

A737 St James to  
Kilbarchan Collision Study  
SCOTTISH TRUNK ROAD  
NETWORK - SOUTH WEST UNIT  
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## Executive Summary

As part of the Network Management Contract for the management and maintenance of the Scottish Trunk Road Network (South West Unit), Amey has been commissioned by Transport Scotland to undertake a road safety study to develop proposals aimed at reducing the number and severity of collisions on the A737 trunk road between St James Interchange and Kilbarchan Junction. This section combines several links and cluster sites identified as part of the 2021 Annual Road Safety Report produced by Amey.

This report works toward developing a **road network that considers the Transport Scotland 'Policy Problems' listed below and aims to reduce the risk of harm to the general public and damage to crown property:**

- adopt an approach that aims to prevent collisions with a better outcome if an incident or accident occurs
- provide safe systems that benefit the public and the operating company maintenance operatives thus embracing Construction Design and Management principles
- acquire, maintaining and protecting the existing/proposed Transport Scotland assets.

In addition to the above, reducing the risk of collisions to the travelling public will reduce the number of incidents and accidents within the network thus increasing network resilience and reducing the burden on the health service and society following a road traffic collision.

This report is based on the five-year period between 1<sup>st</sup> September 2016 and 31<sup>st</sup> August 2021 where a total of 32 personal injury collisions were identified within the study period. Analysis of the collision information shows that the following locations of the A737 trunk road contributed to 30 of the 32 (94%) collisions within this study and have been investigated further:

- A737 Mainline between St James Interchange and Kilbarchan Junction – 16 Collisions
- A737 St James Interchange Slip Roads – 7 Collisions
- A737 Linclive Junction Slip Roads – 7 Collisions.

Following this analysis, several interventions have been recommended that support the Scottish **Government's targets for 'Scotland to have the best road safety performance in the world'** <sup>1</sup> and the interim targets for 2030 included therein.

**Aligning with the actions contained within Transport Scotland's Strategic Road Safety Plan (2016),** the following interventions are recommended:

- Install improved road markings (WeatherLine or RainSafe) and new studs on the A737 mainline between St James Interchange and Kilbarchan junction to improve the conspicuity of the road layout during dark and wet conditions.

- Introduction of Solar studs to further enhance the road layout even with street lighting present.
- Install vehicle actuated signs at three locations in each direction to help reduce vehicle speeds on the A737 mainline between St James Interchange and Kilbarchan junction.
- On the A737 St James Interchange northbound off-slip it is recommended to install 40mph repeater signs, roundabout warning signs, lane destination signs, chevron signs and a sight screen as well as road marking improvements and vegetation cut back on the left-hand bend.
- Improved road markings on the A737 Linclive Junction northbound on-slip to provide a clear reduction from two lanes to a single lane prior to the A737 merge.

The following are recommendations for further investigations to upgrade the existing road network and provide improvements in line with the Safe System Approach to Road Safety or Active Travel :

- Consultation with Renfrewshire Council with regards to the potential signalisation of the A737 northbound off-slip entry arm to St James Interchange roundabout.
- Topographical survey of the A737 southbound on-slip from St James Interchange at the merge with the A737 mainline to determine if any improvements can be made to the road markings at the merge within the current footprint.
- Topographical survey of the A737 northbound off-slip at Linclive Junction to determine if the wide single lane can be changed to two for a greater length.
- Topographical survey of the A737 southbound on-slip and exit from Linclive Roundabout to determine if the wide single lane can be reduced to include a lane plus a hard shoulder
- Consultation with Renfrewshire Council and further investigations into providing signalised pedestrian crossings on the northern A737 slip roads at Linclive Junction to provide a safer active travel route. This would include pedestrian surveys at the roundabout

Additionally, it is recommended that Safe System Approach to Road Safety improvements are implemented on the A737 mainline, A737 St James Interchange slip roads and A737 Linclive Junction slip roads. These improvements consist of passive safety upgrades to road signs, passive safety upgrades to street lighting columns and upgrading sub-standard vehicle restraint system terminals.

The estimated total costs of the collision remedial measures are £442,500 providing an overall First Year Rate of Return value of 128%. The estimated cost of the Safe System measures is £1,044,000.

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<sup>1</sup> Scotland's Road Safety Framework to 2030



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## 1 Introduction

- 1.1.1 The Scottish Government has set out a long-term goal for road safety where no-one dies or is seriously injured by 2050. As part of the safer roads and roadsides pillar within the safe system approach to road safety, the Annual Road Safety Review Report screens accident records and identifies accident cluster sites and links that require further investigation.
- 1.1.2 As part of the Network Management Contract for the management and maintenance of the Scottish Trunk Road Network (South West Unit), the 2021 Annual Road Safety Report undertaken by Amey, identified the A737 trunk road between St James Interchange and Kilbarchan junction as a section that meets the criteria for a road safety study due to several personal injury collisions occurring in recent years. Figure 1-1 details the location of the study.



Figure 1-1 – Location Plan

- 1.1.3 The A737 trunk road within the study location is a two-way dual carriageway with grade separated junctions and street lighting for a total length of 6.2km. The speed limit for the mainline is a National Speed Limit and there are four grade separated junctions (St James Interchange, Linclive, Barrochan and Kilbarchan) where the slip roads have individual speed limits.
- 1.1.4 An automatic traffic counter located between Linclive and Barrochan junctions shows that this section of the A737 has an annual average daily traffic flow (AADT) of 41,302 vehicles (2021) with approximately 5.5% being heavy goods vehicles (HGVs). This counter shows average speeds of 64mph on this section. Traffic flow in the northbound direction peaks at approximately 1,200vph in the AM peak (07:00 to 08:00) and then fluctuates between 800vph and 1000vph for the majority of the day until 18:00. The southbound traffic flow rises to 1,400vph in the AM peak (08:00 to 09:00) before further increased to a peak of 2,900vph in the PM peak (16:00 to 17:00).
- 1.1.5 This study has been undertaken to identify the cause of these collisions and, where appropriate, make recommendations to reduce the number of future incidents, potential risks and casualty severity on the A737 trunk road between St James Interchange and Kilbarchan Junction.
- 1.1.6 The review of the collisions from the five-year period between 1<sup>st</sup> September 2016 and 31<sup>st</sup> August 2021 showed a total of 32 recorded personal injury collisions. A breakdown of the collision severity is shown below in Table 1-1.

Table 1-1 – Severity of Personal Injury Collisions

Year	Slight	Serious	Fatal	Total	Percentage
2016*	1	0	0	1	3%
2017	7	1	0	8	25%
2018	5	1	0	6	19%
2019	7	2	0	9	28%
2020	3	1	0	4	13%
2021*	3	1	0	4	13%
Total	26	6	0	32	-
Percentage	81%	19%	0%	-	-

\*Partial year



## 2 Collision Analysis

### 2.1 Overview of Collisions

2.1.1 Details of the recorded collisions were sourced from Transport **Scotland's WebIRIS**. The five-year period between 1<sup>st</sup> September 2016 and 31<sup>st</sup> August 2021 has been included for analysis.

2.1.2 Personal injury collisions are defined as the following:

- Fatal accident – where the level of injuries sustained cause death within 30 days of the accident
- Serious accident – where the injuries sustained cause death after 30 days of the accident, where the person has been detained in hospital, or sustained a fracture, concussion, internal injuries, crushing, severe cuts or lacerations, or severe shock
- Slight accident – where a person has sustained injuries that are neither fatal or serious, e.g., sprains, bruising or slight shock requiring roadside attention.

2.1.3 During the study period there were 32 reported personal injury collisions comprising six serious collisions and 26 collisions which were slight in severity, as shown previously in Table 1-1.

2.1.4 It is noted that within the investigation period a total of 107 personal injury collisions have occurred on the whole length of the A737 trunk road, meaning that this investigation accounts for 30% of these collisions. The total length of the A737 trunk road is **32.2km, therefore 30% of all collisions occurred within 19% of the route's length** within the study extents. This highlights the increased risk of a collision occurring within this section of the A737.

2.1.5 The location of the collisions is shown in Figure 2-1 below. A summary of the collision analysis findings has been provided in Table 2-1 below and full details of the collisions are within Appendix A.

2.1.6 Referring to Table 2-1 below, the dark and wet accident rates are comparable to the national and network-wide averages discussed in Section 2.2 below.

Table 2-1 – Collision Analysis Summary

Condition	All Severity		KSI		Slight	
	No.	%	No.	%	No.	%
Daylight	21	66	3	50	18	69
Darkness	11	34	3	50	8	31
Dry Surface	18	56	4	67	14	54
Wet Surface	14	44	2	33	12	46



Figure 2-1 – Collision Plot A737 St James to Kilbarchan

Key:  
 Slight Collision ●  
 Serious Collision ●  
 Fatal Collision ●

## 2.2 Wet & Dark Accidents

- 2.2.1 Of the 32 recorded collisions, 14 (44%) occurred on a wet road surface and 11 (34%) occurred during the hours of darkness. Eight of those collisions occurred during both wet and dark conditions. This gives a total of 17 collisions in wet or dark conditions. It should however be noted that the section of the A737 within the scheme extents has street lighting present.
- 2.2.2 This has been compared to the national statistics for non-built-up roads (Reported Road Casualties Scotland 2019 (RRCS2019)) and network-wide collision statistics (Annual Road Safety Review 2021 (ARSR21)) to understand if this site is over-represented for accidents in these conditions and the recorded collisions are statistically significant.
- 2.2.3 The analysis shown in Table 2-2 below suggests that there is a slight over representation in wet collisions within the study area when compared to the South West Network and RRCS 2019 average. There is also an over representation in collisions which occurred during the hours of darkness within the study extents when compared to the South West Network and RRCS 2019 averages.
- 2.2.4 It is therefore recommended that measures to improve the visibility of the road alignment during the hours of darkness and wet road conditions are considered.

Table 2-2 – Wet & Dark Collision Comparisons

Condition	Site		ARSR21		RRCS 2019
	Number	%	A737 %	South West %	National %
Wet collisions	14	44	44	36	42
Dark collisions	11	34	29	26	26

## 2.3 Casualties by Mode & Age

- 2.3.1 An analysis of casualties by mode of transport and age group has been conducted to understand if there are any casualty, vehicle or age groups which are over-represented within the study extents when compared to the RRCS 2019 average. The results of the analysis are shown within Tables 2-3 and 2-4 below.
- 2.3.2 From Table 2-3 it can be concluded that there are no clear over representations within the study when compared to the national averages for casualty transport modes.
- 2.3.3 Referring to Table 2-4 there are also no clear over representations within casualties by age group when compared with the national average.

