

SKANSKA

Freedom Bridge Roundabout

Wisbech Access Study

August 2017

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Freedom Bridge Roundabout

Cambridgeshire County Council / Fenland District Council

August 2017

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Contents

1	Introduction	7
	Wisbech Access Study	7
	Operation of Freedom Bridge Roundabout	7
	Scheme Location	7
2	Existing Conditions	9
	Introduction	9
	Junction Turning Flows	9
	A1101 Freedom Bridge Approach	11
	B198 Lynn Road Approach	16
	A1101 Churchill Road Approach	20
	Nene Quay Approach	24
	Accident Data	28
	Land Ownership	31
	Flood Risk	32
	Environmental Issues	32
3	Development Proposals for Wisbech	34
	Introduction	34
	Urban Extensions	34
	Development Phasing	35
	Additional Development – Nene Waterfront and Port Area	37
	Development Growth – Impact on Freedom Bridge Roundabout	37
4	Option Development	39
	Introduction	39
	Options Devised for Freedom Bridge Roundabout	39
	Option FB 2	41
	Option FB 3	42
	FB Option 4	42
	Option FB 5	44
5	Option Assessment	48
	Introduction	48
	Modelling Assessment	48
	Modelled Scenarios	48
	Modelling Conclusions	48

6 Preferred Option – Concept Highway Design	50
Introduction.....	50
Preferred Option	50
Design Assumptions and Input Decisions	51
STATS Review	53
Road Safety Review	55
Scheme Cost Estimate	57
Land Acquisition and Demolition Costs.....	57
7 Summary	59

Figures

Figure 1.1: Wisbech Access Study Components.....	7
Figure 1.2: Scheme Location in Relation to Wisbech.....	8
Figure 1.3: Existing Scheme Location.....	8
Figure 2.1: Freedom Bridge Roundabout 12 Hour Traffic Count (07:00 – 19:00).....	9
Figure 2.2: Freedom Bridge Roundabout AM Peak Traffic Count (08:00 – 09:00)....	10
Figure 2.3: Freedom Bridge Roundabout PM Peak Traffic Count (17:00 -18:00).....	11
Figure 2.4: A1101 Freedom Bridge Queue Lengths AM Peak Hour (08:00 -09:00) ...	13
Figure 2.5: A1101 Freedom Bridge Queue Lengths PM Peak Hour (17:00 -18:00)....	13
Figure 2.6: A110 Freedom Bridge Approach Average Speed AM Peak Hour (08:00 - 09:00)	15
Figure 2.7: A1101 Freedom Bridge Approach Average Speed PM Peak Hour (17:00 - 18:00)	15
Figure 2.8: B198 Lynn Road Queue Lengths AM Peak Hour (08:00 -09:00)	17
Figure 2.9: B198 Lynn Road Queue Lengths PM Peak Hour (17:00 -18:00)	17
Figure 2.10: B198 Lynn Road Approach Average Speed AM Peak Hour (08:00 - 09:00)	19
Figure 2.11: B198 Lynn Road Approach Average Speed PM Peak Hour (17:00 - 18:00)	19
Figure 2.12: A1101 Churchill Road Queue Lengths AM Peak Hour (08:00 -09:00) ...	21
Figure 2.13: A1101 Churchill Road Queue Lengths PM Peak Hour (08:00 -09:00)....	21
Figure 2.14: A1101 Churchill Road Approach Average Speed AM Peak Hour (08:00 - 09:00)	23
Figure 2.15: A1101 Churchill Road Approach Average Speed PM Peak Hour (17:00 - 18:00)	23
Figure 2.16: B198 Nene Quay Queue Lengths AM Peak Hour (08:00 -09:00)	25
Figure 2.17: B198 Nene Quay Queue Lengths PM Peak Hour (17:00 -18:00)	25
Figure 2.18: B198 Nene Quay Approach Average Speed AM Peak Hour (08:00 - 09:00)	27
Figure 2.19: B198 Nene Quay Approach Average Speed PM Peak Hour (17:00 - 18:00)	27
Figure 2.20: Accident Plot Part 1	29
Figure 2.21: Accident Plot Part 2	30
Figure 2.22: Highway Boundary Plan for Freedom Bridge Roundabout.....	31
Figure 2.23: Land Ownership Surrounding Freedom Bridge Roundabout	31
Figure 2.24: Flood Risk for Freedom Bridge Roundabout	32
Figure 2.25: Ecological Issue (Habitats) to consider around Freedom Bridge Roundabout.....	33
Figure 3.1: Urban Extensions Proposed for Wisbech	35
Figure 4.1: Option FB 4 Layout	43
Figure 4.2: Option FB 5 Layout	45
Figure 4.3: Option FB 5B Layout.....	47
Figure 6.1: Option FB 5A Concept Highway Design.....	52
Figure 6.2: Freedom Bridge Roundabout Option FB 5b STAT Plan	54

Tables

Table 2.1: Maximum and Average Queue Lengths on the A1101 Freedom Bridge Approach to FBR.....	12
Table 2.2: Journey Times and Delay for the A1101 Freedom Bridge Approach to FBR	14
Table 2.3: Maximum and Average Queue Lengths on the B198 Lynn Road Approach to FBR.....	16
Table 2.4: Journey Times and Delay for the A1101 Freedom Bridge Approach to FBR	18
Table 2.5: Maximum and Average Queue Lengths on the A1101 Churchill Road Approach to FBR.....	20
Table 2.6: Journey Times and Delay for the A1101 Freedom Bridge Approach to FBR	22
Table 2.7: Maximum and Average Queue Lengths on the B198 Nene Quay Approach to FBR.....	24
Table 2.8: Journey Times and Delay for the B198 Nene Quay to FBR.....	26
Table 2.9: Accident Summary	28
Table 3.1: Development Phasing for Wisbech Urban Extensions	36
Table 3.2: Infrastructure Phasing for Wisbech Urban Extensions.....	36
Table 3.3: Traffic Flow Growth at Freedom Bridge Roundabout – AM Peak Hour....	37
Table 3.4: Traffic Flow Growth at Freedom Bridge Roundabout – PM Peak Hour....	37
Table 4.1: Workshop Conclusions	40
Table 4.2: Option FB 2 Workshop Discussion	41
Table 4.3: Option FB 3 Workshop Discussion	42
Table 4.4: Option FB 4 Workshop Discussion	44
Table 4.5: Option FB 5 Workshop Discussion	46
Table 5.1: Option FB 5B Assessment Conclusions	49
Table 6.1: STATs Present in Scheme Area.....	53
Table 6.2: Road Safety Review for Freedom Bridge Roundabout	55
Table 6.3: Option FB 5A Cost Estimate	58

1 Introduction

Wisbech Access Study

This assessment forms part of the first phase of the Wisbech Access Study. The Wisbech Access Study consists of two distinct phases. The first phase is a series of individual scheme assessments, and the second phase of the study consists of a packaging assessment, as shown in **Error! Reference source not found.1** beneath. Note that this assessment is highlighted in green to demonstrate its relationship to the wider study.

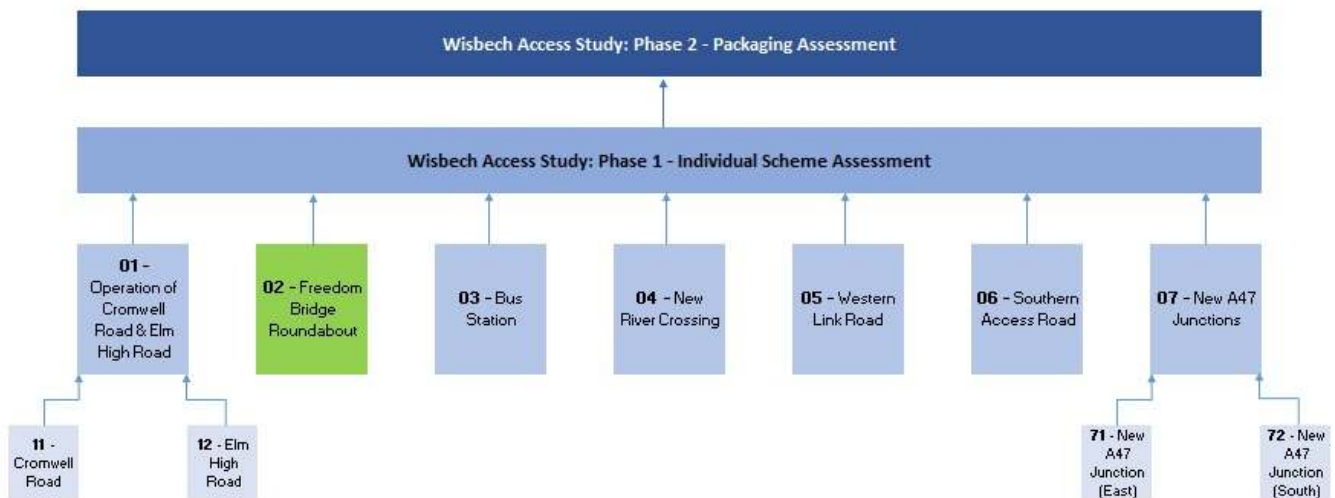


Figure 1.1: Wisbech Access Study Components

Operation of Freedom Bridge Roundabout

Freedom Bridge Roundabout is one of nine individual scheme areas included within the wider Wisbech Access Study. Freedom Bridge roundabout is a pinch point junction within the town centre for vehicles travelling via Wisbech from the A17 (Lincolnshire) and the A47 (Cambridgeshire and Norfolk). This study focuses on improving the operation of the roundabout to accommodate proposed development traffic (as set out within the Local Plan 2014), through a series of junction improvements.

The inclusion of Freedom Bridge Roundabout within the Wisbech Access Study is primarily to address existing peak hour congestion and impact of bottlenecking, and to mitigate the impact of future development traffic, which is predicted to have a significant impact on the junction.

Scheme Location

Freedom Bridge Roundabout is a five arm roundabout located to the north of the town centre. The roundabout is positioned parallel to the River Nene, with the A1101 Freedom Bridge approach facilitating one of two river crossings alongside Town Bridge.

The roundabout provides primary access for the Horsefair Bus Station, Albion House (Job Centre), Nene Waterfront Regeneration Area (via Bedford Street) and the Petrol Station. Additional features on the roundabout include a signalised pedestrian crossing across the A1101 Freedom Bridge approach and informal crossings over Churchill Road and Nene Quay.

Figure 1.2 on the following page shows the roundabout in relation to Wisbech, whilst Figure 1.3 highlights the existing junction layout.

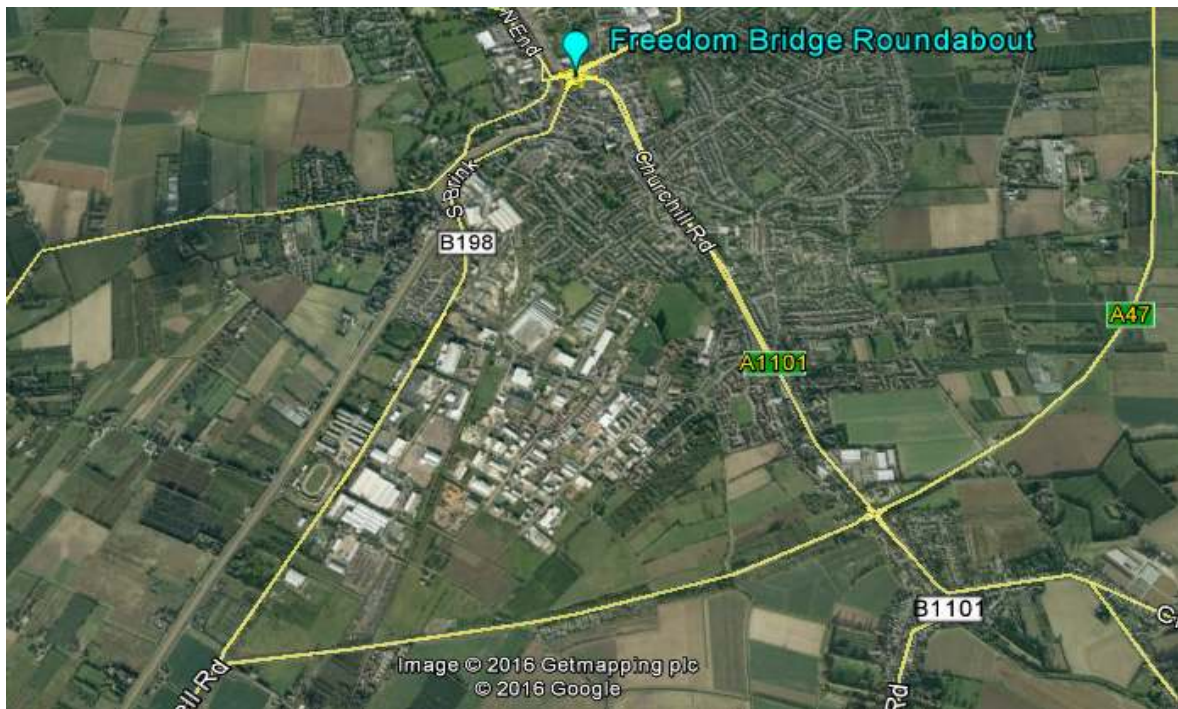


Figure 1.2: Scheme Location in Relation to Wisbech



Figure 1.3: Existing Scheme Location

2 Existing Conditions

Introduction

Existing conditions of Freedom Bridge Roundabout are considered within this chapter, with regards to the approaches with the greatest traffic flows including the A1101 Freedom Bridge, B198 Lynn Road, A1101 Churchill Road and B198 Nene Quay.

Additional conditions reported within this chapter include:

- Accident Data;
- Land Ownership;
- Flood Risk; and,
- Environmental Considerations.

Each of the roundabout approaches mentioned above will be discussed in turn with regards to traffic flow, queue lengths, journey times, delay and average speeds.

Junction Turning Flows

Turning counts were undertaken at Freedom Bridge Roundabout on the 14th January 2016. The survey recorded vehicle turning movements at the junction over a 12-hour period between 07:00 -19:00. The day of survey was considered typical, with no incidents reported that might affect the observed turning movements.

The results from the surveys are shown beneath in Figures 2.1 to 2.3 for the 12 hour period, AM (08:00 – 09:00) and PM (17:00 – 19:00) peak hours. The survey data shows the number of vehicles passing through Freedom Bridge Roundabout on a daily basis.

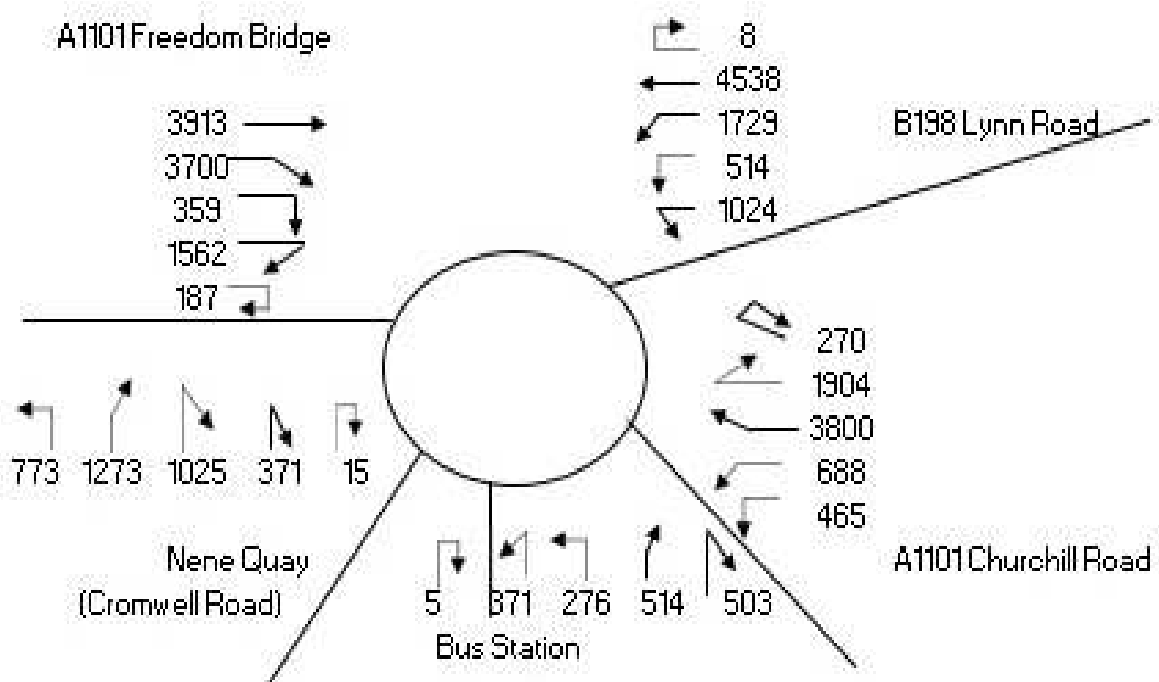


Figure 2.1: Freedom Bridge Roundabout 12 Hour Traffic Count (07:00 – 19:00)

Figure 2.1 shows the two primary traffic flows through Freedom Bridge Roundabout over a 12 hour period are from:

- The A1101 Freedom Bridge to the B198 Lynn Road (and vice versa), and;
- The A1101 Freedom Bridge to the A1101 Churchill Road (and vice versa).

Traffic flows on the latter north to south axis (Churchill Road / A1101 Freedom Bridge) appears well balanced, with 3800 vehicles travelling northbound and 3700 vehicles travelling southbound over a 12 hour period.

Results for the AM peak hour are shown below.

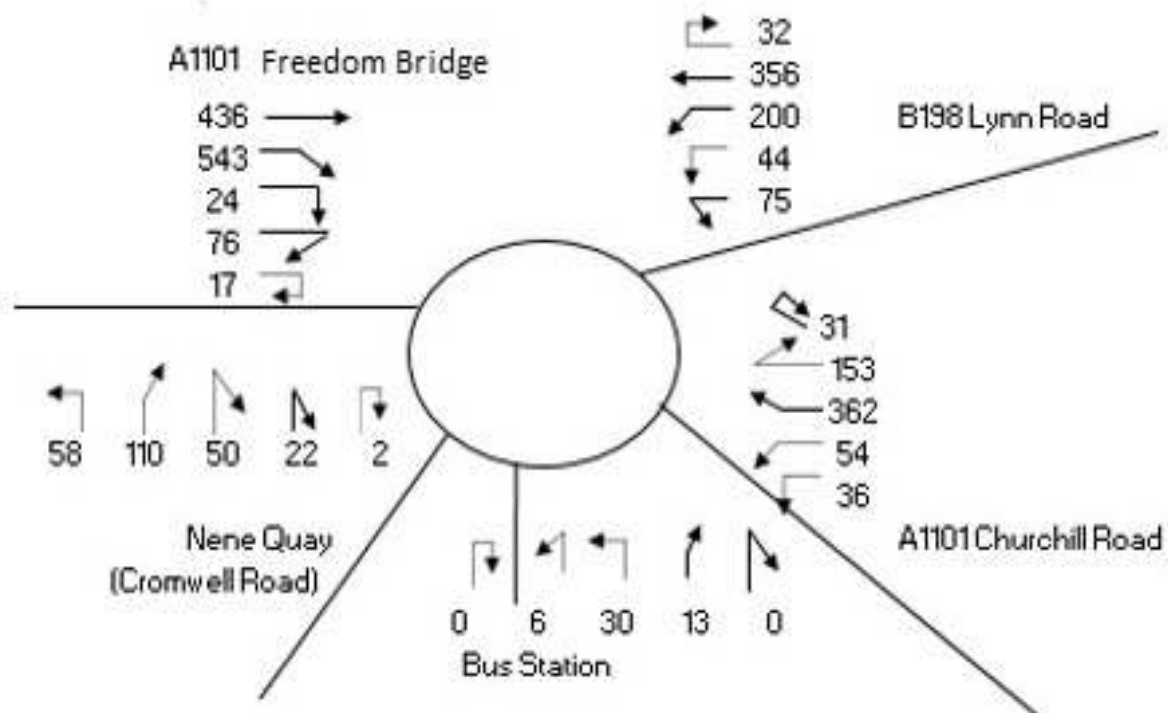


Figure 2.2: Freedom Bridge Roundabout AM Peak Traffic Count (08:00 – 09:00)

The A1101 Freedom Bridge is the busiest approach during the AM peak hour, with the heaviest movements from this approach being southbound along Churchill Road (543 vehicles) and eastbound to the B198 Lynn Road (436 vehicles).

Vehicles travelling to the west of the river from both the B198 Lynn Road and the A1101 Churchill Road appear well balanced, with 356 vehicles travelling westbound from Lynn Road and 362 vehicles northbound from Churchill Road.

Nene Quay and the Bus Station are the least heavily used approaches during this period. A total of 242 vehicles were counted on Nene Quay within the hour, the majority of which (110) continued travelling beyond Wisbech via Lynn Road. A total of 49 vehicles were counted on the Horsefair approach.

The PM peak survey results are discussed on the following page.

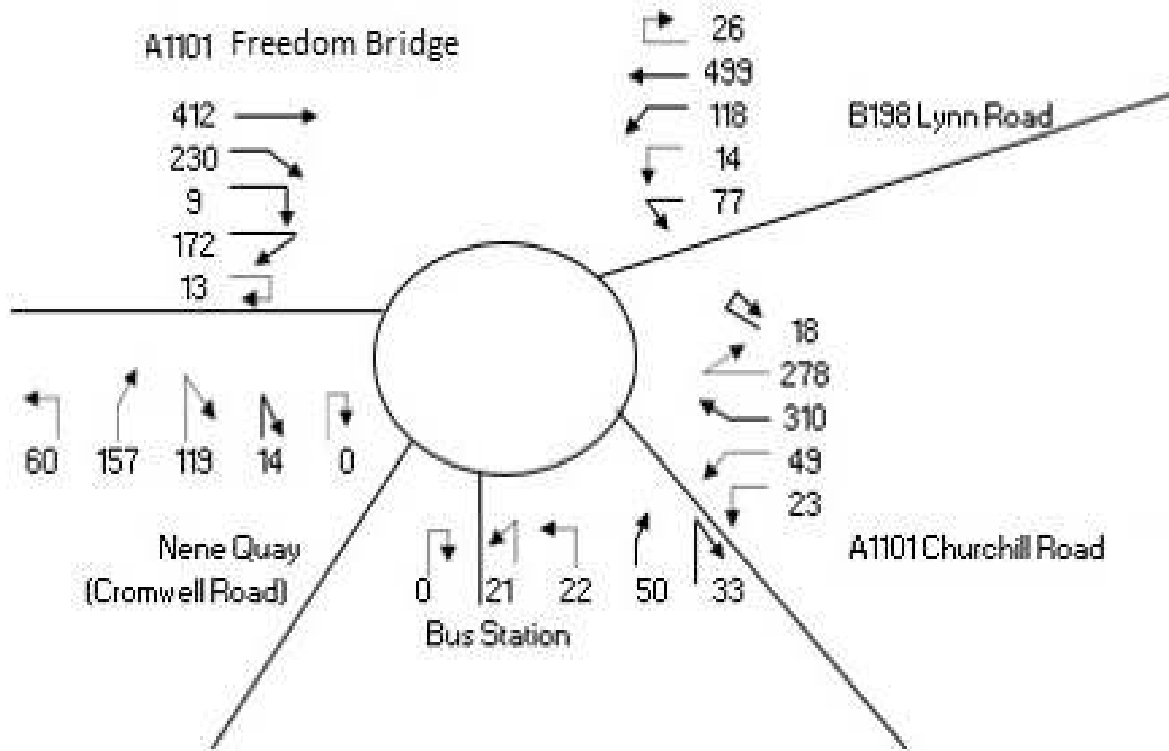


Figure 2.3: Freedom Bridge Roundabout PM Peak Traffic Count (17:00 -18:00)

The heaviest turning movement during the PM peak hour is from the B198 Lynn Road to the A1101 Freedom Bridge, with 499 vehicles making this movement. Turning counts for the reverse of this movement (A1101 Freedom Bridge to Lynn Road), remains high at 412 vehicles, however this total is slightly lower than the AM peak.

Turning counts between the A1101 Freedom Bridge/Churchill Road are lower during this period when compared to the AM peak, with 230 vehicles travelling southbound from the west of the river and 310 vehicles travelling northbound via Churchill Road.

Nene Quay appears to have an increased traffic flow during the PM peak hour, with the eastbound movement to Lynn Road (157) remaining the dominant flow. Vehicles travelling to Churchill Road during this period is over doubled when compared to the AM peak.

The Bus Station is the least heavily used approach during this period, however sees an increase in traffic flow with a total of 126 vehicles using this approach.

A1101 Freedom Bridge Approach

Queue Lengths

Queue length surveys were undertaken at Freedom Bridge Roundabout on the 14th January 2016, over a 12 hour period (07:00 – 19:00). The day of survey was considered typical, with no incidents reported for 5 of the approaches. However an incident was reported in regards to a camera fault on Lynn Road, resulting in queue lengths recorded being lower than expected.

Please note, for these surveys a queue is defined as vehicles at a junction which are stationary or which have slowed to walking speed or less.

Table 2.1 and Figures 2.4 and 2.5 beneath show the maximum and average queue lengths observed for the A1101 Freedom Bridge approach to the roundabout. Data is presented for the peak hours, with data representative of both the nearside and offside lanes.

Table 2.1: Maximum and Average Queue Lengths on the A1101 Freedom Bridge Approach to FBR

Time Segment	AM		Time Segment	PM	
	Average (m)	Max (m)		Average (m)	Max (m)
08:00	0	0	17:00	0	0
08:05	0	0	17:05	0	0
08:10	7.5	15	17:10	10	15
08:15	2.5	5	17:15	2.5	5
08:20	0	0	17:20	35	40
08:25	22.5	35	17:25	0	0
08:30	0	0	17:30	5	10
08:35	7.5	10	17:35	0	0
08:40	0	0	17:40	0	0
08:45	15	30	17:45	5	10
08:50	0	0	17:50	0	0
08:55	32.5	60	17:55	5	5

The data shows that the queues on the A1101 are fairly similar across peak hours. However, the greatest maximum queue length recorded is 60 metres which occurs during the AM peak hour, compared to a high of 40 metres in the PM peak hour.

Greater queue lengths recorded during the AM peak hour reflects traffic counts displayed within Figures 2.2 and 2.3, whereby a total of 1,087 vehicles originate from the A1101 Freedom Bridge approach during the AM peak hour which decreases to 836 vehicles during the PM peak hour.

Figures 2.4 and 2.5 on the following page shows this data for both peak hours, reported in 5 minute intervals.

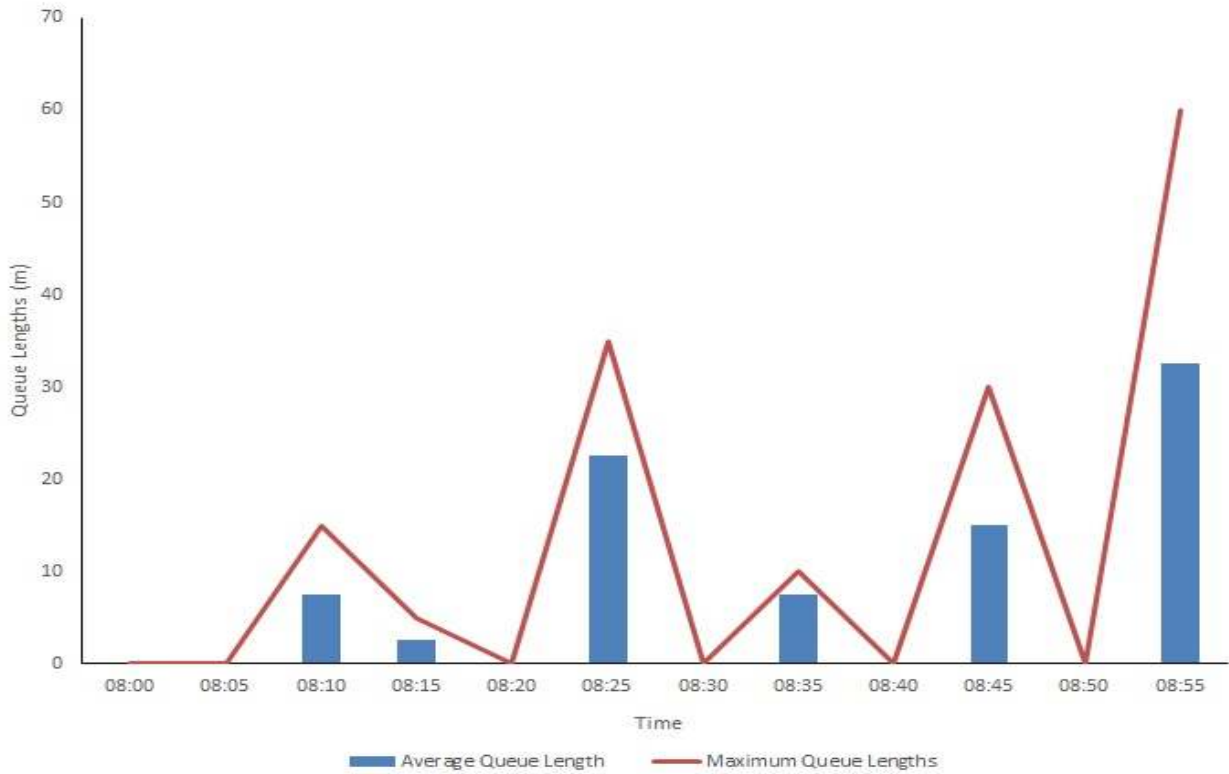


Figure 2.4: A1101 Freedom Bridge Queue Lengths AM Peak Hour (08:00 -09:00)

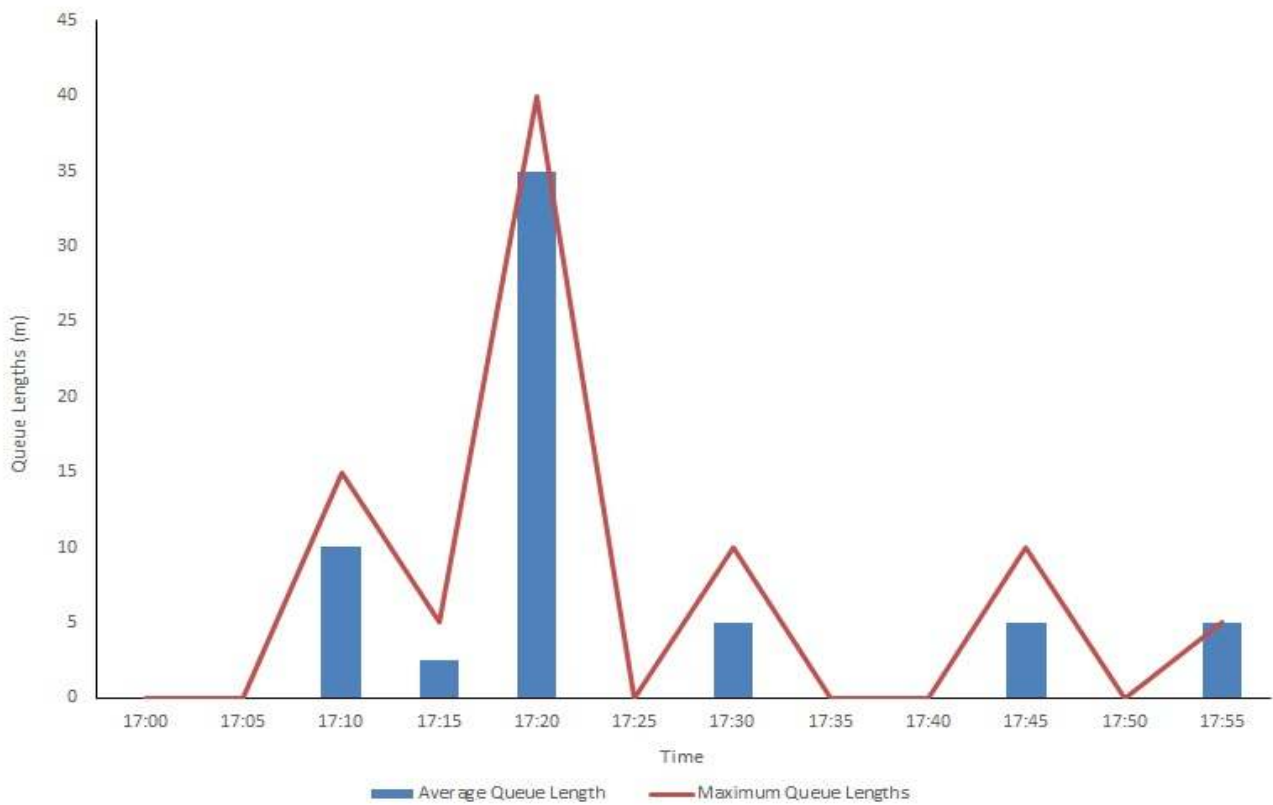


Figure 2.5: A1101 Freedom Bridge Queue Lengths PM Peak Hour (17:00 -18:00)

Journey Times and Delay

Satellite Navigation (TomTom) data has been used to assess journey times and delay on the A1101 Freedom Bridge approach to Freedom Bridge Roundabout.

The TomTom dataset is based on information collected between 2nd November 2015 and 22nd January 2016, excluding weekends, bank holidays and the Christmas period. Time periods selected to assess journey time and delay include:

- Free Flow – between hours of 0:00 and 05:00;
- AM Peak – between hours of 08:00 and 09:00; and,
- PM Peak – between hours of 17:00 and 18:00.

Within the TomTom dataset the carriageway is divided into multiple sections called segments. In order to compare journey times and calculate delay, road segments have been totalled providing an average travel time for the length of the corridor.

To calculate delay, the average travel time for the Free Flow period has been used as the base measurement as it represents conditions of unobstructed travel. The additional travel time (beyond that recorded in the Free Flow period) for each of the peak hours is then taken as the delay, as shown in the equation below:

$$\text{AM (or PM) Average Travel Time (s)} - \text{Free Flow Average Travel Time (s)} = \text{Delay (s)}$$

The following tables highlight the journey time and delay for the Freedom Bridge approach to Freedom Bridge Roundabout. Segments used within this assessment total 149.6 metres.

Table 2.2: Journey Times and Delay for the A1101 Freedom Bridge Approach to FBR

A1101 Freedom Bridge		Average Travel Time (Seconds)	Average Delay (Seconds)
Free Flow	(00:00 – 06:00)	24.7	N/A
AM Peak	(08:00 – 09:00)	44.5	19.8
PM Peak	(17:00 – 18:00)	89.5	64.8

As shown in Table 2.2 the Free Flow time when approaching the roundabout from this approach is 24 seconds over a distance of 149 metres (from the west gyratory to the stop line).

Delay is experienced in both the AM and PM peak hours, however is more prevalent in the PM peak hour, with 64 seconds (1 minute 4 seconds) added to journey times compared to 19 seconds in the AM peak hour.

Average Speeds

Average speeds for the A1101 Freedom Bridge approach to Freedom Bridge Roundabout have been extracted from the same TomTom data set described above. Figures 2.6 and 2.7 on the following page highlight the average speeds of this approach for both the AM and PM peak hours.

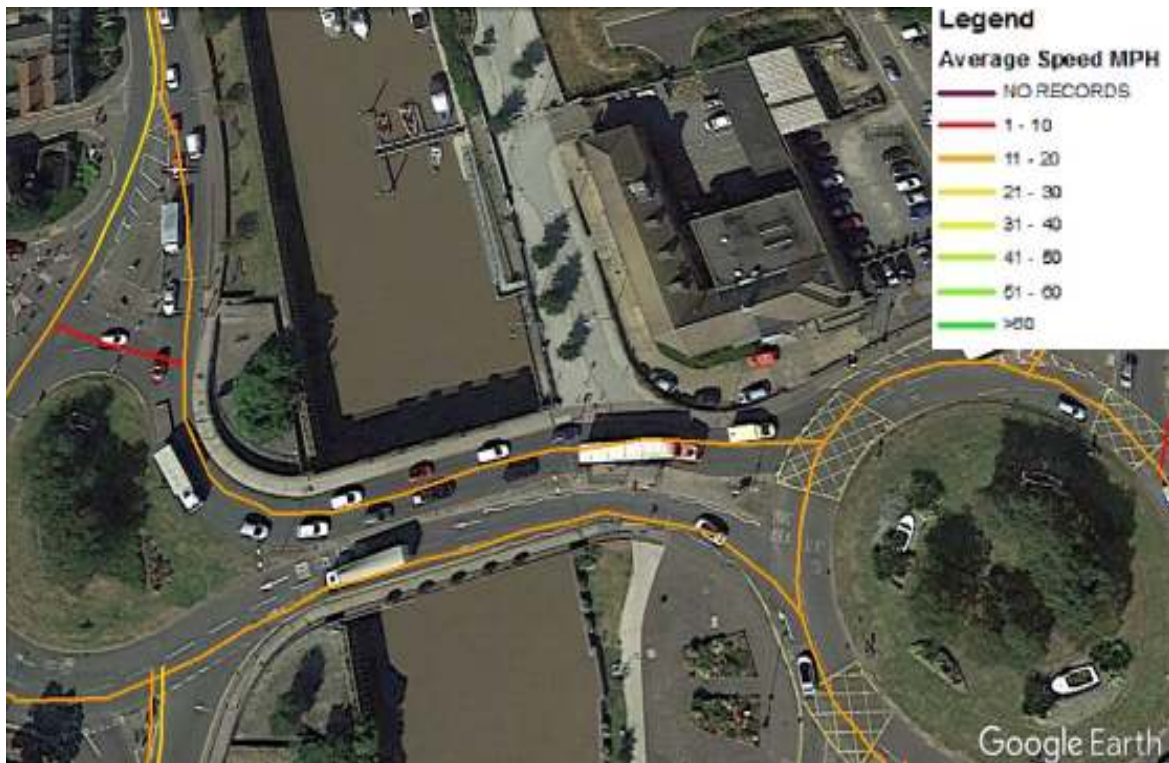


Figure 2.6: A110 Freedom Bridge Approach Average Speed AM Peak Hour (08:00 - 09:00)

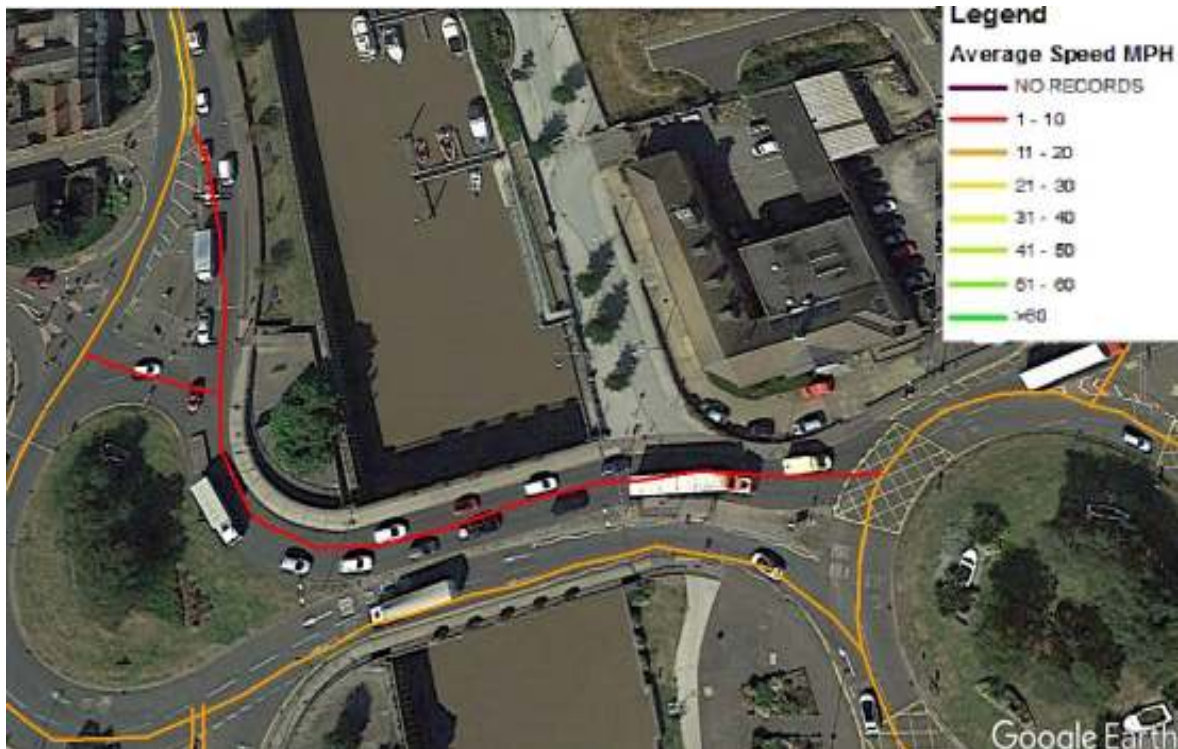


Figure 2.7: A1101 Freedom Bridge Approach Average Speed PM Peak Hour (17:00 - 18:00)

The average speed on this approach during the AM peak hour is shown to be between 11 -20 mph, which decreases to between 1- 10 mph in the PM peak hour.

