Project:	**Highways England Spatial Planning Arrangement**	Job No:	**60540307**
Subject:	**A1 - Burghley Estate Stamford**	Date:	**16 February 2018**
HE ref:	**APS3 – Leics – Lincs - Rut**	Task:	**L0004**

1. Introduction

This Technical Note reviews the Land North of Stamford A1 Access Report Update dated January 2018, prepared by Peter Brett Associates LLP (PBA) on behalf of Burghley Estates and Larkfleet Homes to support the allocation of a proposed residential-led mixed use development through the South Kesteven and Rutland Local Plans revision. The proposed residential-led development comprises:

- Land North of Stamford (within South Kesteven District) for up to 1,350 dwellings;
- Quarry Farm (within Rutland District) for up to 650 dwellings;
- 2 Local Centres units, in which each unit comprises:
  - 1 supermarket (A1 Food) – 1.200sqm;
  - 9 retail units (A1 Retail) – 720sqm;
  - 1 restaurant (A3 Restaurant) – 150sqm;
  - 1 pub (A4 – Pub) – 280 sqm; and
  - 1 community building (D1 Non-residential institution) – 375sqm.

The proposed site is located northwest of Stamford as shown in **Figure 1** below.

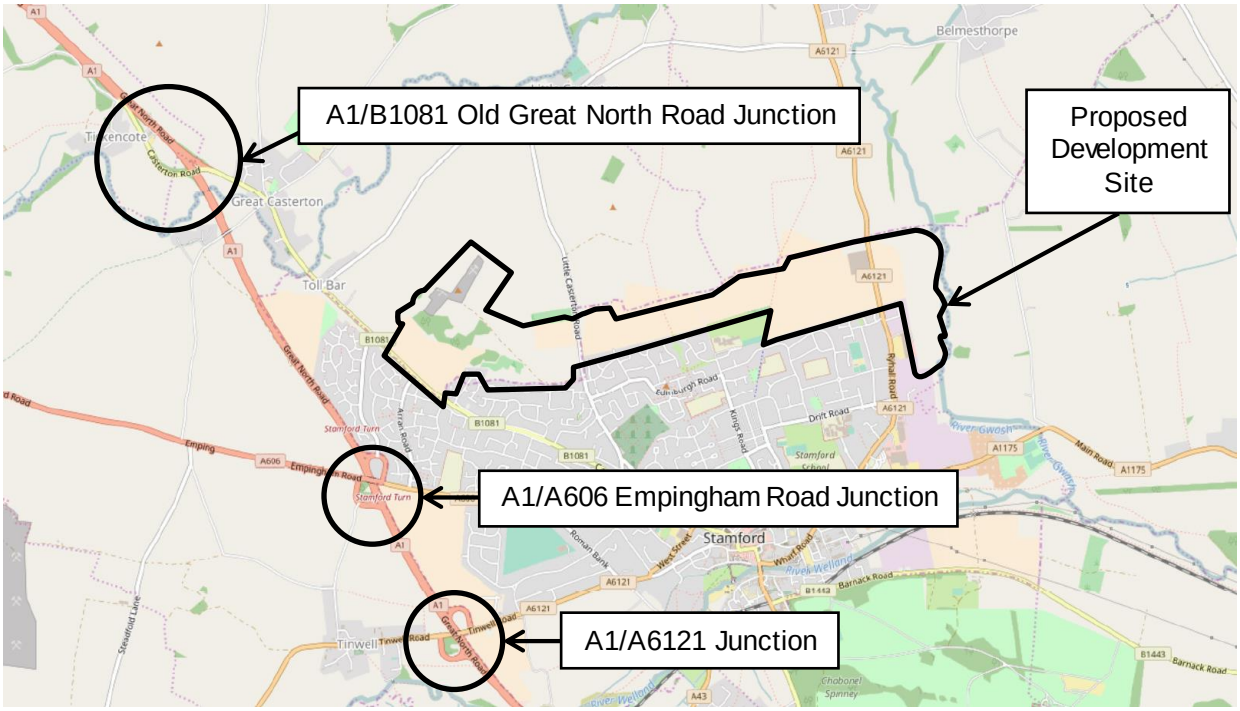

Figure 1 - Location of the Proposed Burghley Estate Stamford Development.

The principal points of impact for the traffic generated by the proposed development on the Strategic Road Network (SRN) are the following junctions along the A1 Trunk Road:

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- A1 / A6121 Junction;
- A1 / A606 Empingham Road Junction; and
- A1 / B1081 Old Great North Road Junction.

2. Background

In February 2017 AECOM, on behalf of Highways England, reviewed the "*Land North of Stamford - Preliminary Traffic Impact Assessment Relating to access to the A1*" note submitted by PBA to promote a residential-led mixed use development through the South Kesteven Local Plan and Rutland Local Plan reviews.

Following extensive discussions held between AECOM and the developers' consultant PBA regarding the preliminary assessments, an updated Preliminary Traffic Impact Assessment (PTIA) was presented in March 2017. This was reviewed in AECOM Technical Note 1 (TN1) dated June 2017, in which we agreed trip rates, generation, distribution, assignment, assessment years and growth figures.

Notwithstanding that, AECOM identified that significant improvements may be required at both the A1 / A606 Empingham Road Junction and the A1 Trunk Road mainline in order to accommodate the traffic growth associated with the proposed North of Stamford development. As such, AECOM advised PBA to undertake further work to support the inclusion of the proposed development in the South Kesteven Local Plan and Rutland Local Plan revisions.

During a meeting held in May 2017, PBA confirmed that an update of the existing Stamford VISUM transport model was going to be undertaken by WSP Mouchel on behalf of Lincolnshire County Council (LCC).

The outputs of the updated Stamford VISUM transport model have been used by PBA to inform the A1 Access Report Update submitted in January 2018. This assesses the impact of the proposed Stamford North development and the link road across the north of Stamford.

2. Trip Rates and Generation

The development trip generation considered in the assessment has been calculated by deriving the trip rates for each of the proposed zones and land uses. Trip rates for the AM peak (08:00-09:00) and PM peak (17:00-18:00) are shown in **Table 1** below.

Table 1: Trip rates used in the Stamford Transport Model for the Land North of Stamford development

Land Use	AM Peak			PM Peak		
	Arr	Dep	Total	Arr	Dep	Total
C3 (Residential)	0.135	0.379	**0.514**	0.325	0.174	**0.499**
A1 Food	4.446	4.115	**8.561**	7.63	7.899	**15.53**
A1 Retail	4.446	4.115	**8.561**	7.63	7.899	**15.53**
A3 Restaurant	-	-	**-**	5.993	1.884	**7.877**
A4 Pub	-	-	**-**	2.763	1.9	**4.663**
D1 (Non-residential institution)	1.345	0.736	**2.081**	0.634	1.015	**1.649**

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AECOM has checked the trip rates used in the assessment using TRICS v.7.4.4 and finds them appropriate.

The proposed two-way vehicle trips during the AM and PM peaks are 1,372 and 1,656 respectively, which we find suitable.

3. Committed Development

The updated VISUM model has included the committed Land West of Stamford development (planning reference S12/0864) in the Do Minimum and Do Something scenarios tested. This site is for a mixed-use development (400 dwellings, 10ha Business Park and a neighbourhood centre) located on a land between Empingham Road and Tinwell Road. It was granted planning permission in 2013. Development flows associated with the site have been taken from the Transport Assessment produced in 2012 by Bryan G. Hall.

AECOM finds appropriate the inclusion of this committed development in the assessment, although we recommend that PBA liaise with relevant local planning authorities to determine all the committed developments that should be included in the assessment.

4. Growth Factors

2016 base flows included in the updated Stamford Transport VISUM Model have been growthed to 2036 using TEMPro, applying alternative planning assumptions. These have consisted of removing all employment and housing growth and leaving only base change in demand resultant from car ownership and trip rate changes over the model horizon. AECOM finds this methodology acceptable. However, it would be useful to understand how committed developments have been incorporated.

5. Flow Scenarios

The flow scenarios presented by PBA in the A1 Access Report Update have been derived from the Stamford Model Update for each of the proposed assessment years (2016 Base Year, 2020 Opening Year and 2036 Design Year).

AECOM notes a lack of detail in terms of how the forecast model was developed e.g. growth figures, committed development network adjustments. It is assumed this detail features in the Model Forecast Report (August 2017) which was supplemented by the Forecast Scenario Update Report. From what information is given in the report, overall, there are no concerns with the approach taken in developing the forecast model and in the representation of flows on the A1 and local roads connecting to it. In particular, we note that:

- Industry standard software has been used e.g. TRICS and TEMPRO, NTM;
- Up to date count data has been used to improve the forecasting of future year flows;
- The new count data covers a good number of A1 mainline links, on/off slips and access roads;
- Routing choices between the A1 and proposed link road are logical;
- Flow changes on the 22 key links that have been included in the model look reasonable; and
- Models converge to WebTag guidance for its use in operational analysis.

The only departure from standard forecasting practices is in regards to adjustment of modelled output flows. Due to issues encountered with the WSP Model output correlation with the observed flows from 2016, PBA has adjusted the output flows from the Model Update to ensure a more robust assessment. These hybrid flows have been calculated by adding the difference between the 2016 traffic surveys and the base VISUM model to the flows extracted by VISUM. The hybrid flows have been calculated for each scenario and then used to revise the junction capacity assessment tests.

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This could be considered a crude way of dealing with large differences in modelled and observed flow, particularly as no explanation is given as to why or how they came to be so different. However, AECOM considers these adjustments reasonable in order to get more representative traffic flows to feed into the detailed junction assessments.

2016 Base Year

In order to determine the current level of traffic on the road network around the proposed site, PBA has used data from several sources. Turning counts from traffic surveys collected on Tuesday 8th November 2016 (Junction 1), on Wednesday 12th October 2016 (Junction 2 and Junction 4) and on Thursday 30th June 2016 (Junction 3 and 5) have been used to calculate the traffic flows at the following sites:

- Junction 1 – Sidney Farm Lane / Sidney Farm Lane Spur Road;
- Junction 2 – Sidney Farm Lane / A606 Empingham Road;
- Junction 3 – A1 Northbound Off-Slip / A606 Empingham Road; and
- Junction 4 – Sidney Farm Lane / B1081 Old Great North Road;
- Junction 5 – A1 Southbound Off-Slip / B1081 Old Great North Road.

Moreover, PBA has interrogated WebTRIS to obtain traffic information on the A1 Trunk Road. WebTRIS data was selected for 5 consecutive weekdays between 27th June and 1st of July 2016 and an average of the flows for the AM peak and PM peak was derived for the following sites:

- A1 / A606 Empingham Road Junction Southbound Off-slip;
- A1 / A606 Empingham Road Junction Southbound On-slip;
- A1 / A606 Empingham Road Junction Northbound Off-slip;
- A1 / A606 Empingham Road Junction Northbound On-slip.

Having compared the figures presented in PBA's Report with the survey data provided and WebTRIS data, we have found some minor inconsistencies. However, the 2016 background traffic presented by PBA is deemed acceptable on the whole.

2020 Opening Year Flow scenario

The report prepared by PBA includes a 2020 opening year assessment. As previously mentioned, the 2020 flows used by PBA in the assessment have been calculated adding the difference between the 2016 traffic surveys and the base VISUM model to the 2020 flows extracted by the Model Update.

