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**JUNCTION STRATEGY REPORT  
LINKS TO ST ATHAN AND CARDIFF  
AIRPORT ENTERPRISE ZONE**

*Welsh Government*

3512646D-HHC/05

*Final*



# **JUNCTION STRATEGY REPORT LINKS TO ST ATHAN AND CARDIFF AIRPORT ENTERPRISE ZONE**

**3512646D-HHC / 05**

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**1 INTRODUCTION****1.1 Purpose of this report**

1.1.1 Parsons Brinckerhoff and TACP are currently undertaking a commission on Links to St Athan and Cardiff Airport Enterprise Zones on behalf of the Welsh Government and in partnership with the Vale of Glamorgan Council. The overall objective of the commission is to assess and develop proposals for improving the strategic access to the Enterprise Zones at St Athan and Cardiff Airport. From this assessment, a solution will be put forward to the Local Planning Authority in the form of a Planning Application, for improvements to Five Mile Lane (A4226).

1.1.2 The purpose of this report is to provide details of the junction alternatives which have been considered as part of the proposed improvements to Five Mile Lane.

1.1.3 This report will also provide an overview and assessment of the horizontal alignments, vertical alignments and junction improvements considered as part of the improvements.

## **2 HIGHWAY ALIGNMENT DESIGN**

### **2.1 Design Scenarios**

2.1.1 A number of alternative alignments and junction designs have been considered as part of the design development process for the scheme. This has resulted in two options, Option A and Option B, being considered at this stage.

2.1.2 The Option A alignment consists of the following:

- At grade crossing at Amelia Trust Farm
- Structure at Whitton Lodge Cross Roads
- At grade crossing in the vicinity of Northcliff Cottage
- Rejoin existing carriageway on approach to Weycock Bridge.

2.1.3 The Option B alignment consists of the following:

- At grade crossing at Amelia Trust Farm
- At grade crossing at Whitton Lodge Cross Roads
- At grade crossing in the vicinity of Northcliff Cottage
- Rejoin existing carriageway on approach to Weycock Bridge.

2.1.4 The alignments are very similar throughout, with the junctions coinciding with the locations of side roads off the existing Five Mile Lane. The most significant design difference is the vertical alignment in the vicinity of the property known as *Whitton Lodge*.

2.1.5 The design speed along the main-line alignment for all scenarios is 100KPH, with a speed limit of 60MPH.

2.1.6 The design speed for all side roads has been assumed to be 60KPH, with a speed limit of 30MPH.

### **2.2 Horizontal Alignment**

2.2.1 The minimum horizontal curvature provided for both Option A and Option B is 720m. This is the desirable minimum horizontal curvature for a design speed of 100KPH, as specified within Table 3 of TD 9/93.

2.2.2 The desirable minimum stopping sight distance of 215m is achieved at all points along the mainline of the carriageway, in accordance with the requirement of Table 3 of TD 9/93.

### **2.3 Vertical Alignment**

2.3.1 The vertical alignment for both options has been optimised to reduce any unnecessary gradients and ensure the safety of all road users is maintained.

2.3.2 Due to a high pressure underground gas main crossing both proposed alignments at Chainage 650, there is limited possibility to provide a cutting in this area.

2.3.3 In order to achieve a fully compliant vertical alignment, embankments are required for both Option A and Option B, in the vicinity of Whitton Lodge.

Option A

2.3.4 The embankment provided as part of Option A has a total height of approximately 6.5m (the highest of the two options), to provide sufficient clearance for the underpass to accommodate the existing unclassified road at Whitton Lodge.

2.3.5 The gradient on the approach to the bridge proposed at Whitton Lodge as part of Option A is 5%.

2.3.6 The steepest gradient provided as part of Option A is 6% over a length of approximately 500m between the River Weycock Bridge and Northcliff Cottage.

Option B

2.3.7 The embankment for Option B is significantly reduced (less height and length) therefore the cost and visual impacts are both reduced.

2.3.8 There is no significant gradient in the vertical alignment of Option B on the approach to Whitton Lodge.

2.3.9 The steepest gradient provided as part of Option B is also 6% over a length of approximately 500m between the River Weycock Bridge and Northcliff Cottage.

2.3.10 Due to the clearance and approach angle required as part of Option A, it is anticipated that more fill will be required as part of the construction process, than for Option B.

