

A947 Route Improvement Strategy

Appendices



Appendices

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Appendix A

Appendix A: List of Options from Previous Studies

Source: A947 Route Analysis Action Report, AECOM 2009		
Option	Description	Location
Lining	<ul style="list-style-type: none"> Review of road marking improvements along the route was undertaken to identify specific road marking improvements which may be required at specific locations. Recommendation that lining is maintained to an acceptable standard and edge markings in particular kept clear of encroaching vegetation. This will improve driver awareness, especially during the hours of darkness, with a possible improvement in road safety. 	Route Wide
Signing Improvements, including Hazard Warning Signs, Bend Ahead Signs, Side Road Ahead Signs, and Passively Safe Poles.	<ul style="list-style-type: none"> Recommendation for existing signage to be rationalised, in combination with proposed new signage, in order to provide continuity along the route. Recommendation to increase visibility of signs through the use of 1200mm height signs, and use of highest grade retro-reflective materials. Continued maintenance of roadside vegetation. 	Route Wide
Barriers	<ul style="list-style-type: none"> Implementation of safety barriers, to reduce potential for collisions with trees and telegraph poles (which increase the severity of collision). One possible solution raised was NatureRail (more aesthetically pleasing than traditional safety barriers). 	Route Wide
Intelligent Road Studs	<ul style="list-style-type: none"> Implementation of Intelligent Road Studs to increase visibility for drivers (IRS are highly visible for distances of up to 1000m which is approximately 10 times that of conventional road studs) including during adverse weather. 	Route Wide
Interactive Chevrons	<ul style="list-style-type: none"> Development of interactive chevrons at specific bends to give motorists advance warning of the corner ahead. Detection thresholds are sets such that signs only illuminate when vehicles exceed the designated speed. 	Route Wide (specific bends)
Road Surface Treatments including High Friction Surfacing, Stone Mastic Asphalt (SMA) surfacing, Hot Rolled Asphalt (HRA), Micro Surfacing, Surface Dressing and Retexturing.	<ul style="list-style-type: none"> Surface treatments to address various areas (based on SCRIM data). The findings highlighted that there were a large number of areas that fell within the zone that required further investigation. From onsite observations, the amount of "polishing" in these areas varied greatly and investigation into the remedial treatments of these sections was recommended. 	Specific areas on the route
Speed Cameras, including Average and Fixed Speed Cameras	<ul style="list-style-type: none"> Average speed cameras control 85th percentile road speeds. Have a higher capital cost in comparison to other technologies and require a "best value" approach to identifying suitable locations. Fixed speed cameras can distinguish between vehicle types (e.g. HGVs and cars). 	Specific areas on the route

Source: A947 Route Analysis Action Report, AECOM 2009

Option	Description	Location
Maintenance	<ul style="list-style-type: none"> Better maintenance of existing infrastructure could have a positive impact on road safety. Ongoing maintenance will also be associated with any new infrastructure on the route. 	Route Wide

Source: A947 Route Study Report, Grontmij 2011

Option	Description	Location
Bend Mitigation Measures	<ul style="list-style-type: none"> Application of mitigation measures on bends, which have had categories assigned. Work identified a total of 147 bends, with an indicative cost for the measures of approx. £180,000. 	Specific areas on the route
Major Junction Improvements	<ul style="list-style-type: none"> Proposed junction improvements including renewal of road markings, "Keep Clear" diagram 1026 road marking (B977 to Balmedie), appropriate tapers and ghost island (A920 to Ellon), requiring detailed junction traffic assessment to confirm the need for these. 	Major Junctions
Drainage	<ul style="list-style-type: none"> New gully provision identified across the route. New filter drains or trenches also required in places, with general maintenance of existing drainage highlighted. 	Route Wide
Lay-by Location Review	<ul style="list-style-type: none"> Proposals involved retaining the location of eight lay-bys on the route, relocating five lay-bys to new sites, and creating one new lay-by. 	Specific locations on the route (lay-bys)
Mobile Safety Camera Sites	<ul style="list-style-type: none"> Retention/removal of existing mobile camera sites, and introduction of new sites. 	Route Wide
Roadside Furniture	<ul style="list-style-type: none"> Follows principle of a 'forgiving roadside' – 2m verges proposed to increase visibility, and all vehicle restraint systems, signposts etc. passively safe. 	Route Wide
Verge vegetation maintenance	<ul style="list-style-type: none"> Prioritised on a regular basis throughout the year. 	Route Wide
Partnering	<ul style="list-style-type: none"> Partnering arrangement to review, prioritise and implement recommendations in the report. 	N/A
Highway Asset Management	<ul style="list-style-type: none"> An all-in asset management database system to be fully implemented within Aberdeenshire's T&I service. 	N/A
The 4 E's	<ul style="list-style-type: none"> Education and Encouragement, together with Engineering and Enforcement measures to facilitate the reduction of accidents on the A947. 	Route Wide

Appendix B

Appendix B: Historic Traffic Flow Data

Year	LA Boundary - B977	% Change	A920-B977	% Change	A947 Sth Road-A920	% Change	B9170 Urquhart Rd-A947 Sth Road	% Change	B9005-B9170	% Change	B9025 Market Street-B9005	% Change	B9026 Myrus Avenue-B9025 Market Street	% Change	A98-B9026 Myrus Avenue	% Change
2000	20246		5667		9424		4399		4838		5115		3191		3293	
2001	19330	-4.52%	5715	0.85%	8614	-8.60%	4476	1.75%	4908	1.45%	5175	1.17%	3240	1.54%	3349	1.70%
2002	20362	5.34%	6577	15.08%	8839	2.61%	4666	4.24%	5104	3.99%	5431	4.95%	3141	-3.06%	3487	4.12%
2003	19645	-3.52%	6816	3.63%	9075	2.67%	4861	4.18%	4653	-8.84%	5638	3.81%	3262	3.85%	3631	4.13%
2004	20357	3.62%	6151	-9.76%	9171	1.06%	4910	1.01%	4685	0.69%	5347	-5.16%	3281	0.58%	3660	0.80%
2005	20966	2.99%	6168	0.28%	9238	0.73%	4920	0.20%	4683	-0.04%	5357	0.19%	3594	9.54%	3678	0.49%
2006	22212	5.94%	6438	4.38%	9355	1.27%	5011	1.85%	4790	2.28%	5723	6.83%	3647	1.47%	3747	1.88%
2007	17686	-20.38%	6492	0.84%	9667	3.34%	4524	-9.72%	4725	-1.36%	5777	0.94%	3604	-1.18%	3521	-6.03%
2008	17973	1.62%	6407	-1.31%	9516	-1.56%	4487	-0.82%	4690	-0.74%	5385	-6.79%	3577	-0.75%	3497	-0.68%
2009	18284	1.73%	6513	1.65%	8963	-5.81%	4550	1.40%	4760	1.49%	5473	1.63%	3631	1.51%	3555	1.66%
2010	18221	-0.34%	6419	-1.44%	8889	-0.83%	4438	-2.46%	4658	-2.14%	5404	-1.26%	3556	-2.07%	3467	-2.48%
2011	16000	-12.19%	6528	1.70%	8854	-0.39%	4447	0.20%	4674	0.34%	5492	1.63%	3570	0.39%	3476	0.26%
2012	16044	0.28%	6578	0.77%	8822	-0.36%	4363	-1.89%	4582	-1.97%	5536	0.80%	3500	-1.96%	3409	-1.93%
2013	15952	-0.57%	5975	-9.17%	8832	0.11%	4435	1.65%	4657	1.64%	5578	0.76%	3237	-7.51%	3467	1.70%
Total increase		-21.21%		5.43%		-6.28%		0.82%		-3.74%		9.05%		1.44%		5.28%

(Source: DfT)

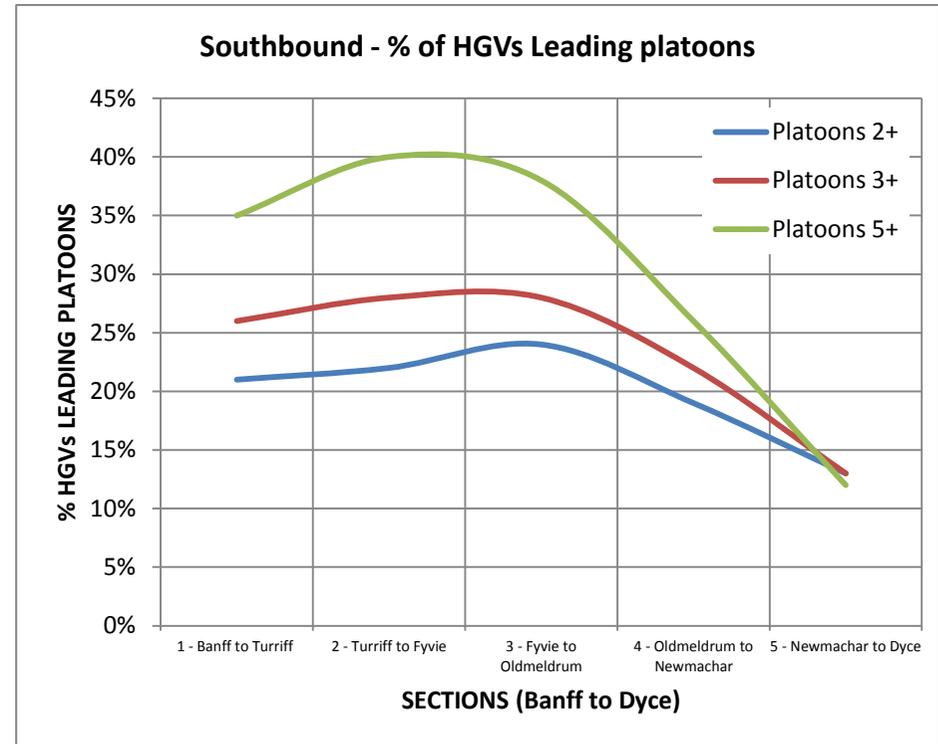
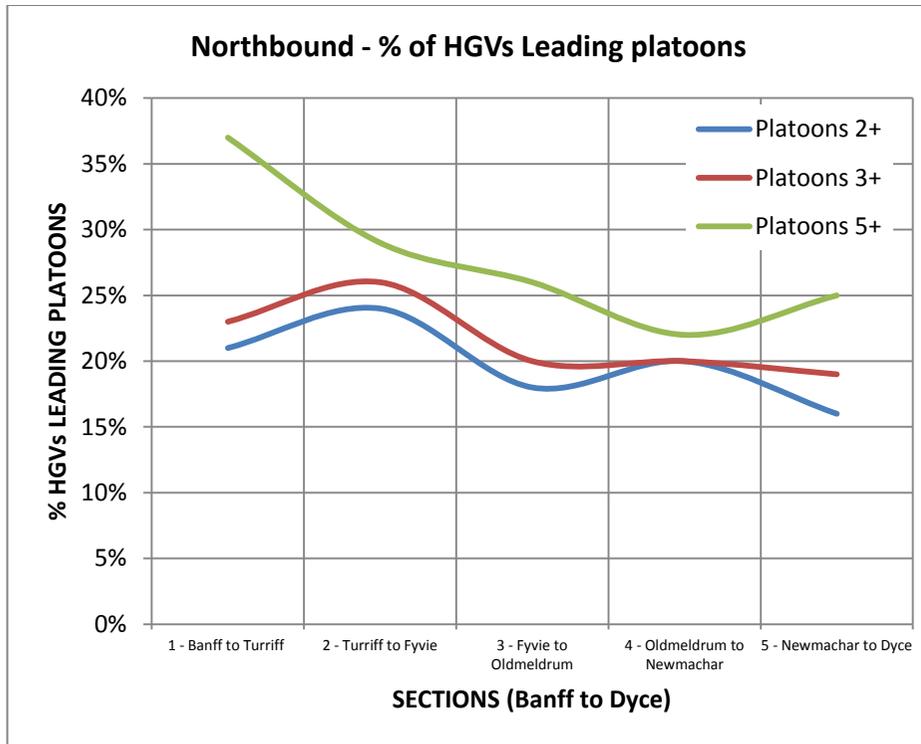
Appendix C

