Technical Note

DATE:	29 September 2023	**CONFIDENTIALITY:**	Public
SUBJECT:	Ide Roundabout Traffic Impact Assessment		
PROJECT:	Ide Roundabout	**AUTHOR:**	WSP

Background

WSP have been commissioned by Teignbridge District Council (TDC) to undertake a traffic modelling exercise for the Ide Roundabout. This is to assess the traffic impact on the roundabout from the nearby proposed Markham Village development which would see 900 new homes built close to the south west corner of the roundabout. The development will also include local community facilities including a primary school and shop.

The Ide Roundabout is located to the south west of Exeter close to the village of Ide. The roundabout is four-armed with entries from the Alphington Road, A30 northbound off-slip, Ide Lane and the A30 southbound off-slip.

A VISSIM microsimulation traffic model has been developed as the primary source of evidence for testing for any potential impact on the Ide Roundabout as a result of the Markham Village development and also wider traffic growth brought about by development of the surrounding area including Exeter, East Devon and Mid-Devon.

The A30 is part of the Strategic Road Network (SRN) operated by National Highways. As part of the traffic impact assessment, checks were undertaken to see whether an increase in traffic on the roundabout may lead to additional queuing on the A30 off-slips and back onto the A30 itself, which would be considered a safety concern.

Known issues with queuing back from the Alphington Road exit arm into the Ide Roundabout, which occurs particularly in the AM peak period, were included within the model to provide as accurate a reflection of the existing operation of the roundabout as possible.

The modelling methodology as set out in this technical note has been developed alongside partners and has been agreed by Devon County Council (DCC) and National Highways.

Base Modelling

A base model was developed to represent the existing roundabout layout with 2023 traffic flows applied. The model network was scaled and built using ariel mapping overlays applied within VISSIM to ensure that link lengths and the roundabout geometry matches with the existing layout.

2023 trip demand matrices were produced for the AM and PM time periods with 2023 count data taken in March 2023 supplied by National Highways. The counts did not include through trips on the A30 which pass over the roundabout on the flyover. Therefore, to test the interaction between trips merging onto the A30 from the roundabout on-slips with A30 mainline traffic, A30 trips were filled in using March 2023 data from National Highways Webtris count data.

The peak traffic hours defined in the model are as below:

- **AM peak:** 07:30 – 08:30
- **PM peak:** 16:30 – 17:30

The base model network as coded in VISSIM can be seen in Figure 1 overleaf:

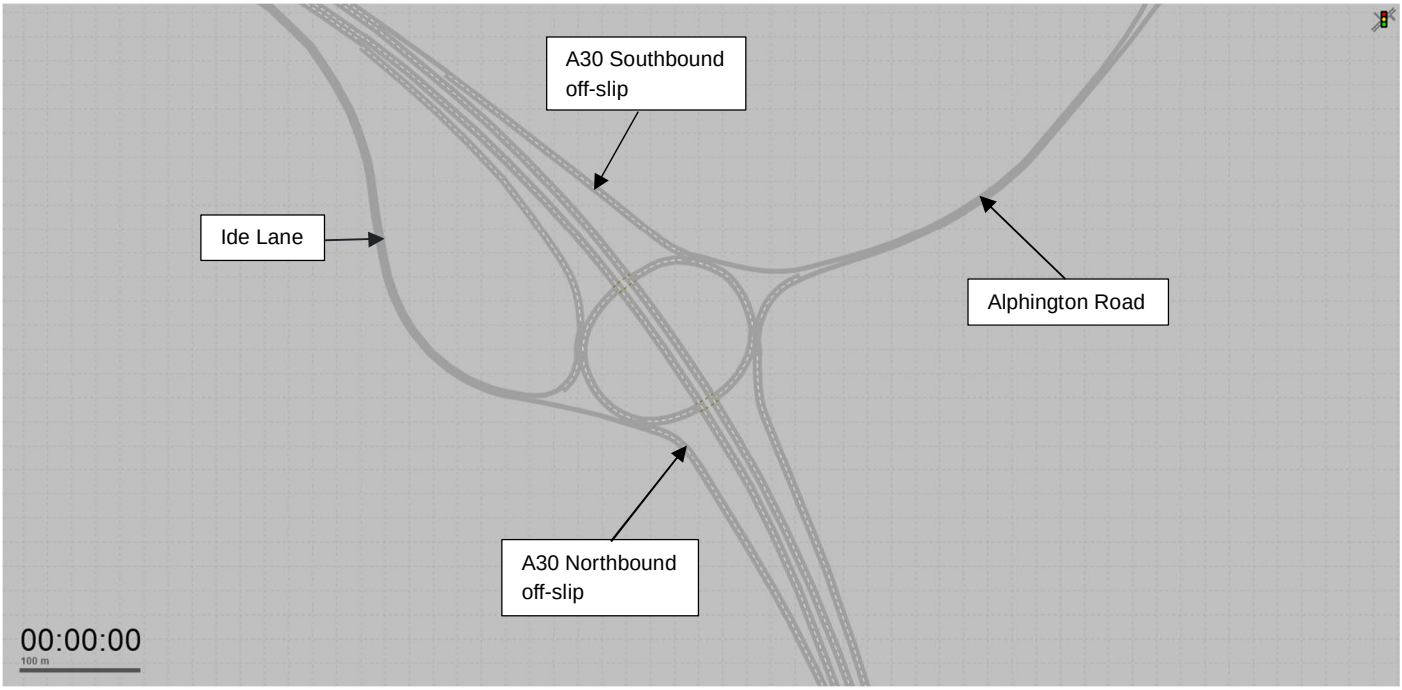

Figure 1 - VISSIM model network displaying Ide Roundabout

The base model was calibrated and validated using turning count data (to ensure modelled traffic flows matched observed data) and 2021 journey time data supplied by DCC (to ensure that modelled journey times match with observed data).

