TECHNICAL NOTE – Operational Implications on the HA network

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This document has been prepared to supplement the Transport Assessment and is submitted to PCC for their approval.

Purpose

The purpose of this Technical Note is to respond to comments that have been provided by the Highways Agency (HA) and Plymouth City Council (PCC) concerning the accident record at the Weston Mill / A38 junction complex, which forms part of the HA's strategic highway network. These comments have been provided in relation to the planning application which has been submitted in support of the proposed Energy from Waste Combined Heat and Power (EfW CHP) facility at North Yard, Devonport.

In particular, this Technical Note responds to the correspondence received from PCC, dated 26th July 2011, and associated documentation, consisting of the "A38 Weston Mill Junction Safety Study" (March 2010). The URS Scott Wilson Transport Assessment (May 2011) is also referred to within this Technical Note.

Introduction

URS Scott Wilson prepared a Transport Assessment (TA) on behalf of MVV Umwelt GmbH in support of a planning application for an Energy from Waste Combined Heat and Power (EfW CHP) facility at North Yard, Devonport in May 2011.

The assessment was prepared on the basis of an agreed TA Scope in addition to a number of consultations and meetings which were held with officers of Plymouth City Council (PCC), throughout the preparation of the TA.

As such, the TA included an analysis of road safety at the Weston Mill junction complex, utilising the most recently available Personal Injury Accident data, covering the five year period from 1st September 2005 to 1st September 2010.

Background

Since the submission of the TA which accompanied the planning application, comments have been received from PCC in an email dated 26th July 2011, concerning the accident record at the Weston Mill junction complex. The TA indicated that there were 28 reported accidents at the junction complex within the study period, three of which were recorded as serious in severity, and 25 as slight.

This corresponds with an accident study, produced by Enterprisemouchel in March 2010, which indicated that there were 29 collisions at the junction complex, for the study period 1st January 2004 to 31st December 2008. As such, the March 2010 study provides recommendations concerning possible improvements at the junction complex, at an estimated cost of £44,005.89 for the short term measures. The report, and its associated appendices, is presented at **APPENDIX A** of this Technical Note.

For clarity however, the short term measures suggested in the March 2010 Enterprisemouchel document include:

- Clearing the vegetation between the eastbound off-slip junction and the bridge, to increase visibility;
- Removal of 33m of metal environmental barrier on the eastbound on-slip, to provide clear visibility between the A38 main line flow and on-slip;
- Improving the appearance of the hatching at the bottom of the westbound off-slip, and replacement of existing verge marker posts with passively safe high visibility cylinders, or similar;
- In-filling the hatched areas of the westbound on-slip;
- De-activation of existing street-lighting on both on-slips;
- Liaison with Plymouth City Council to produce the correct TRO for the speed limit

The TA considered the impact of the development proposals on the highway network, based on the anticipated day to day average operation of the site. Additionally, a number of supplementary scenarios were also considered, and included at Annex G of the TA. These supplementary scenarios included consideration of potential changes in development traffic flow due to the different seasons of the year, and also a maximum trip generation scenario. Whilst the TA states that the maximum trip generation scenario is unlikely to occur, it has nevertheless been considered in the analysis presented below.

A38 Weston Mill Junction – Road Safety Improvements

An assessment of the potential impact of the development proposals on the A38 at Weston Mill has been presented in Annex G of the TA. The percentage impact calculations were prepared according to the anticipated level of development traffic accessing the A38 at the Weston Mill junction in the AM and PM peak hours, in relation to the Do Something and Do Something Maximum scenarios.

This indicated that a maximum impact of 2.22% may occur in the PM peak hour of the "Peak Hour Factored 'Maximum' Development Flows on the A38" scenario, which takes account of the potential seasonal variation in traffic flow at this location. Further detail is provided at annex G of the TA, however, a summary table is provided below (replicated from TABLE G.15 of annex G).

TABLE 1.1 Peak Hour Factored 'Maximum' Development Flows on the A38 and Percentage Impact

Peak	Monday – Thursday Average	Factored Development Traffic	Percentage Impact
0800-0900	3712	70	1.88%
1600-1700	3097	69	2.22%

It is recognised however, that the majority of accidents reported both in the TA and 2010 Enterprisemouchel report occurred at the on and off-slip junctions and approaches. An analysis has therefore been undertaken, based on the proportions of development traffic at these locations (compared with 'background' traffic) in the Do Something scenario.

The results of this analysis are presented in **TABLES 1.2** and **1.3** below, with the traffic flow information being taken from tables 6.1, 6.2, 7.3 and 7.4 of the TA.