B198 Lynn Road Approach

Queue Lengths

Queue length data for the Lynn Road approach to Freedom Bridge Roundabout has been extracted from the same survey described above. A camera fault was reported for this approach during the day of the survey, so despite data being collected and presented below, the expectation of queue lengths in this area is much greater.

Table 2.3 beneath and Figures 2.8 and 2.9 show the maximum and average queue lengths recorded for this approach across the AM and PM peak hours.

Table 2.3: Maximum and Average Queue Lengths on the B198 Lynn Road Approach to FBR

Time Segment	AM		Time Segment	PM	
	Average (m)	Max (m)		Average (m)	Max (m)
08:00	7.5	10	17:00	10	20
08:05	2.5	5	17:05	22.5	40
08:10	5	10	17:10	0	0
08:15	12.5	25	17:15	7.5	15
08:20	7.5	15	17:20	0	0
08:25	0	0	17:25	12.5	20
08:30	17.5	35	17:30	0	0
08:35	20	35	17:35	0	0
08:40	0	0	17:40	5	5
08:45	20	35	17:45	0	0
08:50	7.5	15	17:50	0	0
08:55	12.5	25	17:55	0	0

The data shows that the greatest maximum queue length recorded for this approach is 40 metres which is recorded during the PM peak hour. Despite the PM peak having the greatest queue length, queue length during the AM peak appear to be more continuous across the hour period, with only two 5 minute intervals recording queue lengths of zero.

Figures 2.8 and 2.9 on the following page shows this data for both peak hours, reported in 5 minute intervals.

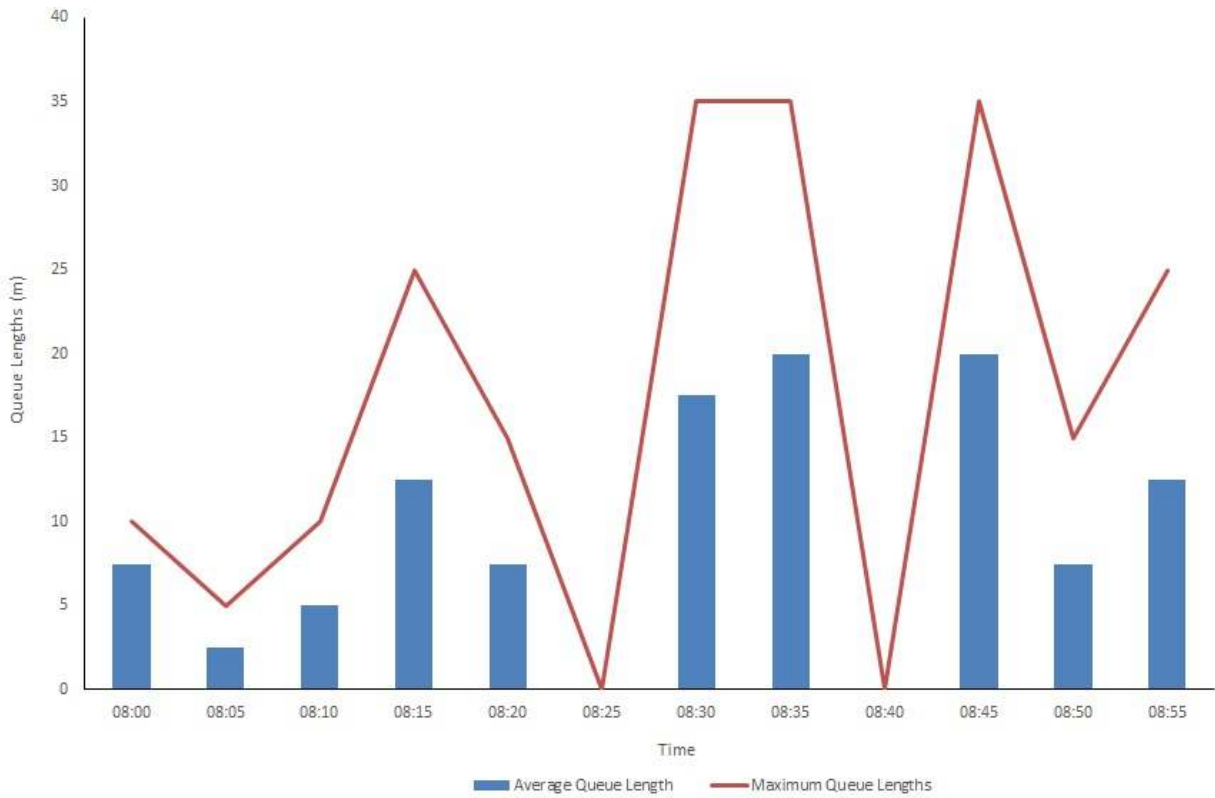


Figure 2.8: B198 Lynn Road Queue Lengths AM Peak Hour (08:00 -09:00)

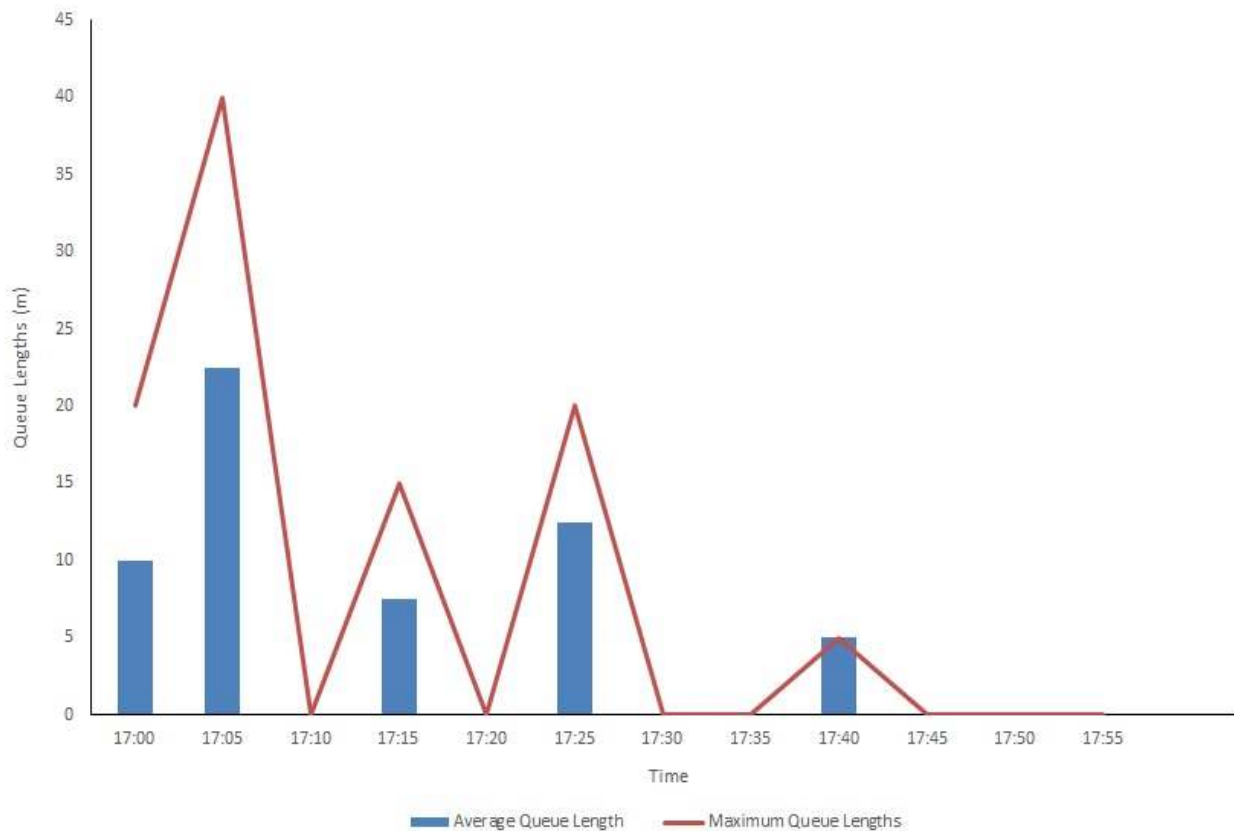


Figure 2.9: B198 Lynn Road Queue Lengths PM Peak Hour (17:00 -18:00)

Journey Times and Delay

Journey times and delay for the Lynn Road approach to Freedom Bridge Roundabout have been assessed using the same TomTom data set described within this chapter. Table 2.4 beneath highlights the journey time and delay results for the Lynn Road approach to the roundabout across the AM and PM peak hours.

Segments used within this assessment total 147.5 metres from the stop line, reaching De Havilland Road junction.

Table 2.4: Journey Times and Delay for the A1101 Freedom Bridge Approach to FBR

B198 Lynn Road		Average Travel Time (Seconds)	Average Delay (Seconds)
Free Flow	(00:00 – 06:00)	29.4	N/A
AM Peak	(08:00 – 09:00)	65.9	36.4
PM Peak	(17:00 – 18:00)	62.9	33.4

Table 2.4 above shows the Free Flow time when approaching the roundabout from Lynn Road is 29.4 seconds.

Delay on this approach appears similar across both peak hours, with 36 seconds added to journey times in the AM peak hour, and 33 seconds in the PM peak hour. This balance in delay across peak hours is reflective of balanced traffic flows outlined in Figures 2.2 and 2.3, which shows a total of 707 vehicles originate from Lynn Road in the morning peak hour, and 734 vehicles originate from this approach during the PM peak hour.

Average Speeds

Average speeds for the B198 Lynn Road approach to Freedom Bridge Roundabout have been extracted from the same TomTom data set described above. Figures 2.10 and 2.11 on the following page highlight the average speeds of this approach for both the AM and PM peak hours.

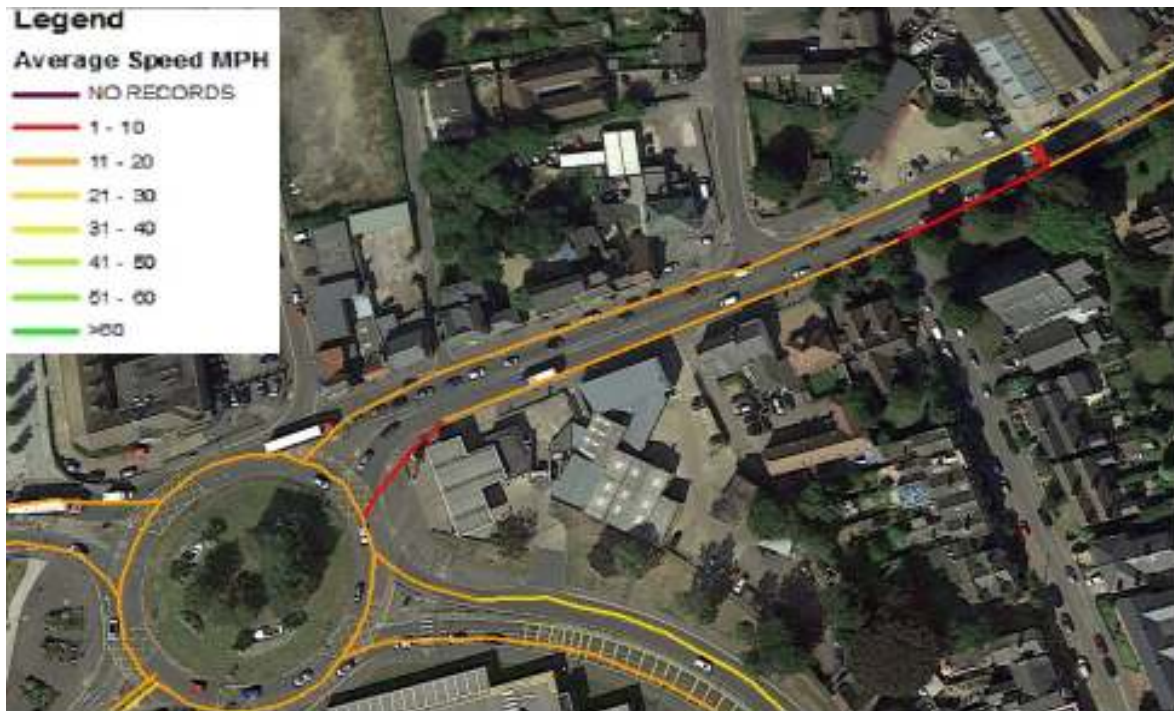


Figure 2.10: B198 Lynn Road Approach Average Speed AM Peak Hour (08:00 - 09:00)

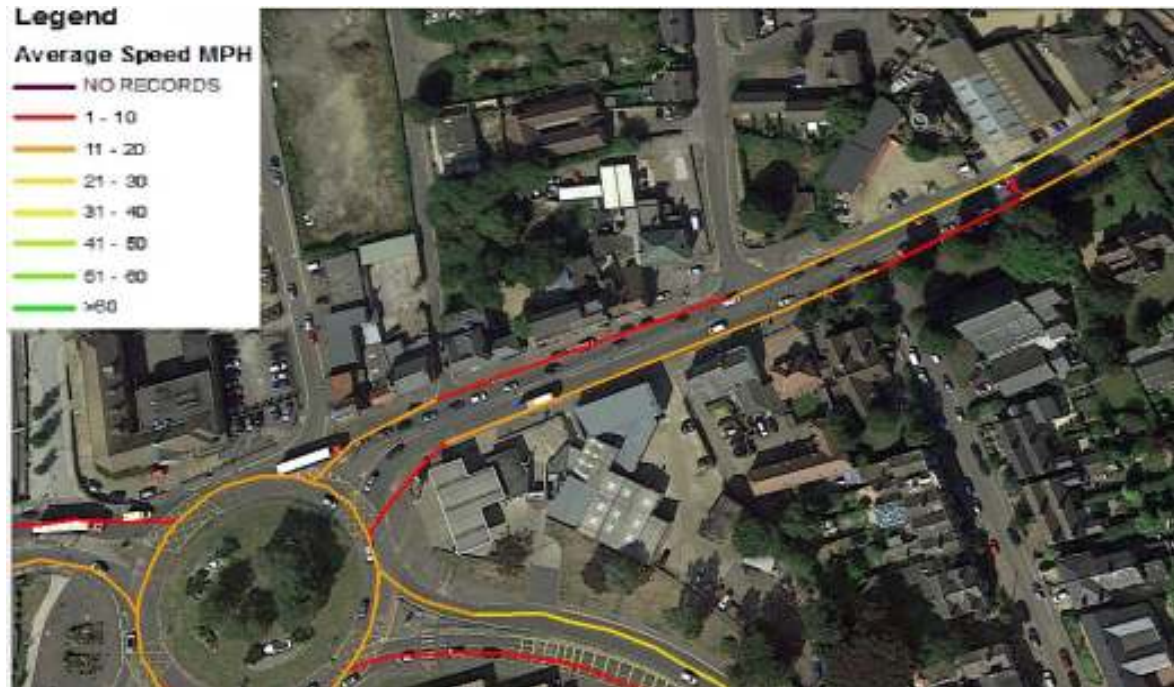


Figure 2.11: B198 Lynn Road Approach Average Speed PM Peak Hour (17:00 - 18:00)

Figure 2.10 and 2.11 shows a similar pattern in relation to Average speeds for this approach across the peak hours. Immediately at the stop line the average speed is recorded between 1- 10 mph, however increases to between 11- 20 mph when east of the petrol station.

A1101 Churchill Road Approach

Queue Lengths

Queue length data for the Churchill Road approach to Freedom Bridge Roundabout has been extracted from the same survey described above. Table 2.5 beneath and Figures 2.12 and 2.13 show the maximum and average queue lengths recorded for this approach across the AM and PM peak hours.

Table 2.5: Maximum and Average Queue Lengths on the A1101 Churchill Road Approach to FBR

Time Segment	AM		Time Segment	PM	
	Average (m)	Max (m)		Average (m)	Max (m)
08:00	5	10	17:00	12.5	25
08:05	0	0	17:05	17.5	35
08:10	12.5	20	17:10	47.5	55
08:15	25	50	17:15	75	75
08:20	17.5	25	17:20	2.5	5
08:25	12.5	20	17:25	17.5	20
08:30	17.5	35	17:30	5	10
08:35	0	0	17:35	0	0
08:40	2.5	5	17:40	0	0
08:45	10	10	17:45	0	0
08:50	20	40	17:50	0	0
08:55	25	45	17:55	0	0

The data shows that the greatest maximum queue length recorded for this approach is 75 metres which is recorded during the PM peak hour, compared to the maximum queue of 50 metres during the AM peak hour.

Greater queue lengths recorded in the PM peak are supported by findings indicated within traffic counts (Figure 2.2 and 2.3), which highlight a greater volume of traffic originating from this approach between 17:00 -18:00.

Despite the PM peak having the greatest queue length, queue length during the AM peak appear to be more continuous across the hour period, with only two 5 minute intervals recording queue lengths of zero. In comparison queue lengths during the PM peak occur between 17:00 – 17:30, thereafter traffic is shown to remain free flowing.

Figures 2.12 and 2.13 on the following page shows this data for both peak hours, reported in 5 minute intervals.

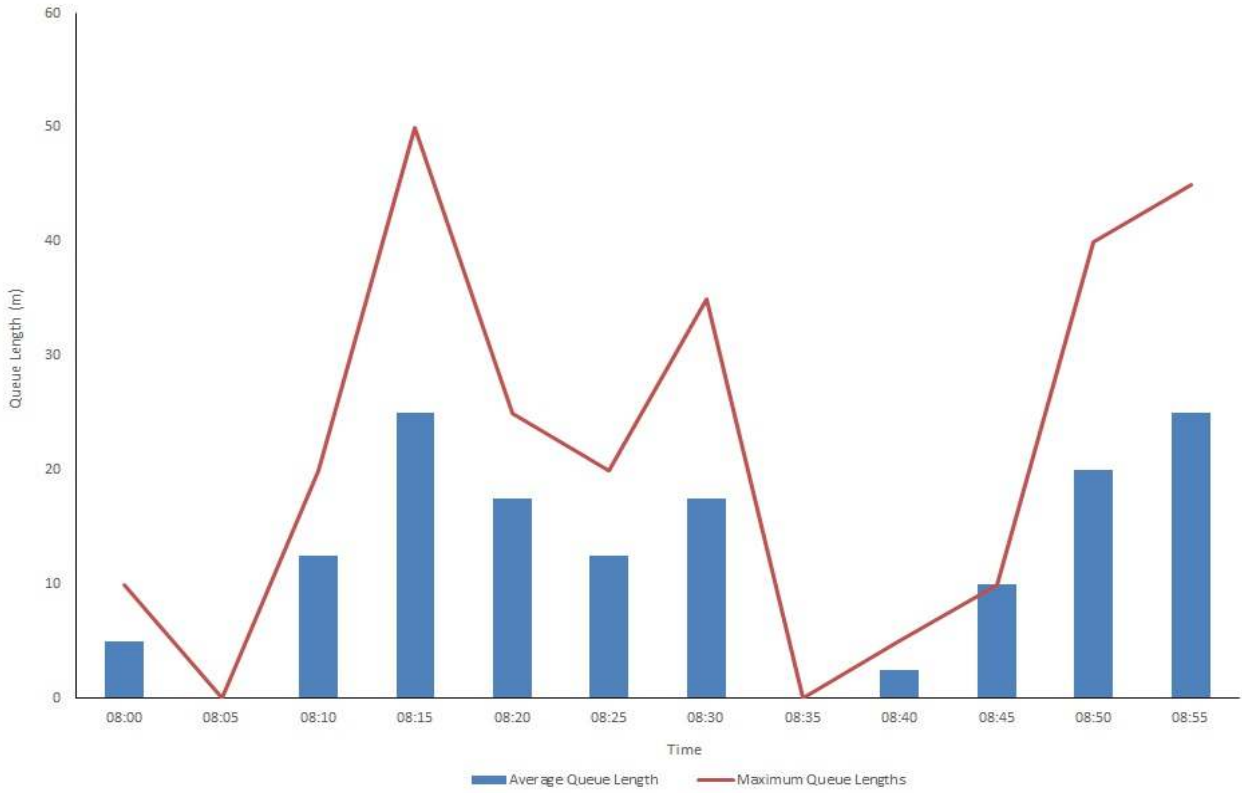


Figure 2.12: A1101 Churchill Road Queue Lengths AM Peak Hour (08:00 -09:00)

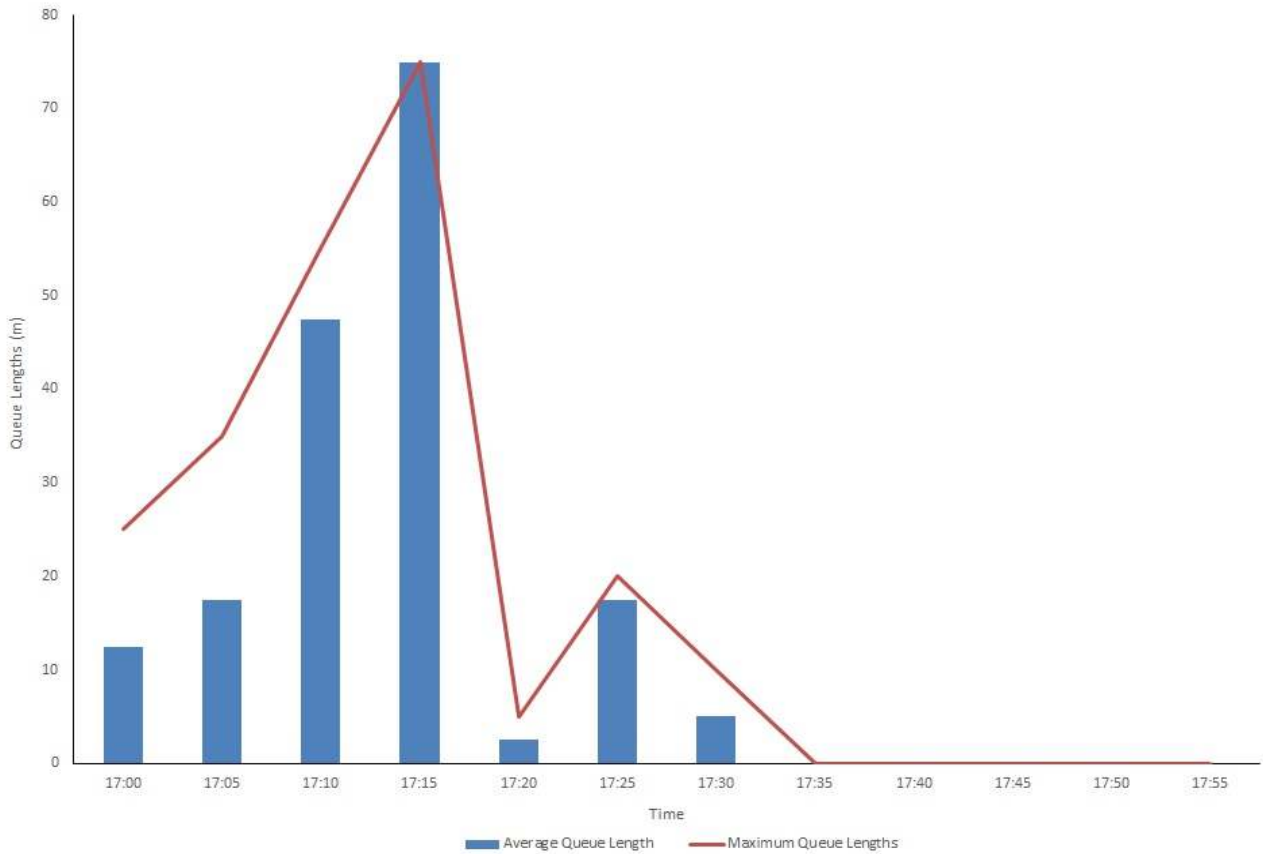


Figure 2.13: A1101 Churchill Road Queue Lengths PM Peak Hour (08:00 -09:00)

Journey Times and Delay

Journey times and delay for the Churchill Road approach to Freedom Bridge Roundabout have been assessed using the same TomTom data set described within this chapter. Table 2.6 beneath highlights the journey time and delay results for this approach across the AM and PM peak hours.

Segments used within this assessment total 215.4 metres from the stop line, reaching the Empire Theatre.

Table 2.6: Journey Times and Delay for the A1101 Freedom Bridge Approach to FBR

A1101 Churchill Road		Average Travel Time (Seconds)	Average Delay (Seconds)
Free Flow	(00:00 – 06:00)	18.9	N/A
AM Peak	(08:00 – 09:00)	31.5	12.5
PM Peak	(17:00 – 18:00)	48.3	29.3

Table 2.6 shows the Free Flow time for Churchill Road is 18.9 over a distance of 215 metres.

Delay is shown to be fairly low along this approach, however it is higher during the PM peak hour whereby 29 seconds is added to journey times. A higher PM peak delay is reflected within traffic flows reported at the beginning of this chapter, where a total of 668 vehicles originate from this approach during the PM peak hour, which is decreased to 636 vehicles during the AM peak hour.

Average Speeds

Average speeds for the A1101 Churchill Road to Freedom Bridge Roundabout have been extracted from the same TomTom data set described above. Figures 2.14 and 2.15 on the following page highlight the average speeds of this approach for both the AM and PM peak hours.

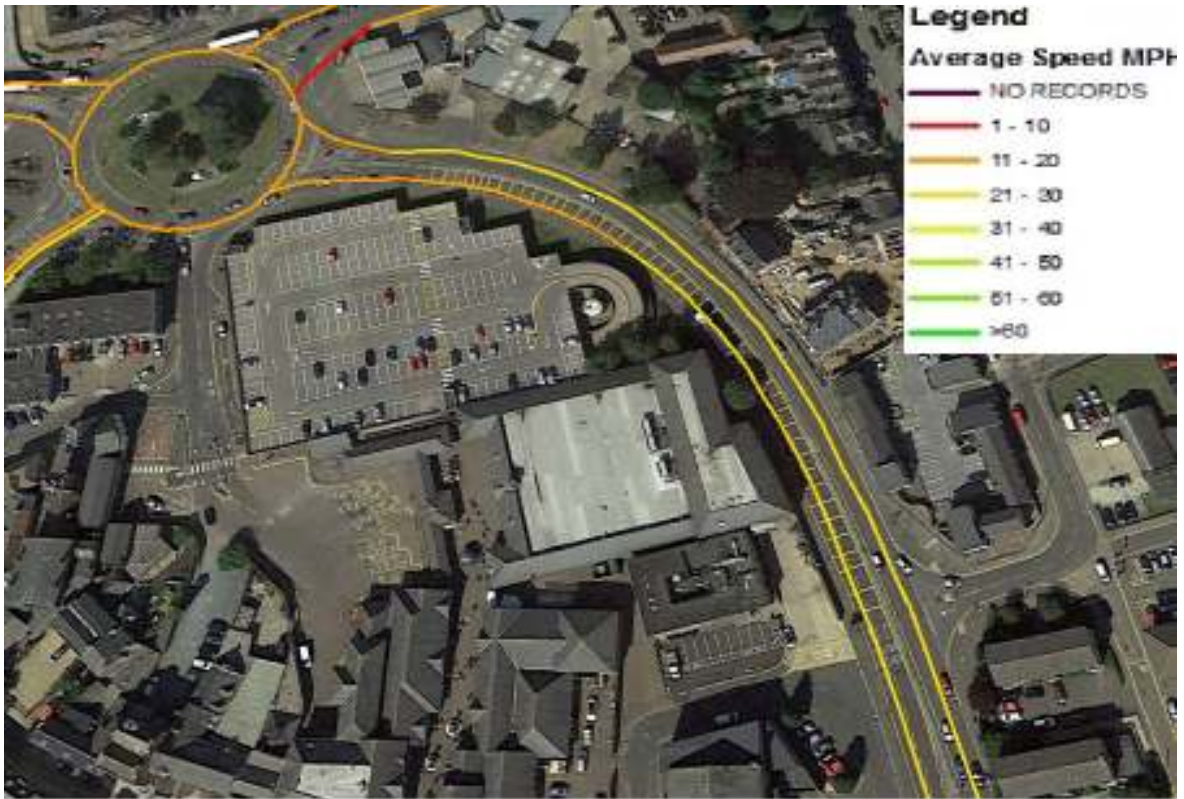


Figure 2.14: A1101 Churchill Road Approach Average Speed AM Peak Hour (08:00 - 09:00)

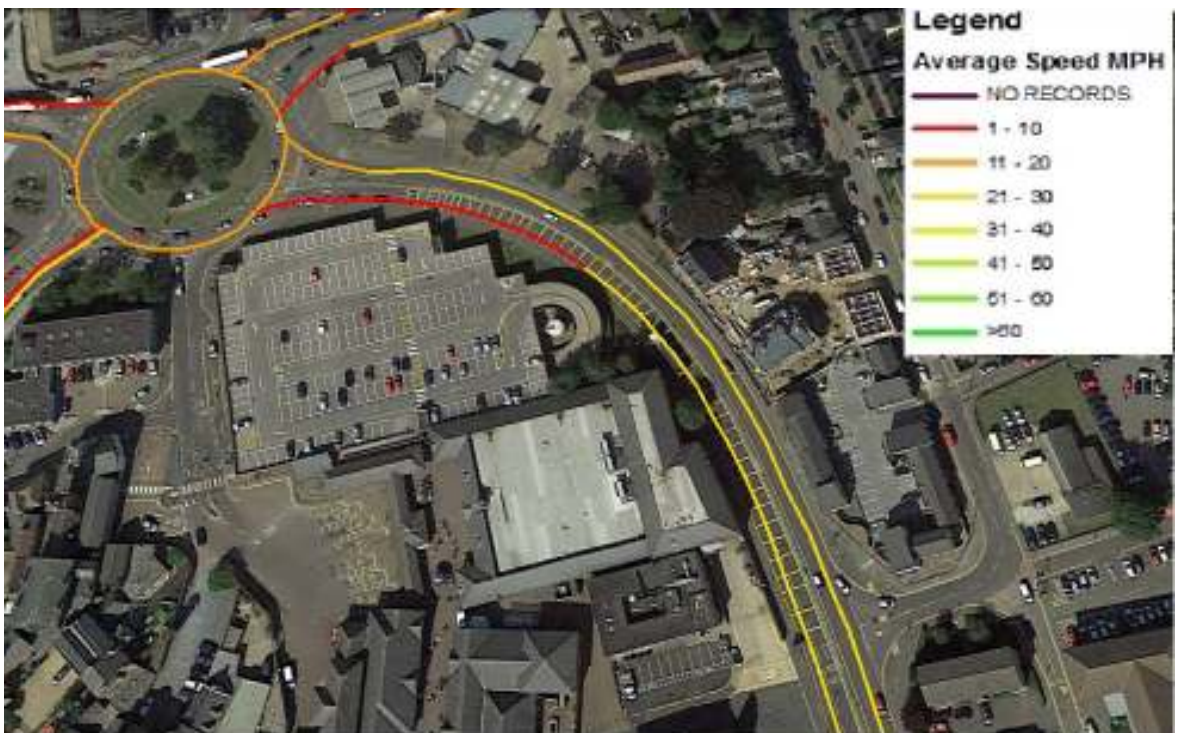


Figure 2.15: A1101 Churchill Road Approach Average Speed PM Peak Hour (17:00 - 18:00)

Average speeds at the stop line of Churchill Road are shown to be between 11 -20 mph in the AM peak hour, however is shown to decrease to between 1 – 10 mph in the PM peak.

Nene Quay Approach

Queue Lengths

Queue length data for the B198 Nene Quay approach to Freedom Bridge Roundabout has been extracted from the same survey described above. Table 2.7 beneath and Figures 2.16 and 2.17 show the maximum and average queue lengths recorded for this approach across the AM and PM peak hours.

Table 2.7: Maximum and Average Queue Lengths on the B198 Nene Quay Approach to FBR

Time Segment	AM		Time Segment	PM	
	Average (m)	Max (m)		Average (m)	Max (m)
08:00	0	0	17:00	0	0
08:05	0	0	17:05	0	0
08:10	5	10	17:10	32.5	45
08:15	0	0	17:15	22.5	40
08:20	0	0	17:20	25	45
08:25	0	0	17:25	0	0
08:30	0	0	17:30	2.5	5
08:35	0	0	17:35	0	0
08:40	0	0	17:40	10	20
08:45	5	10	17:45	5	10
08:50	0	0	17:50	7.5	15
08:55	5	5	17:55	0	0

The data shows that the greatest maximum queue length recorded for this approach is 45 metres which is recorded during the PM peak hour.

Queue lengths during the AM peak appear much lower, with a maximum queue length of 10 metres being recorded. In addition to lower recordings, queue lengths in this peak hour are fragmented, the majority of the time the approach is shown to remain free flowing.

Data presented in Table 2.7 is supported by traffic flows discussed earlier within this chapter, which shows a total of 244 vehicles originate from Nene Quay during the AM peak hour, and increases to 350 vehicles during the PM peak hour.

Figures 2.16 ad 2.17 on the following page highlight this data, which is shown in 5 minute intervals.

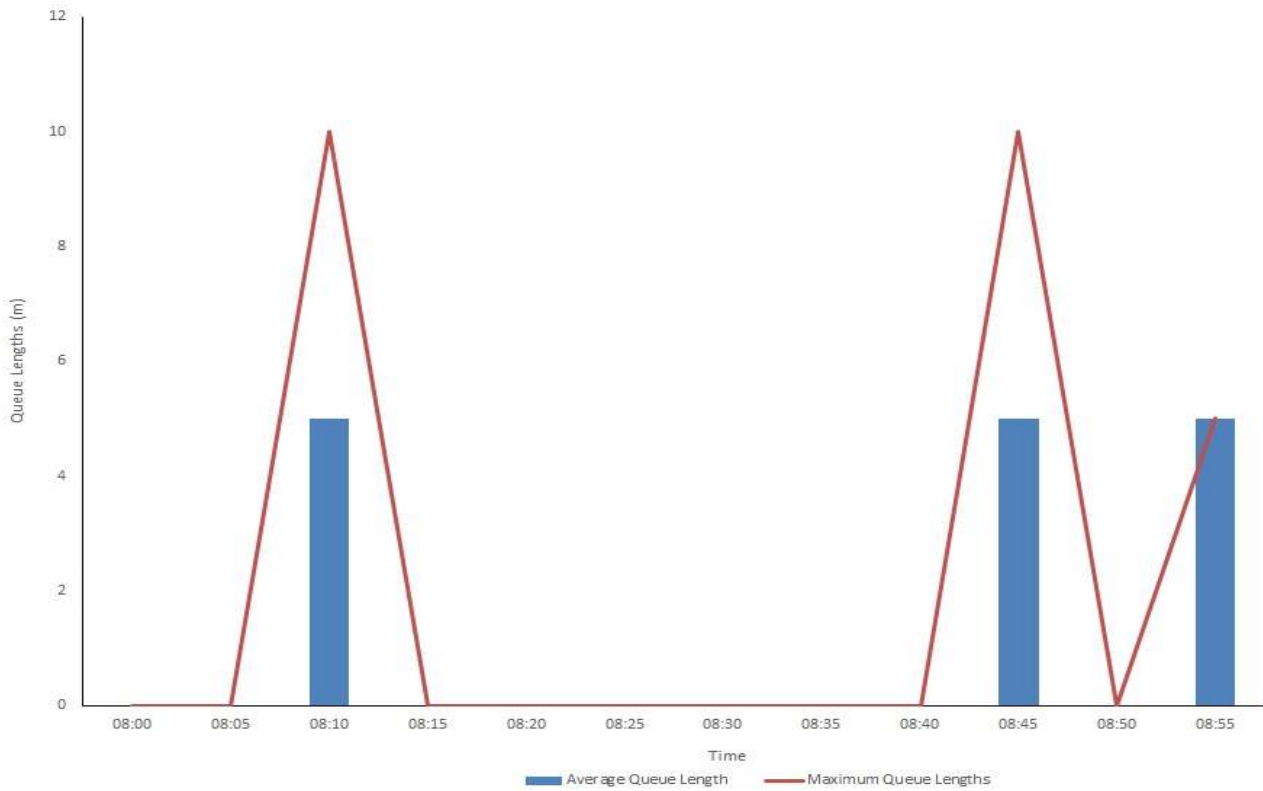


Figure 2.16: B198 Nene Quay Queue Lengths AM Peak Hour (08:00 -09:00)

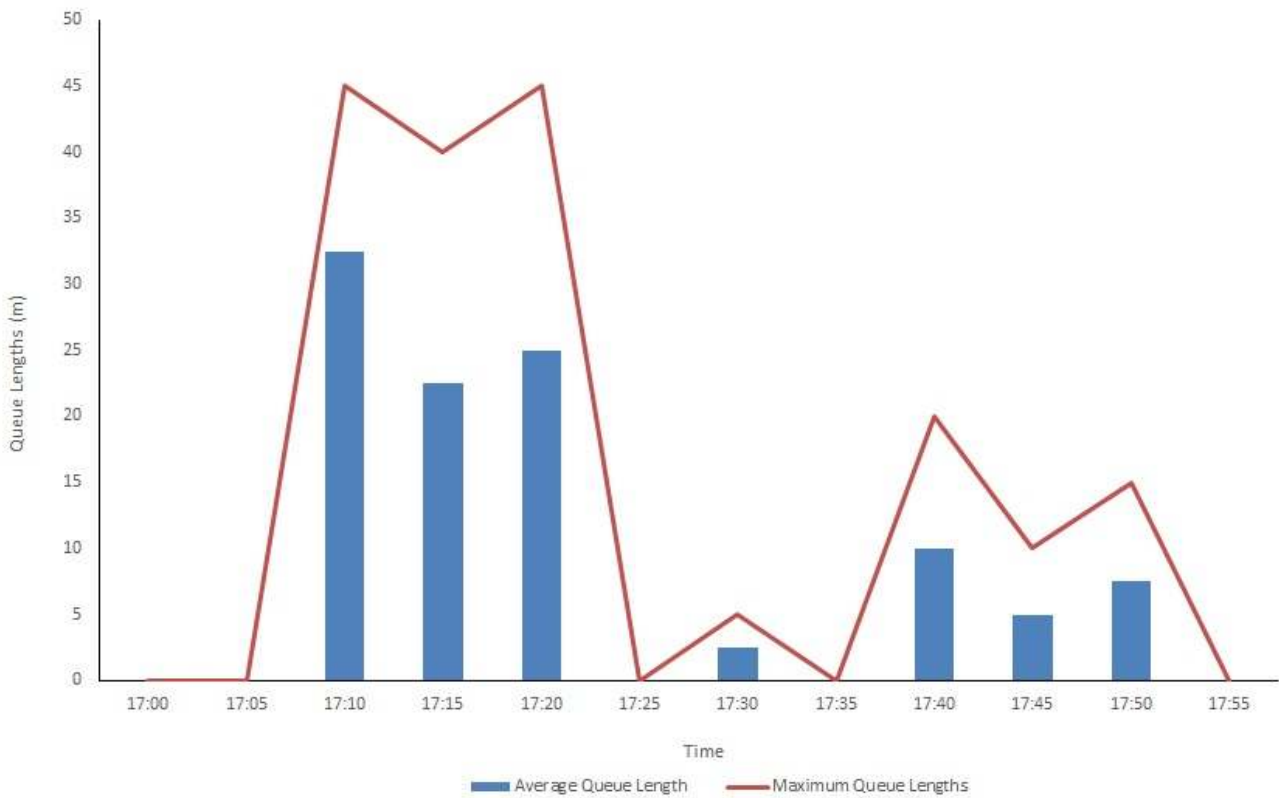


Figure 2.17: B198 Nene Quay Queue Lengths PM Peak Hour (17:00 -18:00)

Journey Times and Delay

Journey times and delay for the Nene Quay approach to Freedom Bridge Roundabout have been assessed using the same TomTom data set described within this chapter. Table 2.8 beneath highlights the journey time and delay results for this approach across the AM and PM peak hours.

