Norfolk County Council

SPIXWORTH
B1150 / CROSTWICK LANE JUNCTION IMPROVEMENT

Feasibility Study

001
AUGUST 2023

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PROJECT NO: PLA353

DATE: AUGUST 2023

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JUNCTION IMPROVEMENT

Feasibility Study

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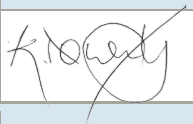
Signature	
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EXECUTIVE SUMMARY

INTRODUCTION

WSP have been commissioned by Norfolk County Council (NCC) to update a feasibility study previously undertaken in May 2023 for the B1150 North Walsham Road / Crostwick Lane junction in Spixworth.

A need to update the May 2023 feasibility study has arisen so as to understand the changes to high level feasibility due to time lapse, changes in estimated costs and changes in traffic conditions. The updated study will also test a signalised layout, followed by a Benefit Cost Ratio (BCR) assessment.

The B1150 / Crostwick Lane junction was originally identified in 2021 as part of the network that could possibly benefit from improvement amid local concerns about its accident record and peak time congestion following the opening of the Broadland Northway in 2018. Access to and from Rackheath Lane, that previously intersected B1150 to the east to form a staggered 4-arm junction was closed to vehicular traffic as part of the Broadland Northway works in 2018. This was implemented to simplify turning movements, allowing drivers waiting at the Crostwick Lane arm to concentrate on the vehicle movements on the B1150 in light of a predicted increase in traffic flows on the B1150 following the opening of the Broadland Northway .

REPORT PURPOSE

This document has been prepared to:

- Update the May 2023 (PLA353) feasibility study.
- Update the scheme costs with a forecast build date in 2026.
- Update the BCR to reflect updated scheme cost estimates for options considered as mentioned above.

EXISTING JUNCTION

The B1150 / Crostwick Lane junction is an existing uncontrolled T-junction where the B1150 North Walsham Road is intersected from the west by Crostwick Lane. The B1150 is part of the main route between Norwich and North Walsham. It is a single lane carriageway which currently has a ghost island right turn lane into Crostwick Lane. Crostwick Lane is the main route in and out of the village of Spixworth.

A desktop study was undertaken in October 2022 to determine what, if any, improvements to the existing infrastructure could be achieved. The potential improvements identified were a signalised junction, a compact roundabout with the current 50mph speed limit on B1150 retained, and a compact roundabout with the speed limit on B1150 reduced to 40mph.

Several existing constraints have been identified and are worthy of further investigation as the scheme develops into detailed design.

Junction assessments have been undertaken using industry standard Junctions 10 and LinSig modelling software, to assess the junction capacity for the scheme opening year (2026) and scheme forecast year (2041).These dates and have not been confirmed and are purely theoretical dates for the purposes of pricing and Benefit cost Ratio Analysis. The assessment results show that the roundabout Options B and C are expected to operate within capacity and with minimal delays at similar levels. The signalised Option A is expected to operate with reserve capacity, though in comparison to the roundabout operational queuing is expected, however queues are likely to clear during the junction cycle time.

As part of the study, scheme cost estimates have been reviewed and updated and BCRs have been calculated for all three options.

CONCLUSION

Based on the feasibility assessments carried out during this study both the signalised junction option and both compact roundabout options are likely to reduce waiting times for traffic wishing to exit Crostwick Lane and would achieve accident reductions based on the historical data.

The conversion of the junction to a compact roundabout with a 40mph speed limit in place on the B1150 would represent a medium Value for Money (VfM) with an initial BCR of 1.97:1.

The conversion of the junction to a compact roundabout with a 50mph speed limit in place on the B1150 would represent a slightly increased Value for Money (VfM) with an initial BCR of 2.02:1, rated as high by the Department for Transport Value for Money Framework.

The implementation of a signalised junction with a 40mph speed limit in place on the B1150 would represent the greatest Value for Money (VfM) with an initial BCR of 3.63:1, rated as high by the Department for Transport Value for Money Framework.

A signalised junction would also provide the safest facilities for pedestrians and cyclists wishing to access Rackheath Lane form Crostwick Lane. Further to this no land purchase would be required as it would for both compact roundabouts options.

It is the report’s recommendation that the feasibility study should now be passed on to local members and Spixworth Parish Council and be made available for community feedback.

No funding stream has currently been identified for the implementation of any proposals although Norfolk Council Officers are continuing to look for funding opportunities. If funding is identified any improvement scheme would likely have to compete against other similar requests within the county.

1

INTRODUCTION

1 INTRODUCTION

1.1 OVERVIEW

1.1.1. WSP have been commissioned by Norfolk County Council (NCC) to update a feasibility study previously undertaken in May 2023 for the B1150 North Walsham Road / Crostwick Lane junction in Spixworth.

1.1.2. A feasibility study was carried out under NCC project PLA353 Spixworth Feasibility Study and subject to concept designs during early 2023.

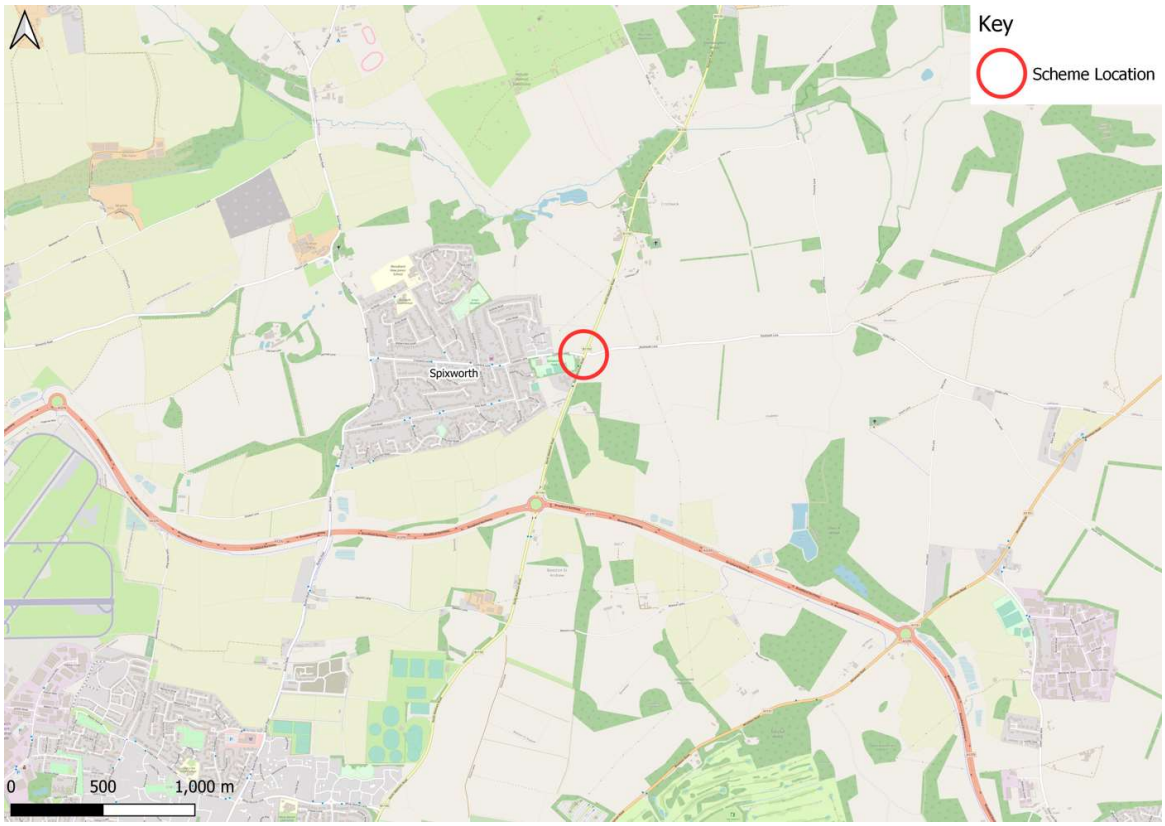
1.1.3. A need to update the May 2023 feasibility study has arisen to understand the changes to high level feasibility due to time lapse, changes in estimated costs, test a signalised layout, followed with a benefit cost ratio assessment.

1.2 LOCATION OF SCHEME

1.2.1. Spixworth is a village located in the County of Norfolk, within the district of Broadland 5 miles north of Norwich, with a population of 3,718 as of the 2011 census.

1.2.2. Figure 1-1 illustrates the location of the scheme in relation to Norwich and the Broadland Northway (shown in orange to the south). The location of the junction and the surrounding highway network can also be seen on drawing no. PLA353-HPD-100-001, which is included in Appendix A.

Figure 1-1 - Location Plan



1.3 REPORT PURPOSE

1.3.1. This document has been prepared to:

- Update the May 2023 feasibility study including all three aforementioned options,
- Update the scheme costs with a forecast build date in 2026.
- Update the BCR to reflect updated scheme cost estimates for options considered as mentioned above.

1.4 REPORT STRUCTURE

1.4.1. The remainder of this report is structured as follows:

- Chapter 2 – Existing Conditions
- Chapter 3 – Development of Options
- Chapter 4 – Junction Assessment
- Chapter 5 – Cost Estimates & Cost Benefit Analysis
- Chapter 6 – Conclusion and Recommendations

2 EXISTING CONDITIONS

2.1 EXISTING JUNCTION

2.1.1. The B1150 / Crostwick Lane junction is an existing uncontrolled T-junction where the B1150 North Walsham Road is intersected from the west by Crostwick Lane, as shown in Figure 2-1.

Figure 2-1 – Existing B1150 / Crostwick Lane Junction

Source: Google Maps

2.1.2. The B1150 North Walsham Road runs north from Norwich and the A1270 Broadland Northway to Coltishall village and on to the town of North Walsham. The B1150 is a single lane carriageway which currently has a ghost island right turn lane into Crostwick Lane. The speed limit on this section of the B1150 is currently 50mph.

2.1.3. Crostwick Lane is the main route in and out of the village of Spixworth. It currently benefits from a 30mph speed limit with a pedestrian footway along its north side.

2.1.4. The area is semi-rural with several residential properties and a care home located to the south of the junction on both sides of the B1150. The most notable of these properties is Toll Bar Cottage which is located on the southwest corner of the junction with an access off Crostwick Lane.

2.2 EXISTING ACCIDENT RECORD

2.2.1. Norfolk County Council maintain a long list of roads and junctions which are prioritised for improvements depending on the number of accidents and traffic congestion levels. Whilst the junction has not been classified as a 'local safety highlighted location' it was identified as an accident cluster site in late 2021 (defined as five personal injury accidents recorded within a 100m radius within 3 years). This led to verge maintenance and road markings works being delivered by the North Area office. It was also a key factor in the decision to undertake the junction feasibility study. There have been 7 recorded accidents in the last 5 years (between 1st September 2017 and 31st August 2022), with 1 serious accident and 6 slight accidents. The serious collision was due to a vehicle turning right out of Crostwick Lane failing to give way to vehicle travelling on the B1150. 4 of the slight accidents were also due to a failure to give way, with another being struck from the rear whilst waiting to turn in the designated right turn lane. The other two slight accidents were due to loss of control to avoid an object. It is notable that the accident record has improved since the 2022 maintenance works were carried out. For further details see Appendix E.

2.3 SAFETY BENEFITS

2.3.1. The proposed options considered for the junction are two compact roundabouts of varying size and a signalised junction option, which are likely to reduce the number of future accidents at the junction. Considering the semi-rural location of the junction, it has been agreed with NCC that the following parameters would be used for accident reduction:

- A 50% reduction in accidents and a reduction in severity if a roundabout option was implemented.
- A 70% reduction in accidents if a traffic signal option was implemented.

2.4 DESKTOP STUDY

2.4.1. A desktop study was undertaken in October 2022 using information provided by Norfolk County Council and readily available public information. The purpose of which was to determine, if any, improvements to the existing infrastructure could be achieved.

2.4.2. The desktop study has shown the carriageway to be in an overall good condition on the south and north B1150 approaches. Verge maintenance and road markings works were delivered by the North Area office in 2022. All road markings and signage appear to be in good condition and located appropriately.

2.5 CONSTRAINTS

2.5.1. Several existing constraints have been identified and are recommended for further investigation as the scheme develops. These are:

- Services – The only underground utilities identified at this stage are a Virgin Fibre Optic Broadband cable and an Anglia Water potable water main. These will need to be located prior to works commencing and may require re-routing. Utilities plans are available in Appendix F.
- The location is not part of an existing conservation area, special protected area, SSSI or any similar protected area.
- The mature oak tree situated on east side of the B1150 to the south of the junction, whilst being located within the highway boundary is not the property of Norfolk

County Council. The deeds for the purchase of the land by NCC stipulate that the oak shall not be removed.

- The junction is bounded by private land on all sides. A private property is located very close to the southwest corner of the junction and significantly reduces options of major improvements to the alignment. The vehicular access to this property will need to be considered as part of any option both in the design and construction phases.
- The private land ownership has been investigated by means of a land registry search on the adjoining boundaries to the highway.
- There are several properties to the south of the existing junction, these are situated at sufficient distance that they concern no issues to scheme development i.e., they are not obstacles to the construction of the roundabout or carriageway realignment.
- Traffic Regulation Orders – The signalised junction option and 40mph compact roundabout option will require a traffic regulation order to reduce the speed limit on the B1150 on both approaches from the current 50mph to 40mph.

The above list is not exhaustive and further investigations should be carried out at the detailed design stage to assess all potential risks and constraints.

2.6 CONSULTATIONS

2.6.1. No consultations have taken place in preparation of this report. On-site meetings have been held with Parish Council representatives and several local residents. A further on-site meeting was held with Hevingham and Spixworth and Norfolk County Council Local Member for Wroxham.

2.7 ACCOMMODATION WORKS

2.7.1. Access to Toll Bar Cottage to the southwest of the junction will need extending to the newly aligned kerbline in both compact roundabout designs.

2.8 DRAINAGE

2.8.1. There are no records of existing positive drainage systems at this location, carriageway gullies are present, but it is assumed this discharge into now overgrown field boundary ditches.

2.8.2. A Sustainable Drainage System (SUDS) feature will be required to drain the proposed roundabout feature and discharge to either a lagoon or soakaway dependant on ground conditions. Trial pits and infiltration tests will be required to assess the suitability for the construction of a soakaway feature.

2.9 DATA COLLECTION

Existing Traffic Conditions

2.9.1. As part of a study to assess the impact of the newly opened A1270 Broadland Northway the junction was surveyed for Manual Classified Turning Counts (MCCs) on Tuesday 25th September 2018. A further MCC was carried out at the junction on Thursday 6th October 2022.

2.9.2. Automated Traffic Counts (ATCs) surveys were undertaken on both the B1150 and Crostwick Lane for a continuous 1-week period between 6th October and13th October 2022.

2.9.3. A queue length survey observing traffic exiting Crostwick Lane was carried out on Wednesday 21st September 2022 between 07:00 and 19:00.

2.9.4. A Classified pedestrian crossing count was carried on Thursday 6th October 2022 between 07:00 and 19:00.

2.9.5. The B1150 (both directions) have a heavy traffic flow with an Average Daily Traffic (ADT) of 16,250 vehicles. The estimated mean speed of vehicles approaching the junction was recorded at 40.6mph (07:00 to 19:00). The estimated 85%ile speed of vehicles approaching the junction was recorded at 47mph (07:00 to 19:00).

2.9.6. Crostwick Lane (eastbound approach only) has a moderate traffic flow, with an Average Daily Traffic (ADT) of 1,781 vehicles. The estimated mean speed of vehicles approaching the junction was recorded at 22.8mph (07:00 to 19:00). The estimated 85%ile speed of vehicles approaching the junction was recorded at 27.2mph (07:00 to 19:00).

2.9.7. The 2022 queue data has been used to calibrate and validate the base model. The base model is considered to provide a valid representation of real-world network conditions and therefore calibrates and validates well.

2.9.8. Please refer to Appendix D for more information on data collection and base model calibration / validation.

3 DEVELOPMENT OF OPTIONS

3.1 TRAFFIC SIGNALS

3.1.1. Traffic signals, sometimes referred to as traffic lights, are a vital part of a transport network, providing a key operational function to improve free flow traffic conditions, reduce congestion and delays. Traffic signals require less land take and can be programmed to detect traffic flows and optimise who has priority. They also work well when there is a lot of traffic from one direction which could make a roundabout difficult to enter.

3.1.2. There are currently two types of intelligent traffic signal control systems, these being SCOOT (Split Cycle Offset Optimisation Technique) and MOVA (Microprocessor Optimised Vehicle Actuation). The standard method of traffic light control relies on the detection of vehicles on the stop line, whereas intelligent traffic control systems (SCOOT and MOVA) require detection on the approach to the traffic signals well in advance of the stop line.

3.1.3. The intelligent traffic control systems react automatically to the traffic conditions at their location and assign priority as deemed by their software. This allows the intelligent signals to adjust their green time required for each approach based on the number of vehicles approaching the signals, which helps maximise the operation of junctions. Ultimately, this solution supports the reduction in congestion and delays, which facilitates improvements in traffic flow and junction capacity.

3.1.4. Intelligent traffic signals can be delivered in two forms. MOVA is a well-established method for the control of traffic light signals at isolated junctions and can cater a range of traffic conditions from low to high traffic flows. MOVA functions to minimise delay at a junction, however if an approach becomes overloaded, then the system shifts to a capacity maximising function.

SCOOT differs from MOVA in that it operates across multiple junction which feed into a central Urban Traffic Control system. The information across all junctions within the system is used to adapt the phasing of the traffic lights that are connected as a whole system, this optimises traffic flow of an area rather than one junction. Therefore, SCOOT control would not be appropriate at this location and has not been considered at this stage.

Constraints:

- Traffic signal heads and pole locations – It is necessary to have a signal head on the near side and far side of the carriageway. The primary heads will be situated around 2.5m away from the relevant stop lines. The secondary heads will be positioned for the visibility required and the constraints of the site.
- Traffic signal carriageway sideways clearance - All poles and traffic signal equipment must have a minimum clearance from the carriageway of 600mm. Poles should be installed in retention sockets for future maintenance and replacement. In the event of a pole being damaged, the old pole can be removed and replaced quickly and easily (no excavation required). The size of the retention socket foundation may impact on the pole's locations.
- Traffic Signal Controller – The traffic signal controller, which controls how the junction works, should ideally be positioned to allow a traffic signal engineer to stand at the controller and see as much of the traffic signals as possible, this is for installation and maintenance purposes.

- Detection - Due to the nature of the site and the intelligent method of control and detection, inductive loops will need to be used and cut into the carriageway. This will need road closures to install and for maintenance purposes if they need replacing.
- Maintenance – A maintenance bay will be required for the safe attendance of the maintenance engineers during the life of the equipment.

3.2 COMPACT ROUNDABOUTS

3.2.1. Compact roundabouts differ from standard roundabouts in that they have smaller inscribed circle diameters (ICDs) and have singular approach lanes rather than multiple approach lanes, as a result they require less land take. They are also a suitable option, as they provide similar benefits to traffic signals without the control and are more free flowing.

3.2.2. Roundabouts are popular due to the benefits that they provide. These benefits include dramatic reductions in serious injury and fatality crashes as well as reductions in delays for road users. Benefits of modern roundabouts have been shown to occur in both urban and rural areas under a wide range of traffic conditions.