## **2.4 Environmental Considerations**

Animal Connectivity

2.4.2 Currently both Five Mile Lane and the minor route passing Whitton Lodge offer wildlife corridors through the area.

2.4.3 The proposals for Five Mile Lane, including the embankments and a wider carriageway, would present a potential barrier to the wildlife using these corridors.

2.4.4 It is extremely important to preserve these corridors to ensure the wildlife and biodiversity of the area is maintained.

2.4.5 Option A provides a wildlife corridor, accommodated by an underpass. Due to the expected low traffic flow along this route, this will provide a relatively safe crossing point for wildlife.

2.4.6 Opportunities for crossing points in both options are possible through the installation of oversized pipes within the embankment or beneath the live carriageway. Although both Options A & B provide adequate cover for this, Option A would provide more obvious opportunities due to the additional height and extent of the embankment.

Visual Impact

2.4.7 Given the landform around Whitton Lodge and the proposed embankment, the visual impact caused by any raised embankments will be considerable.

2.4.8 Due to the extent of the embankment in Option A, this option has a much greater visual impact than Option B. The maximum embankment height for Option A is 12m. The maximum embankment height for Option B is 6.9m, over a much shorter length and only where it is required to achieve the vertical design parameters.

**2.5 Statutory Undertakers Equipment**

2.5.1 The high pressure gas main in the vicinity of the Amelia Trust Farm results in limited scope for the reduction of embankments or the provision of earthworks cuttings for either option.

2.5.2 The information provided by the Statutory Undertakers also shows the presence of underground Welsh Water and BT apparatus, in the side road adjacent to Whitton Lodge. Any excavation of the side road, to facilitate the construction of a bridge, would have to ensure that these services have sufficient cover or are diverted in advance of the works.

**2.6 Cost**

2.6.1 An initial outline cost estimate has been undertaken for Option A and Option B. The costs have considered the construction costs and the following additional percentages to cover other elements:

- Preparation Costs 10%
- Supervision Costs 3%
- Optimism Bias 44%

2.6.2 The summary of the costs is shown in Table 2.1 below.

Option	Estimated Construction Cost	Land Costs	Preparation Costs @ 10%	Supervision Costs @ 3%	Optimism Bias @ 44%	Grand Total
Option A	£ 25,091,990	£ 314,318	£ 2,540,631	£ 762,189	£ 6,068,240	<b>£ 34,777,368</b>
Option B	£ 18,817,924	£ 314,318	£ 1,193,224	£ 473,967	£ 4,547,254	<b>£ 26,166,687</b>

**Table 2.1: Summary of Outline Cost Estimates**

2.6.3 The total costs for Option A are significantly higher than the costs for Option B due to the increased earthworks and the additional structure required in the vicinity of Whitton Lodge. The increase is then compounded when applying the recommended optimism bias to the costs.

2.6.4 An optimism bias of 44% has been applied to the Estimated Construction Cost only as part of the estimate, in line with the Treasury Green Book guidance for a standard civil engineering project at feasibility stage.

**3 JUNCTION OPTIONS**

**3.1 Options Considered**

3.1.1 In total, six junctions have been considered along the scheme length. These are summarised below:

Junction 1 – Chainage 820

3.1.2 Ghost island junction to Western side of Five Mile Lane, at Amelia Trust Farm

Junction 2 – Chainage 1,300

3.1.3 Ghost island junction to Eastern side of Five Mile Lane, near the property known as *Whitton Lodge*

Junction 3 – Chainage 2,200 to 2,300

3.1.4 Staggered ghost island junction to both sides of Five Mile Lane, near Northcliff Cottage

Junction 4 – Chainage 2,300

3.1.5 Ghost island junction to Eastern side of Five Mile Lane, near Northcliff Cottage

Junction 5 – Chainage 2,300

3.1.6 4-arm roundabout to both sides Five Mile Lane, near Northcliff Cottage

Junction 6 – Chainage 3,700

3.1.7 Ghost island junction to Western side of Five Mile Lane, near Sutton Woods

**3.2 Junction Scenarios**

3.2.1 A total of six junction scenarios have been considered as part of the design, and are summarised in the Table 3.1 below. Option A includes the embankment at Whitton Lodge, Option B does not have this embankment.

