

# South Wales Trunk Road Agent

Managing and Improving  
Motorways and Trunk Roads  
through South Wales



# Asiant Cefnffyrdd De Cymru

Rheoli a Gwella'r Traffyrdd  
a'r Cefnffyrdd yn Ne  
Cymru

## M4 Junction 48 and A4138

### WelTAG Appraisal (Stage 3) – The Transport Case (Addendum)



Yn gweithio ar ran  
Llywodraeth Cymru  
Working on behalf of the  
Welsh Government

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**M4 Junction 48 and A4138**

**WeITAG Appraisal (Stage 3) – The Transport Case (Addendum)**

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## Contents

<b>1</b>	<b>INTRODUCTION.....</b>	<b>3</b>
1.1	INTRODUCTION.....	3
<b>2</b>	<b>M4 J48 WELTAG STAGE 3 APPRAISAL ADDENDUM .....</b>	<b>4</b>
2.1	INTRODUCTION.....	4
2.2	ORIGINAL PREFERRED OPTION – DESIGN DEVELOPMENT .....	4
2.2.1	<i>WeITAG Stage 2 – Option 2a .....</i>	<i>4</i>
2.2.2	<i>Stage 3 Design Review.....</i>	<i>4</i>
2.2.3	<i>Original Detailed Design .....</i>	<i>5</i>
2.3	MODIFIED PREFERRED OPTION – DESIGN DEVELOPMENT .....	6
2.4	TRANSPORT CASE.....	7
2.4.1	<i>Introduction .....</i>	<i>7</i>
2.4.2	<i>Operational Analysis (LinSig) .....</i>	<i>7</i>
	<i>Overview .....</i>	<i>7</i>
	<i>Option 2a Scheme Appraisal (Original Design) .....</i>	<i>9</i>
	<i>Manually Optimised Timings .....</i>	<i>9</i>
	<i>Option 2a Scheme Appraisal (Modified Design).....</i>	<i>10</i>
	<i>Manually Optimised Timings .....</i>	<i>10</i>
	<i>M4 Off-Slips – Queue Lengths.....</i>	<i>15</i>
2.4.3	<i>Scheme Objectives Assessment .....</i>	<i>16</i>
2.4.4	<i>Economic Appraisal.....</i>	<i>17</i>
	<i>Scheme Costs .....</i>	<i>17</i>
	<i>2018 Prices .....</i>	<i>17</i>
	<i>Optimism Bias .....</i>	<i>17</i>
	<i>Present Year Costs.....</i>	<i>18</i>
	<i>Assessment Methodology.....</i>	<i>18</i>
	<i>Monetised Scheme Benefits .....</i>	<i>18</i>
	<i>Economic Appraisal.....</i>	<i>18</i>
2.4.5	<i>Deliverability.....</i>	<i>19</i>
	<i>Land Take .....</i>	<i>19</i>
	<i>General Buildability.....</i>	<i>19</i>
	<i>Future Maintenance.....</i>	<i>19</i>
	<i>Funding .....</i>	<i>19</i>
<b>3</b>	<b>SUMMARY AND CONCLUSIONS .....</b>	<b>20</b>
3.1	OVERVIEW.....	20
3.2	ORIGINAL PREFERRED OPTION – DESIGN DEVELOPMENT .....	20
3.3	MODIFIED PREFERRED OPTION – DESIGN DEVELOPMENT .....	20
3.4	TRANSPORT CASE.....	20
3.4.1	<i>Operational Analysis (LinSig) .....</i>	<i>20</i>
	<i>M4 Junction 48.....</i>	<i>20</i>
	<i>Westbound Off-Slip .....</i>	<i>21</i>
3.4.2	<i>Scheme Objectives Assessment .....</i>	<i>21</i>
3.4.3	<i>Economic Appraisal.....</i>	<i>21</i>

**APPENDICES**

**APPENDIX A – PREFERRED SCHEME – DETAILED DESIGN (ORIGINAL)**

**APPENDIX B – PREFERRED SCHEME – DETAILED DESIGN (MODIFIED)**

**APPENDIX C – STAGE 1 RSA**

# 1 **Introduction**

## 1.1 **Introduction**

The Welsh Government's (WG) South Wales Trunk Road Agent (SWTRA) has commissioned Atkins to produce an Addendum to the M4 Junction 48 (J48) and A4138 Pontarddulais Road WeITAG Stage 3 Appraisal (October 2018) to reflect modifications to the preferred option.

## **2 M4 J48 WeITAG Stage 3 Appraisal Addendum**

### **2.1 Introduction**

The purpose of this WeITAG Stage 3 Addendum is to assess a modified preferred option. The appraisal focuses on the transport planning and economics, design and engineering aspects of the option.

In accordance with WeITAG 2017, this report presents the detailed design and appraisal work undertaken in respect to the modified preferred option.

### **2.2 Original Preferred Option – Design Development**

#### **2.2.1 *WeITAG Stage 2 – Option 2a***

The original preferred option (Option 2a) retained from the Stage 2 Appraisal incorporated the following key elements:

- Removal of central reservation under the M4 overbridge, replaced by a right turn lane for traffic travelling from the A4138 to the M4 eastbound on-slip;
- Removal of the give way line on the eastbound on-slip, replaced by the nearside lane being a dedicated lane for Hendy traffic. All other slip road traffic would utilise the offside lane; and
- Signalisation of the M4 westbound off-slip right-turn lane and the right-turn from the A4138 southbound to the M4 westbound on-slip.

The complementary measures associated with the preferred option is as follows:

- A4138 Southbound Improvements
  - On the A4138 southbound (towards Llanelli) it is proposed that an extended physical separation followed by a change to the lane markings is provided. The physical separation will extend c.200m from the M4 westbound off-slip between the nearside and offside lanes on the A4138 southbound, followed by the TSRGD 1041 (Diagram 1041) lane markings to the point where vehicles will be forced to merge when the A4138 becomes a single carriageway at the top of the hill.

#### **2.2.2 *Stage 3 Design Review***

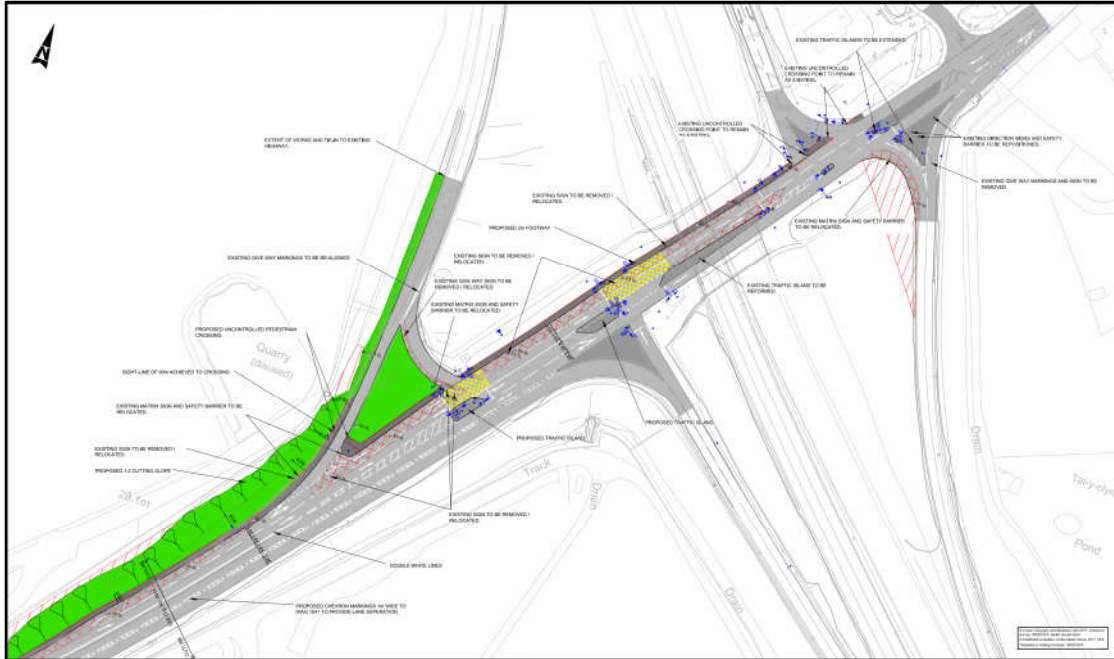
A detailed design of the original preferred option was developed for the Stage 3 WeITAG Appraisal (October 2018); taking into consideration the outcomes of a design review, consultation, Road Safety Audit (RSA) and operational appraisal. As part of this process the following amendments were made to the original proposed design (Option 2a):



- The initial proposal included the provision of a physical island between motorists joining the A4138 from the M4 westbound off-slip. This aspect was revised to the provision of hatched markings so as to remove the need to acquire third party land at this location. The land would have been required in order to provide the required lane width;
- Detailed design of the traffic signals has resulted in minor amendments to stop line and traffic island positions and the removal of the A4138 (northbound carriageway) advanced stop line immediately adjacent of the eastbound on-slip;
- A free flow merge was originally proposed on the westbound M4 J48 entry slip, however, a detailed review of the existing levels determined standard gradients could not be achieved without full reconstruction of this area. On the grounds of the level of disruption this would cause to the travelling public being disproportionate to the benefit, the decision was made to revert to the existing give way layout;
- The existing width of the A4138 is slightly less than the DMRB standard. Through discussions with Carmarthenshire County Council (CCC) it was agreed that there was no material benefit of widening the southern section of the A4138 by less than 0.5m to achieve the required standard due to the cost and disruption that would result. An appropriate tie in location was identified as a result;
- The earthwork design along the realigned westbound entry slip road has been amended to provide a wider highway verge to improve visibility sight lines to the uncontrolled pedestrian crossing facility which links the northern footway network; and
- The RSA identified minor issues which are proposed to be addressed by the addition of some louvres, signal aspect amendments and additional vegetation clearance to enhance visibility.

### 2.2.3 *Original Detailed Design*

The design of the original preferred option is shown in **Figure 2-1** below (and in **Appendix A**).



*Figure 2-1 Scheme Detailed Design (Original)*

## 2.3 Modified Preferred Option – Design Development

Following comments from key stakeholders, the preferred option (Option 2a) retained from the Stage 2 Appraisal has been amended as follows:

- The signalisation of the A4138 / Tal-Y-Coed junction;
- In reference to INM H6 (which is an aspirational Shared Use Route connecting Hendy and Llangennech), the upgrading of the northbound footway to a Shared Use Path; and
- The introduction of Toucan Crossings (at the proposed signal controlled junctions).

The modified preferred option (Option 2a) is shown in **Figure 2-2** below (and in **Appendix B**).

The Stage 1 RSA (and designers' response) are provided in **Appendix C**.

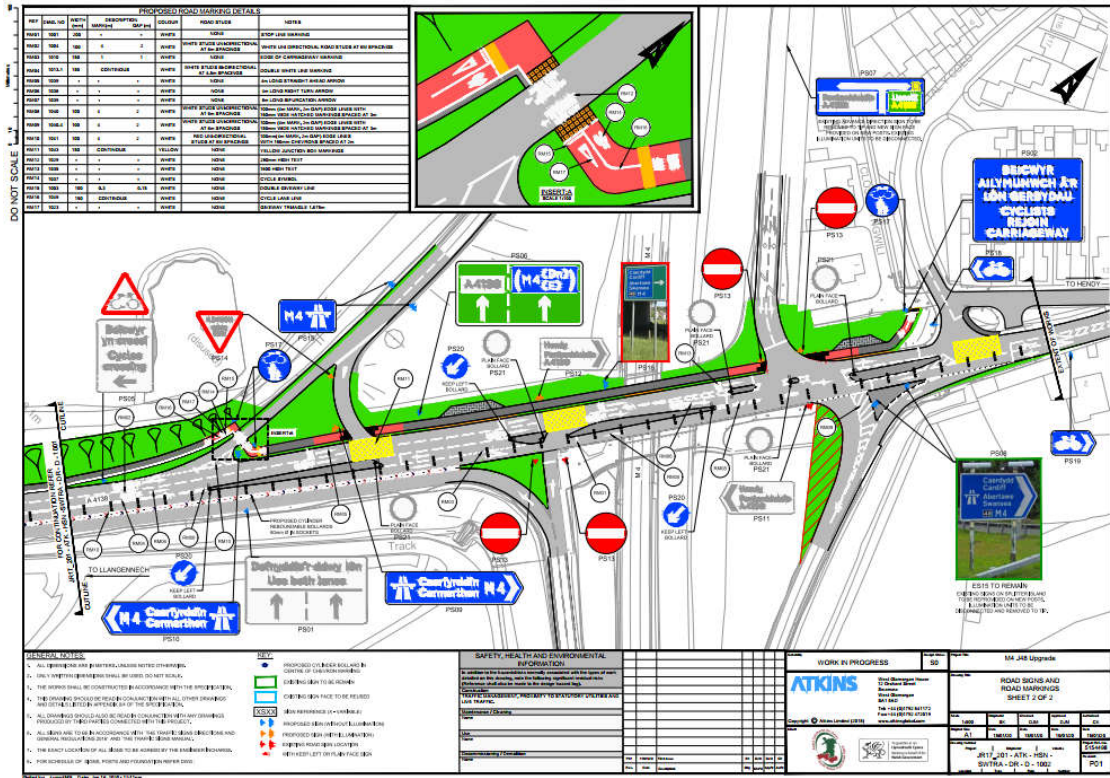


Figure 2-2 Scheme Detailed Design (Modified)

## 2.4 Transport Case

### 2.4.1 Introduction

This section considers the Transport Case for the revised proposed improvements to the A4138 and M4 J48 and incorporates the following:

- Operational Analysis (LinSig);
- Assessment against the Scheme Objectives; and
- Economic Appraisal.

