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Executive Summary

This Technical Note describes the modelling audit of the South Caldecotte forecast Vissim models of the A5/A4146 Kelly's Kitchen Roundabout, provided by BWB to support the planning application of the proposed South Caldecotte development in Milton Keynes. The audit was carried out based on WebTAG guidance and best practice recommended in Transport for London (TfL) Traffic Modelling Guidance.

AECOM has previously undertaken four reviews of the base models (reference 'South Caldecotte VISSIM Model Review_v10' – dated 2nd November 2018, 'Revised South Caldecotte VISSIM review_v8' – dated 26th April 2019 and 'South Caldecotte Revised VISSIM Review_v7' – dated 1st August 2019), in the last of which, the base models were approved (subject to minor amendments) and agreed to be taken forward for forecast modelling.

Subsequently, AECOM carried out two reviews of the proposed models ('TN07 South Caldecotte Revised Forecast VISSIM review_v13' – dated 24th January 2020 and 'TN09 South Caldecotte Revised Forecast VISSIM Review_v14' – dated 20th March 2020) and recommended that concerns raised during the reviews were addressed and the models and forecast report were resubmitted for review.

This audit focuses on the updated models and forecast report submitted by BWB on 2nd April 2020.

The note draws attention to the elements described in BWB's TN 'SCD-BWB-GEN-XX-RP-TR-010_Forecast Model TN-S2-P1':

- Changes to the model from the previous submission;
- Modelling results;
- Outstanding comments from the previous review; and
- Analysis and interpretation of modelling results.

Issues/Errors that were found in the models have been classified into three levels:

- **MINOR** – The issues found are likely to produce minimal changes in the results.
- **MEDIUM** – The issues found could have a medium impact on the results.
- **SIGNIFICANT** – The issues are considered as an error and are likely to have a large/ significant impact on the results.

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Table 1 summarises the status of the issues identified during the previous audits:

Table 1. Summary of outstanding issues with the models from previous audits.

Issue Identified in Previous Audit	Level of Issue	Resolved?	Comments
General Coding Errors (Overlapping vehicles)	Significant	Yes	The changes made to signal controllers prevent queues from backing up to upstream conflict points, which prevents vehicles overlapping.
Incomplete definition of scenarios	Minor	No	The new report does not contain a description of the modelled scenarios
Use of both priority rules and conflict areas	Minor	No	The model still contains priority rules and conflict areas controlling the same conflict points
Signal operation	Significant	Yes	The changes made to signal controllers prevent excessive queues from forming inside the roundabout. The junction operates with more realistic signal timings.

No other modelling issues were found in the models that require further attention.

The modelling results show that, while journey times on Brickhill Street northbound and the A5 southbound improve significantly with the proposed mitigations, the impact of the development on journey times along the A4146 and the A5 northbound is not mitigated.

However, overall network performance results show that with mitigation, average delay across the network is reduced in the Do Something scenario, compared to the Reference Case. Delays at the junction remains at similar levels to the Reference Case in the AM peak hour, and are significantly reduced in the PM peak hour.

It is likely that further signal optimisation would allow more even distribution of the benefits observed on the A5 southbound among other arms of the junction, providing a better distribution of benefits on all approaches.

Observations of the model operation indicate that in the 2023 Do Something scenario the queuing on the A5 south approach is significantly longer than the Reference Case scenario, which AECOM considers equates to a severe impact that can be attributed to the proposed development.

From HE's perspective, AECOM recommend that further measures are sought to ensure that the impact of the proposed development on the A5 northbound approach is not considered severe. This could potentially be demonstrated through the optimisation of signal timings (this should be consistent and applied in all scenarios) that protects the operation of the A5 approaches and ensures that the impact of the South Caldecotte development on these arms is not severe.

1 Introduction

This Technical Note (TN10) provides a summary of the audit work conducted on the revised forecast Vissim models (dated 2nd April 2020) developed for the A5 Kelly's Kitchen Roundabout by BWB. The Vissim models have been prepared to support the planning application of an employment development at South Caldecotte in Milton Keynes.

This Technical Note follows on from AECOM Technical Note 03 ('South Caldecotte VISSIM Model Review_v10'), Technical Note 04 ('Revised South Caldecotte VISSIM review_v8'), Technical Note 05 ('Revised South Caldecotte VISSIM review_v7'), and Technical Note 07 ('TN07 South Caldecotte Revised Forecast VISSIM review_v13') which document the review of the previous base and forecast models. In addition, AECOM Technical Note 06 ('TN06_Review of South Caldecotte TA_v7') and AECOM Technical Note 08 ('TN08_Review of South Caldecotte revised TA info v6') document the review of the revised Transport Assessment (TA) associated with the proposed development.

