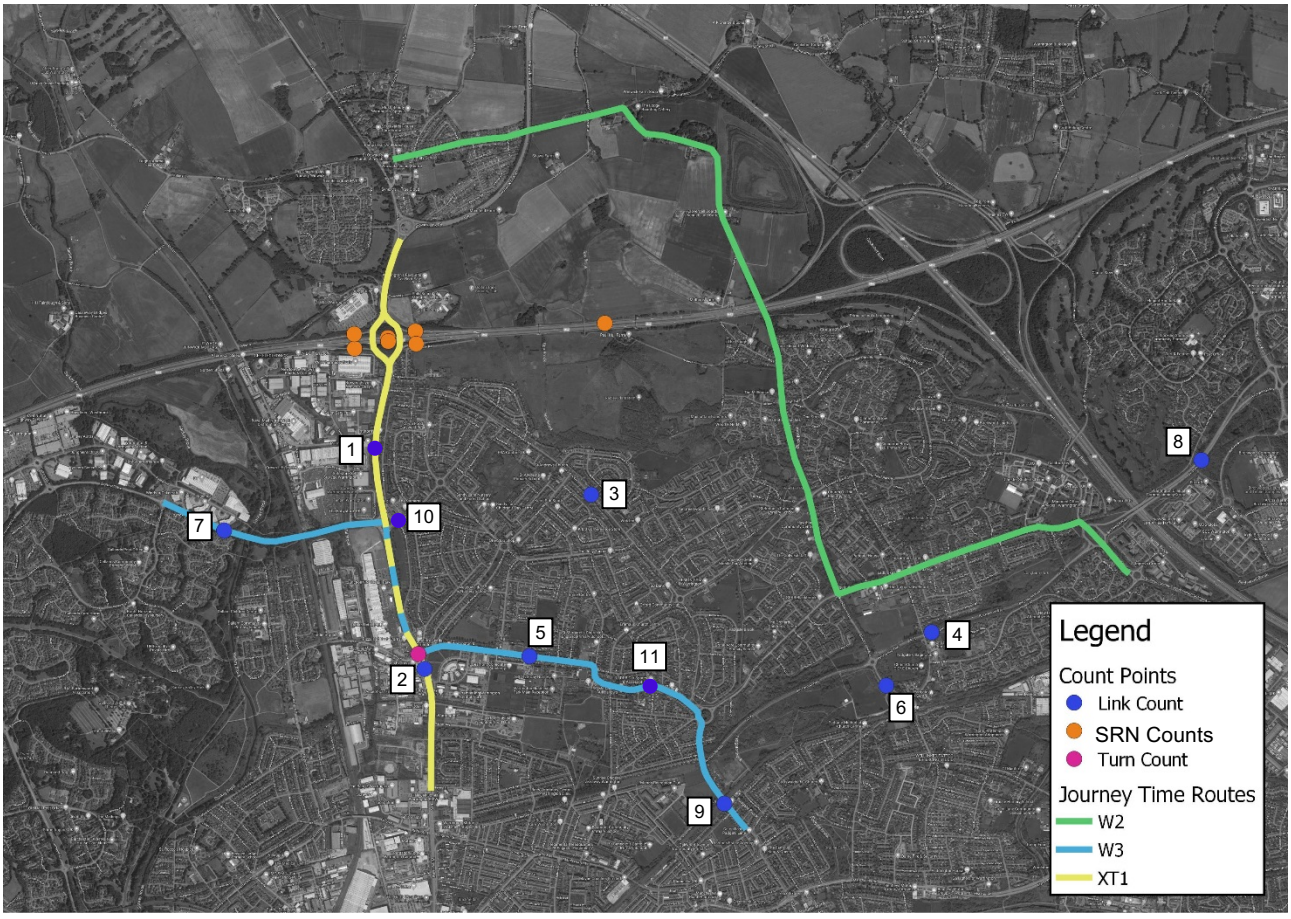
6. Existing Model Calibration & Validation

The WMMTM16 has a simulation area that covers the entire WBC boundary, with an extensive buffer network beyond that. To support this scale of model development, an extensive data collection exercise was undertaken to calibrate and validate the model flows against observed conditions. The WMMTM16 calibrates well against DfT guidance.

However, it is possible that some areas of the network perform better than others due to the level of data coverage. Therefore, the first task in this assessment was to check the level of highway model performance in the vicinity of the study area represented in **Figure 1** & **Figure 2**.

There are a total of 29 link and SRN counts and 12 turning count movements within the study area in WMMTM16, alongside 3 journey time routes that pass through the area. These are shown in **Figure 5**.

Figure 5 WMMTM16 Available Count Sites & Journey Time Routes



Link Counts

The existing count data for sites within the cordoned area have been considered. There are eleven two-way link count sites on the local road network within the cordoned area and a further seven one-way counts on the M62 and slip roads around Junction 9. The level of calibration achieved at each site in the 2016 base year model validation is shown in

Table 2 and **Table 3**.

In summary, the number of link counts achieving a GEH statistic of 5 or less is as shown in **Table 1.** The model achieves a good level of link flow validation in each peak.

WebTAG M3.1, Section 3.2 outlines the guidance criteria for highway calibration/validation. On this basis, all three peaks meet WebTAG guidance for link flows.

Table 1 Proportion of Sites Achieving a GEH Statistic of 5 or Less

Period	All Sites	GEH <=5	Proportion <=5
AM	29	26	90%
PM	29	27	93%

Table 2 Observed and Modelled Counts for Cordon Area – Local Road Network

FRef	Site	AM Peak			PM Peak		
		Obs	Mod	GEH	Obs	Mod	GEH
1	Winwick Road (s of M62)	1,682	1,773	2.2	1,348	1,573	5.9
	Winwick Road (s of M62)	1,205	1,157	1.4	1,823	1,638	4.4
2	Winwick Rd (south of Long lane)	1,846	1,689	3.7	1,374	1,349	0.7
	Winwick Rd (south of Long lane)	1,065	1,064	0.0	1,591	1,589	0.0
3	Poplars Avenue	212	192	1.4	350	326	1.3
	Poplars Avenue	369	353	0.8	284	286	0.1
4	Birchwood Way (west of M6)	1,014	716	10.1	603	611	0.3
	Birchwood Way (west of M6)	490	526	1.6	1,003	1,026	0.7
5	Long Lane	644	545	4.1	602	589	0.5
	Long Lane	433	395	1.9	526	534	0.4
6	Blackbrook Av (cordon entry point)	830	835	0.2	559	608	2.0
	Blackbrook Av (cordon entry point)	714	829	4.1	947	847	3.3
7	Cromwell Av (cordon entry point)	637	651	0.5	908	903	0.2
	Cromwell Av (cordon entry point)	866	845	0.7	955	961	0.2
8	Birchwood Way (east of M6) (cordon entry point)	2,419	2,173	5.1	1,098	1,114	0.5
	Birchwood Way (east of M6) (cordon entry point)	971	1,027	1.8	1,855	1,744	2.6
9	Orford Road (cordon entry point)	703	651	2.0	686	560	5.0
	Orford Road (cordon entry point)	564	408	7.1	599	301	14.1
10	Sandy Lane (EB)	315	364	2.7	408	457	2.3
	Sandy Lane (WB)	341	421	4.1	422	425	0.1
11	Orford Green (West)	451	423	1.3	476	449	1.3
	Orford Green (East)	496	464	1.5	547	538	0.4

Table 3 Observed and Modelled Counts for Cordon Area – Motorway Network

Site	AM Peak			PM Peak		
	Obs	Mod	GEH	Obs	Mod	GEH
M62 J9 EB on-slip	511	773	10.4	623	396	10.1
M62 J9 Wb off-slip	701	830	4.7	785	528	10.0
M62 J9 WB on-slip	767	639	4.8	1039	712	11.1
M62 J9 EB off-slip	866	827	1.3	936	958	0.7
M62 EB (J9-J10)	3,767	3,968	3.2	4,645	4,287	5.4
M62 through J9 WB	3,681	3,670	0.2	4,596	4,596	0.0
M62 through J9 EB	3,143	3,194	0.9	3,879	3,891	0.2

Turning Counts

Turning count data was collected at one junction in the cordoned study area; the A49 junction with Hawleys Lane and Long Lane. The comparison of modelled and observed turning count movements is shown in

Table 5.

The criteria used to assess these movements are:

- A GEH value less than 5; and
- For turn flows less than 700 vehicles, absolute error less than 100; or
- For turn flows greater than 700 vehicles, absolute error less than 15%.

These criteria are given in WebTAG Unit M3.1 as acceptability guidelines for link flows and turning movements. The Unit notes in paragraph 3.2.9 that the acceptability level of 85% may be difficult to achieve for turning counts.

The results summary shows that 56% of flow comparisons have a GEH value less than 5. The proportion achieving the flow criteria is higher, the AM peak proportion is 67% while the PM peak is close to or above 85%.

Table 4 Proportion of Turning Count Movements Achieving GEH Less Than 5

Period	All Sites	GEH <=5	Proportion GEH <=5	GEH <= 5 or flow error <100	Proportion
AM	12	6	50%	8	67%
PM	12	7	58%	10	83%

Table 5 Turning Count Validation

From Arm	To Arm	AM Peak Obs	AM Peak Mod	AM Peak GEH	PM Peak Obs	PM Peak Mod	PM Peak GEH
B	A	208	254	3.0	304	612	14.4
B	D	119	111	0.8	140	176	2.9
B	C	54	2	9.9	97	24	9.4
A	D	253	76	13.8	254	184	4.7
A	C	1,404	1,404	0.0	998	1,127	4.0
A	B	216	188	1.9	180	112	5.7
D	C	388	288	5.5	280	198	5.3
D	B	157	182	1.9	141	183	3.3
D	A	237	124	8.4	253	114	10.2
C	B	65	133	6.9	73	75	0.3
C	A	769	838	2.4	1,273	1,297	0.7
C	D	231	93	10.9	245	217	1.9

Arm	Approach
A	Winwick Road North
B	Hawleys Lane
C	Winwick Road South
D	Long Lane

Journey Time Validation

The modelled journey time routes that pass through the study area were identified and data for the relevant sub-sections of three routes that pass through the study area was extracted. The 3 routes identified are:

- Warrington 2 – M6 J21 to M62;
- Warrington 3 – Cromwell Avenue to Chestier Road; and
- Cross Town route XT1 –A49.

The sections within the study area were extracted and a comparison between observed and modelled times is shown in **Table 7**. A summary of the results is shown in **Table 6**. Overall, for all routes and time periods, the percentage within ±15% is above the recommended WebTAG value of 85%. In the AM peak period only one site falls below the standard while in the PM peak all routes are within ±15%.

Table 6 Summary of Journey Time Runs

Period	Sections within ±15%	Percentage within ±15%
AM	5	83%
PM	6	100%
Total	**16**	89%

Table 7 Journey Time Comparisons (mins)

		AM Obs	AM Mod	AM Error	PM Obs	PM Mod	PM Error
Wton_2 - Woolston Grange Road to Winwick via Fearnhead Ln and Blackbrook Ave	NB	11.07	8.26	-25.4%	9.58	8.97	-6.4%
	SB	10.31	11.78	14.3%	9.11	8.60	-5.6%
Wton_3- Cromwell Avenue to Birchwood Way via Long Lane	CW	9.86	8.63	-12.5%	8.46	8.88	5.0%
	ACW	7.06	7.27	2.9%	8.87	8.37	-5.6%
XT1 - A49 between Kerfoot St and B&Q Junction	NB	6.95	7.76	11.6%	10.09	9.08	-10.1%
	SB	10.76	10.83	0.7%	7.48	8.46	13.1%

Summary of WMMTM16 Validation

Reviewing the available count data from the original WMMTM16 base model in the study area shows that the model gave a good representation of flows and times in the cordon area, though not all time periods and sites were able to meet WebTAG guidance criteria when looking at turning counts.

