Welsh Government

A40 Llanddewi Velfrey to Penblewin Improvements

Road Safety Audit - Stage 1 Designer's Response

A40LVP-ARP-GEN-SWI-RP-C-0004

P03 | S4

12/11/18

Contents

1 The Project

1.1 Context

1.1.1 In February 2017 the Welsh Government appointed Carillion, with Arup and RML (the 'Carillion Team') as their technical and environmental advisors, to develop the design of the proposed A40 Llanddewi Velfrey to Penblewin Improvements up to publication of draft Orders.

1.1.2 Carillion entered liquidation in January 2018. The Welsh Government subsequently appointed Arup, supported by RML, to continue the development of the design up to publication of draft Orders and to support the Welsh Government through the Statutory process.

1.2 Project history

1.2.1 In December 2004 the Welsh Government announced the outcome of the A40 West of St Clears study into the consideration of both single carriageway and dual carriageway improvements to the A40 between St Clears and Haverfordwest. This study came about as a result of a number of previous reports that all concluded that the A40 needed improvement.

1.2.2 In December 2004 the Minister announced the publication of his Addendum to the 2002 Trunk Road Forward Programme (TRFP) and this included two major single carriageway improvement schemes for the A40 west of St Clears. The improvements would use the 2+1 configuration allowing overtaking on the two-lane direction, with overtaking prohibited in the one lane direction and would be delivered in the following phases:

1. A40 Penblewin - Slebech Park
2. A40 Llanddewi Velfrey - Penblewin.

1.2.3 The first of these projects, Penblewin - Slebech Park, was completed in March 2011.

1.2.4 In July 2013, Edwina Hart AM CStJ MBE, Minister for Economy, Science and Transport, published a written statement outlining her priorities for Transport. The statement included the following:

"Improving the A40 has been identified as a priority by the Haven Waterway Enterprise Zone Board and I intend to undertake further development of previously proposed improvements."

1.2.5 On 12 November 2014, in providing an update on the closure of the Murco Refinery in Milford Haven, the Minister made an oral Statement in Plenary:

"In terms of transport links, I have instructed my officials to accelerate to the fullest extent possible the programme for delivering improvements at Llanddewi Velfrey."

1.2.6 In June 2015, in a written statement on the A40 Improvement Study the Minister noted *"It is my intention to progress delivery of the A40 Llanddewi Velfrey to Penblewin scheme as soon as possible…"*

1.3 The problems

1.3.1 Consultation with key stakeholders, including the Local Authority, Welsh Government Departments and the Regional Transport Planner has identified the following problems:

1. The road is substandard and where overtaking provision does exist it is currently not spread along the length of the A40 such as there are long lengths in each direction with no safe overtaking opportunities
2. Limited overtaking opportunities lead to poor journey time reliability and driver frustration.
3. Occasional convoys of heavy goods vehicles from the ferry ports and slow moving agricultural vehicles contribute to periods of platooning and journey time unreliability, which is exacerbated with limited overtaking opportunities.
4. Seasonal spikes in traffic volumes along the A40 especially during the summer months leads to slow moving traffic causing journey

time unreliability, which is exacerbated with limited overtaking opportunities.

5. The community of Llanddewi Velfrey is severed by the A40, which reduces accessibility, increases risks of non-motorised user accidents and results in noise and air pollution.
6. There are many side road junctions and direct accesses to properties and agricultural fields off the A40, which contributes to operational problems along the road.
7. A mix of traffic types using the road, contributing to journey time unreliability and driver frustration, risky manoeuvres and collision incidents.
8. A lack of strategic public transport connectivity in Pembrokeshire generally means there is a dependence on the private car for inter-urban connections.

1.4 Scheme objectives

1.4.1 A number of transport planning objectives have been developed iteratively during previous development work and engagement on the A40 project, aiming to address one or more of the identified problems. During the early stages of Key Stage 3 the problems and objectives were refreshed during a focused workshop event with key stakeholders to take into account the WelTAG 2017 guidance and Wellbeing of Future Generations (Wales) Act wellbeing goals. The scheme objectives are:

O1 To enhance network resilience and improve accessibility along the east-west transport corridor to key employment, community and tourism destinations.