AECOM notes that the work undertaken up to date by PBA is solely to be used in support of the proposed allocation of the Burghley Estate Stamford development within the Local Plans revisions and that an opening year assessment is not a requirement of Highways England at this stage of the planning process. As such, AECOM has not undertaken a review of the 2020 flows and related assessments.

We do however note that, if a formal planning application is to be submitted in the future, PBA will be required to identify a suitable opening year and submit appropriate impact assessments of the proposed development generated traffic in accordance with DfT's Circular 02/2013.

We do however anticipate that, considering the scale and nature of the proposed development, 2020 does not appear to be a realistic opening year scenario.

2036 Flow scenarios

PBA has adopted 2036 as the future year assessment in line with the proposed end year of the Local Plans, which are currently under revision to update and extend the plan period from 2026 to 2036. AECOM finds this suitable.

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The assessment has been carried out comparing the following scenarios:

- 2036 Do Minimum: traffic flows including background growth and the committed Stamford West development; and
- 2036 Do Something: traffic flows including background growth, the Stamford West development and the proposed Land at North of Stamford development.

For both scenarios, the 2036 flows used by PBA in the assessment have been calculated adding the difference between the 2016 traffic surveys and the base VISUM model to the 2036 flows extracted by VISUM.

6. Junction Capacity Assessments

PBA has assessed the capacity for the 2036 Do Minimum and Do Something scenarios at the following junctions, which are part of the SRN or nearby to it (with potential impact on the SRN network):

- Junction 1: A1 Southbound On-Off slips / Sidney Farm Lane;
- Junction 2: Sidney Farm Lane / A606 Empingham Road;
- Junction 3: A1 Northbound On-Off slips / A606 Empingham Road;
- Junction 4: Sidney Farm Lane / B1081 Old Great North Road.

The impact assessment on the four junctions listed above has been carried out using the PICADY module of TRL JUNCTIONS 9 software. Having reviewed all the parameters input in the assessments (geometric parameters, visibility splays and AM and PM flow matrices), AECOM confirms that they are appropriate.

All junctions appear to operate in capacity for all scenarios except for Junctions 1 and 3. The results of the assessments indicate that the Sidney Farm Lane entry approach to the north of Junction 1 operates over capacity in the 2036 DM scenario (0.97 RFC) and that the capacity issues on this arm are exacerbated in the 2036 DS scenario with a RFC of 1.02 and mean average queues of 18 PCUs. A review of the Queue Variation Results shows that the 95th percentile of queues reaches 55 PCUs on Sidney Farm Lane approach during the PM peak.

Also Junction 3 operates slightly over capacity during both the 2036 DM and 2036 DS scenarios. The analysis of the Queue Variation Results undertaken for the DS scenario shows that queues on the A1 Northbound slips could occasionally be long, with a 95th percentile of queues reaching up to 31 PCUs (about 180 m) during the AM peak.

7. Merge / Diverge Assessments

Additionally, PBA has undertaken a merge/diverge assessment of the slips at A1 / A606 Empingham Road Junction for the 2036 Do Minimum and 2036 Do Something scenarios using DMRB TD 22/06 (Layout of Grade Separated Junctions). However we note that based on a desktop analysis of the existing junction's layout, the existing A1 / A606 Empingham Road Junction appears to have been designed more in accordance with the Compact Grade Separated Junction standards (DMRB TD 40/94) than with the Layout of Grade Separated Junctions (DMRB TD 22/06). We therefore consider that the assessment carried out by PBA is purely theoretical and has been prepared to provide an indication of what could be required in case a fully grade separated junction were to be implemented.

However, AECOM's review of the 2017 AADT flows on the A1 Trunk Road mainline at the A1 / Empingham Road Junction extracted from WEBTris appear to indicate that a Grade Separated Junction could be economically justified at this location in accordance with TD 40/84 (design flows above 30,000

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AADT (Two-way) on the A1 Trunk Road mainline). On the southbound, the mainline has an AADT (one way) of 22,712 vehicles (measured at TMU Site 6511/2 in 2017). On the northbound, the mainline has an AADT (one way) of 23,291 vehicles (measured at TMU Site 6510/2 in 2017). Therefore the A1 Trunk Road mainline AADT (Two-way) through A1 / A606 Empingham Road Junction is 46,000 vehicles.

Therefore, AECOM has undertaken an independent merge/diverge assessment using TD 22/06, which provides an indication of the layout that could be advised based purely on weekdays peak periods flows.

The resulting merge and diverge diagrams that AECOM has prepared can be found in **Appendix A** together with PBA's assessments. As it can be seen, some flow inconsistencies have been identified in between PBA's and AECOM's assessments. However, these are only relevant at the A1 Southbound On-slip assessment, for which PBA was identifying the need of a lane gain while AECOM did not.

Based on the assessment undertaken by AECOM using the 2036 Do Something flows extracted by the Updated Stamford model, it appears that there is no need for any lane gains/drops of the current merges and diverges at the A1 / A606 Empingham Road Junction.

8. Proposed Mitigation Schemes – Design Checks

PBA has proposed the following mitigation scheme options:

- Option 1: A1 / A606 Empingham Road junctions signalised arrangement, Sidney Farm and Lane / Sidney Farm Lane Loop Road junction signalised arrangement and closure of the A1 Southbound off-slip;
- Option 2: A1 / A606 Empingham Road junctions signalised arrangement with A1 Southbound off-slip retained; and
- Option 3: Widening of the existing A1 / A606 Empingham Road priority junctions.

It is noted that PBA has focussed its assessment of standards against DMRB Standard TD 22/06 (Layout of Grade Separated Junctions).

Although it is recognised that existing traffic flows on the A1 would suggest that a standard grade separated junction is required for this junction, existing A1 junction is much closer in layout to a Compact Grade Separated Junction.

As such, AECOM has assessed the mitigation schemes proposed by PBA in accordance with DMRB Standard TD 40/94 (Layout of Compact Grade Separated Junctions), although these would usually only be provided where mainline flows are up to approximately 30,000 AADT.

All Options

Visibility: In accordance with TD 40 the desirable minimum Stopping Sight Distance (SSD) for a Compact Connector Road is 70m, which the loops to/from the northbound and southbound carriageways of the A1 fail to achieve due to the surrounding vegetation. A one step Relaxation in SSD to 50m is permissible and this would appear to be the maximum visibility available at present. The removal of the existing vegetation where possible should be included within all options in order to provide the required visibility splays.

Curve widening & Lane Widths: Neither the existing nor the proposed loops show any curve widening using central hatched markings. The purpose of these markings is to provide sufficient room for large vehicles to travel through the tight loop bends without encroaching into the opposing traffic lane. According to TD 40, the absolute minimum width for these markings is 0.6m otherwise a Departure from

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Standard is to be considered. If these markings are not provided the applicant must at least demonstrate that large vehicles can safely travel through the revised loops without affecting the opposing traffic.

All lane widths proposed seem to be at least 3m. This must be specified as lane widths below 3.3m along compact connector roads could be considered as Relaxations or even Departures from Standards depending on traffic flows and large vehicles proportions;

Signalised junctions (Options 1 and 2): Existing vegetation located at the proposed signalised junctions will obstruct the inter-visibility. Part of this vegetation falls within the highway boundary of Highways England, but some of it is likely to be located within third party land. Any significant obstacle within the inter-visibility area, such as dense vegetation that cannot be removed, is considered as a Departure from Standards as specified in paragraph 2.16 of TD 50 (The Geometric Layout of Signal Controlled Junctions and Signalised Roundabouts). It is unclear why the drawing notes state that the opposite is true. As well as vegetation clearance, some advancement of the currently proposed stop lines might help to mitigate this problem.

In terms of signal layout design, the proposals seem appropriate however more detail is needed in order to provide a more accurate analysis. The signalised junctions should be assessed to demonstrate that large vehicles can perform all manoeuvres in a safe manner and the proposed left and right turn approach lanes have adequate length to accommodate the predicted turning queues. We would note that the feasibility of 4 lanes across the existing structure over the A1 seems unlikely based on the apparent available width, but as noted by the applicant, surveys and detailed structural calculations would be required to confirm this. If 4 lanes cannot be provided, this will have an impact on the layout of the adjacent signalised junctions.

Vertical curvature, super-elevation and gradient: This information has not been provided and has therefore not been reviewed.

Shared-Use Footway / Cycleway: New sections of shared use footway / cycleway are proposed alongside amended kerblines, however they appear to be only 2.0m in width, together with a 1.0m buffer from the kerbline in some locations. The preferred minimum width for a shared use footway / cycleway is 3.0m, with additional width required against vertical faces and ideally, clearance from the kerbline. 2.0m width may be satisfactory depending on the usage (see TA 90/05 (The Geometric Design of Pedestrian, Equestrian and Cycle Routes).

Option 1:

Southbound off-slip closure: While the principal of the closure is acceptable from a design perspective, it would have further operational and capacity implications within the surrounding road network. This change would force southbound road users to leave the A1 at the previous junction with the B1081, which is located approximately 2.3km to the north, or at the subsequent exit towards the A6121, located approximately 1km to the south. If the closure is to be pursued then further network capacity and operation assessment is recommended.

A1 Southbound loop radius: The proposed loop has a smaller radius than the existing road. While an accurate measurement cannot be taken as CAD drawings are not available, the proposed radius appears to be greater than the desired minimum of 40m.

A1 Southbound loop signalised junctions: The signalised junctions with Sidney Farm Lane and A606 will not have a direct impact on the SRN at this junction, due to the closure of the southbound off-slip.

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Option 2:

A1 Southbound loop radius: The proposed loop has a smaller radius than the existing road. While an accurate measurement cannot be taken as CAD drawings are not available, the proposed radius appears to be greater than the desired minimum of 40m.

A1 Southbound loop signalised junctions: It is proposed to signalise the junction with Sidney Farm Lane. This junction is located just over 100m away from the back of the diverge nose. With visibility for vehicles decelerating from 70mph around the curve after the diverge severely restricted due to the embankment and associated vegetation, there is a risk of rear end collisions between vehicles leaving the southbound carriageway of the A1 and those waiting at a red light. We consider that the proposal may significantly worsen the safety of the existing layout.

The drawing states that 90m visibility would be available to an offside primary signal. While this is more than the Desirable Minimum visibility for a Compact Connector road (i.e. 70m), it is of concern that an offside primary at red, on the inside of the loop, could be completely obscured by a large heavy goods vehicle, meaning that the signal aspect would not be apparent to a driver until they had sight of the nearside primary. Double height signals may be required to mitigate this issue.

The developer proposes several measures to help mitigate the impact of this option on safety, including road signs, high friction surfacing and queue loop detectors. Even though these measures may go some way to mitigating the effects of the installation of a traffic signal controlled junction with Sidney Farm Lane, the visibility around the left hand bend is not achievable. Queues developing back from the signalised junction could result in collisions along the connector road due to the poor forward visibility. These would significantly affect the strategic road network and reduce safety for road users.

Option 3:

Priority junctions with the A606: Visibility splays of 215m are not achievable to either side from each of the priority junctions. If the speed limit is reduced to 30mph the desirable minimum stopping sight distance reduces to 90m. Even in this case only the visibility to the right from the northern junction could be achievable. Further survey information is needed to confirm these issues and develop a satisfactory solution.