3.2.3. CD 116 Geometric design of roundabouts which supersedes the previously used Technical Design guides indicates that road lighting shall be provided on all roundabouts. However similar previously constructed roundabouts in Norfolk have been constructed without direct lighting, but with illuminated signing only. Similar requirements are anticipated for this proposal and appropriate costs will need to be investigated further.

Constraints:

- Cost – Whilst the compact roundabout designs will require less land than standard roundabouts a certain amount of private land will need to be purchased.
- Accidents – Although roundabouts reduce serious and fatal accidents compared to other options, minor accidents can occur more regularly due to driver negligence, for example, not giving way to traffic already on the roundabout.

3.3 PREVIOUS CONCEPT DESIGNS

3.3.1. **Option A:** The signalised junction design has remained largely unchanged since its conception.

3.3.2. **Option B:** The 50mph compact roundabout design situated on the footprint of the existing junction originally would have required the purchase of land from Toll Bar Cottage.

3.3.3. **Option C:** The 40mph compact roundabout design situated on the footprint of the existing junction originally would have required the purchase of land from Toll Bar Cottage.

3.4 REVISED CONCEPT DESIGNS

3.4.1. WSP have reconsidered the previous designs A, B and C have been reassessed with new traffic data. All concept design options have been audited by NCC's safety Team and reviewed by NCC's Highways Design Team. Options considered in the study are detailed below.

3.4.2. **Option A:** The initial signalised junction design has been assessed by NCC's safety team and following from their recommendations the new pedestrian refuge to the south of the junction has been widened to 2.5m to better accommodate cyclists and pushchairs.

3.4.3. **Option B:** The initial 50mph compact roundabout design would have required land take from the field to northwest of the junction as well as land from Toll Bar Cottage to the southwest. The revised design has seen the roundabout moved to the north to ensure that land purchase from Toll Bar Cottage is not required. Several safety recommendations by the Safety Team regarding exit and approach widths and the safety of cyclists and pedestrians have further been incorporated into the design.

3.4.4. **Option C:** The initial 40mph compact roundabout design would have required land take from the field to northwest of the junction as well as land from Toll Bar Cottage to the southwest. The revised design has seen the roundabout moved to the north to ensure that land purchase from Toll Bar Cottage is not required. Several safety recommendations by the Safety Team regarding exit and approach widths and the safety of cyclists and pedestrians have further been incorporated into the design.

3.4.5. Layouts of the Options A, B and C are presented in in APPENDIX B.

4 JUNCTION ASSESSMENT

4.1 JUNCTION MODELLING SOFTWARE AND CAPACITY PARAMETERS

4.1.1. Following on from the results from the Development of Options assessment stage, WSP have tested the following 3 options for the B1150 / Crostwick Lane junction:

- Option A: Signalised Junction – A 3-arm signal-controlled junction.
- Option B: 50mph Roundabout – A 3-arm roundabout with the existing 50mph speed limit on the B1150 to be retained.
- Option C: 40mph Roundabout – A 3-arm roundabout with the existing 50mph speed limit on the B1150 reduced to 40mph.

4.1.2. Junction assessments have been undertaken using industry standard Junctions 10 and LinSig modelling software.

4.1.3. Junctions 10 (ARCADY 10 module) has been used to model roundabout (Options B and C).

4.1.4. LinSig (Version 3) has been used to model the signalised junction (Option A).

4.2 JUNCTION MODELLING

Forecasting

4.2.1. To assess the junction capacity for the scheme opening year (2026) and scheme forecast year (2041), growth rates have been calculated from TEMPro (v7.2c).

4.2.2. To understand the impacts of traffic growth on the existing junction, a Do Minimum (DM) model has been developed using the base model with 2026 and 2041 neutral weekday forecast demands. The results for the 2041 weekday DM model are presented in Table 2-1 alongside the model option results for comparison.

4.3 JUNCTION ASSESSMENT

4.3.1. **Forecast Traffic Impacts**

4.3.2. To understand the impacts of traffic growth on the existing junction, a Do Minimum (DM) model has been developed using the base model with 2026 and 2041 weekday forecast demands. The results for the 2041 weekday DM model are presented alongside the model option results for comparison.

WSP have tested the following 3 model options for the B1150 North Walsham Road / Crostwick Lane junction.

- Do Something 1 (DS1) – Option A: Signalised Junction,
- Do Something 2 (DS2) – Option B: Compact Roundabout 50mph,
- Do Something 3 (DS3) – Option C: Compact Roundabout 40mph.

The Option A: Signalised Junction has been designed for a 40mph speed limit, with a pedestrian crossing on B1150 North and is shown in Appendix B.

The base year LinSig model provided by the Norfolk County Council (NCC) has been assessed with 3 stages: one stage for the B1150, second stage for the pedestrian crossing

and third stage for the Crostwick Lane. In order to improve the performance of the junction with 2041 traffic, the LinSig model has been optimised with 2041 traffic flows. The optimised signal timings can be found in the Appendix D.

In Paramics, LinSig timings has been used with an assumption that the pedestrian stage will be called every alternate cycle (on average 20 times per hour). This is assumed to be a worst-case scenario, given the location of the junction where pedestrian demand is not expected to be particularly high.

The Option B: Compact Roundabout, has been designed as a 3-arm priority roundabout with a design speed of 50mph, as can be seen in Appendix B.

Similarly, the Option C: Compact Roundabout, has been designed as a 3-arm priority roundabout with a design speed of 40mph, as shown in Appendix B.

Operation Assessment Summary

This section is aimed to evaluate the operational performance of the options on general traffic for the 2041 forecast year. Please refer to Appendix G for additional modelling outputs of Mean Maximum Queues (MMQ) and Journey Times for 2026 forecast year.

Table 4.1 presents the comparison of MMQs at the junction for the 2041 forecast year during the AM and PM peak hours. See Appendix D for further information.

Table 4.1 - Mean Max Queue (MMQ) Comparison (meters)

Peak Hour	Route Names	Mean Max Queue (MMQ) Comparison (m)				
		2022 Base	2041 DM	2041 DS1	2041 DS2	2041 DS3
AM	B1150 North (southbound)	4	7	113	44	48
	B1150 South (northbound)	12	12	90	42	33
	Crostwick Lane	30	55	70	26	23
PM	B1150 North (southbound)	7	18	69	27	26
	B1150 South (northbound)	30	32	125	144	83
	Crostwick Lane	28	55	92	29	29

4.3.3. The DS1 traffic modelling results indicate that the MMQs on Crostwick Lane are expected to slightly increase in comparison to the DM model, by +15m in the AM peak and +37m in the PM peak.

4.3.4. With this option, MMQs are also forecast to increase on B1150 in both peak hours, although this is to be expected with the type of option and provides the opportunity to manage turning movements at the junction. To note, from model visualisation it's observed that queues on B1150 are often cleared every alternate cycle.

4.3.5. The DS2 traffic modelling results show that the MMQs on Crostwick Lane are expected to reduce in the AM and PM peak hours (-29m and -32m respectively) in comparison to the DM model. With this option, MMQs are forecast to increase on B1150, particularly on B1150

South (+112m) in the PM peak hour. However, queueing on the B1150 is to be expected with a roundabout design as vehicles will be required to give way.

4.3.6. Similarly, the DS3 traffic modelling results show that MMQs are projected to reduce on Crostwick Lane by -32m in the AM peak and -26m in the PM peak in comparison to the DM model. With this option, MMQs are forecast to increase on B1150, mostly on B1150 South (+51m) in the PM peak.

4.3.7. Journey times for all five models have also been modelled and are available in Appendix D

4.4 SUMMARY

4.4.1. The DS1 traffic modelling results indicate that the MMQs on Crostwick Lane are expected to slightly increase in comparison to the DM model, by +15m in the AM peak and +37m in the PM peak. The DS2 and DS3 traffic modelling results show that the MMQs on Crostwick Lane are expected to reduce in both peak hours.

4.4.2. All options are expected to increase queueing on B1150, which can be expected on the major arm of a junction with a signalised junction or roundabout. During model visualisation of the DS1 model it is observed that queues on B1150 are often cleared every alternate cycle.

4.4.3. With the DS1 option there are forecast improvements to journey times for vehicles exiting Crostwick Lane in the AM peak hour and in the DS2 and DS3 options reductions are forecast in both peak hours.

4.4.4. Journey times for straight ahead movements on B1150 are expected to increase with all options, although this is to be expected with a roundabout or signalised junction.

4.4.5. For the signalised option all traffic queues are expected to clear within the first cycle.

4.4.6. All options are expected to increase the average journey times for vehicles at the junction, although deliver other benefits such as addressing safety concerns, inclusion of Non-Motorised Users (NMU) facilities.

5 COST ESTIMATES & COST BENEFIT ANALYSIS

5.1 COST ESTIMATES

GENERAL

5.1.1. WSP Commercial Team have estimated the cost of implementing the roundabout or traffic signal option using the Contractor (Tarmac) rates as of the first quarter of 2026. Where certain rates were unavailable, industry standard cost data, as well as estimates from previous schemes have been used to derive the estimate.

5.1.2. The price estimates are exclusive of value-added tax (VAT), optimism bias (OB), future inflation beyond first quarter of 2026, land purchase and costs associated with legal procedures.

5.1.3. A summary of the cost estimates for all options are shown in Table 5-1 below. Further details of the cost break downs are provided in Appendix C.

ASSUMPTIONS

5.1.4. The assumptions made can be found in the full cost break downs (Appendix C). This includes, but is not limited to the following:

- Allowance of 21% to cover Professional Fee
- Allowance of 10% to cover early contractor involvement (ECI).
- Allowance of 30% to cover unforeseen risks and/or for contingencies.

Table 5-1 - Cost Estimate

Item Description	Option A Signalised Junction	Option B 50mph Roundabout	Option B 40mph Roundabout
Direct Construction Costs			
Base Construction Cost	£390,000	£437,000	£452,000
Indirect Construction Costs			
Main Contractor's Preliminaries, TM and Overheads and Profit	£446,900	£471,100	£475,600
Indirect Non-Construction Costs			
Utilities	£78,000	£87,400	£90,400
Professional Fees	£81,900	£91,770	£94,920
Tarmac ECI	£39,000	£43,700	£45,200

Total Cost (excl. Risk/Contingency)	**£875,900**	**£1,130,970**	**£1,158,120**
Risk / Contingency	£262,770	£339,291	£347,436
Total excl. inflation	**£1,139,000**	**£1,471,970**	**£1,506,000**
Inflation	£123,012	£158,868	£162,648
Total	**£1,263,000**	**£1,630,000**	**£1,669,000**

5.2 COST BENEFIT ANALYSIS

5.2.1. The economic appraisal of the developed options has been undertaken in line with Department for Transport TAG (Transport analysis guidance). The benefits and costs are considered over a 60-year period from the proposed scheme's opening in 2026. The capital costs of the scheme are assumed to be incurred in 2026[1], prior to the scheme's opening.

5.2.2. Journey time savings and safety benefits are the most significant impacts expected at this stage. Additional impacts such as vehicle operating costs, local air quality, noise etc, are likely to be second order effects and have not been monetised at this stage. The scale of these impacts is not considered to have a substantial bearing on the Value for Money (VfM) assessment of the scheme.

5.2.3. Journey time savings are shown below in Table 5-2

Table 5-2: Journey Time Savings Benefit

(£s, 2010 PV over the appraisal period)

Impact	Signalised	Roundabout 50mph	Roundabout 40mph
Journey Time Savings (£, 2010 PV)	-6,877	2,006	3,150

5.2.4. Monetised Accident Benefits are shown below in Table 5-3

Table 5-3: Accident Benefits

(£s, 2010 PV over the appraisal period)

Impact	Signalised	Roundabout 50mph	Roundabout 40mph
Accident Benefits (£, 2010 PV)	2,627,443	1,876,745	1,876,745

5.2.5. Benefit Cost Ratio Analysis

A Benefit Cost Ratio (BCR) has been calculated by comparing the benefits of the scheme to costs. This BCR provides some insight into the Value for Money (VfM) of the scheme i.e., to

[1] Cost estimates are based at 1Q 2026

what extent do the benefits counterbalance the scheme costs. The assessment of VfM has been based on the DfT Value for Money Framework, which provides a consistent measure and approach to decision making. The Framework sets out six VfM categories which BCRs fall into, ranging from Very Poor to Very High:

- Very Poor VfM: BCR less than or equal to 0
- Poor VfM: BCR between 0 and 1.0
- Low VfM: BCR between 1.0 and 1.5
- Medium VfM: BCR between 1.5 and 2.0
- High VfM: BCR between 2.0 and 4.0
- Very High VfM: BCR greater than or equal to 4.0

Consistent with DfT guidance for the treatment of benefits and costs, and as described above, the economic appraisal of the B1150 North Walsham Road / Crostwick Lane Junction scheme produces the benefit-to-cost ratio (BCR), as presented below in Table 5-4.

Table 5-4: Benefit to Cost Ratio

(£s, 2010 PV over the appraisal period)

Description	Signalised	Roundabout 50mph	Roundabout 40mph
Noise	0	0	0
Local air quality	0	0	0
Greenhouse gases	0	0	0
Journey quality	0	0	0
Physical activity	0	0	0
Accidents	2,627,443	1,876,745	1,876,745
Economic efficiency: commuters	-2,610	761	1,196
Economic efficiency: other	-2,059	601	943
Economic efficiency: business users and providers	-2,208	644	1,011
Wider public finances (indirect tax)	0	0	0
Present Value of Benefits (PVB)	**2,620,566**	**1,878,751**	**1,879,895**
Present Value of Costs (PVC)	**721,524**	**931,663**	**954,004**
Net Present Value (NPV)	1,899,042	947,088	925,892
Benefit-Cost Ratio (BCR)	3.63	2.02	1.97
VfM	**High**	**High**	**Medium**

5.2.6. The conversion of the B1150 / Crostwick Lane priority junction to a 40mph compact roundabout junction represents a **medium VfM** with an initial BCR of 1.97:1.

5.2.7. The conversion of the B1150 / Crostwick Lane priority junction to a 50mph compact roundabout junction represents a **high VfM** with an initial BCR of 2.02:1.

5.2.8. The conversion of the B1150 / Crostwick Lane priority junction to a signalised junction represents **high VfM** with an initial BCR of 3.63:1.

5.2.9. Further details on the economic appraisal can be viewed in APPENDIX C.

6 CONCLUSION AND FURTHER INVESTIGATION

6.1 CONCLUSION

6.1.1. Both the compact roundabout options and the traffic signals option have been assessed using the current and forecasted traffic information and through modelling are predicted to provide benefits, both in terms of capacity and safety.

6.1.2. All options are likely to reduce the frequency of future road traffic collisions; NCC have assumed the following collision reduction rate:

- A 50% reduction in accidents and a reduction in severity if a compact roundabout option was implemented.
- A 70% reduction in accidents if a traffic signal option was implemented.

6.1.3. The signalised junction option provides the greatest predicted monetised accident benefit.

6.1.4. All options will produce an *overall* increase in journey times, as traffic on the B1150 will no longer have priority. Of the three options, the signalised option will produce the smallest increase in AM and PM peak journey times.

6.1.5. Modelling indicates that all options will reduce AM peak journey times for traffic exiting Crostwick Lane. It should be noted whilst Mean Maximum Queue lengths will increase on Crostwick Lane, the actual time that vehicles spend waiting to exit the junction will decrease.

6.1.6. As no land purchase would be required for the signalised option, additional costs for land purchase and legal fees are not expected to be incurred. However, for a signalised option, it's isolated location and future regular maintenance cost need to be taken into consideration.

6.1.7. In conclusion the signalised option offers the greatest value for money with BCR 0f 3.63:1 which almost twice that of the two compact roundabout options.

6.1.8. Any decisions for choice of scheme needs to be considered based on other criterion such as further feasibility, land intake, isolated location for a signalised junction, safety concerns etc.

6.2 FURTHER INVESTIGATION

6.2.1. Statutory undertakers' utility information has been provided by Norfolk County Council. Further engagement is required with Statutory Undertakers to understand the full costs of utility works at this location. This will include any diversion / protection works and the cost of providing a suitable power supply to the site, for the traffic signalled control option and possible illumination signage for both options.

6.2.2. No environmental impact assessment was undertaken as part of the study. It is suggested that an environmental impact assessment is undertaken to understand the full environmental impact of all junction options.

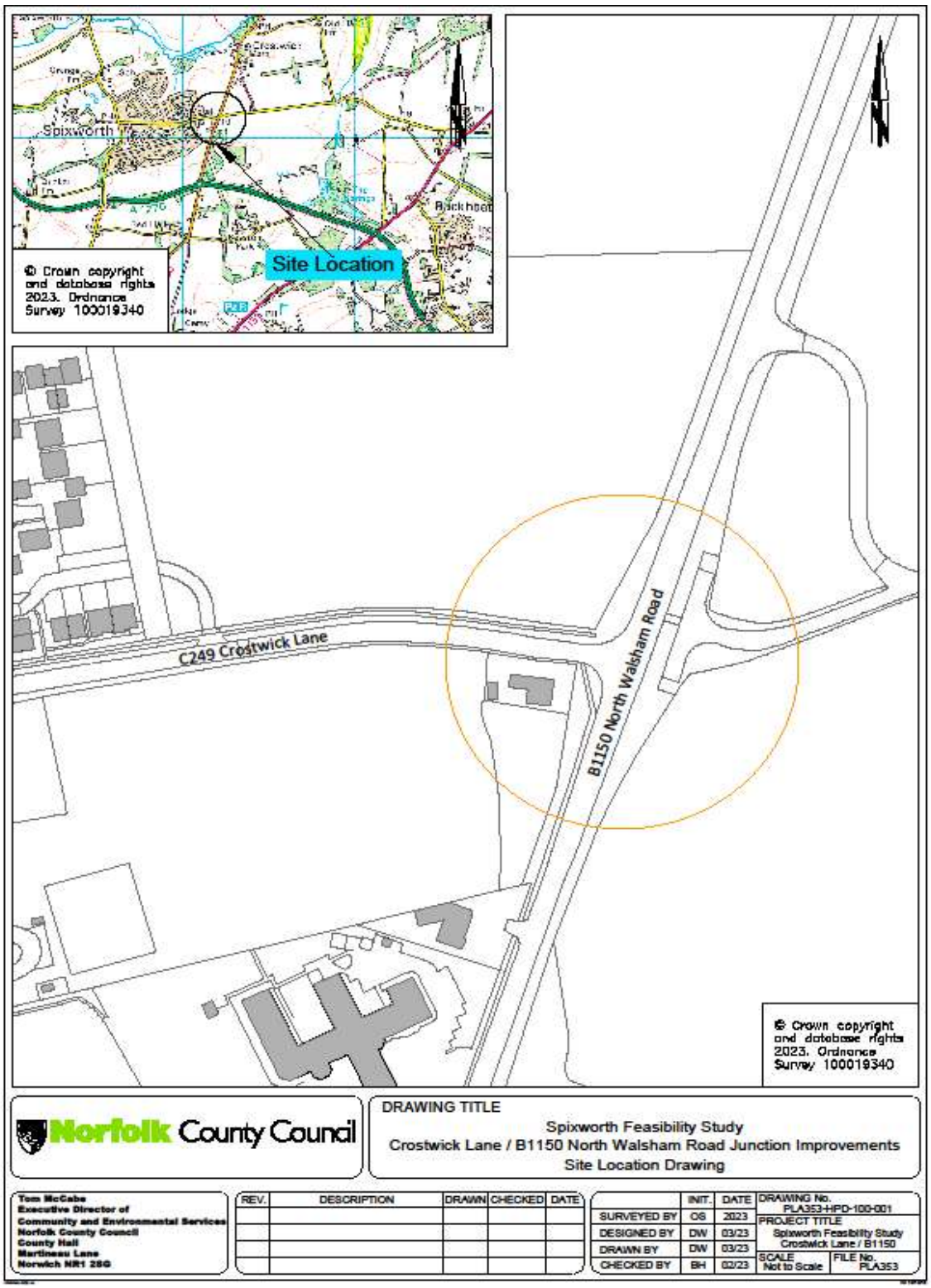
6.2.3. Additional Traffic Regulations Orders will need to be considered at the detailed design stage.