Figures Figure 6**,** Error! Reference source not found. and **Figure** 7 summarise the GEH performance for each of the model time periods.

Figure 6 WMMTM16 AM GEH Summary

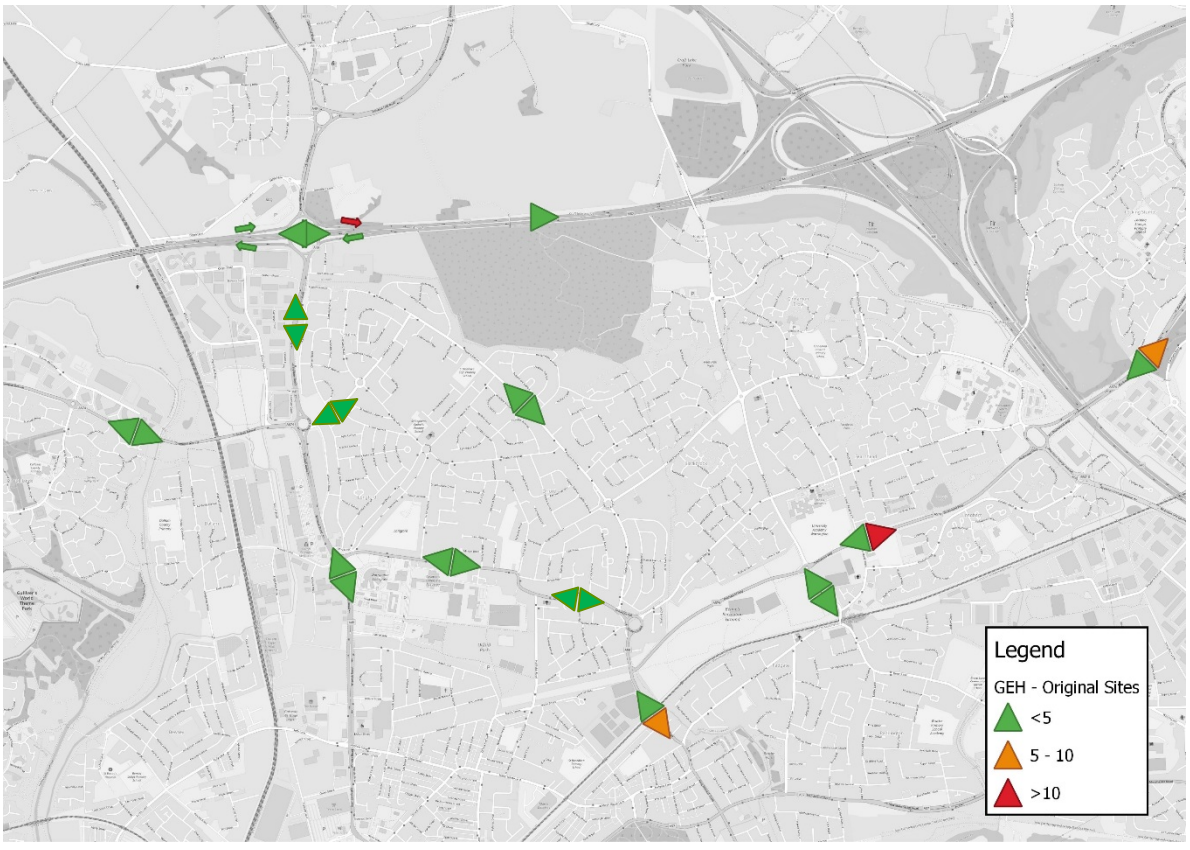


Figure 7 WMMTM16 PM GEH Summary

Additional count data information was provided by Highgate on 04/07/19 to determine whether further work is needed on the cordon base model to ensure a more accurate reflection of traffic demand in the study area. The results of this secondary review are presented in the next section.

7. Additional Data Available

Additional data from Highgate has been provided in the form of manual classified turning counts (a single day survey) and automatic traffic counts (a one-week survey). The majority of the count data available relates to April 2019 and are spread across the cordoned area.

In addition to 2019 data, the following data was also requested:

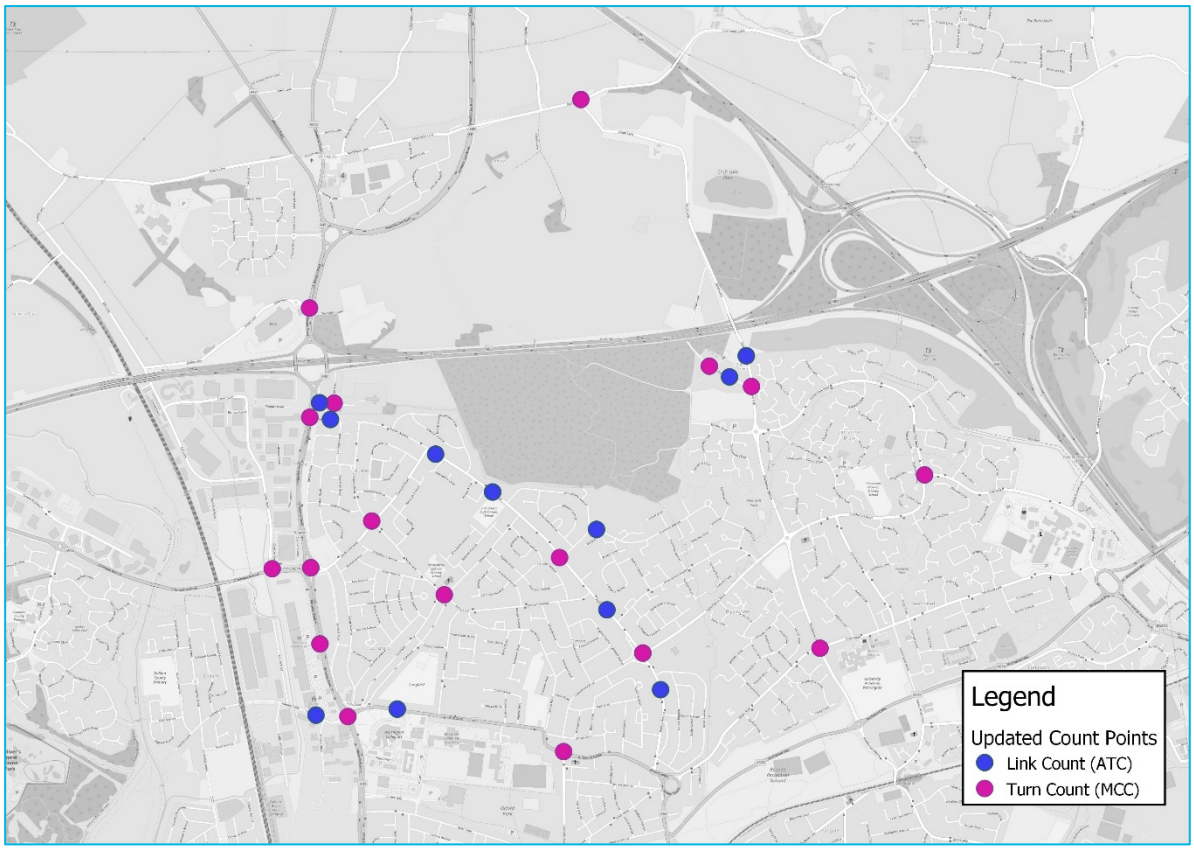
- October and November 2017 - A49 ATC and March 2018; and
- February and March 2016.

The cordon model has been reviewed against data from the original 2016 Base Model (June 2016 counts) and the 2019 April data provided by Highgate as this was the largest dataset offering the largest coverage. The April 2019 dataset (locations shown in **Figure 8**) represents:

- 17 manual classified junction turning counts; and
- 11 link-based automatic traffic counts.

This dataset has been reviewed against the WMMTM16 base model outputs. Comparisons have been carried out with the AM Peak counts for the hour 0800-0900 and the PM peak 1700-1800. These periods do not match exactly with the WMMTM16 modelled hours but should not give a significant difference when being used in the context of this analysis.

Figure 8 Location of Highgate 2019 Counts



Agreed Methodology/Approach:

The assumption at this stage was not to re-base the secondary count data to 2016 levels as it was felt that there would not have been significant growth or reduction in traffic levels between 2016 and 2019. However seasonal variation in addition to 2016-2019 changes will impact on what will be deemed to be a suitable performance from the model.

Link Counts

Link flows have been extracted from the count dataset for key links in the cordoned area. The results are derived from a combination of one-day manual classified turning counts and one-week automatic traffic counts. The turning counts were carried out for AM and PM peak periods only.

A summary of the fit between observed and modelled counts is shown in **Table 8**. Full details of locations and counts is given in **Table 9**. **Table 10** presents 2017 and 2018 link count results for 2 additional sites along Winwick Road as these were missing from the 2019 dataset.

