

Transport Scotland

**A96 Dualling East of Huntly to Aberdeen**

**Spring 2018 Traffic Survey Analysis**

A96PEA-AMAR-TXD-SWI-RP-TR-000001

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It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

**Amey Arup Joint Venture**  
Office 7  
Thainstone Business Centre  
Inverurie  
AB51 5TB  
United Kingdom



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# 1 Introduction

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## 1.1 Scheme Background

AmeyArup have been commissioned to undertake DMRB Stage 2 and Stage 3 assessments of the eastern section of the A96 Dualling between Inverness and Aberdeen. The Eastern section is the corridor between East of Huntly and Aberdeen. The Stage 1 DMRB Assessment has already established the economic, engineering, traffic and environmental advantages and disadvantages of the scheme resulting in a number of Improvement Strategies being identified. Stage 2 looks in greater detail at options from an economic, engineering, traffic and environmental perspective, to determine options to be taken forward for consultation and ultimately the selection of a preferred option. Stage 3 is a detailed assessment of the preferred option requiring the production of an Environmental Statement and identification of land.

## 1.2 Purpose of this Report

Existing traffic data for the Huntly to Aberdeen section of the A96, as well as for major routes within the wider region, was collated from multiple sources. It consisted of permanent link counters operated by Transport Scotland and Aberdeenshire Council as well as temporary junction and/or link count sets, including:

- 29 link counts on A96 minor road approaches (November 2014);
- 8 link counts on other A-roads in Aberdeenshire (May 2015);
- 12 turning counts at A96 junctions with classified roads (April/May 2013);
- 9 junction turning counts in the Inverurie urban area (April 2017);
- Other smaller and ad-hoc collection exercises, as required.

The previous traffic data collection exercises have been summarised in the Traffic Data Analysis Report (TDAR, document A96PEA-AMAR-GEN-SWI-AS-TR-000001) to gain an understanding of the existing patterns of traffic behaviour on the A96 between Huntly and Aberdeen, on junctions with the A96, to and from urban areas served by the A96, and on the wider local road network.

The TDAR highlighted data deficiencies on the A96 and locations for future traffic surveys which would improve the level of understanding of traffic behaviour were identified. Following a review of the available data and the requirements of the A96 Corridor Route Assignment Model (CRAM), junctions were identified as targets for new turning count surveys.

The purpose of this report is to detail the data that was procured, the rationale for each survey, and the results from the surveys conducted with observations.

In addition, this report discusses another data source, journey time and traffic flow information from INRIX, which was made available in the period since the Traffic Data Analysis Report was published.

## 2 Traffic Data Collection Brief

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### 2.1 Surveys Performed

The turning count surveys focused on areas where there is no traffic data available at present, where traffic behaviour is likely to have changed due to changes in the road network, and where the existing traffic data is unreliable and/or contradictory when compared to nearby data. The junctions surveyed fall into seven distinct groups:

- A96 junctions – 12 surveys focused either on minor road junctions where significant turning traffic is predicted by the existing minor road link counts and/or the presence of accident cluster sites, or at major junctions where existing traffic data is out-of-date;
- Colpy to Oldmeldrum – seven surveys focused on the A920 corridor which existing data suggests may be attracting long-distance traffic towards Aberdeen and runs parallel to the existing A96 in this area. The surveys focused on the A920 and its junctions with routes to and from Inverurie (B9001 and B9170);
- Oldmeldrum to Dyce – seven surveys focused on the A947 which provides an alternative route to the A96 for access to Dyce/Bucksburn. The surveys focused on east-west routes which intersect the A947, as well as the major junctions in the Dyce urban area which had not previously been surveyed;
- Westhill and its hinterland – eight surveys focused on the A944 and on routes between it and the A96, to follow up on observations that southbound A96 traffic turns off at Kintore or Blackburn and potentially routes towards Westhill;
- Inverurie and its hinterland – six surveys supplementing those performed in 2017, focusing on routes between the north (B9001 and B9170) and the main A96 junctions, to gain a better understanding of routing behaviour in the town;
- Kintore – eight surveys within the town to improve understanding of the traffic levels in the urban area, of local vehicle routing, and to determine if traffic from other locations such as Kemnay route via Kintore to reach the A96;
- Two further surveys, one in Insch and one in Blackburn, to indicate the volume of traffic routing through these areas and if or where it joins the A96.

The coverage of link counts in the wider network was extensive with most routes surveyed at some point in the previous five years, and many routes covered by permanent continuous automatic traffic counters. A single link count survey was undertaken, covering the A97 to the south of Huntly as no previous survey data was available on this route.

### 2.2 Survey Specification

The specification for the link and junction turning count surveys was included in the Proposed Additional Data Collection Technical Note (A96PEA-AMAR-GEN-SWI-AS-TR-000004). The specification was for counts to be performed on a weekday (Tuesday, Wednesday or Thursday) in a neutral month. The surveys were timed to avoid dates on which traffic would be affected by a closure of the Aberdeen to Inverness rail line, beginning on 12 May 2018 and scheduled to last 14 weeks.

Traffic flows were reported at 15 minute intervals over the survey period, between the hours of 06:00 and 19:00. Surveys commenced before 07:00 to reflect on-site observations that significant queueing occurred before 07:00 at key junctions where traffic from urban areas joined the A96.

Roadside interview surveys, planned to supplement the data from the junction and link surveys, could not be procured in advance of the railway closure on 12 May 2018 and have therefore been postponed until the autumn.

The surveys were conducted on Tuesday 27 March 2018. Three junctions (Kinmundy, Auchencleith and Kirkhill Forest) were re-surveyed on Thursday 19 April due to errors in the original survey. Kirkhill Forest was also surveyed on Saturday 21 and Sunday 22 April as it is a tourist and recreational attraction that may generate more traffic at the weekend than on weekdays.

In the Aberdeen, Bucksburn and Dyce areas, there is likely to be significant changes in traffic behaviour once the Aberdeen Western Peripheral Route (AWPR) opens to traffic in the autumn of 2018. Junctions within these areas will therefore be re-surveyed after the opening date, and survey information will be obtained for the AWPR junctions themselves.

## 3 Junction Turning Counts

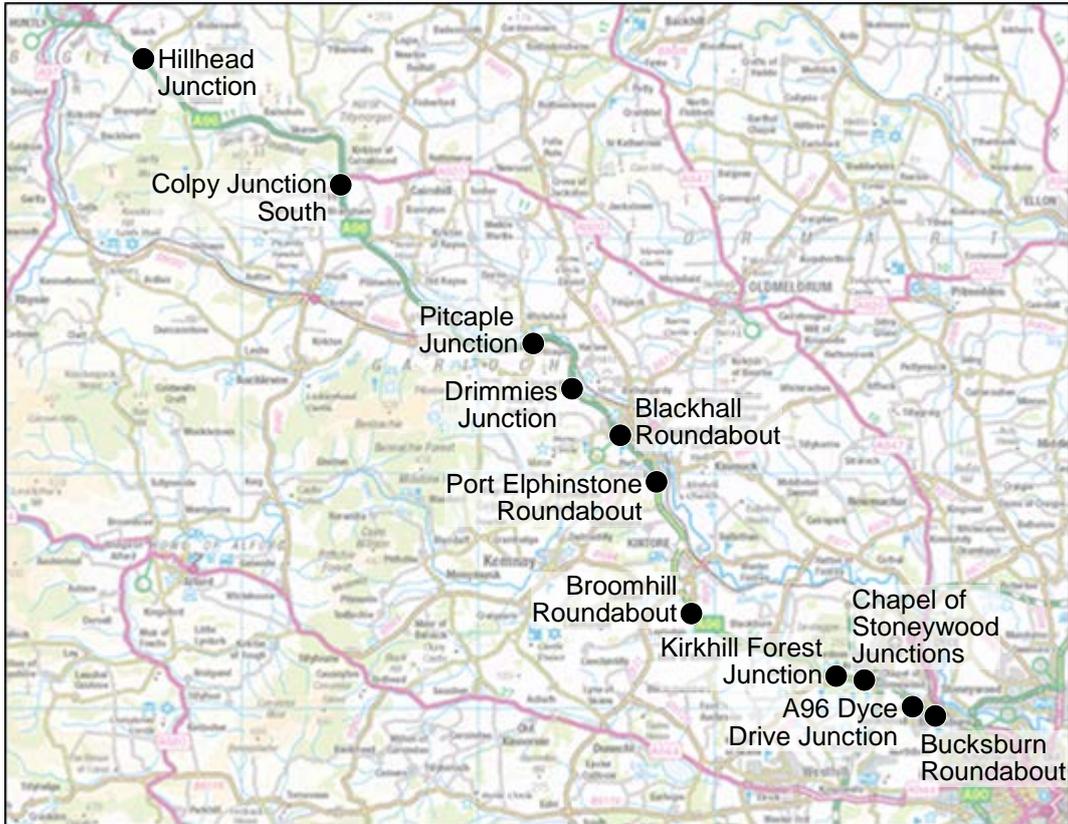
### 3.1 A96

The list of surveys conducted on the A96 is shown in Table 1 and Figure 1. They are listed in order from north-west to south-east with their Ordnance Survey grid references. The code numbers are used to identify the individual surveys within the survey output data which are included in electronic form as Appendix A.

Table 1: A96 junction turning count surveys

Code	Junction Name	Easting	Northing
3571-SCO-30	Hillhead Junction	357892	835471
3571-SCO-33	Colpy Junction South	364281	832473
3571-SCO-34	Pitcaple Junction	372280	825682
3571-SCO-35	Drimmies Junction	374270	823426
3571-SCO-11	Blackhall Roundabout	376105	821582
3571-SCO-2	Port Elphinstone Roundabout	377682	819731
3751-SCO-1	Broomhill Roundabout	379073	814231
3571-SCO-31	Kirkhill Forest Junction	385400	811400
3571-SCO-14	Chapel of Stoneywood Junction (West)	386539	811227
3571-SCO-15	Chapel of Stoneywood Junction (East)	386610	811243
3571-SCO-9	A96 Dyce Drive Junction	387963	810698
3571-SCO-3	Bucksburn Roundabout	389409	809762

Figure 1: A96 junction turning count survey locations



The hour in which peak AM and PM flows were recorded, as well as the total number of junction entries throughout the survey and the percentage of heavy vehicles detected, is shown in Table 2.

Table 2: A96 peak hour and total flow statistics

Junction	AM peak statistics		PM peak statistics		Full day statistics	
	Hour from	Entries	Hour from	Entries	Entries	% OGV
Hillhead	07:45	732	16:30	870	8,042	9.8%
Colpy South	07:45	663	16:00	731	7,280	9.5%
Pitcaple	07:30	1,015	16:45	1,161	11,296	6.9%
Drimmies	07:00	1,052	16:45	1,145	11,488	6.6%
Blackhall	08:00	2,160	16:30	2,419	24,495	5.4%
Port Elphinstone	07:30	2,862	16:30	3,248	31,482	5.7%
Broomhill	07:15	2,722	16:30	2,880	26,066	6.3%
Kirkhill Forest	07:15	2,733	16:30	2,802	25,489	6.7%
Stoneywood West	07:15	2,734	16:30	2,684	25,200	7.0%
Stoneywood East	07:15	2,728	16:15	2,664	25,273	6.9%
A96 Dyce Drive	07:00	2,780	16:15	2,640	28,140	6.0%
Bucksburn	07:00	4,108	16:00	3,658	41,557	5.9%

Two general trends are emerging from the A96 traffic data; with proximity to Aberdeen, traffic volumes increase and that the peak hours occur earlier in the day. There are a few exceptions, for example Port Elphinstone roundabout in Inverurie has a particularly high overall flow (31,482 vehicles over 13 hours) compared to junctions further south, and the AM peak hour at Blackhall Roundabout occurs later than at surrounding junctions (08:00 to 09:00), although this junction is notable in having a significant non-A96 which is discussed in more detail in section 3.1.5 and Table 3.

The AM peak hours for the Inverurie roundabouts do not align with the periods when queues were observed at these locations; these occur earlier and in some cases before 07:00.

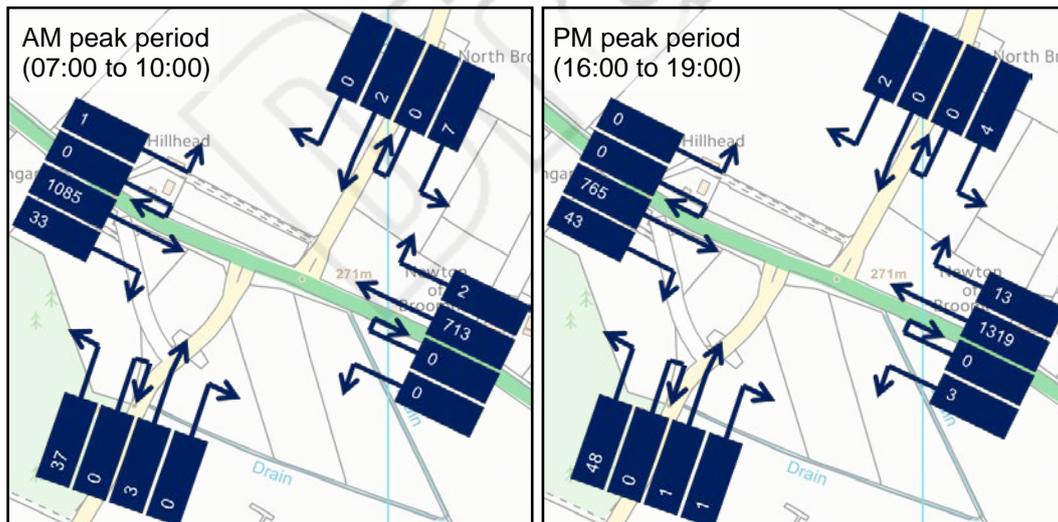
The flows at Bucksburn Roundabout are significantly higher than at any other A96 junction surveyed, suggesting high volumes of traffic approaching this junction from both the A96 and A947 throughout the day.

### 3.1.1 Hillhead Junction

Hillhead Junction is a staggered crossroads where the A96 meets the C82S and C66S local roads, the former proceeding north to Thomastown and Brideswell and the latter proceeding south to Insch which has a relatively large population for the area (2,282 based on 2011 census data). Both right turns from the A96 are protected by ghost islands.

This junction was surveyed to determine if it attracted traffic from the Insch direction and the onward direction of those vehicles. Flows are shown in Figure 2 for the AM peak period (07:00 to 10:00) and PM peak period (16:00 to 19:00) respectively.

Figure 2: Peak period flows at Hillhead Junction



The survey shows a tidal flow from north to south (towards Aberdeen and Inverurie) in the AM peak and returning in the PM peak. The flow is 18% lower southbound in the AM peak than northbound in the PM peak, although the total number of vehicles making both A96 movements (northbound and southbound) over the full day is consistent to within 1 vehicle in 3,840. It is therefore more likely that this extra flow is due to extra non-commuting movements in the afternoon and early evening as compared to the morning.

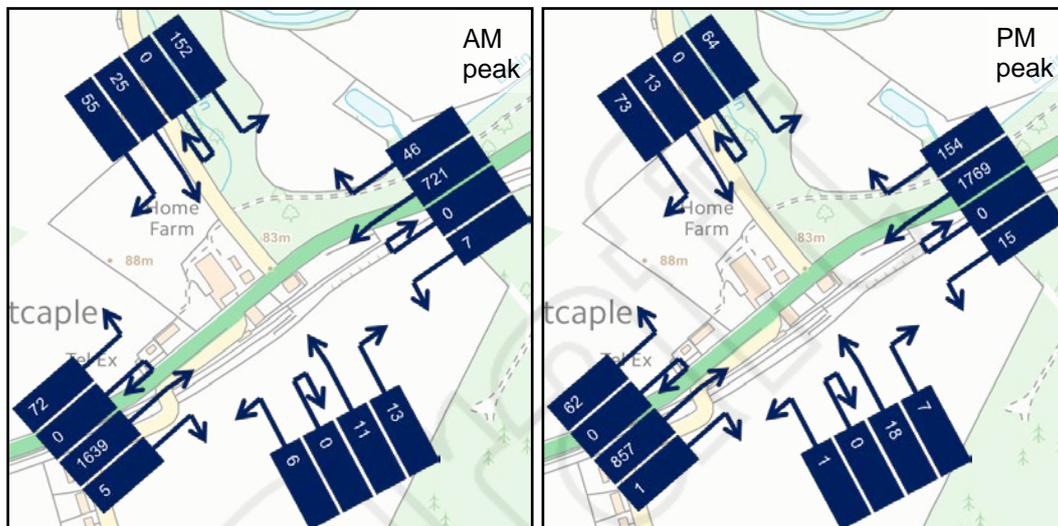


immediately adjacent to residential properties, hence there is no space to provide protection for right turners from the A96.

Local link count surveys from 2013 and 2014 suggested some traffic may have turned here to reach the parallel C120C, using it in preference to the A96, presumably to avoid Inveramsay Bridge which is a low and narrow rail underbridge necessitating shuttle working and causing delays. The A96 was realigned in 2016 to avoid the bridge, so the survey here was undertaken to determine if this rerouting behaviour had been eliminated.

The junction is also positioned in a local population centre with local amenities that may attract traffic, is co-located with an accident cluster site which turning traffic may contribute to, and forms a waypoint on potential route to and from Oldmeldrum avoiding Inverurie. The peak period flows are shown in Figure 4.

Figure 4: Peak period flows at Pitcaple Junction



A96 through traffic is approximately 50% higher than in the Colpy South Junction survey, and it is presumed that much of this traffic routes to and from Oyne and Insch on the B9002. 7% fewer vehicles route southbound in the AM peak than do northbound in the PM peak, although when considering the full 13-hour survey 4% more vehicles proceed southbound than northbound overall (note that the A96 “southbound” progresses approximately north-east at this location).

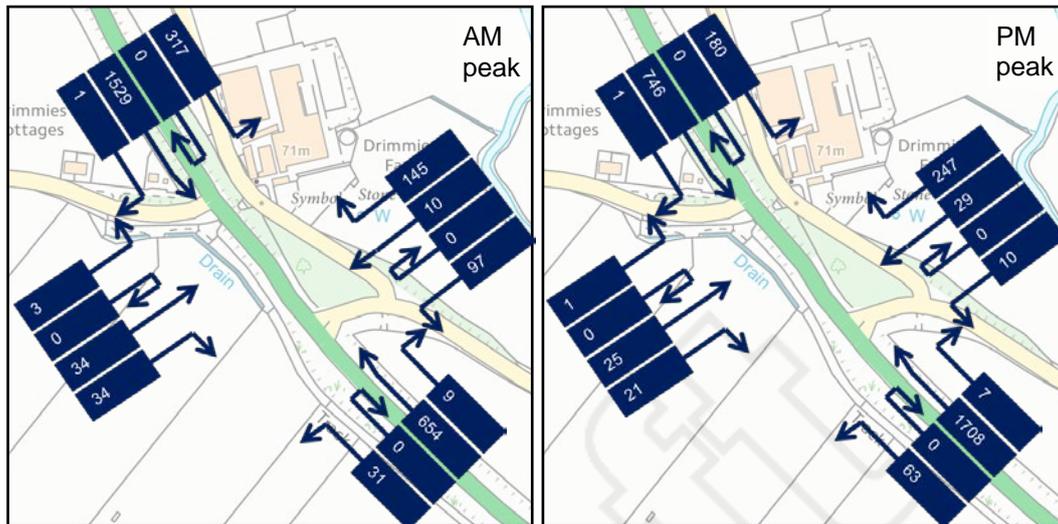
The turns to and from Whiteford on the C83C attract significant traffic, with 50 vehicles per hour in the AM peak joining the A96 southbound and returning in the PM peak; 15 to 25 vehicles per hour make both turns between the C83C and A96 north, consistently in both peaks. By comparison the C117C arm of the junction is relatively quiet, with at most 10 entries or exits per hour.

### 3.1.4 Drimmies Junction

Drimmies Junction is the staggered crossroads between the A96 and C120C, the northern access to Inverurie at northern extent of its bypass; the junction also allows access to and from Chapel of Garioch to the west. For A96 traffic there are extended deceleration lanes for left turners and ghost islands for right turners. There is a narrow unsurfaced underpass which allows C120C through traffic to proceed without using the junction; it did not form part of the survey.

The junction was surveyed to improve understanding of the volumes of traffic routing between Inverurie and the A96 north, and as it is another junction at which traffic behaviour will have changed due to the 2016 Inveramsay Bridge improvements. There are also current and planned developments in northern Inverurie which will impact use of the junction. The peak period flows are shown in Figure 5.

Figure 5: Peak period flows at Drimmies Junction



A96 through traffic levels are slightly lower than at Pitcaple, with more vehicles turning between the A96 and the C120C to and from Inverurie. Of those that do proceed straight through, they do so in the same tidal pattern as observed to the north, with 10% fewer doing so southbound in the AM peak than northbound in the PM peak but the flows throughout the day summing to a consistent value.

106 vehicles per hour proceed from the north into Inverurie in the AM peak, presumably commuting trips into the town, although only 82 vehicles per hour make the return trip in the PM peak. Conversely, fewer vehicles turn on to the A96 from the western arm in the AM peak than are observed to make the return movement in the PM peak. These discrepancies, which are reflected in the total number of vehicles making each turn throughout the full day, are presumed to be the result of vehicles adjusting their route into and out of Inverurie owing to congestion within the town and/or at its other accesses to the A96.

Despite the presence of the underpass, approximately 10 vehicles per hour continue to make the straight across movement here.

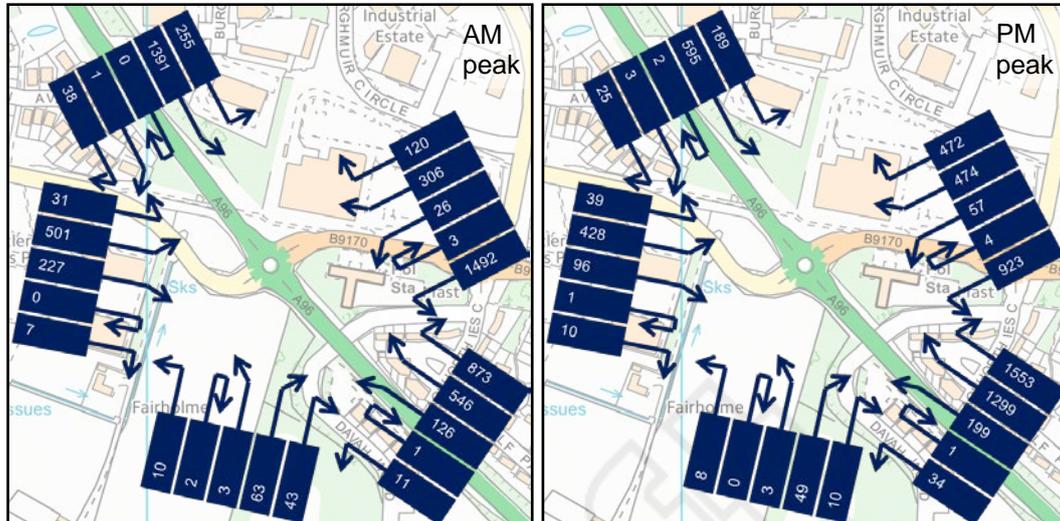
### 3.1.5 Blackhall Roundabout

Blackhall is a five-armed roundabout on the Inverurie Bypass where the A96 meets the B9170 Blackhall Road, one of the main accesses to the town, the C116C which links to Highclere Business Park, and a local road (Corsmanhill Drive) to a new housing development. The roundabout entry flares and circulatory carriageway are two lanes wide (three lanes when circulating between the B9170 and C116C arms).

The roundabout was last surveyed in 2013 when it had a significantly smaller diameter and only four arms as Corsmanhill Drive had not yet been constructed. A new survey was therefore necessary to understand how traffic behaviour has changed at the roundabout following its reconstruction. The new flow data will

improve the modelling of queueing which is observed here but not reproduced in the current version of the A96 CRAM. The peak period flows are shown in Figure 6 (note that the background image shows the previous roundabout configuration with four arms, omitting Corsmanhill Drive).

Figure 6: Peak period flows at Blackhall Roundabout



The busiest movement at Blackhall Roundabout is not between the two A96 arms; it is that from Inverurie (B9170) to the A96 south in the AM peak and returning in the PM peak. Approximately 500 vehicles per hour make these movements, while the maximum flow on the north-south A96 movement is around 460 vehicles per hour. The net result is that the A96 is more than twice as busy south of this point than it is to the north.

The total number of entries from the B9170 in the AM peak is greater than any other arm at 649 vehicles per hour; 17% of these cross the roundabout to either of the local western arms, while of those approaching from the west, the majority route into Inverurie. Therefore, as well as handling strategic traffic, there is a significant number of local movements at this roundabout; 304 AM peak and 342 PM peak movements per hour do not use either A96 arm.

85 vehicles per hour turn from the A96 north into Inverurie in the AM peak while 157 vehicles per hour return in the PM peak; overall 24% more vehicles make the east-to-north journey than its reciprocal over the 13-hour survey period. This supports observations made at Drimmies Junction, suggesting that vehicles prefer to leave the A96 for Inverurie at Drimmies in the AM peak but return via Blackhall Roundabout in the PM peak.

**Peak hours and queueing observations**

There are inconsistencies between the calculated peak hours at this roundabout as shown in Table 2 and the periods when queueing was observed on site. Therefore, the peak hour data has been examined in more detail and differentiated by entry and exit arm as shown in Table 3.

Table 3: Peak periods differentiated by arm at Blackhall Roundabout

Arm	AM peak entries		AM peak exits		PM peak entries		PM peak exits	
	Hour	Entries	Hour	Exits	Hour	Entries	Hour	Exits
A96 north	07:00	663	09:00	252	16:00	319	16:45	725
B9170	08:15	706	08:15	731	16:30	753	16:15	800
A96 south	09:00	566	06:30/45	1,365	16:30	1,113	16:15	640
Local	08:00	51	08:45	18	16:00	31	17:15	40
C116C	08:00	339	08:45	212	16:15	253	17:00	262
<b>Combined</b>	<b>08:00</b>	<b>2,160</b>	<b>08:00</b>	<b>2,160</b>	<b>16:30</b>	<b>2,419</b>	<b>16:30</b>	<b>2,419</b>

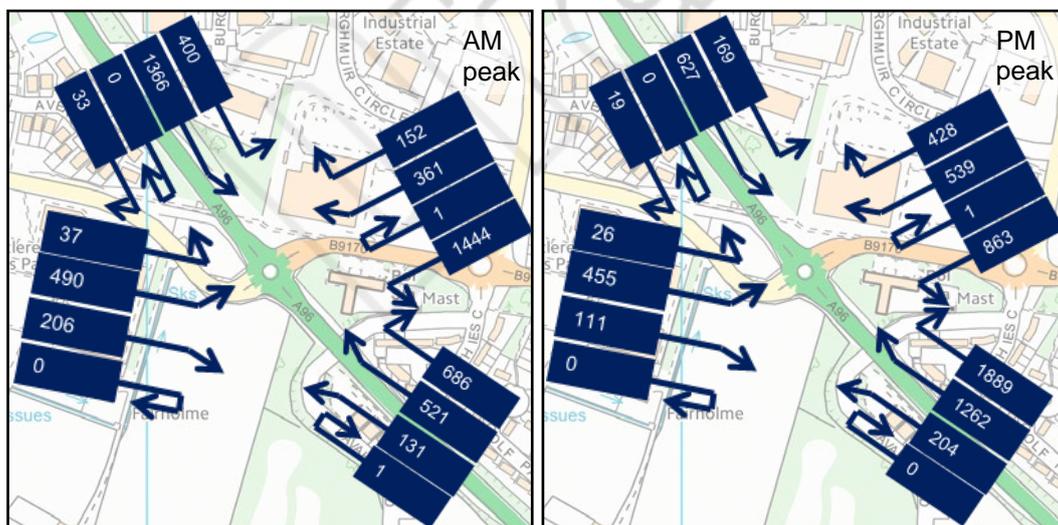
Although the AM peak hour for all movements combined is 08:00-09:00, entries from the A96 northern arm peak earlier at 07:00-08:00 and the peak for exits to the south occurs in the hours 06:30-07:30 and 06:45-07:45 (tied). This earlier peak coincides the observed queueing on the B9170, suggesting that it is associated with heavy opposing flows on the roundabout rather than those approaching the stopline.

The AM peaks for the A96 northbound flow occur in the hour 09:00-10:00. 10:00 is the end of the AM peak period but flows continue to increase into the interpeak.

**2013 survey**

For comparison with the 2018 survey, the turning counts obtained from the survey on Tuesday 30 April 2013 are shown in Figure 7.

Figure 7: Peak period flows at Blackhall Roundabout – 2013 survey



In the AM peak, traffic volumes for each turn (which existed in 2013) generally show small increases in flows owing to traffic growth in the intervening five years, although two significant changes are noted: the volume of traffic turning left from the A96 southbound to the B9170 towards Inverurie has reduced by 36% since 2013, while the volume turning from the A96 northbound towards Inverurie has increased by 27%.

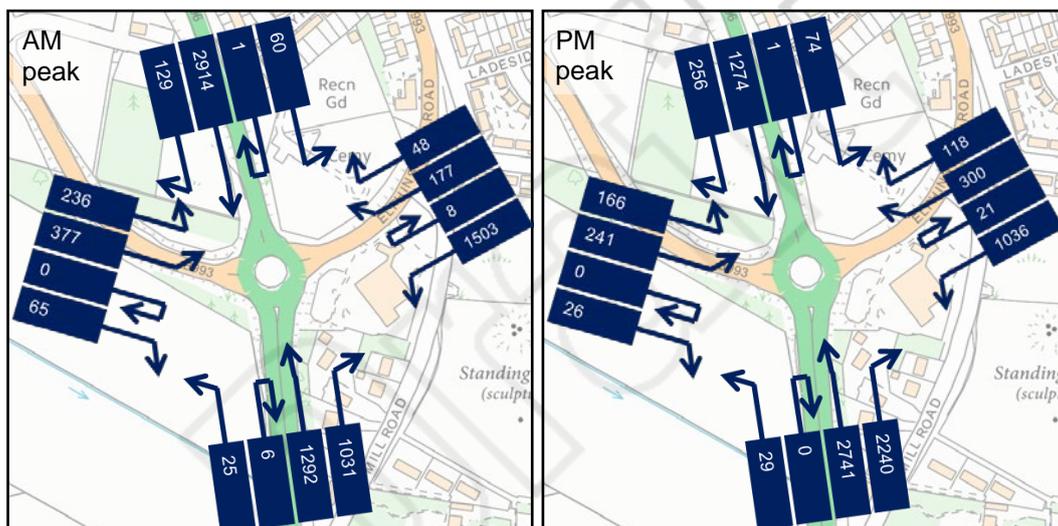
The major PM peak changes between 2013 and 2018 is the significant fall (18%) in vehicles making the right turn from the A96 northbound towards Inverurie. For most other turns, stripping out the effect of the extra arm at Corsmanhill Drive, flows have been stable over the five-year period.

### 3.1.6 Port Elphinstone Roundabout

Port Elphinstone Roundabout (signed as “Inverurie Roundabout” but re-named here to avoid ambiguity) is a four-armed roundabout at the south end of the Inverurie Bypass between the A96 and the B993. It provides access between Inverurie and the A96 south and to and from Kemnay to the south-west. There are two circulatory lanes on the roundabout, which marks the furthest extent of the A96 dual carriageway northwest of Aberdeen.

As with Blackhall Roundabout, the previous survey here was conducted in 2013. It has been resurveyed as significant development in the town is likely to have induced additional traffic, and the observed queues are not reproduced in the current version of the A96 CRAM. The peak period flows are shown in Figure 8.

