1.0 Executive Summary

1.1 This Technical Note has been prepared by David Tucker Associates (DTA) on behalf of Albion Land, the promotors of Catalyst Bicester within the Bicester 10 employment allocation and adjacent land.

1.2 Over a 20-month period of liaison the access roundabout design has been subject to refinement taking on board comments made by OCC. Throughout the design process, the design has reflected the north-south National Cycle Network designation on Wendlebury Road.

1.3 The design comprises single lane entries to allow cyclists to position themselves on carriageway whilst discouraging drivers to attempt to pass. It is as compact as vehicular swept path movements of HGVs will allow.

1.4 The adjacent section of Wendlebury Road to the north will be enhanced with an extensive off carriageway footway/cycleway linking into the wider Bicester off carriageway cycle network. The roundabout design provides a convenient, safe cohesive strategy to link into this facility.

1.5 Very late in the process, OCC introduced a request for a radical overhaul of the design. DTA have considered that request in significant detail. The design was further refined to introduce further elements of cycle infrastructure where those features could be delivered without contradicting independent safety advisor input and without adversely affecting technical design standards compliance and hence jeopardising technical approval at the S278 stage. The design is therefore considered to be safe and convenient for cyclists who favour travelling on-carriageway and those who favour travelling off-carriageway.

1.6 There remain a number of key differences as summarised in **Table 1** below. Issues have been colour coded (green – acceptable; amber – potentially capable of being acceptable; red – fundamentally not acceptable) to 'traffic light' areas of concern.

1.7 The site access roundabout design proposal complies with relevant technical design standards. There is no hindrance to technical approval via the S278 process being secured. The design has been subject to an independent safety audit. It fully meets the NPPF requirements of the development proposal. It will provide betterment for the local area, including the NCN route. In so doing it provides a safe and convenient design for non-car users, with extensive facilities for cyclists, whilst respecting the function of the junction to provide access to a proposed Business Park covered by a Local Plan Allocation for employees and deliveries.

Table 1 Comparison of roundabout design elements

	DTA Design	Full 'Dutch' Roundabout
Demand		
Pedestrian Cycle Vehicular	Appropriate Appropriate Appropriate	Too low to be suitable Too low to be suitable Appropriate
Convenience		
Pedestrian Cycle Vehicular	Desireline accommodated Desireline accommodated Desireline accommodated	Desireline accommodated Desireline accommodated Desireline accommodated
Legibility		
Pedestrian Cycle Vehicular	Familiar Familiar Familiar	Unfamiliar Unfamiliar Unfamiliar/incongruous in setting
Safety		
Independent Review	Deemed suitable	Deemed unsuitable
Management of Road User Conflict		
Pedestrian – vehicle interaction Cycle – vehicle interaction	Technical standards achieved for links and crossings on all desirelines Technical standards achieved for all links, crossings and on-carriageway desirelines	Crossing reliant on behaviour change of drivers Crossing reliant on widespread behavioural change of drivers
Regulatory and technical compliance		
CD116 (DMRB) CD195 (DMRB) Traffic Signs Manual (TSRDG)	Yes Yes Yes	Incorporates design elements not covered by technical guidance Yes Would require DfT authorisation
Guidance		
OCC Guidance	Yes	Yes
Cost		
Construction	Equivalent to alternative	Equivalent to DTA design
Business Park Access Functionality		
How HGVs are accommodated by the design	Appropriate	Incongruous
Deliverability		
Technical approval	Yes	Without precedent for OCC. Subject to extremely protracted post planning discussion. Outcome uncertain.

2.0 Introduction

2.1 This Technical Note has been prepared by David Tucker Associates (DTA) on behalf of Albion Land, the promotors of Catalyst Bicester within the Bicester 10 employment allocation and adjacent land. The development comprises employment and leisure components. To date DTA has undertaken the preliminary access designs, the appraisal of the transport implications of the development, as reported in the Transport Assessment, and developed the on-going Travel Plan framework for management and promotion of sustainable travel by end users on the site.

2.2 The employment part of the site will be served from a new roundabout junction on Wendlebury Road. A design for this roundabout fully compliant with prevailing technical guidance and regulations was submitted as part of the planning application. This small roundabout was further developed in response to OCC feedback that further prioritisation for cyclists should be provided. The amended compact geometry provides a dedicated cycle link on the NCN51 movements in both northbound and southbound directions.

2.3 This note responds to the assertion by Oxfordshire County Council (OCC) that the site access still fails to meet the required design principles with respect to providing for cyclists in the context of the climate emergency.

2.4 OCC has a Cycling Design Guidance (2017) which sets out a vision but is extremely limited in terms of technical details. Whilst it is understood that OCC would like to push the design further than covered by current UK design standards, guidance and evidence, indeed introduce elements which are ruled out on safety grounds, OCC has not offered any technical evidence to support this position. This note therefore considers the technical credentials of the access roundabout now proposed from the perspective of all road users with respect to UK (as cited in the OCC Cycling Design Guidance) and international design standards and best practice guidance. It explains why the opportunities available have been fully exploited and why other options are not available or not required.

2.5 Whilst some of these options are not available now the junction has been designed to allow for changes to be made in the future by OCC/others. This could include changes to priorities at the crossings should there be a material change in context.

2.6 Overall the roundabout junction as proposed has been designed to take into account the safety, convenience and accessibility of all road users.

3.0 Background

Bicester 10

3.1 The Bicester 10 site is one of the main employment sites to balance the housing growth planned in Bicester and was allocated for B1 employment use with the Cherwell Local Plan. B1 use covers a range of employment uses including office, research and development and light industry/production.

3.2 The allocation is not in a single ownership. Bloombridge has promoted the development of Phase 1 within the Bicester 10 allocation as Bicester Gateway for B1 use and a hotel. Consent was granted with access reserved. The hotel has been subject to a reserved matters application and is currently under construction.

3.3 The Catalyst proposal envisages a focus on knowledge industries with an emphasis of research and development and light industry/production. The proposals also include a Health and Racquets Club (David Lloyd – DL).

Catalyst Bicester

3.4 As set out in **Table 2** (TA, December 2019, Table 16) the site will generate around 2,500-3,000 two-way vehicle movements per day of which less than 100 vehicles would be heavy goods vehicles. This traffic will be split between the roundabout site access and the DL site access (simple priority junction) and will assign primarily onto Wendlebury Road north (inbound traffic to the site from Bicester/North) and the Vendee Link Road (outbound traffic and traffic from South). These reflect typical mode share and three scenarios reflect the range of potential uses on the site and a sensitivity test requested by OCC to reflect a higher car mode share (in light of the high cycle mode share in the proxy sites).

Table 2 Scenario 4 Trip Generation (garden gate)

Science Park	All vehicles			OGV		
	Arrive	Depart	Total	Arrive	Depart	Total
AM Peak (08:00 – 09:00)	260	70	330	0	0	1
PM Peak (17:00-18:00)	94	192	286	0	0	0
12 Hour (07:00 – 19:00)	1192	1173	2365	5	4	10
Science Park (sensitivity)	**All vehicles**			**OGV**		
	Arrive	Depart	Total	Arrive	Depart	Total
AM Peak (08:00 – 09:00)	283	73	355	0	0	1
PM Peak (17:00-18:00)	95	207	302	0	0	0
12 Hour (07:00 – 19:00)	1243	1223	2466	5	4	11
Knowledge Industry	**All vehicles**			**OGV**		
	Arrive	Depart	Total	Arrive	Depart	Total
AM Peak (08:00 – 09:00)	221	65	287	4	3	7
PM Peak (17:00-18:00)	106	223	329	3	3	6
12 Hour (07:00 – 19:00)	1427	1449	2876	34	32	67

3.5 Typically it is assumed that walking and cycling is a convenient mode option for trips up to around 5km. This equates to a journey time of 20-30 minutes but this will vary from person to person. A pre-requisite of encouraging commuting by bicycle is the availability of local employment. The 2011 Census for the existing local employees shows a 50:50 split between origins in Bicester and outside. On this basis there is significant potential for sustainable travel modes such as walking and cycling.

3.6 If employment land does not come forward to support the housing in line with Local Plan expectations, or indeed is converted to more housing, than the rate of car based out commuting will accelerate and the potential for cycling is diminished. On this basis employment development is at best neutral in terms of net traffic on the local road network but has potential to be significantly beneficial (i.e. support a shift from car use reducing overall traffic levels).

Existing Conditions

3.7 The site is accessed from Wendlebury Road. Wendlebury Road has long since been bypassed by the A41 which runs parallel a short distance to the West. Its primary function is to provide local access to Bicester including from Wendlebury in the northbound direction only as its local junction onto the A41 is a left in left out junction. OCC plan to build a south east perimeter road (SEPR) around Bicester (funded in part by Catalyst Bicester as required by the Bicester 10 allocation). This road would create a new junction to the north of Wendlebury on the A41 providing a more direct access to Wendlebury. Therefore should the SEPR proceed then Wendlebury Road may be redundant. Traffic flow on the road is currently very low, circa 2,000 vehicles per day north of Vendee Link Road (i.e. inclusive of Bicester Avenue). To the south traffic flow is circa 1,000 vehicles per day.

3.8 The road is designated as part of National Cycle Network 51. DfT count data indicates average daily two-way bicycle movements on NCN51 (south of Wendlebury nr Weston on the Green) at 14 bicycles per day.

3.9 The road has a rural character. The road is derestricted but its alignment is poor in relation to contemporary design guidance and forward visibility is inconsistent. There are no footways on Wendlebury Road (there is a short section of narrow cycleway along the new hotel's frontage) but verges of variable widths. The road is unlit.

3.10 Further expansion of the site is not feasible: immediately to the south is a large archaeological site, the site of the ancient Roman town of Alchester; to the East is the railway line and flood plain. To the West is the A41. It is a finite area therefore and it is peri-urban context and rural character of roads on approach to the site are unlikely to change given these constraints.

3.11 Bloombridge has promoted the development of Phase 1 within the Bicester 10 allocation for B1 use and a hotel. Consent was granted with access reserved but it was anticipated that pedestrian and cycle access would be onto the A41 whilst vehicular access would be onto Wendlebury Road. To support this development the Vendee Drive Link Road approach to the A41 roundabout would be further flared and the Wendlebury Road – Vendee Drive Link Road would be amended to a mini-roundabout layout. Whilst rebalancing priorities at this location this mini-roundabout layout did not have any provision for pedestrians and cyclists, and would be non-compliant in terms of providing the minimum level of visibility required by them and

current design standards to ensure its safe operation. Notwithstanding this, given that this is a committed development, this does represent the current baseline position.