The audit of the most recently submitted forecast model (Technical Note 09 – 20th March 2020) recommended that modelling issues highlighted in the report were addressed, and the models and forecast report were resubmitted for review.

The models/information received by AECOM for this audit include:

- The forecast VISSIM models; and
- Updated Forecast Model Report (*SCD-BWB-GEN-XX-RP-TR-010_Forecast Model TN-S2-P1*).

2 Forecast model review

2.1 Changes from previous model submission

2.1.1 Modelling approach

BWB report that one of the committed developments previously included in the models, Levante Gate, has recently been rejected planning permission. Consequently, BWB has included a set of scenarios in the model, as shown in Table 2, to assess the impact of South Caldecotte development and associated mitigations, without the inclusion of Levante Gate in the committed development flows. However, the analysis of modelling results is provided for the impact of South Caldecotte development for both sets of scenarios (with and without Levante Gate included in the committed developments).

It should be noted that the scenario labelled 'Do Minimum' includes the proposed development, but no mitigation. To evaluate the impact of the proposed development trips and mitigation on the network, a comparison should be made against the 'Reference Case – without proposed development but with committed Kelly's Kitchen Hamburger Scheme (by others)' and 'Do Minimum - with development' and the 'Do Something – with development, plus lane designation alterations to A5 SB approach'.

A drawing illustrating the proposed mitigation at the A5/A4146 junction has not been provided by BWB as part of this submission. It is recommended that once the mitigation scheme has been agreed in principle, that a drawing illustrating the proposed mitigation measures is provided such that the proposed modifications can be subjected to Highways England's Road Safety Audit procedures and to allow the drawing to be referenced in planning conditions, as appropriate, such that may it be attached to the potential planning permission in the event planning permission is granted.

Table 2. Composition of modelled scenarios.

	Flows	Schemes
Reference Case 2023	Base + Committed Developments	Kelly's Kitchen Roundabout Scheme
Do Min 2023	Base + Committed developments + Proposed development	Kelly's Kitchen Roundabout Scheme
Do Something 2023	Base + Committed developments + Proposed development	Kelly's Kitchen Roundabout Scheme + Tilbrook Roundabout Scheme + change in lane allocation on A5 SB
Reference Case 2031	Base + Committed Developments	Kelly's Kitchen Roundabout Scheme
Do Min 2031	Base + Committed developments + Proposed development	Kelly's Kitchen Roundabout Scheme
Do Something 2031	Base + Committed developments + Proposed development	Kelly's Kitchen Roundabout Scheme + Tilbrook Roundabout Scheme + change in lane allocation on A5 SB
Reference Case 2023 – <i>Levante Gate test</i>	Base + Committed Developments (without Levante Gate)	Kelly's Kitchen Roundabout Scheme
Do Min 2023 – <i>Levante Gate test</i>	Base + Committed developments (without Levante Gate) + Proposed development	Kelly's Kitchen Roundabout Scheme
Do Something 2023 – <i>Levante Gate test</i>	Base + Committed developments (without Levante Gate) + Proposed development	Kelly's Kitchen Roundabout Scheme + Tilbrook Roundabout Scheme + change in lane allocation on A5 SB
Reference Case 2031 – <i>Levante Gate test</i>	Base + Committed Developments (without Levante Gate)	Kelly's Kitchen Roundabout Scheme
Do Min 2031 – <i>Levante Gate test</i>	Base + Committed developments (without Levante Gate) + Proposed development	Kelly's Kitchen Roundabout Scheme
Do Something 2031 – <i>Levante Gate test</i>	Base + Committed developments (without Levante Gate) + Proposed development	Kelly's Kitchen Roundabout Scheme + Tilbrook Roundabout Scheme + change in lane allocation on A5 SB

2.1.2 Changes to demand

In line with the changes in development assumptions described in §2.1.1 for the '*Levante Gate test*' scenarios. The demand in these scenarios has been reduced as shown in Table 3. These figures are in line with the trip generation assumptions as shown in the Transport Assessment of Levante Gate (planning application 17/03233/OUT).

Table 3. Reduction in vehicle inputs on different approaches to the junction attributed to Levante Gate development.

Input	AM	PM
Brickhill St	-28	-64
Station Rd	-8	-16
A5 NB	-20	-48
A4146	-308	-116
Watling St	-4	-4
A5 SB	-36	-92

2.1.3 Network Changes

No changes to the network have been introduced in the model since the last submission. It should be noted that the network was considered acceptable in previous reviews.

