

# 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

## A40 Hardwick Interchange to Raglan Roundabout Safety Barrier (ORA) (2021/22)

### Operational Risk Assessment

March 2022



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## A40 Hardwick Interchange to Raglan Roundabout Safety Barrier (ORA) (2021/22)

### Operational Risk Assessment

Service Provider/Consultant Name:	<b>WSP</b>
Service Provider/Consultant Project Number	<b>70094930</b>
Scheme Reference:	<b>21/SW/CAM/013</b>
Programme:	<b>CSF – Safety Fencing</b>

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A40 Hardwick Interchange to Raglan Roundabout  
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## **1 Introduction**

SWTRA has commissioned WSP to undertake an assessment of the risks associated with the reported poor condition of existing road restraint systems (RRS) in the east and west bound verge of the A40 at 6 separate locations in the 14km stretch of the A40 between the Hardwick gyratory and Raglan.

The scheme is limited to existing discrete sections of safety barrier providing protection to overbridge piers in each verge. The overbridges relevant to this report are as below:

- A4042 200 Cefn Coch,
- A40 220 Middle Barn,
- A40 230 Pitt Village,
- A40 250 Llanarth Road,
- A40 280 Herbert Arms,
- A40 290 Milestone and
- A40 320 Penpergwm

## **2 Relevant Standards**

This report has been prepared with reference to the following standards:

- CD377 Requirement for Road Restraint Systems (DMRB 2.2.8)
- CD 127 Cross sections and Headrooms

## **3 Site Description**

The A40 is a 2 lane, dual carriageway trunk road with a hard strip but no hard shoulder. Laybys are present along the A40 to provide rest areas and emergency refuges for vehicles.

The A40 is lit in the vicinity of junctions at its eastern and western extents, with lighting residing in the nearside verge and it is un-kerbed along the length except at laybys and for the 100m in advance of the Hardwick Gyratory and the 30m in advance of Raglan Roundabout.

Highway drainage consists of gullies along the kerbed edges and filter drain elsewhere.



## 4 Existing Situation

### 4.1 Road Restraint Systems

The arrangement of RRS on the A40 between the Hardwick Gyratory and Raglan Junction comprises a single line of double-sided corrugated beams in the central reserve. The nearside verge has single sided corrugated beams or open box beams at locations where the steep gradient of the verge creates a hazard or protecting the carriageway from hazards such as culverts or underbridges.

This report focuses on the nearside verge barrier protecting the overbridge piers at 6 locations along the area of the A40 in question.

The existing arrangement of safety barriers is similar at the 12 pier locations. Each comprises a line of single sided open box beam on posts, with ramped terminals at both approach and departure ends. Terminals include welded angle beams and inspections have indicated that the open box beams and posts are heavily corroded. Due to this, it is considered that the existing safety barriers do not provide adequate protection to the hazards, are no longer serviceable and need to be replaced wholesale.

### 4.2 Traffic Volumes

The traffic flows for the A40 have been taken from the Department for Transport website for 2019, prior to the pandemic. All data is presented in Appendix B. The data is presented as Annual Average Daily Flow (AADF):

A40 Direction	AADF
Eastbound	6858
Westbound	6653

### 4.3 Traffic Speeds

There is no traffic speed survey data available for the A40 in this location, but the road is subject to the national speed limit of 70mph.





## 4.4 Personal Injury and Accident Damage

### 4.4.1 Personal Injury Collisions

Accident data held on the Welsh Government's IRIS system has been reviewed. This historical data can be used to determine the frequency or type of accidents encountered and any potential trends.

The table below identifies the collision numbers and severity over a nine-year period between 01/01/2011 – 31/12/2020.

All collisions on the section of the A40 and associated Junctions relevant to this report.

YEAR	FATAL	SERIOUS	SLIGHT	ALL
2011	-	2	-	<b>2</b>
2012	-	2	1	<b>3</b>
2013	1	-	2	<b>3</b>
2014	-	-	2	<b>2</b>
2015	-	1	-	<b>1</b>
2016	-	-	-	<b>0</b>
2017	-	-	-	<b>0</b>
2018	-	2	1	<b>3</b>
2019	-	1	1	<b>2</b>
2020	-	1	1	<b>2</b>
<b>Total</b>	<b>1</b>	<b>9</b>	<b>8</b>	<b>18</b>

Further analysis of this collision data locations shows that none of the recorded collisions are in the vicinity of the verge RRS.

Maps showing the locations of the collisions are contained in Appendix C.

### 4.4.2 Category 1 Defects – Accident Damage

In addition to formal accident data, a review has been undertaken of recorded category 1 defects associated with safety barriers along the route, caused by accident damage. Schedules of the recorded defects and repair instructions are contained in Appendix D. A summary of the data received for the last 5 years is presented in the table below. This information provides an indication of the frequency of historical collisions between vehicles and central reserve safety barriers.



Year	Westbound Verge	Central Reserve		Eastbound Verge	Total
		Westbound	Eastbound		
2017	-	1	2	-	<b>3</b>
2018	1	3	-	-	<b>4</b>
2019	-	1 (both E/B and W/B)	1 (both E/B and W/B)	-	<b>1</b>
2020	1	3	2	-	<b>6</b>
2021	-	3 (both E/B and W/B)	1 (both E/B and W/B)	-	<b>3</b>
<b>Total</b>	<b>2</b>	<b>11</b>	<b>6</b>	<b>0</b>	<b>17</b> (2 collisions required both E/B and W/B repairs)

#### 4.4.3 Accident Damage Summary

The Cat 1 defects data shows that there are more collisions with the central reserve than indicated by the Personal Injury Accidents Data.

The proportion of accidents in the westbound direction compared to eastbound indicates that vehicles are more likely to collide with the central reserve in that direction but the reason for this is unclear.

There does not seem to be a clear cluster or causation between the collisions.

Of the damage reports only 1 is relevant to this report as it involves a road traffic collision with, and subsequent repair of the Llanarth overbridge safety barrier in the westbound direction.