Segments used within this assessment total 278.5 metres from the stop line, reaching just north of Town Bridge Junction.

Table 2.8: Journey Times and Delay for the B198 Nene Quay to FBR

B198 Nene Quay		Average Travel Time (Seconds)	Average Delay (Seconds)
Free Flow	(00:00 – 06:00)	24.2	N/A
AM Peak	(08:00 – 09:00)	32.2	8.0
PM Peak	(17:00 – 18:00)	69.3	45.1

Table 2.8 shows the Free Flow time for B198 Nene Quay is 24.2 over a distance of 278 metres.

Delay is shown to be very low along this approach during the AM peak hour, with only 8 seconds of delay added to journey times. In comparison, delay shown for the PM peak is 45 seconds. This reflects traffic flows shown earlier within this chapter.

Average Speeds

Average speeds for the B198 Nene Quay approach to Freedom Bridge Roundabout have been extracted from the same TomTom data set described above. Figures 2.18 and 2.19 on the following page highlight the average speeds of this approach for both the AM and PM peak hours.



Figure 2.18: B198 Nene Quay Approach Average Speed AM Peak Hour (08:00 - 09:00)

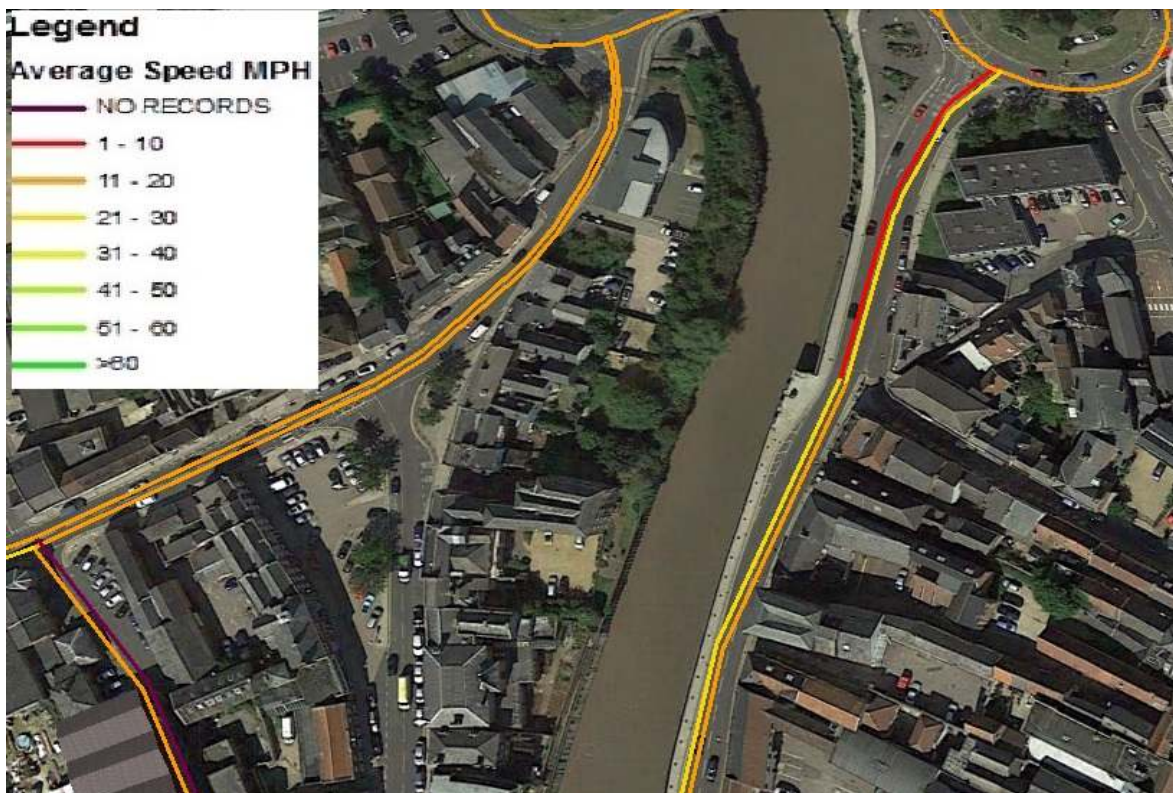


Figure 2.19: B198 Nene Quay Approach Average Speed PM Peak Hour (17:00 - 18:00)

Average speeds at the stop line of Nene Quay are shown to decrease from 11- 20 mph in the AM peak hour to between 1-10 mph in the PM peak.

Accident Data

Accident data for Freedom Bridge Roundabout and the surrounding area has been obtained from Cambridgeshire County Council for the five year period of 2010 to 2015.

During this time there were 101 reported accidents in the vicinity of Freedom Bridge Roundabout. The location of the accidents are shown in series of figures beneath, with a summary of the accidents shown in Table 2.9 below

Table 2.9: Accident Summary

Year	Fatality	Serious	Slight	Total
2010	0	0	24	24
2011	0	1	9	10
2012	0	1	13	14
2013	0	1	11	12
2014	0	3	19	22
2015	0	0	9	9

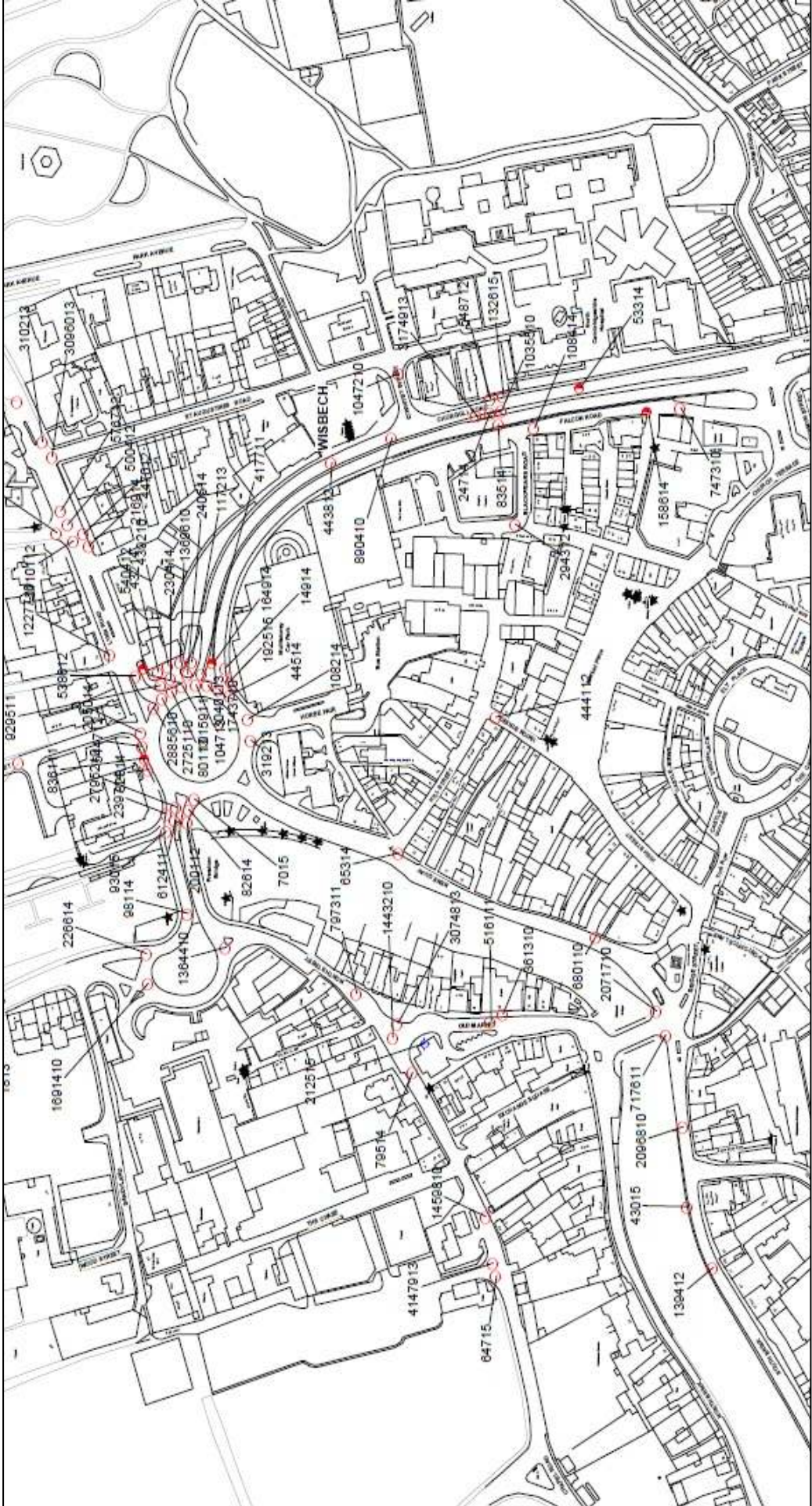


Figure 2.20: Accident Plot Part 1

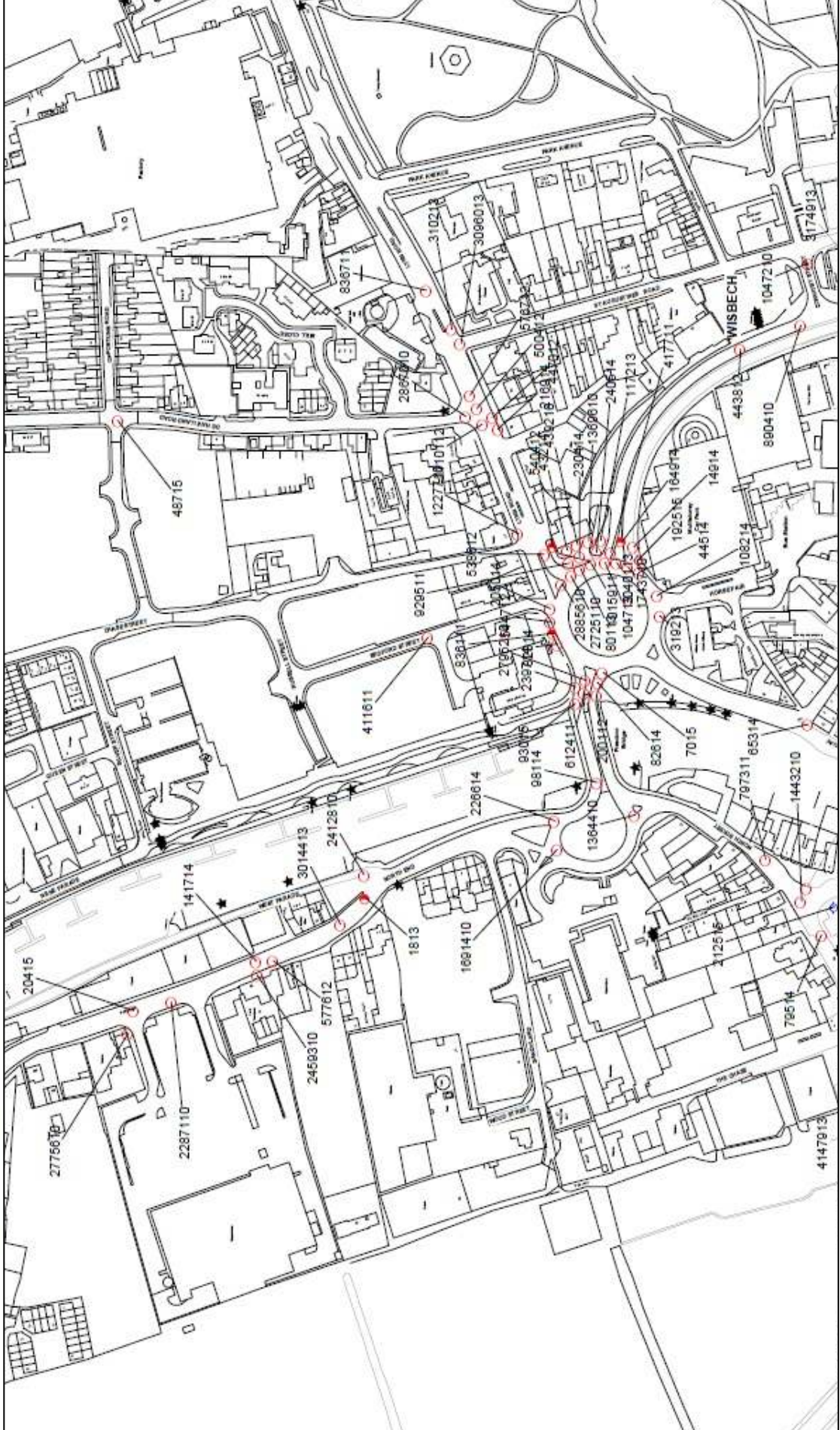


Figure 2.21: Accident Plot Part 2

Land Ownership

Freedom Bridge Roundabout is under the responsibility of Cambridgeshire County Council. The Highways England boundary for the junction are shown in Figure 2.22 beneath. Land ownership within the vicinity of the junction is shown in Figure 2.23.



Figure 2.22: Highway Boundary Plan for Freedom Bridge Roundabout

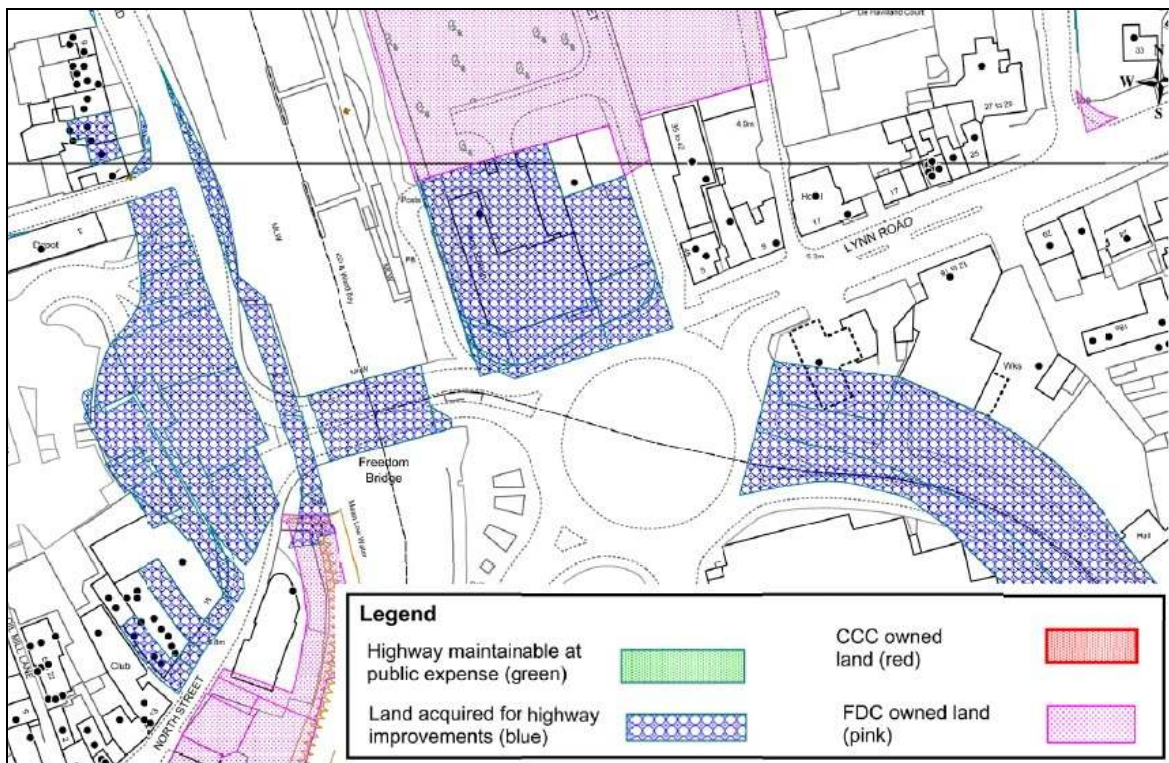


Figure 2.23: Land Ownership Surrounding Freedom Bridge Roundabout

Flood Risk

Using data provided by The Environment Agency, Figure 2.24 highlights the flood risk within the vicinity of Freedom Bridge Roundabout.



Figure 2.24: Flood Risk for Freedom Bridge Roundabout

As shown in Figure 2.24 the infrastructure of Freedom Bridge Roundabout is not positioned within a flood risk zone, following flood defence protection to the immediate west. Despite this, a flood risk is present to the north (flood zone 2), west (flood zone 3) and east (flood zone 2).

Environmental Issues

An environmental assessment of the study area has been completed using DEFRA's mapping tool MAGIC. The assessment identified the following environmental considerations:

- Deciduous Woodland north/ northwest and east of the roundabout, as well as parkland to the southwest, and;
- Species which are breeding birds across the town.

These observations should be considered within any scheme design, but are not considered to be sensitive enough to significantly impact on the deliverability of a scheme at this location.

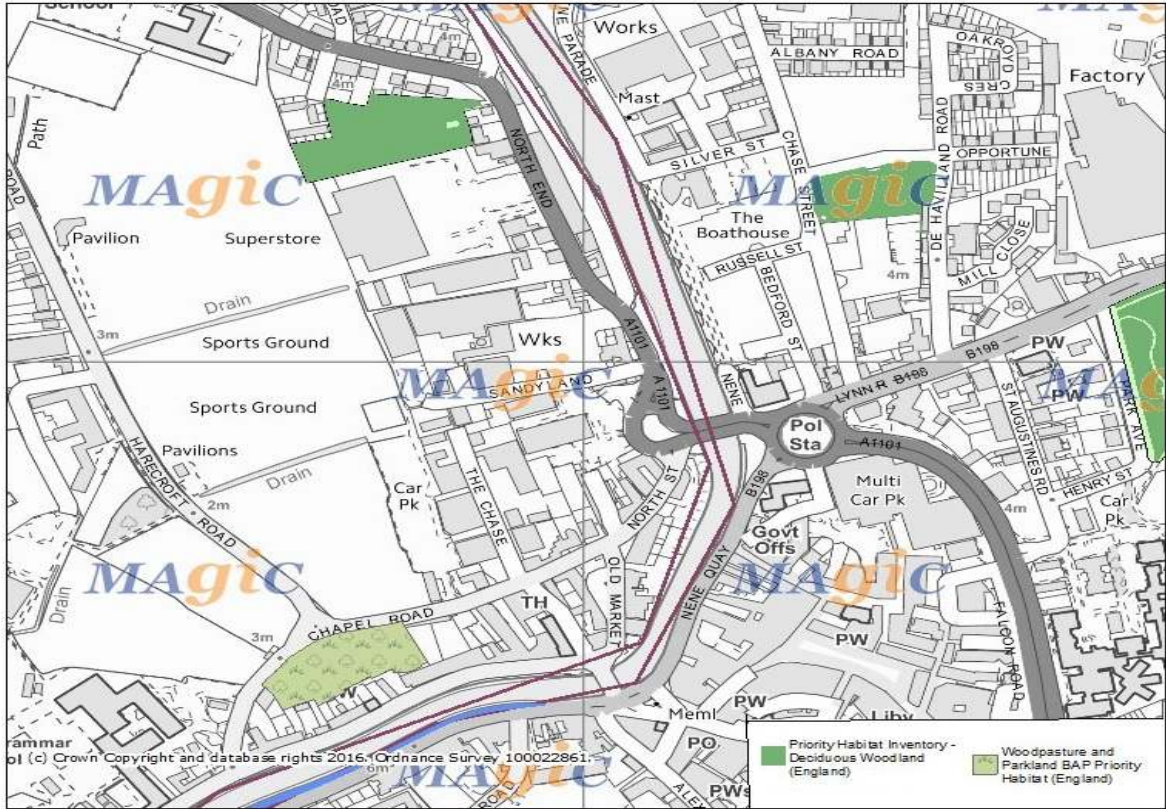


Figure 2.25: Ecological Issue (Habitats) to consider around Freedom Bridge Roundabout

3 Development Proposals for Wisbech

Introduction

This chapter provides an overview of urban extensions proposed for Wisbech as detailed in the Fenland Local Plan, outlining development proposals and corresponding network/infrastructure changes for the South, East and West Wisbech sites. The Nene Waterfront and Port regeneration proposals are also discussed.

Urban Extensions

As stated within the Fenland Local Plan (Policy LP8), there are three urban extensions proposed for Wisbech, which consist of:

- South Wisbech –Broad Location of Growth:
 - Employment, industrial, distribution and small residential area.
- East Wisbech – Strategic Allocation of Growth:
 - Residential development only.
- West Wisbech – Broad Location of Growth:
 - Residential development with small area of employment.

Figure 3.1 on the following page shows the locations of these urban extensions, as shown in the Local Plan.

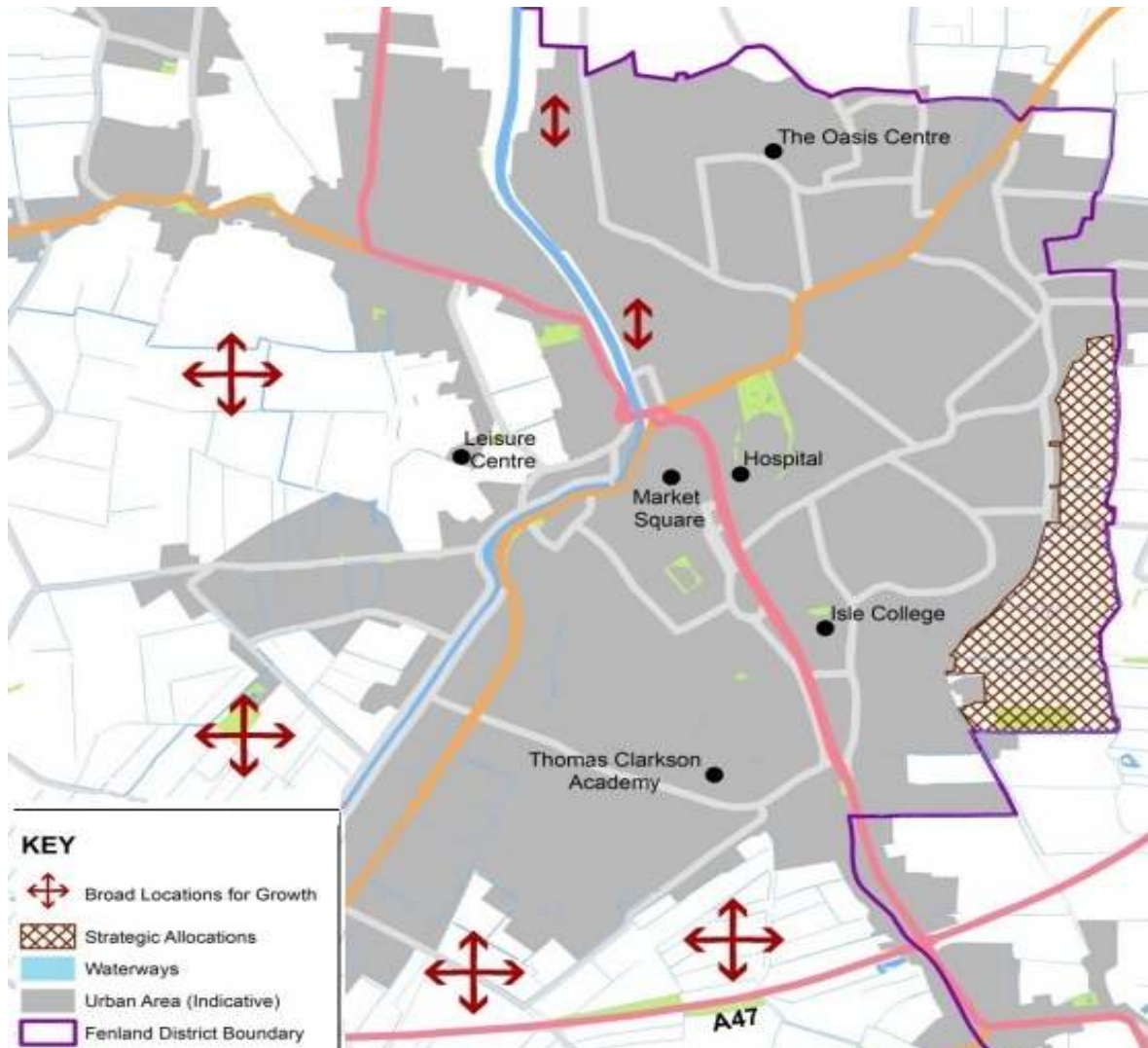


Figure 3.1: Urban Extensions Proposed for Wisbech

Development Phasing

Table 3.1 on the following page shows the development phasing (total development completed up to a specific year) for each of the three urban extensions mentioned above, whilst Table 3.2 demonstrates the phasing and year of completion of infrastructure changes associated with each development.

Table 3.1: Development Phasing for Wisbech Urban Extensions

	2021	2026	2031
South Wisbech	<ul style="list-style-type: none"> Phase 1 complete Phase 2 – 300 dwellings 	<ul style="list-style-type: none"> Phase 1 complete Phase 1a complete Phase 2 – 357 dwellings Phase 3 1551 jobs 	<ul style="list-style-type: none"> Phase 1 complete Phase 1a complete Phase 2 complete Phase 3 complete – 2755 jobs
East Wisbech	<ul style="list-style-type: none"> 360 dwelling complete 	<ul style="list-style-type: none"> 960 dwellings complete 	<ul style="list-style-type: none"> 1550 dwellings complete
West Wisbech			<ul style="list-style-type: none"> 750 dwellings complete
Total across three sites	<ul style="list-style-type: none"> 660 dwellings built 514 jobs created on south site 	<ul style="list-style-type: none"> 1317 dwellings built 2065 jobs created on south site 	<ul style="list-style-type: none"> 2700 dwellings built 3269 jobs created on south site

Table 3.2: Infrastructure Phasing for Wisbech Urban Extensions

	2021	2026	2031
South Wisbech	<ul style="list-style-type: none"> Link Road between Boleness Road and New Bridge Lane Access to Phase 2 and Half Penny Lane 	<ul style="list-style-type: none"> Access to Phase 1a New junction on A47 	
East Wisbech	<ul style="list-style-type: none"> Access provided Junction upgrade at Broadend Road 		
West Wisbech		<ul style="list-style-type: none"> Link Road to Barton Road 	<ul style="list-style-type: none"> Link Road to Dowgate Road

Additional Development – Nene Waterfront and Port Area

The Nene Waterfront and port area, positioned to the immediate north of Freedom Bridge Roundabout, is detailed in the Local Plan (2014) as an additional Broad Location of Growth. Proposals for this site consist of:

- Residential area of 300 homes;
- Leisure and retail facilities;
- Employment to the north of the site (Boat House), and;
- Retaining the river frontage for marine and port related activities.

Development Growth – Impact on Freedom Bridge Roundabout

At present vehicles travelling north to south between the A17 to the north (via the A1101) and the A47 to the south, use the heavily trafficked Freedom Bridge Roundabout, due to no practical alternative route being available. With high volumes of traffic already recorded at the junction, issues such as peak hour congestion and delay are expected to increase with traffic growth.

The table below shows the predicted traffic growth at Freedom Bridge Roundabout, as a result of development growth at the East, West and South Wisbech sites. Note, the traffic flow shown within the cells is the total count of all turning movements per approach arm.

Table 3.3: Traffic Flow Growth at Freedom Bridge Roundabout – AM Peak Hour

	2021	2026	2031
Lynn Road	862	870	956
Churchill Road	646	505	500
Nene Quay	385	221	236
A1101 Freedom Bridge	1,268	1,003	1,156

Table 3.4: Traffic Flow Growth at Freedom Bridge Roundabout – PM Peak Hour

	2021	2026	2031
Lynn Road	837	865	981
Churchill Road	1,019	787	766
Nene Quay	758	727	757
A1101 Freedom Bridge	1,014	787	798

Tables 3.3 and 3.4 show higher traffic flows are expected during the PM peak hour, reflecting the existing traffic flow pattern as observed within the 2016 traffic counts (see Figures 2.1 - 2.3).

Traffic flows during the AM peak hour are shown to increase alongside development growth for Lynn Road, however start higher and decrease for the remaining three

approaches. Despite a decrease shown, traffic flows do appear to be fairly balanced across the years assessed for the approaches. This pattern in the change of traffic flow growth is reflected within the PM peak hour.

4 Option Development

Introduction

A workshop was held on the 3rd March 2016 at the Wisbech Boathouse Business Centre, to collectively discuss and devise improvement options for the following schemes:

- Elm High Road;
- Cromwell Road; and,
- Freedom Bridge Roundabout.

The workshop was attended by twenty stakeholders, which represented areas of:

- Transport Planners/ modellers (Skanska/ ATKINS);
- Highway Engineers/ Highways Cambridgeshire;
- Cambridge County Council;
- Fenland District Council;
- Highways England;
- Norfolk County Council; and,
- King's Lynn and West Norfolk Borough Council.

Attendees were divided into three groups, of around six members, to concentrate solely on one of the three schemes identified above. Once options were devised (per scheme) a group discussion was held, allowing comments to be made from the remaining groups.

Options Devised for Freedom Bridge Roundabout

Five options were devised for Freedom Bridge Roundabout as a result of the workshop. Options devised for this scheme considered improvement through redesign, signalisation, and changes to the individual approaches / accesses, namely Horsefair and Bedford Street. A summary of the options devised are outlined below:

- **FB 1** – Roundabout signalisation. Idea abandoned and replaced with Option 5;
- **FB 2** – Divert Horsefair onto Nene Quay via School Lane, and signalise the roundabout on an anti-clockwise staging (based on Cuckoo Corner- Southend);
- **FB 3** – Signalised contra-flow implemented to the north of the existing circulatory for vehicles travelling between Lynn Road and the A1101 Freedom Bridge approaches, with the southern half of the roundabout retained under the existing layout with give way approaches;
- **FB 4** – Large gyratory system spanning both sides of the river; and,
- **FB 5** – Creation of an east-west bus station link between Nene Quay and Churchill Road, and the reconfiguration of the circulatory minus the Horsefair approach.

Option Review Workshop

A second workshop was held on the 19th October 2016, which aimed to review options devised for Freedom Bridge Roundabout. Group discussions were used to collectively determine which options were operationally viable (either in their own right or in

combination with others) after initial modelling assessments, and should be retained for further inclusion within the packaging assessment.

Group discussions were based on the following criteria:

- Initial assessment results;
- Pedestrian/ cycle facility considerations,
- Level of disruption to the network during construction; and,
- Level of benefit when compared to other options (where applicable).

Alongside reviewing the five options devised within the initial workshop, one additional option was devised within the review process, based on the inclusion of pedestrian facilities and aiding the operation of the wider network beyond the roundabout. The new option is summarised below:

- **FB 5A** – A series of network improvements to the roundabout and surrounding area, following the inclusion of several elements of Option 4 and 5.

Workshop Conclusions

Table 4.1 beneath shows the conclusions of the Review Workshop, indicating which of the six options devised (across both workshops) have either been retained or discarded from further progression within the study.

Table 4.1: Workshop Conclusions

	Retain	Discard	Comments
FB 1		✓	<ul style="list-style-type: none"> • Withdrawn before option testing stages.
FB 2		✓	<ul style="list-style-type: none"> • Signalisation likely to create queuing issues on the circulatory, resulting in vehicles blocking approaches • Issues predicted for Nene Quay which would remain as give way control.
FB 3		✓	<ul style="list-style-type: none"> • Signalisation predicted to impede the operation of the roundabout • Signals likely to create queuing on the circulatory resulting in blocked approaches on the southern half of roundabout
FB 4		✓	<ul style="list-style-type: none"> • Larger gyratory predicted to improve existing conditions, however expected to exacerbate issues in future years
FB 5		✓	<ul style="list-style-type: none"> • Two lane entry/ exits on the A1101 Freedom Bridge and Churchill Road predicted to reduce delay / queue lengths • Western section of the gyratory predicted to perform worse, following the release of more vehicles upstream • Current issues with capacity, poor lane use and difficulty with numerous accesses would remain within this option
FB 5a	✓		<ul style="list-style-type: none"> • Additional benefit west of gyratory expected to significantly improve the operation of the A1101 • Benefits of pedestrian safety within this location outweighs

Each of the options described above (with the exception of FB 1) are described in turn beneath, the more detailed assessment of retained options is then considered within the next chapter.

Option FB 2

This option involves the signalisation of the roundabout, with signals being implemented on the three heaviest arms of A1101 Freedom Bridge, B198 Lynn Road and the A1101 Churchill Road. Nene Quay remains as a give way approach following lower traffic flows. Signalisation within this option would follow an anti-clockwise direction.

A second element of this option includes the removal of the Horsefair approach with vehicles being diverted to Nene Quay via School Lane.

Additional network changes made within the modelling assessment for this options are as follows:

- Petrol station access onto the circulatory is removed, with vehicles rerouted via Lynn Road and Churchill Road;
- Signal staging allows one approach to run at a time, starting with the A1101 Freedom Bridge and moves anti-clockwise thereafter, and;
- Three separate stages are used, one for each of the three signalised approaches.

Workshop Comments

Table 4.2 below highlights the strengths and weaknesses associated with this option.

Table 4.2: Option FB 2 Workshop Discussion

Strengths	Weaknesses
<ul style="list-style-type: none"> • Improves access onto the network for buses 	<ul style="list-style-type: none"> • Off peak delay from signalisation
<ul style="list-style-type: none"> • Removes an approach arm from the roundabout 	<ul style="list-style-type: none"> • Queuing on the approach to the circulatory is more likely to be heavier with signals
<ul style="list-style-type: none"> • Signalisation of the roundabout allows for greater traffic control 	<ul style="list-style-type: none"> • Nene Quay may perform worse as remaining as a give way approach
<ul style="list-style-type: none"> • Lane discipline is likely to be improved with signalisation 	<ul style="list-style-type: none"> • Little scheme benefit beyond the roundabout itself, such as the gyratory to the west and De Havilland Road
<ul style="list-style-type: none"> • Anti-clockwise signalisation avoids the need to stop traffic on the circulatory, mitigating against queues blocking approaches 	

Option Outcome

This option has been **discarded** from further progression within the study, on the basis of:

- Initial assessments show signalisation impedes the operation of the roundabout, creating delay and queues off and on peak;
- Little or no benefit beyond the roundabout; and,
- Doesn't improve the pedestrian facilities on the roundabout.

Option FB 3

This option involves a signalised contra-flow implemented to the north of the existing circulatory, allowing vehicles travelling from the B198 Lynn Road to the A1101 Freedom Bridge to continue straight (in both directions) without circling the roundabout.

The southern section of the roundabout within this option will be retained under the existing arrangement, resulting in arms of the A1101 Churchill Road, Horsefair and Nene Quay retaining give way controls.

An additional element within this option includes removing the petrol station access onto the circulatory.

Workshop Comments

Table 4.3 below highlights the strengths and weaknesses associated with this option.

Table 4.3: Option FB 3 Workshop Discussion

Strengths	Weaknesses
<ul style="list-style-type: none"> Improves access onto the network for buses 	<ul style="list-style-type: none"> Off peak delay from signalisation
<ul style="list-style-type: none"> Signalisation of the roundabout allows for greater traffic control 	<ul style="list-style-type: none"> Queuing on the approach to the circulatory is more likely to be heavier with signals
<ul style="list-style-type: none"> Lane discipline is likely to be improved with signalisation 	<ul style="list-style-type: none"> Unconventional layout may impact driver behaviour and potentially create a safety issue
	<ul style="list-style-type: none"> Little scheme benefit beyond the roundabout itself, such as the gyratory to the west and De Havilland Road

Option Outcome

This option has been **discarded** from further progression within the study, on the basis of:

- Initial assessments show signalisation impedes the operation of the roundabout, creating delay and queues off and on peak;
- Little or no benefit beyond the roundabout, and;
- Doesn't improve the pedestrian facilities on the roundabout.

FB Option 4

This option enlarges the existing roundabout to create a dualled gyratory system, which spans over both sides of the river. All approaches on the gyratory are assumed to have give way control.

Network changes required within this option are outlined beneath:

- Exit onto Churchill Road is widened to two lanes, allowing dual carriageway on the gyratory for A1101 traffic;
- Additional bridge across the River Nene is required;

- Existing signals positioned on the A1101 Freedom Bridge approach are removed from the gyratory, and are incorporated into the new Aldi junction access;
- Bedford Street becomes two way, allowing vehicles to bypass De Havilland Road Junction;
- Petrol Station is removed in this option, allowing designated left slip from Lynn Road to Churchill Road;
- Aldi supermarket junction is removed from the western gyratory, with store access being relocated further north at Sandyland Junction (priority junction); and,
- Pedestrian facilities over the roundabout have been extended to North Street, enabling an increased queuing capacity after Nene Quay.

The layout of this option is shown within Figure 4.1, whereby the network changes stated above are shown.



Figure 4.1: Option FB 4 Layout

Workshop Comments

Table 4.4 below highlights the strengths and weaknesses associated with this option.

Table 4.4: Option FB 4 Workshop Discussion

Strengths	Weaknesses
<ul style="list-style-type: none"> • Larger gyratory allows for reallocation of lane movement and additional lanes creating increased roundabout capacity 	<ul style="list-style-type: none"> • Significant land take, demolition and cost involved with the option
<ul style="list-style-type: none"> • Reallocation of lane movement likely to improve driver/ lane discipline 	<ul style="list-style-type: none"> • Greater detours for vehicles around the circulatory than is existing
	<ul style="list-style-type: none"> • Conflict between vehicles either side of the gyratory, which doesn't occur under the existing layout
	<ul style="list-style-type: none"> • Creates a car –dominant environment within the town centre, poor regeneration value associated with the option
	<ul style="list-style-type: none"> • No change to Horsefair bus station access

Option Outcome

This option has been **discarded** from further progression within the study, on the basis of:

- Initial assessments show little benefit to the operation of the roundabout is offered under this option without the construction of the Western Link Road;
- Side roads (North Street) connecting to the gyratory are impacted, that aren't otherwise impacted under the existing layout, and;
- Greater impact is added to the Bus Station access, current issues exacerbated within this option.

Option FB 5

This option reconfigures Freedom Bridge Roundabout through a series of improvements to individual approaches. All approaches within this option remain as give way control.

A key feature of this reconfigured layout concerns the removal of Horsefair and the creation of a new station access on Nene Quay.

Network improvements required with this option are detailed below and shown within Figure 4.2. Note: network changes below have been separated by the approach.

- A1101 Freedom Bridge:
 - The exit is widened to two lanes increasing the queuing capacity at the crossing;
 - Vehicles travelling to North Street have been routed via the nearside lane of Churchill Road and Lynn Road; and,
 - Vehicles travelling to Aldi via Freedom Bridge have been routed via the offside lane when travelling from Lynn Road.

- A1101 Churchill Road:
 - The exit is widened to two lanes, allowing vehicles to travel in two lanes around the circulatory from the A1101 Freedom Bridge.
- Horsefair Bus station:
 - Horsefair approach / exit is removed from the roundabout; and,
 - Bus station and car park access is reconfigured to new signalised junction on Nene Quay.
- Lynn Road/ Petrol Station:
 - A designated left turn lane to Churchill Road is formed with the petrol station removed.
- Bedford Street:
 - Approach becomes two way, allowing vehicles to bypass De Havilland Road Junction.