2.1.4 Changes to signal controllers

The previous audit raised concerns regarding inconsistencies in the signal operation of the Do Something scenarios, which allowed unrealistically long queues to build up inside the roundabout. The signal timings issues have now been addressed and all scenarios run with a consistent queuing limit within the roundabout.

A change in the operation of signal controllers 'North Stream 2' and 'South Stream 2' has been introduced in all scenarios where additional detectors have been added into the Kelly's Kitchen Roundabout (as shown in Figure 1 and Figure 2), which limit the length of queues allowed to form inside the roundabout. These changes effectively address the queuing issues highlighted in the previous review for all scenarios and are considered appropriate.

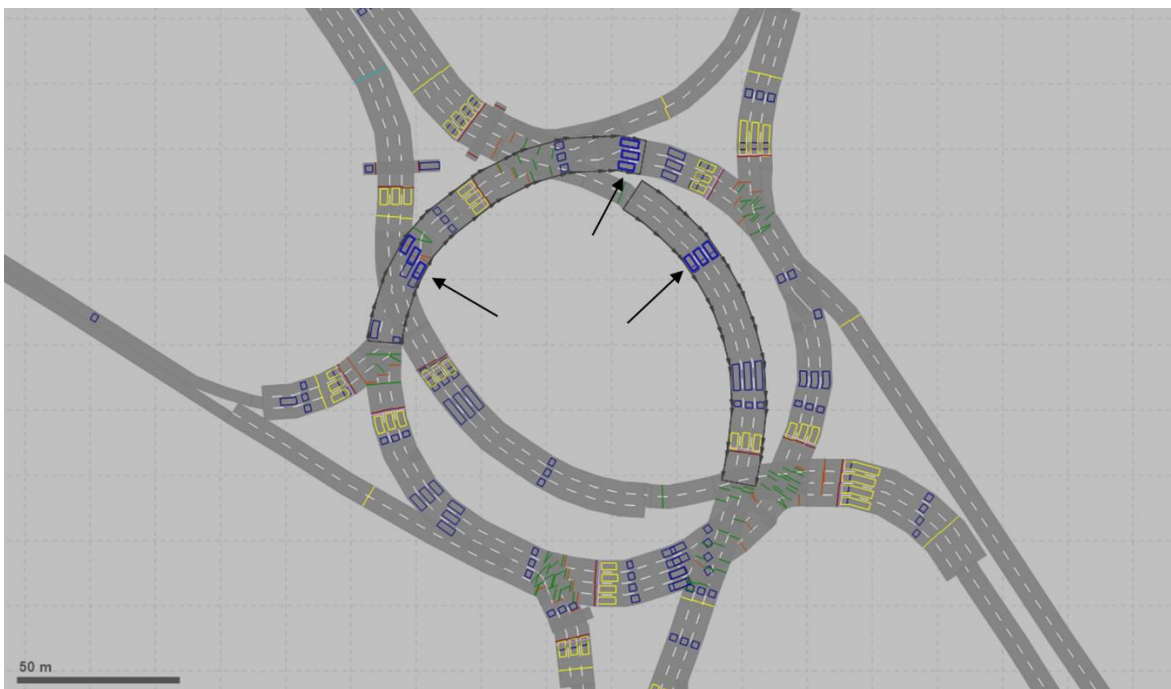


Figure 1. Detectors added on north stream 2, signal controller 2.

