Performance Report – Level Crossing Study

MG0172 – Level Crossing Study

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NETWORK RAIL

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2	DRAFT	NR comments have been addressed	Network Rail
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Issue control

Issue	Date	Author	Contributors	Approved	Date
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5	24/11/2022	NC	NC	DB	24/11/2022

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APPENDICES

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1 INTRODUCTION

1.1 Introduction

1.1.1 Modelling Group, in partnership with Tracsis Traffic Data Ltd have been appointed by Network Rail to analyse traffic and congestion implications of upgrading 7 level crossings to MCB-OD2 / MCB-CCTV type operation, with a view to understanding the impacts the upgrades will have on the local communities and the wider transport network.

1.1.2 The purpose of this report is to assess the likely transport implications and issues which may arise from the conversion described above.

1.2 Study extents

1.2.1 The modelling study involves the assessment of 7 level crossings within Cambridgeshire and Norfolk. These include:

- Milton Fen, Fen Road, CB24 6AF. Ordinance Survey grid reference TL 484 623.
- Waterbeach, Clayhithe Road, CB25 9HS. Ordinance Survey grid reference TL 500 649
- Dimmocks Cote, Newmarket Road, CB6 3LJ. Ordinance Survey grid reference TL 526 730
- Croxton, A1075, IP24 2RQ. Ordinance Survey grid reference TL 902 867
- Six Mile Bottom, London Road, CB8 0UJ, Ordinance Survey grid reference TL 576 567
- Dullingham, Station Road, CB8 9UT. Ordinance Survey grid reference TL 618 585
- Meldreth, Meldreth Road, SG8 6XA. Ordinance Survey grid reference TL 388 477

1.3 Overview of the methodology

1.3.1 A methodology report titled "**210603 Level Crossing Study - Modelling Methodology.pdf**" has been produced to detail the methodology, which can be summarised by the following topics:

- Study extents
- Traffic survey requirements
- Explanation of the calibration and validation of the VISSIM model

1.3.2 A Local Model Validation report titled "**210730 Level Crossing Study - LMVR v1.pdf**" has been developed which provides the requisite detail on the model development and its compliance with microsimulation guidelines.

1.3.3 For this study, the following scenarios have been tested:

- **Validated base model** – Existing flows and existing barrier down time.
- **Do-Nothing scenario** – Future year flows based on opening year (traffic future demand) and existing barrier down time.
- **Do-something scenario** – Future year flows based on opening year (traffic future demand) and proposed increased barrier down time.

Scenario	Network Changes	Traffic Demand
Validated model	None	2021
Do-Nothing	None	Opening Yrs
Do-Something	Extended Barrier Down Time	Opening Yrs

TABLE 1.1: SCENARIO DESCRIPTIONS

1.3.4 The opening year is defined as the year when changes to the operation of the level crossing take place.

1.4 Future year development

Traffic growth

1.4.1 The following future years are proposed for the upgraded level crossings, in line with Network Rail's anticipated commissioning dates:

- Milton Fen – 2023 (prospective start May 2023)
- Waterbeach – 2023 (prospective start May 2023)
- Dimmocks Cote – 2023 (prospective start May 2023)
- Croxton – 2024 (prospective start April 2024)
- Six Mile Bottom – 2024 (prospective start December 2024)
- Dullingham – 2024 (prospective start December 2024)
- Meldreth – 2023 (prospective start December 2023)

1.4.2 To develop these future year flows, growth factors have been calculated using Tempro 7.2b which is the industry standard software to calculate vehicle traffic increased, as detailed in Table 1.2.

Level Crossing	MSOA bdry	Opening Years	AM Peak	PM Peak
Milton Fen	E02003781	2023	1.0176	1.0186
Waterbeach	E02003778	2023	1.0158	1.0168
Dimmocks Cote	E02003736	2023	1.0169	1.0183
Croxton	E02005516	2024	1.0332	1.0342
Six Mile Bottom	E02003785	2024	1.0307	1.0323
Dullingham	E02006825	2024	1.0308	1.0339
Meldreth	E02003792	2023	1.0171	1.0187

TABLE 1.2: GROWTH FACTOR TABLE

1.4.3 These growth factors have been applied to each individual peak period modelled.

1.5 Readjustment factor – COVID-19 related

1.5.1 Due to the base traffic flows being collected in 2021, when the COVID-19 pandemic was still in effect, a readjustment factor has been applied to these flows to account for any reduction in traffic as a result of the pandemic.

Level Crossing	2021 Total Weekday Daily Flow	Historical Data	Historical total Weekday Daily Flow	Readj. Factor
Milton Fen	221	28/04/2018 to 06/05/2018	182	0.82
Waterbeach	8,081	02/06/2018 to 10/06/2018	5,802	0.72
Dimmocks Cote	4,350			
Croxton	6,043	05/09/2016 to 18/09/2016	6,383	1.06
Six Mile Bottom	10,778	-	-	
Dullingham	674	-	-	
Meldreth	1,329	-	-	
			COVID 19 Readj. Factor	1.06

TABLE 1.3: READJUSTEMENT FACTOR TABLE

1.5.2 Traffic data captured on the 6th of July 2021 has been compared against historical data available for Milton Fen, Waterbeach and Croxton locations.

1.5.3 A large increase in traffic was observed at the Waterbeach level crossing due to roadworks present on the A10 Ely Road in the southbound direction. A similar trend was also observed on Milton Fen and as a result, these two sites have been removed from the calculation of the average.

1.5.4 This readjustment factor has not been applied to Milton Fen because the 2021 figures were higher than the 2018 figures (and therefore already represents a worst-case scenario).

1.5.5 A readjustment factor of 1.06 has been applied to Dimmocks Cote, Croxton, Six Mile Bottom, Dullingham and Meldreth to take account of the impact that the COVID-19 pandemic had on local traffic. It should be noted that whilst we have no evidence that the traffic has reduced in these locations, we have assumed that it has for robustness and a worst-case scenario test.

1.5.6 The methodology summarised in Figure 1.1 has been applied to each of the level crossing models.

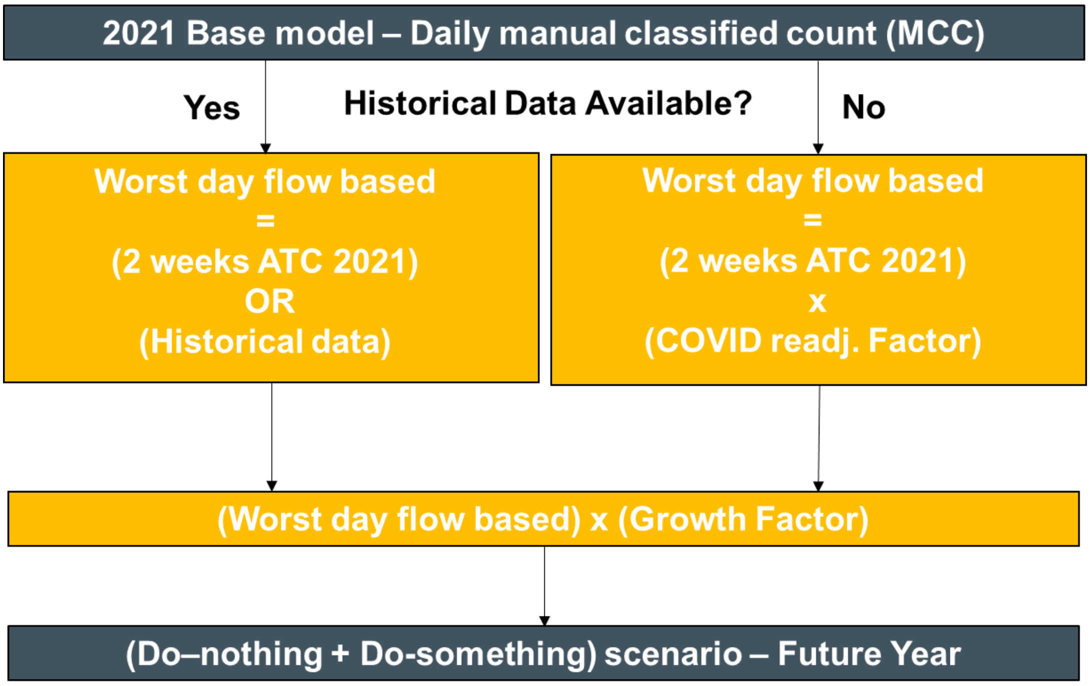

FIGURE 1.1: TRAFFIC FLOW METHODOLOGY

1.6 Train frequency growth

1.6.1 A review of the train demand was carried out to assess the impact of the COVID-19 pandemic on each level crossing. The results of this analysis are presented in Table 1.4 and Table 1.5.

Level Crossing	COVID readjustment (train number)
Milton Fen	1
Waterbeach	2
Dimmocks Cote	4
Croxton	0
Six Mile Bottom	1
Dullingham	1
Meldreth	2

TABLE 1.4: ADDITIONAL TRAIN NUMBERS – AM PEAK

Level Crossing	COVID readjustment (train number)
Milton Fen	0
Waterbeach	0
Dimmocks Cote	0
Croxton	2
Six Mile Bottom	1
Dullingham	1
Meldreth	1

TABLE 1.5: ADDITIONAL TRAIN NUMBERS – PM PEAK

1.6.2 These additional trains have been added to the existing train demand to ensure a suitable number of trains were modelled for the study.

1.7 Do-Something Network changes

1.7.1 The only physical change introduced to the Do-Something network is an extended barrier down time which is the result of the changes to the railway system, when introducing the safety improvements.

1.7.2 To inform the proposed barrier down times for the upgraded level crossings, Network Rail has provided Modelling Group with the following data:

- A set of absolute minimum barrier closure times for each crossing, with the exception of Meldreth where the times are proposed to be in line with the Shepreth crossing.
- Barrier down times for the Hinxton level crossing from 11th December 2017, which has been upgraded to MCB-OD control.

1.7.3 To develop suitable barrier down times for each level crossing, the Hinxton level crossing data has been analysed and plotted to show the variation across the day, as well as the median time from all of the samples. This is shown in Figure 1.2.

FIGURE 1.2: HINXTON LEVEL CROSSING – BARRIER DOWN TIMES

1.7.4 From the Hinxton level crossing data, the absolute minimum barrier down time was 84 seconds (01:24), whilst the median barrier down time was 139 seconds (2:19). The strike-in time of Hinxton is not consistent hence using the median rather than the average value provides a fair estimate of the average barrier down time. The difference between the absolute minimum down time and the average was therefore 55 seconds (00:55).

1.7.5 To calculate the average barrier times for each of the level crossings, the absolute minimum times and the difference between the minimum and median times from the Hinxton crossing have been used. The resulting barrier down times proposed to be used for each of the upgraded level crossings are shown in Table 1.6.

No.	Level Crossing	Min Barrier Down Time (s)	Min Barrier Down Time + Hinxton Difference (s)	Min Barrier Down Time + Hinxton Difference (mm:ss)
1	Milton Fen	150	205	03:15
2	Waterbeach	125	180	03:00
3	Dimmocks Cote	149	204	03:14
4	Croxton	119	174	02:54
5	Six Mile Bottom	140	140**	02:20**
6	Dullingham	113	168	02:48
7	Meldreth		169*	02:49

TABLE 1.6: CALCULATED BARRIER DOWN TIMES FOR UPGRADED LEVEL CROSSINGS

**For the Meldreth level crossing, as no other data is available, the barrier down time has been based on the average time from all of the other level crossings.*

***For Six Mile Bottom, the Hinxton difference has not been applied due to the very consistent strike-in time, as specified by Network Rail.*

1.7.6 Various parameters have been extracted to compare the performance of the various scenarios tested. These performance parameters include:

No.	Parameter	Unit	Description
1a	Network Performance – Average Vehicle Delay	Seconds per vehicle	The average delay experienced by each vehicle within the modelled network.
1b	Network Performance – Average Speed	Miles per hour	The average speed of vehicles within the modelled network.
1c	Network Performance – Latent Demand	No. of vehicles	The number of vehicles that could not enter the network during the simulation period (due to queuing back to the start of links, for example).
2	Journey Times	Seconds	The average time taken for vehicles to travel along a defined section within the network.
3	Queue Lengths	Metres	The average queue length captured on the approach to each level crossing.

TABLE 1.7: MODEL PARAMETER DEFINITIONS

2 MILTON FEN VISSIM MODEL

2.1 Traffic Data

2.1.1 The barrier down time of the Do-Nothing and Do-something scenario has been updated in line with Table 1.4 and Table 1.5.

2.1.2 Figure 2.1 and Figure 2.2 show the barrier down time across the peak periods. A longer barrier down time in line with Table 1.6 is observed in the Do-Something scenario. It was observed that this longer barrier down time allows multiple trains to pass through at once, whilst the shorter barrier down time only allows one train to pass through at a time.

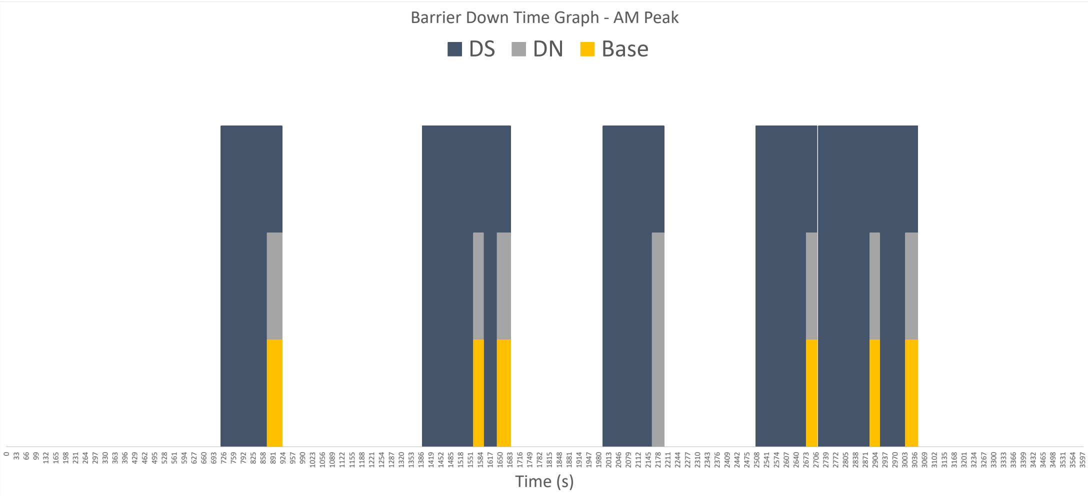

FIGURE 2.1: BARRIER DOWN TIMES – MILTON FEN – AM

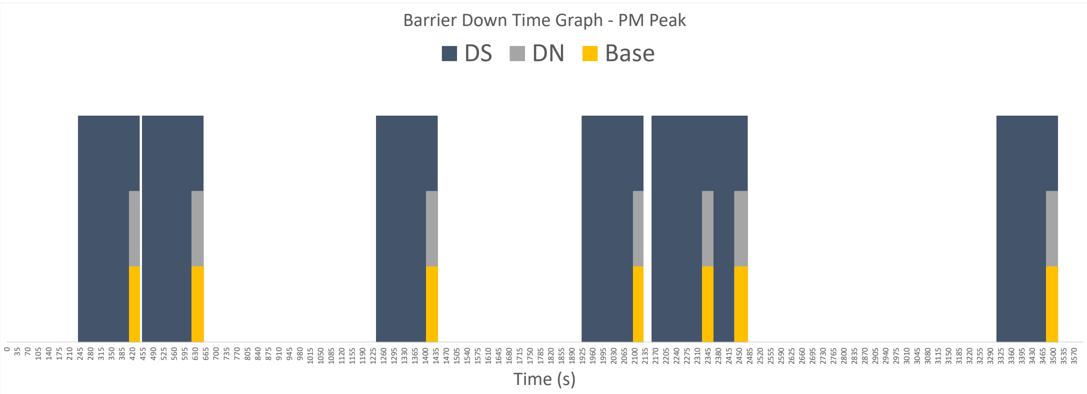

FIGURE 2.2: BARRIER DOWN TIMES – MILTON FEN – PM

2.1.3 The network performance results in Table 1.7 show that the average delay will not exceed 1 minute and that there is no latent demand. This implies that the upgraded crossing will not have a significant impact on the network.

	Average Delay (s)			Average Speed (mph)			Latent Demand	
Peak	**DN**	**DS**	**Diff.**	**DN**	**DS**	**Diff.**	**DN**	**DS**
AM	2.2	19.8	18.7	34.4	24.8	-9.6	0	0
PM	2.6	17.1	31.2	28.7	21.4	-7.4	0	0

TABLE 2.1: NETWORK PERFORMANCE – MILTON FEN

2.1.4 The proposed upgraded level crossing will increase the journey times as a result of the longer barrier down time, however this is by less than 1 minute on average and is not considered significant.

FIGURE 2.3: JOURNEY TIME ROUTE – MILTON FEN

Journey time (s)				
Direction	**Peak**	**DN**	**DS**	**Diff.**
EB	**AM**	70	99	30
EB	**PM**	178	184	5
WB	**AM**	77	123	46
WB	**PM**	78	105	27

TABLE 2.2: JOURNEY TIMES – MILTON FEN

2.1.5 A slight increase in the queue lengths has been observed in the eastbound and westbound directions with the upgraded level crossing, however it is not an issue because the traffic flow is very low at this crossing and the queue lengths equate to one vehicle length at most.