Table 8 Proportion of Sites achieving GEH less than 5

Period	All Sites	GEH <=5	Proportion <=5
AM	18	6	33%
PM	18	4	22%

Figure 9 AM GEH Summary - Highgate Sites 2019

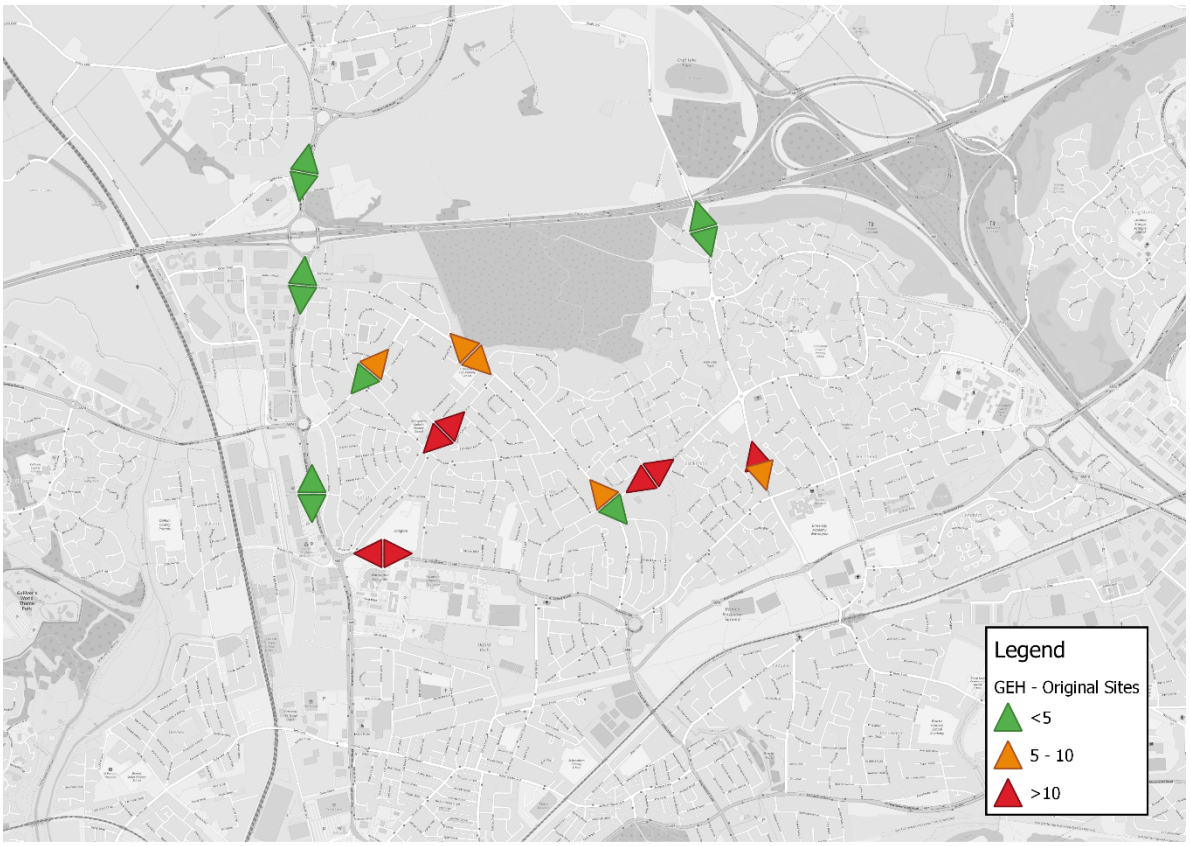


Figure 10 PM GEH Summary - Highgate Sites 2019

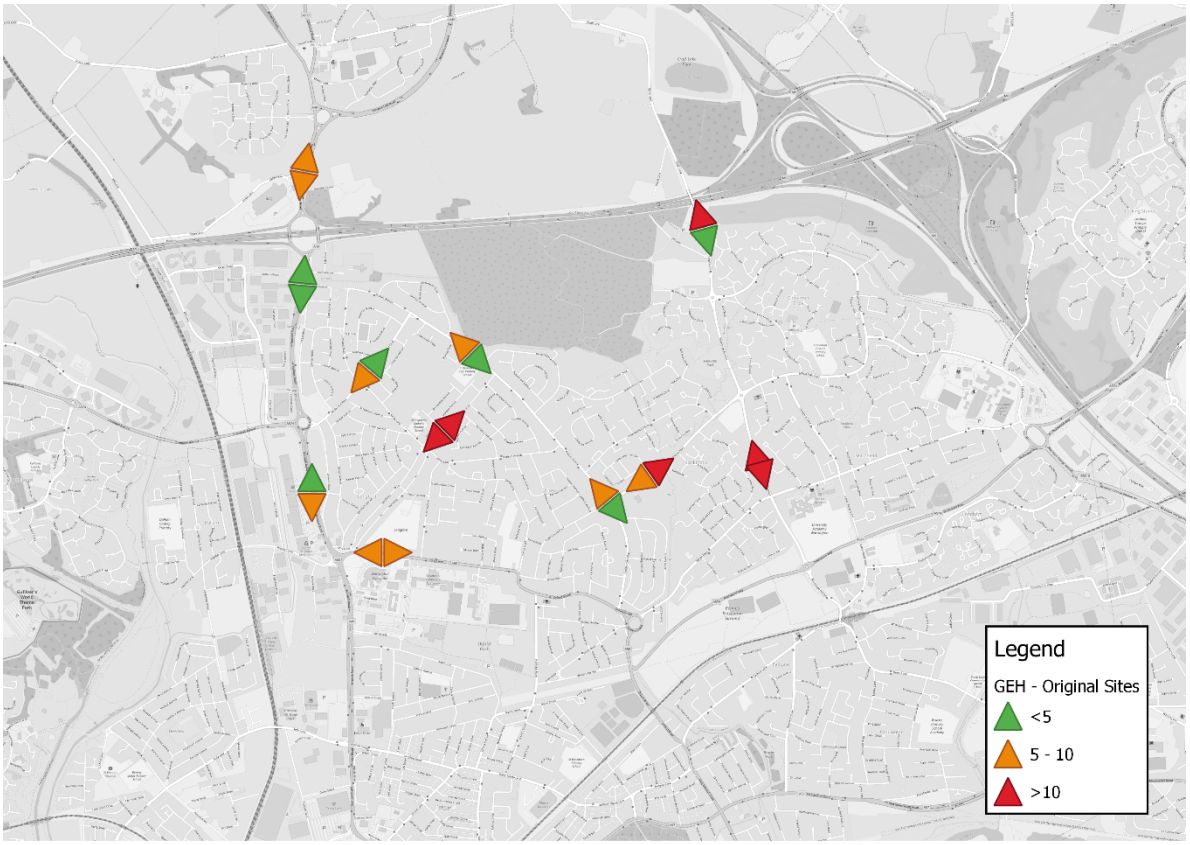


Table 9 Link Flow Data – Highgate Sites (2019 counts)

Site	Type		AM Peak			PM Peak		
		Dir	Obs	Mod	GEH	Obs	Mod	GEH
Mill Lane at M62	ATC	NB	351	439	4.4	480	267	11.0
		SB	500	475	1.1	358	297	3.4
Blackbrook Ave N of Hilden Road	MCC	NB	391	180	12.5	330	171	10.0
		SB	341	254	5.1	400	178	13.0
Poplars Av at Capesthorne Road	MCC	NB	302	412	5.8	477	620	6.1
		SB	392	467	3.6	360	339	1.1
Capesthorne Road E of Poplars Av	MCC	EB	169	578	21.2	148	430	16.6
		WB	281	487	10.5	268	459	10.0
Howson Rd	MCC	NB	108	23	10.5	193	23	16.4
		SB	214	21	17.8	133	14	13.8
Cleveland Road	MCC	NB	222	116	8.2	185	239	3.7
		SB	150	102	4.2	193	81	9.6
A49 N of Delph Lane	MCC	NB	1,361	1,236	3.5	1,956	1,719	5.5
		SB	1,778	1,665	2.7	1,402	1,172	6.4
Poplars Ave	ATC	EB	330	211	7.2	303	243	3.6
		WB	171	103	5.8	244	170	5.1
A50	ATC	EB	594	337	11.9	644	512	5.5
		WB	712	359	15.3	697	523	7.1

NB *- Site type ATC = One week automatic traffic count; MCC = One day manual turning count.*

It is noted that in the majority of cases, around 70% in each peak, the observed count exceeds the model value. It is possible therefore that growth in traffic between 2016 and 2019 may be a factor.

Table 10 Extra Sites – Winwick Road for Highgate 2017 and 2018 Count Data

Site	Year	Dir	AM Peak			PM Peak		
			Obs	Mod	GEH	Obs	Mod	GEH
A49 Winwick Road between Hawleys Lane and Cromwell Ave	2018	NB	1,124	1,157	1.0	1,815	1,638	4.3
		SB	1,689	1,773	2.0	1,328	1,573	6.4
A49 Winwick Road between Cromwell Ave and M62 J9	2017	NB	1,096	1,256	4.7	1,652	1,821	4.0
		SB	1,718	1,695	0.6	1,357	1,292	1.8

Table 11 Proportion of Sites achieving GEH less than 5 (once Extra Winwick Sites Added)

Period	All Sites	GEH <=5	Proportion <=5
AM	22	10	45%
PM	22	7	32%

When compared to **Table 8**, adding the extra Winwick Road sites improves the overall performance of the additional sites, albeit still under the WebTAG guidance threshold.

Junction Turning Counts

The majority of extra counts have been carried out on the local road network in the study area. Several represent junctions that are not fully represented in the WMMTM16 base model; they are modelled as 'stubs', representing locations whereby local traffic enters the network via the model zones and are therefore, not fully represented in the WMMTM. These junctions have not been assessed. However, turning movements at eight junctions have been compared with the WMMTM16 base model flows.

The results show that the GEH criteria are met for very few turns although the proportion achieving the flow criteria is much higher. This is to some extent because the junctions are characterised by a number of small volumes on turns for which relatively small absolute errors lead to high values for the GEH statistic, skewing the overall result.

Table 12 Summary of Junction Turning Comparison

Period	Proportion GEH` <=5	Proportion achieving flow criteria
AM Peak	26.9%	66.7%
PM Peak	32.1%	74.4%

Table 13 Junction Turning Count Summary- Proportion of Turns at a Junction that meet criteria

Count No	Junction Name	Percentage of turns passing GEH criteria		Percentage of turns passing flow criteria	
		AM Peak	PM Peak	AM Peak	PM Peak
1	A573 / Myddleton Lane	33%	0%	33%	17%
2	A49 / Golborne Road	33%	33%	33%	33%
4	Blackbrook Ave / Insall Lane / Hilden Road	25%	25%	75%	92%
10	Sandy Lane / Cotswold Road / Cleveland Road	33%	25%	83%	92%
11	Sandy Lane / Howson Road	17%	33%	92%	83%
13	Poplars Avenue / Capesthorpe Road	25%	33%	75%	83%
14	A49 / Delph lane	33%	50%	50%	83%
16	A49 / A50 Hawleys Lane	25%	50%	50%	67%

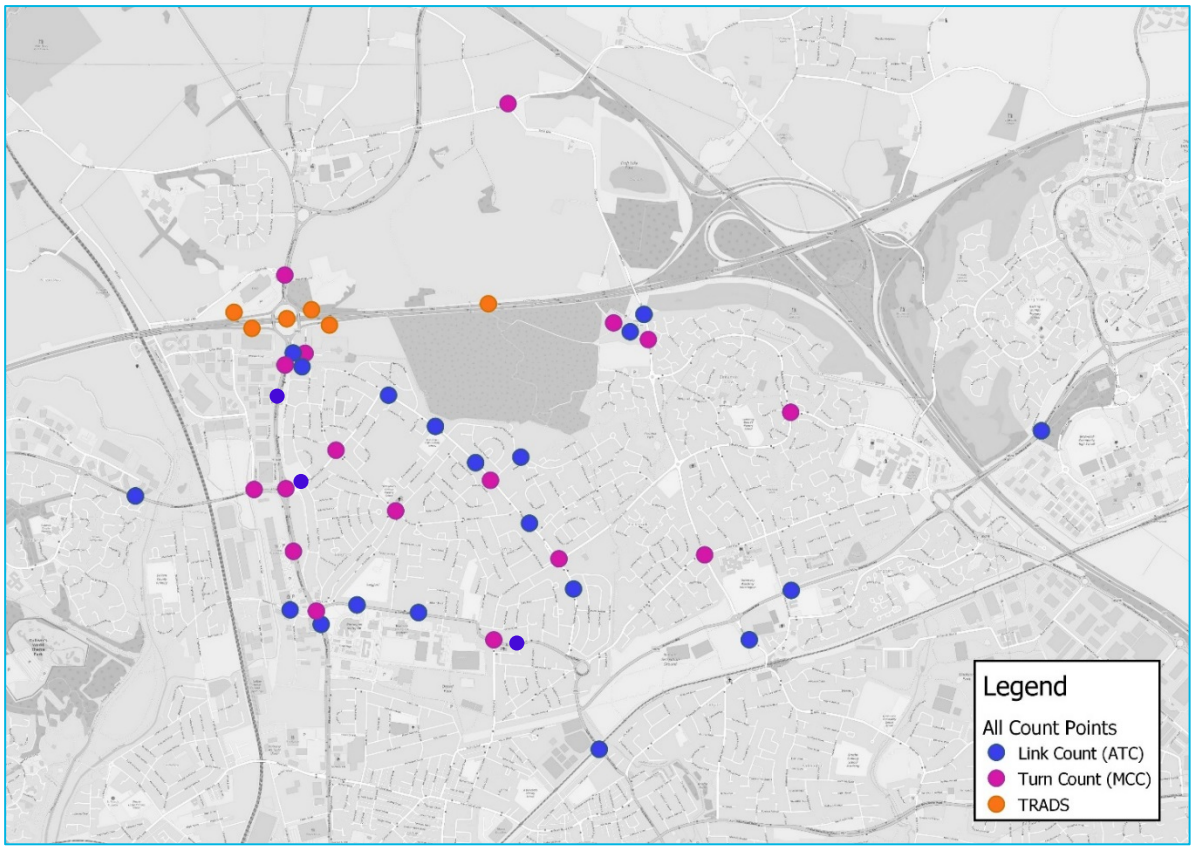
8. Overall Calibration Performance – Pre Adjustment

The cordon model has been reviewed against data from the original model development and against new data for the local area provided by Highgate.