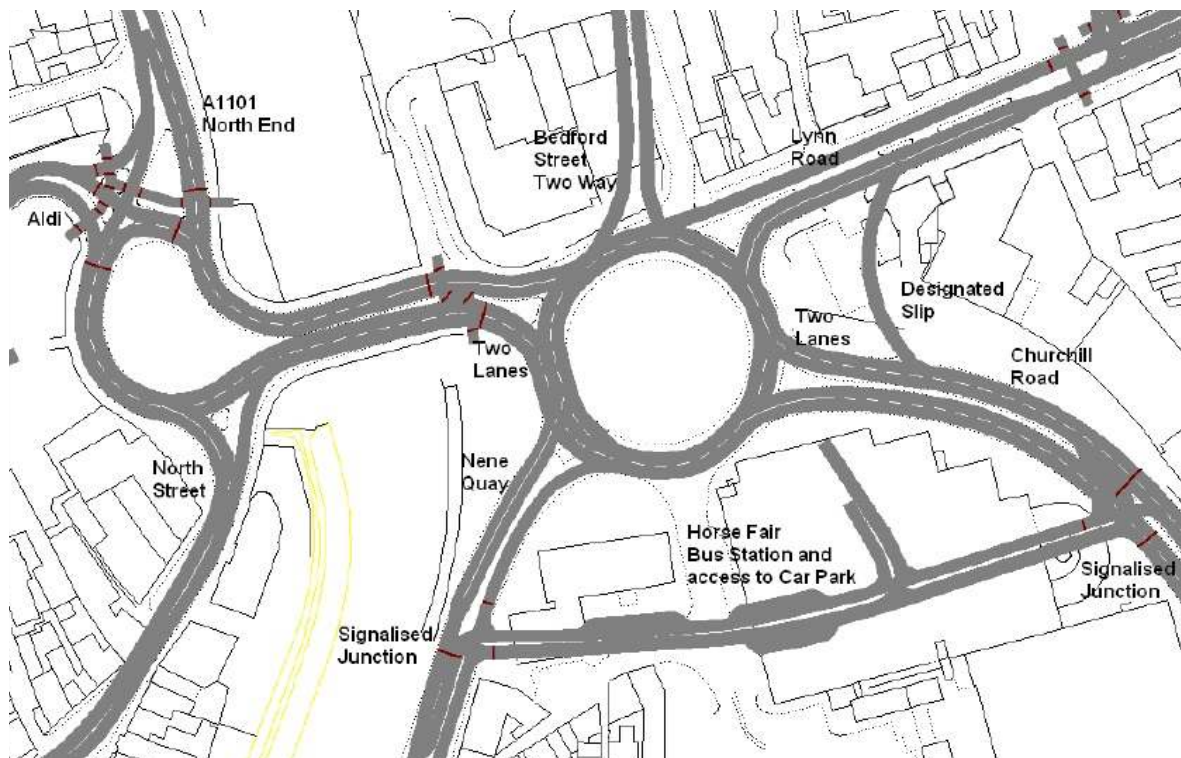


Figure 4.2: Option FB 5 Layout

Workshop Comments

Table 4.5 below highlights the strengths and weaknesses associated with this option.

Table 4.5: Option FB 5 Workshop Discussion

Strengths	Weaknesses
<ul style="list-style-type: none"> Reduction in the number of approaches on the roundabout 	<ul style="list-style-type: none"> Demolition and land take are required for this option
<ul style="list-style-type: none"> Improves access onto the network for buses 	<ul style="list-style-type: none"> Potential for queue backs from the new bus station junction on Nene Quay / Churchill Road to reach back to the roundabout
<ul style="list-style-type: none"> Removal of the petrol station removes a safety concern 	
<ul style="list-style-type: none"> Realignment and widening the exit of Freedom Bridge improves HGV movement and lane discipline 	
<ul style="list-style-type: none"> Pedestrian facilities are retained 	
<ul style="list-style-type: none"> Bedford Street improvements alleviate pressure on Lynn Road and De Havilland Junction 	

Option Outcome

Initial modelling results of Option FB 5 showed that implementing a series of changes to Freedom Bridge Roundabout and the immediate area has benefit over the existing (Do Minimum) layout. However, by increasing capacity and processing more vehicles through the junction under this option, the operation of the western side of the gyratory, particularly North Street, is decreased from current. Therefore opportunity to develop the option further in order to address this issue was presented.

Option Variation

The original Option FB 5 underwent several variations and refinements within the Option Assessment process to respond to the results from the traffic modelling and highway design input. These were:

- Option FB 5** – This is the option described above, which was defined in the Option Development Workshop in March 2016;
- Option FB 5A** – This option was devised during the Option Refinement Workshop held in October 2016, whereby attendees identified a combination of elements from FB 4 and FB 5, which were found to improve the operation of the roundabout. This option retained elements of capacity enhancements to individual approaches, the opening of two way access on Bedford Street and the new bus station access on Nene Quay, however incorporate a new Aldi Access at Sandylane Junction, right turn ban at De Havilland Junction as well as a greater number of pedestrian facilities;
- Option FB 5B** – This version of the option addressed operational issues identified within assessments of FB 5A. This main differences of this option included the retaining of the petrol station with access on Lynn Road only, one ahead lane on Churchill Road instead of two, and the decision to revert back to the original layout of the Aldi / Freedom Bridge junction. The latter change was the result of a response that stated this would not be altered onsite.

Option Outcome

The final variation of Option of FB 5B has been **shortlisted** for further assessment within the study on the basis of:

- Initial assessments show more vehicles are processed through the junction due to increased capacity and the opening of Bedford Street;
- The operation of the roundabout across forecast years is within capacity, improved when compared to the Do Minimum;
- Pressure is relieved at De Havilland Road, allowing the operation of the junction to be improved. This also aids the operation of the Lynn Road approach to the roundabout; and,
- The upgrade of pedestrian facilities increases safety on the roundabout and is not forecast to have a detrimental impact on the operation of this option.

Option Development Summary

Based on the Option Review Workshop, and the results from the initial transport modelling, Option FB 5B (Figure 4.3) is the only option retained for further assessment within the study. This assessment of this option is discussed in greater detail within the following chapter.

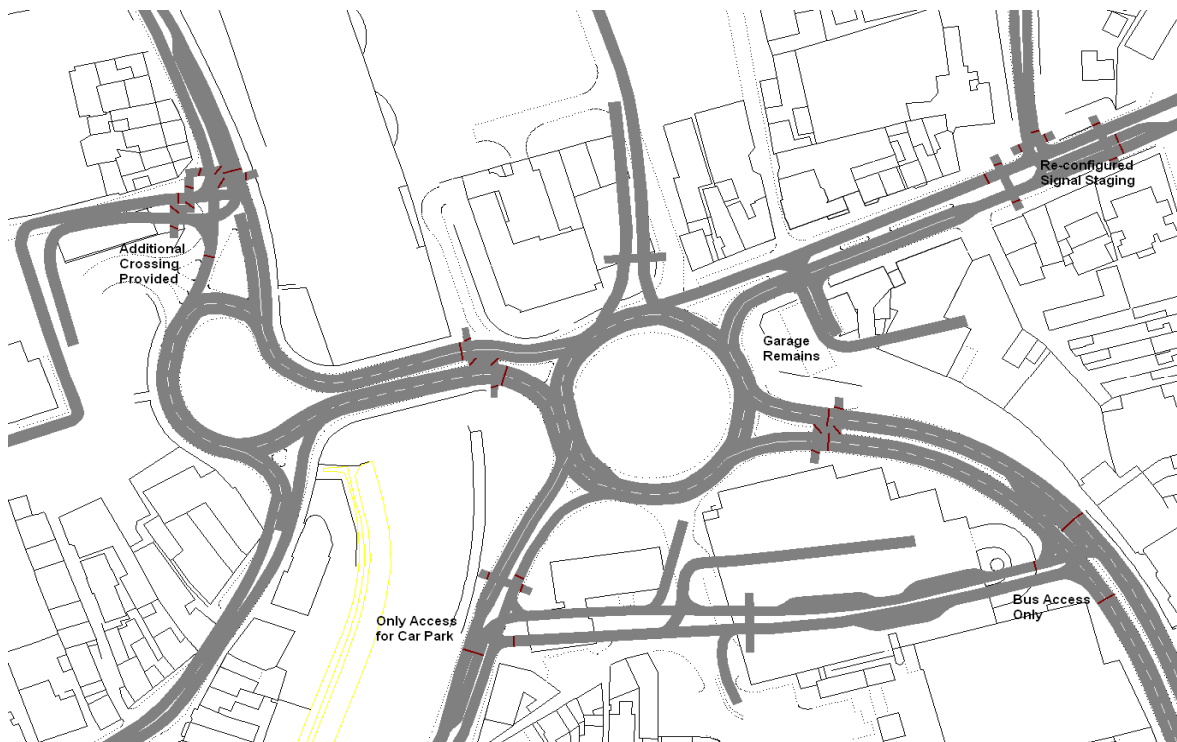


Figure 4.3: Option FB 5B Layout

5 Option Assessment

Introduction

This chapter presents the results from the traffic modelling that was undertaken as part of the Option Assessment, and used to inform the Option Review Workshop and ultimately option sifting process.

The operational performance of the shortlisted Option FB 5B, identified within the previous chapter, is summarised beneath. Further details on the model development, and full results outputs are provided in the Freedom Bridge Roundabout Option Assessment Technical Note.

Modelling Assessment

In order to evaluate the proposed scheme and quantify the potential benefits, both the existing conditions and the new design have been assessed using traffic modelling software.

Modelling assessments for this scheme have been conducted using VISSIM micro-simulation software (version 5.40-09), which is part of the PTV Vision Transport modelling. The five basic components that VISSIM is built upon include:

- Highway network (Link / connectors);
- Traffic control systems (signals, stop-give way controls);
- Traffic inputs;
- Vehicle type and compositions; and,
- Vehicle routes.

VISSIM has been used to analyse the movement of motorised and non-motorised traffic, including car, bus, pedestrian and cycle operations, under constraints such as lane configuration, traffic composition and junction form.

More information regarding VISSIM and model validation can be found within the [‘Wisbech VISSIM Model LMVR report’](#).

Modelled Scenarios

The following scenarios have been assessed for Option FB 5B for both the AM and PM peak hours, for the forecast years of 2021, 2026 and 2031.

- Do Minimum scenario;
- Do Something (With scheme) Scenario; and,
- Without the Western Link Road.

Results for the above assessments can be found in the Freedom Bridge Roundabout Options Technical Note.

Modelling Conclusions

The following conclusions have been extracted from the ‘Freedom Bridge Options Technical Note’ (Appendix A). Results below highlight the performance of this option across forecasted years. The ‘Without’ link road scenario is representative of the worst case scenario, with traffic flows at Freedom Bridge Roundabout predicted to be higher.

Table 5.1: Option FB 5B Assessment Conclusions

		Freedom Bridge Roundabout Option 5b Without WLR		
		2021	2026	2031
AM Peak	All approaches to FB operating within capacity. Overall LOS B. Approaches to Aldi junction operate better than DM.	All approaches to FB operating within capacity. Overall LOS C.	All approaches to FB operating within capacity. Overall LOS C.	All approaches to FB operating within capacity. Overall LOS C.
PM Peak	All approaches to FB operating within capacity with LOS D and delays reduced. Significant improvement at A1101. North St worse, LOS E, due to merging and queues at Aldi.	Churchill Road operating over capacity and Nene Quay at capacity. FB Operating at LOS E. Merge issues causing congestion back to Freedom Bridge blocking the circulatory of the roundabout. A1101 operating within capacity and significantly better than DM.	All approaches to FB operating over capacity with LOS F and at all surround junctions. However, the scheme provides benefits over the DM.	

Results from the assessments shows that Option FB 5B is predicted to provide benefit to both peak hours of each forecast year, with delay along the A1101 approach being reduced when compared against the Do Minimum scenario.

Weaknesses within this option concerns the operation of the Aldi Junction, which operates worse than existing in 2031 PM peak, due to the change in signal timings and additional green time given to the A1101 approach. Benefits of this option for the A1101 greatly outweighs the delay at the Aldi Junction.

The one ahead lane on the A1101 Churchill Road eases issues when merging on the western gyratory, however moves the congestion and delay on both Churchill Road itself and Lynn Road.

6 Preferred Option – Concept Highway Design

Introduction

This chapter outlines the Concept Highway Design and cost - estimate for the preferred option identified within this report. The chapter includes:

- Design Assumptions and Input decisions;
- Concept Design Drawings;
- STATS Review, and;
- Road Safety Review.

Preferred Option

The schemes within the Wisbech Access Study have been designed to concept design level. Designs are based on national and local highway standards, and make clear reference where departures from standards are proposed. Concept designs are adequate to undertake transport assessments, and to inform Outline Business Cases. Any further level of design would require highway surveys, including topographical surveys.

Scheme designs have been informed by an initial STATs search, to identify if any public utilities would be affected by the scheme, and a cost provision added to the scheme cost if anything was found.

As identified within the previous chapter, Option FB 5B was the preferred option progressed to the concept design stage of the Wisbech Access Study. This option consists of:

'A series of network improvements focused on enhancing the capacity of approaches, whilst reducing the number of approach arms either directly opening onto the circulatory or positioned within the close vicinity of the roundabout (and the west gyratory).'

As previously discussed this option consists of individual elements, which could either be incorporated within the packaging assessment phase as a standalone element or used in combination with the remaining elements to create an option with greater improvement for Freedom Bridge Roundabout. The individual elements are:

- Alterations to the signal timings on the western gyratory, with pedestrian facilities added;
- Creation of a two way link on Bedford Street;
- Right turn out of De Havilland Road banned;
- Retaining of the petrol station with entry / egress being via Lynn Road only;
- Upgrade Churchill Road zebra to a signalised pedestrian crossing;
- One ahead lane from Churchill Road to the A1101 Freedom Bridge;
- Remove Horsefair approach / exit from Freedom Bridge Roundabout, with new access on / off Nene Quay, and;
- Widen the Freedom Bridge exit from the roundabout to reduce instances of HGV's straddling lanes.

Design Assumptions and Input Decisions

All designs are concept designs based on Ordnance Survey mapping. Level information is unknown and therefore embankments/cuttings and footprints should be treated as indicative.

This scheme has been designed in accordance with the Manual for Streets 1 & 2 and the Cambridgeshire Estate Road specification.

Scheme assumptions concerning geometric parameters of lane length alongside capacity decisions, have been informed by the assessment work described earlier within this report.

Assumptions made for each of the individual elements (detailed above) are outline below:

- Horsefair approach removed and new junction on Nene Quay;
 - New access provided by Bus Priority;
 - Existing bus station to remain with additional layover facilities provided, and;
 - Demolition of Albion House.
- Two way traffic on Bedford Street;
 - Land take required to provide entry and exit lane, and;
 - Right turns out of De Havilland Road are not permitted, with motorists to use the junction on Bedford Street to enter FBR.
- Petrol station/ Churchill Road;
 - Petrol station egress onto the circulatory removed, forecourt routine of motorists altered to exit on Lynn Road, and;
 - Pedestrian facilities on Churchill Road upgraded to signalised crossing.
- Freedom Bridge Exit;
 - Lanes widened to reduce straddling of HGV's.

Figure 6.1 on the following page shows the concept design for Freedom Bridge Roundabout.

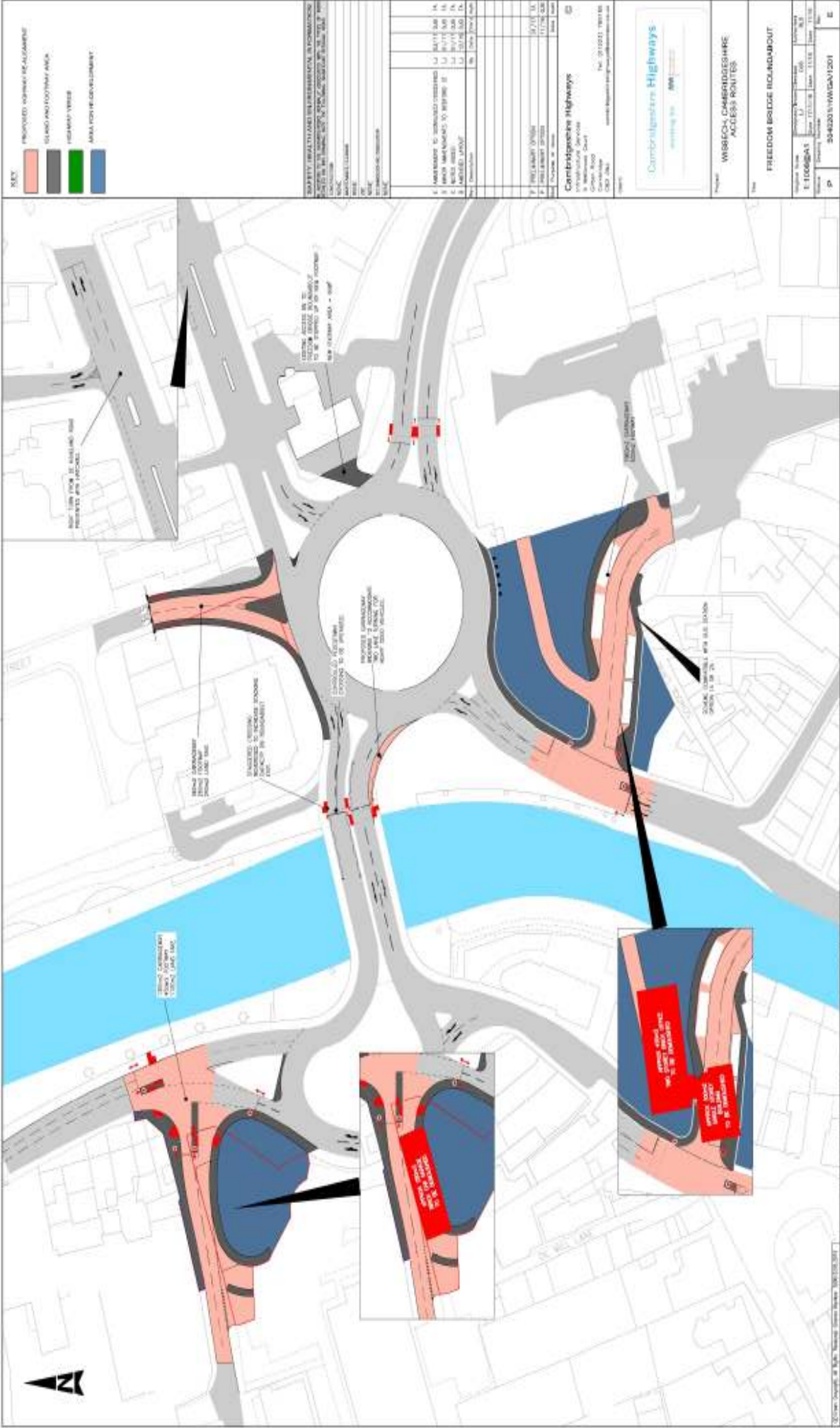


Figure 6.1: Option FB 5A Concept Highway Design

STATS Review

As part of the concept design process, searches have been undertaken to determine whether any STATS exist within the vicinity of the proposed schemes. STATS refers to utilities or services which run beneath the surface of the road, for example:

- Electricity Cables;
- Gas Mains;
- Water Mains and sewers, and;
- Telecommunications Wires.

This information will be necessary for further design stages, including more detailed scheme cost estimates. The presence of STATS may also dictate amendments to a scheme design at a later point.

Table 6.1 and Figure 6.2 below highlights the STATS present within the vicinity of the scheme location.

The cells highlighted in blue within Table 6.1 indicate the STATS present within this scheme location.

Table 6.1: STATs Present in Scheme Area

Anglian Water surface sewer (SWS)	Anglian Water portable water (AW)	Anglian Water foul sewer (Foul)	National Grid LP Gas Main (Gas LP)	National Grid MP Gas Main (Gas MP)
UKPN overhead electric (Elec OH)	UKPN underground electric (Elec UG)	Gas Main (Fulcrum MPG)	BT open reach underground Comms (BT)	Virgin Media underground Comms (VM)

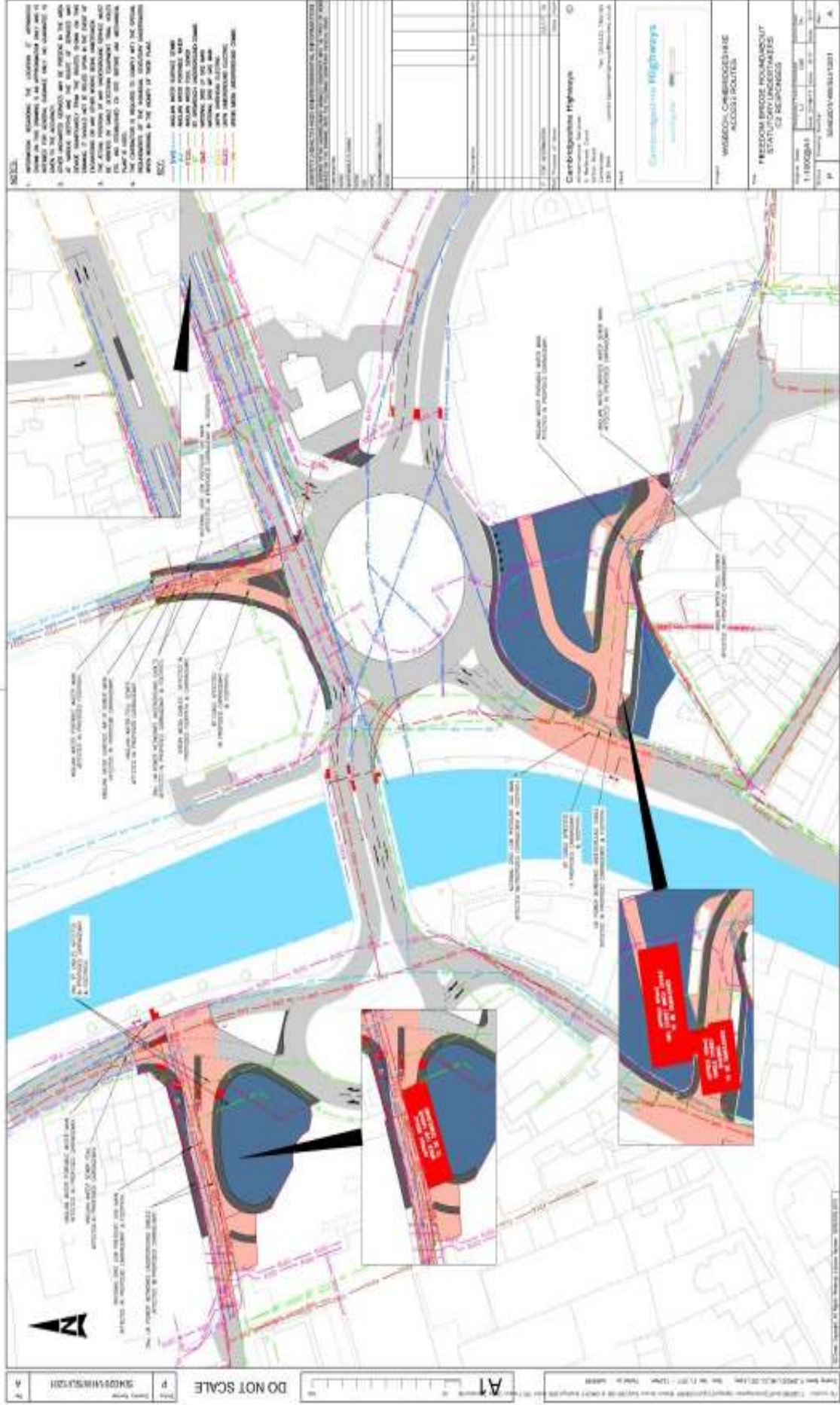


Figure 6.2: Freedom Bridge Roundabout Option FB 5b STAT Plan

Road Safety Review

The Concept Designs have been subject to an initial Road Safety Review by Cambridgeshire County Council. The purpose of the Road Safety Review is to identify potential safety issues associated with the schemes prior to any further design phase, and in particular any that could compromise scheme deliverability.

Note that this does not constitute a formal Road Safety Audit, and is instead initial feedback based on the Concept Designs. It should also be noted that it does not necessarily reflect the opinions of Norfolk County Council or Highways England. Schemes that fall within the jurisdiction of Norfolk County Council or Highways England will also need to satisfy their Road Safety Requirements as part of the design process.

Comments from the Road Safety Review are documented in the following table, which are separated into several design elements.

Table 6.2: Road Safety Review for Freedom Bridge Roundabout

Road Safety Feedback	Comment
A1101 Freedom Bridge exit lane	
The safety audit for the current layout recommended a trial of the kerb alignment. Concerns for sideswipe type accidents if two vehicles exited the roundabout at the same time	The likelihood of two HGV's exiting at the same time is considered very low. Large vehicles currently straddle both lanes when exiting the roundabout, which is a safety issue.
Undertake swept path analysis to determine what will be required here to safely exit two large vehicles at once	Swept path analysis has been undertaken in order to address this issue
There are several shunt type accidents in this area	Accident data has been considered as part of the scheme development and design
The design is highly likely to be constrained/restricted by the bridge deck	The current design works within the constraints of the bridge decks
Bedford Street	
This is currently a section of one way allowing vehicles to exit the roundabout only. A new entry to the roundabout so close to the exit of Lynn Road raises concerns for side impact collisions on the circulatory	Access improvements into the Nene Quay waterfront area are required to facilitate development in this area. The precise configuration between Bedford Street approach and Lynn Road exit can be considered at the detailed design stage
Churchill Road Zebra Crossing	
Whilst it is appreciated that this is an existing layout, it is of great concern to the road safety team with a high number collisions on and around the crossing	Subsequent revisions of this option have upgraded this crossing, to a signalised pedestrian crossing
Accident investigations lead to the feasibility of removing the zebra crossing and converting it to signal crossing.	See above

<p>Feasibility checks would include the adjustments to lane widths to get a central staggered island, capacity impact and desire line checks</p>	<p>See above</p>
<p>Nene Quay B198</p>	
<p>The forward visibility to the signal heads on Nene Quay, from the roundabout, may be inappropriate and may result in shunt type accidents.</p>	<p>Slight re-alignment of the Nene Quay exit from the roundabout could be considered at the detailed design stage. Additionally, speed calming measures or advanced signage could also be incorporated into further design work</p>
<p>Petrol Station (Lynn Road and Churchill Road)</p>	
<p>It is presumed that there will be an In and Out system proposed here, which will simplify the existing layout and should reduce conflicts that are existing issues</p>	<p>The current proposal is for the vehicles to enter the petrol station from both Churchill Road and Lynn Road and to pass through the pumps from east to west. Once filled vehicles would exit via Lynn Road</p>
<p>Lynn Road / De Havilland Road Junction</p>	
<p>By physically extending the island you not only prevent right turn out but right turn in, which will result in drivers having to use the roundabout to 'U' turn to access the junction. With the roundabout being a top cluster site it will increase the potential for collisions at the roundabout.</p>	<p>This has been incorporated into the design.</p>

Scheme Cost Estimate

A cost estimate has been produced for Freedom Bridge Roundabout, which incorporates the four individual elements discussed within this chapter. The cost of this overall scheme is £2, 868, 529.35, which has been produced using 2017 prices.

It should be noted that the inflation rate within the construction industry is approximately 4 -5 %per annum.

Although this costs is considered robust, the cost estimate is based on a concept level design, and may alter in the future subject to further information becoming available during later design stages.

The cost estimate includes the following items:

- Drainage;
- Carriageway;
- Junctions;
- Footpaths;
- Street Lighting;
- Signing and Lining;
- Preliminaries, including design (10% const. cost) and supervision (20% const. cost);
- Traffic Management;
- Land purchase and compulsory purchase estimates;
- Demolition;
- Land Acquisition, and,
- Optimism Bias @ 45%.

The cost estimates excludes the following items:

- Services Diversions;
- Contaminated Land Treatment, and;
- Local Planning Fees.

Land Acquisition and Demolition Costs

The following costs have been applied where land acquisition or demolition is required by a scheme. These costs are considered relevant to the location of the schemes and are derived from experience of other similar schemes within the region.

Land Acquisition – Agricultural £37, 500 per hectare;

Land Acquisition – Urban / Built £125,000 per hectare;

Compulsory Purchase Order – Dwelling £277,500 per dwelling, and;

Demolition – £70m² or £7,500 per dwelling.

Optimism Bias

The scheme costs also include 45% optimism bias. This is an uplift that is applied to the final scheme cost in line with DfT guidance on preparing scheme cost estimates. The DfT describes optimism bias in their Web Tag Note 'A1.2 Scheme Costs' (November 2014) as:

'Optimism bias is the demonstrated systematic tendency for appraisers to be overly optimistic about key parameters. Theorists on cost overrun suggest that optimism bias could be caused by the organisation of the decision-making process and strategic behaviour of stakeholders involved in the planning and decision-making processes.'

Different levels of optimism bias should be applied to scheme costs depending on the nature of the scheme (road, rail, ITS etc.) and how developed proposals or designs are. The schemes costed as part of the study are road schemes and are all at the first stage of scheme development. As a result of this an optimism bias of 45% is applied to the scheme costs.

Cost estimates for each of the schemes, including optimism bias are summarised in the table beneath. More detailed breakdowns of the costs are provided in Appendix B. Note that these costs assume schemes are delivered in isolation, and do not reflect the potential cost savings that may be associated with delivering adjacent or overlapping schemes at the same time.

Table 6.3: Option FB 5A Cost Estimate

Road Safety Feedback	Comment
Land Acquisition	£3,000.00
Demolition	£72,100.00
Construction	£1,381,997.00
Design (10% of const. cost)	£138,199.70
Supervision, site facilities and site fences (20% of const.cost)	£276,399.40
Traffic management	£106,600.00
Sub Total	£1,987,296.10
Optimism bias (@45%)	£890,233.25
Total	£2,868,529.35

7 Summary

Skanska have been commissioned by Cambridgeshire County Council to undertake an assessment based on improving the operation of Freedom Bridge Roundabout. This assessment forms the first phase of the Wisbech Access Study.

The purpose of this scheme assessment is to identify a series of options that could potentially enhance the operation of the roundabout, by either amending and/or removing entries/exits of the roundabout, as well as reconfigure the layout of the circulatory.

The key drivers behind investigating improvements for this location concerns peak hour congestion and the impact of bottlenecking, as well as the chaotic layout and poor driver discipline.

This report has considered the existing conditions along the corridor including traffic flow, journey times and delay, land use and ownership, flood risk and other ecological considerations.

Urban extensions proposed for Wisbech (as stated within the Fenland Local Plan) are outlined within Chapter three of this report, with the chapter addressing development proposals and infrastructural changes across future years for Wisbech South, East and West sites. Development of the Nene Waterfront and Port area is also briefly discussed.

A summary of the Option Development Workshop held in March 2016 is outlined within Chapter four of this report, whereby the context and procedure of the day is explained. Five options were generated within the workshop, focussing on signalisation and reconfiguration of the circulatory.

A Review Workshop was undertaken in October 2016, whereby an additional option was created and named FB 5. This option underwent several variations and incorporated numerous elements of other options that were agreed by the group to add benefit to the junction performance. Through assessment the original FB 5 was superseded to Option FB 5B, which was the only shortlisted option for this scheme element.

The shortlisted option included:

- FB 5B - Variation of Option FB 5, focusing on a series of improvements to individual approaches whilst minimising the number of accesses on / off the roundabout. The original Aldi access is retained and right turn movement banned from De Havilland Road.

The report then considers the option assessment process which was undertaken using VISSIM micro-simulation software. The assessment suggests Option FB 5B was the optimum performer out of all options generated within the initial workshop, with the series of elements providing benefit to:

- AM and PM peaks across future years assessed;
- Approaches with the heaviest flows, namely A1101 Freedom Bridge, A1101 Churchill Road and Lynn Road due to increased capacity;
- De Havilland Junction performance, due to opening Bedford Street to two way access; and,
- Pedestrian safety due to increased number of crossing points.

The report concludes with showing the Outline Highway Design for Option FB 5B, outlining the scheme cost, and road safety review comments.

Appendix A – VISSIM Assessment Report

Technical note

Project:	Wisbech Access Study	To:	Richard Jones
Subject:	Freedom Bridge Roundabout Option Assessment	From:	Emma White / Rachel McKay
Date:	20 Dec 2016	cc:	

1. Introduction

Atkins has been appointed by Skanska on behalf of Fenland District Council (FDC) and Cambridgeshire County Council (CCC) to evaluate a number of proposed highway improvement schemes around Wisbech, as part of the wider Wisbech Access Study.

In March 2016 Atkins undertook base year VISSIM modelling for the AM (0800-0900) and PM (1700-1800) peak periods which were successfully validated to observed traffic flows and journey times. Further details on this modelling can be located in the 'Wisbech VISSIM Model LMVR' report dated September 2016.

An option development workshop was held on 3rd March 2016 to propose and develop options for the network. The options were considered in 3 separate streams – Freedom Bridge Roundabout, Cromwell Road and Elm High Road. A number of options were selected for each of these areas to be taken forward for modelling to assess their performance.

The options have been divided into 3 separate technical notes, for ease of reporting, and represent the 3 separate streams from the workshop.

This note documents the assessment and results of the Freedom Bridge Roundabout proposed option modelling. Depending on the requirement of the individual options, schemes have been modelled in either VISSIM or LinSig. LinSig has been used to test signalisation schemes and VISSIM to test the priority options. Figure 1 below shows the current layout of Freedom Bridge Roundabout.

All options have been assessed using two traffic flow scenarios. The first is 'without Western Link Road' and the second is the 'with Western Link Road' which assumes the creation of a new link road connecting the A1101 to the north with the A47 to the south of Wisbech, via a route to the west of Wisbech. The 'with Western Link Road' scenario has a reduced number of trips through the model network, as a proportion of this traffic has been diverted via the new link road.

All assumptions made during this assessment, and documented within this report, have been agreed with the Wisbech Access Study Project Team (CCC / FDC / Skanska).

All options within this note have been modelled based on concept drawings in order to investigate feasibility. At this stage of the project it is recognised the drawings may not necessarily conform to highway standards. Once performance has been assessed and the better performing options selected to be taken forward agreed, detailed design will be undertaken.

Technical note

Figure 1. Freedom Bridge Roundabout



The following Options shown in Table 1 below have been assessed and are documented in more detail in each section of this Technical note.

Table 1. Freedom Bridge Option Testing

Option	Description	Software
2	Anti-clockwise signalisation of roundabout	LinSig
3	Signalisation of roundabout including straight through movement between Lynn Road to A1101	LinSig
4	Give way Roundabout with increased gyratory size	VISSIM
5	Give way Roundabout with removal of Horse Fair approach	VISSIM

The option numbering was developed during the Option Development Workshop held in March 2016. Note that an Option 1 was developed, but not progressed to assessment.

The technical consists of the following sections;

- Methodology;
- Option 2 assessment;
- Option 3 assessment;
- Option 4 assessment;
- Option 5 assessment;
- Option Adjustments;
- Option 5a assessment; and,
- Conclusions.

Technical note

2. Methodology

2.1. Traffic Flows

The options for Freedom Bridge were tested with the base year (2016) and future year's traffic flows 2021, 2026 and 2031 with and without the Western Link Road (WLR).

At present, a re-validation of the WATS SATURN model to 2015/2016 traffic counts and updates to the road network is currently taking place independently to this project. It was originally planned to use the re-validated WATS SATURN model to inform the VISSIM modelling of the future year flows.

The WATS SATURN model refresh is currently being undertaken so the future year flows utilised in VISSIM for this part of the assessment have been taken from the 2016 *forecast* from the 2008 base model (the first forecast year).

To ensure the 2015 updated WATS model was fit for purpose, a comparison of the 2008 SATURN model counts to the 2015 traffic counts was undertaken and reported in the 'Saturn Wisbech Benchmarking TN' dated 26th August 2016. It was concluded that the 2016 forecast modelled data matches closer to the 2015 traffic count data, suggesting the 2016 forecast modelled data should be used for option testing as opposed to using the 2008 base year modelled data.

However, some limitations were identified with using the previous WATS model including:

- The network structure within the 2008 SATURN model along Cromwell Road is now out of date. The developments have since been built on site and therefore, there are notable discrepancies between SATURN and VISSIM representations;
- Within SATURN there are 3 zones that feed onto New Bridge Lane, rather than being split across various new accesses; and,
- The SATURN model appears to have forecast much higher trip generation along Cromwell Road than is actually occurring on site. This is due to out of date development assumptions that were originally made in 2008 that were not actually built (office development space that was rejected).

Therefore, the future traffic flows along the southern end of Cromwell Road and from the Wisbech South Development are considered to be particularly high in the 2008 WATS model and therefore have a knock on effect on the future year flows utilised in VISSIM.

The re-validated WATS model that is currently being undertaken is using the same traffic data as the VISSIM model and should therefore provide more realistic future year flows to assess all the options once completed in January 2017.

However, the flows utilised for this assessment could be considered to represent a worst case scenario and are suitable to inform decisions for which options should be taken forward for option packaging and which should be ruled out.

The traffic flows for 2021, 2026 and 2031 were created using the following process:

- Turning counts for the VISSIM network were extracted from the 2016, 2021 and 2026 Saturn model (2008 Base);
- The absolute and percentage difference between SATURN modelled 2016 and each future year were calculated;
- The percentage difference for each future year was then applied to the VISSIM 2016 flows. Large percentage differences (below 50% or above 150%) were sense checked and absolute values were applied if necessary (a large percentage difference may not be a large absolute difference);
- The flows were then balanced for use in VISSIM; and,
- This process was carried out for both light and heavy vehicles separately.

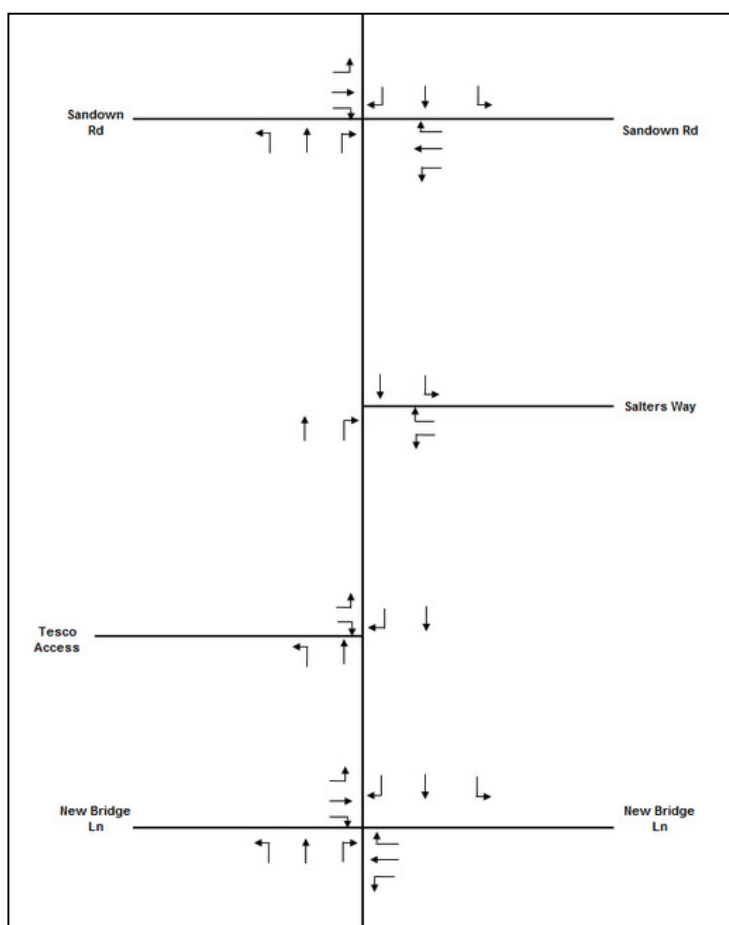
The following assumptions have been included within the modelling process, as agreed with the Project Team:

Technical note

- Traffic flows in the south of Cromwell Road from the new developments have been distributed between New Bridge Lane / Tesco and Salters Way (as SATURN was loading them all onto New Bridge Lane);
- Traffic to and from Sandown Road west and Tesco has been split 50-50 as this development was unconfirmed at the time the 2008 WATS SATURN model was developed; and,
- Where there is no flow, as the roads were not coded into the 2008 WATS SATURN models, the 2016 count data utilised in VISSIM has been used and no growth assumed (as the model will have incorporated the growth in the existing movements).

Figure 2 shows the network structure along Cromwell Road, for the above accesses.

