A47 North Tuddenham to Easton Dualling

Scheme Number: TR010038

9.15 Alternative Wood Lane Junction Options Appraisal

The Infrastructure Planning (Examination Procedure) Rules 2010
Rule 8(1)(c)

Planning Act 2008

December 2021

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Examination Procedure) Rules 2010

The A47 North Tuddenham to Easton Development Consent Order 202[x]

ALTERNATIVE WOOD LANE JUNCTION OPTIONS APPRAISAL

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Rev 0	November 2021	Deadline 4 Issue
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1 SCHEME INTRODUCTION

1.1 Background

1.1.1 The A47 North Tuddenham to Easton Scheme (the Scheme) consists of constructing 9km of new dual carriageway from the existing dual carriageway at North Tuddenham to the existing dual carriageway at Easton, running to the south of the existing A47 at Hockering and to the north of the existing A47 at Honingham.

1.1.2 There are two proposed full grade separated junctions with slip roads within the Scheme, both being of 'dumbbell' configuration with slip road entry and exit systems.

- 'Wood Lane junction' (located where the A47 currently passes the staggered junction at Berry's Lane and Wood Lane)
- 'Norwich Road junction' (located west of Easton where the A47 currently joins the Norwich Southern Bypass at Blind Lane and Taverham Road

1.2 Purpose

1.2.1 The purpose of this report is to review the alternative Wood Lane junction configurations proposed by Mr Meynell and compare these to the Applicant's submitted Scheme.

1.2.2 Mr Meynell submitted proposals to the Examining Authority (ExA) at Deadline 1 and Deadline 3. A summary of these submissions is presented below:

Deadline 1 (1st September):

Written Representation ACM 04 Transport Consultants Report (**REP1-057**) was submitted to the ExA at Deadline 1. The proposed alternatives outlined in this submission were revised further by Mr Meynell and submitted to the Applicant on Friday 17th September at 11.38pm in .pdf format with digital two-dimensional AutoCad (.dwg) files received on Tuesday 21st September 2021.

Deadline 3 (5th October):

"Presentation of Alternatives" (**REP3-045**) and "Comments on Applicant's replies to ExA's First Written Questions: Annex 4" (**REP3-043**) were submitted to the ExA at Deadline 3. The proposed alternatives had been revised further by Mr Meynell and now included earthworks on the proposed junction layouts.

1.2.3 Each option presented has been assessed against key design, operational performance and land take assessment criteria with the outcome summarised by the Applicant's technical delivery team.

1.2.4 The main focus of this initial review has been to ascertain if the alternative options are technically and operationally viable. Other considerations, such as significant environmental effects and construction requirements are noted where relevant. The benefits of removing works within and avoiding severance of access to Berry Hall Estate are not discussed as it is understood this is the aim of the alternative designs.

1.2.5 The review has been completed by the Applicant's consultant (Sweco UK), who are specialists in the technical design and delivery of highways in accordance with the UK Design Manual for Roads & Bridges (DMRB).

1.2.6 The review of the alternative design was led by Gordon Gray (Sweco UK), a Chartered Engineer and Fellow of the Chartered Institution of Highways and Transportation with over 20 years' experience in the design of major road schemes in the United Kingdom.

2 ALTERNATIVE DESIGN PLANS

2.1.1 Mr Meynell proposes four alternative options to the proposed Scheme design for Wood Lane Junction, shown in Figures 2-1 and 2-2.

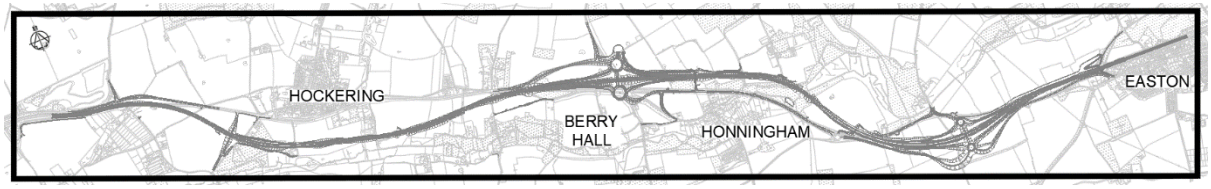


Figure 2-1: Position of Wood Lane Junction within Scheme Extents

Figure 2-2: Scheme's Design of Wood Lane Junction

2.1.2 The four alternative options comprise two alternative designs, with each alternative containing two options for the way that future local traffic will pass east–west between the existing Wood Lane / Berry's Lane junction north-west of Honingham and the Sandy Lane / Church Lane Junction east of Hockering. The options have been identified by the Applicant as follows:

- OP1A: Meynell Alternative 1 with a 'dumbbell' two roundabout arrangement. Option variation A includes the 'Lady's Grove' underpass following the existing A47 alignment
- OP1B: Meynell Alternative 1 with a 'dumbbell' two roundabout arrangement. Option variation B includes a link road from Sandy Lane to Wood Lane
- OP2A: Meynell Alternative 2 with a single gyratory roundabout arrangement. Option variation A includes the 'Lady's Grove' underpass following the existing A47 alignment
- OP2B: Meynell Alternative 2 with a single gyratory roundabout arrangement. Option variation B includes a link road from Sandy Lane to Wood Lane

2.1.3 Figures 2-3 and 2-4 show Meynell Alternatives 1 and 2, respectively, with Option variations A and B on the same plan. The plans are to be read as if only Option variations A or B is built, not both.

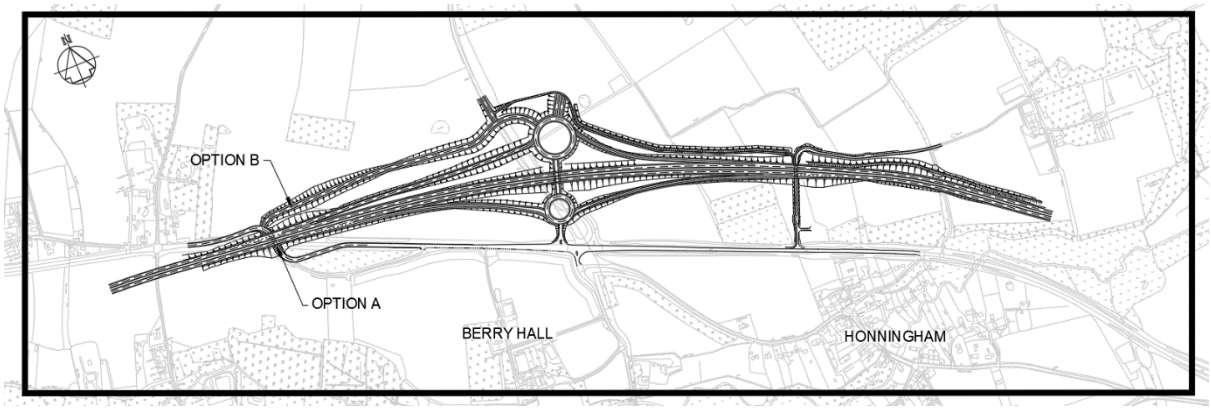


Figure 2-2: Wood Lane Junction Alternative 1

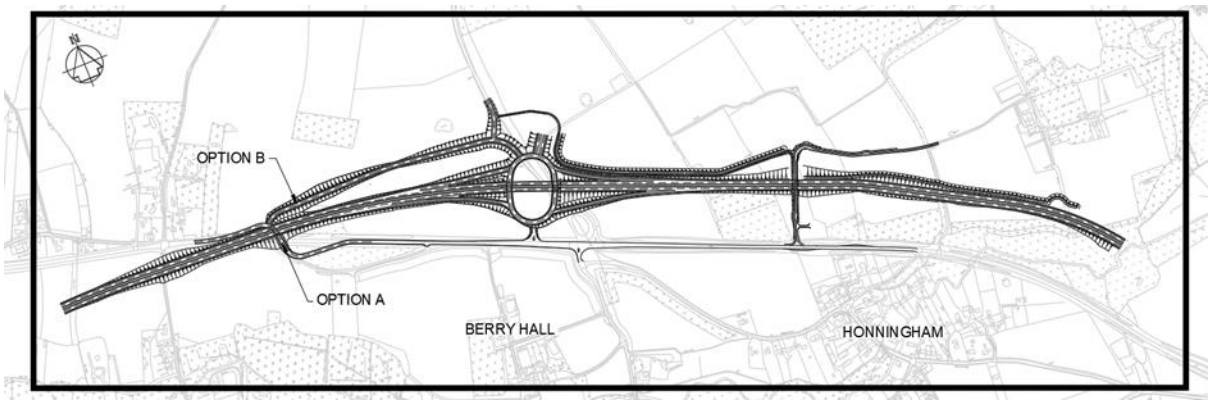


Figure 2-3: Wood Lane Junction Alternative 2

3 DESIGN AND DMRB COMPLIANCE REVIEW

3.1 Applicability of the DMRB

3.1.1 The Design Manual for Roads and Bridges (DMRB) includes all current standards, advice notes and other documents relating to the design, assessment and operation of motorways and all-purpose trunk roads for which one of the Overseeing Organisations is the highway authority (e.g. Highways England).

3.1.2 The DMRB embodies the collective experience of the Overseeing Organisations, their agents and designers. It provides requirements and advice resulting from research, practical experience of constructing and operating motorway and all--purpose trunk roads, and from delivering compliance to legislative requirements.

3.1.3 DMRB documents are not statutory or regulatory documents or training manuals; neither do they cover every point in exhaustive detail. In general, the DMRB does not duplicate National, UK and European legislative requirements.

3.1.4 In England, the DMRB forms part of Highways England's own policy, guidance and standards developed to deliver Highways England's statutory duty as the Secretary of State's appointed strategic highways company by way of an Order in accordance with section 1 of the Infrastructure Act 2015 (2015 Act).

3.1.5 The effect of this appointment is to confer upon Highways England the legislative functions of a strategic highways company as regards the areas and highways in respect of which it is appointed. As a result, the Applicant is the highway authority, traffic authority and street authority for the strategic road network.

3.1.6 The policy documents represent a part of the performance framework to deliver Highways England's statutory duties as the licence holder, by responding to the Secretary of State's statutory directions and guidance to Highways England as required by the 2015 Act. The policy documents and standards have evolved from those established and applied by Highways England's predecessor (the Highways Agency). This framework makes clear, to both Highways England and the wider community of road users and stakeholders, what Highways England is expected to achieve and how they must behave in discharging their duties and in delivering their vision and plans for the network, set out in the Road Investment Strategy. Highways England's compliance with its duties is monitored by the Office of Rail and Road.

3.1.7 The Highways England Licence document (2015) sets out key requirements which must be complied with by the licence holder as well as statutory guidance. In exercising its functions and complying with its legal duties and obligations, the licence holder must act in such a manner which it considers best calculated to deliver the following, amongst other commitments presented in Section 4.1 of the Case for the Scheme (**APP-140**):

- ensure the effective operation of the network
- ensure the maintenance, resilience, renewal, and replacement of the network
- ensure the improvement, enhancement and long-term development of the network.

3.1.8 Although the Applicant is the source of policy, standards and guidance for the strategic highway network, those documents are monitored against the Secretary of State's statutory guidance and directions. On that basis, although the Applicant understands that it might appear that there is an element of it setting the tests it has to meet, the reality is that the relevant policy, standards and guidance are derived from the Applicant's statutory duties and they cover the whole of the strategic road network in England, not just the areas of the Scheme. On that basis, the Applicant considers that significant weight should be given to its policies.

3.1.9 The Applicant has followed the Project Control Framework (PCF) governance for the delivery of major projects. This sets out in detail how to manage and deliver major road improvement projects. Consultation is accordingly mandated and is undertaken throughout scheme development with the defined consultees:

- Operations directorate
- Safety, Engineering and Standards (SES) directorate.
- Local authorities
- Statutory environmental bodies, including Natural England, Historic England, the Internal Drainage Board and the Environment Agency

3.2 Mainline

3.2.1 The mainline geometry values required are obtained from the UK DMRB, CD109 - Highway link design, Table 2.10.

Horizontal Geometry

Scheme Design

3.2.2 The mainline horizontal geometry provided over the assessment area is generally above the desirable minimum radius for a 120 kilometres per hour (kph) design speed and therefore complies with the required standards.

3.2.3 The exception to this is the 720m horizontal radius used at the eastern extent of the assessment area. This falls one step below desirable minimum horizontal radius of 1,020m required of a 120kph design speed road and is therefore a horizontal relaxation.

Alternative 1 (dumb-bell layout)

3.2.4 The mainline horizontal geometry shown is generally above the desirable minimum radius for a 120kph design speed and therefore complies with the required standards.

3.2.5 The exception to this is the 990m horizontal radius used at the eastern tie-in to the developed design. This falls one step below desirable minimum horizontal radius of 1,020m required of a 120kph design speed road and is therefore a horizontal relaxation.

3.2.6 As this relaxation occurs in advance of the junction diverge slip, widening to provide full stopping sight distance would be necessary to avoid this being classified as a "Departure from standard" (CD 109, Clause 2.13).

3.2.7 This has not been accounted for in the alternative design and would increase permanent land take accordingly.

3.2.8 The new mainline alignment would be closer to residential properties at Hall Farm, thus increasing likely noise impacts for properties already predicted to experience a significant adverse residual noise effect during operation of the Scheme design; see Environmental Statement Chapter 11 Noise and Vibration (**APP-150**).

3.2.9 Option A, with Lady's Grove underpass, would also bring the proposed existing A47 side road closer to Hillcrest Cottage compared to the Scheme design.

Alternative 2 (two-bridge roundabout layout)

3.2.10 The mainline horizontal geometry shown falls below the desirable minimum radius for a 120kph design speed in two locations:

- A 720m horizontal radius is used east of the farm access underpass.
- A 720m horizontal radius is used at the eastern tie-in to the developed design.

3.2.11 Both these fall one step below desirable minimum horizontal radius of 1,020m required of a 120kph design speed road and are therefore horizontal relaxations.

3.2.12 As these relaxations occur in advance of the junction diverge slip, widening to provide full stopping sight distance would be necessary in order to avoid this being classified as a departure from the standard (CD 109, 2.13).

3.2.13 This has not been accounted for in the alternative design and would increase permanent land take accordingly.

3.2.14 Option A, with Lady's Grove underpass, would also bring the proposed existing A47 side road closer to Hillcrest Cottage compared to the Scheme design.

Vertical Geometry

3.2.15 The proposed mainline vertical geometry has not been provided for any of the alternative options.

3.2.16 The Applicant notes that the latest proposals from Mr Meynell submitted at Deadline 3 (**REP3-045**) show earthworks on the proposals. The Applicant contacted the representatives of Mr Meynell to request the 3D models be provided for assessment as part of this exercise.

3.2.17 The representatives of Mr Meynell confirmed, via email, that no 3D modelling had been undertaken and that the earthworks shown on the proposed alternatives were "indicative" (i.e. graphical only).

3.2.18 The report submitted by Mr Meynell (**REP3-045**) does not reference that the proposals were not designed to include vertical elevations and that the earthworks shown in the proposals are indicative (i.e. graphical).

3.2.19 The report submitted does not provide any information on the assumptions used to define how these earthworks were applied to the alternative design proposals.

3.2.20 Therefore, the Applicant has commented on the following criteria based on Technical Expertise.

Scheme Design

3.2.21 The mainline vertical geometry provided over the assessment area meets or exceeds the desirable minimum values for a 120kph design speed and therefore complies with the required standards.

3.2.22 Across the assessment area, a junction underbridge (Wood Lane Junction) and combined walking, cycling and horse-riding (WCH) and farm access underpass (Hall Farm Underpass) are to be provided. The Scheme vertical alignment provides sufficient clearance to allow for the safe operation and construction.

Alternative 1, Option A (dumbbell layout with Lady's Grove underpass)

3.2.23 The vertical design needs to provide clearance for a junction underbridge and farm underpass that are to be provided in this option, in similar locations to those required in the Scheme design.

3.2.24 An additional underpass is required in this option to maintain the existing A47. Such an underpass would require a headroom of 5.3m. Provision of this compliant headroom would require the proposed dualled A47 to be raised by approximately 5.3m.

3.2.25 The mainline would require to be raised above the Scheme design levels for a length of approximately 1,200m, with additional earthworks/materials and increased environmental impacts, especially landscape, visual and noise for properties around Church Lane, Sandy Lane and Park Lane, over this extent as a result. In particular, there is a risk to:

- the Scheme design's 'no significant effects' assessment for Noise Important Area 5201 and the effectiveness of the proposed noise barrier 3 mitigation north of Church Lane as mitigation for properties at risk of significant noise impacts from the Scheme design; see Environmental Statement Chapter 11 Noise and Vibration (**APP-050**) and Sheet 2 of Environmental Statement Figure 11.2 (**APP-074**).

- The existing A47 rises to the east, so the mainline dual carriageway would need to be raised more than for the alternative alignment shown should the underpass be moved east. This would also have implications for the design of Wood Lane junction and the slip roads. Moving west would require additional permanent loss of land within the residential properties at the junction of Sandy Lane and the existing A47.

Alternative 1, Option B (dumbbell layout with link road)

3.2.26 The vertical design needs to provide clearance for a junction underbridge and farm underpass that are to be provided in this option, in similar locations to those required in the Scheme design.