Queue Length (m)				
	AM		PM	
Direction	Max	Avg	Max	Avg
DN - Eastbound	1	1	1	0
DS - Eastbound	6	2	7	3
Diff.	5	1	6	2
DN - Westbound	1	0	3	1
DS - Westbound	3	1	4	2
Diff.	2	1	1	0

TABLE 2.3: QUEUE LENGTHS – MILTON FEN

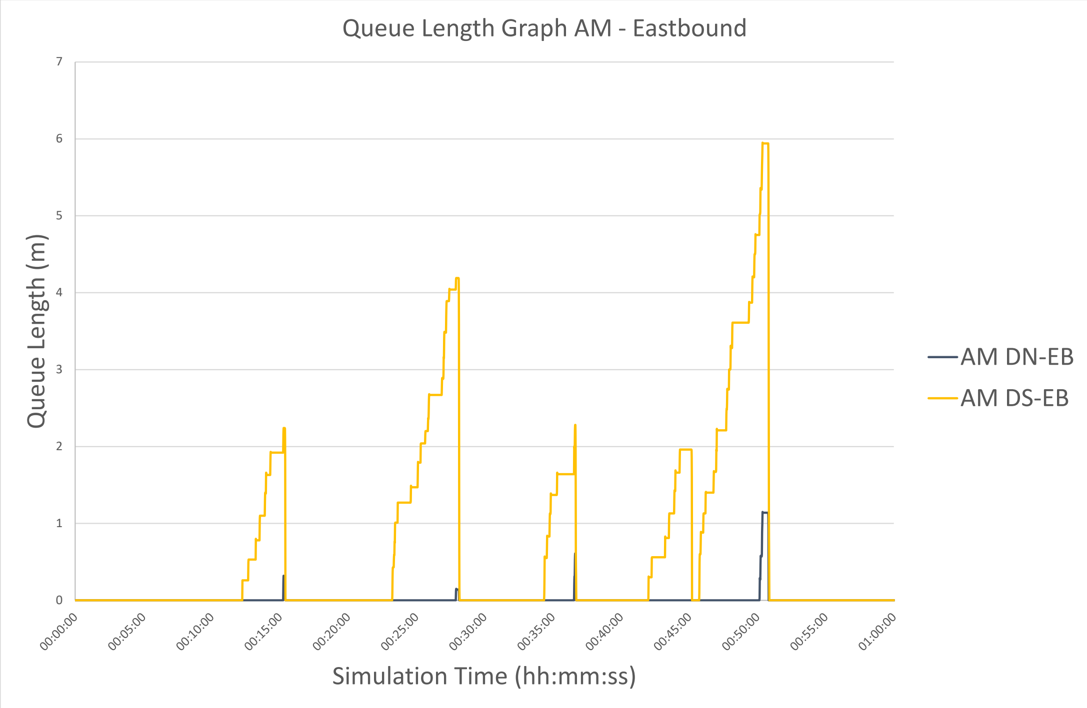

FIGURE 2.4: QUEUES – EASTBOUND - AM PEAK – MILTON FEN

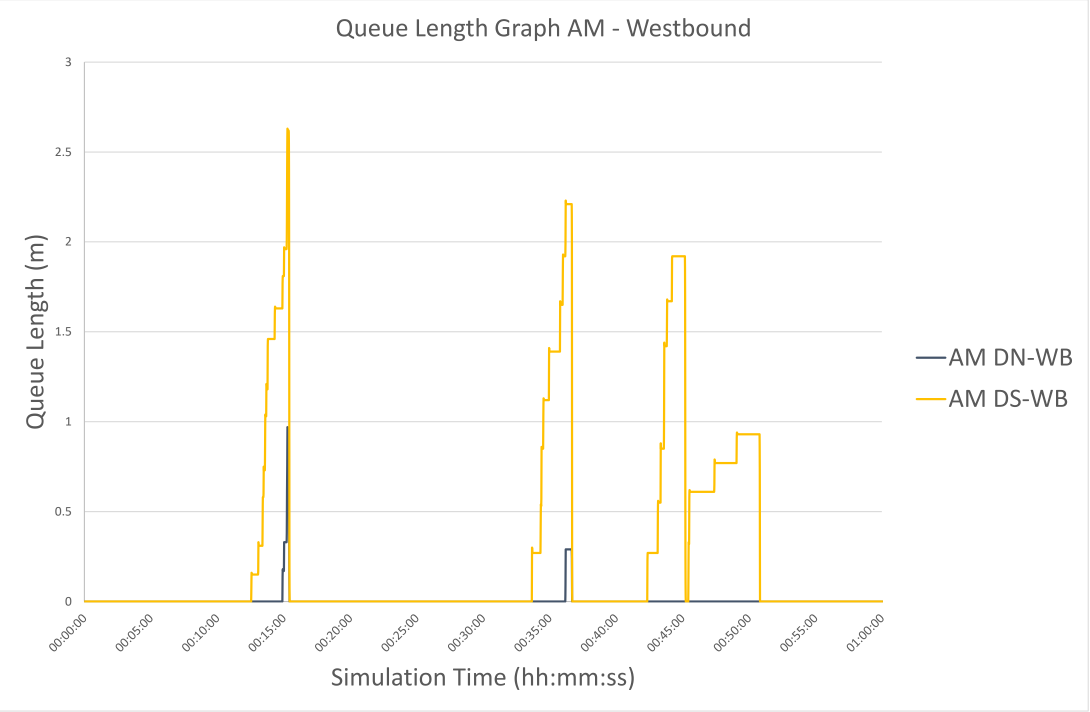

FIGURE 2.5: QUEUES – WESTBOUND - AM PEAK – MILTON FEN

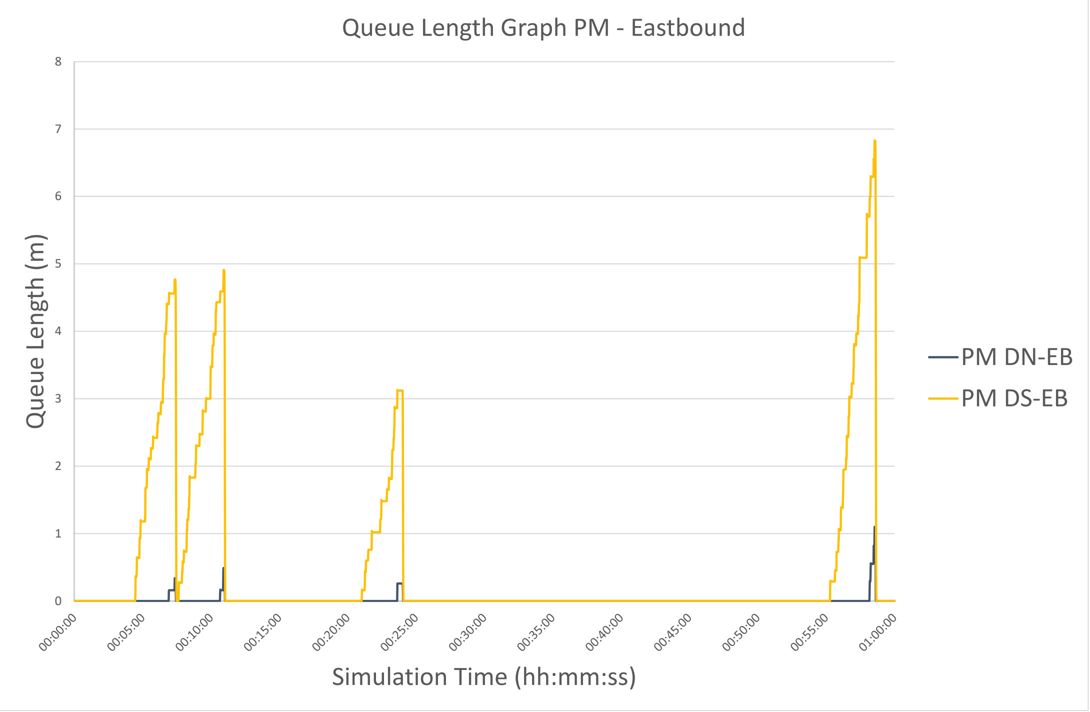

FIGURE 2.6: QUEUES – EASTBOUND - PM PEAK – MILTON FEN

FIGURE 2.7: QUEUES – WESTBOUND - PM PEAK – MILTON FEN

2.2 Conclusion

2.2.1 The analysis above show that the upgraded Milton Fen level crossing will have a minimal impact on the performance of the network and will not cause any significant issues.

3 WATERBEACH VISSIM MODEL

3.1 Traffic Data

3.1.1 The barrier down time of the Do-Nothing and Do-something scenario has been updated in line with Table 1.4 and Table 1.5.

3.1.2 Figure 3.1 and Figure 3.2 show the barrier down time across the peak periods. A longer barrier down time in line with Table 1.6 is observed in the Do-Something. It was observed that this longer barrier down time allows multiple trains to pass through at once, whilst the shorter barrier down time only allows one train to pass through at a time.

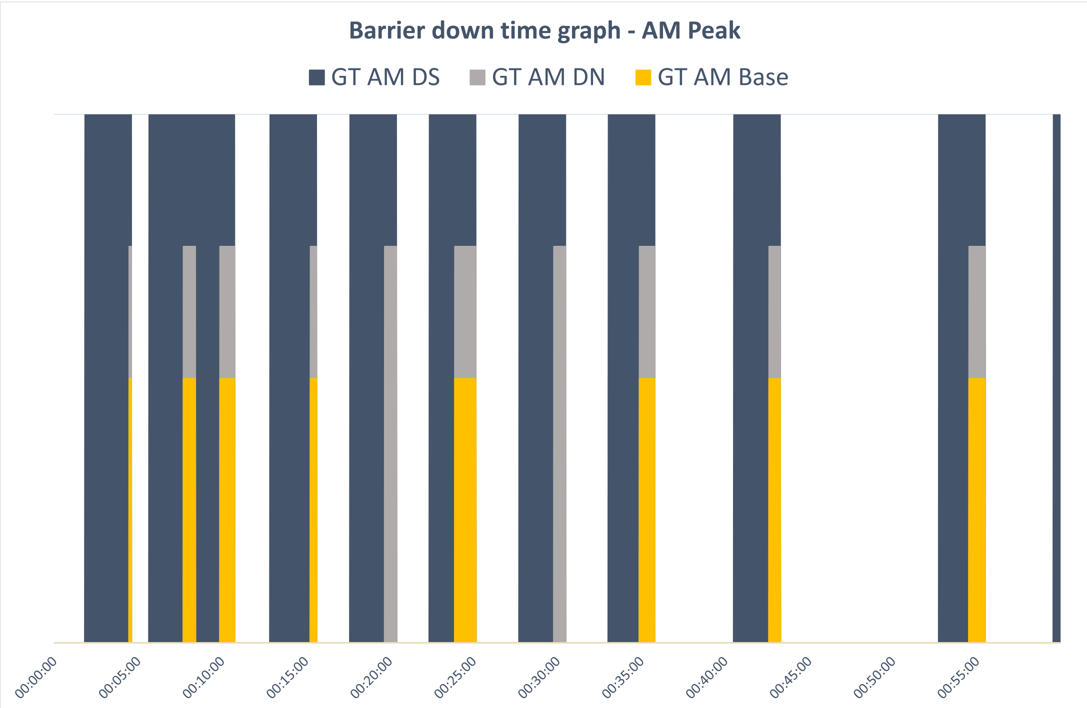

FIGURE 3.1: BARRIER DOWN TIMES – WATERBEACH – AM

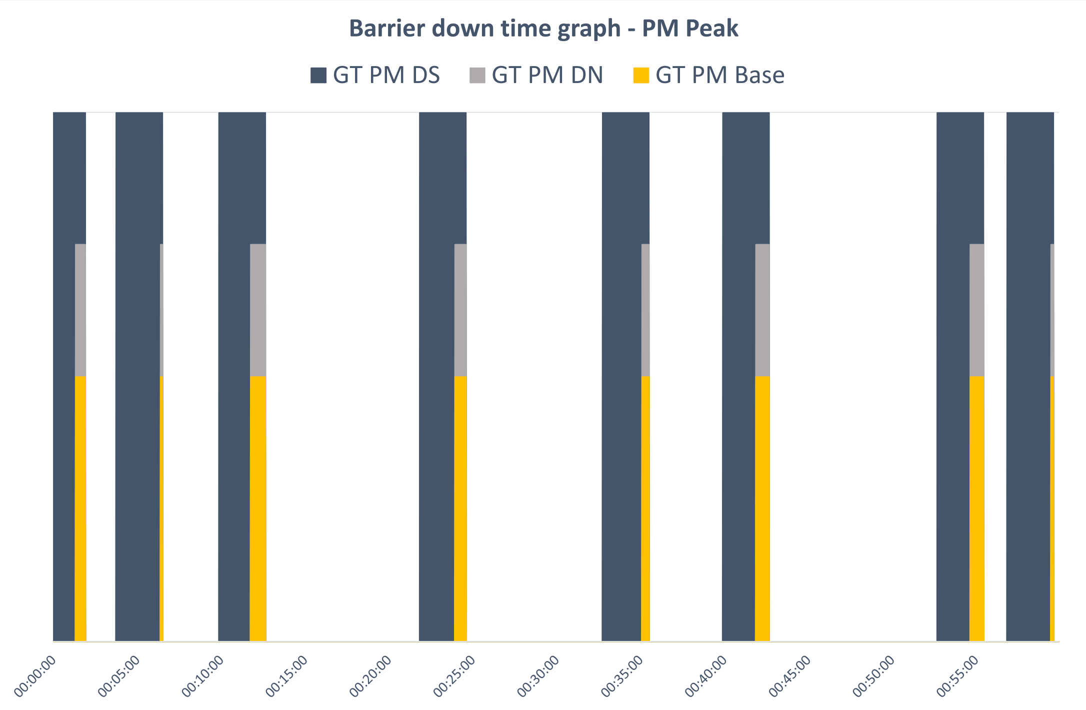

FIGURE 3.2: BARRIER DOWN TIMES – WATERBEACH – PM

3.1.3 Census data have been captured and compared for year 2018, 2021 and 2022 at the Waterbeach level crossing as shown in Figure 3.1and Figure 3.2.

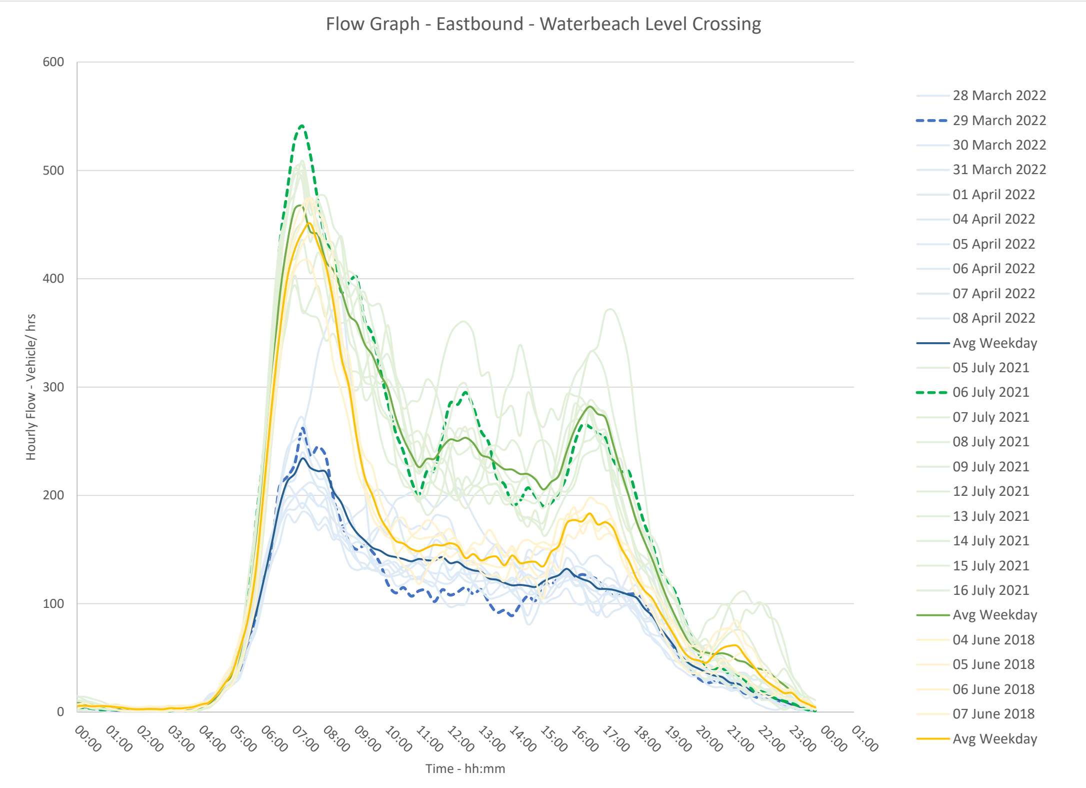

FIGURE 3.3: EASTBOUND HOURLY TRAFFIC FLOW

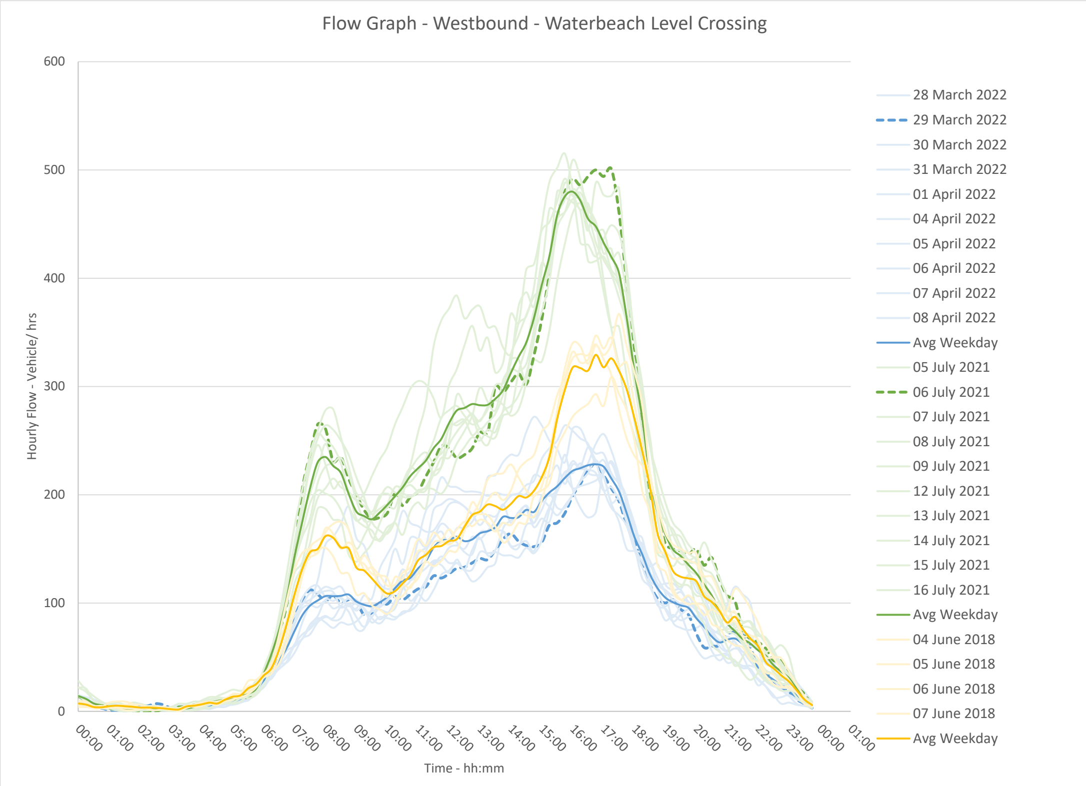

FIGURE 3.4: WESTBOUND HOURLY TRAFFIC FLOW

3.1.4 The data presented includes weekday hourly flow data only and weekend has been excluded. The data shows that the traffic pattern is tidal across the day with a high number of vehicles travelling eastbound during the morning peak and westbound during the afternoon peak period.

3.1.5 The 2021 data shows high traffic levels in both directions due to road works on the A10 near the A14 interchange. Congestion around the interchange has encouraged drivers to divert through Waterbeach, which consequently made the data invalid because it is not representative of a typical weekday. As a result, this data has not been used to assess the scheme.

3.1.6 Data was also captured outside COVID-19 restrictions in 2018 and 2022. It shows that the data captured in 2022 is lower than in 2018 in both peak periods. Discussions have taken place with Cambridge County Council (CCC) regarding the validity of the 2022 and they are currently reviewing traffic level across the county. CCC have observed instability in the dataset post COVID-19, however traffic levels were periodically back to normal level. It was agreed to proceed with a sensitivity test to assess the impact of the 2018 data on the network as a wort-case situation.

3.1.7 Three scenarios have been tested as part of this assessment and consists of the following:

- **DN** - 2023 Do-Nothing Scenario
- **DS 1** - 2023 Do-Something Scenario based on the 2022 Data and with the Train Station Relocation
- **DS 2** - Sensitivity test **-** 2023 Do-Something Scenario based on the 2018 Data and with the Train Station Relocation

3.1.8 A full planning application was granted for the relocation of the Waterbeach Train Station. The relocated station planning application was designed to Network Rail's GRIP 3 stage. The station relocation is linked to the outline planning application for Waterbeach New Town (as enabling works), which then went through the planning process as a separate application and received outline approval in January 2021.

3.1.9 The scheme includes the relocation of the Train Station as well as its car park as shown in Figure 3.5. It is estimated that the relocation of the car park will reduce the number of trips across the level crossing and will consequently improve its safety.