Using the original data, it was shown that the model gave a good representation of flows and travel times in the cordon area to a level acceptable at WebTAG standards.

Additional data from Highgate has been provided in terms of manual classified turning counts (single day) and automatic traffic counts (one week). The majority of the count data relates to April 2019 and are collected across the cordoned area. A summary of all the count site locations is shown in **Figure 11**.

Figure 11 Total Count Site Coverage Within Cordon Area



Overall GEH performance by site and time period is shown in **Figures Figure** 12**,** Error! Reference source not found. and **Figure** 13.

Figure 12 AM GEH Summary - All Sites

Figure 13 PM GEH Summary - All Sites

The results show some significant differences between modelled flows and count data, particularly on some of the minor roads to the east of the A49. It should not be surprising that the strategic model does not more accurately represent traffic flows in this local residential area. The differences are a result of an absence of count data in the area used during the original model development, the scale of the model and its network and the level of zone configuration and disaggregation in the area.

The important differences appear to be an issue with routing along the parallel Capesthorne Avenue and A50 / Hilden Road and flow differences along Myddleton Lane and Golborne Road. However, in this area, the Highgate count data appears inconsistent along this section and Matrix Estimation would not work. An example of this is shown in **Figure 14**. This figure shows two Highgate counts along Myddleton Lane with vastly different flows (one 2016 and one 2019). There is no significant network between the two locations which would explain the difference in flow. If both these counts were included in the Matrix Estimation process, one count would have to take priority over the other meaning the secondary count would never be matched (as the differences are too great).

Agreed Methodology/Approach:

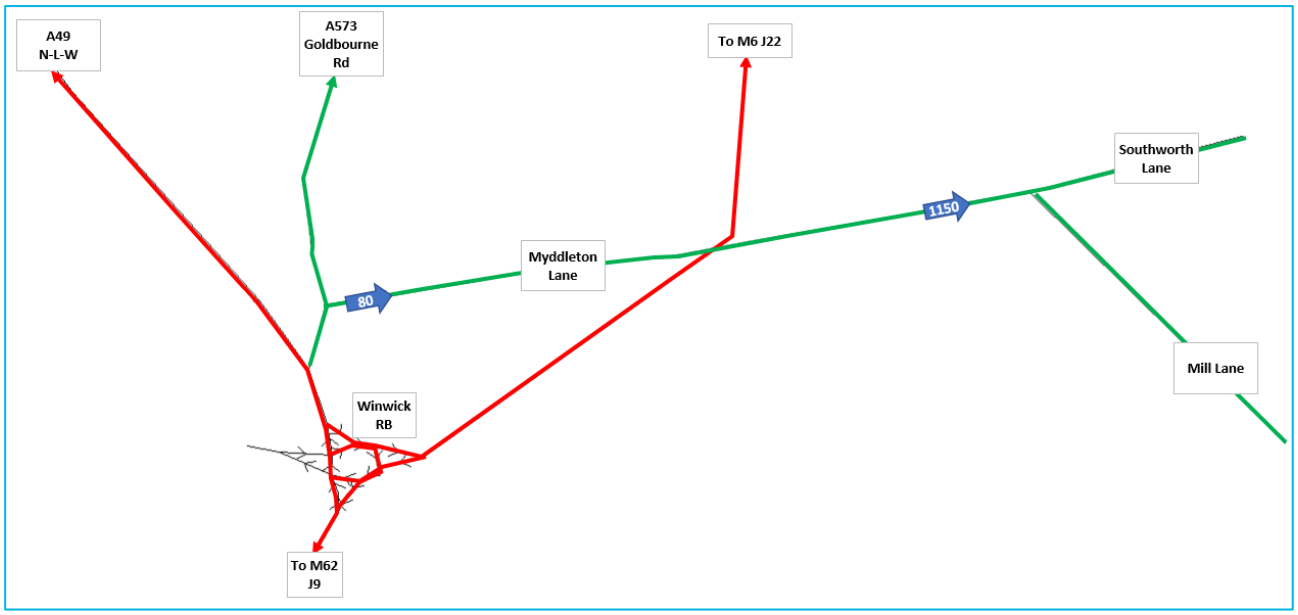
Highgate have undertaken an MCC survey at the A573 Goldbourne Road junction with Myddleton Lane and the Mill Lane / Myddleton Lane on Wednesday 17th July to help improve understanding on what traffic demand patterns are like in this area, particularly with respect to turning proportions.

Caveats have been agreed with respect to this dataset, namely:

- Data is being collected outside of a ‘neutral’ month; and
- Risk of data being unrepresentative and unable for further use in this piece of work.

AECOM will review the data against the model flows when available and provide feedback on its suitability for use.

Figure 14 Count Inconsistency Example



Agreed Methodology/Approach:

For the purposes of using the cordon model to assess the Peel Hall Farm development it appears that there may be value in some model refinement. This work should be commensurate with the requirements of the study and limited to better representing flows on the main distributors through the area.

To obtain a WebTAG acceptable fit to all the available counts, it is likely that a significant amount of zone disaggregation would be required and a refinement to the zone loading points. It was agreed that this not considered to be a useful exercise at this time.

It was agreed that the following would be undertaken, where possible:

- Adjust all of the available count data to a common base, taking account of seasonality and year, in line with source model;
- Review the performance of the model against these 'corrected' counts and identify areas for improvement;
- Investigate network speeds on the routes between the A49 and Blackbrook Avenue to improve routing in the area and also review zone connectors;
- On Golborne Road and Myddleton lane we would review routing in the strategic model, it appears that some degree of 'rat running' may be being picked up by the counts which is not evident in the model;
- If still considered necessary then undertake limited matrix estimation recognising that it is unlikely to be possible to achieve full calibration on the more minor links within the model areas.

9. Overall Calibration Performance – Post Adjustment

Following a review of both the WMMTM16 and Highgate counts in the study area, a number of areas were identified that could be targeted for improvement in network calibration performance. This section presents the results of these changes.

Speeds Review

Speeds have been reviewed and updated along a number of local roads in the study area where calibration against the 2019 Highgate counts is currently poor. Sections of Capesthorne Road, Poplars Avenue, and Blackbrook Avenue have had their link speeds reduced from 48kph (30mph) to 32kph (20mph).

This adjustment has been applied to reflect the fact that the capacity and travel speeds along these routes are impacted by high levels of on-street parking, narrow roads, and a number of traffic calming measures present (including priority give-way areas, and speed bumps).

The effects of this change has been to improve calibration due to reassignment of demand on the altered network at:

- Capesthorne Road (east of Poplars Ave);
- Poplars Ave; and
- Blackbrook Ave.

Table 14 Change in GEH for Highgate Sites

Site	Type	Dir	Original		NEW	
			AM GEH	PM GEH	AM GEH	PM GEH
Blackbrook Ave N of Hilden Road	MCC	NB	12.5	10.0	2.3	0.5
		SB	5.1	13.0	5.1	9.3
Capesthorne Road E of Poplars Av	MCC	EB	21.2	16.6	2.5	9.6
		WB	10.5	10.0	3.1	3.8
Poplars Ave	ATC	EB	7.2	3.6	4.5	2.7
		WB	5.8	5.1	0.5	1.8

Overall, the impact on the total GEH proportion is as follows:

Table 15 Change in Overall GEH Performance for Highgate Sites

Time Period	No. of Sites Assessed	No. of Sites with a GEH < 5		No. of Sites with a GEH > 10	
		Original	New	Original	New
AM	18	6 (33%)	10 (55%)	7 (39%)	4 (22%)
PM	18	4 (22%)	7 (39%)	7 (39%)	3 (17%)

Whilst an improvement at these sites, the overall performance of the Highgate dataset still fall short of WebTAG acceptability criteria.

Zone Connectors Review

The final network check was along the A50 and a review of the zone connections to the network. The following changes have been made:

- Changes to the zone loading points for zone 8297 which is representing land to the south of the A50 and east of the A49; and
- Speed reductions along Gough Avenue (from 32kph to 20kph) to reduce the amount of parallel routing and 'rat running'.

Table 16 Change in GEH for Highgate Sites along the A50

Site	Type	Dir	Original		NEW	
			AM GEH	PM GEH	AM GEH	PM GEH
At A50 / A49 Long Lane Jcn (Turning Count)	WMMTM	EB	16.2	2.5	9.2	2.1
		WB	2.6	7.4	8.9	4.1
Northway to Fisher Ave	Highgate	EB	13.1	5.5	12.8	6.7
		WB	10.7	7.1	12.6	5.2
Fisher Ave to Beatty Ave	WMMTM	EB	0.6	0.5	0.1	2.1
		WB	3.0	0.4	1.4	0.3
Orford Green	WMMTM	EB	0.5	0.4	0.5	2.1
		WB	0.9	0.5	0.1	0.5

The Northway to Fisher Avenue site is a 2019 Highgate ATC site. Whilst the flow from this count is consistent with the other WMMTM counts along the A50, the survey location is straddled by the zone connectors for the college. This means that unlike the count, any traffic to and from the college will not be picked up in the modelled flow on this one link, hence suggesting in the GEH comparison that modelled flows are lower than the observed. **Figure 15** and **Figure 16** shows this issue before and after the locations of the zone connectors on the A50 are adjusted. The 2019 Highgate count is shown in orange.