2.3.4 However, individual user groups will be investigated further as part of the focussed investigation throughout this report.

Table 2-3 – Casualties by Transport Mode

Transport Mode	Number	%	RRCS 2019 %
Pedestrian	0	0	16
Pedal Cycle	0	0	8
Motorcycle	4	6	7
Car	55	87	60
Other	4	6	9

Table 2-4 – Casualties by Age Group

Age Group	Number	%	RRCS 2019 %
0-15	2	5	10
16-22	4	10	13
23-59	30	71	58
60+	6	14	19

## 2.4 Breakdown of Collision Location

2.4.1 Table 2-5 provides a breakdown of the recorded collisions and their associated location within the study extents. It can be seen from the below breakdown that the 32 collisions are spread across various sections. From this data and with a collision cluster for investigation generally regarded as three collisions (within a 100m radius) or more, it is proposed to further investigate the A737 mainline, St James Interchange slip roads and Lincrive Junction slip roads.

Table 2-5 – Collisions by Location

Location	No. Collisions
A737 Mainline	16
St James Interchange NB Off-Slip	3
St James Interchange SB On-Slip	4
Lincrive NB Off-Slip	1
Lincrive NB On-Slip	3
Lincrive SB Off-Slip	1
Lincrive SB On-Slip	2
Barrochan NB Off-Slip	1
Barrochan NB On-Slip	0
Barrochan SB Off-Slip	1
Barrochan SB On-Slip	0
Kilbarchan Off-Slip	0
Kilbarchan On-Slip	0

### 3 Mainline Collision Review

#### 3.1 Overview

3.1.1 A total of 16 collisions were recorded on the A737 mainline between St James Interchange and Kilbarchan junction. Of these, four were serious injury collisions and 12 were slight in severity. These collisions are shown in Figure 3-1 below.

3.1.2 Of the 16 collisions, seven occurred in the southbound direction and nine collisions occurred northbound. It can be seen from the recorded collisions that there was a total of 23 casualties.

3.1.3 A review of the times of the collisions was undertaken and it was highlighted that five collisions occurred during the typical PM peak traffic hours (16:00 to 18:00) and two collisions during the typical AM peak traffic hours (07:00-09:00). This means that nine of the collisions occurred out with the peak traffic hours.

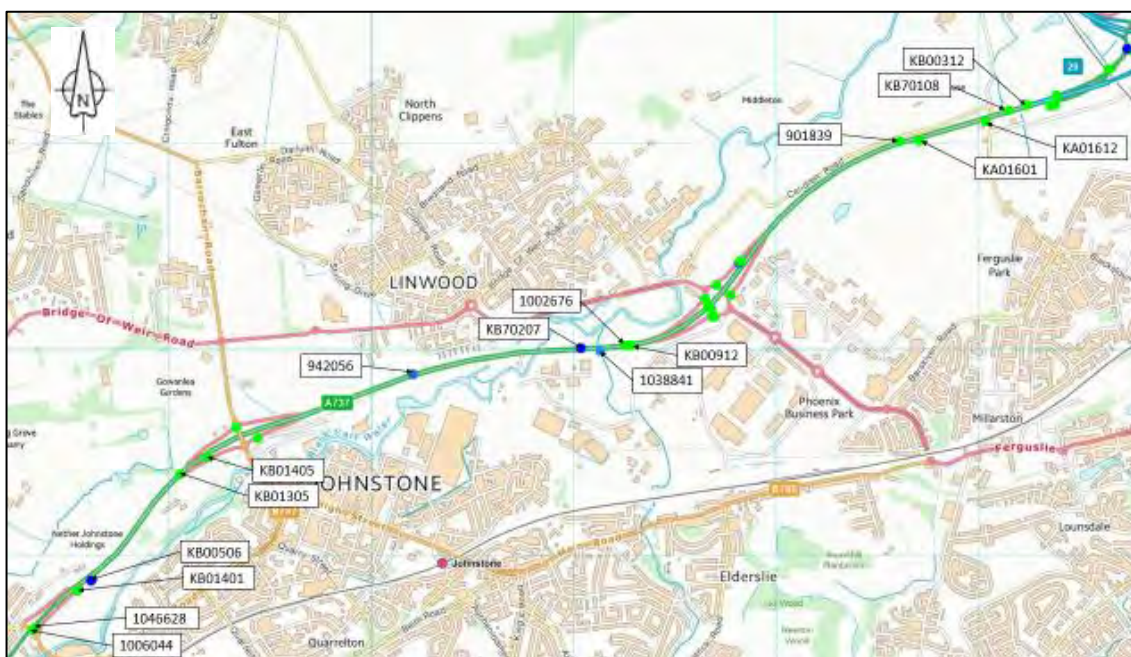


Figure 3-1 – A737 St James to Kilbarchan Mainline Collision Plan

- 3.1.4 As part of the Safe System Approach to Road Safety, this section of the A737 has been reviewed to identify any possible measures to improve the safety of the road and roadsides where possible. It should be noted that although these improvements may not directly link to collisions within this report, they will ultimately reduce the risk of collisions and reduce the severity of injury should a collision occur. Several measures have been identified on this section of the A737 including passive safety upgrades to the street lighting columns and road signs and the replacement of sub-standard P1 vehicle restraint system (VRS) terminal ends. Figure 3-2 below shows an example of non-passively safe street lighting columns and road signs alongside a sub-standard P1 VRS terminal.
- 3.1.5 The Safe System Approach to Road Safety measures are further discussed in Chapter 9.



Figure 3-2 – A737 Mainline Northbound Verge Safe System Defects

## 3.2 Road and Light Conditions

- 3.2.1 A review was undertaken of the carriageway surface (weather) and light conditions, to determine if these had an impact on the 16 personal injury mainline collisions. See Tables 3-1 and 3-2 below.



Table 3-1 - Mainline Carriageway Surface Conditions Collision Numbers

	Number	%	RRCS 2019	SW Unit Average	A737 Route Average
Wet	8	50%	42%	36%	44%
Dry	8	50%	58%	64%	56%
Total	16				

Table 3-2 – Mainline Lighting Conditions Collision Numbers

	Number	%	RRCS 2019	SW Unit Average	A737 Route Average
Dark	8	50%	26%	26%	29%
Light	7	44%	74%	74%	64%
Unknown	1	6%	-	-	7%
Total	16				

3.2.2 It can be seen from Tables 3-1 and 3-2 those collisions in wet surface conditions and in darkness are overrepresented against the RRCS 2019 and SW unit averages. However, it is also notable that for this investigation period they are above the percentage of collisions in these conditions for the A737, showing that this section can be considered to having a higher-than-average contribution to these collisions. As discussed in 2.1.4 this section comprises only 19% of the length of the route but 30% of collisions for the route, further highlighting this higher-than-average contribution.

3.2.3 Five of the collisions occurred in both wet surface conditions and during the hours of darkness. This means that of the 16 collisions, 11 (69%) of the collisions were in either wet, dark or both conditions.

3.2.4 Whilst the level of dark accidents is above these percentages, it should be noted that the whole section has street lighting, which was upgraded to LED lanterns in the last SW Unit contract. This work was undertaken between 2015 to 2018. The street lighting throughout is combined with static road stud provision. Table 3-3 below shows the breakdown of dark collision by year for this investigation.

Table 3-3 – Dark Collisions by Year

Year	Number
2016	0
2017	5
2018	3
2019	3
2020	3
2021	2

← 2018 – Completion of LED upgrade



3.2.5 It can be seen from Table 3-3 above that the dark collisions are evenly spread before and after the 2018 completion of upgrading the street lighting to LED standard, with collisions during the hours of darkness continuing to occur. This could suggest that the street lighting effectiveness in highlighting the road alignment is limited at this location.

3.2.6 It should be noted that for the majority of 2020, Scotland was under lockdown due to the COVID 19 pandemic and therefore travel habits and traffic flow would be considerably lower than previous years. However, the level of collisions on this section remained consistent with previous years.

3.2.7 The existing road markings and studs have been surveyed and appear to be in poor condition and insufficient, particularly in dark and wet conditions.

### 3.3 Contributory Factors

3.3.1 Further investigation of the 16 mainline collisions, was undertaken by reviewing the contributory factors recorded, to determine if any were overrepresented and could give further insight towards identifying the measures required to prevent these collisions occurring in the future. Table 3-4 below details the factors that contributed to the collisions on the A737 in the five-year period. It should be noted that one collision can have several contributory factors.

Table 3-4 – A737 Mainline Contributory Factors

Contributory Factor	Number	% age	RRCS % age
Road Layout	1	3%	2%
Impaired by Alcohol	2	6%	2%
Fatigue	1	3%	1%
Exceeding Speed Limit	3	9%	2%
Loss of Control	3	9%	7%
Distraction in Vehicle	1	3%	1%
Deposit on Road	1	3%	1%
Failed to Look Properly	3	9%	16%
Temporary Road Layout	3	9%	0%
Nervous/Uncertain/Panic	1	3%	1%
Following too Close	2	6%	2%
Sudden Braking	1	3%	2%
Illness or Disability	2	6%	1%
Careless/Reckless/In a Hurry	1	3%	7%
Poor Turn or Manoeuvre	2	6%	6%
Swerved	1	3%	2%
Impaired by Drugs	1	3%	1%
Dazzling Sun	1	3%	2%
Slippery Road	1	3%	5%
Failed to Judge Other Person's Path or Speed	2	6%	9%
** Values in Red highlight those above RRCS2019 percentage			

3.3.2 It should be noted that of the 16 collisions, two did not have any contributory factors associated with them. Of these collisions, one involved hitting an object on the carriageway resulting in a shunt with a waiting vehicle which occurred at 08:30 on a wet road. Whilst the other collision involved an overtaking car that overturned.

3.3.3 From Table 3-4 above, it is shown that nearly all the contributory factors are either overrepresented or equal against the RRCS percentages. As discussed previously, the best way to determine which behaviours can be further investigated is to group similar factors together to understand their overall percentage.

3.3.4 The most prevalent issues that can be drawn from Table 3-4 are speed related factors and driver awareness factors. Therefore, further investigation into these collisions and the on-site behaviour is carried out below.