TABLE 1.2 Percentage Impact Calculations at the A38 Weston Mill junctions – 2014 Do Something AM (0800-0900)

	A38 Eastbound off-slip	A38 Eastbound on-slip	A38 Westbound off-slip	A38 Westbound on-slip	All on and off-slips
Total traffic flow	757	454	448	303	1962
Development Traffic	2	6	12	1	21
Proportion (%)	-	-	-	-	1.07%

TABLE 1.3 Percentage Impact Calculations at the A38 Weston Mill junctions – 2014 Do Something PM (1600-1700)

	A38 Eastbound off-slip	A38 Eastbound on-slip	A38 Westbound off-slip	A38 Westbound on-slip	All on and off-slips
Total traffic flow	316	902	391	874	2483
Development Traffic	1	10	5	2	18
Proportion (%)	-	-	-	-	0.72%

As presented above, the development related traffic is predicted to have a maximum impact of 1.07% in the AM peak hour of the 2014 Do Something scenario.

As discussed, Annex G of the TA also presented a supplementary 'Maximum scenario', based on a worst case trip generation scenario. Further analysis has therefore been undertaken, using the maximum trip generation information presented in Annex G of the TA.

The results of this analysis are presented in **TABLES 1.4** and **1.5** below.

TABLE 1.4 Percentage Impact Calculations at the A38 Weston Mill junctions – 2014 Do Something 'Maximum' AM (0800-0900)

	A38 Eastbound off-slip	A38 Eastbound on-slip	A38 Westbound off-slip	A38 Westbound on-slip	All on and off-slips
Total traffic flow	759	473	467	305	2004
Development Traffic	4	25	31	3	63
Proportion (%)	-	-	-	-	3.14%

TABLE 1.5 Percentage Impact Calculations at the A38 Weston Mill junctions – 2014 Do Something 'Maximum' PM (1600-1700)

	A38 Eastbound off-slip	A38 Eastbound on-slip	A38 Westbound off-slip	A38 Westbound on-slip	All on and off-slips
Total traffic flow	319	921	410	877	2527
Development Traffic	3	30	25	4	62
Proportion (%)	-	-	-	-	2.45%

As indicated above, the results of the Do Something 'Maximum' scenario suggest that the development traffic could have an impact of 3.14% in the AM peak hour, and 2.45% in the PM peak hour, at the A38 Weston Mill junction complex.

Summary

URS Scott Wilson prepared a Transport Assessment (TA) on behalf of MVV Umwelt GmbH in support of a planning application for an Energy from Waste Combined Heat and Power (EfW CHP) facility at North Yard, Devonport in May 2011.

Since the submission of the TA which accompanied the planning application, comments have been received from PCC in an email dated 26th July 2011, concerning the road safety record of the A38 Weston Mill junction. The email contained an attachment of the March 2010 Enterprisemouchel report "A38 Weston Mill Junction Safety Study". A review of the road safety study has therefore been conducted, and has identified existing safety concerns at the junction complex. This is also supported by the analysis presented within the TA.

The safety study proposes a number of improvements to the junction complex, with an associated cost of approximately £44,000. A proportional junction impact analysis has therefore been undertaken to determine the anticipated level of development traffic passing through the junction.

Based on the calculations presented within this Technical Note, it is anticipated that the development traffic will have an impact of approximately 1.07% at the A38 Weston Mill junction complex, in the AM peak hour of the 2014 Do Something scenario. Whilst this indicates that the development may lead to an increase in traffic passing through the junction, it is anticipated that this will not have a significant effect on the overall safety of the junction, particularly when considering the proposed road safety improvements identified in the March 2010 Enterprisemouchel road safety report.

The analysis presented above has also considered the 2014 Do Something 'Maximum' scenario, which was included as a supplementary assessment provided at Annex G of the TA. It should be noted that the TA considers that this scenario is unlikely to occur; however the calculations presented above indicate that the development may have a maximum impact of approximately 3.14% at the junction complex. Again, it is not anticipated that this will have a significant effect on road safety at this location, given the proposed improvements indicated in the March 2010 Enterprisemouchel report.

Appendix A – A38 Weston Mill Junction Safety Study

enterprisemouchel

A38 Weston Mill

Junction Safety Study

1st March 2010

Produced for
Highways Agency

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Contents

1 Executive Summary

1.1 The Highways Agency commissioned EnterpriseMouchel to undertake a Safety Study to review road safety on the A38 Trunk Road and slip roads at Weston Mill. The aim of the study was to identify why there was a consistently high collision rate around the junction and identify suitable measures to alleviate any identified collision problems at this location.

1.2 Analysis of the collision data for the five-year period 1st January 2004 to 31st December 2008 revealed that 29 Personal Injury Collisions (PICs) have taken place within the study area. The 29 collisions resulted in 43 casualties. There were no fatalities, 3 collisions were classed as serious with the remaining 26 being classed as slight. The collision details are shown in Appendix C.