Queue lengths were also checked for the A30 off-slips comparing the modelled queue lengths against data collected in March 2023. This showed that average modelled queue lengths were on average higher than the survey data. However, it was agreed that the degree of queuing on the A30 off-slips in the model was in line with expected queue lengths and matched National Highways observations, and therefore provided a good basis for the traffic impact assessment.

The model calibration and validation showed that the model matches closely both in terms of turning counts and journey times in both the AM and PM peak periods and was therefore considered to be fit-for-purpose for the traffic impact assessment.

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Forecast Modelling

Upon completion of the base modelling and following agreement from the stakeholder group that all were content with the operation of the base model, forecast modelling was produced. This saw the testing of three separate forecast scenarios as below:

- **Forecast Scenario 1 (FS1):** Traffic growth applied to the model to account for expected trips from the Markham Village development plus wider background traffic growth.
- **Forecast Scenario 2 (FS2):** As Forecast Scenario 1 with reductions in traffic applied to account for proposed mitigation measures to reduce the impact of Markham Village traffic.
- **Forecast Scenario 3 (FS3):** Traffic growth applied to the model for expected trips from the Markham Village development only i.e. no background growth applied. FS3 does not include the proposed Markham Village mitigation measures applied to FS2.

The trips for the Markham Village development were extracted from DCC's Greater Exeter Strategic Plan (GESP) strategic traffic model, background growth was informed by the Department for Transport's (DfT's) National Trip End Model (NTEM) using TEMPro and trip distributions from the Markham Village development were informed by assumptions included in the document *'Markhams Village Infrastructure Delivery Plan'* written by Horizon Consulting Engineers on behalf of the land owners in June 2023.

Trip demand matrices for each of the three forecast model scenarios were produced based on the traffic growth assumptions for each. The trip demand matrices were then assigned to the Ide Roundabout VISSIM network to assess the impact of traffic associated with the Markham Village development on the roundabout and roundabout entry arms.

Model Results

FORECAST SCENARIO 1

Network performance results extracted from the FS1 VISSIM scenario can be seen in Table 1 below:

	Base (AM)	FS1 (AM)	Difference	Base (PM)	FS1 (PM)	Difference
Total Vehicles	4730	5491	761	5070	5891	821
Total Delay (s)	180895	662740	481845	90896	341452	250556
Average Speed (mph)	30	17	-13	37	25	-11
Average Delay / Vehicle	38	121	83	18	58	40

Table 1 - Forecast Scenario 1 Network Performance Results

The network performance results for FS1 indicate that with the Markham Village development and wider background growth accounted for there will be a predicted increase in traffic of 761 vehicles in the AM peak and 821 additional vehicles in the PM peak.

The increase in traffic exacerbates the existing issues with queuing on Alphington Road with the additional vehicles heading towards Exeter city centre causing a queue to rapidly form back into the roundabout in the AM peak hour in particular. This in turn leads to queuing and increased levels of delay on the Ide Lane and

A30 northbound off-slip arms, resulting in lower average speeds across the modelled network and an increase in average per vehicle delay of 83 seconds in the AM peak and 40 seconds in the PM peak in comparison to the equivalent base model values.

The increased queuing on the northbound off-slip in FS1 is as illustrated in the queue data seen in Figures 2 and 3 below for the AM and PM peaks respectively. The length of the northbound off-slip is 300 metres, any queue length beyond this would see the back of the queue extending onto the A30 mainline.