Figure 8: Peak period flows at Port Elphinstone Roundabout



This roundabout is significantly busier than Blackhall and all points to the north on the A96, due to the added southbound traffic which entered the A96 at Blackhall. Almost 1,000 vehicles per hour cross the roundabout from north to south in the AM peak, but only 914 make the return journey in the PM peak, although through the entire survey period 11% more traffic proceeds northbound than southbound.

Fewer vehicles join the A96 from Inverurie (the B993 eastern arm) in the AM peak (501 vehicles per hour) than return in the PM peak (747 vehicles per hour); this again suggests complex routing behaviour through the Inverurie urban areas, with vehicles adjusting their choice of junction for ingress and egress by time of day. The reverse movement – i.e. commuting trips into Inverurie in the AM peak and returning south in the PM peak – accounts for around 350 vehicles per hour.

Most vehicles approaching from the west proceed into Inverurie, with relatively few turning to the A96 south which represents a near U-turn from the alignment of the B993. The tidal flow is away from Kemnay in the AM peak and returning in the PM peak.

### Peak hours and queueing observations

An inconsistency between the calculated peak flow hour and periods of observed queueing on the entry arm from Inverurie in the AM peak occurs here as at Blackhall Roundabout. A similar analysis of peak hour by arm has therefore been performed to attempt to account for this inconsistency, as shown in Table 4.

Table 4: Peak periods differentiated by arm at Port Elphinstone Roundabout

Arm	AM peak entries		AM peak exits		PM peak entries		PM peak exits	
	Hour	Entries	Hour	Exits	Hour	Entries	Hour	Exits
A96 north	06:45	1,306	09:00	572	16:45	648	16:00	1,109
B993 east	07:45	643	08:15	571	16:45	564	16:30	1,032
A96 south	09:00	879	06:45	1,807	16:30	1,906	16:15	911
B993 west	08:15	273	08:15	134	16:15	160	16:45	243
<b>Combined</b>	<b>07:30</b>	<b>2,862</b>	<b>07:30</b>	<b>2,862</b>	<b>16:30</b>	<b>3,248</b>	<b>16:30</b>	<b>3,248</b>

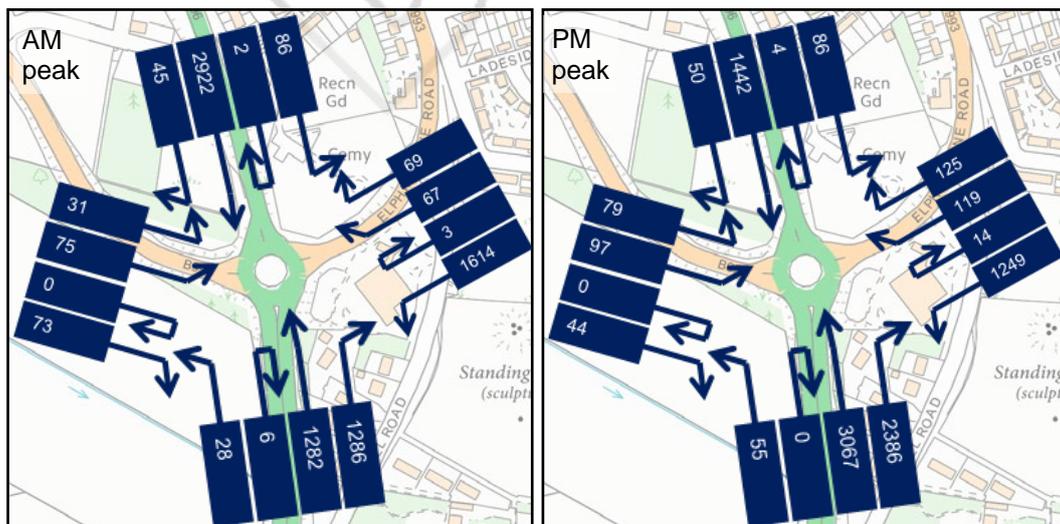
As with Blackhall Roundabout, the AM peak for all traffic movements combined occurs later (07:30-08:30) than that for the A96 southbound movement itself (peak A96 north entries and A96 south exits occur in the hour 06:45-07:45) and queueing on the B993 eastern arm which is observed at approximately 07:00 is therefore more likely to be associated with the heavy opposing flow than the demand from Inverurie itself, as at Blackhall.

Traffic on the A96 northbound continues to build through the AM peak period into the interpeak. The PM peak hours are more consistent between the four arms, all beginning between 16:00 and 17:00.

### 2013 survey

For comparison with the 2018 survey, the turning counts obtained from the survey on Tuesday 30 April 2013 are shown in Figure 9.

Figure 9: Peak period flows at Port Elphinstone Roundabout – 2013 survey



The comparison of AM peak data shows a significant increase in the number of vehicles approaching the junction from Kemnay on the B993 eastbound, the total

demand increasing almost four-fold. The number of vehicles turning towards Kemnay also shows a significant increase over this period. Meanwhile the number of vehicles turning from the A96 northbound towards Inverurie on the B993 has fallen by 20%, although the surveys at Blackhall Roundabout suggest that traffic may be entering Inverurie there instead. Other turns show only small changes; notably, the flow southbound through the junction on the A96 shows only a negligible change.

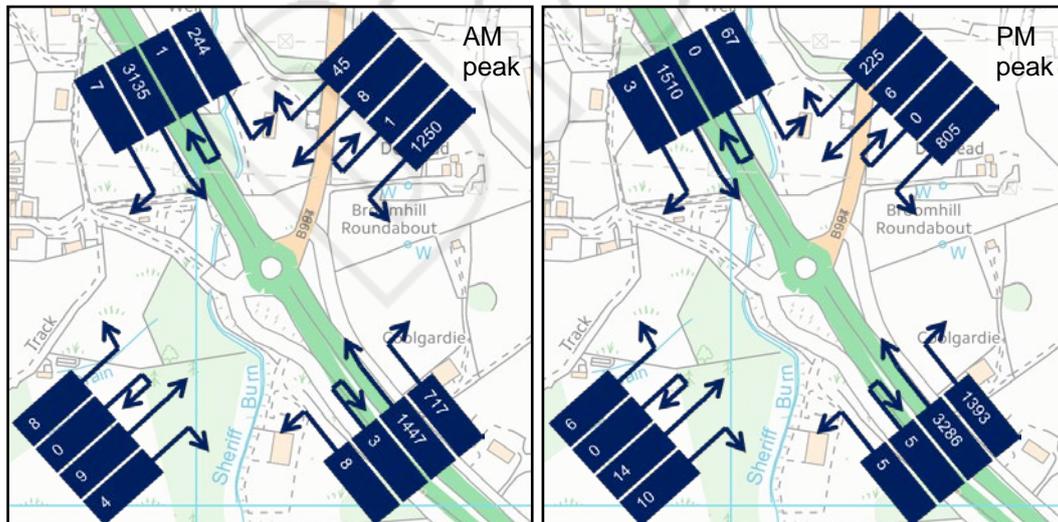
Similar reciprocal increases to traffic to and from Kemnay on the B993 are observed in the PM peak, as is a fall in the number of vehicles existing Inverurie to the A96 southbound. When combined, these surveys show that routing for vehicles commuting to Inverurie in the morning and away in the evening has during the five-year gap between the surveys, presumably due to changes in employment locations and/or congestion in the town.

### 3.1.7 Broomhill Roundabout

Broomhill is a four-armed roundabout at the southern end of the Kintore bypass. There are a small number of residential and industrial properties accessed from the western arm (numbered U242C) while the eastern arm allows access to and from the south of Kintore via a link which is officially the B987 but signed as the B994. The circulatory carriageway and roundabout entries have two lanes.

As with Blackhall and Port Elphinstone roundabouts, the roundabout has been re-surveyed since it has not been surveyed since 2013 and significant development has taken place in the interim; and because no significant queueing is modelled in the A96 CRAM despite local observations of delays when accessing the A96. The peak period flows are shown in Figure 10.

Figure 10: Peak period flows at Broomhill Roundabout



Over 1,100 vehicles per hour approach the junction from the north in the AM peak, almost all of which proceed southbound on the A96 with the tidal flow direction towards Aberdeen. 5% more vehicles make the return trip in the PM peak, although overall 3% more vehicles proceed southbound than northbound through the roundabout over the full day. With more traffic routing to and from the A96 southern arm at this roundabout, the A96 is busier south of here with approximately 1,500 vehicles per direction per hour.

417 vehicles per hour join the A96 southbound from Kintore (B987) in the AM peak, while 464 vehicles per hour make the return journey, although again over the full day the difference in flows between the two reciprocal movements is much smaller. No more than 10 vehicles per hour utilise the western arm of the junction.

### Peak hours and queuing observations

As queuing is observed early in the AM peak period here as at the Inverurie Bypass roundabouts, a similar comparison of peak hours by arm compared to those for the junction as a whole has been conducted, as shown in Table 5.

Table 5: Peak periods differentiated by arm at Broomhill Roundabout

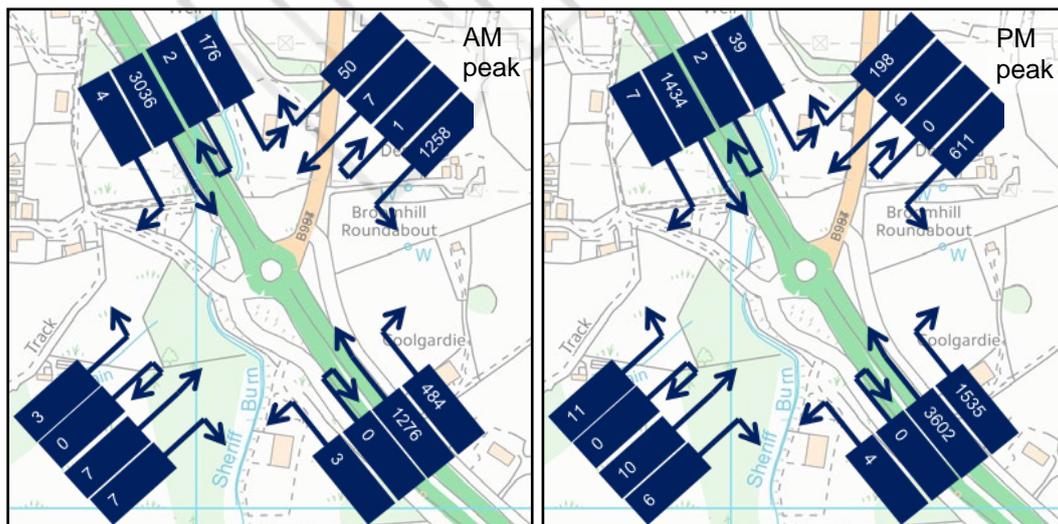
Arm	AM peak entries		AM peak exits		PM peak entries		PM peak exits	
	Hour	Entries	Hour	Exits	Hour	Entries	Hour	Exits
A96 north	06:45	1,465	08:00	540	16:30	614	16:15	1,409
B987	07:15	559	07:45	414	16:15	453	16:30	596
A96 south	07:45	841	07:00	1,886	16:30	1,830	16:30	902
U242C	08:00	9	07:30	11	17:30	16	16:00	6
<b>Combined</b>	<b>07:30</b>	<b>2,862</b>	<b>07:30</b>	<b>2,862</b>	<b>16:30</b>	<b>3,248</b>	<b>16:30</b>	<b>3,248</b>

As with the Inverurie bypass roundabouts, the AM peak hour for the A96 southbound precedes the overall junction peak, and when counted from entries to the roundabout from the north, begins before 07:00.

### 2013 survey

For comparison with the 2018 survey, the turning counts obtained from the survey on Wednesday 1 May 2013 are shown in Figure 11.

Figure 11: Peak period flows at Broomhill Roundabout – 2013 survey



Between 2013 and 2018, there has been an increase of almost 50% in AM peak turns from the A96 northbound to Kintore via the B987, and 40% for the left turn from the A96 southbound into Kintore, suggesting more local commuting traffic.

A96 AM peak through traffic has increased by 3% southbound and 13% northbound over the five-year period.

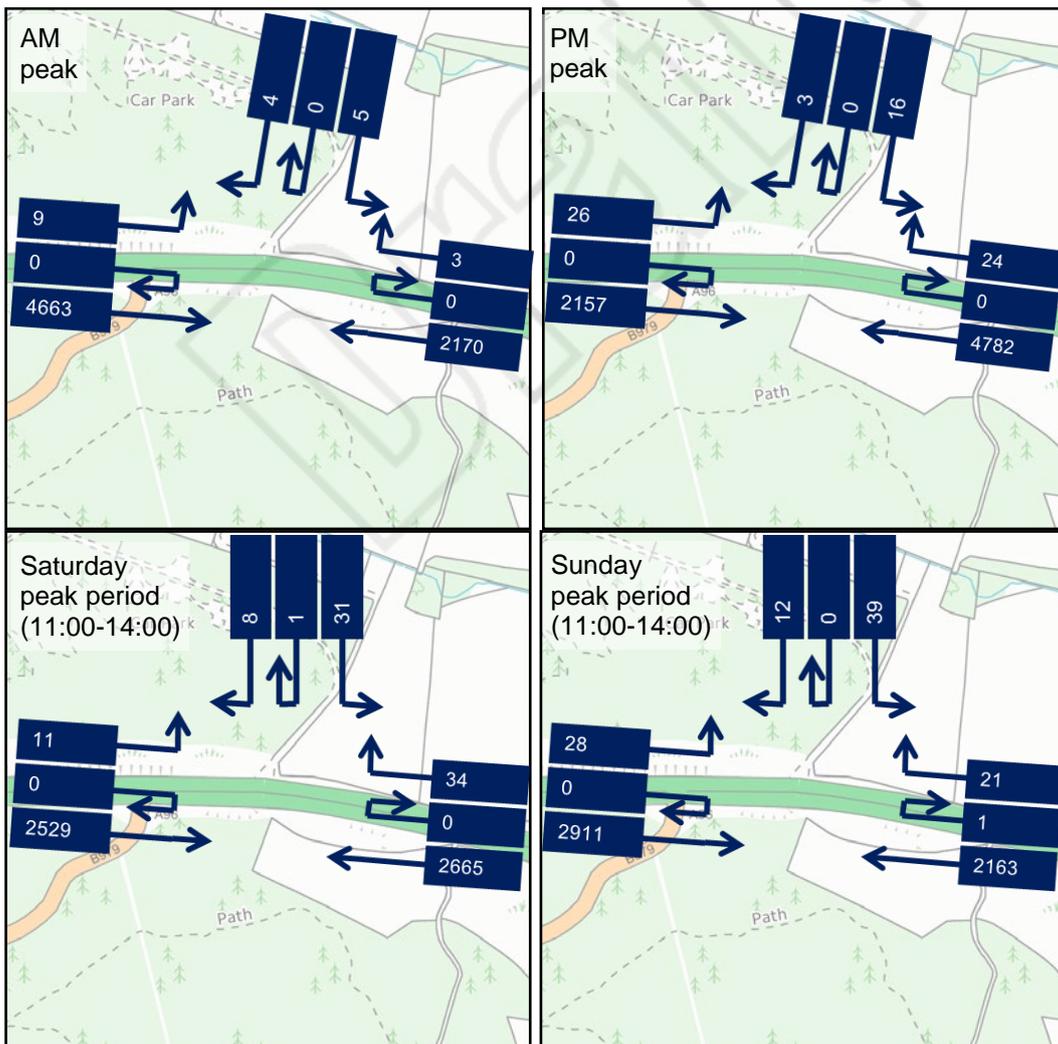
Conversely there is a fall in northbound movements of 9% from 2013 to 2018 and fewer vehicles exit the A96 northbound to Kintore here. This may be due to traffic rerouting away from the A96 to parallel routes, e.g. via Gauchhill Junction.

### 3.1.8 Kirkhill Forest Junction

The junction at Kirkhill Forest is used to access the eponymous attraction, a Forestry Commission site used by walkers, mountain bikers and equestrians. It is located immediately east of the B979 Tyrebagger junction and is a T-junction on the dual carriageway A96. There is a short deceleration lane for right-turners in advance of the gap in the central reserve.

Kirkhill Forest is a recreational facility that may attract significant leisure traffic, particularly at weekends. For this reason, a weekend survey was also procured at this location in addition to a weekday survey. The peak period flows are shown in Figure 12 for the AM and PM peak periods, as well as for the periods of peak flow on Saturdays and Sundays which were observed to occur between 11:00 and 14:00.

Figure 12: Peak period and weekend max flows at Kirkhill Forest Junction



Very few vehicles access Kirkhill Forest at peak periods, particularly in the AM peak with a total of 7 vehicles per hour making a turning movement, as compared to over 1,550 vehicles per hour proceeding southbound. More vehicles access the site in the PM peak (13 vehicles per hour) with fewer exiting; peak tidal behaviour would not be expected for a recreational facility. However, all turning movements represent less than 1% of total junction movements in the PM peak.

Kirkhill Forest is slightly busier during the weekend, although the number of turning movements to and from the site remains very small in the context of through traffic on the A96, with less than 17 vehicles per hour accessing or exiting from the site at the busiest times on Saturdays and Sundays.

The weekend survey shows that peak weekend traffic on the A96 at this location is no greater than 1,000 vehicles per hour per direction over the peak period, while weekday traffic is up to 1,600 vehicles per hour per direction over the peak.

### 3.1.9 Chapel of Stoneywood Junctions

The Chapel of Stoneywood junctions are a pair of offset T-junctions on the dual carriageway A96 immediately west of Craibstone. The link to the north is the C53C and to the south C89C. Both arms provided shortcuts to urban and industrial areas (Kirkhill Industrial Estate in Dyce and Kingswells respectively) but both were severed by the construction of the AWPR; access will be partially restored for the C89C after construction is complete. Both right turns off the A96 have long deceleration lanes; the central reserve is also wide enough to accommodate vehicles making two-stage right turns out of the minor roads.

These junctions have been surveyed to identify the traffic generation in the immediate local area, and as they are form an accident cluster site indicating possible driver frustration. Use of the C89C will change over time as it will eventually allow access from the A96 westbound to the AWPR parallel to that via Craibstone Junction, and therefore this junction will be resurveyed once it has been constructed and opened.

The peak period flows are shown in Figure 13 for the western junction and Figure 14 for the eastern junction; separate surveys were conducted at each T-junction.

Figure 13: Peak period flows at Chapel of Stoneywood western junction

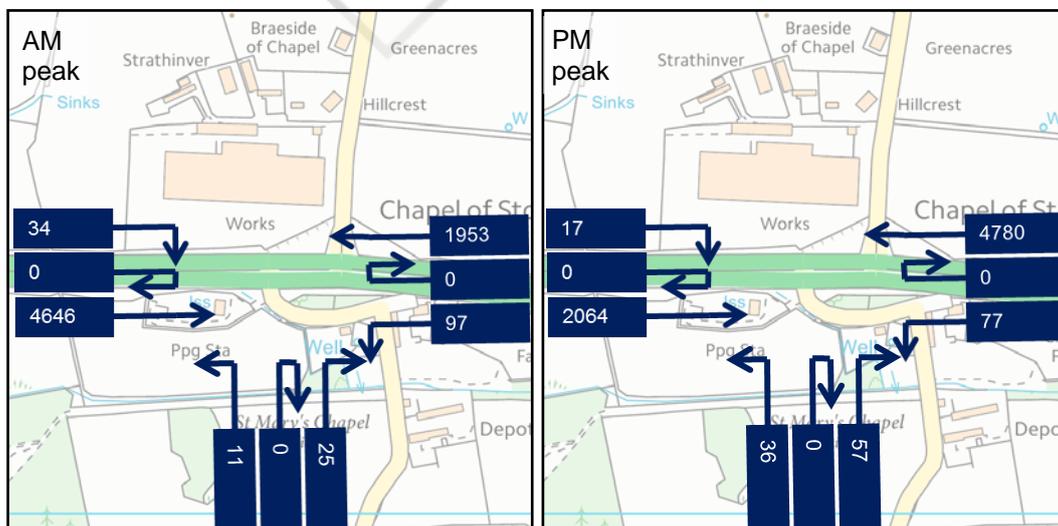
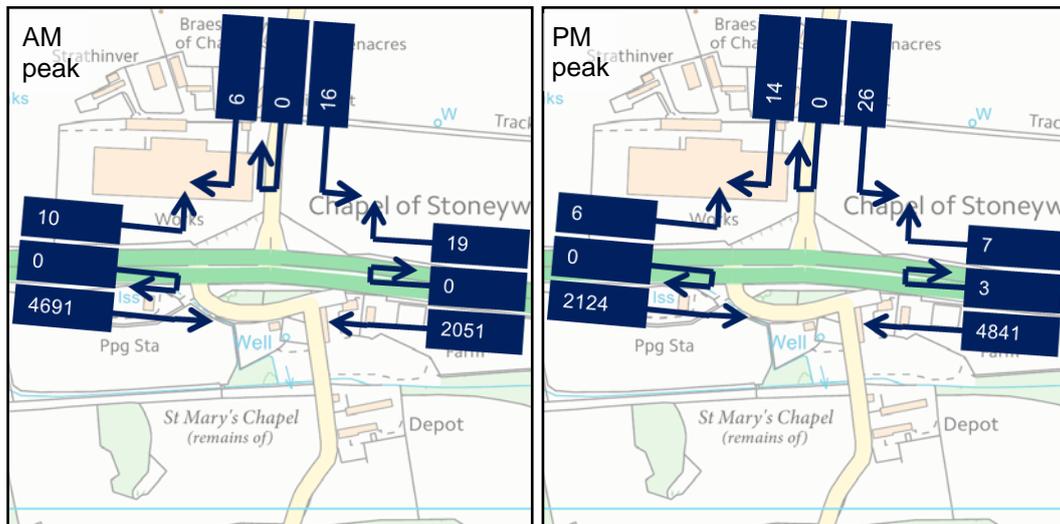


Figure 14: Peak period flows at Chapel of Stoneywood eastern junction



The surveys show that most traffic proceeds through on the A96 without turning here; fewer than 2% of vehicles entering the junction from the A96 turn to the C89C. Fewer still use the C53C, which is permanently severed approximately 250 metres north of the junction, and therefore only used to access local industrial properties. Accidents at this junction may have been associated with more junctions making turns here to access Kingswells and/or Dyce, although this cannot be confirmed.

Both junction surveys show that the total number of vehicles proceeding into Dyce and Aberdeen in the AM peak is 3% lower than the number of vehicles returning on the A96 in the PM peak, but the overall flows in the 13-hour survey period are very similar, in common with many of the other A96 survey sites.

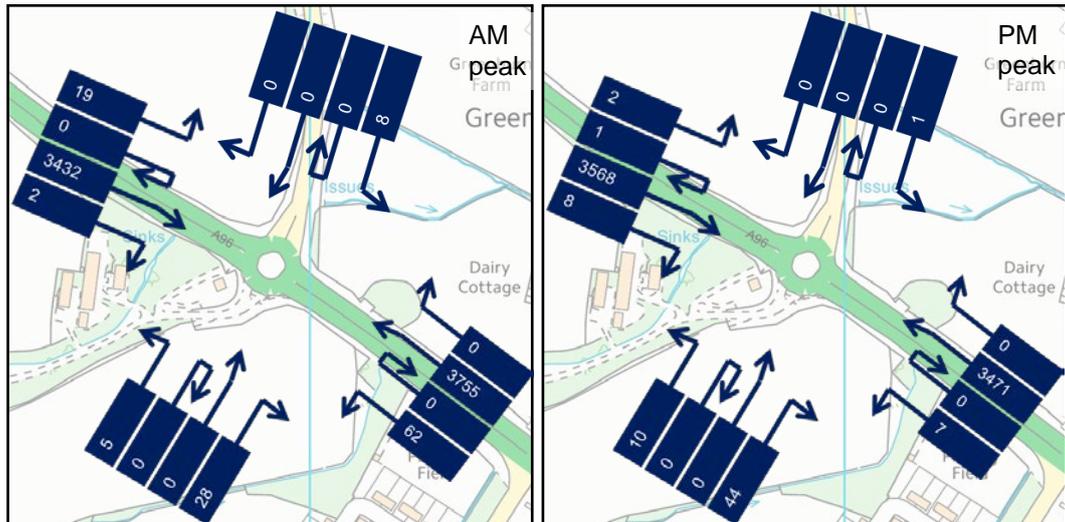
### 3.1.10 A96 Dyce Drive Junction

The A96 Dyce Drive junction is a signalised crossroads between the A96 and Dyce Drive, the former access to Aberdeen Airport to the north and the access to the Aberdeen campus of Scotland’s Rural College to the south. All four left turns use dedicated slips and there are dedicated lanes and signal stages for both right turns from the A96.

Dyce Drive has not been surveyed since 2009; it was remodelled from a roundabout to a signalised crossroads in 2017 (note that the aerial image shows the junction in its previous configuration). Surveys were performed here to indicate how traffic behaviour has evolved following these changes. The junction will also play a part in understanding the interaction between the AWPR and A96 and will therefore be resurveyed after the AWPR opens. The coding of the junction in the current version of the A96 CRAM also requires revision.

The peak period flows are shown in Figure 15. The survey was conducted while the northern arm of the junction was closed for construction work, so this is not likely to be representative of normal use of this junction in the future. It is anticipated that Dyce Drive will reopen following completion of the AWPR.

Figure 15: Peak period flows at A96 Dyce Drive Junction



The A96 through flows are much lower at than those observed at other junctions between here and Kintore, with at most 1,252 vehicles per hour progressing on the A96. Furthermore, the tidal behaviour observed at all other A96 surveys west of here is not present, with slightly more traffic proceeding northbound in the AM peak than southbound, and vice versa.

Given these observations, large numbers of vehicles (at least 400 vehicles per hour from both the west and east) must leave the A96 at Craibstone Roundabout and proceed towards Aberdeen Airport in the AM peak, returning in the PM peak.

Craibstone Roundabout was not surveyed at present due to the AWPR works (the roundabout is presently unfinished) but will be surveyed after the construction period. It is likely that some trips between Aberdeen and the airport and/or Dyce would route through Dyce Drive in preference to Craibstone Roundabout, as it is a shorter route.

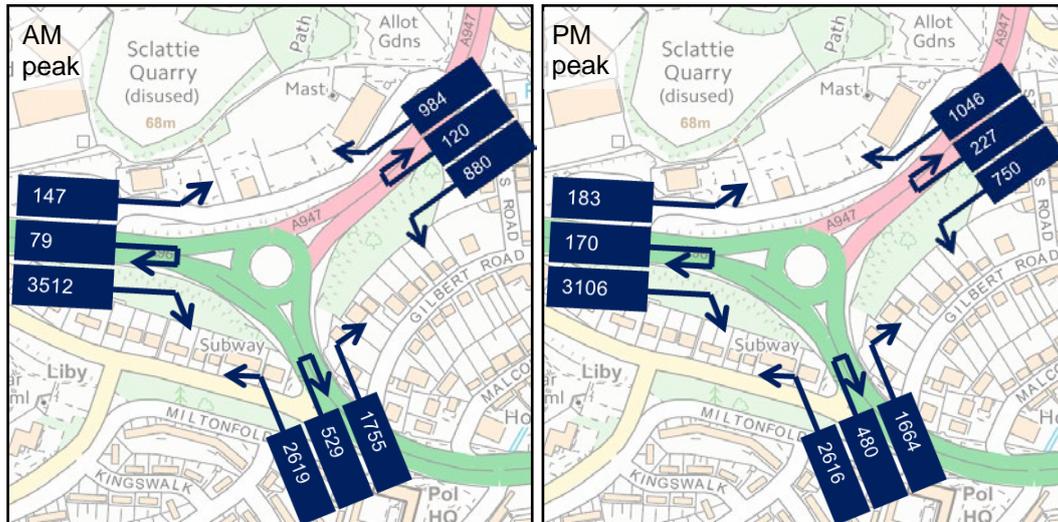
Very few vehicles access the rural college, and those that do tend to route to and from Aberdeen. All vehicles routing to and from Dyce Drive were construction vehicles, so no meaningful conclusions can be drawn from this data.

### 3.1.11 Bucksburn Roundabout

Bucksburn is a three-armed roundabout between the A96 and A947 at Bucksburn, north-western Aberdeen. All three approach arms are dual carriageways and there are two circulatory lanes on the roundabout. There is a direct left-turn bypass for traffic continuing westbound on the A96 avoiding the roundabout.

The roundabout was last surveyed in 2012, and only at peak times. It was re-surveyed to update this data and to indicate how it may be affected by potential A96 routes which run in closer proximity to the A947. Traffic routing may be altered significantly by the AWPR when it opens, and therefore a re-survey will take place at that time. The peak period flows are shown in Figure 16.

Figure 16: Peak period flows at Bucksburn Roundabout



In comparison to all previous junctions on the A96 surveyed, Bucksburn Roundabout is significantly busier overall with 32% more junction entries over the survey period. Almost all turning movements have significant flows, including U-turn movements which are necessitated by closures in the central reserve preventing right turns on the dual carriageways upstream of each roundabout approach, significantly adding to the number of movements at the roundabout.

In both peak periods, significantly more vehicles turn from the A96 north to south (approximately 1,175 vehicles per hour in the AM peak and 1,035 in the PM peak) than from south to north (approximately 875 vehicles per hour), and more make the turn from the A96 south to the A947 (approximately 570 vehicles per hour) than the opposite movement (approximately 270 vehicles per hour).

This behaviour is observed throughout the survey duration suggests that vehicles adjust their routing owing to congestion in Dyce, running in a counter-clockwise loop by entering Dyce from Aberdeen using the A947 but returning via the A96.

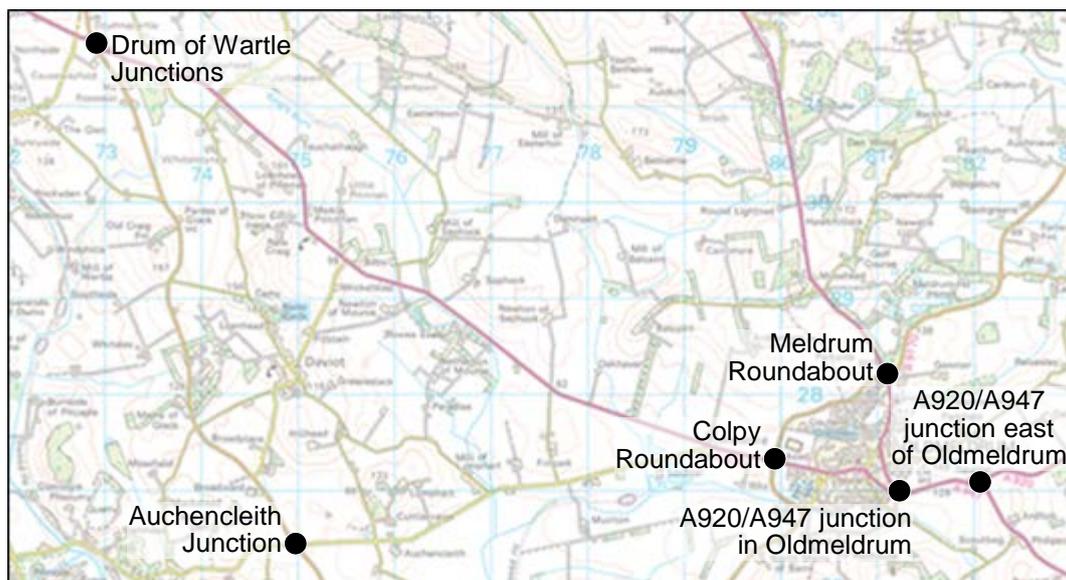
### 3.2 Colpy to Oldmeldrum

The list of surveys conducted on the corridor between Colpy and Oldmeldrum is shown in Table 6 and Figure 17, listed in order from west to east.

