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Elm High Road

Wisbech Access Study

August 2017

Wisbech Access Study

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Cambridgeshire County Council / Fenland District Council

August 2017

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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 Figure 1.1 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 Elm High Road

The A1101 Elm High Road is one of the nine areas included within the wider Wisbech Access Study. Elm High Road is the key corridor into Wisbech from the A47 and south east, with northern section (north of Weasenham Lane) of the corridor following the alignment of the historic canal. This study focuses on improving the operation of the east corridor, through a series of junction and / or carriageway improvements.

The inclusion of Elm High Road within the Wisbech Access Study is primarily to address existing capacity restraints and peak hour congestion, and to mitigate against the impact of future development traffic, which is anticipated to have significant impact on the lower portion of the corridor between Weasenham Lane and the A47.

The A47 / Elm High Road roundabout is considered to be the worst performing junction along the east corridor, with increased delay and queue lengths being commonplace. The roundabout heavily impacts the operation of the wider network, therefore improvements to this junction feature heavily within this study assessment.

Existing issues on the approach to Freedom Bridge Roundabout are discussed within this report, when considering the potential impact on the Churchill Road approach. However, options to address these issues are reported separately within the Freedom Bridge Roundabout scheme assessment (see Figure 1.1), which informs this element of the study.

Scheme Location

Elm High Road is located to the east of Wisbech, between Freedom Bridge Roundabout in the north and the A47 / A1101 roundabout in the south. Figure 1.2 shows the stretch of road in relation to Wisbech.

Figure 1.2: Scheme Location In Relation to Wisbech

Elm High Road between Freedom Bridge Roundabout and the A47 roundabout is 2.3km long. The corridor is a single carriageway to the south of Weasenham Lane and dual carriageway to the north of Weasenham Lane, where the road becomes known as Churchill Road.

Along the corridor there are numerous junctions, predominantly signalled, providing access to residential, commercial and industrial areas.

2 Existing Conditions

Existing conditions along the corridor for key junctions including Freedom Bridge Roundabout, Weasenham Lane and the A47 / Elm High Road Roundabout are considered within this chapter.

Additional conditions reported within this chapter, which correspond to the entire length of the Elm High Road corridor include:

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

Each of the junctions mentioned above will be discussed in turn (north – south), with regards to traffic flows, queue lengths, journey times, delay and average speeds.

Freedom Bridge Roundabout

Traffic 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 survey are shown within Figures 2.1 to 2.3 below for the 12 - hour period, AM peak (08:00 – 09:00) and PM peak (17:00 – 18:00). Extracted data from the survey provides an indication of the number of vehicles entering the corridor from the north via Freedom Bridge Roundabout on a daily basis. This analysis focused on the Churchill Road approach which forms part of the Elm High Road corridor. Further analysis of the other approaches is included within the Freedom Bridge Roundabout report.

Survey results for the 12 hour period are shown on the following page.

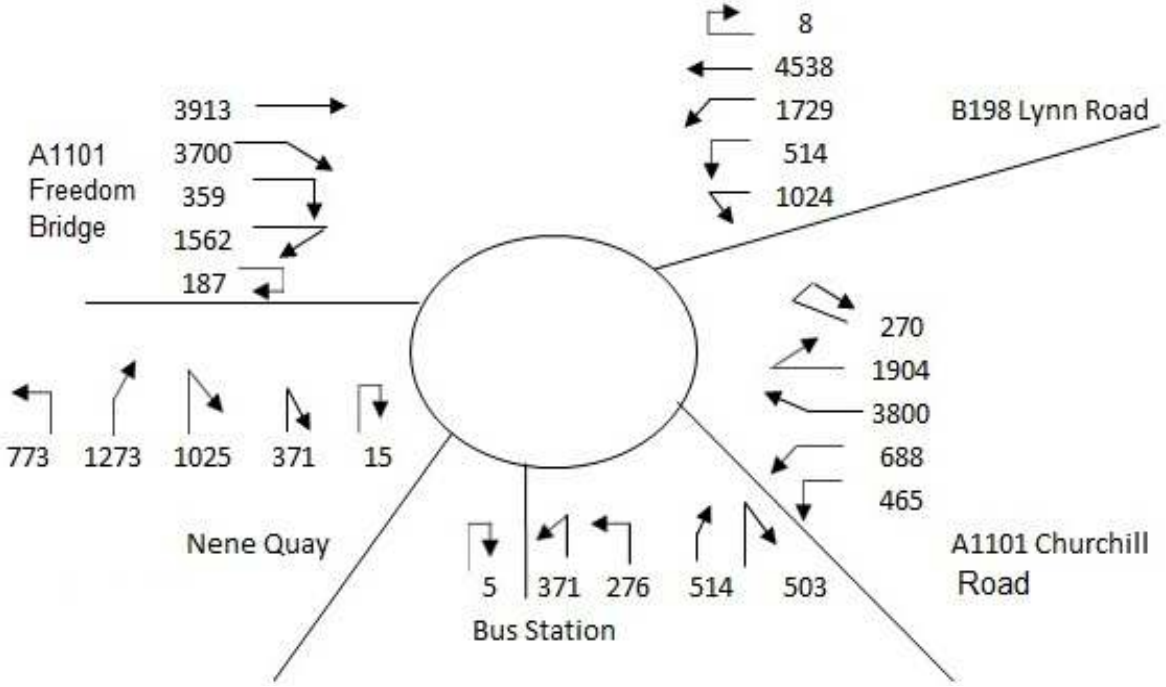

Figure 2.1: Freedom Bridge Roundabout 12 Hour Traffic Count (07:00 -19:00)

Figure 2.1 show 6,549 vehicles originated from Churchill Road, and 6,927 Vehicles were destined for Churchill Road over a 12 hour period.

The dominant movement for both northbound (originating from Churchill Road) and southbound (arriving at Churchill Road) traffic is the A1101 Freedom Bridge, suggesting a high demand for vehicles travelling along the north-south axis, from either the A17 in the north (via the A1101) or the A47 to the south.

The results from the AM peak are shown in Figure 2.2 beneath.

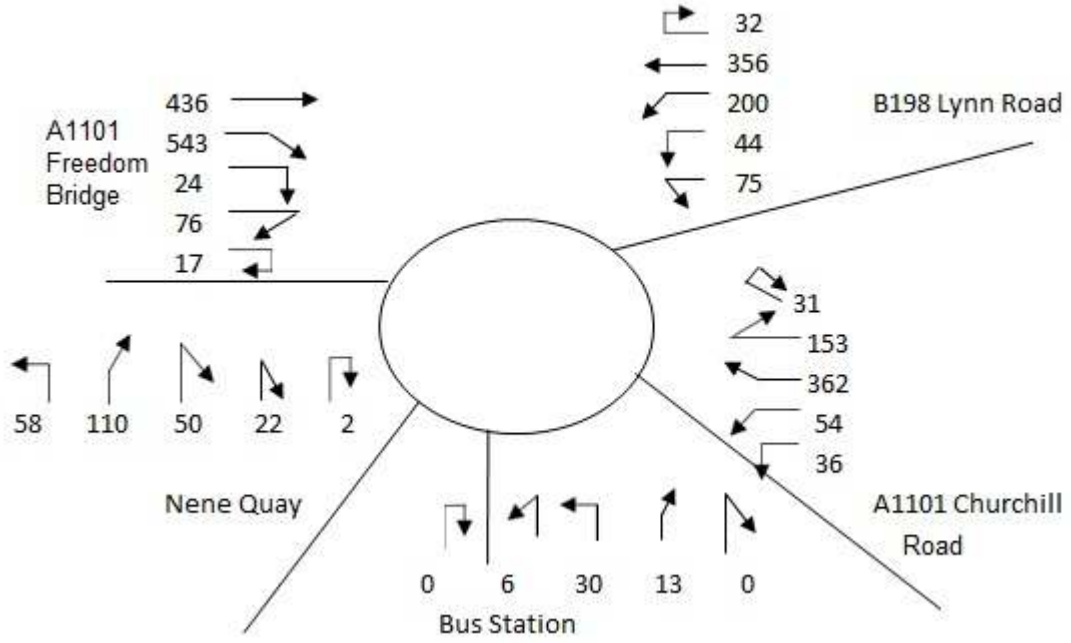

Figure 2.2: Freedom Bridge Roundabout AM Peak Turning Count (08:00 - 09:00)

During the AM peak a total of 626 vehicles were recorded originating from the Churchill Road approach, whilst 668 vehicles were destined for Churchill Road. Similarly to the pattern shown across the 12 hour count, the highest turning movement in both directions concerns the A1101 Freedom Bridge approach.

Results from the PM peak are shown in Figure 2.3 on the following page.

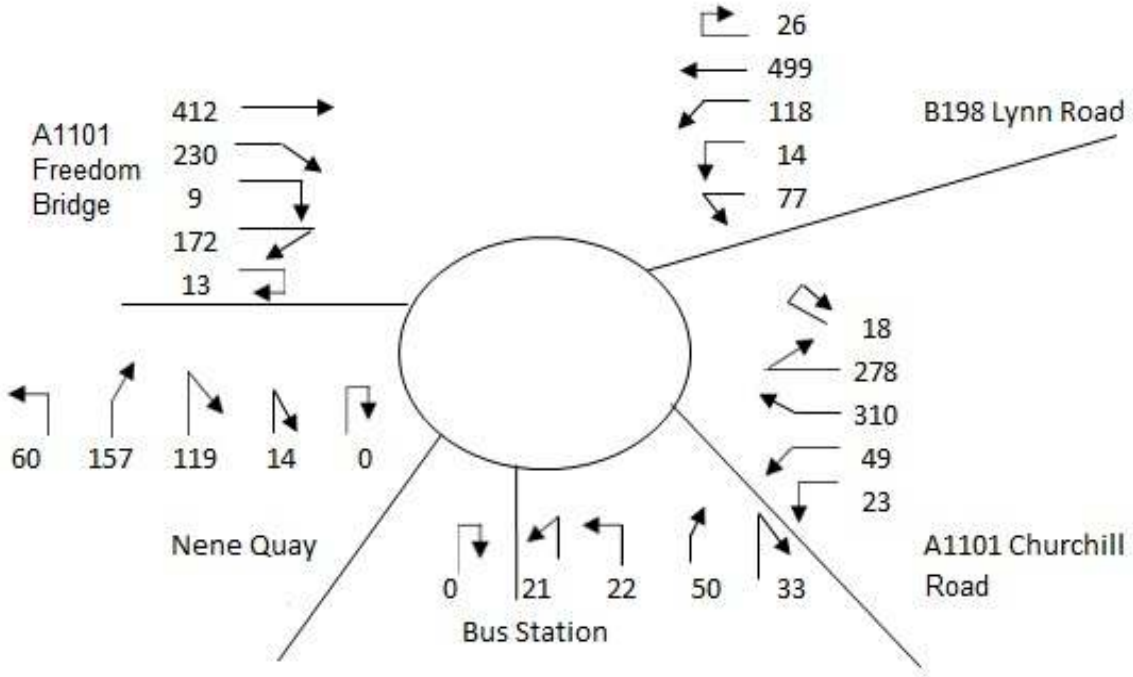

Figure 2.3: Freedom Bridge Roundabout PM Peak Turning Count Results (17:00 - 18:00)

During the PM peak hour 678 vehicles originated from Churchill Road, whilst 459 vehicles were recorded entering Churchill Road from the roundabout. A comparison of the AM and PM peak hour traffic flows on the Churchill Road approach / exit of Freedom Bridge Roundabout show that there is a tidal flow, with a greater volume of traffic travelling southbound during the AM peak hour and northbound during the PM peak hour.

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). Only queue length data for the Churchill Road approach has been reported beneath, full details of queue lengths on each of the approaches to Freedom Bridge Roundabout are included within the scheme report.

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

Table 2.1 and Figure 2.4 / 2.5 on the following page show the maximum average queue lengths observed for the A1101 Churchill Road approach to Freedom Bridge Roundabout. Data is presented for the AM (08:00 – 09:00) and PM (17:00 -18:00) peak hours, with data being representative of both the nearside and offside lanes.

Table 2.1: 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 queue lengths are more prevalent during the PM peak hour, with queue lengths reaching a maximum of 75 metres, compared to 50 metres in the AM peak hour.

Greater queue lengths in the PM peak hour on the approach to Freedom Bridge Roundabout may reflect the tidal flow indicated within the turning counts (Figure 2.1 and 2.3), with a greater volume of traffic travelling southbound during the AM peak hour and northbound during the PM peak hour.

The queue length survey results show that queues are maintained across the course of the AM peak hour, whereas queue lengths during the PM peak hour are present within the first 30 minutes between 17:00 and 17:30 only.

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

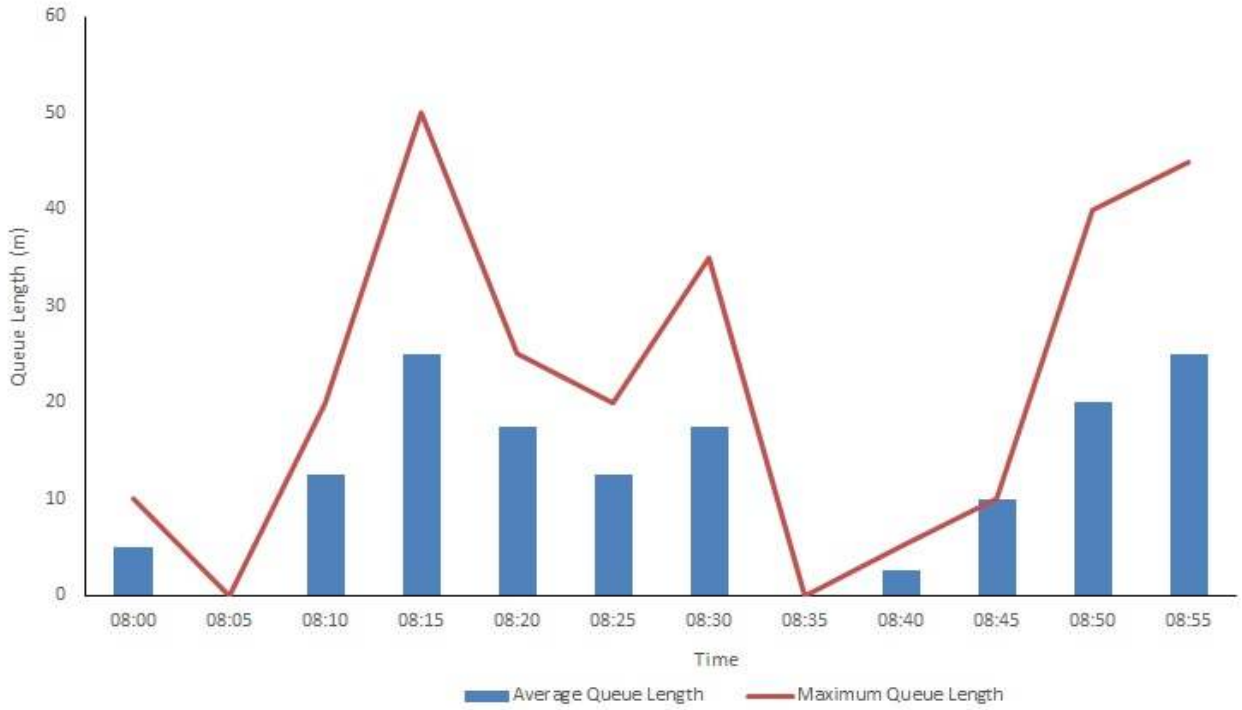

Figure 2.4: A1101 Churchill Road Queue Lengths AM Peak Hour (08:00 - 09:00)

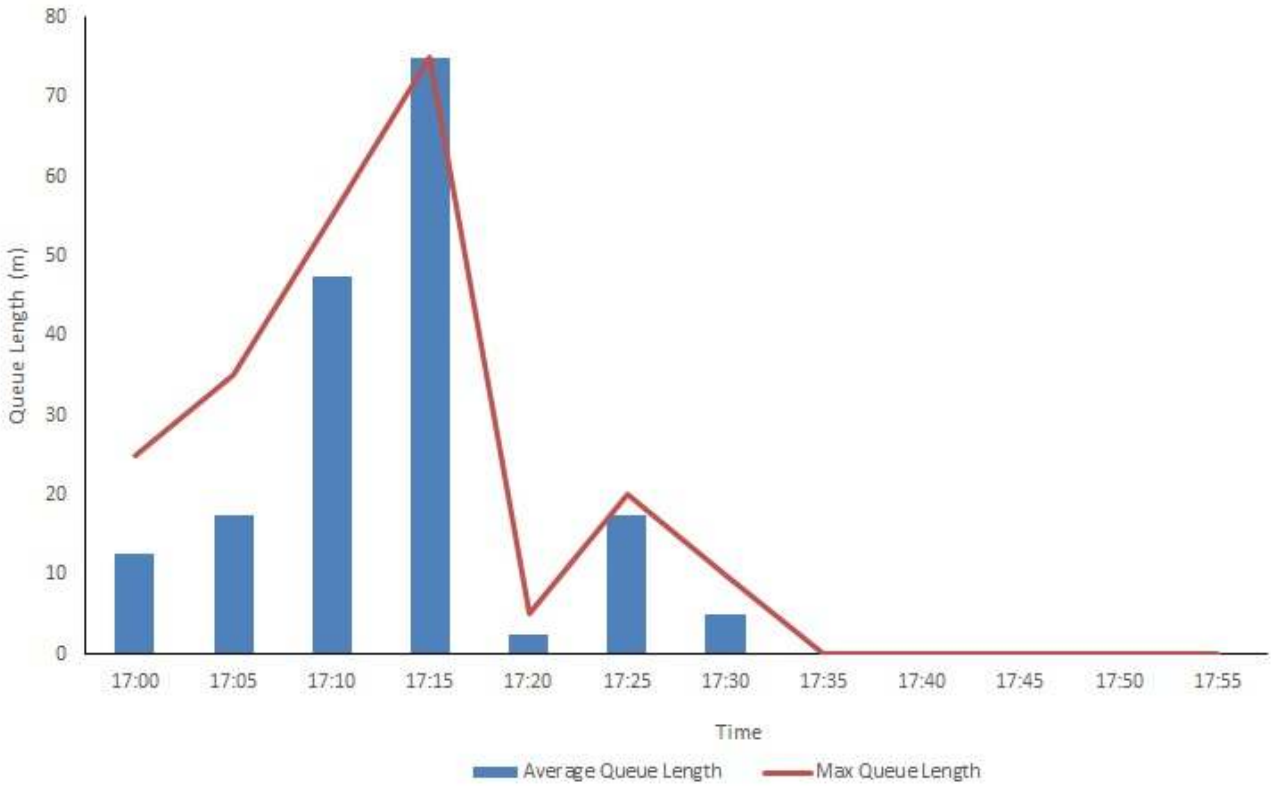

Figure 2.5: A1101 Churchill Road Queue Lengths PM Peak Hour (17:00 - 18:00)

Journey Times and Delay

Satellite Navigation (TomTom) data has been used to assess journey times and delay on the A1101 Churchill Road 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:

AM (or PM) Average Travel Time (s) – Free Flow Average Travel Time (s) = Delay (s)

The following tables highlight the journey time and delay for the Churchill Road approach to Freedom Bridge Roundabout. Segments used within this assessment total 215.4 metres (reaching just north of Stermyn Street).

Table 2.2: Journey Times and Delay for A1101 Churchill Road Approach to FBR

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)	31.4	12.5
PM Peak	(17:00 – 18:00)	48.3	29.3

Table 2.2 shows the Free Flow time when approaching Freedom Bridge Roundabout is 18.9 seconds over 215 metres.

Churchill Road experiences delay across both peak hours, however PM delay is shown to be slightly higher with 29.3 seconds added to journey times. A higher PM delay reflects the higher volumes of traffic as identified in Figure 2.3.

AM delay is shown to be less severe at 12.5 seconds. This is also demonstrated by the smaller queue lengths shown within Figure 2.4.

Average Speeds

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

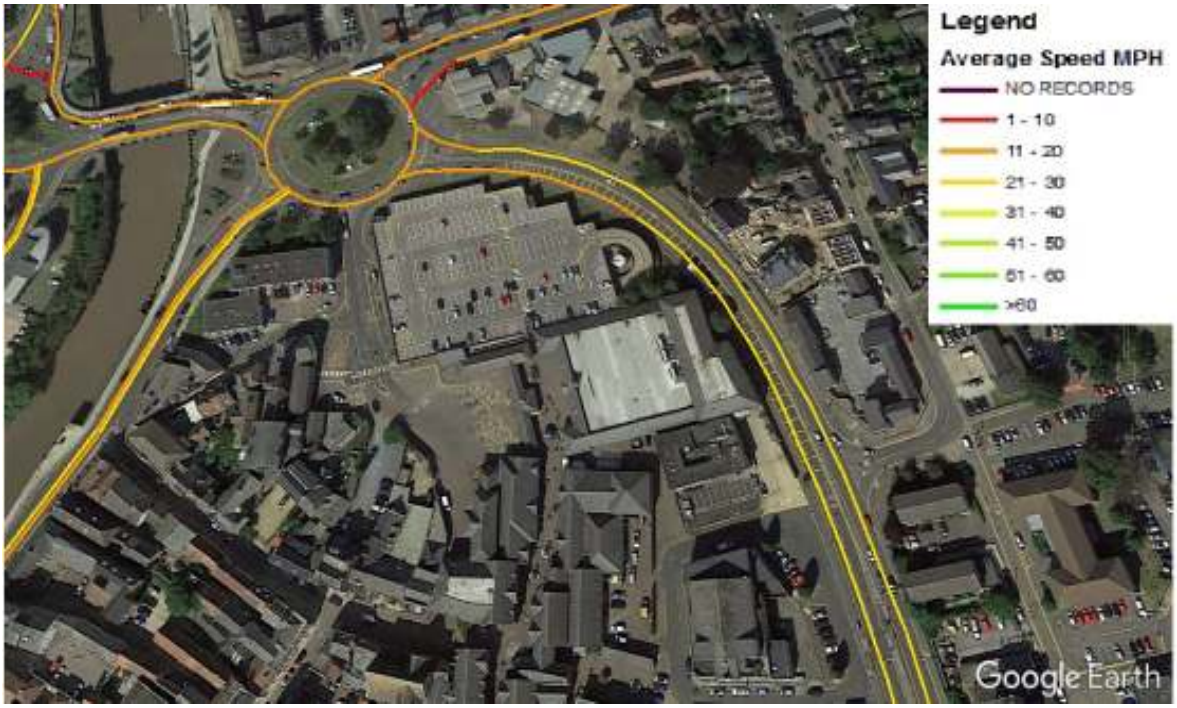

Figure 2.6: Churchill Road Average Speed AM Peak Hour (08:00 - 09:00)

The figure above shows the average speeds when approaching the stop line of Freedom Bridge Roundabout during the AM peak are between 11 – 20mph.

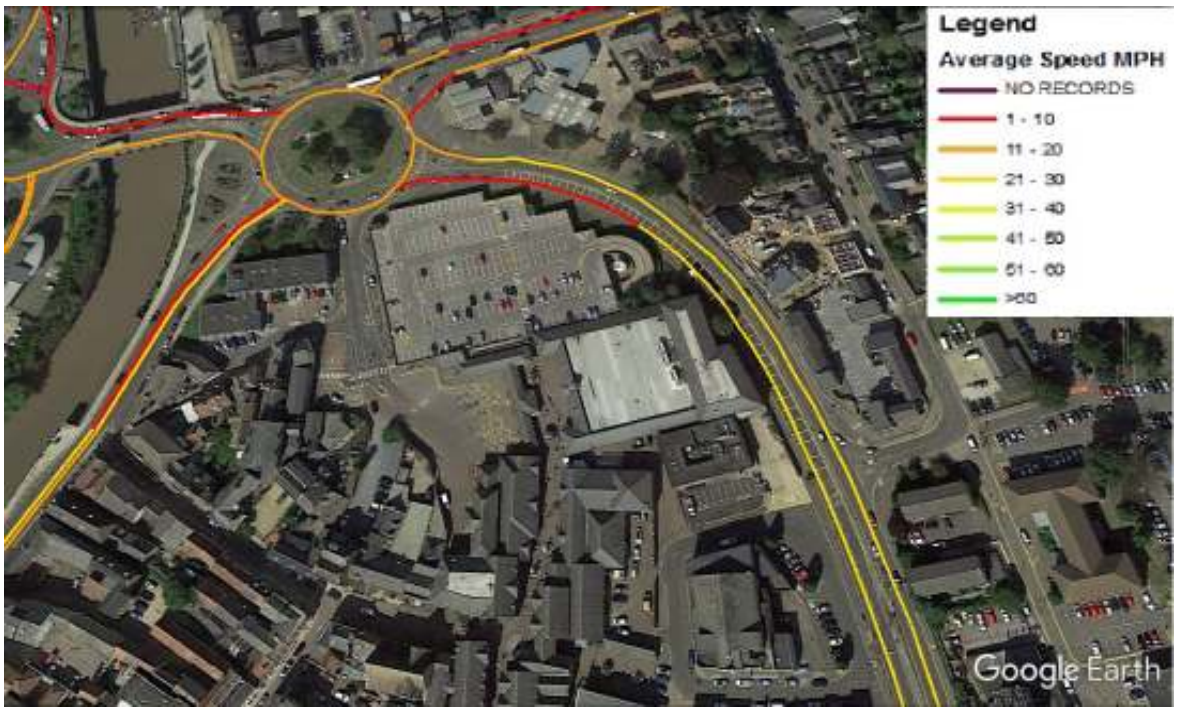

Figure 2.7: Churchill Road Average Speed PM Peak Hour (17:00 - 19:00)

The figure above shows the average speeds when approaching the stop line of Freedom Bridge Roundabout during the PM peak are between 1 – 10mph.

Weasenham Lane Junction

Traffic Flows

Turning counts were undertaken at the Elm High Road / Weasenham Lane Junction 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 survey are shown within Figures 2.8 to 2.10 below for the 12 - hour period, AM peak (08:00 – 09:00) and PM peak (17:00 – 18:00). The following analysis of survey data provides an indication of the volume of traffic joining Elm High Road from Weasenham Lane and vice versa on a typical weekday.

The results from the 12 hour count are shown in Figure 2.8 below.

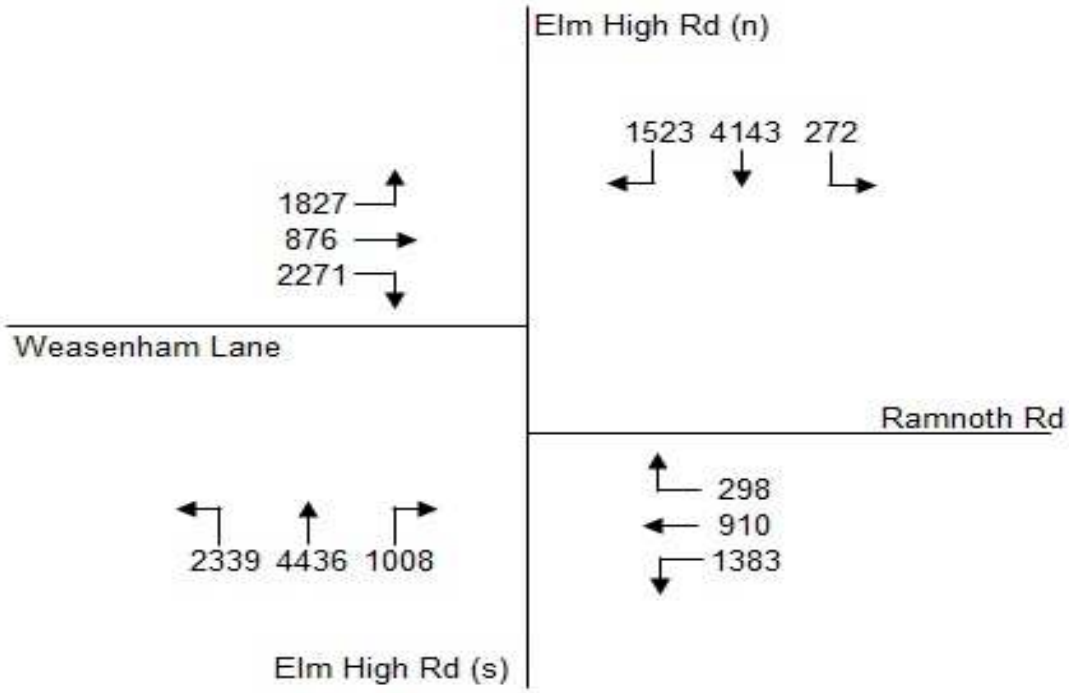

Figure 2.8: Weasenham Lane 12 Hour Traffic Count (07:00 -19:00)

Over a 12 hour period, the number of vehicles originating from Weasenham Lane totals 4,974 vehicles, whilst 4,772 vehicles arrive at Weasenham Lane.

The dominant turning movements for Weasenham Lane concerns Elm High Road south, with, 2,271 vehicles turning right onto Elm High Road South from Weasenham Lane, and 2,339 vehicles turning left onto Weasenham Lane from Elm High Road South.

The ahead movement for Elm High Road appears fairly balanced across both directions, with 4,436 vehicles travelling northbound and 4,143 vehicles travelling southbound over the 12 hour survey period.

AM peak hour results are shown in Figure 2.9 on the following page.

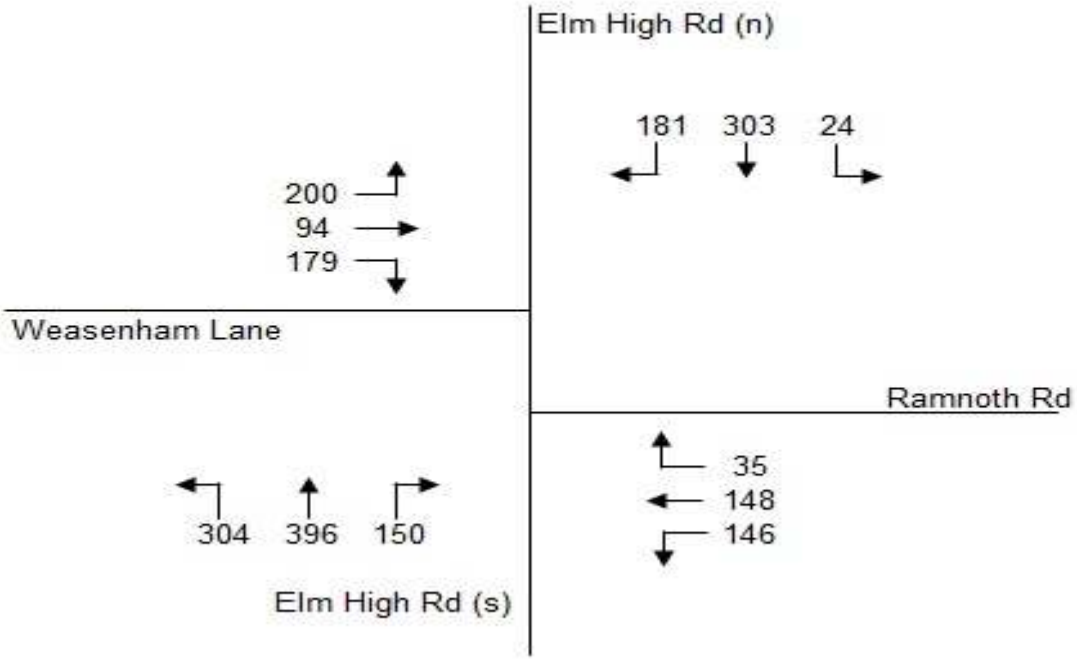

Figure 2.9: Weasenham Lane AM Peak Hour Traffic Count (08:00 -09:00)

Figure 2.9 shows that 473 vehicles originated from Weasenham Lane during the AM peak hour, the majority of which (200) turn left towards Freedom Bridge Roundabout. Vehicles arriving at Weasenham Lane totalled 633 during this time period, of which 304 vehicles originate from Elm High Road south.

PM peak results are shown below within Figure 2.10.

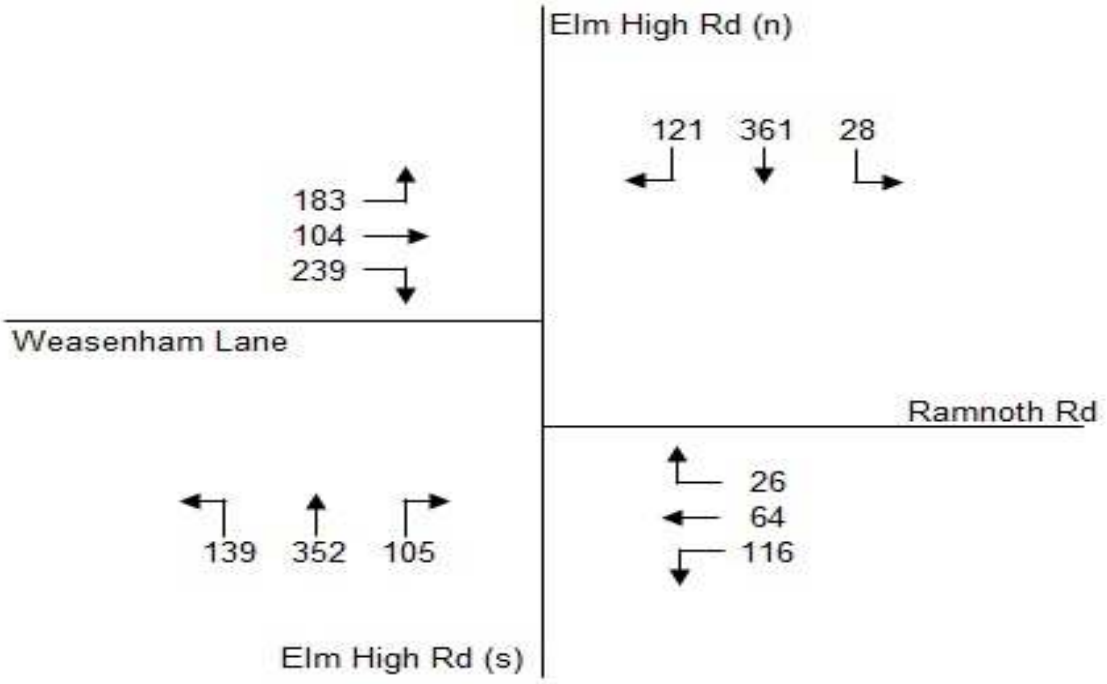

Figure 2.10: Weasenham Lane PM Peak Hour Traffic Count (17:00 -18:00)

Figure 2.10 shows that 526 vehicles originate from Weasenham Lane during the PM peak hour, the majority of which (239) turn right towards the A47 roundabout.

Vehicles arriving at Weasenham Lane totals 424 during this time period, which results in a decrease of 239 vehicles when compared to the AM peak. The dominant movement for vehicles entering Weasenham Lane is from Elm High Road south, with 139 vehicles making the left turn.

Queue Lengths

Queue length surveys were undertaken at Elm High Road / Weasenham Lane Junction on the 14th January 2016. Queue lengths were recorded on each approach arm of 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 congestion.

Queue lengths have been assessed for the following approaches (Figure 2.11):

- Elm High Road North (Southbound movement);
- Elm High Road (Northbound movement), and;
- Weasenham Lane approach.

Ramnoth Road approach has not been included within this assessment, due to the relatively low volumes of traffic identified earlier within this chapter.

Figure 2.11: Weasenham Lane Junction Approaches Assessed for Queue Lengths

The following series of tables and figures show the maximum and average queue lengths observed on Weasenham Lane, Churchill Road and Elm High Road approaches. Data is presented for the AM (08:00 – 09:00) and PM (17:00 -18:00) peak hours, with data representative of both the nearside and offside lanes.

Table 2.3: Maximum and Average Queue Lengths on the Weasenham Lane Approach

Time Segment	AM		Time Segment	PM	
	Average (m)	Max (m)		Average (m)	Max (m)
08:00	8.3	25	17:00	23.3	50
08:05	25	55	17:05	26.6	60
08:10	15	35	17:10	25	75
08:15	26.6	70	17:15	31.6	65
08:20	26.6	75	17:20	33.3	75
08:25	28.3	75	17:25	8.3	15
08:30	26.6	75	17:30	3.3	10
08:35	26.6	75	17:35	18.3	50
08:40	18.3	45	17:40	25	45
08:45	0	0	17:45	15	40
08:50	0	0	17:50	21.6	65
08:55	11.6	25	17:55	1.6	5

The data shows that queue lengths are fairly balanced over the peak hours, with a maximum queue length of 75 metres being recorded for both the AM and PM peak hours.

In comparing the AM and PM data, it would appear queues are maintained at the maximum of 75 metres (between 08:20 – 08:35) for longer during the AM peak hour, reflecting the volume of traffic originating from this approach during this time period.

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

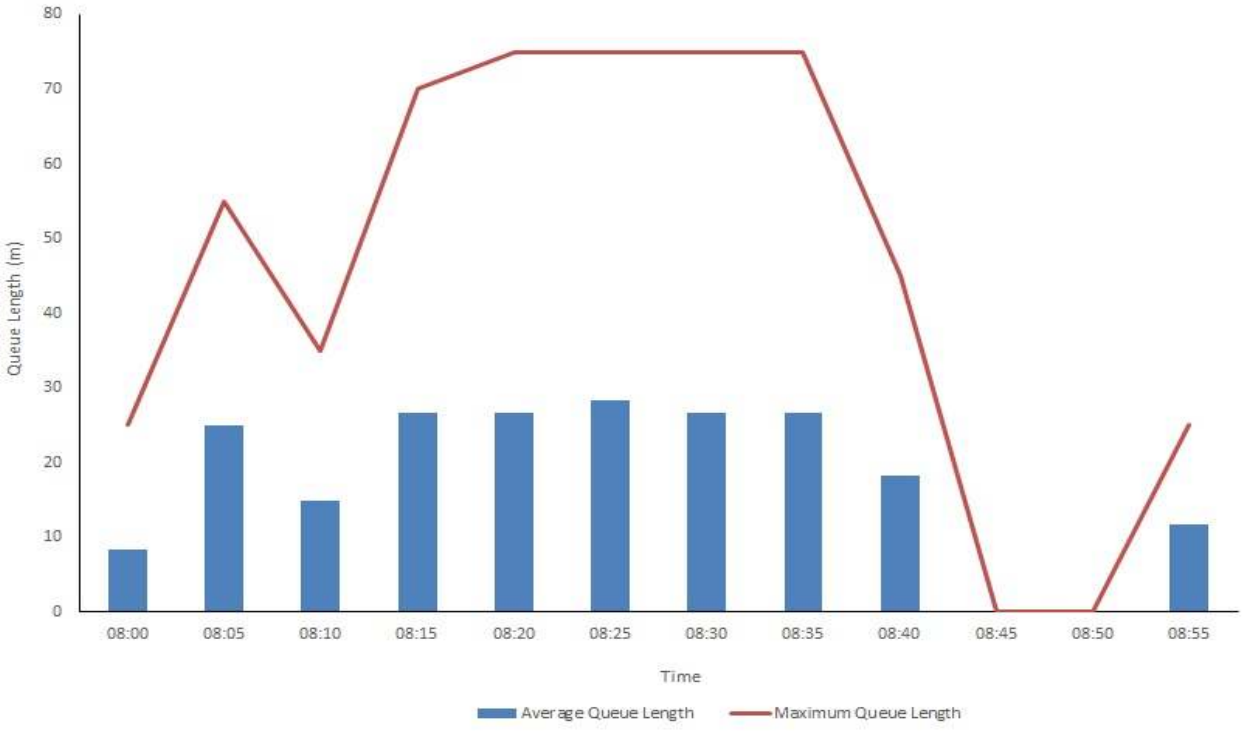

Figure 2.12: Weasenham Lane Queue Lengths AM Peak Hour (08:00 - 09:00)

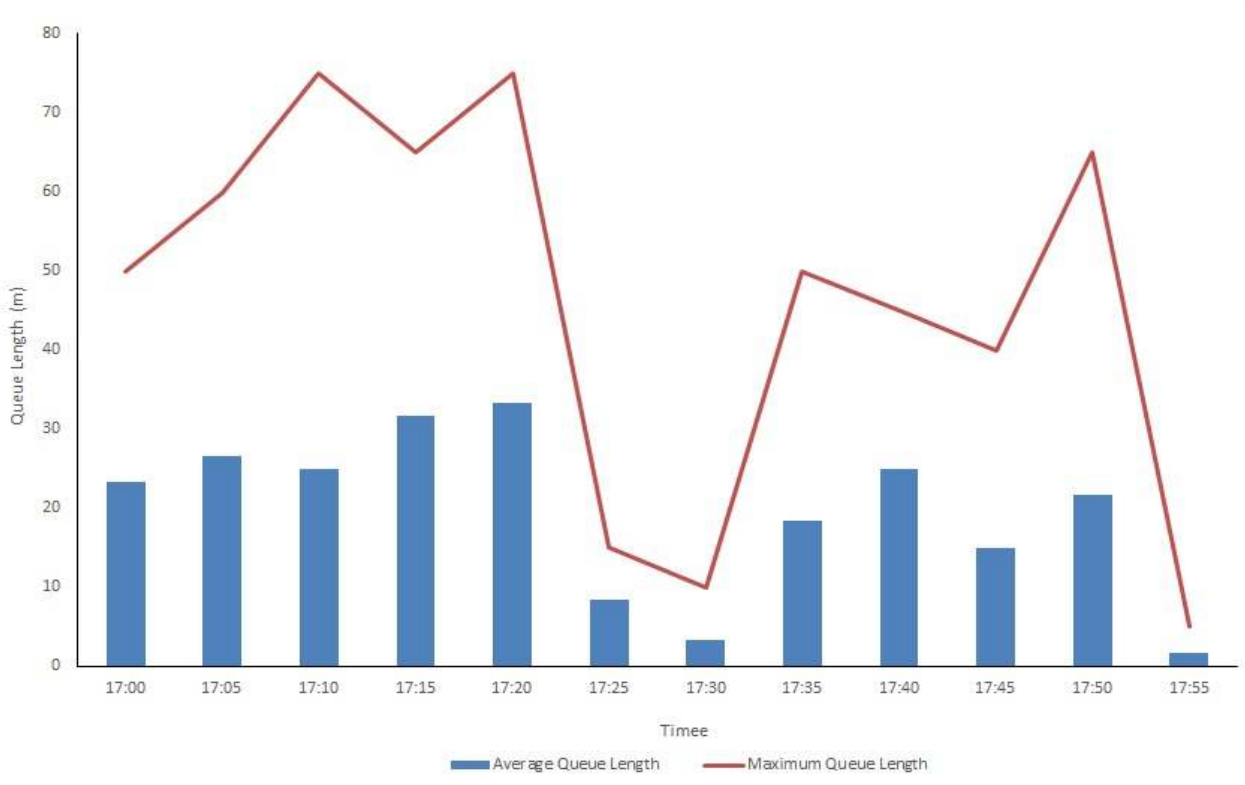

Figure 2.13: Weasenham Lane Queue Lengths PM Peak Hour (17:00 - 18:00)

Table 2.4: Maximum and Average Queue Lengths on the A1101 Elm High Road North Approach

Time Segment	AM		Time Segment	PM	
	Average (m)	Max (m)		Average (m)	Max (m)
08:00	41.6	75	17:00	16.6	30
08:05	33.3	75	17:05	10	15
08:10	33.3	75	17:10	21.6	35
08:15	43.3	75	17:15	21.6	50
08:20	36.6	75	17:20	31.6	55
08:25	36.6	60	17:25	8.3	15
08:30	15	25	17:30	25	35
08:35	25	55	17:35	20	35
08:40	10	20	17:40	10	20
08:45	15	25	17:45	40	65
08:50	5	10	17:50	24.1	62.5
08:55	21.6	40	17:55	13.3	20

Table 2.4 shows queue lengths on this approach are more prevalent during the AM peak hour, with a maximum queue length of 75 metres recorded between 08:00 and 08:20. Greater queue lengths recorded for this peak hour reflects traffic flows originating from this approach within the peak hour, as displayed within Figure 2.9.

