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# The Norfolk County Council (Norwich Northern Distributor Road (A1067 to A47(T))) Order

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## 10.1 Road Safety Audits and Briefs

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Planning Act 2008

Infrastructure Planning

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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*Author:* Norfolk County Council

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## **INTRODUCTION**

This document is submitted in relation to the application for a Development Consent Order by Norfolk County Council (NCC) to the Secretary of State, under the Planning Act 2008.

The application is for the Norfolk County Council (Norwich Northern Distributor Road (A1067 to A47(T))) Order, to grant development consent for the construction of a new highway running west to east, to south, between the A1067 Fakenham Road and the A47 Trunk Road at Postwick, including improvements to the existing highway network to the north and north east of Norwich.

This document comprises part of the application documents and relates to Regulation 5(2)(q) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009.

The scheme has been the subject of a number of road safety audits carried out by NCC's independent audit teams in accordance with DMRB HD 19/03: Road Safety Audit throughout the development of the scheme.

The NDR Stage 1 Safety Audit was carried out in November 2013. The brief submitted to the road safety audit team, the Safety Audit Report and the response of NCC's highway design team (the Designer's response) are included in Appendix A of this document.

Separate Stage 1 Safety Audits for the three 'off-line schemes', namely Crostwick Junction, Rackheath Junction and Thorpe End Improvements were carried out in September 2013. The brief submitted to the road safety audit team, the Safety Audit Report and the Designer's response are included in Appendix B of this document, which is in three parts: Part 1 – Crostwick Junction; Part 2 – Rackheath Junction; and Part 3 – Thorpe End Improvements.



The Postwick Junction Stage 2 Safety Audit was undertaken in April 2013. The brief submitted to the road safety audit team, the Safety Audit Report and the Designer's response are included in Appendix C of this document.

The road safety audit team at Norfolk County Council has confirmed that the Designer's response for the NDR Stage 1 Safety Audit, Postwick Junction Stage 2 Safety Audit, Crostwick Junction Stage 1 Safety Audit, Rackheath Junction Stage 1 Safety Audit and Thorpe End Improvements Stage 1 Safety Audit are satisfactory and there are no outstanding issues.

## **SCHEDULE OF APPENDICES AND REPORTS INCLUDED IN THIS DOCUMENT**

Document Title	Date
<b>Appendix A comprising:</b>	
Norwich Northern Distributor Road – Stage 1 Safety Audit submission	November 2013
NDR Stage 1 Safety Audit Report	November 2013
Norwich Northern Distributor Road – Stage 1 Safety Audit Designer's Response	November 2013
<b>Appendix B comprising:</b>	
<b>Part 1</b>	
Crostwick Junction Improvements Preliminary Design Stage 1 Safety Audit Submission	September 2013
B1150 Crostwick: Junction Improvement Stage 1 Safety Audit	25 September 2013
Stage 1 Safety Audit, NDR Off Line Improvements – Crostwick Junction Response Sheet	29 September 2013



<b>Part 2</b>	
Rackheath Junction Preliminary Design Stage 1 Safety Audit Submission	September 2013
A1151 Rackheath: Green Lane Junction Improvement Stage 1 Safety Audit	26 September 2013
Stage 1 Safety Audit, NDR Off Line Improvements – Rackheath Junction, Response Sheet	29 November 2013
<b>Part 3</b>	
Thorpe End Highway Improvements Preliminary Design Stage 1 Safety Audit Submission	September 2013
C874 Plumstead Road Thorpe End: Highway Improvement Stage 1 Safety Audit	25 September 2013
Stage 1 Safety Audit, NDR Off Line Improvements – Thorpe End, Response Sheet	29 November 2013
<b>Appendix C comprising:</b>	
A47/A1042 Postwick Hub Junction Stage 2 Safety Audit Submission	April 2013
Postwick Hub Junction Stage 2 Safety Audit	10 April 2013
Postwick Hub Junction Stage 2 Safety Audit, Response Sheet	24 May 2013



## Abbreviations

BGBP	Broadland Gate Business Park
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
ECI	Early Contractor Involvement
HA	Highways Agency
ICD	Inscribed Circle Diameter
kph	kilometres per hour
mph	miles per hour
NCC	Norfolk County Council
NDR	Norwich Northern Distributor Road
NMU	Non-Motorised User
TUBA	Transport Users Benefit Appraisal
SUDS	Sustainable Urban Drainage Systems
vph	vehicles per hour





## Glossary

<b>accommodation works</b>	works to private properties affected by the scheme
<b>connector road</b>	a collective term for interchange links, link roads, slip roads and loops
<b>crest curve</b>	a vertical curve that rises to a high point
<b>cycle track</b>	a track separated from the main carriageway for use by cyclists
<b>footway</b>	the pedestrian-only area normally adjacent to a road and often separated from it by means of a kerb
<b>ghost island</b>	an area of carriageway suitably marked to separate lanes of traffic travelling in the same direction on both merge and diverge layouts
<b>grade separated junction</b>	a road junction where roads cross at different levels
<b>hardstrip</b>	a surfaced strip that abuts the carriageway edge
<b>infiltration</b>	the act of storm water slowly filtering into the ground
<b>lane drop</b>	a layout where a lane or lanes of the upstream carriageway becomes the diverging connector
<b>mainline</b>	the carriageway carrying the main flow of traffic (generally passing straight through a junction or interchange)
<b>merge/diverge</b>	a layout where merging or diverging traffic joins or leaves the mainline carriageway
<b>non-motorised user</b>	pedestrian, cyclists and equestrians (sometimes abbreviated to NMU)
<b>overbridge</b>	a bridge that carries a side road over the main road
<b>pavement</b>	the part of the road on which vehicles travel; the construction make-up of the road carriageway



# APPENDIX A

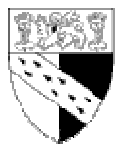


# APPENDIX A

Norwich Northern Distributor Road –  
Stage 1 Safety Audit submission

November 2013





**Norfolk** County Council

# **NORWICH NORTHERN DISTRIBUTOR ROAD**

## **Stage 1 Safety Audit**

# **2013**

Prepared by Norfolk County Council

**November 2013**

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# **NORWICH NORTHERN DISTRIBUTOR ROAD**

## **Stage 1 Safety Audit**

# **2013**

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# Norwich Northern Distributor Road

## Stage 1 Safety Audit


2013

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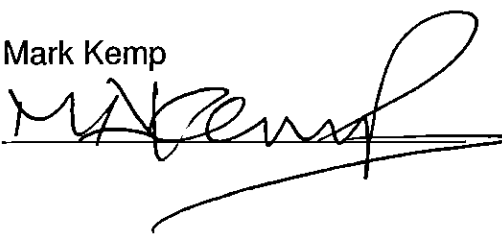


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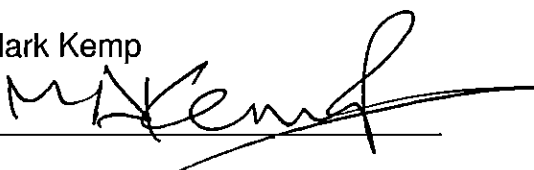


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## Contents - Stage 1 Safety Audit Report 2013

	Page No
1. Background .....	9
2. Previous Safety Audits.....	10
3. Outcome of Consultations.....	10
4. Traffic Modelling.....	11
5. Road Design Standards and Speed Limits.....	11
6. Departures and Relaxations from Standard.....	12
7. Scheme Description.....	15
8. Junctions.....	17
9. Structures.....	19
10. Wildlife Structures.....	20
11. Drainage.....	20
12. Public Utilities.....	21
13. Landscaping.....	21
14. Non Motorised Users.....	22
15. Signage.....	22
16. Lighting.....	23
17. Vehicle Restraint Systems.....	23
18. Drawings.....	24

## **Appendices - Stage 1 Safety Audit Report 2013**

- A      NDR Layout – Design Speeds (Drawing No R1C093-R1-4342)
- B      Junction Layouts (Drawing No R1C093-R1-4068C to 4080C, 4297C, 4302A & 4303A)
- C      Junctions Geometry Parameters (Drawing R1C093-GP01 to GP15)
- D      Engineering Layout Sheets 1-12 (Drawing No R1C093-R1-4003E to 4014E)
- E      Typical Cross Sections Sheets 1-16 (Drawing No R1C093-R1-5115 to 5130)
- F      Non-Motorised User Links Drawing R1C093-R1-4053A

## **1. BACKGROUND**

- 1.1. The aim of this Safety Audit is to bring together all the elements of the Norwich Northern Distributor Road (NDR) and its associated works into one audit prior to submitting an application for development consent under the Planning Act 2008.
- 1.2. The audit will present some modifications to the scheme that have not previously been formally part of the earlier reports. These modifications are in part, the result of a recent round of formal Public Consultation and previous comments received from the audit team in 2012. The significant modifications have been highlighted in section 1.3 and 1.4 below.
- 1.3. The modifications referred to above comprise:
  - Provision of dual carriageway between A1067 and A140
  - Provision of a new Roundabout at western end of NDR – close to A1067
  - Removal of closure on Fir Covert Road with junction of Reepham Road
  - Provision of new bridge carrying Bell Farm Track over the NDR.
  - Closure of Drayton Lane to the south of the Reepham Road.
  - Removal of at grade roundabout at junction with A140 and provision of grade separated junction.
  - Closure of Broad Lane north of Plumstead Road.
  - Removal of pedestrian/cycle/agricultural vehicle bridge at Low Road, Gt Plumstead and provide all vehicle bridge at Middle Road instead.

1.4. In addition to the above; a number of off-line improvements are also being undertaken at the same time as the main scheme these are as follows:

- Improvements to A1151/Green Lane West Junction.
- Highway improvements on Plumstead Road, Thorpe End.
- Improvements to Crostwick Lane/North Walsham Road junction including closure of Rackheath Lane.

## **2. PREVIOUS SAFETY AUDITS**

2.1. The following historical Safety Audits have been undertaken:

- Stage 0 was carried out in March 2007
- Stage 1 was carried out in December 2008
- Stage 1 was carried out in February 2012
- Stage 2 was carried out in April 2013 (Postwick Hub Junction only)
- Stage 1 was carried out in September 2013 (off-line improvements only)

2.2. As set out in 2.1 above the last full audit was undertaken in February 2012.

2.3. The Safety Audit submissions listed in 2.1 above have not been included in the appendices of this report, but can be made available if required.

## **3. OUTCOME OF CONSULTATIONS**

3.1. A series of exhibitions were undertaken on the NDR (including the Postwick Hub Junction) in July/August/September 2013 as part of the statutory process prior to submitting an application for development consent. The results of these consultations have been considered and where appropriate are reflected in the drawings contained within this safety audit.



#### **4. TRAFFIC MODELLING**

- 4.1. The standard of the NDR has been determined so that the Scheme will meet its key objectives whilst balancing the provision against the Scheme cost and its environmental impact.
- 4.2. Throughout development of the scheme modelling work has demonstrated that improving the level of provision at junctions leads to greater attractiveness to drivers of the new route as an alternative to existing roads and diverts residual traffic away from inappropriate parts of the network. There is potential demand in the network that may only be alleviated by larger or split level junctions. However, Norfolk County Council is looking to provide an optimum and a decision has to be made between the ever increasing costs of larger junctions and their environmental impacts, compared to benefits accruing on the rest of the network. It becomes uneconomic and is likely to impose unacceptable impacts to design for free flow conditions on the NDR at all times, and the additional costs for greater capacity provision for NDR would be at the expense of other improvements in the city and county given the limitations on the Council's transport budget. Hence, accepting some level of congestion on the scheme at peak times, as we already do at other locations on the existing highway network, in order to maintain the cost of the scheme within an affordable budget, makes the best use of Council resources.
- 4.3. The current strategic transport model used to assess the impact of the NDR for the NSIP Development Consent Order (DCO) application is based largely on new origin destination surveys and extensive traffic counts carried out in autumn 2012.

#### **5. ROAD DESIGN STANDARDS AND DESIGN SPEEDS**

- 5.1. All main line links will be designed to the Design Manual for Roads and Bridges (DMRB):

- TD 9/93: (Highway Link Design)
- TD 27/05: (Cross-Sections and Headrooms)
- TD 22/06: (Layout of Grade Separated Junctions)
- TD 51/03: (Segregated Left Turn Lanes and Subsidiary Deflection Islands at Roundabouts)

Roundabouts are designed in accordance with the DMRB

- TD 16/07: (Geometric design of roundabouts).

5.2. Refer to drawing in Appendix A which sets out the design speeds used. Junction Details are contained within in Appendix B and Junction Geometry Details in Appendix C.

## **6. DEPARTURES AND RELAXATIONS FROM STANDARDS**

6.1. The NDR is designed in accordance with the Design Manual for Roads and Bridges (DMRB). Where it has not been possible to comply with the DMRB a Departure from Standards will be sort. These are categorized as follows, those on the Trunk Road network and those on a County Road network.

6.2. The NDR alignment has been designed using the design speeds shown in Appendix C. Based on these design speeds section 5.2 and 5.3 sets out the Departures from Standards that are required

### **6.3. Trunk Road Network – Highways Agency**

6.3.1. Eastbound Diverge Slip Road - layout was submitted to the HA as a Departure from Standard and approved in 2012.

6.3.2. Eastbound Merge Slip Road - layout was submitted to the HA and approved as a Departure from Standard in 2008.

6.3.3. Westbound Merge Slip Road - Departure from Standard to retain the existing two-lane taper merge was submitted to the HA and approved in 2013.

6.3.4. New Postwick Bridge - Departure from Standard for the omission of Abutment Galleries was submitted to the HA and approved in 2010.

6.3.5. The Departure from Standards submissions and approvals listed in 5.2.1 to 5.2.4 above have not been included in the appendices of this report, but can be made available if required.

#### 6.4. **County Road Network – Norfolk County Council**

6.4.1. Cross Sections: The proposed cross section along the length of the mainline design is in accordance with TD27/05 for carriageway, hardstrip and central reserve widths, in some cases verge width provision is 1.5m rather than the required 2.5m. In these situations the verge is reduced due to the need for a shallow drainage swale. The swales are generally 3.0m wide with 1 in 5 side slopes and 200mm depth

6.4.2. NDR/A140 Grade Separated Junction: Based on the vph traffic flows for the eastbound and westbound merge slip roads the ideal layout is a Type E lane gain layout in accordance with TD22/06 Figure 2/3. A Type E layout would provide a single lane merge slip road joining a one lane NDR mainline carriageway to form a two lane downstream mainline carriageway. However, for reasons of route continuity, the NDR mainline has been designed with two lanes throughout. Therefore the nearest compliant layout is a Type A single lane taper merge. A Type A layout has therefore been adopted.

6.4.3. NDR/A140 Grade Separated Junction: The westbound merge slip road has a two way section near the A140 Cromer Road Roundabout South. This is to allow access to a property and for maintenance vehicles to access the lagoon. Therefore the eastbound flow on the slip road will be extremely low. Paragraph 5.27 in TD22/06 states that two way slip roads must be dual carriageway with opposing traffic separated by a physical central reserve with vehicle restraint system. Due to the low opposing flow it is considered that a physical separation would result in an oversized layout. Therefore the two-way section of the slip road is a departure from standards and has been designed as a 7.3m wide two way carriageway. Signing will be provided to

inform drivers of the layout ahead.

- 6.4.4. The NDR passes under Middle Road bridge between Plumstead Road Roundabout (South) and the Business Park Roundabout. At this location the Stopping Sight Distance (SSD) is restricted to 2 steps below standard due to the presence of the required Vehicle Restraint System (VRS) and the bridge pier within the central reservation. Two steps below desirable minimum would normally be considered a relaxation. The horizontal radius under the bridge is also 1 step below standard and therefore this combination of relaxations is a departure from standards.

The departure is considered acceptable by the design team as reduction in SSD will be momentary visibility impairment only. Increased visibility will be achievable over the VRS and behind the bridge pier.

- 6.4.5. At-Grade NMU Crossings: Uncontrolled crossings via refuge islands are provided for cyclists/pedestrians at or close to roundabouts on the NDR. This is considered an acceptable approach given the low crossing flows of pedestrians in particular). DMRB TD16/07 Table 6/1 shows normal provision for pedestrians and cyclists at or near roundabouts where there is significant demand to justify them. However the crossing flows do not support the provision of signalised facilities and their introduction, as suggested in LTN 1/95 paragraph 4.2.4, may actually be detrimental to safety with drivers becoming habituated in to not seeing a red signal. Grade separation of these low flow routes would not be cost effective.

- 6.4.6. At-Grade NMU Equestrian Crossings: Three equestrian crossings are proposed near to roundabouts on the NDR. Holding areas will be provided for equestrians either side of the minor road where equestrians will cross. Due to equestrians taking longer to make a decision to enter the carriageway and the need to manoeuvre from holding areas, these crossing points need to be set further back from the roundabout junctions, using the visibility requirements in TA90/05 Table 3.4. Traffic speeds will be considerably less than the speed limit when leaving the roundabout, therefore it is considered that a 'y' distance of 135m is appropriate for the visibility splay towards the roundabout. For

traffic approaching the roundabouts the 'y' distance should be appropriate to the actual approach speed and visibility splays will be provided in accordance with TA90/05 Table 3.4. Refuse islands will not be provided at equestrian crossing points.

- 6.4.7. With regards to the equestrian crossing point on Wroxham Road, a slightly less 'y' distance of 120m northwards towards the roundabout will be provided.

## **7. SCHEME DESCRIPTION**

- 7.1. The Scheme (the Norwich Northern Distributor Road, known as the NDR) is a dual carriageway all-purpose strategic distributor road, which would link the A1067 Fakenham Road, near Attlebridge to the A47 Trunk Road (T) at Postwick. This will be over a length of approximately 20.4km
- 7.2. From west to east, the NDR is proposed to start at a new at-grade roundabout junction with the A1067 Fakenham Road, located to the west of Taverham. This would then continue eastwards as a dual carriageway to a new at-grade roundabout junction with the C262 Fir Covert Road. From this roundabout, the NDR would then cross the Marriott's Way (a permissive path providing a pedestrian, cycling and horse riding facility along the route of a disused railway; which will cross over the NDR via a new bridge), to a new at-grade roundabout junction with the C261 Reepham Road. This would then continue south eastwards, crossing Bell Farm Track/Horsford Restricted Byway No. 5 (which will be taken up over the NDR via a new Restricted Byway and private access accommodation bridge) before connecting with the C282 Drayton Lane via a new at-grade roundabout junction. Sections of the C282 Drayton Lane either side of its junction with the NDR will be re-aligned.
- 7.3. The NDR would then continue south eastwards from its junction with C282 Drayton Lane to a new grade separated junction (provision of a bridge over the NDR with slip roads to/from the NDR) with the A140 Cromer Road, located close to and just North-West of Norwich International Airport. The provision of this grade separated junction will require the stopping up of

lengths of the B1149 Holt Road and U57142 Holly Lane and the re-alignment westwards of parts of the A140 Cromer Road to take it over the NDR. East of the A140, the NDR would continue as a dual carriageway, turning north eastwards around the northern boundary of the airport to a further new at-grade roundabout junction at the northern tip of the airport. The primary purpose of this roundabout is to allow the NDR to undertake a roughly 90 degree change of direction. From this roundabout, the NDR would continue to follow around the north east part of the airport boundary before turning eastwards and passing under the C246 Buxton Road; which would be re-aligned eastwards and cross over the NDR on a new bridge. The route of the dual carriageway NDR would then continue eastwards through the north of Beeston Park. This would then connect with both the B1150 North Walsham Road and the A1151 Wroxham Road via a new at-grade roundabout at each location, before entering the north eastern section of Rackheath Park approximately 250m from the western end of Sir Edward Stracey Road. The NDR would then turn toward the south-east, passing under re-aligned Newman Road, which will run over the NDR via a new Bridleway/Private Access accommodation bridge.

- 7.4. The NDR would then connect with the C283 Salhouse Road via a new at-grade roundabout, before rising up on an embankment (maximum height approximately 8.5m) to cross both the Norwich to Sheringham rail line and the C874 Plumstead Road on individual bridges in close proximity, prior to a new roundabout on the NDR, which would connect it via new local connections and a further small at-grade roundabout to the C874 Plumstead Road.
- 7.5. The NDR route would then continue southwards, crossing the C442 Middle Road (which would pass over the NDR via a new bridge) before connecting with a new at grade roundabout known as the Business Park Roundabout.
- 7.6. At this point a single carriageway link is provided west to the existing Broadland Way/Peachman Way roundabout and includes an at-grade roundabout on the link road to the proposed Broadland Gate Business Park.

7.7. From the Business Park roundabout the NDR proceeds southwards as a dual carriageway to a new Postwick North East at-grade roundabout immediately north of the A47(T). This roundabout has links from a modified A47(T) eastbound diverge slip road and a new A47(T) eastbound merge slip road. The NDR continues over the A47(T) as a four lane carriageway one lane north and three South; on a new bridge and terminates at its southernmost point at a signalised junction, which replaces the existing Park and Ride roundabout with the A1042 Yarmouth Road.

7.8. This signalised junction provides further links:

- Directly to and from the park and ride site for buses;
- West to the existing Postwick North West roundabout, via the existing Postwick bridge over the A47(T);
- East to the proposed park and ride site entrance at the proposed Oak's Lane roundabout and further East to the Brundall Low Road junction with the A1042 Yarmouth Road to Postwick village; and
- West to the A47(T) via an existing westbound merge slip road.

7.9. The works at the A47 (T) Postwick Junction, will include modifications to the existing Postwick North West roundabout (as a result of closing the existing eastbound diverge slip road) and to the existing A1042 Yarmouth Road overbridge of the A47(T) to provide revised traffic lanes and the provision of a shared use cycle/footway.

## **8. JUNCTIONS**

8.1. Grade separated junctions will be required in the following locations:

- A140 Cromer Road (to include eastbound and westbound merge and diverge slip roads) (Chainage 6800)
- A47 Postwick (to include new roundabout east of the existing roundabout with provision of new eastbound diverge and eastbound merge slip roads)

to/from the A47(T)) (Chainage 19450 – 20400)

8.2. At-grade junctions will be required in the following locations:

- A1047 Fakenham Road (Chainage 510)
- C262 Fir Covert Road (Chainage 1750)
- C621 Reepham Road (Chainage 2910)
- C282 Drayton Lane (Chainage 5330)
- B1150 North Walsham Road (Chainage 12100)
- A1151 Wroxham Road (Chainage 14240)
- C283 Salhouse Road (Chainage 16100)
- 874 Plumstead Road (South) (Chainage 17300)

8.3. On-line access roundabouts will be required in the following locations:

- Northernmost point of Norwich Airport to include a new access to the Petans offshore training facilities and secure access to Norwich International Airport. (Chainage 9120)
- At the proposed Broadland Gate Business Park location to link the NDR new road to the proposed Broadland Gate link road. (Chainage 19450 – 20400)

8.4. Off-line roundabouts will be required in the following locations:

- C282 Drayton Lane/B1149 Holt Road junction
- C874 Plumstead Road (North)
- Proposed site of the Broadland Gate Business Park

8.5. Major/minor priority junction will be required in the following location:



- C282 Drayton Lane/C621 Reepham Road

## **9. STRUCTURES**

9.1. Structures will be required in the following locations:

### **9.1.1. New Overbridges**

- Marriott's Way – permissive path providing a pedestrian, cycling and horse riding facility along the route of disused railway. (Chainage 2390)
- Bell Farm Track – Horsford Restricted Byway No. 5 and private means of access. (Chainage 3980)
- A140 Cromer Road (Chainage 6800)
- C246 Buxton Road (Chainage 10940)
- Private means of access leading from Newman Road (Chainage 15500)
- C442 Middle Road (Chainage 18060)

### **9.1.2. New Underbridges**

- Norwich to Sheringham railway line (Chainage 16920)
- C874 Plumstead Road (Chainage 17010)
- New flood culvert/bat underpass which will be located to the West of Rackheath (Chainage 14810)
- A47 Trunk Road at Postwick (Chainage 2022)

## **10. WILDLIFE STRUCTURES**

10.1. In addition to the above, structures would be provided to facilitate the movement of wildlife across the road and also confinement of some species.

These comprise:

- Badger fencing to confine badger movement and prevent access to carriageway at Deighton Hills, Drayton Drewray, Marriott's Way and Sprowston Wood.
- Seven high level bat bridges at Chainage's 760, 5780, 10020, 12650, 13140, 17730 and 19000 linking to tree canopies, to facilitate the movement of bats across the NDR. These would comprise poles with a horizontal steel structure covered with netting approximately three metres wide between the tree canopies and supported on poles placed so the ends are close to tree branches.
- Deer reflectors to discourage deer from the carriageway.

## **11. DRAINAGE**

11.1. Highway drainage has been designed, in consultation with the Environment Agency, using the principles of sustainable drainage in accordance with government guidance set out in Planning Policy Statement (PPS) 25 and the DMRB and the Construction Industry Research and Information Association (CIRIA) Report C697. Various legislative controls and guidance on ground

and surface water quality will also be followed, and assessments made using guidance within the DMRB.

- 11.2. The majority of the scheme will be drained using a system of grass swales, which will convey water from the carriageway into 30 infiltration basins eventually resulting in the runoff discharging into the ground.

## **12. PUBLIC UTILITIES**

- 12.1. Various utility services are present along the NDR route, mainly on arterial roads crossing the NDR where plant will be protected or diverted. The affected utilities are:

- |                           |                            |
|---------------------------|----------------------------|
| ▪ Anglian Sewage          | ▪ Vodafone                 |
| ▪ Anglian Water           | ▪ Virgin Media             |
| ▪ UK Power Networks       | ▪ High Pressure Gas (GPSS) |
| ▪ National grid Gas mains | ▪ BT                       |

## **13. LANDSCAPING**

- 13.1. Landscaping is shown on the Engineering Layout Drawings Appendix D and is proposed beyond areas where sight-lines are required, the principal measures being:

- Planting of side slopes
- Provision of boundary hedges
- Combined ecological and landscape mitigation areas to link existing woodland areas, comprising a mixture of woodland, scrub and grassland.
- Additional planting by agreement with adjacent landowners to augment the

roadside planting.

- Larger blocks of planting proposed at adjacent fields in conjunction with earth mounding at specific locations where screening is required for affected properties.

## **14. NON MOTORISED USERS (NMU)**

- 14.1. Public rights of way and private access track proposals are on the Engineering Layout Drawings Appendix D. The NDR should bring benefits for NMUs in conjunction with the aim of the NDR scheme to reduce traffic levels on local roads. This should provide a more conducive environment for pedestrians and cyclists and encourage a greater number of journeys by these modes. Wider NMU links are shown on the drawing in Appendix F.
- 14.2. PROW proposals have been consulted on with relevant user groups (Ramblers, Cyclists, Sustrans, British Horse Society) and the Local Access Forum (set up under the Countryside and Rights of Way Act to represent users of soft roads and public rights of way).
- 14.3. An NMU Audit is currently being undertaken and will be submitted as part of the Stage 2 Safety Audit.

## **15. SIGNAGE**

- 15.1. The NDR will be signed in accordance with The Traffic Signs Regulations and General Directions 2002 including the Traffic Signs Manual, and other relevant standards. This will include all relevant warning and regulatory signs, direction signs to provide route information and other information signs that are considered necessary. Signing will be required on the NDR and the side roads which join it. Other signs on the existing road network may need to be

modified to take account of the introduction of the NDR, to be compatible with both the Highway Agency and the County Councils routing strategies. Signs will be unlit where Regulations permit; those that will require illumination will be within 50 yards of a street lighting system.

## **16. LIGHTING**

16.1. The majority of the proposed scheme will not be lit. The exception to this is the Postwick area of the scheme which will provide lighting as follows:

- From the Business Park roundabout West to the Peachman Way roundabout on 10m high columns. (Chainage 19450 – 20400)
- South to and including the Postwick North East roundabout on 12m high columns. (Chainage 19450 – 20400)
- South from the Postwick North East roundabout across the new overbridge to the signalised junction on 12m high columns. (Chainage 19450 – 20400)
- The signalised junction on 12m high columns. (Chainage 19450 – 20400)
- On the modified A47(T) bridge on 10m columns. (Chainage 19450 – 20400)
- From the modified A47(T) bridge to and including Postwick North West roundabout on 12m high columns. (Chainage 19450 – 20400)

## **17. VEHICLE RESTRAINT SYSTEMS**

- 17.1. The development of the proposals for vehicle restraint systems (VRS) have been assessed and designed dependent on whether the section of the scheme forms part of the Trunk Road Network or the Local County Highway Network.
- 17.2. On the Trunk Road sections of the scheme, the provision of VRS has been assessed and designed in accordance with the DMRB TD19/06 and the Road Restraint Risk Assessment Process (RRRAP)
- 17.3. A Speed limit of 40mph is proposed for the Postwick Junction links, which form part of the local County Highway network. Consequently, the provision of VRS has been assessed using the emerging "The Use of Vehicle Restraint Systems in Norfolk" guidance on County Roads developed by Norfolk County Council.
- 17.4. The NDR from Business Park roundabout north-westwards is subject to national speed limit, therefore it is considered more appropriate for VRS to be assessed in accordance with the DMRB TD19/06 and the Road Restraint Risk Assessment Process (RRRAP), and will be submitted as part of the Stage 2 Safety Audit.

## **18. DRAWINGS**

- 18.1. Relevant drawings are provided in the Appendices as follows:
- The NDR Layout – Design Speeds drawing number R1C093-R1-4342, Appendix A (Naming conventions, design speeds and speed limits are shown on this drawing)
  - The Engineering Layout Sheets 1 - 12, drawings numbers R1C093-R1-4003E to 4014E in Appendix D (Public rights of way and private access tracks are shown on these drawings)
  - Typical cross-sections drawings numbers R1C093-R1-5115 to 5130 in Appendix E

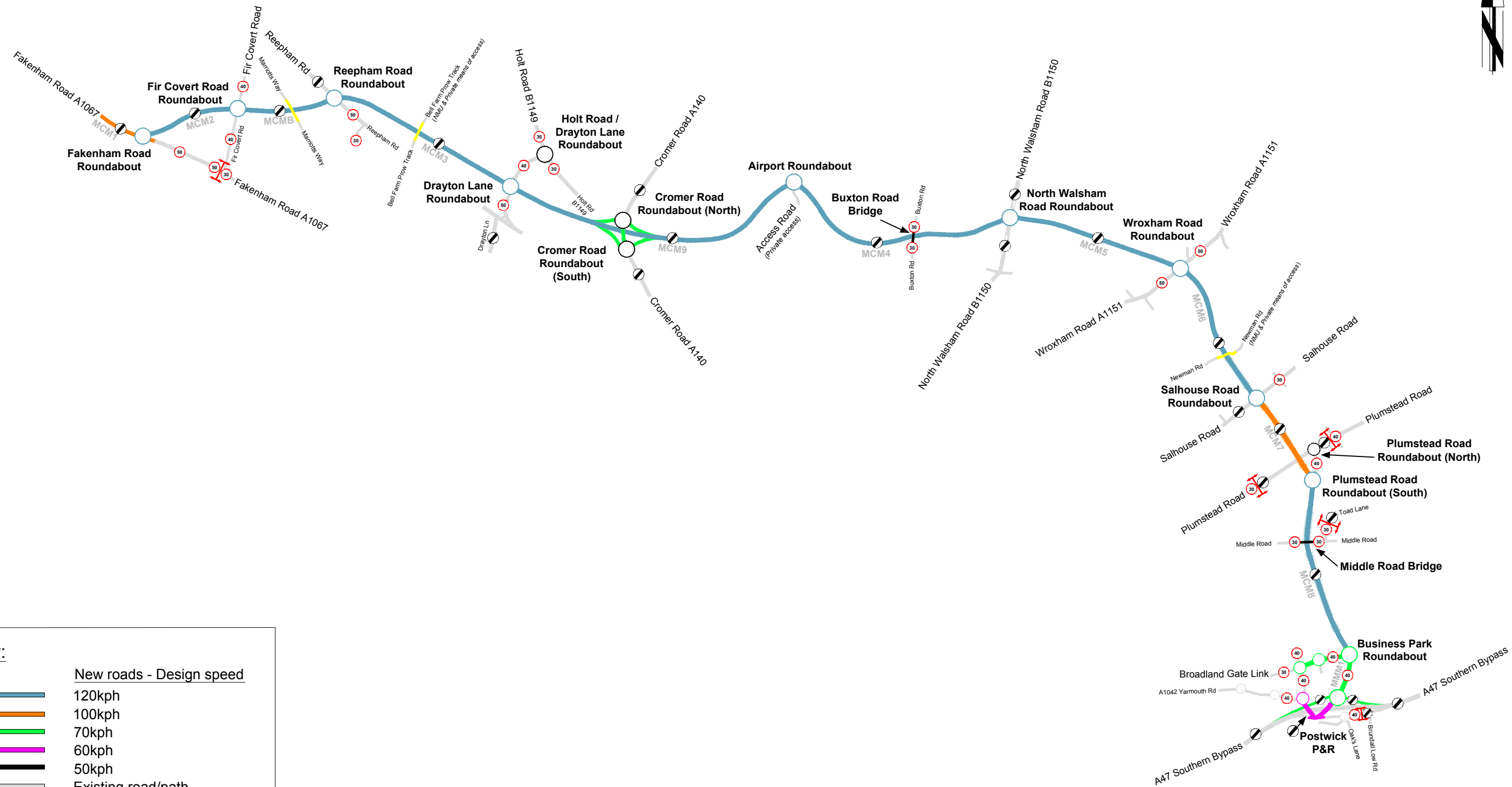
- Individual Junctions drawings numbers R1C093-R1-4068C to 4080C, 4297C, 4302A & 4303A in Appendix B
- Non-Motorised User Links drawing number R1C093-R1-4053A in Appendix F





Appendix A  
NDR Layout – Design Speeds  
(Drawing No R1C093-R1-4342)





**Key:**

New roads - Design speed

- 120kph
- 100kph
- 70kph
- 60kph
- 50kph

Existing road/path

Non motorised user (NMU) crossing

Speed limit MPH/National

Link road reference number

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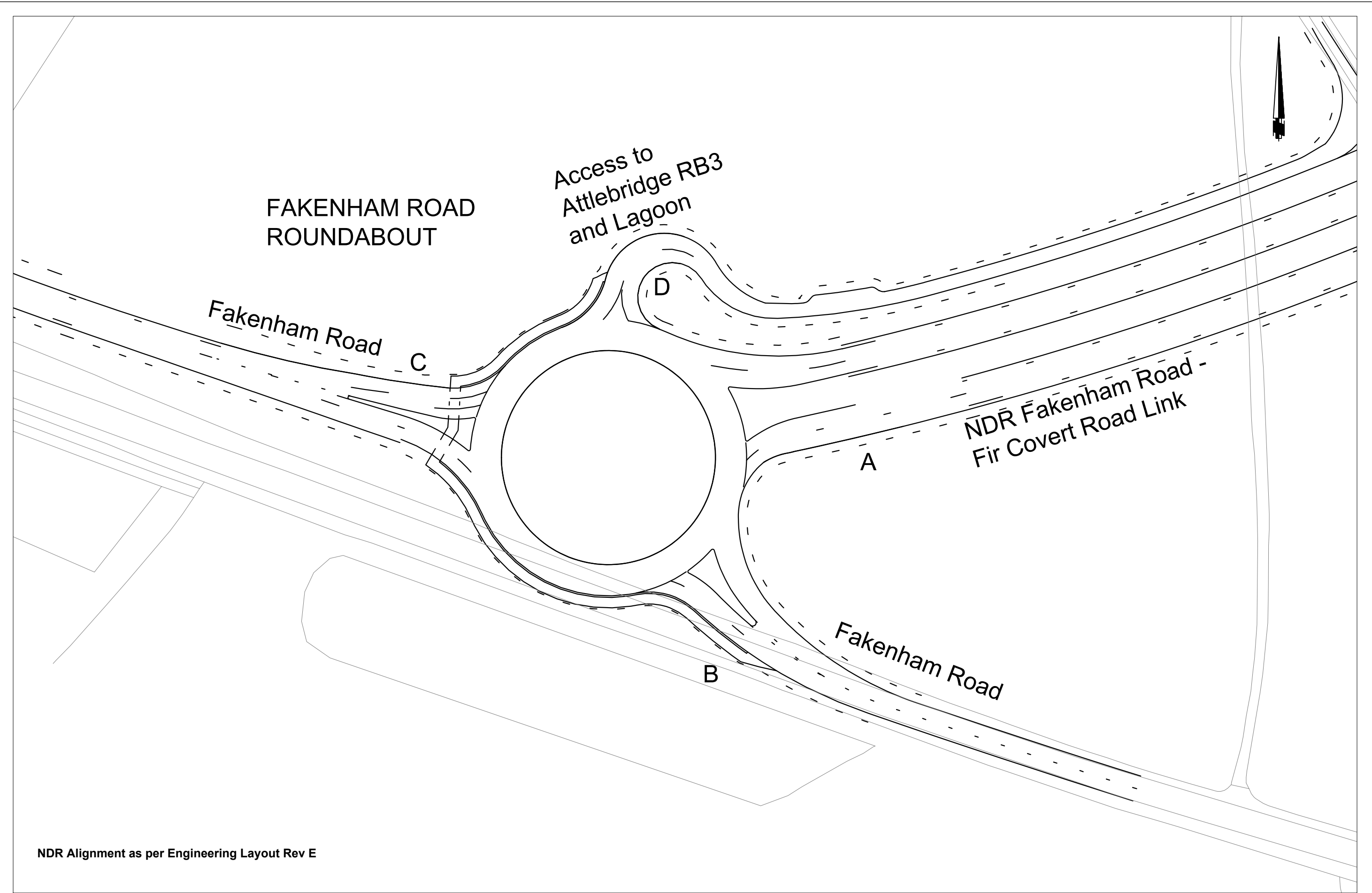
**Tom McCabe**  
Interim Director of Environment  
Transport and Development  
Norfolk County Council  
County Hall, Martineau Lane  
Norwich NR1 2SG

DRAWING TITLE  
NORWICH NORTHERN DISTRIBUTOR ROAD (NDR)  
NDR LAYOUT - DESIGN SPEEDS



REV.	DESCRIPTION	CHECKED	DATE


INITIALS	DATE	DRAWING No.
		R1C093-R1-4342
SURVEYED BY	OS	PROJECT TITLE
DESIGNED BY	AC-J	Norwich Northern Distributor Road
DRAWN BY	AC-J	SCALE
CHECKED BY	SWC	1:50000 at A3
		FILE No.
		R1C093

Appendix B  
Junction Layouts  
(Drawing No R1C093-R1-4068C to  
4080C, 4297C, 4302A & 4303A)



NDR Alignment as per Engineering Layout Rev E



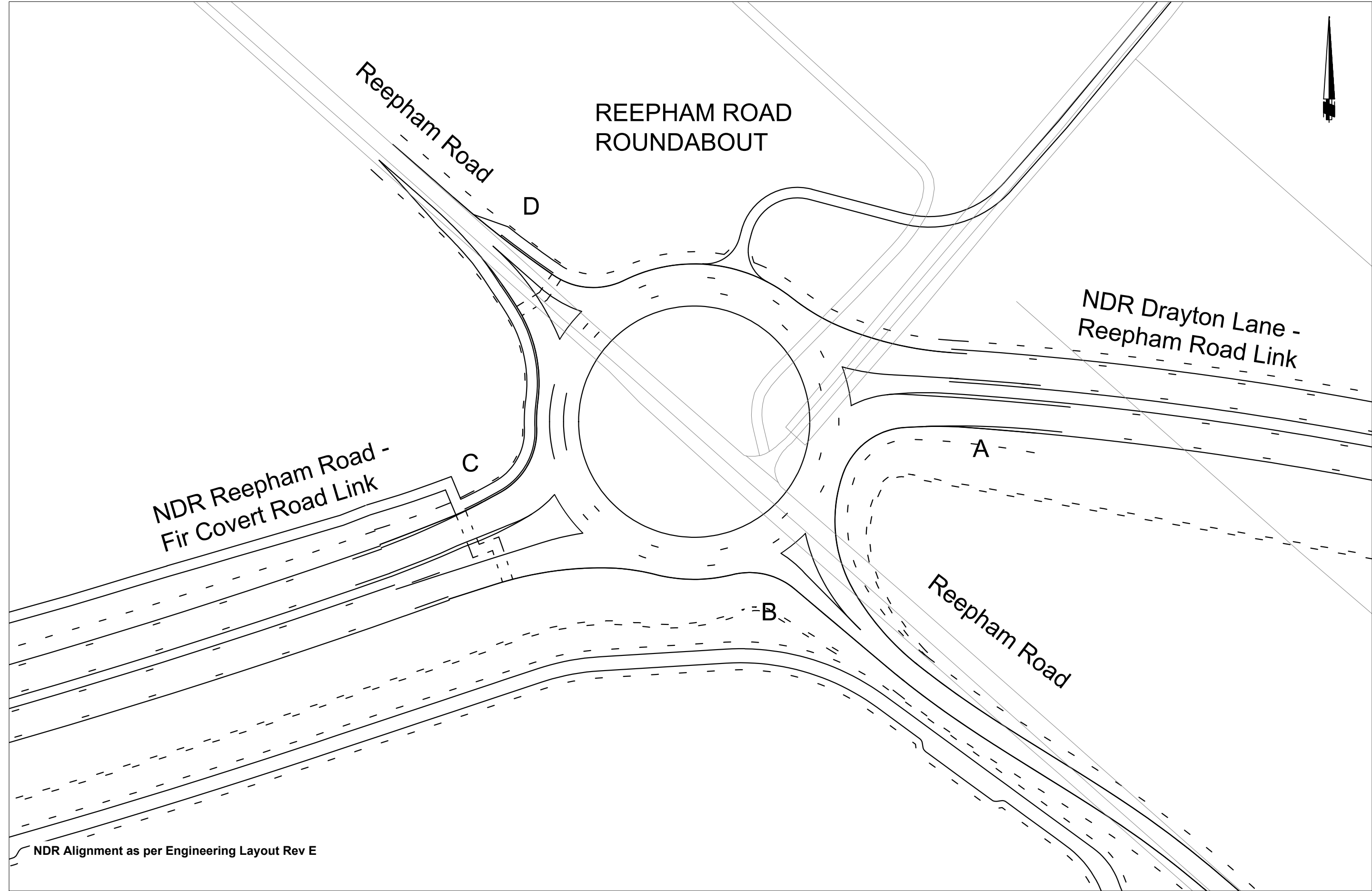


**Mike Jackson**  
Director of Environment,  
Transport and Development  
Norfolk County Council  
County Hall, Martineau Lane  
Norwich NR1 2SG

**DRAWING TITLE**  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ROUNDAABOUT GEOMETRY - SHEET 1 OF 14  
FAKENHAM ROAD ROUNDABOUT

REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached geometry unchanged from Rev D	MKu	10/13

	INITIALS	DATE	DRAWING No. R1C093-R1-406-C
SURVEYED BY	-	-	PROJECT TITLE
DESIGNED BY	DG	11/12	Norwich Northern Distributor Road
DRAWN BY	DG	11/12	SCALE 1:1000 A3
CHECKED BY	MKu	11/12	FILE No. R1C093



NDR Alignment as per Engineering Layout Rev E

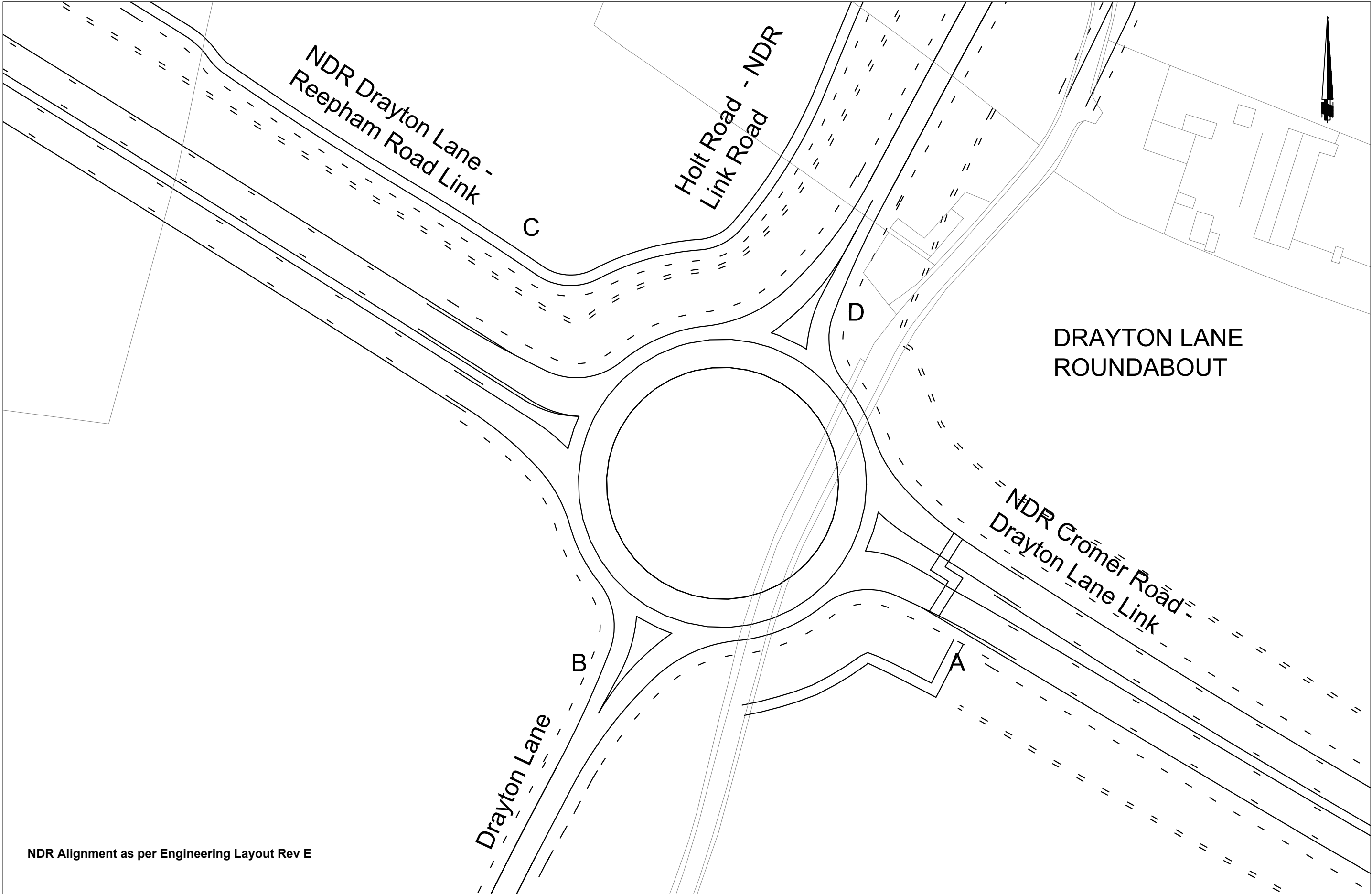


Mike Jackson  
Director of Environment,  
Transport and Development  
Norfolk County Council  
County Hall, Martineau Lane  
Norwich NR1 2SG



DRAWING TITLE  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ROUNDBOUT GEOMETRY - SHEET 2 OF 14  
REEPHAM ROAD ROUNDBOUT


REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached 'geometry unchanged' from Rev D	MKu	10/13

	INITIALS	DATE	DRAWING No. R1C093-R1-4069C
SURVEYED BY	-	-	PROJECT TITLE Norwich Northern Distributor Road
DESIGNED BY	DG	11/12	SCALE 1:1000 A3
DRAWN BY	DG	11/12	FILE No. R1C093
CHECKED BY	MKu	11/12	



NDR Alignment as per Engineering Layout Rev E



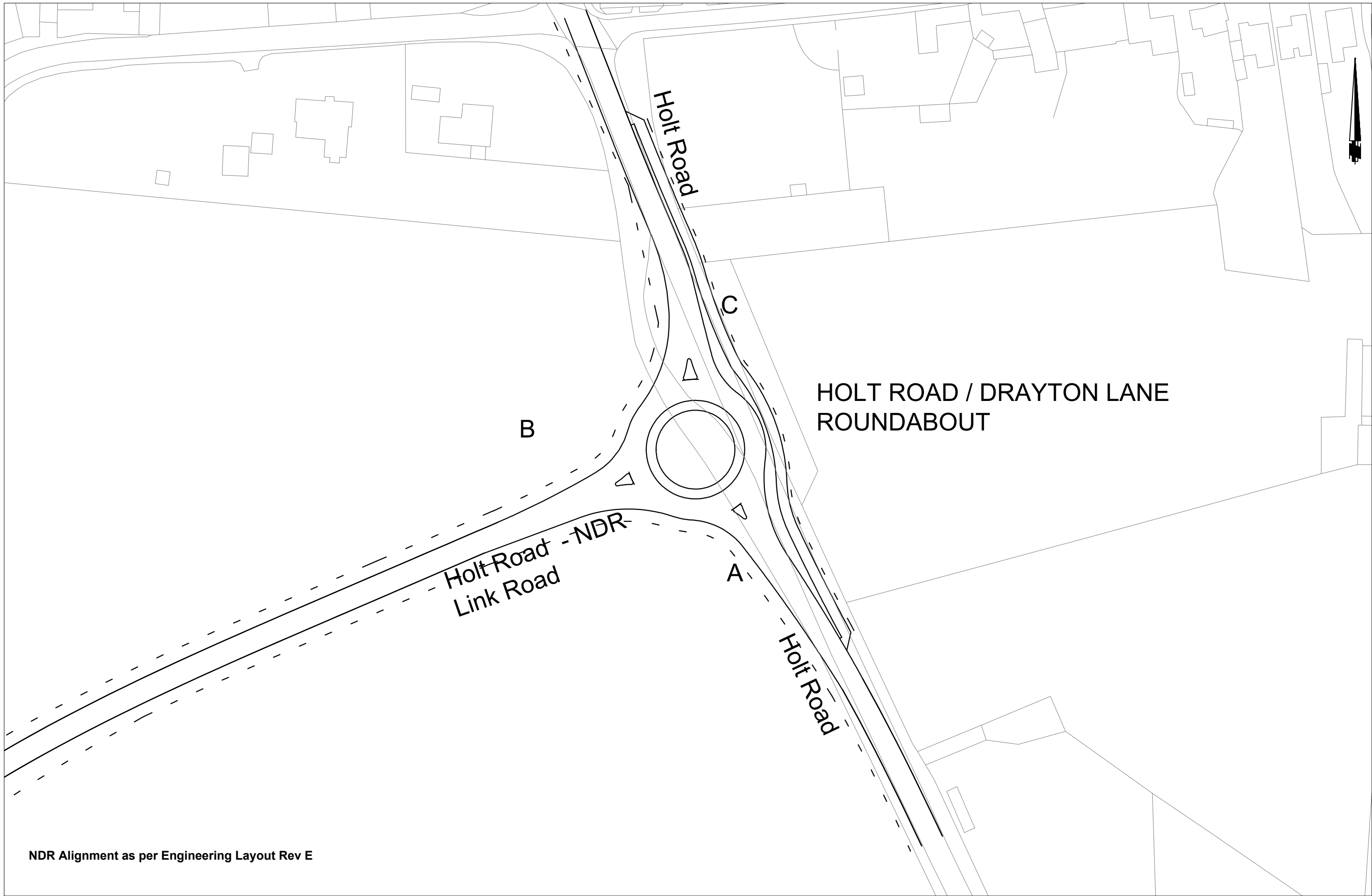


**Mike Jackson**  
Director of Environment,  
Transport and Development  
Norfolk County Council  
County Hall, Martineau Lane  
Norwich NR1 2SG



**DRAWING TITLE**  
NORWICH NOTHERN DISTRIBUTOR ROAD  
ROUNDABOUT GEOMETRY - SHEET 3 OF 14  
DRAYTON LANE ROUNDABOUT


REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached geometry unchanged from rev D	MKu	10/13

	INITIALS	DATE	DRAWING No. R1C093-R1-4070C
SURVEYED BY	-	-	PROJECT TITLE
DESIGNED BY	DG	11/12	Norwich Northern Distributor Road
DRAWN BY	DG	11/12	SCALE 1:1000 A3
CHECKED BY	MKu	11/12	FILE No. R1C093



NDR Alignment as per Engineering Layout Rev E





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Norwich NR1 2SG

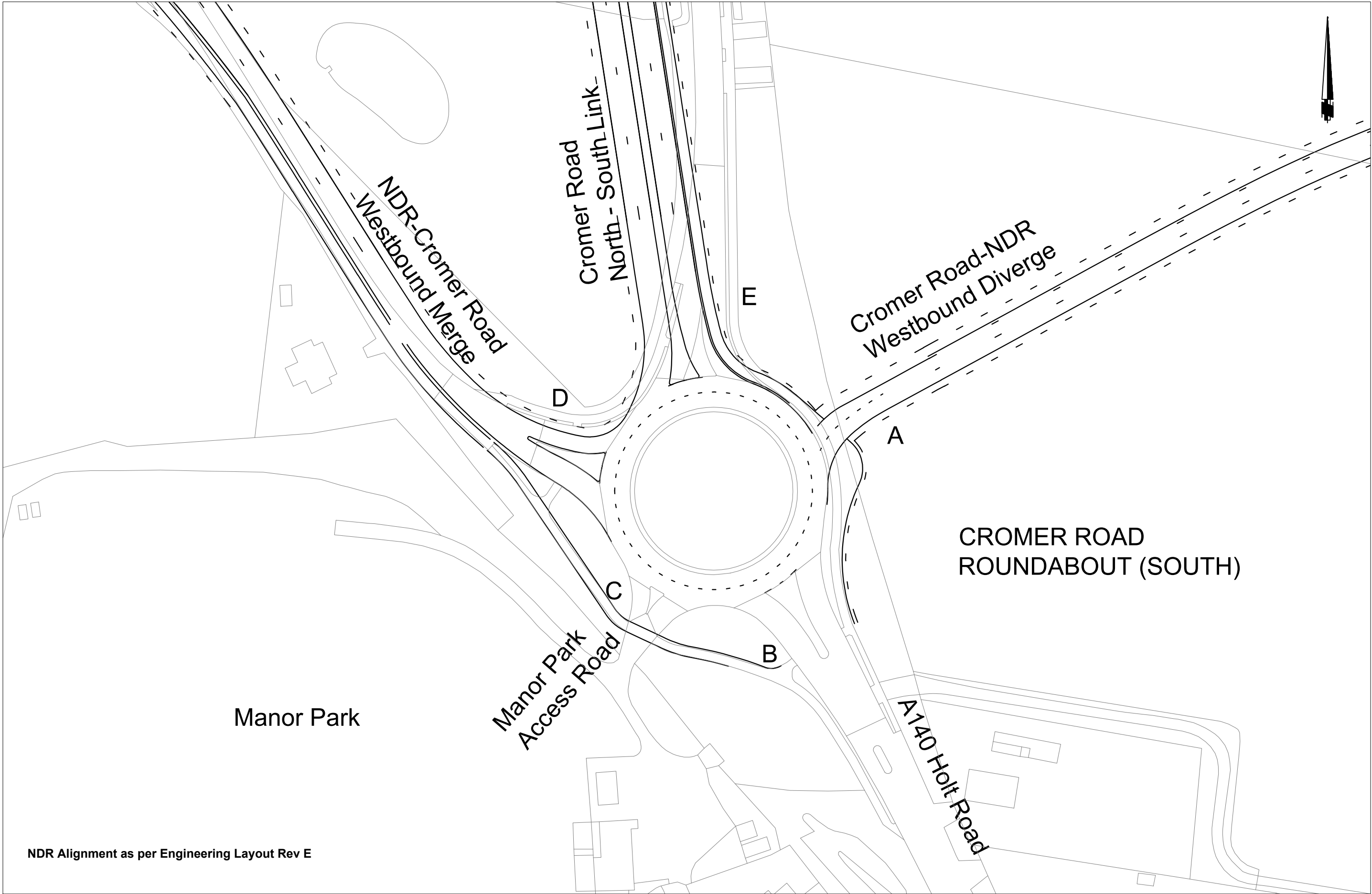
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NORWICH NORTHERN DISTRIBUTOR ROAD  
ROUNDAABOUT GEOMETRY - SHEET 4 OF 14  
HOLT ROAD / DRAYTON LANE ROUNDABOUT

REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached: geometry unchanged from Rev D	MKu	10/13

	INITIALS	DATE
SURVEYED BY	-	-
DESIGNED BY	DG	11/12
DRAWN BY	DG	11/12
CHECKED BY	MKu	11/12

DRAWING No. R1C093-R1-4071C	
PROJECT TITLE Norwich Northern Distributor Road	
SCALE 1:1000 A3	FILE No. R1C093





NDR Alignment as per Engineering Layout Rev E

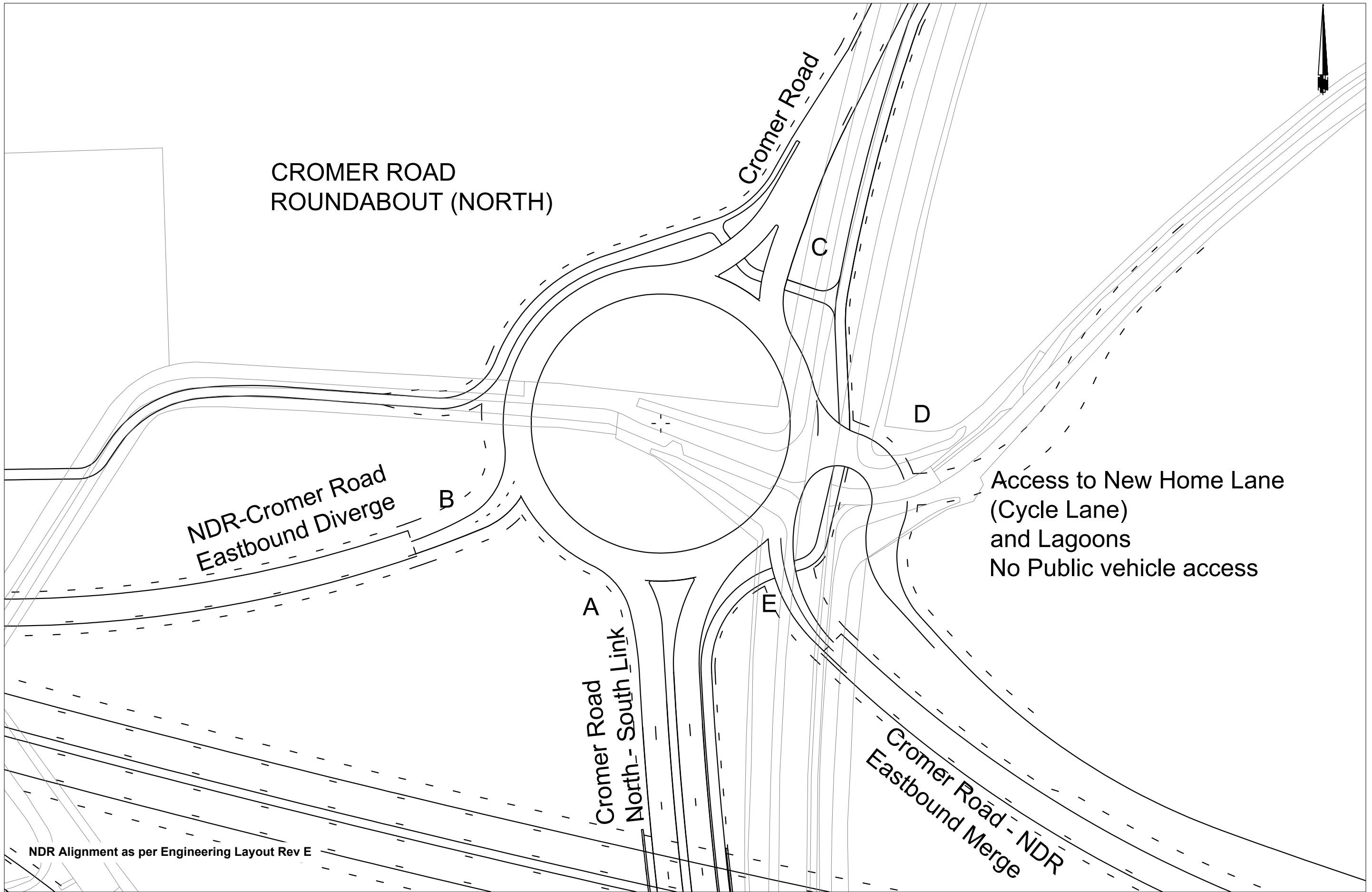



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Director of Environment,  
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Norwich NR1 2SG

DRAWING TITLE  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ROUNDABOUT GEOMETRY - SHEET 5 OF 14  
CROMER ROAD ROUNDABOUT (SOUTH)

REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached 'geometry unchanged' from Rev D	MKu	10/13

	INITIALS	DATE	DRAWING No. R1C093-R1-4072C
SURVEYED BY	-	-	PROJECT TITLE Norwich Northern Distributor Road
DESIGNED BY	DG	11/12	SCALE 1:1000 A3
DRAWN BY	DG	11/12	FILE No. R1C093
CHECKED BY	MKu	11/12	



