MODELLING GROUP

Land at Peel Hall, Warrington
Reopened Inquiry

Proof of Evidence on VISSIM Matters

Luke Best, Group Director, Modelling Group
On behalf of
Satnam Millennium Limited
(APP/M0655/W/17/3178530)

DOCUMENT CONTROL ISSUE SHEET

Project & Document Details

Project Name	A49 Corridor, Warrington
Project Number	MG0123
Document Title	Luke Best VISSIM Proof of Evidence
Document Reference	Version 15_10/02/2021

Modelling Group Ltd.
Registered in England & Wales: 12262604 Group Director: Luke Best
Registered address: Crosby Court, 28 George Street, Birmingham B3 1QG

Contents

Page

List of Figures

List of Tables and Charts

Appendices

Glossary of Terms	Meaning
Cool-Down Period	Period after the main peak-period, usually used for assessing peak spreading.
Daily Network Average Analysis	A measure created through the averaging of AM and PM model output data.
Do Minimum	Future year scenarios without Peel Hall development flows or mitigation measures. Includes all background and committed scheme traffic growth, as well as any committed mitigation measures.
Do Something	As per Do Minimum, but with the addition of Peel Hall development related flows and mitigation measures.
Comparative Peak Spreading Analysis	Comparison of the level of Peak Spreading found in the Do Minimum and Do Something model data.
Error File	File produced at the end of every model run, detailing any model run warnings and including details of vehicle demand unable to enter the network during the total run time.
Flow Conversion Spreadsheets	Spreadsheets used to convert all WMMTM16 SATURN model hourly flow outputs into VISSIM-ready vehicle input and vehicle routing formats.
Green Wave	Term used to describe a condition caused when signal timings at separate stop lines within a junction are coordinated to allow key vehicle movements to be flushed through the junction in one go.
Latent Delay	A measure of total delay experienced by vehicles described as Latent Demand. Only ever a theoretical measure, as it is timing vehicles not yet in the VISSIM network.

Latent Demand	The volume of demand assigned/coded to start trips within the peak hour, but unable to gain access to the network due to delays/queuing levels within the network.
% Latent Demand to Total Demand	A measure aimed at providing context to levels of reported Latent Demand, by referring it to the Total Demand for the hour in each model.
Low-Granularity Data	Data provided in a low resolution, or level of detail i.e. aggregated over a long time period or large physical area.
M4 Mitigation	The final package of mitigation measures proposed for the Peel Hall development.
MOVA	Microprocessor Optimised Vehicle Actuated - a mini-computer based signal controller, capable of constantly improving signal timings through 'awareness ' of traffic conditions fed by detectors buried in the carriageway.
Network Performance	A low detail data output from the VISSIM model allowing a broad overview of hourly average vehicle and network wide performance metrics.
Peak Spreading	Used to describe the process of the current peak hour getting longer (or spreading) in future years.
Random Seed	Traffic conditions vary day-to-day as a result of random driver behaviours such as speed selection, lane changing, driver route choice, bus and parked vehicle dwell times. The stochastic (random probability distribution) traffic model in VISSIM attempts to replicate this day-to-day random variability by altering individual driver decisions based on random numbers each simulation run.
Reference Case	An overarching term to describe the Do Minimum models – each was a reference for comparison purposes for the equivalent Do Something models.

SATURN	A highway assignment software, used to create large-scale (often county-wide), strategic highway models.
S+ Mitigation	An earlier version of the proposed Peel Hall development mitigation package (not including the M62 Junction 9 proposed works to the eastbound on-slip.
Signal Optimisation	The process of making tiny, iterative changes to signal timings to balance all movements and improve capacity.
Signal Phase e.g. Phase A	Term to describe the signals controlling each separate approach or movement at a signal-controlled junction
VISSIM	VISSIM is a microscopic multi-modal traffic flow simulation software package, used to create smaller scale, highly detailed highway models.
WMMTM16	The name of the Warrington SATURN model used for this study.

1.0 Introduction

1.1 My name is Luke Best, and I am Group Director and joint owner of Modelling Group Ltd. I am a transport modelling specialist with 20 years' experience working within the transport planning and highways engineering sectors. This has included working for Faber Maunsell (later AECOM), Amey, and WSP over the first decade of my career and since 2012 I have owned my own businesses, which provides transport modelling as a specialist consultancy service to the industry. Modelling Group now consists of five full-time modelling specialists with over 90 years of combined industry experience.

1.2 This proof of evidence is presented on behalf of Satnam Millennium Limited and in particular I will confirm that the VISSIM modelling developed is fit for the intended purpose and is entirely acceptable based on national, industry-wide guidance and standards. As a consequence, the modelling work I have carried out can be relied upon to show that the traffic impact of the appeal proposals will not be severe or have adverse impacts on highway safety. Additionally, the evidence presented will clearly demonstrate that for the majority of vehicles trips throughout the network, it is possible to achieve some level of improvement to delay.

1.3 My evidence should be read in conjunction with Dave Tighe's Supplementary Proof of Evidence that deals with VISSIM matters.

1.4 I have visited the site and surrounding area, including the A49 corridor that is the subject of the VISSIM modelling.

2.0 Background and Scope of Evidence

2.1 Modelling Group (then BestMore Consulting) were appointed as the Appellant's modelling consultants in October 2019. The November 2019 methodology developed (BM0123_A49 Corridor Warrington Modelling Methodology v1.2 1st November 2019 – **Appendix LB/1**) was based on the understanding that a previously approved VISSIM of the wider Peel Hall study area, developed from a former Highways England model by AECOM for a 2015 base, would be the basis of the 2019 model.

2.2 It was agreed that this previous model would be cordoned to focus on the A49 corridor to the north and south of the M62 Junction 9. The model was to be checked against pre-held 2019 data to ensure that it was still representative of real-world conditions, before carrying out a series of scenario tests to assess and/or mitigate any development-related highway impacts.

2.3 As part of the November 2019 methodology (paragraph 4.3, **Appendix LB/1**), it was agreed that the VISSIM model would be calibrated for turning counts and validated for journey times along the corridor. Although not part of the calibration or validation process, it was also set out in the methodology that queues would be assessed visually. This was to be a visual assessment of the queues in the cordoned 2019 corridor VISSIM against the 2015 AECOM model base of the wider area. It was also agreed that the modelling would allow for signal optimisation in the future years.

2.4 The methodology confirmed that the 2019 base model would then be used for future year modelling under different scenarios carried out for 2022, 2027 and 2032. The different scenarios are:

i. 2022 Background & Committed Traffic Growth + Committed Mitigation Measures (Reference Case)
ii. 2022 Background & Committed Traffic Growth + Peel Hall Development Traffic (Full Development Scenario) + Committed & Proposed Mitigation Measures (Proposed Test)
iii. 2022 Background & Committed Traffic Growth + Peel Hall Development Traffic (Full Development Scenario) + Committed & Proposed Mitigation Measures + M4 Mitigation Package (Mitigation Test)
iv. 2027 Background & Committed Traffic Growth + Committed Mitigation Measures (Reference Case)
v. 2027 Background & Committed Traffic Growth + Peel Hall Development Traffic (Part-Build Out with no Internal Link Development Scenario) + Committed & Proposed Mitigation Measures (Proposed Test)
vi. 2027 Background & Committed Traffic Growth + Peel Hall Development Traffic (Part-Build Out with no Internal Link Development Scenario) + Committed & Proposed Mitigation Measures + M4 Mitigation Package (Mitigation Test)
vii. 2032 Background & Committed Traffic Growth + Committed Mitigation Measures (Reference Case)
viii. 2032 Background & Committed Traffic Growth + Peel Hall Development Traffic (Full Development Scenario) + Committed & Proposed Mitigation Measures (Proposed Test)
ix. 2032 Background & Committed Traffic Growth + Peel Hall Development Traffic (Full Development Scenario) + Committed & Proposed Mitigation Measures + M4 Mitigation Package (Mitigation Test)

2.5 After agreement of the proposed methodology (**Appendix LB/1** - VISSIM methodology report v1.2), it soon became clear that more significant changes had occurred on the network since the completion of the validated 2015 AECOM base model.

2.6 This led to a requirement to make more direct use of 2019 traffic survey data where it was available for the base model, as agreed with the highway authority, which in turn lead to the creation of a more hybrid 2015/2019 approach and full model revalidation, in order to create the most representative and fit for purpose model, making use of all available datasets.

2.7 The first base model version created was delivered on January 10th, 2020.

2.8 The development and updating of the existing 2015 base models proved to be a lengthy process, with multiple submissions of the 2019 base models being made in an attempt to satisfy auditor comments and suggestions and to provide more information to detail the processes carried out. As work progressed it became clear that the audit teams were stepping away from the agreed methodology.

2.9 For example, it was apparent from the February 7th, 2020 (Highways England) audit report that the auditors were not happy with multiple elements which they had previously agreed regarding the methodology of the VISSIM modelling. There were many examples, amongst them, the model was an approved Highways England model, but they raised an issue with it having been "coded in a geographical location such that the background mapping is slightly mis-aligned to the model". Another example is "It is unclear as to why the model has been converted from Dynamic to Static assignment" when this had been clearly set out in the agreed methodology of November 2019.

2.10 Given the above, this led to an ever-increasing amount of reworking and recoding of the network between January 2020 and November 2020 to maintain appropriate levels of validation. As a result, timescales to finish the model were lengthened due to the creation of a regularly growing list of new queries and comments with each subsequent model submission.

2.11 It is recognised that traffic modelling requires a pragmatic approach to discussions between modeller and auditor in order to achieve the goal of a fit for purpose model, that is robust and ready for scheme evaluation. However, it appears that the approach adopted by the auditors made it unusually difficult to attain auditor satisfaction and ultimate base model sign-off.

2.12 The future years modelling originally had an agreement for a clear and simple methodology for the conversion of traffic flows from WMMTM16 to VISSIM – to add approved levels of growth, which were to be provided as outputs from Warrington Borough Council's county-wide strategic model (WMMTM16), to add committed and proposed mitigation measures into relevant comparative scenarios, and finally to optimise network signal timings in order to suit the resultant changes to flow patterns and volumes.

2.13 However, in order to make progress with the auditors the agreed methodology was amended and issued 15th May 2020, with particular regard to the process of adding future levels of growth. A modelling addendum document (MG0123_A49 Warrington Corridor Methodology Addendum v1, contained in **Appendix LB/2**) was prepared and submitted after auditing teams raised a concern with the originally agreed approach of using WMMTM16 flows directly 'as provided'. Instead, and after discussion, a methodology was developed, presented, and agreed upon which meant using a more complex proportional calculation process in order to ensure future year growth related to the validated flows found in the 2019 base year VISSIM models, even if these were different to data used to develop WMMTM16.

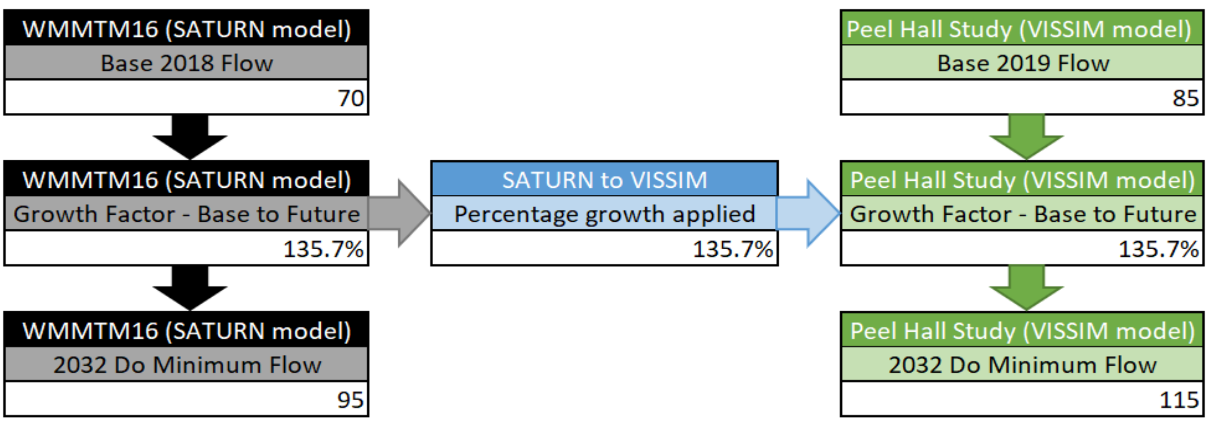


Figure 1 – Worked Example of WMMTM16 to VISSIM Flow Conversion Process

2.14 **Figure 1** shows a worked example of the conversion process used to bring traffic growth from WMMTM16 to the VISSIM model future year scenarios. Once the percentage growth for any Origin-Destination (OD) pairing in WMMTM16 is known, it is simply applied as a multiplication to the VISSIM base year flow for the same OD pair. So, in the example shown in **Figure 1**: **In SATURN: 95 vehicles as a percentage of 70 vehicles = 135.7%. Then in VISSIM: 85 vehicles x 135.7% = 115 vehicles.**

2.15 At the opening of the September 2020 inquiry, Warrington Borough Council highlighted an 'error' relating to the complex flow and routing development process arising from the agreed revised methodology, which had been pulled through in the August future years model submissions. This affected total flow and profile split (and therefore journey times, as well as queue formation and length) on the Sandy Lane West and Long Lane links in all future year scenarios.

2.16 This 'error' was a computer glitch and consisted of an embedded link in the development flows spreadsheet to an external data source not automatically updating as would be expected - this was easily remedied as part of the package of edits and modifications being carried out for the subsequent 8th September 2020 model submission and had in fact been remedied within 24 hours of being queried by the audit team, over two weeks prior to the inquiry commencement.

2.17 The current position with regard to the 2019 base modelling is that the model has been fully accepted and signed-off as fit for purpose by both Highway's England (via consultant Atkins) and Warrington Borough Council (via consultant WSP).

2.18 The current position with regard to all future years modelling is that they have been confirmed as technically acceptable by the audit teams and therefore suitable for use in providing assessment of the impact from the addition of the Peel Hall development traffic and proposed mitigation measures.

2.19 Following on from the final submission of future years modelling, Warrington Borough Council have raised some matters in relation to network operation. This is primarily in regard to the exact specifics of my approach to signal timing optimisation. There are also matters raised relating to the achieved levels of performance/impacts experienced on two specific local roads (Sandy Lane West and Long Lane), as well as the meaning to be derived from the data output known as '**Latent Demand**'.

2.20 Therefore, the matters arising that need to be considered in this evidence are:

i. Is it reasonable to expect that forecast demand in VISSIM should be consistent with SATURN WMMTM16, in all zones?
ii. Does the M4 Mitigation at Cromwell Avenue create a demonstrable safety issue for merging vehicles?
iii. Is the signal timing optimisation at the M62 Junction 9 appropriate?
iv. Is the signal timing optimisation at the A49/Cromwell Avenue/Sandy Lane West junction appropriate?
v. Do the comparisons of latent demand and queue lengths on Sandy Lane West indicate development impact that cannot be mitigated in the PM Peak in 2027 and 2032?
vi. Do the levels of latent demand and queue lengths on the A50 Long Lane indicate that the impact of the development on this link cannot be adequately assessed?
vii. Is the concern regarding latent demand appropriate?
viii. Is the zone distribution from D to G, as raised in WSP TN12 page 6, of significance?

(Points 1-7 are taken from WSP TN12 summary and point 8 from page 6 January 2021 – Core Document APP35)

3.0 Modelling Results

3.1 Following the adjournment of the inquiry in September 2020 and up until submission of all final modelled future years packages on 2nd December 2020, work was carried out to ensure that the VISSIM model and its data outputs were being used to their full potential. Every effort has been made to confirm that all outputs are demonstrating the modelling conclusions in the clearest manner possible.

3.2 During the model development and future year optimisation process, the desired outcome was always to achieve the best network performance for the largest number of vehicles, and therefore people, as was possible. This inherently created a focus on the maintenance of performance for the two strategic corridors within the model extents; the A49 and M62. This is linked to resolving the highway safety issue involving blocking back onto the motorway off-slips and M62 mainline as a result of queuing conditions on the A49 (see paragraph 3.28). This puts the issue of queuing and delay on Sandy Lane West into perspective. However, I can also confirm that every effort was made to minimise any impacts and create the optimum performance for junctions and side roads within the local road network connecting with the A49.

3.3 Existing VISSIM model outputs for the peak hour Network Performance data have been reviewed in order to draw a clearer narrative, which is simpler for all to understand. Micro-simulation models produce a large quantity of data outputs, and the required context allowing a simple understanding can sometimes get lost in the technical breadth and depth reported.

3.4 The following **paragraphs 3.5** to **3.18** addresses Network Performance analysis. This includes evaluation of average, network wide traffic flow, journey time and delays data. Following on from this, **paragraphs 3.19** to **3.36** provide a breakdown of more detailed Local Route Performance analysis, including a comparative assessment of performance on key routes within the modelled network. Please note that the convention I have adopted is that the blue text is my attempt at providing a simple summary, prior to my technical response.

Network Performance

3.5 This data for network performance is useful for showing high-level trends and comparisons between scenario models, prior to the more comprehensive assessment of detailed model outputs, such as the Local Route Performance analysis. The key summary is that it shows minimal differences between the equivalent Do Minimum and Do Something models. In 2032, there is a maximum increase to average journey times of 5%, found in the morning peak model. Furthermore, the difference in total percentage of time spent in delay conditions and the level of increase to the size of the future year peak period ('**Peak Spreading**') are both within 2%, in the morning and evening peak models. This is clearly only a very negligible impact from the development.

3.6 **Tables 3.1** and **3.3** on the following pages show the comparative trip analysis taken from the Network Performance data outputs for the morning and evening peak models, respectively. 2032 data has been highlighted and will be the focal point for discussion within this evidence, as it is considered the most relevant test given the Peel Hall development programme. However, for the purpose of transparency, the comparable data outputs from the other future year scenarios are also included, in the same format.

3.7 **Tables 3.2** and **3.4** show details regarding the conversion of the peak hour latent demand data to actual levels of '**Peak Spreading**' (a process described in greater detail from **paragraph 3.13** onwards) in the forecast future models, for the morning and evening peak models, respectively.