Table 6: Colpy to Oldmeldrum junction turning count surveys

Code	Junction Name	Easting	Northing
3571-SCO-16	Drum of Wartle Junction (North)	372858	831718
3571-SCO-17	Drum of Wartle Junction (South)	372929	831589
3571-SCO-36	Auchencleith Junction	374989	826413
3571-SCO-37	Colpy Roundabout	379935	827303
3571-SCO-18	Meldrum Roundabout	381082	828162
3571-SCO-19	A920/A947 junction in Oldmeldrum	381260	826994
3571-SCO-20	A920/A947 junction east of Oldmeldrum	382038	827050

Figure 17: Colpy to Oldmeldrum junction turning count survey locations



The hour in which peak AM and PM flows were recorded, as well as the total number of junction entries throughout the survey and the percentage of heavy vehicles detected, is shown in Table 7.

Table 7: Colpy to Oldmeldrum peak hour and total flow statistics

Junction	AM peak statistics		PM peak statistics		Full day statistics	
	Hour from	Entries	Hour from	Entries	Entries	% OGV
Drum of Wartle North	07:00	549	16:45	686	5,495	6.8%
Drum of Wartle South	07:00	548	16:45	678	5,495	6.9%
Auchencleith	07:45	524	16:45	691	6,048	4.4%
Colpy Roundabout	08:15	1,207	16:45	1,202	10,471	6.6%
Meldrum	07:45	1,084	16:30	1,318	11,060	8.5%
A920/A947 West	07:15	1,089	16:30	1,187	10,144	7.2%
A920/A947 East	07:15	1,079	16:30	1,165	10,008	7.4%

The Drum of Wartle junctions are significantly quieter than those in Oldmeldrum, with earlier AM peak hours. The Oldmeldrum western bypass is approximately as busy as the main road through the town with approximately 10,000 junction entries in the 13-hour survey period. The peak flows on the western bypass are slightly larger, particularly in the PM peak, suggesting more commuting traffic routing via the B9170 to and from Inverurie than using the A947 in this area.

### 3.2.1 Drum of Wartle Junctions

At Drum of Wartle there are two junctions between the A920 and B9001 north-west of Inverurie, co-located with a petrol station, public house and farmhouse. Rothienorman is to the north on the B9001 and Oldmeldrum to the east on the A920. The A920 gives way to the B9001 at both ends of the junction.

Previous surveys suggest that some traffic may be routing between Huntly and Aberdeen using the A920 and A947 in preference to the A96, particularly in the AM

peak. This junction has therefore been surveyed as it forms an important node on that route. The peak period flows are shown in Figure 18 for the northern crossroads and Figure 19 for the southern T-junction.

Figure 18: Peak period flows at Drum of Wartle North Junction

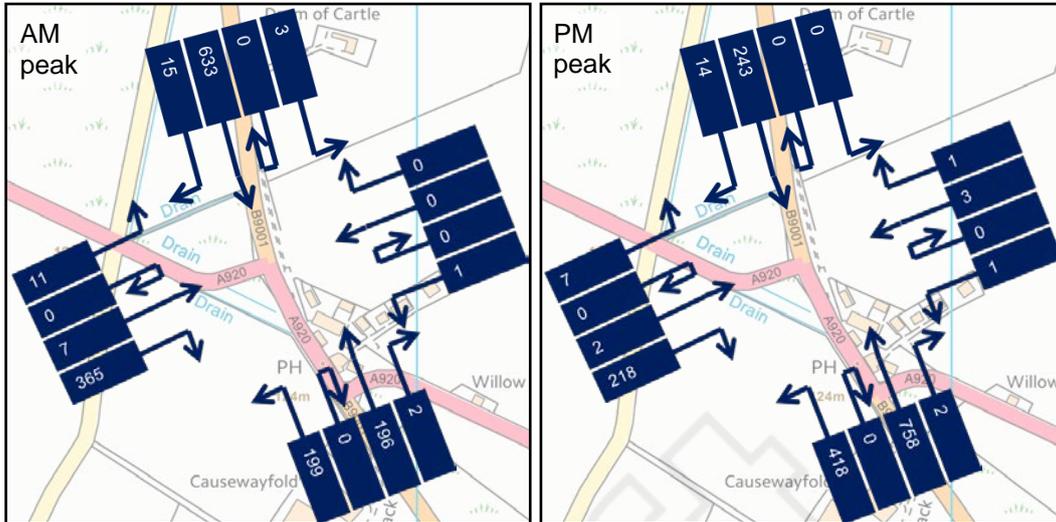
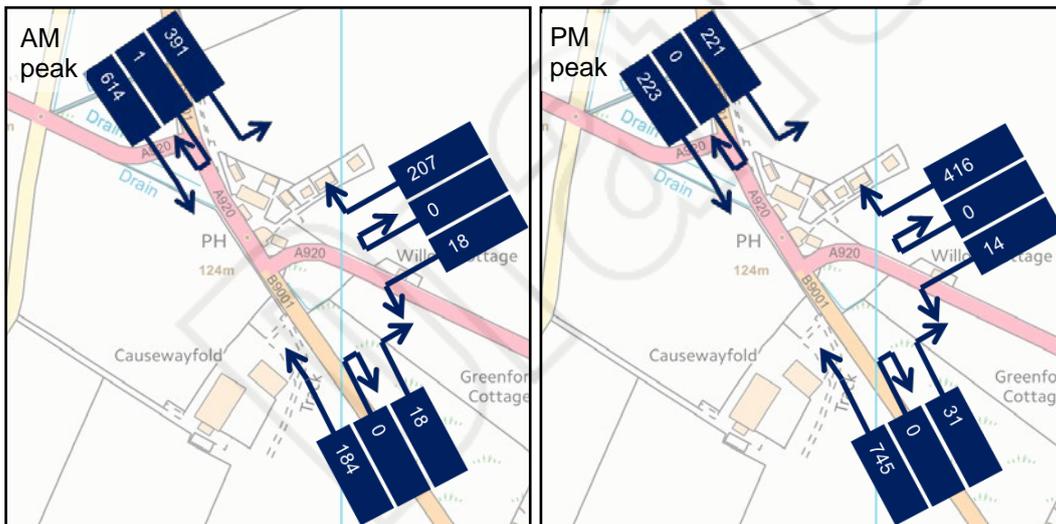


Figure 19: Peak period flows at Drum of Wartle South Junction



Comparing the flows at both junctions, similar numbers of vehicles enter the Drum of Wartle area and exit on the same route; 211 vehicles per hour enter from the B9001 north arm in the AM peak and 205 exit to the B9001 south, while 122 vehicles per hour enter from the A920 western arm in the AM peak and 130 exit to the A920 east. While it is possible that this is coincidental, it suggests that most traffic is proceeding on north-south and east-west axes here, not adjusting its route; traffic from the west is not accessing Inverurie here, and vice versa.

There are two predominant tidal flows at the Drum of Wartle junctions; from the B9001 north and A920 west towards the south and east in the AM peak and returning in the PM peak. The number of PM peak junction entries exceeds those in the AM peak by around 15%, contrary to the assumption that vehicles are using the A920 eastbound from Huntly to Aberdeen in the AM peak and returning using

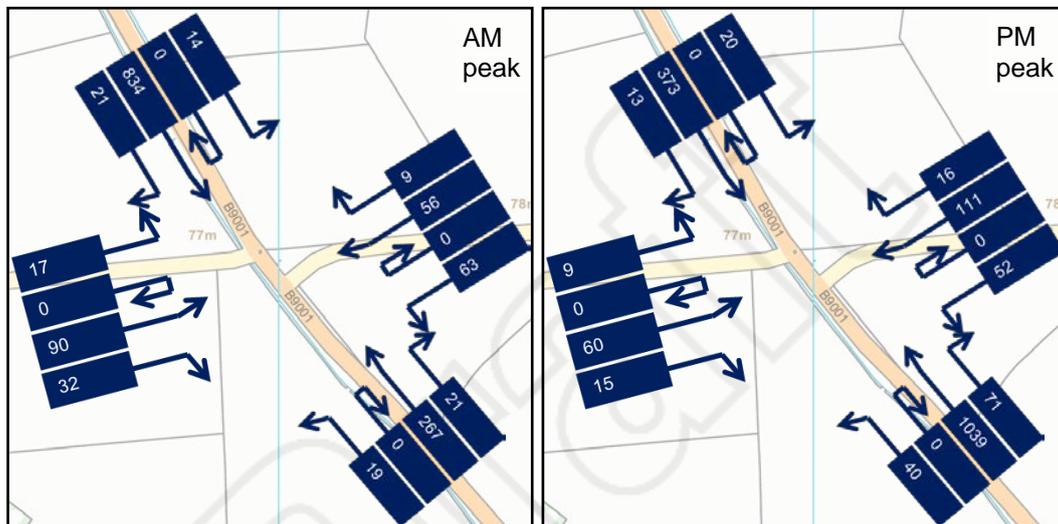
the A96 in the PM peak. Over the full day survey, the numbers of vehicles making these reciprocal turns is approximately consistent.

### 3.2.2 Auchencleith Junction

South of Drum of Wartle on the B9001, the junction at Auchencleith is a staggered crossroads where it meets the local road (C76C) between Pitcaple and Oldmeldrum. The B9001, the priority route through the junction, is slightly wider than a single lane through the junction, with strips marked with dashed lines on each side, not of sufficient width to accommodate a whole car.

This junction was surveyed as it forms a routing node for trips to the north of the Inverurie local area which may be routing to and from other settlements and avoiding congestion in either the Inverurie urban area or on the A96 between there and Aberdeen. The peak period flows are shown in Figure 20.

Figure 20: Peak period flows at Auchencleith Junction



Most traffic proceeds from north to south in the AM peak, returning in the PM peak, as suggested from the surveys at Drum of Wartle to the north. As with many of the Inverurie sites, traffic levels are significantly greater on this movement in the PM peak than the AM, increasing from 278 vehicles per hour to 346, but are approximately equal over the full 13-hour survey period.

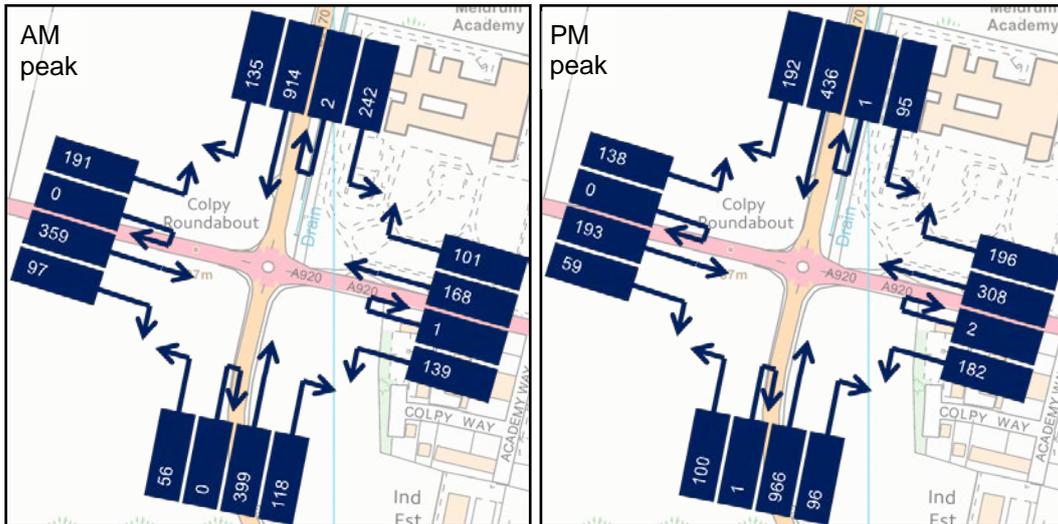
The only other movement which attracts more than a handful of vehicles per hour is west to east on the C76C in the AM peak and the return in the PM peak. This route, between the A96 at Pitcaple and Oldmeldrum, attracts no more than 37 vehicles per hour, suggesting this junction does not form a major routing node.

### 3.2.3 Colpy Roundabout

Colpy Roundabout is at the centre of the Oldmeldrum western bypass (B9170) where it meets the A920. It is a four-armed roundabout with a single circulatory lane and over-run. The B9170 continues south to Inverurie, 8 kilometres away.

The roundabouts on the Oldmeldrum bypass have been surveyed as they are important in understanding vehicle routing between here and Inverurie, Dyce and Aberdeen, and whether traffic from Oldmeldrum and points north routes to the A96 via Inverurie or the A947. The peak period flows are shown in Figure 21.

Figure 21: Peak period flows at Colpy Roundabout



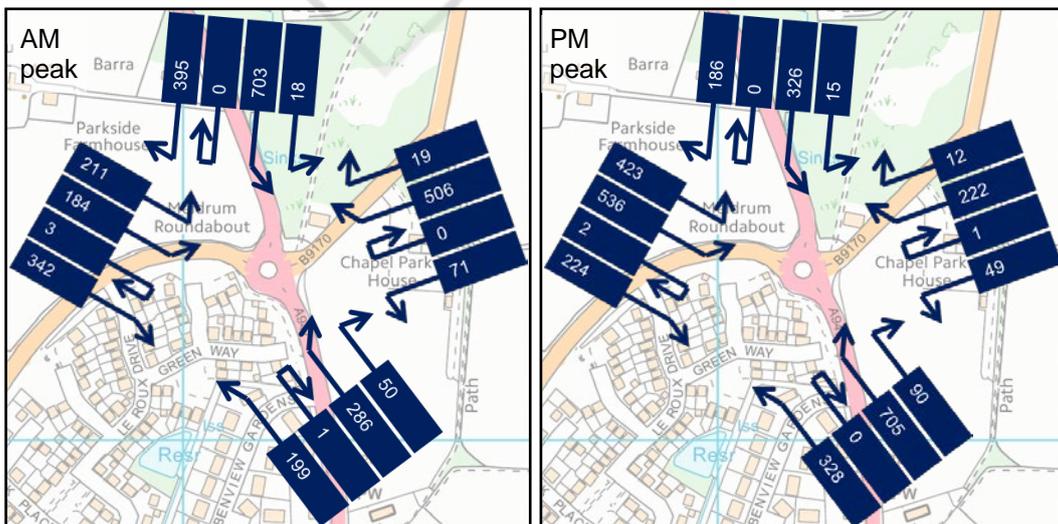
The predominant tidal flow at Colpy Roundabout is from north to south on the B9170 in the AM peak and returning in the PM peak, with just over 300 vehicles per hour. 120 vehicles per hour proceed into Oldmeldrum on the A920 in the AM peak hour, although only 103 vehicles per hour return in the PM peak.

Between 30 and 80 vehicles per hour turn off their routes at the roundabout, most of which occur in a regular tidal pattern which may be indicative of commuting movements. Most traffic which does not proceed straight on routes between the B9170 bypass and Oldmeldrum town centre, suggesting that much of the traffic has a local origin or destination.

### 3.2.4 Meldrum Roundabout

Meldrum Roundabout is at the north of the Oldmeldrum western bypass where the B9170 meets the A947. It is of a similar design to Colpy Roundabout. The A947 accesses Oldmeldrum town centre while the B9170 continues north-east to Methlick and New Deer. The peak period flows are shown in Figure 22.

Figure 22: Peak period flows at Meldrum Roundabout



The busiest approach to Meldrum Roundabout in the AM peak is the A947 north arm from Fyvie and Turriff; it splits between the A947 south and B9170 west in a ratio of approximately 2:1, suggesting that most of this traffic commutes beyond Oldmeldrum towards Dyce and Aberdeen and fewer enters Oldmeldrum or continues to Inverurie via Colpy Roundabout. This behaviour is tidal and the opposite movements are made in the PM peak.

Almost all traffic entering from the B9170 east in the AM peak (around 200 vehicles per hour) continues on the B9170 Oldmeldrum bypass. When all arms are considered, the western and southern exits from the junction are approximately as busy as each other in the AM peak, and are similarly busy roundabout approaches in the AM peak.

The movements between the south and west attract around 100 vehicles per hour in each direction in each peak, which given their geometry could only be logically used for local movements.

### 3.2.5 A920/A947 Junctions

There are two consecutive junctions between the A920 and A947 east of Oldmeldrum town centre. The western junction is in the urban area and allows access between the A947 and the A920 South Road, the latter forming the main access to the town. The eastern junction is 800 metres away, adjacent to the local golf club where the A920 continues east to Pitmedden and Ellon. Both are T-junctions at which the A920 gives way to the A947 through route.

They have been surveyed to indicate if their present routing behaviour makes them likely to influence traffic levels on any routing of the A96 which runs closer to Oldmeldrum than at present. The surveys were also used to detect if vehicles turn from A920 to A947 on long-distance trips between Huntly and Aberdeen, which may be suggested by previous link counts on those routes.

The peak period flows are shown in Figure 23 for the western junction and Figure 24 for the eastern junction; separate surveys were conducted at each T-junction.

Figure 23: Peak period flows at A920/A947 junction in Oldmeldrum

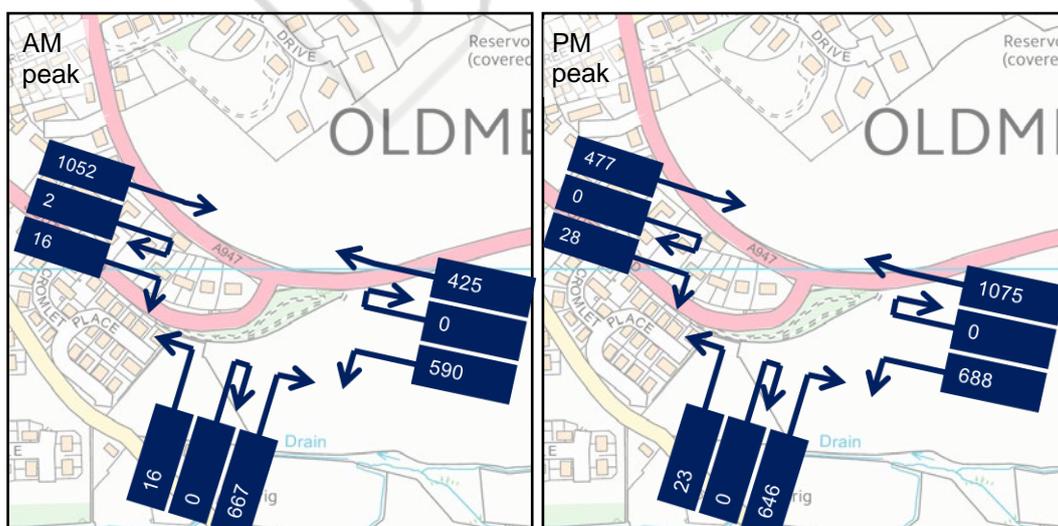
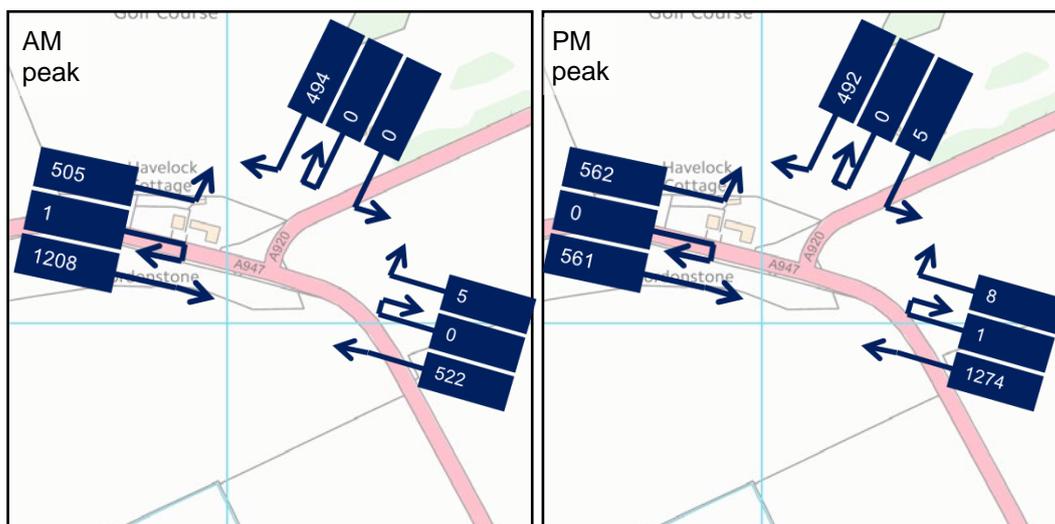


Figure 24: Peak period flows at A920/A947 junction east of Oldmeldrum



Considering the junction complex as a whole, the A947 northern arm is the busiest in the AM peak with 357 entries per hour, while 228 vehicles per hour approach from the A920 west and around 170 per hour from the south and east; almost all such vehicles proceed via the link between the two A920 junctions.

The movements to and from both A920 arms are not significantly tidal, with 200-230 vehicles per hour entering and exiting Oldmeldrum in both peak periods, while approximately 170 vehicles per hour proceed to and from Pitmedden and Ellon.

Given the similarity in these flows, and the geometry of the A920 and A947 through the area, it is assumed that most vehicles are making through movements on north-south and west-east axes on either the A947 or A920 respectively and not exchanging between them, like the behaviour seen at Drum of Wartle. This further suggests that movements between Huntly and Aberdeen using the A920 and A947 in preference to the A96 are less prevalent than previously assumed.

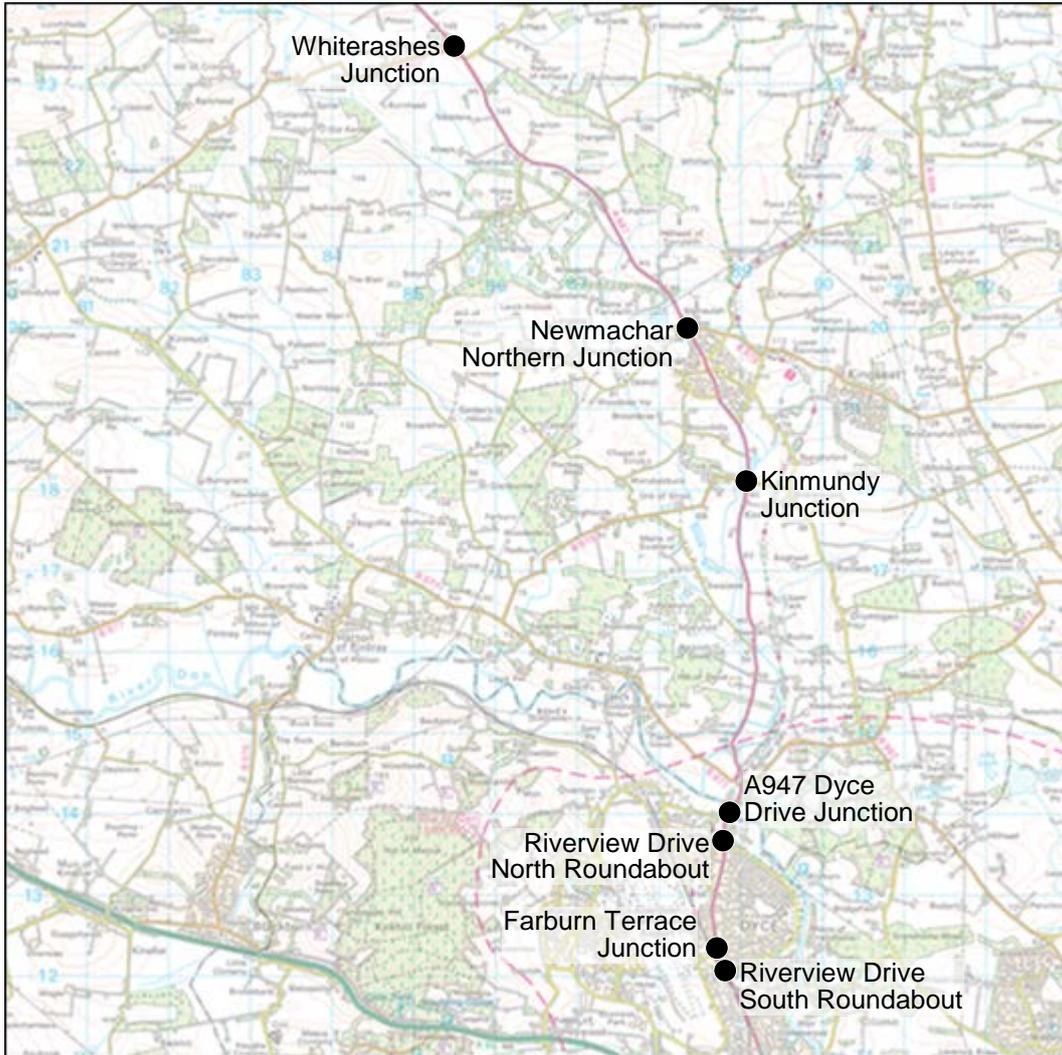
### 3.3 Oldmeldrum to Dyce

The list of surveys conducted on the corridor between Oldmeldrum and Dyce is shown in Table 8 and Figure 25, listed in order from north to south on the A947.

Table 8: Oldmeldrum to Dyce junction turning count surveys

Code	Junction Name	Easting	Northing
3571-SCO-21	Whiterashes Junction	385469	823492
3571-SCO-38	Newmachar Northern Junction	388380	819945
3571-SCO-39	Kinmundy Junction	389091	818105
3571-SCO-22	A947 Dyce Drive Junction	388814	813971
3571-SCO-4	Riverview Drive North Roundabout	388823	813676
3571-SCO-6	Farburn Terrace Junction	388713	812305
3571-SCO-5	Riverview Drive South Roundabout	388871	812019

Figure 25: Oldmeldrum to Dyce junction turning count survey locations



The hour in which peak AM and PM flows were recorded, as well as the total number of junction entries throughout the survey and the percentage of heavy vehicles detected, is shown in Table 9.

Table 9: Oldmeldrum to Dyce peak hour and total flow statistics

Junction	AM peak statistics		PM peak statistics		Full day statistics	
	Hour from	Entries	Hour from	Entries	Entries	% OGV
Whiterashes	07:15	944	16:30	977	7,970	6.7%
Newmachar North	07:15	941	16:30	992	8,188	6.4%
Kinmundy	07:15	1,256	16:30	1,251	10,912	4.8%
A947 Dyce Drive	07:15	1,807	16:00	1,643	16,269	8.0%
Riverview Drive North	07:30	1,248	16:30	1,051	11,517	6.0%
Farburn Terrace	07:15	1,436	16:00	1,327	14,694	3.8%
Riverview Drive South	07:30	1,845	16:00	1,684	19,600	5.1%

The peak hours are approximately consistent over the length of the A947 south of Oldmeldrum, particularly in the AM peak.

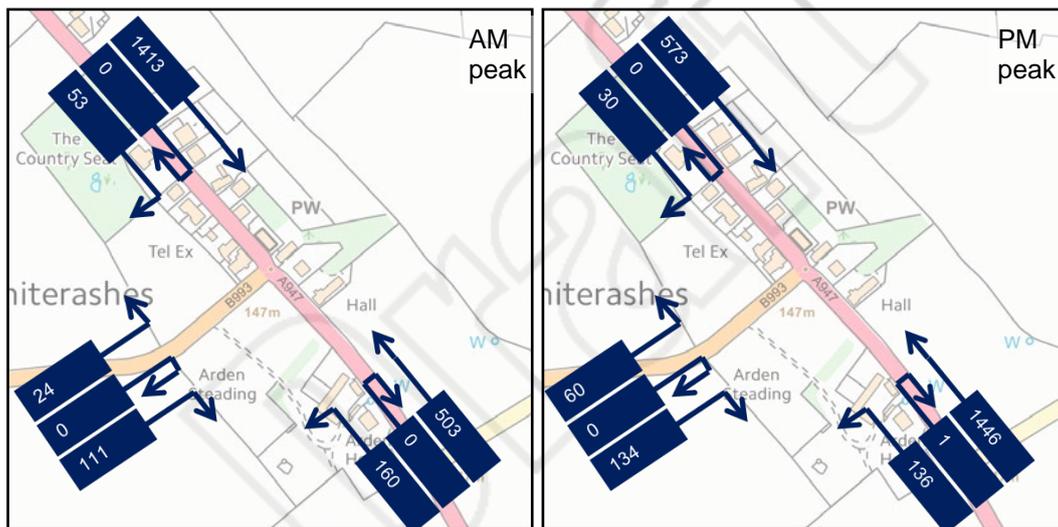
Traffic volumes are higher in Dyce than in locations to the north, suggesting that it is a significant trip generator. The peak flows and OGV percentages are highest at the A947 Dyce Drive junction, which may suggest significant use of Dyce Drive to access the business and industrial estates surrounding Aberdeen Airport.

### 3.3.1 Whiterashes Junction

The T-junction in the village of Whiterashes is where the A947 meets the eastern end of the B993 from Keithhall and south-eastern Inverurie. The B993 is the minor arm of the junction; there is a hatched central reserve on the A947 but it is not wide enough to accommodate a right turning vehicle.

The B993 could be used for trips to and from Inverurie and therefore may form an alternative route for trips between Inverurie and Dyce/Aberdeen which avoid the A96. The surveyed was therefore performed to determine if traffic is attracted from Inverurie. The peak period flows are shown in Figure 26.

Figure 26: Peak period flows at Whiterashes Junction



The predominant movement at the junction straight through on the A947; the movement is tidal in that traffic progresses south towards Dyce and Aberdeen in the AM peak and returns north in the PM peak; approximately 480 vehicles per hour make this movement.

Of the vehicles that do make turns at this junction, most route between the west and south (around 50 vehicles per hour in both peaks) although the lack of tidal flow suggests this is not a significant commuting movement; therefore, few commuting trips from Inverurie in the AM peak are assumed to be attracted few here.

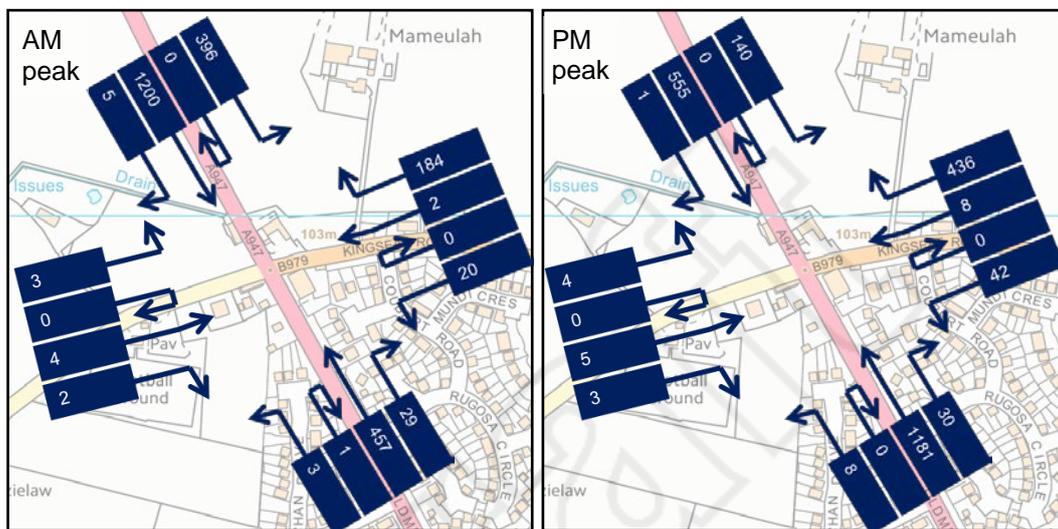
The less popular turning movement, between the west and the south, is tidal (around 20 vehicles per hour from north to south in the AM peak, returning in the PM peak) suggesting a small number of commuting trips may be heading in the direction of Inverurie, although there are also other smaller settlements nearby on this route such as Keithhall.

### 3.3.2 Newmachar Northern Junction

Adjacent to the Newmachar Hotel and the north of the urban area, the A947 meets the B979 Kingseat Road which proceeds east towards the A90. The junction is a crossroads in which the fourth arm is a narrow link to Disblair. This junction is located within the urban area so there is no stacking space for right turners off the A947.