6.2.4. Further consultation will be required with adjacent landowners to fully understand likely costings of land purchase.

Appendix A

SITE LOCATION PLAN

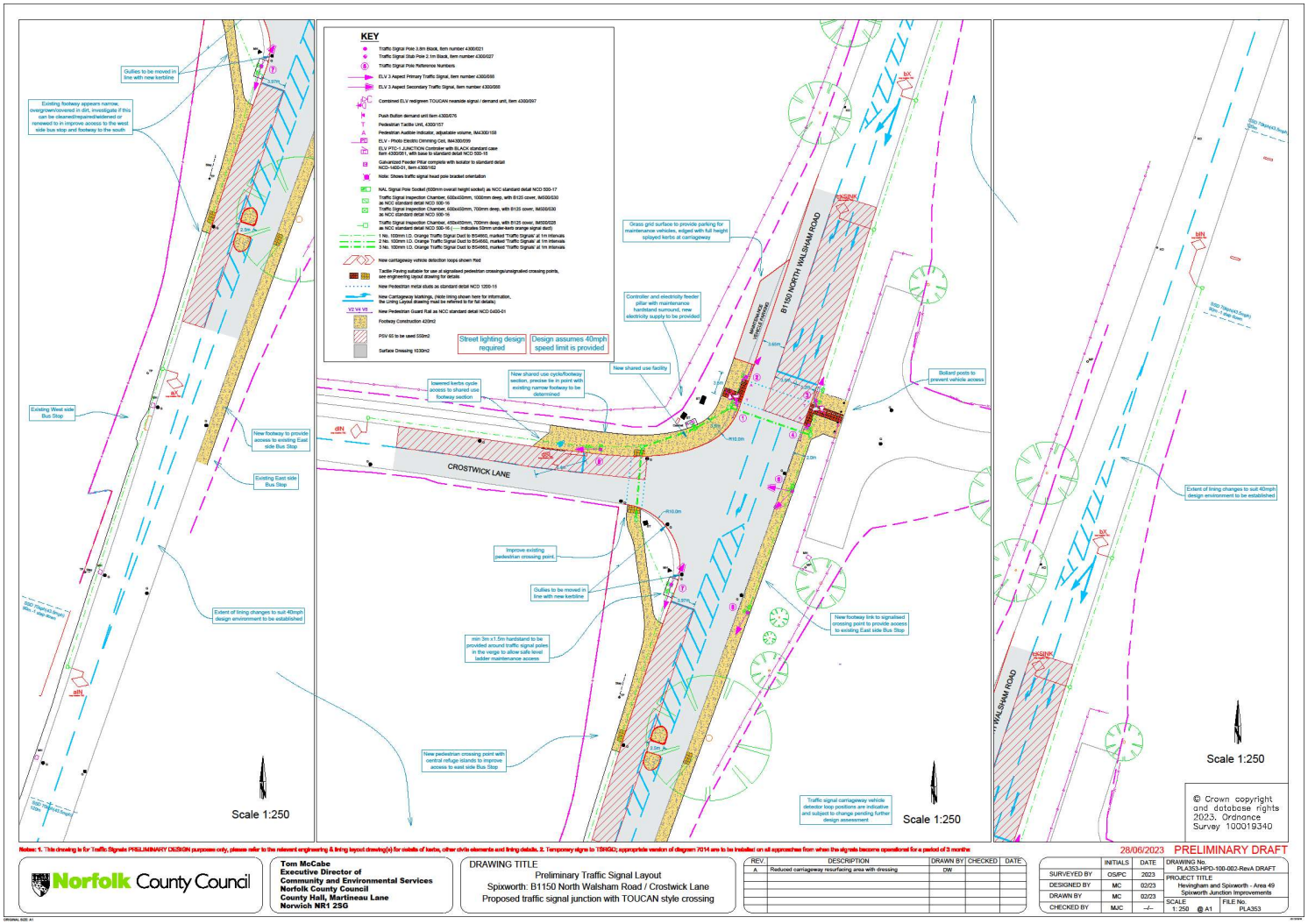
Site Location Plan



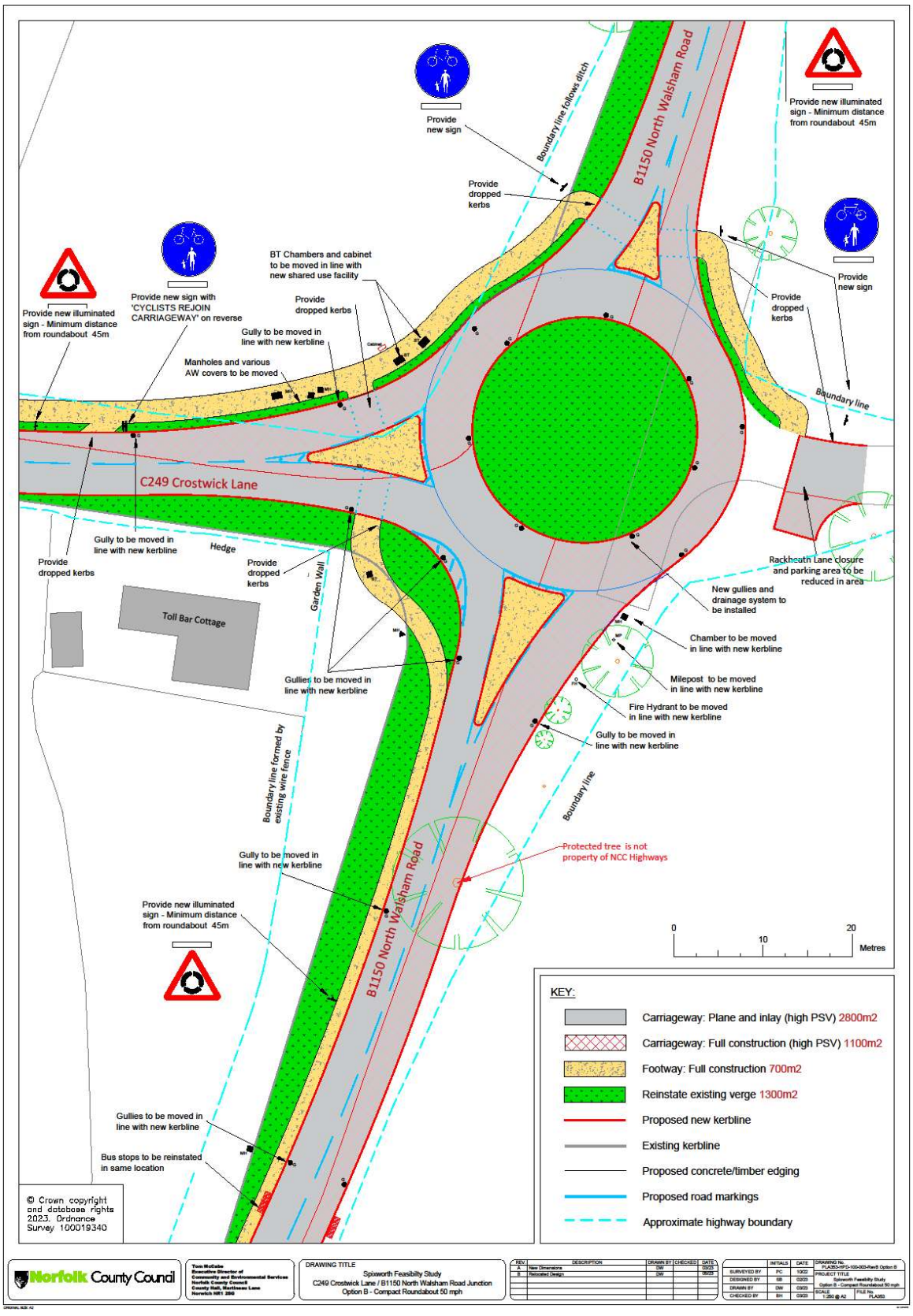
Appendix B

DESIGN OPTIONS

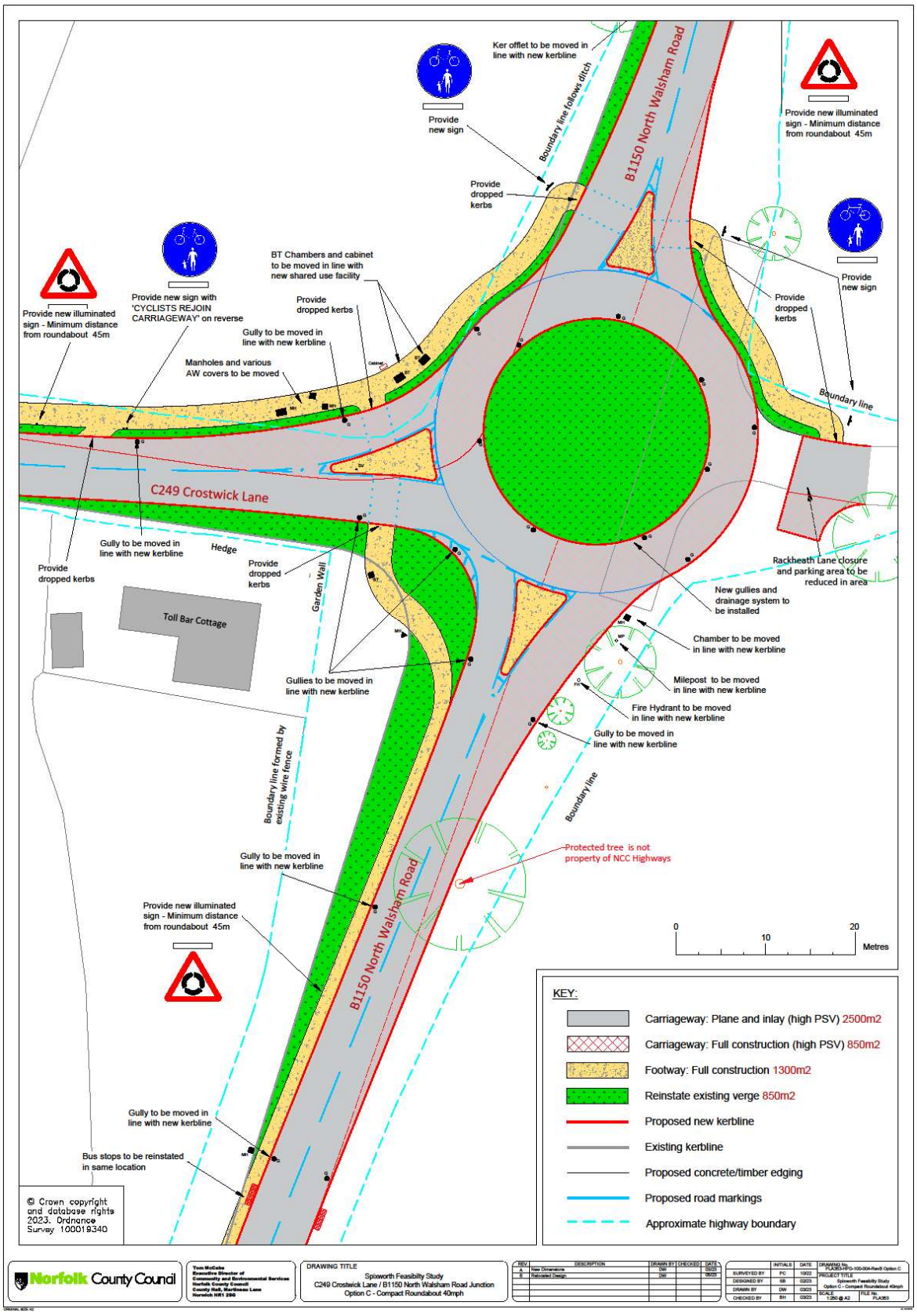
Option A: Signalised Junction with Toucan Style Crossing



Option B: Compact Roundabout 50mph



Option C: Compact Roundabout 40 mph



Appendix C

SCHEME COST ESTIMATES & BCR

Spixworth Scheme - Option A - Signalised Junction - Feasibility Design Cost Estimate

Client	Norfolk County Council		
Project	Spixworth Scheme - Option A - Signalised Junction		
Title	Feasibility Design Cost Estimate		
Project Number	70111092		
Date	16 June 2023		
Revision	1		
Prepared By	David Grey	Staff Grade	P05
Checked / Approved By	John Caygill	Staff Grade	P06
Authorised By	Brijesh Singh	Staff Grade	

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1.1 Estimate History

	Notes / Variations	Date Issued
1.1	Feasibility Design Cost Estimate	16/06/2023

2.1 Document Register

Document Title	Document Reference	Revision	Format	Date
Hevingham and Spixworth - Area 49 Spixworth Junction Improvements	PLA353-HPD-100-002 DRAFT		PDF	01/06/2023

Comments on above

3.1 Notes

Pricing Notes
Estimates are based at 1Q 2023
Estimates have been based upon drawing numbers as scheduled on the attached and viewing on Google maps

Exclusions
Legal issues
VAT
Land take
Optimism Bias
Future inflation beyond 1Q 2023

Assumptions
All assumptions are included within the estimate

4.1 Cost Summary

Item Description	
Direct Construction Costs	
Base Construction Cost	£390,000
Indirect Construction Costs	
Minor items not measured / picked up due to design stage	£39,000
Main Contractor's Preliminaries, Overheads and Profit	£117,000
Traffic Management	£170,000
Indirect Non-Construction Costs	
Utilities	£78,000
Professional Fees	£81,900
Total excl. Risk, OB and Inflation	**£875,900**
Risk / Contingency	£262,770
Total excl. Inflation	**£1,139,000**
Inflation	£123,012
Total	**£1,263,000**

Item	Item Description	Notes / Assumptions	Quantity	Unit	Rate	Total
	Series 200: Site Clearance					
	General site clearance					£2,930
	Remove existing kerb					£1,500
	Take up or down and set aside for re-use existing gullies, chamber and kerb offlet					£20
	Allowance for items not identified at this stage					£10,000
	Series 400: Road restraint systems					
	Pedestrian guardrail					£3,144
	Series 500: Drainage					
	Gully to be moved in line with new kerbline					£800
	Series 600: Earthworks					
	Excavation of unacceptable material	Footway - Full construction				£2,033
	Excavation of unacceptable material	Footway - Traffic island				£16
	Extra over for hard material					£3,005
	Disposal of material					£1,047
	Transport to tip	Assume 10km transport				£5,234
	Series 700: Pavements					
	60mm binder course	Plane and inlay				£45,623
	40mm surface course	Plane and inlay				£39,699
	High friction surfacing					£29,767
	Tack coat					£5,201
	Planing					£79,193
	Disposal of material	Planing materials				£2,604
	Transport to tip	Planing materials - Assume 10km transport				£13,022
	Grasscrete	Maintenance vehicle parking				£5,300
	Series 1100: Kerbs, footways and paved areas					
	Kerbing - HB					£3,078
	Kerbing - HB	Traffic island				£379
	Kerbing - BN					£311
	Kerbing - Transition					£462
	Kerbing - Quadrant					£130
	Kerbing - Foundations					£1,297
	Kerbing - Edging					£1,608
	Kerbing - Foundations					£656
	Footpath - 150mm sub-base	Full construction				£3,134
	Footpath - 150mm sub-base	Traffic island				£75
	Footpath - Binder course and surface course	Full construction				£13,397
	Footpath - Binder course and surface course	Traffic island				£319
	Footpath - Tactile paving					£2,640
	Series 1200: Traffic signs and road markings					
	Allowance for road markings					£2,000
	Allowance for new signage					£5,000
	Allowance for traffic signalisation works					£105,000
					sub-total	£390,000
		Minor items not measured / picked up due to design stage			10%	£39,000
		Main Contractor's Preliminaries, Overheads and Profit			30%	£117,000
					sub-total	£546,000
			Traffic Management			£170,000
			Utilities		20%	£78,000
			Professional Fees		15%	£81,900
					sub-total	£875,900
			Risk / Contingency		30%	£262,770
					sub-total	£1,139,000
			Inflation		10.8%	£123,012
	Total Indicative Estimate				**Total**	**£1,263,000**

Spixworth Scheme - Option B - Compact Roundabout 50mph - Feasibility Design Cost Estimate

Client	Norfolk County Council		
Project	Spixworth Scheme - Option B - Compact Roundabout 50mph		
Title	Feasibility Design Cost Estimate		
Project Number	70111092		
Date	16 June 2023		
Revision	1		
Prepared By	David Grey	Staff Grade	P05
Checked / Approved By	John Caygill	Staff Grade	P06
Authorised By	Brijesh Singh	Staff Grade	

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1.1 Estimate History

Notes / Variations	Date Issued
1.1 Feasibility Design Cost Estimate	16/06/2023

2.1 Document Register

Document Title	Document Reference	Revision	Format	Date
Spixworth Feasibility Study Roundabout Option C (50mph)	PLA353-HPD-100-004-RevB Option D	B	PDF	01/05/2023

Comments on above

3.1 Notes

Pricing Notes
Estimates are based at 1Q 2023
Estimates have been based upon drawing numbers as scheduled on the attached and viewing on Google maps

Exclusions
Legal issues
VAT
Land take
Optimism Bias
Future inflation beyond 1Q 2023

Assumptions
All assumptions are included within the estimate

4.1 Cost Summary

Item Description	
Direct Construction Costs	
Base Construction Cost	£437,000
Indirect Construction Costs	
Minor items not measured / picked up due to design stage	£43,700
Main Contractor's Preliminaries, Overheads and Profit	£131,100
Traffic Management	£340,000
Indirect Non-Construction Costs	
Utilities	£87,400
Professional Fees	£91,770
Total excl. Risk, OB and Inflation	**£1,130,970**
Risk / Contingency	£339,291
Total excl. Inflation	**£1,471,000**
Inflation	£158,868
Total	**£1,630,000**