#### 4.5 Summary of Existing Situation

The 12 lengths of safety barriers are in a poor condition and are unlikely to perform as intended during a collision. A sample Road Restraint Risk Assessment (RRRAP) has been completed at one location and confirms that the bridge pier is a hazard requiring VRS protection. Therefore, subject to completion of site specific RRRAPs at all locations, new VRS is required and shall be installed to current standards

Records of traffic collisions and instructions to undertake accident repairs to existing safety barriers have been obtained from IRIS or provided by SWTRA and reviewed, but generally indicate a low number of instances of collisions within the length of interest.



## **5 Risk Assessment**

It is accepted that it will take a period of time to commission investigations, surveys, and assessments to feed into detailed design and construction. Therefore, a risk assessment of several potential mitigation measures has been undertaken. The preferred mitigation measure should be implemented as soon as is practicable and remain in place until works to replace the defective safety barriers are complete.

The risk assessment has been undertaken, taking into consideration the findings and observations identified in this report. The risk assessment assesses the likelihood and severity of potential incidents involving errant vehicles striking the existing verge safety barrier. The risk assessment is presented in Appendix A.

The risk assessment confirms that there is currently a risk to road users due to the current condition of safety barriers in the verge at overbridges. A range of potential mitigation measures have been identified to reduce the current risk and then assessed to determine if the measure in question reduces the level of the risk to be as low as reasonably practicable (ALARP). Potential mitigation measures are listed and discussed in the following sections.

## **6 Options**

The following immediate mitigation options have been identified to be installed while the permanent solution is investigated and designed:

- Do nothing
- Replace ramped terminals with one compliant with CD377
- Reduce speed limit. Introduce a temporary speed limit of 40 or 50mph to reduce the likelihood and severity of accidents
- Install a series of speed cameras or average speed cameras to improve compliance with the reduced speed limit
- Provide Variable Message Sign(s) in the vicinity, displaying relevant safety messages
- Decrease lane widths to increase the set back to the existing RRS
- Lane 1 closure
- Install temporary safety barrier at each location

Each option is discussed in section 7 of this report with a final recommendation in section 9.

## **7 Discussion**

Below is an expansion on the options listed in section 6.



## 7.1 Do Nothing

The do-nothing option would only be considered if the existing RRS is in good condition and no safety concerns have been identified. This is the least disruptive option however it cannot be considered viable due to the RRS being in such a poor condition.

The existing VRS at the 6 structures has been identified as being in poor condition and unlikely to perform as intended in a collision. This option will not improve the existing risk and should not be considered.

## 7.2 Replace the Ramped Leading Terminals with a Compliant P4 Terminals

Replacing the ramped terminals on the existing RRS with new P4 terminals will remove the risk of vehicles becoming airborne and hitting the overbridge as a result of striking the end of the barrier.

Whilst upgrading the existing ramped terminals would reduce the risk, this would only upgrade the relatively short leading terminal, not the remainder of the life-expired open box beam. In this instance, VRS installations should be replaced in their entirety.

## 7.3 Apply a Reduced Speed Limit

Reducing the speed limit may also reduce the likelihood and severity of accidents. The existing speed limit on this section of the A40 is national speed limit. There is no existing speed data available for the section of A40 between Raglan Roundabout and Hardwick to ascertain current compliance to the speed limit. It is suggested that a proposed reduced speed limit of 50mph is implemented in this instance.

Temporary mandatory speed limits, correctly signed and supported by an appropriate traffic order is recommended as road users are less likely to comply with advisory speed limits.

Resultant traffic speeds should be monitored to confirm compliance. If speed limit compliance is found to be poor, supplementary measures such as speed activated variable message signs or temporary average speed cameras should also be employed. See paragraphs 7.4 and 7.5.

## 7.4 Speed Enforcement

The installation of temporary speed cameras should be considered if there is poor compliance to a reduced speed limit. This will act as a greater deterrent for those drivers ignoring the new speed limit.



The installation of a new speed camera system may be costly and will take time to implement. Requesting assistance from the police may also be considered in enforcing the speed limit in the area.

## 7.5 Installation of Mobile Variable Message Signs

Placing temporary variable message signs (VMS) with useful, informative messages will assist in reducing speeds and accidents. The messages can display messages about vehicle speed, the highway layout or traffic information. There is sufficient space within the highway boundary along the route that could accommodate such signs.

Speed activated VMS signs could be considered to notify those drivers travelling at excessive speeds.

## 7.6 Reduced Lane Widths

The reduction of the lane widths would increase the setback from lane 1 to the verge RRS would reduce the likelihood of an errant vehicle strike. This option may also increase the likelihood of other accidents such as vehicle collisions on the running lanes, so additional measures, such as reduced speed limits, should be used.

Costs to remove existing road markings and studs, install narrow lanes and ongoing maintenance are high, yet yields a residual risk score comparable with installation of a temporary speed limit.

Installation, maintenance and removal of narrow lanes involves significant resources and puts the workforce at risk from the hazards associated with working in the highway. Full carriageway closures should be considered during installation and removal of narrow lanes.

## 7.7 Installation of Lane 1 Closure

Close lane 1 to traffic, thus maximising the distance between traffic and the non-compliant terminals and defective safety barriers. Additional measures, such as a reduced speed limits, should also be used.

With reduced traffic speeds and increased distance from the hazard, this option is likely to reduce the severity of injury to occupant of an errant vehicle colliding with the existing terminals or barriers/piers. However, maintenance costs will be considerable. As the easternmost structure affected by the work is close to Raglan interchange, it is likely that a lane closure will have to be installed on the westbound approach to Raglan Roundabout. This could cause congestion



## 7.8 Installation of Temporary Safety Barriers

Temporary barriers installed at the nearside of the carriageway, adjacent to the existing piers will provide suitable protection. It is likely that temporary barriers will require the implementation of narrow lanes to ensure compliance with set back and working width. A reduced speed limit would also be recommended.

Whilst temporary barriers indicate the lowest resultant risk score of the potential mitigation measures, installation, maintenance and removal costs of these and narrow lanes are significant and will take time to procure and install.