	Average Per Vehicle Trip - AM PEAK (08:00 - 09:00)							
AM 2022 - 08:00 - 09:00	Delay	No of Stops	Stopped Delay	Total hourly Flow	Average Journey Time	% Change	Total Delay as % of trip	Stopped Delay as % of trip
Do Minimum	170s	9	66s	18,862veh	348s		49%	19%
Do Something (M4 Mit)	232s	13	98s	19,423veh	409s	17%	57%	24%
AM 2027 - 08:00 - 09:00	Delay	No of Stops	Stopped Delay	Total hourly Flow	Average Journey Time	% Change	Total Delay as % of trip	Stopped Delay as % of trip
Do Minimum	251s	14	96s	20,334veh	425s		59%	23%
Do Something (M4 Mit)	285s	16	115s	20,524veh	458s	8%	62%	25%
AM 2032 - 08:00 - 09:00	Delay	No of Stops	Stopped Delay	**Total Hourly Flow**	**Average Journey Time**	**% Change**	**Total Delay as % of trip**	**Stopped Delay as % of trip**
Do Minimum	288s	15	133s	**21,204veh**	**459s**		**63%**	**29%**
Do Something (M4 Mit)	312s	16	145s	**21,100veh**	**483s**	**5%**	**65%**	**30%**

Table 3.1 Network Performance – AM Peak Comparative Trip Analysis

	PEAK SPREADING - AM PEAK (08:00 - 09:00)		
AM 2022 - 08:00 - 09:00	'Latent Demand'	% Latent Compared to Total Demand	Actual Peak Increase
Do Minimum	294veh	2%	56s
Do Something (M4 Mit)	827veh	4%	153s
AM 2027 - 08:00 - 09:00	'Latent Demand'	% Latent Compared to Total Demand	Actual Peak Increase
Do Minimum	583veh	3%	103s
Do Something (M4 Mit)	1,072veh	5%	188s
AM 2032 - 08:00 - 09:00	**'Latent Demand'**	**% Latent Compared to Total Demand**	**Actual Increase of Peak Period**
Do Minimum	**1,250veh**	**6%**	**212s**
Do Something (M4 Mit)	**1,721veh**	**8%**	**294s**

Table 3.2 Network Performance – AM Peak Comparative Peak Spreading Analysis

	Average Per Veh Journey - PM PEAK (17:00 - 18:00)							
PM 2022 - 17:00 - 18:00	Delay	No of Stops	Stopped Delay	Total hourly Flow	Average Journey Time	% Change	Total Delay as % of trip	Stopped Delay as % of trip
Do Minimum	134s	4	75s	21,545veh	312s		43%	24%
Do Something (M4 Mit)	143s	4	81s	21,769veh	322s	3%	44%	25%
PM 2027 - 17:00 - 18:00	Delay	No of Stops	Stopped Delay	Total hourly Flow	Average Journey Time	% Change	Total Delay as % of trip	Stopped Delay as % of trip
Do Minimum	150s	4	85s	22,897veh	325s		46%	26%
Do Something (M4 Mit)	154s	4	84s	22,901veh	332s	2%	46%	25%
PM 2032 - 17:00 - 18:00	Delay	No of Stops	Stopped Delay	**Total Hourly Flow**	**Average Journey Time**	**% Change**	**Total Delay as % of trip**	**Stopped Delay as % of trip**
Do Minimum	181s	6	99s	**24,080veh**	**355s**		**51%**	**28%**
Do Something (M4 Mit)	180s	6	94s	**24,163veh**	**356s**	**0%**	**51%**	**26%**

Table 3.3 Network Performance – PM Peak Comparative Trip Analysis

	PEAK SPREADING - PM PEAK (17:00 - 18:00)		
PM 2022 - 17:00 - 18:00	'Latent Demand'	% Latent Compared to Total Demand	Actual Peak Increase
Do Minimum	294veh	1%	49s
Do Something (M4 Mit)	827veh	4%	137s
PM 2027 - 17:00 - 18:00	'Latent Demand'	% Latent Compared to Total Demand	Actual Peak Increase
Do Minimum	583veh	3%	92s
Do Something (M4 Mit)	1,072veh	5%	169s
PM 2032 - 17:00 - 18:00	**'Latent Demand'**	**% Latent Compared to Total Demand**	**Actual Peak Increase**
Do Minimum	**1,250veh**	**5%**	**187s**
Do Something (M4 Mit)	**1,721veh**	**7%**	**256s**

Table 3.4 Network Performance – PM Peak Comparative Peak Spreading Analysis

3.8 Network wide, low-granularity data is useful as a tool to pick up early patterns but can easily be misunderstood. This is especially so given that there is potential for the data to be skewed, sometimes heavily, by the results from a small area, or even single entry to the model if these are very different between scenarios. An example of this skewing of network wide results is the delay recorded on Northway arising from the limited opportunity to access the A50 Long Lane. This relatively low volume of vehicles, in a very localised area, has a disproportionately large impact on network wide average delay and speed metrics.

3.9 A useful early indicator, which can be taken from network wide performance data can be found through the answering of the following questions:

i. Do average vehicle journey times increase in any sort of a significant manner between scenarios?
ii. Does the level of delay and/or stopped delay increase in any sort of a significant manner between scenarios?
iii. Is the level of traffic flow getting into the model during the peak hour either increasing or reducing significantly between scenarios?

3.10 For each of these high-level questions, the answer is "no". In the PM peak results, there is very little difference seen between the Do Minimum and Do Something data. The AM results do show more difference between Do Minimum and Do Something model outputs, however this would still not count as significant. This is very apparent when the most relevant 2032 data is compared.

3.11 The data set out in **Tables 3.1** to **3.4** allows for an additional analysis to be carried out, further to the questions answered in **paragraph 3.9**.

3.12 The analysis of '**Latent Demand**' represents the volume of vehicles which have been coded to start a trip during the peak hour, but have been unable to access the VISSIM network, usually as a result of delays and/or queuing conditions in a specific location. As such, these vehicle trips will enter the VISSIM network after the peak hour.

3.13 The interpretation of this data represents an analysis of how much the base year peak hour is forecast to widen in future year scenarios – a process known simply as '**Peak Spreading**'. It is expected, and generally accepted by experienced hands-on modelling professionals, that there is likely to be some level of peak spreading in future year scenarios as a result of traffic growth, particularly in areas already experiencing high levels of congestion and when forecasting for 10+ years into the future. However, I acknowledge that high levels of peak spreading, resulting in a significantly extended future peak period, is not a desirable outcome. Therefore, I will explore this in more detail below.

3.14 When the Network Performance data (**Tables 3.1** and **3.3**) is analysed for this scheme, it is immediately clear that in all scenario comparisons except one, the network is capable of accommodating increased '**Total Hourly Flow'** of up to almost 600 vehicles per hour. The exception, AM 2032, shows a total hourly reduction of 104 vehicles, representing less than -0.5% reduction when compared against the equivalent Do Minimum results. This is an insignificant difference in modelling terms.

3.15 It is also clear that, although average journey times show some increase in Do Something scenarios when compared to the relevant Do Minimum reference case, the levels of delay and stopped delay remain very similar relative to those average trips. The net outcome can be seen in Tables 3.2 and 3.4 – the '**Comparative Peak Spreading Analysis'**. In summary, there are between 2-3% increases in the levels of '**% Latent Demand to Total Demand'**, between the Do Minimum and Do Something scenarios for each future year.

3.16 This amounts to equivalent real-world increases to the length of the peak hour itself (the '**% Latent Demand to Total Demand'** as a percentage of an hour), when compared against the relevant Do Minimum scenario, of between 70-97 seconds, or approximately a 1-1.5 minute peak hour extension. It is clear that this is not a significant level of peak hour spreading.

3.17 Although micro-simulation models are, of course, designed to operate and be assessed in a relatively high level of detail, it is usually accepted that when you are looking up to 12 years into the future, rationality and pragmatism should be applied.

3.18 This should include a wider acceptance of the level of granularity/realism a simulation can ever really represent – when your comparisons are providing differences in the low single-digit percentages at a network wide level, this is generally accepted to be the level where *'background-noise'* is starting to be present in the results i.e. the differences start to look less and less like they should be viewed as having any real significance. '*Background-noise'*, in this example, is a term used to describe the level of distortion or variability within the data. When looking at quite small differences between large datasets, the likelihood that the differences being described are actually just distortion or variability within the data increases. These differences are then increasingly unlikely to represent anything of real significance.

Local Route Performance

3.19 The assessment of journey times on key local routes is one of the most relatable types of detailed model output analysis. It describes the comparative experience of actually travelling within the network, including any impact that may arise from queuing. The clear summary to be taken from this data is that almost all comparative differences are either in the low, single-digit percentage increases, where there is any increase at all, or show varying degrees of improvement, particularly in the evening peak.

3.20 Even in the three locations (A49 southbound, A50 Long Lane, Cromwell Avenue) which, during the morning peak, show a slightly larger journey time increase, when the size of the modelled link is considered (all between 1-3km), the difference is shown to be insignificant – i.e. 42 to 88 seconds.

3.21 '**Journey Time**' data is widely accepted by experienced modelling professionals as being one of the most representative, and therefore important, tools to assess scheme impacts. This is one of the most relatable and reliable ways to convey the relative difference of how being in the network, in a vehicle, will actually be experienced.

3.22 It should be noted that other data, such as queue length analysis, can be difficult to convey (and easy to misinterpret) as the software handles it in a very different manner to a human on-street. It should also be noted that there is no UK standard for validating or calibrating models to queue lengths. However, it is recognised that journey time comparisons include for the effect queuing traffic has on the network.

3.23 **Tables 3.5** and **3.6** on the following pages show a comparative summary breakdown of network journey times on key routes, for the morning and evening peak periods, respectively. As set out previously, 2032 data has been highlighted and will be the focal point for discussion within this evidence, as it is considered the most relevant to the likely lifecycle of the Peel Hall development.

	STRATEGIC HIGHWAY				LOCAL ROAD			
AM 2022 - 08:00 - 09:00	A49 SB	A49 NB	M62 EB	M62 WB	Cromwell Avenue approach	Sandy Lane West approach	Long Lane approach	Hawley's Lane approach
Do Minimum	760s	514s	695s	305s	167s	129s	285s	71s
Do Something (M4 Mit)	893s	486s	753s	273s	168s	174s	417s	110s
Average Journey Time Difference (s)	133s	-28s	57s	-32s	1s	45s	132s	38s
Average Journey Time Difference (%)	17%	-5%	8%	-11%	0%	35%	46%	54%
AM 2027 - 08:00 - 09:00	A49 SB	A49 NB	M62 EB	M62 WB	Cromwell Avenue approach	Sandy Lane West approach	Long Lane approach	Hawley's Lane approach
Do Minimum	860s	584s	903s	385s	186s	167s	427s	62s
Do Something (M4 Mit)	965s	516s	928s	305s	280s	179s	506s	50s
Average Journey Time Difference (s)	105s	-68s	25s	-80s	94s	12s	80s	-12s
Average Journey Time Difference (%)	12%	-12%	3%	-21%	50%	7%	19%	-19%
AM 2032 - 08:00 - 09:00	**A49 SB**	**A49 NB**	**M62 EB**	**M62 WB**	**Cromwell Avenue approach**	**Sandy Lane West approach**	**Long Lane approach**	**Hawley's Lane approach**
Do Minimum	**1014s**	**739s**	**721s**	**342s**	**317s**	**200s**	**587s**	**83s**
Do Something (M4 Mit)	**1102s**	**600s**	**743s**	**349s**	**359s**	**204s**	**633s**	**77s**
Average Journey Time Difference (s)	**88s**	**-139s**	**22s**	**8s**	**42s**	**3s**	**46s**	**-6s**
Average Journey Time Difference (%)	**9%**	**-19%**	**3%**	**2%**	**13%**	**2%**	**8%**	**-8%**

Table 3.5 Journey Time Summary – Network AM Peak Analysis

	STRATEGIC HIGHWAY				LOCAL ROAD			
PM 2022 - 17:00 - 18:00	A49 SB	A49 NB	M62 EB	M62 WB	Cromwell Avenue approach	Sandy Lane West approach	Long Lane approach	Hawley's Lane approach
Do Minimum	524s	626s	372s	281s	146s	185s	593s	298s
Do Something (M4 Mit)	510s	654s	346s	285s	151s	132s	701s	342s
Average Journey Time Difference (s)	-14s	28s	-26s	4s	5s	-53s	108s	45s
Average Journey Time Difference (%)	-3%	4%	-7%	2%	3%	-29%	18%	15%
PM 2027 - 17:00 - 18:00	A49 SB	A49 NB	M62 EB	M62 WB	Cromwell Avenue approach	Sandy Lane West approach	Long Lane approach	Hawley's Lane approach
Do Minimum	625s	669s	446s	295s	168s	124s	641s	293s
Do Something (M4 Mit)	515s	680s	407s	296s	150s	125s	691s	328s
Average Journey Time Difference (s)	-110s	11s	-39s	1s	-18s	1s	50s	35s
Average Journey Time Difference (%)	-18%	2%	-9%	0%	-11%	0%	8%	12%
PM 2032 - 17:00 - 18:00	**A49 SB**	**A49 NB**	**M62 EB**	**M62 WB**	**Cromwell Avenue approach**	**Sandy Lane West approach**	**Long Lane approach**	**Hawley's Lane approach**
Do Minimum	**686s**	**757s**	**394s**	**324s**	**206s**	**140s**	**770s**	**314s**
Do Something (M4 Mit)	**564s**	**726s**	**430s**	**291s**	**178s**	**132s**	**701s**	**332s**
Average Journey Time Difference (s)	**-122s**	**-31s**	**36s**	**-33s**	**-28s**	**-9s**	**-68s**	**18s**
Average Journey Time Difference (%)	**-18%**	**-4%**	**9%**	**-10%**	**-14%**	**-6%**	**-9%**	**6%**

Table 3.6 Journey Time Summary – Network PM Peak Analysis

	STRATEGIC HIGHWAY				LOCAL ROAD			
AVERAGE 2022	A49 SB	A49 NB	M62 EB	M62 WB	Cromwell Avenue approach	Sandy Lane West approach	Long Lane approach	Hawley's Lane approach
Do Minimum	642s	570s	534s	293s	156s	157s	439s	185s
Do Something (M4 Mit)	702s	570s	549s	279s	159s	153s	559s	226s
Average Journey Time Difference (s)	59s	0s	15s	-14s	3s	-4s	120s	41s
Average Journey Time Difference (%)	9%	0%	3%	-5%	2%	-3%	27%	22%
AVERAGE 2027	A49 SB	A49 NB	M62 EB	M62 WB	Cromwell Avenue approach	Sandy Lane West approach	Long Lane approach	Hawley's Lane approach
Do Minimum	742s	627s	674s	340s	177s	146s	534s	178s
Do Something (M4 Mit)	740s	598s	667s	300s	215s	152s	599s	189s
Average Journey Time Difference (s)	-2s	-29s	-7s	-40s	38s	6s	65s	11s
Average Journey Time Difference (%)	0%	-5%	-1%	-12%	21%	4%	12%	6%
AVERAGE 2032	**A49 SB**	**A49 NB**	**M62 EB**	**M62 WB**	**Cromwell Avenue approach**	**Sandy Lane West approach**	**Long Lane approach**	**Hawley's Lane approach**
Do Minimum	**850s**	**748s**	**558s**	**333s**	**262s**	**170s**	**678s**	**199s**
Do Something (M4 Mit)	**833s**	**663s**	**587s**	**320s**	**268s**	**168s**	**667s**	**205s**
Average Journey Time Difference (s)	**-17s**	**-85s**	**29s**	**-13s**	**7s**	**-3s**	**-11s**	**6s**
Average Journey Time Difference (%)	**-2%**	**-11%**	**5%**	**-4%**	**3%**	**-2%**	**-2%**	**3%**

Table 3.7 Journey Time Summary – Daily Network Average (average peak data) Analysis

A49 Southbound		
VISSIM Daily Variation	Do Min (Sig Opt)	Do Som (M4 Mit)
AM 2022	275.4s	413.5s
AM 2027	272.3s	362.2s
AM 2032	331.1s	388.6s
PM 2022	113.7s	103.8s
PM 2027	213.8s	146.9s
PM 2032	313.7s	230.0s

Table 3.8 Daily Variation in Journey Times – Difference between VISSIM MIN & MAX Timings

3.24 If the data from the AM and PM peaks is combined, it allows the creation of an average '**Daily Network Average Analysis'**, as can be seen in **Table 3.7.** This clearly demonstrates that when viewed as representative of overall average daily performance, there is little change by 2032, although a lot of comparisons actually show small percentage improvements to the network within the Do Something scenario as a result of the mitigation measures proposed i.e. greater impact than nil-detriment across the network.

3.25 It is therefore clear for the majority of the strategic road network (A49 and M62) in all scenario comparisons, that there are not significant increases to journey times as a result of the Peel Hall development and proposed mitigation measures. The exception to this is the A49 southbound during in the AM peak although in 2032 this is only an increase of 88 seconds over a 3km stretch of congested network. This is well within the daily variation of travel time – as shown through the running of multiple '**Random Seed**' model runs in VISSIM, a process aimed at, and widely accepted as, replicating daily variation as shown in **Table 3.8** – and is entirely resultant of two factors.

3.26 The first is outside of the control of this model, as it is a fixed constraint at the southern A49 exit from the model, installed by agreement during base model validation to replicate site conditions resultant of queuing and delays further to the south, heading towards Warrington centre. Due to this being in the signed-off 2019 base year modelling, as part of the highway authority approved validation process, its effects are also an inherent part of all future modelling. As a result, as the peak progresses, queuing extends back further and further into the model, affecting the Long Lane/Hawley's Lane junction and the A49 southbound approach to it.

3.27 The second is a result of changes to the signal control strategy made by me during the model optimising of this scheme. This involves some degree of intentional queue relocation in the corridor as follows:

i. From the southbound A49 approach to the A49/Sandy Lane West/Cromwell Avenue junction (that extends back to M62 Junction 9)
ii. Relocated to the A49 southbound approach into the M62 Junction 9

3.28 Although this does create longer queuing conditions in the northern section of the model extents than the equivalent queue levels in the optimised Do Minimum scenario models, the strategy is intended to ensure that southbound queue levels on the A49 to the south of M62 Junction 9 do not ever reach back to M62 Junction 9, the motorway off slips and ultimately the M62 mainline itself. This level of queuing is clearly a significant highway safety issue and a recognised situation which occurs already, in reality, as well as in the existing validated base year and the Do Minimum models (with and without signal strategy optimisation in future years).

3.29 This creates a measurable increase in comparable queuing levels when reviewing the output data, and therefore journey times (55 seconds over 1km and 88 seconds over 3km) on the southbound A49 approach to the M62 Junction 9. It was considered that this was a much safer location for the queue storage, if it has to go anywhere, where there is no risk of having slow moving or even stationary traffic extending onto and along the M62 mainline.

3.30 Slow moving or stationary traffic extending onto and along the M62 mainline is clearly a situation that would create a very high risk of accidents given the speed and volumes of traffic through the motorway mainline.

