LCC/SRBC3

Appendix 3G

WSP Base Model Review

National Highways

PICKERINGS FARM

Base Model Review

NW 010
APRIL 2022

CONFIDENTIAL

National Highways

PICKERINGS FARM

Base Model Review

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70095637

OUR REF. NO. NW 010

DATE: APRIL 2022

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Model Review	NH Comments	LCC Comments	
Date	29/04/2022	06/05/2022	12/05/2022	
Prepared by	MG	MG	MG	
Signature				
Checked by	ER	ER	ER	
Signature				
Authorised by	PW	PW	PW	
Signature				
Project number	70095637	70095637	70095637	
Report number	NW 010 v1	NW 010 v2	NW 010 v3	
File reference				

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INTRODUCTION

1 INTRODUCTION

1.1 PREAMBLE

1.1.1. National Highways have been appointed by the Secretary of State for Transport as a strategic highway company under the provisions of the Infrastructure Act 2015. National Highways are responsible for operating, maintaining and improving the Strategic Road Network (SRN) in England, in accordance with the Licence issued by the Secretary of State for Transport (April 2015) and Government policies and objectives.

1.1.2. The National Highways approach to engaging with the planning system is governed by the advice and guidance set out in:

1.1.3. **The Strategic Road Network Planning for the Future** – A guide to working with Highways England (the former name of National Highways) on planning matters (2015).

1.1.4. The document is written in the context of statutory responsibilities as set out in National Highway's Licence, and in the light of Government policy and regulation, including the:

- National Planning Policy Framework (NPPF);
- Town and Country Planning Development Management (Procedure) Order (England) 2015 (DMPO); and
- DfT Circular 02/2013 The Strategic Road Network and the delivery of sustainable development ('the Circular').

1.1.5. As a statutory consultee in the planning system, National Highways has a regulatory duty to co-operate. Consequently, National Highways are obliged to give consideration to all proposals received and to provide **appropriate, timely and substantive** responses.

1.1.6. National Highway's desire to be a proactive planning partner goes beyond this statutory role, but follows the spirit of the Licence which stipulates that National Highways should: "Support local and national economic growth and regeneration"

1.2 DEVELOPMENT OVERVIEW

1.2.1. Taylor Wimpey and Homes England are appealing their application for an outline planning application, with all matters reserved, except for the principal means of access, which was rejected at South Ribble Borough Council (SRBC) planning committee in November 2021. The proposed development is a residential-led mixed-use development in Penwortham, Lancashire. The proposed development is located on land to the east of Penwortham Way and part of a wider SRBC site allocation designated within the South Ribble Local Plan known locally as Pickering's Farm.

1.2.2. Vectos, the appointed transport consultants for the scheme, have completed transport evidence in support of the planning application in the form of a Transport Assessment (TA) and Framework Travel Plan (FTP). The TA includes a highway appraisal using a wide area Paramics Discovery model. National Highways has been consulted by SRBC and have subsequently commissioned WSP to review the transport submission for the development to ensure an appropriate assessment of the development traffic impacts of the SRN is undertaken with particular attention to the M6/M65 interchange and the M6/A6/Church Road junction.

1.2.3. National Highways provided comments on the TA and Travel Plan prior to the planning committee meeting but had not reached agreement on the suitability of the evidence provided. Vectos have provided some commentary on a number of outstanding concerns with the transport evidence following the November committee meeting, including some commentary on traffic modelling methods.

1.3 BACKGROUND

1.3.1. No pre-application scoping discussions were held between the transport consultants and National Highways prior to the submission of the planning application (Planning Reference: 07/2021/00887/FUL), although it should be noted that National Highways were consulted as part of consultation held for a previous application for the site (Planning Reference: 07/2020/00014/FUL).

1.3.2. A timeframe of the consultation held between Vectos (the applicants transport consultants), National Highways and WSP is shown below:

- 11th August 2021: TA submitted by Vectos (Planning Reference: 07/2021/00887/FUL)
- 10th September 2021: National Highways consulted on the planning application by SRBC;
- 28th September 2021: TA review issued by WSP
- 26th November 2021: WSP issued a Comments Tracker (File Name: 21.11.25 Comments Tracker) Recommending National Highways Implement a Holding Recommendation
- 29th November 2021: SRBC Planning Committee – Application Refused
- 24th January 2022: Updated Tracker (File Name: National Highways Comments Tracker 24.01.2022) Issued by Vectos
- 2nd March 2022: Meeting held between Vectos, National Highways and Lancashire County Council (LCC)
- 8th March 2022: WSP issued a revised Comments Tracker (File Name: LCC and NH Comment Tracker 02.03.22 (WSP Updated 100322)) providing further commentary.
- 24th March 2022: Appeal Submitted by the Applicant (Appeal Reference: APP/F2360/W/22/3295502)
- 23rd August 2022 Planning Inquiry Opening Date (scheduled to last four weeks)

1.3.3. This report looks to address the comments raised in the revised Comments Tracker (File Name: LCC and NH Comment Tracker 02.03.22 (WSP Updated 100322)) in particular the following comments:

- Recommend that Vectos provide information on the data source for the SRN mainline traffic demands.
- Need to view the base matrix development process in more detail to form a judgement on its suitability
- A full review on the suitability and application of the demand profiles will need to be carried out to judge the suitability of the model.
- Need to view the matrix and models assignment to comment fully on the suitability of the routeing around the SRN junctions.
- Further information is required about the TomTom data used to validate the model.
- An independent model review on behalf of National Highways will be required to review the models coding around the SRN junctions. It is noted that the Systra review has already been carried out on behalf of the applicant and did not raise any concerns with the modelled data sources.

1.4 THIS REPORT

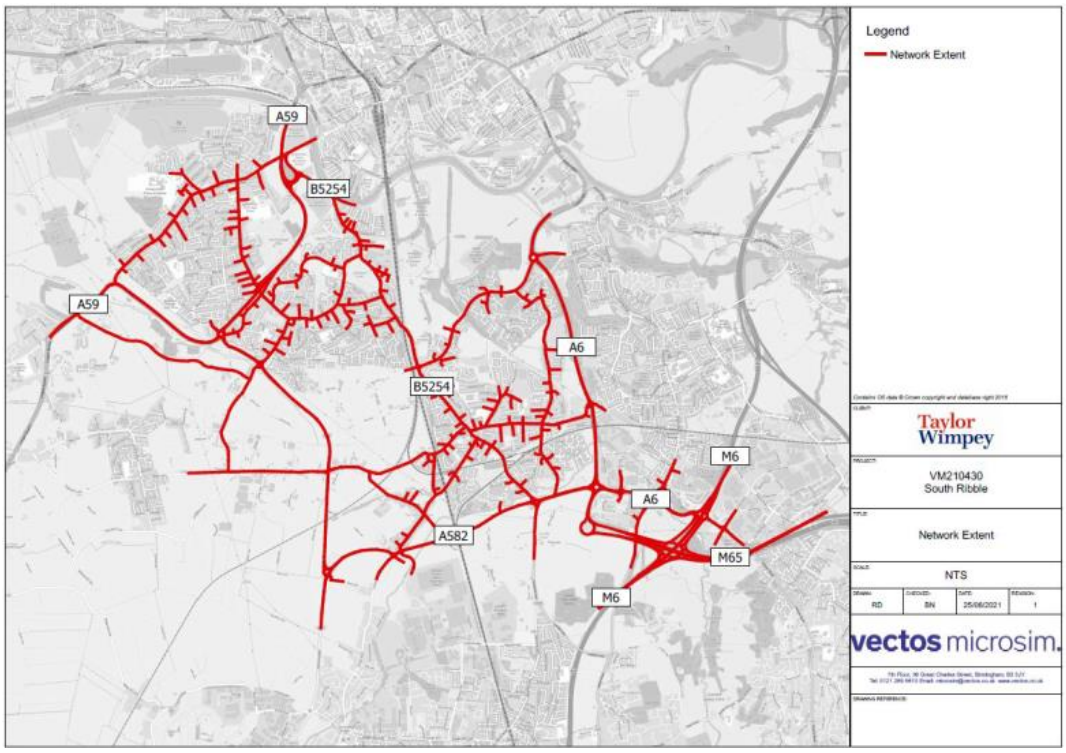
1.4.1. This report has been prepared to detail a review of the base year Paramics model developed as part of the evidence base only. This report does not provide any commentary on the traffic forecasting completed as part of the Vectos TA works, a view on the forecast can only be supplied once the base model is agreed to be a suitable base. The following information has been provided to WSP by Vectos to assist with the base model review:

- VM210430.M001. 2021 South Ribble Base Model – The base model files;
- VM210430.R002 LMVR ISSUE – The Local Model Validation Report (LMVR) for the supplied model;
- VM210430.Sp004 Calibration and Validation_ISSUE – Spreadsheet containing the model outputs for the base model including flow calibration and journey time validation;
- VN211918 TN03 Traffic and Modelling Review – Commentary from Vectos on various concerns raised over the transport evidence by LCC and National Highways. This review will only comment on those issues pertinent to the base Paramics model development.

1.4.2. The model has been developed to represent a 2021 base year in Paramics Discovery, with the purpose of the model being to support the assessment of highway network operation following the inclusion of the proposed 'The Lanes, Penwortham' residential led development adjacent to the A582 Penwortham Way.

1.4.3. The study area for the model includes Lower Penwortham and the Lostock Hall area, to the south of Penwortham. The network extent captures the A59, A582, A6, B5254 Leyland Road and M6 junction 29, in addition to local arterial routes identified within the study area. The model extents are shown in Figure 1.

Figure 1 – Model Extents



1.4.4. WSP has requested signal specifications from LCC and National Highways to undertake the review, with signal specifications provided for the following locations:

- M65 / M6 junction 29;
- A6 / Wigan Road;
- A6 / Cuerden Way / Craven Drive;
- A6 / A582 / M65;
- A582 / B5254 Watkin Lane / Stanifield Lane;
- Watkins Lane pedestrian crossing, next to the Co-op;
- Watkin Lane / Jubilee Road;
- Watkin Lane / Brownedge Road / Coote Lane;
- Brownedge Road / Todd Lane North
- A582 / B5253 (Tank roundabout);
- A582 / Chain House Lane;
- A582 / Pope Lane;
- A582 / John Horrocks Way;
- Cop Lane / A582 / Millbrook Way;
- Liverpool Road / Penwortham Tesco;
- Liverpool Road / Cop Lane;
- A59 Pedestrian crossing at Crookings Lane;
- A59 Pedestrian crossing at Central Drive;
- A59 / John Horrocks Way;
- Leyland Road Pedestrian crossing at Stricklands Lane;
- Leyland Road Pedestrian crossing at Brydeck Avenue;
- Leyland Road Pedestrian crossing at Pembury Avenue; and
- The Cawsey / Firs Drive.

1.4.5. Signal information has not been received for the following locations:

- A59 / Golden Way;
- A59 / Liverpool Road;
- A59 Pedestrian crossing at Queensway;

1.4.6. The focus of the review for National Highways is the SRN, however a full review has been undertaken of the model and the LMVR. As a result, this report has been split into the following subsections:

- **Chapter 2: LMVR Review** – A review of the provided LMVR
- **Chapter 3: Strategic Road Network Review** – A review of model coding and calibration/validation at the SRN junctions/mainline
- **Chapter 4: Full Model Review** – A review of the model coding throughout the rest of the network
- **Chapter 5: Summary & Conclusions** – A summary of the findings of the review and suggestions of next steps.

1.4.7. A supplementary spreadsheet named ‘Base Review Comment Log’ has been provided with the report to provide additional detail relating to the comments in the report.

2

LMVR REVIEW

2 LMVR REVIEW

2.1.1. WSP has undertaken a review of the provided LMVR, with comments provided in the following subsections.

2.2 OBSERVED DATA

MODEL CALIBRATION DATA

2.2.1. Traffic data was collected by Nationwide Data Collection (NDC) in April 2021 in support of the study. Vectos note in their LMVR that WebTRIS data was used from April 2021 for the M6 and M65 mainline, in response to the query from WSP regarding the source of the SRN mainline demands.

2.2.2. National Highways previously raised a concern of using April 2021 data being suitable as a baseline dataset as a result of certain coronavirus restrictions still being in place at this time. Whilst there are concerns regarding when the surveys were undertaken, the locations of the surveys appear reasonable to cover the main junctions within the study area.

