Technical Note

TO	Greater Cambridge Partnership	**FROM**	WSP
DATE	May 2018	**Version**	1.2
SUBJECT	**Milton Road Summary Modelling Results – 'Do Nothing' VS 'Preliminary Design'**		

AIM OF THIS TECHNICAL NOTE

The following note sets out the results of the modelling work that has been undertaken to support the development of the proposed Milton Road preferred design scheme, comparing a future 'Do Nothing' scenario with the proposed 'Preliminary Design'. The modelling work has resulted in a set of results based on a validated 2016 baseline scenario and an assumed 2031 future scenario.

TRAFFIC MODELLING INTRODUCTION

To support the development of the proposed Milton Road Scheme, peak period microsimulation traffic modelling has been undertaken using industry standard software (S-Paramics) to assess and compare the 'Preliminary Design and 'Do Nothing' options, in terms of bus and non-bus journey times and expected peak hour maximum queue lengths, along the whole length of the proposed scheme, based on 2016 and 2031 flows.

As is industry standard practice, the model has been run multiple times and an average of the results has been taken. The results focus on the AM peak (8am-9am) and PM peak (5pm-6pm) periods where vehicle movements are at their busiest along the road. The variations in bus journey times have been assessed to provide an indication of how bus journey reliability would be affected within each scenario.

Traffic flows for 2031 have been provided by the Cambridge Sub-Region Model B Series (CSRM2) which has recently been updated to reflect more accurately the capacity of the road network, take into account the emerging Local Plan developments and to reflect the anticipated influence on traffic levels from City Deal measures and other transport infrastructure improvements, which are expected to be delivered over the coming years.

As agreed in discussion with Cambridgeshire County Council, the CSRM2 model runs have also incorporated a 2031 'A10 Do Nothing' scenario, for consistency with other City Deal schemes being modelled. This means that besides the baseline consideration of expected future local plan developments and transport infrastructure in 2031, this scenario also includes the A10 improvements and the Waterbeach new town development, which has direct impact on Milton Road.

Due to the expected housing and employment growth around Cambridge, the CSRM2 modelling predicts that traffic flows on Milton Road will be greater in 2031 than 2016.

When comparing the 'Preliminary Design' and 'Do Nothing' scenarios, it should be noted that Milton Road 2031 'Preliminary Design' scenario includes the effects of the proposed City Access Study which aims to reduce vehicle trips into Cambridge City Centre, and an assumed wider cycle improvement scheme across Cambridge. The CSRM2 modelling therefore predicts a 6.9% traffic flow reduction in AM peak and 10.6% traffic flow reduction in PM peak specifically along Milton Road, when directly compared to the 2031 'Do Nothing' scenario, which assumes no City Access measures.

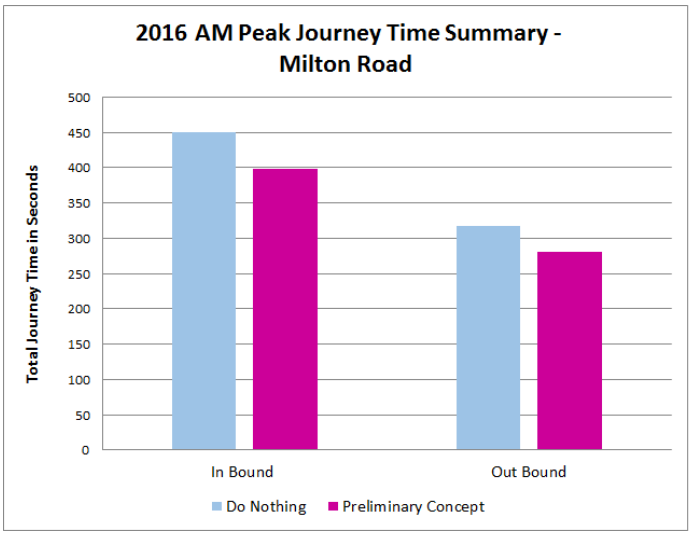
MODELLING RESULTS

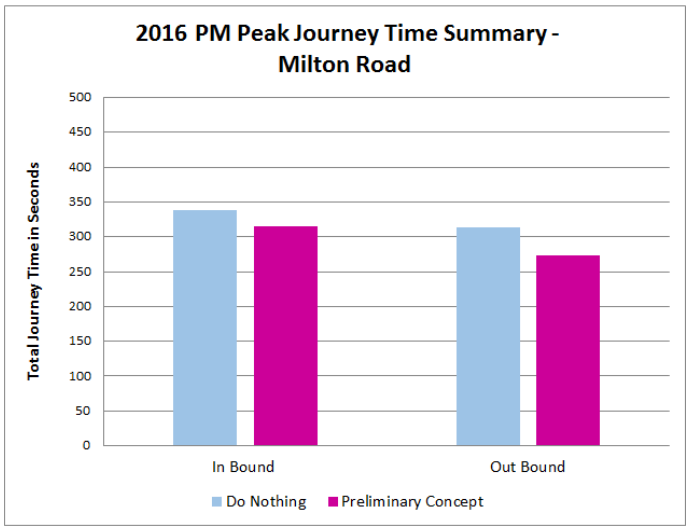
JOURNEY TIMES IN PEAK PERIODS (2016)

The graphs below provide a summary of 2016 peak period journey times for all vehicle trips (combined bus and non-bus). The times relate to journeys made between the Guided Bus Way and Mitcham's Corner. Compared with the 'Do Nothing' scenario, in the AM peak, the 'Preliminary Design' proposal shows a reduced journey time into Cambridge from 7.5 mins to 6.6 mins. Outbound journeys would decrease from 5.3 mins to 4.7 mins. In the PM peak inbound journey times are estimated to decrease from 5.6 to 5.2 mins and outbound trips journey time would decrease by from 5.2 mins to 4.6 mins.

The journey time difference between the two scenarios is primarily achieved due to the signal setting changes in the 'Preliminary Design' scenario at the various junctions along Milton Road. Overall, the journey time comparison demonstrates that the 'Preliminary Design' manages to not only maintain but slightly decrease the delays to vehicle journey times while also making big improvements to cycle and pedestrian infrastructure and priority along Milton Road. It is therefore a Design which achieves both a benefit to cyclists, pedestrians and the general vehicle traffic flow in the 2016 baseline scenario.

