

Technical Note 01

Kronospan Response to LHA Consultation Response

Prepared for: Kronospan Ltd

June 2023

3046-01-TN01

1.0 INTRODUCTION

1.1 Preamble

1.1.1 This Technical Note (TN) has been prepared in connection to the application for the construction and operation of a northern access road and lorry park ('the Proposed Development') north of the existing Kronospan Facility in Chirk, Wrexham (planning application reference P/2022/1080).

1.1.2 Wrexham County Borough Council (WCBC), acting in their capacity as the Local Highway Authority (LHA), provided a consultation response for the proposed scheme dated 5th May 2023 (included in **Appendix A**).

1.2 Points of Agreement

1.2.1 It is noted from the response that a number of points provided in the Transport Assessment (TA) submitted in support of the scheme have been agreed. In particular it has been agreed that:

- i) The LHA offers no objection to a reduction in the speed limit of the B5070 Holyhead Road at this location from 50mph to 40mph (subject to the approval of the WCBC traffic management team);
- ii) A junction capacity assessment has been conducted for the proposed roundabout junction which concludes that the proposed compact roundabout would operate within capacity;

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- iii) A high-level link flow assessment of the proposed development traffic has been provided which indicates that the proposal is expected to result in a percentage impact less than 5% on all arms of the B5070 / A5 roundabout and A5 / A483 Halton roundabout. The highest proportional HGV impact is expected on the B5070 Holyhead Road at 24%, however this is reflective of the low absolute HGV baseline on this link; and,
 - iv) A Construction Traffic Management Plan (CTMP) may be secured via a suitably worded planning condition.
- 1.2.2 Turning to the various other comments provided in the response, this TN provides further commentary on the residual matters.



2.0 RESIDUAL MATTERS

2.1 Scheme Revision

LHA Comment - “The application is for a 91 space lorry park at the Kronospan site in Chirk, Wrexham. Vehicle access would be from a new access road and roundabout on the B5070 north of Chirk.”

2.1.1 It should be noted that the LHA comments were prepared on the basis of the information provided for the scheme at that time. Following further engagement between the applicant and Cadw regarding alternatives to minimise impacts on the historic environment, the Proposed Development design is currently being revised with a reduced lorry park footprint and associated reduction in the number of HGV parking bays.

2.1.2 The ongoing revision to the Proposed Development design makes no substantive changes to the traffic generation, distribution and assignment exercises included in the TA accompanying this application. Additional details of the revised design will be formally provided to WCBC in July 2023 and supported by updated application documents including updated Environmental Statement (ES) chapters; from a transport perspective, a TA addendum report will be provided which will include further consideration of the parking accumulation, traffic generation and distribution of the Proposed Development. This revised design information will not be reproduced in this TN (which refers only to the as currently submitted design).

2.2 Speed Limit Reduction

LHA Comment - “The CD116 roundabout compliance checklist provided by the applicant within the Transport Assessment notes the speed limit on the B5070 will be reduced from 50mph to 40mph. WCBC have no plans at present to reduce the speed limit from 50mph on this section. In principle WCBC offer no objection to the reduction of the speed limit however this would be subject to approval from WCBC Traffic Management team and would also be subject to statutory consultation to amend the Traffic Regulation Order (TRO).”

2.2.1 The response indicates that a reduction in the speed limit of the B5070 Holyhead Road would be acceptable to the LHA, subject to approval by the WCBC Traffic Management Team.



- 2.2.2 Axis has subsequently sought the opinion of the proposed change in speed limit with WCBC's Traffic Management team. Jamie Edge, acting as the Network and Asset Team Leader, provided an email response on 5th June 2023. The email exchange is included in **Appendix B**. The email provides the teams in principle approval of the proposed change in speed limit and noted the good sense in reducing the speed limit on the approach to the proposed roundabout.
- 2.2.3 It is considered that the LHA and Traffic Management Team have therefore provided in principle approval to this reduction, subject to the administrative process of enacting the change in TRO. It is understood that formalising the change in speed limit would only be put into place following the grant of planning permission. Therefore, it is considered that the administrative process of the speed limit change should be deferred to the detailed design stage.
- 2.2.4 Regardless of the posted speed limit, sufficient deflection has been provided in the roundabout design in order to meet the entry path radius set out in paragraphs 3.2.1 to 3.2.5 of the Design Manual for Roads and Bridges (DMRB) CD116 and to deter excessive speed. The role of appropriate entry path radius is to provide sufficient deflection to encourage approaching vehicles to slow. Drivers will necessarily reduce their speed in order to navigate roundabouts and this is an integrated part of the design guidance provided in CD116.

2.3 Visibility Splays

LHA Comment – “The applicant has provided visibility splays of 2.4m x 120m appropriate for a 40mph speed limit. Revised visibility splays should be provided in line with TAN18 for 50mph.”

- 2.3.1 Contrary to the comments provided in the LHA response, it is considered that the visibility splays for the proposed roundabout included on **Drawing No' 3046-01-D01** contained within **Appendix C** are appropriate for the anticipated design speed of the road, following the reduction of the posted speed limit to 40mph.



2.4 Roundabout Selection

LHA Comment - “The proposed roundabout layouts provided by the applicant (Ref. 3046-01-D01 & 3046-01-ATR01) indicate a compact roundabout design. A standard roundabout should be provided to accommodate the level of HGV movements to and from the site. This should comprise two circulatory lanes and a flared two-lane entry at the B5070 north arm. The right entry lane should be of sufficient length to accommodate a right turning HGV with the left lane for general traffic”

- 2.4.1 The LHA has indicated that a normal roundabout would be required in order to accommodate the level of HGV movements associated with the Proposed Development. The proposed roundabout (including its classification as a compact roundabout) has been designed in accordance with the guidance provided in the Design Manual for Roads and Bridges (DMRB) CD116. To this end, a CD116 compliance checklist was submitted alongside the TA and is reproduced in **Appendix D**.
- 2.4.2 Review of the CD116 checklist indicates that a compact roundabout would be permissible in this location. It is evident from the checklist that the proposed roundabout is compliant with CD116, with minor relaxations in the interest of the efficient use of space, highway safety, and in order to fit the roundabout into the context of the site.
- 2.4.3 When considering the suitability of a proposed junction design it is essential to note the verbal forms used in the DMRB as set out in GG101. Of particular note is how the use of “must” indicates a statutory / legislative requirement, “shall” indicates a requirement of the overseeing organisation (Welsh Government (WG)) and “should” indicates a recommendation. This is commonly interpreted to relate to the WG departure from standards process, in which “must” and “shall” verbs denote a more onerous departure from standards, compared to “should” which may be interpreted as a relaxation. The use of the word ‘may’ indicates advice expressed as a permissible approach.
- 2.4.4 The selection of a normal or compact roundabout is dependent on a number of paragraphs in CD116 which are outlined in **Table 1** below.



Table 1 – CD116 Compact Roundabout Extracts

Paragraph	Standard	Commentary
2.3	For roads with a speed limit of 50mph or greater <u>and</u> traffic levels of greater than 8,000 two-way AADT on any approach, a normal roundabout <i>shall</i> be used.	Although traffic levels are anticipated to exceed 8,000 two-way trips AADT, the posted speed limit is to be reduced to 40mph (see section 2.3). The standard indicates that the road must meet both tests for a normal roundabout to be expressly required. This is not the case, and a compact roundabout would therefore be a permissible solution.
2.3.1	Where the speed limit is 50mph or greater regardless of traffic flow, normal roundabouts <i>should</i> be provided.	As noted above, the speed limit is to be reduced to 40mph. Nonetheless it is noted that this requirement would represent a relaxation, rather than departure, with no statutory requirement.
2.3.3	For roads with a posted speed limit of 40mph or below, either a compact or a normal roundabout <i>may</i> be provided.	Given the reduced 40mph speed limit, flexibility is given in CD116 to provide a compact roundabout.

*Italics added for emphasis

- 2.4.5 The reasoning provided by the LHA that the Proposed Development traffic could not be accommodated on the proposed compact roundabout is unfounded. As agreed by the LHA, detailed junction capacity assessments of the proposed compact roundabout were included in the TA. The results of the capacity assessment indicated that the proposed roundabout would be able to accommodate development traffic satisfactorily with significant residual capacity. Indeed, the operation of the roundabout could be expected to result in a maximum queue of less than 1 PCU during the most robust future scenario. It is not therefore clear on what basis the LHA have asserted that the proposed roundabout is unsuitable for development traffic.
- 2.4.6 If it is inferred from the response that the LHA is concerned that a multiple lane entry / exit arm would be required in order to accommodate the manoeuvres of HGVs to and from the site, again this is unfounded. The swept path analysis provided in the TA (**Drawing No: 3046-01-ATR01** contained within **Appendix E** at the end of this report) demonstrates that a single lane entry / exit would be sufficient to accommodate the manoeuvres of a 16.5m long articulated HGV. This is consistent with paragraph 3.14.3 of DMRB CD116 which states that “*Vehicle swept paths should be assessed using the largest design vehicle that is anticipated to use each entry lane*”. The LHA’s response infers that compact roundabouts are not able to accommodate the swept paths / manoeuvres of large HGVs. Given sufficient entry / exit kerb radius, circulatory carriageway width and various other factors as set out in CD116 for compact roundabouts, this is demonstrably not the case.

- 2.4.7 Ultimately, it is considered that a compact roundabout is compliant with design standards, appropriate for the location and sufficient to accommodate development traffic.

2.5 Traffic Generation

LHA Comment – “To understand the trip generation associated with the proposals, further clarity is requested on:

- whether HGV trips to and from the new facility will solely comprise trips related to the existing Kronospan operation.***
- how access into the lorry park would be managed to restrict non-Kronospan trips given the HGV driver facilities proposed.***
- whether the existing lorry park facility, located south of the existing site access road, would be lost as part of the proposals.***
- the proposed daily traffic levels associated with the lorry park. This could be provided in the form of a 24 hour flow profile detailing the parking accumulation for the 91 space lorry park.***
- the proposed daily traffic levels associated with the new weighbridge car park comprising 32 spaces and whether these will be new trips or relocated from the existing site.”***

- 2.5.1 Additional details concerning the traffic generation of the revised scheme will be included in part of a forthcoming TA addendum. Nonetheless, in answer to the specific queries raised above;

- i) All proposed HGV trips comprise existing movements that already take place as part of the existing Kronospan operation. The proposal simply entails the redistribution of existing HGV trips from the southern access to the new northern access road / roundabout;
- ii) Appropriate signage would be installed at the proposed site access displaying the use of the area for HGV parking and noting that it is private land;
- iii) Further details will be included in the TA addendum;
- iv) Further details of the maximum HGV parking occupancy will be included in the TA addendum; and,



- v) The weighbridge car park would not generate any additional traffic and would simply entail the relocation of existing staff parking from elsewhere on the site.

2.6 Parking and Turning Provision

LHA Comment – “Vehicle tracking will need to be submitted to demonstrate HGV parking and turning provision within the site along with vehicle access and egress via the North Access Road.”

- 2.6.1 Swept path analysis of the proposed northern access road and roundabout are included in **Drawing No. 3046-01-ATR01A** in **Appendix E**.
- 2.6.2 The swept path of the (revised) HGV parking area will be provided in the TA addendum.



3.0 CONCLUSION

- 3.1.1 In view of the evidence provided above, it is considered that the remainder of the LHA queries should now be satisfied and there should be no transport-related reason to resist the proposals.