Surveys at this and Kinmundy Junction to the south were performed as routing here is key to understanding how traffic between the Kintore hinterland, this area, the A90 and Aberdeen would interact should the A96 be re-routed on any corridor parallel to the A947. The peak period flows are shown in Figure 27.

Figure 27: Peak period flows at Newmachar Northern Junction



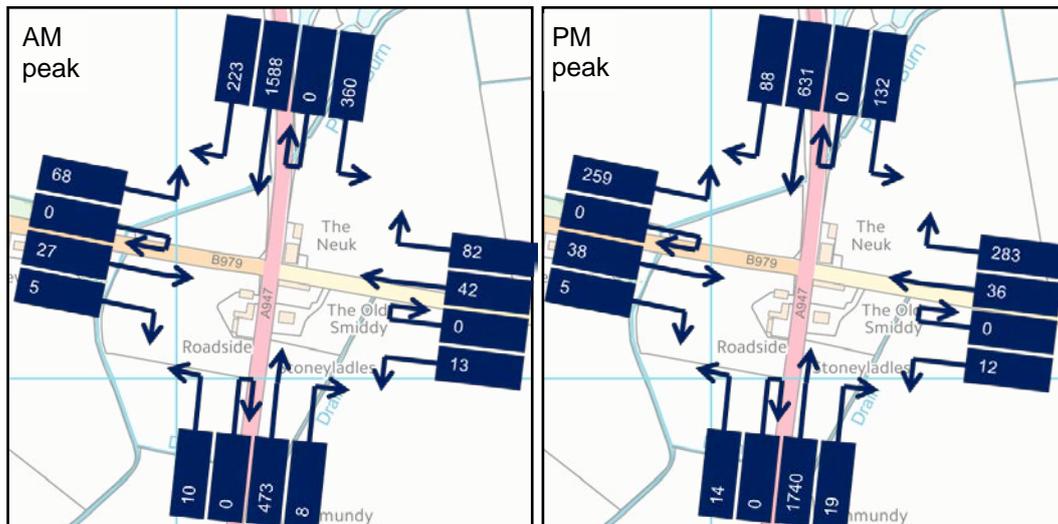
70% of all traffic at the junction in the AM peak approaches from the north. Of this, three-quarters proceeds south on the A947 and one quarter turns east to join the B979. This left-turning traffic, 132 vehicles per hour, is therefore proceeding east towards Kingseat which is an unlikely destination for this volume of traffic; it is more likely routing towards the B999 and the A90 to proceed into Aberdeen on that route. Similar volumes of traffic make the return movements in the PM peak, suggesting a tidal commuting movement. Resultantly, the A947 is quieter in Newmachar than it is further north.

None of the other movements at the junction have flows greater than 10 vehicles per hour, with the link to and from Disblair particularly quiet at no more than 5 junction entries per hour.

### 3.3.3 Kinmundy Junction

The crossroads at Kinmundy is where the A947 meets the westward leg of the B979, to and from Hatton of Fintray and Kintore via the B977. The minor eastern arm provides access to Whitecairns. There is a hatched area between traffic flows on the A947 but this is consistent over much of the A947 and used to further segregate through traffic rather than to provide a ghost island for right turners. The peak period flows are shown in Figure 28.

Figure 28: Peak period flows at Kinmundy Junction



As with the sites further north on the A947, the predominant flow at the junction is southbound on the A947 in the AM peak and returning in the PM peak. Peak traffic levels on the A947 are approximately 75% busier than at Newmachar, suggesting that it provides significant commuter traffic to the south. Approximately 530 vehicles per hour proceed to the south in the AM peak, while 580 vehicles per hour proceed north in the PM peak; however, over the course of the full day survey, 8% more traffic proceeds southbound than northbound.

As at Newmachar North Junction, a significant proportion of southbound AM peak traffic (120 vehicles per hour) turns left to proceed towards the coast and the A90; there are no logical intervening settlements that could be attracting this traffic. Some 75 vehicles per hour also turn right to head westwards towards Hatton of Fintray and possibly Kintore.

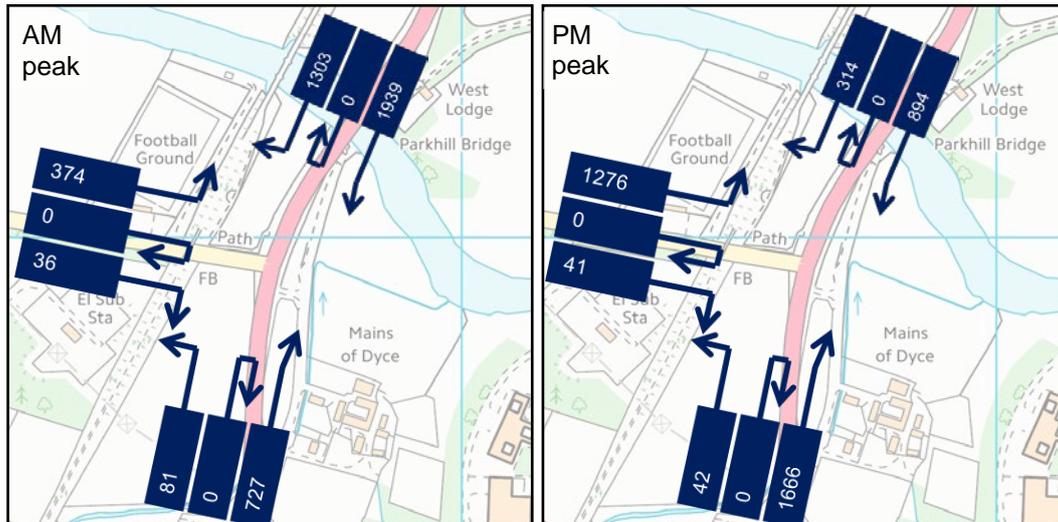
Both turning movements are tidal, with traffic returning to the north in the PM peak, although the numbers doing so from the east are lower at around 95 vehicles per hour. This, combined with the increased tidal flow northbound in the PM peak, may suggest that traffic is choosing to divert off the A947 in the AM peak but return using it in the PM peak.

### 3.3.4 A947 Dyce Drive Junction

The A947 Dyce Drive junction is located between the under-construction AWPR junction at Goval and the Dyce urban area. It is used to access the Kirkhill business and industrial estates and facilities associated with Aberdeen Airport. It is a T-junction at which Dyce Drive gives way, and the A947 southbound has a ghost island for right turners.

The survey here, along with the A96 Dyce Drive survey, will indicate the level of demand on Dyce Drive and therefore the routing implications of realigning the A96 nearer either. As with other junctions within the boundaries of the AWPR, it will also be re-surveyed following completion of its construction. The peak period flows are shown in Figure 29.

Figure 29: Peak period flows at A947 Dyce Drive Junction



Southbound AM peak traffic levels are far greater than those at the previous junction at Kinmundy; only 535 vehicles per hour exit Kinmundy to the south but more than twice that arrive at this junction. This suggests that significant volumes of traffic are attracted to the A947 southbound from intermediate junctions, presumably the B977 junctions at Goval. These are being reconstructed at present in conjunction with the AWPR Goval junction so will be surveyed after construction of the AWPR is complete and traffic behaviour has stabilised.

Vehicles arriving at Dyce Drive in the AM peak split between turning right to access Dyce Drive and continuing south to Dyce town centre in the ratio 2:3; therefore, the north and west Dyce business and industrial estates attract a significant proportion of the traffic from the north.

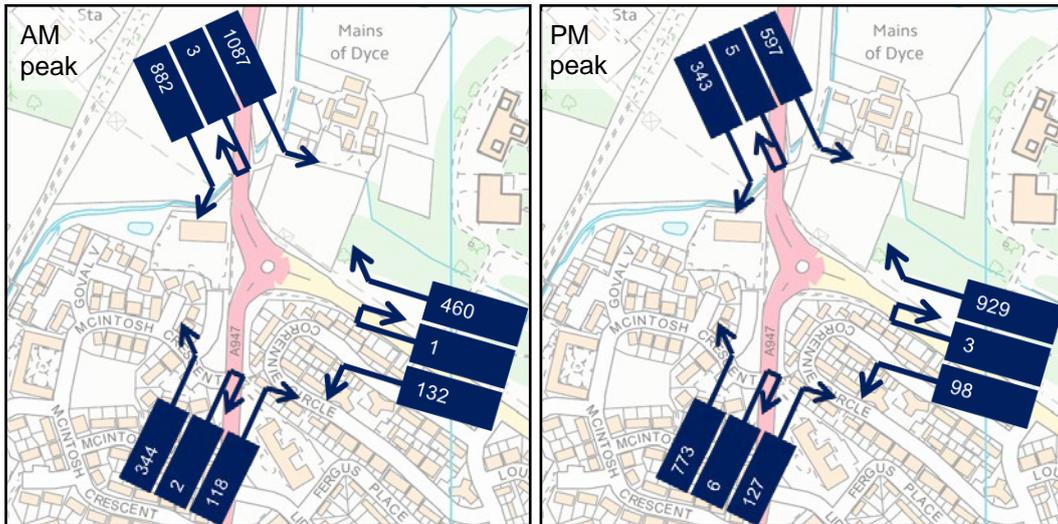
These movements are tidal and therefore presumably commuters which return to the north in the PM peak. Significantly more vehicles proceed southbound in the AM peak (646 per hour) than northbound in the PM peak (555 per hour) and over the full day southbound flows are 13% greater than northbound, suggesting some differentiation of routing over the course of the day with traffic entering Dyce from the A947 but leaving by a different route.

### 3.3.5 Riverview Drive North Roundabout

The A947 has two roundabouts with Riverview Drive, a semi-circular route that bypasses Dyce town centre to its east. The northern roundabout has three arms with two-lane entry and circulatory carriageways. Signposts direct through traffic to use Riverview Drive in preference to the A947 to reach the A96 and Aberdeen.

The Riverview Drive roundabouts, and the survey at Farburn Terrace junction which is located between them, were surveyed to determine traffic demands and routing in the Dyce area, and how much traffic is likely to be generated in the town and how much is passing through. The peak period flows are shown in Figure 30.

Figure 30: Peak period flows at Riverview Drive North Roundabout



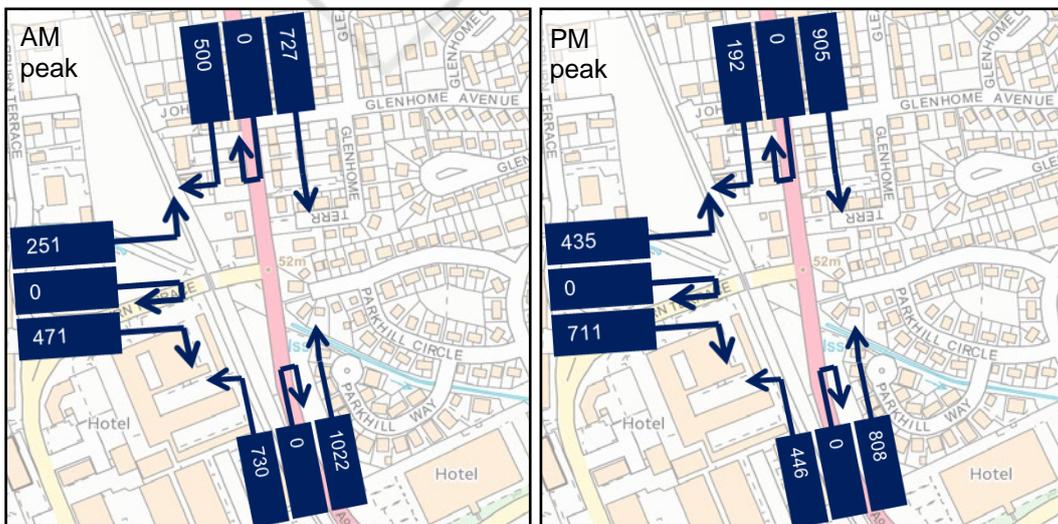
Of the 657 vehicles per hour approaching the roundabout from the north, 55% route to Riverview Drive and 45% continue to the A947 Victoria Street, presumably with a destination in Dyce itself. These are tidal movements which return in the PM peak, albeit in smaller numbers suggesting commuting traffic is avoiding travelling north through the Dyce urban area in the PM peak.

Approximately 115 vehicles per hour proceed northbound on the A947 towards Dyce Drive in the AM peak and return in the PM peak, while around 35 vehicles per hour make turns between the east and south consistently in both peaks.

### 3.3.6 Farburn Terrace Junction

Farburn Terrace is a signalised T-junction in Dyce town centre. Farburn Terrace crosses under the railway near Dyce station and is used to access the industrial estates and hotels surrounding Aberdeen Airport. The A947 arms have one lane for each turn, while the Farburn Terrace approach is in a single lane. The peak period flows are shown in Figure 31.

Figure 31: Peak period flows at Farburn Terrace Junction



The tidal nature of the A947 north of Dyce, with flow predominantly southbound in the AM peak and northbound in the PM peak, is not observed in central Dyce as more traffic approaches this junction in the AM peak from the south (584 vehicles per hour) than the north (409 vehicles per hour).

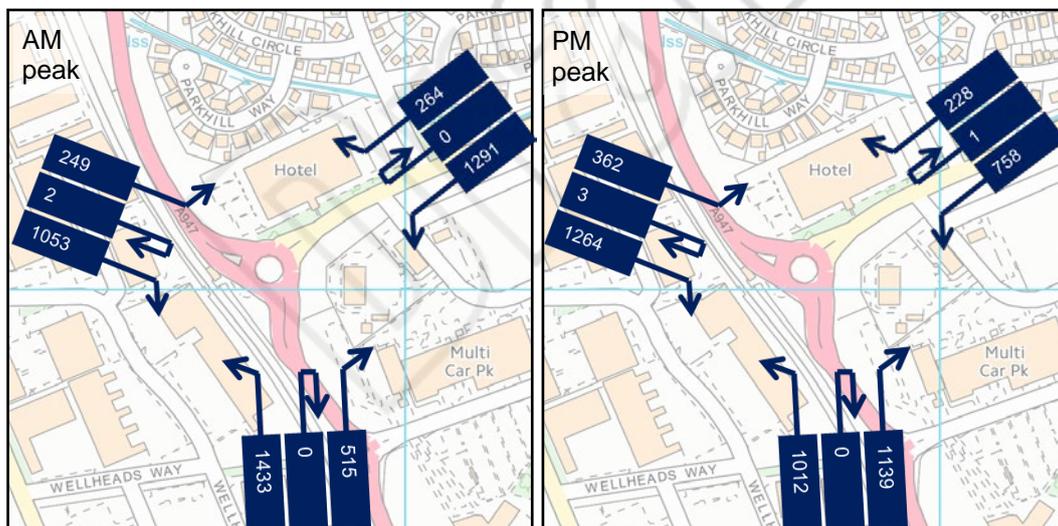
Both turning movements into Farburn Terrace attract a significant proportion of A947 traffic, resulting in all three junction exits having similar volumes of traffic in the AM peak (400 to 425 vehicles per hour). This suggests that the junction caters for different commuting movements within the urban area. The busiest single movement at the junction is the northbound movement on the A947 with 341 vehicles per hour.

Traffic behaviour is generally tidal with each of the reciprocal movements made in the PM peak. Fewer vehicles return southbound on the A947 than proceeded northbound in the AM peak (302 vehicles per hour) while the opposite movement is more popular in the PM peak (269 per hour) than the AM peak (242 per hour). However, given the location of the junction in the urban area, many of these movements may be local and non-commuting in nature.

### 3.3.7 Riverview Drive South Roundabout

The roundabout at the southern end of Riverview Drive has a similar configuration to the northern roundabout, with three two-lane approaches, the A947 continuing on a north-south axis and Riverview Drive to the east. The peak period flows are shown in Figure 32.

Figure 32: Peak period flows at Riverview Drive South Roundabout



The busiest approach to the roundabout in the AM peak is from the south. These are presumably vehicles commuting into Dyce, and this is reflected in the observation that most of those, 478 vehicles per hour, proceed into Dyce town centre while only 172 per hour turn right to bypass Dyce on Riverview Drive. The roundabout has approximately 1,600 vehicle entries per hour in both peaks.

Both the northern and eastern arm of the roundabout also provide at least 430 entries per hour to the roundabout, of which almost all proceeds south towards Aberdeen. These movements are all tidal, suggesting a range of commuting movements; from Aberdeen into Dyce, from Dyce into Aberdeen, and from places north of Dyce into Aberdeen.

All three of these major movements are busier in the AM peak than the PM peak, which may suggest that a proportion of commuting traffic from all directions is avoiding the roundabout in the PM peak. At most other counter sites in this survey, PM peak flows have been greater than those of the AM peak, likely due to additional non-commuting journeys in the afternoon and early evening, however the opposite is true here.

### 3.4 Westhill and its Hinterland

The list of surveys conducted within Westhill and its hinterland is shown in Table 10 and Figure 33.

Table 10: Westhill and hinterland junction turning count surveys

Code	Junction Name	Easting	Northing
3571-SCO-23	Dunecht Junction	375343	809074
3571-SCO-41	Lyne of Skene Junction	376472	810537
3571-SCO-42	Loch of Skene Junction	379427	807576
3571-SCO-43	East Auchronie Junction	382053	809134
3571-SCO-44	Kirkton of Skene Junction	380149	807271
3571-SCO-45	Arnhall Roundabout	383558	806630
3571-SCO-25	Bishopdams Junction	384104	806340
3571-SCO-24	Clinterty Fork	383435	810287

Figure 33: Westhill and hinterland junction turning count survey locations



The hour in which peak AM and PM flows were recorded, as well as the total number of junction entries throughout the survey and the percentage of heavy vehicles detected, is shown in Table 11.

Table 11: Westhill and hinterland peak hour and total flow statistics

Junction	AM peak statistics		PM peak statistics		Full day statistics	
	Hour from	Entries	Hour from	Entries	Entries	% OGV
Dunecht	07:15	899	16:30	1,034	8,277	11.0%
Lyne of Skene	07:15	654	16:30	754	5,801	14.5%
Loch of Skene	07:15	1,076	16:45	1,122	8,759	9.8%
East Auchronie	07:45	989	16:30	1,069	7,493	1.7%
Kirkton of Skene	07:15	1,053	16:45	1,213	9,045	9.5%
Arnhall	07:30	2,612	16:30	3,172	30,511	1.8%
Bishopdams	07:15	3,081	16:30	3,308	29,429	2.5%
Clinterty Fork	07:15	545	16:45	572	3,777	1.6%

For the sites on the A944 (Dunecht, Loch of Skene, Kirkton of Skene, Arnhall and Bishopdams) the timing of the peak hours is consistent, not differing from one another by more than 15 minutes. The local junctions between the A96 and A944 (Lyne of Skene, East Auchronie and Clinterty Fork) follow a similar pattern with the only outlier being East Auchronie which has a later AM peak of 07:45-08:45.

At the two junctions in Westhill (Arnhall and Bishopdams) overall traffic flows are more than three times those to the west suggesting that it generates significant traffic to and from Aberdeen.

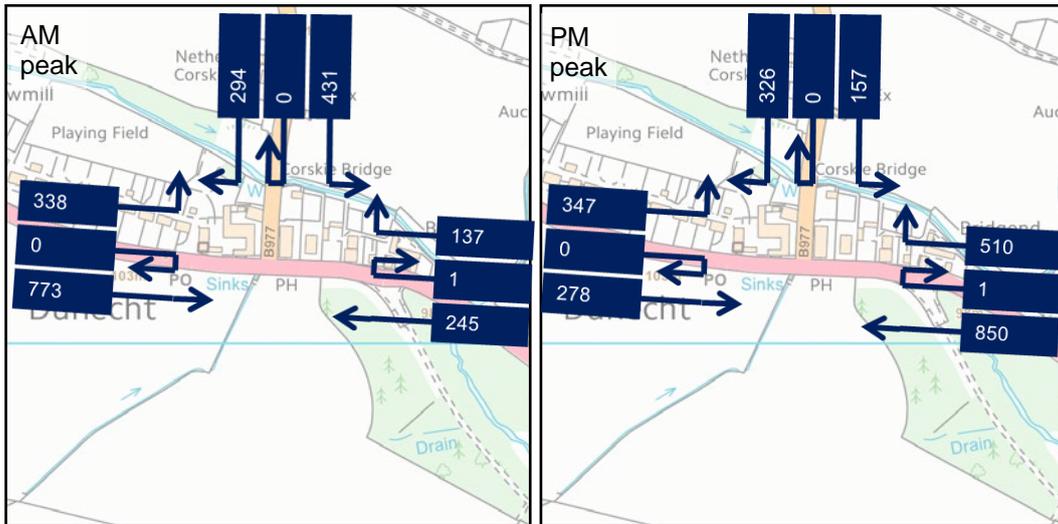
The percentage of heavy vehicles increases with distance west of Westhill on the A944. This suggests that either heavy vehicles to and from the west end their journeys in Westhill or that they are travelling further and therefore constitute a greater percentage of vehicles in the lower flow areas west of Westhill.

### 3.4.1 Dunecht Junction

There are two significant A-road junctions in the village of Dunecht, both with the B977. The eastern junction, where the B977 from the north meets the A944 at a T-junction, was surveyed. There is a private access to the south which did not form part of the junction survey. There is no formal provision for right turners from the A944 although there may be sufficient carriageway width to accommodate through traffic while a right-turner is waiting.

This, and the junctions at Lyne and Loch of Skene, have been surveyed to indicate how traffic which leaves the A96 at Gauchhill Junction and proceeds southbound on the B977 routes in this area – whether it turns left and continues into Westhill or Aberdeen on the A944, or whether it continues further south to locations south of Aberdeen using a route which is recommended by web-based route planning software. The peak period flows are shown in Figure 34.

Figure 34: Peak period flows at Dunecht Junction



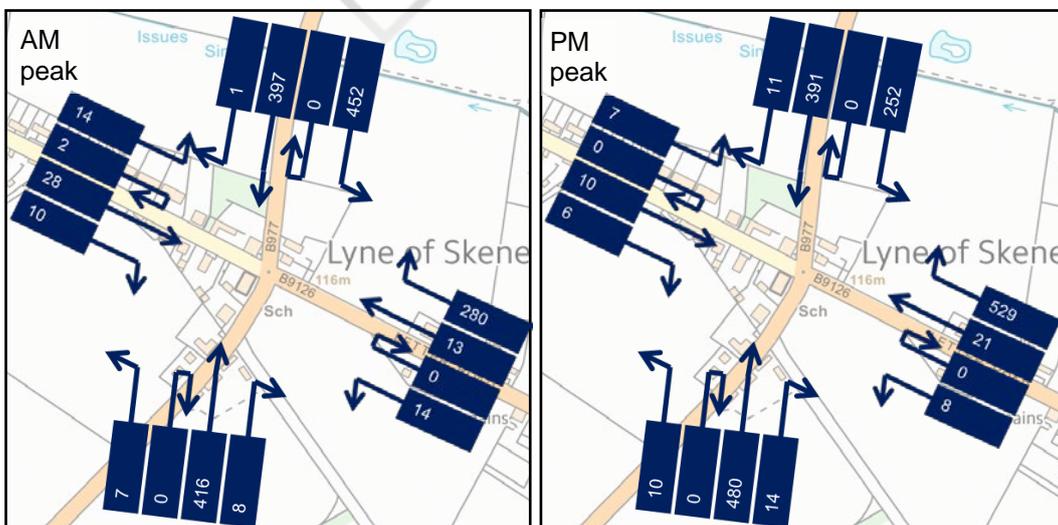
The busiest movements at Dunecht are from west to east in the AM peak, returning in the PM peak, with approximately 270 vehicles per peak hour (slightly more in the PM peak than in the AM peak and 6% greater over the full day).

Of traffic approaching from the B977 (242 vehicles per hour in the AM peak), 60% turns right to join the A944 towards Westhill and 40% turns right to proceed west. Given the lack of trip attractors to the west of Dunecht (Alford being 20km to the northwest) this would suggest that most of this traffic – around 100 vehicles per hour in both peak periods – is progressing southbound on the B977 towards places south of Aberdeen.

### 3.4.2 Lyne of Skene Junction

The junction at Lyne of Skene is located immediately north of Dunecht. It is a crossroads adjacent to the village hall where the B977 meets Letter Road, classified as the B9126 to the east of the junction. The B9126 forms a short-cut between the B977 north and the A944 east. The B977 is the priority route through the junction. The peak period flows are shown in Figure 35.

Figure 35: Peak period flows at Lyne of Skene Junction



More than half of all junction entries to Lyne of Skene in the AM peak arrive from the north (from Kintore via Gauchhill Junction). Of those, the majority (150 vehicles per hour) proceed towards Westhill using the B9126. This movement is tidal and suggests that these vehicles are commuting towards the Westhill or Aberdeen areas, possibly avoiding the A96 in the process.

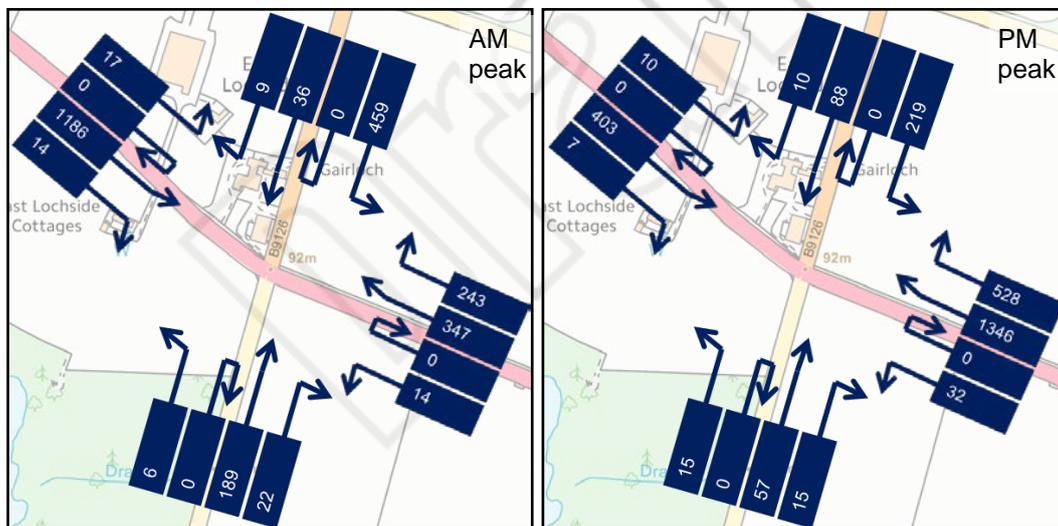
Both B977 through movements (north to south and south to north) have a consistent 130 to 150 vehicles per hour in both periods. Given the lack of trip attractors on the B977 through route, and given the observations at Dunecht Junction, these trips are also possibly A90 to A96 movements which are purposely avoiding Aberdeen. These movements appear in both peak periods.

The only other significant movement at the junction (greater than 10 vehicles per hour) is from the B9126 to the B977 northbound in the AM peak and returning in the PM peak, suggesting around 90 vehicles per hour commuting from Westhill and its hinterland towards Kintore and Inverurie.

### 3.4.3 Loch of Skene Junction

The junction at Loch of Skene is at the eastern point of the triangle formed by the A944, B977 and B9126; it is located at the east end of the B9126 where it gives way to the A944. The loch is sited in the south-western quadrant of the junction. The junction is a crossroads, with the southern arm a C-road (C136C) to Gairlogie. The peak period flows are shown in Figure 36.

Figure 36: Peak period flows at Loch of Skene Junction



Almost all traffic from the north and east continues towards Westhill on the A944 in the AM peak, having routed from either Lyne of Skene or Dunecht. A total of 556 vehicles per hour proceed to the east, making this the busiest arm of the junction.

These movements are both tidal, although it is notable that more vehicles in the PM peak make both the straight ahead A944 movement (449 per hour) and the right turn to the B9126 (176 per hour) than make the reciprocal AM peak movements (395 and 153 per hour respectively), suggesting some differentiation of commuting movements in the AM peak.

63 vehicles per hour proceed from Gairlogie to the B9126 in the AM peak, a movement which is not tidal or as busy at any other time. It is not clear why this

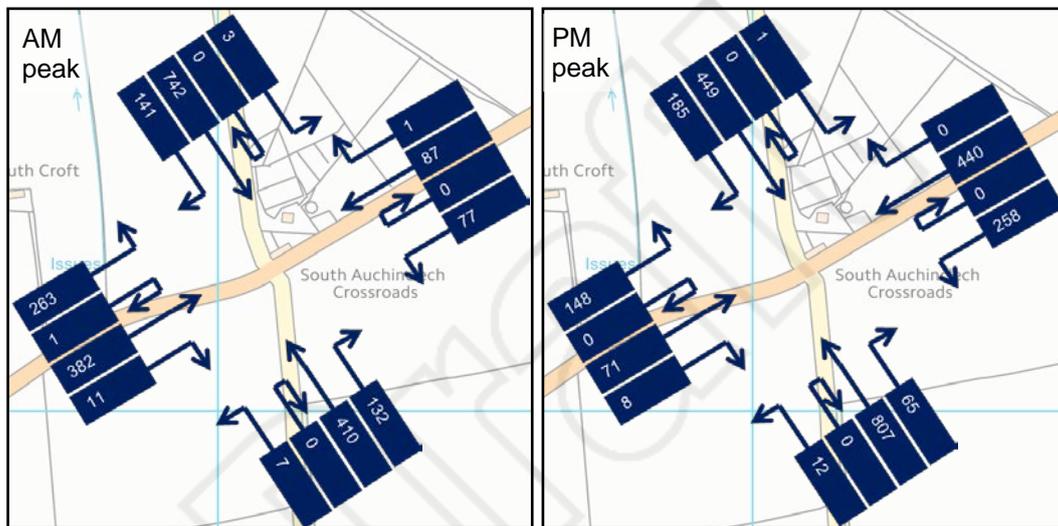
movement is so prevalent in the AM peak, but it may be indicative of long distance south to north movements of the type seen at Dunecht. This traffic is therefore likely to be impacted by the construction of the AWPR, which will provide a high-capacity alternative for vehicles making such a movement.

### 3.4.4 East Auchronie Junction

The junction near the East Auchronie farmhouse is a crossroads between the B979 and an unclassified road (U91C). The B979 from Tyrebagger to Kirkton of Skene is the priority route through the junction.

The junction sits on the intersection two routes which may be in use for traffic to exchange between the A96 and A944. Surveys were performed here and at Kirkton of Skene to indicate if vehicles are progressing between the north and south on these routes and whether they exchange between them. The peak period flows are shown in Figure 37.

Figure 37: Peak period flows at East Auchronie Junction



The counts show that a range of movements are made at the crossroads with the classified road carrying fewer vehicles than the unclassified one. Most vehicles cross between east and west or between north and south, not changing their route here, with the most popular movement (around 250 vehicles per hour) being vehicles commuting using the U91C from the north (the A96 at Blackburn) to the south (A944 at Westhill).

Around 140 vehicles per hour make the opposite movement from Westhill to Blackburn, which suggests commuting movements to the north-west, for example Inverurie, and a similar number commute from west to east, suggesting commuting trips from the Westhill hinterland to northern Aberdeen or Dyce. All these journeys are tidal and attract slightly more vehicles in the PM peak than in the AM peak.