Additionally, further detail is required in order to provide a more accurate analysis in terms of corner radii and tapers. The recommended corner radius for rural simple junctions is 15m with tapers of 1:10 over a distance of 25m. If considered together as a staggered junction the required taper will be of 1:8 over a distance of 32m. These recommendations are based on a reasonable proportion of large goods vehicles. If this proportion is significant then the compound curve shown in Figure 7/3 of TD 42 must be considered.

It is advised that vehicle tracking assessments are undertaken at both priority junctions to demonstrate that large vehicles can safely execute all manoeuvres without encroaching onto other lanes.

9. Proposed Mitigation Schemes – LinSig Model Checks

A review of the following LinSig models provided by PBA has been undertaken:

- *(1). A606 Empingham Road_A1 Slips Road.* This includes the A1 Northbound-Off-Slip / A606 Empingham Road and Sidney Farm Lane Loop / A606 Empingham Road T-Junctions;
- *(2). New LinSig Model 1 - HE Comments - Open Slips - Hybrid_CH*. This includes the A1 Southbound-Off-Slip / A606 Sidney Farm Lane T-Junction;

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- *(3). New LinSig Model 1 -hybrid flows - (Closed Slip).* This includes the A1 Southbound-Off-Slip / A606 Sidney Farm Lane T-Junction.

A number of issues have been found, particularly within the A1 Southbound-Off-Slip / A606 Sidney Farm Lane T-Junction model (2) where no signal phase has been included at the West approach to the junction. A pedestrian phase is also missing within the A1 Southbound-Off-Slip / A606 Sidney Farm Lane T-Junction models (3).

As a result of the above intergreens should be revised for each of the models as well as stages and stage sequences.

Additionally, minor issues have been found for several lane types, lane lengths and turning radius as well as flow inconsistencies in the PM scenarios for OD movements from B to A.

AECOM has used the models submitted by PBA and has amended the outstanding issues identified in order to understand their impact in capacity terms. These have shown similar results and conclusions to the ones presented by PBA. Although we note that LinSig models provided suggest that the proposed mitigations offer sufficient capacity to accommodate 2036 demands at all junctions tested (except for Option 1 scenario where rerouting will take place as a result of the A1 Southbound Off-slip closure which has not been tested), we recommend that the LinSig models are amended based on comments above and design considerations highlighted in Section 8.

A more detailed review of the LinSig models can be found in **Appendix A**.

10. Conclusions

This Technical Note has reviewed the Land North of Stamford A1 Access Report Update produced by PBA for the proposed allocation through the South Kesteven and Rutland Local Plans revision of a residential-led mixed use development of 2000 dwellings on land to the north of Stamford. Furthermore, it provides comments on the Updated Stamford Model that has informed PBA's 2036 assessment. The main conclusions are:

- AECOM is content with the trip rates and generation proposed in the assessment.
- Based on the information provided in the report, the updated forecast model on which PBA's assessment is based on is considered suitable for reproducing sensible route choices, forecast flows and hence, forecasting the impacts of the future developments in Stamford on the A1 and surrounding roads.
- PBA has proposed to assess impacts for the 2036 future year scenario in line with the end of the proposed South Kesteven and Rutland Local Plans and AECOM finds it suitable.
- The inclusion of the Land West of Stamford (planning reference S12/0864) in the assessments as committed development is considered suitable.
- AECOM has identified that there is no need for any lane gains/drops of the current merges and diverges at the A1 / A606 Empingham Road Junction.
- PBA has presented 3 potential mitigation options at the A1 / A606 Empingham Road Junction. AECOM has reviewed these and provided extensive comments in Sections 8 and 9 of this note.
- AECOM advises that further assessment work is undertaken in order to address design, safety and capacity concerns highlighted in Sections 8 and 9 of this note.
- Regarding Option 1, which proposes the closure of the A1 Southbound off-slip, AECOM finds this acceptable from a design perspective. However, further network capacity and operation assessment should be undertaken in order to allow an understanding of the trip reassignment implications and wider impacts on the surrounding road network.

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11. Recommendations

It is recommended that this note is forwarded on to PBA so they may take note of the points raised.

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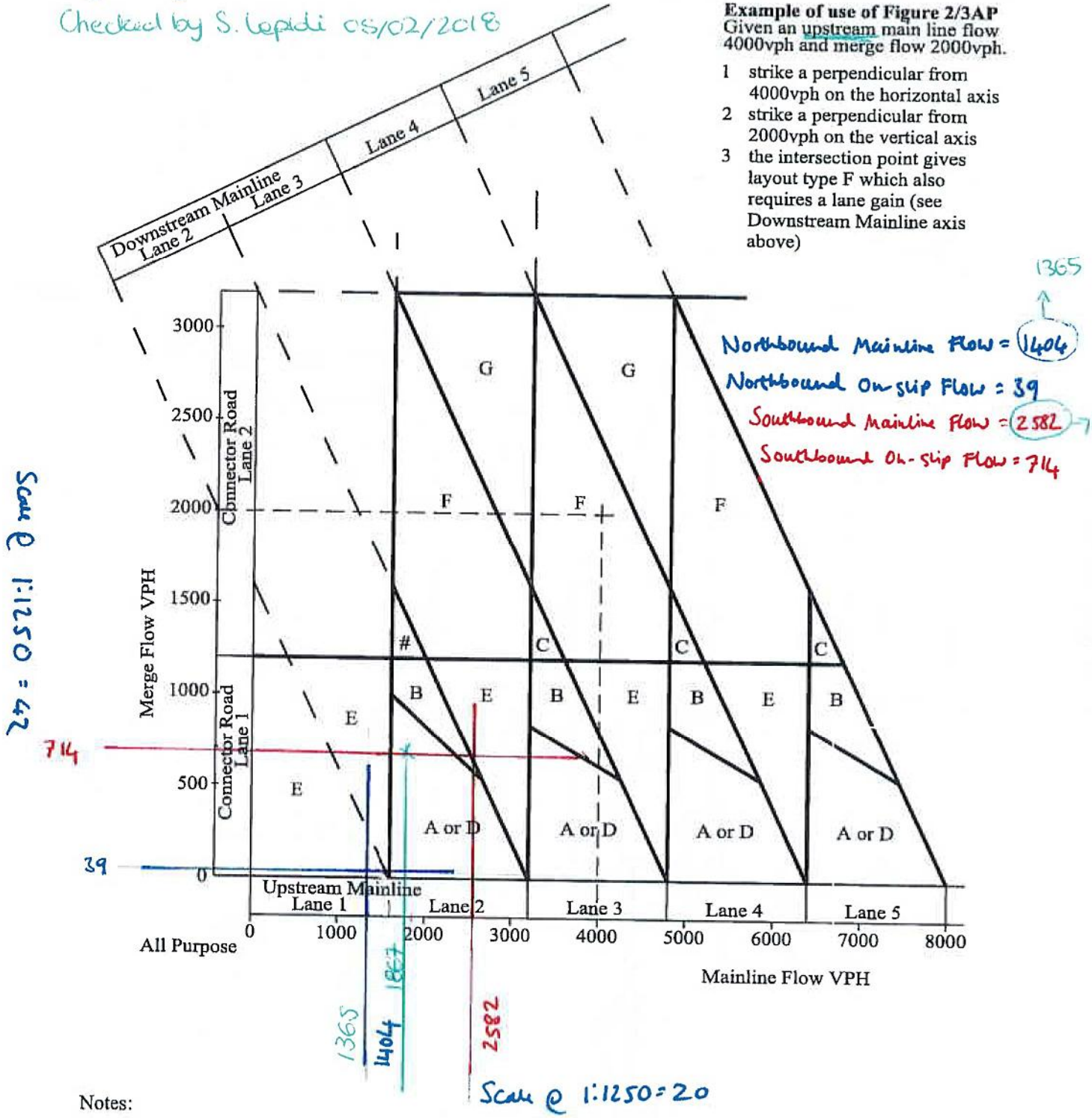
Prepared by P. Cullen 26/10/2017

Checked by S. Lapidi 05/02/2018

Example of use of Figure 2/3AP
Given an upstream main line flow 4000vph and merge flow 2000vph.

1 strike a perpendicular from 4000vph on the horizontal axis
2 strike a perpendicular from 2000vph on the vertical axis
3 the intersection point gives layout type F which also requires a lane gain (see Downstream Mainline axis above)



Notes:

\# Area of uncertainty – In this area the choice will depend on the downstream provision. If there is a lane gain then use Layout E or F.

See paragraph 2.29 and the example above, for explanation of the usage of this diagram.

Figure 2/3 AP All-Purpose Road Merging Diagram

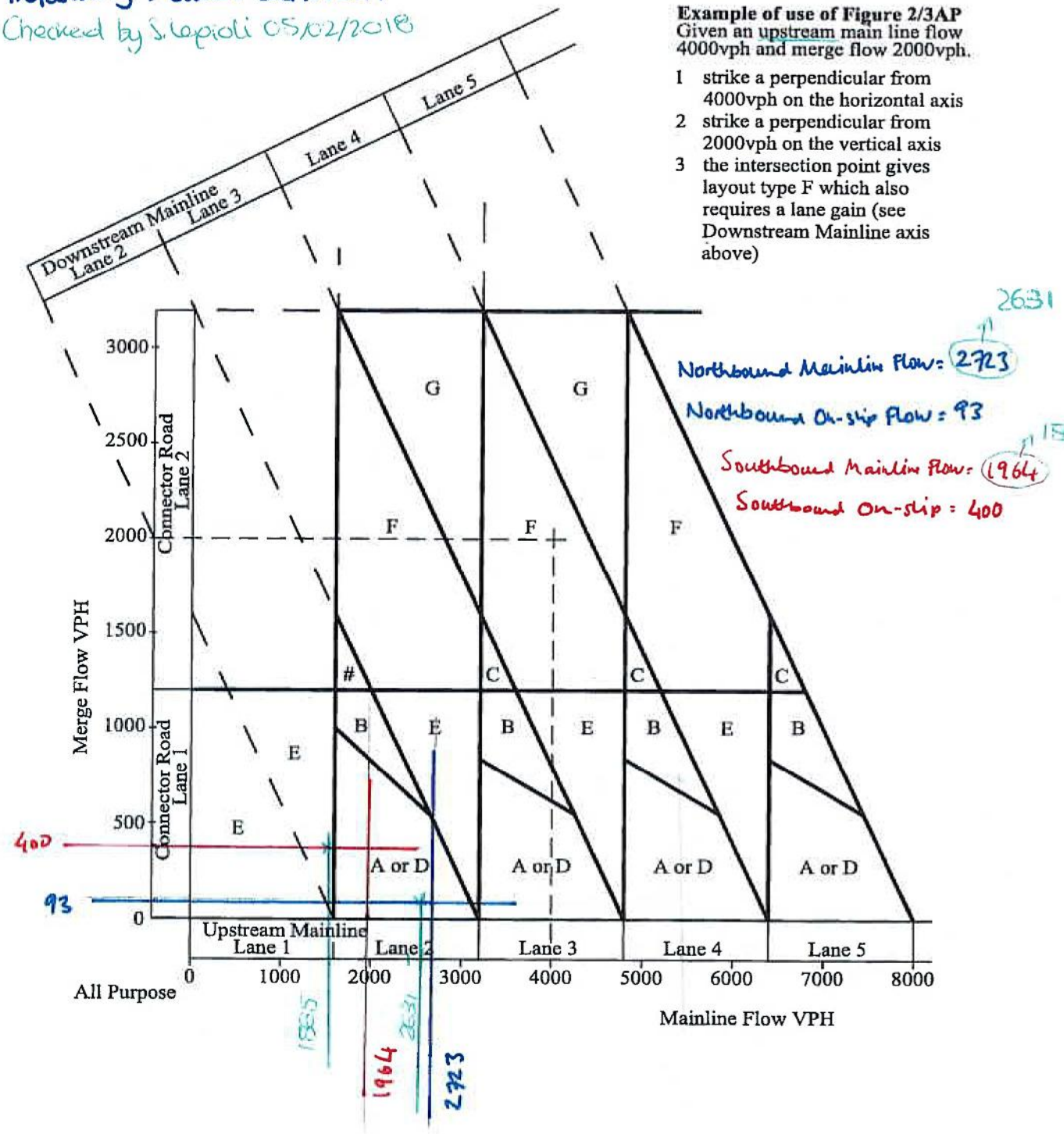
SOUTHBOUND: Layout A or D
NORTHBOUND: Layout E

2036 Do Minimum PM Model Merge Flows

Prepared by P. Cullen 26/10/2017
Checked by S. Lapioli 05/02/2018

Example of use of Figure 2/3AP
Given an upstream main line flow 4000vph and merge flow 2000vph.