NDR Alignment as per Engineering Layout Rev E

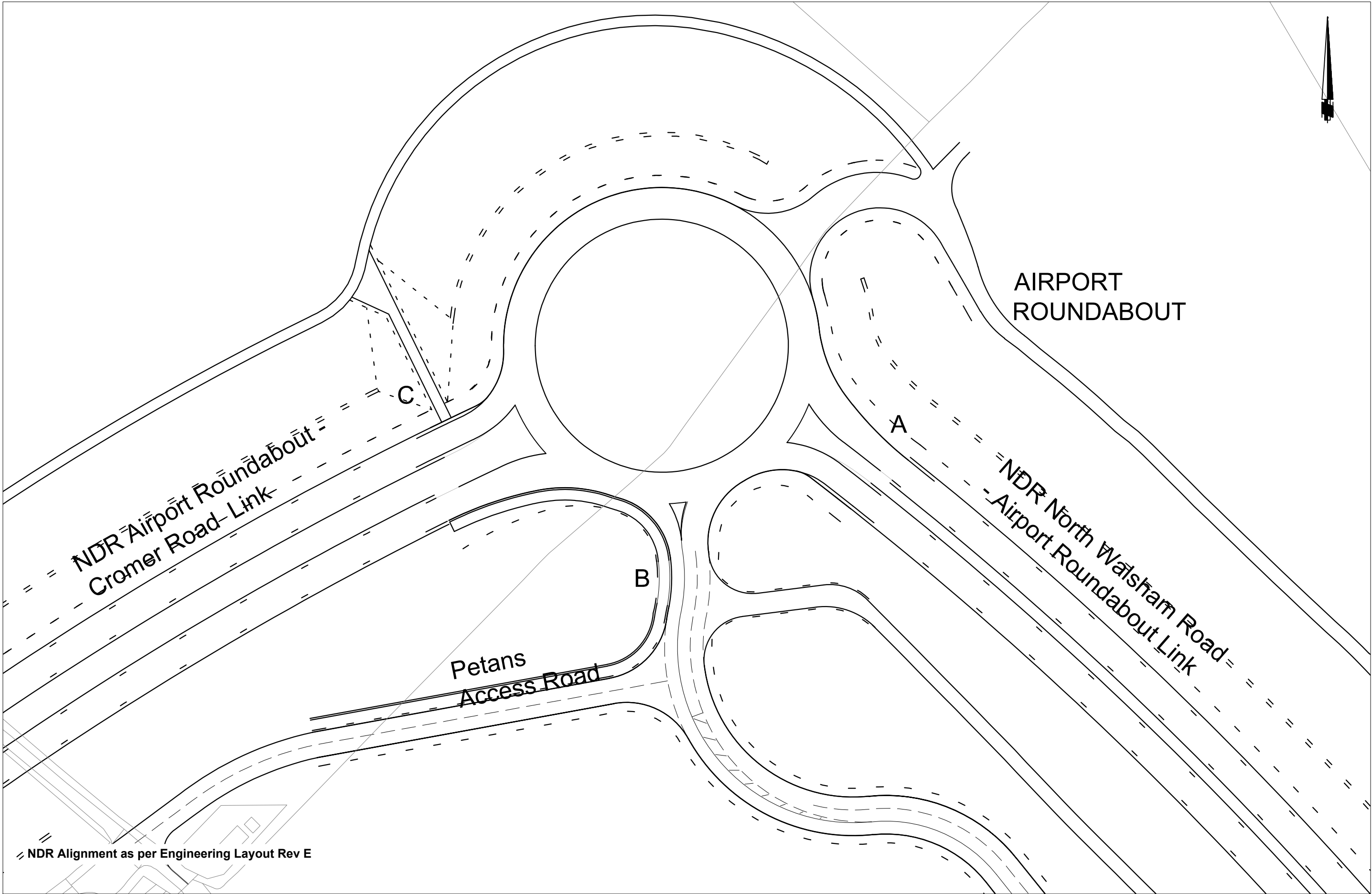


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Norwich NR1 2SG

DRAWING TITLE  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ROUNDBOUT GEOMETRY - SHEET 6 OF 14  
CROMER ROAD ROUNDBOUT (NORTH)

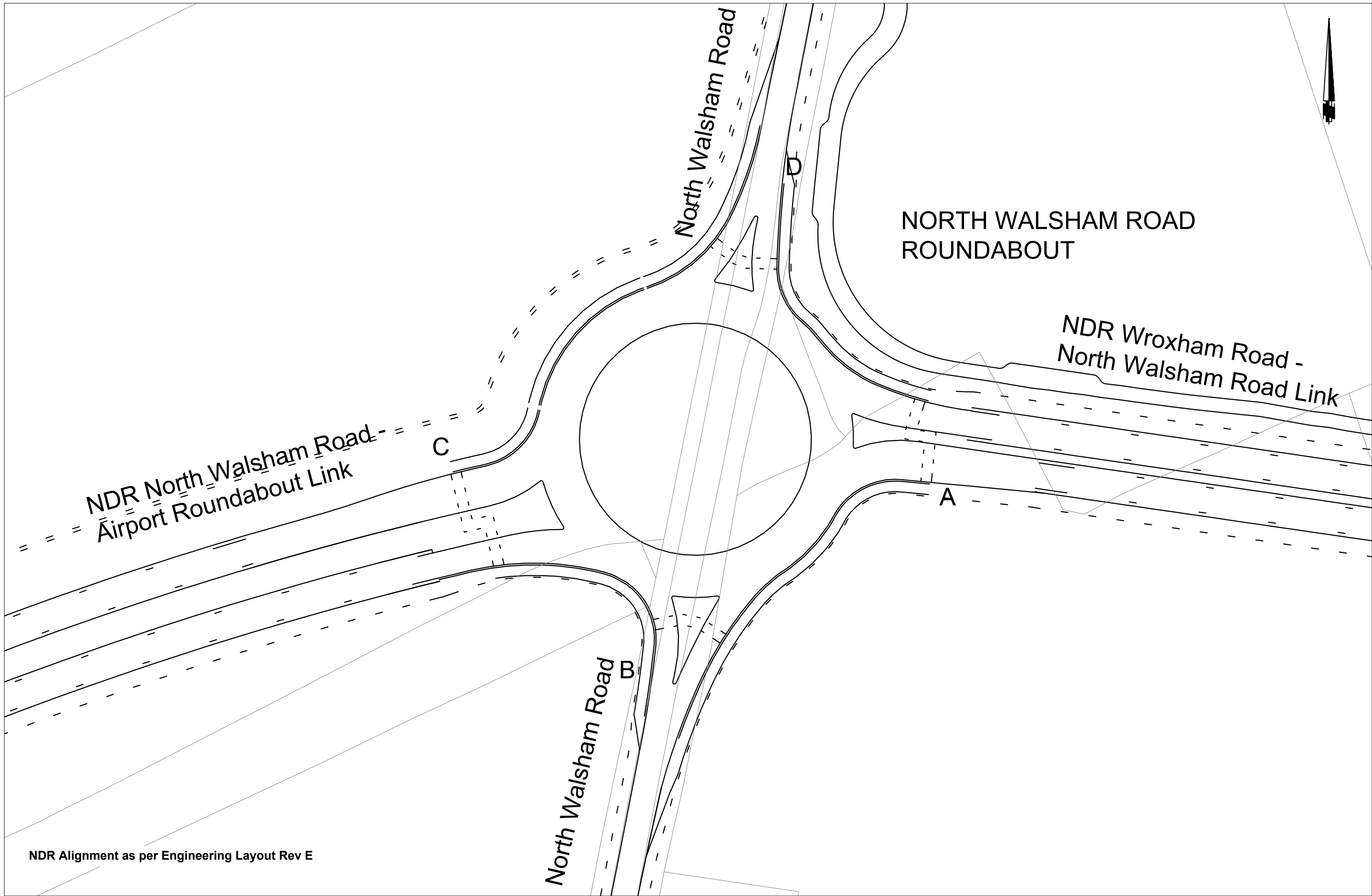
REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached geometry unchanged from Rev D	MKu	10/13

	INITIALS	DATE	DRAWING No. R1C093-R1-4073C
SURVEYED BY	-	-	PROJECT TITLE Norwich Northern Distributor Road
DESIGNED BY	DG	11/12	SCALE 1:1000 A3
DRAWN BY	DG	11/12	FILE No. R1C093
CHECKED BY	MKu	11/12	



REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached geometry unchanged from Rev D	MKu	10/13

	INITIALS	DATE	DRAWING No. R1C093-R1-4074C
SURVEYED BY	-	-	PROJECT TITLE
DESIGNED BY	DG	11/12	Norwich Northern Distributor Road
DRAWN BY	DG	11/12	SCALE 1:1000 A3
CHECKED BY	MKu	11/12	FILE No. R1C093



NDR Alignment as per Engineering Layout Rev E



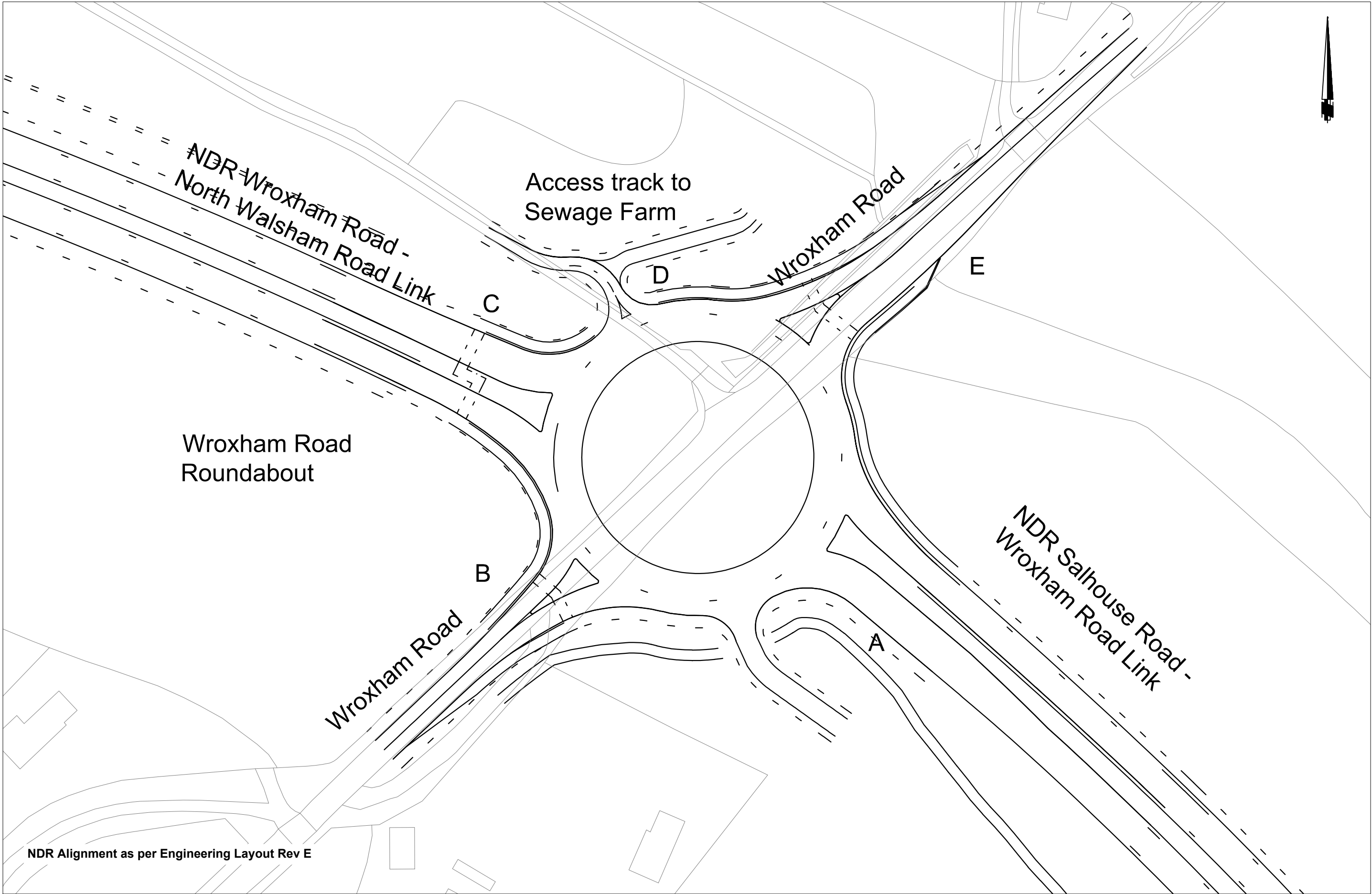
Mike Jackson  
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Norwich NR1 2SG

DRAWING TITLE  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ROUNDAABOUT GEOMETRY - SHEET 1 OF 14  
NORTH WALSHAM ROAD ROUNDAABOUT

REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached geometry unchanged from Rev D	MKu	10/13

	INITIALS	DATE	DRAWING No. R1C093-R1-4075C
SURVEYED BY	-	-	PROJECT TITLE Norwich Northern Distributor Road
DESIGNED BY	DG	11/12	SCALE 1:1000 A3
DRAWN BY	DG	11/12	FILE No. R1C093
CHECKED BY	MKu	11/12	





NDR Alignment as per Engineering Layout Rev E

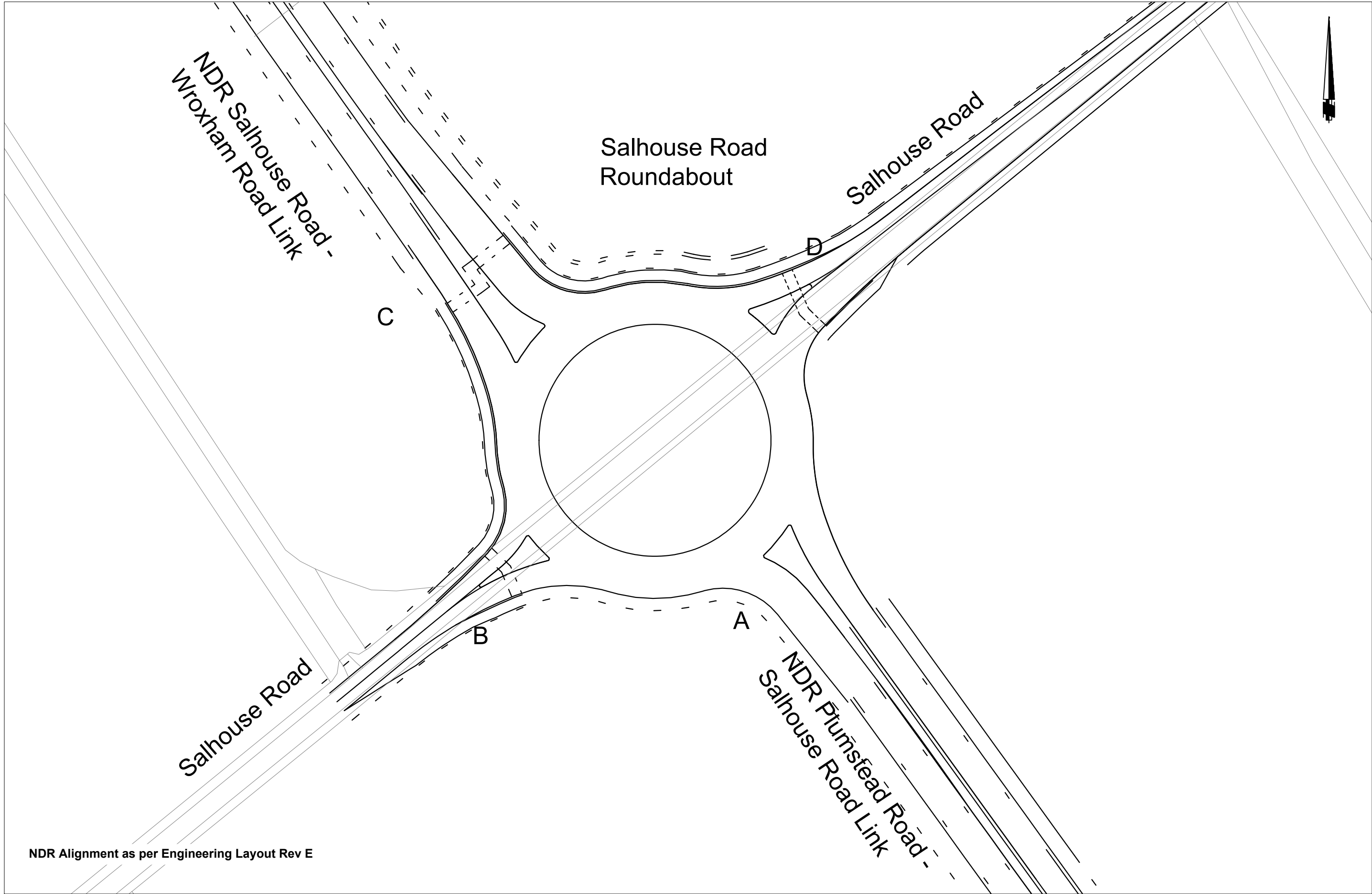


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Norwich NR1 2SG




DRAWING TITLE  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ROUNABOUT GEOMETRY - SHEET 9 OF 13  
WROXHAM ROAD ROUNABOUT

REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached geometry changed from Rev D	SWC	10/13

	INITIALS	DATE	DRAWING No. R1C093-R1-4076C
SURVEYED BY	-	-	PROJECT TITLE Norwich Northern Distributor Road
DESIGNED BY	DG	11/12	SCALE 1:1000 A3
DRAWN BY	DG	11/12	FILE No. R1C093
CHECKED BY	MKu	11/12	



NDR Alignment as per Engineering Layout Rev E

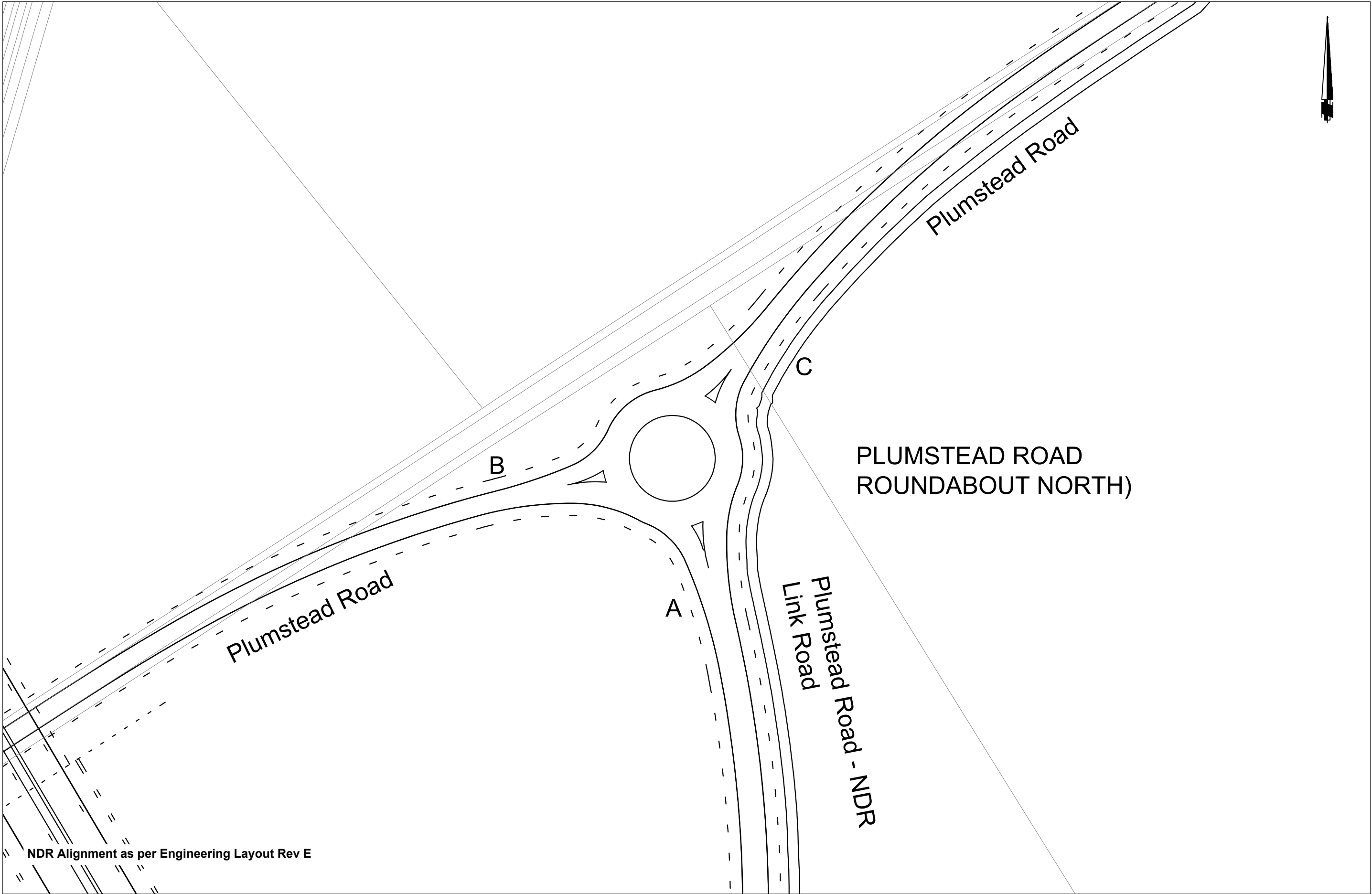


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**DRAWING TITLE**  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ROUNDAABOUT GEOMETRY - SHEET 10 OF 14  
SALHOUSE ROAD ROUNDAABOUT

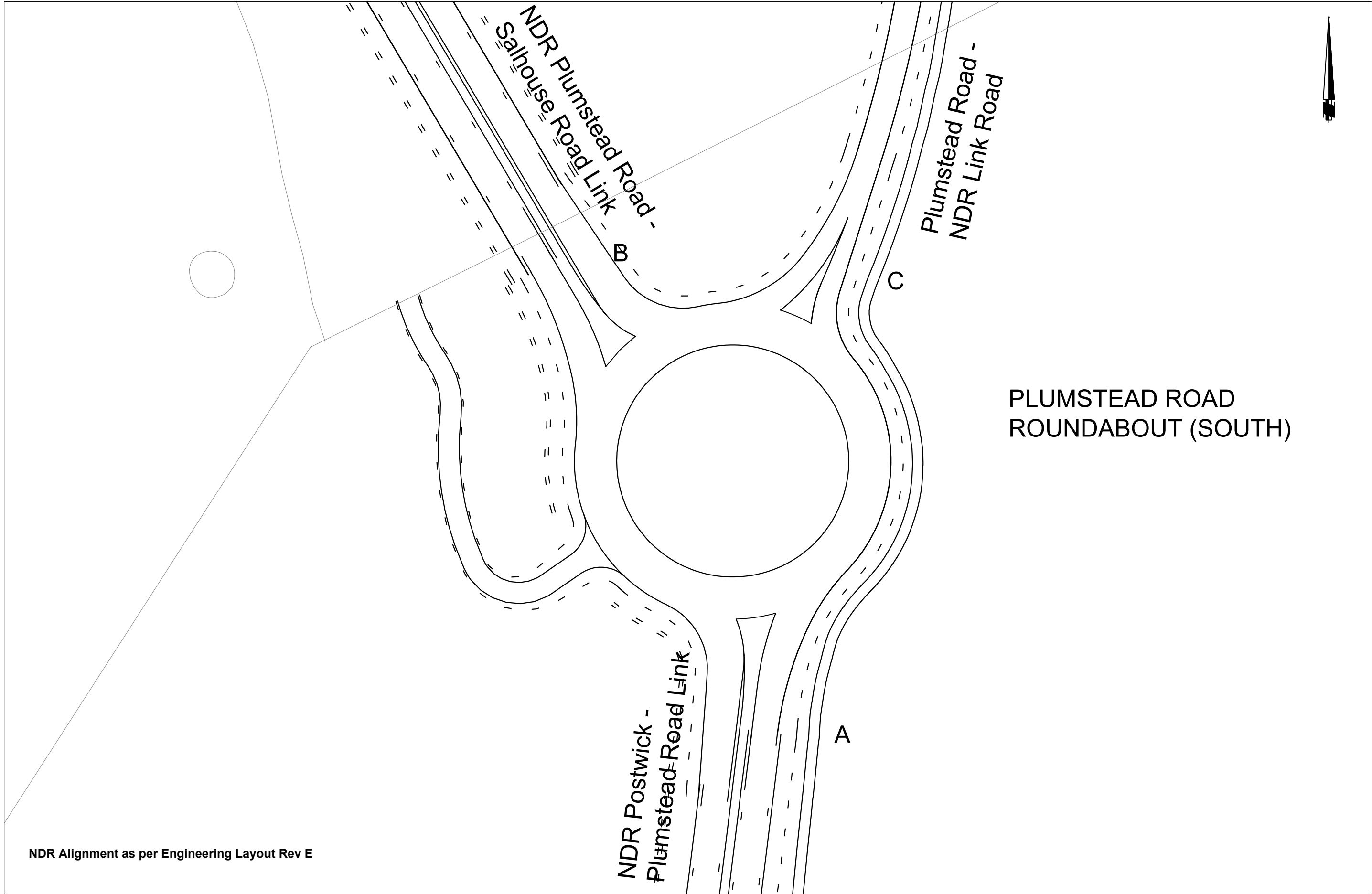
REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached geometry changed from Rev D	SWC	10/13

	INITIALS	DATE	DRAWING No. R1C093-R1-4077C
SURVEYED BY	-	-	PROJECT TITLE Norwich Northern Distributor Road
DESIGNED BY	DG	11/12	
DRAWN BY	DG	11/12	SCALE 1:1000 A3
CHECKED BY	MKu	02/12	FILE No. R1C093

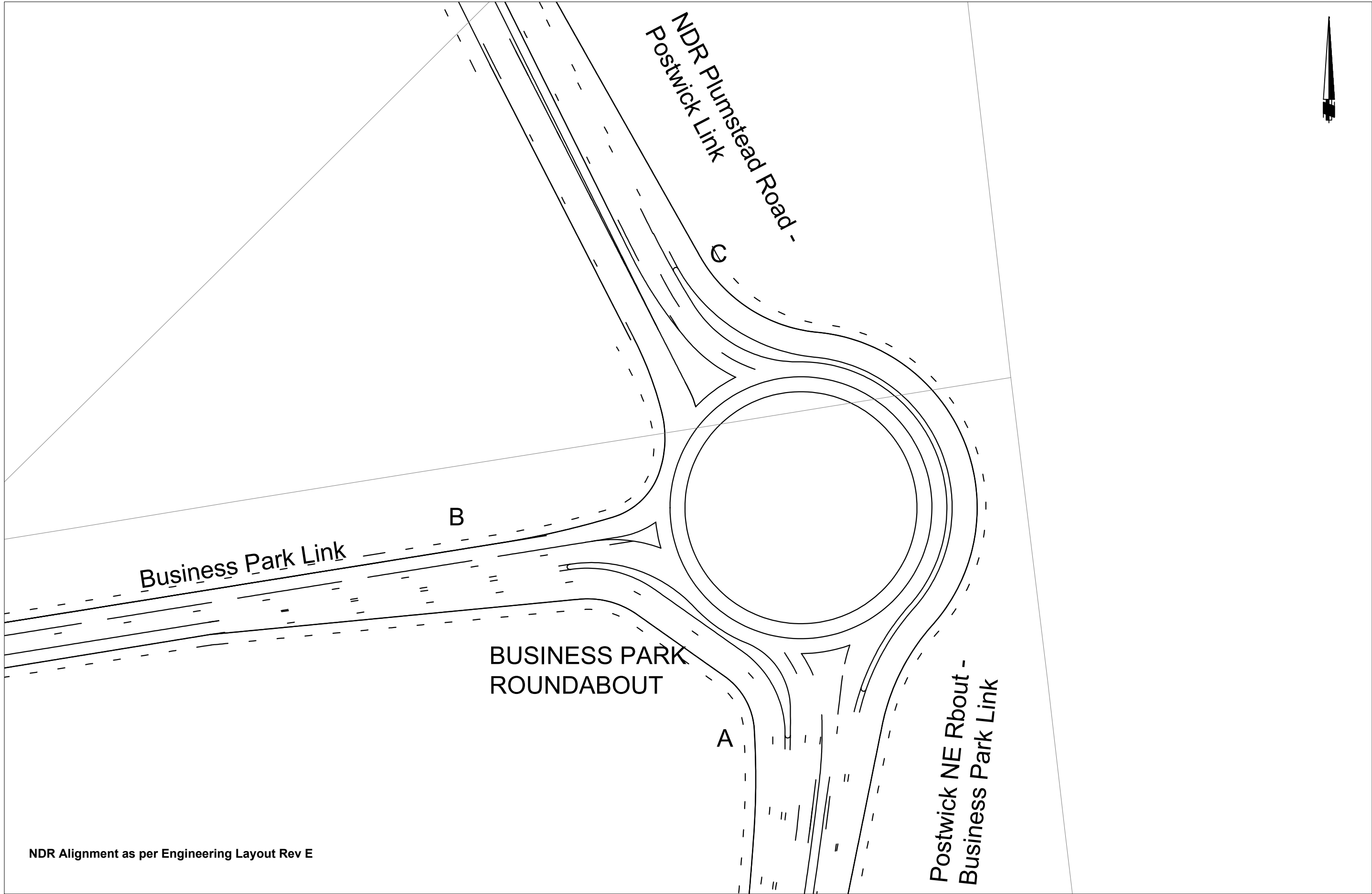


REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached: geometry unchanged from Rev D	MKu	10/13

	INITIALS	DATE	DRAWING No. R1C093-R1-407-C
SURVEYED BY	-	-	PROJECT TITLE
DESIGNED BY	DG	11/12	Norwich Northern Distributor Road
DRAWN BY	DG	11/12	SCALE 1:1000 A3
CHECKED BY	MKu	11/12	FILE No. R1C093







NDR Alignment as per Engineering Layout Rev E

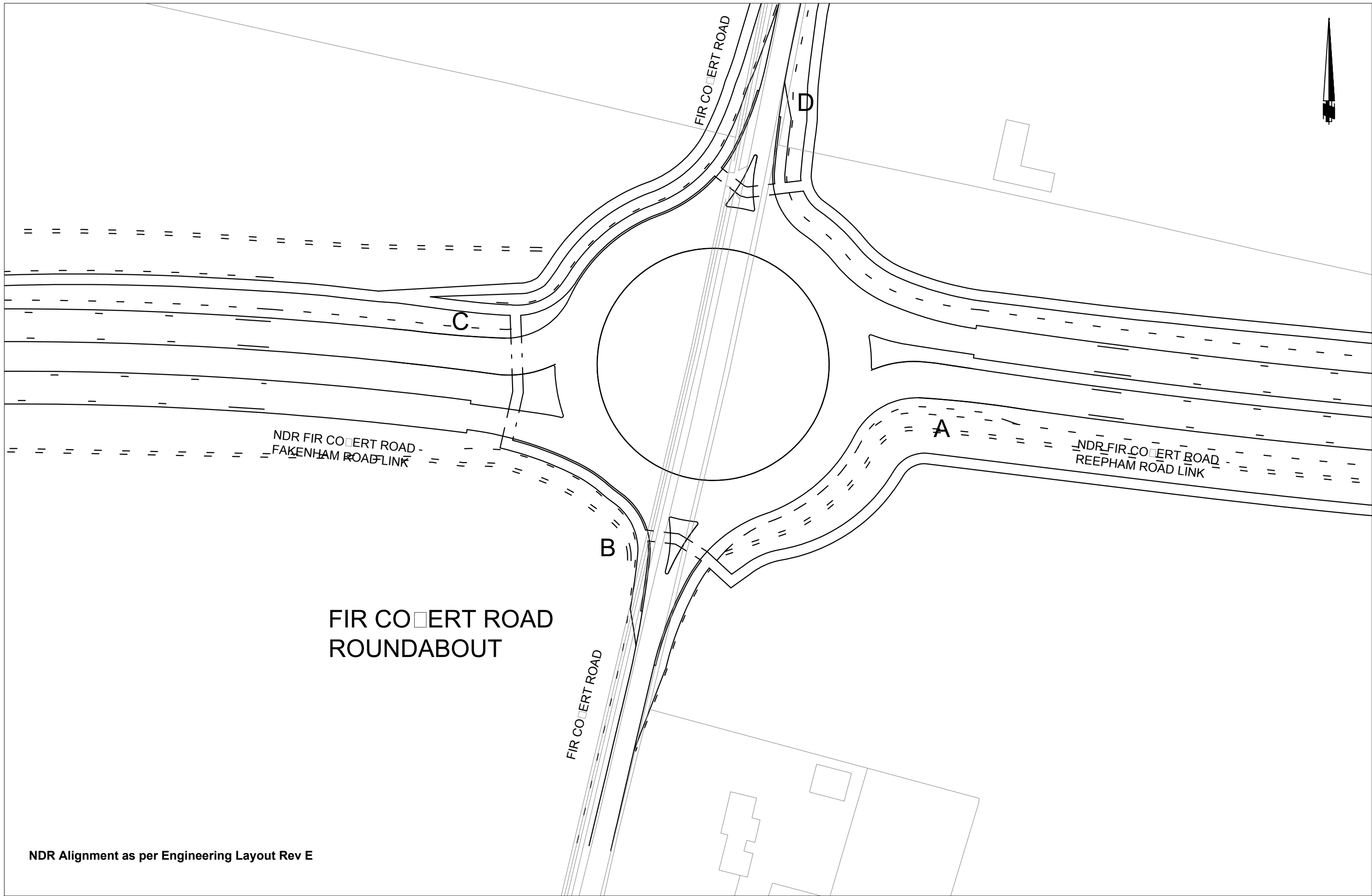



**Mike Jackson**  
Director of Environment,  
Transport and Development  
Norfolk County Council  
County Hall, Martineau Lane  
Norwich NR1 2SG



DRAWING TITLE  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ROUNDAABOUT GEOMETRY - SHEET 13 OF 14  
BUSINESS PARK ROUNDABOUT JUNCTION


REV.	DESCRIPTION	CHECKED	DATE
A	Geometry check revised using Design Rev B model	MKu	04/13
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached: geometry unchanged from Rev D	MKu	10/13

	INITIALS	DATE	DRAWING No. R1C093-R1-40: DC
SURVEYED BY	-	-	PROJECT TITLE
DESIGNED BY	DG	11/12	Norwich Northern Distributor Road
DRAWN BY	DG	11/12	SCALE 1:1000 A3
CHECKED BY	MKu	04/13	FILE No. R1C093



NDR Alignment as per Engineering Layout Rev E





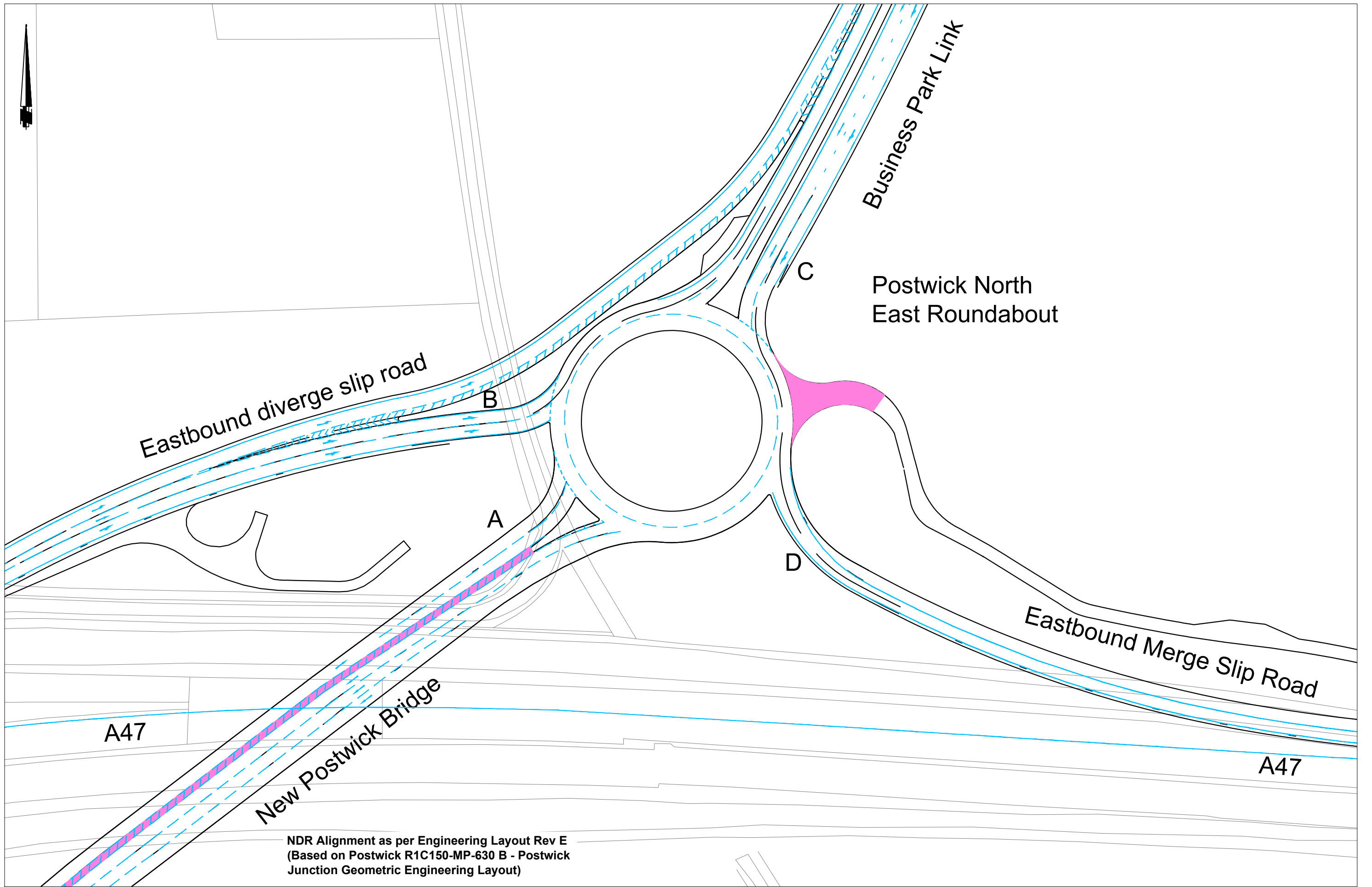
**Mike Jackson**  
Director of Environment,  
Transport and Development  
Norfolk County Council  
County Hall, Martineau Lane  
Norwich NR1 2SG

**DRAWING TITLE**  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ROUNDABOUT GEOMETRY - SHEET 14 OF 14  
FIR COBERT ROAD ROUNDABOUT JUNCTION

REV.	DESCRIPTION	CHECKED	DATE
A	There is no Rev A for this drawing		
B	Geometry check revised using Design Rev D model	MKu	07/13
C	Engineering layout Rev E attached geometry unchanged from Rev D	MKu	10/13

	INITIALS	DATE
SURVEYED BY	-	-
DESIGNED BY	DG	07/13
DRAWN BY	DG	07/13
CHECKED BY	MKu	07/13

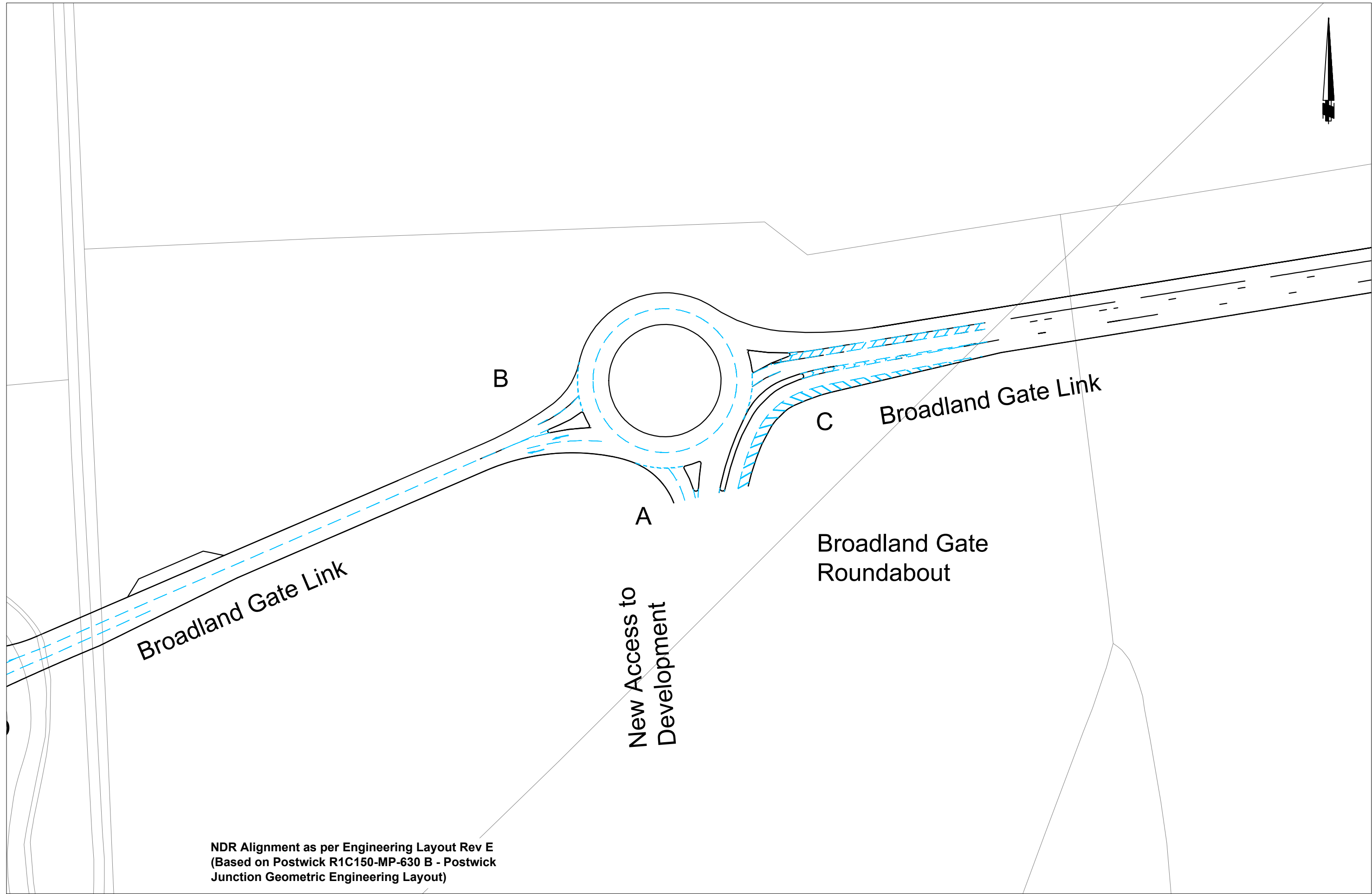
DRAWING No. R1C093-R1-4297C	
PROJECT TITLE Norwich Northern Distributor Road	
SCALE 1:1000 A3	FILE No. R1C093



NDR Alignment as per Engineering Layout Rev E  
(Based on Postwick R1C150-MP-630 B - Postwick  
Junction Geometric Engineering Layout)

REV.	DESCRIPTION	CHECKED	DATE
A	ENGINEERING LAYOUT RE: E ATTACHED	SWC	10/13
	GEOMETRY UNCHANGED FROM RE: D		

	INITIALS	DATE	DRAWING No. R1C093-R1-4302A
SURVEYED BY	-	-	PROJECT TITLE Norwich Northern Distributor Road
DESIGNED BY	DG	07/13	
DRAWN BY	DG	07/13	
CHECKED BY	MKu	07/13	SCALE 1:1000 A3
			FILE No. R1C093



NDR Alignment as per Engineering Layout Rev E  
(Based on Postwick R1C150-MP-630 B - Postwick  
Junction Geometric Engineering Layout)

REV.	DESCRIPTION	CHECKED	DATE
A	ENGINEERING LAYOUT RE: E ATTACHED	SWC	10/13
	GEOMETRY UNCHANGED FROM RE: D		

	INITIALS	DATE	DRAWING No. R1C093-R1-4303A
SURVEYED BY	-	-	PROJECT TITLE Norwich Northern Distributor Road
DESIGNED BY	DG	07/13	
DRAWN BY	DG	07/13	
CHECKED BY	MKu	07/13	SCALE 1:1000 A3
			FILE No. R1C093

Appendix C  
Junctions Geometry Parameters  
(Drawing R1C093-GP01 to GP15)



R1C093-GP01- Fakenham Road Roundabout		
Drawing No: R1C093-R1- 4068C		
Description	Measurement	Notes
D = inscribed circle diameter	80.0	
central island diameter	62.0	
<b>Arm A:- NDR Fakenham Road - Fir Covert Road Link Westbound</b>		
v = approach half width	7.3	
e = entry width	7.7	
l' = effective flare length	6.2	
r = kerb entry radius	20.0	
Ø = entry angle	35°	
Segregated left turn lane	No	
<b>Arm B:- Fakenham Road Northbound</b>		
v = approach half width	3.7	
e = entry width	8.0	
l' = effective flare length	36.8	
r = kerb entry radius	20.0	
Ø = entry angle	46°	
Segregated left turn lane	No	
<b>Arm C:- Fakenham Road Eastbound</b>		
v = approach half width	3.7	
e = entry width	9.0	
l' = effective flare length	26.8	
r = kerb entry radius	20.0	
Ø = entry angle	25°	
Segregated left turn lane	No	
<b>Arm D:- Access to Attlebridge RB3 and Lagoon Southbound</b>		
v = approach half width	3.0	
e = entry width	4.5	
l' = effective flare length	24.0	
r = kerb entry radius	10.0	
Ø = entry angle	42°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: M KUREK	Date: 04/10/2013	

R1C093-GP02- Fir Covert Road Roundabout		
Drawing No: R1C093-R1- 4297C		
Description	Measurement	Notes
D = inscribed circle diameter	90.0	
central island diameter	66.0	
<b>Arm A:- NDR Fir Covert Road - Reepham Road Link Westbound</b>		
v = approach half width	7.3	
e = entry width	10.6	
l' = effective flare length	14.1	
r = kerb entry radius	20.0	
Ø = entry angle	45°	
Segregated left turn lane	No	
<b>Arm B:- Fir Covert Road Northbound</b>		
v = approach half width	3.1	
e = entry width	7.0	
l' = effective flare length	12.4	
r = kerb entry radius	20.0	
Ø = entry angle	40°	
Segregated left turn lane	No	
<b>Arm C:- NDR Fir Covert Road - Fakenham Road Link Eastbound</b>		
v = approach half width	7.3	
e = entry width	10.7	
l' = effective flare length	13.9	
r = kerb entry radius	20.0	
Ø = entry angle	27°	
Segregated left turn lane	No	
<b>Arm D:- Fir Covert Road Southbound</b>		
v = approach half width	2.9	
e = entry width	6.9	
l' = effective flare length	11.9	
r = kerb entry radius	20.0	
Ø = entry angle	40°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: M KUREK	Date: 04/10/2013	



R1C093-GP02- Reepham Road Roundabout		
Drawing No: R1C093-R1- 4069C		
Description	Measurement	Notes
D = inscribed circle diameter	90.0	
central island diameter	66.0	
<b>Arm A:- NDR Drayton Lane - Reepham Road Link Westbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	13.8	
r = kerb entry radius	20.0	
Ø = entry angle	58°	
Segregated left turn lane	No	
<b>Arm B:- Reepham Road Northbound</b>		
v = approach half width	3.0	
e = entry width	7.0	
l' = effective flare length	9.2	
r = kerb entry radius	20.0	
Ø = entry angle	42°	
Segregated left turn lane	No	
<b>Arm C:- NDR Reepham Road-Fir Covert Road Link Eastbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	12.8	
r = kerb entry radius	20.0	
Ø = entry angle	46°	
Segregated left turn lane	No	
<b>Arm D:- NDR Reepham Road Southbound</b>		
v = approach half width	3.0	
e = entry width	7.0	
l' = effective flare length	11.7	
r = kerb entry radius	20.0	
Ø = entry angle	41°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: M KUREK	Date: 04/10/2013	

<b>R1C093-GP03- Drayton Lane Roundabout</b>		
<b>Drawing No: R1C093-R1- 4070C</b>		
<b>Description</b>	<b>Measurement</b>	<b>Notes</b>
D = inscribed circle diameter	90.0	
central island diameter	66.0	
<b>Arm A:- NDR Cromer Road - Drayton Lane Link Westbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	12.4	
r = kerb entry radius	20.0	
Ø = entry angle	55°	
Segregated left turn lane	No	
<b>Arm B:- Drayton Lane Northbound</b>		
v = approach half width	3.3	
e = entry width	6.5	
l' = effective flare length	15.9	
r = kerb entry radius	20.0	
Ø = entry angle	46°	
Segregated left turn lane	NA	
<b>Arm C:- NDR Drayton Lane - Reephams Road Link Eastbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	12.5	
r = kerb entry radius	20.0	
Ø = entry angle	49°	
Segregated left turn lane	No	
<b>Arm D:- Holt Road - NDR Link Road Southbound</b>		
v = approach half width	3.3	
e = entry width	6.5	
l' = effective flare length	15.7	
r = kerb entry radius	20.0	
Ø = entry angle	41°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: M KUREK	Date: 04/10/2013	

R1C093-GP04- Holt Road / Drayton Lane Roundabout		
Drawing No: R1C093-R-4071C		
Description	Measurement	Notes
D = inscribed circle diameter	40.0	
central island diameter	28.0	
<b>Arm A:- Holt Road Northbound</b>		
v = approach half width	3.3	
e = entry width	6.0	
l' = effective flare length	30.4	
r = kerb entry radius	20.0	
Ø = entry angle	44°	
Segregated left turn lane	No	
<b>Arm B:- Holt Road - NDR Link Road Eastbound</b>		
v = approach half width	3.3	
e = entry width	6.0	
l' = effective flare length	12.2	
r = kerb entry radius	20.0	
Ø = entry angle	43°	
Segregated left turn lane	No	
<b>Arm C:- Holt Road Southbound</b>		
v = approach half width	3.3	
e = entry width	6.0	
l' = effective flare length	14.4	
r = kerb entry radius	20.0	
Ø = entry angle	37°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: M KUREK	Date: 04/10/2013	

R1C093-GP05- Cromer Road Roundabout (South)		
Drawing No: R1C093-R1-4072C		
Description	Measurement	Notes
D = inscribed circle diameter	65.0	
central island diameter	47.5	
<b>Arm A:- Westbound Diverge</b>		
v = approach half width	3.7	
e = entry width	8.8	
l' = effective flare length	14.5	
r = kerb entry radius	20.0	
Ø = entry angle	39°	
Segregated left turn lane	No	
<b>Arm B:- A 140 Holt Road Northbound</b>		Existing
v = approach half width	4.0	
e = entry width	7.4	
l' = effective flare length	27.3	
r = kerb entry radius	20.0	
Ø = entry angle	54°	
Segregated left turn lane	No	
<b>Arm C:- Manor Park Access Road</b>		Existing
v = approach half width	3.0	
e = entry width	4.5	
l' = effective flare length	12.3	
r = kerb entry radius	20.0	
Ø = entry angle	27°	
Segregated left turn lane	No	
<b>Arm D:- Westbound Merge</b>		
v = approach half width	3.7	
e = entry width	4.5	
l' = effective flare length	28.0	
r = kerb entry radius	12.0	
Ø = entry angle	37°	
Segregated left turn lane	No	
<b>Arm E:- Cromer Road North-South Link Road Southbound</b>		
v = approach half width	7.3	
e = entry width	7.6	
l' = effective flare length	2.7	
r = kerb entry radius	20.0	
Ø = entry angle	37°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: M KUREK	Date: 04/10/2013	

<b>R1C093-GP06- Cromer Road Roundabout (North)</b>			
<b>Drawing No: R1C093-R1-4073C</b>			
<b>Description</b>	<b>Measurement</b>	<b>Notes</b>	
D = inscribed circle diameter	90.0		
central island diameter	74.0		
<b>Arm A:- Cromer Road North-South Link Road Northbound</b>			
v = approach half width	7.3		
e = entry width	8.0		
l' = effective flare length	14.4		
r = kerb entry radius	20.0		
Ø = entry angle	34°		
Segregated left turn lane	No		
<b>Arm B:- Eastbound Diverge</b>			
v = approach half width	3.7		
e = entry width	7.3		
l' = effective flare length	9.9		
r = kerb entry radius	20.0		
Ø = entry angle	38°		
Segregated left turn lane	NA		
<b>Arm C:- Cromer Road Southbound</b>			
v = approach half width	3.7		
e = entry width	6.7		
l' = effective flare length	29.3		
r = kerb entry radius	20.0		
Ø = entry angle	32°		
Segregated left turn lane	No		
<b>Arm D:- Private Means of Access</b>			
v = approach half width	3.0		
e = entry width	5.0		
l' = effective flare length	39.4		
r = kerb entry radius	10.0		
Ø = entry angle	36°		
Segregated left turn lane	NA		
<b>Arm E:- Eastbound Merge</b>		Exit Only	
v = approach half width	NA		
e = entry width	NA		
l' = effective flare length	NA		
r = kerb entry radius	NA		
Ø = entry angle	NA		
Segregated left turn lane	NA		
Originator: D Goutam	Date: 06/11/2012		
Revised: D Goutam	Date: 03/10/2013		
Checker: M KUREK	Date: 04/10/2013		

<b>R1C093-GP07- Airport Roundabout</b>		
<b>Drawing No: R1C093-R1-4074C</b>		
<b>Description</b>	<b>Measurement</b>	<b>Notes</b>
D = inscribed circle diameter	90.0	
central island diameter	72.0	
<b>Arm A:- NDR North Walsham Road - Airport Roundabout Link Westbound</b>		
v = approach half width	7.3	
e = entry width	7.8	
l' = effective flare length	3.6	
r = kerb entry radius	20.0	
Ø = entry angle	36°	
Segregated left turn lane	No	
<b>Arm B:- Petan Access Road Northbound</b>		
v = approach half width	3.7	
e = entry width	6.4	
l' = effective flare length	5.3	
r = kerb entry radius	20.0	
Ø = entry angle	40°	
Segregated left turn lane	No	
<b>Arm C:- NDR Airport Roundabout - Cromer Road Link Eastbound</b>		
v = approach half width	7.3	
e = entry width	7.7	
l' = effective flare length	3.4	
r = kerb entry radius	20.0	
Ø = entry angle	36°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: M KUREK	Date: 04/10/2013	

<b>R1C093-GP08- North Walsham Road Roundabout</b>		
<b>Drawing No: R1C093-R1- 4075C</b>		
<b>Description</b>	<b>Measurement</b>	<b>Notes</b>
D = inscribed circle diameter	90.0	
central island diameter	66.0	
<b>Arm A:- NDR Wroxham Road - North Walsham Road Link Westbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	34.8	
r = kerb entry radius	20.0	
Ø = entry angle	45°	
Segregated left turn lane	No	
<b>Arm B:- North Walsham Road Northbound</b>		
v = approach half width	3.7	
e = entry width	7.3	
l' = effective flare length	27.4	
r = kerb entry radius	20.0	
Ø = entry angle	38°	
Segregated left turn lane	No	
<b>Arm C:- NDR North Walsham Road - Airport Roundabout Link Eastbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	44.5	
r = kerb entry radius	20.0	
Ø = entry angle	42°	
Segregated left turn lane	No	
<b>Arm D:- North Walsham Road Southbound</b>		
v = approach half width	3.7	
e = entry width	7.3	
l' = effective flare length	23.6	
r = kerb entry radius	20.0	
Ø = entry angle	37°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: M KUREK	Date: 04/10/2013	

<b>R1C093-GP09- Wroxham Road Roundabout</b>		
<b>Drawing No: R1C093-R1-4076C</b>		
<b>Description</b>	<b>Measurement</b>	<b>Notes</b>
D = inscribed circle diameter	90.0	
central island diameter	66.0	
<b>Arm A:- NDR Salhouse Road - Wroxham Road Link Northbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	47.3	
r = kerb entry radius	20.0	
Ø = entry angle	48°	
Segregated left turn lane	No	
<b>Arm B:- Wroxham Road Eastbound</b>		
v = approach half width	3.7	
e = entry width	7.3	
l' = effective flare length	12.7	
r = kerb entry radius	20.0	
Ø = entry angle	39°	
Segregated left turn lane	No	
<b>Arm C:- NDR Wroxham Road - North Walsham Road Link Southbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	26.3	
r = kerb entry radius	20.0	
Ø = entry angle	44°	
Segregated left turn lane	No	
<b>Arm D:- Access Track to Sewage Farm Southbound</b>		
v = approach half width	2.5	
e = entry width	4.0	
l' = effective flare length	2.7	
r = kerb entry radius	10.0	
Ø = entry angle	37°	
Segregated left turn lane	No	
<b>Arm E:- Wroxham Road Westbound</b>		
v = approach half width	3.7	
e = entry width	10.5	
l' = effective flare length	77.7	
r = kerb entry radius	20.0	
Ø = entry angle	59°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 02/11/2012	
Revised : D Goutam	Date: 27/09/2013	
Checker: S. CLIFF	Date: 27/09/2013	



R1C093-GP10- Salhouse Road Roundabout		
Drawing No: R1C093-R1-4077C		
Description	Measurement	Notes
D = inscribed circle diameter	90.0	
central island diameter	66.0	
<b>Arm A:- NDR Plumstead Road - Salhouse Road Link Northbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	38.3	
r = kerb entry radius	20.0	
Ø = entry angle	62°	
Segregated left turn lane	No	
<b>Arm B:- Salhouse Road Eastbound</b>		
v = approach half width	3.3	
e = entry width	7.3	
l' = effective flare length	11.5	
r = kerb entry radius	20.0	
Ø = entry angle	40°	
Segregated left turn lane	No	
<b>Arm C:- NDR Salhouse Road - Wroxham Road Link Southbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	51.0	
r = kerb entry radius	20.0	
Ø = entry angle	52°	
Segregated left turn lane	No	
<b>Arm D:- Salhouse Road Westbound</b>		
v = approach half width	3.3	
e = entry width	10.5	
l' = effective flare length	71.0	
r = kerb entry radius	20.0	
Ø = entry angle	54°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 02/11/2012	
Revised : D Goutam	Date: 27/09/2013	
Checker: S. CLIFF	Date: 27/09/2013	

<b>R1C093-GP11- Plumstead Road Roundabout (North)</b>		
<b>Drawing No: R1C093-R1-4078C</b>		
<b>Description</b>	<b>Measurement</b>	<b>Notes</b>
D = inscribed circle diameter	40.0	
central island diameter	24.4	
<b>Arm A:- NDR Plumstead Road - NDR Link Road Northbound</b>		
v = approach half width	3.7	
e = entry width	7.0	
l' = effective flare length	11.3	
r = kerb entry radius	20.0	
Ø = entry angle	39°	
Segregated left turn lane	No	
<b>Arm B:- Plumstead Road Eastbound</b>		
v = approach half width	2.8	
e = entry width	6.0	
l' = effective flare length	11.3	
r = kerb entry radius	20.0	
Ø = entry angle	52°	
Segregated left turn lane	No	
<b>Arm C:- Plumstead Road Westbound</b>		
v = approach half width	2.8	
e = entry width	6.0	
l' = effective flare length	12.8	
r = kerb entry radius	20.0	
Ø = entry angle	35°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: M KUREK	Date: 04/10/2013	

<b>R1C093-GP12- Plumstead Road Roundabout (South)</b>		
<b>Drawing No: R1C093-R1- 4079C</b>		
<b>Description</b>	<b>Measurement</b>	<b>Notes</b>
D = inscribed circle diameter	90.0	
central island diameter	66.0	
<b>Arm A:- NDR Postwick - Plumstead Link Northbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	28.2	
r = kerb entry radius	20.0	
Ø = entry angle	41°	
Segregated left turn lane	No	
<b>Arm B:- NDR Plumstead - Salhouse Link Southbound</b>		
v = approach half width	7.3	
e = entry width	11.0	
l' = effective flare length	23.1	
r = kerb entry radius	20.0	
Ø = entry angle	42°	
Segregated left turn lane	No	
<b>Arm C:- Plumstead Road - NDR Link Road Southbound</b>		
v = approach half width	3.7	
e = entry width	7.3	
l' = effective flare length	12.3	
r = kerb entry radius	20.0	
Ø = entry angle	40°	
Segregated left turn lane	No	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: M KUREK	Date: 04/10/2013	

**Geometric Parameters**  
**(Based on NDR Alignment as per Engineering Layout Rev E)**  
**Norwich Northern Distributer Road**