Queue lengths during the PM peak hour are still shown to be significant, with a maximum of 65 metres recorded, within the latter stages of the hour.

Figures 2.14 and 2.15 on the following page show this data for both peak hours, reported in 5 minute intervals.

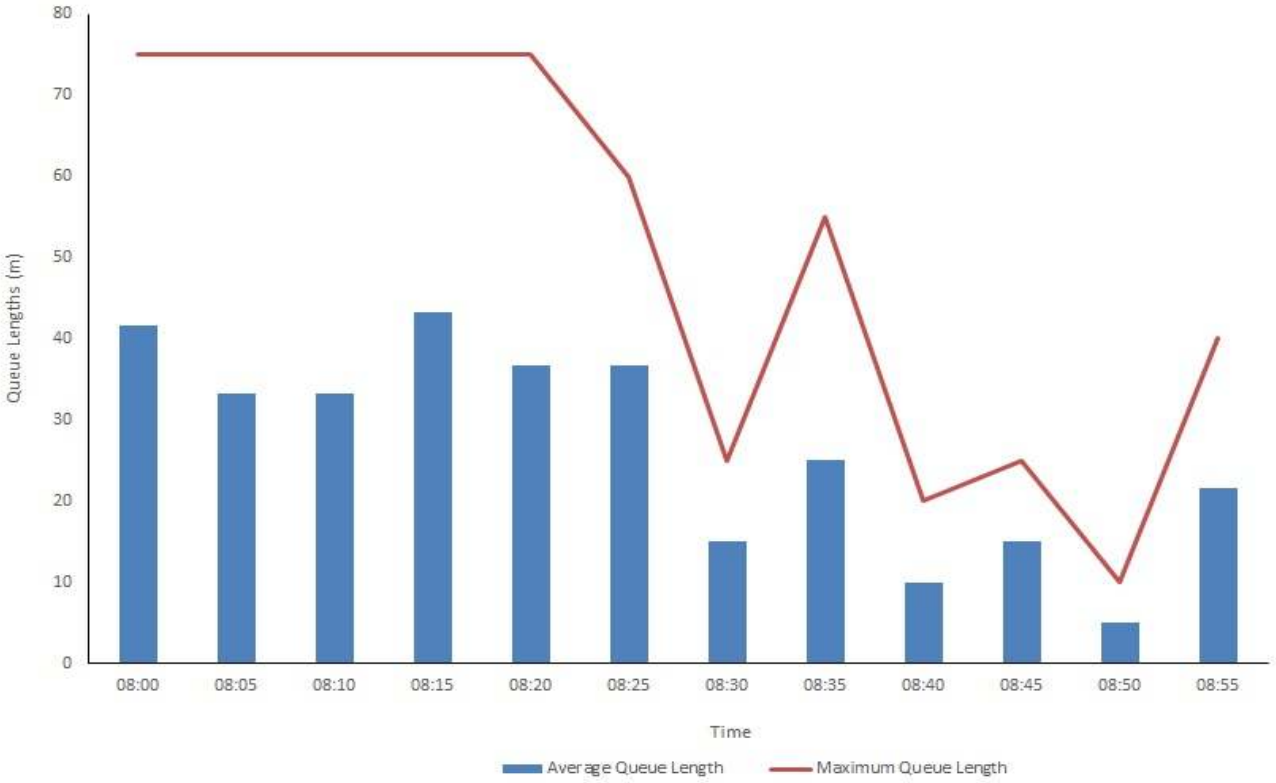

Figure 2.14: Elm High Road North Approach Queue Lengths AM Peak Hour (08:00 - 09:00)

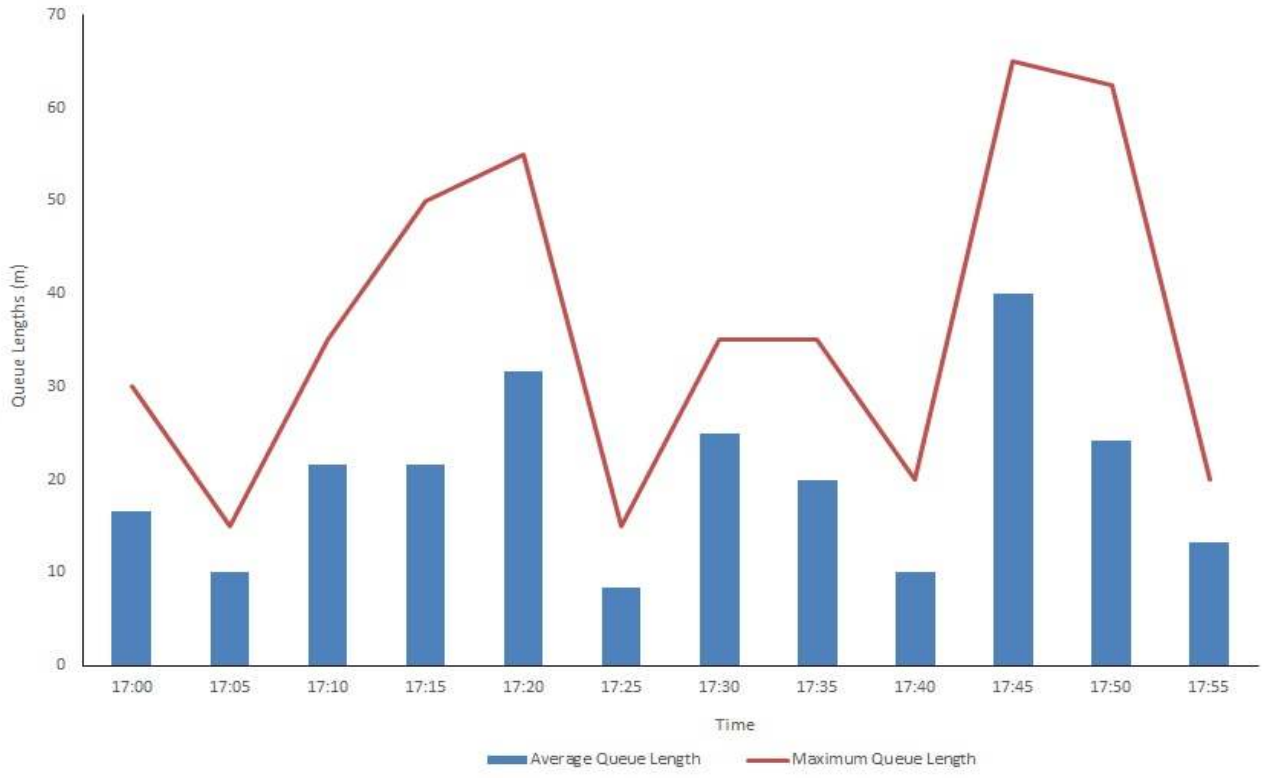

Figure 2.15: Elm High Road Approach Queue Lengths PM Peak Hour (17:00 - 18:00)

Table 2.5: Maximum and Average Queue Lengths on the A1101 Elm High Road South Approach

Time Segment	AM		Time Segment	PM	
	Average (m)	Max (m)		Average (m)	Max (m)
08:00	30	70	17:00	26.6	45
08:05	39.1	75	17:05	20	25
08:10	30	75	17:10	30	45
08:15	36.6	75	17:15	31.6	40
08:20	43.3	75	17:20	28.3	35
08:25	41.6	75	17:25	20	30
08:30	35.8	62.5	17:30	15	40
08:35	43.3	75	17:35	35	50
08:40	47.5	75	17:40	20.8	30
08:45	30	75	17:45	31.6	70
08:50	41.6	75	17:50	21.6	45
08:55	45	75	17:55	26.6	35

The data shows that the queues are more prevalent during the AM peak hour, with queue lengths reaching a minimum of 62 metres over the course of an hour.

Greater queue lengths on Elm High Road south approach reflect traffic flows indicated within the turning counts (Figures 2.8 and 2.10), whereby a greater volume of traffic originate from the A47 roundabout and travel northbound (850 vehicles) during the AM peak hour, when compared to PM peak flows of 696 vehicles.

Queue lengths during the PM peak hour are also shown to reach a maximum of 70 metres, however appear much lower over the course of an hour, when compared to the AM peak results.

Figures 2.16 and 2.17 on the following page shows this data for both peak hours, reported in 5 minute intervals.

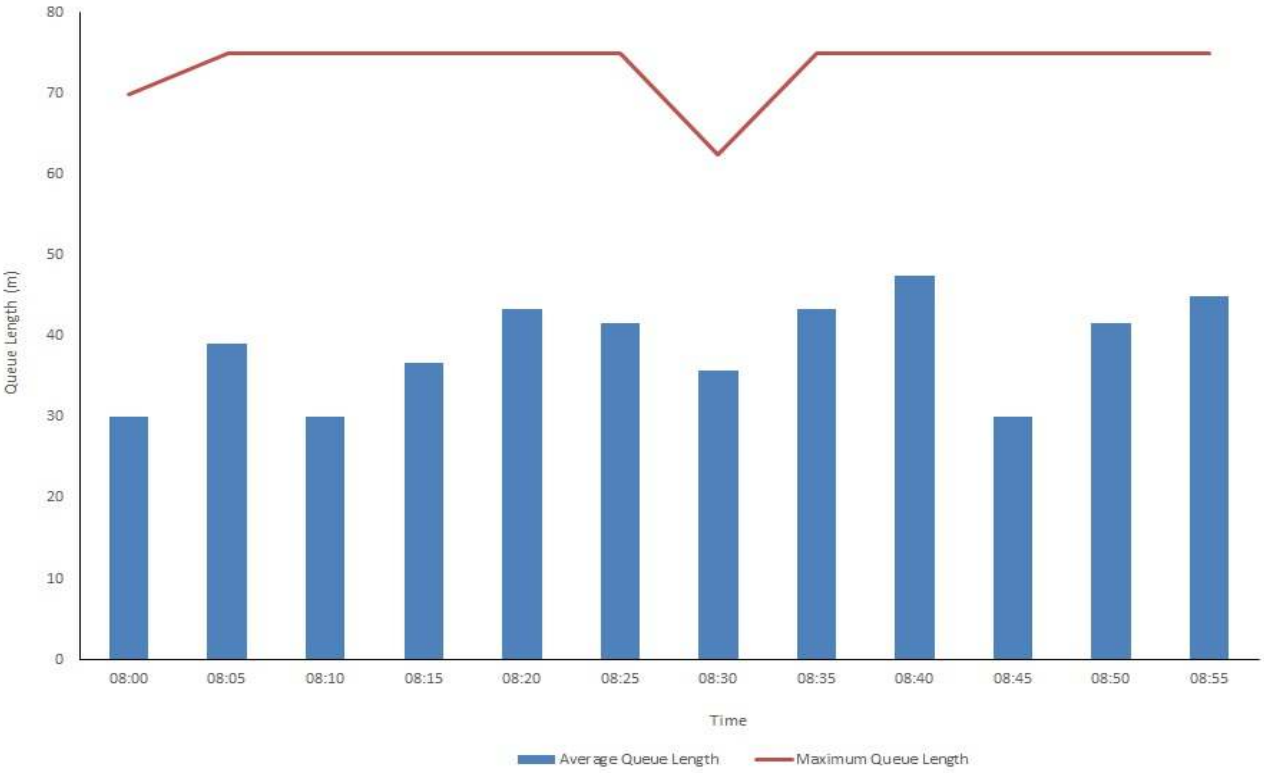

Figure 2.16: Elm High Road South Approach Queue Lengths AM Peak Hour (08:00 - 09:00

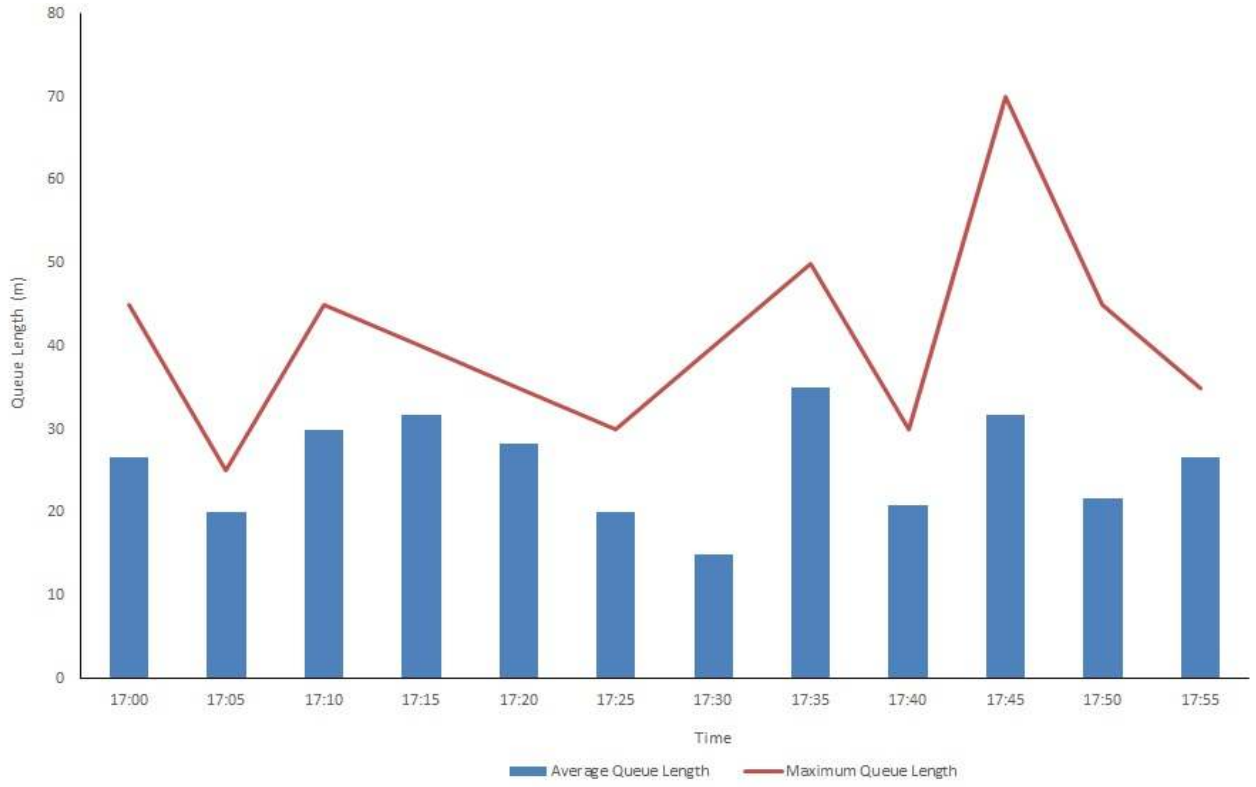

Figure 2.17: A1101 Elm High Road South Approach Queue Lengths PM Peak Hour (17:00 - 18:00)

Journey Times and Delay

The same Satellite Navigation (TomTom) data has been used to assess journey times and delay at the Elm High Road / Weasenham Lane Junction. Data has been extracted for the approaches of Weasenham Lane, Churchill Road (north) and Elm High Road (south), see Figure 2.11). The total length of segments used for each approach are detailed below and shown within Figure 2.18:

- Weasenham Lane – 89.7 metres;
- Elm High Road North – 59.2 metres, and;
- Elm High Road South - 133 metres.

Figure 2.18: Elm High Road / Weasenham Lane Junction TomTom Segments Assessed

The tables on the following pages show the results for each of the named approaches.

Table 2.6: Journey Times and Delay for Weasenham Lane Approach

Weasenham Lane		Average Travel Time (Seconds)	Average Delay (Seconds)
Free Flow	(00:00 – 06:00)	12.7	N/A
AM Peak	(08:00 – 09:00)	47.1	34.4
PM Peak	(17:00 – 18:00)	46.7	33.9

Table 2.6 shows the Free Flow time when travelling along Weasenham Lane towards the Elm High Road corridor, is 12.7 seconds over a distance of 89 metres.

Delay shown along Weasenham Lane appears to be balanced across the peak hours, with approximately 34 seconds added to journey times. This balance in delay reflects the similar pattern shown with queue length and traffic count data already discussed within this chapter.

Table 2.7: Journey Times and Delay for Elm High Road North Approach

Elm High Road North		Average Travel Time (Seconds)	Average Delay (Seconds)
Free Flow	(00:00 – 06:00)	6.6	N/A
AM Peak	(08:00 – 09:00)	24.4	17.8
PM Peak	(17:00 – 18:00)	34.6	28.0

Table 2.7 shows the Free Flow time when travelling southbound along the corridor is 6.6 seconds over a distance of 59 metres.

Elm High Road north approach experiences delay across both the AM and PM peak hours, however the PM peak is shown to be higher with 28 seconds added to journey times.

Table 2.8: Journey Times and Delay for Elm High Road South Approach

Elm High Road South		Average Travel Time (Seconds)	Average Delay (Seconds)
Free Flow	(00:00 – 06:00)	11.8	N/A
AM Peak	(08:00 – 09:00)	46.4	34.6
PM Peak	(17:00 – 18:00)	38.6	26.7

Table 2.8 shows the Free Flow time when travelling northbound along Elm High Road corridor is 11.8 seconds, over a distance of 133 metres.

Delay on this approach is shown to occur across both peak hours, however it is more prevalent in the AM peak hour, whereby 34 seconds are added to journey times. Higher AM delay supports the greater queue lengths recorded in Figure 2.16.

Average Speeds

Average speeds for the Elm High Road / Weasenham Lane Junction have been extracted from the same TomTom data set described within this chapter. Figure 2.19 and 2.20 beneath highlight the average speeds and areas of congestion for both the AM and PM peak hours.

Figure 2.19: Elm High Road / Weasenham Lane Approach Average Speed AM Peak Hour (08:00 - 09:00)

Figure 2.19 shows the average speed when approaching the junction from both Elm High Road north and south is between 11 – 20 mph. Average speeds on Weasenham Lane appear to be lower at 1 -10 mph, when nearing the stop line.

Figure 2.20: Elm High Road / Weasenham Lane Approach Average Speed PM Peak Hour (17:00 - 18:00)

Figure 2.20 shows the average speeds when approaching the junction during the PM peak hour are worse for both Weasenham Lane and Elm High Road south, whereby speeds of between 1 -10mph are recorded. Similarly to the AM peak hour, average speeds on Elm High Road north remain at 11 -20mph.

A47 / Elm High Road Roundabout

Traffic Flows

Turning counts were undertaken at the A1101 Elm High Road / A47 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 survey are shown within Figures 2.21 to 2.23 below for the 12 - hour period, AM peak (08:00 – 09:00) and PM peak (17:00 – 18:00). Extracted data provides an indication of the number of vehicles entering the corridor from the south on the daily basis.

Survey results for the 12 hour period are shown below.

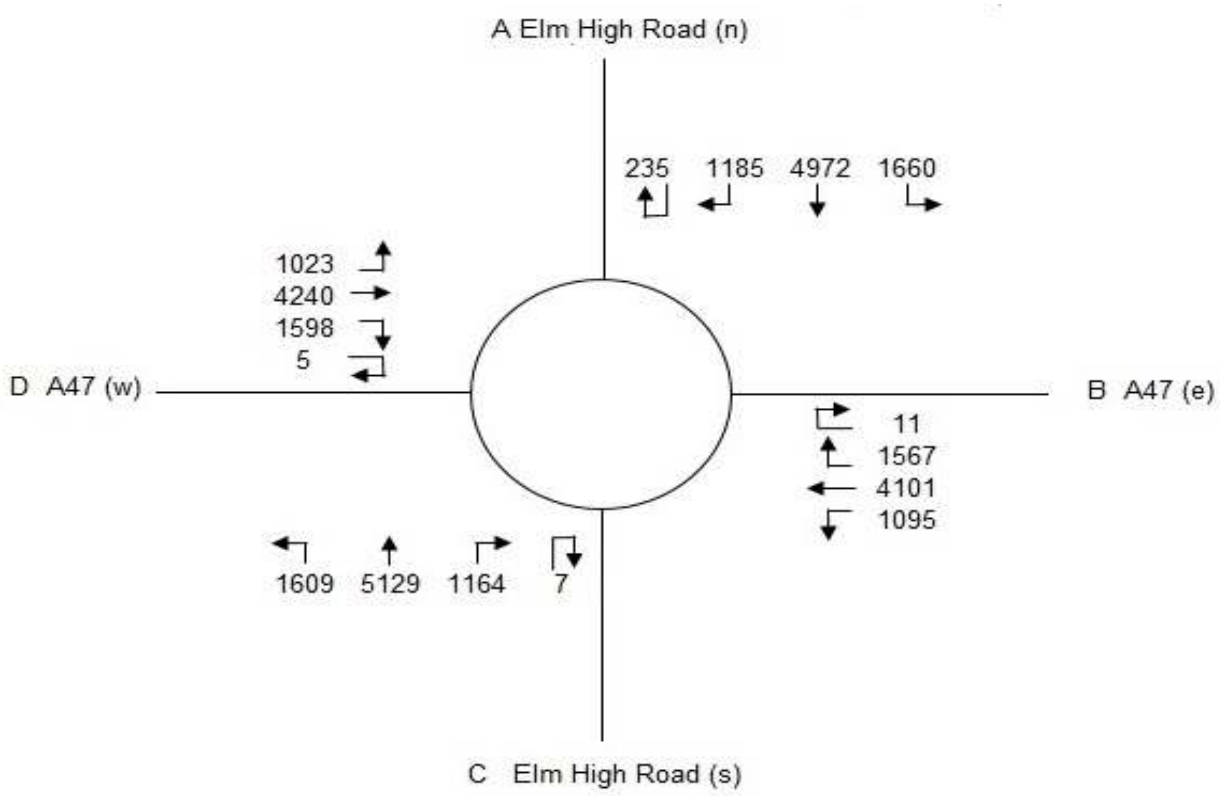

Figure 2.21: Elm High Road / A47 Roundabout 12 Hour Traffic Count (07:00 -19:00)

Figure 2.21 shows the largest turning movements at the roundabout over a 12 hour period, are from Elm High Road North and South approaches. However, ahead movements on remaining A47 approach arms are fairly comparable.

A total of 7,954 vehicles join the Elm High Road corridor via the A47 roundabout over a 12 hour period, whist 7,052 vehicles originate from the corridor and join the circulatory over this period.

Turning movements along the A47 approaches indicates a greater proportion of traffic enter Elm High Road from the A47 East.

AM peak results are shown in Figure 2.22 on the following page.

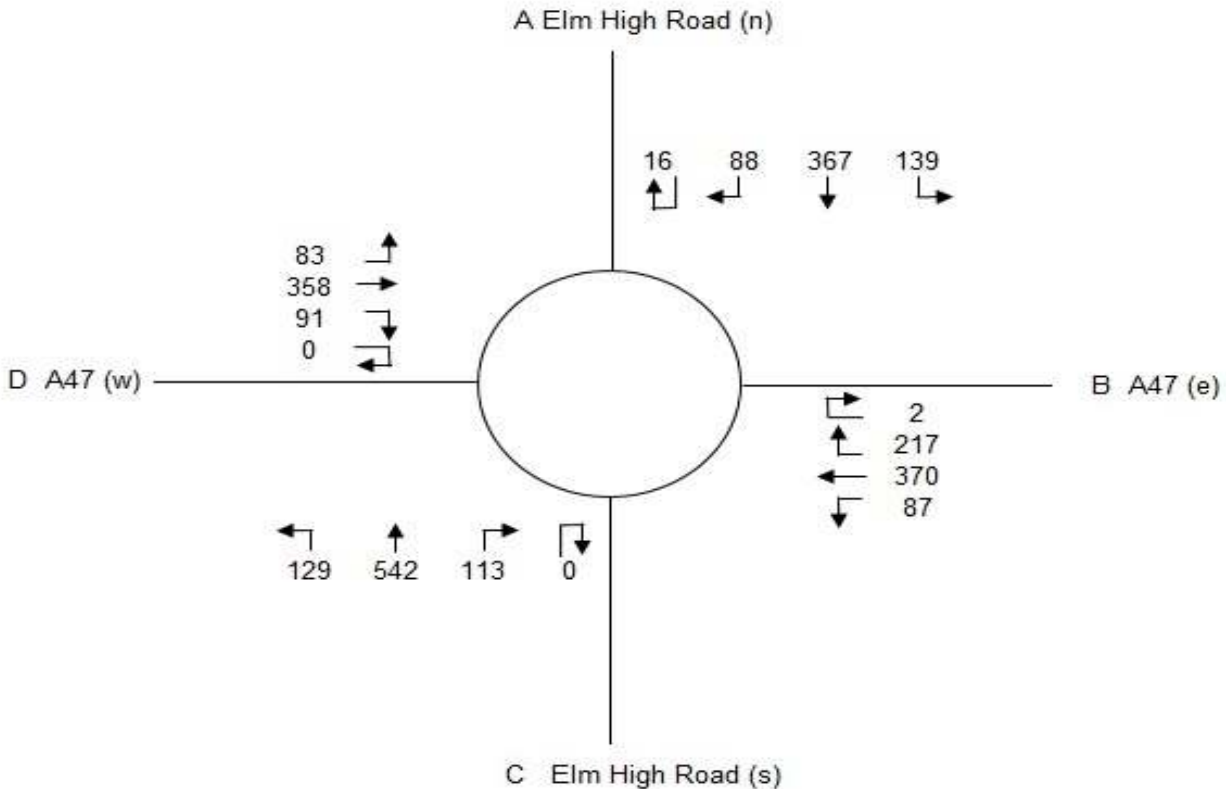

Figure 2.22: Elm High Road / A47 Roundabout AM Peak Hour Traffic Count (08:00 - 09:00)

During the AM peak hour, 658 vehicles arrived at Elm High Road, of which 542 vehicles originated from the Elm High Road south approach.

Over the AM peak hour 610 vehicles originated from the corridor, with the dominant movement being ahead to Elm High Road south (367 vehicles), as well as a left turn to the A47 east (139 vehicles) approach.

Pm peak hour results are shown in Figure 2.23 on the following page.

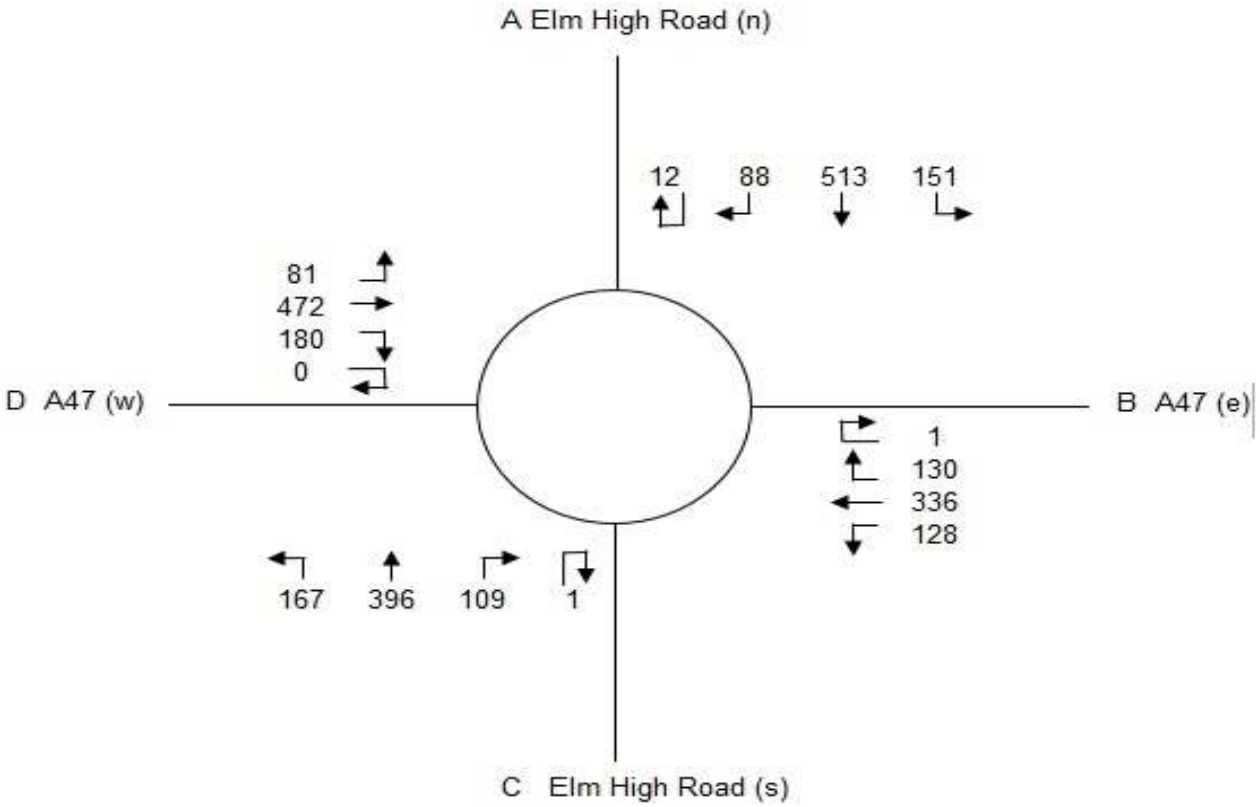

Figure 2.23: Elm High Road / A47 Roundabout PM Peak Hour Traffic Count (17:00 - 18:00)

Figure 2.23 shows that during the PM peak, 619 vehicles originate from Elm High Road, whilst 764 vehicles enter the corridor via this junction.

Likewise to the AM peak, a greater proportion of vehicles entering the corridor originate from Elm High Road South (396) and the A47 east (130). However, traffic flows for these movements are reduced during the PM peak hour.

Queue Lengths

Queue length surveys were undertaken at the Elm High Road / A47 roundabout on the 14th January 2016. Queue lengths were recorded 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 congestion.

For the purpose of this assessment, queue length data for the Elm High Road north approach has been extracted.

Table 2.9 and Figures 2.24 and 2.25 on the following pages show the maximum and average queue lengths recorded for this approach. Data is presented for the AM (08:00 – 09:00) and PM (17:00 -18:00) peak hours, with data representative of both the nearside and offside lanes.

Table 2.9: Maximum and Average Queue Lengths on the Elm High Road North Approach to the A47 Roundabout

Time Segment	AM		Time Segment	PM	
	Average (m)	Max (m)		Average (m)	Max (m)
08:00	0	0	17:00	37.5	75
08:05	0	0	17:05	40	75
08:10	10	20	17:10	37.5	75
08:15	5	5	17:15	37.5	75
08:20	5	10	17:20	37.5	75
08:25	5	10	17:25	40	75
08:30	0	0	17:30	37.5	75
08:35	2.5	5	17:35	37.5	75
08:40	15	30	17:40	0	75
08:45	0	0	17:45	37.5	75
08:50	0	0	17:50	0	0
08:55	0	0	17:55	0	0

Queue lengths when approaching the A47 roundabout from Elm High Road appear more prevalent during the PM peak hour, whereby an average of 75 metres is reached for 50 minutes of the hour period. In comparison the maximum queue length recorded for the AM peak hour is 30 metres.

Figures 2.24 and 2.25 show this data for both peak hours, reported in 5 minute intervals.

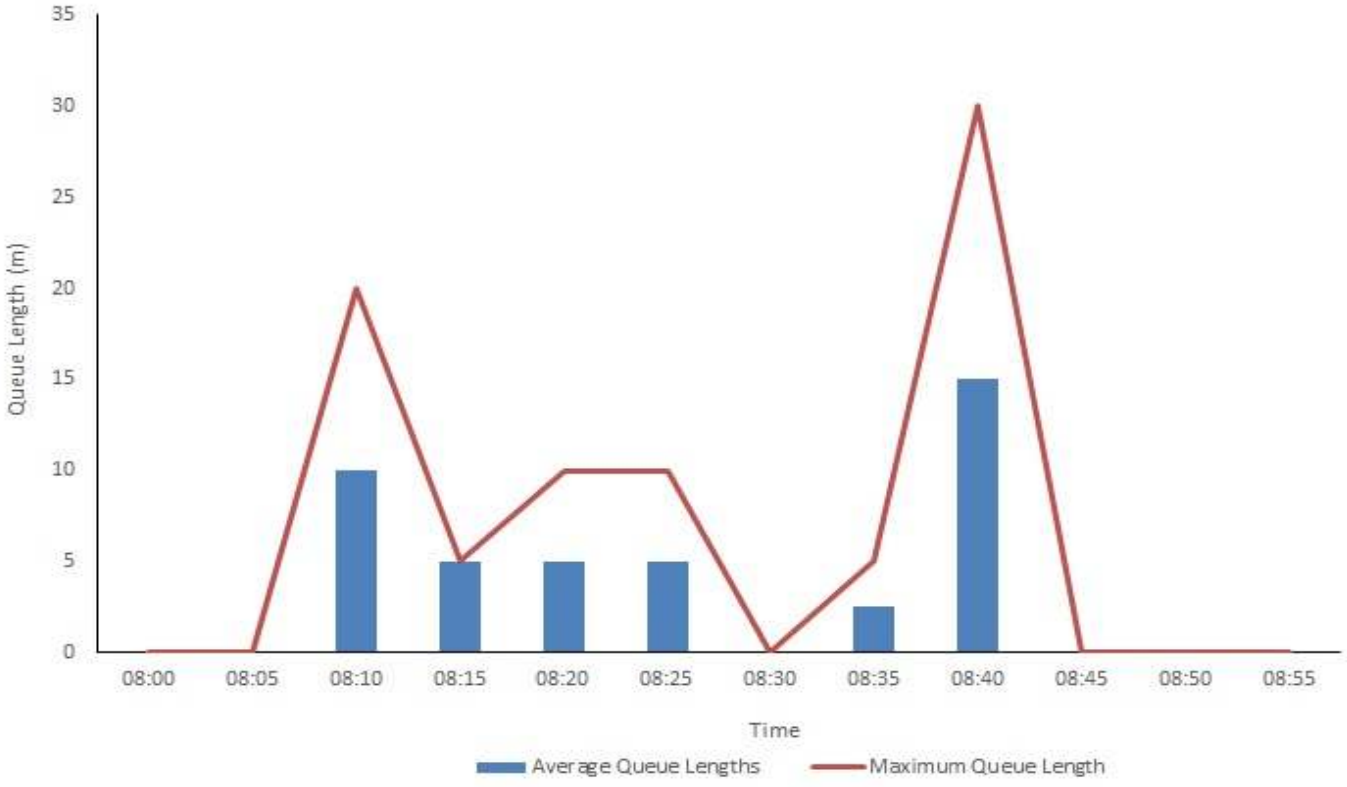

Figure 2.24: Elm High Road / A47 Roundabout Queue Lengths AM Peak (08:00 - 09:00)

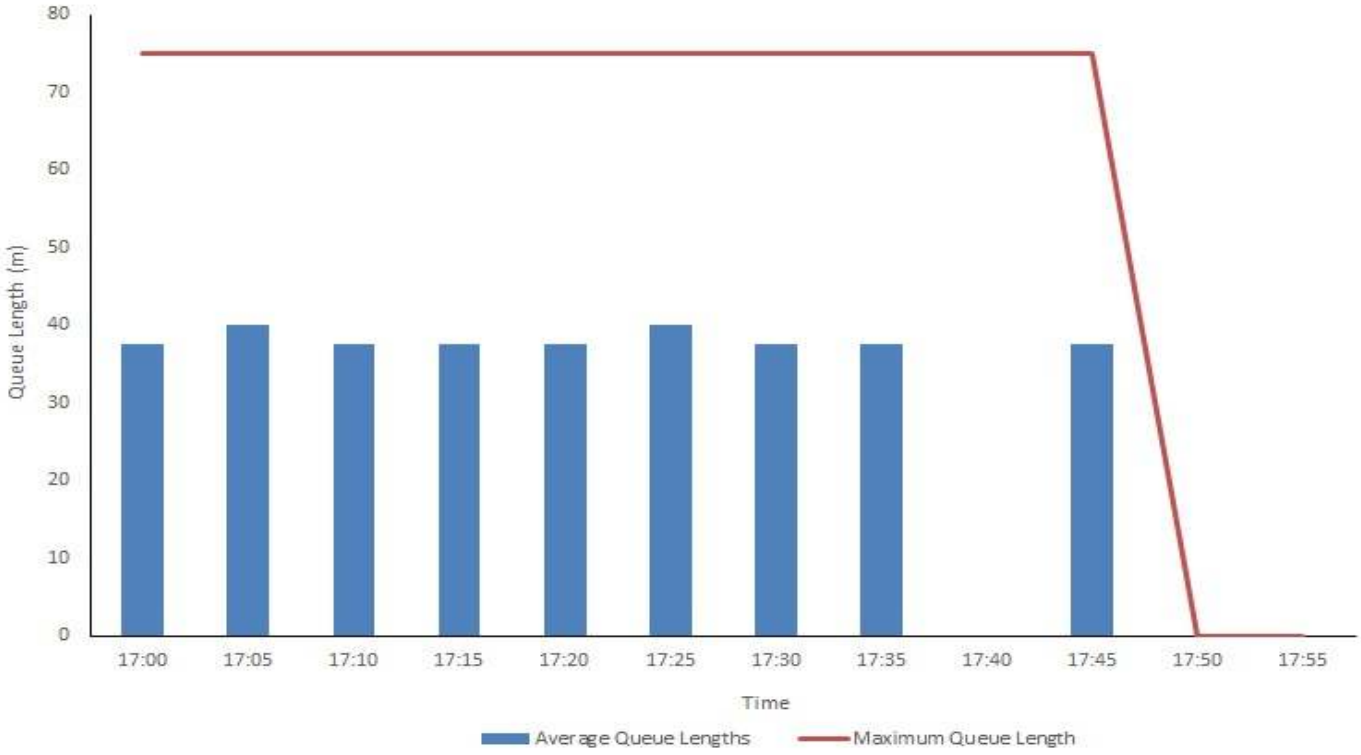

Figure 2.25: Elm High Road / A47 Roundabout Queue Lengths PM Peak (17:00 - 18:00)

Journey Times and Delay

The same Satellite Navigation (TomTom) data has been used to assess journey times and delay on Elm High Road (north) when approaching the A47 roundabout. Road segments used in this assessment total190 metres from the stop line (reaching the Morrison's / retail junction).

Table 2.10: Journey Times and Delay for Elm High Road North Approach to the A47 Roundabout

Elm High Road North		**Average Travel Time** (Seconds)	**Average Delay** (Seconds)
Free Flow	(00:00 – 06:00)	14.2	N/A
AM Peak	(08:00 – 09:00)	24.5	10.2
PM Peak	(17:00 – 18:00)	60.3	46.1

Table 2.10 shows the Free Flow time when approaching the A47 roundabout from this approach is 14.2 seconds, over the distance of 190 metres.

Elm High Road north experiences delay across both peak hours, however delay is shown to be greater during the PM peak hour whereby 46 seconds is added to journey times. This higher PM delay reflects traffic flows identified within Figure 2.22 and 2.23, whereby a greater volume of traffic travelled southbound during the PM peak (764 vehicles) when compared to 619 vehicles in the AM peak hour.

Average Speeds

Average speeds for the Elm High Road / A47 roundabout have been extracted from the same TomTom data set described within this chapter. Figure 2.26 and 2.27 on the following page highlight the average speeds and areas of congestion for both the AM and PM peak hours.

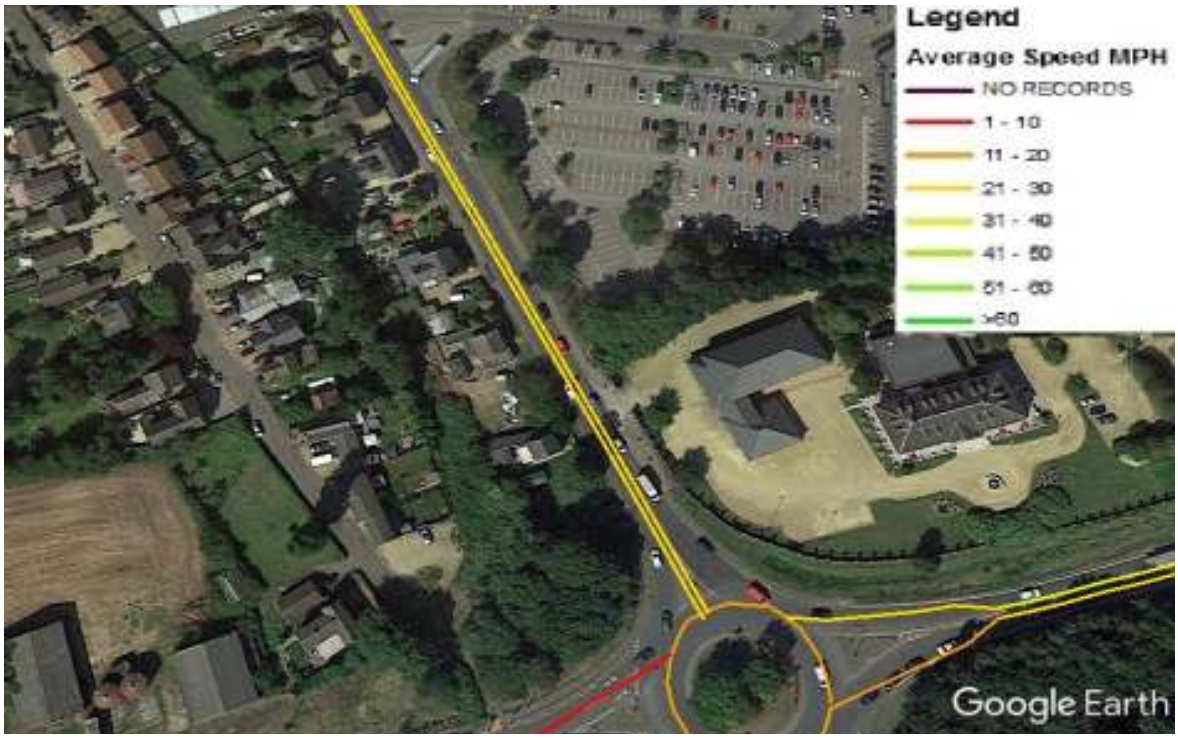

Figure 2.26: A47 Roundabout Average Speed AM Peak Hour (08:00 - 09:00)

Figure 2.27: A47 Roundabout Average Speed PM Peak Hour (17:00 - 18:00)

During the AM peak hour, the average speeds when approaching the A47 roundabout are between 21 -30 mph, which decreases to between 1 - 10 mph in the PM peak hour.

