



A41 Pioneer Road Roundabout, Graven Hill, Bicester

Transport Assessment

On behalf of



June 2020

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This document has been prepared and checked in accordance with Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001:2018)

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1. Introduction

1.1 Purpose

This Transport Assessment Report has been produced to support a planning application for major junction improvements at the Pioneer Road junction on the A41 (also known as Aylesbury Road) at Graven Hill, Bicester.

The purpose of the report is to provide the Local Highway Authority, Oxfordshire County Council (OCC), with the necessary level of detail to demonstrate that the roundabout proposals would be safe and operate satisfactorily i.e. without having a detrimental impact upon the safe operation of the local highway network. This report also includes an assessment of the existing facilities for pedestrians and cyclists and where appropriate identifies opportunities for improvement.

1.2 Scheme Background

The proposals comprise a 4-arm roundabout at the Pioneer Road junction on the A41 at Graven Hill, Bicester. The roundabout would connect the Graven Hill development (currently under construction), via the proposed Employment Access Road (EAR), to the wider highway network. The proposals would also allow for future access to a proposed development (Wretchwick Green) on land to the north of the A41. The roundabout is primarily aimed to help improve access for all users between the two development sites.

A drawing showing the roundabout proposals is included in **Appendix A**.

1.3 Study Area

The location of the proposed roundabout is shown in **Figure 1** in map form (indicated by the yellow star) and a more detailed satellite image illustrating the approximate localised extent of the scheme for reference in **Figure 2**. The assessment area covers approximately a 150m radius from the centre of the scheme.



Source: https://www.google.co.uk/maps/@51.8962514,- Source: https://www.google.co.uk/maps/@51.8823951,-1.1603666,14.17z 1.1350964,409m/data=!3m1!1e3



1.4 Report Layout

Following this introductory section, the layout of the study is as follows:

- Section 2 summaries the planning status for the developments at Graven Hill and Wretchwick Green;
- Section 3 describes the existing local conditions and the sustainable transport facilities available within the local area;
- Section 4 outlines the proposed junction arrangements and the design parameters;
- Section 5 considers the road safety implications of the scheme;
- · Section 6 reviews the operation/performance of the proposed junction; and
- Section 7 provides a summary of the report.



2. Planning Status

2.1 Graven Hill

In August 2014 planning permission was granted (Application No: 11/01494/OUT) for a development south east of Bicester at Graven Hill. The application proposals are as follows:

"Redevelopment of former MOD sites including demolition of existing buildings, development of 1900 homes; local centre to include a 2 form entry primary school (class D1), a community hall of 660sqm, five local shops or facilities to include A1, A2, A3, A5 and D1 uses totalling up to 1358sqm, up to 1000sqm gross A1 uses, a pub/restaurant/hotel (class A4/A3/C1) up to 1000sqm and parking areas; employment floorspace comprising up to B1(a) 2160sqm, B1(b) 2400sqm, B1(c) and B2 20520sqm and B8 uses up to 66960sqm; creation of public open space and associated highway improvement works, sustainable urban drainage systems, biodiversity improvements, public transport improvements and services infrastructure. Erection of a 70400sqm fulfilment centre on 'C' site and associated on site access improvement works, hardstanding, parking and circulation areas."

A plan illustrating the proposed site layout is provided in Figure 3.



Figure 3: Graven Hill Site Layout

Source: https://planningregister.cherwell.gov.uk/Planning/Display/19/00937/OUT - 1982-A-L-010-U



The S106 agreement for Graven Hill requires improvements to the A41 Pioneer Road junction. A copy of the "Transport Payment No. 4" quotation in respect to the S106 agreement and the A41 is provided below.

"Transport Payment No.4"	The sum of £1,960,000 (One Million Nine Hundred And Sixty
	Thousand Pounds) Index Linked towards improvement/provision
	of the second access to the Site, including provision of a new
	roundabout instead of the existing priority junction serving Pioneer
	Road and the A41 pedestrian and cycle facilities where
	appropriate and such other mitigation works as appropriate;

Source: Planning obligation by deed of agreement under Section 106 of the Town and Country Planning Act 1990 Relating to land at Graven Hill, Bicester, Oxfordshire. Trowers & Hamlins LLP 8th August 2014

This Transport Assessment Report has been produced to support a planning application for the delivery of the improvement scheme in lieu of the S106 payment. OCC Highways have confirmed that the improvement scheme must not prejudice delivery of the Wretchwick Green development to the north of the A41 (described in more detail in section 2.2).

2.2 Wretchwick Green

In June 2016 an Outline Planning Application (Application No: 16/01268/OUT currently under consideration) was jointly submitted by Redrow Homes Ltd and Wates Developments Ltd for a development south east of Bicester at Wretchwick Green. The application proposals are as follows:

"Outline application with all matters reserved apart from access for residential development including up to 1,500 dwellings, up to 7ha of employment land for B1 and/ or B8 uses, a local centre with retail and community use to include A1 and/ or A2 and/ or A3 and/ or A4 and/ or A5 and/ or D1 and/ or D2 and/ or B1, up to a 3 Form Entry Primary School, drainage works including engineering operations to re-profile the land and primary access points from the A41 and A4421, pedestrian and cycle access, circulation routes, related highway works; car parking; public open space and green infrastructure and sustainable drainage systems."

The Wretchwick Green Application Site forms a major part of the Bicester 12 (South East Bicester) allocation in the adopted Cherwell District Local Plan 2011-2031 Part 1. The location of the Bicester 12 Allocation, in relation to the remaining allocated sites in Bicester including Graven Hill (identified as site 'Bicester 2') is shown in **Figure 4** overleaf.





Figure 4: Location of Bicester 12 (Wretchwick Green)

Source: Extract from Cherwell District Council's Key Policies Map

The proposals include two new vehicular accesses onto the adjacent A4421 and one access onto the A41. The vehicular access onto the A41 takes the form of a new roundabout approximately 700m east of the existing A41/A4421 roundabout (Rodney House Roundabout). The vehicular access would be constructed broadly adjacent the existing A41 Pioneer Road junction and would be circa 60 metres in diameter. The roundabout would include four arms; the eastern and western arms of the A41, the northern arm would form the access into the Wretchwick Green development and the southern arm would connect with Pioneer Road which travels south into the Graven Hill site. The scheme proposals also include for a reduction in the speed limit on the A41 to 40mph through the roundabout only.

A plan indicating the Wretchwick Green scheme proposals is shown overleaf in **Figure 5** with the applicants proposed roundabout arrangement included in **Figure 6**.



Figure 5: Land Use Masterplan



Source: i-Transport Ref: VACE/JW/dc/ITM7245-017C R





Figure 6: Proposed Site Access / New 4 arm Roundabout

Source: i-Transport Ref: VACE/JW/dc/ITM7245-017C R

The phasing of the Wretchwick Green development does not accord with the programming requirements for the Graven Hill site and the delivery requirements of the proposed A41 Pioneer Road improvements. An alternative design has therefore been prepared by Waterman, at the request of, and on behalf of, Graven Hill Village Development Company.



3. Existing Highway Conditions

This section summarises the highway conditions on the A41 and Pioneer Road within the study area.

3.1 A41

The A41 is a street lit 50mph single carriageway road measuring circa 10m wide. At its junction with Pioneer Road the carriageway widens to include a ghost island right turn facility. This is typical of many of the junctions along the A41.

The A41 includes narrow street lit footways either side of the carriageway. To the north the footway runs alongside the carriageway edge. To the south the footway to the east of Pioneer Road runs alongside the carriageway edge whereas to the west of Pioneer Road (towards Rodney House Roundabout) the footway is segregated from the carriageway by a grass verge. Photographs illustrating the existing conditions along the A41 are provided below in **Photograph 1** and **Photograph 2**.



There are no formal crossing facilities on the A41 or at the A41 / Pioneer Road junction, although it is possible to take refuge within the island on Pioneer Road. The refuge island includes two lit bollards. The crossing would not meet pedestrian crossing standards and would present particular difficulties for those with mobility impaired movements.

The footway located to the south of the A41 is a dedicated narrow-shared foot/cycleway. The footway/cycleway is signed at the junction of Pioneer Road, as illustrated in **Photograph 3** and **Photograph 4** (Note: Photograph 4 has been taken to the rear of the sign).



Photograph 3: Cycle Sign (East of Pioneer Road) Photograph 4: Cycle Sign (West of Pioneer Road)



Lighting on the A41 is positioned over the footway and shared use path, giving more visibility and security to pedestrians, cyclists and other path users.

3.2 Pioneer Road

Pioneer Road currently provides access to the Ministry of Defence (MoD) St David's Barracks site. For security reasons (at the request of the MoD) no photographs of Pioneer Road have been included within this report.

Pioneer Road is an unlit 20mph single carriageway road measuring circa 6m wide. The majority of junctions along Pioneer Road consist of simple priority T junctions. At its junction with the A41, Pioneer Road flares out to allow space for 2 vehicles to wait side-by-side.

Pioneer Road is bounded by grass verges and vegetation with no provision for pedestrians and is particularly unsuited for the mobility impaired. The grass verges show no apparent sign of use by pedestrians.

There are no designated cycling facilities available along Pioneer Road. However, it is considered that travelling along the carriageway is acceptable for cyclists due to the lightly trafficked nature of the road.

3.3 Traffic Flows

Traffic flows along the A41 and Pioneer Road were calculated to be as follows during the morning and evening peak hours in 2012 (Source: i-Transport Ref: VACE/CP/JW/dc/ITM7245-013A R):

A41 (eastbound and westbound)

- AM Peak Hour 2,296 vehicles
- PM Peak Hour 2,397 vehicles

Pioneer Road (Northbound and Southbound)

- AM Peak Hour 196vehicles
- PM Peak Hour 145 vehicles



3.4 Collision Data

A review of the road safety records for the immediate local highway network has been undertaken to determine if there are any prevailing trends that may suggest deficiencies in the current highway layout, or where an increase in traffic flows may lead to an increased risk to highway safety. In-line with Planning Guidance, data from the most recent 26-month period (2017 to 2019) has been reviewed for A41 / Pioneer Road junction. A plan illustrating the location of the collisions within the vicinity of the site is provided in Error! Reference source not found..





Source: https://www.crashmap.co.uk/Search

Error! Reference source not found. shows that no collisions occurred in the vicinity of the A41 / Pioneer Road junction. The area is not considered to have any inherent highway safety issues.



4. Proposed Scheme

4.1 Roundabout

The proposals comprise a 4-arm roundabout at the Pioneer Road junction on the A41 at Graven Hill, Bicester. The roundabout would connect the Graven Hill development, via the proposed EAR to the wider highway network (namely the A41). The proposals would also allow for future access to a proposed development at Wretchwick Green on land to the north of the A41. The proposals include a 3m wide shared use footway/cycleway along with traffic signal controlled crossings on all arms of the junction.

A drawing showing the proposed roundabout arrangement is included in **Appendix A** (Drawing WIE11386-A41-03-001-A01-General Arrangement). An extract of the drawing is included as **Figure 8**.