Figure 2. Junction locations along Cromwell Road



All options have been modelled with and without the WLR. The WLR is proposed to run from the A47 / Cromwell Road roundabout, over the river and join with the A1101 North End to the north of Wisbech. Only one option within the model network directly connects onto the proposed Western Link Road which is CR Opt 7. As each of the options have been assessed as standalone schemes, the following assumptions have been made regarding how the WLR traffic enters / leaves the network in the absence of CR Opt 7. These assumptions revolve around redistributing this traffic onto other arms of the roundabout where the WLR connects with the model network. . The assumptions regarding traffic at the B198/A47 roundabout include:

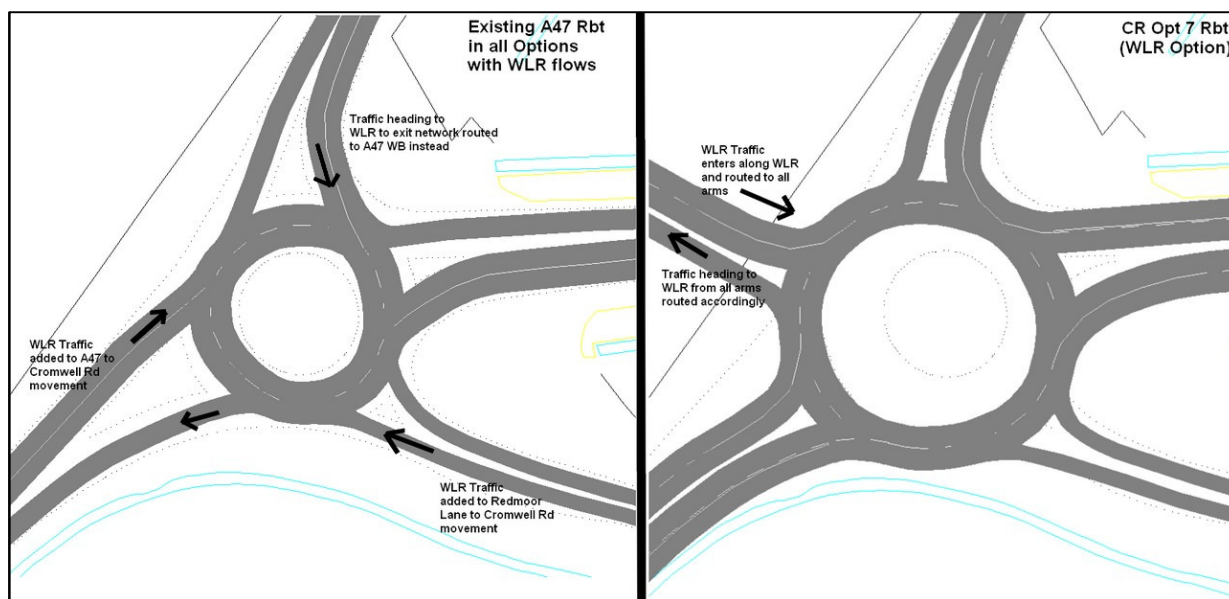
- The WLR trips entering the network to travel north along Cromwell Road has been split 50/50 between the A47 West and Redmoor Lane approaches when CR Opt 7 is not applied;
- All other WLR trips to other arms have been removed entirely as these leave the network from this junction;
- In the absence of CR Opt 7, trips from Cromwell Road to the WLR have been applied to the Cromwell Road to A47 West movement;

Technical note

- All other trips heading to the WLR from other arms have been removed, as they would not enter the model network beyond this junction; and,
- CR Opt 7 has the WLR arm at the roundabout, so all movements to and from the WLR have been included in this option.

Figure 3 shows the existing layout of the A47 roundabout compared with CR Opt 7 detailing this in more detail.

Figure 3. WLR Flow Assignment



The VISSIM models are considered to reflect the flows for 2021 and 2026 as accurately as feasible. Until the new WATS SATURN model is available the full accuracy of the flows is unknown. Due to the higher flows it was agreed 2031 would not be assessed using these flows but will be included once the WATS model is refreshed. The methodology and limitations have all been discussed and agreed with Skanska.

2.2. Do Minimum VISSIM Modelling

In order to evaluate and quantify the benefits of the proposed options in the future years, a Do Minimum (DM) scenario is required for each future year assessment. The Base VISSIM model was updated with the 2021 and 2026 flows to create a DM scenario.

As a result of the increased flows in the future years, especially along Cromwell Road, optimisations were made to the existing signal timings as follows:

AM Peak Without WLR:

- SC102 Cromwell Rd / Tesco: Max A increased from 50s to 60s;
- SC104 Cromwell Rd / Sandown Rd: Include phase B in stage 2 maximums, Max C increased from 15s to 30s; and,
- SC105 Cromwell Rd / Weasenham Lane: Max C increased from 19s to 29s.

PM Peak Without WLR:

- SC105 Cromwell Rd / Weasenham Lane: Max A increased from 31s to 40s and added gap out B to stage 2.

AM Peak With WLR: no changes, signals as Without WLR.

Technical note

PM Peak With WLR:

- SC205 Elm High Rd / Weasenham Lane: Max D increased from 15s to 36s;
- SC104 Cromwell Rd / Sandown Rd: added Max B of 25s, Max D decreased to 10s from 15s, Max E decreased to 7s from 10s, Max F decreased to 15s from 30s and Max G decreased to 25s from 30s; and,
- SC105 Cromwell Rd / Weasenham Lane: Gap B added to stage 2, Max A decreased to 25s from 31s, Max C increased to 40s from 29s and Max D increased from 22s to 30s.

2.3. LinSig

On site Freedom Bridge Roundabout operates under give-way control. To test whether the signalisation schemes (Option 2 and Option 3) would operate within capacity on site initial LinSig analysis was undertaken. No base/DM LinSig model was created due to the give way control on site.

LinSig models vehicles as Passenger Car Unit (PCU) which is a method used to allow for the different vehicle types within a traffic flow group to be assessed in a consistent manner. The traffic flows used within VISSIM are in vehicles and have been taken directly from the manual classified turning count surveys. Therefore, in order to use LinSig to assess the proposed options, the surveyed flows were required to be converted into PCUs. The same PCU factors that were utilised in the WATS SATURN model were used for this to maintain consistency which are: 1 for car or light goods vehicle (LGV); 2 for heavy goods vehicles (HGV) and buses; and 0.4 for a motorcycle.

The base year VISSIM balanced traffic flows were already separated into lights, heavies and buses. The appropriate factor was used accordingly and then the totals for light, heavies and buses were added together to determine total PCUs for the network. This flow in PCUs was used in the LinSig models for each of the options tested. Where different options required the closure of a link, flows were re-routed over alternative links.

It should be noted that the flows in LinSig are demand flows as LinSig does not model the whole network therefore traffic has not been held up in other parts of the network.

LinSig version 3.2.32 was utilised.

3. Freedom Bridge Option 2

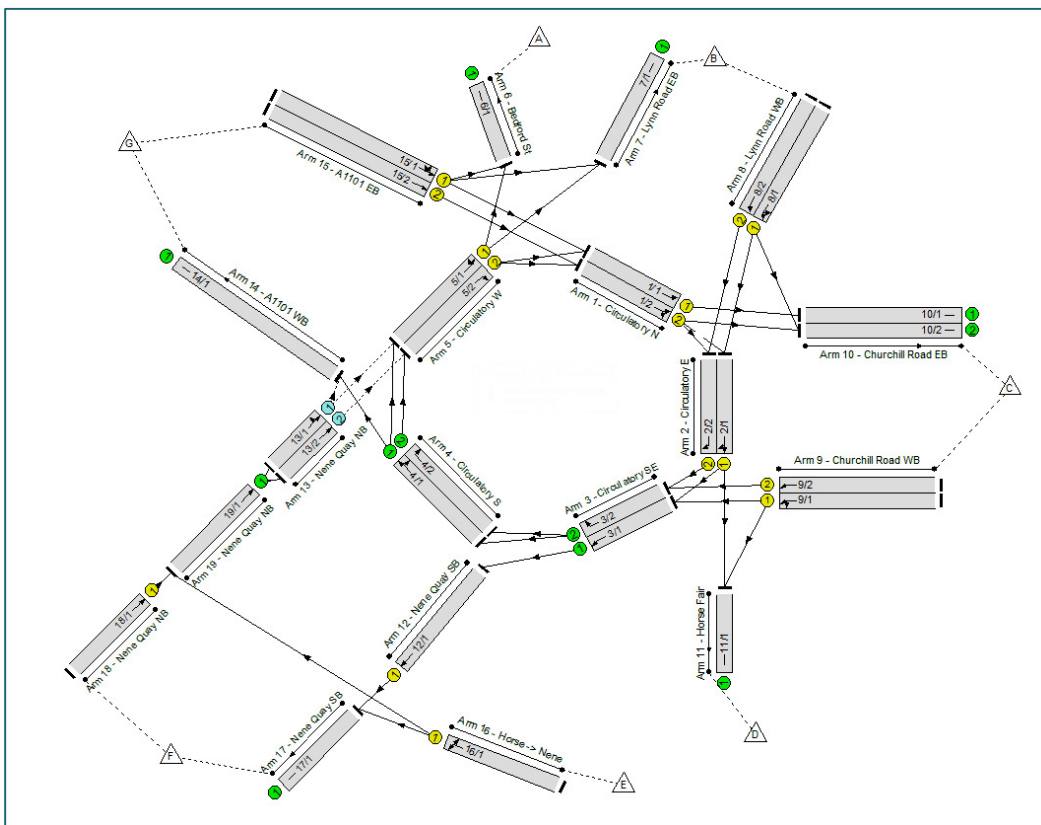
3.1. Network Changes

A number of changes were made to the network to represent this option. Figure 4 shows a diagram of the LinSig model for this option. A list of network changes are as follows:

- Freedom Bridge Option 2 utilises an anti-clockwise operation at the roundabout. This involves modelling 3 arms under signal control (three highest traffic flows approach) and one under give way (lowest traffic flow);
- Access to Freedom Bridge roundabout from the petrol station is removed and all flows are rerouted via Lynn Road WB;
- Access to the roundabout from Horse Fair NB is removed and all flows are rerouted via a new signalised junction on Nene Quay. The Horse Fair SB exit from the roundabout remains;
- A signalised junction on Nene Quay is added for all movements for access out of Horse Fair.
- A priority junction is added at the intersection of Nene Quay and the roundabout with traffic from Nene Quay giving way to traffic on the roundabout;
- The roundabout is signalised at all entrances/exits with the exception of the Nene Quay where a priority junction is added;
- The signal staging allows one approach to run at a time starting at the A1101 and moving anti-clockwise around the roundabout;
- Three separate stages are used, one for each of the three signalised approaches.

Technical note

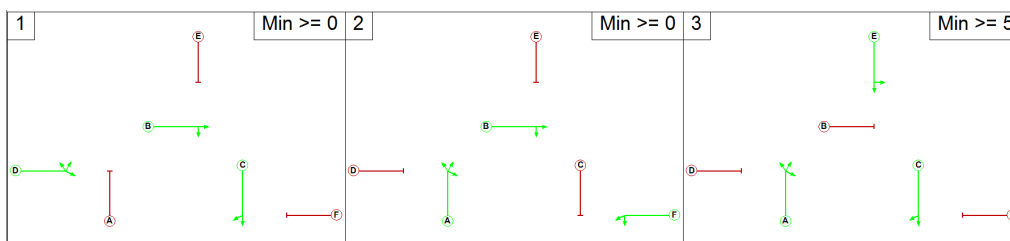
Figure 4. LinSig Diagram of Freedom Bridge Roundabout Option 2



3.2. Signal Staging

Figure 5 shows the stages used in the assessment, whilst Figure 6 shows the stages used for the new junction between Horse Fair and Nene Quay. For the junction of Horse Fair and Nene Quay, the Horse Fair arm would run on demand only¹.

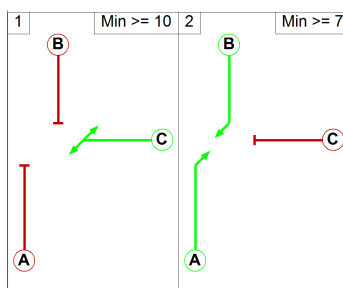
Figure 5. Stage diagram for Freedom Bridge Roundabout in Option 2



¹ Horse Fair and Nene Quay cannot be modelled on demand in LinSig therefore have been called every cycle.

Technical note

Figure 6. Stage Diagram for Horse Fair and Nene Quay Junction in Option 2



Cycle Time optimisation was run for both the AM and PM peak and then the signal timings were optimised to minimise delay. Table 2 shows a summary for the results for each peak.

3.3. 2016 Results Summary

Table 2 shows a summary of the results for the 2016 AM and PM Peak for Option 2.

Table 2. 2016 Summary of Results for Freedom Bridge Roundabout Opt 2

Link Number	Name	AM Peak CT 70 secs				PM Peak CT 60 secs			
		DOS (%)	Queue (pcu)	Av. Delay Per PCU (s/pcu)	Flow	DOS (%)	Queue	Av. Delay Per PCU (s/pcu)	Flow
1/1	Circulatory N Ahead	29.4%	3.90	9.20	295	34.9%	2.90	11.90	304
1/2	Circulatory N Right Ahead	52.6%	10.40	16.40	528	43.6%	5.90	13.80	379
2/1	Circulatory E Right Ahead	57.9%	7.50	17.50	402	45.4%	5.90	20.90	368
2/2	Circulatory E Right	62.1%	1.40	8.50	431	70.6%	1.90	8.70	572
3/1	Circulatory SE Ahead	19.0%	0.10	1.20	342	19.8%	0.10	1.20	357
3/2	Circulatory SE Right	56.3%	1.50	2.60	1014	66.9%	2.00	3.40	1205
4/1	Circulatory S Right Ahead	54.6%	0.60	2.20	982	65.9%	1.00	2.90	1187
4/2	Circulatory S Right	1.8%	0.00	1.00	32	1.0%	0.00	1.00	18
5/1	Circulatory W Left Ahead	45.4%	3.80	11.10	362	84.0%	9.80	27.40	529
5/2	Circulatory W Right	17.6%	0.80	6.30	140	38.9%	2.70	15.10	245
8/1	Lynn Road WB Ahead Left	57.5%	6.40	26.20	362	35.0%	3.30	17.00	257
8/2	Lynn Road WB Ahead	61.3%	7.50	26.60	414	71.0%	9.00	23.50	559
9/1	Churchill Road WB Ahead Left	9.7%	1.00	11.90	91	9.5%	0.80	13.80	74
9/2	Churchill Road WB Ahead	57.7%	8.80	17.10	583	76.1%	10.50	24.40	633
12/1	Nene Quay SB Ahead	46.9%	3.40	20.20	342	29.5%	2.20	7.50	357
13/1	Nene Quay NB Ahead Left	43.6%	3.60	14.10	235	77.2%	4.00	27.40	307
13/2	Nene Quay NB Ahead	20.7%	1.40	10.80	108	58.6%	2.40	18.50	227
15/1	A1101 EB Ahead U-Turn Left	79.7%	12.80	28.70	642	54.6%	6.60	15.10	513
15/2	A1101 EB Ahead	57.1%	7.90	20.60	493	34.9%	3.90	12.40	352
16/1	Horse Fair Nene Left Right	8.6%	0.90	13.00	77	40.2%	2.40	29.90	145
18/1	Nene Quay NB Ahead	38.9%	4.30	20.20	284	34.5%	3.60	7.90	418
19/1	Nene Quay NB Ahead	17.5%	0.10	1.10	343	27.2%	0.20	1.30	534
Overall PRC %		13.00				7.20			
Overall Delay (pcuHr)		30.78				32.62			

The table shows in both peaks the roundabout is predicted to operate within capacity with a Practical Reserve Capacity (PRC) of 13% and 7.2% respectively for the AM and PM Peak.

Although the roundabout is operating within capacity, there is an issue with queueing on the circulatory stop lines, as shown by the cells highlighted in orange. It is predicted that queues on the circulatory will be longer than the stacking space available, causing traffic to block back across the junction and other approaches.

Technical note

LinSig has been set up to minimise the queues at the circulatory, but it will likely be an issue due to the interaction of the give way arm on this roundabout. Generally this layout operates best when the approach with the lowest flow is operating on give way. Although Nene Quay has the lowest flow of all approaches, the flow is still too high for this type of signalisation to operate efficiently.

3.4. 2021 Without WLR Results Summary

A summary of the 2021 Without WLR LinSig results for Freedom Bridge Option 2 are shown in Table 3 beneath for the AM and PM peak hours.

Table 3. 2021 Without WLR AM Peak and PM Peak Results Freedom Bridge Option 2

Link Number	Name	AM Peak CT 90 secs				PM Peak CT 90 secs			
		DOS (%)	Queue (pcu)	Av. Delay Per PCU (s/pcu)	Flow	DOS	Queue	Av. Delay Per PCU (s/pcu)	Flow
1/1	Circulatory N Ahead	29.0%	4.40	6.80	319	24.9%	2.50	10.10	264
1/2	Circulatory N Right Ahead	50.7%	13.30	15.60	558	46.3%	12.30	16.40	491
2/1	Circulatory E Right Ahead	53.8%	9.00	23.70	387	54.2%	9.10	41.80	358
2/2	Circulatory E Right	63.3%	1.80	10.20	456	90.2%	10.00	27.00	595
3/1	Circulatory SE Ahead	19.0%	0.10	1.20	342	19.8%	0.10	1.20	356
3/2	Circulatory SE Right	57.2%	3.40	2.70	1029	70.8%	6.20	3.90	1275
4/1	Circulatory S Right Ahead	55.5%	0.60	2.20	999	69.8%	1.10	3.30	1256
4/2	Circulatory S Right	1.7%	0.00	1.00	30	1.1%	0.00	1.00	19
5/1	Circulatory W Left Ahead	39.9%	3.60	8.50	367	58.1%	7.40	8.40	653
5/2	Circulatory W Right	15.9%	0.60	4.00	146	23.1%	2.30	6.10	236
8/1	Lynn Road WB Ahead Left	55.9%	7.30	33.60	321	41.2%	5.30	28.80	254
8/2	Lynn Road WB Ahead	68.8%	10.40	37.00	424	87.9%	17.10	49.60	582
9/1	Churchill Road WB Ahead Left	10.9%	1.40	14.00	106	8.0%	1.00	12.10	83
9/2	Churchill Road WB Ahead	55.1%	10.50	19.40	573	61.3%	12.50	18.70	680
12/1	Nene Quay SB Ahead	58.0%	3.10	18.60	342	24.3%	2.10	4.60	356
13/1	Nene Quay NB Ahead Left	42.0%	4.90	17.50	227	124.2%	76.60	431.50	438
13/2	Nene Quay NB Ahead	22.1%	2.30	13.80	116	65.5%	5.30	29.80	217
15/1	A1101 EB Ahead U-Turn Left	88.3%	18.60	45.50	649	83.0%	14.30	44.40	520
15/2	A1101 EB Ahead	64.2%	11.20	29.40	506	69.8%	11.30	35.50	469
16/1	Horse Fair Nene Left Right	6.6%	0.90	10.50	74	60.4%	4.20	56.10	145
18/1	Nene Quay NB Ahead	48.7%	6.30	31.80	287	36.8%	4.90	6.00	539
19/1	Nene Quay NB Ahead	17.5%	0.10	1.10	343	33.3%	0.20	1.40	655
Overall PRC %		1.90				-38.00			
Overall Delay (pcuHr)		38.78				99.09			

Table 3 shows that Option 2 is forecast to operate over capacity by 2021, particularly in the PM Peak due to the higher traffic flows. Nene Quay approach is over capacity (DoS 124%) and the A1101 and Lynn Road are close to capacity. As per the 2016 models, the circulatory links (as shown by the cells highlighted in orange) are also over capacity with queues longer than the link lengths causing blocking back which will further affect the approaches.

3.5. 2021 With WLR Results Summary

A summary of the 2021 with WLR LinSig results for Freedom Bridge Option 2 are shown in Table 4 beneath for the AM and PM peak hours.

Technical note

Table 4. 2021 With WLR AM Peak and PM Peak Results Freedom Bridge Option 2

Link Number	Name	AM Peak CT 70 secs				PM Peak CT 90 secs			
		DOS (%)	Queue (pcu)	Av. Delay Per PCU (s/pcu)	Flow	DOS	Queue	Av. Delay Per PCU (s/pcu)	Flow
1/1	Circulatory N Ahead	21.0%	2.00	18.40	151	8.1%	0.40	5.70	88
1/2	Circulatory N Right Ahead	46.5%	6.30	18.30	335	21.9%	5.20	12.80	236
2/1	Circulatory E Right Ahead	50.7%	8.20	13.60	495	44.5%	6.50	24.80	285
2/2	Circulatory E Right	43.3%	0.80	3.50	423	84.2%	7.10	18.20	539
3/1	Circulatory SE Ahead	25.9%	0.20	1.30	467	15.6%	0.10	1.20	281
3/2	Circulatory SE Right	49.1%	1.30	2.30	884	55.3%	1.30	2.40	996
4/1	Circulatory S Right Ahead	47.4%	0.50	1.90	854	55.3%	0.60	2.20	996
4/2	Circulatory S Right	1.7%	0.00	1.00	30	0.0%	0.00	0.00	0
5/1	Circulatory W Left Ahead	46.4%	4.70	10.90	370	56.4%	7.80	8.90	575
5/2	Circulatory W Right	18.7%	1.00	7.70	149	10.7%	1.00	5.90	109
8/1	Lynn Road WB Ahead Left	43.1%	5.40	15.10	401	46.0%	5.90	30.50	274
8/2	Lynn Road WB Ahead	42.4%	5.70	14.80	423	84.3%	15.10	46.00	539
9/1	Churchill Road WB Ahead Left	18.5%	1.80	20.30	118	7.6%	1.00	11.60	80
9/2	Churchill Road WB Ahead	67.5%	8.70	28.30	461	40.4%	6.90	14.60	457
12/1	Nene Quay SB Ahead	79.2%	6.00	29.20	467	19.2%	0.80	2.10	281
13/1	Nene Quay NB Ahead Left	36.7%	3.30	11.80	236	85.3%	13.90	31.70	503
13/2	Nene Quay NB Ahead	18.9%	1.50	9.90	119	19.8%	0.80	8.70	109
15/1	A1101 EB Ahead U-Turn Left	66.5%	9.30	23.20	536	76.6%	12.30	39.50	480
15/2	A1101 EB Ahead	33.2%	4.00	17.10	287	32.0%	4.30	27.00	215
16/1	Horse Fair Nene Left Right	7.1%	0.70	10.00	74	60.4%	4.20	56.10	145
18/1	Nene Quay NB Ahead	50.7%	5.20	26.40	299	33.9%	4.40	5.80	496
19/1	Nene Quay NB Ahead	18.1%	0.10	1.10	355	31.1%	0.20	1.30	612
Overall PRC %		13.60				5.50			
Overall Delay (pcuHr)		27.31				34.98			

Table 4 shows that Option 2 is forecast to operate within capacity with the WLR in 2021, though Nene Quay and Lynn Road are close to capacity in the PM Peak. Though the approaches are operating within capacity the circulatory links are again forecast to be over capacity with queues longer than the link lengths, as highlighted in the table.

3.6. 2026 Without WLR Results

A summary of the 2026 without WLR LinSig results for Freedom Bridge Option 2 are shown in Table 5 beneath for the AM and PM peak hours.

Technical note

Table 5. 2026 Without WLR AM Peak and PM Peak Results Freedom Bridge Option 2

Link Number	Name	AM Peak CT 90 secs				PM Peak CT 90 secs			
		DOS (%)	Queue (pcu)	Av. Delay Per PCU (s/pcu)	Flow	DOS (%)	Queue	Av. Delay Per PCU (s/pcu)	Flow
1/1	Circulatory N Ahead	37.2%	6.40	7.20	409	34.0%	5.10	11.50	362
1/2	Circulatory N Right Ahead	49.4%	12.70	14.80	543	35.0%	9.00	14.60	371
2/1	Circulatory E Right Ahead	61.6%	11.00	20.60	505	52.9%	9.20	42.40	370
2/2	Circulatory E Right	53.7%	1.50	7.00	440	87.4%	9.80	21.50	612
3/1	Circulatory SE Ahead	25.4%	0.20	1.30	458	20.6%	0.10	1.30	370
3/2	Circulatory SE Right	52.2%	1.50	2.50	940	75.6%	9.20	4.80	1360
4/1	Circulatory S Right Ahead	50.6%	0.50	2.00	910	74.6%	1.50	3.90	1342
4/2	Circulatory S Right	1.7%	0.00	1.00	30	1.0%	0.00	1.00	18
5/1	Circulatory W Left Ahead	42.8%	3.70	10.30	351	60.2%	8.50	9.50	766
5/2	Circulatory W Right	14.4%	0.70	5.30	118	20.4%	2.70	8.00	200
8/1	Lynn Road WB Ahead Left	71.7%	10.40	39.00	412	45.5%	6.00	29.60	281
8/2	Lynn Road WB Ahead	67.3%	10.00	36.50	415	90.5%	18.50	54.30	599
9/1	Churchill Road WB Ahead Left	10.2%	1.30	16.90	88	8.6%	1.10	13.20	85
9/2	Churchill Road WB Ahead	54.1%	9.60	22.50	500	70.4%	15.30	22.50	748
12/1	Nene Quay SB Ahead	77.7%	10.60	28.00	458	28.2%	2.10	5.40	370
13/1	Nene Quay NB Ahead Left	44.5%	6.00	17.00	275	190.2%	176.80	984.90	563
13/2	Nene Quay NB Ahead	14.6%	1.50	10.60	88	65.8%	3.30	33.20	182
15/1	A1101 EB Ahead U-Turn Left	91.8%	23.00	46.90	774	101.1%	32.00	110.30	677
15/2	A1101 EB Ahead	55.0%	9.70	23.40	497	48.7%	7.30	28.10	350
16/1	Horse Fair Nene Left Right	6.6%	0.90	10.50	74	36.9%	3.40	38.30	145
18/1	Nene Quay NB Ahead	52.1%	6.90	32.50	307	48.0%	8.10	10.00	629
19/1	Nene Quay NB Ahead	18.5%	0.10	1.10	363	37.9%	0.30	1.50	745
Overall PRC %		-2.00				-111.30			
Overall Delay (pcuHr)		43.05				215.47			

Table 5 shows that Option 2 is forecast to operate over capacity in both the AM and PM peak hours (-2% and -111.30% PRC respectively) in 2026 without WLR. The network issues are the same as the 2021 Without WLR scenario, but exacerbated in 2026.

3.7. 2026 With WLR Results

A summary of the 2026 with WLR LinSig results for Freedom Bridge Option 2 are shown in Table 6 beneath for the AM and PM peak hours.

Technical note

Table 6. 2026 With WLR AM Peak and PM Peak Results Freedom Bridge Option 2

Link Number	Name	AM Peak CT 70 secs				PM Peak CT 90 secs			
		DOS (%)	Queue (pcu)	Av. Delay Per PCU (s/pcu)	Flow	DOS	Queue	Av. Delay Per PCU (s/pcu)	Flow
1/1	Circulatory N Ahead	21.9%	2.00	8.70	197	9.4%	0.40	5.90	98
1/2	Circulatory N Right Ahead	45.0%	7.30	14.60	405	21.9%	5.00	12.80	228
2/1	Circulatory E Right Ahead	51.4%	7.30	16.80	410	42.4%	6.70	30.70	288
2/2	Circulatory E Right	53.6%	1.10	6.30	427	89.4%	10.40	24.10	608
3/1	Circulatory SE Ahead	19.4%	0.10	1.20	349	15.7%	0.10	1.20	282
3/2	Circulatory SE Right	45.6%	0.90	2.00	820	58.9%	1.40	2.60	1060
4/1	Circulatory S Right Ahead	43.9%	0.40	1.80	790	57.9%	0.70	2.40	1042
4/2	Circulatory S Right	1.7%	0.00	1.00	30	1.0%	0.00	1.00	18
5/1	Circulatory W Left Ahead	44.0%	4.00	11.00	351	54.5%	5.80	7.60	556
5/2	Circulatory W Right	18.2%	0.90	6.00	145	11.8%	1.30	6.00	120
8/1	Lynn Road WB Ahead Left	45.6%	5.30	20.50	337	41.4%	5.40	28.00	264
8/2	Lynn Road WB Ahead	51.9%	6.60	21.20	411	88.8%	18.00	49.80	608
9/1	Churchill Road WB Ahead Left	10.5%	1.00	14.40	87	7.9%	1.00	12.70	80
9/2	Churchill Road WB Ahead	44.1%	5.70	17.70	393	41.6%	7.10	16.00	452
12/1	Nene Quay SB Ahead	54.1%	3.70	22.40	349	21.5%	0.50	2.80	282
13/1	Nene Quay NB Ahead Left	33.6%	2.70	8.00	232	95.9%	19.50	66.30	512
13/2	Nene Quay NB Ahead	17.0%	1.10	6.40	115	20.2%	1.00	10.30	102
15/1	A1101 EB Ahead U-Turn Left	72.0%	10.60	25.00	580	86.2%	15.50	48.10	540
15/2	A1101 EB Ahead	41.8%	5.30	18.10	361	30.7%	4.10	26.80	206
16/1	Horse Fair Nene Left Right	7.5%	0.80	11.10	74	36.9%	3.40	38.30	145
18/1	Nene Quay NB Ahead	45.1%	4.90	23.60	291	38.0%	5.80	8.90	498
19/1	Nene Quay NB Ahead	17.7%	0.10	1.10	347	31.2%	0.20	1.30	614
Overall PRC %		25.00				-6.60			
Overall Delay (pcuHr)		24.60				44.86			

Table 6 shows that Option 2 is forecast to operate within capacity in the AM Peak but over capacity in the PM Peak. In the PM Peak Nene Quay, Lynn Road and the A1101 will be close to capacity and in both the AM and PM Peak the circulatory links are forecast to be over capacity with queues longer than the link lengths, as shown by the cells highlighted in orange.

It should be noted that the flow at Freedom Bridge Roundabout for the 2026 with WLR AM Peak scenario is slightly lower than the equivalent 2021 scenario. This may be due to the re-routing of vehicles in the SATURN model due to the new link road and the high traffic flows/issues along Cromwell Road.

4. Freedom Bridge Option 3

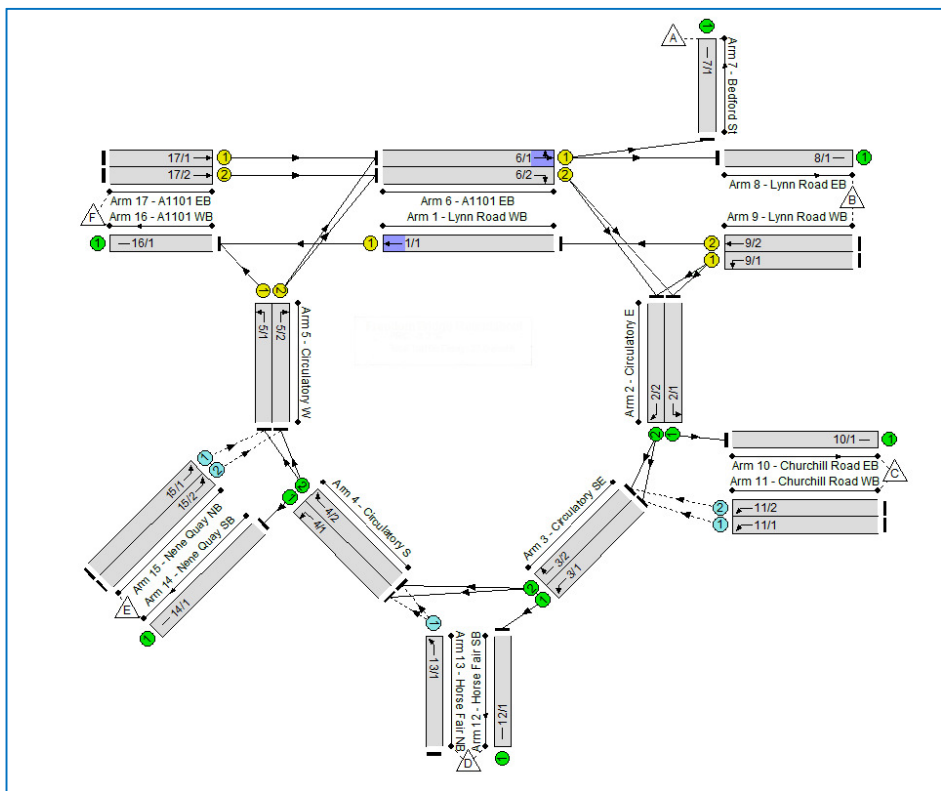
4.1. Network Changes

A number of changes were made to the network to represent this option. Figure 7 shows a diagram of the LinSig model for this option. A list of network changes are as follows:

- The north end of the roundabout is opened up to two way traffic with vehicles able to travel directly from Lynn Road WB to the A1101 WB without needing to circle the roundabout;
- The southern portion of the roundabout remains as is, with giveway approaches;
- Access via the petrol station is removed and all flows are rerouted via Lynn Road WB;
- 6 Phases are added to the northern section of the roundabout to regulate the two way traffic;
- The 6 phases are run on two stages, with traffic flowing east and west on the first stage. Traffic turning onto the A1101 EB and WB from the roundabout and turning onto the roundabout from the A1101 EB are on the second stage. The ahead lane to Lynn Road and Bedford Road from the A1101 EB runs on both stages.

Technical note

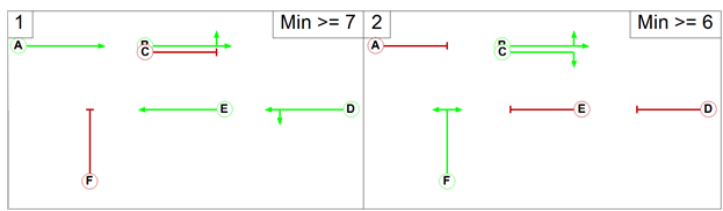
Figure 7. LinSig diagram of Freedom Bridge Roundabout Option 3



4.2. Signal Staging

The signal staging was optimised for delay, and is shown in Figure 8.

Figure 8. Stage Diagram for Freedom Bridge Roundabout in Option 3



4.3. 2016 Results Summary

Table 7 shows the results summary for the 2016 AM and PM Peak for Option 3.

Technical note

Table 7. 2016 Summary of Results for Freedom Bridge Roundabout Opt 3

Link Number	Name	AM Peak CT 90s				PM Peak CT 90s			
		DOS (%)	Queue (pcu)	Av. Delay Per PCU (s/pcu)	Flow	DOS	Queue	Av. Delay Per PCU (s/pcu)	Flow
1/1	Lynn Road WB Ahead	58%	1.00	7.30	377	91%	4.90	32.40	529
2/1	Circulatory E Left	39%	0.30	1.50	766	28%	0.20	1.30	559
2/2	Circulatory E Right	22%	0.10	1.10	456	20%	0.10	1.10	411
3/1	Circulatory SE Left	8%	0.00	1.00	151	4%	0.00	0.90	85
3/2	Circulatory SE Right	46%	0.40	1.60	979	49%	0.50	1.60	1033
4/1	Circulatory S Left	18%	0.10	1.10	360	19%	0.10	1.10	386
4/2	Circulatory S Right	33%	0.20	1.30	696	37%	0.30	1.30	792
5/1	Circulatory W Left	42%	6.10	10.10	478	36%	5.40	9.70	436
5/2	Circulatory W Right	44%	7.20	13.00	502	65%	12.70	14.90	774
6/1	A1101 EB Left Ahead	42%	0.40	1.60	814	49%	0.50	1.80	956
6/2	A1101 EB Right	70%	20.70	33.80	823	56%	15.50	23.40	683
9/1	Lynn Road WB Left	70%	9.90	38.00	399	56%	6.80	36.50	287
9/2	Lynn Road WB Ahead	61%	8.80	34.50	377	97%	20.60	84.90	529
11/1	Churchill Road WB Left	2%	0.00	0.90	35	1%	0.00	0.90	24
11/2	Churchill Road WB Left	66%	7.40	8.80	639	69%	5.80	7.80	683
12/1	Horse Fair SB	8%	0.00	1.00	151	4%	0.00	1.00	85
13/1	Horse Fair NB Left	20%	0.60	7.30	77	45%	2.30	15.30	145
14/1	Nene Quay SB	18%	0.10	1.10	360	20%	0.10	1.10	386
15/1	Nene Quay NB Left	3%	0.00	1.00	63	4%	0.00	1.00	66
15/2	Nene Quay NB Left	33%	1.10	4.30	221	61%	2.80	9.40	352
17/1	A1101 EB Ahead	72%	11.20	37.10	452	76%	11.30	42.20	427
17/2	A1101 EB Ahead	102%	33.50	118.00	683	73%	11.20	39.60	438
Overall PRC %		-13.00				-7.30			
Overall Delay (pcuHr)		50.19				43.72			

Table 7 shows that in both the AM and PM peak hours the roundabout is operating over capacity with a PRC of -13% in the AM Peak and -7.3% in the PM Peak. In the AM Peak the A1101 EB approach is over capacity with a high DoS (102%) and queue lengths (34 pcu's).

In the PM Peak the Lynn Road approach is over capacity along with the internal stop line travelling eastbound / westbound between Lynn Road and A1101. The queues on the internal stop lines would cause stacking issues on the roundabout as the queues are longer than the link lengths, particularly on links 5/2 and 6/2.

4.4. 2021 Without WLR Results

A summary of the 2021 Without WLR LinSig results for Freedom Bridge Option 3 are shown in Table 8 beneath for the AM and PM peak hours.

Technical note

Table 8. 2021 Without WLR AM Peak and PM Peak Results Freedom Bridge Option 3

Link Number	Name	AM Peak CT 90s				PM Peak CT 90s			
		DOS (%)	Queue (pcu)	Av. Delay Per PCU (s/pcu)	Flow	DOS	Queue	Av. Delay Per PCU (s/pcu)	Flow
1/1	Lynn Road WB Ahead	59%	1.00	7.10	392	92%	5.20	32.90	552
2/1	Circulatory E Left	38%	0.30	1.50	779	33%	0.20	1.40	638
2/2	Circulatory E Right	21%	0.10	1.10	451	19%	0.10	1.10	401
3/1	Circulatory SE Left	8%	0.00	1.00	151	4%	0.00	0.90	85
3/2	Circulatory SE Right	46%	0.40	1.60	979	51%	0.50	1.70	1079
4/1	Circulatory S Left	18%	0.10	1.10	360	19%	0.10	1.10	385
4/2	Circulatory S Right	33%	0.20	1.30	693	39%	0.30	1.40	839
5/1	Circulatory W Left	42%	6.50	11.60	467	42%	6.60	11.60	489
5/2	Circulatory W Right	46%	8.30	14.50	513	75%	18.70	21.70	889
6/1	A 1101 EB Left Ahead	41%	0.40	1.60	791	58%	0.70	2.20	1123
6/2	A 1101 EB Right	74%	21.80	35.70	877	63%	18.20	26.50	755
9/1	Lynn Road WB Left	59%	8.20	33.60	353	53%	6.60	34.80	284
9/2	Lynn Road WB Ahead	61%	9.10	33.60	392	97%	21.40	83.90	552
11/1	Churchill Road WB Left	2%	0.00	0.90	38.00	1%	0.00	0.90	23
11/2	Churchill Road WB Left	67%	6.00	7.30	641.00	74%	8.80	8.90	740
12/1	Horse Fair SB	8%	0.00	1.00	151.00	4%	0.00	1.00	85
13/1	Horse Fair NB Left	19%	0.40	6.50	74.00	54%	2.40	21.00	145
14/1	Nene Quay SB	18%	0.10	1.10	360.00	20%	0.10	1.10	385
15/1	Nene Quay NB Left	3%	0.00	1.00	55.00	5%	0.00	1.00	103
15/2	Nene Quay NB Left	34%	0.30	4.00	232.00	83%	11.10	25.40	436
17/1	A 1101 EB Ahead	65%	9.90	33.50	424.00	81%	12.80	44.40	470
17/2	A 1101 EB Ahead	105%	44.40	162.10	731.00	83%	14.30	45.60	519
Overall PRC %		-16.90				-7.40			
Overall Delay (pcuHr)		59.96				53.48			

Table 8 shows that Option 3 is forecast to operate over capacity in both the AM and PM peak hours. In the AM Peak the A1101 EB approach is over capacity (DoS 105%) and in the PM Peak Lynn Road is over capacity (97%) and the A1011 EB approach is close to capacity. Circulatory link 1/1 and 5/2 are also predicted to experience queues longer than their link length, causing a blocking back issue in the PM peak hour.

4.5. 2021 With WLR Results

A summary of the 2021 with WLR LinSig results for Freedom Bridge Option 3 are shown in Table 9 beneath for the AM and PM peak hours.