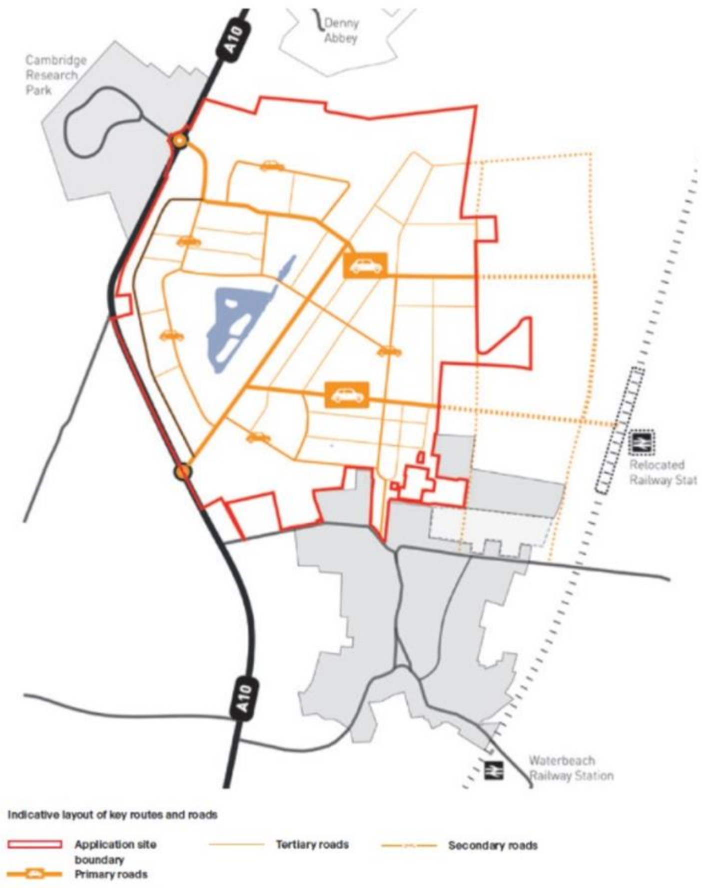

FIGURE 3.5: WATERBEACH TRAIN STATION RELOCATION

3.1.10 The network performance table shows that the average delay will not exceed 1 minute and that there is no latent demand. It also show a small decrease in average speed.

Average Delay (s)					
	DN	DS1	DS2	Diff. DS1 - DN	Diff. DS2 - DN
AM	18.7	25.8	39.6	7.2	21.0
PM	18.1	22.7	25.2	4.6	7.2

TABLE 3.1: NETWORK PERFORMANCE – AVERAGE DELAY

	Average Speed (mph)				
	DN	DS1	DS2	Diff. DS1 - DN	Diff. DS2 - DN
AM	29.7	27.9	24.8	-1.8	-4.8
PM	30.7	29.4	28.6	-1.3	-2.1

TABLE 3.2: NETWORK PERFORMANCE – AVERAGE SPEED (MPH)

Latent Demand (Vehicle)					
	DN	DS1	DS2	Diff. DS1 - DN	Diff. DS2 - DN
AM	0	0	0	0.0	0.0
PM	0	0	0	0.0	-0.1

TABLE 3.3: NETWORK PERFORMANCE – LATENT DEMAND

3.1.11 The proposed upgraded level crossing will increase the journey times as a result of the longer barrier down time, however this is by less than 1 minute on average and is not considered significant.

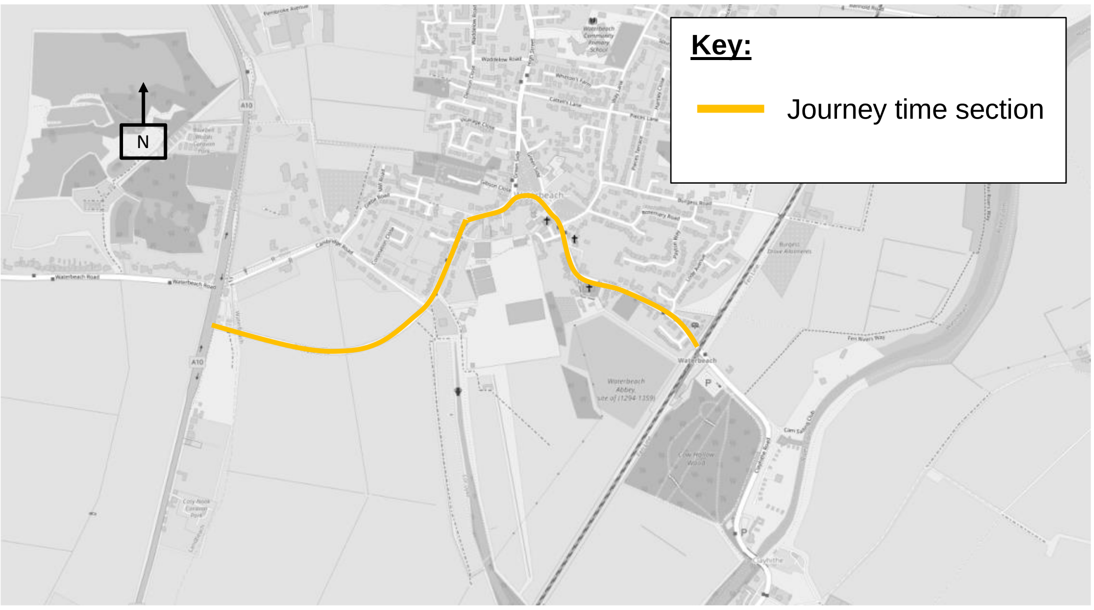

FIGURE 3.6: JOURNEY TIME ROUTE

Journey time (s)						
Direction	Peak	DN	DS1	DS2	Diff. DS1 - DN	Diff. DS2 - DN
EB	AM	127	180	180	53	53
EB	PM	131	169	175	37	44
WB	AM	132	136	136	4	4
WB	PM	132	136	190	4	58

TABLE 3.4: JOURNEY TIME TABLE

3.1.12 The maximum queue length will increase considerably in the eastbound direction in scenario 2, by up to 525 metres during the AM peak period. This queue is expected to be present for 30 minutes during the AM peak hour. The impact of the upgraded crossing increases exponentially when the queue reaches the section of on-street parking described in Figure 3.7. The complex interaction between vehicles giving way to each other along Station Road contributes to reducing the throughput considerably. The Do-Something 1 scenario is based on 2022 data and shows a best-case situation, with queue increases of 175m for approximately 5 minutes, which is acceptable.

FIGURE 3.7: ON STREET PARKING LOCATION

Queue Length (m)				
	AM		PM	
Direction	Max	Avg	Max	Avg
DN - Eastbound	37	11	13	4
DS1 - Eastbound	212	48	46	19
DS2 - Eastbound	562	214	67	28
Diff. DS1 - DN	175	37	33	15
Diff. DS2 - DN	525	203	53	24
DN - Westbound	12	4	24	8
DS1 - Westbound	52	15	76	32
DS2 - Westbound	70	20	118	50
Diff. DS1 - DN	40	11	52	24
Diff. DS2 - DN	58	17	94	42

TABLE 3.5: QUEUE LENGTHS – WATERBEACH

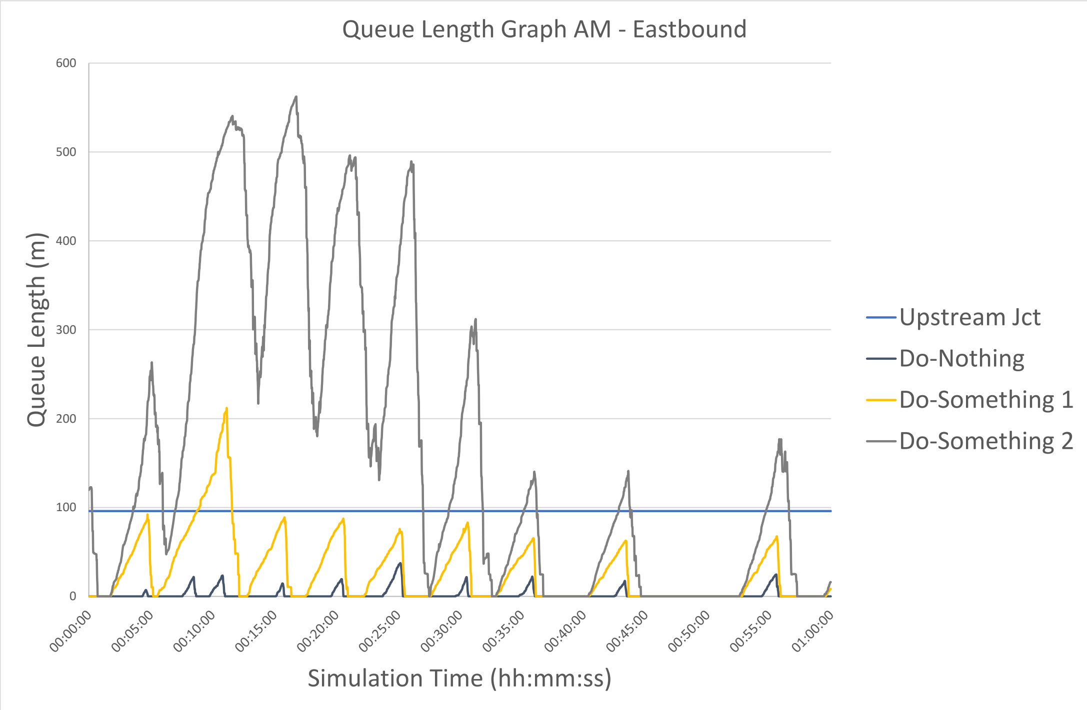

FIGURE 3.8: QUEUES – EASTBOUND – AM PEAK – WATERBEACH

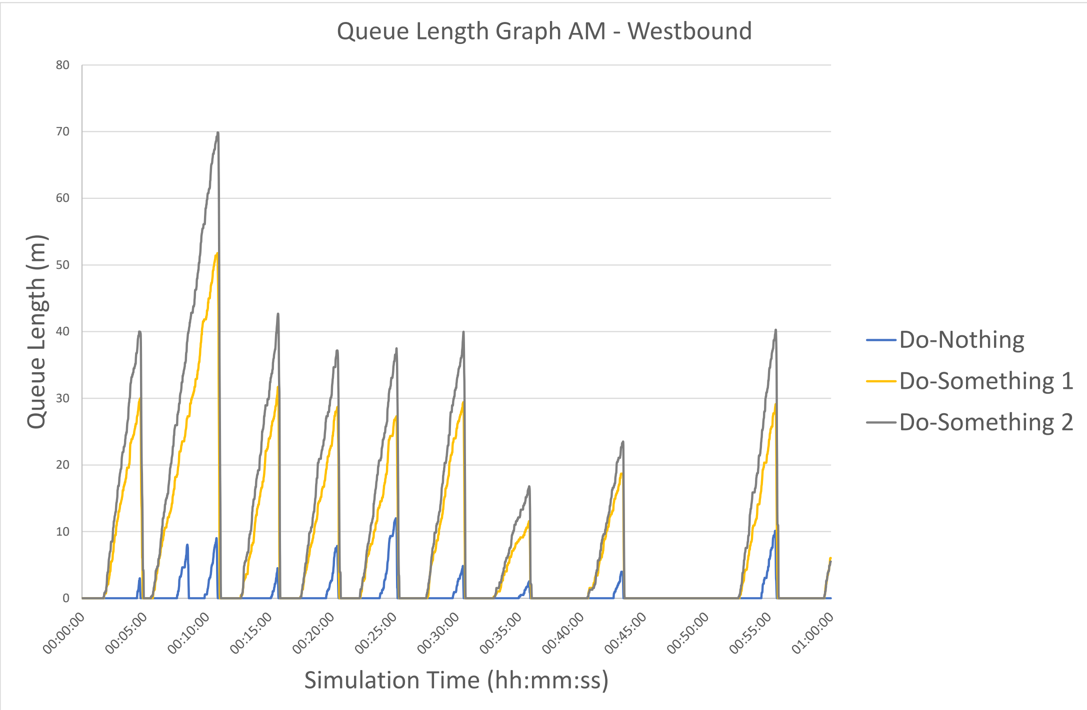

FIGURE 3.9: QUEUES – WESTBOUND – AM PEAK – WATERBEACH

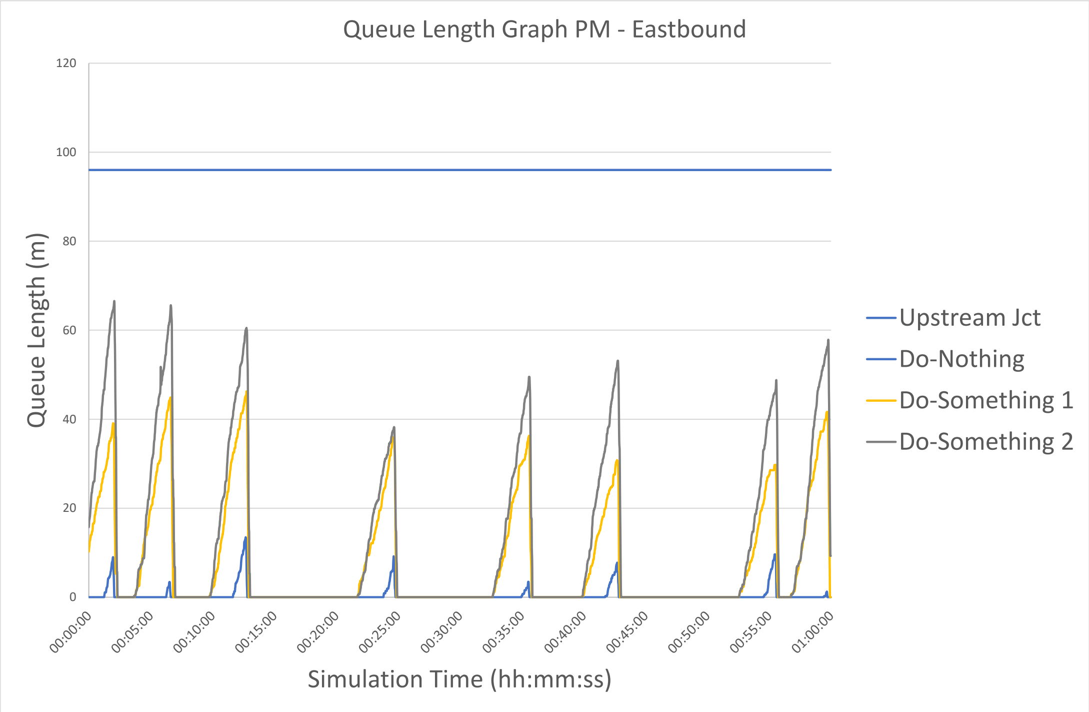

FIGURE 3.10: QUEUES – EASTBOUND – PM PEAK – WATERBEACH

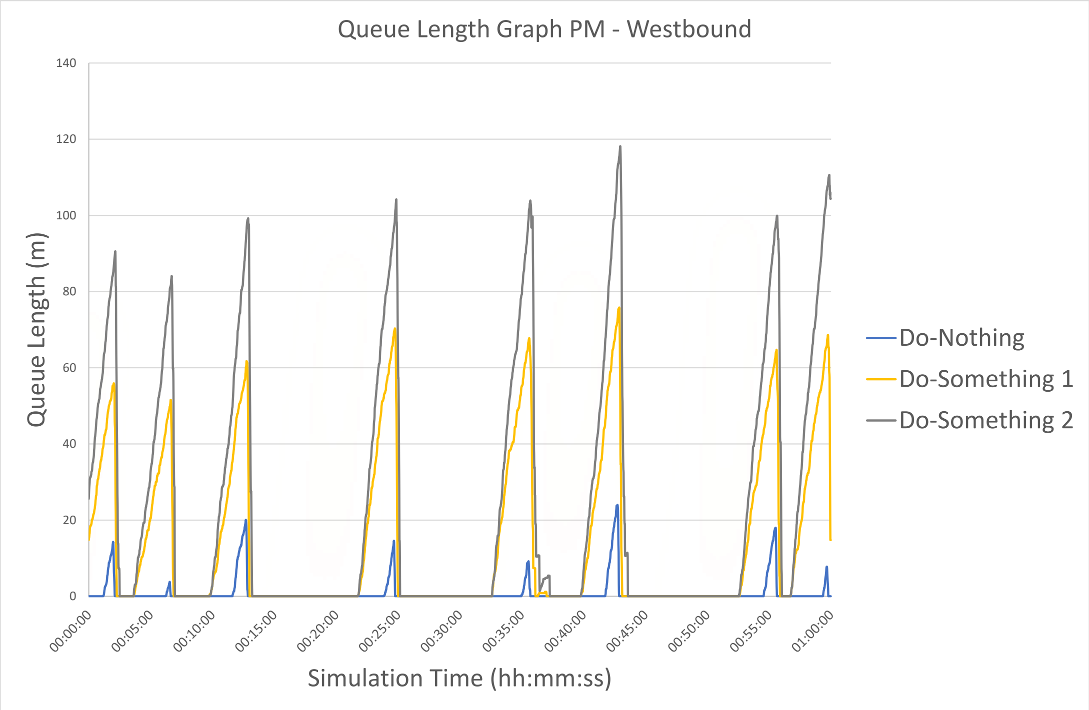

FIGURE 3.11: QUEUES – WESTBOUND – PM PEAK – WATERBEACH

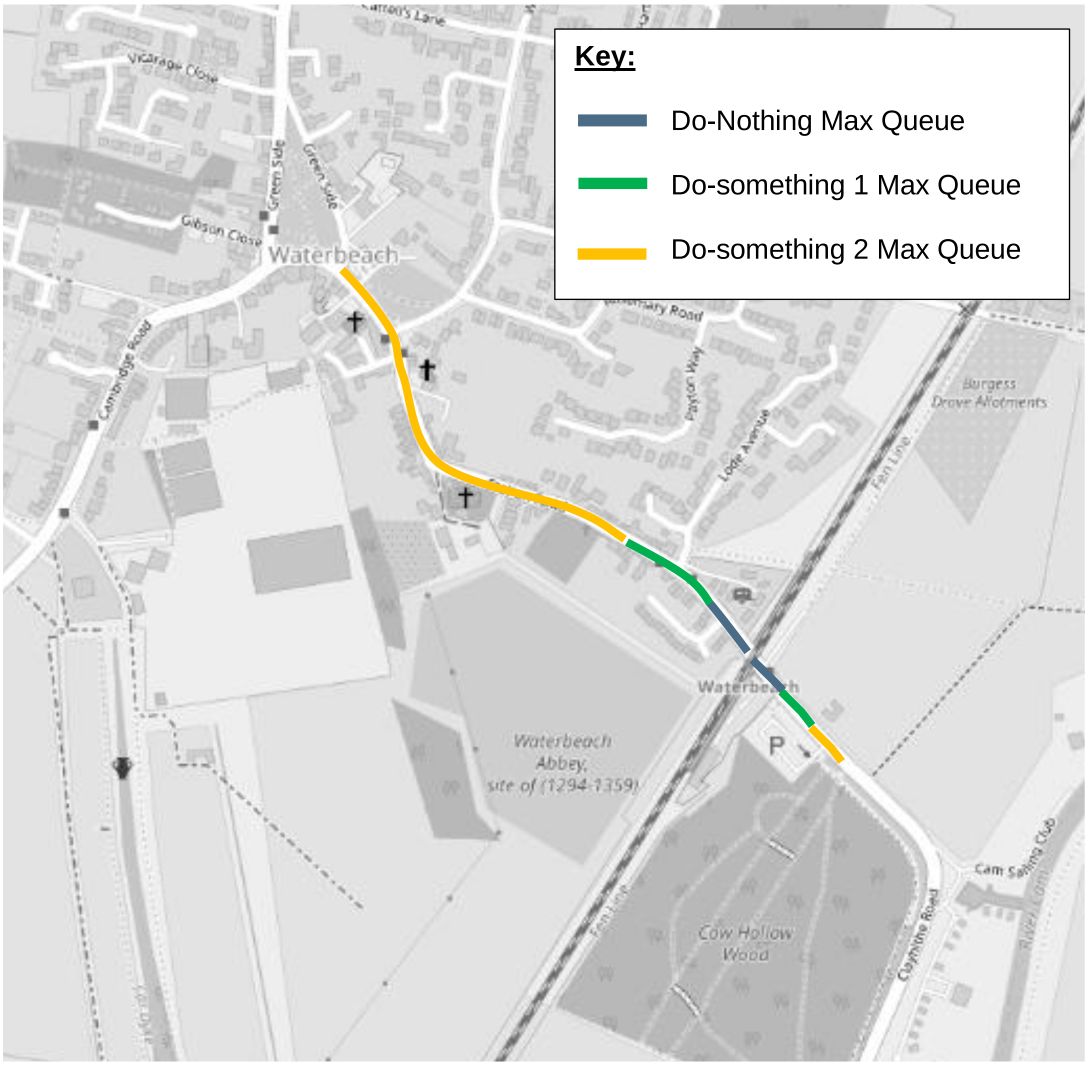

FIGURE 3.12: MAXIMUM QUEUE LENGTHS - WATERBEACH

3.2 Conclusion

3.2.1 It can be concluded that the impact of the upgraded level crossing will have a significant impact if the 2018 data is compared. However, the best-case situation shows an acceptable level of queuing in the eastbound direction when the 2022 data is used. There are encouraging signs that the level of traffic has dropped in 2022 compared to 2018 and Cambridge County Council is actively monitoring the level of traffic across the county to confirm that traffic levels are back to normal - post pandemic.