Appendix A – LHA Consultation Response



MEMORANDUM

From:	Chief Officer, Environment & Technical	To:	Head of Environment and Planning
Our Ref:	ET/DC/MM/P/2022/1080	FAO:	Gwyn Humphreys
		Your Ref:	P/2022/1080
Date:	5 May 2023		

**Land immediately adjacent Kronospan Ltd, Holyhead Rd, Chirk, LL14 5NT
North access road, lorry park, roundwood storage areas and associated structures, 132kV
substation and ancillary works**

Further to the Transport Assessment prepared by AXIS on behalf of the applicant, I comment as follows:-

The application is for a 91 space lorry park at the Kronospan site in Chirk, Wrexham. Vehicle access would be from a new access road and roundabout on the B5070 north of Chirk.

Access

The applicant proposes the site will be accessed from a new priority-controlled roundabout located at the existing Holyhead Road / Old Black Park Road / Afon Bradley Farm access road staggered junction. This will facilitate access to the new site to the north of the Kronospan site via a new internal access road (referred to as the 'North Access Road'). The North Access Road would be reached from the western arm of the new roundabout.

The proposed roundabout layouts provided by the applicant (Ref. 3046-01-D01 & 3046-01-ATR01) indicate a compact roundabout design. A standard roundabout should be provided to accommodate the level of HGV movements to and from the site. This should comprise two circulatory lanes and a flared two-lane entry at the B5070 north arm. The right entry lane should be of sufficient length to accommodate a right turning HGV with the left lane for general traffic.

Updated swept path drawings will need to be provided for any revised roundabout design to demonstrate all vehicle movements can be accommodated.

Consideration should also be given to the gradient of the approach arms to the roundabout as part of the vertical alignment of any future design.

The CD116 roundabout compliance checklist provided by the applicant within the Transport Assessment notes the speed limit on the B5070 will be reduced from 50mph to 40mph. WCBC have no plans at present to reduce the speed limit from 50mph on this section. In principle WCBC offer no objection to the reduction of the speed limit however this would be subject to approval from WCBC Traffic Management team and would also be subject to statutory consultation to amend the Traffic Regulation Order (TRO).

The applicant has provided visibility splays of 2.4m x 120m appropriate for a 40mph speed limit. Revised visibility splays should be provided in line with TAN18 for 50mph.

The proposed roundabout design should be agreed in principle with WCBC as the local highway authority prior to any planning determination. This should also include agreement on limits of highway adoption for the new roundabout and the North Access Road, if applicable.

Road Safety Audit

An independent Stage 1 Road Safety Audit has been undertaken of the submitted highway design. This identified four items. An audit response form has been prepared by the applicant which partly addresses the audit recommendations.

A Stage 1 Road Safety Audit will be needed for any revised roundabout design and will be reviewed by WCBC as the overseeing organisation.

Trip Generation

To understand the trip generation associated with the proposals, further clarity is requested on:

- whether HGV trips to and from the new facility will solely comprise trips related to the existing Kronospan operation.
- how access into the lorry park would be managed to restrict non-Kronospan trips given the HGV driver facilities proposed.
- whether the existing lorry park facility, located south of the existing site access road, would be lost as part of the proposals.
- the proposed daily traffic levels associated with the lorry park. This could be provided in the form of a 24 hour flow profile detailing the parking accumulation for the 91 space lorry park.
- the proposed daily traffic levels associated with the new weighbridge car park comprising 32 spaces and whether these will be new trips or relocated from the existing site.

Junction Capacity

A junction capacity assessment has been undertaken of the proposed roundabout junction using the Junctions 10 ARCADY package. This concludes that the proposed junction, in its current design, would operate within capacity.

A junction capacity assessment will need to be provided for any updated roundabout design.

Parking and Turning Provision

The submitted proposed site layout plan ('Planning Drawing 1') appears to indicate the provision of 91 HGV lorry spaces.

Vehicle tracking will need to be submitted to demonstrate HGV parking and turning provision within the site along with vehicle access and egress via the North Access Road.

Construction Traffic

Construction is estimated to occur for a period of three years between 2023 and 2026. Chapter 5 of the Transport Assessment estimates construction traffic of 200 two-way HGVs per day.

Peak hour flows would comprise 48 construction trips in both the AM and PM peak network hours of which 17 would be HGVs. A high-level link flow assessment has been produced for the 2026 scenario for all arms of the B5070 / A5 roundabout and the A5 / A483 Halton roundabout. This indicates total construction traffic would be below 5% across all arms. The highest proportional HGV impact is predicted to be on the B5070 Holyhead Road in the PM peak with a 24% increase in HGVs however this is reflective of a low absolute baseline.

Overall construction vehicle trips are predicted to be in the region of around 30 two-way peak hour movements and under a 5% increase. This is considered to be reasonable in accordance with TAN18 paragraph E.4.

Construction Traffic Management Plan

In order to construct the proposed scheme, the applicant will need to submit a Construction Traffic Management Plan (CTMP) including details of contractor parking and appropriate routes for construction traffic. This could be included as a planning condition should an application be supported.

Conclusion

Subject to agreement on the proposed roundabout design, should an application be supported, the development shall not begin until the local planning authority has approved in writing a full scheme of works for a new roundabout junction of the B5070 / Black Park Road / North Access Road and improvements to the B5070. The occupation of the development shall not begin until those works have been completed in accordance with the local planning authority's approval and have been certified in writing as complete by or on behalf of the local planning authority.

The following further information is required for approval:

- Revision to the proposed roundabout design for the consideration of WCBC
- Any updated roundabout design would require:
 - Revised swept path drawings
 - Revised visibility splays
 - A new junction capacity assessment
 - A new Stage 1 Road Safety Audit
- Additional clarity on the proposed trip generation associated with the proposals
- Swept path drawings demonstrating HGV parking, turning provision, site access and egress

A handwritten signature in black ink, appearing to be 'R. Khan', is positioned above the title of the Chief Officer.

Chief Officer, Environment & Technical

Appendix B – Network Management Discussion



Jamie Whittall

From: Jamie Edge <Jamie.Edge@wrexham.gov.uk>
Sent: 05 June 2023 14:26
To: Jamie Whittall
Cc: Catherine Zoeftig; Darren Williams; Clare Whiting
Subject: RE: Proposed Speed Limit Change - B5070 / Kronospan Chirk Plant

Good afternoon Jamie,

In principle I don't have an issue with the proposed speed reduction, as it makes sense to reduce the speed of the traffic approaching the roundabout.

A TRO typically costs £2000 and takes a couple of months to process depending on our workload/available resource.

I will need to look at the whole design in closer detail and discuss options with planning and DC, but as I said I can't see any major issues.

Regards

Jamie Edge
Network and Asset Team Leader
Arweinydd Tîm Rhwydwaith ac Ased



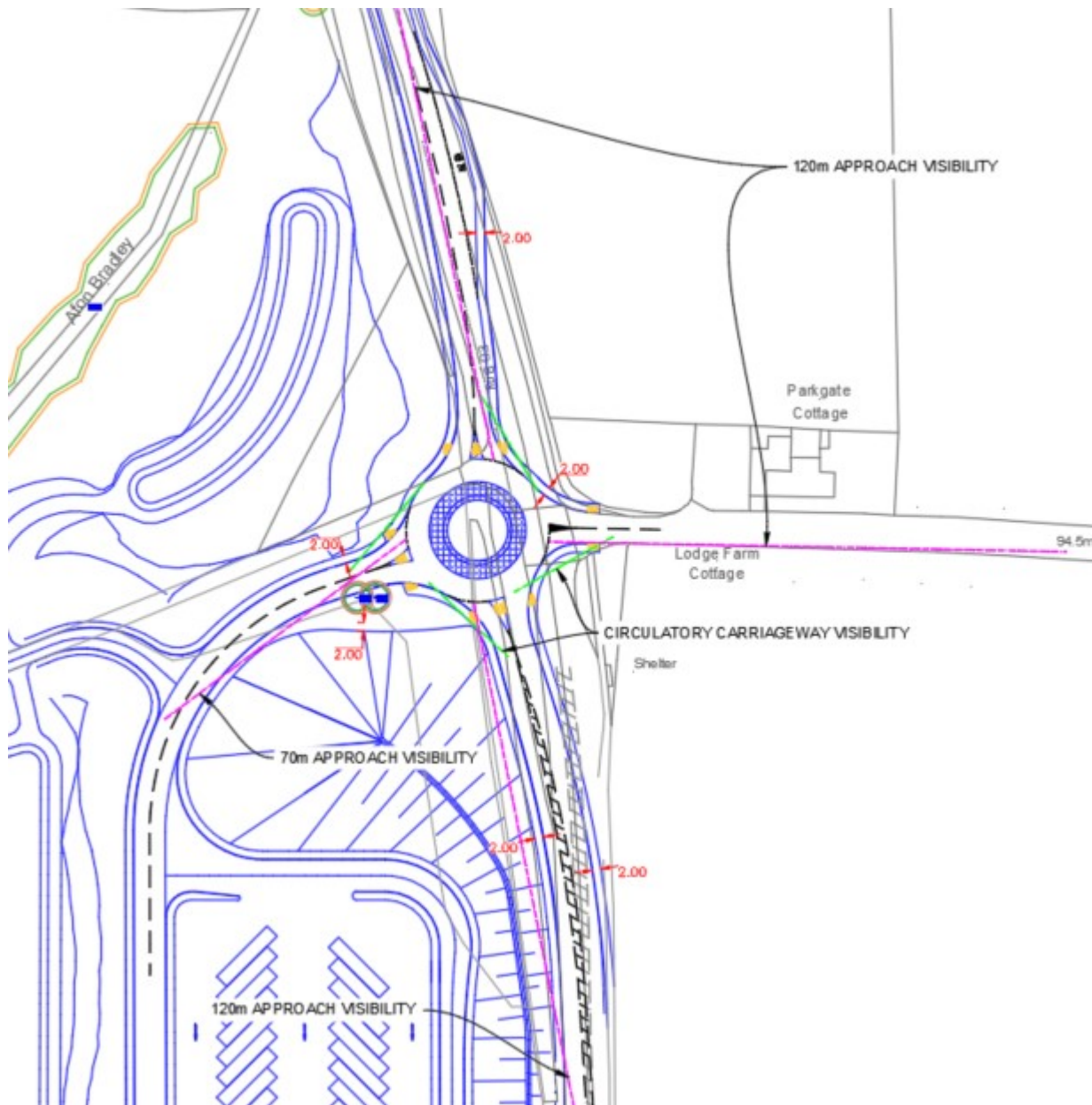
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Adran Amgylchedd a Chynllunio, De Ffordd yr Abaty, Ystad Ddiwydiannol
Wrecsam, Wrecsam, LL13 9PW
Environment and Planning Department, Wrexham County Borough Council,
Abbey Road South, Wrexham Industrial Estate, Wrexham, LL13 9PW
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From: Jamie Whittall <jamiwhittall@axis.co.uk>
Sent: 01 June 2023 12:46
To: Darren Williams <Darren.Williams@wrexham.gov.uk>
Cc: Catherine Zoeftig <CatherineZoeftig@axis.co.uk>
Subject: Proposed Speed Limit Change - B5070 / Kronospan Chirk Plant

Hi Darren,

My apologies if you are not the right man for this enquiry. I am trying to get in contact with someone in the Traffic Management Team as my enquiry relates to TROs. I'd be grateful if you could forward this message onto the relevant team.

