Appendix 1

local transport projects

traffic engineering and transport planning

Caerphilly County Borough Council

B4251 Gelligroes to Ynysddu

Road Safety Review and Road Restraint System (RRS) Assessment

September 2023

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B4251 Gelligroes to Ynysddu

Road Safety Review and Road Restraint System (RRS) Assessment

March 2023

Client Commission			
Client:	Caerphilly County Borough Council	Date Commissioned:	February 2023

LTP Quality Control			
Job No:	LTP/23/5353	File Ref:	B4251 Road Safety Review and RRS Assessment - Final Issue 2

Issue	Revision	Description	Author	Checked	Date
FINAL	Issue 2	Revised final (minor revs)	RP	RP	06/09/2023
FINAL	Issue 1	Final report to Client	RP	NW	30/03/2023
			Authorised for Issue:		NW

LTP PROJECT TEAM

As part of our commitment to quality the following team of transport professionals was assembled specifically for the delivery of this project. Relevant qualifications are shown and CVs are available upon request to demonstrate our experience and credentials.

Team Member	LTP Designation	Qualifications
Nigel Wilson	*Technical Director*	*CEng FIHE MCIHT*
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B4251 GELLIGROES TO YNYSDDU

ROAD SAFETY REVIEW & ROAD RESTRAINT SYSTEM (RRS) ASSESSMENT

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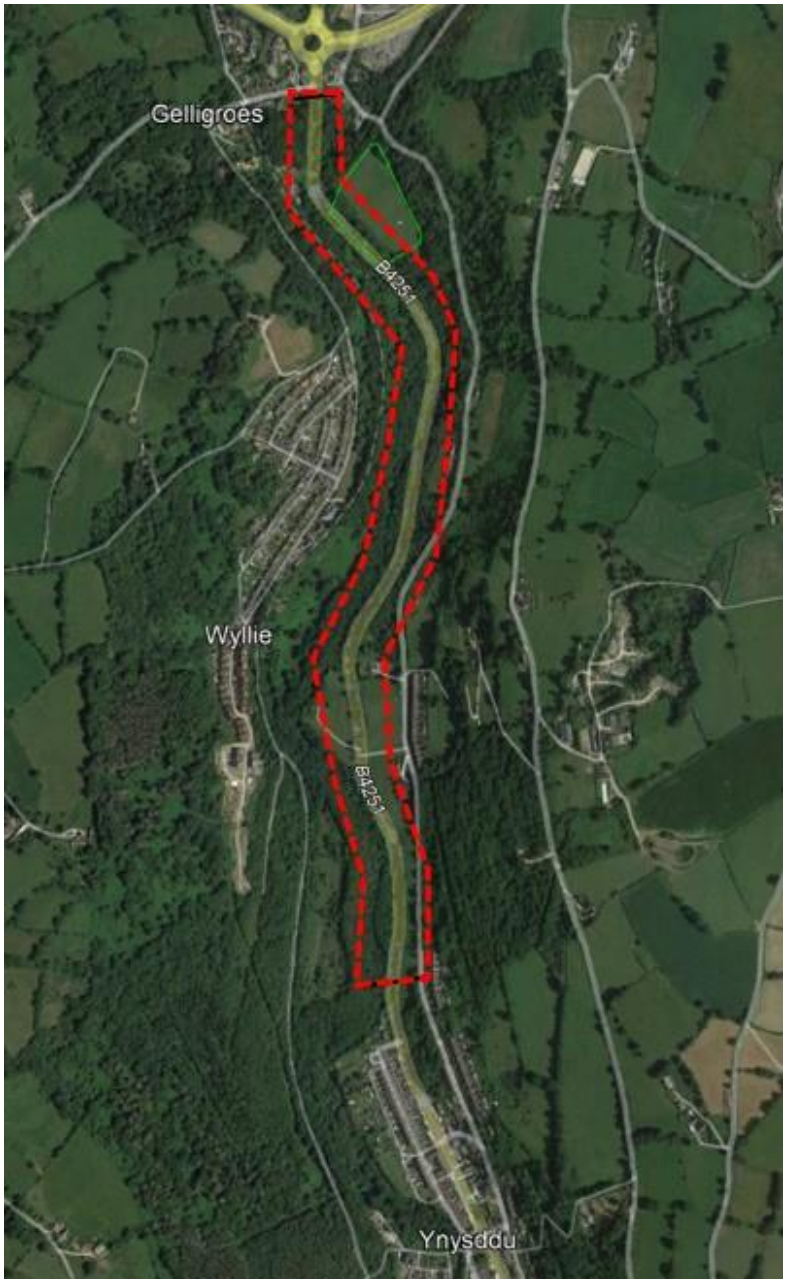
1.1 Background

1.1.1 Local Transport Projects Ltd (LTP) has been commissioned by Caerphilly County Borough Council (CCBC) to undertake a Road Safety Review and Road Restraint System (RRS) Assessment for the approximate 1.8km length of the B4251 between Gelligroes and Ynysddu. As identified within Figure 1, the study area extends from south of Heolddu Road in Gelligroes to the village boundary in Ynysddu. Gelligroes roundabout, which is located a short distance north of Heolddu Road, is not included within the study area.

Figure 1: Study Route



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1.2 Route History

1.2.1 The study route has been subject to a number of recent studies, assessments and highway interventions and a brief timeline is provided below:

1.2.2 **October 2019 – '*CCBC Vehicle Restraint System Risk Scoring Assessment*' (CCBC, 2019)**. The route scored as a medium priority site.

1.2.3 **March 2020 – '*Caerphilly CBC – B4251 Safety Improvement Study*' (Amey Consulting, 2020)**. The study outlines that "*in general, the road itself was found to be in good condition and well maintained, however analysis of the major geometry found that it fell below the standard that would be required for a newly constructed route. Following the appraisal of existing conditions several recommendations are made for the improvement of the route with regards to safety. The most notable recommendation being the reduction of the speed limit to 40mph throughout, which was made based on traffic survey data and geometric analysis. Furthermore, as the route comprises many tight, blind bends it is recommended that additional warning signs and surface markings be installed to give warning to motorists. It is also recommended that steps be taken to discourage any overtaking along the entire route. As well as these additions there are also several comments made regarding future maintenance.*"

1.2.4 The study also provided a draft risk scoring assessment in accordance with '*Provision of Road Restraint Systems on Local Authority Roads*' (UK Roads Liaison Group, 2011) based on the assumption that a 40mph speed limit is implemented on the route. The route was scored as a medium priority site. The risk level at a medium priority site is defined as "*intervention may be required to introduce control measures to drive residual risk towards the Lower Priority Site category. The residual risk can be tolerated only if further risk reduction is impracticable or requires action that is grossly disproportionate to the reduction in risk achieved*" (UK Roads Liaison Group, 2011). In terms of outcomes, for a medium priority site the same document outlines that "*where the risk evaluation has identified a site as a medium priority a RRS may be justified however a non-RRS approach to reducing the risk may prove sufficient to negate the need for a RRS. If suitable effective measures cannot be introduced then the appraisal process would normally continue in order to consider the other criteria*."

1.2.5 **Summer 2020 – Implementation of road safety measures**. A number of road safety measures recommended within the Amey Consulting report were implemented during the summer of 2020. The measures included the provision of chevron signing at the most severe bends and localised carriageway resurfacing works.

1.2.6 **September 2020 – Tree removal**. Much of the B4251 route was lined by established mature trees but during September 2020 a significant tree felling operation commenced along the route to remove ash dieback. The CCBC '*Cabinet Report 9th February 2022: B4251 Ynysddu to Wyllie Highway Improvement*' notes that "*the removal of these substantial trees opened-up the embankments and created additional perceptions of danger and renewed requests for a VRS* [Vehicle Restraint System]. *In November 2020 a review of the site was undertaken to consider the concerns being raised*" (CCBC, 2022). The review identified that "*it is possible that a wooden post and rail or concrete post and chain-link fence could be installed which may reduce the risk of a vehicle leaving the road given the topography of the area. This would also provide some form of protection to both pedestrians and vehicles*" (CCBC, 2022).

1.2.7 **January 2021 – Implementation of 40mph speed limit**. The speed limit on the section of the B4251 that was subject to the national speed limit (60mph) was reduced to 40mph, with the Traffic Regulation Order (TRO) sealed on 1st January 2021.

1.2.8 **June/July 2022 – Provision of steel post and chain-link fence**. During June/July 2022, CCBC erected a steel post and chain-link fence along sections of the route between Heolddu Road and Wyllie.

1.3 Scope

1.3.1 This Road Safety Review and Road Restraint System (RRS) Assessment forms a review and assessment of the current highway conditions on the study route as at the time of the study (February/March 2023). Reference to some of the previous reporting/assessment work undertaken by others is made as appropriate. The scope of this Road Safety Review and Road Restraint System (RRS) Assessment is summarised below:

1.3.2 **Road Safety Review** – Assessment of current highway conditions on the route, including:

- Assessment of vehicle speed, vehicle flow and injury collision data for the route;
- Site-based and desktop assessments of cross section, geometry, surface condition, carriageway falls/drainage, kerbing, road markings/studs, signing, road lighting, road restraint system, fencing and other relevant features; and
- Overall Road Safety Review conclusions and recommendations.

1.3.3 **Road Restraint System (RRS) Assessment** – RRS Assessment for the study route with reference to '*Provision of Road Restraint Systems on Local Authority Roads*' (PRRSLAR) (UK Roads Liaison Group, 2011) which provides an appraisal process to help authorities decide when a RRS is justified.

2. ROAD SAFETY REVIEW – DATA ASSESSMENTS

2.1 Introduction

2.1.1 This section of the Road Safety Review considers recent vehicle speed, vehicle flow and injury collision data that has been supplied by CCBC.

2.2 Vehicle Speeds

2.2.1 Between Saturday 4th and Friday 10th March 2023, an independent specialist survey company installed Automatic Traffic Counters (ATC) to record vehicle speed information at the following two locations on the B4251:

- A – At lighting column IH07, approximately 440m south of Heolddu Road (latitude: 51.642175, longitude: -3.188379); and
- B – At lighting column IH32, approximately 100m north of the Pont-gam bus stops (latitude: 51.635274, longitude: -3.189735).