### 3.4 Speed Related Factors

3.4.1 The grouped speed related contributory factors are shown within Table 3-5 below. These speed factors relate to seven (44%) of the mainline injury collisions. There is an overrepresentation against the RRCS average for speed related factors.

Table 3-5 – Speed Related Contributory Factors

Contributory Factor	Number	% age	RRCS % age
Loss of Control	3	9%	7%
Exceeding Speed Limit	3	9%	2%
Careless/Reckless/In a Hurry	1	3%	7%
Swerved	1	3%	2%
Following Too Close	1	3%	2%
** Values in Red highlight those above RRCS2019 percentage			

3.4.2 As noted previously in Table 3-1 and Table 3-2, collisions in dark and/or wet conditions were overrepresented, therefore, this section was assessed further for these collisions. The assessment showed that six of the seven collisions (86%) involving speed related contributory factors were in darkness and four (57%) also on a wet road surface. This shows that the dark and/or wet collisions on the mainline of the A737 are above the respective national and route averages for speed related collisions, in line with their representation for all collisions.

3.4.3 Due to speed related contributory factors being overrepresented against RRCS averages, a survey of vehicle speeds was commissioned at various locations on the A737 to provide more details on the speeds throughout this section. A total of four sites were identified, with surveys undertaken in each direction, resulting in eight total locations. The locations and results are shown in Figure 3-3 and the results contained in Table 3-6 below.

Note that in Table 3-6 below, values highlighted in Red show those above the respective speed limit for the vehicle class.

Table 3-6 – Vehicle Speeds by Site

Speed Limit (mph)		Average Speed (mph)			85th%ile Speed (mph)			% speeding		
		70	50	60	70	50	60	70	50	60
Site	Direction	MC/Car/LGV	HGV	Bus	MC/Car/LGV	HGV	Bus	MC/Car/LGV	HGV	Bus
1	EB	65.8	59.7	55.3	74.3	68.7	61.1	30%	93%	24%
2	WB	65.9	60.8	55.5	75.7	70.8	62.6	37%	94%	21%
3	EB	65.5	60.0	55.8	73.2	68.6	61.4	28%	93%	23%
4	WB	63.0	57.9	53.9	70.3	65.4	62.4	16%	90%	28%
5	EB	62.5	56.4	53.1	71.7	65.2	56.8	20%	81%	9%
6	WB	61.5	57.0	54.2	71.5	65.9	59.1	20%	85%	13%
7	EB	63.3	58.3	54.8	71.6	66.5	59.0	20%	91%	11%
8	WB	59.1	54.9	51.5	67.7	62.3	55.7	9%	80%	5%
Average	EB	64.3	58.6	54.8	72.7	67.3	59.6	25%	90%	17%
	WB	62.4	57.7	53.8	71.3	66.1	60.0	21%	87%	17%
** Values in Red highlight those above relevant speed limit										



Figure 3-3 – A737 Mainline Speed Survey Sites

3.4.4 It can be seen from Table 3-6 above that there is a varying level of speeding amongst all the vehicle types within the relevant speed limit classes. With the highest being within the 50mph (HGV) class. However, with 21% to 25% of cars/mc/LGVs also speeding, this confirms that inappropriate speed is an issue and could be contributing to collisions on the A737 mainline. Given this, the data was reviewed to understand the levels of vehicles involved in collisions and reviewed against their representation nationally (RRCS) and as part of the traffic surveyed. This can be seen below in Table 3-7.

Table 3-7 – Vehicles Exceeding Speed Limit by Class

Vehicle Type	Speed limit (mph)	Number involved in collisions	%age in collisions	RRCS %age	Estimated weekly vehicles	%age Speeding	Estimated weekly speeding vehicles
Car	70	31	89%	76%	137557	23%	37331
Motorcycle		3	9%	5%	670		
Van (<3.5t)		0	0%	6%	24080		
Bus	60	1	3%	3%	11381	17%	1935
HGV	50	0	0%	10%	459	89%	407
<b>Total</b>		<b>35</b>					

3.4.5 What is clear from Table 3-7 above is the level of vehicles in the 70mph speed limit category is a significant level of vehicles per week and they account for 94% of all speeding vehicles, as well as 89% of vehicles involved in collisions.

3.4.6 It is therefore recommended that measures are introduced to better manage vehicle speeds throughout the investigation area, particularly during hours of darkness and in wet conditions. **This aligns with Scotland's Road Safety Framework to 2030 which aims to ensure road users understand and travel at appropriate speeds to the conditions and within the speed limit.**

### 3.5 Driver Awareness Contributory Factors

3.5.1 Table 3-8 below shows those factors relating to driver awareness which are also overrepresented against RRCS percentages within the mainline collisions. It is noted that there are eight contributory factors in total that relate to five (31%) of the sixteen mainline injury collisions.

Table 3-8 – Driver Awareness Related Contributory Factors

Contributory Factor	Number	%age	RRCS %age
Failed to Look Properly	3	9%	16%
Failed to Judge Other Person's Path or Speed	2	6%	9%
Following too Close	1	3%	2%
Poor Turn or Manoeuvre	2	6%	6%

3.5.2 Of the five collisions three occurred in the dark (60%) and two were also on a wet road surface (40%). As noted in Tables 3-1 and 3-2 above, collisions in dark and wet were overrepresented, and this shows that the dark collisions are above the national and route averages, whilst the wet road surface numbers are in line with these, for driver awareness related collisions.

3.5.3 It is therefore recommended that measures which increase the conspicuity of the road alignment are considered.

### 3.6 Road Surface Review

3.6.1 Due to the levels of dark and wet accidents occurring on the A737 mainline, the road surface condition has been reviewed. The Sideways Co-Efficient Routine Investigatory Machine (SCRIM) results show the level of grip the road provides under wet conditions **and has been extracted from Transport Scotland's WebIRIS database.**

- 3.6.2 It should be noted that there are three structural maintenance schemes programmed for January 2023 located within the study area. Schemes 22-SW-0103-20 and 22-SW-0103-21 cover the A737 in both directions from Kilbarchan Junction to Barrochan Junction. Scheme 22-SW-0101-8 is located on the A737 from Linclive Junction to St James Interchange but in the northbound direction only. The associated road sections within these schemes shall be excluded from the road surface review below. A total of nine mainline collisions occurred within the excluded area.
- 3.6.3 The SCRIM data has been collated for the remaining seven collision locations and is shown in Table 3-9 below.

Table 3-9 – SCRIM Data

Section	Collision No.	SCRIM IL	Measured SCRIM Value	SCRIM Deficiency	Surface Type
14315/40	942056	0.35	0.39	0.04	CL942 14mm TSC
14315/40	KB70207	0.35	0.37	0.02	CL942 14mm TSC
14315/40	1002676	0.35	0.33	-0.02	CL942 14mm TSC
14315/40	KB00912	0.35	0.33	-0.02	CL942 14mm TSC
14315/39	1038841	0.35	0.37	0.02	CL942 14mm TSC
14315/05	KA01601	0.35	0.37	0.02	CL942 14mm TSC
14315/05	KA01612	0.35	0.38	0.03	CL942 14mm TSC

- 3.6.4 Referring to Table 3-9, the SCRIM values at the collision locations are generally comparable to their appropriate investigatory level. Looking closer at Section 14315/10 where four collisions have occurred it can be advised that parts of this section have SCRIM levels lower than the investigatory level for the road and could be contributing to the collisions. Only one of the four collisions occurred during wet road surface conditions and only one collision recorded a vehicle skidding. This indicates that the road surface **isn't contributing to collisions at this location.**
- 3.6.5 Section 14315/39 was the locus for a single collision which occurred during dry conditions and therefore no recommendations are to be made for road surface improvements.
- 3.6.6 Ongoing liaison with Structural Maintenance team has highlighted they have a programme for improvements at locations on the A737, that are highlighted through their identification process.
- 3.6.7 Finally, two collisions are located within Section 14315/05 both involving vehicles skidding in wet or damp conditions. Although the measured SCRIM values are appropriate to the road investigatory levels, consideration should be made to retexturing the carriageway at this location.

### 3.7 Mainline Recommendations

3.7.1 In summary the following measures are recommended to address the collisions occurring on the A737 mainline between St James Interchange and Kilbarchan junction:

- Improved road markings (WeatherLine or RainSafe) and new studs - to improve the conspicuity of the road layout during wet conditions. The increased reflectivity can also benefit during hours of darkness.
- Solar road studs should also be considered - to improve the conspicuity of the road layout during hours of darkness and in wet conditions.
- Vehicle actuated signs (showing sign diagram number 671 – NSL) at three locations in each direction – to improve adherence with the relevant vehicle speed limits.
- Safe System improvements – passive safety upgrades to lighting columns, passive safety upgrades to road signs and upgrading sub-standard VRS terminals.

3.7.2 An alternative to the introduction of vehicle actuated signs at this location could involve a road safety campaign which highlights the A737 from St James Interchange to Kilbarchan junction as a vulnerable route for speed to the public. A more unconventional approach could also be to incentivise drivers by introducing speed cameras which reward good driving. The idea to ticket speeding drivers as per normal but also to reward motorists who drove at or under the speed limit was trialled in Sweden. The average speed of cars was reduced from 32km/h before the trial to 25km/h during the trial period. This would require significant consultation with Safety Cameras Scotland and Police Scotland.

3.7.3 While it is recommended to make the street lighting columns passively safe on the A737 mainline from St James Interchange to Kilbarchan junction, a trial could be undertaken to switch off the lighting columns if measures are introduced to increase the conspicuity of the road alignment. If successful, this would allow for the removal of approximately 180 lighting columns from the roadside reducing the road side hazard risk. This will require liaison with the relevant lighting teams to determine the condition of the columns and any replacement programme.

## 4 St James Interchange Collision Review

### 4.1 St James Interchange Collisions Overview

4.1.1 A total of seven collisions were recorded on the A737 St James Interchange slip roads. Of these one was a serious injury collision and six were slight in severity. The locations of these collisions are shown in Figure 4-1 below.

4.1.2 The two A737 slip roads are orientated north east to south west and connect to St James Interchange roundabout. This grade separated roundabout is partially signalised and forms M8 Junction 29 allowing access to the M8 and A726 as well as the A737. It should be noted that the roundabout circulatory is the responsibility of Renfrewshire Council.