I am currently involved in a scheme to provide a compact roundabout on the B5070 with a new access arm to the Kronospan Chirk plant (approximately at LL14 5ER):



I have received comments from your colleague in highways, via the case officer Gwyn Humphreys, in relation to the proposal, in which they state that they have no objection to the proposed accompanying reduction in the speed limit of the B5070 from 50mph to 40mph. Although they do state that this would be subject to approval from WCBC traffic team.

I am therefore contacting you to get your in principle opinion on the speed limit change and hope you might be able to provide some information on the process through which the TRO change might be secured, costs and timescales. I anticipate that these are details that can be facilitated through the detailed design stage and following the grant of planning permission, but would nonetheless appreciate your views on this.

I'd be grateful if you could provide any initial thoughts or alternatively we can arrange a call so that we can discuss this in more detail.

Many thanks.



Jamie Whittall
Transport Planner

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T: 0344 8700 007

M: 07816 856720

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Appendix C – Drawing No. 3046-01-D01A: Proposed Roundabout Layout and Visibility Splays



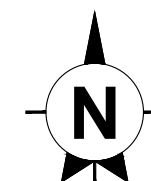
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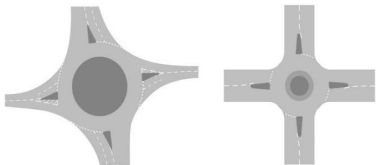
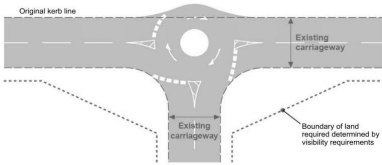
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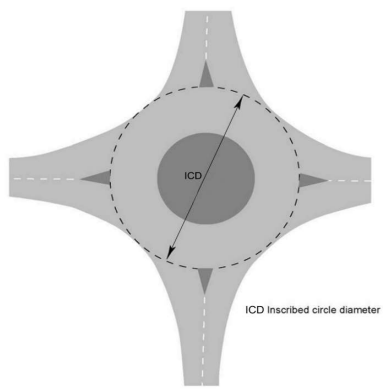
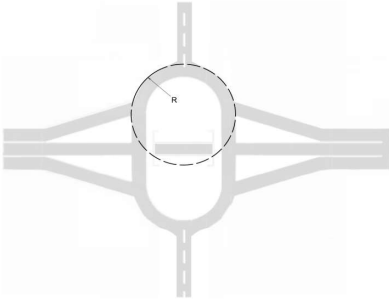
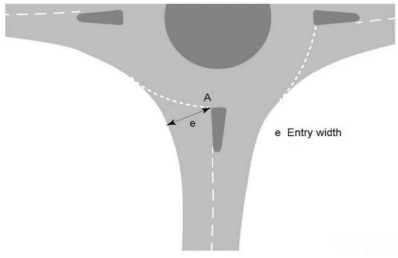
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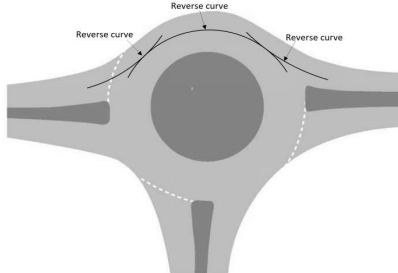
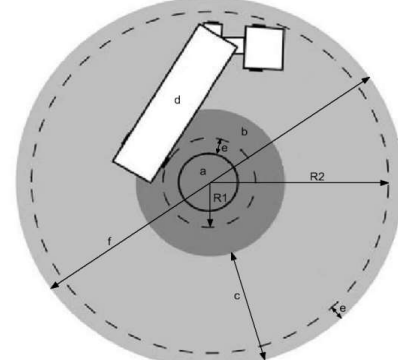


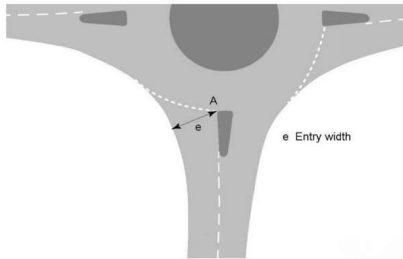
Appendix D – DMRB CD116 Compliance Checklist

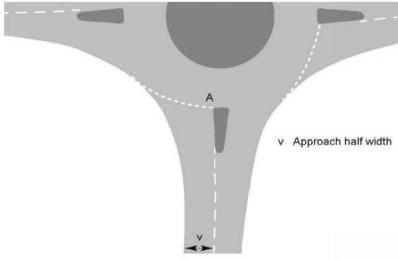
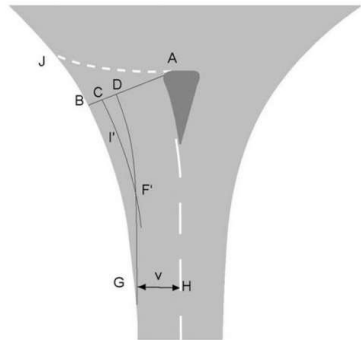


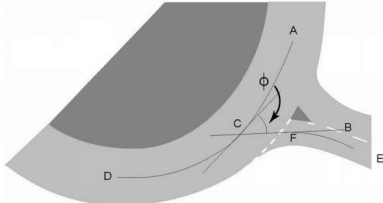
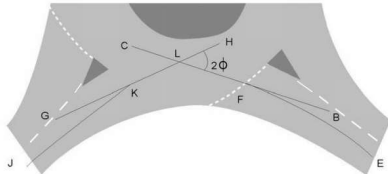
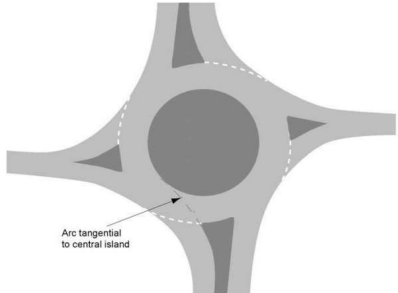
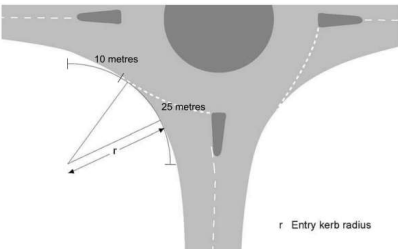
Priority Controlled Roundabout Design Standards (CD116 Revision 2)					
Paragraph	Description	Standard	Departure (shall) or Relaxation (should)	Achieved	Comments
2.1	Not on motorways	At-grade roundabouts shall not be provided on motorways.	Departure	Yes	
2.1.1	Do not locate roundabouts on:	On all-purpose trunk roads, roundabouts should not be located: 1) on rural three-lane dual carriageway roads, as it is difficult to achieve suitable deflection; 2) where an approach road exceeds a gradient of 2% over the desirable minimum stopping sight distance (SSD) measured from the give way or stop line.	Relaxation	Yes	
2.1.2	3 arms minimum	A roundabout should have 3 or more arms.	Relaxation	Yes	
2.1.4	Conspicuity	Roundabouts should be made conspicuous through the provision of clear signage and road markings.	Relaxation	Yes	Signage details to be provided at detailed design stage
NOTE	Ways to improve conspicuity	The following measures can help improve conspicuity of roundabouts: 1) re-positioning and/or repeating (e.g. nearside and offside) of warning signs; 2) providing additional map type direction signs in advance of the roundabout, possible sign configurations include: a) 3 lane dual-carriageway (50, 60 or 70mph) - 1 mile ADS, 1/2 mile ADS and final direction sign and warning signs (3 lane dual-carriageway approaches to a roundabout are not preferred); b) 2 lane dual-carriageway (60 or 70mph) - 1 mile ADS (optional - site specific road safety issue / high traffic volume), 1/2 mile ADS and final direction sign and warning signs; or c) any dual carriageway (lower than 50mph) - final direction sign and, if considered necessary, one pair of warning signs; 3) making the give way line more conspicuous; 4) extending the central island chevron sign further to the left to emphasise the angle of turn; 5) extending the central island chevron sign further to the right or providing additional chevrons on the approach central island where the approach geometry masks the roundabout entry from view; 6) on dual carriageway roads, placing additional chevron signs in the central reserve in line with the offside lane approach.	N/A	N/A	
2.2	Lighting	Road lighting shall be provided on all roundabouts.	Departure	Yes	Lighting details to be provided at detailed design stage
2.3	Normal roundabout selection (volume)	For roads with a speed limit of 50mph or greater and traffic levels of greater than 8,000 two-way AADT on any approach, a normal roundabout shall be used.	Departure	N/A	Speed limit to be reduced to 40mph
2.3.1	Normal roundabout selection (speed)	Where the speed limit is 50mph or greater regardless of traffic flow, normal roundabouts should be provided.	Relaxation	N/A	
2.3.2	Compact roundabout exception (single lane entries and < 8,000 AADT volume)	Where the speed limit is 50mph or greater, and traffic levels are less than 8,000 two-way AADT on any approach and where single lane entries are provided, compact roundabouts may be provided.	N/A	N/A	
2.3.3	Compact roundabout selection (speed)	For roads with a posted speed limit of 40mph or below, either a compact or a normal roundabout may be provided.	N/A	N/A	Compact roundabout selected
NOTE	Higher speed compact roundabout design	On roads with speed limits exceeding 40mph, the design of compact roundabouts is similar to that for normal roundabouts, but single-lane entries and exits are provided.	N/A	N/A	
NOTE	Roundabout selection recommendations	Where the posted speed limit is 40mph or less, compact roundabouts are recommended for traffic levels of less than 8,000 two-way AADT on all approaches and normal roundabouts are recommended for traffic levels of greater than 12,000 two-way AADT on any approach.	N/A	N/A	
NOTE	Alternative roundabout selection	Alternatives to normal or compact roundabout types (i.e., signalised, double, through-about and double-through-about, mini, or provision of an SLTL) can be used where the traffic modelling indicates a benefit.	N/A	N/A	
2.14	Alternative roundabout benefits	Where the design of a normal roundabout could lead to high circulatory speeds then a double roundabout or signalisation can be used to reduce speeds and to regulate traffic flow.	N/A	N/A	
2.3.4	5 arm maximum	Normal roundabouts with five or more arms should not be provided.	Relaxation	N/A	
2.4	No compact roundabouts on dual carriageways	Compact roundabouts shall not be used at any location with a dual carriageway approach, irrespective of speed or AADT	Departure		
NOTE	Compound roundabout pros and cons	A compact roundabout has less capacity than a normal roundabout but can be more suitable where there is a need to accommodate at-grade crossings for pedestrians or cyclists.	N/A	N/A	
NOTE	Compact roundabout pedestrian benefit	Non-flared entries/exits of a compact roundabout give more flexibility for the inclusion of pedestrian crossings in the roundabout design.	N/A	N/A	
NOTE	Normal and compact roundabout illustration	Normal and compact roundabouts are as illustrated in Figure 2.4N3. Figure 2.4N3 Illustrative layout of a normal roundabout (left) and compact roundabout (right)	N/A	N/A	
					
2.8	Mini roundabout selection (speedP)	Mini-roundabouts shall only be used on roads with a speed limit of 30mph or less and where the 85th percentile dry weather speed of traffic is less than 35mph within a distance of 70 metres from the proposed give way line on all approaches.	Departure	N/A	
2.9	Mini roundabout exceptions and illustration	Mini-roundabouts (as illustrated in Figure 2.9) shall not be used at: 1) new junctions; 2) accesses serving or intended to serve, one or more properties, and linking directly to the site; or 3) on dual carriageways. Figure 2.9 Illustrative layout of a mini-roundabout	Departure	N/A	
					