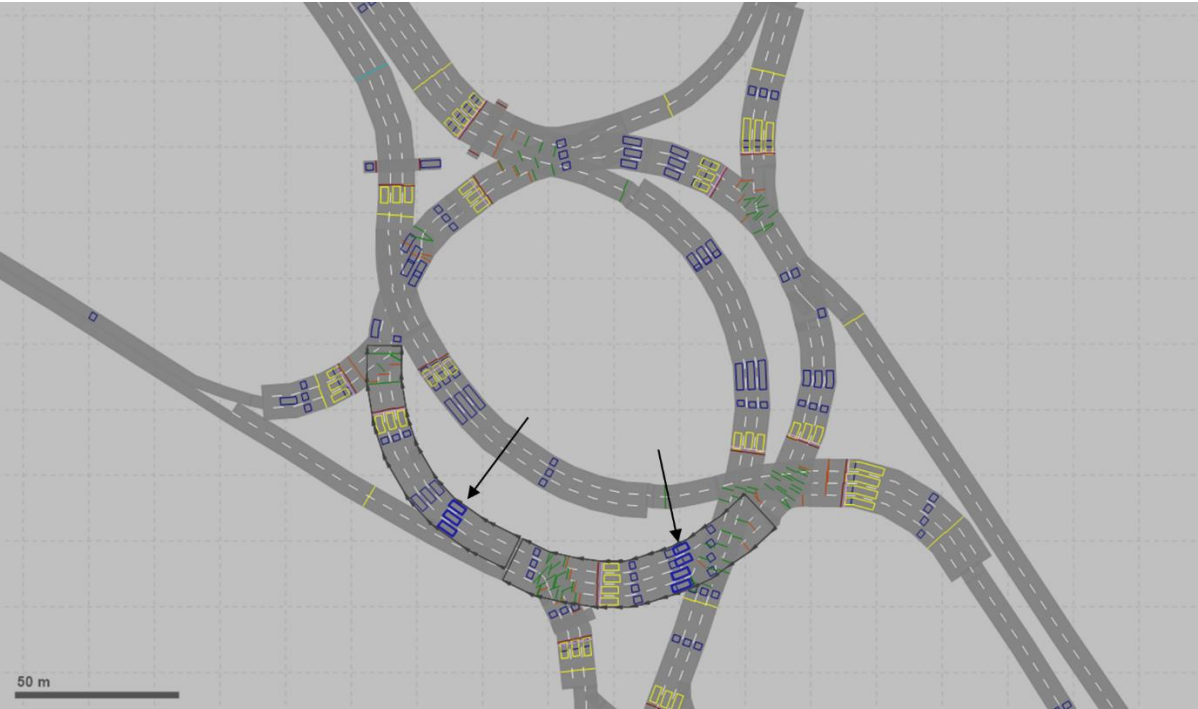


Figure 2. Detectors added on south stream 2, signal controller 6.

2.2 Modelling results

2.2.1 Replication of modelling results

The model results contained in the forecast report have been successfully replicated by AECOM for all scenarios.

2.2.2 Analysis of modelling results

As detailed in §2.1.1, modelling results have been analysed for two sets of forecast scenarios, one with all committed development flows including the Levante Gate development, and another without Levante Gate.

Figure 3 shows the location of the journey time sections defined across the model.

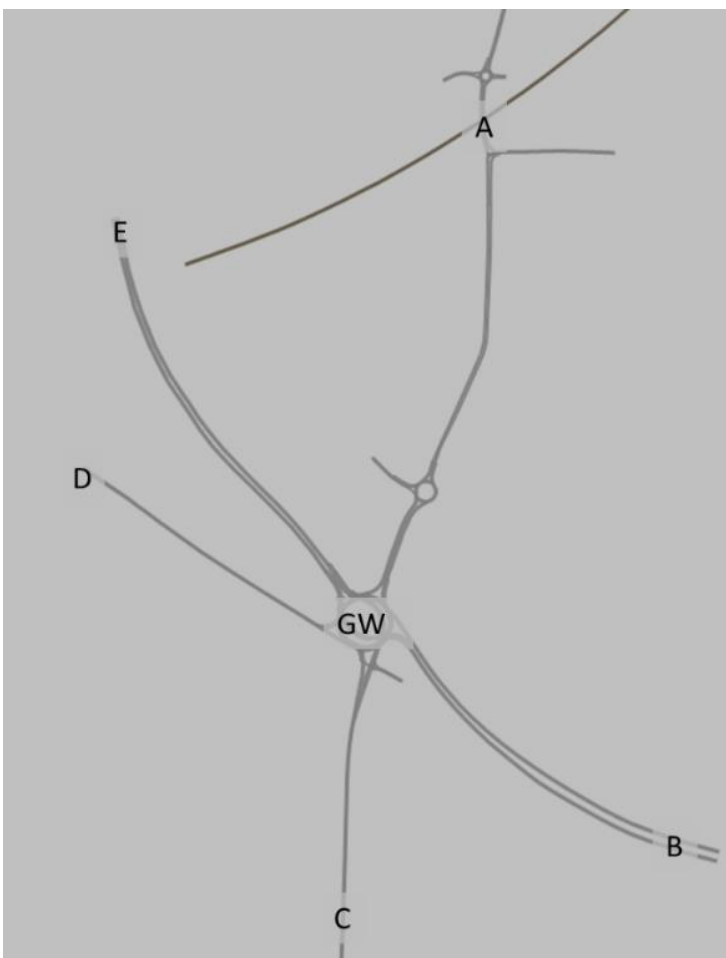


Figure 3. Journey time sections through the model.