4.1.3 The slip roads are both subject to a 40mph speed limit. The A737 mainline changes to the National Speed Limit (70mph) 50m southwest of the St James Interchange on-slip and is a two-lane dual carriageway.

4.1.4 Of the seven collisions, four occurred in the southbound direction on the A737 off-slip, and three collisions occurred northbound on the on-slip. A review of the times of the collisions was undertaken and it was highlighted that two of the collisions occurred during the typical AM peak traffic hours (07:00 to 09:00) with none in the PM traffic hours. This means that five of the collisions occurred out with the peak traffic hours.

4.1.5 One of the collisions occurred in both wet and dark conditions with the remaining collisions in light and dry conditions.

4.1.6 **It is noted that seven (64%) of the 11 total contributory factors relate to 'driver awareness'. Three (27%) of the remaining four factors are speed related.**

4.1.7 Therefore, it appears that measures which will increase driver awareness and reduce speeds on the slip roads should be considered. As such the existing layout of the St James slip roads has been reviewed below to identify any possible improvements.





Figure 4-1 – A737 St James Interchange Slip Roads Collision Plan

## 4.2 A737 St James Interchange Northbound Off-Slip Review

4.2.1 As shown in Figure 4-1 previously, three collisions (KB00508, KA01110 and KB70305) occurred on the A737 St James northbound off-slip. The three collisions occurred at different locations on the off-slip and have no commonality regarding time of day, weather conditions and collision type. Therefore, the collisions have been reviewed individually below.

4.2.2 Collision KB00508 was slight in severity and located near the diverge of the A737 off-slip. This collision involved a single vehicle losing control and swerving due to a deposit on the road. This resulted in the vehicle skidding, leaving the nearside of the carriageway and colliding with a lighting column. The collision occurred at 18:30 when the road surface was dry.

4.2.3 Figure 4-2 below, depicts the road space on the A737 off-slip road at the diverge. There is an uphill climb to a crest prior to a left-hand bend where visibility appears to be restricted. The alignment of the slip road is considered to be one of the contributing factors of the 40mph speed limit which is in place immediately from the beginning of the slip road.

- 4.2.4 The 40mph speed limit signs on the slip road are not particularly conspicuous. A 50mph roundel sign immediately beyond in the offside, serving the northbound A737 mainline carriageway on the viaduct, potentially provides conflicting information to drivers. This may encourage higher speeds than desirable on the slip road. It is feasible to enhance conspicuity of the 40mph gateway by relocating the signs, however this will require amendment of existing traffic regulation orders. The verges at this location are also extremely saturated with vehicle restraint systems, vegetation, drainage, and lighting columns. A potential solution to reduce speeds on the slip road is to provide 40mph repeater signs spaced between 250m-350m over the full length of the off-slip as per **Chapter 3 of the 'Traffic Signs Manual' (TSM)**.



Figure 4-2 – A737 Northbound Off-Slip Diverge View

- 4.2.5 Collision KA01110 occurred on the sweeping left-hand bend approaching St James Interchange roundabout on the off-slip. The collision was slight in severity and occurred during the hours of darkness at 07:30 in wet conditions. The collision data describes a vehicle failing to judge another vehicles path or speed resulting in a shunt with a vehicle who was waiting to go ahead, indicating there may have been slow moving traffic or a queue on the approach to the roundabout past the left-hand bend.

- 4.2.6 The left-hand bend is illustrated in Figures 4-3 and 4-4 below. Considering the slip road through the sweeping left-hand bend, the lane line extends through the first half of the bend before it changes to hazard warning line. As per Chapter 5 of the TSM the hazard warning line should have a minimum of seven marks on approach to the hazard. Therefore, the hazard warning lines should be extended through the full extents of the left-hand bend to a point where the forward visibility is no longer reduced to accord with the TSM.
- 4.2.7 There also appears to be an area of vegetation to the back of the VRS which further restricts the forward visibility around the bend, and it is recommended that this vegetation is cleared as much as practicable to increase visibility.



Figure 4-3 – A737 Northbound Off-Slip Bend View 1



Figure 4-4 – A737 Northbound Off-Slip Bend View 2

- 4.2.8 The final collision (KB70305) that occurred on the A737 northbound off-slip was located at the entry to St James Interchange roundabout. The collision was serious in severity and involved a single motorcycle occurring at 16:00 in dry conditions. The collision data details the driver failing to look properly and failing to judge another vehicles speed or path causing them to lose control. This resulted in the motorcycle skidding and colliding with the VRS.
- 4.2.9 Figure 4-5 illustrates that the chevron-type sign (TSRGD Diagram no. 515) is not clearly visible on the approach (circa 100m – **150m before the 'Give way'**) and the position of the sign appears to be further round the bend on the approach and more visible directly at the give way point.
- 4.2.10 The roundabout entry appears to be set at an acute angle. This means that drivers **approaching the 'Give way' would need to turn their head over their right shoulder to** fully check for oncoming circulatory traffic. If the driver approaches at a higher than appropriate speed, which is possible given the contributory factor analysis, then they may make an early decision to enter the roundabout with only a cursory look and may fail to see a vehicle.

- 4.2.11 It is noted that this A737 entry to St James Interchange Roundabout is the only trunk road arm which is not signalised with both of the M8 off-slips and also the A726 local authority arm from Paisley being signalised. It is recommended that the A737 entry is considered for signalisation in consultation with Renfrewshire Council.
- 4.2.12 As an interim measure, a sight screen is recommended to be installed on approach to the roundabout in order to help reduce approaching speeds and encourage drivers to take more care when approaching the roundabout. Additional chevron signs to diagram 515 could be incorporated within the sight screen.



Figure 4-5 – A737 Northbound Off-Slip Approaching St James Interchange Roundabout View

- 4.2.13 The only sign in advance of the St James Interchange roundabout, warning of the junction, is an advanced direction sign in the offside verge as shown within Figure 4-3. **This is approximately 190m in advance of the roundabout 'give way' line which is greater than the recommended siting distance (90m-150m) provided within LTN 1/94 'The Design and Use of Directional Informatory Signs'.** This sign was previously located within the recommended siting distance described within LTN 1/94, however, visibility to the sign was severely limited and therefore it has been relocated to achieve maximum

visibility to the sign face.

- 4.2.14 It is recommended that roundabout **warning 'reduce speed now' signs are installed on the slip** to further warn of the roundabout ahead. This would provide consistency with the northbound off-slip at Linclive Junction where additional warning signs were introduced in the previous term contract.
- 4.2.15 The two lanes approaching the roundabout have destination road markings however no lane destination signs accompany these road markings. It is therefore recommended that lane destination signs are installed to help improve lane discipline on the slip road.
- 4.2.16 Taking a more holistic view of the A737 northbound off-slip it can be noted that there are several safe system defects including street lighting columns in front of VRS and a non-standard VRS terminal end. It is recommended that these defects are rectified as part of the safe system approach.
- 4.2.17 In summary the following measures are recommended to address the collisions occurring on the A737 northbound off-slip:
- Install 40mph repeater signs along full extents of off-slip in accordance with Chapter 3 of the TSM - to reinforce 40mph speed limit to increase compliance with the speed limit.
  - Install hazard warning road marking over the full extent of the left-hand bend in accordance with Chapter 5 of the TSM – to increase conspicuity of left-hand bend alignment for drivers.
  - Cut back vegetation behind the VRS on the inside of the left-hand bend – to improve forward visibility on the bend.
  - Install/relocate Diagram No. 515 chevron sign on approach to St James interchange roundabout – to increase conspicuity of roundabout entry for drivers.
  - Install lane destination sign to accompany the destination road markings – to improve lane discipline on the slip road.
  - Consult with Renfrewshire Council with consideration to signalling the A737 entry to the roundabout – to provide a controlled entry and ensure consistency with the other trunk road and local authority arms.
  - Install a sight screen on approach to the roundabout – to help reduce approach speeds and encourage drivers to take more care when approaching the roundabout. Additional chevron signs may be incorporated within this sight screen.

- Install roundabout warning signs on the slip – to help reduce approach speeds on the slip road.
- Rectify safe system defects including passive safety improvements to lighting and signs, VRS terminal upgrade and relocation of lighting columns.

#### 4.3 A737 St James Interchange Southbound On-Slip Review

4.3.1 As shown in Figure 4-1 previously, four collisions (865967, KA70204, KA70111 & 863329) are located on the A737 St James northbound on-slip. Three of the collisions are located at the merge with the A737 mainline while the remaining collision is located at the exit of the A737 St James Interchange roundabout. All the collisions were slight in severity and occurred during daylight, in fine weather and in dry conditions.

4.3.2 Collision 865967 was slight in severity and located at the St James Interchange roundabout exit onto the A737 southbound on-slip. This collision involved two vehicles resulting in a rear end shunt. No contributory factors have been attributed to the collision, however the entry to the A737 on-slip has been reviewed further below.

4.3.3 Figure 4-6 below, illustrates the view from the St James Interchange roundabout circulatory toward the exit to the A737 southbound on-slip. The image shows a two-lane exit from the roundabout with a short dedicated left lane delineated by double white lines. Whilst it is appreciated that this use of a double white line system is not wholly in line with Traffic Signs Manual Chapter 5, it is on the Local Authority carriageway and we are not sure of their purpose so do not want to amend. There appears to be a restriction to forward visibility at the exit caused by tree branches and foliage immediately behind the VRS on the nearside, however, it is unlikely this contributed to the recorded collision at this location. It should also be noted that the prior two arms of the roundabout before the A737 on-slip exit are signalised helping to manage traffic behaviour.



Figure 4-6 – St James Interchange Roundabout Exit to A737 On-Slip

- 4.3.4 The three collisions (863329, KA70111 & KA70204) that occurred on the approach to the merge at the A737 southbound mainline, comprise of two rear end shunt-type collisions and one changing lane collision on the approach to the merge at the end of the southbound on-slip. All of the incidents occurred during daylight hours, in fine weather and when the carriageway surface was dry. The collisions are spread throughout the year with no apparent pattern. One of the collisions involved four vehicles, one involved three vehicles and the other involved two vehicles. All nine vehicles involved were recorded as cars.
- 4.3.5 It can be advised that upon review of the contributory factors within the three collisions, failure to look properly was the most common factor making up three of the four total contributory factors. This indicates drivers may have difficulty merging with the mainline of the A737 at this location and as such the merge and its approach has been investigated further below.