### 2.4.2 Operational Analysis (LinSig)

#### Overview

Operational analysis of the modified preferred option has been undertaken using LinSig. LinSig is a computer software package produced by JCT and recommended by the Department of Transport (DfT) for the assessment of traffic signal junctions. The model output shows the maximum Degree of Saturation (DoS) on any one arm of the junction and the maximum queue expressed in Passenger Car Units (PCUs). It also provides forecasts of vehicular delay and these have been utilised to determine the economic benefits of the scheme, which are discussed later in this chapter.

A signalised junction is considered to be over-saturated when one of the phases has a DoS greater than 90%. The model also outputs the Practical

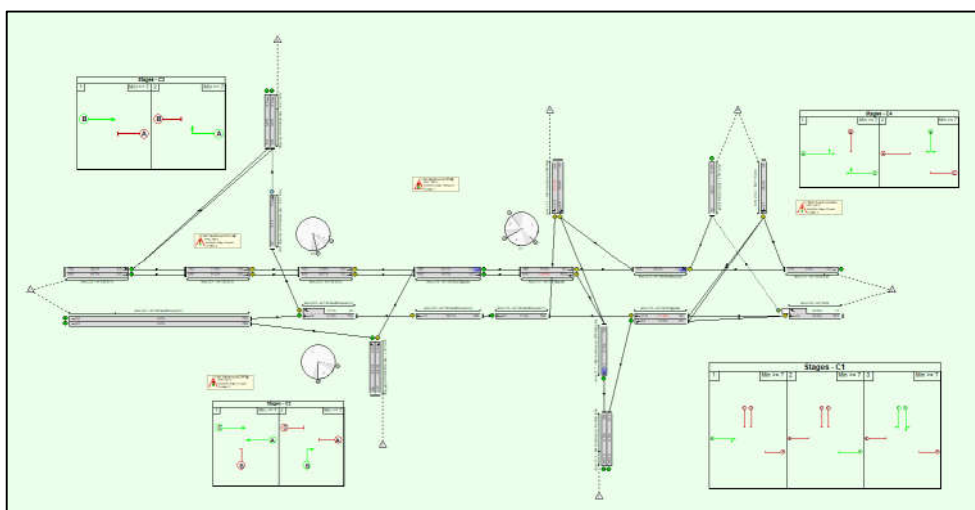
Reserve Capacity (PRC), which indicates the level of capacity within the junction that could be utilised before one of the links breaches the 90% DoS threshold; a positive PRC therefore illustrates a signal junction that has spare operational capacity.

The LinSig model assumes that traffic arrives at a constant rate over the modelled period. It effectively replicates a single 'average' cycle with a single set of signal timings and a demand that is proportional to the number of cycles within the hour. In practice, observations have indicated that the traffic profile at the M4 J48 (and at the Talyclun Signals) are not constant with demand rising and falling during each peak hour, with the current signal timings differing from cycle to cycle due to the implementation of MOVA (Microprocessor Optimised Vehicle Actuation). MOVA continually adjusts the green time required on each approach, whilst understanding the overall impact on the junction, resulting in less queuing and delay.

The modified Option 2a (once implemented on the ground) will run via MOVA, and due to the operation of MOVA not being able to be modelled accurately, the modelling results shown will therefore broadly illustrate the proposed operational benefit of the junction.

The nearby Talyclun signalised junction is also MOVA operated, with the opportunity of the preferred option to be complemented with additional standalone improvements at the Talyclun Signals, which could be considered by CCC.

**Figure 2-3** illustrates the LinSig model for the modified preferred option (Option 2a).



**Figure 2-3** M4 J48 LinSig Model (Option 2a – Modified)

**Option 2a Scheme Appraisal (Original Design)****Manually Optimised Timings**

A model of the original preferred junction arrangement (Option 2a) was developed, with the signal times optimised in LinSig (for PRC %). This was undertaken to fully reflect the potential benefits of the proposed scheme.

The 2019 and 2034 results of the LinSig modelling for the original preferred Option 2a using the manually optimised timings is shown in **Table 2-1** and **Table 2-2**.

Arm	AM		PM	
	Degree of Saturation (%)	Mean Maximum Queue (PCU)	Degree of Saturation (%)	Mean Maximum Queue (PCU)
M4 Eastbound Off-Slip – RT Lane	104.1%	28.0	83.4%	12.5
M4 Eastbound Off-Slip – Ahead / LT Lane	8.9%	0.7	5.5%	0.5
A4138 SB (Hendy) (M4 Eastbound On-Slip)	103.1%	33.5	81.4%	7.2
A4138 NB (Llanelli) – Ahead Lane	49.6%	2.9	83.8%	11.4
A4138 NB (Llanelli) – RT Lane (M4 Eastbound On-Slip)	105.5%	44.5	72.0%	16.4
M4 Westbound Off-Slip – RT Lane	77.3%	5.6	58.2%	9.2
A4138 SB (Llanelli) – M4 Westbound On-Slip RT / Ahead	52.8%	5.6	59.6%	0.8
<b>PRC % (All Lanes)</b>	<b>-17.3</b>		<b>7.4</b>	
<b>Total Delay (PCU/hr)</b>	<b>93.92</b>		<b>33.28</b>	

\*Derived from the maximum DoS noted on any lane on the arm.

**Table 2-1** 2019 Original Preferred Scheme Modelling Results (Manually Optimised Timings)

Arm	AM		PM	
	Degree of Saturation (%)	Mean Maximum Queue (PCU)	Degree of Saturation (%)	Mean Maximum Queue (PCU)
M4 Eastbound Off-Slip – RT Lane	115.3%	53.0	90.3%	17.1
M4 Eastbound Off-Slip – Ahead / LT Lane	10.0%	0.8	5.9%	0.7
A4138 SB (Hendy) (M4 Eastbound On-Slip)	114.2%	85.6	88.2%	9.8
A4138 NB (Llanelli) – Ahead Lane	54.9%	7.4	91.5%	16.0
A4138 NB (Llanelli) – RT Lane (M4 Eastbound On-Slip)	116.9%	85.3	78.9%	21.0
M4 Westbound Off-Slip – RT Lane	65.6%	5.2	64.0%	11.9
A4138 SB (Llanelli) – M4 Westbound On-Slip RT / Ahead	55.6%	8.2	64.9%	1.5
<b>PRC % (All Lanes)</b>	<b>-29.9</b>		<b>-1.7</b>	
<b>Total Delay (PCU/hr)</b>	<b>207.79</b>		<b>45.86</b>	

\*Derived from the maximum DoS noted on any lane on the arm.

**Table 2-2** 2034 Original Preferred Scheme Modelling Results (Manually Optimised Timings)

### Option 2a Scheme Appraisal (Modified Design)

#### Manually Optimised Timings

A model of the modified preferred junction arrangement (Option 2a) has been developed (incorporating the signalisation of the A4138 / Tal-Y-Coed junction), with the signal times optimised in LinSig (for PRC %). This has once again been undertaken to fully reflect the potential benefits of the proposed scheme.

The 2019 and 2034 results of the LinSig modelling for the modified Option 2a using the manually optimised timings is shown in **Table 2-3** and **Table 2-4**.



Arm	AM		PM	
	Degree of Saturation (%)	Mean Maximum Queue (PCU)	Degree of Saturation (%)	Mean Maximum Queue (PCU)
M4 Eastbound Off-Slip – RT Lane	104.1%	28.0	83.4%	12.5
M4 Eastbound Off-Slip – Ahead / LT Lane	8.9%	0.7	5.5%	0.5
A4138 SB (Hendy) (M4 Eastbound On-Slip)	100.8%	16.8	81.4%	6.5
A4138 NB (Llanelli) – Ahead Lane	49.6%	7.5	83.8%	11.4
A4138 NB (Llanelli) – RT Lane (M4 Eastbound On-Slip)	105.5%	44.5	72.0%	16.4
M4 Westbound Off-Slip – RT Lane	55.2%	4.4	58.2%	9.2
A4138 SB (Llanelli) – M4 Westbound On-Slip RT / Ahead	57.1%	10.7	59.6%	0.8
A4138 SB (Tal-Y-Coed Junction) – Ahead / RT Lane	57.5%	7.8	25.9%	2.4
A4138 NB (Tal-Y-Coed Junction) – Ahead / LT Lane	25.6%	1.0	44.7%	0.5
<b>PRC % (All Lanes)</b>	<b>-17.3</b>		<b>7.4</b>	
<b>Total Delay (PCU/hr)</b>	<b>81.79</b>		<b>33.91</b>	

\*Derived from the maximum DoS noted on any lane on the arm.

**Table 2-3** 2019 Modified Preferred Scheme Modelling Results (Manually Optimised Timings)

Arm	AM		PM	
	Degree of Saturation (%)	Mean Maximum Queue (PCU)	Degree of Saturation (%)	Mean Maximum Queue (PCU)
M4 Eastbound Off-Slip – RT Lane	115.3%	53.0	90.3%	17.1
M4 Eastbound Off-Slip – Ahead / LT Lane	10.0%	0.8	5.9%	0.7
A4138 SB (Hendy) (M4 Eastbound On-Slip)	111.6%	31.8	88.1%	9.4
A4138 NB (Llanelli) – Ahead Lane	54.9%	8.4	89.5%	15.1
A4138 NB (Llanelli) – RT Lane (M4 Eastbound On-Slip)	116.9%	85.3	77.1%	20.9
M4 Westbound Off-Slip – RT Lane	65.6%	5.2	64.0%	11.9
A4138 SB (Llanelli) – M4 Westbound On-Slip RT / Ahead	56.1%	1.2	64.9%	1.5
A4138 SB (Tal-Y-Coed Junction) – Ahead / RT Lane	63.8%	9.5	28.0%	2.6
A4138 NB (Tal-Y-Coed Junction) – Ahead / LT Lane	28.3%	1.2	48.1%	0.6
<b>PRC % (All Lanes)</b>	<b>-29.9</b>		<b>-0.3</b>	
<b>Total Delay (PCU/hr)</b>	<b>163.77</b>		<b>45.12</b>	

\*Derived from the maximum DoS noted on any lane on the arm.

**Table 2-4** 2034 Modified Preferred Scheme Modelling Results (Manually Optimised Timings)

A comparison of the 2019 and 2034 results of the LinSig modelling using the manually optimised timings for the modified preferred Option 2a and for the original Option 2a layout is shown in **Table 2-5** and **Table 2-6**.



Arm	AM		PM	
	Degree of Saturation (%)	Mean Maximum Queue (PCU)	Degree of Saturation (%)	Mean Maximum Queue (PCU)
M4 Eastbound Off-Slip – RT Lane	0.0%	0.0	0.0%	0.0
M4 Eastbound Off-Slip – Ahead / LT Lane	0.0%	0.0	0.0%	0.0
A4138 SB (Hendy) (M4 Eastbound On-Slip)	-2.3%	-16.7	0.0%	-0.7
A4138 NB (Llanelli) – Ahead Lane	0.0%	4.6	0.0%	0.0
A4138 NB (Llanelli) – RT Lane (M4 Eastbound On-Slip)	0.0%	0.0	0.0%	0.0
M4 Westbound Off-Slip – RT Lane	-22.1%	-1.2	0.0%	0.0
A4138 SB (Llanelli) – M4 Westbound On-Slip RT / Ahead	4.3%	5.1	0.0%	0.0
A4138 SB (Tal-Y-Coed Junction) – Ahead / RT Lane				
A4138 NB (Tal-Y-Coed Junction) – Ahead / LT Lane				
<b>PRC % (All Lanes)</b>	<b>0.0</b>		<b>0.0</b>	
<b>Total Delay (PCU/hr)</b>	<b>-12.13</b>		<b>0.63</b>	

\*Derived from the maximum DoS noted on any lane on the arm.

**Table 2-5** 2019 Modified Preferred Scheme v Original Preferred Scheme (changes to LinSig results)

Arm	AM		PM	
	Degree of Saturation (%)	Mean Maximum Queue (PCU)	Degree of Saturation (%)	Mean Maximum Queue (PCU)
M4 Eastbound Off-Slip – RT Lane	0.0%	0.0	0.0%	0.0
M4 Eastbound Off-Slip – Ahead / LT Lane	0.0%	0.0	0.0%	0.0
A4138 SB (Hendy) (M4 Eastbound On-Slip)	-2.6%	-53.8	-0.1%	-0.4
A4138 NB (Llanelli) – Ahead Lane	0.0%	1.0	-2.0%	-0.9
A4138 NB (Llanelli) – RT Lane (M4 Eastbound On-Slip)	0.0%	0.0	-1.8%	-0.1
M4 Westbound Off-Slip – RT Lane	0.0%	0.0	0.0%	0.0
A4138 SB (Llanelli) – M4 Westbound On-Slip RT / Ahead	0.5%	-7.0	0.0%	0.0
A4138 SB (Tal-Y-Coed Junction) – Ahead / RT Lane				
A4138 NB (Tal-Y-Coed Junction) – Ahead / LT Lane				
<b>PRC % (All Lanes)</b>	<b>0.0</b>		<b>1.4</b>	
<b>Total Delay (PCU/hr)</b>	<b>-44.02</b>		<b>-0.74</b>	

\*Derived from the maximum DoS noted on any lane on the arm.