2016 'Do Nothing' vs 'Preliminary Design' journey time comparison

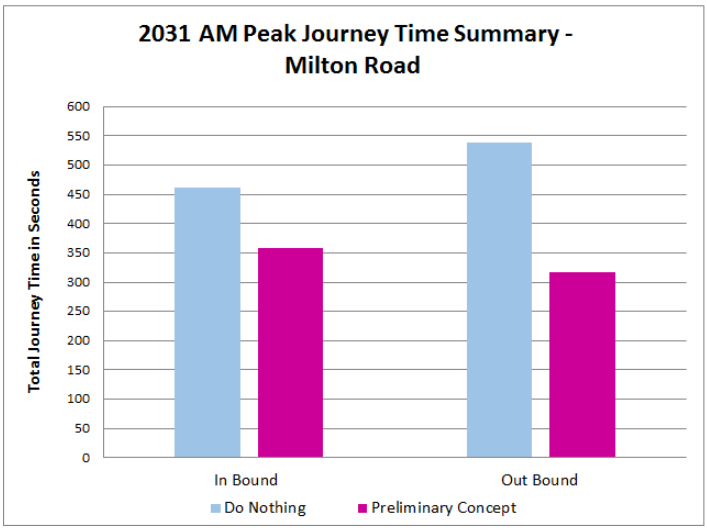


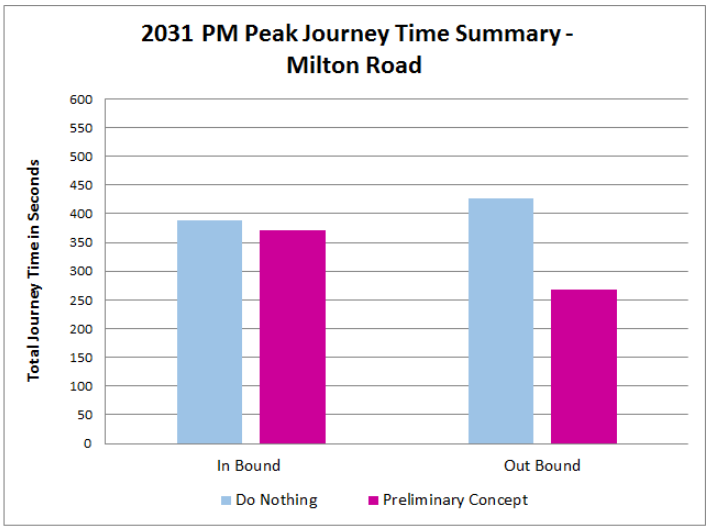


JOURNEY TIMES IN PEAK PERIODS (2031)

The graphs below provide a summary of 2031 peak period journey times for all vehicle trips (combined bus and non-bus). It shows that the extra vehicle flow that is predicted in 2031 (when compared to 2016 results above) increases the delays in the network in both peak periods.

'2031 'Do Nothing' vs 'Preliminary Design' journey time comparison





Compared with 'Do Nothing' scenario, the 'Preliminary Design' noticeably decreases the inbound journey time by 1.7 minutes in the 2031 AM Peak and the outbound journey time is significantly decreased by about 3.7 mins. In the PM peak, the inbound journey time is reduced by 0.3 minutes and the outbound journey time is reduced by about 2.6 mins. The significant reduction in journey times in the 2031 'Preliminary Design' scenario is achieved through a combination of mode shift to public transport/ cycling resulting from the proposed City Access measures and the proposed cycle scheme along Milton Road, as well as the optimised signal settings at the main junctions along Milton Road, proposed within the 'Preliminary Design'.

Overall, the 2031 journey time comparison shows the 'Preliminary Design' provides a shorter journey time in both directions on Milton Road, in comparison to 'Do Nothing' scenario which assumes no change to the current day situation along Milton Road.

BUS JOURNEY TIME AND BUS RELIABILITY IN PEAK PERIODS

The impact on bus reliability on Milton Road is shown in more detail below. The bus journeys shown in these results are based on those services that travel the full length of the scheme (i.e. Busway A, which travels the full length of the road from the Bus Way north of Kings Hedge junction to Victoria Avenue) and does not make any allowance for dwell times at stops, in order to enable a fair comparison with general traffic journey times along the length of Milton Road.

It should be noted the bus journey times reviewed in this section are not fully comparable to the combined journey time, as the bus routes modelled also include for the journey time along Mitcham's Corner and Victoria Ave, therefore the bus journey times shown in the graphs are covering a greater distance then the general traffic, which does not includes the journey time along these sections of road. However what the results do provide is a direct comparison between scenarios, in regards to bus journey time and reliability.

To enable a robust assessment, it should also be noted that, at this stage, the modelling work does not currently take account of measures within traffic signal sequences to prioritise bus movements, which could

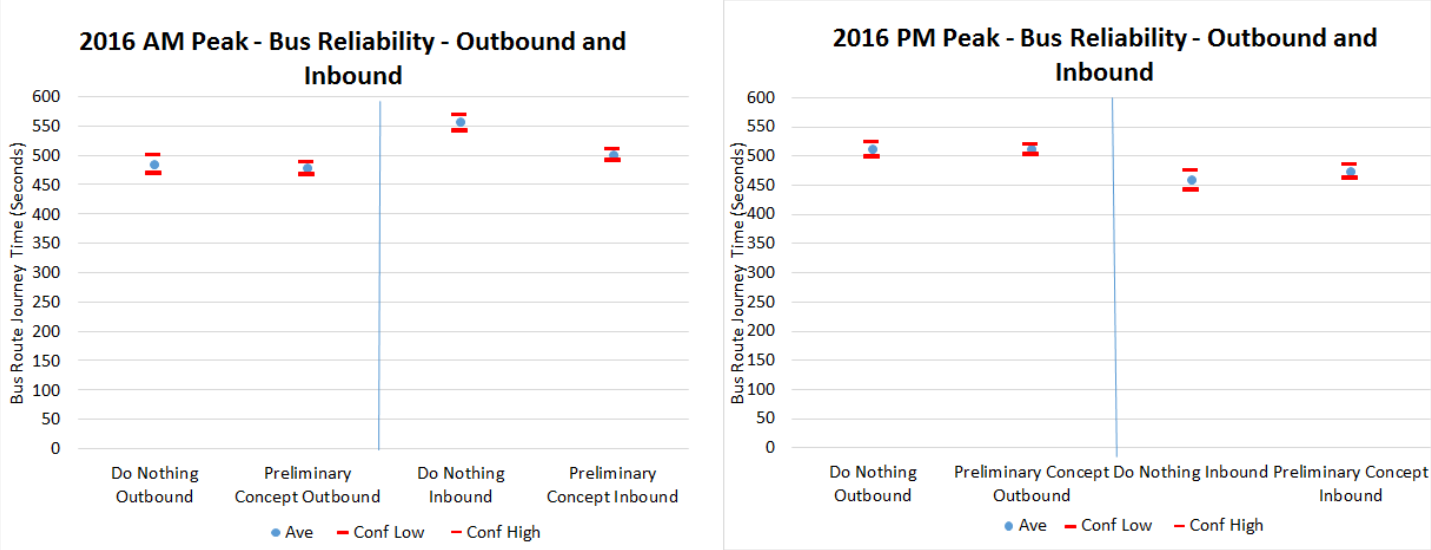
further reduce bus journey times but may lengthen journey times for other traffic. This will be considered further in the next stage of detailed design development.