1 strike a perpendicular from 4000vph on the horizontal axis
2 strike a perpendicular from 2000vph on the vertical axis
3 the intersection point gives layout type F which also requires a lane gain (see Downstream Mainline axis above)



Notes:

\# Area of uncertainty – In this area the choice will depend on the downstream provision. If there is a lane gain then use Layout E or F.

See paragraph 2.29 and the example above, for explanation of the usage of this diagram.

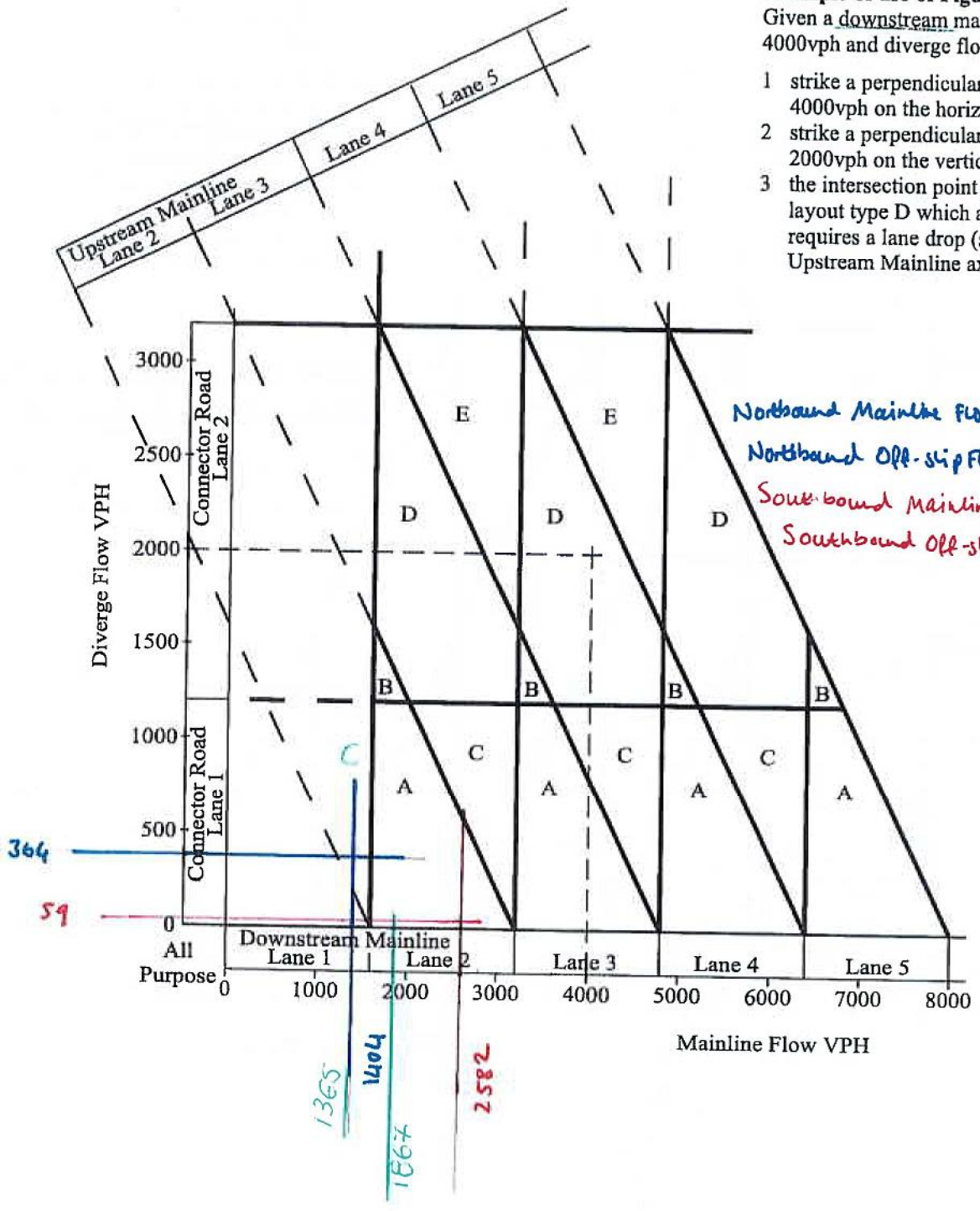
Figure 2/3 AP All-Purpose Road Merging Diagram

2036 Do Minimum AM Model Flows - Diverge

Checked by: S. Lapidi 05/02/2018

Example of use of Figure 2/5AP
Given a downstream main line flow 4000vph and diverge flow 2000vph.

1 strike a perpendicular from 4000vph on the horizontal axis
2 strike a perpendicular from 2000vph on the vertical axis
3 the intersection point gives layout type D which also requires a lane drop (see Upstream Mainline axis above)



1365
Northbound Mainline Flow = 1404
Northbound Off-slip Flow = 364
1867
Southbound Mainline Flow = 2582
Southbound Off-slip Flow = 59

Scale 1:2 = 30

Notes:

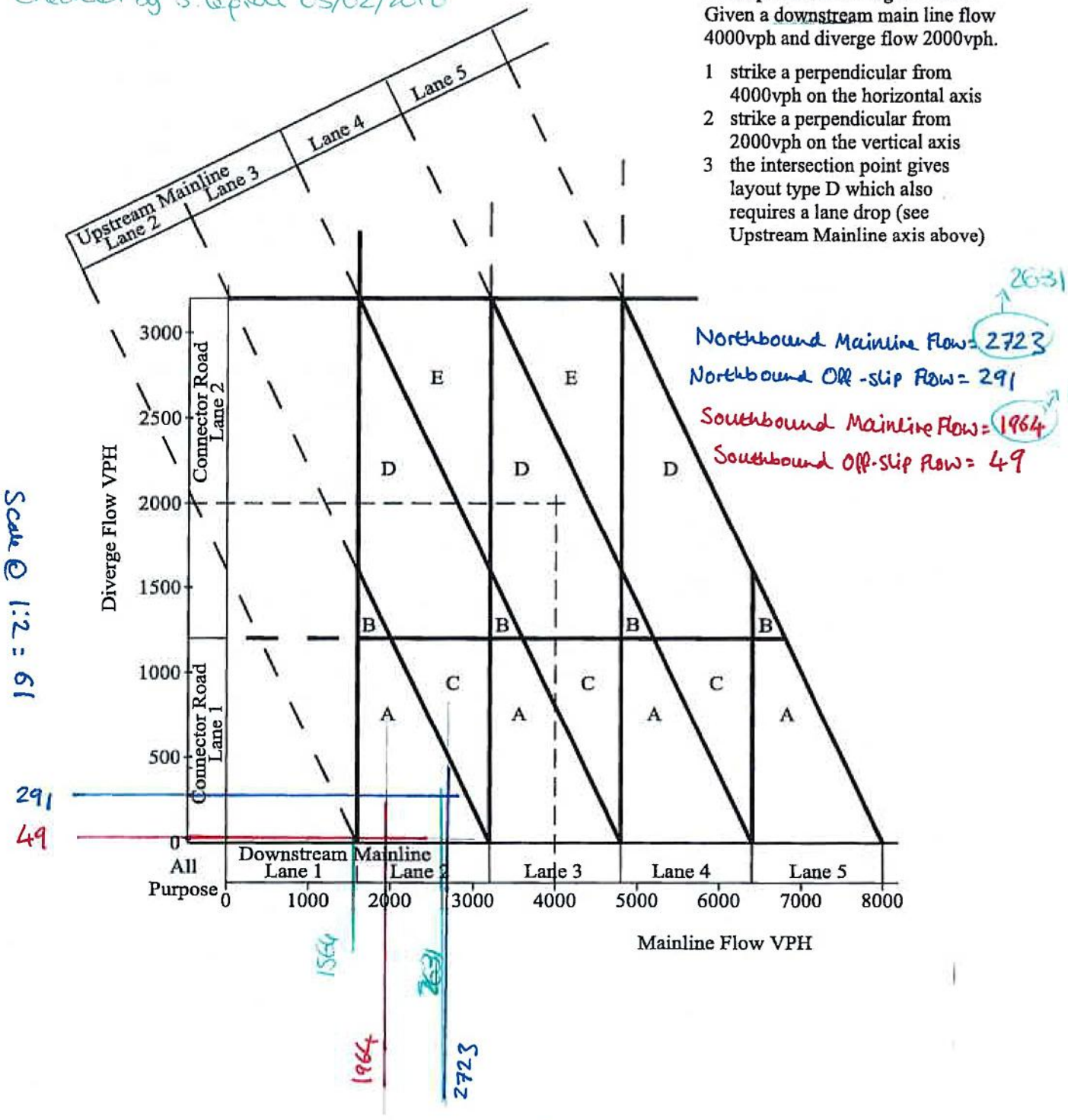
See paragraph 2.43 and the example above, for explanation of the usage of this diagram.

Figure 2/5 AP All-Purpose Road Diverging Diagram

Prepared by - P. Cullen 26/10/2017
Checked by S. Lepidi 05/02/2018

Example of use of Figure 2/5AP
Given a downstream main line flow 4000vph and diverge flow 2000vph.

1 strike a perpendicular from 4000vph on the horizontal axis
2 strike a perpendicular from 2000vph on the vertical axis
3 the intersection point gives layout type D which also requires a lane drop (see Upstream Mainline axis above)



Notes:

See paragraph 2.43 and the example above, for explanation of the usage of this diagram.