2.9.1	Mini roundabout exception (traffic flows)	Mini-roundabouts should not be installed where traffic flows or turning proportions differ significantly between arms.	Relaxation	N/A	
2.9.2	Mini roundabout exception (u-turns)	Mini-roundabouts should not be used where there is a risk that vehicles will use them to perform U-turns.	Relaxation	N/A	
2.9.3	Mini roundabout queues	The introduction of a mini-roundabout should be assessed to check that queues created by the mini-roundabout do not adversely impact upon the operation and safety of the junction or adjoining network.	Relaxation	N/A	
2.10	Mini roundabout number of arms	Mini-roundabouts shall only have 3 or 4 arms.	Departure	N/A	
2.11	3-arm mini roundabout exception (volume)	A 3-arm mini-roundabout shall not be used where the predicted two-way annual average daily traffic flow (AADT) on any arm of a junction is below 500 vehicles a day.	Departure	N/A	

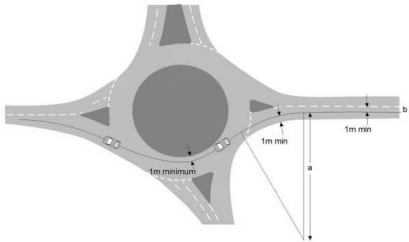
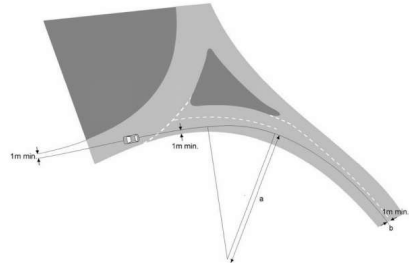
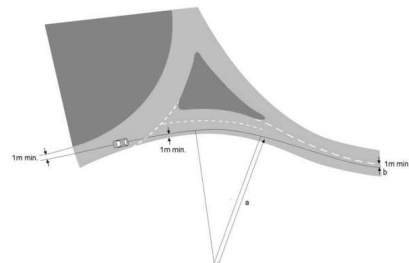
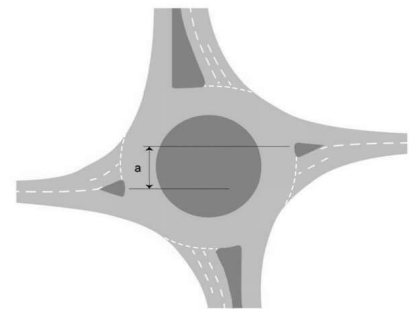
2.12	4-arm mini roundabout exception (volume)	A 4-arm mini-roundabout shall not be used where the predicted two-way annual average daily traffic flow (AADT) on any arm of a junction is below 500 vehicles a day unless the design incorporates features to encourage vehicles to give way on all approaches	Departure	N/A	
2.12.1	4-arm mini roundabout exception (volume)	A 4-arm mini-roundabout should not be used where the sum of the maximum peak hour entry flows for all arms exceeds 500 vehicles per hour.	Relaxation	N/A	
3.1	Inscribed Circle Diameter (ICD)	The inscribed circle diameter (ICD) of a roundabout shall be the diameter of the largest circle that can be inscribed within the junction kerbs. Figure 3.2 Inscribed circle diameter at a normal or compact roundabout 	Departure	Yes	ICD = 33.2m
3.3	ICD of non-circular roundabout	Where the outline of the roundabout is non-circular, two times the radius at the respective entry shall be used to calculate the corresponding ICDs, as shown in Figure 3.3. Figure 3.3 Inscribed circle diameter (2 x R) at a non-circular roundabout 	Departure	N/A	
3.5	Minimum ICD	The minimum value of the ICD for a normal or compact roundabout shall be 28 metres; this is the smallest roundabout that can accommodate the swept path of the design vehicle.	Departure	Yes	ICD = 33.2m
3.5.1	Compact roundabout maximum ICD	The ICD of a compact roundabout should not exceed 36 metres.	Relaxation	Yes	ICD = 33.2m
3.5.2	Normal roundabout maximum ICD	The ICD of a normal roundabout should not exceed 100 metres.	Relaxation	N/A	
NOTE	Excessive ICD	Large ICD can lead to excessive vehicle speeds on the circulatory carriageway	N/A	N/A	
3.6	Circulatory carriageway width	The width of the circulatory carriageway for normal or compact roundabouts shall be between 1.0 and 1.2 times the maximum entry width, excluding any overrun area.	Departure	Yes	Circulatory carriageway width = 5.4m Maximum entry width = 4.5m
NOTE	Entry width illustration	The entry width is shown on Figure 3.11. Figure 3.11 Entry width and approach half width 	N/A	N/A	
3.6.1	Circulatory carriageway shape	The circulatory carriageway of normal or compact roundabouts should be circular and of constant width.	Relaxation	Yes	Circulatory carriageway width = consistent 5.4m
NOTE	Roundabout shape	Roundabouts can be non circular due to staggered road arrangements, land constraints, to allow for dominant mainline flow capacity, and/or to cater for associated structures and slip road layouts for grade separated junctions.	N/A	N/A	
NOTE	Varying carriageway width	Varying widths of circulatory carriageways can be used to optimise safety and capacity at roundabouts where traffic flows differ widely between arms.	N/A	N/A	
3.6.3	Circulatory road markings	Dedicated lane signs and road markings may be used on the circulatory carriageway where appropriate.	N/A	N/A	
3.6.5	Unused carriageway	Where the turning proportions are such that one section of the circulatory carriageway has a relatively low flow, resulting in an unused area of carriageway, the circulatory carriageway should be reduced in width.	Relaxation	N/A	
3.6.6	Maximum carriageway width	At normal roundabouts the width of the circulatory carriageway should not exceed 15 metres.	Relaxation	N/A	
3.6.7	Number of circulatory lanes	The width of the circulatory carriageway on a normal roundabout should accommodate the number of lanes provided on entries and exits.	Relaxation	N/A	
3.6.8	Compact roundabout carriageway width	At compact roundabouts, the width of the circulatory carriageway should not exceed 6 metres, so that it is not possible for two cars to pass one another.	Relaxation	Yes	Circulatory carriageway width = 5.4m