**Table 2-6** 2034 Modified Preferred Scheme v Original Preferred Scheme (changes to LinSig results)

As shown in Table 2-5 and Table 2-6, there are negligible differences forecast between the modified preferred scheme compared to the original preferred arrangement (with the modified scheme slightly forecast to operate with increased capacity):

- 2019 AM Peak
  - No changed in the junction PRC; with
  - A reduction of 12.13s in the total delay at the junction (reducing from 93.92s to 81.79s).
- 2019 PM Peak
  - No changed in the junction PRC; with
  - An increase of 0.63s in the total delay at the junction (increasing from 33.28s to 33.91s).
- 2034 AM Peak
  - No changed in the junction PRC; with
  - A reduction of 44.02s in the total delay at the junction (reducing from 207.79s to 163.77s).
- 2034 PM Peak

- The junction PRC increases from -1.7% to -0.3% (increasing by 1.4%); with
- A reduction of 0.74s in the total delay at the junction (reducing from 45.86s to 45.12s).

Once again (as per the original preferred junction layout), during the AM peak, the modified preferred junction is still forecast to operate over capacity with Option 2a in place, however total delay at the junction has reduced by over a minute (in 2019) and by over three minutes (in 2034) compared to the existing layout. During the PM peak, the modelling for the existing layout demonstrated that the junction is forecast to be operating over capacity (PRC -48.5% in 2019 and -72.4% in 2034). However, with the modified Option 2a in place, the junction is forecast to be operating with spare capacity in 2019 (PRC 7.4% with a reduction in total delay of over two minutes compared to the existing layout) and operating close to within capacity in 2034 (PRC -0.3% with a reduction in total delay of nearly four minutes compared to the existing layout).

### **M4 Off-Slips – Queue Lengths**

As previously mentioned in the WeITAG Stage 1 and Stage 2 Report, WG and SWTRA are concerned that congestion in the PM peak at the M4 J48 is causing vehicles to queue from the M4 westbound off-slip lanes back to the M4 mainline, with vehicles utilising the hard shoulder for queuing purposes.

A comparison of the slip road queue lengths (as forecast by LinSig for the 2019 'Opening Year' and 2034 'Design Year') for the existing layout and the original preferred scheme (utilising manually optimised signal timings) is shown in **Table 2-7**.

Scenario	M4 Westbound Off-Slip (50 PCU Capacity)				M4 Eastbound Off-Slip (121 PCU Capacity)			
	AM Peak	Queuing Availability (PCU)	PM Peak	Queuing Availability (PCU)	AM Peak	Queuing Availability (PCU)	PM Peak	Queuing Availability (PCU)
2019 Existing	4.3	45.7	83.8	-33.8	44.6	76.4	69.8	51.2
2019 Original	5.6	44.4	9.2	40.8	28	93	12.5	108.5
2034 Existing	7.8	42.2	118.1	-68.1	66.8	54.2	101.5	19.5
2034 Original	5.2	44.8	11.9	38.1	53	68	17.1	103.9

\*Maximum value taken from both lanes.

**Table 2-7** M4 Off-Slips – Original Preferred Scheme v Existing Layout (Manually Optimised Timings)

As demonstrated in Table 2-7, in the 2019 'Opening Year' and 2034 'Design Year', the existing layout of the junction is forecast to result in queuing on the M4 westbound off-slip; to extend back onto the M4 mainline in the PM peak. The original proposed layout (Option 2a) was forecast to reduce this queuing, with queues shown to be accommodated within the M4 westbound off-slip extent.

A comparison of the slip road queue lengths (as forecast by LinSig for the 2019 'Opening Year' and 2034 'Design Year') for the original preferred layout and the modified preferred scheme (utilising manually optimised signal timings) is shown in **Table 2-8**.

Scenario	M4 Westbound Off-Slip (50 PCU Capacity)				M4 Eastbound Off-Slip (121 PCU Capacity)			
	AM Peak	Queuing Availability (PCU)	PM Peak	Queuing Availability (PCU)	AM Peak	Queuing Availability (PCU)	PM Peak	Queuing Availability (PCU)
2019 Original	5.6	44.4	9.2	40.8	28	93	12.5	108.5
2019 Modified	4.4	45.6	9.2	40.8	28	93	12.5	108.5
Difference	-1.2	1.2	0	0	0	0	0	0
2034 Original	5.2	44.8	11.9	38.1	53	68	17.1	103.9
2019 Modified	5.2	44.8	11.9	38.1	53	68	17.1	103.9
Difference	0	0	0	0	0	0	0	0

\*Maximum value taken from both lanes.

**Table 2-8** M4 Off-Slips – Original Preferred Scheme v Modified Preferred Scheme (Manually Optimised Timings)

As shown in Table 2-8, there is a negligible difference forecast between the modified preferred scheme compared to the original preferred scheme (with the modified preferred scheme slightly forecast to operate with reduced queuing on the M4 westbound off-slip in the 2019 AM peak scenario).

Once again, it is also recommended that traffic signal loops are installed at the entry of both the M4 westbound and eastbound off-slips to ensure queuing does not extend onto the M4 mainline along with Mobile VMS.

### 2.4.3 Scheme Objectives Assessment

An assessment of the original preferred option against the scheme objectives was provided in the combined Stage 1 and Stage 2 WeITAG Report and given that the detailed design process had only resulted in minimal alterations to the

proposal, the assessments undertaken at Stage 2 remained appropriate and no further assessment was considered necessary.

This approach is also viewed as appropriate in terms of the modified preferred option.

#### **2.4.4 Economic Appraisal**

This section provides an appraisal of the economic impacts (in line with the assessment undertaken in the WeITAG Stage 3 Appraisal (October 2018) to provide an appropriate comparison) of the modified proposed improvements for M4 J48 and incorporates the following:

- Scheme Costs;
- Assessment Methodology;
- Monetised Scheme Benefits; and
- Economic Assessment.

#### **Scheme Costs**

##### **2018 Prices**

The project scheme cost (estimated in 2018 prices) has increased to £2.0m. The scheme cost allows for the following elements:

- Construction;
- Land;
- Supervision; and
- Preparation.

##### **Optimism Bias**

The HM Treasury Green Book (2018, p.30) defines optimism bias as “a demonstrated systematic, tendency for project appraisers to be overly optimistic”. This can result in an underestimation of scheme costs. In calculating the appropriate optimism bias for the M4 J48 scheme, reference has been made to WebTAG Unit A1.2 (DfT, Nov 2014) and in particular Tables 7 and 8.

Table 7 defines project categories and the stage of scheme development, with the M4 J48 scheme categorised as a Highway Agency Scheme and at Stage 1 ‘PCF Options Phase’. Table 8 sets out the recommended optimism bias uplifts for different projects at different stages of the life of a transport project. The recommended optimism bias uplift for a Stage 1 road scheme is 44%. Whilst the scheme could now be categorised as being at Stage 2 (Order Publication / Works Commitments) given the potential requirement for further consultation and associated scheme refinement (and to ensure consistency with the Stage 3 WeITAG report) 44% optimism bias has been retained.

An uplift of 44% has been applied to the costs and as a result the economic appraisal has been undertaken using a scheme cost of £2.88m (2018 prices including optimism bias).

### **Present Year Costs**

The scheme costs were provided in 2018 prices, but the economic appraisal considers costs and benefits in 2010 prices, referred to as the Present Year. For assessment purposes the 2018 Scheme Cost (2018 retained for consistency purposes) and Benefits has been deflated to 2010 levels using a 3.5% discount rate.

### **Assessment Methodology**

WeITAG and WebTAG principles have been used to provide an indication of the modified scheme's economic benefits using outputs from the LinSig model of M4 J48.

### **Monetised Scheme Benefits**

A series of annualisation factors were applied to the reported delay savings to estimate the total delay savings for the AM and PM peak hours on 253 working days per year in both 2019 and 2034.

The forecast annualised delay savings (for the original and modified preferred option) are shown in **Table 2-9** below.

Year	Original Option 2a Delay Savings (PCU-Hrs)	Modified Option 2a Delay Savings (PCU-Hrs)
2019	55,136	58,046
2034	94,827	106,151

*Table 2-9 Annualised Delay Savings*

### **Economic Appraisal**

This section outlines the forecast economic benefits of the delay savings presented in Table 2-9. The monetary benefits of the delay savings have been estimated based on conservative Non-working (Commuting) values of time derived from WebTAG. The results (for the original and modified preferred option) are shown in **Table 2-10** below.

Year	Original Option 2a Delay Savings (£)	Modified Option 2a Delay Savings (£)
2019	£422,082	£444,355
2034	£868,760	£972,508

*Table 2-10 Monetary Benefits of the Delay Savings*

The journey time savings accrued from the improvements have been capped at 2034 values to provide a 60-year appraisal period using a 3.5% discount rate over the whole appraisal period. Finally, these values were used to generate a stream of discounted benefits and to calculate the Present Value of Benefits (PVBs). The resulting PVB for the scheme (in 2010 prices) is calculated to be:

- Original Preferred Scheme PVB - £14.21m;
- Modified Preferred Scheme PVB - £15.76m.

The benefits outlined above are based solely on vehicular delay savings at Junction 48 and does not take into account changes in collisions or the potential benefits from improved lane discipline along the A4138 towards Talyclun.

To provide an indication of the Scheme's Benefit to Cost Ratio (BCR) the PVBs provided above have been divided by the reported total construction cost for the scheme. The total cost of the scheme is £2.88m (£2.0m uplifted by 44% OB) or £2.19m in 2010 prices. The BCR for the:

- Original Preferred Scheme was 8.7; and the
- Modified Preferred Scheme is 7.2.

#### **2.4.5 Deliverability**

The following deliverability requirements are envisaged in terms of taking the scheme forward.

#### **Land Take**

Highway boundary land is required for the widening of the M4 eastbound on-slip (requiring a thin strip of land in the vicinity of the A4138) and the implementation of the Shared Use Path.

#### **General Buildability**

Clearance of land which is currently vegetated would need to be undertaken in accordance with environmental best practice. There are understood to be no other restrictions on the works proceeding in this area.

#### **Future Maintenance**

Maintenance of the network will remain as present with SWTRA responsible for elements of the scheme on the Trunk Road network and CCC for the local road network.

#### **Funding**

It is understood that WG have agreed to fund the scheme.

## 3 Summary and Conclusions

### 3.1 Overview

The Welsh Government's (WG) South Wales Trunk Road Agent (SWTRA) has commissioned Atkins to undertake an Addendum to the M4 Junction 48 (J48) and A4138 Pontarddulais Road WeITAG Stage 3 Appraisal (October 2018) in respect to a modified preferred option.

The purpose of this WeITAG Stage 3 Addendum is to assess the modified preferred option focusing on the transport planning and economics, design and engineering aspects.

### 3.2 Original Preferred Option – Design Development

The original preferred option retained from the Stage 2 Appraisal was Option 2a. This is shown in Appendix A.

### 3.3 Modified Preferred Option – Design Development

Following comments from key stakeholders, the preferred option (Option 2a) retained from the Stage 2 Appraisal has been amended as follows:

- The signalisation of the A4138 / Tal-Y-Coed junction;
- In reference to INM H6 (which is an aspirational Shared Use Route connecting Hendy and Llangennech), the upgrading of the northbound footway to a Shared Use Path; and
- The introduction of Toucan Crossings (at the proposed signal controlled junctions).

The modified preferred option is shown in Appendix B.

The Stage 1 RSA (and designers' response) are provided in Appendix C.

### 3.4 Transport Case

The Transport Case for the revised proposed improvements to the A4138 and M4 J48 incorporates the following:

- Operational Analysis (LinSig);
- Assessment against the Scheme Objectives; and
- Economic Appraisal.

#### 3.4.1 *Operational Analysis (LinSig)*

##### **M4 Junction 48**

There are negligible differences forecast between the modified preferred scheme compared to the original preferred arrangement (with the modified scheme slightly forecast to operate with increased capacity).



Once again (as per the original preferred junction layout), during the AM peak, the modified preferred junction is still forecast to operate over capacity with Option 2a in place, however total delay at the junction has reduced by over a minute (in 2019) and by over three minutes (in 2034) compared to the existing layout. During the PM peak, the modelling for the existing layout demonstrated that the junction is forecast to be operating over capacity (PRC -48.5% in 2019 and -72.4% in 2034). However, with the modified Option 2a in place, the junction is forecast to be operating with spare capacity in 2019 (PRC 7.4% with a reduction in total delay of over two minutes compared to the existing layout) and operating close to within capacity in 2034 (PRC -0.3% with a reduction in total delay of nearly four minutes compared to the existing layout).

### ***Westbound Off-Slip***

There are concerns that congestion in the PM peak at the M4 J48 is causing vehicles to queue from the M4 westbound off-slip lanes back to the M4 mainline, with vehicles utilising the hard shoulder for queuing purposes.

In the 2019 'Opening Year' and 2034 'Design Year', the existing layout of the junction is forecast to result in queuing on the M4 westbound off-slip to extend back onto the M4 mainline in the PM peak. The modified preferred layout (Option 2a) is forecast to reduce this queuing, with queues shown to be accommodated within the M4 westbound off-slip extent. Nevertheless, it is recommended that traffic signal loops are installed at the entry of both the M4 westbound and eastbound off-slips to ensure queueing does not extend onto the M4 mainline.

### **3.4.2 *Scheme Objectives Assessment***

An assessment of the original preferred option against the scheme objectives was provided in the combined Stage 1 and Stage 2 WeITAG Report and given that the detailed design process had only resulted in minimal alterations to the proposal, the assessments undertaken at Stage 2 was viewed as remaining appropriate and no further assessment was considered necessary.

This approach is also viewed as appropriate in terms of the modified preferred option.

### **3.4.3 *Economic Appraisal***

An appraisal of the economic impacts of the modified proposed improvements (in line with the assessment undertaken in the WeITAG Stage 3 Appraisal (October 2018) to provide an appropriate comparison) for M4 J48 has been undertaken.