04 October 2013

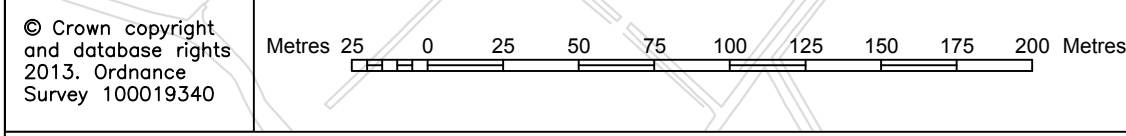
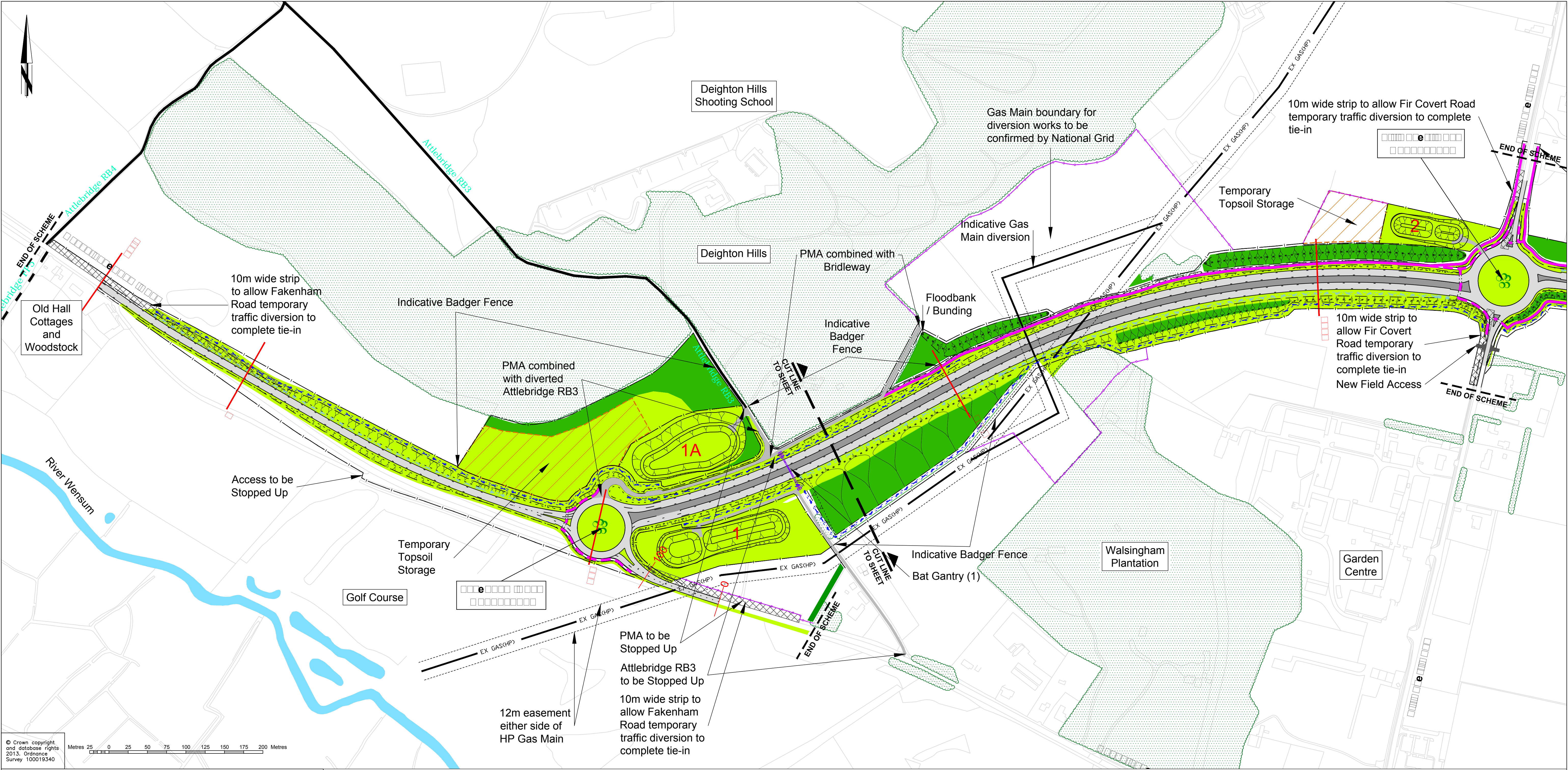
<b>R1C093-GP13 Geometric Parameters for Business Park RBT - Option 4 - With SLT</b>		
<b>Drawing No: R1C093-R1-4080C</b>		
<b>Description</b>	<b>Measurement</b>	<b>Notes</b>
<b>Business Park Roundabout</b>		
D = inscribed circle diameter	83.0	
central island diameter	66.0	
<b>Arm A:- Business Park Link Road</b>		
v = approach half width	7.3	
e = entry width	7.9	
l' = effective flare length	35.0	
r = kerb entry radius	20.0	
Ø = entry angle	40°	
Segregated left turn lane	Yes	
<b>Arm B:- Broadland Gate Link Road</b>		
v = approach half width	3.7	
e = entry width	7.3	
l' = effective flare length	12.2	
r = kerb entry radius	20.0	
Ø = entry angle	49°	
Segregated left turn lane	No	
<b>Arm C:- NDR Link Road</b>		
v = approach half width	7.3	
e = entry width	8.1	
l' = effective flare length	11.4	
r = kerb entry radius	35.0	
Ø = entry angle	26°	
Segregated Southbound Filter Lane	Yes	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: M KUREK	Date: 04/10/2013	

<b>R1C150-GP14 Geometric Parameters for Postwick Junction</b>		
<b>Drawing No: R1C093-R1-4302A</b>		
<b>Description</b>	<b>Measurement</b>	<b>Notes</b>
<b>North East Roundabout</b>		
D = inscribed circle diameter	70.0	
central island diameter	52.0	
<b>Arm A:- New Postwick Bridge</b>		
v = approach half width	3.7	
e = entry width	8.0	
l' = effective flare length	34.5	
r = kerb entry radius	20.0	
Ø = entry angle	41°	
Segregated left turn lane	No	
<b>Arm B:- Eastbound diverge slip road</b>		
v = approach half width	7.3	
e = entry width	7.7	
l' = effective flare length	4.5	
r = kerb entry radius	20.0	
Ø = entry angle	42°	
Segregated left turn lane	Yes	
<b>Arm C:- Business Park Link Road</b>		
v = approach half width	7.3	
e = entry width	7.9	
l' = effective flare length	5.4	
r = kerb entry radius	20.0	
Ø = entry angle	44°	
Segregated left turn lane	No	
<b>Arm D:- Eastbound Merge Slip Road</b>		
v = approach half width	N/A	Exit only
e = entry width	N/A	
l' = effective flare length	N/A	
r = kerb entry radius	N/A	
Ø = entry angle	N/A	
Segregated left turn lane	N/A	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: S Cliff	Date:	

<b>R1C150-GP15 Geometric Parameters for Postwick Junction</b>		
<b>Drawing No: R1C093-R1-4303A</b>		
<b>Description</b>	<b>Measurement</b>	<b>Notes</b>
<b>Broadland Gate Roundabout</b>		
D = inscribed circle diameter	50.0	
central island diameter	32.0	
<b>Arm A:- New Access to Development</b>		
v = approach half width	3.7	
e = entry width	7.0	
l' = effective flare length	17.0	
r = kerb entry radius	20.0	
Ø = entry angle	39°	
Segregated left turn lane	No	
<b>Arm B:- Eastbound Broadland Gate Link Road</b>		
v = approach half width	3.7	Width excludes additional westbound lane for Segregated left turn
e = entry width	7.3	
l' = effective flare length	8.3	
r = kerb entry radius	20.0	
Ø = entry angle	41°	
Segregated left turn lane	No	
<b>Arm C:- Westbound Broadland Gate Link Road</b>		
v = approach half width	3.7	
e = entry width	6.0	
l' = effective flare length	7.5	
r = kerb entry radius	20.0	
Ø = entry angle	35°	
Segregated left turn lane	Yes	
Originator: D Goutam	Date: 06/11/2012	
Revised: D Goutam	Date: 03/10/2013	
Checker: S Cliff	Date: 07/10/2013	

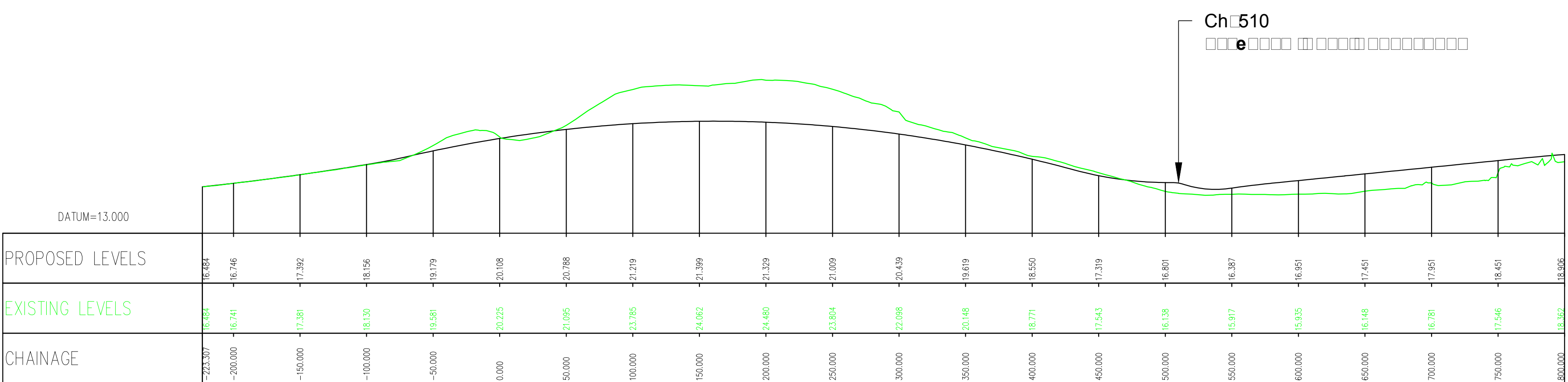
Appendix D  
Engineering Layout Sheets 1-12  
(Drawing No R1C093-R1-4003E to 4014E)





## Key

	Northern Distributor Road		Existing Footpaths
	Indicative Woodland creation		Existing Restricted Byways (RB) and Bridleways (BR)
	Indicative Grassland creation		Proposed Cycle Tracks (with right of way on foot)
	Indicative Scrubland creation		Proposed Footways/Cycleways
	Existing Woodland		Proposed Bridleways
	Existing pond / lake or river		Proposed Private Means of Access (PMA)
	Proposed Site Compound		Proposed Turning Heads (some with combined Field Access)
	Proposed Temporary Topsoil Storage area		Proposed Swales
	Proposed Temporary Traffic Diversion (to complete tie-in)		Proposed Ditches
	Proposed Culverts		Chainage
	Proposed Drainage Lagoons		
	Proposed Bat Gantry		



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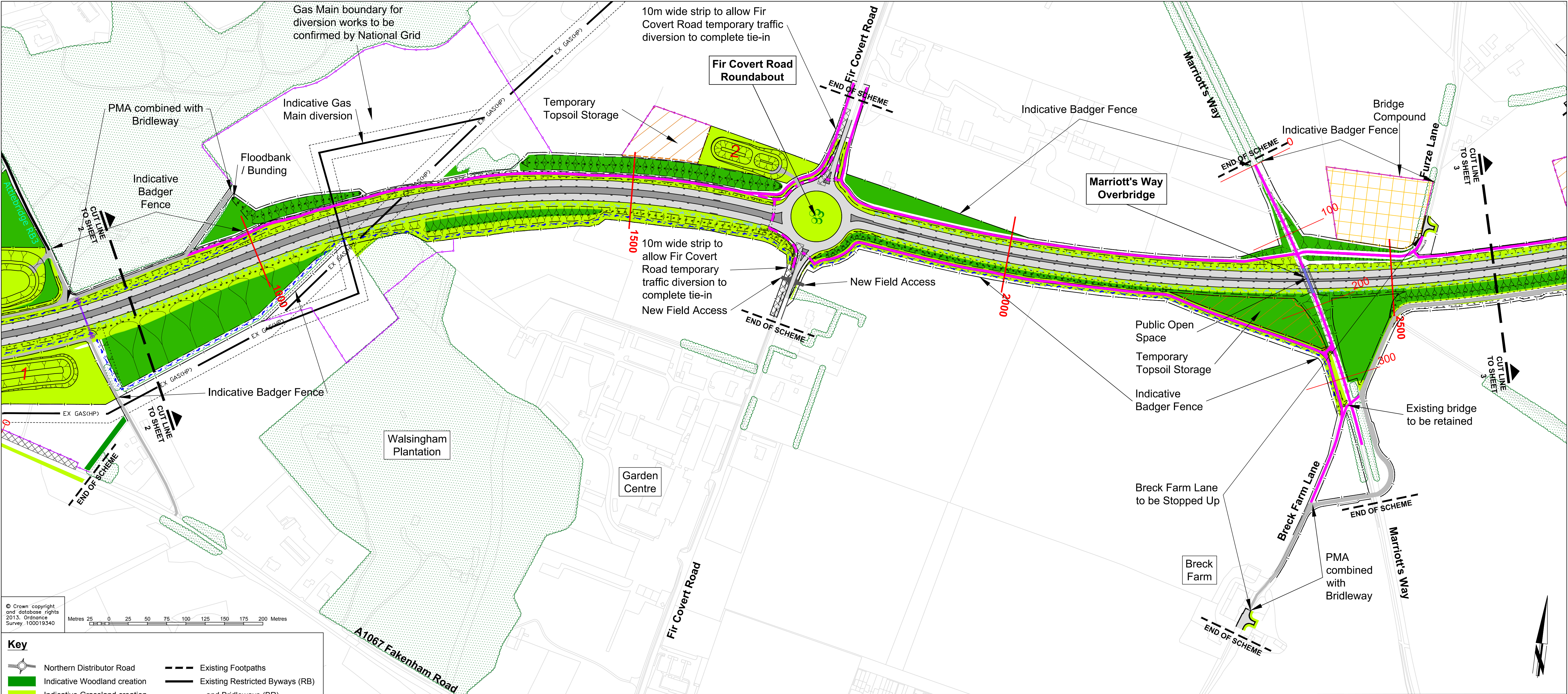
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NORWICH NORTHERN DISTRIBUTOR ROAD  
ENGINEERING LAYOUT AND PROFILE - MAINLINE  
SHEET 1 OF 12

REVISION	DESCRIPTION	CHECKED	DATE
A	See Revision Sheet for details	MKu	01/13
B	See Revision Sheet for details	MKu	04/13
C	See Revision Sheet for details	MKu	07/13
D	See Revision Sheet for details	MKu	01/13
E	See Revision Sheet for details	JB	09/13

SURVEYED BY	INITIALS	DATE	DRAWING No
SURVEYED BY	OS	200	R1C093-R1-4003E
DESIGNED BY	JT	05/12	PROJECT TITLE
DRAWN BY	JT	05/12	Norwich Northern Distributor Road
CHECKED BY	MKu	06/12	SCALE 1:2500/1:250

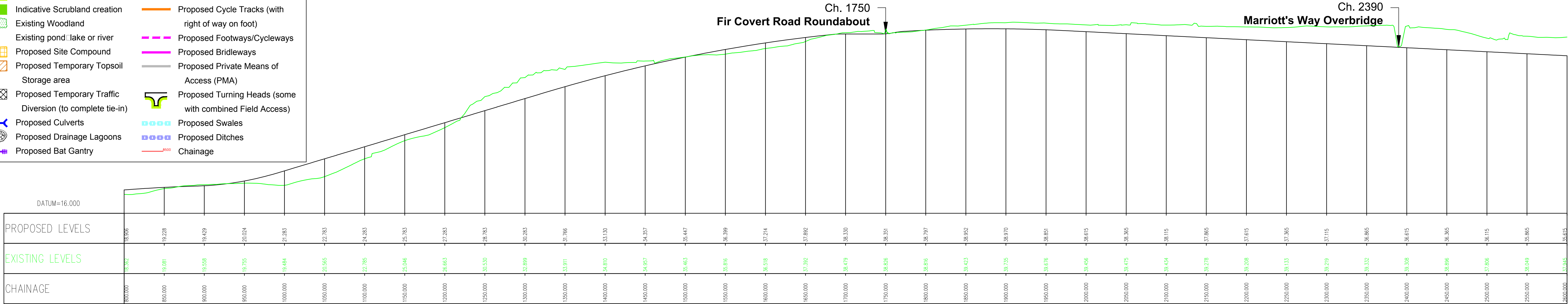
FILE No
R1C093





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Key	
	Northern Distributor Road
	Indicative Woodland creation
	Indicative Grassland creation
	Indicative Scrubland creation
	Existing Woodland
	Existing pond/lake or river
	Proposed Site Compound
	Proposed Temporary Topsoil Storage area
	Proposed Temporary Traffic Diversion (to complete tie-in)
	Proposed Culverts
	Proposed Drainage Lagoons
	Proposed Bat Gantry
	Existing Footpaths
	Existing Restricted Byways (RB) and Bridleways (BR)
	Proposed Cycle Tracks (with right of way on foot)
	Proposed Footways/Cycleways
	Proposed Bridleways
	Proposed Private Means of Access (PMA)
	Proposed Turning Heads (some with combined Field Access)
	Proposed Swales
	Proposed Ditches
	Chainage



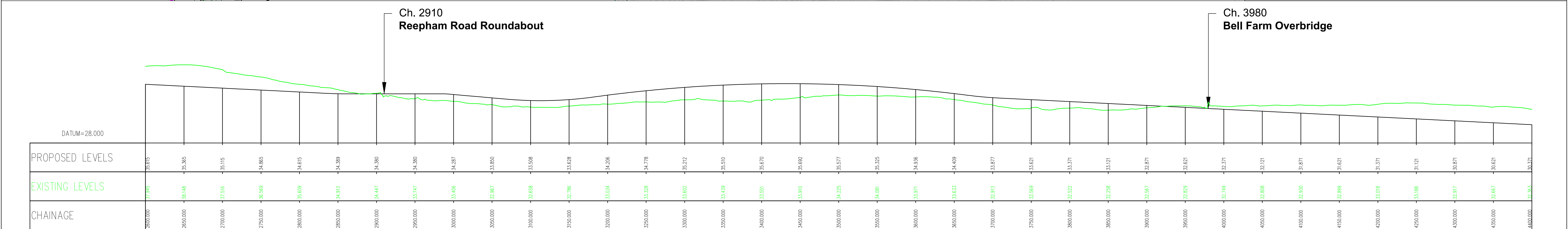
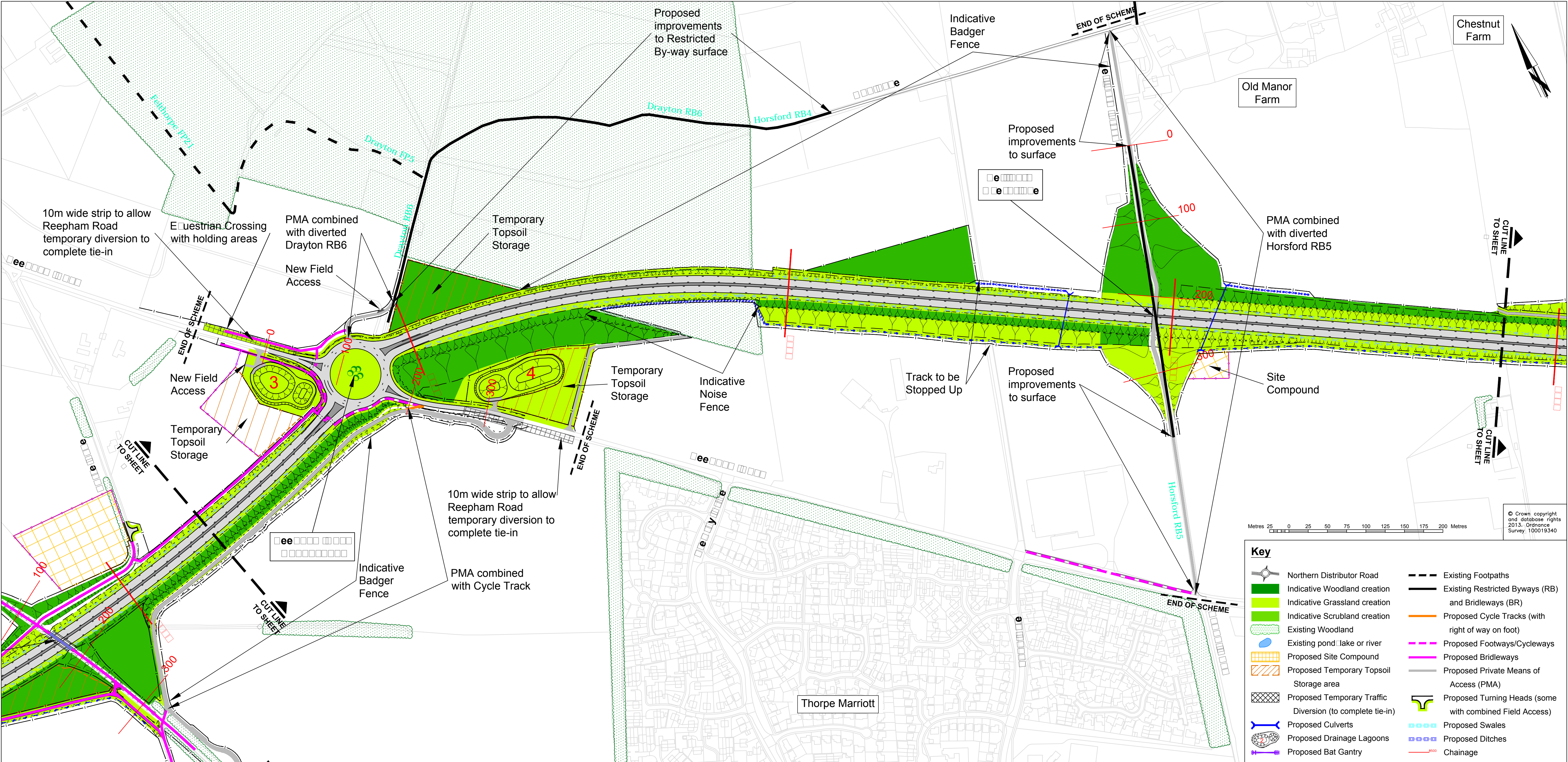
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DRAWING TITLE  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ENGINEERING LAYOUT AND PROFILE - MAINLINE  
SHEET 2 OF 12

REVISION	DESCRIPTION	CHECKED	DATE
A	See Revision Sheet for details	MKu	01/13
B	See Revision Sheet for details	MKu	04/13
C	See Revision Sheet for details	MKu	07/13
D	See Revision Sheet for details	MKu	01/13
E	See Revision Sheet for details	JB	09/13

SURVEYED BY	INITIALS	DATE	DRAWING No
OS	200	05/12	R1C093-R1-4004E
DESIGNED BY	INITIALS	DATE	PROJECT TITLE
JT	05/12		Norwich Northern Distributor Road
DRAWN BY	INITIALS	DATE	SCALE
JT	05/12		1:2500/1:250
CHECKED BY	INITIALS	DATE	FILE No
MKu	06/12		R1C093







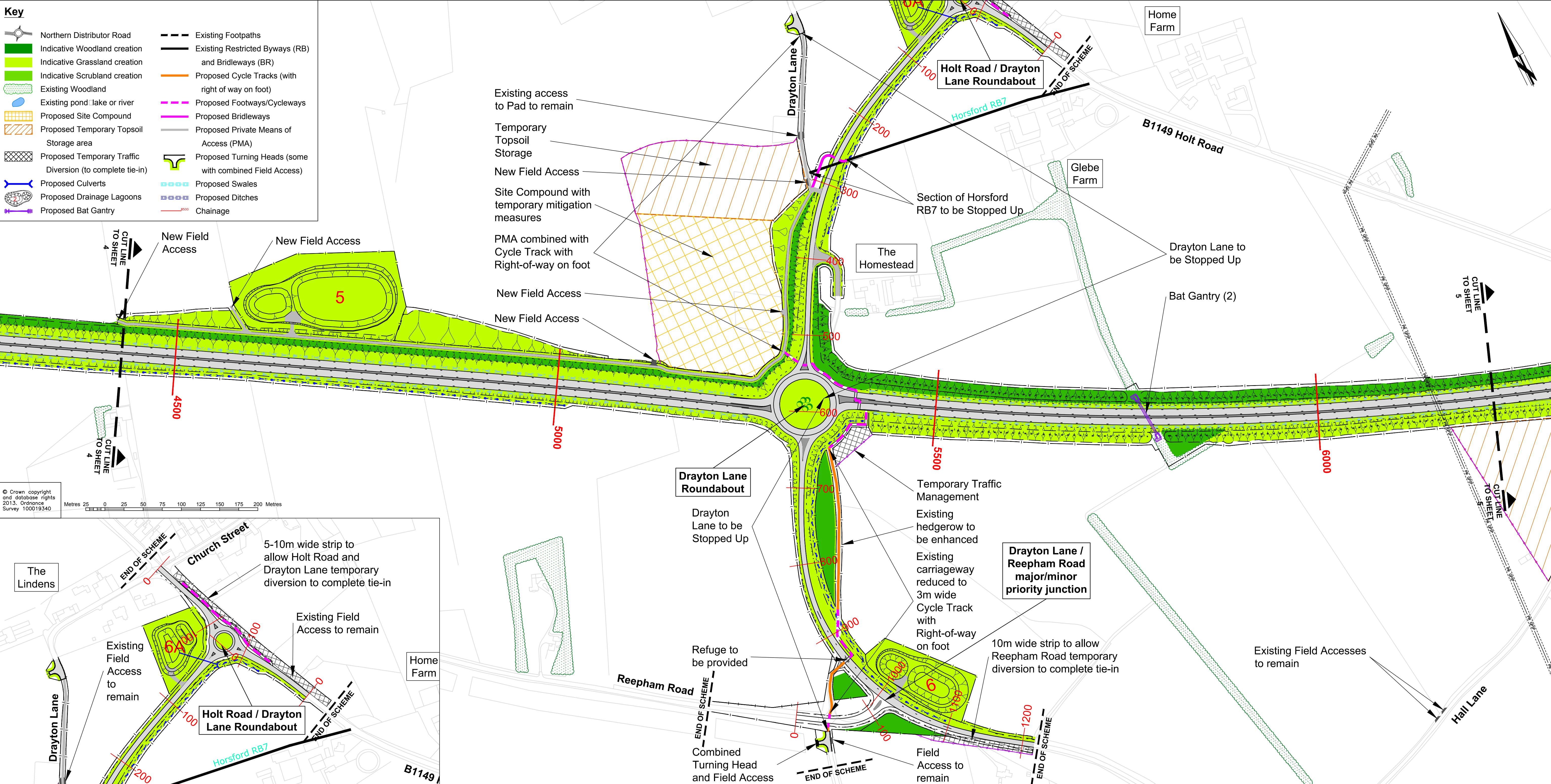
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**DRAWING TITLE**  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ENGINEERING LAYOUT AND PROFILE - MAINLINE  
SHEET 3 OF 12



REVISION	DESCRIPTION	CHECKED	DATE
A	See Revision Sheet for details	MKu	01/13
B	See Revision Sheet for details	MKu	04/13
C	See Revision Sheet for details	MKu	07/13
D	See Revision Sheet for details	MKu	01/13
E	See Revision Sheet for details	JB	09/13

SURVEYED BY	OS	200	INITIALS	OS	DATE	05/12	DRAWING No	R1C093-R1-4005E
DESIGNED BY	JT	05/12	PROJECT TITLE	Norwich Northern Distributor Road				
DRAWN BY	JT	05/12	SCALE	1:2500/1:250	FILE No	R1C093		
CHECKED BY	MKu	06/12						





DATUM=26.000	
PROPOSED LEVELS	30.371 30.121 29.871 29.621 29.374 29.128 28.878 28.629 28.379 28.130 27.880 27.631 27.381 27.132 26.883 26.633 26.384 26.135 25.886 25.637 25.388 25.139 24.889 24.640 24.391 24.142 23.893 23.644 23.395 23.146 22.897 22.648 22.399 22.150 21.901 21.652 21.403 21.154 20.905 20.656 20.407 20.158 19.909 19.660 19.411 19.162 18.913 18.664 18.415 18.166 17.917 17.668 17.419 17.170 16.921 16.672 16.423 16.174 15.925 15.676 15.427 15.178 14.929 14.680 14.431 14.182 13.933 13.684 13.435 13.186 12.937 12.688 12.439 12.190 11.941 11.692 11.443 11.194 10.945 10.696 10.447 10.198 9.949 9.700 9.451 9.202 8.953 8.704 8.455 8.206 7.957 7.708 7.459 7.210 6.961 6.712 6.463 6.214 5.965 5.716 5.467 5.218 4.969 4.720 4.471 4.222 3.973 3.724 3.475 3.226 2.977 2.728 2.479 2.230 1.981 1.732 1.483 1.234 0.985 0.736 0.487 0.238 0.000
EXISTING LEVELS	32.363 31.909 31.455 30.999 30.545 30.091 29.637 29.183 28.729 28.275 27.821 27.367 26.913 26.459 26.005 25.551 25.097 24.643 24.189 23.735 23.281 22.827 22.373 21.919 21.465 21.011 20.557 20.103 19.649 19.195 18.741 18.287 17.833 17.379 16.925 16.471 16.017 15.563 15.109 14.655 14.201 13.747 13.293 12.839 12.385 11.931 11.477 11.023 10.569 10.115 9.661 9.207 8.753 8.299 7.845 7.391 6.937 6.483 6.029 5.575 5.121 4.667 4.213 3.759 3.305 2.851 2.397 1.943 1.489 1.035 0.581 0.127 0.000
CHAINAGE	4400.000 4450.000 4500.000 4550.000 4600.000 4650.000 4700.000 4750.000 4800.000 4850.000 4900.000 4950.000 5000.000 5050.000 5100.000 5150.000 5200.000 5250.000 5300.000 5350.000 5400.000 5450.000 5500.000 5550.000 5600.000 5650.000 5700.000 5750.000 5800.000 5850.000 5900.000 5950.000 6000.000 6050.000 6100.000 6150.000 6200.000



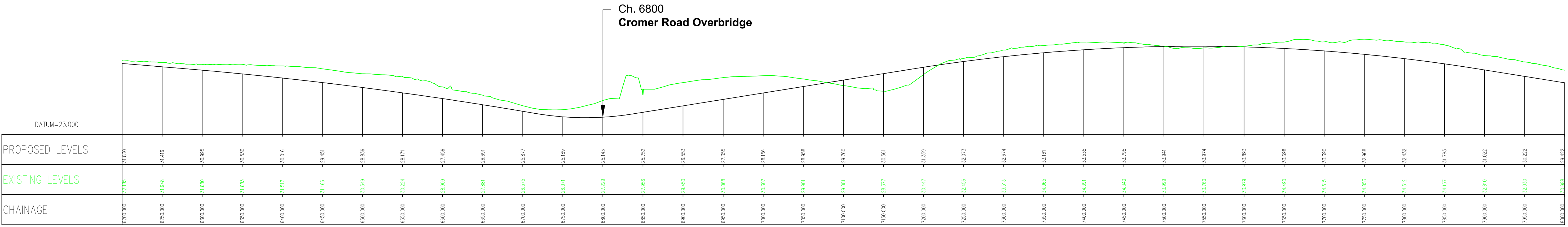
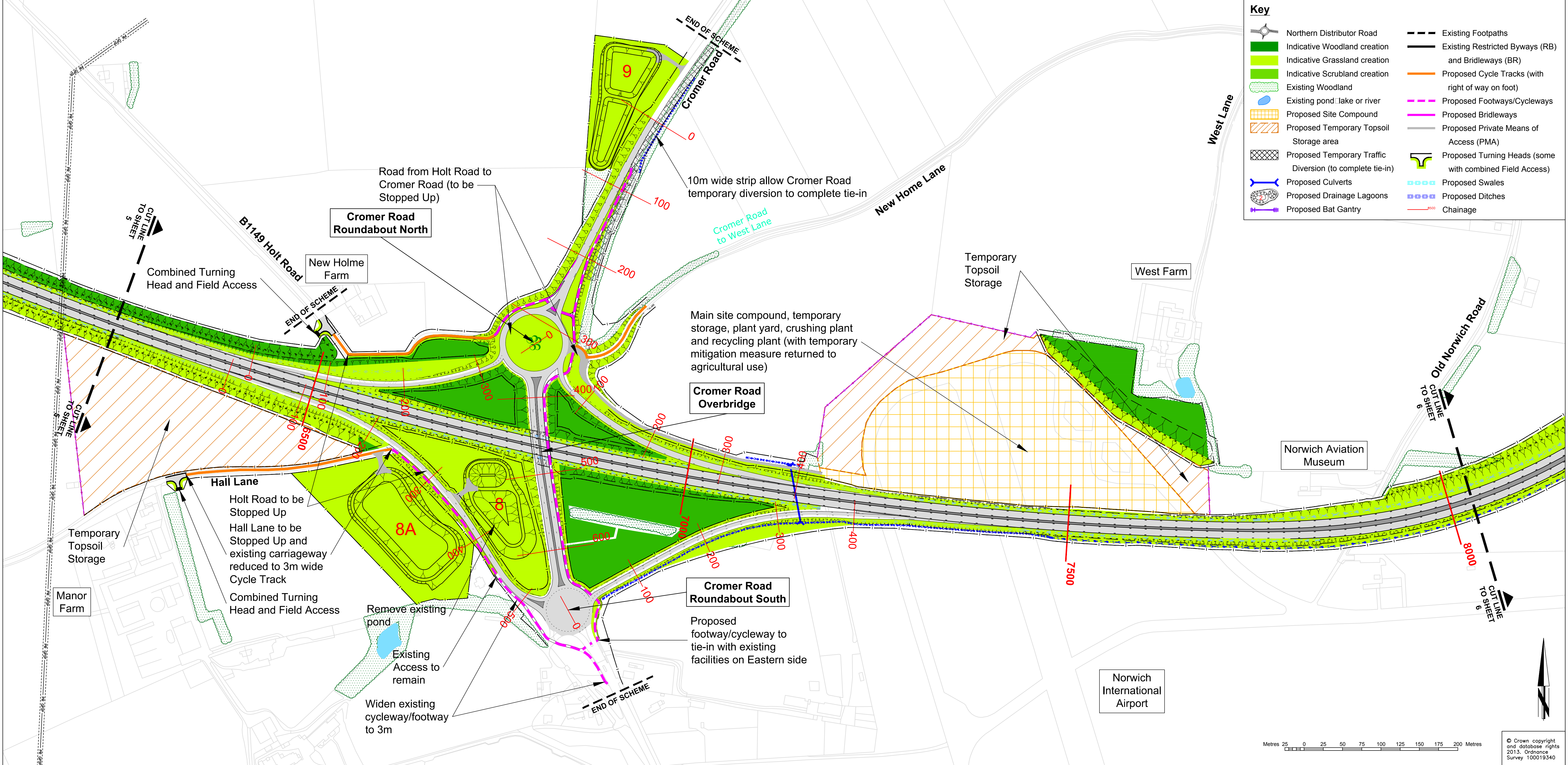
Mike Jackson  
Director of Planning and Transportation  
Norfolk County Council  
County Hall  
Martineau Lane  
Norwich NR1 2SG

**DRAWING TITLE**  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ENGINEERING LAYOUT AND PROFILE - MAINLINE  
SHEET 4 OF 12

REV	DESCRIPTION	CHECKED	DATE
A	See Revision Sheet for details	MKu	01/13
B	See Revision Sheet for details	MKu	04/13
C	See Revision Sheet for details	MKu	07/13
D	See Revision Sheet for details	MKu	01/13
E	See Revision Sheet for details	JB	09/13

SURVEYED BY	OS	200	DRAWING No	R1C093-R1-4006E
DESIGNED BY	JT	05/12	PROJECT TITLE	Norwich Northern Distributor Road
DRAWN BY	JT	05/12	SCALE	1:2500/1:250
CHECKED BY	MKu	06/12	FILE No	R1C093





Mike Jackson  
Director of Planning and Transportation  
Norfolk County Council  
County Hall  
Martineau Lane  
Norwich NR1 2SG

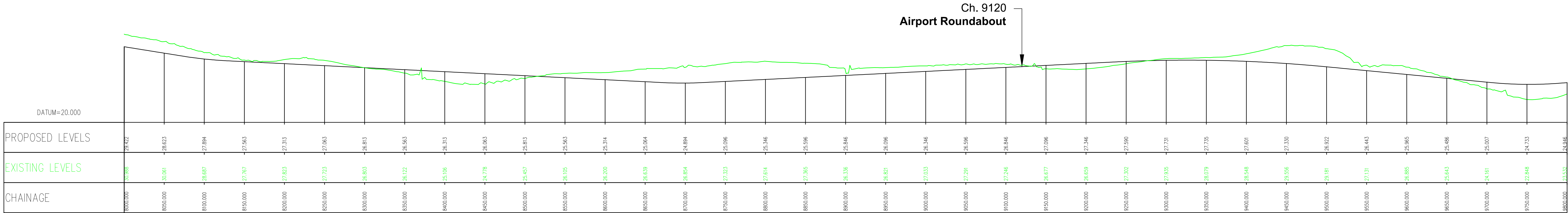
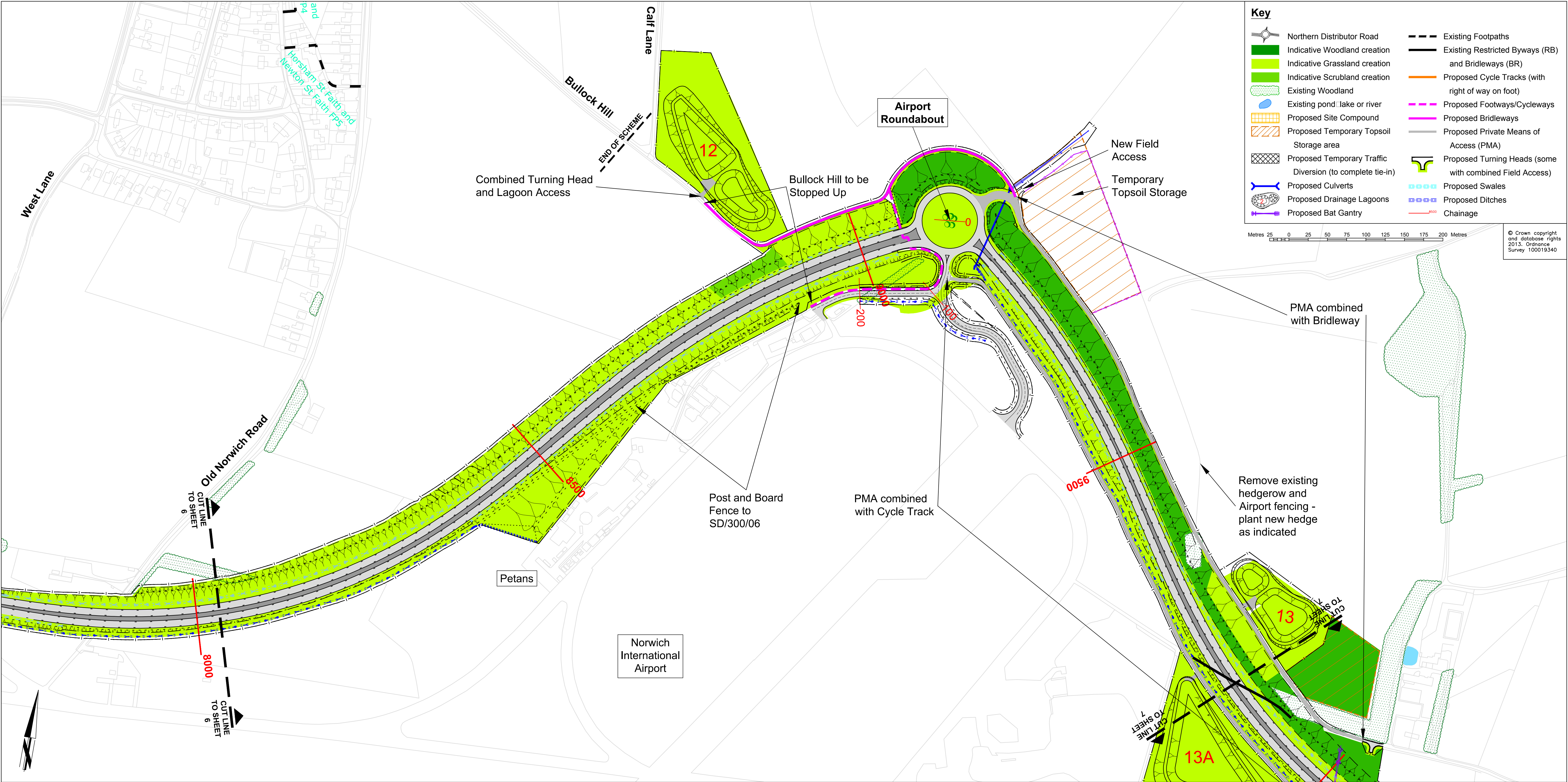
DRAWING TITLE  
NORWICH NORTHERN DISTRIBUTOR ROAD  
ENGINEERING LAYOUT AND PROFILE - MAINLINE  
SHEET 5 OF 12

REVISION	DESCRIPTION	CHECKED	DATE
A	See Revision Sheet for details	MKu	01/13
B	See Revision Sheet for details	MKu	04/13
C	See Revision Sheet for details	MKu	07/13
D	See Revision Sheet for details	MKu	01/13
E	See Revision Sheet for details	JB	09/13

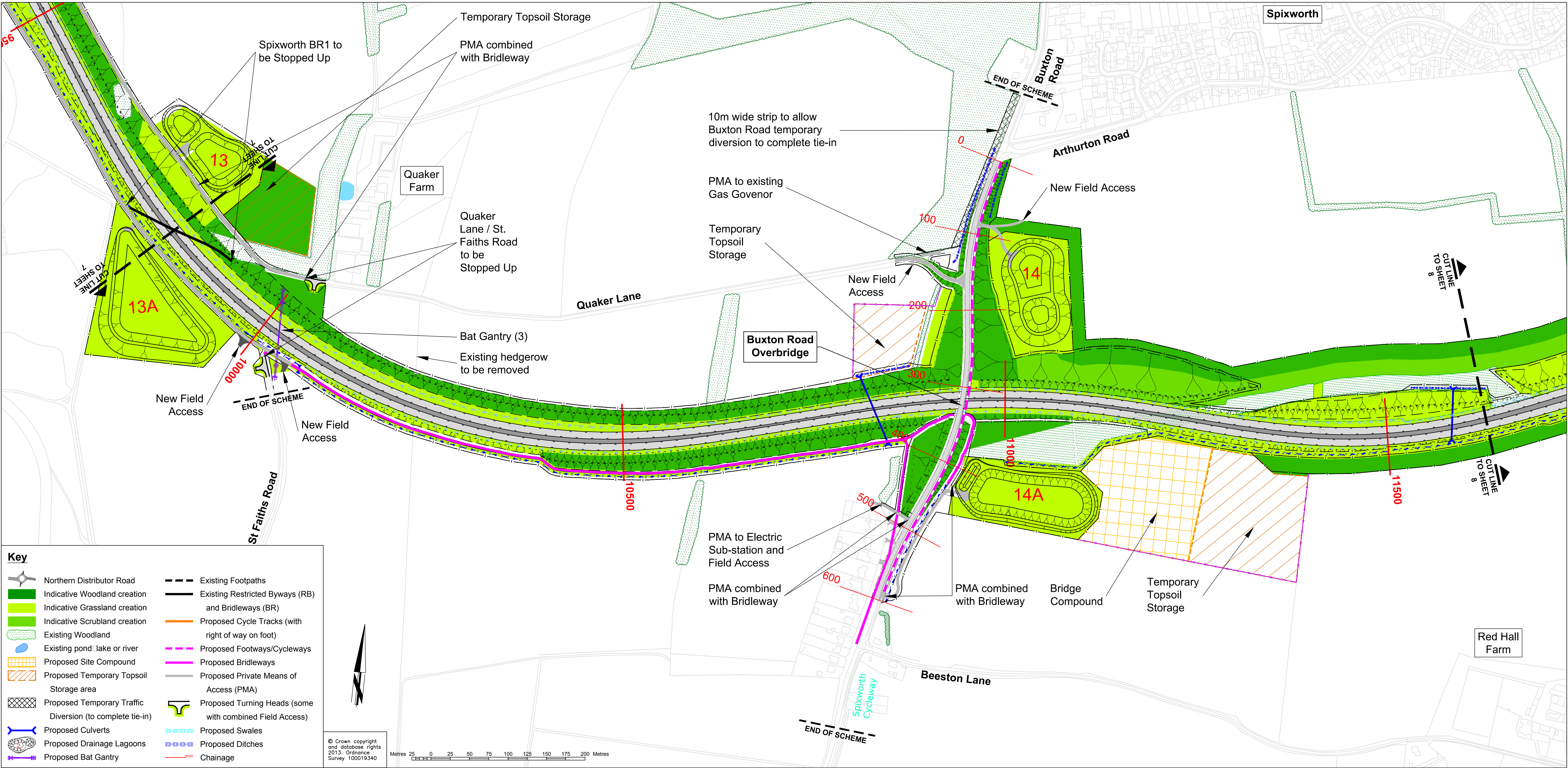
SURVEYED BY	INITIALS	DATE	DRAWING No
OS	200	01/12	R1C093-R1-4007E
DESIGNED BY	JT	01/12	PROJECT TITLE
DRAWN BY	JT	01/12	Norwich Northern Distributor Road
CHECKED BY	MKu	06/12	SCALE 1:2500/1:250

FILE No
R1C093









**Key**

Northern Distributor Road

Indicative Woodland creation

Indicative Grassland creation

Indicative Scrubland creation

Existing Woodland

Existing pond lake or river

Proposed Site Compound

Proposed Temporary Topsoil Storage area

Proposed Temporary Traffic Diversion (to complete tie-in)

Proposed Culverts

Proposed Drainage Lagoons

Proposed Bat Gantry

Existing Footpaths

Existing Restricted Byways (RB) and Bridleways (BR)

Proposed Cycle Tracks (with right of way on foot)

Proposed Footways/Cycleways

Proposed Bridleways

Proposed Private Means of Access (PMA)

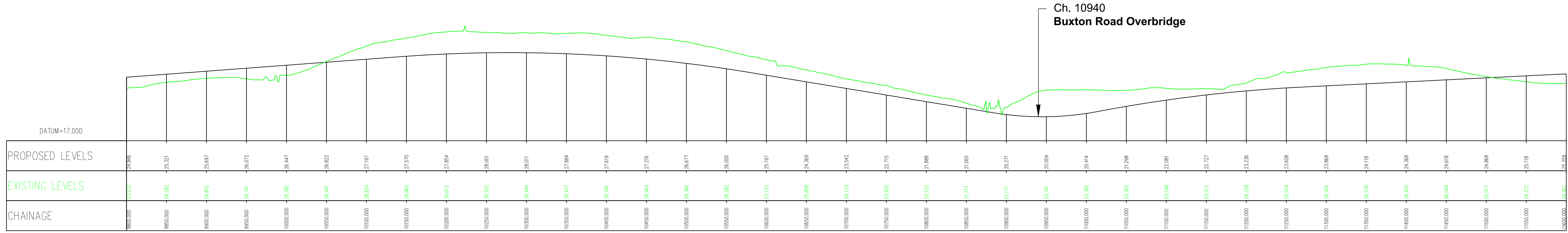
Proposed Turning Heads (some with combined Field Access)

Proposed Swales

Proposed Ditches

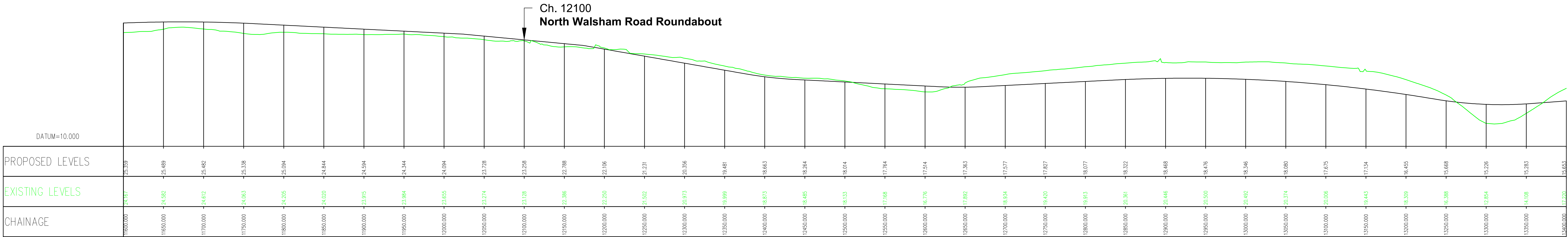
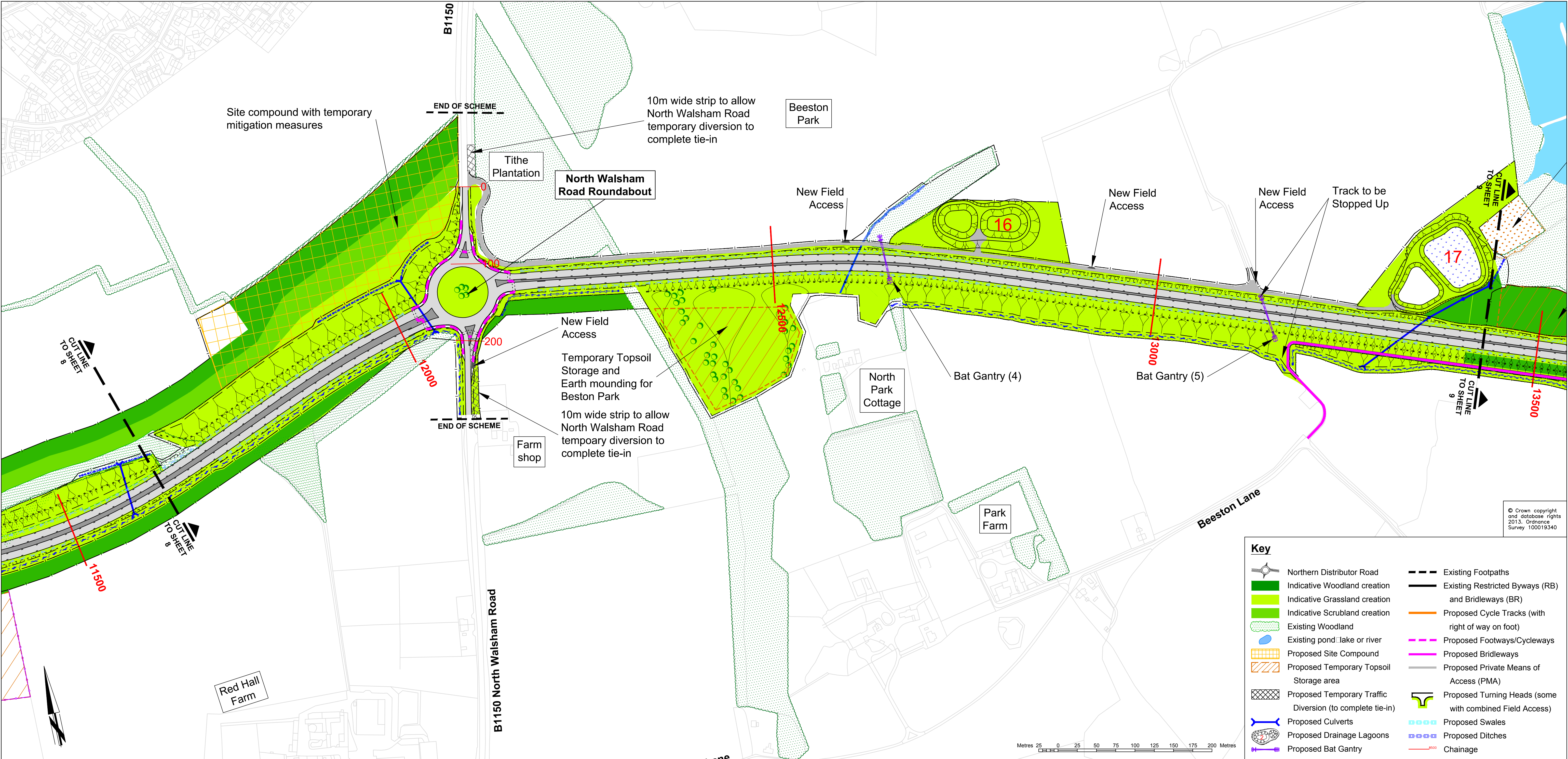
Chainage

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PROPOSED LEVELS		24.96																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											</
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Key

Northern Distributor Road

Indicative Woodland creation

Indicative Grassland creation

Indicative Scrubland creation

Existing Woodland

Existing pond, lake or river

Proposed Site Compound

Proposed Temporary Topsoil Storage area

Proposed Temporary Traffic Diversion (to complete tie-in)

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Proposed Footways/Cycleways

Proposed Bridleways

Proposed Private Means of Access (PMA)

Proposed Turning Heads (some with combined Field Access)

Proposed Swales

Proposed Ditches

Chainage

0

25

50

75

100

125

150

175

200

Metres

25

50

75

100

125

150

175

200

Metres

0

100

200

300

400

500

600

700

800

900

1000

1100

1200

1300

1400

1500

1600

1700

1800

1900

2000

2100

2200

2300

2400

2500

2600

2700

2800

2900

3000

3100

3200

3300

3400

3500

3600

3700

3800

3900

4000

4100

4200

4300

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4500

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50600

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50900

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51200

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51800

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52000

52100

52200

52300

52400













Ch. 19450, Postwick Hub Junction	
PROPOSED LEVELS	25.076
EXISTING LEVELS	25.571
CHAINAGE	19800.000
	19850.000
	19900.000
	19950.000
	20000.000
	20050.000
	20100.000
	20150.000
	20200.000
	20250.000
	20300.000
	20350.000

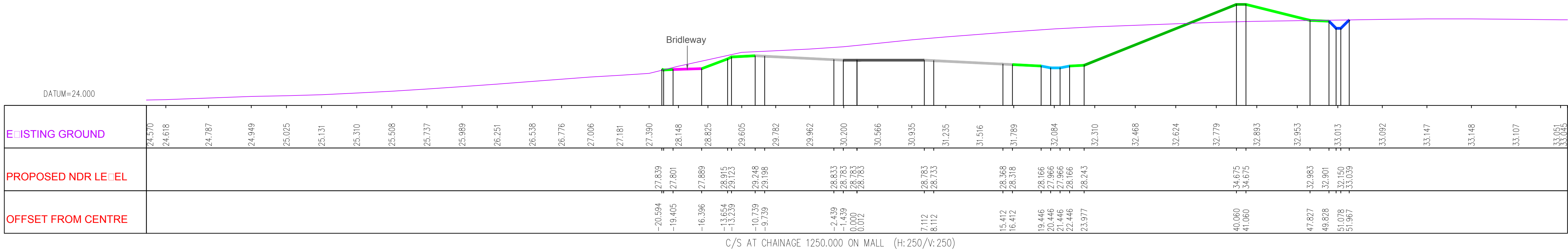
REVISION	DESCRIPTION	CHECKED	DATE
A	See Revision Sheet for details	MKu	01/13
B	See Revision Sheet for details	MKu	04/13
C	See Revision Sheet for details	MKu	07/13
D	See Revision Sheet for details	MKu	01/13
E	See Revision Sheet for details	JB	09/13

SURVEYED BY	INITIALS	DATE	DRAWING No
OS	OS	2001	R1C093-R1-4014E
DESIGNED BY	INITIALS	DATE	PROJECT TITLE
JT	JT	05/12	Norwich Northern Distributor Road
DRAWN BY	INITIALS	DATE	SCALE
JT	JT	05/12	1:2500/1:250
CHECKED BY	INITIALS	DATE	FILE No
MKu	MKu	06/12	R1C093

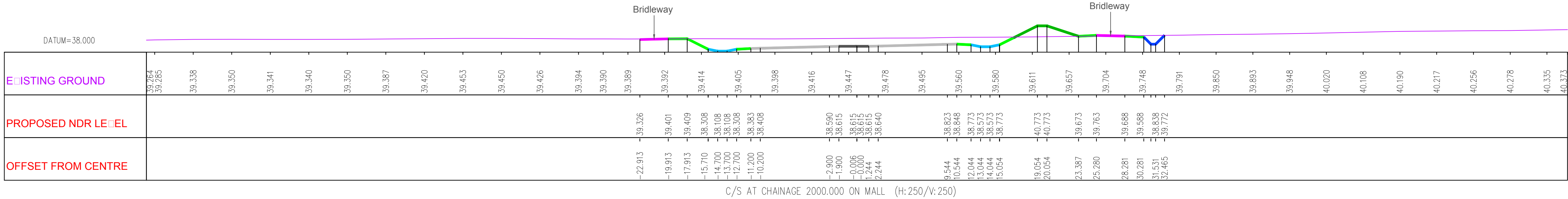
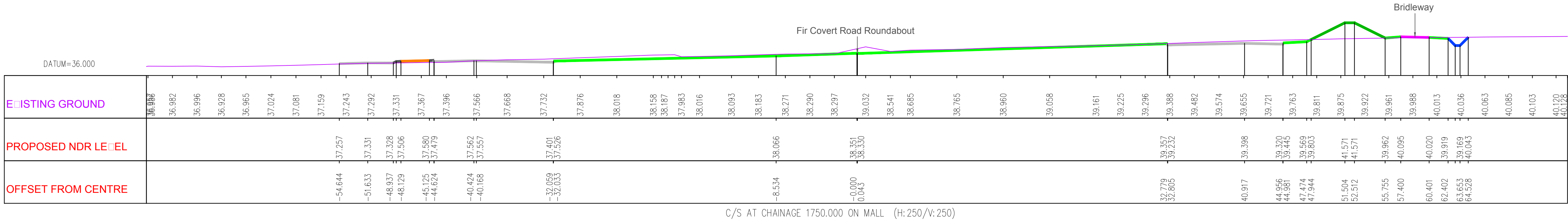
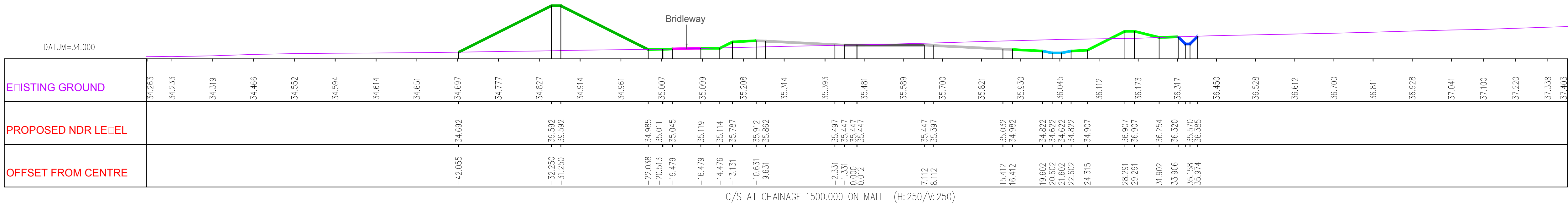


Appendix E  
Typical Cross Sections Sheets 1-16  
(Drawing No R1C093-R1-5115 to 5130)





- KEY
- Carriageway
  - Central reservation
  - Grass / Scrubland
  - Woodland
  - Hedge
  - Swale
  - Ditch
  - Lagoon
  - PMA / Bridleway
  - Footway / Cycleway
  - Retaining Wall
  - Existing ground level



NDR ALIGNMENT AS PER ENGINEERING LAYOUT REV E



Mike Jackson  
Director of Environment, Transport and Development  
Norfolk County Council  
County Hall  
Martineau Lane  
Norwich NR1 2SG

DRAWING TITLE  
Northern Distributor Road  
Mainline Cross Sections - Chainage 1250 to 2000  
(Sheet 2 of 16)

RE	DESCRIPTION	CHECKED	DATE

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DRAWN BY	RH	10/13				
CHECKED BY						

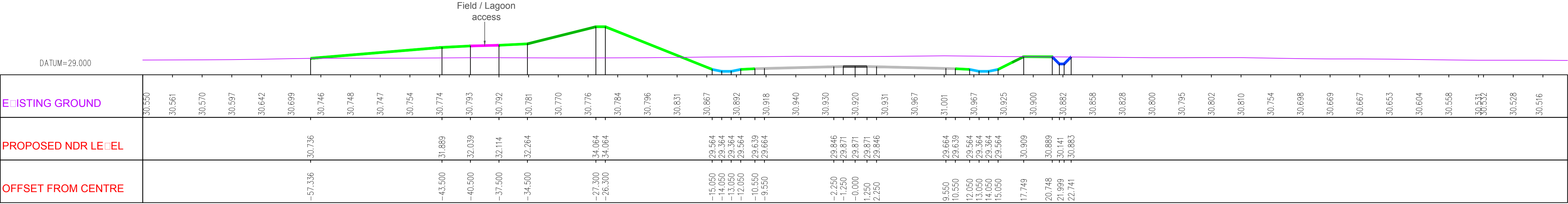
DRAFT  
Revision: 02  
Date: 19/10/13



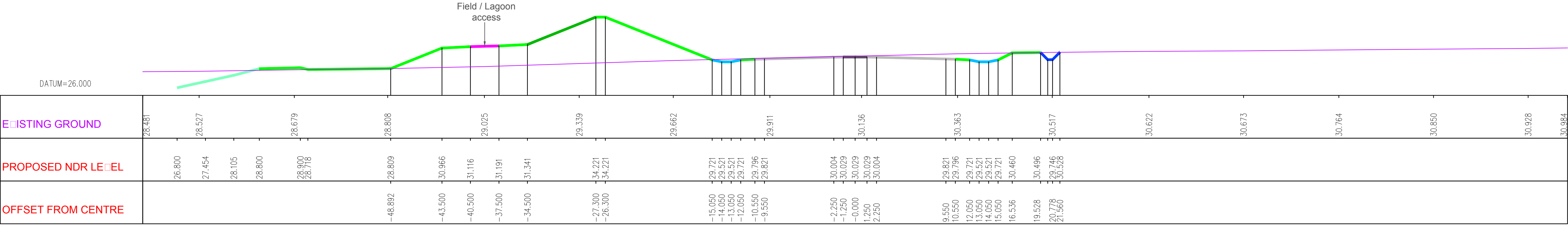






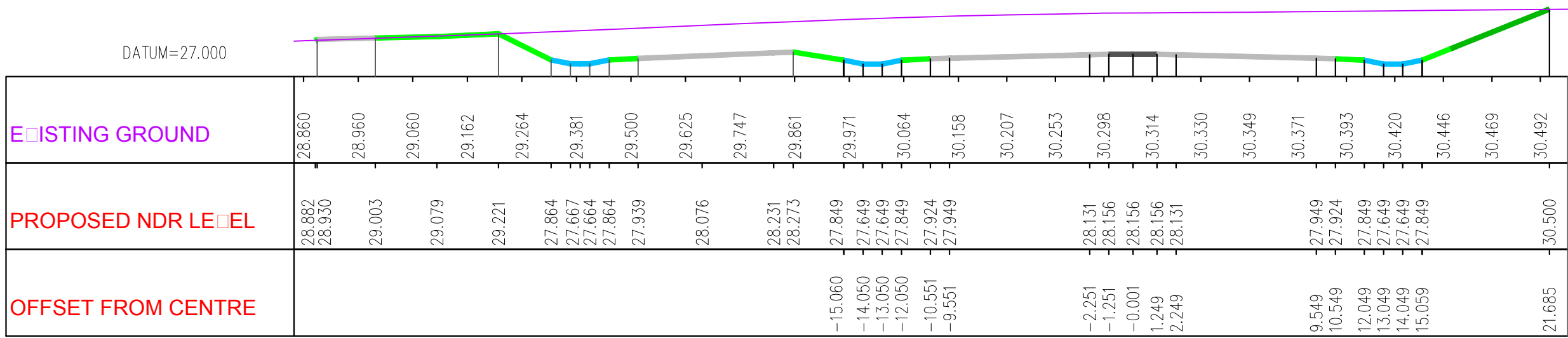


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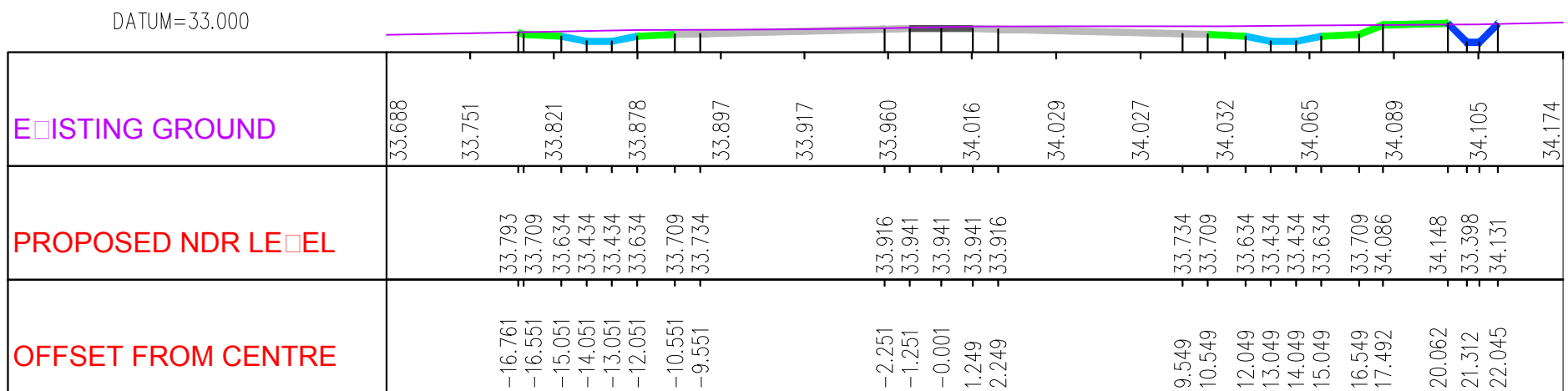