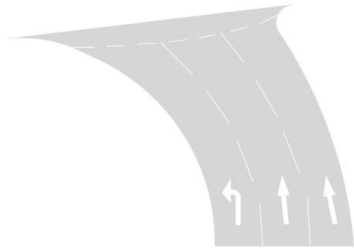
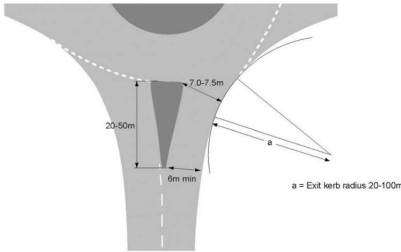
3.6.9	Reverse curve	On the circulatory carriageway, short lengths of reverse curve should be avoided between entry and adjacent exits. Figure 3.6.9N2 Three-arm roundabout illustrating reverse curvature 	Relaxation	Yes																																					
3.6.10	Circulatory lane markings	The circulatory carriageway lane markings should be designed to 1) create smooth paths around the junction for all movements; 2) maximise the use of the circulatory carriageway width wherever possible; and 3) provide a smooth link between any entry and exit markings to guide drivers safely around the junction.	Relaxation	Yes																																					
NOTE	HGV overturning	Research has shown that an articulated HGV with a centre of gravity height of 2.5 metres above the ground can overturn on a 20 metre radius bend at speeds as low as 15mph (24kph). See TRL LR788 [Ref 1.] .	N/A	N/A																																					
3.6.11	Circulatory markings visibility	The circulatory markings should be positioned so that the circulating lanes are visible from each entry to offer drivers a clearly defined position on the circulatory carriageway to which to direct their vehicle, thereby reducing potential conflict.	Relaxation	N/A	Circulatory carriageway edge denoted by change in surface / raised overrunnable surface for HGVs																																				
3.6.12	Lane direction arrows on circulatory carriageway	Lane direction arrows may be used on the circulatory carriageway.	N/A	N/A																																					
3.6.13	Lane direction arrows on circulatory carriageway	Lane direction arrows should be visible to both entering and circulating drivers.	Relaxation	N/A																																					
3.6.14	Straight ahead and right arrow markings	To facilitate better driver perception on the circulating carriageway, "straight ahead" and "right" arrows may be used to denote lanes that continue to circulate.	N/A	N/A																																					
NOTE	Use of ahead and right arrow markings	Driver's perception of what is represented by "left", "straight ahead" and "right" arrows is less clear when circulating, further guidance on the use of direction arrows is provided in TSM Chapter 5 [Ref 13.N].	N/A	N/A																																					
3.6.15	Left turn arrows prior to an exit	Lane direction arrows denoting a left turn immediately prior to an exit may be utilised and prove beneficial to signify that a lane drop around the circulatory carriageway is approaching.	N/A	N/A																																					
3.6.16	Use of route numbers / destinations	The use of route numbers and/or destinations can also assist drivers' understanding, although their use should not clutter the circulatory carriageway or make the markings unduly confusing, as may happen where destinations are seen to change between circulatory lanes.	N/A	N/A																																					
3.6.17	Spiral hatch markings	Spiral hatch markings should be provided on larger diameter normal roundabouts where the number of circulating lanes is to be varied to aid general operation.	Relaxation	N/A																																					
3.6.18	Hatch markings and vehicle paths	Spiral markings and vehicle paths through roundabouts should: 1) follow smooth flowing alignments; and 3) avoid reducing radius.	Relaxation	N/A																																					
3.6.19	Spiral marking radii	Spiral marking radii should be gradual to avoid: 1) increasing the likelihood of load shedding by HGV; or 2) causing loss of control accidents (particularly for PTW).	Relaxation	N/A																																					
3.7	Central island minimum diameter	The central island of normal and compact roundabouts shall be at least 4 metres in diameter.	Departure	Yes	Central island diameter = 14m																																				
3.7.1	Central island shape	The central island of normal and compact roundabouts should be circular.	Relaxation	Yes																																					
NOTE	Central island shape exception	The central island can be non-circular due to staggered road arrangements, land constraints, to allow for dominant mainline flow capacity, and/or to cater for associated structures and slip road layouts for grade separated junctions.	N/A	N/A																																					
3.7.2	Central island kerb	The central island of normal and compact roundabouts should be kerbed.	Relaxation	Yes																																					
3.7.3	Restriction on planting	To achieve circulatory visibility requirements, the use of planting on roundabouts within central islands of 10 metres or less should be avoided.	Relaxation	Yes	Landscaping / planting details to be provided at detailed design stage																																				
NOTE	Restriction on planting exception	As long as visibility is not restricted, planting on central islands less than 1 metre in height can help to mitigate against any see through effect, which can result in failure to give way, particularly on roundabouts with downhill approaches.	N/A	N/A																																					
3.7.4	Restriction on solid features	Solid features such as statues, trees or rocks should not be placed on the central islands of roundabouts with high speed approaches, or anywhere within the highway boundary adjacent to the roundabout where there is a high risk of collision.	Relaxation	Yes	Landscaping / planting details to be provided at detailed design stage																																				
3.7.5	Allowance for passive infrastructure	Non-passive infrastructure and landscaping may be located on the central island of urban roundabouts where there is sufficient space to do so and there are low speed approaches on all arms.	N/A	N/A																																					
3.8	Required space	A roundabout shall provide space for the turning movements of the design vehicle in accordance with Table 3.8.1N1. Figure 3.8.1N1 Turning widths required for compact or smaller normal roundabouts 	Departure	Yes	Central island diameter = 14m R1 = 8m R2 = 15.6 ICD = 33.2m																																				
		Table 3.8.1N1 Turning widths required for compact or smaller normal roundabouts <table><tr><th>Central island diameter (metres)</th><th>R1 (metres)</th><th>R2 (metres)</th><th>Minimum ICD (metres)</th></tr><tr><td>4.0</td><td>3.0</td><td>13.0</td><td>28.0</td></tr><tr><td>6.0</td><td>4.0</td><td>13.4</td><td>28.8</td></tr><tr><td>8.0</td><td>5.0</td><td>13.9</td><td>29.8</td></tr><tr><td>10.0</td><td>6.0</td><td>14.4</td><td>30.8</td></tr><tr><td>12.0</td><td>7.0</td><td>15.0</td><td>32.0</td></tr><tr><td>14.0</td><td>8.0</td><td>15.6</td><td>33.2</td></tr><tr><td>16.0</td><td>9.0</td><td>16.3</td><td>34.6</td></tr><tr><td>18.0</td><td>10.0</td><td>17.0</td><td>36.0</td></tr></table>	Central island diameter (metres)	R1 (metres)	R2 (metres)	Minimum ICD (metres)	4.0	3.0	13.0	28.0	6.0	4.0	13.4	28.8	8.0	5.0	13.9	29.8	10.0	6.0	14.4	30.8	12.0	7.0	15.0	32.0	14.0	8.0	15.6	33.2	16.0	9.0	16.3	34.6	18.0	10.0	17.0	36.0			
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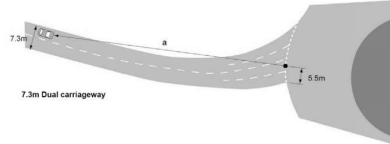
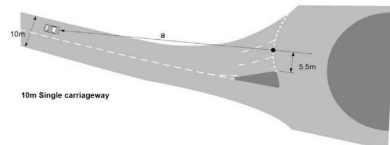
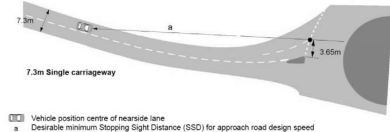
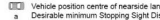
3.8.1	Overrun area	An overrun area may be necessary (Figure 3.8.1N1) to provide sufficient entry/deflection for vehicles at compact or smaller normal roundabouts while still allowing large vehicles to circulate.	N/A	N/A	
NOTE	Illustration key	An overrun area for a compact or smaller normal roundabout is illustrated in Figure 3.8.1N1, where: 1) a, is the main central island; 2) b, is the central overrun area (where provided); 3) c, is the remaining circulatory carriageway width (1.0 to 1.2 times the maximum entry width); 4) d, is the vehicle; 5) e, is the 1 metre minimum clearance from the edge of kerbing (provided on both the inside and the outside of the circulatory carriageway); 6) f, is the ICD; 7) R1, is the radius from the centre of the roundabout to the outside of the inner 1 metre clearance (e) (values for R1 can be found in Table 3.8.1N1); and 8) R2, is the radius from the centre of the roundabout to the inside of the outer 1 metre clearance (e) (values for R2 can be found in Table 3.8.1N1).	N/A	N/A	
3.8.2	Swept paths in constraints	The swept path for the design vehicle may impinge by up to 0.3 metres into either the inner or outer 1 m clearance allowance (e) as shown on Figure 3.8.1N1 of the central island where there are constraints.	N/A	N/A	
NOTE	Inner and outer clearance for low frequency design vehicles	Given the anticipated low frequency of the design vehicle, the impingement into the inner and outer clearance is not particularly significant and the dimensions in Figure 3.8.1N1 need not be increased accordingly	N/A	N/A	
3.9	Overrun dimensions	The profile dimensions for an overrun area shall be in accordance with SI 1999/1026 [Ref 7.N]. [Reproduced from SI 1999/1026: 6. Where a rumble device is constructed or maintained in a highway— (a) no vertical face of any material forming that device shall exceed 6 millimetres measured vertically from top to bottom of that face; and, (b) no part of the device shall be more than 15 millimetres above the surface of the carriageway]	Departure	Yes	
NOTE	Recommendations on overrun areas	Advice on appropriate use of overrun areas is provided in TAL 12/93 [Ref 9.N].	N/A	N/A	
3.9.1	Overrun attractiveness to a car	The compact and normal roundabout overrun area should be capable of being mounted by the trailers of a HGV, but be unattractive to cars e.g. by having a slope and/or a textured surface.	Relaxation	Yes	
3.9.2	Overrun restriction for peds etc.	Overrun areas should not be used adjacent to walkers, cyclists and horse-riders (WCHR) crossings.	Relaxation	Yes	
3.9.3	Use of overrun near footways	Where an overrun area is used adjacent to a pedestrian crossing, the overrun areas should not resemble foot-ways or refuges in order to discourage pedestrians utilising it to cross the carriageway.	Relaxation	N/A	
3.10	Use of traffic islands	Traffic islands shall be used on each arm of a normal or compact roundabout, located and shaped so as to separate and direct traffic entering and leaving the roundabout.	Departure	Yes	
NOTE	Central reservation as a traffic island	On dual carriageway approaches to roundabouts, the central reserve acts as a traffic island separating opposing traffic flows.	N/A	N/A	
3.10.1	Traffic island kerbs	Traffic islands should be kerbed physical islands.	Relaxation	Yes	Only the eastern arm traffic island does not feature a raised kerb. This is necessary to accommodate the swept path of the worst case design vehicle.
NOTE	Traffic islands as refuge	Kerbed traffic islands can act as WCHR refuges.	N/A	N/A	
3.10.2	Siting of street furniture on islands	Signs and other street furniture which are sited on kerbed islands should be located so as not to interfere with visibility	Relaxation	Yes	Signage details to be provided at detailed design stage
3.10.3	Traffic island kerb exception	Where there is insufficient space to accommodate a kerbed island, traffic islands may consist entirely of markings.	N/A	N/A	
3.11	Entry width	The entry width shall be measured from point A at the right-hand end of the give way line along the normal to the nearside kerb where there are no road markings or hatching alongside the kerbs, as shown in Figure 3.11. 	Departure	Yes	
3.11.1	Entry width with edge lining	Where there is white edge lining or hatching the measurement should be taken between the edges of the markings closest to the running lanes rather than kerb to kerb.	Relaxation	Yes	Entry width measured from the corner of the proposed hatched overunnable area.
3.12	Maximum entry width	On a single carriageway approach to a normal roundabout, the entry width shall not exceed 10.5 metres.	Departure	N/A	
3.12.1	Compact roundabout selection	On a single-carriageway road, where predicted flows are low and increased lane width is not operationally necessary, a compact roundabout with single lane entries should be used.	Relaxation	N/A	
NOTE	TM requirement for single lane entry	The use of single lane entries can result in entry closures during planned maintenance and would be subject to an agreed traffic management plan with the Overseeing Organisation.	N/A	N/A	
3.13	Maximum entry width dual carriageway	On a dual carriageway approach to a normal roundabout, the entry width shall not exceed 15 metres.	Departure	N/A	
3.14	Give way line minimum and maximum width	Lane widths at the give way line for normal and compact roundabouts shall be no less than 3 metres and no greater than 4.5 metres.	Departure	Yes	Lane widths = 4.5m (excluding hatched overunnable area)
3.14.1	Single lane give way line width	At the give way line, a lane width value of 4.5 metres should be used at single lane entries.	Relaxation	Yes	Lane widths = 4.5m (excluding hatched overunnable area)
3.14.2	Multi lane give way line width	At the give way line, lane width values of between 3 metres and 3.5 metres should be used at multi-lane entries.	Relaxation	N/A	
3.14.3	Design vehicle use	Vehicle swept paths should be assessed using the largest design vehicle that is anticipated to use each entry lane.	Relaxation	Yes	Swept path analysis conducted with a 16.5m long HGV
3.13.4	Swept paths of multi lane entries	Vehicle swept paths should be assessed on multi-lane entries to ensure sufficient width is provided for each entry lane.	Relaxation	N/A	
3.14.5	Number of upstream lanes	No more than two lanes should be added to the number of upstream lanes on the entry to a roundabout.	Relaxation	Yes	
3.14.6	Maximum number of entry lanes	No entry should be more than four lanes wide.	Relaxation	Yes	
3.14.7	Entry flare minimum lane width	Where entry flaring is provided, lane markings indicating the tapered lanes should only be provided from a point where both lanes will have a minimum width of 2.5 metres.	Relaxation	N/A	
3.14.8	No short lanes on entry	When developing additional entry lanes, short offside lanes should not be used.	Relaxation	N/A	
3.15	No entry hatching near crossings	Hatching on the entry to reduce the entry width shall not be used in the controlled area of a zebra or signal controlled crossing.	Departure	N/A	
3.15.1	No entry hatching near crossings	Hatching should not be used to reduce the entry width in areas adjacent to pedestrian crossing points.	Relaxation	Yes	

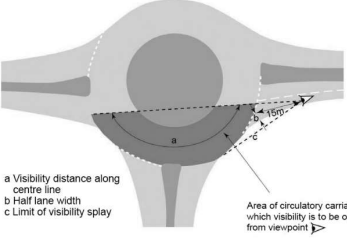
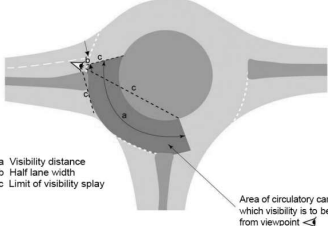
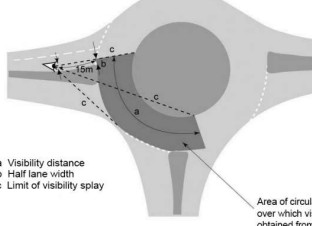
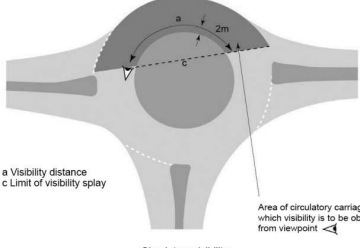
3.16	Approach half width	The approach half width shall be measured as the width of the approach carriageway, excluding any hatching, in advance of any entry flare, as shown in Figure 3.16. Figure 3.16 Entry width and approach half width 	Departure	Yes	
NOTE	Approach half width measure	The approach half width is the shortest distance between the median line, or the edge of the central reserve on dual carriageway roads, and the nearside edge of the road.	N/A	N/A	
3.16.1	Approach half width measure between markings	Where there is white edge lining or hatching, the measurement of approach half width should be taken between markings rather than kerb to kerb.	Relaxation	Yes	
3.17	Entry flare width	Entry flaring shall be measured using the average effective flare length, I' as shown on Figure 3.17. Figure 3.17 Average effective flare length 	Departure	Yes	
NOTE	Average effective flare length	The average effective flare length, I' , is the average length over which the entry widens, and is the length of the curve CF' .	N/A	N/A	
NOTE	Average effective flare length measure	The average effective flare length, I' (as illustrated in Figure 3.17) is determined following the below methodology: - construct lines AB and GH; a) AB is the entry width; b) and GH illustrates the approach half width, at a point G which is the best estimate of the start of the flare; - construct curve GD parallel to the median HA (centre line or edge of central reserve or traffic island), maintaining a distance between the two lines equivalent the approach width, v; - where AB is perpendicular to the median HA, the length of AD is to match the approach half width, v (line GH); - where AB is not perpendicular to the median HA, the length of AD will vary slightly from the approach half width. D is to be situated at the point where the line (GD) parallel to the median cuts the entry width, e, (line AB); - curve BG is formed by the design kerb line; - construct curve CF' parallel to curve BG (the nearside kerb) and at a constant distance of $\frac{1}{2}$ BD from BG, with F' being the point where CF' intersects line GD; - the length of curve CF' is the average effective flare length, I'.	N/A	N/A	
NOTE	Entry widening measure	The total length of the entry widening (BG) can be about twice the average effective flare length, I' .	N/A	N/A	
3.17.1	Minimum effective flare length	A minimum average effective flare length of 5 metres in urban areas and 25 metres in rural areas should be used, but capacity can be the determining factor for the actual length.	Relaxation	No	The effective flare length for the southern, western and northern arms exceeds 5m. The effective flare length of the eastern arm is below 5m. The appropriate flare length could be achieved by artificially narrowing the eastern arm, however it is not considered that this would result in any positive impact on highway safety. Actual vehicle traffic is proportionally low along the eastern arm.
3.17.2	Gradual entry widening	Where the design speed is high, entry widening should be developed gradually with no sudden changes in direction.	Relaxation	N/A	Speed limit to be reduced to 40mph
3.18	Entry angle	The entry angle for roundabouts shall be measured as the conflict angle, ϕ, between: - the entering and circulating traffic streams for normal roundabouts, where the arms are well separated, as shown in Figure 3.18N2; or - the entering and exiting traffic streams for compact roundabouts and normal roundabouts, where the arms are close together, as shown in Figure 3.18N3.	Departure	Yes	