Note: Bus priority measures at traffic signals can be counter-productive unless applied in a balanced way avoiding undue delay for other traffic which can, in itself, lead to delays to buses upstream of key junctions. Further detailed work on this will be undertaken as part of the detailed design work once any further final adjustments to key junction layouts have been determined and remodelled, for the purposes of a business case to ensure that signalise bus priority is beneficial when considering a range of traffic conditions.

In the results shown below, bus reliability indicators are provided for both the 2016 and the 2031 scenarios. These are calculated by taking the average journey time for the services over 10 model runs, and by comparing the journey times over the hour, to give a standard deviation and confidence interval which indicates journey time variability during the peak hours.

The graphs below show the reliability indicator for the 2016 bus services, for each scenario. The closer the low/high confidence interval is to the average, the less variability has been recorded in the bus journeys within the model and hence the more reliable the bus service journey time is. The journey time is indicated on the Y axis.

2016 'Do Nothing' vs 'Preliminary Design' bus journey time and reliability



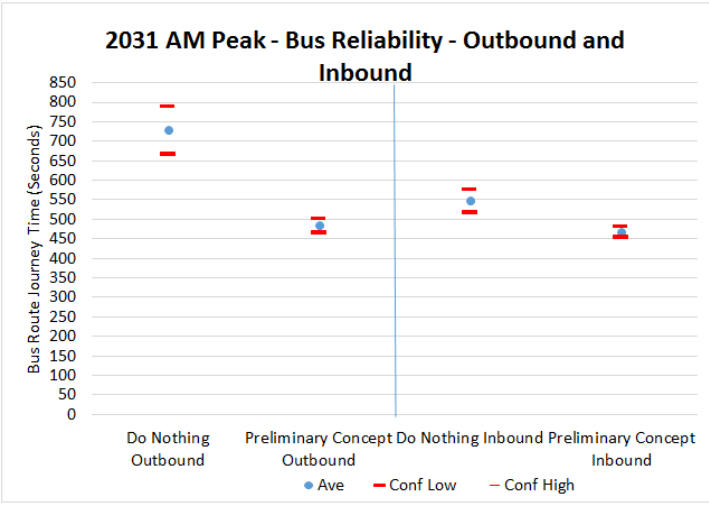
The 'Preliminary Design' provides a similar total length of bus lane to the 'Do Nothing' scenario but allocates these sections of bus lane more evenly between inbound and outbound bus travel, in comparison to the 'Do Nothing' scenario which focuses bus lanes on inbound bus travel.

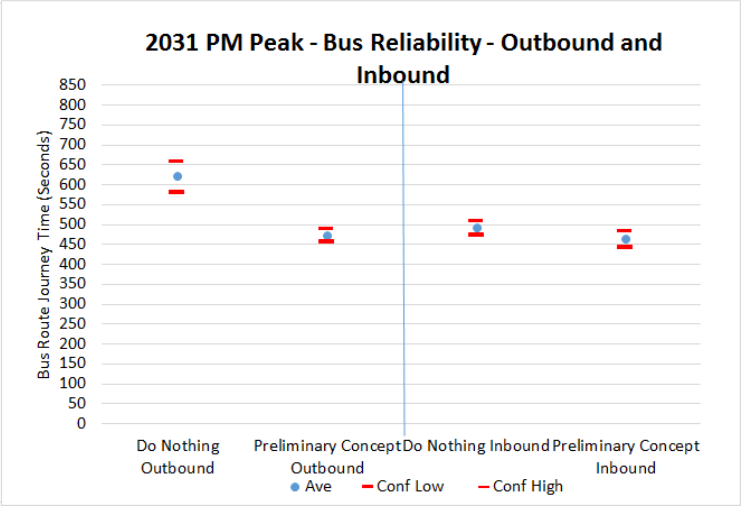
The 2016 AM 'Preliminary Design' bus reliability results shows improved bus reliability for both directions of travel, maintaining average bus journey times inbound (even with a reduction of bus lanes on this side of the road in comparison to 'Do Nothing') and improving outbound average bus journey times by 0.9 mins in comparison to 'Do Nothing' (through increasing bus lane length on this side of the road).

In the 2016 PM peak, the 'Preliminary Design' again seeks to strike a balance and shows improved bus reliability for both directions of travel while maintaining average journey times to the 'Do Nothing' scenario.

Overall the bus journey time reliability analysis shows that the reallocation of bus lane within the 'Preliminary Design' can improve the bus reliability in 2016. However the benefits of bus lane reallocation is not significant in 2016 because there is limited delay between Mitcham's Corner and Kings Hedge junction. However, this is not expected to still be the case in 2031.

2031 ‘Do Nothing’ vs ‘Preliminary Design’ bus journey time and reliability





Overall in 2031, bus journey times compared to those in 2016 will be longer, due to increased traffic flows along Milton Road in general. However, the ‘Preliminary Design’ in the 2031 AM Peak shows improved bus reliability in both directions of travel and improved average journey times over the ‘Do Nothing’ scenario, saving 4.1 minutes in average journey time for outbound bus travel and 1.3 minutes for inbound bus travel.

In the 2031 PM peak, the ’Preliminary Design’ also shows improvements in bus reliability in both directions of travel and improved average journey times over the ‘Do Nothing’ scenario, saving 2.5 minutes in average journey time for outbound bus travel and 0.6 minutes for inbound bus travel.

Overall, the model results demonstrate that the ’Preliminary Design’ should noticeably benefit the bus journey times and improve bus reliability in 2031, compared to a ‘Do Nothing’ Scenario.