Figure 4 and 6 show the journey time results for AM and PM produced by the model submitted by BWB. Figure 5 shows screenshots from the 2023 AM Peak model observations on the A5 south approach.

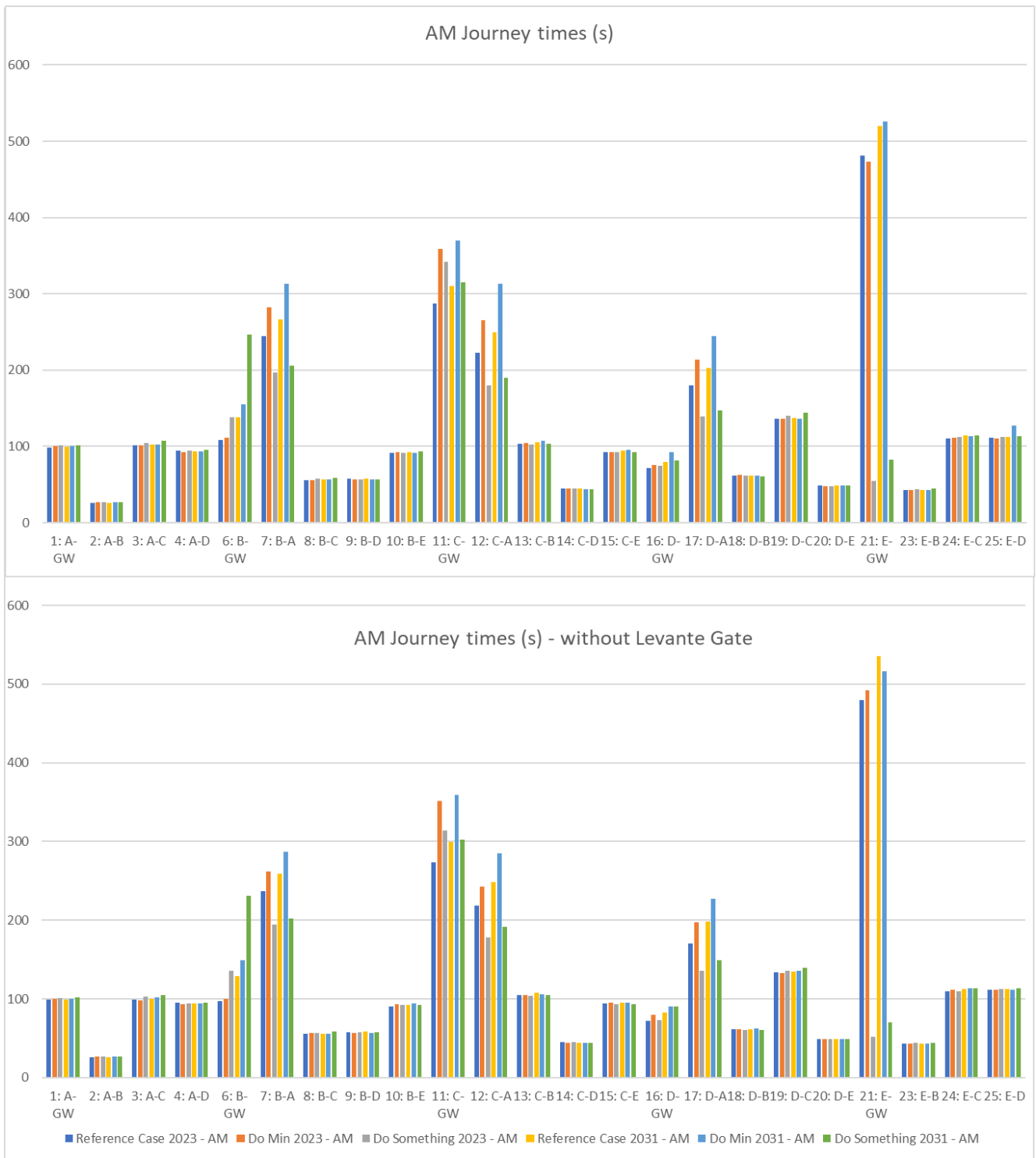


Figure 4. Modelled AM journey times.