## 8 Mitigation Option Summary

Option Ref	Mitigation Measure	Risk Score	Estimated Installation and maintenance cost (1 year)	Effect on Traffic Flow	Comments
1	Do Nothing	8	£0	· No impact on traffic flow	· Should not be considered
2	Replace ramped Leading Terminal with Compliant P4 terminal	3	<b>£113,600</b> Replace 12 No ramped with P4 terminals (Assumed in filter drain)	· No impact on traffic flow	· Whilst measure mitigates risk of vehicles becoming airborne on impact, the likelihood is extremely low, and this measure does not alleviate the risks associated with the remaining defective length of safety barrier at and before the piers
3	Application of a Reduced Speed Limit	3	<b>£130,000</b> Permanent signing with terminals illuminated over a 10km length	· No impact on traffic flow	· Dependent upon anticipated procurement of design and construction, costs assume permanent



Option Ref	Mitigation Measure	Risk Score	Estimated Installation and maintenance cost (1 year)	Effect on Traffic Flow	Comments
			of dual carriageway		signing will be installed to remove maintenance costs associated with temporary signage
4	Speed Enforcement (in Conjunction with Reduced Speed Limit)	-	<b>£287,000</b> (in addition to speed limit signing) Costs include install, 1 year maintenance and removal.	<ul style="list-style-type: none"> <li>Should assist in regulating traffic speeds</li> <li>No impact on traffic flow</li> </ul>	<ul style="list-style-type: none"> <li>This would be an "add-on" to option refs 3, 6, 7 and 8 should traffic speed compliance be poor</li> </ul>
5	Installation of Variable Message Signs	-	<b>£42,000</b> Includes 6 signs installed, 1 year maintenance and removal. (In addition to speed limit signing)	<ul style="list-style-type: none"> <li>Should assist in regulating traffic speeds</li> <li>No impact on traffic flow</li> </ul>	<ul style="list-style-type: none"> <li>This would be an "add-on" to option refs 3, 6, 7 and 8 should traffic speed compliance be poor</li> </ul>
6	Installation of Narrow Lanes	3	<b>£5,254,000</b> Installed, 1 year maintenance and removal over a 10km length of dual carriageway (in addition to speed limit signing)	<ul style="list-style-type: none"> <li>Driver caution when overtaking larger vehicles</li> <li>No impact on traffic flow</li> </ul>	<ul style="list-style-type: none"> <li>Operated in conjunction with temporary speed limit</li> <li>Significant installation, maintenance and removal costs</li> <li>Exposes additional workforce to increased risks due to installation, maintenance and removal liabilities</li> </ul>
7	Installation of 2 x Lane 1 Closures	2	<b>£808,100</b> Installed, 1 year maintenance and removal over a 10km length of dual carriageway (in	<ul style="list-style-type: none"> <li>Potential increase in congestion on westbound approach to Raglan</li> </ul>	<ul style="list-style-type: none"> <li>Operated in conjunction with temporary speed limit</li> <li>Significant, maintenance</li> </ul>



Option Ref	Mitigation Measure	Risk Score	Estimated Installation and maintenance cost (1 year)	Effect on Traffic Flow	Comments
			addition to speed limit signing)	<ul style="list-style-type: none"> <li>Roundabout</li> <li>Increase driver frustration as a long length of closure would be required, with road users perceiving that no works are being undertaken</li> </ul>	<ul style="list-style-type: none"> <li>and removal costs</li> <li>Exposes additional workforce to increased risks due to installation, maintenance and removal liabilities</li> </ul>
8	Installation of Temporary Safety Barriers	2	<b>£5,532,000</b> 12 No. installations, each comprising 50m Temporary VRS and 1 No. Crash Cushion. Installation, 1 year maintenance and removal of temp VRS with narrow lanes on both carriageways for 10km. (in addition to speed limit signing)	<ul style="list-style-type: none"> <li>Road closures required during installation and removal</li> <li>No effect on traffic flows during operation</li> </ul>	<ul style="list-style-type: none"> <li>Operated in conjunction with temporary speed limit and narrow lanes</li> <li>May become an obstruction to constructing new barriers</li> </ul>





## 9 Conclusions

The South Wales Trunk Road Agent (SWTRA) has identified the poor condition of the verge RRS on the A40. Reports from SWTRA indicate the single line of open box beam safety barrier in the east and west bound verge is no longer serviceable and therefore life expired and should be replaced to current standard.

It is considered that procurement of surveys, investigation, assessments and detailed design will take a period of time to complete before construction works can be procured and mobilised, all subject to available budgets.

The need for options to mitigate the risks associated with the defective and non-standard VRS elements measures has been considered for implementation in the intervening period until works to replace the barriers can be completed. The mitigation measures have been risk assessed, costed, and consider the impact on road users.

This report determines that the existing level of risk to road users caused by ineffective safety barriers at the bridge piers is not acceptable but can be reduced by the implementation of measures considered in this report.

## 10 Recommendations

Until permanent works to upgrade the central reserve VRS are implemented, measures to mitigate against the existing life expired systems should be implemented. A review of collision data indicates that the likelihood of collisions with the safety barriers at the piers is low. However, the risk of an errant vehicle colliding with any of the piers needs mitigation.

It is therefore recommended that a mandatory temporary speed limit of 50 mph should be implemented initially, supported by a temporary traffic order. Estimated construction costs to install a compliant speed limit signing scheme are in the region of £130,000. This figure assumes that permanent signage is installed to remove any maintenance liability. It is further recommended that post implementation speed monitoring is carried out to gauge the level of speed limit compliance. The results of this future assessment may lead to supporting the need for speed enforcement measures. This would incur additional costs in the order of £280,000.

It should be noted that the above control measures will not fully remove the risk of incidents and it should be reiterated that permanent works to replace the affected safety barriers should be implemented as soon as possible.



In terms of the permanent replacement of the barriers, site surveys and other investigation works are required to help inform the RRRAP when determining detailed design requirements.