1.3 This study recommends:

- Removal of vegetation at the tear-drop junction between the eastbound off-slip and bridge abutment.
- Removal of 33 metres of the metal environmental barrier between eastbound on-slip and main carriageway.
- Infill hatching at bottom of westbound off-slip with red coloured High Friction Surface (HFS) and replace verge masters with passively safe cylinders (Rediweld 'Jislon' poles or similar).
- Extend HFS to 100m from the give way line on both off-slips.
- Infill the hatched areas with grey coloured HFS, provide solid edge line for the first 50m of the westbound on-slip and a 'Slow' making in advance of the bend.
- Switch off the street lights on all slip roads.

1.4 The cost of these measures is estimated to be £44,005.89 and the proposals are detailed in Appendix D It is also recommended that the feasibility of introducing traffic signal control at this junction is considered by a detailed study.

1.5 Analysis of the proposals was undertaken using a short Project Appraisal Report (PAR 5.0), which is included within Appendix E. A saving of 1.93 collisions per year has been predicted, giving a First Year Rate of Return (FYRR) of 456.8% for this scheme.

1.6 The proposals have been discussed with EnterpriseMouchel's Network Manager and Design Manager, who support the introduction of the recommendations. Plymouth City Council have also made comment on the proposals.

1.7 It is recommended that the contents of this report be endorsed, and that the proposals be progressed to Value Management and then preliminary design, detailed design and construction stages.

2 Introduction

2.1 Project Background

2.1.1 Weston Mill junction was identified as a Cluster Site within the 2007 Area 1 Safety Action Plan collision cluster review.

2.1.2 An inspection of the collision records for the A38 at this location revealed a higher than average number of collisions for a site in Area 1 in the last 5 years, with 29 occurring overall. As a result this site has been recommended as a site which should be investigated further.

2.1.3 The Highways Agency commissioned EnterpriseMouchel to undertake a Safety Study to analyse collisions that have taken place on the A38 Trunk Road at Weston Mill. The aim of this study is to analyse collision information using the previous 5 years' historical collision data and identify improvement measures that could be implemented to address the collisions taking place at this location.

2.1.4 The objectives of this study are to:

- Review the 5-year collision records for this location from 2004 to 2008;
- Identify the problem(s) in terms of safety, movement of motor vehicles, cyclists / pedestrians, environment and other factors, as appropriate;
- Provide options to alleviate any identified collision pattern(s) at this location;
- Prepare preliminary drawings of the proposed improvement measures;
- Prepare an economic assessment of the proposals;
- Present the proposals to a local Value Management Workshop in Spring 2010.

3 Site Description

3.1 Description of the Current Conditions

3.1.1 Weston Mill is situated on the A38 Plymouth Parkway trunk road to the north-west of Plymouth City Centre, at the Ordnance Survey grid reference 246340, 058614.

3.1.2 The junction forms the intersection between the A38 (T) and the A3064 Weston Mill Drive. The junction is approximately 600 metres to the east of the St Budeaux junction (B3413) and the Manadon junction (A386) is approximately 1.3 miles to the east.

3.1.3 The A38 (T) at this location generally runs in a west to east alignment. The junction is a grade separated junction with the trunk road travelling over the Plymouth City road via an embankment and bridges.

3.1.4 The A3064 Weston Mill Drive leads from the A38 to Devonport Dockyard and Plymouth City Centre. It is currently street lit and the system of street lighting extends approximately half way up each slip road. There is no street lighting upon the A38 (T) at this point.

3.1.5 The A38 (T) eastbound approach to the study length is a relatively straight section of carriageway on a slight downhill gradient from the St Budeaux junction. The A38 (T) westbound approach is also straight and on a slight downhill gradient from Honicknowle Lane Bridge. Refer to Photograph A, Appendix B.

Eastbound off-slip

3.1.6 The 300 yards count down sign for the eastbound exit is located near the end of the merge area from the St Budeaux junction on-slip.

3.1.7 The slip road runs over a blind rolling crest just after the nosing, which can mask vehicles ahead. This then leads straight and down hill into the tear drop junction at the bottom of the slip road.

3.1.8 The primary 'Give Way Ahead' sign at 100 metres is clearly visible from the main A38 carriageway.

3.1.9 The approach to the give way line has 50 metres of buff High Friction Surface (HFS) up to the line. There is a grass and vegetation area to the right along the A3064 between the slip road and the embankment and bridge. Refer to Photograph D, Appendix B. Visibility is restricted by the embankment / bridge abutment on the approach to the give way line but complies with the required minimum.

3.1.10 The junction at the end of the slip road is slightly unusual as the road which it meets (A3064 Weston Mill Drive) is not a through road – it only leads to and from the A38.

Eastbound on-slip

3.1.11 The eastbound on-slip has a gradual up hill gradient bending slightly to the left prior to the merge area, where it straightens and levels.

3.1.12 There is a sheet metal environmental barrier attached to the safety fencing between the main carriageway and the slip road for the whole length of the safety fence. It is understood that this was originally placed to eliminate sound until local trees had grown sufficiently.