2.2.3. Vectos has produced a technical note (TN03) to provide a comparison between 2018 and 2021 data, with a comparison of Manual Classified Count (MCC) traffic flows provided. It is noted that this table was provided using Passenger Car Units (PCUs), and therefore the percentage comparison presented may differ if the numbers were converted to vehicles and indeed to be disaggregated by vehicle type (albeit would still show a positive/negative as in the table). Following the provision of this information WSP have the following comments:

- The data has been provided as junction totals. A full by turn comparison is required to form a considered view of the changes between the data.
- It is noted that Vectos provide sensitivity model assignments with a blanket increase in demand of 20%, which are reported in increasing the base modelled delay by ~14% in the morning peak and ~20% in the evening peak. It is not clear what conclusions can be drawn from this presented information.
- There are infrastructure changes, the opening of the Cawsey Link Road and the Penwortham Bypass, to the network since 2018 which have had an impact on traffic routeing, and total junction throughputs between 2018 and 2021. It is therefore not possible to form a direct view on demand differences at all of the locations within the supplied data comparison.

2.2.4. Based on the information provided it is not possible to state that the April 2021 counts are suitable for development of an appraisal tool. The counts were conducted when coronavirus restrictions were in place and irrespective of their total values can not been deemed a reliable source of baseline traffic data. On this basis we would request that either strong further evidence is provided that the April 2021 counts are representative or that the modelling work is revisited with an alternative data source.

MODEL VALIDATION DATA

2.2.5. The LMVR states that observed journey times were extracted from the Streetwise TomTom dataset for a selection of key corridors across the study area. However, no information has been provided regarding the dates and times that the journey time data has been collected for, and therefore this information is requested.

2.2.6. The journey time routes (as shown in Figure 3 of the LMVR) appear reasonable to be used to validate the journey times within the model. Each of the journey time routes are split into subsections, which appears reasonable. It is noted that the subsections of these journey time routes sometimes pass through several junctions, and therefore clarification is sought over any potential discrepancy between what the model may be capturing and the data that the TomTom data may include. For example, for Route 6, Section 2, the route goes through several minor junctions. Within the model, vehicles entering the network from the minor arms of these junctions are not being picked up within the journey time analysis. Therefore, if the TomTom data is based upon individual link information rather than a full route, there may be discrepancies.

2.2.7. Paragraph 3.7 of the LMVR states that "it was determined that the M65/M6 junction should also be included to enable an assessment of any potential impact on the Strategic Road Network close to the development area." However, there has been no validation undertaken within this area and therefore is it unclear how the model will be used to assess the impact on the Strategic Road Network, and therefore this requires clarification.

2.3 BASE MODEL DEVELOPMENT

TIME PERIODS

2.3.1. The time periods used within the model appear reasonable. Clarification is sought over how the morning and evening peak hours used for assessment (0800-0900 and 1700-1800) were identified. We note that the previous application for this development location identified peak hours of 0800-0900 and 1630-1730, which were agreed with the local highway authority. It is recommended that the assessment periods are agreed prior to completing any further modelling work.

NETWORK EXTENT

2.3.2. The network extent of the model appears reasonable, covering the key junctions around the development site, in addition to the wider network including the M65/M6 junction.

VEHICLE TYPES

2.3.3. The methodology used to calculate the vehicle type proportions appears reasonable, with the presented values reflected within the modelling.

FAMILIARITY AND PERTURBATION

2.3.4. The familiarity and perturbation values specified within the LMVR appear reasonable and have been reflected within the modelling.

LINK TYPE

2.3.5. Figure 5 of the LMVR shows that the M6/M65 has the 'Highway' Link Type, which is reasonable given the nature of these roads. However, in the model these links have been coded as an 'Urban' Link Type. Clarification is sought regarding why the model has been coded with an 'Urban' Link type, and the contradiction with the LMVR.

LINK CLASSIFICATION

2.3.6. The classification of the major and minor links as shown in Figure 6 of the LMVR appears reasonable and have been applied to the model accordingly.

LINK CATEGORIES/SPEED LIMITS

2.3.7. The link categories shown in Figure 7 of the LMVR generally appear to be reasonable. However, further information is requested regarding the methodology used to take the TomTom data and apply free flow speeds to the network, including a map showing the differences in the modelled and on-street speed limits. This approach should be used with caution, as the model should be attempting to replicate delays from geometry, priorities, congestion in the network and signals. If the speed is manually reduced, the model may not be appropriately replicating conditions in these areas of the network, and such limitations should be noted within the LMVR.

2.3.8. Where possible, the model should try to replicate delays/areas where there is slow moving traffic without manually adjusting the speed. An example is Brownedge Road which is coded as 20mph rather than the on-street speed limit of 30mph. Along Brownedge Road there are three zebra crossings and speed humps which are likely to impact speed, and therefore it is recommended that these elements be included within the modelling rather than manually reducing the speed.

2.3.9. As mentioned, additional information is requested regarding the methodology and data used to determine these speeds, to allow the appropriateness of these manual changes to be determined. It is noted that there is a reduction between the A6/Brownedge Road and the A6/A582 from 60mph (speed limit) to 40mph (modelled) which is a substantial difference, and therefore we request the information to provide clarity on this, and other speed changes in the model.

2.3.10. There are some discrepancies between the speed limits in the LMVR and the modelled speed limits. For example, on Flensburg Way between the Flensburg Way/Penwortham Way roundabout (to the west) and the A583/Croston Road double roundabout (to the east), the model is coded as 60mph, but the figures suggest that a 30mph speed limit has been applied.

PUBLIC TRANSPORT

2.3.11. The LMVR states that a total of 40 routes have been defined within the model, which appears reasonable for a model of this geographical scope. Paragraph 3.33 states that a dwell time at bus stops has been set at 15 seconds. The model has a minimum dwell time of 10 seconds and a maximum dwell time of 15 seconds; therefore, it is recommended that the wording is updated within the LMVR. The local highway authority has provided WSP with advice that morning peak bus stop dwell times can be up to 30 seconds. We recommend that prior to any further modelling that Vectos agree bus dwell times with Lancashire County Council prior to proceeding.

SIGNPOSTING

2.3.12. A review of the signposting within the model has been undertaken in the Model Review sections of this report.

ZONE SYSTEM

2.3.13. The zone system and methodology of applying demand to zones generally appears reasonable.

ZONE PORTALS

2.3.14. In the absence of data from every junction within the network, the methodology of using land spread information to determine the percentage applied to each entry zone appears reasonable.

SIGNALS

2.3.15. The LMVR does not provide any information regarding the data/methodology used to code the signalised junctions/pedestrian crossings into the model. WSP request that this information is provided.

2.4 MATRIX DEVELOPMENT

2.4.1. As part of the initial comments provided by WSP to Vectos, WSP requested to view the base matrix development process in more detail to form a judgement on its suitability. Vectos responded stating that they would provide the relevant files for review, however these have not been supplied. WSP require the spreadsheets summarising the matrix build process to undertake this review.

2.4.2. Google journey route data has been used in the matrix development process to assign the 2011 Census data to the network, it is not clear when Google routeing data was obtained and it may not be reflective of typical peak conditions, furthermore it would be expected that the routeing choices might be different by time period, it is not clear if this has been completed. The matrix development process outlined in the modelling report does not appear to consider none work based trips, the model covers a large area with several supermarkets, large retail stores and schools. Information is requested regarding the dates and times the Google routeing data was used for, in addition to further information regarding the number of Google routes used (i.e. was it just the quickest route used).

2.5 NETWORK CALIBRATION

VISIBILITY

2.5.1. The visibility applied in the model has been set at either 0m or 30m, and further calibration does not appear to have been undertaken at locations where visibility may fall in between the two values. Guidance on the Paramics Microsimulation support portal ('Set Visibility on approach to junctions') states that "*A standard value of 30m is generally a good starting point for visibility and this can be refined in specific locations is necessary*". WSP suggest that consideration is made regarding the calibration of visibility values used in the model, to determine the appropriateness of using a 0m visibility or a 30m visibility with nothing in between.

GAP ACCEPTANCE

2.5.2. Gap acceptance changes are generally acceptable in the model, where observed behaviour is attempting to be replicated, however it is noted that there are some inconsistencies between the gap acceptance in the model and in the LMVR which should be rectified. A review of priority coding has been undertaken as part of the model review and does note some specific concerns where gap acceptance values have been edited from the default values.

HEADWAY

2.5.3. Headway factors have been included on different links within the network. The LMVR states that a headway factor of 1.5 has been applied along the A59 (approximately 2.25km in length) as "*this section of the network that accesses Central Preston is known to experience queueing on a regular basis alongside a number of interactions with side roads and large speed differentials meaning that vehicles are inclined to leave slightly larger gaps within this area*". WSP require clarification over the appropriateness of using a headway factor along the full corridor, and request evidence regarding

the congestion relating to the queueing on this corridor (perhaps by comparing free flow speeds to peak speeds along this corridor to understand where there is congestion). Observations of the model running do not suggest congestion issues at this location.

2.5.4. A headway factor of 1.75 has been coded along the full B5254 corridor (over 4km in length), with the LMVR stating "*the B5254 is understood to be relatively busy being a key access between Lower Penwortham and Lostock Hall*" and it has been applied to reflect on-street behaviour. WSP require clarification over the appropriateness of using a headway factor for the full corridor, and request evidence to support the use of headway factor across the corridor. The road goes through several different areas, with different vehicle behaviours likely to occur along the corridor. We note that part of this section, to the north of The Cawsey roundabout has reported on street parking delays which are not reflected within the model.

2.5.5. The LMVR does not provide justification for the 0.2 headway factor applied at the A582/Croston Road roundabout, and therefore this is requested.

LOOK THROUGH

2.5.6. WSP acknowledge that methodology of using look throughs at locations with short adjacent links as reasonable, although the use of less than 25m should be reviewed on a case-by-case basis depending on the vehicle behaviour at this location (i.e. there may be adjacent links greater than 25m which may require a look through applied based on higher vehicle speeds).

GIVE WAY TO ONCOMING TRAFFIC

2.5.7. The methodology of using the give way to oncoming traffic feature appears reasonable where there are directional priorities along a road, with the suitability of the coding commented on in the model review section of this report.

CLEAR EXIT ADHERENCE

2.5.8. The clear exit adherence parameter is used to let opposing vehicles out of a road when traffic is in a slow moving or queued state. This may also act to replicate yellow box behaviour. The LMVR states three locations where clear exit adherence has been applied (Figure 19) but the model only has two. It is recommended that this is rectified within the LMVR.

COST FACTORS

2.5.9. WSP acknowledge that in a model with route choice, cost factors can be used to influence route choice, with justification as is provided in the Vectos LMVR. It is noted that there is a discrepancy between the LMVR on the M65 westbound which suggests a cost factor of 0.8 has been applied but the model has a cost factor of 1. It is recommended that this is rectified within the LMVR.

VEHICLE RELEASE PROFILES

2.5.10. The LMVR states that wherever possible the profiles within the model have been derived directly from count data, with this approach being reliant on data sites being in close proximity to the zones and the data being disaggregated into, at least, 15 minute profiles. The model only has 11 profiles for light vehicles and 11 profiles for heavy vehicles, which is coarse given the extents of the model and the number of zones. More information is requested regarding the calculation of the profiles, including which count sites have been used to determine the profiles for which zones, in addition to the data from the counts sites which have been used (i.e. approach link, total junction flow, flow by

turn). WSP request that information is provided to show that the profiling at the SRN junctions (and SRN mainline) is appropriate compared to the observed data.

2.6 FLOW CALIBRATION

THE GEH STATISTICS

2.6.1. The GEH statistic has been used to assess the flow calibration of the model, which WSP welcome as an acceptable methodology. Paragraph 6.5 of the LMVR states that 10 morning peak and evening peak runs have been undertaken, with Figures 21/22 showing the variance in the number of vehicles in the model network in each individual run by time period. WSP request evidence of whether 10 runs are sufficient given the extents of the model and the potential route choice within the model, or whether further runs are required. Within the morning peak figure (Figure 21), there are some larger differences between the number of vehicles in the model. For example, between Run 1 and Run 10 at approximately 08:45, with there being approximately 2,600 vehicles in the network in Run 1 and 2,900 vehicles in the network in Run 10. In the evening peak, there are also some of these larger differences, for example between Run 1 and Run 7, with approximately 200-400 more vehicles in the network in Run 7 between 16:45 and 17:45. A review of model stability using journey times or vehicle delays opposed to total demand is requested.