## Appendix A – Risk Assessment

A40 Hardwick Interchange to Raglan Roundabout  
Safety Barrier (ORA) (2021/22)

Operational Risk Assessment



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Ref	Hazard/Risk Description	Risk			Response/ Control Measure	Residual Risk			Details/assumptions/ monitoring
		L	S	R		L	S	R	
1	Existing barrier holds no structural integrity and therefore bridge piers effectively unprotected Injury to occupants of errant vehicle colliding with pier	2	4	8	Replace existing barrier with a compliant RRS to CD377	2	2	4	Replacement VRS design to be determined from RRRAP assessment
2	Until VRS is replaced, the existing barrier holds no structural integrity and therefore bridge piers effectively unprotected Injury to occupants of errant vehicle colliding with pier	2	4	8	Do Nothing	2	4	8	The existing safety barriers will not perform as intended under impact and are an unacceptable risk so must be replaced with consideration to mitigation measures to be implemented as soon as possible and maintained until safety barrier upgrades at the piers are complete. RRRAP assessment should be undertaken at each site to confirm minimum length of need of full height barrier requirements.
3	Until VRS is replaced, existing leading ramped terminals are a hazard and could cause a vehicle to become airborne collide with hazard	1	4	4	Replace ramped terminal with compliant P4 terminal	1	2	3	Whilst upgrading the non-compliant terminal realises a slight reduction in risk, the terminal is only a small portion of each VRS installation and should not be undertaken unless in conjunction with upgrade of the remaining life expired barrier.
4	Until VRS is replaced, the existing barrier holds no structural integrity and therefore bridge piers effectively unprotected. Similarly, existing ramped terminals are a hazard and could cause a vehicle to become airborne and collide with the hazard causing Injury to occupants of errant vehicle colliding with pier	2	4	8	Implement a temporary reduced speed limit of 50mph along the route, supported by traffic signing in compliance with Chapter 3 of the Traffic Signs Manual and a temporary traffic order	1	3	3	Vehicle compliance to reduced speed limit should be monitored. Should compliance be unacceptable, consider implementation of speed activated variable message signs or temporary average speed cameras

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Ref	Hazard/Risk Description	Risk			Response/ Control Measure	Residual Risk			Details/assumptions/ monitoring
		L	S	R		L	S	R	
5	Until VRS is replaced, the existing barrier holds no structural integrity and therefore bridge piers effectively unprotected. Similarly, existing ramped terminals are a hazard and could cause a vehicle to become airborne and collide with the hazard causing Injury to occupants of errant vehicle colliding with pier	2	4	8	Installation of temporary narrow lanes to increase the setback to existing VRS, thus moving traffic away from the hazard. Should be implemented in conjunction with a temporary speed limit.	1	3	3	Vehicle compliance to reduced speed limit should be monitored. Should compliance be unacceptable, consider implementation of speed activated variable message signs or temporary average speed cameras
6	Poor lane discipline resulting in sideswiping between vehicles in narrow lanes situation	2	3	6	Introduce measures to improve lane discipline such as "Stay in lane" signs, or "check your blind spot" messages via VMS	1	3	3	Vehicle compliance to reduced speed limit should be monitored. Should compliance be unacceptable, consider implementation of speed activated variable message signs or temporary average speed cameras
7	Until VRS is replaced, the existing barrier holds no structural integrity and therefore bridge piers effectively unprotected. Similarly, existing ramped terminals are a hazard and could cause a vehicle to become airborne and collide with the hazard causing Injury to occupants of errant vehicle colliding with pier	2	4	8	Installation of temporary safety barrier at each pier location Likely to require installation alongside narrow lanes to ensure setbacks and working widths are compliant. Therefore, should also be implemented alongside a temporary speed limit	1	2	2	Vehicle compliance to reduced speed limit should be monitored. Should compliance be unacceptable, consider implementation of speed activated variable message signs or temporary average speed cameras
8	Until VRS is replaced, the existing barrier holds no structural integrity and therefore bridge piers effectively unprotected. Similarly, existing ramped terminals are a hazard and could cause a vehicle to become airborne and collide	2	4	8	Installation of lane 1 closure to increase the setback to existing VRS, thus moving traffic away from the hazard. Also eliminates lane switching	1	2	2	Vehicle compliance to reduced speed limit should be monitored. Should compliance be unacceptable, consider implementation of speed activated variable message signs or temporary average speed cameras

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Ref	Hazard/Risk Description	Risk			Response/ Control Measure	Residual Risk			Details/assumptions/ monitoring
		L	S	R		L	S	R	
	with the hazard causing Injury to occupants of errant vehicle colliding with pier				Should be implemented in conjunction with a temporary speed limit.				
9	The existing barrier is currently considered life expired and there is uncertainty of its performance under impact.  When impacted the barrier could increase the severity of the collision by increasing the risk of secondary incidents due to the scattering of debris creating a hazard	2	3	6	Replace existing barrier with a compliant RRS to CD377	2	2	4	Replacement VRS design to be determined from RRRAP assessment
10	The existing barrier is currently considered life expired and there is uncertainty of its performance under impact.  When impacted the barrier could increase the severity of the collision by warping, buckling, or deforming on impact.	2	4	8	Replace existing barrier with a compliant RRS to CD377	2	2	4	Replacement VRS design to be determined from RRRAP assessment
11	The existing barrier is currently considered life expired with uncertainty around its performance under impact.  When impacted the barrier could increase the severity of the collision by sheering and creating sharp hazards at the point of collision.	2	4	8	Replace existing barrier with a compliant RRS to CD377	2	2	4	Replacement VRS design to be determined from RRRAP assessment

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Likelihood (L) x Severity (S) = Risk value (R)		Severity (S)				
		Minor harm; Minor damage or loss no injury	Moderate harm; Slight injury or illness, moderate damage or loss	Serious harm; Serious injury or illness, substantial damage or loss	Major harm; Fatal injury, major damage or loss	Extreme harm; Multiple fatalities, extreme loss or damage
Likelihood (L)	Very unlikely; Highly improbable, not known to occur	1	2	3	4	5
	Unlikely; Less than 1 per 10 years	2	4	6	8	10
	May happen; Once every 5-10 years	3	6	9	12	15
	Likely; Once every 1-4 years	4	8	12	16	20
	Almost certain; Once a year or more	5	10	15	20	25
Risk Value (R)		Required action				
Low (1-9)		Ensure assumed control measures are maintained and reviewed as necessary.				
Medium (10-19)		Additional control measures needed to reduce risk rating to a level which is equivalent to a test of "reasonably required" for the population concerned.				
High (20-25)		Activity not permitted. Hazard to be avoided or risk to be reduced to tolerable.				