The project scheme cost (estimated in 2018 prices) has increased to £2.0m. An uplift of 44% has been applied to the costs to account for optimism bias resulting in a scheme cost of £2.88m (£2.19m in 2010 prices).

WeITAG and WebTAG principles have been used to provide an indication of the scheme's economic benefits using outputs from the LinSig model. The time savings accrued from the improvements have been used to calculate the Present Value of Benefits (PVBs), which is as follows:

- Original Preferred Scheme PVB - £14.21m;
- Modified Preferred Scheme PVB - £15.76m.

Resulting in the following BCR:

- Original Preferred Scheme of 8.7; and the
- Modified Preferred Scheme being 7.2.

## **APPENDIX A**

### **PREFERRED SCHEME – DETAILED DESIGN (ORIGINAL)**

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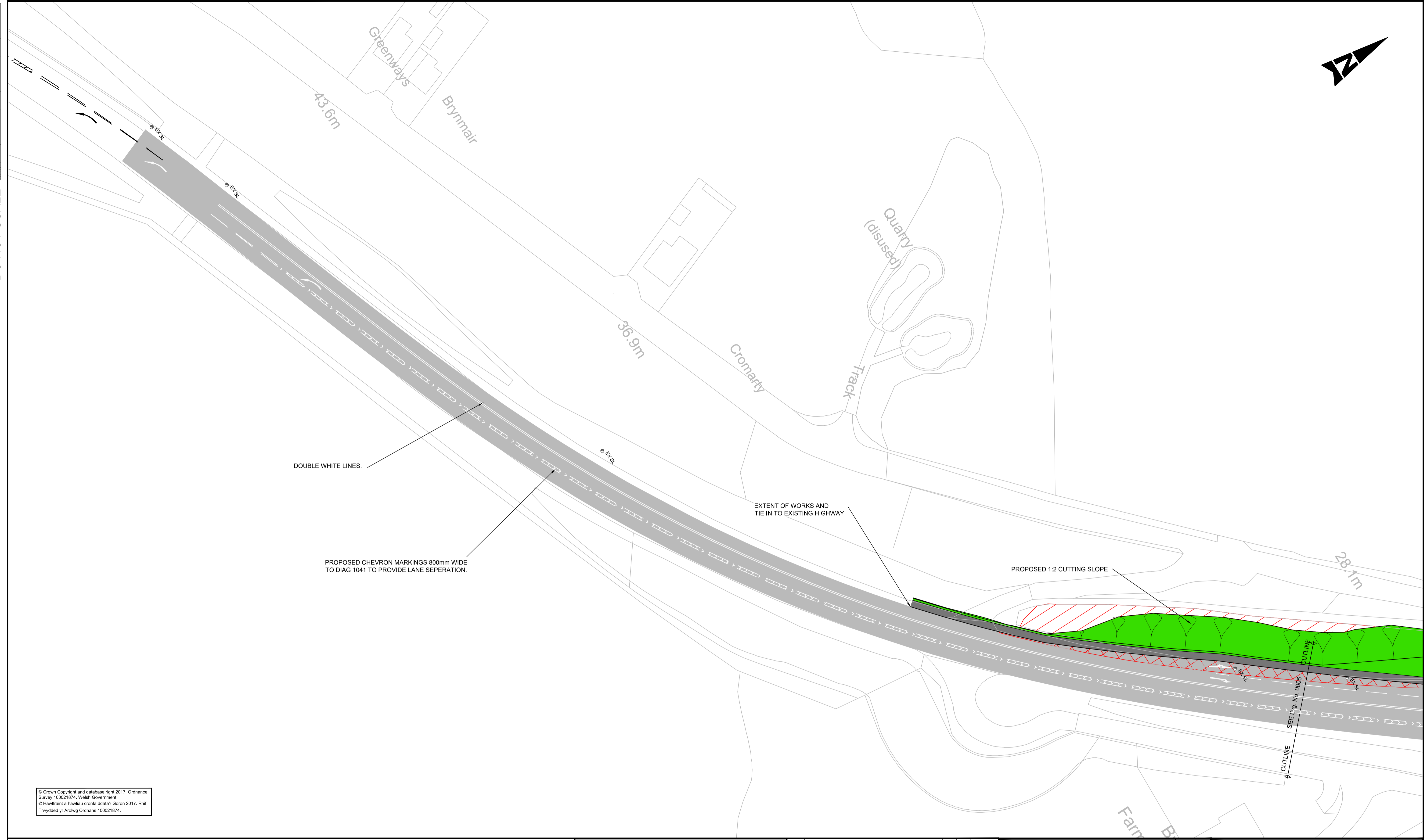
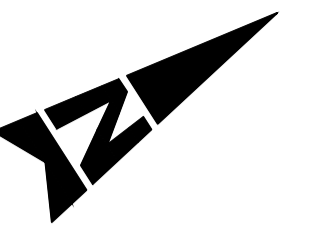




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 2. ONLY WRITTEN DIMENSIONS TO BE USED, DO NOT SCALE.

**KEY:**

	EXISTING LIGHTING COLUMN TO BE RELOCATED / RENEWED
	PROPOSED 2m WIDE FOOTWAY
	PROPOSED CARRIAGEWAY
	PROPOSED VERGE / EMBANKMENT
	EXISTING PAVED AREA / VERGE TO BE EXCAVATED TO PROVIDE FULL DEPTH CARRIAGEWAY CONSTRUCTION
	PROPOSED AREA OF TREE CLEARANCE.
	PROPOSED LANDSCAPE PLANTING TO BE AGREED.

**SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION**

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction (Enter "None" if applicable)							
Maintenance / Cleaning (Enter "None" if applicable)							
Use (Enter "None" if applicable)							
Decommissioning / Demolition (Enter "None" if applicable)							
Rev.	Date	Description	Org	Chk'd	App'd	Aur'd	

P01	24/05/17	First Issue	AD	DNJ	JR	JR
P02	26/01/18	First Issue	SW	DNJ	DJM	JR
P03	09/02/18	First Issue	SW	DNJ	DJM	JR
P04	26/04/18	First Issue	SW	DJM	JR	JR
P05	01/08/18	First Issue	SW	DNJ	CJ	CJ

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Client:

Yn gweithio ar ran  
 Llywodraeth Cymru  
 Working on behalf of the  
 Welsh Government

Design Status	S2								
Project Title	M4 J48 Upgrade								
Drawing Title	GENERAL ARRANGEMENT 2 OF 2								
Scale	1:500	Originator	SW	Checked	DNJ	Approved	CJ	Authorised	CJ
Original Size	A1	Date	01/08/18	Date	01/08/18	Date	01/08/18	Date	01/08/18
Drawing Number	JR17_201 - ATK - HGN - SWTRA - DR - D - 0014			Project Ref. No.	5154498		Revision	P05	
Location	Type	Role	Number						

## **APPENDIX B**

### **PREFERRED SCHEME – DETAILED DESIGN (MODIFIED)**

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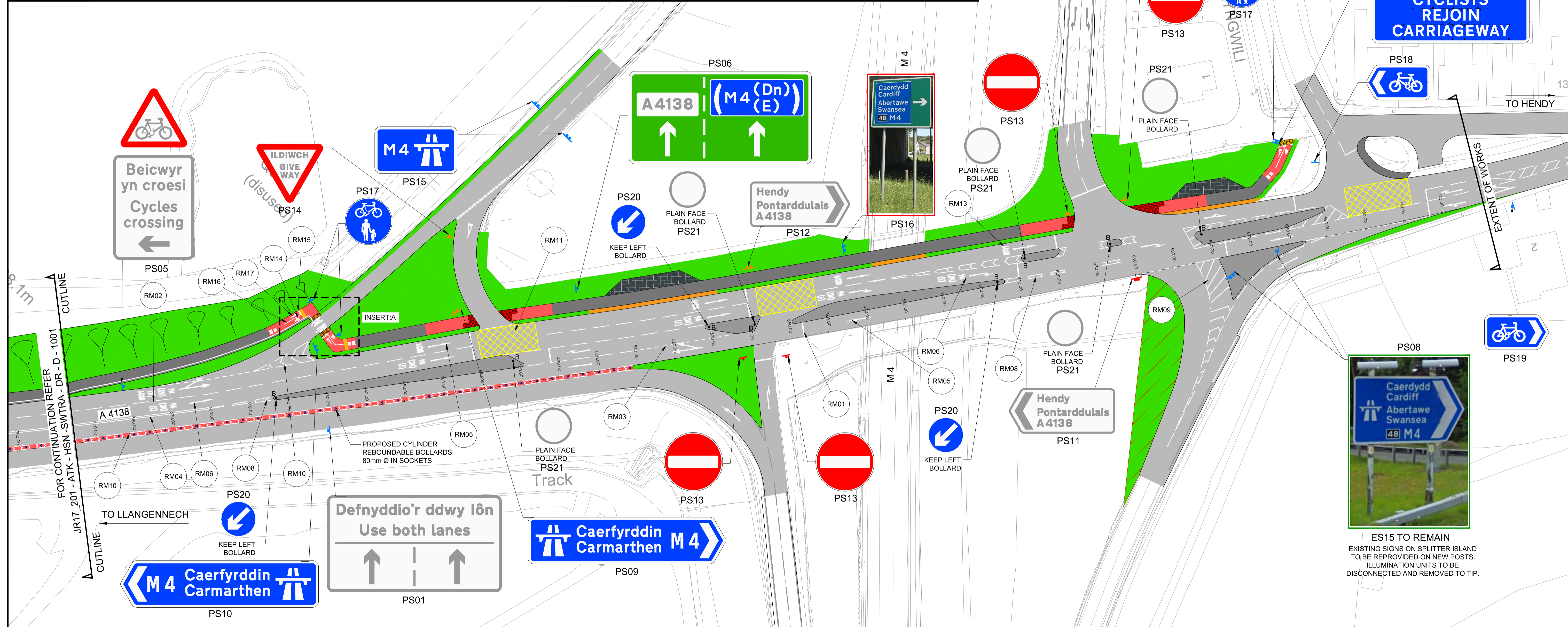
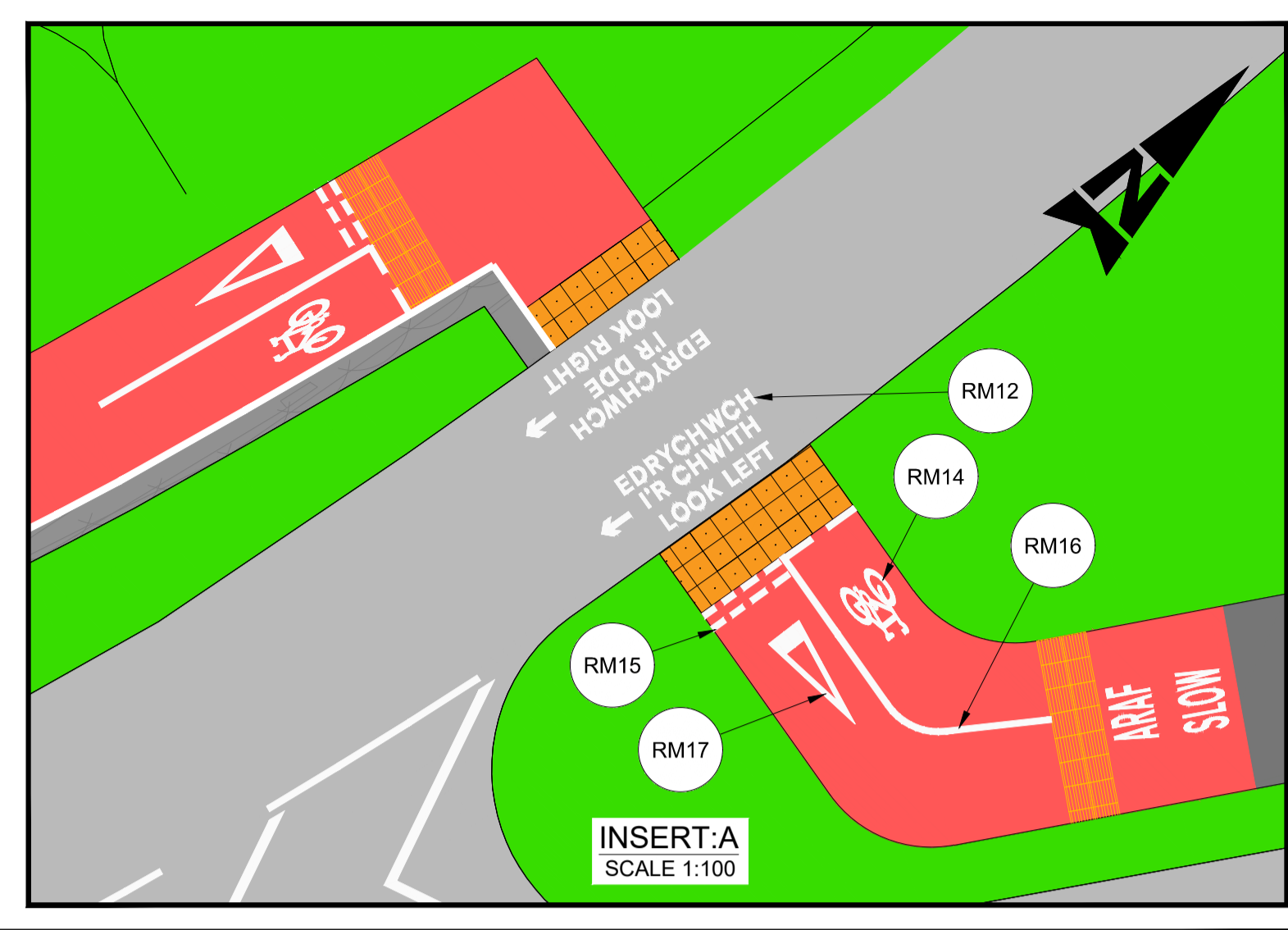
DO NOT SCALE