3.1.13 There is evidence that an area at the start of the on-slip is used as a pick up / drop off point for car sharing and there are a number of informal tracks through to residential areas to the north.

Westbound off-slip

3.1.14 The A38 approach is straight and on a slight downhill gradient, with the slip road running gradually down to the A3064 on a slight left handed deflection leading in to the give way line.

3.1.15 There is 50 metres of buff HFS leading up to the give way line with hatching and verge master markers to the off-side. The hatching creates a visual narrowing of the end of the slip road but allows sufficient carriageway width for traffic. Visibility is restricted by the embankment / bridge abutment on the approach to the give way line but complies with the required minimum.

3.1.16 There are two 'junction ahead' warning signs placed at 130 & 90m from the give way line along with the start of the A3064 50mph speed limit just prior to the give way line.

3.1.17 The form of the junction directs traffic to turn left onto the A3064. The right turn is not prohibited but is only used to perform u-turns on the A38. There is some indication that this manoeuvre may be being used as part of a route for 'boy racers' - this observation has been forwarded to the local Constabulary. It should also be noted that winter maintenance vehicles go straight across the A3064 junction.

Westbound on-slip

3.1.18 The approach along the A3064 has a 50 mph speed limit and a designated left turn lane to join the A38 westbound, with a sharp bend to the left / advisory 20mph maximum speed warning sign at the deflection.

3.1.19 There is a chevron on the off-side verge to indicate the severity of the bend and hatching to the off side of the buff HFS leading into a gradual up hill straight on to the A38 westbound. There is a lot of gravel / debris in the offside hatched area, which could cause difficulties for any vehicles which run wide, especially motorcycles.

3.1.20 The A38 (T) has an auxiliary third lane for the merge and exit lanes between Weston Mill and St Budeaux junctions.

General

3.1.21 SCRIM levels have been checked for both off-slips and were all found to be above the criteria for intervention. EnterpriseMouchel continues to monitor and adjust SCRIM intervention levels and this site will be considered at future reviews.

3.1.22 The AADT (Average Annual Daily Traffic) for the main carriageway using the 2007 figures from the TRADS database is as follows:

- Westbound: East of junction 23,456, west of junction 25,562.
- Eastbound: West of junction 24,038, east of junction 23,934.

This suggests that, on an average day, on the westbound carriageway 2,106 more vehicles join the A38 at this junction than leave and on the eastbound 104 fewer vehicles join than leave the A38.

3.1.23 Peak traffic flows during a week day are between 08.00 and 09.00 and between 16.00 and 18.00. There is little seasonal difference in traffic flow; the peak summer month (July) is 15% greater than the lowest (January).

3.1.24 The morning peak period is longer than normal due to shift patterns at Devonport Dockyard, as Weston Mill junction is the main access point from the A38. Dockyard traffic peaks at 6.50 to 7.00am and the peak for other traffic is from 8.00am. However, the early peak does no appear to have a significant effect on collisions.

3.1.25 There is a dedicated cycle route adjacent to the northbound A3064. This commences some 400m south of the westbound on-slip and continues on-carriageway up to the on-slip. There is a short section of off-carriageway cycle route, which then crosses over the westbound on-slip and continues adjacent to the northbound A3064. The cycle rout finishes under the A38 overbridge to the south of the eastbound off-slip. The cycle route is highlighted with red coloured surfacing throughout it's 550m length. The route does not appear to serve a particular purpose as it starts and finished without leading cyclists to safer alternative routes. See photographs X, Y & Z in Appendix B. A cycle route is available via Mowhay Road, just to the west of the A3064, which crosses the A38 via a pedestrian bridge and continues into Honicknowle.

3.1.26 Plans showing the existing views, traffic signs and other key features are included in Appendix A.

4 Assessment of Personal Injury Collisions

4.1 Collision records

4.1.1 Collision data was obtained for the period 1st January 2004 to 31st December 2008. During this period 29 personal injury collisions were recorded on the A38 (T) .Three of these collisions was classified as serious and the remaining 26 were classified as slight. The locations of these collisions are plotted in Appendix C.

4.1.2 Table 1 below summarises the collision details recorded during each year of the study period.

Year	No. of Collisions	Collision Severity			Rain/wet road	Dark
		Fatal	Serious	Slight		
2004	4	-	-	4 (4)	4	-
2005	9	-	2 (2)	7 (10)	5	1
2006	6	-	-	6 (12)	3	2
2007	8	-	1 (1)	7 (11)	5	1
2008	2	-	-	2 (3)	-	-
Total	**29**	-	**3 (3)**	**26 (40)**	**17**	**4**
%age of total	-		**11%**	**89%**	**58%**	**13%**
				National Average	33.8%	25.6%

Table 1 – Collision Severity by Year.

Note: The number of casualties is shown in brackets.