		JUNCTION					
		1	2	3	4	5	6
<b>SCENARIO</b> (A – Option A) (B – Option B)	<b>A 1</b>	✓			✓		✓
	<b>A 2</b>	✓		✓			
	<b>A 3</b>	✓				✓	
	<b>B 1</b>	✓	✓		✓		✓
	<b>B 2</b>	✓	✓	✓			
	<b>B 3</b>	✓	✓			✓	

**Table 3.1: Summary of Junction Scenarios**

- 3.2.2 Scenarios A1, A2 and A3 are associated with Option A, the alignment raised in the vicinity of Whitton Lodge.
- 3.2.3 Scenarios B1, B2 and B3 are associated by Option B, the alignment with an at-grade crossing at Whitton Lodge.
- 3.3 Junction Design**
- 3.3.1 All junctions are fully compliant with the appropriate elements of the Design Manual for Roads and Bridges (DMRB).
- 3.4 Traffic Flows**
- 3.4.1 The current traffic flows on the A4226 Five Mile Lane are approximately 7,500 AADT with the side road flows between 90 AADT and 471 AADT.
- 3.4.2 Accordingly, the most suitable junctions for these flows, as recommended in TD 42/95, would be either a standard ghost island or a staggered ghost island junction.
- 3.5 Journey Times**
- 3.5.1 The provision of a standard ghost island or staggered ghost island junction also reduces the journey times when compared with a roundabout option.
- 3.5.2 Reduced and reliable journey times are part of the scheme objectives, to ensure the new alignment provides a suitable strategic route through the Vale of Glamorgan.
- 3.6 Severance**
- 3.6.1 Scenarios A2 and B2, with the staggered ghost island junction, reduces the severance for residents on either side of the proposed alignment.
- 3.6.2 In addition, the staggered ghost island junction as incorporated into Scenarios A2 and B2 provide additional benefits to NMUs, as NMUs will not be forced to travel additional distance along the improvements to gain access to the existing road.
- 3.7 Strategic Route Impacts**
- 3.7.1 Scenarios A2 and B2 includes fewer junctions than Scenario A1 and B1, and therefore is better suited for inclusion along a strategic route.
- 3.7.2 The differences in journey times between the two scenarios will be minimal, as the origins and destinations and total distances will be similar.

## 4 JUNCTION TYPES

4.1.1 A number of different junction types have been considered as part of the design. These are:

- Junction Type 1: Standard Ghost Island Junction
- Junction Type 2: Staggered Ghost Island Junction
- Junction Type 3: 4 arm Roundabout

4.1.2 The following sections highlight the different characteristics of the three junctions types.

### 4.2 Junction Type 1 – Ghost island

#### Standard Junction Form

4.2.1 All ghost island junctions within this design have been designed in accordance with the requirements of TD 42/95.

4.2.2 All ghost island junctions in this design, are fully compliant with DMRB and therefore require no departures or relaxations for the design speed of 100KPH.

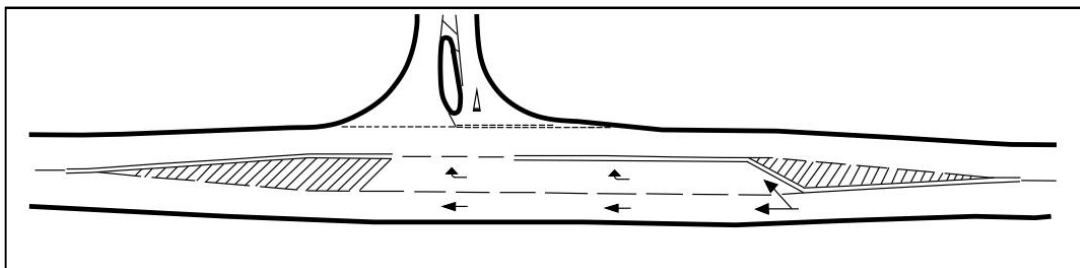
4.2.3 Where possible, a 1.0 metre hard strip is provided on both the northbound and southbound carriageway.

4.2.4 The width of the ghost island turning lane is 3.5m, and chevron hatching is to be provided as part of the ghost island arrangement.