2.2.2 The above speed survey locations are identified within Figure 2 and the survey results summarised within Table 1. The complete ATC data is included as Appendix 1.

Figure 2: B4251 Speed Survey Locations

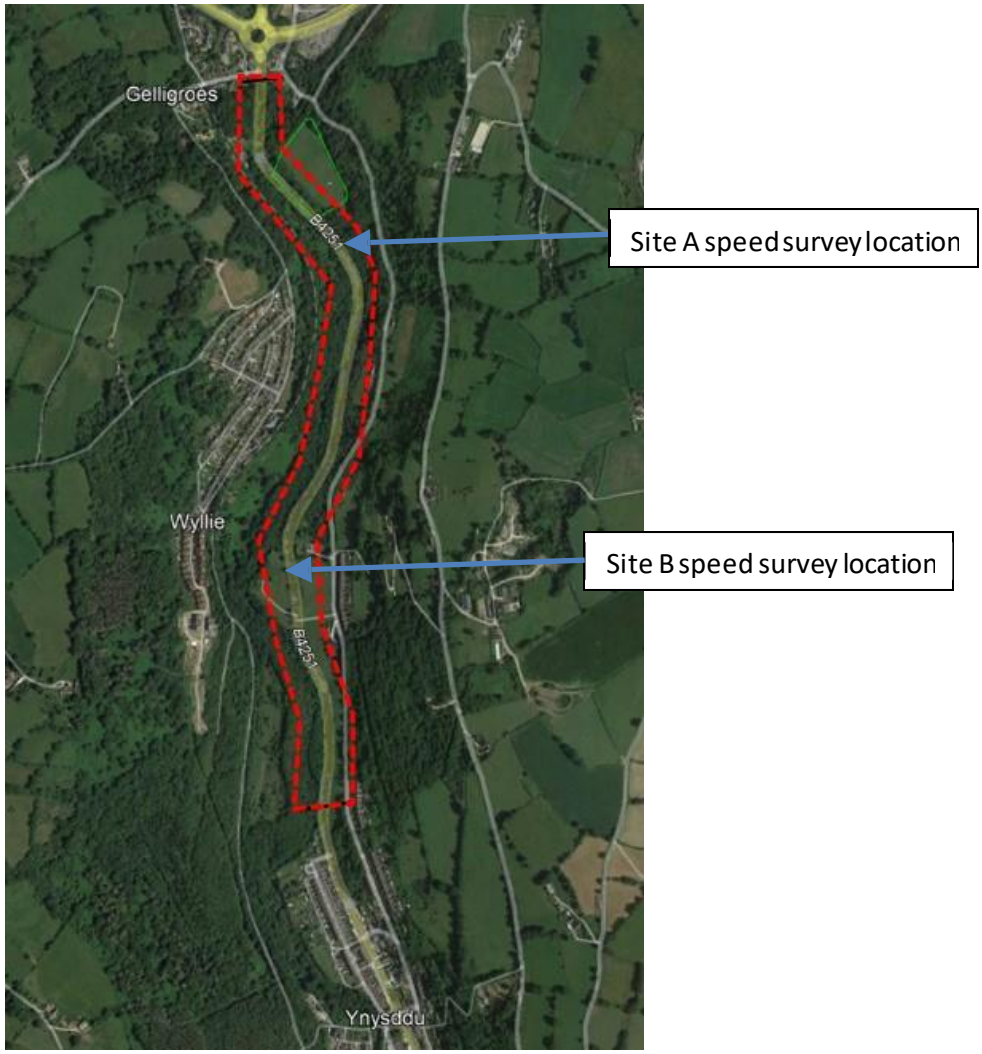

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Table 1: B4251 Speed Survey Results

Survey Location	Posted Speed Limit	Mean Speed			85th %ile Speed		
		Northbound	Southbound	Two-way	Northbound	Southbound	Two-way
A	40mph	39.3mph	41.7mph	41mph	43.6mph	46.6mph	45mph
B	40mph	37 mph	41.8mph	39mph	40.7mph	46.4mph	44mph

2.2.3 Two-way mean vehicle speeds are 41mph at Site A and 39mph at Site B and are therefore considered generally consistent with the posted 40mph speed limit. Recorded 85th %ile speeds are around 4-5mph higher than mean speeds and this magnitude of difference is in line with what could typically be expected.

2.2.4 '*Setting Local Speed Limits in Wales*' states that "*mean speeds should be used as the basis for determining local speed limits as these reflect what the majority of drivers perceive as an appropriate speed for the road. The aim should be for the mean speed driven on the road to be at or below the posted speed limit*" (Welsh Assembly Government, 2009). Based on the recorded speed data, it is considered that the current 40mph speed limit on the route is appropriate.

2.3 Vehicle Flows

2.3.1 The ATC data also provides vehicle flow information at the two survey locations. This is summarised within Table 2, with the complete data included as Appendix 1. Recorded flows are almost identical at both survey locations as there are no opportunities for vehicles to join/leave the B4251 between the two survey points.

Table 2: B4251 Traffic Flows

Flow Category	Location	Northbound	Southbound	Two-way
Average Weekday				
24-hour Flow	A	5001	4754	9755
	B	4985	4749	9734
12-hour Flow (07:00-19:00)	A	4184	3613	7797
	B	4170	3608	7778
Typical AM Peak Hr (08:00-09:00)	A	326	425	751
	B	324	427	751
Typical PM Peak Hr (16:00-17:00)	A	536	325	861
	B	533	324	857
7-day Average				
24-hour Flow	A	4557	4321	8878
	B	4542	4316	8858
12-hour Flow (07:00-19:00)	A	3792	3326	7118
	B	3780	3321	7101

2.3.2 Average daily (24-hour) two-way weekday traffic flows on the B4251 total just less than 10,000 vehicles, with a generally even northbound/southbound distribution. It is noted that the Wednesday traffic flows are around 3,000 vehicles less than those recorded on the other weekdays. This is likely to be explained by snowfall on this day. Discounting the Wednesday flows, average daily (24-hour) two-way weekday traffic flows would total approximately 10,350 vehicles.

2.3.3 Around 80% of daily weekday traffic flows take place during the 12-hour daytime period 07:00-19:00.

2.3.4 Two-way traffic flows during typical weekday AM and PM peak hours total approximately 750 vehicles and 850 vehicles respectively.

2.3.5 The ATC data indicates that buses/rigid vehicles/articulated vehicles make up around 1.8% of the total vehicle flow on the B4251.

2.4 Personal Injury Collision (PIC) Data

2.4.1 **PIC totals (10-year record)** – PIC data for the study route for the 10-year period 01/07/2012 to 30/06/2022 has been supplied by CCBC and the PIC plot is included as Appendix 2. The plot includes an approximate 100m length of the B4251 north of Alexandra Road that is subject to a 30mph speed limit and is located outside of the study area. As summarised within Table 3, a total of 17 PICs have been recorded during the study period, providing an average of 1.7 PICs per year.

Table 3: 10-year Collision History

Year	Fatal	Serious	Slight	Total	3-Yr Av
01/07/2012 to 30/06/2013			3	**3**	-
01/07/2013 to 30/06/2014		1	1	**2**	-
01/07/2014 to 30/06/2015	1		1	**2**	2.2
01/07/2015 to 30/06/2016				**0**	1.3
01/07/2016 to 30/06/2017			2	**2**	1.3
01/07/2017 to 30/06/2018			1	**1**	1
01/07/2018 to 30/06/2019		1	1	**2**	1.7
01/07/2019 to 30/06/2020	1	1	1	**3**	2
01/07/2020 to 30/06/2021			1	**1**	2
01/07/2021 to 30/06/2022			1	**1**	1.7
Total	**2**	**3**	**12**	**17**	**1.7**

2.4.2 The PIC rate across the 10-year period has remained relatively stable, with a rolling 3-year average of between 1.3-2.2 PICs per year (currently at 1.7 PICs per year). Of the 17 PICs, 5 (29%) were either serious (3) or fatal (2) in severity.

2.4.3 **PIC totals (post 40mph speed limit implementation)** – As previously discussed, the major change on the study route which could influence collision rates was when the speed limit along the majority of the route was reduced from 60mph to 40mph on 1st January 2021 (a short length of 40mph already existed south of Gelligroes roundabout). As such, Table 4 provides speed limit information for the recorded PICs, separating this out for the pre and post 1st January 2021 periods.

Table 4: Collision by Speed Limit

PIC Record 01/07/2012 to 31/12/2020 (102 months)		
Speed Limit at PIC Location	**PICs**	**PIC Rate per Year**
30mph*	1*	0.12
40mph (near Gelligroes r'abt)	1	0.12
60mph	14	1.65
Total	**16**	**1.88**
PIC Record 01/01/2021 to 30/06/2022 (18 months)		
Speed Limit at PIC Location	**PICs**	**PIC Rate per Year**
40mph (full study area)	1	0.67
Total	**1**	**0.67**
* PIC included within supplied data but was recorded outside of study area within the 30mph speed limit extents close to Alexandra Road.		

2.4.4 A single PIC (slight in severity) has been recorded since the 40mph speed limit was implemented and involved a driver having a medical episode. Although relatively limited 'after' data is currently available (18 months), the route's PIC record with the 40mph speed limit in place is 0.67 PICs per year. The PIC record on the section of the route that was previously subject to a 60mph speed limit is some way higher at 1.65 PICs per year. This suggests much improved road safety performance since the 40mph speed limit was implemented.

2.4.5 The remaining analysis within this section focuses on the 10-year collision record along the route to establish longer term patterns but also makes specific reference as appropriate to the collision record following the introduction of the 40mph speed limit.

2.4.6 **PIC conditions** – Table 5 summarises the recorded PICs by road surface, weather and lighting conditions. The final column of the Table provides the average for the CCBC area across the 10-year period 2012-2021 (data obtained from the DfT's online road traffic statistics – roadtraffic.dft.gov.uk/custom-downloads).