Figure 15 Original Zone Connectors

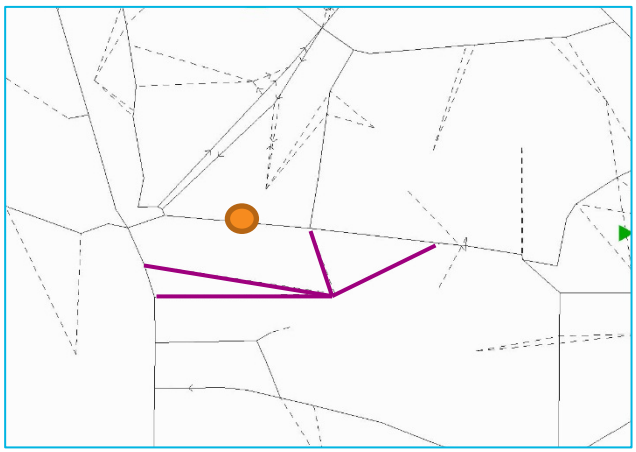
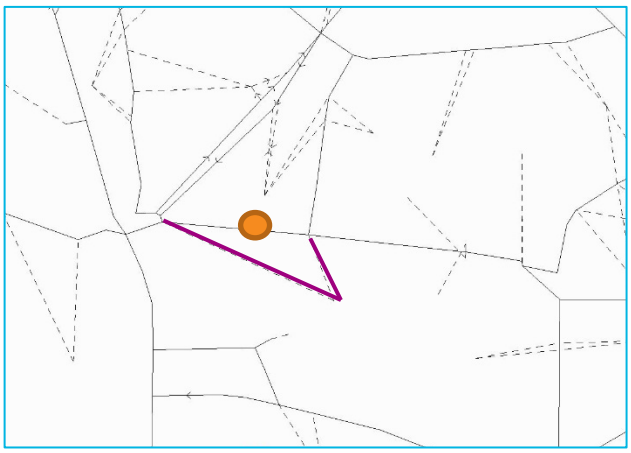


Figure 16 Revised Zone Connectors



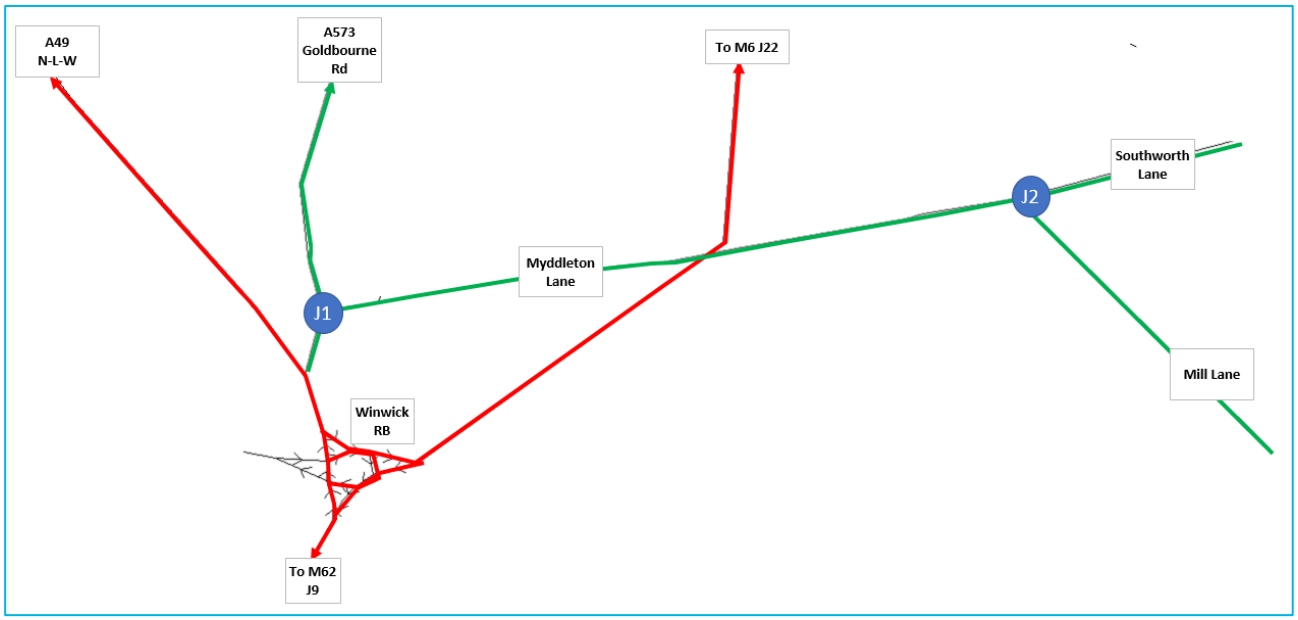
Myddleton Lane Counts Update

A one-day, manual classified turning count survey was undertaken on 17th July 2019 at two junctions:

- **Junction 1** - Golborne Road / Mydleton Lane
- **Junction 2** - Delph Lane / Myddleton Lane

The locations are shown in **Figure 17**.

Figure 17 Location of Additional Surveys



Comparisons have been made between link flows and turning flows from the new counts and the flows from the 2016 base model.

The link flow comparison is shown in **Table 17** and **Table 18**. For Junction 1, both peak periods demonstrate that 50% of link observations have a GEH value of 5 or less, while for Junction 2, no observations in the PM peak have a GEH of 5 or less. For both Junctions, the AM peak provides a better fit than the PM peak.

Table 19 shows the number of turning flows within the two junctions meeting the WebTAG criteria of either GEH less than or equal to 5, or an error of less than 100 vehicles. For the AM peak 50% of movements meet the criteria, for the PM peak 42% of flows meet the criteria.

The observed counts show a significant increase in flow on Myddleton Lane between Golborne Road and Delph Lane. This is such that flows at the Delph Lane end are greater than flows at the Golborne Road end in both directions and in both peaks. This is most apparent in the PM peak westbound where the flow is 83% higher at Delph Lane and eastbound in the AM peak where the flow is 31% higher. This may be attributable to rat running on Highfield Lane or Waterworks Lane as has been suggested.

Such a scale of difference is not reflected in the model, and the minor 'rat-running' routes are not present in the coding and, since no count data in this area was available for the original WMMTM base model development it would appear that this route choice is not reflected by the model (it is also worth noting that this area of network is on the periphery of the borough where levels of network detail begin to decrease).

It is therefore suggested that some limited matrix estimation may be reasonable to infill this missing movement.

Table 17 Junction 1 - Golborne Road Junction Link Flow Comparison

		AM Peak			PM Peak		
Site	Dir	Observed	Modelled	GEH	Observed	Modelled	GEH
Golborne Rd North of Junction	NB	402	622	9.7	397	725	13.9
	SB	346	768	17.9	298	282	1.0
Myddleton Lane	EB	622	695	2.8	499	379	5.7
	WB	359	410	2.6	425	411	0.7
Golborne Rd South of Junction	NB	621	647	1.0	392	760	15.3
	SB	609	486	5.3	352	327	1.3

Table 18 Junction 2 - Delph Lane Junction Link Flow Comparison

		AM Peak			PM Peak		
Site	Dir	Observed	Modelled	GEH	Observed	Modelled	GEH
Myddleton Lane West of Junction	EB	816	713	3.7	586	355	10.6
	WB	439	354	4.2	781	471	12.4
Delph Lane	NB	359	467	5.3	465	291	8.9
	SB	468	568	4.4	414	296	6.3
Southworth Lane East of Junction	EB	533	408	5.7	291	160	8.7
	WB	265	160	7.2	435	281	8.1

Table 19 Turn Flow 'Goodness of Fit' Statistics

	AM Peak		PM Peak	
	No of turn flows	%	No of turn flows	%

	meeting criteria		meeting criteria	
Junction 1 Golborne Road	4	67%	3	50%
Junction 2 Delph Lane	2	33%	2	33%
Total	6	50%	5	42%

Figure 18 AM GEH Summary - NEW Surveys

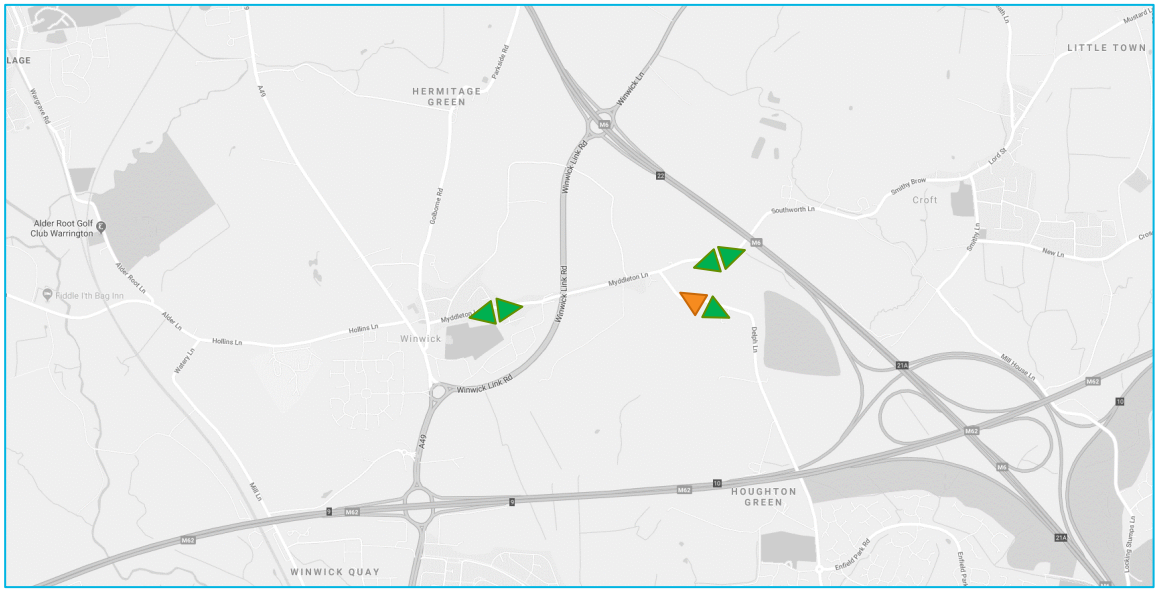
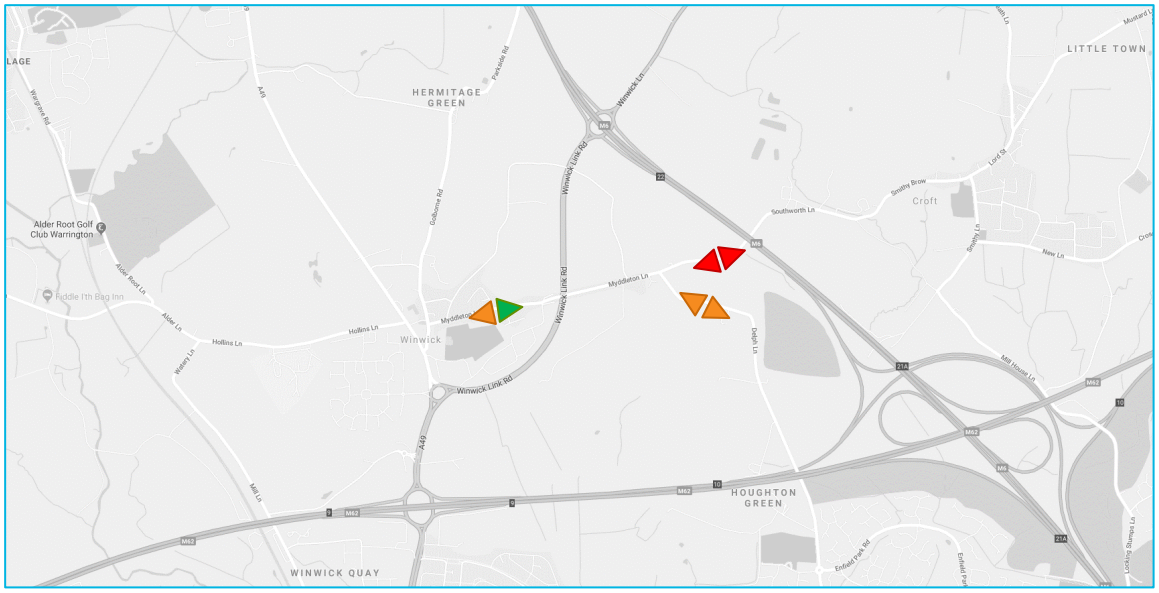


Figure 19 PM GEH Summary - NEW Surveys



Agreed Methodology/Approach:

For the purposes of using the cordon model to assess the Peel Hall Farm development it appears that there is some value in undertaking some matrix estimation. This exercise will be commensurate with the requirements of the study and limited to better representing flows on the main distributors through the area.

The agreed approach was to undertake the following:

- Undertake limited matrix estimation recognising that it is unlikely to be possible to achieve full calibration on the more minor links within the model areas.