TAG CRITERIA

2.6.2. WSP acknowledge the use of TAG criteria for undertaking the calibration/validation of the model. WSP note that for the modelled journey times, the criteria states that routes should be over 3km in length. Whilst not explicitly stated within the criteria, routes shorter than 3km should use the one-minute rule with caution, and models should aim to be closer to the 15% where possible.

TURN AND LINK CALIBRATION

2.6.3. The calibration of the morning and peak hours of 08:00-09:00 and 17:00-18:00 appears reasonable given the size of the model being calibrated, noting our wider concerns over the use of April 2021 calibration data. A review of the SRN calibration has been undertaken in the following section of this review.

2.7 VALIDATION

2.7.1. The journey time routes for the morning and evening peaks generally fall within 15%, with 12/14 (86%) and 14/14 (100%) falling within 15% in the morning and the evening peak respectively, meeting the criteria of more than 85% of routes falling within 15%.

2.7.2. With the disaggregation of the journey time routes into sections, 20/26 (77%) and 19/26 (73%) fall within 15% in the morning and evening peak hour respectively. The sections which do not fall within 15% include the following:

- Morning Peak
  - Route 1 Section 2 SB- 27s (17%) too slow in the model
  - Route 1 Section 2 NB- 23s (22%) too quick in the model
  - Route 2 Section 1 EB- 39s (16%) too slow in the model
  - Route 5 Section 2 SB- 44s (16%) too slow in the model
  - Route 7 EB- 26s (31%) too slow in the model
  - Route 7 WB- 15s (19%) too quick in the model

- Evening Peak
  - Route 1 Section 2 SB- 31s (20%) too slow in the model
  - Route 1 Section 3 NB- 28s (25%) too quick in the model
  - Route 2 Section 2 WB- 52s (18%) too slow in the model
  - Route 3 Section 1 NB- 17s (19%) too quick in the model
  - Route 3 Section 2 SB- 12s (17%) too quick in the model
  - Route 4 Section 1 SB- 106s (40%) too slow in the model
  - Route 4 Section 2 SB- 58s (23%) too quick in the model

2.7.3. All of the above journey time sections are classified as passing, with the exception of Route 4 Section 1 SB, as a result of these sections being within 1 minute. As mentioned, use of the 60 second rule should be used with caution for shorter routes, and therefore the section validation should be reviewed to improve the journey time closer to 15% where possible.

2.7.4. It is noted that Route 4 southbound meets criteria across the full route in the evening peak, however when looking at the sections separately, Section 1 is 106 seconds too slow and Section 2 is 58 seconds too quick. The discrepancies in the comparison between the modelled and observed journey time suggests the model may not be replicating the operation of the network within the individual subsections and therefore this should be revised.

2.7.5. There are sections which are consistently too slow or too quick in the model in both the morning and evening peak hour by over 15%, suggesting that the operation within the model may not be replicating the observed operation, including:

- Route 1 Section 2 SB (too slow in the model)
- Route 1 Section 3 NB (too quick in the model).

2.7.6. Other sections which are outside the 15% criteria in one time period and not the other, but are consistently too quick or too slow include:

- Route 2 Section 2 WB (too slow in the model)
- Route 3 Section 1 NB (too quick in the model)
- Route 7 WB (too quick in the model)

2.7.7. Sections which are consistently too quick or too slow across time periods suggests that the model may not be replicated observed behaviour in these locations. It is requested that a review of the journey time validation is undertaken, in line with the comments made as part of this review relating to the LMVR and model coding.

2.7.8. Upon review of the subsections in Appendix C, it is noted that the percentage differences and actual differences use opposite signs for if a difference is positive or negative. It is recommended that the LMVR is updated so the differences are consistent to avoid confusion.

3

STRATEGIC ROAD NETWORK REVIEW

3 STRATEGIC ROAD NETWORK REVIEW

3.1.1. This section of the report is split into two subsections:

1) A review of the model coding of the junctions which form part of the SRN, or are adjacent to, and of the modelled motorway mainline sections.

2) A review of the calibration/validation of the SRN junctions/motorway mainline.

3.2 SRN MODEL REVIEW

3.2.1. This subsection details review findings into the model coding of the junctions which form part of the SRN, and of the modelled motorway mainline sections. Namely:

- The M6 mainline (between the south of the M6 junction 29 and north of the M6/A6/Church Road) and the M65 mainline (between the east and west of junction 1);
- M6/A6/Church Road; and
- M6 junction 29/M65 junction 1.

3.2.2. It is noted that the A6/A582 has an arm from the M65. Comments for this junction are provided in the Full Model Review section. The model coding review has been supplemented with model observations undertaken for the morning and evening peak periods only.

3.2.3. We note that paragraph 3.7 of the LMVR it is stated that “it was determined that the M65/M6 junction should also be included to enable an assessment of any potential impact on the Strategic Road Network close to the development area.” Consequently, the model will be required to be of a sufficient detail and accuracy in this location.

3.2.4. The model review has been developed to provide a table of comments by comment type. A yellow, amber, red system has been used to categorise the comments by severity:

- Yellow- Minor Change
- Amber- Narrative required/review required within the model
- Red- Requires action.

M6 JUNCTION 29/M65 JUNCTION 1

3.2.5. The following comments are made regarding the M6 junction 29/M65 junction 1:

Table 1 – M6 Junction 29/M65 Junction 1 Comments

Coding Element	Comment	Severity
Overlay	The majority of links are coded in appropriate positions relative to the overlay, however there are locations where the links cross the kerb/island lines on the overlay including: • Link 108:1088 • Link 6:19 • Link 3:17 • Link 1080:1081	

Link Coding	The coding of how the free-flow left turn lanes develop has not been replicated in the model, with the model allowing vehicles to turn into this lane at the approximate location of the island. The lanes should widen to three lanes in advance of the free-flow left turn, which would allow this traffic to bypass queues from the circulatory.	
Link Coding	The model does not appear to consistently consider the actual length of links as shown in satellite imagery, and generally appears to be underestimating certain link lengths within the model. The overlay does not include lane markings/hatching, and the model generally has not taken these into account, instead coding based on the island/kerb locations. Examples include: • M65 eastbound off-slip (Link 64:18) - Two lane section in model is too short. • M65 westbound on-slip (Link 17:63) - Two lane section in model is too short. • M6 southbound on-slip (Link 23:1080) - Two lane section in model is too short. • M65 westbound off-slip (Link 65:22) - Two lane section in model is too short. • M6 southbound merge (Link 1081:1082) – Two lane section in model is too short.	
Link Coding-Diverges	The link coding of the M65 westbound diverge/off-slip and M6 northbound diverge/off-slip does not reflect satellite imagery. The model has the M65 westbound diverging just to the west of the A6 bridge (node 79), with vehicles unable to use the diverge after this point. In reality, vehicles can continue to move into the diverging lane up until the nose of the diverge (approx. 260m west of the bridge). The model has the M6 northbound off-slip diverging at node 46, with vehicles unable to use the diverge after this point. In reality, vehicles could still use the diverge up until the nose of the diverge.	
Link Coding-Merge	The southbound merge onto the M6 does not reflect satellite imagery. The model has a merging link of approximately 60m (1081:1082), however the merge in reality is upward of 150m.	
Link Coding-Merge	The M65 eastbound on-slip coding in the model does not reflect satellite imagery. • The distance of the three-lane link from the nose of the free-flow lane to the solid white line at the first merge point (Link 21:108) is longer in the model than satellite imagery • The first merge point has a distance of approximately 140m from the solid white line to the merge onto the M65, which the model does not replicate with Link 108:1088 having a length of 78m • The first merge onto the M65 (Link 1088:73) has a link length of 125m, compared to the measure length of less than 85m. It is acknowledged that the stopline positions have been changed in an attempt to reflect this, but model observations show vehicles using more than the available space to change lanes, potentially overestimating the capacity of this merge point.	

	• The two-lane section after the first merge point (Link 108:110) is coded as only 113m, however measurements suggest that the length is upwards of 240m • The length of the two links from the first merge to the lane gain (Link 108:110 and 110:111) is approximately 250m, whilst it should measure approximately 390m	
Roundabout Lanes	Lane markings indicate that two lanes can be used to undertake the movement from the M6 northbound off-slip to the M65 eastbound exit. The model has only been coded as one lane until after the eastbound approach (Link 5:6), where vehicles are allowed to use both lanes.	
Signal Coding	The signals at the eastbound approach/corresponding circulatory are coded as always being on green and without any give-way coding.	
Signal Coding	The intergreen values within the model have not explicitly been modelled. However, the model is coded with 5 seconds of all red between each stage, effectively implementing a 10 second intergreen between each stage. The signal specification suggests that the intergreen should be 5 seconds, meaning the model has 10 seconds of lost green time every cycle. This will only impact upon the model operation if the above comment is fixed.	
Look Through	No look through coding has been applied to the relevant circulatory links at the priority approaches to the roundabout, leading to some vehicle collisions (Links 16:2, 8:9 and 12:13).	
Gap Acceptance/Look Through	The Link 20:9 (southbound approach) has been coded with a lower gap acceptance than the default values. In combination with the no look through coding on Link 8:9, vehicles on this approach don't always appropriately give way and collide with the circulatory traffic.	
Headway Factors	Low headway factors of 0.4 have been applied on the M6 southbound on-slip and M65 southbound on-slip. The use of these low headway factors should be reviewed in line with the comments made regarding the coding of the slip roads.	
Signpost Distance	A signpost distance of 100m has been applied to Node 63, potentially allowing vehicles merging from Link 44:17 to move across to the right lane before having to move across to the left upon reaching the 100m distance. Signage shows that vehicles are told in advance of the merge point with the roundabout traffic that the two lanes will be reducing to one downstream.	
Visibility	Visibility values have been applied as 30m on all priority approaches with no calibration or consideration of visibility obstacles, meaning that the visibility may be overestimated on certain approaches.	
Model Observations	At node 23 vehicles from the free flow left turn are frequently observed to flow directly into the right lane on Link 23:1080, conflicting/colliding with traffic entering this link from the circulatory.	
Model Observations	At the southbound on-slip merge (Link 1081:1082), the lane changing of vehicles is causing collisions. This may be remedied by reviewing the coding of the on-slip and considering the use of ramp coding.	

Model Observations	Vehicles in the middle lane on Link 66:67 are moving into the right lane on Link 67:68 at node 67 instead of continuing in the same lane. These vehicles are observed to undertake this movement even if there is a vehicle in the right lane.	
Model Observations	Vehicles entering the M65 eastbound on-slip (Link 21:108) from the free-flow left turn immediately flow into the outside lane on Link 21:108, conflicting with other traffic exiting the roundabout. It would be expected that these vehicles remain in Lane 1 until they have a gap to move into Lane 2.	
Model Observations	Vehicles in the right lane on Link 21:108 are observed to change lanes, including at the end of the link, conflicting with other traffic.	

M6/A6/CHURCH ROAD

3.2.6. The following comments are made regarding the M6/A6/Church Road roundabout:

Table 2 – M6/A6/Church Road Comments

Coding Element	Comment	Severity
Roundabout Lanes	The movement from Church Road (Link 38:33) to Lostock Road (26:41) has been coded to allow two lanes to undertake this movement, despite lane marking suggesting that only the left lane can do this.	
Gap Acceptance/Look Through	Consideration of a look through for Link 30:31 is suggested given the shortness of the link and the observed collisions of some vehicles entering the roundabout. The low gap acceptance is also likely to be contributing to this.	
Visibility	Visibility values have been applied as 30m on all priority approaches with no calibration or consideration of visibility obstacles undertaken, meaning that the visibility may be overestimated on certain approaches.	
Model Observations	Some vehicles on Link 27:42 are aligning themselves in the right lane on approach to the roundabout, however cut across to the left lane upon entering the roundabout, cutting across those vehicles in the left lane.	

3.2.7. In addition to the comments made above, it is noted that the M6 and M65 have been coded as a 'Urban' Road Type rather than a 'Highway' Road Type. This is in contradiction to Figure 5 in the LMVR which suggests that these roads are coded as Highway Links. It is unclear why the model has been developed with Urban rather than Highway link types and therefore clarification is sought. Paragraph 3.17 of the LMVR states key features of a Highway Link, which appears reasonable to apply to these links.