Table 5: Collision Conditions

Road Surface	**PICs**	**%**	**CCBC Ave 2012-21**
Dry	3	**18%**	68%
Wet or Damp	13	**76%**	30%
Frost or Ice	1	**6%**	2%
Weather	**PICs**	**%**	
Fine without high winds	8	**47%**	77%
Rain without high winds	7	**41%**	16%
Rain with high winds	1	**6%**	3%
Other	1	**6%**	5%
Lighting*	**PICs**	**%**	
Daylight	8	**47%**	74%
Dark (street lights present and lit)	1	**6%**	20%
Dark (street lights present but not lit)	3	**18%**	2%
Dark (no street lighting)	2	**12%**	4%
Dark (street lighting status unknown)	3	**18%**	1%

* Lighting conditions as reported within the PIC data supplied by CCBC.

2.4.7 The proportion of wet/damp road PICs within the study area (76%) is considerably higher than the CCBC average (30%).

2.4.8 Of the 13 wet/damp road PICs, 8 were recorded whilst it was raining (62%) which is a similar proportion to the CCBC average (60%).

2.4.9 9/17 PICs (53%) are recorded as taking place in dark conditions which is almost double the CBBC average (27%). Of these 9 PICs, the data is coded as follows:

- 'dark – street lights present but not lit' – 3 PICs;
- 'dark – street lighting status unknown' – 3 PICs;
- 'dark – no street lighting' – 2 PICs; and
- 'dark – street lights present and lit' – 1 PIC.

2.4.10 The PIC that was recorded following the introduction of the 40mph speed limit was recorded in daylight.

2.4.11 **Time of day** – Table 6 summarises the recorded PICs by time of year.

Table 6: Collision Times

Time of Year	PICs	%	CCBC Ave 2012-21
Winter (Dec-Feb)	2	**12%**	25%
Spring (Mar-May)	4	**24%**	23%
Summer (Jun-Aug)	4	**24%**	25%
Autumn (Sep-Nov)	7	**41%**	28%

2.4.12 The Autumn period recorded the greatest concentration of PICs (7 or 41%). All 7 of these PICs were recorded between late September (26th) and mid-November (19th).

2.4.13 **Day of week and time** – Table 7 summarises the recorded PICs by day of week and time of day.

Table 7: Collision by Day & Time

Day	Early Morning (00:00-06:00)	Typical AM Peak (06:00-09:00)	Morning (09:00-12:00)	Afternoon (12:00-15:00)	Typical PM Peak (15:00-18:00)	Evening / Night (18:00-00:00)	Total	%	CCBC Ave
Monday	3	1				2	**6**	**35%**	14%
Tuesday	1						**1**	**6%**	15%
Wednesday				1			**1**	**6%**	15%
Thursday	1			1	1		**3**	**18%**	14%
Friday	1				3		**4**	**24%**	17%
Saturday							**0**	**-**	13%
Sunday					2		**2**	**12%**	11%
Total	**6**	**1**	**0**	**2**	**6**	**2**	**17**		
%	**35%**	**6%**	**-**	**12%**	**35%**	**12%**			
CCBC Ave	6%	12%	14%	18%	25%	25%			

2.4.14 Over a third of PICs (6/17) were recorded during the early morning period (00:00-06:00) when traffic flows are likely to be at their lightest. This is almost six times higher than the CCBC average (6%). The PIC that was recorded since the introduction of the 40mph speed limit was recorded during the Wednesday afternoon period.

2.4.15 Of the 6 early morning PICs, 3 were recorded between 05:30-06:00. In addition to the 6 early morning PICs, a further 2 PICs were recorded reasonably late at night (22:07 and 23:55).

2.4.16 The PICs were concentrated on weekdays, particularly Monday (6), Friday (4) and Thursday (3).

2.4.17 **PIC locations** – The 17 PICs were generally dispersed across the study route as follows (described north to south):

- 2 PICs (1 serious and 1 slight) a short distance south of Heolddu Road;
- 1 PIC (slight) at the first bend south of Heolddu Road;
- 2 PICs (1 serious and 1 slight) on a straight section of carriageway south of the above bend;
- 2 PICs (both slight) at the second bend south of Heolddu Road (including the PIC that was recorded following the implementation of the 40mph speed limit);
- 2 PICs (both slight) on a straight section of carriageway south of the above bend;
- 4 PICs (1 fatal, 1 serious and 2 slight) within the general vicinity of the bend towards the southern end of Wyllie;
- 1 PIC (fatal) south of Wyllie within the vicinity of the 30mph speed limit countdown markers (three bars);
- 1 PIC (slight) approximately 100m north of the 40mph/30mph terminal speed limit signs at Ynysddu; and
- 1 PIC (slight) approximately 80m south of the 40mph/30mph terminal speed limit signs at Ynysddu (located outside of the study area).

2.4.18 **Type of PIC** – Clear language description information has been supplied in relation to most of the recorded PICs. This provides an indication of the type and nature of the collision based on the professional opinion of a Police Officer who attended the scene. This information is summarised within Table 8.

Table 8: Type of PIC

PIC Type	PICs	Additional Details
Single vehicle collision – failed to negotiate bend or loss of control on route (4 coded as going ahead right bend, 2 left bend & 3 going ahead other)	9	• 8/9 involved vehicles leaving the road and colliding with objects (most commonly trees) • 6/9 involved northbound vehicles
Two vehicle collision – head-on collision	2	-
Two or three vehicle collision – rear shunt	2	Both involved northbound vehicles
Vehicle overtaking a cyclist	1	Involved northbound vehicle
Driver has medical episode	1	Involved northbound vehicle (post 40mph speed limit implementation PIC)
Limited details provided	2	Both involved northbound vehicles
Total	**17**	

2.4.19 Single vehicle loss of control/failure to negotiate bend collisions are the dominant PIC type (9/17), with two-thirds of these involving northbound vehicles. The PIC that occurred following the implementation of the 40mph speed limit in January 2021 involved a driver having a medical episode was not a loss of control/failure to negotiate bend collision.

2.4.20 There is a pattern of PICs generally involving northbound drivers (14/17 PICs).

2.4.21 **Causation factors** – The supplied PIC data includes information on possible/very likely causation factors associated with the PICs based on the opinion of a Police Officer who attended the scene. The most cited causation factors are detailed within Table 9.

Table 9: Causation Factors

Causation Factor	PICs	Confidence
Loss of control	8	V likely (5), Possible (3)
Slippery road (due to weather)	7	V likely (4), Possible (3)
Travelling too fast for conditions	6	V likely (4), Possible (2)
Sudden braking	4	V likely (2), Possible (2)
Exceeding speed limit	3	V likely (2), Possible (1)
Careless / reckless / in a hurry	3	V likely (2), Possible (1)
Road layout (bends, hills etc)	3	V likely (1), Possible (2)

2.4.22 Loss of control (8), slippery road (7) and travelling too fast for the conditions (6) are the most commonly cited causation factors. None of these factors are associated with the PIC that was recorded following the implementation of the 40mph speed limit.

2.4.23 Although the above causation factor information is useful, it is recognised that collisions are complex, multi-factor events and the Royal Society for the Prevention of Accidents (RoSPA) note that most collisions have several causes, the main ones being human error, the road environment and mechanical/vehicle defects. RoSPA consider that human error is a factor in 95% of collisions, road environment a factor in 12% of collisions and mechanical/vehicle defects a factor in 2% of collisions (RoSPA, 2017).

2.4.24 **Casualties** – The 17 PICs resulted in 21 casualties (an average of 1.2 casualties per PIC). Table 10 provides a breakdown of the casualties according to the mode of travel and age group.

Table 10: Casualty Road User Groups

	Age (years)							
Road User Group	**Unknown**	**0 to 15**	**16 to 19**	**20 to 29**	**30 to 59**	**60 Plus**	**Total**	**%**
Car Driver			2	7	6	2	**17**	**81%**
Car Passenger				2	1		**3**	**14%**
Cyclist				1			**1**	**5%**
Total	-	-	**2**	**10**	**7**	**2**	**21**	
%	-	-	**9%**	**48%**	**33%**	**9%**		

2.4.25 Of the 21 casualties, 20 were car occupants (predominantly drivers). A high proportion of car driver casualties were of a young age; of the 17 car drivers 9 were aged between 17 and 26 (17, 19, 21, 21, 21, 23, 23, 25 and 26). Of these 9 drivers, 7 were injured in the single vehicle failure to negotiate bend/loss of control PICs identified within Table 8. The driver injured in the PIC which occurred following the introduction of the 40mph speed limit was aged 73.

2.4.26 Given the high proportion of young driver casualties across the study area, CCBC may want to consider undertaking targeted Education, Training and Publicity (ETP) activities on the route.

2.4.27 **Summary** – The key conclusions from the PIC analysis are that:

- Although caveated by the limited amount of 'after' data currently available (18 months), the annual PIC rate on the route is much lower since the speed limit was lowered to 40mph in January 2021. Since this date, a single PIC (slight in severity) has been recorded on the route. Additional analysis should be undertaken once further 'after' data is available to determine whether this improved road safety performance is maintained; and
- Across the wider 10-year study period, some common PIC patterns have been identified, including high proportions of wet road / dark / early hours of the morning / young driver / single vehicle / loss of control collisions. However, these patterns are not evident since the introduction of the 40mph speed limit.

2.5 Consultation with Gwent Police Collision Investigation Team

2.5.1 Gwent Police Collision Investigation Team were contacted to determine if they have any comments regarding the operation and safety of the study route. No comments were received from Gwent Police.

3. ROAD SAFETY REVIEW – SITE/DESKTOP ASSESSMENTS

3.1 Site/Desktop Assessments – Assessment Details

3.1.1 This Road Safety Review has involved both detailed site-based and desktop assessments. Site inspections undertaken by a team of two qualified professionals were carried out as follows:

3.1.2 **Site inspection during dark conditions** – Tuesday 7th February 2023, between 18:45-19:15. The route was driven in both directions by the site inspection team. Weather and road surface conditions were dry at the time of the inspection and road lighting along the route was illuminated; and

3.1.3 **Site inspection during daylight conditions** – Wednesday 8th February 2023, between 08:45-12:00. The route was walked and driven in both directions by the site inspection team. Weather conditions were dry and sunny. For approximately half of the inspection, a slight frost was present on the carriageway.

3.1.4 In terms of desktop assessments, a topographical survey which covers the approximate 1.2km northern section of the route has been supplied by CCBC, with Ordnance Survey (OS) mapping available for the remainder of the route. A chainage has been applied to the route, beginning at 0m at the southern end and terminating at 1825m at the northern end. Relevant references to chainages are made throughout this section.