Alternative 2, Option A (two-bridge roundabout layout with Lady's Grove underpass)

3.2.1 The vertical design needs to provide clearance for a farm underpass to be provided in this option, in a similar location to that required in the Scheme design.

3.2.2 The vertical design also needs to provide clearance for two junction underbridges that replace the single structure of the Scheme design.

3.2.3 An additional underpass is required in this option to maintain the existing A47. Such an underpass would require a headroom of 5.3m. Provision of this compliant headroom would require the proposed dualled A47 to be raised by approximately 5.6m.

3.2.4 The mainline would require to be raised above the Scheme design levels for a length of approximately 1,200m, with additional earthworks/materials and increased environmental impacts, especially landscape, visual and noise for properties around Church Lane, Sandy Lane and Park Lane, over this extent as a result. In particular, there is a risk to: the Scheme design's 'no significant effects' assessment for Noise Important Area 5201 in Environmental Statement Chapter 11 Noise and Vibration (**APP-050**); and the effectiveness of the proposed noise barrier 3 mitigation north of Church Lane could be compromised as mitigation for properties at risk of significant noise impacts from the Scheme design. These features are shown on Sheet 2 of Environmental Statement Figure 11.2 (**APP-074**).

Alternative 2, Option B (two-bridge roundabout layout with link road)

3.2.5 The vertical design needs to provide clearance for a farm underpass to be provided in this option, in a similar location to that required in the Scheme design.

3.2.6 The vertical design needs to provide clearance for two junction underbridges that replace the single structure of the Scheme design.

3.3 Junctions

3.3.1 The Wood Lane grade separated junction and alternative options are assessed against the UK DMRB, CD122 – Geometric design of grade separated junctions.

3.3.2 At grade junctions of the Scheme design and alternative options are assessed against the UK DMRB, CD123 – Geometric design of at-grade priority and signal controlled junctions.

3.3.3 The roundabouts of the Scheme design and alternative options are assessed against the UK DMRB, CD116 – Geometric design of roundabouts.

DMRB Junction Hierarchy

Grade Separated Junction

3.3.4 CD 122 was released in August 2019 to replace TD22/06 (Layout of Grade Separated Junctions) and in combination with CD 123 supersedes TD 40/94 (Layout of Compact Grade Separated Junctions).

3.3.5 The design of junctions, be it grade separated (CD122) or at grade (CD 123), are inherently hierarchical based on traffic flows and safety in the same fashion as diverge and merge slip road layouts increase in relation to capacity provision.

TD 22/06, Clause 2.11 states:

"Recommended layouts for consideration in order of increasing traffic flow level are (i) to (v)."

Whilst CD 122 does not state this explicitly, as the below table demonstrates the hierarchical approach remains:

TD 22/06, Clause 2.11	**CD 122, Appendix A**
i) Diamond or half cloverleaf	A1) Diamond
	A2) Half-cloverleaf
ii) Dumbbell roundabout	A3) Dumbbell roundabout
iii) Two bridge roundabout	A4) Two bridge roundabout
iv) 3 level roundabout	A5) Interchanges
v) interchange	

3.3.6 The Scheme design selected a dumbbell roundabout junction (Layout A3) as being the most appropriate grade separated junction form for this location, based on the junction hierarchy outlined in CD 122 Appendix A and operational traffic modelling.

3.3.7 CD 122, Appendix A outlines examples of full grade separated junction layouts and provides further information on the selected option A3 (Dumbbell roundabout). Benefits of this are as follows:

- suitable capacity for predicted future traffic flows
- requires only one structure
- allows direct links to the existing A47 for local traffic

3.3.8 Alternative 1 also proposes a dumbbell roundabout junction arrangement, but this proposed design requires access to be taken via Wood Lane following a simple priority junction with the existing A47 (applies to westbound traffic only for Option B).

3.3.9 Alternative 2 proposes a two-bridge roundabout layout with the same access arrangements as described for Alternative 1 above.

3.3.10 The two-bridge roundabout was not selected in this location for the Scheme design as:

- the junction would be significantly overdesigned in terms of the number of structures (two) and junction footprint
- operational capacity would be significantly over provided for the Scheme Design Year (2040) traffic flows, as discussed in Chapter 4 'Transport Assessment' for the Case for the Scheme (**APP-140**)
- It requires an additional bridge structure, which would:
  - increase capital and maintenance costs
  - not comply with the hierarchical approach to carbon management, which applies the principles of build nothing, build less, build clever, build efficiently (as described in PAS 2080: Carbon Management in Infrastructure). This is presented in the Scheme Design Report (**APP-142**).

3.3.11 The UK DMRB, CD 122 Appendix A, Option A4 provides further information on this junction form, noting that they "require two bridges and have a greater footprint" compared with a dumbbell arrangement.

DMRB Compliance

Grade Separated Junction

3.3.12 Lack of preliminary vertical design information prevents a direct comparison between the Scheme design and the proposed alternative options.

Scheme Design

3.3.13 The eastbound diverge and both merge slips within the Scheme design ensure the required stopping sight distance can be achieved on leaving and joining the A47 dual carriageway. The required horizontal and vertical geometry are provided on junction slips to enable this.

3.3.14 There is reduced stopping sight distance on approach to the westbound diverge slip and the eastbound diverge taper is to a Type A Option 1 Taper Diverge arrangement instead of the required Layout Type C Lane Drop (CD122, 3.26). More details are provided in Section 5 and Appendix A of this report.

3.3.15 The slip road lengths were optimised to provide an efficient junction footprint while complying with the UK DMRB requirements.

Alternative 1, Option A (dumb-bell layout with Lady's Grove underpass)

3.3.16 Indicative slip roads are shown to a similar length of the Scheme design, but do not take into account that the A47 mainline levels would require to be raised west of the junction to accommodate the proposed Lady's Grove underpass carrying the existing A47.

3.3.17 The eastbound diverge and westbound merge slips would not meet the UK DMRB requirements in their current form, due to the increased level difference to be overcome between the junction roundabout(s) and the mainline.

3.3.18 Based on the current slip road lengths a non-compliant vertical profile would be required to meet this level difference, resulting in critical departures from standard for both vertical geometry and stopping sight distance which would present safety issues within the conflict area of the junction.

3.3.19 Compliant slip roads would only be possible for this alternative layout by significantly increasing the length of the slip roads, resulting in increased land take and associated increase in environmental impacts.

3.3.20 The increased lengths in slip roads may require the alternative mainline A47 to move further south, which would impact the proposed Wood Lane Junction location with a similar shift to the south, resulting in operational difficulties with the proposed junction on the existing A47 south of Wood Lane junction.

Alternative 1, Option B (dumbbell layout with link road)

3.3.21 Indicative slip roads are shown to a similar length as the Scheme design, as this option has comparable constraints, and the lengths indicated appear to meet the DMRB requirements, though no assessment of vertical alignment has been carried out.

Alternative 2, Option A (two-bridge roundabout layout Lady's Grove underpass)

3.3.22 Indicative slip roads are shown to a similar length of the Scheme design, but do not take into account that the A47 mainline levels would require to be raised west of the junction to accommodate the proposed Lady's Grove underpass carrying the existing A47.

3.3.23 The eastbound diverge and westbound merge slips would not meet the DMRB requirements in their current form, due to the increased level difference to be overcome between the junction roundabout(s) and the mainline.

3.3.24 Based on the current slip road lengths a non-compliant vertical profile would be required to meet this level difference, resulting in critical departures from standard for both vertical geometry and stopping sight distance which would present safety issues within the conflict area of the junction.

3.3.25 Compliant slip roads would only be possible for this alternative layout by significantly increasing the length of the slip roads, resulting in increased land take and associated increase in environmental impacts.

3.3.26 The increased lengths in slip roads may require the alternative mainline A47 to move further south, which would impact the proposed Wood Lane Junction location with a similar shift to the south, resulting in operational difficulties with the proposed junction on the existing A47 south of Wood Lane junction.

Alternative 2, Option B (two-bridge roundabout layout with link road)

3.3.27 Indicative slip roads are shown to be significantly shorter than the Scheme design, as this option has similar constraints, the lengths indicated do not meet the DMRB requirements in their current form.

3.3.28 Based on the current slip road lengths a non-compliant vertical profile would be required to meet this level difference, resulting in critical departures from standard for both vertical geometry and stopping sight distance.

3.3.29 Compliant slip roads would only be possible for this alternative layout by significantly increasing the length of the slip roads, resulting in increased land take and associated increase in environmental impacts.

3.3.30 The increased lengths in slip roads may require the alternative mainline A47 to move further south, which would impact the proposed Wood Lane Junction location with a similar shift to the south, resulting in operational difficulties with the proposed junction on the existing A47 south of Wood Lane junction.

At-Grade Junctions

Scheme Design

3.3.31 At-grade junction selection for the Scheme design was based upon the predicted traffic flows of the minor and major roads at each location (UK DMRB CD 123, section 2.3.1 & Figure 2.3.1).

3.3.32 Simple priority junctions have been provided in the Scheme Design with the exception of ghost island junction arrangements in the following locations:

- B1535 Wood Lane with the realigned existing A47 (Detrunked) to the north of the junction.
- Mattishall Lane Link Road with the existing A47 (Detrunked).
- Dereham Road with the existing A47 (Detrunked).

3.3.33 At grade junction designs were submitted to the Local Highway Authority (Norfolk County Council) for review and comment prior to submitting the preliminary design.

Alternative 1, Option B (dumbbell layout with link road)

3.3.34 No road markings have been provided for the link from the Existing A47 (Detrunked) to the southern roundabout, however from reviewing the widths shown in the drawing this suggests a ghost island junction will be provided.

3.3.35 For an 85kph Design Speed, the 38m spacing of this left/right staggered junction is less than required by CD 123, Clause 2.25 and will require a Departure from Standard.

3.3.36 Additionally, this layout cannot provide the 55m deceleration lengths for either junction, requiring a further Departure from Standard to CD 123, Clause 5.22.

3.3.37 The proposed junction of the B1535 Wood Lane with the western A47 link from the northern roundabout is shown as a simple priority junction, omitting the ghost island junction provided in the Applicant's design. This junction is located on a sharp curve (radius 80m) which is advised against in CD 123, Clause 2.1.1:

"Priority junctions should not be located on a sharp curve on a major road"

3.3.38 Following CD 123 Figure 2.3.1 this "should" be a ghost island junction, the omission of this within the Alternative Option is likely to cause conflicts between the traffic exiting the roundabout and that queuing to turn right into Wood Lane.

3.3.39 This combination of relaxations given the location and proximity of the junctions leads to safety concerns which would require the approval of the Local Highway Authority.

3.3.40 The proposals do not allow for verge widening for visibility therefore it is assumed that junction visibility and additional land take has not been allowed for within the alternative design and would require further review.

Alternative 2, Option B (two-bridge roundabout layout with link road)

3.3.41 No road markings have been provided for the link from the Existing A47 (Detrunked) to the southern roundabout, however from reviewing the widths shown in the drawing this suggests a ghost island junction will be provided.

3.3.42 For an 85kph Design Speed, the 108m spacing of this left/right staggered junction meets the requirements of CD 123, Clause 2.25 for spacing and CD 123, Clause 5.22 for the deceleration lengths.

3.3.43 The proposed junction of the B1535 Wood Lane with the western A47 link from the northern roundabout is shown as a simple priority junction, omitting the ghost island junction provided in the Applicant's design. This junction is located on a sharp curve (Radius 80m) which is advised against in CD 123, Clause 2.1.1:

"Priority junctions should not be located on a sharp curve on a major road"

3.3.44 Following CD 123, Figure 2.3.1 this "should" be a ghost island junction, and the omission of this within the Alternative Option is likely to cause conflicts between the traffic exiting the roundabout and that queuing to turn right into Wood Lane.

3.3.45 This combination of relaxations given the location and proximity of the junctions leads to safety concerns which would require the approval of the Local Highway Authority.

3.3.46 The proposals do not allow for verge widening for visibility therefore it is assumed that junction visibility and additional land take has not been allowed for within the alternative design and would require further review.

3.4 Sideroads

3.4.1 The Applicant has used the UK DMRB as a framework for the geometrical design of the sideroads in the absence of a local highway authority design standard as agreed with the Local Highway Authority (Norfolk County Council) who will be adopting the local roads.

3.4.2 The sideroad geometry across the assessment area is in accordance with the standards specified in the UK DMRB, CD109 - Highway link design, Table 2.10.The Applicant engaged with the Local Highway Authority and submitted Departure Applications where this was not possible.

3.4.3 Departures from standard for the Scheme design and alternative options are shown in Section 5.

Alternative Options with Lady's Grove Underpass (1A and 2A)

3.4.4 Alternative Options 1A and 2A, with the proposed Lady's Grove underpass, do not detail a tie-in to the B1535 Wood Lane sideroad being maintained north of the proposed junction(s).

3.4.5 For the purposes of modelling it has been assumed this is a direct connection to the northern roundabout.

3.4.6 As no design has been provided for the B1535 Wood Lane sideroad geometry, it has not been possible to undertake an assessment on this element.

3.4.7 With no vertical alignment proposals provided we are unable to determine whether such a tie-in could be provided within the DCO permanent land take boundary.

3.4.8 Verge widening for visibility has not been shown; therefore, we are unable to determine whether such a connection could be provided within the DCO permanent land take boundary.

Alternative Options with Link Road (1B and 2B)

3.4.9 The proposed link road in both alternative options is shown to fall out with the Scheme DCO boundary along the full extent of the proposed link.

3.4.10 Both link roads contain non-compliant horizontal geometry at the eastern tie-in with the proposed Wood Lane junction alternatives.

3.4.11 With no vertical alignment proposals provided we are unable to determine whether such a tie-in could be provided within the DCO permanent land take boundary. The earthworks shown in the proposals contain no vertical levels and are indicative (i.e. graphical).

4 OPERATIONAL TRAFFIC

4.1 Introduction

4.1.1 Chapter 4 'Transport Assessment' of the Case for the Scheme (**APP-140**) describes how the Norwich Area Transport Study (NATS) model was used to undertake the forecasting assessment and economic appraisal of the Scheme.

4.1.2 The NATS model traffic forecasts are dependent on demand growth forecasts and highway scheme assumptions. The local growth forecasts consider the local authority growth projections and the national growth forecasts take wider anticipated growth into account. The uncertainty log details the local authority development schemes in regions which are both nearby and significant to the model. This includes assumptions on local uncertainty, which is dependent on whether developments or other planned transport schemes close to the Scheme area are proposed.

4.1.3 The core scenario represents the most unbiased and realistic set of assumptions. It is intended to provide a sound basis for decision-making given current evidence. It must be robust and evidence-based taking on board various factors and noting uncertainties affecting travel demand in the future.

4.1.4 In accordance with Department for Transport (DfT) Transport Appraisal Guidance (TAG), the uncertainty log includes the management of the uncertainties required for formulating the core scenario.

4.1.5 The following alternative scenarios have also been assessed using a fixed demand assignment based on the 2040 NATS model's Do-Something (DS) core scenario for the Scheme:

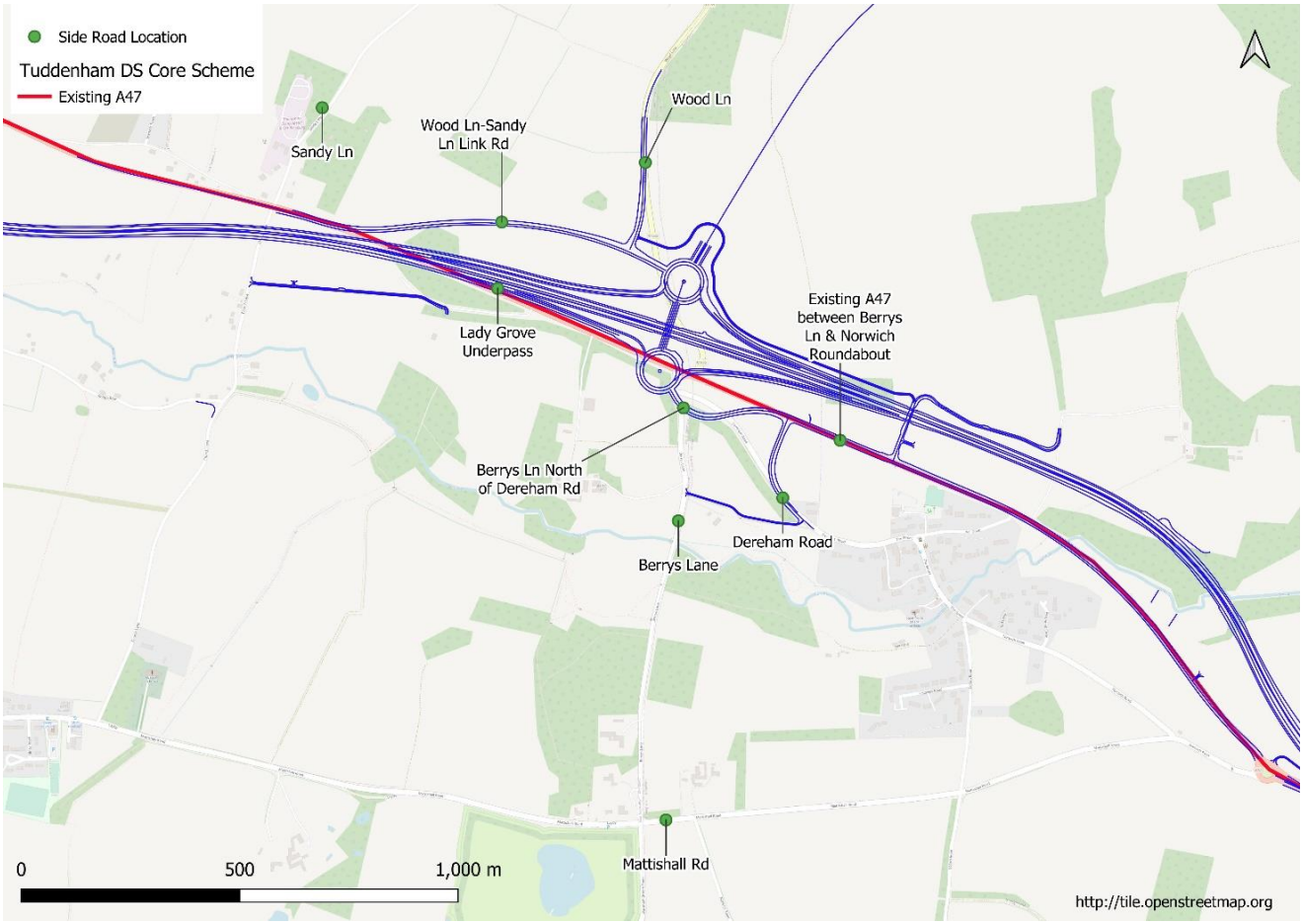
- OP1A: Meynell Alternative 1 with a 'dumbbell' two roundabout arrangement. Option variation A includes the 'Lady's Grove' underpass following the existing A47 alignment
- OP1B: Meynell Alternative 1 with a 'dumbbell' two roundabout arrangement. Option variation B includes a link road from Sandy Lane to Wood Lane
- OP2A: Meynell Alternative 2 with a single gyratory roundabout arrangement. Option variation A includes the 'Lady's Grove' underpass following the existing A47 alignment
- OP2B: Meynell Alternative 2 with a single gyratory roundabout arrangement. Option variation B includes a link road from Sandy Lane to Wood Lane

4.1.6 The results of the 2040 NATS models assessment of OP1A, OP1B, OP2A and OP2B form the basis of the SATURN modelling assessment are detailed in this chapter. It should be noted that the SATURN strategic highway assignment model provides a consistent comparison of the impacts of each option.