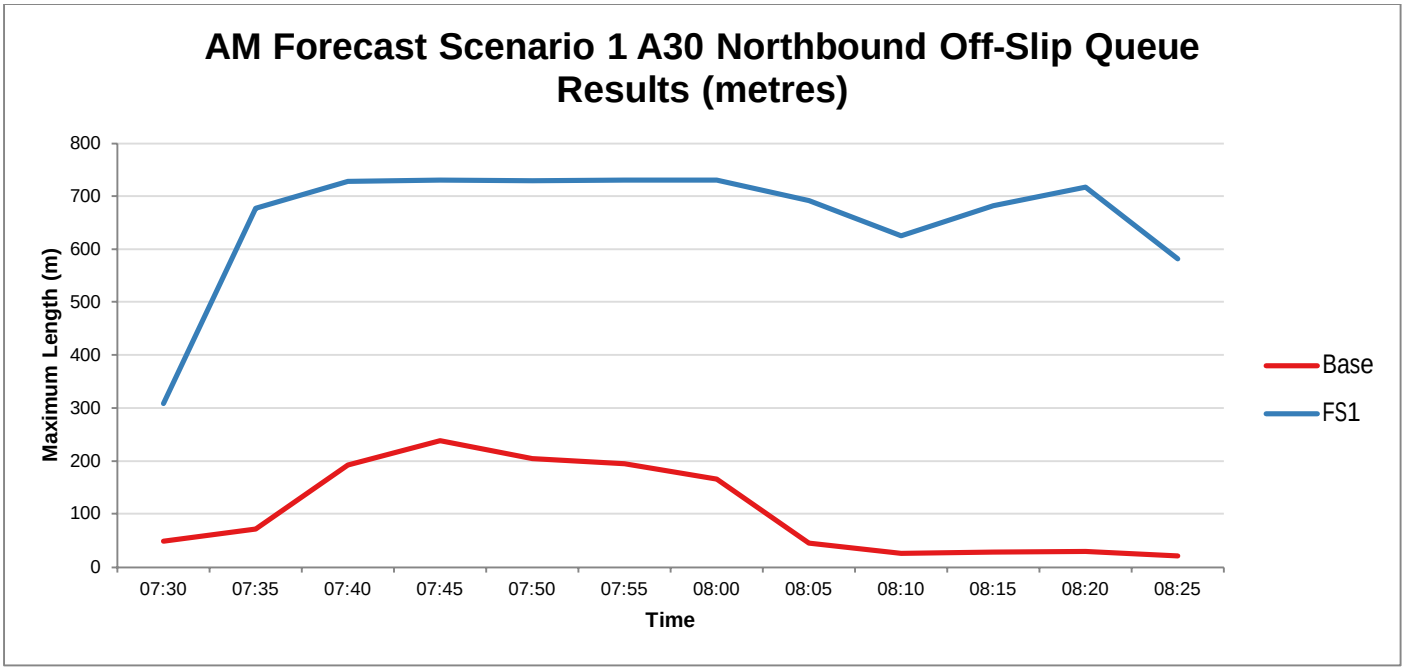

Figure 2 - Forecast Scenario 1 AM A30 northbound off-slip queue results

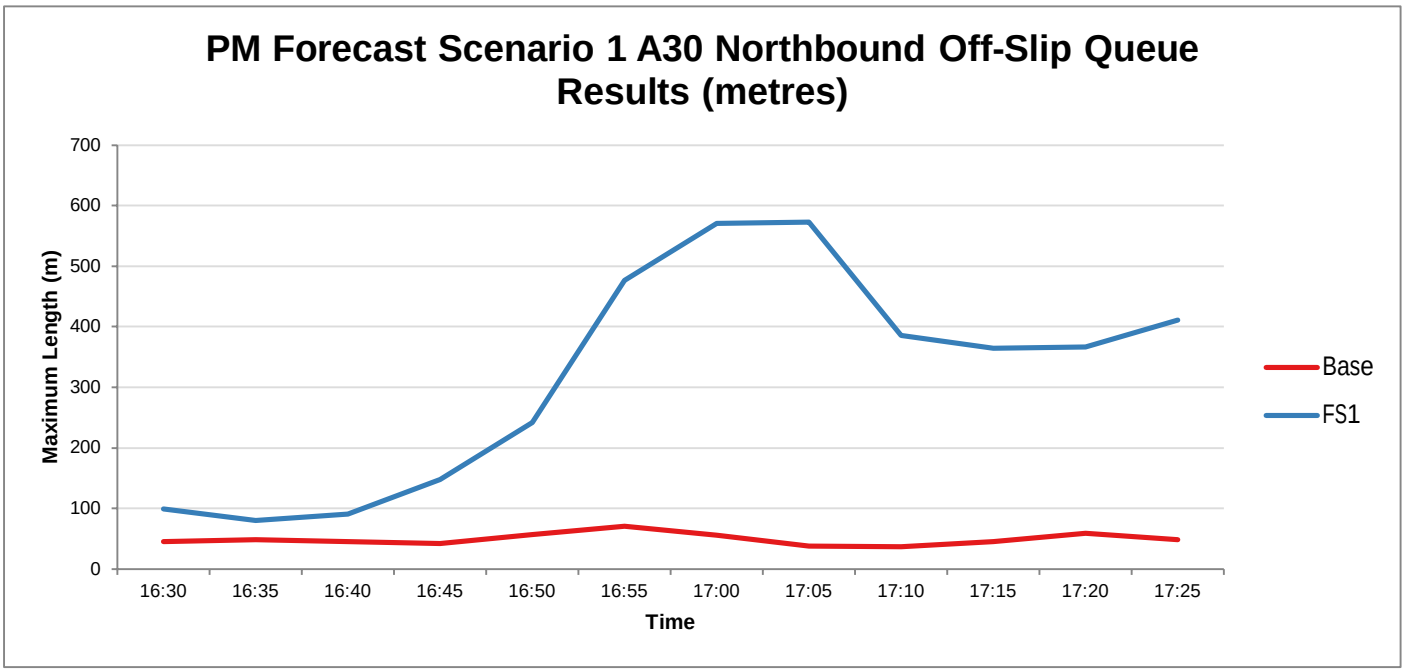

Figure 3 - Forecast Scenario 1 PM A30 northbound off-slip queue results

In the AM peak a queue forms rapidly from the start of the peak hour at 07:30 and queues back into the A30. The queue plateaus at 700 metres, which is the extent of the model boundary, and is maintained throughout the peak hour until 08:25 when the queue starts to decrease in length.

The impact from the increase in traffic in the PM peak hour also sees a queue form back into the A30. However, the queue is less rapid to build than in the AM peak hour with the queue extending back from the A30 northbound off-slip between approximately 16:50 to the end of the peak hour at 17:30.