The roundabout has been designed in accordance with 'DMRB Volume 6 Section 2 CD 116 Revision 1 Road layout – Design - Geometric design of roundabouts (formally TD 16/07) and includes the following design characteristics (detailed in **Table 1** and on Drawing WIE11386-SA-03-26-A03-Geometry in **Appendix A**).



Arm	Entry Width	Flare	Entry Radii	Conflict Angle	ICD
A41 (East)	10.5m	70.0m	40.0m	28.0 ⁰	60.0m
EAR	7.45m	18.0m	30.0m	28.0 ⁰	60.0m
A41 (West)	7.0m	125.0m	25.0m	39.0 ⁰	60.0m
Wretchwick Green	7.4m	3.0m	26.0m	35.0 ⁰	60.0m

Table 1:	A41	Pioneer	Road	Roundabout	Design	Charachteristics
		1 1011001	itouu	rtoundabout	Doolgii	onaraonitoriotioo

The proposed roundabout would be located within either the adopted highway (maintained at the publics expense) or land controlled by the Graven Hill Village Development Company. The design is not dependent upon any third-party land and can be delivered prior to the Wretchwick Green development.

The proposed A41 roundabout would provide a secondary access into the Graven Hill residential development, as well as a vehicular access to the adjacent proposed Wretchwick Green development. The EAR (formally known as Pioneer Road) would also provide vehicular access to the wider employment land at Graven Hill and is also safeguarded as part of the wider South East Perimeter Road (SEPR) for Bicester. Consultation on the SEPR was undertaken in 2015 and a number of routes were identified, however the section through Graven Hill is safeguarded, along with the section through Wretchwick Green, See below figure showing the proposed route(s) of the SEPR.



Figure 9: Safeguarded & Route Options for the South East Perimeter Road

Source:

file:///C:/Users/NMNJH/Downloads/Options_for_a_South_East_Perimeter_Road_for_Bicester_Low_resoluti on_version.pdf



4.2 Vehicle Tracking

The swept path of a 16.5m articulated vehicle undertaking all movements at the roundabout is provided in **Appendix B**. The drawing illustrates that the vehicle would be able to satisfactorily turn left, right or travel ahead from each approach arm.

4.3 Alternative Designs & Consultation with OCC Highways

Early consultation was undertaken with the highway authority, OCC, and a number of designs and iterations were considered in respect to the design of the roundabout. Following consultation with highway development control, Road Agreements Team and other interested parties the design, shown in **Figure 8** overleaf was considered to deliver the required operational capacity, whilst maintain high-levels of highway safety and provision for non-motorised and vulnerable users.

4.4 Walking, Cycling and Horse-Riding Assessment and Review

A Walking, Cycling and Horse-Riding Assessment and Review (WCHAR) has been produced in accordance with the requirements set out in GG 142 (formally DMRB HD 42/17). The report provides an assessment of the existing facilities and provision for pedestrians, cyclists and equestrians at the A41 Pioneer Road junction. A copy of the WCHAR is provided in **Appendix C**.

The WCHAR identifies opportunities for improving pedestrian and cyclist facilities (Note: Due to scheme location, lack of existing facilities and nature of the proposed scheme, the requirements of equestrians are not specifically identified in this instance). The specific opportunities identified in the report are highlighted in **Table 2** and **Table 3**.

Ref	Opportunity
1	Incorporation of new footways or shared use facilities on Pioneer Road to link to any facilities as part of the Graven Hill development (currently there are no facilities for pedestrians along Pioneer Road from its junction with the A41). The width/design of the footway or shared use facilities should consider the nature/quantum of those likely to be using the route.
2	Incorporation of footways or shared use facilities to link to any facilities as part of the proposed development (Wretchwick Green) to the north of the A41. This would help 'future proof' the scheme for pedestrians and possibly cyclists. The width/design of the footway or shared use facilities should consider the nature/quantum of those likely to be using the route.
3	Provision of appropriate crossing points on the A41, Pioneer Road and the northern access road. This would improve the situation for any pedestrians wishing to use the area and would also benefit cyclists. These could be incorporated into shared facilities for cyclists - see Opportunities 8 below.
4	Provision of a wider footway/cycleway alongside the A41 (to the south of carriageway), particularly to the west of Pioneer Road, leading into Bicester (i.e. towards many of the key local trip generators). This would benefit existing and future users and would allow cyclists to safely pass pedestrians on the shared use route (currently pedestrians have to step out into the verge or carriageway to avoid colliding with a cyclist). This is repeated below in cyclist specific opportunities 9.
5	A wider footway may also be potentially useful along the northern side of the A41, although suppressed demand and potential usage levels are unclear

Table 2: Pedestrian Specific Opportunities



Ref Opportunity

6

The speed limit along the A41 is currently 50mph. High Speeds were observed during the site visits. The scheme may benefit from a reduction in the speed of traffic along the A41 to provide a more attractive environment for pedestrians and also cyclists traveling alongside and attempting to cross the A41.

Vegetation was observed to be over hanging and obstructing the footway and shared use footway/cycleway in places. Pedestrian would benefit from the vegetation being cut back along with an appropriate maintenance regime to prevent future problems (repeated in cyclist specific opportunities 10.

Table 3: Cyclist Specific Opportunities

Ref Opportunity

8 Consideration of provision of appropriate crossing points at the proposed roundabout to provide for safe crossing of the carriageway. This would provide benefit for pedestrians too.

Incorporation of appropriate shared use path facilities across the scheme extent to provide offroad facilities for cyclists to negotiate the roundabout areas would greatly improve the existing situation for cyclists who are already using this route and would help to encourage levels of

- 9 cycling in the area. Tie-ins between the shared facility and the proposed development access roads (i.e. Pioneer Road and the northern access road) would need careful consideration to cater for all anticipated movements and anticipated cyclist types adequately. Consideration should also be given to the on-carriageway facilities at the roundabout to ensure that cyclists preferring to use the road are not disadvantaged by the new roundabout arrangement.
- Vegetation was observed to be over hanging and obstructing the footway and shared use
 footway/cycleway in places. Cyclists would benefit from the vegetation being cut back along with an appropriate maintenance regime to prevent future problems.

Where appropriate the opportunities listed in **Table 2** and **Table 3** have been incorporated into the design appended to this report in **Appendix A**.

4.5 **Programme for Delivery**

In consultation with Graven Hill Village Development Company, OCC and Cherwell District Council (CDC) the roundabout is expected to be completed and operational during quarter 3 of 2021. The opening of the roundabout would coincide with the construction and delivery of the EAR into the Graven Hill site.



5. Road Safety

A stage 1 Road Safety Audit (RSA) was undertaken on the current roundabout proposals during April 2020. The RSA Audit Team examined and reported on the road safety issues and considered non-motorised users. A total of six problems were identified by the RSA Audit Team, which are detailed in **Table 4** overleaf along with recommendations and the designer's comments:

A copy of the full RSA is provided in **Appendix D**.

It is clear from the RSA that there are no fundamental road safety issues which would affect delivery of the proposed A41 Pioneer Road Roundabout, with further consideration required at the detailed design stage.



Table 4: Road Safety Audit Summary

Problem	Location	Summary	Recommendation	Designers Response
3.1	A41 (East and West of Roundabout)	No Consideration of existing field accesses - To the north-west and south-east of the proposed roundabout there are existing field accesses which provide access into the land to the north and south of the A41. The scheme does not appear to provide for these points of access. Failure to provide safe points of access into these parcels of land could result in vehicles mounting/dismounting the kerb at inappropriate locations. This could increase the risk of rear end shunts with vehicles slowing down to mount the kerb.	Provision should be made for vehicles to access, if necessary, the existing parcels of land using these access locations to the north and south of the A41.	The access to the south-east of the roundabout is to be stopped up, so to is the access located immediately to the north-west of the roundabout. The access located 150m to north-west of the roundabout would be retained off the A41.
3.2	A41 (South- Eastern Arm)	Insufficient width for shared use footway/cycleway adjacent Toucan Crossing - The scheme proposals include a Toucan crossing on the A41 eastern arm. On the southern side of the A41 there is an existing footway/cycleway which is very narrow in width (<2m). This width is also restricted by the location of a street lighting column within the footway/cycleway (adjacent to the proposed crossing point). See below photograph. The proposed widening of the footway/cycleway does not commence until further to the west of the crossing. This narrow section of footway/cycleway would bring cyclists and pedestrians closer together (particularly if waiting to cross the road). Failure to provide sufficient space for pedestrians/cyclists to pass one another at the crossing could lead to collisions in close proximity to a busy section of road and could also result in pedestrians or cyclists using the road, resulting in slip/trip/fall incidents as pedestrians/cyclists mount/dismount the kerb.	It is recommended that this section of footway / cycleway is widened to 3m minimum to allow pedestrians/cyclists to safely pass one another.	Back of footway has been offset 3m to provide a sufficient width for pedestrians / Cyclists. Footway ties back into to existing footway to the East



Problem	Location	Summary	Recommendation	Designers Response
3.3	A41 (East and West of Roundabout)	Narrow footway/cycleway width - There is currently a narrow and lengthy section of footway/cycleway, circa 1.2m wide along the southern side of the A41. The proposed scheme ties a 3m wide shared use footway/cycleway into this existing footway/cycleway circa 150m to the northwest and southeast of the roundabout. The narrow section of footway/cycleway would bring cyclists and pedestrians closer together and therefore could lead to collisions in close proximity to a busy section of high-speed road.	It is recommended that remedial measures are taken to warn cyclists of the narrow footway / cycleway ahead and to reduce speed accordingly.	Further details including signage would be provided during the detailed design stage.
3.4	A41 (North- Western arm)	Insufficient lane width - The width at the start of the offside lane on the A41 eastbound approach arm appears narrow (<2m) alongside the nearside lane. There is insufficient width for vehicles to drive within the offside lane without overlapping the white lines. The introduction of such a narrow lane width increases the likelihood of rear end shunts with traffic in the adjacent/nearside lane.	It is recommended that the width (and consistency of width) of lanes should be reviewed. Generally, it is considered that a minimum lane width of 3 metres is required on through routes, with additional lane width being provided where the traffic movements using the lane are either on a radius or making a turning movement.	Lane widths have been reviewed and adjusted. A minimum lane width of 3m is now provided. See drawing WIE11386-SA-03-026-A03.
3.5	A41 (South- Eastern arm)	Vehicles colliding with crossing pedestrians - The Toucan Crossing on the A41 eastern arm is not located on the desire for north-south movements. The crossing is located circa 70m east of the roundabout. Therefore, vehicle speeds at the crossing location could be high as they would not be constrained by the proximity of the roundabout. Pedestrian/cyclists may instead choose to cross via the uncontrolled crossing, located closer to the roundabout (circa 5m). Crossing via the uncontrolled crossing point would	It is recommended that pedestrians/cyclists are encouraged to cross using the Toucan Crossing where the crossing is controlled, the carriageway is narrower and where visibility is improved, whilst still supporting the pedestrian desire line. It is therefore recommended that the location of the Toucan Crossing is reviewed and also the	To encourage use of the controlled crossing the uncontrolled crossing on this arm has been removed. The location of the toucan crossing has been reviewed and is considered to be appropriately located.