O2 To improve prosperity and provide better access to the county town of Haverfordwest, the Haven Enterprise Zone and the West Wales ports at Fishguard, Milford Haven and Pembroke Dock.

O3 To reduce community severance and provide health and amenity benefits.

O4 To reduce the number and severity of collisions.

O5 To promote active travel by cycling, horse riding and walking to provide opportunities for healthy lifestyles.

O6 To deliver a scheme that promotes social inclusion and integrates with the local transport network to better connect local communities to key transport hubs.

O7 Deliver a project that is sustainable in a globally responsible Wales, taking steps to reduce or offset waste and carbon.

O8 Give due consideration to the impact of transport on the environment and provide enhancement when practicable.

2 Introduction

This Road Safety Audit Response Report relates to the Stage 1 Road Safety Audit Report for the scheme.

The Design Team have carefully considered the problems and recommendations in the Stage 1 Road Safety Audit Report. This Road Safety Audit Response Report includes all the problems and recommendations raised by the Road Safety Audit Team, as well as the Design Team's response to these issues.

3 Key Personnel

3.1 Welsh Government (Project Sponsor)

Emyr Davies	Project Engineer
Matthew Enoch	Project Director

3.2 Arcadis | Mott Macdonald (Employer's Agent)

Chris Nichols	Project Engineer, Arcadis
Geraint Davies	Project Director, Arcadis

3.3 TMS Consultancy (Road Safety Audit Team)

Robert Cyples	Audit Team Leader
Stephen Proctor	Audit Team Member

3.4 Arup (Engineering Design)

Gary Davies	Project Director, Arup
Tom Edwards	Project Manager, Arup

4 Items Raised at the Stage 1 Road Safety Audit

4.1 General Problems

The following issues are relevant at more than one location throughout the scheme, and, where appropriate, reference to specific examples are made within the text.

Problem 4.1.1

Location	General – at structures e.g. mammal crossings and attenuation ponds
Summary	Risk of loss of control collisions. There are a number of structures along the route which are sited close to the carriageway. Vehicles losing control could strike the structures or descend into the ponds leading to occupant injury. The collision data for this route demonstrates a very high KSI index (35%) so any collision of this nature could lead to death or serious injury.
Recommendation	Structures should be protected as appropriate by road restraint systems.
Design Team Response	Agreed – An initial Road Restraint Risk Assessment Process (RRRAP) has been conducted to inform the preliminary design of the scheme considering hazards identified at this stage. A further RRRAP would be conducted during the detailed design of the scheme, which the Vehicle Restrain System (VRS) layout will reflect. Verge widths within the preliminary design have been designed to accommodate VRS without adversely affecting required forward visibility requirements.

Problem 4.1.2

Location	General throughout scheme
Summary	Risk of loss of control collisions The site visit revealed that adjacent sections of the A40 have lay-bys provided. With the exception of the rest area, there are no lay-bys proposed on this section of the A40. Drivers who are tired could fall asleep at the wheel, leading to loss of control and occupant injury.
Recommendation	Review existing layby provision on adjacent sections and provide where required (see also problem 2.2.2 referring to the rest area and the westbound approach to the Penblewin Roundabout).
Design Team Response	Agreed - A review of existing layby provision along the route of the A40 between St. Clears and Haverfordwest has been carried out (project document A40LVP-ARP-HML-M01-FN-D-0001). In the eastbound direction, 2 laybys would be removed from the A40 network, one of which does not comply with the standards required in TD69 for this type of road. In the westbound direction 1 layby, which does not comply with TD69, would be removed from the A40 network. Travelling eastbound towards the scheme, the distance between the nearest eastbound layby and the rest area is approximately 0.8 km. The distance between the Rest Area and the next eastbound layby is approximately 13km. Travelling westbound, the distance between the nearest westbound layby and the rest area is approximately 6.5km. The distance between the Rest Area and the next westbound layby is approximately 9km. The recommended distance is between 2 – 5km. The proposed scheme geometry does not allow replacement laybys to be safely incorporated into the scheme design. A Departure from Standard would be required to include laybys within the proposed scheme due to the geometric requirements of the siting of laybys. The existing rest area located 350 metres east of Penblewin roundabout would be sign-posted from the scheme, with vehicles travelling both eastbound and westbound having access from Penblewin roundabout. Signs indicating local