The AM journey time results are broadly consistent for both scenarios showing that:

- The mitigations in the Do Something scenario effectively offset the increase in journey times seen from the Reference Case to Do Minimum (with development trips added) on all approaches to the junction except the A5 northbound (route 6 - B-GW) and the A4146 (route 11 - C-GW), in both the 2023 AM peak and 2031 AM peak;
- The approach on the A5 northbound (B-GW) suffers a significant increase in journey time in the Do Something scenarios, The increase along this route is 30 seconds in 2023 and 107 seconds in 2031 compared to the reference case, similar results have been observed without Levante Gate flows;
- The mitigation at Tilbrook Roundabout results in a significant reduction in northbound journey times along Brickhill St (route 7 - B-A, route 12 - C-A, and route 17 - D-A); and
- The change in lane allocation at the southbound approach on the A5 (route 21 - E-GW) in the Do Something scenarios result in a large reduction in journey times, such that it is an improvement to those in the Reference Case.

In addition to the analysis of the model outputs presented within the BWB technical note, AECOM have undertaken observation of model runs to understand the extent of the queuing generated on the A5 south approach in the 2023 AM peak Reference Case and Do Something scenario. Screenshots of these observations are presented below in Figure 5. The observations indicate that queuing increases significantly in the Do Something scenario when compared with the Reference Case scenario.

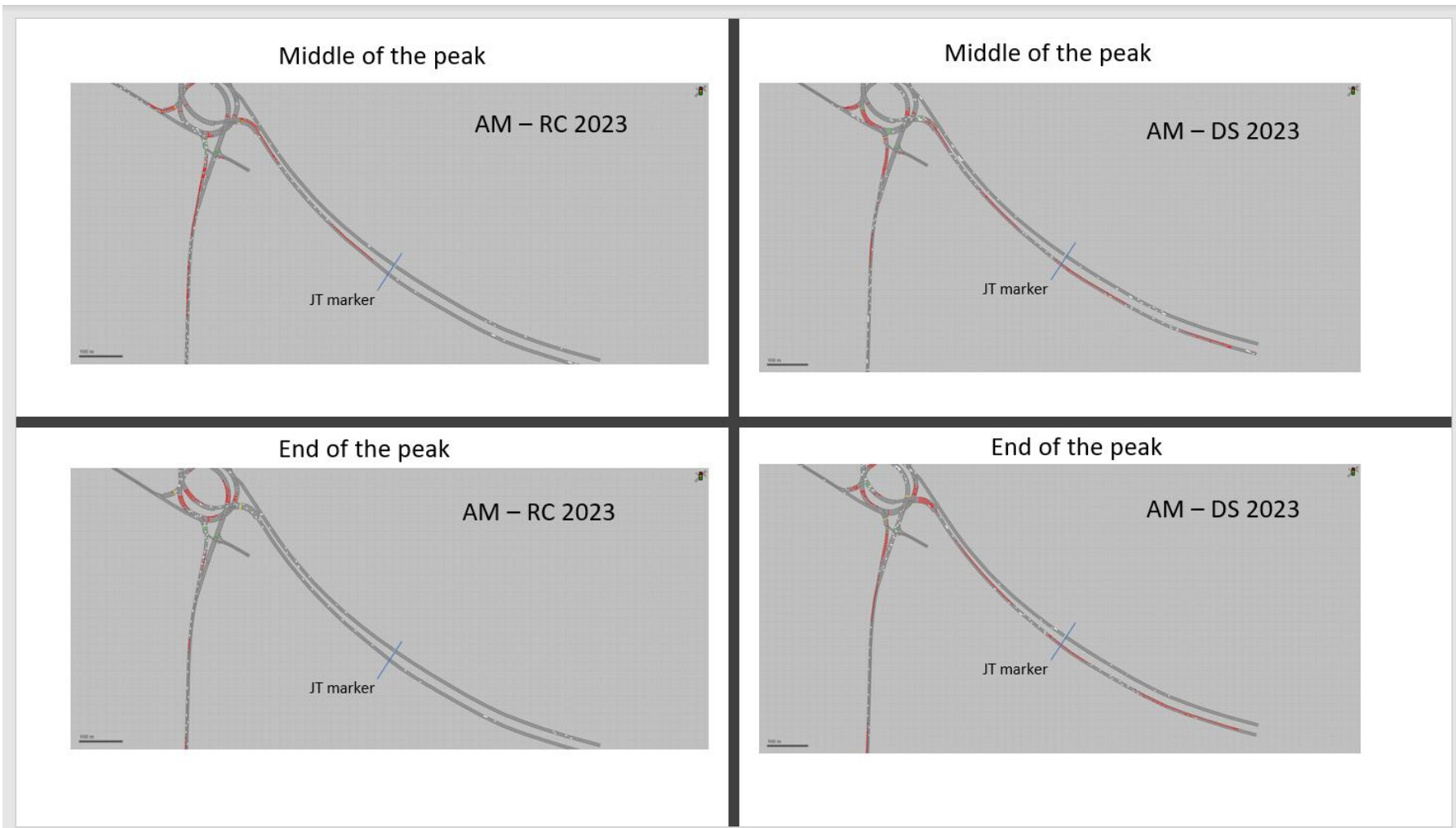


Figure 5. 2023 AM Peak model observations



Figure 6. Modelled PM journey times.