The two areas to be targeted are:

- A50 corridor – at the southern end of the cordon model area
- Myddleton lane / Mill Lane corridor – at the northern end of the cordon model area focusing on improving the latest count data, particularly in PM Peak

By targeting these two corridors specifically, the intention is to ensure that the volume of traffic entering and exiting the cordon model network is of the right quantum meaning, that if demand on the internal network is different to observed patterns, this then becomes a routing question rather than one of demand.

10. Matrix Estimation Results

Matrix estimation (ME) is a process of modifying the demand matrices such that assigned flows better match the observed flows. The counts used for ME have been the link counts from the two junctions surveyed by Highgate in July 2019 plus additional counts on the eastern side of the model (along the A50, Blackbrook Avenue area). The intention has been to modify flows through the new sites while trying to 'fix' the counts in the internal areas of the model.

Additionally new link flows on Cromwell Avenue and Sandy Lane West were used for matrix estimation to improve the model fit to observed flows on Sandy Lane West.

A key principle of ME is that it should not be used to infill movements missing from the model rather, it should be used to adjust the relative volumes of movements represented within the model to better fit the counts. In this case, ME is being used to increase volumes of demand around the extremities of the cordoned area. The purpose is not to introduce movements that might affect route choice in the test scenarios, but to ensure that existing demand at junctions is accurately reflected in the model (when compared against observed conditions) and hence any changes to demand as a result of the development coming forward would also be reflected.

A limited matrix estimation exercise has been carried out on the AM and PM peak cordon base models. The intention has been to improve the representation of flow on Myddleton Lane, Delph Lane and the A50 in the cordon area after earlier analysis has demonstrated that these sites are currently under-performing in replicating observed conditions. To ensure that the model reflects observed movements at the A49 junction with Cromwell Avenue and Sandy Lane West, this junction has also been considered at the request of WBC.

Link flows from the 2019 Highgate counts into, and out from, the following junctions were entered into the ME process:

- Golborne Avenue / Myddelton Lane;
- Myddleton Lane / Delph Lane;
- A49 / Cromwell Avenue / Sandy Lane West; and
- Hilden Road / Blackbrook Avenue.

Link flows on the A49 at the Sandy Lane West / Cromwell Avenue junction were not used in the ME process. They were deliberately held back from the process so they could be considered as an independent verification of the ME process.

To to limit the impacts on the rest of the network, link flows at the following locations were included in the ME process. The modelled flows at these locations were already close to the observed values so the intention was to 'fix' rather than to adjust these flows.

- Orford Road (cordon entry point);
- Birchwood Road (cordon entry point);
- A49 N Delph Lane;
- Capesthorne Road;
- Cleveland Road; and
- Poplars Avenue.

Impacts of the Matrix Estimation Process

Change in Matrix Totals

As a result of the ME process, the overall change in the matrix totals is relatively small (shown in **Table 20**). The number of car trips in the model increases by 1,078 vehicles (4.7%) in the AM peak and 1,029 vehicles (3.9%) in the PM peak. Overall demand changed by 682 vehicles (1.9%) in the AM peak and 741 vehicles (2.0%) in the PM peak.

Table 20 Matrix Totals Before and After Matrix Estimation

Vehicle Type	AM Peak			PM Peak		
	Prior to ME	Post ME	% Change	Prior to ME	Post ME	% Change
Car - Commute	10,040	10,510	4.7%	10,767	11,297	4.9%
Car - Business	3,647	3,720	2.0%	3,534	3,595	1.7%
Car - Other	9,426	9,962	5.7%	12,142	12,581	3.6%
All Car Trips	**23,114**	**24,192**	**4.7%**	**26,443**	**27,472**	**3.9%**
LGV	3,863	3,783	-2.1%	3,883	3,877	-0.2%
HGV	8,284	7,969	-3.8%	6,573	6,292	-4.3%
All Vehicles	**35,261**	**35,944**	**1.9%**	**36,899**	**37,640**	**2.0%**

Change in Calibration Statistics

The ME process changes the overall 'goodness of fit' for the traffic flows against observed counts from values of 66% to 83% in the AM peak and 58% to 91% in the PM peak.

The emphasis in the process has been to improve the match between modelled flows and the new Highgate counts bringing model flows closer without changing the areas of the model developed using the original count data. Thus, **Tables 21** and **22** show that the 'goodness of fit' measures for the original WMMTM sites are not significantly changed while the fit between modelled and observed flows at the new count locations is improved.

Overall, 28 of the 59 count sites were used as control values for ME, 47% of the available data.

Table 21 AM Peak Calibration Summary

	Before ME					After ME			
	No. of Sites	GEH <=5		GEH or Flow criteria met		GEH <=5		GEH or Flow criteria met	
Original WMMTM sites	29	21	72.4%	21	72.4%	21	72.4%	21	72.4%
Original Highgate sites	18	9	50.0%	12	66.7%	14	77.8%	16	88.9%
New Highgate sites	12	6	50.0%	6	50.0%	12	100.0%	12	100.0%
Total	59	36	61.0%	39	66.1%	47	79.7%	49	83.1%

Table 22 PM Peak Calibration Summary

	Before PM					After ME			
	Sites	GEH <=5		GEH or Flow criteria met		GEH <=5		GEH or Flow criteria met	
Original WMMTM sites	29	22	75.9%	22	75.9%	26	89.7%	26	89.7%
Original Highgate sites	18	8	44.4%	8	44.4%	15	83.3%	16	88.9%
New Highgate sites	12	6	50.0%	4	33.3%	12	100.0%	12	100.0%
Total	59	36	61.0%	34	57.6%	53	89.8%	54	91.5%

The following tables below are updated versions of the tables presented in Section 6 to show the changes in calibration at each individual site following ME.

Table 23 is an update of Table 2.

Some sites that previously had a GEH value less than 5 now have a value greater than 5 and vice versa. There is no material overall change to the level of validation at these sites.

Table 23 Observed and Modelled Counts for Cordon Area – Local Road Network

Ref	Site	Dir	AM Peak			PM Peak		
			Obs	Mod	GEH	Obs	Mod	GEH
1	Winwick Road (s of M62)	SB	1682	1509	4.3	1348	1407	1.6
	Winwick Road (s of M62)	NB	1205	1210	0.2	1823	1694	3.1
2	Winwick Rd (south of Long lane)	SB	1846	1491	8.7	1374	1513	3.6
	Winwick Rd (south of Long lane)	NB	1065	1129	1.9	1591	1563	0.7
3	Poplars Avenue	NB	212	231	1.3	350	342	0.5
	Poplars Avenue	SB	369	368	0.1	284	288	0.2
4	Birchwood Way (west of M6)	EB	1014	814	6.6	603	628	1.0
	Birchwood Way (west of M6)	WB	490	523	1.5	1003	1034	1.0
5	Long Lane	WB	644	601	1.7	602	546	2.3
	Long Lane	EB	433	416	0.8	526	506	0.9
6	Blackbrook Av (cordon entry point)	WB	830	745	3.0	559	670	4.5
	Blackbrook Av (cordon entry point)	EB	714	597	4.6	947	965	0.6
7	Cromwell Av (cordon entry point)	EB	637	932	10.5	908	1496	17.0
	Cromwell Av (cordon entry point)	WB	866	663	7.3	955	860	3.1
8	Birchwood Way (east of M6) (cordon entry point)	EB	2419	2100	6.7	1098	1161	1.9
	Birchwood Way (east of M6) (cordon entry point)	WB	971	1041	2.2	1855	1755	2.3
9	Orford Road (cordon entry point)	NB	703	703	0.0	686	670	0.6
	Orford Road (cordon entry point)	SB	564	534	1.3	599	539	2.5
10	Sandy Lane	EB	315	479	8.2	408	449	2.0
	Sandy Lane	WB	341	418	3.9	422	479	2.7
11	Orford Green	WB	496	481	0.7	547	550	0.1
	Orford Green	EB	451	449	0.1	476	481	0.2

Table 24 is an update of Table 3.

These sites were not used in the ME process and again, there is no material change in the level of validation at these sites.

Table 24 Observed and Modelled Counts for Cordon Area – Motorway Network

Site	AM Peak			PM Peak		
	Obs	Mod	GEH	Obs	Mod	GEH
M62 J9 EB on-slip	511	885	14.2	623	540	3.4
M62 J9 WB off-slip	701	607	3.7	785	464	12.8
M62 J9 WB on-slip	767	715	1.9	1039	867	5.6
M62 J9 EB off-slip	866	971	3.5	936	1002	2.1
M62 EB (J9-J10)	3767	4230	7.3	4645	4671	0.4
M62 through J9 WB	3681	3871	3.1	4596	4500	1.4
M62 through J9 EB	3143	3346	3.6	3879	4130	4.0

Table 25 is an update of Table 9.

This table includes Blackbrook Avenue and Poplars Avenue which were used for ME. Overall, there has been an increase in the number of sites in this table achieving good levels of calibration.

Table 25 Link Flow Data – Highgate Sites (2019 counts)

Site	Type		AM Peak			PM Peak		
		Dir	Obs	Mod	GEH	Obs	Mod	GEH
Mill Lane at M62	ATC	NB	351	367	0.9	480	413	3.2
		SB	500	432	3.1	358	406	2.5
Blackbrook Ave (North of Hilden Road)	MCC	NB	391	379	0.6	330	332	0.1
		SB	341	334	0.4	400	366	1.7
Poplars Av (at Capesthorne Road Jcn)	MCC	NB	302	294	0.5	477	563	3.8
		SB	392	392	0.0	360	361	0.0
Capesthorne Road (East of Poplars Ave)	MCC	EB	169	202	2.4	148	244	6.8
		WB	281	235	2.9	268	320	3.1
Howson Rd	MCC	NB	108	18	11.4	193	20	16.8
		SB	214	21	17.9	133	14	13.9
Cleveland Road	MCC	NB	222	138	6.2	185	249	4.3
		SB	150	175	2.0	193	139	4.2
A49 N of Delph Lane	MCC	NB	1361	1363	0.1	1956	1947	0.2
		SB	1778	1778	0.0	1402	1405	0.1
Poplars Ave	ATC	EB	330	229	6.0	303	250	3.2
		WB	171	165	0.4	244	208	2.4
A50	ATC	EB	594	333	12.1	644	382	11.6
		WB	712	356	11.4	697	566	5.2

NB *- Site type MCC = One day manual turning count*

Table 26 and Table 27 are updates to Table 26 and **Table 18.**

These are the sites for which ME was applied to and, as a result, all links now have GEH values of less than 5.