4.0 OCC guidance

4.1 Design principles would normally be fashioned into design standards and design guidance. In this regard, OCC refer to their Oxfordshire Cycling Design Standards (Summer 2017) and whilst this document articulates the vision for cycling it does not purport to be technical guidance.

> *'It is not intended to be exhaustive or to replicate detailed national or local guidance or regulations that already apply (examples include Design Manual for Roads and Bridges (DMRB) and Traffic Signs Regulations and General Directions 2016 (TSRGD)). Instead, it aims to 'sign post' to these documents.'*

4.2 The guidance sets a threshold for the provision of cycle infrastructure at 2,500 vehicles per day

> *3.1.1 No specific cycle infrastructure is required or desired on streets where traffic is light and speed is low. For the purposes of this document this is defined as where the average annual daily motor traffic flow is less than 2,500. Most residential streets fall into this category.*

4.3 No individual link in the immediate vicinity of the site exceeds this threshold. Notwithstanding this it has been agreed to provide a 3m cycle path along the eastern side of Wendlebury Road from the site access to the A41 to link with a widened facility on the A41 up to Pioneer Way. The proposals therefore exceed the expectations of the guidance.

4.4 Junction design is covered within the document on a single page

> *This guidance document does not at present aim to cover detailed design aspect of junctions. For this reason it is essential to refer to the more detailed guidance on junctions contained within these reference documents:*
>
> - *Interim Advice Note 195/16 – Cycle Traffic and the Strategic Road Network (2016) (sections 2.4, 2.6 and 2.7)*
> - *Design Guidance - Active Travel (Wales) Act 2013 (2014)*
> - *London Cycling Design Guidance (2014)*
> - *Greater Manchester Cycling Design Guidance (2014)*

4.5 These references are now largely out of date and superceded as set out within this note.

4.6 Roundabout design is covered within a single paragraph

> *Roundabouts can be particularly daunting for some cycle users, especially large multi-lane roundabouts. Approaches, exits and the geometry of roundabout should aim to cause traffic to slow down to use the roundabout and therefore reduce the risk to cycle users – roundabout entry should be radial not tangential in order to slow traffic. These aspects are covered in some of the documents listed in 3.3.2*

4.7 Whilst the PBA Transport Assessment for Phase 1 on behalf of Bloombridge envisaged a large roundabout with multi-lanes (see Figure 5 below), the original proposal for a roundabout for

the Catalyst sites was for a small roundabout with single lane entries as this better accommodates the needs for all road users. This has been further revised to adopt a compact arrangement.

4.8 All roundabout are designed to slow vehicles. A normal roundabout (designed to contemporary design guidance) achieves this by geometrically constraining the entry paths into the junction to 100m such that speeds are no greater than 30mph. This has been further tightened on the current design (DTA Drawing 19539-18c) with entry paths of 70m on the arms with enhanced cycle crossings. The entry radii have been reduced to 20m to further constrain entry speeds. Whereas it is likely that the A41 Vendee Drive roundabout is likely to be daunting to cyclists (and probably some drivers), the character and form of the access roundabout is significantly different and many of the characteristics that are highlighted above are not relevant.

4.9 Whilst the guidance is very high level OCC has significantly more experience than many highway authorities in providing cycle track priority. This was considered in detail in TRL report 462 (2000). Two locations were studied in detail in Oxford at Prestwich Place and Davanant Road. The report noted:

> A comparison between this cycle track crossing and the similar site at Prestwich Place emphasises the need for sites to have good visibility. In addition, other factors such as high vehicle flows on the major and minor roads increase interaction and reduce the perceived safety of the crossing. Prestwich Place and Davenant Road both have an alternative parallel bus lane for cyclists to use. The low flows of motor vehicles out of Prestwich Place and the good visibility for all road users encourage cyclists to use the cycle track. At Davanant Road there are more motor vehicle turning movements, a good on-road alternative route and confusion about whether vehicles will give way. Therefore, cyclists feel safer using the road.

4.10 Below are extracts from the surveys undertaken by TRL which show very different user responses to the arrangements such that the behavioural response from users is an important consideration; ultimately users will have a choice. There is no mandatory requirement for cyclists to use an off-road facility and the perceived safety of such a facility is likely to be key as to its ultimate worth.

Figure 1 Prestwich Place Demand (from TRL report 462)

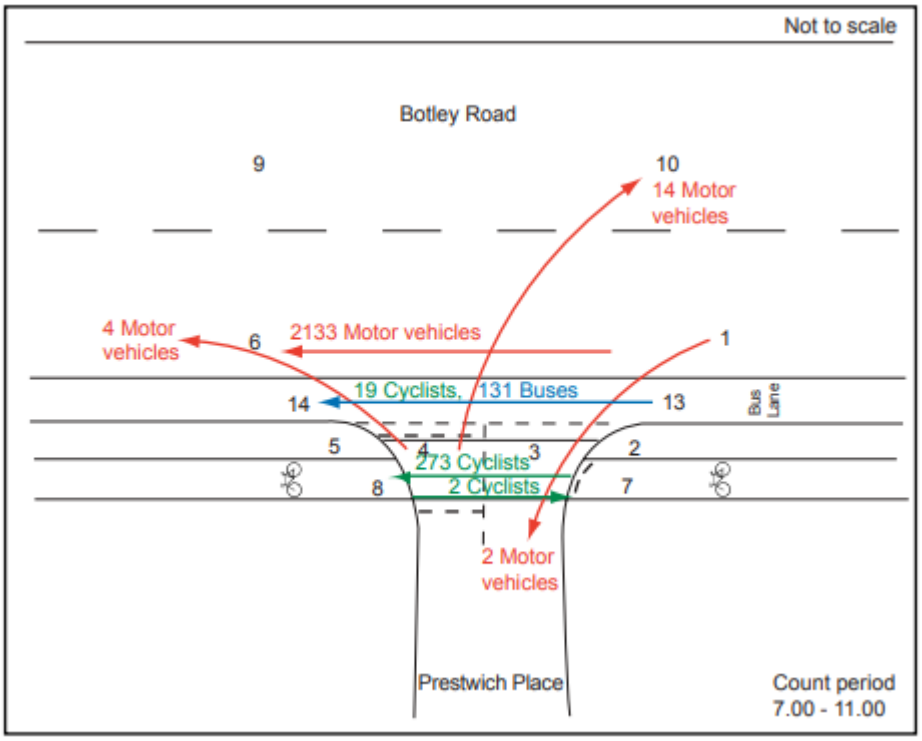
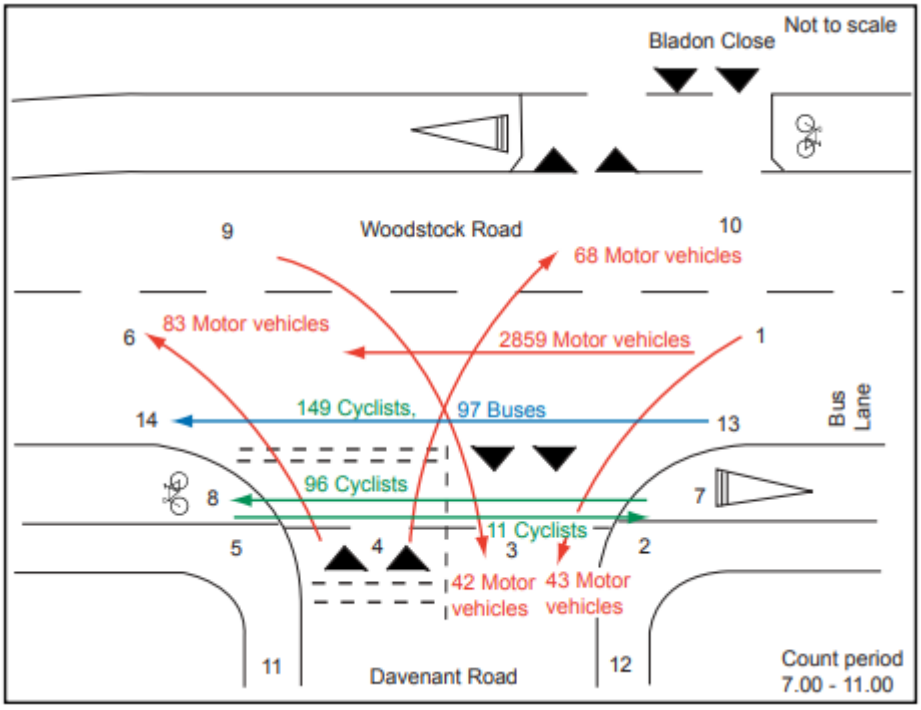


Figure 2 Davenant Road Demand (from TRL report 462)



5.0 UK Guidance

Dutch Roundabouts - UK experience

5.1 The first 'Dutch' style roundabout is currently under construction in Cambridge. There is therefore limited practical experience of the overall package of measures. There are however compact roundabouts (since 2007) and Parallel crossings (2016) albeit not yet widely adopted.

5.2 In 2013 TRL (Report reference: RPN751) undertook off street trials of a Dutch-style roundabout on behalf of TfL as part of a project to identify cycle friendly infrastructure.

Figure 3 TRL 'Dutch' roundabout

5.3 Overall the research found support from users but that there was a significant reduction in capacity. The following conclusions were reported:

1. Where sufficient road space is available the geometry used in Arm 1 (and possibly Arm 4) should be the priorities for on-road trialling, given their generally better performance in both the measured priority violations and users' perceived safety and preference in the off road trials. In addition, the full width pedestrian crossing markings (i.e. across the entrance and exit cycle track, as in Arm 1) significantly clarified priorities.

2. The layouts used for Arms 2 and 3 of the trial roundabout (particularly the entrance geometry of both and the Arm 2 exit) should not be used for on-road trials without considerable redesign, although such an approach may need further consideration where available land precludes the use of those on Arm 1 and 4.

3. Given the limitations of the off-street trials a precautionary approach would be to conduct initial on-street trials at locations where traffic flows are comparatively low (especially of HGVs) and cycle and pedestrian flows are comparatively high, so that drivers expect their presence.

4. Any trial should be accompanied by extensive publicity, including temporary road signs, and public information work, to maximise the chances that a given road user will know what to expect of the infrastructure in terms of priorities.

5. Monitoring and evaluation of the ways in which people use the infrastructure, and the ways in which they perceive it, should follow the same basic approach as used in the trials described in this report, so that issues with implementation can be identified.

6. Cycle priority reinforced on the roundabout exits by clear markings and/or signs made priorities clearer for users; users expressed a preference for further methods to highlight the cycle crossing, such as coloured surfacing and speed reduction at the crossings such as raised tables. There is evidence that Dutch "shark's teeth" markings were considered clearer than standard UK "give way" lines, and a full sized UK "give way" triangle was clearer still.

