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A96 Inverness to Nairn (including Nairn Bypass)

A9 to A96 Connections Study
Problem Definition and Objective Setting

July 2013

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Contents

1 Introduction

1.1 Purpose of this Report

The purpose of this report is to set out evidence of observed problems on the strategic road network and thereby allow objectives to be set that target the observed issues. This Problem Definition and Objective Setting Report presents a summary of the development of the rational for the A96 Inches to Nairn scheme; as well as a review of traffic survey data and other information sources that may help to explain the current operational problems on the trunk road network around Inverness. The report then sets out local objectives derived from the Strategic Transport Projects Review (STPR) and maps problems, objectives and potential solutions. Key junctions within the study area are located in Figure 1 below.

Figure 1: Location Plan showing relevant junctions

1.2 The Strategic Transport Projects Review

The Strategic Transport Projects Review (STPR) sets out the context in which the A96 Inches to Nairn scheme in its current form was conceived. Section 2 of this report highlights the key points from each of the following reports:

- *Report on Network Performance (Report 1);*
- *Report on Gaps and Shortfalls (Report 2);*
- *Report on Generation, Sifting and Appraisal of Interventions (Report 3); and*

- *Final Report (Report 4).*

This effectively presents a summary of the development of the rational for the A96 Inches to Nairn scheme.

1.3 Review of Available Traffic Survey Data

Sections 3 and 4 of this report present:

- *a review of the existing traffic movements through Raigmore Interchange including queue delay surveys;*
- *a review of the existing traffic movements through Longman Roundabout including queue length surveys;*
- *a review of traffic surveys at Harbour Road Roundabout, Inches Junction and Inches Roundabout; and*
- *a review of journey time data on sections of the A96, A9, A82, B865 and B9006.*

Taken together, these provide evidence as to operational problems on the existing road network.

1.4 Bluetooth Survey Data

A number of Bluetooth detectors were installed adjacent to the trunk road network over a nine day period in February 2012. Each detector records the presence of a Bluetooth enabled device passing in the vicinity of the detector and the data was matched across detector pairs. This provides an indication of the number of devices passing between any two detection locations and the time taken to travel between these points. This data cannot be used to establish vehicle flows at any point on the network nor does it contain any routing information: it has to be assumed that a travel time is via the most logical route. As such the data was only used in aggregate to gauge journey time variation. This data is discussed further in Section 5.

1.5 Analysis of the Moray Firth Transport Model (MFTM)

As no Road Side Interview (RSI) has been undertaken on the A96 immediately east of Raigmore Interchange in recent years, the Moray Firth Transport Model (MFTM) has been used to help understand the travel patterns of existing A96 users including where they are travelling to in the westbound direction and from in the eastbound direction. The analysis undertaken on the MFTM is presented in Section 6. The exercise was repeated using the 2031 Do Minimum models, to confirm that these travel patterns are not forecast to change significantly.

1.6 Other Observations

Section 7 presents a number of other observations relevant to the setting of objectives, which include bus service provision, provision for cyclists, accident data and potential issues arising from future development.

1.7 Summary of Problem Definition

Section 8 presents a summary of the rational for the A96 Inches to Nairn scheme and identifies the existing problems with the road network around Raigmore Interchange.

1.8 Objective Setting

This report finishes with the setting of Objectives for the appraisal of interventions and maps the relationship between the problems identified; the objectives set under the Strategic Transport Projects Review (STPR) and the local objectives. A list of interventions that may address the problems identified is also defined.

2 Development of the Recommendation from the STPR

2.1 Overview of the Strategic Transport Projects Review (STPR)

The Strategic Transport Projects Review (STPR) was published in 2008 following an extensive review of both current and potential future issues with Scotland's transport infrastructure with the aim of highlighting what should be Scotland's transport priorities for at least the next decade from 2012 onwards.

The study reviewed both existing and forecast network performance and identified gaps and shortfalls in terms of performance, provision and meeting national objectives. A long list of potential interventions that could potentially address these was considered. These were sifted and the most promising options appraised in ever greater detail until a shorter list of 29 transport interventions were finally recommended. One of these recommendations, Recommendation 18, was to Upgrade A96 to Dual Carriageway between Inverness and Nairn.

The following sections highlight the key points from each of the STPR reports in relation to explaining the justification for the proposed intervention, including the Inches to Smithton link.

2.2 Network Performance (STPR Report 1)

Two sections of the STPR Report on Network Performance are particularly relevant to the review of the connection between the A9 and A96. Section 6.1 discusses Inverness as a strategic node, while section 7.4 discusses the Aberdeen to Inverness corridor (Corridor 4).

Section 6.1 highlights that "*housing pressures exist in Inverness which is leading to an increased demand for new housing outside Inverness. A masterplan, encompassing development immediately east of Inverness and at a number of towns along the A96 is under review. This strategy includes new housing, commercial development, regeneration and new public amenities, all of which are likely to increase demand to travel, particularly on the eastern approach to the city*".

"The current Inverness Local Plan identifies the A96 corridor (towards Aberdeen) as a major strategic economic development opportunity. A total of 396ha of land has been allocated for economic development on this corridor linked to the A96 via direct or distributor roads. It is estimated that the population could increase by approximately 40,000 people in this corridor by 2041. Economic development on this scale is likely to generate a significant increase in travel demand between Corridor 4 and Inverness and within the strategic node itself".

With regards the identification of current operational issues, the report highlights that *"Peak time congestion is experienced on the A9, A96 and A82 routes into Inverness and the main route through the town centre"*. It then highlights that *"the focus of road congestion is located on the following five junctions:*

- *Raigmore Interchange;*
- *Inshes Junction;*
- *Longman Junction; and*
- *A82 Kenneth Street including Harbour Road Roundabout and Telford Street Roundabout."*

The report on Network Performance does not indicate any specific problems with the operation of these junctions other than to highlight that peak period congestion occurs at these locations on the trunk road network.

Looking to the future, the report summarises the key drivers that are likely to impact on the performance of Inverness as a strategic node in the future as *"expected population and economic growth is likely to increase the demand for travel to and from Inverness. Significant growth in employment and population is planned on the A96 corridor to the east of Inverness. Current local authority projections indicate a potential increase in population of 40,000 by 2041 along this corridor and a substantial increase in the number of job opportunities, as well as continued growth at Inverness Airport. This growth in demand will increase pressure on the road and rail network on the eastern approaches to Inverness".*

In a similar vein, Section 7.4, which discusses the Aberdeen to Inverness Corridor, highlights that, "*Housing development at Nairn and the development of a number of new communities along the A96 will result in an increase in demand to travel along the route, particularly on the eastern approach to Inverness".*

"*Congestion occurs in the peak periods at either end of the corridor, on the approaches to Aberdeen and Inverness" and "the interaction of mainline and side road traffic at priority junctions and at-grade roundabouts, increases congestion and impacts journey time. The presence of HGV traffic, high traffic demand and lack of overtaking opportunities on the mainly single carriageway also affects operation*".

Section 7.4 also highlights that the "*corridor exhibits higher than average accident rates and severity ratios, than would be expected for a route of this nature. A number of accident clusters have been identified*".

Again, section 7.4 highlights "*Significant growth in employment and population is planned on this corridor to the east of Inverness as well as continued growth at Inverness Airport. This growth in demand will place an increased pressure on the road and rail network. On the A96, capacity thresholds are likely to be exceeded at localised points such as Elgin and Inverurie, and also on approach to both Aberdeen and Inverness*".

In summarising the key drivers that are likely to impact on the performance of the corridor in the future, section 7.4 highlights that "*the most significant external factor impacting on the performance of this corridor is the forecast growth in population and employment on the approaches to Inverness, coupled with the continuing increase in passenger numbers through Inverness and Aberdeen Airports*".

Therefore, whilst the STPR Report on Network Performance indicates peak time congestion on the trunk road network around Inverness, it is the future development proposals in the A96 corridor that was the principal driver for considering an intervention that would improve capacity on the A96 east of Inverness.

2.3 Gaps and Shortfalls (STPR Report 2)

A summary of the objectives, set out in Section 3.4, relating to the Inverness strategic node relevant to the A96 was:

- *To reduce the conflict between longer distance and local traffic;*
- *To improve connectivity, particularly by public transport between Inverness city centre and the growth area to the east including Inverness Airport; and*

- *To promote continuing reduction in accident rates and severity rates across the strategic transport network.*

The comparable objectives relating to the Aberdeen to Inverness Corridor (Corridor 4) were:

- *To improve connectivity, particularly by public transport between Inverness city centre and the growth area to the east including Inverness Airport;*
- *To improve journey time and increase opportunities to travel, particularly by public transport, between Aberdeen and Inverness; and*
- *To reduce the accident rate and severity rate to current national average.*

Against the National Objective to maximise labour catchment area in city regions, "*the A96 corridor to the east of Inverness is identified as a strategic development opportunity*", which led to the STPR specific objective "*To improve connectivity, particularly by public transport, between Inverness city centre and the growth area to the east including Inverness Airport*".

2.4 Generation, Sifting and Appraisal of Interventions (STPR Report 3)

The STPR report on option generation identifies 136 interventions for consideration at the initial appraisal stage. These included "*Upgrade A96 to Dual Carriageway between Inverness and Nairn*" as one of the options for consideration in the Aberdeen to Inverness Corridor (Intervention ID 3) and "*Inverness Southern Bypass from A96 to A82*" as the only option at the Inverness strategic node (Intervention ID 55).

Both of these options were taken forward during the sifting process. The justification for taking forward the Inverness Southern Bypass from the A96 to A82 was that "*This intervention would significantly contribute to the objective 'to reduce the conflict between longer distance and local traffic' by allowing long distance traffic from the A9 and A96 to the A82 to avoid Inverness city centre. It would also further reduce conflict and contribute to the objective of 'improving connectivity, particularly by public transport between Inverness city centre and the growth area to the east including Inverness Airport' by allowing traffic between the A9 and A96 to avoid Raigmore Interchange. Reducing this conflict and delay at Raigmore could significantly benefit trips from the south heading into Inverness or east towards Nairn, and also reduce delays for trips from Inverness Airport, Nairn and communities east of Inverness travelling into Inverness city centre"*.

The reason why removing traffic from Raigmore Interchange would be beneficial is not explicitly defined, but all movements through the junction to or from the east may be relieved by the construction of a southern bypass, including traffic from the north (Longman Roundabout), which is the signed route through Inverness from the A82.

The justification for taking forward an intervention to Upgrade A96 to Dual Carriageway between Inverness and Nairn was that "*this intervention would significantly contribute to the objectives of 'improving connectivity particularly by public transport between Inverness city centre and the growth areas to the east, including Inverness Airport'; 'reducing the accident rate and severity to the national average'; and 'improving journey time and increased opportunities to travel, particularly by public transport between Aberdeen and Inverness'. Upgrading the A96 to dual carriageway between Nairn and Inverness would have a significant impact on reducing accident rates by providing a higher standard of road compared*

with the existing single carriageway. It would also significantly improve connectivity between Inverness and communities to the east by reducing journey times, along this section of the corridor, and for longer distance journeys between Aberdeen and Inverness".

At the detailed appraisal stage, these two interventions were amalgamated and redefined. The Inverness Southern Bypass from the A9 to A82 (Ref E6) was dropped because it "*is a high cost, road based intervention which largely provides local benefits for local traffic*". The eastern section of the bypass intervention between the A9 and the A96 was then considered for inclusion as part of the intervention to Upgrade A96 to Dual Carriageway between Inverness and Nairn (Ref D16). The reason for this was that "*a new link connecting the A96 and the A9 (south of Inverness) would provide relief for Raigmore Interchange*".

Removal of traffic between the A9 and A96 would obviously reduce the total volume of traffic travelling through Raigmore Interchange and therefore some improvement in the operation of Raigmore Interchange may be expected. However, the intention of the Inverness Southern Bypass along the full extent from the A96 to the A82 was that the route would provide some relief for the traffic movement between Longman Roundabout and the A96 (which is the current signed route between the A82 and A96) as well as removing traffic making the south to east movement between the A9 and A96. In essence, not constructing the full Inverness Southern Bypass may be expected to reduce the strategic benefits of constructing the section between the A9 and A96 trunk roads, compared to the benefits from the option that this link was originally part of.

The detailed appraisal of the intervention to Upgrade A96 to Dual Carriageway between Inverness and Nairn highlights that "*the A96 to the east of Inverness is currently single carriageway and although no existing strategic capacity problem has been identified, considerable growth is planned to the east of Inverness. Provision of a dual carriageway along this stretch and a dual carriageway link to the A9 at Inshes would provide additional capacity for growth to the east of Inverness*".

In summary, this indicates that the A96 Inches to Nairn scheme is primarily intended to address a potential future capacity issue rather than specifically address an existing operational problem.

2.5 Final Report (STPR Report 4)

This report summarises the appraisal work undertaken in the previous STPR reports as Recommendation 18. This recommendation is based on the need to provide additional capacity for growth to the east of Inverness.

3 Review of Turning Count and Queue Delay Survey Data

3.1 Introduction

A number of manual classified junction turning counts, queue length and queue delay surveys have been undertaken at Raigmore and surrounding junctions as part of the development of the Transport Model for Scotland (TMfS) and the Moray Firth Transport Model (MFTM). This section undertakes a review of the available data to present a summary of the issues at each location.

The junctions considered in this section are:

- *Raigmore Interchange (A9 / A96);*
- *Longman Roundabout (A9 / A82 / B9168);*
- *Harbour Road Roundabout (A82);*
- *Inches East Junction (A9 / B9006);*
- *Inches Roundabout (B9006 / B8082);*
- *Inches North Junction (A9 / B8082); and*
- *B9006 / Tower Road Junction*

3.2 Raigmore Interchange

3.2.1 Turning Count and Queue Delay Data (June 2009)

A manual classified junction turning count was undertaken by Streetwise Services Limited on Thursday 18th June 2009. This shows that across the day, the dominant movement is from the north to the east: traffic from Longman Roundabout travelling eastwards on the A96. Other significant flows are from the A96 towards Inverness on the B865 and towards Longman Roundabout via the A9 northbound carriageway and from Inverness (B865) to the A96. One issue with this count is that it records a significant number of vehicles leaving the A9 both northbound and southbound and then rejoining the A9, for no apparent reason, which reduces confidence in the recorded turning proportions. Nevertheless, a brief summary of this data is presented below because a peak time queue delay survey was undertaken at the same time.

(a) AM Time Period

In the AM time period (07:00 to 10:00) an average of 722 vehicles per hour used the A9 southbound diverge slip road, with almost three quarters of this demand bound for the A96: the remaining traffic would logically travel towards Inverness on the B865. From the east, an average of 1,296 vehicles per hour approached Raigmore Interchange. Around 46 per cent was travelling towards Inverness city centre via the B865, with the same proportion joining the A9 northbound carriageway, travelling towards Longman Roundabout. The remaining traffic, about nine per cent of the traffic approaching Raigmore Interchange from the east, joined the A9 southbound carriageway.

From the south, an average of 376 vehicles per hour used the A9 northbound diverge slip road, with around half of the traffic travelling towards Inverness on the B865: the remainder would logically be bound for the A96. From the west, an average of 438 vehicles per hour approached Raigmore Interchange, with around two thirds of this traffic bound for the A96 and the remainder joining either the A9 northbound or southbound carriageways.

A queue delay survey undertaken on the same day indicates that an average vehicle on the A9 southbound diverge slip road was delayed for approximately 13 seconds during the AM time period, with the actual delay per vehicle varying between four and 53 seconds. The average delay experienced by vehicles on the A96 approach was approximately 17 seconds, with the delay per vehicle varying between two seconds and five minutes 12 seconds, the latter of which is one of two obvious outliers. Ignoring these, the third highest delay experienced by a surveyed vehicle on the A96 approach was only 26 seconds.

An average vehicle on the A9 northbound diverge slip road was delayed by approximately 13 seconds in the AM time period, with the actual delay experienced ranging between four and 35 seconds. An average vehicle on the B865 approach from Inverness was delayed by 24 seconds, with the actual delay per vehicle ranging between three seconds and one minute 59 seconds.

In summary, this indicates no significant operational issues at Raigmore Interchange during the AM time period besides a few vehicles on the B865 approach being delayed by more than a minute, although such delay occurrences appear to be spread randomly throughout the morning peak.

(b) Inter-peak Time Period

In the Inter-peak time period (10:00 to 16:00) the average hourly flows on all approach arms were actually slightly higher than during the AM time period. The overall balance of turning movements is broadly similar with some subtle differences. From the north, the average hourly flow increases from 722 vehicles per hour in the AM period to 896 vehicles per hour in the Inter-peak period with the majority of the additional traffic destined for the A96. This north to east movement accounts for more than three quarters of the flow on the southbound diverge slip road during the inter-peak period.

(c) PM Time Period

In the PM time period (16:00 to 19:00), the average hourly flows on all arms were higher than both the AM and Inter-peak time periods, which indicates that the existing junction is currently operating under greatest pressure at this time. The peak hour was recorded as being 16:45 to 17:45. Of particular note is the increased importance of the A96 exit as a destination in this time period. Approximately 83 per cent of traffic on the southbound diverge slip road is bound for the A96 in the evening time period and 65 per cent of traffic on the A9 northbound diverge slip.

The queue delay survey in the PM time period indicates that the average delay experienced by a vehicle on the A9 southbound diverge slip road was one minute and 24 seconds, with the actual delay per vehicle ranging between five seconds and four minutes and 41 seconds. Within the peak hour, the average vehicle delay was close to three minutes.

On the A96 approach, the average vehicle experienced approximately 30 seconds of delay, with the actual delay per vehicle ranging between four seconds and ten minutes and 11 seconds, although the later figure is an obvious outlier: the second longest surveyed delay on this approach was only 39 seconds. On the A9 northbound diverge slip road, the average vehicle experienced approximately 16 seconds of delay, with the actual delay per vehicle ranging between two seconds and two minutes and 12 seconds. Finally, on the A865 approach, the average vehicle experienced 38 seconds of delay, with the actual delay per vehicle ranging

between three seconds and ten minutes 54 seconds, although the later figure is again an obvious outlier: the second longest surveyed delay on this approach was two minutes and eight seconds.

The higher traffic flows in the PM peak and the greater delays on each of the approaches compared to the AM peak survey, indicates that Raigmore Interchange operates under greatest pressure during the evening peak and the most significant delays are experienced by traffic on the A9 southbound diverge slip road, the majority of which is destined for the A96.

3.2.2 Turning Count Data (November 2012)

(a) Comparison with 2009 Data

A more recent turning count was undertaken at Raigmore Interchange by Streetwise Services Limited on Thursday 22 November 2012. This count indicates that traffic levels through the junction are slightly lower than in June 2009. This may be seasonal, but the same pattern of flows was observed with the exception of substantially fewer vehicles being observed leaving and rejoining the A9 carriageways. As such, the most recent survey provides increased confidence in the proportion of vehicles making each turn.

(b) Observed Turning Proportions (2012)

A comparison of the level of flow on each approach between the two surveys is presented in Table 1 below along with the turning proportions by time period on each approach:

Table 1: Observed Turning Proportions at Raigmore Interchange (November 2012)

Arm	Time Period	Jun 2009 (vph)	Nov 2012 (vph)	Turning Proportions (Nov 2012)
A96	AM	1,296	1,262	49% to A9 North (Longman) 42% to B865 (Inverness) 9% to A9 South (Inches)
	IP	1,343	1,248	44% to B865 (Inverness) 39% to A9 North (Longman) 17% to A9 South (Inches)
	PM	1,429	1,309	43% to A9 North (Longman) 38% to B865 (Inverness) 19% to A9 South (Inches)
A9 NB Diverge	AM	376	371	51% to A96 (East) 49% to B865 (Inverness)
	IP	425	394	59% to A96 (East) 40% to B865 (Inverness)
	PM	491	415	63% to A96 (East) 36% to B865 (Inverness)
B865	AM	438	424	66% to A96 (East) 24% to A9 North (Longman) 10% to A9 South (Inches)
	IP	745	721	67% to A96 (East) 19% to A9 North (Longman) 14% to A9 South (Inches)
	PM	926	872	67% to A96 (East) 18% to A9 North (Longman) 15% to A9 South (Inches)

A9 SB Diverge	AM	722	692	71% to A96 (east) 28% to B865 (Inverness)
	IP	896	742	77% to A96 (East) 21% to B865 (Inverness)
	PM	929	856	79% to A96 (East) 20% to B865 (Inverness)

Further analysis indicates that taken over the 12 hour survey period, traffic flows on the A96 were balanced: 15,199 vehicles westbound and 15,214 vehicles eastbound. The westbound flow (towards Inverness) was dominant in the AM time period, with the eastbound flow dominant in the Inter-peak and PM time periods. However, the total flows over 12 hours on the other arms were less balanced. From the south, more traffic approached the gyratory at Raigmore Interchange than left to join the southbound A9 carriageway: 4,719 vehicles northbound and only 3,467 vehicles southbound. This pattern was noted in each time period.

Traffic flows on the B865 were higher in the westbound direction (towards Inverness) and lower in the eastbound direction: 10,342 vehicles westbound and only 8,212 vehicles eastbound (towards Raigmore Interchange). The difference largely occurred during the AM and Inter-peak time periods, with slightly more traffic travelling towards Raigmore Interchange in the PM time period. Similarly from the north, more traffic approaches Raigmore Interchange from Longman Roundabout than travels northbound towards Longman Roundabout: 9,095 vehicles southbound and only 8,202 vehicles northbound. This difference largely occurred in the Inter-peak and PM time periods: slightly more traffic was observed travelling north in the AM time period.

Each of these flow imbalances is potentially due to delays at other junctions on the surrounding road network that result in drivers taking different routes through Inverness on their initial and return journeys. This may arise from delays at Longman Roundabout and at the Inches Junction / Inches Roundabout.

(c) Principal Movements through Raigmore Interchange

Table 2 below summarises the principal movements recorded through the junction on 22 November 2012 across a 12-hour period. Note that this excludes movements from North to South and vice versa, which use the flyover as opposed to passing through the gyratory.

Table 2: Daily flows for Movements through Raigmore Interchange (November 2012)

Movement	12 hour flow (2-way)	Percentage of flow
North to East / East to North	13,436	36%
East to West / West to East	11,838	32%
South to East / East to South	5,083	14%
North to West / West to North	3,653	10%
South to West / West to South	3,061	8%
Other (mainly U-turns)	154	-
	37,225	100%

It is noted that the three heaviest two-way movements through the gyratory at Raigmore Interchange are all connected with accessing the A96, but only 14 per cent of the traffic travelling through Raigmore Interchange travels from south to east and vice versa. The proportion of this flow that would switch to a dedicated link between Inches and Smithton would be dependent on the junction form at each end:

particularly the junction with the A9 and B9006 at Inches as only some of this traffic continues to travel on the A9 south of the Inches Junction.

The AM and PM flows in Table 1 are presented diagrammatically in Figure 2 and Figure 3 below.

Figure 2: AM traffic flows through Raigmore Interchange (November 2012)

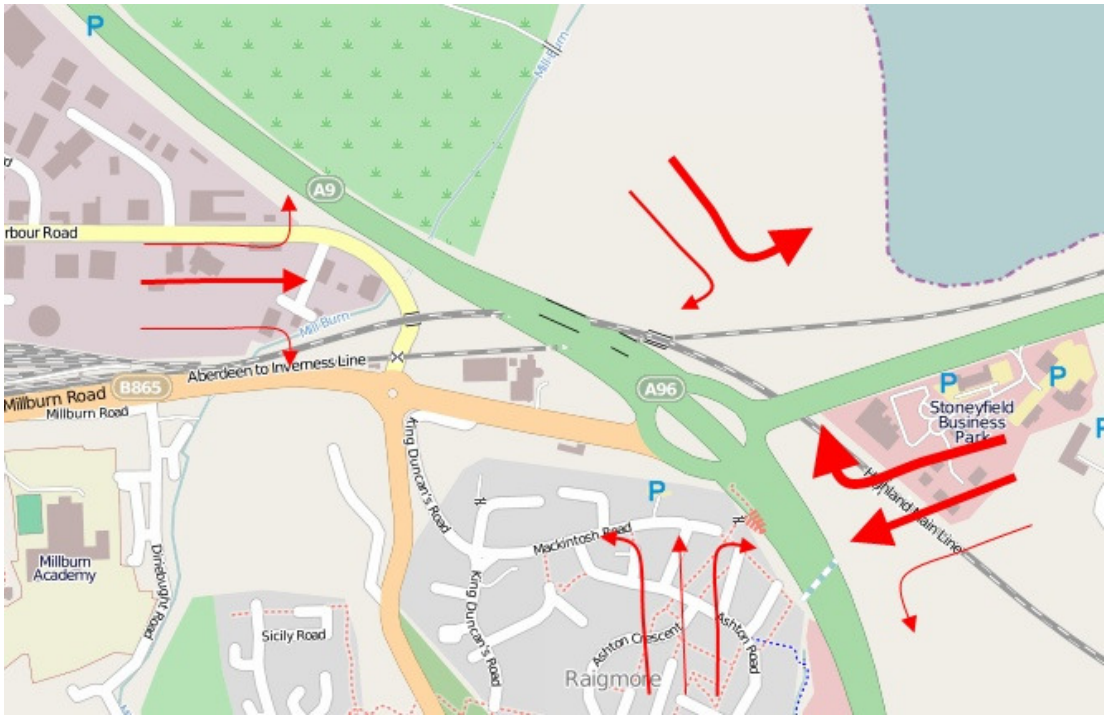
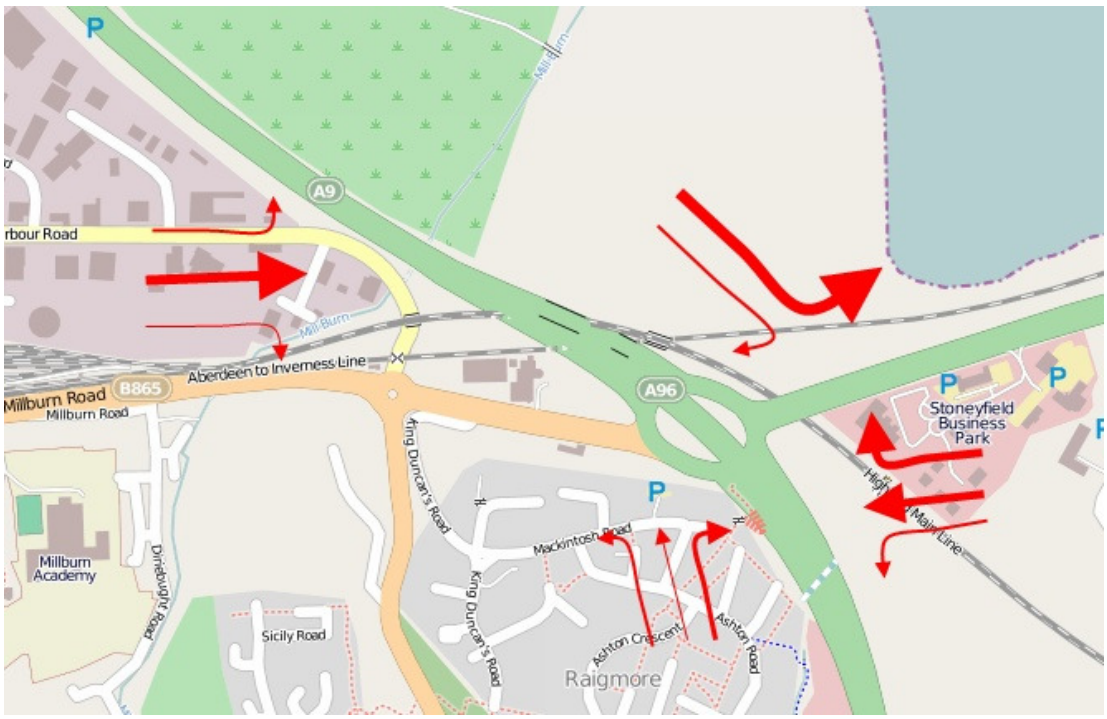


Figure 3: PM traffic flows through Raigmore Interchange (November 2012)



In terms of identifying any current problem with Raigmore Interchange, it appears that it is this north to east movement in the PM time period which is the most important movement to address in terms of providing additional capacity or reducing delay.