3.3 SRN MODEL CALIBRATION REVIEW

3.3.1. WSP has undertaken a review of the calibration/validation undertaken in the model, relating to the SRN, based upon the information provided in the LMVR and the associated calibration/validation spreadsheets, noting the general concerns over the suitability of the April 2021 calibration data. WSP require clarification of how the model will be used to enable an assessment of any potential impact on the SRN if baseline validation has not been undertaken.

3.3.2. Turn flow calibration has been undertaken for the M6/M65 and the M6/A6/Church Road roundabouts, with link flow calibration also undertaken for each of the approaches to the roundabouts. WSP has used the information provided to calculate the flow calibration of the exit links to the junction. Link flow calibration has also been undertaken for the M65 and M6 through the M6/M65 junction.

3.3.3. The turn flow calibration for the M6/M65 and M6/A6/Church Road is summarised in Table 3.

Table 3 – SRN Turn Flow Calibration Summary

Junction	0700 - 0800	0800 - 0900	0900 - 1000	1000 - 1100	1100 - 1200	1200 - 1300	1300 - 1400	1400 - 1500	1500 - 1600	1600 - 1700	1700 - 1800	1800 - 1900
M6/A6/Church Road												
Count	12	12	12	12	12	12	12	12	12	12	12	12
GEH>=5	2	0	0	0	0	2	1	0	0	0	0	0
% GEH <5	83%	100%	100%	100%	100%	83%	92%	100%	100%	100%	100%	100%
M6/M65												
Count	10	10	10	10	10	10	10	10	10	10	10	10
GEH>=5	1	1	2	2	2	1	2	1	0	0	1	0
% GEH <5	90%	90%	80%	80%	80%	90%	80%	90%	100%	100%	90%	100%
Combined												
Count	22	22	22	22	22	22	22	22	22	22	22	22
GEH>=5	3	1	2	2	2	3	3	1	0	0	1	0
% GEH <5	86%	95%	91%	91%	91%	86%	86%	95%	100%	100%	95%	100%

3.3.4. The results show that for the majority of modelled time periods, the turn counts at the M6/M6/Church Road achieve 100% calibration. The Church Road to My Bypass SW movement did not calibrate across multiple time periods, with too few vehicles in model in the morning period and too many in the interpeak.

3.3.5. The results for the M6/M65 junction show that the majority of time periods have one or two turns not meeting the GEH criteria, with the turns from the M6 Preston Bypass NE to M65 (west), and M65 (West) to Preston Bypass NE frequently not meeting GEH criteria. The M6 Preston Bypass NE to M65 (west) movement generally have too many vehicles, whilst the M65 (West) to M6 Preston Bypass NE has too few vehicles (except 13:00-14:00), potentially suggesting routeing issues through the junction.

3.3.6. At the M6/M65 junction the morning peak hour of 08:00-09:00 experiences a GEH of 9 for the M65 west to M6 Preston Bypass NE, whilst the evening peak hour of 17:00-180:0 experiences a GEH of 10 for the Preston Bypass NE to M65 W. Clarification is sought regarding why these two turns do not meet criteria.

3.3.7. The combination of the results for the turn calibration show that all time periods have calibration above 85%.

3.3.8. A summary of the link flow calibration for the two junctions is summarised in Table 4.

Table 4 – SRN Link Flow Calibration Summary

Junction	0700 - 0800	0800 - 0900	0900 - 1000	1000 - 1100	1100 - 1200	1200 - 1300	1300 - 1400	1400 - 1500	1500 - 1600	1600 - 1700	1700 - 1800	1800 - 1900
Approach Links												
Count	12	12	12	12	12	12	12	12	12	12	12	12
GEH>=5	2	0	0	0	2	1	1	0	0	0	1	0
% GEH <5	83%	100%	100%	100%	83%	92%	92%	100%	100%	100%	92%	100%
Exit Links												
Count	8	8	8	8	8	8	8	8	8	8	8	8
GEH>=5	2	0	0	0	2	3	2	0	0	1	3	0
% GEH <5	75%	100%	100%	100%	75%	63%	75%	100%	100%	88%	63%	100%
Combined												
Count	20	20	20	20	20	20	20	20	20	20	20	20
GEH>=5	4	0	0	0	4	4	3	0	0	1	4	0
% GEH <5	80%	100%	100%	100%	80%	80%	85%	100%	100%	95%	80%	100%

3.3.9. The majority of time periods have 100% calibration for approach links. The flow on the M6 Preston Bypass NE was a location where the flow did not meet calibration criteria across multiple time periods.

3.3.10. . As with the approaches, the majority of time periods do have 100% calibration, albeit with 3 out of 8 exit links not meeting GEH criteria in the 17:00-18:00 evening peak hour. These links are the A6 Lostock Lane and M6 Preston Bypass SW exits at the M6/A6/Church Lane junction, and the M65 W exit at the M6/M65 junction. Clarification is sought regarding the reasoning behind the miscalibration in the evening peak hour.

3.3.11. A summary of the M65/M6 calibration against the WebTRIS data is summarised in Table 5.

Table 5 – M6/M65 Link Flow Calibration Summary

Junction	0700 - 0800	0800 - 0900	0900 - 1000	1000 - 1100	1100 - 1200	1200 - 1300	1300 - 1400	1400 - 1500	1500 - 1600	1600 - 1700	1700 - 1800	1800 - 1900
M65												
Count	2	2	2	2	2	2	2	2	2	2	2	2
GEH>=5	2	1	1	1	1	1	1	1	1	2	1	0
% GEH <5	0%	50%	50%	50%	50%	50%	50%	50%	50%	0%	50%	100%
M6												
Count	2	2	2	2	2	2	2	2	2	2	2	2
GEH>=5	0	0	0	1	1	2	2	1	0	0	0	1
% GEH <5	100%	100%	100%	50%	50%	0%	0%	50%	100%	100%	100%	50%
Combined												
Count	4	4	4	4	4	4	4	4	4	4	4	4
GEH>=5	2	1	1	2	2	3	3	2	1	2	1	1
% GEH <5	50%	75%	75%	50%	50%	25%	25%	50%	75%	50%	75%	75%

3.3.12. The results highlight that in the majority of time periods the flow on the M65 does not meet GEH criteria. In both the morning and evening peak periods, the flow is too low in the model compared against the observed data, in both the eastbound and westbound direction. The morning and evening peak periods generally meet criteria on the M6, with some mis-calibration in the evening peak. Clarification is sought regarding the reasoning behind the mis-calibration of the SRN.

3.3.13. With the two SRN junctions, and the SRN itself, being on the edges of the network the flow through these locations is largely controlled by the demand to/from the zones. It is noted that there is some route choice between the two junctions, however clarification is sought regarding the mis-calibration during the peak periods to understand whether the level of demand in this area of the network is appropriate and whether the routeing matches what the data suggest occurs.

4

FULL MODEL REVIEW

4 FULL MODEL REVIEW

4.1.1. Following the review of the coding, calibration and validation around the SRN a review has been undertaken of the wider model network. Given that there are some consistent comments for different locations around the model, the review has been undertaken by coding element rather than location. However, suggested locations have been provided of where this comment is applicable to for reference. Further details are provided in the 'Base Review Comment Log' spreadsheet.

4.1.2. The review covers the following coding elements/model observations:

- Overlay
- Link Coding
- Visibility
- Stopline Coding
- Lane Points
- Roundabout Lanes
- Signal Coding
- Standalone Pedestrian Crossings
- Signpost Distance
- Hazard Overrides
- Priority Coding
- Public Transport
- Model Observations.

4.1.3. The review uses the same yellow, amber, red rating system as was used as for the SRN review:

- Yellow- Minor Change
- Amber- Narrative required/review required within the model
- Red- Requires action.

4.2 OVERLAY

4.2.1. An overlay has been inserted into the model to allow for the model links to be drawn over the top, and to support the positioning of the stoplines within the model. The overlay gives an indication of the edges to the road but does not take into account hatching or road markings, which can make it more difficult to reflect where there are changes in the characteristics of the road (e.g. road widening). Satellite imagery should be used in conjunction with the overlay to ensure the building of the links in the network is accurate.

4.2.2. Comments regarding the coding on the model overlay are summarised in Table 6.

Table 6 – Overlay Comments

Comment	Location(s)	Severity
There are instances where the model links/stoplines are coded over islands/kerbs, and the vehicle trajectory would take the vehicles over the islands/kerbs. This may impact vehicle movements around the network.	• Old Lostock Lane (Link 170:171) • A582/Chain House Lane(Node 375) • A582/John Horrocks Way (Links 773:786, 789:776, 791:778, 780:1073) • A582/Cop Lane (Link 873:810) • Factory Lane (Link 1018:614) • Liverpool Road (Link 732:731 and 725:731) • A6/A582 (Link 216:101) • A6/B628 (Link 157:140, 140:141, 149:140)	

4.2.3. The locations highlighted are those on the key modelled links within the model, however it is noted that there are other locations on minor routes (e.g. Link 863:862) which also do not match the overlay but have not been provided in the table. The coding of the links/stoplines should be reviewed in the model against the overlay accordingly. Additional nodes/curvature of some links in the network, such as Link 863:862, would help better match the links to the overlay.

4.3 LINK CODING

4.3.1. Link coding has been undertaken on top of the overlay, as described in Section 4.2. When coding links in the model, a combination of the overlay, satellite imagery and street-view imagery should be used to ensure that the model has an appropriate link structure. The comments regarding the link coding in the model are summarised in Table 7.

Table 7 – Link Coding Comments

Comment	Location(s)	Severity
There are locations in the model where the number of lanes do not match the observed number of lanes	• A6/A582 (Link 100:101) • A582/Cop Lane (Link 813:810) • A6 Lostock Lane/B6258 (Link 159:158)	
The model has locations where the formation of a flare (from one to two, or two to three lanes, etc) differs in the model compared to satellite imagery	• The three-lane section on Cuerden Way (Link 183:184) • Eastbound approach to the A6/Cuerden Way junction (node 191) • Eastbound approach to the A6/A583 roundabout (Link 218:217) • A582 north-westbound approach to A582/Pope Lane (Link 1176:385) • Pope Lane north-eastbound approach to A582/Pope Lane (Node 823) • Pope Lane south-westbound approach to A582/Pope Lane (Node 836)	

Comment	Location(s)	Severity
	• A582 eastbound approach to Pope Lane (nodes 799 and 812) • A582 northbound approach to A59/A582 (Link 695:694) • Liverpool Road southbound approach to A59/Liverpool Road junction (Link 720:719) • A59 Liverpool Road south-westbound (Link 721:722) • A59 at A59/Lindle Lane (Link 902:903)	
The model coding at the A59/Cop Lane/Priory Lane, A59/Tesco and A59/Hill Road has not been updated to the current road layout. The current layout was implemented on-street in February 2021, prior to the model data collection, with temporary signals. The permanent signals were implemented in June 2021	• A59 Cop Lane/Priory Lane (node 732) • A59/Tesco (node 731) • A59/Hill Road (node 725)	
The model has been coded with right turn pockets that are longer than observed	• A59 Liverpool Road/Chesmere Drive (Link 747:749) • A59 Liverpool Road/Queensway (Link 957:739)	
Right turn pockets have been excluded from the model coding and should be included	• Handshaw Drive (Link 540:539) • Saxon Place (539:540) • Eagleton Way (536:537)	

4.4 VISIBILITY

4.4.1. The visibility in the model details how far back from a node drivers begin to assess gaps in opposing traffic. In Paramics, drivers will assess this gap when they reach the end of the link as a result of the visibility being 0m. In reality, drivers may be able to see if they can continue before they reach a junction and therefore a visibility greater than 0m can be added. The model includes a visibility value of 0m or 30m at all priority junctions within the network.

4.4.2. The comments regarding the coding of link visibility are summarised in Table 8.

Table 8 – Visibility Comments

Comment	Location(s)	Severity
Whilst it is acknowledged that some locations will have no visibility and therefore 0m is acceptable, and other locations have high visibility and therefore 30m is acceptable, there are locations which will have visibility in the region of 0-30m and this has not been taken into account of. Guidance on the Paramics Microsimulation support portal ('Set Visibility on approach to junctions') states that "A standard value of 30m is generally a good starting point for visibility and this can be refined in specific locations is necessary".	Across the full model. One example is Church Lane (Link 331:315) which has an obstructed view and therefore does not have 30m visibility but is coded with 30m.	