FORECAST SCENARIO 2

Network performance results extracted from the FS2 VISSIM scenario can be seen in Table 2 below:

	Base (AM)	FS2 (AM)	Difference	Base (PM)	FS2 (PM)	Difference
Total Vehicles	4730	5482	752	5070	5935	866
Total Delay (s)	180895	490644	309749	90896	315287	224392
Average Speed (mph)	30	20	-10	37	26	-10
Average Delay / Vehicle	38	90	51	18	53	35

Table 2 - Forecast Scenario 2 Network Performance Results

The traffic demand assumptions for FS2, which factor in the proposed mitigation measures for Markham Village, including improved cycling and pedestrian links to Exeter among others, lead to a small decrease in vehicles in the network. Adjustments to the traffic demand matrix were also made to factor in assumed trips

diverting from the A30 due to assumed usage of a proposed 'Park and Change' site, with approximately 100 vehicles removed from Alphington Road with a 70/30 split between traffic originating from the A30 northbound off-slip and southbound off-slip respectively.

While the mitigation measures lead to an improvement in FS2 results in comparison to FS1, FS2 continues to show an overall worsening of network performance in comparison to the base model. Compared to the base model, average per vehicle delay increases by 51 seconds in the AM peak and 35 seconds in the PM peak with a related decrease in average speed across the network of 10mph in both peaks, indicating an increase in congestion.

FS2 queue results for the A30 northbound off-slip for the AM and PM peak periods can be found in Figure 4 and Figure 5. For the sake of comparison the FS1 queue results are also shown. The length of the northbound off-slip is 300 metres, any queue length beyond this would see the back of the queue extending onto the A30 mainline.