3.3 Longman Roundabout

3.3.1 2012 Survey Data

(a) Observed Turning Proportions (2012)

A junction turning count was also undertaken by Streetwise Services Limited on Thursday 22 November 2012 at Longman Roundabout. The level of flow on each approach and the turning proportions are presented in Table 3 below:

Table 3: Observed Turning Proportions at Longman Roundabout (November 2012)

Arm	Time Period	Nov 2012 (vph)	Turning Proportions (Nov 2012)
Stadium Road	AM	70	74% to A9 South (Raigmore) 15% to A9 North (Kessock Bridge) 10% to A82 Longman Road
	IP	141	72% to A9 South (Raigmore) 14% to A9 North (Kessock Bridge) 14% to A82 Longman Road
	PM	239	78% to A9 South (Raigmore) 12% to A9 North (Kessock Bridge) 10% to A82 Longman Road
A9 South (Raigmore)	AM	1,442	60% to A82 Longman Road 33% to A9 North (Kessock Bridge) 6% to Stadium Road
	IP	1,182	52% to A82 Longman Road 41% to A9 North (Kessock Bridge) 7% to Stadium Road
	PM	1,399	52% to A9 North (Kessock Bridge) 46% to A82 Longman Road 2% to Stadium Road
A82 Longman Road	AM	925	54% to A9 South (Raigmore) 35% to A9 North (Kessock Bridge) 6% U-turners 4% to Stadium Road
	IP	1,223	61% to A9 South (Raigmore) 32% to A9 North (Kessock Bridge) 5% U-turners 3% to Stadium Road
	PM	1,494	56% to A9 South (Raigmore) 41% to A9 North (Kessock Bridge) 3% U-turners 1% to Stadium Road
A9 North (Kessock Bridge)	AM	1,353	50% to A9 South (Raigmore) 42% to A82 Longman Road 9% to Stadium Road
	IP	951	50% to A9 South (Raigmore) 43% to A82 Longman Road 6% to Stadium Road

	PM	979	61% to A9 South (Raigmore) 35% to A82 Longman Road 4% to Stadium Road

It should be noted that since this survey was undertaken in November 2012 a number of changes to the local road network were made in advance of maintenance works on the Kessock Bridge, which started in February 2013. It is not clear precisely what impact these changes may have on traffic patterns following completion of the bridgeworks. In particular, the signalisation of the Henderson Road / Longman Road junction to permit a right turn manoeuvre from Henderson Road is likely to virtually eliminate U-turns from the A82 approach.

A new dedicated left turn lane from Stadium Road to the A9 southbound carriageway has been constructed, but it is no longer possible for general traffic to make a straight ahead or right turn manoeuvre from Stadium Road as access to Longman Roundabout from Stadium Road is now designated bus only. The left turn proportion on this turn is therefore effectively 100 per cent following these works.

(b) Principal Movements through Longman Roundabout

Table 4 below summarises the principal movements recorded through Longman Roundabout on 22nd November 2012 across a 12-hour period.

Table 4: Daily Flows for Movements through Longman Roundabout (November 2012)

Movement	12 hour flow (2-way)	Percentage of flow
West to South / South to West	16,656	37%
North to South / South to North	13,224	30%
North to West / West to North	10,324	23%
East to South / South to East	2,158	5%
North to East / East to North	1,093	2%
West to East / East to West	572	1%
U-turners (principally from A82)	657	1%

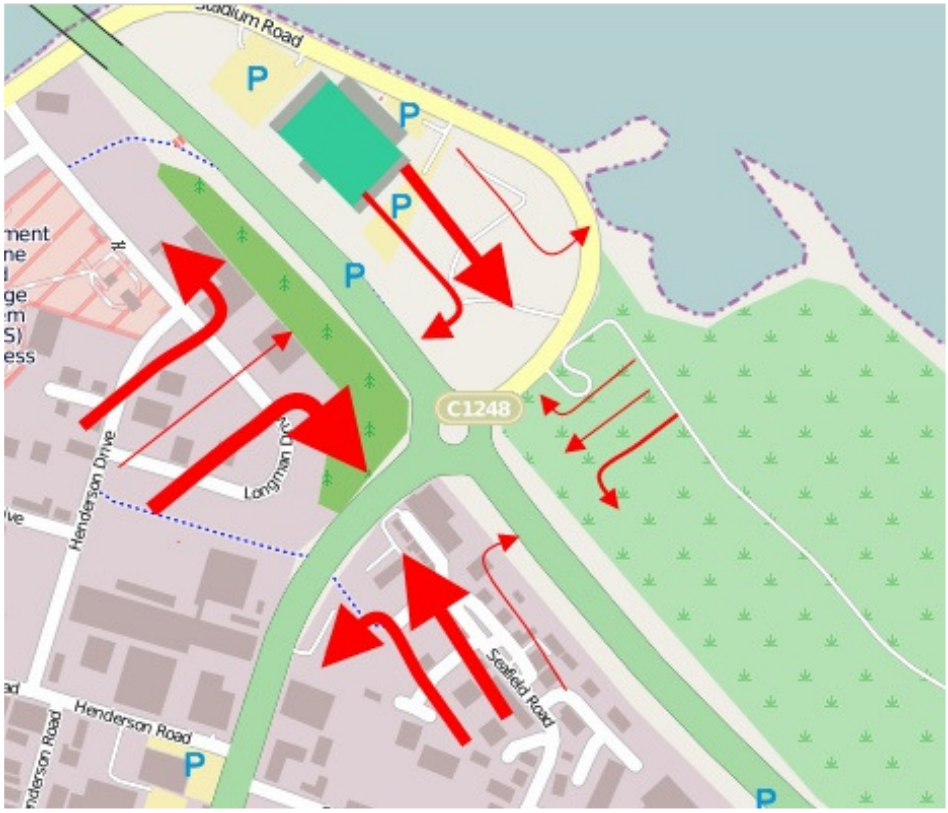
It is noted that the three heaviest two-way movements account for 90 per cent of the traffic using Longman Roundabout: the most significant of these is the West to South movement from the A82 to A9 (south) and vice versa. This may imply that a significant proportion of the traffic from the A96, which is making a right turn onto the A9 northbound carriageway at Raigmore Interchange, then travels along the A82 Longman Road, possibly to access employment areas within Inverness. This is discussed further in relation to the analysis of Bluetooth data and output from the Moray Firth Transport Model (MFTM) in Sections 5 and 6 of this report.

As indicated above, the signalisation of the Henderson Road junction and the changes to the Stadium Road approach will reduce the number of U-turners and also virtually eliminate flows from east to north and east to west.

The AM and PM flows in Table 3 are presented diagrammatically in Figure 4 and Figure 5.

Figure 4: AM traffic flows through Longman Roundabout (November 2012)

Figure 5: PM traffic flows through Longman Roundabout (November 2012)



3.3.2 2009 Survey Data

A junction turning count was undertaken in the AM and PM time periods only at Longman Roundabout by Streetwise Services Limited on Wednesday 11th November 2009 (AM time period only) and Tuesday 17th November 2009 (PM time period only). These surveys indicated that in the AM time period, the peak hour was between 08:00 and 09:00 and in the PM time period, the peak hour was between 16:30 and 17:30. The average flows across each three hour period (07:00 to 10:00 and 16:00 to 19:00 respectively) are summarised in Table 5 below. These are broadly similar to the levels of flow and turning proportions observed in November 2012 and set out in Table 3 above.

Table 5: Observed Turning Proportions at Longman Roundabout (November 2009)

Arm	Time Period	Nov 2009 (vph)	Turning Proportions (Nov 2009)
A82 (south) – Harbour Road	AM	942	36% to A9 North (Kessock Bridge) 2% to Stadium Road 53% to A9 South (Raigmore) 8% U-turners
	PM	1454	45% to A9 North (Kessock Bridge) 1% to Stadium Road 51% to A9 South (Raigmore) 3% U-turners
A9 North (Kessock Bridge)	AM	1341	6% to Stadium Road 49% to A9 South (Raigmore) 45% to A82 Longman Road
	PM	893	5% to Stadium Road 62% to A9 South (Raigmore) 33% to A82 Longman Road
Stadium Road	AM	64	73% to A9 South (Raigmore) 23% to A82 Longman Road 4% to A9 North (Kessock Bridge)
	PM	209	87% to A9 South (Raigmore) 6% to A82 Longman Road 7% to A9 North (Kessock Bridge)
A9 South (Raigmore)	AM	1386	58% to A82 Longman Road 31% to A9 North (Kessock Bridge) 10% to Stadium Road
	PM	1230	45% to A82 Longman Road 53% to A9 North (Kessock Bridge) 2% to Stadium Road

3.3.3 Queue Length Surveys

Queue length surveys were undertaken at various junctions on the A82 through Inverness including Longman Roundabout on Wednesday 11th November 2009. The maximum length of the queue on each approach was recorded at five minute intervals throughout the AM and PM time periods. Although these surveys do not indicate the average duration for which vehicles were delayed, they do indicate the times at which queues build and dissipate within the peak periods and demonstrate the current operational issues with Longman Roundabout.

Table 6 below, shows the queue length on each arm at Longman Roundabout in the AM time period. This indicates that at Longman Roundabout, extensive queues develop on the A9 arm from the north, with the queue typically extending to over one

kilometre for a full one hour period. The maximum queue length was in the order of 1.75 kilometres over the period 08:25 to 08:40. Table 6 also indicates extensive queuing on the A9 arm from the south, although this is noted to be shorter in length, and duration. Queues on the A9 south arm are also longest over the period 08:25 to 08:40 building to almost one kilometre in length. Queue lengths on the Stadium Road and A82 arms are much less significant in the AM time period.

Table 6: Queue Length Surveys at Longman Roundabout (November 2009) - AM

Time	A9 North	Stadium Rd	A9 South	A82
07:00 - 07:05	71	17	44	31
07:05 - 07:10	99	36	44	79
07:10 - 07:15	56	54	39	35
07:15 - 07:20	207	96	152	73
07:20 - 07:25	79	26	44	54
07:25 - 07:30	88	53	78	82
07:30 - 07:35	100	74	106	119
07:35 - 07:40	397	34	248	95
07:40 - 07:45	355	16	397	78
07:45 - 07:50	416	0	391	61
07:50 - 07:55	1044	21	588	56
07:55 - 08:00	1131	85	487	34
08:00 - 08:05	898	91	323	72
08:05 - 08:10	1230	34	472	49
08:10 - 08:15	1379	137	628	40
08:15 - 08:20	1452	46	635	60
08:20 - 08:25	1454	19	635	29
08:25 - 08:30	1748	26	766	28
08:30 - 08:35	1727	122	968	36
08:35 - 08:40	1749	85	870	125
08:40 - 08:45	1571	33	483	44
08:45 - 08:50	1524	74	502	74
08:50 - 08:55	1219	120	347	27
08:55 - 09:00	716	40	149	40
09:00 - 09:05	257	43	364	52
09:05 - 09:10	276	74	142	27
09:10 - 09:15	209	77	80	53
09:15 - 09:20	95	75	94	22
09:20 - 09:25	159	78	145	20
09:25 - 09:30	126	74	118	7
09:30 - 09:35	152	65	99	26
09:35 - 09:40	166	111	78	15
09:40 - 09:45	88	144	24	7
09:45 - 09:50	183	287	114	11
09:50 - 09:55	216	103	69	46
09:55 - 10:00	231	56	114	43

Table 7 below shows the queue length on each arm at Longman Roundabout in the PM time period. This indicates that the most significant queues occur on the A9 arm from the south, although a queue of at least 0.5 kilometres in length was observed on all approaches, albeit these queues occurred at different times within the peak period.

Table 7: Queue Length Surveys at Longman Roundabout (November 2009) - PM

Time	A9 North	Stadium Rd	A9 South	A82
16:00 - 16:05	75	59	266	230
16:05 - 16:10	357	44	301	279
16:10 - 16:15	731	37	626	284
16:15 - 16:20	624	75	677	288
16:20 - 16:25	519	87	864	248
16:25 - 16:30	177	81	1026	68
16:30 - 16:35	55	77	953	307
16:35 - 16:40	103	59	692	310
16:40 - 16:45	146	133	780	263
16:45 - 16:50	127	200	619	187
16:50 - 16:55	63	163	706	358
16:55 - 17:00	38	162	869	406
17:00 - 17:05	50	201	973	401
17:05 - 17:10	82	321	983	328
17:10 - 17:15	68	538	1116	391
17:15 - 17:20	138	564	811	477
17:20 - 17:25	140	553	1046	285
17:25 - 17:30	118	632	1035	442
17:30 - 17:35	44	660	833	481
17:35 - 17:40	52	688	1323	693
17:40 - 17:45	69	712	1315	691
17:45 - 17:50	77	143	1331	694
17:50 - 17:55	27	148	1440	702
17:55 - 18:00	37	131	1386	699
18:00 - 18:05	41	120	1333	696
18:05 - 18:10	38	48	1332	623
18:10 - 18:15	37	26	1332	603
18:15 - 18:20	12	14	1336	646
18:20 - 18:25	17	14	1329	692
18:25 - 18:30	14	13	1330	617
18:30 - 18:35	35	14	1308	672
18:35 - 18:40	22	10	1254	617
18:40 - 18:45	31	10	1222	261
18:45 - 18:50	43	31	69	26
18:50 - 18:55	35	11	25	11
18:55 - 19:00	60	0	35	43

The largest queues on the A9 approach from the north occurred around 16:15 and were of relatively short duration. Queues on the Stadium Road approach exceeded 0.5 kilometres between 17:10 and 17:45, with queues on the A82 arm reaching the same length between 17:35 and 18:40. Extensive queues are noted on the A9 arm from the south for much of the three hour survey period, but queues are longest (in excess of 1.25 kilometres) between 17:35 and 18:40, which broadly corresponds with the peak queues on the A82 approach. On both of these arms the queue length peaked at between 17:50 and 17:55.

These queue lengths are indicated graphically in Appendix A and the maximum queue lengths are shown in Figure 6 and Figure 7 below.

Figure 6: Diagram of Queuing at Longman Roundabout (AM)

It is not clear what impact signalisation of Longman Roundabout in February 2013 is likely to have on queue lengths on each of the approaches to Longman Roundabout.

Figure 7: Diagram of Queuing at Longman Roundabout (PM)

3.4 A82 Harbour Road Roundabout

A junction turning count was undertaken in the AM and PM time periods only at Harbour Road Roundabout on the A82 to the south of Longman Roundabout by Streetwise Services Limited on Wednesday 11th November 2009. This indicated that in the AM time period, the peak hour was between 08:00 and 09:00 and in the PM time period, the peak hour was between 16:00 and 17:00. The average flows across each three hour period (07:00 to 10:00 and 16:00 to 19:00 respectively) are summarised in Table 8 below.

Table 8: Observed Turning Proportions at Harbour Road Roundabout (November 2009)

Arm	Time Period	Nov 2009 (vph)	Turning Proportions (Nov 2009)
A82 (south) – Rose Street Roundabout	AM	913	3% to Harbour Road (west) 58% to A82 Longman Road (north) 37% to Harbour Road (east) 2% U-turners
	PM	1040	3% to Harbour Road (west) 72% to A82 Longman Road (north) 22% to Harbour Road (east) 3% U-turners
Harbour Road (west)	AM	255	51% to A82 Longman Road (north) 42% to Harbour Road (east) 8% to A82 Longman Road (south)
	PM	414	60% to A82 Longman Road (north) 33% to Harbour Road (east) 7% to A82 Longman Road (south)

A82 (north) – Longman Roundabout	AM	1404	10% to Harbour Road (east) 55% to A82 Longman Road (south) 15% to Harbour Road (west) 20% U-turners
	PM	1094	9% to Harbour Road (east) 65% to A82 Longman Road (south) 10% to Harbour Road (west) 16% U-turners
Harbour Road (east)	AM	412	55% to A82 Longman Road (south) 19% to Harbour Road (west) 27% to A82 Longman Road (north)
	PM	335	71% to A82 Longman Road (south) 15% to Harbour Road (west) 14% to A82 Longman Road (north)

Table 8 indicates that the heaviest flows are on the A82, particularly on the approach from Longman Roundabout in the AM time period.

It is not clear what impact changes to junctions on the A82 in February 2013 may impact on travel patterns. Although changes to the Longman Road / Henderson Road junction now permit a right turn manoeuvre from Henderson Road, the continued absence of a right turn facility from Longman Road into Henderson Road implies that the high percentage of U-turn movements from the north is likely to remain.

3.5 A9 / B9006 Inches Junction

A junction turning count was undertaken in the AM and PM time periods only at the signalised junction between the slip roads to and from the A9 southbound carriageway and the B9006 by Streetwise Services Limited on Thursday 12th November 2009. This indicated that in the AM time period, the peak hour was between 08:00 and 09:00 and in the PM time-period the peak hour was recorded between 16:45 and 17:45.

A more recent 12-hour junction turning count was undertaken by Streetwise Services Ltd on Thursday 22nd November 2012, which indicates that traffic levels approaching on the B9006 are slightly lower than in November 2009, while traffic approaching from the A9 has increased. It is not clear whether this growth in traffic from the A9 could be attributed to the recent creation of an additional stacking lane on the slip road. The average flows across each three hour peak period in both years is summarised in Table 9 below, along with inter-peak flows and the turning proportions in November 2012. These turning proportions are not significantly different from the 2009 survey.

Table 9: Observed Turning Proportions at Inches Junction (November 2009)

Arm	Time Period	Nov 2009 (vph)	Nov 2012 (vph)	Turning Proportions (Nov 2012)
B9006 (east)	AM	639	611	99% to B9006 (west) – Inches 1 % to A9 South – Perth
	IP	-	520	98% to B9006 (west) – Inches 2% to A9 South – Perth
	PM	526	520	98% to B9006 (west) – Inches 2% to A9 South – Perth
A9 (Inches)	AM	409	467	77% to B9006 (west) – Inches 23% to B9006 (east) – Culloden
	IP	-	531	73% to B9006 (west) – Inches 27% to B9006 (east) – Culloden
	PM	594	684	72% to B9006 (west) – Inches 28% to B9006 (east) – Culloden
B9006 (west)	AM	336	316	86% to B9006 (east) – Culloden 14% to A9 South – Perth
	IP	-	477	87% to B9006 (east) – Culloden 13% to A9 South – Perth
	PM	688	625	88% to B9006 (east) – Culloden 12% to A9 South – Perth

Table 9 indicates that most traffic from the east proceeds straight through the junction, which is logical as most traffic bound for the A9 southbound carriageway is more likely to use the B9177 to access to the A9 at the Milton of Leys junction. Around three-quarters of traffic from the A9 southbound carriageway turns left towards Inches Roundabout.

The AM and PM flows in Table 9 are presented diagrammatically in Figure 8 and Figure 9 respectively.

Figure 8: AM traffic flows through Inches Junction (November 2012)

Figure 9: PM traffic flows through Inches Junction (November 2012)

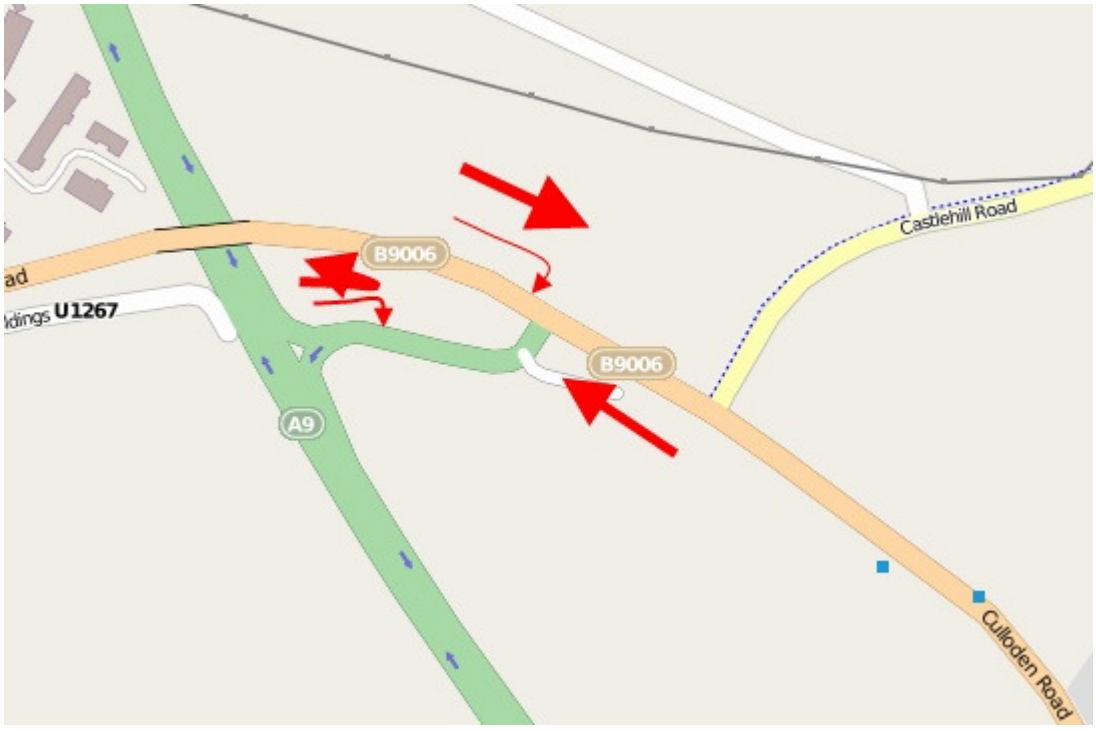


Table 10 summarises the principal movements recorded through Inches East Junction on 22nd November 2012 across a 12-hour period.

Table 10: Daily Flows for Movements through Inches East (November 2012)

Movement	12 hour flow (2-way)	Percentage of flow
East to West / West to East	11,380	60%
A9 to West / West to A9	5,620	30%
A9 to East / East to A9	1,841	10%

Over the 12 hour survey period, traffic flows are not balanced with more traffic on the B9006 heading westbound than eastbound and significantly more traffic approaching the B9006 from the A9 than joining the A9 southbound carriageway. This reflects the layout of the A9 Inches junction and the higher traffic volumes on the A9 carriageway to the north of Inches junction than to the south. Traffic from the north leaving the A9 at Inches to access areas to the west of the A9 will not pass through this junction on the return trip. Traffic from the north leaving the A9 at Inches to access areas to the east are likely to pass through the junction on the return trip, but in an east to west direction, which explains the higher westbound flows on the B9006.