4.5 STOPLINE CODING

4.5.1. Stopline coding within the model impacts the trajectory of vehicles throughout the network, in addition to the position where vehicles will stop at signals/priority locations.

4.5.2. The comments regarding the stopline coding in the model are summarised in Table 9.

Table 9 – Stopline Coding Comments

Comment	Location(s)	Severity
The stopline positions at certain junctions do not take into account pedestrian crossings and therefore may be overestimating the capacity at these locations	• A6 Lostock Lane/B6258- northern (Link 157:140) and southern (Link 149:140) arms • A6/Cuerden Way (node 167)	
The stopline positions at certain junctions do not reflect the stopline positions in satellite imagery	• A582/Cop Lane (Links 810:813 and 873:810) • A59/A59 Liverpool Road (Link 716:717) • The Cawsey/Firs Drive (Link 1067:534) • Brownedge Road/Watkin Lane (Link 402:403)	
Stacking within the junction has not been considered for junctions where there is available space within the junction itself for vehicles to give way	• Brownedge Road/Todd Lane • Brownedge Road/Watkin Lane	

4.6 LANE POINTS

4.6.1. Lane points are used in the model to help determine which lanes may be used to proceed to the next lane (e.g. which lanes could be used at a diverge)

4.6.2. The comments regarding the lane point coding are summarised in Table 10.

Table 10 – Lane Point Coding Comments

Comment	Location(s)	Severity
For certain merges on exit, vehicles are allowed to use either lane at the merge down to one lane, rather than attempting to get into the required lane. This approach has been applied inconsistently in the model, with some locations coding the merge on exit with vehicles reducing down to one lane to reflect the on-street markings. The difference in approach may impact operation with increased levels of traffic and therefore should be considered.	• Link 827:799 • Link 363:364	
The model has locations where the right lane has been coded allowing ahead movements, when the right lane should be for right turners only.	• A59 Liverpool Road/Howick Moor Lane (Link 914:915) • A59 Liverpool Road/Howick Cross Lane (Link 918:916)	

4.7 ROUNDABOUT LANES

4.7.1. Roundabout lanes are used in Paramics to control the lanes which vehicles use on the approaches and circulatory to navigate a roundabout.

4.7.2. The comments regarding the roundabout lane coding in the model are summarised in Table 11.

Table 11 – Roundabout Lane Coding Comments

Comment	Location(s)	Severity
The model has incorrect lane usage at roundabouts in the model	• A6/A582 • A582/B5253 • Booths Roundabout (A582/John Horrocks Way) • A59/A582	

4.8 SIGNAL CODING

4.8.1. Signals are coded into Paramics Discovery using the signal editor function. The editor allows phasing and staging to be implemented, in addition to inputting intergreen values for checking the modelled intergreens. Phase delays/gains can also be modelled. The signal editor includes a review function to check the modelled information such as cycle time, stage length, and green time.

4.8.2. The comments regarding the signal coding in the model are summarised in Table 12.

Table 12 – Signal Coding Comments

Comment	Location(s)	Severity
No intergreens explicitly coded. Whilst this does not impact the coding of the signals, it doesn't allow checking of the intergreens to take place	• Penwortham Way/Chain House Lane (Node 375) • Tank Roundabout (nodes 350,343, 345,352,346) • A582/Cop Lane-northern section (node 813) • A6/A582 (nodes 101, 103, 97, 99, 225) • A6/Cuerden Way (nodes 167, 1076, 1077, 1078, 1079) • A6/Wigan Road (nodes 140, 164) • M65 eastbound off-slip (node 5) • Watkin Lane/Brownedge Road (node 403) • Leyland Road/Jubilee Road (node 259) • Leyland Road/Coote Lane (node 404) • Brownedge Lane/Todd Lane (node 435) • Lostock Lane/Farington Road Roundabout (nodes 234, 236, 243, 205, 203, 1319) • The Cawsey/Firs Drive (node 534)	
In some locations where intergreens have been coded in the model, there is a discrepancy between the intergreen hard-coded into the model, and the intergreen which the model will be running. For example at Booths Roundabout intergreens have been hard-coded as 7 seconds. However, an all-red of 5 seconds has been coded between each stage, effectively meaning that the model will be running a 10 second intergreen.	• Booths Roundabout (nodes 772, 774, 776, 778, 784) • Penwortham Bypass/A59 (node 890) • Penwortham Way/Pope Lane (nodes 838, 839, 1069, 1071, 1072, 1184) • A582/Cop Lane- southern section (node 810)	
There are locations where intergreens have not been hard-coded but an all-red of 5 seconds has been coded between each stage effectively meaning that the model will be running a 10 second intergreen. This appears to have been generically applied to locations throughout the network.	• Penwortham Way/Chain House Lane (Node 375) • Tank Roundabout (nodes 350,343, 345,352,346) • A582/Cop Lane-northern section (node 813)	

Comment	Location(s)	Severity
	• A6/Cuerden Way (nodes 167, 1076, 1077, 1078, 1079) • A6/Wigan Road (nodes 140, 164) • M65 eastbound off-slip (node 5) • Leyland Road/Coote Lane (node 404)	
Locations with phases running green times of less than 7 seconds have been noted, and should be reviewed/revised as required.	• Penwortham Way/Chain House Lane (Node 375) • Booths Roundabout (nodes 772, 774, 776, 778, 784) • Penwortham Bypass/A59 (node 890) • A582/Cop Lane (nodes 810, 813) • Leyland Road/Jubilee Road (node 259) • Leyland Road/Coote Lane (node 404) • Penwortham Way/Pope Lane (nodes 838, 839, 1069, 1071, 1072, 1184) • The Cawsey/Firs Drive (node 534)	
There are junctions with pedestrian crossing facilities which aren't taken into account in the staging.	• Leyland Road/Jubilee Road (node 259) • The Cawsey/Firs Drive (node 534) • A6/A582- second stopline (node 227) and northbound exit (node 226) • A582/B5252 (node 240)	
There are locations in the model where pedestrian crossings are taken into consideration, however the time allocated in the model may not be long enough to cover the intergreens/crossing times.	• Leyland Road/Coote Lane (node 404) • Brownedge Lane/Todd Lane (node 435)	
Inconsistent intergreen values were coded between the morning/evening peak and the interpeak.	• Leyland Road/Coote Lane (node 404)	
The signals at the A59/John Horrocks Way have changed since the model was built (towards the end of 2021). Therefore, the base model requires reflection of the old signal specification, with any forecasting representing the newer signal specification.	• Penwortham Bypass/A59 (node 890)	

Comment	Location(s)	Severity
Review of signal coding is required in accordance with signal specifications, as aspects of many of the signalised junctions do not match the specifications. Signal specifications should be obtained, if they have not been previously. The review for signals includes: • Phasing • Staging • Intergreens • Phase Delays/Gains • Green times • Pedestrian crossings (all reds/ensuring model has enough time allocated for intergreens + crossing time).	• Network Wide	

4.9 STANDALONE PEDESTRIAN CROSSING

4.9.1. There is a separate function to the signal editor within Paramics Discovery which can allow for standalone pedestrian crossings to be modelled. This function allows for variable timings to be implemented using a minimum/maximum pedestrian crossing duration and activation interval.

4.9.2. The comments regarding the signal coding in the model are summarised in Table 13.

Table 13 – Standalone Pedestrian Crossing Coding Comments

Comment	Location(s)	Severity
Signalised pedestrian crossings have been excluded from certain locations in the model.	• Carrwood Road (node 530) • Watkin Lane (Link 259:258) • Watkin Lane (Link 249:250) • A59 Liverpool Road southbound (node 904/1089)	
Zebra crossings in the model have not been included.	• Brownedge Road (node 631) • Brownedge Road (node 441) • Brownedge Road (node 438)	
The timings applied to pedestrian crossings is consistent across the network, with a minimum pedestrian crossing duration of 10s and maximum of 15s. Is the time allocated in the model sufficient to cover a preceding intergreen, the crossing time for pedestrians and a following intergreen? Where possible, signal specifications should be used.	• Network Wide	

4.10 SIGNPOST DISTANCE

4.10.1. The signpost distance informs vehicles in the network of an upcoming hazard (e.g. junction, diverge, road narrowing) downstream.

4.10.2. Comments regarding the signpost distances applied to nodes are summarised in Table 14.

Table 14 – Signpost Distance Coding Comments

Comment	Location(s)	Severity
The signpost distance has been coded at a length where vehicles may make multiple lane changes on approach to a junction, instead of getting straight into the correct lane as would be expected.	• A6/A582 (node 103)	
Locations in the model where there is a merge after the exit to a junction are generally coded with a 25m/50m/100m signpost distance. This may be appropriate for short term merge lengths, however, longer merge lengths may benefit from a larger signpost distance to prevent vehicles inappropriately changing lanes on the exit to a junction. Values should be applied on a case-by-case basis to prevent unnecessary/unrealistic lane changing.	• Network wide	

4.11 HAZARD OVERRIDES

4.11.1. Hazard overrides are used to help vehicles to get into an appropriate lane for a hazard downstream. An example may be a two-lane section of road, widening to four lanes on approach to a roundabout. Hazard overrides can be used to inform the driver to use the left lane of the two-lane section, to use the left two lanes of the four-lane section.

4.11.2. The comments regarding the hazard override coding in the model are summarised in Table 15.

Table 15 – Hazard Override Coding Comments

Comment	Hazard Override	Severity
Hazard overrides have been applied for locations where a hazard does not exist, and therefore the override does not work as intended.	• 173:167, 1-2, 134:135, 1-1 • 138:139, 1-2, 134:135, 1-1 • 138:148, 1-1, 134:135, 2-2	
Hazard overrides have been applied for movements that are controlled by roundabout lanes, and therefore the override is not working as intended.	• 349:358, 1-2, 356:357 • 341:314, 1-2, 368: 367, 1-1 • 349:358, 1-2, 314:341, 2-2 • 281:273, 2-2, 294:289 • 281:273, 2-2, 295:291 • 279:283, 1-1, 294:289, 1-1	

Comment	Hazard Override	Severity
Hazard override 817:839, 1-2, 816:817, 2-3 appears reasonable. However, vehicles don't use the right lane on link 1176:385, the middle lane on link 385:816, and the third lane on 816:817 to use lanes 1-2 on link 817:839.	• 817:839, 1-2, 816:817, 2-3	
Hazard overrides are not working as intended due to differences between the lane ranges applied in the model and those in the hazard override.	• 182:103, 2-2, 167:180, 1-1	
Hazard overrides not working due to the signpost distance not being long enough.	• 182:103, 1-1, 167:180, 1-1	
The hazard override coding requires review in the model to ensure that vehicles are getting into the correct lane on approach to junctions/roundabouts. Hazard overrides are beneficial when there is widening on approach to ensure vehicles are using the correct lanes.	• Network Wide	

4.12 PRIORITY CODING

4.12.1. There are several aspects of priority coding in Paramics including:

- Major/Medium/Minor Priority
- Gap acceptance
- Give Way to All/Give Way to offside.

4.12.2. The major/medium/minor priority function is used to tell a vehicle if they have to give way at a specific point. A major priority is where vehicles have the priority and aren't required to give way. A medium priority is generally used where vehicles have to give way to one lane of traffic at a priority junction (for example a right turn into a side road). A minor priority is generally used where vehicles have to give way to more than one lane at a priority junction (for example the right turn out of a side road). The model has generally coded the appropriate priority coding in terms of major/medium/minor at priority junctions within the network.

4.12.3. The comments regarding priority coding in the model are summarised in Table 16.

Table 16 – Priority Coding Comments

Comment	Location	Severity
Vehicles are not coded to give way to opposing traffic.	• A59/John Horrocks Way (node 890) • Coote Lane (Link 416:417)	
Coding of priorities at locations allowing unrealistic route choice. A medium priority at node 814, potentially allows vehicles to use the slip road intended for southbound right turners, instead of vehicles turning at node 813.	• A582/Cop Lane (node 813)	
A Give Way to All adherence of 70% has been used when this has been applied in the model. Clarification is sought why 70% has been used.		