4.1.7 Therefore, this chapter presents two Scenarios – one where Berrys Lane is retained open in all the alternative options, and the other with Berrys Lane closed in all alternative options.

4.1.8 Figure 4-1 shows the location of the local side roads included in the assessment of the alternative option scenarios (OP1A, OP1B, OP2A, OP2B) based on the 2040 NATS model.

Figure 4-1: Local Road Site Locations



4.2 Operational Capacity and Queuing (with Berrys Lane closed)

4.2.1 Tables 4-1 to 4-5 show the NATS 2040 results for each of the OP1A, OP1B, OP2A, OP2B and DS core scenarios with Berrys Lane closed in all five scenarios.

4.2.2 These tables include the Volume over Capacity (V/C) and stop line delay results for each of the approach arms to the roundabout, gyratory and priority junctions included in the assessed scenarios. In general, a V/C value higher than 85% provides an indicator that an approach arm is operating close to its available capacity limitation. Therefore, all V/C values close to or greater than 85% are highlighted in red.

4.2.3 In OP1B, OP2B and the DS core scenario the provision of the new link road from Sandy Lane to Wood Lane will result in a V/C of 90% or over, with an associated delay of approximately 29-31 seconds, in the PM peak.

4.2.4 OP1B performs slightly worse than the DS core scenario with respect to the interchange link approach arm at the southern roundabout, which is forecast to operate close to capacity in both the AM (87%) and PM (84%) peak hours. The rest of the approach arms in both OP1B and OP2B all operate within the available capacity across all three time periods.

4.2.5 By contrast, the provision of the Lady's Grove underpass in OP1A and OP2A results in a higher V/C (>95%), in the PM peak, on the southbound minor arm of the priority junction intersecting with the existing A47.

4.2.6 Similar to OP1B, in OP1A the interchange link at the southern roundabout is forecasted to operate close to capacity in both the AM (84%) and PM (87%) peak hours. The rest of the approach arms in both OP1A and OP2A all operate within the available capacity across all three time periods.

4.2.7 In summary, the comparison above indicates that OP2 (either A or B) performs slightly better than OP1 (A or B) due to higher operational capacity provided by the gyratory layout.

4.2.8 The improvement in operational performance in OP2 is to be expected as it includes a full two lane circulatory which provides more capacity than the single lane link road in OP1.

4.2.9 Overall, analysis of OP2B shows a slightly higher V/C ratio on the new link road from Sandy Lane to Wood Lane than the DS core scenario in the PM peak. Whereas analysis of OP2A shows PM peak congestion issues, which are not present in the DS core scenario, on the southbound minor arm of the priority junction intersecting with the existing A47.

4.2.10 Therefore, due to the operational capacity issues in the PM peak, the DS core scenario performs better than OP2, which is noted above to perform slightly better than OP1.

Table 4-1 – Option 1A Operational Assessment – DS2040

Roundabout	Approach	V/C (%)			Delay (second)		
		AM	IP	PM	AM	IP	PM
Northern Roundabout	Wood Lane	29	16	58	6	4	14
	Norwich Western Link	70	41	66	3	3	3
	Interchange Link	27	17	51	3	3	3
	A47 EB Off-slip	51	37	69	3	3	4
Southern Roundabout	Interchange Link	**84**	58	**87**	3	3	3
	A47 WB Off-slip	45	28	71	6	4	9
	South Approach from existing A47	31	15	54	5	4	7
Priority Junction – Existing A47	Southbound minor approach	70	48	**96**	4	3	17
	Existing A47 East Arm	37	23	48	2	2	3
	Existing A47 West Arm	4	2	12	0	0	0

Table 4-2 - Option 1B Operational Assessment – DS2040

Junction	Approach	V/C (%)			Delay (second)		
		AM	IP	PM	AM	IP	PM
Northern Roundabout	Link Road	39	21	**90**	6	4	29
	Norwich Western Link	72	42	69	3	3	3
	Interchange Link	44	31	69	3	3	3
	A47 EB Off-slip	50	37	78	3	3	6
Southern Roundabout	Interchange Link	**87**	60	**84**	3	3	3
	A47 WB Off-slip	45	29	69	6	4	8
	South Approach from existing A47	38	19	55	6	4	8

Table 4-3 - Option 2A Operational Assessment – DS2040

Roundabout	Approach	V/C (%)			Delay (second)		
		AM	IP	PM	AM	IP	PM
Single Gyratory	Wood Lane	21	13	54	6	4	14
	Norwich Western Link	71	42	67	3	3	3
	A47 WB Off-slip	47	31	76	6	4	10
	South Approach from existing A47	39	19	60	5	4	8
	A47 EB Off-slip	52	37	69	3	3	4
Priority Junction – Existing A47	Southbound minor approach	72	53	**97**	4	3	19
	Existing A47 East Arm	38	22	48	2	2	3
	Existing A47 West Arm	9	5	14	0	0	0

Table 4-4 - Option 2B Operational Assessment – DS2040

Roundabout	Approach	V/C (%)			Delay (second)		
		AM	IP	PM	AM	IP	PM
Single Gyratory	Link Road	41	22	**92**	7	4	31
	Norwich Western Link	73	43	70	3	3	3
	A47 WB Off-slip	51	31	80	7	4	12
	South Approach from existing A47	40	19	62	6	4	11
	A47 EB Off-slip	52	37	79	3	3	6

Table 4-5 - Core Scenario Operational Assessment – DS2040

Roundabout	Approach	V/C (%)			Delay (second)		
		AM	IP	PM	AM	IP	PM
Northern Roundabout	Link Road	39	21	**90**	6	4	29
	Norwich Western Link	72	42	69	3	3	3
	Interchange Link	46	31	71	3	3	4
	A47 EB Off-slip	50	37	83	4	3	8
Southern Roundabout	Interchange Link	77	59	72	3	3	3
	A47 WB Off-slip	42	29	60	5	4	6
	South Approach from existing A47	35	19	49	5	4	7
	South Exit to existing A47	12	8	12	0	0	0

4.3 Impact on the Side Road Network (with Berrys Lane closed)

4.3.1 Tables 4-6 and 4-7 show the local road two-way peak hour traffic flows to the nearest 10 vehicles for each alternative option scenario as well as the overall Annual Average Daily Traffic (AADT) rounded to the nearest 100 vehicles.

4.3.2 In all of the DS, OP1 and OP2 scenarios Berrys Lane is closed to through traffic movements between Dereham Road and Mattishall Road.

4.3.3 Therefore, traffic flows remain relatively constant between all scenarios on: Berrys Lane (0 AADT all scenarios); the downgraded existing A47 between the junction with Berrys Lane and Honingham roundabout (DS 4,600 AADT, OP1 4,600-5,300 AADT, OP2 4,700-5,200 AADT); and on Mattishall Road (DS 8,400 AADT, OP1 8,400-8,500 AADT, OP2 8,400-8,600 AADT). On the downgraded existing A47 between the junction with Berrys Lane and Honingham roundabout, there is a slight increase in flow when Lady's Grove underpass is open in the OP1A & OP2A scenarios.

4.3.4 Traffic flows on Dereham Road remain relatively constant between all scenarios, as the downgraded existing A47 alignment provides a more direct route for through traffic movements.

4.3.5 The B1535 Wood Lane traffic flows increase in OP1B and OP2B (DS 2,300 AADT, OP1B 3,600 AADT, OP2B 3,400 AADT) compared to the DS core scenario.

4.3.6 However, in OP1B and OP2B traffic flows on Sandy Lane show a decrease of approximately 1,000 AADT compared to the DS core scenario.

4.3.7 In OP1A and OP2A traffic levels on the B1535 Wood Lane stay approximately equivalent to the DS core scenario. On Sandy Lane traffic levels increase by approximately around 500-1,000 AADT.

4.3.8 In total a traffic flow of approximately 4,500-5,000 AADT is forecast to utilise the Lady's Grove underpass in OP1A and OP2A. The level of traffic on the Lady's Grove underpass is broadly in line with the traffic flow on the Wood Lane to Sandy Lane link road in the DS core scenario.

4.3.9 Overall, the results of the NATs model indicate that the alternative scenarios, with Berrys Lane closed, relative to the wider road network, will have a relatively low change in traffic AADTs on Wood Lane, Sandy Lane, the downgraded A47 and Mattishall Road in the order of around +/-1,000 AADT.

Table 4-6 - Local Road Traffic Flows – 2040 DS core and Option 1

Link	2040 DS Peak Hour Flow (veh)			2040 OP1B Peak Hour Flow (veh)			2040 OP1A Peak Hour Flow (veh)		
	AM Peak	PM Peak	AADT	AM Peak	PM Peak	AADT	AM Peak	PM Peak	AADT
Sandy Lane	80	210	1,300	0	10	0	170	230	2,100
B1153 Wood Lane	200	240	2,300	280	440	3,600	200	250	2,300
Link Road between Wood Lane and Sandy Lane	400	690	4,800	190	380	2,700	0	0	0
Lady's Grove Underpass	0	0	0	0	0	0	320	590	4,300
Berrys Lane North of Dereham Road	490	580	5,300	60	70	700	60	70	700
Berrys Lane	0	0	0	0	0	0	0	0	0
A47 between Berrys Lane & Norwich Roundabout	430	500	4,600	430	500	4,600	490	580	5,300
Dereham Road	60	70	700	60	70	700	60	70	700
Mattishall Road	720	780	8,400	720	790	8,400	730	800	8,500

Table 4-7 - Local Road Traffic Flows – 2040 DS core and Option 2

Link	2040 DS Peak Hour Flow (veh)			2040 OP2B Peak Hour Flow (veh)			2040 OP2A Peak Hour Flow (veh)		
	AM Peak	PM Peak	AADT	AM Peak	PM Peak	AADT	AM Peak	PM Peak	AADT
Sandy Lane	80	210	1,300	0	60	200	170	200	2,000
B1153 Wood Lane	200	240	2,300	260	390	3,400	130	260	1,900
Link Road between Wood Lane and Sandy Lane	400	690	4,800	210	440	3,000	0	0	0
Lady's Grove Underpass	0	0	0	0	0	0	400	620	4,900
Berrys Lane North of Dereham Road	490	580	5,300	60	70	700	60	70	700
Berrys Lane	0	0	0	0	0	0	0	0	0
A47 between Berrys Lane & Norwich Roundabout	430	500	4,600	440	510	4,700	490	580	5,200
Dereham Road	60	70	700	60	70	700	60	70	700
Mattishall Road	720	780	8,400	730	790	8,500	740	800	8,600

4.4 Operational Capacity and Queuing (with Berrys Lane open)

4.4.1 Tables 4-8 to Table 4-12 show the NATS 2040 results for each of the OP1A, OP1B, OP2A, OP2B and DS core scenarios with Berrys Lane open only in the four alternative options (i.e. not DS core scenario).

4.4.2 These tables include the Volume over Capacity (V/C) and stop line delay results for each of the approach arms to the roundabout, gyratory and priority junctions included in the assessed scenarios. In general, a V/C value higher than 85% provides an indicator that an approach arm is operating close to its available capacity limitation. Therefore, all V/C values greater than 85% are highlighted in red.

4.4.3 In OP1B, OP2B and the DS core scenario the provision of the new link road from Sandy Lane to Wood Lane will result in a V/C over 90%, with an associated delay of approximately 30-37 seconds, in the PM peak.

4.4.4 OP1B performs slightly worse than the DS core scenario with respect to the interchange link approach arm at the southern roundabout, which is forecasted to operate close to capacity in both the AM (91%) and PM (88%) peak hours. The rest of the approach arms in both OP1B and OP2B all operate within the available capacity across all three time periods.

4.4.5 By contrast, the provision of the Lady's Grove underpass in OP1A and OP2A results in a higher V/C (>95%), in the PM peak, on the southbound minor arm of the priority junction intersecting with the existing A47. Similar to OP1B, in OP1A the interchange link at the southern roundabout is forecasted to operate close to capacity in both the AM (87%) and PM (91%) peak hours. The rest of the approach arms in both OP1A and OP2A all operate within the available capacity across all three time periods.

4.4.6 In summary, the comparison above indicates that OP2 (either A or B) performs slightly better than OP1 (A or B) due to higher operational capacity provided by the gyratory layout. The improvement in operational performance in OP2 is to be expected as it includes a full two lane circulatory which provides more capacity than the single lane link road in OP1.

4.4.7 Overall, analysis of OP2B shows a slightly higher V/C ratio on the new link road from Sandy Lane to Wood Lane than the DS core scenario in the PM peak. Whereas analysis of OP2A shows PM peak congestion issues, which are not present in the DS core scenario, on the southbound minor arm of the priority junction intersecting with the existing A47. Therefore, due to the operational capacity issues in the PM peak, the DS core scenario performs better than OP2, which is noted above to perform slightly better than OP1.

Table 4-8 – Option 1A Operational Assessment – DS2040

Roundabout	Approach	V/C (%)			Delay (second)		
		AM	IP	PM	AM	IP	PM
Northern Roundabout	Wood Lane	30	16	57	6	4	14
	Norwich Western Link	71	43	66	3	3	3
	Interchange Link	29	19	52	3	3	3
	A47 EB Off-slip	51	39	68	3	3	4
Southern Roundabout	Interchange Link	**87**	63	**91**	3	3	3
	A47 WB Off-slip	46	28	62	6	4	8
	South Approach from existing A47	35	21	60	5	4	7
Priority Junction – Existing A47	Southbound minor approach	77	58	**95**	5	3	15
	Existing A47 East Arm	43	30	60	2	2	2
	Existing A47 West Arm	5	3	13	0	0	0

Table 4-9 - Option 1B Operational Assessment – DS2040

Junction	Approach	V/C (%)			Delay (second)		
		AM	IP	PM	AM	IP	PM
Northern Roundabout	Link Road	42	22	**94**	7	4	35
	Norwich Western Link	73	44	71	3	3	4
	Interchange Link	46	33	71	3	3	3
	A47 EB Off-slip	51	39	78	3	3	6
Southern Roundabout	Interchange Link	**91**	64	**88**	3	3	3
	A47 WB Off-slip	46	30	68	7	4	9
	South Approach from existing A47	45	25	63	7	4	9

Table 4-10 - Option 2A Operational Assessment – DS2040

Roundabout	Approach	V/C (%)			Delay (second)		
		AM	IP	PM	AM	IP	PM
Single Gyratory	Wood Lane	21	13	51	6	4	13
	Norwich Western Link	72	44	68	3	3	3
	A47 WB Off-slip	48	32	76	6	4	11
	South Approach from existing A47	43	24	69	6	4	9
	A47 EB Off-slip	53	39	70	3	3	5
Priority Junction – Existing A47	Southbound minor approach	80	62	**97**	5	3	19
	Existing A47 East Arm	43	30	58	2	2	3
	Existing A47 West Arm	9	5	15	0	0	0

Table 4-11 - Option 2B Operational Assessment – DS2040

Roundabout	Approach	V/C (%)			Delay (second)		
		AM	IP	PM	AM	IP	PM
Single Gyratory	Link Road	44	23	**94**	7	5	37
	Norwich Western Link	74	44	71	3	3	4
	A47 WB Off-slip	52	32	81	7	4	13
	South Approach from existing A47	47	26	71	7	4	12
	A47 EB Off-slip	53	39	80	4	3	7

Table 4-12 - Core Scenario Operational Assessment – DS2040

Roundabout	Approach	V/C (%)			Delay (second)		
		AM	IP	PM	AM	IP	PM
Northern Roundabout	Link Road	39	21	**90**	6	4	29
	Norwich Western Link	72	42	69	3	3	3
	Interchange Link	46	31	71	3	3	4
	A47 EB Off-slip	50	37	83	4	3	8
Southern Roundabout	Interchange Link	77	59	72	3	3	3
	A47 WB Off-slip	42	29	60	5	4	6
	South Approach from existing A47	35	19	49	5	4	7
	South Exit to existing A47	12	8	12	0	0	0

4.5 Impact on the Side Road Network (with Berrys Lane open)

4.5.1 Tables 4-13 and 4-14 show the local road two-way peak hour traffic flows to the nearest 10 vehicles for each alternative option scenario as well as the overall Annual Average Daily Traffic (AADT) rounded to the nearest 100 vehicles.