Summary of Elm High Road Corridor – Journey Time and Delay Data

Delay for the entire length of the east corridor, between Freedom Bridge Roundabout and A47 / Elm High Road Roundabout, is shown in Tables 2.11 and 2.12.

Data displayed within these tables is representative of TomTom dataset previously mentioned within this chapter. Road segments used during this assessment total 1.5 miles.

Table 2.11: Journey Times and Delay for the Elm High Road Corridor (Northbound)

EHR Northbound		Average Travel Time (Seconds)	Average Delay (Seconds)
Free Flow	(00:00 – 06:00)	171.5	N/A
AM Peak	(08:00 – 09:00)	296.6	125.1
PM Peak	(17:00 – 18:00)	298.9	127.5

Table 2.12: Journey Times and Delay for the Elm High Road Southbound

EHR Southbound		Average Travel Time (Seconds)	Average Delay (Seconds)
Free Flow	(00:00 – 06:00)	174.5	N/A
AM Peak	(08:00 – 09:00)	260.4	85.8
PM Peak	(17:00 – 18:00)	467.7	293.2

As shown in Tables 2.11 and 2.12, the Free Flow time along the Elm High Road corridor is 171 seconds (2 minute 51 seconds) northbound, and 174 seconds (2 minute 54 seconds) southbound.

Elm High Road experiences delay in both directions during the AM and PM peak hours, with greatest delay experienced by southbound traffic due to congestion at Elm High Road Roundabout.

Northbound delay appears well balanced during peak hours, with a total of 125 seconds (2 minutes 5 seconds) of delay added to journey times. Vehicles travelling southbound during the AM peak hour experience 85 seconds of delay (1 minute 25 seconds). This increases to 293 seconds of delay (4 minutes 53 seconds) in the PM peak hour. As noted above, higher southbound delay is a result of congestion at Elm High Road Roundabout, which is discussed in greater detail below.

Southbound Delay

Table 2.13 on the following page shows the southbound delay experienced on a segment by segment basis. The table shows the average travel time by segment for the Free Flow, AM peak hour and PM peak hours.

Note cells highlighted in yellow represent an increase in delay of between 25-100% on the Free Flow average travel time. Those highlighted in orange represent an increased delay of over 100% on the Free Flow time.

Table 2.13: Journey Time and Delay for Elm High Road Southbound per TomTom Segment

Elm High Road (Southbound)			Average Travel Time (seconds)		
Segment Location	Segment ID	Length (metres)	FreeFlow	AM	PM
Churchill Road exit from FBR	18260045486847	28.59	7.57	5.19	5.24
	18260045486848	192.37	18.71	17.72	18.39
	-18260046004451	49.76	3.76	5.8	6.16
	-18260046004450	117.11	8.65	10.12	10.84
	-18260046004196	30.85	2.65	3.58	5.42
	-18260046337976	22.42	2.75	3.53	6.67
	-18260045486874	8.82	0.66	1.02	1.11
Norwich Road Junction	-18260045486873	177.9	14.62	35.99	30.41
	18260045852779	17.33	1.51	3.13	2.57
	18260045852780	20.92	2.34	2.65	2.56
	18260045450432	197.97	14.09	14.98	14.94
	18260045362259	31.02	2.04	2.19	2.4
	18260045362260	20.15	1.34	1.42	1.64
	18260045362261	246.61	14.54	18.21	16.18
	18260045021139	36.59	2.03	2.73	2.31
	18260045581845	284.64	16.39	23.86	33.91
	18260045582054	19.71	1.41	5.14	7.32
Approach to Weasenham Lane	18260045582055	23.61	2.55	11.36	14.77
	-18260045538704	15.92	2.7	7.97	12.52
	-18260045582115	9.89	1.76	4.71	6.11
	-18260045582114	32.2	3.24	7.99	14.27
	18260046826171	46.14	3.44	4.72	25.24
	18260046826172	7.8	0.55	0.66	3.92
	18260045486485	11.33	0.78	0.9	3.53
	18260045479643	5.88	0.4	0.46	2.58
	18260045479644	67.31	4.38	5.09	21.93
	18260045758319	24.53	1.55	1.92	7.58
	18260046003782	21.32	1.32	1.65	7.03
	18260046003783	23.04	1.4	1.74	6.87
	18260045843765	64.62	3.87	4.72	18.74
	18260045843766	287.89	17.23	24.7	94.21
Elm High Road approach to the A47	18260046803358	190.83	14.26	24.52	60.36
		Total	**174.49**	**260.37**	**467.73**
		Delay		**85.88**	**293.24**

The data contained in the table above shows delay across both peak hours is greatest when vehicles approach Weasenham Lane Junction and continue towards the A47 roundabout.

Table 2.13 suggests queues, which form as a result of congestion when approaching the A47 roundabout, stack back to Weasenham Lane and ultimately block access for vehicles wanting to make the right turn movement to join Elm High Road.

Delay on the approach to the A47 roundabout is particularly high in the PM peak hour, which reflects traffic flows outlined earlier within this chapter.

Accident Data

Accident data has been obtained from the Cambridge County Council website, for the period of 2010 to 2015. Over this period a total of thirty four accidents have occurred along the Elm High Road corridor.

Table 2.14 provides a summary of the accidents that have occurred within this time period.

Table 2.14: Accident Summary for Elm High Road Corridor

Year	Fatal	Serious	Slight
2010	-	-	-
2011	1	1	5
2012	-	-	3
2013	-	1	9
2014	-	1	9
2015	-	-	4

The following series of figures show the locations of accidents along the Elm High Road corridor. For the purpose of providing more detail within each figure, the corridor has been spilt into sections, which include:

- FBR to the Church Terrace junction;
- Church Terrace junction to Norwich junction;
- Norwich Road to Elm Road Junction;
- Elm Road to Weasenham Lane junction, and;
- Weasenham Lane to the A47 roundabout.

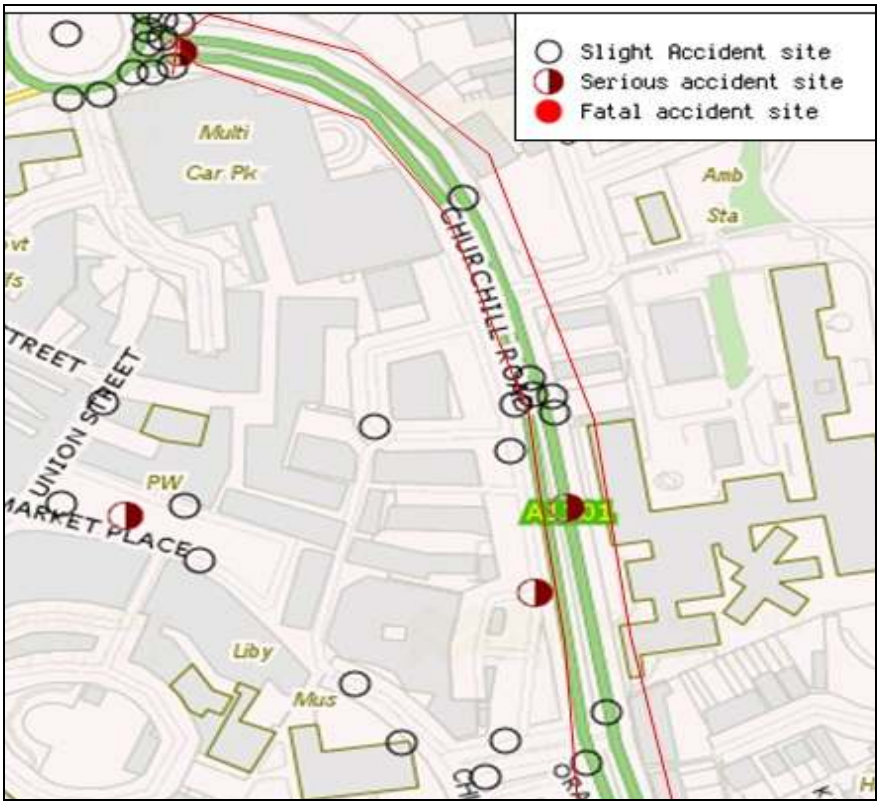

Figure 2.28: Accident Plot – FBR to Church Terrace Junction

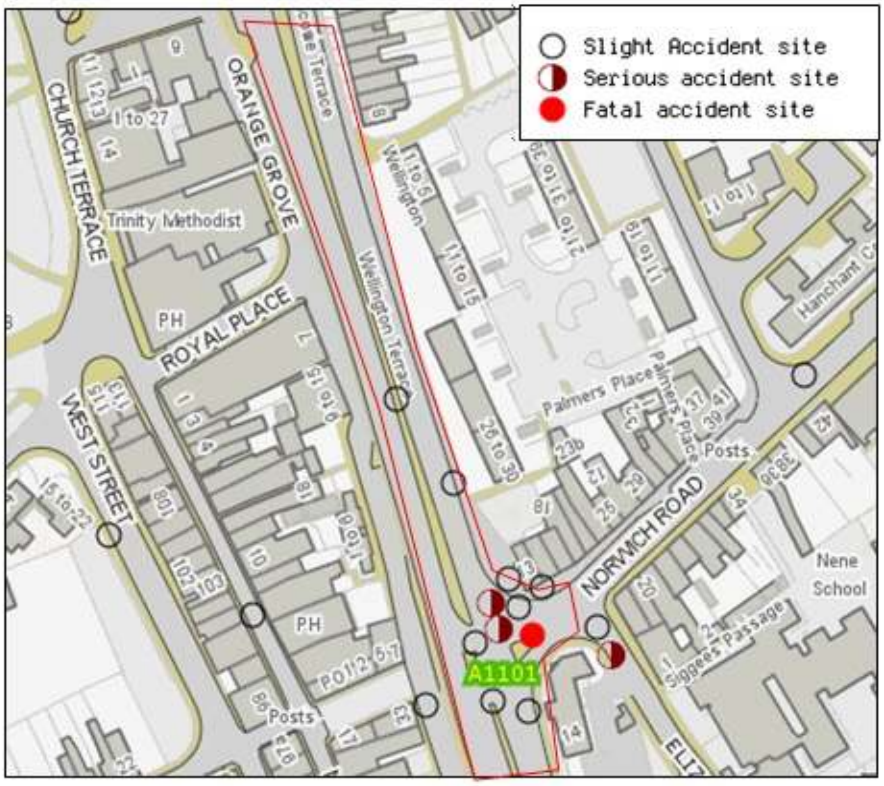

Figure 2.29: Accident Plot – Church Terrace to Norwich Road Junction

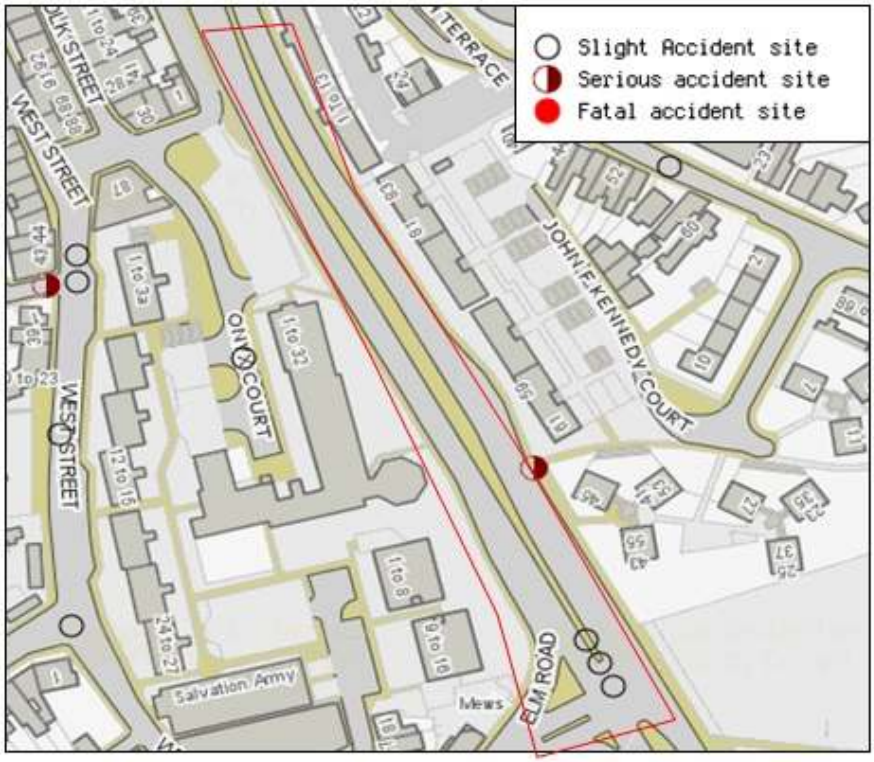

Figure 2.30: Accident Plot – Norwich Road to Elm Road Junction

Figure 2.31: Accident Plot – Elm Road to Weasenham Lane Junction

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Figure 2.32: Accident Plot – Weasenham Lane to A47 Roundabout

Land Ownership / Highway Boundary

Elm High Road is under the responsibility of Cambridgeshire County Council. The boundary plans for the corridor including the approach to FBR, Weasenaham Lane Junction, and the approach the A47 Roundabout. Note: green shading is representative of highway that is maintained at public expense.

Figure 2.33: Highway Boundary Plans for Key Junctions along the Elm High Road Corridor

Flood Risk

Using data provided by The Environment Agency, Figure 2.34 shows Elm High Road is clear of flood risk. However, areas immediately to the east and of FBR and northern parts of Churchill road are located within flood zone 2 (low risk).

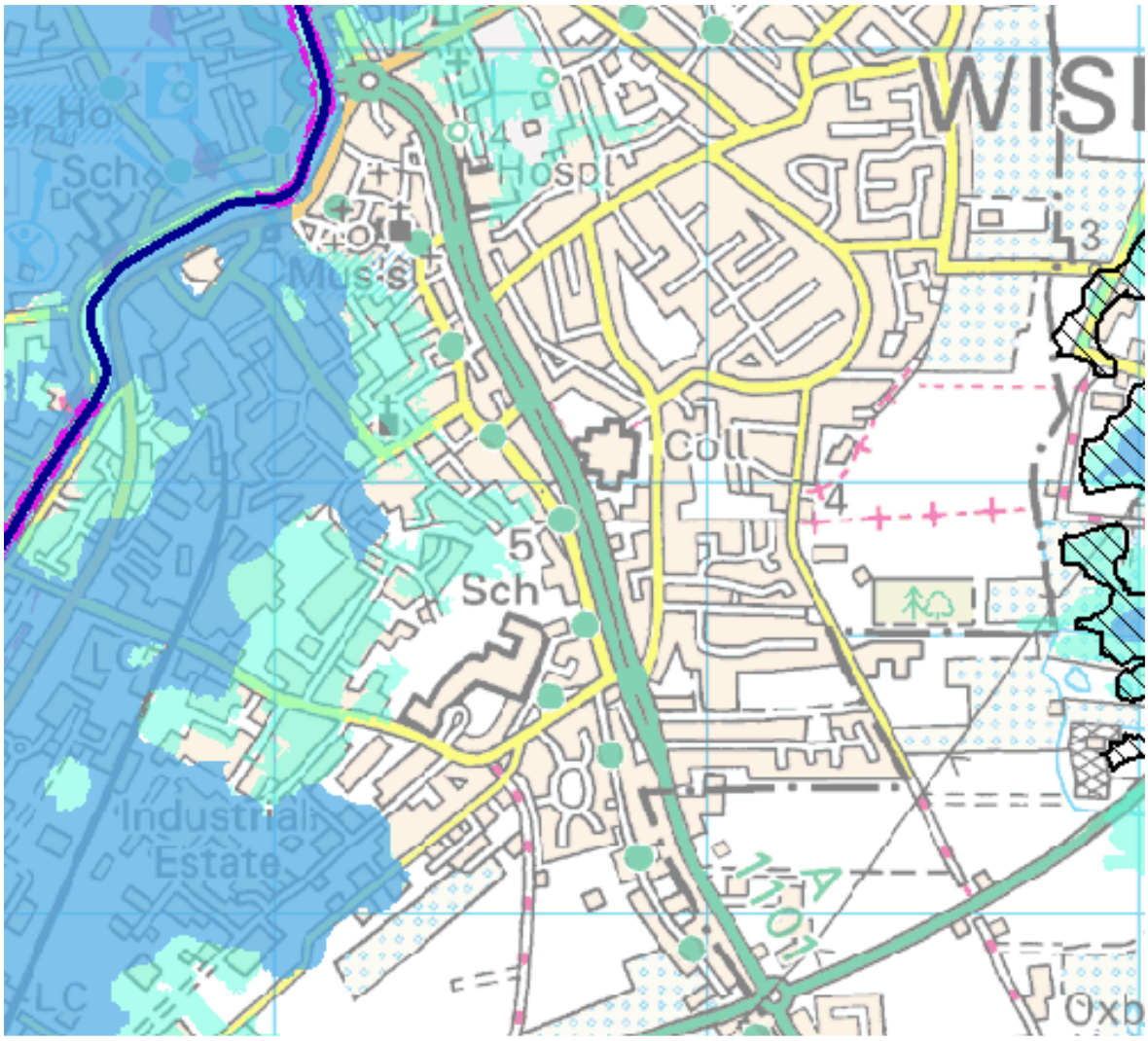


Figure 2.34: Flood Risk for Elm High Road Corridor

Environmental Issues

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

- The presence of traditional Orchards to the southwest of the corridor as shown in Figure 2.35; and,
- The presence of the breeding species across the entirety of Wisbech.

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

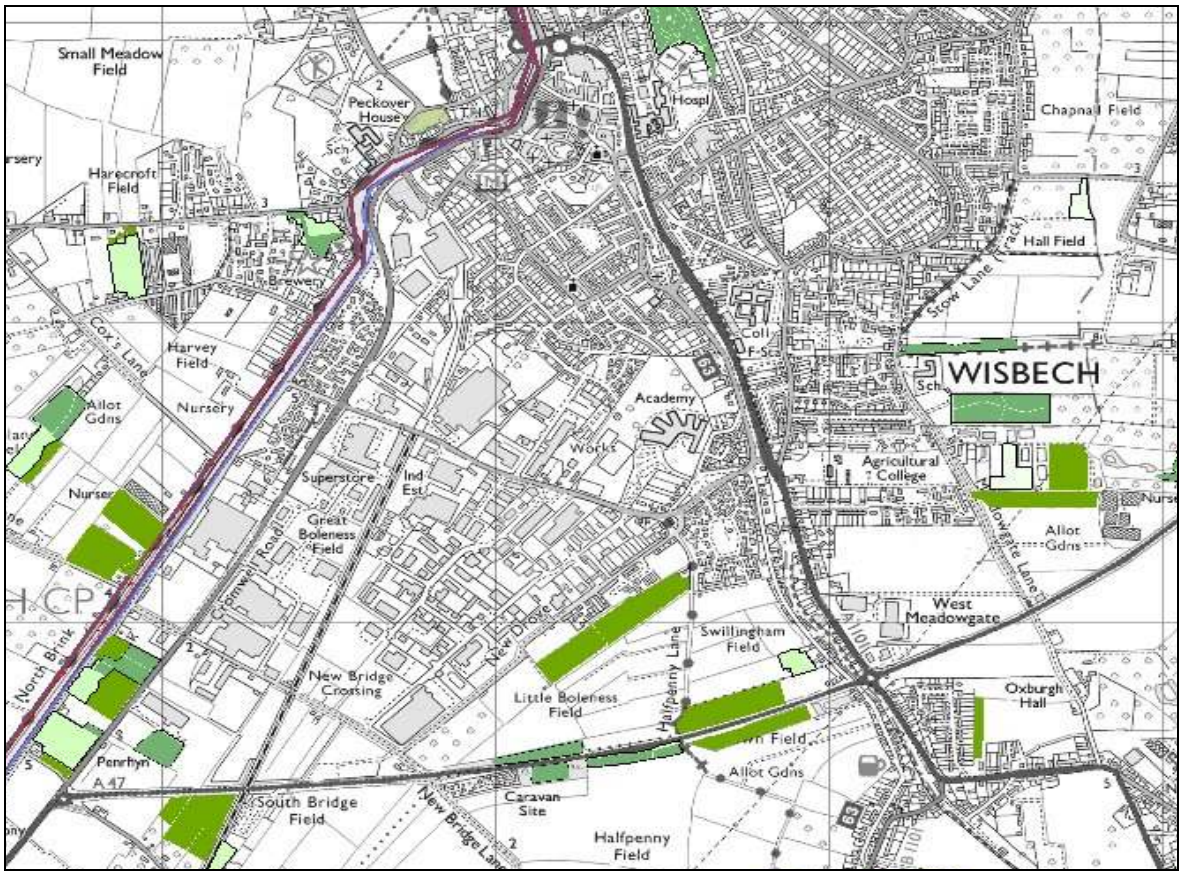


Figure 2.35: Ecological Issues along Elm High Road

3 Development Proposals

Introduction

This chapter provides an overview of the South West Wisbech extension outlining the development proposals and the potential impact development traffic could have on the operation of the Weasenham Lane Junction and the southern section of Elm High Road.

The college of West Anglia (COWA) development site is also discussed in relation to the proposals for Ramnoth Road.

South Wisbech Development Site

The South West Wisbech Broad Location for Growth is defined in Policy LP8 of the Fenland Local Plan (2014) and includes around 217 acres of land to the north of the A47, with the River Nene forming the western boundary of the site and Elm Low Road the eastern boundary.

The Local Plan 2014 describes the South West Wisbech development site as follows:

"This area is located broadly to the north of the A47, south-east of New Drove, north and south of New bridge Lane, and along Cromwell Road between New bridge Lane and the A47/B198 roundabout. Will require improved east-west road links to relieve pressure on Weasenham Lane. This will form the basis of the Southern Access road also being investigated as part of the Wisbech Access study. The area will be predominantly for business purposes, though there is some potential for residential development. Existing areas of high quality woodland, including some mature orchards, should be retained and enhanced to serve as multifunctional public open space areas with amenity, biodiversity and community food value. Noise mitigation and screening measures should be provided along the A47, and between the residential and business areas as appropriate."

A Broad Concept Plan (BCP) of the site was produced in April 2015. The BCP shows that site split into 4 phases, these are Phase 1, Phase 1a, Phase 2 and Phase 3. The BCP is shown on the following page.

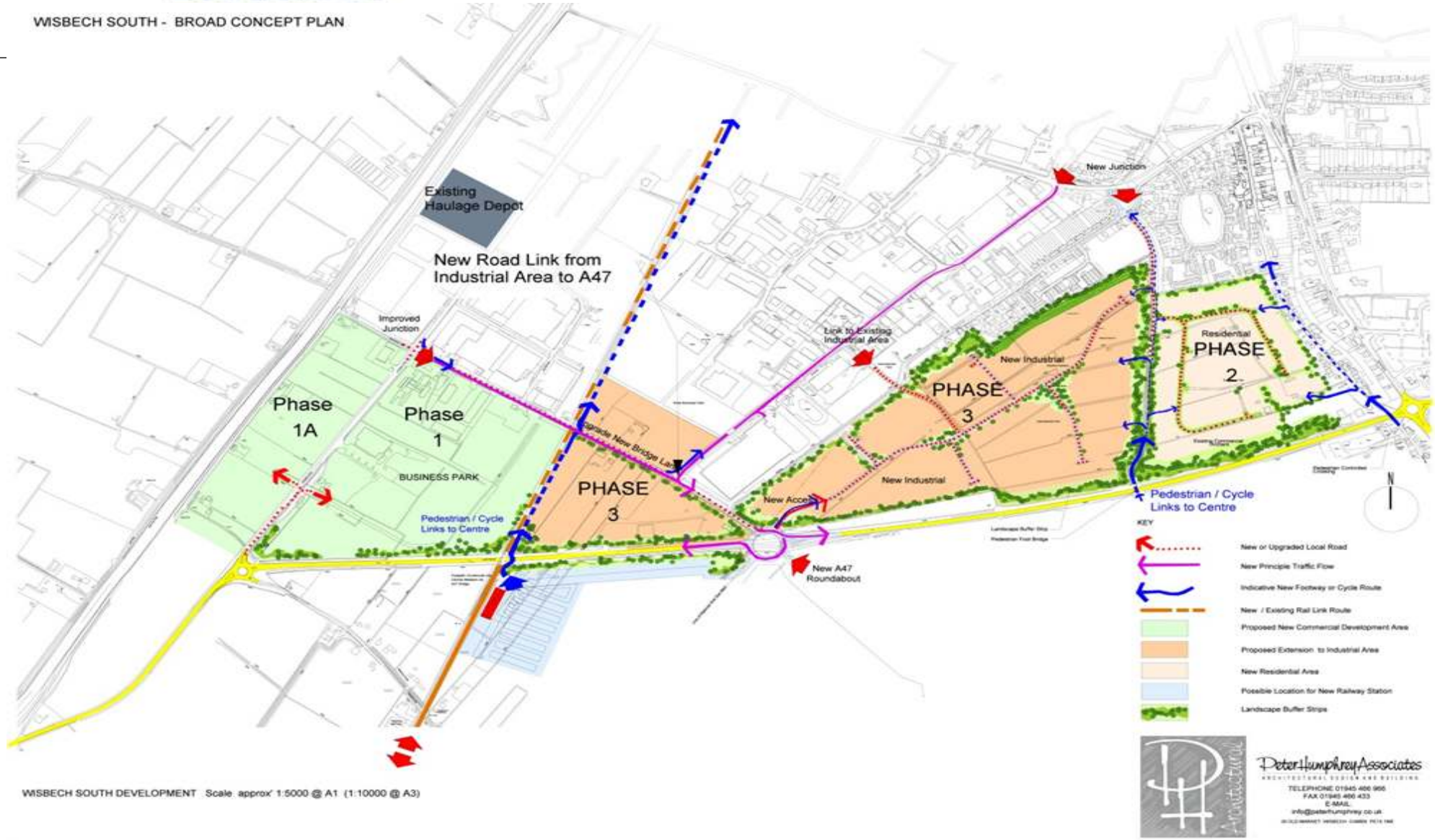


Figure 3.1: South Wisbech Broad Concept Plan

The composition of the four phases shown in the BCP are detailed beneath.

Assumptions for Phase 1

Phase 1 consists of a series of land parcels:

- **Site A:** This site is about 2ha and will consist of a mix of development split between office use (2,100 sq m) and warehouse use (2896 sq m).
- **Site B:** The site is about 2.4ha with expected job creation of 134.
- **Site C:** This site is 4.7ha and will create around 380 jobs on a breakdown of 10% B1 office use, 60% B2 industry use and 30% B8 distribution use.
- **Site D** About 1.2ha site, with an assumed 10% B1 office, 60% B2 Industry use and 30% B8 Distribution use. This site also includes a Pub / Restaurant.
- **Access Assumptions:** The BCP shows access to Phase 1 via a new junction with Cromwell Road. Previous traffic modelling work undertaken by Atkins to inform the Local Plan (Wisbech Traffic Model, Strategic Development Sites: March 2015) has assumed that this junction is a four arm signalised junction providing access to / from Cromwell Road from the Phase 1 and Phase 1A sites. This assumption has been retained for the Wisbech Access Study and is included within this particular assessment by virtue of the traffic flows extracted from the WATS model and used in the Option Assessment.

  As well as an access point onto Cromwell Road, this assessment has also included an additional access onto New Bridge Lane at the existing junction with Salter's Way.

Assumptions for Phase 1A

- Phase 1A will have one access point into and out of the site, as with Phase 1 this is assumed to be via a signalised junction with Cromwell Road. The site is about 10ha of proposed commercial development.

Assumptions for Phase 2

- Phase 2 has an indicative timeline of 2016 – 2021 and consists of 14.30ha of residential land use. The current assumptions are for 25 houses per hectare and will be built at a rate of around 80 dwellings per year for 5 years, with the total number of house estimated to be approximately 360. The site will be accessed from New Drove / Half Penny Lane.

Assumptions for Phase 3

- Phase 3 consists of approximately 35ha. of industrial land which is forecast to be developed between 2018 – 2031. This expected to generate 1,611 jobs between 2018 and 2025 (based on the same land use split as Phase 1), and a further 1,144 jobs between 2025 and 2031.
- Access into Phase 3 has been assumed to be via three local access junctions along New Bridge Lane and Boleness Road.

Development Traffic

Forecast traffic flows for future years of 2021, 2026 and 2031 have been extracted from the 2015 Wisbech Access Transport Study (WATS) model.

The Broad Concept Plan is represented within the WATS model using a series of SATURN zones dedicated to development traffic. The zones are shown in the figure beneath.

Figure 3.2: Representation of the Wisbech South West Phases in Saturn Zones

The zones from the 30000 series (30218, 30222, 30251, 30215 and 30221) represent the Wisbech South development site. Zones 121 (green) represent existing traffic generated by the areas adjacent to the development site.

South Wisbech Development Traffic and Impact on the Elm High Road Corridor

To assess the impact of development traffic on the operation of the Elm High Road corridor, the following data has been extracted from the SATURN based WATS model or WATS VISSIM Model (2015 base):

- Predicted traffic growth from development zones as well as the number of vehicles destined for Weasenham Lane, New Bridge Lane and igh Road corridor; and,
- Level of service (LOS) data reporting the predicted quality of traffic flow and associated delay, represented by categories between A (free-flowing) and F (Breakdown).

The Do Minimum Model has been used to extract the above data, which is presented for both the AM (08:00 – 09:00) and PM (17:00 – 18:00) peak hours, as well as the forecast years assessed within this study.

For information regarding the 'Do Minimum Model' please read the Elm High Road Option Assessment Technical Note in conjunction with this report, see Appendix A.

South West Development Traffic

The number of development trips destined for the Elm High Road / Weasenham Lane Junction and the lower section of Elm High Road (between Weasenham Lane and the A47 roundabout) has been assessed.

Traffic flows from both Phase 2 (SATURN zone 30221) and Phase 3 (SATURN zone 30215) of the development area have been extracted using the SLA tool within SATURN. The use of SLA has enabled the number of trips generated from each zone to be identified, whilst allowing the movement of the development traffic to be traced across the network.

Note: Only the zones noted above were used during this assessment, due to traffic on the remaining zones (Development Phase 1 and part of Phase 3) were found to disperse onto the wider network via the New Bridge Lane junction.

The tables beneath shows traffic flows generated by each development zone as well as how many vehicles are expected to pass through Weasenham Lane junction and continue southbound toward the A47. Data presented is for the peak hours of the each of the forecast years assessed.

Table 3.1: South Wisbech Development Traffic Network Dispersal - 2021

SATURN Zone	AM		PM	
	Reaching WHL	Southbound toA47	Reaching WHL	Southbound to A47
30221	54	8	31	22
30215	25	5	22	11
Total	79	12	53	33

Table 3.2: South Wisbech Development Traffic Network Dispersal - 2026

SATURN Zone	AM		PM	
	Reaching WHL	Southbound toA47	Reaching WHL	Southbound to A47
30221	55	7	32	22
30215	39	8	46	20
Total	94	15	78	42

Table 3.3: South Wisbech Development Traffic Network Dispersal - 2031

SATURN Zone	AM		PM	
	Reaching WHL	Southbound toA47	Reaching WHL	Southbound to A47
30221	57	8	91	48
30215	64	13	33	23
Total	121	21	124	71

The tables above show a high proportion of the development traffic is predicted to use the Elm High Road / Weasenham Lane Junction. By 2031, 121 vehicles are expected to travel through Weasenham Lane junction during the AM peak hour, which increases to 124 vehicles during the PM peak hour.

The dispersal of development traffic from Weasenham Lane toward the A47 roundabout is shown to higher during the PM peak hour, with 71 vehicles predicted to make this journey during 2031.

Impact of Development Traffic

The impact on Weasenham Lane and the lower section of Elm High Road, due to traffic growth, is shown in Tables 3.5 beneath, which outlines the LOS for each of the approaches to both Weasenham Lane junction and the A47 roundabout.

It should be noted that the following LOS data takes into account the traffic growth associated with all three development sites, outlined within the Local Plan (2014). Despite this, it can be concluded that the majority of development traffic utilising the Weasenham Lane Junction and lower Elm High Road would be destined for or originating from the South Wisbech Development site due to its close proximity to these junctions.

The following measures have been used within this assessment:

Table 3.4: LOS Descriptions

LOS Category	Description	Delay (signals) (sec)	Delay (no signals) (sec)
A	Junction operating within capacity. Free flowing traffic, motorists have able mobility for manoeuvres	<15	<15
B	Junction operating within capacity. Reasonably free flowing traffic. LOS A speeds are maintained, manoeuvrability within the traffic stream is slightly restricted	10 - 20	10 -15
C	Junction operating within capacity. Stable traffic flow, ability to manoeuvre through lanes is restricted and lane changes require more driver awareness	20 - 35	15 - 25
D	Junction approaching capacity. Traffic flow becoming unstable, with speeds slightly decrease as traffic volume slightly increased. Freedom to manoeuvre within the traffic stream is much more limited	35 - 55	25 - 35
E	Junction is at capacity. Traffic flow is unstable, and becoming irregular with varied speeds. Traffic speeds rarely reach the legal speed limit. Delay and congestion commonplace	55 - 80	35 - 50
F	Junction is over capacity, with a break down in traffic flow. Congestion and delay are significantly increased.	>80	>50

Table 3.5: LOS on Lower Elm High Road

		LOS					
Junction	Approach	2021		2026		2031	
		AM	PM	AM	PM	AM	PM
Weasenham Lane	Churchill Road (N)	D	F	F	F	F	F
	Ramnoth Road	D	F	F	F	F	F
	Elm High Road (S)	E	C	F	D	F	D
	Weasenham Lane	E	F	F	F	F	F
A47 Roundabout	Elm High Road (N)	B	E	B	E	E	F
	A47 East	B	F	C	F	E	F
	Elm High Road (S)	F	E	F	F	F	F
	A47 West	F	F	F	F	F	F

Various LOS are shown across both junctions and forecast years assessed. It should be noted that LOS 'F' is shown as early as 2021 for all approaches in either the AM and PM peak hours, except the Elm High Road South approach at Weasenham Lane Junction and the Elm High Road North approach to the A47 Roundabout.

Table 3.5 above shows that by 2031 three of the four approaches of Weasenham Lane Junction are predicted to operate under a LOS 'F' (over capacity) on the Do Minimum model, with delay likely to exceed 80 seconds.

The exception of this is shown to be the Elm High Road South approach, which operates under a LOS 'F' in the AM peak hour and 'D' during the PM peak hour. Delay on this approach across peak hours is likely to be between 55 - >80 seconds. The LOS 'D' on this approach reflects the tidality of traffic flows indicated within chapter 2 of this report, with a greater demand shown for southbound traffic along the corridor during the PM peak hour and then northbound traffic in the AM peak hour.

LOS results for the A47 roundabout also highlight that by 2031 all approaches are predicted to operate with a LOS 'F' and therefore over capacity for the PM peak hour of the Do Minimum Model. This reflects the existing conditions of congestion and delay at this junction. During the AM peak hour both the Elm High Road North and A47 West approaches operate with a LOS 'E', which still indicates an unstable flow, whereby congestion and delay are commonplace.

In undertaking this assessment, it is clear schemes to enhance the operation of the junctions are required at these two locations, when additional traffic is placed on the network due to the development sites outlined in the Local Plan.

College of West Anglia (CWA) Development Site

The CWA development site detailed below is not part of the Wisbech Access Study. It is considered within the Elm High Road element of the study, due to the potential impact development traffic (of this site) would have on key junctions along the east corridor such as Weasenham Lane and the A47 roundabout.

Applications for a housing development has been submitted to Fenland District Council for approval, to develop 5.59 ha of land (approximately 139 dwellings) on the old CWA site east of Ramnoth Road. Figure 3.3 on the following page shows the proposed site.

Figure 3.3: CWA Development Proposal

As part of the application, the developers have issued a Transport Assessment (TA) and within this have provided details on a proposal to upgrade the current Weasenham Lane Junction to form two separate signalised junctions within close proximity of each other.

The scheme proposes to (see Figure 3.4 below):

- Re-align Ramnoth Road to join Elm High Road further south than the current layout to form a new signalised junction;
- Incorporate left turners from Ramnoth Road into the signalised junction, no longer on give way;
- Incorporate pedestrian facilities over Ramnoth Road into the signalised junction; and,
- Alter lane allocations on the Churchill Road approach to have a single ahead and single left, rather than the existing two ahead.

Figure 3.4: CWA Development Access Proposal

4 Option Development

An Option Development 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 approximately twenty stakeholders of various planning, transport planning and highways disciplines, from:

- Cambridgeshire County Council;
- Fenland District Council;
- Highways England;
- King's Lynn and West Norfolk Borough Council, and;
- Skanska / Atkins.

Attendees were divided into three groups, of around six members each, to concentrate on developing options for one of the three areas identified above. Once this process was complete, a group discussion was held to review each of the individual options, each of which being challenged by the remaining two groups.

Options Devised During the Workshop

Six options were devised for Elm High Road, as a result of the workshop. Options devised for this study element consider improvement to different sections along the corridor including the Elm High Road / A47 roundabout and the Elm High Road / Weasenham Lame Junction. In line with the requirements for funding, all of the options were devised focussed on enabling the growth identified within the Local Plan, in particular the South Wisbech Development site.

Below is a summary of the options developed during the workshop, each of which are discussed in turn within this chapter:

- **EH 1** – Capacity enhancements to the existing A47 / A1101 Elm High Road Junction;
- **EH 2** – Provision of a pedestrian footbridge over the A47 to replace the at grade crossing on the A47 eastbound approach;
- **EH 3** – Re-locate the A47 / A1101 Elm High Road Junction further to the east and enhance capacity;
- **EH 4 –** Amendments to the existing signalised junction of A1101 Elm High Road / Weasenham Lane / Ramnoth Road;
- **EH 5** – Reduce Churchill Road to a single carriageway, and;
- **EH 6** - Weasenham Lane junction converted to a priority controlled roundabout.

Note: that during the following Option Development Workshop, several options for **EH 6** were discussed and this eventually evolved into **EH 7**, before any assessments had been undertaken, consequently Option EH 6 is referred to as EH 7 for the remainder of the study.

Option Review Workshop

A second workshop was held on the 19th October 2016 to further refine these options following initial assessment, and provide the opportunity to consider more options. 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 which were to be retained for further assessment and potential inclusion within the packaging assessment.

The discussion considered the following criteria:

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

Results from the initial modelling assessment were used to inform the workshop discussion, and some of the conclusions drawn from the modelling work are discussed within this chapter. Full details of the option assessments are provided in the technical notes contained within Appendix A.

Additional options were also created during the review process, for inclusion within the option assessment process, these were

- **EH 1a** – Sensitivity test of Option 1, focusing on capacity enhancements of the Elm High Road North approach only;
- **EH 3b** – Sensitivity Test of Option 3, retaining the idea of relocating the Elm High Road Roundabout, however is new roundabout location is west of the original Option 3.
- **EH 8** – Sensitivity test of Option 7, a series of amendments to the geometry of the roundabout, the inclusion of pedestrian facilities and alterations to the geometry of the Elm High Road North approach to the A47 roundabout;
- **EH 9** – Weasenham Lane Junction (particularly in regards to Ramnoth Road) improvements based on COWA development proposal.

Note: During the workshop discussion of Option **EH 8** the naming convention used was amended, due to the minimal difference between this option and the original Option 7. Consequently, EH 8 is referred to as **EH 7a** for the remainder of the study.

Please note that no scheme has currently been assessed for Option EH 5 because:

- Existing conditions show little congestion and queue backs when approaching Freedom Bridge Roundabout during peak hours;
- Alterations to the network in this location is not directly associated with any growth site, which is a significant factor in the funding requirements; and,
- Implementation of this scheme would be dependent on the performance of other preferred schemes identified within the study, such as Freedom Bridge Roundabout, Weasenham Lane junction and the Western Link Road.

The requirement for an option at this location may be reviewed once the packaging assessment has been undertaken and the level of benefit and performance of other identified options for Elm High Road are fully understood.

Workshop Conclusions

Table 4.1 reports the outcome of the Review Workshop, indicating which of the options devised (disregarding EH 5) have either been retained or dismissed from further assessment within the study.

Table 4.1: Workshop Conclusions

	Retain	Discard	Comments
EH 1	✓		• Performed well, new layout allowing more vehicles to pass through the roundabout • Queues and delay are likely to be reduced at the roundabout
EH 1a		✓	• Benefit to EHR north, causes greater issues on remaining arms.
EH 2		✓	• Seen to be a project outside this study (HE)
EH 3		✓	• Relocation adds capacity to roundabout. • Queues and delay are likely to be reduced at all approaches • Signalled junction on Elm High Road blocks access for vehicles originating from Morrison's and residential area
EH 3b	✓		• Relocation adds capacity to roundabout. • Inclusion of changes to Weasenham Lane signal timings alleviates issues shown within Option 3
EH 4	✓		• Amendments to junction layout and signal timings allows more vehicles to pass through the junction • Queues and delays likely to be reduced
EH 7		✓	• Roundabout allows more vehicles to be processed through the junction. • Queues and delays likely to be reduced, aiding Southbound movement on Elm High Road
EH 7a	✓		• Pedestrian crossing cause marginal impact on the overall junction performance, when compared to Option 7; • Slightly more vehicles pass through WHL and Ramnoth Road as greater gaps are created by the crossing signals being called.
EH 9	✓		• Would help facilitate the South Wisbech development site • Would allow more vehicles to be processed through the junction, aiding the southbound movement on Elm High Road.