3.6 Inches Roundabout

Inches Roundabout is a six-arm roundabout connecting the B9006, B8082, Inches Retail Park and the Northern Constabulary Police Headquarters. A 12-hour junction turning count was undertaken by Streetwise Services Ltd on Thursday 22nd November 2012. The level of flow on each approach and the turning proportions are presented in Table 11 below:

Table 11: Observed Turning Proportions at Inches Roundabout (November 2012)

Arm	Time Period	Nov 2012 (vph)	Turning Proportions (Nov 2012)
B8082 Sir Walter Scott Drive (North)	AM	134	14% to B9006 (East) – Culloden 13% to Inches Retail Park 25% to B8082 Sir Walter Scott Dr (South) 4% to Police HQ / Drakies Area 42% to B9006 (West) - Culcabock 2% U-turns
	IP	163	17% to B9006 (East) – Culloden 19% to Inches Retail Park 22% to B8082 Sir Walter Scott Dr (South) 8% to Police HQ / Drakies Area 31% to B9006 (West) - Culcabock 3% U-turns
	PM	250	22% to B9006 (East) – Culloden 22% to Inches Retail Park 22% to B8082 Sir Walter Scott Dr (South) 10% to Police HQ / Drakies Area 22% to B9006 (West) - Culcabock 1% U-turns
B9006 (East)	AM	974	14% to Inches Retail Park 21% to B8082 Sir Walter Scott Dr (South) 5% to Police HQ / Drakies Area 29% to B9006 (West) - Culcabock 30% to B8082 (North)

	IP	903	31% to Inches Retail Park 20% to B8082 Sir Walter Scott Dr (South) 2% to Police HQ / Drakies Area 29% to B9006 (West) - Culcabock 18% to B8082 (North)
	PM	995	24% to Inches Retail Park 37% to B8082 Sir Walter Scott Dr (South) 2% to Police HQ / Drakies Area 21% to B9006 (West) - Culcabock 16% to B8082 (North)
Inches Retail Park	AM	423	3% to B8082 Sir Walter Scott Dr (South) 2% to Police HQ / Drakies Area 26% to B9006 (West) - Culcabock 49% to B8082 (North) 19% to B9006 (East) – Culloden
	IP	512	4% to B8082 Sir Walter Scott Dr (South) 2% to Police HQ / Drakies Area 27% to B9006 (West) - Culcabock 45% to B8082 (North) 22% to B9006 (East) – Culloden
	PM	514	5% to B8082 Sir Walter Scott Dr (South) 1% to Police HQ / Drakies Area 21% to B9006 (West) - Culcabock 52% to B8082 (North) 21% to B9006 (East) – Culloden
B8002 Sir Walter Scott Drive (South)	AM	420	3% to Police HQ / Drakies Area 23% to B9006 (West) – Culcabock 57% to B8082 (North) 18% to B9006 (East) – Culloden 1% to Inches Retail Park
	IP	398	2% to Police HQ / Drakies Area 24% to B9006 (West) – Culcabock 41% to B8082 (North) 30% to B9006 (East) – Culloden 2% to Inches Retail Park
	PM	478	1% to Police HQ / Drakies Area 20% to B9006 (West) – Culcabock 40% to B8082 (North) 37% to B9006 (East) – Culloden 1% to Inches Retail Park
Police HQ / Drakies Area	AM	89	10% to B9006 (West) – Culcabock 47% to B8082 (North) 22% to B9006 (East) – Culloden 16% to Inches Retail Park 3% to B8082 Sir Walter Scott Dr (South)
	IP	86	12% to B9006 (West) – Culcabock 31% to B8082 (North) 22% to B9006 (East) – Culloden 25% to Inches Retail Park 11% to B8082 Sir Walter Scott Dr (South)
	PM	133	9% to B9006 (West) – Culcabock 25% to B8082 (North) 25% to B9006 (East) – Culloden 30% to Inches Retail Park 12% to B8082 Sir Walter Scott Dr (South)

B9006 (West)	AM	403	35% to B8082 (North) 31% to B9006 (East) – Culloden 17% to Inches Retail Park 16% to B8082 Sir Walter Scott Dr (South) 1% to Police HQ / Drakies Area
	IP	681	25% to B8082 (North) 30% to B9006 (East) – Culloden 32% to Inches Retail Park 12% to B8082 Sir Walter Scott Dr (South) 1% to Police HQ / Drakies Area
	PM	688	28% to B8082 (North) 36% to B9006 (East) – Culloden 25% to Inches Retail Park 11% to B8082 Sir Walter Scott Dr (South) -% to Police HQ / Drakies Area

Table 11 indicates that the busiest approach is the B9006 from the east. Figure 10 presents the principal flows graphically in the AM peak, while Figure 11 presents the same in relation to the PM peak.

Figure 10: AM traffic flows through Inches Junction (November 2012)

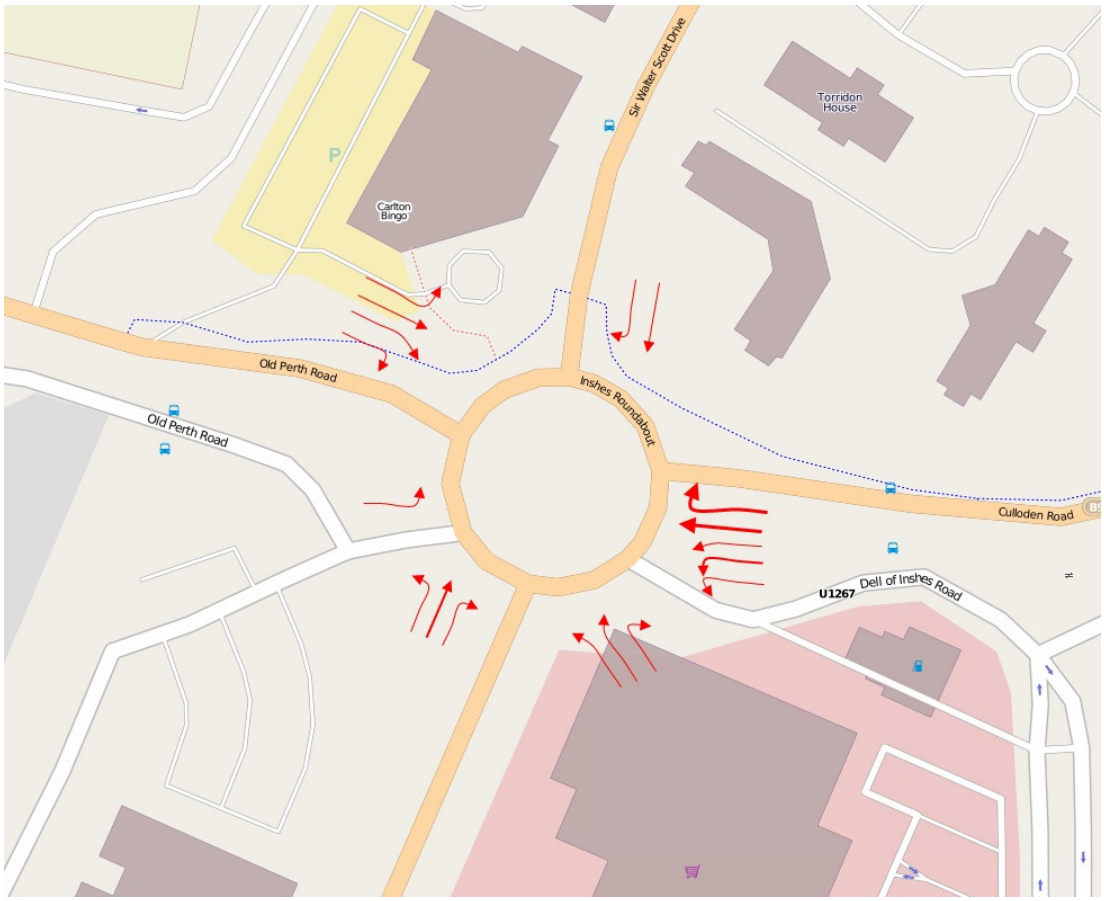


Figure 11: PM traffic flows through Inches Junction (November 2012)

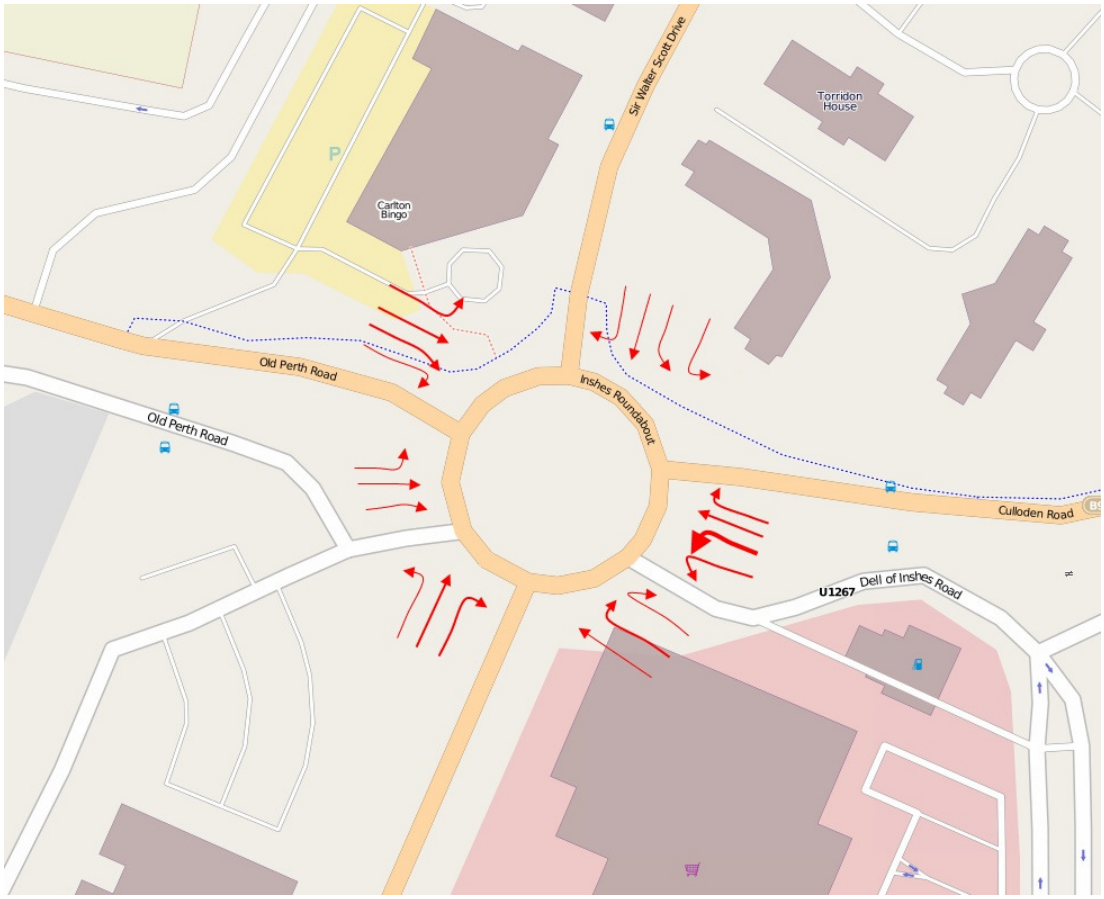


Table 12 summarises the principal movements recorded through Inches Roundabout on 22nd November 2012 across a 12-hour period.

Table 12: Daily Flows for Movements through Inches Roundabout (November 2012)

Movement	12 hour flow (2-way)	Percentage of flow
East to West / West to East	5,527	16%
East to South / South to East	4,270	13%
North to South / South to North	2,762	8%
East to North / North to East	2,727	8%
West to North / North to West	2,651	8%
West to South / South to West	2,050	6%
East to Retail / Retail to East	4,048	12%
West to Retail / Retail to West	3,529	11%
North to Retail / Retail to North	3,211	10%
South to Retail / Retail to South	311	1%
Police to Retail / Retail to Police	388	1%
East to Police / Police to East	565	2%
North to Police / Police to North	557	2%
South to Police / Police to South	221	1%
West to Police / Police to West	176	1%
U-Turns	66	-%

Approximately 60 per cent of traffic travelling through Inches Roundabout uses only the B-road network. The remaining 40 per cent of traffic uses Inches Roundabout to directly access Inches Retail Park, the Police Headquarters or the Drakies housing

area. This indicates that local traffic, terminating or originating in the Inches area is a significant contributor to delays experienced at the Inches Roundabout.

A queuing delay survey was undertaken on four of the six approach arms in the AM and PM time periods by Streetwise Services Limited on Thursday 18th June 2009.

Table 13 sets out the range of observed delays on the approaches that were surveyed.

Table 13: Queue Delays at Inches Roundabout (June 2009)

Approach Arm	Time Period	Minimum Time	Maximum Time	Average Time
B9006 (East arm)	AM	00:01	01:17	00:11
	PM	00:02	10:13 *	00:19
Inches Retail Park	AM	00:03	03:47	00:51
	PM	00:05	03:40	00:36
B8082 (South arm)	AM	00:05	05:22	00:50
	PM	00:05	04:43	01:14
B9006 (West arm)	AM	00:00	00:49	00:14
	PM	00:00	02:15	00:26

Table 13 indicates that in each time period, the largest queuing delays are experienced on the B8082 approach from the south: the maximum delay of over ten minutes recorded on the B9006 east arm is an obvious outlier, as the second highest recorded delay was only 48 seconds. Significant delays were also experienced by vehicles leaving the Inches Retail Park. Of the two arms that connect with the A9 Inches Junction, the B8082 north arm was not surveyed and the B9006 east arm does not indicate substantial levels of delay compared to the delay on other approaches. The delays observed on the B9006 arms are in line with the journey times recorded on the B9006 and discussed in Section 4 and the Bluetooth survey data discussed in Section 5.

3.7 Inches Junction (B8082 / A9)

A junction turning count at the priority junction on the B8082 closest to the A9 northbound carriageway was undertaken by Streetwise Services Ltd on Thursday 22nd November 2012. The average period flows and turning proportions are shown in Table 14.

Table 14: Observed Turning Proportions at Inches Junction (November 2012)

Arm	Time Period	Nov 2012 (vph)	Turning Proportions (Nov 2012)
B8082(North)	AM	128	86% to B8082 (south) - Inches 14% to Local Access
	IP	78	98% to B8082 (south) - Inches 2% to Local Access
	PM	83	96% to B8082 (south) - Inches 4% to Local Access
B8082 (South)	AM	809	15% to Local Access 85% to B8082 (north) - Raigmore
	IP	707	7% to Local Access 93% to B8082 (north) - Raigmore
	PM	824	8% to Local Access 92% to B8082 (north) - Raigmore

Access	AM	27	49% to B8082 (north) - Raigmore 51% to B8082 (south) - Inches
	IP	64	41% to B8082 (north) - Raigmore 59% to B8082 (south) - Inches
	PM	166	45% to B8082 (north) - Raigmore 55% to B8082 (south) - Inches

Table 14 indicates that the dominant movement on the B8082 is in the northbound direction, away from Inches Roundabout towards Raigmore Interchange. This imbalance is consistent with the observations at the A9 / B9006 junction and at Inches Roundabout and is created by traffic originating from the north, which will typically pass through each junction in either the inbound or outbound trip. From the A9 northbound carriageway, the approach flow is highest in the AM time period, with a higher percentage making the right turn movement into the access road than during the remainder of the day. This is balanced by a higher flow from the access road in the PM.

Table 15 summarises the principal movements recorded through Inches North Junction on 22nd November 2012 across a 12-hour period.

Table 15: Daily Flows for Movements through Inches North (November 2012)

Movement	12 hour flow (2-way)	Percentage of flow
North to South / South to North	9,330	83%
Access to / from Inches	1,380	12%
Access to / from A9	491	4%

3.8 B9006 / Tower Road Junction

A junction turning count at the priority junction on the B9006 at the Tower Road junction to the east of the A9 was undertaken by Streetwise Services Ltd on Thursday 22nd November 2012. The average period flows and turning proportions are shown in Table 16.

Table 16: Observed Turning Proportions at B9006 / Tower Road (November 2012)

Arm	Time Period	Nov 2012 (vph)	Turning Proportions (Nov 2012)
Tower Road	AM	265	10% to B9006 (east) 90% to B9006 (west)
	IP	218	15% to B9006 (east) 85% to B9006 (west)
	PM	244	17% to B9006 (east) 83% to B9006 (west)
B9006 (East)	AM	224	87% to B9006 (west) 13% to Tower Road
	IP	151	79% to B9006 (west) 21% to Tower Road
	PM	162	73% to B9006 (west) 27% to Tower Road
B9006 (West)	AM	224	62% to Tower Road 38% to B9006 (east)
	IP	319	60% to Tower Road 40% to B9006 (east)
	PM	512	55% to Tower Road 45% to B9006 (east)

Table 17 summarises the principal movements recorded through the B9006 / Tower Road Junction on 22nd November 2012 across a 12-hour period.

Table 17: Daily Flows for Movements through Inches North (November 2012)

Movement	12 hour flow (2-way)	Percentage of flow
North to West / West to North	4,844	54%
East to West / West to East	3,372	37%
North to East / East to North	805	9%

4 Analysis of Available Journey Time Data

4.1 Introduction

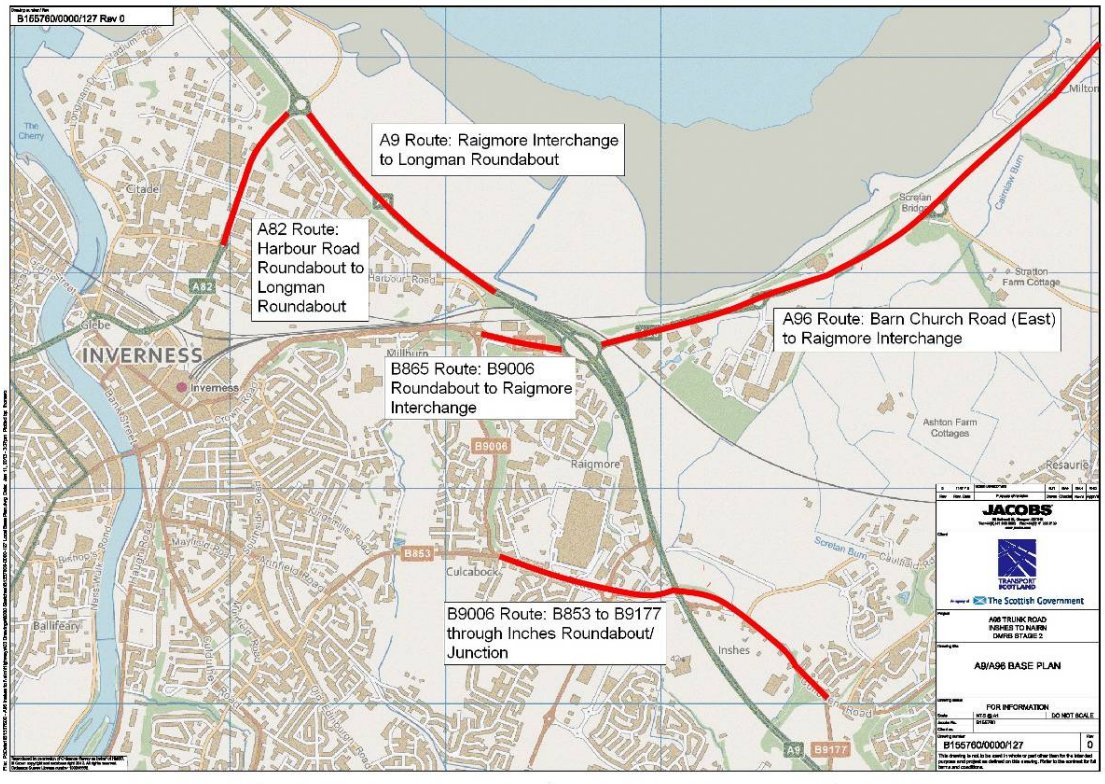
A number of journey time surveys have been undertaken on the road network surrounding Raigmore as part of the development of the Transport Model for Scotland (TMfS) and the Moray Firth Transport Model (MFTM) or for other studies. This data was reviewed and a summary of journey times over the sections of the network with the greatest variability are presented in this section.

The journey time routes considered in this section are:

- *A96 Journey times (Barn Church Road (East) to Raigmore Interchange);*
- *A9 Journey times (Raigmore Interchange to Longman Roundabout);*
- *A82 Journey times (Harbour Road Roundabout to Longman Roundabout);*
- *B865 Journey times (B9006 Roundabout to Raigmore Interchange); and*
- *B9006 Journey times (B853 to B9177 through Inches Roundabout / Junction).*

The journey time routes are also shown in Figure 12 below.

Figure 12: Diagram of Journey Time Routes



4.2 A96 Journey Times

Colin Buchanan were commissioned by Transport Scotland to undertake a data collection exercise in the Nairn area in 2010, which included journey time surveys on the A96 between Gollanfield Crossroads and Raigmore Interchange (Route 6).

Seven journey time surveys were undertaken in the westbound direction in each of the AM, Inter-peak and PM time periods on 21st September 2010. In the eastbound direction, seven surveys were undertaken in the AM period, with six full length surveys conducted in the Inter-peak and PM time periods. A summary of the journey times over the western section of this route between the Barn Church Road East Junction and Raigmore Interchange are presented in Table 18 below.

Table 18: A96 Journey Times - Barn Church Road (East) to Raigmore Interchange (September 2010)

Direction	Time Period	Minimum Time	Maximum Time	Average Time
Westbound	AM	04:08	07:45	05:02
	IP	04:20	05:23	04:59
	PM	04:15	05:33	04:53
Eastbound	AM	04:05	06:30	04:39
	IP	03:56	04:20	04:07
	PM	04:02	04:35	04:15

This appears to indicate slightly greater journey time variability in the AM time period in both directions, although this can primarily be attributed to delays encountered on isolated runs. In the westbound direction, the survey notes record that a gulley cleaning operation on the A96 between the Seafield Business Park Roundabout and the Barn Church Road West Roundabout was creating delays during one specific survey run. Ignoring this run, would reduce the average journey time in the AM period to 04:21, which is broadly in line with the averages in the other time periods. This implies that there are no significant journey time issues on the western end of the A96 in the eastbound direction.

In the westbound direction, despite a single journey time in the AM period being significantly longer than the others, the average journey time across the day is reasonably consistent. The survey records the times at which the survey vehicle reached the back of any queue, as well as the time that it crossed the stop line at each intermediate junction. Closer examination of the slowest journey time survey indicates that the survey vehicle encountered one minute and 27 seconds of queuing delay at the Barn Church Road West Roundabout and only 21 seconds of the longest journey time was attributed to queuing delay at Raigmore Interchange. Only two of the seven surveys recorded any queuing delay at Raigmore Interchange with delays of 15 seconds and 21 seconds being recorded. These delays are in line with those recorded during the queuing delay survey on 18th June 2009 as discussed in Section 3, indicating once more that there does not appear to be any specific journey time or delay issue on the A96 approach to Raigmore Interchange at the present time.

4.3 A9 Journey Times

In addition to the journey time surveys undertaken on the A96, journey time surveys were also undertaken on the A9 between the B851 junction to Fort Augustus and the A82 Longman Roundabout on 21st September 2010 (Route 8). In the northbound direction, journey time variability was greatest on the approach to Longman Roundabout: all journey times were reasonably constant to the south of Raigmore Interchange. Journey times between the north facing slips at Raigmore Interchange (northbound merge and southbound diverge) and Longman Roundabout are presented in Table 19 below:

Table 19: A9 Journey Times - Raigmore Interchange to Longman Roundabout (September 2010)

Direction	Time Period	Minimum Time	Maximum Time	Average Time
Northbound	AM	00:56	05:15	02:17
	IP	00:50	01:18	01:00
	PM	00:52	03:04	01:51
Southbound	AM	00:49	00:55	00:52
	IP	00:48	00:58	00:53
	PM	00:50	01:03	00:55

This indicates that in the absence of queuing delay at Longman Roundabout, drivers may expect to travel this distance is just under one minute. However, the journey time surveys imply that throughout most of the day, drivers in the northbound direction will experience some delay queuing on the A9 southern approach to Longman Roundabout. Eight of the nine surveys undertaken in the AM time period encountered a queue on this arm at Longman Roundabout; six of the eight surveys undertaken in the Inter-peak period also encountered a queue; while six of the seven surveys undertaken in the PM period incurred queuing delay. The queuing delay ranged from as little as three seconds in the Inter-peak period to several minutes at peak times.

None of the northbound surveys recorded the queue from Longman Roundabout extending as far south as Raigmore Interchange: a distance of approximately 1.3 kilometres. However, the queue length survey discussed in Section 3 indicated a maximum queue of more than 1.3 km for part of the PM time period indicating that the queue from the Longman Roundabout can extend into the merge area from the northbound slip road at Raigmore Interchange. Therefore, whilst in general, any queue at Longman Roundabout is perhaps unlikely to adversely impact the operation of Raigmore Interchange, the delay incurred on the A9 northbound carriageway is likely to have an impact on the travel patterns through Raigmore Interchange: the likely delay at Longman Roundabout will potentially determine whether some drivers enter Inverness via the B865 or the A82.

In the southbound direction, journey times between Longman Roundabout and Raigmore Interchange are reasonably consistent at just under one minute.

It is not clear what impact the signalisation of Longman Roundabout in February 2013 is likely to have on journey times on the A9 northbound carriageway.

4.4 A82 Journey Times

A number of journey time surveys were undertaken in the Inverness area by Streetwise Services Limited for the Moray Firth Transport Model (MFTM) in 2009, one of which included the A82 approach to Longman Roundabout from the southwest (Inner Route 2). Six journey time surveys were undertaken in each direction during the AM time period and eight journey time surveys were undertaken in each direction in the PM period on 19th November 2009. No surveys were undertaken in the Inter-peak period.

Journey time variability was greatest on the approach to Longman Roundabout in the PM time period: journey times between Harbour Road Roundabout and Longman Roundabout are presented in Table 20 below:

Table 20: A82 Journey Times – Harbour Road Roundabout to Longman Roundabout (November 2009)

Direction	Time Period	Minimum Time	Maximum Time	Average Time
Northbound	AM	01:06	01:15	01:09
	PM	01:10	04:54	02:28
Southbound	AM	01:04	02:20	01:29
	PM	01:05	01:11	01:07

Table 20 indicates that under typical traffic conditions, journeys on the A82 between Harbour Road Roundabout and Longman Roundabout take a little more than one minute. In the southbound direction, a single journey time survey recorded a time of two minutes and 20 seconds. This survey run commenced just after 08:30 implying this is likely to be around the time of peak demand for travel into Inverness in the morning. The survey runs undertaken approximately ten minutes earlier and ten minutes later recorded times close to the average. This implies that peak traffic conditions and the consequential delays in the AM time period are of relatively short duration.

Table 21 presents the eight surveyed journey times on the A82 northbound approach to Longman Roundabout in the PM time period. These indicate that journey times increase to peak around 17:15 before dropping back to typical travel times of just over one minute by around 17:45. Journey times of more than two minutes are however noted over five consecutive survey runs over a period of approximately one hour implying that the PM peak is of significantly longer duration than the AM peak. It is noted that the survey run that encountered the largest journey time between Harbour Road Roundabout and Longman Roundabout also encountered a significantly greater travel time on the A82 between Rose Street Roundabout and Harbour Road Roundabout.