Site	Location (Lat / Long) ¹	Direction	Total No. of Platoons (5+) ²	Total No. of Platoons (5+) 6-9 AM	Total No. of Platoons (5+) 4-7 PM	Avg No. Platoons (5+) p/hr ¹⁹	Avg No. Platoons (5+) p/hr 6-9 AM	Avg No. Platoons (5+) p/hr 4-7 PM	Max Platoon Size ¹⁹	Avg Speed of Vehicles leading platoons with 5+ vehicles (mph) ¹⁹	Proportion of platoons (5+) being led by slower moving vehicles ³
1	A947 between Banff-Turriff (57.572899,-2.442622)	N'bound	54	5	34	1	0	3	8	42.79	37%
		S'bound	96	47	10	2	4	1	12	42.62	35%
2	A947 between Turriff-Fyvie (57.523207,-2.442340)	N'bound	279	28	148	5	2	12	13	45.71	29%
		S'bound	47	26	3	1	2	0	8	42.56	40%
3	A947 between Fyvie-Oldmeldrum (57.410266,-2.336184)	N'bound	174	7	113	3	1	9	14	45.95	26%
		S'bound	310	156	35	6	13	3	20	43.54	38%
4	A947 between Oldmeldrum-Newmachar (57.312704,-2.260775)	N'bound	294	27	160	5	2	13	18	45.12	22%
		S'bound	420	276	34	8	23	3	17	40.59	26%
5	A947 between Newmachar-Dyce (57.245086,-2.183619)	N'bound	224	6	102	4	1	9	13	41.02	25%
		S'bound	173	117	1	3	10	0	10	44.06	12%

¹ See Figure 3.9

² Based on four days counts, 6am-8pm (Tuesday 27th October-Friday 30th October).

³ Based on four days counts, 6am-8pm (Tuesday 27th October-Friday 30th October). Slower moving vehicles are defined as non-cars – 'Short Towing – Trailer, Caravan, Boat, etc.', 'Two axle truck or Bus', 'Three axle truck of Bus', 'Four axle truck', 'Three axle articulated vehicle or Rigid vehicle and trailer', 'Four axle articulated vehicle or Rigid vehicle and trailer', 'Five axle articulated vehicle or Rigid vehicle and trailer', 'Six (or more) axle articulated vehicle or Rigid vehicle and trailer', 'B-Double or Heavy Truck and trailer' and 'Double or triple road train or Heavy truck and two (or more) trailers'.



Summary of Results:

- The level of slow moving vehicles leading platoons along the A947 is generally similar in both directions over the survey period.
- Results highlight the influence of slow moving vehicles on platoons; whilst between 10 and 30% of platoons consisting of 2+ or 3+ vehicles were led by slow moving vehicles, the proportion of platoons consisting of 5+ vehicles led by a slow moving vehicles was up to 40% on some sections.
- The route section between Newmachar and Dyce (Southbound) shows a drop down to 10% of total platoons led by HGVs for all platoons.
- The northern sections of route e.g. between Banff and Fyvie, show to have the highest proportion of platoons led by HGVs; Northbound presents values close to 40% between Banff and Turriff, whilst Southbound present similar values down to Fyvie.
- In summary, results demonstrate that the issue of platoons caused by slow moving vehicles appears to be most prominent in the northern sections of route (i.e. north of Oldmeldrum).

Appendix D

Project:	A947 Route Improvement Strategy	Job No:	60335603
Subject:	A947 Journey Time Reliability (TomTom Data)		
Prepared by:	Adrian Garcia	Date:	30/06/2015
Checked by:	Peter Fullerton	Date:	27/07/2015
Approved by:	Richie Fraser	Date:	13/08/2015

1 Introduction

AECOM have been commissioned by Aberdeenshire Council to prepare a Route Improvement Strategy (the Strategy) for the A947. To support the identification of problems and issues that the Strategy should address, the average journey time for the route has been analysed using TomTom data¹ provided via Streetwise Services.

The purpose of this technical note is to provide an overview of the TomTom journey time data and emerging findings.

The structure of this note, following this introductory section, is as follows:

2. Journey Time Data – Scope
3. A947 Aberdeen to Banff – Key Findings
4. A947 Sectional Breakdown – Key Findings
5. Summary.

2 Data Specification

Data was provided for the year 2012 between the 1st of March and 30th of November and related to the following time periods: 0700-0800; 0800-0900; 0900-1000; 1000-1600; 1600-1700; 1700-1800; 1800-1900. Data relating to Fridays, Saturdays, Sundays, Mondays, July and August were excluded.

The data provided the average speed of vehicles passing at a number of points on the route. The following information was also provided:

- Average speeds (kph)
- Median speeds (kph)
- Percentile speeds (kph)
- Percentile travel time (s)
- Cumulative travel time (s)
- Relative standard deviation

¹ TomTom data was procured via Streetwise Service by AECOM on behalf of Transport Scotland for use as part of a separate commission, but with prior agreement that the data could be shared with Aberdeenshire Council for the purposes of the A947 Route Improvement Strategy.

2.1 Sample Size

The Sample Rates (the number of observations per data entry point) corresponding to the time periods are shown in Table 1 below. Note that the Sample Rates also relate to sections of road other than the A947².

Table 1: Sample Rates				
Route Description		Sample Rates		
From	To	0800 - 0900	1000 - 1600	1700 - 1800
A97 Gartly	A96 Aberdeen	100	500	80
A96 Aberdeen	A97 Gartly	90	500	90
A947 Oldmeldrum	A98 Banff	80	400	60
A98 Banff	A947 Oldmeldrum	60	500	60

Despite the relatively low sample rates on a few routes, the TomTom data collection method provides significantly more observations than the Moving Car Observer (MCO) method that has traditionally been used to derive journey times for model validation purposes.

2.2 Limitations with data and points of uncertainty

There are a number of known limitations which should be borne in mind when interpreting the data and results as follows:

- The sample rates are an average and results for particular data entry points may be based on a relatively low number of vehicles (possibly resulting in “spikes” in the data when displayed in a graph);
- The data does not allow for a distinction to be made between vehicle types. Accordingly, average speeds provided will relate in part to LGVs and HGVs which are subject to reduced speed limits;
- Users of TomTom devices could be motorists who are unfamiliar with the route; and
- Results could be influenced by vehicles which are stationary at a layby or shop for instance and for which data is still being collected.

2.3 Amendments to the original data

Following receipt of the raw data, it was reviewed with the following amendments made:

- The speed data has been converted from KPH into MPH;
- The speed limit for some sections has been amended due to inaccuracies in the raw data; and

² The TomTom data relates to the A947 and a wider road network. The data has been filtered such that only data relating to the A947 has been analysed as part of this report. However, the Sample Rates cannot be broken down further than that shown in Table 1.

- The peak morning and evening periods were calculated as 0800-0900 and 1700-1800 and the remaining data relating to the morning and evening periods has been excluded in this analysis.

Furthermore, additional information was added to the raw data to allow general comparisons as follows:

- The UK free flow average speed for 30, 40 and 60mph roads and considering all vehicle speeds which was obtained from the UK government 2013 Statistics report³; and
- An estimated UK average speed for 50mph roads⁴.

3 Key Findings

3.1 A947 Aberdeen to Banff

This section summarises average journey time and corresponding average speed for journeys on the A947 between Aberdeen and Banff (65.8 kilometres / 40.9 miles).

The following table provides results between Aberdeen (junction between the A96 and A947 within the Aberdeen City Council boundary) and Banff (junction between the A98 and A947).

Table 2: Average Journey Time and Average Speed between Aberdeen and Banff						
Aberdeen - Banff (Northbound)						
Distance	Average Journey Time			Average Speed		
	0800- 0900	1000 - 1600	1700 - 1800	0800 - 0900	1000 - 1600	1700 - 1800
40.9 miles	1h 9m 12s	1h 1m 26s	1h 1m 53s	35.6 mph	36.7 mph	36.4 mph
Banff - Aberdeen (Southbound)						
Distance	Average Journey Time			Average Speed		
	0800-0900	1000 - 1600	1700 - 1800	0800 - 0900	1000 - 1600	1700 - 1800
40.9 miles	1h 5m	1h 1m 45s	1h 7m 19s	35.3 mph	36.3 mph	35.9mph

- The average northbound journey time in the AM peak period was approximately seven minutes slower than the PM peak period equivalent. The shortest average journey time for the northbound journey was during the inter-peak period although there was negligible difference between it and the PM peak period.