3.2 Design Standards / Guidance

3.2.1 As part of this Road Safety Review, reference is made to specific design standards/guidance contained within documents which form part of the *'Design Manual for Roads and Bridges'* (DMRB). It is important to note that the DMRB is only mandatory on motorways and all-purpose trunk roads and the B4251 is not a motorway or trunk road. As such, there is not a strict requirement for compliance with the DMRB on roads such as the B4251. However, in the absence of local design standards/guidance, Local Highway Authorities often tend to fall back on the DMRB as a reference point, particularly in higher speed rural environments.

3.2.2 Other design guidance does exist and '*GG 101 Introduction to the Design Manual for Roads and Bridges*' outlines that where "*works are to be carried out on roads that are not part of the trunk road network and the use of the DMRB could result in significant over-specification, alternative documents such as the Manual for Streets or Designing Streets 2010* [Scotland] *may be used with the approval of the Overseeing Organisation*" (National Highways, 2021).

3.2.3 '*Manual for Streets*' (MfS1) (Department for Transport (DfT), 2007) focuses on lightly-trafficked residential streets and is not appropriate on roads such as the B4251. However, '*Manual for Streets 2*' (MfS2) (CIHT), 2010) forms a companion guide to MfS1 and "*builds on the guidance contained in MfS1, exploring in greater detail how and where its key principles can be applied to busier streets and non-trunk roads, thus helping to fill the perceived gap in design guidance between MfS1 and the Design Manual for Roads and Bridges*" (CIHT, 2010).

3.2.4 Two key messages are evident from the above, these being that:

- Whilst design standards/guidance within the DMRB is useful, there is no requirement for strict compliance with the DMRB on local roads such as the B4251; and
- Other guidance, which allows for a greater consideration of local context, is available and is generally more applicable in lower speed environments. Since the implementation of the 40mph speed limit on the B4251, the principles outlined in documents such as MfS2 are likely to be more pertinent to the B4251 than when the route was subject to a 60mph speed limit.

3.3 Cross Section

3.3.1 The B4251 is a single carriageway (S2) road with several bends and straight sections, with key cross-sectional characteristics as follows:

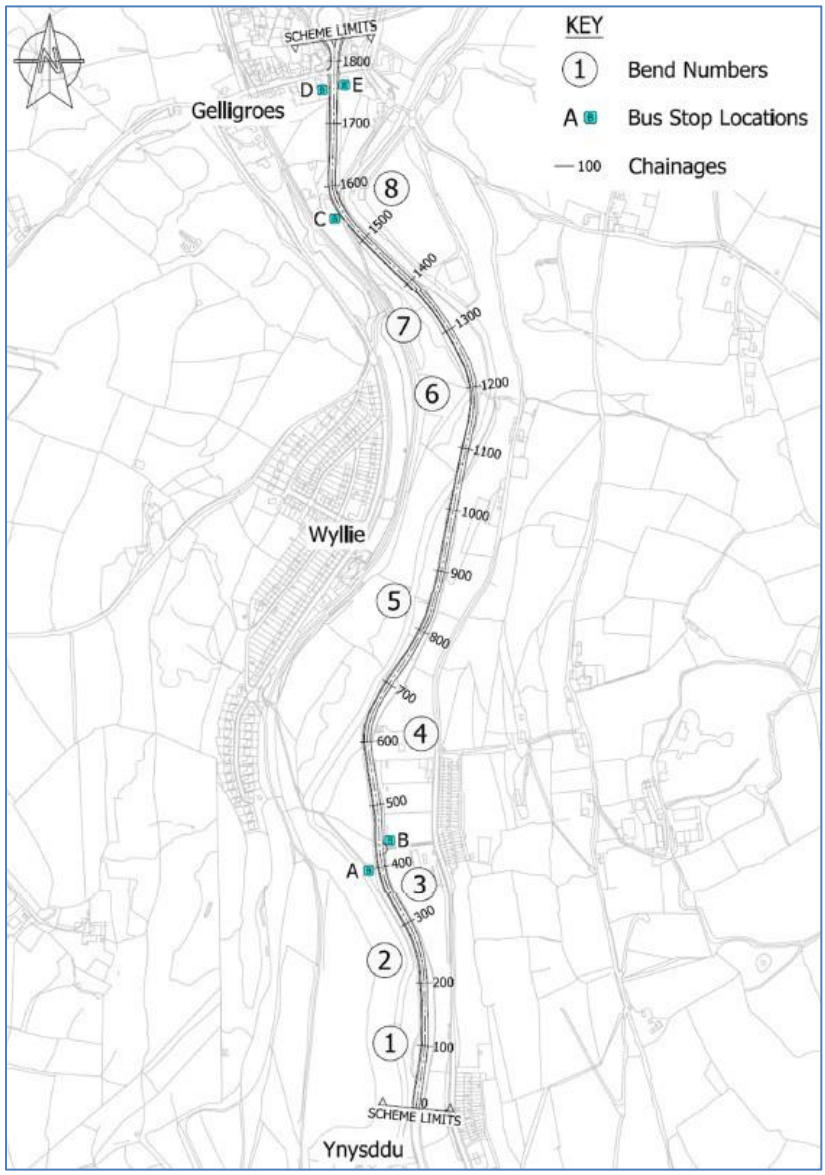
- A carriageway of approximately 9.2m in width, flanked by a 1.8m wide footway on the western side (these dimensions vary to a small extent in places);
- A central hatched area of approximately 1.7m in width which separates opposing traffic flows and results in traffic lanes of approximately 3.8m (northbound) and 3.7m (southbound) in width. The lane widths are generally consistent with those quoted within '*CD 127 Cross-sections and Headrooms*' (Highways England, 2021a) for rural all-purpose single carriageways;
- A crown in the centre of the carriageway with varying super-elevation at bends;
- An approximate 55m length of RRS on the eastern side of the road to the north of the river over-bridge;
- A steel post and chain-link fence along sections of the route between Heolddu Road and Wyllie (provided June/July 2022). The fence is provided on the same side of the road as the Sirhowy River (i.e.; north of the river over-bridge the fence is on the eastern side and is on the western side to the south). Short sections of timber post and rail fencing are provided at other locations along the route; and
- Areas beyond the edge of carriageway/back of footway are generally lined with trees (though it is noted that some tree felling took place during September 2020 to remove ash dieback).

3.4 Geometry

3.4.1 Geometric assessments of the study route were undertaken as part of the '*Caerphilly CBC – B4251 Safety Improvement Study*' (Amey Consulting, 2020) and, at this time, most of the route was subject to a 60mph speed limit. Since this previous assessment, a 40mph speed limit prevails on the fully study route. The following paragraphs provide commentary on the geometric assessments prior to the speed limit reduction and provide relevant assessments following the speed limit reduction.

3.4.2 **Bend radii for new roads (previous assessment)** – The '*Caerphilly CBC – B4251 Safety Improvement Study*' (Amey Consulting, 2020) identified that the study route includes 8 notable radii and these are numbered within Figure 3 (bus stop locations also identified).

Figure 3: Bend Radii



Source: Amey Consulting, 2020

3.4.3 The previous assessment with reference to Figure 9.23N2 '*CD 109 Highway Link Design*' (Highways England, 2020) identified that "*the radii should be 510-1020m for a 100kph road (100kph equates to a 60mph national speed limit for this classification of road*" (Amey Consulting, 2020). LTP would not necessarily agree with this as Figure 9.23N2 refers to design speed rather than the posted speed limit. Using Figure 2.1 of the same document, it is considered that the alignment and layout constraints on the route are more akin to a design speed of 85kph (53mph), rather than 100kph (62mph).

3.4.4 Regardless of the above, the previous assessment found that radii on all 8 bends fell well below the current standards for the 100kph speed which was used (see Table 11). In commenting on this, the report outlined that "*as the stretch of road within the study area is a well-established route, it is not expected to conform to current standards. Motorists are obligated to take the road as they find it, which means they should drive at an appropriate speed for the conditions. However, motorists may differ significantly in their interpretation of the conditions. This conflict has the potential to cause a hazard to all road users*" (Amey Consulting, 2020).

3.4.5 **Bend radii for new roads (current assessment)** – As outlined above, LTP consider the route to have a design speed of 85kph. However, at the same time, recent speed surveys have identified actual vehicle speeds on the route to be lower than this with mean speeds of 39-41mph and 85th %ile speeds of 44-45mph. This is not uncommon and '*MfS2*' states that designers should "*consider the potential for reducing design speed locally, where it is appropriate that traffic should travel more slowly*" (CIHT, 2010). The next design speed below 85kph in CD 109 is 70kph, which equates to a speed of 43.5mph which is broadly in line with the recorded 85th %ile speeds on the route (44-45mph).

3.4.6 The final two columns of Table 11 identify radii requirements for speeds of 85kph (design speed of the route) and 70kph (actual speeds on the route). Aside from at bend 7, the achievable radii at all bends remains below the levels required at speeds of 85kph and 70kph. However, and as per the previous assessment, as a well-established route it is very unlikely that it would meet current DMRB standards. It is considered that the bend radii on the route, although below standards outlined within DMRB, are not significantly different from bends that can be found at other comparable locations in Caerphilly and across Wales. As previously outlined, it is also noted that the application of DMRB standards is not mandatory on roads such as the B4251. The previously discussed collision record also identifies improved road safety performance since the 40mph speed limit covered the full route. In addition, the speed data identifies that the 40mph speed limit appears to be successfully controlling vehicle speeds to around the level of the posted limit which should encourage more appropriate driving speeds at the bends.

Table 11: Bend Radii Measurements

Radii N°	Radii Measurement	Radii Requirement 100kph Speed	Radii Requirement 85kph Road	Radii Requirement 70kph Road
1	88m	510-1020m	360-720m	255-510m
2	203m			
3	130m			
4	102m			
5	130m			
6	163m			
7	378m			
8	72m			

3.4.7 **Full Overtaking Sight Distance (FOSD) (previous assessment)** – The previous assessment assumed a design speed of 100kph and at this level CD 109 indicates that a FOSD of 580m should be provided. It was found that this distance was not achievable on any part of the route, with the longest straight section being 350m between radii 5 and 6. Again, as previously outlined, LTP consider the design speed to be 85kph which equates to a FOSD of 490m (which is also not achievable).