Problem	Location	Summary	Recommendation	Designers Response
		require pedestrians/cyclists to cross 2 lanes of south-eastbound traffic (8.6m) and 3 lanes of north-westbound traffic (10.5m). The crossing distance (particularly on the approach to the roundabout from the southeast) would expose pedestrians to live traffic for a longer period than necessary when crossing. This would increase the risk of pedestrian/vehicle collisions. The visibility to the right/east at the crossing point (south / north) is also restricted by trees/vegetation to the south of the carriageway. The combination of the crossing distance, higher vehicle speeds and poor visibility may lead to an increased risk of vehicles colliding with pedestrians using the crossing.	appropriate pedestrian visibility splays are provided at the uncontrolled crossing.	
3.6	A41 (North- Western arm)	Uncontrolled crossing provision located near controlled crossings - The scheme includes both controlled and uncontrolled crossing points on the A41 approach arms to the roundabout and the Graven Hill development access road (Note: The Toucan Crossing lies outside of the limits of this RSA on this arm). For movements across the junction (i.e. between Graven Hill and Wretchwick Green or along the A41), the uncontrolled crossings are located closer to the pedestrian/cyclist desire line. Use of the controlled crossings would therefore require pedestrians/cyclists to walk/cycle a greater distance. Pedestrians and cyclist are therefore likely to use the uncontrolled crossing points. This could result in increased likelihood of conflict between crossing pedestrians/cyclists and vehicles, particularly as drivers may be concentrating on the signal-controlled crossing and/or the roundabout junction ahead.	The uncontrolled pedestrian crossing provision at the roundabout should be removed or relocated to encourage use of the controlled crossings. The toucan crossings should be relocated closer to the roundabout.	The uncontrolled pedestrian crossing provision at the roundabout has been removed to encourage use of the controlled crossings. The toucan crossings are designed in accordance with DMRB standards (CD116) and so cannot be relocated closer than 20m from the roundabout. CD116 Paragraph 3.53.1: "Crossings should not be sited between 20 metres and 60 metres from the give way line."



6. Junction Performance

The following paragraphs consider the future operation and capacity of the proposed A41 Pioneer Road Roundabout.

6.1 Methodology

Junction capacity modelling has been undertaken on the proposed A41 Pioneer Road Roundabout, to ensure the roundabout operates satisfactorily and that sufficient spare capacity is realised for future design years.

OCC Highways have previously advised Waterman that traffic flows from the Wretchwick Green development Transport Assessment Addendum (i-Transport Ref: VACE/JW/dc/ITM7245-017C R) would be suitable to use for the purposes of the junction modelling. The traffic flows in the Transport Assessment include base flows (increased to an agreed future assessment year of 2031) along with development traffic flows associated with the Graven Hill development and Wretchwick Green development. The traffic flow data used within the modelling assessment is included in **Table 5**.

Approach Arm	Destination	AM Peak Hour					PM Peak Hour			
Approach Ann		Car	LGV	HGV	Total	Car	LGV	HGV	Total	
A41 (West)	A41 (West)	0	0	0	0	0	0	0	0	
A41 (West)	Wretchwick Green	45	1	0	47	42	0	0	43	
A41 (West)	A41 (East)	567	64	1	631	627	25	1	652	
A41 (West)	Pioneer Road	36	1	0	38	50	0	0	50	
Wretchwick Green	A41 (West)	67	2	0	69	62	2	0	64	
Wretchwick Green	Wretchwick Green	0	0	0	0	0	0	0	0	
Wretchwick Green	A41 (East)	441	110	10	561	304	49	16	370	
Wretchwick Green	Pioneer Road	256	20	4	280	364	23	4	391	
A41 (East)	A41 (West)	591	56	1	648	856	56	0	912	
A41 (East)	Wretchwick Green	303	54	11	369	468	94	5	566	
A41 (East)	A41 (East)	0	0	0	0	0	0	0	0	
A41 (East)	Pioneer Road	502	101	23	625	382	68	37	488	
Pioneer Road	A41 (West)	44	1	0	46	54	1	0	54	
Pioneer Road	Wretchwick Green	146	10	2	158	251	20	4	375	
Pioneer Road	A41 (East)	339	83	38	459	354	59	37	450	
Pioneer Road	Pioneer Road	32	0	0	32	30	0	0	30	

Table 5	2031	Base +	Graven	Hill +	Wretchwick	Green	Traffic	Flows
Table J.	2001		Olaven	$1 \text{ mm} \pm$	VIELCHWICK	Oleen	Trainc	1 10 103



The A41 Pioneer Road Roundabout has been modelled using the computer software package 'Junctions 8'. Through consultation with OCC Highways, it has been agreed that for the purposes of the junction modelling an RFC (Ratio of Flow to Capacity) value over 0.85 would be acceptable, subject to the following parameters not being exceeded:

- No more than 30 vehicles queuing or blocking any other junction on the approaches to the roundabout; and
- A delay per vehicle of no more than 120 seconds.

6.2 Assessment Results

The results of the capacity assessment are summarised in **Table 6**. The full results are included in **Appendix E**.

Junction Arm	AM	Peak (08:00-0	9:00)	PM Peak (17:00-18:00)			
Junction Ann	RFC	Delay (s)	Queue	RFC	Delay (s)	Queue	
A41 (East)	0.72	5	3	0.90	14	8	
EAR	0.61	7	2	1.02	87	27	
A41 (West)	0.61	7	2	0.77	14	3	
Wretchwick Green	0.76	11	3	0.70	9	2	

Table 6: Junction Capacity Assessment Results

As can be seen from the results summarised in **Table 6**, the proposed design would have capacity to accommodate the predicted traffic flows passing through the roundabout. The recorded delays and queue lengths do not exceed the values set by OCC Highways. It has, therefore been demonstrated that the proposed design would satisfactorily cater for the future predicated traffic levels.



7. Summary

This Transport Assessment Report has been produced to support a planning application for major junction improvements at the Pioneer Road junction on the A41 at Graven Hill, Bicester.

The proposals comprise a 4-arm roundabout at the Pioneer Road junction on the A41 at Graven Hill, Bicester. The roundabout would connect the Graven Hill development, via the proposed EAR to the wider highway network (namely the A41). The proposals would also allow for future access to a proposed development at Wretchwick Green on land to the north of the A41. The proposals include a 3m wide shared use footway/cycleway along with controlled and uncontrolled crossings on approach to the roundabout.

The roundabout has been designed in accordance with 'DMRB Volume 6 Section 2 CD 116 Revision 1 Road layout – Design - Geometric design of roundabouts (formally TD 16/07).

An analysis of road traffic collision data has been undertaken and it has been determined that there are no existing road safety issues. A Stage 1 Road Safety Audit has been undertaken and it has been demonstrated that the proposed site access arrangement does not result in an inherent road safety issue.

The proposed design would have capacity to accommodate the predicted traffic flows passing through the roundabout. The recorded delays and queue lengths do not exceed the values set by OCC Highways. It has, therefore been demonstrated that the proposed design would satisfactorily cater for the future predicated traffic levels.

In transportation terms the proposed roundabout is suitable for approval by the Highway Authority.



Appendices



A. A41 Pioneer Road Roundabout Design





This drawing should not be scaled. Dimensions to be verified on site. Any discrepancies should be referred to the Engineer prior to work being put in hand.

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GENERAL NOTES

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- 2. ALL DIMENSIONS AND LEVELS ARE TO BE CHECKED ON SITE BY THE CONTRACTOR PRIOR TO PREPARING ANY WORKING DRAWINGS OR COMMENCING ON SITE.
- 3. THE CONTRACTOR MUST ENSURE AND WILL BE HELD RESPONSIBLE FOR THE OVERALL STABILITY OF THE BUILDING/STRUCTURE/EXCAVATION AT ALL STAGES OF THE WORK.
- 4. ALL WORK BY THE CONTRACTOR MUST BE CARRIED OUT IN SUCH A WAY THAT ALL REQUIREMENTS UNDER THE HEALTH AND SAFETY AT WORK ACT ARE SATISFIED.
- 5. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES AND REGULATIONS.



GRAVEN HILL

Amendments

A41 PIONEER ROAD ROUNDABOUT **DESIGN - GEOMETRY**



Graven Hill Village Development Company Limited



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	mail@watern	t 01	21 212 7700	androup com		
Drawing Status	man@water	nangroup.com	ii www.wateriii	angroup.com		
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Designed by	JG	Checked b	y DP	Project No		
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Category

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A1-Wat-S-GHVDC, Combined Hway LTA2 Boundary, S38-RDB-CAD within HB a04, Site boundary, Survey R15 1106 MK-SERR

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Publisher

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A1-Wat-S-GHVDC, Combined Hway LTA2 Boundary, S38-RDB-CAD within HB a04, Site boundary, Survey R15 1106 MK-SERR



B. Vehicle Tracking



Path \(\)H bm\(\)wiel\\Projects\(\)ME11386_GH\(0_LTA 2\)#\(\)WO145_A41 ROUNDABOUT_Got PO\(\)_CAL

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C. Walking, Cycling and Horse-Riding Assessment and Review





A41 Pioneer Road Roundabout, Graven Hill, Bicester

Walking, Cycling and Horse-Riding Assessment and Review

On behalf of



May 2020

Waterman Infrastructure & Environment Ltd Halifax House, Halifax Place, Nottingham, NG1 1QN www.watermangroup.com


Client Name:	Graven Hill Village Development Company Limited
Document Reference:	WIE11386-145-WCHAR-3-1-3
Project Number:	WIE11386

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001:2018)

 Issue
 Date

 A01
 22/05/20

Prepared by Laura Smith Graduate Consultant **Checked by** James Picton Senior Consultant Approved by Nick Jones-Hill Senior Associate Director

Comments

A01 - Report issued for comments



Disclaimer

This report has been prepared by Waterman Infrastructure & Environment Limited, with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporation of our General Terms and Condition of Business and taking account of the resources devoted to us by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at its own risk.



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1. Introduction

1.1 Purpose

This Assessment Report has been produced in accordance with the requirements set out in GG 142 (formally DMRB HD 42/17) Walking, Cycling and Horse-Riding Assessment and Review (WCHAR) as part of proposed major junction improvements at the Pioneer Road junction on the A41 at Graven Hill, Bicester.

The purpose of the report is to provide an assessment of the existing facilities and provision for pedestrians, cyclists and equestrians that will help inform decision making throughout the design process. Where appropriate, opportunities for improvements have been identified with the intention that these should be considered through the design process and re-visited during the GG 142 process through the production of the Review Report.

1.2 Background

The designer proposing this scheme is Waterman Infrastructure & Environment Ltd (Waterman I&E). Nick Jones-Hill is the Design Team Leader for the scheme and has appointed the following Lead Assessor to undertake the Walking, Cycling and Horse-Riding Assessment and Review process:

• Lead Assessor: James Picton BSc (Hons) MILT – Senior Consultant, Waterman I&E

James's skills and experience are aligned with the Lead Assessor Competencies set out in GG 142. James has determined the scheme to be a 'large scheme' in accordance with GG142 as it is a major rural allpurpose junction improvement. James has appointed Laura Smith (Graduate Transport Planner) as an additional Assessor.