7. Visibility of cyclists circulating on the cycle track from HGV's was highlighted as a key concern which should be carefully considered. While there is a lack of research into this issue, it is noted that this type of roundabout is in use in the Netherlands.

5.4 The research clearly flags a number of design and implementation issues with respect to legibility of the arrangement and makes recommendations regard the context for real world implementation and also for supporting measures that would be appropriate.

Roundabout Design Guidance

5.5 Current UK practice for roundabout design is set out in the Design Manual for Roads and Bridges in CD116 published in 2019.

2.3 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.

2.3.1 Where the speed limit is 50mph or greater regardless of traffic flow, normal roundabouts should be provided.

2.3.2 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.

2.3.3 For roads with a posted speed limit of 40mph or below, either a compact or a normal roundabout may be provided.

5.6 OCC has confirmed that the reduction of speed limit of Wendlebury Road is considered to be appropriate. This would be required for the implementation of the Bloombridge scheme.

2.4 Compact roundabouts shall not be used at any location with a dual carriageway approach, irrespective of speed or AADT

5.7 The Bloombridge concept of changing the Vendee Link Road to a dual two lane boulevard is therefore incompatible with a compact roundabout arrangement.

2.8 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 20 CD 116 Revision 0 2. Roundabout types proposed give way line on all approaches.

NOTE 1 Traffic calming measures on the approach to a mini-roundabout can be used to reduce 85th percentile speeds to below 35mph. Advice on speed reduction measures can be found in TAL 2/05 [Ref 18.I], LTN 1/07 [Ref 4.I], SI 1999 No.1026 [Ref 7.N], and SI 1999 No.1025 [Ref 15.I].

NOTE 2 Mini-roundabouts can be inappropriate for use on routes frequently used by HGVs and buses due to difficulty in completing turning manoeuvres.

NOTE 3 Mini-roundabouts are not suitable where large volumes of cyclists, motorcyclists, or inexperienced cyclists (on routes to schools for example) are likely to use them except in conjunction with speed reduction measures.

2.9 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.

5.8 A mini-roundabout is not proposed here. Whereas a compact or a normal roundabout are designed to geometrically constrain entry speeds, mini-roundabouts are not constrained and therefore additional measures are required to constrain speeds.

3.5 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.

3.5.1 The ICD of a compact roundabout should not exceed 36 metres.

5.9 A compact roundabout should have and ICD between 28m and 36m, i.e. there is considerable overlap with a small normal roundabout.

3.6 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.

3.6.8 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.

5.10 A compact roundabout should therefore be constrained to a single circulatory lane.

<u>Cycle Design Guidance</u>

5.11 Cycle guidance is contained in the DMRB at CD195.

5.12 The design should achieve the best balance of the five design criteria set out in Table E/1.1.1.

Table E/1.1.1 Cycling design criteria

Coherence	Cycle networks link trip origins and destinations, including public transport access points and are continuous and easy to navigate.
Directness	Cycle networks serve all the main destinations and seek to offer an advantage in terms of distance and journey time.
Comfort	Infrastructure meets design standards for alignment and surface quality, and caters for all types of user, including children and disabled people.
Attractiveness	Aesthetics, noise reduction and integration with surrounding areas are important.
Safety	Cycle networks not only improve cyclists' and other road users' safety, but also their feeling of how safe the environment is (their personal security).

5.13 At E/2.1 CD195 states that: The dimensions of the cycle design vehicle shall be 2.8 metres long and 1.2 metres wide. This has been applied in the design of the splitter islands where cyclists are expected to cross. These islands are 3.0m in width.

5.14 At E/4.1 CD195 states that: 'the type of cycle crossing to be provided on links and junctions shall be in accordance with Table E/4.1 (reproduced below):

Table E/4.1 Suitable types of cycle crossing

Speed limit	Location type	Two-way traffic flow on carriageway to be crossed, AADT	Maximum number of lanes to be crossed in one movement	Preferred cycle crossing type	Other possible cycle crossing type(s) in order of preference
≥60 mph	All	Any	Any	Grade separated	No alternative
40 mph and 50 mph	All	>10000	Any	Grade separated	Signal controlled cycle crossing
		6000-10000	2 or more	Grade separated	Signal controlled cycle crossing
		0-10000	1	Uncontrolled: cycle traffic gives way	Grade separated or signal controlled cycle crossing
		0-6000	2	Uncontrolled: cycle traffic gives way	Grade separated or signal controlled cycle crossing
≤30 mph	Links	>8000	Any	Grade separated	Signal controlled cycle crossing
		0-8000	2	Parallel pedestrian/cyclist crossing	Signal controlled cycle crossing or grade separated
		0-4000	1	Uncontrolled: cycle traffic has priority	Signal controlled cycle crossing or grade separated
	Roundabout entries	>8000	Any	Grade separated	Signal controlled cycle crossing
		0-8000	2	Parallel pedestrian/cyclist crossing	Signal controlled cycle crossing or grade separated
		0-4000	1	Uncontrolled: cycle traffic gives way	Signal controlled cycle crossing or grade separated
	Roundabout exits	>8000	Any	Grade separated	Signal controlled cycle crossing
		0-8000	1	Parallel pedestrian/cyclist crossing	Signal controlled cycle crossing or grade separated
		0-4000	1	Uncontrolled: cycle traffic gives way	Signal controlled cycle crossing or grade separated

5.15 On the basis of this table the preferred cycle crossing type is uncontrolled cycle traffic gives way. Note however that the maximum number of lanes to be crossed in one movement at roundabout entry and exits is 1 lane requiring the provision of an appropriately sized splitter island.

Table E/4.1 Suitable types of cycle crossing (continued)

Speed limit	Location type	Two-way traffic flow on carriageway to be crossed, AADT	Maximum number of lanes to be crossed in one movement	Preferred cycle crossing type	Other possible cycle crossing type(s) in order of preference
≤30 mph	Side road entries	>8000	Any	Grade separated	Signal controlled cycle crossing
		0-8000	2	Parallel pedestrian/cyclist crossing	Signal controlled cycle crossing or grade separated
		0-2000	1	Uncontrolled: cycle traffic has priority	Signal controlled cycle crossing or grade separated
	Side road exits	>8000	Any	Grade separated	Signal controlled cycle crossing
		0-8000	1	Parallel pedestrian/cyclist crossing	Signal controlled cycle crossing or grade separated
		0-2000	1	Uncontrolled: cycle traffic has priority	Signal controlled cycle crossing or grade separated

5.16 For side road entries however cycle traffic should have priority.

Traffic Signs Manual (TSM) Chapter 6 (December 2019)

5.17 The TSM applies to roads with a speed limit of 40mph or under particularly in urban areas. It *'takes its lead from Manual for Streets and Manual for Streets 2 which include a hierarchy of provision putting pedestrians at the top and motor traffic at the bottom'*. The long standing advice on the provision of pedestrian and cycle crossings in LTN 1/95 and LTN 2/95 were withdrawn and replaced by revised guidance within the Traffic Signs Manual at Chapter 6 reflecting the change in emphasis in design philosophy and changes to the Traffic Regulations and General Directions 2016 (as amended) (TSRGD) that have taken place since 1995 (TSRGD requirements are mandatory unless otherwise authorised by DfT).

5.18 Within Chapter 6, crossings are addresses in Section II:

> *13.1.4 The three main objectives of any crossing should be safety, convenience and accessibility. A crossing that does not improve on all three to some degree is unlikely to satisfactory, and consideration of these criteria will form an important part of the assessment process.*

5.19 There are three main types of crossing:

- Uncontrolled or informal crossing;
- Zebra or Parallel crossing; and,
- Signal Controlled crossing.

5.20 Signal controlled crossings are not suitable in this location given that they would not enhance convenience to any road user group, i.e. all groups will incur additional delay.

5.21 Zebra crossings give priority to pedestrians on a crossing however should not be used by cyclists. Parallel crossings are relatively novel, introduced in 2016 and hence not widespread, and provide for both pedestrians and cyclists in tandem.

> *17.1.1 Where there is a need for cyclists to cross the road as well as pedestrians but a Toucan crossing is not justified, a Parallel crossing may be suitable. This consists of black and white stripes for pedestrians, as at a Zebra crossing, with a parallel route for cyclists indicated by markings to diagram 1055.3. Vehicles must*

give way to any pedestrian or cyclist on the crossing, and pedestrians and cyclists establish precedence on the crossing in the same way as at a Zebra.

5.22 There are no cycle only crossings; these are effectively crossroads. Whilst in these circumstances a parallel crossing could be used TSM states:

17.1.3 If the pedestrian and cyclist desire lines do not coincide a Parallel crossing is unlikely to be suitable. If there are large flows of cyclists but very few pedestrians a Parallel crossing may not be the best solution and a signal controlled facility using cycle only signals may be more suitable. A parallel crossing may also be unsuitable if significant numbers of cyclists are expected to turn right from the main road onto the cycle route at this point.

5.23 In discussions OCC has suggested that so long as drivers have visibility of the full width of the crossing that this would be sufficient. This presumes that cyclists will stop as the edge of carriageway and only enter the crossing if safe to do so. This is effectively how a zebra crossing works however, whilst TSM is not prescriptive in terms of visibility, it does not presume that cyclists would stop:

17.1.2 The same considerations of vehicle speed and flow apply as for Zebra crossings and a Parallel crossing should not be placed on roads with an 85%ile speed of 35mph or above with speed reducing measures. Cyclists travel faster than pedestrians, and as a Parallel crossing does not require them to stop and wait for a green signal as a Toucan does, good visibility is essential to ensure traffic can see cyclists in time to stop. Cyclists should also be able to see oncoming traffic in time to react as they have no priority over other traffic until they are on the crossing.

5.24 TSM advises that consideration should be given to the design of the cycle approaches to manage speeds:

17.2.7 Cyclists generally travel faster than pedestrians. On the approach to a Parallel crossing if the cycle route joins the crossing at or near a right angle to the main road, this may lead to cyclists entering the crossing at an inappropriate speed, which could endanger themselves and intimidate pedestrians.

17.2.8 To ensure cyclists have sufficient time to assess whether there is a large enough gap in which to cross and to allow drivers to see cyclists approaching and be ready to give way, the designer should consider how the cycle route layout can be varied to ensure cyclists do not enter the crossing too fast, for example, by deflecting the cycle route on approach. Pedestrian guard railing for this purposes should only be used as a last resort and positioned with great care, as it can create a conflict between cyclists and pedestrians.

5.25 It is understood that OCC consider this approach contrary to their guidance.

6.0 Netherlands Guidance

6.1 CROW (Center for Regulation and Research in Ground, Water and Road Construction and Traffic Technology), the organisation in the Netherlands which publishes highway design guidance, has been contacted for guidance on the design of 'Dutch' style roundabouts. They advise that 'we use the standards for inspiration not as a law' and that 'local circumstances are essential for the final design'.