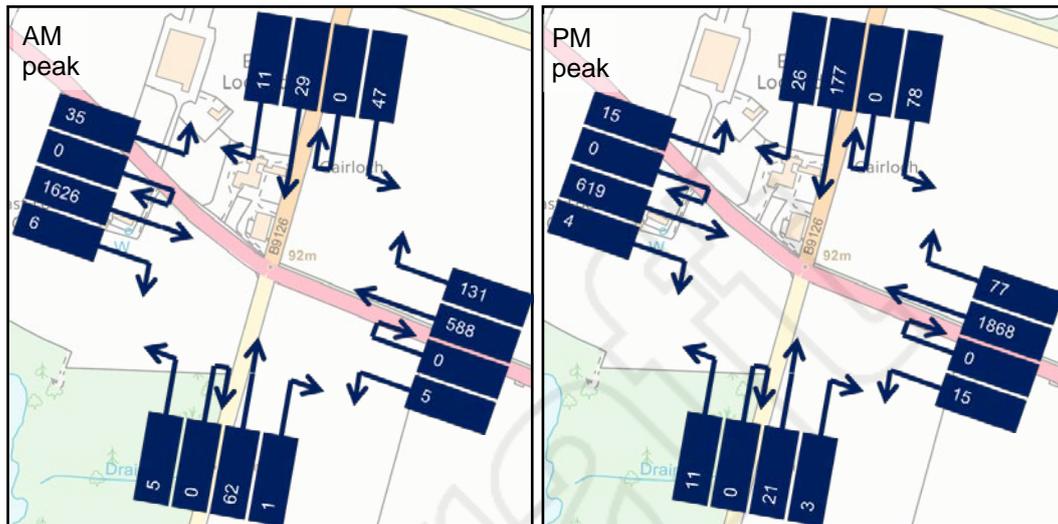
These movements suggest that (as with observations in the A944 surveys further west) there is some differentiation of route choice, particularly in the AM peak. This is supported by the observation that the B979 west to U91C north turning movement is particularly popular in the AM peak (91 vehicles per hour), with fewer return journeys, while the movement from B979 east to U91C south is popular in the PM peak (86 vehicles per hour) with far fewer vehicles making the reciprocal movement in the AM peak. 38% more vehicles approach the junction from the

B979 eastern arm than return using it over the course of a day, suggesting that some of those journeys made from the east towards Westhill return using a different route. East Auchronie junction therefore appears to be used by different traffic flows for different purposes at different times of day.

### 3.4.5 Kirkton of Skene Junction

Kirkton of Skene Junction is south-west of East Auchronie where the B979 meets and gives way to the A944 east-west route. As with Loch of Skene junction, there is a fourth, local arm to the crossroads which continues to Gask. The peak period flows are shown in Figure 38.

Figure 38: Peak period flows at Kirkton of Skene Junction



By far the busiest movement at Kirkton of Skene is the eastbound commuting movement into Westhill/Aberdeen in the AM peak, returning in the PM peak. 15% more vehicles make the PM trip (562 per hour) than the AM, but the overall flows throughout the day are similar in both directions.

There are few other significant turning movements at the junction. The PM peak north-to-south movement, from B979 to the local road, has a relatively high flow (59 vehicles per hour) which does not appear to be reciprocated, however it is the opposite movement to that made in the AM peak at nearby Loch of Skene junction, and therefore may represent a tidal movement from areas south of the A944 to the north in the AM peak and returning in the PM via a parallel route. As observed at Loch of Skene, this may be longer-distance traffic avoiding the congested A90 in Aberdeen, and therefore may reroute once the AWPR opens and diverts traffic around Aberdeen.

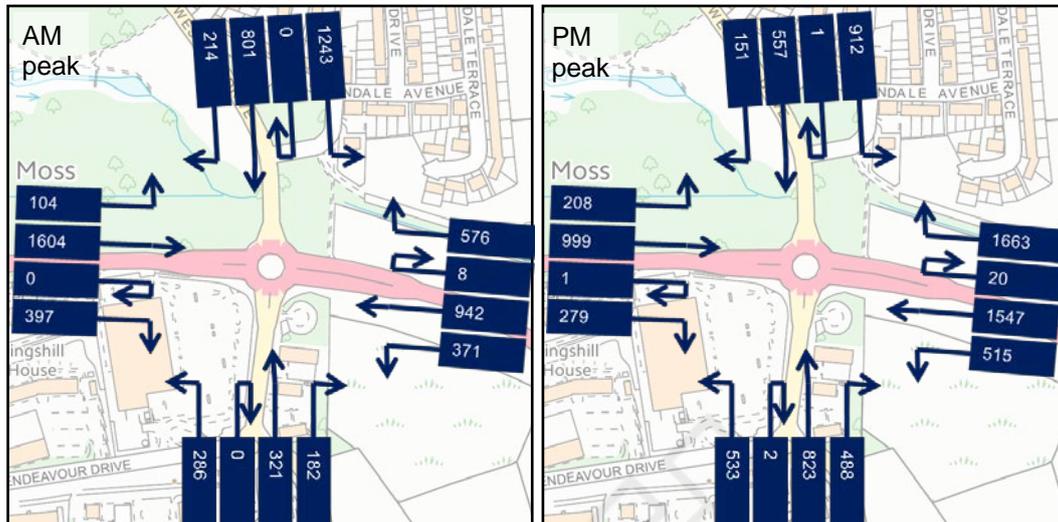
### 3.4.6 Arnhall Roundabout

The roundabout at Arnhall Industrial Estate is located in south-eastern Westhill. It is one of several four-armed roundabouts on the A944, where it meets a distributor from the north (the U91C road from East Auchronie) and serves the business park to the south via Endeavour Drive. The A944 is a dual carriageway and its approaches, and therefore the roundabout, have two circulatory lanes.

The roundabout provides access to busy employment areas in Westhill and therefore surveys here and at nearby Bishopdams show the volume of trips in the

local area which begin or end in Westhill, rather than those which continue to Aberdeen and therefore may be routing away from the A96 at peak periods. The peak period flows are shown in Figure 39.

Figure 39: Peak period flows at Arnhall Roundabout



Traffic levels at Arnhall are much greater than any of the surveyed locations west of Westhill with 2,350 junction entries per hour in the AM peak and a much higher 2,900 entries per hour in the PM peak – a large disparity which matches the observations on previous A944 junctions that traffic levels are generally higher in the PM peak than the AM peak.

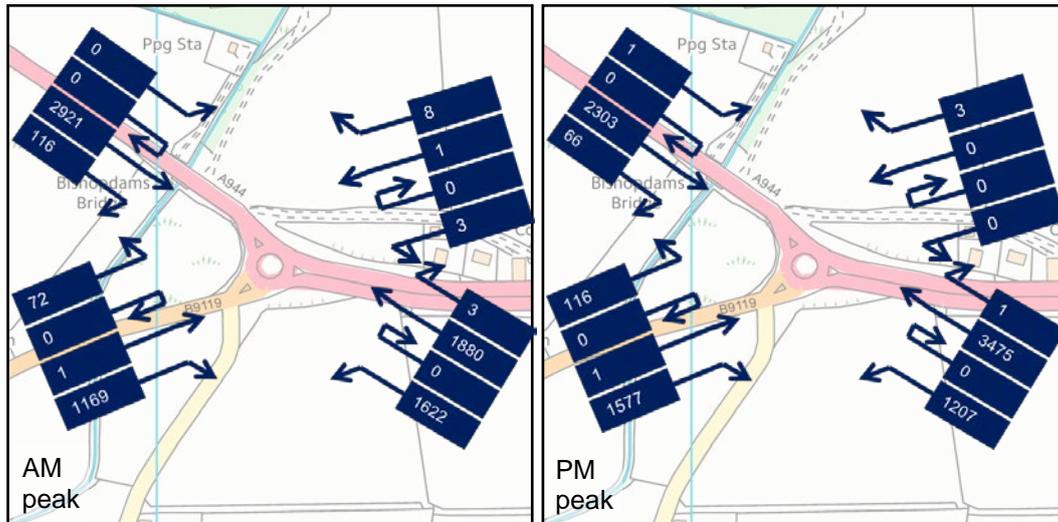
The busiest arm of the junction is to the east, with traffic attracted towards Aberdeen in the AM peak and away in the PM peak, suggesting that Westhill is operating primarily as a commuter town for Aberdeen. However, the other three arms do attract significant volumes of traffic in the AM peak so there are several different commuting movements being made here.

Almost every turning movement has a flow of at least 100 vehicles per hour, and in almost every case the return flow in the PM peak is greater than the outgoing flow in the AM peak. Taking the full day survey into account, 6% more traffic exits the roundabout to Endeavour Drive than enters from it, and there are 11% more vehicles proceeding eastbound towards Aberdeen than westbound away from it.

### 3.4.7 Bishopdams Junction

The signalised junction near Bishopdams Bridge is located at the eastern extent of the Westhill urban area where the A944 meets the B9119, the distributor road for the business parks and industrial estates in southern Westhill. The junction is an offset crossroads with a narrow, northern arm used to access farmhouses at West Kingsford. The classified approaches to the junction have two arms, with auxiliary third lanes for given turns (located beyond the stopline in the case of the A944 western arm). The peak period flows are shown in Figure 40, although the image shows the junction in its previous roundabout configuration.

Figure 40: Peak period flows at Bishopdams Junction



The major flows at the junction are between the two western arms (A944 and B9119) and the eastern A944 arm to/from Aberdeen. Both sets of movements – eastward and westward – have significant flows in both peak periods, suggesting a mixture of commuting trips to Aberdeen and to Westhill.

974 vehicles per hour flow from the A944 at Arnhall towards Aberdeen (eastbound) in the AM peak and 627 per hour make the east-to-west journey, while 541 per hour flow from the A944 at Kingswells/Aberdeen towards south-western Westhill and 390 per hour make the west-to-east journey. As with the other A944 counts conducted in this survey, traffic levels on the A944 itself are greater in the PM peak than the AM peak, although the number of commuters to and from the B9119 arm of the junction is approximately constant in both peak periods.

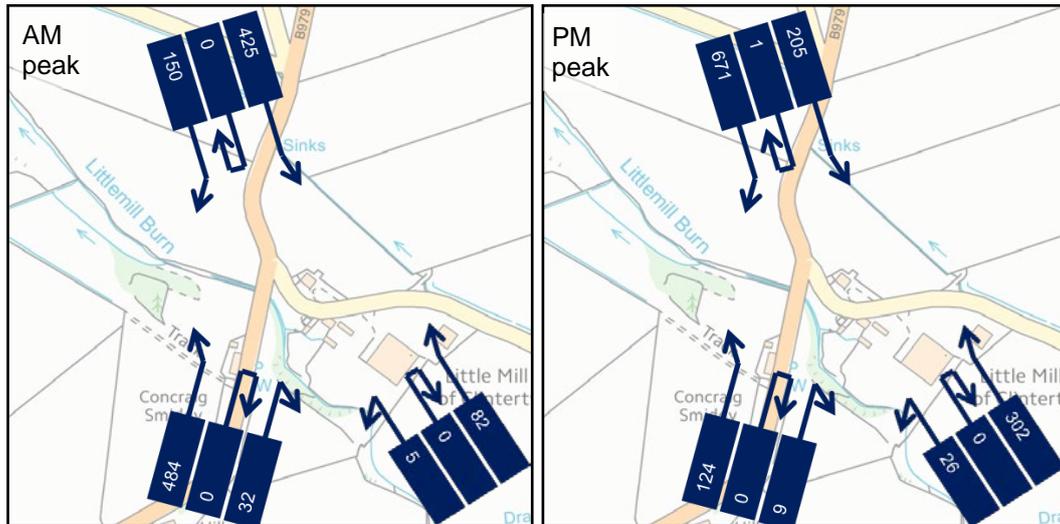
There is almost no traffic associated with the north-eastern arm of the junction.

### 3.4.8 Clinterty Fork

The fork junction south of Clinterty is located on a bend in the B979 where a local road (the C93C Borrowstone Road) provides a link to the A944 at Kingsford near the under-construction AWPR junction. The B979 is the priority route through the junction.

Previous surveys show that significant volumes of traffic exit the A96 at Tyrebagger towards the south and this junction. A survey was performed here to indicate if this traffic is routing to Westhill, Kingswells or Aberdeen and therefore whether it is avoiding a logical route via the A96. The peak period flows are shown in Figure 41.

Figure 41: Peak period flows at Clinterty Fork



The survey shows two significant AM peak movements; between the B979 north (from the A96 at Tyrebagger) to the south-east (towards Kingswells and Aberdeen) and from the south-west on the B979 towards Tyrebagger, both with between 140 and 160 vehicles per hour.

This behaviour is not reciprocated in the PM peak, where there is one significant majority flow, from the north at Tyrebagger to the south-west, with over 220 vehicles per hour; the numbers making return trips from those made in the AM peak is significantly reduced. Over the full day, 51% more vehicles approach the junction from the north than exit to the north.

This suggests that the junction is forming part of an alternative route to either the A96 or A944, but in one peak period only; either A96 southbound/eastbound traffic to Aberdeen crossing to the A944 using the C93C in the AM peak only avoiding Dyce, or added traffic crossing from the A96 westbound/northbound to the A944 in the PM peak only avoiding western Aberdeen.

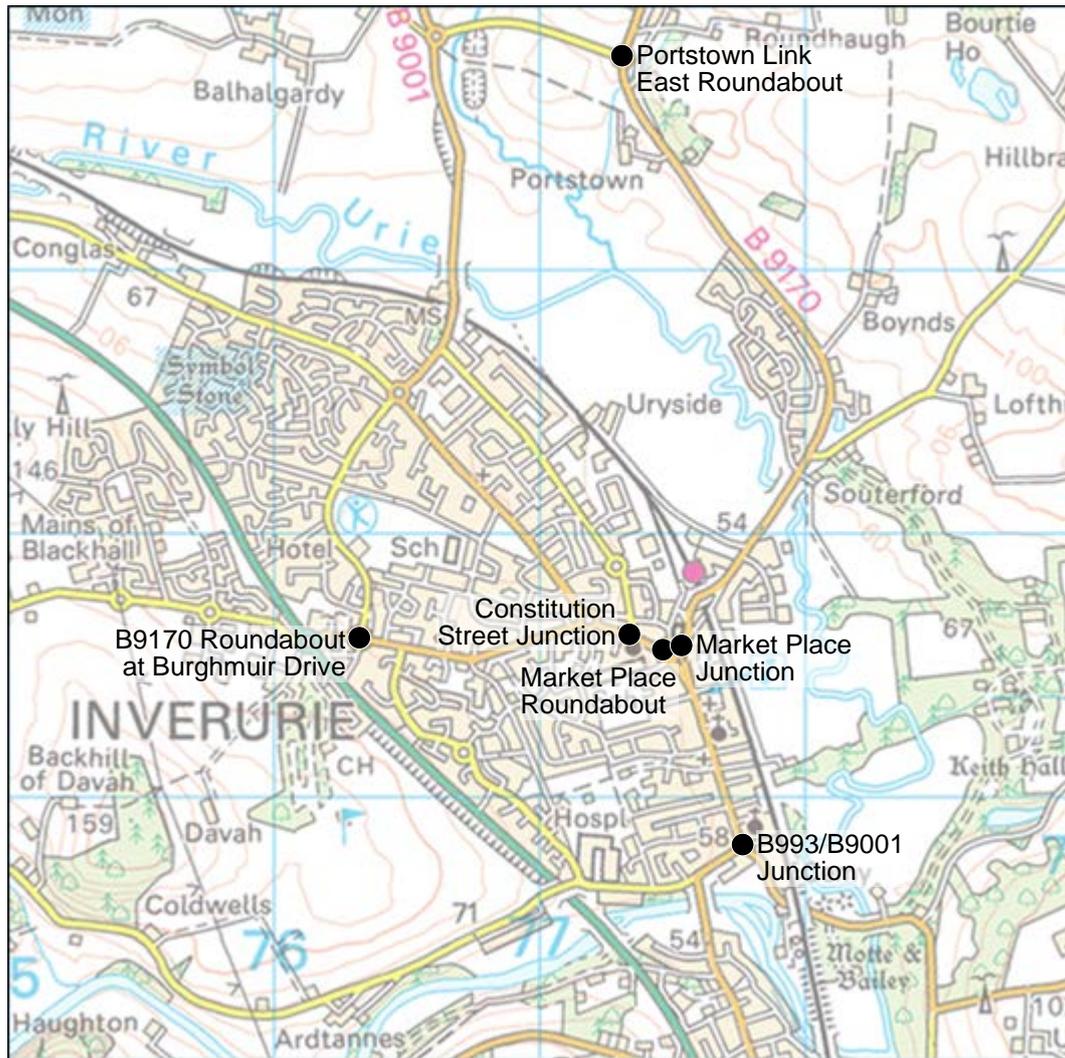
### 3.5 Inverurie and its Hinterland

The list of surveys conducted within Inverurie and its hinterland is shown in Table 12 and Figure 42, excluding those already discussed within Chapter 3.1 of this report (Blackhall and Port Elphinstone Roundabouts).

Table 12: Inverurie and hinterland junction turning count surveys

Code	Junction Name	Easting	Northing
3571-SCO-12	B9170 Roundabout at Burghmuir Drive	376322	819731
3571-SCO-8	Constitution Street Junction	377370	821584
3571-SCO-13	Market Place Roundabout	377510	821567
3571-SCO-7	Market Place Junction	377566	821584
3571-SCO-10	B993/B9001 Junction	377780	820813
3571-SCO-26	Portstown Link East Roundabout	377322	823804

Figure 42: Inverurie and hinterland junction turning count survey locations



The hour in which peak AM and PM flows were recorded, as well as the total number of junction entries throughout the survey and the percentage of heavy vehicles detected, is shown in Table 13.

Table 13: Inverurie and hinterland peak hour and total flow statistics

Junction	AM peak statistics		PM peak statistics		Full day statistics	
	Hour from	Entries	Hour from	Entries	Entries	% OGV
B9170/Burghmuir Dr	08:30	1,834	16:30	2,422	21,852	3.1%
Constitution Street	08:30	1,074	16:15	1,407	14,456	1.8%
Market Place Rbt.	08:30	1,159	16:15	1,416	15,184	2.0%
Market Place Jct.	08:15	796	16:45	922	9,549	4.8%
B993/B9001	08:15	1,286	16:45	1,568	15,122	4.4%
Portstown Link East	08:00	923	16:45	1,052	9,708	5.3%

The AM peak hours for sites within and around Inverurie fall later in the day (beginning at 08:00 or later) than for most sites which formed part of this survey, with peak hours at major junctions on the B9170 ending as late as 09:30.

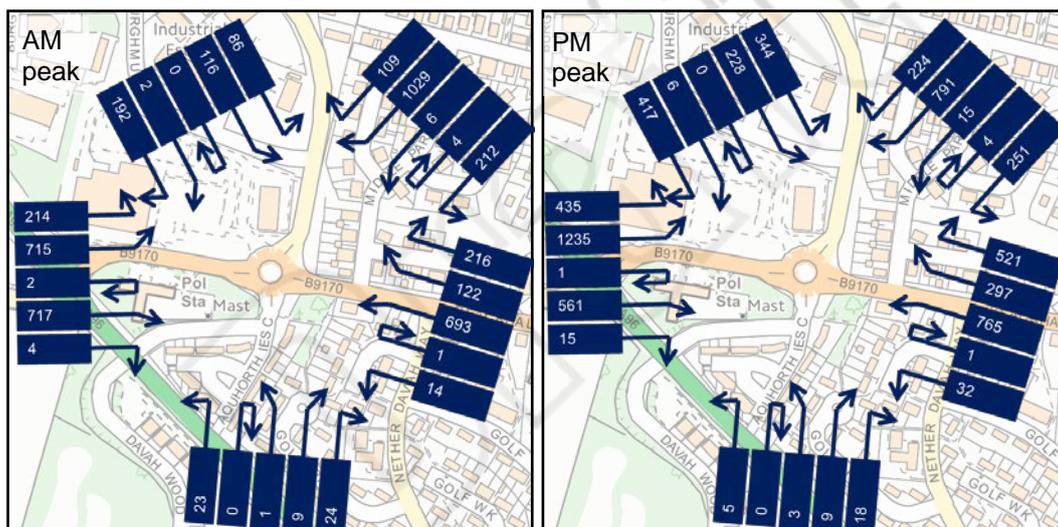
In all cases the PM peak hourly flow is significantly greater than the AM, although within an urban area this is likely due to additional non-commuting journeys being made in the afternoon/evening compared to in the morning. Of the routes connected by the Inverurie junction surveys, the B9170 from Blackhall Roundabout to the town centre is busier than the north-south routes, particularly west of the roundabout with Burghmuir Drive.

### 3.5.1 B9170 Roundabout at Burghmuir Drive

The roundabout immediately east of Blackhall Roundabout on the A96 is a five-armed roundabout between the B9170 Blackhall Road, Burghmuir Drive which is a major access from the north of the town, a local development (Aquorthies Circle) and an access to a Morrisons supermarket. All five arms have approaches which flare from one lane to two and the roundabout has two circulatory lanes.

A peak time only survey was conducted here in 2017; it did not capture the period before 07:00 when on-site observations show queues present. The roundabout was therefore re-surveyed to identify peak traffic times and to indicate if there is any relationship between flows and queues here and at the adjacent Blackhall Roundabout. The peak period flows are shown in Figure 43.

Figure 43: Peak period flows at the B9170 roundabout at Burghmuir Drive



In the AM peak, there are three busy approaches to the junction: from Burghmuir Drive, with most traffic proceeding towards the A96; from the town centre via the B9170 Blackhall Road, again with most traffic proceeding west to the A96, and from the A96, with traffic splitting between Burghmuir Drive towards the north of Inverurie and towards the town centre via the B9170.

While no one movement in the AM peak has more than 350 vehicles per hour associated with it, the number different movements (a total of 1,372 per hour) results in significant congestion, especially for traffic from Burghmuir Drive which faces the most opposing traffic. The roundabout handles many movements both into and out of Inverurie in both peak periods.

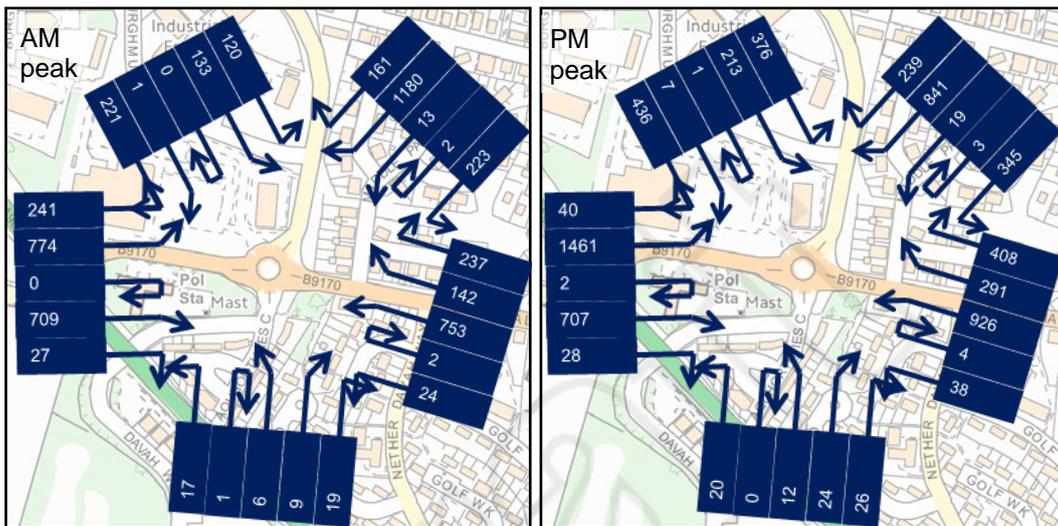
In the PM peak, the supermarket access becomes busier later in the day, so there are four busy arms to the roundabout. The total number of entries to the roundabout increases to 1,728 vehicles per hour over the peak period as several tidal movements are busier in the PM peak than in the AM, particularly Burghmuir

Drive to and from Blackhall Roundabout which increases from 343 vehicles per hour to 412. This suggests that vehicles are commuting using other routes in the AM peak but returning via Blackhall Roundabout to this junction; however, the full day survey data suggests the opposite with 9% more vehicles overall exiting towards Blackhall Roundabout then entering from that direction. There is therefore some variation in traffic behaviour at this location.

**2017 survey**

For comparison with the 2018 survey, the turning counts obtained from the survey on Thursday 20 April 2017 are shown in Figure 44.

Figure 44: Peak period flows at the B9170 roundabout at Burghmuir Drive - 2017



Despite the short period between the two surveys, the 2018 counts show a significant traffic decrease relative to those in 2017, with decreases in traffic making all of the busy movements at the junction in the AM peak including Burghmuir Drive to Blackhall Road west (13%), Blackhall Road west to Burghmuir Drive and Blackhall Road east to west (both 8%).

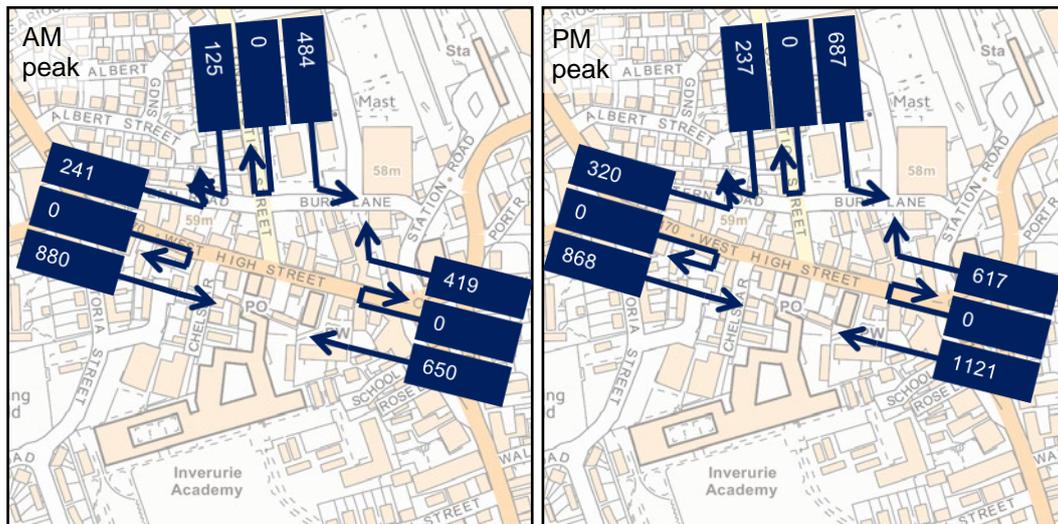
Similar changes are observed in the PM peak period with 2018 traffic significantly lower on the busiest turns from east to west (17%), west to north (16%) and north to west (6%). These are significant changes over an 11-month period.

**3.5.2 Constitution Street Junction**

Constitution Street, one of the main north-south distributor roads north of Inverurie town centre, meets the B9170 West High Street at a T-junction in the central area. The local road gives way at a stop-line to the B9170.

This junction was surveyed as it links the town centre to employment and industrial areas to its north and is therefore important in understanding routing within the town. It also forms part of a short-cut between the B9001 and the town centre via Harlaw Road and may therefore form part of local and longer distance journeys. The peak period flows are shown in Figure 45.

Figure 45: Peak period flows at Constitution Street Junction



A significant proportion of traffic towards the town centre in both peak periods emerges from Constitution Street, particularly in the PM peak where the turn towards the centre is nearly as busy (229 vehicles per hour) as the eastbound B9170 movement (293 vehicles per hour). The overall number of turns between Constitution Street and the town centre is generally equal in both directions in each individual peak period, but higher in the PM peak (210-230 vehicles per hour) than in the AM peak (140-160 vehicles per hour).

The number of vehicles approaching the town centre from the west is constant in both peak periods at around 290 vehicles per hour, whereas the number of westbound journeys almost doubled in the PM peak (407 per hour) compared to the AM peak (217 per hour). This is reflected in the number of vehicles that arrive at the B9170 Burghmuir Drive roundabout, which is greater in the PM peak.

Over the whole day, 69% more vehicles make the left turn into Constitution Street than make the right turn out of it, suggesting that traffic prefers not to make the right turn out across the B9170 and traffic from the north of Inverurie to the west chooses to make those turns at another location which imparts less delay.

### 3.5.3 Market Place Roundabout and Junction

Inverurie’s Market Place is in the town centre, enclosing a triangular park which hosts the town’s war memorial. There is a roundabout in the north-western corner of the triangle and a T-junction in the north-eastern corner.

The roundabout has five arms, although for the survey this has been rationalised to four as the segregated parking has been included with the adjacent B9001. The B9170 crosses the roundabout and the northern arm links to the town’s railway station. Immediately to its east is a T-junction where the B9170 meets the road flanking the eastern section of the park, used by traffic continuing north or south. Traffic on the western flank (from the roundabout) gives way.

Survey were conducted here to show the volume of traffic in the town centre and to show how vehicles to and from the north route (whether they enter the town or continue south towards Port Elphinstone). Behaviour at the third point of the triangular park can be inferred from the other two. The peak period flows are shown in Figure 46 for the roundabout and Figure 47 for the T-junction to its east.

Figure 46: Peak period flows at Market Place Roundabout

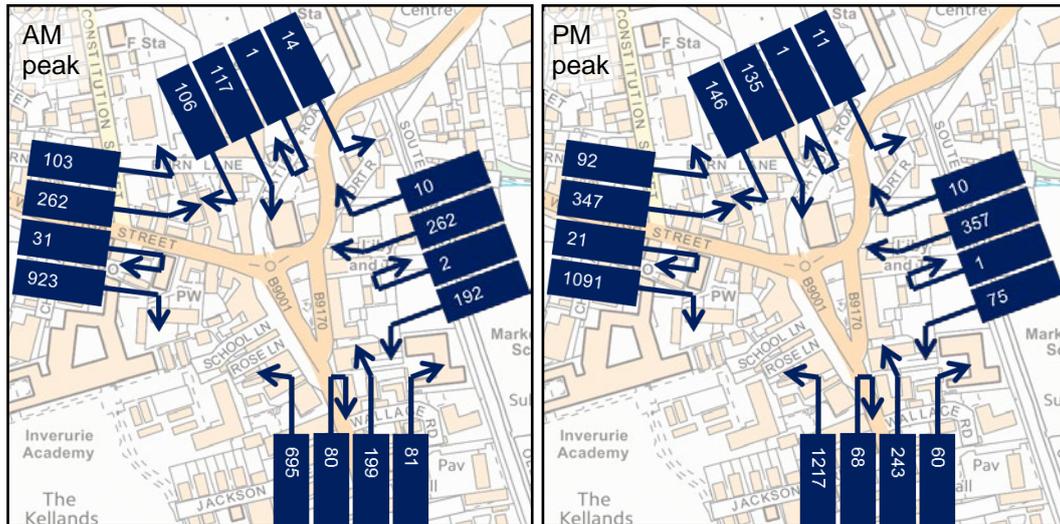
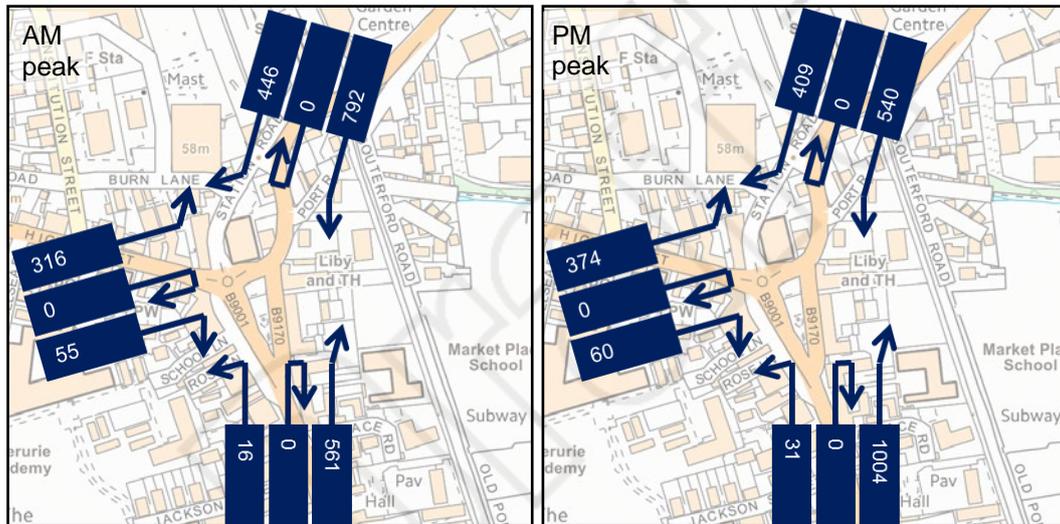


Figure 47: Peak period flows at Market Place Junction



In the AM peak, the two busiest movements at the junction complex feed traffic towards the B9001 High Street and presumably south towards Port Elphinstone; 308 vehicles per hour turn from the West High Street (having presumably entered from the north and west of the town) and 264 per hour from the B9170 Port Road (from the eastern and north-eastern areas including Oldmeldrum).