3.31 For the local road examples included in these tables, there is more variety in results. Although the local road network is clearly very important, the initial network signal optimisation strategy included for the fact that the volume of traffic on these roads represents a small percentage of network total. In this instance, from the M62 south, within the model extents the volume of traffic on local roads represents approximately 11% of the total including strategic highways.

3.32 The aim of the modelling is to minimise delay where possible and prioritise the strategic highway. This is mandatory in terms of impact on the motorway and the obvious choice for the A49, as this strategy stood to create the most benefit for the most people, meaning some additional delay being inevitably created on local roads.

3.33 Predominantly, in 2032, this delay on the local network is seen in the morning peak only e.g. on Cromwell Avenue (increase in delay of 42 seconds or 13%, over a link length of 1.1km) and A50 Long Lane (increase of 46 seconds or 8%, over a link length of 1.5km). Generally, the larger increases in journey time as a result of delay are the result of just two factors which need considering when interpreting the results.

3.34 Firstly, traffic travelling along Long Lane towards the A49 is heavily affected by the conditions detailed in **paragraph 3.26** i.e. the southbound queuing on the A49, stemming from delays outside the model extent but blocking back to and beyond the A49/Long Lane/Hawley's Lane junction. As this is exit arm blocking, it cannot be remedied through a simple reassignment of signal green time to the Long Lane approach.

3.35 Secondly, traffic travelling along Sandy Lane West towards the A49 is affected by delays away from the A49 junction mouth. During the validation exercise, journey time data made it very obvious that there is a measurable level of current delay experienced approximately halfway along the modelled link that is Sandy Lane West. This location is discussed in greater detail in **paragraphs 3.37** to **3.51.**

3.36 It is important to note that both Cromwell Avenue and A50 Long Lane are longer within the model than the model extents illustrated in the November 2019 methodology, a change carried out with full agreement. Given the length of these links, the delays highlighted in **paragraph 3.33** are very small and therefore not significant when considering driver experience over these lengths.

Sandy Lane West

3.37 This location has required more detailed analysis and description, as the modelled link, taken from validated base year data ONLY covers the geographic area of Sandy Lane West itself i.e. 300m between A49 Winwick Road and the Cotswold Road/Cleveland Road/Sandy Lane roundabout. As a result, any assessment of vehicle volumes, queue lengths and journey times beyond this 300m link are happening in the model on an artificial, straight-link extension, unrelated to underlying geometry. The relevant data which can be analysed for this link shows very little change to journey times in either the morning (+3 seconds) or evening (-9 seconds) peak periods in the 2032 Do Something models (this is demonstrated in **Tables 3.5** and **3.6**, with the network average in **Table 3.7** showing an overall average decrease of 3 seconds).

3.38 On Sandy Lane West, there are a number of side road access junctions, as well as an access junction to a relatively recently built local retail park (which includes an Aldi and Stonemill carvery), in very close proximity to the A49 junction as detailed in **Figure 3** on page 22 – it was considered a reasonable assumption that these were the likely origin of the delays showing in the journey time data, so a fixed constraint was created to recreate site conditions. This can be observed in the model video submission (Core Document APP37).

3.39 When future growth was added to the model, the validated link, which is just 300m in length to reflect Sandy Lane West which is itself only 300m long, reached a point of being unable to accommodate additional traffic flow due to the fixed constraint used to replicate base model delays, despite overall journey times being maintained or improved on in 2032.

3.40 This was not seen to be a result of capacity at the stop line entering the junction with the A49 – if there was not the point of delay caused by the fixed constraint/real-life conflict point halfway along Sandy Lane West, there would be scope to assign additional green time to this approach at the junction, increasing throughput and reducing the modelled delay on Sandy Lane West.

3.41 Further consideration has been given to traffic flows on and along Sandy Lane West (see **Appendix LB/5**, HTp TN/25/B). This report from Highgate Transportation shows that traffic associated with the residential area to the immediate south of the appeal site is demonstrated to be low, accounting for a maximum of 1.5 vehicles per minute travelling to and along Sandy Lane West in the busiest peak hour, with less at other times. Given this, it is clear that over three quarters of traffic forecast on and along Sandy Lane West westbound are unlikely to be associated with the existing residential area and that Peel Hall development-related trips are of a similar magnitude i.e. around 1.5 vehicles per minute. As such, it can be strongly concluded that this significant additional traffic flow in the future years modelling is rat running traffic causing and experiencing the delay.

3.42 Additionally, when the Do Something models are assessed visually, it is immediately obvious how low a proportion of overall traffic flow is made up of Peel Hall development traffic (shown as red vehicles). **Figure 2** shows a single screen shot of the accompanying video file (Core Document APP37).

Figure 2 – PM Peak 2032 Model screenshot (red cars are development traffic)

3.43 Furthermore, the above **Figure 2** shows that there is obvious capacity at the front of the queue at the Sandy Lane West stop line with the A49 roundabout.

3.44 The three figures on the following pages aim to demonstrate that there are existing conditions already responsible for creating delays within the present conditions, on the ground. There are multiple junctions within very close proximity to the Sandy Lane West stop line at the A49, as can be seen in **Figure 3**. It can clearly be seen in the photograph (taken from Google StreetView) in **Figure 4** that there are multiple conflicting movements, a situation confirmed by the large dataset of detailed TomTom-based journey time measurements used for validation. **Figure 5** shows an aerial photograph taken in 2013, showing how recently the Aldi site was unoccupied.

3.45 Taking the factors discussed here into consideration, it became clear that the Warrington Borough Council's WMMTM16 strategic model had no such conflict points, fixed constraints or even delays on this link. This needs to be considered when assessing the performance of this link in future year VISSIM scenarios.

3.46 As the VISSIM model was validated for the 300m length of Sandy Lane West, it can be used to provide a fair assessment of comparative journey time performance in future year scenarios. This comparison shows that in 2032, there is no material worsening of performance and, in the evening peak, there is actually a small improvement to journey times.

3.47 If queue data is viewed, it is clear in 2032 that all modelled scenario queue lengths quickly extend beyond the length of the validated Sandy Lane West link. Although this can still provide a comparison of sorts, it stops being any sort of exact measure as it is then unknown how the slow-moving traffic flow will be distributed across the three different approaches to the Cotswold Road/Cleveland Road/Sandy Lane/Sandy Lane West roundabout, as well as all of the many links subsequently connecting to these links.

3.48 **Figures 6** and **7** show this comparative queue data for the 2032 future year models. In order to provide context, the Do Minimum results minus any signal optimisation are provided, i.e. with base year signal timings. This clearly demonstrates That the Do Something performs better than the non-optimised model, in both peaks.

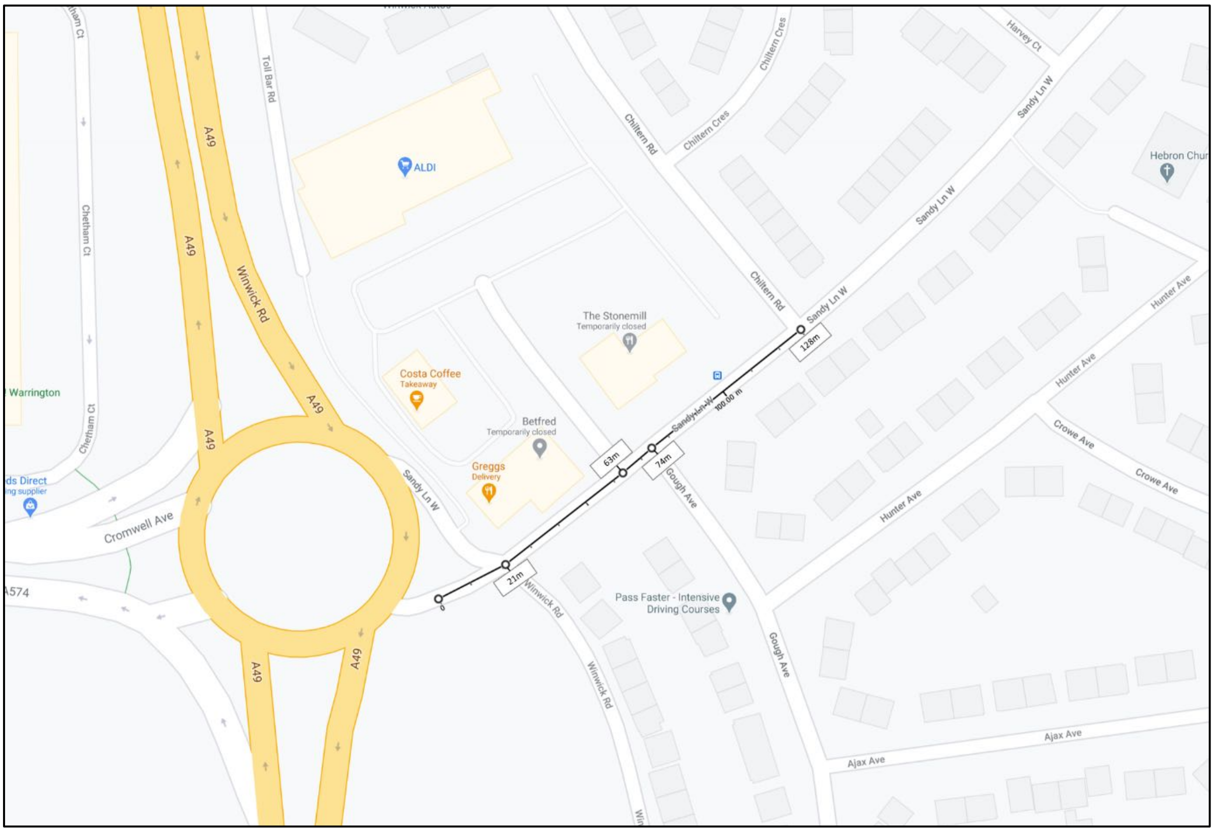


Figure 3 – Map showing four connections to/from Sandy Lane West within 130m of the Sandy Lane West stop line, including a retail park within 65m

Figure 4 – Example of current busy conditions causing delays on Sandy Lane West in the modelling with or without the Peel Hall development

Figure 5 – Aerial photograph showing the Aldi site prior to its redevelopment

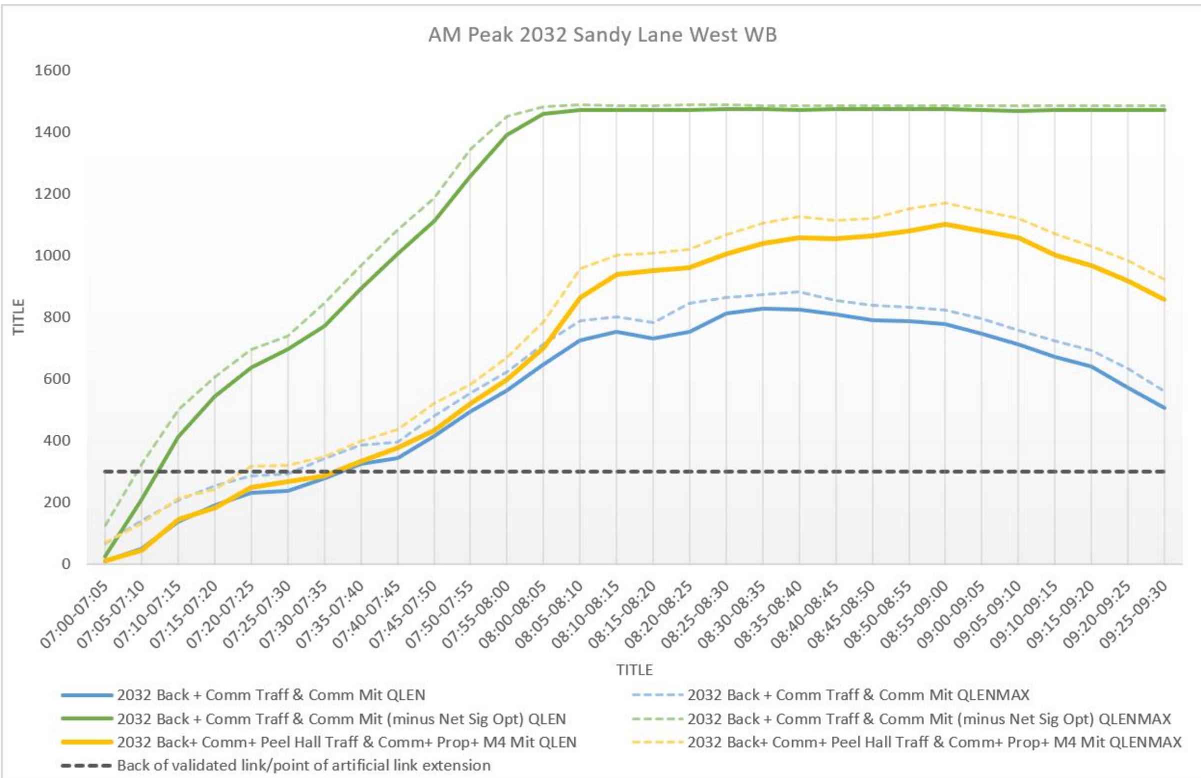


Figure 6 – AM 2032 Scenarios - Comparative queue length data

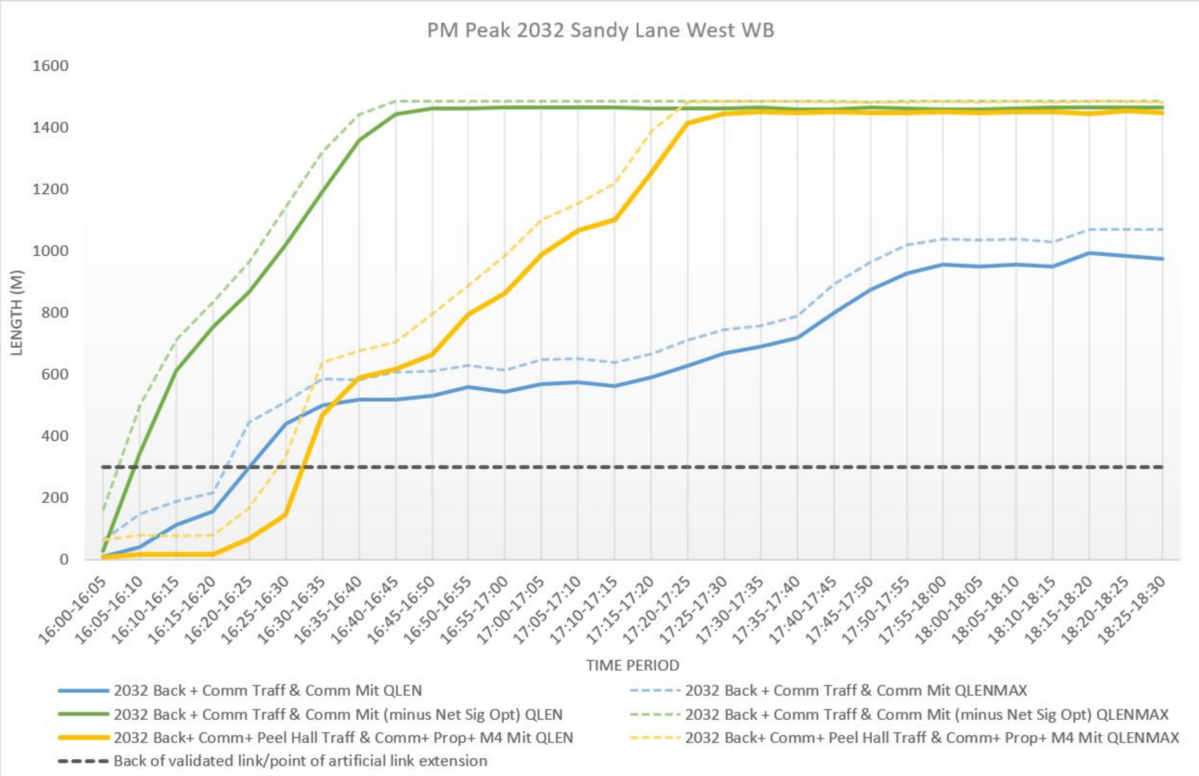


Figure 7 – PM 2032 Scenarios - Comparative queue length data

3.49 Even with an allowance for all of the factors detailed here, it is still important to note that **Table 3.5** on Page 14 (Journey Time Summary – Network AM Peak Analysis) it can clearly be seen that the 2032 data shows that there is only a comparative 3 seconds increase to delay on this link – an insignificant 2% raise in journey times.

3.50 It is also important to highlight that any queue data beyond the 300m length of Sandy Lane West itself, is created on an artificial link extension. As a result, the maximum queue length in the modelling of 1,400m (i.e. an extra 1,100m) shown on the queue charts (**Figures 6** and **7**) is not representative of an actual queue, but an aggregate of all of the many links feeding into and leading up to each of the three other approach arms to the Cotswold Road/ Cleveland Road/ Sandy Lane/ Sandy Lane West junction.

3.51 As is demonstrated in **Figure 4.1 (a-e)** in Dave Tighe's supplementary evidence, historical average data taken from Google traffic supports that there is over 1,100m of aggregate queuing traffic approaching this junction now, in the current situation. Therefore, the queue lengths recorded in VISSIM are not considered to represent development impact that cannot be mitigated.

Summary

3.52 In summary, it is considered that the results clearly demonstrate that the primary focus of ensuring minimal impact and continued or improved performance for traffic travelling on the strategic corridors of the A49 and M62 has been achieved.

3.53 Although there are some impacts observed in the model outputs, these are resultant of existing issues to the south of the corridor, outside this modelled area. Equally, impact to the performance of some side roads on the local road network is evident, but within the overall context of network wide performance it can be seen that data outputs are very similar or often improved when comparing the same peak scenarios.

4.0 Matters Arising

4.1 A number of matters have been raised by WSP as queries requiring further explanation. These primarily focus on the specific details of some signal controller set-up/timings used, delays to two links (Sandy Lane West and Long Lane) within the local road network and the issue of '**Latent Demand**'.

4.2 Although further detail is provided as an answer to each query, there is an overarching response worth making first. Although it is, of course, important to ensure that operation of signal controllers (as with any modelled element) is accurate and that any changes and optimisations made are justifiable. It is also important to note that this exercise is a preliminary one, to establish feasibility.

4.3 All UK national guidance is followed for modelling and signal timing changes; however, no element is meant to be prescriptive in detailing exactly how the proposed changes would actually operate on site. This central context is important when deciding what level of detail critique of methodology and results should be assessed to.