6.2 The CROW guidance is however for standard roundabouts for urban situations; in rural locations such roundabouts are considered unsafe. It is understood that nearly all 'Dutch' roundabout in the Netherlands are in urban areas.

6.3 Typical geometry is as set out below:

- Inner radius (radius of inner circle): 10.5 metres
- Outer radius (radius of entire circle including traffic lanes, cycle lanes and so on): 16.00 metres (x2=inscribed circle diameter)
- Entry radius: 8.00 metres without refuge island for pedestrians; 12.00 m with island
- Exit radius: 12.00m without island; 15.00 with island
- Approach width: standard lane width; mostly 3.00 metres
- Entry width: 4.00 metres
- Circulatory roadway width: 5.50 metres
- Exit width: 4.50 metres
- Departure width: standard lane width: mostly 3.00 metres
- Apron width: 1.50 metres

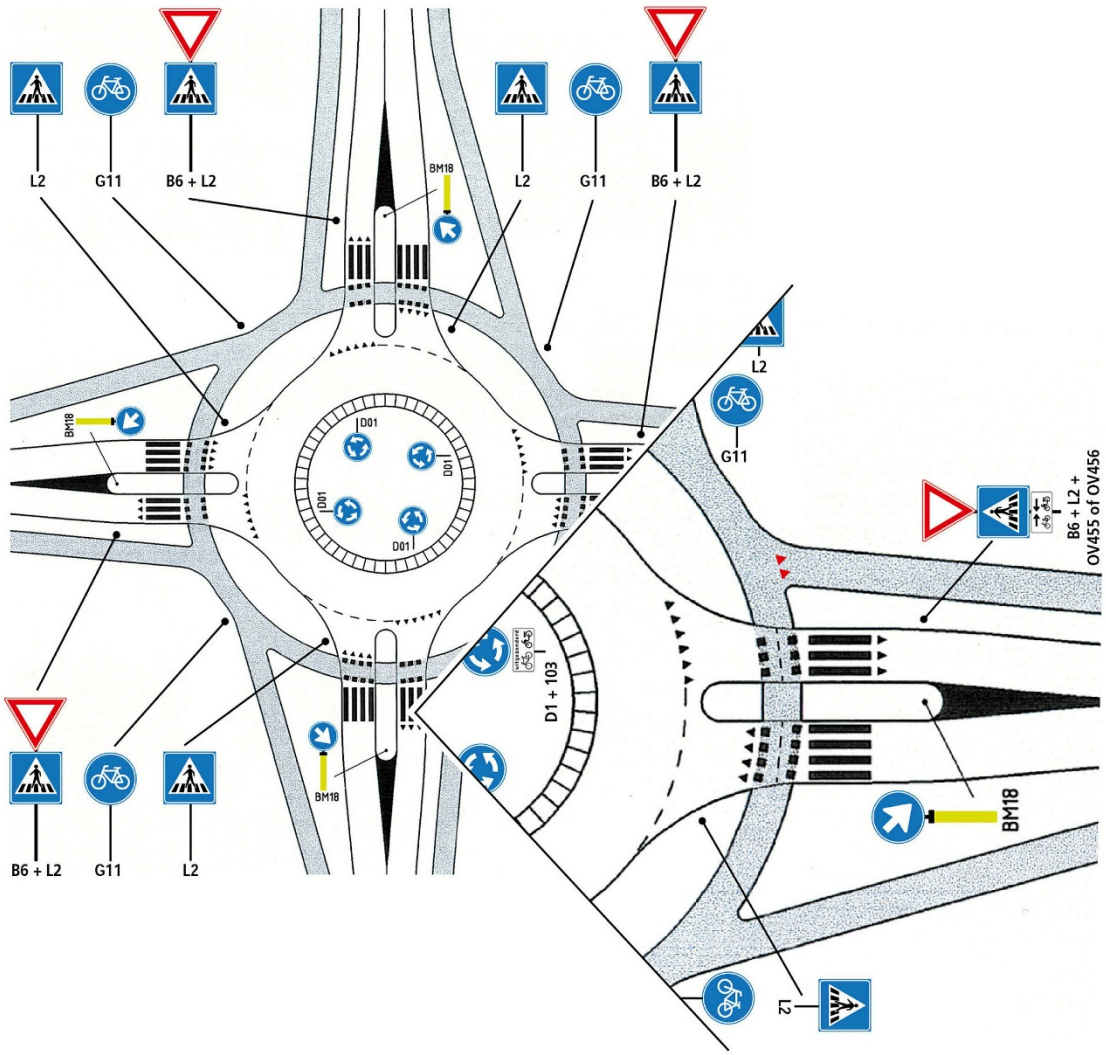
6.4 The above parameters are not significantly different from the roundabout geometry proposed and the variations are largely due to the requirements to be able to physically accommodate a UK maximum legal articulated lorry as will require access to the employment area. The circulatory comprises the carriageway plus an apron with a combined width of 7m.

6.5 UK guidance allows a circulatory of 6m, an apron at 1m plus 1m offsets to kerbs (i.e. effectively widening the inner apron to 2m). Note the UK roundabouts drain towards the centre rather than outwards which has implications for the construction and maintenance of the junction if directly transposed.

6.6 The standard width of an industrial estate road is 7.3m hence wider approach and departure widths. The entry and exit radii are also marginally larger again in line with CD116 requirements.

6.7 **Figure 1** below shows the typical configuration where parallel crossings are provided on all arms. Whereas the OCC guidance seeks to differentiate between tangential and radial arms at this scale of roundabout the differences are small.

Figure 4 Configuration of a 'dutch' roundabout



7.0 Development of Design

Pattern of Demand

7.1 The busiest arm of the junction will be the Vendee Drive Link Road which will carry up to 4,000 vpd (in practice this is likely to be circa 3,500 vpd as inbound traffic from Bicester is likely to use the Wendlebury Road junction). Wendlebury Road North is likely to be second busiest at around 2,000-3,000 vpd. The site access and Wendlebury Road South are both liked to carry circa 1,000-1,500 vpd.

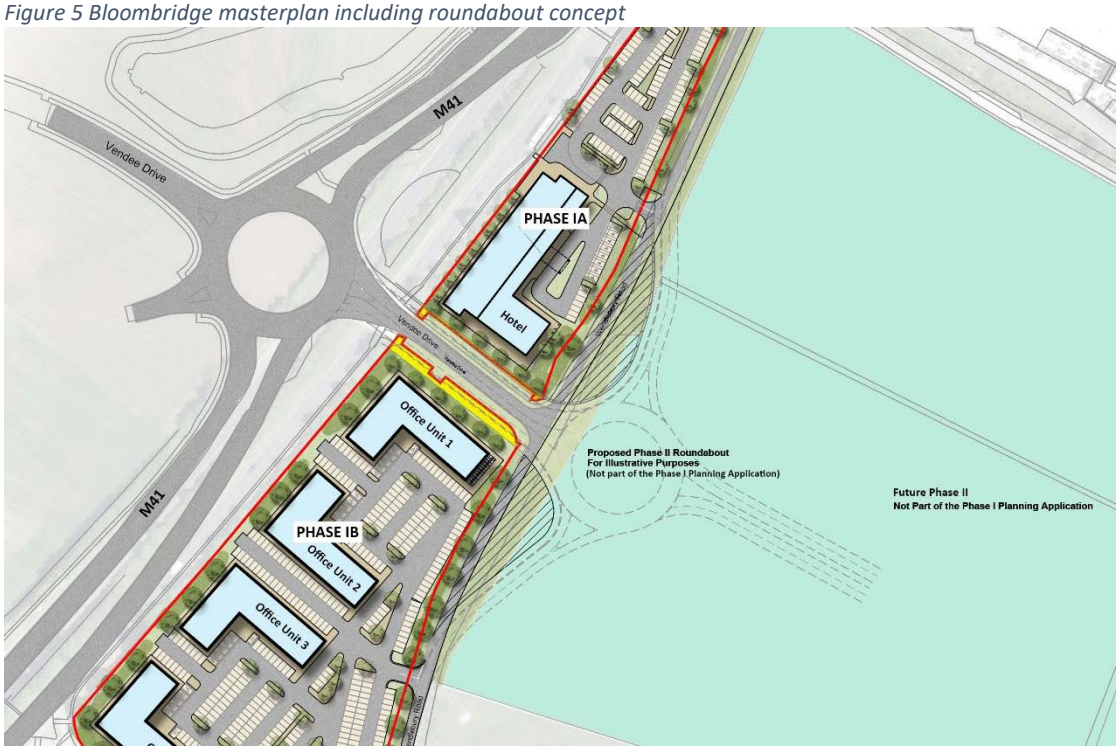
7.2 In terms of cycle demand, the available data on the demand on NCN51 suggests that this is limited south of Wendlebury (currently less than 20 cyclists per day). There is likely to be, or potentially is more demand between Wendlebury and Bicester although the quality of the route in a holistic sense is poor. The road alignment is poor, the road condition is poor, the speed limit is high and it is unlit.

7.3 The majority of the demand to the site is therefore to and from the north both in terms of traffic from Bicester and from Kingsmere. The latter are highly likely to use the Pioneer Way crossing to route to the south, not just due to the natural desire line, but also when comparing the enhanced Wendlebury Road (NCN) route to the deficiencies of the A41/Vendee Drive roundabout in catering for cyclist safety.