Item	Item Description	Notes / Assumptions	Quantity	Unit	Rate	Total
	Series 200: Site Clearance					
	General site clearance					£2,630
	Remove existing kerb					£4,800
	Take up or down and set aside for re-use existing BT chamber					£20
	Take up or down and set aside for re-use existing manholes and various AW covers					£30
	Take up or down and set aside for re-use existing gullies, chamber and kerb offlet					£130
	Take up or down and set aside for re-use existing bus shelter					£200
	Allowance for items not identified at this stage					£10,000
	Series 500: Drainage					
	Gully					£4,594
	Drainage pipe					£13,399
	Gully to be moved in line with new kerbline					£4,400
	Chamber to be moved in line with new kerbline					£400
	Kerb offlet to be moved in line with new kerbline					£400
	Reinstatement of manholes and various AW covers					£1,200
	Series 600: Earthworks					
	Excavation of unacceptable material	Carriageway - Full construction				£8,276
	Excavation of unacceptable material	Footway - Full construction				£1,839
	Excavation of unacceptable material	Footway - Traffic island				£194
	Excavation of acceptable material	Verge and roundabout area				£3,295
	Extra over for hard material					£15,119
	Disposal of material					£8,893
	Transport to tip	Assume 10km transport				£44,466
	Landscaping					
	Topsoil	150mm depth				£5,217
	Subsoil	250mm depth				£3,255
	Compaction of fill					£555
	Series 700: Pavements					
	250mm sub-base	Full construction				£20,711
	200mm base course	Full construction				£88,117
	60mm binder course	Full construction				£29,597
	40mm surface course	Full construction				£25,754
	60mm binder course	Plane and inlay				£27,143
	40mm surface course	Plane and inlay				£23,618
	Tack coat					£8,156
	Planing					£23,557
	Disposal of material	Planing materials				£775
	Transport to tip	Planing materials - Assume 10km transport				£3,874
	Series 1100: Kerbs, footways and paved areas					
	Kerbing - HB					£8,523
	Kerbing - HB	Roundabout				£1,894
	Kerbing - HB	Traffic island				£2,131
	Kerbing - BN					£519
	Kerbing - BN	Traffic island				£249
	Kerbing - Transition					£462
	Kerbing - Transition	Traffic island				£308
	Kerbing - Foundations					£4,300
	Kerbing - Edging					£2,502
	Kerbing - Foundations					£1,021
	Footpath - 150mm sub-base	Full construction				£2,836
	Footpath - 150mm sub-base	Traffic island				£896
	Footpath - Binder course and surface course	Full construction				£12,121
	Footpath - Binder course and surface course	Traffic island				£3,828
	Series 1200: Traffic signs and road markings					
	Allowance for road markings					£2,000
	Allowance for new signage					£5,000
	Allowance for reinstatement of existing bus shelters					£1,000
	Series 1500: Motorway communications					
	Reinstatement of BT chamber and cabinets					£800
	Series 3000: Landscape and ecology					
	Allowance for seeding and preparation of soil					£1,000
					sub-total	£437,000

Item	Item Description	Notes / Assumptions	Quantity	Unit	Rate	Total
		Minor items not measured / picked up due to design stage			10%	£43,700
		Main Contractor's Preliminaries, Overheads and Profit			30%	£131,100
					sub-total	£611,800
				Traffic Management		£340,000
				Utilities	20%	£87,400
				Professional Fees	15%	£91,770
					sub-total	£1,130,970
				Risk / Contingency	30%	£339,291
					sub-total	£1,471,000
				Inflation	10.8%	£158,868
	Total Indicative Estimate				**Total**	**£1,630,000**

Spixworth Scheme - Option C - Compact Roundabout 40mph - Feasibility Design Cost Estimate

Client	Norfolk County Council		
Project	Spixworth Scheme - Option C - Compact Roundabout 40mph		
Title	Feasibility Design Cost Estimate		
Project Number	70111092		
Date	16 June 2023		
Revision	1		
Prepared By	David Grey	Staff Grade	P05
Checked / Approved By	John Caygill	Staff Grade	P06
Authorised By	Brijesh Singh	Staff Grade	

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1.1 Estimate History

Notes / Variations	Date Issued
1.1 Feasibility Design Cost Estimate	16/06/2023

2.1 Document Register

Document Title	Document Reference	Revision	Format	Date
Spixworth Feasibility Study Roundabout Option D (40mph)	PLA353-HPD-100-004-RevB Option D	B	PDF	01/05/2023

Comments on above

3.1 Notes

Pricing Notes
Estimates are based at 1Q 2023
Estimates have been based upon drawing numbers as scheduled on the attached and viewing on Google maps

Exclusions
Legal issues
VAT
Land take
Optimism Bias
Future inflation beyond 1Q 2023

Assumptions
All assumptions are included within the estimate

4.1 Cost Summary

Item Description	
Direct Construction Costs	
Base Construction Cost	£452,000
Indirect Construction Costs	
Minor items not measured / picked up due to design stage	£45,200
Main Contractor's Preliminaries, Overheads and Profit	£135,600
Traffic Management	£340,000
Indirect Non-Construction Costs	
Utilities	£90,400
Professional Fees	£94,920
Total excl. Risk, OB and Inflation	**£1,158,120**
Risk / Contingency	£347,436
Total excl. Inflation	**£1,506,000**
Inflation	£162,648
Total	**£1,669,000**

Item	Item Description	Notes / Assumptions	Quantity	Unit	Rate	Total
	Series 200: Site Clearance					
	General site clearance					£2,630
	Remove existing kerb					£4,750
	Take up or down and set aside for re-use existing BT chamber					£20
	Take up or down and set aside for re-use existing manholes and various AW covers					£30
	Take up or down and set aside for re-use existing gullies, chamber and kerb offlet					£120
	Take up or down and set aside for re-use existing bus shelter					£200
	Allowance for items not identified at this stage					£10,000
	Series 500: Drainage					
	Gully					£4,594
	Drainage pipe					£13,399
	Gully to be moved in line with new kerbline					£4,000
	Chamber to be moved in line with new kerbline					£400
	Kerb offlet to be moved in line with new kerbline					£400
	Reinstatement of manholes and various AW covers					£1,200
	Series 600: Earthworks					
	Excavation of unacceptable material	Carriageway - Full construction				£6,857
	Excavation of unacceptable material	Footway - Full construction				£1,936
	Excavation of unacceptable material	Footway - Traffic island				£145
	Excavation of acceptable material	Verge and roundabout area				£2,860
	Extra over for hard material					£13,108
	Disposal of material					£7,715
	Transport to tip	Assume 10km transport				£38,573
	Landscaping					
	Topsoil	150mm depth				£4,585
	Subsoil	250mm depth				£2,841
	Compaction of fill					£485
	Series 700: Pavements					
	250mm sub-base	Full construction				£17,175
	200mm base course	Full construction				£73,073
	60mm binder course	Full construction				£24,544
	40mm surface course	Full construction				£21,357
	60mm binder course	Plane and inlay				£34,650
	40mm surface course	Plane and inlay				£30,151
	Tack coat					£8,148
	Planing					£60,146
	Disposal of material	Planing materials				£1,978
	Transport to tip	Planing materials - Assume 10km transport				£9,890
	Series 1100: Kerbs, footways and paved areas					
	Kerbing - HB					£8,641
	Kerbing - HB	Roundabout				£1,894
	Kerbing - HB	Traffic island				£1,657
	Kerbing - BN					£457
	Kerbing - BN	Traffic island				£249
	Kerbing - Transition					£462
	Kerbing - Transition	Traffic island				£308
	Kerbing - Foundations					£4,168
	Kerbing - Edging					£2,609
	Kerbing - Foundations					£1,065
	Footpath - 150mm sub-base	Full construction				£2,948
	Footpath - 150mm sub-base	Traffic island				£672
	Footpath - Binder course and surface course	Full construction				£12,600
	Footpath - Binder course and surface course	Traffic island				£2,871
	Series 1200: Traffic signs and road markings					
	Allowance for road markings					£2,000
	Allowance for new signage					£5,000
	Allowance for reinstatement of existing bus shelters					£500
	Series 1500: Motorway communications					
	Reinstatement of BT chamber and cabinets					£800
	Series 3000: Landscape and ecology					
	Allowance for seeding and preparation of soil					£1,000
					sub-total	£452,000

Item	Item Description	Notes / Assumptions	Quantity	Unit	Rate	Total
		Minor items not measured / picked up due to design stage			10%	£45,200
		Main Contractor's Preliminaries, Overheads and Profit			30%	£135,600
					sub-total	£632,800
				Traffic Management		£340,000
				Utilities	20%	£90,400
				Professional Fees	15%	£94,920
					sub-total	£1,158,120
				Risk / Contingency	30%	£347,436
					sub-total	£1,506,000
				Inflation	10.8%	£162,648
	Total Indicative Estimate				**Total**	**£1,669,000**

TECHNICAL NOTE 2 – Economic Appraisal Note

DATE:	25 July 2023	**CONFIDENTIALITY:**	Confidential
SUBJECT	Spixworth Junction Feasibility Update – Economic Appraisal Note		
PROJECT:	70111092	**AUTHOR:**	Virender Sharma
CHECKED:	Claudia Green	**APPROVED:**	Brijesh Singh

INTRODUCTION

Norfolk County Council (NCC) are undertaking a feasibility study to address safety and congestion issues at the B1150 North Walsham Road / Crostwick Lane priority junction, located to the east of Spixworth.

As part of this feasibility study, NCC have commissioned WSP to carry out performance assessment, economic appraisal and preparation of high-level cost estimates for a series of scheme options that have been designed for junction improvement.

This Technical Note (TN) reports on the economic appraisal of three options proposed for the B1150 / Crostwick Lane junction and presents on the Benefit Cost Ratio (BCR) that have been calculated for each option.

TECHNICAL NOTE 2 – Economic Appraisal Note

DATE:	25 July 2023	**CONFIDENTIALITY:**	Confidential
SUBJECT	Spixworth Junction Feasibility Update – Economic Appraisal Note		
PROJECT:	70111092	**AUTHOR:**	Virender Sharma
CHECKED:	Claudia Green	**APPROVED:**	Brijesh Singh

3 OPTIONS APPRAISED

The B1150 North Walsham Road / Crostwick Lane junction is a priority junction situated just outside of Spixworth, with the adjacent junction on A1270 Broadland Northway located approximately 0.8km away. The B1150 connects Norwich to North Walsham, via Coltishall and Crostwick Lane is one of the main routes in and out of the village of Spixworth.

There are currently perceived delays and safety concerns at the junction, therefore the following proposed options have been developed to assess their feasibility:

- Option A – Signalised Junction
- Option B – Compact Roundabout 50mph
- Option C – Compact Roundabout 40mph

More details regarding the proposed options are provided in *Technical Note 1 – Transport Note, July 2023*.

TECHNICAL NOTE 2 – Economic Appraisal Note

DATE:	25 July 2023	**CONFIDENTIALITY:**	Confidential
SUBJECT	Spixworth Junction Feasibility Update – Economic Appraisal Note		
PROJECT:	70111092	**AUTHOR:**	Virender Sharma
CHECKED:	Claudia Green	**APPROVED:**	Brijesh Singh

METHODOLOGY AND ASSUMPTIONS

APPRAISAL

The appraisal of costs and benefits has been undertaken in line with Department for Transport TAG (Transport analysis guidance). The benefits and costs are considered over a 60-year period from the proposed scheme's opening in 2026. The capital costs of the scheme are assumed to be incurred in 2026[2], prior to the scheme's opening.

Following TAG, the scheme costs and benefits have been adjusted such that they are in equivalent units and align to the DfT base year (2010). To convert to 2010 Present Values (PV), the costs and benefits have been deflated to 2010 prices using GDP Deflator forecasts from the May 2023 TAG Databook, discounted to 2010 values using Table A1.1.1 from the May 2023 TAG Databook, and converted to market prices using a factor of 1.19.

A Benefit Cost Ratio (BCR) has been calculated by comparing the benefits to the scheme costs. This BCR provides some insight into the Value for Money (VfM) of the scheme i.e., to what extent do the benefits counterbalance the scheme costs. The assessment of VfM has been based on the DfT Value for Money Framework, which provides a consistent measure and approach to decision making. The Framework sets out six VfM categories which BCRs fall into, ranging from Very Poor to Very High:

- Very Poor VfM: a BCR less than or equal to 0
- Poor VfM: a BCR between 0 and 1.0
- Low VfM: a BCR between 1.0 and 1.5
- Medium VfM: a BCR between 1.5 and 2.0
- High VfM: a BCR between 2.0 and 4.0
- Very High VfM: a BCR greater than or equal to 4.0

[2] Cost estimates are based at 1Q 2023.

TECHNICAL NOTE 2 – Economic Appraisal Note

DATE:	25 July 2023	**CONFIDENTIALITY:**	Confidential
SUBJECT	Spixworth Junction Feasibility Update – Economic Appraisal Note		
PROJECT:	70111092	**AUTHOR:**	Virender Sharma
CHECKED:	Claudia Green	**APPROVED:**	Brijesh Singh

0 SCHEME OPTION COSTS

10.1.1. The capital costs of converting the Spixworth priority junction to Signalised/Roundabout junction will cost in the region of £1.00-£1.32m[3] for signalisation and roundabout, based on base direct construction cost, indirect construction, indirect non-construction costs (utilities and professional fees) and inflation. The cost spend profile of the options are outlined in Table 2 below.

Table 2: Cost Spend Profile (£000s)

Outturn Cost excl. Bias[4]	2026-27
Option A – Signalised Junction	10.1.2. 999
10.1.3. Option B – Compact Roundabout 50mph	10.1.4. 1,290
10.1.5. Option C – Compact Roundabout 40mph	10.1.6. 1,321

10.1.7. At this SOC stage, a 46% uplift for optimism bias (OB) is recommended to the base scheme costs. Using this, the optimism bias values are £0.46-£0.60m for signalisation and roundabout. This compares to the risk allowance in the outturn costs of £0.26-£0.35m (21% uplift). Given this value of OB is greater than the recommended value of risk allowance, the OB value rather than the risk allowance value has been used within the appraisal.

10.1.8. Following the application of OB, the scheme costs have been adjusted to produce costs consistent with the benefits, namely 2010 prices and values, with the market factor adjustment applied.

[3] Cost spend profiles are without the risk and contingency, due to different treatment of costs in PVC calculation.
[4] Optimism bias included separately in the analysis.

TECHNICAL NOTE 2 – Economic Appraisal Note

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PROJECT:	70111092	**AUTHOR:**	Virender Sharma
CHECKED:	Claudia Green	**APPROVED:**	Brijesh Singh

1 BENEFITS MODELLING APPROACH

11.1.1. At this stage of the study and information available, assessment of the impact on time savings and accidents has been undertaken to enable these benefits to be monetised. Other impacts have not been assessed or monetised at this stage.

Journey Time Saving

11.1.2. B1150 North Walsham Road / Crostwick Lane junction is a priority junction, and its transformation into signalised or roundabout junction will reduce delays for some movements at the junction. Users will benefit from the reduction in delays in terms of journey time savings. The model results delay inputs and processes are discussed further below.

11.1.3. Model Results

The preliminary design models for the AM and PM periods with model years 2026 and 2041 have been used to extract model results in terms of delays for the various options (signalisation and roundabout options from Paramics Discovery). IP peak hour is assumed to be the average of both. The detailed delay summary of the options is presented in *Technical Note 1 – Transport Note*.

11.1.4. The output of the modelled peak hour delays has been annualised. Factors assumed for the peak periods and annualisation are as set out in Table 3.

Table 3: Peak Period and Annualisation Factor

Time Period	Peak Period and Annualisation Factor
AM (07:30-08:30)	3
PM (16:45-17:45)	3
IP (Average of AM and PM)	6
No. of Weekdays	253
No. of Weekends	52

11.1.5. Time savings were valued using the Value of Time values for business, commuters, and other users, assuming the DfT default car purpose splits. The rule of a half was applied to the estimated time savings as per the DfT guidance. The outputs from each modelled period (AM, Inter Peak and PM) were annualised.

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Safety benefits

11.1.6. Accident data has been obtained from NCC for B1150 North Walsham Road / Crostwick Lane junction for the period between 2017 to 2022. During this period, 7 accidents occurred on the junction, with 6 being slight, 1 serious, and 0 fatal.

11.1.7. The proposed options considered for the junction are a roundabout or signalised option, which are likely to reduce the future accidents at the junction. It has been suggested by NCC's Network Safety team that the following parameters can be used for accident reduction:

- A 70% reduction in accidents if a traffic signal option was implemented.
- A 50% reduction in accidents if a roundabout option was implemented.

	Accident Savings by Severity			
	Fatal	**Serious**	**Slight**	**Total**
Cost of a casualty (£, 2010, TAG Databook v1.21)	£1,832,816	£210,645	£21,470	
Number of collisions (5 years)	0	1	6	7
Collision avoided on signalised (70% accident reduction assumption)	0	0.7	4.2	4.9
Collision avoided on roundabout (50% accident reduction assumption)	0	0.5	3	3.5
Number of prevented accidents per annum on signalised	0	0.14	0.84	0.98
Number of prevented accidents per annum on roundabout	0	0.1	0.6	0.7
Accident savings per annum on signalised (£, 2010)	£0	£29,490	£18,035	£47,525
Accident savings per annum on roundabout (£, 2010)	£0	£21,065	£12,882	£33,947

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2 SUMMARY

12.1.1. The main appraisal assumptions are set out in Table 4.

Table 4: Economic Appraisal Assumptions

Criteria	Assumption	Source
Opening year	2026	Project Programme
Base year	2010	DfT Base Year
Appraisal period	60 years	DfT guidance
Discount rate	3.5% 0-30 years 3.0% 31-75 years	May 2023 TAG Data Book (A1.1.1)
GDP Deflator	-	May 2023 TAG Data Book (Annual Parameters)
Journey purpose split	Business: 14.85% Commuting: 31.21% Other: 53.94%	May 2023 TAG Data Book
Values of time (2023, market prices)	12.1.2. Business – £19.42 12.1.3. Commuter – £10.93 Other – £4.99	May 2023 TAG Databook (A1.3.2)
Market price adjustment factor	1.19	May 2023 TAG Databook (A1.3.1)
Optimism bias on capital costs	46%	TAG Unit A1-2
Cost spend profile	2026/27 See Table 2	Project Programme

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3 APPRAISAL RESULTS

13.1.1. The results of the economic appraisal are described below.

journey time savings

13.1.2. Table 5 below presents the benefits of the scheme journey time savings to users.

Table 5: Journey Time Savings Benefit

(£s, 2010 PV over the appraisal period)

Impact	Signalised	Roundabout 50mph	Roundabout 40mph
Journey Time Savings (£, 2010 PV)	-6,877	2,006	3,150

Accident Benefits

13.1.3. Table 6 below presents the benefits of the scheme accident savings.

Table 6: Accident Benefit

(£s, 2010 PV over the appraisal period)

Impact	Signalised	Roundabout 50mph	Roundabout 40mph
Accident Benefits (£, 2010 PV)	2,627,443	1,876,745	1,876,745

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4 BENEFIT TO COST RATIO

14.1.1. Consistent with DfT guidance for the treatment of benefits and costs, and as described above, the economic appraisal of the B1150 North Walsham Road / Crostwick Lane Junction scheme produces the benefit-to-cost ratio (BCR), as presented below.