Extract from GG104 Revision 0 – Requirements for Safety Risk Assessment



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## Appendix B – Traffic Data

A40 Hardwick Interchange to Raglan Roundabout  
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year	local authority name	road name	easting	northing	estimation method	direction of travel	pedal cycles	two wheeled motor vehicles	cars and taxis	buses and coaches	lgvs	hgvs 2 rigid axle	hgvs 3 rigid axle	hgvs 4 or more rigid axle	hgvs 3 or 4 articulated axle	hgvs 5 articulated axle	hgvs 6 articulated axle	all hgvs	all motor vehicles
														axle	axle	axle	axle		
2000	Monmouthshire	A40	340000	208500	Counted	E	3	22	3977	31	558	257	21	17	105	275	141	816	5404
2000	Monmouthshire	A40	340000	208500	Counted	W	2	43	4098	50	595	273	35	17	118	280	127	850	5636
2001	Monmouthshire	A40	340000	208500	Counted	E	0	30	3541	30	546	202	29	25	109	240	125	730	4877
2001	Monmouthshire	A40	340000	208500	Counted	W	0	29	4459	25	712	174	29	30	74	278	154	739	5964
2002	Monmouthshire	A40	340000	208500	Counted	E	0	27	4134	28	716	201	27	48	108	306	104	794	5699
2002	Monmouthshire	A40	340000	208500	Counted	W	0	23	4160	28	752	251	21	57	112	341	88	870	5833
2003	Monmouthshire	A40	340000	208500	Counted	E	1	36	4439	19	767	158	26	30	79	218	141	652	5913
2003	Monmouthshire	A40	340000	208500	Counted	W	1	34	4482	31	780	172	38	35	81	246	127	699	6026
2004	Monmouthshire	A40	340000	208500	Counted	E	1	19	4319	29	840	147	35	14	103	233	113	645	5852
2004	Monmouthshire	A40	340000	208500	Counted	W	2	27	4345	18	940	174	34	32	104	262	145	751	6081
2005	Monmouthshire	A40	340000	208500	Counted	E	1	42	4229	27	830	160	41	17	72	232	156	678	5806
2005	Monmouthshire	A40	340000	208500	Counted	W	1	35	4510	40	873	193	50	26	62	201	147	679	6137
2006	Monmouthshire	A40	340000	208500	Counted	E	1	26	3365	16	487	169	44	45	57	193	103	611	4505
2006	Monmouthshire	A40	340000	208500	Counted	W	1	30	3622	17	608	165	46	59	43	171	92	576	4853
2007	Monmouthshire	A40	340000	208500	Counted	E	2	17	3685	36	729	206	34	31	52	250	124	697	5164
2007	Monmouthshire	A40	340000	208500	Counted	W	1	12	4145	54	889	234	44	29	48	217	101	673	5773
2008	Monmouthshire	A40	340000	208500	Counted	E	0	35	4783	40	803	188	26	21	60	301	165	761	6422
2008	Monmouthshire	A40	340000	208500	Counted	W	1	47	4687	52	896	196	31	31	42	246	157	703	6385
2009	Monmouthshire	A40	340000	208500	Estimated	E	0	35	4769	41	801	173	26	20	55	259	160	693	6339
2009	Monmouthshire	A40	340000	208500	Estimated	W	1	47	4673	54	894	180	31	30	39	212	152	644	6312
2010	Monmouthshire	A40	340000	208500	Estimated	E	0	32	4702	42	826	181	26	17	61	234	154	673	6275
2010	Monmouthshire	A40	340000	208500	Estimated	W	1	42	4608	56	922	188	31	26	43	191	146	625	6253
2011	Monmouthshire	A40	340000	208500	Estimated	E	0	35	4674	43	848	175	27	18	45	221	156	642	6242
2011	Monmouthshire	A40	340000	208500	Estimated	W	1	46	4580	58	947	181	32	28	32	180	148	601	6232
2012	Monmouthshire	A40	340000	208500	Counted	E	0	42	4314	14	908	171	34	26	49	233	199	711	5988
2012	Monmouthshire	A40	340000	208500	Counted	W	0	23	4345	30	1017	230	44	35	43	209	159	720	6135
2013	Monmouthshire	A40	340000	208500	Estimated	E	0	43	4304	14	939	165	35	28	37	229	210	705	6005
2013	Monmouthshire	A40	340000	208500	Estimated	W	0	24	4335	29	1052	223	46	38	33	206	168	713	6154
2014	Monmouthshire	A40	340000	208500	Estimated	E	0	47	4293	15	978	162	37	29	36	205	217	687	6020
2014	Monmouthshire	A40	340000	208500	Estimated	W	0	26	4324	30	1096	218	49	39	33	184	173	696	6172
2015	Monmouthshire	A40	340000	208500	Estimated	E	0	47	4263	15	1065	169	42	31	46	208	221	717	6107
2015	Monmouthshire	A40	340000	208500	Estimated	W	0	26	4294	31	1193	227	55	41	41	187	177	728	6272
2016	Monmouthshire	A40	340000	208500	Estimated	E	0	49	4391	15	1150	179	40	35	48	200	232	734	6339
2016	Monmouthshire	A40	340000	208500	Estimated	W	0	27	4423	31	1288	241	54	47	43	180	185	749	6518
2017	Monmouthshire	A40	332347	210167	Counted	E	3	41	4978	19	1073	147	48	21	28	222	204	669	6779
2017	Monmouthshire	A40	332347	210167	Counted	W	0	32	4917	12	1054	122	41	30	22	165	181	562	6577
2018	Monmouthshire	A40	332347	210167	Estimated	E	3	43	4961	18	1123	149	48	21	28	224	206	677	6822
2018	Monmouthshire	A40	332347	210167	Estimated	W	0	33	4901	12	1103	124	41	31	23	167	182	569	6618
2019	Monmouthshire	A40	332347	210167	Estimated	E	3	43	5003	17	1119	147	48	21	28	223	206	675	6858
2019	Monmouthshire	A40	332347	210167	Estimated	W	0	34	4942	11	1099	123	42	31	23	166	182	567	6653
2020	Monmouthshire	A40	332347	210167	Estimated	E	3	26	3361	10	890	122	41	18	24	196	174	575	4862
2020	Monmouthshire	A40	332347	210167	Estimated	W	0	20	3320	7	874	101	35	26	20	146	154	482	4703



A40 Hardwick Interchange to Raglan Roundabout  
Safety Barrier (ORA) (2021/22)

Operational Risk Assessment



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## Appendix C - Collision and Bridge Location Maps

A40 Hardwick Interchange to Raglan Roundabout  
Safety Barrier (ORA) (2021/22)