In common with other surveys in Inverurie, the volume of traffic in the PM peak is higher still at 406 and 335 vehicles per hour respectively. As with the adjacent Constitution Street junction, nearly every local movement is busier in the PM peak than in the AM, with 30 extra vehicles per hour crossing the roundabout from west-to-east and east-to-west. This may suggest either more local non-commuting journeys in the PM peak or traffic avoiding the congested centre in the AM peak.

The AM peak flows at the T-junction show that, of the AM peak traffic entering the town from the north-east, almost two-thirds continue through the centre to the south of the town (with most presumably continuing to Port Elphinstone) and one third turning right to enter the town centre (with most presumably staying in the urban area).

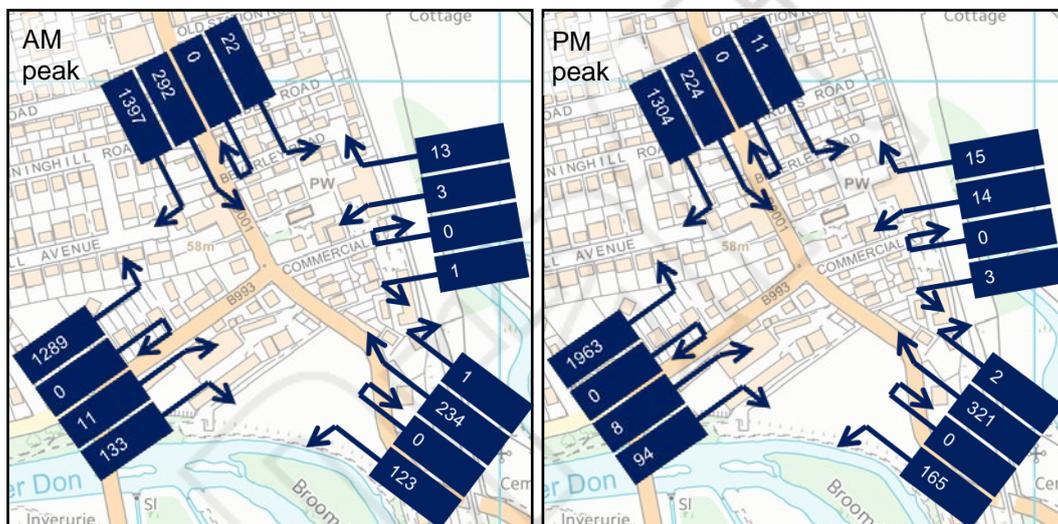
These conclusions suggest that the town centre junctions are being used for both local and strategic trips, which due to the lack of alternative routes are forced to share space in Inverurie town centre.

### 3.5.4 B993/B9001 Junction

The signalised crossroads between the B993 and B9001 is adjacent to the River Don bridge in south-eastern Inverurie. The B993 forms the western (St James's Place) and southern (Kirkland Terrace) arms with the B9001 running to and from the north (St Mary's Place) with the local arm to the east (Commercial Road). The western arm has two lanes at the stopline and all other arms one lane.

This is the busiest junction between the A96 at Port Elphinstone and Inverurie town centre and the A96 CRAM suggests it is likely to be over capacity in future years, so a survey was performed here to validate the accuracy of the model. It also allows for trips eastwards on the B993 towards the A947, a potential alternative to the A96. The peak period flows are shown in Figure 48.

Figure 48: Peak period flows at B993/B9001 Junction



Most traffic travels between the west and the south (between Port Elphinstone Road and the town centre). Flow is not tidal in the AM peak (430-470 vehicles per hour in both directions) but east to north demand is much greater in the PM peak at 654 vehicles per hour; this suggests that much more traffic enters Inverurie from the south in the PM peak than leaves it from the north, as may be suggested by the differences in flows in and out of Inverurie at Port Elphinstone Roundabout.

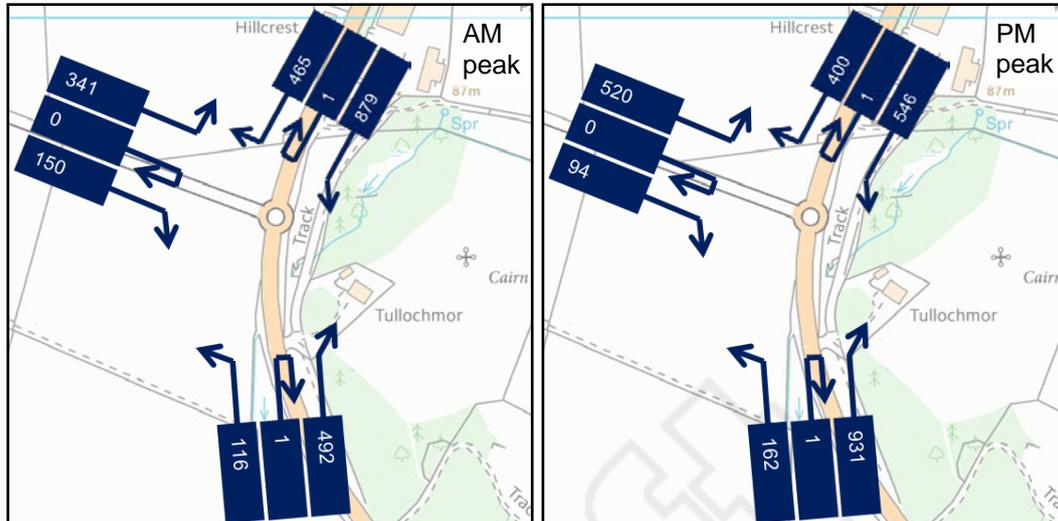
The only other significant movement at the junction is between the B993 south-eastern arm (Keithhall Road) and the town centre, with approximately 100 vehicles per hour in both peak periods and therefore not significantly tidal.

### 3.5.5 Portstown Link East Roundabout

The three-armed roundabout north-east of Inverurie is where the B9170 meets the Portstown link road, a road constructed in 2016 which links the B9170 to the B9001. The roundabout has two circulatory lanes and each arm has one-lane approaches flaring to two.

The roundabout was surveyed to indicate the volume of traffic exchanging between the B9170 and B9001, and therefore which of the two routes traffic prefers to use when routing between Inverurie and places north. The peak period flows are shown in Figure 49.

Figure 49: Peak period flows at Portstown Link East Roundabout



The busiest AM peak approach is from the north (Oldmeldrum) with almost 450 vehicles per hour, approximately two-thirds of which continue south on the B9170 and one-third turn on to the link road, presumably to turn to the B9001 southbound towards western Inverurie and Blackhall Roundabout.

More traffic runs between the north and west than between the south and west, suggesting that traffic predominantly uses the link road westbound in the AM peak to run between Oldmeldrum and western Inverurie. This corroborates with the existing survey at the western roundabout which was conducted in April 2017. Almost as many vehicles turn from west to north in the AM peak than from north to west, suggesting a significant commuting movement from western Inverurie towards the town's north-eastern hinterland and the Oldmeldrum area.

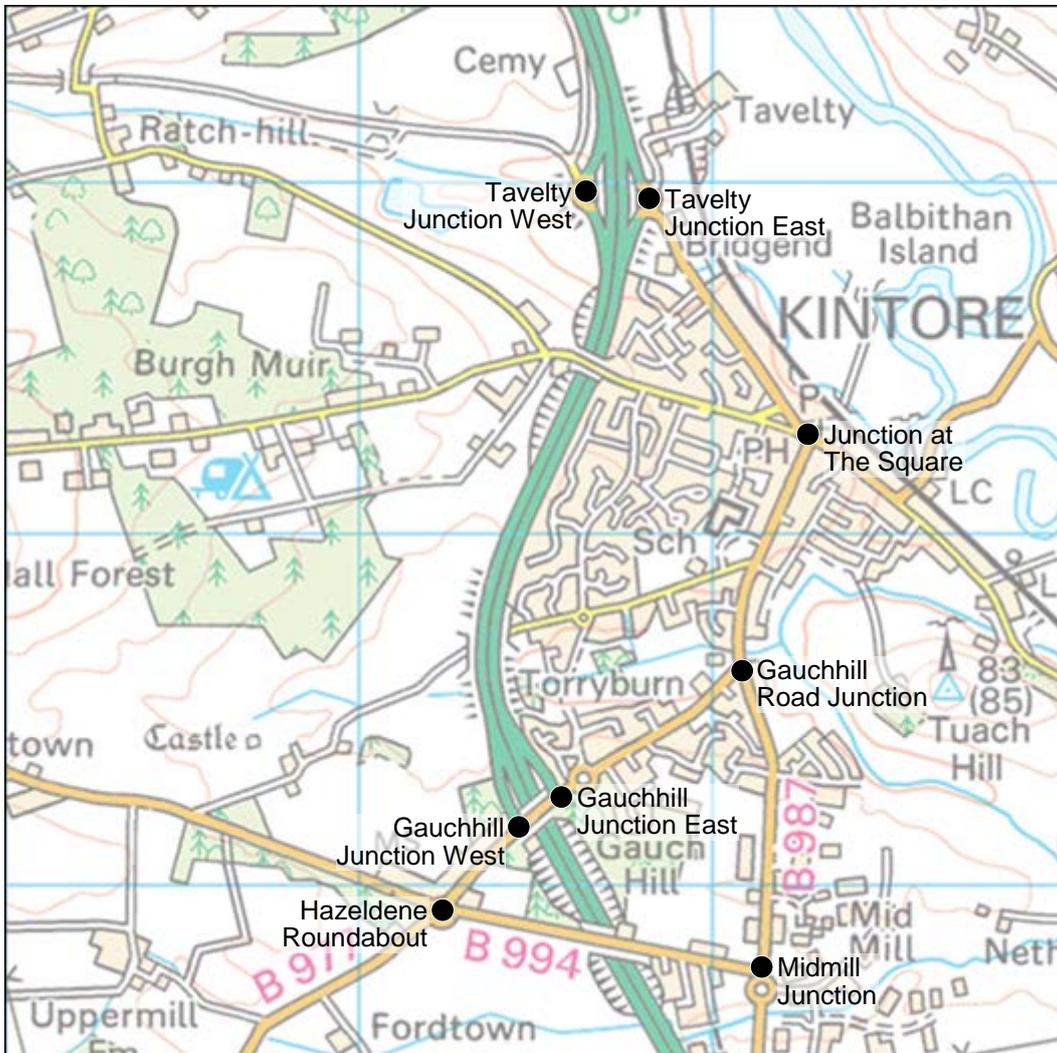
### 3.6 Kintore

The list of surveys conducted within Kintore is shown in Table 14 and Figure 50. They are shown from north to south on the B987 and from west to east on the B977.

Table 14: Kintore junction turning count surveys

Code	Junction Name	Easting	Northing
3571-SCO-47	Tavelty Junction (West)	378698	816984
3571-SCO-48	Tavelty Junction (East)	378786	816978
3571-SCO-46	Junction at The Square	379281	816273
3571-SCO-27	Gauchhill Road Junction	379097	815620
3571-SCO-28	Midmill Junction	379153	814754
3571-SCO-40	Hazeldene Roundabout	378257	814923
3571-SCO-49	Gauchhill Junction (West)	378456	815158
3751-SCO-50	Gauchhill Junction (East)	378537	815227

Figure 50: Kintore junction turning count survey locations



The hour in which peak AM and PM flows were recorded, as well as the total number of junction entries throughout the survey and the percentage of heavy vehicles detected, is shown in Table 15.

Table 15: Kintore peak hour and total flow statistics

Junction	AM peak statistics		PM peak statistics		Full day statistics	
	Hour from	Entries	Hour from	Entries	Entries	% OGV
Tavelty West	08:15	256	16:00	215	2,575	21.5%
Tavelty East	07:30	360	16:15	387	4,199	8.7%
The Square	08:15	459	16:30	555	4,896	2.5%
Gauchhill Road	08:15	595	16:45	596	5,175	2.2%
Midmill	07:15	923	16:30	988	8,437	6.0%
Hazeldene	07:15	1,130	16:30	1,295	10,297	11.0%
Gauchhill West	07:30	688	16:30	800	6,725	11.5%
Gauchhill East	07:30	543	16:30	501	4,736	8.5%

There is significant variation in the timing of peak hours at junctions in Kintore, particularly for the AM peak. There is also significant variation in traffic levels, with junctions to the west and south of the town centre much busier as a commuter route than those in the town centre.

The data also shows that there are significantly greater proportions of heavy vehicles progressing west from Gauchhill Junction than are in the town centre. There is also a very high OGV percentage (21.5%) at Tavelty West junction, possibly due to traffic to and from the nearby quarry.

### 3.6.1 Tavelty Junction

Tavelty Junction is a grade-separated dumbbell interchange at the northern end of the A96 Kintore bypass. The slip roads from the A96 meet a local road to the west (U242C) which accesses a quarry and cemetery, and the main route into Kintore from the north which is officially numbered B987 but is shown as B977 on signs (it meets the B977 in the town); the official number will be used here. The slip roads are one lane in width with a hard shoulder.

Tavelty Junction (and Gauchhill Junction further south) were last surveyed in 2013, so have been resurveyed to update traffic data for trips through the town, which has undergone significant development. The peak period flows are shown in Figure 51 for the western dumbbell and Figure 52 for the eastern dumbbell; separate surveys were conducted at each dumbbell roundabout.

Figure 51: Peak period flows at Tavelty Junction western roundabout

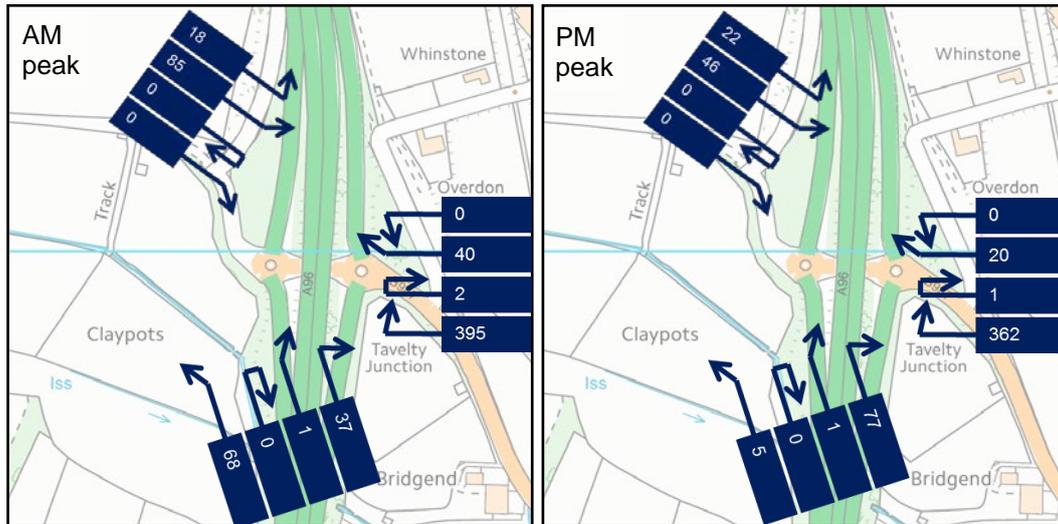
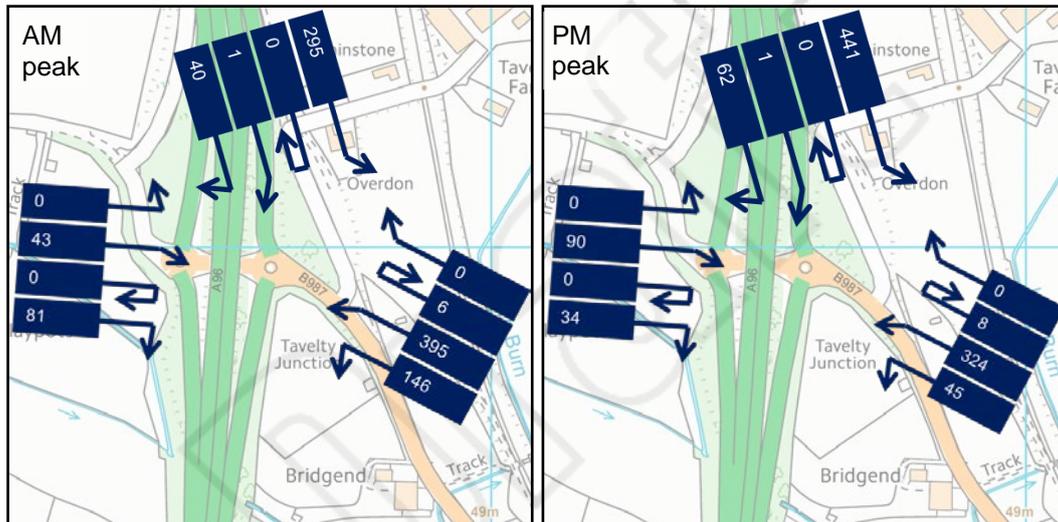


Figure 52: Peak period flows at Tavelty Junction eastern roundabout



Compared with other A96 junctions in Inverurie and Kintore, Tavelty Junction handles relatively little traffic as it caters only for movements between Kintore and Inverurie, and few journeys to and from Aberdeen and Dyce. Both roundabouts combined handle around 350 vehicle movements per hour in both peaks.

100 to 130 vehicles per hour proceed between Kintore and the A96 north, a flow which is slightly tidal in that more vehicles leave Kintore towards the A96 north in the AM peak and return in the PM peak than the opposite movements.

15 to 20 vehicles per hour use the junction to U-turn from the A96 southbound to northbound in both peaks. This is due to two junctions immediately to the north, Kintore Business Park and Clovenstone Road, being left-in, left-out junctions at which vehicles cannot turn right.

**2013 survey**

For comparison with the 2018 survey, the turning counts obtained from the survey on Tuesday 30 April 2013 are shown in Figures 53 and 54.

Figure 53: Peak period flows at Tavelty Junction western roundabout – 2013

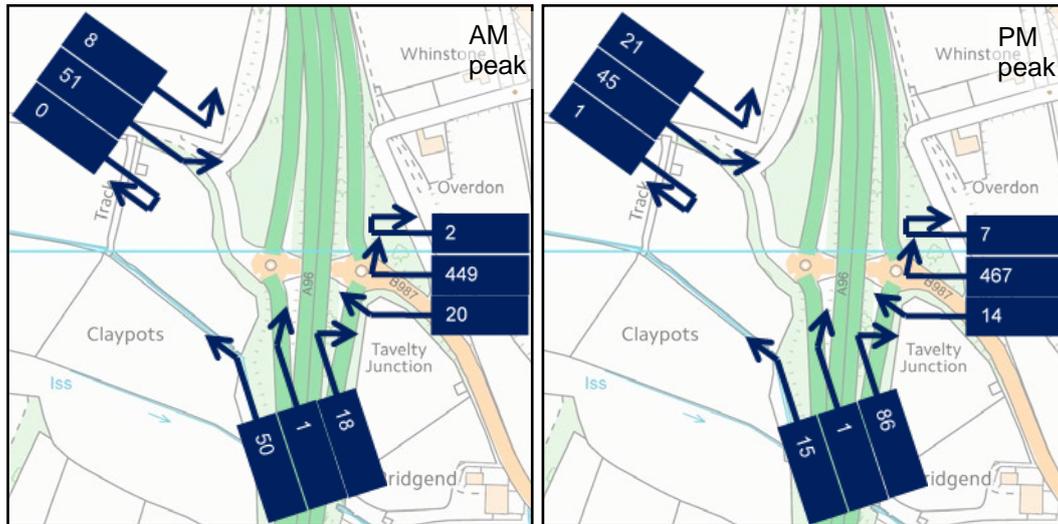
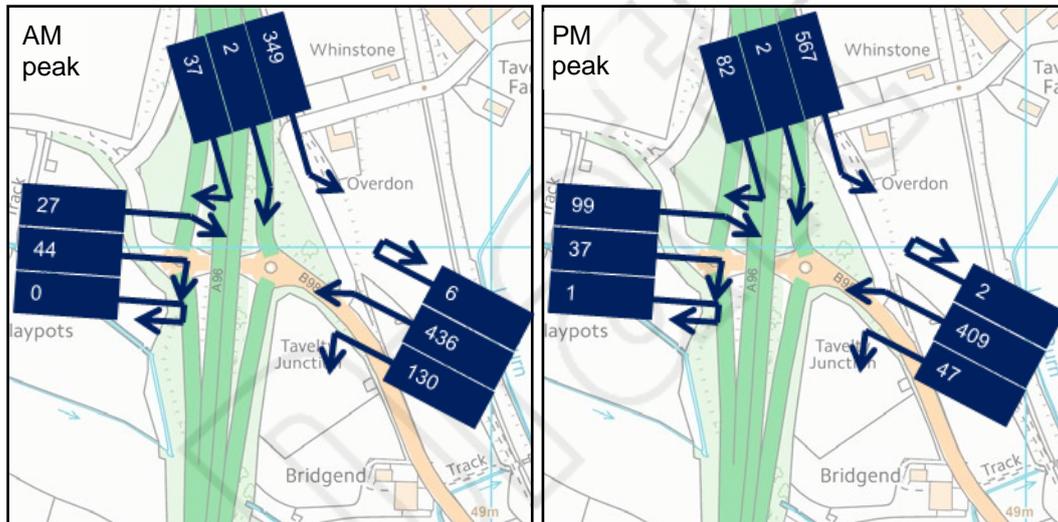


Figure 54: Peak period flows at Tavelty Junction eastern roundabout - 2013



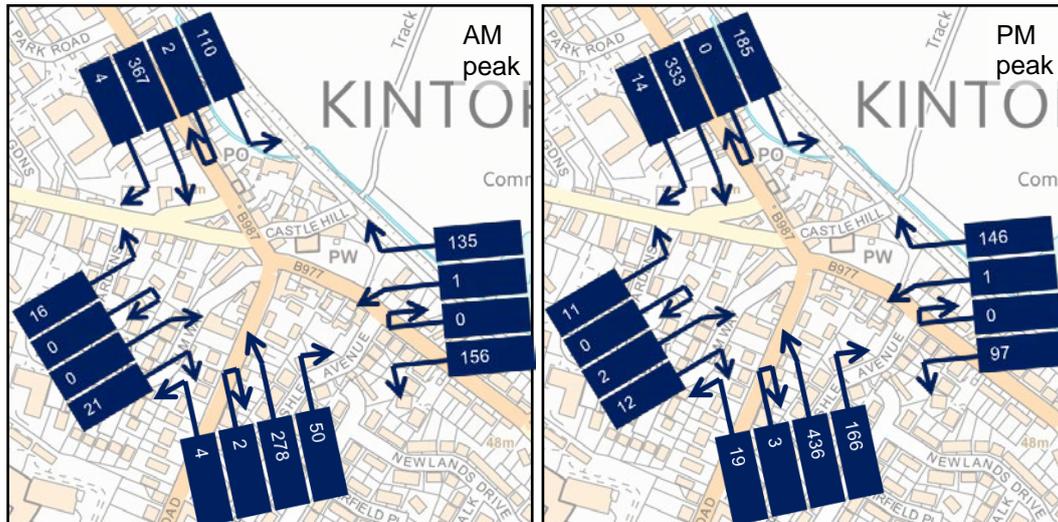
The quarry (far western) arm of the roundabout is almost twice as busy in the AM peak in 2018 than in 2013, but otherwise traffic volumes at Tavelty Junction have fallen since 2013; the amount of traffic exiting Kintore has fallen by at least 10% in both peaks and use of the southbound A96 off-slip has fallen by up to 22%.

### 3.6.2 Junction at The Square

The junction at The Square in central Kintore is a crossroads at which the through route, the B987 School Road (signed as B977 as at Tavelty Junction) meets the town’s main access from the east, Kingsfield Road (B977) and Elm Way, a residential street to the west.

This is one of three junctions (including Gauchhill Road and Midmill) where traffic can exchange between the main street in Kintore, the west-east routes which cross it and the junctions on the A96 Kintore bypass. These surveys were performed to understand the routing of vehicles to and through Kintore, and whether traffic is using routes which intentionally avoid the A96. The peak period flows are shown in Figure 55.

Figure 55: Peak period flows at The Square



Most traffic at The Square is proceeding through the town on the B987; there is slightly more traffic southbound than northbound in the AM peak, and vice versa in the PM peak; this corroborates with the Tavelty Junction survey and suggests a small degree of tidal commuting flow into Kintore.

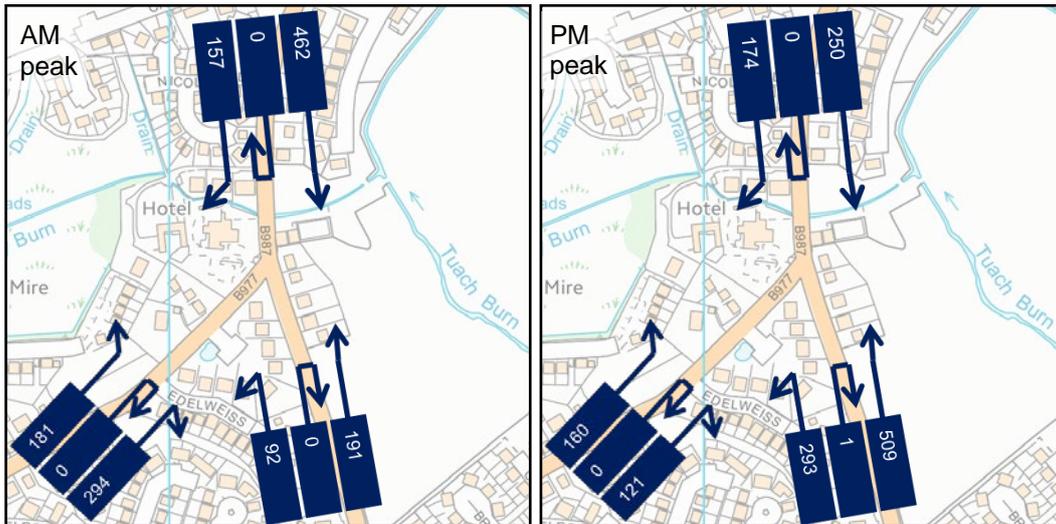
The flows between the B987 north and B977 are not significantly tidal, with around 40 vehicles per hour making both movements in the AM peak and 50-60 vehicles per hour in the PM peak. When considering all traffic entering the junction from the east (from the Hatton of Fintray direction), more traffic turns left to proceed south on the B987 in the AM peak, while more traffic turns from the B987 north to the B977 in the PM peak; this may suggest that vehicles between the A96 bypass and the B977 use different routes in each peak period to avoid congestion. There is comparatively little traffic on Elm Way, with fewer than 15 junction entries per hour.

As with many of the other sites in this survey, the overall flows for most movements are greater in the PM peak than in the AM. This is presumably due to more local movements during after-school working hours rather than routing changes between the peak periods, as there are no junction movements with significant differences between flows in each direction over the full day.

### 3.6.3 Gauchhill Road Junction

The B987 junction at Gauchhill Road is a T-junction at which Gauchhill Road (B977) from the west meets School Road (B987 but signed as B977). Stacking space for right turners is provided within the carriageway on School Road. The peak period flows are shown in Figure 56.

Figure 56: Peak period flows at Gauchhill Road Junction



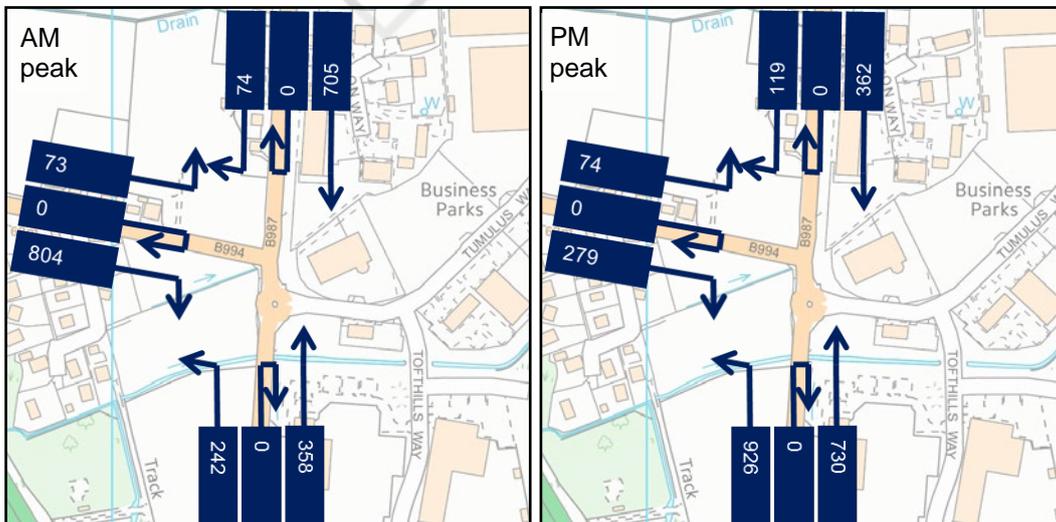
Most of the AM peak flow at Gauchhill Road is towards the south, with traffic presumably proceeding either to Midmill Business Park or the A96. Although the right turn from the west (almost 100 vehicles per hour) is making a near U-turn, it cannot access the A96 southbound from Gauchhill Junction so this is a logical manoeuvre for vehicles commuting towards Aberdeen or Dyce. Both turns to the south are tidal, with traffic returning using the reciprocal routes in the PM peak.

50-60 vehicles per hour turn between the B987 north and the B977 west in both directions; the lack of tidal behaviour suggests this is not a significant commuting movement, with most traffic instead proceeding to and from the A96 southbound at Broomhill Roundabout rather than northbound via Gauchhill Junction.

### 3.6.4 Midmill Junction

The T-junction adjacent to Midmill Business Park is where the B994 from Kemnay meets the Kintore main road (officially B987 but signed as B994) immediately north of the roundabout used to access the industrial estate. B994 traffic must stop and give way. The peak period flows are shown in Figure 57.

Figure 57: Peak period flows at Midmill Junction



The traffic levels at Midmill are significantly higher than at the preceding junction to the north; traffic levels increase consistently as the B987 continues further south. 235 vehicles per hour from the north and 268 per hour from the west proceed southbound towards the business park or the A96 at Broomhill Roundabout in the AM peak; more traffic therefore approaches the south from the hinterland beyond Kintore (accessed from the B994 and serving the Kemnay urban area) than from the town itself.

Few vehicles route between the west and the north, which is logical given that such vehicles are more likely to have routed to and from central Kintore using the B977 and Gauchhill.