100  
Millimetres

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PROPOSED ROAD MARKING DETAILS

REF	DIAG. NO	WIDTH (mm)	DESCRIPTION MARK(m)	GAP (m)	COLOUR	ROAD STUDS	NOTES
RM01	1001	200	-	-	WHITE	NONE	STOP LINE MARKING
RM02	1004	100	4	2	WHITE	WHITE STUDS UNI-DIRECTIONAL AT 6m SPACINGS	WHITE UNI DIRECTIONAL ROAD STUDS AT 6M SPACINGS
RM03	1010	150	1	1	WHITE	NONE	EDGE OF CARRIAGEWAY MARKING
RM04	1013.1	150	CONTINUOUS		WHITE	WHITE STUDS BI-DIRECTIONAL AT 4.5m SPACINGS	DOUBLE WHITE LINE MARKING
RM05	1039	-	-	-	WHITE	NONE	4m LONG STRAIGHT AHEAD ARROW
RM06	1038	-	-	-	WHITE	NONE	4m LONG RIGHT TURN ARROW
RM07	1039	-	-	-	WHITE	NONE	8m LONG BIFURCATION ARROW
RM08	1040	100	4	2	WHITE	WHITE STUDS UNI-DIRECTIONAL AT 6m SPACINGS	100mm (4m MARK, 2m GAP) EDGE LINES WITH 150mm WIDE HATCHED MARKINGS SPACED AT 3m
RM09	1040.4	100	4	2	WHITE	WHITE STUDS UNI-DIRECTIONAL AT 6m SPACINGS	100mm (4m MARK, 2m GAP) EDGE LINES WITH 150mm WIDE HATCHED MARKINGS SPACED AT 3m
RM10	1041	100	4	2	WHITE	RED UNI-DIRECTIONAL STUDS AT 6m SPACINGS	100mm(4m MARK, 2m GAP) EDGE LINES WITH 150mm CHEVRONS SPACED AT 2m
RM11	1043	150	CONTINUOUS		YELLOW	NONE	YELLOW JUNCTION BOX MARKINGS
RM12	1029	-	-	-	WHITE	NONE	280mm HIGH TEXT
RM13	1035	-	-	-	WHITE	NONE	1600 HIGH TEXT
RM14	1037	-	-	-	WHITE	NONE	CYCLE SYMBOL
RM15	1003	100	0.3	0.15	WHITE	NONE	DOUBLE GIVEWAY LINE
RM16	1049	150	CONTINUOUS		WHITE	NONE	CYCLE LANE LINE
RM17	1023	-	-	-	WHITE	NONE	GIVEWAY TRIANGLE 1.875m



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- ALL SIGNS ARE TO BE IN ACCORDANCE WITH 'THE TRAFFIC SIGNS DIRECTIONS AND GENERAL REGULATIONS 2016' AND 'THE TRAFFIC SIGNS MANUAL'.
- THE EXACT LOCATION OF ALL SIGNS TO BE AGREED BY THE ENGINEER INCHARGE.
- FOR SCHEDULE OF SIGNS, POSTS AND FOUNDATION REFER DWG :

**KEY:**

- PROPOSED CYLINDER BOLLARD IN CENTRE OF CHEVRON MARKING
- EXISTING SIGN TO BE REMAIN
- EXISTING SIGN FACE TO BE REUSED
- XSXX SIGN REFERENCE (X - VARIABLE)
- ▶ PROPOSED SIGN (WITHOUT ILLUMINATION)
- ▶ PROPOSED SIGN (WITH ILLUMINATION)
- ▶ EXISTING ROAD SIGN LOCATION WITH KEEP LEFT OR PLAIN FACE SIGN

**SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION**

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction  
TRAFFIC MANAGEMENT, PROXIMITY TO STATUTORY UTILITIES AND LIVE TRAFFIC.

Maintenance / Cleaning  
None

Use  
None

Decommissioning / Demolition  
None

Rev.	Date	Description	Org	Chk'd	App'd	Auf'd
P01	15/01/20	First Issue	SK	DJM	DJM	CK

Suitability: WORK IN PROGRESS  
Design Status: S0

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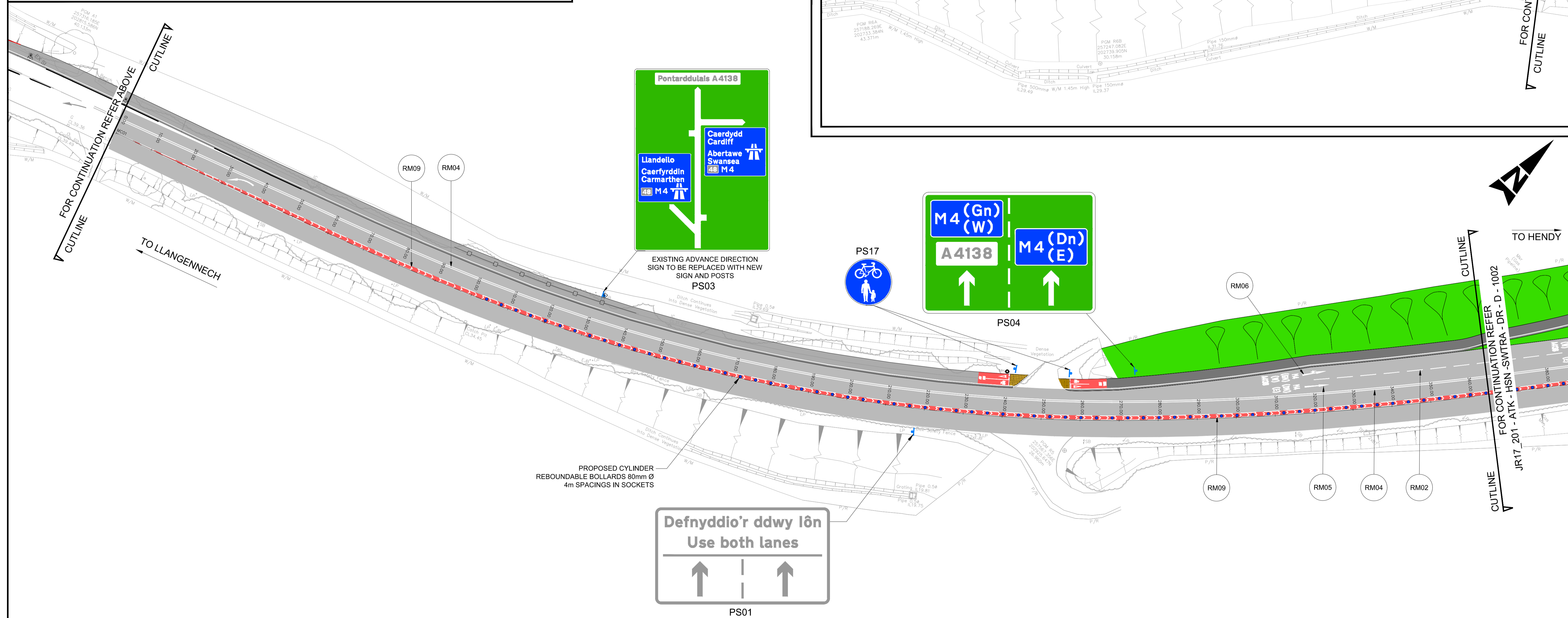
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Project Title		M4 J48 Upgrade			
Drawing Title		ROAD SIGNS AND ROAD MARKINGS SHEET 2 OF 2			
Scale	1:500	Originator	SK	Checked	DJM
Original Size	A1	Date	15/01/20	Date	15/01/20
Approved	DJM	Authorised	CK	Date	15/01/20
Project Ref. No.	JR17_201 - ATK - HSN - SWTRA - DR - D - 1002	Volume	5154498	Date	15/01/20
Location	Type	Rate	Number	Revision	P01



DO NOT SCALE

PROPOSED ROAD MARKING DETAILS							
REF	DIAG. NO	WIDTH (mm)	DESCRIPTION MARK(m)	GAP (m)	COLOUR	ROAD STUDS	NOTES
RM01	1001	200	-	-	WHITE	NONE	STOP LINE MARKING
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RM11	1043	150	CONTINUOUS	-	YELLOW	NONE	YELLOW JUNCTION BOX MARKINGS
RM12	1029	-	-	-	WHITE	NONE	280mm HIGH TEXT
RM13	1035	-	-	-	WHITE	NONE	1600 HIGH TEXT
RM14	1037	-	-	-	WHITE	NONE	CYCLE SYMBOL
RM15	1003	100	0.3	0.15	WHITE	NONE	DOUBLE GIVEWAY LINE
RM16	1049	150	CONTINUOUS	-	WHITE	NONE	CYCLE LANE LINE
RM17	1023	-	-	-	WHITE	NONE	GIVEWAY TRIANGLE 1.875m



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	PROPOSED SIGN (WITHOUT ILLUMINATION)
	PROPOSED SIGN (WITH ILLUMINATION)
	EXISTING ROAD SIGN LOCATION
	WITH KEEP LEFT OR PLAIN FACE SIGN

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION				
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).				
Construction TRAFFIC MANAGEMENT, PROXIMITY TO STATUTORY UTILITIES AND LIVE TRAFFIC.				
Maintenance / Cleaning None				
Use None				
Decommissioning / Demolition None				
PO1	15/01/20	First Issue	SK	DJM
Rev.	Date	Description	Org	Chk'd
			App'd	Auf'd

Sutability		Design Status		Project Title	
WORK IN PROGRESS		S0		M4 J48 Upgrade	
		West Glamorgan House 12 Orchard Street Swansea West Glamorgan SA1 5AD Tel: +44 (0)1792 641172 Fax: +44 (0)1792 472019 www.atkinsglobal.com		Drawing Title <b>ROAD SIGNS AND ROAD MARKINGS SHEET 1 OF 2</b>	
Copyright © Atkins Limited (2018)		Scale: 1:500	Originator: SK	Checked: DJM	Approved: DJM
Client:		Original Size: A1	Date: 15/01/20	Date: 15/01/20	Date: 15/01/20
		Drawing Number: JR17_201 - ATK - HSN - SWTRA - DR - D - 1001	Originator: Volume	Project Ref. No: 5154498	
		Location: Type: Role: Number:	Revision: P01		

**APPENDIX C**

**STAGE 1 RSA**

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# South Wales Trunk Road Agent

Managing and Improving  
Motorways and Trunk Roads  
through South Wales



# Asiant Cefnffyrdd De Cymru

Rheoli a Gwella'r Traffyrdd  
a'r Cefnffyrdd yn Ne  
Cymru

## M4 Junction 48 and A4138 Improvement Works

Stage 1 Road Safety Audit Report  
July 2019  
Final Report



Yn gweithio ar ran  
**Llywodraeth Cymru**  
Working on behalf of the  
**Welsh Government**

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# M4 Junction 48 and A4138 Improvement Works

## Stage 1 Road Safety Audit Final Report

Service Provider/Consultant Name:	<b>Atkins</b>
Service Provider/Consultant Project Number	<b>5167243_701</b>
Scheme Reference: <b>16/SW/CPS/001</b>	Audit File Reference: <b>8003/108/001F</b>

Revision	Date	Status	Author	Checked	Approved
0	July 2019	Final	[Redacted]	[Redacted]	[Redacted]
			[Redacted]	[Redacted]	[Redacted]
			Service provider		

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## Contents

1	Introduction .....	2
1.1	Commission and Terms of Reference .....	2
1.2	Scope .....	2
1.3	Scheme details.....	3
1.4	Report Outline .....	4
2	Items Raised by previous combined Stage 1 RSA.....	5
2.1	PROBLEM.....	5
2.2	PROBLEM.....	5
2.3	PROBLEM.....	6
2.4	PROBLEM.....	7
2.5	PROBLEM.....	8
2.6	PROBLEM.....	8
2.7	PROBLEM.....	9
3	Items Raised by this Stage 1 RSA .....	11
3.1	PROBLEM.....	11
3.2	PROBLEM.....	11
3.3	PROBLEM.....	11
4	Audit Team Statement .....	13
4.1	Road Safety Audit Team .....	13
5	Acceptance .....	14

APPENDIX A: LIST OF DRAWINGS AND DOCUMENTS

APPENDIX B: SCHEME DRAWINGS



# 1 Introduction

## 1.1 Commission and Terms of Reference

Atkins Transportation has been commissioned by the South Wales Trunk Road Agent (SWTRA) on behalf of the Welsh Government to undertake a Stage 1 Road Safety Audit (RSA) of the proposed amendments to the M4 Junction 48 and A4138.

The audit team membership was as follows:

██████████ BEng, MSc (Eng), CEng, MICE, MIGHT, FSoRSA  
(Audit Team Leader) Managing Consultant  
Atkins Transportation

██████████ BA (Hons)  
Transport Planner  
Atkins Transportation

A Certificate of Competency in Road Safety Auditing (gained via the TMS Consultancy route) is held by Rob Hunt, RSA team leader. The RSA team are the subject of a rolling annual approval for undertaking RSAs on the SWTRA network and are understood to be approved for the role of RSA team leader and RSA team member.

This Stage 1 RSA has been conducted with reference to the procedures and scope set out in the Welsh Government's 'Design Manual for Roads and Bridges' (DMRB), GG 119 road safety audit.

## 1.2 Scope

The RSA brief was provided by Jon Robinson of Atkins Transportation in an email dated 24<sup>th</sup> June 2019. **The signed RSA brief has not yet been received from the Overseeing Organisation, Welsh Government, but following an instruction from SWTRA on 24<sup>th</sup> July 2019, the report has been issued.** Details of the information provided as part of the brief are included in Appendix A.