	facilities within the village of Llanddewi Velfrey would also be provided. Beyond the scheme extents, the settlement of Robeston Wathen also has local facilities signposted from the A40 mainline, which provide the opportunity for road users to stop. The settlement of Whitland also provides an opportunity for road users to stop. The Designer has reviewed the existing layby provision along the length of the A40 as per the Auditor's recommendation, the result of which is that laybys cannot be safely incorporated into the scheme. The Designer has made all reasonable efforts to facilitate access to the Rest Area as part of the scheme, and also to sign available local facilities within Llanddewi Velfrey.

Problem 4.1.3

Location	General throughout scheme
Summary	Risk of pedestrian collisions A number of footpaths are being diverted, with a new crossing point provided. Walkers using the paths may become confused and attempt to cross the A40 at inappropriate locations, with the risk of being struck as they cross the carriageway.
Recommendation	Footpath signage for the diversion routes should be clear and unambiguous, and lead walkers from existing paths to new paths and crossing locations.
Design Team Response	Agreed – A detailed signage strategy for Public Rights of Way would be developed during the detailed design stage of the scheme. This would be clear and unambiguous and would be reflective of desire lines identified within the NMU study and the Scheme layout. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.1.4

Location	General throughout 2+1 sections

Summary	Risk of loss of control / head on collisions The collision data for this route demonstrates a very high KSI index (35%). The most frequently occurring collision type is head-on (3), with a further collision occurring whilst overtaking. Any collision of this nature could lead to death or serious injury. Whilst the 2+1 sections do provide improved opportunity for overtaking, there is still a possibility of vehicles meeting head-on.
Recommendation	The collision data should be re-analysed to determine the severity of the 4 collisions involving head-on / overtaking. If, as suspected, these collisions are of high severity, consideration should be given to providing a vehicle restraint system within the 2+1 sections.
Design Team Response	Agreed – The collision data for the scheme extent has been analysed and can be seen in the Initial Traffic and Accident Data Report (A40LVP-ARP-VTR-SWI-RP-TR-0002). It is accepted that the head-on / overtaking collision types within the defined study area are of high severity, with four of these collisions resulting in two fatalities. Within the accident study area, both fatal accidents occurred outside of the scheme extents. A review of the accident reports concludes that whilst both were classed as 'head-on' collisions, the supporting information available suggest that an avoidance manoeuvre to avoid collision with a vehicle turning out of a layby may have resulted in one of the fatalities, with the mainline vehicle colliding 'head-on' with oncoming traffic. Furthermore, the accident rate between Bethel Chapel and Penblewin roundabout is well below the average accident rate for this type of road. As such, the introduction of a VRS along sections of 2+1 is considered to introduce an additional hazard to road users, and the risks associated with the provision of a VRS within the median strip are considered to outweigh the benefits of any provision. The WS2+1 layout removes direct access, including farm accesses / side road accesses, from the mainline thus reducing the amount of conflict areas along the mainline. Additionally, the 2+1 sections would include a 1m median strip throughout to segregate head-on facing traffic. The 1m median would also be surfaced with raised-rib road

	markings providing additional warning for vehicles inadvertently crossing lanes. Signs to Diagram 888 of the Traffic Signs Regulations and General Directives (TSRGD) would also be provided which would mitigate crossing of the median strip. These measures are considered an improvement when compared to the existing road layout. Furthermore, a VRS would not be in accordance with Figure 3/1 of TD70/08 and a Departure from Standard would be required. The Designer has re-analysed the collision data and considered a VRS in accordance with the Auditor's recommendation, the result of which is that the proposed design (with no VRS in place) is adequate due to the low accident rate.