Table 7: Benefit to Cost Ratio

(£s, 2010 PV over the appraisal period)

Description	Signalised	Roundabout 50mph	Roundabout 40mph
Noise	0	0	0
Local air quality	0	0	0
Greenhouse gases	0	0	0
Journey quality	0	0	0
Physical activity	0	0	0
Accidents	2,627,443	1,876,745	1,876,745
Economic efficiency: commuters	-2,610	761	1,196
Economic efficiency: other	-2,059	601	943
Economic efficiency: business users and providers	-2,208	644	1,011
Wider public finances (indirect tax)	0	0	0
Present Value of Benefits (PVB)	**2,620,566**	**1,878,751**	**1,879,895**
Present Value of Costs (PVC)	**721,524**	**931,663**	**954,004**
Net Present Value (NPV)	1,899,042	947,088	925,892
Benefit-Cost Ratio (BCR)	3.63	2.02	1.97
VfM	**High**	**High**	**Medium**

These results suggested that, based on a comparison of benefits to scheme costs, the signalised option has a higher BCR as compared to roundabout options, which represents high value for money[5].

[5] DfT Value for Money Framework

15 VALUE FOR MONEY STATEMENT

Based on the above assumptions, the conversion of the B1150 North Walsham Road priority junction to signalised junction represents a high VfM with an initial BCR of 3.63:1. The Present Value of Benefits (PVB) due to reductions in delays and accidents has been estimated to be £2,620,566 in 2010 Present Values (PV). The Present Value of Costs (PVC) of this option is £721,524 (2010 PV), including a 46% optimism bias.

Appendix D

TRANSPORT NOTE & TRAFFIC DATA ANALYSIS

TECHNICAL NOTE 1 – Transport Note

DATE:	25 July 2023	**CONFIDENTIALITY:**	Confidential
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PROJECT:	70111092	**AUTHOR:**	Deepa Dileep / Claudia Green
CHECKED:	Inaki Gaspar	**APPROVED:**	Brijesh Singh

16 INTRODUCTION

Norfolk County Council (NCC) are undertaking a feasibility study to address safety and congestion issues at the B1150 North Walsham Road / Crostwick Lane priority junction, located to the east of Spixworth. The feasibility study is also focused on improving safety for Non-Motorised Users (NMUs) due to the lack of pedestrian and cyclist crossing facilities at the junction.

As part of this feasibility study, NCC have commissioned WSP to carry out performance assessment, economic appraisal and preparation of high-level cost estimates for a series of scheme options that have been designed for junction improvement.

This Technical Note (TN) has been produced to evaluate the operational performance of three options put forward for traffic modelling and should be read in conjunction with the Spixworth B1150 / Crostwick Lane Junction Improvement, Feasibility Study.

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17 EXISTING SITUATION

The B1150 North Walsham Road / Crostwick Lane junction is a priority junction situated just outside of Spixworth. The B1150 connects Norwich to North Walsham (via Coltishall) and Crostwick Lane is one of the main routes in and out of the village of Spixworth. The existing junction layout is shown in Figure 2.

17.1

Figure 2 - Existing Junction

17.2 EXISTING TRAFFIC CONDITIONS

To assess the existing traffic conditions a series of Automatic Traffic Counts (ATC), Manual Classified Turning Counts (MCC) and queue surveys were commissioned in October 2022 at the B1150 / Crostwick Lane junction.

Rackheath Lane previously formed a staggered junction with Crostwick Lane however was closed as part of the Broadland Northway scheme and now only permits access for pedestrians and cyclists.

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The farm track that connects to Rackheath Lane has been surveyed for turning counts as it's understood to be an informal cut through for motorists.

ATC surveys were undertaken for 7 days between the 6th and 13th of October 2022, while MCC and queue length surveys were conducted on 6th October 2022.

The MCC data has been collected in 15-minute intervals for the time period between 07:00 – 19:00, from this the peak hours have been identified as:

- AM peak 07:30 – 8:30; and
- PM peak 16:45 – 17:45

Queue length surveys comprise of the maximum number of vehicles queuing, recorded at 5-minute intervals. Queue lengths have been measured by the number of vehicles in the queue in Passenger Car Units (PCUs).

The observed peak vehicular flows passing through the junction are shown Appendix A.

17.3 BUS SERVICES

Bus services corresponding to two routes operating in the model area, X55 and 53C have been included in the model and are shown in Appendix B.

Buses have been modelled to begin their journeys at the first point they enter the modelled network; scheduled according to published weekday timetables; and specified to run along published routes. Bus stops included in the model have been positioned on B1150 North Walsham Road, just south of the junction.

Bus routes and timetables (correct at time of reporting July 2023) were collated for the model area using publicly available online sources, including the moovit (https://moovitapp.com/), Traveline Website (https://www.traveline.info/) and the operators' own Websites: https://www.konectbus.co.uk/ and sanderscoaches.com.

17.4 BASE MODEL

A base year traffic model has been developed using an industry standard microsimulation tool Paramics Discovery version 25.0.4 to understand the existing performance of the junction. The development of the microsimulation network has been based on OS mapping which contained layouts of physical features i.e. road geometry. The road demarcation and delineation, entry and exit lane permitted movements, speed limits and priority information were based on online satellite, street level images and on-site observations.

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Link categories were created for the different speed limit of 50mph, and 30mph roads in the model area. Link visibilities have been defined at priority conflicts (i.e. priority junctions), with the distance specified informed by online aerial photography and site observations.

In addition to the modelled peak hour, warm-up and cool-down periods were included at the start and end of the study periods. The 30 min warm up period simulate road traffic conditions at the before the peak hour and the 30 min cool down allows vehicles to complete their journeys at the end of the model run. In the model, two-hour time periods have been defined, 07:00–09:00 and 16:15–18:15, representing the peak AM and PM periods.

The matrix development process has used the MCC survey data as the basis on which trips from each zone were calculated. The zoning system represents specific areas within the model from which trips start and end. The zone system resulted in 4 zones around the model network namely:

- Zone 1 – B1150 North,
- Zone 2 – Farm access,
- Zone 2 – B1150 South, and
- Zone 4 – Crostwick Lane.

Figure 3 shows the zonal extent of the base model.

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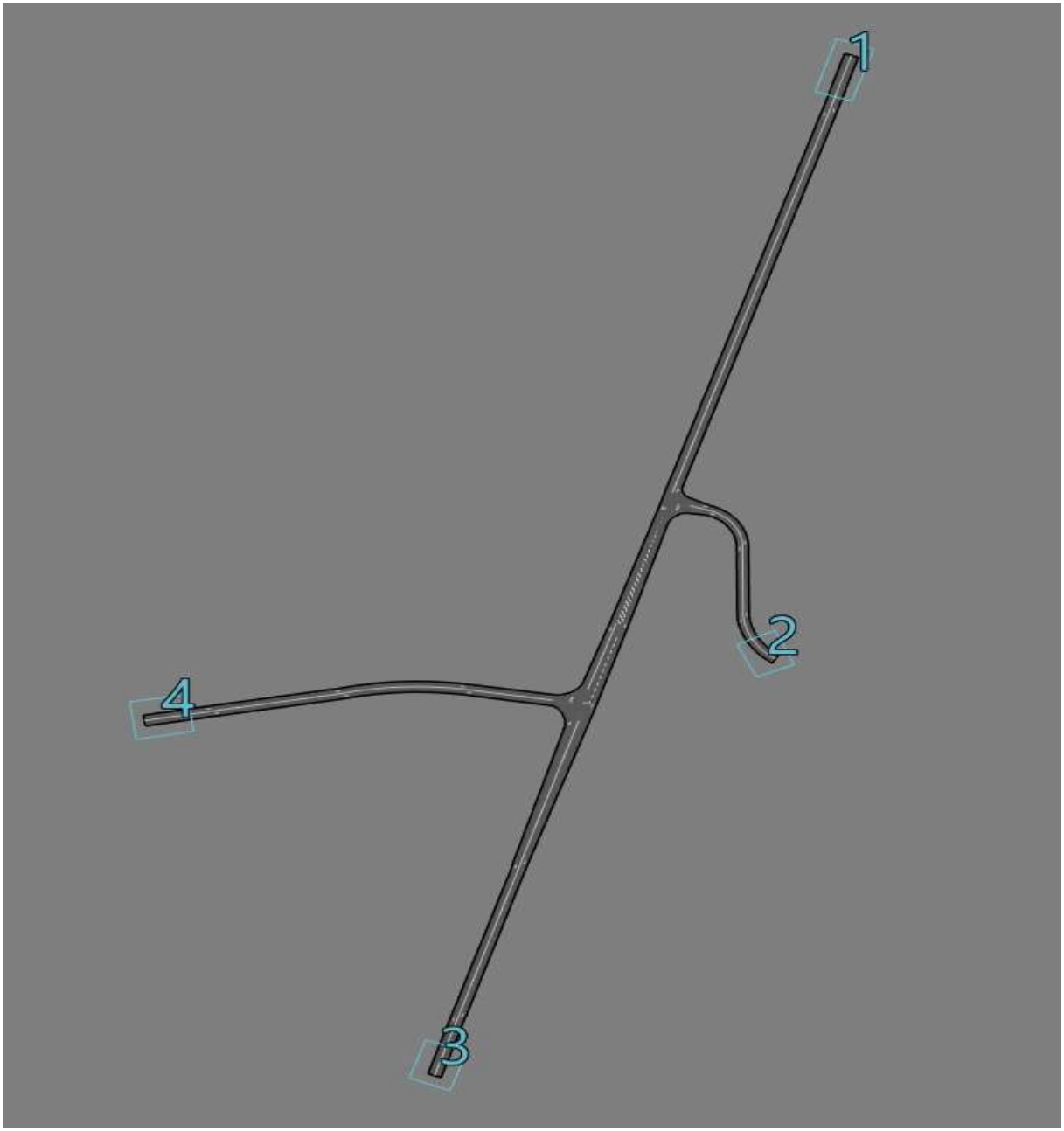


Figure 3 – Base Model Extent

Three separate (two hour) demand matrices have been developed for different vehicle types: Car, LGV and HGVs for each period. The coaches have been included in the HGV matrix. Further details of the matrices can be found in Appendix C.

The vehicle release profiles for the model have been generated from fifteen-minute interval traffic count data of vehicles entering the model area to provide a traffic demand from each zone. Twelve vehicle profiles have been developed, one for each zone and each vehicle matrix for each time period.

17.5 BASE MODEL CALIBRATION

One of the benefits of a microsimulation model is the ability to review the model simulation while it is running to check that it is providing an acceptable representation of reality. Model runs therefore have been observed to check that vehicle behaviour is generally realistic, and vehicles give way appropriately to avoid overestimating or underestimating the capacity of the junction.

The model has been calibrated in accordance with the Department for Transport (DfT) Transport Appraisal Guidance (TAG) Unit M3.1. GEH is used as a method of comparing modelled flows with observed traffic count data. WebTAG gives a guideline criterion of 85% of modelled counts within a GEH value of 5.

Table 1 summarises the GEH statistics for all the turns. All periods show a 100% of modelled flows within a GEH of 5, exceeding the TAG Link Flow and Turning Movement Validation and Acceptability Guidelines (TAG 3.2.8).

Table 8 - Traffic Count Validation

Period	Vehicle type	Count Percentage within 5 GEH
AM Peak	Car	100%
	LGV	100%
	HGV	100%

PM Peak	Car	100%
	LGV	100%
	HGV	100%

The average of 10 randomly seeded model runs generates the modelled data used in the calibration processes. This ensures that the volume of data and analyses what is required is practical, while ensuring that the data reflects variation in the model runs.

Further details regarding the calibration of the base model can be found in Appendix D.

The observed queue data records the maximum number of vehicles queueing every 5-minutes. Paramics -Discovery logs the maximum, the minimum and average queue lengths every 5-minutes. Recorded queue lengths were used to compare the 2022 base year model, so that the baseline traffic flow would generate modelling results which were representative of observed conditions.

The queue data from the survey was available only for Crostwick Lane and the base year model has been calibrated against the observed queue data.

The details of the queue graphs can be found in Appendix E. From the graphs, the modelled queue lengths are considered to adequately reflect observed queue conditions. The maximum difference between observed and modelled queues is 6 vehicles on Crostwick lane during the AM peak and 12 vehicles in the PM Peak.

Based on the above, the base model is considered to provide a valid representation of real-world network conditions and therefore calibrates well.

18 FORECASTING

18.1 METHODOLOGY

In order to assess the junction capacity for the scheme opening year (2026) and scheme forecast year (2041), growth rates have been calculated from TEMPro (v7.2c) for a spatial area of Broadland at MSOA level.

The following parameters have been used to obtain the growth rates from the TEMPro database.

- Growth between 2022 – 2026 and 2041,
- Trip ends by Time period,
- Area – Geographical area – Broadland,
- MSOA - Broadland 003, Broadland 005,
- Trip purpose – All purpose – Car Driver,
- Trip ends by time period – AM Peak / PM Peak,
- NTM – RTF 2018 Scenario 1 – Reference.

The resultant weekday growth factors obtained using the above parameters are shown in Table 2.

Table 9 - Weekday Traffic Growth Factors

Period	AM	PM
2022-2026	1.044	1.047
2022-2041	1.212	1.225

Source: TEMPro Version 7.2c

18.2 FORECAST TRAFFIC IMPACTS

To understand the impacts of traffic growth on the existing junction, a Do Minimum (DM) model has been developed using the base model with 2026 and 2041 weekday forecast demands. The results for the 2041 weekday DM model are presented in Table 3 alongside the model option results for comparison.

19 OPERATION ASSESSMENT

WSP have tested the following 3 model options for the B1150 North Walsham Road / Crostwick Lane junction.

- Do Something 1 (DS1) – Option A: Signalised Junction,
- Do Something 2 (DS2) – Option B: Compact Roundabout 50mph,
- Do Something 3 (DS3) – Option C: Compact Roundabout 40mph.

The Option A: Signalised Junction has been designed for a 40mph speed limit, with a pedestrian crossing on B1150 North and is shown in Appendix H/I.

The base year LinSig model provided by the Norfolk County Council (NCC) has been assessed with 3 stages: one stage for the B1150, second stage for the pedestrian crossing and third stage for the Crostwick Lane. In order to improve the performance of the junction with 2041 traffic, the LinSig model has been optimised with 2041 traffic flows. The optimised signal timings can be found in the Appendix F.

In Paramics, LinSig timings has been used with an assumption that the pedestrian stage will be called every alternate cycle (on average 20 times per hour). This is assumed to be a worst-case scenario, given the location of the junction where pedestrian demand is not expected to be particularly high.

The Option B: Compact Roundabout, has been designed as a 3-arm priority roundabout with a design speed of 50mph, as can be seen in Appendix H/I.

Similarly, the Option C: Compact Roundabout, has been designed as a 3-arm priority roundabout with a design speed of 40mph, as shown in Appendix H/I.

19.1 OPERATION ASSESSMENT SUMMARY

This section is aimed to evaluate the operational performance of the options on general traffic for the 2041 forecast year. Please refer to Appendix G for additional modelling outputs of Mean Maximum Queues (MMQ) and Journey Times for 2026 forecast year.

Table 3 presents the comparison of MMQs at the junction for the 2041 forecast year during the AM and PM peak hours.

Table 10 - Mean Max Queue (MMQ) Comparison (meters)

Peak Hour	Route Names	Mean Max Queue (MMQ) Comparison (m)				
		2022 Base	2041 DM	2041 DS1	2041 DS2	2041 DS3
AM	B1150 North (southbound)	4	7	113	44	48
	B1150 South (northbound)	0	0	90	42	33
	Crostwick Lane	30	55	70	26	23
PM	B1150 North (southbound)	7	18	69	27	26
	B1150 South (northbound)	0	0	125	144	83
	Crostwick Lane	28	55	92	29	29

The DS1 traffic modelling results indicate that the MMQs on Crostwick Lane are expected to slightly increase in comparison to the DM model, by +15m in the AM peak and +37m in the PM peak.

With this option, MMQs are also forecast to increase on B1150 in both peak hours, although this is to be expected with the type of option and provides the opportunity to manage turning movements at the junction. To note, from model visualisation it's observed that queues on B1150 are often cleared every alternate cycle.

The DS2 traffic modelling results show that the MMQs on Crostwick Lane are expected to reduce in the AM and PM peak hours (-29m and -32m respectively) in comparison to the DM model. With this option, MMQs are forecast to increase on B1150, particularly on B1150 South (+144m) in the PM peak hour. However, queueing on the B1150 is to be expected with a roundabout design as vehicles will be required to give way.

Similarly, the DS3 traffic modelling results show that MMQs are projected to reduce on Crostwick Lane by -32m in the AM peak and -26m in the PM peak in comparison to the DM model. With this option, MMQs are forecast to increase on B1150, mostly on B1150 South (+83m) in the PM peak.

In summary, the DS1 results show MMQs are expected to increase slightly on Crostwick Lane and DS2/DS3 results show reductions to MMQs on Crostwick Lane. All options are expected to increase

queueing on B1150, which can be expected on the major arm of a junction with a signalised junction or roundabout.

Like the MMQs comparison, the comparison of journey times in Table 4 shows how the proposed options are expected to impact on general traffic in 2041 forecast year. Table 11 also shows the average journey time for all vehicles at the junction in 2041.

Table 11 - Journey Time Comparison (seconds)

Peak Hour	Route Names	Journey Time Comparison (s)				
		2022 Base	2041 DM	2041 DS1	2041 DS2	2041 DS3
AM	South to North	26	26	37	44	43
	North to South	27	27	42	42	45
	West to North	45	81	68	45	44
	North to West	41	44	64	49	50
	South to West	27	27	34	36	35
	West to South	47	82	64	46	45
PM	South to North	27	28	36	68	54
	North to South	25	26	35	39	41
	West to North	46	96	145	51	50
	North to West	53	78	72	47	47
	South to West	27	28	34	61	46

	West to South	49	101	138	51	51
	Network Statistics	**Average Time (s) / Vehicle**				
AM	Average Time (s) / Vehicle	33	37	47	47	48
PM	Average Time (s) / Vehicle	33	39	50	64	53

The DS1 traffic modelling results show that in comparison to the DM model there are forecast improvements to journey times from Crostwick Lane in the AM peak hour for vehicles turning left (-13secs) and right (-18secs) onto B1150. Although, in the PM peak hour journey times are expected to increase for these turning movements.

With this option journey times for motorists travelling straight ahead on B1150 are expected to slightly increase as expected with traffic signals operating on B1150.

The DS2 traffic modelling results show that journey times are expected to reduce in both peak hours for vehicles exiting Crostwick Lane. Reductions in journey times are forecast for -36secs for left and right turn movements in AM peak hour and by -45secs and -50secs for vehicles turning left and right in the PM peak hour.

With this option, journey times for motorists travelling straight ahead on B1150 are expected to slightly increase; as expected with the give-way operation of a roundabout design.

In terms of operation both roundabout options (DS2 and DS3) perform similar, therefore the design speed of the roundabout should not solely be determined by traffic assessment and instead be decided based on other feasibility criterion such as further feasibility, safety concerns, land intake etc.

Overall, all options are expected to increase the average journey times for vehicles at the junction, although deliver other benefits to the junction e.g. address safety concerns, improve NMU facilities.

20 CONCLUSION

This TN has been prepared to report on the operational performance of the three options developed for the B1150 North Walsham Road / Crostwick Lane priority junction.