3.4.8 **Full Overtaking Sight Distance (FOSD) (current assessment)** – As discussed, though the design speed is considered to be 85kph, actual vehicle speeds are around the 70kph level. The FOSD requirements at these levels are 490m (85kph) and 410m (70kph). As per the previous assessment, these distances are not achievable on any part of the route (longest straight section of 350m between radii 5 and 6). Again, it is unlikely that the B4251, as a well-established route, would meet current DMRB standards. In addition, the collision history does not identify a pattern of overtaking collisions on the route.

3.4.9 **Stopping Sight Distance (SSD) (previous assessment)** – Within the previous assessment, SSD for each of the bus stops was considered with reference to CD 109. A design speed of 100kph was assumed within the 60mph speed limit section and a 70kph in the section of 40mph south of Gelligroes roundabout. The assessment results are summarised within Table 12 and the report comments that "*only one of the bus stops, D, achieves the desirable minimum SSD. However, all except A achieve one step below which is generally acceptable*" (Amey Consulting, 2020).

3.4.10 **Stopping Sight Distance (SSD) (current assessment)** – As previously discussed, LTP would consider the design speed of the route within the section that was reduced to a 40mph speed limit to be 85kph, with actual vehicle speeds around the 70kph level. A design speed of 70kph on the long-standing section of 40mph at bus stops D and E (south of Gelligroes roundabout) is likely to be appropriate. A design speed of 85kph equates to a desirable minimum SSD of 160m and a one step below desirable minimum SSD of 120m. All bus stops except for A and E meet the desirable minimum and both stops meet the one step below desirable minimum. It is also noted that the SSD formula within MfS2 identifies a SSD of 78m for speeds of 45mph. Overall, the route is considered to operate satisfactorily from a SSD point of view.

Table 12: SSD for Existing Bus Stops

Bus Stop	Previous Assessment				Current Assessment			
	Design Speed	Desirable Minimum SSD	1 Step Below Desirable Minimum SSD	Achievable SSD	Design Speed	Desirable Minimum SSD	1 Step Below Desirable Minimum SSD	Achievable SSD
A	100kph	215m	160m	154m	85kph	160m	120m	154m
B	100kph	215m	160m	175m	85kph	160m	120m	175m
C	100kph	215m	160m	203m	85kph	160m	120m	203m
D	70kph	120m	90m	174m	70kph	120m	90m	174m
E	70kph	120m	90m	111m	70kph	120m	90m	111m

3.5 Surface Condition

3.5.1 The B4251 is entirely bituminous construction and a visual inspection of the route identified it to be in generally good condition or very good condition where recently resurfaced. Some minor defects were identified as follows:

- Chainage 110m – Minor dip/depression in carriageway surface across its full width;
- Chainage 122m – Minor transverse crack across the northbound lane;
- Chainage 211m – Short longitudinal crack to the centre of the northbound lane;
- Chainage 232m – Minor potholing within northbound lane for approximately 5m;
- Chainage 265m – Some surface deterioration in central hatched area where the carriageway has been patched;
- Chainage 414m – Reinstatement across whole carriageway with some cracking to the edge of the reinstatement in both the north and southbound lanes;
- Chainage 510m – Detritus in the northbound channel from a nearby gully for approximately 100m. Deposit of leaf mulch and detritus in central hatched area for approximately 50m;
- Chainage 634m – Patched area of carriageway within the northbound lane appears slightly depressed;
- Chainage 770m – Reinstatement to northbound lane appears slightly depressed;
- Chainage 1165m – Reasonably large patch of surface lamination within the central hatched area;
- Chainage 1220m – Slight depression in the carriageway surface within the southbound lane, adjacent to a large tree stump;
- Chainage 1250m – Reinstatement to manhole in centre of carriageway slightly depressed to the western side of the frame;
- Chainage 1621m – Pothole in the northbound lane; and
- Chainage 1790m – Gas valve covers slightly depressed in the road surface.

3.5.2 It is recommended that CCBC review these minor defects and undertake appropriate remedial action if/as required.

3.5.3 SCRIM (Sideway-force Coefficient Routine Investigation Machine) is used to measure wet skidding resistance on road surfaces. CCBC has supplied SCRIM data (2022) for the Local Authority area. Based on the information provided, it appears that levels of skid resistance on the study route are appropriate and not at a level that would require further investigation.

3.6 Carriageway Falls and Drainage

3.6.1 Analysis of the topographical survey identifies that all straight sections of carriageway are provided with a crossfall of at least 1:40, with one side typically having a crossfall well in excess of 1:40. Across the length of the topographical survey, the approximate longfall on the route is 1%.

3.6.2 The five northern bends (4-8) are covered by the topographical survey. Superelevation has been calculated as follows: Bend 4 (3.5%), Bend 6 (1.7%) and Bend 8 (3.5%). Bend 5 and 7 do not have any additional superelevation besides transitioning between crossfalls at chainages either side. The level of superelevation that is provided at the assessed bends is considered to be generally adequate for the nature and use of the route. This is also supported by the most recent collision record along the route.

3.6.3 Although the site inspections were undertaken in dry conditions, no major indicators of significant drainage issues on the route were identified. However, the following minor issues/items were identified with regards to carriageway falls and drainage:

- Chainage 83m – Cracking to the gully surround on the western side of the road;
- Chainage 131m – Evidence of ponding on the north side of the gully on the western side of the road (carriageway in crossfall at this location);
- Chainage 232m – Some slight cracking to the gully surround;
- Chainage 446m – Evidence of blocking of the gully on the western side of the road due to the presence of detritus on the gully frame;
- Chainage 462m – Detritus has gathered on the gully frame on the eastern side of road as well as within the channel (detritus likely to have fallen from the embankment);
- Chainage 510m – Detritus in the channel from the nearby gully for approximately 100m;
- Chainage 560m – Detritus around the gully frame on the eastern side of the road. A reasonable amount of detritus/rubbish was also observed in the eastern channel around the bend, with some standing water alongside the adjacent drystone wall;
- Chainage 600m – Standing water within the eastern channel which appears to be coming from the embankment. It appears that the surface water at this location cannot drain away via the adjacent gully due to leaf detritus and other heavy elements in the channel;
- Chainage 621m – Location where water appeared to be coming out of the embankment;
- Chainage 715m, 738m & 749m – Leaf detritus around the gully frames on the western side of the road;
- Chainage 762m – Leaf detritus around the gully frame on the eastern side of the road;

- Chainage 816m – Cracked gully surround on the western side of the road with the frame sunk towards the edge of the channel;
- Chainage 940m – Leaf detritus around the gully frame on the eastern side of the road;
- Chainage 1098m – Small amount of debris around the gully location; and
- Chainage 1700m – Camber on the eastern side of the road appears a little steeper than adjacent areas, as though the channel level is slightly lower.

3.6.4 It is recommended that CCBC review the above items and undertake appropriate remedial action if/as required. This review should be prioritised given the history of wet road collisions on the route.

3.7 Kerbing

3.7.1 Half battered kerbs of varying upstands are provided on both sides of the B4251. The condition of the kerbing was observed to be generally good, though the following observations are made:

- Chainage 0-83m – From the village boundary, the embankment on the eastern side of the road drops down towards the kerb edge and there is potential for detritus to gather at the highway edge;
- Chainage 700m – Detritus from the steep embankment on the eastern side of the road is masking some of the kerb line, whist discarded rubbish is also present in the channel;
- Chainage 739m – Large rock within the eastern embankment is positioned on top of the kerb and protrudes slightly into the carriageway;
- Chainage 880m – Detritus from the steep embankment on the eastern side of the road is masking some of the kerb line and also falling into the carriageway;
- Chainage 1300m – Eastern kerb/channel appears to have risen up slightly;
- Chainage 1321m – Kerb upstand on the eastern side drops away slightly;
- Chainage 1325m – Minor damage to the kerb on the eastern side and slightly sunken (potentially from vehicle over-run);
- Chainage 1331m – Kerb upstand on the eastern side drops away slightly;
- Chainage 1354m – Small gap in kerbing on the eastern side; and
- Chainage 1700m – Kerb damaged for a length of approximately 10m.

3.7.2 It is recommended that CCBC review the above items and undertake appropriate remedial action if/as required.

3.8 Road Markings

3.8.1 The main road markings that are provided on the study route are:

- Gateway road markings, including red-coloured surfacing, at the 30mph/40mph speed limit terminal point at Ynysddu;
- Central hatch road markings to Diagram 1040 along the full route which divide north and southbound traffic flows; and
- Bus cage markings to Diagram 1025.1 at five bus stop locations (three northbound and two southbound).

3.8.2 The above road markings across the study route were observed to be in generally good condition, though the following minor defects were identified:

- Chainage 0m – Speed limit roundel road markings within the gateway treatment at Ynysddu are slightly worn; and
- Chainage 150m – The western side of the central hatch road markings are worn.

3.8.3 It is recommended that CCBC review these minor defects and undertake appropriate remedial action if/as required.

3.8.4 It is considered that improvements/modifications to the existing road marking arrangements could be made on the route; these being:

3.8.5 **Length of Diagram 1040 central hatch road marking modules** – For speed limits of 40mph or less, Diagram 1040 central hatch road markings should have a module length of 6m (4m line and 2m gap). For speed limits of more than 40mph, the module length should be 9m (6m line and 3m gap). The correct 6m road marking module length is provided on the B4251 within the extents of the original short length of 40mph speed limit located south of Gelligroes roundabout. However, within the extents of the 40mph speed limit that was implemented on the remainder of the study route during January 2021, 9m road marking modules are provided. These are incorrect and could lead to a driver believing that a speed limit in excess of 40mph applies. To accord with the 40mph speed limit, the 9m road marking modules should be changed to 6m modules. This would also require changes to the existing road stud layout to reflect the new road marking layout. Removing/replacing existing road markings can sometimes damage the road surface and on occasion removed markings can remain partially visible to drivers, which can introduce its own problems. Providing a new road marking layout at the same time as a road is surface dressed/resurfaced generally provides a much superior finish. It is not known if surface dressing/resurfacing works are planned for the route.