Problem 4.1.5

Location	General at priority junctions
Summary	Risk of shunt collisions. Drivers wishing to turn left into the junctions along the route will reduce speed, leading to the risk of being struck from behind by faster moving vehicles.
Recommendation	The junction radii should be checked to ensure that large vehicles can turn left without crossing the centre lines. Radii should be designed to accommodate left turners, including larger vehicles and farm traffic likely to use the junctions. Consideration should be given to relaxing the radii on the exits to the minor roads to enable slower moving vehicles to move more quickly onto the mainline.
Design Team Response	Agreed - The left turn design radii have been designed as per clause 7.54 of TD42/95 which states that a radius of 40m must be provided where the mainline speed is greater than 85kph. A left turn corner radius of 40m has been provided. This is considered to be adequate for large vehicles turning left, as the minimum radius for simple junctions is usually 20 metres. Swept path analysis has been undertaken to verify this.

	Nearside diverge taper of 80 metres length and 3.5 metres wide at its widest point would also be provided to allow drivers reducing speed to deviate from the mainline, thereby lessening impact on mainline traffic flows and reducing the risk of shunt collisions. For these reasons, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.1.6

Location	General throughout scheme
Summary	Risk of loss of control collisions A number of locations on the scheme will be lit. Drivers who lose control could leave the road and strike lamp columns. The collision data for this route demonstrates a very high KSI index (35%) and high speed collisions of this nature are likely to lead to death or serious injury.
Recommendation	New lighting columns should be passively safe
Design Team Response	Agreed - Where lighting columns are not located behind a road restraint system, they would be passively safe. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.1.7

Location	General throughout scheme
Summary	Summary: risk of shunt collisions There are a number of (gated) farm accesses throughout the route. Farm vehicles accessing the land will need to stop in order to open the gate. This could lead to them leaving their vehicle overhanging the carriageway with the risk that it is struck by following vehicles.
Recommendation	Gates should open into the farm land and be set back from the carriageway so that a farm vehicle (with trailer) can access the gate without encroaching onto the carriageway.

Design Team Response	Agreed – There are no direct gated farm accesses from the trunk road mainline. The scheme has been designed in accordance with clause 6.5 of TD70/08 which states that *Field accesses must not directly connect to WS2+1 roads.* Separate collector roads have been designed alongside the mainline to provide farm access. Where farm accesses are located on the side roads / collector roads, gates would open into the farmland and would be set back from the road. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.1.8

Location	General throughout scheme
Summary	Risk of loss of control collisions There are a number of mature trees close to re-aligned sections of road, for example within the realigned central island at Penblewin Roundabout. The trees are likely to be close to the new carriageway, and would cause injury to occupants if struck in loss of control collisions.
Recommendation	The location of mature trees sited close to the re-aligned sections throughout the scheme should be identified. The setting out details should detail which of these trees should be removed.
Design Team Response	Agreed - The location of existing mature trees would be considered in a RRRAP assessment conducted during the detailed design of the scheme. New trees would be planted at sufficient distance away from the carriageway. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.1.9

Location	General on side road approaches to mainline
Summary	Risk of loss of control collisions There are locations where the final alignment from a minor

	road approaches the main line on a tight bend, for example the old A40 westbound at the tie-in at Llanddewi Velfrey. There is a risk that drivers will lose control if they approach the bend too quickly.
Recommendation	Appropriate signage should be erected.
Design Team Response	Agreed - Appropriate signage on approach to the junction would be provided as part of this scheme. Further mitigation measures, such as speed limit reductions and traffic calming measures, would be considered as part of any de-trunking works. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.1.10

Location	General: Embankment slopes
Summary	It is noted that the general embankment slope throughout the scheme is 1 in 2. However, steep embankment slopes can present a hazard to occupants of errant vehicles as they can overturn whilst travelling across them, particularly at the tops and bottoms.
Recommendation	Where land is available flatter slopes are preferred. However, in all cases the tops and toes of earthworks should be rounded to a minimum radius of 4 metres.
Design Team Response	Agreed - The tops and toes of embankments would be rounded to a minimum radius of 4 metres. Flatter slopes at a ratio of 1:2.5 have been provided between Llanfallteg Road overbridge and East Llanddewi Velfrey Junction. Land is constrained throughout the Ffynnon junction area by residential properties to the north and environmentally sensitive areas (Ffynnon Wood) to the south. The section between Penblewin roundabout and Ffynnon Junction has low embankments, with the vertical geometry of the road closely following the existing ground level. A general embankment slope of 1:2 has been maintained through this section to minimise landtake. For this reason, the Designer believes that the current design is in accordance with the Auditor's

	recommendation.