A base year model has been developed in Paramics Discovery (version 25.0.4) and has been calibrated using observed MCC data and queue data obtained from the surveys conducted in October 2022. Based on the model calibration results, it's considered that the base year model forms a suitable platform for development of forecast year models.

The following proposed options have been assessed for junction improvement for the scheme opening year (2026) and scheme forecast year (2041):

- Do Something 1 (DS1) – Option A: Signalised Junction,
- Do Something 2 (DS2) – Option B: Compact Roundabout 50mph,
- Do Something 3 (DS3) – Option C: Compact Roundabout 40mph.

The DS1 traffic modelling results indicate that the MMQs on Crostwick Lane are expected to slightly increase in comparison to the DM model, by +15m in the AM peak and +37m in the PM peak. The DS2 and DS3 traffic modelling results show that the MMQs on Crostwick Lane are expected to reduce in both peak hours.

All options are expected to increase to queueing on B1150, which can be expected on the major arm of a junction with a signalised junction or roundabout. During model visualisation of the DS1 model it's observed that queues on B1150 are often cleared every alternate cycle.

With the DS1 option there are forecast improvements to journey times for vehicles exiting Crostwick Lane in the AM peak hour and in the DS2 and DS3 options reductions are forecast in both peak hours.

Journey times for straight ahead movements on B1150 are expected to increase with all options, although this is to be expected with a roundabout or signalised junction.

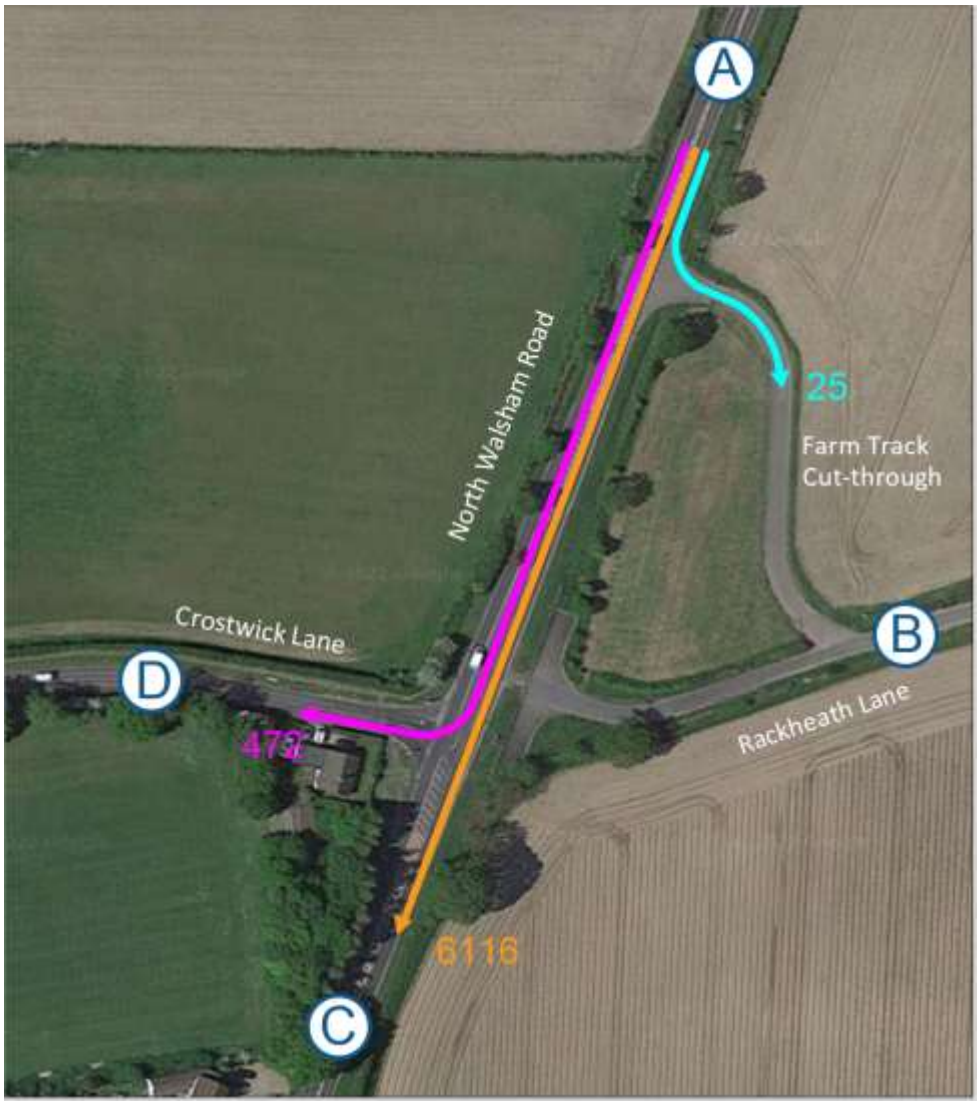
All options are expected to increase the average journey times for vehicles at the junction, although deliver other benefits such as addressing safety concerns, inclusion of NMU facilities.

It is recommended that if Option A (signalised junction) is progressed to detailed design, further signal optimisation is considered.

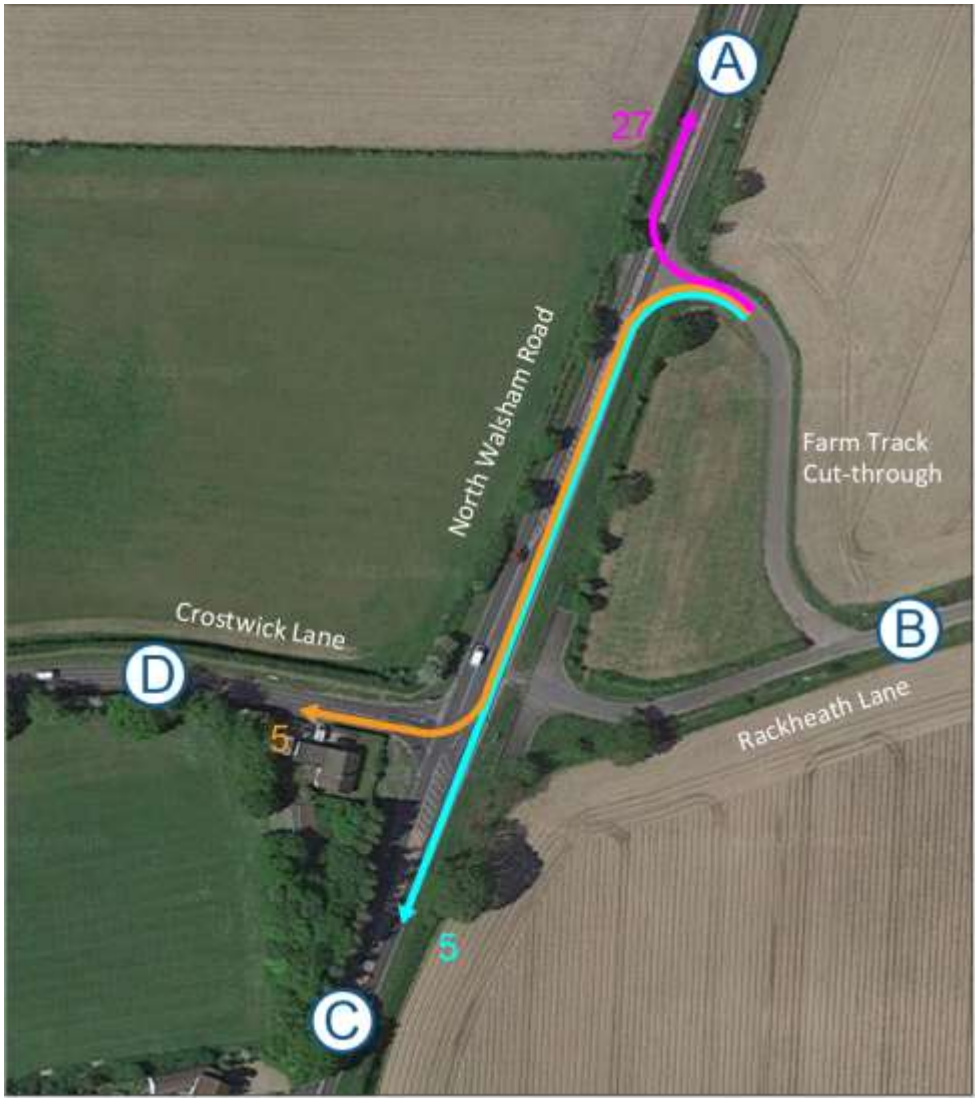
Finally, in terms of operation both roundabout options (DS2 and DS3) perform similar, therefore the design speed of the roundabout should not solely be determined by traffic assessment and instead be decided based on other feasibility criterion such as further feasibility, safety concerns, land intake etc.

Vehicle Turning Totals for Nth Walsham Road Crostwick Lane Junction
6th October 2022 (07:00 – 19:00)

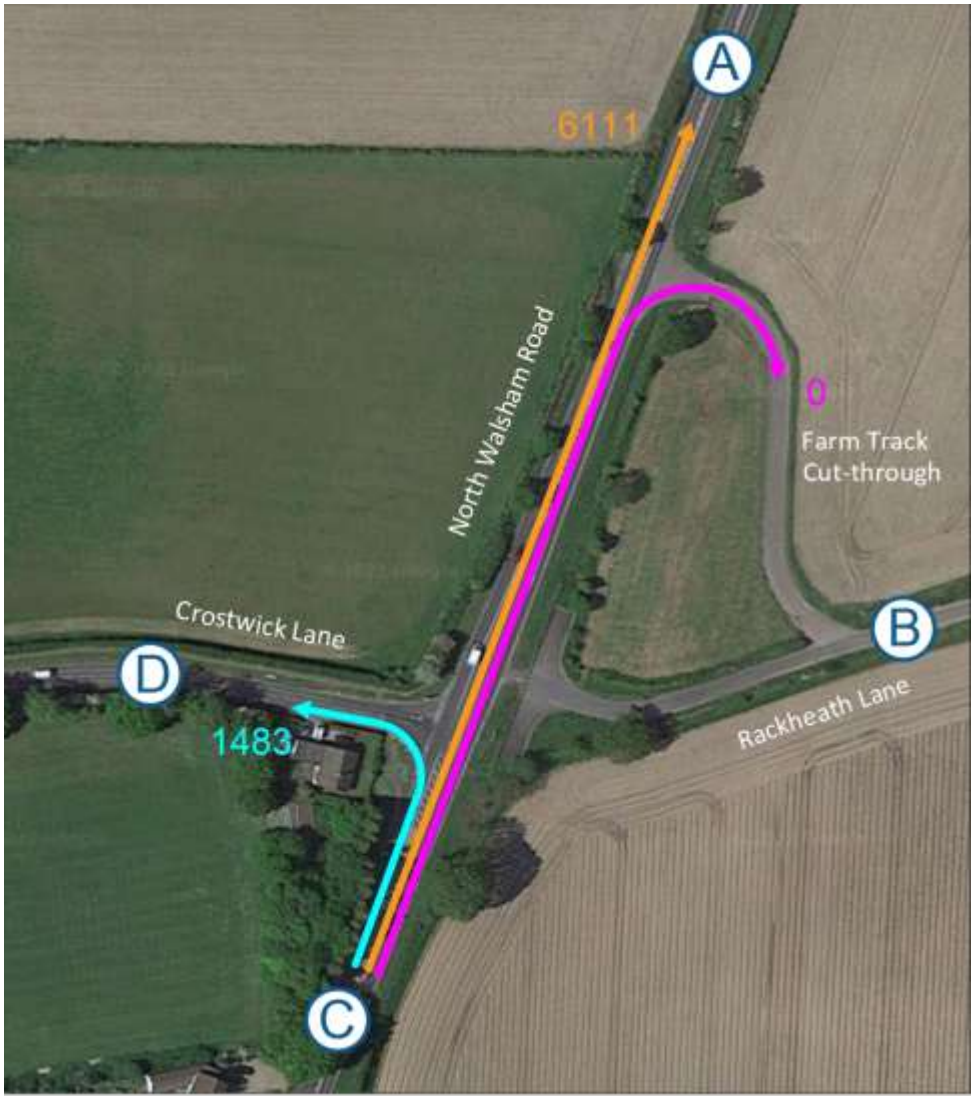
North Walsham Road Southbound Approach



Rackheath Lane (Farm Track Cut-through) Approach



North Walsham Road Northbound Approach



Crostwick Lane Approach

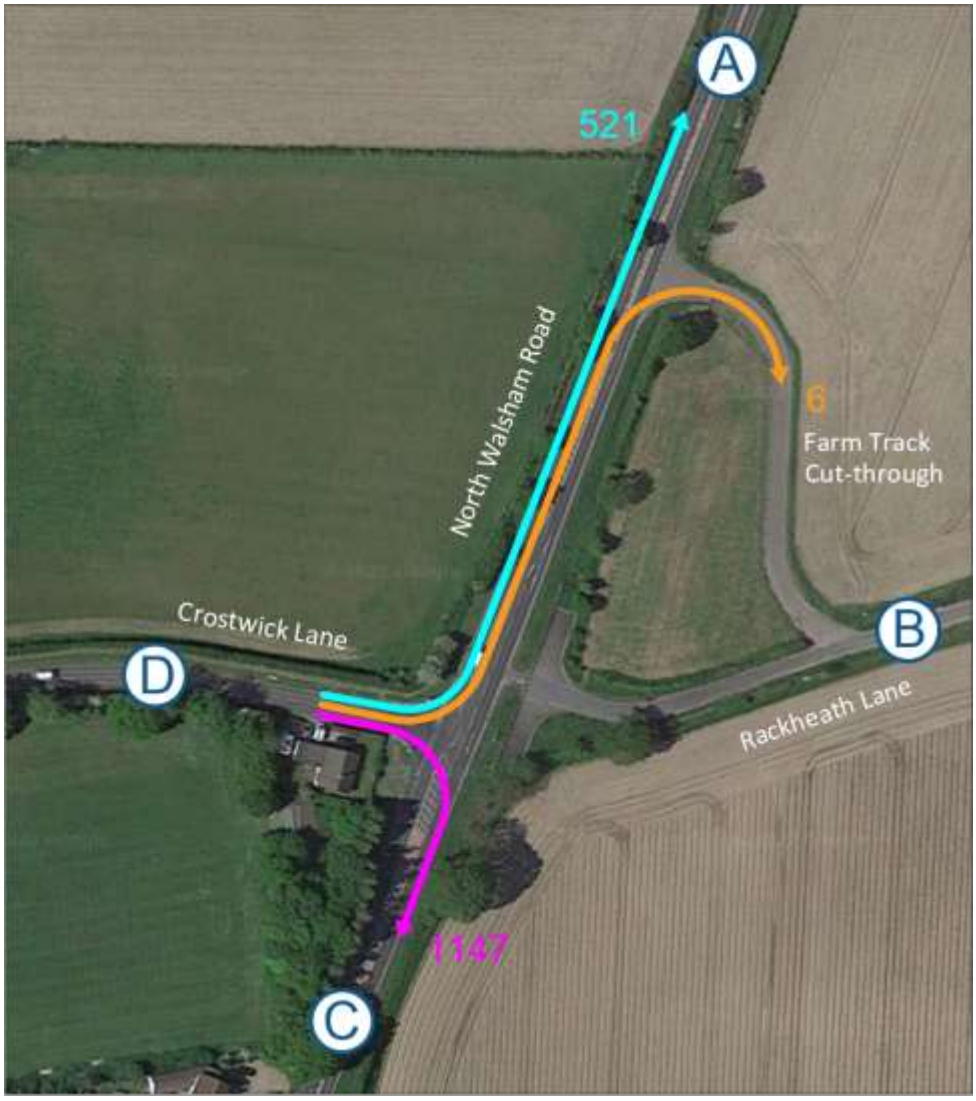

A
521
North Walsham Road
6
Farm Track
Cut-through
B
Crostwick Lane
D
Rackheath Lane
1147
C

Table to Show Vehicle Turning Rate per hour for Nth Walsham Road / Crostwick Lane Junction
25th September 2018

Junction Egress

Junction Approach		A Nth Walsham Rd Northbound			B Rackheath Lane Eastbound			C Nth Walsham Rd Southbound			D Crostwick Lane Westbound		
	A Nth Walsham Rd Southbound				1	0	0	744	518	389	41	55	42
	B Rackheath Lane Westbound	0	0	0				0	0	0	0	0	0
	C Nth Walsham Rd Northbound	439	801	394	1	0	0				72	203	108
	D Crostwick Lane Eastbound	49	44	46	2	1	1	129	75	78			

AM Peak 07:00 – 09:00	PM Peak 16:00 – 18:00	Off Peak

Table to Show Vehicle Turning Rate per hour for Nth Walsham Road / Crostwick Lane Junction
6th October 2022

Junction Egress

Junction Approach	A Nth Walsham Rd Northbound			B Rackheath Lane Eastbound			C Nth Walsham Rd Southbound			D Crostwick Lane Westbound		
A Nth Walsham Rd Southbound				2	4	0	759	575	431	38	53	37
B Rackheath Lane Westbound	3	4	2				1	1	0	0	0	1
C Nth Walsham Rd Northbound	548	746	441	0	0	0				75	185	120
D Crostwick Lane Eastbound	46	46	42	1	1	1	116	98	90			

AM Peak 07:00 – 09:00	PM Peak 16:00 – 18:00	Off Peak

Table to Show Percentage Change in Vehicle Turning Rate per hour for Nth Walsham Road / Crostwick Lane Junction between 25th September and 6th October 2022

Junction Approach	Junction Egress											
	A Nth Walsham Rd Northbound			**B** Rackheath Lane Eastbound			**C** Nth Walsham Rd Southbound			**D** Crostwick Lane Westbound		
A Nth Walsham Rd Southbound				-	-	-	2%	11%	11%	-9%	-4%	-12%
B Rackheath Lane Westbound	-	-	-				-	-	-	-	-	-
C Nth Walsham Rd Northbound	25%	-7%	12%	-	-	-				5%	-9%	11%
D Crostwick Lane Eastbound	-5%	6%	-8%	-	-	-	-10%	31%	16%			