3.2.2 The current on-street parking conditions on Station Road reduces the throughput of the eastbound movement and access to driveways and side roads will need to be addressed with potential yellow boxes suggested as one possible mitigation measure.

4 DIMMOCKS COTE VISSIM MODEL

4.1 Traffic Data

4.1.1 The barrier down time of the Do-Nothing and Do-something scenario has been updated in line with Table 1.4 and Table 1.5.

4.1.2 Figure 4.1 and Figure 4.2 show the barrier down time across the peak period. A longer barrier down time in line with Table 1.6 is observed in the Do-Something. It was observed that this longer barrier down time allows multiple trains to pass through at once, whilst the shorter barrier down time only allows one train to pass through at a time.

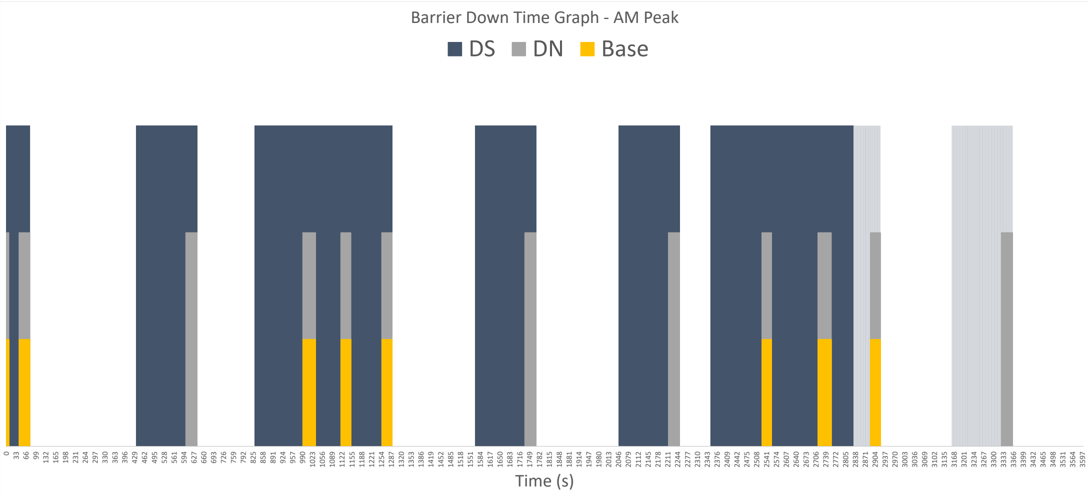

FIGURE 4.1: BARRIER DOWN TIMES – DIMMOCKS COTE – AM

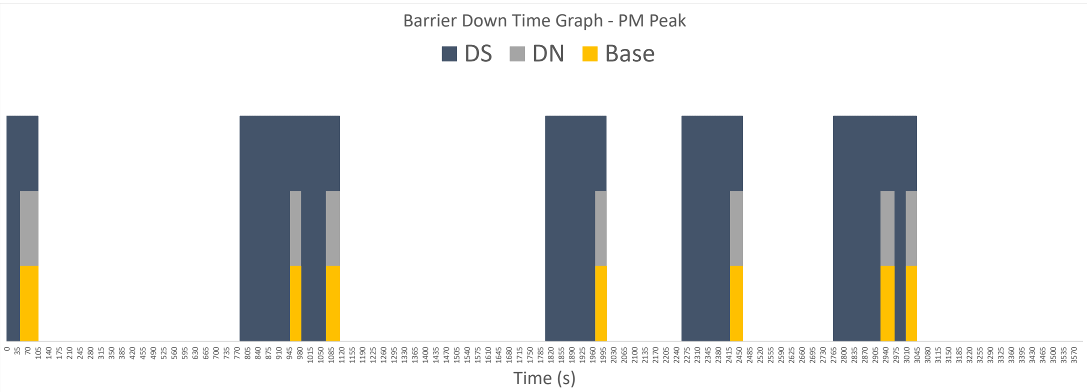

FIGURE 4.2: BARRIER DOWN TIMES – DIMMOCKS COTE – PM

4.1.3 The network performance table shows that the average delay will not exceed 2 minutes with the upgraded level crossing in place. There is also no latent demand which indicates that all traffic can enter the network.

	Average Delay (s)			Average Speed (mph)			Latent Demand	
Peak	**DN**	**DS**	**Diff.**	**DN**	**DS**	**Diff.**	**DN**	**DS**
AM	6.5	109.9	103.4	52.0	23.6	-28.4	0	0
PM	6.3	48.2	41.9	52.3	35.3	-17.0	0	0

TABLE 4.1: NETWORK PERFORMANCE – DIMMOCKS COTE

4.1.4 The proposed upgrade to the level crossing will increase the journey times by 45-116s in both directions during both peak periods. Whilst this increase is around 124% more than in the Do-Nothing scenario, the lack of alternative routes available means that drivers are likely to wait for longer to pass the crossing.

FIGURE 4.3: JOURNEY TIME ROUTE – DIMMOCKS COTE

Journey Time (s)				
Direction	**Peak**	**DN**	**DS**	**Diff.**
EB	**AM**	91.5	205.5	113.9
EB	**PM**	90.9	136.9	46.0
WB	**AM**	91.3	208.3	116.9
WB	**PM**	90.4	135.5	45.1

TABLE 4.2: JOURNEY TIMES – DIMMOCKS COTE

4.1.5 The queue length comparisons show that there will be increases in both the eastbound and westbound directions. When considering the maximum queue lengths, the westbound direction in the AM peak has the highest increase (244m), whist there are increases of 216m, 133m and 124m for the other maximum queue results.

4.1.6 The average queue lengths all increase by around 46-66m with the upgraded level crossing.

Queue Length (m)				
	AM		PM	
Direction	Max	Avg	Max	Avg
DN - Eastbound	15	5	26	9
DS - Eastbound	230	71	159	62
Diff.	216	66	133	53
DN - Westbound	17	6	18	7
DS - Westbound	261	89	142	52
Diff.	244	83	124	46

TABLE 4.3: QUEUE LENGTHS – DIMMOCKS COTE

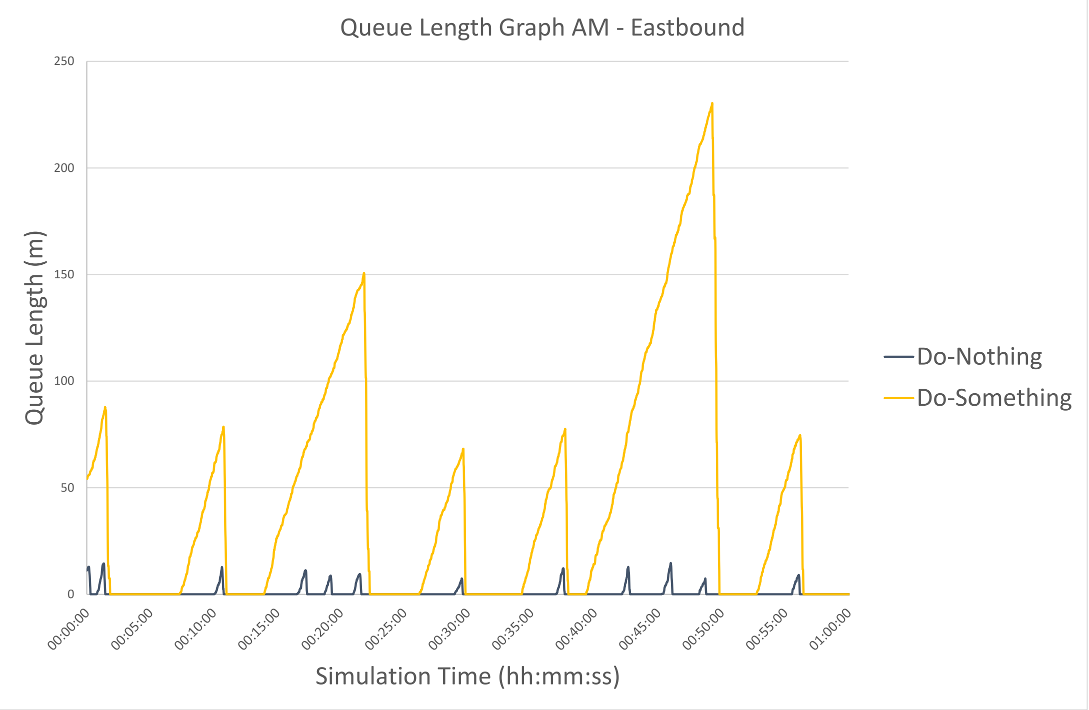

FIGURE 4.4: QUEUES – EASTBOUND - AM PEAK – DIMMOCKS COTE

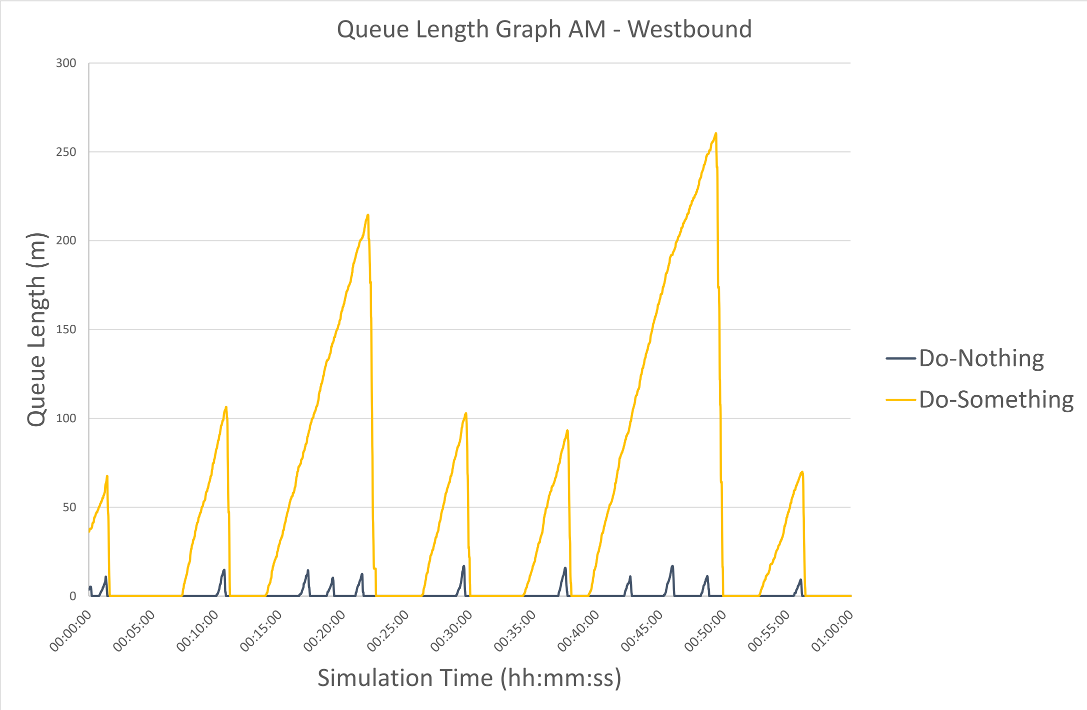

FIGURE 4.5: QUEUES – WESTBOUND - AM PEAK – DIMMCOKS COTE

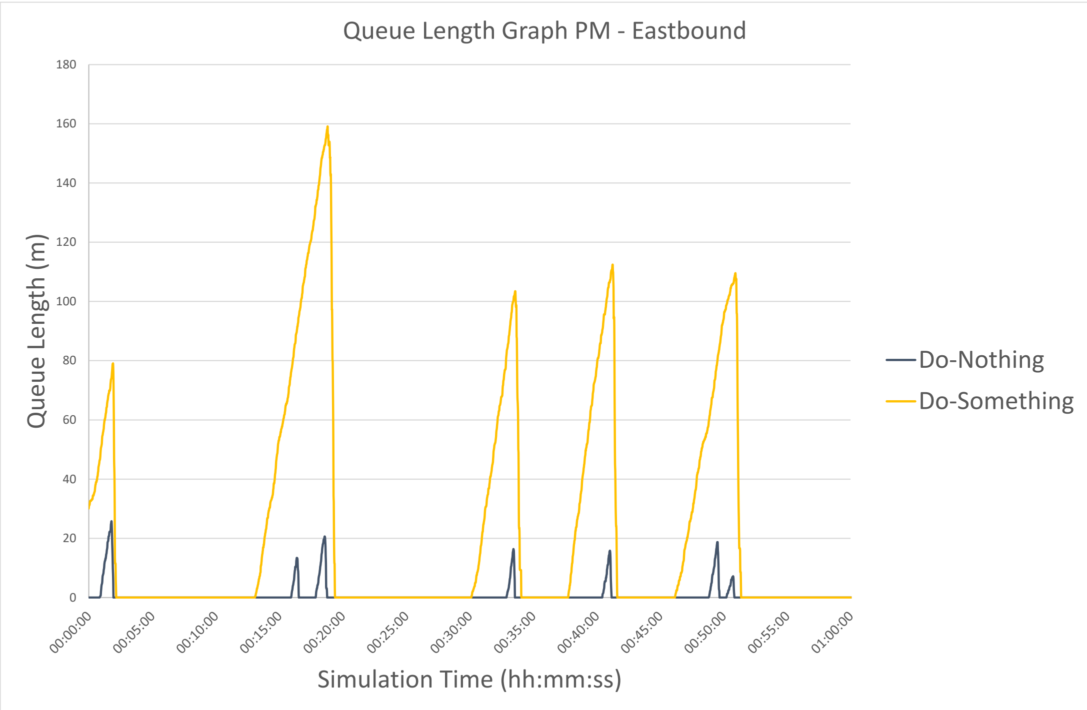

FIGURE 4.6: QUEUES – EASTBOUND – PM PEAK – DIMMOCKS COTE

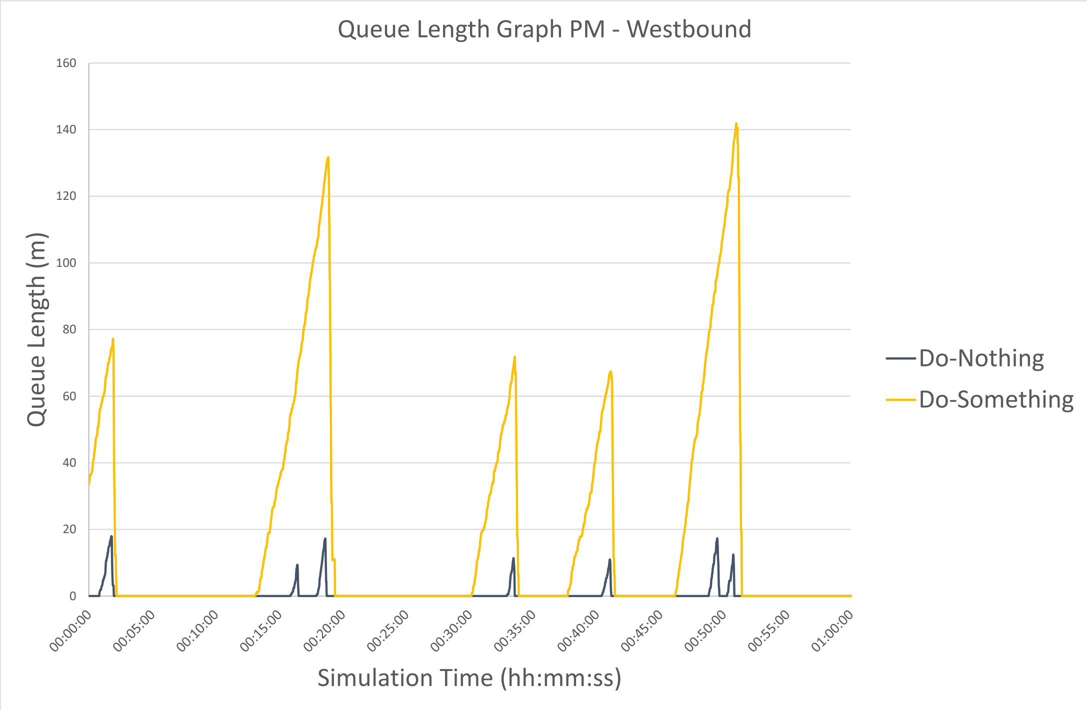

FIGURE 4.7: QUEUES – WESTBOUND – PM PEAK – DIMMOCKS COTE

FIGURE 4.8: MAXIMUM QUEUE LENGTHS – DIMMOCKS COTE

4.2 Conclusion

4.2.1 The proposed upgrade to the level crossing at Dimmocks Cote will have an impact on the journey times and queue lengths at this location. However, it is felt that the impacts will be limited to this location, as there are no other feasible alternative routes for drivers to take. Drivers are likely therefore to sit in the queue and wait for the barriers to open to proceed.

5 CROXTON VISSIM MODEL

5.1 Traffic Data

5.1.1 The barrier down time of the Do-Nothing and Do-something scenario has been updated in line with Table 1.4 and Table 1.5.

5.1.2 Figure 5.1 and Figure 5.2 show the barrier down time across the peak period. A longer barrier down time in line with Table 1.6 is observed in the Do-Something. It was observed that this longer barrier down time allows multiple trains to pass through at once, whilst the shorter barrier down time only allows one train to pass through at a time.