4.13 PUBLIC TRANSPORT

4.13.1. Public transport routes are coded in the model separate to the demands for general traffic. The routes are assigned a schedule detailing the times the public transport enters the network, in addition to the stops it stops at. The public transport stops are coded in a model to reflect on street stops and have a minimum/maximum dwell time which buses stop for.

4.13.2. The comments regarding the public transport coding in the model are summarised in Table 17.

Table 17 – Public Transport Coding Comments

Comment	Location	Severity
The 109 Preston-Chorley does not have a schedule assigned to it.	Route: • 109 Preston-Chorley	
Public transport stops appear to have been excluded from the model.	• A59 Liverpool Road (Cop Lane junction and Horrocks Way junction)- node 890 to 732 • Cop Lane (between A59/Cop Lane and Cop Lane/A582)- node 732 to 813	
There are fewer public transport stops in the model than suggested on satellite imagery/mapping.	• B5254 • Todd Lane N • Brownedge Road • Croston Road	

4.14 MODEL OBSERVATIONS

4.14.1. The comments made from observing the model running are summarised in Table 18.

Table 18 – Model Observation Comments

Comment	Location	Severity
Vehicles are observed using potentially inappropriate lanes against the road markings.	• A6/Cuerden Way/Craven Drive-northbound left turn (Link 1077:1080) • A6/Brownedge Road • A6/Hennel Lane/Carrwood Road • A582/B582/A5083 • A582/B5253 • A582/Pope Lane (Link 1072:872) • Coote Lane/School Lane/Channock Moss (nose 412/623)	

5

SUMMARY & CONCLUSIONS

5 SUMMARY & CONCLUSIONS

5.1.1. WSP, on behalf of National Highways, has undertaken a review of the 2021 South Ribble Paramics Discovery Base model provided by Vectos Microsim, with particular emphasis on the SRN, albeit a full review of the model has been undertaken. The model has been developed with the purpose of supporting the assessment of highway network operation following the inclusion of the proposed 'The Lanes, Penwortham' residential led development adjacent to the A582 Penwortham Way. Paragraph 3.7 of the LMVR states that "it was determined that the M65/M6 junction should also be included to enable an assessment of any potential impact on the Strategic Road Network close to the development area."

5.1.2. The provided base model includes a 2021 network, with traffic survey data collected in April 2021. The model has been calibrated to this 2021 traffic flow data and validated to journey time data obtained from TomTom.

5.1.3. The review undertaken has focused on the following elements:

- A review of the information summarised within the provided LMVR;
- A review of the coding at the SRN junctions and SRN mainline;
- A review of the calibration/validation of the SRN;
- A review of the wider model extents.

5.1.4. Upon a review of the LMVR more information is requested regarding the following:

- Suitability of April 2021 data. Based on the information provided it is not possible to state that the April 2021 counts are suitable for development of an appraisal tool. The counts were conducted when coronavirus restrictions where in place and irrespective of their total values can not been deemed a reliable source of baseline traffic data. On this basis we would request that either strong further evidence is provided that the April 2021 counts are representative or that the modelling work is revisited with an alternative data source.
- The dates/times that the TomTom data has been collected for and that appropriate data is used to align with any traffic data source.
- The methodology of using the TomTom data, whether it is route based or link based, and if it is link based the potential for any discrepancies between the observed data and model results
- How the model will be used to enable an assessment of any potential impact on the SRN without validation undertaken in this location
- Differences between the modelled and on-street speed limits, including the methodology/data used to determine the modelled speed limit changes, noting that the model has been noted to not include a number of elements which would impact on traffic speeds, such as zebra crossings, speed cushions and parked cars.
- The dates and times the Google routeing data was used for, in addition to the number of routes used
- The appropriateness of applying a 0m or 30m visibility to all priority links, with no calibration undertaken
- The appropriateness of applying headway factors along the entirety of two long corridors. Evidence is requested to support the use of these headway factors along the entire length of the corridor

- The coarseness of vehicle release profiles, with only 11 profiles by vehicle type used in the model despite there being large network extents and a large number of zones. Information is requested to show that the profiling at the SRN junctions/mainline is appropriate
- Evidence that the number of runs undertaken (10) is suitable given the large network extents and possible route choice within the model
- Contradictions between LMVR figures and the model including:
  - The M6/M65 being designated as a 'Highway' link type in the LMVR but coded as an 'Urban' Link Type
  - Speed limits assigned to the model and those presented in the LMVR
  - Gap acceptance locations
  - Clear exit adherence locations
  - Cost factors.

5.1.5. The model review has used a yellow, amber, red system to categorise the comments by severity:

- Yellow- Minor Change
- Amber- Narrative required/review required within the model
- Red- Requires action.

5.1.6. The SRN review looked at the M6 junction 29/M65 junction 1, M6/A6/Church Road, and the M6/M65 mainlines. Table 19 summarises the number of yellow, amber and red comments for each coding element.

Table 19 – Coding Review Summary: SRN

Coding Element	Yellow	Amber	Red
M6 junction 29/M65 junction 1	1	6	12
M6/A6/Church Road	0	3	1
Total	*1*	*9*	*13*

5.1.7. The review of the SRN has indicated 13 'red' comments which require action in the model to ensure the model can accurately replicate the operation in this area. Comments include consideration of the actual link lengths from satellite imagery, which are generally underestimated in the model and may impact the model operation in this area, and the operation of the merges onto the M6/M65 mainline. The 9 'amber' comments require narrative or for these comments to be reviewed/revised in the model.

5.1.8. Given the comments raised during this review we cannot conclude that the model accurately reflects the SRN operation or is the model suitable for assessment use.

5.1.9. The model review has looked at the following coding elements across the model as a whole:

- Model Overlay
- Link Coding
- Visibility
- Stopline Coding

- Lane Points
- Roundabout Lanes
- Signal Coding
- Standalone Pedestrian Crossings
- Signpost Distance
- Hazard Overrides
- Priority Coding
- Public Transport
- Model Observations.

5.1.10. Table 20 summarises the number of yellow, amber and red comments for each coding element, noting that one yellow/amber/red comment may reflect several locations within the model extents.

Table 20 – Coding Review Summary

Coding Element	Yellow	Amber	Red
Model Overlay	0	1	0
Link Coding	0	2	3
Visibility	0	1	0
Stopline Coding	1	0	2
Lane Points	0	2	0
Roundabout Lanes	0	0	1
Signal Coding	2	3	4
Standalone Pedestrian Crossings	0	2	1
Signpost Distance	0	2	0
Hazard Overrides	0	6	0
Priority Coding	0	2	0
Public Transport	3	0	0
Model Observations	1	0	0
Total	*7*	*21*	*11*

5.1.11. The review has highlighted eleven ‘red’ issues within the model coding, with four of these relating to the signal coding within the model, and a further three ‘amber’ issues. Upon review of the signals in the model alongside the provided signal specifications, the signals in the model did not match the specifications and therefore require review/updating in the model.

5.1.12. Three ‘red’ comments and two ‘amber’ related to the link coding in the model, with locations where the on-street number of lanes did not match between the model and satellite imagery, and there are

locations where the development of flares in the model does not correlate with satellite imagery (the model likely under/overestimating capacities in different areas of the network).

5.1.13. Given the wide-ranging set of concerns raised during this review we cannot conclude that the model accurately reflects the operation of the network and therefore the model is not suitable for assessment use in its current form. We recommend that any revisions made to the modelling methodology or modelling process is agreed with National Highways and Lancashire County Council prior to commencement. Furthermore, any updates to the model will require further review before the modelling tool can be agreed as appropriate for forecasting appraisals.

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Key

Requires action
Narrative required/review required within model
Minor change

ITEM NO.	ELEMENT	DETAILS	VECTOS RESPONSE
		LMVR REVIEW	
1	Data	Based on the information provided it is not possible to state that the April 2021 counts are suitable for development of an appraisal tool. On this basis we would request that either strong further evidence is provided that the April 2021 counts are representative or that the modelling work is revisited with an alternative data source.	Vectos to provide further details/separate analysis on this
2	Data	No information has been provided regarding the dates and times that the journey time data has been collected for, and therefore this information is requested.	LMVR updated to provide further information on this. See para 2.9
3	Clarification Required	Paragraph 3.7 of the LMVR states that "it was determined that the M65/M6 junction should also be included to enable an assessment of any potential impact on the Strategic Road Network close to the development area." However, there has been no validation undertaken within this area and therefore is it unclear how the model will be used to assess the impact on the Strategic Road Network, and therefore this requires clarification	Journey time validation has been undertaken on all key approaches to the M65/M6 junction. See Tables 20-22 of the updated LMVR for further details
4	Clarification Required	The appropriateness of applying headway factors along the entirety of two long corridors. Evidence is requested to support the use of these headway factors along the entire length of the corridor	Headway factors have been applied on the A59 and B5254 corridors in order to reflect the nature of these routes as best as possible. Given the urban/residential nature of these routes, which typically have a high level of signal junctions, bus stops, shop frontages, parked cars, cycle lanes etc, a gap of greater than the default distance of 2 metres is likely. This headway features has been commented on and deemed acceptable in the Systra model review
5	Clarification Required	The coarseness of vehicle release profiles, with only 11 profiles by vehicle type used in the model despite there being large network extents and a large number of zones. Information is requested to show that the profiling at the SRN junctions/mainline is appropriate	In line with previous discussions with Systra, Vectos have attempted to minimise the number of profiles used within the modelling. The profiling has been developed to create a sector to sector profiling strategy, dependent on the MSOA that the zone in question lies within. This is considered sufficiently robust for this assessment, and in line with the guidance, produced by Systra, for a model of this size. Please note the number of profiles was not an issue picked up in the Systra independent audit of the model. The SRN mainline flows have a flat profile applied, on the basis that it is not the intention of this assessment to model in detail any impacts on the motorway mainline flows
6	Clarification Required	Evidence that the number of runs undertaken (10) is suitable given the large network extents and possible route choice within the model	The model has been re-run with 20 AM/IP/PM runs as part of this model audit repsonse, and continues to calibrate and validate across all periods. On this basis it it considered that 10 runs are demonstrably sufficient for this model assessment
7	Clarification Required	Contradictions between LMVR figures and the model including: • The M6/M65 being designated as a 'Highway' link type in the LMVR but coded as an 'Urban' Link Type • Speed limits assigned to the model and those presented in the LMVR • Gap acceptance locations • Clear exit adherence locations • Cost factors.	Plots within the LMVR have been updated to reflect the latest model parameters
8	Clarification Required	Differences between the modelled and on-street speed limits, including the methodology/data used to determine the modelled speed limit changes, noting that the model has been noted to not include a number of elements which would impact on traffic speeds, such as zebra crossings, speed cushions and parked cars.	Tom Tom free flow speed data has been reviewed and where necessary the modelled speed limits have been adjusted to better reflected observed speeds, where the model has over-estimated vehicle speeds. On urban routes, where there is a high propensity for vehicles to slow down for pedestrians/signal junctions/bus stops etc, the signposted speed limits are rarely reached, and as a result the modelled speed limits have been reduced in line with the Tom Tom free flows data. Further details on the methodology and locations at which this change has been applied are detailed in the LMVR (see para 3.29-3.36)
		STRATEGIC ROAD NETWORK REVIEW - M6 Junction 29/M65 Junction 1	
9	Overlay	The majority of links are coded in appropriate positions relative to the overlay, however there are locations where the links cross the kerb/island lines on the overlay including: Link 108:1088, Link 6:19, Link 3:17, Link 1080:1081	It is not anticipated that this has any impact on the model performance
10	Link Coding	The coding of how the free-flow left turn lanes develop has not been replicated in the model, with the model allowing vehicles to turn into this lane at the approximate location of the island. The lanes should widen to three lanes in advance of the free-flow left turn, which would allow this traffic to bypass queues from the circulatory.	Additional nodes and three lane sections added at node 1327 and 1328. The length of the three lane section has been included roughly in line with observations from satellite imagery
11	Link Coding	The model does not appear to consistently consider the actual length of links as shown in satellite imagery, and generally appears to be underestimating certain link lengths within the model. The overlay does not include lane markings/hatching, and the model generally has not taken these into account, instead coding based on the island/kerb locations. Examples include: • M65 eastbound off-slip (Link 64:18) - Two lane section in model is too short. • M65 westbound on-slip (Link 17:63) - Two lane section in model is too short. • M6 southbound on-slip (Link 23:1080) - Two lane section in model is too short. • M65 westbound off-slip (Link 65:22) - Two lane section in model is too short. • M6 southbound merge (Link 1081:1082) – Two lane section in model is too short.	Node positioning and link lenghts reviewed and updated in line with comments received
12	Link Coding	The link coding of the M65 westbound diverge/off-slip and M6 northbound diverge/off-slip does not reflect satellite imagery. The model has the M65 westbound diverging just to the west of the A6 bridge (node 79), with vehicles unable to use the diverge after this point. In reality, vehicles can continue to move into the diverging lane up until the nose of the diverge (approx. 260m west of the bridge). The model has the M6 northbound off-slip diverging at node 46, with vehicles unable to use the diverge after this point. In reality, vehicles could still use the diverge up until the nose of the diverge.	Coding of the two off-slips referred to has been updated in line with the comments received
13	Link Coding	The southbound merge onto the M6 does not reflect satellite imagery. The model has a merging link of approximately 60m (1081:1082), however the merge in reality is upward of 150m.	Coding updated as per comment received to extend on-slip to 150m
14	Link Coding	The M65 eastbound on-slip coding in the model does not reflect satellite imagery. • The distance of the three-lane link from the nose of the free-flow lane to the solid white line at the first merge point (Link 21:108) is longer in the model than satellite imagery • The first merge point has a distance of approximately 140m from the solid white line to the merge onto the M65, which the model does not replicate with Link 108:1088 having a length of 78m • The first merge onto the M65 (Link 1088:73) has a link length of 125m, compared to the measure length of less than 85m. It is acknowledged that the stopline positions have been changed in an attempt to reflect this, but model observations show vehicles using more than the available space to change lanes, potentially overestimating the capacity of this merge point.The two-lane section after the first merge point (Link 108:110) is coded as only 113m, however measurements suggest that the length is upwards of 240m • The length of the two links from the first merge to the lane gain (Link 108:110 and 110:111) is approximately 250m, whilst it should measure approximately 390m	Following the comments received the node positions and link lenghts have been reviewed and updated in line with the comments
15	Roundabout Lanes	Lane markings indicate that two lanes can be used to undertake the movement from the M6 northbound off-slip to the M65 eastbound exit. The model has only been coded as one lane until after the eastbound approach (Link 5:6), where vehicles are allowed to use both lanes.	Roundabout lanes updated in line with comment received
16	Signal Coding	The signals at the eastbound approach/corresponding circulatory are coded as always being on green and without any give-way coding	It was originally understood that these signals did not operated on a part time basis and as such timings staging/timings had not been included within the modelling. This has been updated following the audit comment with green time assigned to each movement