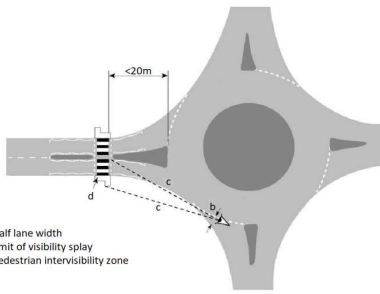
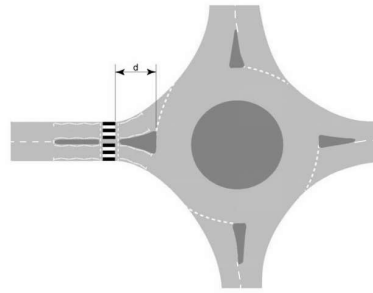
NOTE	Entry lane alignment figure	For a normal roundabout, where the arms are well separated (as illustrated in Figure 3.18N2), the entry angle is determined as the angle between the projected path of an entering vehicle and the path of a circulating vehicle, using the below methodology: 1) construct the curve EF as the locus of the midpoint between the nearside kerb and the median line (or the edge of any traffic island or central reserve); 2) construct BC as the tangent to EF at the give way line; 3) construct the curve AD as the locus of the midpoint of (the used section of) the circulatory carriageway (a proxy for the average direction of travel for traffic circulating past the arm); 4) the entry angle, ϕ, is measured as the acute angle between BC and the tangent to AD. Figure 3.18N2 Entry angle at a normal roundabout where the arms are well separated 	N/A	N/A	
NOTE	Entry lane alignment where arms are close together	For a compact roundabout or normal roundabout, where the arms are close together (as illustrated in Figure 3.18N3), the entry angle is determined as the angle between the projected path of an entering vehicle and the projected path of an exiting vehicle, using the methodology below: 1) construct line BC as in Figure 3.18N3; 2) construct the curve JK in the next exit as the locus of points midway between the nearside kerb and the median line (or the edge of any traffic island or central reserve); 3) construct the line GH as the equivalent of line BC i.e. the tangent to the curve JK at the point where JK intersects the border of the inscribed circle; 4) the lines BC and GH intersect at L; 5) the entry angle, ϕ, is half of angle HLB. ($\phi = [\text{angle HLB}]/2$. Note that if angle GLB exceeds 180 degrees, ϕ is defined as zero.) Figure 3.18N3 Entry angle at a compact or normal roundabout where the arms are close together 	N/A	N/A	
3.18.1	Entry lane alignment angle range	The entry angle should be no less than 20 degrees and no greater than 60 degrees for normal and compact roundabouts.	Relaxation	Yes	
3.18.2	Traffic island tangential kerb	Except on compact roundabouts in urban areas, the kerb line of the traffic island (or central reserve in the case of a dual carriageway) should lie on an arc which, when projected forward, meets the central island tangentially (see Figure 3.18.2). Figure 3.18.2 Example showing an arc projected forwards from the traffic island and tangential to the central island 	Relaxation	Yes	
3.19	Entry kerb radius	The entry kerb radius shall be measured as the minimum radius of curvature of the nearside kerb line over the distance from 25 metres upstream of the give way line to 10 metres downstream of it (see Figure 3.19) Figure 3.19 Entry kerb radius 	Departure	Yes	
3.19.1	Minimum entry kerb radius	The entry kerb radius should not be less than 10 metres.	Relaxation	Yes	
3.19.2	Maximum entry kerb	The entry kerb radius should not be greater than 100 metres.	Relaxation	Yes	
3.19.3	Minimum compact roundabout entry kerb for HGVs	At compact roundabouts, if the approach is intended for regular use by HGVs, the entry kerb radii should not be less than 20 metres.	Relaxation	Yes	The eastern arm features a 10m entry radius, however it is note expected that the eastern arm will be used by HGVs regularly.

3.20	Entry path radius	The entry path radius for an ahead movement at a 4-arm roundabout shall be determined as shown on Figure 3.20. Figure 3.20 Determination of entry path radius for ahead movement at a 4-arm roundabout 	Departure	Yes	
NOTE	Entry path radius measurement	The entry path radius (shown as 'a' on Figures 3.20, 3.22 and 3.23) is measured as the smallest best fit circular curve over a distance of 25 metres occurring along the approach entry path in the vicinity of the give way line, but not more than 50 metres in advance of it.	N/A	N/A	
NOTE	Commencement point	The commencement point (shown as 'b' on Figures 3.20, 3.22 and 3.23) is 50 metres in advance of the give way line and at least 1 metre from the nearside kerb or centre line (or edge of central reserve).	N/A	N/A	
3.2.1	Entry path radius for all movements	The entry path radius (or its inverse, entry path curvature) shall be measured for all turning movements at a roundabout.	Departure	Yes	
NOTE	Entry path radius safety	The entry path radius is a measure of the deflection to the left imposed on vehicles entering a roundabout. It is the most important determinant of safety at roundabouts because it governs the speed of vehicles through the junction and whether drivers are likely to give way to circulating vehicles.	N/A	N/A	
3.22	Entry path radius on left curve	The entry path radius for the left-turn movement where the approach to the roundabout curves to the left shall be determined as shown on Figure 3.22. Figure 3.22 Determination of entry path radius for the left turn where the approach curves to the left 	Departure	Yes	
	Entry path radius on right curve	The entry path radius for the left-turn movement where the approach to the roundabout curves to the right shall be determined as shown on Figure 3.23. Figure 3.23 Determination of entry path radius for the left turn where the approach curves to the right 	Departure	Yes	
3.24	Compact roundabout maximum entry path radius <40mph	At compact roundabouts in urban areas, where the speed limit is 40mph or less within 100 metres of the give way line on any approach, the entry path radius shall not exceed 70 metres.	Departure	Yes	
3.25	Compact roundabout maximum entry path radius >50mph	At compact roundabouts where the speed limit is 50mph or greater within 100 metres of the give way line on any approach, the entry path radius shall not exceed 100 metres.	Departure	N/A	Speed limit to be reduced to 40mph
3.26	Maximum entry path radius (normal roundabout)	At normal roundabouts, the entry path radius shall not exceed 100 metres.	Departure	N/A	
3.26.1	Staggered arms for entry path radius	In order to ensure that the entry path radius provides suitable deflection, the arms may be staggered as shown in Figure 3.26.1. Figure 3.26.1 Staggering of east-west arms to increase deflection 	N/A	N/A	
3.26.2	Ways to accommodate sufficient deflection	On normal and compact roundabouts, where sufficient entry deflection cannot be achieved by means of the central island alone, deflection should be generated by enlarging traffic islands or by providing a central overrun area for HGVs.	Relaxation	N/A	

3.26.3	Subsidiary deflection islands	On normal and compact roundabouts, where inadequate entry deflection is leading to operational and safety problems and it is not possible to improve deflection by increasing the size of the central island and/or extending the traffic islands, subsidiary deflection islands (SDI) may be used.	N/A	N/A	
3.26.4	Signalisation for insufficient entry deflection	On normal and compact roundabouts, where suitable entry deflection cannot be achieved, roundabout signalisation may be used to improve safety and operational effectiveness.	N/A	N/A	
3.26.5	Entry path radius measurement with overrun area	On normal and compact roundabouts, where an overrun area is provided, the entry path radius should be measured relative to the perimeter of this area rather than that of the central island.	Relaxation	Yes	
3.27	No right pointing arrows	Right pointing arrows on lane dedication signs or as markings on the road shall not be used on normal and compact roundabout approaches.	Departure	N/A	
3.27.1	Ahead arrow for right turn	Where a right-hand lane is dedicated to a specific destination, it should be associated with an ahead arrow on the approach.	Relaxation	N/A	
3.27.2	Right turn arrow in circulatory carriageway	A right pointing arrow may be used on the circulatory carriageway.	N/A	N/A	
3.27.3	All lanes road markings	Where any particular lane is dedicated to a specific destination the other lanes should also have arrow markings.	Relaxation	N/A	
3.27.4	Including directional signage	Where any particular lane is dedicated to a specific destination the road markings should be accompanied by direction signing indicating lane dedication.	Relaxation	N/A	
3.27.5	No left turn arrows on circulatory carriageway	Left turn arrows should be avoided on the circulatory carriageway.	Relaxation	N/A	
3.27.6	Entry lane markings should develop from upstream markings	Where lane direction markings have been, or are to be used on the approaches of a particular arm, then the direction markings within the entry lanes should be an extension of those markings in a logical and consistent manner, using the same designation system as those upstream (Figures 3.27.6a and 3.27.6b).	Relaxation	N/A	
		Figure 3.27.6a Example of approach markings  Figure 3.27.6b Example of entry markings 			
3.27.7	Balance queueing	Where no approach markings have been provided, then the entry markings should be designed to give an even balance of any queueing traffic over the entry lanes whilst providing a smooth path onto the roundabout.	Relaxation	N/A	
3.27.8	Position of lane markings	Approach lane markings should be positioned in advance of the give way line in a location where they are not obscured by queuing vehicles, and in a manner which balances the traffic between the approach lanes.	Relaxation	N/A	
3.28	Exit width measurement	On normal and compact roundabouts, the exit width shall be measured as the distance between the nearside kerb and the edge of the traffic island (or central reserve of a dual carriageway) where it intersects with the outer edge of the circulatory carriageway, as shown on Figure 3.28.	Departure	Yes	
		Figure 3.28 Typical single carriageway exit at a normal roundabout with a long traffic island 			
3.28.1	Additional exit lane	The exit width for normal roundabouts should accommodate one more traffic lane than is present on the link downstream.	Relaxation	N/A	
3.28.2	Normal roundabout width for single carriageway	At a normal roundabout, if the downstream link is a single carriageway road, the exit width should be between 7 metres and 7.5 metres and the exit should taper down to a minimum of 6 metres.	Relaxation	N/A	
2.28.3	Exit width taper	Where the downstream link is a single carriageway road, the exit width should reduce at a taper of 1:15 to 1:20, starting at the end of the exit from the roundabout, ensuring 6 metres at end of traffic island, to avoid exiting vehicles encroaching onto the opposing lane at the end of the traffic island.	Relaxation	Yes	
3.28.4	Normal roundabout width for dual carriageway	At a normal roundabout, if the downstream link is an all-purpose two-lane dual carriageway, the exit width should be between 10 metres and 11 metres, with the exit tapering down to two lanes wide.	Relaxation	N/A	
3.28.5	Sufficient exit lane length for merging	Where traffic is required to merge after exiting, sufficient distance should be provided from the exit to allow the merging manoeuvre to take place in a safe and efficient manner.	Relaxation	N/A	
3.28.6	Spiral exit markings	Any exit line markings associated with the concentric-spiral, or spiral type of markings should be designed so as to provide a smooth exit from the circulatory carriageway.	Relaxation	N/A	
3.28.7	Permissible longer exit taper	Where the peak exit volume approaches the capacity of the downstream link, tapers longer than 1:20 may be provided.	N/A	N/A	
3.28.8	Exit width length on up gradient	Where the exit is on an up gradient, the exit width may be maintained for a short distance before tapering in.	N/A	N/A	