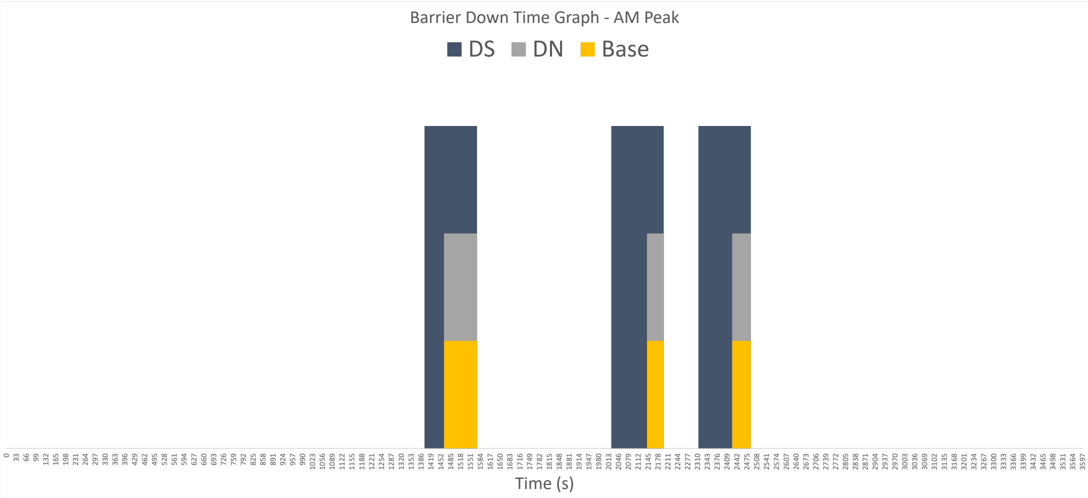

FIGURE 5.1: BARRIER DOWN TIMES– CROXTON – AM

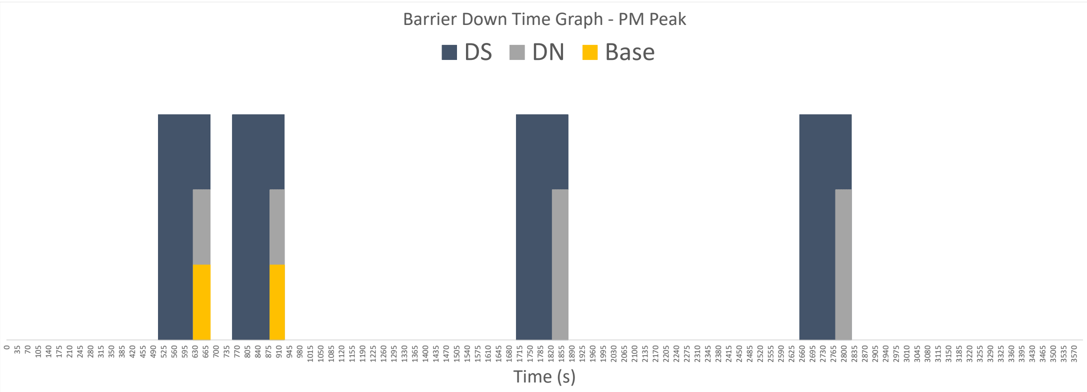

FIGURE 5.2: BARRIER DOWN TIMES– CROXTON – PM

5.1.3 The network performance table shows that the average delay will not exceed 1 minute with the upgraded level crossing. This, along with no latent demand indicate that all traffic can enter the network.

	Average Delay (s)			Average Speed (mph)			Latent Demand	
Peak	DN	DS	Diff.	DN	DS	Diff.	DN	DS
AM	19.4	30.6	11.2	40.8	38.2	-2.7	0	0
PM	18.3	36.4	18.1	41.4	37.1	-4.3	0	0

TABLE 5.1: NETWORK PERFORMANCE - CROXTON

5.1.4 The proposed increase barrier down time will increase the journey time by less than 1 minute for both directions during both peak periods. This is not considered a significant increase.

FIGURE 5.3: JOURNEY TIME ROUTE - CROXTON

Journey time (s)				
Direction	**Peak**	**DN**	**DS**	**Diff.**
EB	**AM**	171	184	13
EB	**PM**	163	183	20
WB	**AM**	164	173	9
WB	**PM**	169	188	19

TABLE 5.2: JOURNEY TIMES - CROXTON

5.1.5 The upgraded level crossing will increase the average and maximum queues. The biggest of these increases is the maximum queue eastbound in the PM peak, where there is an additional 80m of queue.

5.1.6 Whilst there are increases in the queue lengths, the modest increases in journey times and lack of viable alternative routes means that drivers will likely wait for the barrier to open before progressing with their journey.

Queue Length (m)				
	AM		**PM**	
Direction	**Max**	**Avg**	**Max**	**Avg**
DN - Eastbound	43	13	35	14
DS - Eastbound	71	23	115	57
Diff.	28	10	80	43
DN - Westbound	73	26	23	8
DS - Westbound	134	63	83	37
Diff.	62	37	60	29

TABLE 5.3: QUEUE LENGTHS – CROXTON

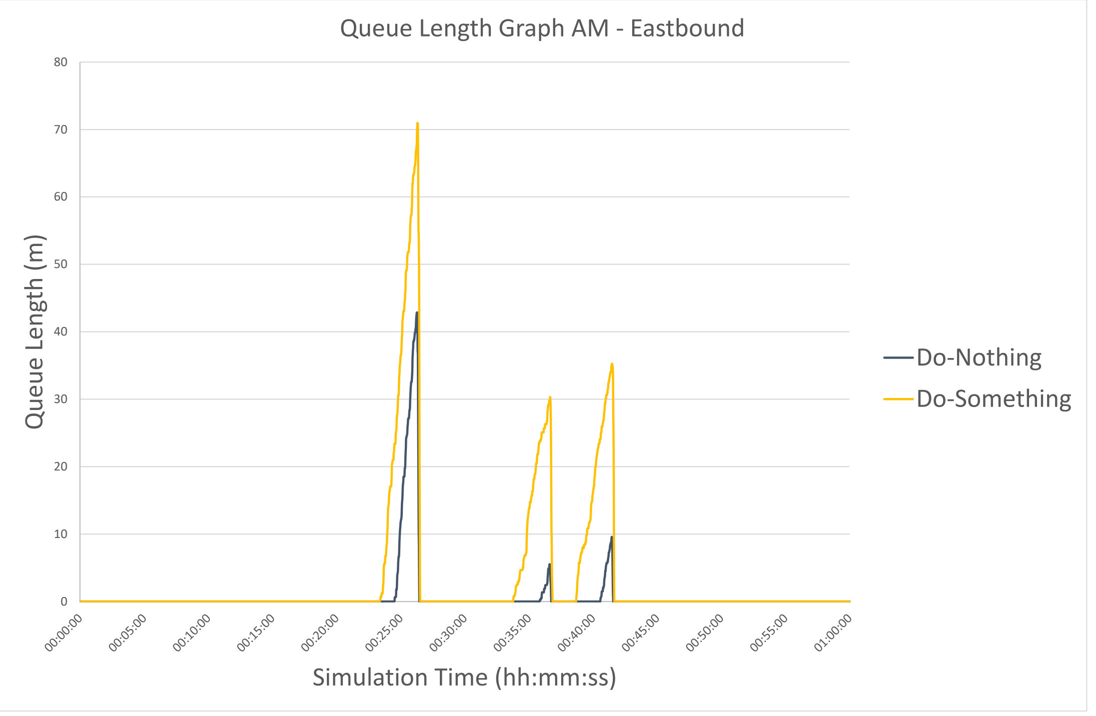

FIGURE 5.4: QUEUES – EASTBOUND – AM PEAK – CROXTON

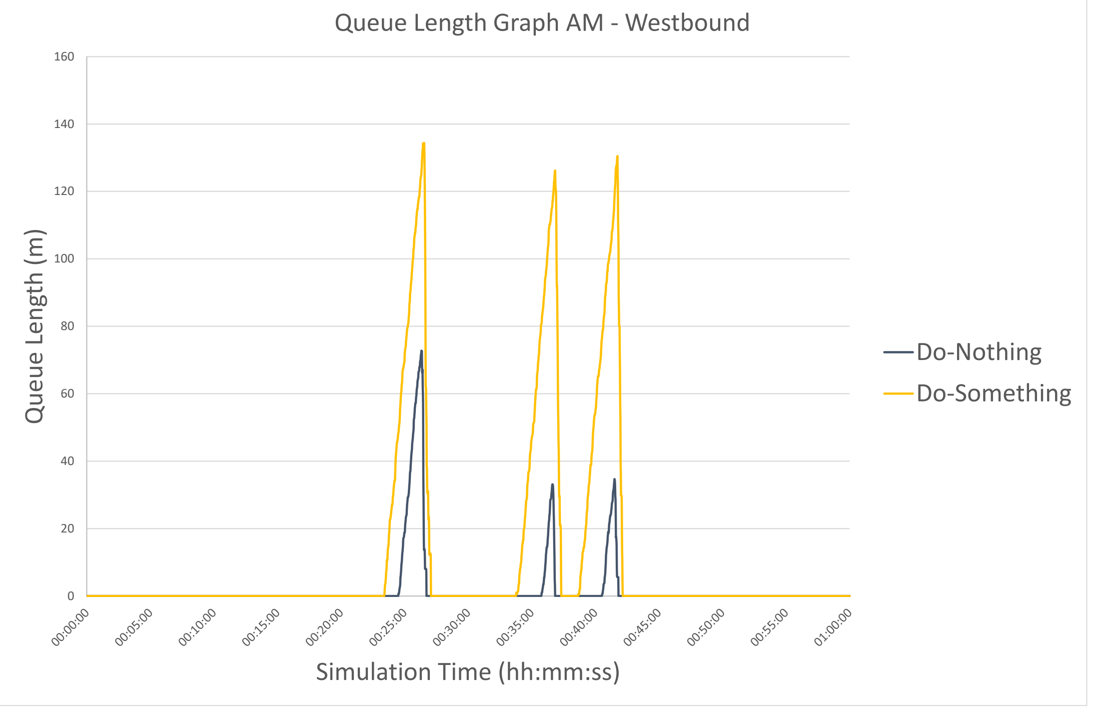

FIGURE 5.5: QUEUES – WESTBOUND – AM PEAK – CROXTON

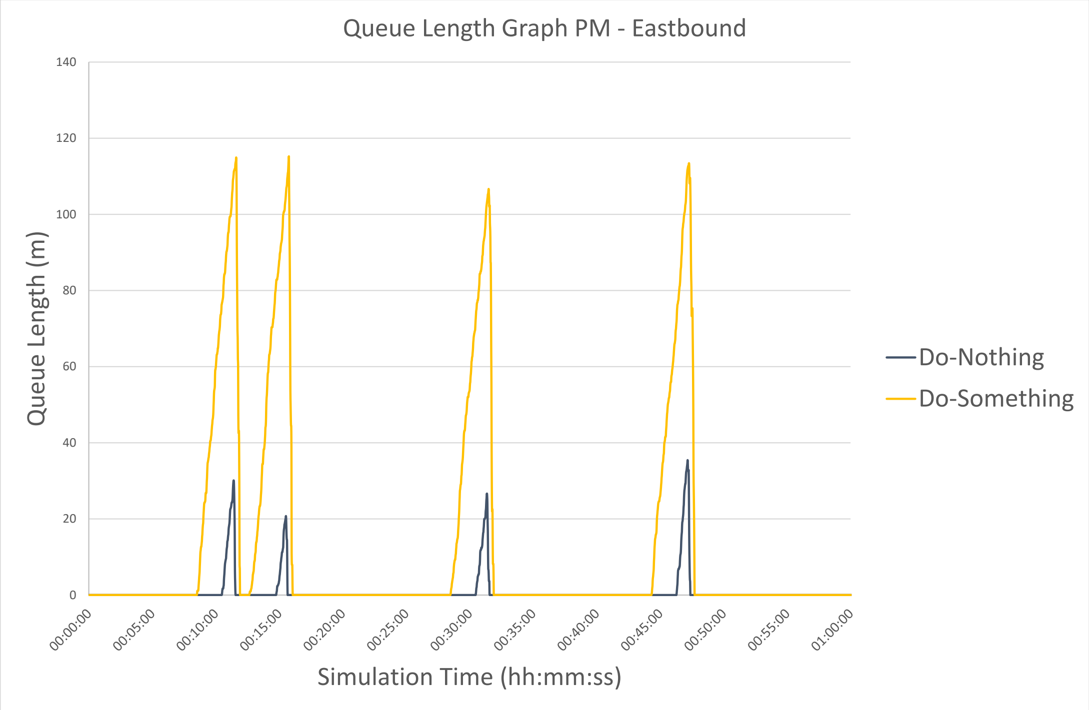

FIGURE 5.6: QUEUES – EASTBOUND – PM PEAK – CROXTON

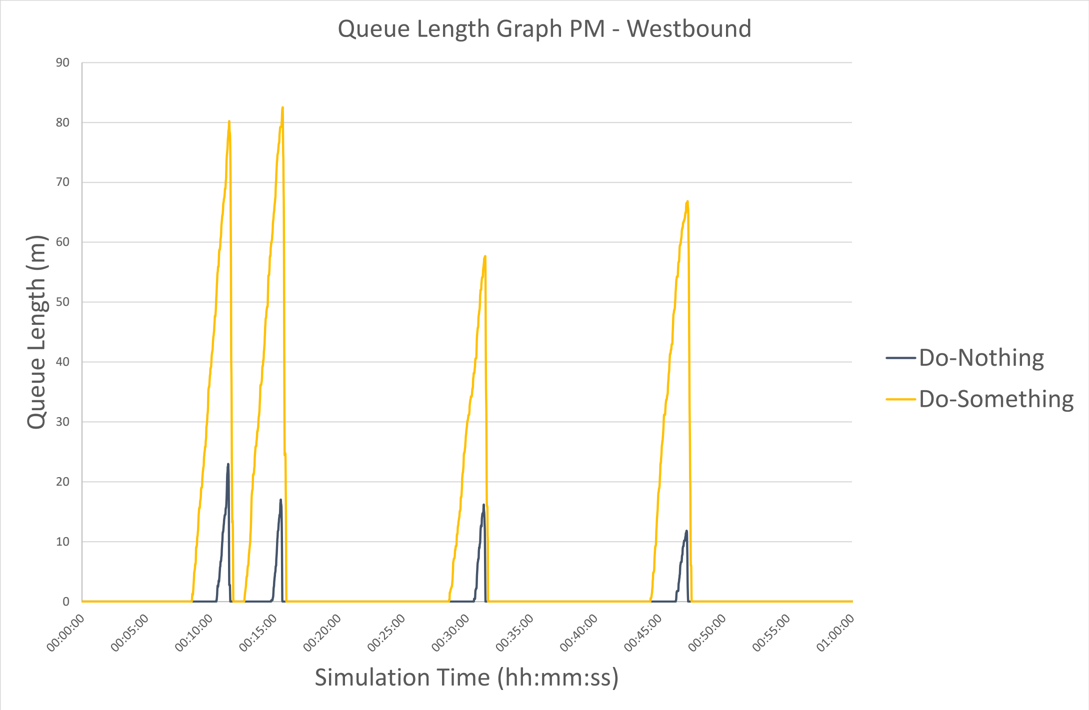

FIGURE 5.7: QUEUES – WESTBOUND – PM PEAK – CROXTON

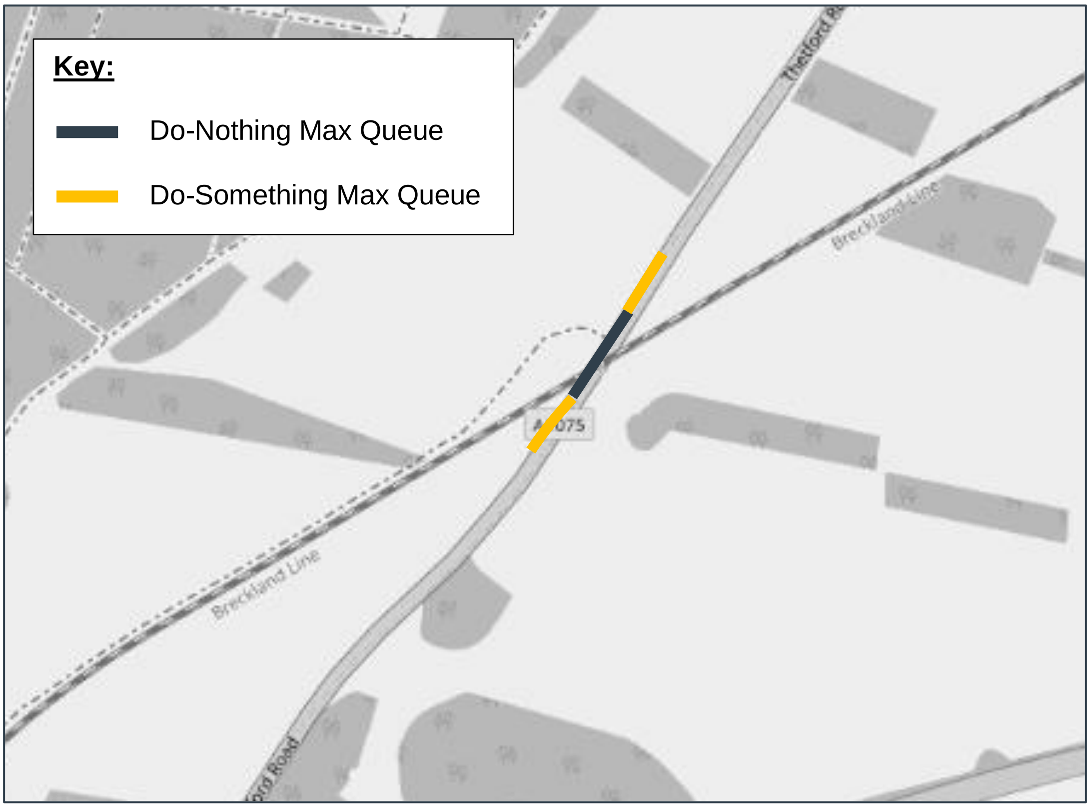

FIGURE 5.8: MAXIMUM QUEUE LENGTHS - CROXTON

5.2 Conclusion

5.2.1 The impact of the proposed upgrade to the Croxton level crossing will not have a significant impact on the network and given the lack of alternative routes, drivers will likely wait in any additional queues before progressing with their journey. .

6 SIX MILE BOTTOM VISSIM MODEL

6.1 Traffic Data

6.1.1 The barrier down time of the Do-Nothing and Do-something scenario has been updated in line with Table 1.4 and Table 1.5.

6.1.2 Figure 6.1 and Figure 6.2 show the barrier down time across the peak period. A longer barrier down time in line with Table 1.6 is observed in the Do-Something.