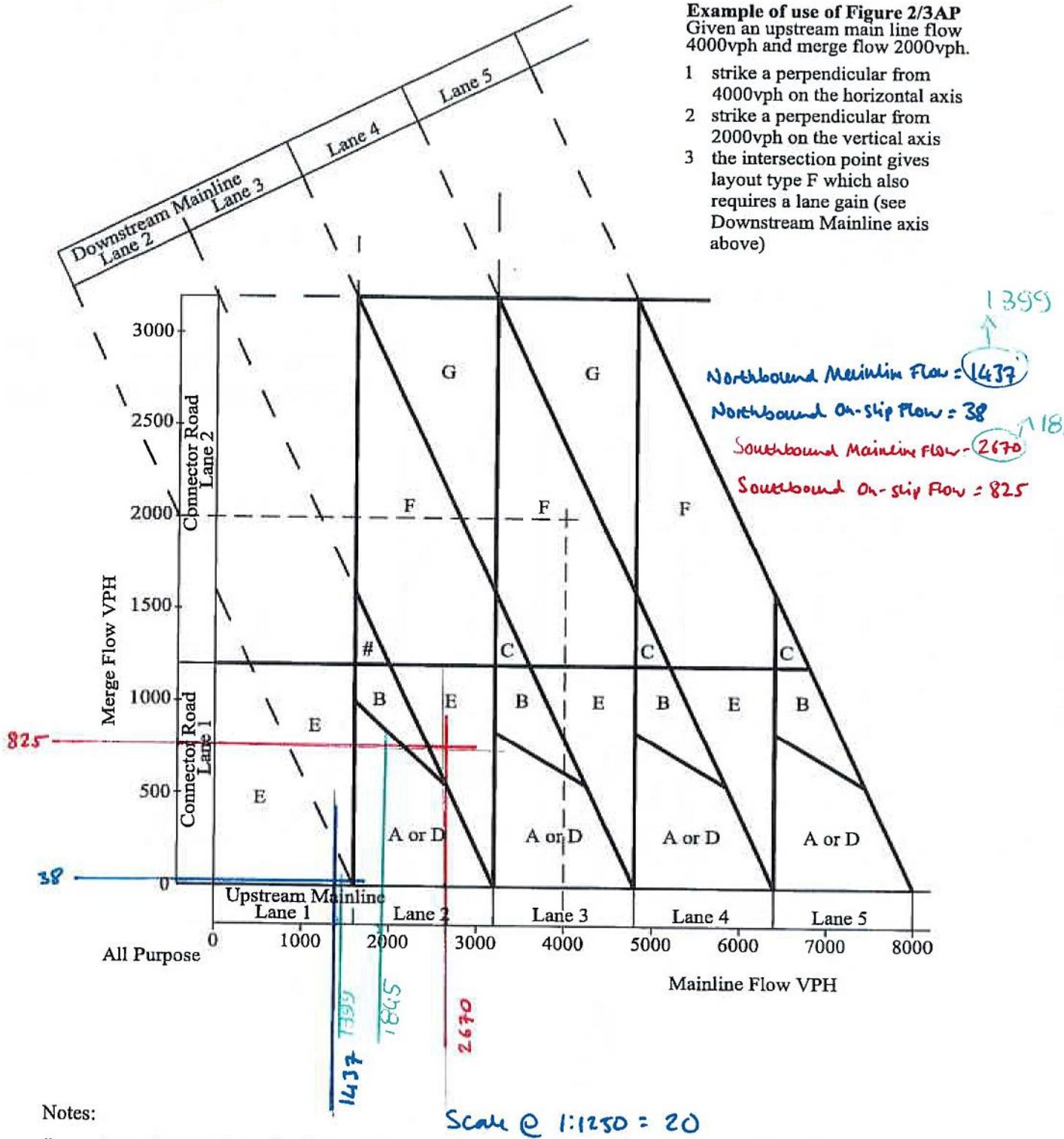
Figure 2/5 AP All-Purpose Road Diverging Diagram

2036 Do Something AM Model Flows - Merge

Checked by : S. Lepkoli 5/02/2018

Example of use of Figure 2/3AP
Given an upstream main line flow 4000vph and merge flow 2000vph.

1 strike a perpendicular from 4000vph on the horizontal axis
2 strike a perpendicular from 2000vph on the vertical axis
3 the intersection point gives layout type F which also requires a lane gain (see Downstream Mainline axis above)



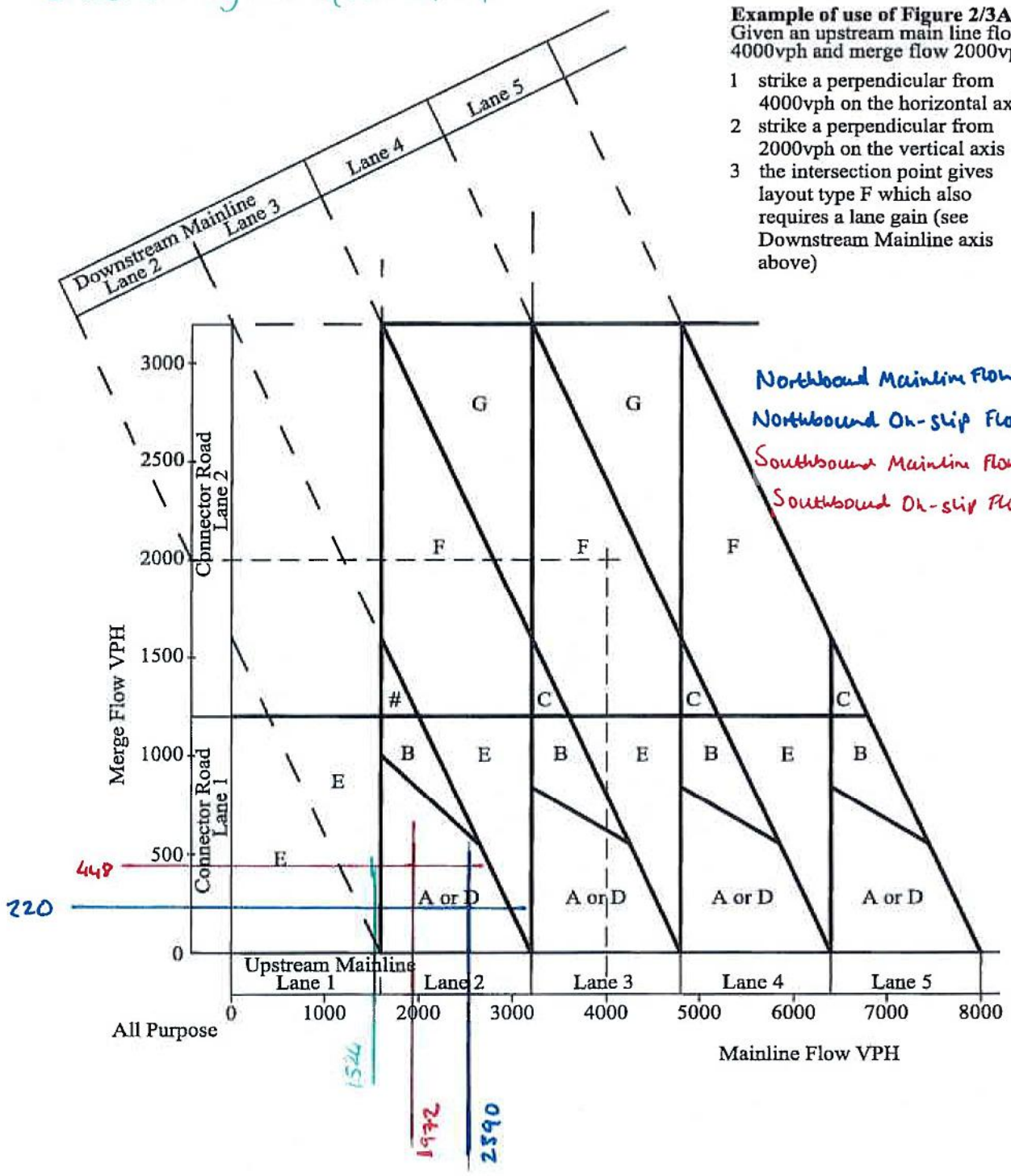
Notes:

\# Area of uncertainty – In this area the choice will depend on the downstream provision. If there is a lane gain then use Layout E or F.

See paragraph 2.29 and the example above, for explanation of the usage of this diagram.

Figure 2/3 AP All-Purpose Road Merging Diagram

Checked by: S. Lepadi 5/02/2018



Notes:

\# Area of uncertainty – In this area the choice will depend on the downstream provision. If there is a lane gain then use Layout E or F.

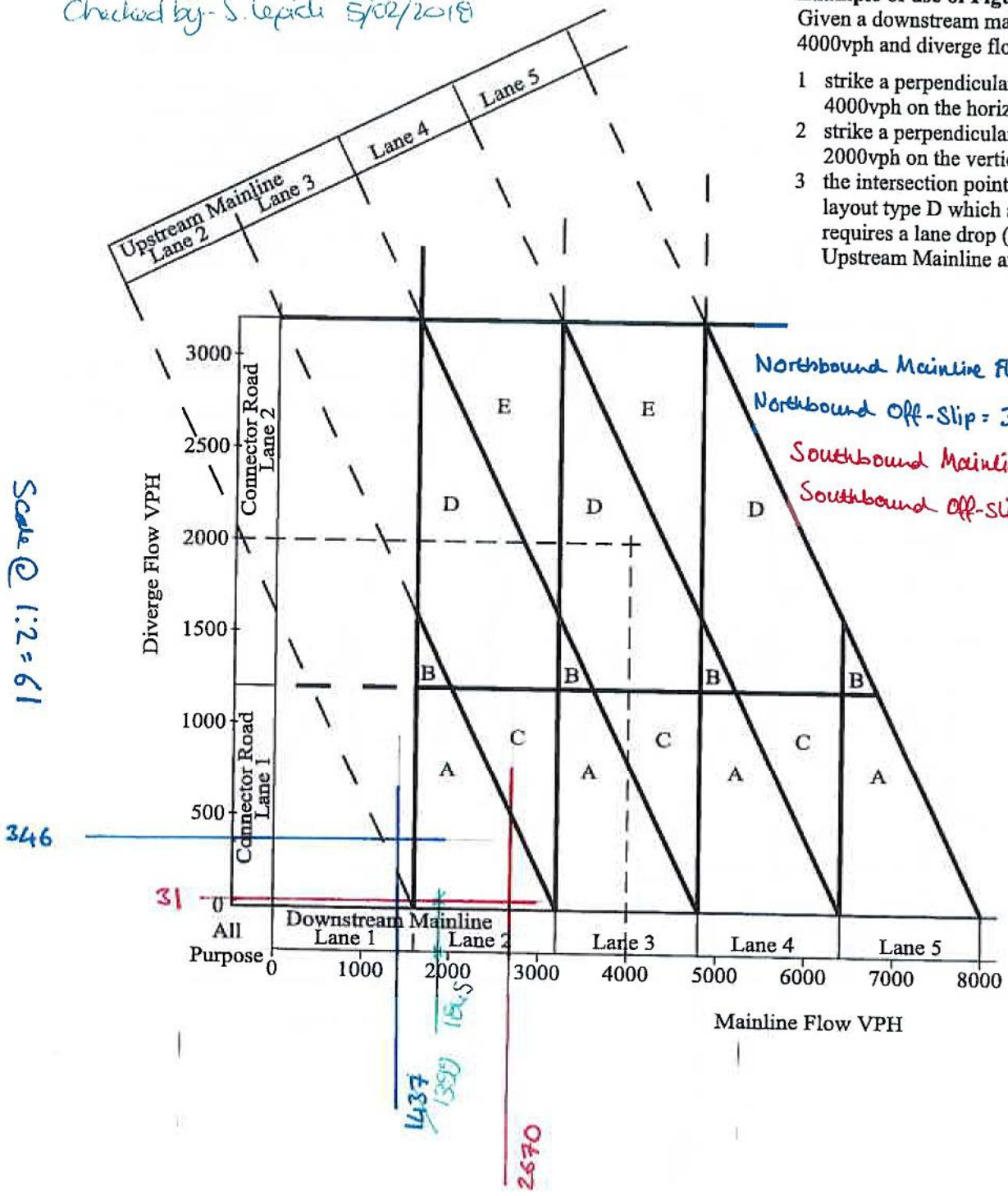
See paragraph 2.29 and the example above, for explanation of the usage of this diagram.