	17	Signal Coding	The intergreen values within the model have not explicitly been modelled. However, the model is coded with 5 seconds of all red between each stage, effectively implementing a 10 second intergreen between each stage. The signal specification suggests that the intergreen should be 5 seconds, meaning the model has 10 seconds of lost green time every cycle. This will only impact upon the model operation if the above comment is fixed.	No signal specification has been made available during the model build for this junction, however in-line with the comment above timings have been included, and the intergreen is now included as suggested
	18	Look Through	No look through coding has been applied to the relevant circulatory links at the priority approaches to the roundabout, leading to some vehicle collisions (Links 16:2, 8:9 and 12:13).	Given the length of the links referred to (above 25m in length) it has not be deemed suitable to apply the look through parameter, given the impact this will have on achieving the observed levels of traffic throughput
	19	Gap Acceptance	The Link 20:9 (southbound approach) has been coded with a lower gap acceptance than the default values. In combination with the no look through coding on Link 8:9, vehicles on this approach don't always appropriately give way and collide with the circulatory traffic.	In response ot the comment received and the observations wihtin the model, the gap acceptance parameter on this aproach have been reset at default values
	20	Headway Factors	Low headway factors of 0.4 have been applied on the M6 southbound on-slip and M65 southbound on-slip. The use of these low headway factors should be reviewed in line with the comments made regarding the coding of the slip roads.	The application of 0.4 headway on the slip roads referred to has been applied in line with guidance provided by Systra and is intended to reflect realistic patterns of motorway merge/diverage behaviour within the model as far as possible within the confines of the software
	21	Signpost Distance	A signpost distance of 100m has been applied to Node 63, potentially allowing vehicles merging from Link 44:17 to move across to the right lane before having to move across to the left upon reaching the 100m distance. Signage shows that vehicles are told in advance of the merge point with the roundabout traffic that the two lanes will be reducing to one downstream.	This signposting length has been applied to ensure that vehicles use the right hand lane, rather than seeing the lane drop at node 63 further out from the hazard point and therefore only using the left hand lane. Extending the signposting distance further was observed to reflect in unrealistic lane usage
	22	Visibility	Visibility values have been applied as 30m on all priority approaches with no calibration or consideration of visibility obstacles, meaning that the visibility may be overestimated on certain approaches	Given the level of calibration and validation achieved on the approaches to the junction the visibility applied is considered appropriate
	23	Model Observations	At node 23 vehicles from the free flow left turn are frequently observed to flow directly into the right lane on Link 23:1080, conflicting/colliding with traffic entering this link from the circulatory.	Next lanes applied to improve vehicle behaviour in this area
	24	Model Observations	At the southbound on-slip merge (Link 1081:1082), the lane changing of vehicles is causing collisions. This may be remedied by reviewing the coding of the on-slip and considering the use of ramp coding.	The coding of the on-slip in this location is in line with guidance provided by Systra on the coding of motorway merges on models developed by Vectos elsewhere. The vehicle behaviour at this location has been reviewed and improved through the adjustments to signposting, lane points and next lanes where possible
	25	Model Observations	Vehicles in the middle lane on Link 66:67 are moving into the right lane on Link 67:68 at node 67 instead of continuing in the same lane. These vehicles are observed to undertake this movement even if there is a vehicle in the right lane.	Next lanes applied to improve vehicle behaviour in this area
	26	Model Observations	Vehicles entering the M65 eastbound on-slip (Link 21:108) from the free-flow left turn immediately flow into the outside lane on Link 21:108, conflicting with other traffic exiting the roundabout. It would be expected that these vehicles remain in Lane 1 until they have a gap to move into Lane 2.	Next lanes applied to improve vehicle behaviour in this area
	27	Model Observations	Vehicles in the right lane on Link 21:108 are observed to change lanes, including at the end of the link, conflicting with other traffic	Next lanes applied to improve vehicle behaviour in this area
	STRATEGIC ROAD NETWORK REVIEW - M6/A6/Church Road			
	28	Roundabout Lanes	The movement from Church Road (Link 38:33) to Lostock Road (26:41) has been coded to allow two lanes to undertake this movement, despite lane marking suggesting that only the left lane can do this.	Roundabout lanes updated in line with comment received
	29	Gap Acceptance	Consideration of a look through for Link 30:31 is suggested given the shortness of the link and the observed collisions of some vehicles entering the roundabout. The low gap acceptance is also likely to be contributing to this.	Look through applied on Link 30:31 and gap acceptance increased on link 39:31 in line with comment received
	30	Visibility	Visibility values have been applied as 30m on all priority approaches with no calibration or consideration of visibility obstacles undertaken, meaning that the visibility may be overestimated on certain approaches	The visibility parameter is a tool afforded to the modeller to try to calibrate the behaviour of traffic at a junction, and is intended to to reflect the distance back from the stop line that an approaching vehicle will consider their gap acceptance calculation, rather than the actual on-street visbility. The visibility has been applied in line with the 30m suggested by Systra, and then reviewed against flow (calibration) and delay (validation). Any locations where the resultant throughput/journey times are too high/low, the visibility parameter has been adjusted, as detailed wihtin the LMVR. Where the modelled flow/journey times are in line with observed then the default visibility remains unchanged
	31	Model Observations	Some vehicles on Link 27:42 are aligning themselves in the right lane on approach to the roundabout, however cut across to the left lane upon entering the roundabout, cutting across those vehicles in the left lane.	Signposting distance at the downstream Church Road/Walton Summit Road roundabout has been reduced which improves the west to east lane range behaviour on link 42:27
	32	Link Type	It is noted that the M6 and M65 have been coded as a 'Urban' Road Type rather than a 'Highway' Road Type. This is in contradiction to Figure 5 in the LMVR which suggests that these roads are coded as Highway Links. It is unclear why the model has been developed with Urban rather than Highway link types and therefore clarification is sought	The links have been coded as urban link types following discussions with Systra regarding the best approach to coding similar junctions elsewere - the figure within the LMVR requires updating to reflect this.
	FULL MODEL REVIEW			
	33	Overlay	There are instances where the model links/stoplines are coded over islands/kerbs, and the vehicle trajectory would take the vehicles over the islands/kerbs. This may impact vehicle movements around the network.	It is not anticipated that this has any impact on the model performance
	34	Link Coding	There are locations in the model where the number of lanes do not match the observed number of lanes: • A6/A582 (Link 100:101) • A582/Cop Lane (Link 813:810) • A6 Lostock Lane/B6258 (Link 159:158)	Model coding updated at the locations highlighted to increase/decrease number of lanes as appropriate. Note a dummy 5th lane has been added on links 101:102, 103:88 and 97:98 at the A6/A582 roundabout to improve lane range behaviour on the roundabout circulatory. These additional lanes are not used to increase capacity around the junction, simply to ensure vehicle behaviour and lane ranges can be reflected as accurately as possible
	35	Link Coding	The model has locations where the formation of a flare (from one to two, or two to three lanes, etc) differs in the model compared to satellite imagery: • Eastbound approach to the A6/Cuerden Way junction (node 191) • Eastbound approach to the A6/A583 roundabout (Link 218:217) • A582 north-westbound approach to A582/Pope Lane (Link 1176:385)A582 eastbound approach to Pope Lane (nodes 799 and 812) • A582 northbound approach to A59/A582 (Link 695:694) • Liverpool Road southbound approach to A59/Liverpool Road junction (Link 720:719) • A59 Liverpool Road south-westbound (Link 721:722) • A59 at A59/Lindle Lane (Link 902:903) • Pope Lane north-eastbound approach to A582/Pope Lane (Node 823) • Pope Lane south-westbound approach to A582/Pope Lane (Node 836)	In all instances the coding has been applied in order to best reflect observed lane choice and vehicle trajectories. Vectos believe there are no instances whereby the location of the flare wil have any bearing on over-estimating the model performance and throughput at the locations highlighted.
	36	Link Coding	The model coding at the A59/Cop Lane/Priory Lane, A59/Tesco and A59/Hill Road has not been updated to the current road layout. The current layout was implemented on-street in February 2021, prior to the model data collection, with temporary signals. The permanent signals were implemented in June 2021: • A59 Cop Lane/Priory Lane (node 732) • A59/Tesco (node 731) • A59/Hill Road (node 725)	Coding updated within this area to reflect Google Satelite imagery
	37	Link Coding	The model has been coded with right turn pockets that are longer than observed: • A59 Liverpool Road/Chesmere Drive (Link 747:749) • A59 Liverpool Road/Queensway (Link 957:739)	Right turn bays shortened at locations noted
	38	Link Coding	Right turn pockets have been excluded from the model coding and should be included: • Handshaw Drive (Link 540:539) • Saxon Place (539:540) • Eagleton Way (536:537)	Coding updated to include right turn bays at locations highlighted