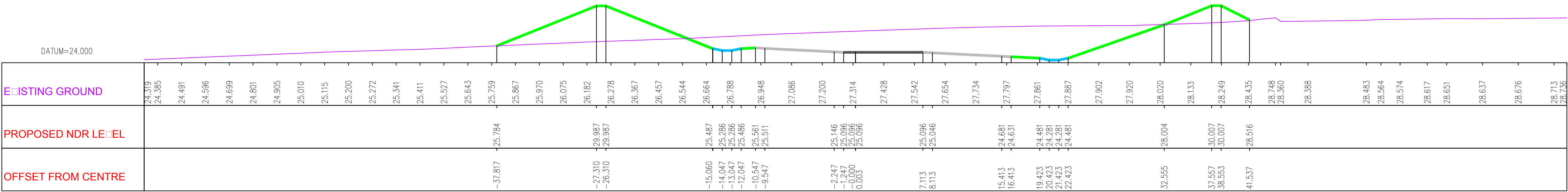




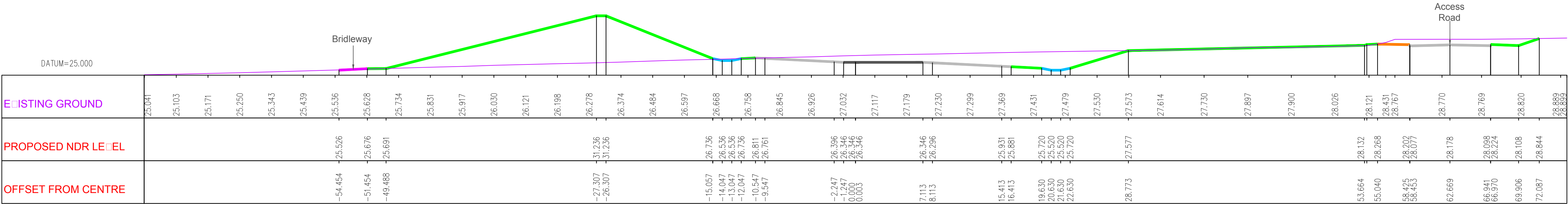


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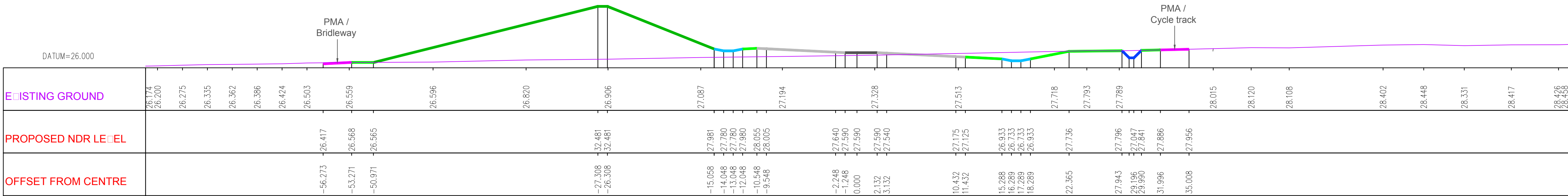




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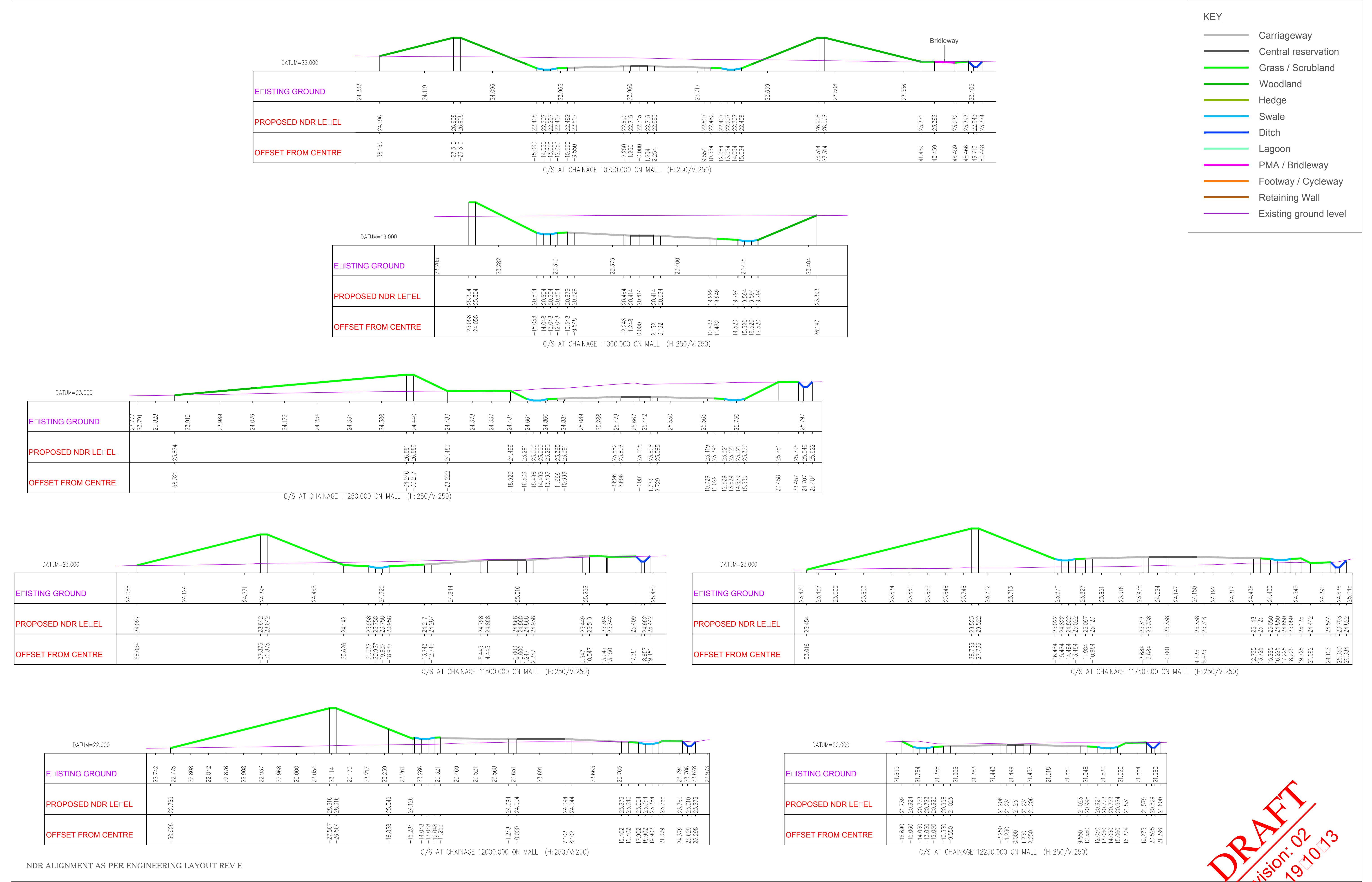


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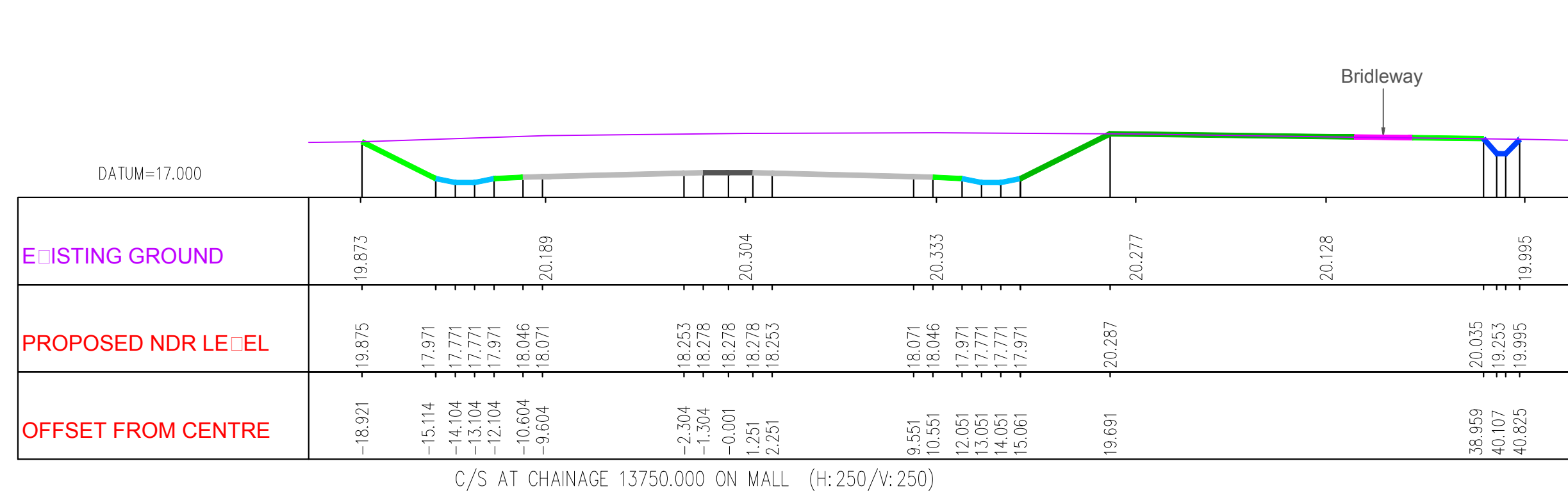
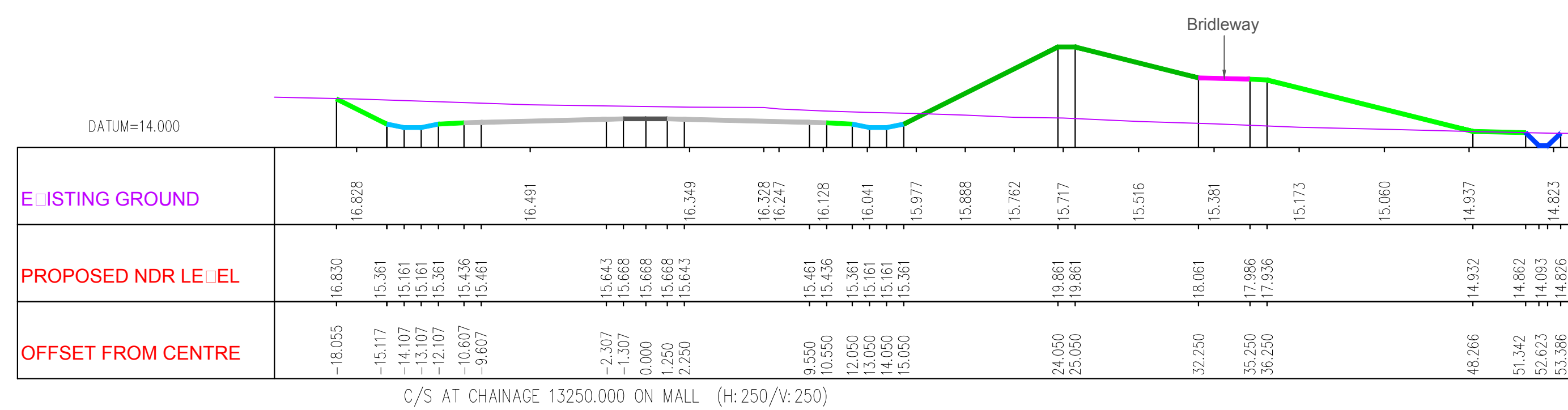
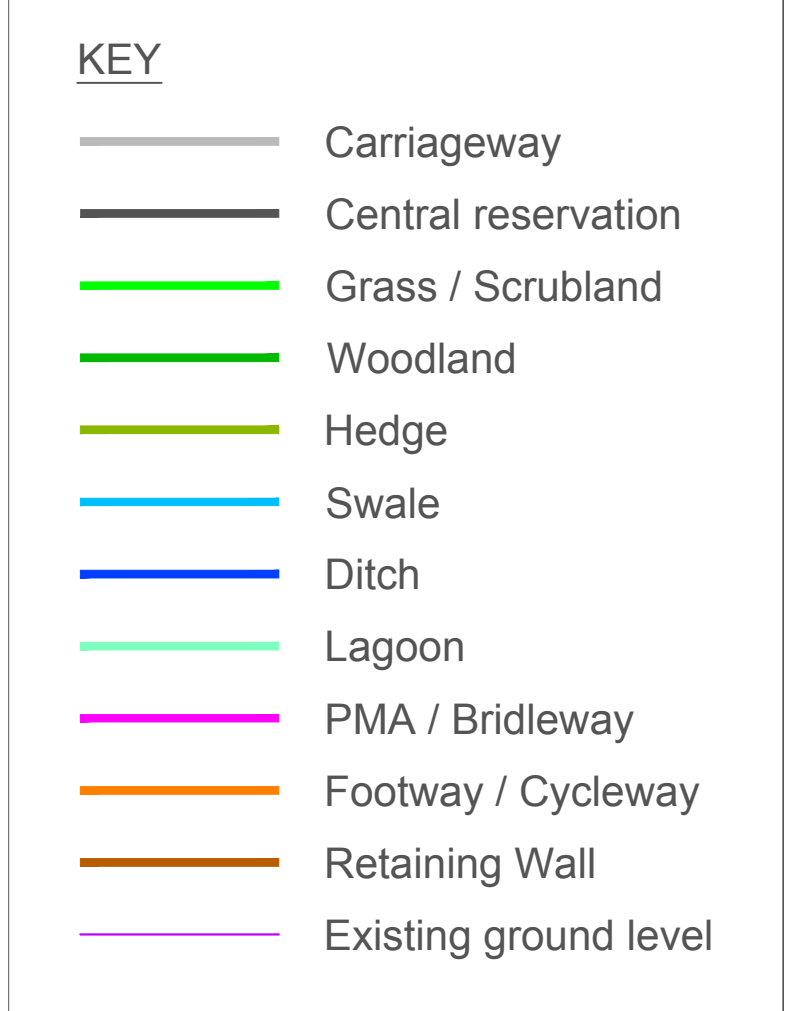




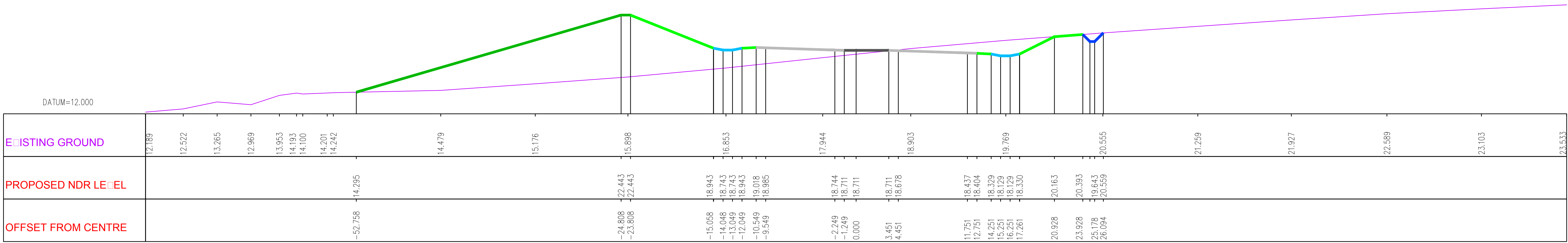




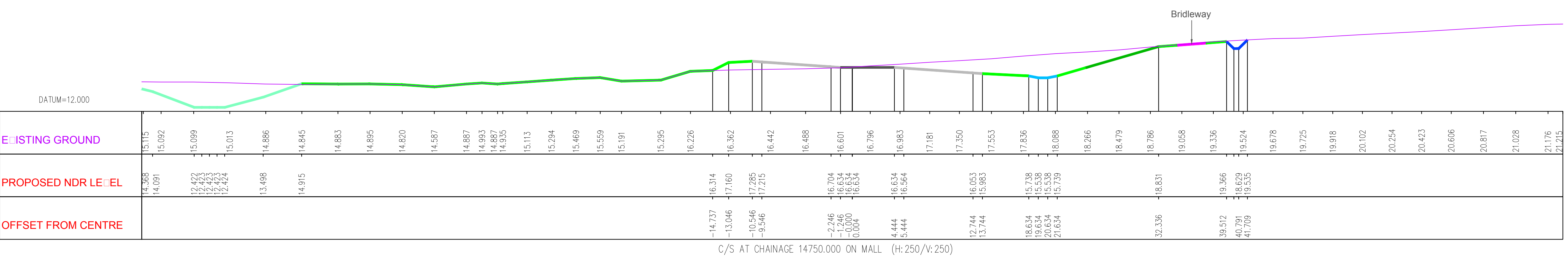
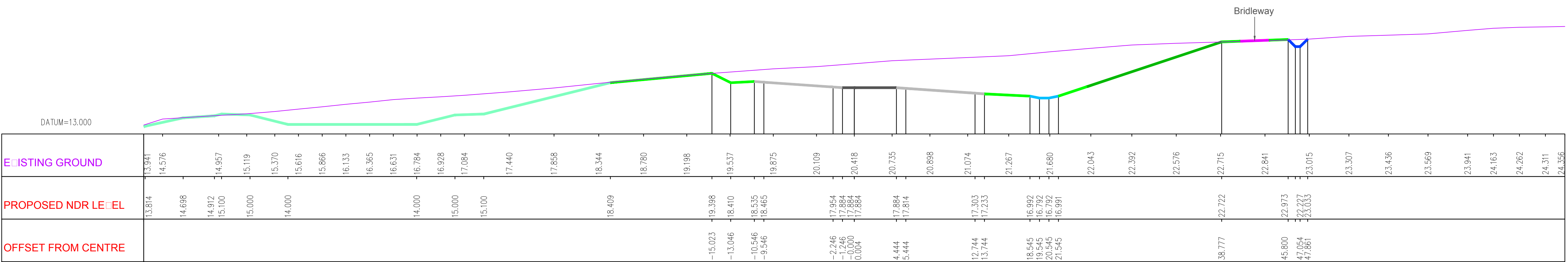
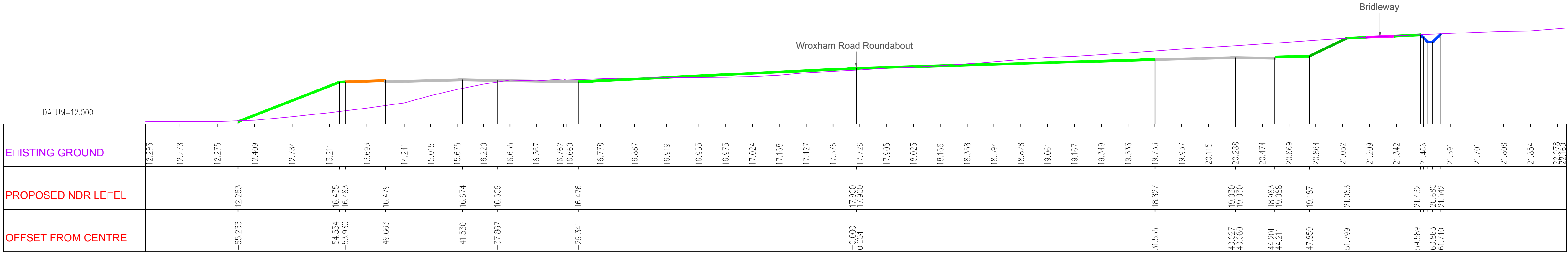




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	10/13	PROJECT NAME
	10/13	Norwich Northern Distributor Road (NDR)



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- Carriageway
  - Central reservation
  - Grass / Scrubland
  - Woodland
  - Hedge
  - Swale
  - Ditch
  - Lagoon
  - PMA / Bridleway
  - Footway / Cycleway
  - Retaining Wall
  - Existing ground level



NDR ALIGNMENT AS PER ENGINEERING LAYOUT REV E



Mike Jackson  
Director of Environment, Transport and Development  
Norfolk County Council  
County Hall  
Martineau Lane  
Norwich NR1 2SG

DRAWING TITLE

Mainline Cross Sections - Chainage 14000 to 14750  
(Sheet 12 of 16)

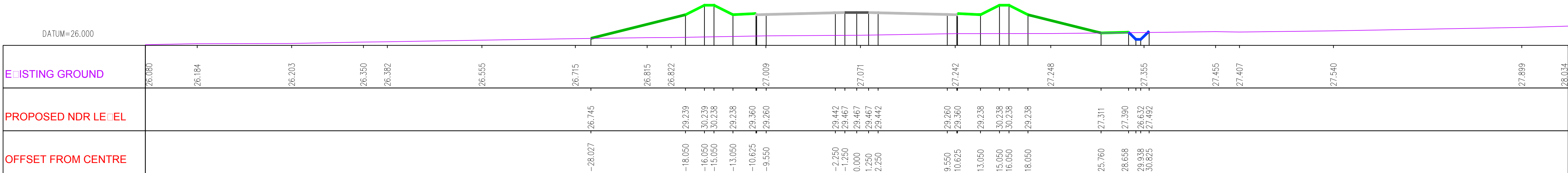
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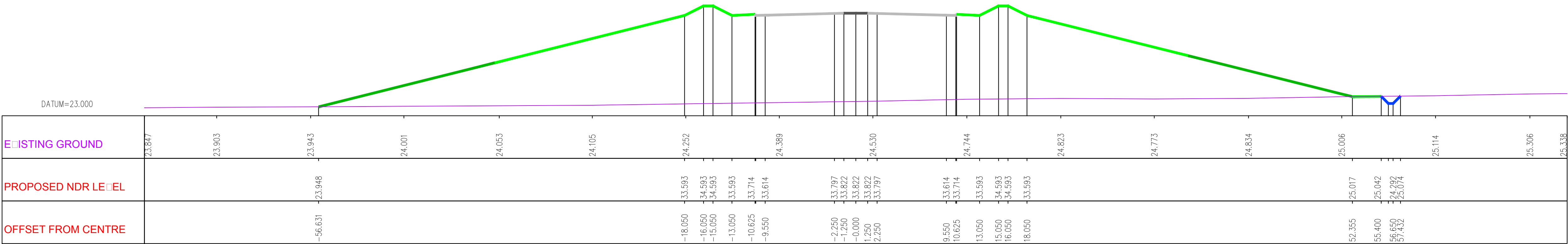
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Revision: 02  
Date: 19/10/13



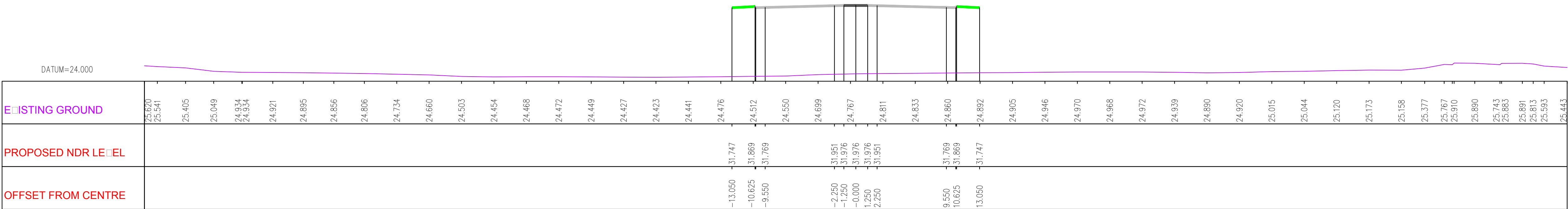




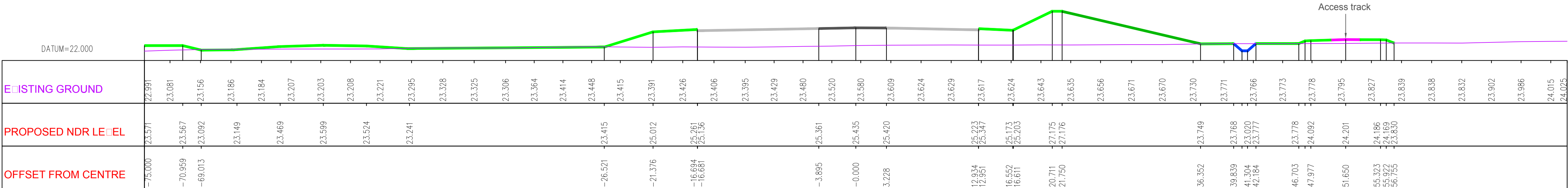
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C/S AT CHAINAGE 16750.000 ON MALL (H: 250/V: 250)



C/S AT CHAINAGE 17000.000 ON MALL (H: 250/V: 250)



C/S AT CHAINAGE 17250.000 ON MALL (H: 250/V: 250)

NDR ALIGNMENT AS PER ENGINEERING LAYOUT REV E

**DRAFT**  
Revision: 02  
Date: 19/10/13



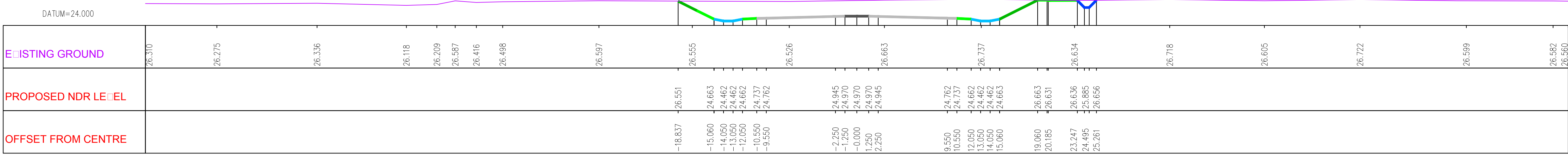
Mike Jackson  
Director of Environment, Transport and Development  
Norfolk County Council  
County Hall  
Martineau Lane  
Norwich NR1 2SG

DRAWING TITLE  
Northern Distributor Road  
Mainline Cross Sections - Chainage 16500 to 17250  
(Sheet 14 of 16)

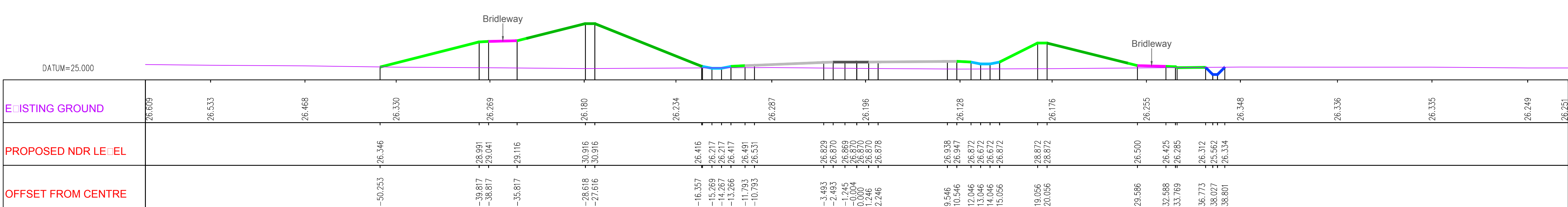
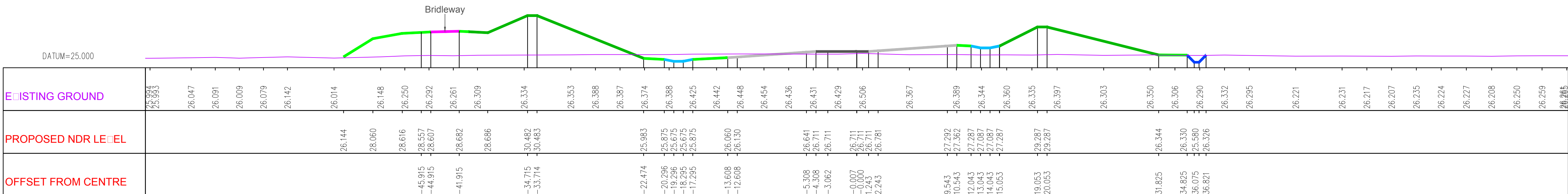
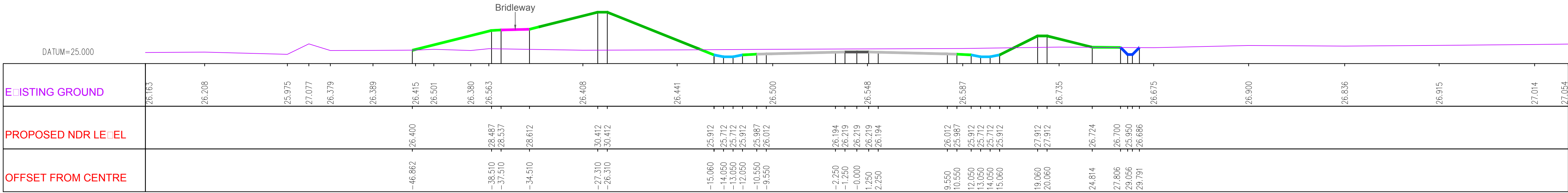
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DRAWN BY	INITIALS	DATE	Northern Distributor Road (NDR)
RH	RH	10/13	
CHECKED BY	INITIALS	DATE	SCALE
			1:250 A1
			FILE No
			R1C093





- KEY
- Carriageway
  - Central reservation
  - Grass / Scrubland
  - Woodland
  - Hedge
  - Swale
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  - Lagoon
  - PMA / Bridleway
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NDR ALIGNMENT AS PER ENGINEERING LAYOUT REV E



Mike Jackson  
Director of Environment, Transport and Development  
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County Hall  
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Norwich NR1 2SG

DRAWING TITLE  
Northern Distributor Road  
Mainline Cross Sections - Chainage 17500 to 18250  
(Sheet 15 of 16)

REVISION	DESCRIPTION	CHECKED	DATE

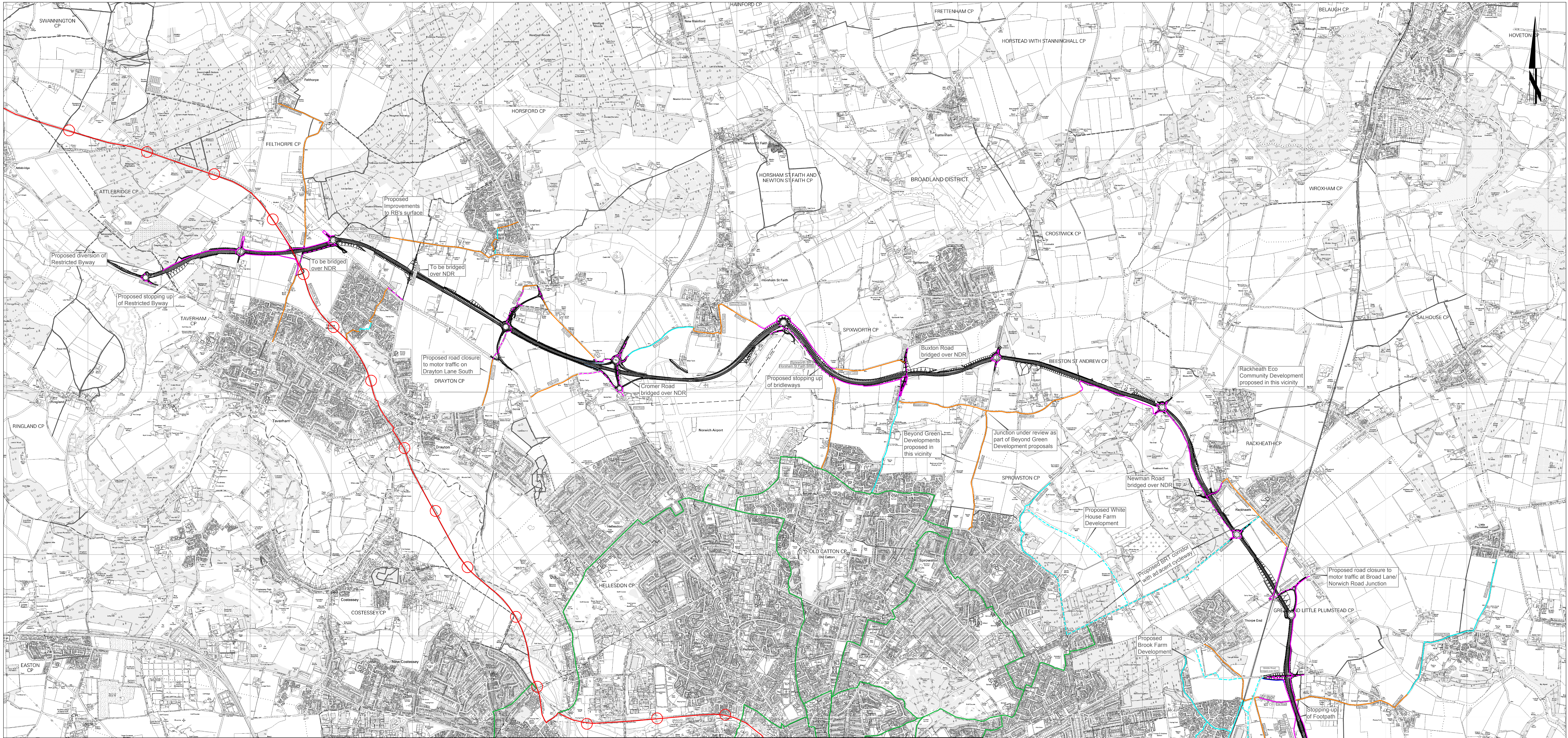
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CHECKED BY	RH	10/13	Norwich Northern Distributor Road (NDR)
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DRAFT  
Revision: 02  
Date: 19/10/13








Appendix F  
Non-Motorised User Links  
Drawing R1C093-R1-4053A








**KEY**


**Cycle Routes**

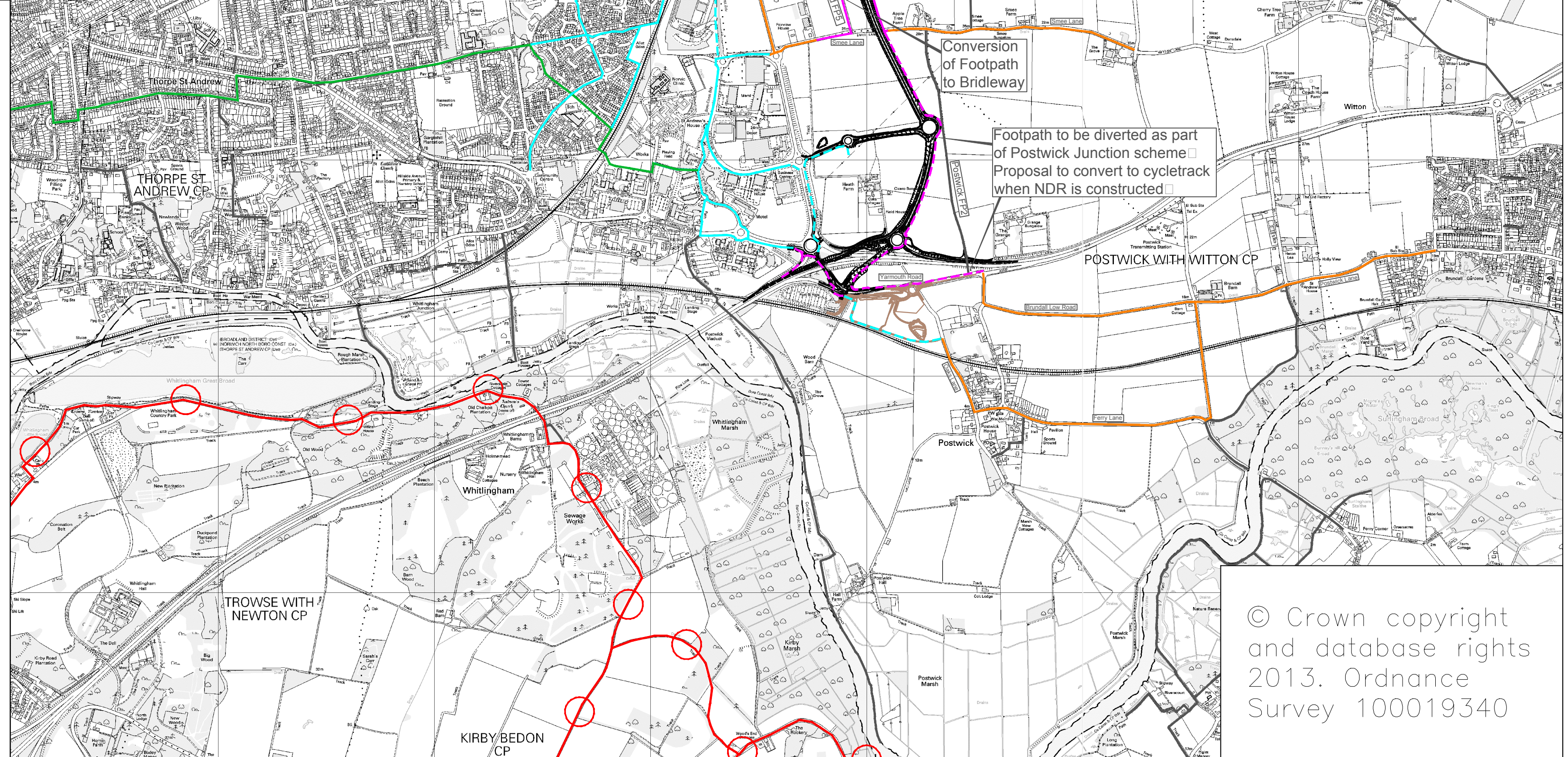
-  National Cycle Route 1
-  Cross City Pedalways (Norwich City Cycle Map)
-  Suggested links using existing Footways/Cycleways
-  Proposed Footway/Cycleway
-  Proposed Footway/Cycleway (Non-NDR Scheme)

**Public Rights of Way**

-  Existing Footpaths
-  Existing Restricted Byways / Bridleways
-  Proposed Footway/Cycleway/Bridleway

**Other**

-  Suggested links using existing roads



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Survey 100019340

RE	DESCRIPTION	CHECKED	DATE
A	Updates to reflect Engineering Layout Rev E	GB	10/2013

SURVEYED BY	INITIALS	DATE	DRAWING No
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DESIGNED BY	INITIALS	DATE	PROJECT TITLE
DN/GB	DN/GB	01/2013	Norwich Northern Distributor Road
DRAWN BY	INITIALS	DATE	SCALE
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CHECKED BY	INITIALS	DATE	FILE No
GB	GB	01/2013	R1C093



# APPENDIX A

## NDR Stage 1 Safety Audit Report

November 2013





## INTRODUCTION

This report contains the results of a Stage 1 Safety Audit carried out on the above scheme. The Audit was carried out at the request of Norfolk County Council Highways Group.

The Audit Team membership was as follows:-

Nevil Calder BSc(Hons) CEng MICE MCIHT MSoRSA (Audit Team Leader)	Principal Consultant Mott MacDonald
--	--

Kevin Allen BEng(Hons) IEng MCIHT MSoRSA (Audit Team Member)	Project Engineer Network Analysis + Safety Norfolk County Council
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Specialist Advisors:-

Andrew Sykes	Casualty Reduction Officer Norfolk County Council
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The Audit took place at Carrow House on 08 and 14 November 2013. The audit comprised an examination of the Safety Audit submission document, previous safety audits of the scheme and a site inspection on 14 November 2013 by the Audit Team Leader. The weather was bright and road surfaces dry.

The terms of reference are as described in Environment, Transport and Development Highways Service Manual Procedure SP03-07. The Auditors have examined and reported only on the road safety implications of the scheme as presented and have not verified the compliance of the design to any other criteria.

## **ITEMS RAISED AT PREVIOUS AUDIT**

Some safety issues raised at previous safety audits (stage 0 March 2007, stage 1 Dec 2008 and Feb 2012) have not been fully addressed and are referred to again in this report under items 1.1, 2.3, 5.1 and 5.3.

## **ITEMS RAISED AT THIS STAGE 1 AUDIT**

### **1.0 General**

#### **1.1 Problem**

Location: roadside throughout the scheme

Summary: risk of high severity impact with mature trees

Details of proposed planting were not included in this submission. On high speed roads mature trees present a significant hazard to errant vehicles, resulting in high severity injuries.

#### **Recommendation**

In accordance with TD19/06 no shrub planting should occur within 4.5m of the carriageway and no climax species within 9.0m unless protected by VRS.

Consideration should also be given to sideslope gradients within these distances.

Slopes steeper than 1in3 are considered non-traversable ie. on downslopes errant vehicles are likely to rollover or speed up towards any hazard at the bottom.

Where planting is proposed adjacent to visibility splays it should be set back at least 1m in order to allow for future growth. Permanent markers delineating such splays can assist future maintenance.

#### **1.2 Problem**

Location: roadside throughout the scheme

Summary: risk of high severity impact with roadside fencing

Details of proposed fencing were not submitted at this stage. On high speed roads fencing with rigid horizontal rails presents a significant hazard to errant vehicles. Impact can result in penetration of the vehicle cabin causing high severity injuries.

#### Recommendation

On NDR mainline no fencing should have rigid horizontal rails

## **2.0 Alignment**

### **2.1 Problem**

Location: CH8200 and CH10200

Summary: visibility partially obstructed by median VRS

There are locations where visibility appears to be restricted to 2 steps below standard by median VRS in combination with horizontal curvature of 1 step below. This obstruction to visibility is partial (only affects lower height objects) and occurs on non-event sections, away from junctions where braking/queuing might be anticipated; however it should be noted as a departure from standard.

#### Recommendation

In order to minimise the obstruction to visibility, a median VRS of the wire rope barrier type is recommended due to its narrow profile and lower height.

### **2.2 Problem**

Location: CH8600 approach to airport roundabout

Summary: visibility obstructed by median VRS

Visibility appears to be restricted by the median VRS to 1 step below standard on approach to a roundabout junction. As above, the obstruction is partial, however a departure from standard is not considered appropriate here due to the likelihood of braking/queuing.



## Recommendation

Check visibility and amend the alignment and/or widen the median in order meet standard SSD.

### 2.3 Problem

Location: CH18700

Summary: lay-by provision introduces conflicts

In view of the distributor nature of the road and frequent junction provision, a strategy of non provision of lay-bys has been adopted. The proposed lay-bys at this point are the only ones on the 21km length and the exceptional nature of this location is not understood. They appear to introduce unnecessary potential conflicts.

## Recommendation

Delete the proposed lay-bys.

## 3.0 Junctions

### 3.1 Problem

Location: NDR roundabouts - radial route approaches

Summary: splitter island lengths

The splitter islands on many of the radial route arms are shorter than desirable on a high speed approach. A longer island would aid conspicuity (particularly as roundabouts will be unlit), improve tangential guidance and minimise risk of crossover accidents on busy exits.

## Recommendation

Extend splitter island lengths to 30-50m where practicable.

### 3.2 Problem

Location: Fakenham Road roundabout

Summary: narrow 3 lane entry/circulatory increases risk of side swipe collisions

The 3-lane north-western entry feeding into a 9m circulatory carriageway is considered to raise the risk of side swipe collisions. Projected traffic flows here do not appear to require 3 lanes.

#### Recommendation

Reduce the Fakenham Road north-west entry to 2 lanes. This may also offer the opportunity to improve the tangential path guidance provided by the splitter island.

### 3.3 Problem

Location: Fakenham Road roundabout

Summary: relaxed entry path curvatures raises risk of failure to give way

The entry path radius on the Fakenham Road SE arm appears to be in excess of 100m raising the risk of failure to give way.

#### Recommendation

Check entry path radius and modify geometry as necessary.

### 3.4 Problem

Location: Fir covert Road roundabout

Summary: excessive circulatory width for projected flows

The 12m circulatory width (in common with other NDR roundabouts) appears excessive for the projected flows here. This can lead to poor lane discipline, higher speeds and increased risk of accidents on the circulatory area.

#### Recommendation

Review the need for such a wide circulatory carriageway. If the capacity is judged necessary in the long term then temporary measures to reduce the width may be appropriate.

### 3.5 Problem

Location: Reepham Road roundabout

Summary: SE arm geometry safety implications

Inadequate tangential guidance is provided by the splitter island on the SE arm which raises the risk of striking the central island or losing control. The flare length also appears to be very short raising concern over potential queuing on this arm.

#### Recommendation

Review the geometry of this arm to address these issues.

### 3.6 Problem

Location: Cromer Road westbound merge slip road

Summary: 2-way layout poses risk of head-on collisions

The length of the proposed 2-way section coupled with low eastbound usage raises concern over westbound drivers using it either deliberately or mistakenly for overtaking.

#### Recommendation

Reposition the access to lagoon 8A to its SE corner thereby significantly shortening the 2-way length to mitigate this risk.

### 3.7 Problem

Location: Various roundabouts

Summary: Private/service accesses

A number of the roundabouts have an arm serving private access to farms or drainage lagoons. This adds to the complexity of the roundabout layout which can have



adverse safety implications. In addition to clear signing, a different surface treatment would help differentiate these exits for circulating traffic.

#### Recommendation

Provide flush kerbs and a band of contrasting coloured surfacing to these arms.

### 3.8 Problem

Location: Airport roundabout

Summary: southern arm layout is potentially misleading for drivers

A 2-lane exit from the roundabout is shown for the private access road to the Airport and Petans training centre. This will make it look unnecessarily like the other dual carriageway exits, increasing the potential for driver confusion. The airport access in particular will need to be gated to avoid inadvertent entry to the airfield.

#### Recommendation

Redesign this arm to reduce the potential for confusion, providing conspicuous gates together with turning facilities for any errant vehicle to rejoin NDR without reversing onto the roundabout.

### 3.9 Problem

Location: Broad Lane closure at Plumstead Road

Summary: farm road offers potential rat-run

A farm access road is indicated which bypasses the closure point at the Broad Lane junction. This could be attractive to general through traffic, eroding the benefit of the closure and increasing use of the lower standard farm access junction.

#### Recommendation

Ensure that the access road is gated

### 3.10 Problem

Location: Business Park Roundabout

Summary: high speed approach to segregated straight ahead lane

As noted in TD51 (parag 2.71), segregated straight ahead lanes have a number of inherent safety issues. These are exacerbated on a high speed dual carriageway where traffic approaching at 70mph is required to safely negotiate reverse curves of radius more than 6 design steps below standard. The reverse curves make application of superelevation extremely problematical. There is therefore a high attendant risk of loss of control, run-off accidents and HGV rollover.

#### Recommendation

Reconsider whether this feature is essential (it appears that conflicting traffic on the circulatory is limited to a single lane entry from the Business Park Link which will be interrupted by frequent northbound NDR traffic). If so, then provide measures to reduce speeds on entry to the segregated ahead lane to less than 40mph; the proposed mandatory speed limit is unlikely to suffice. In addition provide measures to mitigate against loss of control (eg high friction surfacing) and potential run-off (eg VRS).

## 4.0 Non-motorised Users

### 4.1 Problem

Location: Fir Covert Road Roundabout

Summary: bridleway ends at busy roundabout

A bridleway is indicated on the south side of NDR between Marriotts Way and Fir Covert Road. However this would bring horses out onto Fir Covert Rd roundabout with no obvious continuation of the facility.



---

Recommendation

Redesignate this stretch as footway/cycleway only.

4.2 Problem

Location: Reepham Road Roundabout

Summary: bridleway adjacent to busy roundabout

A bridleway is indicated on the north-western side of the roundabout in close proximity to the circulatory area where horses may be startled by the close proximity to heavy traffic. Furthermore the bridleway appears to be shown crossing Reepham Road using the roundabout splitter island which is not considered a safe refuge for horses.

Recommendation

Realign the bridleway route further from the roundabout to link with the specific horse crossing of Reepham Road.

4.3 Problem

Location: bridleway - CH10900 beneath Buxton Rd overbridge

Summary: proximity of bridleway to NDR mainline

A bridleway is indicated passing beneath the Buxton Rd overbridge adjacent to the westbound carriageway of NDR. The proximity to oncoming fast moving heavy traffic within the confines of the bridge structure is considered likely to be intimidating for horses with potential for rearing/bolting. This not only poses a danger to riders but also to NDR traffic should fencing not contain the animal.

Recommendation

Delete this section of bridleway; an alternative route appears to be available.

4.4 Problem

Location: Wroxham Road Roundabout

Summary: bridleway adjacent to busy roundabout

A bridleway is indicated on the south-eastern side of the roundabout in close proximity to the circulatory area where horses may be startled by the close proximity to heavy traffic. This appears to be a shared pedestrian cycle route posing a danger to other users. Furthermore there is concern about the risk of pedestrian/cycle crossing points being mistakenly used by horse riders.

The identified horse crossing point on the southern arm of Wroxham Road is around 120m from the roundabout suggesting that visibility in that direction will be less than recommended in TA90 even assuming 50kph roundabout exit speeds.

#### Recommendation

Realign the horse route further from the roundabout, segregated from ped/cycle use if possible. Move the horse crossing point further from the roundabout.

#### 4.5 Problem

Location: CH17000 Road Roundabout

Summary: bridleway adjacent to railway line

A bridleway is proposed between Plumstead Road and Broad Lane directly adjacent to the railway line. Although rail traffic is quite light, horses may be startled by their close proximity, with potential for rearing/bolting.

#### Recommendation

Provide secure fencing/screening between bridleway and railway.

#### 4.6 Problem

Location: bridleway - Plumstead Rd South Roundabout to CH17700

Summary: proximity of bridleway to NDR mainline

A bridleway is indicated adjacent to roundabout circulatory and southbound carriageway of NDR. Horses may be startled by the close proximity to fast moving heavy traffic, with potential for rearing/bolting. This poses a danger to riders and also to NDR traffic.

## Recommendation

Move the proposed bridleway further from the carriageway and provide screening/fencing.

## **5.0 Signs, Lighting and Markings**

### **5.1 Problem**

Location: throughout the scheme

Summary: lack of street lighting increases night time accident risk

It is noted that the cost/benefit of lighting the scheme has been subject to a separate safety assessment in accordance with TD47/07 and that lighting is not proposed except for the complex Postwick interchange. Nevertheless there is some concern about night time risk, particularly at the large multi-lane roundabouts where some mitigation measures would be beneficial.

## Recommendation

Full provision of white, red, amber and green road studs is recommended throughout in accordance with the TSM. Reduced stud spacing may be advantageous on approach to the unlit roundabouts. It is also recommended that key signs associated with the roundabout junctions should be lit, particularly direction signs at each exit (on the circulatory area the sweep of headlights tends to lag behind the driver's viewpoint).

Lighting is particularly beneficial to the safety of vulnerable road users. It may be considered that VRU crossing points at the roundabouts are initially likely to be very lightly used at night. However this should be reviewed in future in conjunction with planned development within and close to the NDR.



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5.2 Comment

Location: NDR mainline

Summary: safety benefit of raised profile edge lines

Specific details of road markings were not submitted at this stage. However raised profile edge markings are recommended, not only for the benefit of audio vibratory warning but also improved night time and wet weather visibility.

5.3 Comment

Location: roadside throughout the scheme

Summary: risk of high severity impact with large diameter sign posts and lighting columns

Post details were not submitted at this stage. However the benefits of passive posts should be assessed in accordance with NCC policy *The Use of Passively Safe Street Furniture in Norfolk*

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## AUDIT TEAM STATEMENT

We certify that this audit has been carried out in accordance with Norfolk County Council Environment, Transport and Development Procedures.

Signed (ATL)

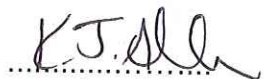


Nevil Calder

Dated

20 Nov 2013

Signed



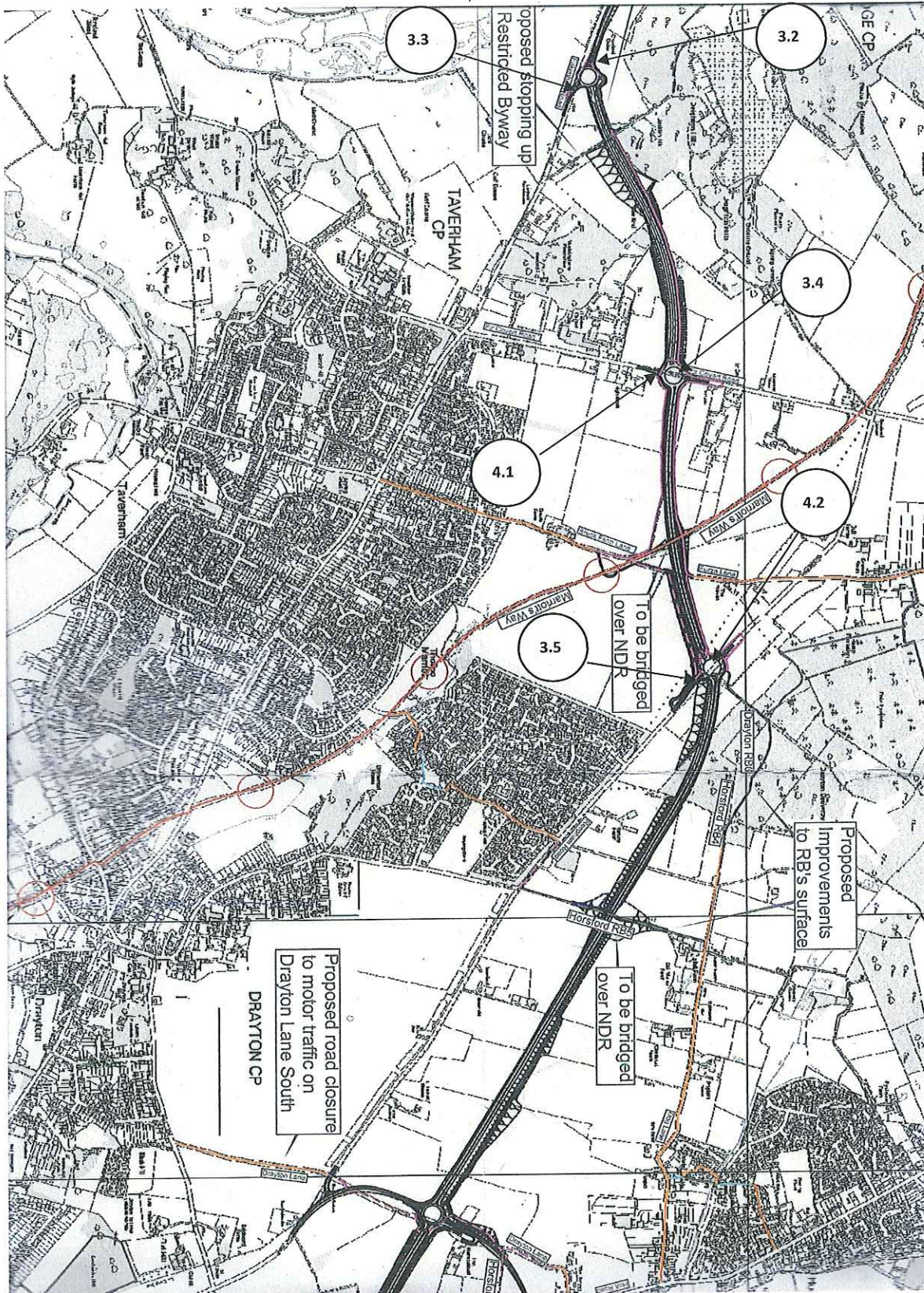
Kevin Allen

Dated

28 November 2013

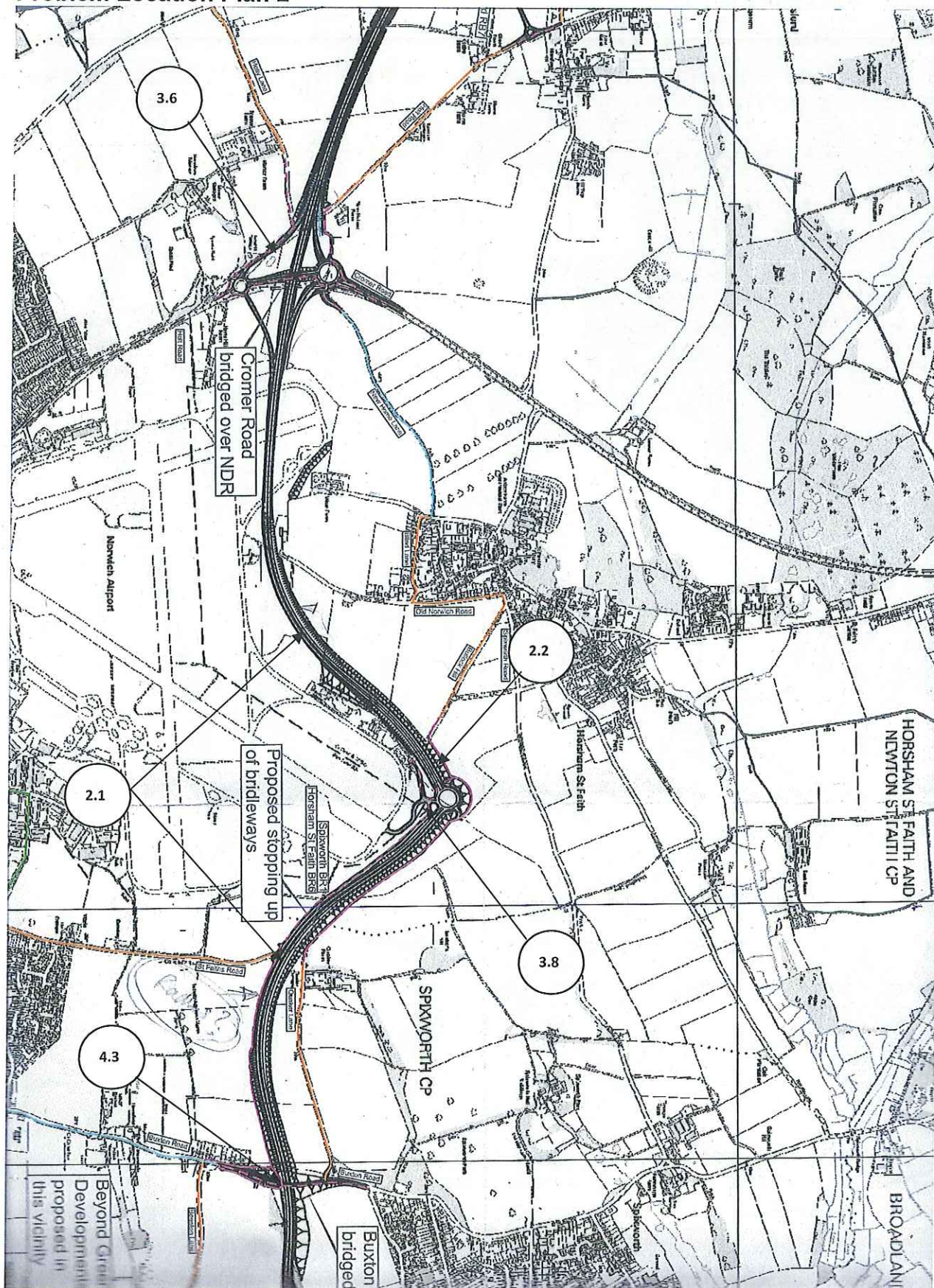


**APPENDIX A – Problem Location Plan 1**



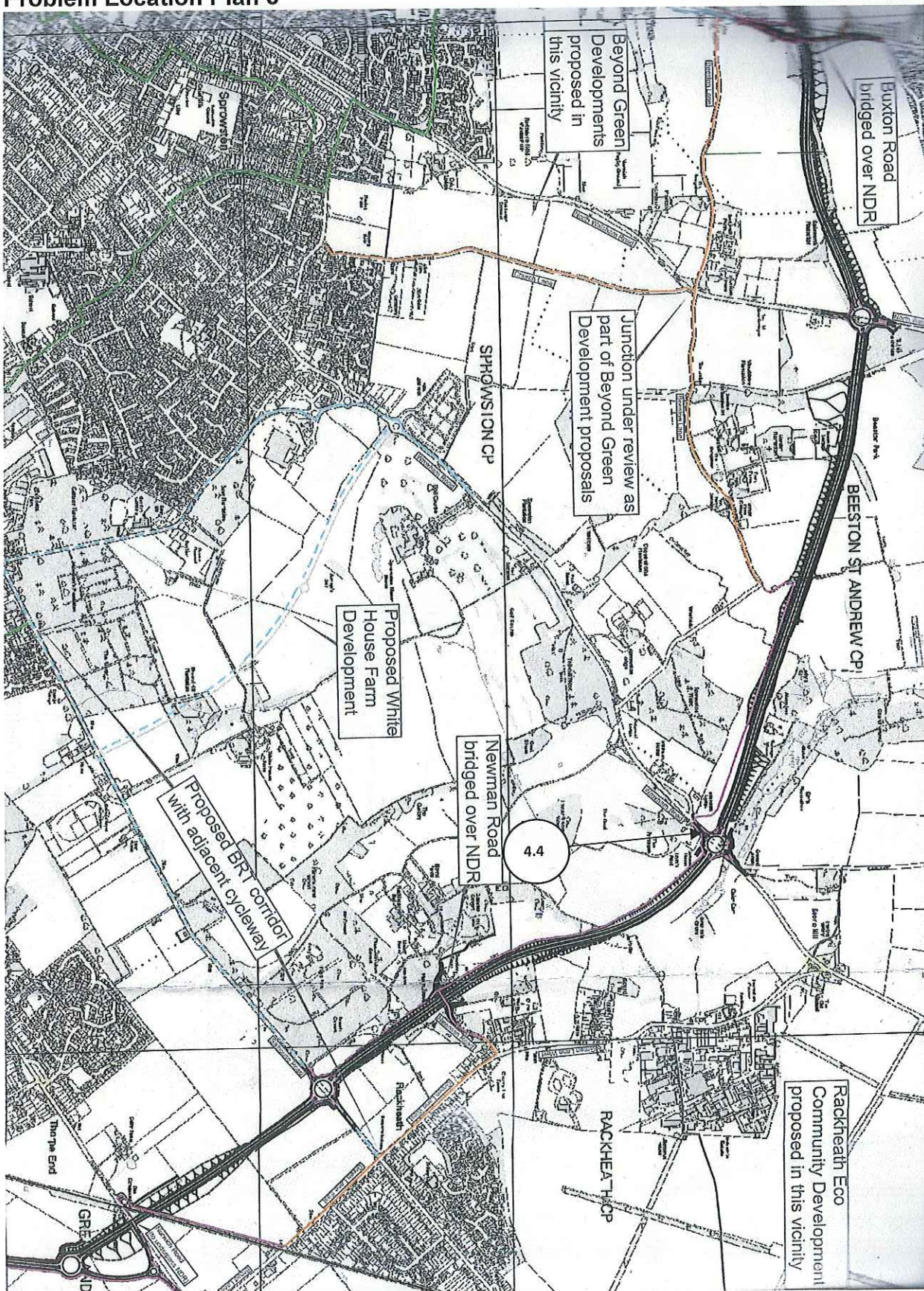


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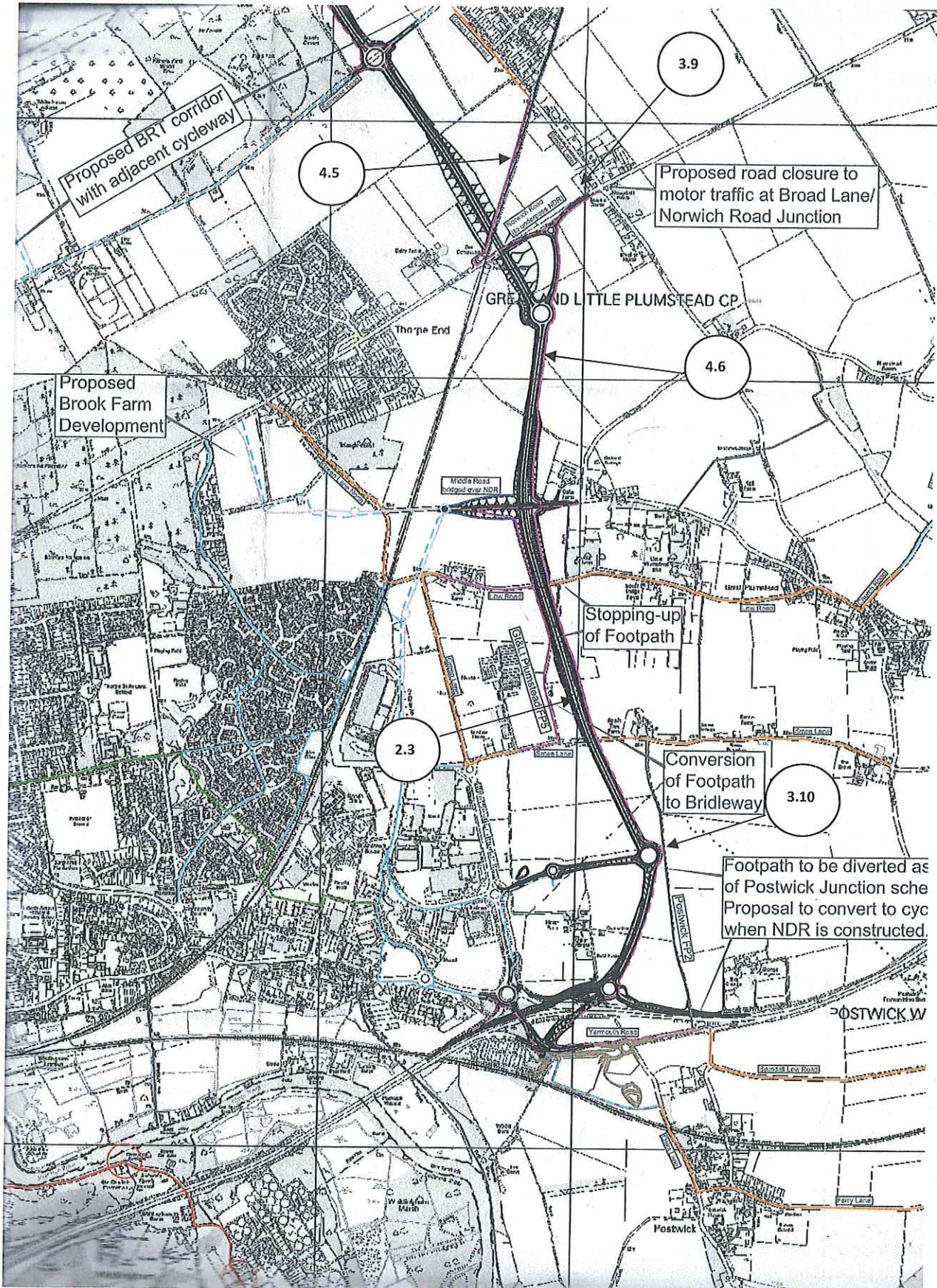


**Problem Location Plan 3**





**Problem Location Plan 4**







# APPENDIX A

## Norwich Northern Distributor Road – Stage 1 Safety Audit Designer's Response

November 2013







**Norfolk** County Council

# **NORWICH NORTHERN DISTRIBUTOR ROAD**

## **Stage 1 Safety Audit Designer's Response**

Prepared by Norfolk County Council  
**November 2013**

<http://www.norfolk.gov.uk>

<http://www.mottmac.com>





# **NORWICH NORTHERN DISTRIBUTOR ROAD**

## **Stage 1 Safety Audit Designer's Response**

**November 2013**

**Prepared by:-**

Environment, Transport and Development  
Norfolk County Council  
County Hall  
Martineau Lane  
Norwich  
Norfolk  
NR1 2SG

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contact Jonathan Taylor on  
01603 224200 minicom 223833.