³ <https://www.gov.uk/government/statistics/free-flow-vehicle-speeds-in-great-britain-2013>

⁴ The relationship between the average speed and speed limit for 40mph and 60mph roads has been used to estimate the average speed corresponding to 50mph.

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- The average southbound journey time in the AM peak period was approximately two minutes faster than the PM peak period equivalent. The shortest average journey time for the southbound journey was during the inter-peak period.
 - There is little difference in the shortest southbound and northbound average journey times, e.g. northbound – 1 hour 1 minute 26 seconds and southbound – 1 hour 1 minute 45 seconds.
 - The inter-peak average journey time results are lower than the peak results. This may be explained by the fact that there are fewer vehicles during the inter-peak period with less congestion in built-up areas on the route.

In addition, some notes have been applied to the graph to highlight possible explanations for periodic drops in average speeds.

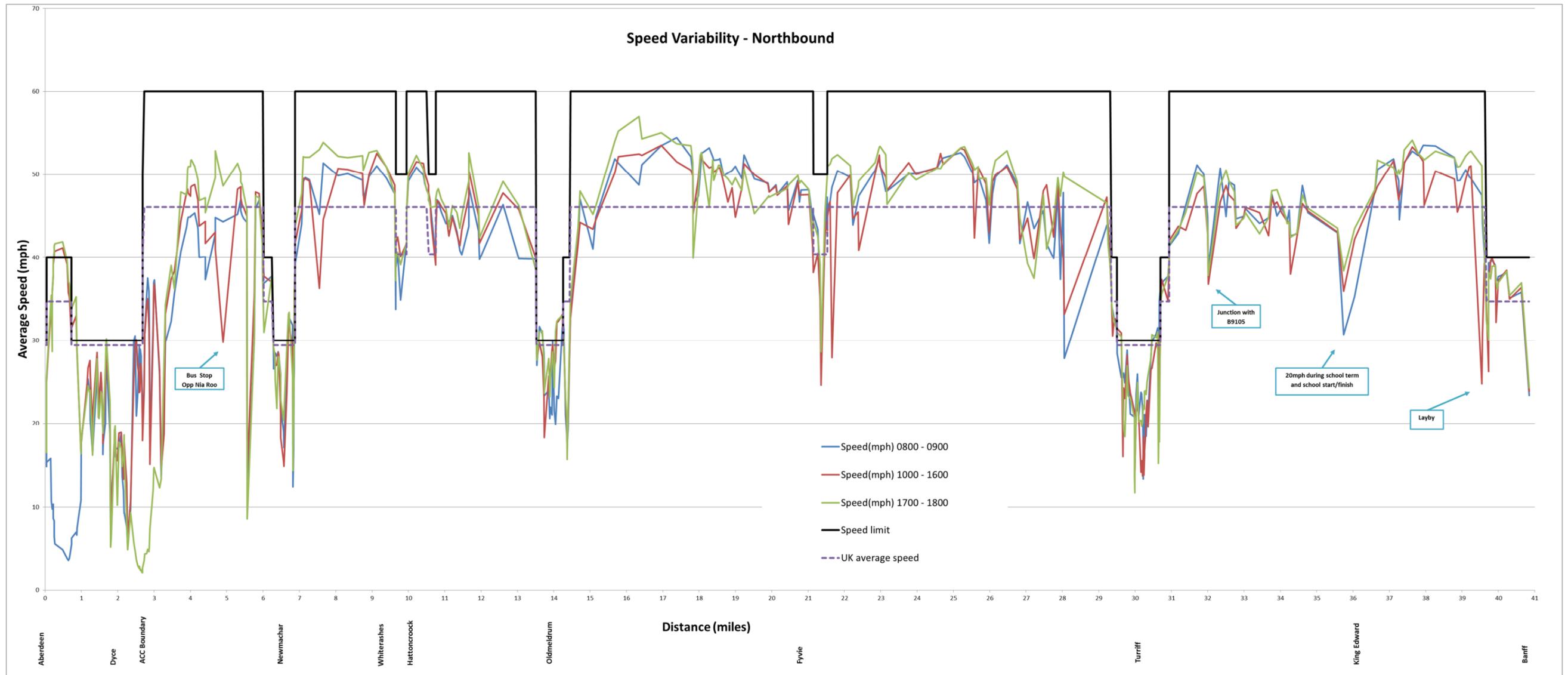


Figure 1: Speed Variability – Northbound

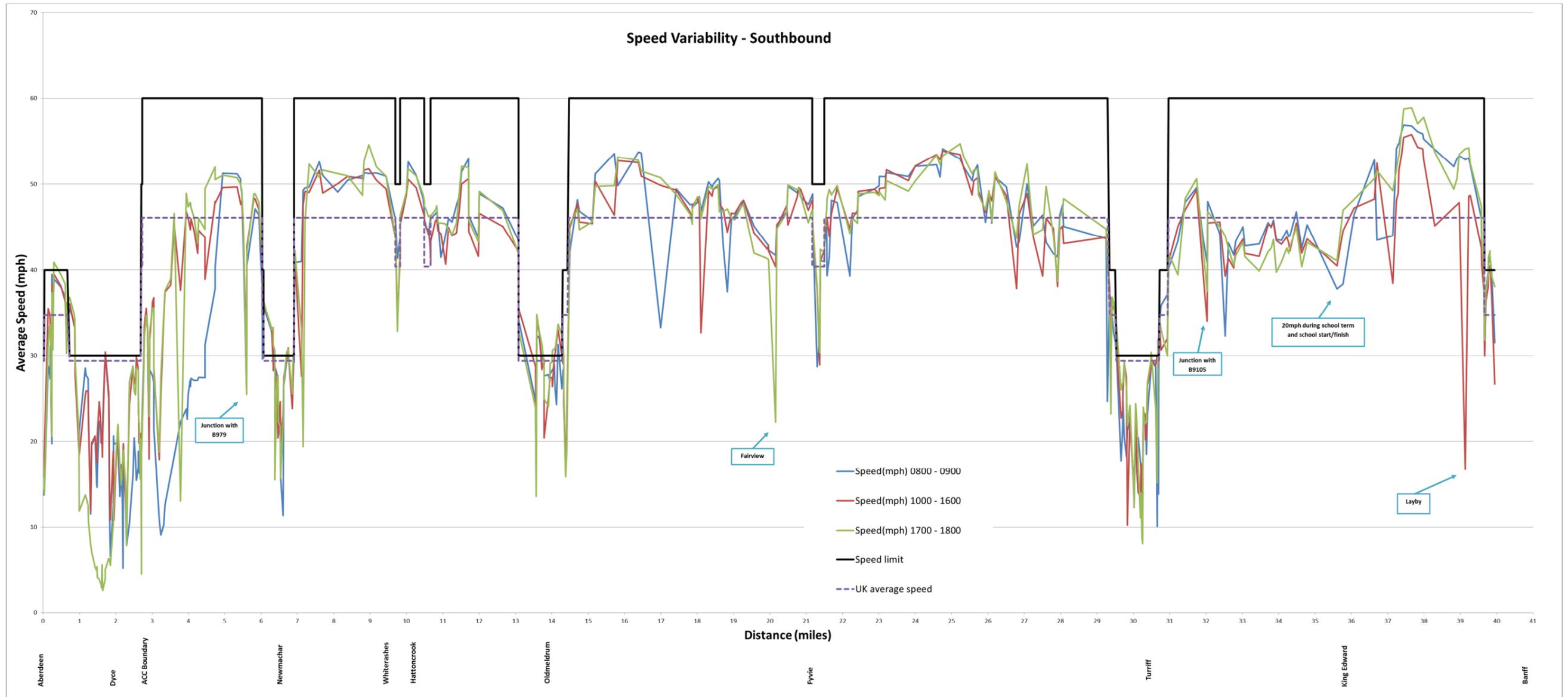


Figure 2: Speed Variability – Southbound

The key findings from more detailed analysis of the results shown in Figures 1 and 2 are:

- Average speeds drop significantly in built up areas;
- The highest average speeds occur to the south of Banff for northbound and southbound traffic, and additionally to the north of Oldmeldrum for northbound traffic;
- The lowest average speeds occur between Aberdeen and a point to the north of the boundary between the Council's boundary for both northbound and southbound traffic;
- Based on the assumption that greater correlation of average speeds between time periods indicates greater journey reliability, then journey reliability is lessened between Aberdeen and Newmachar.
- Excluding built up areas, there are four areas where the average speed is predominantly and consistently below the UK national average speed. These are (1) between the Council boundary and Newmachar, (2) between Hattoncrook and Oldmeldrum, (3) the 3.25 mile stretch immediately south of Turriff, and (4) the 3.5 mile stretch to the north of Turriff beginning approximately 2 miles outside of Turriff. (A further area exists in the southbound direction for some time periods between Fyvie and Oldmeldrum).
- The only time that the average speed exceeds the speed limit is within built up areas (especially on the entry/exit of built up areas).

4 A947 section by section findings

4.1 A947 between Aberdeenshire Council boundary and Banff

Further analysis has been undertaken which separates the data relating to the A947 into different sections; one section includes all data relating to the A947 within Aberdeen City Council allowing issues specific to Aberdeenshire Council to be examined.

The boundary between Aberdeen City Council and Aberdeenshire Council is located to the north of Dyce at the point where the A947 crosses the River Don.

Table 3 provides results relating to the stretch of A947 between the Aberdeenshire Council boundary and Banff.

Table 3: Average Journey Time and Average Speed between the Aberdeenshire Council boundary and Banff						
Aberdeenshire Council boundary – Banff (Northbound)						
Distance	Average Journey Time			Average Speed		
	0800- 0900	1000 - 1600	1700 - 1800	0800 - 0900	1000 - 1600	1700 - 1800
37.8 miles	53m 8s	53m 35s	52m 46s	39.7 mph	39.4 mph	40.6 mph
Banff – Aberdeenshire Council boundary (Southbound)						
Distance	Average Journey Time			Average Speed		
	0800-0900	1000 - 1600	1700 - 1800	0800 - 0900	1000 - 1600	1700 - 1800
37.8 miles	55m 41s	53m 33s	52m 5s	38.7 mph	39.5 mph	40.3 mph

In terms of key findings:

- The average northbound journey time across all time periods was broadly similar.
- The average southbound journey time in the AM peak period was approximately 3.5 minutes slower than the PM peak period equivalent. The shortest average journey time for the southbound journey was during the PM peak period.
- There is little difference in the shortest northbound and southbound average journey times (both of which occur in the PM peak); possibly demonstrating that average journey times are not dependent upon direction to any great degree.