Figure 4-7 – St James Interchange On-Slip Approach to A737 Mainline Merge

- 4.3.6 Figure 4-7 above illustrates the view from the southbound on-slip looking towards the merge onto the A737 mainline. The image highlights the presence of heavy shrub growth that separates the slip road from the southbound mainline carriageway. This growth appears to restrict inter-visibility between mainline and on-slip road traffic. Comparing the available visibility at the merge to the requirements within DMRB CD122, it can be advised that there are no obstructions to visibility between the connector road and mainline along the full length of the merge nosing and the desirable minimum mainline stopping sight distance (215m) is available from the back of nose.
- 4.3.7 It is also worth noting that the southbound on-slip road is narrowed to a single lane and, in a line of traffic accelerating towards the merge point, drivers will have varying driver perception to what is an acceptable gap to merge into the flowing main line traffic. For example, one driver may react and brake harshly when a mainline vehicle appears in view, while another may not, and it is suggested that this may be the reason for the shunt-type collisions (two multi-vehicle) that have been occurring at this location.
- 4.3.8 The existing taper merge has been reviewed against DMRB CD122 to check the existing merge properties are to standard. It can be confirmed that the taper length is to standard

however the nose ratio appears to be substandard for a 60mph urban road speed limit merge. In accordance with CD122, the minimum nose ratio shall be 1:15 with a maximum width of 8 metres at the back of the nose. The existing back of the nose has a width of approximately 10 metres and a ratio of 1:7.5 (75m length of nose). This means that the merge point is at a greater angle than should be the case which may result in poorer visibility in side-view mirrors (wing mirrors) and therefore potentially result in hesitation at the merge point which may be a contributing factor of the collisions at this location. It is recommended that a topographical survey of the slip road and merge point is undertaken to better understand if any improvements to the slip road and merge road markings can be implemented within the current footprint to better comply with the standards.

- 4.3.9 The alignment of the on-slip has also been reviewed against DMRB CD109 to confirm the roads horizontal and vertical alignment is to standard.
- 4.3.10 There are two main horizontal curves on the southbound on-slip road, a right-hand curve at the northern end that measures approximately 380m in radius and another right-hand curve at the southern end of the slip road that measures 490m in radius. These curves are also at the desirable minimum and require superelevation of 5%. IRIS data suggests that the superelevation around these curves roughly varies between 3.5% to 5%.
- 4.3.11 The southbound on-slip road is shown to rise in level to a crest curve, approximately 160m from the roundabout exit, that coincides with the position of the railway bridge. The road falls to a sag curve at approx. 310m, beneath the viaduct carrying the M8 junction 28A southbound off-slip road, and thereafter climbs to another crest curve approximately 475m. The final section of falls at a gentle gradient to the slip road merge (637m length). IRIS suggests the maximum gradient is approximately 5% upgrade on the approach to the crest at the railway bridge.
- 4.3.12 As far as can be determined from this desktop assessment, the southbound slip road generally appears to conform to the DMRB in terms of road alignment and layout except for the nose at the merge.

- 4.3.13 The existing merge type has been reviewed against Figure 3.12a within CD122 to ascertain whether the merge type is suitable for current vehicles flows on the on-slip and A737 mainline. With a merge flow of 900vph and upstream mainline flow of 2200vph it can be advised that Figure 3.12a (Appendix B) indicates a 'Layout B' parallel merge with single lane merge, auxiliary lane and two lane upstream mainline to be appropriate. Due to the restrictions in land space and an overbridge passing Blackstone Road, it is unlikely that the construction of this type of merge is feasible or cost effective.
- 4.3.14 Finally, the proximity of the national speed limit speed change on the mainline of the A737 could be contributing to collisions at this location. The national speed limit signs are located approximately 250m west of the merge point, clearly within view of mainline traffic which could cause vehicle speeds on the mainline to increase whilst slip road traffic is trying to merge.
- 4.3.15 It can be noted that there are safe system defects including non-passively safe signing in front of VRS and a non-standard VRS end terminal within the slip road and it is recommended that these defects are rectified as part of the safe system approach.
- 4.3.16 In summary the following measures are recommended to help address the collisions occurring on the A737 southbound off-slip:
- Undertake a topographical survey of the slip road and merge point – to identify if any improvements can be made to the road markings at the nose/taper to better align with the standard.
  - Rectify safe system defects including passive safety improvements to signs and VRS terminal upgrade.

## 5 Linclive Junction Collision Review

### 5.1 Linclive Junction Collisions Overview

5.1.1 A total of seven collisions were recorded on the A737 Linclive Junction slip roads comprising one serious and six slight collisions. The locations of these collisions are shown in Figure 5-1 below.

5.1.2 It should be noted that data from CrashMap shows that there were a further four collisions which occurred on the roundabout circulatory or local authority arms immediately at the roundabout within this study period.

5.1.3 The A737 Linclive Junction slip roads are orientated north east to south west and join into Linclive Roundabout. The roundabout is a Renfrewshire Council road and is located below the A737 mainline, connecting with the A761 allowing access to Linwood, Paisley, Linwood Industrial Estate with retail areas also within close proximity. The roundabout is partially signalised at the A737 northbound off-slip entry to the roundabout which also provides a signalised pedestrian crossing of the slip road.

5.1.4 All slip roads are subject to the national speed limit with a 30mph speed limit in place on the roundabout circulatory.

5.1.5 Of the seven trunk road collisions, three occurred on the A737 northbound on-slip, two on the southbound on-slip and a single collision occurred on each of the northbound and southbound off slips.

5.1.6 A review of the times of the collisions was undertaken and it was highlighted that one collision occurred in the typical PM traffic peak hours (16:00 to 18:00) with none in the typical AM peak traffic hours (07:00 to 09:00). This means that six collisions occurred out with the peak traffic hours.

5.1.7 Four of the seven collisions (57%) occurred in wet conditions with two of those also occurring during darkness. Four of the collisions (57%) have contributory factors which **related to 'driver error/awareness' and three (43%) were speed related.**

5.1.8 Therefore, it appears that measures which will increase driver awareness and reduce speeds on the slip roads should be considered. As such the existing layout of the Linclive junction slip roads and their associated collisions have been reviewed below to identify any possible improvements.

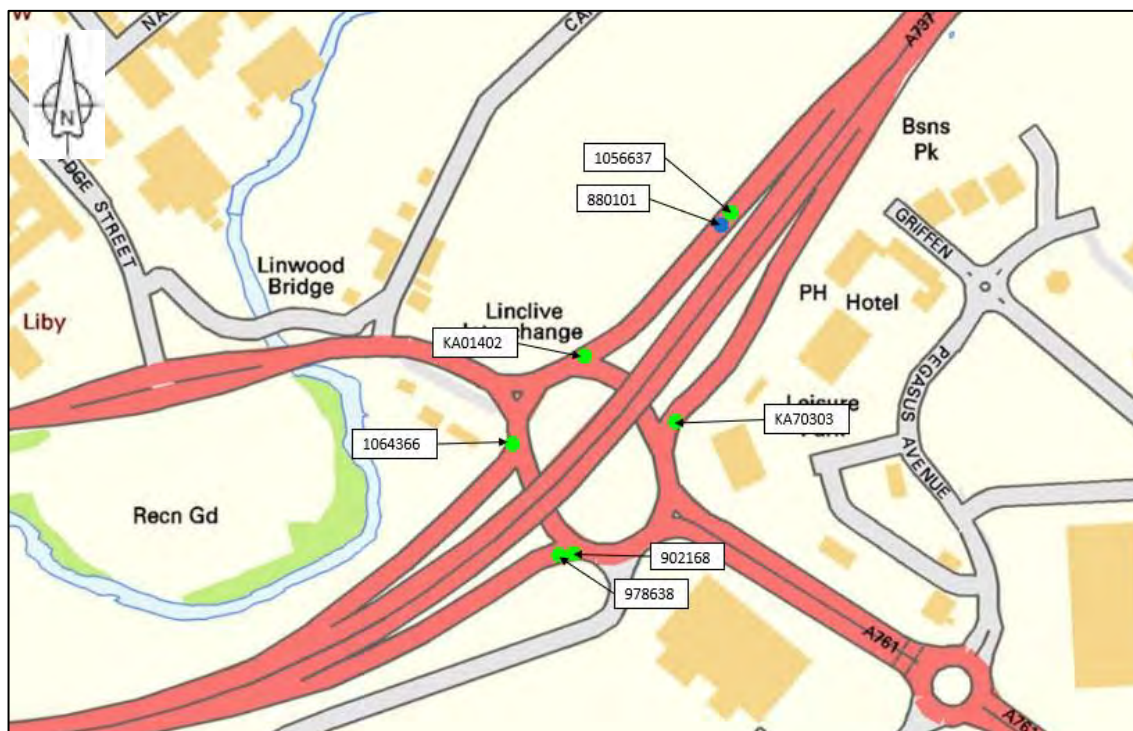


Figure 5-1 – A737 Linclive Junction Slip Roads Collision Plan

## 5.2 A737 Linclive Junction Northbound On-Slip

- 5.2.1 Three of the collisions (KA01402, 880101 and 1056637) were located on the A737 northbound on-slip comprising one serious and two slight collisions.
- 5.2.2 Collision KA01402 was slight in severity and involved two vehicles entering the A737 northbound on-slip from Linclive Roundabout. One vehicle already on the roundabout circulatory attempted to overtake a second vehicle who joined from the A761 north-western arm. It should be noted that since the collision in 2018, the road markings on the approach to the slip road entry have been improved to include a double white line segregated left turn lane from the A761 western arm to better manage lane discipline at this location. Whilst it is appreciated that this use of a double white line system is not wholly in line with Traffic Signs Manual Chapter 5, it is on the Local Authority carriageway, and we are not sure of their purpose so do not want to amend. The current road layout is shown within Figure 5-2 below.



Figure 5-2 – Linclive Junction Northbound On-Slip Entry

- 5.2.3 Collisions 880101 and 1056637 occurred further along the northbound on-slip. Collision 880101 was serious in severity and involved a single vehicle losing control and leaving the carriageway during the daytime when the road was wet. Driver error and speed related factors can be attributed to the collision, and it is likely the vehicle was not driving to the conditions of the road.
- 5.2.4 Collision 1056637 involved two vehicles and was slight in severity. The collision occurred during the day and when the road surface was dry. It can be advised that a vehicle was parked on the A737 northbound on-slip and was struck by another vehicle attempting to overtake. The main contributory factor was failure to look properly which indicates the driver misjudging the parked **car's** location was the causation of this collision. The road layout of the northbound on-slip at the approximate location of Collisions 880101 and 1056637 is shown within Figure 5-3 below.