Table 26 Junction 1 - Golborne Road Junction Link Flow Comparison

Site	Dir	AM Peak			PM Peak		
		Obs	Mod	GEH	Obs	Mod	GEH
Golborne Rd (North of Junction)	NB	228	278	3.1	397	501	4.9
	SB	479	542	2.8	298	291	0.4
Myddleton Lane	EB	622	635	0.5	499	533	1.5
	WB	359	379	1.1	425	525	4.6
Golborne Rd (South of Junction)	NB	621	621	0.0	671	681	0.4
	SB	609	629	0.8	498	455	2.0

Table 27 Junction 2 - Delph Lane Junction Link Flow Comparison

Site	Dir	AM Peak			PM Peak		
		Obs	Mod	GEH	Obs	Mod	GEH
Myddleton Lane (West of Junction)	EB	816	753	2.3	586	555	1.3
	WB	439	354	4.3	781	701	2.9
Delph Lane	NB	359	367	0.4	465	413	2.5
	SB	468	432	1.7	414	406	0.4
Southworth Lane (East of Junction)	EB	533	572	1.7	291	289	0.1
	WB	265	239	1.7	435	429	0.3

Turning Flows

Table 28 is an update of **Table 5**

Table 28 Turning Count Validation (Junction of A50 / A49)

From Arm	To Arm	AM Peak Obs	AM Peak Mod	AM Peak GEH	PM Peak Obs	PM Peak Mod	PM Peak GEH
B	A	208	290	5.2	304	631	15.1
B	D	119	109	0.9	140	166	2.1
B	C	54	1	10.1	97	24	9.3
A	D	253	144	7.7	254	130	8.9
A	C	1,404	1,236	4.6	998	1,306	9.1
A	B	216	189	1.9	180	102	6.6
D	C	388	218	9.8	280	252	1.7
D	B	157	247	6.3	141	180	3.1
D	A	237	170	4.7	253	144	7.7
C	B	65	190	11.1	73	83	1.2
C	A	769	796	1.0	1,273	1,301	0.8
C	D	231	117	8.7	245	180	4.5

Arm	Approach
A	Winwick Road North
B	Hawleys Lane
C	Winwick Road South
D	Long Lane

Table 29 presents the turning counts at the A49 junction with Cromwell Avenue and Sandy Lane West.

Table 29 Turning Count Validation (A49 / Cromwell Av / Sandy Lane West

From Arm	To Arm	AM Peak Obs	AM Peak Mod	AM Peak GEH	PM Peak Obs	PM Peak Mod	PM Peak GEH
A	B	194	123	5.6	233	321	5.3
A	C	1,290	1,257	0.9	835	812	0.8
A	D	246	347	5.9	306	372	3.6
B	A	212	143	5.2	205	114	7.2
B	C	81	41	5.1	103	32	8.7
B	D	208	237	1.9	266	368	5.8
C	A	784	924	4.8	1,444	1,364	2.1
C	B	72	65	0.8	105	53	5.9
C	D	430	291	7.3	660	484	7.4
D	A	201	145	4.3	405	305	5.3
D	B	316	311	0.3	266	288	1.3
D	C	646	631	0.6	523	694	6.9

Arm	Approach
A	Winwick Road North
B	Sandy Lane West
C	Winwick Road South
D	Cromwell Avenue

Table 30 is an update of **Table 19.**

Table 30 Turn Flow 'Goodness of Fit' Statistics

	AM Peak		PM Peak	
	No of turn flows meeting criteria	%	No of turn flows meeting criteria	%
Junction 1 Golborne Road	2	33%	1	17%
Junction 2 Delph Lane	3	50%	4	67%
Total	5	42%	5	42%

Journey Time Changes

Table 31 and **Table 32** provide an update to **Table 6** and **Table 7** showing the modelled and observed journey times. The changes in demand lead to some changes in journey times through the network but overall, the level of fit between observed and modelled times remains within acceptable levels.

Table 31 Summary of Journey Time Runs

Period	Sections within ±15%	Percentage within ±15%
AM	5	100%
PM	6	83%
Total	**16**	89%

Table 32 Journey Time Comparisons (mins)

Route		AM			PM		
		Obs	Mod	% Error	Obs	Mod	% Error
Wton_2 - Woolston Grange Road to Winwick via Fearnhead Ln and Blackbrook Ave	NB	11.07	9.74	-12.0%	9.58	9.15	-4.5%
	SB	10.31	9.08	-11.9%	9.11	8.5	-6.7%
Wton_3- Cromwell Avenue to Birchwood Way via Long Lane	CW	9.86	9.15	-7.2%	8.46	10.01	18.3%
	ACW	7.06	7.37	4.4%	8.87	8.1	-8.7%
XT1 - A49 between Kerfoot St and B&Q Junction	NB	7.75	8.15	5.2%	10.89	10.36	-4.9%
	SB	10.76	10.83	0.7%	7.48	8.42	12.6%

Measures against WebTAG criteria

WebTAG guidance requires specific tests to be carried out to ensure that the ME process has not significantly distorted the matrices. The criteria and resulting boundary scores are shown in **Table 33**.

Table 33 WebTAG Guidelines from Unit M3.1 Table 5

Measure	Significance Criteria
Matrix zonal cell values	• Slope within 0.98 and 1.02 • Intercept near zero • R^2 in excess of 0.95
Matrix zonal trip ends	• Slope within 0.99 and 1.01 • Intercept near zero • R^2 in excess of 0.98
Trip length distributions	• Means within 5% • Standard deviations within 5%

Matrix Zonal Cell Values

The values for the three measures are shown for each vehicle type and modelled time period in **Table 34**. The results demonstrate that the WebTAG criteria are met for all vehicle classes.

Table 34 Matrix Zonal Cell Changes

Vehicle Type		AM Peak	PM Peak
Car	Slope	1.002	1.006
	Intercept	0.140	0.117
	R^2	0.994	0.995
LGV	Slope	0.95	1.000
	Intercept	-0.008	-0.001
	R^2	0.997	1.000
HGV	Slope	0.999	0.998
	Intercept	-0.041	-0.036
	R^2	0.999	0.999

Origin and Destination Trip Ends

The results for the three measures are shown in **Table 35** and

Table 36

For both origin and destination car trips the intercept value is relatively high. The primary cause for this is that some control sites are very close to the edges of the cordon and very few external zones are available for the process to make adjustments. Any change to external trip ends was thus focussed in a single external zone.

While this action would not normally be considered, in this case this is not deemed to have a significant effect on the cordon model results since the process is being used to pre-load these areas of the network with trips that would not have a route choice alternative in the cordon.

Table 35 Origin Trip Ends

Vehicle Type		AM Peak	PM Peak
Car	Slope	1.013	1.004
	Intercept	9.051	10.661
	R^2	0.993	0.994
LGV	Slope	0.991	0.999
	Intercept	-0.068	-0.010
	R^2	0.998	1.000
HGV	Slope	0.996	0.983
	Intercept	-2.272	-2.005
	R^2	0.999	0.999

Table 36 Destination Trip Ends

		AM Peak	PM Peak
Car	Slope	1.009	1.028
	Intercept	10.117	3.454
	R^2	0.993	0.993
LGV	Slope	0.996	0.999
	Intercept	-0.745	-0.022
	R^2	0.995	0.999
HGV	Slope	0.997	0.996
	Intercept	-3.338	-2.958
	R^2	0.999	0.998

Change in trip length distribution

The results of this comparison are shown in **Table 37**. They show that the WebTAG criteria are met for all demand segments.

Table 37 Difference between Prior and Post ME trip lengths.

Vehicle Type	AM Peak		PM Peak	
	Mean	Standard Deviation	Mean	Standard Deviation
Car – commute	-1.29%	-1.55%	-0.98%	-1.48%
Car – business	-0.65%	-0.94%	-0.64%	-0.80%
Car – other	-1.16%	-2.42%	-0.98%	-1.41%
LGV	0.98%	0.97%	0.64%	0.09%
HGV	0.33%	1.90%	0.76%	2.13%

Summary

A comparison between count data collected during the original WMMTM16 base model development and modelled flows showed a good fit in terms of achieving WebTAG calibration criteria. When the WMMTM16 base model was cordoned for use in this assessment, the overall fit achieved was still robust but there were a number of areas where improvements could be made.

Some improvement in fit was obtained through network changes, specifically changes to link speeds and changes to zone loading points, these are reported in Section 9, not all sites could be improved. It was therefore agreed that a limited ME exercise would be required.

ME has been carried out on the AM and PM peak cordon base models. The intention has been to improve the representation of flow on a number of under-performing sites to improve their replication of observed conditions. To ensure that the model reflects observed movements, sites have been added to ME both to target improvement, but also to ensure that a number of sites that are currently performing well, do no deteriorate as part of the ME exercise.

The results presented in Section 10 demonstrate that ME has improved the level of calibration performance for both the AM and PM peak models. Pending sign-off of the ME approach and results, the next stage is to apply the models for use in the forecast scenarios outlined in Section 3.

11. Scenario Testing

Section 3 of this note and Paragraph 13 of 1901/TN/03 sets out the scenarios to be modelled. This section presents the details of the assessment methodology from the models. The results of each scenario test are provided as a separate outputs pack.

Forecasting

Forecasts have been prepared for four future years;

- 2018;
- 2022;
- 2027; and
- 2032.

Forecast models have been prepared on the basis of NTEM growth rates and the development traffic for the Peel Hall Site as defined by Highgate in their Model Specification Report.

The forecast models cover two access strategies for the loading of development demand within the development site area – **Strategy A** and **Strategy B** as defined in the Model Specification Report. These access options are also show in **Figure 3** and **Figure 4** of this report (See Section 5).

TEMPRO v7.2 has been used to extract NTEM growth for Warrington Borough and for the North West region. The Borough growth rates have been applied to all zones within the modelled area, with the exception of the M62 and M6 links which have had the wider regional growth rates applied.

Fuel price and income adjustment factors have been applied in each case for the appropriate years drawn from the *May 2019 version of the WebTAG databook*.

The growth rates applied are shown in **Table 38**.

Table 38 Car Trip Growth Rates

Sector	Year	Commute	Business	Other
Internal	2018	1.0161	1.0196	1.0204
	2022	1.0716	1.0820	1.0853
	2027	1.1216	1.1372	1.1490
	2032	1.1757	1.1972	1.2193
External	2018	1.0174	1.0189	1.0229
	2022	1.0769	1.0811	1.0923
	2027	1.1356	1.1423	1.1590
	2032	1.1982	1.2076	1.2315

Growth rates for freight trips have been taken from the *2018 Road Traffic Forecasts* produced from the National Transport Model. Growth rates for LGV and OGV have been extracted for each year from the forecasts for the North West region. Freight growth rates are shown in **Table 39**.

Table 39 Growth Rates for Freight Trips

Year	LGV	HGV
2018	1.0371	0.9966
2022	1.0960	0.9917
2027	1.1508	0.9906
2032	1.2192	0.9973

Development Traffic

Parkside

Traffic Impact Assessments have been provided by WBC for the Parkside development site in neighbouring St Helens. There are two aspects to the development:

- Residential and employment development; and
- Construction of a new link road.

The location of the site is outside the model cordon so it cannot be modelled explicitly in the Peel Hall Farm model for this scheme.

Agreed Methodology/Approach:

On the basis of the information provided it was agreed that:

- Only a proportion of development traffic would use the A49 from the north to access the M62 westbound at J9;
- In the Parkside SATURN Model a significant volume of development traffic was shown to route along the A49 Winwick Link Road and onto the Winwick Road roundabout towards the A49 Newton Road. However, this traffic was diverted as a result of the introduction of the Parkside Link Road Scheme. As the Peel Hall Farm cordon model assumes the link road is built, there is no significant volume of traffic making this movement in the Peel Hall Farm cordon model.

From this analysis it was concluded that the only impact of the Parkside development on the study area would be an additional volume of traffic between Winwick Road and the M62 west. A select link analysis on the Parkside SATURN Model suggested this would be 15% of the total Parkside development traffic.

Scheme Development Traffic

Development traffic has been provided in the Highgate Model Specification Report for two development scenarios. Six access points have been specified which have been coded as separate zones in the model:

- Zone 8801 - Poplars Avenue (central)
- Zone 8802 - Poplars Avenue (west)
- Zone 8803 - Mill Lane
- Zone 8804 - Mill Lane / Blackbrook Avenue
- Zone 8805 - Birch Avenue
- Zone 8806 - Grasmere Avenue

The locations of the new zone loading points are shown in **Figure 20** and **Figure 21**.