## Introduction

This report is the Designer's response to the Stage 1 Road Safety Audit carried out on the Norwich Northern Distributor Road (NDR). Text extracted from the Stage 1 Road Safety Audit is indicated in italics. The Designer's response to each comment follows the Auditor's original Summary and Recommendation.

The Stage 1 Road Safety Audit report is titled **Norwich NDR Stage 1 Safety Audit** and is dated **14 November 2013**.

**Items Raised At This Stage 1 Audit** (using the Auditors' numbering references )

## 1 General

- 1.1 Location: roadside throughout the scheme**  
**Summary: risk of high severity impact with mature trees**  
**Designer's Response: Agree**

Detailed design of the landscape and planting proposal will be carried out in accordance with the recommendation.

- 1.2 Location: roadside throughout the scheme**  
**Summary: risk of high severity impact with roadside fencing**  
**Designer's Response: Agree**

Generally, fencing along the highway boundary will be post and wire with hedge planting where required. We will take into consideration the recommendation during ongoing discussions with landowners and during detailed design.

## 2 Alignment

- 2.1 Location: CH8200 and CH10200**  
**Summary: visibility partially obstructed by median VRS**  
**Designer's Response: Disagree**

We have investigated this issue and we can confirm that visibility will be restricted to 1 step below standard. Therefore in combination with horizontal curvature of 1 step below standard this is the relaxation and not a departure from standard.

- 2.2 Location: CH8600 approach to airport roundabout**  
**Summary: visibility obstructed by median VRS**  
**Designer's Response: Disagree**

We have investigated this issue and we can confirm that visibility of 295m will be achieved on approach to the Airport roundabout.

- 2.3      Location: CH18700**  
**Summary: lay-by provision introduces conflicts**  
**Designer's Response: Disagree**

The provision of Lay-bys has been considered in accordance with TD 69/07. The spacing of Junctions on the scheme (on average 1 per 2km) is more frequent than the recommended frequency of lay-bys (1 per 2.5km) and therefore generally obviates the need for lay-bys. However two lay-bys on either side of the NDR at chainage 18700 are proposed due to their proximity to the strategic road network where journeys could involve longer distance routes and so their provision is considered appropriate at this location.

### **3          Junctions**

- 3.1      Location: NDR roundabouts - radial route approaches**  
**Summary: splitter island lengths**  
**Designer's Response: Disagree**

The proposed junction layout including splitter islands complies with the current design standard.

- 3.2      Location: Fakenham Road roundabout**  
**Summary: narrow 3 lane entry/circulatory increases risk of side swipe collisions**  
**Designer's Response: Agree**

We will consider modifying the layout from three lanes to two lanes at detailed design stage.

- 3.3      Location: Fakenham Road roundabout**  
**Summary: relaxed entry path curvatures raises risk of failure to give way**  
**Designer's Response: Disagree**

We have investigated this issue and we can confirm that the entry path radius is below 100m in accordance with the current design standard.

- 3.4      Location: Fir covert Road roundabout**  
**Summary: excessive circulatory width for projected flows**  
**Designer's Response: Agree**

We will review the circulatory width at the detailed design stage.

- 3.5      Location: Reepham Road roundabout**  
**Summary: SE arm geometry safety implications**  
**Designer's Response: Agree**

We will review the tangential alignment of the splitter island at the detailed design stage.



- 3.6 Location: Cromer Road westbound merge slip road**  
**Summary: 2-way layout poses risk of head-on collisions**  
**Designer's Response: Disagree**

The drainage lagoon 8A will be accessed from Holly Lane. The 2-way carriageway is only proposed up to the Lagoon 8 access point.

- 3.7 Location: Various roundabouts**  
**Summary: Private/service accesses**  
**Designer's Response: Agree**

We will review the use of the different surface treatment at detailed design stage.

- 3.8 Location: Airport roundabout**  
**Summary: southern arm layout is potentially misleading for drivers**  
**Designer's Response: Agree**

We will review the possibility of reducing the exit width at detailed design stage and also ensure that appropriate signing and gating is provided to avoid inadvertent entry to the airfield. The signing will be developed during detailed design and submitted as part of the Stage 2 Safety Audit.

- 3.9 Location: Broad Lane closure at Plumstead Road**  
**Summary: farm road offers potential rat-run**  
**Designer's Response: Agree**

Access road will be gated.

- 3.10 Location: Business Park Roundabout**  
**Summary: high speed approach to segregated straight ahead lane**  
**Designer's Response: Agree**

The segregated straight ahead filter lane is necessary at this location. Speed reduction measures will be investigated at detailed design stage.

## **4 Non-motorised users**

- 4.1 Location: Fir Covert Road Roundabout**  
**Summary: bridleway ends at busy roundabout**  
**Designer's Response: Disagree**

A physical barrier will be provided at Fir Covert Road to avoid inadvertent equestrian access onto Fir Covert Road.

- 4.2 Location: Reepham Road Roundabout**  
**Summary: bridleway adjacent to busy roundabout**  
**Designer's Response: Agree**

As part of the detailed design, we will review the proposals and realign the bridleway as far as possible from the roundabout. Fence segregation between footway/cycleway and the bridleway will be provided. A cycle barrier will be installed to prevent equestrians using the roundabout splitter island.

- 4.3 Location: bridleway - CH10900 beneath Buxton Rd overbridge**  
**Summary: proximity of bridleway to NDR mainline**  
**Designer's Response: Disagree**

Clear signing and cyclist barrier will be provided to encourage equestrians to use the alternative route and a barrier to prevent equestrian's access to the underpass. The facility is suitable for cyclists and pedestrians and eliminates the need to cross Buxton Road.

- 4.4 Location: Wroxham Road Roundabout**  
**Summary: bridleway adjacent to busy roundabout**  
**Designer's Response: Agree and Disagree**

As part of the detailed design, we will review the proposals and realign the bridleway as far as possible from the roundabout.

The equestrian crossing point is only 15m less than the 135m which is described in the design standard as a preferred minimum (and not an absolute minimum). The design will maximise visibility at the crossing point. Also, visibility is in excess of stopping site distance for main line vehicular traffic.

All bridleways are intended for shared use by equestrians, cyclists and pedestrians. A cycle barrier will be installed to prevent equestrians using the roundabout splitter island.

Positive signing will be developed at detailed design stage to encourage equestrians to use the designated crossing point.

- 4.5 Location: CH17000 Road Roundabout**  
**Summary: bridleway adjacent to railway line**  
**Designer's Response: Agree**

We will investigate the possibility of fencing and hedge planting at detailed design stage.

- 4.6 Location: bridleway - Plumstead Rd South Roundabout to CH17700**  
**Summary: proximity of bridleway to NDR mainline**  
**Designer's Response: Agree**

As part of the detailed design, we will review the proposals and realign the bridleway as far as possible from the roundabout and investigate the possibility of fencing and hedge planting.

## **5 Signs, Lighting and Markings**

- 5.1 Location: throughout the scheme**  
**Summary: lack of street lighting increases night time accident risk**  
**Designer's Response: Agree**

We will investigate the provision of white, amber and green road studs and the lighting of the key roundabout signs at detailed design stage.

- 5.2      Location: NDR mainline**  
**Summary: safety benefit of raised profile edge lines**  
**Designer's Response: Agree**

We will consider the use of raised profile edge markings at detailed design stage.

- 5.3      Location: roadside throughout the scheme**  
**Summary: risk of high severity impact with large diameter sign posts and lighting columns**  
**Designer's Response: Agree**

Passive posts will be considered at detailed design stage in accordance with The Use of Passively Safe Street Furniture in Norfolk.





# APPENDIX B





# APPENDIX B

## Part 1

### Crostown Junction Improvements Preliminary Design Stage 1 Safety Audit Submission

September 2013



# **CROSTWICK JUNCTION IMPROVEMENTS PRELIMINARY DESIGN STAGE 1 SAFETY AUDIT SUBMISSION**

**September 2013**

Author of Report      Xiangwei Fan

Checked by              Umit Kangalli

Document Ref: 233906-ES-01/S Audit 1/XF

*Xiangwei Fan*  
*Umit Kangalli*



**Project Manager/Resident Engineer:** Umit Kangalli  
**Staff Involved in the Design Process:** Xiangwei Fan

## **CONTENTS**

	Page No.
1. Background	1
2. Design Standards	1
3. Plans	1
4. Site Photographs or Video Recording	3
5. Traffic Data	3
6. Other Data	

## **APPENDICES**

- A Scheme Drawings
- B Photographs
- C
- D

## **1. Background**

- (a) Traffic modelling work for the proposed NDR shows that there will be an increase in traffic along North Walsham Road (B1150). Turning right out of Crostwick Lane on to the B1150 is currently not easy manoeuvre, particularly during peak time, due to the traffic flow on to the B1150 as well as traffic joining from Rackheath Lane heading in to Norwich. The situation is made worse by the fact that the bell mouth of Crostwick Lane is only a single car width, meaning all cars whether they are performing a left or right turn or going straight ahead must all wait in the same queue.
- (b) The scheme is proposed to widen the existing bell mouth on Crostwick Lane to allow additional capacity for vehicles turning left on to the B1150 and close Rackheath Lane to remove the conflict with vehicles joining the B1150 from Crostwick Lane.

## **2. Design Standards**

- (a) Design speed adopted – Original speed limits to be maintained (North Walsham Road 50mph, Rackheath Lane 60mph, Crostwick Lane 30mph)
- (b) Any departures from standards, giving reasons – There are no departures from standards

## **3. Plans**

### **(a) General Scheme Layout**

A general scheme layout is included in Appendix A - Drawing No. 233906-ES-01-C-DR-00-XX-002

#### **i. Junctions, including visibility splays**

The left side of the bell mouth on Crostwick lane will be widened to provide extra space for private cars or public service vehicle/refuse vehicle turning left while a private car is waiting at the giveway line.

#### **ii. Parking**

N/A.

#### **iii. Accesses:-**

Rackheath Lane will be closed and a turning head will be provided to accommodate HGVs before Rackheath, B1150 junction.

#### **iv. Levels/gradients:-**

There will be no significant changes to levels.

#### **v. Details of abutments, parapets, fences, existing signs, central barriers, crests, vehicle parking, and any other restriction to visibility:-**

There will be no restrictions to visibility.

**vi. Accommodation works:-**

There are no known accommodation works at this stage.

**vii. Street lighting:-**

Junction is not lit and no new lighting proposed.

**viii. Signing and lining details, including diagram numbers, sizes and mounting heights:-**

Road marking on B1150 needs to be updated. Removing arrows indicating right turn to Rackheath Lane. Signage design will be done as part of NDR.

**ix. Drainage information:-**

Gullies at the bell mouth of Crostwick lane and Rackheath lane need to be backfilled and new gullies will be provided along the new kerb. Existing kerb outlet needs to be removed and new one will be placed along the new kerb line, connected to existing outlet. See Appendix A – Drawing No. 233906-ES-01-C-DR-00-XX-003.

**x. Kerbing details and surfacing information:-**

Providing new kerbs at the edge of the widened carriageway and also providing new kerbs along the right side of B1150 to close Rackheath Lane.

**xi. Existing and proposed TROs:-**

Stopping up of existing Rackheath junction will be done as part of NDR.

**xii. Safety fences/barriers:-**

N/A.

**xiii. Pedestrian provision, including refuges, guard railing, signing, dropped kerbs:-**

Existing informal crossing will be kept. No new footway proposed.

**xiv. Provision for cyclists:-**

N/A.

**xv. Equestrian provision:-**

N/A.

**xvi. Provision for disabled persons:-**

N/A. Existing pedestrian facilities will not be affected.

**xvii. Bus stops and lay-bys:-**

N/A.

**xviii. Landscaping:-**

None



**xix. Service apparatus:-**

Existing BT cables and water pipe might be affected by the widening. See Appendix A – Drawing No. 233906-ES-01-C-DR-00-XX-100.

**(b) Local Highway Network**

A location plan showing the surrounding highway network is included in Appendix A – Drawing No. 233906-ES-01-C-DR-00-XX-001.

**4. Site Photographs or Video Recording**

Photographs are included in Appendix B.

**5. Traffic Data**

- (a) Route hierarchy status of all effected roads – Crostwick Lane, North Walsham Road (B1150), Rackheath Lane
- (b) Latest traffic counts, including turning movements where appropriate. Indication of presence of regular queuing or junctions operating near capacity –N/A.
- (c) Traffic forecast data – N/A.
- (d) Measured speed data – N/A.
- (e) Non vehicular movements – N/A.

**6. Accident Data**

07/11/2012 (Daylight) – Collision with vehicle from right – Slight  
04/04/2013 (Daylight) – Right turn joining, head on – Slight  
30/07/2013 (Daylight) – Tail end collision – Slight

**7. Construction Programme & Operation**

- (a) The scheme will form part of the NDR DCO application and will be delivered together with the mainline works.
- (b) Preliminary design is to be completed by the end of September 2013.
- (c) Detailed design - TBC

**8. Other Relevant Information**

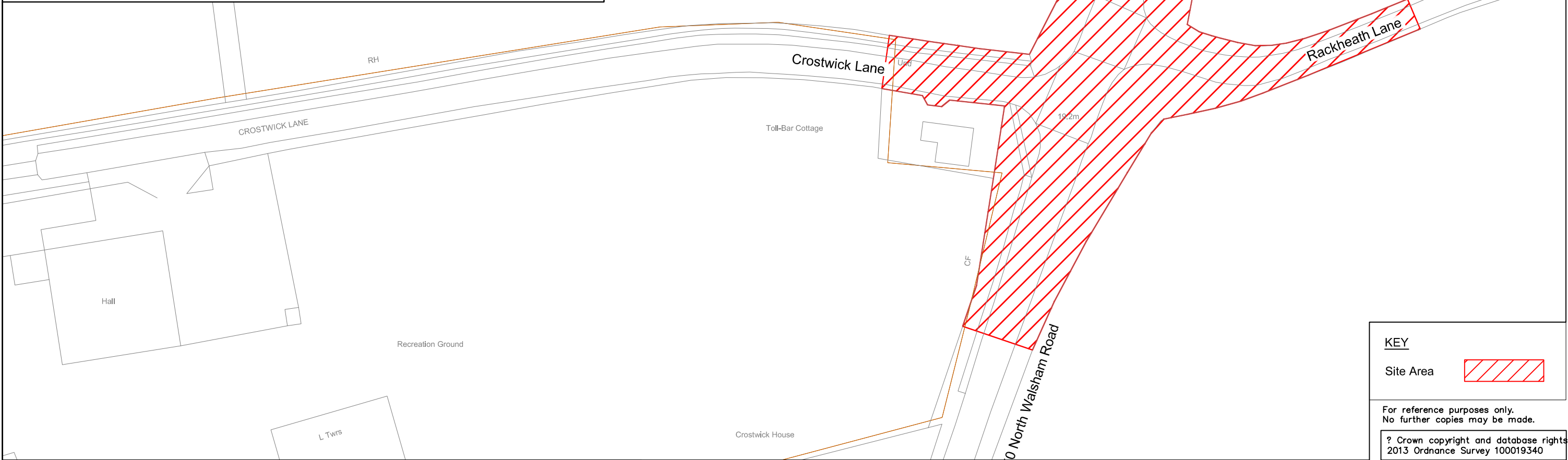
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## **APPENDIX A**

### **SCHEME DRAWINGS**





**KEY**

Site Area 

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Director of Environment, Transport and Development  
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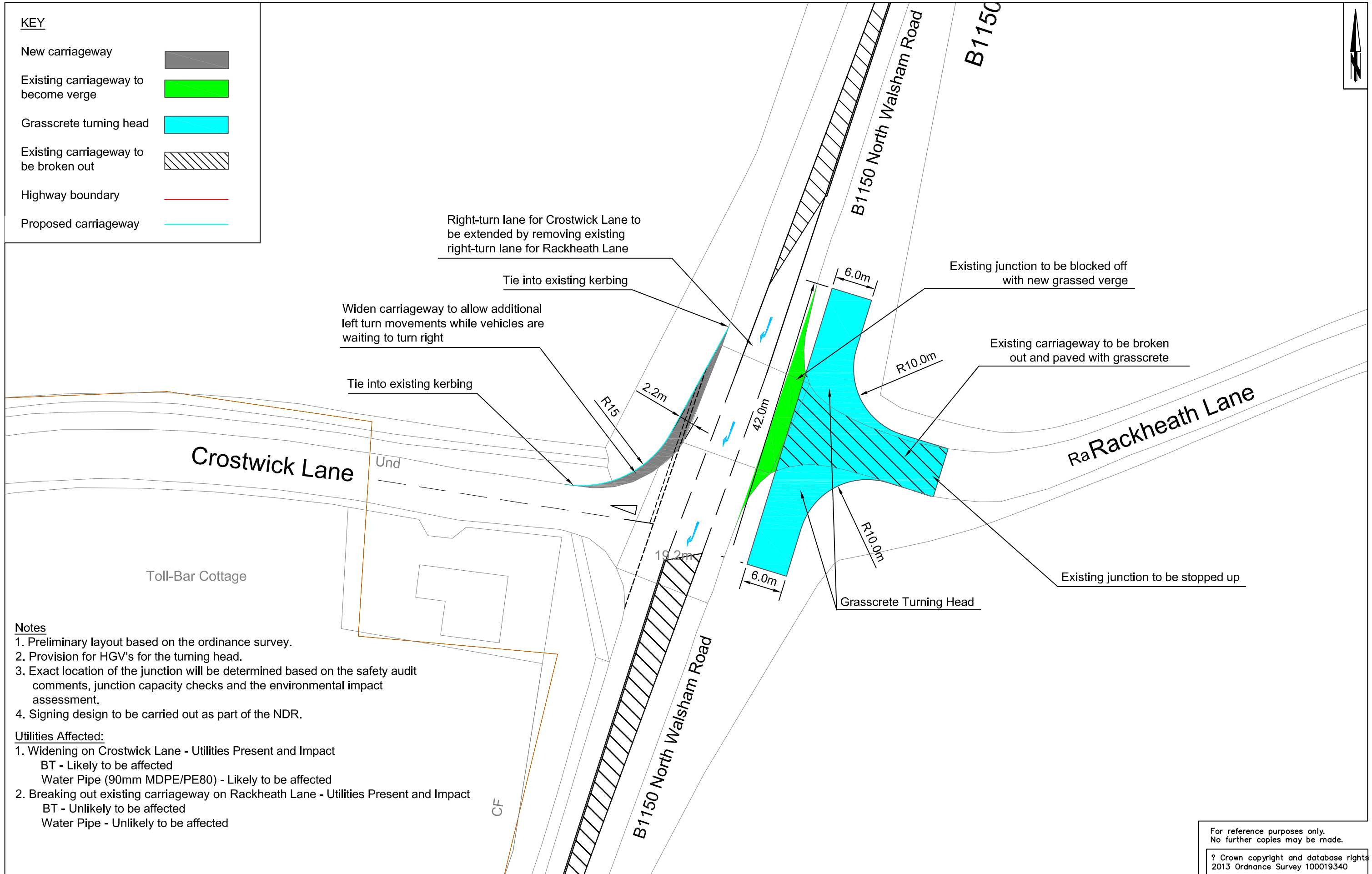
**DRAWING TITLE**  
Site Location Plan

REV.	DESCRIPTION	CHECKED	DATE

	INIT.	DATE	DRAWING No. MMD-233906-ES-01-C-DR-00-XX-001	
DESIGNED BY	JCR	09/13	PROJECT TITLE Crostwick Junction Improvements	
DRAWN BY	JCR	09/13		
CHECKED BY	UK	09/13		
APPROVED BY	MMG	09/13	SCALE AT A3 1:1000	FILE No. 233906-ES-01

KEY

New carriageway	
Existing carriageway to become verge	
Grasscrete turning head	
Existing carriageway to be broken out	
Highway boundary	
Proposed carriageway	



Notes


1. Preliminary layout based on the ordinance survey.
2. Provision for HGV's for the turning head.
3. Exact location of the junction will be determined based on the safety audit comments, junction capacity checks and the environmental impact assessment.
4. Signing design to be carried out as part of the NDR.

Utilities Affected:


1. Widening on Crostwick Lane - Utilities Present and Impact  
BT - Likely to be affected  
Water Pipe (90mm MDPE/PE80) - Likely to be affected
2. Breaking out existing carriageway on Rackheath Lane - Utilities Present and Impact  
BT - Unlikely to be affected  
Water Pipe - Unlikely to be affected

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**MAY GURNEY**



**Mike Jackson**  
Director of Environment, Transport and Development  
**Norfolk County Council**  
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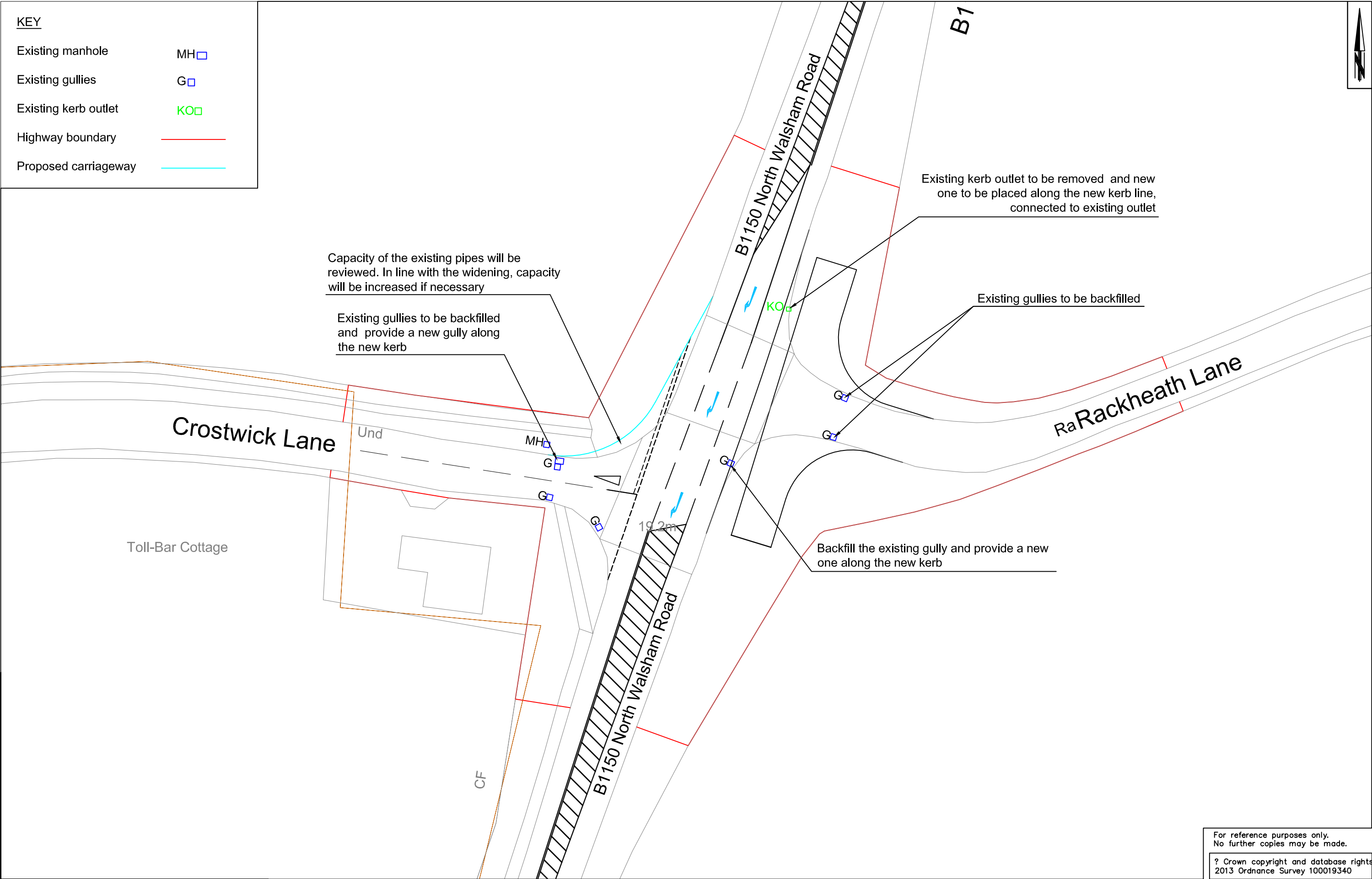
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**DRAWING TITLE**  
Preliminary General Arrangement

REV.	DESCRIPTION	CHECKED	DATE

	INIT.	DATE	DRAWING No. MMD-233906-ES-01-C-DR-00-XX-002
DESIGNED BY	XF	09/13	PROJECT TITLE Crostwick Junction Improvements
DRAWN BY	JCR	09/13	
CHECKED BY	UK	09/13	SCALE AT A3 1:500
APPROVED BY	MMG	09/13	FILE No. 233906-ES-01







Key

BTBTBTBTBTBT

Underground BT Line

BTBTBTBTBTBT

Overhead BT Line

HVHVHVHVHVHV

Underground HV Cable

LVLVLVLVLVLV

Underground LV Cable

HVHVHVHVHVHV

Overhead HV Cable

WWWWWWWW

Water Line

LP LP LP LP LP LP

LP Gas Mains

MP MP MP MP MP MP

MP Gas Mains

IP IP IP IP IP IP

IP Gas Main

VM VM VM VM VM VM

Virgin Media Line

FS FS FS FS FS FS

Foul Sewer

CS CS CS CS CS CS

Combined Sewer

SS SS SS SS SS SS

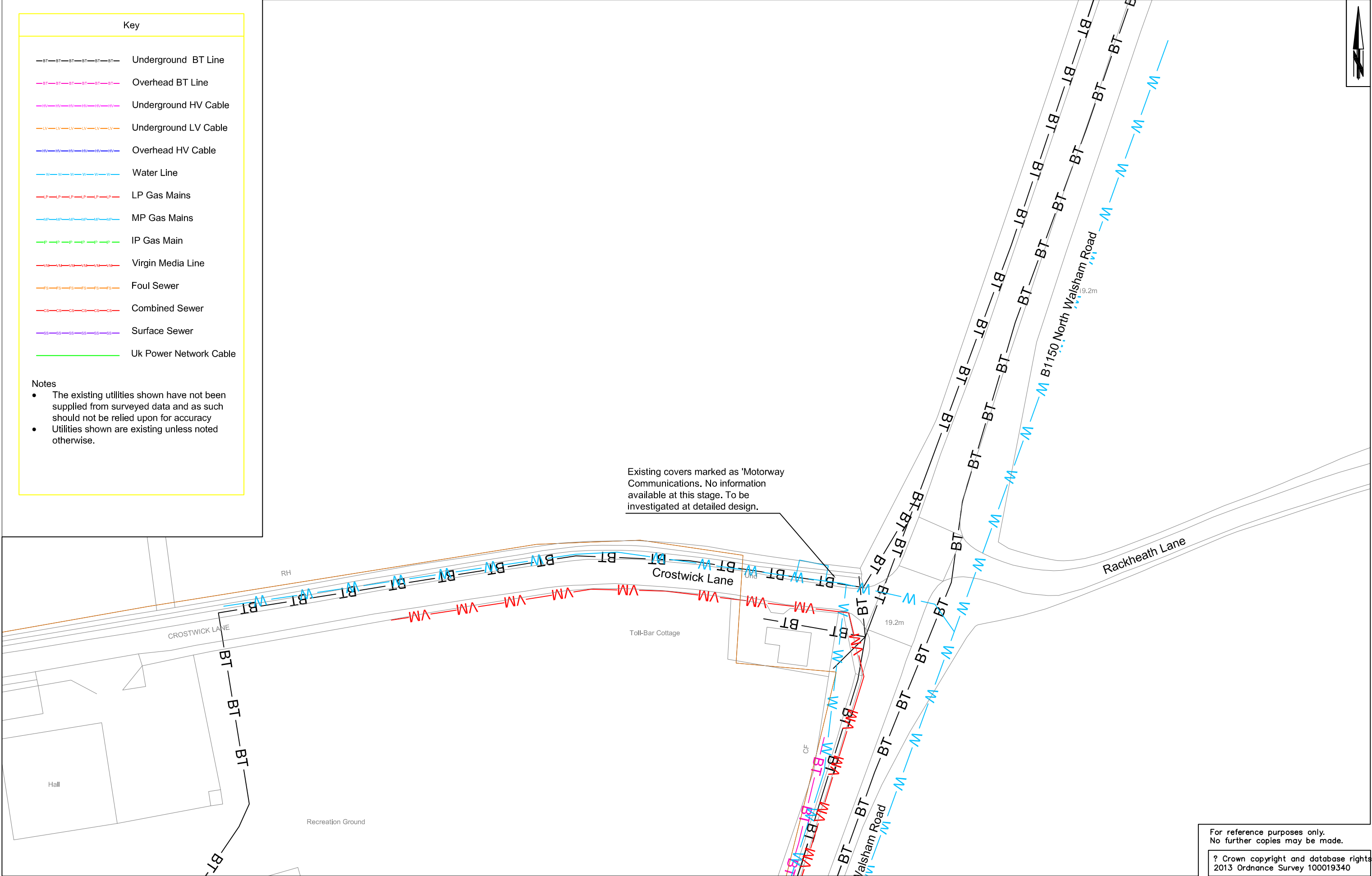
Surface Sewer

Uk Power Network Cable

Notes

The existing utilities shown have not been supplied from surveyed data and as such should not be relied upon for accuracy

Utilities shown are existing unless noted otherwise.



Existing covers marked as 'Motorway Communications'. No information available at this stage. To be investigated at detailed design.

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DRAWING TITLE

Utilities Layout

REV.	DESCRIPTION	CHECKED	DATE
A	Utilities updated.	UIK	09/2013

	INIT.	DATE	DRAWING No.	
DESIGNED BY	JCR	09/13	MMD-233906-ES-01-C-DR-00-XX-100A	
DRAWN BY	JCR	09/13	PROJECT TITLE	
CHECKED BY	UK	09/13	Croswick Junction Improvements	
APPROVED BY	MMG	09/13	SCALE AT A3	FILE No.
			1:1000	233906-ES-01

## **APPENDIX B**

### **SITE PHOTOGRAPHS**







PHOTO 1 Facing East on the footway at the left of Crostwick Lane



PHOTO 2 Facing East on the footway at the left of Crostwick Lane





PHOTO 3 Facing Northeast at the bell mouth of Crostwick Lane



PHOTO 4 Facing North at the bell mouth of Crostwick Lane





PHOTO 5 Facing Northeast at the right side kerb of North Walsham Road (B1150)

# APPENDIX B

## Part 1

B1150 Crostwick: Junction Improvement  
Stage 1 Safety Audit  
25 September 2013





## INTRODUCTION

This report contains the results of a Stage 1 Safety Audit carried out on the above scheme. The Audit was carried out at the request of Norfolk County Council Highways Group.

The Audit Team membership was as follows:-

Nevil Calder BSc(Hons) CEng MICE MCIHT MSoRSA (Audit Team Leader)	Principal Consultant Mott MacDonald
--	--

Kevin Allen BEng(Hons) IEng MCIHT MSoRSA (Audit Team Member)	Project Engineer Network Analysis + Safety Norfolk County Council
---	---

Specialist Advisors:-

Andy Micklethwaite	Casualty Reduction Officer Norfolk County Council
--------------------	--

The Audit took place at Carrow House on 25 September 2013. The audit comprised an examination of the Safety Audit submission document and a site inspection on 26 September 2013 by the Audit Team Leader. The weather was bright and the road surface dry.

The terms of reference are as described in Environment, Transport and Development Highways Service Manual Procedure SP03-07. The Auditors have examined and reported only on the road safety implications of the scheme as presented and have not verified the compliance of the design to any other criteria.

## **ITEMS RAISED AT PREVIOUS AUDIT**

No previous safety audit.

## **ITEMS RAISED AT THIS STAGE 1 AUDIT**

### **1.0 General**

1.1 No comment

### **2.0 Alignment**

2.1 No comment

### **3.0 Junctions**

3.1 Problem

Location: B1150 right turn into Crostwick Lane

Summary: substandard length RTL increases risk of tail-end collision

The proposed central right turn lane is not dimensioned but scales at 50m. While this is a considerable improvement on the existing situation, it is substandard for a 50mph road, increasing the risk of tail-end collision.

#### **Recommendation**

Increase the length of RTL to 65m in accordance with TD42. The adjacent eastern verge appears to offer scope to achieve the necessary carriageway widening.



### 3.2 Problem

Location: B1150 eastern verge/Rackheath Lane turning head

Summary: potential conflict between mainline traffic and turning traffic

The proposed turning head on Rackheath Lane lies within the eastern verge of B1150 presenting a number of safety issues:-

- Turning vehicles may appear to be on or entering the mainline, causing confusion/distraction to drivers on B1150. This will be exacerbated at night with the added risk of headlight dazzle.
- Any vehicle stationary in the turning head would be an obstruction of the verge, presenting a collision risk in event of a vehicle leaving the carriageway.
- The narrow width between the turning head and B1150 would be easy to cross encouraging abuse of the closure.

### Recommendation

Provide a minimum 3.5m wide verge to B1150 free of obstruction. Behind this a physical closure should be provided (see also 4.1 below); ideally this should be a continuous hedgeline to give visual closure without posing a collision hazard to errant vehicles. Rather than provide a turning head at this location it may be better to gate Rackheath Lane at a point further east.



### 3.3 Comment

Location: Crostwick Lane approach to B1150

Summary: angle of intersection of the junction

Crostwick Lane currently meets B1150 at an angle of around 80degrees. In widening the bellmouth, the opportunity should be taken to true up the final approach to 90degrees in order to optimise driver positioning at the give way lane.

### 3.4 Comment

Location: Crostwick Lane approach to B1150

Summary: visibility to the left obstructed

It was noted at the time of site visit that the B1150 verge to the north of Crostwick Lane has been allowed to become overgrown by bushes which obstruct visibility to the left for drivers emerging from Crostwick Lane. This should be remedied as soon as possible to achieve 4.5m x 160m splay.



Bushes (behind sign array) obstructing visibility splay

#### **4.0 Non-motorised Users**

##### **4.1 Problem**

Location: B1150 at junction

Summary: risk of serious injury to NMUs in conflict with heavy traffic

The closure of Rackheath Lane will make this route more attractive and suitable for NMUs, however the busy B1150 poses a crossing risk.

##### **Recommendation**

An appropriate gap should be provided in the physical closure point. A refuge island sited in the central hatching immediately south of the RTL would assist pedestrians and cyclists in crossing.

#### **5.0 Signs, Lighting and Markings**

##### **5.1 No comment at this stage**

## AUDIT TEAM STATEMENT

We certify that this audit has been carried out in accordance with Norfolk County Council Environment, Transport and Development Procedures.

Signed (ATL) .....

*N. Calder*

Nevil Calder

Dated

*27/9/13*

Signed

*K. J. Allen*

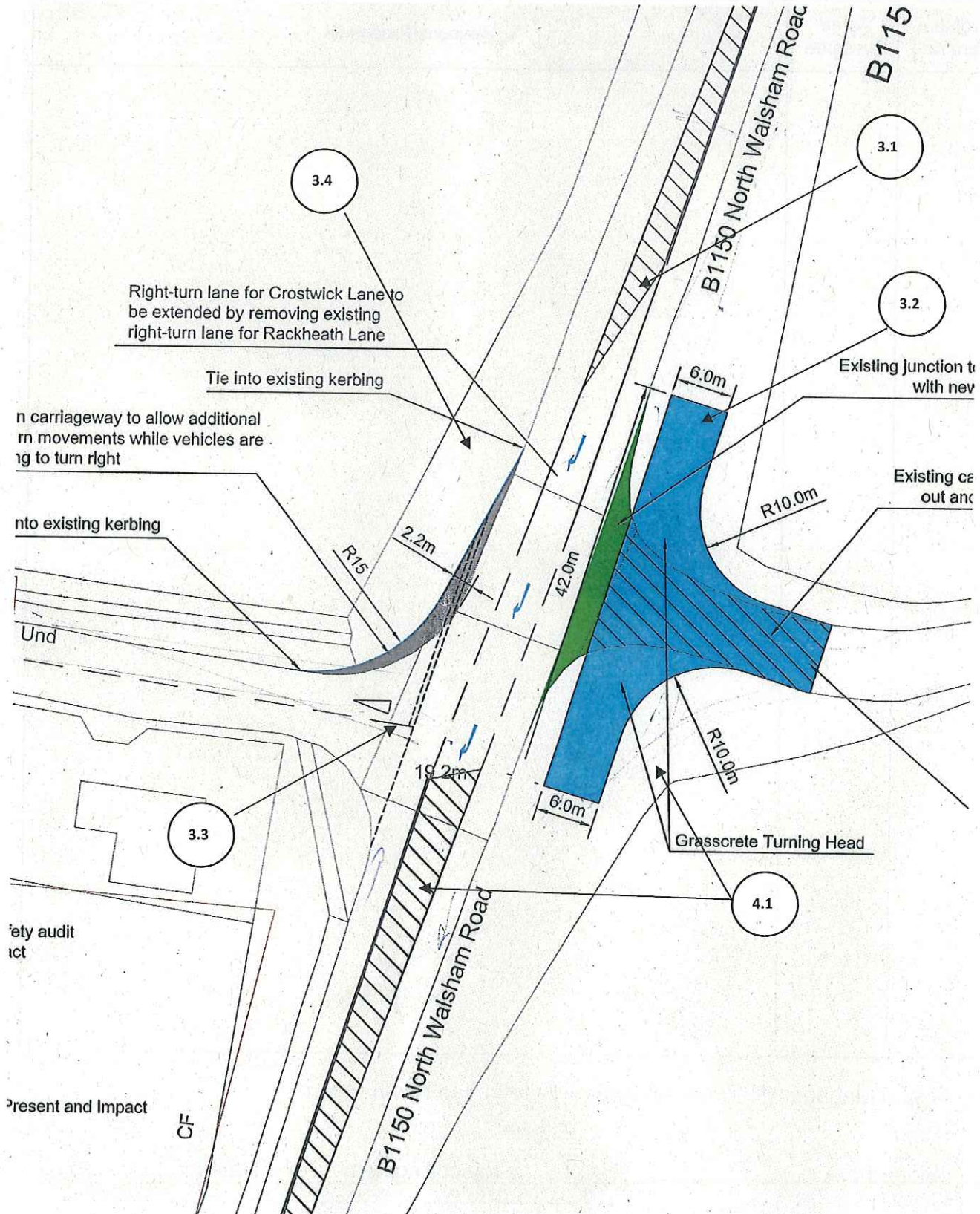
Kevin Allen

Dated

*27/9/13*



**APPENDIX A – Problem Location Plan**



Template Version #8 06/10 JF



# APPENDIX B

## Part 1

### Stage 1 Safety Audit, NDR Off Line Improvements – Crostwick Junction Response Sheet

29 November 2013





**NDR Off line Improvements – Crostwick Junction**

**RESPONSE SHEET**

Problem (para no.)	Agree/ Disagree	Reasons/Proposals
3.1	Agree	The length of turning lane is increased to 65m.
3.2	Agree	Alternative solutions indicated on the drawings. This will be addressed at later stage.
3.3		The alignment and the roadmarkings are revised to improve the intersection angle, however this is based on OS map because a topo-survey is not available at present.
3.4		Maintenance issue beyond the scope of this scheme, NCC informed.
3.5	Disagree	During site visits no evidence of pedestrian use on the East of B1150 is identified. Also there are not any facilities for pedestrians along the Rackheath lane and it is not anticipated that NDR on its own will cause an increase in the number of pedestrians on the East of B1155. Potential increase in the number of pedestrians due to other developments is beyond the scope of our works.

To:- Principal Engineer (Casualty Reduction):

From. UMIT KANGALLI

Signed..........Project Engineer      Dated: 29.11.2013

**Attached:** MMD-233906-ES-01-C-DR-00-XX-002A - Preliminary GA (Latest layout)

Note: If you intend to produce your own version of this page please include Safety Audit file no/date and ATL name





# APPENDIX B

## Part 2

Rackheath Junction Preliminary Design  
Stage 1 Safety Audit Submission

September 2013



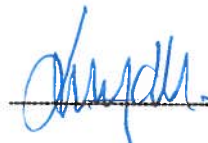

# **RACKHEATH JUNCTION PRELIMINARY DESIGN STAGE 1 SAFETY AUDIT SUBMISSION**

**September 2013**

Author of Report      Umit Kangalli

Checked by             Andrew Howes

Document Ref: 233906-ES-02/S Audit 1/XF

  
\_\_\_\_\_  
  
\_\_\_\_\_



**Project Manager/Resident Engineer:** Umit Kangalli  
**Staff Involved in the Design Process:** Xiangwei Fan

## **CONTENTS**

	Page No.
1. Background	1
2. Design Standards	1
3. Plans	1
4. Site Photographs or Video Recording	3
5. Traffic Data	3
6. Other Data	

## **APPENDICES**

- A Scheme Drawings
- B Photographs
- C
- D

## **1. Background**

- (a) Traffic modelling work for the proposed NDR shows that there will be an increase in traffic along Wroxham Road (A1151). The visibility at the existing Green Lane West/A1151 junction is poor and there is a need to improve the junction to encourage vehicles (particularly HGVs) accessing the Rackheath Industrial estate to use this junction rather than any alternative routes which may take additional traffic through Rackheath village.
- (b) The scheme is proposed to close the existing junction and re-align Green Lane West so it forms a give-way junction with Wroxham Road to the south of the existing location, where both horizontal and vertical visibility can be improved. It is also proposed to widen the existing carriageway to be able to introduce a right hand turn lane on the A1150 for vehicles turning into the re-aligned Green Lane West.

## **2. Design Standards**

- (a) Design speed adopted – Proposed new carriageway 40mph, Green Lane West 40mph, Wroxham Road (A1151) 50mph.
- (b) Any departures from standards, giving reasons – Vertical visibility to the right at the new junction to be checked once the topographical survey is made available.

## **3. Plans**

### **(a) General Scheme Layout**

A general scheme layout is included in Appendix A - Drawing. No. 233906-ES-02 -C-DR-00-XX-006

#### **i. Junctions, including visibility splays**

The ghost island junction will improve the visibility to meet the standard and provide an extra lane for right turning vehicles from A1151.

#### **ii. Parking**

N/A.

#### **iii. Accesses:-**

The existing Green Lane West will be closed at the original A1151 junction and a turning head will be provided there to accommodate Large Refuse vehicle.

#### **iv. Levels/gradients:-**

The farm is 1.2 metres lower than the edge of A1151 carriageway. High point of A1151 is 10-20 m to the north of existing junction. Low point of A1151 is approximately 600 m to the south of existing junction.

Green Lane West has a low point close to the mid point of the road between the existing junction and its proposed junction with the re-aligned road.

- v. **Details of abutments, parapets, fences, existing signs, central barriers, crests, vehicle parking, and any other restriction to visibility:-**  
Trees and fences along A1151 which restrict visibility need to be removed.
- vi. **Accommodation works:-**  
There are no known accommodation works at this stage.
- vii. **Street lighting:-**  
Junction is not lit and no new lighting proposed.
- viii. **Signing and lining details, including diagram numbers, sizes and mounting heights:-**  
Road markings on A1151 junction and new Green Lane West junction will be updated. Sign design will be done as part of NDR.
- ix. **Drainage information:-**  
The existing drainage of A1151 and Green Lane West junction is improved by using grasscrete. For the proposed carriageway and Northeast part of the new A1151 junction, combined kerb drainage along southern channel is introduced to minimize land taken. For the Southeast part of the new A1151 junction, kerb outlets is to be introduced to increase capacity of existing drainage, discharging to existing swale. Refer to Appendix A - Drawing. No. 233906-ES-02 -C-DR-00-XX-007.
- x. **Kerbing details and surfacing information:-**  
New kerbs are along proposed carriageway and new A1151 junction. Combined kerb drainage and kerb outlets are included in Appendix A - Drawing. No. 233906-ES-02 -C-DR-00-XX-007.
- xi. **Existing and proposed TROs:-**  
All TROs including stopping up orders will be managed as part of NDR DCO.
- xii. **Safety fences/barriers:-**  
None.
- xiii. **Pedestrian provision, including refuges, guard railing, signing, dropped kerbs:-**  
Existing footpath along Green Lane west will be realigned to match the new layout. Indicative footpath shown on the general arrangement.
- xiv. **Provision for cyclists:-**  
N/A.



**xv. Equestrian provision:-**

N/A.

**xvi. Provision for disabled persons:-**

N/A.

**xvii. Bus stops and lay-bys:-**

The existing lay-by on Green Lane West will be stopped. No changes to existing bus stops to the north of existing junction on A1151. Proposed realignment is not anticipated to have negative impact on these.

**xviii. Landscaping:-**

New trees will be planted to replace the trees that will be felled as a result of the widening on A1151. Potential location is the land between the new road and the existing property to the north of it.

**xix. Service apparatus:-**

Existing BT cables might be affected. Refer to Appendix A – Drawing No. 233906-ES-02-C-DR-00-XX-100.

**(b) Local Highway Network**

A location plan showing the surrounding highway network is included in Appendix A – Drawing No. 233906-ES-02-C-DR-00-XX-001.

**4. Site Photographs or Video Recording**

Photographs are included in Appendix B.

**5. Traffic Data**

- (a) Route hierarchy status of all effected roads – Green Lane West, Wroxham Road (A1151)
- (b) Latest traffic counts, including turning movements where appropriate. Indication of presence of regular queuing or junctions operating near capacity –N/A.
- (c) Traffic forecast data – N/A.
- (d) Measured speed data – N/A.
- (e) Non vehicular movements – N/A.

**6. Accident Data**

06/09/2008 (Daylight) – Right turn joining, head on – Slight

16/09/2008 (Daylight) – Tail end with vehicle waiting to turn right – Slight

31/01/2012 (Daylight) – Right turn joining, head on – Serious  
12/05/2012 (Daylight) – Tail end collision – Slight

**7. Construction Programme & Operation**

- (a) The scheme will form part of the NDR DCO application and will be delivered together with the mainline works.
- (b) Preliminary design is to be completed by the end of September 2013.
- (c) Detailed design - TBC.

**8. Other Relevant Information**

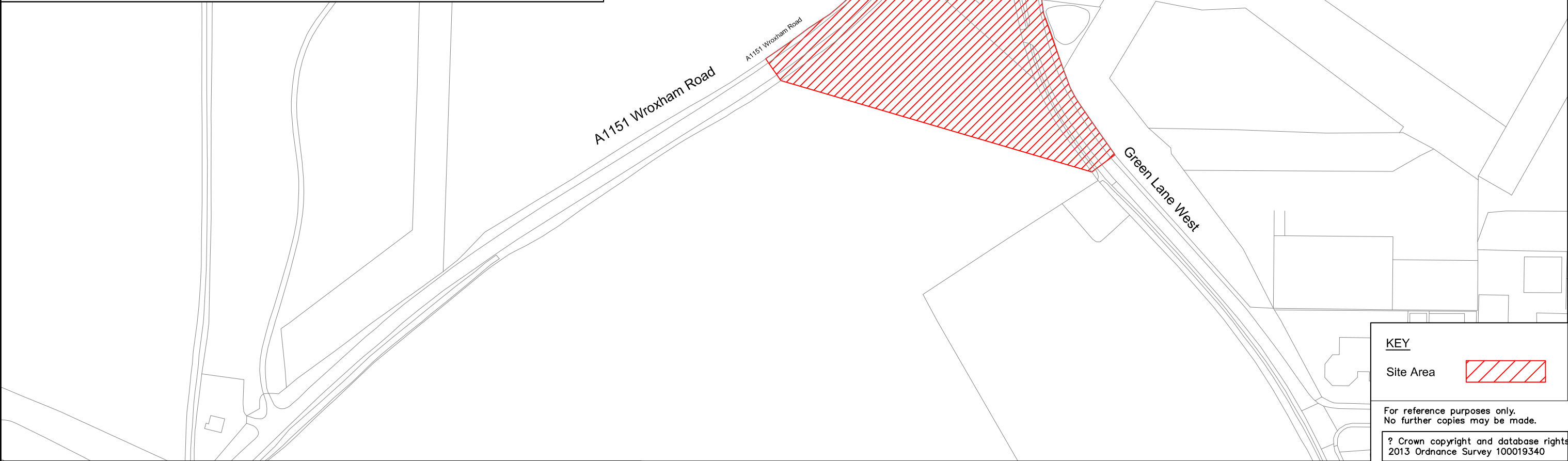
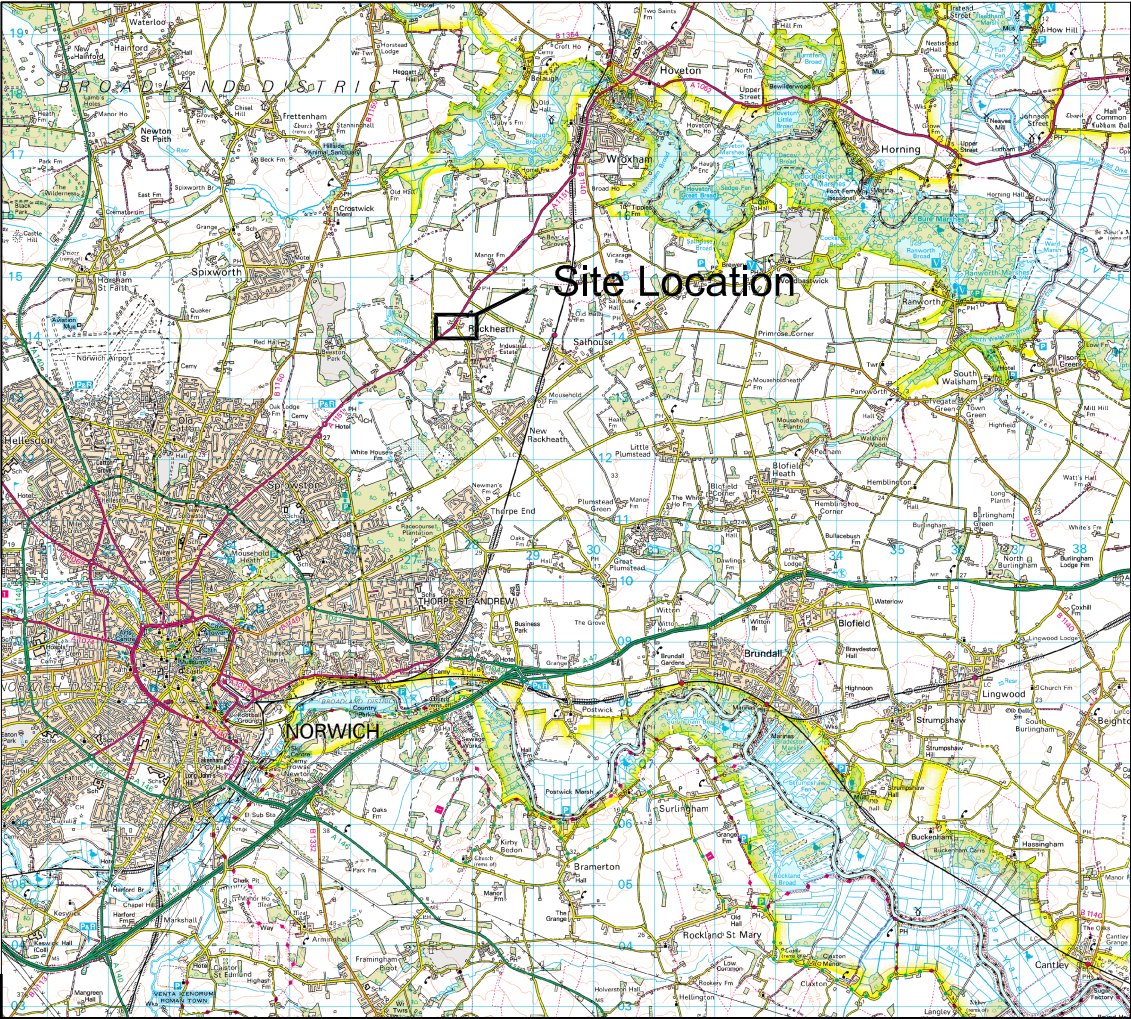
N/A

## **APPENDIX A**

### **SCHEME DRAWINGS**








**KEY**

Site Area 


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**Norfolk County Council**  
working with  
**MAY GURNEY**



**Mott MacDonald**

**Mike Jackson**  
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**DRAWING TITLE**  
Site Location

REV.	DESCRIPTION	CHECKED	DATE

	INIT.	DATE	DRAWING No. MMD-233906-ES-02-C-DR-00-XX-001	
DESIGNED BY	JCR	08/13	PROJECT TITLE	
DRAWN BY	JCR	09/13	Green Lane West - Wroxham Road	
CHECKED BY	AH	09/13	Junction Improvements	
APPROVED BY	MMG	09/13	SCALE AT A3 1:2000	FILE No. 233906-ES-02



KEY

New carriageway

Existing carriageway to become verge

Grasscrete turning head

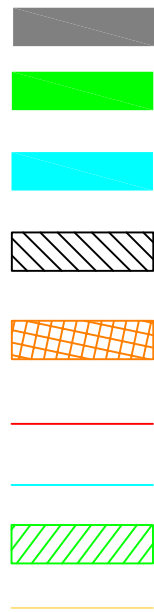
Existing carriageway to  
be broken out

Approximate area of  
required land

Highway boundary

Proposed Carriageway

### Visibility splay

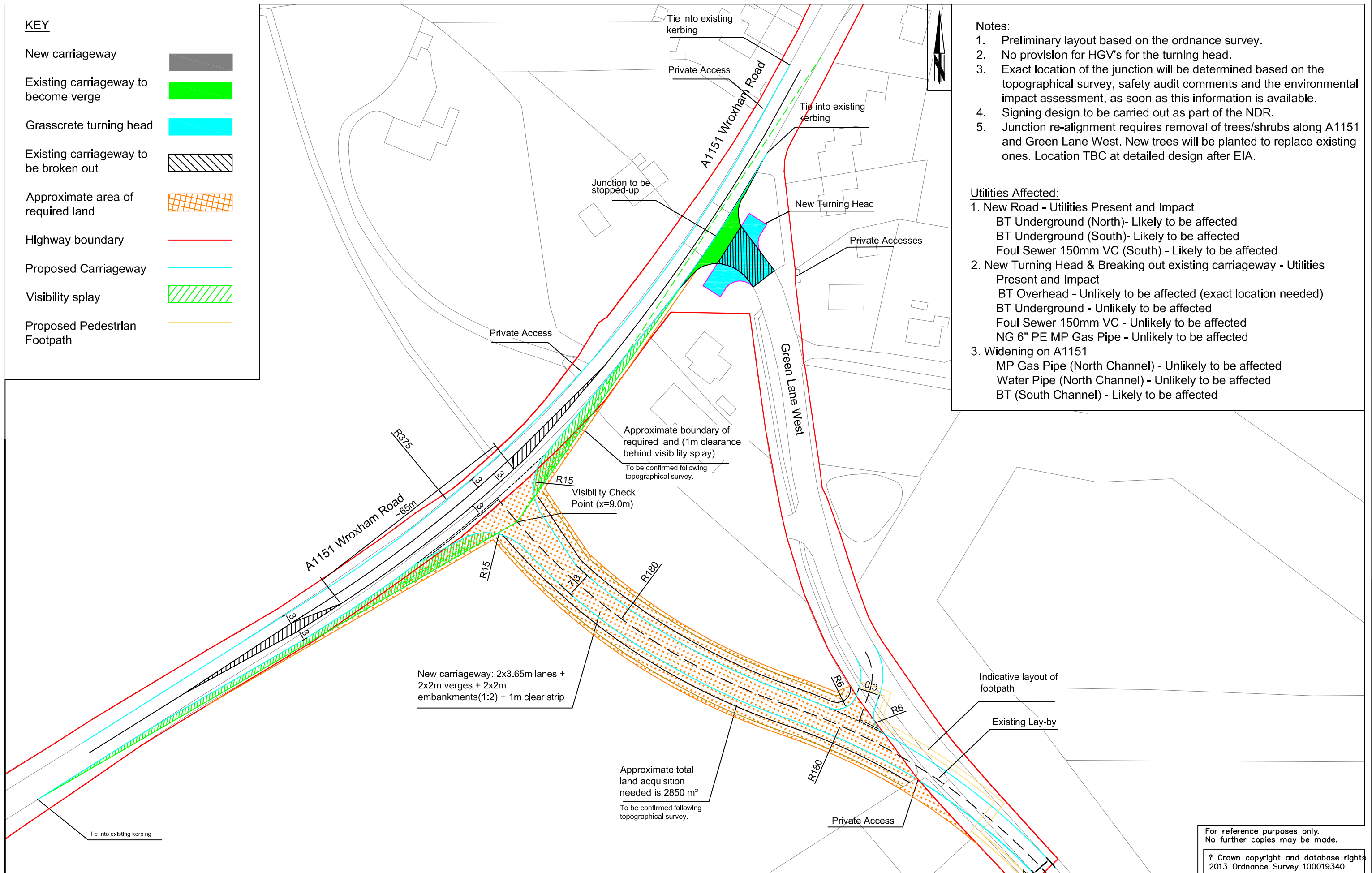
Proposed Pedestrian  
Footpath

Notes:

1. Preliminary layout based on the ordnance survey.
2. No provision for HGV's for the turning head.
3. Exact location of the junction will be determined based on the topographical survey, safety audit comments and the environmental impact assessment, as soon as this information is available.
4. Signing design to be carried out as part of the NDR.
5. Junction re-alignment requires removal of trees/shrubs along A1151 and Green Lane West. New trees will be planted to replace existing ones. Location TBC at detailed design after EIA.