4.2 A947 subsections between settlements

The following section describes key findings for five different sections that have been identified along the A947 route:

- Aberdeen to Dyce;
- Dyce to Newmachar;
- Newmachar to Oldmeldrum;
- Oldmeldrum to Turriff; and
- Turriff to Banff.

Table 4 indicates how journey time and average speed vary by section.

Table 4: A947 Sections Journey Time and Average speed by period							
Aberdeen-Banff (Northbound)							
Specific Section	Distance (miles)	Average Journey Time			Average Speed (mph)		
		0800-0900	1000 - 1600	1700 - 1800	0800 - 0900	1000 - 1600	1700 - 1800
Aberdeen - Dyce	2.15	13m 6s	5m 12s	5m 15s	15.0	26.0	25.7
Dyce - Newmachar	4.38	8m 36s	8m 14s	18m 2s	32.5	33.1	26.5
Newmachar - Oldmeldrum	7.38	10m 28s	10m 27s	10m 7s	39.3	39.8	41.3
Oldmeldrum - Turriff	16.19	21m 43s	21m 32s	21m 31s	41.0	40.6	41.8
Turriff - Banff	10.79	15m 16s	15m 59s	14m 57s	39.4	37.8	39.5
Banff-Aberdeen (Southbound)							
Specific Section	Distance (miles)	Average Journey Time			Average Speed (mph)		
		0800-0900	1000 - 1600	1700 - 1800	0800 - 0900	1000 - 1600	1700 - 1800
Banff - Turriff	10.79	15m 36s	15m 57s	15m 2s	38.4	37.3	38.8
Turriff - Oldmeldrum	16.19	22m 10s	21m 59s	21m 32s	40.5	40.8	41.3
Oldmeldrum - Newmachar	7.38	10m 4s	10m 18s	10m 2s	41.0	40.3	40.9
Newmachar - Dyce	4.38	11m 7s	7m 14s	8m 24s	26.7	33.2	33.2
Dyce - Aberdeen	2.15	6m 1s	5m 42s	12m 17s	23.9	24.6	17.0

Table 5 displays the difference between the northbound and southbound average journey times and speeds by section.

Specific Section	Distance (miles)	Difference in Average Journey Time			Difference in Average Speed (mph)		
		0800-0900	1000 - 1600	1700 - 1800	0800 - 0900	1000 - 1600	1700 - 1800
Aberdeen - Dyce	2.15	7m 5s	-0m 30s	-7m 2s	-8.9	1.4	8.7
Dyce - Newmachar	4.38	-2m 31s	1m 0s	9m 38s	5.8	-0.1	-6.7
Newmachar - Oldmeldrum	7.38	0m 24s	0m 9s	0m 5s	-1.7	0.5	0.4
Oldmeldrum - Turriff	16.19	0m 27s	-0m 27s	-0m 1s	0.5	-0.2	0.5
Turriff - Banff	10.79	-0m 20s	0m 2s	-0m 5s	1	0.5	0.7

In terms of key findings:

- Tables 4 and 5 demonstrate that the average journey time (and corresponding average speed) for the stretch of the A947 between Newmachar and Aberdeen is dependent on direction for the peak hours.
- The highlighted (red) cells demonstrate noticeable differences in average journey time (and corresponding average speed) by section. For example between Dyce and Newmachar the northbound average journey time in the PM peak is 9 minutes and 38 seconds longer than the southbound journey. The equivalent average journey time is 2 minutes and 31 seconds shorter in the AM peak for northbound journeys compared to southbound.
- Average journey times for the stretch of the A947 north of Newmachar are consistent across time periods and by direction.

Figures 3 and 4 show the proportion of time that users take to travel through each section of the route by time period:

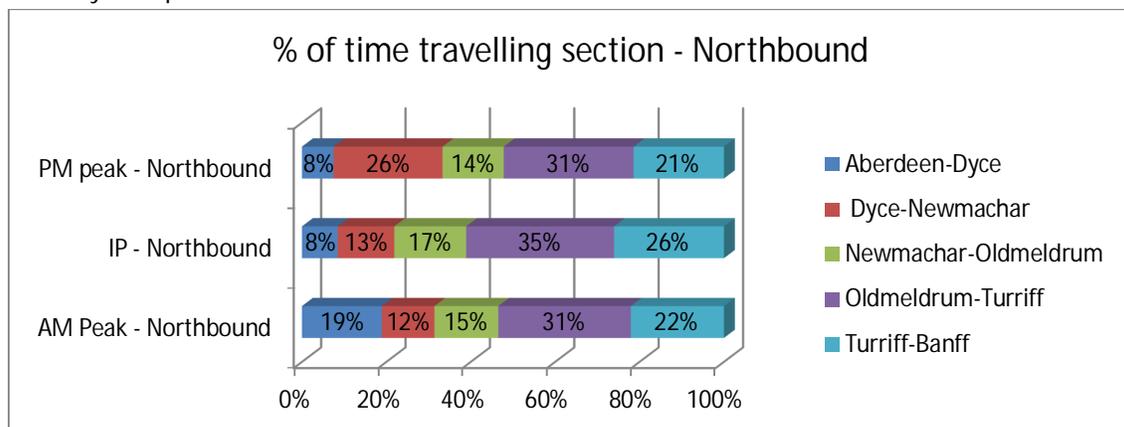


Figure 3: % of time travelling by section - Northbound

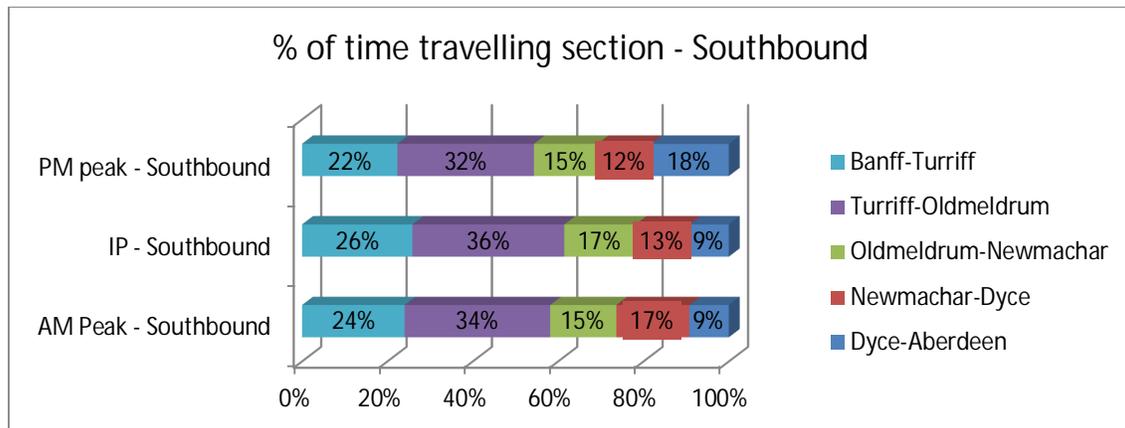


Figure 4: % of time travelling by section - Southbound

In terms of key findings:

- For the stretch between Aberdeen and Newmachar the proportion of time travelling these sections fluctuates between time periods and direction:
 - the proportion of time travelling the section between Aberdeen and Dyce is greater for northbound traffic in the AM peak and southbound traffic in the PM peak when compared with other time periods in either direction; and
 - the proportion of time travelling the section between Dyce and Newmachar is greater for southbound traffic in the AM peak and northbound traffic in the PM peak when compared with other time periods in either direction.
- For the stretch between Banff and Newmachar the proportion of time travelling each section is reasonably consistent across time periods and directions (with a maximum difference of 5% experienced across both time periods and direction).
- This demonstrates the importance of the Dyce area as an attractor of trips during the AM Peak and as a generator of trips during PM peak.

Figures 5 and 6 display, for each time period, the ratio of average journey time against the distance for each section. Figures 7 and 8 display, for each time period, the average speeds for each section.