Technical note

Table 9. 2021 With WLR AM Peak and PM Peak Results Freedom Bridge Option 3

Link Number	Name	AM Peak CT 90s				PM Peak CT 90s			
		DOS (%)	Queue (pcu)	Av. Delay Per PCU (s/pcu)	Flow	DOS	Queue	Av. Delay Per PCU (s/pcu)	Flow
1/1	Lynn Road WB Ahead	64%	1.20	9.00	388	88%	3.80	23.80	509
2/1	Circulatory E Left	20%	0.10	1.10	392	16%	0.10	1.10	313
2/2	Circulatory E Right	25%	0.20	1.10	530	15%	0.10	1.00	315
3/1	Circulatory SE Left	7%	0.00	1.00	146	4%	0.00	0.90	84
3/2	Circulatory SE Right	45%	0.40	1.50	963	36%	0.30	1.30	768
4/1	Circulatory S Left	24%	0.20	1.20	485	16%	0.10	1.10	310
4/2	Circulatory S Right	26%	0.20	1.10	552	28%	0.20	1.20	603
5/1	Circulatory W Left	28%	2.90	8.30	332	35%	5.30	10.30	415
5/2	Circulatory W Right	44%	7.20	11.40	519	57%	11.20	14.10	684
6/1	A 1101 EB Left Ahead	44%	0.40	1.70	856	54%	0.60	2.00	1055
6/2	A 1101 EB Right	40%	10.90	23.30	486	26%	6.20	19.70	324
9/1	Lynn Road WB Left	82%	12.30	48.30	436	60%	7.30	37.40	304
9/2	Lynn Road WB Ahead	68%	9.70	38.70	388	93%	17.50	68.70	509
11/1	Churchill Road WB Left	2%	0.00	0.90	32.00	1%	0.00	0.90	23
11/2	Churchill Road WB Left	59%	7.50	8.90	547.00	47%	3.30	4.30	514
12/1	Horse Fair SB	8%	0.00	1.00	146.00	4%	0.00	1.00	84
13/1	Horse Fair NB Left	17%	0.50	8.60	74.00	24%	0.60	4.40	145
14/1	Nene Quay SB	25%	0.20	1.20	485.00	16%	0.10	1.10	310
15/1	Nene Quay NB Left	4%	0.00	1.00	72.00	9%	0.10	1.00	173
15/2	Nene Quay NB Left	27%	0.40	3.00	227.00	41%	1.00	3.90	323
17/1	A 1101 EB Ahead	83%	13.60	47.00	486.00	85%	13.90	50.80	480
17/2	A 1101 EB Ahead	54%	7.60	32.50	337.00	36%	4.50	30.00	215
Overall PRC %		8.10				-3.20			
Overall Delay (pcuHr)		29.37				33.12			

Table 9 shows that Option 3 is forecast to operate within capacity by 2021, with the WLR in the AM Peak, but will be over capacity in the PM Peak. In the PM Peak the Lynn Road approach is predicted to be over capacity (93% DoS) and the A1101 EB is close to capacity (85% DoS).

4.6. 2026 Without WLR Results

A summary of the 2026 without WLR LinSig results for Freedom Bridge Option 3 are shown in Table 10 beneath for the AM and PM peak hours.

Technical note

Table 10.2026 Without WLR AM Peak and PM Peak Results Freedom Bridge Option 3

Link Number	Name	AM Peak CT 90s				PM Peak CT 90s			
		DOS (%)	Queue (pcu)	Av. Delay Per PCU (s/pcu)	Flow	DOS	Queue	Av. Delay Per PCU (s/pcu)	Flow
1/1	Lynn Road WB Ahead	56%	0.90	6.50	383	94%	6.70	44.10	569
2/1	Circulatory E Left	38%	0.30	1.50	834	32%	0.20	1.30	631
2/2	Circulatory E Right	25%	0.20	1.10	562	20%	0.10	1.10	413
3/1	Circulatory SE Left	7%	0.00	1.00	135	4%	0.00	0.90	85
3/2	Circulatory SE Right	46%	0.40	1.60	1015	55%	0.60	1.90	1161
4/1	Circulatory S Left	23%	0.10	1.20	476	20%	0.10	1.10	399
4/2	Circulatory S Right	29%	0.20	1.20	613	43%	0.40	1.50	907
5/1	Circulatory W Left	41%	6.40	11.60	451	47%	7.80	11.60	570
5/2	Circulatory W Right	43%	7.60	14.20	469	78%	21.50	19.40	966
6/1	A1101 EB Left Ahead	41%	0.40	1.60	788	65%	0.90	2.60	1260
6/2	A1101 EB Right	75%	21.90	37.60	952	58%	17.10	25.20	733
9/1	Lynn Road WB Left	72%	11.00	37.20	444	64%	7.70	39.80	311
9/2	Lynn Road WB Ahead	58%	8.60	31.80	383	108%	42.50	217.60	569
11/1	Churchill Road WB Left	1%	0.00	0.90	22.00	1%	0.00	0.90	24
11/2	Churchill Road WB Left	66%	5.80	8.80	566.00	82%	11.40	12.80	809
12/1	Horse Fair SB	7%	0.00	1.00	135.00	4%	0.00	1.00	85
13/1	Horse Fair NB Left	20%	0.40	6.80	74.00	76%	3.70	47.70	145
14/1	Nene Quay SB	23%	0.10	1.20	476.00	20%	0.10	1.10	399
15/1	Nene Quay NB Left	5%	0.00	1.00	87.00	9%	0.00	1.00	171
15/2	Nene Quay NB Left	28%	0.50	3.30	220.00	102%	38.00	118.40	458
17/1	A1101 EB Ahead	65%	10.20	32.60	437.00	91%	16.40	64.10	494
17/2	A1101 EB Ahead	116%	85.10	316.00	834.00	92%	17.70	63.80	533
Overall PRC %		-29.00				-20.40			
Overall Delay (pcuHr)		101.41				97.09			

Table 10 shows that Option 3 is forecast to operate over capacity in both the AM and PM Peak in 2026 without the WLR.

4.7. 2026 With WLR Results

A summary of the 2026 with WLR LinSig results for Freedom Bridge Option 3 are shown in Table 11 beneath for the AM and PM peak hours.

Technical note

Table 11. 2026 With WLR AM Peak and PM Peak Results Freedom Bridge Option 3

Link Number	Name	AM Peak CT 90s				PM Peak CT 90s			
		DOS (%)	Queue (pcu)	Av. Delay Per PCU (s/pcu)	Flow	DOS	Queue	Av. Delay Per PCU (s/pcu)	Flow
1/1	Lynn Road WB Ahead	65%	1.20	9.40	376	89%	4.40	24.90	578
2/1	Circulatory E Left	26%	0.20	1.20	513	15%	0.10	1.10	302
2/2	Circulatory E Right	22%	0.10	1.10	461	15%	0.10	1.00	318
3/1	Circulatory SE Left	7%	0.00	1.00	148	4%	0.00	0.90	86
3/2	Circulatory SE Right	37%	0.30	1.30	793	36%	0.30	1.30	764
4/1	Circulatory S Left	18%	0.10	1.10	367	16%	0.10	1.10	311
4/2	Circulatory S Right	24%	0.20	1.10	500	28%	0.20	1.20	598
5/1	Circulatory W Left	25%	3.00	7.80	295	37%	5.90	12.50	420
5/2	Circulatory W Right	41%	7.20	11.60	496	60%	11.40	16.60	676
6/1	A1101 EB Left Ahead	43%	0.40	1.60	835	57%	0.70	2.10	1096
6/2	A1101 EB Right	49%	14.20	26.00	602	28%	6.00	20.50	326
9/1	Lynn Road WB Left	73%	9.70	42.80	372	51%	6.60	32.40	294
9/2	Lynn Road WB Ahead	69%	9.40	40.00	376	94%	19.70	66.60	578
11/1	Churchill Road WB Left	2%	0.00	0.90	34.00	1%	0.00	0.90	24
11/2	Churchill Road WB Left	46%	3.50	5.70	446.00	47%	2.60	3.90	508
12/1	Horse Fair SB	8%	0.00	1.00	148.00	4%	0.00	1.00	86
13/1	Horse Fair NB Left	13%	0.20	3.80	74.00	24%	0.50	4.40	145
14/1	Nene Quay SB	19%	0.10	1.10	367.00	16%	0.10	1.10	311
15/1	Nene Quay NB Left	2%	0.00	1.00	45.00	8%	0.00	1.00	153
15/2	Nene Quay NB Left	28%	0.40	2.80	246.00	44%	0.60	4.10	345
17/1	A1101 EB Ahead	86%	14.30	51.80	484.00	86%	15.50	48.10	540
17/2	A1101 EB Ahead	76%	11.80	41.30	457.00	31%	4.10	26.80	206
Overall PRC %		4.50				-4.20			
Overall Delay (pcuHr)		30.81				35.21			

Table 11 shows that by 2026, Option 3 with the WLR is forecast to operate within capacity in the AM Peak, but over capacity in the PM Peak. In the PM Peak the Lynn Road is over capacity (94% DoS) and both circulatory links 1/1 and 5/2 are also over capacity with queues longer than the link length causing blocking back across the circulatory and approaches.

5. Freedom Bridge Option 4

5.1. Network Changes

This option has been modelled within the micro-simulation software VISSIM. The base VISSIM model (described in the LMVR) has been utilised and updated with the following changes, which are also shown in more detail in Figure 9 below:

- Freedom Bridge Roundabout altered into an enlarged dualled gyratory that spans both sides of the river;
- All approaches operate on give way control;
- The Aldi signalised junction is removed from the western gyratory and access to the store is relocated further north at the Sandyland junction. This has been modelled as a priority controlled junction;
- The A1101 approach to the gyratory now operates on give-way to the circulatory, with the signals removed as part of the relocation of the Aldi junction;
- Bedford Street becomes two way, allowing vehicles to bypass the De Havilland Road junction if they are travelling to the gyratory, 80% of traffic that previously used De Havilland to turn right has been assumed to route via Bedford Street to the gyratory;
- The petrol station is removed in this scenario, allowing a designated slip from Lynn Road to Churchill Road (for the purpose of this study, the petrol station traffic remains in the network coded from/to Lynn Road);
- The exit onto Churchill Road has been widened to 2 lanes, allowing cars to travel in two lanes around the gyratory from the A1101;

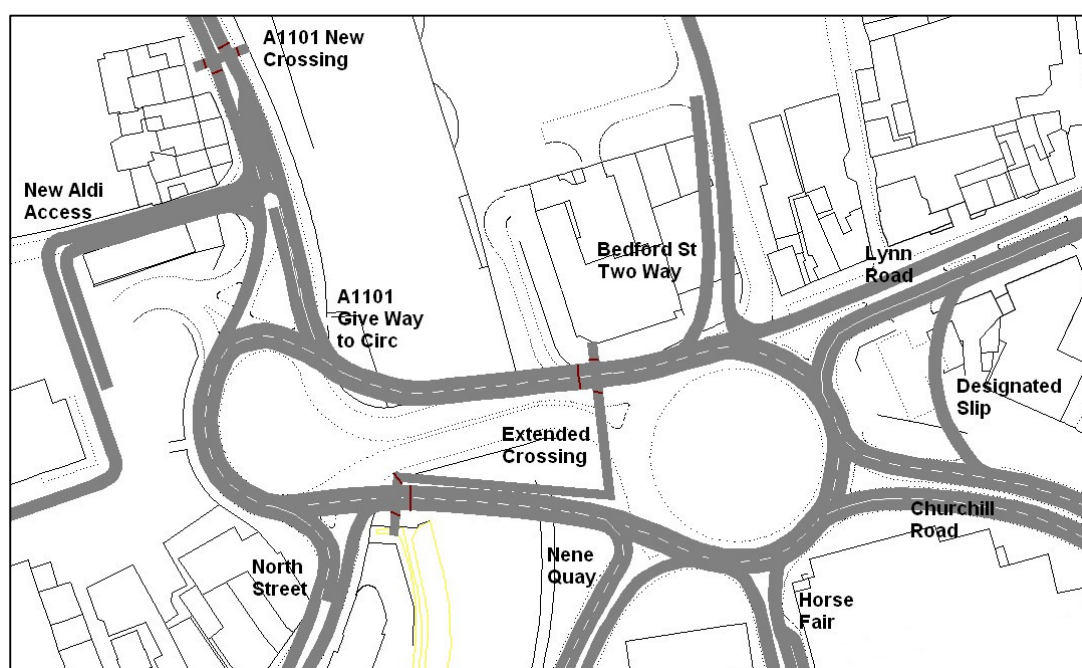
Technical note

- For the purpose of this scenario, the existing pedestrian facilities over the roundabout have been extended to North Street, to enable queuing capacity after Nene Quay; and,
- The Aldi crossing is moved north along the A1101, upstream of the new junction.

Option 4 was initially tested with the current single lane right turn and single lane ahead on the circulatory opposite to the Aldi entrance, however this caused very long queues on North Street, as the majority of traffic was routed right to all other arms of the gyratory. This was especially notable in the PM peak, with queues along North Street often extending out of the network, as vehicles were unable to enter the gyratory. Therefore, Option 4 was updated to provide a two lane circulatory around the western section, which helped to alleviate this issue as vehicles can use both lanes from North Street to turn right, along with the two lanes from other arms.

The rest of the Wisbech model network has been modelled as part of this assessment and therefore, the flow reaching Freedom Bridge is dependent on network performance and congestion elsewhere within the model.

Figure 9. Freedom Bridge Option 4 VISSIM Layout



5.2. 2016 Results Summary

A summary of each approach to Freedom Bridge Roundabout, Aldi and Lynn Road junctions have been compared back to the base model results and are shown in Tables 12 and 13 beneath for the AM and PM peaks respectively. The results have been compared for Volume, Average Queue, Delay and Level of Service (LOS) for each approach. LOS is an American concept derived from their Highway Capacity Manual (2000). It rates performance based upon delay thresholds on an A to F grading as follows:

- LOS A – 0 to 10 seconds;
- LOS B – 10 to 20 seconds (10 to 15 seconds for unsignalised junctions);
- LOS C – 20 to 35 seconds (15 to 25 seconds for unsignalised junctions);
- LOS D – 35 to 55 seconds (25 to 35 seconds for unsignalised junctions);
- LOS E – 55 to 80 seconds (35 to 50 seconds for unsignalised junctions); and,
- LOS F – Over 80 seconds (over 50 seconds for unsignalised junctions).

The light blue shaded cells represent the optimum performer.

Technical note

Table 12. 2016 AM Peak Approach Comparison Results Freedom Bridge Option 4

Junction	Approach	AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
		Base	FB Opt 4	Base	FB Opt 4	Base	FB Opt 4	Base	FB Opt 4
Freedom Bridge	Lynn Rd	691	537	12.5	10.8	13.3	17.4	B	C
	Churchill Road Slip	-	72	-	0.0	-	0.6	-	A
	Churchill Road	444	627	20.4	5.0	31.5	14.8	D	B
	Churchill Road Right	183	-	2.5	-	12.2	-	B	-
	Horse Fair	63	63	2.1	0.7	23.1	16.1	C	C
	Nene Quay	268	266	3.8	1.8	15.0	18.2	B	C
	North Street	370	370	4.1	11.4	32.1	26.3	D	D
	A1101	742	773	63.7	22.7	41.7	18.4	D	C
	Bedford Street	-	130	-	1.3	-	13.6	-	B
	Overall Junction Summary	2747	2837	10.9	7.5	17.2	17.7	C	C
Aldi	A1101 North End (N)	742	748	63.7	41.2	41.7	32.2	D	D
	A1101 North End (S)	-	603	-	0.0	-	1.1	-	A
	Aldi Access	44	44	0.2	0.5	26.5	16.8	C	C
	Overall Junction Summary	1958	1394	8.6	14.0	25.1	18.3	C	C
Lynn Rd	Lynn Road (N)	615	626	53.5	6.8	50.0	16.7	D	B
	Lynn Road (S)	583	614	18.0	14.1	13.0	9.1	B	A
	De Havilland Road	187	61	11.0	2.9	37.9	33.2	D	C
	Overall Junction Summary	1385	1299	27.5	7.9	32.7	13.9	C	B

Table 12 shows that Option 4 in the 2016 AM Peak is forecast to provide benefits around Lynn Road / De Havilland Road junction as vehicles have been re-routed via Bedford Street to Freedom Bridge, thus calling the De Havilland Road signals less often. The Nene Quay and Lynn Road approach is forecast to perform worse than the base around Freedom Bridge Roundabout.

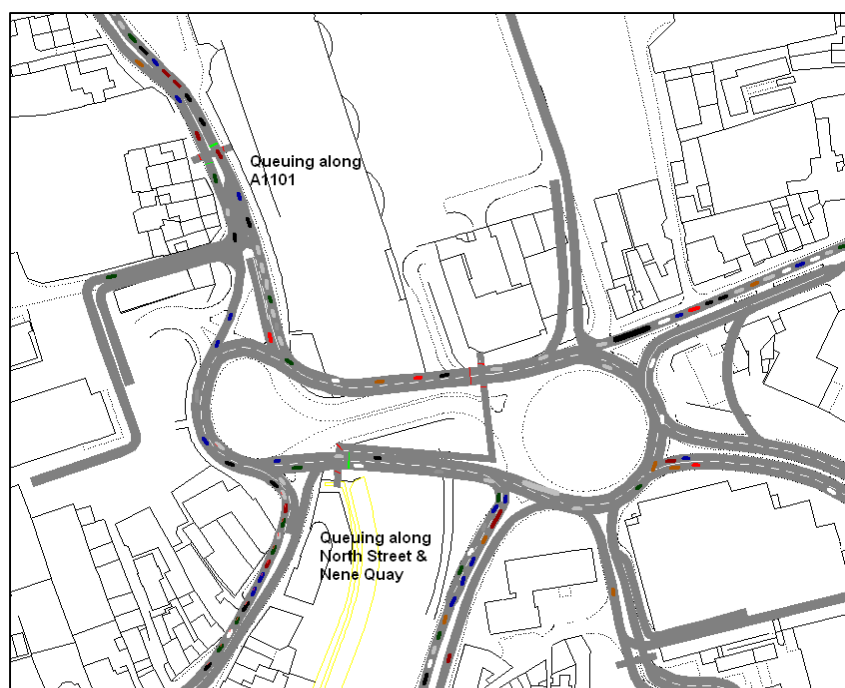
Technical note

Table 13. 2016 PM Peak Approach Comparison Results Freedom Bridge Option 4

Junction	Approach	PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
		Base	FB Opt 4	Base	FB Opt 4	Base	FB Opt 4	Base	FB Opt 4
Freedom Bridge	Lynn Rd	737	573	10.1	7.9	13.1	18.3	B	C
	Churchill Road Slip	-	80	-	0.0	-	0.5	-	A
	Churchill Road	390	697	47.9	6.8	72.1	22.3	F	C
	Churchill Road Right	305	-	32.3	-	27.8	-	D	-
	Horse Fair	135	133	60.0	4.8	179.7	32.8	F	D
	Nene Quay	402	402	28.8	10.7	49.6	40.1	E	E
	North Street	338	338	7.5	44.7	32.5	76.0	D	F
	A1101	582	625	94.8	33.8	89.1	31.0	F	D
	Bedford Street	-	113	-	1.8	-	20.9	-	C
Overall Junction Summary		2902	2960	31.3	15.5	40.4	31.8	E	D
Aldi	A1101 North End (N)	582	576	94.8	70.4	89.1	69.0	F	F
	A1101 North End (S)	-	753	-	0.1	-	3.7	-	A
	Aldi Access	99	99	1.3	1.7	30.2	22.3	C	C
Overall Junction Summary		1963	1427	13.3	24.1	38.0	31.4	D	D
Lynn Rd	Lynn Road (N)	650	648	42.1	10.5	41.2	19.6	D	B
	Lynn Road (S)	782	812	28.1	21.9	14.6	10.2	B	B
	De Havilland Road	258	145	18.1	8.5	43.1	38.5	D	D
Overall Junction Summary		1689	1606	29.4	13.6	29.1	16.5	C	B

Table 13 shows that in 2016 PM Peak Option 4 is forecast to improve the overall performance of Freedom Bridge Roundabout, although the junction is still operating close to capacity as shown in Figure 10.

Figure 10. Freedom Bridge Option 4 Queuing



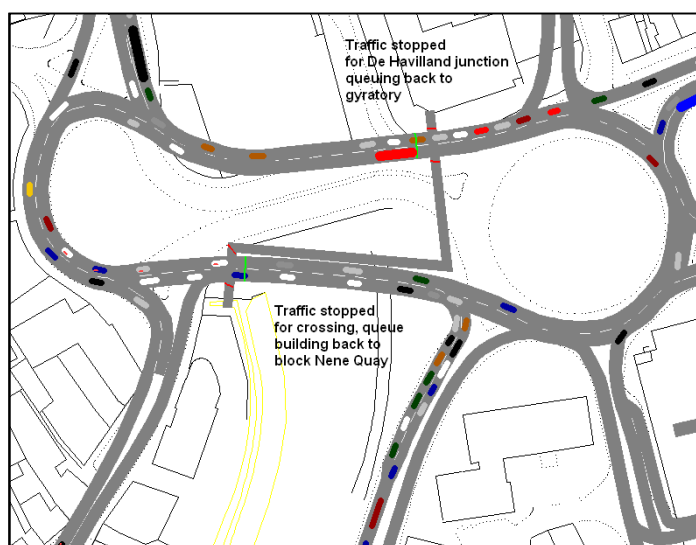
Technical note

In the 2016 PM Peak, North Street is operating over capacity as a result of the higher demand of conflicting traffic that is now being routed around the gyratory (that previously used the roundabout circulatory).

Nene Quay is still forecast to operate at capacity as a result of more vehicles being processed from Lynn Road and Churchill Road due to the dualled gyratory. However, the performance is marginally better than the base results as vehicles are able to use two lanes at the approach to turn right. The queues on this approach are occasionally exacerbated when the pedestrian crossing is called, as the queue builds back, preventing vehicles from accessing the gyratory, as shown in Figure 11.

Figure 11 also shows that queuing from the De Havilland Road junction is still present with this option and this extends back through the gyratory

Figure 11. Freedom Bridge Option 4 Nene Quay



5.3. 2021 Without WLR Results Summary

A summary of each approach to Freedom Bridge Roundabout, Aldi and Lynn Road junctions have been compared back to the 2021 Without WLR DM results and are shown in Tables 14 and 15 beneath for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Technical note

Table 14.2021 Without WLR AM Peak Approach Comparison Results Freedom Bridge Option 4

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4
Freedom Bridge	Lynn Rd	679	476	13.1	8.7	14.4	17.9	B	C
	Churchill Road Slip	-	106	-	0.0	-	0.6	-	A
	Churchill Road	447	642	14.2	4.2	25.1	13.6	D	B
	Churchill Road Right	195	-	1.3	-	11.9	-	B	-
	Horse Fair	57	57	1.9	0.8	22.7	18.0	C	C
	Nene Quay	263	264	3.0	1.7	13.4	17.9	B	C
	North Street	333	334	2.3	6.3	32.3	22.6	C	C
	A1101	820	855	141.1	22.1	70.6	17.7	E	C
	Bedford Street	-	131	-	1.3	-	14.1	-	B
Overall Junction Summary		2784	2862	11.6	6.3	16.7	16.6	C	C
Aldi	A1101 North End (N)	820	826	141.1	36.6	70.6	29.5	E	D
	A1101 North End (S)	-	626	-	0.0	-	1.1	-	A
	Aldi Access	44	44	0.2	0.3	28.8	16.4	C	C
Overall Junction Summary		2012	1496	15.1	12.4	37.3	17.3	D	C
Lynn Rd	Lynn Road (N)	597	599	36.5	6.1	40.7	16.4	D	B
	Lynn Road (S)	544	581	16.6	13.2	13.0	9.2	B	A
	De Havilland Road	189	61	10.5	2.6	36.4	30.6	D	C
Overall Junction Summary		1329	1241	21.2	7.3	28.8	13.8	C	B

Table 15.2021 Without WLR PM Peak Approach Comparison Results Freedom Bridge Option 4

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4
Freedom Bridge	Lynn Rd	752	548	9.8	7.0	13.9	19.4	B	C
	Churchill Road Slip	-	126	-	0.0	-	0.6	-	A
	Churchill Road	408	729	40.8	7.3	61.7	23.1	F	C
	Churchill Road Right	326	-	28.1	-	27.3	-	D	-
	Horse Fair	132	130	30.9	4.5	126.4	32.6	F	D
	Nene Quay	468	501	198.3	31.9	192.1	63.7	F	F
	North Street	334	334	2.3	34.4	27.3	67.1	D	F
	A1101	659	617	704.0	51.4	370.5	39.1	F	E
	Bedford Street	-	115	-	1.1	-	16.9	-	C
Overall Junction Summary		3086	3099	50.6	19.3	58.6	36.3	F	E
Aldi	A1101 North End (N)	659	572	704.0	899.9	370.5	600.5	F	F
	A1101 North End (S)	-	698	-	0.0	-	3.6	-	A
	Aldi Access	97	97	1.2	2.5	31.6	31.8	C	D
Overall Junction Summary		2091	1367	71.8	300.9	125.3	253.9	F	F
Lynn Rd	Lynn Road (N)	668	668	35.7	11.3	35.4	19.7	D	B
	Lynn Road (S)	740	749	27.3	20.2	15.0	10.4	B	B
	De Havilland Road	257	144	18.0	8.0	43.0	36.8	D	D
Overall Junction Summary		1664	1561	27.0	13.2	27.5	16.8	C	B

Technical note

Table 15 shows that Option 4 is forecast to offer benefits in the AM Peak overall except for on the Nene Quay approach. Table 16 shows that Option 4 is forecast to offer benefits overall in the PM Peak but the North Street approach to Freedom Bridge operates worse than the DM with increased delays, and the A1101 North End approach to the Aldi junction operates much worse with delays over 600s.

5.4. 2021 With WLR Results

A summary of each approach to Freedom Bridge, Aldi and Lynn Road junctions have been compared back to the 2021 With WLR DM results and are shown in Tables 16 and 17 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 16.2021 With WLR AM Peak Approach Comparison Results Freedom Bridge Option 4

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4
Freedom Bridge	Lynn Rd	757	620	4.8	6.5	6.7	11.3	A	B
	Churchill Road Slip	-	38	-	0.0	-	0.5	-	A
	Churchill Road	354	554	7.6	3.9	20.8	13.8	C	B
	Churchill Road Right	202	-	1.7	-	14.0	-	B	-
	Horse Fair	57	57	1.4	1.0	18.9	18.7	C	C
	Nene Quay	276	274	2.0	1.1	10.2	15.4	B	C
	North Street	267	266	0.9	3.4	15.5	18.7	B	C
	A1101	586	617	12.8	10.1	22.4	13.9	C	B
	Bedford Street	-	130	-	0.6	-	10.2	-	B
Overall Junction Summary		2489	2554	3.2	3.7	11.0	13.6	B	B
Aldi	A1101 North End (N)	586	586	12.8	3.4	22.4	10.8	C	B
	A1101 North End (S)	-	572	-	0.0	-	1.1	-	A
	Aldi Access	44	44	0.1	0.1	23.5	9.0	C	A
Overall Junction Summary		1594	1202	1.6	1.2	13.9	6.1	B	A
Lynn Rd	Lynn Road (N)	676	676	15.9	9.0	23.6	17.7	C	B
	Lynn Road (S)	552	585	17.4	13.5	13.2	9.3	B	A
	De Havilland Road	188	60	10.1	2.6	34.4	30.8	C	C
Overall Junction Summary		1416	1321	14.5	8.4	21.0	14.6	C	B

Technical note

Table 17.2021 With WLR PM Peak Approach Comparison Results Freedom Bridge Option 4

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4
Freedom Bridge	Lynn Rd	730	566	2.3	2.5	7.6	11.7	A	B
	Churchill Road Slip	-	84	-	0.0	-	0.5	-	A
	Churchill Road	286	525	2.8	2.1	16.9	16.0	C	C
	Churchill Road Right	236	-	1.7	-	14.9	-	B	-
	Horse Fair	129	130	4.3	1.8	24.3	20.2	C	C
	Nene Quay	468	466	62.0	6.3	68.0	29.3	F	D
	North Street	310	308	3.0	13.7	20.7	40.5	C	E
	A1101	432	482	21.0	20.1	38.0	24.8	D	C
	Bedford Street	-	113	-	0.5	-	12.9	-	B
	Overall Junction Summary	2605	2674	11.8	6.6	23.7	21.4	C	C
Aldi	A1101 North End (N)	432	434	21.0	13.8	38.0	26.7	D	D
	A1101 North End (S)	-	731	-	0.0	-	3.7	-	A
	Aldi Access	97	98	1.2	1.1	28.3	16.8	C	C
	Overall Junction Summary	1741	1261	3.7	5.0	18.8	12.7	B	B
Lynn Rd	Lynn Road (N)	644	644	14.8	10.3	23.2	19.4	C	B
	Lynn Road (S)	711	747	25.0	19.8	14.4	10.2	B	B
	De Havilland Road	258	144	16.2	7.9	38.9	35.7	D	D
	Overall Junction Summary	1613	1535	18.6	12.6	21.8	16.4	C	B

Tables 16 and 17 show that introducing the WLR reduces trips from the A1101 North End by approximately 300 vehicles in the AM peak hour and 200 vehicles in the PM peak hour. As a result all approaches to the junction are operating within capacity, with the exception of North Street in the PM peak hour.

It is worth noting that whilst Option 4 provides marginal benefits over the DM, the DM is still operating within capacity in this scenario.

5.5. 2026 Without WLR Results

A summary of each approach to Freedom Bridge Roundabout, Aldi and Lynn Road junctions have been compared back to the 2026 Without WLR DM results and are shown in Tables 18 and 19 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Technical note

Table 18. 2026 Without WLR AM Peak Approach Comparison Results Freedom Bridge Option 4

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4
Freedom Bridge	Lynn Rd	730	529	16.6	13.9	15.7	20.9	C	C
	Churchill Road Slip	-	138	-	0.0	-	0.6	-	A
	Churchill Road	368	518	6.9	3.8	19.8	14.0	C	B
	Churchill Road Right	150	-	0.6	-	11.1	-	B	-
	Horse Fair	57	57	1.6	0.9	20.4	18.1	C	C
	Nene Quay	264	265	2.9	1.2	12.2	15.5	B	C
	North Street	346	347	1.8	4.2	33.7	17.7	C	C
	A1101	879	955	471.4	21.6	151.4	15.9	F	C
	Bedford Street	-	129	-	1.5	-	15.0	-	C
Overall Junction Summary		2783	2936	10.0	6.6	15.2	16.0	C	C
Aldi	A1101 North End (N)	879	926	471.4	63.7	151.4	35.3	F	E
	A1101 North End (S)	-	583	-	0.0	-	1.1	-	A
	Aldi Access	45	44	0.2	0.4	29.5	16.3	C	C
Overall Junction Summary		2024	1553	47.9	21.4	74.1	22.0	E	C
Lynn Rd	Lynn Road (N)	649	683	251.9	11.0	144.5	19.0	F	B
	Lynn Road (S)	521	569	16.1	12.8	13.1	9.2	B	A
	De Havilland Road	189	61	13.4	2.8	45.3	32.7	D	C
Overall Junction Summary		1358	1312	93.8	8.9	80.1	15.4	F	B

Table 19. 2026 Without WLR PM Peak Approach Comparison Results Freedom Bridge Option 4

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4
Freedom Bridge	Lynn Rd	782	552	7.7	5.6	12.3	17.7	B	C
	Churchill Road Slip	-	148	-	0.0	-	0.5	-	A
	Churchill Road	370	736	25.6	6.8	47.3	22.9	E	C
	Churchill Road Right	344	-	20.3	-	32.3	-	D	-
	Horse Fair	128	127	31.5	4.0	135.4	30.9	F	D
	Nene Quay	407	467	238.7	27.6	251.9	62.8	F	F
	North Street	336	336	1.8	27.1	26.5	57.6	D	F
	A1101	650	619	868.3	51.1	468.4	39.4	F	E
	Bedford Street	-	114	-	1.2	-	17.7	-	C
Overall Junction Summary		3015	3099	53.0	17.3	62.8	34.1	F	D
Aldi	A1101 North End (N)	650	572	868.3	924.8	468.4	621.6	F	F
	A1101 North End (S)	-	680	-	0.0	-	3.5	-	A
	Aldi Access	97	97	1.2	2.3	31.1	29.1	C	D
Overall Junction Summary		2077	1350	88.0	309.1	154.5	266.2	F	F
Lynn Rd	Lynn Road (N)	681	690	25.9	13.8	28.6	20.8	C	C
	Lynn Road (S)	790	814	29.3	21.8	15.0	10.1	B	B
	De Havilland Road	273	148	20.0	8.6	44.0	37.9	D	D
Overall Junction Summary		1743	1652	25.1	14.7	24.8	17.1	C	B

Technical note

Table 18 shows that with Option 4 in the AM peak, the A1101 North End is forecast to operate at capacity, but is performing much better than the DM scenario. Nene Quay is operating worse than the DM scenario.

Tables 19 shows that in the PM peak more approaches are operating over capacity in Option 4 although the option still provides some benefits over the DM scenario.

5.6. 2026 With WLR Results

A summary of each approach to Freedom Bridge Roundabout, Aldi and Lynn Road junctions have been compared back to the 2026 With WLR DM results and are shown in Tables 20 and 21 beneath for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 20. 2026 With WLR AM Peak Approach Comparison Results Freedom Bridge Option 4

Junction	Approach	AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
		DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4
Freedom Bridge	Lynn Rd	682	522	5.7	5.1	8.0	11.7	A	B
	Churchill Road Slip	-	63	-	0.0	-	0.5	-	A
	Churchill Road	294	452	2.3	1.7	12.4	11.0	B	B
	Churchill Road Right	157	-	0.5	-	10.2	-	B	-
	Horse Fair	57	58	0.8	0.5	13.2	14.8	B	B
	Nene Quay	247	247	1.5	0.8	9.3	14.4	A	B
	North Street	314	314	1.4	3.7	16.9	17.4	B	C
	A1101	645	673	14.7	9.8	23.3	13.7	C	B
	Bedford Street	-	131	-	0.8	-	11.0	-	B
	Overall Junction Summary	2384	2457	2.5	3.2	9.6	12.9	A	B
Aldi	A1101 North End (N)	645	643	14.7	3.2	23.3	10.4	C	B
	A1101 North End (S)	-	570	-	0.0	-	1.0	-	A
	Aldi Access	45	45	0.1	0.1	24.2	9.2	C	A
	Overall Junction Summary	1639	1258	1.9	1.2	15.3	6.2	B	A
Lynn Rd	Lynn Road (N)	602	601	11.5	6.1	22.4	16.7	C	B
	Lynn Road (S)	577	608	17.8	14.2	13.1	9.2	B	A
	De Havilland Road	189	61	9.6	2.6	32.9	31.3	C	C
	Overall Junction Summary	1367	1271	13.0	7.7	19.9	13.8	B	B

Technical note

Table 21. 2026 With WLR PM Peak Approach Comparison Results Freedom Bridge Option 4

Junction	Approach	PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
		DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4	DM	FB Opt 4
Freedom Bridge	Lynn Rd	785	601	2.4	2.9	8.3	12.6	A	B
	Churchill Road Slip	-	102	-	0.0	-	0.4	-	A
	Churchill Road	292	497	3.8	2.2	19.9	16.3	C	C
	Churchill Road Right	201	-	1.3	-	16.8	-	C	-
	Horse Fair	130	128	4.7	1.7	27.3	20.1	D	C
	Nene Quay	436	424	79.8	6.1	92.5	30.8	F	D
	North Street	302	302	3.3	12.6	23.5	39.1	C	E
	A1101	492	542	42.1	21.0	54.8	23.0	D	C
	Bedford Street	-	112	-	0.9	-	15.1	-	C
	Overall Junction Summary	2653	2710	15.5	6.6	28.8	21.2	D	C
Aldi	A1101 North End (N)	492	492	42.1	14.2	54.8	25.7	D	D
	A1101 North End (S)	-	753	-	0.2	-	3.7	-	A
	Aldi Access	97	98	1.1	1.3	29.0	18.5	C	C
	Overall Junction Summary	1838	1342	6.4	5.3	24.3	12.9	C	B
Lynn Rd	Lynn Road (N)	699	699	19.4	13.7	24.6	20.5	C	C
	Lynn Road (S)	786	814	27.9	21.4	14.2	9.9	B	A
	De Havilland Road	257	144	17.6	8.5	42.1	38.5	D	D
	Overall Junction Summary	1742	1658	21.6	14.5	22.5	16.9	C	B

Tables 21 and 22 show that as per the 2021 With WLR, traffic has been removed from the A1101 North End approach and the Churchill Road approach. In the AM Peak both the DM and Option are operating within capacity and Option 4 only offers benefits to the A1101 approach to Freedom Bridge. In the PM Peak Option 4 is forecast to offers benefits to the Nene Quay approach but dis-benefits to North Street.

6. Freedom Bridge Option 5

6.1. Network Changes

This option has been modelled within the micro-simulation software VISSIM. The base model has been utilised and updated with the following changes, which are also shown in more detail in Figure 12 below:

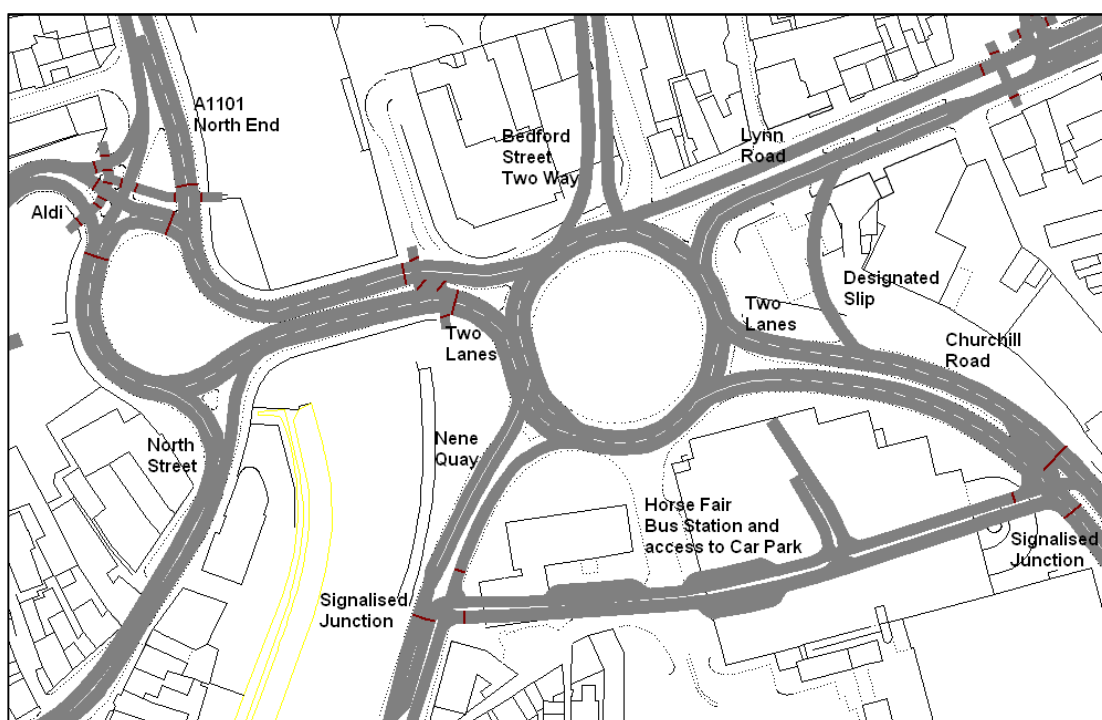
- All approaches to Freedom Bridge operate on give way control;
- Bedford Street becomes two way, allowing vehicles to bypass the De Havilland Road junction if they are travelling to the roundabout. 80% of traffic that previously used De Havilland Road to turn right has been assumed to route via Bedford Street to Freedom Bridge roundabout;
- The petrol station is removed, allowing a designated slip from Lynn Road to Churchill Road (for the purpose of this study, the petrol station traffic remains in the network coded from/to Lynn Road);
- The exit onto Churchill Road is widened to 2 lanes, allowing cars to travel in two lanes around the roundabout from the A1101;
- The exit from Freedom Bridge roundabout to the A1101 is widened to two lanes, allowing slightly more queueing capacity at the crossing. Vehicles travelling to North Street have now been routed via the nearside lane from Lynn Road and Churchill Road as a result of the widening. A1101 and Aldi bound traffic have been routed via the offside lane from Lynn Road, and either lane from Churchill Road;
- The Horse Fair approach/exit is removed from Freedom Bridge;
- Access to the bus station and car park is now offered in the form of two new signalised junctions at Nene Quay and Churchill Road;

Technical note

- The Nene Quay junction is used by Horse Fair traffic from/to Nene Quay and Horse Fair traffic and buses to A1101, North Street and Bedford Street;
- The Churchill Road junction is used by Horse Fair traffic to/from Churchill Road, Horse Fair bound traffic and buses from all arms of Freedom Bridge and Horse Fair traffic to Lynn Road;
- No vehicles are routed through the new Horse Fair link road to bypass Freedom Bridge (Nene Quay to Churchill Road traffic in both directions); and,
- As per the base model, the bus station has not been modelled in any detail, nor has the internal workings of the car park access from the new through road.