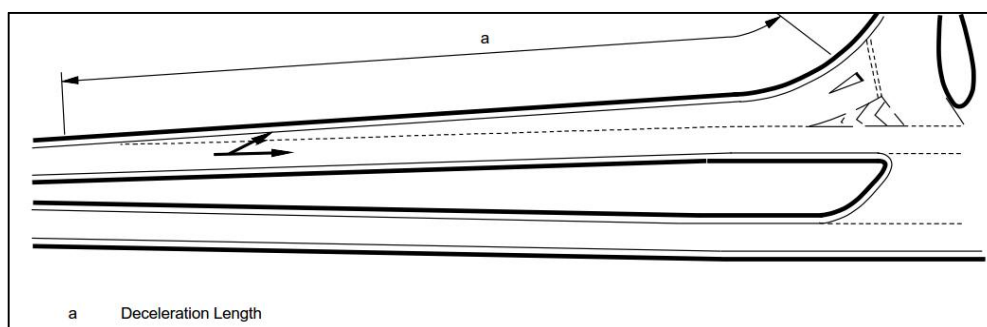
4.2.5 The design speed along the main-line alignment for all scenarios is 100KPH, with a speed limit of 60MPH. The design speed for all side roads has been assumed to be 60KPH, with a speed limit of 30MPH.

#### Indicative Layout

4.2.6 As per TD 42/95, the ghost junctions and diverge lanes have been designed to DMRB standards as shown below in Figure 4.1 and Figure 4.2.



**Figure 4.1: Indicative Ghost Island Junction Layout**



**Figure 4.2: Indicative Diverge Lane Layout**

4.2.7 The ghost island junction will be designed with a central turning lane with sufficient capacity to accommodate turning traffic to ensure no delays are caused by traffic queuing onto the main-line of the new alignment.

4.2.8 Neither the A4226 Five Mile Lane nor the entry side roads are currently lit. As such, as per TD42/95, paragraph 7.79, no road lighting is required.

**Traffic Flows**

4.2.9 Ghost island junctions are recommended in TD42/95, Figure 2/2 for traffic flows of between 200- 17,500 AADT on the major road and 200-5,000 AADT on minor roads.

4.2.10 The major road flows along A4226 Five Mile Lane are approximately 7,500 AADT, with a peak hour flow of approximately 900 vehicles.

4.2.11 The minor road flows on all side roads connecting to Five Mile Lane are low. Data gathered in June 2014 shows that the side road to Moulton has the largest flow, of 470 AADT. The side road with the lowest flow, of 90 AADT, was the unclassified road to the east of Five Mile Lane at Whitton Lodge. This information shows that all traffic roads are well under the maximum recommended 5,000 AADT for a ghost island junction as recommended in TD 42/95.

4.2.12 TD42/95 states that with 2-way flows less than 300 AADT a *Simple Junction* should be provided. With the proposed strategic nature of these improvements the lack of dedicated turning lanes could present additional safety concerns, and therefore this option has been discarded.

4.2.13 The percentage of HGVs along Five Mile Lane is approximately 3%, as measured in traffic surveys conducted in March 2014.

4.2.14 The assessment of future years traffic for the proposed improvement is currently under assessment. For the purposes of this analysis, the current traffic volumes are used as a basis for this note.

**Journey Time**

4.2.15 Major/minor junctions have the advantage that major road through traffic is not impeded, except at simple junctions. However, the high speed difference between through and turning traffic results in a poorer safety record than for roundabouts.



4.2.16 Provided that the ghost island turning lane has adequate capacity to facilitate turning traffic, no substantial delay would be caused to through traffic by the junction. Should this capacity be inadequate along with high volumes of traffic in both directions, severe delays could be possible for through traffic. This is not likely to be the case on Five Mile Lane.

4.2.17 Due to the high volume of flow along the main route and considerably lower flow along minor side roads, minimal delay to journey time may be encountered. The greater visibility through the new road layout will help to minimise this delay and result in a delay that is less than those experienced with the current layout.

### **4.3 Junction Type 2 – Staggered Ghost Island**

#### **Standard Junction Form**

4.3.1 The staggered ghost island junction has been designed in accordance with the requirements of TD 42/95.

4.3.2 The staggered ghost island junction is fully compliant with DMRB and therefore requires no departures or relaxations.

4.3.3 The stagger distance for 100kph design speed is 100m and is a right/left stagger (as shown in Figure 4.3). This is located adjacent to Northcliff Cottage and Grovelands Farm.