3.28.9	Exit width length on up gradient and curve	Where the exit road is on an up gradient combined with an alignment which bends to the left, the exit width may be maintained over a longer distance.	N/A	N/A													
3.28.10	Compact roundabout exit width	At a compact roundabout, the exit width should be similar to the entry width.	Relaxation	Yes													
3.29	Exit kerb radius key	The exit kerb radius shall be measured as shown in Figure 3.28.	Departure	Yes													
3.29.1	Exit kerb radius exceed entry radii	At normal roundabouts the exit kerb radius should exceed the largest entry radius.	Relaxation	N/A													
3.29.2	Normal roundabout exit radius	At normal roundabouts, the exit kerb radius should be 40 metres.	Relaxation	N/A													
3.29.3	Exit kerb radius where 40m not achievable	Where an exit kerb radius of 40 metres cannot be achieved, the exit kerb radius should be no less than 20 metres and no greater than 100 metres	Relaxation	N/A													
3.29.4	Larger exit kerb radius exception	A higher exit kerb radius may be used on normal roundabouts with larger ICDs on high speed roads to suit the overall junction geometry.	N/A	N/A													
3.29.5	Compact roundabout exit kerb radius	At compact roundabouts the exit kerb radius should be equal to the largest entry radius.	Relaxation	Yes													
3.29.6	Compact roundabout exit kerb radius range	At a compact roundabout, the value of the exit kerb radius should be no less than 15 metres and no greater than 20 metres.	Relaxation	Yes													
3.29.7	Larger exit kerb radius not next to ped crossings etc.	Larger values of exit radius, which lead to high exit speeds, should not be located where there are significant numbers of cyclists using the junction or where pedestrian crossing facilities are located immediately downstream.	Relaxation	N/A													
3.29.8	Exit tracking	Exits should be checked to ensure that vehicle paths are smooth and vehicles are not directed towards traffic islands.	Relaxation	Yes													
3.29.9	Traffic island end tangent to centre line	On an exit, traffic islands should end at a tangent (or, at least, parallel) to the centre line and be long enough to prevent an exiting vehicle from crossing the centre line into oncoming traffic.	Relaxation	Yes													
3.36	Visibility measurement (SSD)	Visibility shall be measured in accordance with the envelope of visibility for measurement of stopping sight distance (SSD) in CD 109 [Ref 3.N], with visibility obtainable from a driver's eye height of between 1.05 metres and 2 metres to an object height of between 0.26 metres and 2 metres, except for: 1) visibility to the right at entry; and 2) across the central island.	Departure	Yes													
NOTE	Exception for narrow obstructions	Isolated objects less than 550mm wide such as lighting columns, sign supports or bridge columns are acceptable.	N/A	N/A													
3.37	Forward visibility on approach	On a 7.3 metres wide dual carriageway, SSD shall be measured to the position of an object at the give way line (5.5 metres from the traffic island) as shown on Figure 3.37. 	Departure	N/A													
3.38	SSD measure on 10m single carriageway	On a 10 metre wide single carriageway, SSD shall be measured to the position of an object at the give way line (5.5 metres from the edge of the traffic island) as shown on Figure 3.38. 	Departure	Yes													
3.39	SSD measure on 7.3m single carriageway	On a 7.3 metre wide single carriageway, SSD shall be measured to the position of an object at the give way line (3.65 metres from the edge of the traffic island) as shown on Figure 3.39.  	Departure	Yes													
3.40	Visibility length	Visibility on the approach, 'a', to the roundabout shall conform to CD 109 [Ref 3.N].	Departure														
NOTE	Visibility key	Visibility on the approach, 'a' shown on Figures 3.37, 3.38 and 3.39, is the desirable minimum SSD for the design speed of the road.	N/A	N/A													
NOTE	Approach visibility position	The visibility on the approach is measured from a vehicle position in the centre of the nearside lane, measured from the centre of the lane as shown on Figures 3.37, 3.38 and 3.39.	N/A	N/A													
3.41	Visibility of chevron signs	Where chevron signs are located on the central island, they shall be visible to approaching drivers in all lanes from a distance equal to the desirable minimum SSD measured back along the approach lanes from the give way line.	Departure	N/A													
NOTE	Approach visibility position	The desirable minimum SSD is measured back from the give way line as this is the point at or before which road users need to be able to reduce speed.	N/A	N/A													
3.43	Horizontal visibility requirement	Drivers of all vehicles approaching the roundabout shall be able to see objects of height between 0.26 metres and 2 metres on the full width of the circulatory carriageway, from the centre of the nearside lane at a distance of 15 metres back from the give way line, for the visibility distance as shown in Table 3.43. <table><tr><th colspan="2">Table 3.43 Visibility distances required along the centre of the circulatory carriageway</th></tr><tr><th>ICD (m)</th><th>Visibility distance (m) ('a' in Figures)</th></tr><tr><td>< 40</td><td>Whole junction</td></tr><tr><td>40 - 60</td><td>40</td></tr><tr><td>> 60 - 100</td><td>50</td></tr><tr><td>> 100</td><td>70</td></tr></table>	Table 3.43 Visibility distances required along the centre of the circulatory carriageway		ICD (m)	Visibility distance (m) ('a' in Figures)	< 40	Whole junction	40 - 60	40	> 60 - 100	50	> 100	70	Departure	Yes	
Table 3.43 Visibility distances required along the centre of the circulatory carriageway																	
ICD (m)	Visibility distance (m) ('a' in Figures)																
< 40	Whole junction																
40 - 60	40																
> 60 - 100	50																
> 100	70																

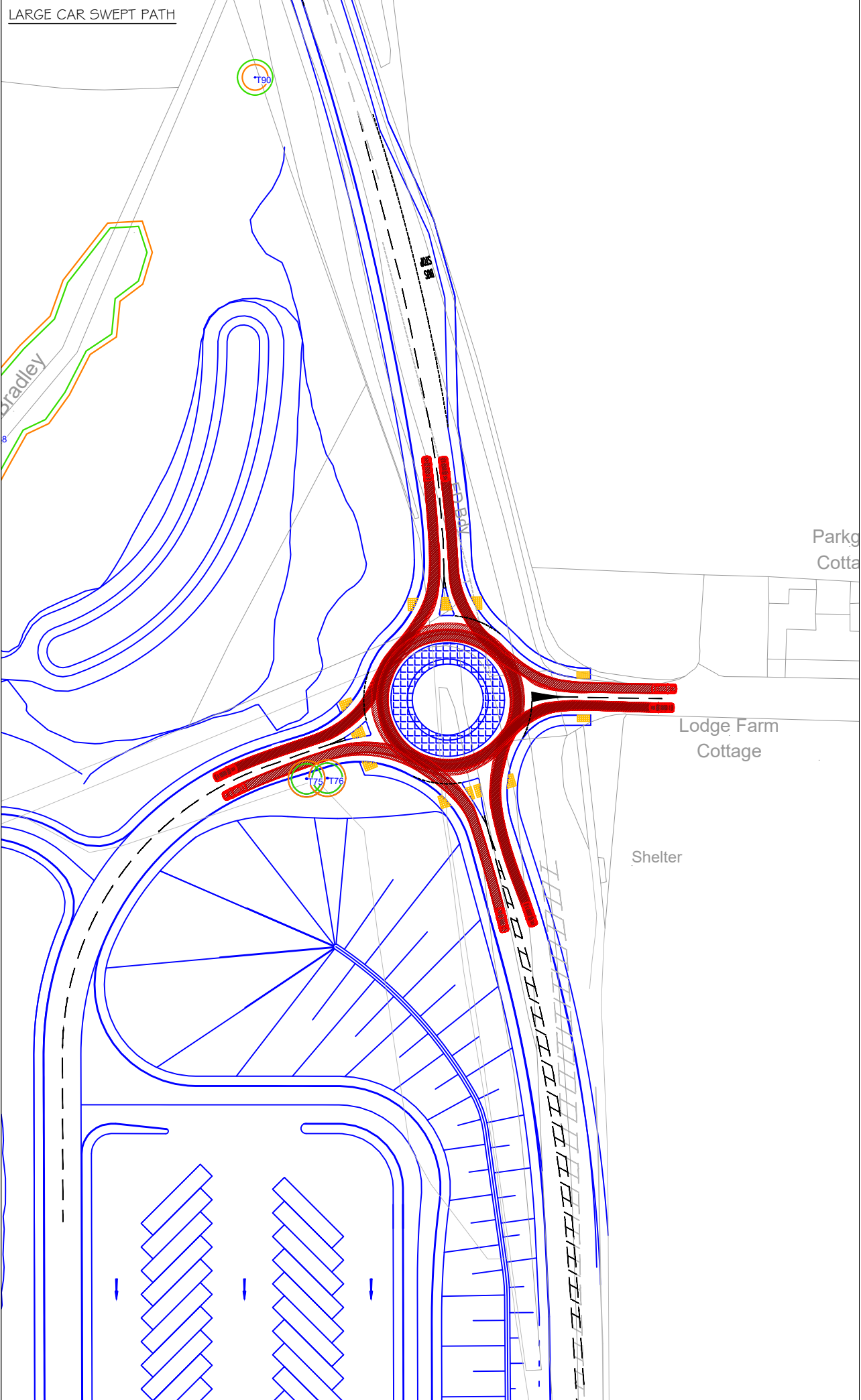
NOTE	Forward visibility illustration	The visibility distance is given in Table 3.43 is measured along the centre of the circulatory carriageway as shown in Figure 3.43N. Figure 3.43N Forward visibility measured at entry  a Visibility distance along centre line b Half lane width c Limit of visibility splay Area of circulatory carriageway over which visibility is to be obtained from viewpoint	N/A	N/A	
3.44	Visibility to the right	For visibility to the right, the envelope of visibility shall be obtainable from a driver's eye height of between 1.05 metres and 2 metres to an object height of between 1.05 metres and 2 metres.	Departure	Yes	
3.45	Visibility to the right illustration	Drivers of all vehicles approaching the roundabout shall be able to see the full width of the circulatory carriageway to their right, from the centre of the offside lane at the give way line, for the visibility distance provided in Table 3.43 and as shown in Figure 3.45. Figure 3.45 Visibility to right along circulatory carriageway measured at entry (from give way line)  a Visibility distance b Half lane width c Limit of visibility splay Area of circulatory carriageway over which visibility is to be obtained from viewpoint	Departure	Yes	
3.45.1	Visibility screening	To reduce excessive approach speeds on dual carriageway approaches, visibility to the right may be limited by screening the vehicle until it is within 15 metres of the give way line.	N/A	N/A	
3.45.2	Screening height	Screening provided to reduce the visibility to the right should be at least 2 metres high in order to block the view of all road users.	Relaxation	N/A	
3.46	Visibility measurement to the right	Visibility to the right shall conform to Table 3.43 and be measured from the centre of the offside lane at a distance of 15 metres back from the give way line, as shown in Figure 3.46. Figure 3.46 Visibility to right along circulatory carriageway measured at 15 metres in advance of give way line  a Visibility distance b Half lane width c Limit of visibility splay Area of circulatory carriageway over which visibility is to be obtained from viewpoint	Departure	Yes	
3.47	Circulatory visibility	For circulatory visibility, the envelope of visibility shall be obtainable from a driver's eye height of between 1.05 metres and 2 metres to an object height of between 1.05 metres and 2 metres.	Departure	Yes	
3.48	Circulatory visibility illustration	This visibility shall be checked at a distance of 2 metres in from the central island, as shown in Figure 3.48. Figure 3.48 Circulatory visibility measurement  a Visibility distance b Half lane width c Limit of visibility splay Area of circulatory carriageway over which visibility is to be obtained from viewpoint Circulatory visibility	Departure	Yes	
3.49	Visibility full width of circulatory carriageway	Drivers on the circulatory carriageway shall be able to see the full width of the circulatory carriageway ahead of them for the visibility distance given in Table 3.43.	Departure	Yes	
3.49.1	Height of outerh 2m of central island	At least the outer 2 metres of the central island should be hard standing or planted with grass or similar low level vegetation to prevent visibility issues occurring.	Relaxation	Yes	
3.50	Exit visibility requirement	On the circulatory carriageway, the exit visibility shall conform to Table 3.43.	Departure	Yes	
3.51	Visibility to zebra crossing	Drivers approaching a roundabout with a zebra crossing across the entry, shall be able to see the full width of the crossing from a distance at least equal to the desirable minimum SSD for the design speed of the roundabout approach.	Departure	N/A	