3.8.6 **Potential provision of edge of carriageway road markings (Diagram 1012.1)** – Edge of carriageway road markings to Diagram 1012.1 are used to help delineate the edge of carriageway, particularly on unlit classified roads and those roads not having clearly defined raised kerbs. Although the B4251 is kerbed and street-lit (but not between 00:00-05:30), there may be merit in considering the provision of Diagram 1012.1 markings either on a full-route basis or at key locations (e.g.; bends). As previously outlined, there is evidence of vegetation/detritus from embankments masking the kerb at some locations and there is a history of collisions involving drivers leaving the carriageway. As such, the provision of additional lining to provide enhanced delineation of the edge of carriageway may be beneficial. If such lining is provided it should be ensured that sufficient traffic lane widths can be maintained along the route.

3.9 Road Studs

3.9.1 Road studs are installed within the gaps of the central hatch road markings over the length of the route that had its speed limit reduced from 60mph to 40mph during January 2021. The majority of the road studs are original form single ended studs, with a small number of newer 'stick down' studs provided in areas where the carriageway surface has been resurfaced/repaired. The road studs were observed to be in generally good condition, though a small number were observed to be missing. The missing studs were located at chainages 161m (southbound), 211m (northbound) and 340m (southbound). It is recommended that CCBC review these locations and undertake appropriate remedial action if/as required.

3.9.2 As outlined within the 'Road Markings' section, if the 9m central hatch road marking modules are replaced by 6m modules, the road stud layout will also require modifying. Although CCBC's policy on road studs is not known, it is noted that road studs are not provided on the original short length of 40mph speed limited located south of Gelligroes roundabout. As such, CCBC may wish to consider whether it is necessary to re-provide road studs within the newer section of 40mph if the road marking modules are changed.

3.10 Signing

3.10.1 Various traffic signs are provided on the study route, including speed limit signs, associated repeater signs, direction signs, bend warning signs and chevron signing. The condition of the signing was observed to be generally good, though the following observations are made:

- Chainage 0m – The 30mph speed limit terminal signs and safety camera signs are legible but would benefit from cleaning. One of the four marker posts (northbound) at the gateway entry treatment is missing;
- Chainage 100m – Road narrows sign on the eastern side of the road is leaning away from the carriageway. The sign face would also benefit from cleaning;
- Chainage 110m – Although legible, the speed limit countdown signs (one bar) on both sides of the road are dirty and would benefit from cleaning;

- Chainage 211m – Although legible, the speed limit countdown signs (two bars) on both sides of the road are dirty and would benefit from cleaning;
- Chainage 265m – Chevron sign on the eastern side of the road appears to have sustained minor damage to its corners, potentially caused by passing vehicles. The sign face would also benefit from cleaning;
- Chainage 286m – Chevron sign on the eastern side of the road appears to have sustained minor damage to the top right corner, potentially caused by passing vehicles;
- Chainage 322m – Although legible, the speed limit countdown signs (three bars) on both sides of the road are dirty and would benefit from cleaning. The sign on the western side of the road is located behind a timber post and rail fence;
- Chainage 816m – Northbound chevron sign face missing;
- Chainage 840m – Chevron sign on the eastern side of the road has sustained some minor damage. The sign face would also benefit from cleaning;
- Chainage 1558m – The Gelligroes roundabout Advance Direction Sign (ADS) is legible but not in good condition. Some letters at the bottom right corner of the sign face are faded/have peeled off. Potentially the sign has previously been subject to graffiti and the removal of this may have damaged the retro-reflectivity of the sign face. The coating on the sign posts is also coming off and showing rusted steel beneath. The ADS is also located approximately 275m in advance of the roundabout which is much further away than the 90-150m siting distance recommended within the '*Traffic Signs Manual: Chapter 7*' (DfT, 2018). It may be difficult to position the ADS closer to the recommended siting distance due to the steep/rocky embankment and adjacent vegetation. Visibility of the sign face is also partially obstructed by the lighting column/speed limit sign located in front of the ADS as well as by overhanging vegetation;
- Chainage 1665m – Bus stop sign missing at the bus stop on the western side of the road;
- Chainage 1749m – The series of bends ahead warning sign (Diagram 513) for one mile located on the eastern side of the road has a well-rusted post. The sign face also has the potential to be masked by adjacent vegetation, particularly during the summer months. The supplementary 'for one mile' plate is only provided in English, whilst the corresponding sign at the opposite end of the bends in Ynysddu is bi-lingual;
- Chainage 1774m – Visibility of the direction signs to the hotel, golf course and Wyllie is very poor due to masking by the bus shelter and adjacent vegetation. The signs are also positioned at a mounting height of approximately 1500mm which is unsuitable for a location adjacent to a footway. The sign posts are also in a poor condition (rusting);

- Chainage 1780m – The illuminated two-way traffic sign (Diagram 521) on the eastern side of the road is completely obscured by foliage. It is unclear why this sign is required.
- Chainage 1815m – Direction sign to Gelligroes Mill on the western side of the road is partially obscured by adjacent buses/shrubs; and
- Chainage 1825m – Some minor damage (peeling) to the weight limit / end of clearway signs located on the western side of the road. These signs are also not bi-lingual.

3.10.2 It is recommended that CCBC review the above items and undertake appropriate remedial action if/as required.

3.10.3 In addition to the above, it considered that improvements/modifications to the existing signing arrangements could be made on the route; these being:

3.10.4 **Speed limit signing** – A speed limit signing inconsistency was identified at the location of the previous 40mph/60mph speed limit terminal point (chainage 1540m). At this location, illuminated 40mph terminal speed limit signs are provided rather than standard un-lit, smaller speed limit repeater signs. This could give the incorrect impression to approaching drivers that they are entering a new speed limit when in fact the signs are just intended to provide a reminder of the existing 40mph speed limit. It is recommended that the existing signs are replaced with standard speed limit repeater signing at this location.

3.10.5 **Chevron signing** – Chevron signing to Diagram 515 (including yellow backing boards) was provided at the most severe bends along the route during the summer of 2020. Good forward visibility of the signs is provided and they help to improve the conspicuity of the bends. However, several of the sign faces had sustained minor damage, most likely caused by passing vehicles and potentially some of the signing is located too close to the edge of carriageway. As such, it recommended that the positions of all chevron signing is reviewed and, if required, relocated as appropriate.

3.11 Road Lighting

3.11.1 A system of LED road lighting is provided throughout the study route. As per CCBC's part night lighting policy, all lights are switched off between approximately 00:00-05:30. At the time of the site inspection during darkness (18:45-19:15), all lighting columns were illuminated. The following observations in terms of road lighting are made:

- Chainage 0m – Lighting column adjacent to the speed limit signs has potential for its lantern to be obscured by an adjacent tree;
- Chainage 322m – Lantern of lighting column on the eastern side of the road is close to the tree canopy;
- Chainage 565m – Lantern at this location is below the winter tree canopy and the cover to the electrical housing on the column is loose and secured with tape;
- Chainage 1286m – Lighting column on the eastern side of the road appears to be leaning away from the carriageway slightly and also to the right;

- Chainage 1346m, 1445m and 1478m – The three lighting columns on the eastern side of the road appear to be leaning away from the carriageway slightly;
- Chainage 1774m – Foliage growing around the base of the lighting column on the western side of the road, potentially obscuring light from reaching the footway and the western side of the northbound lane; and
- Chainage 1825m – Foliage growing around the base of the lighting column on the eastern side of the road, potentially obscuring light from reaching the footway and parts of the carriageway.

3.11.2 It is recommended that CCBC review the above items and undertake appropriate remedial action if/as required. This review should be prioritised given the history of dark collisions on the route.

3.12 Road Restraint System

3.12.1 An approximate 55m length (chainage 1110 to 1165m) of vehicle barrier (Open Box Beam) is located on the eastern side of the B4251 to the north of the river over-bridge. It is assumed that this has been installed to protect road users from the bridge parapet after exiting bend 6.

3.12.2 With reference to the vehicle barrier, the '*Caerphilly CBC – B4251 Safety Improvement Study*' outlines that "*the barrier begins with a ramped terminal facing oncoming traffic which does not comply with current standards which do not allow ramped terminals to be used on roads with speed limits above 50mph. In its current configuration the barrier will prevent motorists who leave the carriageway from impacting the bridge parapet, but likely "launch" the vehicle over the parapet and into the river below. This creates a serious hazard should motorists lose control while exiting the bend*." (Amey Consulting, 2020).

3.12.3 Although the speed limit has been reduced to 40mph, the ramped terminal remains and the risk of launching an errant southbound vehicle towards the river remains. The CCBC '*Cabinet Report 9th February 2022: B4251 Ynysddu to Wyllie Highway Improvement*' (CCBC, 2022) identifies that the Council have a capital programme to address this at this site and other similar sites. A CCBC update provided to LTP as part of this commission confirmed that the terminal/barrier is to be replaced and an installation date is awaited.

3.12.4 A Road Restraint System (RRS) Assessment for the study route is provided within Section 5 of this document.

3.13 Fencing

3.13.1 A steel post and chain-link fence is provided along sections of the route between Heolddu Road and Wyllie. This was installed during June/July 2022 and is provided on the same side of the road as the Sirhowy River (i.e.; north of the river over-bridge the fence is on the eastern side and is on the western side to the south). Visually, the fencing provides a level of delineation between the back of the highway and adjacent embankment areas/trees. The fencing was observed to be in generally good condition. Although the fencing may offer some edge protection to errant vehicles, it is not provided with vehicle restraining properties.

3.13.2 Generally short sections of timber post and rail fence are provided at some other locations along the route and was observed to be in generally good condition. Although not known for certain, the fencing is likely to have been provided to offer some protection from specific hazards.

3.14 Any Other Safety Criteria / Features / Observations

3.14.1 Although generally reflective of the rural nature of the B4251, it is noted that there is very little provision for Non-Motorised Users (NMUs) (i.e.; cyclists and pedestrians) along the study route. No specific facilities for cyclists are provided, though very few cyclists were observed at the time of the site inspections and there is no known collision history involving cyclists.