4.5.2 In the OP1 and OP2 alternative scenarios Berrys Lane is open to through traffic movements between Dereham Road and Mattishall Road. Opening Berrys Lane to through traffic, in OP1 and OP2, causes a decrease in traffic on the downgraded existing A47 between the junction with Berrys Lane and Honingham roundabout (DS 4,600 AADT, OP1 0-800 AADT, OP2 0-500 AADT), as well as on Mattishall Road (DS 8,400 AADT, OP1 4,700 AADT, OP2 4,700 AADT), compared to the DS core scenario. During the AM and PM peak hours two-way flows reduce to around 0-130 vehicles on the existing A47 north of Honingham and around 350 vehicles on Mattishall Road.

4.5.3 In contrast, on Berrys Lane there is an increase in through traffic, of around 6,000 AADT, in both OP1 and OP2. In the AM and PM peak hour there is a two-way traffic flow of around 530-670 vehicles on Berrys Lane. It is worth noting that Figure 4.18 in the Case for the Scheme (**APP-140**) shows 4,400 AADT along Berrys Lane in the 2040 Do Minimum (no scheme) scenario. Therefore, OP1 and OP2 would increase traffic along Berrys Lane by 36% with an associated increased safety risk and disturbance impacts to its local residents that include properties managed by the children's charity Childhood First, plus walkers and cyclists; this in contrast to the DS core scenario's closure of Berrys Lane to through traffic.

4.5.4 Keeping Berrys Lane open to through traffic and allowing an increase in 2040 traffic under OP1 and OP2 would also be reverse the Applicant's commitment in response to Statutory Consultation feedback. In response to statutory consultation feedback, the Applicant collaborative engaged with the Local Highway Authority (Norwich County Council), the South of the A47 Taskforce (led by George Freeman MP), the multi parish "Local Liaison Group" and individual Parish Councils to discuss concerns raised about north-south traffic movements.

4.5.5 Several changes to the proposed sideroad network were subsequently incorporated into the final Scheme design, including closure of Berrys Lane to through traffic. These changes are reported in Table 4.12 of the Consultation Report (APP-024).

4.5.6 North of Dereham road traffic flows on Berrys Lane are slightly higher in OP1 and OP2 than the DS (DS 5,300, OP1 6,700-6,900, OP2 6800-7,000 AADT). Traffic flows on Dereham Road remain relatively constant between all scenarios, as the downgraded existing A47 alignment provides a more direct route for through traffic movements.

4.5.7 The B1535 Wood Lane traffic flows increase slightly in OP1B and OP2B (DS 2,300 AADT, OP1B 3,600 AADT, OP2B 3,400 AADT) compared to the DS core scenario. However, in OP1B and OP2B traffic flows on Sandy Lane show a slight decrease of approximately 1,000 AADT compared to the DS core scenario.

4.5.8 In OP1A and OP2A traffic levels on the B1535 Wood Lane stay approximately equivalent to the DS core scenario. On Sandy Lane traffic levels slightly increase by approximately around 500-1000 AADT. In total a traffic flow of approximately 4,500-5,000 AADT is forecasted to utilise the Lady's Grove underpass in OP1A and OP2A. The level of traffic on the Lady's Grove underpass is broadly in line with the traffic flow on the Wood Lane to Sandy Lane link road in the DS core scenario.

4.5.9 Overall, the results of the NATs model indicate that the alternative scenarios, relative to the wider road network, will have a low change in traffic AADTs on the local roads of Wood Lane and Sandy Lane in the order of around +/-1,000 AADT.

4.5.10 However, the closure of Berrys Lane to through traffic has a more significant impact causing a reduction of approximately 6,000 AADT or 530-670 peak hour two-way vehicles.

4.5.11 The displaced through traffic will primarily divert away from the rural Berrys Lane on to higher quality roads including the A47 existing alignment between Berrys Lane and Honingham Roundabout and Mattishall Road.

4.5.12 As discussed above, in OP1 and OP2 the increase in through traffic along Berrys Lane would also have an associated increased safety risk and disturbance impacts for the local residents.

Table 4-13 - Local Road Traffic Flows – 2040 DS core and Option 1

Link	2040 DS Peak Hour Flow (veh)			2040 OP1B Peak Hour Flow (veh)			2040 OP1A Peak Hour Flow (veh)		
	AM Peak	PM Peak	AADT	AM Peak	PM Peak	AADT	AM Peak	PM Peak	AADT
Sandy Lane	80	210	1,300	0	10	0	170	250	2,100
B1153 Wood Lane	200	240	2,300	280	440	3,600	200	250	2,300
Link Road between Wood Lane and Sandy Lane	400	690	4,800	210	380	2,800	0	0	0
Lady's Grove Underpass	0	0	0	0	0	0	330	620	4,600
Berrys Lane North of Dereham Road	490	580	5,300	580	710	6,700	590	740	6,900
Berrys Lane	0	0	0	530	640	6,000	530	660	6,200
A47 between Berrys Lane & Norwich Roundabout	430	500	4,600	0	0	0	40	130	800
Dereham Road	60	70	700	60	70	700	60	70	700
Mattishall Road	720	780	8,400	360	370	4,700	360	360	4,700

Table 4-14 - Local Road Traffic Flows – 2040 DS core and Option 2

Link	2040 DS Peak Hour Flow (veh)			2040 OP2B Peak Hour Flow (veh)			2040 OP2A Peak Hour Flow (veh)		
	AM Peak	PM Peak	AADT	AM Peak	PM Peak	AADT	AM Peak	PM Peak	AADT
Sandy Lane	80	210	1,300	0	60	200	170	160	1,900
B1153 Wood Lane	200	240	2,300	260	390	3,400	130	300	2,000
Link Road between Wood Lane and Sandy Lane	400	690	4,800	230	450	3,200	0	0	0
Lady's Grove Underpass	0	0	0	0	0	0	420	600	5,000
Berrys Lane North of Dereham Road	490	580	5,300	600	710	6,800	600	740	7,000
Berrys Lane	0	0	0	540	640	6,100	540	670	6,300
A47 between Berrys Lane & Norwich Roundabout	430	500	4,600	0	0	0	40	60	500
Dereham Road	60	70	700	60	70	700	60	70	700
Mattishall Road	720	780	8,400	350	360	4,700	350	360	4,700

5 SAFETY REVIEW

5.1 Safety Baseline and Objectives

5.1.1 The safety baseline for the A47 North Tuddenham to Easton Dualling scheme is based on the safety performance of the current layout which includes single carriageways with at grade staggered junctions.

5.1.2 The safety objectives are for the Scheme to operate better than the existing performance with collision and casualty rates better than the strategic road network performance for the type of road.

5.1.3 This safety review of the alternative layouts considered aspects such as safety related departures and operational safety.

5.1.4 The safety review was completed by a specialist with over 30 years' experience in highways, traffic and road safety engineering in both private and public sectors. In particular, they are a full member of the Society of Roads Safety Auditors (SoRSA), including roles as a Committee member and Vice Chairman. They also bring 20 years' experience serving as a Special Constable with the Tayside Police/Police Scotland, including 7 years in the Scotland Roads Policing Unit specialising in enforcement and collision investigation.

5.2 Departures

5.2.1 The alternative options provided were to a horizontal design only with no vertical information presented, as such any departures resulting from vertical constraints are not available in the following assessment.

Scheme Design

5.2.2 Departures from standard for Wood Lane Junction within the Scheme design have been submitted and approved by the relevant Overseeing Organisations and are summarised for the assessment area in Appendix A.

5.2.3 There are 2 No. Departures from Standard to the DMRB for the Strategic Road approved by Safety, Engineering & Standards (SES), and 6 No. Departures from Standard for the local road network approved by the local Highway Authority (Norfolk County Council).

Alternative 1, Option A (dumbbell layout with Lady's Grove underpass)

5.2.4 Nine additional departures have been identified across the re-aligned A47 and the B1535 (Wood Lane), as detailed in in Table 5-1 below and the sketches in Appendix B.

Table 5-1 : Alternative 1, Option A Departures

Reference	Departure Type	Standard Required	Standard Provided
A47T2M-B1535-101	Stopping Sight Distance	160m visibility from 240m in advance of roundabout	47m northbound visibility
A47T2M-B1535-102	Stopping Sight Distance	160m visibility from 240m in advance of A47 junction	47m southbound visibility
A47T2M-A47-106	Junction Stagger	50m junction stagger	38m junction stagger
A47T2M-A47-107	Horizontal	510m horizontal radius on re-aligned A47	45m horizontal radius north of underbridge
A47T2M-A47-108	Horizontal	510m horizontal radius on re-aligned A47	45m horizontal radius south of Lady's Grove underpass
A47T2M-A47-109	Horizontal	510m horizontal radius on re-aligned A47	110m horizontal radius at eastern tie-in
A47T2M-A47-110	Stopping Sight Distance	160m visibility on re-aligned A47	30m WB visibility at Lady's Grove underpass
A47T2M-A47-111	Stopping Sight Distance	160m visibility on re-aligned A47	30m EB visibility at Lady's Grove underpass
A47T2M-A47-112	Stopping Sight Distance	160m visibility on re-aligned A47	45m WB visibility east of Lady's Grove underpass

5.2.5 The severity of the horizontal radii and stopping sight distance departures required to provide the underpass arrangement are such, that it is unlikely that these departures would be approved by the Overseeing Organisation (Norfolk County Council).

Alternative 1, Option B (dumbbell layout with link road)

5.2.6 Nine additional departures have been identified across the re-aligned A47 and the B1535 (Wood Lane), as detailed in Table 5-2 below and the sketches in Appendix B.

Table 5-2 : Alternative 1, Option B Departures

Reference	Departure Type	Standard Required	Standard Provided
A47T2M-A47-101	Horizontal	510m horizontal radius on re-aligned A47	70m horizontal radius
A47T2M-A47-102	Horizontal	510m horizontal radius on re-aligned A47	90m horizontal radius
A47T2M-A47-103	Stopping Sight Distance	160m visibility from 240m in advance of Wood Lane junction	78m eastbound visibility
A47T2M-A47-104	Stopping Sight Distance	160m visibility from 240m in advance of roundabout	75m eastbound visibility
A47T2M-A47-105	Stopping Sight Distance	160m visibility from 240m in advance Wood Lane junction	55m westbound visibility
A47T2M-B1535-101	Stopping Sight Distance	160m visibility from 240m in advance of roundabout	47m northbound visibility

Reference	Departure Type	Standard Required	Standard Provided
A47T2M-B1535-102	Stopping Sight Distance	160m visibility from 240m in advance of A47 junction	47m southbound visibility
A47T2M-A47-106	Junction Stagger	75m junction stagger	38m junction stagger
A47T2M-A47-113	Deceleration Length	55m	9m

Alternative 2, Option A (two-bridge roundabout layout Lady's Grove underpass)

5.2.7 Eight additional departures have been identified across the B1535 (Wood Lane) and the re-aligned A47, as detailed in in Table 5-3 below and the sketches in Appendix B.

Table 5-3 : Alternative 2, Option A Departures

Reference	Departure Type	Standard Required	Standard Provided
A47T2M-B1535-203	Stopping Sight Distance	160m visibility from 240m in advance of roundabout	42m northbound visibility
A47T2M-B1535-204	Stopping Sight Distance	160m visibility from 240m in advance of A47 junction	42m southbound visibility
A47T2M-A47-204	Horizontal	510m horizontal radius on re-aligned A47	45m horizontal radius north of Lady's Grove underpass
A47T2M-A47-205	Horizontal	510m horizontal radius on re-aligned A47	45m horizontal radius south of Lady's Grove underpass
A47T2M-A47-206	Horizontal	510m horizontal radius on re-aligned A47	110m horizontal radius at eastern tie-in
A47T2M-A47-207	Stopping Sight Distance	160m visibility on re-aligned A47	30m WB visibility at Lady's Grove underpass
A47T2M-A47-208	Stopping Sight Distance	160m visibility on re-aligned A47	30m EB visibility at Lady's Grove underpass
A47T2M-A47-209	Stopping Sight Distance	160m visibility on re-aligned A47	45m WB visibility east of Lady's Grove underpass

5.2.8 The severity of the horizontal radii and stopping sight distance departures required to provide the underpass arrangement are such, that it is unlikely that these departures would be approved by the Overseeing Organisation (Norfolk County Council).

Alternative 2, Option B (two-bridge roundabout layout with link road)

5.2.9 Seven additional departures have been identified across the re-aligned A47, and B1535 (Wood Lane), as detailed in in Table 5-4 below and the sketches in Appendix B.

Table 5-4 : Alternative 2, Option B Departures

Reference	Departure Type	Standard Required	Standard Provided
A47T2M-A47-201	Horizontal	510m horizontal radius on re-aligned A47	80m horizontal radius
A47T2M-A47-202	Stopping Sight Distance	160m visibility from 240m in advance of roundabout	72m eastbound visibility
A47T2M-A47-203	Stopping Sight Distance	160m visibility from 240m in advance of Wood Lane junction	53m westbound visibility
A47T2M-B1535-201	Horizontal	510m horizontal radius on Wood Lane	100m horizontal radius
A47T2M-B1535-202	Stopping Sight Distance	160m visibility from 240m in advance of re-aligned A47 junction	87m southbound visibility
A47T2M-B1535-203	Stopping Sight Distance	160m visibility from 240m in advance of roundabout	42m northbound visibility
A47T2M-B1535-204	Stopping Sight Distance	160m visibility from 240m in advance of A47 junction	42m southbound visibility

5.2.1 The severity of the horizontal radii and stopping sight distance departures required to provide the underpass arrangement are such, that it is unlikely that these departures would be approved by the Overseeing Organisation (Norfolk County Council).

5.3 Safety Related Departures Concerns

5.3.1 The Scheme Design has been developed with a balanced approach to compliance with minimum design standards and the overall impact of the Scheme.

5.3.2 Whilst the Scheme Design does incorporate Departures from Standard within the Wood Lane junction area, these have been considered to be proportionate to the layout of the existing roads and been subject to approval through consultation with the Local Highway Authority (Norfolk County Council).

5.3.3 The Alternative options have not been through this process and are considered by the Applicant to be more severe in their reduction of geometrical standards, with associated safety implications.

5.3.4 These Departures from Standard were approved by the Local Highway Authority as sufficient justification for their inclusion has been provided for in terms of their negligible impact on the operational safety of the proposed Scheme Design.

Horizontal Geometry

5.3.5 The substantially reduced horizontal geometry present on the re-aligned existing A47 in Options 1A and 2A would subject drivers to a sudden change of direction, with the curve not suitable for the design speed.

5.3.6 This increases the likelihood of a vehicle entering the curve at the road's design speed, where it would not have the centripetal force to remain on the road, resulting in an accident.

Stopping Sight Distance

5.3.7 The reduced visibility on approach to junctions, present across all four alternative options, results in drivers not gaining full visibility of the junction and of any stationary vehicles until a point nearer to the junction.

5.3.8 This gives drivers less time to slow appropriately, with a possible vehicle collision should there be a queue of traffic waiting at the junction.

Junction Stagger

5.3.9 The reduced left/right stagger junction between Wood Lane and Berrys Lane junctions, present across both Alternative 1 options increases the likelihood of traffic travelling between the two minor roads having to wait in the centre of the major road.

5.3.10 This increases the risk of vehicle stacking and visibility obstructions occurring for right-turning vehicles from the minor roads. The reduced stagger distance amplifies this issue and negatively influences the intended operation of the layout.

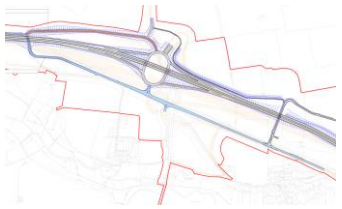
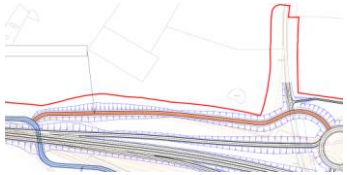
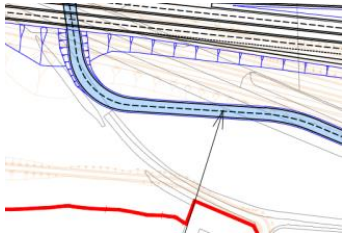
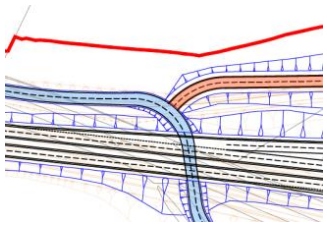
5.3.11 Given the complexity of the proposed staggered junction arrangement, it is likely that additional lighting would be required along the existing A47 to ensure the operational safety of alternative layout.