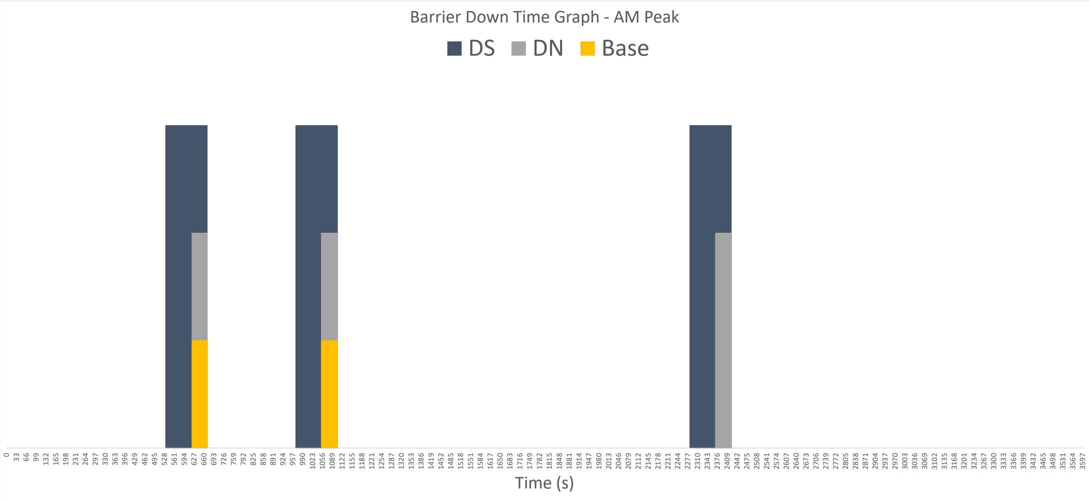

FIGURE 6.1: BARRIER DOWN TIMES – SIX MILE BOTTOM – AM

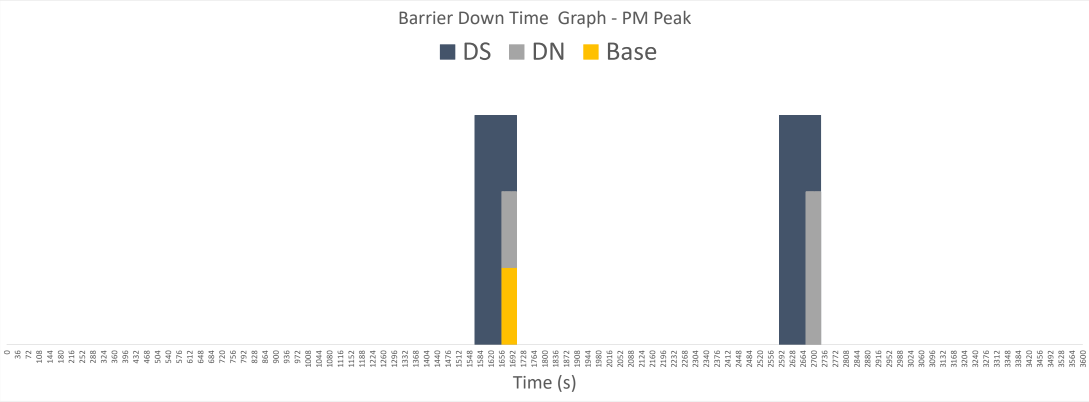

FIGURE 6.2: BARRIER DOWN TIMES – SIX MILE BOTTOM – PM

6.1.3 The network performance table shows that the average delay will not exceed 1 minute with the upgraded level crossing. However, this is a significant increase on the Do-Nothing scenario.

6.1.4 There is no latent demand in the model, which indicates that all traffic can enter the network.

	Average Delay (s)			Average Speed (mph)			Latent Demand	
Peak	DN	DS	Diff.	DN	DS	Diff.	DN	DS
AM	16.7	30.4	13.7	33.4	29.9	-3.5	0	0
PM	25.1	35.5	10.4	31.5	29.2	-2.3	0	0

TABLE 6.1: NETWORK PERFORMANCE – SIX MILE BOTTOM

6.1.5 The proposed upgrade to the level crossing will increase the journey times, with increases of 6-12s observed. However, as there are no viable alternative routes, drivers will likely wait for the barrier to open before progressing with their journey.

FIGURE 6.3: JOURNEY TIME ROUTE – SIX MILE BOTTOM

Journey time (s)				
Direction	**Peak**	**DN**	**DS**	**Diff.**
EB	**AM**	138	150	11
EB	**PM**	158	169	12
WB	**AM**	129	141	12
WB	**PM**	115	121	6

TABLE 6.2: JOURNEY TIMES – SIX MILE BOTTOM

With the upgraded level crossing in place, there are some considerable increases in the queue lengths. The Westbound direction in the PM peak will increases, with an average queue increase of 71m and a maximum queue increase of 147m. This will have an impact on the A1304 London Road / Brinkley Road junction and the queue on Brinkley Road in the westbound direction will reach the level crossing located further upstream. This will have some safety implications which will need to be reviewed further.

6.1.6 In the eastbound direction, the queues are likely to reach the slip road from the A11. Whilst these do not look like directly impacting on the A11, it is recommended that National Highways are consulted to understand their views on this queuing.

Queue Length (m)				
	AM		**PM**	
Direction	**Max**	**Avg**	**Max**	**Avg**
DN - Eastbound	43	18	162	24
DS - Eastbound	119	42	485	110
Diff.	76	25	322	87
DN - Westbound	95	43	25	11
DS - Westbound	242	114	81	38
Diff.	147	71	56	27

TABLE 6.3: QUEUE LENGTHS – SIX MILE BOTTOM

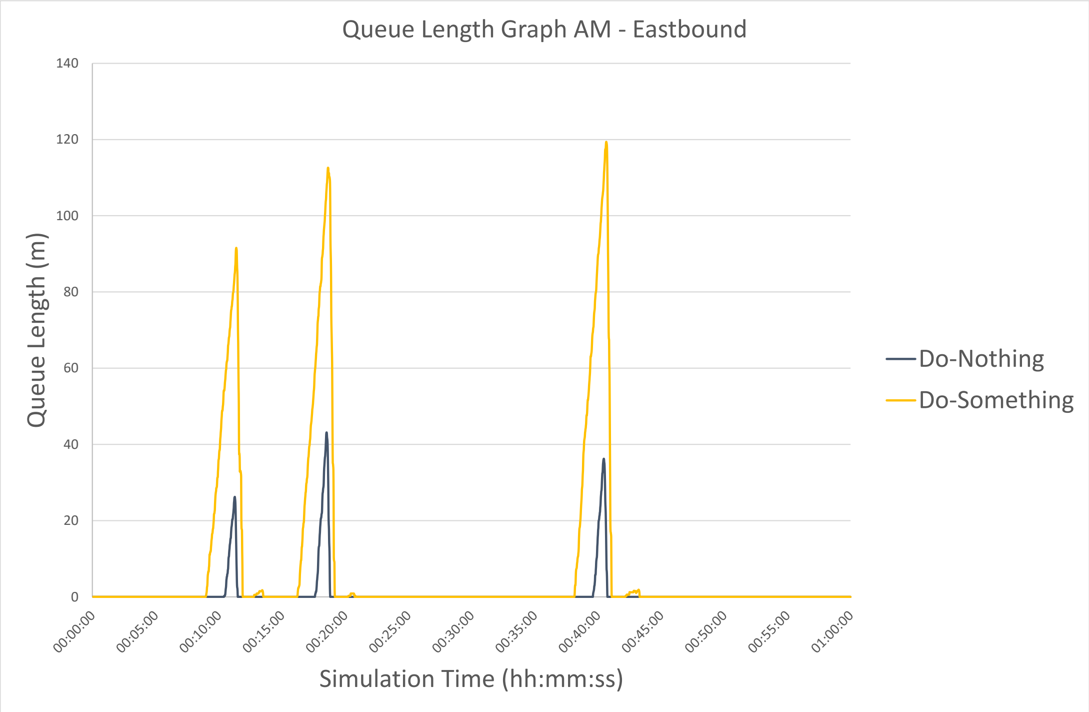

FIGURE 6.4: QUEUES – EASTBOUND – AM PEAK – SIX MILE BOTTOM

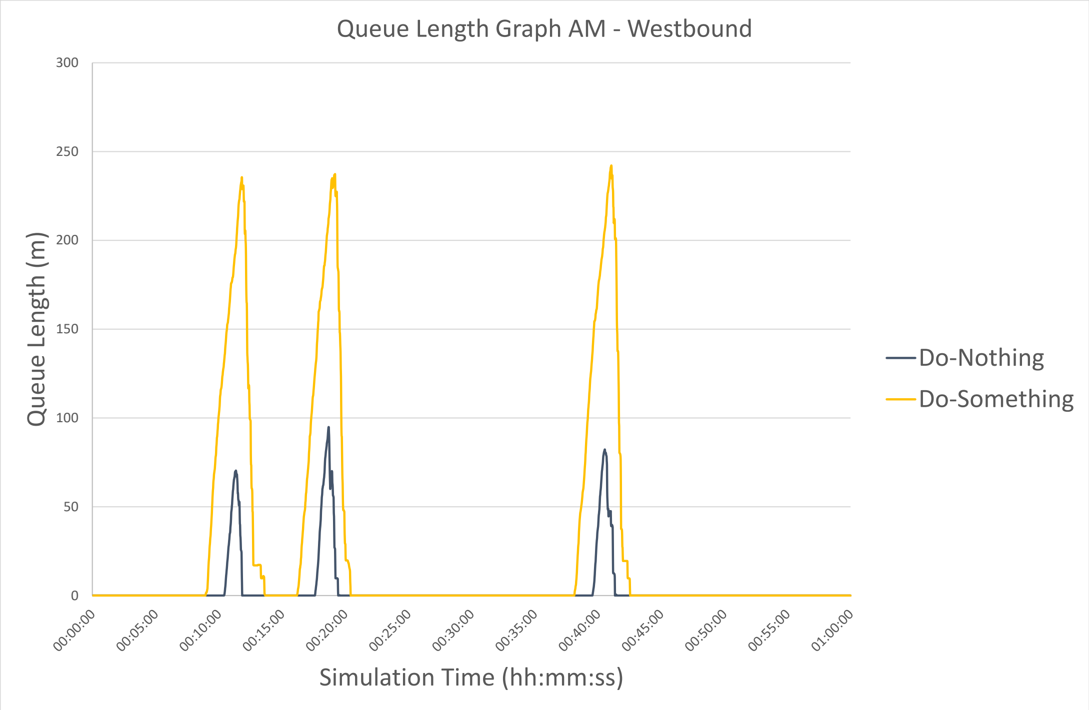

FIGURE 6.5: QUEUES – WESTBOUND – AM PEAK – SIX MILE BOTTOM

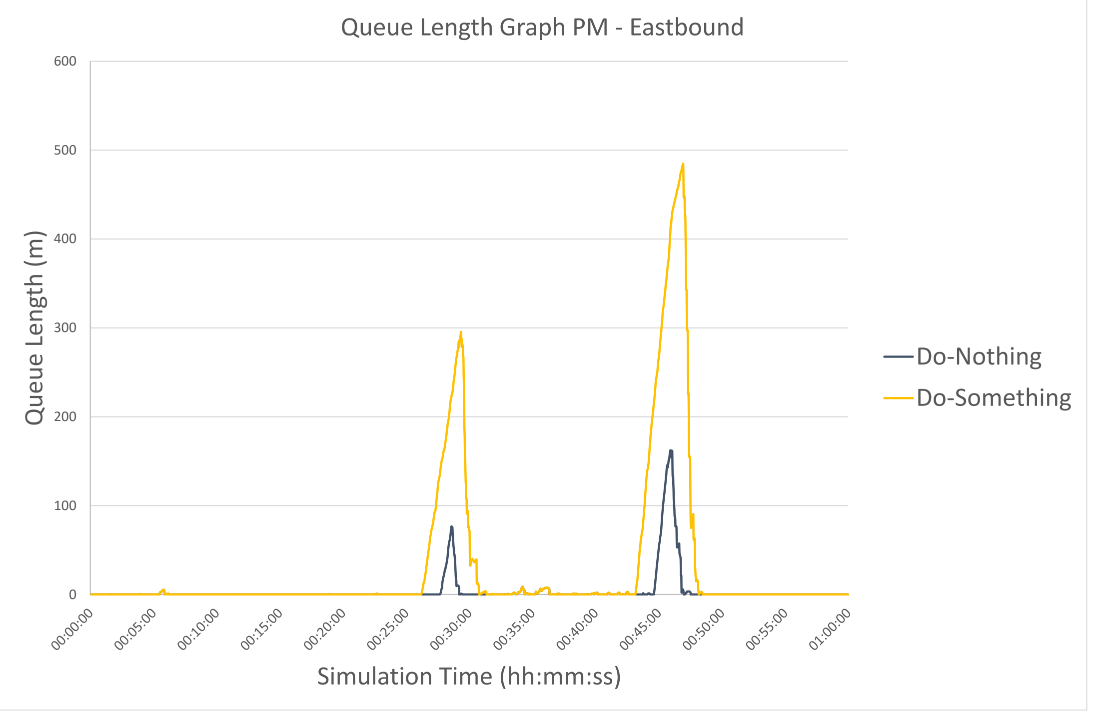

FIGURE 6.6: QUEUES – EASTBOUND – PM PEAK – SIX MILE BOTTOM

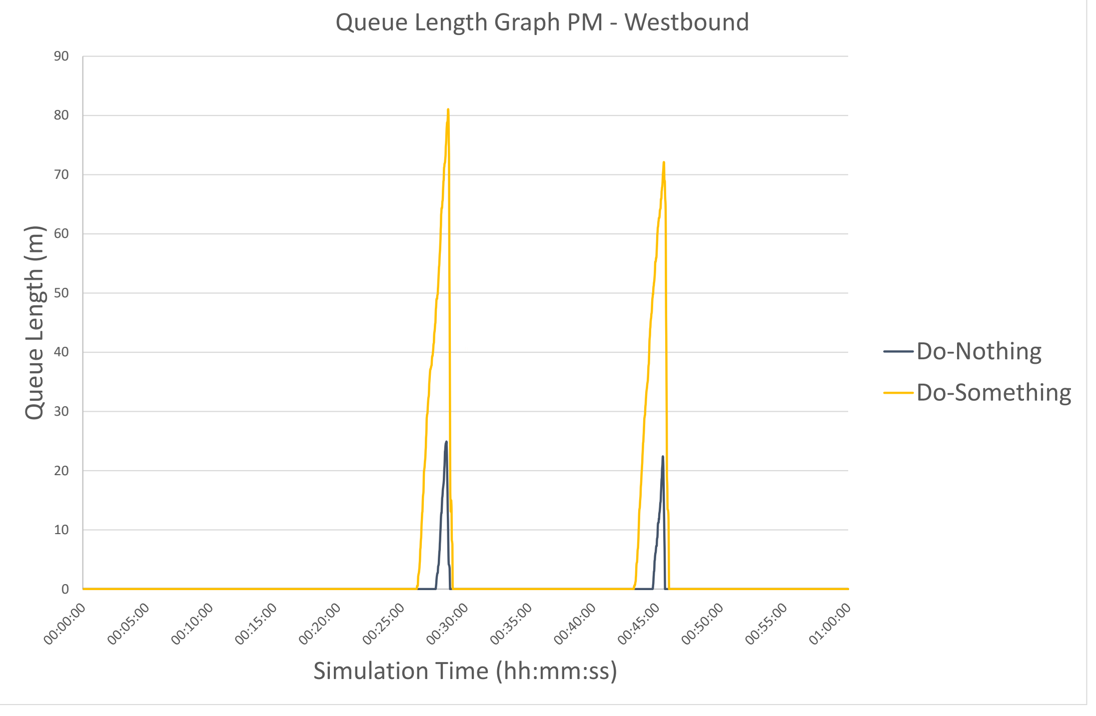

FIGURE 6.7: QUEUES – WESTBOUND – PM PEAK – SIX MILE BOTTOM

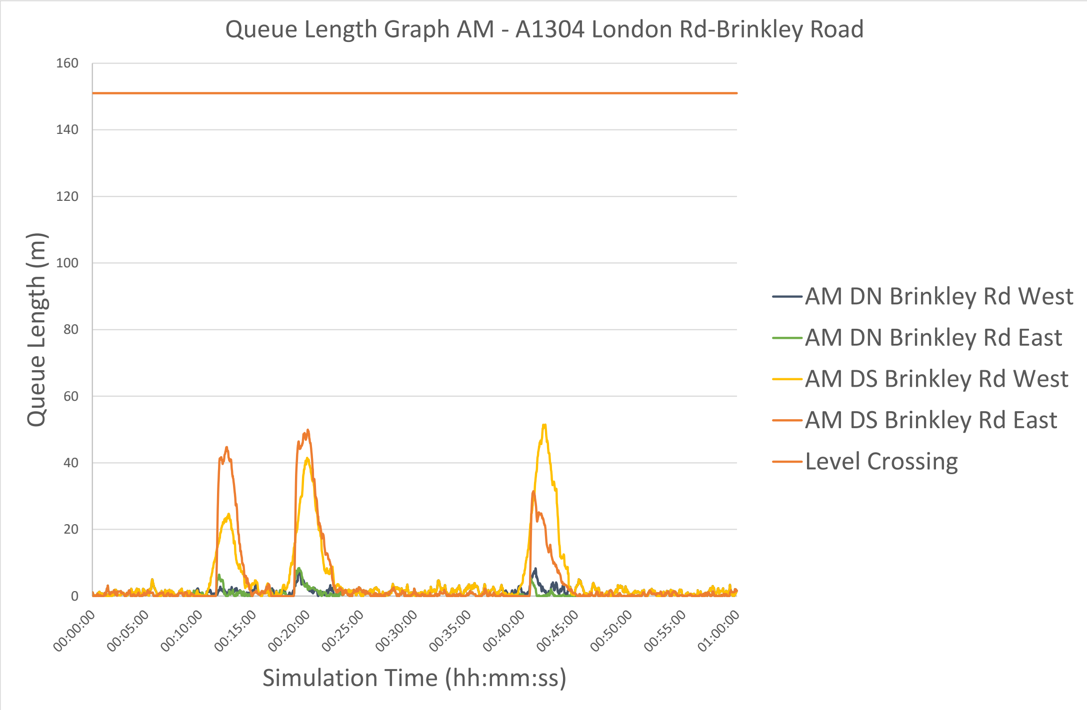

FIGURE 6.8: QUEUES – AM PEAK - A1304 LONDON RD-BRINKLEY RD JCT

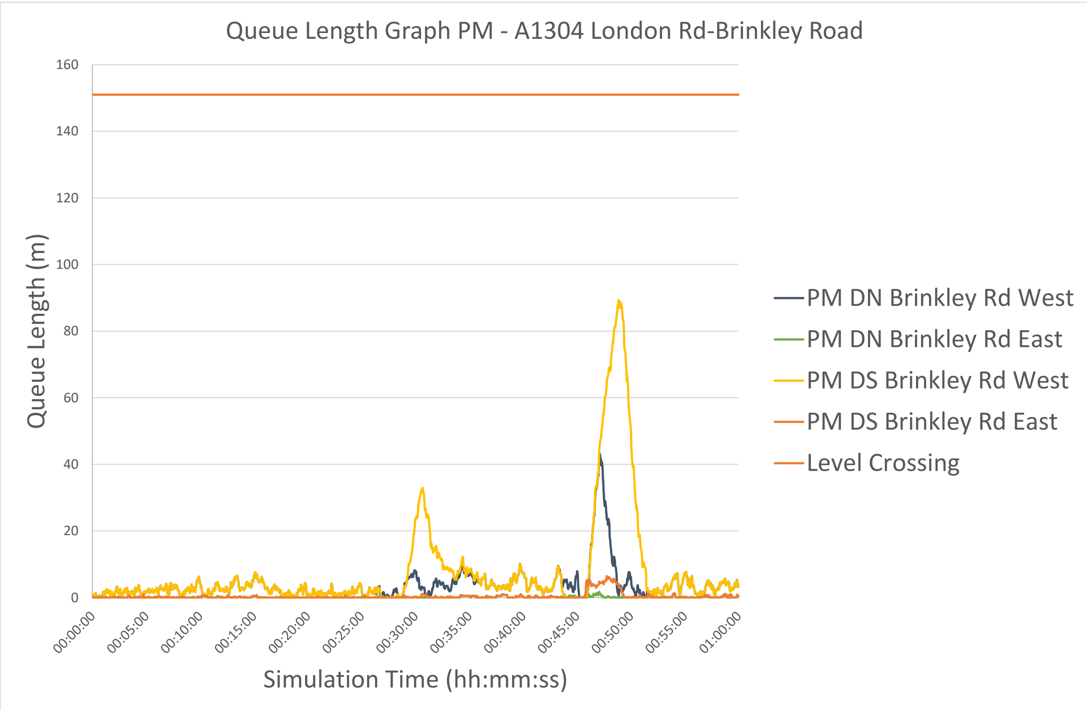

FIGURE 6.9: QUEUES – PM PEAK – LONDON RD – BRINKLEY RD JCT

FIGURE 6.10: MAXIMUM QUEUE LENGTHS – SIX MILE BOTTOM

6.2 Conclusion

6.2.1 The upgraded crossing at Six Mile Bottom will have a considerable impact on the surrounding road network.

6.2.2 In the eastbound direction, whilst the queuing will not reach the A11, they will be onto the slip road and the view of National Highways should be sought to understand their views on this queuing.