The PM journey time results are broadly consistent for both scenarios showing that:

- The Do Something scenario journey times are slower than the Reference Case on the A4146 (route 11 - C-GW) with an increase of 54 seconds;
- Journey times on the southbound approach on the A5 (route 21 - E-GW) in the Do Something scenarios are significantly faster than the Reference Case.

Table 4 and Figure 7 show the network performance results, as produced by the models submitted by BWB.

There is predicted to be a significant reduction in average delay and latent demand with the implementation of the proposed mitigations (comparison between Reference Case, Do Minimum and Do Something).

The total delay figures are calculated as the delay experienced by all vehicles loaded in the network, plus the delay experienced by vehicles that could not be loaded on to the network during the simulation. The results indicate that much of the delay caused by the development in the AM peak hour is mitigated for. The results also show that there is less delay in the Do Something scenarios compared to the Reference Case scenarios in the PM peak hour.

It should be noted however that this assessment includes the mitigation at the Tilbrook Roundabout. The latent demand indicates, that due to congestion, not all vehicles are able to enter the model network.

Table 4. Modelled network performance results.

		Delay Avg	Speed Avg	Veh arrived	Latent demand	Total delay ¹
With Levante Gate						
AM	Reference Case 2023	220	13	6663	1576	1609077
	Do Min 2023	227	13	6832	1915	1711879
	Do Something 2023	129	19	7273	1531	1005415
	Reference Case 2031	249	12	6756	2240	1869689
	Do Min 2031	266	11	6865	2634	2044897
	Do Something 2031	176	15	7566	1928	1441811
PM	Reference Case 2023	203	14	6381	1158	1405799
	Do Min 2023	207	14	6561	1414	1476146
	Do Something 2023	159	17	7282	457	1248400
	Reference Case 2031	213	14	6509	1862	1509292
	Do Min 2031	214	14	6678	2111	1550798
	Do Something 2031	179	16	7389	1139	1418685
Without Levante Gate						
AM	Reference Case 2023	210	14	6651	1121	1525181
	Do Min 2023	221	13	6778	1544	1645577
	Do Something 2023	125	20	7225	1099	962556
	Reference Case 2031	245	12	6734	1810	1826470
	Do Min 2031	257	11	6896	2169	1974733
	Do Something 2031	168	16	7552	1472	1372304
PM	Reference Case 2023	198	15	6266	951	1343518
	Do Min 2023	203	14	6481	1134	1429504
	Do Something 2023	137	19	7247	167	1062919
	Reference Case 2031	212	14	6428	1582	1481340
	Do Min 2031	216	14	6579	1855	1545695
	Do Something 2031	171	16	7361	799	1355028