Utilities Affected:

1. New Road - Utilities Present and Impact
  - BT Underground (North)- Likely to be affected
  - BT Underground (South)- Likely to be affected
  - Foul Sewer 150mm VC (South) - Likely to be affected
2. New Turning Head & Breaking out existing carriageway - Utilities Present and Impact
  - BT Overhead - Unlikely to be affected (exact location needed)
  - BT Underground - Unlikely to be affected
  - Foul Sewer 150mm VC - Unlikely to be affected
  - NG 6" PE MP Gas Pipe - Unlikely to be affected
3. Widening on A1151
  - MP Gas Pipe (North Channel) - Unlikely to be affected
  - Water Pipe (North Channel) - Unlikely to be affected
  - BT (South Channel) - Likely to be affected



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**Web [www.mottmac.com](http://www.mottmac.com)**

DRAWING TITLE

### Preliminary General Arrangement

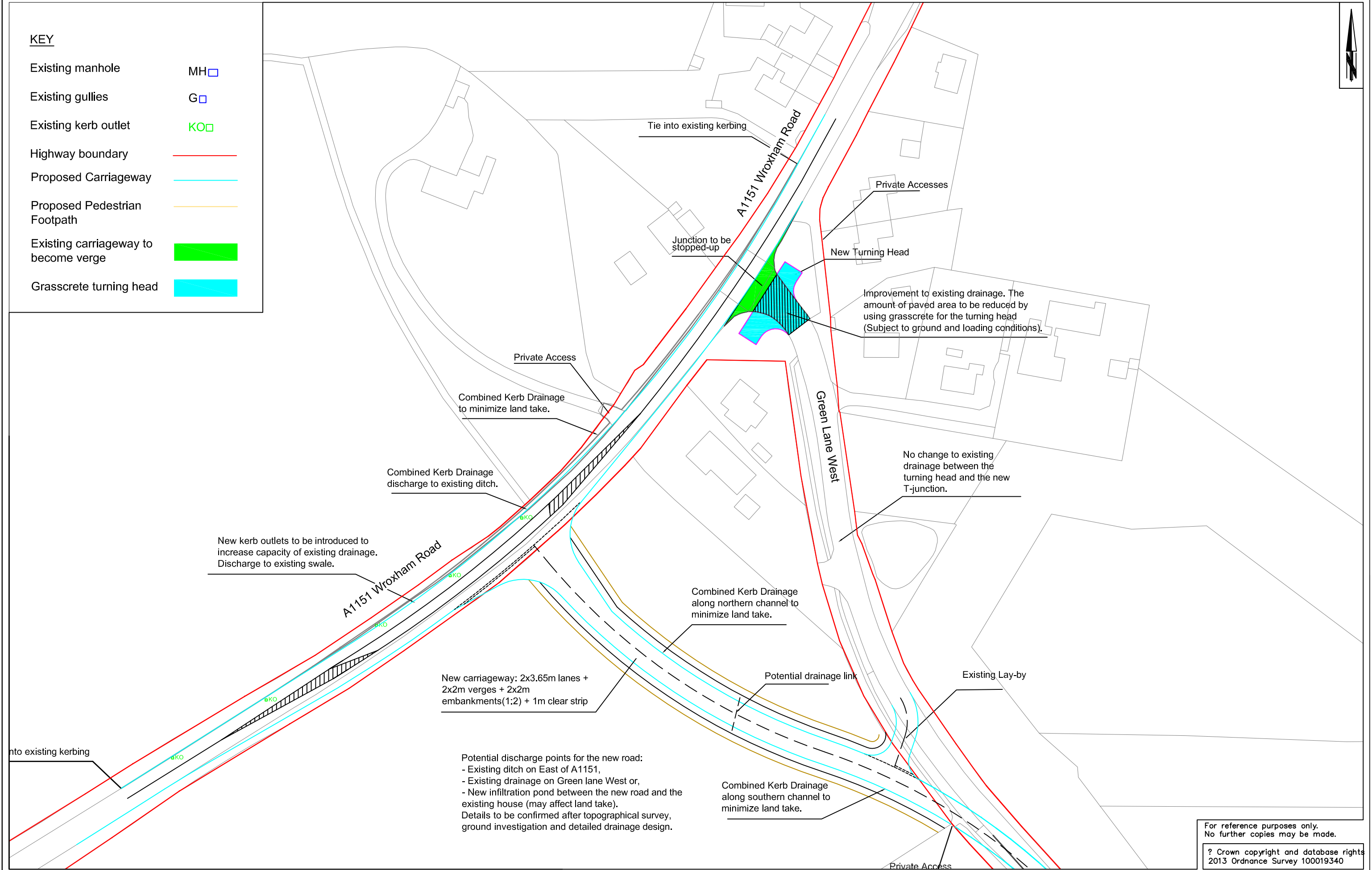
REV.	DESCRIPTION	CHECKED	DATE

	INIT.	DATE	DRAWING No. MMD-233906-ES-02-C-DR-00-XX-006	
DESIGNED BY	UK	09/13	PROJECT TITLE	
DRAWN BY	JCR	09/13	Rackeath Junction Improvements	
CHECKED BY	AH	09/13		
APPROVED BY	MMG	09/13	SCALE AT A3 1:1000	FILE No. 233906-ES-02



KEY

- Existing manhole
- MH
- Existing gullies
- G
- Existing kerb outlet
- KO
- Highway boundary
- 
- Proposed Carriageway
- 
- Proposed Pedestrian Footpath
- 
- Existing carriageway to become verge
- 
- Grasscrete turning head
- 



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**DRAWING TITLE**  
Outline Drainage Layout

REV.	DESCRIPTION	CHECKED	DATE

	INIT.	DATE	DRAWING No.	
DESIGNED BY	UK	09/13	MMD-233906-ES-02-C-DR-00-XX-007	
DRAWN BY	JCR	09/13	PROJECT TITLE	
CHECKED BY	AH	09/13	Rackeath Junction Improvements	
APPROVED BY	MMG	09/13	SCALE AT A3	FILE No.
			1:1000	233906-ES-02

Key

BTBTBTBTBTBTBT

Underground BT Line

BTBTBTBTBTBTBT

Overhead BT Line

LVLVLVLVLVLVLV

Underground HV Cable

LVLVLVLVLVLVLV

Underground LV Cable

LVLVLVLVLVLVLV

Overhead HV Cable

WVWVWVWVWVWV

Water Line

LP LP LP LP LP LP LP

LP Gas Mains

MP MP MP MP MP MP MP

MP Gas Mains

IP IP IP IP IP IP IP

IP Gas Main

VM VM VM VM VM VM VM

Virgin Media Line

FS FS FS FS FS FS FS

Foul Sewer

CS CS CS CS CS CS CS

Combined Sewer

SS SS SS SS SS SS SS

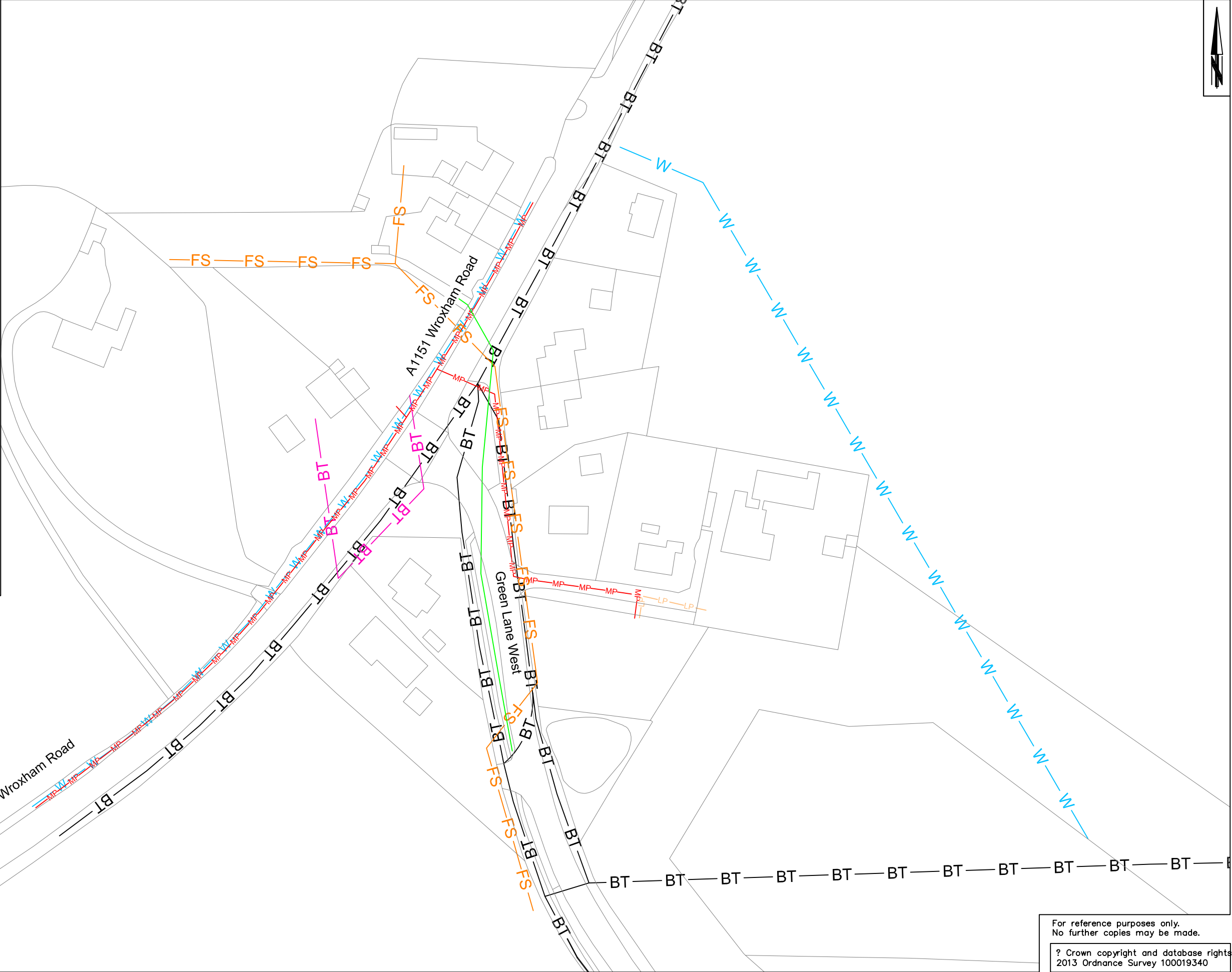
Surface Sewer

Uk Power Network Cable

Uk Power Network Cable

- Notes
- The existing utilities shown have not been supplied from surveyed data and as such should not be relied upon for accuracy

Utilities shown are existing unless noted otherwise.



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DRAWING TITLE  
Utilities Layout

REV.	DESCRIPTION	CHECKED	DATE

	INIT.	DATE	DRAWING No. MMD-233906-ES-02-C-DR-00-XX-100	
DESIGNED BY	JCR		PROJECT TITLE Green Lane West - Wroxham Road	
DRAWN BY	JCR		Junction Improvements	
CHECKED BY	AH		SCALE AT A3 1:1000	FILE No. 233906-ES-02
APPROVED BY	MMG			

## **APPENDIX B**

### **SITE PHOTOGRAPHS**







PHOTO 1 Facing Northwest on the footway behind the existing lay-by at the left of Green Lane West



PHOTO 2 Facing North on the footway at the left of existing lay-by





PHOTO 3 Facing North on the footway at the left of Green Lane West



PHOTO 4 Facing Northeast at the bell mouth of Green Lane West





PHOTO 5 Facing Northeast at the right side kerb of Wroxham Road (A1151)



PHOTO 6 Facing Northeast at the left side kerb of Wroxham Road (A1151)





PHOTO 7 Facing Northeast at the right side kerb of Wroxham Road (A1151)



PHOTO 8 Facing Southwest at the left side kerb of Wroxham Road (A1151)





PHOTO 9 Facing Southeast at Wroxham Road (A1151), the farm is 1.2m lower than the existing carriageway





# APPENDIX B

## Part 2

A1151 Rackheath: Green Lane Junction  
Improvement Stage 1 Safety Audit

26 September 2013





## INTRODUCTION

This report contains the results of a Stage 1 Safety Audit carried out on the above scheme. The Audit was carried out at the request of Norfolk County Council Highways Group.

The Audit Team membership was as follows:-

Nevil Calder BSc(Hons) CEng MICE MCIHT MSoRSA (Audit Team Leader)	Principal Consultant Mott MacDonald
--	--

Kevin Allen BEng(Hons) IEng MCIHT MSoRSA (Audit Team Member)	Project Engineer Network Analysis + Safety Norfolk County Council
---	---

Specialist Advisors:-

Andy Micklethwaite	Casualty Reduction Officer Norfolk County Council
--------------------	--

The Audit took place at Carrow House on 26 September 2013. The audit comprised an examination of the Safety Audit submission document and a site inspection on 26 September 2013 by the Audit Team Leader. The weather was bright and the road surface dry.

The terms of reference are as described in Environment, Transport and Development Highways Service Manual Procedure SP03-07. The Auditors have examined and reported only on the road safety implications of the scheme as presented and have not verified the compliance of the design to any other criteria.

---

## **ITEMS RAISED AT PREVIOUS AUDIT**

No previous safety audit.

## **ITEMS RAISED AT THIS STAGE 1 AUDIT**

### **1.0 General**

1.1 No comment

### **2.0 Alignment**

2.1 Problem

Location: A1151 at closure point

Summary: potential conflict between mainline traffic and turning traffic

Proximity of the proposed turning head on Green Lane West to the A1151 carriageway presents a number of safety issues:-

- The lack of visual closure on the outside of a curve may mislead south-westbound drivers on A1151.
- Turning vehicles may appear to be on or entering the mainline, causing confusion/distraction to drivers on A1151. This will be exacerbated at night with the added risk of headlight dazzle.
- The narrow width between the turning head and A1151 would be easy to cross, encouraging abuse of the closure.

#### **Recommendation**

Provide a minimum 3.5m wide verge to A1151 free of obstruction. Behind this a physical closure should be provided in the form of a continuous hedgeline to give visual closure without posing a collision hazard to errant vehicles. An 'L' or 'Y' shaped turning head might better fit the remaining space.



---

## 2.2 Problem

Location: new alignment of Green Lane West

Summary: lack of forward visibility envelope

The new alignment departs from the old with a proposed left-hand curve of radius 180m; however no visibility splay is shown on the inside of the curve for north-westbound traffic.

Recommendation

Provide 120m forward visibility envelope. Any boundary hedge should be set back at least 1m from this to allow for future growth, and sufficient land should be acquired for this purpose.

## 2.3 Comment

Location: A1151

Summary: kerb profile

All proposed kerbing on A1151 should have a 45degree batter profile as this is more forgiving in event of impact on high speed roads.

## 3.0 Junctions

### 3.1 Problem

Location: A1151 proposed ghost island RTL

Summary: abrupt tapers increases risk of collision for northbound traffic

The development tapers at each end of the proposed ghost island right turn lane are too abrupt, with substandard tapers of around 1:11. This creates a sharp deflection in the path of south-westbound traffic, raising the risk of loss of control and run-off collisions with potentially serious outcomes.



---

### Recommendation

Redesign the tapers to the TD42 standard of 1:25. With the ghost island being on an existing curve (radius 1 step below standard) it is important that the resulting outside channel line should be a smooth curve not a series of individual changes in direction.

### 3.2 Problem

Location: A1151 ghost island RTL

Summary: narrow lanes and substandard curve increase the risk of conflict

The proposed ghost island lies on an existing curve of radius 1 step below standard. The RTL will be heavily used by HGVs accessing the nearby industrial estate. In these circumstances the proposed relaxation of RTL width to 3.0m is considered to raise the risk of collision with potential for serious outcomes.

### Recommendation

Increase the width of the central RTL to 3.5m to provide adequate lateral clearance on the curving alignment.

### 3.3 Problem

Location: new junction onto A1151

Summary: lack of channelising island in junction mouth reduces safety

Traffic islands in the mouth of minor roads at rural junctions have significant safety benefit. They are normally provided at all except simple junctions. They help to channelise and guide vehicular movements, shelter waiting vehicles and raise junction conspicuity.

### Recommendation

Provide a channelising island in the junction mouth.

---

3.4 Problem

Location: new junction onto A1151

Summary: gradient of approach

The proposed diversion of Green Lane crosses land which is lower than adjacent A1151. However it is important to avoid a significant uphill gradient on immediate approach to the new junction as this creates delay/difficulty for vehicles pulling out, raising the risk of collision with main road traffic. This is particularly so for the frequent HGVs coming from the nearby industrial estate.

Recommendation

The first 15m of the new road from the junction should be level with A1151.

3.5 Comment

Location: junction of old Green Lane West with new alignment

Summary: lack of junction visibility splay

Visibility splays are not indicated for this junction and there is concern that adequate provision should be made.

Recommendation

Ensure visibility is available at 2.4m set-back - 120m is recommended to the left and 90m to the right (from the side road driver's perspective). Any proposed boundary hedge should be set back at least 1m from this to allow for future growth and sufficient land should be acquired for this purpose.

**4.0 Non-motorised Users**

4.1 No comment

---

## **5.0 Signs, Lighting and Markings**

### **5.1 Comment**

Location: A1151 proposed ghost island

Summary: potential overtaking through ghost island

There is an existing prohibitory double white line system in this vicinity due to restricted forward visibility. This system should be extended through the proposed ghost island in order to deter overtaking





---

**AUDIT TEAM STATEMENT**

We certify that this audit has been carried out in accordance with Norfolk County Council Environment, Transport and Development Procedures.

Signed (ATL) ..

*N. Calder*

Nevil Calder

Dated

*27/9/13*

Signed

*K. Allen*

Kevin Allen

Dated

*27th September 2013*



# APPENDIX B

## Part 2

Stage 1 Safety Audit, NDR Off Line  
Improvements – Rackheath Junction,  
Response Sheet

29 November 2013





**NDR Off line Improvements – Rackheath Junction**

**RESPONSE SHEET**

Problem (para no.)	Agree/ Disagree	Reasons/Proposals
2.1	Agree	Alternative solutions indicated on the drawings. This be addressed at later stage.
2.2	Agree	Green Lane West alignment is revised to improve the visibility after discussions with the NDR Team.
2.3		All materials not finalized at this stage.
3.1	Agree	The geometry of the ghost island is improved in accordance with the comments from NDR Team and further input from Casualty Reduction team.
3.2	Agree	The geometry of the ghost island is improved considering the comments from NDR Team and further input from Casualty Reduction team. Revised design shows an RTL lane with reducing from 3.5m to 3.1 at the junction.
3.3	Agree	Junction geometry revised giving consideration to the amount of turning movements, geometric requirements and land issues. A splitter island is provided. A second island required to separate the SB-left turning traffic is not provided because of possible negative impact on the capacity of A1151. Current design is agreed by NCC and Casualty Reduction team.
3.4		Design undertaken from OS map. The site visit and general topography is not likely to require steep slopes on the junction approach. This will be dealt at the detailed design stage.
3.5		The layout of the new simple T junction is improved as part of revisions to the Green Lane West alignment. Current design provides required visibilities.
5.1		The roadmarkings shown on the layouts are indicative. This will be dealt at the detailed design stage.

To:- Principal Engineer (Casualty Reduction):

From. UNIT KANGALLI

Signed..........Project Engineer

Dated: 29.11.2013

**Attached:** MMD-233906-ES-02-C-DR-00-XX-006C - Preliminary GA (Latest layout)

Note: If you intend to produce your own version of this page please include Safety Audit file no/date and ATL name



# APPENDIX B

## Part 3

### Thorpe End Highway Improvements Preliminary Design Stage 1 Safety Audit Submission

September 2013



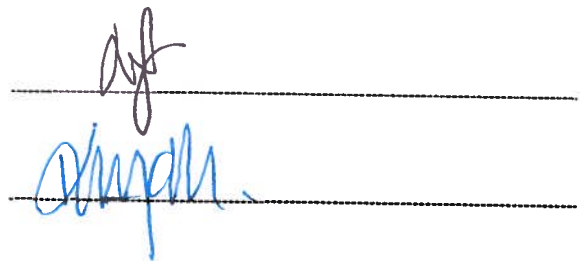
# **THORPE END HIGHWAY IMPROVEMENTS PRELIMINARY DESIGN STAGE 1 SAFETY AUDIT SUBMISSION**

**September 2013**

Author of Report      Joseph Tetteh

Checked by            Umit Kangalli

Document Ref: 233906-ES-03/S Audit 1/JT



Handwritten signatures of Joseph Tetteh and Umit Kangalli over horizontal lines.



**Project Manager/Resident Engineer:** Umit Kangalli  
**Staff Involved in the Design Process:** Joseph Tetteh

## **CONTENTS**

	Page No.
1. Background	1
2. Design Standards	1
3. Plans	1
4. Site Photographs or Video Recording	3
5. Traffic Data	3
6. Other Data	

## **APPENDICES**

- A Scheme Drawings
- B Photographs
- C
- D

## **1. Background**

- (a) Traffic modelling work for the proposed NDR indicates that there will be an increase in traffic along Plumstead Road (C874). As a result Great and Little Plumstead Parish Council raised concerns about increase of traffic through Thorpe End. Therefore a series of highway improvements were investigated to help mitigate any increased traffic through Thorpe End.
- (b) The provision of a new footway in the northern verge of Plumstead Road will allow pedestrians to access the Thrope End shopping area or the existing zebra crossing to access the bus stop and on the southern side of Plumstead Road further to the west. In addition to this the provision of a mini-roundabout at the Plumstead Road/Broadland Drive will assist vehicles from exiting Broadland Drive onto Plumstead Road where difficulties are experienced at present.

## **2. Design Standards**

- (a) Design speed adopted – Original speed limits to be maintained (Broadland Drive 20mph, Plumstead Road 30mph)
- (b) Any departures from standards, giving reasons – There are no departures from standards

## **3. Plans**

### **(a) General Scheme Layout**

A general scheme layout is included in Appendix A - Drawing No. 233906-ES-03-C-DR-00-XX-002

#### **i. Junctions, including visibility splays**

The scheme involves the realignment of the existing T-junction into a mini-roundabout to define priority and assist vehicles from exiting Broadland Drive. The existing visibility splay will be reduced by the introduction of the mini-roundabout, however it is proposed that this can be improved by the removal of the small tree on Broadland Drive as indicated on drawing no. 233906-ES-03-C-DR-00-XX-002

#### **ii. Parking**

N/A.

#### **iii. Accesses:-**

There is an existing access unto Thorpe End garage but this will not be affected by the proposed works.

#### **iv. Levels/gradients:-**

Mini-roundabout to be domed and with raised asphalt islands but proposed levels and gradients are to be kept as close to existing levels as possible

- v. Details of abutments, parapets, fences, existing signs, central barriers, crests, vehicle parking, and any other restriction to visibility:-**  
Existing trees close to the junction restricts the visibility on Broadland Drive. Removal of small tree on Broadland Drive will improved the visibility splay
- vi. Accommodation works:-**  
There are no known accommodation works at this stage.
- vii. Street lighting:-**  
Existing street lighting to be revised following confirmed alignment of mini-around
- viii. Signing and lining details, including diagram numbers, sizes and mounting heights:-**  
New road markings layout as shown on drawing no. 233906-ES-03-C-DR-00-XX-002 and designed in accordance with TSRGD 2002 and Chapter 5 of the Traffic Signs Manual. Signage design will be done as part of NDR.
- ix. Drainage information:-**  
There is an existing drainage system at the junction and this will be and t may be necessary to carry out a drainage survey before detailed design stage.
- x. Kerbing details and surfacing information:-**  
Junction will be resurfaced as part of the scheme.
- xi. Existing and proposed TROs:-**  
All TROs will be done as part of NDR.
- xii. Safety fences/barriers:-**  
N/A.
- xiii. Pedestrian provision, including refuges, guard railing, signing, dropped kerbs:-**  
There is a proposal to provide a new 1.5m footway in the northern verge of Plumstead Road with drop kerbs at crossing points.
- xiv. Provision for cyclists:-**  
N/A.
- xv. Equestrian provision:-**  
N/A.
- xvi. Provision for disabled persons:-**  
N/A. Existing pedestrian facilities will not be affected.
- xvii. Bus stops and lay-bys:-**  
N/A.



**xviii. Landscaping:-**

None

**xix. Service apparatus:-**

Existing BT cables and water pipe may be affected by works See Appendix A – Drawing No. 233906-ES-03-C-DR-00-XX-100.

**(b) Local Highway Network**

A location plan showing the surrounding highway network is included in Appendix A – Drawing No. 233906-ES-03-C-DR-00-XX-001.

**4. Site Photographs or Video Recording**

Photographs are included in Appendix B.

**5. Traffic Data**

- (a) Route hierarchy status of all effected roads – Broadland Drive and Plumstead Road
- (b) Latest traffic counts, including turning movements where appropriate. Indication of presence of regular queuing or junctions operating near capacity –N/A.
- (c) Traffic forecast data – N/A.
- (d) Measured speed data – N/A.
- (e) Non vehicular movements – N/A.

**6. Accident Data**

There is no accident recorded at this junction

**7. Construction Programme & Operation**

- (a) The scheme will form part of the NDR DCO application and will be delivered together with the mainline works.
- (b) Preliminary design is to be completed by the end of September 2013.
- (c) Detailed design - TBC

**8. Other Relevant Information**

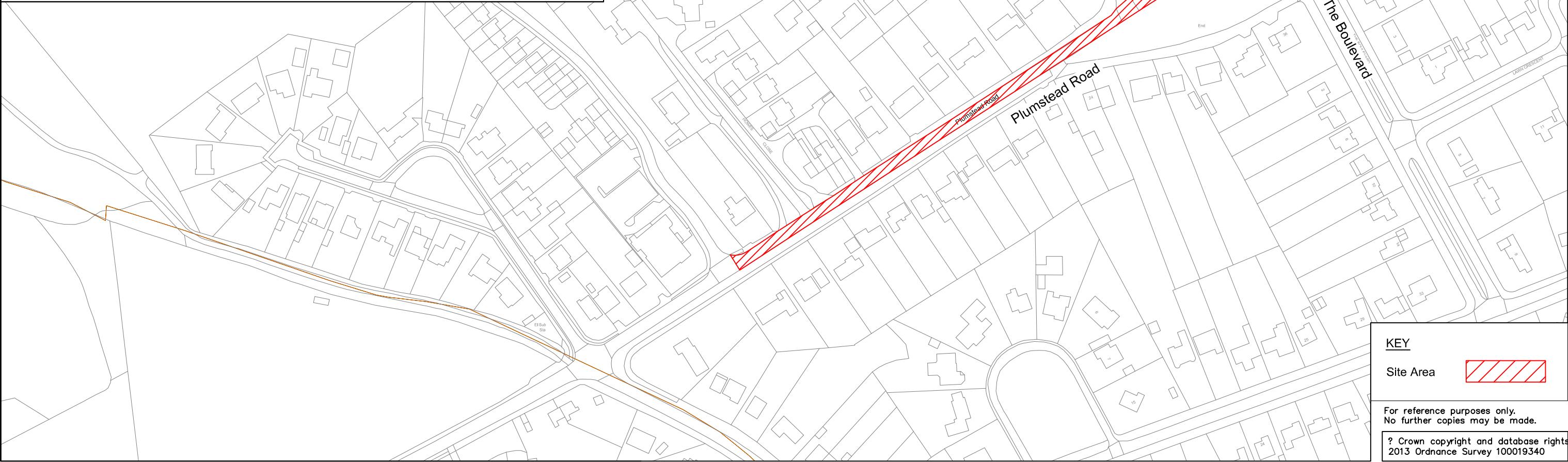
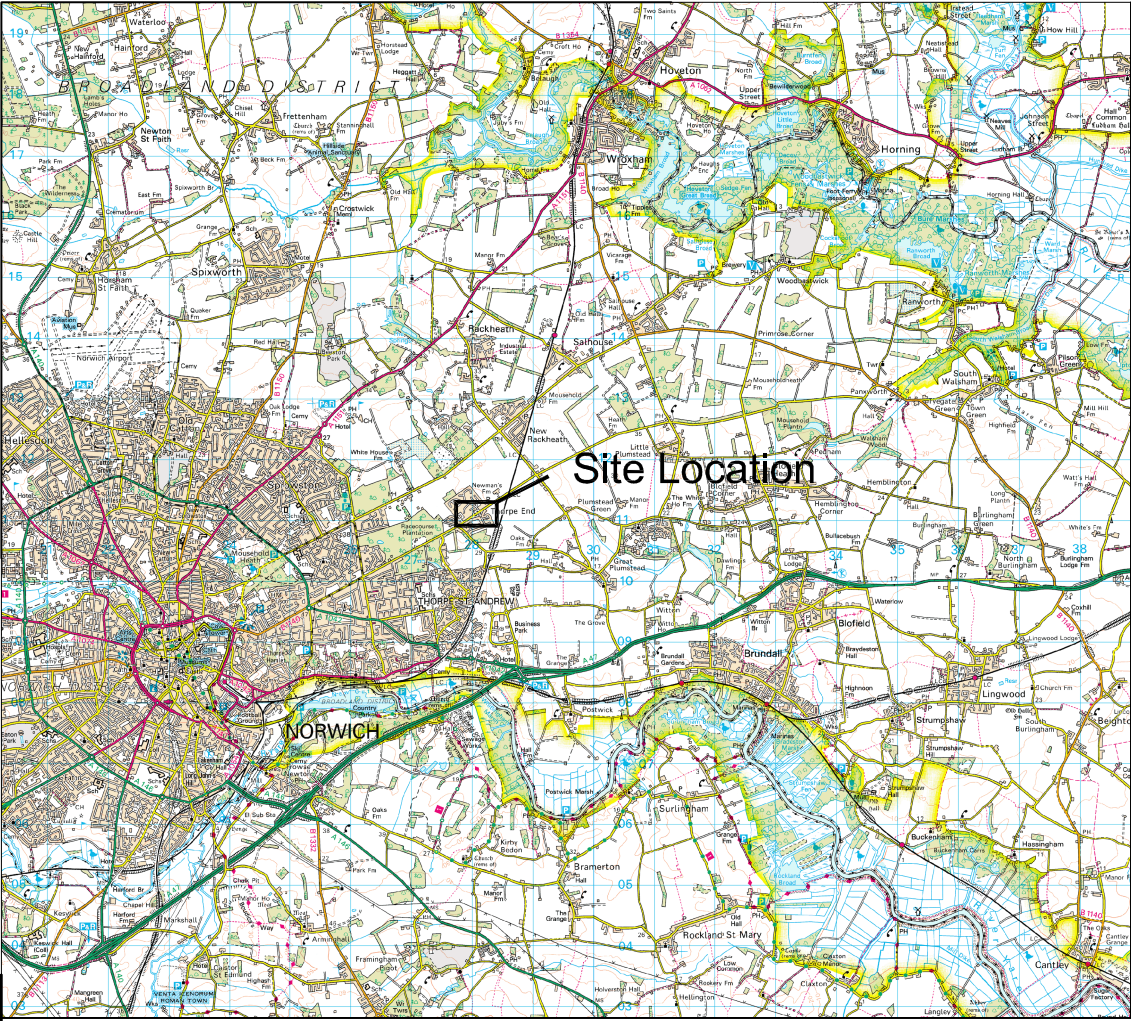
N/A



## **APPENDIX A**

### **SCHEME DRAWINGS**






**KEY**

Site Area 


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**Norfolk County Council**  
working with  
**MAY GURNEY**



**Mike Jackson**  
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**Mott MacDonald**  
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Fax 01603 226760  
Web [www.mottmac.com](http://www.mottmac.com)

**DRAWING TITLE**

Site Location Plan

REV.	DESCRIPTION	CHECKED	DATE

DESIGNED BY	JT	09/13	DRAWING No. MMD-233906-ES-03-C-DR-00-XX-001 PROJECT TITLE Thorpe End - Plumstead Road Highways Improvements SCALE AT A3 1:2000	FILE No. 233906-ES-03
DRAWN BY	JCR	09/13		
CHECKED BY	AH	09/13		
APPROVED BY	MMG	09/13		

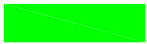


KEY

New carriageway



Existing carriageway to be built out



Existing verge to become Footway



Highway boundary



Visibility splay



Proposed Road Markings



Proposed breedon gravel surface footway



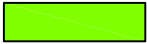
Proposed Asphalt surface footway



Retain existing footway



Retain Existing Verge



Approximate Location of Existing Tree

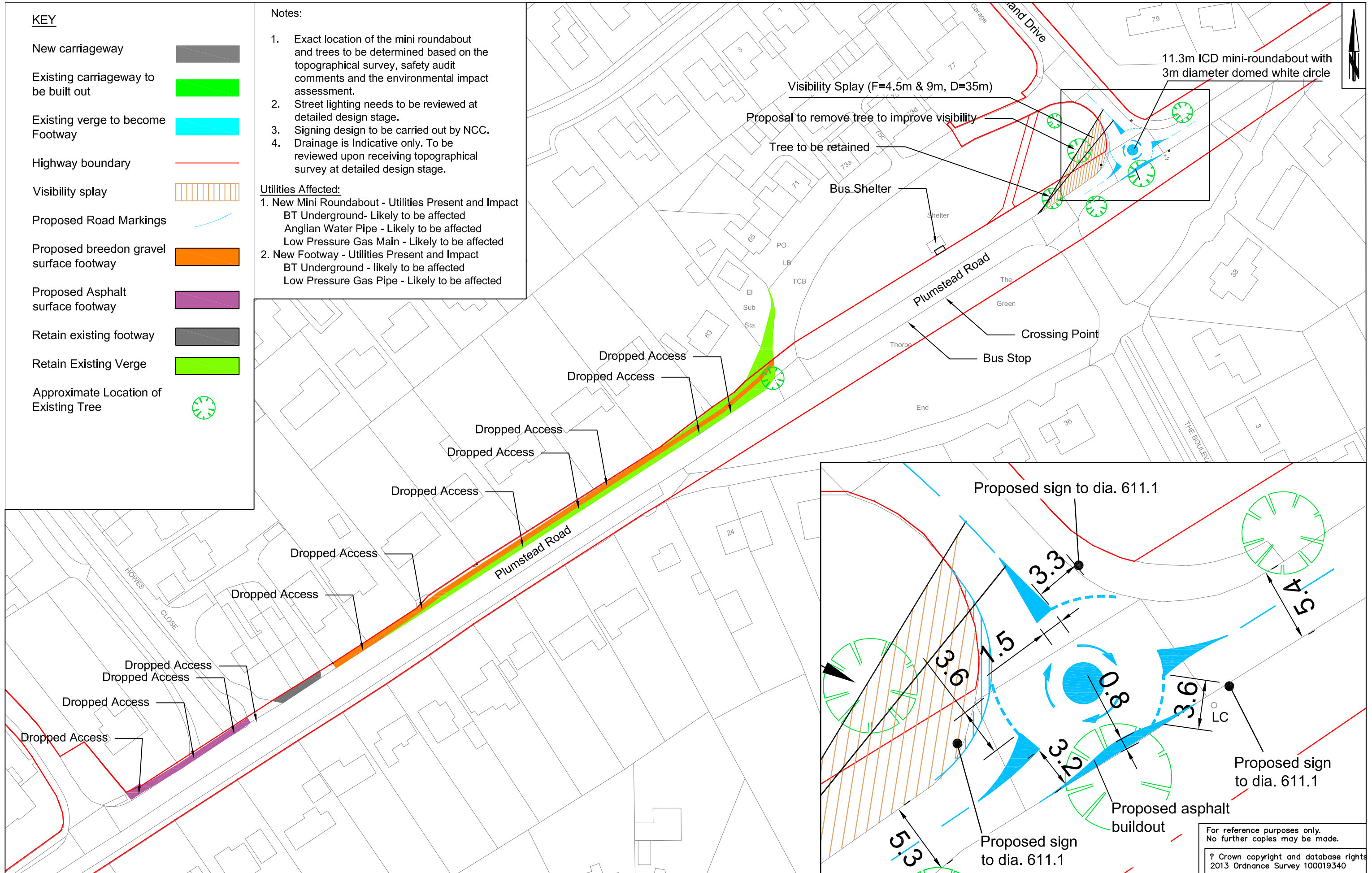


Notes:

1. Exact location of the mini roundabout and trees to be determined based on the topographical survey, safety audit comments and the environmental impact assessment.
2. Street lighting needs to be reviewed at detailed design stage.
3. Signing design to be carried out by NCC.
4. Drainage is Indicative only. To be reviewed upon receiving topographical survey at detailed design stage.

Utilities Affected:

1. New Mini Roundabout - Utilities Present and Impact  
BT Underground - Likely to be affected  
Anglian Water Pipe - Likely to be affected  
Low Pressure Gas Main - Likely to be affected
2. New Footway - Utilities Present and Impact  
BT Underground - likely to be affected  
Low Pressure Gas Pipe - Likely to be affected



Visibility Splay (F=4.5m & 9m, D=35m)

Proposal to remove tree to improve visibility

Tree to be retained

Bus Shelter

Plumstead Road

Crossing Point

Bus Stop

Dropped Access

Dropped Access

Dropped Access

Dropped Access

Dropped Access

Dropped Access

Dropped Access

Dropped Access

Dropped Access

Dropped Access

Dropped Access

Proposed sign to dia. 611.1

3.3

3.3

3.3

3.3

3.3

3.3

3.3

3.3

3.3

3.3

Proposed asphalt buildout

Proposed sign to dia. 611.1

Proposed sign to dia. 611.1

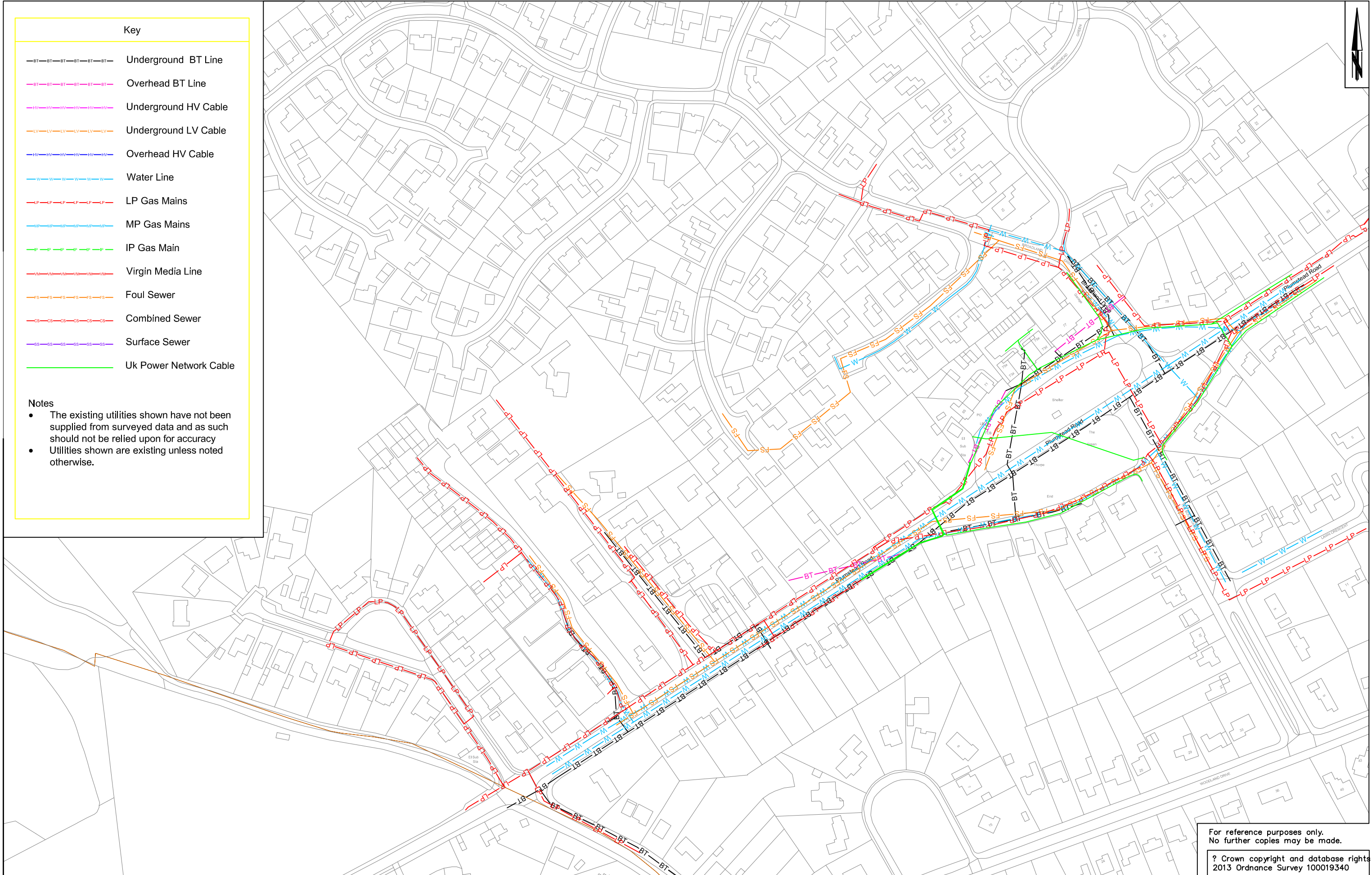
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REV.	DESCRIPTION	CHECKED	DATE
A	Mini roundabout alignment revised.	UK	09/13

DESIGNED BY	INIT.	DATE	DRAWING No.
JT	JT	09/13	MMD-233906-ES-03-C-DR-00-XX-002A
DRAWN BY			PROJECT TITLE
JCR	JCR	09/13	Thorpe End - Plumstead Road
CHECKED BY			Highways Improvements
AH	AH	09/13	SCALE AT A3
APPROVED BY			FILE No.
MMG	MMG	09/13	1:1000
			233906-ES-02





Key

- Underground BT Line
- Overhead BT Line
- Underground HV Cable
- Underground LV Cable
- Overhead HV Cable
- Water Line
- LP Gas Mains
- MP Gas Mains
- IP Gas Main
- Virgin Media Line
- Foul Sewer
- Combined Sewer
- Surface Sewer
- Uk Power Network Cable

Notes

- The existing utilities shown have not been supplied from surveyed data and as such should not be relied upon for accuracy
- Utilities shown are existing unless noted otherwise.

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Web [www.mottmac.com](http://www.mottmac.com)

**DRAWING TITLE**  
Utilities Plan

REV.	DESCRIPTION	CHECKED	DATE

	INIT.	DATE	DRAWING No. MMD-233906-ES-03-C-DR-00-XX-100	
DESIGNED BY	JCR		PROJECT TITLE	
DRAWN BY	JCR		Thorpe End - Plumstead Road	
CHECKED BY	AH		Highways Improvements	
APPROVED BY	MMG		SCALE AT A3 1:2000	FILE No. 233906-ES-03



## **APPENDIX B**

### **SITE PHOTOGRAPHS**





PHOTO 1 Facing East on Broadland Drive





PHOTO 2 Facing North on Plumstead Road





PHOTO 3 Facing North on Plumstead Road





PHOTO 4 Facing South on Plumstead Road at the bell mouth of junction



# APPENDIX B

## Part 3

### C874 Plumstead Road Thorpe End: Highway Improvement Stage 1 Safety Audit

25 September 2013



---

## INTRODUCTION

This report contains the results of a Stage 1 Safety Audit carried out on the above scheme. The Audit was carried out at the request of Norfolk County Council Highways Group.

The Audit Team membership was as follows:-

Nevil Calder BSc(Hons) CEng MICE MCIHT MSoRSA (Audit Team Leader)	Principal Consultant Mott MacDonald
--	--

Kevin Allen BEng(Hons) IEng MCIHT MSoRSA (Audit Team Member)	Project Engineer Network Analysis + Safety Norfolk County Council
---	---

Specialist Advisors:-

Andy Micklethwaite	Casualty Reduction Officer Norfolk County Council
--------------------	--

The Audit took place at Carrow House on 25 September 2013. The audit comprised an examination of the Safety Audit submission document and a site inspection on 26 September 2013 by the Audit Team Leader. The weather was bright and the road surface dry.

The terms of reference are as described in Environment, Transport and Development Highways Service Manual Procedure SP03-07. The Auditors have examined and reported only on the road safety implications of the scheme as presented and have not verified the compliance of the design to any other criteria.



---

## **ITEMS RAISED AT PREVIOUS AUDIT**

No previous safety audit.

## **ITEMS RAISED AT THIS STAGE 1 AUDIT**

### **1.0 General**

1.1 No comment

### **2.0 Alignment**

2.1 No comment

### **3.0 Junctions**

3.1 Comment

Location: proposed mini roundabout

Summary: low side road flows

No traffic flow data was provided with the submission. While overall flows are likely to be appropriate for a mini roundabout, there is concern that due to its residential nature, off-peak flows on Broadland Drive will be low. For regular drivers westbound on Plumstead Road this may affect their expectation of the need to give way. For safe operation of mini roundabouts, side road flows should generally not be less than 10% of main road flows.

3.2 Problem

Location: proposed mini roundabout eastbound approach

Summary: excessive visibility of adjacent entry leading to high approach speeds

---

Eastbound drivers approaching on Plumstead Road will have excessive visibility of any opposing westbound vehicles due to the straight highway layout. This can lead to early decision making of the need to give way and (in the absence of any opposing traffic) high entry speeds. This can result in conflict with any driver attempting to enter the roundabout from Broadland Drive.

#### Recommendation

Provide a kerbed splitter island on the eastbound entry to enforce greater lateral shift and encourage lower speeds.

## **4.0 Non-motorised Users**

### **4.1 No comment**

## **5.0 Signs, Lighting and Markings**

### **5.1 Problem**

Location: proposed mini roundabout

Summary: late awareness of mini roundabout due to low conspicuity

There is concern about conspicuity of the proposed mini roundabout within the long straight visual corridor of this stretch of Plumstead Road. This could lead to late driver awareness of the feature and late braking and overshoot collisions.

#### Recommendation

The kerbed island recommended in 3.2 above would help in this regard, as would a reflective post sited on the proposed build-out on the southern side of the circulatory area. Clear unobstructed siting of the mini roundabout signs is also crucial and the designer should give special consideration to night time conditions.



---

**AUDIT TEAM STATEMENT**

We certify that this audit has been carried out in accordance with Norfolk County Council Environment, Transport and Development Procedures.

Signed (ATL) ... *N. Calder*      Nevil Calder  
Dated *27/9/13*

Signed *K. J. Allen*      Kevin Allen  
Dated *27th September 2013*



---

## **APPENDIX A – Problem Location Plan**

Not included due to limited nature of the scheme



# APPENDIX B

## Part 3

### Stage 1 Safety Audit, NDR Off Line Improvements – Thorpe End, Response Sheet

29 November 2013





**NDR Off line Improvements – Thorpe End**

**RESPONSE SHEET**

Problem (para no.)	Agree/ Disagree	Reasons/Proposals
3.1		Traffic forecast on the minor road at the design year is expected to be more than 10% of the main line, based on the NATS/NDR model. The southern channel line on the WB approach of the road is realigned which will help reducing the speed of WB traffic and improving the expectation of the need to give way.
3.2	Agree	Traffic counts carried out and the mini roundabout geometry revised in accordance with the visibility requirements (for the side road) for the expected future traffic. This is agreed with the NCC and Casualty Reduction Team. Also the geometry of the splitter island roadmarking is improved to increase the deflection of EB traffic. Splitter islands are not found feasible due to narrow road width and the site constraints such as mature oak trees, existing bus stop and boundary issues.
5.1	Agree	The geometry of the splitter island road markings and the southern channel line is improved to reduce the approach speeds. Detailed design of the signs and road markings will be carried out considering this at later stage of the scheme.

To:- Principal Engineer (Casualty Reduction):

From. UMIT KANGALLI

Signed.....Project Engineer      Dated: 29.11.2013

**Attached:** MMD-233906-ES-03-C-DR-00-XX-002D - Preliminary GA (Latest layout)

Note: If you intend to produce your own version of this page please include Safety Audit file no/date and ATL name





# APPENDIX C



# APPENDIX C

## A47/A1042 Postwick Hub Junction Stage 2 Safety Audit Submission

April 2013





# **A47/A1042 Postwick Hub Junction**

## **Stage 2 Safety Audit Submission**

**April 2013**

PREPARED BY:-

Environment Transport and Development  
Design Division  
Norfolk County Council  
County Hall  
Martineau Lane  
Norwich  
Norfolk  
NR1 2SG  
Document Ref: R1C150



# A47/A1042 Postwick Hub Junction

Author of Submission:-

Highways Technician


Mike Auger

(Sig.)  \_\_\_\_\_

Checked by:-

Project Engineer

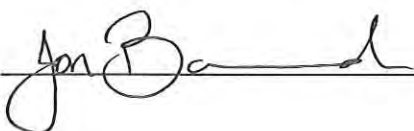
Matt Harrison/Sam Cliff

(Sig.)  \_\_\_\_\_

Approved by:-

Project Manager

Jon Barnard

(Sig.)  \_\_\_\_\_

Issue Status: Final

Date: 09 April 2013

Document Ref: R1C150



<b>Project Manager/Resident Engineer:</b>	Matt Harrison/Sam Cliff
<b>Staff Involved in the Design Process:</b>	Matt Harrison/Sam Cliff/Durga Goutam/Dave Parkin

## CONTENTS

	Page No.
1. Background	1
2. Scheme Description and Design Standards	7
3. Street lighting	17
4. Vehicle Restraint Systems	18
5. Planned Development	19
6 Traffic Data	20
7 Proposed Traffic Regulation Orders	21
8 Scheme Location	21

## APPENDICES

A	Previous Safety Audit Drawings
	R1C193-R1-1285H General Junction Layout
	249610-AD-023F Postwick Park and Ride Extension Site Plan
	R1C150-MP-636 Park and Ride Signalised Junction - Traffic Signal Layout
B	Safety Audit Submission Drawings
	R1C150-MP-101A Postwick Junction Exhibition Plan
	R1C150-MP-608 Non motorised user facilities, existing eastbound diverge slip road
	R1C150-MP-609 Non motorised user facilities, Postwick Park and Ride
	R1C150-MP-636A Park and Ride Signalised Junction - Traffic signal layout
	R1C150-MP-660 Landscaping, pavements, kerbings and footways (Sheet 1 of 3)
	R1C150-MP-661 Landscaping, pavements, kerbings and footways (Sheet 2 of 3)
	R1C150-MP-662 Landscaping, pavements, kerbings and footways (Sheet 3 of 3)
	R1C150-MP-663 Traffic signs, road markings, road restraints and street lighting (Sheet 1 of 3)
	R1C150-MP-664 Traffic signs, road markings, road restraints and street lighting (Sheet 2 of 3)
	R1C150-MP-665 Traffic signs, road markings, road restraints and street lighting (Sheet 3 of 3)
	249610-AD-61 Church Road Bus Stop and Shelter
C	Norwich Cycle Map



## **Executive Summary**

The aim of this safety audit is to bring together all the elements of the A47/A1042 Postwick Hub Junction and its associated works into one safety audit.

The audit will present some modifications to the scheme that have not previously been seen as part of the previous safety audit reports, including additional non motorised user (NMU) measures that have been developed following comments received from various NMU groups during the development of the scheme.





## 1.0 Background

- 1.0.1. The aim of this safety audit is to bring together all the elements of the Postwick Junction and its associated works into one safety audit.
- 1.0.2. The general layout for the Postwick Junction scheme and it's associated works are shown in drawing number R1C150-MP-101A included in Appendix B. All references to elements of the junction in this report are based on figure 1 below.

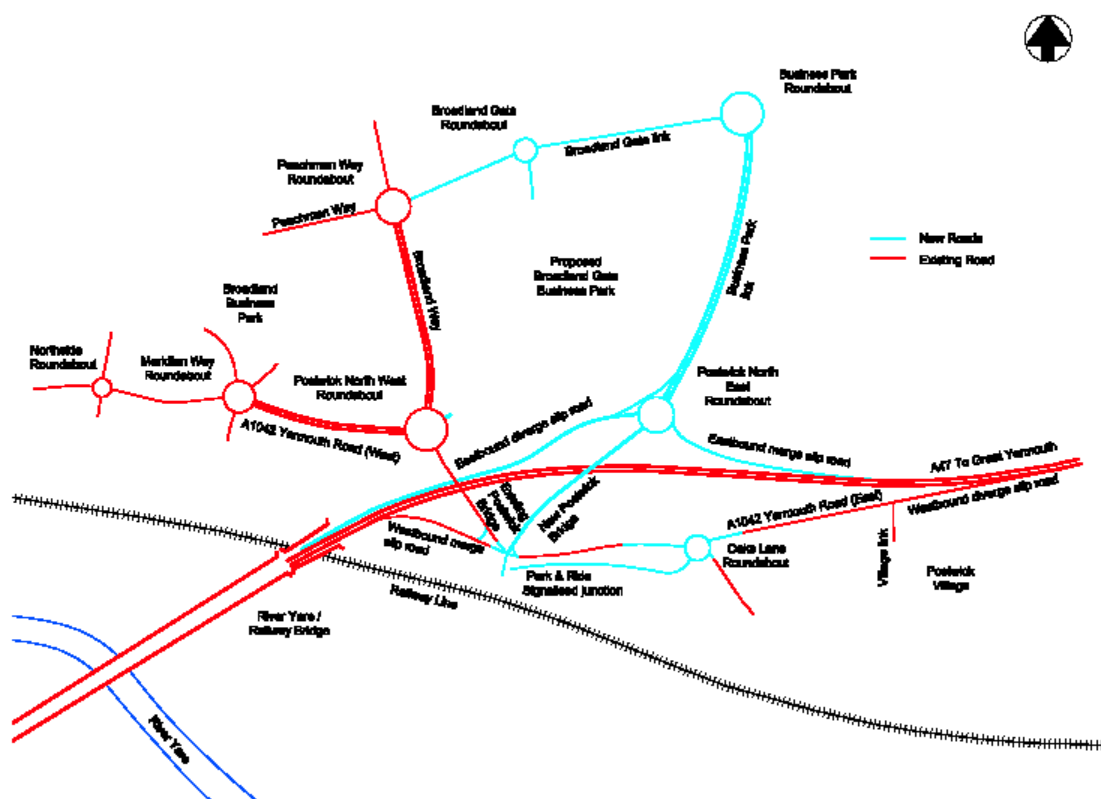


Figure 1 - Schematic layout and naming convention

- 1.0.3. The section below aims to set out each element, how it ties into the proposed Postwick Junction improvements and the previous safety audits processes that it has been through.
- 1.0.4. In the course of the recent development of the project, there have been a number of modifications to the proposed scheme and its associated works

which have not been included in the previous safety audits. The significant modifications have been highlighted in section 1.8 below.

## **1.1. The Postwick Junction**

- 1.1.1. The existing Postwick junction was constructed as part of the A47 Norwich Southern Bypass which opened in 1992. It is a grade separated junction linking the A47 trunk road to the A1074 Yarmouth Road leading to the east of Norwich. The Postwick junction provides access to the existing Broadland Business Park immediately to the north of the junction, and to the village of Postwick which lies to the south east. There is a single overbridge linking two roundabouts giving access to these areas. Slip roads on and off the trunk road link to these roundabouts. The westbound diverge slip road leaves the trunk road some way east of the rest of the junction, to join a section of the former trunk road, now the A1042 Yarmouth Road, which also gives access to the village of Postwick.
- 1.1.2. The existing Postwick junction has already been modified since its construction, with the enlargement of the Postwick North West roundabout (located on the north side of the A47) and the addition of segregated left turn lanes. The Highways Agency is concerned that increases in volumes of traffic using the junction could result in operational problems, and in particular that queues on the eastbound diverge slip road off the A47 could extend onto the A47 mainline carriageway, resulting in an unacceptable safety risk. Therefore the Highways Agency have made further development (which could lead to increased demand on this Postwick junction) in the vicinity of the existing Broadland Business Park or to the north east of Norwich, conditional upon the prior improvement of the Postwick Hub junction.
- 1.1.3. Stage 1 Safety Audits were carried out between November 2007 and October 2009 considering a number of different junction options. Thereafter the junction layout shown in R1C093-R1-1285H in Appendix A was submitted for a Stage 2 Safety Audit in January 2010. This audit aimed to provide final details of the proposed Postwick Junction prior to construction of the scheme later that year following the scheme being granted planning permission.



- 1.1.4. Following the January 2010 Audit, the Secretary of State requested in August 2010 that a Public Inquiry into the Slip and Side Roads Orders is held and therefore construction did not commence. The Public Inquiry into the Slip and Side Roads Orders will be held on 3 July 2013.
- 1.1.5. A further interim Stage 2 Safety Audit was then undertaken on the Park and Ride Signalised Junction in March 2013 following some minor changes to the layout and signal timings to optimise the junction following some further modelling work. The Park and Ride Signalised Junction layout submitted for the Safety Audit is shown in drawing R1C150-MP-636 included in Appendix A.
- 1.1.6. The purpose of this safety audit submission was to assess the Park and Ride signalised junction only, focusing on the general junction layout, phasing, traffic flows and queue lengths with details such as vehicle restraint systems, street lighting and earthworks not considered at that time.
- 1.2. **Expansion of Postwick Park and Ride site**
  - 1.2.1. A proposed scheme to provide 500 additional parking spaces at the Postwick Park & Ride was developed in 2009 to address capacity issues at the site and cater for future additional demand.
  - 1.2.2. The scheme is part of the Norwich Area Transportation Strategy (NATS) policy to encourage long stay at Park & Ride site, freeing up city centre car parks for short stay shoppers and visitors, thus allowing for substantial numbers of commuter vehicles to be removed from Norwich city centre.
  - 1.2.3. The proposed scheme included new access and egress arrangements for the Park and Ride site. This included a bus only entrance and exit at the proposed signalised junction with the general access and egress for vehicles being moved to a new roundabout at Oaks Lane.
  - 1.2.4. The proposed layout shown on drawing number 249610-AD-023F Appendix A, underwent a Stage 2 Safety Audit in January 2010.
  - 1.2.5. It is proposed to construct the new access road roundabout at Oaks Lane and the pedestrian/cyclist shared use facility at the same time as the Postwick

Junction improvement. The delivery of the extension of the parking facilities at the Park and Ride site will follow at a later date (currently projected to be 2015).

### **1.3. Recent developments**

- 1.3.1. As discussed above, during the recent development of the scheme there have been a number of modifications made to the proposals that have not been included in the previous audits and are therefore now being presented in this safety audit for the first time.
- 1.3.2. The significant changes are highlighted in the paragraphs below and discussed further in the relevant section of the safety audit.

#### **New Postwick Bridge**

- 1.3.3. The previous Safety Audits submitted for the Postwick Junction scheme showed the cross section over the New Postwick Bridge as a 2.0m footway on the east side and a 2.0m wide hardened verge on the west side of the bridge, and a four lane 16.4m wide carriageway providing three lanes southbound and one lane northbound with the opposing traffic flows would be separated by a hatched central reserve.
- 1.3.4. Following feedback from local access groups, it has been highlighted that in addition to the walking link over the bridge, it could prove valuable to allow for the provision of a cycling link if this was incorporated into a sustainable transport route as part of the Northern Distributor Road scheme. Therefore the cross section over the bridge has now been changed to allow a 3m wide footway on the east side of the bridge. This has been achieved by reducing the hardened verge on the west side of the bridge to 1.0m. This will ensure that the bridge can accommodate such a route should this be progressed as part of a future NDR in the future.

#### **Existing Eastbound Diverge Slip Road**

- 1.3.5. Following feedback from various local access groups it has become evident that the existing slip road is currently being used informally by pedestrians and cyclists to access the service path over the A47 Viaduct and bridge over the

Norwich to Great Yarmouth railway line to gain access to Sustrans National Cycle Network Route 1 and Whitlingham Park.