3.14.2 A continuous footway is provided along the western side of the B4251 and is likely to be able to suitably accommodate the pedestrian demand on the route. A footway is provided on the eastern side at isolated locations only. At approximate chainages of 400m and 1760m, bus stops are provided on both sides of the road. However, no pedestrian crossing facilities (i.e.; dropped kerbs and tactile paving) are provided between the bus stops. Given this, people with disabilities, the elderly and those with physical/visual impairments may experience difficulties when attempting to cross the B4251 at these locations. It is noted that there does not appear to be a recorded collision history associated with pedestrians attempting to cross the B4251 at these locations, but the provision of crossing facilities would provide an enhanced level of service.

3.14.3 On the western side of the B4251, an uncontrolled pedestrian crossing point (dropped kerbs and tactile paving) is provided across a side road access at chainage 1545m. The tactile paving does not appear to be correctly aligned and the crossing point is not sufficiently visible due to verge encroachment/leaf debris.

3.14.4 It is recommended that CCBC review the above comments as appropriate.

4. ROAD SAFETY REVIEW – CONCLUSIONS & RECOMMENDATIONS

4.1 Road Safety Review Conclusions & Recommendations

4.1.1 The Road Safety Review has not identified any major road safety issues on the approximate 1.8km length of the B4251 between Gelligroes and Ynysddu. Some suggested improvements have been identified along with some minor defects/issues/items which are generally maintenance related. This information is summarised within Table 13 and it is recommended that it is reviewed and afforded further consideration by CCBC.

Table 13: Road Safety Review Items for Consideration by CCBC

Item	Rpt Ref	Comments	
Vehicle speeds	2.2	Mean speeds are consistent with the posted 40mph speed limit	
Vehicle flows	2.3	Average daily weekday flows are around 10,000 vehicles per day	
Collision record	2.4	Although relatively limited 'after' data is currently available, the route's collision record is much lower since a 40mph speed limit covered the full route. Additional analysis should be undertaken once further 'after' data is available to determine if this improved road safety performance is maintained.	
Item	**Rpt Ref**	**Suggested Improvements / Comments**	**Minor Defects/Issues/Items**
Cross section	3.3	No significant cross section issues identified.	No items identified.
Geometry	3.4	As a local road there is no requirement for strict compliance to DMRB standards. Geometry on the route not considered significantly different from that which can be found at other comparable locations in Caerphilly and across Wales.	No items identified.
Surface condition	3.5	No significant issues identified.	Some minor defects identified mainly relating to carriageway depressions, cracking and potholing. It is recommended that CCBC review these items and undertake appropriate remedial action if/as required.
Carriageway falls & drainage	3.6	No significant issues identified.	Some minor items/issues identified mainly relating to gathered detritus at gullies, evidence of ponded surface water and cracking at gully frames. It is recommended that CCBC review these items and undertake appropriate remedial action if/as required. This should be prioritised given the history of wet road collisions on the route.
Kerbing	3.7	No significant issues identified.	Some minor items/issues identified mainly relating to detritus masking the kerb, kerb upstand inconsistencies and damaged kerbs. It is recommended that CCBC review these items and undertake appropriate remedial action if/as required.
Road markings	3.8	Improvements identified as follows: • Within the length of 40mph speed limit that was provided in January 2021, the central hatch road marking modules should be 6m in length (currently 9m). • Consider provision of edge of carriageway road makings to provide enhanced delineation of the edge of carriageway.	A small number of worn road markings were identified. It is recommended that CCBC review these items and undertake appropriate remedial action if/as required.
Road studs	3.9	No significant issues identified. However, if the central hatch road markings are changed to 6m modules (see 3.8 above), this will require modification of the existing road stud layout.	Road studs were identified to be missing at three locations. It is recommended that CCBC review these locations and undertake appropriate remedial action if/as required.

Item	Rpt Ref	Suggested Improvements	Minor Defects/Issues/Items
Signing	3.10	Improvements identified as follows: • Replace existing 40mph speed limit terminal signs at chainage 1540m with standard 40mph speed limit repeater signs. • Review location of all chevron signing and potentially relocate further away from the edge of carriageway.	Some minor items/issues identified mainly relating to the need for sign face cleaning, minor sign face damage, obscured visibility of signs and lack of bi-lingual information. It is recommended that CCBC review these items and undertake appropriate remedial action if/as required.
Road lighting	3.11	No significant issues identified.	Some minor items/issues identified mainly relating to foliage obscuring lanterns and leaning lighting columns. It is recommended that CCBC review these items and undertake appropriate remedial action if/as required. This should be prioritised given the history of collisions in dark conditions on the route.
Road Restraint System	3.12	Improvement identified as follows: • Ramped terminal at existing vehicle barrier provides a risk of launching vehicles over the bridge parapet. This should be replaced with a suitable crash-friendly end terminal (understood that CCBC have a capital programme to address this).	N/a – a Road Restraint System (RRS) Assessment for the study route is provided within Section 5 of this document.
Fencing	3.13	No significant issues identified.	No items identified.
Any other features	3.14	No significant issues identified.	Although the B4251 is acknowledged to be a rural route, comments made with regards to the level of pedestrian/cycling provision on the route. It is recommended that CCBC review these comments as appropriate.

5. ROAD RESTRAINT SYSTEM (RRS) ASSESSMENT

5.1 Introduction

5.1.1 A Road Restraint System (RRS) Assessment for the approximate 1.8km length of the B4251 between Gelligroes and Ynysddu has been undertaken with reference to '*Provision of Road Restraint Systems on Local Authority Roads*' (PRRSLAR) (UK Roads Liaison Group, 2011). The PRRSLAR guidance provides the outline of an appraisal process to help authorities decide when a RRS is justified. This appraisal "*takes account of the many diverse influencing factors including risk assessment, alternative solutions, system feasibility, cost benefit analysis and the availability of funding*" (UK Roads Liaison Group, 2011).

5.1.2 The DMRB Road Restraint Risk Assessment Process (RRRAP) contained within '*CD 377 Requirements for Road Restraint Systems*' (Highways England, 2021b) which superseded '*TD 19/06 Requirements for Road Restraint Systems*' (Highways Agency 2006) is not considered appropriate for local roads as its application is limited to motorways and all-purpose trunk roads with speed limits of 50mph or more and two-way traffic flows of 5,000 AADT (average annual daily traffic) or more. Although the B4251 has a traffic flow in excess of 5,000 AADT it is subject to a 40mph speed limit (it is also not a motorway or all-purpose trunk road).

5.1.3 The PRRSLAR guidance outlines that the "*application of the risk based approach in that standard* [TD 19/06, subsequently superseded by CD 377] *is likely to result in over use of RRSs and not represent best use of limited resources. TD 19* [and CD 377 which superseded it] *is therefore not suitable for use on the majority of the nation's local road network*" (UK Roads Liaison Group, 2011).

5.2 Previous Assessments / Status of this Current RSS Assessment

5.2.1 Previous RSS Assessments have been undertaken by others as follows:

- October 2019 – '*CCBC Vehicle Restraint System Risk Scoring Assessment*' (CCBC, 2019). This assessment was undertaken when most of the study route was subject to a 60mph speed limit. It is understood that the assessment was undertaken with reference to the PRRSLAR guidance (rather than TD 19/06). The route scored as a medium priority site; and
- March 2020 – '*Caerphilly CBC – B4251 Safety Improvement Study*' (Amey Consulting, 2020). Although a 60mph speed limit was in place on most of the route, a draft risk scoring assessment with reference to the PRRSLAR guidance was undertaken on the assumption that a 40mph speed limit would be implemented on the route. The route scored as a medium priority site.

5.2.2 This current RRS Assessment forms a new assessment and is based on the existing conditions on the route. Where appropriate, this RSS makes use of relevant data/information obtained and analysed as part of the Road Safety Review contained with sections 2 to 4 of this document.

5.3 RRS Assessment – Methodology

5.3.1 The PRRSLAR guidance outlines that "*one of the fundamental criteria to justify provision of a RRS is to establish if the risk level without a RRS is unacceptable*" (UK Roads Liaison Group, 2011). The approach applied in the guidance is to prioritise the assessed site into one of the three groupings shown in Table 14.

Table 14: PRRSLAR Site Risk Categories

Category	Risk Level	Outcomes
Higher priority site	Risk cannot be accepted save in extraordinary circumstances.	Where the risk assessment has defined a site as Higher Priority the installation of a RRS is justified in terms of the level of risk. Further consideration is then required to determine if the site meets the other appraisal criteria. Even at high risk sites non-RRS interventions may reduce the risk to a level where a RRS can be omitted.
Medium priority site	Intervention may be required to introduce control measures to drive residual risk towards the Lower Priority Site category. The residual risk can be tolerated only if further risk reduction is impracticable or requires action that is grossly disproportionate to the reduction in risk achieved.	Where the risk evaluation has identified a site as Medium Priority a RRS may be justified however a non-RRS approach to reducing the risk may prove sufficient to negate the need for a RRS. If suitable effective measures cannot be introduced then the appraisal process would normally continue in order to consider the other criteria.
Lower priority site	Level of risk regarded as generally acceptable. Further effort to reduce risk is not likely to be required as resources to reduce risk would be grossly disproportionate to the risk reduction achieved.	Where the risk evaluation identifies a site that is lower priority further appraisal is not required and the level of risk does not normally support installation of a RRS. Simple low cost measures that could reduce the risk can still be considered.

5.3.2 The guidance provides three different risk assessment methodologies, these being 'accident assessment' (A), 'Network Rail methodology' (B) and 'risk scoring' (C). A detailed appraisal of the collision history on the route has been provided within the Road Safety Review included within this document. A key finding from this was that although relatively limited 'after' data is currently available, the route's collision record is much lower since a 40mph speed limit covered the route and other mitigation measures, such as chevron signing were implemented. Additional analysis should be undertaken once further 'after' data is available to determine if this improved road safety performance is maintained.

5.3.3 In terms of the 'accident assessment' approach, the PRRSLAR guidance outlines that "*in some situations where the existing accident history does not indicate a significant likelihood of a future safety problem there may remain doubts surrounding the non-provision of a RRS particularly where the potential accident cost could be substantially higher than indicated by past accident histories alone e.g. in populous areas. In these situations method C (risk scoring) may further inform the risk categorisation*" (UK Roads Liaison Group, 2011). The guidance also notes that "*if personal injury accidents were easy to predict then a prescriptive set of standards could be produced. The purpose of this process is to assist in categorising the total risk at a site. Common with all forms of risk evaluation and assessment, professional judgement has been required in its development and will be required in subsequent application or adjustment*" (UK Roads Liaison Group, 2011).