Figure 20 Development Zone Loading Points (Access Strategy A)

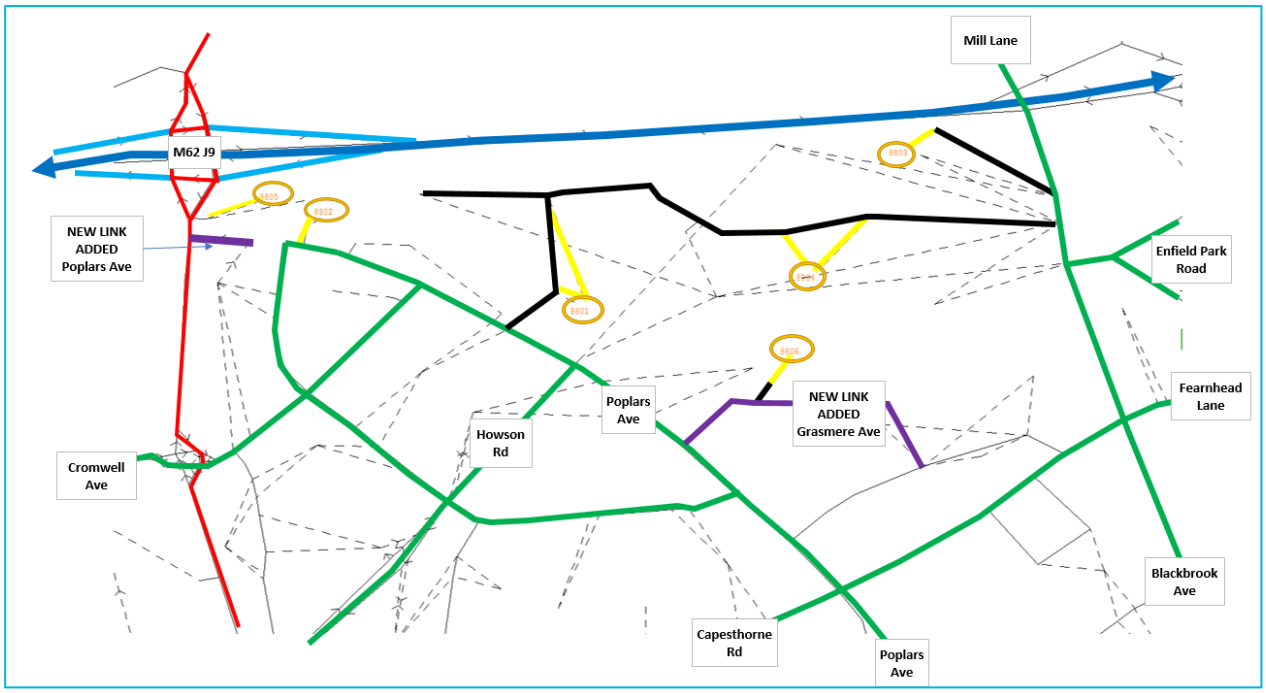
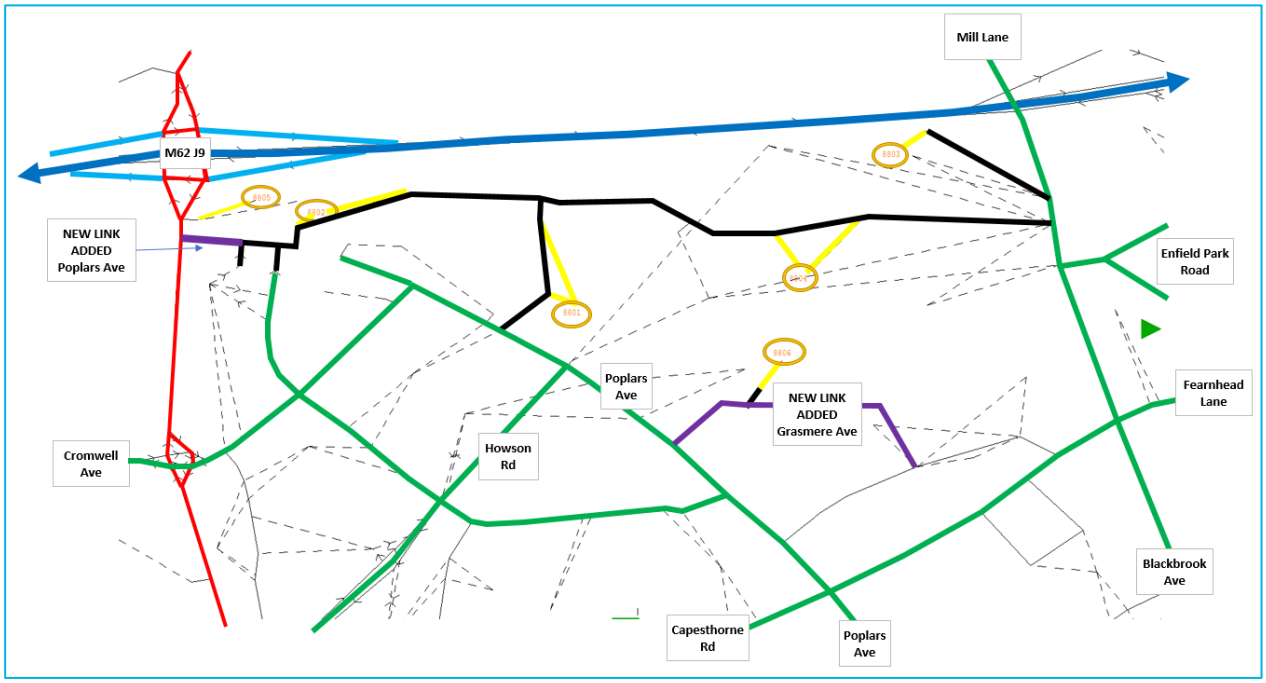


Figure 21 Development Zone Loading Points (Access Strategy B)



- The trips added in each scenario for each zone are shown in

Table 40 to **Table 42**. These trips were treated as being over and above the NTEM growth.

Table 40 2022 Development Traffic

Zone	Strategy A				Strategy B			
	AM In	AM Out	PM In	PM Out	AM In	AM Out	PM In	PM Out
8801	14	31	30	18	14	31	30	18
8802	0	0	0	0	0	0	0	0
8803	14	31	30	18	14	31	30	18
8804	0	0	0	0	0	0	0	0
8805	0	0	0	0	0	0	0	0
8806	0	0	0	0	0	0	0	0
Total	**28**	**62**	**60**	**36**	**28**	**62**	**60**	**36**

Table 41 2027 Development Traffic

Zone	Strategy A				Strategy B			
	AM In	AM Out	PM In	PM Out	AM In	AM Out	PM In	PM Out
8801	76	119	174	135	76	119	174	135
8802	34	79	74	46	34	79	74	46
8803	34	79	74	46	34	79	74	46
8804	0	0	0	0	0	0	0	0
8805	5	11	10	6	5	11	10	6
8806	10	5	7	8	10	5	7	8
Total	**159**	**293**	**339**	**241**	**159**	**293**	**339**	**241**

Table 42 2032 Development Traffic

Zone	Strategy A				Strategy B			
	AM In	AM Out	PM In	PM Out	AM In	AM Out	PM In	PM Out
8801	76	119	174	135	76	119	174	135
8802	68	158	148	92	248	485	431	275
8803	158	366	347	215	34	79	74	46
8804	57	40	10	14	0	0	0	0
8805	5	11	10	6	5	11	10	6
8806	10	5	7	8	10	5	7	8
Total	**374**	**699**	**696**	**470**	**373**	**699**	**696**	**470**

In 2032, a proportion of the traffic to zone 8803 is treated as 'pass by' traffic related to the local store. This is removed from the matrices as 'household production' and replaced with 'household to store' trips.

Matrix Growth

- The overall changes in the assignment matrices are shown in

Table 43 for the AM, and **Table 44** for the PM.

Table 43 AM Peak Matrix Totals

Year	Level of Development Applied	Matrix Total			Growth from Base		
		Car	LGV	HGV	Car	LGV	HGV
2016	None	23,759	3,741	7,967	-	-	-
2018	None	24,267	3,880	7,941	1.02	1.04	1.00
2022	None	25,838	4,100	7,901	1.09	1.10	0.99
	Part	25,965	4,100	7,901	1.09	1.10	0.99
	Full	26,920	4,100	7,901	1.13	1.10	0.99
2027	None	27,349	4,305	7,892	1.15	1.15	0.99
	Part	27,801	4,305	7,892	1.17	1.15	0.99
2032	None	28,974	4,561	7,946	1.22	1.22	1.00
	Full	30,019	4,561	7,946	1.26	1.22	1.00

Table 44 PM Peak Matrix Totals

Year	Level of Development Applied	Matrix Total			Growth from Base		
		Car	LGV	HGV	Car	LGV	HGV
2016	None	26,983	3,821	6,271	-	-	-
2018	None	27,501	3,963	6,250	1.02	1.04	1.00
2022	None	29,180	4,188	6,219	1.08	1.10	0.99
	Part	29,314	4,188	6,219	1.09	1.10	0.99
	Full	30,296	4,188	6,219	1.12	1.10	0.99
2027	None	30,826	4,398	6,212	1.14	1.15	0.99
	Part	31,406	4,398	6,212	1.16	1.15	0.99
2032	None	32,624	4,659	6,254	1.21	1.22	1.00
	Full	33,702	4,659	6,254	1.25	1.22	1.00

Flow Conversion Factors

Factors have been calculated using ATC data provided by Highgate to convert the model period flows to 24-hour AADT and 18-hour AAWT.

The model represents an average hour during the peak period. Standard factors have been calculated to convert modelled flows to three hour peak periods for the WMMTM model. These are;

- AM Peak – **2.60**
- PM Peak – **2.74**

Four ATC sites, as specified in the Highgate Model Specification Report, have been used to calculate average factors. These sites are:

- Poplars Avenue (ATC site C)
- A50 (ATC Site K)
- A49 (Highgate 2018 count)

- Mill Lane (ATC site A)

From this data, the following factors have been calculated.

- Sum of AM and PM (three hour) peaks to 24-hour (7-day week) - **2.261**
- 24-hour (all week) to 18-hour (weekday) - **1.047**

A further factor could be applied to convert these to full AADT and AAWT values. Given that the seasonality index for town centre flows would be expected to be close to 1.00 and the counts used represent neutral month counts it might be assumed that the further factors will be close to 1.00.

At present, the above factors have been applied in the results spreadsheet to derive an estimate of 'daily flows'.

Model Runs

Forecast assignment runs have been carried out for the following model scenarios:

- Existing 2016 Base Cordon Model;
- 2018 baseline model (assuming no development);
- Opening Year 2022;
  - Access Strategy A & B;
    - No development;
    - Partial development (120); and
    - Full development.
- 5 year after opening 2027;
  - Access Strategy A & B;
    - No development; and
    - Partial development (600).
- 10 year after opening 2032;
  - Access Strategy A & B;
    - No development; and
    - Full development.

The results of each of the model assignments have been analysed and the following outputs produced:

- Link flows (spreadsheet and plots);
- Turning flows (spreadsheet);
- Flow difference plots;
- Node delay plots;
- Node V/C plots;
- Development zone select link analysis plots; and
- Development traffic plots.

These results have been provided as a separate outputs pack. Ref: ***Peel Hall Farm_Outputs_180919***