Figure 5-3 – Lincrive Junction Northbound On-Slip

- 5.2.5 It can be advised that the width of the on-slip shown within Figure 5-3 is 7m from kerb to kerb. According to DMRB CD127 for an MG1B single lane slip road there should be a 3.3m hard shoulder, 3.7m lane and 0.3m offside hard strip. Two lanes exit Lincrive Roundabout onto the northbound on-slip however there are no formal road markings or signs to reducing the lanes to a single lane prior to the merge onto the A737 mainline. It is recommended therefore that road markings and signs are introduced to formally reduce the lanes to a single lane prior to the A737 merge as shown in Figure 3.14b of CD122.
- 5.2.6 Similarly to the A737 mainline, the lighting columns on the slip road are not passively safe and it is recommended that these are upgraded in line with the Safe System Approach to Road Safety.

### 5.3 A737 Lincrive Junction Northbound Off-Slip

- 5.3.1 Collision 1064366 was located on the northbound off-slip at the entry to Lincrive Roundabout. The rear end shunt collision was slight in severity and involved a car failing to judge a vehicles (bus) path or speed, braking suddenly before colliding with the bus. The collision can be attributed to driver awareness and inappropriate speeds.



Figure 5-4 – Lincrive Junction Northbound Off-Slip

- 5.3.2 Figure 5-4 illustrates the view from the A737 northbound off-slip approach looking towards the traffic signals at this arm of Lincrive Roundabout. A pedestrian crossing phase can be called upon demand and therefore high friction surfacing is present 100m in advance of the crossing location. The slip road has a '**New Traffic Signals Ahead**' warning sign, a roundabout advanced direction sign and a lane destination sign. SLOW road markings are located 120m and 170m from the roundabout entry, however these would suggest that the slip road is a single 6m wide lane on the slip road which may increase approaching speeds. It is recommended that the width of the slip road is further investigated to determine if any improvements can be implemented such as lane line road markings further back on the slip road, removing the 6m wide single lane and helping to reduce vehicle speeds.



5.3.3 Similarly to the A737 mainline, the lighting columns on the slip road are not passively safe and it is recommended that these are upgraded in line with the Safe System Approach to Road Safety. There are also non-passively safe sign assemblies on the slip road which are recommended to be replaced with passively safe alternatives.

#### 5.4 A737 Lincrive Junction Southbound On-Slip

5.4.1 Two collisions (978638 and 902168) were located at the exit from Lincrive Roundabout onto the southbound on-slip. Both collisions were slight in severity and occurred during the day however collision 978638 occurred in dry conditions while collision 902168 occurred in the wet conditions.

5.4.2 The details for collision 902168 are very limited which makes determining a causation for the collision difficult. The data states a single vehicle was involved in the collision and **the only contributing factor was failure to judge other person's path or speed**. Without details of a second vehicle, it is not possible to attribute the collision to the current road layout at this location.

5.4.3 Collision 978638 involved a vehicle striking a pedestrian while crossing the southbound on-slip arm at Lincrive roundabout. No contributory factors are recorded within the collision data.



Figure 5-5 – Lincrive Junction Southbound On-Slip

- 5.4.4 Figure 5-5 shows the view looking from Linclive Roundabout towards the southbound on-slip. There is currently an uncontrolled pedestrian crossing with dropped kerbs and tactile paving in place. The crossing distance is 7.2m and the visibility to crossing is to standard according to DMRB CD116 Table 3.43. As mentioned previously, the other pedestrian crossing on this side of the roundabout is signal-controlled at the northbound off-slip however this uncontrolled arrangement provides a less suitable crossing arrangement for pedestrians, particularly those who are mobility impaired, given the likely volume of vehicles exiting the roundabout on to the slip road.
- 5.4.5 Due to the spiral road markings on the roundabout circulatory, only a single lane can exit the roundabout on to the slip road which then comprises a single 6m wide lane. It is recommended that the slip road is investigated further to identify if a single lane plus hard shoulder can be installed to better align with the required standards in CD127.
- 5.4.6 Similarly to the A737 mainline, the lighting columns on the slip road are not passively safe and it is recommended that these are upgraded in line with the Safe System Approach to Road Safety.
- 5.5 A737 Linclive Junction Southbound Off-Slip
- 5.5.1 Collision KA70303 was slight in severity and is located at the southbound off-slip entry to Linclive Roundabout. The collision involved a pedestrian wearing dark clothing being hit while impaired by alcohol crossing the slip road at the uncontrolled crossing point. The collision can be attributed to external factors however brings the total number of pedestrian collisions at Linclive Roundabout to two. Like the southbound on-slip, the crossing distance is 7.2m and the visibility to crossing is to standard according to DMRB CD116 Table 3.43.
- 5.5.2 It can be advised that the A737 southbound off-slip has been subject to road safety improvements in previous term contracts including passive safety upgrades to signing and lighting.

## 5.6 A737 Lincrive Junction Active Travel

- 5.6.1 As previously discussed, there are pedestrian routes on both the north and south of the roundabout circulatory with crossing points across the slip road entry and exit points from the roundabout. These routes are a key link between the more residential area of Linwood to the west of the A737 with the retail sections to the east at Phoenix Leisure and Retail Park areas which consists of a number of trip attractors including restaurants and fast-food eateries, a cinema and shops.
- 5.6.2 Lincrive Roundabout is partially signalised at the A737 northbound off-slip entry to the roundabout where there is a signalised pedestrian crossing phase. However, all of the other crossing points on the slip roads are uncontrolled crossings which may not be suitable for all pedestrians, particularly those who are mobility impaired, given the volume of traffic on the roundabout and slip roads.
- 5.6.3 Based on the likely origins and destinations for pedestrians, it would appear that the pedestrian desire line would be on the northern side of the roundabout which is contradictory to where the one signalised pedestrian crossing is. The southern route from west to east would likely require pedestrians to cross the A761 western arm (signalised crossing at the Bridge Street Junction), cross the signalised crossing on the northbound off-slip arm, cross the uncontrolled crossing on the southbound on-slip arm, cross another uncontrolled crossing on Burnbrae Road (industrial area with limited visibility at the crossing point) and then either cross the A761 dual carriageway eastern arm at an uncontrolled crossing point 30m from the roundabout or route further east 200m to an underpass, in order to access the Phoenix area. The northern route would therefore likely be preferred for pedestrians in order to minimise the number of crossings required and be more direct.
- 5.6.4 In order to provide safe crossings on all arms, a full signalised roundabout was considered. However, discussions with Renfrewshire Council have highlighted that this was previously analysed and resulted in significant disbenefits and delays to vehicular traffic. One potential proposal from the discussions with the local authority is to construct standalone signalised pedestrian crossings on the northern slip road arms (northbound on-slip and southbound off-slip). This would provide a safer active travel route on the desire line however would require further investigations and consultations to determine the feasibility of the proposal.

- 5.6.5 It is recommended that pedestrian surveys are undertaken to identify the volume of pedestrian activity and the most used crossing locations. It is also recommended that the construction of signalised pedestrian crossings on the northern slip road arms is investigated further including topographical surveys and preliminary layout proposals for consultation with Renfrewshire Council.

## 6 Barrochan Junction Collision Review

### 6.1 Barrochan Junction Collisions Overview

- 6.1.1 A total of two collisions were recorded on the A737 Barrochan Junction slip roads. One collision occurred on the northbound off-slip and the other on the southbound off-slip with both being slight collisions.
- 6.1.2 The A737 Barrochan Junction slip roads are orientated north east to south west and connect to B789 Barrochan Road which links to Johnstone. The junctions with the slip roads and Barrochan Road are signal-controlled which incorporate signalised pedestrian crossing phases across the slip roads.
- 6.1.3 The slip roads are subject to the national speed limit reducing to 30mph on approach to Barrochan Road.
- 6.1.4 Given the low number of collisions and following a review of the slip roads, no obvious improvements have been identified.
- 6.1.5 Similarly to the A737 mainline the lighting columns on the slip roads are not passively safe and it is recommended that these are upgraded in line with the Safe System Approach to Road Safety. The signs on the slip roads however appear to have been upgraded to passively safe assemblies.

## 7 Kilbarchan Junction Collision Review

### 7.1 Kilbarchan Junction Collisions Overview

7.1.1 No collisions were recorded on the A737 Kilbarchan Junction slip roads.

7.1.2 The A737 Kilbarchan Junction is a half-diamond grade separated junction with northbound on-slip and southbound off-slip slip roads only which connect to B787 Kilbarchan Road via small at-grade roundabouts.

7.1.3 The slip roads are subject to the national speed limit reducing to 30mph on approach to the roundabouts.

7.1.4 Given the low number of collisions and following a review of the slip roads, no obvious improvements have been identified.

7.1.5 Similarly to the A737 mainline the lighting columns on the slip roads are not passively safe and it is recommended that these are upgraded in line with the Safe System Approach to Road Safety. There is also an advanced direction sign on the southbound off-slip which is not passively safe and it is recommended that this is upgraded.

## 8 Summary of Recommendations

8.1.1 The estimated costs and first year rate of return (FYRR) for each of the recommendations are included within Table 8-1. The FYRR is an estimate of the monetary benefits to be gained in collisions savings in the first year set against the cost of the scheme proposals. It should be noted costs provided are estimates only.