4.4 **Paragraphs 2.19** and **2.20** set out the matters raised by Warrington Borough Council and these are now addressed in turn. The grey text in quotes is taken from WSP's TN12 (January 2021, Core Document APP35) summary.

i. **Is it reasonable to expect that forecast demand in VISSIM should be consistent with SATURN WMMTM16, in all zones?**

"Forecast demand in VISSIM is not consistent with Saturn in some zones. These zones include Sandy Lane West and Junction Nine Retail Park. Trips from/to these zones are underestimated, therefore the impact of the development may not be fully reflected in the models."

4.5 No, it is not reasonable to expect that forecast demand should be consistent with WMMTM16 in all zones.

4.6 There are existing demand differences between SATURN WMMTM16 and VISSIM, however, this is a direct result of following the exact methodology, as agreed to by all parties, regarding the strict conversion process from SATURN WMMTM16 to VISSIM.

4.7 It should also be noted that SATURN WMMTM16 has separate distributions for Do Minimum and Do Something scenarios. The methodology detailed a process designed to ensure that all SATURN WMMTM16 future year outputs were adjusted to be relevant and proportional to the VISSIM base year flows, which were validated to a higher level of precision, being a microsimulation model.

4.8 As a result, these differences to forecast demand can be seen throughout the model but are not inconsistencies, just a valid result of the methodology used.

ii. **Does the M4 Mitigation at Cromwell Avenue create a demonstrable safety issue for merging vehicles?**

4.9 No. There is a lower volume of merging movements made in the Do Something (M4 Mitigation) model than is found in the comparable Do Minimum model, with the existing highway layout. Data was output from the PM 2032 model scenarios (as a worst case due to highest vehicle volumes on link) for the purpose of comparison and showed a clear reduction in merging vehicle volumes. **Figure 8** shows a single screen shot of the accompanying video file (Core Document APP43).

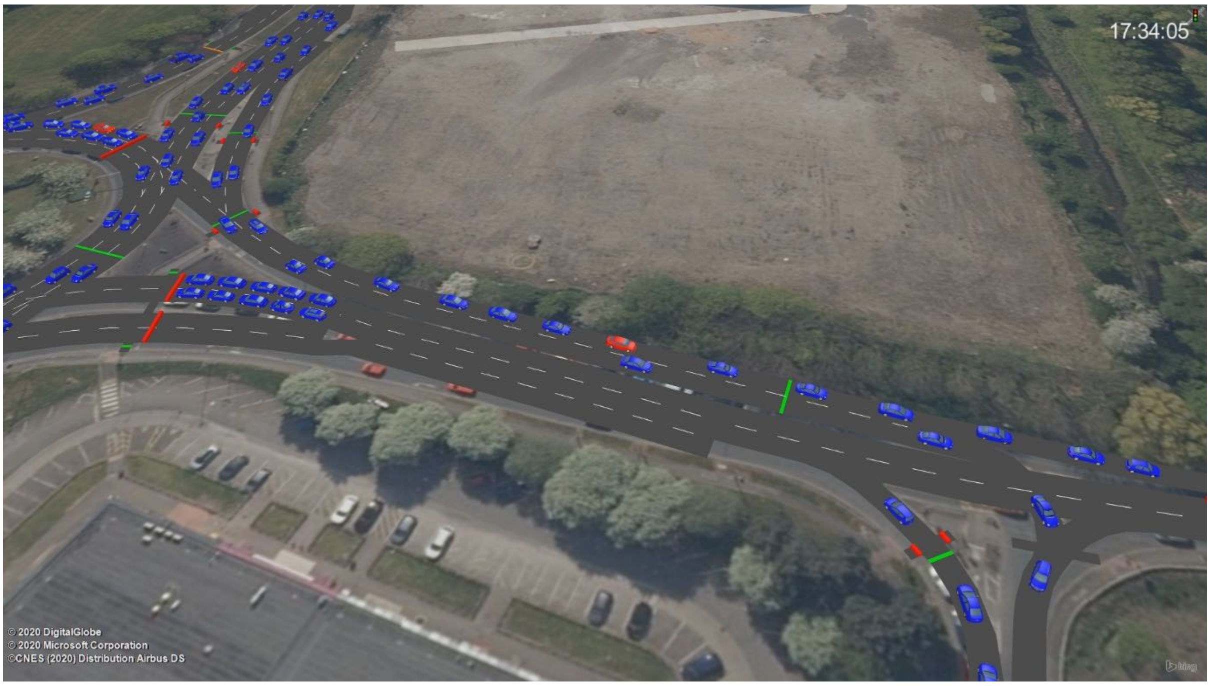


Figure 8 – PM Peak 2032 Model screenshot showing operation of Cromwell Avenue (view from North to South)

4.10 Measurements taken from the PM Do Minimum 2032 model show that there are approximately 90-135 lane changes made per hour, equating to almost 2-3 lane changes per cycle (signals run 70 second cycle time). Comparable data taken from the PM Do Something M4 2032 model shows approximately 45-60 lanes changes per hour, equating to just over 1 lane change per cycle. This is as a direct result of the proposed mitigation layout as part of the future years modelling package.

4.11 The lane change manoeuvres in the Do Minimum model are resultant of the current highway arrangement and are predominantly vehicles from the northbound A49, turning left onto Cromwell Avenue using the single A49 filter lane and merging into the offside lane of Cromwell Avenue to turn right at Calver Road. It can be noted from Dave Tighe's supplementary evidence (**paragraph 4.26-4.27**) that there has been no recorded accident pattern involving merge/side-swipe type PIA in this location.

4.12 In the Do Something model, however, these vehicles are able to use the dedicated lane of the proposed A49 left-turn mitigation. The lane changes observed in the modelling are therefore predominantly vehicles from the northbound A49, aiming to head westbound on Cromwell Avenue, but changing lanes after they have gone through the signal stopline, on Cromwell Avenue itself.

4.13 In the Do Something modelling i.e. with mitigation, the average occurrence of lane changing is only around 1 vehicle each signal cycle (much less than the equivalent Do Minimum), and with approximately 130m from stop line to stop line to merge, it is not considered that this will create a demonstrable safety issue and is in fact evidenced from the modelling to be an improvement in highway safety terms. See Dave Tighe's supplementary evidence regarding Road Safety Audit Stage 1 and Designer's Response (**paragraph 4.28**).

iii. **Is the signal timing optimisation at the M62 Junction 9 appropriate?**
Signal timing optimisation at the M62 Junction 9, where the concern raised is "that the optimisation [...] prioritises the approach arms over the circulatory carriageway of the roundabout. Thus, vehicles are less likely to get a "green wave" on the circulatory carriageway and this will lead to increased stopping and starting."

4.14 The WSP summary statement is just not true. Signal timings at the M62 Junction 9 are considered appropriate through the application of any fair measure of suitability. There is full compliance with UK national standards regarding the setup of signal timings. Added to this, the "green wave" mentioned by WSP is still present for all key traffic movements. An exercise to balance the prioritisation of approach arms and ensure better use of the available internal storage space within the junction has been carried out, this has been guided by repeatedly observing the VISSIM runs, and the results still clearly demonstrate comparable/improved junction performance for the majority of movements/uses of this junction.

4.15 Using data outputs available in the model and spreadsheet analysis supplied, an exercise to compile the model queue data outputs from all scenarios, for internal stoplines at M62 Junction 9, has been undertaken for the inquiry to show localised modelled performance. Details can be seen in **Appendix LB/3** and **LB/4**. These charts show the comparative performance of the different future year models; the Do Minimum scenarios, modelled both with and without signal optimisation, and the Do Something scenarios. There is also a clear indication of the point at the rear of each signal stop line approach, beyond which queuing traffic could cause some level of conflict and/or delay.

4.16 In summary, it is clear that at worst, the signal optimisation strategy used gives comparable performance when the junction is viewed as a whole. There are, in addition, a number of locations in different scenarios where leaving the timings as they are currently setup in the validated base year models (i.e., non-optimised) clearly demonstrates that certain movements are being prioritised to the detriment of other movements – meaning the junction as a whole is performing less well without signal optimisation.

4.17 In specific regard to the key query raised about providing a “green wave”, this is indeed an important consideration for any junction like this with internal stoplines and was considered in detail during the optimisation process.

4.18 As can be seen in **Figure 9**, in the morning peak, if the primary A49 southbound movement is followed through the junction, **Phase H** (A49 Newton Road southbound stopline) starts at 39 seconds in the cycle, then the released traffic leads onto **Phase C** (on the roundabout, next to the M62 west off-slip), which starts 7 seconds later. When the distance between stoplines is considered, this is a green wave.

4.19 Other key movements also have a green wave to assist in traffic passing through the junction in one go, where possible. Another example is the A49 northbound movement. This starts with **Phase F** (A49 Winwick Road northbound stopline), at 42 seconds in the cycle. Released traffic moves north over the roundabout, to **Phase A** (on the roundabout, next to the M62 east off-slip), which starts 11 seconds later. When the distance between stoplines is considered, this can certainly be considered as a green wave.

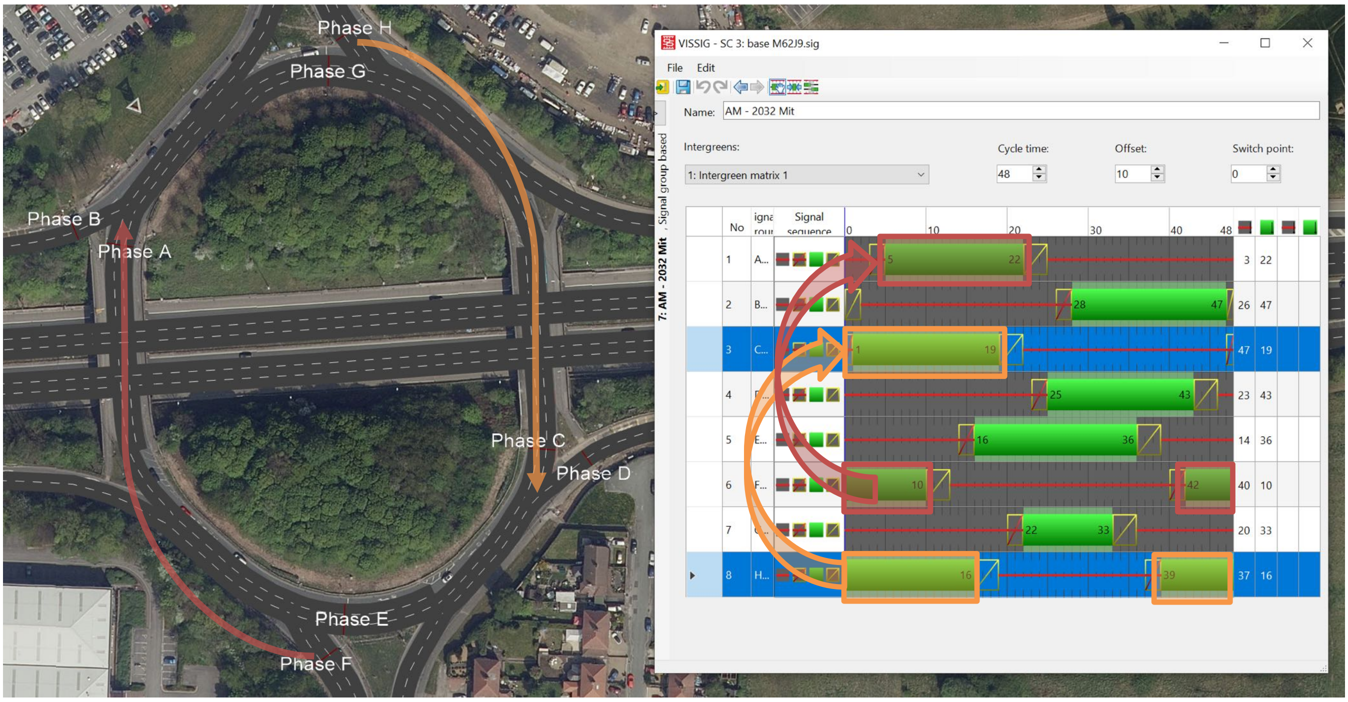


Figure 9 – AM 2032 Proposed with Mitigation (M4) – M62 Junction Signal Timings Used

4.20 During the evening peak, as can be seen in **Figure 10**, when the primary A49 northbound movement is followed through the junction, **Phase F** (A49 Winwick Road northbound stopline) leads onto **Phase A** (on the roundabout, next to the M62 east off-slip). Phase F starts at 3 seconds in the cycle, with Phase A starting seven seconds later at 10 seconds – this also demonstrates a green wave, designed to flush traffic through the junction.

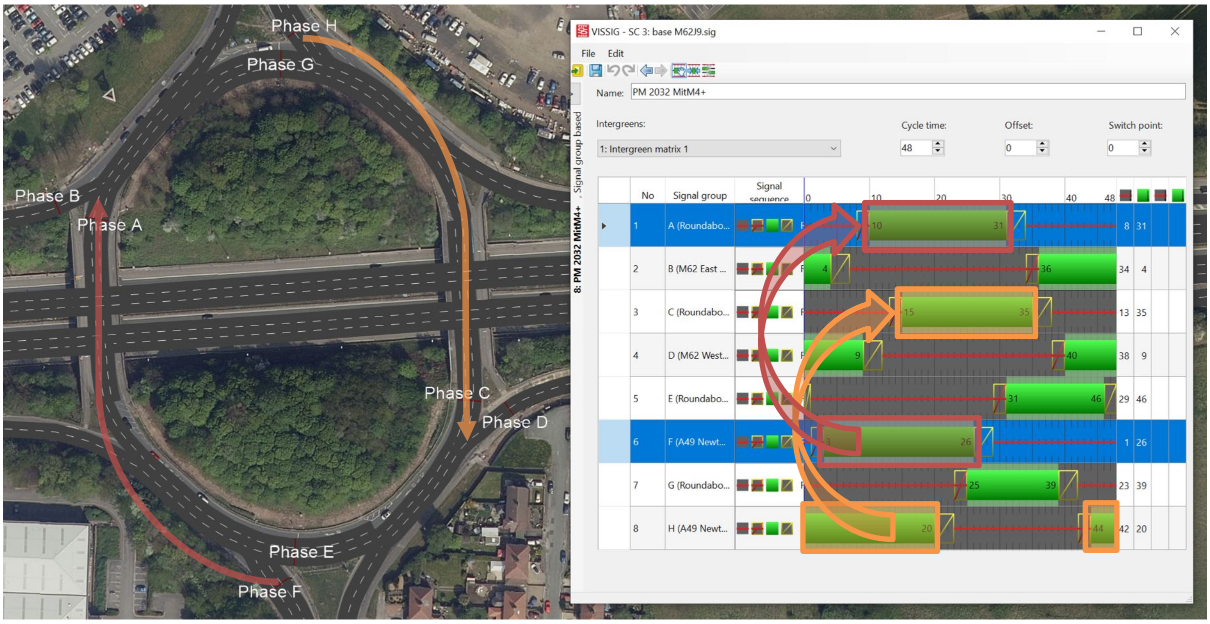


Figure 10 – PM 2032 Proposed with Mitigation (M4) – M62 Junction Signal Timings Used

4.21 This approach has been used in all scenarios. There are examples where there are larger or smaller overlaps in the amount of time both phases run together, however this is based on the sum total of literally hundreds of hours of modeller time spent watching different variants of the models running, all the way through the peak times, often in real-time.

4.22 This approach is similar to the approach taken by signal engineers in reality i.e. to take an initial set of timings suggested through modelling, then to spend time tweaking and assessing the impact in real conditions in order to fine tune to site conditions and driver behaviour. This is exactly what has been attempted to be replicated, to as high a level of detail and refinement as possible in these micro-simulation models.

4.23 The key overarching point in response to the original query of "Is the signal timing optimisation at the M62 Junction 9 appropriate?" is 'Yes'. It has been optimised within the bounds of national guidelines, as part of a lengthy process of optimising the entire network, in an attempt to provide a balanced improvement to as many users of the road network as possible.

4.24 Every attempt has been made to ensure this remains safe and is also representative of what should be achievable on site, however it is worth emphasising that in reality, on the ground, the signals on site are constantly being optimised by a MOVA controller, and this will be the case in the future, meaning that if anything, performance should be better, by anything up to 10%, than the performance demonstrated in this modelling exercise, as a result of it using less flexible, fixed-time signal plans used for the purposes of testing.

iv. **Is the signal timing optimisation at the A49/Cromwell Avenue/Sandy Lane West junction appropriate?**

Signal timing optimisation at the A49/Cromwell Avenue/Sandy Lane West junction where the concern raised is "that the optimisation [...] prioritises the approach arms over the circulatory carriageway of the roundabout. Thus, vehicles are less likely to get a "green wave" on the circulatory carriageway and this will lead to increased stopping and starting." A discussion between WSP model auditors and Warrington UTC signal engineers is also detailed – the conclusion made by the WSP auditor is that "The response from Warrington UTC would cast doubt on whether this signal optimisation would actually work when implemented on site, as extensive signal time optimisation has already been undertaken." Finally, there is also the concern that "The comparisons of latent demand and queue lengths on Sandy Lane West indicate the development impact cannot be mitigated on this link in the PM peak in 2027 and 2032."

4.25 Signal timings at the A49/Cromwell Avenue/Sandy Lane West junction are considered appropriate through the application of any fair measure of suitability. There is full compliance with UK national standards regarding the setup of signal timings. Added to this, the "green wave" mentioned is still present for all key traffic movements.

4.26 An exercise to balance the prioritisation of approach arms and ensure better use of the available internal storage space within the junction has been carried out, this has been guided by repeatedly observing the VISSIM runs, and the results clearly demonstrate comparable/improved junction performance for the majority of movements/uses of this junction.

4.27 The point raised suggests that the optimisation carried out has been to prioritise the approach arms at the expense of green waves to flush traffic right through the junction. As with the previous junction where a similar point was made, the response has to be simply that the contention that approach arms have priority over the circulatory carriageway is just not true.

4.28 As can be seen in **Figure 11**, if the primary morning peak A49 movements are followed through, **Phase M** (A49 Winwick Road Southbound) has a good green wave onto **Phase N** (Roundabout at Sandy Lane) when the distance between stoplines and the fact that the storage space is clearly flushed through first is also considered. **Phase B** (A49 Winwick Road Northbound) also has a good green wave onto **Phase H** (Roundabout at Cromwell Avenue) when the distance between stoplines is considered.

4.29 **Figure 12** shows the same junction signal timings, but for the evening peak. If the primary A49 movements are followed through, **Phase B** (A49 Winwick Road Northbound) has a good green wave onto **Phase H** (Roundabout at Cromwell Avenue) when the distance between stoplines is considered. **Phase M** (A49 Winwick Road Southbound) also has a good green wave onto **Phase N** (Roundabout at Sandy Lane) when the distance between stoplines and the fact that the storage space is clearly flushed through first is also considered.