Each of the options described above are described in turn beneath, the more detailed assessment of retained options is then considered within the next chapter.

Option EH 1

Option 1 proposes to upgrade and enhance capacity at the A47 / Elm High Road Roundabout, whilst retaining the operation as priority control.

An additional lane is added to the entry of both Elm High Road approaches, allowing the following lane allocations; a dedicated left turn lane to the A47 and two ahead lanes. This lane configuration will reflect the demand at the junction as identified within the traffic surveys (see Figures 2.11 to 2.13). Exits of both these approaches are also increased to two lanes.

A third lane is also added to the A47 East approach also allowing a dedicated left turn lane to the Elm High Road south to be facilitated. No changes are made to the A47 West approach during this option, due to the restriction of the pedestrian crossing.

Figure 4.1 beneath shows the proposed layout for this option, highlighting additional improvements to the Elm High Road North approach which is widened to two lanes downstream of the Morrison's Junction.

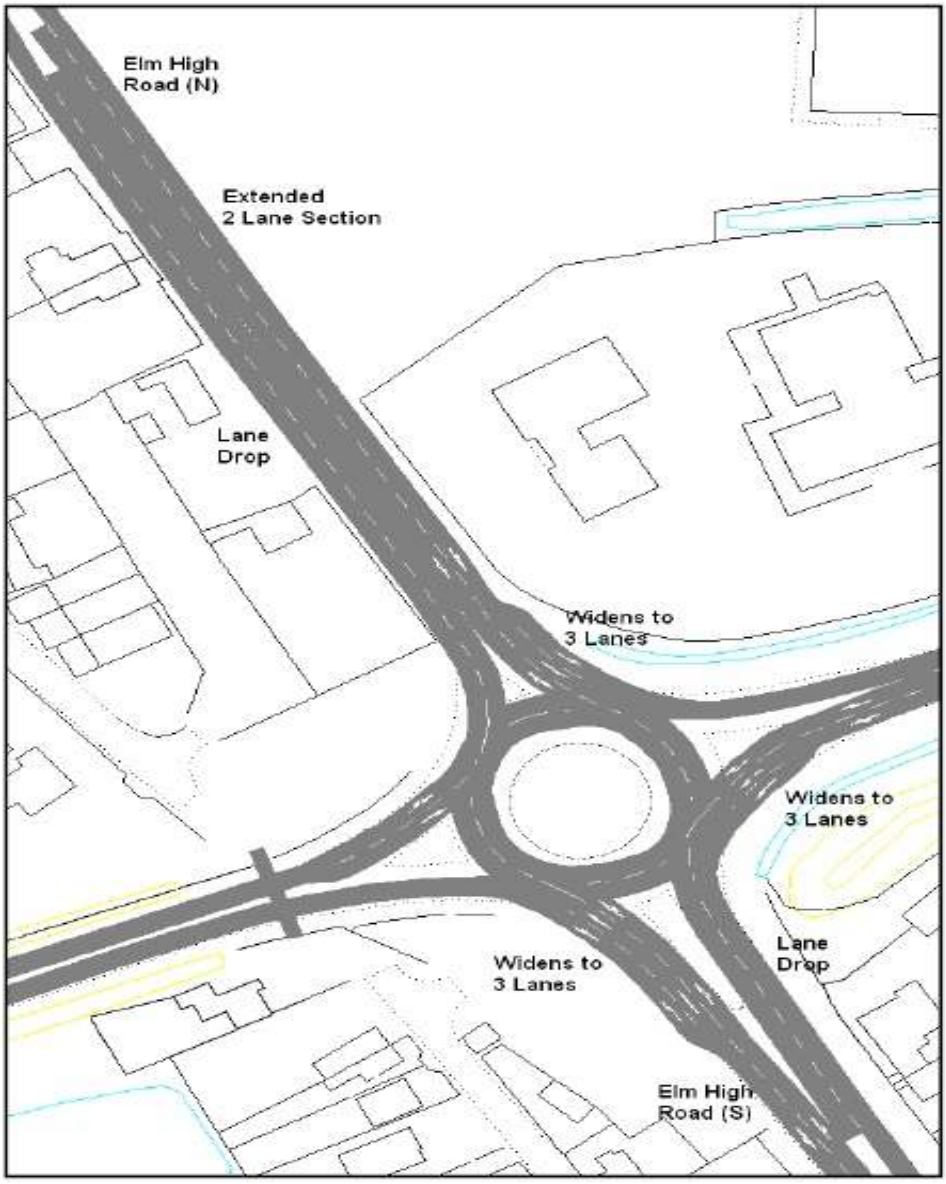


Figure 4.1: Option EH 1 Model Plan

Alongside the layout changes to the A47 / Elm High Road roundabout, changes to the Weasenham Lane / Ramnoth Road signal timings were found to be necessary within initial modelling. Changes in signal timing at this location will enable the junction to remain within capacity despite higher traffic flows, as more vehicles are processed northbound from the A47 roundabout.

Workshop Comments

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

Table 4.2: Option EH 1 Workshop Discussion

Strengths	Weaknesses
• Retains and enhances the existing roundabout infrastructure	• Significant disruption is likely to occur during construction
• Enhancements to geometry increases capacity on all approaches to assist traffic flows	• Junctions on the wider network may be impacted because of this scheme, such as Weasenham Lane
• Enhancements will reduce delay on the A47 trunk road	
• Pedestrian facility between Elm High Road North and South approaches is retained	
• Improvement to a congestion hotspot within the town centre	

Option Outcome

This option has been **shortlisted** for further progression within the study, on the basis of:

- Sound future year assessments, with enhancements improving a congestion hotspot junction;
- Improvements expected at Weasenham Lane junction which will aid development growth at the Wisbech South Development South site, and;
- Pedestrian facilities between Elm High Road North and South maintained.

Option EH 1a

This option is a sensitivity test of Option 1, which proposes to enhance capacity on the Elm High Road North approach of the A47 Roundabout only.

The purpose of assessing this option is to determine whether the proportion of benefit found in Option 1 (when travelling southbound toward the roundabout), could be retained without amending the geometry of the remaining roundabout approaches (e.g. A47 East and Elm High Road South).

This option therefore considers a lower costing option that has less network disruption associated with it, when compare to the original Option 1.

Improvements to Elm High Road North are the same as described above for Option 1, and shown in Figure 4.1

Workshop Comments

Table 4 3 below highlights the strengths and weaknesses associated with this option.

Table 4.3: Option EH 1a Workshop Discussion

Strengths	Weaknesses
• Requires minimal infrastructure changes to deliver this scheme	• Fewer benefit associated with the option when compared to Option 1
• Changes to this approach will reduce congestion southbound	• Significant disruption is likely to occur during construction
• Cheaper scheme to implement	• Junctions on the wider network may be impacted because of this scheme, such as Weasenham Lane

Option Outcome

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

- Weaker benefit to the roundabout when compared to Option 1A, and;
- Initial assessment shows greater impact on the wider network and congestion hotspot areas of the A47 roundabout and Weasenham Lane Junction.

Option EH 2

This option proposes to upgrade the pedestrian facility positioned on the A47 West approach to the A47 / Elm High Road roundabout. The existing signalised crossing, located 30 metres from the circulatory stop line, will be replaced with a raised footbridge within this option.

Workshop Comments

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

Table 4.4: Option EH 2 Workshop Discussion

Strengths	Weaknesses
• Improves pedestrian access across the A47	• Does not address traffic issues such as congestion and delay within the study

Option Outcome

Option 2 was **discarded** from further progression within the study, on the basis that the pedestrian facility is positioned on the A47 trunk road and therefore beyond the scope of the Wisbech Access Study.

Despite this option upgrade being discarded, the existing infrastructure of the pedestrian crossing has been included within modelling work for shortlisted options such as Option EH 1.

Option EH 3

Option 3 proposes to relocate the A47 / Elm High Road roundabout approximately 630 metres to the east of its existing location. The new site is unconstrained allowing the construction to facilitate increased capacity as required.

The new relocated roundabout will be enlarged to a 44 m ICD, allowing capacity to be increased on all four approach arms through the addition of two lane entries and exits. All approaches will be reduced back to a single lane, with the length of tapers being 250 m for the A47 approaches, 150 m for Elm High Road North and 100 m for Elm High Road South.

The A1101 Elm High Road North and South approaches will be facilitated by new link roads that will connect to the existing network, via a signalised junction (upstream of Morrison's) on Elm High Road North and a priority junction on Elm High Road South.

Within this option the existing roundabout infrastructure will be completely removed, with access to the A47 blocked from the existing Elm High Road North and South approaches. These current approaches will be maintained for residential access only, and in the case of Elm High Road North for commercial access at the Morrison's site.

Figure 4.2 shows the model plan for this option, whereas Figure 4.3 highlights the proposed design for the signalised junction positioned on Elm High Road North.

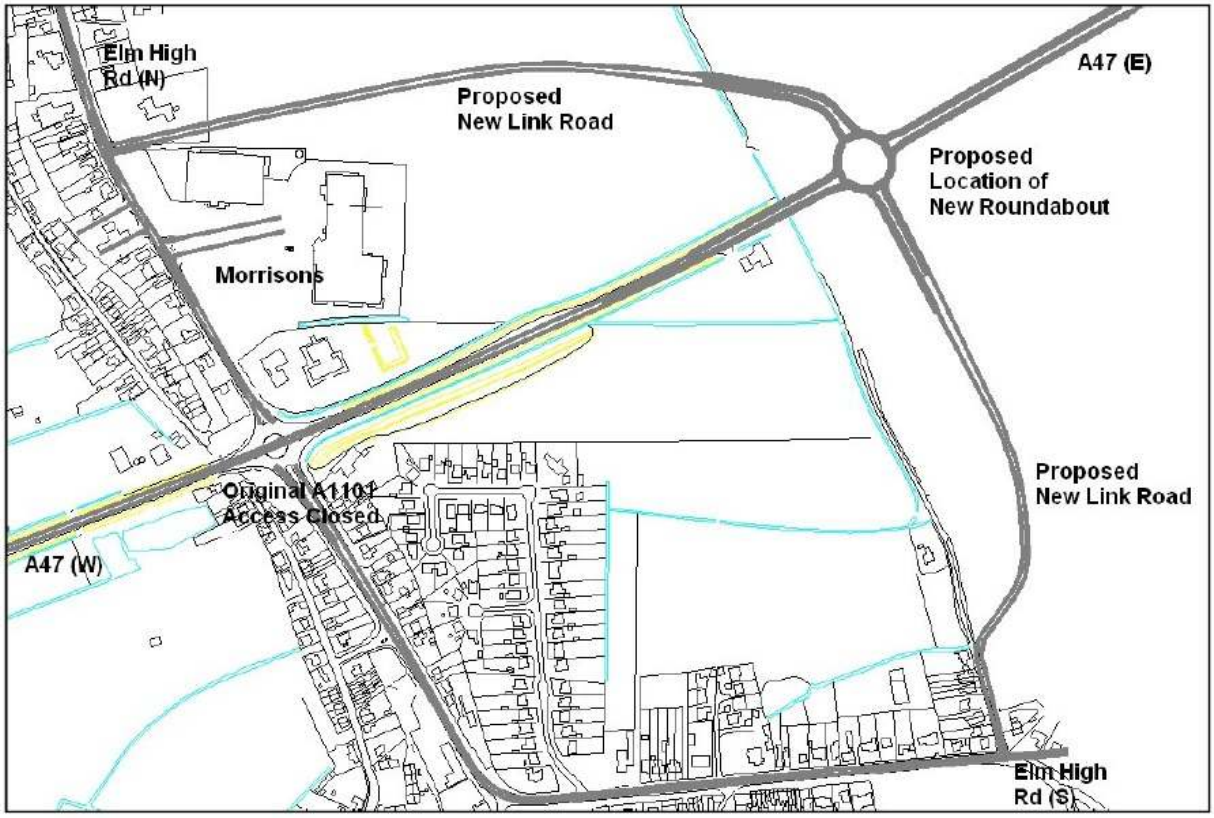


Figure 4.2: Option EH 3 Model Plan

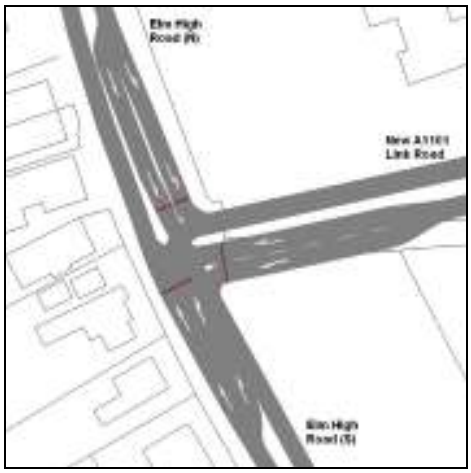


Figure 4.3: Option EH 3 Model Signalised Junction Plan

Workshop Comments

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

Table 4.5: EH Option 3 Workshop Discussion

Strengths	Weaknesses
• Enlarged roundabout allows for increased capacity likely to reduce junction delay and congestion	• Land take is required for the scheme
• Not constrained by existing development and site location	• Improvement schemes are required at Weasenham Lane junction with this scheme implemented
• Current approaches will be retain for local and commercial traffic only	• Diversion for vehicles travelling north or south on the A1101 are required within this scheme
• Future proofing – this option would be able to facilitate additional development growth in upcoming years	• Higher cost estimate than when compared to EH 3A.
	• Signals coupled with heavy southbound traffic along Elm High Road, creates queues and block back for vehicles originating from Morrison's and residential areas on lower Elm High Road

Option Outcome

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

- Fewer benefit and a higher estimated cost when compared to Option EH 3a, which offers a variation of this option.

Option EH 3b

This option is a sensitivity test of Option 3, which proposes to relocate the A47 / Elm High Road roundabout approximately 300 metres to the east of its existing location.

In addition to the location of the roundabout being closer to the existing location, geometry changes to this option include a 45 m ICD and longer flares and merges. Signal timings at the Weasenham Lane junction will utilise the timings used within EH Option 1.

The layout of new link roads and new network junctions for the Elm High Road approaches remains as shown within Option 3.

Figure 4.4 beneath shows the change in roundabout location.

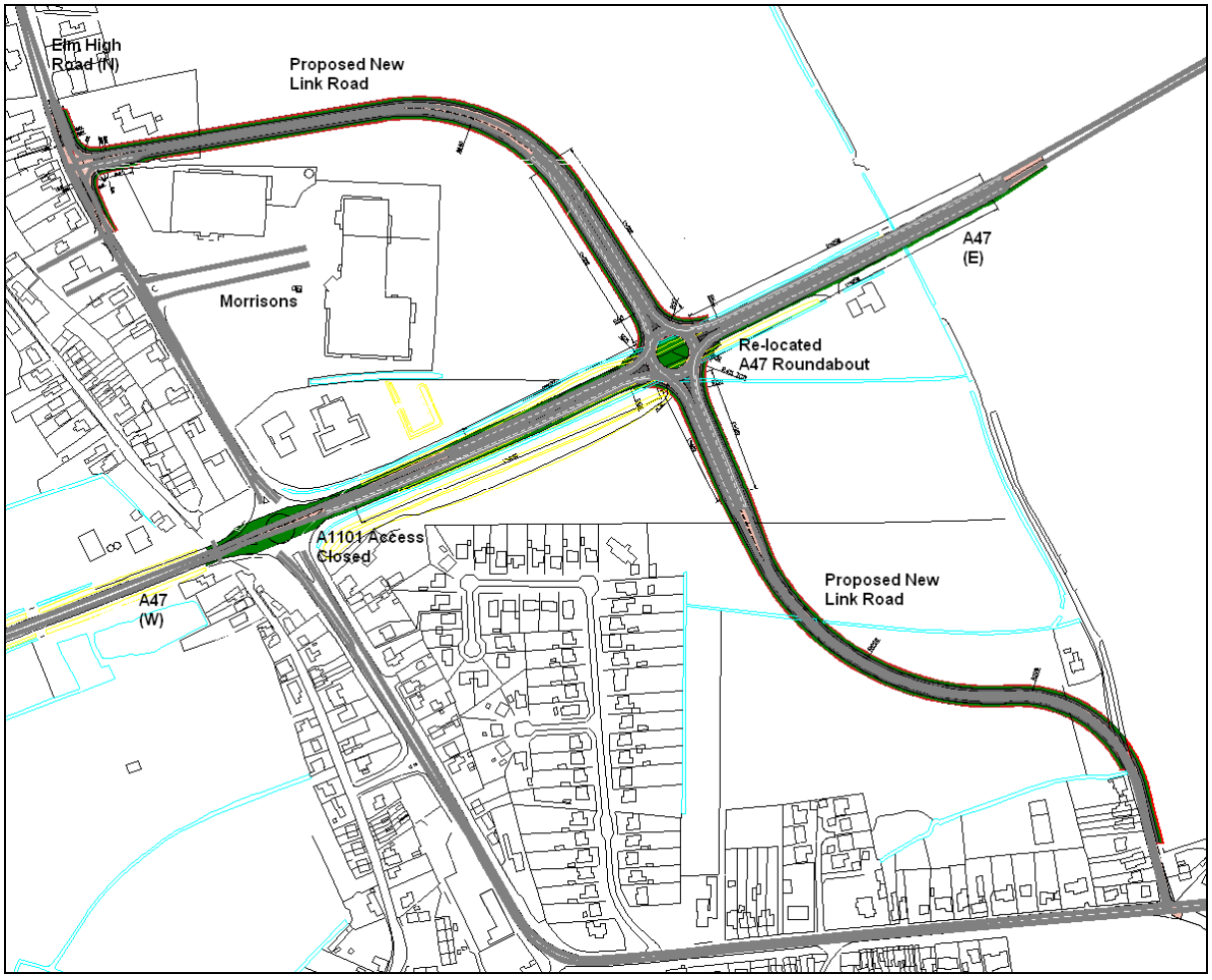


Figure 4.4: Option EH 3b Roundabout Positioning

Workshop Comments

Table 4.6 below highlights the strengths and weaknesses associated with this option.

Table 4.6: Option EH 3b Workshop Discussion

Strengths	Weaknesses
• Enlarged roundabout allows for increased capacity likely to reduce junction delay and congestion	• Improvement schemes are required at Weasenham Lane junction with this scheme implemented
• Not constrained by existing development and site location	• Diversion for vehicles travelling north or south on the A1101 are required within this scheme
• Current approaches will be retain for local and commercial traffic only	• Land take required
• Future proofing – this option would be able to facilitate additional development growth in upcoming years	

Option Outcome

This option has been **shortlisted** for further progression within the study, on the basis of:

- Good initial results highlighting capacity benefits at a congestion hotspot area, and;
- Will aid improvement at Weasenham Lane junction, therefore unlocking growth for the South Wisbech Development site.

Option EH 4

Option 4 proposes to enhance the capacity at the Elm High Road / Weasenham Lane Junction, through a series of amendments to signal timings, additional lanes and changes in lane allocations. Approaches altered within this option concern Weasenham Lane, Ramnoth Road and Elm High Road South.

An additional Lane (flare 90 m) is added to the Elm High Road South approach, enabling a dedicated lane for left turning traffic destined for Weasenham Lane. This is proposed to alleviate congestion at the traffic signals for the northbound traffic. The signal timings for the left turn lane will be incorporated into the same phase as the ahead movement, reflecting the existing conditions on site.

Capacity enhancements for Weasenham Lane concerns the change in lane allocation for right turners. The nearside lane will be for vehicles travelling to Ramnoth Road, whilst the offside lane will be for Elm High Road traffic.

Changes to Ramnoth road include the nearside lane feeding into a designated left turn lane.

In addition to changes made at this junction, this option also incorporates improvements to the southbound approach to the A47 roundabout, as shown in Option EH 1.

Figure 4.5 on the following page shows the model plan, including lane allocations for this option.

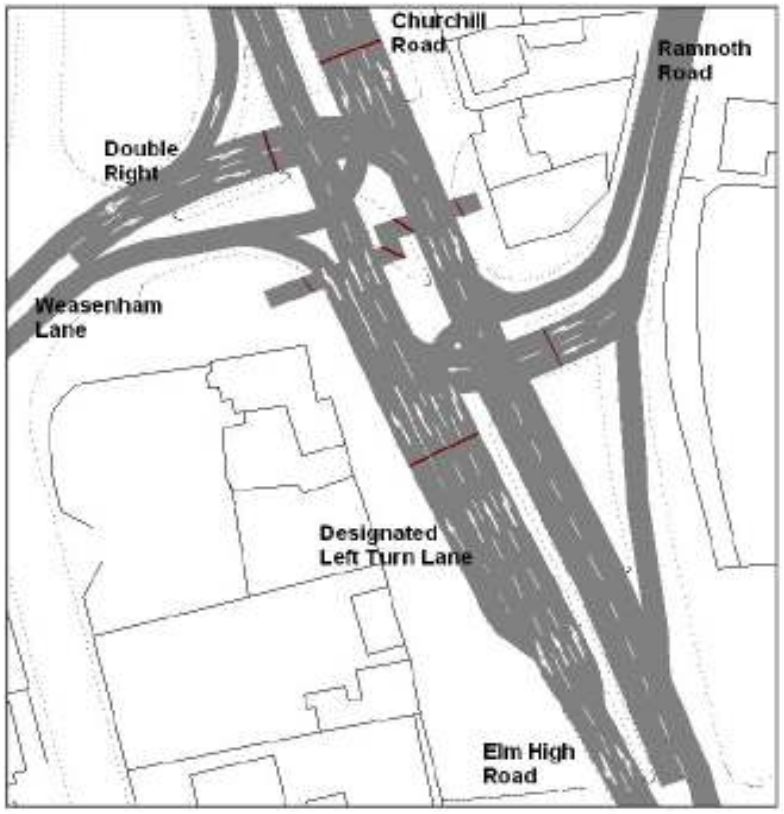


Figure 4.5: Option EH 4 Weasenham Lane Model Plan

Workshop Comments

Table 4.7 below highlights the strengths and weaknesses associated with this option.

Table 4.7: EH Option 4 Workshop Discussion

Strengths	Weaknesses
• Approach amendments allow for change in lane allocations and greater capacity	• Impact on streetscape and public realm
• Pedestrian crossings are retained	• Greater movements across the junction for pedestrians
• Largely uses the existing infrastructure and Highway boundaries	

Option Outcome

This option has been **shortlisted** for further progression within the study, on the basis of:

- That is considered alongside schemes improving the A47 roundabout;
- Improvements expected at Weasenham Lane junction which will aid development growth at the Wisbech South Development South site, and;
- Pedestrian facilities are maintained across the junction.

Option EH 7

Option 7 proposes to reconfigure the Weasenham Lane junction into a standard four arm priority controlled roundabout.

The design of the roundabout assumes an ICD of 20 metres, with dedicated left turn lanes incorporated within the layout for Weasenham Lane, Ramnoth Road and Elm High Road South approaches.

Access from Elm Road onto Weasenham Lane is assumed to be closed within this option, enabling a longer left turn slip road to the stop line. In addition, an extended merge for Churchill Road northbound traffic is enabled within this option.

Pedestrian crossings have been removed within this option.

Figure 4.6 beneath highlights the model plan for this option

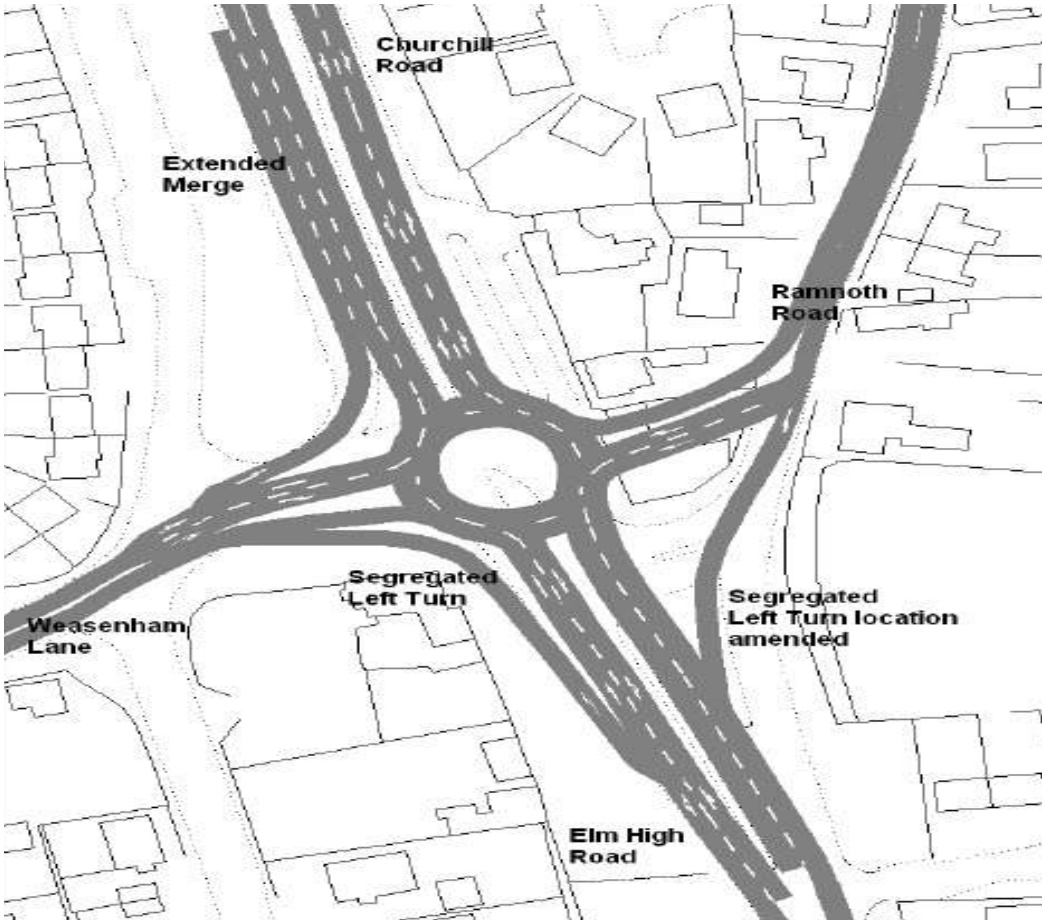


Figure 4.6: Option EH 7 Weasenham Lane Roundabout Model Plan

Workshop Comments

Table 4.8 below highlights the strengths and weaknesses associated with this option.

Table 4.8: Option EH 7 Workshop Discussion

Strengths	Weaknesses
• Layout changes increases capacity for all approaches, enabling more vehicles to be processed through the junction	• Reduces accessibility for pedestrians
• Improvements to the junction will help facilitate traffic growth of the South Wisbech Site	• Impact on street scape and public realm
• Segregated left turns likely to reduce congestion and delay along the corridor	• Demolition required for this option to be viable

Option Outcome

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

- Greater benefits were shown in the sensitivity test of this Option, see Option 7a below, and;
- The removal of pedestrian facilities within the option.

Option EH 7a

A sensitivity test of Option 7 that was developed during the Review Workshop. This option includes a series of changes as described below:

- Reintroducing pedestrian facilities at the junction, including signalised crossings on Churchill Road and Elm High Road, and an informal crossing on Ramnoth Road;
- Increased size of the roundabout's ICD to 38 m;
- The removal of the segregated left turn lanes from all approaches; and,
- Geometry changes are made to the Elm High Road North approach to the A47 roundabout, as per Option EH 1.

Figure 4.7 on the following page shows the model plan for Option EH 7a.

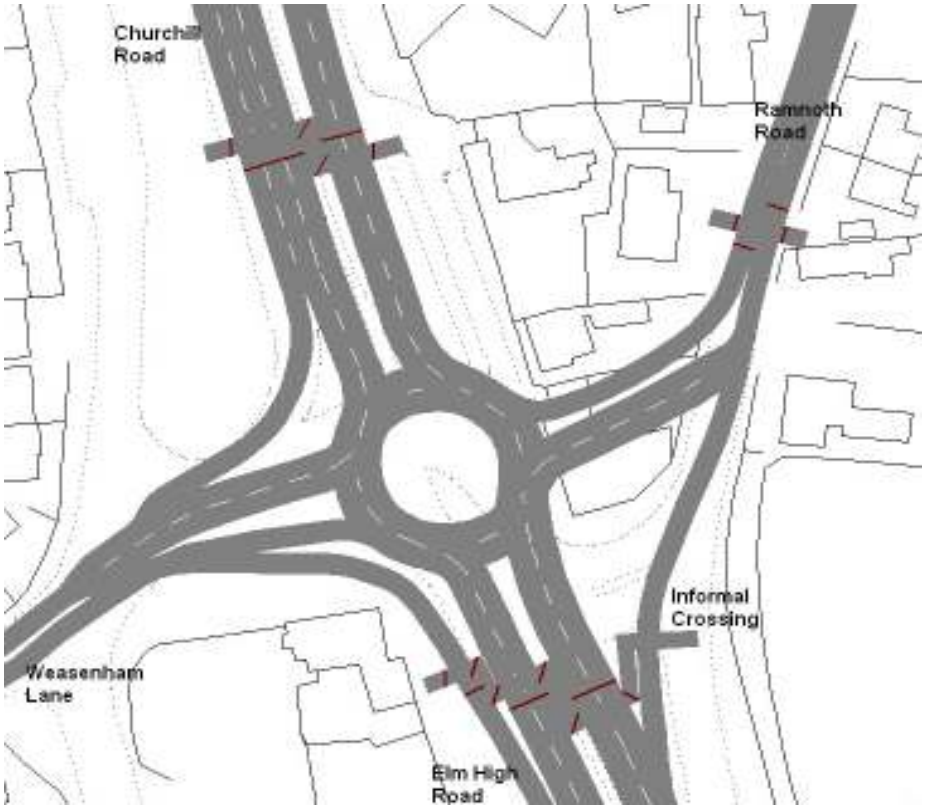


Figure 4.7: Option EH 7a Weasenham Lane Roundabout / Pedestrian Facility Model Plan

Workshop Comments

Table 4.9 below highlights the strengths and weaknesses associated with this option.

Table 4.9: Option EH 7a Workshop Discussion

Strengths	Weaknesses
• Increased capacity on all approaches, enables more vehicles to be processed through the junction	• Impact on street scape and public realm
• Junctions improvements help facilitate South Wisbech traffic	• Demolition required for this option to be viable
• Segregated left turns likely to reduce congestion and delay along the corridor	
• Improved pedestrian facilities on all approaches	

Option Outcome

This option has been **shortlisted** for further progression within the study, on the basis of:

- Inclusion of pedestrian crossings provides benefit, despite delays being marginally increased due to signals when compared to Option 7, and;
- Improvements expected at Weasenham Lane junction which will aid development growth at the Wisbech South Development South site.

Option EH 9

Option EH 9 introduces a scheme to upgrade the current Weasenham Lane Junction and Ramnoth Road connection, by forming two separate signalised junctions within close proximity to each other. The layout of this option has been developed as part of a housing proposal which lies outside of this study.

The design of this option is shown within Figure 4.8 below, with key changes to the junction as follows:

- Ramnoth Road is re-aligned and joing Elm High Road further south, forming a new signalised junction;
- The left turn movment from Ramnoth Road as well as the pedestrian crossing are both incorporated into the signal timings of the Ramnoth Road signalled approach; and;
- Lane allocations for Churchill Road are altered, providing a single ahead lane and single left lane.

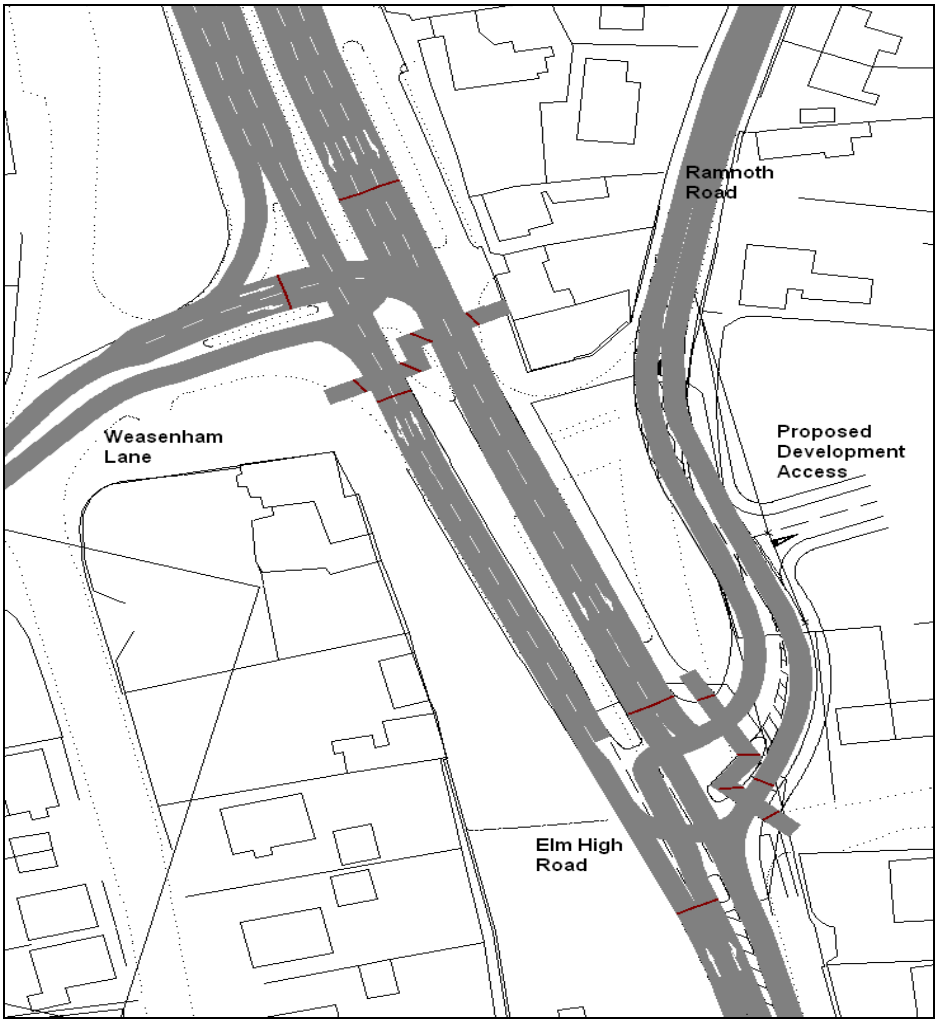


Figure 4.8: Option EH 9 Weasenham Lane Staggered Signalised Junction Model Plan

It should be noted that improvements to the Elm High Road North approach to the A47 roundabout (Option EH 1) are required alongside this option.

Workshop Comments

Table 4.10 below highlights the strengths and weaknesses associated with this option.

Table 4.10: Option EH 9 Workshop Discussion

Strengths	Weaknesses
• Junctions improvements are likely to help facilitate South Wisbech site	• Would require improvement to the A47 Roundabout
• Improved pedestrian facilities on all approaches	• Change in lane allocations on Churchill Road is likely to create issues of congestion and poor driver behaviour
• Limited impact on street scape within this location	• Inclusion of pedestrian crossings within signal timings likely to create queue backs
	• Signals on Weasenham lane could block access for left turners off Weasenham Lane, creating congestion delay for this approach

Option Outcome

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

- Initial assessments show little benefit is provided to the overall operation of the junction, with issues being present on Weasenham Lane; and,
- There are two other schemes assessed at this location, which operate better and have a greater number of benefits attached.

Option Development Summary

Based on the Option Review Workshop, and the results from the transport modelling which is discussed in further detail in the next chapter, the following schemes have been retained for inclusion within the study:

- EH 1;
- EH 3b;
- EH4, and;
- EH 7a.

It should be noted that assessment results have showed a relationship between the operation at Weasenham Lane Junction and the A47 roundabout, with each location being influenced by the operation / condition of the other junction. With this said schemes at either of these locations will include minor changes to address issues at the adjacent junction.

For example; Options EH 4 and 7a include changes to the Elm High Road North approach of the A47 roundabout (EH 1), as this aids the flow of traffic at Weasenham Lane, and Option EH 1 for the A47 roundabout includes changes to signal timings at Weasenham Lane Junction.

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 the option selection.

The operational performance for each of the shortlisted options identified in the previous chapter (EH 1. EH 3b, EH 4 and EH 7a) have been summarised within this chapter. Further detail on the model development, and full results outputs are provided in the Elm High Road Option Assessment Technical Note contained within Appendix A.

Additional model summaries of dismissed options can also be found in Appendix A.

Modelling Assessment

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

Modelling assessments for these schemes have been conducted using the 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 the Wisbech VISSIM Model Validation can be found within the 'Wisbech VISSIM Model LMVR Report'.

Modelled Scenarios

The following scenarios have been assessed for all options for both the AM and PM peak hours, for the forecast years of 2021, 2026 and 2031:

- Do Minimum Scenario, and;
- Do Something (with scheme).

The initial option assessment was undertaken using two sets of traffic flows for both the Do Minimum and Do Something scenarios, to represent the impact of changes beyond the model network. These traffic flows sets were:

- Without Western Link Road (w / out WLR), and;
- With Western Link Road (with WLR).

The purpose of this was to ensure that the options being assessed were still able to provide benefit, and operate efficiently, in both scenarios as there was still some uncertainty over the delivery of the Western Link Road at that stage of the study.

However, work undertaken on the development of the WLR (see the Western Link Road Option Assessment Report) provided further clarity on the development and phasing of the link road, which was reflected in the reassessment of these options using the new WATS model (November 2015). This work identified that the WLR was not required in its entirety before 2031, and consequently the reassessment of the new options across the whole study was undertaken on traffic flows that did not include the WLR (w/out WLR) to ensure that they could operate without the diversionary benefits that the WLR was expected to deliver.

Therefore the following option summaries only include the 'W/out WLR' scenario.

Option Summaries

Results for each of the shortlisted options are discussed in turn below. Please note, the following colour coding has been used to highlight the difference in scheme operation over the forecasted years;

- Green: No issues, scheme operates within capacity;
- Yellow: Scheme operates close to capacity, either one approach or junction overall. Or, if a schemes performance is constrained by the need for improvements at an adjacent junction; and,

Red: Scheme operates at / overcapacity, either one approach or junction overall.

Option EH 1

Table 5.1: Option EH 1 Result Summary

	Without WLR		
	2021	2026	2031
AM Peak	All approaches to Rbt operating within capacity, except A47 (W) which is over capacity, although delays reduced. Overall LOS E. Largest improvement at Elm High Road (S) approach.	A47 (W) and Elm High Road (S) operating over capacity. Overall junction LOS F. More traffic processed northbound which queues back from Weasenham Lane blocking the roundabout.	A47 (W) and Elm High Road (S) operating over capacity, A47 (E) operating at caapacity. Overall junction LOS F. More traffic processed northbound which queues back from Weasenham Lane blocking the roundabout earlier on than 2026.
PM Peak	Rbt operates over capacity with LOS F. A47 (W) approach still over capacity as no changes have been made to the approach. Largest improvement at Elm High Road (N) approach which significantly improves Weasenham Lane jct performance.	A47 (W) approach over capacity. Overall Junction LOS F. Largest improvement at Elm High Road (N) and A47 (E) approaches which significantly improves Weasenham Lane jct performance.	Two A47 approaches operating over capacity. Elm High Road (N) has the largest improvement. Junction LOS F.

The main benefit of this option concerns the improved operation of the Elm High Road North approach, which removes southbound congestion along the corridor, which in turn improves the performance of Weasenham Lane Junction as a greater number of vehicles are able to exit the Weasenham Lane approach. This benefit is shown across all scenarios assessed.

In the AM peak, junction improvements allow more traffic to be processed northbound from Elm High Road South approach. Despite this benefiting this approach, it does however result in longer queues on the corridor extending back from Weasenham Lane. To address this issue of higher northbound demand, alterations were made to the signal timings allowing more green time for the Elm High Road South approach to the junction.

The A47 (W) approach is shown to operate over capacity across both peak hours, as no alterations to the approach are being made. Queue backs on this approach will impact the operation of the adjacent Cromwell Road roundabout.

Therefore, the conclusions from this assessment is that any improvements made to the roundabout, must be alongside an improvement scheme at Weasenham Lane Junction and on the A47 West approach.

Option EH 3b

Table 5.2: Option EH 3b Result Summary

	Without WLR		
	2021	2026	2031
AM Peak	All approaches to new Rbt operating within capacity and delays reduced. A47 (W) is at capacity. Overall LOS C. Queues can extend along the new Link Road from Weasenham Lane.	A47 (W) and Elm High Road (S) operating over capacity as a result of queuing back from Weasenham Lane, blocking the roundabout. Overall LOS F.	A47 (W) and Elm High Road (S) operating over capacity as a result of queuing back from Weasenham Lane, blocking the roundabout. A47 (W) performs worse than the DM. Overall LOS F.
PM Peak	All approaches to new Rbt operating well within capacity and delays reduced. Overall LOS C.	All approaches to new Rbt operating better than the DM. Overall LOS D. Processes significantly more traffic than DM.	All approaches to new Rbt operating well within capacity and delays reduced. Overall LOS C.

The relocation and enhancement of the A47 roundabout to the east of its existing location, helps to improve performance of the junction across all scenarios assessed. Note, that the amber shading indicates that this option is constrained by the operation of Weasenham Lane Junction.

The same constraint of ‘a higher northbound demand’ (as seen in Option EH 1) is shown to be relevant to this option, as more traffic is processed towards Weasenham Lane. This is shown to cause congestion along the Elm High Road North link road, extending back to the new roundabout. This is shown to be an issue for the AM peak hours of 2026 and 2031. The snowball effect associated with queue backs from Weasenham Lane is that the operation of the A47 West approach is decreased, with performance being worse than the Do Minimum scenario.

In the PM peak hour the roundabout is predicted to operate within capacity in all forecast years and performs better than the DM for all approaches, apart from the Elm High Road North approach in 2026 which performs marginally worse than the Do Minimum scenario.

The conclusion of this assessment is to combine this option with upgrades to Weasenham Lane Junction.