Scheme Development

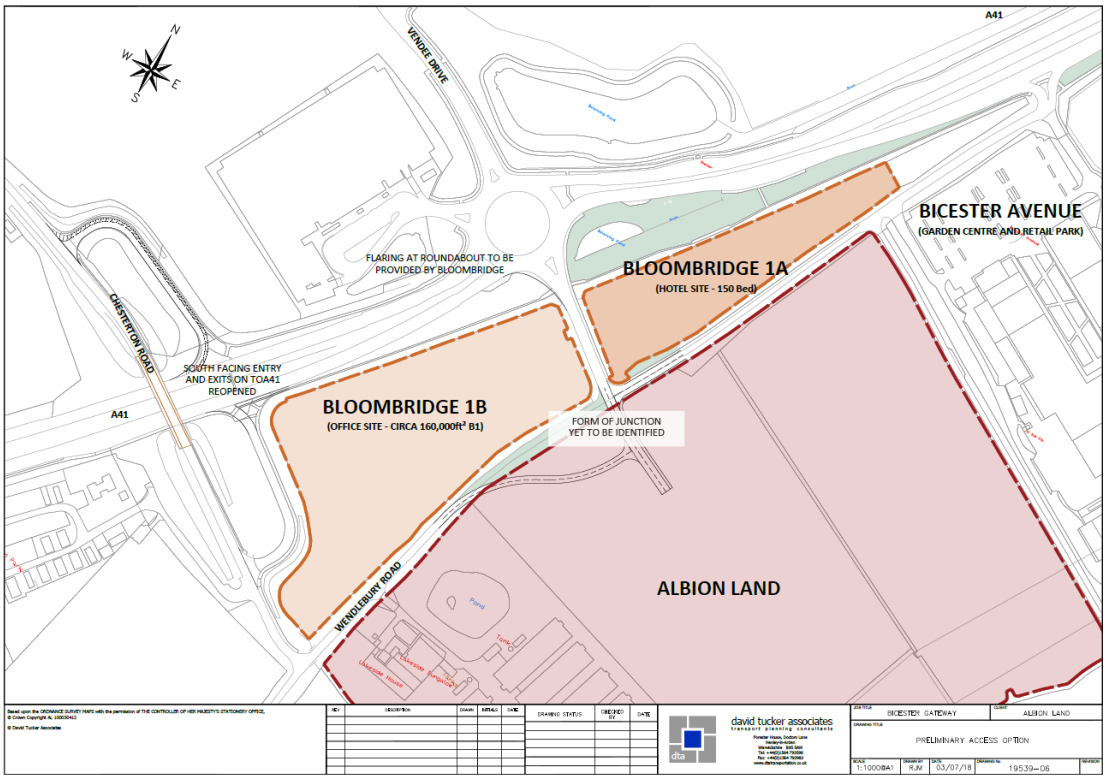
7.4 Bloombridge included an indicative sketch of how the site could come forward to demonstrate that their access strategy would be consistent with the wider allocation. This was prepared without discussions with Albion Land and was not however assessed in the context of the overall travel demand.

Figure 5 Bloombridge masterplan including roundabout concept



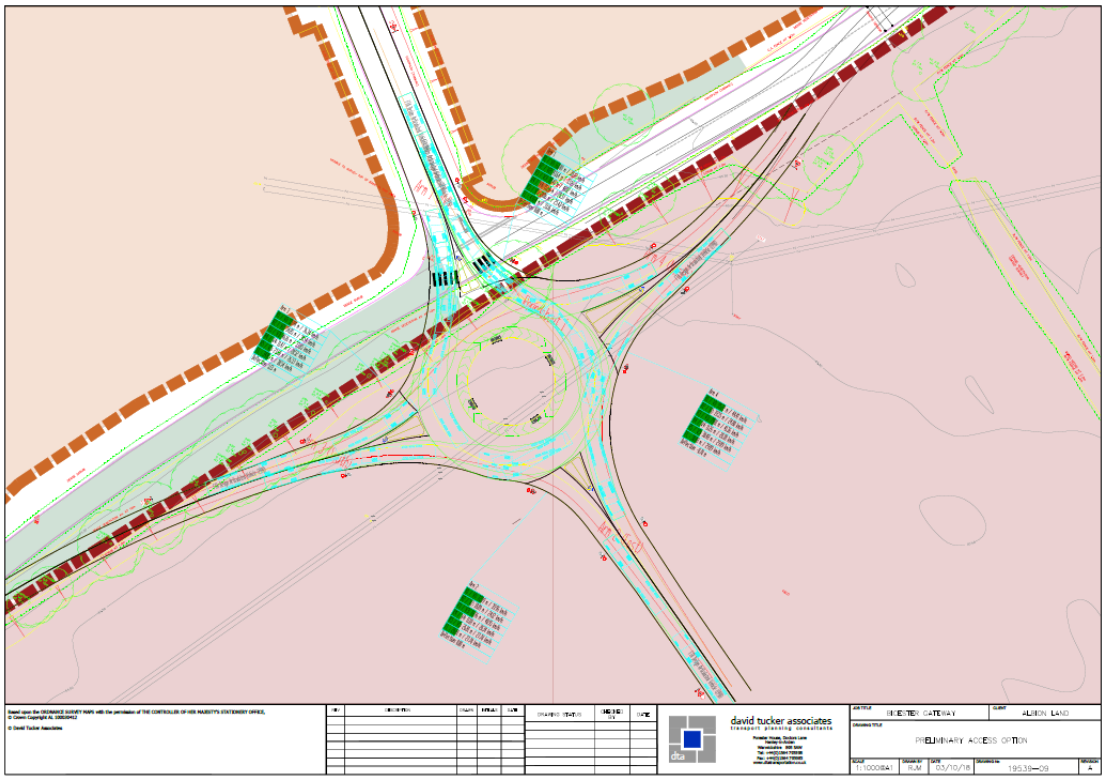
7.5 Pre-application advice was sought from OCC early in the project to understand whether by allowing Bloombridge to promote part of the allocation without considering the implications of the full allocation, whether the site had been constrained. At this stage a number of solutions had been put forward by DTA in July 2018 including options to effectively downgrade Wendlebury Road to pre-empt concerns from adjacent communities about the potential for rat-running.

Figure 6 Early concept sketch



7.6 The feedback at this stage was however that both CDC and OCC considered that a roundabout would be most appropriate to act as a gateway into the site; i.e. it would have a place making function. This was adopted in emerging schemes from November 2018.

Figure 7 Preliminary roundabout option



7.7 In developing the design for the roundabout, mindful of the presence of the National Cycle Route designation on Wendlebury Road, the roundabout was developed as a small normal roundabout with single lane entries in full accordance with the guidance in the Design Manual for Roads and Bridges. At this stage it was not considered necessary to provide dedicated provision for cyclists given the limited existing cycle infrastructure in place. Notwithstanding this the roundabout was designed with single lane entries and exits and a relatively narrow circulatory carriageway constrained in width to the design vehicles that will require access into and out of the allocation. The roundabout was therefore designed to allow cyclists to appropriately position themselves within the carriageway whilst discouraging drivers from attempting to pass.

7.8 The OCC pre-application response 10th December 2018 did not comment on the detail of the proposed roundabout geometry but commented on NCN51:

> *Although provision has been provided for those walking immediately out and into the site, the application needs to provide continuous pedestrian facilities/routes from the existing highway preferably the A41. Wendlebury Road is a Sustrans cycle route (NCN51) and consideration will need to be given to how the development proposals would tie into the existing cycle and pedestrian infrastructure without compromising safety and operation of the NCN51. I suggest that the application considers a cycle infrastructure provision along the site frontage to mitigate for increased traffic.*

7.9 The design submitted with the application in August 2019 envisaged a small roundabout with a 36m ICD capable of supporting either normal roundabout geometry or compact roundabout geometry (Figure 6). A normal roundabout layout is mandatory (CD116 Para 2.3) where the speed limit is 50mph or greater and traffic levels are greater than 8,000 two-way AADT on any approach. Here the Wendlebury Road is derestricted. Where flows are less than 8,000 two-way AADT a compact geometry may be provided. The future post development flows in this location will be significantly lower than this.

7.10 Within the OCC application consultation response (dated 23rd October 2019 although received later) and within a meeting with OCC/CDC on 13th December 2019, the only requirement suggested by the highway authority was the extension of the cycle lane on the site frontage to the south. Whilst this was contrary to the independent safety auditor's view, this was nevertheless incorporated in a revised design (Figure 7) presented within the Revised TA dated 24th December 2019 and formally submitted in early January 2020.

Figure 8 Initial TA arrangement

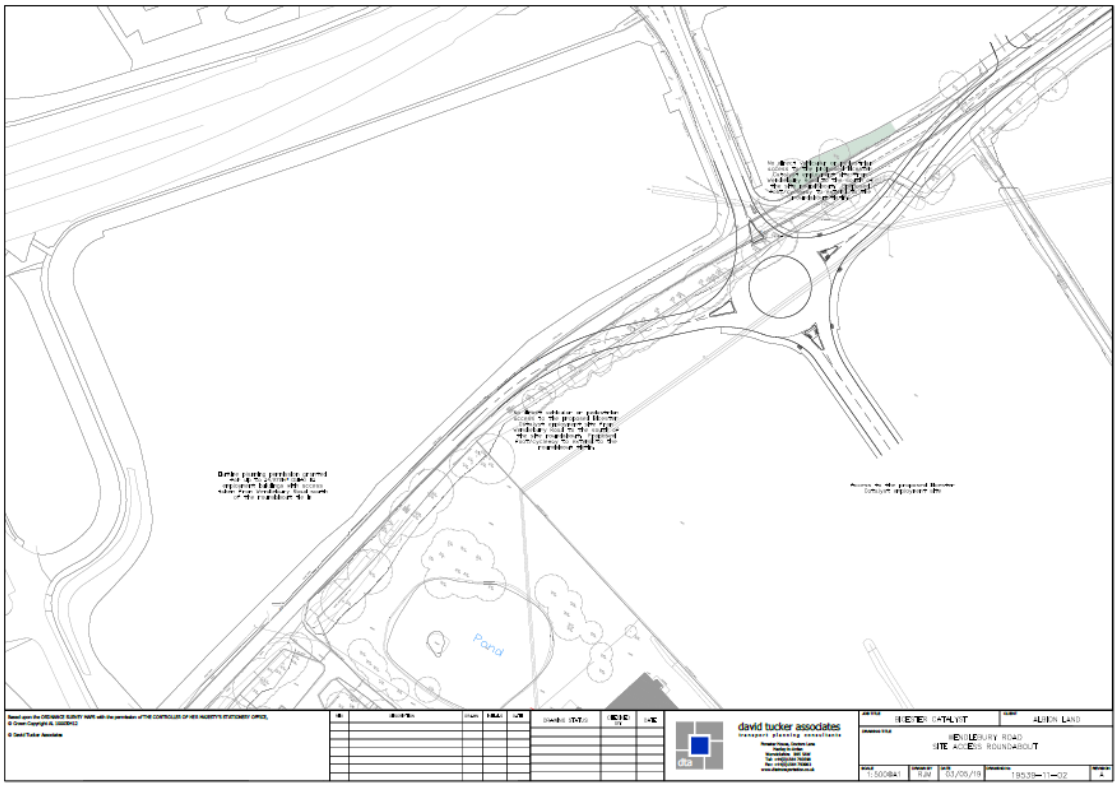
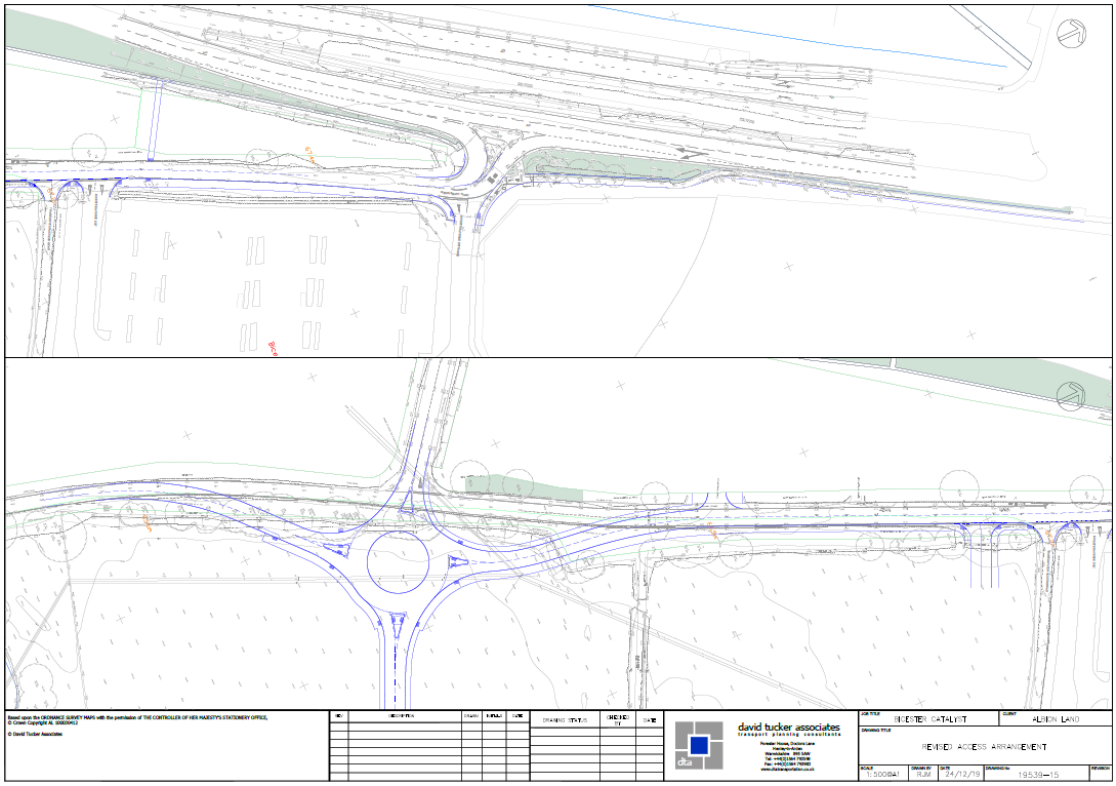