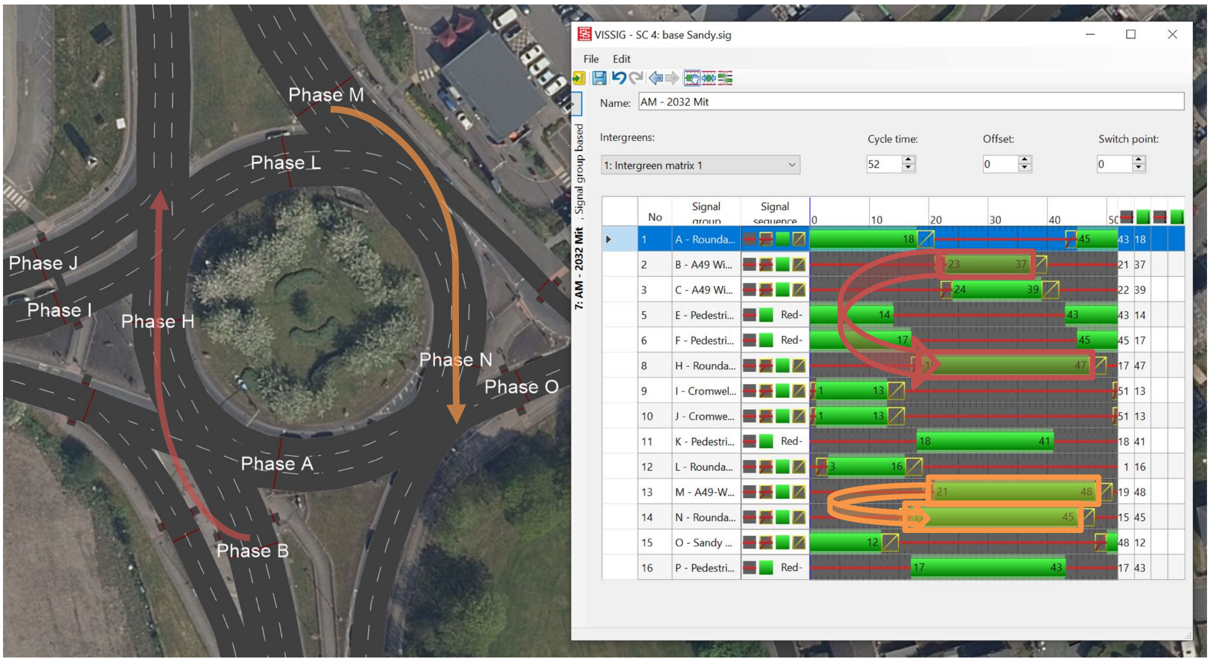


Figure 11 – AM 2032 Proposed with Mitigation (M4) – A49/Sandy Lane West/Cromwell Avenue Junction Signal Timings Used

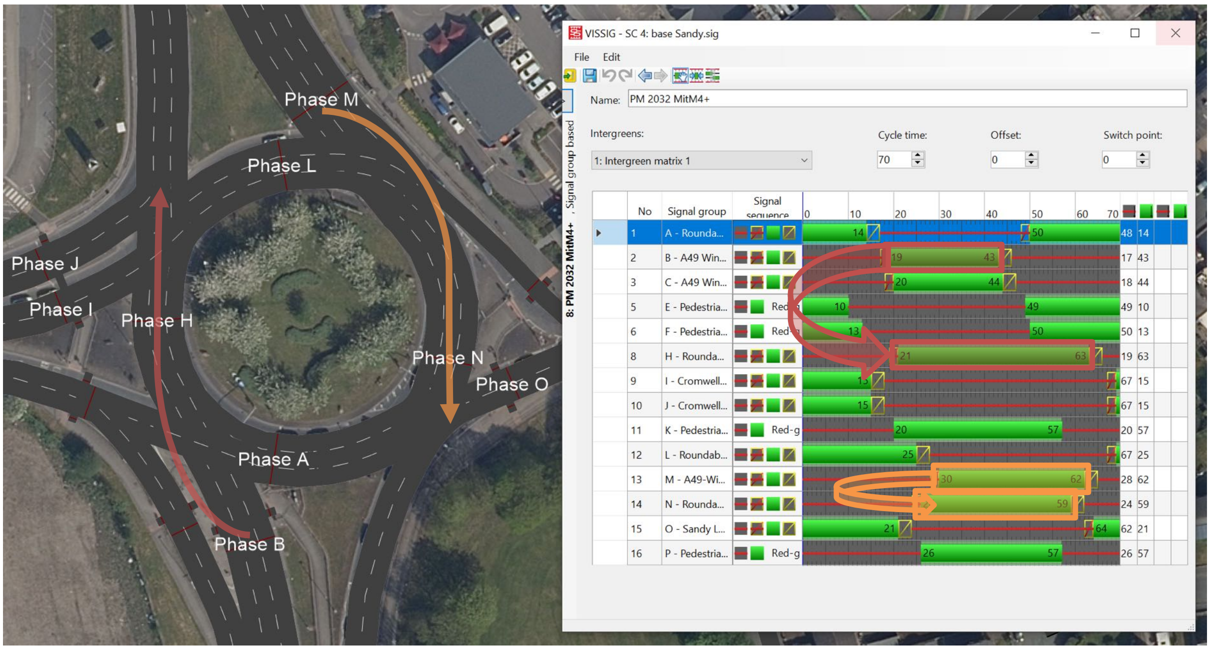


Figure 12 – PM 2032 Proposed with Mitigation (M4) – A49/Sandy Lane West/Cromwell Avenue Junction Signal Timings Used

4.30 The key point to make again is that huge amounts of time have been spent, watching the models run over and over again for each scenario, ensuring that the signal timings used don't just work as hourly averages as found in a lot of modelling packages, but actually take advantage of the attention that can be paid within micro-simulation modelling thanks to the second-by-second level of detail achievable.

4.31 In reference to the second point made in (**iv** – page 32) – the WSP conclusion that their querying of WBC UTC signal engineers resulted in:

> "The response from Warrington UTC would cast doubt on whether this signal optimisation would actually work when implemented on site, as extensive signal time optimisation has already been undertaken."

4.32 It is worth noting that this is not what UTC signal engineers are saying in the quote given – the relevant parts of the actual quote are as follows:

> "The Sandy Lane junction has been looked at in the past and we have spent some considerable time 'honing' the timings [...] The timings are changed throughout the day in response to peak times by introducing different plan timings but also in response to certain conditions reactively by monitoring congestion levels/flows [...]
>
> We consider the current timings to be the optimal ones in achieving the best performance from the junction with congestion at an acceptable and manageable level."

4.33 The UTC signal engineer's actual quote can only refer to previous and present efforts for the exploration of options, which ultimately require monitoring of current conditions with the built-in ability to adaptively change running signal timings between different fixed plans, at different times of day and to suit different conditions. The current timings are therefore considered as optimal, but this can only be read in reference to current conditions, as this is the sum total of what is being discussed.

4.34 The modelling carried out does not set out to change any of these conditions or options already available to the signal engineers. The clear difference though is that the modelled signal operation and specific timings operate in agreed forecast/proposed future scenarios – something that the UTC signal engineers cannot be realistically commenting on regarding optimal timings, unless they have evidence equivalent to this modelling exercise, following a similar future year forecasting process.

4.35 The modelling exercise carried out introduces committed changes to all modelled scenarios, whether Do Minimum or Do Something. It also introduces growth to all scenarios, based on altered flow distributions taken from WMMTM16. For the Do Something models there is also development associated traffic and highway mitigation schemes.

4.36 This equates to considerable, network wide flow changes to traffic patterns around the modelled area, in both peak periods, in each analysed future year scenario. The point of this type of expansive modelling exercise is to take full account of all of the agreed traffic growth, all of the committed and proposed changes to the future network, and to mitigate against and accommodate for exactly these kind of hard-to-predict changes in a manner which can be demonstrated as feasible outcome.

4.37 The remaining point for Sandy Lane (v), and point regarding Long Lane (vi), refer to the same query and are therefore considered together below:

v. **Do the comparisons of latent demand and queue lengths on Sandy Lane West indicate development impact that cannot be mitigated in the PM Peak in 2027 and 2032?**

“The comparisons of latent demand and queue lengths on Sandy Lane West indicate the development impact cannot be mitigated on this link in the PM peak in 2027 and 2032.”

vi. **Do the levels of latent demand and queue lengths on the A50 Long Lane indicate that the impact of the development on this link cannot be adequately assessed?**

The perceived impact for traffic on A50 Long Lane where the concern raised is “Given the level of latent demand and queuing that occurs on Long Lane in all models, the impact of the development on this link cannot be adequately assessed."

4.38 The levels of latent demand and queue lengths visible on these links in some scenarios do not indicate that development impact cannot be mitigated on Sandy Lane West or that development impact on Long Lane cannot be assessed.

4.39 We understand Warrington Borough Council's concern to be with the current conditions on these local roads. The Council's assertion is that because of delays and travel patterns on these links, now and forecast for the future, development impact is unable to be assessed.

4.40 In terms of Sandy Lane West, once you have levels of delay and queue lengths on a link beyond the validated link length, defining the levels of latent demand and delay as caused by the development traffic is incorrect. All scenarios have this issue: 2019 base; Do Minimum; Do Something.

4.41 In terms of Long Lane, levels of queuing only equate to a worst case average journey time increase of 46 seconds in the 2032 morning peak, for the entire 1.5km link length, as a result of similar conditions being experienced in the Do Minimum model. All scenarios are affected by the same cause – i.e. delays caused due to blocking back from further south, at the model extent, on the A49.

4.42 Both locations discussed have delays resulting from future year growth exacerbating existing conditions (fixed constraints) present within the approved, validated base year modelling. These fixed constraints are modelled to include delay conditions away from/outside of the agreed model extents. It is clear that these delays are not linked to the development traffic as they are observed in the respective Do Minimum models.

4.43 On Sandy Lane West, the constraint is resultant of the interaction between multiple small junctions within a very short distance on the A49 approach (see **Figure 3** page 22), and this will be further exacerbated by future year traffic growth, regardless of the Peel Hall development. This is not highlighting that the development impact can't be mitigated. The majority of the westbound traffic flow on this link is not development traffic, and as demonstrated in this evidence (**Appendix LB/5**, HTp TN/25/B) is 'rat-running' traffic.

4.44 For the A50 Long Lane, the modelling highlights an indirect impact of the improved network arising from the Peel Hall mitigation package i.e. more traffic released through the A49 corridor to the south of the model.

4.45 If delays originating from further south than the model extents used for this study remain the same as those found in the validated and approved base model, there will be a gradual process of increasingly greater levels of blocking back affecting the operation of the A49 Winwick Road/A50 Long Lane/Hawley's Lane junction.

4.46 The signal optimisation exercise, carried out for all future year models, has been focussed on achieving the best possible balance of delays, delivering benefits for the highest possible volume of road users whilst minimising impacts wherever possible.

4.47 However, there is clearly a capacity constraint further south on the A49 and Warrington Borough Council as highway authority will need to make a strategic decision regarding the forecast levels of traffic growth and their network south of the Peel Hall study area.

vii. **Is the concern regarding latent demand appropriate?**

Latent demand where the concern raised is "The M4 mitigation produces a minimal change in network performance in the AM peak compared to the DS scenario. In the PM peak the M4 mitigation returns network performance to a level similar to the reference case. However, this is achieved by increasing the amount of latent demand across all modelled years in the PM peak. The majority of this latent demand is in the south of the model, at the A49/A50/Hawleys Lane junction. The presence of the latent demand in the south of the model and the forecast demand issues identified at both Junction Nine Retail Park and Sandy Lane West, would suggest that the performance of the M4 mitigation has not been fully assessed as the A49 NB and junction circulatory flows will be underestimated."

4.48 No, the concern regarding Latent Demand raised by WSP is not appropriate.

4.49 The aim of providing the following data is to simply show what an insignificant variation the latent demand differences between each Do Minimum and Do Something model really are, when put in context. This data certainly should not be considered as providing any evidence of flows within the model being underestimated, or that impacts, and therefore performance of the M4 mitigation package, are in any way not being assessed.

4.50 In all future year models, latent demand as a proportion of total demand increases between the Do Minimum and Do Something models, in the morning and evening peaks, by between 2-3%.

4.51 In modelling terminology, '**Latent Demand**' is a phrase used to describe nothing more complicated than the volume of peak hour demand having to enter the model after the peak hour, due to delays and/or queuing. This phenomenon can also be described as resulting in '**Peak Spreading**' – the process of the peak hour effectively becoming longer than an hour due to the peak hour demand taking longer to get into the model.

4.52 This 'Peak Spreading' can also be measured, as has been demonstrated (pages 9 – 13, **paragraphs 3.6 to 3.18**) all increases in peak spreading are between 70-97 seconds, or approximately a 1-1.5 minute extension to the peak hour period. It is clear that this is not a significant level of peak hour spreading.

viii. **Is the zone distribution from D to G, as raised in WSP TN12 page 6, of significance?**

4.53 No, it is not. The issue raised in regard to the distribution between zones D and G (from Junction Nine Retail Park, to Sandy Lane West) refers to an outcome of the approved flow conversion methodology (May 2020) **Appendix LB2**.

4.54 This process allowed for two different conversion methodologies to be used to calculate all future year flows.

4.55 The first was based on a percentage conversion and is the preferred approach used for most zone pairings. This is the process detailed in WSP TN12 page 6 and shown in **Figure 13** (but also described in the worked example on pages 5-6). The net result of following this agreed approach is an outcome of zero background vehicle trips being assigned to this zone pairing in the VISSIM Do Something PM future year models, with zero being a result of VISSIM not being able to model negative flow values. This is not inaccurate or an error, as the output from WMMTM16 clearly shows in the example in **Figure 13** (row 6), that there is no forecast background traffic making this movement. Development trips are still included, as these are assigned in VISSIM separately.

4.56 The second agreed approach to interpreting the conversion was to use actual WMMTM16 flow values. This was the 'fall-back' option if 'errors' were found during the checking of the percentage flow conversion process. This zone pairing was of course not highlighted, as the agreed methodology did not define negative values as potential 'errors' and has not been previously raised by the audit teams despite being present since early on in the modelling process.

4.57 However, if the data from this zone pairing had been highlighted (see paragraph 4.50) and the actual WMMTM16 flow values had been used instead, there would have been a maximum additional background flow of only three vehicles in 2022 (row 4 in Table 6 below), increasing to only seven vehicles in 2032.

4.58 The result of understanding this context is to see that the zone distribution raised in WSP TN12 cannot be considered to be of any significance when viewed in relation to the agreed flow conversion methodology.

Table 6 Forecasting of lights/car trips from Zone D to G in 2022 PM

	Model	Trips
1	Saturn Base	3
2	Saturn Do Minimum	2
3	Growth from Base to Do Minimum (2/1)	67%
4	Saturn Do Something (inc devs)	3
5	Saturn development trips	6
6	Saturn Do Something (without devs) (4-5)	-3
7	Growth from Base to Saturn Do Something (without devs)	-100%
8	Vissim Base	67
9	Vissim Do Minimum (8*3)	45
10	Vissim Do Something (without devs) (8*7)	-67
11	Adjusted Vissim Do Something (without devs)	0
12	Vissim Do Something (with devs) (5+11)	6

Figure 13 – WSP TN12 Table 6

5.0 Summary and Conclusions

5.1 The process of model development has clearly been longer and more arduous than originally anticipated. The agreed methodology from November 2019 was required to be changed, firstly for the development of the existing 2015 base year modelling in order to accommodate changes to network operation since its original build, and subsequently for the creation of future year flows in order to convert WMMTM16 into a format and level relevant to the developed VISSIM 2019 base.

5.2 Through multiple submissions, in late 2020, base model acceptance and approval was achieved from Warrington Borough Council (WSP) and Highways England (Atkins). Highways England first signed the base model off as fit for purpose on 10th June 2020 (May 2020 submission) as set out in Appendix DT/V4 of Dave Tighe's supplementary evidence, VISSIM Timeline and Chronology TN/31.

5.3 In early January 2021, both audit teams confirmed that the future year modelling provided in the final submission on 2nd December 2020 is technically acceptable.

5.4 2032 data has been highlighted as the focal point within this evidence, as it is considered the most relevant test given the Peel Hall development programme.

5.5 Warrington Borough Council's auditors WSP set out a number of remaining queries regarding the specifics of model operation, optimisation, and outcome. This evidence answers those queries and concludes that:

i. It is reasonable to expect that forecast demand in VISSIM will not be consistent with SATURN WMMTM16 in all zones. This is as a result of the agreed model flow conversion methodology (May 2020).

ii. It is confirmed that the M4 Mitigation at Cromwell Avenue will not create a safety issue for merging vehicles and that the mitigation is demonstrated to actually have a reduction in total number of merge movements recorded in VISSIM per cycle when compared to the Do Minimum modelling. For example, the PM Do Minimum 2032 model shows that there are approximately 90-135 lane changes made per hour. Comparable data taken from the PM Do Something M4 2032 model shows only around 45-60 lane changes made per hour.

iii. The signal timing optimisation at the M62 Junction 9 is appropriate. Changes made from the base VISSIM model setup are small and green waves are maintained or improved upon. Furthermore, the signal controller on the ground at this junction will run constantly optimised MOVA timings and so will provide an even greater improvement to that shown in the modelling. Queue lengths are optimised for the benefit of the majority of the network.

iv. The signal timing optimisation at the A49/Cromwell Avenue/Sandy Lane West junction is appropriate. Changes made from the base VISSIM model setup are relatively small, green waves are maintained or improved upon, and queue lengths are optimised for the benefit of the majority of the network.

v. The comparisons of latent demand and queue lengths on Sandy Lane West do not indicate that development impact cannot be mitigated in the PM Peak in 2027 and 2032. Delays on this link already cause queuing beyond the length of the actual validated length (300m) in the Do Minimum equivalents of both scenarios, indicating a pre-existing condition not resultant of development impacts.

vi. The levels of latent demand and queue lengths on the A50 Long Lane do not indicate that development impact on this link cannot be adequately assessed. Journey time data shows an increase of 46 seconds in the VISSIM Do Something AM 2032 model (this is over a 1.5km length), which is not significant.

vii. The concern regarding latent demand is not appropriate. Latent demand in this case represents 2-3% of total peak hour demand. Therefore, this represents only a very minor amount of peak spreading (1-1.5 minutes) in the future years. This is better than expected given the congested future year networks modelled.

viii. The zone distribution from D to G (raised in WSP TN12) is not of significance. This zone distribution in not an underestimation and it follows the agreed methodology. Even if WMMTM16 direct flow inputs had been used instead of the agreed methodology, this zone distribution relationship could only ever have had a maximum flow of seven vehicles during the evening peak hour in 2032. This is not significant.