MAXIMUM AVERAGE QUEUE LENGTH IN PEAK PERIODS

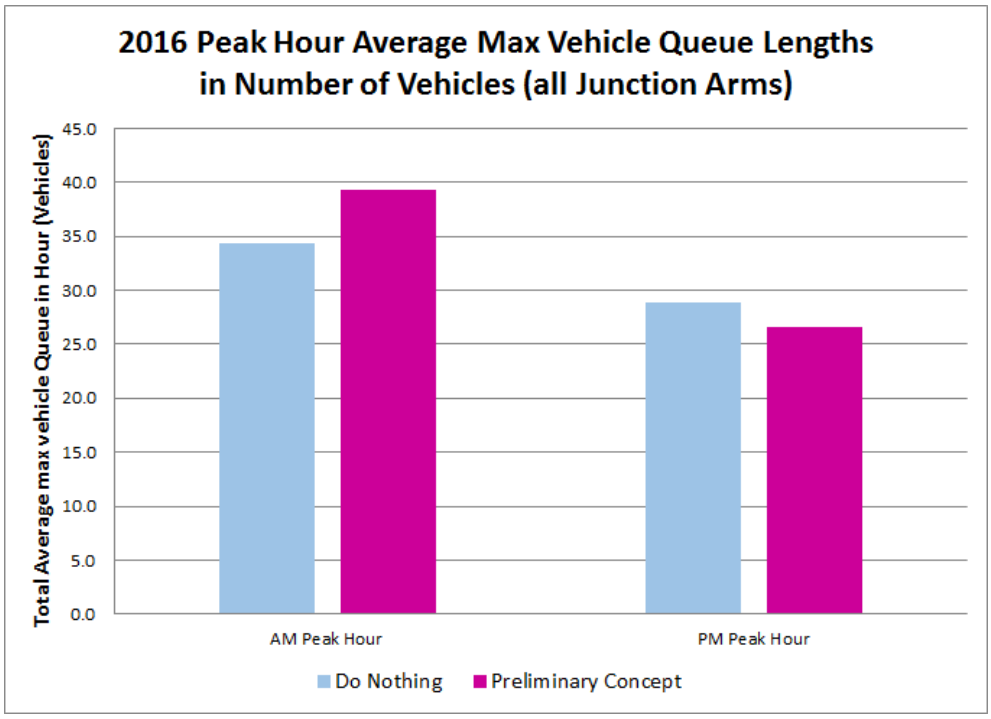
At the four key junctions on Milton Road, peak period queue length modelling has been undertaken to assess the impact of the proposed ‘Preliminary Design’ scheme, namely:

- Gilbert Road (ped/cycle provision improvements and signal optimisation),
- Elizabeth Way (signalised roundabout with ped/cycle provision),
- Arbury Road (ped/cycle provision improvements and signal optimisation), and
- King’s Hedges Road (ped/cycle provision improvements and signal optimisation)

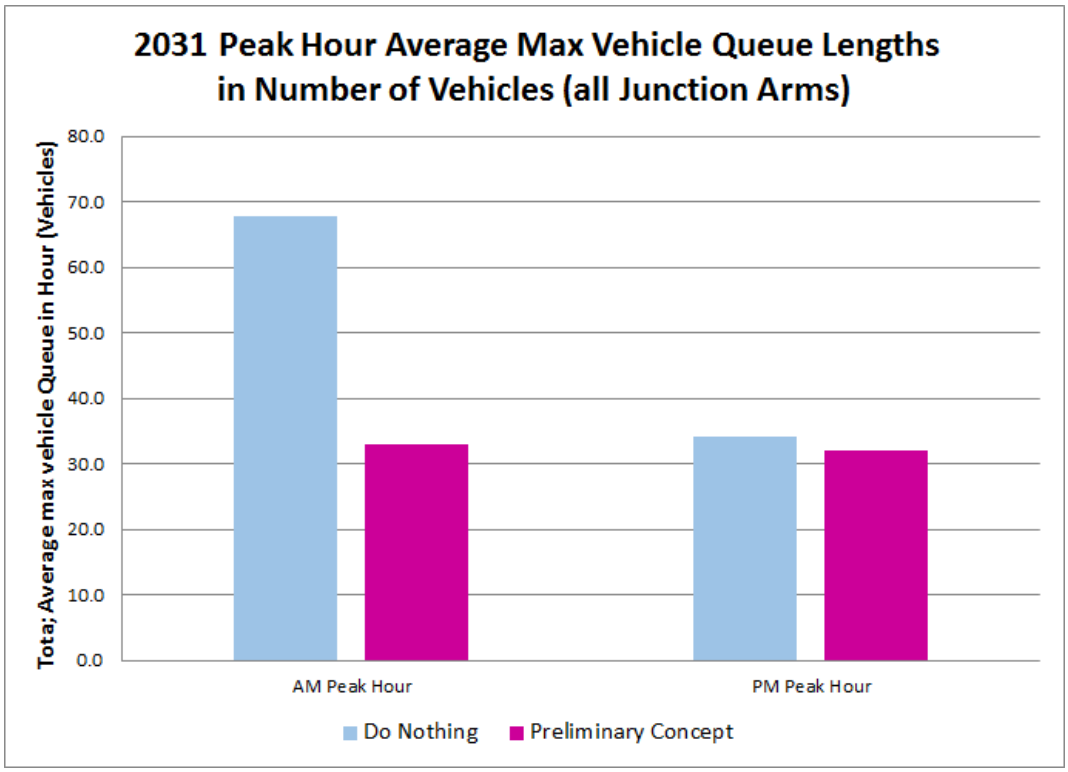
Gilbert Road Junction

The graph below compares total 2016 peak hour average max queue lengths, at the Gilbert Road junction, in the ‘Do Nothing’ and ‘Preliminary Design’ scenario.

The ‘Preliminary Design’ slightly increases the max queue length on the junction in the AM Peak of 2016, as the introduction of cycle facilities at this junction slightly increases the inbound queue along Milton Road. In generally, the total max queue length is similar in both scenarios, within the 2016 time period, indicating that the improved pedestrian and cycle facilities do not have a significant impact on the junction’s maximum queues.



The graph below compares total 2031 peak hour average max queue lengths, at the Gilbert Road junction, in the 'Do Nothing' and 'Preliminary Design' scenario.