4.1.3 Table 1 indicates that on average 5.8 collisions were recorded per year, resulting in an average of 1.48 casualties per collision, this equates to an average of 8.6 casualties per year. The table also indicates that the proportions of collisions occurring on a wet road surface are significantly higher than expected when compared to the national average but the number of collisions occurring during the hours of darkness are lower than the national average .

4.1.4 The severity ratio of collisions taking place at this location is 0.11. The national average severity ratio for collisions taking place on Dual/single carriageway 60mph roads in 2005 was 0.27 taken from Road Casualties

Great Britain 2006, however it should be noted that this figure does not distinguish between urban and rural roads.

4.1.5 Of the 29 recorded collisions:

- 22 involved a shunt type collision;
- 5 involved the driver loosing control;
- 2 involved the driver making an error;
- 1 was attributed to the driver loosing control after hitting standing water.

4.2 Distribution of Collisions

4.2.1 Eastbound off-slip This site has six recorded collisions. Analysis of the collisions has revealed two 'clusters' – approximately half way along the slip road and at the junction with the A3064. Numbers 5, 6 and 7 are located half way down the slip, just over the rolling crest (all being recorded as slight injury). Three occurred at the give way junction, recorded as one serious and two slight (numbers 15, 16 & 17). This section is hatched in blue on the Collision Plan in Appendix C.

4.2.2 Eastbound on-slip This site has recorded four injury collisions, one serious and three slight (numbered 24, 25, 27 & 28 - number 28 involved a pedal cyclist and was serious) during the study period. All of these collisions occurred within the merge area. This section is hatched in green on the Collision Plan in Appendix C.

4.2.3 Westbound off-slip There were 12 recorded collisions on this slip road. Two were in the vicinity of the exit area (numbered 22 & 23). The collisions are then divided into two collision sites, approximately half way down (numbers 18, 19 & 20) and at or near the give way junction with the A3064 (numbers 8 to 14). This section is hatched in orange on the Collision Plan in Appendix C.

4.2.4 Westbound on-slip. There have been three recorded collisions, one on the on-slip and two near the merge area (1, 2, and 4). This section is hatched in yellow on the Collision Plan in Appendix C.

4.2.5 A38 Main Carriageway. Four collisions occurred on the main carriageway in the vicinity of the junction but did not involve vehicles entering or leaving the A38 (numbered 3, 21, 26 and 29). Collision 3 was classed as serious and was recorded at the start of the eastbound off-slip. This involved a motorcyclist whose luggage became tangled in the machine causing loss of control. Collision 21 was to the west of the westbound off-slip and was a multiple vehicle shunt in poor weather. Collision 26 occurred to the east of the westbound off-slip and was also a multiple vehicle shunt in poor weather. Collision 29 occurred to the east of the

east merge area and involved a shunt type collision. This section is hatched in purple on the Collision Plan in Appendix C.

4.2.6 The junction as a whole is currently a Collision Cluster Site as defined by the Area 1 Safety Action Plan, as more than 6 collisions occurred within the current 3 year period.

4.2.7 The details for these 29 collisions were as follows:

Eastbound Off-slip

- Collision Number 5 – Car 2 was in slow moving traffic exiting A38 to A3064 eastbound when struck in the rear by Car 1;
- Collision Number 6 – Car 1 struck lamp post on eastbound exit to A3064.
- Collision Number 7 – Car 2 was in slow moving traffic exiting A38 to A3064 eastbound when struck in the rear by Car 1;
- Collision Number 15 – Car 2 exited A38 eastbound, stopped at junction of A3064 then hit in rear by Car 1;
- Collision Number 16 – Car 2 exited A38 eastbound, stopped at junction of A3064 then hit in rear by Car 1;
- Collision Number 17 – Car 1 pulled out of eastbound slip road onto A3064 into path of motor cycle (serious);

Eastbound On-slip

- Collision Number 24 – Car 2 parked on eastbound on-slip road when struck in rear by Car 1;
- Collision Number 25 – Car 2 entering A38 eastbound from A3064 at merge area was hit in rear by Car 1;
- Collision Number 27 – Car 1 swerved to join main carriageway from eastbound on-slip in front of Car 2 which hit its rear;
- Collision Number 28 – Pedal cycle entering A38 eastbound when struck in rear by car 2 which had failed to notice pedal cycle (serious);

Westbound Off-slip

- Collision Number 8 – Car 2 exited A38 westbound to join A3064 stopped at junction then hit in the rear by Car 1;
- Collision Number 9 – Car 2 exited A38 westbound to join A3064 stopped at junction then hit in the rear by Car 1;
- Collision Number 10 – Car 2 exited A38 westbound to join A3064 stopped at junction and was hit in the rear by Car 1, both moved onto A3064 and Car 2 was hit by Car 3;
- Collision Number 11 – Car 2 exited A38 westbound, slowed for queuing traffic at junction of A3064 and was hit in the rear by Car 1;