Figure 2/3 AP All-Purpose Road Merging Diagram

Prepared by - P. Curran 26/10/2017
Checked by - S. Lepidi 5/02/2018

Example of use of Figure 2/5AP
Given a downstream main line flow 4000vph and diverge flow 2000vph.

1 strike a perpendicular from 4000vph on the horizontal axis
2 strike a perpendicular from 2000vph on the vertical axis
3 the intersection point gives layout type D which also requires a lane drop (see Upstream Mainline axis above)



Notes:

Scale @ 1:2 = 30

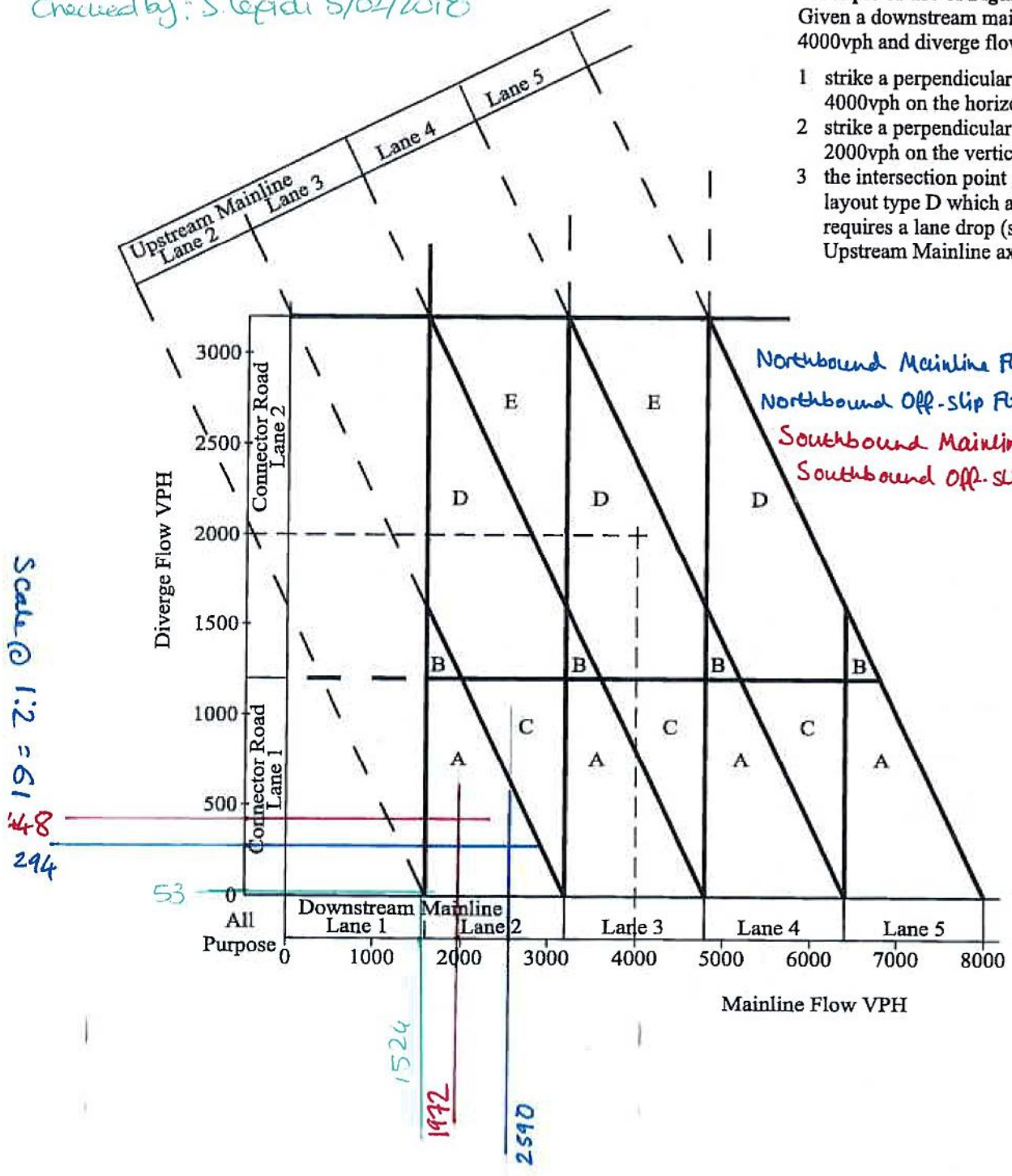
See paragraph 2.43 and the example above, for explanation of the usage of this diagram.

Figure 2/5 AP All-Purpose Road Diverging Diagram

Prepared by - P. Cullen 26/10/2017
Checked by: S. Lepidi 5/02/2018

Example of use of Figure 2/5AP
Given a downstream main line flow 4000vph and diverge flow 2000vph.

1 strike a perpendicular from 4000vph on the horizontal axis
2 strike a perpendicular from 2000vph on the vertical axis
3 the intersection point gives layout type D which also requires a lane drop (see Upstream Mainline axis above)



Notes:

Scale @ 1:2 = 30

See paragraph 2.43 and the example above, for explanation of the usage of this diagram.

Figure 2/5 AP All-Purpose Road Diverging Diagram

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LINSIG V3 Model Checking Report

AECOM

Project:	**L0004 -A1 Burghley Estate Stamford**	Job No:	**Project No**
Model:	**A606 Empingham Road_A1 Slips Road**	Model Submitted:	**26/01/18**

Modelled By: Peter Brett Associates **Checked by: Matthew Rainsford (AECOM)**

This check sheet is reviewing the LinSig modelling provided by PBA in order to identify the effect of the signalisation of the slip roads at the A1/ A606 Empingham Road.

Results Key

× - Changes required before work is signed off
? – Changes may be required before work is signed off, further work required
✓ - No further changes required before work is signed off

File Checked: Hyperlink to model

Network Information					
Checked by/date	**Checks Made**	**Result**	**Comments**	**Action taken after Audit**	**Checked by/date**
	Scenario title(s) entered	✓			
	Project name entered	✓	Four scenarios have been entered. 2036 DS AM Peak 2036 DS PM Peak 2036 DS AM Peak Hybrid 2036 DS PM Peak Hybrid		
	Modeller details recorded	✓			
	Network location details entered	?			
	File name is logical	✓	Unsure why there are two models however. One has CH at the end of the file name.		

Network Setup

Junction Drawings: Hyperlink to Junction Drawings
Sat Flow Measurements / Calculations: Hyperlink to Sat Flow Measurements

Checked by/date	**Checks Made**	**Result**	**Comments**	**Action taken after Audit**	**Checked by/date**
	Junctions				
	Appropriate junctions setup	✓	Due to the separate signals, two junctions have been used.		
	Junction info/ signal controllers complete	✓			
	Logical arm structure setup	✓			
	Lanes				
	Lane setup reflects junction drawings	✓	After checking the model against the drawing in Appendix H, all lanes appear to represent the design correctly.		
	Check each lane that is signal controlled	✓			
	Lanes matched to controller and phase	✓	Two controllers have been provided for each junction.		
	Lane length appropriate	?	Arm J1:3 and J2:1is possibly set too long at 110 metres and should be about 90m. However this amendment does not make any difference to the outcome of the modelling. Arm J1:1 has been set as 110 metres for the flare, however this seems too great. 60 metres seems more realistic. This does not affect the results of the modelling greatly however.		
	Custom occupancy (if req)	N/A			
	Saturation Flows				
	Justified method to derive saturation flows				
	Check observed sat flows (if used)	N/A			
	Check RR67 sat flows calculations (if used)	×	RR67 has been used for all saturation flows within the model. A radius of 15 should be provided for lane J2:2. Infinite has currently been used here. At lane J1:3/1, a radius of 16.5m has been used for the ahead lane when this should be specified for the ahead lane instead. Lane J1:2/2 has an 'infinite' radius provided when 16 metres should be used.		
	Check external sat flows calculations (if used)	N/A			
	Check sat flows for any bottleneck links	N/A			
	Advanced Lane Settings				
	Use of start / end green displacements (if req)	N/A	Default used.		
	Use of queue limits on short links (if req)	N/A			
	Use of weightings for optimiser constraints (if req)	N/A			
	Use of random delay or queue de-sliver (if req)	N/A			

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	Give Ways	N/A	None of the arms are priority controlled and using the stage arrangement provided, there will be no give ways required for right turning traffic.		
	Check each lane that is priority controlled				
	Measurement of max/min flow when giving way				
	Flow when opposing traffic stopped reasonable				
	Measurement of give-way co-efficient				
	Measurement of clear conflict time of opposing traffic				
	Check all controlling movements identified				
	Measurement of storage in front of stop-line				
	Max turns in inter-green reasonable				
	Measurement of non-blocking storage				
	Lane Connectors				
	Lane connectors provided reasonable				
	Cruise time reasonable	?	All cruise speeds have been provided within 24km/h which is equivalent to 15mph. Following the amendment to work out the time taken to pass from one link to another using the connectors, the model has been updated within this check. However the model results remain unchanged.		
	Default platoon dispersion used unless observed				
	Zones				
	Zones match O-D matrix	✓			
	Pedestrians	N/A	No pedestrian crossings are provided within the model or are required on the drawing.		
	Ped crossings represented by ped links (if req)				
	Ped link data correct (if req)				
	Ped connector walk times reasonable (if req)				
	Ped links matched to appropriate phases (if req)				
	Ped zones match ped O-D matrix (if req)				

Controllers

Controller Specifications: Hyperlink to Controller Specification (if req)
Intergreen Calculations: Hyperlink to Intergreen Calculations (if req)

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	General Controller Set-up				
	Sufficient controllers setup	✓	Two controllers have been used for the two junctions.		
	Multiple stage streams setup correctly (if req)	N/A			
	Non-standard filters setup correctly (if req)	N/A			
	Signal Settings				
	Check phases for each controller	✓	Three phases have been provided, one for each approach arm.		
	Check phase mins/type reasonable	✓	Minimum green of 7 seconds have been provided as is standard.		
	Check inter-greens calculations/coding		Junction 1 The intergreen from phase C to A should be 7 seconds instead of 5. The intergreen from A to C should be 6 seconds instead of 5 seconds. The intergreen from A to B should be 6 seconds instead of 5 seconds. Even with these changes, no change in junction operation is identified.		
	Stages reasonable	✓	Three stages have been used, one for each approach arm.		
	Phase delays reasonable (if req)	N/A			