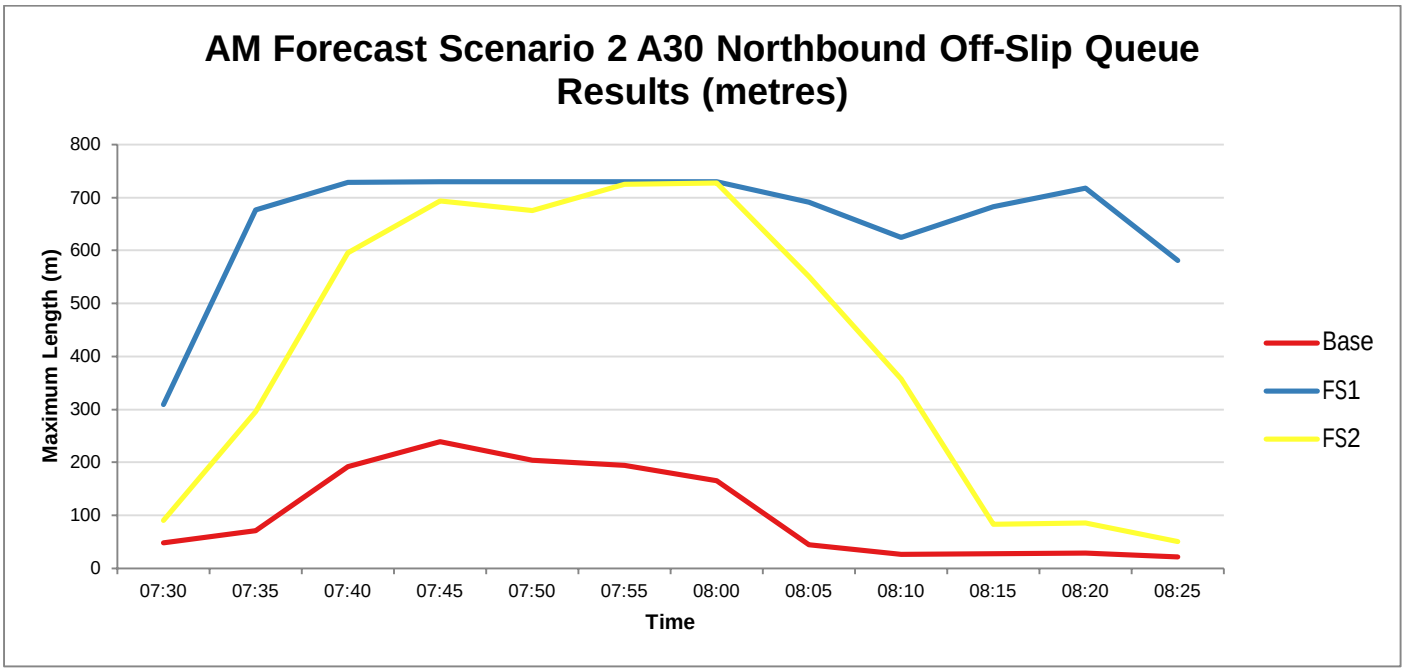

Figure 4 - Forecast Scenario 2 AM A30 northbound off-slip queue results

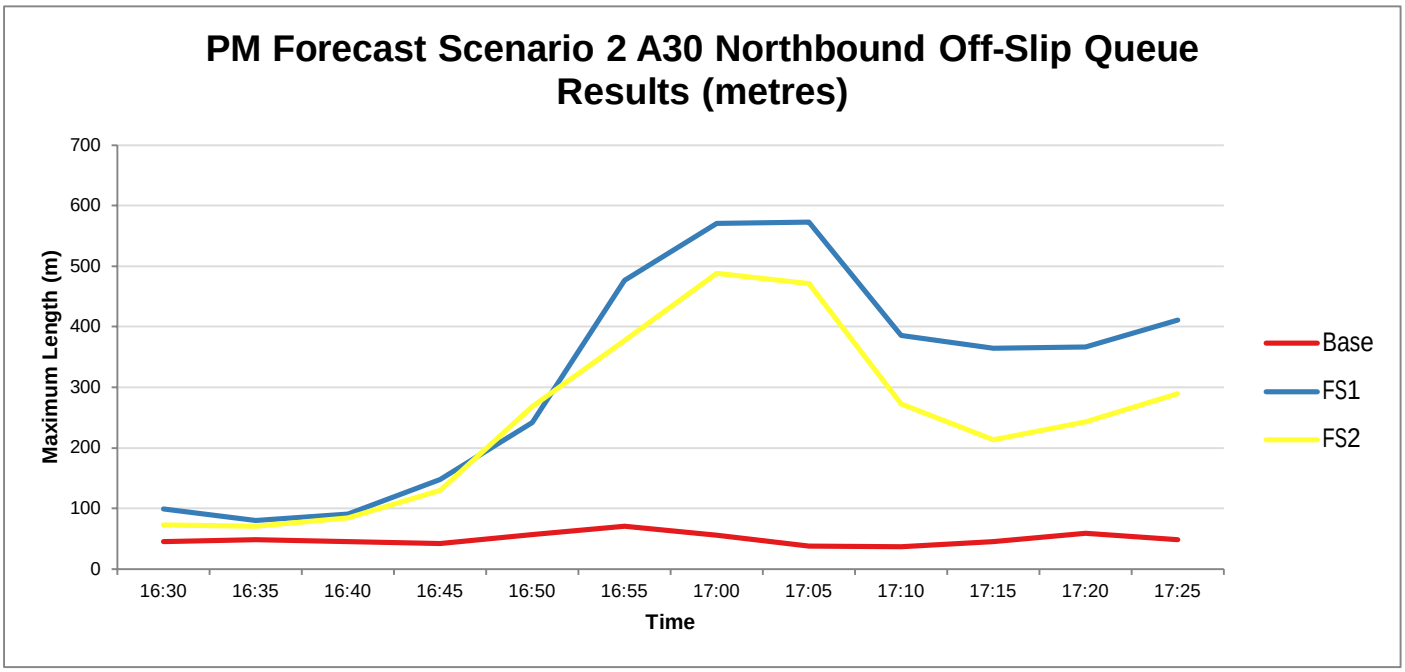

Figure 5 - Forecast Scenario 2 PM A30 northbound off-slip queue results

The FS2 results continue to see a queue forming back onto the A30 in both the AM and PM peak periods. In the AM peak the queue on the northbound off-slip reaches the maximum length of the off-slip with queuing back onto the A30 from approximately 07:35. The queue on to the A30 is maintained until around 08:00 at which time the queue length rapidly decreases with the queue back below 300 metres by 08:10.

In the PM peak the FS 2 results indicate that the A30 northbound off-slip queue will extend back into the A30 between 16:50 to 17:10 with the queue less than 300 metres for the remaining duration of the peak hour.

FORECAST SCENARIO 3

Network performance results extracted from the FS3 VISSIM scenario can be seen in Table 3 below.

	Base (AM)	FS3 (AM)	Difference	Base (PM)	FS3 (PM)	Difference
Total Vehicles	4730	5053	323	5070	5418	349
Total Delay (s)	180895	423577	242682	90896	153961	63066
Average Speed (mph)	30	21	-9	37	33	-4
Average Delay / Vehicle	38	84	46	18	28	10

Table 3 - Forecast Scenario 3 Network Performance Results

FS3 does not include the proposed Markham Village mitigation measures as seen in FS2 and therefore the results for this scenario depict the predicted 'worst case' impact of predicted trip generation from the

Markham Village development without assumptions applied for the 'Park and Change', bus measures or active travel measures.

The FS3 results indicate that with Markham Village development traffic alone, there is an increase in total vehicles of 323 in the AM peak and 349 PM peak, accounting for trips to and from the Markham Village development itself.

The increase in traffic leads to an increase in average delay per vehicle of 46 seconds in the AM peak and 10 seconds in the PM peak in comparison to the base model results. Similarly average speeds decrease in both the AM peak and PM peak by 9 mph and 4 mph respectively, indicating an increase in congestion across the modelled network.

FS3 queue results for the A30 northbound off-slip for the AM and PM peak periods can be found in Figure 6 and Figure 7 below, for the sake of comparison the FS1 queue results are also shown. The length of the northbound off-slip is 300 metres, any queue length beyond this would see the back of the queue extending onto on the A30 mainline.