5.6 I also conclude that the modelling and results demonstrate that the network can adequately accommodate the proposed levels of growth and the Peel Hall development traffic, through optimisation and mitigation.

5.7 I further conclude that it is clearly demonstrated that the VISSIM modelling to support the Peel Hall development is fit for the intended purpose and is entirely acceptable based on national, industry-wide guidance and standards. I consider that the modelling has achieved the best network performance for the largest number of vehicles, and therefore people. My evidence clearly shows that for the majority of vehicle trips throughout the network, it is possible to achieve improvements to delay, reduce journey times and increase the number of vehicles in the network.

5.8 I finally conclude that the modelling work I have carried out can be relied upon to show that the traffic impact of the appeal proposals will not be severe or have adverse impacts on highway safety.

Appendix LB/1 – BM0123_A49CorridorWarrington_ModellingMethodology_v1.2

Project	A49 Corridor, Warrington		
Report Title	Proposed VISSIM Modelling Methodology		
Version	1.2	**Date:**	01/11/2019
Prepared by:	Luke Best	**Reviewed by:**	Carl Moreno
Client:	Satnam Millenium Ltd.		

1. Introduction

1.1. This document is intended to set out the proposed methodology for the development of VISSIM micro-simulation models of the area to the north of Warrington, and south of Winwick, surrounding the A49 corridor (see Figure 1 below).

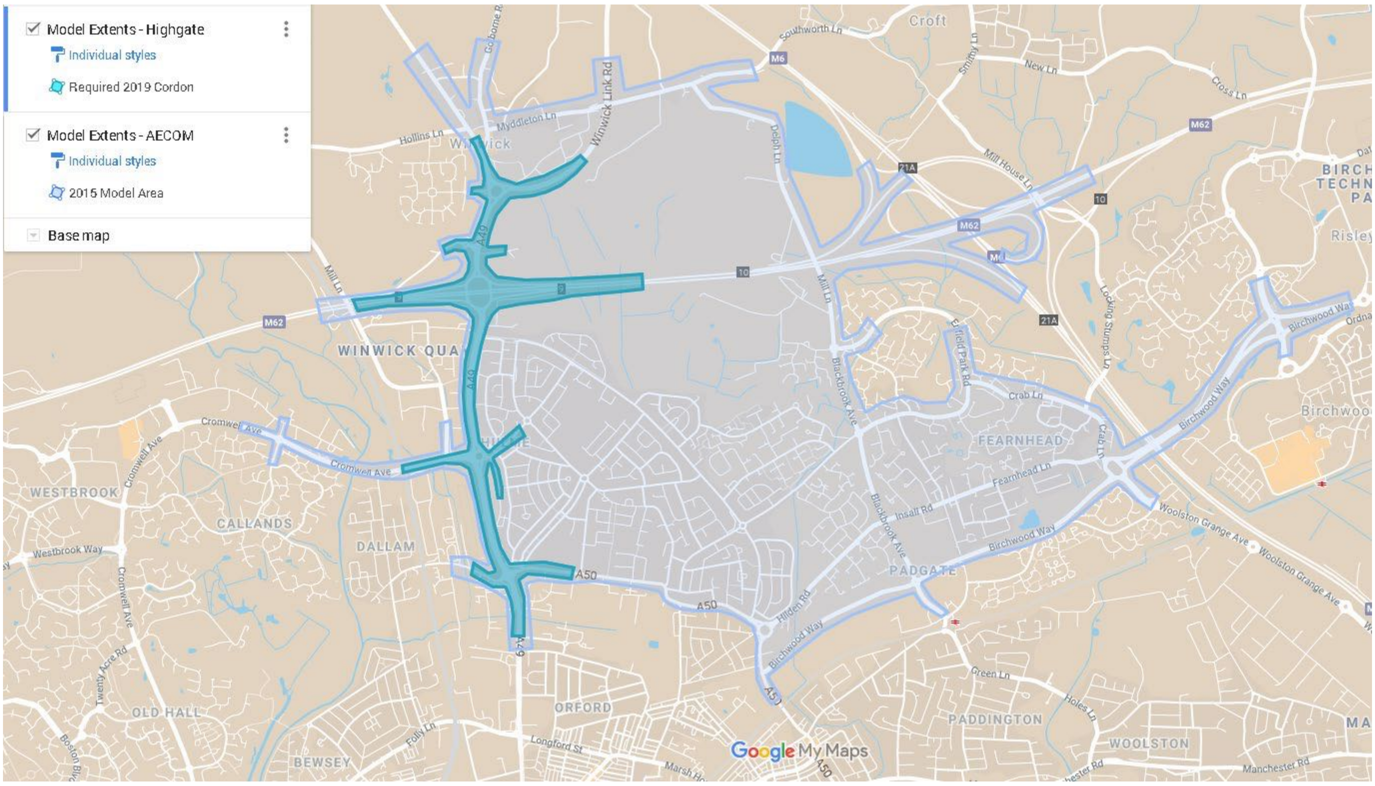


Figure 1: Proposed Model Extents

1.2. A corridor model of the A49 was developed in 2014 by AECOM, and then extended to cover the Peel Hall study area and growthed to a 2015 base year in 2017, as agreed with Highways England and Warrington Borough Council. Given that the area of interest is now the A49 corridor itself, rather than the much larger area of the extended Peel Hall study, there is now a need to cordon the model/s to the required A49 area only, which will make them much easier to work with, taking account of the following:

- The models are already approved in their current extents and base flow years. There is a desire to adjust the model extents without needing to carry out another full recalibration and revalidation exercise.

- The base year models are 2015, which is now 4-years old. Guidance states that models should not generally use traffic survey/ flow data older than 3-years old, without careful checking in order to ensure that the models are still representative and fully fit for purpose.

1.3. The aim of this document is therefore to set out a methodology which demonstrates that with the correct approach, sufficient due diligence and proof of checking, the current model/s can be used with minimal overall adjustment (other than that necessary to network extents and flows). Every effort will be made to prove that the models are still directly comparable to both the original models and to more current traffic survey information.

1.4. If this methodology is deemed acceptable, it should allow a faster route to a suitable base model proven to be robust and fit for purpose, without the need for a full validation and audit approval route – the model has already been approved, so the effort will be put into proving that performance is still comparable to the original model/s after the cordoning process.

2. Convert Existing Model to Static Assignment

Full Internal Peer Review:

2.1. It is already noted that the model is built in VISSIM version 8.00-04.

2.2. A check will be carried out as to whether converting this to a newer version of VISSIM (latest tested and stable version is currently 11.00-11) will make any sort of significant difference to calibration and validation data. Version 8 has previously been found to be less stable than more current versions, and also has early development implementations of certain tools (i.e. scenario manager) which can be extremely useful for ensuring consistency and efficiency of delivery. Later versions of VISSIM also make much better use of computer resources, leading to much faster run times.

2.3. If the validation and performance differences are proven to be minimal when compared against the original models running in the original software version, the model will be converted to a newer VISSIM version to take advantage of updated features, reliability, stability and speed.

Convert Assignment from Dynamic to Static:

2.4. Due to the need to 'freeze' the assignment found in the current AECOM model; it is proposed to convert the assignment from dynamic to static. As there is no route choice, it is not felt that this will necessarily affect the future usefulness of the model, whilst also contributing to the possibility of not needing a full re-validation of the base scenario by ensuring that all elements stay as close to the original as possible.

2.5. This is a process of going through each vehicle type, separately creating static routing (in theory, the inbuilt 'convert to static routing' tool found within the dynamic assignment module should just be able to do this in one go, but experience suggests carrying this out manually).

2.6. Once the assignment has been converted, a full check will be carried out in order to ensure no erroneous routes have been created, and a full visual check to check for any issues which would suggest issues with the assignment conversion.

3. Cordon Model Area to Agreed Extents:

Cordon Static Routing

3.1. This process is completed using a bespoke VBA macro which tracks the link sequence of each newly defined static route within the *.inpx file, cutting it and defining a new end on the links which will become the extents of the newly cordoned network.

3.2. A full visual check of all newly created cordoned static routing will be carried out at this stage to ensure that all routes previously passing through our area of interest are now captured and cordoned to the required extents.

Cordon Physical Network

3.3. The process of carefully trimming the network structure will be completed manually, cutting links to separate the agreed area of interest from the larger, older model. All network elements will need to be set to 'on' visually in order to ensure that no errors are created, or existing objects broken. PT lines will need adjusting as the link editing takes place, making sure that all routes passing through the agreed area of interest are adjusted to have new start and/ or end points.

3.4. The unwanted, larger model area will then be deleted, leaving the cordoned physical network with all physical elements intact, static routing per vehicle type, and public transport routing all as it was previously in the larger model.

Cordon Time Period

3.5. As a result of the considerable reduction in overall network scale and extents, it may prove reasonable to reduce the simulation time period currently found in the AECOM models, although this will need to be dependent on traffic conditions and the local peak profile. The current model simulation time periods are as follows:

- AM model – 07:00-09:30 (2.5 hours)
- PM model – 16:00-18:30 (2.5 hours)

3.6. There is currently heavy congestion in this area, so it may be that longer warm-up and/or cool-down periods are necessary, but with the revised, reduced model extents, a two-hour simulation period with half-hour warm-up and cool-down periods would normally be considered adequate.

Create New Vehicle Inputs

3.7. This process is also completed using a bespoke VBA macro, which will pick up all flows from all routes as the new cut down static routes are created and pass the data per vehicle type to new vehicle inputs for the cordoned model.

3.8. All vehicle inputs will then need manually checking – the internal VISSIM processing tool for converting dynamic assignment into static assignment tends to create a unique traffic composition for each vehicle input, for each time period, with vehicle types entered as a factor of the actual flow. This is rather clumsy to work with, as there is a volume and set of factors per vehicle type for every time period (every 10 minutes for this model), for every input. In comparison, the external VBA macro creates vehicle inputs with actual flows, per vehicle type, per time period, which is judged to be easier to work with. Any remaining VISSIM default input formats will therefore be converted so that all model inputs are consistent, in the same format.

4. Check Model Flows

Comparison Against Original 2015 Model Flows

4.1. First phase checks are to ensure that all data has been correctly converted from the original dynamic assignment models to the new static assignment models. Link counts and junction turning counts will be checked for all vehicle types. Differences will be expected to be minor – the GEH statistic will be used as a test, all measures will be expected to achieve 3 or lower.

4.2. Second phase checking will be to then compare the static 2015 models against all currently held traffic survey data. There is a large, mixed dataset including Automatic Traffic Counts (ATC), Manual Classified Counts (MCC) and Queue length surveys (see Figure at the end of this note). The data held covers a large range of relevant sites, as well as spanning the timeframe between 2014-2019. This is particularly useful, as it allows the assessment of the same, or similar, locations but at different times, in order to demonstrate how changes and trends have occurred.

4.3. Checks of flows and turning counts will be carried out using the GEH statistic and WebTAG flow criteria. Journey time data will be assessed using WebTAG guidance, as a minimum. Queues will be assessed visually.

4.4. Model journey times will be validated against a ‘Big Data’ source such as TrafficMaster (or similar) for a neutral month in 2019, to ensure that the model is representative of current conditions.

4.5. If there are discrepancies, these will likely fall into one of the following criteria:

- *Network level volume difference* – This would likely primarily represent the naturally occurring difference from 2015-2019 due to background growth/ shrinkage in the wider area. This would generally manifest as a relatively even level of change across the entire network, whilst the overall vehicle flow patterns remained comparatively similar.

- It is entirely possible that this level of change would not push any individual measures of flow volume and pattern over nationally acceptable validation criteria levels. If this was the case, the model/s would have been proven to still be relevant for use, regardless of the time since their original construction.

- If however there was found to be more significant levels of change (again, acting reasonably and using accepted WebTAG guidelines to inform the decision), it would be the simplest discrepancy to amend, as it would only be a matter of factoring the vehicle volumes for the network until comparative volumes & performance are achieved, with no real physical changes necessarily being needed to the approved model structure, as provided.

- *Local level volume difference* – Whilst this still may just represent the background growth difference from 2015-2019, this would likely manifest as certain areas experiencing localised growth or traffic pattern changes, whilst others did not, or experienced different levels of localised growth or traffic pattern changes. As with the wider network, this would most likely still fall within the ranges set out by WebTAG validation criteria (being used as guidance), which would allow the changes to be defined as non-critical or insignificant, and the model/s would have been proven to still be relevant for use, regardless of the time since their original construction.

- As with the network level volume difference, if there was found to be more significant levels of change in certain areas, a combination of local route factoring and manual volume tweaks for select movements should be able to still ultimately achieve comparative volumes & performance to those recorded in the updated traffic survey data, without any significant changes to the approved model structure, as provided. This should then still be able to be deemed as a model representative of onsite conditions, and therefore robust and fit for the purpose of current option testing.

- *Full Flow Profile & Tidal Flow Change* – This is the only foreseen scenario with a possible outcome that would mean the current model may not be suitable for use without major updating and revalidating. Although very much an outside possibility, this would be a worst-case outcome involving such significant levels of both traffic volume, and traffic profile change, as to render the existing models unsuitable for use. This of course depends on the severity of the differences found – it is a very unlikely outcome in most areas of the country, as four years is usually not nearly enough for the occurrence of any level of significant change.

4.6. In all scenarios apart from Full Flow Profile and Tidal Flow Change, there should be the option of either:

- Leaving the 2015 model as it is, without any changes to the flows, but just making sure that this exercise of cordoning and checking against multiple datasets is documented and carried forwards as a consideration in case of future issues; or,

- Making minor adjustments to the flows, either globally or locally, leading to the ability to effectively present the model as a base year fit for the purpose of 2019-based option testing.

Mobile 07870 983386 Website bestmoreconsulting.co.uk
Email Luke@bestmoreconsulting.co.uk
Address 11 Cofton Park Drive | Birmingham | B45 8DF

5. Model Refinement & Re-Calibration:

5.1. Although it is planned that the model extents be reduced, and the model flows be either shown to be comparable or factored and adjusted to be comparable to an up to date traffic survey dataset, the aim is that there will not be much else which will need changing.

5.2. If there have been physical changes (i.e. new lanes or junction arrangements) which are now built and fully operational within the relevant section of the A49 corridor (or were built and operational within the new agreed area of interest when the 2019 surveys were carried out) then the inclusion of these needs to be considered.

5.3. There may also be minor, performance based, or primarily cosmetic based improvements which would add to the overall usability and/ or functionality of the updated model, whilst being shown to not impact on previously achieved performance indicators.

5.4. If the model has proven initially to perform in a demonstrably similar manner, in an updated version of VISSIM, one of the key changes would be to place the model under scenario management. This tool allows a greater level of efficiency and transparency to be achieved, with all peaks and scenarios sitting within one VISSIM model, and any model changes being tracked and auditable through the use of modification files.

6. Future Year Option & Mitigation Testing

Proposed Scenarios for Testing

6.1. If the methodology included within this report is agreed and the work to cordon the base year models and prove that they are fit for purpose is successful, the following scenarios are proposed to be individually tested and analysed, using the resultant model of the included process as a base:

- 2022 Do Minimum – Opening Year, No development
- 2022 Do Something – (Opening Year, 120 Dwellings) – Access Strategy Option A
- 2022 Do Something – (Opening Year, 120 Dwellings) – Access Strategy Option B
- 2022 Do Something – (Opening Year, Full Development) – Access Strategy Option A
- 2022 Do Something – (Opening Year, Full Development) – Access Strategy Option B
- 2027 Do Something – (Opening Year +5, No Development) – Access Strategy Option A
- 2027 Do Something – (Opening Year +5, No Development) – Access Strategy Option B
- 2027 Do Something – (Opening Year +5, 600 Dwellings + Local Centre) – Access Strategy Option A
- 2027 Do Something – (Opening Year +5, 600 Dwellings + Local Centre) – Access Strategy Option B
- 2032 Do Something – (Opening Year +10, No Development) – Access Strategy Option A
- 2032 Do Something – (Opening Year +10, No Development) – Access Strategy Option B

- 2032 Do Something – (Opening Year +10, Full Development) – Access Strategy Option A
- 2032 Do Something – (Opening Year +10, Full Development) – Access Strategy Option B

6.2. Traffic flows will be cordoned from Warrington Borough Council's SATURN model (WMMTM16) recently run for the Peel hall development profile and future year scenarios and provided as hourly data. These outputs will then be processed to create per vehicle type flows in the form of excel network flow diagrams by the team at Highgate Transportation. Both sets of data will be made available to the modelling team.

6.3. Once received, these network flow diagrams will be simply converted to network origin destination data and entered into the VISSIM model modification files to create the static routing and vehicle input changes for each flow scenario.