Stage Sequences

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	Check stage sequences observed / optimised	✓			
	Check stage timings observed / optimised	✓			

Traffic Counts and Calculations

Traffic Flow Data: Hyperlink to Traffic Flow Data
Matrix Calculations: Hyperlink to Matrix Calculations (if required)
Lane Balancing Calculations: Hyperlink to Lane Balancing Calculations (if required)
Site Observations: Hyperlink to Site Flows Observations

LINSIG V3 Model Checking Report

AECOM

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	Suitability of traffic surveys undertaken	?	Matrices have been taken from the VISUM model and then refined using traffic counts.		
	Are there sufficient site observations	N/A			
	Check O-D matrix calculations	✓	The flows entered into the model have been entered correctly as per the spreadsheet provided. No additional checks on the actual matrix values have been undertaken.		
	Are lane balancing calculations sufficient / consistent	✓	Lane balancing was used, however even when delay based is used, no great changes in results are identified.		
	Does lane balancing match lining	N/A			
	Does lane balancing match matrices	N/A			

Traffic Flows

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	Traffic & ped flow (if req) groups setup	✓			
	Desired flows match O-D matrices	×	2036 Do Something Hybrid Flows PM peak flows have been input incorrectly. From zone B to A, 250 has been entered instead of 350 and should be altered.		
	Actual flows match desired flows	✓			
	Inappropriate routes closed	✓			
	Route flows match lane balancing	✓			

Modelling

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	Scenario set up with correct options	✓	Four scenarios have been used for 2036, two with and two without the hybrid flows for both AM and PM peaks.		
	Cycle time appropriate for network control	✓			
	Cycle time optimised (if req)	?	60 second cycle time has been used, however on optimisation alternate cycle times may be used, however these will only improve the results so 60 seconds is satisfactory.		

Results

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	Are all values as expected (Demand Flows, Green Times etc)				
	Deg Sat >100% for existing situation with no modelled suppressed demand?	✓	The DoS for all of the links are acceptable.		
	Deg Sat appropriate? Validated?	✓			
	Capacity conclusions	✓	The PRC value for the model is over 50% and therefore has a lot of spare capacity.		
	If suppressed demand has been modelled, do queues validate?	N/A			
	Queues appropriate?	✓			
	Queue limits exceeded?	✓	The MMQ produced are all acceptable with a maximum queue of about 5 PCUs being identified within the model.		
	Queuing conclusions (will exit blocking modify these?)	✓	The queues do not cause any issues at the junction.		
	If suppressed demand has been modelled do journey times validate?	N/A			
	Journey time conclusions?	✓	The delay within the model scenarios are below 20 seconds.		

Conclusions and Recommendations

Following updating the model with the changes recommended above, the signalisation scheme at the slip roads appears to work acceptably with spare capacity being identified.

The updated model can be found here: \\Ukbhm2fp002\ukbhm2fp002-v1tp\TP\PROJECT\Traffic - HESPA - 17\APS 3 Leics -Lincs-Rut\2.DP\L0004 -A1 Burghley Estate Stamford\3 - Tech Info Rcvd\180126 from PBA\Model Checks MR

In order to check that the amendments advised would provide an acceptable operating model, the junction has been updated with the following changes:

- J1:3 and J2:1 lane lengths have been amended slightly to 90m from 110m. Also arm J1:1 has been set to 60 metres from 110m.
- The turning radius for the saturation flows for lane J2:2 has been amended to 15m from infinite. Similarly J1:2/2 has been updated to 16m from infinite too. J1:3/1 has been amended so the right turn has this radius provided and not the ahead movement.
- Connectors have had their cruise speed times updated.
- Intergreens have been amended slightly.
- In the 2036 Do Something Hybrid Flows PM matrices, the movement from B to A has been amended to 350 instead of 250.
- The models have been re-optimised.

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LINSIG V3 Model Checking Report

Project:	**L0004 -A1 Burghley Estate Stamford**	Job No:	**Project No**
Model:	**New LinSig Model 1 - HE Comments - Open Slips - Hybrid_CH**	Model Submitted:	**26/01/18**

Modelled By: Peter Brett Associates **Checked by: Matthew Rainsford (AECOM)**

This check sheet is reviewing the LinSig modelling provided by PBA in order to identify the effect of the signalisation of the Sidney Farm lane junction. In this option the southbound off-slip has been assumed to remain open.

Results Key

× - Changes required before work is signed off
? – Changes may be required before work is signed off, further work required
✓ - No further changes required before work is signed off

File Checked: Hyperlink to model

Network Information					
Checked by/date	**Checks Made**	**Result**	**Comments**	**Action taken after Audit**	**Checked by/date**
	Scenario title(s) entered	✓			
	Project name entered	✓	Two scenarios have been entered. 2036 DS AM Peak 2036 DS PM Peak As the model is named with "Hybrid" at the end, it is assumed that		
	Modeller details recorded	✓			
	Network location details entered	?			
	File name is logical	✓	There are two model files; one has CH at the end. Following reviewing the two model files, it seems that the one with CH at the end provides some amendments to the model has a later save date. Therefore this is the one that is being checked.		

Network Setup

Junction Drawings: Hyperlink to Junction Drawings
Sat Flow Measurements / Calculations: Hyperlink to Sat Flow Measurements

Checked by/date	**Checks Made**	**Result**	**Comments**	**Action taken after Audit**	**Checked by/date**
	Junctions				
	Appropriate junctions setup	✓	One junction has been used as would be expected.		
	Junction info/ signal controllers complete	✓	One signal controller which is correct.		
	Logical arm structure setup	✓	The arm structure is correct as per the drawing.		
	Lanes				
	Lane setup reflects junction drawings	×	Lane 1/1 should be a short lane as this is a flare.		
	Check each lane that is signal controlled	×	Arm 6 has not been signalised and should be as per the drawing provided within Appendix H of the report saved here: \\\Ukbhm2fp002\ukbhm2fp002-v1tp\TP\PROJECT\Traffic - HESPA - 17\APS 3 Leics - Lincs-Rut\2.DP\L0004 -A1 Burghley Estate Stamford\3 - Tech Info Rcvd\180118 From PBA		
	Lanes matched to controller and phase	×	Arm 6 should be signalised and have a phase associated to it.		
	Lane length appropriate	×	Arm 1/1 should be about 35 metres and not 345 metres and should be changed to a short lane.		
	Custom occupancy (if req)	N/A			
	Saturation Flows				
	Justified method to derive saturation flows	✓	RR67 has been used for all saturation flows within the model which is acceptable.		
	Check observed sat flows (if used)	N/A			
	Check RR67 sat flows calculations (if used)	×	For lane 6/1, a radius of 15 has been provided for the right turn to arm 5. This seems too straight and a radius of 7 is more acceptable. For lane 1/1 a radius of 14m is more acceptable than 20m that is provided.		
	Check external sat flows calculations (if used)	N/A			
	Check sat flows for any bottleneck links	N/A			
	Advanced Lane Settings				
	Use of start / end green displacements (if req)	N/A	Default has been used of a start displacement of 2 seconds and an end of 3 seconds.		
	Use of queue limits on short links (if req)	N/A			
	Use of weightings for optimiser constraints (if req)	N/A			

	Use of random delay or queue de-sliver (if req)	N/A			
	Give Ways	N/A	No give way movements have been provided.		
	Check each lane that is priority controlled				
	Measurement of max/min flow when giving way				
	Flow when opposing traffic stopped reasonable				
	Measurement of give-way co-efficient				
	Measurement of clear conflict time of opposing traffic				
	Check all controlling movements identified				
	Measurement of storage in front of stop-line				
	Max turns in inter-green reasonable				
	Measurement of non-blocking storage				
	Lane Connectors				
	Lane connectors provided reasonable	×	Lane 2/2 has a connector provided for the straight movement to arm 4. However, the drawing provided within the report identifies this lane as a right turn only and should be removed from the model.		
	Cruise time reasonable	✓	Cruise speed times have all been set at 5 seconds and this seems acceptable.		
	Default platoon dispersion used unless observed	✓	Default used of 35.		
	Zones				
	Zones match O-D matrix	✓			
	Pedestrians				
	Ped crossings represented by ped links (if req)	✓	A pedestrian crossing link has been provided within the model.		
	Ped link data correct (if req)	?	Puffin has been selected as the type. The drawing does not identify the type however. 10 seconds crossing time seems acceptable.		
	Ped connector walk times reasonable (if req)	N/A			
	Ped links matched to appropriate phases (if req)	✓			
	Ped zones match ped O-D matrix (if req)	N/A	No ped zones provided or required.		

Controllers

Controller Specifications: Hyperlink to Controller Specification (if req)
Intergreen Calculations: Hyperlink to Intergreen Calculations (if req)

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	General Controller Set-up				
	Sufficient controllers setup	✓			
	Multiple stage streams setup correctly (if req)	N/A			
	Non-standard filters setup correctly (if req)	N/A			
	Signal Settings				
	Check phases for each controller	×	Two phases have been provided along with a pedestrian crossing phase too. An additional phase for Arm 6 (west approach) is also required.		
	Check phase mins/type reasonable	✓	Minimum green times of 7 seconds have been provided for all phases. The pedestrian phase could possibly be 5 seconds.		
	Check inter-greens calculations/coding	×	No intergreens have been provided for the pedestrian crossing. From A to D (new phase) = 21-9 = 12m = 6 seconds D to A = 5 seconds. From A to B = 30-24 = 6m = 5 seconds B to A = 5 seconds. From A to C = 5 seconds From C to A = 11 seconds (=10/1.2 + 2 rounded up). From B to C = = 25 metres = 7 seconds From D to C = 17 metres = 6 seconds. From C to B = 11 seconds From C to D = 11 seconds From B to D= 5 seconds From D to B= 5 seconds		
	Stages reasonable	×	Stage sequence will need updating to incorporate the new phase that will be added on to arm 6.		
	Phase delays reasonable (if req)	N/A			

Stage Sequences

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	Check stage sequences observed / optimised	?	To be updated.		

	Check stage timings observed / optimised	?			

Traffic Counts and Calculations

Traffic Flow Data: Hyperlink to Traffic Flow Data
Matrix Calculations: Hyperlink to Matrix Calculations (if required)
Lane Balancing Calculations: Hyperlink to Lane Balancing Calculations (if required)
Site Observations: Hyperlink to Site Flows Observations

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	Suitability of traffic surveys undertaken	?	Traffic matrices have all been taken straight from the spreadsheet provided along with the LinSig models. No further checks have been undertaken for the traffic flow calculations.		
	Are there sufficient site observations	N/A			
	Check O-D matrix calculations	✓	The matrices provided within the model are the same as those provided within the spreadsheet used to identify the flows.		
	Are lane balancing calculations sufficient / consistent	✓			
	Does lane balancing match lining	N/A			
	Does lane balancing match matrices	N/A			

Traffic Flows

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	Traffic & ped flow (if req) groups setup	✓			
	Desired flows match O-D matrices	×			
	Actual flows match desired flows	✓			
	Inappropriate routes closed	✓			
	Route flows match lane balancing	✓			

Modelling

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	Scenario set up with correct options	✓			
	Cycle time appropriate for network control	✓			
	Cycle time optimised (if req)	?	Possible for a cycle time of 23 to be used as this provides even more improved results. However this cycle time is too low to be used so 60 seconds is acceptable. This may be required to be changed when the west approach signals are provided. 112 seconds has been used following updating the models to include the traffic phase on the west approach.		