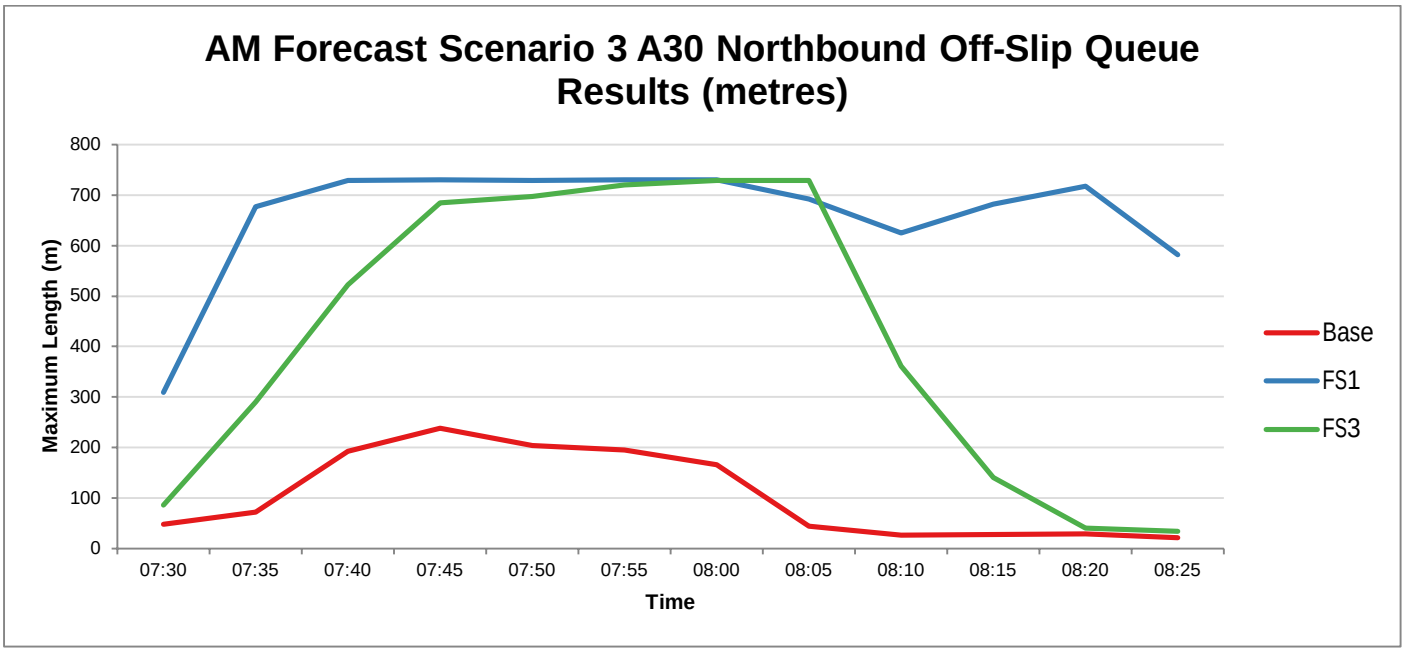

Figure 6 - Forecast Scenario 3 AM A30 northbound off-slip queue results

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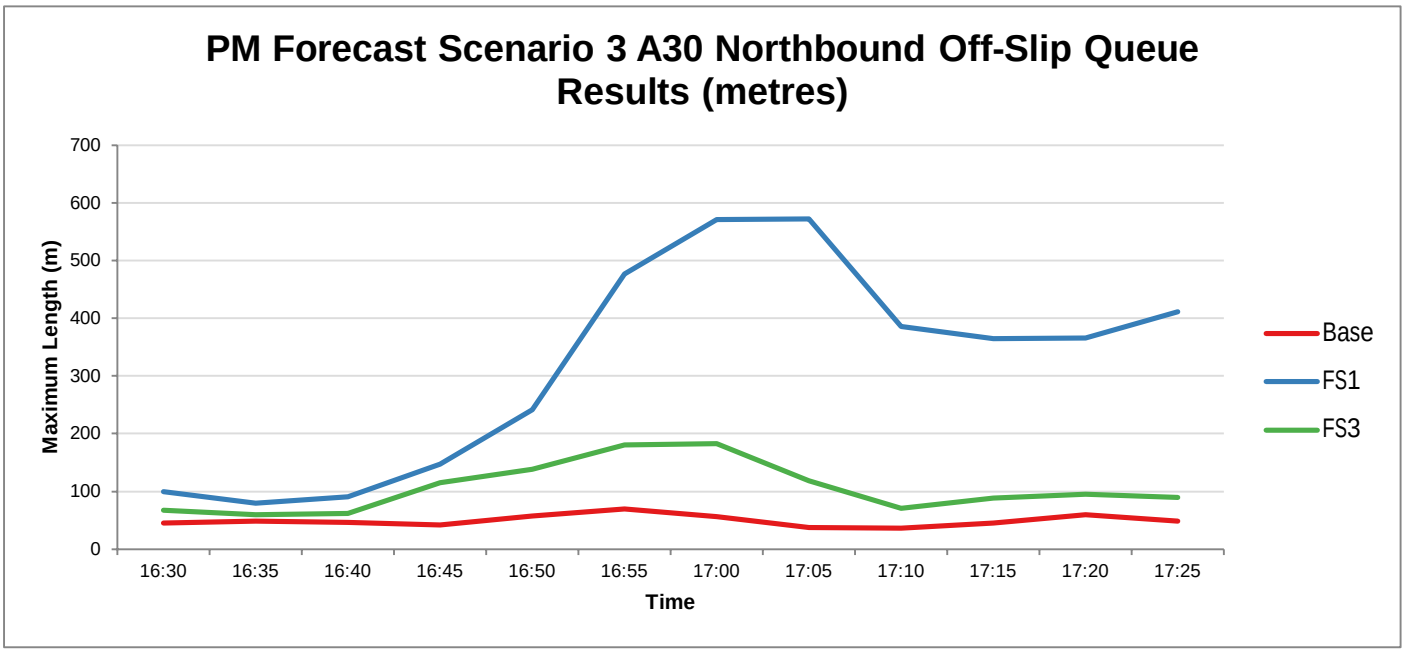

Figure 7 - Forecast Scenario 3 PM A30 northbound off-slip queue results

The FS3 results indicate that In the AM peak a queue will appear back onto the A30 by 07:35 and will be maintained until just after 08:00 at which time the queue on the A30 northbound off-slip quickly decrease dropping below 300 metres and therefore contained within the off-slip itself by 08:10. The results suggest that the Alphington Road exit arm is sensitive to any increase in traffic with the relatively small increase in trips caused by the Markham Village development alone causing the queue to extend back into the A30, albeit less rapidly and for a shorter duration than FS1 which also includes wider background growth.