The associated Review Report will be produced at the early stages of the S278 detailed design process and then be treated as an ongoing document. Due to the scheme project programme, this preliminary design stage Review Report is planned to be delivered during the preliminary design phase of the scheme.

1.3 Scheme Proposals

The scheme currently comprises the intention to form a 4-arm roundabout at the Pioneer Road junction on the A41 at Graven Hill, Bicester. The roundabout would connect the Graven Hill development, via the proposed Employment Access Road (EAR) to the wider highway network. The proposals would also allow for future access to a proposed development (Wretchwick Green) on land to the north of the A41.

The roundabout is primarily aimed to help improve access (for all users) to the Graven Hill and Wretchwick Green developments. It is intended that the information within this Assessment Report will help inform the design team as to the needs of and issues faced by pedestrians, cyclists and equestrians as they progress improvement options at the junction.

1.4 Study Area

The broad study area is shown in **Figure 1** in map form and a more detailed satellite image shows the approximate localised extent of the scheme for reference in **Figure 2**. The assessment area has been set by the Lead Assessor and covers approximately a 500m diameter centred upon the scheme.





Source: https://www.google.co.uk/maps/@51.8962514,- Source: https://www.google.co.uk/maps/@51.8823951,-1.1603666,14.17z 1.1350964,409m/data=!3m1!1e3

1.5 Clarifications

GG 142 sets out procedures required to implement WCHAR for highway schemes and includes requirements and advice to be used in the assessment and review of walking, cycling and horse-riding opportunities. The purpose is to facilitate the inclusion of all walking, cycling and horse-riding modes in the design process from the earliest stage, enabling the design team to identify potential opportunities for improved facilities and integration with the local and national networks throughout the design process.

It is stated that the Assessment shall be undertaken during the options or concept stage and the Assessment Report shall be completed before the end of preliminary design. Due to project programming the concept and options design stages were already underway when the decision to undertake the WCHAR was made (the designs had not been finalised). The delivery of this Assessment report is however timed to coincide with the end of the preliminary design stage and prior to the commencement of the detailed design.

As a 'large' scheme, as defined in GG 142, the Assessment stage should also include the collation and analysis of walking, cycling and horse-riding user survey data. Where it does not already exist, this data shall be obtained to include current usage figures for pedestrians, cyclists and horse-riders. However as referred in chapter 2 it is considered that in this instance recorded statistics would bring minimal benefit and have therefore not been obtained.

Although WCHARs are conducted to primarily consider the requirements of pedestrians, cyclists, equestrians and other vulnerable road users (i.e. wheelchair users, push chair users and the mobility-impaired), due to scheme location, lack of existing facilities and nature of the proposed scheme, the requirements for equestrians are not specifically identified in this instance.



2. WCHAR Assessment

This section summarises the findings of the assessment as set out in Section 4 of GG 142.

2.1 Assessment of Walking, Cycling & Horse-Riding Policies and Strategies

The following documents have been reviewed as part of the assessment:

- National Policy Statement for National Network;
- National Planning Policy Framework;
- National Planning Practice Guidance: Travel Plans, Transport Assessments and Statements in Decision Making;
- Relevant chapters of the Design Manual for Roads and Bridges (DMRB) and associated Interim Advice Notes.
- Oxfordshire LTP4; and
- Oxfordshire Residential Design Guide (2015)

2.2 Collision Data

A review of the road safety records for the immediate local highway network has been undertaken to determine if there are any prevailing trends that may suggest deficiencies in the current highway layout, or where an increase in traffic flows may lead to an increased risk to highway safety. In-line with Planning Guidance, data from the most recent 26-month period (2017 to 2019) has been reviewed for A41 / Pioneer Road junction. A plan illustrating the location of the collisions within the vicinity of the site is provided in **Figure 3**.

Figure 3: Collision Location Plan



Source: https://www.crashmap.co.uk/Search

Figure 3 shows that no collisions occurred within the study area (indicated by the yellow box). The existing highway network is not considered to have any inherent highway safety issues.



2.3 Existing Pedestrian & Cyclist Facilities within the Study Area

Multi-Modal Provision

There are not cycle parking or bus stops within the study area.

Walking Provision

The A41 includes narrow street lit footways either side of the carriageway. To the north the footway runs alongside the carriageway edge. To the south the footway to the east of Pioneer Road runs alongside the carriageway edge whereas to the west of Pioneer Road the footway is separated from the carriageway by a grass verge. Photographs illustrating the existing conditions along the A41 are provided below in **Photograph 1** and **Photograph 2**.

Photograph 1: A41 (West of Pioneer Road) Photograph 2: A41 (East of Pioneer Road)

Pioneer Road is bounded by grass verges and vegetation with no provision for pedestrians and particularly unsuited for the mobility impaired. Pioneer Road currently serves as the access to a live Ministry of Defence (MoD) site. For security reasons (at the request of the MoD) no photographs of Pioneer Road have been included within this report.

There are no Public Rights of Way (PRoW) within the study area.

There are no formal crossing facilities on the A41 or at the A41 / Pioneer Road junction although there is a refuge island on Pioneer Road. The refuge island includes two illuminated/reflective bollards.

Cycle Provision

A narrow-shared use foot/cycleway is provided alongside the A41 to the south of the carriageway. The footway/cycleway is signed at the junction of Pioneer Road, as illustrated in **Photograph 3** and **Photograph 4** (Note: Photograph 4 shows temporary barriers present during the site visits).





Photograph 3: Cycle Sign (East of Pioneer Road) Photograph 4: Cycle Sign (West of Pioneer Road)

There are no designated cycling facilities available along Pioneer Road. However, it is considered that travelling along the carriageway is acceptable for cyclists due to the lightly trafficked nature of the road.

2.4 Existing Pedestrian and Cyclist Facilities Beyond Scheme Extents

The study area is rural in nature and continues to be so to the east and south. To the northwest lies the southern outskirts of Bicester and is therefore more urban/residential in nature.

The following pedestrian and cyclist facilities lie outside the immediate scheme extents and have been identified:

- As with the localised area, the rural part of the study area has very limited facilities for pedestrians, but with basic footway provision within the more urban areas.
- Several public footpaths are located to the north of the A41 including footpaths 105/1, 105/4 and 105/5. These are shown on the Public Rights of Way Map in **Figure 4**.
- National Cycle Network Route 51 is located to the north and west routing through Bicester. Route 51 is a long-distance cycling route that connects several cities in southern England. It begins in Oxford and passes Milton Keynes, Bury St Edmunds and Ipswich before reaching the coast at Felixstowe. A plan illustrating the route through Bicester is provided as **Figure 5**.







Source: https://publicrightsofway.oxfordshire.gov.uk/Web/standardmap.aspx



Figure 5: Sustrans Cycle Route Map

Source: https://osmaps.ordnancesurvey.co.uk/51.89151,-1.13591,14



2.5 Pedestrian & Cyclist Survey Data

Due to health and safety factors associated with the ongoing Covid-19 pandemic coupled with the negligible current usage (evident during site visits) a decision was made and agreed with the Local Highway Authority that in this particular case, no pedestrian, cycling or equestrian user surveys were to be commissioned for this scheme.

2.6 Trip Generators

Trip generators within the study area which could be popular with pedestrians and cyclists include:

- Bicester (urban area);
- Graven Hill development (residential and employment);
- Proposed developments (Wretchwick Green and Graven Hill) to the north and south of the A41 respectively;
- Rural villages including Ambrosden, Blackthorn, Launton etc;
- Bicester Retail Village;
- Primary/Secondary Schools including Langford Village Community School, St Edburg's Church of England School, Bicester Secondary School etc;
- Bus stops;
- Rail Stations including Bicester Village and Bicester North; and
- Bicester Park & Ride.

2.7 Site Visit

A site visit was conducted by the Lead Assessor and Assessor on Thursday 21st November 2019 and again on Thursday 23rd April 2020 in order to gain an appreciation of existing usage at different times of the day.

The weather during the first site visit was cold with a dry carriageway surface. During the second site visit the weather was much warmer with a dry carriageway surface. Traffic conditions were quiet/uncongested during the first site visit. The second site visit occurred during the 'Lockdown period' and so was uncharacteristically quiet.

During the site visits the following items were noted (Table 1):

Table 1:Site Visit Notes

Site Visit Notes

- 1. There is a surfaced narrow footway for pedestrians to the north of the A41. There is evidence of vegetation encroachment and no obvious signs of significant regular use. No pedestrians were observed using the footway during the site visits.
- 2. There is a surfaced narrow shared footway/cycleway for pedestrians and cyclists to the south of the A41. There is evidence of vegetation encroachment and no obvious signs of significant regular use, although cyclists were observed to be using the route during the site visits (see Photograph 5). It was noted that pedestrians had to step into the carriageway or verge when a cyclist was passing.
- 3. On Pioneer Road there are no footways and the grass verges show no apparent sign of use by pedestrians. No pedestrians or cyclists were observed along Pioneer Road during the site visits.
- 4. Relatively high vehicle speeds during the site visits were apparent on the A41. This could be considered unattractive to pedestrians walking alongside such a high speed and for on-road cycling (should this occur). Speeds along Pioneer Road were considerably lower and considered more attractive for on-road cycling and walking.



Site Visit Notes

- 5. Crossing facilities are limited to the splitter islands at the A41 Pioneer Road junction.
- 6. Street lighting is provided along the A41 and at the Pioneer Road junction. Lighting on the A41 is positioned over the footway and shared use path, giving more visibility and security to pedestrians, cyclists and other path users.



Photograph 5: Cyclist using Shared Use Footway/Cycleway

2.8 Liaison with Key Stakeholders, Local User Groups and Wider Public

No consultation has taken place with key stakeholders, local user groups or the wider public.



3. User opportunities

3.1 Pedestrian & Cyclist User Opportunities

Opportunities relevant to the highway scheme are highlighted in **Table 2** and

Table 3. These should be considered by the design team leader throughout the progression of the highway scheme design in addition to any further opportunities that may arise through the ongoing development of the design.

Table 2: Pedestrian Specific Opportunities

Ref	Opportunity
1	Incorporation of new footways or shared use facilities on Pioneer Road to link to any facilities as part of the Graven Hill development (currently there are no facilities for pedestrians along Pioneer Road from its junction with the A41). The width/design of the footway or shared use facilities should consider the nature/quantum of those likely to be using the route.
2	Incorporation of footways or shared use facilities to link to any facilities as part of the proposed development (Wretchwick Green) to the north of the A41. This would help 'future proof' the scheme for pedestrians and possibly cyclists. The width/design of the footway or shared use facilities should consider the nature/quantum of those likely to be using the route.
3	Provision of appropriate crossing points on the A41, Pioneer Road and the northern access road. This would improve the situation for any pedestrians wishing to use the area and would also benefit cyclists. These could be incorporated into shared facilities for cyclists - see Opportunities 8 below.
4	Provision of a wider footway/cycleway alongside the A41 (to the south of carriageway), particularly to the west of Pioneer Road, leading into Bicester (i.e. towards many of the key local trip generators). This would benefit existing and future users and would allow cyclists to safely pass pedestrians on the shared use route (currently pedestrians have to step out into the verge or carriageway to avoid colliding with a cyclist). This is repeated below in cyclist specific opportunities 9.
5	A wider footway may also be potentially useful along the northern side of the A41, although suppressed demand and potential usage levels are unclear
6	The speed limit along the A41 is currently 50mph. High Speeds were observed during the site visits. The scheme may benefit from a reduction in the speed of traffic along the A41 to provide a more attractive environment for pedestrians and also cyclists traveling alongside and attempting to cross the A41.
7	Vegetation was observed to be over hanging and obstructing the footway and shared use footway/cycleway in places. Pedestrian would benefit from the vegetation being cut back along with an appropriate maintenance regime to prevent future problems (repeated in cyclist specific opportunities 10.