Table 21: A82 Journey Times (PM Profile) – Harbour Road Roundabout to Longman Roundabout (November 2009)

Approximate Survey Time	Journey Time
16:39	02:35
16:50	02:42
17:04	03:17
17:18	04:54
17:29	02:14
17:47	01:10
17:51	01:36
18:07	01:13

This indicates the likely timing of peak travel demand approaching Raigmore Interchange from the north and is consistent with the peak recorded from the junction turning count at Raigmore Interchange undertaken on 18th June 2009. Although a similar pattern of delay may be expected on the A9 southbound diverge slip road at Raigmore Interchange, the presence of traffic signals tends to randomise the delay experienced by drivers at this later location.

4.5 B865 Journey Times

In addition to the surveys undertaken on the A82, journey time surveys were also undertaken on the B865 approach to Raigmore Interchange on the 11th November

2009 (Inner Route 3). Six journey time surveys were undertaken in each direction in both the AM and PM time periods: no surveys were undertaken in the Inter-peak period.

Table 22 below presents a summary of journey times between the B9006 Old Perth Road / Harbour Road Roundabout and Raigmore Interchange:

Table 22: B865 Journey Times – Old Perth Road to Raigmore Interchange (November 2009)

Direction	Time Period	Minimum Time	Maximum Time	Average Time
Eastbound	AM	00:37	00:50	00:43
	PM	00:43	02:51	01:16
Westbound	AM	00:31	01:16	00:41
	PM	00:26	00:51	00:37

Table 22 indicates that under typical traffic conditions, journeys on the B865 between the B9006 Old Perth Road Roundabout and Raigmore Interchange take less than one minute. In the westbound direction, a single journey time survey recorded a time of one minute and 16 seconds: this survey run commenced just after 08:37, which is slightly later than the peak journey time on the A82. This could indicate that once delays at Longman Roundabout and on the A82 start to peak in the morning, some drivers reroute to enter Inverness via the B865. The queue length survey at Longman Roundabout, as discussed in Section 3, indicated that the maximum queue on the A9 northbound carriageway was experienced between 08:30 and 08:35. As on the A82, the duration of the peak is relatively short, with the survey runs approximately ten minutes earlier and later indicating little or no delay.

In the eastbound direction, only two of the six journey time surveys exceed 50 seconds. The journey time of two minutes and 51 seconds was recorded on approach to Raigmore Interchange at approximately 17:21 and a journey time of one minute and 37 seconds was recorded at 17:39. Again, this is consistent with, but slightly later than the timing of the peak recorded at Longman Roundabout, possibly indicating different routing occurring once the delays at Longman Roundabout reach a certain level.

4.6 B9006 Journey Times

Several journey time surveys were undertaken throughout the day along the B9006 on the 16th, 17th and 18th June 2009 by Streetwise Services Limited. The eastern extent of these journey time surveys was at the B9006 junction with the A96 with the western end incorporating a loop via the B9006, B865 through Raigmore Interchange and A9 to return to the B9006 at Inches Junction. Two sections of this route not previously discussed include the section through Inches Junction and Roundabout in the east to west and west to east directions and the slip road from the A9 southbound carriageway to the B9006.

Table 23 below indicates average journey times along the B9006 through Inches Roundabout and Inches Junction from the B853 Culcabock Road to the B9177 Drumossie Road.

Table 23: B9006 Journey Times –B853 Culcabock Road to B9177 Drumossie Road (June 2009)

Direction	Time Period	Minimum Time	Maximum Time	Average Time
Eastbound	AM	02:46	05:16	04:06
	IP	02:48	05:49	04:08

	PM	03:37	12:53	05:58
Westbound	AM	02:20	09:30	04:30
	IP	02:35	07:56	03:33
	PM	02:54	04:31	03:32

In the eastbound direction, journey times are highest in the PM time period. For the largest journey times, the majority of the delay is experienced on the section of the B9006 between Inches Roundabout and the signalised junction to the east providing access to the A9 southbound carriageway (Inches Junction). In the westbound direction, journey times are highest in the AM time period. For the largest journey times, the majority of the delay is experienced on the first part of the route between the B9177 and the slip road from the A9 southbound carriageway (Inches Junction).

In both directions, the signalised junction connecting the B9006 to the A9 appears to be a more significant contributor to journey time variability on the B9006 than Inches Roundabout.

Table 24 below indicates the average journey times from Raigmore Interchange to the B9006 via the A9 Inches Junction. A total of ten surveys were undertaken over the three survey days in the AM time period, 19 surveys in the Inter-peak period and 11 surveys in the PM time period.

Table 24: Journey Times – Raigmore Interchange to B9006 via A9 Inches Junction (June 2009)

Direction	Time Period	Minimum Time	Maximum Time	Average Time
Southbound	AM	01:21	04:56	02:32
	IP	01:21	03:48	02:03
	PM	01:20	07:58	03:10

Table 24 indicates that a journey from Raigmore Interchange to the B9006 via the Inches Junction may take as little as one minute and 20 seconds, although this will depend on the level of traffic and the display aspect of the B9006 traffic signals on arrival. The highest average and maximum journey times were recorded in the PM time period. An intermediate timing point was recorded at the point of diverge from the A9 southbound carriageway. Journey time variability is noted on the A9 southbound carriageway upstream of the diverge point, which may imply that the queue from the B9006 traffic signals sometimes extend back to the A9 carriageway and may therefore influence the speeds of traffic approaching on the A9 carriageway.

It is not clear to what extent the impact of the creation of an additional stacking lane on the slip road has reduced the tendency of queues at the signals to block back to the A9.

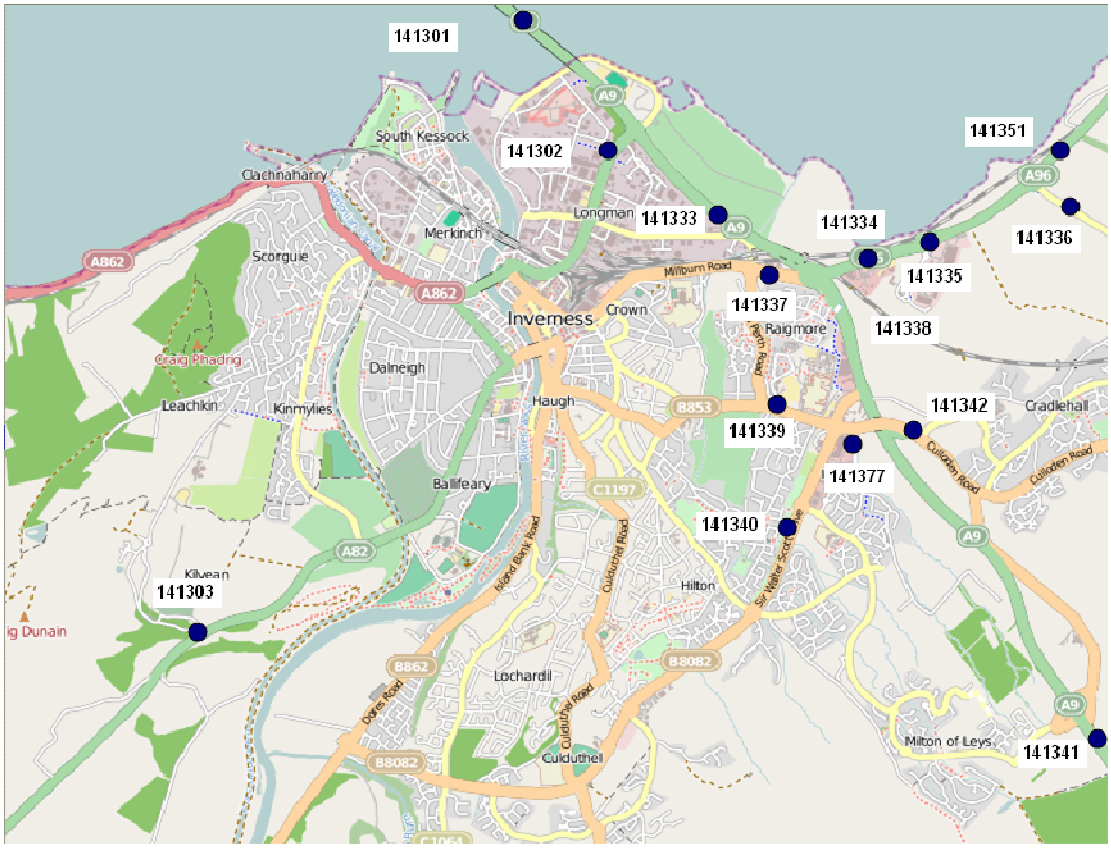
5 Bluetooth Data Analysis

5.1 Survey Locations

Transport Scotland commissioned the temporary placement of a number of Bluetooth detectors adjacent to the trunk road network over a nine day period in February 2012. Each detector records the presence of a Bluetooth enabled device passing in the vicinity of the detector and the device identification codes were matched across detector pairs. This provides an indication of the number of devices passing between any two detection locations and the time taken to travel between these points. This data cannot be used to establish vehicle flows at any point on the network nor does it contain any routing information: it has to be assumed that a travel time is via the most logical route. As such the data was only used in aggregate to gauge journey time variation over relatively short distances and to confirm that the trip distribution patterns obtained from the Moray Firth Transport Model (MFTM) were logical.

Bluetooth detectors were placed at the locations shown in Figure 13 below.

Figure 13: Diagram of Bluetooth data sites



The Bluetooth data was used to establish the observed range of journey times between receptors as discussed overleaf and to validate the flow patterns obtained from the Moray Firth Transport Model (MFTM) as presented in Section 6.

5.2 Journey Time Variation from Bluetooth Data

5.2.1 Overview

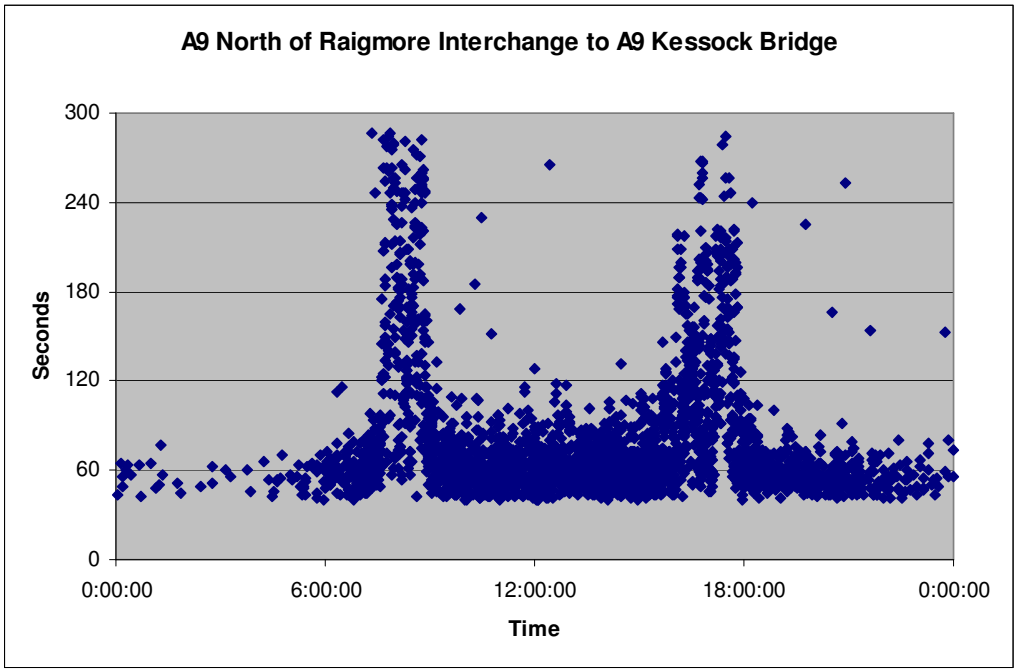
Each of the matched pairs of Bluetooth detector locations are relatively close together and therefore the journey times between these would be expected to be relatively short: in the order of a few minutes. However, the raw Bluetooth data contains matches where the travel time may be recorded as hours or even days. Such data may occur if, for example, the Bluetooth device is no longer transmitting a signal as it passes the second detector but is detected at the second location on a subsequent journey; the driver of a vehicle stops for any reason between the detector locations; or the device detected may be carried by a pedestrian or cyclist, who may follow a different route and may not travel at the speed of general traffic.

It was therefore necessary to 'clean' the data by removing such random outliers. This was achieved by ascertaining the journey time for each percentile of data. Where the variation in journey time between one percentile and the next was low, the data was considered to be robust, but journey times above the point at which travel times varied significantly were filtered out. Only weekday data has been used for this exercise. A large set of relevant journey time data is presented in Appendix B, but the following sections provide evidence of where problems with journey time variability and delays exist.

5.2.2 A9 delays at Longman Roundabout

The survey data presented in Sections 3 and 4 of this report indicates problems with queuing and journey time variation on the A9 at Longman Roundabout. The data presented in Figure 14 below also shows significantly longer journey times through Longman Roundabout in the northbound direction in both the AM and PM peaks. This is consistent with the significant queuing that occurs on the southern approach to Longman Roundabout at these times.

Figure 14: Bluetooth journey time graph for A9 north of Raigmore Junction to Kessock Bridge



Note that the travel times obtained from the Bluetooth data are from the first detector location and not the back of any queue. Where queue from Longman Roundabout extend beyond the detector location, a greater level of delay may be encountered.

Figure 15 indicates that in the southbound direction, journey times on the A9 are observed to peak in the AM time period, which is consistent with the long queues noted on the Kessock Bridge at that time. Again, the travel times are from the detector location, not the back of the observed queue. No significant increase in journey times is noted in the PM period, which is consistent with the significantly shorter queues observed at this time.

Figure 15: Bluetooth journey time graph for A9 Kessock Bridge to north of Raigmore Junction

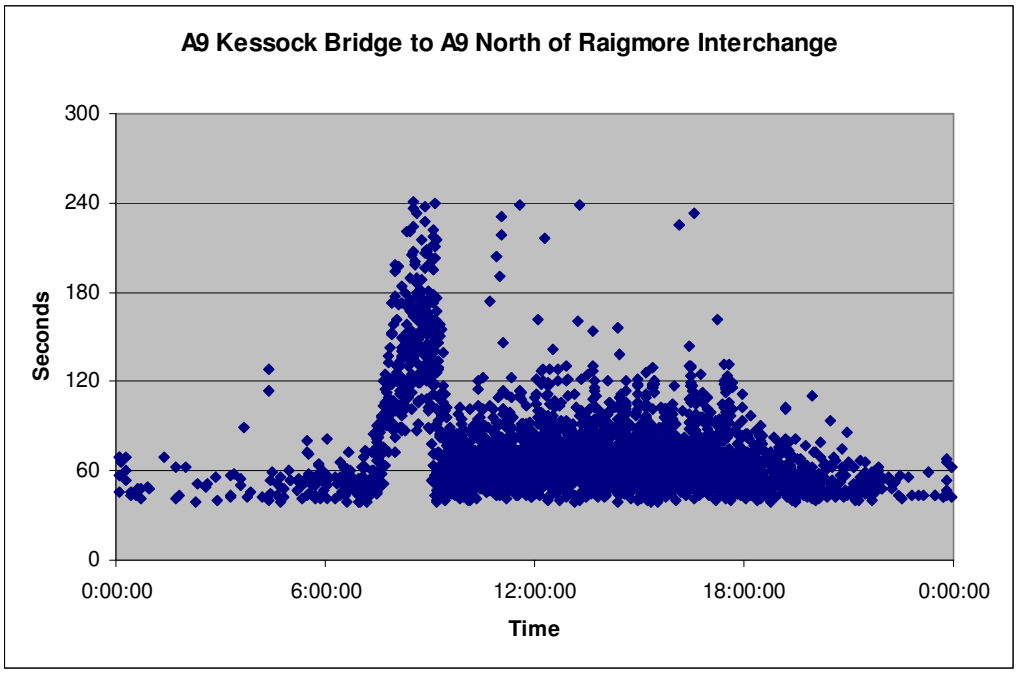
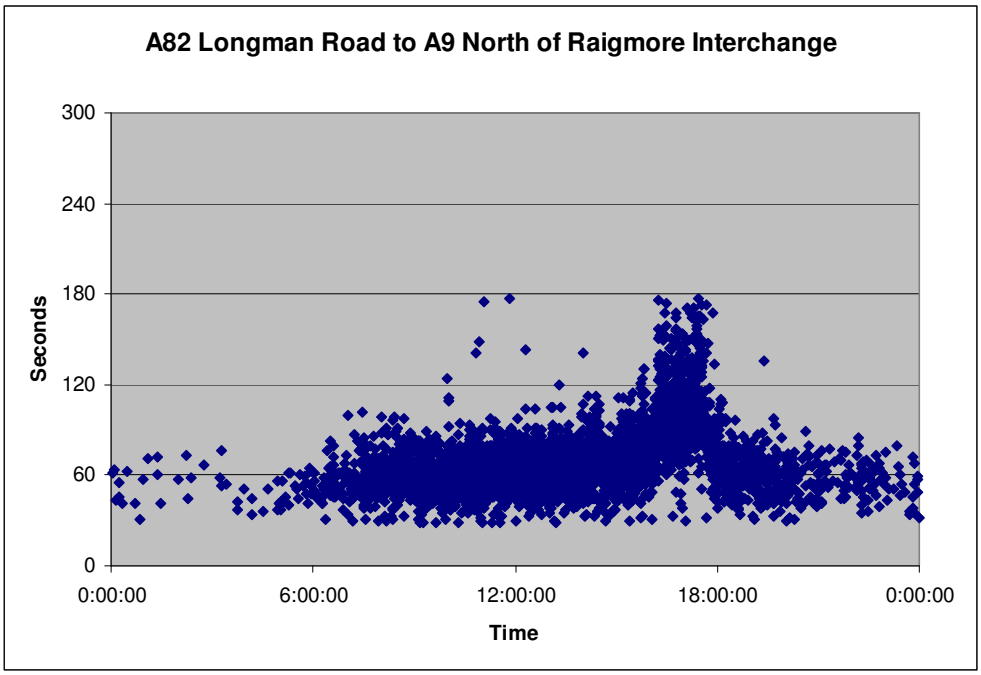


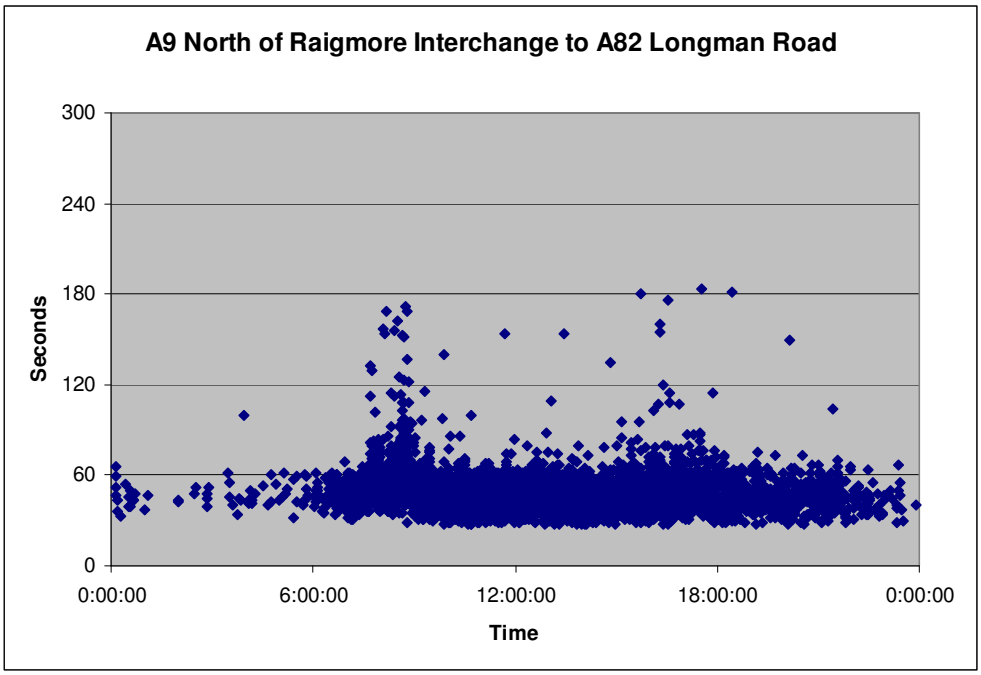
Figure 16 indicates longer journey times in the PM peak for traffic travelling between the A82 Longman Road and the A9 north of Raigmore Interchange. Again, this is consistent with the queuing observed at this location in the PM.

Figure 16: Bluetooth journey time graph for A82 Longman Road to A9 North of Raigmore Interchange



For traffic travelling from the A9 north of Raigmore Interchange to the A82, a segregated left turn lane was provided at Longman Roundabout at the time of the survey, which means that this traffic stream did not have to give way to any conflicting movement at the roundabout. Figure 17 indicates that although this traffic stream may not give way, journey times in the AM period may be slightly longer than at off-peak times, potentially due to delays resulting from weaving traffic making lane change manoeuvres on the approach. However, the delays are significantly less than shown in Figure 14 for traffic travelling from the same point across the Kessock Bridge.

Figure 17: Bluetooth journey time graph for A9 North of Raigmore Interchange to A82 Longman Road



5.2.3 Raigmore Interchange

The queue delay survey undertaken at Raigmore Interchange in June 2009, as presented in Section 3 of this report, indicates that the principal location at which delays occur is at the traffic signals on the A9 southbound diverge slip road, although some delay is also noted on the B865 approach. Figure 18 shows travel times for north to east movements through Raigmore Interchange, which whilst demonstrating a small increase in typical journey times in the PM peak does not present a clear problem. Figure 19 shows travel times for west to east movements through Raigmore Interchange, which also indicates an increase in the spread of travel times during the PM peak.

Figure 18: Bluetooth journey time graph for A9 North of Raigmore to A96 East of Raigmore Interchange

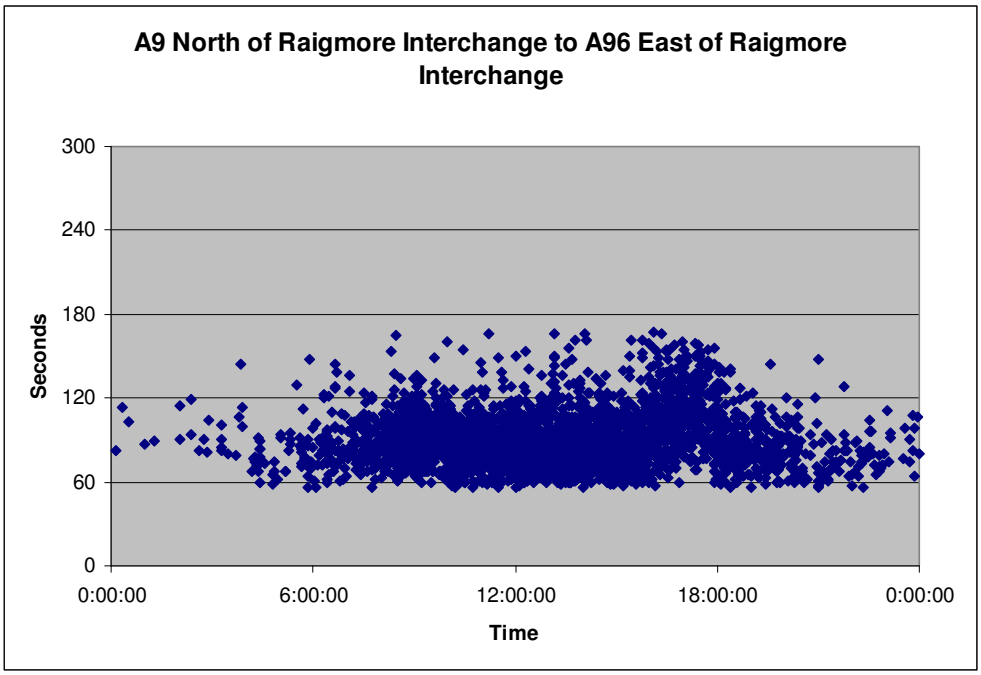
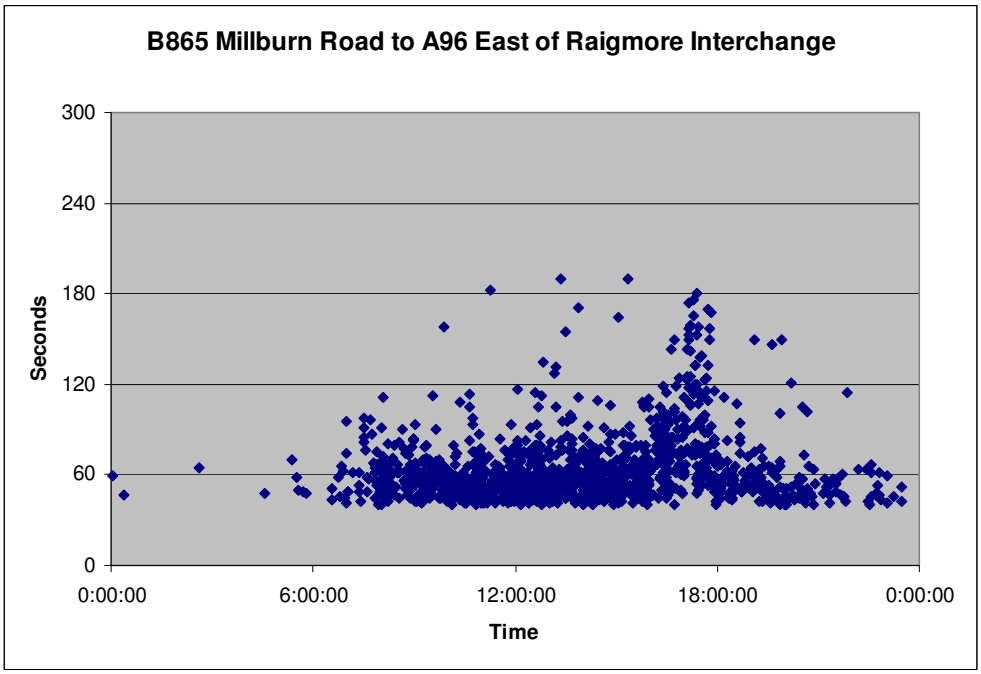


Figure 19: Bluetooth journey time graph for B865 Millburn Road to A96 East of Raigmore Interchange

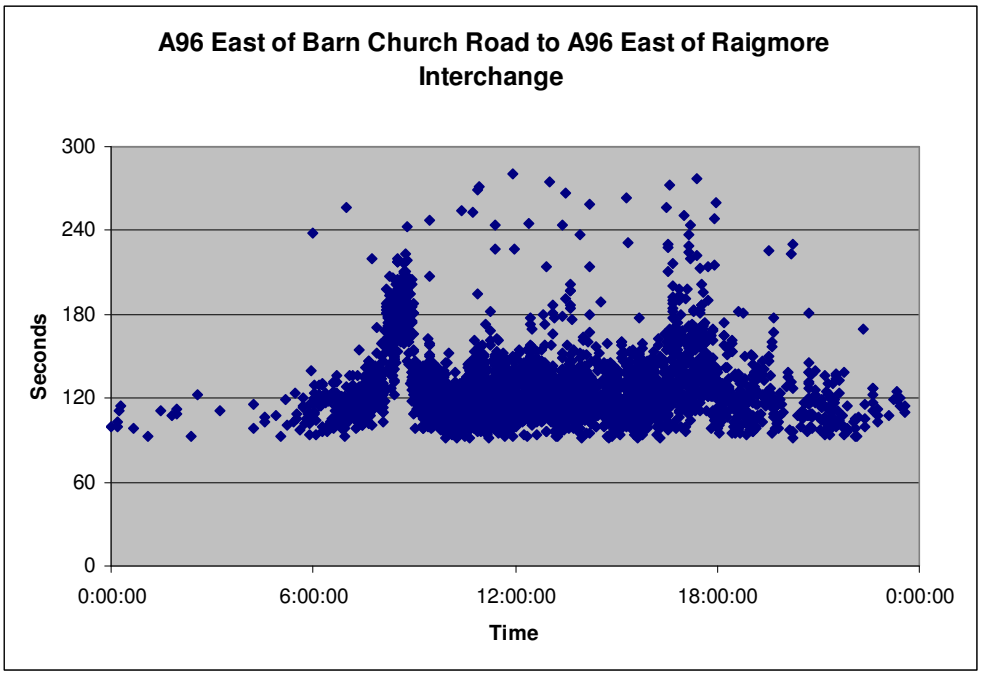


5.2.4 A96 east of Raigmore Interchange

Figure 20 shows travel times on the A96 westbound from east of Barn Church Road to east of Raigmore Interchange. Lengthened journey times are observed in the AM peak and a small increase in journey time variability is also noted in the PM peak. This indicates that delays are likely at peak times at either or both of the roundabouts at Barn Church Road and the Inverness Retail Park. It is not possible

to ascertain from the Bluetooth data at which of these locations the majority of any delays may be experienced.