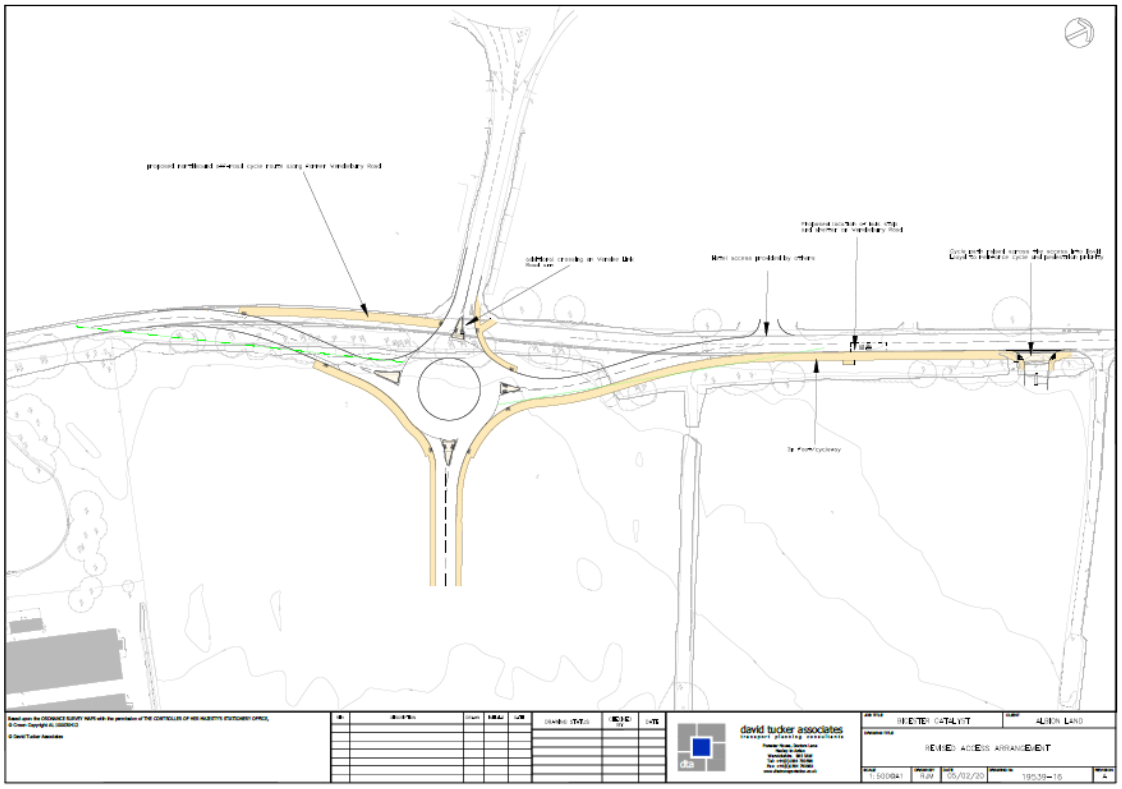
Figure 9 Updated TA arrangement with foot/cycleway



7.11 In late January/early February 2020, at the request of OCC a cycle route on the western side of the junction was reintroduced, i.e. the existing alignment of Wendlebury Road could be

retained and repurposed for cyclists. This would require careful detailing of the crossing of the western arm. This was formally submitted on 12th February 2020 (see Figure 8).

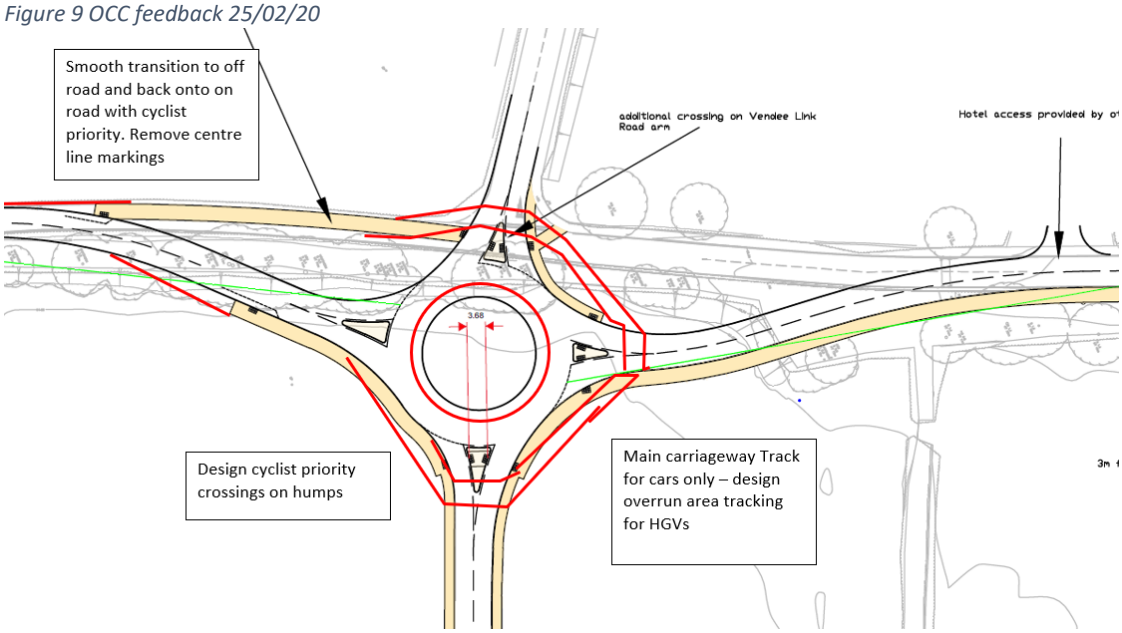
Figure 10 Design submitted 12/2/20



7.12 On 18th February 2020, (20 months after liaison started and within 1-2 weeks of their previous set of requests, which had been labelled by them as being "final") OCC for the first time introduced design requests based on a radically different approach. They provided feedback on the above arrangement noting that the northbound cyclist would be expected to give way 4 times to access the employment site, whereas on road the cyclist would give way just once. In practice it was assumed that a northbound cyclist would cross into the site to the south of the roundabout i.e. also only give way to the modest southbound Wendlebury Road traffic.

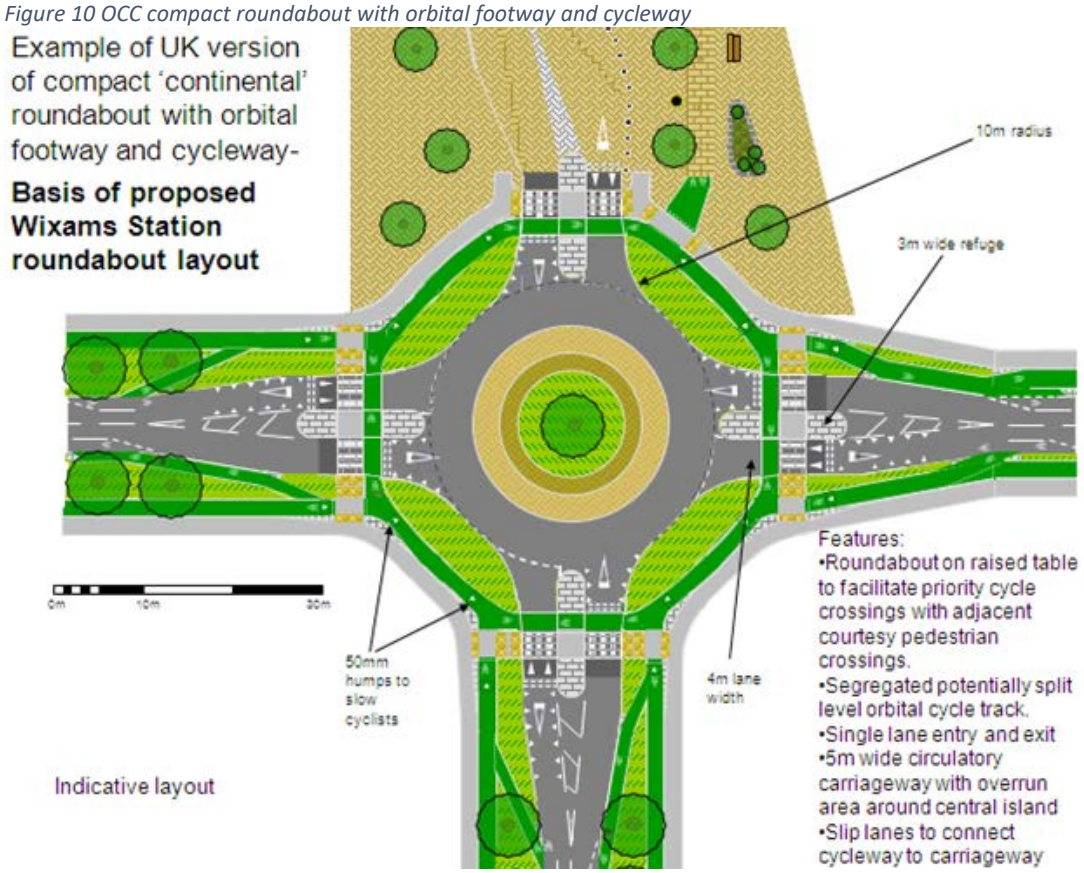
7.13 A concept sketch for modifications to the design was provided by OCC which is shown on **Figure 8** below. The modifications however bear no relation to the issue identified and present multiple issues with respect to legibility, intervisibility and visibility requirements, path and road alignment and crossing priorities.