In 2031, the expected increased traffic flow significantly increases the maximum queue length at Gilbert Road junction in the AM peak 'Do Nothing' scenario. In the AM Peak, the max queue length in the 2031 'Do Nothing' Scenario is significantly increased compared to the 2016 'Do Nothing' Scenario as a result of increases in queueing on all approaches but most notably on Gilbert Road. This occurs because of the additional delay and queuing that is experienced at Elizabeth Way roundabout, in the 'Do Nothing' Scenario, which causes blocking back to Mitcham's Corner and impacts on the ability of traffic to exit from

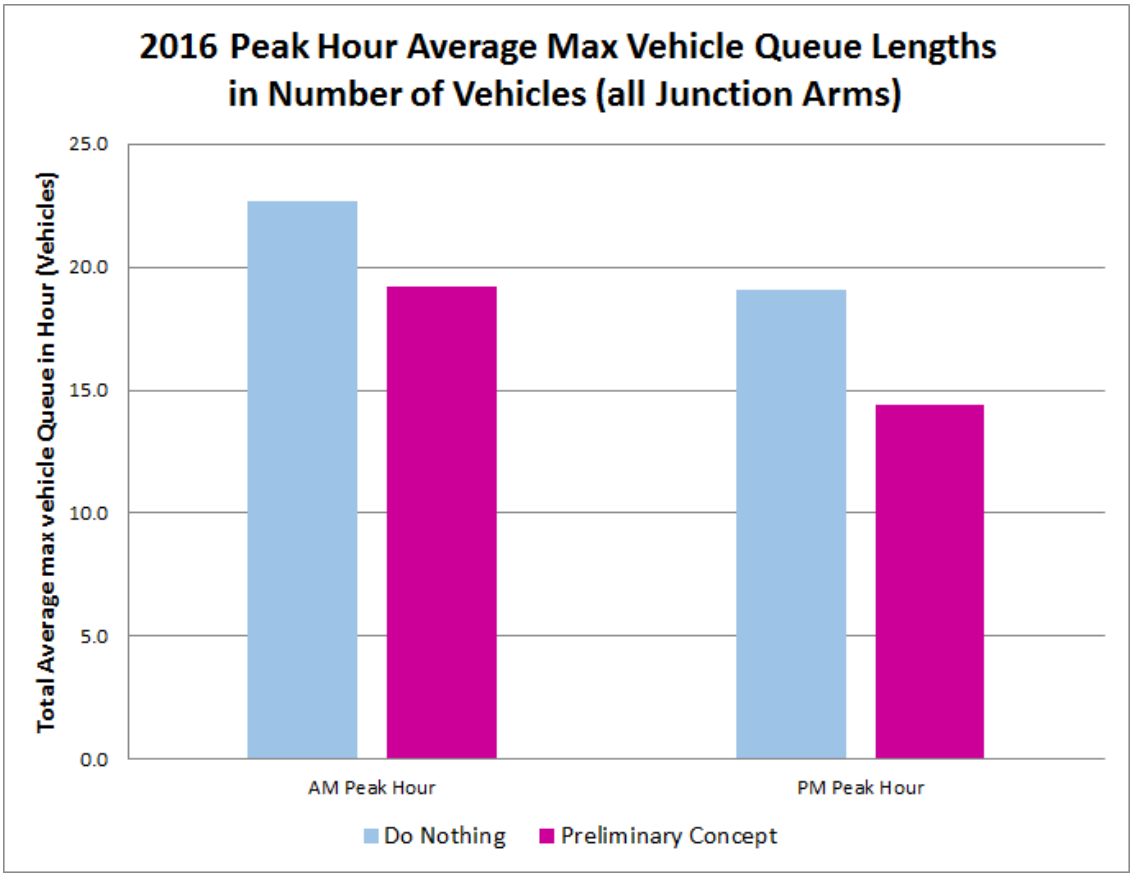
Gilbert Road. The 'Preliminary Design' significantly reduces the max queue length on the junction in the AM Peak of 2031 by signalising the Elizabeth Way roundabout and the City Access study, in combination with the Milton Road scheme, creating a shift in mode from car to public transport and cycling.

In the PM peak, the queue length is, in general, greater in the 2031 scenarios compared to the 2016 scenarios, as a result of the extra flow in 2031. The increased 2031 traffic flow does not significantly affect the performance of the junction, and as such the max queue length is similar in both the 'Do Nothing' and the 'Preliminary Design' scenarios in this PM peak period.

Overall, the results show that the 'Preliminary Design' is able to provide improved cycle facilities at this junction without adversely affecting total max queuing at the Junction and in-fact assists in significantly reducing the maximum total queue lengths in the AM Peak in 2031.

Elizabeth Way Roundabout

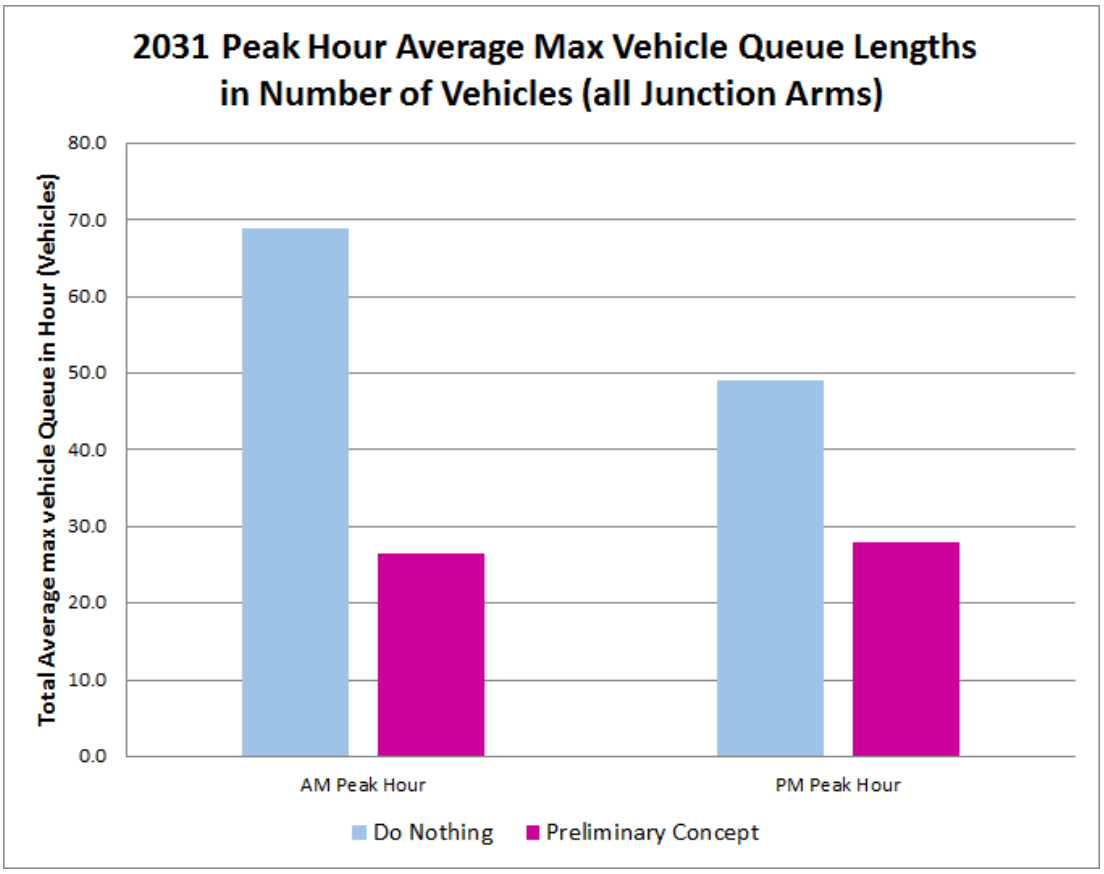
The graph below compares total 2016 peak hour average max queue lengths, at the Milton Road/Elizabeth Way roundabout, in the 'Do Nothing' and 'Preliminary Design' scenarios.