6.4. The following committed mitigation measures will also be included as individual modification files, allowing them to be easily added and combined to each relevant test scenario at a later point (2027 and 2032 scenarios):

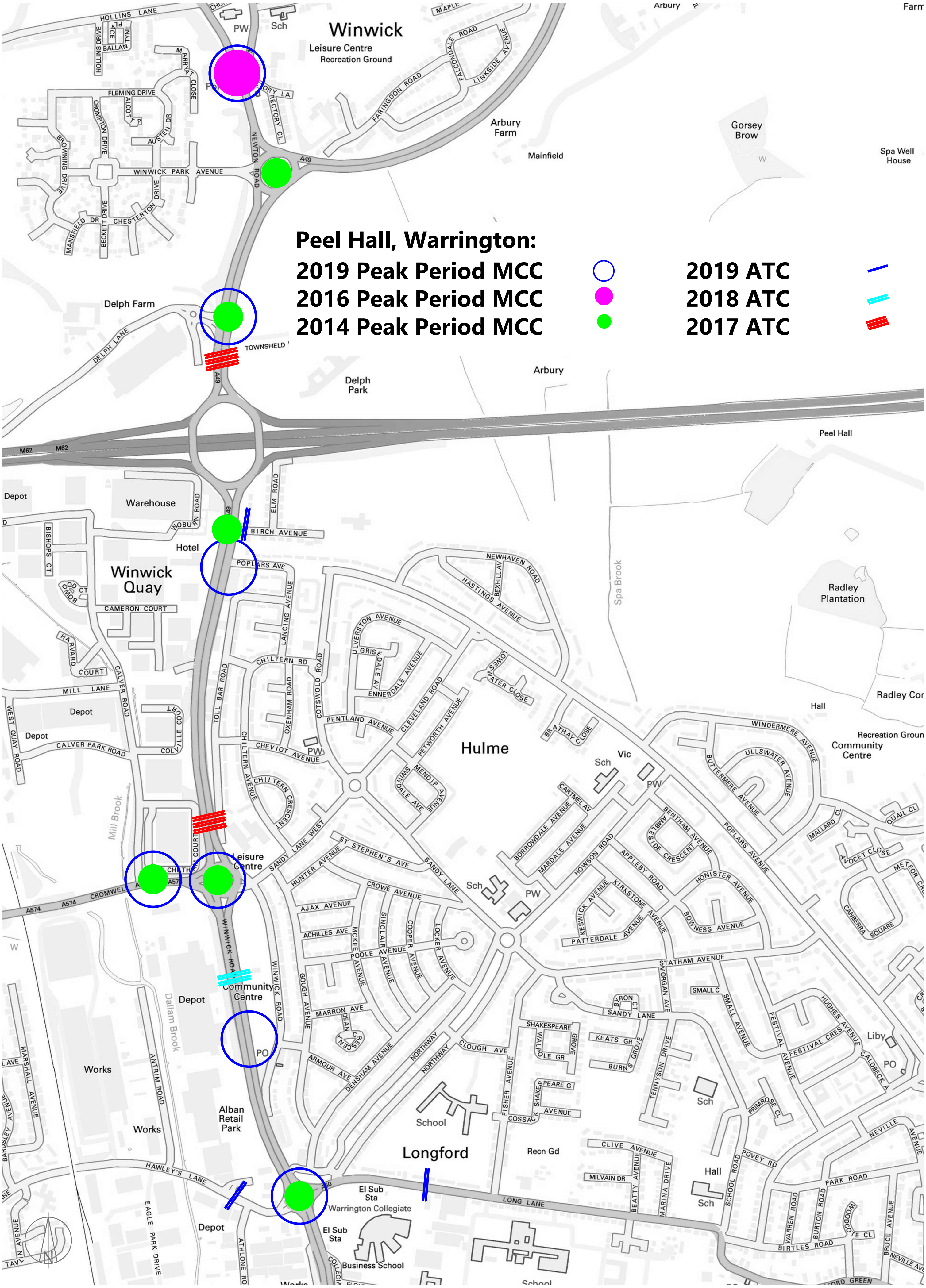
- M62 J9 (eastbound off-slip works)
- Delph Lane/B&Q signalised junction improvement scheme
- Winwick Roundabout mitigation
- Junction 9 Retail Park junction modifications

6.5. Placing the entire project under the scenario manager tool allows each scenario to be separately 'constructed' using the modification files detailed in the previous bullet lists. This allows the combination of flow sets and combinations of mitigation/ network changes to originate from the same modification files, making checking and editing efficient and simpler to track.

6.6. Any tweaks to signal timings and/ or vehicle behaviour is then also recorded using per scenario modification files. This keeps the modelling process transparent, throughout all stages of modelling and analysis.

7. Summary

7.1. We seek WBC and Highways England to agree the above methodology and provide constructive comments where necessary.


Peel Hall, Warrington:
2019 Peak Period MCC
2016 Peak Period MCC
2014 Peak Period MCC
2019 ATC
2018 ATC
2017 ATC
Winwick
Leisure Centre
Recreation Ground
Arbury Farm
Gorsey Brow
Mainfield
Spa Well House
Delph Farm
Delph Park
Arbury
Peel Hall
Winwick Quay
Warehouse
Hotel
Depot
Radley Plantation
Hulme
Community Centre
Longford
Alban Retail Park
Works
Warrington Collegiate
Business School
School
Recn Gd
M62
A49
A574

Appendix LB/2 – MG0123_A49WarringtonCorridor_MethodologyAdendum_v1

METHODOLOGY ADENDUM

ORIGINAL METHODOLOGY TEXT

6.2. Traffic flows will be cordoned from Warrington Borough Council's SATURN model (WMMTM16) recently run for the Peel hall development profile and future year scenarios and provided as hourly data. These outputs will then be processed to create per vehicle type flows in the form of excel network flow diagrams by the team at Highgate Transportation. Both sets of data will be made available to the modelling team.

6.3. Once received, these network flow diagrams will be simply converted to network origin destination data and entered into the VISSIM model modification files to create the static routing and vehicle input changes for each flow scenario.

AMENDED METHODOLOGY

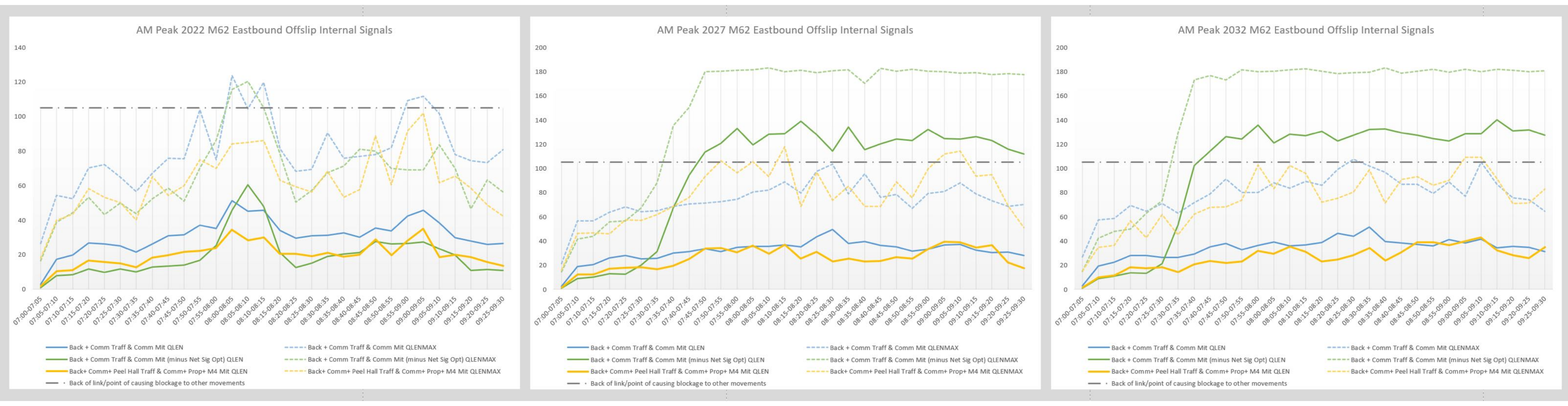
6.2. Traffic flows will be cordoned from Warrington Borough Council's SATURN model (WMMTM16) recently run for the Peel hall development profile and future year scenarios and provided as hourly data. These outputs were then processed to create per vehicle type flows in the form of excel network flow diagrams by the team at Highgate Transportation, before being provided to the modelling team.

6.3. Once received, these network flow diagrams were then converted into per origin-destination pair actual and percentage difference matrices. In the first instance, the percentage difference matrices will be applied to the actual flow O-D pairs in the VISSIM model, in order to apply the same per route percentage growth to the validated base year VISSIM flows as found in the SATURN model outputs.

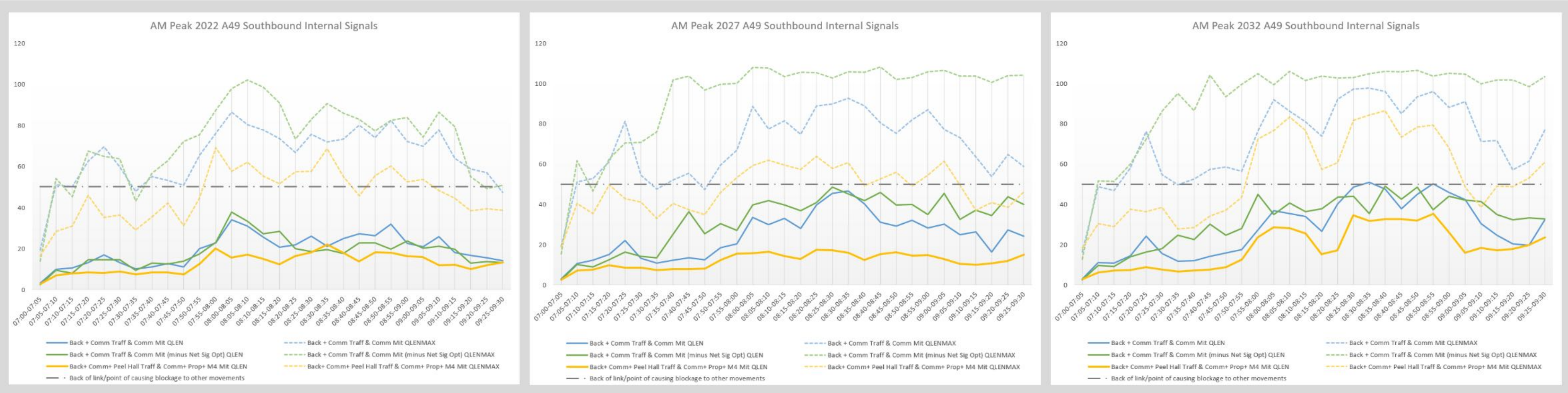
6.4. However, sense-checks will also be carried out to all adjustments. There is the possibility that, as a result of large differences between individual link input flows in the SATURN and VISSIM models, a sensible percentage in the SATURN model between two relatively small numbers, could result in a large percentage change between two much larger numbers in the VISSIM model. In this instance, actual differences will be applied rather than percentage differences.

Appendix LB/3 – AM Peak M62 Junction 9 Internal Queue Length Comparative Data

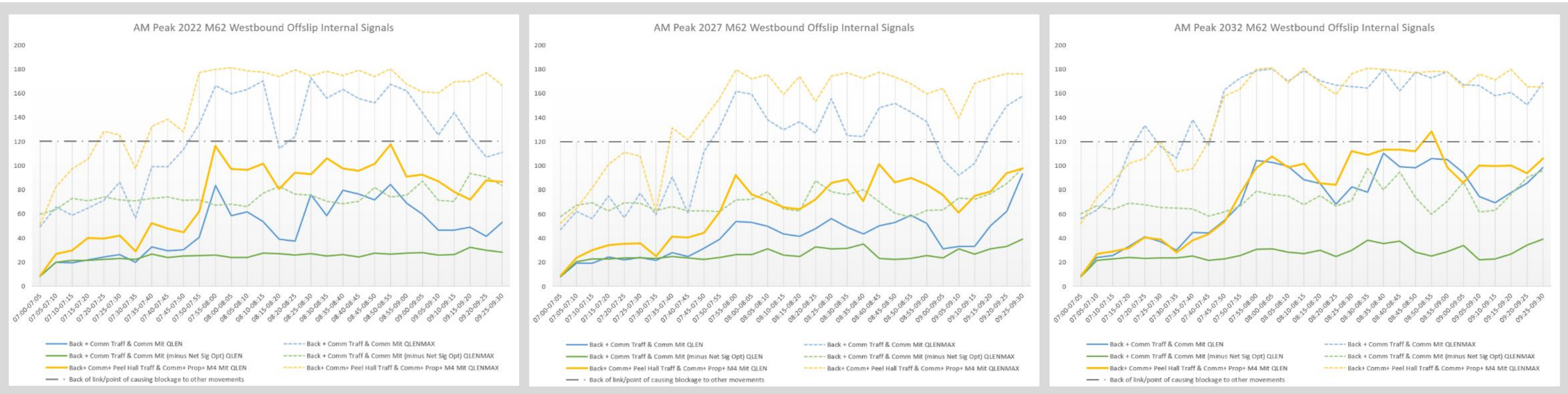
i – AM Internal Signal Data at M62 Eastbound Offslip Junction



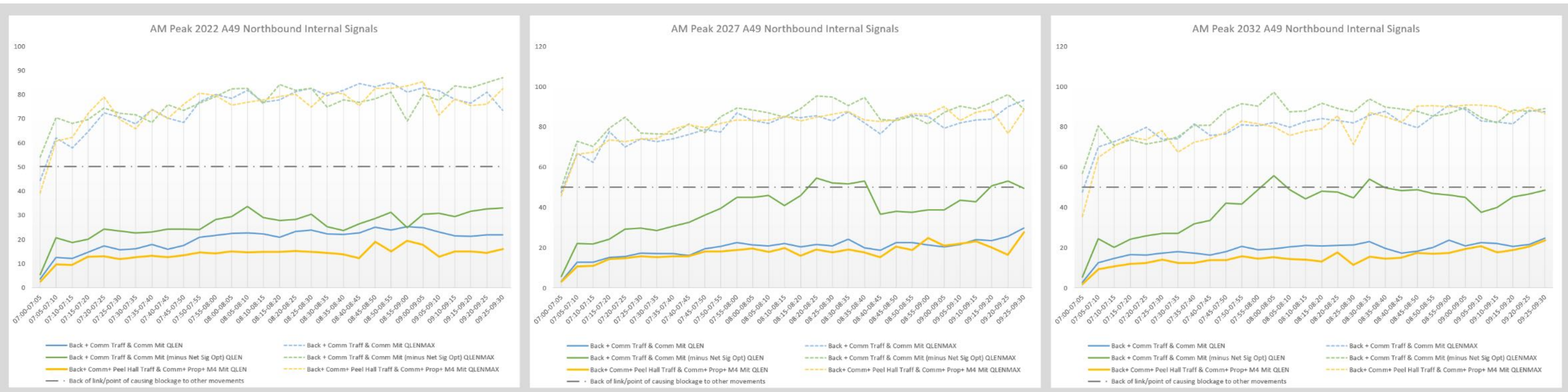
ii – AM Internal Signal Data at A49 Southbound Junction



iii – AM Internal Signal Data at M62 Westbound Offslip Junction

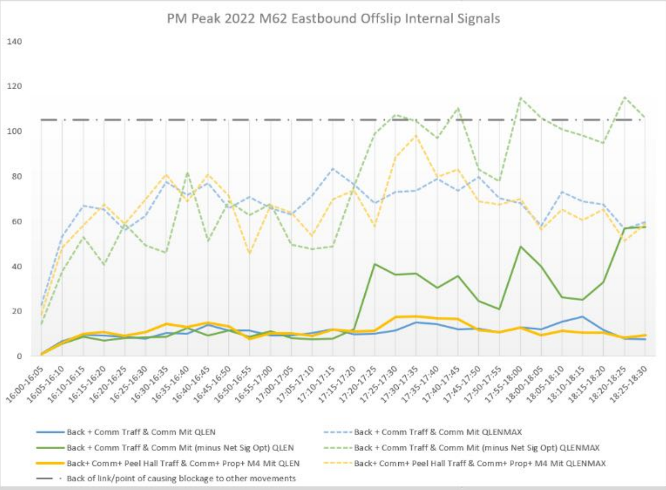


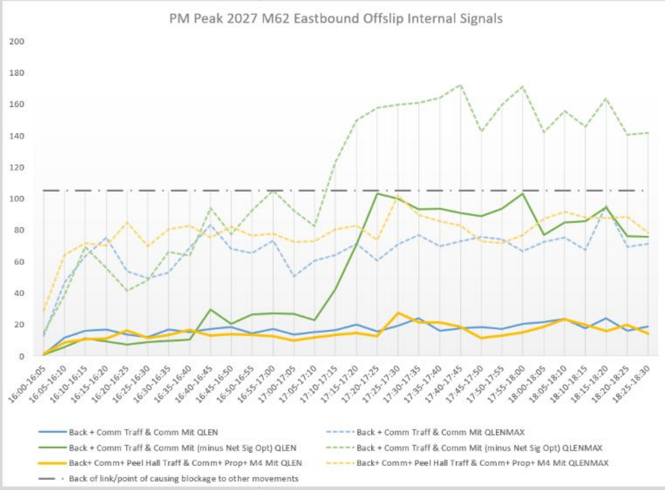
iv – AM Internal Signal Data at A49 Northbound Junction

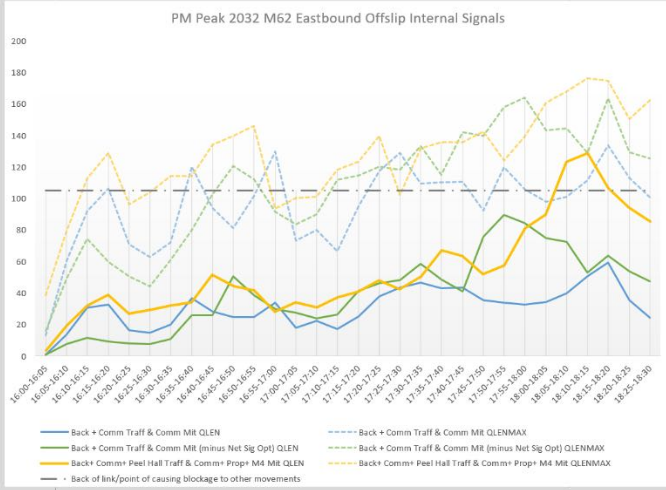


Appendix LB/4 – PM Peak M62 Junction 9 Internal Queue Length Comparative Data

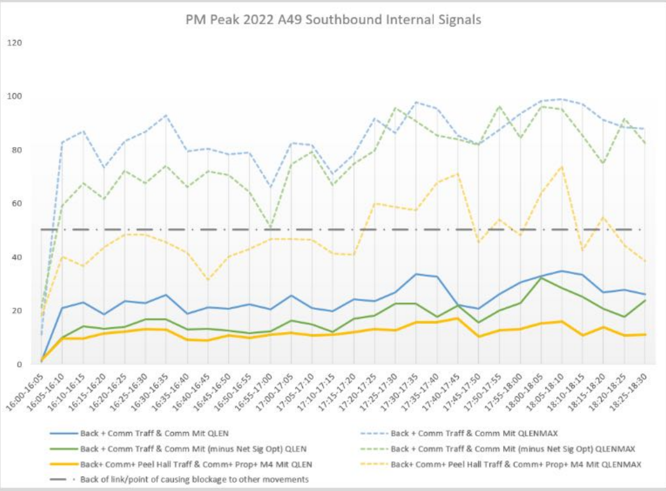
i – PM Internal Signal Data at M62 Eastbound Offslip Junction