Figure 20: Bluetooth journey time graph for A96 East of Barn Church Road to A96 East of Raigmore Interchange



5.2.5 Inches Roundabout

Figure 21 shows travel times for the west to east movement through Inches Roundabout, while Figure 22 shows travel times in the reverse direction. Both data sets show that travel times on the B9006 can be variable with journeys typically taking between two and four minutes, but no specific issues are highlighted in either the morning or evening peak.

Figure 21: Bluetooth journey time graph for B9006 through Inches Roundabout (eastbound)

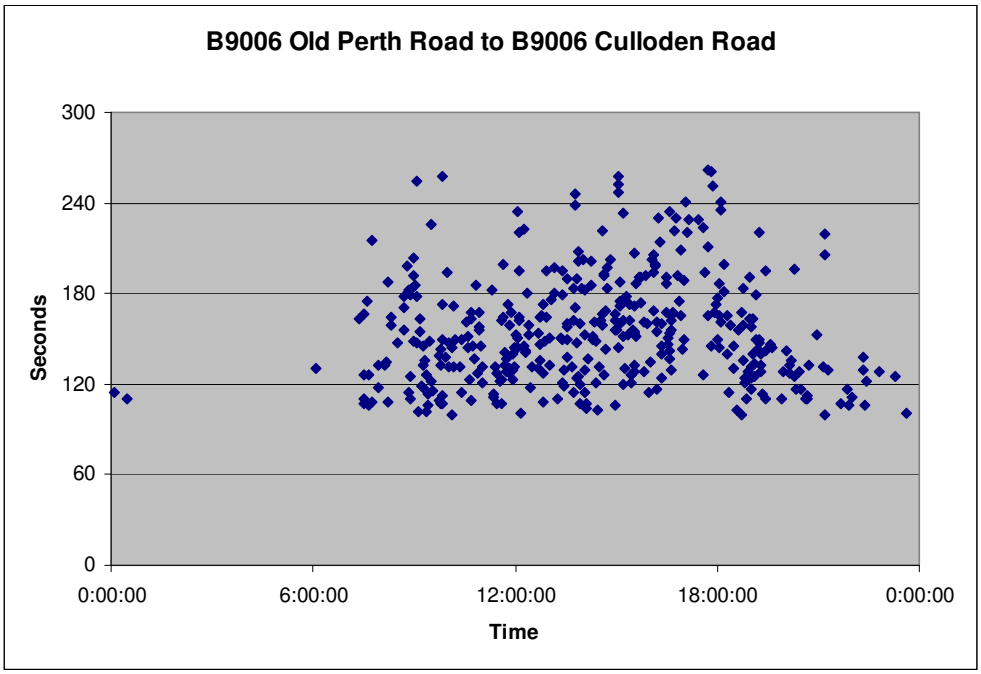
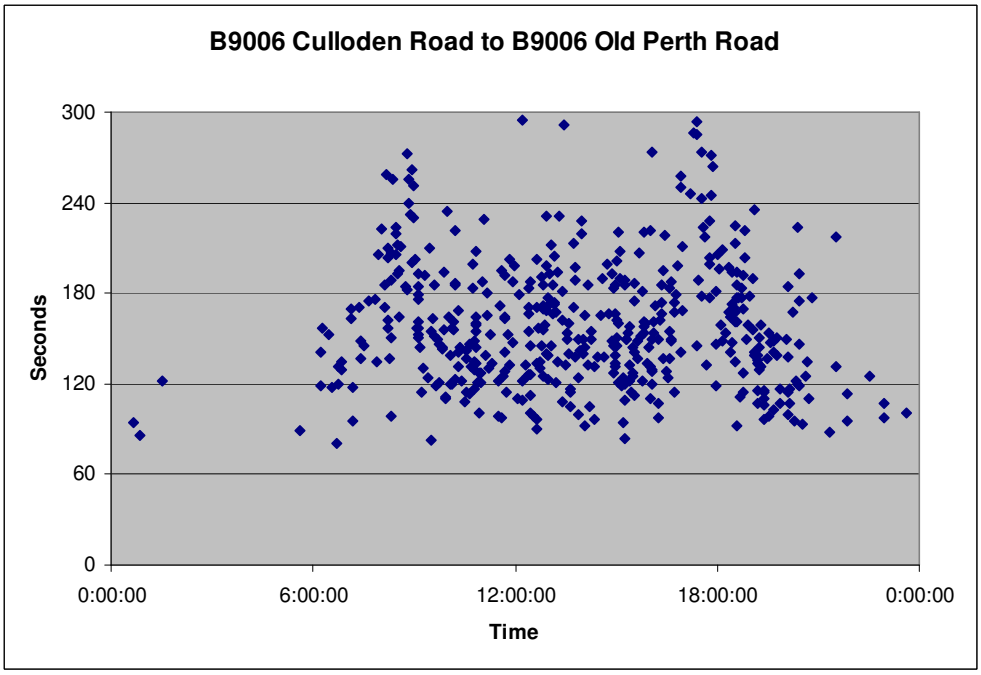


Figure 22: Bluetooth journey time graph for B9006 through Inches Roundabout (westbound)



5.3 Bluetooth data summary

The Bluetooth data usefully confirms potential journey time reliability issues at a number of locations where problems were noted in the analysis of other data sources. The number of cleaned observations made between pairs of detectors also provides a useful indication of the dominant movements, which was used to verify that the traffic patterns obtained from the Moray Firth Transport Model (MFTM) and discussed in Section 6 are logical

6 Analysis of A96 Traffic in the Moray Firth Transport Model

6.1 Introduction

The Moray Firth Transport Model (MFTM) was used to provide an approximate breakdown of where inbound traffic on the A96 during the AM peak may be travelling to. This was achieved by creating "flow bundles": the VISUM equivalent to Select Link Analysis. The results of which are displayed in Appendix C.

6.2 A96 Westbound Traffic Destinations (AM)

In the 2009 AM base model the modelled flow on the link approaching Raigmore Interchange is 1721 vehicles per hour (vph). At Raigmore Interchange this flow splits as follows:

- *B865 towards Inverness – 868 vph (50 per cent of the A96 flow);*
- *A9 North towards Longman Roundabout – 736 vph (43 per cent of the A96 flow); and*
- *A9 South towards Inches Junction – 116 vph (seven percent of the A96 flow).*

This pattern is not dissimilar to the observed data presented earlier and therefore it may be concluded that the MFTM is likely to present a good representation of likely onward bound trip patterns.

The model indicates that of the 50 per cent of traffic that travels towards Inverness on the B865 from Raigmore Interchange in the AM peak:

- *310 vph (18 per cent of the A96 flow) subsequently turns right onto Harbour Road to access businesses on Harbour Road or Seafield Road;*
- *290 vph (17 per cent of the A96 flow) continues on Millburn Road to the west of Diriebught Road travelling towards the city centre;*
- *76 vph (four per cent of the A96 flow) turns left onto Diriebught Road;*
- *173 vph (ten per cent of the A96 flow) turns left onto the B9006 Old Perth Road; and*
- *20 vph (one per cent of the A96 flow) turns left onto King Duncan's Road to access the Raigmore Housing Estate.*

Of the 43 per cent of traffic that travels northbound on the A9 towards Longman Roundabout in the AM peak the model indicates that:

- *198 vph (12 per cent of the A96 flow) crosses the Kessock Bridge;*
- *3 vph turns right onto the B9168 Stadium Road at Longman Roundabout; and*
- *534 vph (31 per cent of the A96 flow) turns left at Longman Roundabout onto the A82.*

Of this flow that turns left at Longman Roundabout in the AM peak the model indicates that:

- *150 vph (nine per cent of the A96 flow) U-turns at Harbour Road Roundabout to access Henderson Road;*
- *53 vph (three percent of the A96 flow) turns right at Harbour Road Roundabout to access Harbour Road (West), 15 vph (one per cent of the A96 flow) of which rejoin the A82 at Shore Street Roundabout;*
- *66 vph (four per cent of the A96 flow) proceeds straight through Harbour Road Roundabout to Rose Street;*
- *41 vph (two per cent of the A96 flow) bears right at Shore Street Roundabout to access Grant Street;*
- *8 vph turns proceeds through Harbour Road and Shore Street Roundabouts to turn sharp left at Telford Roundabout onto Wells Street;*
- *61 vph (four per cent of the A96 flow) proceeds straight through Harbour Road and Shore Street Roundabouts to turn left at Telford Roundabout onto A82 Kenneth Street;*
- *81 vph (five per cent of the A96 flow) proceeds straight through Harbour Road and Shore Street Roundabouts to proceed straight ahead at Telford Roundabout onto Harrowden Road; and*
- *91 vph (five per cent of the A96 flow) proceeds straight through Harbour Road and Shore Street Roundabouts to turn right at Telford Roundabout onto the A862 Telford Street;*

Only 35 vph (two per cent of the A96 flow) leaves Inverness on the A82 to the south of General Booth Road at Torvean in the AM peak.

Of the seven per cent of traffic that travels southbound on the A9 towards Inches Junction in the AM peak the model indicates that:

- *49 vph (three per cent of the A96 flow) leaves the A9 at Inches Junction, turning left onto the B9006 and then turns left at Inches Roundabout onto the B8082 Sir Walter Scott Drive;*
- *25 vph (one per cent of the A96 flow) leaves the A9 at Inches Junction, turning left onto the B9006 to access Inches Retail Park;*
- *23 vph (one per cent of the A96 flow) leaves the A9 at Inches Junction, turning left onto the B9006 and then turning right at Inches Roundabout to access the Beechwood Business Park;*
- *12 vph (one per cent of the A96 flow) leaves the A9 at Inches Junction bound for local properties along the B9006;*
- *5 vph continue on the A9 south of Inches Junction; and*
- *3 vph are bound for the Northern Constabulary Police Headquarters at Inches Roundabout.*

This analysis indicates that most of the traffic travelling west on the A96 in the morning peak is bound for Inverness: only 14 per cent of the flow leaves the Inverness area on the trunk road network either crossing the Kessock Bridge, leaving Inverness on the A82 at Torvean or continuing on the A9 south of the Inches Junction.

The traffic travelling southwards towards Inches is primarily local traffic bound for the Inches area or destinations along the B8082 Sir Walter Scott Drive. Traffic travelling towards Inverness on the B865 is primarily bound for the east Longman area, the city centre, or the Crown, Raigmore, Drakies or Culduthel areas. A significant proportion of the traffic travelling northwards towards Longman Roundabout crosses the Kessock Bridge but the majority of traffic making a right

turn at Raigmore Interchange uses the A82 Longman Road to access areas to the north and west of the city.

The model indicates that most traffic from the A96 passes through Harbour Road Roundabout from the northeast on the A82 Longman Road, but the model also indicates that one vehicle approaches from the east having taken a path via the B865. This implies that traffic travelling via Longman Roundabout is primarily travelling to destinations north of the A82 or west of the River Ness and the A82 itself may be regarded as close to the breakpoint which broadly indicates which route a driver approaching Raigmore Interchange is most likely to take.

A similar observation may be made with respect to the south, with the breakpoint between traffic using the B865 and those using the Inches Junction lying immediately west of the existing Inches Roundabout. Traffic travelling to both Raigmore Hospital and the Drakies residential area routes via the B865 and the B9006 Old Perth Road in the AM model.

6.3 A96 Westbound Traffic Destinations (PM)

The process was repeated for the PM peak. In the 2009 PM base model the modelled flow on the link approaching Raigmore Interchange is 1255 vehicles per hour (vph). At Raigmore Interchange this flow splits as follows:

- *A9 North towards Longman Roundabout – 597 vph (48 per cent of the A96 flow);*
- *B865 towards Inverness – 515 vph (41 per cent of the A96 flow);*
- *and*
- *A9 South towards Inches Junction – 141 vph (11 percent of the A96 flow).*

As this pattern is again not dissimilar to the observed data presented earlier it may be concluded that the MFTM is likely to present a good representation of likely onward bound trip patterns in PM time period.

The model indicates that of the 41 per cent of traffic that travels towards Inverness on the B865 from Raigmore Interchange in the PM peak:

- *64 vph (five per cent of the A96 flow) subsequently turns right onto Harbour Road to access businesses on Harbour Road or Seafield Road;*
- *186 vph (15 per cent of the A96 flow) continues on Millburn Road to the west of Diriebught Road travelling towards the city centre;*
- *14 vph (one per cent of the A96 flow) turns left onto Diriebught Road;*
- *232 vph (18 per cent of the A96 flow) turns left onto the B9006 Old Perth Road; and*
- *19 vph (two per cent of the A96 flow) turns left onto King Duncan's Road to access the Raigmore Housing Estate.*

Of the 48 per cent of traffic that travels northbound on the A9 towards Longman Roundabout in the PM peak the model indicates that:

- *260 vph (21 per cent of the A96 flow) crosses the Kessock Bridge;*
- *7 vph (one per cent of the A96 flow) turns right onto the B9168 Stadium Road at Longman Roundabout; and*
- *330 vph (26 per cent of the A96 flow) turns left at Longman Roundabout onto the A82.*

Of this flow that turns left at Longman Roundabout in the PM peak the model indicates that:

- *56 vph (four per cent of the A96 flow) U-turns at Harbour Road Roundabout to access Henderson Road;*
- *10 vph (one percent of the A96 flow) turns right at Harbour Road Roundabout to access Harbour Road (West);*
- *25 vph (two per cent of the A96 flow) proceeds straight through Harbour Road Roundabout to Rose Street;*
- *67 vph (five per cent of the A96 flow) bears right at Shore Street Roundabout to access Grant Street;*
- *12 vph (one per cent of the A96 flow) proceeds through Harbour Road and Shore Street Roundabouts to turn sharp left at Telford Roundabout onto Wells Street;*
- *28 vph (two per cent of the A96 flow) proceeds straight through Harbour Road and Shore Street Roundabouts to turn left at Telford Roundabout onto A82 Kenneth Street;*
- *70 vph (six per cent of the A96 flow) proceeds straight through Harbour Road and Shore Street Roundabouts to proceed straight ahead at Telford Roundabout onto Harrowden Road; and*
- *66 vph (five per cent of the A96 flow) proceeds straight through Harbour Road and Shore Street Roundabouts to turn right at Telford Roundabout onto the A862 Telford Street;*

Only 14 vph (one per cent of the A96 flow) leaves Inverness on the A82 to the south of General Booth Road at Torvean in the PM peak.

Of the 11 per cent of traffic that travels southbound on the A9 towards Inches Junction in the PM peak the model indicates that:

- *59 vph (five per cent of the A96 flow) leaves the A9 at Inches Junction, turning left onto the B9006 and then turns left at Inches Roundabout onto the B8082 Sir Walter Scott Drive;*
- *50 vph (four per cent of the A96 flow) leaves the A9 at Inches Junction, turning left onto the B9006 to access Inches Retail Park;*
- *4 vph leave the A9 at Inches Junction, turning left onto the B9006 and then turning right at Inches Roundabout to access the Beechwood Business Park;*
- *1 vph leaves the A9 at Inches Junction bound for local properties along the B9006; and*
- *27 vph (two per cent of the A96 flow) continue on the A9 south of Inches Junction.*

This analysis indicates that as in the morning peak, most of the traffic travelling west on the A96 in the evening peak is bound for Inverness: although 24 per cent of the flow leaves the Inverness area on the trunk road network compared to only 14 per cent in the AM peak.

Similar conclusions can be drawn as to the AM model: the traffic travelling southwards towards Inches is primarily local traffic bound for the Inches area or destinations along the B8082 Sir Walter Scott Drive. Traffic travelling towards Inverness on the B865 is primarily bound for the east Longman area, the city centre, or the Crown, Raigmore, Drakies or Culduthel areas. A significant proportion of the traffic travelling northwards towards Longman Roundabout crosses the Kessock

Bridge but the majority of traffic making a right turn at Raigmore Interchange uses the A82 Longman Road to access areas to the north and west of the city. Breakpoints would be similarly defined.

6.4 A96 Eastbound Traffic Origins (AM)

In the 2009 AM base model the modelled flow on the link leaving Raigmore Interchange in an eastbound direction is 1271 vehicles per hour (vph). This flow approaches Raigmore Interchange as follows:

- *A9 from Longman Roundabout – 722 vph (57 per cent of the A96 flow);*
- *B865 from Inverness – 396 vph (31 per cent of the A96 flow);*
- *A9 from Inches Junction – 151 vph (12 percent of the A96 flow).*

The model indicates that of the 31 per cent of traffic that approaches Raigmore Interchange from Inverness on the B865 in the AM peak:

- *79 vph (six per cent of the A96 flow) originates from businesses on Harbour Road or Seafield Road;*
- *95 vph (seven per cent of the A96 flow) approaches on Millburn Road from west of Diriebught Road travelling from the city centre;*
- *39 vph (three per cent of the A96 flow) approaches from Diriebught Road;*
- *160 vph (13 per cent of the A96 flow) approaches from the B9006 Old Perth Road; and*
- *23 vph (two per cent of the A96 flow) approaches from King Duncan's Road having originated in the Raigmore Housing Estate.*

Of the 57 per cent of traffic that approaches the gyratory at Raigmore Interchange from Longman Roundabout in the AM peak, the model indicates that:

- *225 vph (18 per cent of the A96 flow) crossed the Kessock Bridge; and*
- *494 vph (39 per cent of the A96 flow) turn right at Longman Roundabout from the A82.*

Of this flow that turns right at Longman Roundabout from the A82 in the AM peak, the model indicates that:

- *64 vph (five per cent of the A96 flow) originate from Henderson Road;*
- *23 vph (two percent of the A96 flow) turns left at Harbour Road Roundabout from Harbour Road (West);*
- *35 vph (three per cent of the A96 flow) originate from Rose Street;*
- *57 vph (four per cent of the A96 flow) joins the A82 at Shore Street Roundabout from Grant Street;*
- *13 vph (one per cent of the A96 flow) joins the A82 from Wells Street at Telford Roundabout;*
- *55 vph (four per cent of the A96 flow) travel along the A82 Kenneth Street;*
- *82 vph (six per cent of the A96 flow) joins the A82 at Telford Roundabout from Harrowden Road; and*
- *172 vph (14 per cent of the A96 flow) joins the A82 at Telford Roundabout from the A862 Telford Street;*

Only 15 vph (one per cent of the A96 flow) approaches Inverness on the A82 to the south of General Booth Road at Torvean in the AM peak.

Of the 12 per cent of traffic that travels northbound on the A9 from Inches Junction in the AM peak the model indicates that:

- *81 vph (six per cent of the A96 flow) originated along the B8082 Sir Walter Scott Drive;*
- *24 vph (two per cent of the A96 flow) originates at the Inches Retail Park;*
- *2 vph originates in the Beechwood Business Park;*
- *1 vph originates from local properties along the B9006;*
- *1 vph originates from the Northern Constabulary Police Headquarters;*
- *19 vph (one per cent of the A96 flow) originate from Raigmore Hospital; and*
- *23 vph (one per cent of the A96 flow) approach on the A9 from south of Inches Junction*

This analysis indicates that most of the traffic travelling east on the A96 in the morning peak originates within Inverness: only 21 per cent of the flow approaches the Inverness area on the trunk road network.

6.5 A96 Eastbound Traffic Origins (PM)

In the 2009 PM base model the modelled flow on the link leaving Raigmore Interchange in an eastbound direction is 1633 vehicles per hour (vph). This flow approaches Raigmore Interchange as follows:

- *A9 from Longman Roundabout – 693 vph (42 per cent of the A96 flow);*
- *B865 from Inverness – 685 vph (42 per cent of the A96 flow);*
- *A9 from Inches Junction – 253 vph (15 percent of the A96 flow).*

The model indicates that of the 42 per cent of traffic that approaches Raigmore Interchange from Inverness on the B865 in the PM peak:

- *150 vph (nine per cent of the A96 flow) originates from businesses on Harbour Road or Seafield Road;*
- *306 vph (19 per cent of the A96 flow) approaches on Millburn Road from west of Diriebught Road travelling from the city centre;*
- *16 vph (one per cent of the A96 flow) approaches from Diriebught Road;*
- *189 vph (12 per cent of the A96 flow) approaches from the B9006 Old Perth Road; and*
- *23 vph (one per cent of the A96 flow) approaches from King Duncan's Road having originated in the Raigmore Housing Estate.*

Of the 42 per cent of traffic that approaches the gyratory at Raigmore Interchange from Longman Roundabout in the PM peak, the model indicates that:

- *222 vph (14 per cent of the A96 flow) crossed the Kessock Bridge;*
- *3 vph turn left from the B9168 Stadium Road at Longman Roundabout; and*
- *468 vph (29 per cent of the A96 flow) turn right at Longman Roundabout from the A82.*

Of this flow that turns right at Longman Roundabout from the A82 in the PM peak, the model indicates that:

- *106 vph (six per cent of the A96 flow) originate from Henderson Road;*

- *30 vph (two percent of the A96 flow) turns left at Harbour Road Roundabout from Harbour Road (West);*
- *44 vph (three per cent of the A96 flow) originate from Rose Street;*
- *48 vph (three per cent of the A96 flow) joins the A82 at Shore Street Roundabout from Grant Street;*
- *8 vph joins the A82 from Wells Street at Telford Roundabout;*
- *130 vph (eight per cent of the A96 flow) travel along the A82 Kenneth Street;*
- *27 vph (two per cent of the A96 flow) joins the A82 at Telford Roundabout from Harrowden Road; and*
- *77 vph (five per cent of the A96 flow) joins the A82 at Telford Roundabout from the A862 Telford Street;*

Only 42 vph (three per cent of the A96 flow) approaches Inverness on the A82 to the south of General Booth Road at Torvean in the PM peak.

Of the 15 per cent of traffic that travels northbound on the A9 from Inches Junction in the PM peak the model indicates that:

- *49 vph (three per cent of the A96 flow) originated along the B8082 Sir Walter Scott Drive;*
- *124 vph (eight per cent of the A96 flow) originates at the Inches Retail Park;*
- *25 vph (two per cent of the A96 flow) originates in the Beechwood Business Park;*
- *8 vph originates from the Drakies residential area; and*
- *43 vph (three per cent of the A96 flow) approach on the A9 from south of Inches Junction*

This analysis indicates that most of the traffic travelling east on the A96 in the evening peak originates within Inverness: only 19 per cent of the flow approaches the Inverness area on the trunk road network.

7 Other Observations

7.1 Overview

This Section presents a number of other observations relevant to the setting of objectives, which include bus service provision, provision for cyclists and other non-motorised users, accident data and potential issues arising from future development.

7.2 Bus Service Provision

Stagecoach is the principal bus operator in the Inverness area and their route map is contained in Appendix D.

The following tables indicate the arrival times in the centre of Inverness of public service provision on the routes approaching Inverness from Culloden and on the Trunk road network on each weekday. Data is based on current timetables, some of which relate to the period commencing 11th February 2013, where changes have been made to reflect maintenance works on the Kessock Bridge.