5.4 Operational Safety

5.4.1 The operational safety of the alternative proposals considers how road users are likely to interact with road layout and identify areas of safety concern, highlighting potential collision types and contributory factors.

5.4.2 The operational safety review in the following tables is not a design check or compliance with standards check. Similar to GG119 "Road Safety Audit" of the Design Manual for Roads and Bridges, the purpose is to consider how road users will interact with the layout.

Table 5--5: Safety issues relating to both alternatives

Ref	Location	Collision type	Description	Plan
A-1	Existing A47 alignment	Junction collisions Non-motorised user collisions	The straight alignment is likely to encourage high speeds which increases the risk of junction collisions, particularly at the staggered cross-roads which the scheme safety objective is to reduce. The Scheme intends to improve conditions for non-motorised users, in particular pedestrians, cyclists and horse riders by removing high speed traffic from the surrounding local roads. The straight alignment provided will encourage high speeds, putting these users at higher risk.	
A-2	Hockering north alignment to Wood Lane roundabout	Junction collisions Non-motorised user collisions	The straight alignment is likely to encourage high speeds which increases the risk of junction collisions, particularly at the staggered cross-roads which the scheme safety objective is to reduce. The Scheme intends to improve conditions for non-motorised users, in particular pedestrians, cyclists and horse riders by removing high speed traffic from the surrounding local roads. The straight alignment provided will encourage high speeds, putting these users at higher risk.	
A-3	Westbound approach to proposed Lady's Grove underpass.	Loss of control	The alignment features a tight right-hand bend which will likely be on a downhill gradient, preceded by a slight left-hand bend which would mask the tighter bend, located at the end of a long straight. It is likely that speeds will be high on the approach, and the left bend may be safely negotiated at speed. This may result in the high speed being carried into the second bend, which is exacerbated by the downhill gradient. This increases the risk of loss of control collisions for vehicles attempting to negotiate the right-hand bend.	
A-4	Eastbound approach to proposed Lady's Grove underpass	Loss of control	The alignment features a tight right-hand bend which will likely be on a downhill gradient, located at the end of a long straight. It is likely that speeds will be high on the approach which is exacerbated by the downhill gradient increasing a vehicles momentum This increases the risk of loss of control collisions for vehicles attempting to negotiate the right-hand bend.	

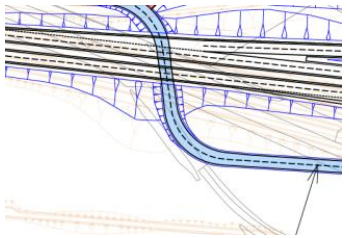
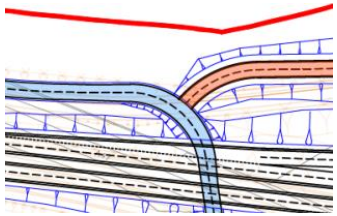
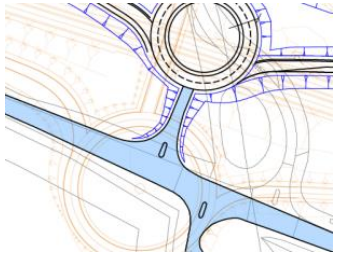
Ref	Location	Collision type	Description	Plan
A-5	Southbound exit from the proposed Lady's Grove underpass	Loss of control	The southbound alignment as vehicles exits the proposed underpass will be uphill and likely to be exposed to low level sun glare during the winter months. This combined with the differential in lighting from the underpass may lead to temporary blindness or dazzle for road users, leading to loss of control or collisions with other road users.	
A-6	Proposed Lady's Grove underpass	Crime	The proposed underpass is likely to be at low level and therefore dark and remote in nature, which will be unattractive to non-motorised vehicles users due to concerns for personal safety.	
A-7	Proposed Lady's Grove underpass (north side)	Loss of control	In winter months it is unlikely that this section of road will receive any sunlight, and due to the low-lying nature when compared with the surrounding topography is more likely to be damp. This may result in build ups of leaves in the autumn and risk of frost in the winter. In both sets of circumstances, the friction properties of the road surface may be lost which increases the risk of loss of control.	

Table 5--6: Alternative 1 – Safety Issues

Ref	Location	Collision type	Description	Plan
1-1	Existing A47 alignment, staggered junction with Berrys Lane.	Shunt collisions	The short stagger arrangement provides little stacking room for vehicles undertaking the north-south or south-north movement, increasing the risk of shunt type collisions with traffic using the old A47 alignment.	
1-2	Short link road between junction's southern roundabout and existing A47.	Shunt and side impact collisions	The short length of road between the existing A47 and the junction's southern roundabout provides little stacking room from the roundabout[1]. The roundabout will operate with an unopposed flow from the north (Norwich Western Link road) to the west, which will reduce opportunities for vehicles entering it from the south at peak periods. This may result in a queue back onto the old A47 resulting in shunt or side impact collisions at the staggered junction.	
1-3	Short link road between junction's southern roundabout and existing A47.	Overshoot and shunt collisions	The short length provided between the junction's southern roundabout and the existing A47 gives little room for warning southbound traffic from the roundabout of the give way ahead. This could result in overshoots of the give way, or shunts with queueing traffic at the give way.	

[1] A very short link provides little room for error by users, so even though flows may be low it does not mean the projected daily or hourly traffic arrives at a statistically perfect period of time between each vehicle. One traffic event could create a queue behind on the local road, such as at school time and during harvest periods with large and slow agricultural vehicles.

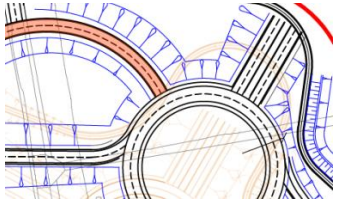
Ref	Location	Collision type	Description	Plan
1-4	Short link road between junction's southern roundabout and existing A47.	Side swipe collisions	The short length provided between the existing A47 and the junction's southern roundabout provides insufficient room for advanced direction signing for northbound traffic approaching the roundabout. This results in insufficient time for drivers to observe and plan for negotiating the roundabout and could lead to side swipes on the circulatory carriageway.	
1-5	B1535 (Wood Lane) junction with the northern alignment to / from Hockering.	Junction side impact collisions	The B1535 (Wood Lane) T-junction will have limited visibility to the right. The northern alignment approach to this junction is relatively straight up to the left bend preceding the junction, which may result in high approach speeds. This may result in vehicles exiting B1535 Wood Lane being struck by eastbound vehicles on the northern alignment.	
1-6	Wood Lane roundabout.	Side swipe collisions	The distances between the northern alignment exit and Norwich Western Link road exit is short which may result in side-swipe collisions between vehicles intending the exit.	

Table 5-7: Alternative 2 – Safety issues

Ref	Location	Collision type	Description	Plan
2-1	Short link road between junction's southern roundabout and existing A47.	Shunt and side impact collisions	The short length of road between the old A47 and the roundabout provides little stacking room from the roundabout[2]. The roundabout will operate with an unopposed flow from the north (Norwich northern link road) to the west, which will reduce opportunities for vehicles entering it from the south at peak periods. This may result in a queue back onto the old A47 resulting in shunt or side impact collisions at the staggered junction.	
2-2	Short link road between junction's southern roundabout and existing A47.	Overshoot and shunt collisions	The short length provided between the junction's southern roundabout and the existing A47 gives little room for warning southbound traffic from the roundabout of the give way ahead. This could result in overshoots of the give way, or shunts with queueing traffic at the give way.	
2-3	Short link road between junction's southern roundabout and existing A47.	Side swipe collisions	The short length provided between the existing A47 and junction's southern roundabout gives little room for advanced direction signing for northbound traffic approaching the roundabout. This gives insufficient time for drivers to observe and plan for negotiating the roundabout and could lead to side swipes on the circulatory carriageway.	
2-4	Wood Lane roundabout.	Side swipe collisions	The distances between the northern sideroad exit and Norwich Western Link road exit is short which may result in, side swipe collisions between vehicles attempting to exit.	

[2] See footnote for reference 1-2 in Table 5-6 above.

Ref	Location	Collision type	Description	Plan
2-5	B1535 (Wood Lane) junction with northern alignment.	Shunts	The distance between the B1535 (Wood Lane) junction and the junction's northern roundabout provides inadequate space for advanced direction signing. This gives the driver little time to observe and plan to take the junction and may lead to shunts due to late braking, or from colliding with vehicles ahead slowing and stopping to turn right.	

6 STRUCTURES

6.1 Alternative 1, Option A (dumbbell layout with Lady's Grove underpass)

6.1.1 The proposed junction underbridge and the farm access underpass structures in this option are to a similar deck size to that required for the Scheme design.

6.1.2 An additional underbridge to cross the existing A47 is required in this option. This structure would:

- require a deck area of 342m^2
- increase capital and maintenance costs
- increase embodied carbon and would not comply with the hierarchical approach to carbon management, which applies the principles of build nothing, build less, build clever, build efficiently (as described in PAS 2080: Carbon Management in Infrastructure).

6.2 Alternative 1, Option B (dumb-bell layout with link road)

6.2.1 The proposed junction underbridge and the farm access underpass structures in this option are to a similar deck size to that required for the developed design.

6.2.2 No additional structures are proposed in this option.

6.3 Alternative 2, Option A (two-bridge roundabout layout with Lady's Grove underpass)

6.3.1 The proposed option requires two junction underbridges each of an approximate deck size 455m^2 (Total = 910m^2) to replace the single junction underbridge, with a deck of 505m^2, in the Scheme design.

6.3.2 The proposed Hall Farm access underpass in this option is to a similar deck size to that required for the Scheme design.

6.3.3 The additional Lady's Grove underpass across the existing A47, with a deck area of 383m^2 is also required in this option.

6.3.4 The two bridge roundabout layout and Lady's Grove underpass would also increase capital and maintenance costs, and does not comply with the hierarchical approach to carbon management, which applies the principles of build nothing, build less, build clever, build efficiently (as described in PAS 2080: Carbon Management in Infrastructure).

6.4 Alternative 2, Option B (two-bridge roundabout layout with link road)

6.4.1 The proposed option requires two junction underbridges each of an approximate deck size 455m^2 (Total = 910m^2) to replace the single junction underbridge, (deck size of 505m^2, in the Scheme design.

6.4.2 This would increase capital and maintenance costs, and does not comply with the hierarchical approach to carbon management, which applies the principles of build nothing, build less, build clever, build efficiently (as described in PAS 2080: Carbon Management in Infrastructure).

6.4.3 The proposed Hall Farm access underpass in this option is to a similar deck size to that required for the Scheme design.

7 PERMANENT LAND TAKE COMPARISON

7.1.1 Permanent land take of the alternative layouts was defined using an offset from the earthworks comparable to the extent used in the boundary of the Scheme design.

7.1.2 This footprint was compared to the land required permanently by the Scheme design, as illustrated in the Land Plans (**REP1-002**), to calculate values provided below.

7.1.3 Sketches detailing locations of change in permanent land take are provided in Appendix C.

7.1.4 However, these sketches only compare the proposed alternative option designs with the Scheme design, but it is considered that additional permanent landtake would likely to be required if those alternatives designs were developed further.

7.2 Alternative 1, Option A (dumbbell layout with Lady's Grove underpass)

7.2.1 A total reduction of 8.89 hectares (Ha) of land required permanently for the alternative layout, as follows:

- 4.83 Ha of woodland and arable land from Berry Hall Estate.
- 1.81 Ha of arable land from Matthew Rampton.
- 1.05 Ha of arable land from David Alston, of Green Farm.
- 1.2 Ha of arable land from an unknown landowner.

7.2.2 In contrast there would be an 8.48 Ha increase in arable land required permanently for the alternative layout from the Easton Estates.

7.2.3 However, the alignment of Alternative option 1 means up to four agricultural fields north of the existing A47 may no longer be of a sufficient size to use for arable purposes. As a consequence, this could mean either: the Applicant permanently acquiring the full extent of the affected fields; or the removal of large lengths of existing mature hedgerows and trees to realign the existing internal access track and merge the affected fields with other fields.

7.2.4 The permanent land take has been established from the information provided by Mr Meynell. As noted in several sections of this report, the alternative design would require further development to be compliant. As such, the land take stated above should be considered as the minimum and subject to increase through design development.

7.2.5 In particular, compliant slip roads are only possible by significantly increasing their length, resulting in increased land take and associated increase in environmental impacts. As such, the land take stated above should be considered as the minimum and subject to increase through design development.

7.2.6 In addition to the above, it is important to note that though the alternative option reduces the loss of woodland within the Berry Hall Estate compared to the Scheme design, the creation of the Lady's Grove underpass would require the removal of mature woodland either side of the existing A47 north of Hillcrest Cottage.

7.2.7 This woodland merges with the western end of the Berry Hall Estate woodland that the alternative option is seeking to protect. Though this affected area is already identified for permanent acquisition in the Scheme design, this was due to it either being existing Highways England land or the Applicant needing to manage risks from works on the edge of woodland within unknown landownership.

7.3 Alternative 1, Option B (dumbbell layout with link road)

7.3.1 A total reduction of 6.7 Ha of land required permanently for the alternative layout, as follows:

- 4.89 Ha of woodland and arable land from Berry Hall Estate.
- 1.81 Ha of arable land from Matthew Rampton.

7.3.2 In contrast there would be a total increase of 10.87 Ha of land required permanently for the alternative layout from other parties, as follows:

- 8.48 Ha of arable land from Easton Estates.
- 1.08 Ha of arable land from David Alston, of Green Farm.
- 1.31 Ha of woodland and arable land from an unknown landowner.

7.3.3 The permanent land take has been established from the information provided by Mr Meynell. As noted in several sections of this report, the alternative design would require further development to be compliant. As such, the land take stated above should be considered as the minimum and subject to increase through design development.

7.3.4 In particular, the alignment of Alternative option 1 means up to four agricultural fields north of the existing A47 may no longer be of a sufficient size to use for arable purposes. As a consequence, this could mean either: the Applicant permanently acquiring the full extent of the affected fields; or the removal of large lengths of mature hedgerows and trees to realign the existing internal access track and merge the affected fields with other fields.

7.4 Alternative 2, Option A (two-bridge roundabout layout with Lady's Grove underpass)

7.4.1 A total reduction of 9.06 Ha of land required permanently for the alternative layout, as follows:

- 4.55 Ha of woodland and arable land from Berry Hall Estate.
- 1.81 Ha of arable land from Matthew Rampton.
- 1.14 Ha of arable land from David Alston, of Green Farm.
- 1.56 Ha of arable land from an unknown landowner.

7.4.2 In contrast there would be a total increase of 4.07 Ha of land required permanently for the alternative layout from Easton Estates.

7.4.3 The permanent land take has been provided from the information submitted by Mr Meynell. As noted in several sections of this report, the alternative design would require further development to be compliant.

7.4.4 For example, compliant slip roads are only possible by significantly increasing their length, resulting in increased land take and associated increase in environmental impacts. As such, the land take stated above should be considered as the minimum and subject to increase through design development.

7.4.5 In addition to the above, it is important to note that though the alternative option reduces the loss of woodland within the Berry Hall Estate compared to the Scheme design, construction of the Lady's Grove underpass would require the removal of mature woodland either side of the existing A47 north of Hillcrest Cottage.

7.4.6 This woodland merges with the western end of the Berry Hall Estate woodland that the alterative option is seeking to protect. Though this affected area is already identified for permanent acquisition in the Scheme design, this was due to it either being existing Highways England land or the Applicant needing to manage risks from works on the edge of woodland within unknown landownership.

7.5 Alternative 2, Option B (two-bridge roundabout layout with link road)

7.5.1 A total reduction of 6.38 Ha of land required permanently for the alternative layout, as follows:

- 4.57 Ha of woodland and arable land from Berry Hall Estate.

- 1.81 Ha of arable land from Matthew Rampton.

7.5.2 In contrast there would be a total increase of 6.46 Ha of land required permanently for the alternative layout from other parties, as follows:

- 4.07 Ha of arable land from Easton Estates.
- 1.08 Ha of arable land from David Alston, of Green Farm.
- 1.31 Ha of woodland and arable land from an unknown landowner.

7.5.3 The permanent land take has been provided from the information submitted by Mr Meynell. As noted in several sections of this report, the alternative design would require further development to be compliant.

7.5.4 For example, compliant slip roads are only possible by significantly increasing their length, resulting in increased land take and associated increase in environmental impacts. As such, the land take stated above should be considered as the minimum and subject to increase through design development.

8 CONCLUSIONS

8.1.1 The analysis demonstrates that each of the alternative options proposed has significant deficiencies across a range of key criteria where assessments were possible.

8.1.2 It follow that the current Scheme design remains the preferred Wood Lane junction design option with regards location and layout to be taken forward as the most appropriate solution in the location.