5.3.4 Taking the above into account, it is considered that an approach which uses 'risk scoring' but also uses the route intelligence gained from its collision history is most appropriate. This approach also generally aligns with the safe system approach to road safety management which provides a strong focus on managing risk. As advocated by the UK Roads Liaison Group, the PRRSLAR guidance "*can be adapted by local highway authorities to create a pragmatic system for decision making to help them make best use of the finite resources available to them*" (UK Roads Liaison Group, 2011).

5.3.5 The risk scoring categories identified within the PRRSLAR guidance are summarised within Table 15.

Table 15: PRRSLAR Risk Scoring Categories

Total Risk Ranking Score	Category
14 or more	Higher priority
9-13	Medium priority
0-8	Lower priority

5.3.6 As similar roadside hazards are present throughout the route, the assessment has been undertaken on a route basis, with risk scoring assigned on a highest severity outcome basis (i.e.; the most severe hazard is assessed/scored).

5.4 RRS Assessment – Scoring

5.4.1 **Location factor** – The PRRSLAR guidance outlines that in terms of location "*the level of risk will vary based on the type of the route, the speed limit as well as the amount and make-up of traffic on the route. The location factor collectively considers all of these issues, acts as a proxy for the probability of a vehicle leaving the carriageway and results in a risk score that represents the nature of the road adjacent to the hazard in question*" (UK Roads Liaison Group, 2011). The location factor score for the study route is provided within Table 16.

Table 16: Location Factor Scoring

Priority Rank	Risk Factor Score
0 – All other roads	0
1 – Rural U and B roads and urban C roads	**1**
2 – Rural A road and urban B road	3
3 – Urban A road	6
Notes on scoring – The B4251 is a rural B road subject to a 40mph speed limit and carries around 10,000 vehicles per day.	

5.4.2 **Layout factor (part 1)** – The first layout factor relates to bend radius. The PRRSLAR guidance outlines that "*fully assessing risk at bends is not a simple matter. According to published accident information, the majority of run-off accidents are not reported at bends, although the vast majority of accidents are not subject to a detailed scientific assessment of the features that make up road alignment. In fully assessing the risk at bends, it is necessary to consider the approach speeds, the bend radius, the superelevation, the influence of transition curves as well as the surface characteristics. An additional consideration is whether a series of more generous bends precedes a tighter bend resulting in over-confidence of the road user*" (UK Roads Liaison Group, 2011). The layout factor (part 1) score for the study route is provided within Table 17.

Table 17: Layout Factor (Part 1) Scoring

Priority Rank	Risk Factor Score
0 – Straight alignment and/or complies with TD9	0
1 – One step below desirable minimum R with superelevation of 5%	1
2 – Two steps below desirable minimum R with superelevation of 5%	2
3 – Three steps below desirable minimum R with superelevation of 5%	**3**
4 – Four steps below desirable minimum R with superelevation of 5%	4
5 – Five steps below desirable minimum R with superelevation of 5%	5
Notes on scoring – Bend radius on the route varies with some a small margin below desirable minimums and others some way below desirable minimums. Vehicle speed data on the route shows speeds to be in line with the speed limit which was reduced to 40mph in January 2021. Chevron signing has been provided at the most severe bends (summer 2020). Road surface conditions have been assessed as good/very good across the route.	

5.4.3 **Layout factor (part 2)** – The second layout factor relates to the complexity of the carriageway layout. The layout factor (part 2) score for the study route is provided within Table 18.

Table 18: Layout Factor (Part 2) Scoring

Priority Rank	Risk Factor Score
0 – No reason for lane changing/manoeuvres	**0**
1 – Some potential for lane changing, overtaking, positioning manoeuvres or avoiding action	2
2 – High likelihood of lane changing, overtaking, positioning manoeuvres or avoiding action	3
Notes on scoring – The route (on straights and at bends) is a two-lane single carriageway and no incidences of overtaking where observed during the site inspections. Traffic was observed to flow freely on the route and at a reasonable speed and, as such, there is no real demand for overtaking manoeuvres. The route alignment also provides few realistic opportunities for overtaking. There is no overtaking collision history associated with the route.	

5.4.4 **Collision factor (part 1: longitudinal features)** – The PRRSLAR guidance outlines considers that "*a spot hazard such as a traffic sign post or lighting column provides less of an obstruction than a longitudinal hazard such as a retaining wall or parallel canal*" (UK Roads Liaison Group, 2011). The collision factor (part 1) score for the study route is provided within Table 19.

Table 19: Collision Factor (Part 1: Longitudinal Features) Scoring

Priority Rank	Risk Factor Score
0 – Individual spot hazard	0
1 – Series of individual hazards less than 50m apart or a longitudinal hazard that might be reached	**1**
2 – Longitudinal hazard that is highly likely to be reached resulting in harm or a spot hazard downstream of a feature which may guide the vehicle towards the hazard	2
Notes on scoring – There are spot hazards at regular intervals along the route (on straights and at bends), including mature trees, steep embankment areas and lighting columns. There are also longitudinal hazards along the route such as masonry walls, bridge parapets (protected on one side by vehicle barriers) and the Sirhowy River which is at a significantly lower level than the carriageway. Collision record identifies that collision with spot hazards (i.e.; trees) is much more likely than reaching and colliding with longitudinal hazards.	

5.4.5 **Collision factor (part 2: severity of outcomes)** – The second collision factor relates to the likely severity of a collision with a roadside hazard. The collision factor (part 2) score for the study route is provided within Table 20.

Table 20: Collision Factor (Part 2: Severity of Outcomes) Scoring

Priority Rank	Risk Factor Score
0 – Percentage of KSI for primary hazard <20%	0
1 – Percentage of KSI for primary hazard 20 - 30%	**1**
2 – Percentage of KSI for primary hazard >30%	2
Notes on scoring – During the most recent 10-years there have been 17 injury collisions recorded on the route of which 5 were fatal (2) or serious (3) in severity. This equates to a KSI ratio of 29.4%.	

5.4.6 **Consequential factor (part 1: secondary incidents)** – The PRRSLAR guidance describes how "*in some cases an initial collision may result in a secondary event that creates a hazard for other road users and increases the risk of a secondary incident. This may be because of a collapse of the primary hazard when struck and may be particularly relevant for example for a pylon carrying power lines, telegraph poles or street lighting columns that may collapse onto the main carriageway or an adjacent route*" (UK Roads Liaison Group, 2011). The consequential factor (part 1) score for the study route is provided within Table 21.

Table 21: Consequential Factor (Part 1: Secondary Incidents) Scoring

Priority Rank	Risk Factor Score
0 – No secondary events likely	**0**
1 – When damaged or collapsed the feature could give rise to the risk of secondary vehicular accidents	1
Notes on scoring – Unlikely that damaged or collapsed features would give rise to secondary vehicular accidents. There is also no evidence of this within the route's collision history.	

5.4.7 **Consequential factor (part 2: network disruption)** – The second consequential factor relates to the potential for a collision to result in network disruption. The PRRSLAR guidance outlines that "*the disruption could be caused by the carriageway being blocked by the collapse of the impacted feature, or in some cases damage to highway infrastructure may result in lane and/or speed restrictions of more than one day*" (UK Roads Liaison Group, 2011). The consequential factor (part 2) score for the study route is provided within Table 22.

Table 22: Consequential Factor (Part 2: Network Disruption) Scoring

Priority Rank	Risk Factor Score
0 – No impact on network availability	0
1 – If hazardous feature was damaged or collapses this could give rise to network disruption for more than one day	**1**
Notes on scoring – For the majority of the route, including at bends, a collision would not be expected to give rise to network disruption for more than one day. However, if the bridge parapet was struck this has the potential to impact the structural integrity of the bridge and network disruption could be experienced over an elongated period.	

5.4.8 **Consequential factor (part 3: cost of damage)** – The third consequential factor relates to the resultant cost of repair or replacement of the infrastructure at risk of impact. The consequential factor (part 3) score for the study route is provided within Table 23.

Table 23: Consequential Factor (Part 3: Cost of Damage) Scoring

Priority Rank	Risk Factor Score
0 – No significant cost implications	0
1 – Significant cost of repair or replacement following collision	**1**
Notes on scoring – Damage to bridge parapets could carry a significant cost of repair. Elsewhere, cost implications of repairs are likely to be much less significant.	

5.4.9 **Total score** – As per the PRRSLAR guidance, the total risk rating is based on the addition of the following factors:

- Location factor (score of 0-6) plus;
- Layout factors (largest of part 1 and part 2 scores) plus;
- Collision factors (sum of part 1 and part 2 scores) plus;
- Consequential factors (sum of part 1, part 2 and part 3 scores).

5.4.10 The total score for the study route is provided within Table 24.

Table 24: RRS Scoring Matrix Summary

Risk Factor	Risk Factor Score
Location	1
Layout (1)	3
Layout (2)	0
Collision (1)	1
Collision (2)	1
Consequential (1)	0
Consequential (2)	1
Consequential (3)	1
Total	**8**

5.4.11 Based on the recommended upper and lower bounds for the risk classifications provided within the PRRSLAR guidance, a score of 8 equates to a 'Lower Priority' category (scores of between 0 and 8).

5.4.12 The suggested outcome within the PRRSLAR guidance for a lower priority site is: "*where the risk evaluation identifies a site that is lower priority further appraisal is not required and the level of risk does not normally support installation of a RRS. Simple low cost measures that could reduce the risk can still be considered*" (UK Roads Liaison Group, 2011).

5.5 RRS Assessment – Summary

5.5.1 Although previously assessed by others as a medium priority site, it is considered that the recent non-RRS interventions (e.g.; 40mph speed limit, chevron signing, localised resurfacing) have contributed to reducing risk on the route to the lower priority category. The findings of this assessment are presented to CCBC for their consideration and comment as appropriate.

6. REFERENCES

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Appendix 1 – ATC Data (Available upon Request)

Appendix 2 – Collision Plot (Available upon Request)