- Collision Number 12 – Car 2 exited A38 westbound to join A3064 stopped at junction then hit in the rear by Car 1;
- Collision Number 13 – Car 2 (learner driver) exited A38 westbound stalled at junction of A3064 and was hit in rear by Car 1;
- Collision Number 14 – Motorcycle exited A38 westbound for A3064 and lost control on-slip road;
- Collision Number 18 – Car 1 exiting A38 westbound for A3064 collided with rear of Car 2 on-slip road;
- Collision Number 19 – Car 1 exited A38 westbound to join A3064 and collided with rear of Car 2;
- Collision Number 20 –Car 1 exiting A38 westbound and lost control due to standing water and collided with safety barrier;
- Collision Number 22 –Car 1 travelling westbound on main carriageway when driver made late decision to exit and lost control;
- Collision Number 23 –Car 1 exiting A38 west to join A3064 slowed for traffic ahead following vehicles but failed to stop in time and collided with vehicles ahead (4 cars involved);

Westbound On-slip

- Collision Number 1 – Car 2 stationary waiting to join main carriageway travelling west when hit in rear by Car 1;
- Collision Number 2 – Car 2 attempting to join main carriageway travelling west when hit in rear by Car 1 (hit and run);
- Collision Number 4 – Car 2 was travelling up the westbound on-slip when it was hit in the rear by Car 1. Snow conditions were contributory;

A38 Main Carriageway

- Collision Number 3 – Motorcycle travelling east on main carriageway when his bag becomes entangled in the rear wheel causing it to lock (serious);
- Collision Number 21 – Car 1 travelling westbound on main carriageway braked for slow traffic ahead, following cars fail to stop in time and collide with rear of vehicles ahead (6 cars involved, poor weather);
- Collision Number 26 – Goods Vehicle travelling west on main carriageway in poor weather conditions braked and was hit in rear by following cars (serious, 5 vehicles involved);
- Collision Number 29 – Car 2 travelling east on main carriageway slowed and was struck in rear by Car 1.

4.3 Collision Clusters

4.3.1 From the collision details above it is noted that three arms of the junction have the majority of collisions.

4.3.2 The westbound on-slip is the exception, with only 3 collisions, (1, 2, 4). Numbers 1 and 2 occurred near the merge of the third west bound lane with the main carriageway and number 4 on the slip road during snow.

4.3.3 **Eastbound off-slip** has had six collisions, three within the middle of the exit slip and three at the tear drop junction (5, 6, 7, 15, 16 & 17). Numbers 5, 7, 15 & 16 were shunt collisions. Number 6 lost control and collided with a lamp post for unknown reasons and number 17 pull out of the give way in front of a motor cycle.

4.3.4 **Eastbound merge** has had four collisions all occurring near to the merge area with the A38 (24, 25, 27 & 28). All were shunt type collisions.

4.3.5 **Westbound off-slip** had twelve collisions. These are broken down in to three specific areas.

- The exit area had two collisions (22 & 23) Number 22 made a late decision and lost control and number 23 was a shunt type collisions due to traffic.
- Numbers 18, 19 and 20 all occurred near the start or mid way down the exit slip road. Numbers 18 and 19 were shunt type collisions due to slowing traffic ahead, and number 20 allegedly lost control due to standing water. It should be noted that the HFS extends for 50m from the give way line and these collisions occurred outside of the area covered.
- Numbers 8 to 14 all occurred within close proximity of the give way junction with the A3064. Six were shunt type collisions and number 14 occurred when a motorcycle lost control in rain / wet surface on approach to the give way line.

4.3.6 **Westbound on-slip** has had three collisions, one on the slip road itself due to loss of control in snow, and two shunts near the merge area due to slow traffic / queuing on the A38.

4.3.7 **A38 main carriageway** had four collisions, two in each direction. On the eastbound side one involved a motorcycle which crashed when its luggage became tangled in the rear wheel and one was a shunt in slow traffic. On the westbound side both collisions were multi-vehicle shunts in poor weather near the start of the off-slip.

4.4 Collision Analysis

4.4.1 Four collisions occurred during the morning peak and eight during the evening peak.

4.4.2 Only one involved a non-motorised user (a pedal cyclist), who was hit from behind whilst attempting to join the eastbound main carriageway.

4.4.3 Three collisions involved motorcyclists, one due to their luggage becoming entangled in the rear wheel (serious), one lost control when it was raining and wet and the third when a car failed to give way at the end of the slip road and hit the oncoming bike, who had right of way (serious).

4.4.4 All of the three serious injury collisions involved vulnerable roads users - one pedal cyclist and two motor cyclists.

4.4.5 Of the 64 vehicles involved in the 29 collisions only 8 had recorded postal addresses out side the PL (Plymouth and south-east Cornwall) post code area and one was not recorded due to it being a hit-and-run.