8.1.3 In addition to the assessment of the proposed options:

- The alternative options provided were to a horizontal design only and as such any departures resulting from vertical constraints were unable to be assessed.
- All options require amendments to the local road design, introducing safety concerns and additional maintenance.
- The Local Highway Authority (Norfolk County Council) would need to be consulted on and accept these options as future owners of the de-trunked existing A47 and local side road connections to the proposed Wood Lane junction.
- Any proposals directly impacting on assets under the current and potential future ownership of the Local Highway Authority would need to meet their expectations and requirement with regards design standards and operational safety.
- The Applicant recommends that the ExA seeks the Local Highway Authority's views on the alternative options.
- All alternative scenarios, due to the operational capacity issues in the PM peak, the Scheme core scenario performs better than the alternative options scenarios. Traffic flows remain relatively constant between all scenarios with Berrys Lane closed. If the alternative options kept Berrys Lane open to through traffic movements between Dereham Road and Mattishall Road, this would increase traffic along Berrys Lane by 36% with an associated increased safety risk and disturbance impacts to its local residents that include properties managed by the children's charity Childhood First. The Scheme's closure of Berrys Lane to through traffic is in response to statutory consultation feedback, following the Applicant's collaborative engagement with the Local Highway Authority (Norwich County Council), the South of the A47 Taskforce (led by George Freeman MP), the multi parish "Local Liaison Group" and individual Parish Councils to discuss concerns raised about north-south traffic movements.

- The Scheme design contains enhancements to the existing WCH network alongside the provision of new links to improve local connectivity. The Applicant has engaged throughout with Norfolk County Council and Parish Councils on the WCH provision contained within the Scheme.

- It is noted that all proposed alternative options remove the enhancement provided between Dereham Road and Berrys Lane. The alternative proposals would result in less direct connections for WCH movements within the locale of Wood Lane and Honingham which are not aligned with the scheme objective.

8.1.4 Alternative 1, Option A (dumb-bell layout with Lady's Grove underpass)

- New mainline alignment would be closer to Hall Farm, increasing likely noise impacts for properties already predicted to experience a significant adverse residual noise effect during operation of the Scheme design.

- Lady's Grove underpass offers a benefit for cyclists travelling east-west. However, the realignment of the existing A47 would also be brought through woodland closer to Hillcrest Cottage and potentially affect the curtilage and gardens of properties at the southern end of Sandy Lane.

- Mainline would need to be raised at least 5.5m above the Scheme design levels for a length of approximately 1,200m, requiring additional earthworks and materials, plus increasing environmental impacts, especially landscape, visual and noise for properties around Church Lane, Sandy Lane and Park Lane; in particular, this could compromise noise barrier mitigation for Church Lane properties at risk of significant noise impacts from the Scheme design.

- Compliant slip roads would only be possible for this alternative layout by significantly increasing the length of the slip roads, resulting in increased land take and associated increase in environmental impacts.

- Due to the operational capacity issues in the PM peak, the design Scheme's Do Something core scenario performs better than the alternative option.

- Introduces 9 new departures and subsequent safety concerns which are not present within the developed design.

- Requires an additional structure, adding cost, associated carbon emissions and additional maintenance considerations.

- Given the complexity of the proposed southern staggered junction arrangement, it is likely that additional lighting would be required along the existing A47 to ensure the operational safety of alternative layout.

- Though there is a predicted 0.41ha net reduction in permanent land take, the land take stated is the minimum required and subject to increase through design development; for example:

- Up to four agricultural fields north of the existing A47 may no longer be of a sufficient size to use for arable purposes, requiring either permanent acquisition by the Applicant or removal of large lengths of mature hedgerows and trees to realign the existing internal access track and merge the affected fields with other fields.
- Compliant slip roads are only possible by significantly increasing their length and land take.

8.1.5 Alternative 1, Option B (dumb-bell layout with link road)

- New mainline alignment would be closer to Hall Farm, increasing likely noise impacts for properties already predicted to experience a significant adverse residual noise effect during operation of the Scheme design.
- Due to the operational capacity issues in the PM peak, the design Scheme's Do Something core scenario performs better than the alternative option.
- Introduces 8 new departures and subsequent safety concerns which are not present within the developed design.
- Given the complexity of the proposed southern staggered junction arrangement, it is likely that additional lighting would be required along the existing A47 to ensure the operational safety of alternative layout.
- Net increase in land required permanently, by 4.17Ha, with this expected to increase further through design development. In particular, up to four agricultural fields north of the existing A47 may no longer be of a sufficient size to use for arable purposes, requiring either permanent acquisition by the Applicant or removal of large lengths of mature hedgerows and trees to realign the existing internal access track and merge the affected fields with other fields.
- Provides direct connection of the B1535 Wood Lane sideroad to the northern roundabout which conflicts with consultation feedback and engagement with the Local Liaison Group.

8.1.6 Alternative 2, Option A (two-bridge roundabout layout with Lady's Grove underpass)

- Mainline would need to be raised at least 5.5m above the Scheme design levels for a length of approximately 1,200m, requiring additional earthworks and materials, plus increasing environmental impacts, especially landscape, visual and noise for properties around Church Lane, Sandy Lane and Park Lane; in particular, this could compromise noise barrier mitigation for Church Lane properties at risk of significant noise impacts from the Scheme design.
- Lady's Grove underpass offers a benefit for cyclists travelling east-west. However, the realignment of the existing A47 would also be brought through woodland closer to Hillcrest Cottage and potentially affect the curtilage and gardens of properties at the southern end of Sandy Lane.

- Compliant slip roads would only be possible for this alternative layout by significantly increasing the length of the slip roads, resulting in increased land take and associated increase in environmental impacts.

- Due to the operational capacity issues in the PM peak, the design Scheme's Do Something core scenario performs better than the alternative option.

- Introduces 8 new departures and subsequent safety concerns which are not present within the developed design.

- Requires 2 additional structures, adding cost, associated carbon emissions and additional maintenance considerations.

- Though there would be a predicted 4.99ha net reduction in permanent land take, the land take stated is the minimum required and subject to further increase through design development. For example, to achieve compliant slip roads This would require a significant increase in their length resulting in additional land take.

- This option passes the whole increase in permanent land take (4.07ha) onto a single landowner already experiencing a large permanent loss of land in the design Scheme.

- Provides direct connection of the B1535 Wood Lane sideroad to the northern roundabout which conflicts with consultation feedback and engagement with the Local Liaison Group.

8.1.7 Alternative 2, Option B (two-bridge roundabout layout with link road)

- Compliant slip roads would only be possible for this alternative layout by significantly increasing the length of the slip roads, resulting in increased land take and associated increase in environmental impacts.

- Due to the operational capacity issues in the PM peak, the design Scheme's Do Something core scenario performs better than the alternative option.

- Introduces 7 new departures and subsequent safety concerns which are not present within the developed design.

- Requires an additional structure, adding cost, associated carbon emissions and additional maintenance considerations.

- Net increase in land required permanently by 0.08Ha, however this would increase through design development. In particular, compliant slip roads are only possible by significantly increasing their length and land take.

APPENDIX A. DEPARTURES FOR DEVELOPED DESIGN (WOOD LANE JUNCTION)

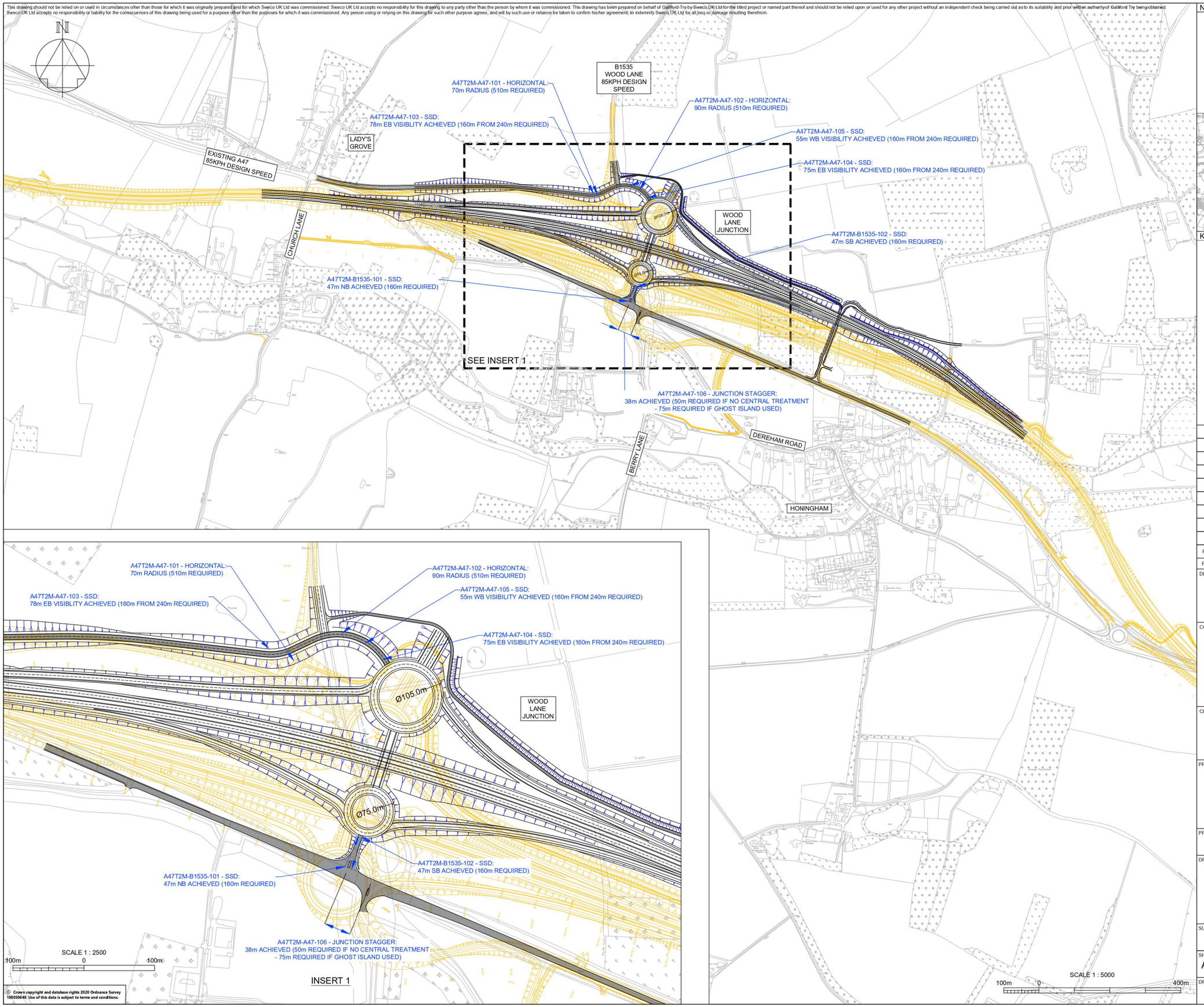
Table 8--1 : HE Safety, Engineering and Standards - Departures Summary

Ref No.	Departure ID	Originator	PIN	Project Safety Risk Category	Departure Safety Risk Category	Departure Criticality	Cost Impact	Qualitative Impact	Deadline Impact	Discipline	Submission Date	Workflow Status	RAG Status	Location	Chainages	Departure Element	Departure Standard	Description of Departure from Standards	Stage 3 Status	Date of Approval
102132 - 0	D-ML-SD-002	Sweco	551489	A	A	4 – Departure is fundamental to option selection	>£1,000,000	Mainline carriageway would need to be realigned. Significant environmental impact if Departure is not approved.	< 2 weeks	Geometry	13/11/2020	Approved	R	A47 Mainline Westbound Carriageway (MC10)	CH 6005 to CH 5910 (mainline)	Stopping Sight Distance	CD 109 Clause 2.13 and Table 2.10. Stopping Sight Distance on Approach to Junction	On the proposed A47 westbound carriageway on the approach to the proposed Wood Lane junction diverge slip, the required stopping sight distance in accordance with CD 109 Clause 2.13 and Table 2.10 is not achieved. The desirable minimum Stopping Sight Distance (SSD) is not achieved in both lanes 1 and 2 to the low object height from chainage 5+905 to 6+060. However, over this extent the desirable minimum SSD is achieved to the high object. The minimum SSD values achieved are 271m in Lane 1 and 288m in Lane 2 to the low object height.	Approved	14/12/2020
102136 - 0	D-WJ-JT-149	Sweco	551489	A	A	5 – Departure is fundamental to viability of the scheme	>£1,000,000	Significant impact on scheme viability if Departure is not approved.	< 2 weeks	Geometry	13/11/2020	Approved	R	Wood Lane Junction Eastbound Diverge Slip Road (MC50)	CH 4+250 to CH 4+915	Radii	CD 122 Clause 3.26 & Figure 3.26a	On the eastbound diverge slip of the Wood Lane Junction it is proposed to provide a Type A Option 1 Taper Diverge arrangement instead of the required Layout Type C Lane Drop.	Approved	14/12/2020

Table 8--2 : Local Highway Authority Departures Summary

Departure ID	Originator	Departure Location	Chainage	Design Speed	Proposed Cross Section	Doc & Clause	Compliant Design Standard	Achieved Standard	Stage 3 Status	Date of Approval
D-WJ-CB-106A	Sweco	Link to Existing A47 (Hockering) Eastbound	370-530	85A	Local Authority 5.5m carriageway width	CD109 Clause 2.12	Crest Curve K=55 160m SSD	Crest Curve K=30 SSD 124m (Min Achieved)	Approved	15/02/2021
D-WJ-CB-107	Sweco	Link to Existing A47 (Hockering) Westbound	580-510	85A	Local Authority 5.5m carriageway width	CD109 Clause 2.12	Crest Curve K=55 160m SSD	Crest Curve K=30 SSD 123m (Min Achieved)	Approved	15/02/2021
D-WJ-CB-109	Sweco	B1535 Wood Lane Northbound	180-270	85A	Local Authority 6.0m carriageway width	CD109 Clause 2.12	Horizontal Curve Radius 510m, 160m SSD	Horizontal Curve Radius 255m SSD 131m (Min Achieved)	Approved	15/02/2021
D-WJ-CB-110	Sweco	B1535 Wood Lane Northbound	390-270	85A	Local Authority 6.0m carriageway width	CD109 Clause 2.12	Horizontal Curve Radius 510m Crest Curve K=55 160m SSD	Horizontal Curve Radius 255m Crest Curve K=35. SSD 131m (Min Achieved)	Approved	15/02/2021
D-WJ-VC-101	Sweco	B1535 Wood Lane Southbound	180-350	85A	Local Authority 6.0m carriageway width	CD109 Clause 2.13	Crest Curve K=55	Crest Curve K=35	Approved	15/02/2021
D-WJ-CB-108	Sweco	B1535 Wood Lane Southbound	260-350	85A	Local Authority 6.0m carriageway width	CD109 Clause 2.12	Horizontal Curve Radius 510m Crest Curve K=55	Horizontal Curve Radius 255m Crest Curve K=35	Approved	15/02/2021

APPENDIX B. ALTERNATIVE OPTION DEPARTURES



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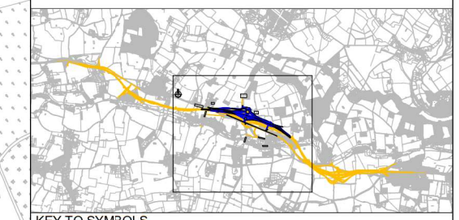


KEY TO SYMBOLS

REV	DATE	REVISION NOTE	ORG	CHK'D	APP'D
P01	25/10/21	DRAWING UPDATE	OH	BArt	BArt

DESIGNER

SWECO

CONTRACTOR

GallifordTry

CLIENT

highways england

PROJECT TITLE

A47 NORTH TUDDENHAM TO
EASTON DUALLING

PROJECT STAGE

PCF STAGE 4

DRAWING TITLE

ALTERNATIVE WOOD LANE JUNCTION OPTIONS
APPRAISAL ALTERNATIVE 1B
DUMB BELL OPTION WITH LINK ROAD

SUITABILITY

SUITABLE FOR REVIEW & COMMENT

SHEET SIZE	SCALE	STATUS	REVISION
A1	1:5000	S3	P01

DRAWING NUMBER

HE551489-GTY-HGN-000-SK-CH-00008

N

A47T2M-A47-110 - SSD:
30m WB ACHIEVED (160m REQUIRED)

LADY'S GROVE

A47T2M-A47-107 - HORIZONTAL:
45m RADIUS (510m REQUIRED)

A47T2M-A47-109 - HORIZONTAL:
110m RADIUS (510m REQUIRED)

B1535
WOOD LANE
85KPH DESIGN SPEED

NO INFORMATION PROVIDED BY MR MEYNELL AS TO HOW THE B1535 WOOD LANE SIDEROAD WOULD DIRECTLY CONNECT INTO THE WOOD LANE NORTHERN ROUNDABOUT IN THIS OPTION..

THIS IS THE CURRENT LOCAL HIGHWAY AUTHORITY HGV ROUTE.