Results

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	Are all values as expected (Demand Flows, Green Times etc)	N/A	This cannot be checked properly until the model has been updated correctly to match the drawing.		
	Deg Sat >100% for existing situation with no modelled suppressed demand?				
	Deg Sat appropriate? Validated?				
	Capacity conclusions				
	If suppressed demand has been modelled, do queues validate?				
	Queues appropriate?				
	Queue limits exceeded?				
	Queuing conclusions (will exit blocking modify these?)				
	If suppressed demand has been modelled do journey times validate?				
	Journey time conclusions?				

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Conclusions and Recommendations
Following updating the model with the changes recommended above the model performance is worse than identified by PBA. However no large queues have been identified which provide a problem and it is unlikely the pedestrian stage will be called every cycle too. The updated model can be found here: \\Ukbhm2fp002\ukbhm2fp002-v1tp\TP\PROJECT\Traffic - HESPA - 17\APS 3 Leics -Lincs-Rut\2.DP\L0004 -A1 Burghley Estate Stamford\3 - Tech Info Rcvd\180126 from PBA\Model Checks MR Following the check the model was updated by AECOM with the following changes provided: • An additional phase (D) has been provided for the west approach as this was previously missed out of the modelling. Phase D has been allocated to Arm 6. • The stages and stage sequence have been updated in order to consider this phase too. • Lane 1/1 and 2/2 have been converted to short lanes and updated with the correct lane lengths. • The RR67 radius for lane 1/1, 6/1 and 2/2 have been updated. • The connector going from arm 2/2 and 4/2 has been removed as this is not a movement that is possible according to the drawing. • The intergreens have been updated as intergreens had not been provided for certain movements. Also intergreens have been provided considering the new phase added for the west approach. • The cycle time has been amended to 112 seconds as 60 seconds has now been identified as being too low following the amendments that have been made. • The model has then been re-optimised.

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LINSIG V3 Model Checking Report

Project:	**L0004 -A1 Burghley Estate Stamford**	Job No:	**Project No**
Model:	**New LinSig Model 1 -hybrid flows**	Model Submitted:	**26/01/18**

Modelled By: Peter Brett Associates **Checked by: Matthew Rainsford (AECOM)**

This check sheet is reviewing the LinSig modelling provided by PBA in order to identify the effect of the signalisation of the Sidney Farm lane junction. Within this model the southbound offslip has been closed and this model identifies how the junction will work considering this.

Results Key

- × - Changes required before work is signed off
- ? – Changes may be required before work is signed off, further work required
- ✓ - No further changes required before work is signed off

File Checked: Hyperlink to model

Network Information					
Checked by/date	**Checks Made**	**Result**	**Comments**	**Action taken after Audit**	**Checked by/date**
	Scenario title(s) entered	✓			
	Project name entered	✓	Two scenarios have been entered. 2036 DS AM Peak 2036 DS PM Peak As the model is named with “Hybrid” at the end, it is assumed that this is using Hybrid calculated flows.		
	Modeller details recorded	✓			
	Network location details entered	?			
	File name is logical	✓	There are two model files for the closure of this slip road, however this model has the latest save date so this one is being reviewed.		

Network Setup

Junction Drawings: Hyperlink to Junction Drawings
Sat Flow Measurements / Calculations: Hyperlink to Sat Flow Measurements

Checked by/date	**Checks Made**	**Result**	**Comments**	**Action taken after Audit**	**Checked by/date**
	Junctions				
	Appropriate junctions setup	✓	One junction has been used as would be expected.		
	Junction info/ signal controllers complete	✓	One signal controller which is correct.		
	Logical arm structure setup	✓	The arm structure is correct as per the drawing.		
	Lanes				
	Lane setup reflects junction drawings	×	Lane 1/1 should be a short lane as this is a flare.		
	Check each lane that is signal controlled	?	Each lane has been signalised, however the pedestrian crossing has not been considered and should be.		
	Lanes matched to controller and phase	×	The pedestrian crossing should be provided and signalised.		
	Lane length appropriate	×	Arm 1/1 should be about 35 metres and not 345 metres and should be changed to a short lane.		
	Custom occupancy (if req)	N/A			
	Saturation Flows				
	Justified method to derive saturation flows	✓	RR67 has been used for all saturation flows within the model which is acceptable.		
	Check observed sat flows (if used)	N/A			
	Check RR67 sat flows calculations (if used)	×	All lanes have been kept as ‘infinite’ which is not correct and require radius measurements being provided.		
	Check external sat flows calculations (if used)	N/A			
	Check sat flows for any bottleneck links	N/A			
	Advanced Lane Settings				
	Use of start / end green displacements (if req)	N/A	Default has been used of a start displacement of 2 seconds and an end of 3 seconds.		
	Use of queue limits on short links (if req)	N/A			
	Use of weightings for optimiser constraints (if req)	N/A			
	Use of random delay or queue de-sliver (if req)	N/A			
	Give Ways	N/A	No give way movements have been provided.		
	Check each lane that is priority controlled				
	Measurement of max/min flow when giving way				
	Flow when opposing traffic stopped reasonable				
	Measurement of give-way co-efficient				
	Measurement of clear conflict time of opposing traffic				
	Check all controlling movements identified				

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	Measurement of storage in front of stop-line				
	Max turns in inter-green reasonable				
	Measurement of non-blocking storage				
	Lane Connectors				
	Lane connectors provided reasonable	×	Lane 2/2 has a connector provided for the straight movement to arm 4. However, the drawing provided within the report identifies this lane as a right turn only and should be removed from the model.		
	Cruise time reasonable	✓	Cruise speed times have not been defined, therefore 5 seconds shall be used which is acceptable.		
	Default platoon dispersion used unless observed	✓	Default used of 35.		
	Zones				
	Zones match O-D matrix	✓			

	Pedestrians				
	Ped crossings represented by ped links (if req)	×	A pedestrian crossing link is required to be added into the model. Also a pedestrian phase is also required as that has not been provided. The pedestrian crossing is identified in the drawing provided in the report.		
	Ped link data correct (if req)	?	All pedestrian crossing details should remain the same between the two modelling options. Puffin has been selected as the type. The drawing does not identify the type however. The controlling phase will be required to be changed to C when arm 6 is updated to being signalised. 10 seconds crossing time seems acceptable.		
	Ped connector walk times reasonable (if req)	N/A			
	Ped links matched to appropriate phases (if req)	✓			
	Ped zones match ped O-D matrix (if req)	N/A	No ped zones provided or required.		

Controllers

Controller Specifications: Hyperlink to Controller Specification (if req)
Intergreen Calculations: Hyperlink to Intergreen Calculations (if req)

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	General Controller Set-up				
	Sufficient controllers setup	✓			
	Multiple stage streams setup correctly (if req)	N/A			
	Non-standard filters setup correctly (if req)	N/A			
	Signal Settings				
	Check phases for each controller	×	Two phases have been provided An additional phase for the pedestrian crossing is also required.		
	Check phase mins/type reasonable	✓	Minimum green times of 7 seconds have been provided for all phases. The pedestrian phase is also required to be added and should be 7 seconds as per the other modelling option.		
	Check inter-greens calculations/coding	×	No intergreens have been provided for the pedestrian crossing. From A to B = 30-24 = 6m = 5 seconds B to A = 5 seconds. From A to C = 5 seconds From C to A = 11 seconds (=10/1.2 + 2 rounded up). From B to C = = 25 metres = 7 seconds From C to B= 11 seconds.		
	Stages reasonable	×	Stage sequence will need updating to incorporate the new phase for the pedestrian crossing.		
	Phase delays reasonable (if req)	N/A			

Stage Sequences

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date
	Check stage sequences observed / optimised	?	To be updated.		
	Check stage timings observed / optimised	?			

Traffic Counts and Calculations

Traffic Flow Data: Hyperlink to Traffic Flow Data
Matrix Calculations: Hyperlink to Matrix Calculations (if required)
Lane Balancing Calculations: Hyperlink to Lane Balancing Calculations (if required)
Site Observations: Hyperlink to Site Flows Observations

Checked by/date	Checks Made	Result	Comments	Action taken after Audit	Checked by/date

	Suitability of traffic surveys undertaken	?	Traffic matrices have all been taken straight from the spreadsheet provided along with the LinSig models. No further checks have been undertaken for the traffic flow calculations.		
	Are there sufficient site observations	N/A			
	Check O-D matrix calculations	×	From zone B to A, the traffic flows need updating in the PM peak as in the model with the slip roads open, the flows was 186 and now it is 53. The number of vehicles undertaking this movement should not have been affected because of this.		
	Are lane balancing calculations sufficient / consistent	✓			
	Does lane balancing match lining	N/A			
	Does lane balancing match matrices	N/A			

Traffic Flows					
Checked by/date	**Checks Made**	**Result**	**Comments**	**Action taken after Audit**	**Checked by/date**
	Traffic & ped flow (if req) groups setup	✓			
	Desired flows match O-D matrices	×			
	Actual flows match desired flows	✓			
	Inappropriate routes closed	✓			
	Route flows match lane balancing	✓			

Modelling					
Checked by/date	**Checks Made**	**Result**	**Comments**	**Action taken after Audit**	**Checked by/date**
	Scenario set up with correct options	✓			
	Cycle time appropriate for network control	✓			
	Cycle time optimised (if req)	?	A cycle time of 90 seconds has been provided, however this may be required to change once the stages and additional pedestrian phase is added.		

Results					
Checked by/date	**Checks Made**	**Result**	**Comments**	**Action taken after Audit**	**Checked by/date**
	Are all values as expected (Demand Flows, Green Times etc)				
	Deg Sat >100% for existing situation with no modelled suppressed demand?	✓			
	Deg Sat appropriate? Validated?	✓			
	Capacity conclusions	✓			
	If suppressed demand has been modelled, do queues validate?	N/A			
	Queues appropriate?	✓			
	Queue limits exceeded?	✓			
	Queuing conclusions (will exit blocking modify these?)	✓			
	If suppressed demand has been modelled do journey times validate?	N/A			
	Journey time conclusions?	✓			

Conclusions and Recommendations

Following updating the model with the changes recommended above, the signalisation scheme at the slip roads appears to work acceptably with spare capacity being identified.

The updated model can be found here: \\Ukbhm2fp002\ukbhm2fp002-v1tp\TP\PROJECT\Traffic - HESPA - 17\APS 3 Leics -Lincs-Rut\2.DP\L0004 -A1 Burghley Estate Stamford\3 - Tech Info Rcvd\180126 from PBA\Model Checks MR

The changes made to the model were:

- Amend the number of phases in order to add a phase for the pedestrian crossing (phase C).
- Update intergreens to consider the pedestrian crossing.
- Update the stages and stage sequence also to related this crossing.
- Amend all RR67 calculations from 'infinite' and provide realistic turning radii.
- Amend lanes 1/1 and 2/2 to short lanes and update the lane length.
- Amend the matrices provided within the model for movement B to A. This should be 186 and 53 as was provided.

Following updating the model, it can be seen that the junction successfully works with spare capacity and is acceptable.

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