4.3.4 The junction is located on a straight at a slight gradient of 0-4%, with a deceleration length of 80m for both northbound and southbound traffic.

4.3.5 The junction has been located to ensure that full stopping sight distance is achieved on the main-line, prior to the start of the 6% gradient in the vicinity of Grovelands Farm.

4.3.6 A 1.0 metre hard strip is provided on both the northbound and southbound carriageways. The hard strip terminates at the end of the entry/exit radii along both side roads.

4.3.7 The width of the ghost island turning lanes is 3.5m in both directions, with chevron hatching to be provided as part of the staggered junction arrangement.

4.3.8 The side road on the eastern side of the new alignment includes 4.0m wide lanes with a 90m radius, to allow for vehicle over-runs. The 90m radius tapers to the width of the existing carriageway, to ensure a smooth transition for all vehicles utilising the junction.

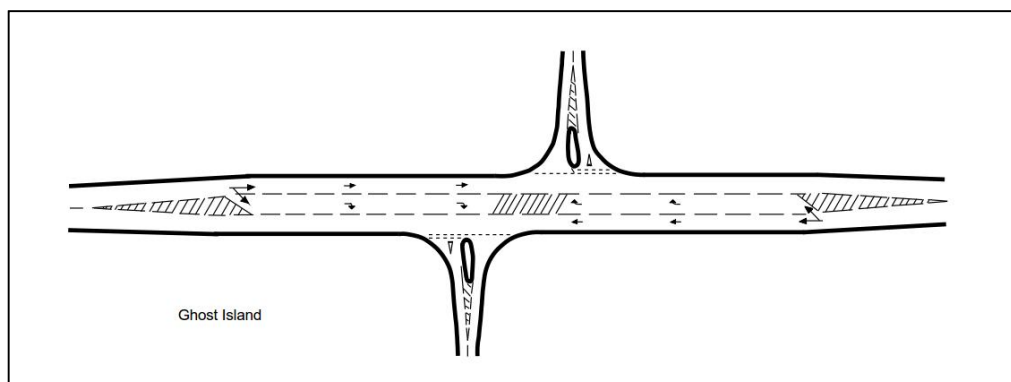
4.3.9 The eastern link also maintains access to Northcliff Cottage with a 30m radius and 3.65m lane widths that tapers to tie into the existing road.

4.3.10 The side road on the western side of the new alignment includes 4.7m wide lanes with a 45m radius, to allow for vehicle over-runs. The radius tapers to the width of the existing carriageway.

4.3.11 The junction has been located on a straight, to maximise safety of all road users. The design includes the provision of 45m radii on both the northbound and southbound carriageways, to minimise the land-take required in adjacent fields.

### Indicative Layout

- 4.3.12 As per TD 42/95, the staggered ghost island junctions and diverge lanes have been designed to DMRB standards as shown below in Figure 4.3.



**Figure 4.3: Indicative Staggered Ghost Island Junction Layout**

- 4.3.13 The staggered ghost island junction has been designed with a central turning lane with capacity to accept all turning traffic at any one point to ensure no delays are caused by turning traffic queuing onto the through lane.

- 4.3.14 Neither Five Mile Lane nor the entry side roads are currently lit. As such, as per TD42/95, paragraph 7.79, no road lighting is required.

### Traffic Flows

- 4.3.15 Ghost Island junctions are recommended in TD42/95, Figure 2/2 for traffic flows of between 200- 17,500 AADT on the major road and 200-5,000 AADT on minor roads.

- 4.3.16 The major road flows along A4226 Five Mile Lane are approximately 7,500 AADT, with a peak hour flow of approximately 900 vehicles.

- 4.3.17 The minor road flows on all side roads connecting to Five Mile Lane are low. Data gathered in June 2014 shows that the side road to Moulton has the largest flow, of 470 AADT. The side road with the lowest flow, of 90 AADT, was the unclassified road to the east of Five Mile Lane at Whitton Lodge. The Northcliff Cottage link has a flow of 150 AADT. This information shows that all traffic roads are well under the maximum recommended 5,000 AADT for a ghost island junction as recommended in TD 42/95.

- 4.3.18 TD42/95 states that with 2-way flows less than 300 AADT a *Simple Junction* should be provided. With the proposed strategic nature of these improvements the lack of dedicated turning lanes could present additional safety concerns, and therefore this option has been discarded.