Option EH 4

Table 5.3: Option EH 4 Result Summary

	Without WLR		
	2021	2026	2031
AM Peak	All approaches to junction close to capacity with LOS D. Weasenham Lane is significantly better.	Ramnoth Road operating over capacity, but all arms performing better than Opt 1. LOS E overall.	Junction performs better than Opt 1 for all approaches, but still operating over capacity with LOS F.
PM Peak	All approaches operating within capacity and delays reduced. Overall LOS C. Churchill Rd performing marginally worse than Opt 1.	All approaches to new junction operating within or close to capacity and delays reduced. Overall LOS D.	All approaches to new junction operating within or close to capacity and delays reduced. Weasenham Lane operating at capacity with LOS E. Overall LOS D.

In order to quantify benefits for this scheme, it was necessary to incorporate the improvements to the Elm High Road Southbound approach to the A47 roundabout, see EH 1. Therefore, the results shown in Table 5.3 above have been compared back to the Option 1 results for this junction to provide a better understanding of benefits.

Results for the AM peak hour show all approaches are forecast to perform better than Option 1 in all years, although by 2031 the junction is forecast to operate over capacity.

The PM peak hour results show the junction operates within capacity in all years, but the Churchill Road approach is marginally worse than Option 1 in 2021 and 2031, and that Ramnoth Road performs worse in 2031 as a result of more traffic being processed from Weasenham Lane due to the introduction of the double right turn facility.

Option EH 7a

Table 5.4: Option EH 7a Result Summary

	Without WLR		
	2021	2026	2031
AM Peak	All approaches to new Rbt operating well within capacity. Overall LOS A.	All approaches to new Rbt operating well within capacity. Overall LOS B.	All approaches to new Rbt operating well within capacity. Overall LOS B.
PM Peak	All approaches to new Rbt operating well within capacity. Overall LOS B.	All approaches to new Rbt operating well within capacity. Overall LOS C. The Ramnoth Road left slip is at capacity as a result of the increased throughput of traffic from Churchill Road and Weasenham Lane.	All approaches to new Rbt operating well within capacity. Overall LOS C. The Ramnoth Road approach and left slip is at capacity as a result of the increased throughput of traffic from Churchill Road and Weasenham Lane.

Results for this option show that converting the signalised junction at Weasenham Lane significantly improves the performance of the junction, with the junction predicted to operate well within capacity across all scenarios assessed.

AM peak hour results show the Junction is predicted to operate under a LOS category A or B, which indicated free flowing traffic.

In the PM peak hour in 2026 and 2031, it should be noted that the operation of the Ramnoth Road approach is operating at capacity as a result of giving way to more vehicles being processed from Churchill Road and Weasenham Lane.

With a greater proportion of traffic being processed southbound from Weasenham Lane junction, improvements included within this option at the southbound approach to the A47 roundabout, enable the operation of the A47 roundabout to remain within capacity.

Concept Highway Designs and cost estimates of these four shortlisted options are detailed within the following chapter.

6 Concept Highway Design

Introduction

This chapter outlines the Concept Highway Design and cost- estimate for the preferred options 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, Options EH 1, EH 3b, EH 4 and EH 7a were the preferred options progressed to the concept design stage of the Wisbech Access Study.

The descriptions below provide a summary of each option:

- **EH 1** – Proposed upgrade and capacity enhancement of the A47 / Elm High Road Roundabout. A series of geometry amendments to the Elm High Road North / South and A47 East approaches, as well as changes to signal timings at Weasenham Lane;
- **EH 3 –** Proposed relocation of the A47 / Elm High Road Roundabout approximately 300 metres to the east of the existing location. New link roads for the A1101 approaches as well as changes to Weasenham Lane junction signal timings are included within this option ;
- **EH 4** – Proposed upgrade and capacity enhancement of the Elm High Road / Weasenham Lane Junction, including a series of changes to signal timings, additional lanes and changes to lane allocations. Improvements to the southbound approach to the A47 are also incorporated within this option; and,
- **EH 7a** – Proposed reconfiguration of the Elm High Road / Weasenham Lane Junction from signals to a standard four arm priority controlled roundabout. Improvements to the southbound approach to the A47 roundabout are included within this option.

Design Assumptions and Input Decisions

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

All schemes have been designed using the Manual for Streets 1 & 2 alongside the Cambridgeshire Estate Road specification. Scheme assumptions concerning geometric parameters alongside capacity decisions have been informed by the assessment work described earlier within this report.

The design assumptions made for each of the options are identified beneath:

Option EH 1

- Lane widths of 3 metres are in accordance with DMRB and CCC guidelines;
- Circulatory island is to remain, and;
- Land take required on the north and south arms.

Option EH 3b

- Roundabout ICD chosen to match existing adjacent roundabouts along the A47;
- Location, lane requirements and signal controls for additional new junction advised by the modelling team, and;
- Land take required in gardens, agricultural land and OS indicated woodlands.

Option EH 4

- 3 metre lane widths assumed;
- Elm Low Road access to be stopped with physical measures to prevent authorised access, and;
- Junction re-designed to the south by approximately 5 metres, to shorten inter-greens and improve junction efficiency.

Option EH 7a

- Existing site constraints means deflection is below standard, although relaxations or departures could be approved and detailed design amendments incorporated to make this work.

The following series of figures show the concept designs for all four of the options described above.

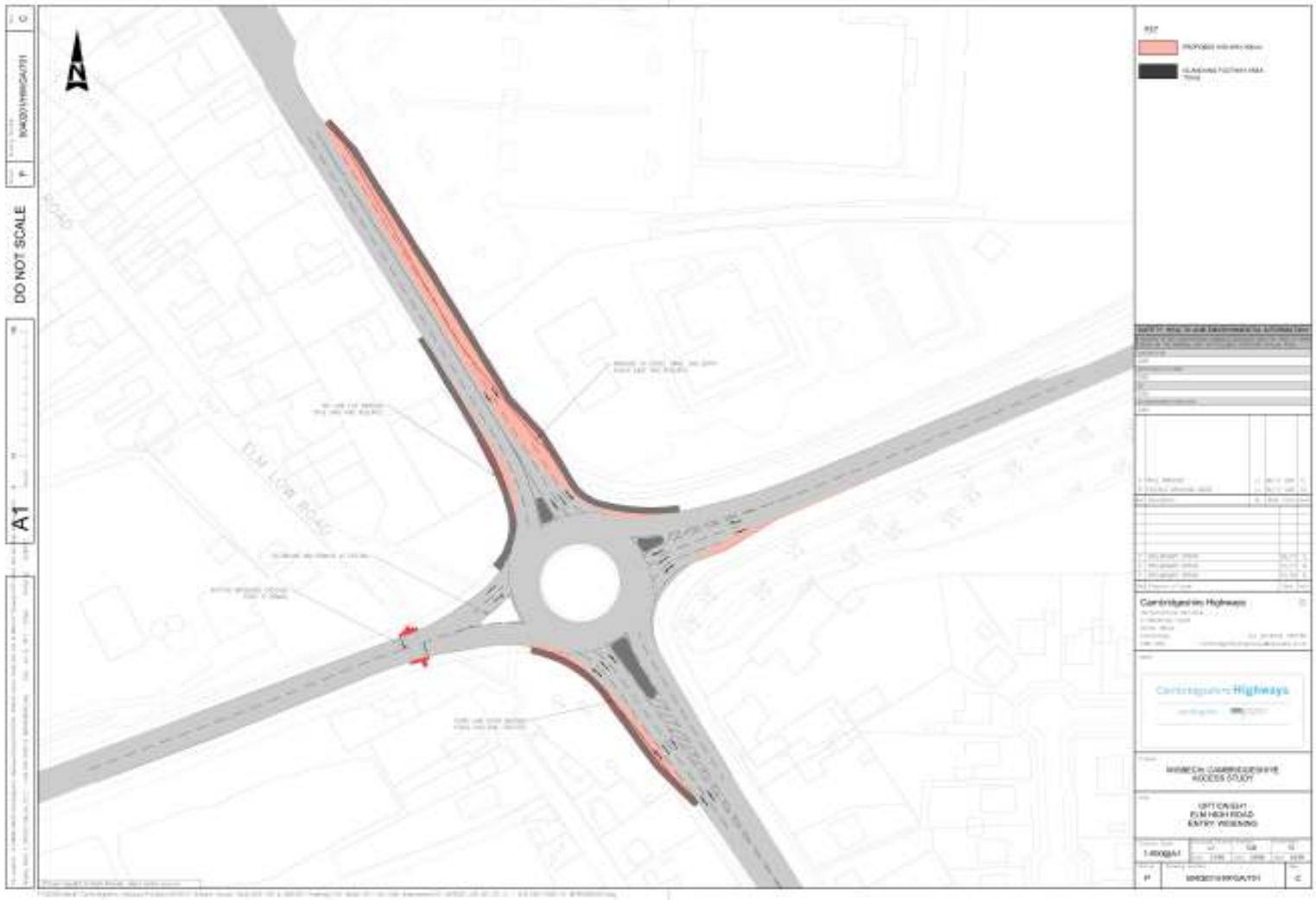


Figure 6.1: Option EH 1 Concept Highway Design

Figure 6.2: Option EH 3b Concept Highway Design

Figure 6.3: Option EH 4 Concept Highway Design

Figure 6.4: Option EH 7a 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 6.5 (EH 1) and Figure 6.6 (EH 3b) below highlights the STATS present within the vicinity of the Elm High Road roundabout.

Table 6.2 and Figure 6.7 (EH 4) and (EH 7a) below highlights the STATS present within the vicinity of the Elm High Road / Weasenham Lane Junction.

The cells highlighted in blue within Table 6.1 and 6.2 indicate the STATS present for within this scheme location.

Table 6.1: STATs Present in for EH 1 and EH 3b

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)

Table 6.2: STATs Present in for EH 4 and EH 7a

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 6.5: Option EH 1 Location STAT Plan

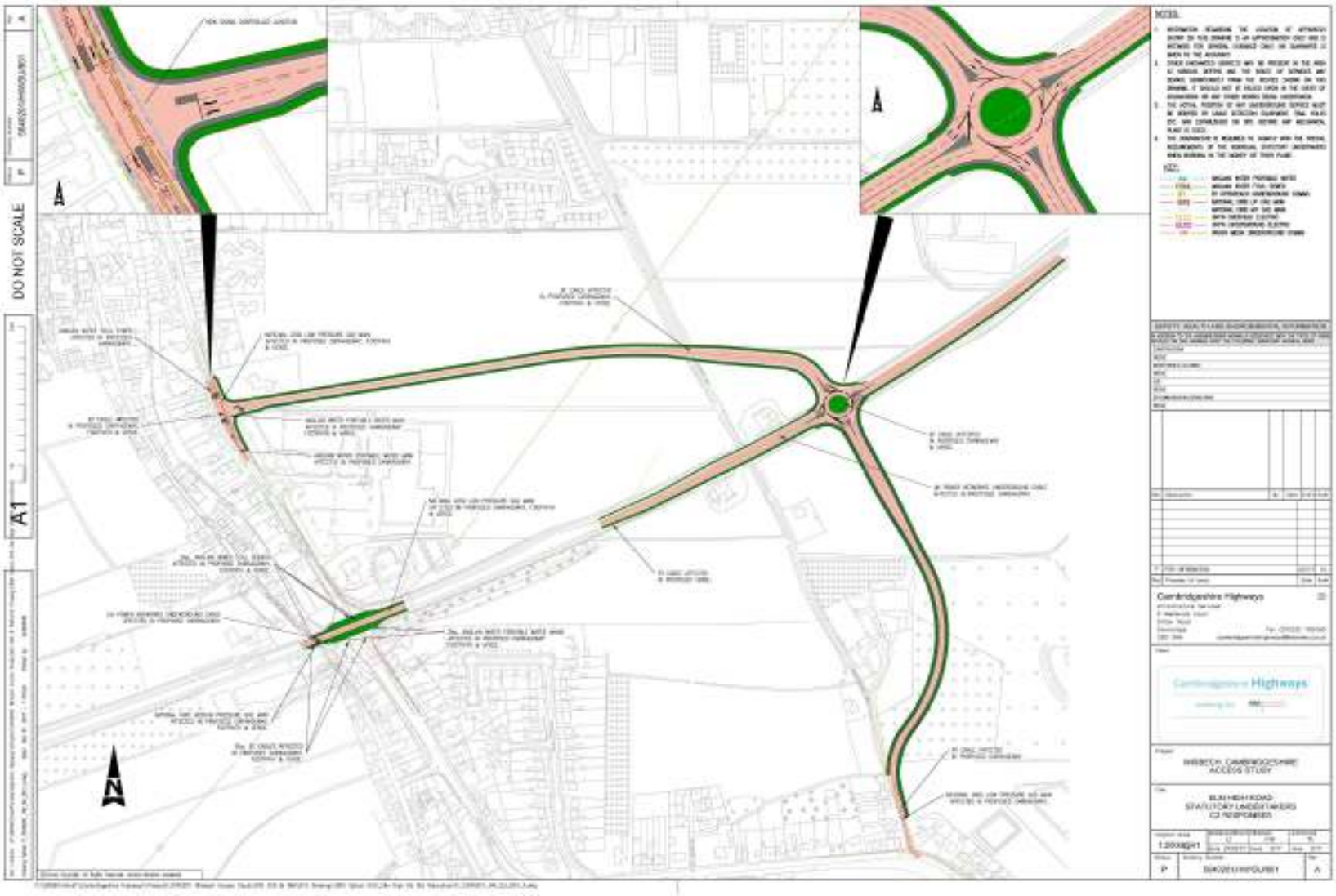


Figure 6.6: Option EH 3b Location STAT Plan

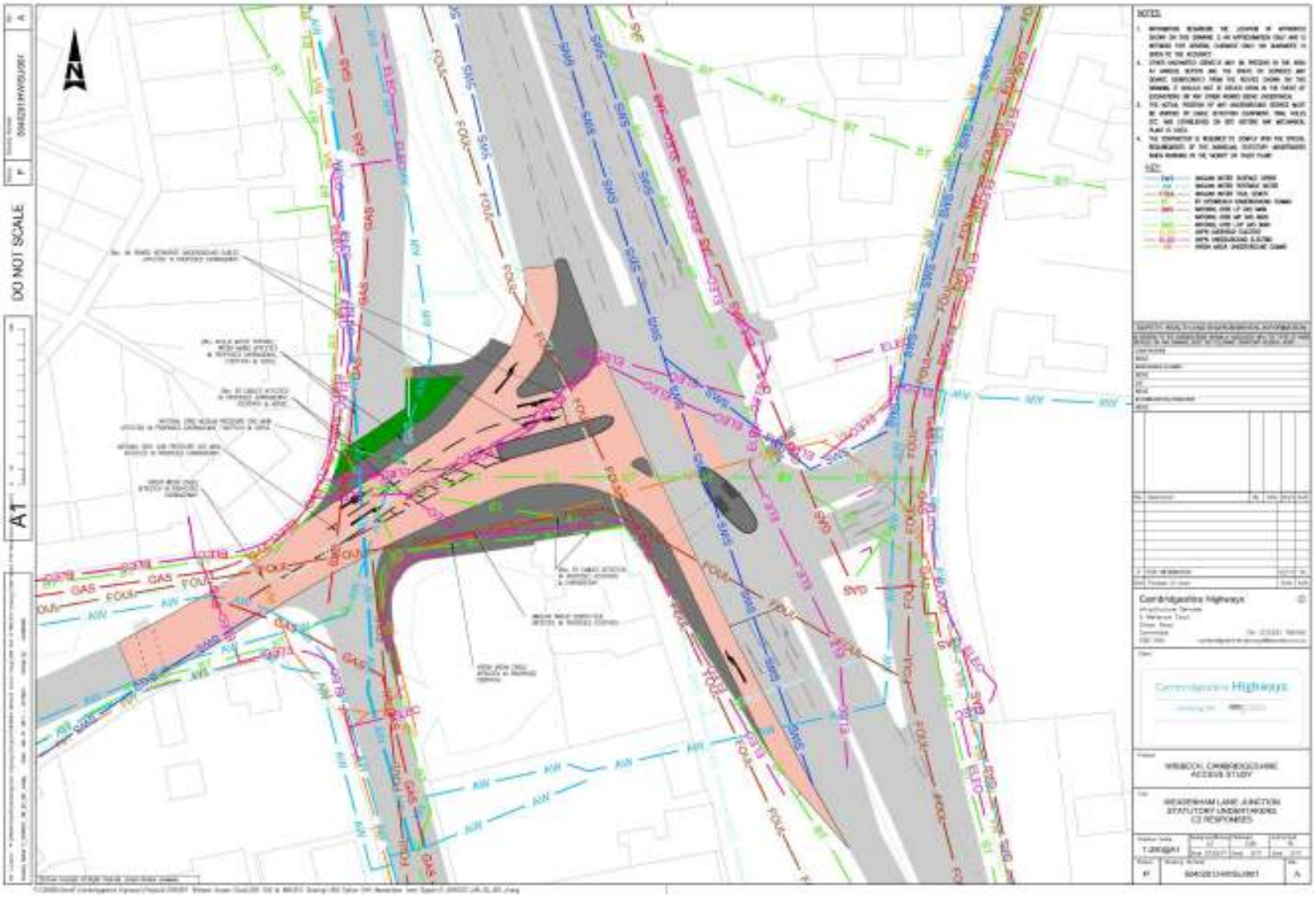


Figure 6.7: Option EH 4 Location STAT Plan

Figure 6.8: Option EH 7a Location 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 does 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.

Road Safety Review comments received from Cambridgeshire County Council for this element of the study concern Option EH 3b (Table 6.3), with options EH 1, EH 4 and EH 7a identified as having 'no significant issues noted'.

Table 6.3: Road Safety Review Comments for Option EH 3b

Road Safety Feedback	Comment
The southern part of Meadowgate Lane is narrow – increased risk to residents of properties along that section	This will be carefully considered during detailed design. The houses will be separated from the road by a footpath and proper vehicle accesses provided. The character of the road at this location is very much that of a village road, and speeds will be restricted to 30mph.
Sweeping curves on southern side could encourage loss of control collisions, similarly the tighter curves on the northern side.	This will be carefully considered during detailed design. The road will be subject to a 30mph speed restriction, super elevation should be introduced and visibility is good in all directions.
2 lanes open out to 4 north and south of proposed roundabout – this will encourage higher speeds. Potential overtaking; loss of control; side swipe accidents.	This is designed based on capacity requirements. Further safety enhancements can incorporated at detailed design stage.
Short merges are an issue	
Fairly straight section on northern side – possible high speeds.	This will be carefully considered during detailed design. The road will be subject to a 30mph speed restriction and appropriately designed to mitigate the risk of speeding.
Narrow traffic lanes at signals – turning movements for large vehicles may be difficult. B&Q/Morrison's etc. on this arm.	This has been assessed for swept paths. Turning movements are possible, although tight. Further variations for this junction are being considered which will negate this issue.
This route appears to go through someone's garden – potential risk to residents.	Land be acquired as part of this scheme. Careful consideration will be given to mitigating the impact of the scheme on residents during the detailed design stage.

Scheme Cost Estimate

Cost estimates have been produced for each of the four shortlisted options, with costs being based on 2017 prices. Inflation for costs within the construction industry is estimated to be at 4 -5 % per annum.

Although considered robust these cost estimates are based on concept level designs, and may alter in the future subject to further information becoming available during later design stages.

The cost estimates include 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 6.4: Option EH 1 Scheme Cost Estimate

Item	Cost
Land Acquisition	£0.00
Demolition	£0.00
Construction	£446,890.00
Design (10% of const. cost)	£45,489.00
Supervision, Site Facilities & Site Fences (20% of const. cost)	£90,978.00
Traffic Management	£160,000.00
Sub Total	**£743,357.00**
Optimism Bias (@45%)	£338,110.65

Table 6.5: Option EH 3b Scheme Cost Estimate

Item	Cost
Land Acquisition	£349,777.50
Demolition	£0.00
Construction	£5,270,805.00
Design (10% of const. cost)	£529,580.50
Supervision, Site Facilities & Site Fences (20% of const. cost)	£1,059,161.00
Traffic Management	£317,500.00
Sub Total	**£7,526,824.00**
Optimism Bias (@45%)	£3,398,320.80
Total	**£10,925,144.80**

Table 6.6: Option EH 4 Scheme Cost Estimate

Item	Cost
Land Acquisition	£0.00
Demolition	£0.00
Construction	£386,375.00
Design (10% of const. cost)	£38,637.50
Supervision, Site Facilities & Site Fences (20% of const. cost)	£77,275.00
Traffic Management	£160,000.00
Sub Total	**£662,287.50**
Optimism Bias (@45%)	£298,029.38
Total	**£960,316.88**

Table 6.7: Option EH 7a Scheme Cost Estimate

Item	Cost
Land Acquisition	£555,000.00
Demolition	£15,000.00
Construction	£1,070,970.00
Design (10% of const. cost)	£107,097.00
Supervision, Site Facilities & Site Fences (20% of const. cost)	£214,194.00
Traffic Management	£132,000.00
Sub Total	**£2,094,261.00**
Optimism Bias (@45%)	£942,417.45
Total	**£3,036,678.45**

7 Summary

Skanska have been commissioned by Cambridgeshire County Council to undertake an assessment of options to improve the operation of the Elm High Road corridor, to the east of the town. This assessment forms the first phase of the Wisbech Access Study.

The purpose of this scheme assessment is to identify a series of junction and carriageway improvements that will unlock capacity on the local network. Key drivers behind investigating this corridor concerns capacity restraints and peak hour congestion, particularly in hotspot areas of the A47 / Elm High Roundabout and Weasenham Lane Junction.

This report has considered the existing conditions along the corridor including traffic flows, queue lengths, journey times/ delay as well as average speeds at key junctions along the corridor including, the approach to Freedom Bridge Roundabout, Weasenham Lane and the A47 roundabout. Accident data, land ownership, flood risk and other ecological considerations are also discussed.

Development proposals for the South Wisbech site, is also discussed within chapter three of this report. Despite the South site not being solely related to Elm High Road, predicted volumes of traffic and the expected impact on Weasenham Lane Junction and lower Elm High Road have been explored.

A summary of the Option Development (March 2016) and the Review Workshop (October 2016) are outlined within Chapter four of this report, whereby the context and procedure of the day is explained. Six options were generated within the initial workshop, focussing on junction improvement to both Weasenham Lane and the A47 /Elm High Road roundabout. Four options were added to during the second review workshop, which were based on sensitivity testing and amendments to original options. The outcome of the workshop was that four options were shortlisted, which included:

- **EH 1** – Capacity enhancements to the existing A47 / A1101 Elm High Road Junction;
- **EH 3b** – Re-locate the A47 / A1101 Elm High Road Junction further to the east and enhance capacity;
- **EH 4** – Amendments to the existing signalised junction of A1101 Elm High Road / Weasenham Lane / Ramnoth Road; and,
- **EH 7a** – Weasenham Lane / Ramnoth Road Junction modelled as a large roundabout.

Assessment results show benefits to each scheme location are achieved within all four options shortlisted. Results shown do vary across the scenarios assessed, as mentioned within Chapter 5 of this report.

It should be noted that assessment results showed a relationship between the operation at Weasenham Lane Junction and the A47 roundabout, with each location being influenced by the operation / condition of the other junction. With this said schemes at either of these locations have included minor changes to address issues at the adjacent junction.

For example; Options EH 4 and 7a include changes to the Elm High Road North approach of the A47 roundabout (EH 1), as this aids the flow of traffic at Weasenham Lane, and Option EH 1 for the A47 roundabout includes changes to signal timings at Weasenham Lane Junction.

For the four options retained for further progression within the study Concept Highway Designs, road safety reviews, STAT reviews and cost estimates are shown within Chapter 6 of this report.

Appendix A – VISSIM Assessment Report

Technical note

Project:	Wisbech Access Study	**To:**	Richard Jones
Subject:	Elm High Road 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 Elm High Road 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.

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.

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

Table 1. Elm High Road Option Testing

Option	Description	Software
1	Capacity improvements to the existing A47 / Elm High Road roundabout	VISSIM
3	Relocation of the A47 roundabout further east and new link road provided	VISSIM
4	Capacity improvements to the existing signalised Weasenham Lane junction	VISSIM
7	Weasenham Lane signalised junction converted to a priority controlled roundabout	VISSIM

The option numbering was developed during the Option Development Workshop held in March 2016. Note that Options 2, 5 & 6 were developed, but not progressed to assessment.

The technical consists of the following sections;

- Methodology;
- Option 1 assessment;
- Option 3 assessment;
- Option 4 assessment;
- Option 7 assessment;
- Option Adjustment:
- Option 1a assessment;
- Option 7a assessment; and,
- Conclusions.

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:

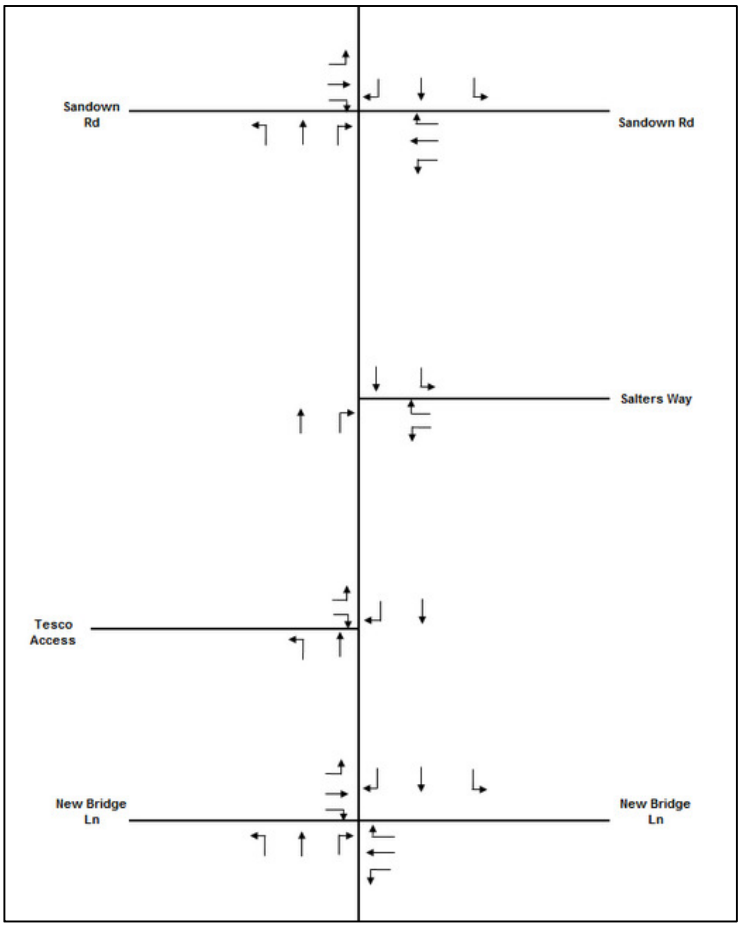
- Turning counts for the VISSIM network were extracted from the 2016, 2021 and 2026 Saturn model (2008 Base);
- The absolute and percentage difference between SATURN modelled 2016 and each future year were calculated;
- The percentage difference for each future year was then applied to the VISSIM 2016 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:

- 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 1 shows the network structure along Cromwell Road, for the above accesses.

Figure 1. Junction locations along Cromwell Road

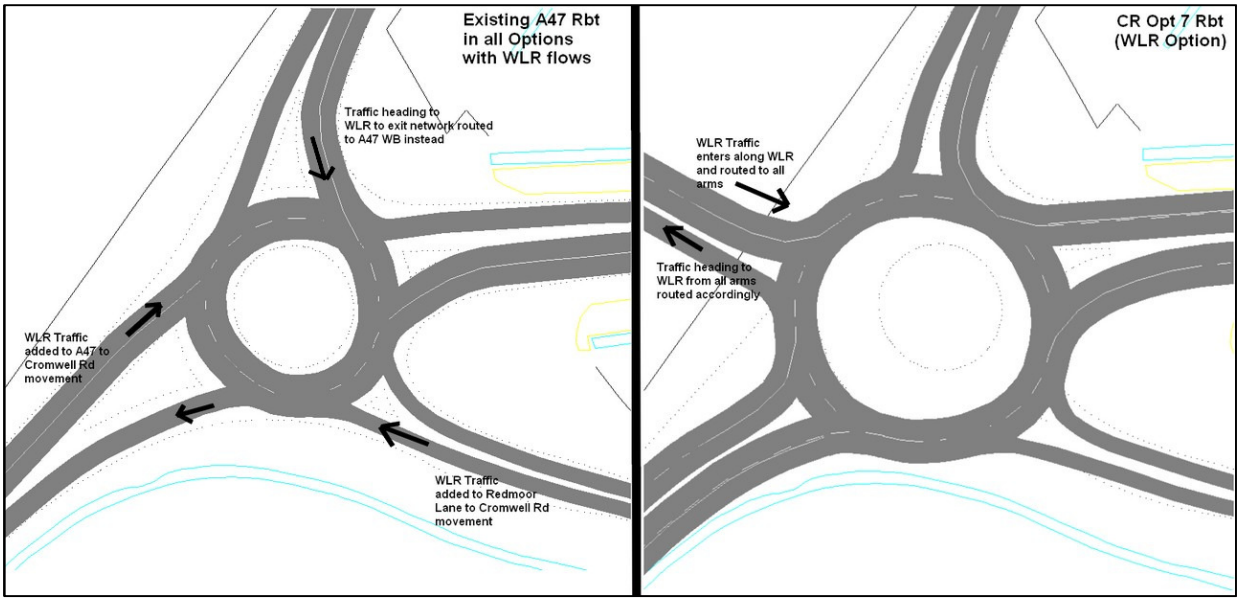


All options have been modelled with and without the WLR. The WLR is proposed to run from the A47 / Cromwell Road roundabout, over the river and join with the A1101 North End to the north of Wisbech. Only one option within the model network directly connects onto the proposed Western Link Road which is 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;
- 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 2 shows the existing layout of the A47 roundabout compared with CR Opt 7 detailing this in more detail.

Figure 2. 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.

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.

3. Elm High Road Option 1

3.1. 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 shown in Figures 3 and 4:

- The A47 / Elm High Road roundabout has been enhanced at the approaches and exits to increase capacity, whilst remaining as a priority controlled junction;
- Elm High Road (N) has been increased to 2 lanes southbound from downstream of the Morrisons junction. It then flares to 3 lanes before the stop line, with a designated left turn lane and two lanes to travel ahead to Elm High Road (S);
- Elm High Road (N) exit has been widened to 2 lanes for 140m;
- A47 (E) approach has been widened to 3 lanes to allow for a dedicated left turn lane into Elm High Road (S);
- Elm High Road (S) approach has been increased to 3 lanes at the stop line, to allow a designated left to A47 (W) and 2 lanes ahead to Elm High Road (N), as the exit has been increased to 2 lanes also; and,
- Elm High Road (S) exit has been widened to allow a 2 lane exit for approximately 60m, to accommodate the 2 lanes ahead from the north arm.

Figure 3. Elm High Road Option 1 Layout

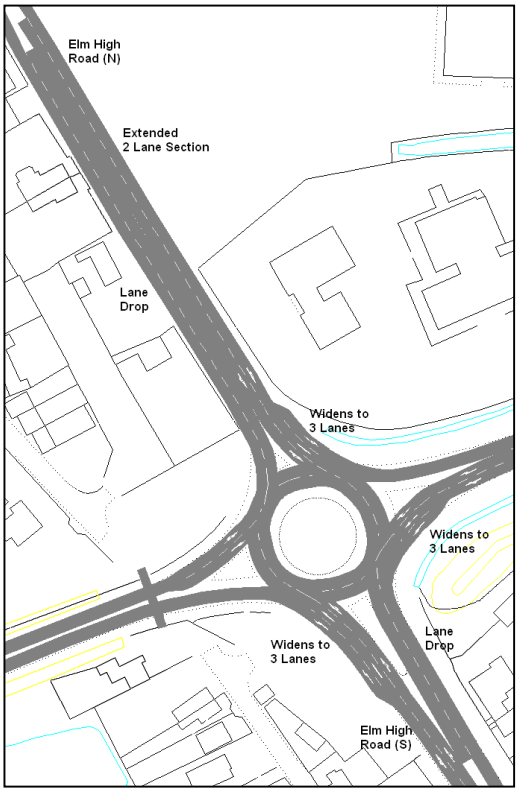
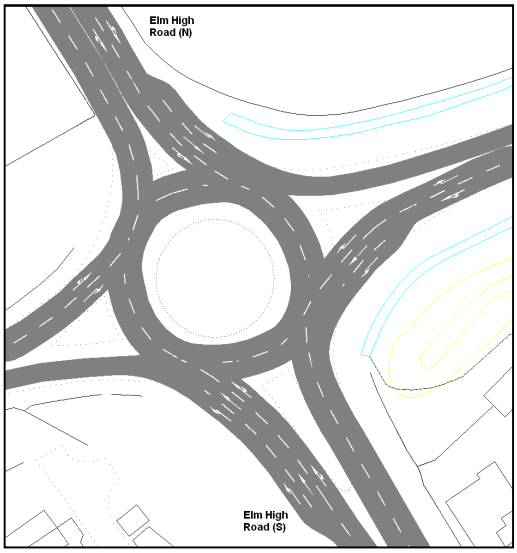


Figure 4. Elm High Road Option 1 Lane Allocations



3.2. 2016 Results

A summary of the results for each approach to the A47 / Elm High Road roundabout, the Morrisons and the Weasenham Lane junctions have been compared back to the existing conditions results and are shown in Tables 2 and 3 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 2. 2016 AM Peak Approach Comparison Results Elm High Road Option 1

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	Base	EH Opt 1	Base	EH Opt 1	Base	EH Opt 1	Base	EH Opt 1
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***535***	532	***34.6***	34.9	***51.6***	51.7	***D***	D
	Ramnoth Rd	329	***331***	***11.4***	***11.4***	***38.9***	39.3	***D***	D
	Elm High Rd (S)	846	***867***	***73.0***	164.5	***51.6***	78.0	***D***	E
	Weasenham Ln	***462***	461	***72.3***	79.2	***75.4***	81.2	***E***	F
	Overall Junction Summary	2170	***2191***	***47.8***	72.5	***54.9***	66.6	***D***	E
Elm High Rd / Morrisons	Elm High Rd (N)	647	***650***	***1.7***	4.1	***5.8***	7.3	***A***	A
	Supermarket Access	***87***	***87***	***1.3***	1.6	***13.8***	16.2	***B***	C
	Elm High Rd (S)	881	***902***	***0.0***	9.6	***2.7***	11.8	***A***	B
	Petrol Station	***93***	***93***	***1.4***	3.5	***14.1***	26.1	***B***	D
	Overall Junction Summary	1710	***1732***	***1.1***	4.6	***5.0***	11.1	***A***	B
A47 / Elm High Rd Rbt	Elm High Rd (N)	***619***	***619***	10.2	***2.6***	11.0	***6.0***	B	***A***
	A47 (E)	***703***	***703***	5.3	***2.7***	10.7	***7.7***	B	***A***
	Elm High Rd (S)	783	***804***	458.7	***2.9***	179.5	***10.6***	F	***B***
	A47 (W)	562	***587***	235.1	***47.3***	159.7	***49.0***	F	***E***
	Overall Junction Summary	2666	***2713***	177.3	***13.9***	91.6	***17.1***	F	***C***

Table 2 shows that increasing capacity at the A47 roundabout is forecast to reduce queues and delays at all approaches, especially at the A47 (W) and Elm High Road (S) approaches, whilst processing more vehicles through the junction (the heaviest traffic flow in AM Peak is northbound on Elm High Road).

However, processing more vehicles through the roundabout causes longer delays at the Morrisons and Weasenham Lane junctions. With more vehicles travelling north, queues extend back along Elm High Road.

Table 3. 2016 PM Peak Approach Comparison Results Elm High Road Option 1

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	Base	EH Opt 1	Base	EH Opt 1	Base	EH Opt 1	Base	EH Opt 1
Churchill Rd / Weasenham Ln	Churchill Rd (N)	526	***528***	14.3	***13.4***	40.4	***31.0***	D	***C***
	Ramnoth Rd	202	***211***	31.4	***1.2***	96.9	***21.0***	F	***C***
	Elm High Rd (S)	612	***617***	***16.0***	***16.0***	***27.7***	28.2	***C***	C
	Weasenham Ln	536	***542***	54.8	***36.5***	66.5	***48.4***	E	***D***
	Overall Junction Summary	1876	***1899***	29.1	***16.8***	47.9	***34.0***	D	***C***
Elm High Rd / Morrisons	Elm High Rd (N)	715	***743***	216.1	***1.0***	121.6	***5.1***	F	***A***
	Supermarket Access	***210***	209	8.9	***2.1***	38.6	***8.9***	E	***A***
	Elm High Rd (S)	655	***657***	1.4	***0.7***	8.7	***4.0***	A	***A***
	Petrol Station	66	***69***	4.1	***0.7***	59.8	***13.7***	F	***B***
	Overall Junction Summary	1646	***1677***	53.6	***1.1***	63.4	***5.5***	F	***A***
A47 / Elm High Rd Rbt	Elm High Rd (N)	758	***779***	163.4	***6.1***	51.0	***9.7***	F	***A***
	A47 (E)	***626***	624	26.5	***4.1***	28.3	***10.3***	D	***B***
	Elm High Rd (S)	***680***	679	14.3	***1.5***	17.3	***8.6***	C	***A***
	A47 (W)	871	***885***	342.2	***104.3***	149.4	***65.4***	F	***F***
	Overall Junction Summary	2935	***2964***	136.6	***29.0***	67.7	***26.3***	F	***D***

Table 3 indicates that the proposed changes at the A47 roundabout are forecast to significantly improve performance along Elm High Road southbound as vehicles are no longer queuing back from the A47 roundabout and causing congestion around the Weasenham Lane junction (the heaviest traffic flow in PM Peak is southbound on Elm High Road).

Although delays have more than halved for the A47 (W) approach to the roundabout, this arm is still operating over capacity.

3.3. 2021 Without WLR Results Summary

A summary of each approach to A47 / Elm High Road roundabout, the Morrisons and the Weasenham Lane junctions have been compared back to the 2021 Without WLR DM results and are shown in Tables 4 and 5 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 4. 2021 Without WLR AM Peak Approach Comparison Results Elm High Road Option 1

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1
Churchill Rd / Weasenham Ln	Churchill Rd (N)	548	***549***	***31.9***	35.4	***50.3***	53.6	***D***	D
	Ramnoth Rd	***379***	***379***	***17.1***	18.0	***46.1***	47.4	***D***	D
	Elm High Rd (S)	636	***644***	***27.5***	28.7	***40.2***	41.1	***D***	D
	Weasenham Ln	***530***	526	135.3	***131.1***	104.2	***102.2***	F	***F***
	Overall Junction Summary	2091	***2098***	***53.0***	53.3	***60.2***	61.0	***E***	E
Elm High Rd / Morrisons	Elm High Rd (N)	625	***626***	0.6	***0.5***	4.0	***3.8***	A	***A***
	Supermarket Access	***75***	***75***	0.4	***0.3***	7.6	***6.8***	A	***A***
	Elm High Rd (S)	663	***665***	***0.0***	0.3	***2.3***	3.1	***A***	A
	Petrol Station	***87***	***87***	***0.5***	0.6	***8.0***	8.4	***A***	A
	Overall Junction Summary	1450	***1454***	***0.4***	0.5	***3.6***	3.9	***A***	A
A47 / Elm High Rd Rbt	Elm High Rd (N)	***578***	***578***	6.5	***1.6***	9.2	***4.9***	A	***A***
	A47 (E)	***832***	***832***	13.5	***5.4***	18.2	***10.8***	C	***B***
	Elm High Rd (S)	773	***777***	85.6	***3.1***	49.4	***11.3***	E	***B***
	A47 (W)	583	***587***	20.3	***11.9***	29.2	***21.7***	D	***C***
	Overall Junction Summary	2766	***2774***	31.5	***5.5***	27.4	***12.0***	D	***B***

Table 5. 2021 Without WLR PM Peak Approach Comparison Results Elm High Road Option 1

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***574***	543	19.8	***18.1***	46.0	***37.2***	D	***D***
	Ramnoth Rd	207	***210***	25.5	***2.1***	103.4	***26.5***	F	***C***
	Elm High Rd (S)	565	***569***	***15.9***	16.2	***30.1***	30.4	***C***	C
	Weasenham Ln	679	***702***	***142.0***	144.9	81.2	***73.4***	F	***E***
	Overall Junction Summary	2023	***2024***	50.8	***45.4***	57.9	***46.7***	E	***D***
Elm High Rd / Morrisons	Elm High Rd (N)	***667***	664	164.9	***0.9***	109.3	***4.6***	F	***A***
	Supermarket Access	***209***	208	5.9	***1.7***	30.6	***7.7***	D	***A***
	Elm High Rd (S)	***619***	618	***0.1***	0.2	6.6	***3.4***	A	***A***
	Petrol Station	***67***	***67***	2.6	***0.6***	51.5	***12.8***	F	***B***
	Overall Junction Summary	***1562***	1558	40.3	***0.9***	55.2	***4.9***	F	***A***
A47 / Elm High Rd Rbt	Elm High Rd (N)	***715***	709	150.2	***4.5***	52.7	***8.7***	F	***A***
	A47 (E)	848	***849***	153.7	***9.6***	87.7	***15.7***	F	***C***
	Elm High Rd (S)	***680***	679	22.5	***2.8***	23.8	***11.0***	C	***B***
	A47 (W)	869	***889***	270.2	***145.4***	126.3	***77.6***	F	***F***
	Overall Junction Summary	3111	***3125***	149.2	***40.6***	76.7	***31.0***	F	***D***

Tables 4 and 5 are consistent with the 2016 assessment and show that the enhancements at the roundabout improve performance for the AM peak, although the Weasenham Lane junction performs marginally worse, but Option 1 provides the most benefits in the PM peak as a result of reducing the queue along Elm High Road southbound.