Table 8-1 – Estimated Costs and FYRR

Recommendation	Estimated Cost	Collisions Affected	Annual Accident Reduction	FYRR <sup>1</sup>
A737 Mainline – Vehicle Actuated Signs	£200,000	9	0.9	115% <sup>3</sup>
A737 Mainline – RainSafe Road Markings	£20,000	8	0.24	308% <sup>5</sup>
A737 Mainline – Solar Studs	£200,000	11	0.55	70% <sup>2</sup>
A737 St James NB Off-Slip – Signs, Road Markings, Sight Screen and Vegetation Clearance	£20,000	3	0.12	154% <sup>4</sup>
A737 Lincive NB On-Slip – Road Markings	£2,500	2	0.06	616% <sup>5</sup>
All combined	£442,500	32	1.6	93% <sup>6</sup>

8.1.2 The following are recommendations for further investigations:

- Consultation with Renfrewshire Council with regards to the potential signalisation of the A737 northbound off-slip entry arm to St James Interchange roundabout
- Topographical survey of the A737 southbound on-slip from St James Interchange at the merge with the A737 mainline to determine if any improvements can be made to the road markings at the merge within the current footprint

<sup>1</sup> FYRR calculated using the trunk road values in Table 10 of Transport Scotland’s Reported Road Casualties Scotland 2021 (£256,551)

<sup>2</sup> Based on an estimated 25% reduction in collisions

<sup>3</sup> Based on an estimated 50% reduction in collisions

<sup>4</sup> Based on an estimated 20% reduction in collisions

<sup>5</sup> Based on an estimated 15% reduction in collisions

<sup>6</sup> Based on an estimated 25% reduction in collisions

- Topographical survey of the A737 northbound off-slip at Linclive Junction to determine if the wide single lane can be changed to two for a greater length
- Topographical survey of the A737 southbound on-slip and exit from Linclive Roundabout to determine if the wide single lane can be reduced to include a lane plus a hard shoulder
- Consultation with Renfrewshire Council and further investigations into providing signalised pedestrian crossings on the northern A737 slip roads at Linclive Roundabout to provide a safer active travel route. This would include pedestrian surveys at the roundabout crossing points.

8.1.3 Table 8-2 below shows a list of proposed measures compared with **Transport Scotland's** 20 Strategic Road Safety Plan Actions, which are included in full in Appendix D.

Table 8-2 Strategic Road Safety Plan Actions (See Appendix C)

Action No.	Action description	Mitigation Measure to meet action
1	Trunk Road Analysis & Collision Screening	The annual road safety review highlighted this section of the A737 as having a higher-than-average collision rate and therefore recommendations were developed as part of this study to help reduce further collisions at this location.
3	In depth analysis of fatal and serious collisions	Six serious collisions have been identified within the study extents. Collision mitigation measures have been identified where appropriate to reduce these types of collisions.
4	Proactive Risk Removal	A number of Safe System Approach to Road Safety measures have been recommended (see Chapter 8) primarily to provide safer road sides which forms part of proactive risk removal.
7	Safer Active Travel	Measures to provide a safer active travel route through Linclive Roundabout have been recommended for further investigations in consultation with Renfrewshire Council.



## 9 Safe System Approach to Road Safety

- 9.1.1 The Safe System Approach to Road Safety is an integral element of the NMC SW contract to improve safety for all road users. This includes the five pillars to improve road safety – Safe Roads and Road Sides, Safe Road Use, Safe Vehicles, Safe Speeds and Post-Crash Response.
- 9.1.2 As part of the safe system, this section of the A737 has been reviewed to identify any possible improvements to improve the safety of the road and roadsides where possible. It should be noted that although these improvements may not directly link to collisions within this report, they will ultimately reduce the risk of collisions and reduce the severity of injury should a collision occur.
- 9.1.3 Table 9-1 below shows a list of measures that are in line with the Safe Systems Approach to Road Safety. It should be noted costs provided are estimates only.

Table 9-1 Safe Systems Approach Proposals

No.	Proposed Measure	Estimated Costs
1	A737 Mainline St James to Kilbarchan Upgrades 180no. Lighting columns passive safety upgrade	£600,000
2	A737 Mainline St James to Kilbarchan Upgrades 30no. VRS terminal upgrade 50no. Sign passive safety upgrade	£250,000
3	A737 St James NB Off-Slip Upgrades 1no. VRS terminal upgrade 4no. Lighting columns relocation and passive safety upgrade	£20,000
4	A737 St James SB On-Slip Upgrades 1no. VRS terminal upgrade 1no. Sign relocation and passive safety upgrade	£5,000
5	A737 Linclive NB On-Slip Upgrades 2no. Sign passive safety upgrade 12no. Lighting columns passive safety upgrade	£55,000
6	A737 Linclive NB Off-Slip Upgrades 6no. Sign passive safety upgrade 13no. Lighting columns passive safety upgrade	£67,000

No.	Proposed Measure	Estimated Costs
7	A737 Lincrive SB On-Slip Upgrades 2no. Sign passive safety upgrade 10no. Lighting columns passive safety upgrade	£47,000

## 10 Summary and Conclusions

- 10.1.1 The Scottish Government has set out a long-term goal for road safety where no-one dies or is seriously injured by 2050. As part of the safer roads and roadsides approach to the safer systems, the annual Moving Cursor Programme screens accident records and identifies accident cluster sites that require further investigation.
- 10.1.2 As part of the above and the Network Management Contract for the management and maintenance of the Scottish Trunk Road Network (South West Unit), Amey has been commissioned by Transport Scotland to undertake a road safety study to develop proposals aimed at reducing the number and severity of collisions on the A737 St James Interchange to Kilbarchan junction following the route being identified as part of the 2021 Annual Road Safety Report.
- 10.1.3 This report is based on the five-year period between 1st September 2016 and 31st August 2021 where a total of 32 personal injury collisions were identified within the study period. Following analysis of the collision information it can be advised that the following locations of the A737 trunk road contributed to 30 of the 32 (94%) collisions within this study and have been investigated further:
- A737 Mainline between St James Interchange and Kilbarchan Junction – 16 Collisions
  - A737 St James Interchange Slip Roads – 7 Collisions
  - A737 Linclive Junction Slip Roads – 7 Collisions
- 10.1.4 Following this analysis, several interventions have been recommended that support the **Scottish Government's targets for 'Scotland to have the best road safety performance in the world' 1 and the interim targets for 2030 included therein.**
- 10.1.5 **Aligning with the actions contained within Transport Scotland's Strategic Road Safety Plan (2016),** the following interventions are recommended:
- Install improved road markings (*WeatherLine* or *RainSafe*) and new studs on the A737 mainline between St James Interchange and Kilbarchan junction to improve the conspicuity of the road layout during dark and wet conditions. A total of eight collisions occurred during wet conditions and eight collisions occurred during hours of darkness. A total of five collisions occurred in both wet and dark conditions. A further improvement to be considered is to install solar studs on the A737 as these are also effective within street-lit sections and this will further enhance the road layout in hours of darkness.

- Install vehicle actuated signs at three locations in each direction to help reduce excessive vehicle speeds on the A737 mainline between St James Interchange and Kilbarchan Junction. Seven of the collisions which occurred on the A737 mainline are directly linked to speed related factors with a further five collisions linked to driver behaviour which would also be assisted by this measure.
- On the A737 St James Interchange northbound off-slip it is recommended to install 40mph repeater signs along full extents of off-slip to reinforce 40mph speed limit to reduce vehicle speeds, install the warning line road marking over the full extent of the left-hand bend to increase conspicuity of left-hand bend for drivers, cut back the vegetation behind the VRS on the left-hand bend, install/relocate Diagram No. 515 chevron signs on approach to St James interchange roundabout to increase conspicuity of roundabout entry for drivers, install a lane destination sign to accompany the destination road markings, install roundabout warning signs and a sight screen on approach to the roundabout entry. These measures will benefit three collisions which have occurred on the slip road within the study period.
- Improved road markings on the A737 Lincrive Junction northbound on-slip to provide a clear reduction from two lanes to a single lane prior to the A737 merge. Two collisions within the study can be linked to overtaking manoeuvres on the slip road.

10.1.6 It is noted that there are structural maintenance schemes programmed for January 2023 within the scheme extents and therefore following discussions between Amey and Transport Scotland in December it was agreed that the improved road markings and studs are to be incorporated within the same construction period.

10.1.7 The following are recommendations for further investigations:

- Consultation with Renfrewshire Council with regards to the potential signalisation of the A737 northbound off-slip entry arm to St James Interchange roundabout
- Topographical survey of the A737 southbound on-slip from St James Interchange at the merge with the A737 mainline to determine if any improvements can be made to the road markings at the merge within the current footprint
- Topographical survey of the A737 northbound off-slip at Lincrive Junction to determine if the wide single lane can be changed to two for a greater length
- Topographical survey of the A737 southbound on-slip and exit from Lincrive Roundabout to determine if the wide single lane can be reduced to include a lane plus a hard shoulder

- Consultation with Renfrewshire Council and further investigations into providing signalised pedestrian crossings on the northern A737 slip roads at Linclive Roundabout to provide a safer active travel route. This would include pedestrian surveys at the roundabout crossing points.

10.1.8 Additionally, it is recommended that Safe System Approach to Road Safety improvements are implemented on the A737 mainline, A737 St James Interchange slip roads and A737 Linclive Junction slip roads. These improvements consist of passive safety upgrades to road signs, passive safety upgrades to street lighting columns and upgrading sub-standard VRS terminals.

10.1.9 The cost of introducing the above measures is summarised below for casualty reduction interventions and safe system improvements

- Casualty Reduction – £342,500.
- Safe System - £1,044,000.

10.1.10 A first-year rate of return has been calculated for the individual interventions based on which collisions they may affect, however if all of the casualty reduction measures were implemented a FYRR of 128% is achieved.