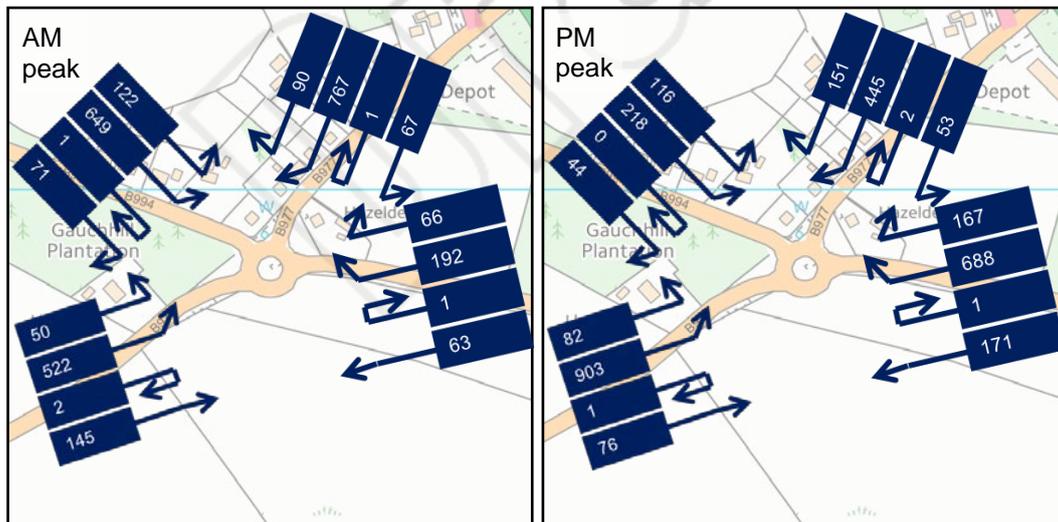
As with The Square junction, the reciprocal flows on each tidal movement are greater in the PM than in the AM, particularly the return journey to the B994 from the B987 south, however, the number of vehicles making these reciprocal movements are approximately equal over the whole day.

### 3.6.5 Hazeldene Roundabout

Located on the south-western corner of the Kintore urban area, Hazeldene is a four-armed roundabout between the B977 (Gauchhill Road) and B994 roads. Each has flared one-lane approaches and the circulatory carriageway has two lanes.

Existing turning counts show that traffic exits the A96 at Gauchhill Junction and proceeds away from Kintore. The survey at this, the next westward junction, was performed to reveal the onward routing of that traffic and improve understanding of commuter routes to and from Kemnay which may also progress through this roundabout. The peak period flows are shown in Figure 58.

Figure 58: Peak period flows at Hazeldene Roundabout



The AM peak surveys show three major movements at Hazeldene Roundabout in the AM peak with more than 170 vehicles per hour; B977 west to east (towards Gauchhill and Kintore); B994 west to east (towards Midmill and presumably the A96 southbound); and B977 east to west (towards Dunecht and the A944).

This suggests a variety of commuting movements proceeding through the roundabout; traffic from Kemnay proceeding to towards Dyce and Aberdeen, as well as movements in both directions between the A96 and B977 (most traffic to

and from the B977 north-eastern arm of the roundabout turns at Gauchhill Junction, based upon the turning counts discussed in section 3.6.6.

This supports the conclusion that traffic is routing off the A96 on southbound AM peak journeys and proceeding down the B977 to the A944 (or to places further south such as the A90 at Stonehaven, as suggested in the surveys for Dunecht Junction in section 3.4.1).

These movements are generally tidal, although there are some differences in how traffic proceeds in the PM peak; the number of vehicles returning towards Gauchhill Junction from the B977 south-west increases to 301 vehicles per hour, suggesting that more people exchange between the A944 and A96 in the PM peak than in the AM peak. The return movement on the B994 is approximately as busy the outward AM peak movement, suggesting normal commuting to and from Kemnay, while the number of vehicles exiting Kintore on the B977 is decreased in comparison to the number entering in the AM peak.

### 3.6.6 Gauchhill Junction

Gauchhill Junction is a grade-separated half-diamond interchange on the A96 Kintore bypass, linking to the B977 Gauchhill Road to and from south and central Kintore. There is no entry to the A96 southbound nor an exit from the A96 northbound. The slip roads are one lane in width with a hard shoulder. The off-slip gives way to the B977 while the right turn to the on-slip is protected by a ghost island. A plant hire depot is located directly opposite the start of the on-slip and was surveyed as part of the turning count.

Separate surveys were conducted at the off- and on-slip. The peak period flows are shown for the western junction (at the on-slip) in Figure 59 and the eastern junction (at the off-slip) in Figure 60.

Figure 59: Peak period flows at Gauchhill Junction on-slip junction

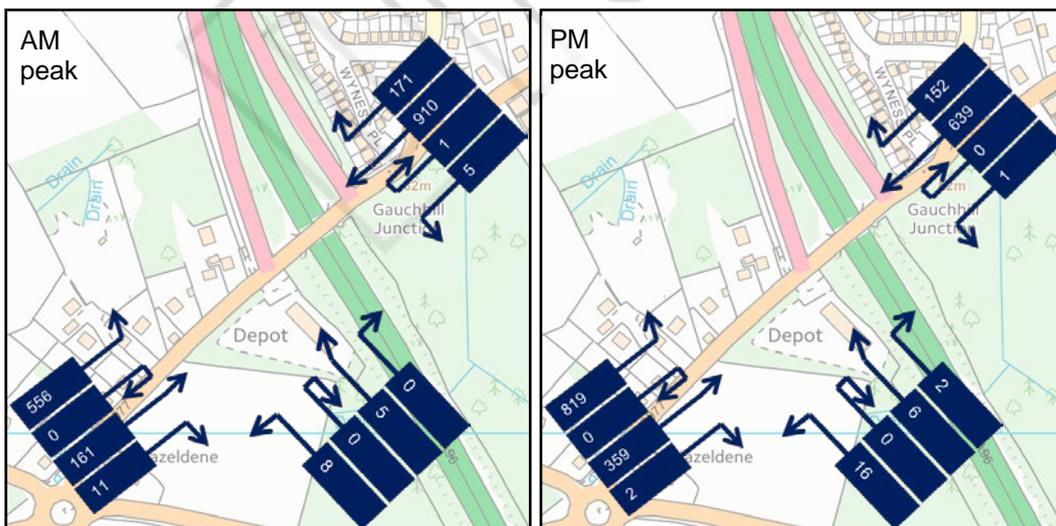
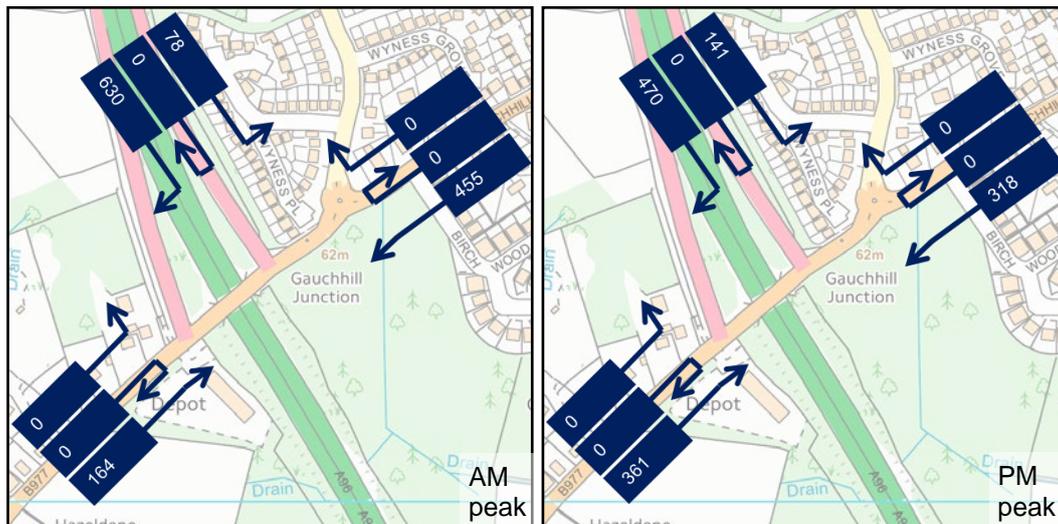


Figure 60: Peak period flows at Gauchhill Junction off-slip junction



Given the logical assumption that no traffic is U-turning on the A96 using Gauchhill Junction, the AM peak surveys show that, of the 152 vehicles per hour approaching the junction from Kintore, 38% turn northbound on to the A96 and 62% continues south-west on the B977; and of 303 vehicles per hour all traffic that proceeds south, 70% turned off the A96 and 30% came from the Kintore urban area.

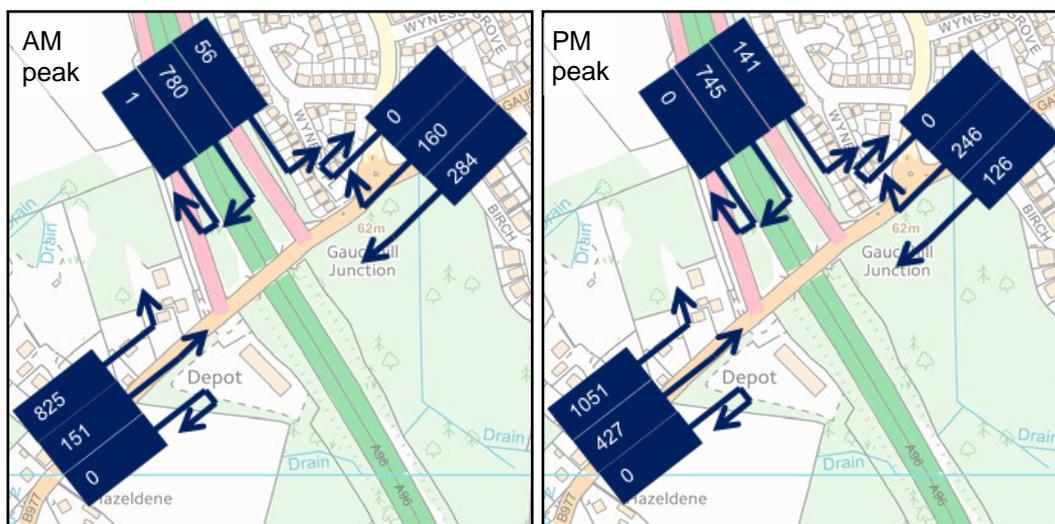
The B977 is therefore twice as busy west of here than east, and this supports the findings from the Hazeldene Roundabout, Lyne of Skene and Dunecht Junctions that commuting traffic is routing off the A96 in the AM peak in the direction of the A96. The number of vehicles returning to Kintore from the south-west in the PM peak is increased compared to the AM peak, agreeing with observations at Hazeldene Roundabout.

It is therefore unlikely that the purpose of traffic exchanging between the A96 and A944 is solely to avoid the Dyce and Aberdeen urban areas in the AM peak, as more vehicles make the return journey in the PM peak. This traffic must be routing to locations on or south of the A944.

**2013 survey**

For comparison with the 2018 survey, the turning counts obtained from the survey on Tuesday 30 April 2013 are shown in Figure 61. Note that the 2013 survey differed as one set of counts was taken which encompassed both the off- and on-slip movements, while the arm to the plant hire depot was omitted.

Figure 61: Peak period flows at Gauchhill Junction - 2013



Traffic levels are significantly lower in 2018 than they were in 2013; the number of vehicles using the off-slip has fallen by 15% in the AM peak and 31% in the PM peak, while the number of vehicles joining the A96 northbound has also fallen by around a quarter in both peak periods.

As use of this junction is primarily connected to use of routes via Dunecht and Westhill which avoid the A96 south of Kintore, the status of that route, and its relative performance against the A96, may be a causal factor in this change.

### 3.7 Smaller Urban Areas

Two further surveys were performed at the town centres of smaller urban areas as listed in Table 16.

Table 16: Junction turning count surveys in smaller urban areas

Code	Junction Name	Easting	Northing
3571-SCO-29	Blackburn Town Centre Junction	362939	827634
3571-SCO-32	Insch Town Centre Junction	382630	812596

The hour in which peak AM and PM flows were recorded, as well as the total number of junction entries throughout the survey and the percentage of heavy vehicles detected, is shown in Table 17.

Table 17: Blackburn and Insch peak hour and total flow statistics

Junction	AM peak statistics		PM peak statistics		Full day statistics	
	Hour from	Entries	Hour from	Entries	Entries	% OGV
Blackburn	07:30	751	16:45	786	6,621	2.8%
Insch	08:15	302	17:15	365	3,316	4.1%

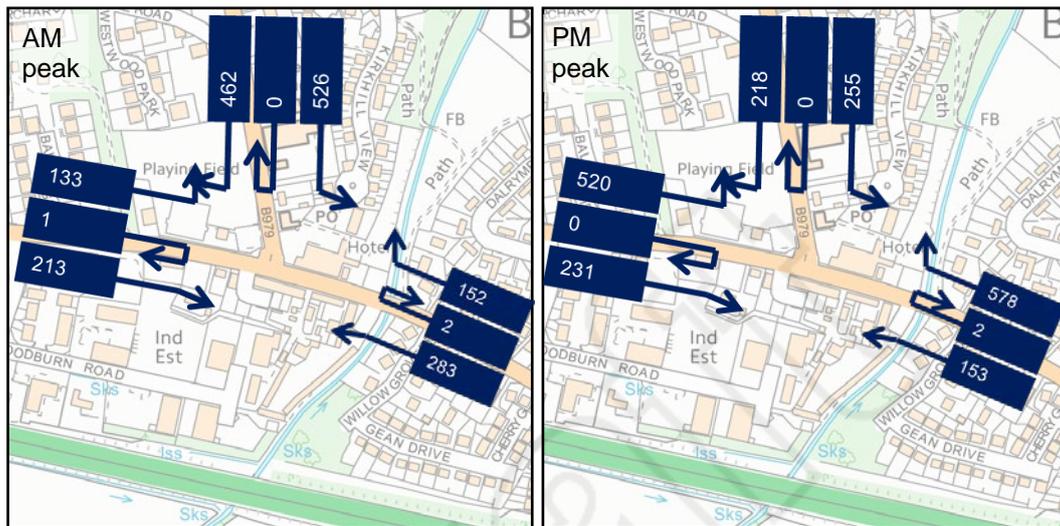
There are significant differences between the two towns in terms of peak hour, peak flow, and overall flow, and no significant conclusions can be drawn by comparing them.

### 3.7.1 Blackburn Town Centre Junction

The T-junction in Blackburn town centre is where the B979 Fintray Road meets the town's Main Street (which is either B973 or B979, depending on the source used). Main Street is the priority route, and has a ghost island for right turners into Fintray Road.

This is the main junction in Blackburn and the survey here was used to inform routing choices to the A96 as well as to the north from Hatton of Fintray and places north-east on the B979. The peak period flows are shown in Figure 62.

Figure 62: Peak period flows at Blackburn Town Centre Junction



In the AM peak, most traffic (329 vehicles per hour) arrives at the junction from Fintray Road and gives way; this suggests that most traffic in the Blackburn area in the PM peak is using it to access the A96 rather than originating there.

This traffic splits between turning left or right on to Main Street in approximately equal numbers; this suggests that almost as much traffic is commuting to the west and/or south via Kinellar Roundabout than is commuting to Aberdeen and Dyce via Clinterty Roundabout. More traffic also proceeds westbound on Main Street (away from Aberdeen) than eastbound in the AM peak.

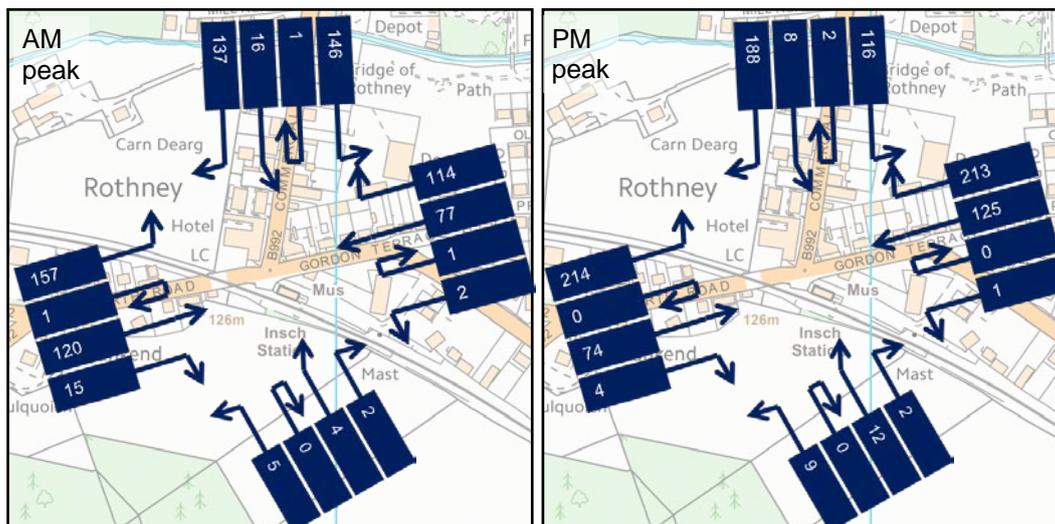
These flows are generally tidal and vehicles are seen to make the return movements in the PM peak, albeit in slightly greater numbers as seen at many survey sites. This may be due to additional late afternoon movements in the Blackburn urban area compared to in the early morning.

### 3.7.2 Insch Town Centre Junction

The junction in Insch town centre is where the B9002 North Road meets the B992 Commercial Road, with the former having priority. The fourth arm is not marked as part of the junction but is used to access the station car park and has therefore been included within the survey.

This is the main junction in the Insch urban area and the survey here was used to inform routing from the town towards the A96 at either Oyne or Kellockbank. The peak period flows are shown in Figure 63.

Figure 63: Peak period flows at Insch Town Centre Junction



Several different movements are made in approximately equal numbers in the Insch urban area; in the AM peak between 40 and 55 vehicles per hour make every movement between two of the three classified B-road arms except for the westbound B9002 movement. Few movements are made to and from the station.

This situation is repeated in the PM peak, with slightly greater flows of up to 71 vehicles per hour turning to the north (into the Insch urban area). As with the Blackburn surveys, the increase is likely due to more local movements during the late afternoon rather than in the early morning.

There is a small tidal bias for traffic to proceed from the north and west towards the east, which suggests commuting movements to the A96 south (Inverurie, Kintore, Dyce and Aberdeen) but this represents fewer than 90 vehicles per hour.

## 4 Link Count

The link count performed as part of this data collection exercise was conducted on the A97 immediately south of Huntly Roundabout, its junction with the A96 south of Huntly town centre. The approximate grid reference for the survey location is 352346 east, 839188 north.

No previous link data was available for the A97 south of the A96; this survey was used to inform how A97 traffic would interact with any potential A96 route which runs in the River Bogie valley. The survey specification for the link count is identical to those for the junction turning counts as described in Chapter 2.2.

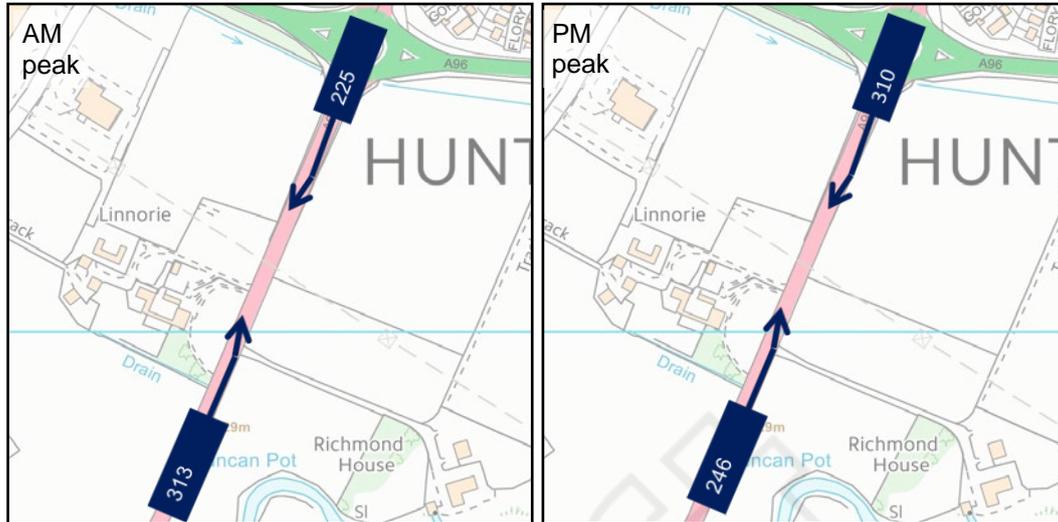
The hour in which peak AM and PM flows are recorded, as well as the total number of junction entries in the 13-hour surveys and the percentage of heavy vehicles detected, is shown in Table 18.

Table 18: A97 Huntly link count peak hour and total flow statistics

Site	AM peak statistics		PM peak statistics		Full day statistics	
	Hour From	Entries	Hour From	Entries	Entries	% OGV
A97 Huntly	08:15	228	17:00	216	2,208	6.8%

The link count shows a 13-hour count of 2,200 vehicles and peak flows of slightly over 200 vehicles per hour (slightly less than 4 per minute). The peak period flows are shown in Figure 64.

Figure 64: Peak period flows on A97 south of Huntly



There is a slight tidal bias towards trips to Huntly in the AM peak and returning southbound in the PM peak, although the difference between the directional flows is less than 30 vehicles per hour. These may be commuting trips to Huntly itself rather than the A96, as most settlements of any size on the A97 can more easily access major commuter locations to the east (for example Aberdeen and Inverurie) using routes parallel to the A96 such as the B9002 or A944.

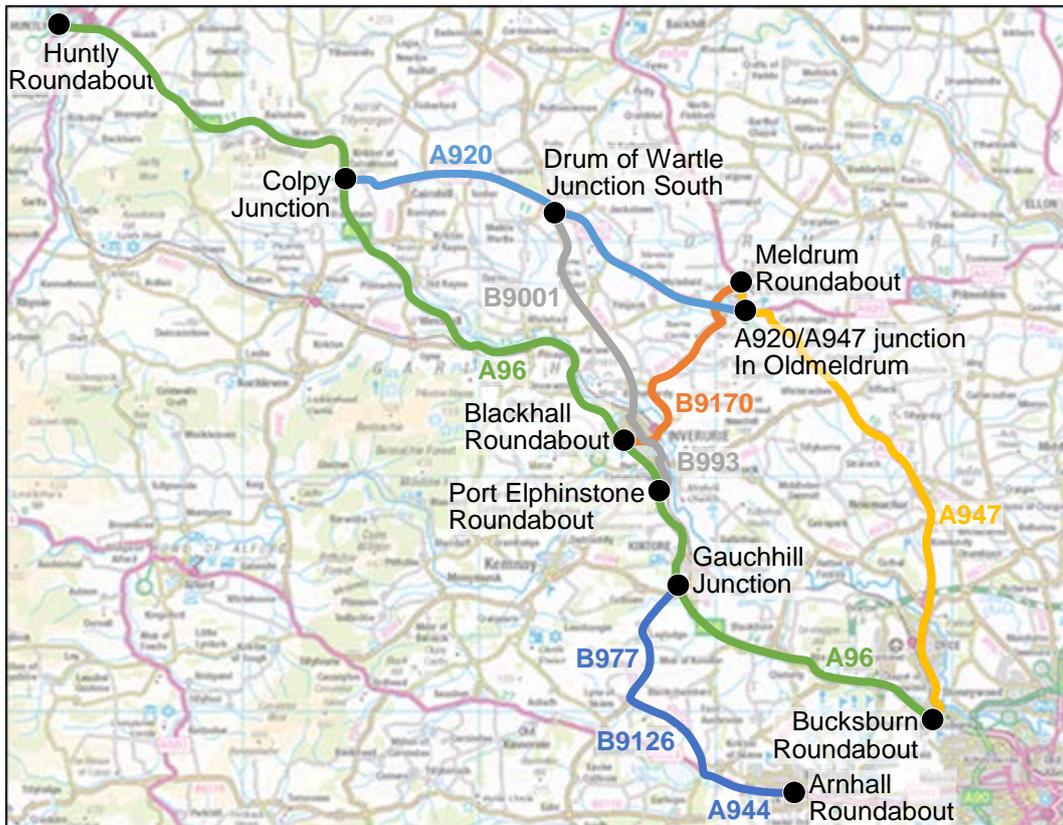
## 5 INRIX Traffic Analytics Data

Traffic analytics data was obtained from INRIX for the period 1 January 2014 to the present, with data continuously added to the service in real-time. Data is collected and disaggregated on a link-by-link basis for all A- and B- class roads in the scheme’s potential area of influence. The data sets collected include vehicle speeds, travel times and a measure of congestion as a function of free-flow travel time. The data is also aggregated to reveal the frequency, duration and severity of incidents (“bottlenecks”) which impact the network.

### 5.1 Assessment Methodology

For the purposes of this analysis, individual links have been aggregated into six routes as shown in Figure 65. These routes cover most of the junctions analysed as part of the turning count surveys and were used to help corroborate this data and other local observations such as periods of queueing.

Figure 65: Routes analysed for journey times and congestion



All data for these analyses was obtained for neutral weekdays (Tuesdays, Wednesdays and Thursdays) in April 2018.

Journey times were aggregated at 15-minute intervals and calculated for the full 24-hour period for each direction.

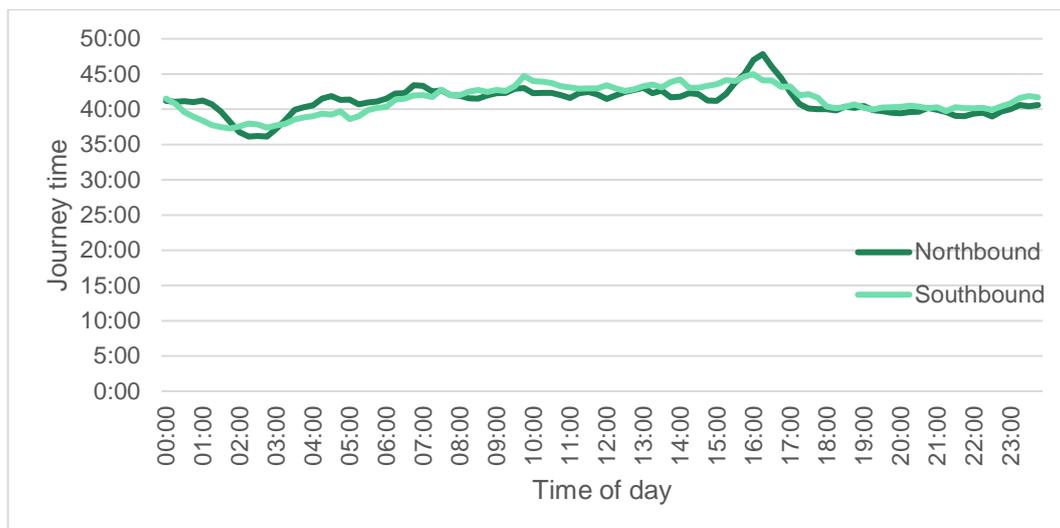
The locations where congestion was observed are also shown. Congestion is defined as a period of at least 15 consecutive minutes' duration in which the recorded speed on a link is less than half of its defined free-flow speed. Links less than 75 metres in length have been excluded as these are generally internal to junctions and can appear as congested despite very small changes in speeds. Only links which end at junctions are recorded, so that a queue which stretches through multiple links is not recorded several times.

## 5.2 A96 Huntly to Bucksburn

The A96 route surveyed with the analytics data runs between the Huntly (A97) and Bucksburn (A947) roundabouts. The route is 54.6 kilometres in length and encompasses the full A96 which forms part of this study.

Journey times on the route over the course of a typical weekday are shown in Figure 66 and locations where congestion is observed are shown in Table 19.

Figure 66: A96 Huntly to Bucksburn journey time analysis



Typical journey times during the interpeak period are between 40 and 45 minutes. There are few delays in the AM peak in either direction, but a detectable increase in journey times in the PM peak, rising from around 41 minutes at 15:00 to a maximum of almost 48 minutes at 16:15 before falling back to 40 minutes by around 17:30. Evening peak journey times are around 40 minutes and faster still journeys are made overnight when there is little traffic on the route.

Table 19: A96 Huntly to Bucksburn congestion analysis

Direction	Junction approach	Congestion duration			% of free flow speed
		Start	Peak	End	
Northbound	Port Elphinstone Roundabout	15:27	16:25	17:01	21%
	Blackhall Roundabout	15:24	16:25	16:57	37%
Southbound	Blackhall Roundabout	06:34	06:45	06:52	32%
		15:48	16:02	16:18	38%
		16:39	16:39	16:54	45%
	Port Elphinstone Roundabout	15:40	16:29	16:52	27%
	A96 Dyce Drive Junction	16:00	16:04	16:23	40%

Almost all congestion recorded on the A96 is associated with one of the two roundabouts on the Inverurie bypass, Port Elphinstone and Blackhall. Both directions of traffic experience congestion when approaching both roundabouts for at least one 15-minute period per day, and on the southbound approach to Blackhall Roundabout there are three separate short periods of congestion spread throughout the day.

Vehicles approaching Blackhall Roundabout southbound are the only ones which experience congestion in the morning, with peak congestion occurring at 06:45 and dissipating before 07:00, when the AM peak period is normally considered to start. This early queuing matches on-site observations.

Similarly, in the afternoon, periods of congestion at Port Elphinstone and Blackhall begin before 16:00 which normally delineates the start of the PM peak. The periods

of queueing are longer, generally lasting over an hour until approximately 17:00, and the level of congestion is higher with speeds reduced to 21% and 27% of free-flow at Port Elphinstone Roundabout northbound and southbound respectively.

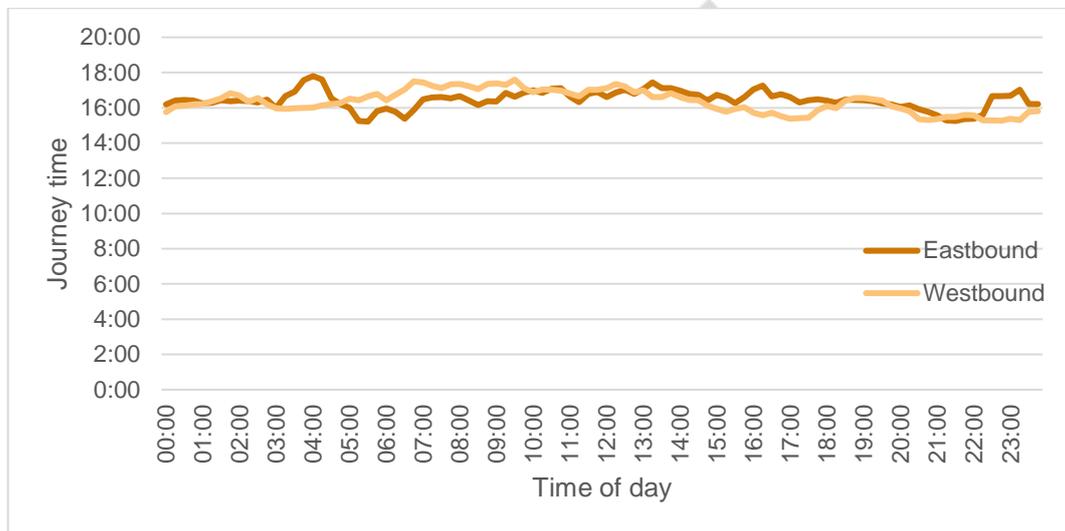
The only other significant congestion observed is at the A96 Dyce Drive junction, where southbound traffic drops to 40% of its free-flow speed with congestion occurring over a 20-minute period at the start of the PM peak.

### 5.3 A920 Colpy to Oldmeldrum

The A920 route runs between its junction with the A96 at Colpy to its western junction with the A947 near Oldmeldrum town centre. The full route length is 19.2 kilometres.

Journey times on the route over the course of a typical weekday are shown in Figure 67.

Figure 67: A920 Colpy to Oldmeldrum journey time analysis



Journey times for the A920 from Colpy to Oldmeldrum vary between 15 and 17 minutes, with no significant increase in journey times at peak periods. Some volatile journey times are observed eastbound in early AM peak hours, possibly due to low sample sizes. Overall, the eastbound journey is slightly faster than the westbound before noon, whereas the westbound journey is generally faster in the afternoon and PM peak; westbound journey times are lower in the PM peak period than at any other time including overnight.