4.4.6 Table 2 (below) gives a breakdown of the collisions by day of week, month and time of day.

Mon	Tue	Wed	Thur	Fri	Sat	Sun
5	2	8	2	6	2	4

Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2	3	6	3	2	2	3	2	2	3	1	-

0000 to 0600	0600 to 1200	1200 to 1800	1800 to 0000		Am peak 7-9 am	Pm peak 4-6 pm
-	8	15	6		4	6

Table 2 - breakdown of collisions by day of week, month and time of day

4.4.7 Table 2 shows that the collisions are fairly evenly spread throughout the year, with a peak in March and no collisions in December. It also shows that collisions occurred in the morning and evening peak periods, which corresponds to peak traffic flow.

5 Discussion of Issues

5.1 Overview

5.1.1 From the assessment of the recorded personal injury collisions and the existing road layout the following points have been highlighted to justify collision remedial measures:

5.1.2 35% of collisions occurred on the two off-slips, the majority being shunts.

5.1.3 The slip roads are clearly signed with visible advanced 'Give Way Ahead' warning signs.

5.1.4 Traffic flow during peak times is high and the junction has to interact with other nearby junctions, which causes queuing issues.

5.1.5 At present there are known issues with land ownership along the Parkway. These are currently being resolved by trunking and de-trunking relevant sections of carriageway, as required. It is anticipated that this will be resolved before the recommendations of this study are constructed. Therefore, the recommendations are based upon what the ownership will be rather than what it currently is.

5.1.6 The tear-drop junction on the A3064 has slow traffic speeds due to its sharp right turn onto the A38 and this, together with high traffic volumes, may cause delay to traffic trying to exit from the eastbound A38. Visibility to the right on the approach to the give way line on the eastbound off-slip is reduced due to overgrown foliage near the bridge abutment. The abutment also restricts visibility on this approach. Visibility on the westbound off-slip is also restricted by the bridge abutment but there are no issues with foliage. The geometry of the off-slips has been checked against the requirements of TD 16/07 and is generally compliant -the visibility requirements would be met if the foliage was cut back.

5.1.7 From observations during the am peak, traffic regularly queues on the eastbound A38 between the St Budeaux junction and Weston Mill off-slip. Queuing traffic has a safety implication for both junctions and there is also a significant economic impact due to delay. Initial assessment suggests that signalisation of the northbound A3064 and the A38 eastbound off-slip would allow the flow of traffic to be controlled, which would therefore reduce congestion throughout the junction. However, a further study is required to consider this proposal in detail.

5.1.8 There is a sheet metal environmental screen attached to the eastbound safety barrier, which restricts visibility between the on-slip and main carriageway. Removal of the last 33m of the barrier should be considered, to improve inter-visibility. However, the continued need for

the barrier must be established to determine whether its removal is feasible.

5.1.9 The left turn from the northbound A3064 onto the westbound A38 has a tight radius (40m). There are signs and chevrons warning of this but evidence suggests that many vehicles run wide: To the offside of the tracked area there is a large amount of gravel and other debris, which would present a significant hazard if overrun by vehicles, especially motorcycles. The main carriageway has been treated with buff coloured HFS but the hatched areas have not. Therefore, any vehicle which runs wide or cuts the corner has one set of wheels on a surface with less grip. Infilling the existing near and off-side hatched areas with HFS would help to ensure vehicles have consistent grip through the bend. Providing a solid white edge line to the hatched areas and an additional 'Slow' marking prior to the bend may also be beneficial. However, it should be noted that none of the collisions occurred in this area. See photograph K in Appendix B.

5.1.10 Although 17 (58%) of the collisions occurred during rain or when the road was wet, only five of these involved a vehicle losing control or skidding. There is no record of flooding or surface water issues but one of the collisions on the westbound off-slip (collision 20) refers to standing water.

5.1.11 The SCRIM intervention levels exceed those required for the main areas of concern. Therefore, no further investigation was carried out into the condition of the road surface.

5.1.12 Several shunt collisions occurred on both off-slips outside of the area currently covered by HFS. This suggests that queuing traffic is blocking the area covered by HFS so the HFS provision should be extended.

5.1.13 There are three lighting columns upon each on-slip and none on the main carriageway. This requires driver's eyes to adjust to the dark whilst approaching the critical area of the merge. Although night time collisions are lower than expected, switching off these lights will assist drivers on the main carriageway as well as those joining the A38, and the effects will be monitored.

5.1.14 The verge marker posts on the off-side of the westbound off-slip require regular replacement as they are frequently being hit by traffic. When the marker posts break off they leave an exposed socket in the carriageway, which is a potential safety hazard for motorcyclists. Therefore it is recommended that more robust, passively safe items are used, such as Rediweld 'Jislon' posts.