- 4.3.19 The percentage of HGVs along Five Mile Lane is approximately 3%, as measured in traffic surveys conducted in March 2014.

- 4.3.20 The assessment of future years traffic for the proposed improvement is currently under assessment. For the purposes of this analysis, the current traffic volumes are used as a basis for this note.

### **Journey Time**

- 4.3.21 The ghost island turning lane has been designed to have adequate capacity to facilitate all turning traffic and it is anticipated that limited delay would be caused to through traffic at the junction.
- 4.3.22 Due to the high volume of flow along the main route and considerably lower flow along minor side roads, minimal delay to journey time may be encountered. The greater visibility through the new road layout will help to minimise this delay and result in a delay that is less than those experienced with the current layout.

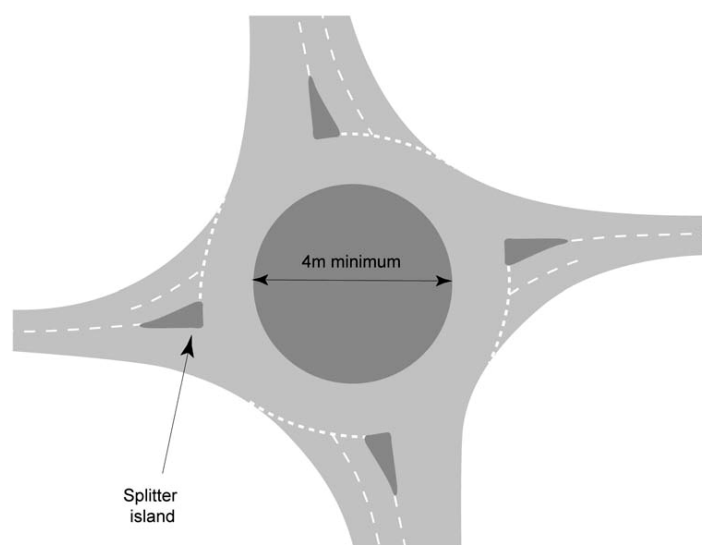
## **4.4 Junction Type 3 – Four Arm Roundabout**

### **Standard Junction Form**

- 4.4.1 The roundabout has been designed in accordance with the requirements of TD 16/07.
- 4.4.2 The roundabout is fully compliant with DMRB and therefore requires no departures or relaxations.
- 4.4.3 The roundabout has been designed with a provisional Inscribed Circle Diameter (ICD) of 70m. All entries have been designed with 40m entry radius and all exits have been designed with 60m exit radius. No Arcady assessment has been carried out at this stage.
- 4.4.4 4.0m wide lanes are provided on the eastern minor approach road, with 90m radius tapered to the width of the existing carriageway.
- 4.4.5 4.7m wide lanes are provided on the western minor approach road, with a 45m radius tapered back to the width of the existing Five Mile Lane alignment. The 45m radius was used in the design to minimise the land-take required for the roundabout.
- 4.4.6 Access to adjoining fields is also provided off the western approach, with 6.0m entry and exit radii.

### **Indicative Layout**

- 4.4.7 As per TD 16/07, the staggered ghost junctions and diverge lanes have been designed to DMRB standards as shown below in Figure 4.4.



**Figure 4.4: Indicative Roundabout Junction Layout**

4.4.8 Street lighting would also be provided at the roundabout to ensure the design is in accordance with DMRB. Therefore the lighting will be designed in accordance with the CE-Series of lighting classes given in Table 2 of BS EN 13201-2 and comply with Clause 22 and Annex B of BS 5489-1.

4.4.9 The provision of street lighting in a rural area is a significant downside to this option, due to the additional light pollution it would create and the impact it would have on bat ecology in the area.

**Traffic Flows**

4.4.10 Roundabouts are recommended in TD42/95, Figure 2/2 for traffic flows of 8,000-20,000+ AADT flow on the major road and 0-8,000 AADT flow on minor roads.

4.4.11 The major road flows along A4226 Five Mile Lane are approximately 7,500 AADT, with a peak hour flow of approximately 900 vehicles.