In the PM peak the FS3 results indicate that the A30 northbound off-slip queue will remain below the 300 metre stacking length available meaning that the queue does not encroach back onto the A30 during the peak hour.

As previously noted, FS3 does not include any assumptions around the proposed Markham Village mitigation measures. Therefore, the FS3 modelled outputs may be considered to be an overestimation of the traffic impact, with queuing likely to be reduced once the impact of the 'Park and Change', bus and active travel measures are considered.

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Summary

A traffic impact assessment for the Ide Roundabout has been carried out using VISSIM microsimulation modelling. This tested the impacts of three traffic forecast scenarios; Forecast Scenario 1 (FS1) which included Markham Village development traffic and wider background traffic, Forecast Scenario 2 (FS2) which is the same as Forecast Scenario 1 with proposed mitigation strategies around Markham Village applied and Forecast Scenario 3 (FS3) which included Markham Village development trips only on top of 2023 base traffic flow data (i.e. excludes wider background traffic and assumptions around the Markham Village mitigation strategy).

All three traffic forecast scenarios saw an increase in traffic using the roundabout which subsequently impacted upon the operation of the roundabout itself. It is observed in the modelling that due to increased traffic on the Alphington Road exit arm of the roundabout, queuing which originates from this arm worsens in each of the scenarios with queueing extending back into the roundabout causing additional queuing and delay on the Ide Lane and A30 northbound off-slip arms in particular.

Queue results for the A30 northbound off-slip for both AM peak and PM peak time periods for the base and three forecast scenarios can be found in Figure 8 and Figure 9 below:

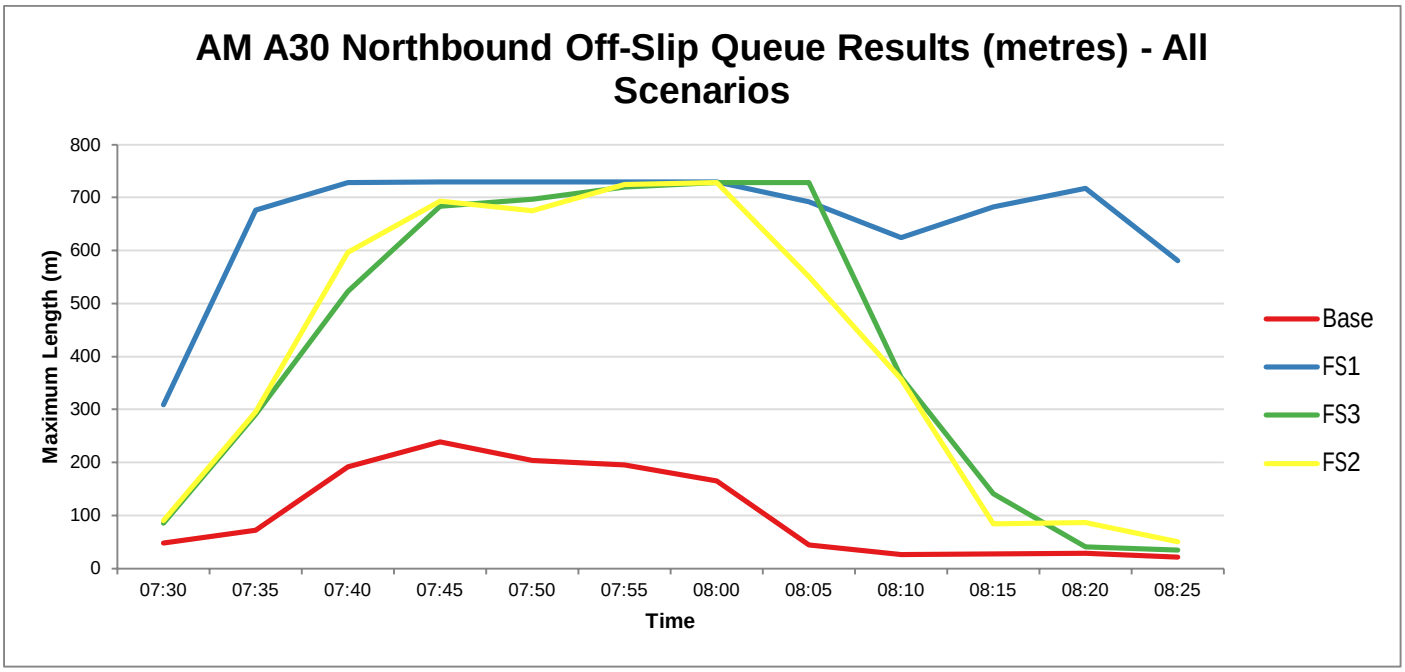

Figure 8 - AM A30 northbound off-slip queue results (all scenarios)