AM Peak 07:00 – 09:00	PM Peak 16:00 – 18:00	Off Peak

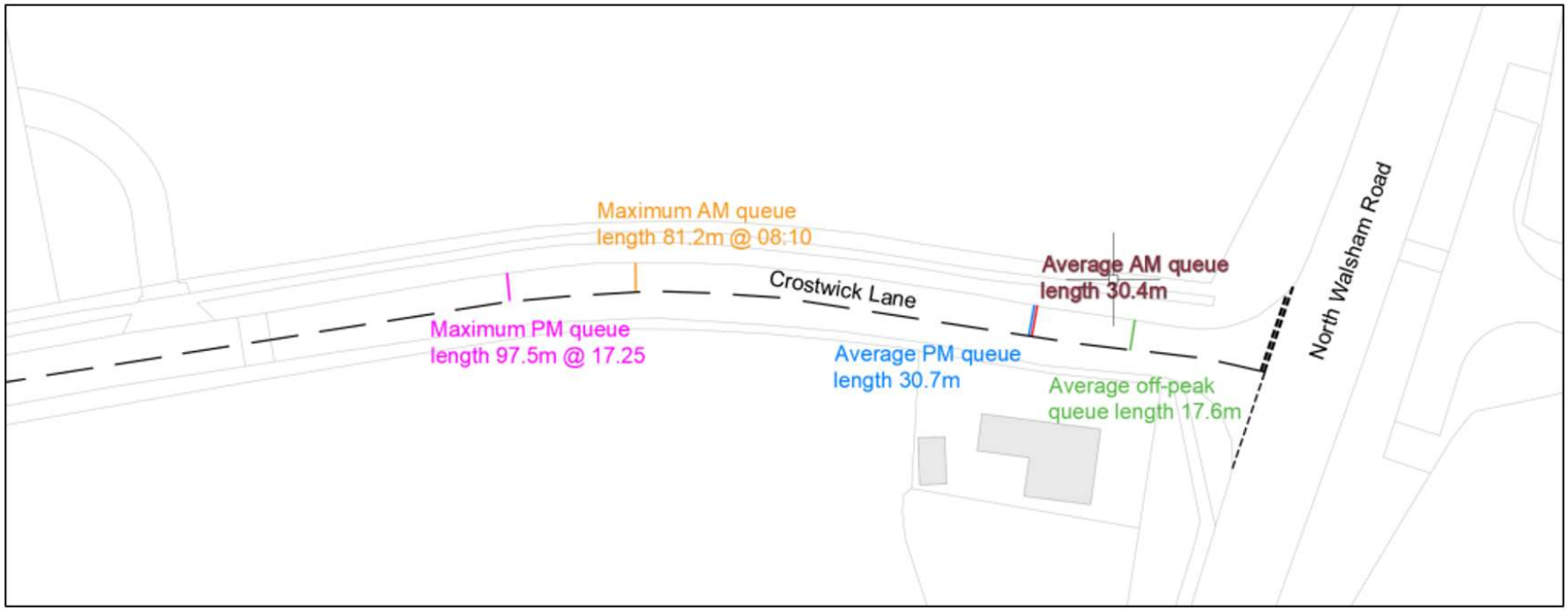
Table to Show Total Vehicle Turning Volumes for Nth Walsham Road / Crostwick Lane Junction 2018 and 2022 (07:00 – 19:00)

Junction Egress

Junction Approach	**A** Nth Walsham Rd Northbound			**B** Rackheath Lane Eastbound			**C** Nth Walsham Rd Southbound			**D** Crostwick Lane Westbound		
A Nth Walsham Rd Southbound				2	25	-	5637	6116	+8%	524	472	-10%
B Rackheath Lane Westbound	1	27	-				0	5	-	10	5	-
C Nth Walsham Rd Northbound	5626	6111	+9%	1	0	-				1413	1483	+5%
D Crostwick Lane Eastbound	551	521	+6%	8	6	-	1028	1147	+12%			

Total Vehicles 25th September 2018	Total Vehicles 6th October 2022	Percentage Change

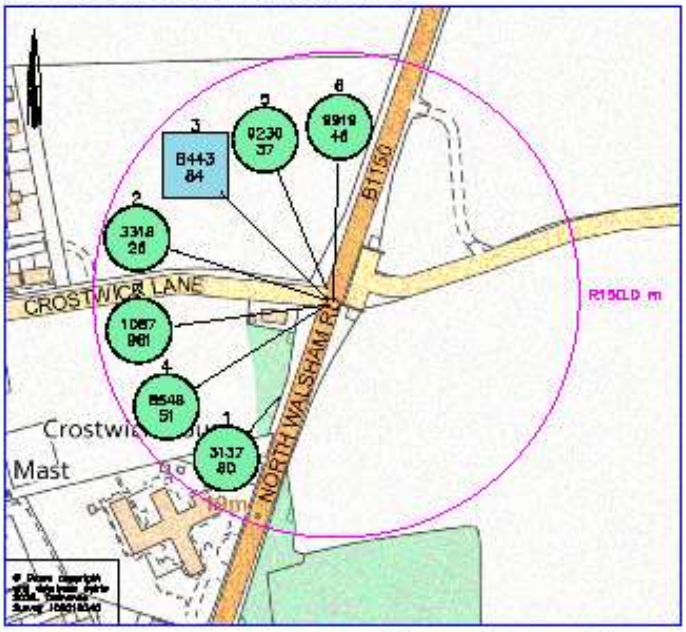
Diagram to show Queue Lengths on Crostwick Lane – October 25th 2022



Appendix E

ACCIDENT DATA

Five years to end April 2022



	1	2	3	4	5	6	7
Reference Number	3137 80	3318 26	8443 84	8546 51	9230 37	9919 46	1087 981
Date / Day	Tu03	Tu25	Su19	Th06	Sa05	We14	Tu07
Month	Jul	Sep	May	Jun	Oct	Oct	Sep
Year	2018	2018	2019	2019	2019	2020	2021
Time	1716	1915	1106	1341	1644	0800	1639
Severity	Sl	Sl	Se	Sl	Sl	Sl	Sl
Dark / Lit							
Weather Conditions							
Road Surface							
Special Conditions							
Carriageway Hazards							
Vehicle Manoeuvres							
Vehicle 1							
Vehicle 2							
Vehicle 3							
Vehicle 4							
Casualty /age							
Failed to Give—Way							
Signal Ignored							
Loss of Control							
Hit Object IN C'way							
Hit Object OFF C'way							
Vehicle Left C'way							
Breath Test							
Contributory Factors 1/2	V1 * 306 V1 * 406	V1 ** 602 V1 ** 405	V1 ** 405 V2 ** 404	V1 ** 405 V1 * 406		V1 ** 405 V1 * 406	V1 * 406 V2 * 404
3/4		V1 ** 605	V1 ** 406	V2 * 404 V1 ** 403		V1 ** 605	V1 * 405
* possible, ** very likely 5/6							
School No./Ref.							
User fields: 1							
2							
3							
4							

Full Details Report Summary -

Accidents Found Date Range: 03/07/2018 - 07/09/2021
Grid Coordinate Range: 625397, 315187 - 625431, 315255
Accident Date BETWEEN '01-May-2017' AND '30-Apr-2022'

Accident Severity

	2018	2019	2020	2021	Total
Serious	0	1	0	0	1
Slight	2	2	1	1	6
Total	2	3	1	1	7

Casualty Severity

	2018	2019	2020	2021	Total
Serious	0	2	0	0	2
Slight	3	4	1	1	9
Total	3	6	1	1	11

Casualty KSI

	2018	2019	2020	2021	Total
Adult KSI	0	2	0	0	2
Slight	3	4	1	1	9
Total	3	6	1	1	11

Accident Date BETWEEN '01-May-2017' AND '30-Apr-2022'

1.3 Accident Reference: 313780 Slight B1150 Accident 1 of 7

1.7 Date & 1.9 Time.....Tuesday 03/07/2018 17:16
1.11 Grid co-ordinates.....625397/315187
1.10 Local Authority.....Broadland
1.12/1.13 1st road identity..B1150
1.18/1.19 2nd road identity..
1.22 Weather.....Fine
1.21 Light conditions.....Daylight
1.20a Crossing(human).....No Human control within 50m
1.20b Crossing(physical).....No crossing facility within
1.15 Speed limit.....50 Mph
1.14 Road type.....Single c'way
1.16 Junction detail.....Not at or within 20m of junction
1.17 Junction control.....
1.24 Special conditions...None
1.25 Carriageway hazards..None
1.5 Number of vehicles...2
1.6 Number of casualties.2
1.23 Surface.....Dry

Contributory Factors	Participant	Confidence	Did a police officer attend?
Exceeding speed limit (Driver/Rider - Injudicious)	Vehicle 001	Possible	Yes
Failed to judge other person's path/speed (Driver/Rider - Error)	Vehicle 001	Possible	

Accident Description
V1 has been travelling along road and has crossed the centre white line, clipping oncoming V2.

2 Vehicles

2.4 Veh ref no.....1
2.17 Other vehicle.....0
2.5 Vehicle class.....M/cycle > 500cc
2.10 Junction location...Not at junction
2.9 Restricted location.On main carriageway
2.8 Movement from/to....South North
2.7 Manoeuvres.....Going ahead other
2.11 Skidding.....Overturned
2.13 Left c'way.....Did not leave c'way
2.6 Towing.....No
2.28 Foreign vehicle.....Not foreign
2.16 First impact.....Offside
2.12 Hit object in c'way..None
2.14 Hit object off c'way.None
2.18 Parts damaged..... / /
2.21 Driver gender.....Male
2.22 Driver age.....53
2.24 Hit and Run.....No
2.23 Breath test.....Negative
2.29 Journey purpose.....Commuting to/from work

2.4 Veh ref no.....2
2.17 Other vehicle.....0
2.5 Vehicle class.....Car
2.10 Junction location...Not at junction
2.9 Restricted location.On main carriageway
2.8 Movement from/to....North South
2.7 Manoeuvres.....Going ahead other
2.11 Skidding.....No
2.13 Left c'way.....Did not leave c'way
2.6 Towing.....No
2.28 Foreign vehicle.....Not foreign
2.16 First impact.....Offside
2.12 Hit object in c'way..None
2.14 Hit object off c'way.None
2.18 Parts damaged..... / /
2.21 Driver gender.....Female
2.22 Driver age.....19
2.24 Hit and Run.....No
2.23 Breath test.....Negative
2.29 Journey purpose.....Commuting to/from work

2 Casualties

3.5 Cas ref no.....1
3.6 Casualty class.....Driver or Rider
3.7 Gender.....Male
3.8 Age.....53
3.9 Severity.....Slight
3.4 Vehicle no.....1
3.12 Ped Direction.....Not a pedestrian
3.15 Car passenger.....No
3.16 PSV passenger.....No
3.14 Seat belt usage.....Not applicable
3.13 School pupil.....Other
(3.19 School .....)
3.10 Pedestrian location..Not a pedestrian
3.11 Pedestrian movement..Not a pedestrian
3.19 Roadworker injured...No

3.5 Cas ref no.....2
3.6 Casualty class.....Driver or Rider
3.7 Gender.....Female
3.8 Age.....19
3.9 Severity.....Slight
3.4 Vehicle no.....2
3.12 Ped Direction.....Not a pedestrian
3.15 Car passenger.....No
3.16 PSV passenger.....No
3.14 Seat belt usage.....
3.13 School pupil.....Other
(3.19 School .....)
3.10 Pedestrian location..Not a pedestrian
3.11 Pedestrian movement..Not a pedestrian
3.19 Roadworker injured...No

Accident Date BETWEEN '01-May-2017' AND '30-Apr-2022'

1.3 Accident Reference:331826 Slight NORTH WALSHAM ROAD B1150 AT JN WITH CROSTWICK LANE Accident 2 of 7

1.7 Date & 1.9 Time.....Tuesday 25/09/2018 19:15	1.15 Speed limit.....50 Mph
1.11 Grid co-ordinates.....625427/315248	1.14 Road type.....Single c'way
1.10 Local Authority.....Broadland	1.16 Junction detail.....T or Staggered junction
1.12/1.13 1st road identity..B1150	1.17 Junction control.....Give way sign or uncontrolled
1.18/1.19 2nd road identity..U	1.24 Special conditions...None
1.22 Weather.....Fine	1.25 Carriageway hazards..None
1.21 Light conditions.....Dark/lights not lit	1.5 Number of vehicles...2
1.20a Crossing(human).....No Human control within 50m	1.6 Number of casualties.1
1.20b Crossing(physical).....No crossing facility within	1.23 Surface.....Dry

Contributory Factors	Participant	Confidence	Did a police officer attend?
Careless/Reckless (Driver/Rider - Behaviour)	Vehicle 001	Very likely	
Failed to look properly (Driver/Rider - Error)	Vehicle 001	Very likely	
Inexperienced or learner driver/rider (Driver/Rider - Behaviour)	Vehicle 001	Very likely	Yes

Accident Description
V2 traveling along, when passing the junction V1 has pulled out into the path of V2.

2 Vehicles

2.4 Veh ref no.....1	
2.17 Other vehicle.....0	2.16 First impact.....Front
2.5 Vehicle class.....Car	2.12 Hit object in c'way..None
2.10 Junction location...Entering main road	2.14 Hit object off c'way.None
2.9 Restricted location.On main carriageway	2.18 Parts damaged..... / /
2.8 Movement from/to....East North	2.21 Driver gender.....Male
2.7 Manoeuvres.....Starting	2.22 Driver age.....17
2.11 Skidding.....No	
2.13 Left c'way.....Did not leave c'way	2.24 Hit and Run.....No
2.6 Towing.....No	2.23 Breath test.....Negative
2.28 Foreign vehicle.....Not foreign	2.29 Journey purpose.....Other

2.4 Veh ref no.....2	
2.17 Other vehicle.....0	2.16 First impact.....Nearside
2.5 Vehicle class.....Car	2.12 Hit object in c'way..None
2.10 Junction location...Approaching or parked on approach	2.14 Hit object off c'way.None
2.9 Restricted location.On main carriageway	2.18 Parts damaged..... / /
2.8 Movement from/to....South North	2.21 Driver gender.....Female
2.7 Manoeuvres.....Going ahead other	2.22 Driver age.....40
2.11 Skidding.....No	
2.13 Left c'way.....Did not leave c'way	2.24 Hit and Run.....No
2.6 Towing.....No	2.23 Breath test.....Negative
2.28 Foreign vehicle.....Not foreign	2.29 Journey purpose.....Commuting to/from work

1 Casualty

3.5 Cas ref no.....1	3.15 Car passenger.....No
3.6 Casualty class.....Driver or Rider	3.16 PSV passenger.....No
3.7 Gender.....Male	3.14 Seat belt usage.....
3.8 Age.....17	3.13 School pupil.....Other
	(3.19 School .....)
3.9 Severity.....Slight	3.10 Pedestrian location..Not a pedestrian
3.4 Vehicle no.....1	3.11 Pedestrian movement..Not a pedestrian
3.12 Ped Direction.....Not a pedestrian	3.19 Roadworker injured...No

Accident Date BETWEEN '01-May-2017' AND '30-Apr-2022'

1.3 Accident Reference:844384 Serious NORTH WALSHAM ROAD (B1150) AT JUNCTION WITH CROSTWICK LANE Accident 3 of 7

1.7 Date & 1.9 Time.....Sunday 19/05/2019 11:06	1.15 Speed limit.....50 Mph
1.11 Grid co-ordinates.....625427/315250	1.14 Road type.....Single c'way
1.10 Local Authority.....Broadland	1.16 Junction detail.....T or Staggered junction
1.12/1.13 1st road identity..B1150	1.17 Junction control.....Give way sign or uncontrolled
1.18/1.19 2nd road identity..U	1.24 Special conditions...None
1.22 Weather.....Fine	1.25 Carriageway hazards..None
1.21 Light conditions.....Daylight	1.5 Number of vehicles...2
1.20a Crossing(human).....No Human control within 50m	1.6 Number of casualties.3
1.20b Crossing(physical).....No crossing facility within 1	1.23 Surface.....Dry

Contributory Factors	Participant	Confidence	Did a police officer attend?
Failed to look properly (Driver/Rider - Error)	Vehicle 001	Very likely	Yes
Failed to signal/misleading signal (Driver/Rider - Error)	Vehicle 002	Very likely	
Failed to judge other person's path/speed (Driver/Rider - Error)	Vehicle 001	Very likely	

Accident Description
V1 has turned right out of a junction into the path of V2.

2 Vehicles

2.4 Veh ref no.....1	
2.17 Other vehicle.....0	2.16 First impact.....Front
2.5 Vehicle class.....Car	2.12 Hit object in c'way..None
2.10 Junction location...Mid junction	2.14 Hit object off c'way.None
2.9 Restricted location.On main carriageway	2.18 Parts damaged..... / /
2.8 Movement from/to....West East	2.21 Driver gender.....Male
2.7 Manoeuvres.....Turning right	2.22 Driver age.....57
2.11 Skidding.....No	
2.13 Left c'way.....Did not leave c'way	2.24 Hit and Run.....No
2.6 Towing.....No	2.23 Breath test.....Negative
2.28 Foreign vehicle.....Not foreign	2.29 Journey purpose.....Other

2.4 Veh ref no.....2	
2.17 Other vehicle.....0	2.16 First impact.....Front
2.5 Vehicle class.....Car	2.12 Hit object in c'way..None
2.10 Junction location...Mid junction	2.14 Hit object off c'way.None
2.9 Restricted location.On main carriageway	2.18 Parts damaged..... / /
2.8 Movement from/to....South North	2.21 Driver gender.....Female
2.7 Manoeuvres.....Going ahead other	2.22 Driver age.....22
2.11 Skidding.....No	
2.13 Left c'way.....Did not leave c'way	2.24 Hit and Run.....No
2.6 Towing.....No	2.23 Breath test.....Negative
2.28 Foreign vehicle.....Not foreign	2.29 Journey purpose.....Other

3 Casualties

3.5 Cas ref no.....1	3.15 Car passenger.....No
3.6 Casualty class.....Driver or Rider	3.16 PSV passenger.....No
3.7 Gender.....Male	3.14 Seat belt usage.....
3.8 Age.....57	3.13 School pupil.....Other
	(3.19 School .....)
3.9 Severity.....Slight	3.10 Pedestrian location..Not a pedestrian
3.4 Vehicle no.....1	3.11 Pedestrian movement..Not a pedestrian
3.12 Ped Direction.....Not a pedestrian	3.19 Roadworker injured...No

3.5 Cas ref no.....2	3.15 Car passenger.....No
3.6 Casualty class.....Driver or Rider	3.16 PSV passenger.....No
3.7 Gender.....Female	3.14 Seat belt usage.....
3.8 Age.....22	3.13 School pupil.....Other
	(3.19 School .....)
3.9 Severity.....Serious	3.10 Pedestrian location..Not a pedestrian
3.4 Vehicle no.....2	3.11 Pedestrian movement..Not a pedestrian
3.12 Ped Direction.....Not a pedestrian	3.19 Roadworker injured...No

3.5 Cas ref no.....3	3.15 Car passenger.....Front
3.6 Casualty class.....Passenger	3.16 PSV passenger.....No
3.7 Gender.....Female	3.14 Seat belt usage.....
3.8 Age.....54	3.13 School pupil.....Other
	(3.19 School .....)
3.9 Severity.....Serious	3.10 Pedestrian location..Not a pedestrian
3.4 Vehicle no.....1	3.11 Pedestrian movement..Not a pedestrian
3.12 Ped Direction.....Not a pedestrian	3.19 Roadworker injured...No

Accident Date BETWEEN '01-May-2017' AND '30-Apr-2022'

1.3 Accident Reference:854651 Slight NORTH WALSHAM ROAD (B1150) AT JUNCTION WITH CROSTWICK LANE Accident 4 of 7

1.7 Date & 1.9 Time.....Thursday 06/06/2019 13:41
1.11 Grid co-ordinates.....625428/315245
1.10 Local Authority.....Broadland
1.12/1.13 1st road identity..B1150
1.18/1.19 2nd road identity..U
1.22 Weather.....Fine
1.21 Light conditions.....Daylight
1.20a Crossing(human).....No Human control within 50m
1.20b Crossing(physical).....No crossing facility within
1.15 Speed limit.....60 Mph
1.14 Road type.....Single c'way
1.16 Junction detail.....T or Staggered junction
1.17 Junction control.....Give way sign or uncontrolled
1.24 Special conditions...None
1.25 Carriageway hazards..None
1.5 Number of vehicles...2
1.6 Number of casualties.2
1.23 Surface.....Dry

Contributory Factors	Participant	Confidence	Did a police officer attend?
Failed to look properly (Driver/Rider - Error)	Vehicle 001	Very likely	Yes
Failed to judge other person's path/speed (Driver/Rider - Error)	Vehicle 001	Possible	
Failed to signal/misleading signal (Driver/Rider - Error)	Vehicle 002	Possible	
Poor turn or manoeuvre (Driver/Rider - Error)	Vehicle 001	Very likely	

Accident Description
V2 was travelling along the main carriageway. V1 was at the junction and thought V2 was turning in so pulled out into the path of V2. V2 collided into V1.