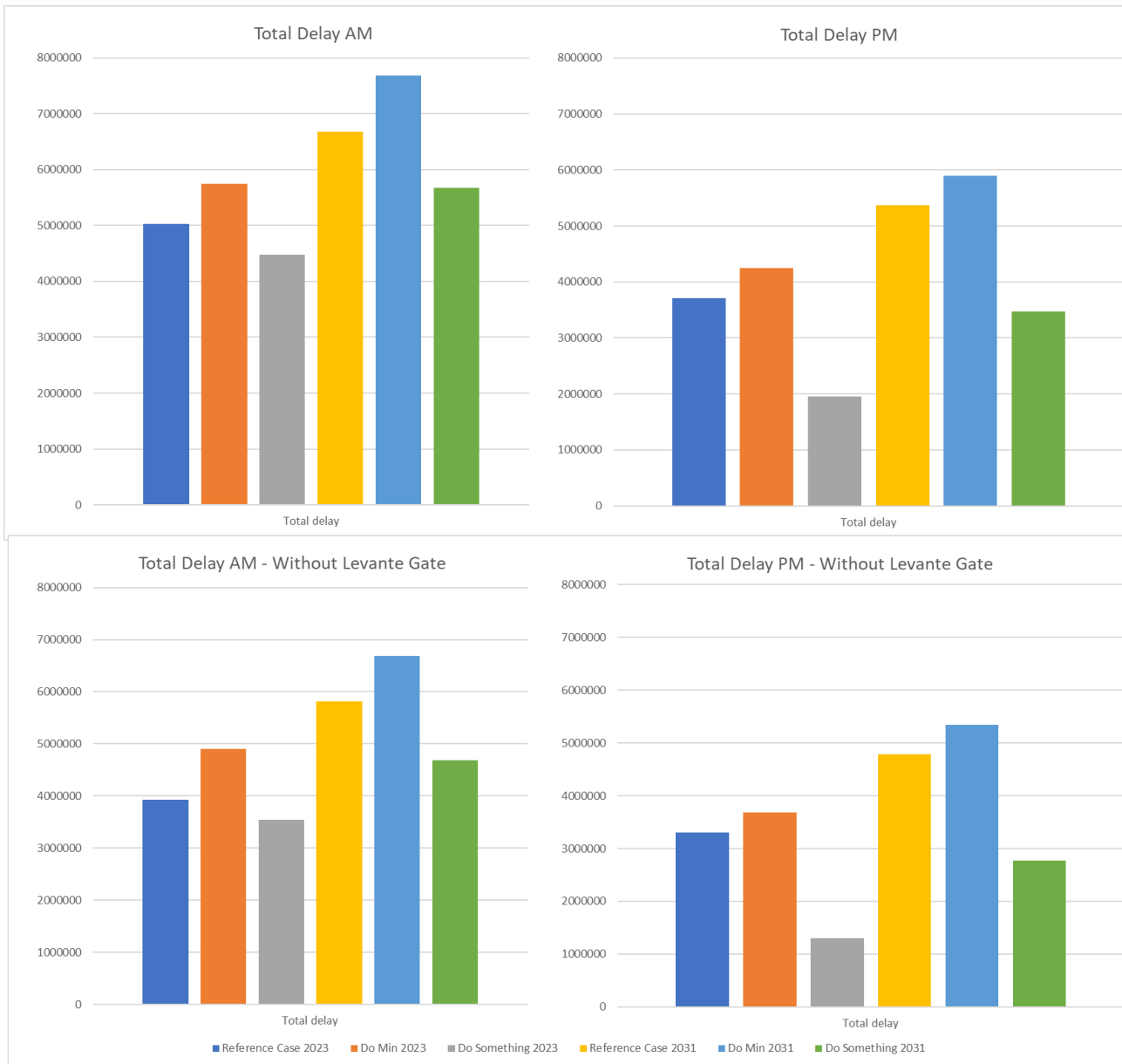


Figure 7. Network Performance results for total delay¹ including latent delay.

¹ Total delay is expressed in seconds and calculated as the sum of the total delay experienced by all vehicles that have been loaded onto the model at the end of the simulation plus the latent delay experienced by all vehicles that could not be loaded onto the network on time.

3 Conclusions

AECOM has undertaken an audit of the South Caldecotte Vissim Base (already approved in previous audits) and Forecast models, as part of a wider review of the potential impact of the proposed South Caldecotte development on the strategic and local road network.

The coding concerns marked as significant during the previous audits of the models have been addressed.

A change in the committed development assumptions has been introduced in this submission, on the basis that the Levante Gate development has been rejected planning permission. However, results and analysis are also provided with this development included for information.

The modelling results indicate that while the journey times on Brickhill Street northbound and the A5 southbound improve significantly with the proposed mitigations, the development increases the journey times along the A4146 (54 seconds in the PM peak hour) and the A5 northbound (30 seconds in the AM peak hour) in 2023, despite the proposed mitigations.

However, the network performance results show that due to the proposed mitigations, delays across the network are reduced in Do Something scenario, compared to the Reference Case. The mitigations offset any overall increase in delay resulting from the proposed development trips in both peak hours. It is likely that further signal optimisation may distribute benefits and delays more evenly for all arms of the junction, whereas the A5 southbound approach currently benefits most from the mitigation.

Observations of the model operation indicate that in the 2023 Do Something scenario the queuing on the A5 south approach is significantly longer than the Reference Case scenario, which AECOM consider equates to a severe impact that can be attributed to the proposed development.

From HE's perspective AECOM recommend that further measures are sought to ensure that the impact of the proposed development on the A5 northbound approach is not considered severe. This could potentially be demonstrated through the optimisation of signal timings (this should be consistent and applied in all scenarios) that protects the operation of the A5 approaches and ensures that the impact of the South Caldecotte development on these arms is not severe.