### 1.3 Scheme details

The RSA brief states:

*“The site is located on A4138 Pontarddulais Road at M4 Junction 48 (approximate co-ordinates X 257748, Y 203170). A WelTAG appraisal was carried out by Atkins following concerns of congestion on the A4138 and J48 of the M4 during peak periods. The appraisal identified the key issues and options and recommended Option 2A to be taken forward and developed. This option has been developed to preliminary design stage and proposes to reduce congestion by increasing capacity on the A4138 through carriageway widening works and controlling movements on the slip roads by introducing/upgrading signal control to the existing junctions.*

*The works include:*

- *Realignment of central reservation on the A4138 under M4 overbridge*
- *Removal of the southbound give way line on the eastbound on-slip*
- *Re-arrangement of the M4 eastbound off-slip signals.*
- *Extension of the two-lane A4138 northbound approach to beyond the M4 westbound on slip entry. This arrangement will increase the two-lane approach by c.110m to a total of c.260m, further reducing the likelihood of traffic travelling to the M4 eastbound on-slip blocking straight-ahead traffic to Hendy on the A4138 northbound.*
- *Signalising the M4 westbound off-slip and the right-turn from the A4138 southbound to the M4 westbound on-slip. Through doing this, the queues on the M4 westbound off-slip right turn lane can be more effectively controlled to ensure queueing does not extend back onto the M4 mainline.*
- *As part of the signalisation of the M4 westbound off-slip, signalised stop-lines will be provided on the A4138 in both directions and on the right-turn lane on the off-slip. The left turn movement from the off-slip to the A4138 southbound carriageway will remain uncontrolled.*
- *Introduction of traffic signals at the Tal-Y-Coed junction immediately to the north of the M4 J48 eastbound off-slip road.*
- *Linking of all proposed traffic signals to ensure efficient operation of the junction*

*At the A4138 northbound right turn onto the M4 J48 eastbound on-slip a number of traffic signal design options have been considered with the appended (refer to Appendix B) drawings currently specifying the provision of a right turn indicative arrow option.*

*The right turn indicative arrow option enables the movement onto the M4 J48 eastbound on slip to turn during gaps in the opposing traffic, as well as having a dedicated right turn arrow which will stop the opposing traffic when after a defined period of time, subject to demand. This option provides additional capacity with the junction, showing as within capacity during all PM peak flows*



tested (2016, 2019 and 2034). During the 2016 AM peak the junction had spare capacity. The 2019 AM flows showed the A4138 junction with the M4 J48 eastbound off-slip fractionally exceeding its capacity, on the M4 J48 eastbound off-slip. Applying the 2034 AM flows showed the northbound right turn onto the M4 eastbound on-slip and the M4 eastbound off-slip were both around 10% over capacity.

The option for a fully signalised right turn onto the M4 eastbound on-slip was over capacity during all AM periods. The northbound right turn onto the M4 eastbound on-slip and the M4 Eastbound off-slip were both around 4-6% over capacity during the 2016 flows. Using the 2019 flows this increases to around 15-17%. Applying the 2034 flows the values on these arms increase to near 20%, with the addition of the A4138 southbound ahead movement now being approximately 15% over capacity. The junction did however operate effectively during all of the PM Peak scenarios.

The results identify that the option for the right turn indicative arrow provides an increase in capacity at the junction by around 10-20% dependent on the flows being used. As such, this option has been proposed on the design drawings to be considered for this RSA1.”

## 1.4 Report Outline

The RSA comprised a desktop review of the information provided in the RSA brief and a subsequent site visit, which was carried out by the RSA team together during daylight hours on the afternoon of Wednesday 10<sup>th</sup> July 2019. Weather conditions at the time of the site visit were bright and sunny, with the road surface condition being dry. Traffic conditions were free-flowing.

The RSA team has examined and reported only on the road safety implications of measures as presented and has not specifically examined or verified the compliance of the designs to any other criteria. The RSA team reviewed the content of the brief provided by the design team.

A previous Stage 1 RSA was undertaken in May 2018 (following HD 19/15). Since that RSA, the design has been changed which necessitates the need for a new Stage 1 RSA which is covered by this report.

Section 2 covers the items raised as part of the previous Stage 1 RSA. Section 3 covers the items raised as part this stage 1 RSA. Section 4 comprises the RSA team statement. Section 5 contains the Overseeing Organisation Acceptance Statement. A scheme layout plan is included in Appendix B.



## 2 Items Raised by previous combined Stage 1 RSA

As part of the brief for this RSA, the RSA team received the RSA Response Report for the previous Stage 1 RSA, which has been responded to below.

### 2.1 PROBLEM

**Location:** A4138 main carriageway through the junction.

**Summary:** Potential for 'see-through' of downstream traffic signals.

The introduction of additional sets of traffic signals on a straight section of road with a number of junction, traffic islands and traffic lanes is likely to make the road layout more difficult to comprehend. For north-eastbound users on the A4138 there will be three sets of traffic signals that may not be showing the same signal at the same time. This could lead to users seeing a downstream green signal when the immediate signal is red. Users could proceed through the red signal and collide with a vehicle making an opposing manoeuvre.

#### Recommendation

As the design is progressed, the traffic signal layout/alignment and staging should prevent or minimise the likelihood of 'see-through' for A4138 users in both directions.

#### *Design team Response:*

*Noted - Additional louvres could be added to the green and amber signal aspects, if required to help minimise the issue of 'see through' on the first 2 sets of traffic signals on the A4138 north-eastbound approach. The 69m distance between the first and second stop line is normally considered sufficient that they will not be required on the second set. The 59m between the second and third stop line may justify louvres on the third set, although it is hoped the phasing/ staging arrangement will negate the need for the louvres, with drivers not seeing a downstream green when held on a red signal.*

#### *RSA 1 Note:*

*The new designs show an additional set of traffic signals, which may lead to a greater likelihood of 'see-through' of downstream traffic signals.*

### 2.2 PROBLEM

**Location:** A4138 north-eastbound main carriageway.



**Summary:** Possible confusion about the location of the right turn.

The right turn from the A4138 onto the M4 eastbound on-slip would be preceded with three sets of traffic signals and six right turn road marking arrows. This may lead to confusion for users looking to make the right turn. This could lead to mistaken manoeuvres onto the M4 westbound off-slip or unexpected slowing down in the lane marked for the right turn. This could lead to head-on or nose-to-tail collisions.

### **Recommendation**

The traffic signal, traffic sign and road marking layouts should be designed to give clear guidance about the location of the right turn.

#### *Design team Response:*

*Agreed - On the A4138 north-eastbound approach, the first and second set of signals could display 'ahead only' green arrows that indicate an ahead movement only. These could be backed up with blue box signs to Diagram 606 (indicating direction of travel) mounted on the signal. This would be subject to detailed design, and any Traffic Regulation Orders that may be existing or introduced. The signal head arrangement at the third set of traffic signals, where the right turn is made, is subject to detailed design and final modelling output.*

#### *RSA 1 Note:*

*Response acknowledges the problem and highlights design features that could help to mitigate the problem if included in the design.*

## **2.3 PROBLEM**

**Location:** M4 westbound on-slip priority layout.

**Summary:** Traffic signals may lead to misunderstanding priorities.

At present the right turn onto the M4 westbound on-slip is a priority movement, which is followed by another priority movement at the point where it merges with the left turn from the A4138. In contrast, the eastbound on-slip layout has the left and right turns retaining a lane each on the on-slip.

As there is already limited visibility to vehicles approaching from the left at the give way on the on-slip, the introduction of traffic signal control at the right turn from the A4138 could lead to users failing to give way to vehicles approaching from the left, leading to side-wipe or nose-to-tail collisions.





## Recommendation

As part of the design proposals, the layout of the give way on the on-slip should be reviewed to ensure priorities are clear. Visibility between the traffic streams approaching from the left and right turns off the A4138 should be improved if the existing layout is to be retained.

### *Design team Response:*

*Agreed – The visibility at the give way line to vehicles approaching from the left will be improved by the proposed on-slip carriageway realignment and proposed wider verges behind the footways. Street furniture in the splitter island will be reviewed and relocated as required to provide better visibilities to vehicles approaching and waiting at the give way line.*

### *RSA 1 Note:*

*Response acknowledges the problem and identifies design features that could help to mitigate the problem if included in the scheme. Mirroring the design of the eastbound onslip at this location where two lanes run side-by-side may further mitigate this problem.*

## 2.4 PROBLEM

**Location:** Traffic signal junction at end of the M4 eastbound off-slip.

**Summary:** Queuing traffic may block other movements at the junction.

The junctions at the end of the westbound off-slip and on-slip both currently have yellow box markings and this would be retained (in a different layout) in the proposals. The introduction of two new sets of traffic signals could change the nature of queuing at the junction. It is not clear if a yellow box marking is required for the traffic signal junction at the end of the eastbound off-slip but, in the event of queuing across the junction on the A4138, a queue could build up on the off-slip reaching back to the main carriageway. The queue could then lead to a collision between stationary vehicles and high-speed main carriageway traffic.

## Recommendation

The operation of the junction should be assessed to determine if a yellow box marking is required to assist in keeping the junction clear.

### *Design team Response:*

*Agreed - No traffic signal issues are envisaged, however excessive queue lengths on the M4 eastbound off-slip could be detected and subject to queue clearance logic to prevent the queue from reaching the main carriageway. This*



*is subject to detailed design and the outcome of the modelling for maximum queue lengths.*

*RSA 1 Note:*

*Response acknowledges the problem and identifies design features that could help to mitigate the problem if included in the design.*

## 2.5 PROBLEM

**Location:** Right turn onto the A4138 from the M4 eastbound off-slip.

**Summary:** Users could pass on the wrong side of the traffic island.

The proposals include the removal of part of a traffic island that currently separates opposing directions of traffic on the A4138. The existing traffic island guides right-turning users into the correct lane but, with the removal of a significant section of the island, unfamiliar users may mistakenly pass to the right of the island where there would be two lanes. This could lead to a collision with oncoming vehicles.

### Recommendation

As the design is progressed, measures should be included to guide users to the left of the traffic island.

*Design team Response:*

*Agreed - The location of the secondary traffic signal is intended to focus drivers vision on the far kerb edge, with a green arrow indicating the right turn movement.*

*RSA 1 Note:*

*Option 2A looks likely to provide greater guidance on the correct route than Option 2B.*

## 2.6 PROBLEM

**Location:** Right turns from the A4138 onto both M4 on-slips.

**Summary:** Provide clarity about priorities for right-turning users.

The existing traffic signals at the right turn onto the M4 eastbound on-slip include a right turn filter signal head which makes it clear to users that they must wait for the green filter arrow before making the right turn.





It is not clear if this arrangement would be retained when the proposals move the stop line further upstream or whether this arrangement would be introduced at the right turn onto the M4 westbound on-slip. Without the right turn green filter arrow (and associated red signal) there is a concern about users failing to give way to oncoming traffic, leading to a head-on or side-impact collision.

### **Recommendation**

Right turn filter signal heads should be included in the traffic signal layout at the right turns onto both on-slips.

#### *Design team Response:*

*Noted - The existing right turn onto the M4 eastbound on-slip is a separately signalled right turn, with its own red/amber/green. Subject to final modelling results being received for maximum capacity, it is possible this right turn could be retained, separately signalled, with no conflicting traffic, or subject to capacity each movement at the junction could run as a separate movement, with no conflicts.*

*It is not possible to have the same arrangement at the M4 westbound on-slip, as the right turn already has its own separately signalled movement, with no conflicts.*

#### *RSA 1 Note:*

*Right turn onto eastbound onslip: a separate filter phase would provide improved safety and remove the potential for conflict between vehicles in opposing directions.*

*Right turn onto westbound onslip: the revised drawing indicates that the design will include a separate right turn filter phase which will remove the potential for conflict.*

*These concerns should be reviewed at the Stage 2 RSA.*

## **2.7 PROBLEM**

**Location:** Downstream end of the M4 eastbound off-slip.

**Summary:** Pedestrians at risk of stepping into the path of vehicles.

The existing pedestrian crossing at the bottom/downstream end of the eastbound off-slip is currently uncontrolled, requiring pedestrians to judge when to cross based upon vehicle movements. This situation would be retained despite the proposals incorporating a more complex layout, which could make it more difficult to judge a safe time to cross. This raises concerns for pedestrians misjudging vehicle movements and being struck as they step into the path of slip road vehicles.



## Recommendation

The traffic signal layout should incorporate formal pedestrian aspects and push buttons to give advice when crossing the end of the off-slip.

### *Design team Response:*

*Noted - The introduction of pedestrian facilities is possible from a signal operation point of view, with the pedestrian phase running in a 'walk with' situation when the A4138 runs. However, the need for formal facilities should be justified based on the number of pedestrians; the impact on capacity (due to longer intergreens) and the requirement to have pedestrian facilities at the other signal junctions, to complement the NMU route. Pedestrian counts could be undertaken to record the likely level of demand.*

### *RSA 1 Note:*

*If the Toucan crossing indicated on the scheme drawings provided as part of the RSA brief is retained, then this problem would be resolved.*



### **3 Items Raised by this Stage 1 RSA**

#### **3.1 PROBLEM**

**Location:** A4138 northbound approach to the westbound onslip turning.

**Summary:** Lack of lane designation information.

Northbound users on the A4138 would have a series of ahead arrows but may be unaware that the offside lane is for the right turn to the eastbound onslip only. The lack of lane designation information could lead to drivers making late lane changes and result in side-swipe collisions.