Table 25: Bus Services approaching Raigmore Interchange on A96 in AM peak

Origin	Arriving at Inverness City Centre before:						
	07:00	07:30	08:00	08:30	09:00	09:30	10:00
Balloch (5 / 5C) & Culloden (5A)	06:34 06:49	07:04 07:24	07:34 07:44 07:54	08:04 08:14 08:24	08:40 08:50	09:02 09:07 09:14 09:24	09:34 09:44 09:54
Elgin (10 / 10A / X10 / 11 / 11A / 35)	06:39	07:28	07:44	08:19	08:39 08:47	09:20	09:38 09:52
Ardersier (11A)	-	07:28	-	-	08:35	-	-

Table 25 above indicates that services from Balloch and Culloden are scheduled to arrive in Inverness, at regular ten minute headway, for the early part of the AM peak (services arriving in Inverness by 08:24). However, the next service is scheduled to arrive in Inverness at 08:40, some 16 minutes later. The reason for the apparent increase in headway during the peak period arises from an assumed increase in congestion between the Inverness Retail Park and the city centre. On the earlier services this section of the journey is timetabled to take 11 minutes, but six minutes is added to the timetabled journey time at the peak time to reflect congestion anticipated or experienced by the bus operator on the A96 and B865 at this time. Shortly after 09:00, the service pattern returns to the pre-peak timings, maintaining a ten-minute headway.

Services 10, 10A, X10, 11, 11A and 35 provide multiple opportunities to travel into Inverness from the settlements of Nairn, Forres and Elgin along the A96. Service 11A travels via Ardersier, which results in two buses arriving in Inverness during the morning peak from Ardersier. The service arriving at 08:39 is the first arrival from Keith, while the service arriving at 09:52 is the earliest arrival from Aberdeen (change at Inverurie). The services arriving at 07:44 and 09:20 both originate in Macduff.

Table 26: Bus Services approaching Inches Roundabout on B9006 in AM peak

Origin	Arriving at Inverness City Centre before:						
	07:00	07:30	08:00	08:30	09:00	09:30	10:00
Westhill / Culloden & Balloch (2 / 2B / 3)	06:43 06:48	07:07 07:18	07:33 07:45 07:50	08:02 08:10 08:25	08:30 08:41	09:03 09:04 09:14 09:28	09:38 09:48 09:58

Table 26 above indicates that services from the Culloden area arriving in Inverness via the B9006 have a slightly less regular service interval when compared to services from the same area travelling via the A96 as presented in Table 25, but the overall number of services each hour is the same. The less regular service pattern is largely due to differences in where the bus travels to after passing through the city centre. The service arriving in Inverness at 08:41 commences in Croy and is the only service from Croy in the morning peak.

Throughout the peak period, services are scheduled to take eight minutes to travel between Woodside Village, Westhill and Raigmore Hospital, irrespective of whether they route via Culloden Road (service 2) or Caulfield Road (service 3). As the scheduled journey time does not vary within the peak, this implies that bus operations are not subject to significantly higher levels of congestion and delays at Inches Roundabout and the signalised junctions along the B9006 at peak times compared to off-peak conditions.

Table 27: Bus Services approaching Inches Roundabout from A9 South in AM peak

Origin	Arriving at Inverness City Centre before:						
	07:00	07:30	08:00	08:30	09:00	09:30	10:00
Newtonmore (32A)	-	-	-	-	08:35	-	-
Aviemore (34X)	-	-	-	-	08:36	-	-

Table 27 above indicates that there only two services arriving in Inverness from the south during the morning peak. Service 32A provides the only service from Kingussie and Kincraig and travels via the A9 north from Aviemore. Service 34X departs Aviemore 45 minutes earlier, to provide a service into Inverness for residents of Boat of Garten, Nethy Bridge, Granton on Spey and Carrbridge. Both services serve the villages of Tomatin, Moy and Daviot. Although the arrival time of both services into Inverness may suit people starting work at 09:00, there is no service provision for anyone who may start work earlier.

Table 28: Bus Services approaching Longman Roundabout from the North in AM peak

Origin	Arriving at Inverness City Centre before:						
	07:00	07:30	08:00	08:30	09:00	09:30	10:00
Cromarty / Fortrose (26 / 26A / 26C)	-	07:29	-	08:09 08:30	-	09:30 (F)	10:00
North Kessock (26A / 22)	-	07:29	-	-	08:42	-	09:34 09:49
Invergordon (25 / 25A / 25X)	-	07:20 07:27	-	08:25 08:26	-	09:06	09:36
Brora (X98)	-	-	-	08:29	-	-	-
Dingwall (27)	06:20 06:50	07:27	07:52	08:24	08:48	09:04 09:14 09:30	10:00
Culbockie (22)	-	-	-	08:25	-	-	09:49

Table 28 indicates that the service provision from some of the settlements to the north of Inverness is variable. Services 26, 26A and 26C generally start in Cromarty with the exception of the service scheduled to arrive in Inverness at 09:30, which commences in journey in Fortrose. Service 26A serves North Kessock, with some of these services commencing their journey in North Kessock. To what extent this level of provision has been impacted by the works currently being undertaken on the Kessock Bridge is not clear. Service 25, 25A and 25X all serve Invergrordon, although a number of these services commence in Tain. Settlements north of Tain are served by the single X98 service scheduled to arrive in Inverness at 08:29.

Services from Dingwall are generally more frequent, with some of these commencing in Contin. It is not possible to ascertain any specific issues from the above and it is not known to what extent the works currently being undertaken on the Kessock Bridge has on the timetable and travel demand patterns. It is however included for completeness.

7.3 Cycling Provision

The National Cycle Network was established by Sustrans and is signed using a system modelled on the Danish Cycle Network and adopted by the Department for Transport, the Scottish Government, the Welsh Assembly and the Northern Ireland Executive. The National Route numbering system is similar to the original A-road numbering system introduced in the 1920's, with primary routes radiating clockwise from London, and their branches adding digits to the primary number.

National Cycle Route 1 runs from Dover to the Shetlands and passes through Culloden and Inverness from the east to the north. Although segregated facilities on the Kessock Bridge form part of National Cycle Route 1, neither the A9 nor the A96 trunk roads in the Inverness area form part of the network.

National Cycle Route 7 runs from Sunderland to Inverness, joining National Cycle Route 1 to the south of Culloden Moor. There are also local routes to the southwest of Inverness. When complete, National Cycle Route 78 will run from Campbeltown to Inverness. Figure 23 highlights the network in the Inverness area.

Whilst the existing National Cycle Network is largely outside of the extents of this study, it should be noted that Sustrans highlight a proposed alternative route from Culloden to the Kessock Bridge, which crosses the A96, runs parallel to the Aberdeen to Inverness railway line and follows a route through the former Longman

landfill site to the Kessock Bridge. Consequently, the development of any infrastructure options in this area would need to consider these proposals during the development process.

Figure 23: National Cycle Route in the Inverness Area

7.4 Green Networks

Green Networks comprise of a network of green spaces and green corridors within and around settlements, linking out into the wider countryside. They can help to enhance the area's biodiversity, quality of life and sense of place. A Green Network also provides the setting in which high quality, sustainable development can occur.

The A96 Corridor Green Network is the first area of the Highland Green Network to be mapped and runs from Inverness to Nairn. This coincided with the work on the Highland Wide Local Development Plan. There are four priorities for the A96 corridor.

Priority 1 – Realise the potential of the Inverness – Nairn Coastal Trail, as well as a Landward Trail, north-south connections between the trails and a tourist trail.

Priority 2 – Maintain and improve green network connections between habitats in areas for proposed development.

Priority 3 – Identify positive land uses for important undeveloped wedges providing a setting and framework for settlements, and maintaining separation of existing settlements.

Priority 4 – Ensure a positive contribution to the further development of the green network and high quality local green space.

These priorities need to be considered in the development and appraisal of options to address the problems identified.

7.5 Accidents

The location and severity of accidents on the Trunk road network over the period 2000 to 2010 are highlighted in Appendix E. Only one fatal accident is noted on the A96: five serious accidents occurred within the study area over this period. However, clusters of slight injury accidents are recorded at a number of locations, in particular around the gyratory at Raigmore Interchange and to a lesser extent at Longman Roundabout.

Measures to reduce the incidence of accidents at these locations should be considered at the option generation stage. It is not known what impact the signalisation of Longman Roundabout in February 2013 may have on the future incidence of accidents at this location.

7.6 Future Problems

The preceding sections of this report have primarily focussed on existing problems. However, as noted in the STPR, the recommendation to dual the A96 between Inverness and Nairn is based on the need to provide additional capacity for planned growth to the east of Inverness. To consider the impact of potential growth in traffic arising from planned development, Appendix F contains output from the Moray Firth Transport Model, which indicates the forecast magnitude of delay at junctions across the study area in the morning and evening peaks.

A comparison between 2031 and the base year of 2009 highlights that significant delays are likely to occur at many more locations than are observed on the current road network, and therefore additional capacity is likely to be required to accommodate growth. The precise magnitude of these forecast delays is not of prime importance at this stage, as these will largely be dependent on where and when any future developments in the A96 corridor may be taken forward and the precise scale and type of development, but the locations serve as a general indication of where future issues may occur.

In the 2031 AM peak, significant delays are noted at both the Smithton Roundabout and the Inverness Retail Park Roundabout on the A96; at the B865 / B9006 Millburn Road Roundabout; and at the B9006 Inches East Junction.

In the 2031 PM peak, significant delays are noted at the Inverness Retail Park Roundabout; the B9006 Inches East Junction; Longman Roundabout; and Harbour Road Roundabout. There are similar levels of delays at other junctions within Inverness that lie outside of the principal study area.

The development of alternative options at the western end of the A96 should also take into consideration these future year constraints, and provide alternatives to reduce the level of traffic travelling through these locations. In addition it is likely that accompanying improvements across the local road network will also be required to increase capacities at key locations.

Such measures would increase the potential for the existing network to accommodate future growth.

The locations at which future development is permitted should take cognisance of infrastructure constraints.

8 Summary of Problem Definition

8.1 Summary of Issues Identified During Analysis

The Strategic Transport Projects Review was intended to look ahead and make recommendations about future transport interventions that may address potential issues with Scotland's transport infrastructure over the next decade. The A96 Inches to Nairn scheme was one of the recommendations of the STPR, which was primarily intended to address potential capacity issues on the A96, which may arise in the future from the level of planned development in the corridor to the east of Inverness. Its inclusion as a STPR recommendation was not specifically to address a current operational problem on the A96 but to enable a development opportunity.

Analysis of recent junction turning count data, queuing delay data and journey time surveys indicate that there are currently no significant problems with the operation of the A96 to the east of Raigmore Interchange or the Interchange itself. However, analysis of Bluetooth data does indicate some delays in the AM time period occurring at either Smithton Roundabout or the roundabout at the Inverness Retail Park. The largest traffic movement through Raigmore Interchange is between the North and the East and traffic volumes, both for this movement and for the junction as a whole, are highest in the evening peak. A queuing delay survey indicates that the highest delays at Raigmore Interchange occur at the traffic signals on the A9 southbound diverge slip road during the evening peak although analysis of Bluetooth data suggests a similar level of delay on the approach from the B865. Both of these issues point to a potential problem caused by convergent dominant movements.

Much of the traffic from the north originates from the employment areas in the north and west of Inverness and travels through Longman Roundabout from west to south approaching Raigmore Interchange from the north, although a significant volume originates north of the Kessock Bridge. There are no specific operational issues noted at Raigmore Interchange with the reverse movement from the A96 towards Longman Roundabout, although this traffic flow through Raigmore Interchange may encounter significant queuing delays on the southern arm at Longman Roundabout in the peak periods depending on its ultimate destination.

Traffic bound for Inverness via the A82 experiences significantly less delay than traffic bound for the Kessock Bridge owing to the presence of a segregated left turn lane for traffic making this movement. In the AM time period travel demand into Inverness is highest, but in the PM time period a greater proportion of traffic on the A9 northbound carriageway ultimately crosses the Kessock Bridge, which results in queues that can extend back to the merge area at Raigmore Interchange. The delays and queues experienced at Longman Roundabout are symptoms of a problem relating to a combination of conflicting dominant movements and insufficient capacity. The operation of the A9 / A82 Longman Roundabout is therefore a significant constraint on the adjacent road network. The extent to which this is changes by the signalisation of Longman Roundabout in February 2013 is not yet clear.

The volume of traffic travelling between the South and the East (from Inches to Smithton) and vice versa is significantly lower than the volume of traffic making either the North to East or West to East movements through Raigmore Interchange and vice versa. Despite the South to East movement not being a particularly high

volume movement, the STPR highlighted that construction of a link between the A9 and A96 would provide some relief to the operation of Raigmore Interchange, by reducing the volume of traffic using the gyratory, and help to permit development to the east of Inverness.

However, although the STPR recommended a link to dual carriageway standard to cater for the planned development of land to the east, the STPR did not specifically identify that this link needed to be strategic in nature with free-flow connections to the A9. Analysis of the Moray Firth Transport Model indicates that most traffic approaching Raigmore Interchange from the east and turning left onto the A9 southbound carriageway is travelling to local destinations in the Inches area or along the B8082 Sir Walter Scott Drive. As such, it may perhaps be more appropriate for any Smithton to Inches link to be constructed as a local road providing access from the A96 or Barn Church Road to the B9006.

At Inches Roundabout to the southwest of Raigmore Interchange, significant delays are noted on both the B8082 approach from the south and at the exit from Inches Retail Park. Neither a moving observer journey time survey on the B9006 nor journey times recorded through the Bluetooth survey pointed to a significant peak in journey times for traffic on the B9006, although moving observer journey time surveys indicated delays at the signalised junction to the east of Inches Roundabout where the B9006 connects with slip roads to and from the A9 southbound carriageway.

The problems at Inches Roundabout may be summarised as a six-arm layout with insufficient capacity combined with competing movements: a mixture of local access and through traffic. At Inches Junction, the layout and signals can be a source of delay.

Other wiser problems that are noted from analysis of output from the Moray Firth Transport Model are capacity issues on the natural local road route between the Longman and Inches areas via Harbour Road and Old Perth Road appears to cause routing via the A9; and forecast capacity pressures at junctions on the A96 approach to Raigmore in 2031.

There are also limited opportunities for travel across the A9 corridor, which focuses east to west movements across the A9 on to the A96 and B9006.

8.2 Problem Summary

8.2.1 Longman Roundabout

Problem 1A – Conflicting dominant movements:

- From A9 (north) with A82 to A9 (south) – AM and PM peak; and
- From A9 (south) to A9 (north) with A82 to A9 (south) and A9 (north) to A82 – PM peak

Problem 1B – Insufficient capacity

8.2.2 Raigmore Interchange

Problem 2 – Convergent dominant movements:

- From A9 (north) to A96; and
- From B865 Millburn Road to A96

8.2.3 Inches Roundabout

Problem 3A – Competing movements – through versus local access

Problem 3B – six-arm layout insufficient capacity

8.2.4 Inches Junction

Problem 4 – Layout and Signalisation issues

8.2.5 Wider Problems

Problem 5A – Capacity pressures on natural local route via Harbour Road / Old Perth Road routing via A9 from Longman to exit at Inches

Problem 5B – Limited cross-corridor opportunities

Problem 5C – Capacity pressures at junctions on A96 approach to Raigmore in 2031

9 Setting Objectives

9.1 The Strategic Transport Projects Review

Following identification of the most significant problems, a review of the Objectives set out in the Strategic Transport Projects Review (STPR) was undertaken. The STPR objectives were set out as national or nationwide objectives and objectives for each corridor, city and strategic node. Those considered relevant, principally those that relate to either the Inverness strategic node or the Aberdeen to Inverness or Perth to Inverness corridors were identified. These are set out in Table 29 below.

Table 29: Relevant Objectives from the Strategic Transport Projects Review

Objective		Source
1	To improve journey time and increase opportunities to travel, particularly by public transport, between Aberdeen and Inverness.	Corridor 4: Aberdeen to Inverness
2	To reduce the conflict between longer distance and local traffic.	Inverness strategic node
3	To improve connectivity, particularly by public transport between Inverness city centre and the growth area to the east including Inverness Airport.	Inverness strategic node & Corridor 4: Aberdeen to Inverness
4	To promote continuing reduction in accident rates and severity rates across the strategic transport network.	Inverness strategic node
	To promote continuing reduction in accident rates and severity rates across the strategic transport network, recognising the need to continue the work of the Strategic Road Safety Plan through the STPR period.	National Objective
	To reduce the accident rate and severity rate to the current national average.	Corridor 4: Aberdeen to Inverness
4	To improve journey time and increase opportunities to travel, particularly by public transport, between Aberdeen and Inverness.	Corridor 4: Aberdeen to Inverness
5	To improve the operational effectiveness of the A9 as it approaches Perth and Inverness.	Corridor 6 Inverness to Perth
	Promote journey time reduction on the trunk road network for prioritised vehicles and users (eg high occupancy vehicles, freight, bus) where STAG appraisal demonstrates that a strong economic case can be balanced with environmental objectives. Elsewhere on the trunk road network provide improvements to journey time reliability.	National Objective

The three separate accident objectives listed as Objective 4 in Table 29 are very similar and may therefore be combined to create a single objective. Objective 5 can be simplified and made more specific to the study area. This therefore results in the following relevant objectives from STPR:

- *To improve journey time and increase opportunities to travel, particularly by public transport, between Aberdeen and Inverness;*
- *To reduce the conflict between longer distance and local traffic;*

- *To improve connectivity, particularly by public transport between Inverness city centre and the growth area to the east including Inverness Airport;*
- *To promote continuing reduction in accident rates and severity rates across the strategic transport network, recognising the need to continue the work of the Strategic Road Safety Plan through the STPR period: in particular to reduce the accident rate and severity rate on the A96 to current national average; and*
- *To improve the operational effectiveness of the A9 as it approaches Inverness.*

9.2 Localising the Objectives

A number of potential interventions may partially address the STPR objectives, but for option appraisal some of the STPR Objectives require to be made more specific.

- *To improve journey time and increase opportunities to travel, particularly by public transport between Aberdeen and Inverness [STPR 1] [Local 1].*

- *To reduce the conflict between longer distance and local traffic [STPR 2].*
  - *To improve the effectiveness of the road network hierarchy in addressing the conflict between longer distance and local traffic through the rationalisation of local movements use of Trunk road junctions [Local 2.1]; and*
  - *Reduce conflicts for longer distance and local traffic for planned development areas to the East [Local 2.2].*

- *To improve connectivity, particularly by public transport between Inverness city centre and the growth area to the east including Inverness Airport [STPR 3].*
  - *To improve connectivity, particularly by public transport and active travel between Inverness city centre and the growth area to the east including Inverness Airport [Local 3].*

- *To promote continuing reduction in accident rates and severity rates across the strategic transport network [STPR 4].*
  - *To improve the safety for motorised and non-motorised users by reducing the accident rate at Trunk road junctions [Local 4].*

- *To improve the operational effectiveness of the A9 as it approaches Inverness [STPR 5].*
  - *Improve the operational performance of the Trunk road network and junctions on the A9 and A96 as they approach Inverness from the Kessock Bridge; south of Inches and the Smithton Roundabout [Local 5.1]; and*
  - *Improve the operational performance of the secondary network and junctions where this may improve the operation of the Trunk road network [Local 5.2].*

9.3 Mapping Problems, Objectives and Solutions

The Table in Appendix G maps the problems identified by this study and summarised in Section 8 against the STPR and localised objectives defined in the preceding sections. Each of these problems has led to the identification of one or more potential interventions for further consideration.

9.4 Next Steps

The next stage is to complete the option generation, prior to commencing option sifting and appraisal. These steps will help to meet the wider aims of study, which is to define and confirm the most appropriate strategy for the western end of the proposed A96 Upgrade from Inverness to Nairn to the A9 corridor, whilst taking cognisance of the potential for development in the A96 Corridor.

Having identified and defined the problems, and defined and agreed the objectives for the A9/A96 Connections Study, this allows for the generation of intervention options to meet the objectives and address the problems. Given the nature of the problems that have been identified, it should be noted that no individual intervention option is likely to provide a single solution for the Connections study. As a result it is anticipated that options will need to be combined in a series of 'packages', once the assessment of the individual options has been completed.

At the option appraisal and sifting stage, each of the intervention options will assessed individually to determine their ability to meet one or more of the objectives and address one or more of the identified problems. The appraisal process will consider the performance of each option in transport terms, and the potential impact with respect to key environmental aspects. The results of the option appraisals will be reported on in Appraisal Summary Tables (AST), and the ASTs will form the main inputs to the option sifting process.

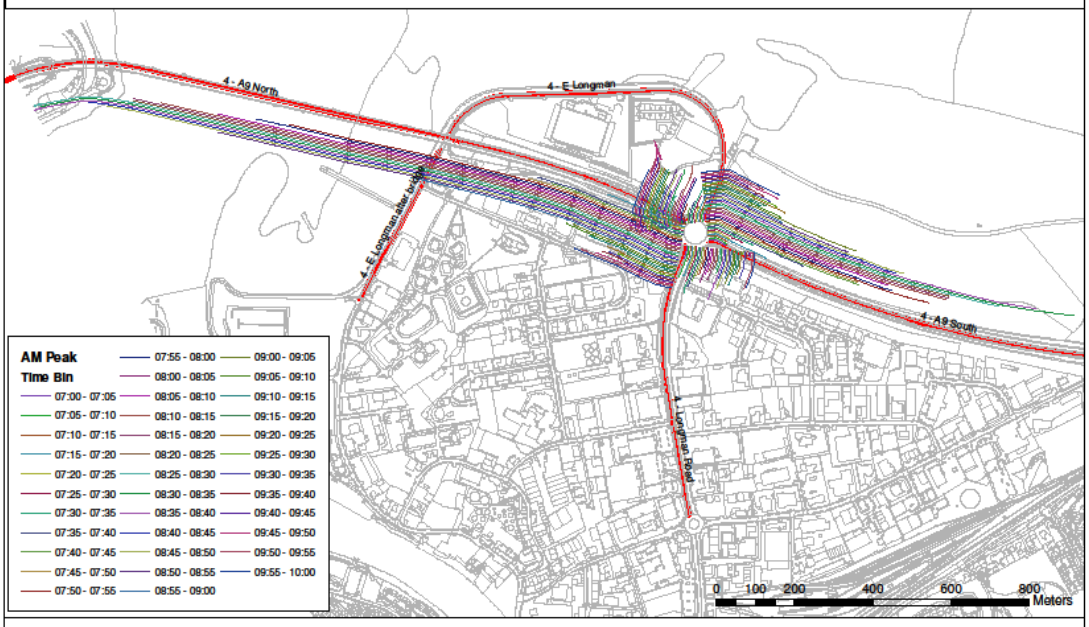
As part of the option sifting process, a workshop is to be held to allow Transport Scotland and The Highland Council officials to discuss and agree the options to be taken forward for further assessment, and the options to be sifted out at this stage. The other key output from the workshop will be to identify packages of combined options to be carried forward for further appraisal.

To complete the appraisal work, the combined option packages will be assessed against the problems and objectives and will include the use of micro-simulation to assess the operational performance of each package in more detail. The outcome will be to present the best performing packages for the A9/A96 Connections Study at the public exhibitions planned for Autumn 2013, alongside the A96 Smithton to Brackley and Nairn Bypass route options.

The option generation, sifting and appraisal will be covered in a separate Option Appraisal Report.