4.4.12 The minor road flows on all side roads connecting to Five Mile Lane are low. The existing Northcliff link has a flow of 150 (2-way) AADT, which would be maintained. The Llancarfan link has an existing flow of 471 (2-way) AADT which when translated into the proposals, may increase due to the addition of trip from other side roads joining the new mainline at this junction.

4.4.13 The percentage of HGVs along Five Mile Lane is approximately 3%, as measured in traffic surveys conducted in March 2014.

4.4.14 These traffic flows suggest that the junctions only just meet the minimum requirements, whereby a roundabout could be justified.

**Non Motorized Users (NMU)**

- 4.4.15 Studies have shown (ref TA 57/87) that at roundabouts the circulating cyclists are particularly vulnerable to accidents involving motor vehicles entering/leaving the roundabout. Wide entry widths and small diameter central islands have been shown to increase this kind of accident. A cycle route avoiding this kind of roundabout is preferable and it may be possible to convert parts of surrounding footways to cycle tracks or to increase vehicle deflection on entry so that vehicle speeds are controlled.
- 4.4.16 Cyclists require special consideration at roundabouts to ensure safe passage through the entry, exit and the circulatory carriageway. 10% of all reported accidents involving cyclists occur at roundabouts; of these 11% are serious or fatal, and more than 50% involve the motorist entering the roundabout and colliding with cyclists using the circulatory carriageway.
- 4.4.17 Roundabouts with an inscribed circle diameter of over 50m and/or dual carriageway entries generally have significantly higher speeds on entry, exit and on the circulatory carriageway, and are of greatest risk to cyclists. In these cases it is recommended that cyclists are provided with an alternative route such as an off-carriageway cycle track around the perimeter of the roundabout, with signal controlled crossing of entry and exit arms, or the provision of a grade separated facility.

**Journey Time**

- 4.4.18 Roundabouts are designed to provide an even flow of traffic in all directions to promote continual flow. This means that the flow from the side roads have the same priority as the flow along the primary route.
- 4.4.19 The speed of traffic using the mainline is also likely to decrease with the provision of a roundabout, as traffic would have to yield to traffic on the circulatory carriageway. This would increase the journey time on the mainline, in comparison with a priority junction.
- 4.4.20 Given the low traffic flows on the side roads, it is anticipated that the provision of a roundabout at this location would not be appropriate.

## **5 NON MOTORIZED USERS (NMU) AT JUNCTIONS**

### **5.1 Introduction**

5.1.1 One of the aims of the scheme as a whole is to provide enhanced pedestrian, cyclist and other non-motorised user facilities in the study area.

### **5.2 Pedestrians**

5.2.1 TD 42/95 states that it is preferable to provide separate pedestrian routes away from the junctions, where road widths are less and traffic movements more predictable.

5.2.2 This is rarely practical, in which case the following facilities should be considered:

- a A minor road central refuge at an unmarked crossing place
- b Zebra crossing, with or without a central refuge
- c Displaced controlled pedestrian crossing
- d Subway or footbridge

5.2.3 Due to the rural nature of this scheme, and that no formal pedestrian facilities are provided along the route, the junction types considered by TD 42/95 are inappropriate.

5.2.4 If necessary, at-grade crossing points can be provided across the new alignment at pre-determined points where all the visibility criteria are met.

5.2.5 No public rights of way are severed or crossed by the new alignment and therefore this is not deemed to be an issue as part of the design.

### **5.3 Cyclists**

5.3.1 Priority junctions present a hazard for pedal cyclists, and 73% of cyclist accidents at junctions occur at major/minor priority junctions. It is therefore important that a cyclist is provided with a safe passage through the junction, and that the design of any cyclist facilities should take into account both their vehicular rights and their particular vulnerability, as suggested by the accident statistics.

5.3.2 Bearing in mind the practicalities and economics, it is important to consider the provision of facilities that take cyclists away from the mouth of the junction. This will minimise the interaction between cyclists and motor vehicles and provide safe crossing points.

5.3.3 Such facilities may include the following:

- a Shared use by pedestrians and cyclists of a displaced cycle track/footway with a controlled or uncontrolled crossing
- b A signposted alternative cycle route away from the junction; which the old Five Mile Lane would provide
- c Full grade separation, for example by means of a combined pedestrian/cyclist subway system

5.3.4 If provision of any of these is not possible, then greater emphasis should be placed on the safety aspects of the design of the major/minor priority junction layout, by careful attention to the provision of crossing places.