#### **Recommendation**

Traffic signs showing lane designation should be provided to assist drivers in advance of the lane changes, to enable drivers to decide well in advance which lane they need to be in before reaching the signal-controlled junction.

#### **3.2 PROBLEM**

**Location:** Northbound exit onto westbound onslip.

**Summary:** Uncontrolled shared use path crossing.

The location of the uncontrolled pedestrian and cycle crossing across the westbound onslip means that users waiting to travel northbound at the crossing would have their backs to approaching traffic. They may be unaware from which direction traffic is approaching, which could lead to a pedestrian or cyclist being struck by a vehicle.

#### **Recommendation**

'LOOK RIGHT' text should be provided on the carriageway to notify northbound path users of the direction of approaching traffic. Similarly, 'LOOK LEFT' text should be provided for southbound path users at the onslip.

#### **3.3 PROBLEM**

**Location:** Eastbound offslip.

**Summary:** Vehicles over-running kerbs.



The kerb alignment at the eastbound offslip may lead vehicles to overrun or overhang the kerb, particularly larger vehicles, at the point where pedestrians and cyclists are waiting to cross. The vehicles could strike the waiting users and result in injury.

### **Recommendation**

Swept-path analysis should be undertaken to inform the kerb and island design at this location.



## 4 Audit Team Statement

We certify that this Road Safety Audit has been carried out in accordance with GG 119.

### 4.1 Road Safety Audit Team

#### Audit Team Leader

██████████

Signed:

██████████

Managing Consultant  
Atkins Transportation

Date: July 2019

#### Audit Team Member

██████████

Signed:

██████████

Transport Planner  
Atkins Transportation

Date: July 2019



## 5 Acceptance

### **This part to be signed by a representative of the Overseeing Organisation.**

In connection with the Stage 1 Road Safety Audit prepared for the M4 Junction 48 and A4138 Improvement Works scheme, I acknowledge receipt of this report.

Signed: .....

Date: .....

Name: .....

Position: .....



## APPENDIX A: LIST OF DRAWINGS AND DOCUMENTS

The Stage 1 Road Safety Audit Brief included:

### DOCUMENTS:

Email dated 24<sup>th</sup> June 2019



Stage 1 RSA Brief

JR18\_601-ATK-HGN-SWTRA-DO-D-0002

Stage 1 Road Safety Audit Response Report

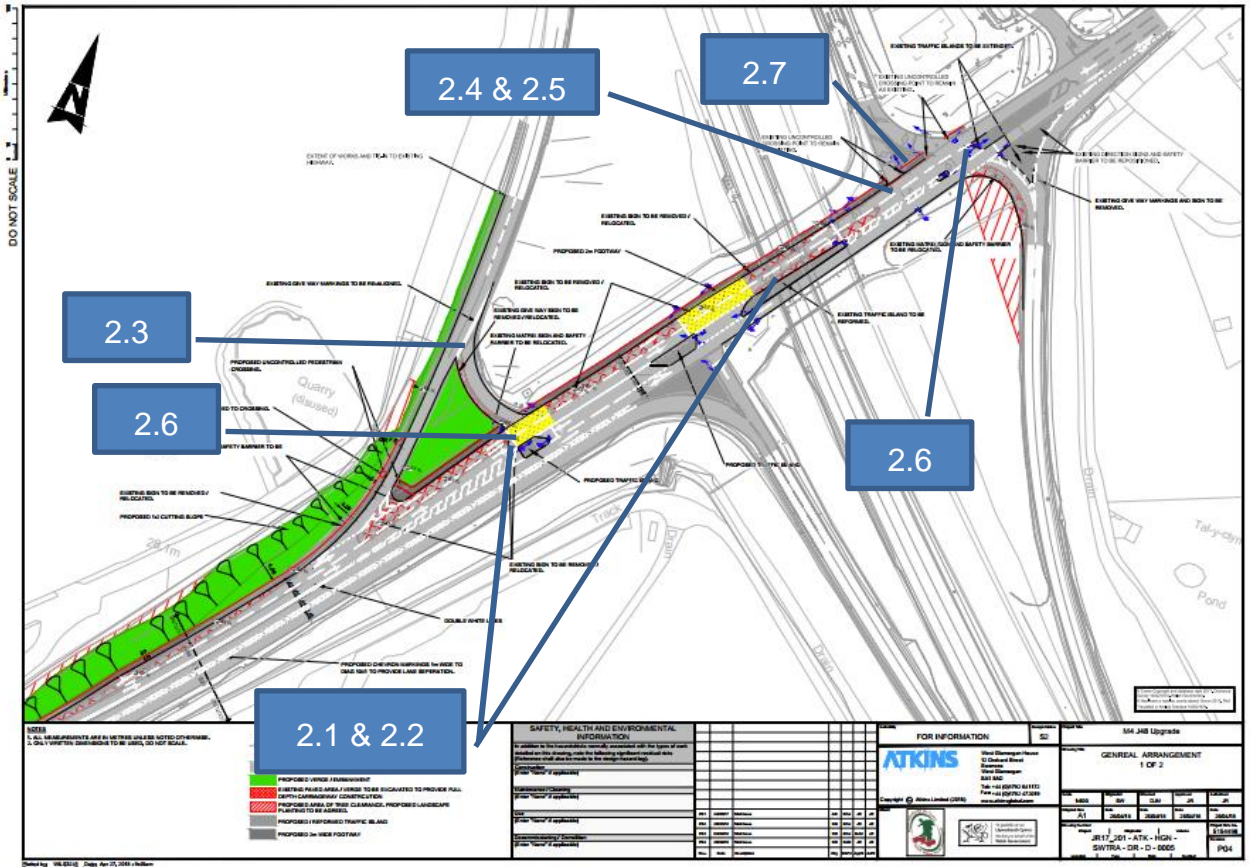
JR18\_601-ATK-HGN-SWTRA-DO-C-0001 RSA1R

### DRAWINGS:

DRAWING NUMBER	DRAWING TITLE
General Arrangement Sheet 1 of 2	JR17_201-ATK-HGN-SWTRA-DR-D-1001
General Arrangement Sheet 2 of 2 Option 2A	JR17_201-ATK-HGN-SWTRA-DR-D-1003
General Arrangement Sheet 2 of 2 Option 2B	JR17_201-ATK-HGN-SWTRA-DR-D-1004



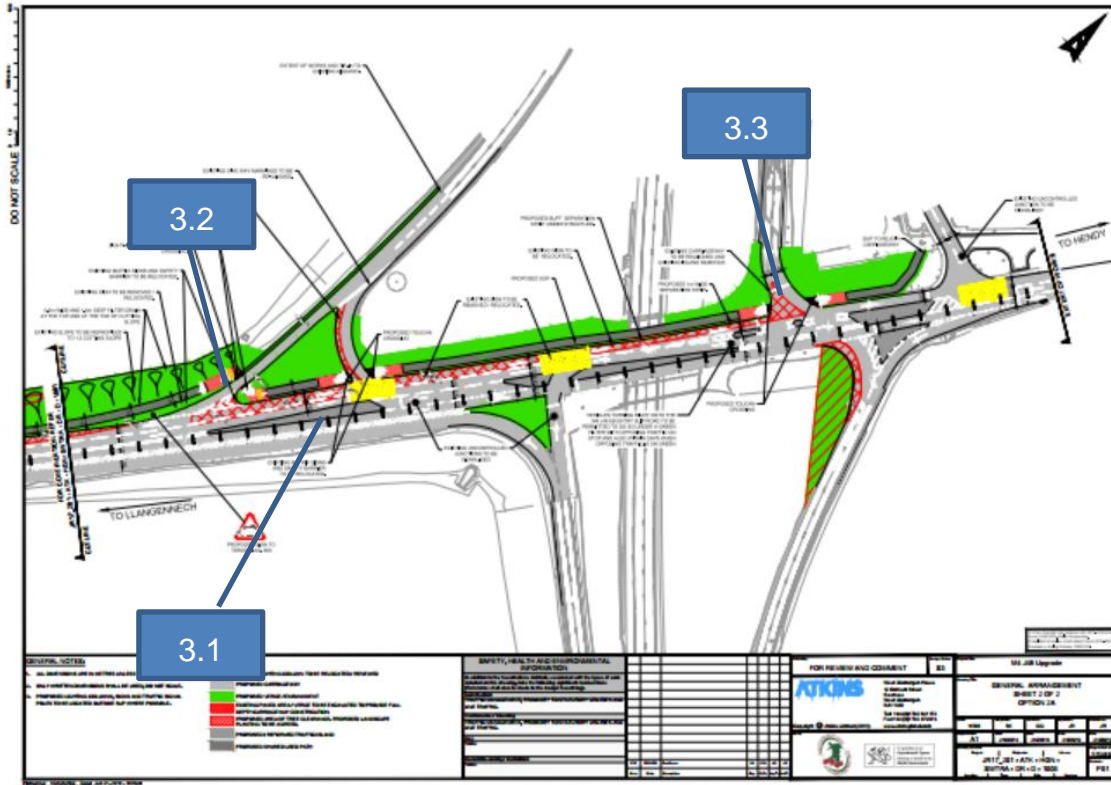
**APPENDIX B: Previous Stage 1 RSA Location Plans**







### APPENDIX C: Current Stage 1 RSA Location Plans





South Wales Trunk Road Agent  
Asiant Cefnffyrdd De Cymru

Unit 12A, Llandarcy House  
The Courtyard, D'Arcy Business Park  
Llandarcy, Neath. SA10 6EJ

[www.southwales-tra.gov.uk](http://www.southwales-tra.gov.uk)



# South Wales Trunk Road Agent

Managing and Improving  
Motorways and Trunk Roads  
through South Wales



# Asiant Cefnffyrdd De Cymru

Rheoli a Gwella'r Traffyrdd  
a'r Cefnffyrdd yn Ne  
Cymru

## M4 Junction 48 and A4138 Improvement Works

### Stage 1 Road Safety Audit Response Report



Yn gweithio ar ran  
**Llywodraeth Cymru**  
Working on behalf of the  
**Welsh Government**

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# M4 Junction 48 and A4138 Improvement Works

## Stage 1 Road Safety Audit Response Report

Document Reference:	JR17_201-ATK-HGN-SWTRA-DO-D-0001		
Prepared by:	Atkins		
On behalf of:	South Wales Trunk Road Agent		
Scheme Reference:	16/SW/CPS/001	Programme:	

			.....	.....	.....
			.....	.....	.....
P01	30/11/2019	DRAFT	█	█	█
Revision	Date	Status	Author	Checked	Approved
			Service provider		

*Left blank intentionally*



## Contents

- 1 Introduction..... 1
  - 1.1 Scheme summary ..... 1
  - 1.2 Design organisation representative ..... 2
- 2 Key personnel..... 3
  - 2.1 Overseeing Organisation ..... 3
  - 2.2 Road safety audit team ..... 3
  - 2.3 Design organisation ..... 3
- 3 Road safety audit decision log..... 4
- 4 Design organisation and Overseeing Organisation statements ..... 8

16/SW/CPS/001

*M4 Junction 48 and A4138 Improvement Works*  
Stage 1 Road Safety Audit  
Response Report



Yn gweithio ar ran  
**Llywodraeth Cymru**  
Working on behalf of the  
**Welsh Government**



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# 1 Introduction

This Road Safety Audit Response Report relates to the Stage 1 Road Safety Audit Report, document reference 8003-108\_M4 Junction 48 and A4138 Improvement Works\_001F for M4 Junction 48 and A4138 Improvement Works.

## 1.1 **Scheme summary**

The site is located on A4138 Pontarddulais Road at M4 Junction 48 (approximate co-ordinates 257748,203170). A WeTAG appraisal was carried out by Atkins following concerns of congestion on the A4138 and J48 of the M4 during Peak periods. The appraisal identified key issues and options and recommended Option 2A to be taken forward and developed. This option has been developed to preliminary design stage and proposes to reduce congestion by increasing capacity on the A4138 through carriageway widening works and controlling movements on the slip roads by introducing/upgrading signal control to the existing junctions.

The works include

- Realignment of central reservation on the A4138 under M4 overbridge
- Removal of the southbound give way line on the eastbound on-slip
- Re-arrangement of the M4 eastbound off-slip signals
- Extension of the two lane A4138 northbound approach to beyond the M4 westbound on slip entry. This arrangement will increase the two-lane approach by c.110m to a total of c.260m, further reducing the likelihood of traffic travelling to the M4 eastbound on-slip blocking straight-ahead traffic to Hendy on the A4138 northbound.
- Signalising the M4 westbound off-slip and the right-turn from the A4138 southbound to the westbound on-slip. Through doing this, the queues on the M4 westbound off-slip right turn lane can be more effectively controlled to ensure queueing does not extend back to onto the M4 mainline.
- As part of the signalisation of the M4 westbound off-slip, signalised stop lines will be provided on the A4138 in both directions and on the right-turn lane on the off-slip. The left turn movement from the off-slip to the A4138 southbound carriageway will remain uncontrolled.
- Introduction of traffic signals at the Tal-Y-Coed junction immediately to the north of the M4 J48 eastbound off-slip road.
- Linking of all proposed traffic signals to ensure efficient operation of the junction.