- 1.3.6. Whilst upgrading the service path across the A47 viaduct is beyond the scope of this scheme, to ensure that cyclists are not disadvantaged by the proposed stopping up of the eastbound diverge slip road, the scheme could be changed to include a shared use facility along the line of the existing slip road. This would enable cyclists using the A47 eastbound to connect with the existing and proposed cycle network at the Postwick North West Roundabout.

### **Broadland Gate Roundabout**

- 1.3.7. The Broadland Gate Roundabout submitted as part of January 2010 Stage 2 showed a standard 3 arm roundabout to provide access to the Broadland Gate Business Park.
- 1.3.8. Following this safety audit, this has now been modified to include segregated left turn lane for west bound traffic on Broadland Way into the Broadland Gate Business Park development as shown in drawing R1C150-MP-660 included in Appendix B.

### **Park and Ride extension**

- 1.3.9. Since the Park and Ride Stage 2 Safety Audit in January 2010, two changes to the design have occurred which have not been previously audited.
- 1.3.10. These changes include the widening of the main access carriageway through the Park and Ride site to 6.0m as recommended in the January 2010 audit response to better accommodate two way traffic flow.
- 1.3.11. The layout submitted as part of this safety audit also include additional cycling measures to provide a link along the access road from the signalised junction to the neighbourhood route from Norwich to Brundall and Blofield as shown in the Norwich cycle map published in June 2010 included in Appendix C.

### **Brundall Low Road and Church Road Bus Stop**



- 1.3.12. As part of the planning conditions for the park and ride extension, the existing bus stop on the A1042 Yarmouth on the northern boundary of the application site is to be moved to the junction of Brundall Low Road and Church Road. The location of the proposed bus stop was not submitted as part of the previous audits. The proposed location of the bus stop is shown in drawing 249610-AD-61 included in Appendix B.

### **Traffic Signs and Road markings**

- 1.3.13. The traffic signs and road markings that were included as part of the Safety Audits in January 2010 and February 2013 have been updated and changed to reflect the latest developments in the scheme. The proposed traffic signs and road markings are shown in drawing R1C150-MP-663, 664 and 665 included in Appendix B.

### **1.4. Previous Safety Audit Reports**

- 1.4.1. The above Safety Audit submissions discussed above in this section have not been included in the appendices of this report, but can be made available if required.

## **2.0 Scheme Description and Design Standards**

- 2.1. The general layout for the Postwick Hub Junction scheme and its associated works are shown in drawings R1C150-MP101A, R1C150-MP-636A and R1C150-MP-660 to 665 included in Appendix B.
- 2.2. The Scheme will be subject to a 40mph speed limit other than on slip roads and the Park and Ride Access Road. Therefore the appropriate design speed is 70kph in accordance with DMRB design standard TD 9/93: Highway Link Design, paragraph 1.8, Table 2. The proposed speed limits are shown in drawings R1C150-MP-663, 664, 665 contained in Appendix B.
- 2.3. The slip road design speed is determined from the mainline A47 design speed, as the A47 is a national speed limit rural dual carriageway a design speed of 120kph applies, therefore the appropriate design speed for the slip road is 70kph in accordance with DMRB design standard TD 22/06: Layout of Grade Separated Junctions paragraph 4.5, Table 4/1.
- 2.4. **Eastbound Diverge Slip Road**
- 2.4.1. The proposed Eastbound diverge slip road passes under the existing Postwick Bridge and connects to the proposed Postwick North East Roundabout. The slip road has been designed to TD22/06 and is a 7.3m wide two lane carriageway with 2.5m verges and 1.0m carriageway edge hardstrips with a maximum gradient of 6%. The existing Eastbound diverge slip road and its associated segregated left turn lane will be closed as a result of the introduction of this new diverge slip road. The new slip road starts at the same location as the existing slip road, which is just off of the eastern end of the existing River Yare/Railway Bridge.
- 2.4.2. The nearest compliant layout that could be provided within the constraints for the new diverge slip road is a Layout Type B. This layout allows a taper diverge, where diverging traffic leaves the mainline A47 over a specified flare distance, the flare is followed by an auxiliary lane which is an additional lane at the side of the mainline to provide increased diverge opportunity and additional space for weaving traffic. This layout was submitted as a Departure from Standard in 2008 and approved in 2012.

## **2.5. Eastbound Merge Slip Road**

- 2.5.1. The proposed Eastbound merge slip road is designed as per TD22/06 with a 3.7m wide single lane with a 2.0m nearside verge and 3.3m nearside hardshoulder, 0.7m offside carriageway edge hardstrip and 2.8m offside verge with a maximum gradient of 6%.
- 2.5.2. The nearest compliant layout that could be provided is a Type B Layout, which has an auxiliary lane followed by a taper merge over a specified flare distance.
- 2.5.3. This layout was submitted and approved by the Highways Agency as a Departure from Standard in 2008.
- 2.5.4. The provision of this slip road has resulted in the need to close the existing private means of access to The Grange property from the A47 trunk road.

## **2.6. Westbound Diverge Slip Road**

- 2.6.1. There are no design changes proposed on the existing diverge from the A47 where the proposed Scheme design would tie into the existing westbound diverge slip road at Oak's Lane.

## **2.7. Westbound Merge Slip Road**

- 2.7.1. The proposed Scheme ties into the existing westbound merge slip road after the Park and Ride signalised junction and retains the existing two-lane taper merge layout onto the A47. The existing layout is not a standard layout as per TD 22/06.
- 2.7.2. A Departure from Standard to retain the existing two-lane taper merge was submitted to the Highways Agency in 2012 and approved in January 2013.

## **2.8. Postwick North East Roundabout**

- 2.8.1. The proposed eastbound diverge slip road connects into a proposed new at-grade North East roundabout. The roundabout is a 4-arm roundabout with an Inscribed Circle Diameter (ICD) of 70m and a 9.0m wide circulatory carriageway.



- 2.8.2. A segregated left turn lane at the proposed roundabout would be provided to cater for the left-turn manoeuvre from the eastbound diverge slip road into the proposed Business Park link road leading to the proposed Business Park roundabout.

## 2.9. **The Grange**

- 2.9.1. The Grange is a private residence to the north of the A47 which currently has a private means of access 200m east of the end of the existing eastbound merge slip road taper. This “entry only” access allows eastbound traffic to enter The Grange by turning left off the A47. This arrangement is unsatisfactory in terms of highway safety, creating a potential conflict with traffic joining the trunk road from the eastbound merge slip road. As the proposed eastbound diverge slip road would join the A47 further east than at present, it is proposed that this “entry only” private means of access will be stopped up as part of the Scheme. A new replacement private means of access via the new Postwick North East Roundabout is proposed.

## 2.10. **Business Park Link Road**

- 2.10.1. The proposed Business Park link road is an all-purpose dual two-lane carriageway linking the North East roundabout and the Business Park roundabout. Each carriageway would be in the form of a 7.3m carriageway comprising two running lanes 3.65m in width with a 1.0m hardstrip on the nearside and offside. The verges would be a minimum 2.5m in width and the central reserve would be 2.5m wide. A 1.0m wide footpath is proposed running along the eastern side of the Business Park Link Road.

## 2.11. **Business Park Roundabout**

- 2.11.1. The proposed Business Park link road connects into the proposed at-grade Business Park roundabout. The roundabout is a 2-arm roundabout with an ICD of 90m and a 12m wide circulatory carriageway.

## 2.12. **Broadland Gate Roundabout**

- 2.12.1. The Broadland Gate roundabout is a 3-arm roundabout with an ICD of 50m and a 9.0m wide circulatory carriageway and a segregated left turn lane for west

bound traffic into the Broadland Gate Business Park development. The roundabout is connected to the Business Park roundabout to the east, the proposed Broadland Gate Business Park to the south and to the existing Peachman Way roundabout to the west by the Broadland Gate link road.

## **2.13. Broadland Gate Link**

- 2.13.1. The proposed Broadland Gate link road would be a single carriageway link road. The link road would be in the form of a 7.3m wide carriageway with 2.5m wide verges and no hardstrips. The carriageway width would increase on the approach to the roundabouts to provide additional lanes on the entry to the circulatory carriageway.

## **2.14. New Postwick Bridge**

- 2.14.1. As discussed in section 1, the layout of the new Postwick Bridge has changed since the previous safety audits. A 3.0m hardened footway will be provided on the west side of the bridge. The proposed link road over the bridge will provide four 3.65m wide carriageway lanes, three lanes southbound and one lane northbound with opposing traffic flows separated by a hatched 1.8m central reserve.
- 2.14.2. The cross section over the bridge comprises 3.0m footway on the east side and a 1.0m wide hardened verge on the west side of the bridge, and the four lane 16.4m wide carriageway.

## **2.15. Existing Postwick Bridge**

- 2.15.1. The scheme proposals over the existing Postwick bridge would utilise the existing bridge deck to provide a 3.0m shared use footway/cycleway on the west side of the bridge, a three lane 9.0m carriageway (two lanes southbound one lane northbound) and a 1.0m verge on the east side of the bridge.
- 2.15.2. The proposed lane widths are below the standard lane width of 3.65m as described in DMRB TD 27/05. DMRB TD 16/07 states at paragraph 7.24 that a minimum lane entry width of 3.0m should be provided on the approach to a roundabout and DMRB TD 50/04 states at paragraph 2.22 a minimum lane entry width of 3.0m should be provided on the approach to a signal controlled

junction. Therefore due to the short length over the bridge of 145m between junctions, the lane widths are considered acceptable as junction approach widths.

## **2.16. Park and Ride Signalised Junction**

- 2.16.1. The existing southern roundabout would be replaced by a fully signalised junction. A drawing of the junction including traffic signal phasing diagrams is shown in drawing R1C150-MP-636A included in Appendix B.
- 2.16.2. The current access into the Park and Ride site will be restricted to bus only access and egress. General car access/egress would be via the new roundabout junction at Oaks Lane proposed as part of the extension of the existing Park and Ride site.
- 2.16.3. The method of control for the traffic signal installation is intended to react to the varying traffic demands throughout the day. The junction will incorporate queue detection to restrict excessive queues.
- 2.16.4. The access to the Park and Ride site, the A47 westbound merge slip road and the segregated right turn from the existing Postwick Bridge will include on demand crossing phases for pedestrians and cyclists.
- 2.16.5. The staging for the traffic signal layout is as follows:
- 2.16.6. Stage 1 - This allows traffic heading southeast bound over the existing Postwick bridge to turn right onto the westbound merge slip road, ahead and right for buses only into the park and ride site, ahead for traffic heading east towards the access to the Park and Ride site and Postwick, and left turn out of the Park and Ride site for buses only. In addition this stage allows pedestrian/cyclist to cross between the large traffic island and the Park and Ride site.
- 2.16.7. Stage 2 - This stage allows traffic heading southwest over the new Postwick bridge into the junction to turn right towards Norwich over the existing Postwick bridge, ahead and right onto the A47 westbound merge slip road, ahead for buses only into the park and ride site and left for traffic heading east towards the access for the Park and Ride site and Postwick. In addition this stage allows pedestrian/cyclists to cross between the existing Postwick bridge and the large



traffic island before the Park and Ride site and across the bus only exit from the Park and Ride site.

- 2.16.8. Stage 3 - This stage allows westbound traffic to travel ahead onto the A47 westbound merge slip road, ahead and right towards Norwich over the existing Postwick bridge and to turn right over the new Postwick bridge. In addition this stage allows pedestrian/cyclist to cross between the existing Postwick bridge and the large traffic island before the Park and Ride site, as well as across the bus only entry and exits from the Park and Ride site.

## 2.17. **Oaks Lane Roundabout**

- 2.17.1. A new roundabout is proposed at Oaks Lane as part of the extension to the existing Park and Ride site. The roundabout is a 4-arm roundabout with a 54m ICD and a 10.0m wide circulatory carriageway width. The eastern arm would connect to the existing A1042 Yarmouth Road, the south eastern arm would connect to Oak's Lane, the south western arm would provide a new access into the Park and Ride site, with the western arm continuing along the A1042 to the Park and Ride signalised junction.

## 2.18. **Postwick Park and Ride**

- 2.18.1. A new access to the Park and Ride site for general vehicles would be provided via the new roundabout at the junction of Oak Lane with the A1042 slip road from the A47. The new access road would be a minimum of 6.0m wide carriageway with two 3.0m carriageway lanes. The access road would be subject to a 10mph speed limit enforced by speed cushions as shown in drawings R1C150-MP-664 included in Appendix B.
- 2.18.2. Buses only would continue to enter and exit the site using the existing entry point via the proposed signalised junction during the morning peak until 11.30 am when they will enter via the new Oak Lane roundabout. Buses would continue to leave the site via the proposed signalised junction as described in section 2.15 above. A new section of bus only carriageway will allow buses to access the existing park and ride bus terminal. Passengers will be picked up and dropped off at the existing bus terminal along with a drop off only point adjacent to the proposed extension site.

- 2.18.3. To prevent unauthorised vehicular access into the Park and Ride site outside the hours of operation, a single arm field gate will be installed across the access to the site, with an automated exit barrier used across the exit carriageway.
- 2.18.4. To prevent unauthorised vehicular access to the access road to the proposed lagoon and access road adjacent to the existing bus terminal, lockable double steel farm gates will be used.
- 2.18.5. **Brundal Low Road/Church Road bus stop**
- 2.18.6. As part of the scheme to expand the park and ride site, the existing bus stop located on the A1042 Yarmouth Road between the existing Park and Ride entrance and Oaks Lane will be moved to the junction of Brundal Low Road and Church Road. The layout and location of the new bus stop and shelter are shown on 249610-AD-61 included in Appendix B.
- 2.19. **New Postwick Bridge**
- 2.19.1. The proposed bridge design is for a three span steel and concrete composite bridge, crossing the A47 Norwich Southern Bypass with a skew angle of 54 degrees.
- 2.19.2. One Departure from Standard has been identified and applied for, this relates to the omission of Abutment Galleries from the design. Abutment galleries are provided below expansion and rotational joints to facilitate inspection and maintenance.
- 2.19.3. DMRB BA 57/01 and BD 57/01: Design for Durability requires that abutment galleries are incorporated into the design. It is proposed that the provision of abutment galleries shall be omitted as it is considered that there is adequate safe access for inspection and maintenance of the bearings at the abutments, in addition it is considered that abutment galleries often constitute a confined space and are susceptible to vandalism and can constitute an additional maintenance liability. In addition it is noted that none of the existing bridge structures on the A47 Norwich Southern by-pass have abutment galleries. Instead it is proposed that the main beams should found directly onto the

bearing shelf with ballast wall immediately behind rather than providing an enclosed abutment gallery

- 2.19.4. Based on these criteria a Departure from Standard for the omission of Abutment Galleries was submitted to the HA and approved in 2010.

## **2.20. Existing Postwick Bridge**

- 2.20.1. The works to the existing bridge fall into two parts, one is the modifications to construct a new off-slip lane between the north pier and abutment, the other is the works to the bridge deck associated with the revision of the carriageway / lane alignment over the bridge and the provision for cyclists.
- 2.20.2. It is proposed that a new eastbound diverge slip road is to be constructed between the north pier and abutment of the bridge, in order to do so the existing batter slope in front of the north abutment will need to be removed. In order to enable this, a new retaining wall structure would need to be constructed in front of the north abutment to ensure that it is supported and does not move when the fill that supports it is removed for the construction of the slip lane.
- 2.20.3. The works to the bridge deck are proposed in order to accommodate the re-alignment of the carriageway over the structure, to provide a 3.0m wide foot / cycleway on the west side with three 3.0m wide lanes for traffic. A new parapet, 1.40m high, on the west side of the bridge is required in order to accommodate cyclists on the new widened west side footway.

## **2.21. Facilities for Non Motorised Users**

- 2.21.1. The details of proposed walking, cycling facilities are shown in drawing R1C150-MP-608 and 609 included in Appendix B.
- 2.21.2. To the east of the Scheme, an existing footpath (Postwick Footpath No. 2) runs south from Smee Lane along a field boundary to the A47, where it crosses the A47 at grade, and continues from the A47 to its terminus on the A1042 Yarmouth Road. There are currently steps either side of the A47 to access this crossing, the current condition of the steps indicates that this footpath is not well used.



- 2.21.3. As part of the proposed Scheme this length of Footpath No. 2 would be stopped up and diverted on a new alignment towards the proposed Business Park Roundabout and then southwards alongside the Business Park link road to a point where a safe crossing could be made across the new eastbound merge slip road. This route would continue across the new Postwick bridge over the A47. From the Park and Ride signalised junction the route would continue along the verge of the A1042 Yarmouth Road to the point where the existing Footpath No. 2 originally joined the A1042 Yarmouth Road.
- 2.21.4. The re-aligned Footpath No. 2 would consist of a 1.0m wide compacted sub-base footpath. Over the new Postwick bridge a 3.0m wide hardened surface would be provided to enable a future upgrade to a pedestrian/cyclist facility. The proposed facilities will remove the need for pedestrians to cross the A47 at grade, providing a significantly safer option.
- 2.21.5. Across the existing Postwick Bridge the current pedestrian and cycle facilities across would be altered, removing both the existing northbound and southbound on-carriageway facility for cyclists, and providing a shared use facility along the western side of the bridge, linking to the shared use facilities on Yarmouth Road and through the Postwick Park and Ride site. The new facilities proposed as part of the Park and Ride extension include a 3.0m wide off-carriageway shared use link from the Park and Ride signalised junction to Oak's Lane.
- 2.21.6. To cater for cyclists using the neighbourhood route from the A1042 Yarmouth Road, across the existing Postwick Bridge and onto Brundall Low Road, shown in the Norwich Cycle Map included in Appendix C, cyclists will be sign posted from the signalised junction along the proposed Park and Ride access road, bypassing the proposed barrier facilities via the arrangement shown in drawing R1C150-MP-609 included in Appendix B, leaving the site via the Oaks Lane Roundabout and continuing on carriageway (as the current situation) to Brundall Low Road.
- 2.21.7. As discussed in section 2.16 the Park and Ride signalised junction would also include signal controlled crossings with on-demand phases for pedestrians and cyclists.

- 2.21.8. As discussed in section 1.3, the existing eastbound diverge slip road is currently being used informally by pedestrians and cyclists to access the service path over the A47 Viaduct and bridge over the Norwich to Great Yarmouth railway line, to gain access to Sustrans National Cycle Network Route 1 and Whitlingham Park.
- 2.21.9. The current service path used by cyclists and pedestrians over the A47 Viaduct and bridge is 1.5m wide with a 0.8m hard strip between kerb edge and solid white line marking the edge of the carriageway. The service path is abutted along the edge of the viaduct by a 1.0m high parapet.
- 2.21.10. The width of the current layout does not comply with current design standards for a Non Motorised User (NMU) facility. The width would need to be a minimum of 2.0m for a pedestrian facility (TA 90/05 paragraph 7.4) and a minimum of 2.5m wide for a shared use pedestrian and cycle facility (TA 90/05 section 7) adjacent to a parapet with a 0.5m separation between the NMU route and the carriageway.
- 2.21.11. In combination with the cost of providing the recommended option above there are also concerns about the potential of lighting conflicts on unlit high-speed roads where the contra-flow cyclists would be extremely vulnerable unless there was considerable separation or lighting baffles and safety barriers throughout the entire length.
- 2.21.12. To ensure that cyclists are not disadvantaged by the proposed stopping up of the eastbound diverge slip road, it is proposed that a shared use facility will be provided on the line of the existing slip road. This would enable cyclists using the A47 eastbound to connect with the existing and proposed cycle network at the Postwick North West Roundabout and would therefore not be disadvantaged by the stopping up. For cyclists travelling westbound down the slip road, end of cycle route and cyclists dismount signs will be provided to inform users that the facility does not continue across the A47 viaduct. The proposed layout is shown in drawing number R1C150-MP-608, included in Appendix B.

### **3.0 Street lighting**

- 3.1. The design of the Street lighting has been developed in accordance with the requirements of the DMRB. Therefore the proposed North East Roundabout, Broadland Gate Roundabout proposed Park and Ride signalised junction will be lit in accordance with TD51/03 and British Standard 5489-1:2013 Code of practice for the design of road lighting.
- 3.2. In accordance with TA 49/07, an initial assessment regarding the need to light the other sections of the proposed scheme has been undertaken. The assessment indicates that it would not be cost beneficial to light the 2 arm Business Park roundabout or the surrounding links, and as the distance between lit sections was sufficiently long enough (greater than 4 times the Stopping Sight Distance) then this section could remain unlit. All other locations would require lighting.
- 3.3. On the above basis the proposed road lighting scheme is shown in drawing R1C150-MP-663, 664 and 665 included in Appendix B.
- 3.4. Traffic signs and bollards will be illuminated as required in accordance with The Traffic Signs and Regulations and General Directions 2002.



## **4.0 Vehicle Restraint Systems**

- 4.1. The development of the proposals for vehicle restraint systems (VRS) have been assessed and designed dependent on whether the section of the scheme forms part of the Trunk Road Network or the Local County Highway Network.
- 4.2. On the Trunk Road sections of the scheme, the provision of VRS has been assessed and designed in accordance with the DMRB TD19/06 and the Road Restraint Risk Assessment Process (RRRAP).
- 4.3. Where the scheme would form part of the local County Highway network, the provision of VRS has been assessed using the emerging "The Use of Vehicle Restraint Systems in Norfolk" guidance on County Roads developed by Norfolk County Council.
- 4.4. The proposed VRS design is shown in drawing R1C150-MP-663, 664 and 665 included in Appendix B.

## **5.0 Planned Development**

- 5.1. There are a number of approved and committed developments in the area. These include the proposed Broadland Gate Business Park development, the proposed Brook Farm / Laurel Farm development, and the additional 1,000 dwellings identified in the Joint Core Strategy. The Broadland Gate Business Park is a significant development comprising a commercial zone of up to 42,000m<sup>2</sup> of B1 and B8 uses; a business village containing up to 4,500m<sup>2</sup> of A1, A2, A3 and A4 uses; a community zone comprising up to 7,500m<sup>2</sup> of C2, C3 and D1 uses; a hotel and leisure zone comprising up to 9,100m<sup>2</sup> of C1, A3, A4 and D2 uses; and a 1,200m<sup>2</sup> car showroom. It has planning approval, which is conditioned on, inter alia, provision of the Postwick Hub junction scheme. The Secretary of State for Transport has required that the BGBP, which would increase the traffic using the Postwick junction of the A47, cannot be occupied until the existing junction has been improved as proposed.
- 5.2. The Brook Farm / Laurel Farm development is a development proposal for the provision of 600 dwellings with a local centre incorporating 1,035 m<sup>2</sup> of A1 retail and a community hall and approximately 57,480 m<sup>2</sup> of B1, B2 or B8 (office, industrial, storage) employment uses, together with a link road and site for a railway halt on land to the north of the existing Broadland Business Park. The proposal has the benefit of a resolution to grant planning permission subject to a planning obligation and various planning conditions. One of the proposed conditions, as directed by the Secretary of State for Transport, is that the development cannot commence until the Scheme has been provided.
- 5.3. The Joint Core Strategy identifies significant potential for further development once the Postwick junction has been improved. This includes the business park expansion and housing development delivered by Broadland Gate Business Park and Brook Farm Laurel Farm, and at least 1,000 further dwellings.

## **6.0 Traffic Data**

- 6.1. The proposed Scheme has been designed to provide a road network with sufficient capacity to cater for planned new development and in which proposed junctions operate adequately and avoid queuing back onto the A47 trunk road with the accompanying safety risk. The Scheme also provides capacity and flexibility so that the Postwick Hub junction would operate satisfactorily if the Northern Distributor Road (NDR) were to be connected to it.
- 6.2. A forecasting report has been produced showing the traffic flows and queue lengths, staging, phasing and signal timings for the whole of the Postwick Hub Junction.
- 6.3. The forecasting years are 2015, 2020 and 2030. Two traffic scenarios have been used, one is called 'Core' and the other is 'High' and the differences between the two scenarios are as follows:

### **Core Scenario**

- Trip generation uses 85 percentile rates from TRICS 2012.
- Trip distribution based on a gravity model.
- Broadland Gate and Laurel Farm development sites are included.

### **High Scenario**

- Trip generation extracted from the Postwick Transport Assessment Report.
- Trip distribution based on Postwick Transport Assessment Report.
- Broadland Gate, Laurel Farm and Brook Farm development sites were included.

- 6.4. The forecasting report can be made available to the audit team if required.



## 7.0 Amendments to existing TRO's

- 7.1. As part of the scheme amendments to two existing Traffic Regulation Orders are proposed.
- 7.2. A TRO will be brought forward to extend 40mph speed limit to a point east of the proposed new Park and Ride access roundabout at the junction with Oaks Lane as shown in drawing R1C150-MP-665 included in Appendix B.
- 7.3. A second TRO is proposed to convert the existing Park and Ride access to a Bus only access and egress as shown in drawing R1C150-MP-664 included in Appendix B.

## 8.0 Site Location

- 8.1. A plan showing the location of the scheme is shown in figure 2 below.

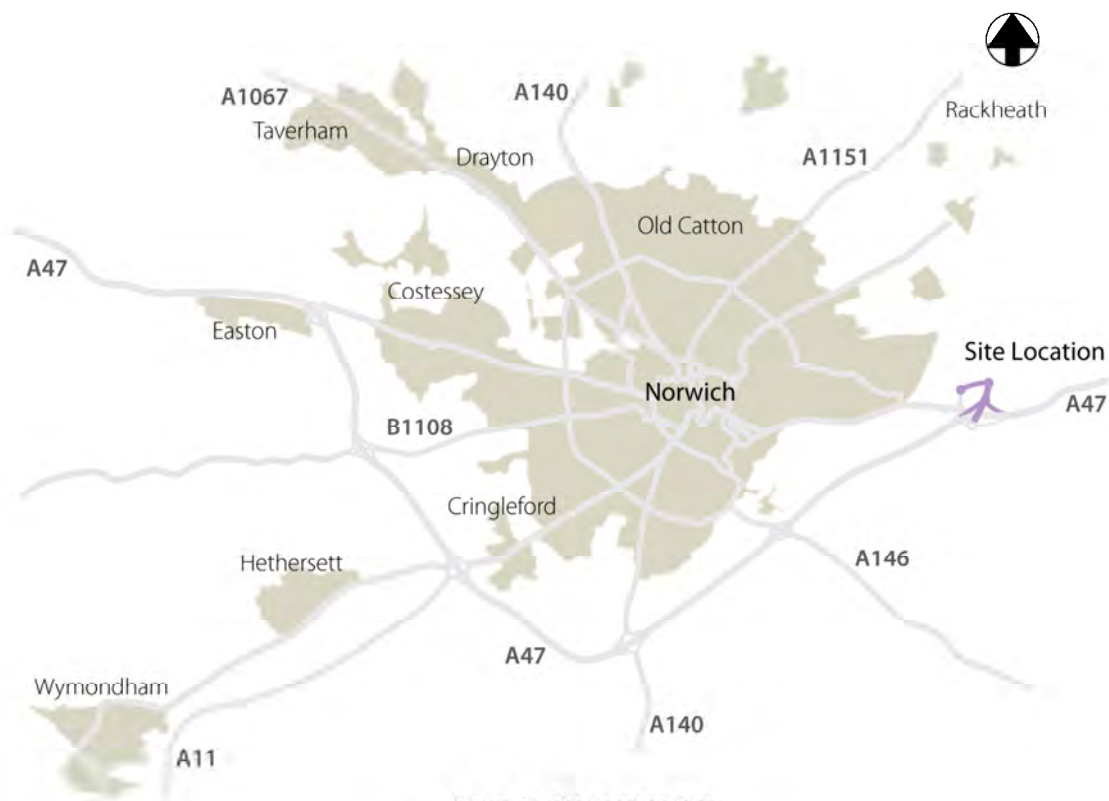


Figure 2 - Site Location Plan

Figure 2 - Site Location

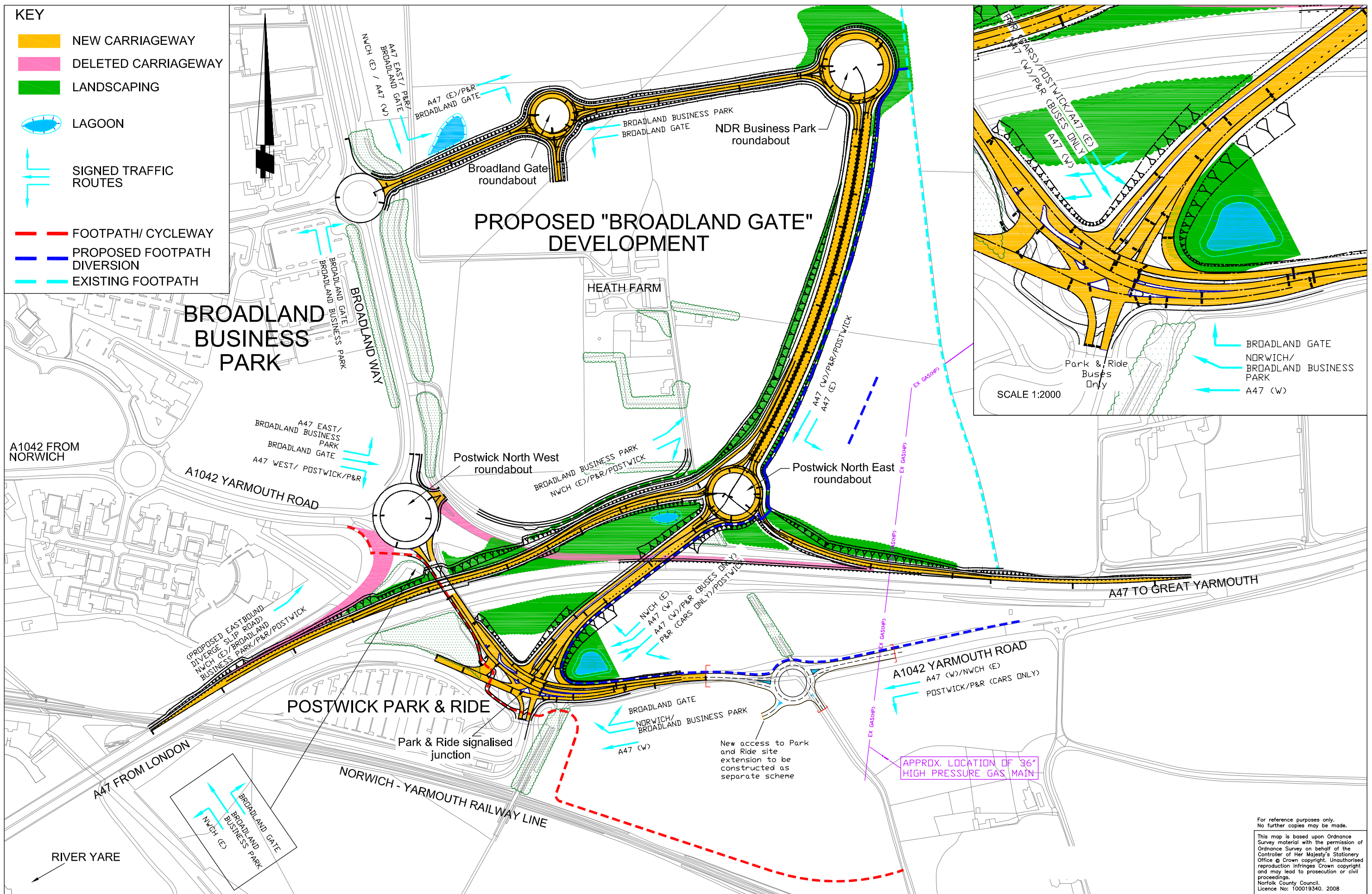


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## APPENDIX A



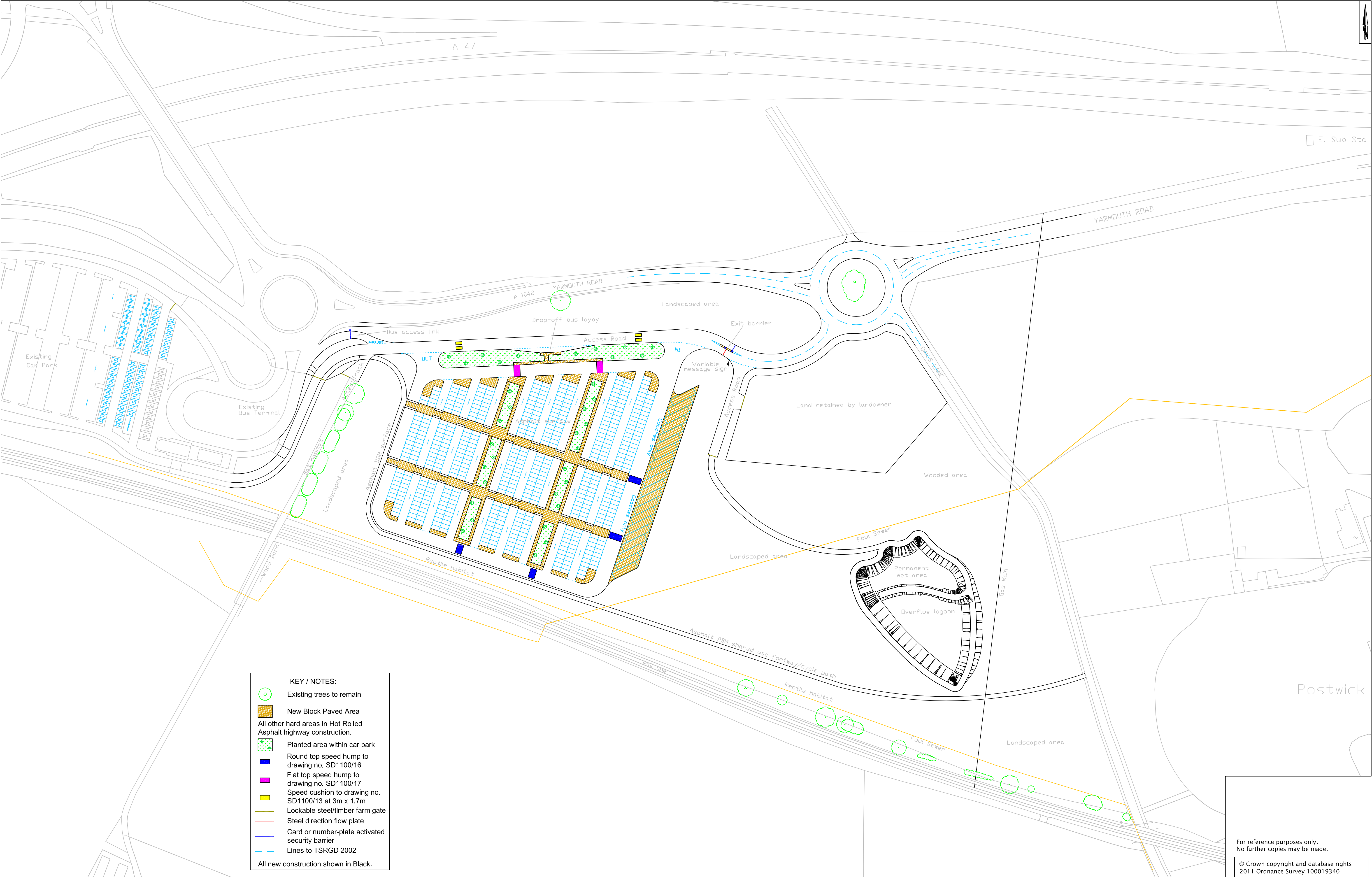




REV.	DESCRIPTION	CHECKED	DATE
C	Postwick model updated, P&R roundabout updated		03/08
D	Cycle routes & footpaths added	RM	05/08
E	New Access to Broadland Gate - Postwick North West R/B	RM	07/09
F	Signed Traffic Routes Changed	RM	07/09
G	Access to BG from NW r/b modified	RM	08/09
H	P&R Signalled Junction Layout Updated	CA	10/09

INITIALS	DATE	DRAWING No.
OS	2008	R1C093-R1-1285H
NCC	01/09	PROJECT TITLE
DB	01/09	Norwich Northern Distributor Road
PD	01/09	SCALE 1:NTS
		FILE No. R1C093





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DRAWING TITLE

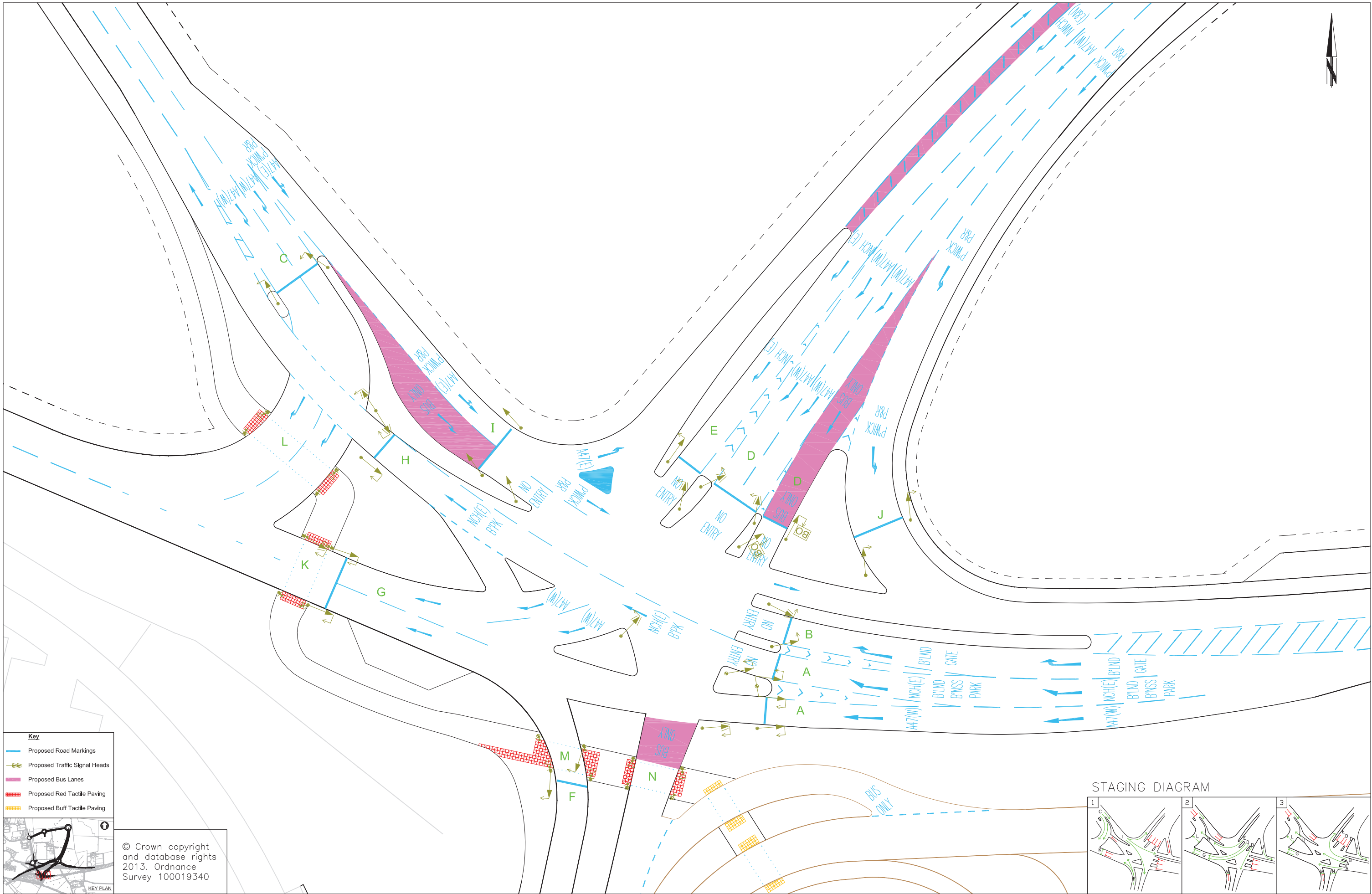
SITE PLAN

REV.	DESCRIPTION	CHECKED	DATE
e	Extra approach lane on A47 off-slip arm	RF	10/09
f	Bus access and drop-off added	RF	10/09

	INIT.	DATE	DRAWING No.
DESIGNED BY	AMH	04/09	249610-AD-023f
DRAWN BY	AMH	04/09	PROJECT TITLE
CHECKED BY	RF	04/09	Postwick Growth Point: Park and Ride Extension and Access Scheme
APPROVED BY	RF	04/09	SCALE AT A1 1:1000
			FILE No. 249610-AD

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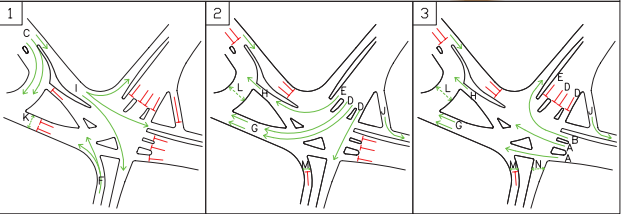
**Key**

- Proposed Road Markings
- Proposed Traffic Signal Heads
- Proposed Bus Lanes
- Proposed Red Tactile Paving
- Proposed Buff Tactile Paving

KEY PLAN

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STAGING DIAGRAM



REV.	DESCRIPTION	CHECKED	DATE

SURVEYED BY	INITIALS	DATE	DRAWING No.
OS/MG	DG	2012/2008	R1C150-MP-636
DESIGNED BY	INITIALS	DATE	PROJECT TITLE
DG	DG	01/13	POSTWICK HUB JUNCTION
DRAWN BY	INITIALS	DATE	SCALE
DG	DG	01/13	1:250@A1
CHECKED BY	INITIALS	DATE	FILE No.
SC	SC	02/13	R1C150



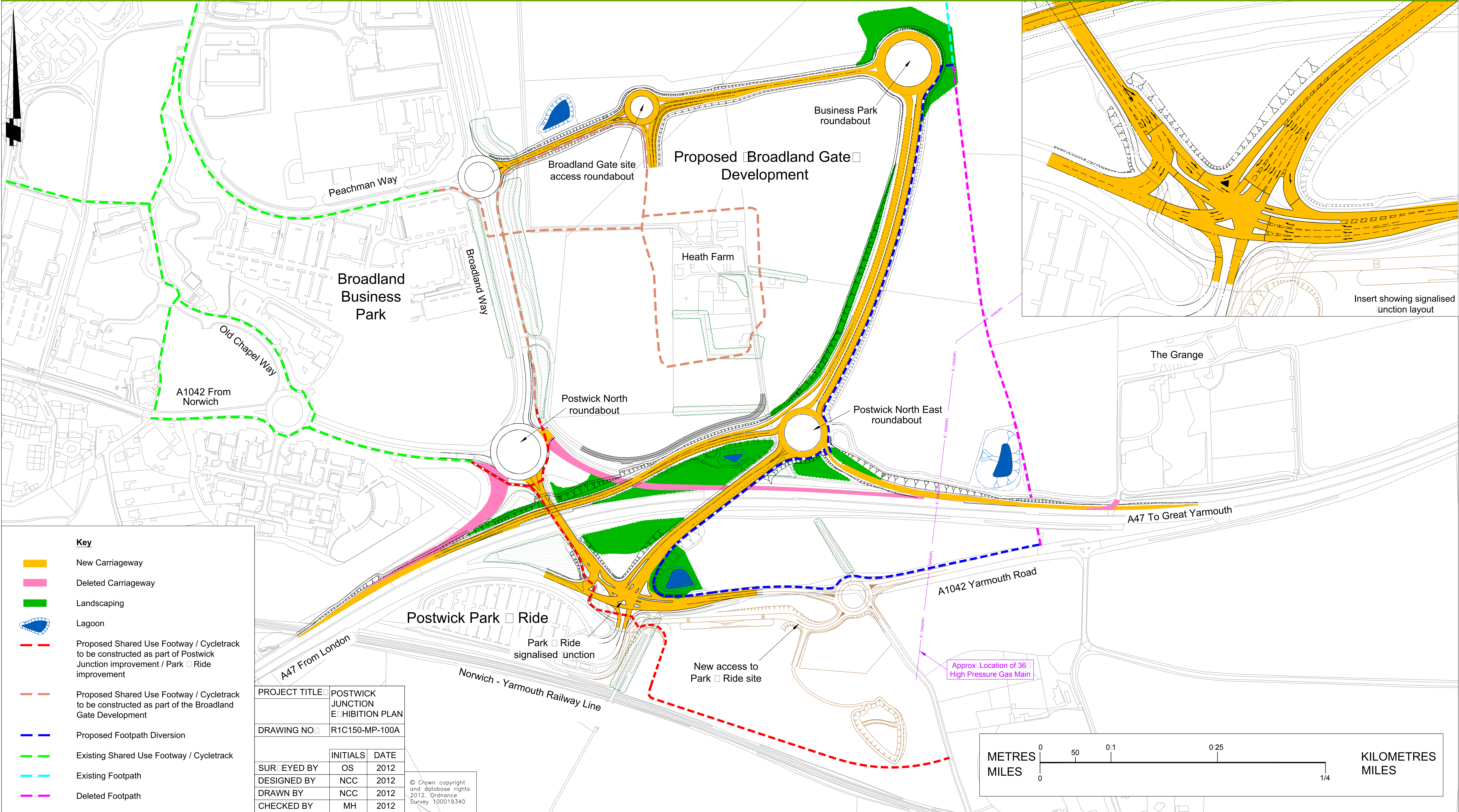
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## APPENDIX B

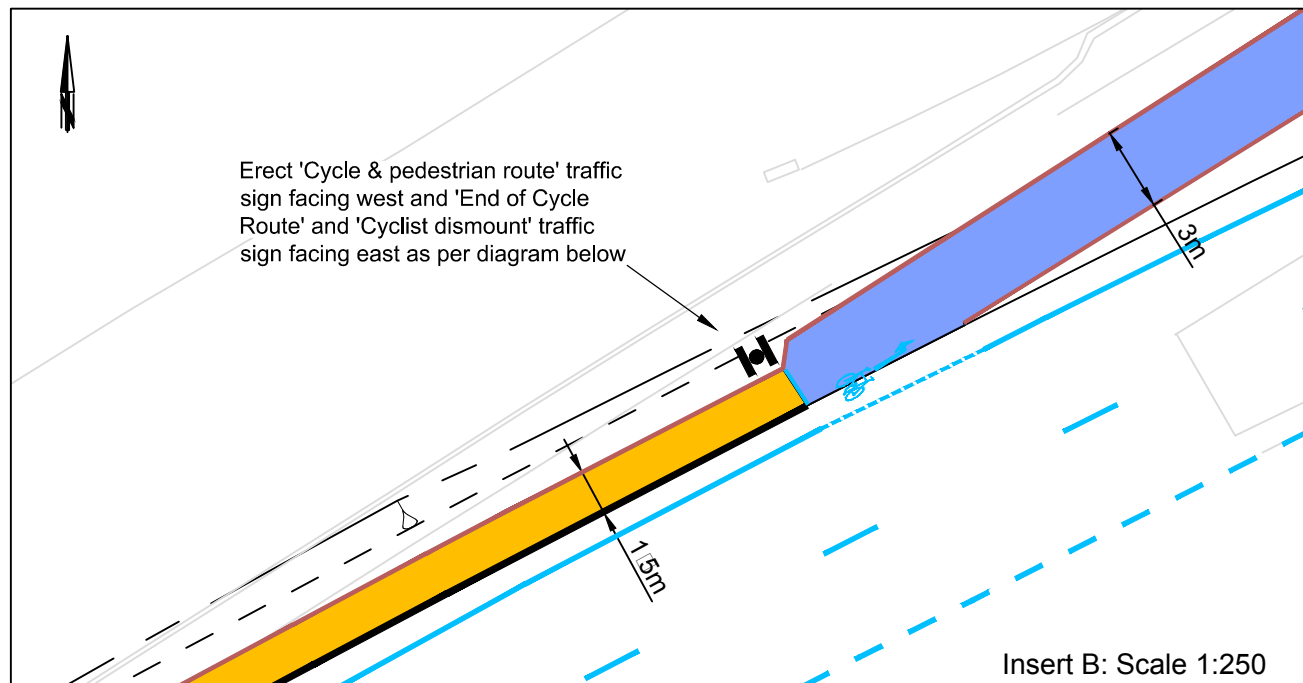
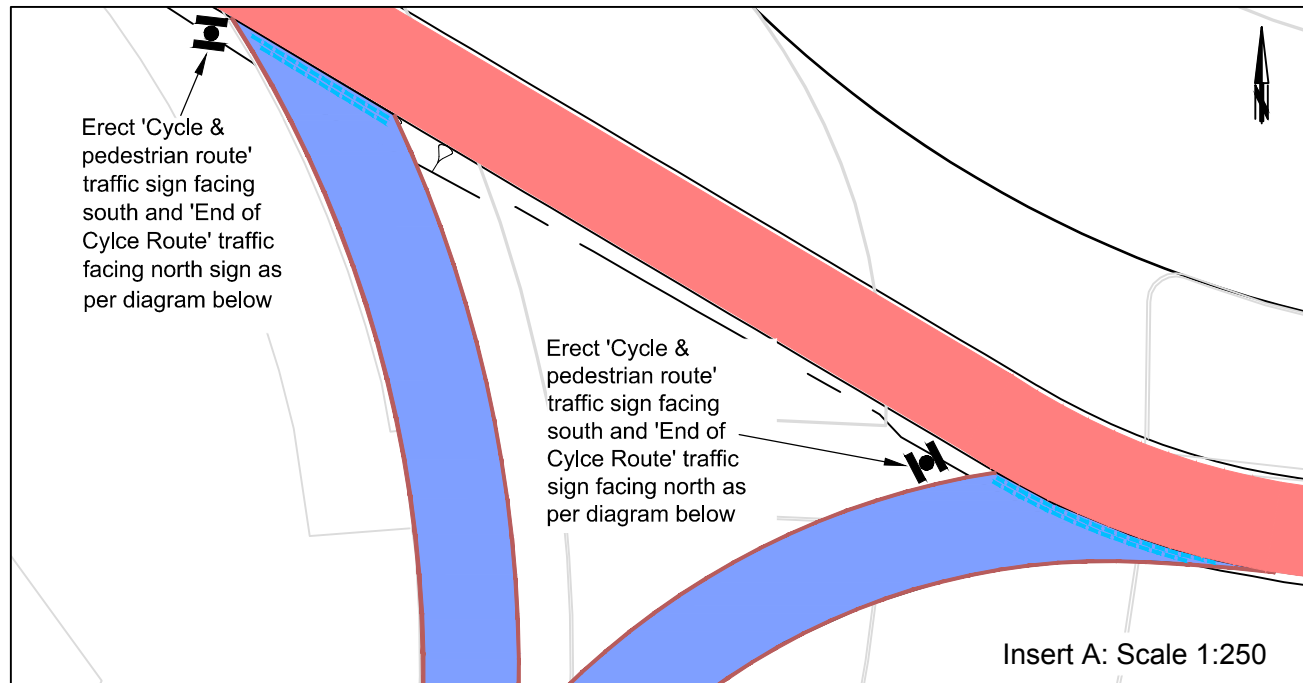


# Norwich Area Transport Strategy Implementation




## Postwick Junction

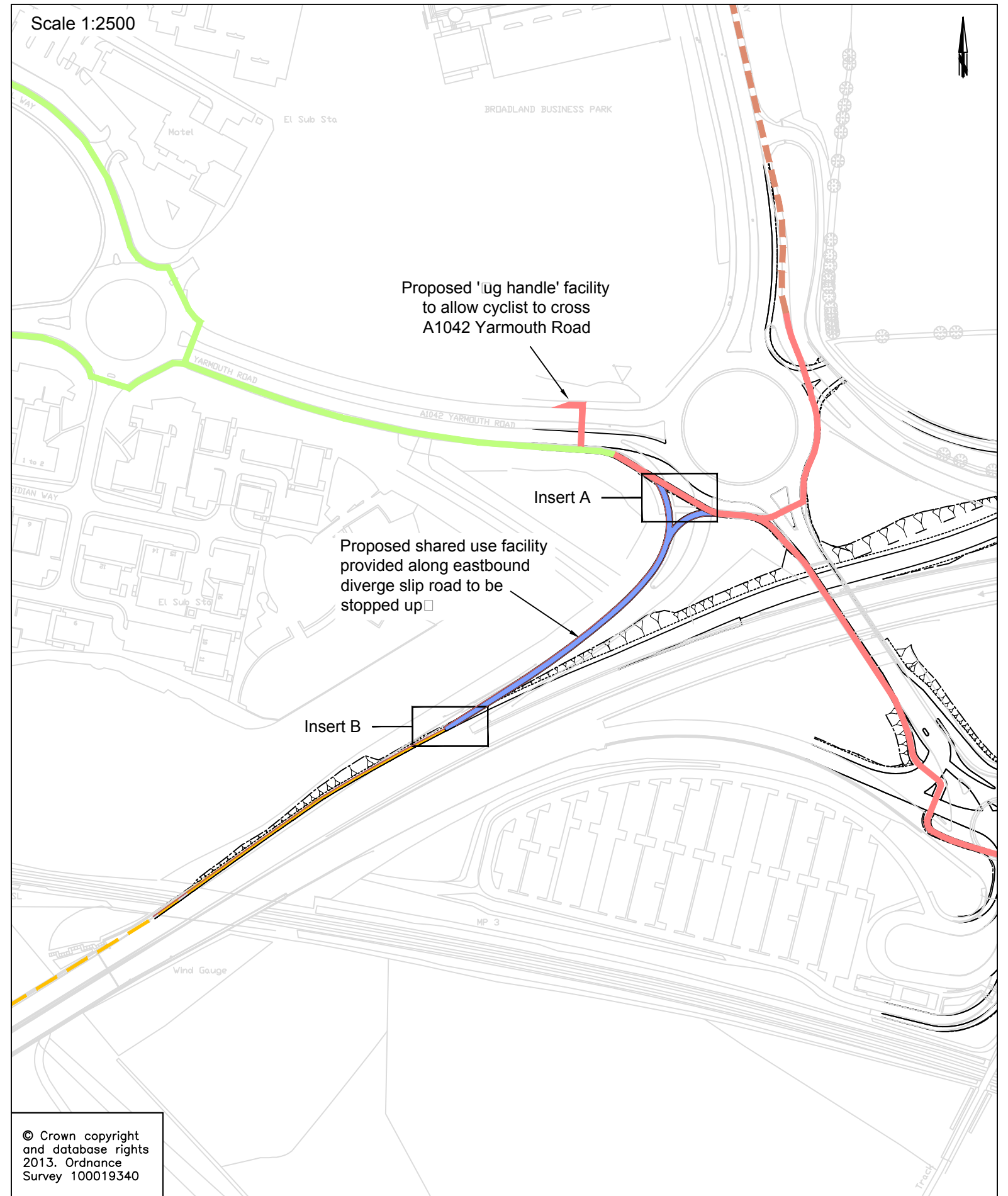






#### Key

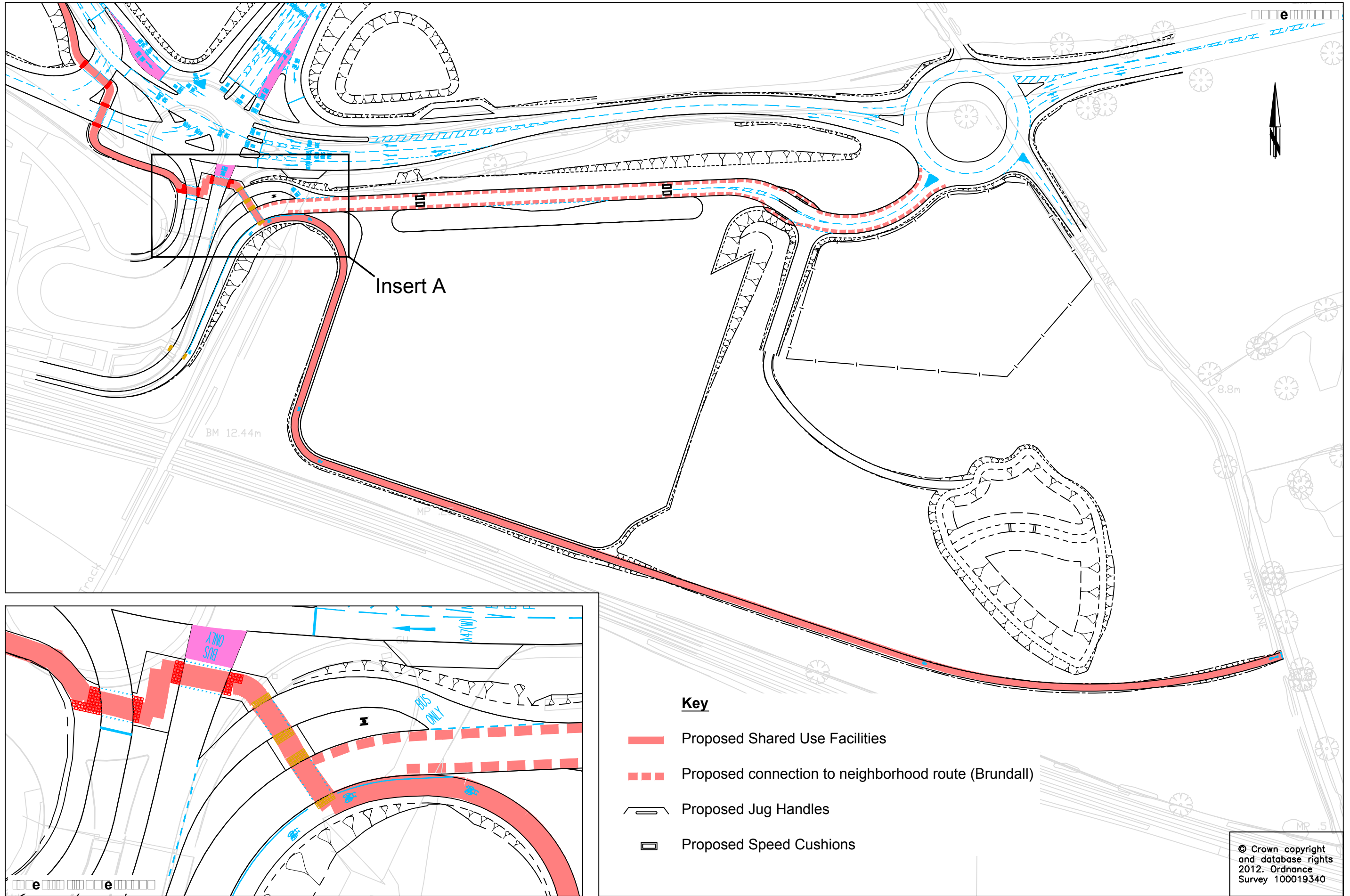
- Proposed Shared Use Facility to be constructed as part of Postwick Junction proposals
  - Proposed Shared Use Facility to be constructed as part of the Broadland Gate Development
  - Proposed Shared Use Facility along deleted carriageway
  - Proposed service path to link to existing service path across A47 River Yare viaduct
  - Existing service path
  - Existing Shared Use Footway / Cycletrack
  - Proposed carriageway markings
- Traffic signs
-  Ref 956 - Shared use facility sign
  -  Ref 965 - End of cycle route sign
  -  Ref 966 - Cyclists dismount sign



REV.	DESCRIPTION	CHECKED	DATE

SURVEYED BY	INITIALS	DATE	DRAWING No.
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DESIGNED BY			PROJECT TITLE
			POSTWICK HUB JUNCTION
DRAWN BY			SCALE
			AS SHOWN
CHECKED BY			FILE No.
			R1C150

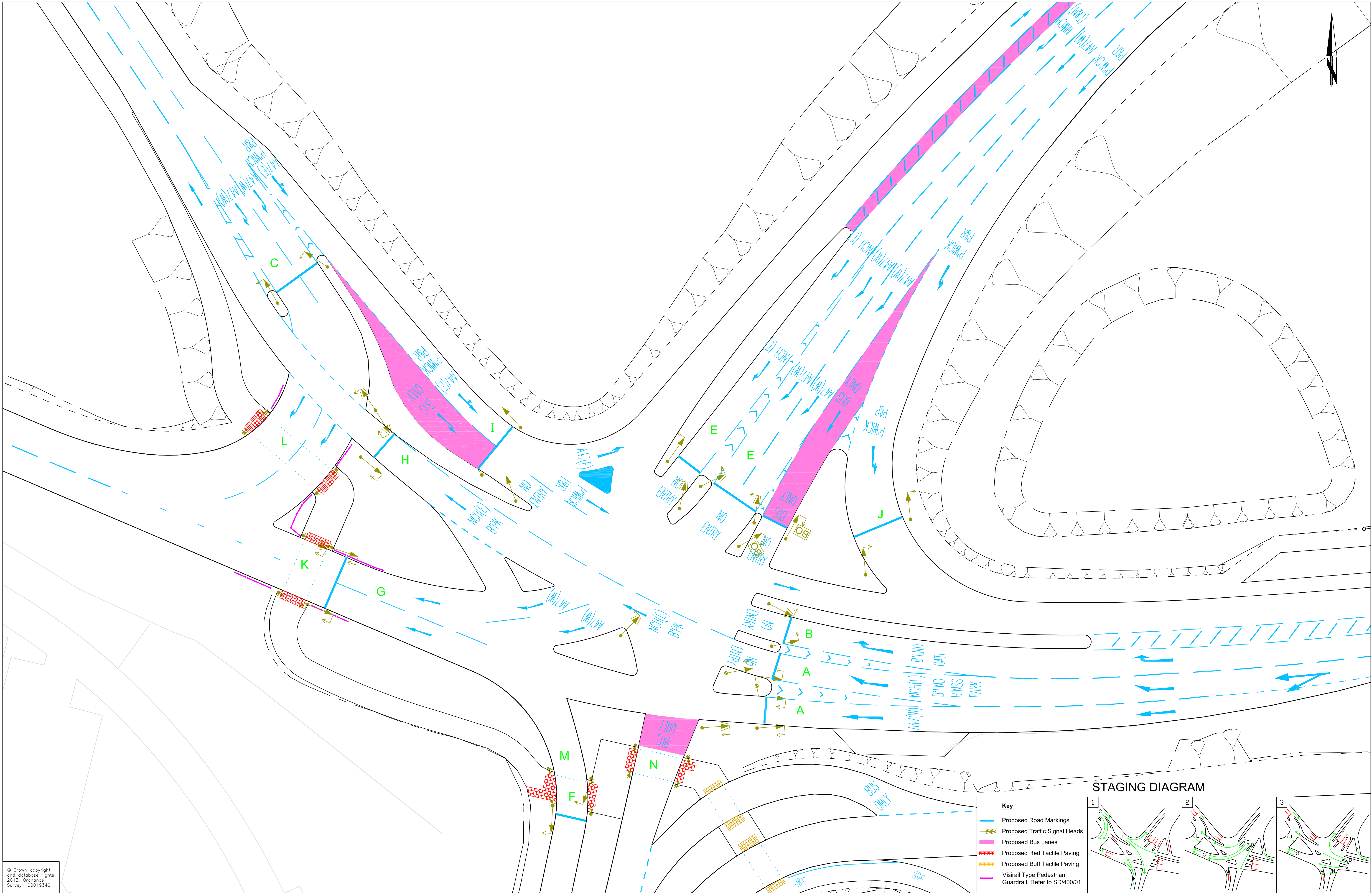




REV.	DESCRIPTION	CHECKED	DATE

SURVEYED BY	INITIALS	DATE	DRAWING No.
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DRAWN BY	BF	09/12	PROJECT TITLE
CHECKED BY	MH	04/13	POSTWICK HUB JUNCTION
			SCALE AS SHOWN
			FILE No. R1C150