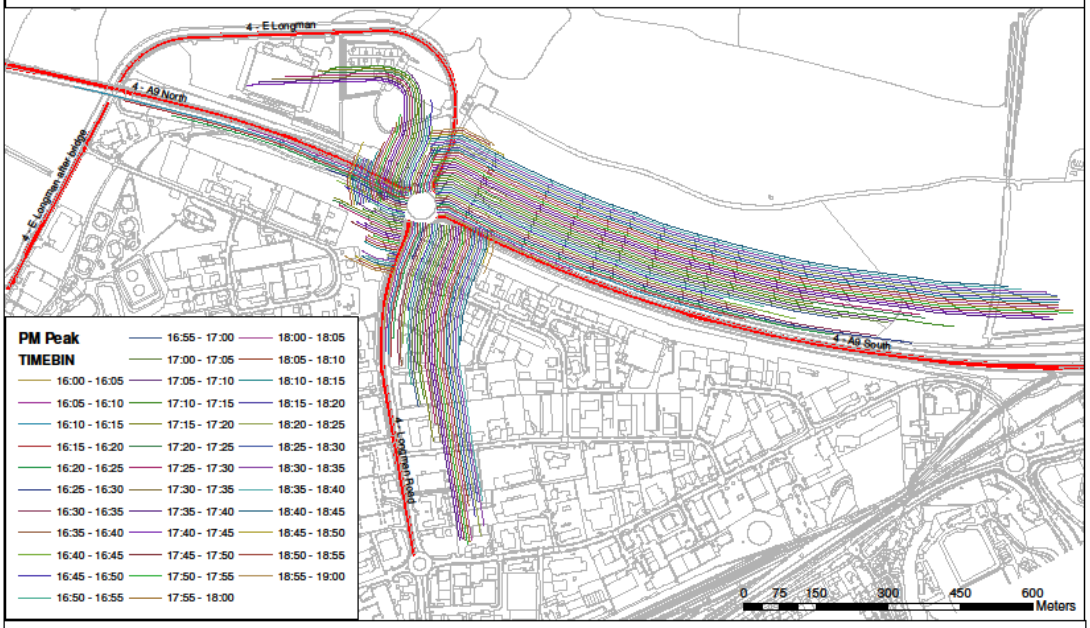
Appendix A Longman Queue Length Surveys

Moray Firth, Queue Length Surveys, Site 4
AM Maximum observed queues (07:00 - 10:00), Wednesday 11th November 2009



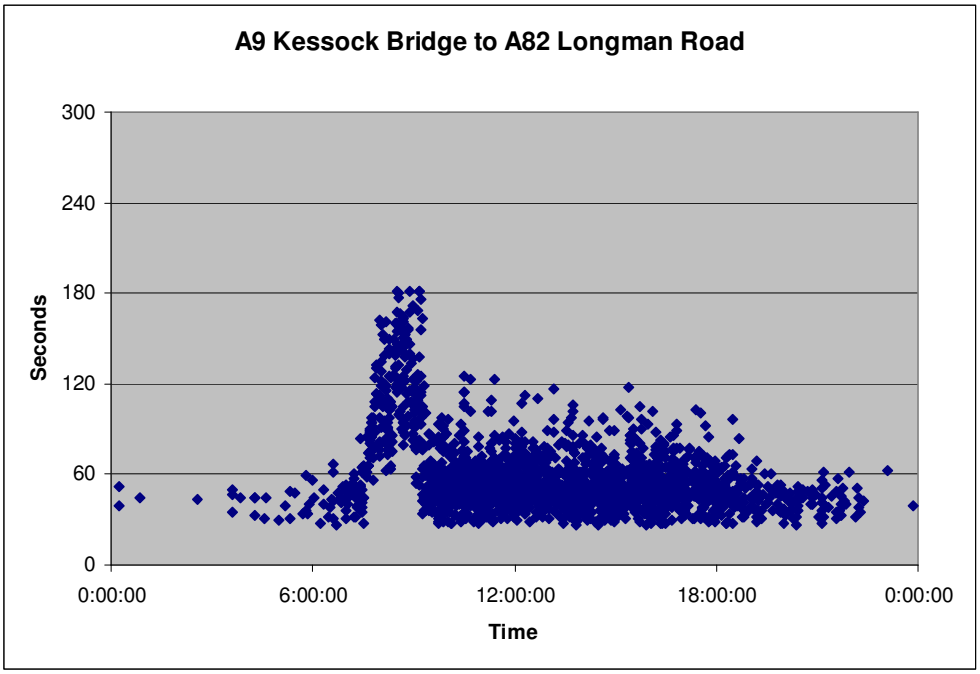
streetwise

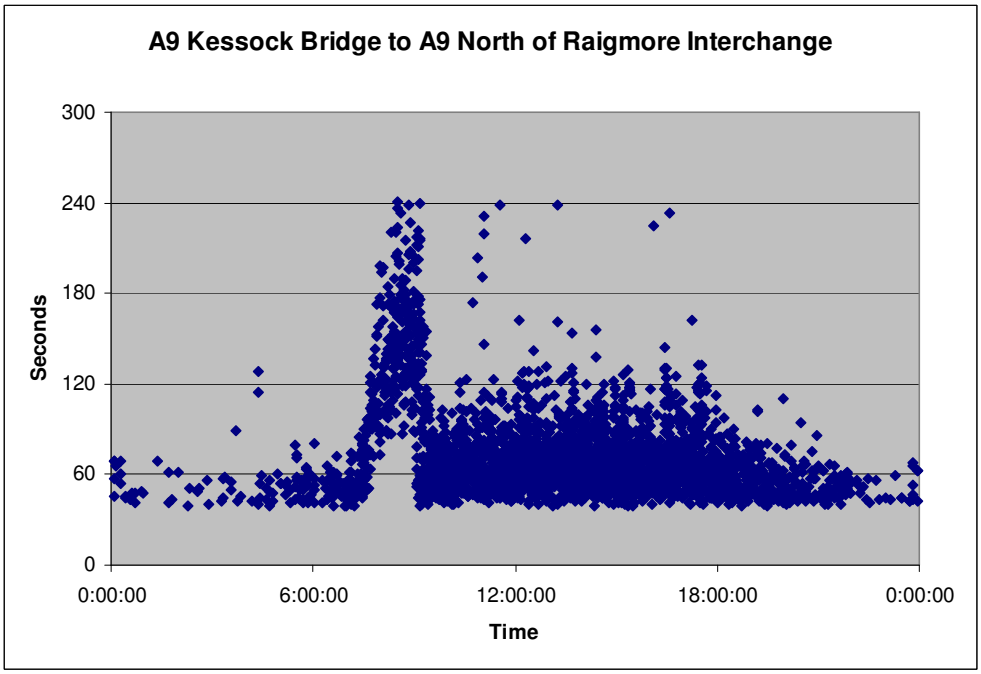
Moray Firth, Queue Length Surveys, Site 4
PM Maximum observed queues (16:00 - 19:00), Wednesday 11th November 2009