2 Vehicles

2.4 Veh ref no.....1
2.17 Other vehicle.....0
2.5 Vehicle class.....Car
2.10 Junction location...Mid junction
2.9 Restricted location.On main carriageway
2.8 Movement from/to....West South
2.7 Manoeuvres.....Turning right
2.11 Skidding.....No
2.13 Left c'way.....Did not leave c'way
2.6 Towing.....No
2.28 Foreign vehicle.....Not foreign
2.16 First impact.....Offside
2.12 Hit object in c'way..None
2.14 Hit object off c'way.None
2.18 Parts damaged..... / /
2.21 Driver gender.....Female
2.22 Driver age.....60
2.24 Hit and Run.....No
2.23 Breath test.....Negative
2.29 Journey purpose.....Unknown

2.4 Veh ref no.....2
2.17 Other vehicle.....0
2.5 Vehicle class.....Car
2.10 Junction location...Mid junction
2.9 Restricted location.On main carriageway
2.8 Movement from/to....South North
2.7 Manoeuvres.....Going ahead other
2.11 Skidding.....No
2.13 Left c'way.....Did not leave c'way
2.6 Towing.....No
2.28 Foreign vehicle.....Not foreign
2.16 First impact.....Offside
2.12 Hit object in c'way..None
2.14 Hit object off c'way.None
2.18 Parts damaged..... / /
2.21 Driver gender.....Male
2.22 Driver age.....84
2.24 Hit and Run.....No
2.23 Breath test.....Negative
2.29 Journey purpose.....Other

2 Casualties

3.5 Cas ref no.....1
3.6 Casualty class.....Driver or Rider
3.7 Gender.....Female
3.8 Age.....60
3.9 Severity.....Slight
3.4 Vehicle no.....1
3.12 Ped Direction.....Not a pedestrian
3.15 Car passenger.....No
3.16 PSV passenger.....No
3.14 Seat belt usage.....Unknown
3.13 School pupil.....Other
(3.19 School .....)
3.10 Pedestrian location..Not a pedestrian
3.11 Pedestrian movement..Not a pedestrian
3.19 Roadworker injured...No

3.5 Cas ref no.....2
3.6 Casualty class.....Driver or Rider
3.7 Gender.....Male
3.8 Age.....84
3.9 Severity.....Slight
3.4 Vehicle no.....2
3.12 Ped Direction.....Not a pedestrian
3.15 Car passenger.....No
3.16 PSV passenger.....No
3.14 Seat belt usage.....Unknown
3.13 School pupil.....Other
(3.19 School .....)
3.10 Pedestrian location..Not a pedestrian
3.11 Pedestrian movement..Not a pedestrian
3.19 Roadworker injured...No

Accident Date BETWEEN '01-May-2017' AND '30-Apr-2022'

1.3 Accident Reference:923037 Slight CROSTWICK LANE NEAR JUNCTION WITH NORTH WALSHAM ROAD (B1150) Accident 5 of 7

1.7 Date & 1.9 Time.....Saturday 05/10/2019 16:44
1.11 Grid co-ordinates.....625427/315255
1.10 Local Authority.....Broadland
1.12/1.13 1st road identity..U
1.18/1.19 2nd road identity..B1150
1.22 Weather.....Fine
1.21 Light conditions.....Daylight
1.20a Crossing(human).....No Human control within 50m
1.20b Crossing(physical).....No crossing facility within
1.15 Speed limit.....50 Mph
1.14 Road type.....Single c'way
1.16 Junction detail.....T or Staggered junction
1.17 Junction control.....Give way sign or uncontrolled
1.24 Special conditions...None
1.25 Carriageway hazards..None
1.5 Number of vehicles...2
1.6 Number of casualties.1
1.23 Surface.....Dry

Contributory Factors	Participant	Confidence	Did a police officer attend?
			No - reported over the counter

Accident Description
Vehicle 1 has pulled-out into the path of vehicle 2 resulting in a collision.

2 Vehicles

2.4 Veh ref no.....1
2.17 Other vehicle.....0
2.5 Vehicle class.....Car
2.10 Junction location...Cleared junction or parked at jun
2.9 Restricted location.On main carriageway
2.8 Movement from/to....West North
2.7 Manoeuvres.....Turning left
2.11 Skidding.....No
2.13 Left c'way.....Did not leave c'way
2.6 Towing.....No
2.28 Foreign vehicle.....Not foreign
2.16 First impact.....Front
2.12 Hit object in c'way..None
2.14 Hit object off c'way.None
2.18 Parts damaged..... / /
2.21 Driver gender.....Female
2.22 Driver age.....83
2.24 Hit and Run.....No
2.23 Breath test.....Not provided
2.29 Journey purpose.....Other

2.4 Veh ref no.....2
2.17 Other vehicle.....0
2.5 Vehicle class.....Car
2.10 Junction location...Cleared junction or parked at jun
2.9 Restricted location.On main carriageway
2.8 Movement from/to....North South
2.7 Manoeuvres.....Going ahead other
2.11 Skidding.....No
2.13 Left c'way.....Did not leave c'way
2.6 Towing.....No
2.28 Foreign vehicle.....Not foreign
2.16 First impact.....Front
2.12 Hit object in c'way..None
2.14 Hit object off c'way.None
2.18 Parts damaged..... / /
2.21 Driver gender.....Female
2.22 Driver age.....53
2.24 Hit and Run.....No
2.23 Breath test.....Negative
2.29 Journey purpose.....Other

1 Casualty

3.5 Cas ref no.....1
3.6 Casualty class.....Driver or Rider
3.7 Gender.....Female
3.8 Age.....83
3.9 Severity.....Slight
3.4 Vehicle no.....1
3.12 Ped Direction.....Not a pedestrian
3.15 Car passenger.....No
3.16 PSV passenger.....No
3.14 Seat belt usage.....
3.13 School pupil.....Other
(3.19 School .....)
3.10 Pedestrian location..Not a pedestrian
3.11 Pedestrian movement..Not a pedestrian
3.19 Roadworker injured...No

Accident Date BETWEEN '01-May-2017' AND '30-Apr-2022'

1.3 Accident Reference:991946 Slight NORTH WALSHAM ROAD (B1150) AT JUNCTION WITH CROSTWICK LANE Accident 6 of 7

1.7 Date & 1.9 Time.....Wednesday 14/10/2020 08:00	1.15 Speed limit.....50 Mph
1.11 Grid co-ordinates.....625431/315247	1.14 Road type.....Single c'way
1.10 Local Authority.....Broadland	1.16 Junction detail.....Slip Road
1.12/1.13 1st road identity..B1150	1.17 Junction control.....Give way sign or uncontrolled
1.18/1.19 2nd road identity..U	1.24 Special conditions...None
1.22 Weather.....Fine	1.25 Carriageway hazards..None
1.21 Light conditions.....Daylight	1.5 Number of vehicles...2
1.20a Crossing(human).....No Human control within 50m	1.6 Number of casualties.1
1.20b Crossing(physical).....No crossing facility within 1	1.23 Surface.....Wet

Contributory Factors	Participant	Confidence	Did a police officer attend?
Failed to look properly (Driver/Rider - Error)	Vehicle 001	Very likely	Yes
Failed to judge other person's path/speed (Driver/Rider - Error)	Vehicle 001	Possible	
Inexperienced or learner driver/rider (Driver/Rider - Behaviour)	Vehicle 001	Very likely	

Accident Description
V1 has turned right out of a lane onto the main road and into the path of V2 impacting with o/s of V1.

2 Vehicles

2.4 Veh ref no.....1	
2.17 Other vehicle.....0	2.16 First impact.....Offside
2.5 Vehicle class.....Car	2.12 Hit object in c'way..None
2.10 Junction location...Cleared junction or parked at jun	2.14 Hit object off c'way.None
2.9 Restricted location.On main carriageway	2.18 Parts damaged..... / /
2.8 Movement from/to....West South	2.21 Driver gender.....Female
2.7 Manoeuvres.....Turning right	2.22 Driver age.....17
2.11 Skidding.....No	
2.13 Left c'way.....Did not leave c'way	2.24 Hit and Run.....No
2.6 Towing.....No	2.23 Breath test.....Negative
2.28 Foreign vehicle.....Not foreign	2.29 Journey purpose.....Unknown

2.4 Veh ref no.....2	
2.17 Other vehicle.....0	2.16 First impact.....Front
2.5 Vehicle class.....Minibus	2.12 Hit object in c'way..None
2.10 Junction location...Approaching or parked on approach	2.14 Hit object off c'way.None
2.9 Restricted location.On main carriageway	2.18 Parts damaged..... / /
2.8 Movement from/to....North South	2.21 Driver gender.....Male
2.7 Manoeuvres.....Going ahead other	2.22 Driver age.....65
2.11 Skidding.....No	
2.13 Left c'way.....Did not leave c'way	2.24 Hit and Run.....No
2.6 Towing.....No	2.23 Breath test.....Negative
2.28 Foreign vehicle.....Not foreign	2.29 Journey purpose.....Journey as part of work

1 Casualty

3.5 Cas ref no.....1	3.15 Car passenger.....No
3.6 Casualty class.....Driver or Rider	3.16 PSV passenger.....No
3.7 Gender.....Female	3.14 Seat belt usage.....
3.8 Age.....17	3.13 School pupil.....Other
	(3.19 School .....)
3.9 Severity.....Slight	3.10 Pedestrian location..Not a pedestrian
3.4 Vehicle no.....1	3.11 Pedestrian movement..Not a pedestrian
3.12 Ped Direction.....Not a pedestrian	3.19 Roadworker injured...No

Accident Date BETWEEN '01-May-2017' AND '30-Apr-2022'

1.3 Accident Reference:1087981 Slight NORTH WALSHAM ROAD AT JUNCTION WITH CROSTWICK LANE Accident 7 of 7

1.7 Date & 1.9 Time.....Tuesday 07/09/2021 16:39	1.15 Speed limit.....50 Mph
1.11 Grid co-ordinates.....625429/315245	1.14 Road type.....Single c'way
1.10 Local Authority.....Broadland	1.16 Junction detail.....T or Staggered junction
1.12/1.13 1st road identity..B1150	1.17 Junction control.....Give way sign or uncontrolled
1.18/1.19 2nd road identity..U	1.24 Special conditions...None
1.22 Weather.....Fine	1.25 Carriageway hazards..None
1.21 Light conditions.....Daylight	1.5 Number of vehicles...2
1.20a Crossing(human).....No Human control within 50m	1.6 Number of casualties.1
1.20b Crossing(physical).....No crossing facility within 1	1.23 Surface.....Dry

Contributory Factors	Participant	Confidence	Did a police officer attend?
Failed to judge other person's path/speed (Driver/Rider - Error)	Vehicle 001	Possible	
Failed to signal/misleading signal (Driver/Rider - Error)	Vehicle 002	Possible	
Failed to look properly (Driver/Rider - Error)	Vehicle 001	Possible	Yes

Accident Description

V2 APPROACHING JUNCTION, V1 PULLED OUT FROM JUNCTION INTO PATHWAY OF V2 AND V2 AND V1 COLLIDED, WITH V2 BEING FLIPPED ONTO ITS SIDE.

2 Vehicles

2.4 Veh ref no.....1	
2.17 Other vehicle.....0	2.16 First impact.....Front
2.5 Vehicle class.....Goods unknown weight	2.12 Hit object in c'way..None
2.10 Junction location...Mid junction	2.14 Hit object off c'way.None
2.9 Restricted location.On main carriageway	2.18 Parts damaged..... / /
2.8 Movement from/to....West North	2.21 Driver gender.....Male
2.7 Manoeuvres.....Turning left	2.22 Driver age.....40
2.11 Skidding.....No	
2.13 Left c'way.....Did not leave c'way	2.24 Hit and Run.....No
2.6 Towing.....No	2.23 Breath test.....Negative
2.28 Foreign vehicle.....Not foreign	2.29 Journey purpose.....Commuting to/from work

2.4 Veh ref no.....2	
2.17 Other vehicle.....0	2.16 First impact.....Front
2.5 Vehicle class.....Car	2.12 Hit object in c'way..None
2.10 Junction location...Mid junction	2.14 Hit object off c'way.None
2.9 Restricted location.On main carriageway	2.18 Parts damaged..... / /
2.8 Movement from/to....South North	2.21 Driver gender.....Male
2.7 Manoeuvres.....Going ahead other	2.22 Driver age.....59
2.11 Skidding.....Overturned	
2.13 Left c'way.....Did not leave c'way	2.24 Hit and Run.....No
2.6 Towing.....No	2.23 Breath test.....Negative
2.28 Foreign vehicle.....Not foreign	2.29 Journey purpose.....Other

1 Casualty

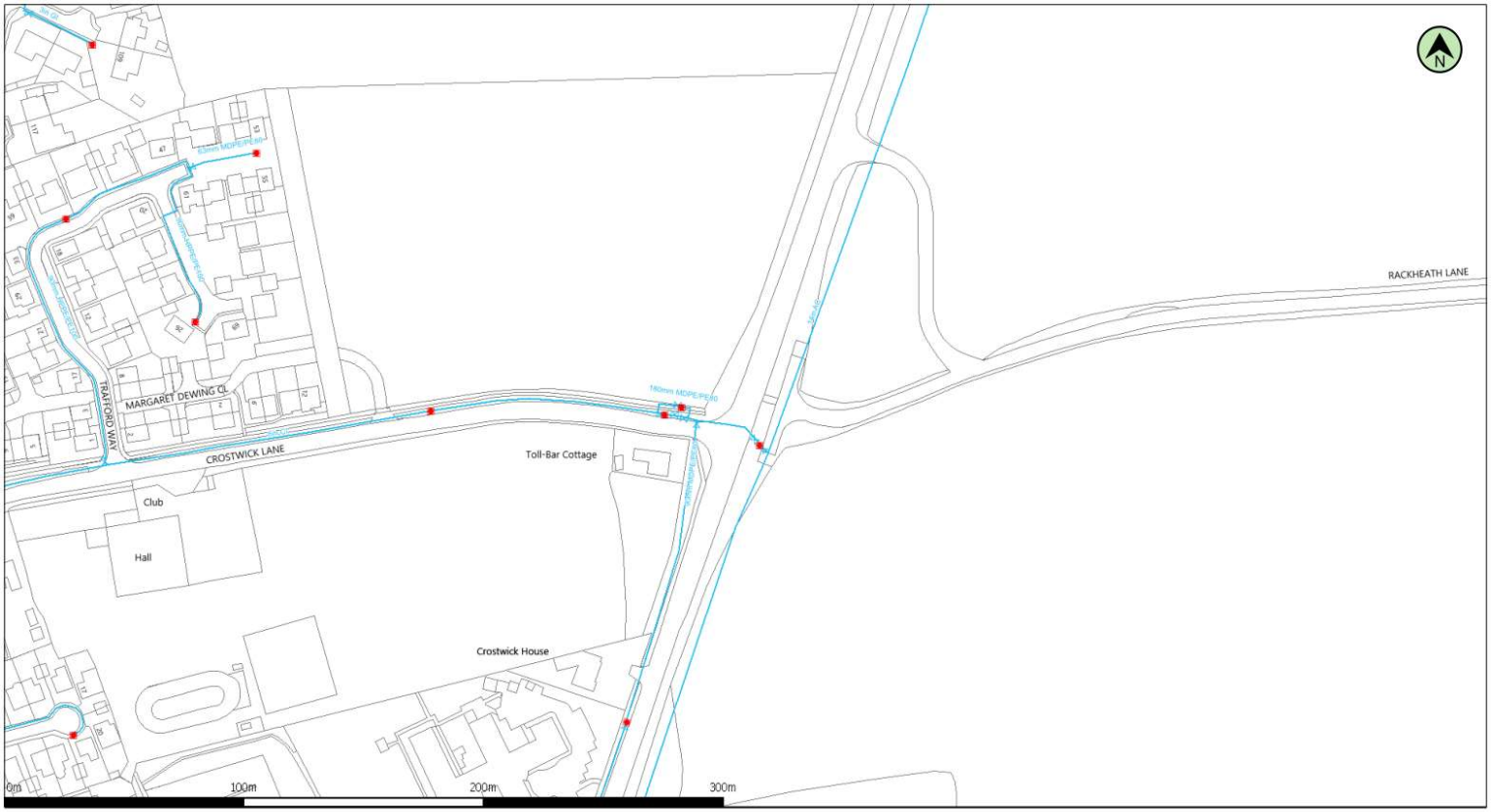
3.5 Cas ref no.....1	3.15 Car passenger.....No
3.6 Casualty class.....Driver or Rider	3.16 PSV passenger.....No
3.7 Gender.....Male	3.14 Seat belt usage.....
3.8 Age.....59	3.13 School pupil.....Other
	(3.19 School .....)
3.9 Severity.....Slight	3.10 Pedestrian location..Not a pedestrian
3.4 Vehicle no.....2	3.11 Pedestrian movement..Not a pedestrian
3.12 Ped Direction.....Not a pedestrian	3.19 Roadworker injured...No

Appendix F

UTILITY PLANS

British Telecom Plans

Anglia Water Mains Water Plans



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Potable Water
Raw Water
Decommissioned Water
Fitting
Hydrant

linda.earrye2@norfolk.gov.uk

PLA353 DW

love every drop anglianwater

Virgin Media Fibre Optic Cable Plans

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Important Information - please read The purpose of this plan is to identify Virgin Media apparatus. We have tried to make it as accurate as possible but we cannot warrant its accuracy. In addition, we caution that within Virgin Media apparatus there may be instances where mains voltage power cables have been placed inside green, rather than black ducting. Further details can be found using the "Affected Postcodes.pdf", which can be downloaded from this website. Therefore, you must not rely solely on this plan if you are carrying out any excavation or other works in the vicinity of Virgin Media apparatus. The actual position of any underground service must be verified by cable detection equipment, etc. and established on site before any mechanical plant is used. Accordingly, unless it is due to the negligence of Virgin Media, its employees or agents, Virgin Media will not have any liability for any omissions or inaccuracies in the plan or for any loss or damage caused or arising from the use of and/or any reliance on this plan. This plan is produced by Virgin Media Limited (c) Crown copyright and database rights 2022 Ordnance Survey 100019209.

Duct, Trench | Chamber / Pole | Cabinet

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PLA353 DW

Virgin media

SPIXWORTH B1150 / CROSTWICK LANE JUNCTION IMPROVEMENT
Project No. PLA353
Norfolk County Council

August 2023

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