3.4. 2021 With WLR Results Summary

A summary of each approach to A47 / Elm High Road roundabout, the Morrisons and the Weasenham Lane junctions have been compared back to the 2021 With WLR DM results and are shown in Tables 6 and 7 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 6. 2021 With WLR AM Peak Approach Comparison Results Elm High Road Option 1

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***261***	***261***	9.8	***9.2***	36.0	***33.8***	D	***C***
	Ramnoth Rd	***410***	402	38.1	***21.5***	73.5	***50.5***	E	***D***
	Elm High Rd (S)	611	***613***	22.1	***21.1***	***34.8***	35.1	***C***	D
	Weasenham Ln	475	***477***	43.8	***28.5***	58.7	***45.6***	E	***D***
	Overall Junction Summary	***1756***	1751	28.5	***20.1***	50.5	***41.3***	D	***D***
Elm High Rd / Morrisons	Elm High Rd (N)	***417***	414	***0.1***	***0.1***	2.9	***2.7***	A	***A***
	Supermarket Access	98	***99***	***0.2***	***0.2***	4.8	***4.4***	A	***A***
	Elm High Rd (S)	***636***	631	***0.0***	0.1	***2.0***	2.5	***A***	A
	Petrol Station	***101***	***101***	***0.5***	0.6	7.6	***7.5***	A	***A***
	Overall Junction Summary	***1252***	1245	***0.3***	***0.3***	***2.9***	3.1	***A***	A
A47 / Elm High Rd Rbt	Elm High Rd (N)	***420***	418	1.8	***0.5***	5.7	***3.6***	A	***A***
	A47 (E)	***748***	747	3.0	***1.4***	8.0	***6.0***	A	***A***
	Elm High Rd (S)	***757***	***757***	12.8	***1.9***	16.2	***9.4***	C	***A***
	A47 (W)	***525***	501	11.8	***7.9***	22.5	***18.4***	C	***C***
	Overall Junction Summary	***2449***	2422	7.3	***3.0***	13.3	***9.2***	B	***A***

Table 7. 2021 With WLR PM Peak Approach Comparison Results Elm High Road Option 1

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***278***	***278***	10.3	***9.6***	38.3	***35.3***	D	***D***
	Ramnoth Rd	206	***207***	2.2	***1.7***	26.9	***24.0***	C	***C***
	Elm High Rd (S)	366	***374***	12.9	***12.4***	33.3	***32.5***	C	***C***
	Weasenham Ln	***669***	665	87.6	***61.9***	58.6	***48.1***	E	***D***
	Overall Junction Summary	1519	***1522***	28.3	***21.4***	44.5	***38.6***	D	***D***
Elm High Rd / Morrisons	Elm High Rd (N)	***603***	600	3.7	***0.1***	10.1	***3.0***	B	***A***
	Supermarket Access	***205***	204	1.6	***0.9***	9.9	***5.3***	A	***A***
	Elm High Rd (S)	403	***405***	***0.0***	***0.0***	2.9	***2.6***	A	***A***
	Petrol Station	***68***	67	0.4	***0.3***	12.4	***8.1***	B	***A***
	Overall Junction Summary	***1278***	1275	1.4	***0.4***	8.0	***3.5***	A	***A***
A47 / Elm High Rd Rbt	Elm High Rd (N)	***678***	669	42.5	***3.2***	25.3	***7.3***	D	***A***
	A47 (E)	***626***	624	12.8	***3.9***	18.7	***10.0***	C	***A***
	Elm High Rd (S)	***653***	***653***	5.3	***2.4***	12.4	***9.9***	B	***A***
	A47 (W)	770	***781***	14.2	***10.7***	23.2	***20.6***	C	***C***
	Overall Junction Summary	2726	***2728***	18.7	***5.1***	20.2	***12.4***	C	***B***

Tables 6 and 7 are consistent with the other results and show that the most benefits are forecast in the PM peak as a result of removing the congestion along Elm High Road southbound.

The Link Road scenario has reduced traffic flow along Elm High Road and therefore the performance is better than without the Link Road for both the DM and Option 1 scenarios.

3.5. 2026 Without WLR Results Summary

A summary of each approach to the A47 / Elm High Road roundabout, the Morrisons and the Weasenham Lane junctions have been compared back to the 2026 Without WLR DM results and are shown in Tables 8 and 9 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 8. 2026 Without WLR AM Peak Approach Comparison Results Elm High Road Option 1

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***584***	581	***125.0***	144.1	***128.7***	145.4	***F***	F
	Ramnoth Rd	***487***	480	***129.1***	185.7	***139.1***	186.9	***F***	F
	Elm High Rd (S)	598	***652***	***29.5***	44.6	***40.6***	49.3	***D***	D
	Weasenham Ln	***519***	515	***70.4***	81.1	***69.2***	77.9	***E***	E
	Overall Junction Summary	2189	***2227***	***88.5***	113.9	***92.6***	110.2	***F***	F
Elm High Rd / Morrisons	Elm High Rd (N)	***664***	661	***0.5***	0.8	***3.9***	4.2	***A***	A
	Supermarket Access	***90***	***90***	0.5	***0.4***	7.4	***6.6***	A	***A***
	Elm High Rd (S)	618	***673***	***0.0***	0.3	***2.3***	3.0	***A***	A
	Petrol Station	***93***	***93***	***0.7***	0.8	***9.1***	9.7	***A***	A
	Overall Junction Summary	1466	***1518***	***0.5***	0.6	***3.8***	4.1	***A***	A
A47 / Elm High Rd Rbt	Elm High Rd (N)	***637***	633	4.8	***2.0***	7.7	***5.1***	A	***A***
	A47 (E)	***864***	863	14.4	***7.1***	19.1	***12.8***	C	***B***
	Elm High Rd (S)	662	***760***	661.9	***6.8***	315.7	***16.1***	F	***C***
	A47 (W)	***472***	465	16.1	***10.4***	27.6	***21.6***	D	***C***
	Overall Junction Summary	2634	***2721***	174.3	***6.6***	92.2	***13.5***	F	***B***

Table 8 shows that in 2026 the enhanced roundabout is forecast to offer significant improvements to the Elm High Road S approach, reducing delays by 300 seconds. However as a result of processing more vehicles northbound, pushes the Weasenham Lane junction to operate over capacity.

Table 9. 2026 Without WLR PM Peak Approach Comparison Results Elm High Road Option 1

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***641***	519	72.3	***16.9***	120.8	***36.6***	F	***D***
	Ramnoth Rd	136	***210***	154.8	***1.7***	661.3	***24.1***	F	***C***
	Elm High Rd (S)	499	***561***	32.9	***15.5***	48.6	***30.2***	D	***C***
	Weasenham Ln	509	***686***	171.8	***137.1***	142.4	***73.4***	F	***E***
	Overall Junction Summary	1785	***1977***	108.0	***42.8***	143.7	***46.3***	F	***D***
Elm High Rd / Morrisons	Elm High Rd (N)	***751***	653	364.3	***0.6***	143.1	***4.6***	F	***A***
	Supermarket Access	192	***208***	24.0	***1.7***	49.3	***7.6***	E	***A***
	Elm High Rd (S)	521	***608***	8.8	***0.2***	12.1	***3.2***	B	***A***
	Petrol Station	63	***67***	6.9	***0.5***	74.5	***11.3***	F	***B***
	Overall Junction Summary	1527	***1535***	93.8	***0.8***	83.6	***4.8***	F	***A***
A47 / Elm High Rd Rbt	Elm High Rd (N)	***791***	700	120.4	***3.5***	38.4	***7.4***	E	***A***
	A47 (E)	657	***848***	761.9	***8.0***	330.5	***14.5***	F	***B***
	Elm High Rd (S)	611	***679***	137.1	***2.9***	36.9	***11.1***	E	***B***
	A47 (W)	475	***747***	175.5	***53.8***	149.3	***45.0***	F	***E***
	Overall Junction Summary	2534	***2973***	298.7	***17.0***	135.6	***20.0***	F	***C***

Table 9 is consistent with the 2021 results for the PM Peak and shows that Option 1 is forecast to provide significant benefits to all junctions, reducing the delay, especially at the Ramnoth Road approach to the Weasenham Lane junction and A47 approaches at the roundabout.

The 2026 results are better than the 2021 results due to more vehicles being held up at the A47/Cromwell Road roundabout, that aren't able to make it to the Elm High Road roundabout.

3.6. 2026 With WLR Results Summary

A summary of each approach to A47 / Elm High Road roundabout, the Morrisons and the Weasenham Lane junctions have been compared back to the 2026 With WLR DM results and are shown in Tables 10 and 11 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 10. 2026 With WLR AM Peak Approach Comparison Results Elm High Road Option 1

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1
Churchill Rd / Weasenham Ln	Churchill Rd (N)	385	***389***	14.8	***13.8***	37.0	***35.8***	D	***D***
	Ramnoth Rd	487	***519***	666.1	***656.4***	583.6	***506.9***	F	***F***
	Elm High Rd (S)	425	***438***	27.7	***15.5***	***34.3***	34.4	***C***	C
	Weasenham Ln	418	***419***	23.8	***16.9***	47.1	***39.9***	D	***D***
	Overall Junction Summary	1715	***1765***	183.1	***175.7***	194.0	***175.0***	F	***F***
Elm High Rd / Morrisons	Elm High Rd (N)	583	***602***	***0.1***	***0.1***	2.7	***2.5***	A	***A***
	Supermarket Access	79	***81***	1.0	***0.2***	4.7	***4.6***	A	***A***
	Elm High Rd (S)	465	***471***	2.5	***0.0***	***2.0***	2.2	***A***	A
	Petrol Station	84	***85***	1.0	***0.3***	6.3	***6.0***	A	***A***
	Overall Junction Summary	1212	***1237***	1.2	***0.2***	***2.8***	***2.8***	***A***	***A***
A47 / Elm High Rd Rbt	Elm High Rd (N)	571	***585***	2.5	***0.9***	5.6	***3.4***	A	***A***
	A47 (E)	826	***832***	6.7	***2.5***	10.8	***7.8***	B	***A***
	Elm High Rd (S)	661	***669***	13.1	***3.2***	14.9	***11.0***	B	***B***
	A47 (W)	***448***	444	9.0	***4.3***	15.2	***13.7***	C	***B***
	Overall Junction Summary	2507	***2533***	7.8	***2.7***	11.5	***8.7***	B	***A***

Table 11. 2026 With WLR PM Peak Approach Comparison Results Elm High Road Option 1

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1	DM	EH Opt 1
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***294***	293	10.8	***10.6***	38.5	***36.8***	D	***D***
	Ramnoth Rd	***130***	***130***	0.9	***0.7***	26.7	***25.9***	C	***C***
	Elm High Rd (S)	417	***422***	***13.9***	14.5	***32.6***	34.5	***C***	C
	Weasenham Ln	732	***778***	154.2	***145.7***	67.8	***60.2***	E	***E***
	Overall Junction Summary	1571	***1623***	44.9	***42.8***	49.6	***46.6***	D	***D***
Elm High Rd / Morrisons	Elm High Rd (N)	566	***585***	***0.3***	***0.3***	4.3	***3.4***	A	***A***
	Supermarket Access	***207***	***207***	1.1	***1.0***	6.1	***5.4***	A	***A***
	Elm High Rd (S)	444	***446***	***0.0***	0.1	***2.2***	2.7	***A***	A
	Petrol Station	***67***	***67***	***0.3***	***0.3***	9.4	***8.5***	A	***A***
	Overall Junction Summary	1284	***1305***	0.5	***0.4***	4.1	***3.7***	A	***A***
A47 / Elm High Rd Rbt	Elm High Rd (N)	627	***641***	12.9	***1.8***	12.8	***5.2***	B	***A***
	A47 (E)	***730***	728	18.2	***3.6***	22.0	***9.7***	C	***A***
	Elm High Rd (S)	***700***	699	6.5	***4.3***	13.4	***11.2***	B	***B***
	A47 (W)	582	***590***	***9.0***	10.5	20.9	***20.6***	C	***C***
	Overall Junction Summary	2637	***2657***	11.7	***5.0***	17.3	***11.5***	C	***B***

Table 10 shows that with lower flows along Elm High Road as a result of the WLR, Option 1 offers more benefits in the AM peak than without the Link Road.

Table 11 is consistent with other PM peak results and shows benefits throughout the network with Option 1. However, the flows are lower than without the WLR and therefore, the DM scenario is also operating within capacity.

4. Elm High Road Option 3

4.1. 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 shown in Figures 5, 6 and 7:

- The Elm High Road / A47 roundabout is relocated to the east of its current location with a new link road for the A1101 north and south;
- The new A1101 link road joins upstream of the Morrisons junction, which has been modelled as a signal controlled junction;
- The new roundabout has been modelled with an ICD of approximately 44m and enhances capacity for traffic with two lane approaches and exits on all arms. All exits have been reduced back to single lanes with appropriate length tapers; and,
- The existing roundabout is completely removed and the A1101 closed in both directions so traffic cannot access the A47.

Figure 5. Elm High Road Option 3 Layout

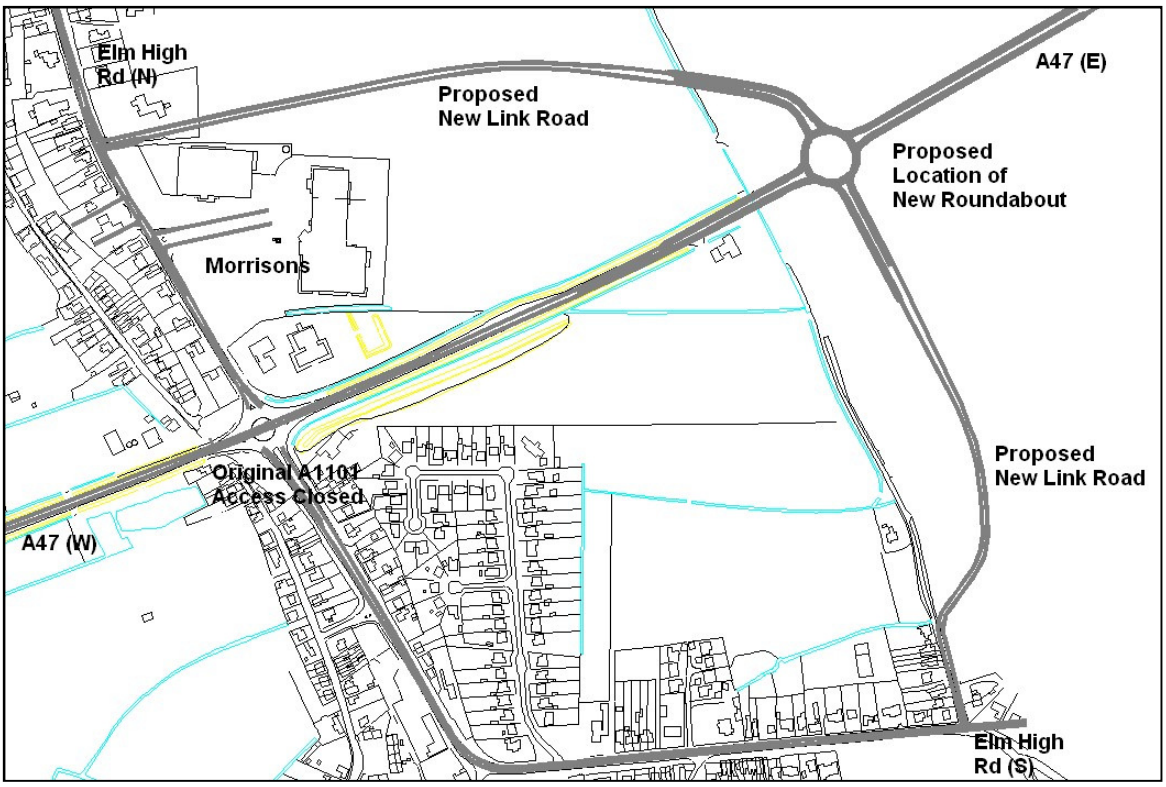


Figure 6. Elm High Road Option 3 Proposed Roundabout Design

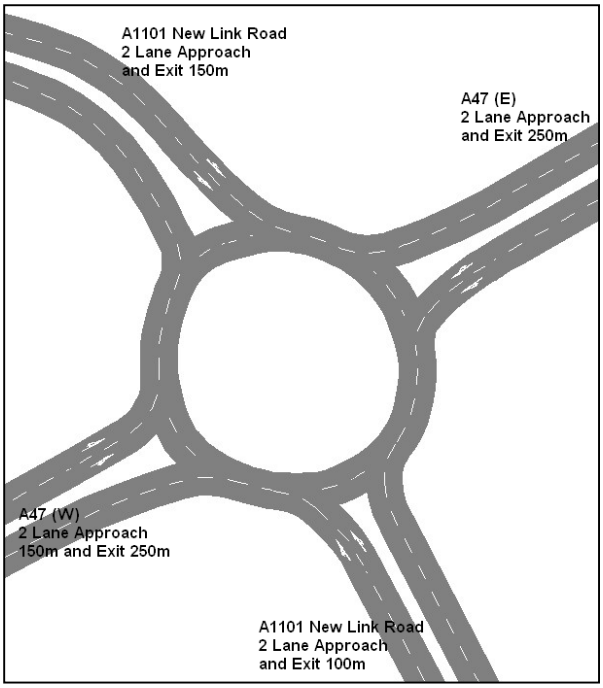
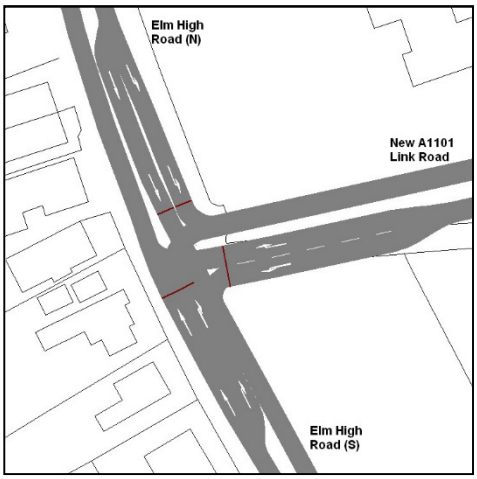


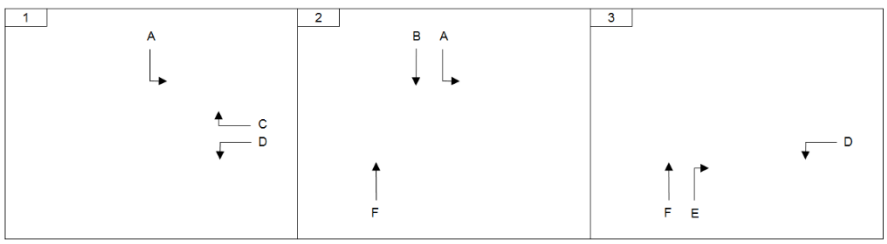
Figure 7. Elm High Road Option 3 Proposed Signalised Junction Design



4.2. Signals

The new signalised junction along Elm High Road has not been assessed in LinSig and is coded as a Vehicle Actuated (VA) junction with 3 stages as shown below in Figure 8.

Figure 8. Elm High Road Option 3 Proposed Signalised Junction Staging



Phases A and B and E and F represent the Elm High Road (N) and (S) approaches respectively, while Phases C and D are the new A1101 Link Road approaches. Stages 2 and 3 are only called on demand. The maximum green times for each stage per peak is provided in Table 12.

Table 12. Stage Maximums

	Maximums	
	AM	**PM**
Stage 1	60	50
Stage 2	10	20
Stage 3	10	15

The junction was initially coded to operate on give way control, although this caused issues with traffic being unable to access the new A1101 Link Road from the south, due to the high volume of traffic from the north. This in turn blocked access onto Elm High Road from the new A1101 Link Road (as right turners have right of way), creating queues extending back to the relocated roundabout resulting in blocking on the A47.

4.3. 2016 Results

A summary of each approach to the new A47 / Elm High Road roundabout, the new signalised junction and the Elm High Road / Weasenham Lane junctions have been compared back to the existing conditions results, where applicable, and are shown in Tables 13 and 14 for the AM and PM peaks respectively.

Table 13. 2016 AM Peak Approach Comparison Results Elm High Road Option 3

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	**Approach**	**Base**	**EH Opt 3**	**Base**	**EH Opt 3**	**Base**	**EH Opt 3**	**Base**	**EH Opt 3**
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***535***	532	***34.6***	36.4	***51.6***	53.9	***D***	D
	Ramnoth Rd	329	***330***	***11.4***	12.0	***38.9***	40.2	***D***	D
	Elm High Rd (S)	846	***860***	***73.0***	140.1	***51.6***	74.5	***D***	E
	Weasenham Ln	***462***	461	***72.3***	84.7	***75.4***	84.3	***E***	F
	Overall Junction Summary	2170	***2183***	***47.8***	68.3	***54.9***	66.5	***D***	E
Elm High Rd / New Link Rd	Elm High Rd (N) LT	-	***541***	-	***5.3***	-	***8.4***	-	***A***
	Elm High Rd (N) Ahead	-	***108***	-	***7.9***	-	***40.5***	-	***D***
	New Link Rd	-	***899***	-	***36.4***	-	***24.1***	-	***C***
	Elm High Rd (S) Ahead	-	***91***	-	***4.4***	-	***31.0***	-	***C***
	Elm High Rd (S) RT	-	***81***	-	***5.2***	-	***38.7***	-	***D***
	Overall Junction Summary	-	***1720***	-	***15.9***	-	***21.3***	-	***C***
A47 / Elm High Rd Rbt	Elm High Rd (N)	619	***624***	10.2	***2.9***	11.0	***10.0***	B	***A***
	A47 (E)	***703***	700	5.3	***1.9***	10.7	***6.2***	B	***A***
	Elm High Rd (S)	783	***804***	458.7	***4.5***	179.5	***12.6***	F	***B***
	A47 (W)	562	***590***	235.1	***7.1***	159.7	***19.6***	F	***C***
	Overall Junction Summary	2666	***2716***	177.3	***4.1***	91.6	***11.9***	F	***B***

Table 13 shows that by relocating the A47 roundabout to the east and enhancing capacity is forecast to reduce the queues and delays significantly at all approaches to the roundabout.

The new signalised junction with the new A1101 Link Road and the old A1101 is forecast to operate well within capacity, although the Elm High Road (N) ahead and the Elm High Road (S) right turn approaches are operating close to capacity as the dominant movements get more green time. Although it is not shown in the

above table, the maximum queue for the 18 Random Seeds shows that the queue along the A1101 Link Road is 618m, which is back to the two lane merge lane drop at the roundabout exit.

The Weasenham Lane junction results highlight that by processing more vehicles through the re-located A47 roundabout to the Weasenham Lane junction, longer queues and delays are forecast at the Elm High Road (S) approach. This queue ultimately extends back to the new signalised junction with the A1101 Link Road, blocking access for traffic wishing to turn right out of the Link Road as shown below in Figure 9. This blocking back is the cause for the maximum queue length of 618m along the new A1101 Link Road.

All other approaches at the Weasenham Lane junction are forecast to perform marginally worse as a result of more traffic on Elm High Road (S) not gapping out the stage and calling stage 5 more often (Elm High Road right turn). The Weasenham Lane approach is forecast to operate over capacity with a LOS F.

Figure 9. Elm High Road Option 3 Proposed Signalised Junction AM Peak Queuing

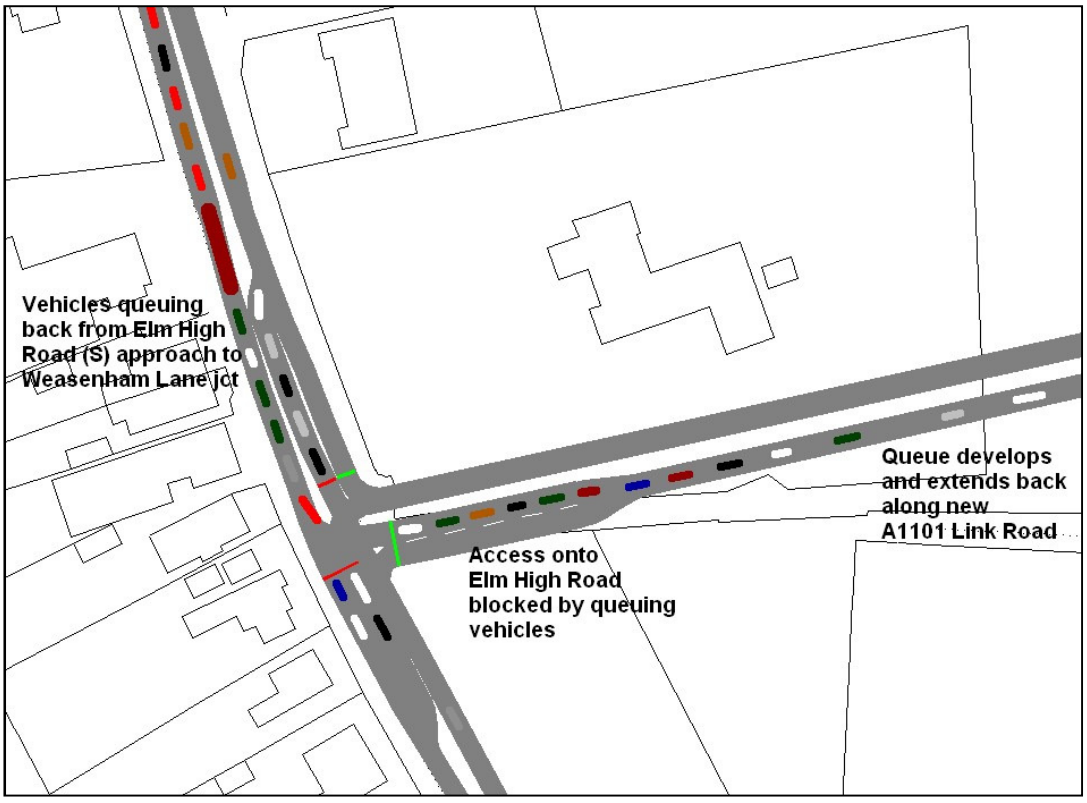


Table 14. 2016 PM Peak Approach Comparison Results Elm High Road Option 3

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Node	Approach	Base	EH Opt 3	Base	EH Opt 3	Base	EH Opt 3	Base	EH Opt 3
Churchill Rd / Weasenham Ln	Churchill Rd (N)	526	***528***	14.3	***13.4***	40.4	***31.3***	D	***C***
	Ramnoth Rd	202	***212***	31.4	***1.4***	96.9	***21.3***	F	***C***
	Elm High Rd (S)	612	***616***	16.0	***15.8***	27.7	***27.4***	C	***C***
	Weasenham Ln	536	***539***	54.8	***35.3***	66.5	***47.7***	E	***D***
	Overall Junction Summary	1876	***1895***	29.1	***16.5***	47.9	***33.6***	D	***C***
Elm High Rd / New Link Rd	Elm High Rd (N) LT	-	***586***	-	***18.8***	-	***17.0***	-	***B***
	Elm High Rd (N) Ahead	-	***153***	-	***20.2***	-	***47.0***	-	***D***
	New Link Rd	-	***657***	-	***10.6***	-	***13.9***	-	***B***
	Elm High Rd (S) Ahead	-	***78***	-	***2.5***	-	***23.4***	-	***C***
	Elm High Rd (S) RT	-	***192***	-	***13.9***	-	***37.8***	-	***D***
	Overall Junction Summary	-	***1668***	-	***12.7***	-	***21.2***	-	***C***
A47 / Elm High Rd Rbt	Elm High Rd (N)	758	***783***	163.4	***6.8***	51.0	***14.9***	F	***B***
	A47 (E)	***626***	623	26.5	***3.1***	28.3	***8.3***	D	***A***
	Elm High Rd (S)	***680***	678	14.3	***2.2***	17.3	***9.5***	C	***A***
	A47 (W)	871	***875***	342.2	***4.1***	149.4	***21.7***	F	***C***
	Overall Junction Summary	2935	***2957***	136.6	***4.1***	67.7	***14.3***	F	***B***

Table 14 shows that the proposed changes in Option 3 are forecast to benefit all approaches for both the Weasenham Lane junction and the re-located A47 roundabout. Delays and queues are all forecast to reduce significantly as the queuing along Elm High Road southbound has been removed as a result of relocating the roundabout and enhancing capacity. However, it should be noted that the Weasenham Lane approach is operating close to capacity with this option, along with the Elm High Road (N) and (S) approaches to the new signalised junction.

4.4. 2021 Without WLR Results Summary

A summary of each approach to the new A47 / Elm High Road roundabout, the new signalised junction and the Elm High Road / Weasenham Lane junctions have been compared back to the 2021 Without WLR DM results and are shown in Tables 15 and 16 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 15. 2021 Without WLR AM Peak Approach Comparison Results Elm High Road Option 3

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3
Churchill Rd / Weasenham Ln	Churchill Rd (N)	548	***550***	***31.9***	33.2	***50.3***	51.5	***D***	D
	Ramnoth Rd	379	***380***	17.1	***16.3***	46.1	***44.9***	D	***D***
	Elm High Rd (S)	636	***639***	***27.5***	27.6	***40.2***	40.3	***D***	D
	Weasenham Ln	***530***	524	135.3	***125.3***	104.2	***98.9***	F	***F***
	Overall Junction Summary	2091	***2093***	53.0	***50.6***	60.2	***58.8***	E	***E***
Elm High Rd / New Link Rd	Elm High Rd (N) LT	-	***518***	-	***5.0***	-	***7.6***	-	***A***
	Elm High Rd (N) Ahead	-	***108***	-	***6.1***	-	***32.8***	-	***C***
	New Link Rd	-	***664***	-	***7.4***	-	***11.2***	-	***B***
	Elm High Rd (S) Ahead	-	***93***	-	***2.5***	-	***19.5***	-	***B***
	Elm High Rd (S) RT	-	***62***	-	***2.8***	-	***29.2***	-	***C***
	Overall Junction Summary	-	***1445***	-	***5.2***	-	***12.8***	-	***B***
A47 / Elm High Rd Rbt	Elm High Rd (N)	578	***579***	6.5	***1.7***	9.2	***7.8***	A	***A***
	A47 (E)	***832***	830	13.5	***1.9***	18.2	***6.1***	C	***A***
	Elm High Rd (S)	773	***777***	85.6	***5.3***	49.4	***13.5***	E	***B***
	A47 (W)	***583***	581	20.3	***3.9***	29.2	***15.1***	D	***C***
	Overall Junction Summary	***2766***	***2766***	31.5	***3.2***	27.4	***10.4***	D	***B***

Table 16. 2021 Without WLR PM Peak Approach Comparison Results Elm High Road Option 3

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Node	Approach	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***574***	***574***	19.8	***19.3***	46.0	***37.4***	D	***D***
	Ramnoth Rd	207	***211***	25.5	***1.8***	103.4	***25.2***	F	***C***
	Elm High Rd (S)	565	***567***	15.9	***14.8***	30.1	***28.1***	C	***C***
	Weasenham Ln	679	***689***	***142.0***	144.1	81.2	***75.7***	F	***E***
	Overall Junction Summary	2023	***2042***	50.8	***45.0***	57.9	***46.5***	E	***D***
Elm High Rd / New Link Rd	Elm High Rd (N) LT	-	***533***	-	***11.0***	-	***13.2***	-	***B***
	Elm High Rd (N) Ahead	-	***151***	-	***13.4***	-	***41.5***	-	***D***
	New Link Rd	-	***620***	-	***9.4***	-	***13.1***	-	***B***
	Elm High Rd (S) Ahead	-	***78***	-	***2.3***	-	***21.8***	-	***C***
	Elm High Rd (S) RT	-	***194***	-	***12.3***	-	***34.6***	-	***C***
	Overall Junction Summary	-	***1576***	-	***9.6***	-	***18.9***	-	***B***
A47 / Elm High Rd Rbt	Elm High Rd (N)	715	***727***	150.2	***5.9***	52.7	***13.9***	F	***B***
	A47 (E)	***848***	***848***	153.7	***5.6***	87.7	***10.5***	F	***B***
	Elm High Rd (S)	***680***	678	22.5	***4.1***	23.8	***12.1***	C	***B***
	A47 (W)	***869***	868	270.2	***5.2***	126.3	***22.4***	F	***C***
	Overall Junction Summary	3111	***3121***	149.2	***5.2***	76.7	***15.0***	F	***B***

Tables 15 and 16 are consistent with the 2016 assessment and show that Option 3 provides benefits to the A47 roundabout, with the most significant decreases to delays in the PM Peak.

4.5. 2021 With WLR Results

A summary of each approach to the new A47 / Elm High Road roundabout, the new signalised junction and the Elm High Road / Weasenham Lane junctions have been compared back to the 2021 With WLR DM results and are shown in Tables 17 and 18 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 17. 2021 With WLR AM Peak Approach Comparison Results Elm High Road Option 3

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3
Churchill Rd / Weasenham Ln	Churchill Rd (N)	261	***262***	9.8	***9.3***	36.0	***34.2***	D	***C***
	Ramnoth Rd	***410***	401	38.1	***22.3***	73.5	***51.4***	E	***D***
	Elm High Rd (S)	611	***613***	22.1	***21.1***	***34.8***	35.0	***C***	D
	Weasenham Ln	***475***	473	43.8	***35.2***	58.7	***50.9***	E	***D***
	Overall Junction Summary	***1756***	1750	28.5	***21.9***	50.5	***43.0***	D	***D***
Elm High Rd / New Link Rd	Elm High Rd (N) LT	-	***316***	-	***2.2***	-	***6.0***	-	***A***
	Elm High Rd (N) Ahead	-	***100***	-	***4.2***	-	***28.9***	-	***C***
	New Link Rd	-	***632***	-	***8.1***	-	***12.1***	-	***B***
	Elm High Rd (S) Ahead	-	***91***	-	***1.9***	-	***16.3***	-	***B***
	Elm High Rd (S) RT	-	***101***	-	***4.2***	-	***26.1***	-	***C***
	Overall Junction Summary	-	***1239***	-	***4.8***	-	***13.3***	-	***B***
A47 / Elm High Rd Rbt	Elm High Rd (N)	***420***	417	1.8	***0.9***	***5.7***	6.3	***A***	A
	A47 (E)	***748***	746	3.0	***1.0***	8.0	***4.6***	A	***A***
	Elm High Rd (S)	***757***	756	12.8	***3.2***	16.2	***10.7***	C	***B***
	A47 (W)	***525***	507	11.8	***3.6***	22.5	***14.2***	C	***B***
	Overall Junction Summary	***2449***	2426	7.3	***2.2***	13.3	***8.8***	B	***A***

Table 18. 2021 With WLR PM Peak Approach Comparison Results Elm High Road Option 3

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Node	Approach	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***278***	277	10.3	***9.3***	38.3	***34.7***	D	***C***
	Ramnoth Rd	***206***	***206***	2.2	***1.4***	26.9	***22.5***	C	***C***
	Elm High Rd (S)	***366***	365	12.9	***12.1***	33.3	***32.2***	C	***C***
	Weasenham Ln	***669***	668	87.6	***53.6***	58.6	***45.2***	E	***D***
	Overall Junction Summary	***1519***	1517	28.3	***19.1***	44.5	***37.1***	D	***D***
Elm High Rd / New Link Rd	Elm High Rd (N) LT	-	***482***	-	***6.5***	-	***9.8***	-	***A***
	Elm High Rd (N) Ahead	-	***120***	-	***6.0***	-	***33.3***	-	***C***
	New Link Rd	-	***405***	-	***4.6***	-	***9.9***	-	***A***
	Elm High Rd (S) Ahead	-	***77***	-	***1.5***	-	***15.6***	-	***B***
	Elm High Rd (S) RT	-	***191***	-	***8.6***	-	***27.0***	-	***C***
	Overall Junction Summary	-	***1274***	-	***5.3***	-	***15.0***	-	***B***
A47 / Elm High Rd Rbt	Elm High Rd (N)	***678***	674	42.5	***4.1***	25.3	***11.3***	D	***B***
	A47 (E)	***626***	624	12.8	***3.0***	18.7	***8.0***	C	***A***
	Elm High Rd (S)	653	***654***	5.3	***2.6***	12.4	***9.6***	B	***A***
	A47 (W)	770	***778***	14.2	***1.8***	23.2	***16.9***	C	***C***
	Overall Junction Summary	2726	***2730***	18.7	***2.9***	20.2	***11.7***	C	***B***

Tables 17 and 18 show that Option 3 is forecast to provide benefits to the majority of the network, although as the flows along Elm High Road have decreased with the introduction of the Link Road, the benefits are not as great as without the Link Road.

4.6. 2026 Without WLR Results

A summary of each approach to the new A47 / Elm High Road roundabout, the new signalised junction and the Elm High Road / Weasenham Lane junctions have been compared back to the 2026 Without WLR DM results and are shown in Tables 19 and 20 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 19. 2026 Without WLR AM Peak Approach Comparison Results Elm High Road Option 3

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***584***	579	***125.0***	129.2	***128.7***	131.0	***F***	F
	Ramnoth Rd	***487***	480	***129.1***	168.8	***139.1***	173.0	***F***	F
	Elm High Rd (S)	598	***648***	***29.5***	41.2	***40.6***	48.5	***D***	D
	Weasenham Ln	***519***	514	***70.4***	71.3	***69.2***	71.5	***E***	E
	Overall Junction Summary	2189	***2222***	***88.5***	102.6	***92.6***	101.9	***F***	F
Elm High Rd / New Link Rd	Elm High Rd (N) LT	-	***553***	-	***5.4***	-	***8.4***	-	***A***
	Elm High Rd (N) Ahead	-	***107***	-	***7.1***	-	***36.4***	-	***D***
	New Link Rd	-	***672***	-	***8.7***	-	***12.2***	-	***B***
	Elm High Rd (S) Ahead	-	***91***	-	***2.7***	-	***20.9***	-	***C***
	Elm High Rd (S) RT	-	***83***	-	***4.2***	-	***31.8***	-	***C***
	Overall Junction Summary	-	***1506***	-	***6.1***	-	***14.1***	-	***B***
A47 / Elm High Rd Rbt	Elm High Rd (N)	***637***	636	4.8	***1.8***	***7.7***	7.9	***A***	A
	A47 (E)	***864***	***864***	14.4	***2.6***	19.1	***7.0***	C	***A***
	Elm High Rd (S)	662	***761***	661.9	***12.5***	315.7	***21.3***	F	***C***
	A47 (W)	***472***	460	16.1	***3.8***	27.6	***15.4***	D	***C***
	Overall Junction Summary	2634	***2719***	174.3	***5.2***	92.2	***12.6***	F	***B***

Table 19 shows that the A47 roundabout is forecast to perform better the Weasenham Lane junction is operating over capacity and marginally worse than the DM as a result of more vehicles being processed from Elm High Road S approach at the roundabout.

Table 20. 2026 Without WLR PM Peak Approach Comparison Results Elm High Road Option 3

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Node	Approach	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***641***	***641***	72.3	***37.5***	120.8	***43.9***	F	***D***
	Ramnoth Rd	136	***146***	154.8	***1.5***	661.3	***31.4***	F	***C***
	Elm High Rd (S)	499	***545***	32.9	***29.1***	48.6	***37.3***	D	***D***
	Weasenham Ln	509	***639***	171.8	***157.8***	142.4	***83.8***	F	***F***
	Overall Junction Summary	1785	***1971***	108.0	***56.5***	143.7	***53.5***	F	***D***
Elm High Rd / New Link Rd	Elm High Rd (N) LT	-	***666***	-	***24.8***	-	***18.7***	-	***B***
	Elm High Rd (N) Ahead	-	***142***	-	***19.4***	-	***46.5***	-	***D***
	New Link Rd	-	***571***	-	***16.5***	-	***16.2***	-	***B***
	Elm High Rd (S) Ahead	-	***76***	-	***3.3***	-	***26.8***	-	***C***
	Elm High Rd (S) RT	-	***192***	-	***14.3***	-	***38.8***	-	***D***
	Overall Junction Summary	-	***1648***	-	***15.8***	-	***23.1***	-	***C***
A47 / Elm High Rd Rbt	Elm High Rd (N)	791	***812***	120.4	***34.2***	38.4	***24.2***	E	***C***
	A47 (E)	657	***833***	761.9	***42.8***	330.5	***20.2***	F	***C***
	Elm High Rd (S)	611	***651***	137.1	***64.9***	36.9	***21.0***	E	***C***
	A47 (W)	***475***	422	175.5	***3.9***	149.3	***27.3***	F	***D***
	Overall Junction Summary	2534	***2718***	298.7	***36.5***	135.6	***22.8***	F	***C***

Table 20 shows significant improvements to delays with Option 3 with all approaches and junctions operating better than the DM. The Weasenham Lane approach is still operating over capacity in Option 3, although delays have reduced by nearly 1 minute, and the Ramnoth Lane approach delays have reduced by over 10 minutes by removing the congestion southbound.