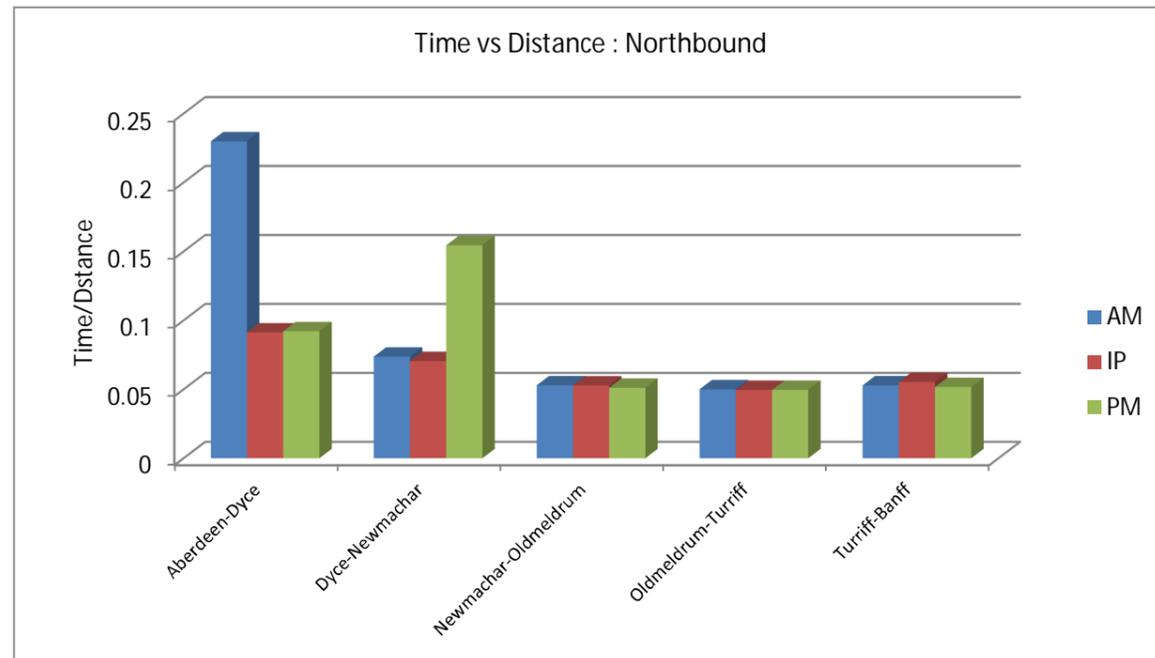


Figure 5: Average Journey Time/Distance Ratio - Northbound

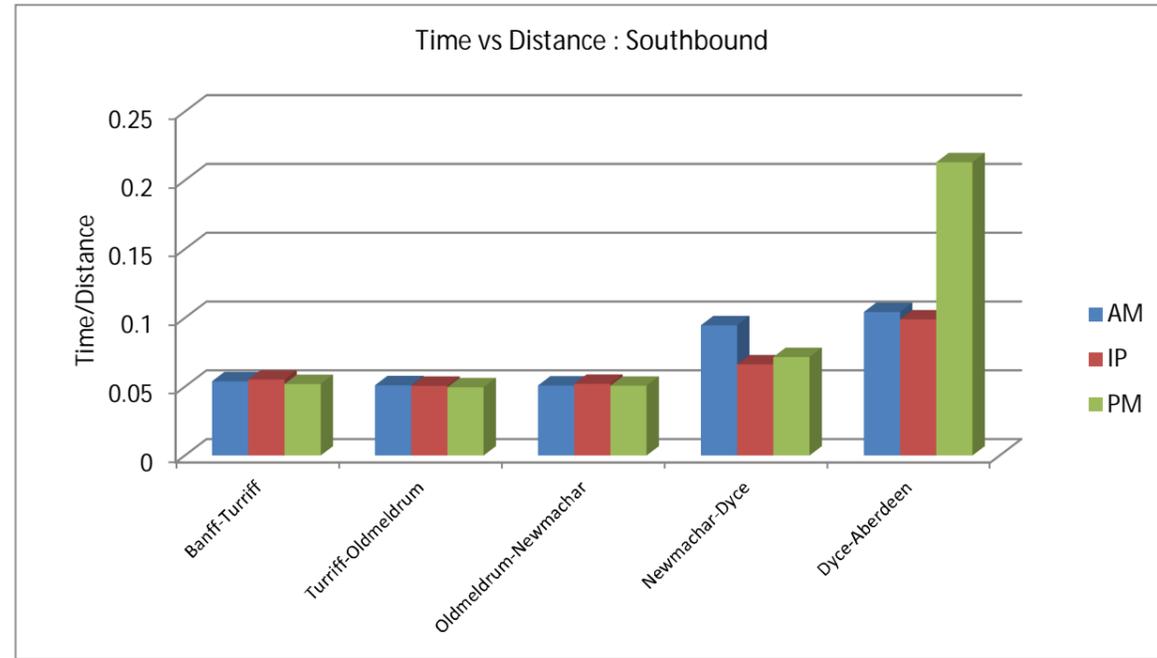


Figure 6: Average Journey Time/Distance Ratio - Southbound

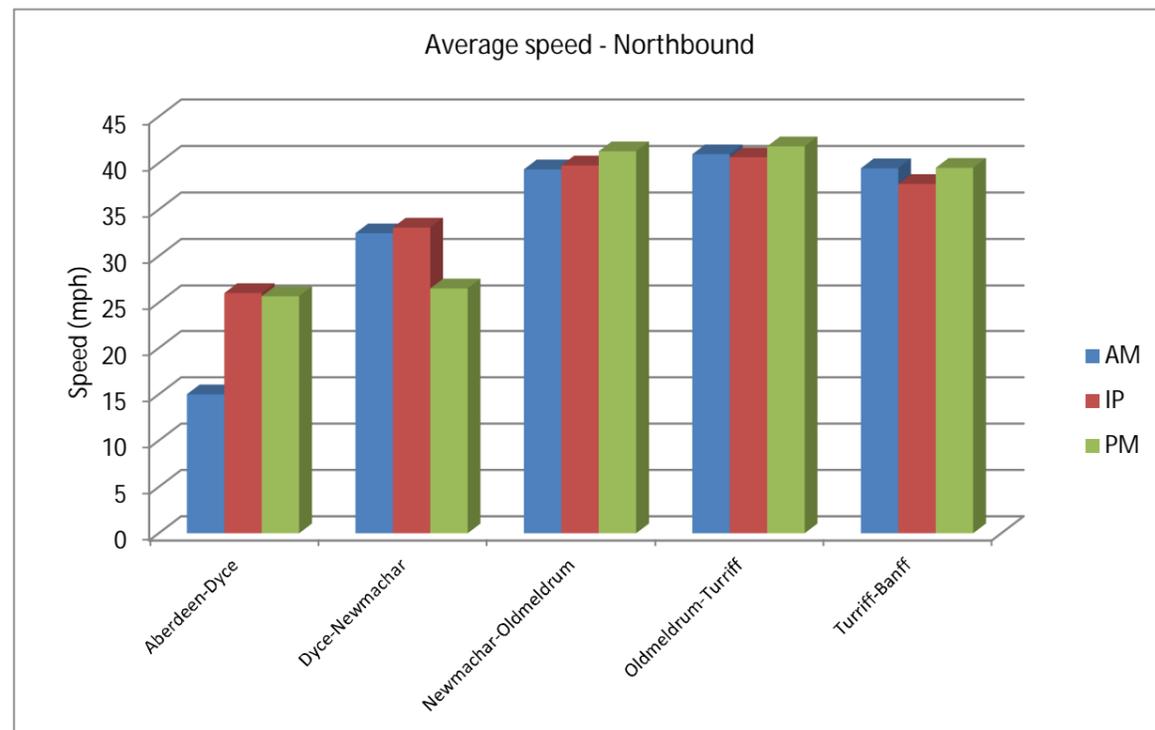


Figure 7: Average speed by section - Northbound

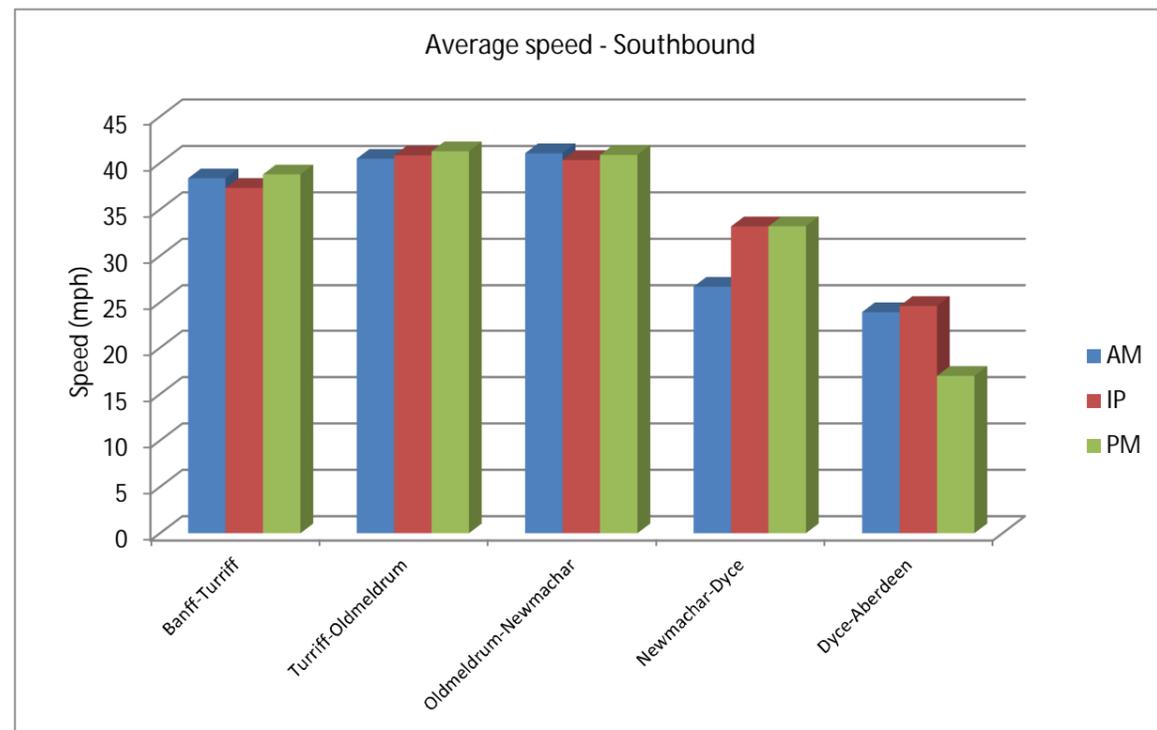


Figure 8: Average speed by section - Southbound

- Figures 5 and 6 demonstrate that average journey time per distance is consistent and lower for the stretch between Banff and Newmachar, is less consistent and higher for the stretch between Newmachar and Aberdeen and there are 'peaks' experienced in the AM and PM peak time periods between Newmachar and Aberdeen. The nature of the peaks is such that:
 - the average journey time per unit of distance for the section between Aberdeen and Dyce is greater for northbound traffic in the AM peak and southbound traffic in the PM peak when comparing with other time periods in either direction; and
 - the average journey time per unit distance for the section between Dyce and Newmachar is greater for southbound traffic in the AM peak and northbound traffic in the PM peak when comparing with other time periods in either direction.
- Figures 7 and 8 correlate well with Figures 5 and 6 demonstrating that the average speeds are higher and consistent for the stretch between Banff and Newmachar and are less consistent and lower for the stretch between Newmachar and Aberdeen.

5 Summary

To support the identification of problems and issues, the average journey time for the A947 has been analysed using TomTom data provided via Streetwise Services.