In 2016, the 'Preliminary Design' shows much improved queue lengths in comparison with the 'Do Nothing' scenario, in large part due the signalisation reducing driver hesitation and delay, increasing capacity at the junction and through better signal optimisation with the Arbury Road junction.

The total max queue length comparison shows that the introduction of the signalisation with the cycle/pedestrian facilities in the 'Preliminary Design' scenario improves the performance of the roundabout.

The graph below compares total 2031 peak hour average max queue lengths, at the Milton Road/Elizabeth Way roundabout



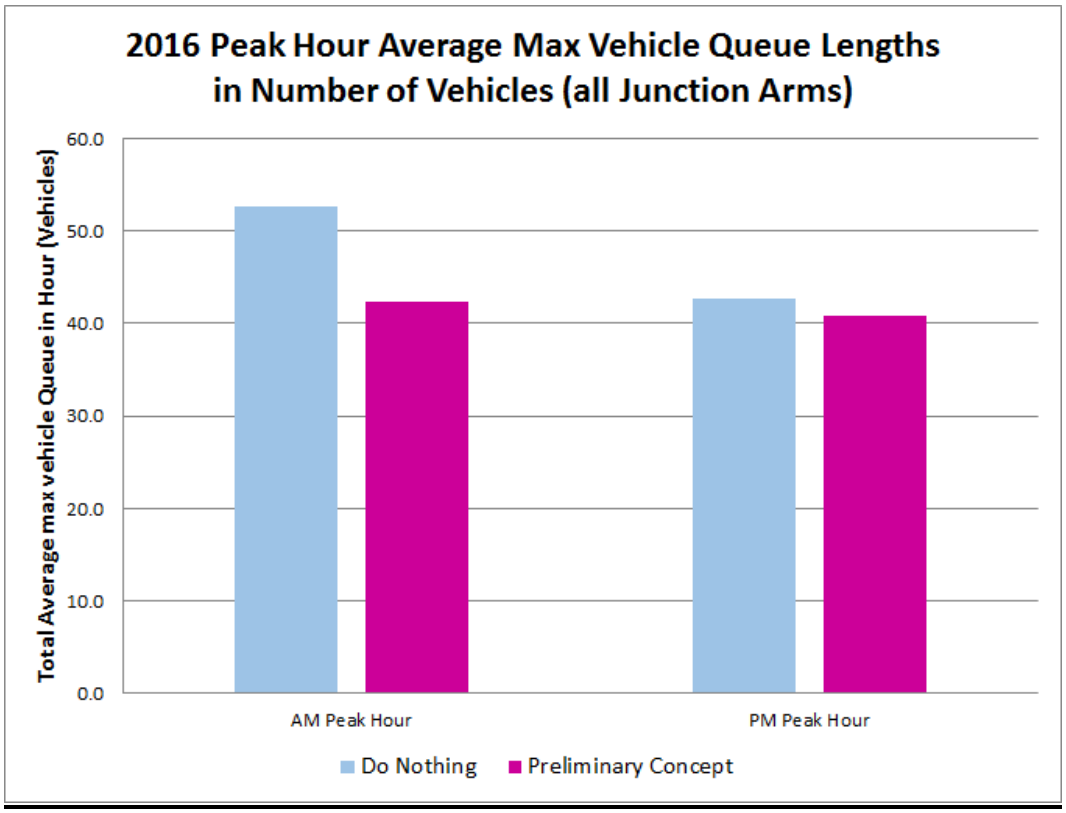
In total, the 2031 flow significantly increases the max queue length at this junction in both AM and PM peak periods. In the 'Do Nothing' Scenario, the congestion in the AM peak results in a blocking back at the Gilbert Road junction and some traffic therefore cannot be released onto Milton Road.

The max queue length in the 'Preliminary Design' scenario is significantly reduced compared to the 'Do Nothing' scenario. This is because the 'Preliminary Design' scenario accounts for the mode shift created by the City Access study and improves the cycle and public transport facilities along Milton Road, resulting in a shift from car to public transport and cycling, creating a re-distribution of vehicle traffic wanting to pass through the junction, as indicated by CSRM2.

The signalisation of the roundabout in the 'Preliminary Design' also helps to improve the performance of the roundabout and balance the queue lengths on each of the arms, avoiding further blocking back. The maximum queue length comparison demonstrates that the 'Preliminary Design' can benefit cyclists by introducing the cycle/pedestrian facilities while also improving the performance of this junction in 2031 (in comparison to 'Do Nothing') by signalising the roundabout and working with the City Access study to encourage mode shift to public transport and cycling.