STAGING DIAGRAM

**Key**

- Proposed Road Markings
- Proposed Traffic Signal Heads
- Proposed Bus Lanes
- Proposed Red Tactile Paving
- Proposed Buff Tactile Paving
- Visirail Type Pedestrian Guardrail. Refer to SD/400/01

1

2

3





KERBING & FOOTWAYS KEY

- Proposed Shared Use Footway/Cycleway with bound surface
- Proposed unbound Footway (1.0m wide)
- Proposed Footway with bound surface
- Existing Footway
- Proposed half-battered kerb - Type 1 (125mm upstand) to NCC standard details SD/1100/1
- Proposed splayed kerb - Type 2 (125mm upstand) to NCC standard details SD/1100/1
- Proposed dropped kerb - Type 4 (0-6mm upstand at pedestrian crossing 25mm for vehicle access) to NCC standard details SD/1100/1
- Proposed transition kerb - Type 7 to NCC standard details SD/1100/1
- Proposed Envirodeck Combined Drainage kerb
- Proposed Drainage Kerb
- Proposed footway edging - Type 6 to NCC standard details SD/1100/1
- Red Tactiles (450 x 450mm)
- Buff Tactiles (450 x 450mm)

PAVEMENTS KEY

- Proposed Carriageway Construction with min. 55 PS Surface Course
- Proposed Carriageway Construction with min. 65 PS Surface Course
- Proposed Pavement for private means of access
- Proposed Maintenance Bay
- Proposed Traffic Island
- Proposed 2.0m wide bitumen channel

GENERAL KEY

- Hedgerow
- Group of specimen trees
- Native tree and shrub mix
- Low maintenance grass seed mix
- Wildflower grass seed mix
- Timber post and 3 strained wire or 3 rail fence
- Stock-Proof fence
- Close-Boarded fence
- New Road Markings

Note:  
1: No tree or shrub shall be planted within 4.5m of the carriageway edge  
2: No tree or shrub shall be planted within 1.0m of the RS

REVISION	DESCRIPTION	CHECKED	DATE

	INITIALS	DATE	DRAWING No. R1C150-MP-660
SURVEYED BY	OS/MG	2012	PROJECT TITLE
DESIGNED BY	SWC	04/13	POSTWICK HUB JUNCTION
DRAWN BY	LW	04/13	SCALE 1:1000 A1
CHECKED BY	MH	04/13	FILE No. R1C150



**KERBING & FOOTWAYS KEY**

- Proposed Shared Use Footway/Cycleway with bound surface
- Proposed unbound Footway (1.0m wide)
- Proposed Footway with bound surface
- Proposed half-battered kerb - Type 1 (125mm upstand) to NCC standard details SD/1100/1
- Proposed splayed kerb - Type 2 (125mm upstand) to NCC standard details SD/1100/1
- Proposed dropped kerb - Type 4 (0-6mm upstand at pedestrian crossing & 25mm for vehicle access) to NCC standard details SD/1100/1
- Proposed transition kerb - Type 7 to NCC standard details SD/1100/1
- Proposed Envirodeck Combined Drainage kerb
- Proposed Drainage Kerb
- Proposed footway edging - Type 6 to NCC standard details SD/1100/1
- Red Tactiles (450 x 450mm)
- Buff Tactiles (450 x 450mm)

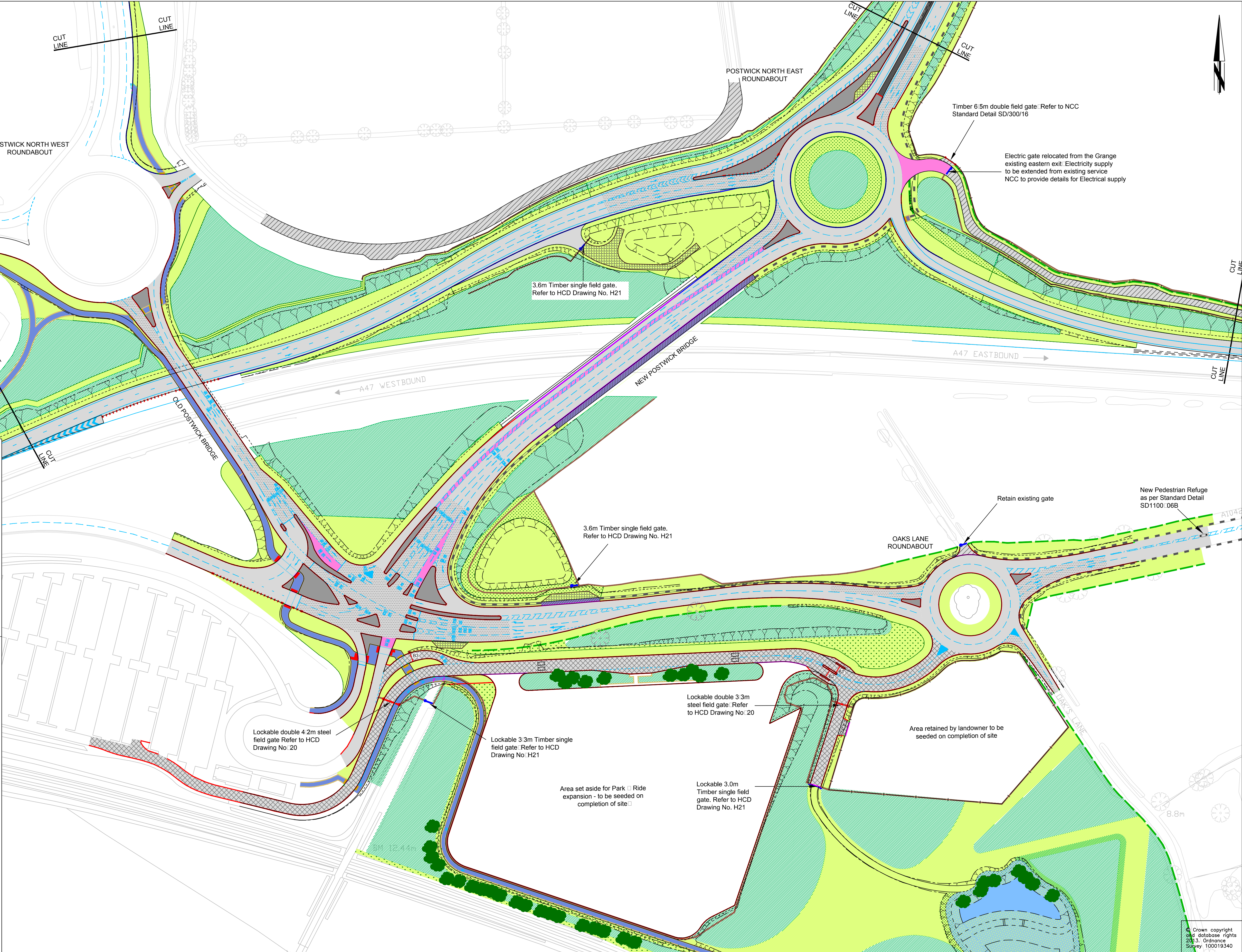
**PAVEMENTS KEY**

- Proposed Carriageway Construction with min. 55 PS Surface Course
- Proposed Carriageway Construction with min. 65 PS Surface Course
- Proposed Pavement for private means of access
- Proposed Pavement for Park Ride access road
- Proposed Maintenance Bay
- Proposed Traffic Island
- Proposed 2.0m wide bitumen channel
- Proposed coloured surfacing

**GENERAL KEY**

- Hedgerow
- Group of specimen trees
- Native tree and shrub mix
- Low maintenance grass seed mix
- Wildflower grass seed mix
- Lagoon Planting Mix
- Marginal Planting Mix
- B1 Automatic 4.2m barrier passcode exit system
- B2 Single 4.2m lockable steel gate with 'flow plate' in carriageway below
- B3 Automatic 4.9m barrier 'bus entry' system
- Timber post and 3 strained wire or 3 rail fence
- Stock-Proof fence
- Close-Boarded fence
- New Road Markings

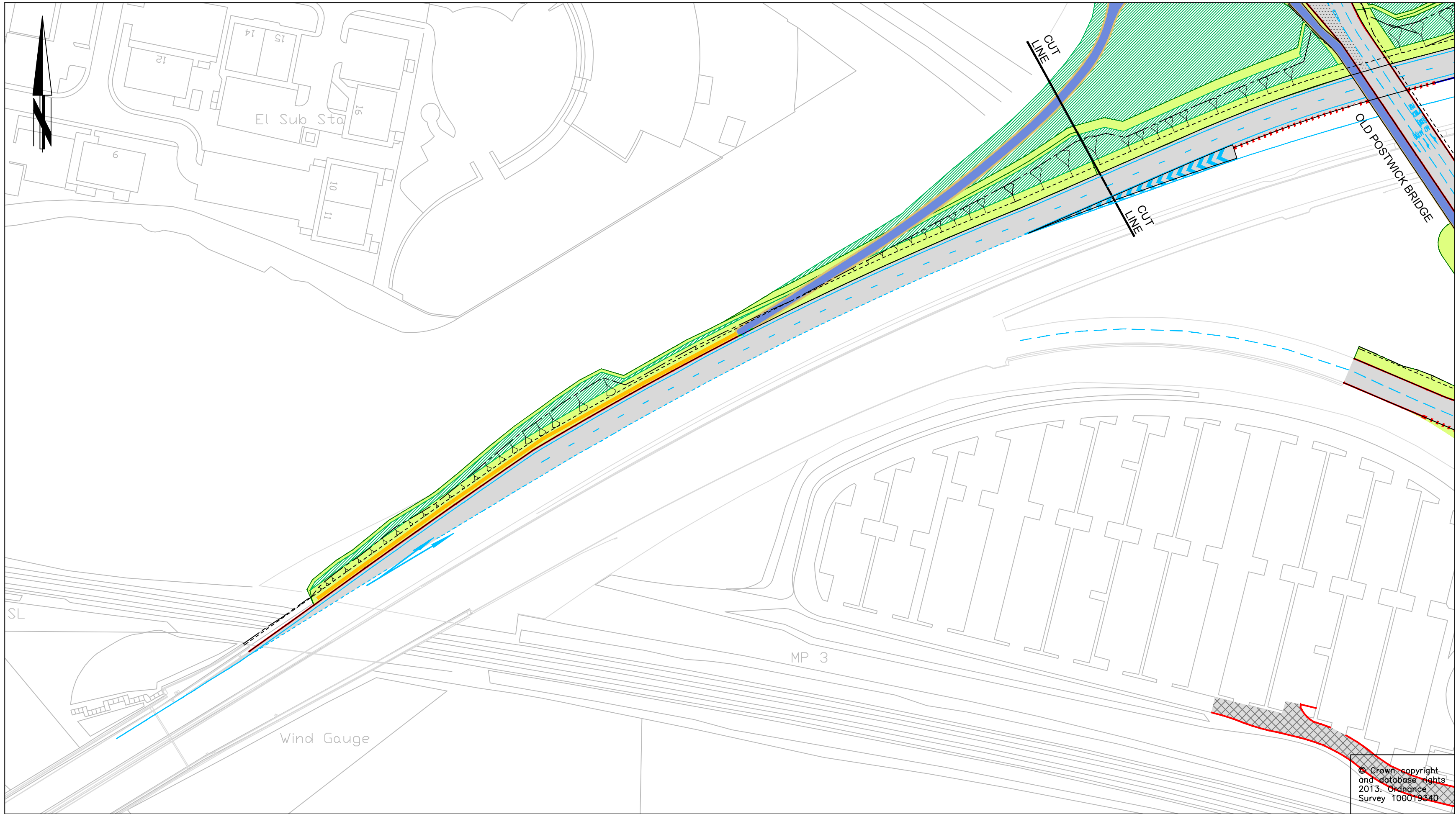
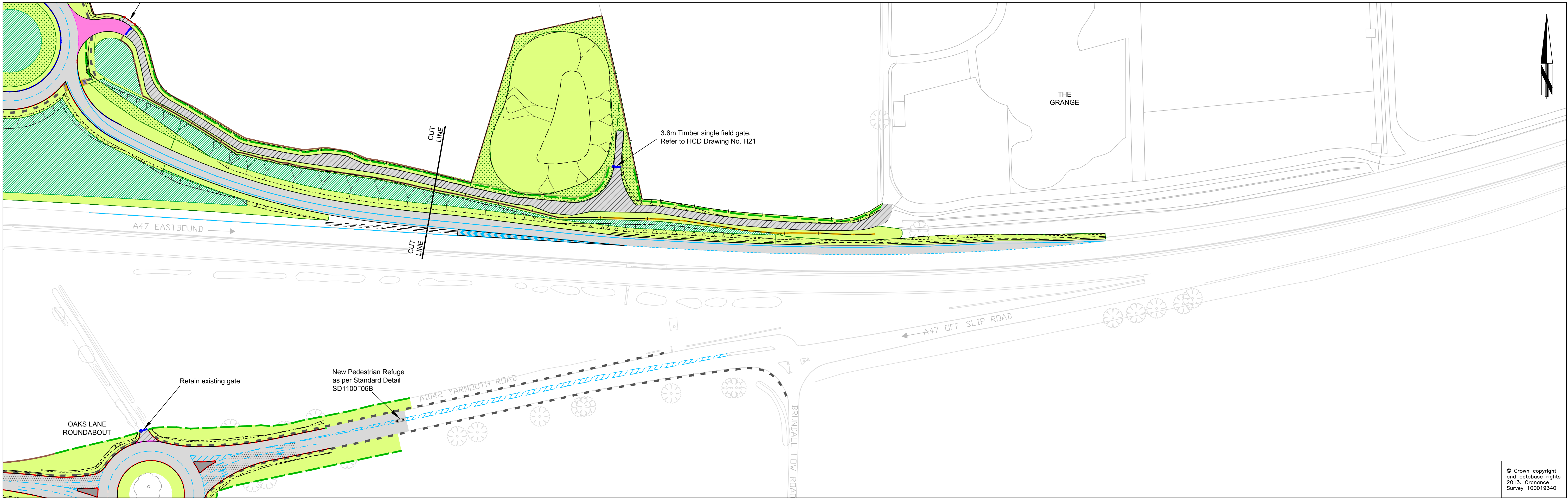
**Note:**  
1. No tree or shrub shall be planted within 4.5m of the carriageway edge  
2. No tree or shrub shall be planted within 1.0m of the IRS



REVISION	DESCRIPTION	CHECKED	DATE

SURVEYED BY	INITIALS	DATE	DRAWING No.
			R1C150-MP-661
DESIGNED BY			PROJECT TITLE
			POSTWICK HUB JUNCTION
DRAWN BY			SCALE
			1:1000 & A1
CHECKED BY			FILE No.
			R1C150





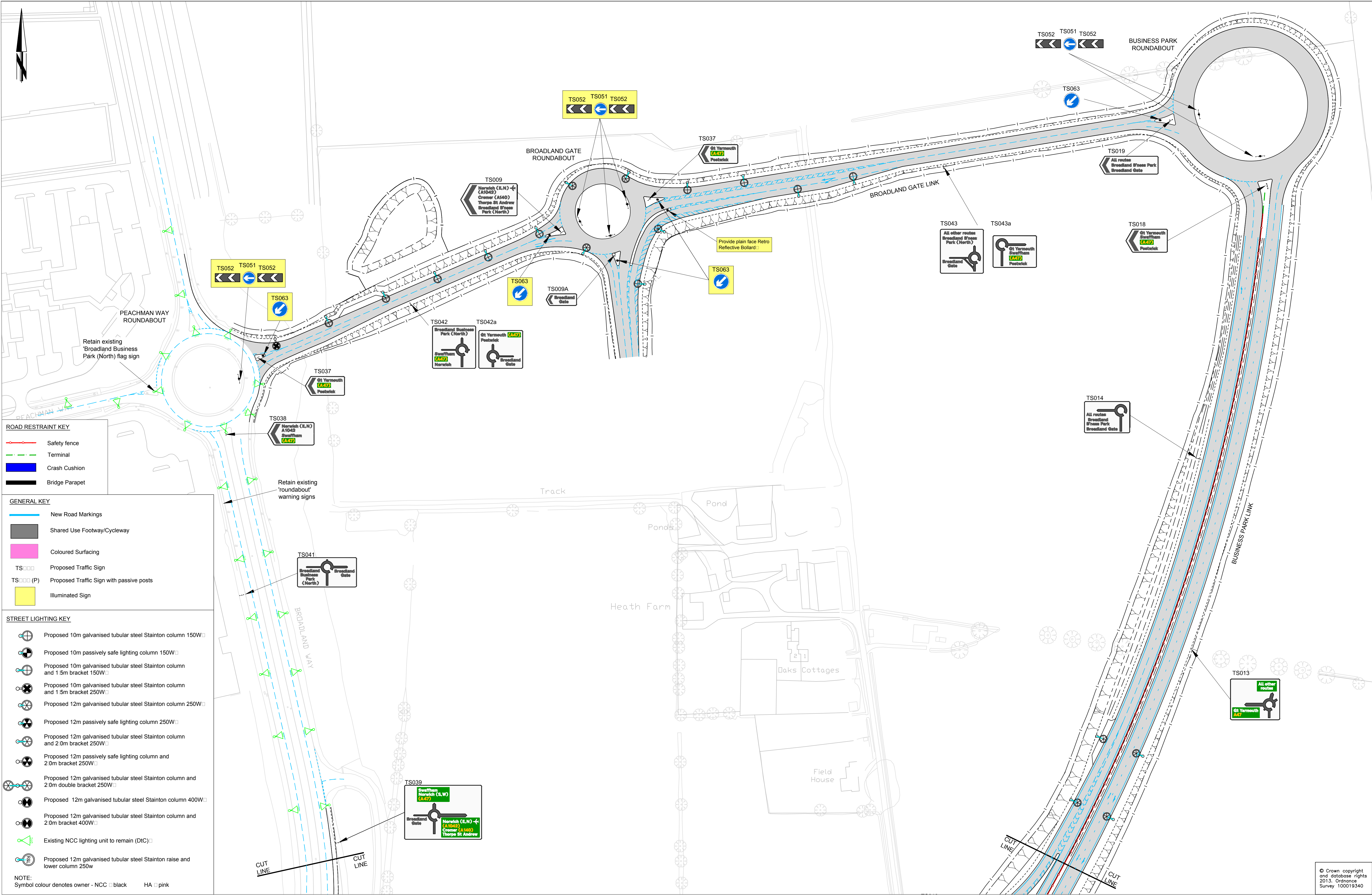
KERBING & FOOTWAYS KEY			
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	Proposed unbound Footway (1.0m wide)		
	Service Path (1.5m wide)		
	Proposed half-battered kerb - Type 1 (125mm upstand) to NCC standard details SD/1100/1		
	Proposed played kerb - Type 2 (125mm upstand) to NCC standard details SD/1100/1		
	Proposed dropped kerb - Type 4 (0-6mm upstand at pedestrian crossing > 25mm for vehicle access) to NCC standard details SD/1100/1		
	Proposed transition kerb - Type 7 to NCC standard details SD/1100/1		

PAVEMENTS KEY			
	Proposed Carriageway Construction with min. 55 PS - Surface Course		
	Proposed Carriageway Construction with min. 65 PS - Surface Course		
	Proposed Pavement for private means of access		
	Proposed Maintenance Bay		
	Proposed Traffic Island		
	Proposed 2.0m wide bitumen channel		

GENERAL KEY	
	Hedgerow
	Group of specimen trees
	Native tree and shrub mix
	Low maintenance grass seed mix
	Wildflower grass seed mix
	Timber post and 3 strained wire or 3 rail fence
	Stock-Proof fence
	Close-Boarded fence
	New Road Markings

Note:  
1. No tree or shrub shall be planted within 4.5m of the carriageway edge  
2. No tree or shrub shall be planted within 1.0m of the RS

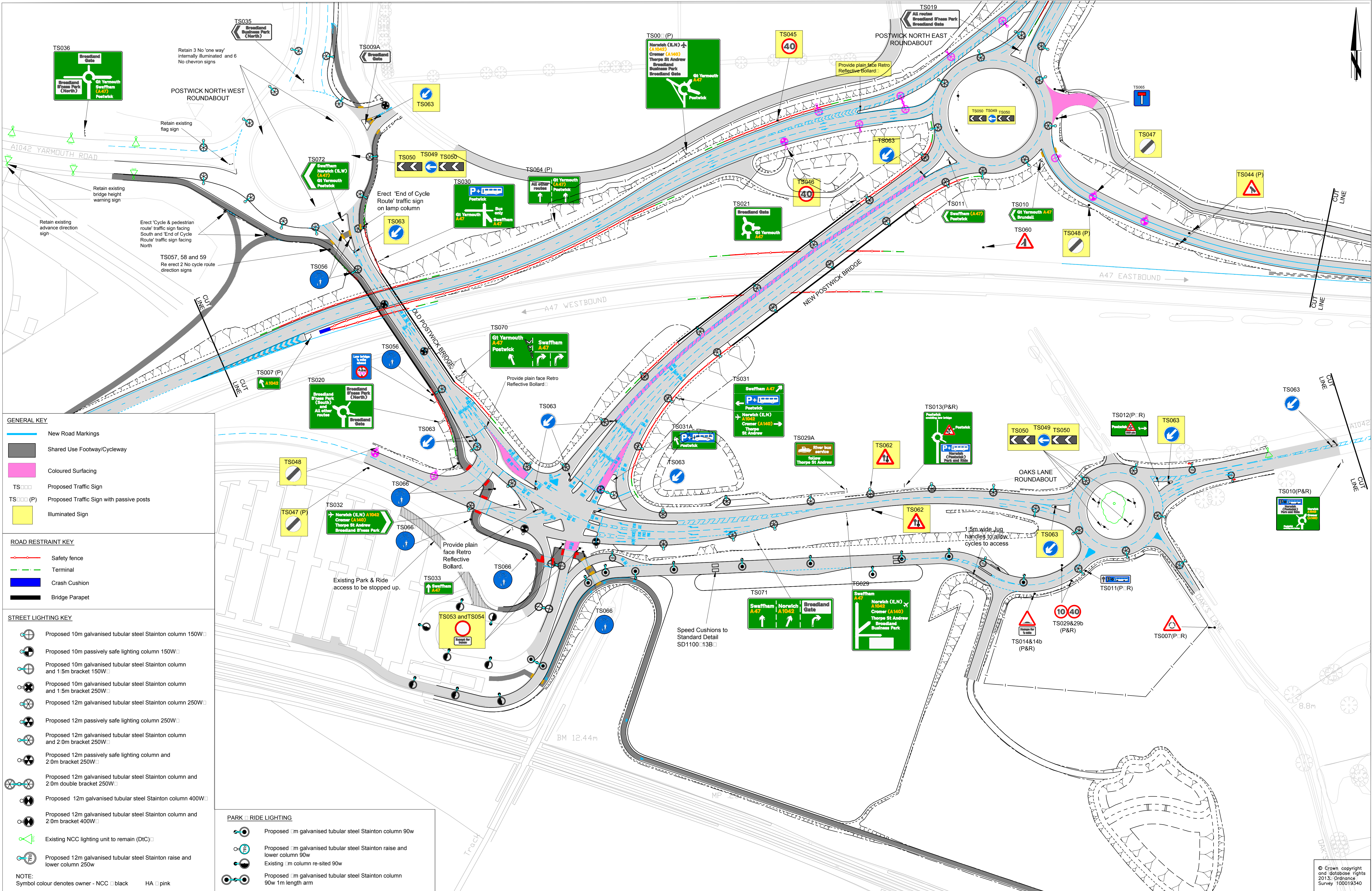




RE	DESCRIPTION	CHECKED	DATE

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				PROJECT TITLE
				POSTWICK HUB JUNCTION
				SCALE 1:1000 A1
				FILE No R1C150

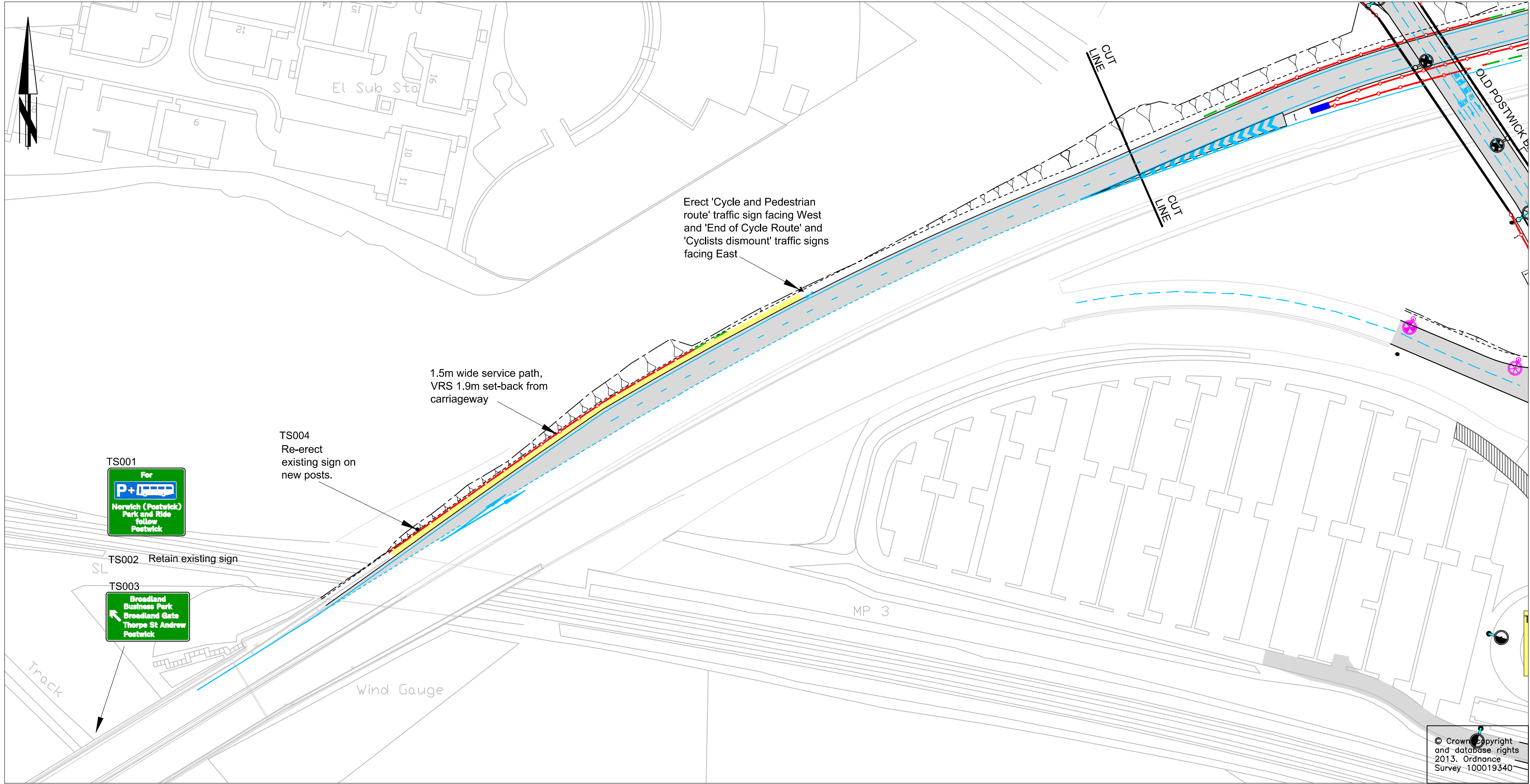
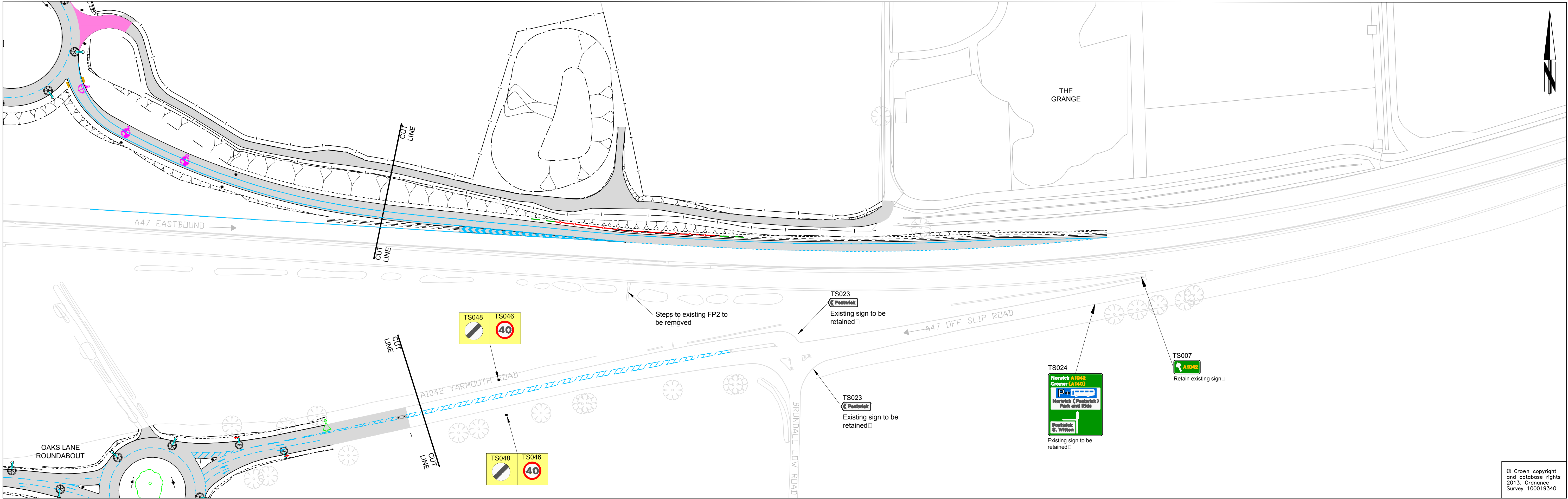




RE	DESCRIPTION	CHECKED	DATE

SURVEYED BY	INITIALS	DATE	DRAWING No
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DESIGNED BY			PROJECT TITLE
			POSTWICK HUB JUNCTION
DRAWN BY			SCALE
			1:1000 A1
CHECKED BY			FILE No
			R1C150





**ROAD RESTRAINT KEY**

- Safety fence
- Terminal
- Crash Cushion
- Bridge Parapet

**STREET LIGHTING KEY**

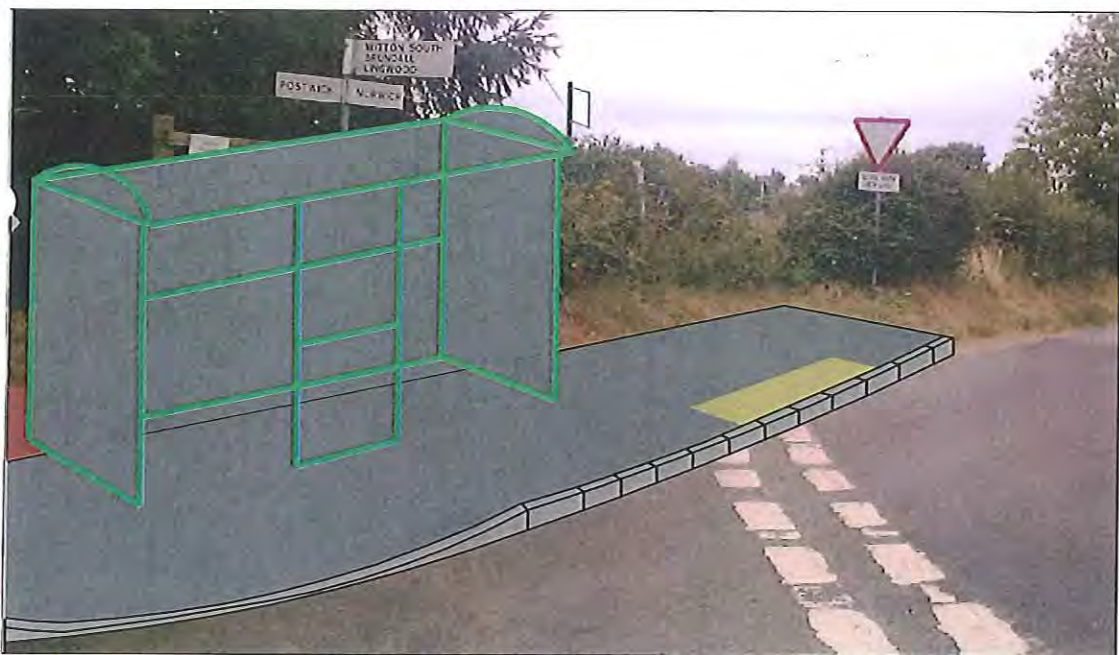
- Proposed 10m galvanised tubular steel Stainton column 150W
- Proposed 10m passively safe lighting column 150W
- Proposed 10m galvanised tubular steel Stainton column and 1.5m bracket 150W
- Proposed 10m galvanised tubular steel Stainton column and 1.5m bracket 250W
- Proposed 12m galvanised tubular steel Stainton column 250W
- Proposed 12m passively safe lighting column 250W
- Proposed 12m galvanised tubular steel Stainton column and 2.0m bracket 250W
- Proposed 12m passively safe lighting column and 2.0m bracket 250W
- Proposed 12m galvanised tubular steel Stainton column and 2.0m double bracket 250W
- Proposed 12m galvanised tubular steel Stainton column 400W
- Proposed 12m galvanised tubular steel Stainton column and 2.0m bracket 400W
- Existing NCC lighting unit to remain (DTC)
- Proposed 12m galvanised tubular steel Stainton raise and lower column 250w

NOTE: Symbol colour denotes owner - NCC black HA pink

**GENERAL KEY**

- New Road Markings
- Shared Use Footway/Cycleway
- Coloured Surfacing
- Proposed Traffic Sign
- Proposed Traffic Sign with passive posts
- Illuminated Sign








# NOTES:

- Excavate existing verge. Construct new stop on 100mm thick Type 1 granular sub-base, install barfaced paving slabs (PA25), and surface with asphalt (PA3) to tie in with new kerb height at bus stop.
- Bus shelter to be installed during construction of bus stop platform

- Ex K1 = Retain existing Type 1 kerbs 125mm upstand.
- K1T = New PCC K1 cut to transition.
- K1R = New PCC K1 raised kerb installed with 150mm upstand.
- K4 = New PCC Type 4 dropped kerb.
- K7 = New PCC Type 7 kerb.
- K6 = New PCC Type 6 kerb to be installed.

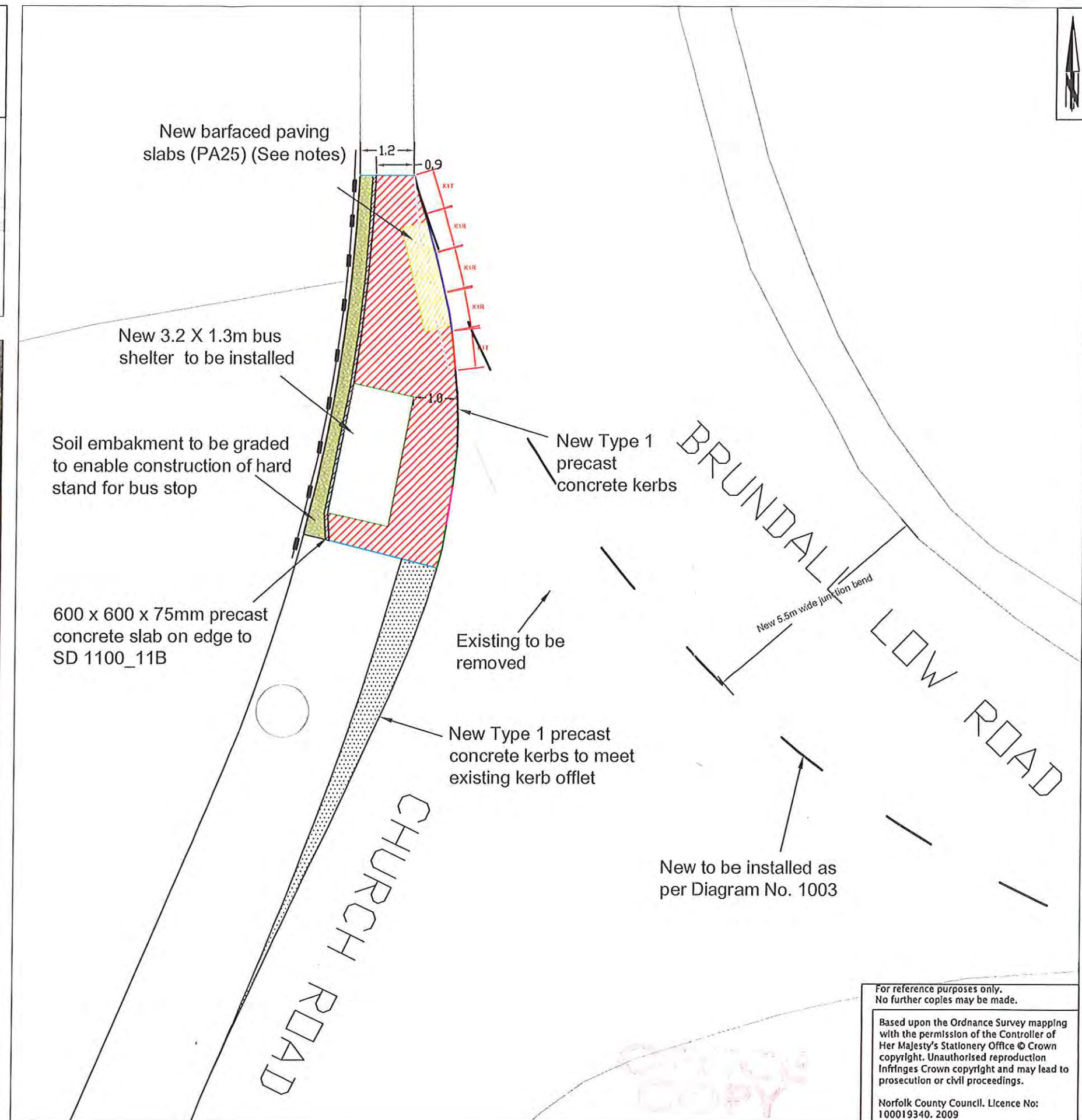
 New hard stand surface Type PA3 and grade d to new raised level.

 Barfaced Paving colour grey (600mm x 600mm)

 Existing wooden fence to act as boundary

 Soil infill behind new new Type 1 precast concrete kerbing

- Refer to NCC Standard detail SD/1100/21 (Latest revision) for further construction information



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**MAY GURNEY** **Mott MacDonald**

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Fax 01603 226760  
Web www.mottmac.com

**DRAWING TITLE**  
Bus Stop and Shelter 1  
Church Road Junction

REV.	DESCRIPTION	CHECKED	DATE

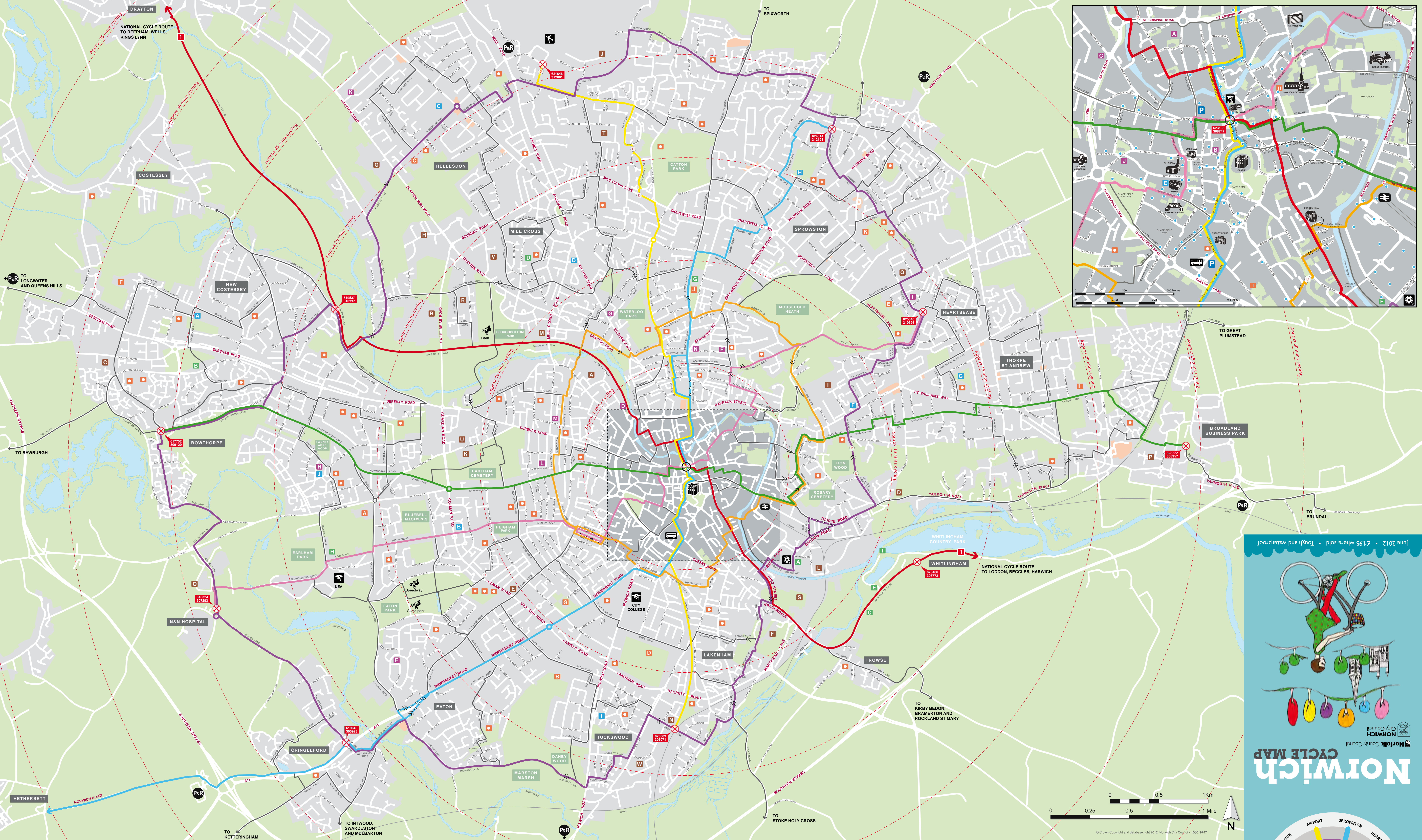
INIT.	DATE	DRAWING No.
NT	08/09	249610-AD-60
NT	09/09	PROJECT TITLE
		Postwick Growth Point: Park & Ride
		Extension and access Scheme
		SCALE AT A3
		1: 100
		FILE No.
		249610-AD



---

## APPENDIX C





## Norwich feels good on a bike...

... the pace is right to spot a bargain in a quirky shop or pause for a conversation with a friend in the park. The city's rich texture rolls out in front of you. The city is compact, making it manageable to ride from the edge to the centre in under twenty minutes. But you need to know where to go...

## ... welcome to the new cycle network.

It features five pedalways that cross the city from one side to the other and meet in the middle at St Andrews Plain. Two more encircle the city – one near the centre (the inner circuit), the other on the edge (the outer circuit). Each has a colour. The coloured pedalways are perfect for commuting and getting fit. They are complemented by neighbourhood routes that help you get around from your home to schools and shops, or they can be connected for longer journeys.

Norwich is yours to discover.

## Happy pedalling!

## How to use this map

### Planning your route

The map has two sides. Use this side for planning your route. It shows where the pedalways go and how they relate to facilities so you can pick the best combination of routes. The main routes are coloured and the colours will be used on signs along the way. There is a larger scale inset map that shows the city centre.

### Journey times and route conditions

Turn over to discover more about the five cross-city pedalways. The route lines have been straightened to show you how far your ride is. Each trip is centred on St Andrews Plain and the miles count by as you travel away from or towards it.

Details of the route conditions are shown on the line so you can see where busy traffic and cycle lanes are. It also shows traffic-free sections. These are usually shared with pedestrians so please ride courteously and be prepared to use your bell. The gradient of each pedalway is beneath each line.

All this information helps you to decide how much time you need for your journey.

### More information

This map will be combined with signs and web-based information. We are also working to improve the network through building projects. These things will happen gradually, so if you want to keep up-to-date with developments or say how we can do better visit [www.norwich.gov.uk](http://www.norwich.gov.uk) or scan the code.



## Pedalways

### Cross city

- Drayton ↔ Whitlingham National Cycle Route 1
- Bowthorpe ↔ Broadland Business Park
- N&N Hospital ↔ Heartsease
- Cringleford ↔ Sprowston
- Lakenham ↔ Airport

### Circular

- Outer circuit
- Inner circuit

### Local

- Neighbourhood routes
- One way
- Cyclists dismount
- Steep hill (arrows point uphill)
- Long stay secure cycle parking
- Cycle stand parking

- Grid reference point
- East reference
- North reference



- Railway station (including cycle hire – opening 2012/13)
- Bus station
- Park and ride (cycle parking available)
- Norwich City Football Club
- Higher and further education
- Norwich 12 buildings (the city's outstanding buildings spanning 1,000 years of history)
- Airport
- Cycle sport venue
- Local shopping centres

## Libraries

- A Costessey
- B Earham
- C Hellesdon
- D Mile Cross
- E Millennium
- F Plumstead Road
- G St Williams Way
- H Sprowston
- I Tuckwood
- J West Earham

## Sport facilities

- A Carrow Park
- B Football Development Centre
- C Norfolk Snowsports Club
- D Norman Centre
- E Norwich Rowing Club
- F Riverside Leisure Centre
- G Sewell Park College Sports Centre
- H UEA Sports Park
- I Whitlingham Outdoor Education Centre

## Schools

- A First, infant, primary or special
- B City Academy
- C City of Norwich School
- D Hellesdon High
- E Hewett
- F Open Academy
- G Ormiston Victory Academy
- H Norwich High School for Girls
- I Norwich School
- J Notre Dame
- K Sewell Park College
- L Sprowston High
- M Thorpe St Andrew High

## Bicycle shops

- A Bicycle Links
- B Cycles UK
- C Freemans
- D Halfords
- E John Borwell
- F Leisure Cycles
- G Mandarin (Aylsham Road)
- H Mandarin (West Earham)
- I Molly's Cycles
- J Pedal Revolution
- K Specialised Cycles
- L Streetlife
- M Velo Cycles

## Employment areas

- A Barker Street
- B Bayer Crop Science
- C Bowthorpe Industrial Estate
- D Broadland District Council
- E Colman Hospital
- F County Hall
- G Hellesdon Hospital
- H Hellesdon Park Industrial Estate
- I HM Prison Knox Road
- J Hurricane Way Industrial Estate
- K Julian Hospital
- L Lawrence Scott Electromotors
- M Mile Cross Business Centre
- N Whiting Road Employment Area
- O Norwich Research Park
- P St Andrews Business Park
- Q Salthouse Road Industrial Estate
- R Sweet Briar Industrial Estate
- S Unilever
- T Vulcan Road Industrial Estate
- U West Norwich Hospital
- V Whiffler Road Industrial Estate
- W White Lodge Business Park

June 2012 • £4.95 where sold • Tough and waterproof

**Norwich**  
NORFOLK County Council  
City Council

**Cycle Map**

Supported by:  
Greater Norwich Partnership  
South Norfolk Council  
EUROPEAN UNION  
sustrans



# APPENDIX C

## Postwick Hub Junction Stage 2 Safety Audit

10 April 2013





## INTRODUCTION

This report contains the results of a Stage 2 Safety Audit carried out on the above scheme. The Audit was carried out at the request of Norfolk County Council Highways Group .

The Audit Team membership was as follows:-

Tim Young BSc, MCIHT, MSoRSA	Engineer
(Audit Team Leader)	Network Analysis + Safety
	Norfolk County Council

Julian Fonseka EngTech, MCIHT, MSoRSA	Project Technician
(Audit Team Member)	Network Analysis + Safety
	Norfolk County Council

### Specialist Advisors:-

Andrew Micklethwaite	P2W Casualty Reduction Officer
	Norfolk County Council
John Thomas	Engineer
	ITS
	Norfolk County Council

The Audit took place at County Hall on 10 April 2013. The audit comprised an examination of the Safety Audit submission document and a site inspection by the Audit Team Leader.

The terms of reference are as described in Environment, Transport and Development Highways Service Manual Procedure SP03-07. The Auditors have examined and reported only on the road safety implications of the scheme as presented and have not verified the compliance of the design to any other criteria.

## **ITEMS RAISED AT PREVIOUS AUDIT**

All issues raised at the previous audit have been resolved.

## **ITEMS RAISED AT THIS STAGE 2 AUDIT**

### **1.0 General**

#### **1.1 Comment – Location of Tree planting**

Location – Throughout scheme

Please ensure that no trees provided as part of landscaping works are planted closer to the edge of the carriageway than 4.5m and that a rigorous maintenance regime is in place to prevent self-seeded trees from encroaching.

### **2.0 Alignment**

#### **2.1 Problem – Alignment of roundabout entry lanes**

Location – Business Park north eastbound entries, Postwick North northbound entry, Oaks Lane east & westbound entries, Peachman Way westbound entry.

The alignment of the entry lanes at the above roundabouts is such that a vehicle is aimed at the central island rather than meeting it tangentially. If the entry lane alignment is not correct then vehicle paths may overlap while manoeuvring or a vehicle may strike the central island.

Recommendation

Check and adjust if necessary the alignment of entry lanes on the approach to the roundabouts within the scheme extents. The geometry of existing roundabouts on the periphery of the scheme should also be checked.



## 2.2 Problem – Length of merge on roundabout exit

Location – Westbound exit of Business Park roundabout

The predominant movement at this roundabout will be from south to west. The proposed layout is a dual carriageway on the Business Park link road which reduces to a single lane on the westbound exit. The westbound merge scales at approximately 20m, this appears too short and could result in vehicles striking the splitter island or being forcing into the oncoming lane whilst attempting to overtake.

### Recommendation

Check that the length of the merge lane is appropriate to anticipated flows and increase its length if necessary to reduce the likelihood of conflict on the westbound exit. It may also be prudent to examine if the other merge tapers on the roundabouts within the scheme have sufficient capacity.

## 3.0 Junctions

### 3.1 Problem – Layout of segregated left turn lane

Location – Broadland Gate roundabout

The proposed layout for the Broadland Gate roundabout shows a segregated left turn lane, however only part of its layout is shown to the south. It is unclear how vehicles on the left turn lane will join the adjacent traffic lane. It is a black box item in TD51/03 that a merge can only be provided where 2 or more lanes on exit can be provided. If not a give way layout is required.

### Recommendation

Provide a revised layout showing the full extent of the segregated left turn/the access road into Broadland Gate. This will allow the correct layout of segregated left turn to be determined from TD51/03 and if it should be a merge or give way arrangement.

### 3.2 Problem – Lane widths at roundabout give way line

Location – Northbound approach to Business Park roundabout

The proposed lane widths scale at approximately 5m each; this is greater than the 3m-3.5m stipulated in paragraph 7.24 of TD16/07. Wider lane widths encourage higher entry speeds onto the circulatory carriageway which can result in failure to give way from adjacent arms or loss of control type collisions.

#### Recommendation

To be read in conjunction with 2.2 above and 3.3 below. Reconsider the width of the northbound approach lanes. If this results in an impact on roundabout capacity then it may be possible to offset this against minor changes in the entry flair, angle and alignment.

### 3.3 Problem - Failure to give way collisions due to imbalanced flows

Location – Business Park roundabout

The proposed layout shows a 2 arm roundabout design for the Business Park roundabout. On opening, the dominant manoeuvres at this junction will be a left turn from the Business Park link road to the Broadland Gate link road and a vice versa right turn from the Broadland Gate to Business Park. The proposed geometry and width of the circulatory carriageway will allow this manoeuvre to be performed at high speed. Consequently drivers will become habituated to not giving way to the right which increases the risk of failure to give way should a driver wish to perform a u turn at the roundabout.

## Recommendation

Redesign the geometry of the roundabout entry from the Business Park link road northbound entry to reflect the expected manoeuvres and reduce entry/circulatory speeds to reduce the risk of failure to give way.

### 3.4 Comment – Position of proposed bus stop

Location – Brundall Low Road

A new bus stop is proposed at the junction of Brundall Low Road and Church Road. Its position on the outside of the bend is such that a bus driver may find it difficult to align with the kerbs/barfaced paving. This would then make boarding and alighting from a bus more difficult for passengers with reduced mobility or those with pushchairs/buggies. The designer should consider if an alternative location can be chosen that has a better alignment.

## 4.0 Non-motorised Users

### 4.1 Problem – Shape of Tactile Paving

Location – Western side of Park and Ride junction

Tactile paving has been provided for the pedestrian crossing points (stages K and L) on the A47 (W) slip road. The layouts proposed for the central island are of the correct rectangular layout however; their opposites are missing the correct leg to form the L shape required. The reason the leg is important is that it provides tactile clues to blind and partially sighted pedestrians on where they may find the push button poles with rotating cones. They also give an indication to blind or partially sighted users of the direction from which traffic will be approaching.



## Recommendation

Provide an appropriate tactile paving leg at these 2 locations to aid blind and partially sighted pedestrians. General convention is for it to extend to the rear of the footway/highway boundary however, in this instance that would result in an overly long and confusing layout. Therefore the designer's discretion should be used to determine the appropriate length at this location.

### 4.2 Problem – Uncontrolled crossing layout

#### Location – Within Park and Ride Site

2 uncontrolled pedestrian crossing points are located within the park and ride site. They are the primary pedestrian access from the park and ride to the new junction. The drawing supplied (R1C150-MP—363A) shows 2 rows of pedestrian studs delineating the crossing points. This layout is incorrect as it is potentially confusing for blind and partially sighted users. This is because the convention is to use pedestrian studs at controlled crossings only.

## Recommendation

Remove the pedestrian studs from the uncontrolled crossing point. In addition as pedestrians have to cross 2 separate traffic lanes one of which being a bus only lane it may be prudent to provide appropriate 'look left' and 'look right' carriageway markings to alert pedestrians.

### 4.3 Comment – Westbound cyclist access to A47

#### Location – Old eastbound A47 slip road

The new shared use facility is designed to allow cyclists to slip off the A47 when eastbound and to access existing and proposed cycling facilities within Broadland Business Park and the Proposed Broadland Gates development. The new shared use

facility will also allow westbound cyclist's access to other parts of the Road Network via the service path. The service path is only 1.5m wide, therefore it is very important that cyclists receive a strong message that they should dismount at this point.

## **5.0 Signs, Lighting and Markings**

### **5.1 Problem – Lack of circulatory lane markings increases risk of side swipe collisions**

Location – Business Park/Broadland Gates/Postwick North and Broadland Way Roundabouts.

The four roundabouts above are not shown to have circulatory lane markings, whereas the Postwick Northeast roundabout does. Lane markings have the benefit of encouraging lower circulatory speeds and reduce the risk of side swipe collisions where 2 vehicles try and occupy the same piece of carriageway. In addition they also have benefits in terms of capacity as they allow a higher number of vehicles to use the junction.

#### **Recommendation**

Provide appropriate circulatory lane markings on all roundabouts to be constructed or affected by this scheme.

### **5.2 Comment – Illumination of signs ref TS063**

Location – A1042 on island east of new P&R roundabout

2 new signs to diagram 610 are located on a refuge island to the east of the new P&R roundabout. Like other signs to diagram 610 within the scheme they are within a street lighting system. Under current regulations these signs require illumination to comply. The designer should ensure that these and all signs to diagram 610 within the street lit sections of scheme are illuminated. This does not apply to those signs present on islands that contain a traffic signal head that faces in the same direction.

**5.3 Problem – Business Park and Broadland Gate Link roads not fully illuminated**

Location – East of Broadland Gate Roundabout and north of Postwick north east roundabout.

Sections of the Broadland Gate and Business Park link roads, including the Business Park roundabout are not illuminated. TD34/07 para 3.18 states that lighting should not terminate closer to the conflict point (the roundabout) than 1.5 times the stopping sight distance. In this case it would be 180m based on a 40mph design speed. Scaling from the plan (R1C150-MP-663) the proposed street lighting to the east of the Broadland Gate roundabout terminates at 120m.

**Recommendation**

Extend the proposed street lighting on the Broadland Gate link road to 180m. This would then terminate only 120m from the Business Park roundabout, which is less than the required 1.5 times the stopping sight distance in TD34/07. Therefore the Business Park roundabout should also be lit and as a consequence the Business Park link would also require lighting.

**5.4 Problem – Position of signs on central islands (reference TS051 and 052)**

Location – Various within scheme

Chevron signing and keep left roundels are being provided on the central islands of roundabouts within the scheme. The position of these signs is critical as they provide a 'target' that informs a driver of the point at which they must perform a sharp change of direction. They also aid drivers in understanding the layout of a junction and formulation of an appropriate approach speed. The positions shown of some of the sign arrangements are away from the direct line of sight of approaching drivers.

**Recommendation**



Check the positions of the sign arrangements on the central islands and ensure that drivers approaching can see them at a minimum of the stopping sight distance appropriate to the chosen design speed.

#### 5.5 Problem – Destination markings on the carriageway

Location – Eastbound diverge slip road

Destination road markings have been proposed extensively within the signalised junction to aid driver's decision making through this complex layout. They have not been used elsewhere in the scheme but could be of benefit to drivers at other locations in addition to the proposed direction signing.

##### Recommendation

An example of where their use might be of benefit would be on the long eastbound diverge slip road where drivers have to decide whether or not to take the left turn slip road and also what lane they are required to be in on the Postwick Northeast roundabout.

#### 5.6 Problem – Non-passively safe sign posts (ref TS024)

Location- A47 westbound off slip

The existing direction sign TS024 is to be retained however it is supported by a wide base post, presumably for illumination purposes. A sign in this location within a 60mph speed limit is not considered passively safe.

##### Recommendation

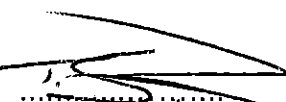
For consistency with other signing arrangements on the A47 slip roads within the scheme this one should also be made passively safe by the use of new posts. It may

also prudent to consider the adjacent sign (TS007) for conversion to passive posts in line with the Highways Agency policy.

## AUDIT TEAM STATEMENT

We certify that this audit has been carried out in accordance with Norfolk County Council Environment, Transport and Development Procedures.

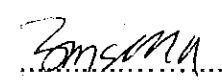
Signed (ATL) .....

  
19/04/13

Tim Young

Dated .....

Signed .....

  
19/04/13

Julian Fonseca

Dated .....





# APPENDIX C

## Postwick Hub Junction Stage 2 Safety Audit, Response Sheet

24 May 2013





## RESPONSE SHEET

Problem (para no.)	Agree/ Disagree	Reasons/Proposals
1.1	Noted	All landscaping has been designed with a 4.5m setback from the carriageway.
2.1	Disagree	All alignments have been checked and are tangential to centre island except the northbound approach to the existing north west roundabout. Accident data does not indicate that there is an issue with entry.
2.2	Agreed	Exit taper to be widened.
3.1	Noted	The detailed design of the internal road layout is still to be completed and will form part of the reserved matters for the Broadland Gate Business Park planning application.
3.2	Agreed	Hatching will be provided adjacent to the splitter island resulting in a reduced entry width of 7.3m
3.3	Agreed	The circulatory width will be reduced to 8m by hatching. The width will be further reduced to 4.0m adjacent to the splitter islands again by providing hatching.
3.4	Agreed	The bus stop is to be located on the opposite side of the junction to aid bus alignment.
4.1	Agreed	Legs to be added to tactile crossings.
4.2	Agreed	Studs to be removed.
4.3	Noted	
5.1	Agreed	Circulatory lane markings will be provided.
5.2	Agreed	Signs will be illuminated.
5.3	Agreed	In line with the County's ongoing commitment to lower CO2 emissions it had been proposed not to light this section. The lighting had been designed one step below standard resulting in a reduced stopping sight distance of 135m. However, following the comments from the audit team the lighting will be extended as recommended.
5.4	Agreed	Location of signs to be reviewed and adjusted.
5.5	Agreed/ Noted	Markings on eastbound diverge will be provided. Suggest that other possible other locations to be reviewed/monitored post construction possibly at Stage 3.
5.6	Agreed	Passive posts on westbound diverge will be provided for TS024 & TS007.

To:- Team Manager (Network Analysis + Safety): fao Tim Young

From: Postwick Hub Junction Project Team

Signed: M Harrison

Project Engineer

Dated: 24<sup>th</sup> May 2013

Note: If producing your own version of this page please include **SAFETY AUDIT FILE NO/DATE & ATL name**