The main findings from the analysis of the data are highlighted below:

- Based on the assumption that greater correlation of average speeds between time periods indicates greater journey reliability, then journey reliability is lessened between Aberdeen and Newmachar (compared to the whole route).
- Average journey times for the stretch of the A947 north of Newmachar are consistent across time periods and by direction.
- Considering the whole route, the average journey time per unit of distance is consistent and lower for the stretch between Newmachar and Banff, and is less consistent and higher for the stretch between Aberdeen and Newmachar.
- The average journey time (and corresponding average speed) for the stretch of the A947 between Aberdeen and Newmachar is dependent on direction for the peak hours.
- Excluding built up areas there are four areas where the average speed is predominantly and consistently below the UK national average speed (the latter being specific to the speed limit). The four areas are: between the Council boundary and Newmachar, between Hattoncrook and Oldmeldrum, the 3.25 mile stretch immediately south of Turriff, and a 3.5 mile stretch to the north of Turriff beginning approximately 2 miles outside of Turriff. (A further area exists in the southbound direction for some time periods between Fyvie and Oldmeldrum).
- The only time that the average speed exceeds the speed limit is within built up areas (especially on the entry/exit of built up areas).

Appendix E

Project:	A947 Route Improvement Strategy	Job No:	60335603
Subject:	A947 Accidents Rates		
Prepared by:	Adrian Garcia	Date:	21/12/2015
Checked by:	Anne Zimare	Date:	22/12/2015
Approved by:	Richie Fraser	Date:	22/12/2015

1 Introduction

AECOM have been commissioned by Aberdeenshire Council to prepare a Route Improvement Strategy for the A947. To support the identification of problems and issues that the Strategy should address, accidents rates for the route have been analysed using data provided by Aberdeenshire Council.

2 Data Specification

Accident data was provided for the years 2009 to 2014. Each data entry contained a large amount of information relating to the accident itself, details of the vehicles involved and information for each of the casualties.

For the purpose of this analysis, the following information has been used:

- Traffic Data: Aberdeenshire Average Annual Daily Traffic values (AADT) for the following sections:
 - o Dyce to Newmachar
 - o Newmachar to North Oldmeldrum
 - o North Oldmeldrum to Fyvie
 - o Fyvie to Turriff
 - o Turriff to Banff

- Accidents Data
 - o Date of accident (Month and Year)
 - o Accidents location (Easting, Northing)
 - o Accident severity (Slight, Serious, Fatal)
 - o Number of casualties by type of accident (Slight, Serious, Fatal)

3 Methodology

The purpose of this analysis is to develop accidents rates for each of the sections detailed above and compare finding against NESAs values. To develop accident rates, the following process has been adopted:

- Mapping of accidents by section.
- Calculate the weighted average AADT per section using data from traffic count sites located along the A947. This was adapted to calculate vehicle kilometres for each section, with could then be used to calculate an accident rate.
- The standard calculation method for accident rates determines the number of personal injury accidents per million vehicle kilometres. For each section the accident rate was

calculated in this manner, with the accumulated vehicle kilometres and accident numbers combined to calculate a route-length accident rate. A two-tailed t test was used to calculate a 95% confidence interval around the frequency of accidents, which was then used to derive a confidence interval around the accident rate.

- Results have been compared against values from the NESAs manual. For this, it has been assumed that the A947 is NESAs road category 26: rural typical road 7.3m - accident type 8. As NESAs provides values for a 2000 base, the accident rate for the type of road was adjusted according to the relevant Beta factor to obtain a 2010 value for the purposes of comparison with the local values.
- Results have been presented using bar charts proportional to length of each of the sections analysed

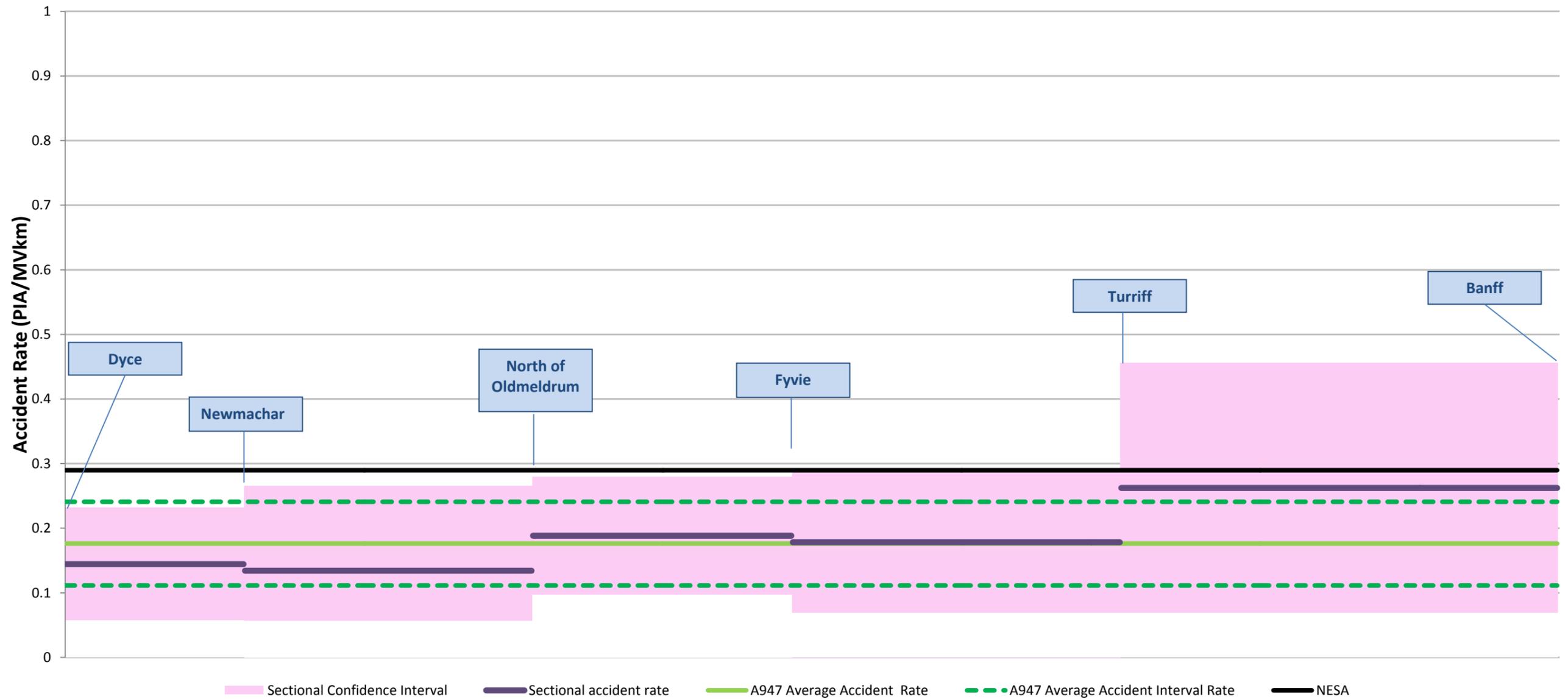
4 Key Findings

The table below summarises the key findings for each of the section, and compares results against the A947 route average and the NESAs manual.

SECTION	DISTANCE (KM)	MVKM 2009 - 2014	ACCIDENT RATES	% ACCIDENT BY SEVERITY			% CASUALTIES BY SEVERITY		
				% Fatal	% Serious	% Slight	% Fatal	% Serious	% Slight
Dyce – Newmachar	7.59	173.0	0.144	8%	20%	72%	0.08	0.28	0.80
Newmachar – North of Oldmeldrum	12.20	216.2	0.134	3%	24%	72%	0.03	0.38	0.90
North of Oldmeldrum – Fyvie	11.03	143.2	0.189	4%	33%	63%	0.04	0.59	0.93
Fyvie – Turriff	13.97	157.2	0.178	7%	39%	54%	0.11	0.46	0.68
Turriff – Banff	18.54	144.9	0.262	3%	16%	82%	0.05	0.26	0.89
A947	63.35	834.6	0.176	5%	26%	69%	0.06	0.39	0.84
NESA	-	-	0.290	3%	16%	81%	0.039	0.222	1.352

4.1 Accidents Rates

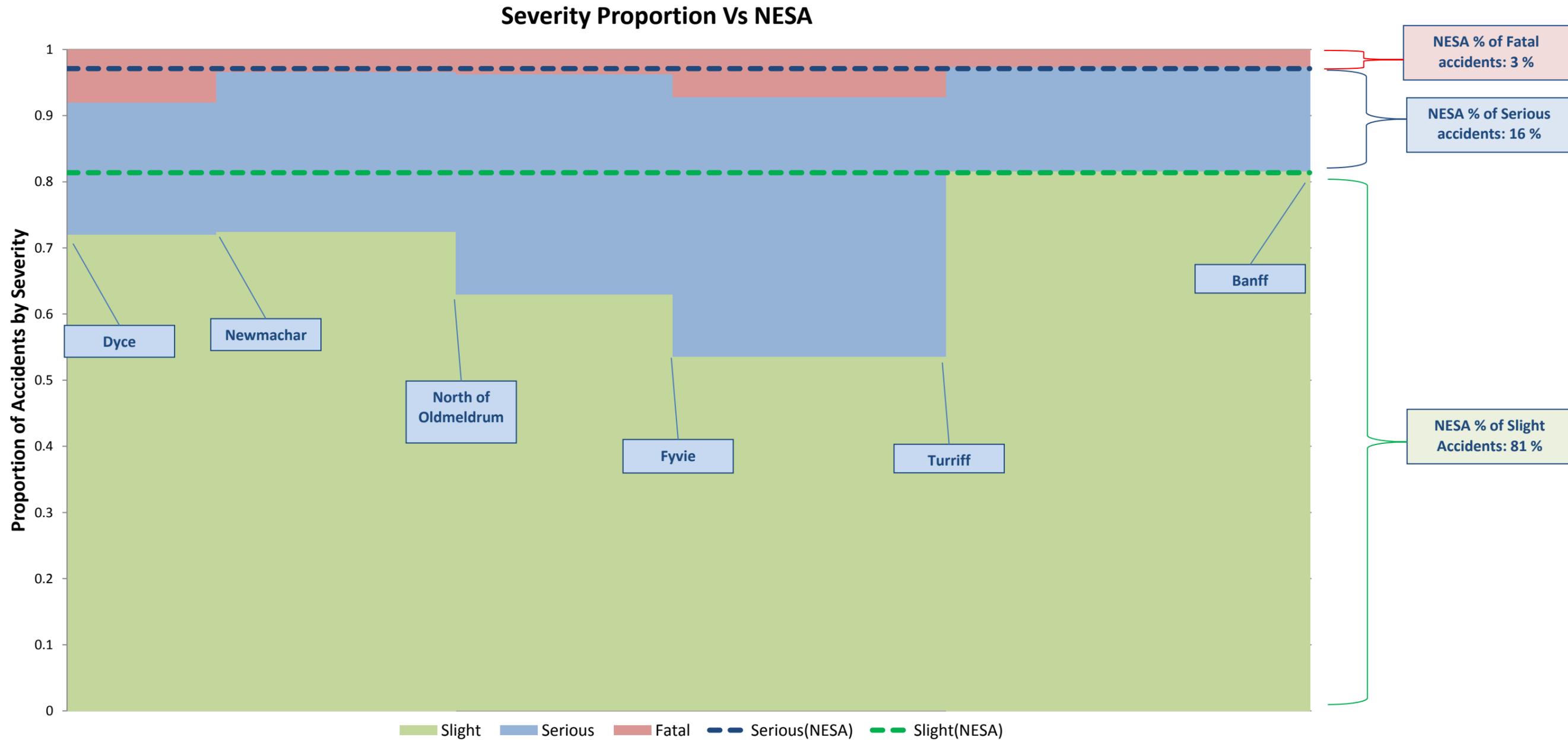
A947 Accidents Rates Vs NESAs



Accidents Rates – Summary:

- Accidents rates for each of the route sections are below the NESAs average value.
- The section between Turriff and Banff shows the highest accident rate (0.262). However the confidence interval shows that this rate may be above the NESAs average value. This is due to the level of dispersion in the accident data with accident numbers varying significantly between 2009 and 2014 (from 14 to 3), although it has remained at a lower level over the past few years.
- The accident rate (0.176) and confidence interval for the whole section is shown to be under the NESAs average value.

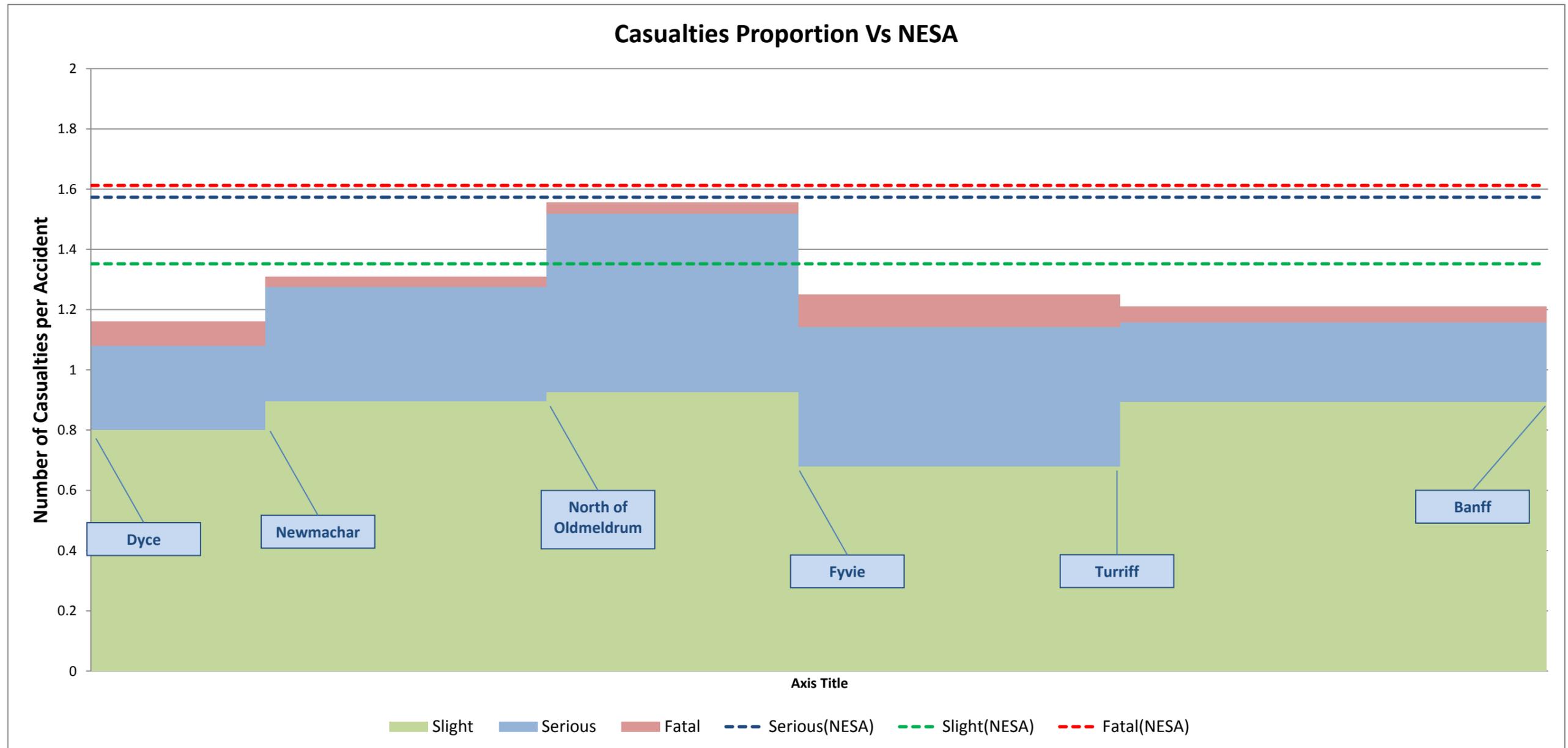
4.2 Severity of Accidents



Severity of Accidents – Summary:

- The proportion of slight accidents is shown to be lower than the equivalent NESAs rate for all sections. Only the section between Turriff and Banff shows a similar percentage of slight accidents (around 81-82%)
- Although accident rates are lower compared to NESAs values, the proportion of serious and fatal accidents is higher for all sections. The proportion of serious accidents is higher between Dyce and Turriff, and in particular between Fyvie and Turriff.
- A similar pattern is observed with fatal accidents, which is shown to be higher than the NESAs rate. The only section that remains within the NESAs levels for each severity category is the northern section between Turriff and Banff, but presents a higher number of slight accidents compared to the other three sections.

4.3 Severity of Casualties



Severity of Casualties – Summary:

- The level of slight casualties is significantly below the NESAs rate.
- The proportion of serious casualties is higher for all sections along the corridor, in particular between North of Oldmeldrum and Fyvie (59%).
- The proportion of fatal casualties is also higher compared to NESAs rates along the corridor. Only the section between Newmachar and North of Oldmeldrum is lower than the NESAs rate.
- These findings tie up with previous studies, confirming that while the overall accident rate of the A947 is below the NESAs rate, the rate of fatal and serious accidents is higher compared to national levels.

Appendix F

Project:	A947 Route Improvement Study	Job No:	60335603 M001.012
Subject:	Key Environmental Designations	Date:	02-09-2015

Introduction

Aberdeenshire Council is proposing to upgrade sections of the A947 between Dyce and Banff. This technical note describes the key environmental designations within 2km of the road and should be read in conjunction with the attached Constraints Mapping. Proposals for improvements along the A947 have not yet been defined and this study aims to assist in the initial stages of routing and design, but is not intended to be interpreted as a full baseline study.

Methods

The Study Area, as defined for the purposes of this report, extends from Banff southwards to Dyce as shown on the attached Constraints Mapping figure. The current route alignment of the A947 has been added to the figure and buffered to 2km to gain an understanding of context in relation to receptors (Study Area).

Information has been gathered from a variety of online sources only with no field surveys undertaken at this time. Data sources consulted included Scottish Natural Heritage (SNH), Historic Scotland (HS), Scottish Wildlife Trust (SWT), and Scottish Environment Protection Agency (SEPA).

Key Environmental Designations

Ecology

Two ecological Site of Special Scientific Interest (SSSI) are located within 2km of the A947 – Gight Woods SSSI which is 2km east of the A947, south of Woodhead. This site is designated for its upland oak woodland and upland mixed ash woodland. Minor localised road improvements to the A947 are not predicted to impact upon this designation due to its distance from the A947. The second site is Corby, Lily and Bishops Lochs which is located 2km east of the A947 just north of Dyce. This biological SSSI is designated for its freshwater habitats and fens.

There are numerous ancient woodlands and semi-natural ancient woodlands within the Study Area, with the A947 currently aligned through some areas. Woodland areas should be avoided by development wherever possible.

Geology

A review of designations held on the SNHi Site Link was undertaken which highlighted that sections of the northern coastline at Banff are designated as a geological SSSI. This designation is cited as Whitehills to Melrose Coast and is an important part of a longer coastal section (Cullen to Troup Head) that provides the longest continuous section of structural and metamorphic geology (Dalradian) in Scotland.

A second geological SSSI is located south west of Oldmeldrum – Hill of Barra, which is designated for its outcrops of igneous rocks. These sites are also designated as Geological Conservation Review (GCR) sites. Any improvements to the A947 should seek to avoid these geologically important areas.

Archaeology

A review of data held on Historic Scotland's database provides a general overview of protected archaeological features. There are several Scheduled Ancient Monuments and one Property in Care between Banff and Dyce. However none of the sites are located directly adjacent to the current road alignment.

Numerous listed buildings are present within the Study Area with a number along the A947 route alignment.

Two Battlefield areas are located in close proximity to the A947 at Fyvie and Oldmeldrum. Historic battlefields make a distinctive contribution to our sense of place and history, both locally and nationally.

Changes to the A947 alignment could impact upon the setting of archaeological features and should be assessed for potential impacts during the design phase of proposed improvements.

Landscape

The A947 is aligned through Banff and Oldmeldrum which contain areas designated as Conservation Areas, in addition to Kingseat, which is over 1km east of the A947.

There are several Gardens and Designed Landscapes between Banff and Dyce with the closes being at Darra, Fyvie and Straloch. Gardens and designed landscapes are an important element of Scotland's historic environment and landscape. They contribute to Scotland's landscapes and social, cultural and economic history. They provide the setting of buildings and monuments, and offer biodiversity and habitats for nature conservation.

Although not covered within this designations review, landscape character should also be taken into consideration during the routing and design phase of improvements to the A947 as changes to road alignments can adversely impact upon the character of the area.