4.7. 2026 With WLR Results

A summary of each approach to the new A47 / Elm High Road roundabout, the new signalised junction and the Elm High Road / Weasenham Lane junctions have been compared back to the 2026 With WLR DM results and are shown in Tables 21 and 22 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 21. 2026 With WLR AM Peak Approach Comparison Results Elm High Road Option 3

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3
Churchill Rd / Weasenham Ln	Churchill Rd (N)	385	***387***	14.8	***14.0***	37.0	***35.9***	D	***D***
	Ramnoth Rd	487	***521***	666.1	***658.4***	583.6	***510.4***	F	***F***
	Elm High Rd (S)	425	***432***	27.7	***15.1***	34.3	***34.2***	C	***C***
	Weasenham Ln	418	***420***	23.8	***20.2***	47.1	***42.4***	D	***D***
	Overall Junction Summary	1715	***1759***	183.1	***176.9***	194.0	***177.2***	F	***F***
Elm High Rd / New Link Rd	Elm High Rd (N) LT	-	***506***	-	***4.0***	-	***6.6***	-	***A***
	Elm High Rd (N) Ahead	-	***96***	-	***3.4***	-	***26.9***	-	***C***
	New Link Rd	-	***471***	-	***5.0***	-	***9.8***	-	***A***
	Elm High Rd (S) Ahead	-	***74***	-	***1.4***	-	***15.4***	-	***B***
	Elm High Rd (S) RT	-	***83***	-	***3.3***	-	***25.3***	-	***C***
	Overall Junction Summary	-	***1230***	-	***3.7***	-	***11.2***	-	***B***
A47 / Elm High Rd Rbt	Elm High Rd (N)	571	***589***	2.5	***0.9***	***5.6***	5.9	***A***	A
	A47 (E)	826	***831***	6.7	***1.4***	10.8	***5.2***	B	***A***
	Elm High Rd (S)	661	***668***	13.1	***6.2***	14.9	***13.6***	B	***B***
	A47 (W)	448	***454***	9.0	***1.8***	15.2	***11.5***	C	***B***
	Overall Junction Summary	2507	***2541***	7.8	***2.6***	11.5	***8.7***	B	***A***

Table 22. 2026 With WLR PM Peak Approach Comparison Results Elm High Road Option 3

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Node	Approach	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3	DM	EH Opt 3
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***294***	292	10.8	***10.2***	38.5	***36.1***	D	***D***
	Ramnoth Rd	***130***	***130***	0.9	***0.6***	26.7	***24.8***	C	***C***
	Elm High Rd (S)	417	***418***	13.9	***13.8***	***32.6***	33.4	***C***	C
	Weasenham Ln	732	***770***	154.2	***150.7***	67.8	***61.8***	E	***E***
	Overall Junction Summary	1571	***1609***	44.9	***43.8***	49.6	***46.8***	D	***D***
Elm High Rd / New Link Rd	Elm High Rd (N) LT	-	***446***	-	***6.7***	-	***10.4***	-	***B***
	Elm High Rd (N) Ahead	-	***135***	-	***7.2***	-	***33.5***	-	***C***
	New Link Rd	-	***446***	-	***5.9***	-	***11.3***	-	***B***
	Elm High Rd (S) Ahead	-	***77***	-	***1.6***	-	***17.0***	-	***B***
	Elm High Rd (S) RT	-	***193***	-	***9.6***	-	***28.5***	-	***C***
	Overall Junction Summary	-	***1298***	-	***6.1***	-	***16.3***	-	***B***
A47 / Elm High Rd Rbt	Elm High Rd (N)	627	***640***	12.9	***2.3***	12.8	***8.6***	B	***A***
	A47 (E)	***730***	727	18.2	***2.2***	22.0	***6.5***	C	***A***
	Elm High Rd (S)	***700***	698	6.5	***2.6***	13.4	***9.7***	B	***A***
	A47 (W)	582	***583***	9.0	***1.5***	20.9	***16.8***	C	***C***
	Overall Junction Summary	2637	***2648***	11.7	***2.1***	17.3	***10.1***	C	***B***

Tables 21 and 22 show that with a reduction in flow, Option 3 still provides benefits to all junctions in both peaks, especially the PM Peak.

The AM peak results show that Ramnoth Road experiences long delays as a result of a higher demand of traffic on this arm compared to the without WLR, and there has been no change to signal timings for the approach.

5. Elm High Road Option 4

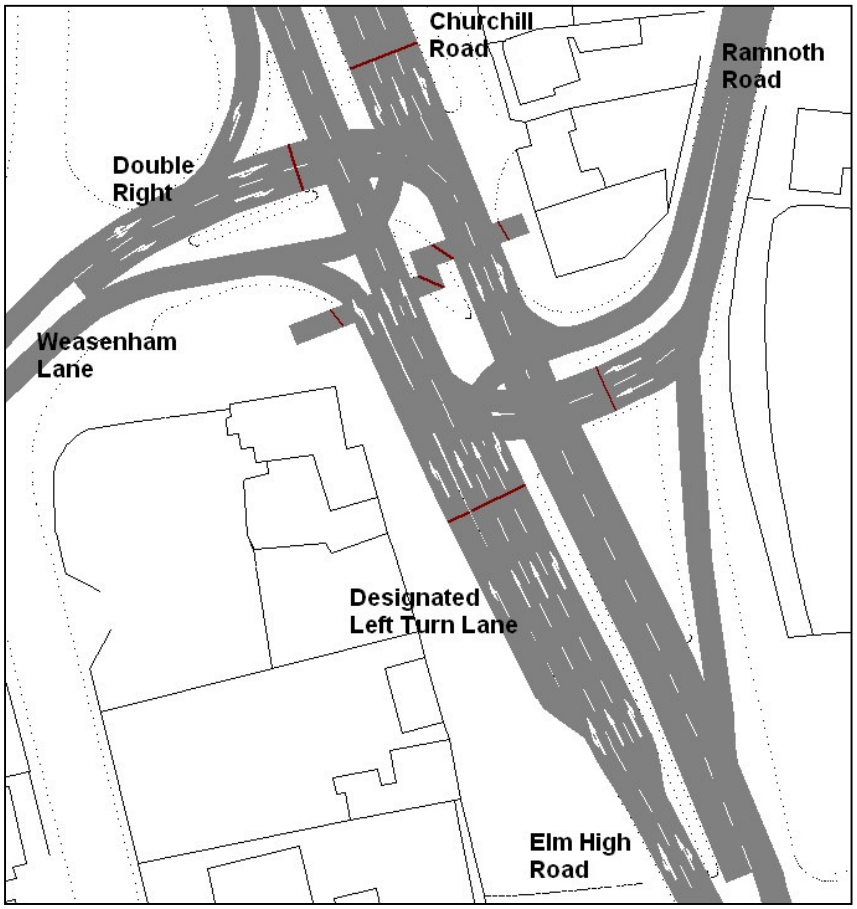
5.1. Network Changes

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 shown in Figure 10:

- The Weasenham Lane junction has been amended to increase capacity for the key problem areas highlighted in the LMVR for the AM and PM peaks;
- An additional lane has been introduced along the Elm High Road (S) approach to the junction for the left turners only to help alleviate some of the congestion issues observed in the AM peak;
- The additional lane will be controlled by signals and will retain the same phase as the ahead movement (as per the existing staging arrangement);
- The signal timings have been slightly altered during the modelling process, with 8 seconds removed from phase A (Elm High Road NB), and re-distributed by adding 2 seconds to phase C (Elm High Road SB right turn) and 6 seconds to phase D (Weasenham Lane) in the AM peak;
- In the PM peak, 6 seconds has been removed from phase A with 3 seconds added to phase C and 3 seconds added to phase D;
- The Ramnoth Road nearside lane will feed into the designated left turn lane;
- The Weasenham Lane approach has been made a double right turn, as currently, the nearside lane is for vehicles travelling to Ramnoth Road, and the offside is for Elm High Road. This will enhance capacity for this approach;
- All other movements remain the same and the pedestrian facilities have been retained; and
- The staging and inter greens have not been updated.

The alterations to the junction have been made to alleviate the observed issues highlighted from the base modelling.

Figure 10. Elm High Road Option 4 Layout



5.2. 2016 Results

A summary of each approach to the Weasenham Lane / Elm High Road junction has been compared back to the existing conditions results, and is shown in Tables 23 and 24 for the AM and PM peaks respectively.

Table 23. 2016 AM Peak Approach Comparison Results Elm High Road Option 4

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	Base	EH Opt 4	Base	EH Opt 4	Base	EH Opt 4	Base	EH Opt 4
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***535***	533	34.6	***22.0***	51.6	***41.1***	D	***D***
	Ramnoth Rd	329	***331***	11.4	***11.0***	***38.9***	39.0	***D***	D
	Elm High Rd (S)	846	***854***	73.0	***43.7***	51.6	***50.7***	D	***D***
	Weasenham Ln	***462***	461	72.3	***51.9***	75.4	***61.7***	E	***E***
	Overall Junction Summary	2170	***2180***	47.8	***32.2***	54.9	***49.0***	D	***D***

Table 23 shows that the amendments to the Weasenham Lane junction layout and signal timings have reduced the queues and delays, whilst processing more vehicles through the junction.

Table 24. 2016 PM Peak Approach Comparison Results Elm High Road Option 4

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	Base	EH Opt 4	Base	EH Opt 4	Base	EH Opt 4	Base	EH Opt 4
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***526***	511	14.3	***14.0***	40.4	***40.4***	D	***D***
	Ramnoth Rd	202	***205***	31.4	***18.1***	96.9	***71.3***	F	***E***
	Elm High Rd (S)	612	***616***	16.0	***0.9***	***27.7***	28.6	***C***	C
	Weasenham Ln	536	***537***	54.8	***49.1***	66.5	***63.3***	E	***E***
	Overall Junction Summary	***1876***	1868	29.1	***20.5***	47.9	***46.3***	D	***D***

Table 24 shows that the proposed changes at the Weasenham Lane junction are forecast to improve the performance for all approaches, with the exception of the Elm High Road (S) approach. Less green time has been given to this approach and re-distributed to the other arms and the difference in delay is marginal.

Delays are forecast to decrease by around 25 seconds for the Ramnoth Road approach preventing it from operating over capacity.

However, any benefits to the junction are constrained as the queuing back from the A47 roundabout still occurs, preventing vehicles from moving freely away from the junction. This is shown as fewer vehicles are being processed from Churchill Road (N).

5.3. 2021 Without WLR Results Summary

A summary of each approach to the Weasenham Lane / Elm High Road junction have been compared back to the 2021 Without WLR DM results and are shown in Tables 25 and 26 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 25. 2021 Without WLR AM Peak Approach Comparison Results Elm High Road Option 4

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln	Churchill Rd (N)	548	***551***	31.9	***28.1***	50.3	***49.1***	D	***D***
	Ramnoth Rd	***379***	377	***17.1***	19.5	***46.1***	50.4	***D***	D
	Elm High Rd (S)	***636***	634	27.5	***6.9***	***40.2***	43.4	***D***	D
	Weasenham Ln	530	***550***	135.3	***126.6***	104.2	***95.5***	F	***F***
	Overall Junction Summary	2091	***2112***	53.0	***45.3***	60.2	***59.7***	E	***E***

Table 26. 2021 Without WLR PM Peak Approach Comparison Results Elm High Road Option 4

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***574***	573	19.8	***18.2***	46.0	***43.5***	D	***D***
	Ramnoth Rd	207	***208***	25.5	***22.3***	103.4	***90.5***	F	***F***
	Elm High Rd (S)	565	***566***	15.9	***0.7***	***30.1***	30.8	***C***	C
	Weasenham Ln	***679***	648	***142.0***	155.0	***81.2***	89.4	***F***	F
	Overall Junction Summary	***2023***	1996	50.8	***49.1***	***57.9***	58.9	***E***	E

Tables 25 and 26 show that the Elm High Road (S) approach is operating marginally worse with Option 4 as a result of removing some green time and re-distributing it to other approaches, although by allowing a designated left turn lane into Weasenham Lane has helped to reduce queues at this approach.

Allowing a double right turn out of Weasenham Lane has helped to reduce delay and queues in the AM peak, but any benefits in the PM peak are constrained by the southbound congestion along Elm High Road as a result of the existing A47 roundabout layout.

Both peaks show that the Weasenham Lane junction is operating at capacity in 2021.

5.4. 2021 With WLR Results Summary

A summary of each approach to the Weasenham Lane / Elm High Road junction have been compared back to the 2021 With WLR DM results and are shown in Tables 27 and 28 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 27. 2021 With WLR AM Peak Approach Comparison Results Elm High Road Option 4

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***261***	***261***	9.8	***9.6***	***36.0***	36.4	***D***	D
	Ramnoth Rd	***410***	402	38.1	***26.2***	73.5	***57.1***	E	***E***
	Elm High Rd (S)	***611***	603	22.1	***2.0***	34.8	***34.6***	C	***C***
	Weasenham Ln	475	***477***	43.8	***30.1***	58.7	***45.4***	E	***D***
	Overall Junction Summary	***1756***	1742	28.5	***17.0***	50.5	***43.0***	D	***D***

Table 28. 2021 With WLR PM Peak Approach Comparison Results Elm High Road Option 4

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***278***	276	10.3	***9.5***	38.3	***35.4***	D	***D***
	Ramnoth Rd	206	***207***	2.2	***1.7***	26.9	***23.4***	C	***C***
	Elm High Rd (S)	***366***	***366***	12.9	***0.2***	33.3	***31.7***	C	***C***
	Weasenham Ln	***669***	666	87.6	***57.0***	58.6	***47.2***	E	***D***
	Overall Junction Summary	***1519***	1515	28.3	***17.1***	44.5	***38.1***	D	***D***

Tables 27 and 28 show that with a reduced flow along Elm High Road as a result of the Western Link Road, Option 4 provides benefits to all approaches and that the junctions are operating close to capacity.

5.5. 2026 Without WLR Results

A summary of each approach to the Weasenham Lane / Elm High Road junction have been compared back to the 2026 Without WLR DM results and are shown in Tables 29 and 30 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 29. 2026 Without WLR AM Peak Approach Comparison Results Elm High Road Option 4

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln	Churchill Rd (N)	584	***600***	125.0	***85.3***	128.7	***95.7***	F	***F***
	Ramnoth Rd	***487***	467	***129.1***	248.1	***139.1***	240.1	***F***	F
	Elm High Rd (S)	598	***599***	29.5	***12.6***	***40.6***	46.5	***D***	D
	Weasenham Ln	519	***526***	***70.4***	73.7	***69.2***	71.3	***E***	E
	Overall Junction Summary	2189	***2190***	***88.5***	104.9	***92.6***	106.8	***F***	F

Table 30. 2026 Without WLR PM Peak Approach Comparison Results Elm High Road Option 4

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln	Churchill Rd (N)	641	***656***	72.3	***64.1***	***120.8***	132.0	***F***	F
	Ramnoth Rd	136	***150***	154.8	***130.9***	661.3	***560.9***	F	***F***
	Elm High Rd (S)	499	***515***	32.9	***2.7***	48.6	***35.8***	D	***D***
	Weasenham Ln	509	***524***	171.8	***171.7***	142.4	***141.9***	F	***F***
	Overall Junction Summary	1785	***1844***	108.0	***92.4***	143.7	***143.4***	F	***F***

Tables 29 and 30 show that Option 4 provides benefits to the PM peak network, although the junction is still constrained by the A47 roundabout congestion.

In the AM peak, the junction performs marginally worse, although the signal timings utilised were from the 2016 assessment and could be adjusted. However, in both peaks the junction is operating over capacity.

5.6. 2026 With WLR Results

A summary of each approach to the Weasenham Lane / Elm High Road junction have been compared back to the 2026 With WLR DM results and are shown in Tables 31 and 32 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 31. 2026 With WLR AM Peak Approach Comparison Results Elm High Road Option 4

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln	Churchill Rd (N)	385	***388***	14.8	***14.0***	37.0	***36.2***	D	***D***
	Ramnoth Rd	487	***493***	666.1	***659.8***	583.6	***551.0***	F	***F***
	Elm High Rd (S)	425	***434***	27.7	***0.6***	34.3	***34.2***	C	***C***
	Weasenham Ln	***418***	***418***	23.8	***18.2***	47.1	***38.8***	D	***D***
	Overall Junction Summary	1715	***1734***	183.1	***173.2***	194.0	***182.7***	F	***F***

Table 31 shows that Option 4 provides benefits over the DM scenario with reductions to delays on all approaches, although the junction is operating over capacity.

Table 32. 2026 With WLR PM Peak Approach Comparison Results Elm High Road Option 4

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***294***	291	10.8	***10.3***	38.5	***36.7***	D	***D***
	Ramnoth Rd	***130***	***130***	0.9	***0.7***	26.7	***25.1***	C	***C***
	Elm High Rd (S)	417	***418***	13.9	***0.4***	32.6	***31.8***	C	***C***
	Weasenham Ln	732	***762***	154.2	***148.3***	67.8	***63.1***	E	***E***
	Overall Junction Summary	1571	***1601***	44.9	***39.9***	49.6	***47.0***	D	***D***

Table 32 shows that the Option 4 changes to the Weasenham Lane junction reduces delays at all approaches to the junction. With lower flows with the Link Road scenario, the congestion heading southbound is not impacting on the junction as much and therefore, benefits can be realised. The junction is operating close to capacity in the PM peak.

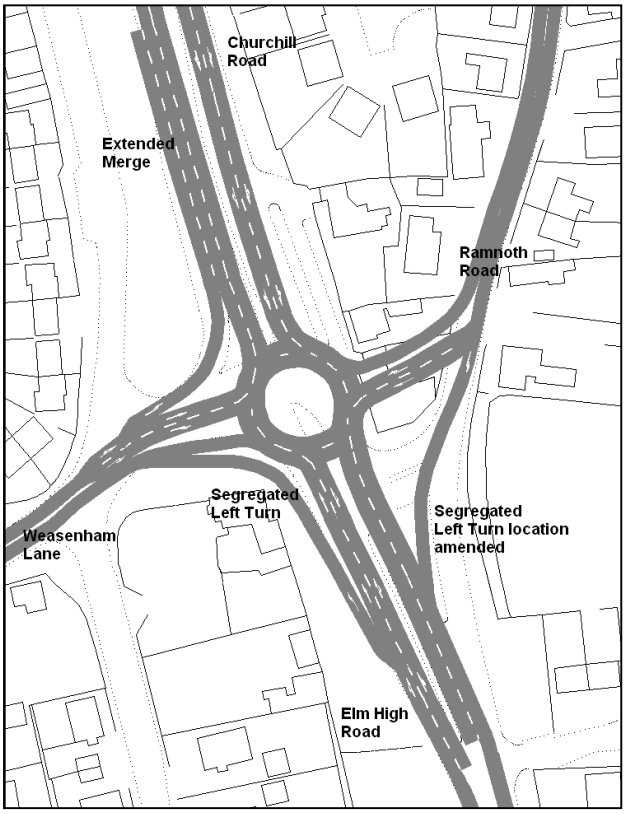
6. Elm High Road Option 7

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 shown in Figure 11:

- The Weasenham Lane junction has been converted from a signalised junction to a 4 arm priority controlled roundabout;
- A segregated left turn from Elm High Road to Weasenham Lane has been provided;
- The segregated left turns from Ramnoth Road and Weasenham Lane have been retained;
- Elm Road access onto Weasenham Lane has been closed, allowing a longer left turn slip;
- As a result of losing the right turn lane from Churchill Road, the merge section from Weasenham Lane has been extended utilising the free space; and,
- The pedestrian crossing over Elm High Road has been removed.

Figure 11. Elm High Road Option 7 Layout



6.2. 2016 Results

A summary of each approach to the Weasenham Lane / Elm High Road junction has been compared back to the existing conditions results, and is shown in Tables 33 and 34 for the AM and PM peaks respectively.

Table 33. 2016 AM Peak Approach Comparison Results Elm High Road Option 7

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	Base	EH Opt 4	Base	EH Opt 4	Base	EH Opt 4	Base	EH Opt 4
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	***535***	531	34.6	***1.0***	51.6	***8.0***	D	***A***
	Ramnoth Rd LT	-	***153***	-	***0.2***	-	***3.9***	-	***A***
	Ramnoth Rd	***329***	178	11.4	***0.6***	38.9	***7.4***	D	***A***
	Elm High Rd (S)	846	***860***	73.0	***0.0***	51.6	***5.3***	D	***A***
	Weasenham Ln	***462***	***462***	72.3	***0.0***	75.4	***5.5***	E	***A***
	Overall Junction Summary	2170	***2184***	47.8	***0.4***	54.9	***6.1***	D	***A***

Table 33 shows that converting the signalised junction to a priority controlled roundabout, is forecast to significantly reduce the delays and queues at all approaches allowing the junction to operate well within capacity.

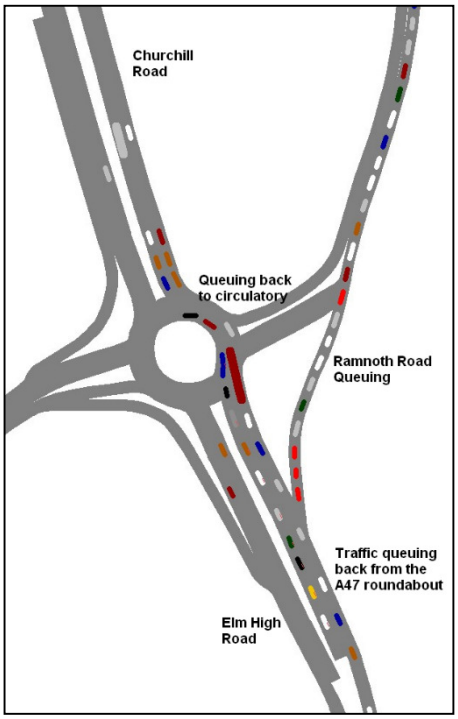
Table 34. 2016 PM Peak Approach Comparison Results Elm High Road Option 7

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	Base	EH Opt 4	Base	EH Opt 4	Base	EH Opt 4	Base	EH Opt 4
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	***526***	513	14.3	***1.5***	40.4	***19.1***	D	***C***
	Ramnoth Rd LT	-	***114***	-	***30.1***	-	***98.9***	-	***F***
	Ramnoth Rd	***202***	88	31.4	***14.6***	96.9	***46.9***	F	***E***
	Elm High Rd (S)	612	***613***	16.0	***0.0***	27.7	***2.7***	C	***A***
	Weasenham Ln	536	***539***	54.8	***0.1***	66.5	***17.8***	E	***C***
	Overall Junction Summary	***1876***	1868	29.1	***5.6***	47.9	***18.4***	D	***C***

Table 34 shows that the roundabout design is forecast to improve delays at all approaches, although the Ramnoth Road approaches are still operating at or over capacity as a result of the queuing back from the A47 roundabout, blocking access onto Elm High Road, which is shown in more detail in Figure 12.

As a result of processing more vehicles from Weasenham Lane, fewer vehicles are processed from Churchill Road (N) as a result of blocking back from the A47 roundabout, which is also shown in Figure 12.

Figure 12. Elm High Road Option 7 PM Peak Queuing



6.3. 2021 Without WLR Results Summary

A summary of each approach to the Weasenham Lane / Elm High Road junction have been compared back to the 2021 Without WLR DM results and are shown in Tables 35 and 36 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 35. 2021 Without WLR AM Peak Approach Comparison Results Elm High Road Option 7

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 7	DM	EH Opt 7	DM	EH Opt 7	DM	EH Opt 7
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	548	***550***	31.9	***1.1***	50.3	***8.1***	D	***A***
	Ramnoth Rd LT	-	***163***	-	***0.1***	-	***3.8***	-	***A***
	Ramnoth Rd	***379***	213	17.1	***0.8***	46.1	***7.7***	D	***A***
	Elm High Rd (S)	636	***637***	27.5	***0.0***	40.2	***4.8***	D	***A***
	Weasenham Ln	530	***572***	135.3	***0.1***	104.2	***5.1***	F	***A***
	Overall Junction Summary	2091	***2134***	53.0	***0.5***	60.2	***6.0***	E	***A***

Table 36. 2021 Without WLR PM Peak Approach Comparison Results Elm High Road Option 7

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 7	DM	EH Opt 7	DM	EH Opt 7	DM	EH Opt 7
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	***574***	556	19.8	***19.0***	46.0	***33.4***	D	***D***
	Ramnoth Rd LT	-	***93***	-	***49.0***	-	***150.9***	-	***F***
	Ramnoth Rd	***207***	99	***25.5***	42.6	***103.4***	117.5	***F***	F
	Elm High Rd (S)	***565***	547	15.9	***0.0***	30.1	***3.6***	C	***A***
	Weasenham Ln	679	***683***	142.0	***4.5***	81.2	***19.6***	F	***C***
	Overall Junction Summary	***2023***	1978	50.8	***18.4***	57.9	***26.7***	E	***D***

Tables 35 and 36 show that the roundabout provides significant benefits to all approaches in the AM peak. In the PM peak, the roundabout still offers benefits, to all approaches, although the Ramnoth Road LT experiences long delays as a result of the queuing along Elm High Road from the A47 roundabout.

6.4. 2021 With WLR Results Summary

A summary of each approach to the Weasenham Lane / Elm High Road junction have been compared back to the 2021 With WLR DM results and are shown in Tables 37 and 38 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 37. 2021 With WLR AM Peak Approach Comparison Results Elm High Road Option 7

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	***261***	***261***	9.8	***0.2***	36.0	***5.7***	D	***A***
	Ramnoth Rd LT	-	***130***	-	***0.0***	-	***2.5***	-	***A***
	Ramnoth Rd	***410***	264	38.1	***0.4***	73.5	***5.1***	E	***A***
	Elm High Rd (S)	***611***	608	22.1	***0.0***	34.8	***3.5***	C	***A***
	Weasenham Ln	***475***	474	43.8	***0.1***	58.7	***4.9***	E	***A***
	Overall Junction Summary	***1756***	1738	28.5	***0.2***	50.5	***4.4***	D	***A***

Table 38. 2021 With WLR PM Peak Approach Comparison Results Elm High Road Option 7

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	***278***	277	10.3	***0.4***	38.3	***7.7***	D	***A***
	Ramnoth Rd LT	-	***112***	-	***0.1***	-	***3.3***	-	***A***
	Ramnoth Rd	***206***	94	2.2	***0.1***	26.9	***4.6***	C	***A***
	Elm High Rd (S)	***366***	364	12.9	***0.0***	33.3	***2.2***	C	***A***
	Weasenham Ln	***669***	664	87.6	***0.2***	58.6	***11.0***	E	***B***
	Overall Junction Summary	***1519***	1513	28.3	***0.2***	44.5	***7.3***	D	***A***

Tables 37 and 38 show that converting the Weasenham Lane junction to a roundabout significantly improves delays in both peaks, as a result of lower flows along Elm High Road with the Western Link Road.

6.5. 2026 Without WLR Results Summary

A summary of each approach to the Weasenham Lane / Elm High Road junction have been compared back to the 2026 Without WLR DM results and are shown in Tables 39 and 40 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 39. 2026 Without WLR AM Peak Approach Comparison Results Elm High Road Option 7

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	584	***611***	125.0	***0.8***	128.7	***7.9***	F	***A***
	Ramnoth Rd LT	-	***239***	-	***0.3***	-	***4.3***	-	***A***
	Ramnoth Rd	***487***	241	129.1	***1.3***	139.1	***9.3***	F	***A***
	Elm High Rd (S)	598	***601***	29.5	***0.0***	40.6	***7.5***	D	***A***
	Weasenham Ln	519	***527***	70.4	***0.0***	69.2	***4.3***	E	***A***
	Overall Junction Summary	2189	***2219***	88.5	***0.5***	92.6	***6.7***	F	***A***

Table 40. 2026 Without WLR PM Peak Approach Comparison Results Elm High Road Option 7

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	***641***	634	***72.3***	179.9	***120.8***	299.4	***F***	F
	Ramnoth Rd LT	-	***61***	-	***317.2***	-	***1444.0***	-	***F***
	Ramnoth Rd	***136***	55	***154.8***	168.5	***661.3***	1199.1	***F***	F
	Elm High Rd (S)	***499***	470	32.9	***13.6***	48.6	***6.8***	D	***A***
	Weasenham Ln	509	***623***	171.8	***7.8***	142.4	***57.1***	F	***F***
	Overall Junction Summary	1785	***1845***	108.0	***105.7***	***143.7***	201.6	***F***	F

Table 39 shows that the junction is forecast to operate within capacity with the roundabout, but operating over capacity in the DM as a signalised junction. Delays have significantly reduced with the proposed roundabout.

Table 40 shows improvements to delays on Elm High Road northbound and at Weasenham Lane, although delays have increased at Ramnoth Road as more vehicles are processed southbound from Weasenham Lane.

As a result vehicles are unable to exit Ramnoth Road as the congestion extends back from the A47 roundabout as identified in the 2016 assessment, although with the increase in flows, the issues are exacerbated.

6.6. 2026 With WLR Results Summary

A summary of each approach to the Weasenham Lane / Elm High Road junction have been compared back to the 2026 With WLR DM results and are shown in Tables 41 and 42 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 41. 2026 With WLR AM Peak Approach Comparison Results Elm High Road Option 7

		AM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	385	***387***	14.8	***0.4***	37.0	***6.4***	D	***A***
	Ramnoth Rd LT	-	***310***	-	***0.2***	-	***4.6***	-	***A***
	Ramnoth Rd	***487***	340	666.1	***1.5***	583.6	***7.8***	F	***A***
	Elm High Rd (S)	425	***435***	27.7	***0.0***	34.3	***4.6***	C	***A***
	Weasenham Ln	418	***419***	23.8	***0.0***	47.1	***4.8***	D	***A***
	Overall Junction Summary	1715	***1894***	183.1	***0.5***	194.0	***5.6***	F	***A***

Table 42. 2026 With WLR PM Peak Approach Comparison Results Elm High Road Option 7

		PM Peak							
		Volume		Avg Queue (m)		Delay (s)		LOS	
Junction	Approach	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4	DM	EH Opt 4
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	***294***	291	10.8	***0.8***	38.5	***8.7***	D	***A***
	Ramnoth Rd LT	-	***64***	-	***0.1***	-	***3.5***	-	***A***
	Ramnoth Rd	***130***	66	0.9	***0.1***	26.7	***5.0***	C	***A***
	Elm High Rd (S)	417	***418***	13.9	***0.0***	32.6	***2.2***	C	***A***
	Weasenham Ln	732	***906***	154.2	***0.4***	67.8	***12.3***	E	***B***
	Overall Junction Summary	1571	***1743***	44.9	***0.3***	49.6	***8.7***	D	***A***

Tables 41 and 42 show that the roundabout in Option 7 performs much better than the signalised junction and provides significant improvements to Ramnoth Road in the AM peak.

7. Elm High Road Option Adjustments

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 modified.

Of the four options originally assessed for Elm High Road, all options have been retained. Two options have been modified and been renamed 1a and 7a.

8. Elm High Road Option 1a

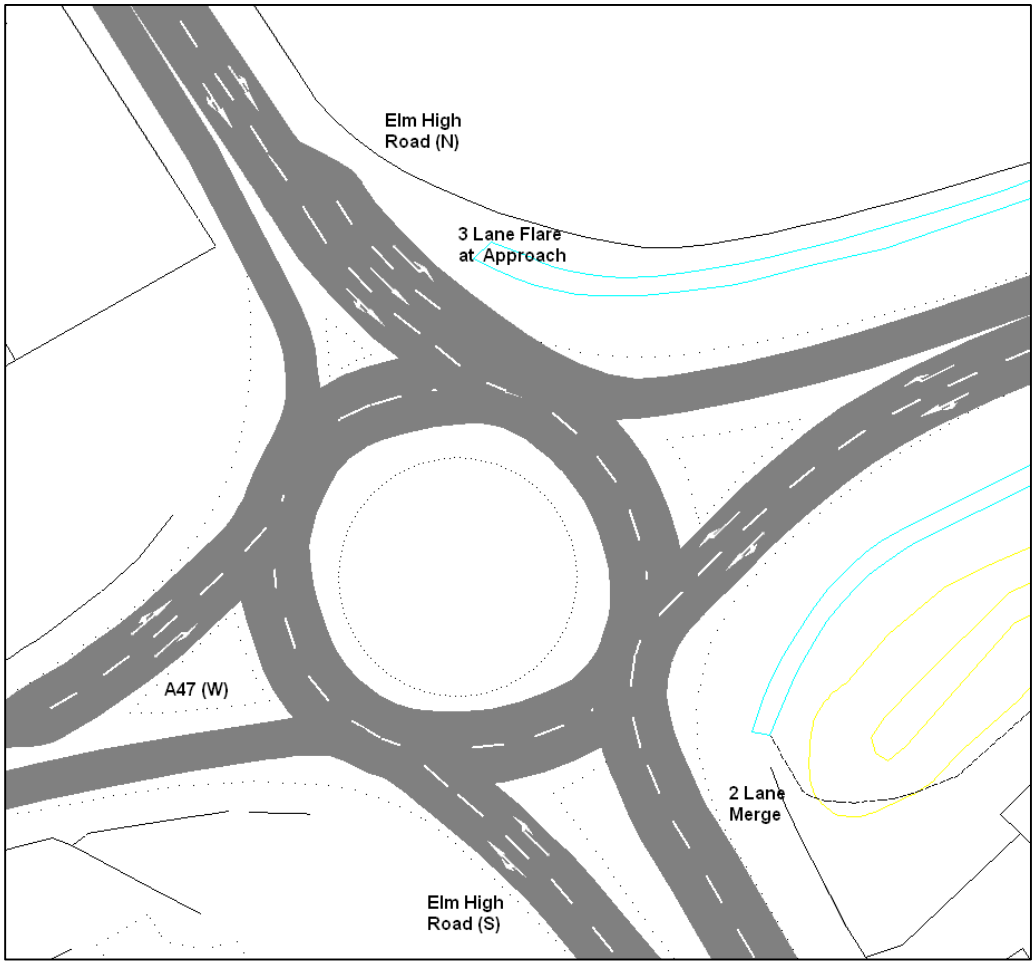
8.1. Network Changes

The original Option 1 model has been updated to only enhance capacity for the southbound approach to the A47 / Elm High Road roundabout, which is where a significant amount of the benefit of that option was found. The purpose of assessing this amended option was to determine whether the significant portion of benefit on this approach from Option EH1 could be retained without the additional cost and disruption that would be experienced with the other elements of the option.

As per the previous model, the southbound approach has been increased to 2 lanes southbound from downstream of the Morrisons junction, where it flares to 3 lanes at the approach. The southbound exit has been widened to 2 lanes to accommodate the 2 lanes ahead from the north approach. This is shown in more detail in Figure 13.

All other approaches and exits remain the same as the Do Minimum network.

Figure 13. Elm High Road Option 1a VISSIM Layout



This option has been modelled for the future years of 2021 and 2026 with and without the Western Link Road, with the results compared back to the Do Minimum (DM) and Option 1 results to quantify any benefits.

8.2. 2021 Without WLR Results Summary

A summary of each approach to the A47 / Elm High Road roundabout, the Morrisons and Weasenham Lane junctions have been compared back to the 2021 Without WLR DM and EH Opt 1 results and are shown in Tables 43 and 44 for the AM and PM peaks respectively.

The light blue shaded cells represent the optimum performer.

Table 43. 2021 Without WLR AM Peak Approach Comparison Results Elm High Road Option 1a

		AM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a
Churchill Rd / Weasenham Ln	Churchill Rd (N)	548	549	***550***	31.9	35.4	***31.3***	50.3	53.6	***49.6***	D	D	***D***
	Ramnoth Rd	379	379	***380***	17.1	18.0	***16.6***	46.1	47.4	***44.8***	D	D	***D***
	Elm High Rd (S)	636	***644***	638	27.5	28.7	***27.3***	40.2	41.1	***39.5***	D	D	***D***
	Weasenham Ln	***530***	526	529	135.3	131.1	***129.8***	104.2	102.2	***101.7***	F	F	***F***
	Overall Junction Summary	2091	***2098***	2097	53.0	53.3	***51.2***	60.2	61.0	***58.8***	E	E	***E***
Elm High Rd / Morrisons	Elm High Rd (N)	625	626	***627***	0.6	***0.5***	0.7	4.0	***3.8***	4.0	A	***A***	A
	Supermarket Access	***75***	***75***	***75***	0.4	***0.3***	***0.3***	7.6	***6.8***	7.4	A	***A***	A
	Elm High Rd (S)	663	***665***	663	***0.0***	0.3	0.1	***2.3***	3.1	2.4	***A***	A	A
	Petrol Station	***87***	***87***	***87***	***0.5***	0.6	0.6	***8.0***	8.4	8.8	***A***	A	A
	Overall Junction Summary	1450	***1454***	1451	***0.4***	0.5	0.5	***3.6***	3.9	3.7	***A***	A	A
A47 / Elm High Rd Rbt	Elm High Rd (N)	578	578	***579***	6.5	1.6	***1.2***	9.2	4.9	***4.3***	A	A	***A***
	A47 (E)	***832***	***832***	***832***	13.5	***5.4***	8.5	18.2	***10.8***	13.9	C	***B***	B
	Elm High Rd (S)	773	***777***	775	85.6	***3.1***	73.3	49.4	***11.3***	44.9	E	***B***	E
	A47 (W)	583	***587***	585	20.3	***11.9***	22.5	29.2	***21.7***	30.0	D	***C***	D
	Overall Junction Summary	2766	***2774***	2771	31.5	***5.5***	26.4	27.4	***12.0***	24.0	D	***B***	C

Table 44. 2021 Without WLR PM Peak Approach Comparison Results Elm High Road Option 1a

		PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a
Churchill Rd / Weasenham Ln	Churchill Rd (N)	574	543	***576***	19.8	***18.1***	19.0	46.0	37.2	***37.0***	D	D	***D***
	Ramnoth Rd	207	210	***211***	25.5	2.1	***1.9***	103.4	26.5	***25.6***	F	C	***C***
	Elm High Rd (S)	565	***569***	565	15.9	16.2	***15.8***	30.1	30.4	***29.4***	C	C	***C***
	Weasenham Ln	679	***702***	693	142.0	144.9	***139.9***	81.2	73.4	***73.3***	F	E	***E***
	Overall Junction Summary	2023	2024	***2045***	50.8	45.4	***44.2***	57.9	46.7	***46.1***	E	D	***D***
Elm High Rd / Morrisons	Elm High Rd (N)	667	664	***685***	164.9	0.9	***0.7***	109.3	4.6	***4.5***	F	A	***A***
	Supermarket Access	***209***	208	208	5.9	***1.7***	1.8	30.6	***7.7***	8.1	D	***A***	A
	Elm High Rd (S)	***619***	618	618	***0.1***	0.2	0.2	6.6	3.4	***3.1***	A	A	***A***
	Petrol Station	***67***	***67***	***67***	2.6	0.6	***0.5***	51.5	12.8	***11.7***	F	B	***B***
	Overall Junction Summary	1562	1558	***1577***	40.3	0.9	***0.8***	55.2	4.9	***4.8***	F	A	***A***
A47 / Elm High Rd Rbt	Elm High Rd (N)	715	709	***725***	150.2	4.5	***3.7***	52.7	8.7	***7.4***	F	A	***A***
	A47 (E)	848	849	***852***	153.7	***9.6***	42.7	87.7	***15.7***	37.2	F	***C***	E
	Elm High Rd (S)	***680***	679	678	22.5	***2.8***	23.8	23.8	***11.0***	24.6	C	***B***	C
	A47 (W)	869	***889***	854	270.2	***145.4***	320.1	126.3	***77.6***	145.2	F	***F***	F
	Overall Junction Summary	3111	***3125***	3108	149.2	***40.6***	97.6	76.7	***31.0***	57.5	F	***D***	F

Table 43 shows that increasing capacity at the north approach only, helps to reduce delays for this approach, but all other arms experience longer delays than with Option 1. By holding back traffic at Elm High Road (S) allows the Weasenham Lane junction to perform better than with Option 1.

Table 44 shows that removing the congestion along Elm High Road southbound to the A47 roundabout by increasing capacity at the A47 roundabout, reduces the delays for this approach. As there is less delay, there are more gaps in traffic around the circulatory allowing the A47 E arm to perform better than the DM and process more vehicles through the junction. The extra vehicles from Elm High Road (N) and A47 (E) conflict with the Elm High Road (S) and A47 (W) approaches, leading to higher delays than the DM on those approaches.

8.3. 2021 With WLR Results Summary

A summary of each approach to the A47 / Elm High Road roundabout, the Morrisons and Weasenham Lane junctions have been compared back to the 2021 With WLR DM and EH Opt 1 results and are shown in Tables 45 and 46 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 45.2021 With WLR AM Peak Approach Comparison Results Elm High Road Option 1a

		AM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	**Approach**	**DM**	**EH Opt 1**	**EH Opt 1a**	**DM**	**EH Opt 1**	**EH Opt 1a**	**DM**	**EH Opt 1**	**EH Opt 1a**	**DM**	**EH Opt 1**	**EH Opt 1a**
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***261***	***261***	***261***	9.8	***9.2***	***9.2***	36.0	***33.8***	34.4	D	***C***	C
	Ramnoth Rd	***410***	402	400	38.1	***21.5***	24.3	73.5	***50.5***	54.0	E	***D***	D
	Elm High Rd (S)	611	***613***	***613***	22.1	21.1	***20.9***	34.8	35.1	***34.1***	C	D	***C***
	Weasenham Ln	475	***477***	***477***	43.8	***28.5***	31.2	58.7	***45.6***	47.8	E	***D***	D
	Overall Junction Summary	***1756***	1751	1751	28.5	***20.1***	21.4	50.5	***41.3***	42.5	D	***D***	D
Elm High Rd / Morrisons	Elm High Rd (N)	***417***	414	416	***0.1***	***0.1***	0.2	2.9	***2.7***	2.8	A	***A***	A
	Supermarket Access	98	***99***	97	***0.2***	***0.2***	0.3	4.8	***4.4***	4.9	A	***A***	A
	Elm High Rd (S)	636	631	***638***	***0.0***	0.1	0.1	***2.0***	2.5	2.0	***A***	A	A
	Petrol Station	***101***	***101***	100	***0.5***	0.6	0.6	7.6	***7.5***	8.0	A	***A***	A
	Overall Junction Summary	***1252***	1245	***1252***	***0.3***	***0.3***	***0.3***	***2.9***	3.1	3.0	***A***	A	A
A47 / Elm High Rd Rbt	Elm High Rd (N)	***420***	418	419	1.8	***0.5***	***0.5***	5.7	3.6	***3.4***	A	A	***A***
	A47 (E)	***748***	747	746	3.0	***1.4***	2.4	8.0	***6.0***	7.2	A	***A***	A
	Elm High Rd (S)	***757***	***757***	755	12.8	***1.9***	11.8	16.2	***9.4***	15.7	C	***A***	C
	A47 (W)	525	501	***540***	11.8	***7.9***	13.5	22.5	***18.4***	23.5	C	***C***	C
	Overall Junction Summary	2449	2422	***2460***	7.3	***3.0***	7.1	13.3	***9.2***	12.7	B	***A***	B

Table 46.2021 With WLR PM Peak Approach Comparison Results Elm High Road Option 1a

		PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***278***	***278***	277	10.3	***9.6***	9.8	38.3	***35.3***	35.6	D	***D***	D
	Ramnoth Rd	206	***207***	***207***	2.2	1.7	***1.5***	26.9	24.0	***23.3***	C	C	***C***
	Elm High Rd (S)	366	***374***	366	12.9	12.4	***11.8***	33.3	32.5	***30.8***	C	C	***C***
	Weasenham Ln	***669***	665	666	87.6	61.9	***55.1***	58.6	48.1	***46.1***	E	D	***D***
	Overall Junction Summary	1519	***1522***	1515	28.3	21.4	***19.6***	44.5	38.6	***37.4***	D	D	***D***
Elm High Rd / Morrisons	Elm High Rd (N)	***603***	600	600	3.7	***0.1***	0.2	10.1	***3.0***	3.2	B	***A***	A
	Supermarket Access	***205***	204	203	1.6	***0.9***	1.0	9.9	***5.3***	5.7	A	***A***	A
	Elm High Rd (S)	403	***405***	403	***0.0***	***0.0***	***0.0***	2.9	2.6	***2.5***	A	A	***A***
	Petrol Station	***68***	67	67	0.4	***0.3***	***0.3***	12.4	***8.1***	8.4	B	***A***	A
	Overall Junction Summary	***1278***	1275	1273	1.4	***0.4***	***0.4***	8.0	***3.5***	3.6	A	***A***	A
A47 / Elm High Rd Rbt	Elm High Rd (N)	***678***	669	668	42.5	3.2	***2.9***	25.3	7.3	***6.7***	D	A	***A***
	A47 (E)	***626***	624	624	12.8	***3.9***	10.8	18.7	***10.0***	16.4	C	***A***	C
	Elm High Rd (S)	***653***	***653***	652	5.3	***2.4***	4.9	12.4	***9.9***	12.0	B	***A***	B
	A47 (W)	770	***781***	776	14.2	***10.7***	14.8	23.2	***20.6***	22.9	C	***C***	C
	Overall Junction Summary	2726	***2728***	2721	18.7	***5.1***	8.3	20.2	***12.4***	14.8	C	***B***	B

Table 45 shows that although the roundabout in Option 1a is operating worse than Option 1, the differences are marginal and the junction is still within capacity and operates better than the DM.