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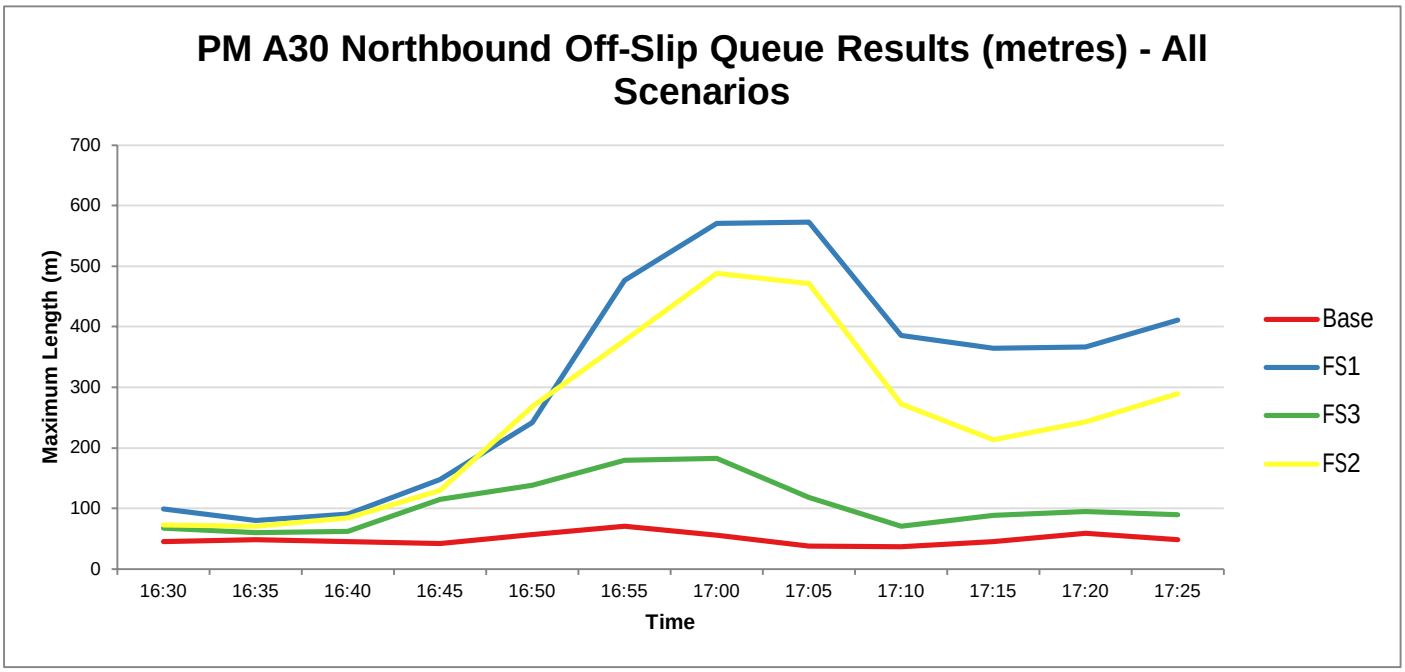

Figure 9 - AM A30 northbound off-slip queue results (all scenarios)

The queue graphs indicate that the highest level of impact is expected in the AM peak period with all three of the scenarios tested reaching a maximum queue length on the A30 northbound off-slip of approximately 730 metres. This is the maximum length from the stop line onto the Ide Roundabout back to the end of the model link on the A30 northbound.

In each case the queue reaches the model boundary. However, FS2 and FS3 appear to show an overall improvement in that while the queue reaches the maximum extent of the A30 northbound link, the queue in FS2 and FS3 builds less rapidly than in FS1 and does not remain at the maximum length for the duration of the model peak hour as seen in FS1.

Figure 8 shows that in comparison to FS1, the queue on the A30 northbound off-slip in FS3 persists for a longer duration. FS1 displays a dip in queue length at 08:00 whereas queuing does not begin to dissipate until 08:05 in FS3. However, this is a symptom of congestion in FS1, with the dip in queue length caused by traffic being unable to reach Alphington Road as this is ‘stuck’ in the A30 queue. As congestion in the network begins to reduce towards the end of the peak hour, the queue on the A30 northbound off-slip begins to build again in FS1 as traffic is unplugged and is able to reach Alphington Road / Ide Roundabout. As congestion is slightly lower in FS3 this effect is not seen as less traffic is caught up in the queue on the A30 or northbound off-slip. This means that the queue on the A30 northbound off-slip is maintained for slightly longer then in FS1 before dropping off quickly (rather than building up again as in FS1).

Tables displaying the base, FS1, FS2 and FS3 network performance results for comparison can be seen in Table 4 and Table 5 below displaying AM and PM outputs respectively:

	AM Network Performance Results				Difference		
	Base	**FS1**	**FS2**	**FS3**	**FS1 - Base**	**FS2 - Base**	**FS3 - Base**
Total Vehicles	4730	5491	5482	5053	761	752	323
Total Delay (s)	180895	662740	490644	423577	481845	309749	242682
Average Speed (mph)	30	17	20	21	-13	-10	-9
Average Delay / Vehicle	38	121	90	84	83	52	46

Table 4 - AM Network Performance Results (all scenarios)

	PM Network Performance Results				Difference		
	Base	**FS1**	**FS2**	**FS3**	**FS1 - Base**	**FS2 - Base**	**FS3 - Base**
Total Vehicles	5070	5891	5935	5418	821	865	348
Total Delay (s)	90896	341452	315287	153961	250556	224391	63065
Average Speed (mph)	37	25	26	33	-12	-11	-4
Average Delay / Vehicle	18	58	53	28	40	35	10

Table 5 - PM Network Performance Results (all scenarios)

FS1 shows the highest level of impact of the three scenarios, with network performance results and levels of queuing improving once assumptions around mitigation measures for the Markham Village development are included in the model (as seen in FS2) or once background traffic growth is removed (as seen in FS3). While queueing back onto the A30 is still predicted to occur in FS2 and FS3 this is not to the same extent or duration as that seen in the FS1 AM peak scenario.