Figure 9 OCC feedback 25/02/20



7.14 OCC also provided the diagram included at **Figure 10** below. Whilst badged as an example of UK version of compact 'continental' roundabout this too is a concept sketch and has not been implemented. This sketch is however more developed than the sketch in **Figure 9** as it is evident that consideration has been given to appropriate speeds on cycle paths albeit the context for this proposed scheme is clearly very different.

Figure 10 OCC compact roundabout with orbital footway and cycleway



7.15 To respond to the comments above the scheme was revisited with a view to maximising the safety, convenience and accessibility for cyclists whilst not significantly impacting on pedestrians (**Figure 11**).

7.16 The NCN runs along Wendlebury Road. In the future it is envisaged that the route will run off carriageway between the site access and the A41 where it will join the existing off carriageway path (which will be improved).

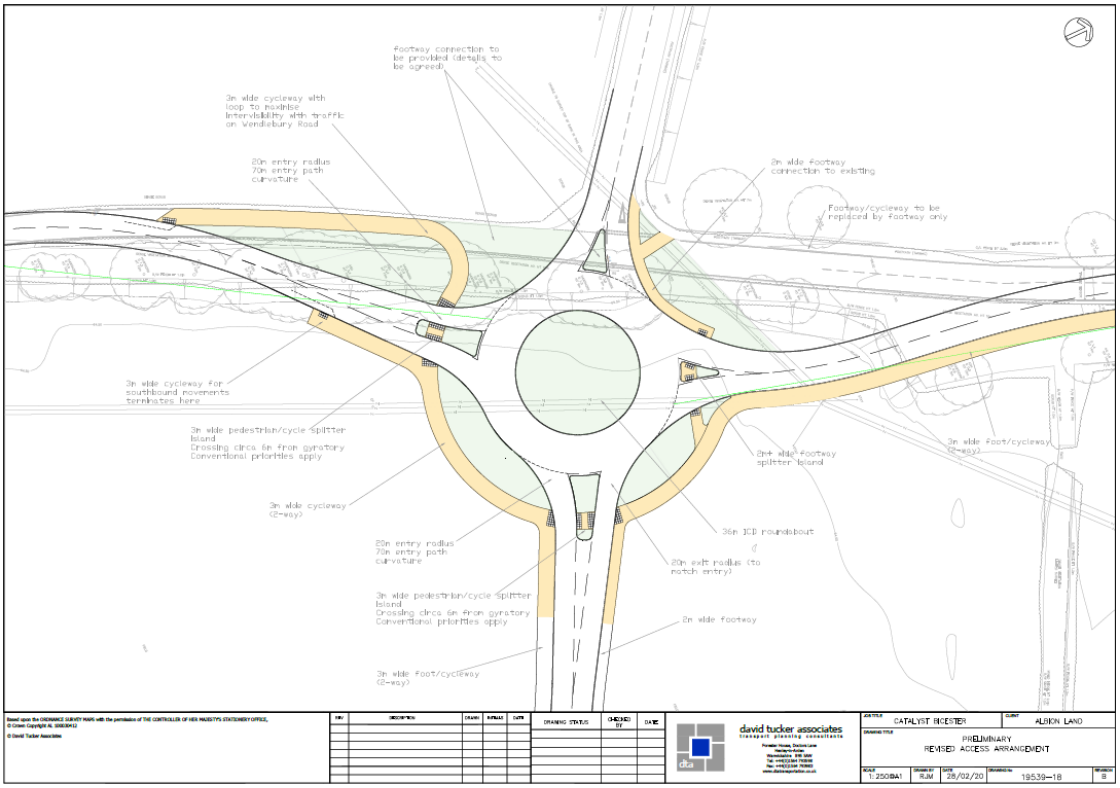
7.17 OCC want the path connection to the south of the roundabout and therefore it is proposed to slip cyclists off Wendlebury Road onto a path following the existing Wendlebury Road alignment. The slip off can be further smoothed. At this stage it is unclear whether the Bloombridge development would provide pedestrian access onto Wendlebury Road in which case it would be beneficial to slow cyclists where they will mix with pedestrians. If there is no pedestrian access then these can be provided with full tapers.

7.18 Northbound cyclists ultimately need to cross two arms of the roundabout to join the off carriageway path. Wendlebury Road South and the Site Access arms will be the lowest traffic volumes arms of the roundabout by a significant degree. It is therefore preferable to cross these arms in terms of safety, convenience and attractiveness for cyclists. The alignment of the path has been developed to maximise intervisibility between cyclists and drivers on Wendlebury Road. The centreline radius will slow cyclists but is not abrupt. Wendlebury Road will be crossed in two stages with a wide 3m refuge. To reduce the approach speeds of vehicles the entry path deflection has been increased to 70m and the kerb radii reduced to 20m on both entry and exit. Around the roundabout the cycle path has been offset from the circulatory to provide a buffer on amenity grounds.

7.19 The site access has been amended to reflect the revised geometry and crossing configuration on Wendlebury Road south. The offset is maintained around to Wendlebury Road north. There will be pedestrian demands from the site which will potentially be heading for the A41 and the bus stops for long distance services. To provide for these a pedestrian crossing has been retained on Wendlebury Road north. To ensure that the layout remains legible for cyclists who are travelling a higher speed the alignment of the pedestrian crossing is shown as distinct from the cycle path. Linkages to the existing footways to the west are provided.

7.20 No crossings are shown on this design on the Vendee Link Road arm as there are no footways on the southwestern quadrant and until Bloombridge has a consented access their strategy in unknown.

Figure 11 Enhanced cycle provision

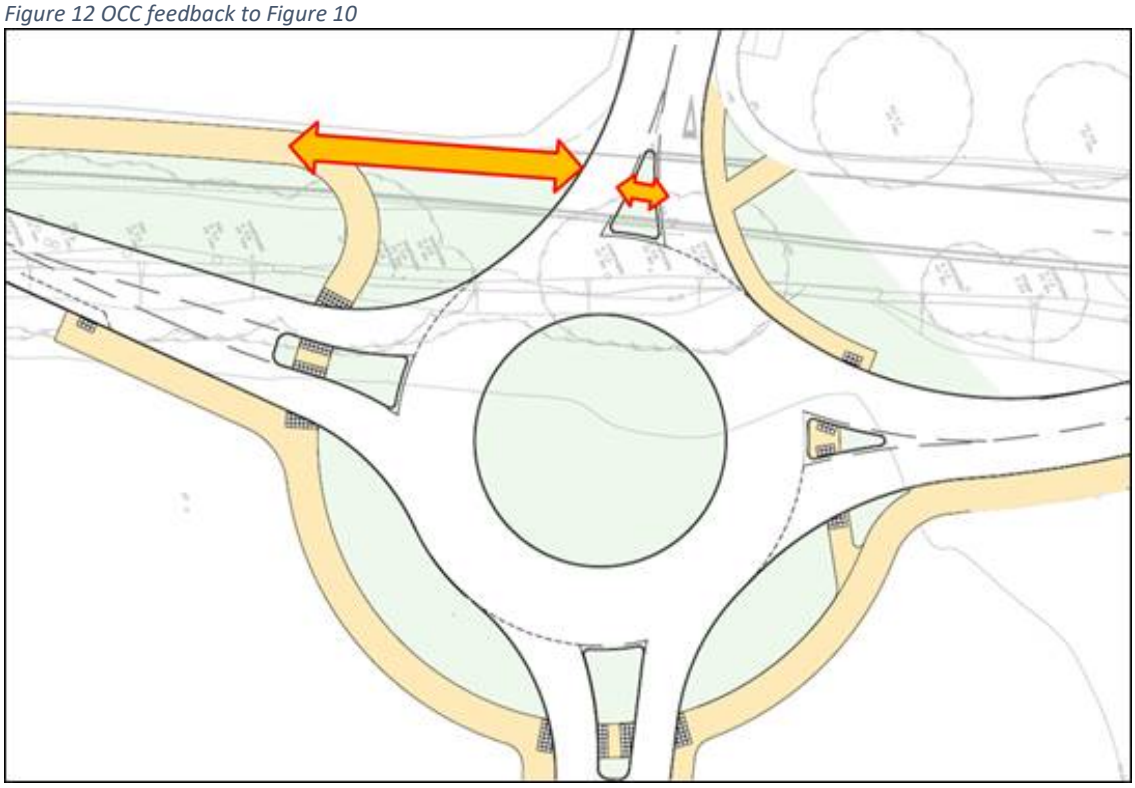


7.21 In response to the redesign, OCC requested that a cycle link be shown across the Vendee Drive Link Road (**Figure 12**). This is considered inappropriate as:

- The provision of this route offers no benefit in terms of journey distance or time;
- The alignment of the cycle path is likely to result in higher speeds by cyclists thereby endangering them as well as pedestrians;
- The alignment of the cycle path results in poor intervisibility with other road users given the angle of approach;
- Visibility on the Vendee Drive Link Road is constrained anyway by the available highway land;
- The route will result in a higher level of potential conflict with other road users given the pattern of movements through the junction.

7.22 This scheme does not provide for pedestrian and cycle priority at the crossing points. This is not warranted on the level of traffic which is too low to generate delays and in practice would offer no benefit to cyclists. If the traffic flows were to materially increase then the layout is capable of being adapted at a later date.