3.53	Crossing visibility illustration	At the give way line, drivers shall be able to see the full width of a pedestrian crossing (whether signal-controlled, zebra or informal) across the next exit if it is within 20 metres of the give way line on that arm, as shown on Figure 3.53. Figure 3.53 Visibility measured at entry to pedestrian crossing at next exit  b Half lane width c Limit of visibility splay d Pedestrian intervisibility zone	Departure	Yes																		
3.53.1	Crossing position	Crossings should not be sited between 20 metres and 60 metres from the give way line.	Relaxation	Yes																		
8.1	Provision for peds etc.	Where there is demand or the desire to encourage pedestrians, cyclists, and / or equestrians at roundabouts, these users shall be provided for.	Departure	Yes																		
NOTE	Catering for peds off junction	Demand for pedestrians, cyclists and equestrians can be catered for off network where it is not suitable to provide facilities on or adjacent to the highway / road.	N/A	N/A																		
8.1.1	Requirements for signal controlled or grade seperated crossings	Where the speed limit within 100 metres of the give way line is greater than 40 mph on any approach, and the traffic flow on any approach is greater than 8,000 two-way AADT, any pedestrian crossing facilities provided should be either signal-controlled or grade-separated.	Relaxation	N/A	Speed limit to be reduced to 40mph																	
8.1.2	Allowance for un-controlled crossings	Where the roundabout is situated on a single carriageway with a speed limit greater than 40 mph and the traffic flow on each of the approaches is less than 8,000 two-way AADT, crossing facilities may be uncontrolled crossings.	N/A	N/A																		
8.1.3	Crossing facility selection < 40mph	Where the speed limit within 100 metres of the give way line on all approaches is less than or equal to 40 mph, Table 8.1.3 below provides suggestions on what crossing facilities may be provided for pedestrians. Table 8.1.3 Suggested pedestrian crossing facilities on roundabouts where the approach roads have a speed limit of 40 mph or less <table><tr><th>Highest class of road on any approach</th><th>Highest two-way AADT on any approach</th><th>Suggested pedestrian crossing provision</th></tr><tr><td rowspan="3">Single</td><td>< 8000</td><td>Uncontrolled</td></tr><tr><td>8000 - 12000</td><td>Uncontrolled / Zebra</td></tr><tr><td>> 12000</td><td>Zebra</td></tr><tr><td rowspan="3">Dual</td><td>< 16000</td><td>Uncontrolled / Zebra</td></tr><tr><td>16000 - 25000</td><td>Zebra / Signal-controlled</td></tr><tr><td>> 25000</td><td>Signal-controlled</td></tr></table>	Highest class of road on any approach	Highest two-way AADT on any approach	Suggested pedestrian crossing provision	Single	< 8000	Uncontrolled	8000 - 12000	Uncontrolled / Zebra	> 12000	Zebra	Dual	< 16000	Uncontrolled / Zebra	16000 - 25000	Zebra / Signal-controlled	> 25000	Signal-controlled	N/A	N/A	
Highest class of road on any approach	Highest two-way AADT on any approach	Suggested pedestrian crossing provision																				
Single	< 8000	Uncontrolled																				
	8000 - 12000	Uncontrolled / Zebra																				
	> 12000	Zebra																				
Dual	< 16000	Uncontrolled / Zebra																				
	16000 - 25000	Zebra / Signal-controlled																				
	> 25000	Signal-controlled																				
8.1.4	Location of crossings	To keep crossings short, stand-alone pedestrian crossing facilities should be outside the flared section, on normal and compact roundabouts without the provision of SLTLs or SDIs, as shown in Figure 8.1.4. Figure 8.1.4 Measurement of distance from roundabout to pedestrian crossing 	Relaxation	N/A																		
NOTE	Entry flare length key	The distance 'd' shown in Figure 8.1.4 is the entry flare length.	N/A	N/A																		
8.3	Kerbed island location	Kerbed islands provided to assist pedestrians crossing the roundabout shall be located within 20 metres of the give way line at the nearest point.	Departure	Yes																		

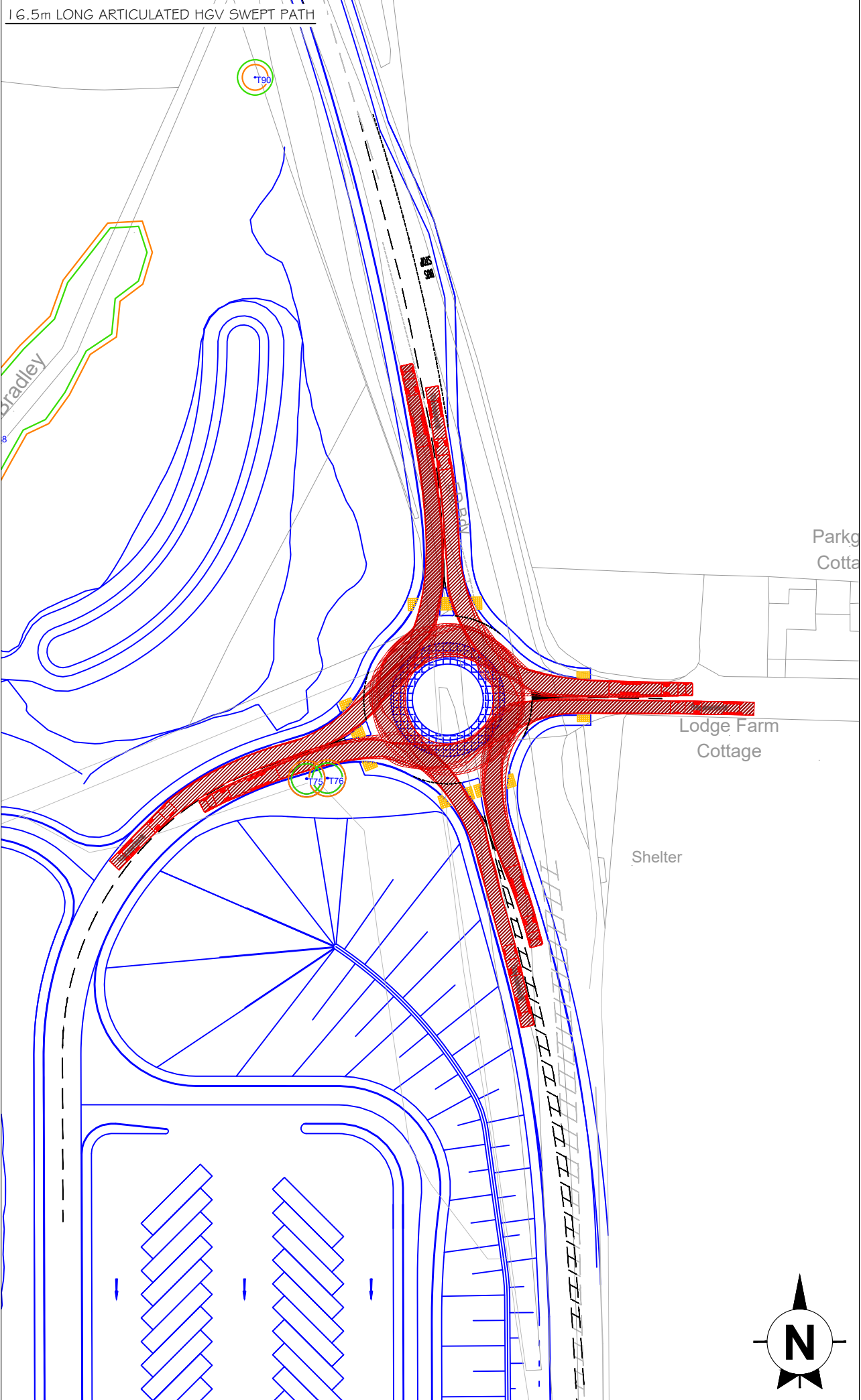
**Appendix E – Drawing No. 3046-01-
ATR01A: Proposed Roundabout Swept
Path Analysis**



LARGE CAR SWEEP PATH



16.5m LONG ARTICULATED HGV SWEEP PATH



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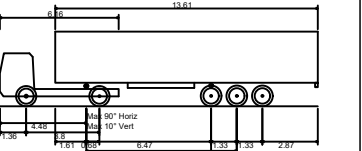
Revision History		Date
A	REVISED SITE LAYOUT	11.10.22

KEY:	PROPOSED LAYOUT
	PROPOSED ROAD MARKINGS
	EXISTING FEATURES

VEHICLES USED IN TRACKING:



Jaguar S-Type	4.939m
Overall Length	1.878m
Overall Width	1.474m
Overall Body Height	0.259m
Min Body Ground Clearance	1.544m
Max Track Width	4.00s
Lock to lock time	6.000m
Kerb to Kerb Turning Radius	



FTA Design Articulated Vehicle (1998)	16.480m
Overall Length	2.550m
Overall Width	3.870m
Overall Body Height	0.515m
Min Body Ground Clearance	2.470m
Max Track Width	3.00s
Lock to lock time	6.550m
Kerb to Kerb Turning Radius	

Client Office: Well House Barns Barton Chester CH4 8DH		South Manchester Office: Canalside House 76 Water Lane Wilmslow SK9 6BB		axis
0844 8700 007		www.axisped.co.uk		
client: KRONOSPAN				
project: KRONOSPAN NORTHERN INFRASTRUCTURE				
drawing title: PROPOSED ROUNDABOUT SWEEP PATH ANALYSIS				
date: 29.05.22		drawn by:		checked:
drawing number:		JW		LK
3046-01-ATRO1		status:		PRELIM
scale(s): 1:1000@A3		rev:		A
planning environment design				