EXISTING A47
85KPH DESIGN SPEED

WOOD LANE JUNCTION

A47T2M-A47-111 - SSD:
30m EB ACHIEVED (160m REQUIRED)

A47T2M-B1535-102 - SSD:
47m SB ACHIEVED (160m REQUIRED)

CHURCH LANE

A47T2M-A47-108 - HORIZONTAL:
45m RADIUS (510m REQUIRED)

A47T2M-A47-112 - SSD:
45m WB ACHIEVED (160m REQUIRED)

SEE INSERT 1

SEE INSERT 2

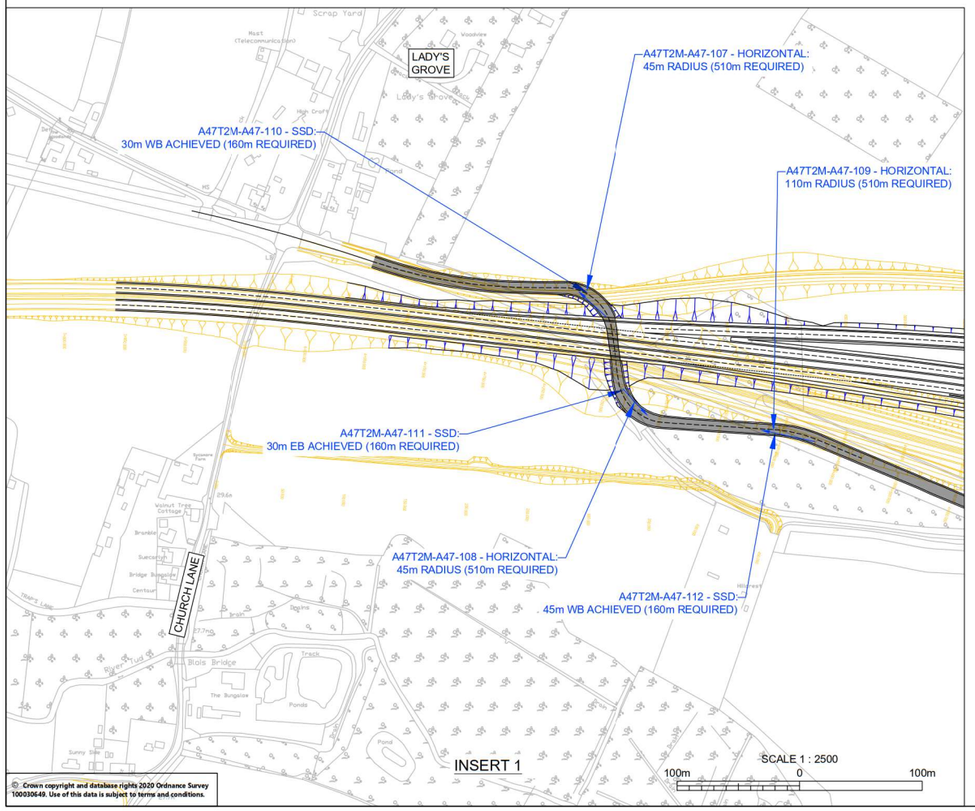
A47T2M-B1535-101 - SSD:
47m NB ACHIEVED (160m REQUIRED)

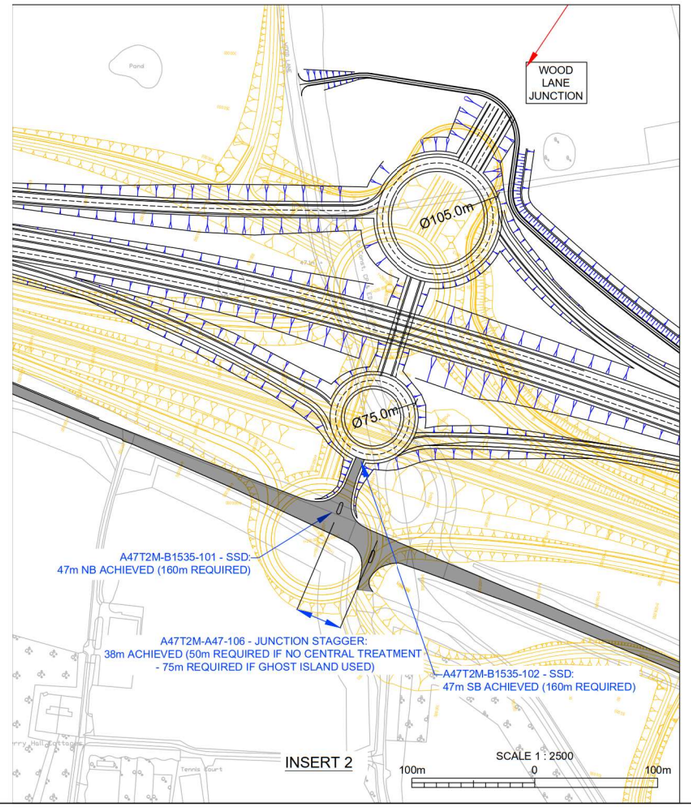
A47T2M-A47-106 - JUNCTION STAGGER:
38m ACHIEVED (50m REQUIRED IF NO CENTRAL TREATMENT
- 75m REQUIRED IF GHOST ISLAND USED)

BERRY LANE

DEREHAM ROAD

HONINGHAM





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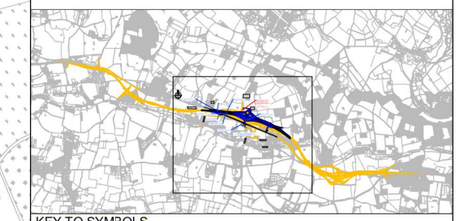


KEY TO SYMBOLS

REV	DATE	REVISION NOTE	ORG	CHK'D	APP'D
P01	25/10/21	DRAWING UPDATE	OH	BArt	BArt

DESIGNER
SWECO

CONTRACTOR
GallifordTry

CLIENT
highways england

PROJECT TITLE
A47 NORTH TUDDENHAM TO EASTON DUALLING

PROJECT STAGE
PCF STAGE 4

DRAWING TITLE
ALTERNATIVE WOOD LANE JUNCTION OPTIONS
APPRAISAL ALTERNATIVE 1A
DUMB BELL OPTION WITH UNDERBRIDGE

SUITABILITY
SUITABLE FOR REVIEW & COMMENT

SHEET SIZE	SCALE	STATUS	REVISION
A1	1:5000	S3	P01

DRAWING NUMBER
HE551489-GTY-HGN-000-SK-CH-00009

B1535
WOOD LANE
85KPH DESIGN
SPEED

A47T2M-B1535-202 - SSD:
87m SB VISIBLITY ACHIEVED (160m FROM 240m REQUIRED)

A47T2M-B1535-201 - HORIZONTAL:
100m RADIUS (510m REQUIRED)

A47T2M-A47-201 - HORIZONTAL:
80m RADIUS (510m REQUIRED)

LADY'S GROVE

EXISTING A47
85KPH DESIGN SPEED

A47T2M-A47-202 - SSD:
72m EB VISIBLITY ACHIEVED (160m FROM 240m REQUIRED)

CHURCH LANE

WOOD LANE JUNCTION

A47T2M-A47-203 - SSD:
53m WB VISIBLITY ACHIEVED (160m FROM 240m REQUIRED)

SEE INSERT 1

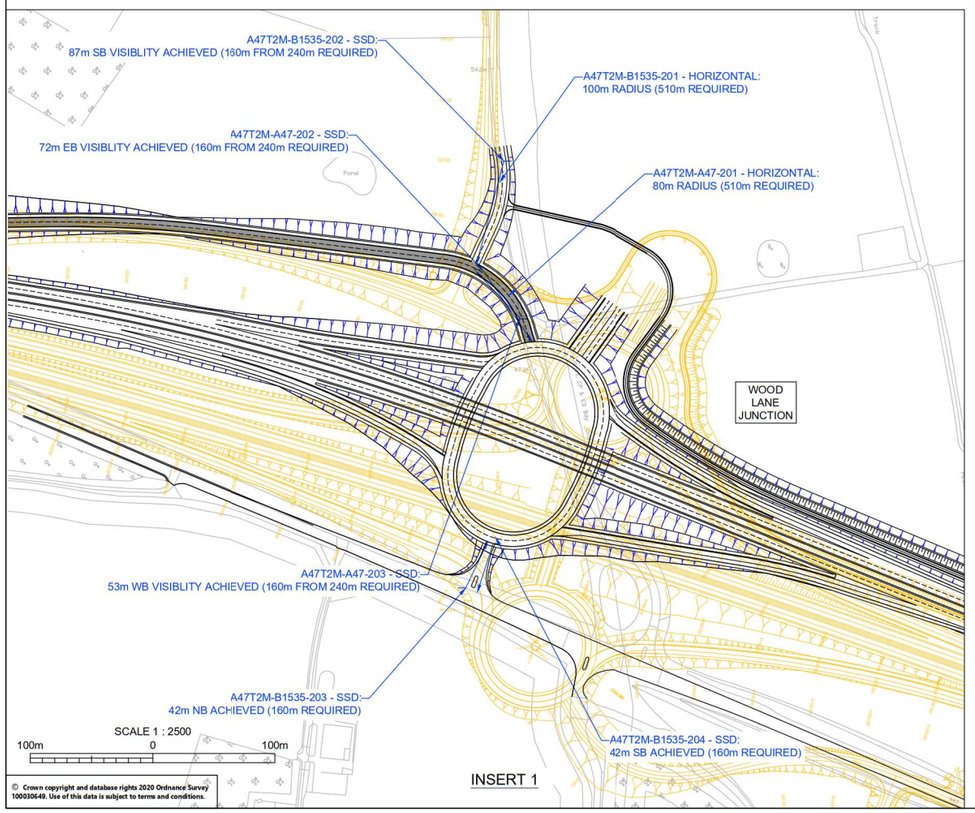
A47T2M-B1535-203 - SSD:
42m NB ACHIEVED (160m REQUIRED)

A47T2M-B1535-204 - SSD:
42m SB ACHIEVED (160m REQUIRED)

DEREHAM ROAD

BERRY LANE

HONINGHAM



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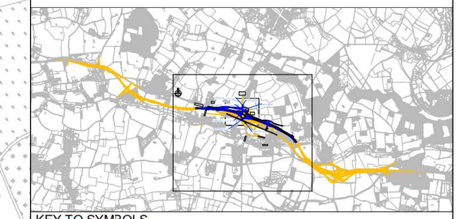

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P01	25/10/21	DRAWING UPDATE	OH	BArt	BArt

DESIGNER
SWECO

CONTRACTOR
GallifordTry

CLIENT
highways england

PROJECT TITLE
A47 NORTH TUDDENHAM TO EASTON DUALLING

PROJECT STAGE
PCF STAGE 4

DRAWING TITLE
ALTERNATIVE WOOD LANE JUNCTION OPTIONS APPRAISAL ALTERNATIVE 2B TWO-BRIDGE ROUNDABOUT OPTION WITH LINK ROAD

SUITABILITY
SUITABLE FOR REVIEW & COMMENT

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DRAWING NUMBER
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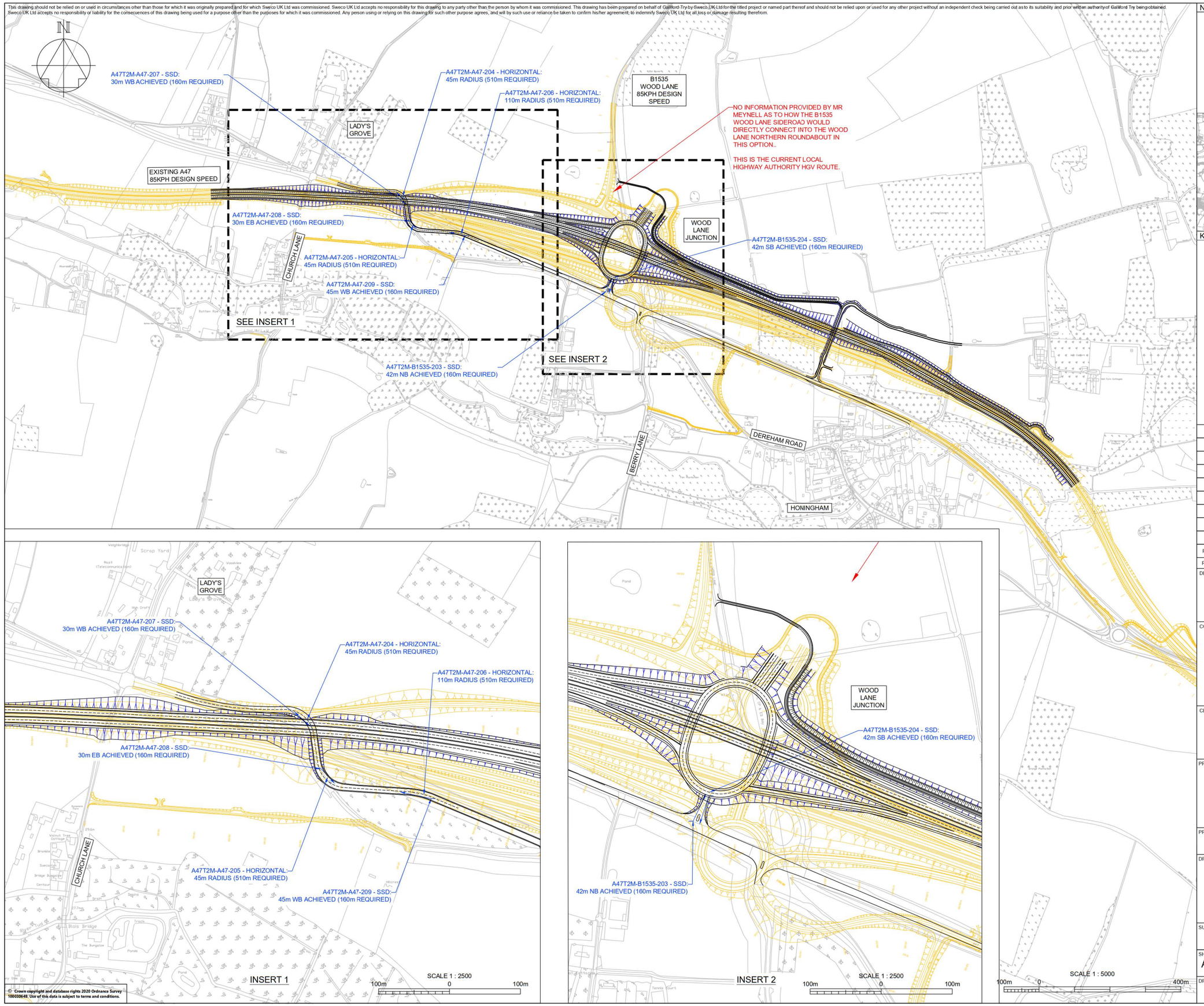

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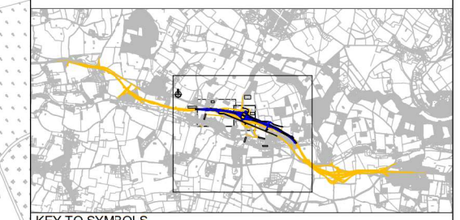

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DESIGNER
SWECO

CONTRACTOR
GallifordTry

CLIENT
highways england

PROJECT TITLE
A47 NORTH TUDDENHAM TO EASTON DUALLING

PROJECT STAGE
PCF STAGE 4

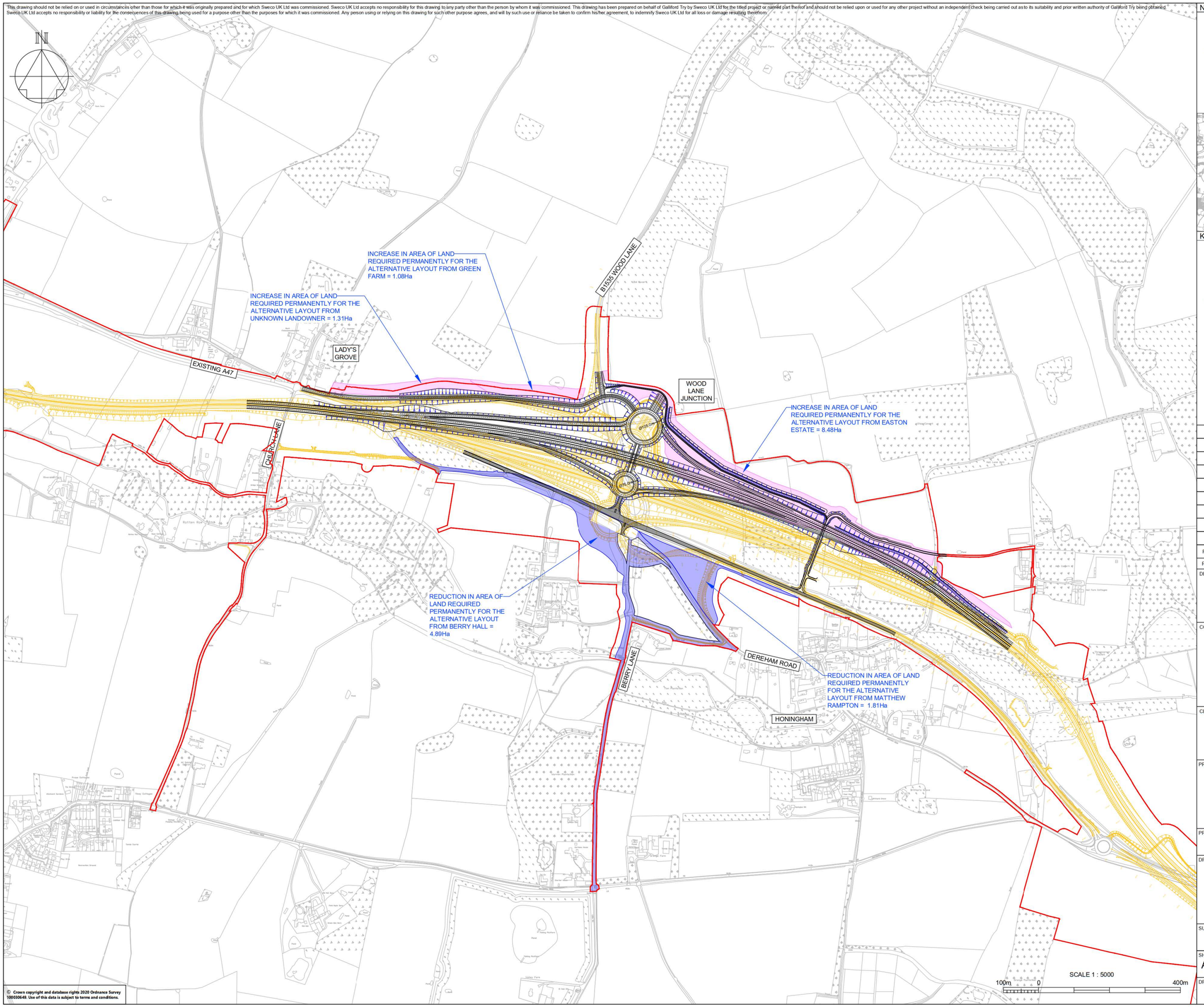
DRAWING TITLE
ALTERNATIVE WOOD LANE JUNCTION OPTIONS APPRAISAL ALTERNATIVE 2A TWO-BRIDGE ROUNDABOUT OPTION WITH UNDERBRIDGE