Appendix A – Personal Injury Collisions Summary Table

Accident Ref	Date	Time	Severity	No of Casualties	No of Vehicles	Weather	Surface Condition	Lighting	Contributory Factors
<b>Redacted</b>			Slight	1	2	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	<b>Redacted</b>
			Slight	1	2	FINE (WITHOUT HIGH WINDS)	WET / DAMP	DAYLIGHT	
			Slight	1	2	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	
			Slight	1	1	FINE (WITHOUT HIGH WINDS)	WET / DAMP	DARKNESS: STREET LIGHTS PRESENT AND LIT	
			Serious	1	1	FINE (WITHOUT HIGH WINDS)	WET / DAMP	DARKNESS: STREET LIGHTS PRESENT AND LIT	
			Slight	2	2	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	



Redacted

Redacted

Accident Ref	Date	Time	Severity	No of Casualties	No of Vehicles	Weather	Surface Condition	Lighting	Contributory Factors
			Slight	1	3	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	
			Slight	1	2	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	
			Slight	1	1	FINE (WITHOUT HIGH WINDS)	WET / DAMP	UNKNOWN	
			Serious	1	1	FINE (WITHOUT HIGH WINDS)	DRY	DARKNESS: STREET LIGHTS PRESENT AND LIT	
			Serious	1	3	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	



Redacted

Redacted

Accident Ref	Date	Time	Severity	No of Casualties	No of Vehicles	Weather	Surface Condition	Lighting	Contributory Factors
			Serious	1	2	FINE (WITHOUT HIGH WINDS)	DRY	DARKNESS: STREET LIGHTS PRESENT AND LIT	
			Slight	1	2	FINE (WITHOUT HIGH WINDS)	DRY	DARKNESS: STREET LIGHTS PRESENT AND LIT	
			Slight	2	2	FINE (WITHOUT HIGH WINDS)	WET / DAMP	DARKNESS: STREET LIGHTS PRESENT AND LIT	
			Slight	1	2	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	
			Slight	1	1	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	
			Slight	1	2	RAINING (WITHOUT HIGH WINDS)	WET / DAMP	DARKNESS: STREET LIGHTS PRESENT AND LIT	
			Slight	1	1	RAINING (WITHOUT HIGH WINDS)	WET / DAMP	DARKNESS: NO STREET LIGHTING	





Redacted

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Accident Ref	Date	Time	Severity	No of Casualties	No of Vehicles	Weather	Surface Condition	Lighting	Contributory Factors
			Serious	1	1	FINE (WITHOUT HIGH WINDS)	WET / DAMP	DAYLIGHT	
			Slight	2	2	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	
			Slight	2	2	RAINING (WITHOUT HIGH WINDS)	WET / DAMP	DARKNESS: STREET LIGHTS PRESENT AND LIT	
			Slight	3	5	FINE (WITHOUT HIGH WINDS)	WET / DAMP	UNKNOWN	
			Slight	2	2	FINE (WITHOUT HIGH WINDS)	FROST / ICE	DAYLIGHT	
			Slight	1	3	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	
			Slight	2	2	FINE (WITHOUT HIGH WINDS)	WET / DAMP	DARKNESS: STREET LIGHTS PRESENT AND LIT	
			Slight	1	3	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	



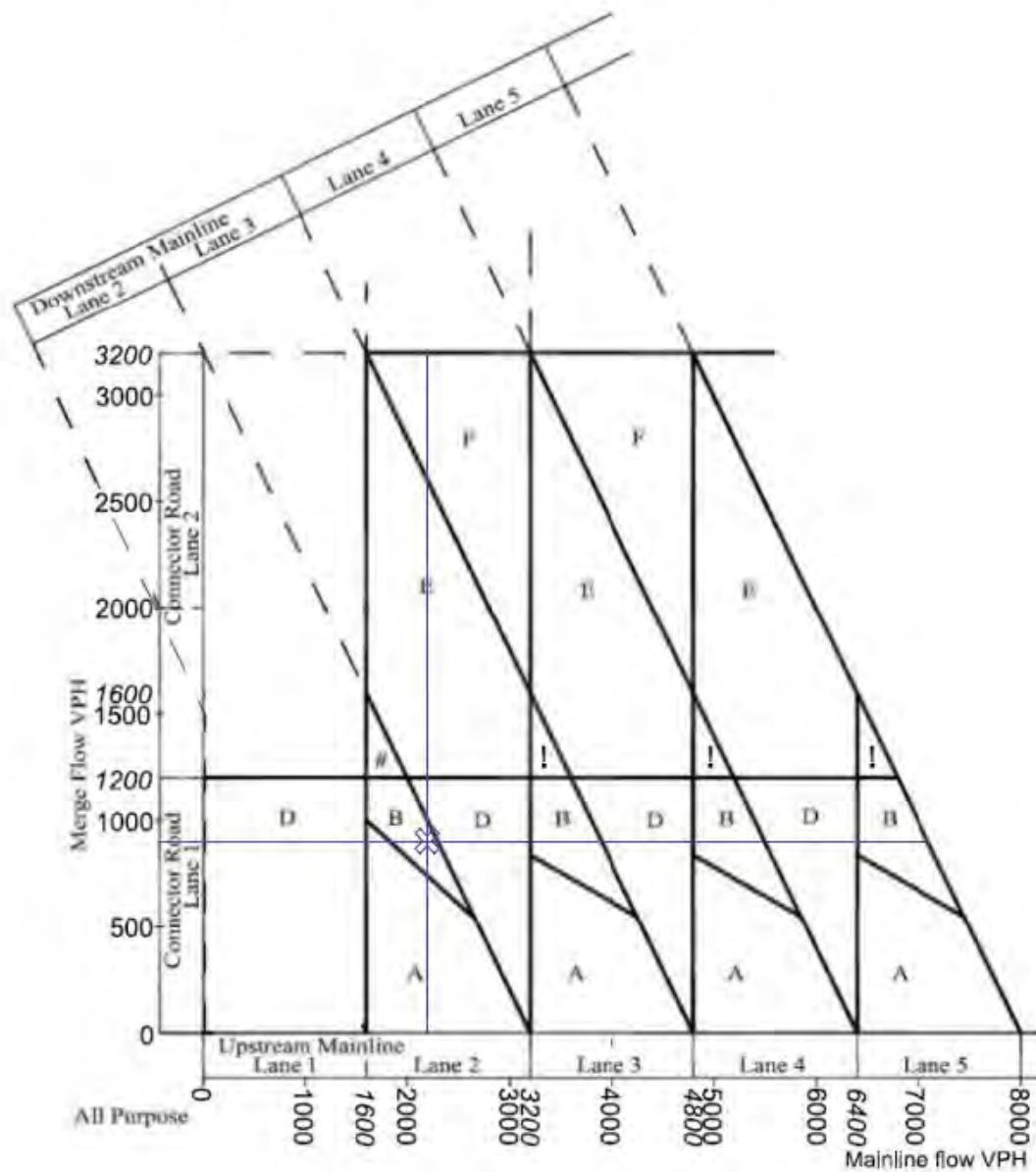
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Accident Ref	Date	Time	Severity	No of Casualties	No of Vehicles	Weather	Surface Condition	Lighting	Contributory Factors
			Slight	1	2	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	
			Slight	1	4	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	
			Slight	3	1	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	
			Slight	1	2	RAINING (WITHOUT HIGH WINDS)	WET / DAMP	DARKNESS: STREET LIGHTS PRESENT AND LIT	
			Serious	1	1	FINE (WITHOUT HIGH WINDS)	DRY	DAYLIGHT	
			Slight	1	1	RAINING (WITHOUT HIGH WINDS)	WET / DAMP	DAYLIGHT	

## Appendix B – A737 St James Interchange Southbound On-Slip Assessment

Figure 3.12a All-purpose road merging diagram



## Appendix C – Strategic Road Safety Action Plan

Action No.	Title	Action	Comments
1	Trunk Road Analysis & Collision Screening	Strategic Road Safety will review the network safety performance and implement evidence led casualty reduction programme to meet our casualty reduction targets to 2030.	The annual road safety review highlighted this section of the A737 as having a higher-than-average collision rate and therefore recommendations were developed as part of this study to help reduce further collisions at this location.
2	Develop Improved Collision Management Software	Strategic Road Safety will continue to enhance the capability, flexibility and accuracy of the accident manager systems	N/A
3	In depth analysis of fatal and serious collisions	Strategic Road Safety will identify the most common accident types resulting in death and serious injury and develop countermeasures	Six serious collisions have been identified within the study extents. Collision mitigation measures have been recommended where appropriate to reduce these types of collisions.
4	Proactive Risk Removal	Strategic Road Safety will develop and implement several annual proactive risk removal strategies aimed at reducing the severity of collisions on the network	A number of Safe System Approach to Road Safety measures have been recommended primarily to provide safer road sides which forms part of proactive risk removal.
5	Road Safety Audit	Strategic Road Safety will consider the requirements of the current road safety audit process and further develop a robust quality system that meets the requirements of the road safety audit standard (HD19/15)	A road safety audit will be completed on the design of any proposals prior to any construction works.
6	Interactive Sign Programme	Strategic Road Safety is committed to more widespread use of interactive signs. An annual programme will be developed and delivered, considering the requirements for monitoring, management, and maintenance all interactive signs.	N/A
7	Safer Active Travel	Strategic Road Safety will engage with key partners on a regular basis to identify and implement specific improvement for pedestrians and cyclists on the trunk road network.	Measures to provide a safer active travel route through Linlive Roundabout have been recommended for further investigations in consultation with Renfrewshire Council.
8	Motorcyclists	Strategic Road Safety will further develop and implement road safety measures specifically for motorcyclists as well as supporting enforcement and education campaigns where appropriate	N/A
9	Young Drivers	Strategic Road Safety remains committed to lower the incidence of collisions involving this high-risk group. It will develop a targeted road	N/A

Action No.	Title	Action	Comments
		safety programme and liaise with other road safety partners in education.	
10	Older Drivers	Strategic Road Safety remains committed to lower the incidence of collisions involving this emerging high-risk group. It will develop a targeted road safety programme and liaise with other road safety partners to assist in the implementation of education programmes.	N/A
11	Trunk Road User Information Website	Transport Scotland will develop a web-based interface to share road safety performance information to all road users in Scotland.	N/A
12	Review of Speed Limits	Strategic Road Safety will continue to monitor the trunk road network and identify speed limit changes where these support casualty reduction or significant change to the network.	N/A
13	Trunk Road Enforcement	Strategic Road Safety will continue to participate in all aspects of the Safety Camera Programme to promote improved speed compliance and a consequent reduction on speed related accidents.	N/A
14	Speed Management in Towns and Villages	Strategic Road Safety will develop and implement a range of appropriate speed management measures to positively influence driver behaviour and deliver benefits to vulnerable road users.	N/A
15	Developing Stakeholder Liaison	Strategic Road Safety will develop and better inform liaison with all parties to ensure effective delivery of the wider road safety programme.	N/A
16	Trunk Road Safety Partnership	Strategic Road Safety will ensure that the successful elements of existing partnerships are implemented elsewhere on the network.	N/A
17	Road Safety Research	Strategic Road Safety will work with Scottish Road Research Board to commission, publish and disseminate research findings to the road safety community	N/A
18	Demonstration Road Safety Projects	Strategic Road Safety will harness developments in technology and bring forward demonstration projects that will raise awareness and disseminate knowledge and best practice.	N/A
19	Road Safety Business Plan	Strategic Road Safety will review the current economic evaluation criteria and consider how a Road Safety Business Plan can be developed to give a greater weighting to more substantial solutions that design out risk.	N/A
20	Continuing Professional Development	Strategic Road Safety Unit, will continue to facilitate road safety training and seminars open to all road safety practitioners in Scotland.	N/A