Within VISSIM the rest of the network has still been modelled and therefore, the flow reaching Freedom Bridge is dependent on network performance and congestion elsewhere within the model.

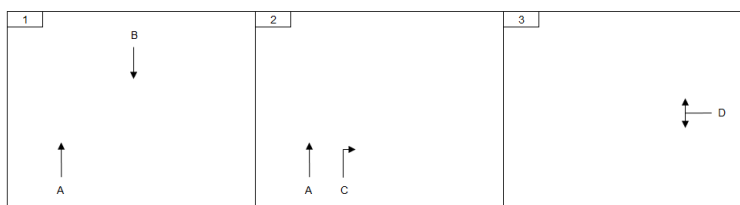
Figure 12. Freedom Bridge Option 5 VISSIM Layout



6.2. Signals

The new signalised junctions are coded as Vehicle Actuated (VA) junctions. Both have been coded as 3 stage as shown below in Figures 13 and 14.

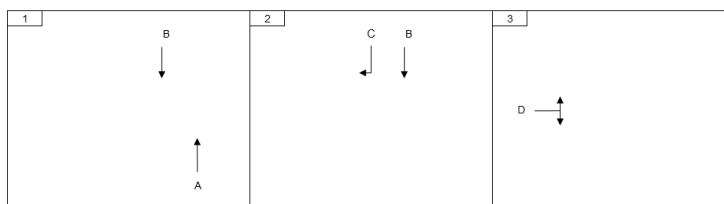
Figure 13. Nene Quay Signalised Junction Staging



Phases A and B represent the B198 Nene Quay mainline, Phase C is the Nene Quay right turn filter and Phase D represents Horse Fair. Stages 2 and 3 are only called on demand and have both been assigned maximum green time of 15 seconds each. Stage 1 has a maximum green time of 60 seconds.

Technical note

Figure 14. Churchill Road Signalised Junction Staging



Phases A and B represent the Churchill Road mainline, Phase C is the Churchill Road right turn filter and Phase D represents Horse Fair. As per the Nene Quay junction, stages 2 and 3 are only called on demand and have both been assigned maximum green time of 15 seconds. Stage 1 has a maximum green time of 60 seconds. Both junctions were observed within the VISSIM model to ensure the timings did not cause any congestion to mainline traffic.

6.3. 2016 Results Summary

A summary of each approach to Freedom Bridge Roundabout, Aldi and Lynn Road junctions have been compared back to the base VISSIM results and are shown in Tables 22 and 23 for the AM and PM peaks respectively. The new signalised junction on Churchill Road and Nene Quay have also been included, although they are unable to be compared back to the base results.

Technical note

Table 22. 2016 AM Peak Approach Comparison Results Freedom Bridge Option 5

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	Base	FB Opt 5	Base	FB Opt 5	Base	FB Opt 5	Base	FB Opt 5
Freedom Bridge	Lynn Rd	691	502	12.5	10.5	13.3	10.5	B	B
	Petrol Station	41	-	0.5	-	22.8	-	C	-
	Churchill Road Slip	-	117	-	0.2	-	2.5	-	A
	Churchill Rd Left / Ahead	444	-	20.4	-	31.5	-	D	-
	Churchill Rd Right	183	-	2.5	-	12.2	-	B	-
	Churchill Road	-	599	-	9.3	-	12.1	-	B
	Horse Fair	63	-	2.1	-	23.1	-	C	-
	Nene Quay	268	270	3.8	2.0	15.0	8.5	B	A
	A1101 Left / Ahead	434	-	8.7	-	8.6	-	A	-
	A1101 Right	625	-	36.8	-	18.5	-	C	-
	A1101	-	1075	-	13.3	-	10.9	-	B
	Bedford Street	-	128	-	1.2	-	10.7	-	B
	Overall Junction Summary		2747	2691	10.9	6.0	17.2	10.5	C
Aldi / North Street	A1101 North End	742	756	63.7	21.2	41.7	25.9	D	C
	Freedom Bridge	801	809	1.6	0.0	6.6	5.6	A	A
	North Street	370	370	4.1	2.8	32.1	25.2	D	D
	Aldi Access	44	44	0.2	0.2	26.5	25.0	C	C
Overall Junction Summary		1958	1980	8.6	3.1	25.1	17.4	C	B
Lynn Rd	Lynn Road (N)	615	636	53.5	7.3	50.0	17.2	D	B
	Lynn Road (S)	583	621	18.0	14.1	13.0	9.1	B	A
	De Havilland Rd	187	61	11.0	2.8	37.9	32.4	D	C
Overall Junction Summary		1385	1318	27.5	8.1	32.7	14.1	C	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	772	-	0.1	-	2.2	-	A
	Churchill Road (S)	-	626	-	2.0	-	3.9	-	A
	Horse Fair	-	20	-	0.3	-	14.8	-	B
Overall Junction Summary		-	1419	-	0.8	-	3.2	-	A
Horse Fair / Nene Quay	Nene Quay (N)	-	328	-	1.0	-	2.8	-	A
	Horse Fair	-	43	-	0.3	-	9.7	-	A
	Nene Quay (S)	-	269	-	0.0	-	3.3	-	A
Overall Junction Summary		-	639	-	0.4	-	3.5	-	A

Table 22 shows that Freedom Bridge Roundabout is forecast to be operating within capacity in the AM peak for Option FB 5, with no major issues on any approaches in the AM Peak 2016. Delays are forecast to reduce along the A1101 North End approach to the Aldi junction from allowing 2 lanes to Churchill Road and along Lynn Road towards Freedom Bridge by re-routing traffic along Bedford Street.

Table 22 shows the two new signalised junctions are forecast to operate well within capacity with a LOS A.

Technical note

Table 23. 2016 PM Peak Approach Comparison Results Freedom Bridge Option 5

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	Base	FB Opt 5	Base	FB Opt 5	Base	FB Opt 5	Base	FB Opt 5
Freedom Bridge	Lynn Rd	737	587	10.1	10.4	13.1	10.4	B	B
	Petrol Station	69	-	1.4	-	24.2	-	C	-
	Churchill Road Slip	-	106	-	0.1	-	1.8	-	A
	Churchill Rd Left / Ahead	390	-	47.9	-	72.1	-	F	-
	Churchill Rd Right	305	-	32.3	-	27.8	-	D	-
	Churchill Road	-	707	-	30.6	-	25.0	-	C
	Horse Fair	135	-	60.0	-	179.7	-	F	-
	Nene Quay	402	427	28.8	14.1	49.6	20.0	E	C
	A1101 Left / Ahead	432	-	30.8	-	26.7	-	D	-
	A1101 Right	434	-	39.3	-	31.4	-	D	-
	A1101	-	848	-	27.6	-	22.6	-	C
	Bedford Street	-	110	-	1.6	-	15.4	-	C
	Overall Junction Summary	2902	2782	31.3	15.3	40.4	19.2	E	C
Aldi / North Street	A1101 North End	582	568	94.8	34.0	89.1	44.9	F	D
	Freedom Bridge	944	941	2.4	0.7	9.0	11.2	A	B
	North Street	338	336	7.5	10.6	32.5	35.8	D	E
	Aldi Access	99	98	1.3	1.2	30.2	27.4	C	C
	Overall Junction Summary	1963	1943	13.3	7.5	38.0	26.1	D	C
Lynn Rd	Lynn Road (N)	650	684	42.1	12.2	41.2	20.0	D	B
	Lynn Road (S)	782	810	28.1	21.0	14.6	10.0	B	B
	De Havilland Rd	258	148	18.1	9.5	43.1	41.3	D	D
	Overall Junction Summary	1689	1642	29.4	14.2	29.1	17.0	C	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	542	-	0.0	-	3.3	-	A
	Churchill Road (S)	-	695	-	11.8	-	12.7	-	B
	Horse Fair	-	67	-	1.8	-	20.4	-	C
	Overall Junction Summary	-	1303	-	4.5	-	9.2	-	A
Horse Fair / Nene Quay	Nene Quay (N)	-	354	-	1.5	-	3.7	-	A
	Horse Fair	-	67	-	0.5	-	9.0	-	A
	Nene Quay (S)	-	403	-	0.5	-	7.1	-	A
	Overall Junction Summary	-	823	-	0.9	-	5.8	-	A

Table 23 shows the model forecasts that Option 5 provides benefits over the base conditions at Freedom Bridge Roundabout, with fewer delays and lower queue lengths at all approaches.

The North Street approach to the Aldi junction is forecast to operate marginally worse (an increase of 3 seconds delay) in Option 5 PM Peak as a result of more traffic being processed from the other approaches and occasional weaving issues on the nearside lane to the A1101 North End.

The new signalised junctions with Horse Fair are all operating within capacity. However, there are occasions during the PM Peak when the Churchill Road approach to Freedom Bridge Roundabout queue extends back through the new Horse Fair junction. Yellow boxes have been coded into the model to prevent vehicles blocking the right turn in and exit out of Horse Fair.

The queue along Lynn Road from the De Havilland Road junction in the PM peak does occasionally extend back onto Freedom Bridge Roundabout, blocking access for the A1101 and Bedford Street approaches.

Technical note

6.4. 2021 Without WLR Results Summary

A summary of each approach to Freedom Bridge Roundabout, Aldi and Lynn Road junctions have been compared back to the 2021 Without WLR DM results and are shown in Tables 24 and 25 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 24. 2021 Without WLR AM Peak Approach Comparison Results Freedom Bridge Option 5

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5
Freedom Bridge	Lynn Rd	679	445	13.1	11.3	14.4	11.3	B	B
	Petrol Station	39	-	0.5	-	24.7	-	C	-
	Churchill Road Slip	-	146	-	0.3	-	2.9	-	A
	Churchill Rd Left / Ahead	447	-	14.2	-	25.1	-	D	-
	Churchill Rd Right	195	-	1.3	-	11.9	-	B	-
	Churchill Road	-	610	-	8.4	-	11.3	-	B
	Horse Fair	57	-	1.9	-	22.7	-	C	-
	Nene Quay	263	267	3.0	1.6	13.4	8.0	B	A
	A1101 Left / Ahead	415	-	10.2	-	8.8	-	A	-
	A1101 Right	690	-	48.6	-	20.0	-	C	-
	A1101	-	1113	-	14.2	-	11.4	-	B
	Bedford Street	-	127	-	1.2	-	10.7	-	B
		Overall Junction Summary	2784	2707	11.6	5.9	16.7	10.5	C
Aldi / North Street	A1101 North End	820	828	141.1	21.3	70.6	25.7	E	C
	Freedom Bridge	815	814	0.4	0.0	6.3	5.4	A	A
	North Street	333	333	2.3	1.7	32.3	22.3	D	C
	Aldi Access	44	44	0.2	0.1	28.8	25.6	C	C
	Overall Junction Summary	2012	2018	15.1	2.7	37.3	17.0	D	B
Lynn Rd	Lynn Road (N)	597	607	36.5	6.3	40.7	16.5	D	B
	Lynn Road (S)	544	580	16.6	12.9	13.0	9.1	B	A
	De Havilland Rd	189	61	10.5	2.8	36.4	32.6	D	C
	Total	1329	1247	21.2	7.3	28.8	13.8	C	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	801	-	0.1	-	2.0	-	A
	Churchill Road (S)	-	641	-	2.1	-	4.0	-	A
	Horse Fair	-	18	-	0.3	-	13.9	-	B
	Overall Junction Summary	-	1460	-	0.8	-	3.0	-	A
Horse Fair / Nene Quay	Nene Quay (N)	-	332	-	1.1	-	3.1	-	A
	Horse Fair	-	40	-	0.3	-	9.1	-	A
	Nene Quay (S)	-	262	-	0.0	-	3.1	-	A
	Overall Junction Summary	-	633	-	0.5	-	3.5	-	A

Technical note

Table 25. 2021 Without WLR PM Peak Approach Comparison Results Freedom Bridge Option 5

Junction	Approach	PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
		DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5
Freedom Bridge	Lynn Rd	752	559	9.8	11.6	13.9	11.6	B	B
	Petrol Station	70	-	1.3	-	25.2	-	D	-
	Churchill Road Slip	-	155	-	0.2	-	2.0	-	A
	Churchill Rd Left / Ahead	408	-	40.8	-	61.7	-	F	-
	Churchill Rd Right	326	-	28.1	-	27.3	-	D	-
	Churchill Road	-	737	-	29.8	-	24.4	-	C
	Horse Fair	132	-	30.9	-	126.4	-	F	-
	Nene Quay	468	524	198.3	18.0	192.1	21.1	F	C
	A1101 Left / Ahead	446	-	37.8	-	25.4	-	D	-
	A1101 Right	486	-	58.1	-	37.4	-	E	-
	A1101	-	964	-	64.8	-	34.9	-	D
	Bedford Street	-	109	-	1.2	-	13.4	-	B
	Overall Junction Summary	3086	3047	50.6	23.0	58.6	23.3	F	C
Aldi / North Street	A1101 North End	659	690	704.0	513.7	370.5	272.5	F	F
	Freedom Bridge	1002	1001	0.8	0.1	7.1	7.1	A	A
	North Street	334	333	2.3	2.1	27.3	29.7	D	D
	Aldi Access	97	97	1.2	1.1	31.6	31.4	C	C
Overall Junction Summary	2091	2121	71.8	52.3	125.3	97.5	F	F	
Lynn Rd	Lynn Road (N)	668	706	35.7	13.2	35.4	20.5	D	C
	Lynn Road (S)	740	794	27.3	22.2	15.0	10.7	B	B
	De Havilland Rd	257	148	18.0	8.9	43.0	39.3	D	D
Overall Junction Summary	1664	1648	27.0	14.8	27.5	17.4	C	B	
Horse Fair / Churchill Rd	Churchill Road (N)	-	603	-	0.0	-	3.0	-	A
	Churchill Road (S)	-	725	-	10.0	-	10.6	-	B
	Horse Fair	-	63	-	1.2	-	16.3	-	B
Overall Junction Summary	-	1391	-	3.8	-	7.6	-	A	
Horse Fair / Nene Quay	Nene Quay (N)	-	352	-	1.5	-	3.9	-	A
	Horse Fair	-	67	-	0.6	-	9.5	-	A
	Nene Quay (S)	-	498	-	1.8	-	8.9	-	A
Overall Junction Summary	-	918	-	1.3	-	7.1	-	A	

Tables 24 and 25 show that Option 5 is forecast to provide benefits to all approaches to Freedom Bridge Roundabout in both peaks. The A1101 North End approach at Aldi is operating over capacity in the PM peak, although delays have been reduced by 100s with the introduction of Option 5.

6.5. 2021 With WLR Results Summary

A summary of each approach to Freedom Bridge Roundabout, Aldi and Lynn Road junctions have been compared back to the 2021 With WLR DM results and are shown in Tables 26 and 27 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Technical note

Table 26. 2021 With WLR AM Peak Approach Comparison Results Freedom Bridge Option 5

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5
Freedom Bridge	Lynn Rd	757	585	4.8	7.0	6.7	7.0	A	A
	Petrol Station	39	-	0.2	-	11.6	-	B	-
	Churchill Road Slip	-	84	-	0.0	-	1.3	-	A
	Churchill Rd Left / Ahead	354	-	7.6	-	20.8	-	C	-
	Churchill Rd Right	202	-	1.7	-	14.0	-	B	-
	Churchill Road	-	529	-	6.1	-	10.1	-	B
	Horse Fair	57	-	1.4	-	18.9	-	C	-
	Nene Quay	276	277	2.0	1.2	10.2	6.6	B	A
	A1101 Left / Ahead	476	-	5.2	-	9.6	-	A	-
	A1101 Right	330	-	2.9	-	9.9	-	A	-
	A1101	-	804	-	8.9	-	10.1	-	B
	Bedford Street	-	127	-	0.6	-	7.2	-	A
		Overall Junction Summary	2489	2408	3.2	3.8	11.0	8.5	B
Aldi / North Street	A1101 North End	586	588	12.8	12.7	22.4	21.7	C	C
	Freedom Bridge	697	687	0.0	0.0	5.6	5.3	A	A
	North Street	267	267	0.9	0.7	15.5	15.9	C	C
	Aldi Access	44	44	0.1	0.1	23.5	22.1	C	C
	Overall Junction Summary	1594	1587	1.6	1.5	13.9	13.6	B	B
Lynn Rd	Lynn Road (N)	676	687	15.9	9.8	23.6	18.0	C	B
	Lynn Road (S)	552	586	17.4	12.7	13.2	8.8	B	A
	De Havilland Rd	188	61	10.1	2.9	34.4	33.2	C	C
	Overall Junction Summary	1416	1333	14.5	8.4	21.0	14.7	C	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	439	-	0.0	-	2.4	-	A
	Churchill Road (S)	-	555	-	1.9	-	3.8	-	A
	Horse Fair	-	17	-	0.2	-	13.5	-	B
	Overall Junction Summary	-	1011	-	0.7	-	3.3	-	A
Horse Fair / Nene Quay	Nene Quay (N)	-	454	-	1.8	-	3.2	-	A
	Horse Fair	-	40	-	0.4	-	11.2	-	B
	Nene Quay (S)	-	272	-	0.0	-	3.3	-	A
	Overall Junction Summary	-	766	-	0.7	-	3.7	-	A

Technical note

Table 27. 2021 With WLR PM Peak Approach Comparison Results Freedom Bridge Option 5

Junction	Approach	PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
		DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5
Freedom Bridge	Lynn Rd	730	581	2.3	5.9	7.6	5.9	A	A
	Petrol Station	69	-	0.3	-	10.8	-	B	-
	Churchill Road Slip	-	111	-	0.0	-	0.9	-	A
	Churchill Rd Left / Ahead	286	-	2.8	-	16.9	-	C	-
	Churchill Rd Right	236	-	1.7	-	14.9	-	B	-
	Churchill Road	-	537	-	5.0	-	10.0	-	A
	Horse Fair	129	-	4.3	-	24.3	-	C	-
	Nene Quay	468	491	62.0	4.8	68.0	11.0	F	B
	A1101 Left / Ahead	476	-	16.7	-	19.3	-	C	-
	A1101 Right	210	-	4.3	-	14.3	-	B	-
	A1101	-	682	-	18.6	-	17.0	-	C
	Bedford Street	-	110	-	0.5	-	8.2	-	A
	Overall Junction Summary	2605	2509	11.8	5.9	23.7	10.7	C	B
Aldi / North Street	A1101 North End	432	432	21.0	19.8	38.0	35.3	D	D
	Freedom Bridge	902	897	0.5	0.2	8.0	9.7	A	A
	North Street	310	309	3.0	3.6	20.7	26.5	C	D
	Aldi Access	97	97	1.2	1.1	28.3	26.2	C	C
Overall Junction Summary	1741	1734	3.7	3.6	18.8	20.0	B	B	
Lynn Rd	Lynn Road (N)	644	684	14.8	12.9	23.2	20.5	C	C
	Lynn Road (S)	711	741	25.0	19.0	14.4	10.1	B	B
	De Havilland Rd	258	147	16.2	8.3	38.9	37.0	D	D
Overall Junction Summary	1613	1573	18.6	13.4	21.8	17.1	C	B	
Horse Fair / Churchill Rd	Churchill Road (N)	-	300	-	0.0	-	3.3	-	A
	Churchill Road (S)	-	522	-	1.8	-	3.9	-	A
	Horse Fair	-	63	-	0.7	-	10.0	-	A
Overall Junction Summary	-	885	-	0.8	-	4.1	-	A	
Horse Fair / Nene Quay	Nene Quay (N)	-	283	-	1.0	-	3.3	-	A
	Horse Fair	-	67	-	0.5	-	8.3	-	A
	Nene Quay (S)	-	466	-	0.3	-	4.9	-	A
Overall Junction Summary	-	816	-	0.6	-	4.6	-	A	

Tables 26 and 27 show that all approaches are operating within capacity in both the AM and PM peaks in Option 5. In the PM Peak the largest benefits are found on Nene Quay with Option 5 reducing delay by approximately 50 seconds. The with WLR scenario also results in a decrease in delay and queues at Freedom Bridge Roundabout and the Aldi / North Street junction in 2021 compared to the without WLR.

6.6. 2026 Without WLR Results

A summary of each approach to Freedom Bridge Roundabout, Aldi and Lynn Road junctions have been compared back to the 2026 Without WLR DM results and are shown in Tables 28 and 29 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Technical note

Table 28. 2026 Without WLR AM Peak Approach Comparison Results Freedom Bridge Option 5

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5
Freedom Bridge	Lynn Rd	730	495	16.6	12.8	15.7	12.8	C	B
	Petrol Station	39	-	0.7	-	30.6	-	D	-
	Churchill Road Slip	-	178	-	0.4	-	2.9	-	A
	Churchill Rd Left / Ahead	368	-	6.9	-	19.8	-	C	-
	Churchill Rd Right	150	-	0.6	-	11.1	-	B	-
	Churchill Road	-	503	-	6.7	-	11.2	-	B
	Horse Fair	57	-	1.6	-	20.4	-	C	-
	Nene Quay	264	268	2.9	1.3	12.2	6.9	B	A
	A1101 Left / Ahead	415	-	5.4	-	7.2	-	A	-
	A1101 Right	762	-	45.0	-	17.7	-	C	-
	A1101	-	1221	-	14.1	-	10.6	-	B
	Bedford Street	-	127	-	1.2	-	11.1	-	B
		Overall Junction Summary	2783	2790	10.0	5.8	15.2	10.3	C
Aldi / North Street	A1101 North End	879	925	471.4	38.4	151.4	31.0	F	C
	Freedom Bridge	756	768	0.2	0.0	5.8	5.0	A	A
	North Street	346	345	1.8	1.5	33.7	23.4	D	C
	Aldi Access	45	44	0.2	0.2	29.5	27.0	C	C
	Overall Junction Summary	2024	2081	47.9	4.4	74.1	20.1	E	C
Lynn Rd	Lynn Road (N)	649	690	251.9	10.3	144.5	18.5	F	B
	Lynn Road (S)	521	567	16.1	12.8	13.1	9.1	B	A
	De Havilland Rd	189	61	13.4	2.9	45.3	33.9	D	C
	Overall Junction Summary	1358	1318	93.8	8.7	80.1	15.2	F	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	848	-	0.1	-	1.9	-	A
	Churchill Road (S)	-	516	-	1.4	-	3.4	-	A
	Horse Fair	-	17	-	0.2	-	11.9	-	B
	Overall Junction Summary	-	1380	-	0.6	-	2.6	-	A
Horse Fair / Nene Quay	Nene Quay (N)	-	438	-	1.6	-	3.2	-	A
	Horse Fair	-	40	-	0.3	-	9.7	-	A
	Nene Quay (S)	-	262	-	0.0	-	3.4	-	A
	Overall Junction Summary	-	740	-	0.6	-	3.6	-	A

Technical note

Table 29. 2026 Without WLR PM Peak Approach Comparison Results Freedom Bridge Option 5

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5
Freedom Bridge	Lynn Rd	782	559	7.7	10.6	12.3	10.6	B	B
	Petrol Station	68	-	1.1	-	22.1	-	C	-
	Churchill Road Slip	-	176	-	0.1	-	1.7	-	A
	Churchill Rd Left / Ahead	370	-	25.6	-	47.3	-	E	-
	Churchill Rd Right	344	-	20.3	-	32.3	-	D	-
	Churchill Road	-	735	-	26.3	-	23.1	-	C
	Horse Fair	128	-	31.5	-	135.4	-	F	-
	Nene Quay	407	491	238.7	13.2	251.9	19.8	F	C
	A1101 Left / Ahead	448	-	43.3	-	29.3	-	D	-
	A1101 Right	469	-	55.6	-	37.0	-	E	-
	A1101	-	964	-	61.5	-	33.2	-	D
	Bedford Street	-	109	-	1.4	-	14.7	-	B
	Overall Junction Summary		3015	3034	53.0	20.7	62.8	22.0	F
Aldi / North Street	A1101 North End	650	691	868.3	829.3	468.4	415.0	F	F
	Freedom Bridge	995	1008	0.7	0.1	6.8	6.6	A	A
	North Street	336	336	1.8	2.1	26.5	28.1	D	D
	Aldi Access	97	97	1.2	1.2	31.1	31.5	C	C
Overall Junction Summary		2077	2133	88.0	83.9	154.5	143.2	F	F
Lynn Rd	Lynn Road (N)	681	726	25.9	14.3	28.6	20.6	C	C
	Lynn Road (S)	790	856	29.3	22.6	15.0	10.1	B	B
	De Havilland Rd	273	147	20.0	9.5	44.0	41.8	D	D
Overall Junction Summary		1743	1729	25.1	15.5	24.8	17.2	C	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	557	-	0.0	-	3.1	-	A
	Churchill Road (S)	-	723	-	6.7	-	8.3	-	A
	Horse Fair	-	60	-	1.0	-	14.7	-	B
Overall Junction Summary		-	1340	-	2.6	-	6.4	-	A
Horse Fair / Nene Quay	Nene Quay (N)	-	358	-	1.4	-	3.6	-	A
	Horse Fair	-	66	-	0.4	-	8.3	-	A
	Nene Quay (S)	-	460	-	0.8	-	6.7	-	A
Overall Junction Summary		-	884	-	0.9	-	5.6	-	A

Tables 28 and 29 show that Option 5 is still forecast to provide benefits over the DM with the growth in traffic in 2026. In the AM Peak all approaches are operating within capacity in Option 5 with the biggest benefits forecast on Lynn Road and the A1101 North End approaches. In the PM Peak all approaches are operating within capacity except North End approach, although the delay is approximately 50 seconds less than the DM.

6.7. 2026 With WLR Results

A summary of each approach to Freedom Bridge Roundabout, Aldi and Lynn Road junctions have been compared back to the 2026 With WLR DM results and are shown in Tables 30 and 31 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Technical note

Table 30. 2026 With WLR AM Peak Approach Comparison Results Freedom Bridge Option 5

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5
Freedom Bridge	Lynn Rd	682	489	5.7	7.3	8.0	7.3	A	A
	Petrol Station	39	-	0.2	-	12.6	-	B	-
	Churchill Road Slip	-	109	-	0.1	-	1.6	-	A
	Churchill Rd Left / Ahead	294	-	2.3	-	12.4	-	B	-
	Churchill Rd Right	157	-	0.5	-	10.2	-	B	-
	Churchill Road	-	425	-	3.5	-	8.1	-	A
	Horse Fair	57	-	0.8	-	13.2	-	B	-
	Nene Quay	247	253	1.5	1.1	9.3	6.5	A	A
	A1101 Left / Ahead	476	-	3.8	-	8.2	-	A	-
	A1101 Right	435	-	5.1	-	10.9	-	B	-
	A1101	-	912	-	8.2	-	9.1	-	A
	Bedford Street	-	126	-	0.7	-	8.1	-	A
		Overall Junction Summary	2384	2312	2.5	3.1	9.6	7.8	A
Aldi / North Street	A1101 North End	645	645	14.7	13.9	23.3	22.1	C	C
	Freedom Bridge	637	632	0.0	0.0	5.8	5.4	A	A
	North Street	314	315	1.4	1.0	16.9	17.7	C	C
	Aldi Access	45	44	0.1	0.1	24.2	22.7	C	C
	Overall Junction Summary	1639	1636	1.9	1.7	15.3	14.8	B	B
Lynn Rd	Lynn Road (N)	602	612	11.5	6.1	22.4	16.6	C	B
	Lynn Road (S)	577	610	17.8	13.8	13.1	9.0	B	A
	De Havilland Rd	189	61	9.6	2.8	32.9	32.2	C	C
	Overall Junction Summary	1367	1283	13.0	7.5	19.9	13.8	B	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	549	-	0.0	-	2.1	-	A
	Churchill Road (S)	-	451	-	1.6	-	3.7	-	A
	Horse Fair	-	17	-	0.2	-	11.6	-	B
	Overall Junction Summary	-	1017	-	0.6	-	3.0	-	A
Horse Fair / Nene Quay	Nene Quay (N)	-	344	-	1.2	-	3.1	-	A
	Horse Fair	-	40	-	0.2	-	8.6	-	A
	Nene Quay (S)	-	246	-	0.0	-	3.3	-	A
	Overall Junction Summary	-	630	-	0.5	-	3.5	-	A

Technical note

Table 31. 2026 With WLR PM Peak Approach Comparison Results Freedom Bridge Option 5

Junction	Approach	PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
		DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5	DM	FB Opt 5
Freedom Bridge	Lynn Rd	785	617	2.4	8.8	8.3	8.8	A	A
	Petrol Station	69	-	0.4	-	12.3	-	B	-
	Churchill Road Slip	-	130	-	0.0	-	0.9	-	A
	Churchill Rd Left / Ahead	292	-	3.8	-	19.9	-	C	-
	Churchill Rd Right	201	-	1.3	-	16.8	-	C	-
	Churchill Road	-	500	-	9.4	-	17.7	-	C
	Horse Fair	130	-	4.7	-	27.3	-	D	-
	Nene Quay	436	444	79.8	5.6	92.5	12.7	F	B
	A1101 Left / Ahead	530	-	27.6	-	23.7	-	C	-
	A1101 Right	208	-	4.3	-	14.1	-	B	-
	A1101	-	740	-	23.2	-	18.7	-	C
	Bedford Street	-	109	-	1.1	-	14.8	-	B
	Overall Junction Summary	2653	2540	15.5	8.1	28.8	14.0	D	B
Aldi / North Street	A1101 North End	492	494	42.1	33.9	54.8	46.3	D	D
	Freedom Bridge	946	938	1.7	0.3	8.3	9.2	A	A
	North Street	302	302	3.3	3.2	23.5	25.3	C	D
	Aldi Access	97	97	1.1	1.1	29.0	27.7	C	C
Overall Junction Summary	1838	1830	6.4	4.9	24.3	22.8	C	C	
Lynn Rd	Lynn Road (N)	699	736	19.4	29.5	24.6	28.0	C	C
	Lynn Road (S)	786	808	27.9	20.7	14.2	9.8	B	A
	De Havilland Rd	257	147	17.6	9.6	42.1	42.3	D	D
Overall Junction Summary	1742	1691	21.6	19.9	22.5	20.6	C	C	
Horse Fair / Churchill Rd	Churchill Road (N)	-	288	-	0.0	-	3.2	-	A
	Churchill Road (S)	-	492	-	5.6	-	10.5	-	B
	Horse Fair	-	61	-	1.0	-	14.2	-	B
Overall Junction Summary	-	840	-	2.2	-	8.2	-	A	
Horse Fair / Nene Quay	Nene Quay (N)	-	283	-	5.4	-	8.6	-	A
	Horse Fair	-	67	-	0.8	-	13.2	-	B
	Nene Quay (S)	-	416	-	0.4	-	5.4	-	A
Overall Junction Summary	-	765	-	2.2	-	7.6	-	A	

Tables 30 and 31 show that reducing the traffic around Freedom Bridge Roundabout with the introduction of the Western Link Road allows all approaches to operate within capacity in both peaks in Option 5.

Technical note

7. Freedom Bridge Roundabout Option Adjustment

On 19th October 2016 a workshop was held to review the options detailed above and during this workshop it was agreed which options should be discarded, which should be taken forward as they were, or which could be modified.

Of the four options originally assessed for Freedom Bridge Roundabout, Options 2, 3 and 4 were discarded as they did not operate within capacity in the future year assessments. Option 5 was retained, but modified to try and improve performance. The modified option was renamed Option 5a.

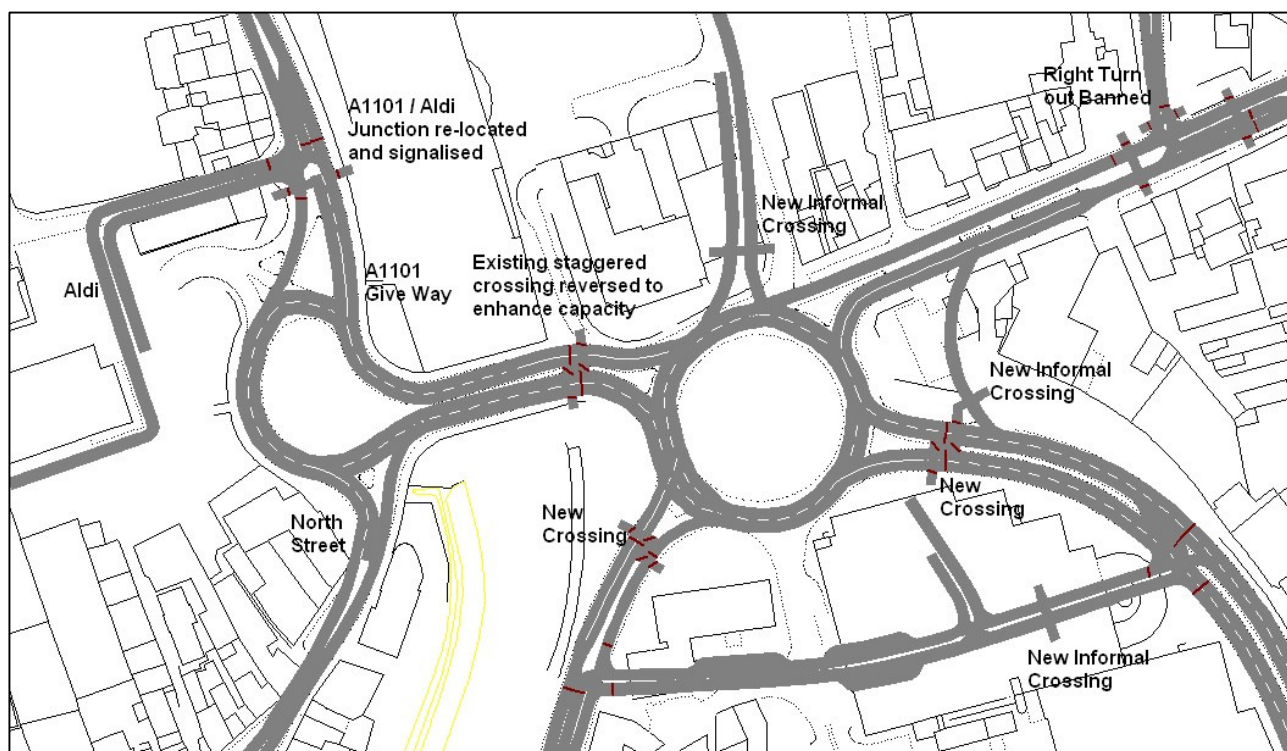
8. Freedom Bridge Option 5a

8.1. Network Changes

The original Option 5 model was updated to incorporate additional pedestrian facilities and included the relocation of the Aldi access to the Sandyland junction as per Option 4. The Aldi junction has been signalised, incorporating a pedestrian crossing as shown in Figure 15.

The De Havilland Road junction was also amended to ban right turns out onto Lynn Road, as vehicles could now use Bedford Street.

Figure 15. Freedom Bridge Option 5a VISSIM Layout



A default number of 20 pedestrians per direction per hour were utilised for the additional pedestrian crossings (40 pedestrians for each crossing).

It is worth noting that vehicles using Bedford Street and Lynn Road / De Havilland Road to leave the network are the same as counted out on site. No assumptions have been made on vehicles re-assigning to leave the network via Bedford Street rather than using Lynn Road / De Havilland Road.

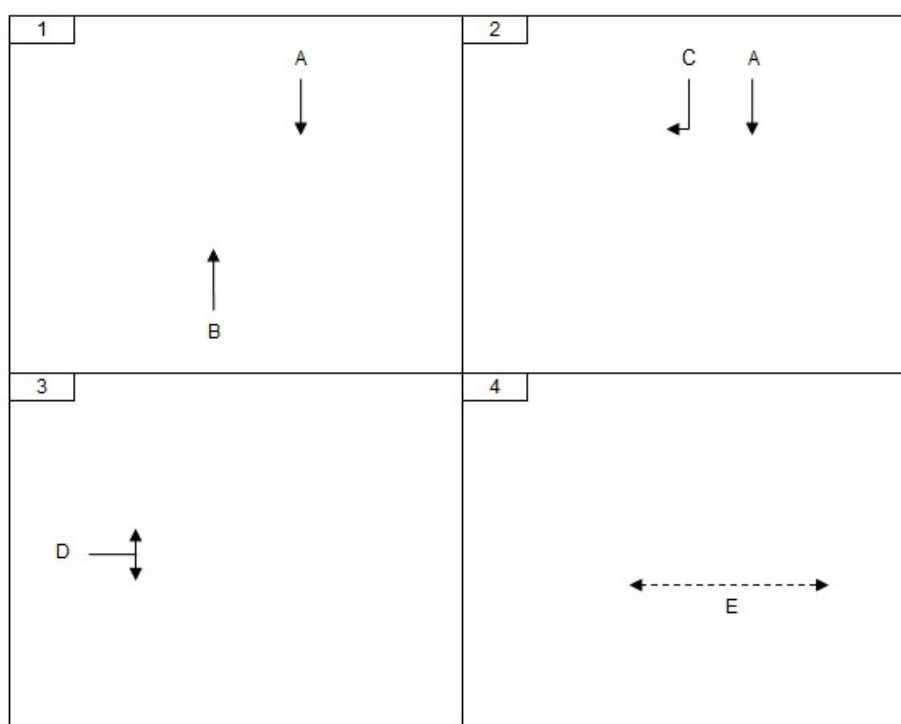
Technical note

The Aldi junction has been coded as a Vehicle Actuated (VA) controlled junction operating with 4 stages as shown in Figure 16. Phases A and B represent the A1101 and Phase D represents the Aldi access. The dotted line for phase E is the pedestrian crossing.

All stages run on demand and the in AM peak stage 1 runs for a maximum of 50 seconds and in the PM it runs for 60 seconds. All other stages run with 7 seconds.

For the purpose of this assessment, stage 2 automatically runs once the maximum or gap out of stage 1 is activated, as there are no right turners into Aldi. This is due to the observed data being separated between junctions at this location, and in the existing conditions it was unknown how many vehicles from the A1101 were actually u-turning at Freedom Bridge to enter Aldi. In order to assess the impact of the right turn, it was necessary to code the stage to automatically be called, rather than setting it to run on demand. Therefore, the signal staging in the model can be considered a worst case assessment.

Figure 16. Aldi Junction Signal Staging



This option has been modelled for the future years of 2021 and 2026, and for the with and without Western Link Road scenarios, with the results compared back to the Do Minimum (DM) and Option 5 results to quantify any benefits.

8.2. 2021 Without WLR Results Summary

A summary of each approach to Freedom Bridge, Aldi and Lynn Road junctions have been compared back to the 2021 Without WLR DM and FB Opt 5 results and are shown in Tables 32 and 33 for the AM and PM peaks respectively.

The light blue shaded cells represent the optimum performer.