Table 3: Cyclist Specific Opportunities

Ref	Opportunity
8	Consideration of provision of appropriate crossing points at the proposed roundabout to provide for safe crossing of the carriageway. This would provide benefit for pedestrians too.
9	Incorporation of appropriate shared use path facilities across the scheme extent to provide off- road facilities for cyclists to negotiate the roundabout areas would greatly improve the existing situation for cyclists who are already using this route and would help to encourage levels of cycling in the area. Tie-ins between the shared facility and the proposed development access roads (i.e. Pioneer Road and the northern access road) would need careful consideration to cater for all anticipated movements and anticipated cyclist types adequately. Consideration should also be given to the on-carriageway facilities at the roundabout to ensure that cyclists preferring to use the road are not disadvantaged by the new roundabout arrangement.
10	Vegetation was observed to be over hanging and obstructing the footway and shared use footway/cycleway in places. Cyclists would benefit from the vegetation being cut back along with an appropriate maintenance regime to prevent future problems.



4. Next Steps

The material contained within this Assessment Report will be used to help the designer confirm engineering solutions with due regard for the needs of pedestrians and cyclists.

The opportunities identified within this report will be reviewed as the scheme design progresses beyond the planning submission, alongside any new opportunities identified as a result of the developing scheme design.

A preliminary design stage Review Report will be provided to identify whether opportunities within the Assessment Report have been included at the preliminary design stage. If opportunities identified have not been implemented, recommendations will be presented prior to the detailed design stage. Due to the scheme project programme, this preliminary design stage Review Report is planned to be delivered during July 2020 i.e. during the preliminary design phase of the scheme.

The detailed design stage Review Report is planned to be provided during August / September 2020. Where identified opportunities have resulted in changes to the highway scheme design, the steps taken to implement the opportunities will be presented within the Review Report. Where opportunities have been identified but not implemented, the reasoning for this shall be recorded in the Review Report. This will encourage sharing of knowledge for future potential schemes in the area.



5. Team Statement

As Lead Assessor, I confirm that this walking, cycling and horse-riding assessment report has been compiled in accordance with GG 142. The walking, cycling and horse-riding assessment was undertaken by the following:

Table 4: Lead Assesso	r
Name	James Picton
Position	Senior Consultant
Organisation	Waterman Infrastructure & Environment Ltd
Signed	
Date	22nd May 2020
Table 5: Assessor	
Name	Laura Smith
Position	Graduate Transport Planner
Organisation	Waterman Infrastructure & Environment Ltd
Signed	
Date	22nd May 2020

As design team leader, I confirm that the assessment has been undertaken at the appropriate stage of the highway scheme development.

I confirm that in my professional opinion the appointed Lead Assessor has the appropriate experience for the role making reference to the expected competencies contained in GG 142.

Table 6: Deisgn Team Leader	
Name	Nick Jones-Hill
Position	Senior Associate Director
Organisation	Waterman Infrastructure & Environment Ltd
Signed	Addill
Date	22nd May 2020



UK and Ireland Office Locations





D. Stage 1 Road Safety Audit (Including Designer's Response)





A41 Pioneer Road Roundabout

Road Safety Audit: Stage 1 Designers Response

On Behalf of



April 2020

Waterman Infrastructure & Environment Limited Halifax House, Halifax Place, Nottingham, NG1 1QN www.watermangroup.com



Client Name:	Graven Hill Village Development Company Limited
Document Reference:	WIE11386-145-R-2DR-1-3-RSA Stage 1 – Designers Response
Project Number:	WIE11386

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001:2018)

IssueDateA01June 2

Date Prepared by June 2020 Aidan Norris Graduate engineer **Checked by** John Green Engineer Approved by Nick Jones-Hill Senior Associate Director

Comments



Disclaimer

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We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

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Appendices

- A. List of Drawings and Documents Provided to the Audit Team
- B. Problem Location Plan



1. Introduction

This report is a Stage 1 Road Safety Audit (RSA) Designers Response carried out on behalf of Graven Hill Village Development Company Limited, regarding a proposed roundabout junction on the A41 Pioneer Road near Bicester.



2. Proposals and Information Provided

This Stage 1 Road Safety Audit considers the road safety of pedestrians, cyclists and vehicles at a proposed roundabout along the A41 Pioneer Road in Bicester. The proposed scheme is a four-armed roundabout that would connect the Graven Hill development to the wider highway network. The proposals would also allow for a future access to a proposed development north of the A41 (known as Wretchwick Green). A drawing showing the roundabout proposals is listed in **Appendix A**.

This audit considers the works within the limits of the roundabout only.

2.1 Documents and Drawings Provided

The drawing provided to the Audit Team is included in Appendix A: Drawing: WIE11386-SA-03-026-A01

2.2 Collision Data

No collisions have occurred at the A41 Pioneer Road junction over the most recent 3-year period (2017-2019).

2.3 Documents and Information Not Provided

No Departures from Standard have been identified to the Audit Team.



3. Matters Arising From This Audit

3.1 **Problem 3.1**

3.1.1 Location and Scheme Drawing: A41 (East and West of Roundabout)

Drawing: WIE11386-SA-03-026-A01

3.1.2 Summary: No Consideration of existing field accesses

To the north-west and south-east of the proposed roundabout there are existing field accesses which provide access into the land to the north and south of the A41. The scheme does not appear to provide for these points of access. Failure to provide safe points of access into these parcels of land could result in vehicles mounting/dismounting the kerb at inappropriate locations. This could increase the risk of rear end shunts with vehicles slowing down to mount the kerb.



3.1.3 Recommendation

Provision should be made for vehicles to access, if necessary, the existing parcels of land using these access locations to the north and south of the A41.



Designers Response

Agreed: Access to the West of the A41 roundabout has been retained.



Access to the East of A41 roundabout to be stopped up.

3.2 Problem 3.2

3.2.1 Location and Scheme Drawing: A41 (South-Eastern Arm)

Drawing: WIE11386-SA-03-026-A01

3.2.2 Summary: Insufficent width for shared use footway/cycleway adjacent Toucan Crossing

The scheme proposals include a Toucan crossing on the A41 eastern arm. On the southern side of the A41 there is an existing footway/cycleway which is very narrow in width (<2m). This width is also restricted by the location of a street lighting column within the footway/cycleway (adjacent to the proposed crossing point). See below photograph. The proposed widening of the footway/cycleway does not commence until further to the west of the crossing. This narrow section of footway/cycleway would bring cyclists and pedestrians closer together (particularly if waiting to cross the road). Failure to provide sufficient space for pedestrians/cyclists to pass one another at the crossing could lead to collisions in close proximity to a busy section of road and could also result in pedestrians or cyclists using the road, resulting in slip/trip/fall incidents as pedestrians/cyclists mount/dismount the kerb.





3.2.3 Recommendation

It is recommended that this section of footway/cycleway is widened to 3m minimum to allow pedestrians/cyclists to safely pass one another.

Designers Response

Agreed: Back of footway has been offset 3m to provide a sufficient width for pedestrians / Cyclists. Footway ties back into to existing footway to the East.

3.3 Problem 3.3

3.3.1 Location and Scheme Drawing: A41 (East and West of Roundabout)

Drawing: WIE11386-SA-03-026-A01

3.3.2 Summary: Narrow footway/cycleway width

There is currently a narrow and lengthy section of footway/cycleway, circa 1.2m wide along the southern side of the A41. The proposed scheme ties a 3m wide shared use footway/cycleway into this existing footway/cycleway circa 150m to the northwest and southeast of the roundabout. The narrow section of footway/cycleway would bring cyclists and pedestrians closer together and therefore could lead to collisions in close proximity to a busy section of high-speed road.





3.3.3 Recommendation

It is recommended that remedial measures are taken to warn cyclists of the narrow footway/cycleway ahead and to reduce speed accordingly.

Designers Response

Agreed: Further details such as signage to be included during the detailed design stage.

3.4 Problem 3.4

3.4.1 Location and Scheme Drawing: A41 (North-Western arm)

Drawing: WIE11386-SA-03-026-A01

3.4.2 Summary: Insufficent lane width

The width at the start of the offside lane on the A41 eastbound approach arm appears narrow (<2m) alongside the nearside lane. There is insufficient width for vehicles to drive within the offside lane without overlapping the white lines. The introduction of such a narrow lane width increases the likelihood of rear end shunts with traffic in the adjacent/nearside lane.





3.4.3 Recommendation

It is recommended that the width (and consistency of width) of lanes should be reviewed. Generally, it is considered that a minimum lane width of 3 metres is required on through routes, with additional lane width being provided where the traffic movements using the lane are either on a radius or making a turning movement.

Designers Response

Agreed: Lane widths have been reviewed and adjusted for a minimum lane width of 3m in drawing WIE11386-SA-03-026-A03.

3.5 Problem 3.5

3.5.1 Location and Scheme Drawing: A41 (South-Eastern arm)

Drawing: WIE11386-SA-03-026-A01

3.5.2 Summary: Vehicles colliding with Crossing Pedestrians

The Toucan Crossing on the A41 eastern arm is not located on the desire for north-south movements. The crossing is located circa 70m east of the roundabout. Therefore, vehicle speeds at the crossing location could be high as they would not be constrained by the proximity of the roundabout. Pedestrian/cyclists may instead choose to cross via the uncontrolled crossing, located closer to the roundabout (circa 5m).



Crossing via the uncontrolled crossing point would require pedestrians/cyclists to cross 2 lanes of southeastbound traffic (8.6m) and 3 lanes of north-westbound traffic (10.5m). The crossing distance (particularly on the approach to the roundabout from the southeast) would expose pedestrians to live traffic for a longer period than necessary when crossing. This would increase the risk of pedestrian/vehicle collisions. The visibility to the right/east at the crossing point (south-north) is also restricted by trees/vegetation to the south of the carriageway. The combination of the crossing distance, higher vehicle speeds and poor visibility may lead to an increased risk of vehicles colliding with pedestrians using the crossing.



3.5.3 Recommendation

It is recommended that pedestrians/cyclists are encouraged to cross using the Toucan Crossing where the crossing is controlled, the carriageway is narrower and where visibility is improved, whilst still supporting the pedestrian desire line. It is therefore recommended that the location of the Toucan Crossing is reviewed and also the appropriate pedestrian visibility splays are provided at the uncontrolled crossing.