6.2.3 The westbound direction will have an impact on the A1304 London Road / Brinkley Road junction and the queue on Brinkley Road in the westbound direction will reach the level crossing located upstream. This will have some safety implication which will need to be reviewed further.

7 DULLINGHAM VISSIM MODEL

7.1 Traffic Data

7.1.1 The barrier down time of the Do-Nothing and Do-something scenario has been updated in line with Table 1.4 and Table 1.5.

7.1.2 Figure 7.1 and Figure 7.2 show the barrier down time across the peak period. The Dullingham level crossing is a manual crossing with a long barrier down time of approximately 281 seconds. The introduction of a MCB-OD2 / MCB-CCTV level will reduce the barrier down time to 168s.

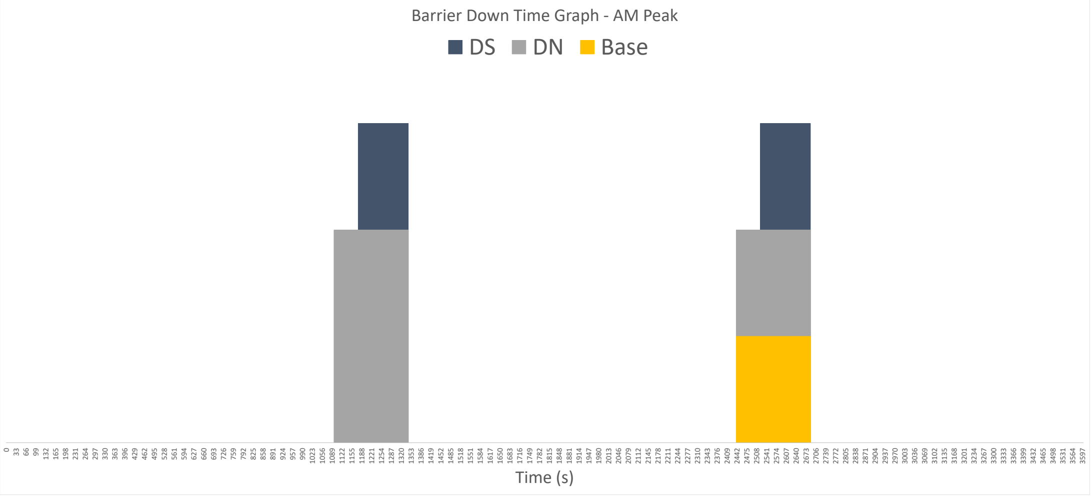

FIGURE 7.1: BARRIER DOWN TIMES – DULLINGHAM – AM

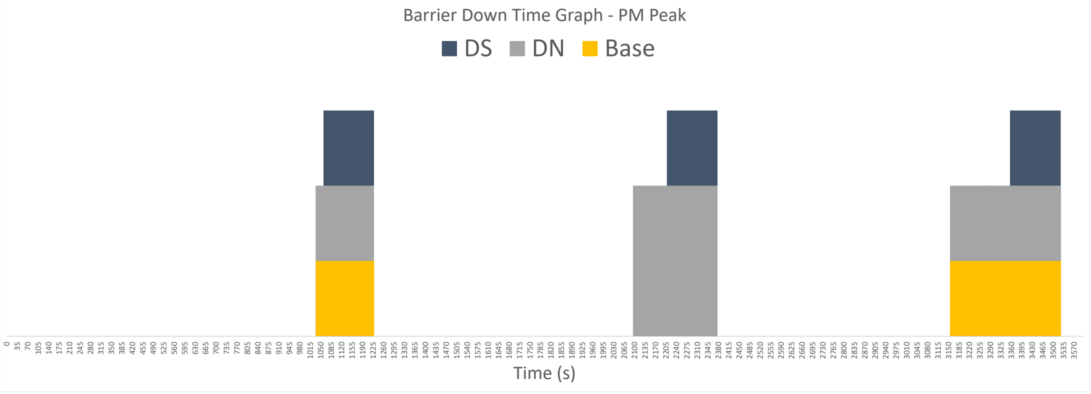

FIGURE 7.2: BARRIER DOWN TIMES – DULLINGHAM – PM

7.1.3 The network performance table shows that the average delay is reduced as a result of the upgraded crossing and that the improvement will have no significant impact on the network. The results show that there is no latent demand and that all traffic can enter the network.

	Average Delay (s)			Average Speed (mph)			Latent Demand	
Peak	**DN**	**DS**	**Diff.**	**DN**	**DS**	**Diff.**	**DN**	**DS**
AM	32.0	9.9	-22.2	27.1	35.2	8.1	0	0
PM	33.0	15.8	-17.3	27.1	32.8	5.7	0	0

TABLE 7.1: NETWORK PERFORMANCE - DULLINGHAM

7.1.4 The proposed level crossing upgrade will provide a modest reduction in journey times in both directions and in both peak periods compared to the Do-Nothing scenario.

FIGURE 7.3: JOURNEY TIME ROUTE – DULLINGHAM

Journey time (s)				
Direction	**Peak**	**DN**	**DS**	**Diff.**
EB	**AM**	117	82	-35
EB	**PM**	103	85	-18
WB	**AM**	100	78	-21
WB	**PM**	109	85	-24

TABLE 7.2: JOURNEY TIMES - DULLINGHAM

7.1.5 The queue results show similar average and maximum queue lengths in the Do-Nothing and Do-Something scenarios, indicating that the upgraded crossing will not have an impact on the network.

Queue Length (m)				
	AM		PM	
Direction	Max	Avg	Max	Avg
DN - Eastbound	18	6	48	20
DS - Eastbound	8	4	30	12
Diff.	-10	-3	-18	-8
DN - Westbound	18	7	14	5
DS - Westbound	9	3	6	3
Diff.	-10	-3	-8	-2

TABLE 7.3: QUEUE LENGTHS - DULLINGHAM

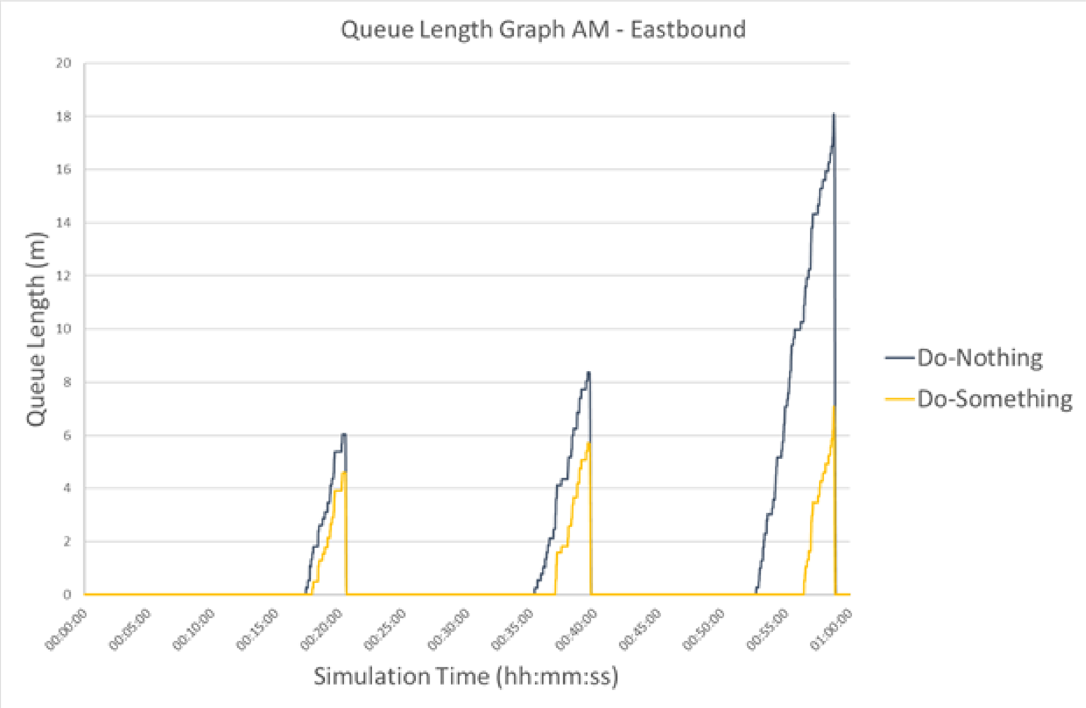

FIGURE 7.4: QUEUES – EASTBOUND - AM PEAK – DULLINGHAM

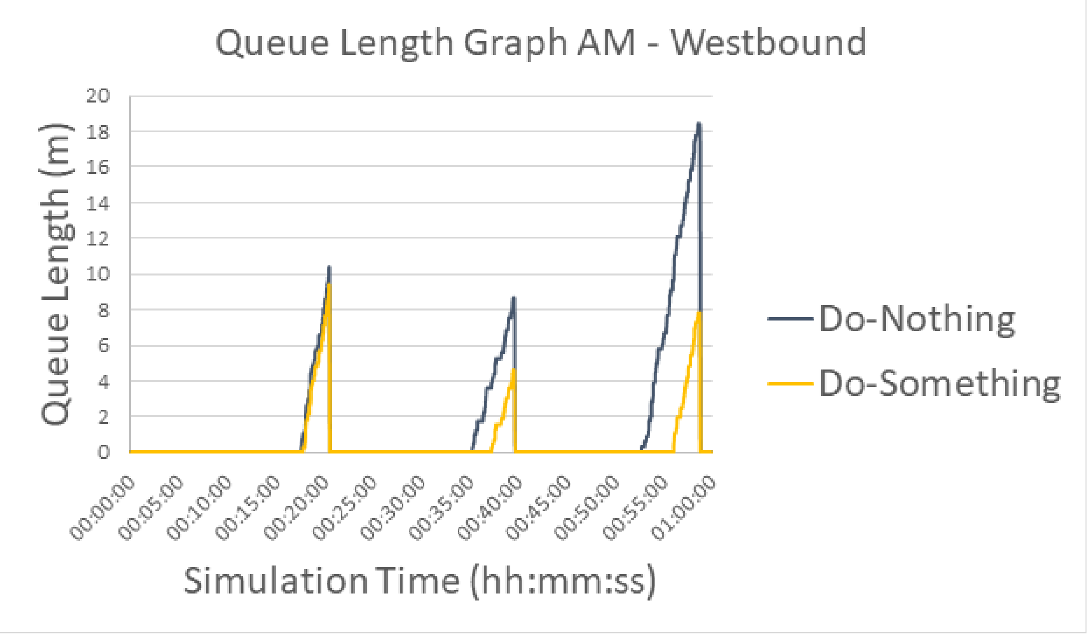

FIGURE 7.5: QUEUES – WESTBOUND - AM PEAK – DULLINGHAM

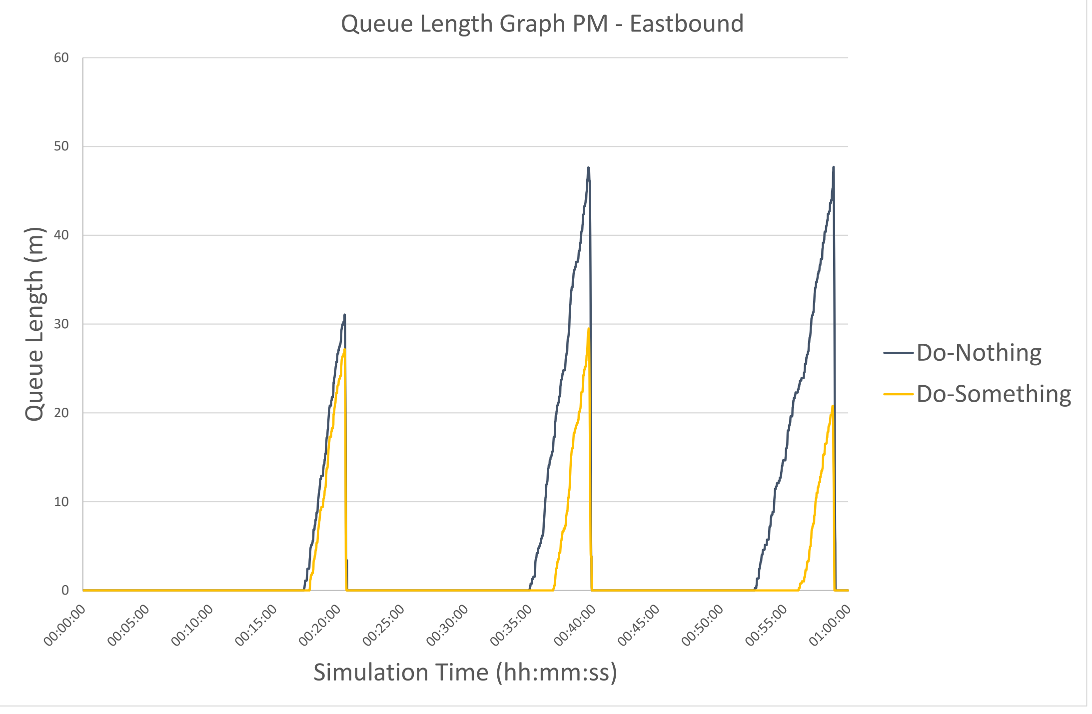

FIGURE 7.6: QUEUES – EASTBOUND - PM PEAK – DULLINGHAM

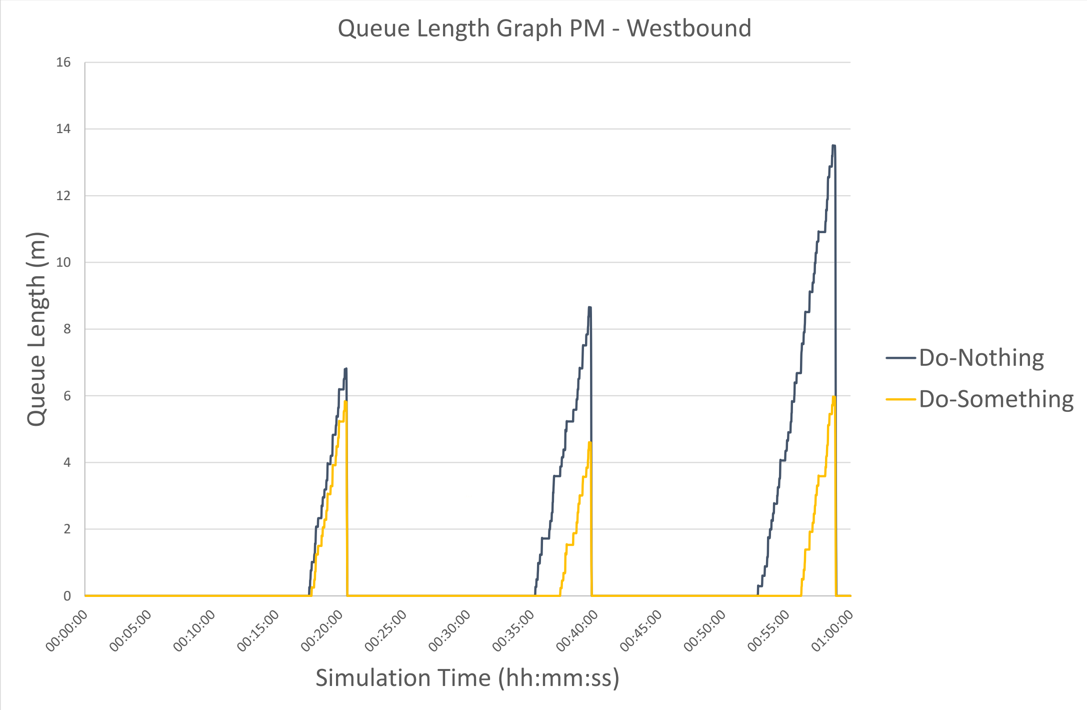

FIGURE 7.7: QUEUES – WESTBOUND - PM PEAK – DULLINGHAM

7.2 Conclusion

7.2.1 It can be concluded that the proposed level crossing upgrade at Dullingham will have a modest improvement to the network in this location. This is largely due to the slight reduction in the time the barriers are down, attributed to the automation of the crossing.

8 MELDRETH VISSIM MODEL

8.1 Traffic Data

8.1.1 The barrier down time of the Do-Nothing and Do-something scenario has been updated in line with Table 1.4 and Table 1.5.

8.1.2 Figure 8.1 and Figure 8.2 show the barrier down time across the peak period. A longer barrier down time in line with Table 1.6 is observed in the Do-Something. It was observed that this longer barrier down time allows multiple trains to pass through at once, whilst the shorter barrier down time only allows one train to pass through at a time.

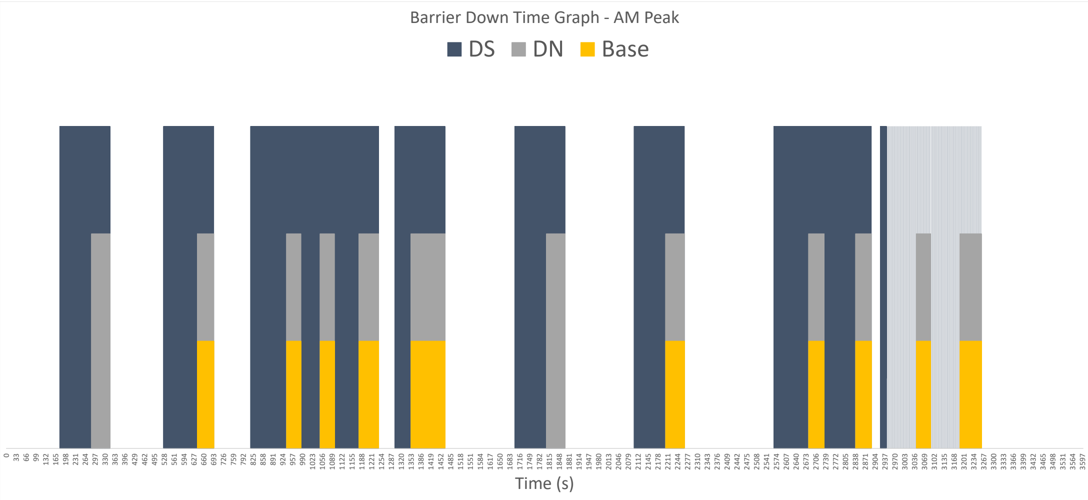

FIGURE 8.1: BARRIER DOWN TIMES – MELDRETH – AM

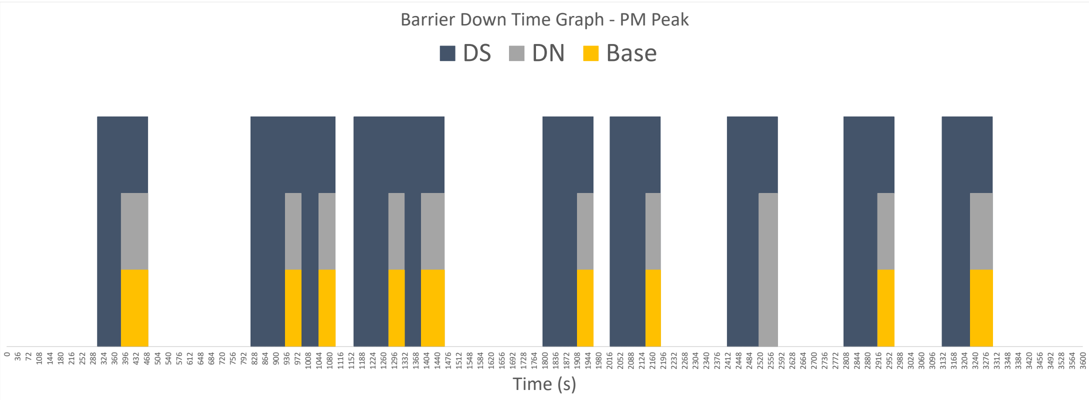

FIGURE 8.2: BARRIER DOWN TIMES – MELDRETH – PM

8.1.3 The network performance table shows that the average delay will not exceed 1 minute which indicates no significant impact on the network. There is no latent demand which demonstrates that all traffic can enter the network.