Problem 4.1.11

Location	General; tie-ins where the new road alignment is off-line
Summary	Risk of loss of control collisions Where the new alignment travels off-line at chainage 1+800 and 4+000, drivers travelling towards these locations may pick up clues from the former road alignment and "see-though" the new road, losing control at the tie-in point.
Recommendation	Landscaping and earthworks should be designed to prevent drivers seeing through on the former alignment. Care will need to be taken at Chainage 1+800 where the Llanddewi Velfrey staggered junction is located close to the tie-in, in order to ensure that the landscaping does not restrict visibility for drivers emerging from the southern arm of the junction (Llanddewi Velfrey west)
Design Team Response	Agreed – The old A40 west of the Southern Arm of Ffynnon Junction would be designed to reflect its new use as an access to an Attenuation Pond and Public Right of Way. This highway would be located along the toe of embankment of the mainline. This would reduce visibility for vehicles travelling along the mainline thus mitigating the "see through" effect. Landscaping would also be provided to reduce the "see through" effect. The proposed landscaping would not restrict visibility for drivers emerging from the southern arm of the junction. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

4.2 Specific Problems

The following issues are relevant to specific locations. The items are listed from west to east.

Problem 4.2.1

Location	Penblewin roundabout – main approaches
Summary	Risk of loss of control collisions

	The alignment on the main line approaches is high speed and straight towards the central island. In both cases there is a risk that drivers will fail to stop and drive straight onto the central island or strike circulating traffic. EPC is one of the most important determinants of safety at roundabouts. Severe EPC (<70m) can lead to loss of control type accidents on entries, especially involving high sided vehicles. Relaxed EPC (>100m) can increase the risk of high speed entry and failure to give-way type accidents. The eastbound approach is offset to the north, with a risk that drivers will drive towards traffic exiting the roundabout.
Recommendation	The entry path curvature on all approaches should be checked and amended to ensure it falls within the range 70m to 100m. The roundabout will require appropriate advance direction signage, and a high friction surface on the main line approaches. Yellow bar markings should be considered. The roundabout central island should be conspicuous, with appropriately placed and sized chevron signs for drivers on each main line approach. Please also see the comments in 2.2.3 referring to the west bound approach to this roundabout.
Design Team Response	Disagreed due to site constraints. The Entry Path Curvature on four of the five approaches to the proposed roundabout lie between 60-100 metres which is considered acceptable by both the designer and the standards set out within TD16/07. A minimum entry path curvature is not defined within TD16/07. Localised improvements during detailed design could improve the EPC to be within the required 70-100 metre range. The mainline westbound approach to the roundabout is constrained to the south by the existing A40 arm. The Entry Path Curvature on this arm is 30 metres, and any improvements at the detailed design stage would be minimal due to this constraint. An assessment would be undertaken to review the need for High Friction Surfacing on the approach to the

	roundabouts, and yellow bar markings would be considered during the detailed design. Appropriate advance directional signing and chevron boards would also be provided. For the reasons given above, the Designer would **seek an exception.**