Designers Response

Agreed: The toucan crossing along the eastern arm cannot be relocated as the entry width is too great at this arm. Vegetation at the back of footway will be maintained periodically to allow for greater visibility at the toucan crossing. Uncontrolled crossing to be removed.

3.6 Problem 3.6

3.6.1 Location and Scheme Drawing: A41 (North-Western arm)

Drawing: WIE11386-SA-03-026-A01



3.6.2 Summary: Uncontrolled crossing provision located near controlled crossings

The scheme includes both controlled and uncontrolled crossing points on the A41 approach arms to the roundabout and the Graven Hill development access road (Note: The Toucan Crossing lies outside of the limits of this RSA on this arm). For movements across the junction (i.e. between Graven Hill and Wretchwick Green or along the A41), the uncontrolled crossings are located closer to the pedestrian/cyclist desire line. Use of the controlled crossings would therefore require pedestrians/cyclists to walk/cycle a greater distance. Pedestrians and cyclist are therefore likely to use the uncontrolled crossing points. This could result in increased likelihood of conflict between crossing pedestrians/cyclists and vehicles, particularly as drivers may be concentrating on the signal-controlled crossing and/or the roundabout junction ahead.

3.6.3 Recommendation

The uncontrolled pedestrian crossing provision at the roundabout should be removed or relocated to encourage use of the controlled crossings. The toucan crossings should be relocated closer to the roundabout.

Designers Response

Disagreed: The toucan crossings on the western arm is currently aligned with DMRB standards (CD116) and so cannot be relocated closer than 20m from the roundabout. Uncontrolled crossing has been removed in drawing WIE11386-SA-03-026-A03.

CD116 Paragraph 3.53.1: "Crossings should not be sited between 20 metres and 60 metres from the give way line."



4. Audit Team Statement

We certify that the audit has been carried out in accordance with the requirements set out in GG 119, unless agreed otherwise with the local highway authority. The issues identified have been noted in this report together with associated safety improvement suggestions which we recommend should be studied for implementation.

AUDIT TEAM LEADER

Dave Prior FCIHT MRTPI, MSoRSA, MTPS, HE RSA Certificate of Competency Associate Director Waterman Infrastructure & Environment Halifax House

Signed

Nottingham NG1 1QN

Date: 29th April 2020

AUDIT TEAM MEMBER

David Whalley Bsc Principal Transport Planner Waterman Infrastructure & Environment Halifax House Nottingham NG1 1QN

Signed	Alihulden
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Date: 29th April 2020



APPENDICES

A. List of Drawings and Documents Provided to the Audit Team

Drawing: WIE11386-SA-03-026-A01



B. Problem Location Plan





UK and Ireland Office Locations







A41 Pioneer Road Roundabout

Road Safety Audit: Stage 1

April 2020

Waterman Infrastructure & Environment Limited Halifax House, Halifax Place, Nottingham, NG1 1QN www.watermangroup.com


Client Name:	Graven Hill Village Development Company Limited
Document Reference:	WIE11386-145-R-2-1-3-RSA Stage 1
Project Number:	WIE11386

Quality Assurance – Approval Status

lssue	Date	Prepared by	Checked by	Approved by
A01	April 2020	David Whalley	David Prior	David Prior
		Principal Transport Planner	Associate	Associate



Disclaimer

This report has been prepared by Waterman Infrastructure & Environment Limited, with all reasonable skill, care and diligence within the terms of the Contract with the client, incorporation of our General Terms and Condition of Business and taking account of the resources devoted to us by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at its own risk.



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Appendices

- A. List of Drawings and Documents Provided to the Audit Team
- B. Problem Location Plan



1. Introduction

This report is a Stage 1 Road Safety Audit (RSA) carried out on behalf of Graven Hill Village Development Company Limited, regarding a proposed roundabout junction on the A41 Pioneer Road near Bicester. It should be noted that proposals for a roundabout junction at this location were subject to a Stage 1 RSA in November 2019. Those proposals have been subject to revision and therefore this report considers the road safety implications of those revised proposals.

The RSA team, staff members from Waterman, present at the RSA were:

- Dave Prior BA (Hons), FCIHT, MRTPI, MSoRSA, MTPS, HE RSA Certificate of Competency Audit Team Leader.
- David Whalley BSc (Hons)
 - Audit Team Member

We confirm that no member of the Audit Team has been involved with the design process.

The Audit team have visited the site on two separate occasions. The first site visit occurred on Thursday 21st November 2019 between 09:30 and 11:00. The weather during the site visit was cold with a dry carriageway surface. The second site visit occurred on Thursday 23rd April 2020 between 12.30 and 13.00. The weather during the site visit was warm with a dry carriageway surface. Traffic conditions were uncongested, with very low flows due to the ongoing Covid-19 restrictions.

The terms of reference of the RSA are as described in the Design Manual for Roads and Bridges GG 119 – Road Safety Audit (previously HD 19/15). The RSA team has examined and reported only the road safety issues of the scheme as presented and has not examined or verified the compliance of the design to any other criteria.

All of the problems described in this report are considered by the RSA auditor to require action in order to improve the safety of the scheme and minimise collision occurrence. However, if any of the problems or recommendations, within this Road Safety Audit report are not accepted, a copy of the signed exception report from the Overseeing Organisation should be sent to the Road Safety Audit Team Leader.



2. Proposals and Information Provided

This Stage 1 Road Safety Audit considers the road safety of pedestrians, cyclists and vehicles at a proposed roundabout along the A41 Pioneer Road in Bicester. The proposed scheme is a four-armed roundabout that would connect the Graven Hill development to the wider highway network. The proposals would also allow for a future access to a proposed development north of the A41 (known as Wretchwick Green). A drawing showing the roundabout proposals is listed in **Appendix A**.

This audit considers the works within the limits of the roundabout only.

2.1 Documents and Drawings Provided

The drawing provided to the Audit Team is included in Appendix A: Drawing: WIE11386-SA-03-026-A01

2.2 Collision Data

No collisions have occurred at the A41 Pioneer Road junction over the most recent 3-year period (2017-2019).

2.3 Documents and Information Not Provided

No Departures from Standard have been identified to the Audit Team.



3. Matters Arising From This Audit

3.1 **Problem 3.1**

3.1.1 Location and Scheme Drawing: A41 (East and West of Roundabout)

Drawing: WIE11386-SA-03-026-A01

3.1.2 Summary: No Consideration of existing field accesses

To the north-west and south-east of the proposed roundabout there are existing field accesses which provide access into the land to the north and south of the A41. The scheme does not appear to provide for these points of access. Failure to provide safe points of access into these parcels of land could result in vehicles mounting/dismounting the kerb at inappropriate locations. This could increase the risk of rear end shunts with vehicles slowing down to mount the kerb.



3.1.3 Recommendation

Provision should be made for vehicles to access, if necessary, the existing parcels of land using these access locations to the north and south of the A41.



3.2 Problem 3.2

3.2.1 Location and Scheme Drawing: A41 (South-Eastern Arm)

Drawing: WIE11386-SA-03-026-A01

3.2.2 Summary: Insufficent width for shared use footway/cycleway adjacent Toucan Crossing

The scheme proposals include a Toucan crossing on the A41 eastern arm. On the southern side of the A41 there is an existing footway/cycleway which is very narrow in width (<2m). This width is also restricted by the location of a street lighting column within the footway/cycleway (adjacent to the proposed crossing point). See below photograph. The proposed widening of the footway/cycleway does not commence until further to the west of the crossing. This narrow section of footway/cycleway would bring cyclists and pedestrians closer together (particularly if waiting to cross the road). Failure to provide sufficient space for pedestrians/cyclists to pass one another at the crossing could lead to collisions in close proximity to a busy section of road and could also result in pedestrians or cyclists using the road, resulting in slip/trip/fall incidents as pedestrians/cyclists mount/dismount the kerb.



3.2.3 Recommendation

It is recommended that this section of footway/cycleway is widened to 3m minimum to allow pedestrians/cyclists to safely pass one another.



3.3 Problem 3.3

3.3.1 Location and Scheme Drawing: A41 (East and West of Roundabout)

Drawing: WIE11386-SA-03-026-A01

3.3.2 Summary: Narrow footway/cycleway width

There is currently a narrow and lengthy section of footway/cycleway, circa 1.2m wide along the southern side of the A41. The proposed scheme ties a 3m wide shared use footway/cycleway into this existing footway/cycleway circa 150m to the northwest and southeast of the roundabout. The narrow section of footway/cycleway would bring cyclists and pedestrians closer together and therefore could lead to collisions in close proximity to a busy section of high-speed road.



3.3.3 Recommendation

It is recommended that remedial measures are taken to warn cyclists of the narrow footway/cycleway ahead and to reduce speed accordingly.



3.4 Problem 3.4

3.4.1 Location and Scheme Drawing: A41 (North-Western arm)

Drawing: WIE11386-SA-03-026-A01

3.4.2 Summary: Insufficent lane width

The width at the start of the offside lane on the A41 eastbound approach arm appears narrow (<2m) alongside the nearside lane. There is insufficient width for vehicles to drive within the offside lane without overlapping the white lines. The introduction of such a narrow lane width increases the likelihood of rear end shunts with traffic in the adjacent/nearside lane.



3.4.3 Recommendation

It is recommended that the width (and consistency of width) of lanes should be reviewed. Generally, it is considered that a minimum lane width of 3 metres is required on through routes, with additional lane width being provided where the traffic movements using the lane are either on a radius or making a turning movement.



3.5 Problem 3.5

3.5.1 Location and Scheme Drawing: A41 (South-Eastern arm)

Drawing: WIE11386-SA-03-026-A01

3.5.2 Summary: Vehicles colliding with Crossing Pedestrians

The Toucan Crossing on the A41 eastern arm is not located on the desire for north-south movements. The crossing is located circa 70m east of the roundabout. Therefore, vehicle speeds at the crossing location could be high as they would not be constrained by the proximity of the roundabout. Pedestrian/cyclists may instead choose to cross via the uncontrolled crossing, located closer to the roundabout (circa 5m). Crossing via the uncontrolled crossing point would require pedestrians/cyclists to cross 2 lanes of south-eastbound traffic (8.6m) and 3 lanes of north-westbound traffic (10.5m). The crossing distance (particularly on the approach to the roundabout from the southeast) would expose pedestrians to live traffic for a longer period than necessary when crossing. This would increase the risk of pedestrian/vehicle collisions. The visibility to the right/east at the crossing point (south-north) is also restricted by trees/vegetation to the south of the carriageway. The combination of the crossing distance, higher vehicle speeds and poor visibility may lead to an increased risk of vehicles colliding with pedestrians using the crossing.



3.5.3 Recommendation

It is recommended that pedestrians/cyclists are encouraged to cross using the Toucan Crossing where the crossing is controlled, the carriageway is narrower and where visibility is improved, whilst still supporting the pedestrian desire line. It is therefore recommended that the location of the Toucan Crossing is reviewed and also the appropriate pedestrian visibility splays are provided at the uncontrolled crossing.