## 1.2 Design organisation representative

The representatives from the design organisation who prepared the RSA response are:

██████████

Highways Engineer

██████████

Highways Principal Engineer



## 2 Key personnel

### 2.1 **Overseeing Organisation**



Network Management Division  
Transport  
Department for Economy, Science and Transport  
Welsh Government

### 2.2 **Road safety audit team**



Audit Team Leader



Audit Team Member

### 2.3 **Design organisation**

Atkins  
West Glamorgan House  
12 Orchard Street  
Swansea  
SA1 5AD

### 3 Road safety audit decision log

A previous Stage 1 RSA was undertaken in May 2018 (following HD 19/15). Tables 1 and 2 below highlight the problems raised during the previous Stage 1 RSA and the current RSA>

Table 1: Road safety audit decision log for items raised in the previous Stage 1 RSA

RSA problem	RSA recommendation	Design organisation response	Updated RSA1 recommendation	Design organisation response 2	Overseeing Organisation response	Agreed RSA action
<b>PROBLEM 1</b>  <b>Location:</b> A4138 main carriageway through the junction  <b>Summary:</b> Potential for 'see-through' of downstream traffic signals	As the design is progressed, the traffic signal layout/alignment and staging should prevent or minimise the likelihood of 'see-through' for A4138 users in both directions	Additional louvres could be added to the green and amber signal aspects, if required to help minimise the issue of 'see through' on the first 2 sets of traffic signals on the A4138 north-eastbound approach. The 69m distance between the first and second stop line is normally considered sufficient that they will not be required on the second set. The 59m between the second and third stop line may justify louvres on the third set, although it is hoped the phasing/ staging arrangement will negate the need for the louvres, with drivers not seeing a downstream green when held on a red signal.	The new designs show an additional set of traffic signals, which may lead to a greater likelihood of 'see-through' of downstream traffic signals	The audit comments are noted and will be considered during the detailed design.		
<b>PROBLEM 2</b>  <b>Location:</b> A4138 north-eastbound main carriageway  <b>Summary:</b> Possible confusion about the location of the right turn	The traffic signal, traffic sign and road marking layouts should be designed to give clear guidance about the location of the right turn	Agreed. On the A4138 north-eastbound approach, the first and second set of signals could display 'ahead only' green arrows that indicate an ahead movement only. These could be backed up with blue box signs to Diagram 606 (indicating direction of travel) mounted on the signal. This would be subject to detailed design, and any Traffic Regulation Orders that may be existing or introduced. The signal head arrangement at the third set of traffic signals, where the right turn is made, is subject to detailed design and final modelling output.	Response acknowledges the problem and highlights design features that could help to mitigate the problem if included in the design.	The audit comments are noted and will be considered during the detailed design.		
<b>PROBLEM 3</b>  <b>Location:</b> M4 Westbound on-slip priority layout  <b>Summary:</b> Traffic signals may lead to misunderstanding priorities.	As part of the design proposals, the layout of the give way on the on-slip should be reviewed to ensure priorities are clear. Visibility between the traffic streams approaching from the left and right turns off the A4138 should be improved if the existing layout is to be retained	Agreed. The visibility at the give way line to vehicles approaching from the left will be improved by the proposed on-slip carriageway realignment and proposed wider verges behind the footways. Street furniture in the splitter island will be reviewed and relocated as required to provide better visibilities to vehicles approaching and waiting at the give way line	Response acknowledges the problem and identifies design features that could help to mitigate the problem if included in the scheme. Mirroring the design of the eastbound on-slip at this location where two lanes run side-by-side may further mitigate this problem.	The audit comments are noted and will be considered during the detailed design.		
<b>PROBLEM 4</b>  <b>Location:</b> Traffic	The operation of the junction should be assessed to determine if a yellow box marking is	Agreed - No traffic signal issues are envisaged, however excessive queue lengths on the M4 eastbound off-slip could be detected and subject to queue clearance	Response acknowledges the problem and identifies design features that could help to mitigate the problem	The audit comments are noted and will be considered during the detailed design.		



RSA problem	RSA recommendation	Design organisation response	Updated RSA1 recommendation	Design organisation response 2	Overseeing Organisation response	Agreed RSA action
<p><i>Signal junction at end of the M4 eastbound off-slip</i></p> <p><b>Summary:</b> Queueing traffic may block other movements at the junction.</p>	required to assist in keeping the junction clear.	logic to prevent the queue from reaching the main carriageway. This is subject to detailed design and the outcome of the modelling for maximum queue lengths.	if included in the design.	-		
<p><b>PROBLEM 5</b></p> <p><b>Location:</b> Right turn onto the A4138 from the M4 eastbound off-slip</p> <p><b>Summary:</b> Users could pass on the wrong side of the traffic island</p>	As the design is progressed, measures should be included to guide users to the left of the traffic island.	Agreed. The location of the secondary traffic signal is intended to focus drivers vision on the far kerb edge, with a green arrow indicating the right turn movement.	Option 2A looks likely to provide greater guidance on the correct route than Option 2B	The audit comments are noted with option 2A to be developed during the detailed design.		
<p><b>PROBLEM 6</b></p> <p><b>Location:</b> Right turns from the A4138 onto both M4 on-slips</p> <p><b>Summary:</b> Provide clarity about priorities for right-turning users.</p>	Right turn filter signal heads should be included in the traffic signal layout at the right turns onto both on-slips.	Noted - The existing right turn onto the M4 eastbound on-slip is a separately signalled right turn, with its own red/amber/green. Subject to final modelling results being received for maximum capacity, it is possible this right turn could be retained, separately signalled, with no conflicting traffic, or subject to capacity each movement at the junction could run as a separate movement, with no conflicts. It is not possible to have the same arrangement at the M4 westbound on-slip, as the right turn already has its own separately signalled movement, with no conflicts.	Right turn onto eastbound onslip: a separate filter phase would provide improved safety and remove the potential for conflict between vehicles in opposing directions. Right turn onto westbound onslip: the revised drawing indicates that the design will include a separate right turn filter phase which will remove the potential for conflict. These concerns should be reviewed at the Stage 2 RSA	The audit comments are noted and will be considered during the detailed design.		
<p><b>PROBLEM 7</b></p> <p><b>Location:</b> Downstream end of the M4 eastbound off-slip</p> <p><b>Summary:</b> Pedestrians at risk of stepping into the path of vehicles.</p>	The traffic signal layout should incorporate formal pedestrian aspects and push buttons to give advice when crossing the end of the off-slip.	Noted. The introduction of pedestrian facilities is possible from a signal operation point of view, with the pedestrian phase running in a 'walk with' situation when the A4138 runs. However, the need for formal facilities should be justified based on the number of pedestrians; the impact on capacity (due to longer intergreens) and the requirement to have pedestrian facilities at the other signal junctions, to complement the NMU route. Pedestrian counts could be	If the Toucan crossing indicated on the scheme drawings provided as part of the RSA brief is retained, then this problem would be resolved.	The audit comments are noted and will be considered during the detailed design.		

RSA problem	RSA recommendation	Design organisation response	Updated RSA1 recommendation	Design organisation response 2	Overseeing Organisation response	Agreed RSA action
		undertaken to record the likely level of demand.				

Table 2: Road safety audit decision log for items raised in the current Stage 1 RSA

RSA problem	RSA recommendation	Design organisation response	Overseeing Organisation response	Agreed RSA action
<p><b>PROBLEM 1</b></p> <p><b>Location:</b> A4138 northbound approach to the westbound onslip turning</p> <p><b>Summary:</b> Lack of lane designation information</p> <p>Northbound users on the A4138 would have a series of ahead arrows but may be unaware that the offside lane is for the right turn to the eastbound onslip only. The lack of lane designation information could lead to drivers making late lane changes and result in side-swipe collisions.</p>	Traffic signs showing lane designation should be provided to assist drivers in advance of the lane changes, to enable drivers to decide well in advance which lane they need to be in before reaching the signal-controlled junction.	Agreed. Appropriate signs and potentially road markings in accordance with the TSRGD shall be added during the detailed design.		
<p><b>PROBLEM 2</b></p> <p><b>Location:</b> Northbound exit onto westbound onslip</p> <p><b>Summary:</b> Uncontrolled shared use path crossing</p> <p>The location of the uncontrolled pedestrian and cycle crossing across the westbound onslip means that users waiting to travel northbound at the crossing would have their backs to approaching traffic. They may be unaware from which direction traffic is approaching, which could lead to a pedestrian or cyclist being struck by a vehicle.</p>	LOOK RIGHT' text should be provided on the carriageway to notify northbound path users of the direction of approaching traffic. Similarly, 'LOOK LEFT' text should be provided for southbound path users at the onslip.	Agreed. LOOK RIGHT and LOOK LEFT Road markings to be provided on both the northbound and southbound paths during the detailed design.		



RSA problem	RSA recommendation	Design organisation response	Overseeing Organisation response	Agreed RSA action
<p><b>PROBLEM 3</b></p> <p><i>Location: Eastbound offslip</i></p> <p><i>Summary: Vehicles over-running kerbs</i> The kerb alignment at the eastbound offslip may lead vehicles to overrun or overhang the kerb, particularly larger vehicles, at the point where pedestrians and cyclists are waiting to cross. The vehicles could strike the waiting users and result in injury.</p>	<p>Swept-path analysis should be undertaken to inform the kerb and island design at this location.</p>	<p>Agreed. Swept path analysis has been undertaken to specify the proposed kerb lines. A drawing shall be produced documenting these details for inclusion with the RSA2 to confirm adequate clearance has been allowed.</p>		

## 4 Design organisation and Overseeing Organisation statements

### 4.1 Design organisation statement

On behalf of the design organisation I certify that:

- 1) the RSA actions identified in response to the road safety audit problems in this road safety audit have been discussed and agreed with the Overseeing Organisation.

Name:	
Signed:	.....
Position:	
Organisation:	Atkins
Date:	

### 4.2 Overseeing Organisation statement

On behalf of the Overseeing Organisation I certify that:

- 1) the RSA actions identified in response to the road safety audit problems in this road safety audit have been discussed and agreed with the design organisation; and
- 2) the agreed RSA actions will be progressed.

Name:	
Signed:	.....
Position:	
Organisation:	
Date:	

16/SW/CPS/001

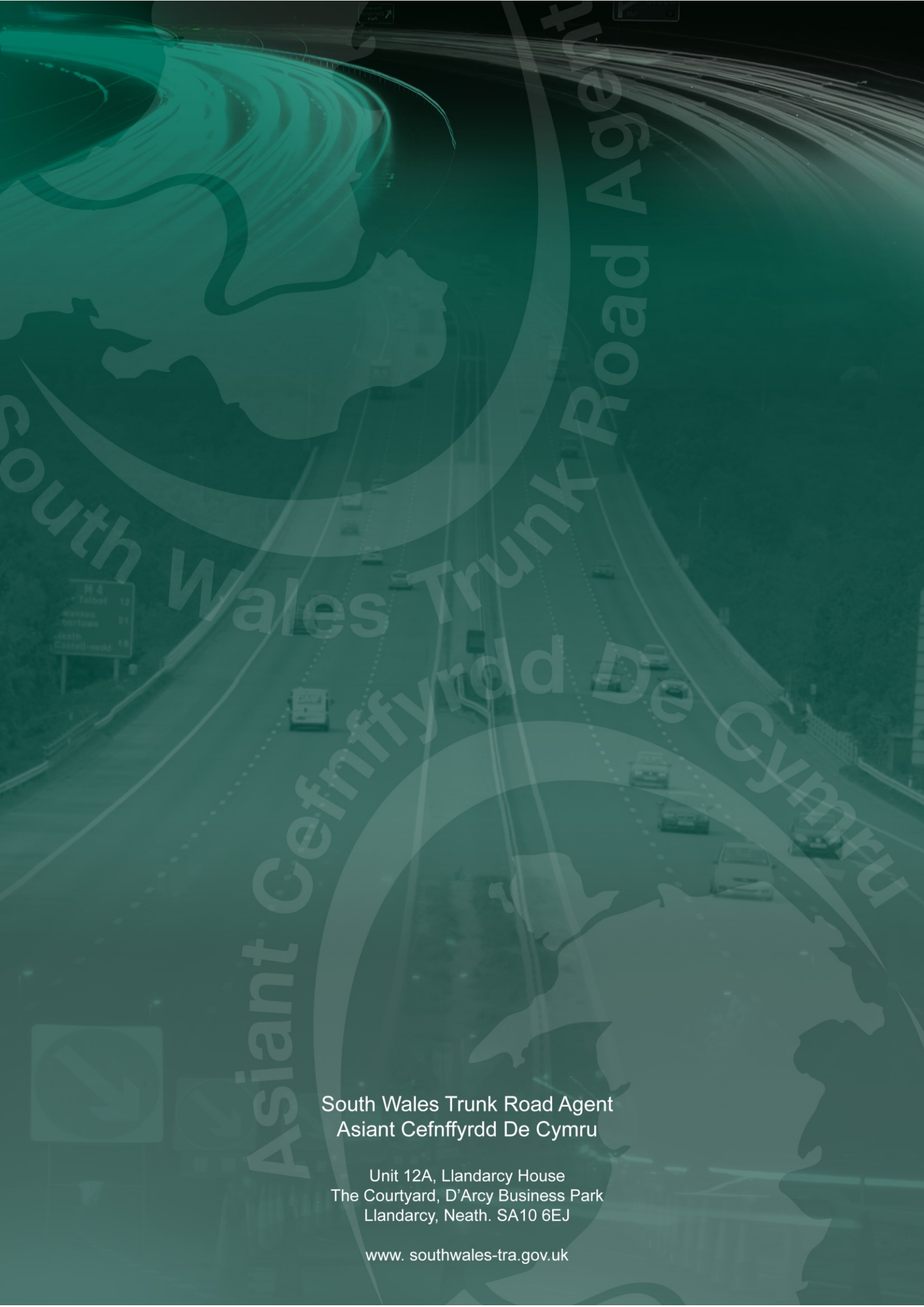
*M4 Junction 48 and A4138 Improvement Works*  
Stage 1 Road Safety Audit  
Response Report



Yn gweithio ar ran  
**Llywodraeth Cymru**  
Working on behalf of the  
**Welsh Government**



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