Problem 4.2.2

Location	Westbound approach to Penblewin Roundabout and access to Penblewin Farm and rest area.
Summary	Risk of vehicle / vehicle collisions on roundabout circulatory carriageway The access to the farm/ rest area forms a fifth arm to this roundabout. Five-arm roundabouts have been demonstrated to have a poor collision record. There is a risk that drivers of slow moving large vehicles and farm vehicles exiting the rest area will enter the circulatory carriageway in conflict with circulating vehicles, leading to potential entry / circulating collisions.
Recommendation	Review the need to provide a fifth arm, instead a left in left out only access to the rest area and the farm maybe a more appropriate design on the eastbound approach (See also 4.1.2 re lay-bys). The westbound approach to the roundabout should be redesigned on a more conventional alignment.
Design Team Response	Agreed - The scheme Design Options Report (document A40LVP-ARP-HGN-SWI-RP-C-0004) outlines the options considered at Penblewin roundabout, including options to remove the fifth arm. These options performed poorly against the scheme objectives, and as such have been discounted. Direct entry into the rest area has also been reviewed separately (document A40LVP-ARP-HML-M01-FN-D-0001) however this cannot be achieved without a Departure from Standard or loss of benefit to the scheme by reducing lengths of overtaking provision. As such, the five-arm Penblewin roundabout is the layout within the preliminary design.

	Having reviewed the access options, the Designer believes that they have acted in accordance with the Auditor's recommendation, and the proposed design offers the best solution to match the scheme's objectives.

Problem 4.2.3

Location	Southeast side of roundabout at Penblewin Farm
Summary	Risk of loss of control collisions The land adjacent to the carriageway on the southbound exit to the roundabout falls away sharply by around 2-3m. A vehicle losing control on the nearside would fall down the embankment, leading to occupant injury.
Recommendation	The drop should be protected with a road restraint system.
Design Team Response	Agreed - A road restraint system compliant with the requirements of TD19/06 would be provided at this location. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.2.4

Location	Penblewin roundabout
Summary	Risk of injury to cyclists Cyclists have a comparatively poor collision record at roundabouts. There is a risk of them being struck on this 5-arm roundabout, particularly as circulating traffic.
Recommendation	If cycle flows are anticipated to increase on the A40, an east-west off carriageway cycle route to avoid the roundabout should be considered.
Design Team Response	Agreed - Appropriate off-line cycle routes have been considered as part of the design to avoid the need of using the mainline wherever possible. A non-motorised user (NMU) survey did not identify cyclist use of the A40. The A40 also does not form part of any national cycle route. However, appropriate off-road

	NMU facilities have been provided where possible. In summary: NMUs travelling between Llanddewi Velfrey towards Crymych would be able to use the proposed Henllan underpass and use the side road north of the proposed A40, completely avoiding the use of Penblewin roundabout. NMUs travelling between Llanddewi Velfrey and Narberth would be able to use the existing A40, and turning left at the roundabout, using a short section only of the roundabout. Cyclists travelling east-west would have to navigate Penblewin roundabout, however this does not currently appear to be a popular cycling route. The off-line NMU routes would be appropriately signed during the detailed design of the scheme. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.2.5

Location	Equestrian bridleway underpass at chainage 1+200
Summary	Risk of injury to non-motorised users. The bridleway accesses a narrow local single track road at both the northern and southern end, with a tight bend at each junction. Inter-visibility between users on the bridleway and the road could be poor, particularly to the north, where there is a significant embankment/ hedge. This could lead to non-motorised users moving out into the path of motor vehicles, leading to possible injury. Horses could be "spooked" by motor traffic or cyclists, leading to riders being unseated.
Recommendation	Appropriate visibility should be provided at the bridleway.
Design Team Response	Agreed - Further design development since the Road Safety Audit has resulted in the location of the bridleway underpass being moved east to Chainage 1+700. The access/egress to the underpass at the new location would be safer and less trafficked. Whilst the bridleway route would still join the local highway network at the same locations as shown in the audit, these would ow be at grade. The removal of the embankment in the immediate

	vicinity of the highway improves visibility. The tight turns on the approaches to the local highway network have also been designed out. It is intended to provide appropriate visibility to all NMU users of the underpass at its new location. This will be considered further at the detailed design stage. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.2.6