Water Environment

A review of the SEPA River Basin Management Plan and indicative Flood Risk Map highlights that the A947 is routed within Salmonid Waters, a Nitrate Sensitive Area & Groundwater Drinking Water Protection Area. It should be noted that the majority of Scotland falls within these designations.

The River Deveron to the west of the A947 is a Drinking Water Protected River and is also an Urban Waste Water Treatment Sensitive River from Banff south to Turriff.

A Bathing Waters Protected Area is located at Banff Boyndie Bay.

2008 River Classifications for watercourses that cross the A947 range from Moderate to Bad.

The northern-most section of the A947 lies within Banff Coastal catchment, heading south from Dounepark to Birkenhills the catchment is the River Deveron, from Birkenhills to Oldmeldrum the catchment becomes the River Ythan, and from Oldmeldrum to Dyce it is the River Don catchment.

The indicative SEPA Flood Map indicates that the areas most likely to potentially be at risk from flooding include, from north to south:

- Gelly Burn (river)
- Burn of Montbletton (surface water)
- Burn of King Edward (river)
- Burn of Kinbate (surface water)
- Burn of Hilton (river)
- Burn of Turriff (river)
- Burn of Gask (river)
- River Ythan (river)
- Elrick Burn (river)
- River Don (river)

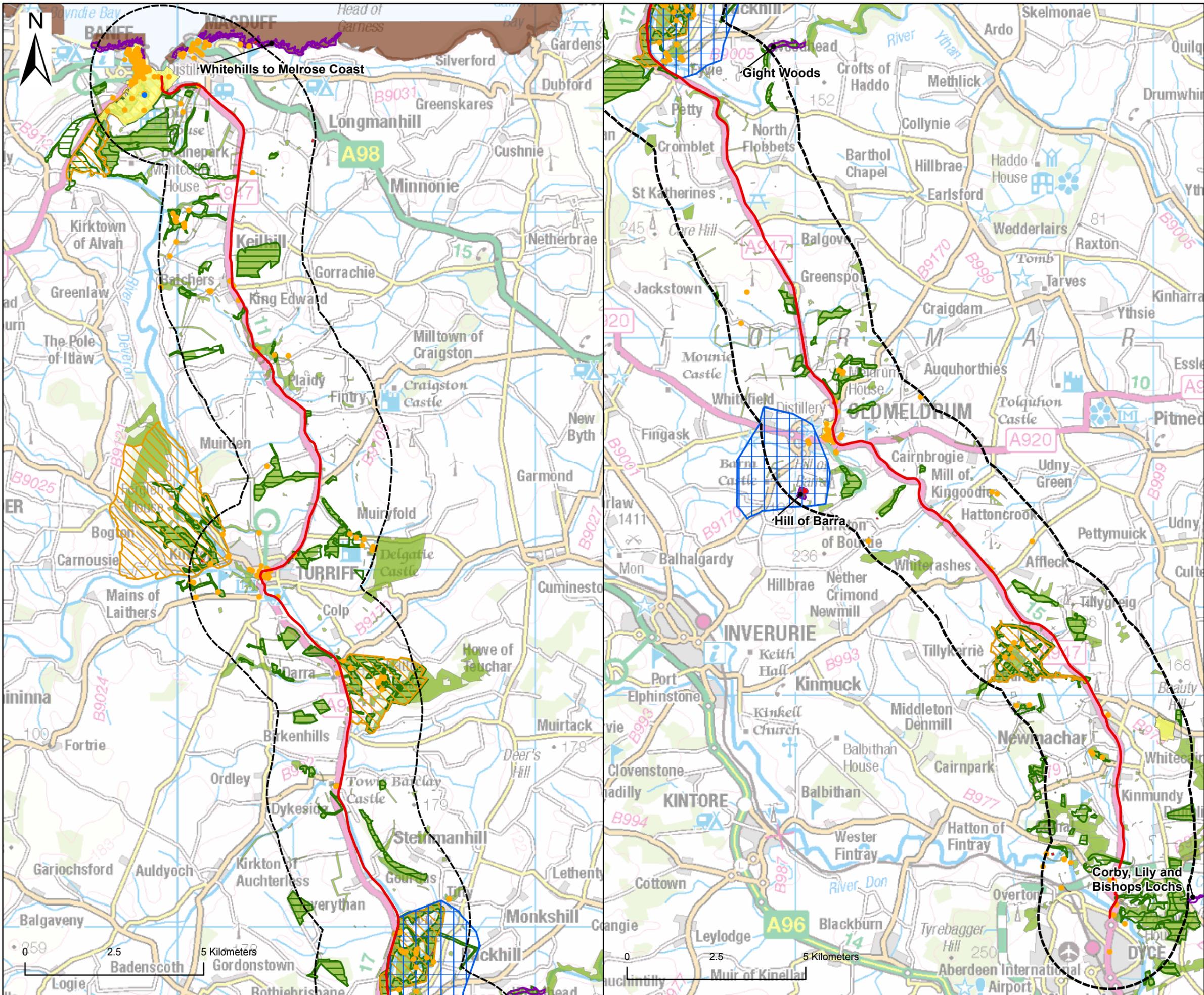
Summary

An initial review of online data sources has highlighted the following key designations to be taken into consideration for the A947 improvements:

- Ancient and Semi-natural ancient woodlands
- Geological sites
- Scheduled ancient monuments
- Listed buildings
- Battlefields

-
- Conservation areas
 - Gardens and designed landscapes
 - River Deveron Drinking Water Protected River

This brief designations study provides a general overview to key potential constraints only and further desk study and field surveys, including data collection on habitats and species, landscape character, local records of archaeological importance, and potential of flood risk should be undertaken to inform the design as the proposals for the A947 progress.



Legend

- A947
- A947 2km Buffer
- Properties In Care
- Listed Buildings
- Battlefields
- Conservation Areas
- Gardens and Designed Landscapes
- Historic Scotland Scheduled Monuments
- Site of Special Scientific Interest
- Ancient Woodland
- Semi Natural Ancient Woodland
- Geological Review Site

Client	Aberdeenshire COUNCIL			
Project	A947 Route Improvement Strategy			
Title	Constraints Mapping			
Scale	1: 100,000	Drawn By	MLS	Rev. 01
Date	11/08/2014	Chk'd By	VB	



Appendix G

Specified Options and DMRB standards

Roads Based Options (ref to Table 5.1)		A947 Single Carriageway trends*	DMRB Standards	DMRB Reference
0	Do Nothing	AADT on the route varies between approx. 3,500 and 10,500	<ul style="list-style-type: none"> - Typical low standard single carriageway road - Tight horizontal radius bends and sharp crests and sags, meaning that speed must often be reduced significantly. - Restricted forward visibility throughout - Variable road cross-section with low standard verge and carriageway widths. 	N/A
5	Route Upgrade and Realignment: Dyce to Newmachar	Aberdeenshire 2014 AADT: 10,394	<p>A new alignment would provide the following carriageway cross sections.</p> <ul style="list-style-type: none"> - Standard Single Carriageway (S2): (Up to 13,000 AADT) 9.3m hard width, 14.3m total width + earthworks. - Wider Single Carriageway (WS2): (6,000 - 21,000 AADT) 12.0m hard width, 17.0m total width + earthworks. - Dual carriageway (D2AP): (11,000 - 39,000 AADT) 18.6m hard width, 26.1m total width + earthworks. <p>The selected cross-section would flow in a consistent manner in line with the required standard suitable for the design speed.</p>	DMRB Volume 6, Section 1
6	Route Upgrade and Realignment: Dyce to Oldmeldrum	Aberdeenshire 2014 AADT: 8,085		
7	Route Upgrade and Realignment: Full Route	Aberdeenshire 2014 AADT: 6,012		
8	Newmachar Bypass	Aberdeenshire 2014 AADT: 10,394		
9	Oldmeldrum Bypass	Aberdeenshire 2014 AADT: 8,085		
10	Turriff Bypass	Aberdeenshire 2014 AADT : 3,500 - 5,000		
11	Town Traffic Calming	<ul style="list-style-type: none"> - Single Carriageway Speed limits applied - Built up areas present 30mph speed limits already, except Fyvie and Whiterashes with 50mph 	<ul style="list-style-type: none"> - Single Carriageway rural roads: 60mph to 50mph - At limits of the settlements: 30mph and 40mph 	DMRB Volume 6, Section 3, Part 5
12	Climbing / Overtaking Lanes	<ul style="list-style-type: none"> - 6% of HGVs (DfT 2013 data); - Sections between north of Oldmeldrum and north of Turriff show up to 8% HGV 	<ul style="list-style-type: none"> - Climbing Lanes – no minimum % of HGVs: <ul style="list-style-type: none"> • Single Carriageways – hills with gradients >2% and longer than 500m • Dual Carriageways – hills with gradients >3% and longer than 500m 	DMRB Volume 6, Section 1
13	Localised Alignment Improvements	-	-	-
14	Bend Mitigation Measures Review	-	-	-
15	Slow Moving Vehicle Lay-bys	-	AADT: > 8,000 - between 2km and 5km	DMRB Volume 6, Section 3, Part 3
			AADT: 2,500 - 8,000 - between 5km and 8km	
			AADT: 1,200 - 2,500 - between 8km and 12km	

16	Junction Improvements	- Potential locations have been identified (e.g. the A920 to Ellon south of Oldmeldrum, B993 to Port Elphinstone at Whiterashes) although detailed junction traffic assessment would be required to confirm the need for these.	- According to DMRB, upgrading should always be considered where the minor road flow exceeds 500 vehicles 2-way AADT, a right turning accident problem is evident, or where vehicles waiting on the major road to turn right inhibit the through flow and create a hazard. - Traffic assessment would therefore be required to confirm the need for intervention.	DMRB Volume 6, Section 2, Part 6
17	Localised Route Improvements	-	-	-

*Single Carriageway does not comply with “DMRB S2 standards” throughout the whole A947 route between Dyce and Banff

Carriageway Standard	Opening Year AADT	
	Minimum	Maximum
S2	Up to 13,000	
WS2	6,000	21,000
D2AP	11,000	39,000
D3AP	23,000	54,000
D2M	Up to 41,000	
D3M	25,000	67,000
D4M	52,000	90,000

Table: Opening Year Economic Flow Ranges, DMRB Volume 5 - Section 1, Part 3