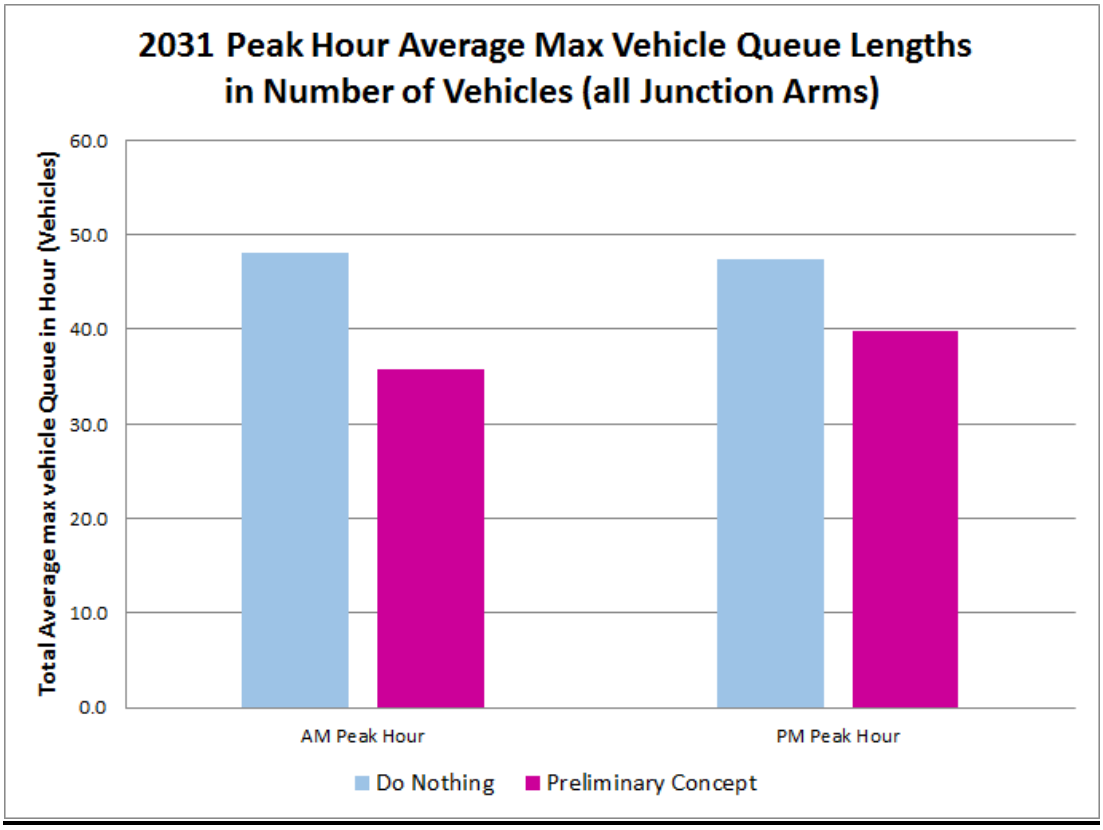
Arbury Road Junction

The graph below compares total 2016 peak hour average max queue lengths, at the Milton Road/Arbury Road junction, in the 'Do Nothing' and 'Preliminary Design' scenarios.



In 2016, the 'Preliminary Design' decreases the total max queue length at this junction due to better signal optimisation incorporated with the Elizabeth Way roundabout.

The graph below compares total 2031 peak hour average max queue lengths, at the Milton Road/Arbury Road junction, in the 'Do Nothing' and 'Preliminary Design' scenarios.



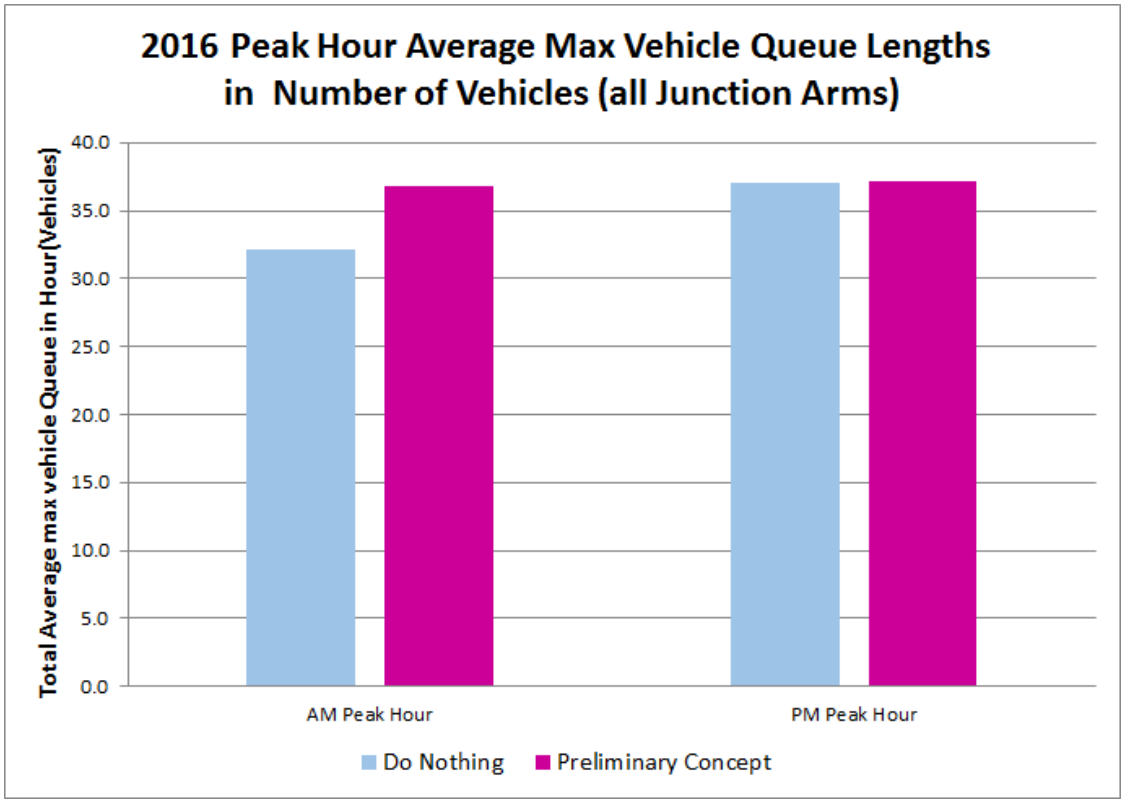
In the AM peak, the queue length is slightly less in the 2031 'Do Nothing' scenario compared to the 2016 scenario. This is because the congestion at Elizabeth Way in the AM peak 'Do Nothing' scenario, results in a blocking back and some traffic therefore cannot be released onto Milton Road.

The max queue length in the 'Preliminary Design' scenario is significantly reduced compared to the 'Do Nothing' scenario in the AM and PM peak. This is because the 'Preliminary Design' scenario accounts for the mode shift created by the City Access study and improves the cycle & public transport facilities along Milton Road, resulting in a shift from car to public transport and cycling, creating a re-distribution of vehicle traffic wanting to pass through the junction, as indicated by CSRM2. The incorporated signal optimisation with Elizabeth Way roundabout in the Preliminary Scenario also improves the performance of both junctions and helps to keep traffic moving smoothly along Milton Road.