3.6 Problem 3.6

3.6.1 Location and Scheme Drawing: A41 (North-Western arm)

Drawing: WIE11386-SA-03-026-A01

3.6.2 Summary: Uncontrolled crossing provision located near controlled crossings

The scheme includes both controlled and uncontrolled crossing points on the A41 approach arms to the roundabout and the Graven Hill development access road (Note: The Toucan Crossing lies outside of the limits of this RSA on this arm). For movements across the junction (i.e. between Graven Hill and Wretchwick Green or along the A41), the uncontrolled crossings are located closer to the pedestrian/cyclist desire line. Use of the controlled crossings would therefore require pedestrians/cyclists to walk/cycle a greater distance. Pedestrians and cyclist are therefore likely to use the uncontrolled crossing points. This could result in increased likelihood of conflict between crossing pedestrians/cyclists and vehicles, particularly as drivers may be concentrating on the signal-controlled crossing and/or the roundabout junction ahead.

3.6.3 Recommendation

The uncontrolled pedestrian crossing provision at the roundabout should be removed or relocated to encourage use of the controlled crossings. The toucan crossings should be relocated closer to the roundabout.



4. Audit Team Statement

We certify that the audit has been carried out in accordance with the requirements set out in GG 119, unless agreed otherwise with the local highway authority. The issues identified have been noted in this report together with associated safety improvement suggestions which we recommend should be studied for implementation.

AUDIT TEAM LEADER

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Date: 29th April 2020

AUDIT TEAM MEMBER

David Whalley Bsc Principal Transport Planner Waterman Infrastructure & Environment Halifax House Nottingham NG1 1QN

Signed Date: 29th April 2020



APPENDICES

A. List of Drawings and Documents Provided to the Audit Team

Drawing: WIE11386-SA-03-026-A01



B. Problem Location Plan





UK and Ireland Office Locations





E. Junction Capacity Assessment Results



Junctions 8 ARCADY 8 - Roundabout Module Version: 8.0.6.541 [19821,26/11/2015] © Copyright TRL Limited, 2020 For sales and distribution information, program advice and maintenance, contact TRL: Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution

Filename: Base models 2031 with dev - Original Final Design.arc8 Path: \\H-bm\wiel\Projects\WIE11386_GH\0_LTA 2\#WO145_A41 ROUNDABOUT_Got PO\6_Design\Calculations\Junction Assessments\Dutch Style\Original Report generation date: 22/06/2020 13:25:25

- » (Default Analysis Set) 2031 with Dev, AM
- » (Default Analysis Set) 2031 with Dev, PM

Summary of junction performance

		AM				РМ		
	Queue (PCU)	Delay (s)	RFC	LOS	Queue (PCU)	Delay (s)	RFC	LOS
			A1 -	2031	with Dev			
Arm 1	2.57	5.03	0.72	А	8.32	14.10	0.90	В
Arm 2	1.58	6.95	0.61	Α	26.51	87.11	1.02	F
Arm 3	1.55	7.12	0.61	А	3.13	14.17	0.77	В
Arm 4	3.14	11.33	0.76	В	2.27	8.91	0.70	А

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle.

"D1 - 2031 with Dev, AM " model duration: 07:45 - 09:15 "D2 - 2031 with Dev, PM" model duration: 16:45 - 18:15

Run using Junctions 8.0.6.541 at 22/06/2020 13:25:24

File summary

Title	A41 Pioneer Road Roundabout
Location	Graven Hill, Bicester
Site Number	
Date	05/05/2020
Version	1
Status	
Identifier	
Client	Graven Hill Village Development Company Limited
Jobnumber	WIE11386
Enumerator	BMJP
Description	Drawing WIE11386-A41-03-001-A01-General Arrangement

Analysis Options

Vehicle Length	Do Queue	Calculate Residual	Residual Capacity Criteria	RFC	Average Delay Threshold	Queue Threshold
(m)	Variations	Capacity	Type	Threshold	(s)	(PCU)
5.75			N/A	0.85	36.00	20.00



Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	PCU	PCU	perHour	s	-Min	perMin

(Default Analysis Set) - 2031 with Dev, AM

Data Errors and Warnings

Severity	Area	ltem	Description
Warning	Geometry	Arm 1 - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Arm 3 - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Pedestrian Crossing	Arm 1 - Pelican/Puffin Details	Pedestrian crossing uses default settings only. Is this correct?
Warning	Pedestrian Crossing	Arm 1 - Pelican/Puffin Details	Pedestrian crossing uses default flow of 0. Is this correct?

Analysis Set Details

Name	Roundabout Capacity Model	Description	Locked	Network Flow Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY			100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Single Time Segment Only	Locked
2031 with Dev, AM	2031 with Dev	AM		ONE HOUR	07:45	09:15	90	15		

Junction Network

Junctions

Junction	Name	Junction Type	Arm Order	Grade Separated	Large Roundabout	Junction Delay (s)	Junction LOS
1	(untitled)	Roundabout	1,2,3,4			7.18	А

Junction Network Options

Driving Side	Lighting		
Left	Normal/unknown		



Arms

Arms

Arm	Arm	Name	Description
1	1	A41 (East)	
2	2	Site Access	
3	3	A41 (West)	
4	4	Comm Dev Access	

Capacity Options

Arm	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Arm	V - Approach road half- width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	5.00	10.50	70.00	40.00	60.00	28.00	
2	5.30	7.45	18.00	30.00	60.00	28.00	
3	5.00	7.00	125.00	25.00	60.00	39.00	
4	7.00	7.40	3.00	26.00	60.00	35.00	

Pedestrian Crossings

Arm	Crossing Type
1	Pelican
2	Pelican
3	Pelican
4	None

Pelican/ Puffin Crossings

Arm	Amber time preceding red (s)	Amber time regarded as green (s)	Time from traffic red start to green man start (s)	Time period green man shown (s)	Clearance Period (s)	Traffic minimum green (s)	Space between crossing and junction entry (PCU)
1	3.00	2.90	1.00	6.00	6.00	7.00	0.00
2	3.00	2.90	1.00	6.00	6.00	7.00	8.00
3	3.00	2.90	1.00	6.00	6.00	7.00	8.00

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Enter slope and intercept directly	Entered slope	Entered intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1		(calculated)	(calculated)	0.779	2936.035
2		(calculated)	(calculated)	0.637	2125.481
3		(calculated)	(calculated)	0.611	2046.622
4		(calculated)	(calculated)	0.641	2192.573

The slope and intercept shown above include any corrections and adjustments.



Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCU Factor for a HV (PCU)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		~	~	HV Percentages	2.00				~	~

Entry Flows

General Flows Data

Arm	Profile Type	Use Turning Counts	Average Demand Flow (PCU/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	1687.00	100.000
2	ONE HOUR	~	748.00	100.000
3	ONE HOUR	~	717.00	100.000
4	ONE HOUR	✓	928.00	100.000

Pedestrian Flows

General Flows Data

Arm	Profile Type	Average Pedestrian Flow (Ped/hr)
1	ONE HOUR	1.00
2	ONE HOUR	10.00
3	ONE HOUR	19.00
4	-	-



Direct/Resultant Flows

Direct Flows Data

Time Segment	Arm	Direct Demand Entry Flow (PCU/hr)	DirectDemandEntryFlowInPCU (PCU/hr)	Direct Demand Exit Flow (PCU/hr)	Direct Demand Pedestrian Flow (Ped/hr)
07:45-08:00	1	1270.06	1270.06		0.00
07:45-08:00	2	563.13	563.13		7.53
07:45-08:00	3	539.80	539.80		14.30
07:45-08:00	4	698.65	698.65		
08:00-08:15	1	1516.58	1516.58		0.00
08:00-08:15	2	672.44	672.44		8.99
08:00-08:15	3	644.57	644.57		17.08
08:00-08:15	4	834.25	834.25		
08:15-08:30	1	1857.42	1857.42		0.00
08:15-08:30	2	823.56	823.56		11.01
08:15-08:30	3	789.43	789.43		20.92
08:15-08:30	4	1021.75	1021.75		
08:30-08:45	1	1857.42	1857.42		0.00
08:30-08:45	2	823.56	823.56		11.01
08:30-08:45	3	789.43	789.43		20.92
08:30-08:45	4	1021.75	1021.75		
08:45-09:00	1	1516.58	1516.58		0.00
08:45-09:00	2	672.44	672.44		8.99
08:45-09:00	3	644.57	644.57		17.08
08:45-09:00	4	834.25	834.25		
09:00-09:15	1	1270.06	1270.06		0.00
09:00-09:15	2	563.13	563.13		7.53
09:00-09:15	3	539.80	539.80		14.30
09:00-09:15	4	698.65	698.65		

Turning Proportions

Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

		То								
		1	2	3	4					
	1	0.000	655.000	649.000	383.000					
From	2	509.000	32.000	46.000	161.000					
	3	632.000	38.000	0.000	47.000					
	4	574.000	285.000	69.000	0.000					

Turning Proportions (PCU) - Junction 1 (for whole period)

	То					
		1	2	3	4	
	1	0.00	0.39	0.38	0.23	
From	2	0.68	0.04	0.06	0.22	
	3	0.88	0.05	0.00	0.07	
	4	0.62	0.31	0.07	0.00	



Vehicle Mix

Average PCU Per Vehicle - Junction 1 (for whole period)

			То		
		1	2	3	4
	1	1.000	1.000	1.000	1.000
From	2	1.000	1.000	1.000	1.000
	3	1.000	1.000	1.000	1.000
	4	1.000	1.000	1.000	1.000

Heavy Vehicle Percentages - Junction 1 (for whole period)

			То		
		1	2	3	4
	1	0.0	0.0	0.0	0.0
From	2	0.0	0.0	0.0	0.0
	3	0.0	0.0	0.0	0.0
	4	0.0	0.0	0.0	0.0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	0.72	5.03	2.57	А
2	0.61	6.95	1.58	А
3	0.61	7.12	1.55	А
4	0.76	11.33	3.14	В

Main Results for each time segment

Main results: (07:45-08:00)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Entry Flow Circulating Flow Pedestrian Demand Capacity (PCU/hr) (PCU/hr) (Ped/hr) (PCU/hr)		Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
1	1270.06	1266.33	317.84	0.00	2625.00	0.484	0.93	2.643	А
2	563.13	560.93	826.38	7.53	1577.83	0.357	0.55	3.533	Α
3	539.80	537.58	813.93	14.30	1510.32	0.357	0.55	3.693	Α
4	698.65	695.61	908.04	0.00	1610.69	0.434	0.76	3.922	Α

Main results: (08:00-08:15)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
1	1516.58	1514.88	380.32	0.00	2625.00	0.578	1.36	3.239	А
2	672.44	671.33	988.59	8.99	1475.89	0.456	0.83	4.468	А
3	644.57	643.46	973.96	17.08	1415.17	0.455	0.83	4.658	А
4	834.25	832.32	1086.83	0.00	1496.12	0.558	1.24	5.408	А