Operational Risk Assessment

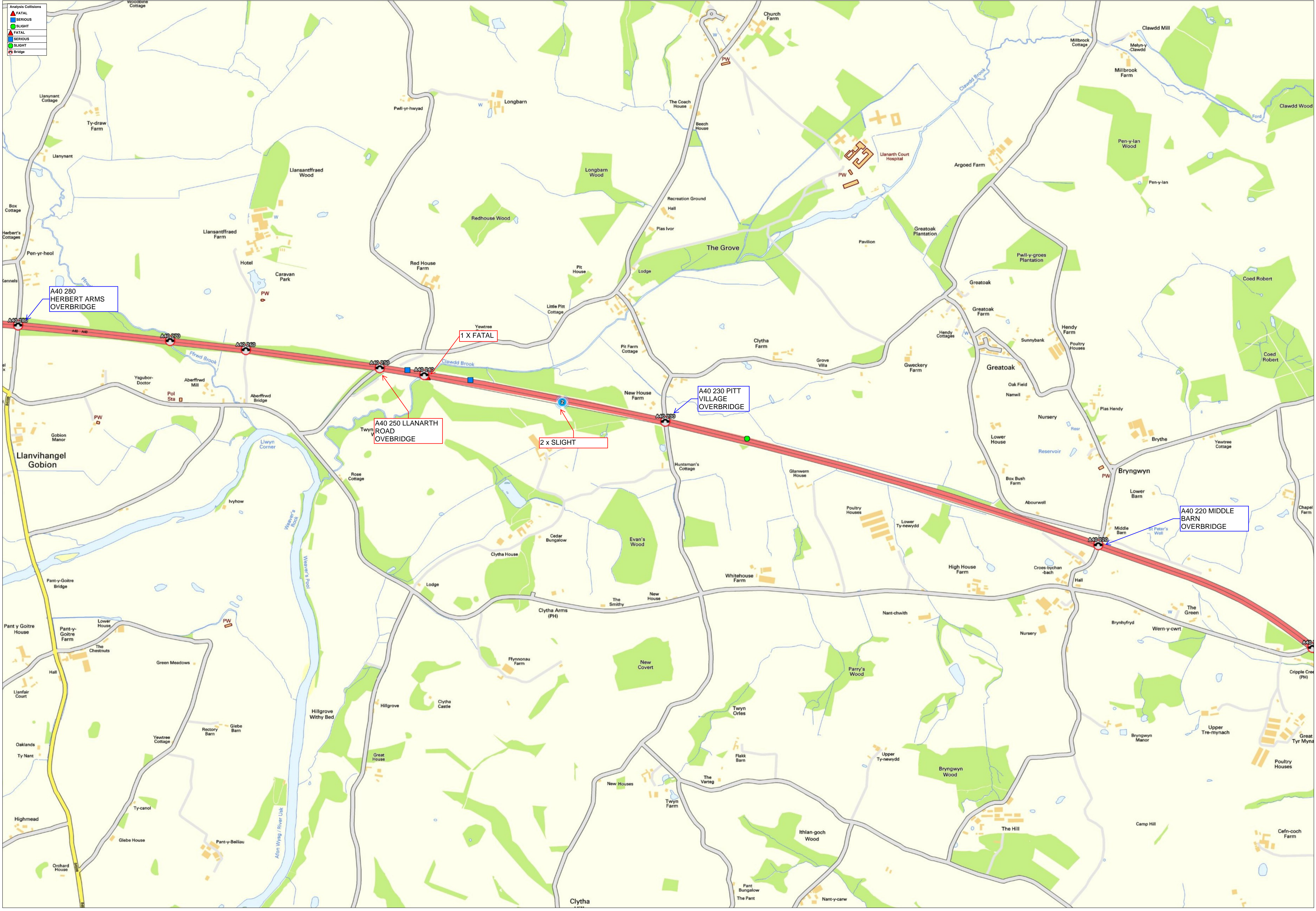


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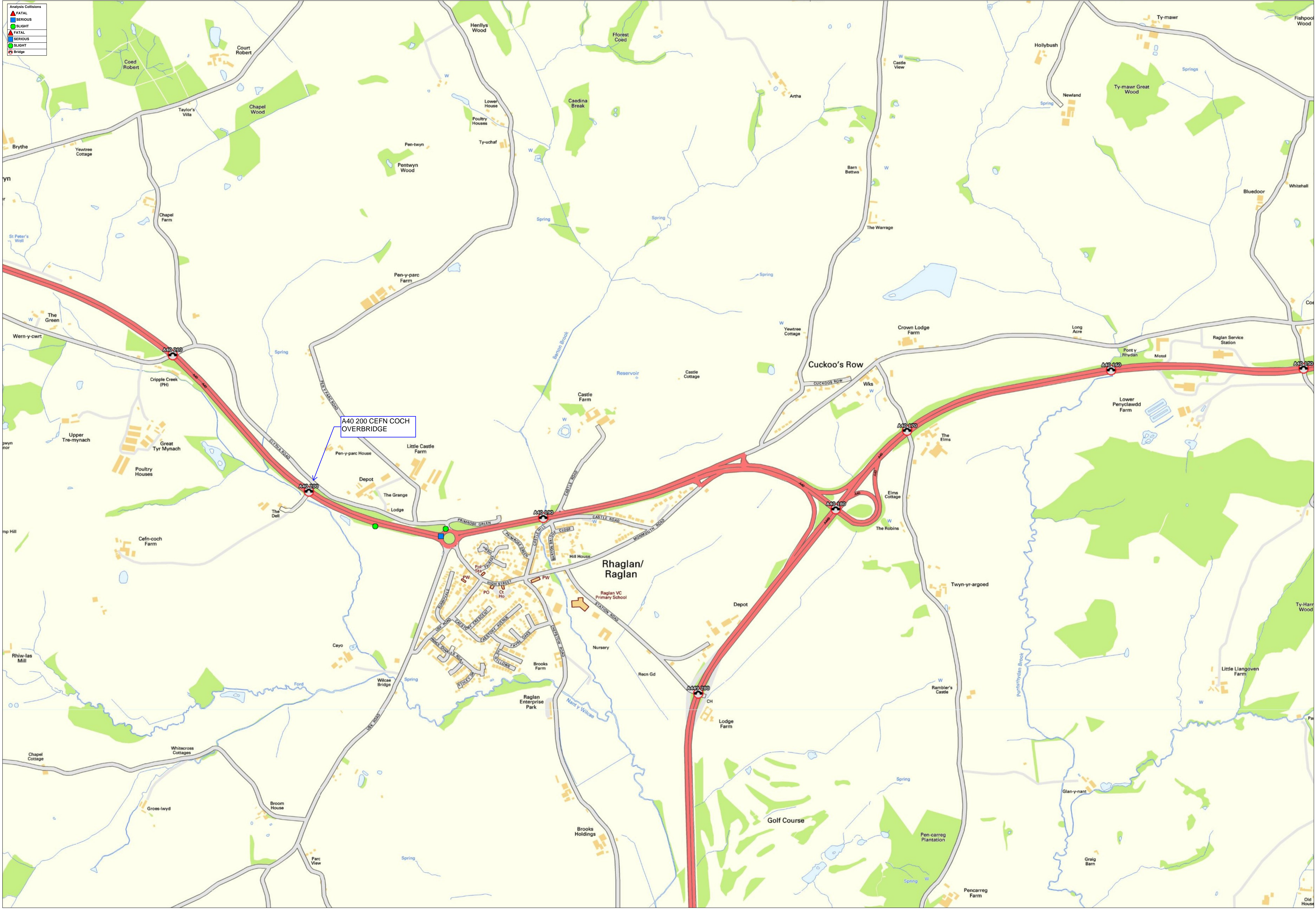