Table 46 shows that the roundabout is forecast to operate marginally worse than Option 1, but the Weasenham Lane junction operates better.

8.4. 2026 Without WLR Results Summary

A summary of each approach to the A47 / Elm High Road roundabout, the Morrisons and Weasenham Lane junctions have been compared back to the 2026 Without WLR DM and EH Opt 1 results and are shown in Tables 47 and 48 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 47. 2026 Without WLR AM Peak Approach Comparison Results Elm High Road Option 1a

		AM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	**Approach**	**DM**	**EH Opt 1**	**EH Opt 1a**	**DM**	**EH Opt 1**	**EH Opt 1a**	**DM**	**EH Opt 1**	**EH Opt 1a**	**DM**	**EH Opt 1**	**EH Opt 1a**
Churchill Rd / Weasenham Ln	Churchill Rd (N)	584	581	***585***	125.0	144.1	***110.5***	128.7	145.4	***115.1***	F	F	***F***
	Ramnoth Rd	***487***	480	486	129.1	185.7	***123.3***	139.1	186.9	***133.3***	F	F	***F***
	Elm High Rd (S)	598	***652***	601	29.5	44.6	***27.2***	40.6	49.3	***39.3***	D	D	***D***
	Weasenham Ln	***519***	515	***519***	70.4	81.1	***59.5***	69.2	77.9	***62.4***	E	E	***E***
	Overall Junction Summary	2189	***2227***	2189	88.5	113.9	***80.1***	92.6	110.2	***85.7***	F	F	***F***
Elm High Rd / Morrisons	Elm High Rd (N)	***664***	661	662	***0.5***	0.8	0.7	3.9	4.2	***3.9***	A	A	***A***
	Supermarket Access	***90***	***90***	***90***	0.5	***0.4***	***0.4***	7.4	***6.6***	7.0	A	***A***	A
	Elm High Rd (S)	618	***673***	617	***0.0***	0.3	0.1	***2.3***	3.0	2.3	***A***	A	A
	Petrol Station	93	93	***94***	***0.7***	0.8	***0.7***	9.1	9.7	***9.1***	A	A	***A***
	Overall Junction Summary	1466	***1518***	1462	***0.5***	0.6	***0.5***	3.8	4.1	***3.7***	A	A	***A***
A47 / Elm High Rd Rbt	Elm High Rd (N)	***637***	633	636	4.8	2.0	***1.5***	7.7	5.1	***4.4***	A	A	***A***
	A47 (E)	***864***	863	***864***	14.4	***7.1***	9.7	19.1	***12.8***	14.7	C	***B***	B
	Elm High Rd (S)	662	***760***	664	661.9	***6.8***	692.1	315.7	***16.1***	332.9	F	***C***	F
	A47 (W)	***472***	465	467	16.1	***10.4***	14.1	27.6	***21.6***	25.0	D	***C***	D
	Overall Junction Summary	2634	***2721***	2630	174.3	***6.6***	179.4	92.2	***13.5***	94.2	F	***B***	F

Table 48. 2026 Without WLR PM Peak Approach Comparison Results Elm High Road Option 1a

		PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a
Churchill Rd / Weasenham Ln	Churchill Rd (N)	641	519	***652***	72.3	***16.9***	26.4	120.8	36.6	***36.1***	F	D	***D***
	Ramnoth Rd	136	***210***	142	154.8	***1.7***	8.8	661.3	24.1	***23.7***	F	C	***C***
	Elm High Rd (S)	499	***561***	476	32.9	***15.5***	25.2	48.6	30.2	***28.4***	D	C	***C***
	Weasenham Ln	509	***686***	642	171.8	***137.1***	144.7	142.4	***73.4***	76.3	F	***E***	E
	Overall Junction Summary	1785	***1977***	1912	108.0	***42.8***	51.2	143.7	***46.3***	47.1	F	***D***	D
Elm High Rd / Morrisons	Elm High Rd (N)	751	653	***792***	364.3	***0.6***	17.9	143.1	***4.6***	12.2	F	***A***	B
	Supermarket Access	192	***208***	199	24.0	***1.7***	8.9	49.3	***7.6***	16.0	E	***A***	C
	Elm High Rd (S)	521	***608***	492	8.8	***0.2***	5.6	12.1	***3.2***	3.9	B	***A***	A
	Petrol Station	63	***67***	64	6.9	***0.5***	1.9	74.5	***11.3***	18.8	F	***B***	C
	Overall Junction Summary	1527	1535	***1546***	93.8	***0.8***	8.1	83.6	***4.8***	10.4	F	***A***	B
A47 / Elm High Rd Rbt	Elm High Rd (N)	791	700	***809***	120.4	***3.5***	20.3	38.4	***7.4***	20.3	E	***A***	C
	A47 (E)	657	***848***	671	761.9	***8.0***	688.5	330.5	***14.5***	265.5	F	***B***	F
	Elm High Rd (S)	611	***679***	540	137.1	***2.9***	273.7	36.9	***11.1***	68.6	E	***B***	F
	A47 (W)	475	***747***	471	175.5	***53.8***	202.2	149.3	***45.0***	170.7	F	***E***	F
	Overall Junction Summary	2534	***2973***	2491	298.7	***17.0***	296.2	135.6	***20.0***	126.1	F	***C***	F

Table 47 shows that in the AM peak both the roundabout and Weasenham Lane are operating over capacity with Option 1a and that the Elm High Road (S) approach experiences very long delays by not enhancing capacity at this approach as per Option 1.

Table 48 shows that the A47 roundabout in Option 1a is operating over capacity at all approaches with the exception of the Elm High Road (N) approach. All arms experience long delays, which are closer to the DM values.

In 2026 Option 1a is not forecast to provide as much benefit to the junction as Option 1.

8.5. 2026 With WLR Results Summary

A summary of each approach to the A47 / Elm High Road roundabout, the Morrisons and Weasenham Lane junctions have been compared back to the 2026 With WLR DM and EH Opt 1 results and are shown in Tables 49 and 50 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 49. 2026 With WLR AM Peak Approach Comparison Results Elm High Road Option 1a

		AM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a
Churchill Rd / Weasenham Ln	Churchill Rd (N)	385	***389***	388	14.8	***13.8***	13.9	37.0	35.8	***35.6***	D	D	***D***
	Ramnoth Rd	487	519	***521***	666.1	***656.4***	660.4	583.6	***506.9***	510.8	F	***F***	F
	Elm High Rd (S)	425	438	***440***	27.7	15.5	***15.2***	34.3	34.4	***33.4***	C	C	***C***
	Weasenham Ln	418	419	***425***	23.8	***16.9***	18.3	47.1	***39.9***	41.4	D	***D***	D
	Overall Junction Summary	1715	1765	***1773***	183.1	***175.7***	176.9	194.0	***175.0***	175.6	F	***F***	F
Elm High Rd / Morrisons	Elm High Rd (N)	583	***602***	***602***	***0.1***	***0.1***	***0.1***	2.7	***2.5***	2.6	A	***A***	A
	Supermarket Access	79	81	***82***	1.0	***0.2***	***0.2***	4.7	***4.6***	4.6	A	***A***	A
	Elm High Rd (S)	465	471	***478***	2.5	***0.0***	***0.0***	***2.0***	2.2	2.1	***A***	A	A
	Petrol Station	84	***85***	***85***	1.0	***0.3***	***0.3***	6.3	***6.0***	6.6	A	***A***	A
	Overall Junction Summary	1212	1237	***1246***	1.2	***0.2***	***0.2***	***2.8***	***2.8***	***2.8***	***A***	***A***	***A***
A47 / Elm High Rd Rbt	Elm High Rd (N)	571	***585***	584	2.5	***0.9***	***0.9***	5.6	***3.4***	3.5	A	***A***	A
	A47 (E)	826	***832***	***832***	6.7	***2.5***	4.3	10.8	***7.8***	9.9	B	***A***	A
	Elm High Rd (S)	661	***669***	667	13.1	***3.2***	7.2	14.9	***11.0***	14.3	B	***B***	B
	A47 (W)	448	444	***490***	9.0	***4.3***	6.2	15.2	***13.7***	15.9	C	***B***	C
	Overall Junction Summary	2507	2533	***2573***	7.8	***2.7***	4.6	11.5	***8.7***	10.7	B	***A***	B

Table 50. 2026 With WLR PM Peak Approach Comparison Results Elm High Road Option 1a

		PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a	DM	EH Opt 1	EH Opt 1a
Churchill Rd / Weasenham Ln	Churchill Rd (N)	***294***	293	284	10.8	***10.6***	13.0	38.5	36.8	***30.5***	D	D	***C***
	Ramnoth Rd	***130***	***130***	129	0.9	***0.7***	0.8	26.7	25.9	***25.2***	C	C	***C***
	Elm High Rd (S)	417	***422***	371	***13.9***	14.5	21.6	32.6	34.5	***31.4***	C	C	***C***
	Weasenham Ln	732	***778***	688	154.2	***145.7***	163.9	67.8	***60.2***	77.9	E	***E***	E
	Overall Junction Summary	1571	***1623***	1472	44.9	***42.8***	49.9	49.6	***46.6***	52.3	D	***D***	D
Elm High Rd / Morrisons	Elm High Rd (N)	566	***585***	543	0.3	0.3	***0.1***	4.3	3.4	***3.0***	A	A	***A***
	Supermarket Access	***207***	***207***	206	1.1	1.0	***0.9***	6.1	5.4	***5.0***	A	A	***A***
	Elm High Rd (S)	444	***446***	404	***0.0***	0.1	***0.0***	2.2	2.7	***2.1***	A	A	***A***
	Petrol Station	***67***	***67***	***67***	***0.3***	***0.3***	***0.3***	9.4	8.5	***8.1***	A	A	***A***
	Overall Junction Summary	1284	***1305***	1219	0.5	0.4	***0.3***	4.1	3.7	***3.3***	A	A	***A***
A47 / Elm High Rd Rbt	Elm High Rd (N)	627	***641***	609	12.9	1.8	***1.2***	12.8	5.2	***4.8***	B	A	***A***
	A47 (E)	***730***	728	706	18.2	***3.6***	61.6	22.0	***9.7***	44.7	C	***A***	E
	Elm High Rd (S)	***700***	699	638	6.5	***4.3***	95.7	13.4	***11.2***	68.6	B	***B***	F
	A47 (W)	582	***590***	472	9.0	10.5	***6.8***	20.9	20.6	***19.0***	C	C	***C***
	Overall Junction Summary	2637	***2657***	2425	11.7	***5.0***	41.3	17.3	***11.5***	32.4	C	***B***	D

Table 49 shows that in the AM peak Option 1a is forecast to operate marginally worse than Option 1, but performs slightly better than the DM scenario.

Table 50 shows that for the PM peak, the A47 roundabout suffers much longer delays than the DM at the A47 (E) and Elm High Road (S) approaches and process fewer vehicles.

As per the 2026 without WLR results, Option 1a is not forecast to provide benefits over the DM scenario.

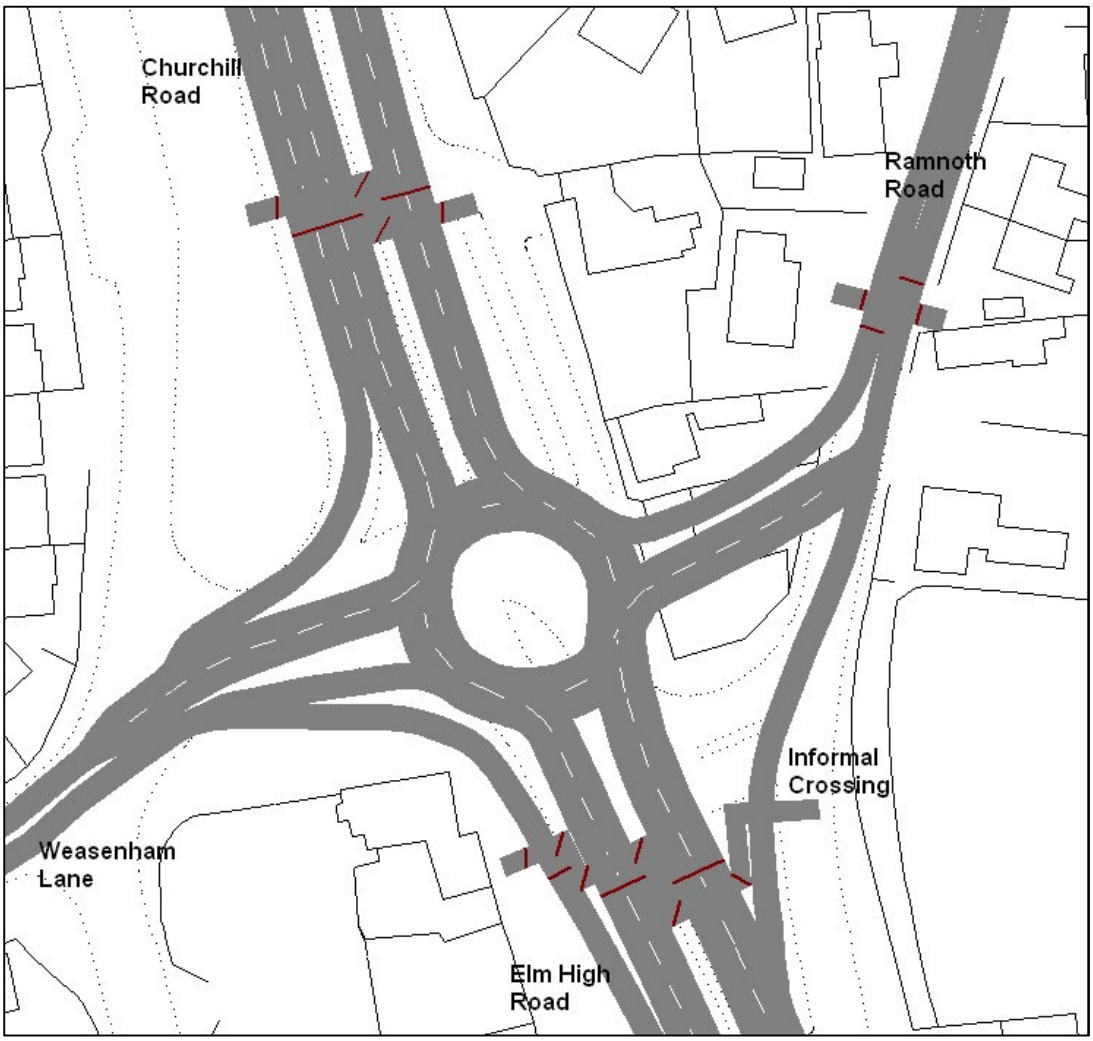
9. Elm High Road Option 7a

9.1. Network Changes

The original Option 7 model was updated to provide full pedestrian facilities, to assess whether these would impact on the potential benefits Option 7 provided.

All crossings within this option are to be signalised with the exception of the Ramnoth Road left slip which is an informal zebra crossing. The existing Weasenham Lane crossing is to be retained as per Option 7. Figure 14 shows the locations of the proposed crossings.

Figure 14. Elm High Road Option 7a VISSIM Layout



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

This option has been modelled for the future years of 2021 and 2026 with and without the Western Link Road, with the results compared back to the Do Minimum (DM) and Option 7 results to quantify any benefits.

9.2. 2021 Without WLR Results Summary

A summary of each approach to the Weasenham Lane junction have been compared back to the 2021 Without WLR DM and EH Opt 7 results and are shown in Tables 51 and 52 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 51. 2021 Without WLR AM Peak Approach Comparison Results Elm High Road Option 7a

		AM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	548	***550***	***550***	31.9	***1.1***	1.4	50.3	***8.1***	12.2	D	***A***	B
	Ramnoth Rd LT	-	***163***	***163***	-	***0.1***	***0.1***	-	***3.8***	7.0	-	***A***	A
	Ramnoth Rd	***379***	213	213	17.1	***0.8***	***0.8***	46.1	***7.7***	10.2	D	***A***	B
	Elm High Rd (S)	636	637	***638***	27.5	***0.0***	***0.0***	40.2	***4.8***	7.4	D	***A***	A
	Weasenham Ln	530	***572***	571	135.3	0.1	***0.0***	104.2	***5.1***	6.3	F	***A***	A
	Overall Junction Summary	2091	***2134***	***2134***	53.0	***0.5***	***0.5***	60.2	***6.0***	8.6	E	***A***	A

Table 52. 2021 Without WLR PM Peak Approach Comparison Results Elm High Road Option 7a

		PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	***574***	556	572	19.8	19.0	***11.1***	46.0	***33.4***	41.8	D	***D***	E
	Ramnoth Rd LT	-	93	***99***	-	49.0	***47.2***	-	***150.9***	154.9	-	***F***	F
	Ramnoth Rd	***207***	99	107	***25.5***	42.6	40.8	***103.4***	117.5	143.0	***F***	F	F
	Elm High Rd (S)	***565***	547	564	15.9	***0.0***	***0.0***	30.1	***3.6***	6.1	C	***A***	A
	Weasenham Ln	679	683	***703***	142.0	4.5	***0.2***	81.2	***19.6***	20.6	F	***C***	C
	Overall Junction Summary	2023	1978	***2045***	50.8	18.4	***15.0***	57.9	***26.7***	32.7	E	***D***	D

Tables 51 and 52 show that adding the pedestrian facilities has a marginal impact on the overall performance of the roundabout, with Option 7a still providing benefits over the DM scenario.

Slightly more vehicles are processed from Weasenham Lane and Ramnoth Road with Option 7a as a result of vehicles being stopped at the northern and southern crossings, thus providing more gaps for this traffic to exit. As with other models of this junction, the delay experienced with Ramnoth Road is a function of vehicles queueing back from the A47 roundabout to the south.

9.3. 2021 With WLR Results Summary

A summary of each approach to the Weasenham Lane junction have been compared back to the 2021 With WLR DM and EH Opt 7 results and are shown in Tables 53 and 54 for the AM and PM peaks respectively. The light blue shaded cells represent the optimum performer.

Table 53.2021 With WLR AM Peak Approach Comparison Results Elm High Road Option 7a

		AM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	**Approach**	**DM**	**EH Opt 7**	**EH Opt 7a**	**DM**	**EH Opt 7**	**EH Opt 7a**	**DM**	**EH Opt 7**	**EH Opt 7a**	**DM**	**EH Opt 7**	**EH Opt 7a**
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	261	261	***262***	9.8	***0.2***	***0.2***	36.0	***5.7***	9.2	D	***A***	A
	Ramnoth Rd LT	-	***130***	***130***	-	***0.0***	***0.0***	-	***2.5***	5.7	-	***A***	A
	Ramnoth Rd	***410***	264	264	38.1	***0.4***	***0.4***	73.5	***5.1***	7.6	E	***A***	A
	Elm High Rd (S)	611	608	***613***	22.1	***0.0***	***0.0***	34.8	***3.5***	6.2	C	***A***	A
	Weasenham Ln	475	474	***478***	43.8	***0.1***	***0.1***	58.7	***4.9***	5.7	E	***A***	A
	Overall Junction Summary	***1756***	1738	1747	28.5	***0.2***	***0.2***	50.5	***4.4***	6.7	D	***A***	A

Table 54.2021 With WLR PM Peak Approach Comparison Results Elm High Road Option 7a

		PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	***278***	277	276	10.3	***0.4***	***0.4***	38.3	***7.7***	11.3	D	***A***	B
	Ramnoth Rd LT	-	***112***	***112***	-	0.1	***0.0***	-	***3.3***	5.7	-	***A***	A
	Ramnoth Rd	***206***	94	94	2.2	***0.1***	0.2	26.9	***4.6***	7.1	C	***A***	A
	Elm High Rd (S)	***366***	364	346	12.9	***0.0***	***0.0***	33.3	***2.2***	4.4	C	***A***	A
	Weasenham Ln	***669***	664	640	87.6	0.2	***0.1***	58.6	***11.0***	12.2	E	***B***	B
	Overall Junction Summary	***1519***	1513	1468	28.3	***0.2***	***0.2***	44.5	***7.3***	9.4	D	***A***	A

Tables 53 and 54 show that in the AM and PM peak, Option 7 is the best performer, although Option 7a still provides significant benefits over the DM scenario with all approaches operating well within capacity.

9.4. 2026 Without WLR Results Summary

A summary of each approach to the Weasenham Lane junction have been compared back to the 2026 Without WLR DM and EH Opt 7 results and are shown in Tables 55 and 56 for the AM and PM peaks respectively.

The light blue shaded cells represent the optimum performer.

Table 55. 2026 Without WLR AM Peak Approach Comparison Results Elm High Road Option 7a

		AM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	584	***611***	610	125.0	***0.8***	1.0	128.7	***7.9***	11.4	F	***A***	B
	Ramnoth Rd LT	-	***239***	***239***	-	0.3	***0.2***	-	***4.3***	7.4	-	***A***	A
	Ramnoth Rd	***487***	241	241	129.1	1.3	***1.2***	139.1	***9.3***	11.6	F	***A***	B
	Elm High Rd (S)	598	601	***602***	29.5	***0.0***	***0.0***	40.6	***7.5***	9.6	D	***A***	A
	Weasenham Ln	519	***527***	526	70.4	***0.0***	***0.0***	69.2	***4.3***	5.3	E	***A***	A
	Overall Junction Summary	2189	***2219***	***2219***	88.5	***0.5***	***0.5***	92.6	***6.7***	9.1	F	***A***	A

Table 56. 2026 Without WLR PM Peak Approach Comparison Results Elm High Road Option 7a

		PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	641	634	***645***	***72.3***	179.9	237.6	***120.8***	299.4	383.2	***F***	F	F
	Ramnoth Rd LT	-	***61***	58	-	317.2	***187.3***	-	1444.0	***1238.9***	-	F	***F***
	Ramnoth Rd	***136***	55	58	***154.8***	168.5	296.4	***661.3***	1199.1	1271.2	***F***	F	F
	Elm High Rd (S)	***499***	470	492	32.9	13.6	***10.7***	48.6	***6.8***	7.5	D	***A***	A
	Weasenham Ln	509	623	***646***	171.8	7.8	***5.6***	142.4	***57.1***	60.0	F	***F***	F
	Overall Junction Summary	1785	1845	***1900***	108.0	***105.7***	140.5	***143.7***	201.6	218.3	***F***	F	F

Table 55 shows that in the AM peak all approaches to the roundabout are operating well within capacity in both options and provides significant benefits over the DM scenario.

Table 56 shows that the junction is operating over capacity, although this is as a result of the congestion from the A47 roundabout extending back up Elm High Road, blocking the approaches.

9.5. 2026 With WLR Results Summary

A summary of each approach to the Weasenham Lane junction have been compared back to the 2026 With WLR DM and EH Opt 7 results and are shown in Tables 57 and 58 for the AM and PM peaks respectively.

The light blue shaded cells represent the optimum performer.

Table 57. 2026 With WLR AM Peak Approach Comparison Results Elm High Road Option 7a

		AM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	385	387	***388***	14.8	***0.4***	0.5	37.0	***6.4***	10.0	D	***A***	B
	Ramnoth Rd LT	-	***310***	***310***	-	***0.2***	***0.2***	-	***4.6***	8.3	-	***A***	A
	Ramnoth Rd	***487***	340	341	666.1	***1.5***	1.8	583.6	***7.8***	10.8	F	***A***	B
	Elm High Rd (S)	425	***435***	***435***	27.7	***0.0***	***0.0***	34.3	***4.6***	6.9	C	***A***	A
	Weasenham Ln	418	***419***	***419***	23.8	***0.0***	0.1	47.1	***4.8***	6.1	D	***A***	A
	Overall Junction Summary	1715	***1894***	***1894***	183.1	***0.5***	0.6	194.0	***5.6***	8.3	F	***A***	A

Table 58. 2026 With WLR PM Peak Approach Comparison Results Elm High Road Option 7a

		PM Peak											
		Volume			Avg Queue (m)			Delay (s)			LOS		
Junction	Approach	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a	DM	EH Opt 7	EH Opt 7a
Churchill Rd / Weasenham Ln Rbt	Churchill Rd (N)	***294***	291	292	10.8	***0.8***	***0.8***	38.5	***8.7***	12.6	D	***A***	B
	Ramnoth Rd LT	-	***64***	***64***	-	0.1	***0.0***	-	***3.5***	6.2	-	***A***	A
	Ramnoth Rd	***130***	66	66	0.9	***0.1***	***0.1***	26.7	***5.0***	7.3	C	***A***	A
	Elm High Rd (S)	417	418	***419***	13.9	***0.0***	***0.0***	32.6	***2.2***	4.6	C	***A***	A
	Weasenham Ln	732	906	***908***	154.2	0.4	***0.3***	67.8	***12.3***	14.0	E	***B***	B
	Overall Junction Summary	1571	1743	***1746***	44.9	***0.3***	***0.3***	49.6	***8.7***	11.0	D	***A***	B

Tables 57 and 58 show that in both the AM and PM peaks, Option 7 is the optimum performer, although 7a still provides benefits over the DM scenario with all approaches operating well within capacity.

10. Elm High Road Conclusions

10.1. Option 1

The enhancement to the A47 roundabout in Option 1 provides benefits to both the 2016 AM and PM peak networks, although the benefits are more notable in the PM peak as a result of removing the congestion southbound along Elm High Road. In the AM peak, the enhancements allow the Elm High Road south approach to process more vehicles northbound, therefore putting more pressure on the Weasenham Lane junction, which performs marginally worse.

The results for without WLR in 2021 and 2026 are consistent with the 2016 results, although the benefits in the PM peak are more significant and reduce delays along Ramnoth Road by 10 minutes in 2026 as a result of removing the congestion southbound to the roundabout. As a result of this, no approach in the 2026 PM Peak is forecast to operate over capacity.

The with WLR have reduced traffic flows along Elm High Road, and therefore, the benefits to delays are smaller as the DM scenarios are not performing as poorly as the without WLR DM scenarios. However the scheme still produces benefits over the DM in both 2021 and 2026.

Table 59. Elm High Road Option 1 Summary

	Elm High Road Option 1			
	Without WLR		With WLR	
	2021	2026	2021	2026
AM Peak	All approaches to Rbt operating within capacity and delays reduced. Overall LOS B. Largest improvement at Elm High Road (S) approach.	All approaches to Rbt operating within capacity and delays reduced. Overall LOS B. Largest improvement at Elm High Road (S) approach, with reduced delays of 300s.	All approaches to Rbt operating within capacity and delays reduced. Overall LOS A. Flows are lower as the WLR has removed trips along Elm High Road.	All approaches to Rbt operating within capacity and delays reduced. Overall LOS A. Flows are lower as the WLR has removed trips along Elm High Road.
PM Peak	Rbt operates within capacity with LOS D. A47 (W) approach still over capacity. Largest improvement at Elm High Road (N) approach which significantly improves Weasenham Lane jct performance.	Rbt operates within capacity with LOS C. A47 (W) approach at capacity. Largest improvement at Elm High Road (N) approach which significantly improves Weasenham Lane jct performance.	Rbt operates within capacity with LOS B. No approach forecast to operate over capacity due to lower flows.	Rbt operates within capacity with LOS B. No approach forecast to operate over capacity due to lower flows.

10.2. Option 3

The relocation and enhancement of the A47 roundabout further east along the A47 in Option 3, helps to improve performance for all approaches in all peaks and years, reducing delays for all approaches. The new roundabout is forecast to operate well within capacity as shown in Table 60 below.

As per Option 1, reducing the congestion southbound helps to improve the performance at the Weasenham Lane junction, especially for Ramnoth Road in the PM peak.

Table 60. Elm High Road Option 3 Summary

	Elm High Road Option 3			
	Without WLR		With WLR	
	2021	2026	2021	2026
AM Peak	All approaches to new Rbt operating within capacity and delays reduced. Overall LOS B.	All approaches to new Rbt operating within capacity and delays reduced. Overall LOS B.	All approaches to new Rbt operating within capacity and delays reduced. Overall LOS A.	All approaches to new Rbt operating within capacity and delays reduced. Overall LOS A.
PM Peak	All approaches to new Rbt operating well within capacity and delays reduced. Overall LOS B.	All approaches to new Rbt operating well within capacity and delays reduced. A47 approach delays signifincantly reduced. Overall LOS C.	All approaches to new Rbt operating well within capacity and delays reduced. Overall LOS B.	All approaches to new Rbt operating well within capacity and delays reduced. Overall LOS B.

10.3. Option 4

The amendments to the Weasenham Lane junction in Option 4 has not provided any significant improvement in performance. Any potential benefits in the PM peak are constrained due to the congestion along Elm High Road southbound as the A47 roundabout remains as per the DM scenario. Therefore, this option should not be considered as a standalone scheme, but should be considered alongside Options 1 or 3.

Table 61. Elm High Road Option 4 Summary

	Elm High Road Option 4			
	Without WLR		With WLR	
	2021	2026	2021	2026
AM Peak	Churchill Rd SB & Weasenham Lane approaches operate better than DM, although junction is still operating at capacity with LOS E.	Churchill Rd SB approach operates better than DM. Junction operating over capacity with LOS F in both DM and Opt 4 scenarios.	All approaches operating better than DM with the exception of Churchill Rd SB. Junction operating within capacity LOS D.	All approaches operating better than DM, but junction is still over capacity due to increased flows from Ramnoth Road observed in 2026. Overall LOS F.
PM Peak	Marginal improvements observed to approaches with signal changes, although any benefit is constrained by southbound congestion to the A47 Rbt. Overall LOS E.	Marginal improvements observed to approaches with signal changes, although any benefit is constrained by southbound congestion to the A47 Rbt. Overall LOS F.	All approaches operating better than DM. Junction operating within capacity LOS D.	All approaches operating better than DM. Junction operating within capacity LOS D.

10.4. Option 7

The conversion of the Weasenham Lane signalised junction to a priority controlled roundabout provides significant benefits to the AM peak in all years.

The roundabout provides benefits to the PM peak, but the congestion along Elm High Road southbound prevents access from Ramnoth Road, causing this approach to experience significantly longer delays than the DM scenario in 2026, as more vehicles can be processed from Weasenham Lane, adding to the existing congestion.

As Option 4, this scenario should be implemented alongside improvements to the A47 roundabout in Options 1 and 3.

Table 62. Elm High Road Option 7 Summary

	Elm High Road Option 7			
	Without WLR		With WLR	
	2021	2026	2021	2026
AM Peak	All approaches to new Rbt operating well within capacity and delays significantly reduced. Overall LOS A.	All approaches to new Rbt operating well within capacity and delays significantly reduced. Overall LOS A.	All approaches to new Rbt operating well within capacity and delays significantly reduced. Overall LOS A.	All approaches to new Rbt operating well within capacity and delays significantly reduced. Overall LOS A.
PM Peak	All approaches to new Rbt operating better than the DM, although Ramnoth Road still operating over capacity as a result of the congestion SB to the A47 Rbt. Overall LOS D.	All approaches (except NB) operating over capacity due to the SB congestion extending back from the A47 rbt blocking the circulatory of the new rbt. Ramnoth Rd is significantly worse with Opt 7. Overall LOS F.	All approaches to new Rbt operating well within capacity and delays significantly reduced. Overall LOS A.	All approaches to new Rbt operating well within capacity and delays significantly reduced. Overall LOS A.

10.5. EH Option 1a

In 2021 Option 1a is forecast to provide benefits over the DM scheme and only marginal increases in delays compared with Option 1.

In 2026 the growth in traffic pushes the roundabout over capacity in both peaks causing delays closer to the DM levels.

Therefore, Option 1a is not considered viable due to the long delays in 2026 pushing the roundabout over capacity at the unchanged approaches.

Table 63. Elm High Road Option 1a Summary

	Elm High Road Option 1a			
	Without WLR		With WLR	
	2021	2026	2021	2026
AM Peak	SB approach improved, other approaches similar to DM, with Elm High Rd (S) approach at capacity. Does not perform as well as Opt 1. Overall LOS C.	SB approach improved, other approaches similar to DM. Elm High Road (S) approach over capacity. Overall LOS F.	SB approach improved, other approaches similar to DM. Does not perform as well as Opt 1. Overall LOS B due to lower flows.	SB approach improved, other approaches similar to DM. Does not perform as well as Opt 1. Overall LOS B due to lower flows.
PM Peak	SB approach improved, other approaches similar to DM. A47 approaches at or over capacity. Overall LOS F.	SB approach improved, all other approaches operating over capacity. Overall LOS F.	SB approach improved, other approaches similar to DM. Does not perform as well as Opt 1. Overall LOS B due to lower flows.	SB approach improved, Elm High Rd (S) & A47 (E) approaches operating at or over capacity due to more vehicles processed from the north. Overall LOS D.

10.6. EH Option 7a

The results have shown that adding pedestrian crossing facilities has a marginal impact on the overall performance of the proposed roundabout. However, by stopping the flow of traffic on the north and south arms allows more vehicles to be processed along Weasenham Lane and Ramnoth Road.

The majority of the benefits are still evident in the AM peak, but in the PM peak, traffic is still constrained by the congestion southbound to the A47 roundabout.

By including pedestrian crossings to the roundabout design, Option 7a is still forecast to provide benefits over the existing signalised junction.

Table 64. Elm High Road Option 7a Summary

	Elm High Road Option 7a			
	Without WLR		With WLR	
	2021	2026	2021	2026
AM Peak	All approaches to new Rbt operating well within capacity, although delays marginally increased from Option 7 due to additional crossings. Overall LOS A.	All approaches to new Rbt operating well within capacity, although delays marginally increased from Option 7. Overall LOS A.	All approaches to new Rbt operating well within capacity. Delays marginally increased compared to Opt 7. Overall LOS A.	All approaches to new Rbt operating well within capacity and delays significantly reduced. Overall LOS A.
PM Peak	Marginal dis-benefits compared with Opt 7, but better performing than DM scenario. Same issues as Option 7. Overall LOS D.	Marginal increase to delays than Option 7. SB congestion still constraining performance. Overall LOS F.	All approaches to new Rbt operating well within capacity. Delays marginally increased compared to Opt 7. Overall LOS A.	All approaches to new Rbt operating well within capacity and delays significantly reduced. Overall LOS B.

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Appendix B – Scheme Cost Summary

Wisbech Access Study 10/04/2017

EH1

Elm High Road, Entry Widening

Highways Only

Site Clearance Generally						2000	m2	4.00	8,000.00
Construction Assumptions:									
Carriageway	s/c	40	15.00	Footpath		25	12.00		
	b/c	65	15.00			65	15.00		
	rd b	200	40.00						
	sub base	450	37.50			260	25.00		
	Capping l:	520	40.00						
	testing		2.00						
	terram		1.00						
		1275				350			
	exc & CA		35.00				30.00		
			185.50				82.00		
Excavate & construct carriageway areas						1000	m2	185.50	185,500.00
Construct Verges						1000	m2	35.00	35,000.00
Excavate & construct footway areas						790	m2	82.00	64,780.00
Breqak out existing surfaces for new islands etc						100	m2	35.00	3,500.00
Carriageway kerbs						450	m	33.00	14,850.00
Footway edgings						300	m	23.00	6,900.00
Carriageway drainage & alterations						1	allow	30,000.00	30,000.00
Street lighting & alterations						1	allow	32,000.00	32,000.00
Duct provision						1	alow	10,000.00	10,000.00
Signs & lines						1	allow	20,000.00	20,000.00
Pedestrain crossing						1	item	9,360.00	9,360.00
Surveys						1	item	25,000.00	25,000.00
Landscaping						1	item	10,000.00	10,000.00
									454,890.00

Prelims

Land Acquisition		m2		-
Demolition		m2		-
Design		10%		45,489.00
Staff, supervision, accommodation, temp fences		20%		90,978.00
Traffic management on trunk road		16	weeks	10,000.00	160,000.00
					751,357.00
Add Contingency & Optimism Bias		45%			338,110.65
					1,089,467.65

Risks/Assumptions

Soil conditions (contamination etc)
Vandalism

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Wisbech Access Study 10/04/2017
EH3b
Elm High Road, Alternative Access
Highways Only

Site Clearance Generally					25000	m2	1.00	25,000.00
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	450	37.5		260	25.00		
	Capping lc	520	40.00					
	testing		2.00					
	terram		1.00					
		1270			350			
	exc & CA		35.00			30.00		
			185.50			82.00		
Excavate & construct carriageway areas					15530	m2	185.50	2,880,815.00
Plane & resurface existing carriageway					9250	M2	25.00	231,250.00
Construct Verges					11070	m2	35.00	387,450.00
Excavate & construct footway areas					220	m2	82.00	18,040.00
Construct roundabout islands, inc approach barriers etc					1	no	100,000.00	100,000.00
Carriageway kerbs					4000	m	33.00	132,000.00
Footway edgings					200	m	23.00	4,600.00
Alter existing junctions					2	item	35,000.00	70,000.00
Break out & reinstate as verge existing carriagewY					1250	m2	55.00	68,750.00
Carriageway drainage & alterations					1	allow	602,200.00	602,200.00
Timber post & rail fence					8000	m	25.00	200,000.00
Street lighting & alterations					1	allow	162,500.00	162,500.00
Duct provision					1	alow	67,500.00	67,500.00
Signs & lines					1	allow	75,000.00	75,000.00
Junction signal alterations/additions/bus priority measures					1	item	100,000.00	100,000.00
Surveys					1	item	60,000.00	60,000.00
Landscaping					1	item	110,700.00	110,700.00
								5,296,805.00

Prelims

Land Acquisition	19274	m2	3.75	349,777.50
Demolition		m2		-
Design	10%			529,580.50
Staff, supervision, accommodation, temp fences & te	20%			1,059,161.00
Traffic Management	30	weeks	5,250.00	157,500.00
Traffic management on trunk road	16	weeks	10,000.00	160,000.00
				7,551,824.00
Add Contingency & Optimism Bias	45%			3,398,320.80
				10,950,144.80

Risks/Assumptions

Soil conditions (contamination etc)
Vandalism

A47 Roundabout works costed seperately

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Wisbech Access Study 10/04/2017

EH 4

Weasenham Lane/Elm High Road Junction

Highways Only

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	450	37.50		260	25.00	
	Capping layer		40.00				
	terram	750	3.00				
		1500			350		
	exc & CA		35.00			30.00	
			185.50			82.00	

Excavate & construct carriageway areas	80	m2	185.50	14,840.00
				-
Excavate & construct footway areas	300	m2	82.00	24,600.00
				-
Break out kerbs, edgings & islands	120	m	15.00	1,800.00
				-
Plane & resurface dual carriageway	1220	m2	25.00	30,500.00
				-
Carriageway kerbs	220	m	33.00	7,260.00
				-
Footway edgings	25	m	23.00	575.00
				-
Construct Pedestrian Crossing	5	no	35,000.00	175,000.00
				-
Construct grassed verge	40	m2	35.00	1,400.00
				-
Carriageway drainage & alterations	1	allow	35,000.00	35,000.00
				-
Street lighting & alterations	1	allow	45,000.00	45,000.00
				-
Duct provision	1	alow	20,000.00	20,000.00
				-
Surveys	1	item	15,000.00	15,000.00
				-
Landscaping	1	item	400.00	400.00
				-
Signs & lines	1	allow	15,000.00	15,000.00
				-
				386,375.00

Prelims

Land Acquisition		m2		-
Demolition		m2		-
Design	10%			38,637.50
Staff, supervision, accommodation	20%			77,275.00
Traffic Management	16	weeks	10,000.00	160,000.00
				662,287.50
Add Contingency & Optimism Bias	45%			298,029.38
				960,316.88

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.

Risks/Assumptions

Soil conditions (contamination etc)
Vandalism

A47 Roundabout works costed seperately

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Wisbech Access Study 10/04/2017

EH 7A

Weasenham Lane Roundabout

Highways Only

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	450	37.50		260	25.00	
	Capping l:	400	40.00				
	tarram	0	3.00				
		1150			350		
	exc & CA		35.00			30.00	
			185.50			82.00	

Excavate & construct carriageway areas	3050 m2	185.50	565,775.00	-
Excavate & construct footway areas	1210 m2	82.00	99,220.00	-
Break out kerbs, edgings & islands	1000 m	15.00	15,000.00	-
Plane & resurface dual carriageway	1220 m2	25.00	30,500.00	-
Carriageway kerbs	1000 m	33.00	33,000.00	-
Footway edgings	1200 m	23.00	27,600.00	-
Construct roundabout island with overrun area	1 no	40,000.00	40,000.00	-
Construct grassed verge	775 m2	35.00	27,125.00	-
Carriageway drainage & alterations	1 allow	70,000.00	70,000.00	-
Street lighting & alterations	1 allow	85,000.00	85,000.00	-
Duct provision	1 allow	20,000.00	20,000.00	
Surveys	1 item	35,000.00	35,000.00	-
Landscaping	1 item	7,750.00	7,750.00	-
Signs & lines	1 allow	15,000.00	15,000.00	-
				1,070,970.00
Prelims				
Land Acquisition	2 dwelling	277,500.00	555,000.00	
Demolition	2 dwelling	7,500.00	15,000.00	
Design	10%		107,097.00	
Staff, supervision, accommodation	20%		214,194.00	
Traffic Management	16 weeks	4,500.00	72,000.00	
Traffic Management on dual carriageway	6 weeks	10,000.00	60,000.00	
				2,094,261.00
Add Contingency & Optimism Bias	45%		942,417.45	
				3,036,678.45

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.

Vandalism

A47 Roundabout works costed seperately