Main results: (08:15-08:30)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Entry Flow Circulating Flow Pedestrian Demand Capacity (PCU/hr) (PCU/hr) (Ped/hr) (PCU/hr)		RFC	End Queue (PCU)	Delay (s)	LOS	
1	1857.42	1852.69	463.80	0.00	2574.52	0.721	2.54	4.955	А
2	823.56	820.62	1208.79	11.01	1339.65	0.615	1.57	6.898	Α
3	789.43	786.56	1190.77	20.92	1289.88	0.612	1.55	7.111	Α
4	1021.75	1014.54	1328.52	0.00	1341.24	0.762	3.05	10.789	В

Main results: (08:30-08:45)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Circulating Flow Pedestrian Demand (PCU/hr) (Ped/hr)		RFC	End Queue (PCU)	Delay (s)	LOS
1	1857.42	1857.30	466.69	0.00	2572.27	0.722	2.57	5.033	А
2	823.56	823.52	1212.12	11.01	1341.55	0.614	1.58	6.949	Α
3	789.43	789.41	1194.54	20.92	1294.80	0.610	1.55	7.122	А
4	1021.75	1021.37	1333.29	0.00	1338.19	0.764	3.14	11.329	В

Main results: (08:45-09:00)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Entry Flow (PCU/hr) Circulating Flow (PCU/hr) Pedestrian Demand (PCU/hr) Capacity (PCU/hr)		Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
1	1516.58	1521.34	384.27	0.00	2625.00	0.578	1.38	3.275	А
2	672.44	675.37	993.24	8.99	1477.53	0.455	0.84	4.503	А
3	644.57	647.42	979.23	17.08	1420.26	0.454	0.84	4.674	А
4	834.25	841.67	1093.45	0.00	1491.88	0.559	1.29	5.597	А

Main results: (09:00-09:15)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Entry Flow (PCU/hr) Circulating Flow (PCU/hr) Pedestrian Demand (PCU/hr) Capacity (PCU/hr)		Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
1	1270.06	1271.81	320.10	0.00	2625.00	0.484	0.94	2.665	Α
2	563.13	564.27	830.11	7.53	1578.62	0.357	0.56	3.554	Α
3	539.80	540.92	818.31	14.30	1513.52	0.357	0.56	3.707	А
4	698.65	700.69	913.58	0.00	1607.14	0.435	0.77	3.980	Α

(Default Analysis Set) - 2031 with Dev, PM

Data Errors and Warnings

Severity	Area	ltem	Description
Warning	Geometry	Arm 1 - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Arm 3 - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Pedestrian Crossing	Arm 1 - Pelican/Puffin Details	Pedestrian crossing uses default settings only. Is this correct?
Warning	Pedestrian Crossing	Arm 1 - Pelican/Puffin Details	Pedestrian crossing uses default flow of 0. Is this correct?

Analysis Set Details

Name	Roundabout Capacity Model	Description	Locked	Network Flow Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY			100.000	



Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Single Time Segment Only	Locked
2031 with Dev, PM	2031 with Dev	FM		ONE HOUR	16:45	18:15	90	15		

Junction Network

Junctions

Junction	Name	Junction Type	Arm Order	Grade Separated	Large Roundabout	Junction Delay (s)	Junction LOS
1	(untitled)	Roundabout	1,2,3,4			28.47	D

Junction Network Options

Driving Side	Lighting		
Left	Normal/unknown		

Arms

Arms

Arm	Arm	Name	Description
1	1	A41 (East)	
2	2	Site Access	
3	3	A41 (West)	
4	4	Comm Dev Access	

Capacity Options

Arm	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Arm	V - Approach road half- width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	5.00	10.50	70.00	40.00	60.00	28.00	
2	5.30	7.45	18.00	30.00	60.00	28.00	
3	5.00	7.00	125.00	25.00	60.00	39.00	
4	7.00	7.40	3.00	26.00	60.00	35.00	

Pedestrian Crossings

Arm	Crossing Type		
1	Pelican		
2	Pelican		
3	Pelican		
4	None		



Pelican/ Puffin Crossings

Arm	Amber time preceding red (s)	Amber time regarded as green (s)	Time from traffic red start to green man start (s)	Time period green man shown (s)	Clearance Period (s)	Traffic minimum green (s)	Space between crossing and junction entry (PCU)
1	3.00	2.90	1.00	6.00	6.00	7.00	0.00
2	3.00	2.90	1.00	6.00	6.00	7.00	8.00
3	3.00	2.90	1.00	6.00	6.00	7.00	8.00

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Enter slope and intercept directly	Entered slope	Entered intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1		(calculated)	(calculated)	0.779	2936.035
2		(calculated)	(calculated)	0.637	2125.481
3		(calculated)	(calculated)	0.611	2046.622
4		(calculated)	(calculated)	0.641	2192.573

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCU Factor for a HV (PCU)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		~	~	HV Percentages	2.00				~	~

Entry Flows

General Flows Data

Arm	Profile Type	Use Turning Counts	Average Demand Flow (PCU/hr)	Flow Scaling Factor (%)
1	ONE HOUR	~	2022.00	100.000
2	ONE HOUR	~	961.00	100.000
3	ONE HOUR	~	746.00	100.000
4	ONE HOUR	✓	849.00	100.000

Pedestrian Flows

General Flows Data

Arm	Profile Type	Average Pedestrian Flow (Ped/hr)
1	ONE HOUR	3.00
2	ONE HOUR	10.00
3	ONE HOUR	20.00
4	-	-



Direct/Resultant Flows

Direct Flows Data

Time Segment	Arm	Direct Demand Entry Flow (PCU/hr)	DirectDemandEntryFlowInPCU (PCU/hr)	Direct Demand Exit Flow (PCU/hr)	Direct Demand Pedestrian Flow (Ped/hr)
16:45-17:00	1	1522.27	1522.27		0.00
16:45-17:00	2	723.49	723.49		7.53
16:45-17:00	3	561.63	561.63		15.06
16:45-17:00	4	639.17	639.17		
17:00-17:15	1	1817.74	1817.74		0.00
17:00-17:15	2	863.92	863.92		8.99
17:00-17:15	3	670.64	670.64		17.98
17:00-17:15	4	763.23	763.23		
17:15-17:30	1	2226.26	2226.26		0.00
17:15-17:30	2	1058.08	1058.08		11.01
17:15-17:30	3	821.36	821.36		22.02
17:15-17:30	4	934.77	934.77		
17:30-17:45	1	2226.26	2226.26		0.00
17:30-17:45	2	1058.08	1058.08		11.01
17:30-17:45	3	821.36	821.36		22.02
17:30-17:45	4	934.77	934.77		
17:45-18:00	1	1817.74	1817.74		0.00
17:45-18:00	2	863.92	863.92		8.99
17:45-18:00	3	670.64	670.64		17.98
17:45-18:00	4	763.23	763.23		
18:00-18:15	1	1522.27	1522.27		0.00
18:00-18:15	2	723.49	723.49		7.53
18:00-18:15	3	561.63	561.63		15.06
18:00-18:15	4	639.17	639.17		

Turning Proportions

Turning Counts / Proportions (PCU/hr) - Junction 1 (for whole period)

			То		
		1	2	3	4
	1	0.000	537.000	913.000	572.000
From	2	498.000	30.000	54.000	379.000
	3	653.000	50.000	0.000	43.000
	4	390.000	395.000	64.000	0.000

Turning Proportions (PCU) - Junction 1 (for whole period)

			То		
		1	2	3	4
	1	0.00	0.27	0.45	0.28
From	2	0.52	0.03	0.06	0.39
	3	0.88	0.07	0.00	0.06
	4	0.46	0.47	0.08	0.00



Vehicle Mix

Average PCU Per Vehicle - Junction 1 (for whole period)

		То								
		1	2	3	4					
	1	1.000	1.000	1.000	1.000					
From	2	1.000	1.000	1.000	1.000					
	3	1.000	1.000	1.000	1.000					
	4	1.000	1.000	1.000	1.000					

Heavy Vehicle Percentages - Junction 1 (for whole period)

			То		
		1	2	3	4
	1	0.0	0.0	0.0	0.0
From	2	0.0	0.0	0.0	0.0
	3	0.0	0.0	0.0	0.0
	4	0.0	0.0	0.0	0.0

Results

Results Summary for whole modelled period

Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS
1	0.90	14.10	8.32	В
2	1.02	87.11	26.51	F
3	0.77	14.17	3.13	В
4	0.70	8.91	2.27	А

Main Results for each time segment

Main results: (16:45-17:00)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
1	1522.27	1516.77	404.03	0.00	2621.11	0.581	1.37	3.244	А
2	723.49	719.07	1161.93	7.53	1369.29	0.528	1.11	5.499	Α
3	561.63	558.75	1107.74	15.06	1335.07	0.421	0.72	4.621	Α
4	639.17	636.53	921.62	0.00	1601.99	0.399	0.66	3.720	Α

Main results: (17:00-17:15)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
1	1817.74	1813.60	483.44	0.00	2559.21	0.710	2.41	4.801	Α
2	863.92	859.31	1389.36	8.99	1233.78	0.700	2.26	9.497	Α
3	670.64	668.64	1324.07	17.98	1211.34	0.554	1.22	6.610	Α
4	763.23	761.69	1102.22	0.00	1486.26	0.514	1.04	4.959	А



Main results: (17:15-17:30)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
1	2226.26	2204.70	588.66	0.00	2477.20	0.899	7.80	12.344	В
2	1058.08	998.78	1689.30	11.01	1049.60	1.008	17.08	47.403	E
3	821.36	814.54	1566.34	22.02	1086.63	0.756	2.93	12.918	В
4	934.77	930.18	1316.34	0.00	1349.05	0.693	2.19	8.502	Α

Main results: (17:30-17:45)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
1	2226.26	2224.17	592.04	0.00	2474.56	0.900	8.32	14.095	В
2	1058.08	1020.37	1703.92	11.01	1040.29	1.017	26.51	87.115	F
3	821.36	820.55	1592.22	22.02	1073.01	0.765	3.13	14.173	В
4	934.77	934.44	1333.87	0.00	1337.82	0.699	2.27	8.910	А

Main results: (17:45-18:00)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
1	1817.74	1840.97	490.49	0.00	2553.72	0.712	2.52	5.209	Α
2	863.92	960.02	1409.92	8.99	1227.53	0.704	2.49	18.548	С
3	670.64	677.72	1426.86	17.98	1172.43	0.572	1.36	7.379	Α
4	763.23	767.79	1166.11	0.00	1445.32	0.528	1.13	5.350	Α

Main results: (18:00-18:15)

Arm	Total Demand (PCU/hr)	Entry Flow (PCU/hr)	Circulating Flow (PCU/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCU/hr)	RFC	End Queue (PCU)	Delay (s)	LOS
1	1522.27	1526.73	407.12	0.00	2618.70	0.581	1.40	3.311	Α
2	723.49	728.93	1169.59	7.53	1373.74	0.527	1.13	5.628	Α
3	561.63	564.15	1119.87	15.06	1337.76	0.420	0.73	4.668	А
4	639.17	641.01	932.13	0.00	1595.25	0.401	0.67	3.781	Α



UK and Ireland Office Locations