5.1.15 The 50mph speed limit for the A3064 includes the slip roads but it is inconsistent in its layout, and possibly unenforceable due to wording /

sign positioning. The Traffic Regulation Order (TRO) for the speed limit on the A3064 states "50mph...inclusive of the slip roads onto and from the Parkway (A38)", however the national speed limit signs are located at the start of the on-slips, which contradicts the Order, see photograph F in Appendix B. This could mean that the speed limit is unenforceable on both the A38 and A3064. It is understood that Plymouth City Council are considering a review of all speed limit orders through the Parkway corridor, which may address this issue. A copy of the Speed Limit Order is included in Appendix F.

5.1.16 Speed data obtained from The Safety Camera Partnership for two periods in 2008/9 revealed that average speeds ranging between 32mph and 33.5mph were recorded within the 50 mph limit along the A3064.

5.1.17 The existing northbound cycle lane adjacent to the A3064 appears to be of little benefit – it commences at an arbitrary point along the A3064 and ends where the only available route is onto the A38 via the eastbound on-slip. A more suitable route for cyclists is available via Mowhay Road, crossing the A38 via the existing footbridge and continuing into Honicknowle and beyond.

5.1.18 The following points have also been identified as general / maintenance issues within the study area:

- Areas of road markings require renewing around the tear drop and eastbound on-slip.
- The hatching at the end of the westbound off-slip requires renewing.
- Certain issues within the above list are on the Plymouth City highway network so do not directly affect the Highways Agency road.

6 Recommendations and Cost / Benefit Analysis

6.1 Recommendations

6.1.1 To target the main causes of collisions at this location the following improvements are recommended:

Issue	Suggested improvement
Short Term Measures	
Poor visibility and shunt collisions on eastbound off-slip.	Clear vegetation between junction and bridge to increase visibility. Extend HFS to 100m in total, to allow for queuing traffic.
Poor visibility and collisions at eastbound on-slip merge area.	Remove 33 metres of metal environmental barrier to provide clear visibility between the A38 main line and the on-slip.
Shunt type collisions on westbound off-slip. Continued replacement of verge marker posts, with increased danger to workforce and motorist from damaged posts.	Increase conspiquity of hatching at bottom of slip by in-filling with red coloured HFS, extend HFS to 100m from give way line. Replace verge marker posts with Rediweld 'Jislon' passively safe high visibility cylinders, or similar.
Tight radius and poor layout at the beginning of the westbound on-slip.	In-fill the hatched areas with grey coloured HFS, edged with solid edge line and provide an additional 'Slow' marking on the approach.
Transition between lit and un-lit roads	Deactivate existing street lights on both on-slips.
Poorly worded 50mph speed limit Order	Liaise with PCC to produce a correct TRO for the speed limit. (PCC network)
Longer Term Measures	
Queuing on the off-slips	Undertake a study into the possibility of introducing traffic signal control at the junction.

Table 3 - Summary of issues and suggested solutions

6.1.2 The construction of the short term measures will cost approximately £44,005.89 and the proposals are shown on the plan in Appendix D:

6.1.3 The proposals have been agreed internally with EnterpriseMouchel's Network and Design Managers and discussed with Plymouth City

Council. Comments made by both the Network and Design Managers and Plymouth City Council have been incorporated into the recommendations.

6.1.4 Consultation has been undertaken with Devon and Cornwall Police. The findings of these consultations will be reported to the designers prior to them undertaking preliminary design.

6.1.5 It is recommended that the suggested improvements be progressed through to Value Management, preliminary design, detailed design and implementation.

6.1.6 It is anticipated that the recommended improvements will produce a reduction in collisions at this location. However, it is apparent from the study that the root cause of the problems at this location is congestion. It is therefore recommended that the feasibility of introducing traffic signal control at this junction is considered in greater detail. A further study should therefore be undertaken to assess:

- Planned and anticipated development in the area including change of usage at the Dockyard and traffic growth;
- Interaction between Westin Mill and St Budeaux junctions;
- Economic and Safety benefits of signalisation.

6.2 Cost / Benefit Analysis

6.2.1 Justification for implementing the proposals is assessed by the completion of a Project Appraisal Report (PAR 5.0). This report and associated worksheets are included in Appendix E for the short term measures. The appraisal system compares scheme costs with collision and congestion savings to provide a First Year Rate of Return.

6.2.2 The predicted annual collision savings resulting from the introduction of these measures are estimated to be 1.93 per year, equivalent to an overall reduction in all collisions of 33.3%.

6.2.3 The costs of the recommendations and anticipated collision savings have been applied to the PAR 5.0 report. The key data is summarised in the following table:

Table 4 = PAR 5 Financial Info Removed.

APPENDICES

Appendix A - Site Location and Existing Details

Appendix B - Site Photographs

Appendix C - Collision Locations

Appendix D - Proposed Measures

Appendix E - Short PAR 5.0 — Not included n/a

Appendix F - Speed Limit Order