Location	Llanddewi Velfrey staggered junction
Summary	Risk of high speed shunts / loss of control collisions There is a risk of vehicles that are turning right being "trapped" in a queue in the centre of the junction. This is exacerbated by the nature of the stagger in that right turning vehicles have to cross each other's path to make the manoeuvre. Main line vehicles travelling at speeds around 60mph may have to brake suddenly, leading to a risk of loss of control or shunt collisions.
Recommendation	The junction should be widened to provide the opportunity to design for non-hooking (side by side) right turns, and solid islands within the hatching.
Design Team Response	Disagree – The queuing length for traffic turning right at this location has been assessed to be 1 vehicle only, as the level of traffic turning right into the minor road on both sides of the junction is very low. The high speed of the proposed road (60mph) would mean that the introduction of physical islands would introduce further risks and, due to the low turning movements, would prove to be more of a hazard than a benefit. The northern arm of the junction exists in its current form with no accidents reported at this location. A stagger distance of 130 metres has been provided, 30m more than the minimum requirement defined in Table 7/7 of TD42/95. The ghost island junction has been designed in accordance with the geometric requirements of TD42/95 for a left/right stagger.

	Additionally, nearside diverge tapers are being provided for left turning vehicles from the major road into the minor road, which will further reduce the risk of high speed shunts. For the reasons given above, the Designer does not agree with the Auditor's recommendation and would therefore **seek an exception.**

Problem 4.2.7

Location	East Llanddewi Velfrey Roundabout Junction – mainline approaches
Summary	Risk of loss of control collisions The alignment on the main line approaches is high speed and straight through the first half of the roundabout. In both cases there is a risk that drivers will fail to stop and give way to circulating traffic or lose control exiting the roundabout. EPC is one of the most important determinants of safety at roundabouts. Severe EPC (<70m) can lead to loss of control type accidents on entries, especially involving high sided vehicles. Relaxed EPC (>100m) can increase the risk of high speed entry and failure to give-way type accidents.
Recommendation	The entry path curvature on all approaches should be checked and amended to ensure it falls within the range 70m to 100m. The roundabout will require appropriate advance direction signage, and a high friction surface on the main line approaches. Yellow bar markings should be considered. The roundabout central island should be conspicuous, with appropriately placed and sized chevron signs for drivers on each main line approach.

Design Team Response	Agreed – Improvements to the roundabout approach alignments during the detailed design of the roundabout would result in improved EPC without requiring additional land take. Appropriate Advance Directional Signage would be provided as well as chevron boards on the roundabout. An assessment would be undertaken to review the need for High Friction Surfacing on the approach to the roundabouts, and yellow bar markings would be considered during the detailed design. For this reason, the Designer believes that the design is in accordance with the Auditor's recommendation.

Problem 4.2.8

Location	East Llanddewi Velfrey Roundabout Junction
Summary	It has not been possible to accurately measure entry angles on the approaches to the roundabout. However, low entry angles place drivers in a merging position where they have to look over their right shoulder to see vehicles on the roundabout. This type of layout does not encourage drivers to give-way and can result in entry versus circulatory type conflicts or rear end shunts on the approach. High entry angles, on the other hand, produce excessive entry deflection and can lead to sharp braking resulting in rear end shunt type accidents.
Recommendation	The entry angles on all approaches should be checked to ensure they fall within the range 200 to 600. However, the aim should be to achieve ideal entry angles of between 300 and 400 where possible.
Design Team Response	It is assumed the response should read 20º to 60º. Agreed – all entry angles on the approaches to the roundabout have been checked. All fall within the range of 20-60º. Localised refinements to the roundabout entries would be undertaken in detailed design to achieve entry angles of 30-40º. For this reason, the Designer believes that the design is in accordance with the Auditor's recommendation.

Problem 4.2.9

Location	East Llanddewi Velfrey Roundabout Junction

Summary	Risk of pedestrian collisions There will be a pedestrian desire line to cross the East Llanddewi Velfrey junction across the eastern arm. A lack of splitter islands will increase the risk of pedestrian crossing the carriageway being struck.
Recommendation	Pedestrian crossing facilities should be provided across the eastern arm of the roundabout to include a refuge island crossing within the splitter island for the proposed roundabout.
Design Team Response	Agreed – A splitter island would be provided with a refuge island for pedestrians crossing this arm of the roundabout. Lighting provision would extend to cover the area of the crossing facility. The final layout of the crossing facility would be undertaken during the detailed design phase of the scheme. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.2.10