The maximum queue length comparison demonstrates that the 'Preliminary Design' can benefit cyclists by introducing improved cycle facilities at this junction, while also improving the performance of this junction in 2031 (in comparison to 'Do Nothing') by optimising the signal timings and working with the City Access study to encourage mode shift to public transport and cycling.

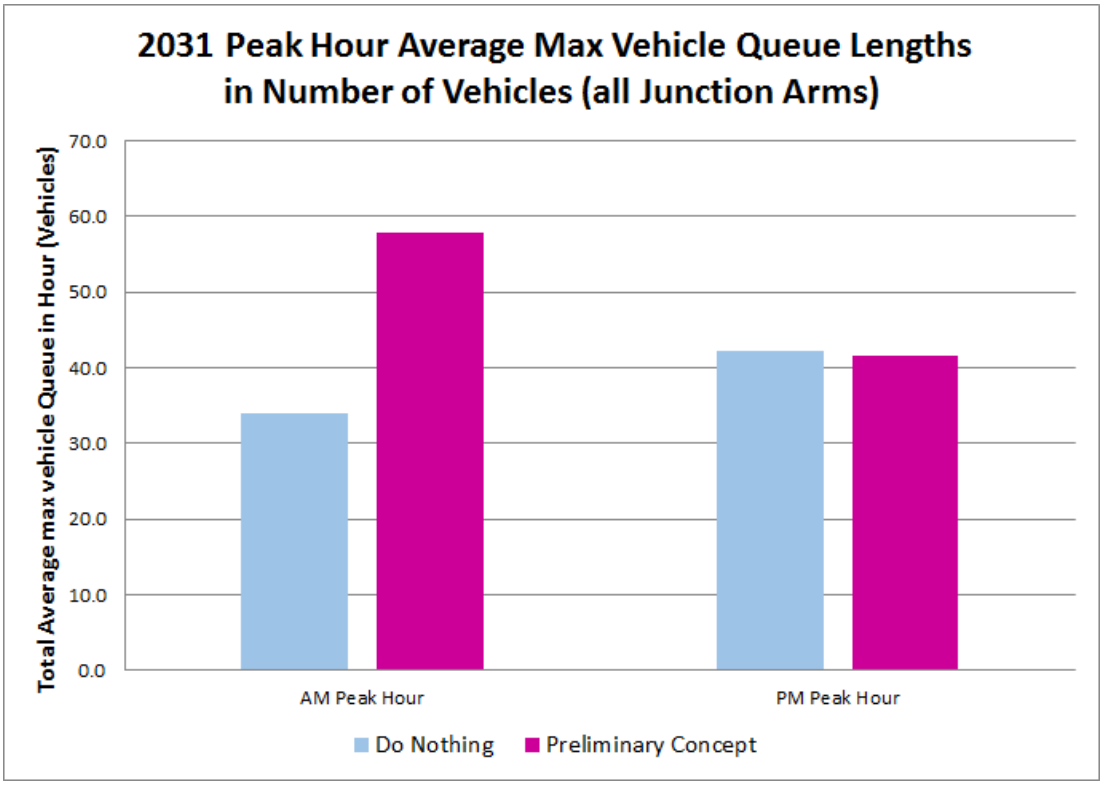
Kings Hedge/ Green End junction

The graph below compares total 2016 peak hour average max queue lengths, at the Kings Hedges/Green End junction, in the 'Do Nothing' and 'Preliminary Design' scenarios.



In 2016 PM Peak, the 'Preliminary Design' scenario has similar maximum queue lengths as the 'Do Nothing' Scenario. In the AM Peak there is a marginal total max queue length increase (due to a slight increase in queueing on Kings Hedge Road), caused by the prioritisation of the Milton Road traffic flow in the 'Preliminary Design' signal timings and due to the introduction of non-staggered crossings for pedestrian and cyclists. Overall the 'Preliminary Design' scheme does not have a significant impact on max total queueing at this junction in 2016.

The graph below compares total 2031 peak hour average max queue lengths, at the Kings Hedges/Green End junction, in the ‘Do Nothing’ and ‘Preliminary Design’ scenarios.



In 2031, the expected increased traffic flow significantly increases the maximum queue length at Kings Hedge junction in most of the scenarios. However, in the AM peak, the ‘Do Nothing' scenario has less queue compared to the 2016 ‘Do Nothing’ scenario due to the congestion at Elizabeth Way, which results in a blocking back and therefore stops some traffic being released onto Milton Road.

In the AM peak, there is a total max queue length increase (due to an increase in queueing on Kings Hedge Road and Green End Road), caused by the prioritisation of the Milton Road traffic flow in the ‘Preliminary Design’ signal timings and introduction of non-staggered crossings for pedestrian and cyclists. The ‘Preliminary Design’ scenario seeks to account and provide for the mode shift and a re-distribution of vehicle traffic at this junction, created by the City Access study and improvements to the cycle facilities along Milton Road. This results in more vehicle traffic distributed on Kings Hedge Road and Green End Road, as indicated by CSRM2.

In the PM peak, the increased 2031 traffic flow does not significantly affect the performance of the junction, and as such the max queue length is similar in both the ‘Do Nothing’ and the ‘Preliminary Design’ scenarios in this PM peak period.

In summary, the ‘Preliminary Design’ scheme does not adversely affect the performance of the junction in 2031 which improving facilities at the junction for cycling and walking.

CONCLUSION OF MODELLING RESULTS

In the 2016 scenario, the modelling work demonstrates that the ‘Preliminary Design’, compared to ‘Do Nothing’ manages to deliver improved cycle and pedestrian infrastructure facilities along Milton Road, and slightly improved bus journey times and bus reliability, without significantly increasing the delays/queuing of general vehicular traffic.

It should be noted that due to the expected housing and employment growth around Cambridge, the CSRM2 modelling predicts traffic flows on Milton Road will be greater in 2031 than 2016.

In light of the above, within the 2031 Scenario, the modelling demonstrates that that in combination with the City Access proposals (and assumed resultant mode shift), the ‘Preliminary Design’, when compared to ‘Do Nothing’ in 2031, will improve overall journey times, improve bus journey times and reliability and, in general, reduce total average maximum queuing at each of the key junctions along Milton Road.