	39	Visibility	Whilst it is acknowledged that some locations will have no visibility and therefore 0m is acceptable, and other locations have high visibility and therefore 30m is acceptable, there are locations which will have visibility in the region of 0-30m and this has not been taken into account of. Guidance on the Paramics Microsimulation support portal ('Set Visibility on approach to junctions') states that "A standard value of 30m is generally a good starting point for visibility and this can be refined in specific locations is necessary".	As per previous visibility comment - the visibility parameter is a tool afforded to the modeller to try to calibrate the behaviour of traffic at a junction, and is intended to to reflect the distance back from the stop line that an approaching vehicle will consider their gap acceptance calculation, rather than the actual on-street visbility. The visibility has been applied in line with the 30m suggested by Systra, and then reviewed against flow (calibration) and delay (validation). Any locations where the resultant throughput/journey times are too high/low, the visibility parameter has been adjusted, as detailed wihtin the LMVR. Where the modelled flow/journey times are in line with observed then the default visibility remains unchanged
	40	Stopline Coding	The stopline positions at certain junctions do not take into account pedestrian crossings and therefore may be overestimating the capacity at these locations: • A6 Lostock Lane/B6258- northern (Link 157:140) and southern (Link 149:140) arms • A6/Cuerden Way (node 167)	Lane point positioning reviewed and updated
	41	Stopline Coding	The stopline positions at certain junctions do not reflect the stopline positions in satellite imagery: • A582/Cop Lane (Links 810:813 and 873:810) • A59/A59 Liverpool Road (Link 716:717) • The Cawsey/Firs Drive (Link 1067:534) • Brownedge Road/Watkin Lane (Link 402:403)	Lane point positioning reviewed and updated.
	42	Stopline Coding	Stacking within the junction has not been considered for junctions where there is available space within the junction itself for vehicles to give way: • Brownedge Road/Todd Lane • Brownedge Road/Watkin Lane	Model updated to reflect potential for stacking space
	43	Lane Points	For certain merges on exit, vehicles are allowed to use either lane at the merge down to one lane, rather than attempting to get into the required lane. This approach has been applied inconsistently in the model, with some locations coding the merge on exit with vehicles reducing down to one lane to reflect the on-street markings. The difference in approach may impact operation with increased levels of traffic and therefore should be considered: • Link 827:799 • Link 363:364	Coding updated as suggested at these two locations
	44	Lane Points	The model has locations where the right lane has been coded allowing ahead movements, when the right lane should be for right turners only: • A59 Liverpool Road/Howick Moor Lane (Link 914:915) • A59 Liverpool Road/Howick Cross Lane (Link 918:916)	Coding updated as suggested
	45	Roundabout Lanes	The model has incorrect lane usage at roundabouts in the model: • A6/A582 • A582/B5253 • Booths Roundabout (A582/John Horrocks Way) • A59/A582	Roundabout lanes updated at the locations detailed
	46	Signal Coding	No intergreens explicitly coded. Whilst this does not impact the coding of the signals, it doesn't allow checking of the intergreens to take place	At the majority of junciton, no signal controller specs were available, so intergreen timings have been input based on a standard, robust number of seconds across the network
	47	Signal Coding	In some locations where intergreens have been coded in the model, there is a discrepancy between the intergreen hard-coded into the model, and the intergreen which the model will be running. For example at Booths Roundabout intergreens have been hard-coded as 7 seconds. However, an all-red of 5 seconds has been coded between each stage, effectively meaning that the model will be running a 10 second intergreen. - Booths Roundabout (nodes 772, 774, 776, 778, 784) • Penwortham Bypass/A59 (node 890) • Penwortham Way/Pope Lane (nodes 838, 839, 1069, 1071, 1072, 1184) • A582/Cop Lane- southern section (node 810)	The 7 second 'hard coded' intergreens at the locations highlighted have been removed from the model
	48	Signal Coding	There are locations where intergreens have not been hard-coded but an all-red of 5 seconds has been coded between each stage effectively meaning that the model will be running a 10 second intergreen. This appears to have been generically applied to locations throughout the network: • Penwortham Way/Chain House Lane (Node 375) • Tank Roundabout (nodes 350,343, 345,352,346) • A582/Cop Lane-northern section (node 813) • A6/Cuerden Way (nodes 167, 1076, 1077, 1078, 1079) • A6/Wigan Road (nodes 140, 164) • M65 eastbound off-slip (node 5) • Leyland Road/Coote Lane (node 404)	In the absence of signal controller specifications at the junctions listed, Vectos believe that the intergreen timings applied are sufficiently robust for the purposes of this modelling. The application of these timings have enabled to the necessary throughput and validation figures to be achieved
	49	Signal Coding	Locations with phases running green times of less than 7 seconds have been noted, and should be reviewed/revised as required: • Penwortham Way/Chain House Lane (Node 375) • Booths Roundabout (nodes 772, 774, 776, 778, 784) • Penwortham Bypass/A59 (node 890) • A582/Cop Lane (nodes 810, 813) • Leyland Road/Jubilee Road (node 259) • Leyland Road/Coote Lane (node 404) • Penwortham Way/Pope Lane (nodes 838, 839, 1069, 1071, 1072, 1184) • The Cawsey/Firs Drive (node 534)	In some instances this short green time is simply to reflect the stage extension/provision of right turn movements (e.g. Stage 2 at node 375, Stage 2 at Node 890) and is therefore deemed appropriate. At each of the remaining locations listed, the signal timings have been adjusted to ensure a minimum of 7 seconds of green time is provided
	50	Signal Coding	There are junctions with pedestrian crossing facilities which aren't taken into account in the staging: • Leyland Road/Jubilee Road (node 259) • The Cawsey/Firs Drive (node 534) • A6/A582- second stopline (node 227) and northbound exit (node 226) • A582/B5252 (node 240)	Pedestrian crossings, or pedestrian stage included within the model at the locations highlighted
	51	Signal Coding	There are locations in the model where pedestrian crossings are taken into consideration, however the time allocated in the model may not be long enough to cover the intergreens/crossing times. • Leyland Road/Coote Lane (node 404) • Brownedge Lane/Todd Lane (node 435)	In the absence of signal controller specs, Vectos believe that the timings included within the modelling are sufficiently robust, especially considering that the pedestrian stages at both junctions referred to have been included within the modelling to be called every cycle
	52	Signal Coding	Inconsistent intergreen values were coded between the morning/evening peak and the interpeak: Leyland Road/Coote Lane (node 404)	Timings updated during inter-peak to reflect AM/PM
	53	Signal Coding	The signals at the A59/John Horrocks Way have changed since the model was built (towards the end of 2021). Therefore, the base model requires reflection of the old signal specification, with any forecasting representing the newer signal specification: Penwortham Bypass/A59 (node 890)	Noted
	54	Signal Coding	Review of signal coding is required in accordance with signal specifications, as aspects of many of the signalised junctions do not match the specifications. Signal specifications should be obtained, if they have not been previously. The review for signals includes: • Phasing • Staging • Intergreens • Phase Delays/Gains • Green times • Pedestrian crossings (all reds/ensuring model has enough time allocated for intergreens + crossing time).	Signal controller specs have not been available for use in the development of this model at the majority of signal junctions, and as such timings have either been informed via previously developed Linsig models, or by creating signal timings that are considered robust in terms of intergreen and cycle times, whilst acheiving the required level of throughput and model validation. Vectos are happy to review the signal timings included against any controller specs should they be available

	55	Pedestrian Crossings	Signalised pedestrian crossings have been excluded from certain locations in the model: • Carrwood Road (node 530) • Watkin Lane (Link 259:258) • Watkin Lane (Link 249:250) • A59 Liverpool Road southbound (node 904/1089)	Pedestrian crossings included at locations highlighted
	56	Pedestrian Crossings	Zebra crossings in the model have not been included: • Brownedge Road (node 631) • Brownedge Road (node 441) • Brownedge Road (node 438)	Pedestrian crossings included at locations highlighted - using the same parameters as assigned to all other pedestrian crossings across the model, which is considered sufficiently robust for the purposes of this assessment
	57	Pedestrian Crossings	The timings applied to pedestrian crossings is consistent across the network, with a minimum pedestrian crossing duration of 10s and maximum of 15s. Is the time allocated in the model sufficient to cover a preceding intergreen, the crossing time for pedestrians and a following intergreen? Where possible, signal specifications should be used.	In the absences of signal specifications, Vectos believe that the signal timings applied are sufficiently robust for the purposes of this modelling
	58	Signpost Distance	The signpost distance has been coded at a length where vehicles may make multiple lane changes on approach to a junction, instead of getting straight into the correct lane as would be expected: • A6/A582 (node 103)	The signposting length applied at this node has been purposely applied to ensure the required level of throughput and vehicle lane choice behaviour is achieved at the upstream A6/Cuerden Way junction
	59	Signpost Distance	Locations in the model where there is a merge after the exit to a junction are generally coded with a 25m/50m/100m signpost distance. This may be appropriate for short term merge lengths, however, longer merge lengths may benefit from a larger signpost distance to prevent vehicles inappropriately changing lanes on the exit to a junction. Values should be applied on a case-by-case basis to prevent unnecessary/unrealistic lane changing.	Signposting distance reviewed for junctions along the A582 and increased from 25m to 75 or 100m where possible
	60	Hazard Overrides	Hazard overrides have been applied for locations where a hazard does not exist, and therefore the override does not work as intended: • 173:167, 1-2, 134:135, 1-1 • 138:139, 1-2, 134:135, 1-1 • 138:148, 1-1, 134:135, 2-2	No change applied if not impacting on model performance
	61	Hazard Overrides	Hazard overrides have been applied for movements that are controlled by roundabout lanes, and therefore the override is not working as intended: • 349:358, 1-2, 356:357 • 341:314, 1-2, 368: 367, 1-1 • 349:358, 1-2, 314:341, 2-2 • 281:273, 2-2, 294:289 • 281:273, 2-2, 295:291 • 279:283, 1-1, 294:289, 1-1	The vehicle behaviour at this roundabout is as per observed and as such there is no perceived reason to adjust and hazard overrides at this location
	62	Hazard Overrides	Hazard override 817:839, 1-2, 816:817, 2-3 appears reasonable. However, vehicles don't use the right lane on link 1176:385, the middle lane on link 385:816, and the third lane on 816:817 to use lanes 1-2 on link 817:839.	A review of vehicle behaviour in this area has been undertaken and addressed through next lanes where necessary. The throughput and journey times on this part of the network match observed levels closely so no significant changes have been applied
	63	Hazard Overrides	Hazard overrides are not working as intended due to differences between the lane ranges applied in the model and those in the hazard override: • 182:103, 2-2, 167:180, 1-1	The vehicle behaviour at this roundabout is as per observed and as such there is no perceived reason to adjust and hazard overrides at this location
	64	Hazard Overrides	Hazard overrides not working due to the signpost distance not being long enough: • 182:103, 1-1, 167:180, 1-1	The vehicle behaviour at this roundabout is as per observed and as such there is no perceived reason to adjust and hazard overrides at this location
	65	Hazard Overrides	The hazard override coding requires review in the model to ensure that vehicles are getting into the correct lane on approach to junctions/roundabouts. Hazard overrides are beneficial when there is widening on approach to ensure vehicles are using the correct lanes.	Picked up through general review of model following updates applied
	66	Priority Coding	Vehicles are not coded to give way to opposing traffic: • A59/John Horrocks Way (node 890) • Coote Lane (Link 416:417)	Priorities updated at node 890. The give way to oncoming parameter has previously been applied at link 416:417
	67	Priority Coding	Coding of priorities at locations allowing unrealistic route choice. A medium priority at node 814, potentially allows vehicles to use the slip road intended for southbound right turners, instead of vehicles turning at node 813.	Movement referred to has now been restricted
	68	Priority Coding	A Give Way to All adherence of 70% has been used when this has been applied in the model. Clarification is sought why 70% has been used.	The 70% parameter has been applied in line with standard application of this parameter undertaken across a number of Paramics Discovery models developed by Vectos. The application of this parameter has previously been discussed with Systra, and it is understood that no clear guidance is available on how to apply this parameter. Accordingly the application at 70% is considered consistent and robust within this modelling. It is also important to note that with the application of this parameter at 70% the model continues to calibrate and validate to observed data well.
	69	Public Transport Coding	The 109 Preston-Chorley does not have a schedule assigned to it.	PT Service updated to ensure correct schedule assigned
	70	Public Transport Coding	Public transport stops appear to have been excluded from the model: • A59 Liverpool Road (Cop Lane junction and Horrocks Way junction)- node 890 to 732 • Cop Lane (between A59/Cop Lane and Cop Lane/A582)- node 732 to 813	On street bus stops on the two routes referred to included within the updated model
	71	Public Transport Coding	There are fewer public transport stops in the model than suggested on satellite imagery/mapping: • B5254 • Todd Lane N • Brownedge Road • Croston Road	On street bus stops included on the routes identified within the updated model
	72	Model Observations	Vehicles are observed using potentially inappropriate lanes against the road markings: • A6/Cuerden Way/Craven Drive- northbound left turn (Link 1077:1080) • A6/Brownedge Road • A6/Hennel Lane/Carrwood Road • A582/B582/A5083 • A582/B5253 • A582/Pope Lane (Link 1072:872) • Coote Lane/School Lane/Channock Moss (nose 412/623)	General review of the model operation undertaken following the updates applied and where necessary vehicle behaviour addressed