Location	East Llanddewi Velfrey Roundabout Junction
Summary	Risk of darkness related conditions Currently the carriageway in the vicinity of the East Llanddewi Velfrey Roundabout Junction is unlit. Road users approaching the junction may not see it or circulating vehicles which could increase the risk of darkness related collisions occurring on approached to and at the roundabout.
Recommendation	The approaches to, and roundabout should be lit as part of the detailed design.
Design Team Response	Accepted - The roundabout would be lit as per TD16/07 as it is defined as a conflict point. The approach arms to the roundabout would be lit for the extent of the queuing length of traffic, which is approximately to the back of the splitter islands of the roundabout. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.2.11

Location	East Llanddewi Velfrey Roundabout Junction
Summary	Risk of injury to cyclists Cyclists have a comparatively poor collision record at roundabouts. There is a risk of them being struck on this 5-arm roundabout, particularly as circulating traffic.
Recommendation	If cycle flows are anticipated to increase on the A40, an off carriageway cycle route to avoid the roundabout should be considered.
Design Team Response	Agreed - Appropriate off-line cycle routes have been considered as part of the design to avoid the need of using the mainline wherever possible. The roundabout at this location is a 4 arm roundabout, not a five-arm as stated. A non-motorised user (NMU) survey did not identify cyclist use of the A40. The A40 also does not form part of any national cycle route. However, appropriate off-road NMU length have been provided where possible. Non-motorised provision throughout Llanddewi Velfrey would be considered further as part of the detrunking proposals for the scheme. The off-line NMU routes shall be appropriately signed during the detailed design of the scheme. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.2.12

Location	Approaches to East Llanddewi Velfrey Roundabout Junction
Summary	Risk of loss of control collisions The Old line EB from Llanddewi village is on a 10% downgrade towards to proposed roundabout junction. Bethel Chapel access road is on 9% downgrade away from roundabout with bends. Steep gradients can lead to

	inappropriate speeds and reduce the braking efficiency of vehicles increasing the risk of loss of control collisions.
Recommendation	Additional mitigating design features should be provided as part of the detailed design to reduce the likelihood of loss of control collisions.
Design Team Response	Agreed – mitigation measures on the approaches to the roundabout would be provided as part of the detailed design of the scheme. These would include advanced warning signage. An assessment would be undertaken to review the need for High Friction Surfacing on the approach to the roundabouts, and yellow bar markings would be considered during the detailed design. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.

Problem 4.2.13

Location	Chainage 0+000 old line EB from Llanddewi village towards East Llanddewi Velfrey Roundabout Junction
Summary	Risk of loss of control collisions Where the new alignment travels off-line at chainage 0+000, drivers travelling eastbound towards East Llanddewi Velfrey Roundabout Junction may pick up clues from the former road alignment and "see-though" the new road losing control at the tie-in point, particularly as the old road will likely remain in part as a service road for adjacent dwellings.
Recommendation	Landscaping and earthworks should be designed to prevent drivers seeing through on the former alignment.
Design Team Response	Agreed – Suitable landscaping would be provided to prevent drivers seeing through on the former alignment. Consideration would be given during any detrunking works to removing the street lighting along the length of the old road, which would reduce the "see-through" effect during hours of darkness.

Problem 4.2.14

Location	Side road to north of existing A40 beyond eastern tie-in at chainage 4+400

Summary	Risk of high speed shunt collisions The radius for the left turn into this junction is tight without a diverge taper and will reduce the speed of left turning vehicles significantly. Drivers approaching the location from the A40 do so on a re-aligned section that could have worse forward visibility to this location. There is a risk that eastbound fast-moving traffic will have to brake suddenly for a slow moving left turner, leading to shunt collisions.
Recommendation	Forward visibility should be checked and the left turn radius at the junction relaxed if appropriate.
Design Team Response	Agreed – the visibility on the approach to this junction has been checked and the required Desirable minimum Stopping Sight Distance on the approach to the junction is provided. The junction in question is outside of the extent of the scheme, therefore there would be no change from the existing provision. Analysis of accidents at this junction does not indicate the left turn being an issue. For this reason, the Designer believes that the current design is in accordance with the Auditor's recommendation.