	Average Delay (s)			Average Speed (mph)			Latent Demand	
Peak	**DN**	**DS**	**Diff.**	**DN**	**DS**	**Diff.**	**DN**	**DS**
AM	63.9	91.8	27.9	16.7	13.9	-2.8	0	0
PM	50.8	72.3	21.5	18.8	16.1	-2.6	0	0

TABLE 8.1: NETWORK PERFORMANCE – MELDRETH

8.1.4 The proposed upgrade to the level crossing will have a minimal impact on the eastbound journey times.

8.1.5 In the westbound direction, the highest increase is 65s, which is not considered significant.

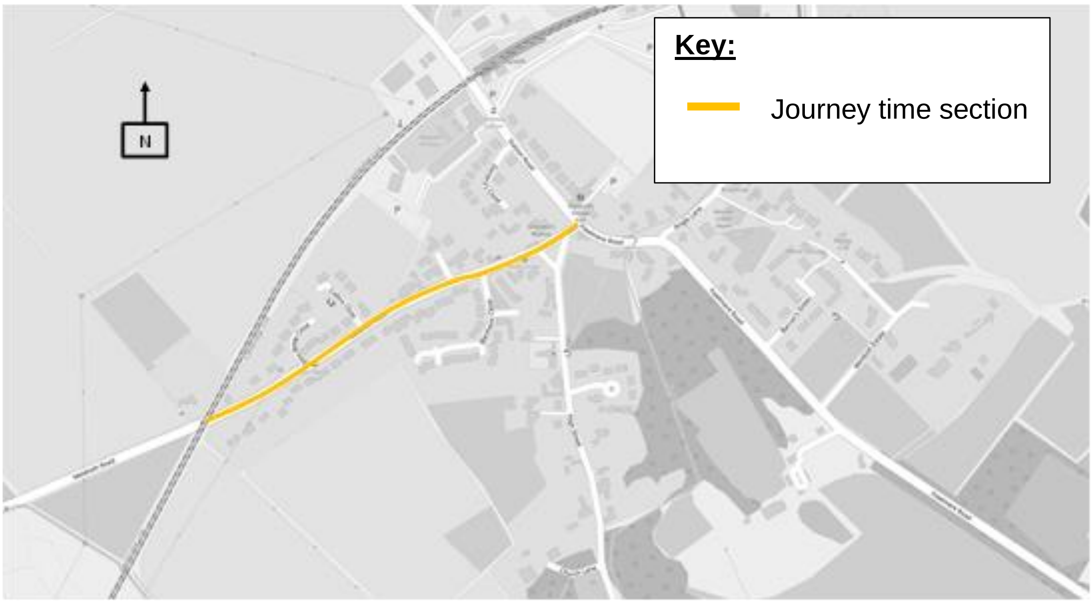

FIGURE 8.3: JOURNEY TIME ROUTE

Journey Time (s)				
Direction	**Peak**	DN	DS	Diff.
EB	**AM**	46	48	2
EB	**PM**	46	48	2
WB	**AM**	47	112	65
WB	**PM**	46	91	46

TABLE 8.2: JOURNEY TIMES - MELDRETH

With the upgraded level crossing in place, the queue results show that there are modest increases in the average and maximum queue lengths. The highest increase is 52m, which is observed for the westbound direction in the AM peak. This equates to approximately 9 vehicles.

Queue Length (m)				
	AM		PM	
Direction	Max.	Avg.	Max.	Avg.
DN - Eastbound	18	4	10	3
DS - Eastbound	69	19	44	15
Diff.	52	15	34	11
DN - Westbound	10	3	13	4
DS - Westbound	40	12	51	15
Diff.	30	9	39	11

TABLE 8.3: QUEUE LENGTHS – MELDRETH

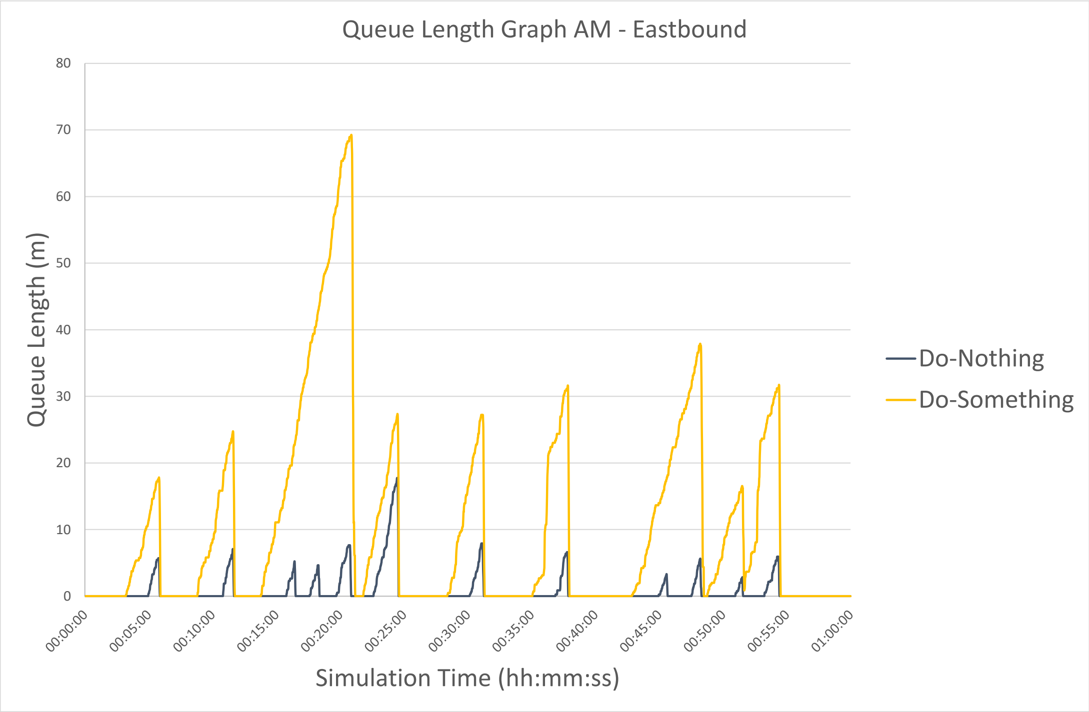

FIGURE 8.4: QUEUES – EASTBOUND - AM PEAK – MELDRETH

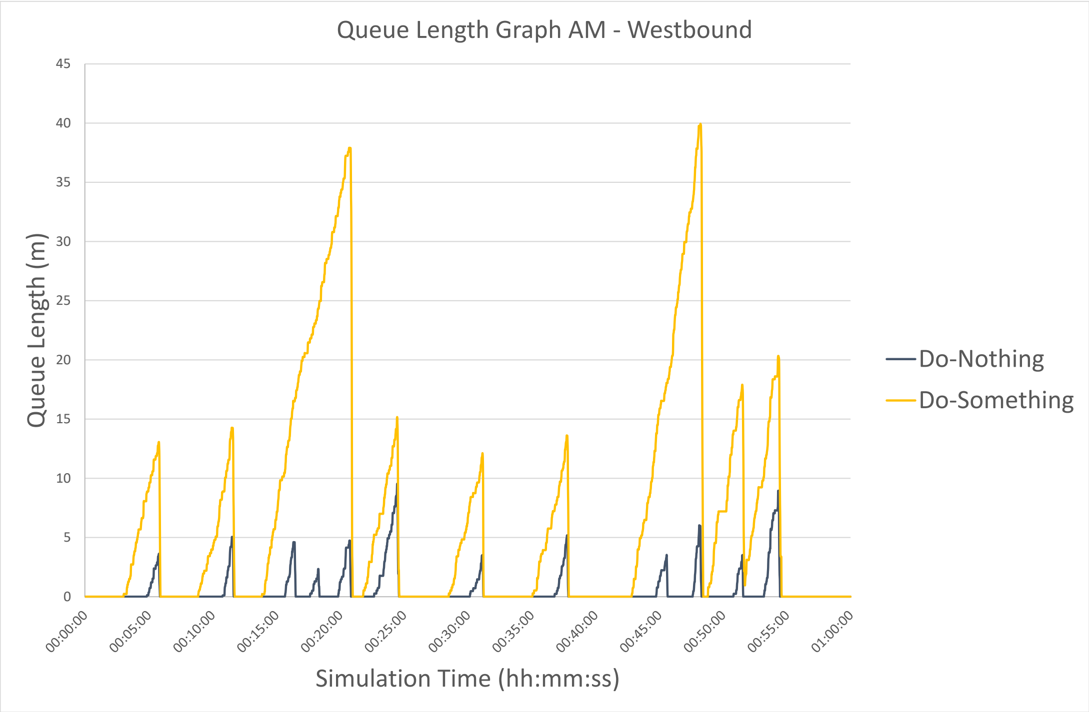

FIGURE 8.5: QUEUES – WESTBOUND – AM PEAK – MELDRETH

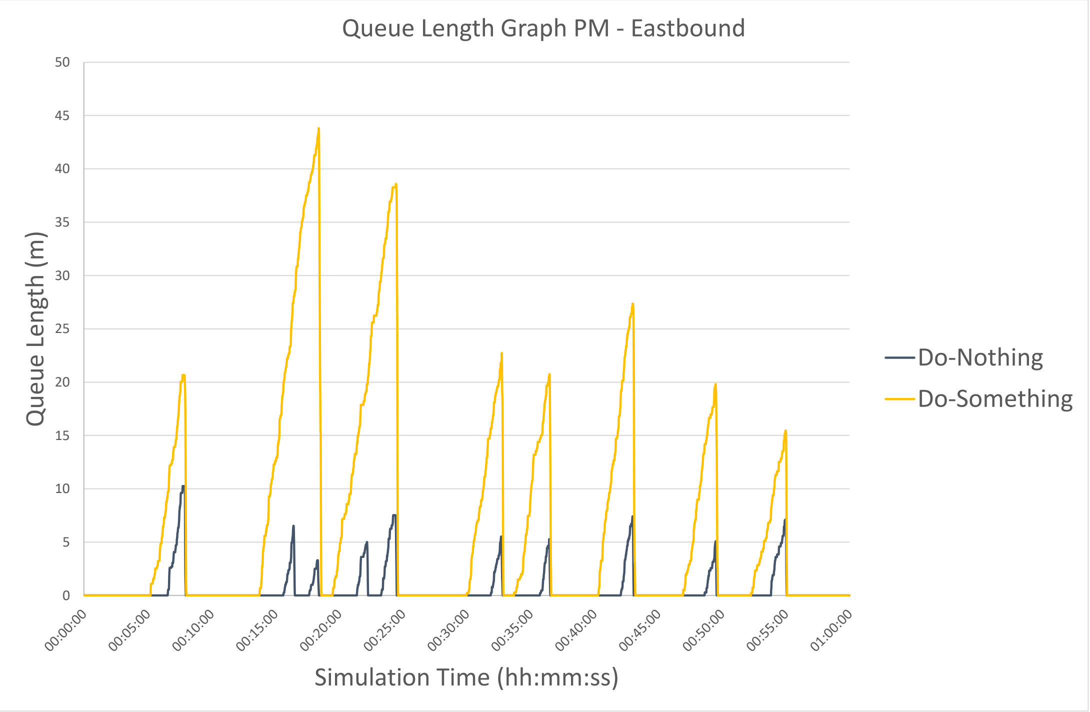

FIGURE 8.6: QUEUES – EASTBOUND – PM PEAK – MELDRETH

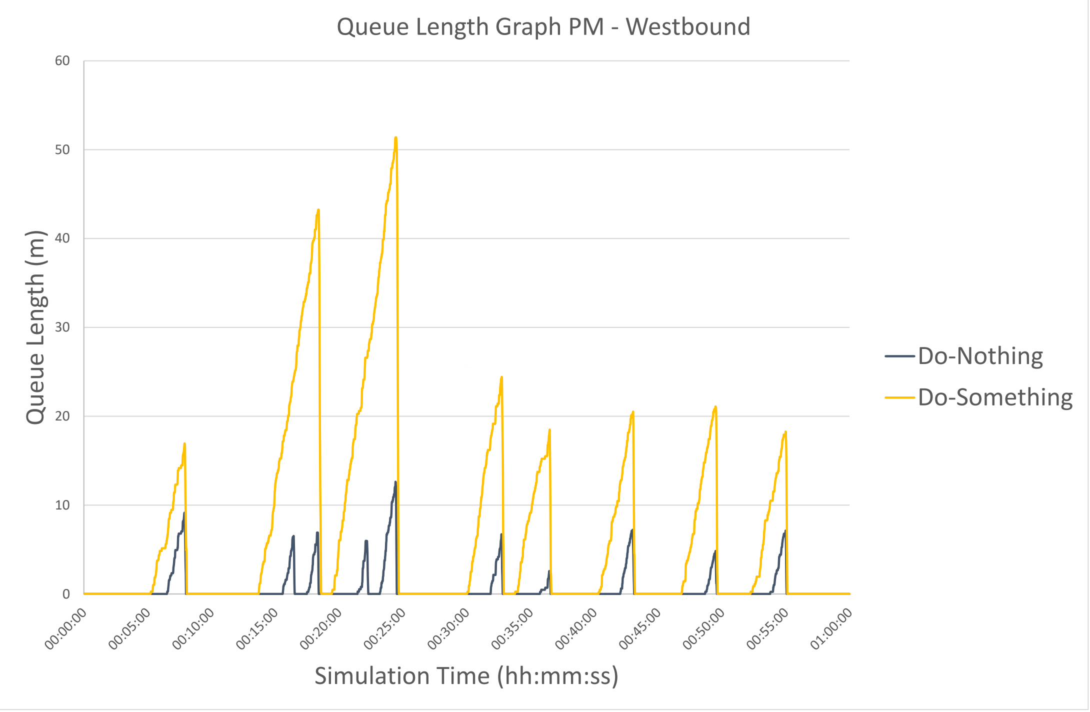

FIGURE 8.7: QUEUES – WESTBOUND – PM PEAK – MELDRETH

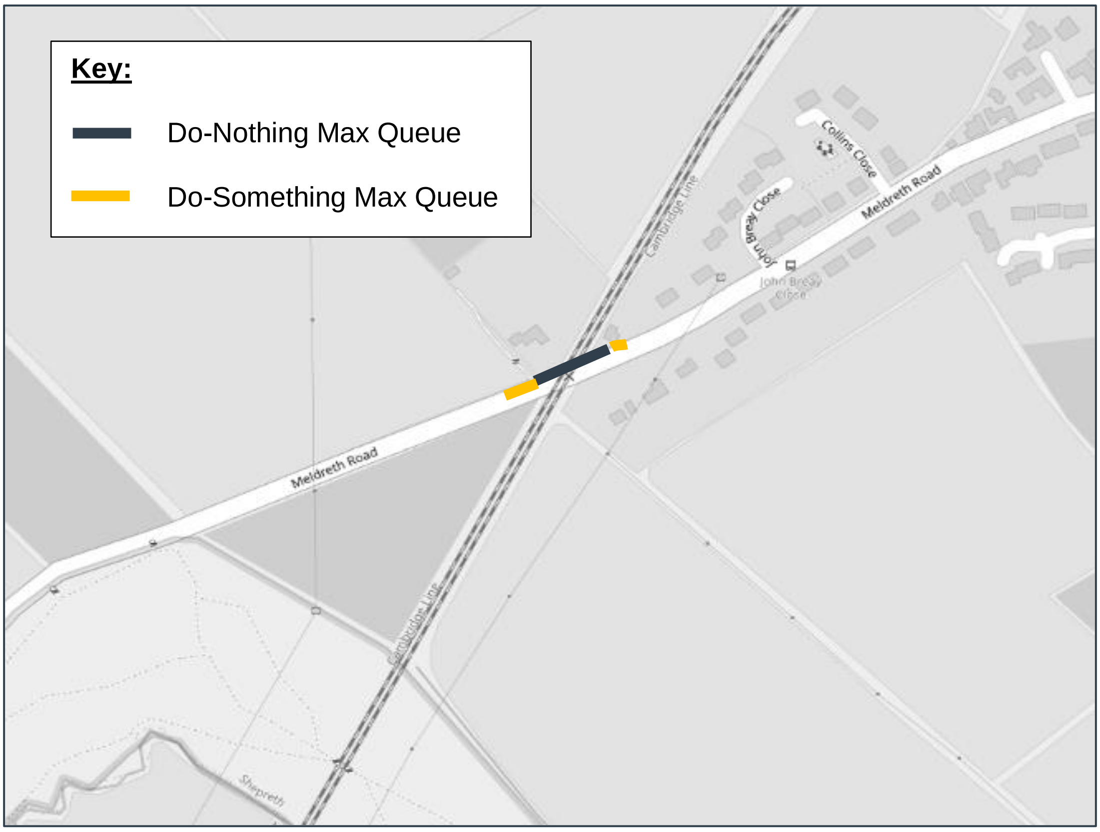

FIGURE 8.8: MAX QUEUE LENGTHS - MELDRETH

8.2 Conclusion

8.2.1 The proposed upgrade to the level crossing at Meldreth is shown to have no significant impacts on the network.

8.2.2 There are modest increases in the journey times for vehicles travelling westbound and there are some minor increases in queues in both directions.

9 CONCLUSION

9.1.1 Modelling Group, in partnership with Tracsis Traffic Data Ltd have been appointed by Network Rail to analyse traffic and congestion implications of upgrading 7 level crossings to MCB-OD2 / MCB-CCTV type operation, with a view to understanding the impacts the upgrades will have on the local communities and the wider transport network.

9.1.2 The results of the modelling is summarised in Table 9.1.

Level Crossing	Increase in Level Crossing Use	Traffic Flow (Veh.)- AM Peak	Traffic Flow (Veh.)- PM Peak	Ped Flow (Veh.)- AM Peak	Ped Flow (Veh.)- PM Peak	Max. Queue Length Increase (m)	Max. Journey Time Increase (s)	Max. Average Delay (s)
Milton Fen	+1	16	14	21	10	6	46	31
Waterbeach	+2	605	480	43	26	175	53	7.2
Dimmocks Cote	+4	403	369	0	0	244	116	103
Croxton	+2	522	481	0	0	80	20	18
Six Mile Bottom	+1	1109	1060	3	0	322	12	13
Dullingham	+1	53	40	4	0	-2	-18	-17
Meldreth	+2	110	114	4	0	52	65	27

TABLE 9.1: PERFORMANCE SUMMARY

9.1.3 The modelling results show that the impacts of the upgrades on Milton Fen, Croxton, Dullingham and Meldreth level crossings are minimal, with queue increase below 100m and average delays per vehicle below 60s.

9.1.4 The impact of the upgrades on the other level crossings (Waterbeach, Dimmocks Cote and Six Mile Bottom) includes an increase in queue lengths, ranging from 244m for Dimmocks Cote and 175m for Waterbeach, and average delay increases of up to 103 seconds for Dimmocks Cote. These results should be presented to the local authorities for further discussion on the impact to road users and the local road network.

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