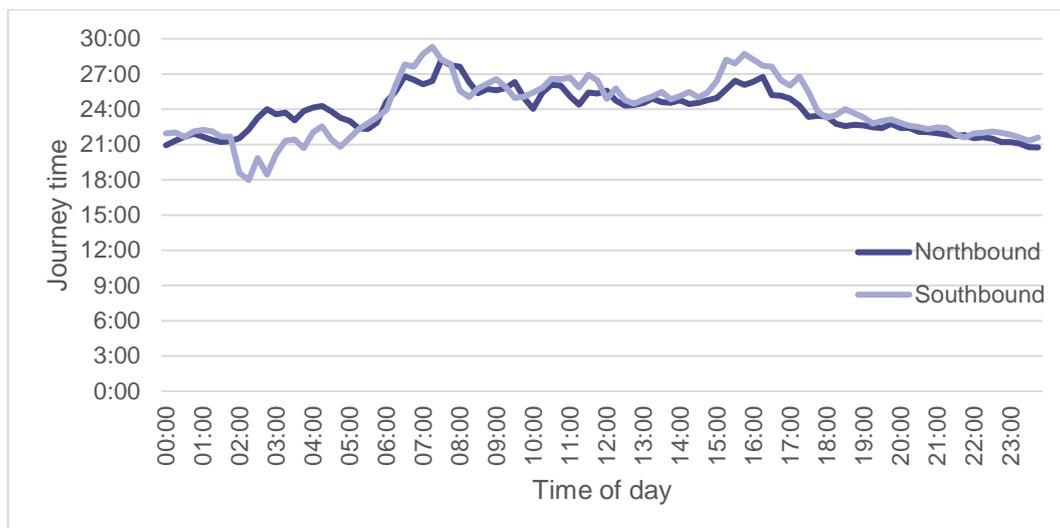
There are no locations where speeds fall to less than 50% of the free-flow value.

### 5.4 A947 Oldmeldrum to Bucksburn

The A947 route runs between the Meldrum and Bucksburn Roundabouts (with the B9170 and A96 respectively) and therefore includes the route as it passes through the Oldmeldrum, Newmachar and Dyce urban areas. The total route distance is 23.0 kilometres.

Journey times on the route over the course of a typical weekday are shown in Figure 68 and locations where congestion is observed are shown in Table 20.

Figure 68: A947 Oldmeldrum to Bucksburn journey time analysis



Journey times on the A947 between Oldmeldrum and Bucksburn are between 24 and 27 minutes in the interpeak, and between 21 and 24 minutes in the evening and overnight except for a period between 01:00 and 06:00 when southbound journey times decrease significantly; this may be distorted by low sample sizes in the off-peak period.

AM peak journey times rise from around 23 minutes at 06:00 to a peak of 29 minutes southbound and 28 minutes northbound at around 07:30. PM peak journey times are slower southbound than northbound, with an increase of around 3 minutes relative to the interpeak northbound and 5 minutes southbound.

Table 20: A947 Oldmeldrum to Bucksburn congestion analysis

Direction	Junction approach	Congestion duration			% of free flow speed
		Start	Peak	End	
North-bound	Market Street crossroads	06:05	06:57	07:13	31%
	A947 Dyce Drive Junction	15:38	15:49	16:05	26%
South-bound	Wellheads Avenue Roundabout	06:48	06:55	07:08	35%
	Bucksburn Roundabout	06:30	06:38	06:45	23%
		07:26	07:43	07:46	24%
	Market Street crossroads	15:09	15:49	16:03	35%
		16:08	16:27	16:38	43%
Riverview Drive South Roundabout	15:14	15:18	15:31	36%	

Congestion is experienced at multiple junctions in Dyce, particularly on the section between Riverview Drive South Roundabout at the southern extent of the town centre and Bucksburn Roundabout at the A96. The signalised crossroads at Market Street and the roundabout at Wellheads Road are two junctions which impart delay on road users which have not featured in this survey.

Both directions of traffic experience congestion at different locations on both peak periods, and as with the congestion on the A96, these occur early in each peak

period with congestion occurring and peaking before 07:00 in the AM peak or 16:00 in the PM peak at most sites.

The worst congestion is experienced southbound in the AM peak, where traffic approaching Bucksburn Roundabout drops to 23% of its free-flow speed before 06:45; southbound PM peak congestion reaches at worst 35% of free-flow speeds. The worst northbound congestion occurs at the A947 Dyce Drive junction, despite the A947 having priority here, suggesting reverse priority behaviour may be in effect.

This level of congestion in the urban area, with several other junctions experiencing short periods of reduced speeds of less than 15 minutes throughout the day, is likely to be a contributor to the changes in routing behaviour observed through the day in the Dyce junction turning count surveys.

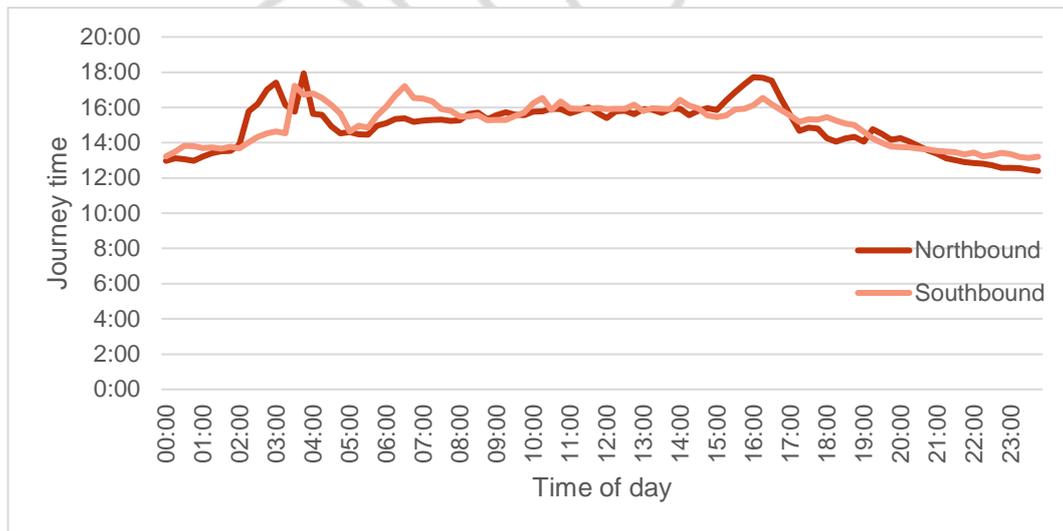
Congestion at the under-construction Goval Junctions with the AWPR has been excluded as the works at these locations are likely to contribute to delays relative to historic data.

### 5.5 B9001/B993 Wartle to Inverurie

The route between Wartle and Inverurie runs between the B9001's southern junction with the A920 at Drum of Wartle and Port Elphinstone Roundabout where the B993 meets the A96. The route follows the B9001 between Wartle and southern Inverurie and then the B993 between there and the roundabout. The total route distance is 13.8 kilometres.

Journey times on the route over the course of a typical weekday are shown in Figure 69 and locations where congestion is observed are shown in Table 21.

Figure 69: B9001/B993 Wartle to Inverurie journey time analysis



Journey times of approximately 16 minutes are recorded consistently through the interpeak period, with increases of approximately 2 minutes in the AM peak southbound and the PM peak northbound. Journey times are faster later in the evening, reaching a minimum of around 13 minutes, and are volatile overnight most likely due to a small sample size from which to generate an average.

Table 21: B9001/B993 Wartle to Inverurie congestion analysis

Direction	Junction approach	Congestion duration			% of free flow speed
		Start	Peak	End	
Northbound	Constitution Street Junction	11:17	11:25	11:41	43%
		13:37	13:46	13:55	37%
	Market Place South Junction	16:06	16:14	16:39	42%
	B993/B9001 Junction	15:54	16:04	16:12	41%
Southbound	Port Elphinstone Roundabout	06:10	06:35	07:06	31%
	Market Place Roundabout	11:01	11:19	11:35	43%
		13:57	14:02	14:12	41%

Congestion is limited to locations in Inverurie. The longest and most severe congestion occurs on the southbound approach to Port Elphinstone Roundabout where traffic is reduced to 31% of its free-flow speed and congestion lasts almost an hour between 06:00 and 07:00, comparatively early in the morning.

Most of the other congestion experienced in the Inverurie urban area is associated with the town centre and occurs in two groups, at around 11:15-11:45 and 13:30-14:15, possibly associated with local shopping and retail trips, or deliveries reducing the width of the carriageway, as these are not peak periods with respect to commuting traffic. Congestion in the town centre is intermittent with short periods of low speeds throughout the interpeak period.

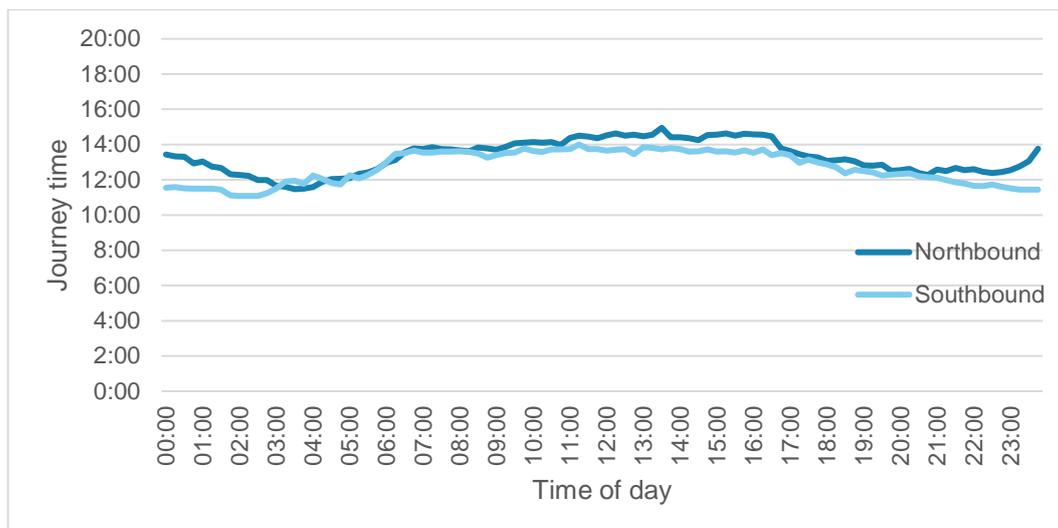
Northbound traffic returning to Inverurie in the PM peak experiences some congestion progressing north towards the town centre, with speeds as low as 41% of free-flow values. As with the A96 itself, these occur relatively early in the day with queues peaking between 16:00 and 16:15 even although the peak traffic levels occur later.

## 5.6 B9170 Inverurie to Oldmeldrum

The B9170 route runs between Blackhall Roundabout on the A96 and Meldrum Roundabout on the A947 via central Inverurie. The total route distance is 11.0 kilometres.

Journey times on the route over the course of a typical weekday are shown in Figure 70 and locations where congestion is observed are shown in Table 22.

Figure 70: B9170 Inverurie to Oldmeldrum journey time analysis



B9170 journey times are approximately 14-15 minutes throughout the day with no significant increase at peak times; after approximately 16:30 journey times decrease and continue to do so through the evening into the overnight off-peak period. Overnight southbound journey times are significantly shorter than northbound between around 21:00 and 03:00, and reach a minimum of 11 minutes.

Table 22: B9170 Inverurie to Oldmeldrum congestion analysis

Direction	Junction approach	Congestion duration			% of free flow speed
		Start	Peak	End	
Northbound	Market Place Roundabout	11:01	11:19	11:35	43%
		13:57	14:02	14:12	41%
Southbound	Blackhall Roundabout	05:30	06:47	07:30	25%
	Constitution Street Junction	11:17	11:25	11:41	43%
		13:37	13:46	13:55	37%

The main congestion location observed on the B9170 is at Blackhall Roundabout, which has the longest lasting congestion observed in this survey, occurring for two hours between 05:30 and 07:30. 05:30 appears abnormally early for such congestion to occur. The congestion peaks at around 06:45 with speeds at one-quarter of free-flow levels.

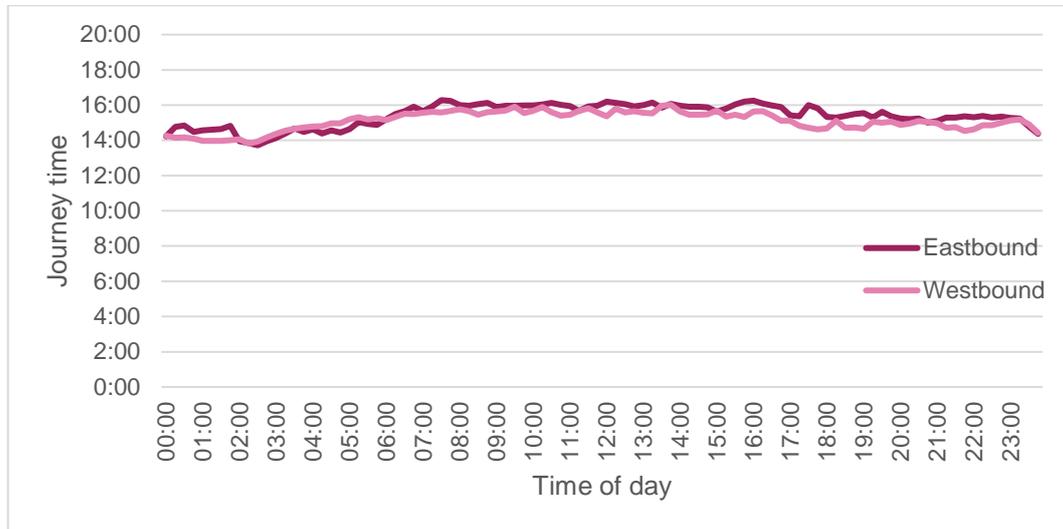
The Market Place and Constitution Street locations are identical to those discussed on the B9001 route, as these routes overlap.

## 5.7 B977/A944 Kintore to Westhill

The route from Kintore to Westhill runs between Gauchhill Junction on the A96 and Arnhall Roundabout in Westhill. The route follows the B977 between Gauchhill and Lyne of Skene, the B9126 between Lyne and Loch of Skene, and the A944 between Loch of Skene and Westhill. This route is based upon the turning count information that suggests some vehicles are using the B9126 to cut the corner between the B977 and A944. The total route distance is 14.8 kilometres.

Journey times on the route over the course of a typical weekday are shown in Figure 71.

Figure 71: B977/A944 Kintore to Westhill journey time analysis



The journey times on the route between Kintore and Westhill are stable at between 15 and 16 minutes throughout most of the day and around 14 minutes overnight. The westbound journey is slightly quicker than the eastbound at most times, but the difference is rarely less than a minute.

No significant additional delay occurs in the peak periods relative to the rest of the day. There are no locations where speeds fall to less than 50% of the free-flow value for more than a few minutes at a time.

## 6 On-Site Observations

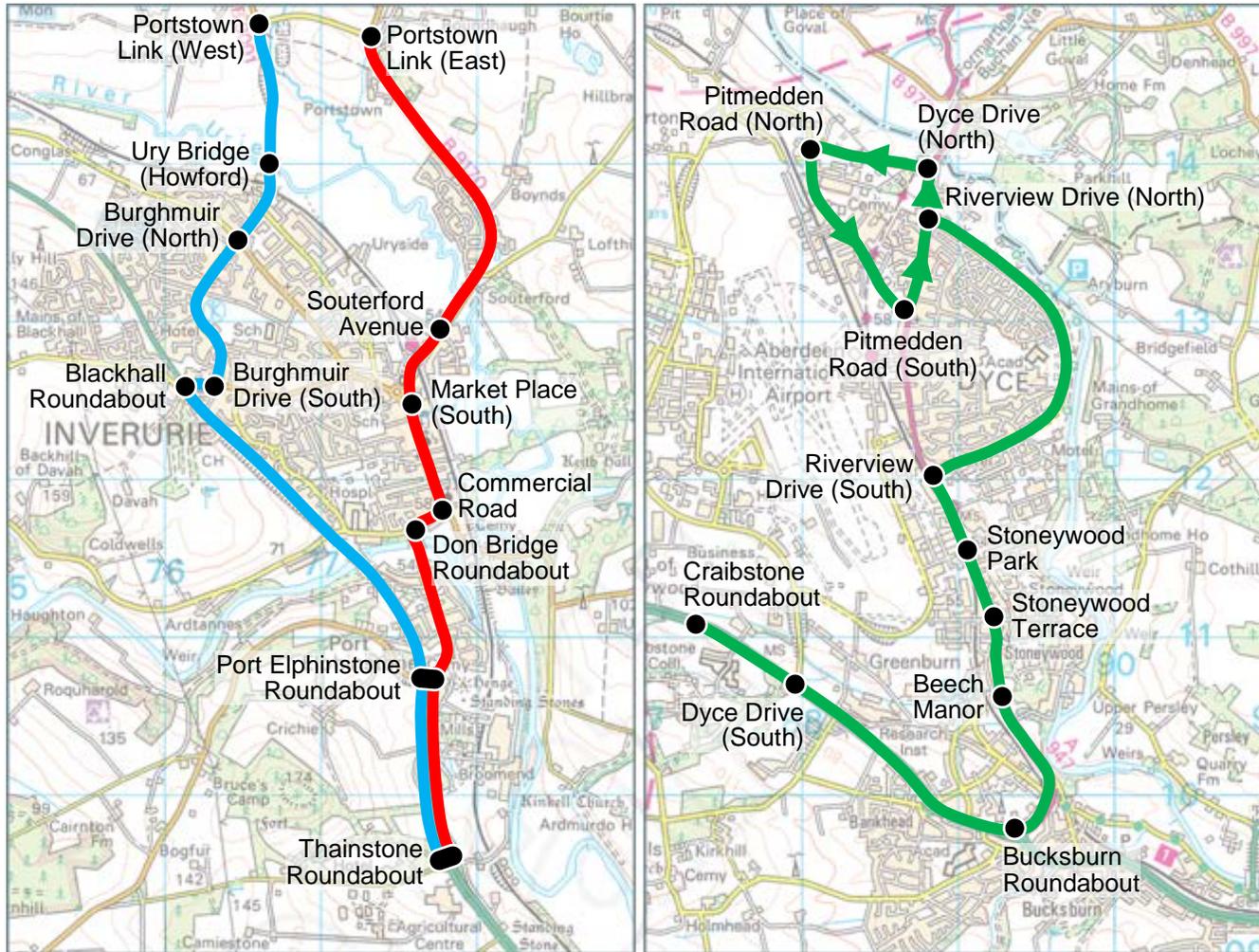
### 6.1 Journey time data

To support the INRIX journey time observations, journey time surveys were performed in Inverurie in July 2018. The routes were surveyed to improve understanding of delay at key junctions and to add data on unclassified roads which are not covered by the INRIX data.

Journey times were measured using the Moving Car Observer method, with a timing points determined in advance and a dashboard camera used for observations. Journeys were performed between 06:00 and 09:00 in the AM peak and 15:00 and 18:00 in the PM peak, to capture the periods of congestion and delay predicted by the INRIX data.

Two bidirectional routes were used in Inverurie, while one circular route was observed in Dyce, as shown in Figure 72, with the timing points used highlighted. The average journey times between each two consecutive timing points are shown in Tables 23 to 25.

Figure 72: Moving car observer journey time routes



## 6.1.1 Inverurie

Table 23: Inverurie western route journey times

Timing point	Northbound journey time		Timing point	Southbound journey time	
	AM peak	PM peak		AM peak	PM peak
Thainstone	0:00	0:00	Portstown Link (W)	0:00	0:00
Port Elphinstone	0:50	1:50	Ury Bridge	0:47	0:58
Blackhall	2:35	3:27	Burghmuir Drive (N)	0:47	0:51
Burghmuir Drive (S)	0:37	0:36	Burghmuir Drive (S)	1:10	1:46
Burghmuir Drive (N)	1:26	1:37	Blackhall	1:03	0:28
Ury Bridge	0:47	0:48	Port Elphinstone	2:19	2:48
Portstown Link (W)	0:48	0:48	Thainstone	0:57	1:01
<b>Sum of averages</b>	<b>7:03</b>	<b>9:06</b>	<b>Sum of averages</b>	<b>7:03</b>	<b>7:52</b>

Six runs (complete loops) of the Inverurie western route were performed in each peak period on Tuesday 3 July 2018. The comparison of journey times between the AM and PM peaks shows that there is congestion on the A96 northbound in the PM peak, with an average delay of around one minute on the Thainstone-Port Elphinstone and Port Elphinstone-Blackhall sections of the route. These apart, journey times are consistent and indicative of little delay northbound through the town.

Southbound, congestion and delay is recorded in the AM peak on the B9170 approach to Blackhall Roundabout (average 35 seconds longer than the PM peak and a maximum delay of around 2½ minutes relative to free-flow conditions), while in the PM peak congestion is greater on Burghmuir Drive itself, suggesting some congestion at the B9170/Burghmuir Drive roundabout, and on the A96 between Blackhall and Port Elphinstone, consistent with congestion at Port Elphinstone owing to a high opposing flow from south-to-east.

Table 24: Inverurie eastern route journey times

Timing Point	Northbound journey time		Timing point	Southbound journey time	
	AM peak	PM peak		AM peak	PM peak
Thainstone	0:00	0:00	Portstown Link (E)	0:00	0:00
Port Elphinstone	0:49	0:52	Souterford Avenue	2:48	3:10
Don Bridge	1:35	1:51	Market Place (E)	1:05	1:17
Commercial Road	0:27	0:43	Commercial Road	1:12	1:36
Market Place (E)	1:14	1:41	Don Bridge	0:23	0:24
Souterford Avenue	1:00	1:17	Port Elphinstone	2:56	1:36
Portstown Link (E)	2:43	2:55	Thainstone	0:53	0:54
<b>Sum of averages</b>	<b>7:48</b>	<b>9:19</b>	<b>Sum of averages</b>	<b>9:17</b>	<b>8:57</b>

Four runs of the Inverurie eastern route were completed in each direction in the AM peak and three runs in the PM peak, also on Tuesday 3 July 2018. The northbound journeys show similar behaviour to the western route; AM peak journeys are slightly faster overall, with general congestion in the urban area in the PM peak contributing to a total journey time increase of around 1½ minutes, spread consistently through timing points in the urban area, due to more general urban traffic in the late afternoon than in the early morning.

The southbound AM and PM peak journey times are more similar; although as per the AM peak movements through the urban area are generally slower in the PM peak than in the AM, this is compensated for by the congestion on the B993 eastern approach to Port Elphinstone Roundabout which accounts for around 1½ minutes average delay and a maximum delay of almost 3 minutes relative to free-flow conditions.

## 6.1.2 Dyce

Table 25: Dyce route journey times

Timing Point	Journey time		Timing point	Journey time	
	AM peak	PM peak		AM peak	PM peak
Craibstone	0:00	0:00	Pitmedden Road (S)	1:49	1:40
Dyce Drive (S)	1:09	1:02	Riverview Drive (N)	1:00	5:23
Bucksburn	2:43	2:31	Riverview Drive (S)	2:48	2:50
Beech Manor	1:20	1:11	Stoneywood Park	0:45	0:48
Stoneywood Terrace	0:52	0:35	Stoneywood Terrace	1:03	0:48
Stoneywood Park	0:44	0:51	Beech Manor	0:48	0:47
Riverside Drive (S)	0:48	0:49	Bucksburn	1:55	1:19
Riverside Drive (N)	2:45	5:34	Dyce Drive (S)	2:46	2:25
Dyce Drive (N)	0:24	1:29	Craibstone	1:09	1:06
Pitmedden Road (N)	2:17	1:08	<b>Sum of averages</b>	<b>27:07</b>	<b>32:14</b>

Five circuits of the Dyce journey time route were performed in the AM peak on Wednesday 4 July 2018. Of these, three were performed in effectively free-flow conditions while two exhibited a total of six minutes delay, with the main congestion points being the approaches to Bucksburn Roundabout (both from the A96 southbound on the outbound leg and A947 on the return leg), the section of Dyce Drive approaching Pitmedden Road, and the signalised junction in Dyce on the A947.

The PM peak data is formed from only two loops on Monday 2 July 2018, one of which was performed in heavy congestion so the averages may not be representative in this case. Significant delays were recorded on the section between Riverside Drive and Pitmedden Road, owing to congestion at the A947/Dyce Drive junction. Despite the A947 having priority at this T-junction, reverse priority behaviour was observed with vehicles permitted to exit Dyce Drive regularly. Long queues resulted on Dyce Drive, A947 Victoria Street and Riverside Drive.

No runs of the Dyce journey time route suggested significant delays associated with the A96/Dyce Drive junction or Craibstone Roundabout. However, the AWPR and its connection to Craibstone was not yet open so upon the opening of the AWPR this observation is subject to change.

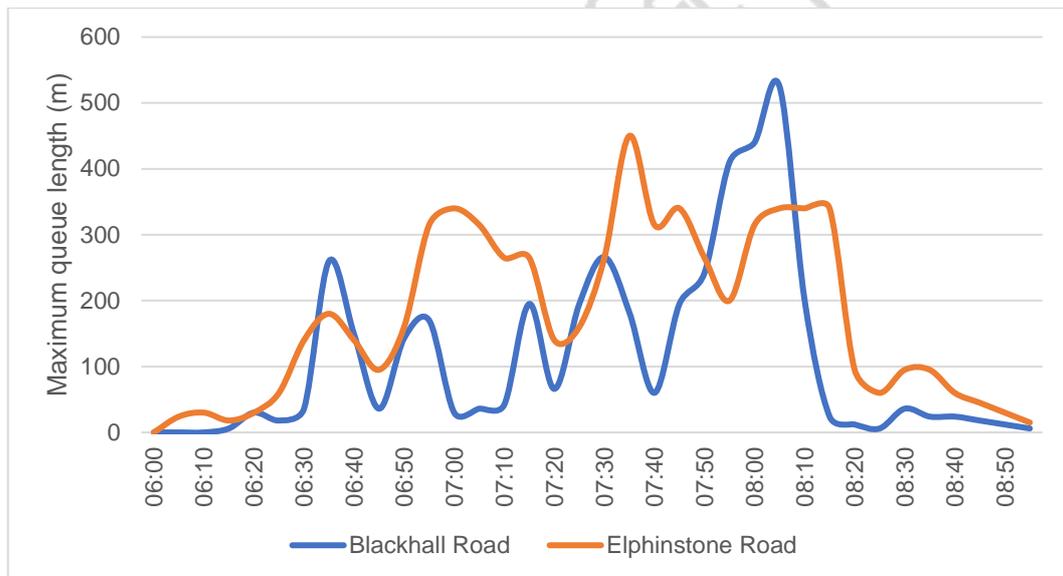
## 6.2 Queue length data

### 6.2.1 Inverurie

AM peak queue lengths were manually measured on the two primary approaches to the A96 from Inverurie; the B993 Elphinstone Road approach to Port Elphinstone Roundabout, and the B9170 Blackhall Road approach Blackhall Roundabout. These were performed concurrently with the journey time surveys on Tuesday 3 July 2018.

The maximum queue length observed in each five-minute bin was recorded. Lengths were measured relative to local landmarks and a vehicle is assumed to contribute 6 metres to a queue. The total queue lengths measured are shown in Figure 73 for the AM peak and Figure 74 for the PM peak.

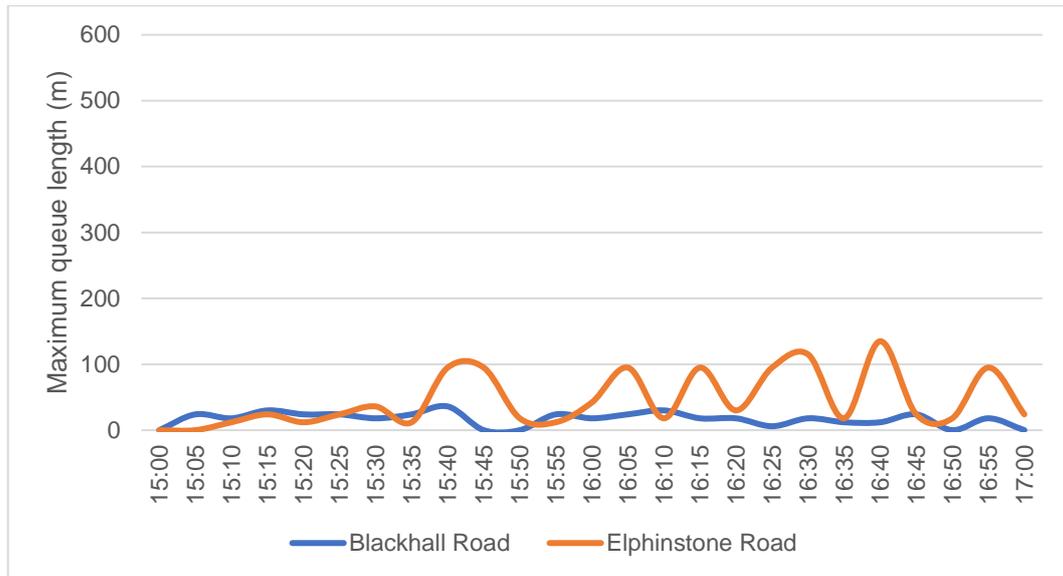
Figure 73: AM peak queue length data for Inverurie approaches to A96



Both approaches to the A96 show significant queueing in the morning peak, with the queues on Elphinstone Road approaching Port Elphinstone Roundabout peaking at approximately 450 metres and those on Blackhall Road approaching Blackhall Roundabout at 525 metres. In both cases this results in blocking back through additional junctions.

Queues on Elphinstone Road are more consistent, with maximum queue lengths in each five-minute bin exceeding 100 metres consistently between 06:45 and 08:15, while queue lengths at Blackhall Roundabout are more variable, with several short peaks which last no more than 15 minutes in addition to the main queueing peak between 07:40 and 08:10.

Figure 74: PM peak queue length data for Inverurie approaches to A96



Queue lengths are much shorter in the PM peak compared to the AM peak, owing to the reduction in demand and in opposing traffic on the A96 southbound. Queues on Elphinstone Road are more volatile in the PM peak, varying between 0 and 100 metres maximum consistently, while no significant queueing was observed on Blackhall Road, never exceeding 6 vehicles at any one time.

### 6.2.2 Dyce

On the morning of Wednesday 4 July 2018, general observations were made in Dyce to detect areas of significant queueing and delay. One observer was posted on the A96 between Craibstone and Bucksburn, while one was posted on the A947 between Bucksburn and the southern end of Riverview Drive.

The A96/Dyce Drive signalised junction was found to have sufficient capacity to accommodate traffic flows in the AM peak, with almost all transitory queues clearing in each signal cycle except in the period 07:30 to 08:20 where occasional over-capacity queues occurred due to an additional phase for right turners from Dyce Drive to the A96 northbound. A96 queue lengths reached a maximum of approximately 20 vehicles (120 metres) immediately before a green stage.

Similarly, the signalised junctions on the A947 resulted in transitory queues of up to 20-25 vehicles (120-150 metres) where vehicles were delayed but always able to proceed through signals in a single cycle. The main capacity constraints on the A947 southbound were Bucksburn Roundabout, with queues in the period 08:00 to 08:30 approximately back to the slip road for Old Meldrum Road (around 350 metres) and the roundabout with Wellheads Avenue, where vehicles turning right from the A96 northbound opposed the A96 southbound flow and caused traffic to occasionally stack back on to Riverview Drive.

Long queues were observed briefly on the A96 southbound approaching Bucksburn Roundabout for the period 07:00-07:20. However these were due to a road traffic accident and did not represent typical conditions.

## Appendix A

### Inverurie and Kintore JTC Reports by Site

(Excel Spreadsheet format)

Draft