5.3.5 Roundabouts present additional problems to cyclists, similar to those for motorcyclists as described above.

#### **5.4 Equestrians**

5.4.1 TD 42/95 recommends that consideration should be given to the provision of dedicated crossing places for horses, where 20 crossings a week are likely. These crossings can take the form of displaced routes, at-grade junctions or suitable structures under or over the mainline.

5.4.2 At-grade crossings should include grass verges extended back on each side of the road at the point of the crossing to provide a 'holding area' for horses with at least a 5 metre grassed width of verge for a length not exceeding 10 metres.

5.4.3 Uncontrolled crossing of a new high-speed carriageway should be avoided and tracks and bridleways should be diverted to a suitable bridge or subway if possible.

5.4.4 In the case of Five Mile Lane, it is not anticipated that dedicated crossing points will be required, despite the rural nature of the scheme. However, verges should be wide enough to accommodate waiting areas where equestrians may seek refuge whilst waiting for the opportunity to cross the new mainline.

## **6 ROAD SAFETY REVIEW**

### **6.1 General**

6.1.1 The following potential road safety issues have been identified for the indicative layouts of the proposed scenarios.

6.1.2 Several at-grade ghost island junctions are proposed across all scenarios. The provision of dedicated right turn lanes and diverge left lanes should help to reduce the possibility of rear shunt collisions involving a vehicle colliding into the rear of another vehicle wanting to turn onto the side roads.

6.1.3 The visibility at the junctions is within the requirements specified within TD 42/95. The junctions have been designed to ensure that the visibility provided from the side roads is not excessive. This will help to ensure that drivers do not focus further down the mainline carriageway when entering the main road, potentially overlooking traffic closer to the junction.

### **6.2 Staggered Ghost Island Junctions**

6.2.1 The road safety review team have identified that the provision of an at-grade staggered junction at Northcliff Cottage/Grovelands Farm could increase the potential for collisions involving slow moving vehicles (particularly agricultural vehicles) travelling from one side road to the other.

6.2.2 This layout provides a right/left staggered junction. Although unlikely to be a significant issue due to the relatively low mainline and side road traffic flows, this option requires that east to west and west to east side road traffic undertakes a right turn when emerging from the side roads. This could increase conflict potential, particularly for slow moving longer vehicles (such as agricultural vehicles).

6.2.3 The road safety review team has had some experience with right/left staggered junctions causing road safety problems on single carriageway A-roads. However these issues have been predominantly attributed to high traffic volumes at these junctions.

6.2.4 The traffic flows at the proposed staggered junction are likely to be in the region of 7,500 AADT on the major road with a maximum side road AADT of 470 vehicles. The road safety review team are of the opinion that these traffic volumes are considered to be relatively low, therefore conflict potential could be low and appropriate gaps in the mainline traffic flow could be frequent.

6.2.5 The road safety review team are aware of problems being experienced with side road traffic choosing to take inappropriate mainline gaps, and turning vehicles simultaneously taking the same gap from both side roads, where mainline flows are twice the level at Five Mile Lane and side road flows are significantly higher than what is likely to be generated at the staggered junction side roads.

### **6.3 Conclusion**

6.3.1 The road safety review team are of the opinion that unless traffic flows in the area are likely to notably increase in the future, there is no obvious reason to assume that the proposed staggered junction will have a higher than expected collision rate.



**7 CONCLUSION AND RECOMMENDATION**

7.1.1 Safety and traffic flows are not the determining factor in the choice of junction type for this improvement.

7.1.2 To maximise the strategic benefit of the proposed improvements, it is imperative that the number of junctions is kept to a minimum, whilst maintaining the existing east-west connectivity across the proposed alignment.

7.1.3 To minimise the cost of the improvements, the junction scenarios associated with Option A (large embankment) have been discarded, due to the anticipated additional construction cost associated with the construction of the structure and earthworks embankment.

7.1.4 Therefore, the recommendation for this improvement is Scenario B2. This option is summarised as follows:

- Amelia Trust Farm - At-grade standard ghost island junction to the west
- Whitton Lodge - At-grade standard ghost island junction to the east
- Northcliff Cottage - At-grade staggered ghost island junction
- Sutton Woods - No junction



## APPENDIX A – DRAWINGS