Table 32. 2021 Without WLR AM Peak Approach Comparison Results Freedom Bridge Option 5a

Junction	Approach	AM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
		DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a
Freedom Bridge	Lynn Rd	679	445	420	13.1	11.3	10.8	14.4	11.3	10.8	B	B	B
	Petrol Station	39	-	-	0.5	-	-	24.7	-	-	C	-	-
	Churchill Road Slip	-	146	143	-	0.3	0.4	-	2.9	3.3	-	A	A
	Churchill Rd Left / Ahead	447	-	-	14.2	-	-	25.1	-	-	D	-	-
	Churchill Rd Right	195	-	-	1.3	-	-	11.9	-	-	B	-	-
	Churchill Road	-	610	611	-	8.4	1.3	-	11.3	9.4	-	B	A
	Horse Fair	57	-	-	1.9	-	-	22.7	-	-	C	-	-
	Nene Quay	263	267	267	3.0	1.6	2.8	13.4	8.0	9.1	B	A	A
	A1101 Left / Ahead	415	-	-	10.2	-	-	8.8	-	-	A	-	-
	A1101 Right	690	-	-	48.6	-	-	20.0	-	-	C	-	-
	A1101	-	1113	1106	-	14.2	12.7	-	11.4	11.5	-	B	B
	Bedford Street	-	127	156	-	1.2	2.0	-	10.7	12.3	-	B	B
	Overall Junction Summary	2784	2707	2703	11.6	5.9	4.5	16.7	10.5	10.3	C	B	B
Aldi / North Street	A1101 North End	820	828	824	141.1	21.3	5.2	70.6	25.7	20.7	E	C	C
	Freedom Bridge	815	814	810	0.4	0.0	0.0	6.3	5.4	9.9	A	A	A
	North Street	333	333	333	2.3	1.7	0.9	32.3	22.3	10.2	D	C	B
	Aldi Access	44	44	44	0.2	0.1	1.9	28.8	25.6	32.5	C	C	C
Overall Junction Summary	2012	2018	2010	15.1	2.7	1.6	37.3	17.0	14.9	D	B	B	
Lynn Rd	Lynn Road (N)	597	607	608	36.5	6.3	5.8	40.7	16.5	15.6	D	B	B
	Lynn Road (S)	544	580	576	16.6	12.9	11.6	13.0	9.1	8.3	B	A	A
	De Havilland Rd	189	61	33	10.5	2.8	1.5	36.4	32.6	32.0	D	C	C
Overall Junction Summary	1329	1247	1218	21.2	7.3	6.3	28.8	13.8	12.6	C	B	B	
Horse Fair / Churchill Rd	Churchill Road (N)	-	801	805	-	0.1	0.1	-	2.0	2.0	-	A	A
	Churchill Road (S)	-	641	641	-	2.1	1.7	-	4.0	3.4	-	A	A
	Horse Fair	-	18	18	-	0.3	0.2	-	13.9	14.5	-	B	B
Overall Junction Summary	-	1460	1463	-	0.8	0.7	-	3.0	2.8	-	A	A	
Horse Fair / Nene Quay	Nene Quay (N)	-	332	328	-	1.1	1.0	-	3.1	4.0	-	A	A
	Horse Fair	-	40	40	-	0.3	0.2	-	9.1	8.8	-	A	A
	Nene Quay (S)	-	262	262	-	0.0	0.0	-	3.1	3.1	-	A	A
Overall Junction Summary	-	633	629	-	0.5	0.5	-	3.5	3.9	-	A	A	

Table 33. 2021 Without WLR PM Peak Approach Comparison Results Freedom Bridge Option 5a

Junction	Approach	PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
		DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a
Freedom Bridge	Lynn Rd	752	559	535	9.8	11.6	11.2	13.9	11.6	11.2	B	B	B
	Petrol Station	70	-	-	1.3	-	-	25.2	-	-	D	-	-
	Churchill Road Slip	-	155	152	-	0.2	0.3	-	2.0	2.3	-	A	A
	Churchill Rd Left / Ahead	408	-	-	40.8	-	-	61.7	-	-	F	-	-
	Churchill Rd Right	326	-	-	28.1	-	-	27.3	-	-	D	-	-
	Churchill Road	-	737	737	-	29.8	3.4	-	24.4	15.0	-	C	C
	Horse Fair	132	-	-	30.9	-	-	126.4	-	-	F	-	-
	Nene Quay	468	524	527	198.3	18.0	14.4	192.1	21.1	18.3	F	C	C
	A1101 Left / Ahead	446	-	-	37.8	-	-	25.4	-	-	D	-	-
	A1101 Right	486	-	-	58.1	-	-	37.4	-	-	E	-	-
	A1101	-	964	982	-	64.8	87.4	-	34.9	34.1	-	D	D
	Bedford Street	-	109	123	-	1.2	2.0	-	13.4	15.6	-	B	C
		Overall Junction Summary	3086	3047	3057	50.6	23.0	21.7	58.6	23.3	20.5	F	C
Aldi / North Street	A1101 North End	659	690	706	704.0	513.7	107.9	370.5	272.5	88.9	F	F	F
	Freedom Bridge	1002	1001	992	0.8	0.1	1.4	7.1	7.1	16.7	A	A	C
	North Street	334	333	333	2.3	2.1	4.0	27.3	29.7	28.3	D	D	D
	Aldi Access	97	97	98	1.2	1.1	7.2	31.6	31.4	58.6	C	C	E
	Overall Junction Summary	2091	2121	2127	71.8	52.3	23.0	125.3	97.5	44.5	F	F	D
Lynn Rd	Lynn Road (N)	668	706	707	35.7	13.2	15.0	35.4	20.5	21.1	D	C	C
	Lynn Road (S)	740	794	804	27.3	22.2	21.4	15.0	10.7	10.3	B	B	B
	De Havilland Rd	257	148	136	18.0	8.9	8.2	43.0	39.3	39.5	D	D	D
	Overall Junction Summary	1664	1648	1646	27.0	14.8	14.9	27.5	17.4	17.3	C	B	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	603	611	-	0.0	0.1	-	3.0	3.1	-	A	A
	Churchill Road (S)	-	725	728	-	10.0	2.4	-	10.6	4.3	-	B	A
	Horse Fair	-	63	63	-	1.2	0.8	-	16.3	12.7	-	B	B
	Overall Junction Summary	-	1391	1402	-	3.8	1.1	-	7.6	4.2	-	A	A
Horse Fair / Nene Quay	Nene Quay (N)	-	352	355	-	1.5	1.5	-	3.9	4.6	-	A	A
	Horse Fair	-	67	67	-	0.6	0.6	-	9.5	9.5	-	A	A
	Nene Quay (S)	-	498	501	-	1.8	1.2	-	8.9	7.2	-	A	A
	Overall Junction Summary	-	918	924	-	1.3	1.1	-	7.1	6.4	-	A	A

Technical note

Tables 32 and 33 show that Option 5a is forecast to operate better around the Aldi junction with lower delays during both peaks. In the PM peak, the delays along the A1101 have reduced significantly and the model network processes more vehicles, although the approach is still operating over capacity.

In the PM peak, the North Street delays have slightly increased in Option 5a as a result of the signals at Aldi. As the right turn is called every cycle, vehicles are held up for longer which does occasionally extend back to block the North Street access to the gyratory.

Delays have also increased for the Aldi approach as more green time is given to the A1101 SB approach compared with the base.

By re-routing all right turners out of De Havilland Road and along Bedford Street helps to improve the performance of the Lynn Road / De Havilland Road junction, with lower delays than Option 5.

The inclusion of the pedestrian crossings and signalisation at the new relocated Aldi junction is not forecast to have a detrimental impact on the operation of Option 5a as the majority of approaches are operating better with Option 5a.

8.3. 2021 With WLR Results Summary

A summary of each approach to Freedom Bridge Roundabout, Aldi and Lynn Road junctions have been compared back to the 2021 With WLR DM and FB Opt 5 results and are shown in Tables 34 and 35 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 34. 2021 With WLR AM Peak Approach Comparison Results Freedom Bridge Option 5a

		AM Peak												
		Volume			Avg Queue (m)			Delay (s)			LOS			
Junction	Approach	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	
Freedom Bridge	Lynn Rd	757	585	556	4.8	7.0	7.4	6.7	7.0	7.4	A	A	A	
	Petrol Station	39	-	-	0.2	-	-	11.6	-	-	B	-	-	
	Churchill Road Slip	-	84	81	-	0.0	0.1	-	1.3	1.6	-	A	A	
	Churchill Rd Left / Ahead	354	-	-	7.6	-	-	20.8	-	-	C	-	-	
	Churchill Rd Right	202	-	-	1.7	-	-	14.0	-	-	B	-	-	
	Churchill Road	-	529	529	-	6.1	1.1	-	10.1	9.2	-	B	A	
	Horse Fair	57	-	-	1.4	-	-	18.9	-	-	C	-	-	
	Nene Quay	276	277	279	2.0	1.2	2.5	10.2	6.6	8.1	B	A	A	
	A1101 Left / Ahead	476	-	-	5.2	-	-	9.6	-	-	A	-	-	
	A1101 Right	330	-	-	2.9	-	-	9.9	-	-	A	-	-	
	A1101	-	804	805	-	8.9	7.0	-	10.1	9.7	-	B	A	
	Bedford Street	-	127	155	-	0.6	1.0	-	7.2	8.2	-	A	A	
	Overall Junction Summary		2489	2408	2404	3.2	3.8	2.8	11.0	8.5	8.5	B	A	A
	Aldi / North Street	A1101 North End	586	588	586	12.8	12.7	1.0	22.4	21.7	14.5	C	C	B
Freedom Bridge		697	687	686	0.0	0.0	0.0	5.6	5.3	10.4	A	A	B	
North Street		267	267	266	0.9	0.7	0.8	15.5	15.9	9.9	C	C	A	
Aldi Access		44	44	44	0.1	0.1	1.5	23.5	22.1	26.6	C	C	C	
Overall Junction Summary		1594	1587	1582	1.6	1.5	0.7	13.9	13.6	12.3	B	B	B	
Lynn Rd	Lynn Road (N)	676	687	686	15.9	9.8	7.9	23.6	18.0	16.2	C	B	B	
	Lynn Road (S)	552	586	586	17.4	12.7	11.0	13.2	8.8	7.9	B	A	A	
	De Havilland Rd	188	61	33	10.1	2.9	1.6	34.4	33.2	33.7	C	C	C	
Overall Junction Summary		1416	1333	1305	14.5	8.4	6.8	21.0	14.7	12.9	C	B	B	
Horse Fair / Churchill Rd	Churchill Road (N)	-	439	439	-	0.0	0.0	-	2.4	2.5	-	A	A	
	Churchill Road (S)	-	555	555	-	1.9	1.5	-	3.8	3.4	-	A	A	
	Horse Fair	-	17	18	-	0.2	0.3	-	13.5	15.1	-	B	B	
Overall Junction Summary		-	1011	1012	-	0.7	0.6	-	3.3	3.2	-	A	A	
Horse Fair / Nene Quay	Nene Quay (N)	-	454	451	-	1.8	1.8	-	3.2	4.1	-	A	A	
	Horse Fair	-	40	40	-	0.4	0.4	-	11.2	11.0	-	B	B	
	Nene Quay (S)	-	272	274	-	0.0	0.0	-	3.3	3.3	-	A	A	
Overall Junction Summary		-	766	766	-	0.7	0.8	-	3.7	4.2	-	A	A	

Table 35. 2021 With WLR PM Peak Approach Comparison Results Freedom Bridge Option 5a

		PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a
Freedom Bridge	Lynn Rd	730	581	557	2.3	5.9	5.4	7.6	5.9	5.4	A	A	A
	Petrol Station	69	-	-	0.3	-	-	10.8	-	-	B	-	-
	Churchill Road Slip	-	111	108	-	0.0	0.1	-	0.9	1.2	-	A	A
	Churchill Rd Left / Ahead	286	-	-	2.8	-	-	16.9	-	-	C	-	-
	Churchill Rd Right	236	-	-	1.7	-	-	14.9	-	-	B	-	-
	Churchill Road	-	537	530	-	5.0	1.1	-	10.0	9.4	-	A	A
	Horse Fair	129	-	-	4.3	-	-	24.3	-	-	C	-	-
	Nene Quay	468	491	486	62.0	4.8	6.5	68.0	11.0	11.2	F	B	B
	A1101 Left / Ahead	476	-	-	16.7	-	-	19.3	-	-	C	-	-
	A1101 Right	210	-	-	4.3	-	-	14.3	-	-	B	-	-
	A1101	-	682	682	-	18.6	22.1	-	17.0	17.0	-	C	C
	Bedford Street	-	110	121	-	0.5	0.8	-	8.2	8.9	-	A	A
		Overall Junction Summary	2605	2509	2484	11.8	5.9	6.2	23.7	10.7	10.6	C	B
Aldi / North Street	A1101 North End	432	432	431	21.0	19.8	1.4	38.0	35.3	18.8	D	D	B
	Freedom Bridge	902	897	878	0.5	0.2	0.4	8.0	9.7	19.7	A	A	C
	North Street	310	309	308	3.0	3.6	4.9	20.7	26.5	26.4	C	D	D
	Aldi Access	97	97	97	1.2	1.1	6.3	28.3	26.2	44.5	C	C	D
	Overall Junction Summary	1741	1734	1714	3.7	3.6	3.3	18.8	20.0	22.1	B	B	C
Lynn Rd	Lynn Road (N)	644	684	687	14.8	12.9	13.4	23.2	20.5	20.4	C	C	C
	Lynn Road (S)	711	741	741	25.0	19.0	19.1	14.4	10.1	10.2	B	B	B
	De Havilland Rd	258	147	134	16.2	8.3	7.7	38.9	37.0	37.3	D	D	D
	Overall Junction Summary	1613	1573	1562	18.6	13.4	13.4	21.8	17.1	17.0	C	B	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	300	299	-	0.0	0.0	-	3.3	3.1	-	A	A
	Churchill Road (S)	-	522	518	-	1.8	1.5	-	3.9	3.7	-	A	A
	Horse Fair	-	63	63	-	0.7	0.6	-	10.0	10.3	-	A	B
	Overall Junction Summary	-	885	1686	-	0.8	0.7	-	4.1	4.5	-	A	A
Horse Fair / Nene Quay	Nene Quay (N)	-	283	280	-	1.0	1.1	-	3.3	4.3	-	A	A
	Horse Fair	-	67	67	-	0.5	0.5	-	8.3	8.6	-	A	A
	Nene Quay (S)	-	466	460	-	0.3	0.4	-	4.9	5.0	-	A	A
	Overall Junction Summary	-	816	1686	-	0.6	0.7	-	4.6	4.5	-	A	A

Technical note

Tables 34 and 35 show that Option 5a is the optimum performer for both peaks with lower delays at Freedom Bridge, the Lynn Road junction and the A1101 approach.

As per the Without WLR results, the Aldi junction operates marginally worse as a result of providing more green time for the A1101 approach and minimal green time to the Aldi approach, however delay is significantly reduced for the A1101 North End in both the AM and PM peak hours.

North Street suffers slightly longer delays as a result of vehicles being stopped at the Aldi junction, with queues occasionally extending back and blocking the approach.

8.4. 2026 Without WLR Results Summary

A summary of each approach to Freedom Bridge Roundabout, Aldi and Lynn Road junctions have been compared back to the 2026 Without WLR DM and FB Opt 5 results and are shown in Tables 36 and 37 for the AM and PM peaks respectively.

The light blue shaded cells represent the optimum performer.

Table 36. 2026 Without WLR AM Peak Approach Comparison Results Freedom Bridge Option 5a

		AM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a
Freedom Bridge	Lynn Rd	730	495	472	16.6	12.8	12.9	15.7	12.8	12.9	C	B	B
	Petrol Station	39	-	-	0.7	-	-	30.6	-	-	D	-	-
	Churchill Road Slip	-	178	169	-	0.4	0.5	-	2.9	3.1	-	A	A
	Churchill Rd Left/ Ahead	368	-	-	6.9	-	-	19.8	-	-	C	-	-
	Churchill Rd Right	150	-	-	0.6	-	-	11.1	-	-	B	-	-
	Churchill Road	-	503	503	-	6.7	1.1	-	11.2	9.9	-	B	A
	Horse Fair	57	-	-	1.6	-	-	20.4	-	-	C	-	-
	Nene Quay	264	268	269	2.9	1.3	2.7	12.2	6.9	8.6	B	A	A
	A1101 Left / Ahead	415	-	-	5.4	-	-	7.2	-	-	A	-	-
	A1101 Right	762	-	-	45.0	-	-	17.7	-	-	C	-	-
	A1101	-	1221	1221	-	14.1	13.0	-	10.6	10.8	-	B	B
	Bedford Street	-	127	155	-	1.2	2.1	-	11.1	12.7	-	B	B
		Overall Junction Summary	2783	2790	2788	10.0	5.8	4.9	15.2	10.3	10.4	C	B
Aldi / North Street	A1101 North End	879	925	926	471.4	38.4	10.3	151.4	31.0	23.6	F	C	C
	Freedom Bridge	756	768	766	0.2	0.0	0.0	5.8	5.0	9.2	A	A	A
	North Street	346	345	345	1.8	1.5	0.8	33.7	23.4	9.3	D	C	A
	Aldi Access	45	44	44	0.2	0.2	1.8	29.5	27.0	32.8	C	C	C
	Overall Junction Summary	2024	2081	2081	47.9	4.4	2.5	74.1	20.1	16.1	E	C	B
Lynn Rd	Lynn Road (N)	649	690	689	251.9	10.3	9.1	144.5	18.5	16.9	F	B	B
	Lynn Road (S)	521	567	567	16.1	12.8	11.2	13.1	9.1	8.2	B	A	A
	De Havilland Rd	189	61	33	13.4	2.9	1.5	45.3	33.9	33.0	D	C	C
	Overall Junction Summary	1358	1318	1290	93.8	8.7	7.3	80.1	15.2	13.5	F	B	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	848	846	-	0.1	0.1	-	1.9	1.8	-	A	A
	Churchill Road (S)	-	516	517	-	1.4	1.3	-	3.4	3.2	-	A	A
	Horse Fair	-	17	17	-	0.2	0.2	-	11.9	12.5	-	B	B
	Overall Junction Summary	-	1380	1380	-	0.6	0.5	-	2.6	2.5	-	A	A
Horse Fair / Nene Quay	Nene Quay (N)	-	438	438	-	1.6	1.8	-	3.2	4.4	-	A	A
	Horse Fair	-	40	40	-	0.3	0.4	-	9.7	10.9	-	A	B
	Nene Quay (S)	-	262	263	-	0.0	0.1	-	3.4	3.8	-	A	A
	Overall Junction Summary	-	740	741	-	0.6	0.7	-	3.6	4.5	-	A	A

Table 37. 2026 Without WLR PM Peak Approach Comparison Results Freedom Bridge Option 5a

		PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a
Freedom Bridge	Lynn Rd	782	559	540	7.7	10.6	10.4	12.3	10.6	10.4	B	B	B
	Petrol Station	68	-	-	1.1	-	-	22.1	-	-	C	-	-
	Churchill Road Slip	-	176	169	-	0.1	0.3	-	1.7	2.2	-	A	A
	Churchill Rd Left / Ahead	370	-	-	25.6	-	-	47.3	-	-	E	-	-
	Churchill Rd Right	344	-	-	20.3	-	-	32.3	-	-	D	-	-
	Churchill Road	-	735	734	-	26.3	4.0	-	23.1	15.8	-	C	C
	Horse Fair	128	-	-	31.5	-	-	135.4	-	-	F	-	-
	Nene Quay	407	491	491	238.7	13.2	11.3	251.9	19.8	17.3	F	C	C
	A1101 Left / Ahead	448	-	-	43.3	-	-	29.3	-	-	D	-	-
	A1101 Right	469	-	-	55.6	-	-	37.0	-	-	E	-	-
	A1101	-	964	1021	-	61.5	104.8	-	33.2	35.1	-	D	E
	Bedford Street	-	109	121	-	1.4	2.4	-	14.7	17.7	-	B	C
		Overall Junction Summary	3015	3034	3077	53.0	20.7	24.5	62.8	22.0	20.8	F	C
Aldi / North Street	A1101 North End	650	691	744	868.3	829.3	251.6	468.4	415.0	156.6	F	F	F
	Freedom Bridge	995	1008	997	0.7	0.1	0.3	6.8	6.6	13.1	A	A	B
	North Street	336	336	337	1.8	2.1	2.2	26.5	28.1	24.3	D	D	C
	Aldi Access	97	97	97	1.2	1.2	7.8	31.1	31.5	65.4	C	C	E
	Overall Junction Summary	2077	2133	2175	88.0	83.9	48.1	154.5	143.2	66.0	F	F	E
Lynn Rd	Lynn Road (N)	681	726	729	25.9	14.3	13.8	28.6	20.6	20.4	C	C	C
	Lynn Road (S)	790	856	880	29.3	22.6	22.9	15.0	10.1	9.9	B	B	A
	De Havilland Rd	273	147	135	20.0	9.5	8.9	44.0	41.8	42.7	D	D	D
	Overall Junction Summary	1743	1729	1744	25.1	15.5	15.2	24.8	17.2	16.9	C	B	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	557	569	-	0.0	0.0	-	3.1	2.8	-	A	A
	Churchill Road (S)	-	723	722	-	6.7	2.5	-	8.3	4.4	-	A	A
	Horse Fair	-	60	60	-	1.0	0.8	-	14.7	11.9	-	B	B
	Overall Junction Summary	-	1340	1352	-	2.6	1.1	-	6.4	4.1	-	A	A
Horse Fair / Nene Quay	Nene Quay (N)	-	358	371	-	1.4	1.4	-	3.6	4.5	-	A	A
	Horse Fair	-	66	67	-	0.4	0.5	-	8.3	9.3	-	A	A
	Nene Quay (S)	-	460	460	-	0.8	0.5	-	6.7	5.8	-	A	A
	Overall Junction Summary	-	884	898	-	0.9	0.8	-	5.6	5.5	-	A	A

Technical note

Table 36 shows that the AM peak network is operating within capacity and that Option 5a provides benefits over Option 5 as a result of reducing delays around the Aldi junction, especially along the A1101.

Table 37 shows that in the PM peak, delays have improved at the Aldi junction, although the A1101 is still operating over capacity. The Aldi approach is operating at capacity as a result of providing more green time to the A1101 in stage 1.

Overall in both peaks, Option 5a is the optimum performer.

8.5. 2026 With WLR Results Summary

A summary of each approach to Freedom Bridge, Aldi and Lynn Road junctions have been compared back to the 2026 with WLR DM and FB Opt 5 results and are shown in Tables 38 and 39 for the AM and PM peaks respectively.

The light blue shaded cells represent the optimum performer.

Table 38. 2026 With WLR AM Peak Approach Comparison Results Freedom Bridge Option 5a

		AM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a
Freedom Bridge	Lynn Rd	682	489	462	5.7	7.3	7.3	8.0	7.3	7.3	A	A	A
	Petrol Station	39	-	-	0.2	-	-	12.6	-	-	B	-	-
	Churchill Road Slip	-	109	103	-	0.1	0.1	-	1.6	1.9	-	A	A
	Churchill Rd Left / Ahead	294	-	-	2.3	-	-	12.4	-	-	B	-	-
	Churchill Rd Right	157	-	-	0.5	-	-	10.2	-	-	B	-	-
	Churchill Road	-	425	423	-	3.5	0.8	-	8.1	7.8	-	A	A
	Horse Fair	57	-	-	0.8	-	-	13.2	-	-	B	-	-
	Nene Quay	247	253	252	1.5	1.1	2.3	9.3	6.5	7.7	A	A	A
	A1101 Left / Ahead	476	-	-	3.8	-	-	8.2	-	-	A	-	-
	A1101 Right	435	-	-	5.1	-	-	10.9	-	-	B	-	-
	A1101	-	912	912	-	8.2	6.1	-	9.1	8.8	-	A	A
	Bedford Street	-	126	155	-	0.7	1.4	-	8.1	9.6	-	A	A
	Overall Junction Summary	2384	2312	2306	2.5	3.1	2.5	9.6	7.8	8.0	A	A	A
Aldi / North Street	A1101 North End	645	645	644	14.7	13.9	1.7	23.3	22.1	16.0	C	C	B
	Freedom Bridge	637	632	631	0.0	0.0	0.0	5.8	5.4	11.2	A	A	B
	North Street	314	315	314	1.4	1.0	0.8	16.9	17.7	9.2	C	C	A
	Aldi Access	45	44	45	0.1	0.1	1.5	24.2	22.7	26.6	C	C	C
	Overall Junction Summary	1639	1636	1633	1.9	1.7	0.8	15.3	14.8	13.1	B	B	B
Lynn Rd	Lynn Road (N)	602	612	612	11.5	6.1	5.2	22.4	16.6	15.1	C	B	B
	Lynn Road (S)	577	610	610	17.8	13.8	12.0	13.1	9.0	8.0	B	A	A
	De Havilland Rd	189	61	33	9.6	2.8	1.4	32.9	32.2	31.6	C	C	C
	Overall Junction Summary	1367	1283	1256	13.0	7.5	6.2	19.9	13.8	12.2	B	B	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	549	548	-	0.0	0.0	-	2.1	2.0	-	A	A
	Churchill Road (S)	-	451	451	-	1.6	1.1	-	3.7	3.1	-	A	A
	Horse Fair	-	17	17	-	0.2	0.2	-	11.6	12.9	-	B	B
	Overall Junction Summary	-	1017	1017	-	0.6	0.4	-	3.0	2.7	-	A	A
Horse Fair / Nene Quay	Nene Quay (N)	-	344	342	-	1.2	1.1	-	3.1	4.1	-	A	A
	Horse Fair	-	40	40	-	0.2	0.3	-	8.6	9.7	-	A	A
	Nene Quay (S)	-	246	246	-	0.0	0.0	-	3.3	3.1	-	A	A
	Overall Junction Summary	-	630	628	-	0.5	0.5	-	3.5	4.1	-	A	A

Table 39. 2026 With WLR PM Peak Approach Comparison Results Freedom Bridge Option 5a

		PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a	DM	FB Opt 5	FB Opt 5a
Freedom Bridge	Lynn Rd	785	617	594	2.4	8.8	6.6	8.3	8.8	6.6	A	A	A
	Petrol Station	69	-	-	0.4	-	-	12.3	-	-	B	-	-
	Churchill Road Slip	-	130	126	-	0.0	0.1	-	0.9	1.2	-	A	A
	Churchill Rd Left / Ahead	292	-	-	3.8	-	-	19.9	-	-	C	-	-
	Churchill Rd Right	201	-	-	1.3	-	-	16.8	-	-	C	-	-
	Churchill Road	-	500	505	-	9.4	1.4	-	17.7	11.6	-	C	B
	Horse Fair	130	-	-	4.7	-	-	27.3	-	-	D	-	-
	Nene Quay	436	444	449	79.8	5.6	6.7	92.5	12.7	12.9	F	B	B
	A1101 Left / Ahead	530	-	-	27.6	-	-	23.7	-	-	C	-	-
	A1101 Right	208	-	-	4.3	-	-	14.1	-	-	B	-	-
	A1101	-	740	737	-	23.2	30.9	-	18.7	17.9	-	C	C
	Bedford Street	-	109	121	-	1.1	1.3	-	14.8	11.6	-	B	B
		Overall Junction Summary	2653	2540	2531	15.5	8.1	8.1	28.8	14.0	12.0	D	B
Aldi / North Street	A1101 North End	492	494	491	42.1	33.9	3.4	54.8	46.3	23.6	D	D	C
	Freedom Bridge	946	938	930	1.7	0.3	1.5	8.3	9.2	22.4	A	A	C
	North Street	302	302	301	3.3	3.2	5.5	23.5	25.3	30.4	C	D	D
	Aldi Access	97	97	98	1.1	1.1	6.8	29.0	27.7	49.9	C	C	D
	Overall Junction Summary	1838	1830	1820	6.4	4.9	4.5	24.3	22.8	25.6	C	C	C
Lynn Rd	Lynn Road (N)	699	736	739	19.4	29.5	16.3	24.6	28.0	21.5	C	C	C
	Lynn Road (S)	786	808	812	27.9	20.7	20.8	14.2	9.8	9.8	B	A	A
	De Havilland Rd	257	147	135	17.6	9.6	8.6	42.1	42.3	41.7	D	D	D
	Overall Junction Summary	1742	1691	1685	21.6	19.9	15.3	22.5	20.6	17.5	C	C	B
Horse Fair / Churchill Rd	Churchill Road (N)	-	288	286	-	0.0	0.0	-	3.2	3.2	-	A	A
	Churchill Road (S)	-	492	495	-	5.6	1.4	-	10.5	3.7	-	B	A
	Horse Fair	-	61	61	-	1.0	0.6	-	14.2	9.7	-	B	A
	Overall Junction Summary	-	840	842	-	2.2	0.7	-	8.2	3.9	-	A	A
Horse Fair / Nene Quay	Nene Quay (N)	-	283	281	-	5.4	2.3	-	8.6	5.9	-	A	A
	Horse Fair	-	67	66	-	0.8	0.6	-	13.2	9.7	-	B	A
	Nene Quay (S)	-	416	420	-	0.4	0.4	-	5.4	5.1	-	A	A
	Overall Junction Summary	-	765	767	-	2.2	1.1	-	7.6	5.8	-	A	A

Technical note

Tables 38 and 39 show in both the AM and PM peaks, Option 5a provides benefits over Option 5 for all junctions.

As a result of introducing the Link Road, flows have reduced at Freedom Bridge Roundabout, allowing the junction to operating within capacity in both peaks.

9. Freedom Bridge Roundabout Conclusions

9.1. Option 2

The Anticlockwise signalisation arrangement at the junction demonstrated that both peaks operate within capacity in 2016, but that internal queueing on the circulatory is an issue causing blocking back to the approaches (which isn't recorded in LinSig). Although the Nene Quay approach has the lowest flow, it is still a relatively high flow for this type of signalisation, and leaving it on give way control showed that vehicles could not proceed onto the roundabout without blocking the circulatory and access for Nene Quay.

By increasing the flow with the predicted growth in 2021 and 2026, it shows that the signalisation does not work and the junction does not operate within capacity in both peaks by 2026. Removing trips with the WLR allows for more capacity, although the junction is still forecast to be over capacity in the PM Peak by 2026.

Table 40. Freedom Bridge Roundabout Option 2 Summary

	Freedom Bridge Roundabout Option 2			
	Without WLR		With WLR	
	2021	2026	2021	2026
AM Peak	Overall PRC 1.90% - Circulatory links over capacity with queues longer than storage length	Overall PRC -2.00% - Circulatory links over capacity with queues longer than storage length	Overall PRC 13.60% - Circulatory links over capacity with queues longer than storage length	Overall PRC 25.00% - Circulatory links over capacity with queues longer than storage length - flows lower than 2021 due to re-routing
PM Peak	Overall PRC -38% - Nene Quay over capacity (DoS 124%) Circulatory links over capacity with queues longer than storage length	Overall PRC -111.30% - Nene Quay over capacity (DoS 190%) Circulatory links over capacity with queues longer than storage length	Overall PRC 5.50% - Nene Quay and Lynn Road close to capacity. Circulatory links over capacity with queues longer than storage length	Overall PRC -6.60% - Nene Quay over capacity (DoS 95.9%) Circulatory links over capacity with queues longer than storage length

9.2. Option 3

The signalisation of the northern section of the roundabout has shown that with the 2016 flows the junction is forecast to operate just within capacity, although long queues are forecast at the A1101 North End, Nene Quay and Lynn Road approaches, with queueing through the north of the junction between stop lines. The southern section of the junction is on give way which causes blocking as queues build at the A1101 opposing circulatory stop line.

Increasing the flows in 2021 and 2026 worsens the queuing and blocking, causing the junction to operate over capacity in both peaks.

With the WLR the junctions are forecast to operate better than without the WLR, although the junction is still over capacity, particularly in the PM Peak.

Technical note

Table 41. Freedom Bridge Roundabout Option 3 Summary

	Freedom Bridge Roundabout Option 3			
	Without WLR		With WLR	
	2021	2026	2021	2026
AM Peak	Overall PRC -16.90% - A1101 EB over capacity (DoS 105%) Circulatory queues longer than storage length causing blocking back	Overall PRC -29.00% - A1101 EB over capacity (DoS 116%) Circulatory queues longer than storage length causing blocking back	Overall PRC 8.10% - Circulatory queues longer than storage length causing blocking back EB and WB	Overall PRC 4.50% - Circulatory queues longer than storage length causing blocking back EB and WB
PM Peak	Overall PRC -7.40% - Lynn Road over capacity (DoS 97%) Circulatory queues longer than storage length causing blocking back EB and WB	Overall PRC -20.40% - Lynn Road & Nene Quay over capacity (DoS 108% & 102%) Circulatory queues longer than storage length causing blocking back EB	Overall PRC -3.20% - Lynn Road over capacity (DoS 93%) Circulatory queues WB longer than storage length causing blocking back	Overall PRC -4.20% - Lynn Road over capacity (DoS 94%) Circulatory queues WB longer than storage length causing blocking back

9.3. Option 4

The creation of an enlarged gyratory shows that with the 2016 flows, the junction operates within capacity in the AM peak, but that the Nene Quay approach is forecast to perform worse than in the base scenario. The PM peak is forecast to help improve the overall performance of Freedom Bridge Roundabout, although the junction is still operating close to capacity. The North Street and Nene Quay approaches are operating over capacity as a result of the higher demand of conflicting traffic that is now being routed around the gyratory.

Increasing the flows in 2021 and 2026 without WLR exacerbates the issues identified in the 2016 assessment causing long queues and delays at the A1101 North End and North Street as vehicles are unable to exit onto the circulatory.

Introducing the WLR reduces trips using A1101 North End and Churchill Road allowing the junction to operate within capacity for both the DM and Option 4 scenarios.

Table 42. Freedom Bridge Roundabout Option 4 Summary

	Freedom Bridge Roundabout Option 4			
	Without WLR		With WLR	
	2021	2026	2021	2026
AM Peak	All approaches to FB operating within capacity and delays reduced. Overall LOS C	All approaches to FB operating within capacity. Overall LOS C Lynn Rd & North St operate worse than DM.	All approaches to FB operating within capacity. Lynn Road, North St & Nene Quay operate worse than DM. Overall LOS B	All approaches to FB operating within capacity. Lynn Road, Horsefair, North St & Nene Quay operate worse than DM. Overall LOS B
PM Peak	Nene Quay & North St operating over capacity LOS F. Overall FB LOS E. A1101 operating over capacity with LOS F and worse than DM.	Nene Quay & North St operating over capacity LOS F. Overall LOS D. A1101 operating over capacity with LOS F and worse than DM.	All approaches to FB operating within capacity, although North St operating at capacity. Lynn Road & North St operate worse than DM. Overall LOS B. A1101 operating within capacity with LOS D and better than DM.	All approaches to FB operating within capacity, although North St operating at capacity. Lynn Road & North St operate worse than DM. Overall LOS C

Technical note

9.4. Option 5

Modifying the existing roundabout at Freedom Bridge, and allowing two lane entries and exits at the A1101 North End and Churchill Road arms provides benefits over the current arrangement in both peaks with less delay and lower queue lengths on all approaches.

The North Street approach is forecast to operate worse in Option 5 in the PM peak as a result of more traffic being released upstream from the other approaches.

Increasing traffic in 2021 and 2026 exacerbates the issues identified in 2016, for both the DM and Option 5 scenarios, although Option 5 is forecast to provide benefits to all arms of Freedom Bridge compared to the DM scenario. With the introduction of the WLR, Option 5 operates within capacity in both 2021 and 2026.

Overall, Option 5 provides benefits over the existing conditions and DM scenarios at Freedom Bridge Roundabout, with fewer delays and lower queue lengths at all approaches.

Table 43. Freedom Bridge Roundabout Option 5 Summary

	Freedom Bridge Roundabout Option 5			
	Without WLR		With WLR	
	2021	2026	2021	2026
AM Peak	All approaches to FB operating within capacity and delays reduced. Overall LOS B.	All approaches to FB operating within capacity and delays reduced. Overall LOS B. A1101 operating significantly better than DM.	All approaches to FB operating within capacity and delays reduced. Overall LOS A.	All approaches to FB operating within capacity and delays reduced. Overall LOS A.
PM Peak	All approaches to FB operating within capacity and delays reduced. Overall LOS C.	All approaches to FB operating within capacity and delays reduced. Overall LOS C. A1101 operating over capacity LOS F, but better than DM.	All approaches to FB operating within capacity and delays reduced. Overall LOS B. A1101 operating within capacity with LOS D and better than DM.	All approaches to FB operating within capacity and delays reduced. Overall LOS B. A1101 operating within capacity with LOS D and better than DM.

9.5. Option 5a

Freedom Bridge Option 5a has provided benefits to both peaks for each future year with delays significantly reduced along the A1101.

In all future year scenarios the Aldi access operates worse as a result of providing more green time to the A1101 in stage 1, although it is never forecast to be over capacity. The benefits observed at the A1101 outweigh the additional delay at the Aldi access.

Delays have increased marginally along Bedford Street and along the Churchill Slip as a result of introducing zebra crossings, although they still operate well within capacity.

Overall Option 5a is forecast to operate better than Option 5 and adding in additional pedestrian facilities does not have a detrimental impact on the network.

Technical note

Table 44. Freedom Bridge Roundabout Option 5a Summary

	Freedom Bridge Roundabout Option 5a			
	Without WLR		With WLR	
	2021	2026	2021	2026
AM Peak	All approaches to FB operating within capacity. Overall LOS B. Approaches to Aldi junction operate better in 5a.	All approaches to FB operating within capacity. Overall LOS B.	All approaches to FB operating within capacity and delays reduced. Overall LOS A.	All approaches to FB operating within capacity and delays reduced. Overall LOS A.
PM Peak	All approaches to FB operating within capacity and delays reduced. Overall LOS C. North St worse due to queues at Aldi, Aldi approach LOS E due to signal timings.	All approaches to FB operating within capacity and delays reduced. Overall LOS C. A1101 operating over capacity LOS F, but significantly better than DM & Opt 5.	All approaches to FB operating within capacity. Overall LOS B. A1101 operating within capacity with LOS B. North St & Aldi worse due to new signal timings.	All approaches to FB operating within capacity and delays reduced. Overall LOS B. A1101 operating within capacity with LOS C and better than DM and Opt 5.

Appendix B – Cost Summary

Wisbech Access Study		27/07/2017				
FBS & BS1a						
Freedom Bridge Roundabout & Surrounding Area (inc. Bus Station)						
Highways Only						
As drwg 3040201/HW/LP/202 - B						
Construction Assumptions:						
Carriageway	s/c	40	15.00	Footpath	25	12.00
	b/c	60	15.00		65	15.00
	rd b	200	40.00			
	sub base	430	37.50		260	25.00
	Capping layer		40.00			
	terram	0	3.00			
		750			350	
	exc & CA		35.00			30.00
			185.50			82.00
Excavate & construct carriageway areas		3564 m2	185.50	661,122.00		
Excavate & construct footway areas		1650 m2	82.00	135,300.00		
Carriageway kerbs		1400 m	33.00	46,200.00		
Footway edgings		1000 m	23.00	23,000.00		
Verge construction		355 m2	35.00	12,425.00		
Extend NRT island - kerbs etc		1 item	5,000.00	5,000.00		
Alter existing junctions/pedestrian crossing		3 item	20,000.00	60,000.00		
Carriageway drainage		1 allow	65,100.00	65,100.00		
Street lighting		1 allow	90,000.00	90,000.00		
Duct provision		1 allow	27,500.00	27,500.00		
Signs & lines		1 allow	15,000.00	15,000.00		
Bus boarder kerbs		120 m	190.00	22,800.00		
Surveys		1 item	35,000.00	35,000.00		
Landscaping		1 item	3,550.00	3,550.00		
Junction signal alterations/additions		3 item	60,000.00	180,000.00		
Total of BS1a		1 item	821,517.00	821,517.00		
						2,203,514.00
Prelims						
Land Acquisition		990 m2	12.50	12,375.00		
Demolition		1780 m2	70.00	124,600.00		
Design		10%		220,351.40		
Staff, supervision, accommodation		20%		440,702.80		
Traffic Management		36 weeks	4,100.00	147,600.00		
						3,149,143.20
Add Contingency & Optimism Bias		45%		1,417,154.44		
						4,566,257.64
Risks/Assumptions						
Soil conditions (contamination etc)						
Vandalism						
Assume drainage connects onto existing arterial SW.						
Assumes street lights reconnected to existing supplies.						
Assumes site cleared by others.						
No allowance for new building						