Figure 12 OCC feedback to Figure 10



Final Scheme

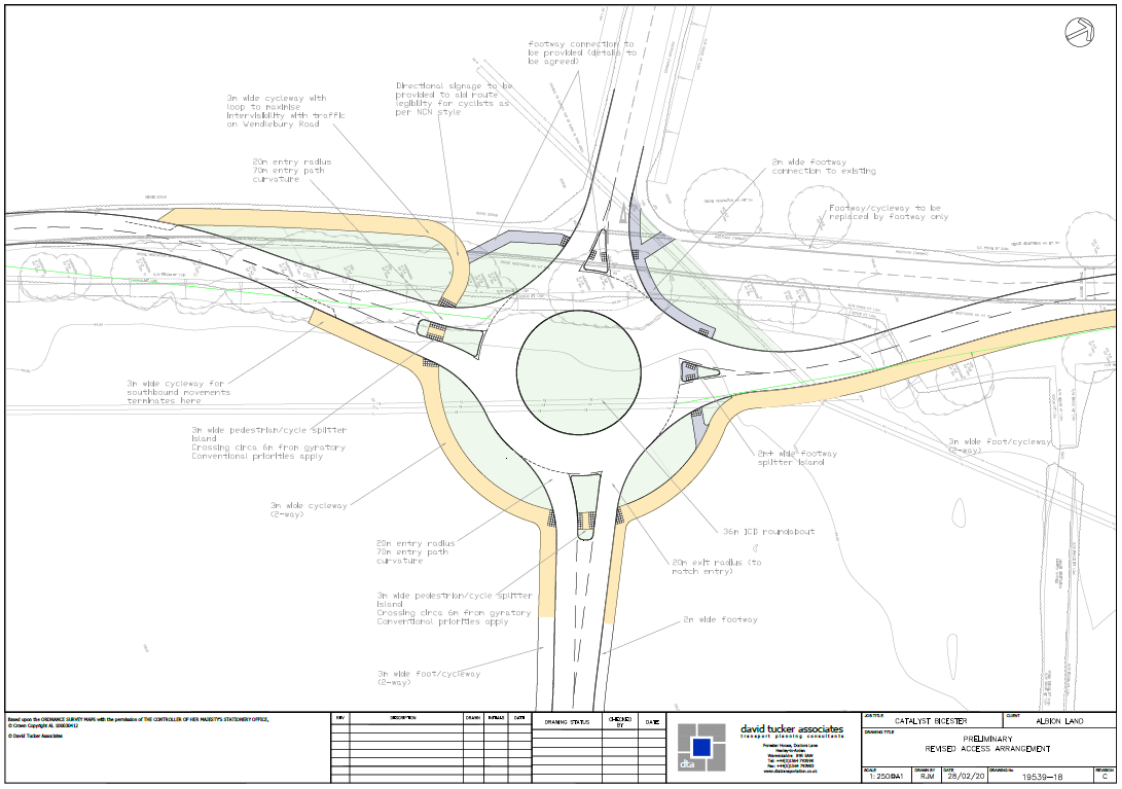
7.23 Whilst it is considered that the scheme at **Figure 11** is wholly appropriate there is merit in safeguarding options for the Bloombridge phase 1 development. The office element of the Bloombridge site is largely land-locked for pedestrian and cyclists and reliant on a long uncontrolled crossing on a flared section of the Vendee Drive Link Road with poor intervisibility. It has therefore been agreed with OCC that a pedestrian crossing to the west of the junction will be reintroduced but that additional signage will be provided to aid legibility for cyclists. The alignment of the path will also discourage unintentional use of this route by cyclists. This design refinement has been submitted to the independent safety auditor who is satisfied that it meets the requirements of the formally prepared Audit Report.

7.24 Overall, it is considered that the final design (**Figure 13**) represents a significant enhancement for cyclists in this location. The layout is simple and legible. It offers a high level of amenity and is convenient for cyclists to use. Whilst it offers a high level of accessibility, accessibility needs to be considered in an holistic sense. The junction certainly will not discourage any cyclists and therefore exceeds any reasonable requirement for sustainable travel appraisal. As previously acknowledged by OCC, the enhanced path along the site frontage up to Pioneer Way is a material betterment to existing users, the Catalyst site and the Bloombridge site. This scheme however comes forward in advance of a strategy for Bicester and its functionally dependent hinterland. In this respect the proposals will be wholly complementary.

7.25 The cyclist initiatives at the site access roundabout and to the north towards Bicester which are proposed and will be delivered by Albion Land will encourage cycle use to the site and will encourage cycle use for other origin-destination journeys (Wendlebury – Bicester). The high quality of these measures is though in stark contrast to the unattractive features of the adjacent NCN route to the south. This goes to highlight that any further cyclist prioritisation

over and above the submitted design is entirely disproportionate. Further initiatives will not enhance safety and will not encourage those who are not cycling to do so. A scaled version of the design is provided under separate cover.

Figure 13 Final access arrangement



8.0 Road Safety Audit

8.1 Mott MacDonald was commissioned to undertake an independent road safety audit of the original scheme (**Figure 6**). Although a number of recommendations were made these did not affect the principle of the scheme and were either adopted or would be addressed at the detailed design stage e.g. the need for regrading to the back of cycleway or provision of a safety fence.

8.2 With the changes to the scheme Mott MacDonald has undertaken another audit (on the design in **Figure 11**). This is provided under separate cover. The recommendations and designer's responses are set out below.

3.1 Problem 2.01

Location: Throughout scheme.

Summary: Drop at back of footway may present a hazard to pedestrians.

A new 3.0m footway / cycleway is proposed along the eastern side of Wendlebury Road, and a new 3.0m cycleway on the western side, south of the proposed roundabout. There is an overgrown ditch running the length of the eastern side of Wendlebury Road throughout the scheme, with a noticeable level difference from the carriageway level to the bottom of the ditch; this is also the case along the western side of carriageway, south of the proposed roundabout. Provision of footway / cycleways at these locations will result in drop at the back of the footway / cycleways, which may present a hazard to pedestrians or cyclists should they leave the paved surface. This may result in falls resulting in personal injury.

Recommendation

It is recommended that a fence or guardrail of suitable height is provided at the back of the footway wherever a drop to surrounding surface levels is present. Alternatively, ground at the edge of the footway/cycleway should be graded to avoid a steep drop.

8.3 This is agreed.

3.2 Problem 2.02

Location: Western side of proposed roundabout.

Summary: Unaccommodated pedestrian desire line may result in trips and falls.

A new 3.0m cycleway is to be provided on the south-western side of the new roundabout to allow northbound cyclists to move between the Wendlebury Road carriageway and the new footway / cycleway along the eastern side via an uncontrolled crossing point across the southern arm of the roundabout. An existing footway is present on the northern side of the A41 link road and a footway / cycleway along the western side of Wendlebury Road north of the proposed roundabout that will become footway only. Pedestrians using or intending to use these facilities may attempt to cross the western arm of the roundabout away from

any formal crossing facilities increasing the likelihood to trips and falls due to crossing a full height kerb or travelling over unmade ground.

Recommendation

It is recommended that a pedestrian crossing is provided across the western arm of the roundabout. Alternatively, appropriate landscaping and / or street furniture could be installed between the new cycleway south of the roundabout and the roundabout to deter pedestrians.

Clear cyclist directional signing should be provided to indicate the route via the southern crossing and eastern footway / cycleway.

8.4 A pedestrian crossing on the Vendee Link Road has been reinstated within the design. This was originally removed on the basis that there would be no pedestrian demand from the southwestern quadrant of the junction, where OCC maintain that there will be no pedestrian permeability into the Bloombridge site from Wendlebury Road, and to aid legibility of the junction layout for cyclists, i.e. route cyclists around the most appropriate route though the junction across to the new cycleway in the northeastern quadrant which minimise potential for conflict with vehicular traffic and with pedestrians. Neither of these have changed. As a compromise it is proposed to sign cyclists as recommended and to provide a pedestrian only link.

3.3 Problem 2.03

Location: Wendlebury Road, south of proposed roundabout.

Summary: Inappropriate provision of tactile paving.

3.0m cycleways are provided on both sides of Wendlebury Road, south of the proposed roundabout to provide appropriately positioned tie-ins between the cycleway and carriageway. At the tie-ins, tactile paving is shown despite no crossing points being present. Pedestrians, particularly those who are visually impaired, may believe there is a crossing point and begin to cross to the other side, increasing their vulnerability of trips and falls, and collision with vehicles.

Recommendation

It is recommended that the tactile paving is omitted from the scheme. Furthermore, where the shared section transitions to a dedicated cycleway, corduroy tactile paving should be installed across the width of the path.

It was noted during the audit that the width of the cycleway at the tie-in points together with the tapers appeared to be narrow; during detailed design, this should be modified to provide a 'smoother' transition.

8.5 The revised design shown in **Figure 13** has been provided to the auditor who considers that the further amendment accords with the content of the Stage 1 Audit of **Figure 11** design.

8.6 The details of the tactile and corduroy paving will be amended to align with 'Guidance in the Use of Tactile Paving Surfaces' and to ensure that there is no confusion to pedestrians.

9.0 Conclusion

9.1 The site access roundabout design proposal complies with relevant technical design standards. There is no hindrance to technical approval via the S278 process being secured.

9.2 The design has been subject to an independent Stage 1 Road Safety Audit.

9.3 Over a 20-month period of liaison the design was been subject to refinement taking on board comments made by OCC. Throughout the design process, the design has reflected the north-south National Cycle Network designation on Wendlebury Road. It comprises single lane entries to allow cyclists to position themselves on carriageway whilst discouraging drivers to attempt to pass.

9.4 The design is as compact as vehicular swept path movements of HGVs will allow.

9.5 The adjacent section of Wendlebury Road to the north will be enhanced with an extensive off carriageway footway/cycleway linking into the wider Bicester off carriageway cycle network. The roundabout design provides a convenient, safe cohesive strategy to link into this facility.

9.6 Very late in the process, OCC introduced a request for a radical overhaul of the design.

9.7 DTA have considered that request in significant detail. The design was further refined to introduce further elements of cycle infrastructure where those features could be delivered without contradicting independent safety advisor input and without adversely affecting technical design standards compliance and hence jeopardising technical approval at the S278 stage. The design is therefore considered to be safe and convenient for cyclists who favour travelling on-carriageway and those who favour travelling off-carriageway.

9.8 This document explains in detail why it would be entirely inappropriate to adopt further elements of OCCs request. To do so would be inappropriate due to the inappropriate traffic characteristics; the limited number of cyclists; the poor nature of the NCN to the south; the peri-urban location; and the absence of any other comparable examples currently in existence in the county and indeed the country.

9.9 The design has therefore very carefully critiqued the request made. The design has been subject to an independent safety audit. It fully meets the NPPF requirements of the development proposal. It will provide betterment for the local area, including the NCN route. In so doing it provides a safe and convenient design for non-car users, with extensive facilities for cyclists, whilst respecting the function of the junction to provide access to a proposed Business Park covered by a Local Plan Allocation for employees and deliveries.