SUITABILITY
SUITABLE FOR REVIEW & COMMENT

SHEET SIZE	SCALE	STATUS	REVISION
A1	1:5000	S3	P01

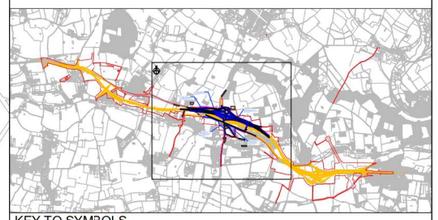
DRAWING NUMBER
HE551489-GTY-HGN-000-SK-CH-00011

APPENDIX C. ALTERNATIVE OPTION LAND TAKE



NOTES

1. PERMANENT LAND TAKE OF THE ALTERNATIVE LAYOUT DEFINED USING AN OFFSET FROM EARTHWORKS COMPARABLE TO THE EXTENT USED FOR THE DEVELOPED DESIGN.
2. THIS FOOTPRINT WAS COMPARED TO THE LAND REQUIRED PERMANENTLY BY THE DEVELOPED DESIGN TO CALCULATE VALUES PROVIDED ON THIS SKETCH.



KEY TO SYMBOLS

- REDUCTION IN AREA OF LAND REQUIRED PERMANENTLY FOR THE ALTERNATIVE LAYOUT
- INCREASE IN AREA OF LAND REQUIRED PERMANENTLY FOR THE ALTERNATIVE LAYOUT
- DCO BOUNDARY

REV	DATE	REVISION NOTE	ORG	CHK'D	APP'D
P01	25/10/21	DRAWING UPDATE	OH	BArt	BArt

DESIGNER
SWECO

CONTRACTOR
GallifordTry

CLIENT
highways england

PROJECT TITLE
A47 NORTH TUDDENHAM TO EASTON DUALLING

PROJECT STAGE
PCF STAGE 4

DRAWING TITLE
ALTERNATIVE WOOD LANE JUNCTION OPTIONS APPRAISAL ALTERNATIVE 1B DUMB BELL OPTION WITH LINK ROAD

SUITABILITY
SUITABLE FOR REVIEW & COMMENT

SHEET SIZE	SCALE	STATUS	REVISION
A1	1:5000	S3	P01

DRAWING NUMBER
HE551489-GTY-HGN-000-SK-CH-00004

REDUCTION IN AREA OF LAND REQUIRED PERMANENTLY FOR THE ALTERNATIVE LAYOUT FROM GREEN FARM = 1.05Ha

REDUCTION IN AREA OF LAND REQUIRED PERMANENTLY FOR THE ALTERNATIVE LAYOUT FROM UNKNOWN LANDOWNER = 1.20Ha

B1535 WOOD LANE

LADY'S GROVE

EXISTING A47

NO INFORMATION PROVIDED BY MR MEYNELL AS TO HOW THE B1535 WOOD LANE SIDEROAD WOULD DIRECTLY CONNECT INTO THE WOOD LANE NORTHERN ROUNDABOUT IN THIS OPTION..

THIS IS THE CURRENT LOCAL HIGHWAY AUTHORITY HGV ROUTE.

WOOD LANE JUNCTION

INCREASE IN AREA OF LAND REQUIRED PERMANENTLY FOR THE ALTERNATIVE LAYOUT FROM EASTON ESTATE = 8.48Ha

CHURCH LANE

REDUCTION IN AREA OF LAND REQUIRED PERMANENTLY FOR THE ALTERNATIVE LAYOUT FROM BERRY HALL = 4.83Ha

DEREHAM ROAD

BERRY LANE

REDUCTION IN AREA OF LAND REQUIRED PERMANENTLY FOR THE ALTERNATIVE LAYOUT FROM MATTHEW RAMPTON = 1.81Ha

HONINGHAM

SCALE 1 : 5000

100m 0 400m

NOTES

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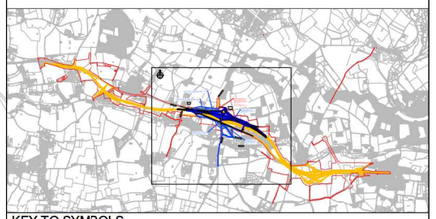

KEY TO SYMBOLS

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- INCREASE IN AREA OF LAND REQUIRED PERMANENTLY FOR THE ALTERNATIVE LAYOUT
- DCO BOUNDARY

REV	DATE	REVISION NOTE	ORG	CHK'D	APP'D
P01	25/10/21	DRAWING UPDATE	OH	BArt	BArt

DESIGNER: SWECO

CONTRACTOR: GallifordTry

CLIENT: highways england

PROJECT TITLE: A47 NORTH TUDDENHAM TO EASTON DUALLING

PROJECT STAGE: PCF STAGE 4

DRAWING TITLE: ALTERNATIVE WOOD LANE JUNCTION OPTIONS APPRAISAL ALTERNATIVE 1A DUMB BELL OPTION WITH UNDERBRIDGE

SUITABILITY: SUITABLE FOR REVIEW & COMMENT

SHEET SIZE	SCALE	STATUS	REVISION
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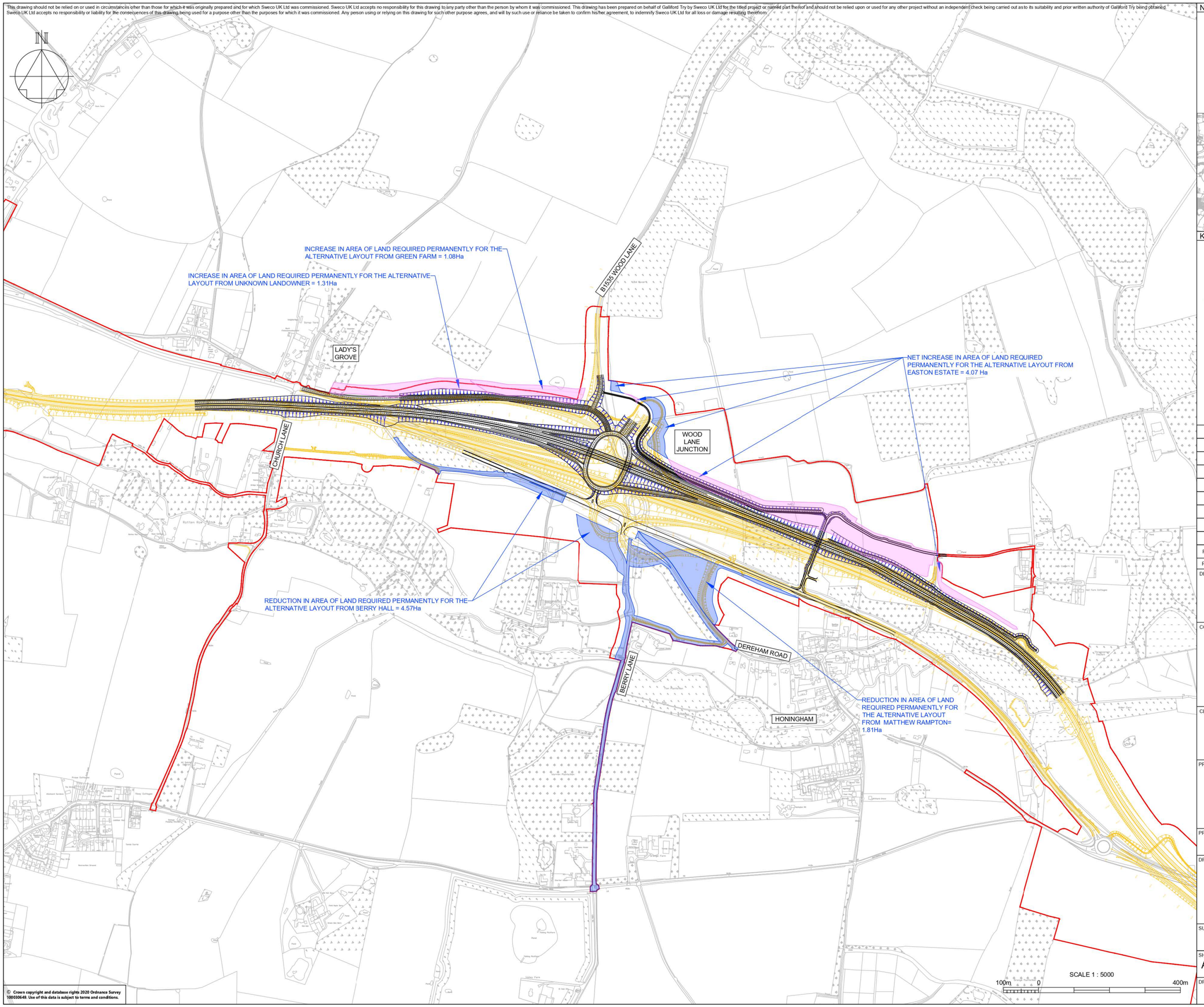
DRAWING NUMBER: HE551489-GTY-HGN-000-SK-CH-00005



NOTES

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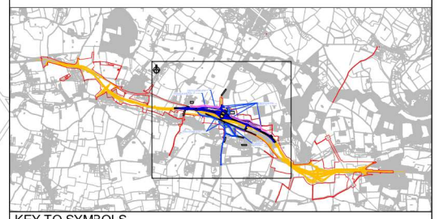
2. THIS FOOTPRINT WAS COMPARED TO THE LAND REQUIRED PERMANENTLY BY THE DEVELOPED DESIGN TO CALCULATE VALUES PROVIDED ON THIS SKETCH.



KEY TO SYMBOLS

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- INCREASE IN AREA OF LAND REQUIRED PERMANENTLY FOR THE ALTERNATIVE LAYOUT
- DCO BOUNDARY

REV	DATE	REVISION NOTE	ORG	CHK'D	APP'D
P01	25/10/21	DRAWING UPDATE	OH	BArt	BArt

DESIGNER
SWECO

CONTRACTOR
GallifordTry

CLIENT
highways england

PROJECT TITLE
A47 NORTH TUDDENHAM TO EASTON DUALLING

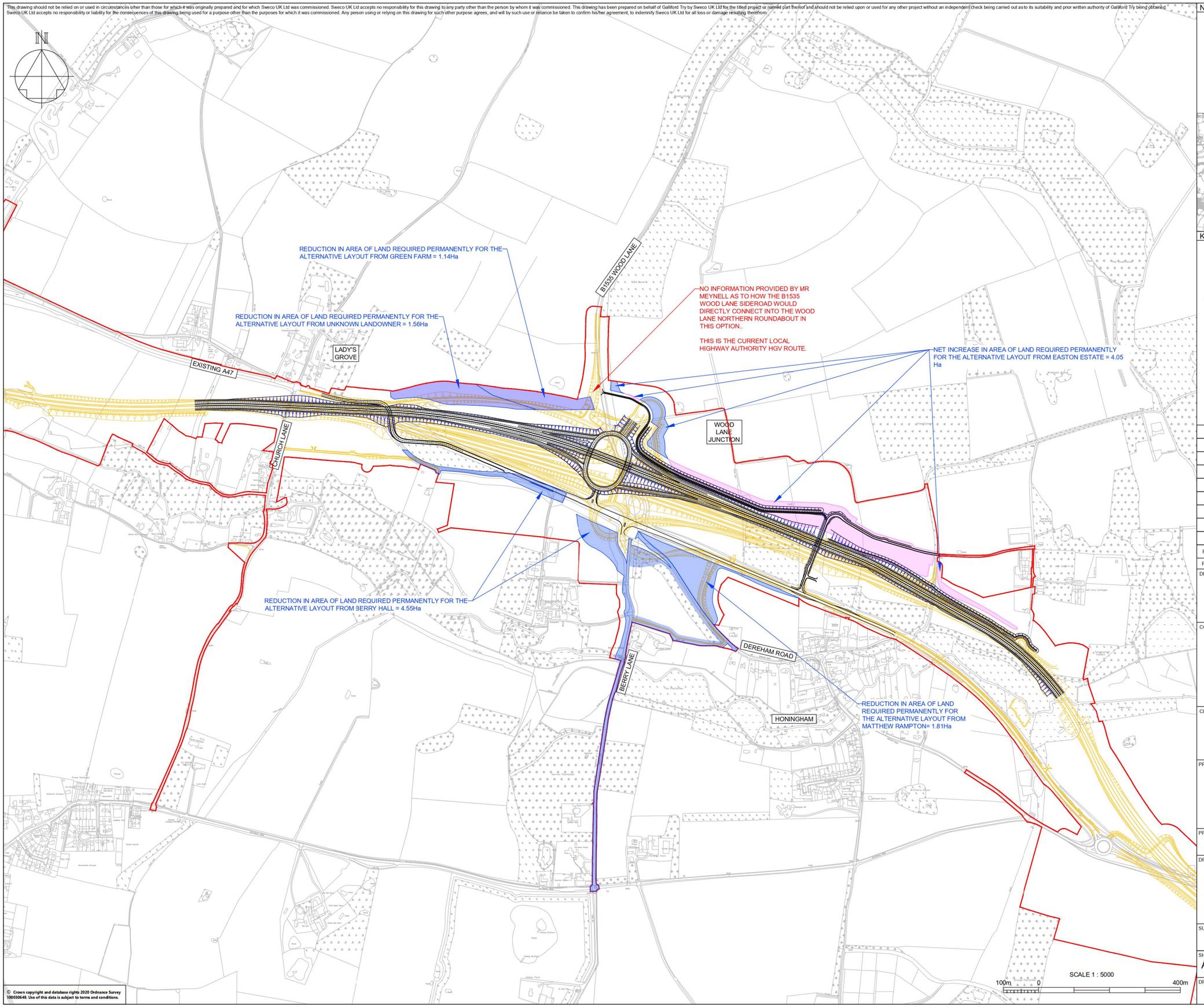
PROJECT STAGE
PCF STAGE 4

DRAWING TITLE
ALTERNATIVE WOOD LANE JUNCTION OPTIONS APPRAISAL ALTERNATIVE 2B TWO-BRIDGE ROUNDABOUT OPTION WITH LINK ROAD

SUITABILITY
SUITABLE FOR REVIEW & COMMENT

SHEET SIZE	SCALE	STATUS	REVISION
A1	1:5000	S3	P01

DRAWING NUMBER
HE551489-GTY-HGN-000-SK-CH-00006



NOTES

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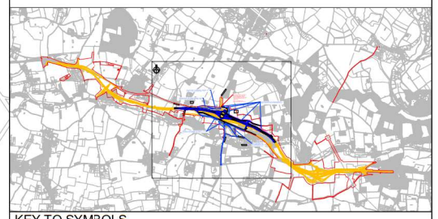
2. THIS FOOTPRINT WAS COMPARED TO THE LAND REQUIRED PERMANENTLY BY THE DEVELOPED DESIGN TO CALCULATE VALUES PROVIDED ON THIS SKETCH.



KEY TO SYMBOLS

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- DCO BOUNDARY

REV	DATE	REVISION NOTE	ORG	CHK'D	APP'D
P01	25/10/21	DRAWING UPDATE	OH	BArt	BArt

DESIGNER: SWECO

CONTRACTOR: GallifordTry

CLIENT: highways england

PROJECT TITLE: A47 NORTH TUDDENHAM TO EASTON DUALLING

PROJECT STAGE: PCF STAGE 4

DRAWING TITLE: ALTERNATIVE WOOD LANE JUNCTION OPTIONS APPRAISAL ALTERNATIVE 2A TWO-BRIDGE ROUNDABOUT OPTION WITH UNDERBRIDGE

SUITABILITY: SUITABLE FOR REVIEW & COMMENT

SHEET SIZE	SCALE	STATUS	REVISION
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DRAWING NUMBER: HE551489-GTY-HGN-000-SK-CH-00007