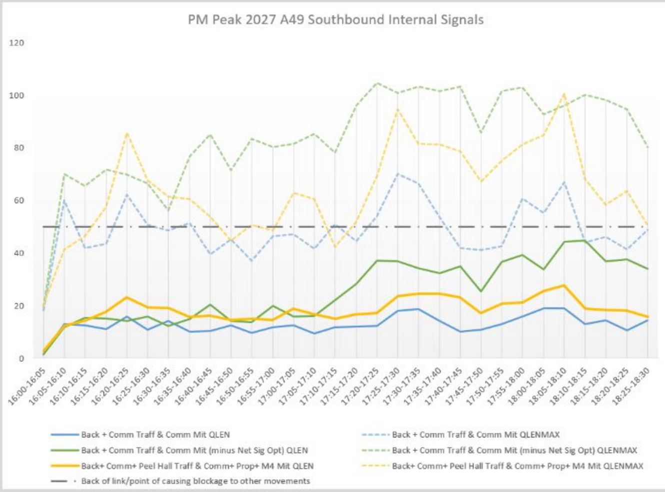


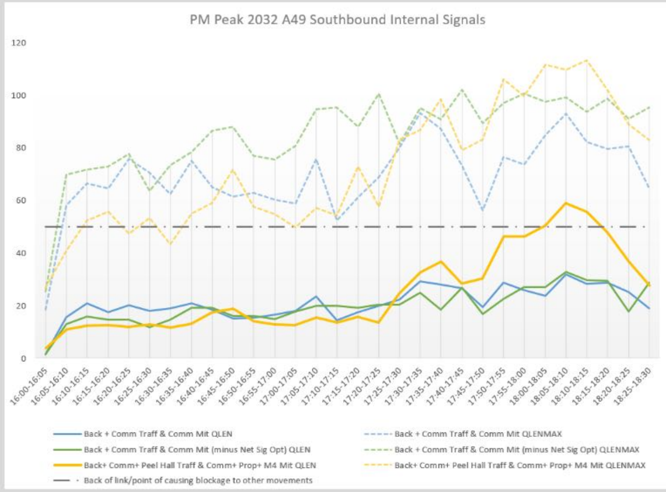




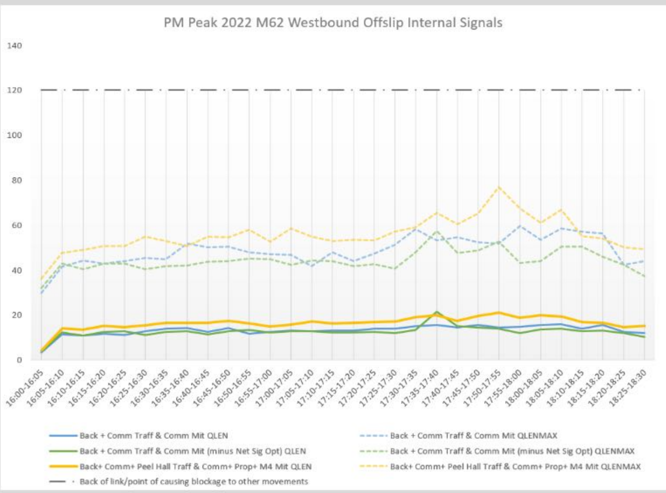
ii – PM Internal Signal Data at A49 Southbound Junction

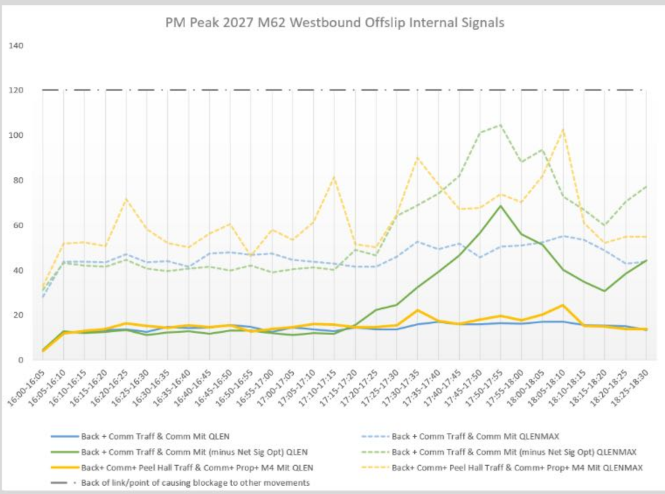


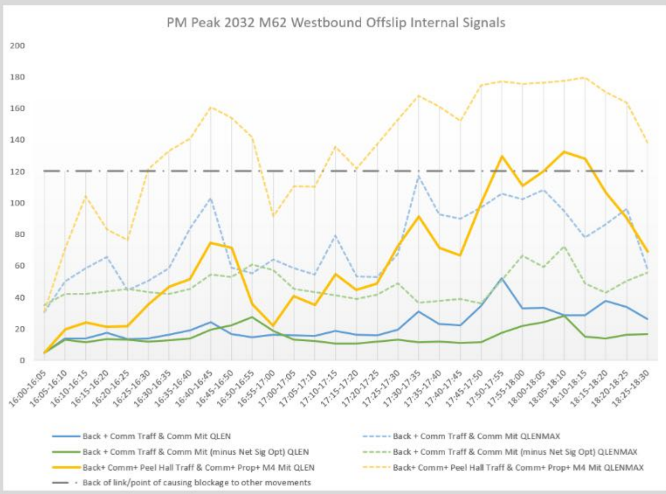




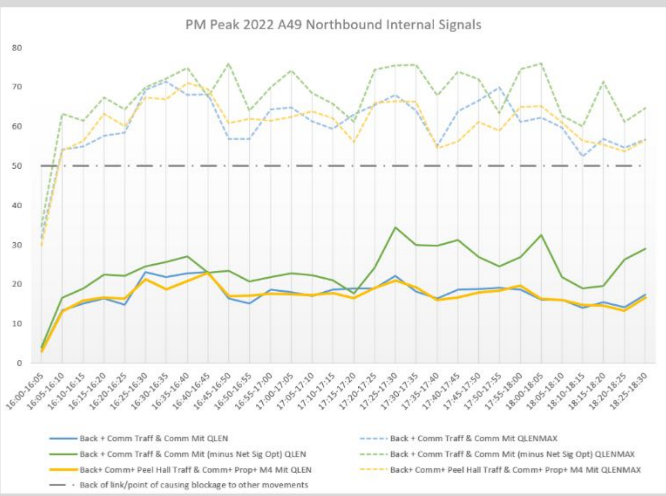
iii – PM Internal Signal Data at M62 Westbound Offslip Junction

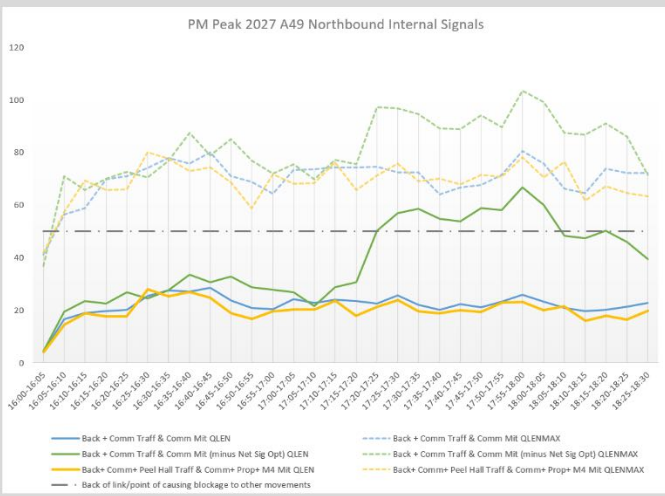


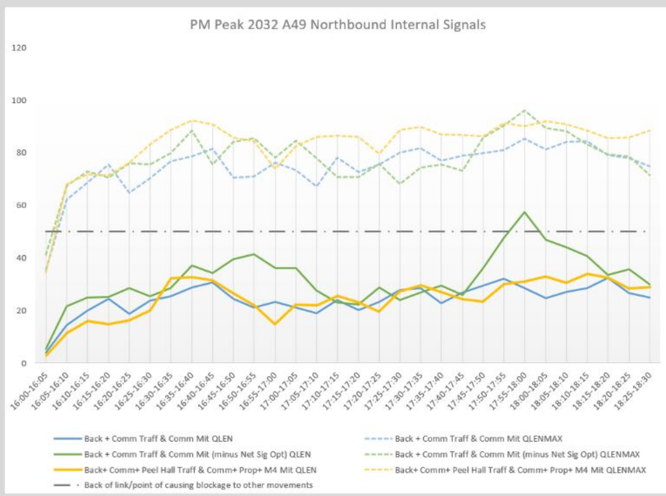




iv – PM Internal Signal Data at A49 Northbound Junction







Appendix LB/5 – HTp TN/25/B Area to the South, Proportion of Traffic Entering VISSIM Corridor at Sandy Lane West

HighgateTransportation

Highgate Transportation Ltd
First Floor, 43-45 Park Street, BRISTOL BS1 5NL
0117 934 9121
Company Registration Number: 07500534

TECHNICAL NOTE

PROJECT: Peel Hall, Warrington

REPORT: 1901/TN/25/B – Area to the South, Proportion of Traffic Entering VISSIM Corridor at Sandy Lane West

DATE: January 2021

---

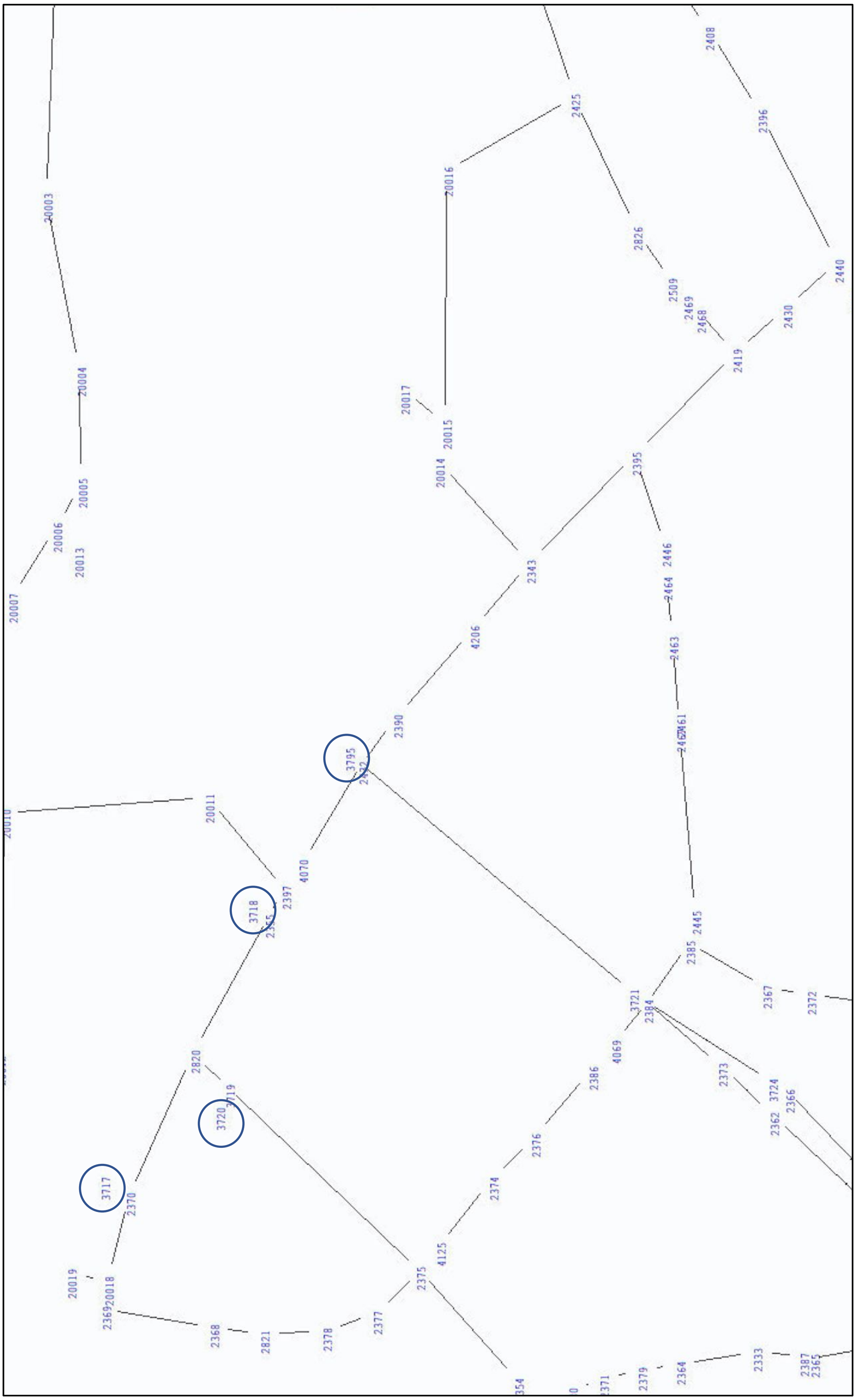
1. This Technical Note has been provided to illustrate the level of traffic emanating from the residential area to the south of the appeal site, in order to identify the proportion of traffic entering the VISSIM corridor model at Sandy Lane West that is likely to be associated with rat-running traffic.

2. The WMMTM16 Peel Hall cordon model data sets from AECOM (received December 2019) are the agreed traffic flows for the Peel Hall transport assessment work. These data sets have been reviewed and it has been confirmed that the loading zone nodes for this area to the south (SATURN network illustrated on **Figure 1**) are:

   i. 3717 – Poplars Avenue near Cotswold Road
   ii. 3718 – Poplars Avenue opposite Brathay Close
   iii. 3720 – Cleveland Road
   iv. 3795 – Poplars Avenue opposite Howson Road

3. Loading zone nodes are areas where traffic flows are added at a specific point to the WMMTM16 network and these form Origin-Destination locations.

Figure 1 – SATURN network for area to the south (loading zone nodes circled blue)



Link Flows

4. The traffic flows associated with these loading zone nodes in 2022 and 2032, with and without development traffic in the peak hours, are set out in **Table 1**. Do Minimum is the traffic network without the Peel Hall development (Do Min) and Do Something is the traffic network with the Peel Hall development (Do Som).

Table 1 – Traffic Flows To/From Loading Zones

Node	AM Arrivals		AM Departures		PM Arrivals		PM Departures	
	Do Min	Do Som	Do Min	Do Som	Do Min	Do Som	Do Min	Do Som
2022								
3717	8	8	0	0	7	11	0	0
3718	7	7	53	53	37	34	22	22
3720	36	37	104	105	75	79	79	79
3795	1	1	2	2	1	1	1	1
2032								
3717	9	8	0	0	7	7	0	0
3718	8	8	59	59	42	42	24	24
3720	40	42	116	117	84	87	88	89
3795	2	2	2	2	1	1	1	1

5. From this table it can be seen that two-way trips from these zones are generally low, from around one vehicle movement every nine minutes up to one vehicle movement per minute in the busiest peak hour at the zone nodes off Poplars Avenue (3717, 3718, 3795), with up to around three vehicles per minute to and from the Cleveland Road zone (3720). Furthermore that, as expected, the development-related vehicles do not make any significant difference to the flow values arriving and departing these zones.

6. The WMMTM16 cordon model spreadsheet data for link flows are contained in **Appendix 1** (electronic only).

Flows – Turning Movements

7. The corresponding turning traffic movements have been reviewed from these loading zone nodes to provide an indication of direction of travel through the area to the south of the appeal site i.e. to Sandy Lane West and the A49 beyond, based on departure profiles.

8. This is to enable provision of a comparison between the traffic arising from this residential area within the WMMTM16 cordon model and traffic travelling through this area to access the wider highway network (rat-running) within the A49 corridor VISSIM model, at Sandy Lane West

9. It is considered that this presents very much a worst case scenario given that some of these node departures may travel from the Cotswold Road/ Cleveland Road/ Sandy Lane/ Sandy Lane West roundabout east to Sandy Lane, instead of south to Sandy Lane West. This information is summarised on **Table 2**.

Table 2 – Zone Departure Turning Movements (destination toward Sandy Lane West)

Node	AM Departures		PM Departures	
	Do Min	Do Som	Do Min	Do Som
2022				
3717	0	0	0	0
3718	19	19	11	11
3720	66	67	63	63
3795	0	0	1	1
Total at Sandy Lane West	*85*	*86*	*75*	*75*
2032				
3717	0	0	0	0
3718	21	21	12	12
3720	73	75	71	71
3795	0	0	1	1
Total at Sandy Lane West	*94*	*96*	*84*	*84*

10. From this table it can be seen that up to around 96 departures from the zone loading nodes in the area to the south of the appeal site could be travelling to, and along, Sandy Lane West in the busiest peak hour (AM) i.e. creating demand in the VISSIM modelling. This is up to around 1.5 vehicles per minute.

11. The WMMTM16 cordon model spreadsheet data for turning movements are contained in **Appendix 2** (electronic only).

Traffic Flow Comparison

12. The 2032 zone departure data from **Table 2** has been compared to the traffic flow data analysis contained in TN/09/A (Dave Tighe's Proof of Evidence on Highway Matters August 2020, Appendix DT/19, Tables 2 and 4) for Sandy Lane West, immediately west of its junction with Cotswold Road/ Cleveland Road/ Sandy Lane. This is set out in the following **Table 3**.

13. Total flow figures are those from the agreed WMMTM16 output. Peel Hall development trips have been shown for reference (included for in Do Something modelling) with percentage of total flow indicated.

Table 3 – 2032 Comparison (traffic originating from within area south of the appeal site compared to total traffic flows)

	Do Minimum				Do Something			
	AM		PM		AM		PM	
	Zone Departure	Total Flow	Zone Departure	Total Flow	Zone Departure	Total Flow	Zone Departure	Total Flow
Vehicles	94	418	84	552	96	503	84	638
Total Flow – Zone Departures	324		468		407		554	
Peel Hall development traffic (% of total flow)					107 (21%)		91 (14%)	

14. From this table it can be clearly seen that traffic originating from the area to the south of the appeal site accounts for between 15-23% of total flows on the Sandy Lane West link immediately west of its junction with Cotswold Road/ Cleveland Road/ Sandy Lane i.e. much less than a quarter of all traffic.

15. This clearly demonstrates how much traffic is forecast to be travelling through this area in 2032 to access the A49 VISSIM corridor model area, that does not originate from this actual area to the south of the appeal site i.e. rat-running.

16. As set out in Appendix 13 of the Transport Assessment Addendum (March 2020), Core Document APP120, and **Table 3** above, it can be seen that traffic from the appeal site is forecast to be around 107 vehicles in the AM peak hour and 91 in the PM peak hour. This is similar in magnitude to the traffic arising from the area to the south of the appeal site i.e. much lower than the additional through traffic (rat-running) in this area.

Summary

17. In summary, traffic associated with the residential area to the immediate south of the appeal site is demonstrated to be low, accounting for a maximum of 1.5 vehicles per minute travelling to and along Sandy Lane West (into the VISSIM corridor modelling) in the busiest peak hour, and less at other times.

18. Therefore, this report illustrates that around three quarters of traffic forecast through the area to the south of the appeal site is unlikely to be associated with the existing residential area. As such, it can be strongly concluded that this significant additional traffic flow is rat running traffic.