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## Appendix D – Cat 1 Defect Records

A40 Hardwick Interchange to Raglan Roundabout  
Safety Barrier (ORA) (2021/22)

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Road Name	XSP	Incident Date	Defect Category	Item Category	Item Detail	Easting	Northing	Comments	Repair Type	Req'd repair date	Repair Date
A40	8 - Right Verge	22/04/2017 00:00:00	CAT1	Safety Fences: Metal/Concrete	Accident damage	331440	211212	APPROX 12M C/RES TCB DAMAGE A/E B41522	Perm	29/04/2017 00:00:00	27/04/2017 00:00:
A40	8 - Right Verge	24/06/2017 00:00:00	CAT1	Safety Fences: Metal/Concrete	Accident damage	338471	209212	APPROX 10M C/RES TCB DAMAGE	Perm	01/07/2017 00:00:00	05/07/2017 00:00:
A40	8 - Right Verge	23/03/2018 17:40:00	CAT1	Safety Fences: Metal/Concrete	Accident damage	340423	208037	RTD damaged C/Res safety fence A/E B45233	Perm	30/03/2018 17:40:00	28/03/2018 00:00:
A40	8 - Right Verge	22/05/2018 00:00:00	CAT1	Safety Fences: Metal/Concrete	Accident damage	339543	208816	10M C/RES TCB RTC DAMAGED.	Perm	29/05/2018 00:00:00	29/05/2018 00:00:
A40	8 - Right Verge	12/05/2019 00:00:00	CAT1	Safety Fences: Metal/Concrete	Accident damage	331861	210568	APPROX 40M AIRCRAFT DAMAGED SAFETY FENCE. A/E B48531	Perm	19/05/2019 00:00:00	15/05/2019 00:00:
A40	8 - Right Verge	14/01/2020 00:00:00	CAT1	Safety Fences: Metal/Concrete	Accident damage	339494	208839	APPROX 10M RTC DAMAGED C/RES TCB S/ FENCE.	Perm	21/01/2020 00:00:00	22/01/2020 00:00:
A40	8 - Right Verge	28/01/2020 00:00:00	CAT1	Safety Fences: Metal/Concrete	Accident damage	331340	211359	APPROX 6M RTC DAMG TCB S/FENCE IN C/RES	Perm	04/02/2020 00:00:00	10/02/2020 00:00:
A40	8 - Right Verge	09/06/2020 08:23:26	CAT1	Safety Fences: Metal/Concrete	Accident damage	333994	209951	APPROX 12M RTC DAMAGED C/RES TCB	Perm	16/06/2020 08:23:26	16/06/2020 00:00:
A40	8 - Right Verge	15/01/2021 08:56:34	CAT1	Safety Fences: Metal/Concrete	Accident damage	338619	209140	40 meters of central res damage and mud in lane 2	Perm	22/01/2021 08:56:34	18/01/2021 00:00:
A40	8 - Right Verge	22/08/2021 16:33:19	CAT1	Safety Fences: Metal/Concrete	Accident damage	332602	210053	2 Posts 1 Beam	Perm	29/08/2021 16:33:19	29/08/2021 12:00:
A40	8 - Right Verge	27/09/2021 11:29:40	CAT1	Safety Fences: Metal/Concrete	Accident damage	330695	212586	4/5 lengths 4 uprights due to a vehicle that had a blow and hit the c/res	Perm	04/10/2021 11:29:40	01/01/9999 00:00:
A40	8 - Right Verge	02/01/2022 08:52:45	CAT1	Safety Fences: Metal/Concrete	Accident damage	340475	208023	APPROX 25M RTC DAMAGED C/RES WIRE ROPE.	Perm	09/01/2022 08:52:45	09/01/2022 12:00:
A40	8 - Right Verge	19/03/2022 18:23:37	CAT1	Safety Fences: Metal/Concrete	Accident damage	335133	209859	Route Steward (Steve Mckenzie) informed CR barrier damage following RTC.	Perm	26/03/2022 18:23:37	01/01/9999 00:00:
A40	3 - Left Verge	22/05/2017 00:00:00	CAT1	Safety Fences: Metal/Concrete	Accident damage	331685	210802	APPROX 15M RTC DAMAGED VERGE FLEXBEAM. A/E B42267	Perm	29/05/2017 00:00:00	30/05/2017 00:00:
A40	3 - Left Verge	31/01/2018 11:39:00	CAT1	Safety Fences: Metal/Concrete	Accident damage	331159	211591	SF DAMAGE IN VERGE 15m flex beam A/E B44478	Perm	07/02/2018 11:39:00	09/02/2018 00:00:
A40	3 - Left Verge	14/08/2018 00:00:00	CAT1	Safety Fences: Metal/Concrete	Accident damage	336189	209719	APPROX 12 M RTC DAMAGED VERGE OBB SAFETY FENCE.	Perm	21/08/2018 00:00:00	23/08/2018 00:00:
A40	3 - Left Verge	17/01/2022 14:50:00	CAT1	Safety Fences: Metal/Concrete	Accident damage	340935	207856	Total closure needed with diversions for RTC Gwent police log number 247  Added at 15:56pm - Damage to nearside barrier that protects overbridge on Eastbound carriageway at marker 8/5	Perm	24/01/2022 14:50:00	01/01/9999 00:00:



A40 Hardwick Interchange to Raglan Roundabout  
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Operational Risk Assessment



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## Appendix E – Sample RRRAP Output

A40 Hardwick Interchange to Raglan Roundabout  
Safety Barrier (ORA) (2021/22)

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Bridge Ref: A40 250 Llanarth Road Overbridge  
 Offset of pier from point of setback: estimated at 1.2m  
 Length of pier: 14m (from bridge drawings)  
 Width of pier: 0.7m (from bridge drawings)  
 Assumed width of verge: 3m  
 Assumed earthworks: Rising at 50%

Outcome: VRS protection required at pier.  
 Minimum length of full height VRS in advance of hazard (pier): 10m

Risk	Hazard Details						Risk Levels		VRS Lengths (m)		VRS Details & Containment		
Output detailed results?	i	Id	Nature of Hazard	Start chainage i	End chainage	Offset(s) from Psb	Is risk without VRS acceptable?	Level of risk with optimum length VRS	Min Length VRS in advance	Min Length VRS beyond	VRS working width class	VRS	Parapet
<input type="checkbox"/>	i	0600.0001	Rising at 50%	0.0	150.0	3.0	Yes						N/A
<input type="checkbox"/>	i	8200.0001	Adjacent Road Single	27.0	41.0	1.2 / 1.2	Yes						N/A
<input type="checkbox"/>	i	1700.0001	Bridge Pier	27.0	41.7	1.2	No	Acceptable	10		W1	N2	N/A

Results 1 - 3 of 3 | Page 1 of 1

For the purposes of the ORA, the 10m minimum in advance is likely to apply to all the overbridges as the basic parameters are similar. Only additional site specific hazards at each bridge may affect this (eg traffic signs, different earthworks profiles).



A40 Hardwick Interchange to Raglan Roundabout  
Safety Barrier (ORA) (2021/22)

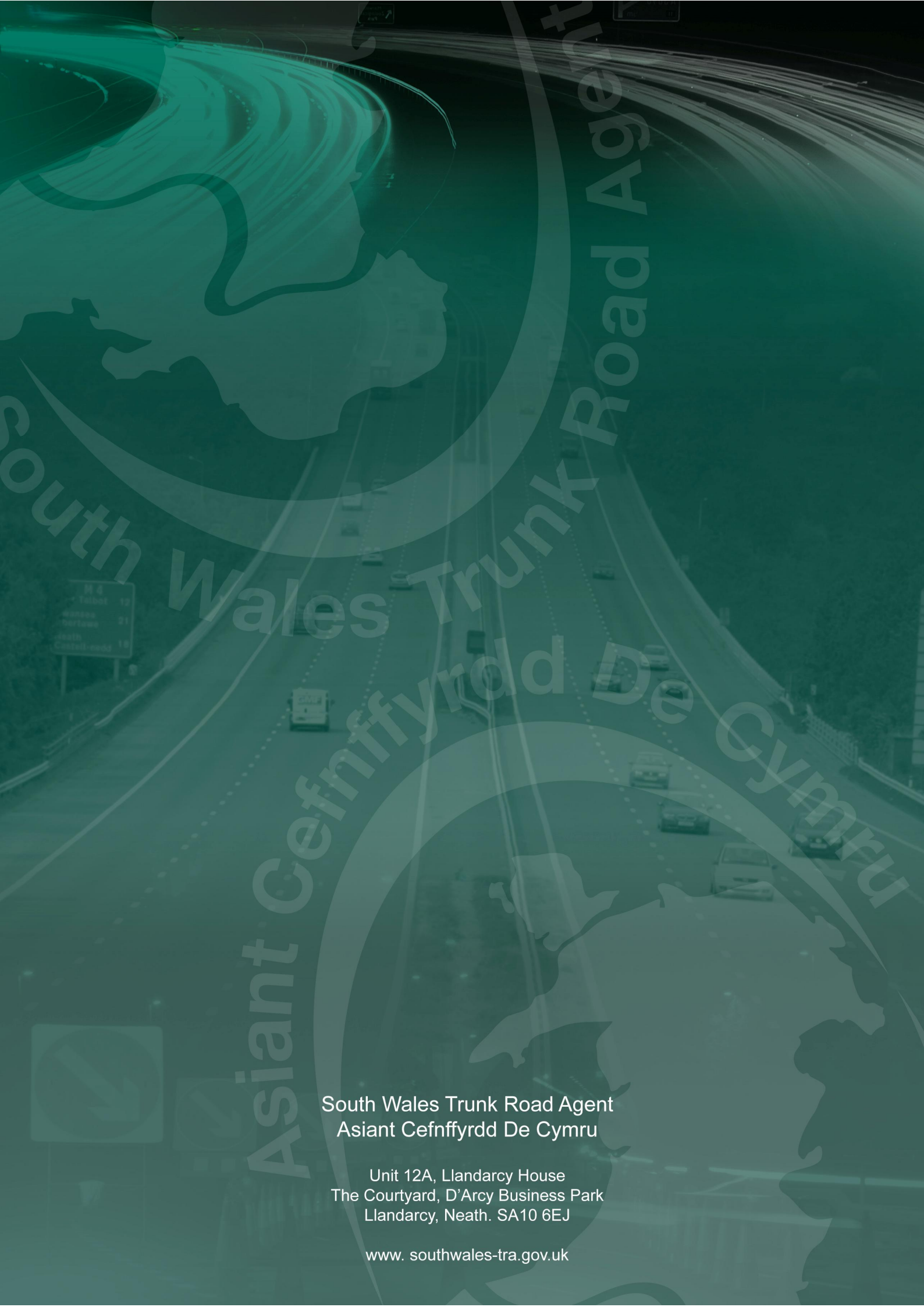
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