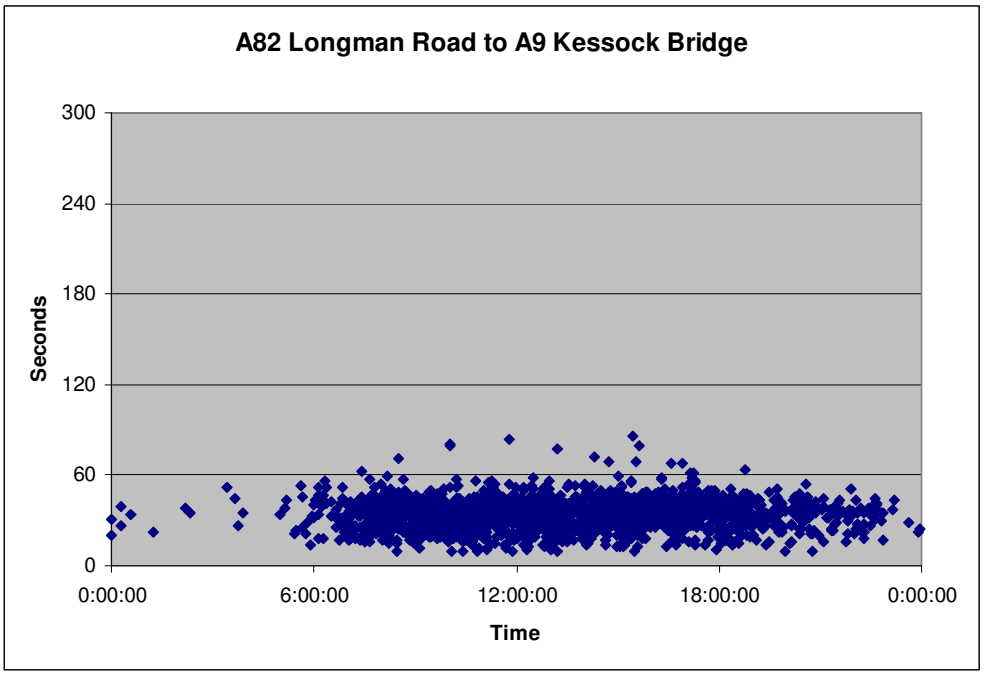


streetwise

Appendix B Bluetooth Data Journey Time Graphs



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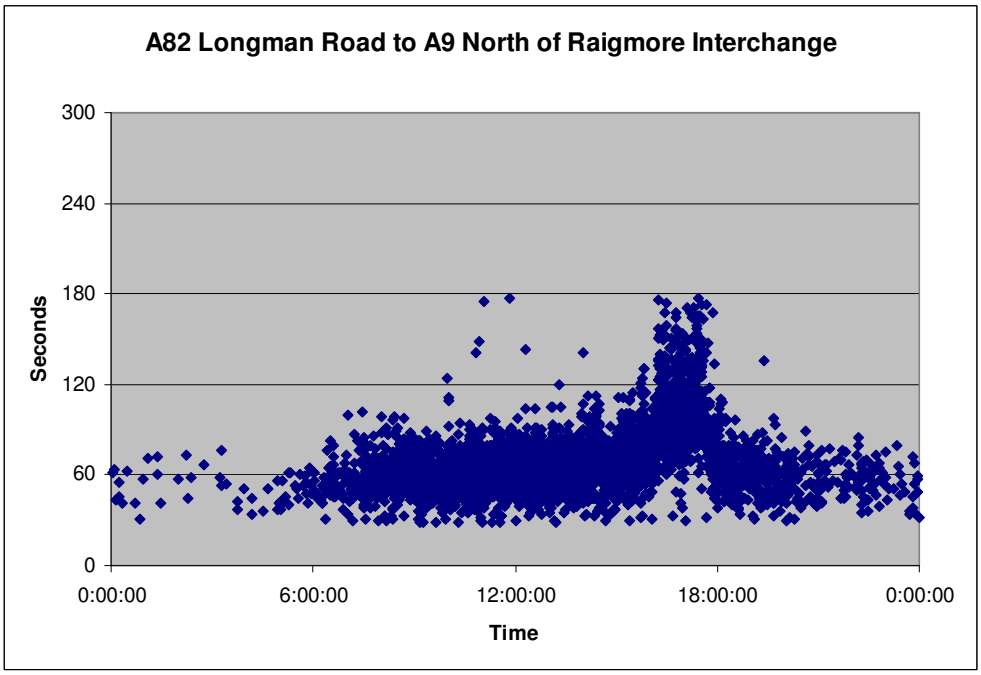
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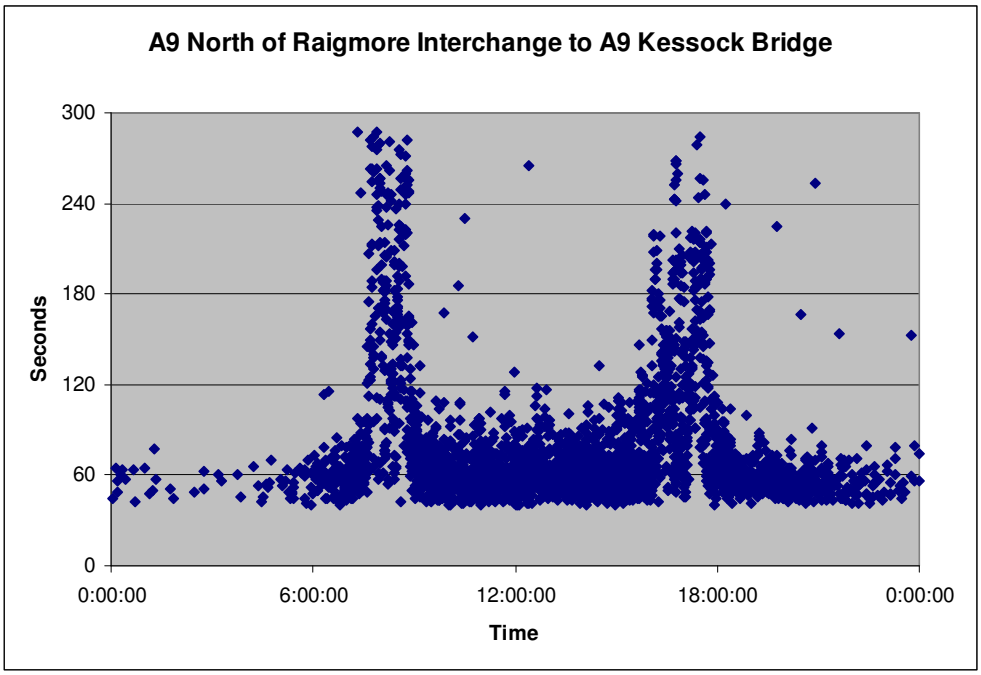
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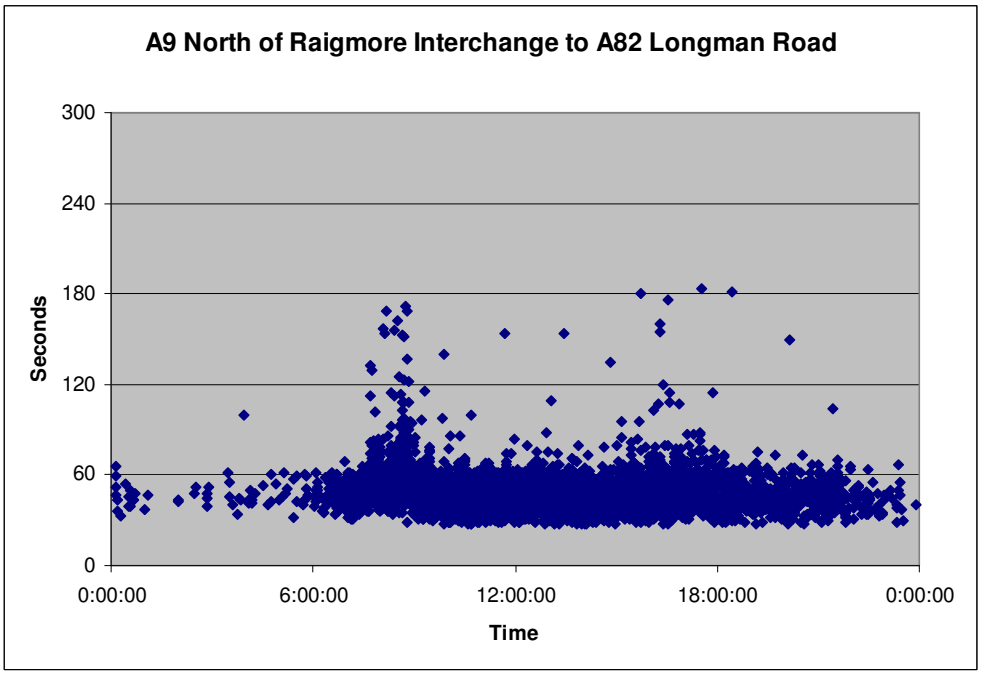
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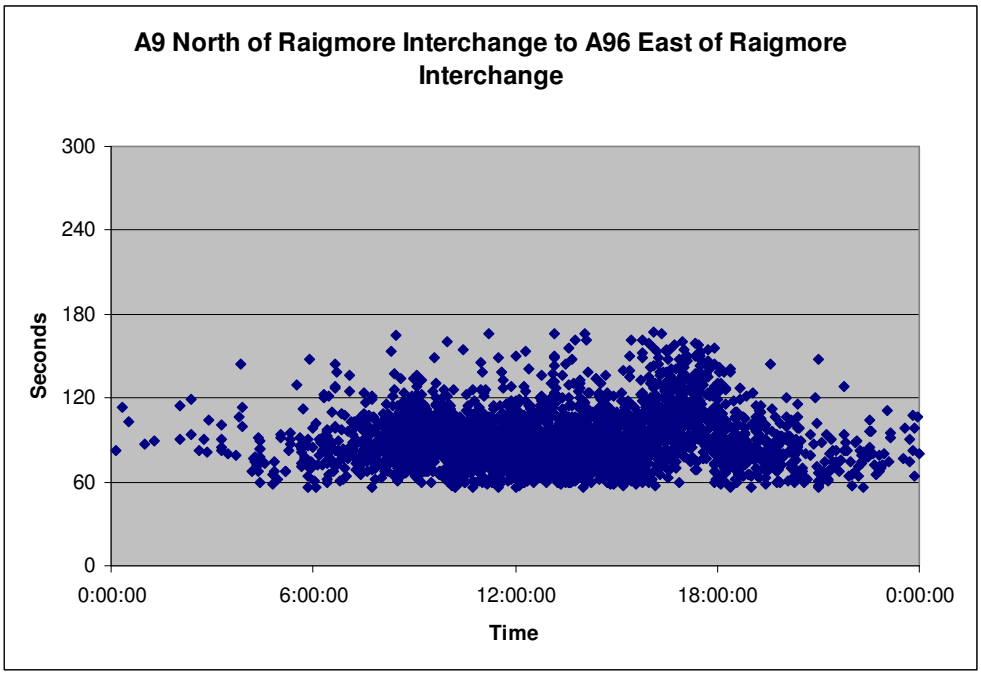
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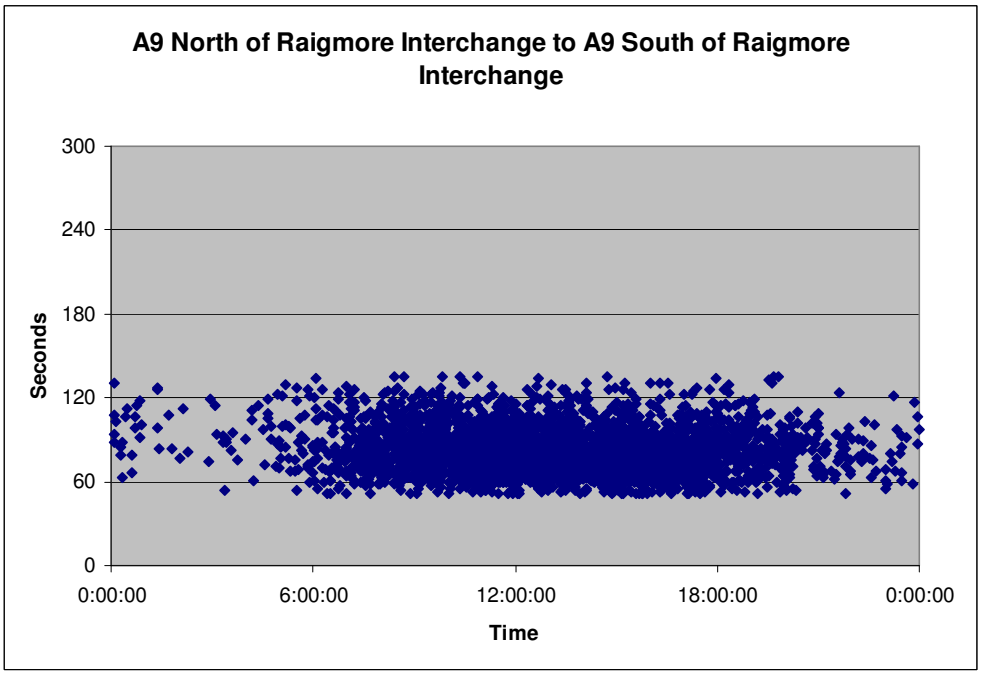
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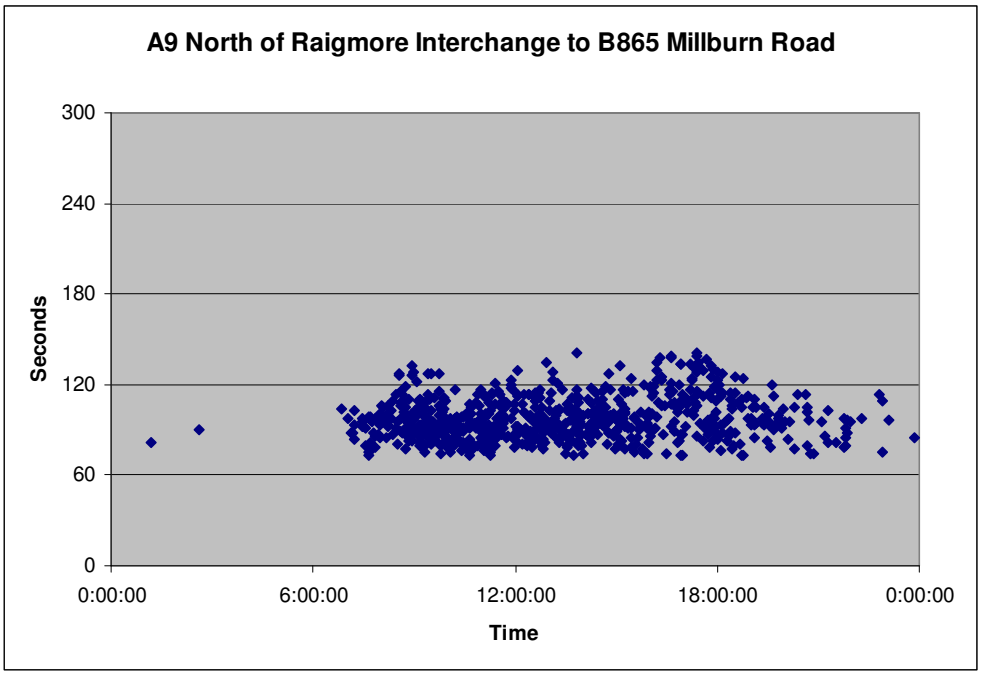
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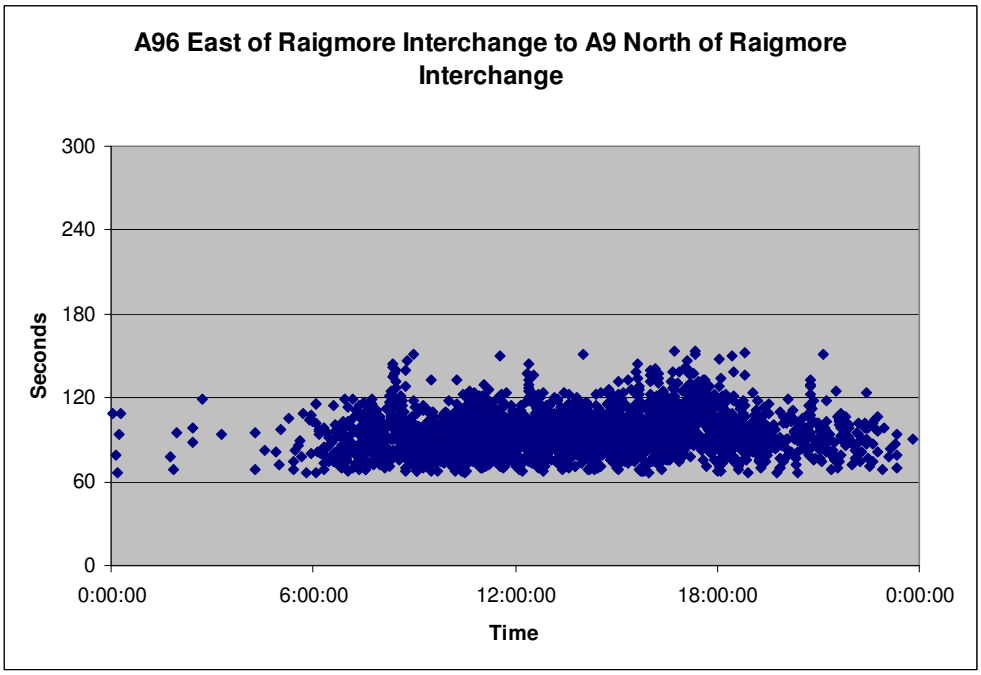
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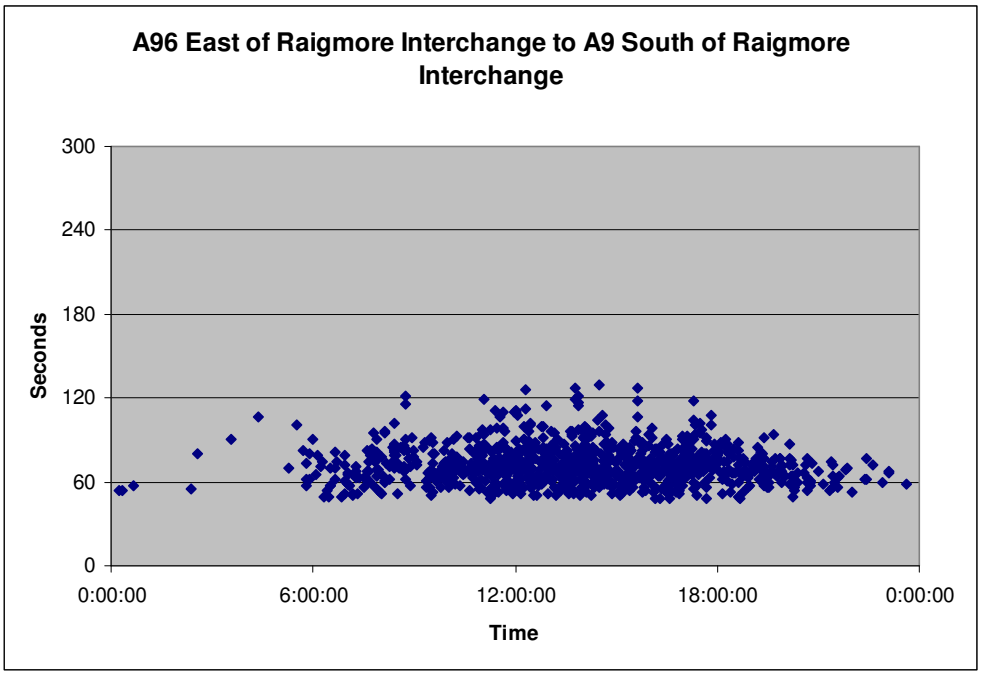
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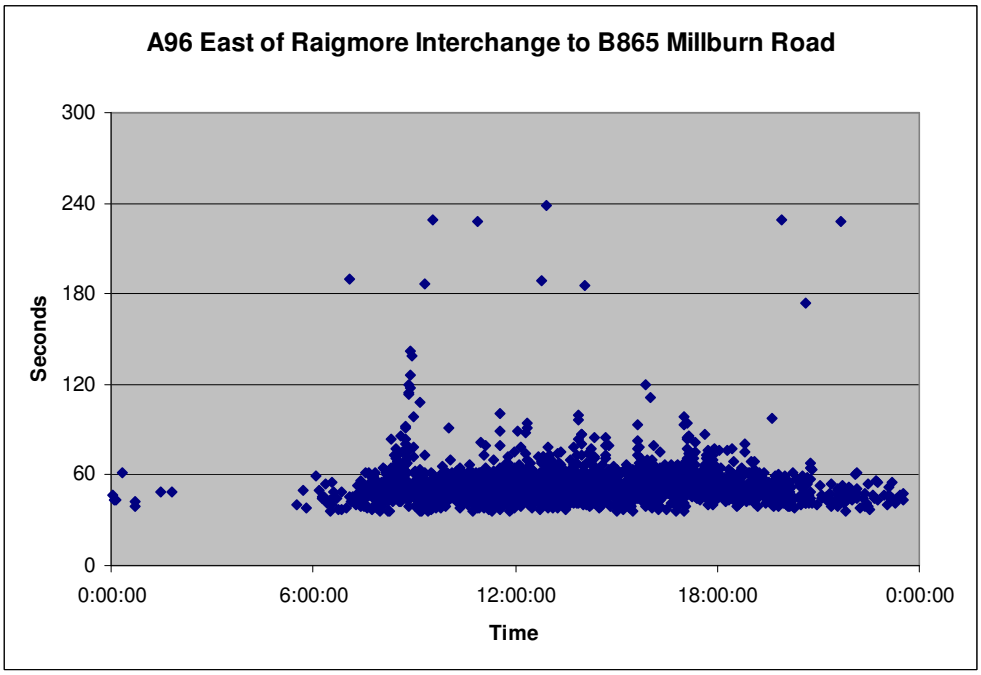
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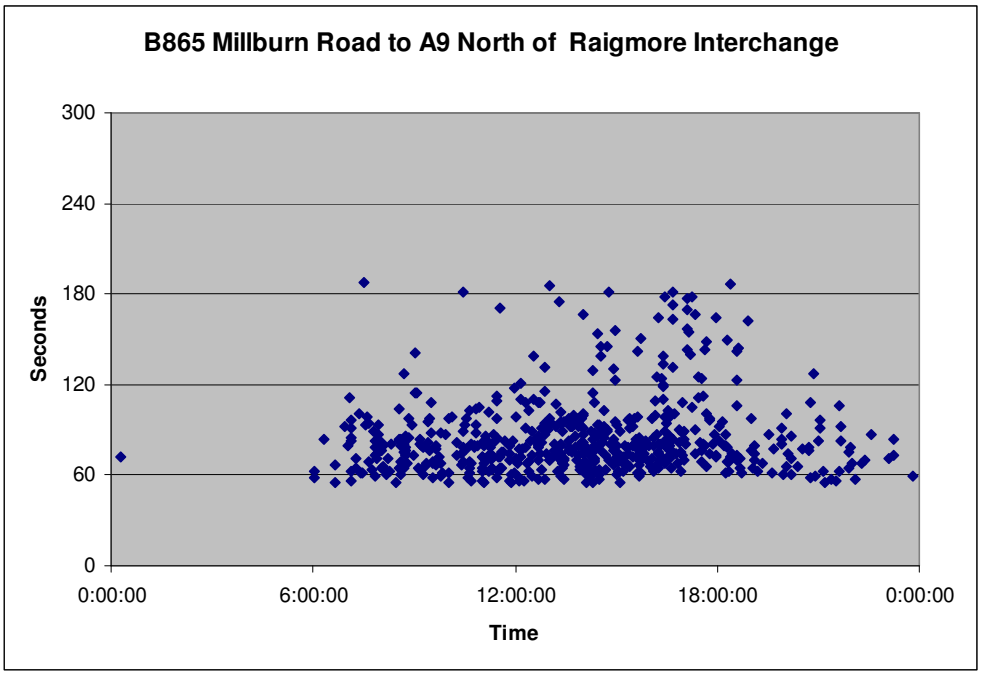
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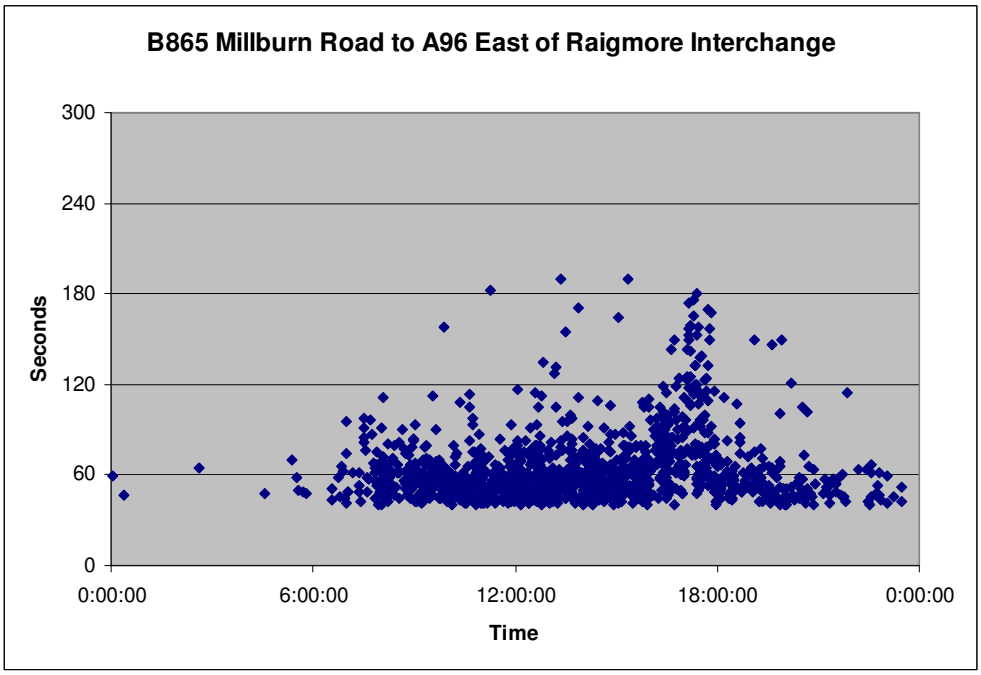
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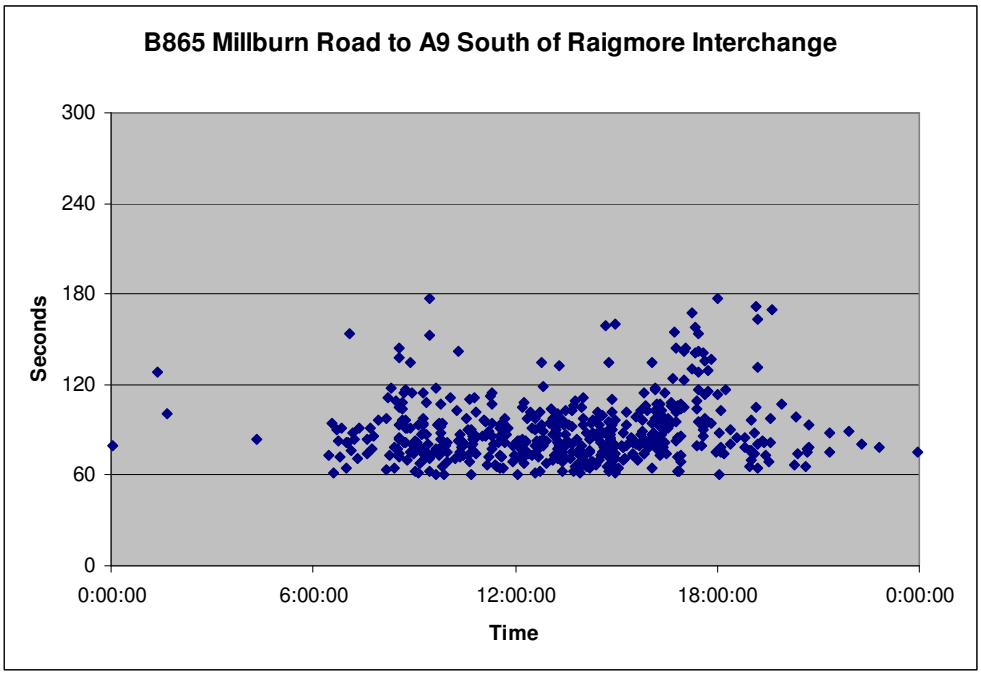
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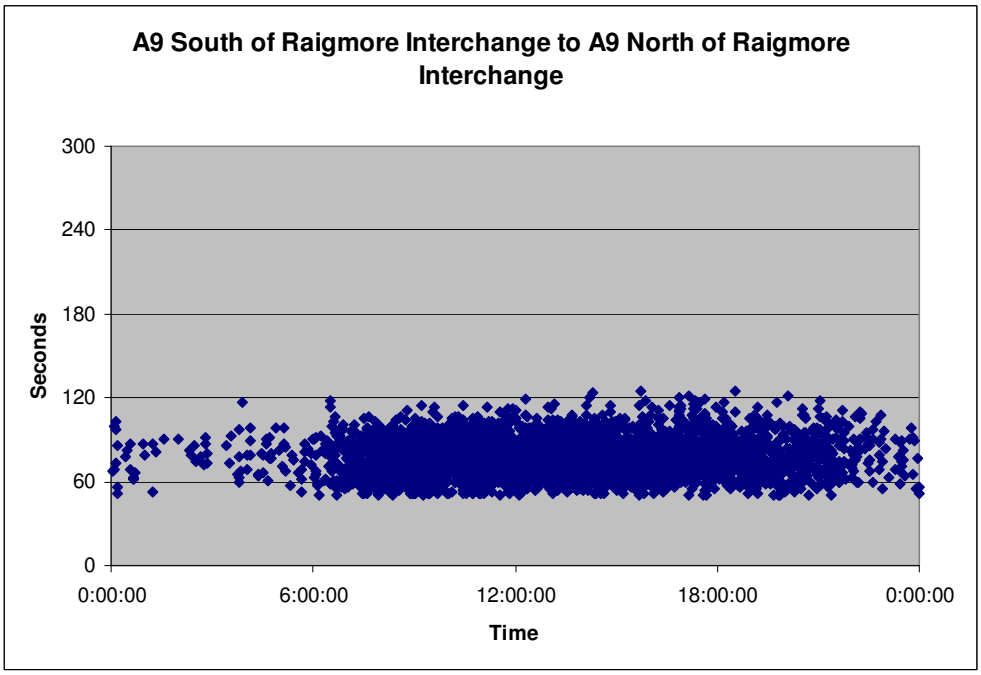
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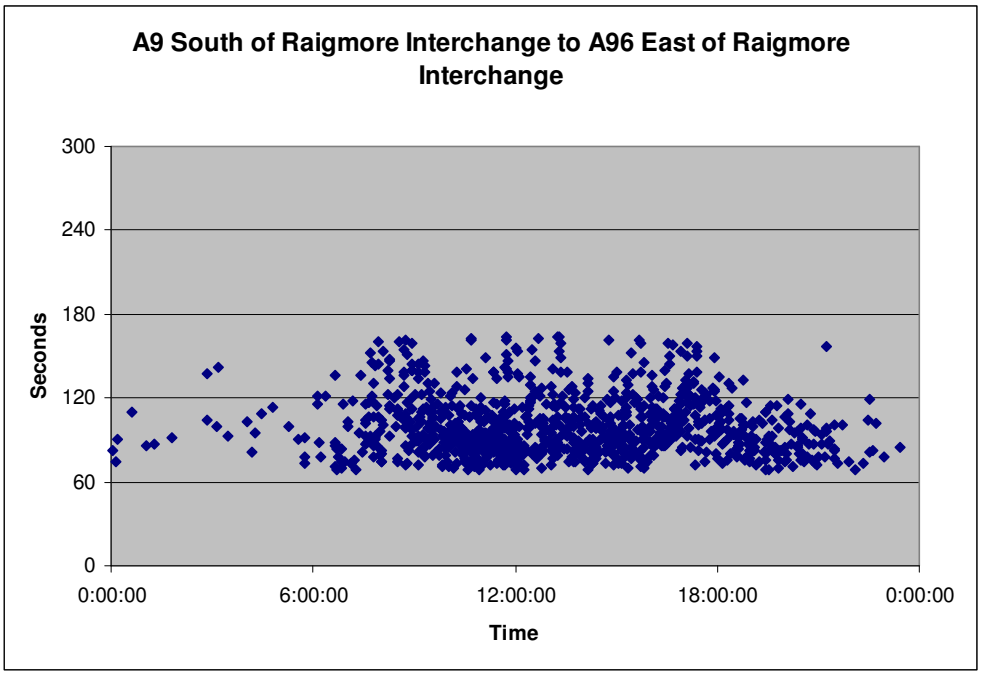
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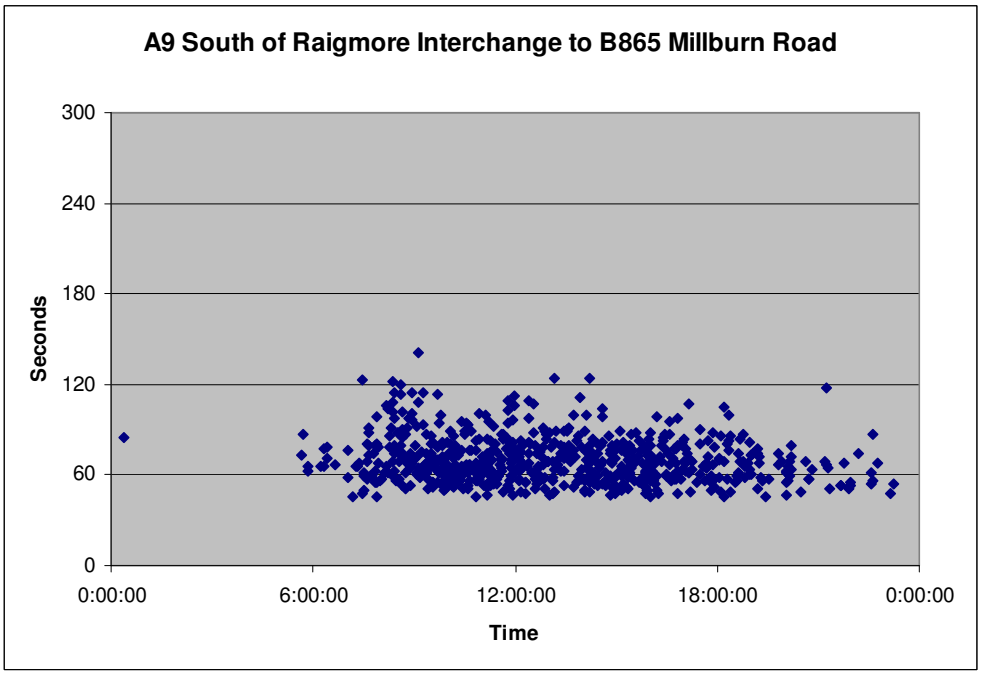
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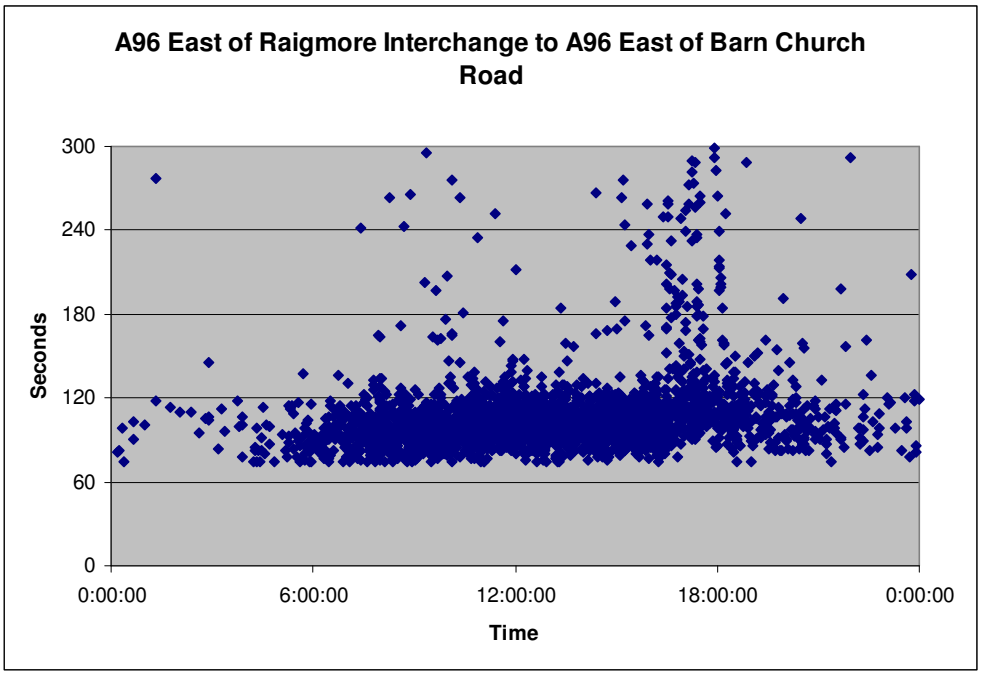
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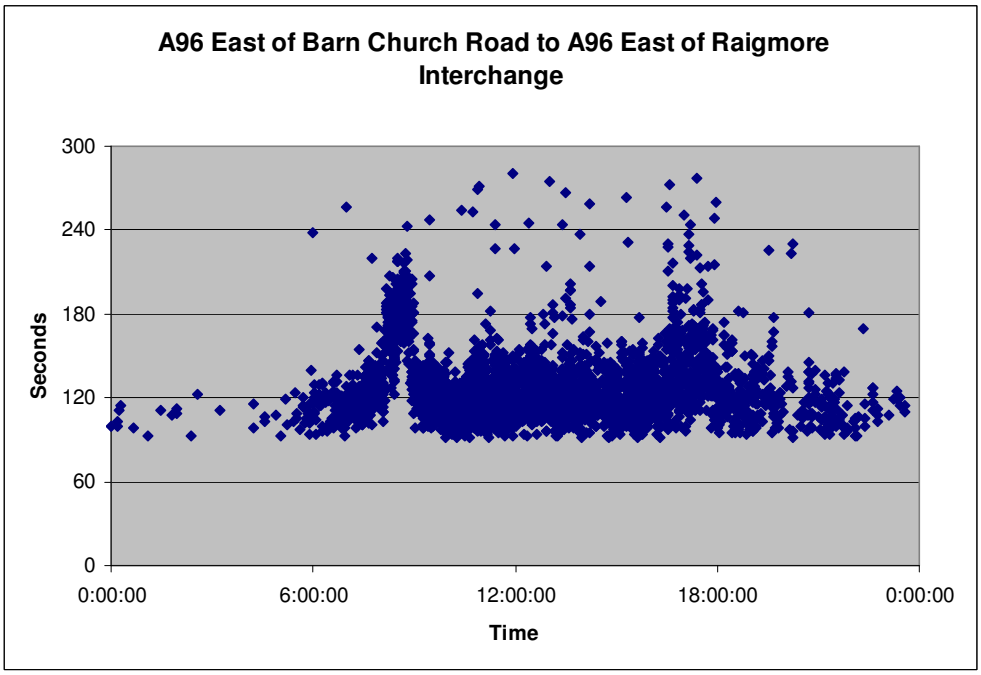
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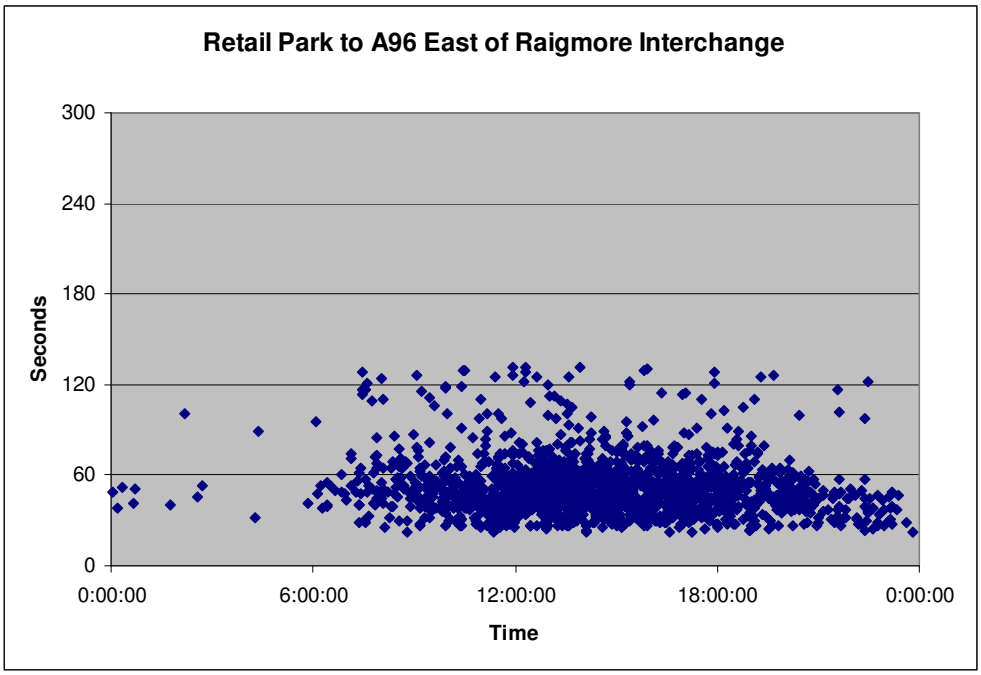
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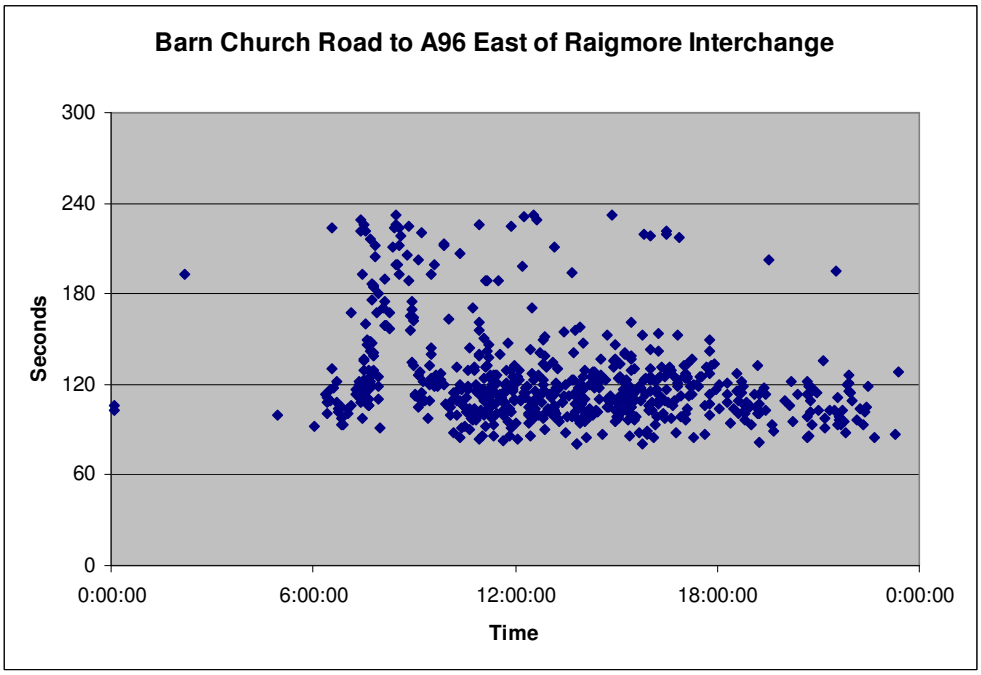
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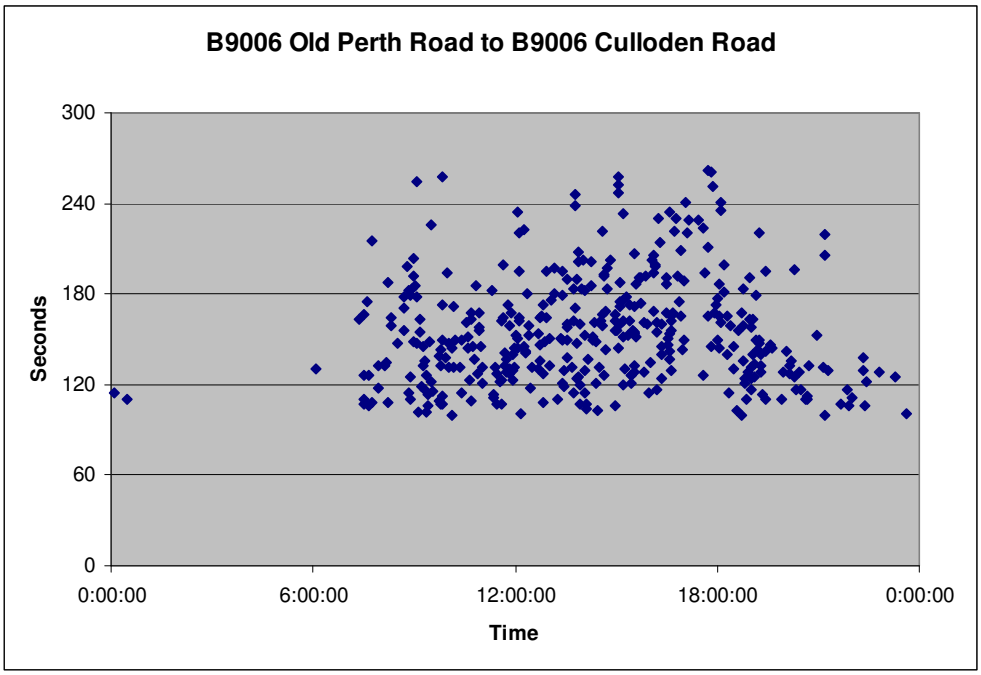
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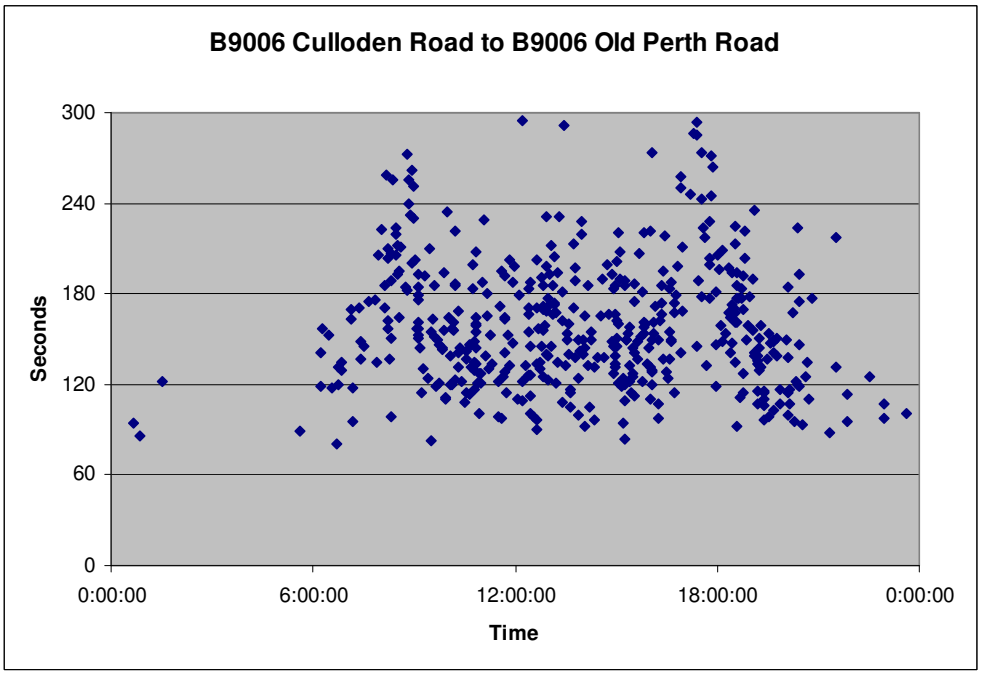
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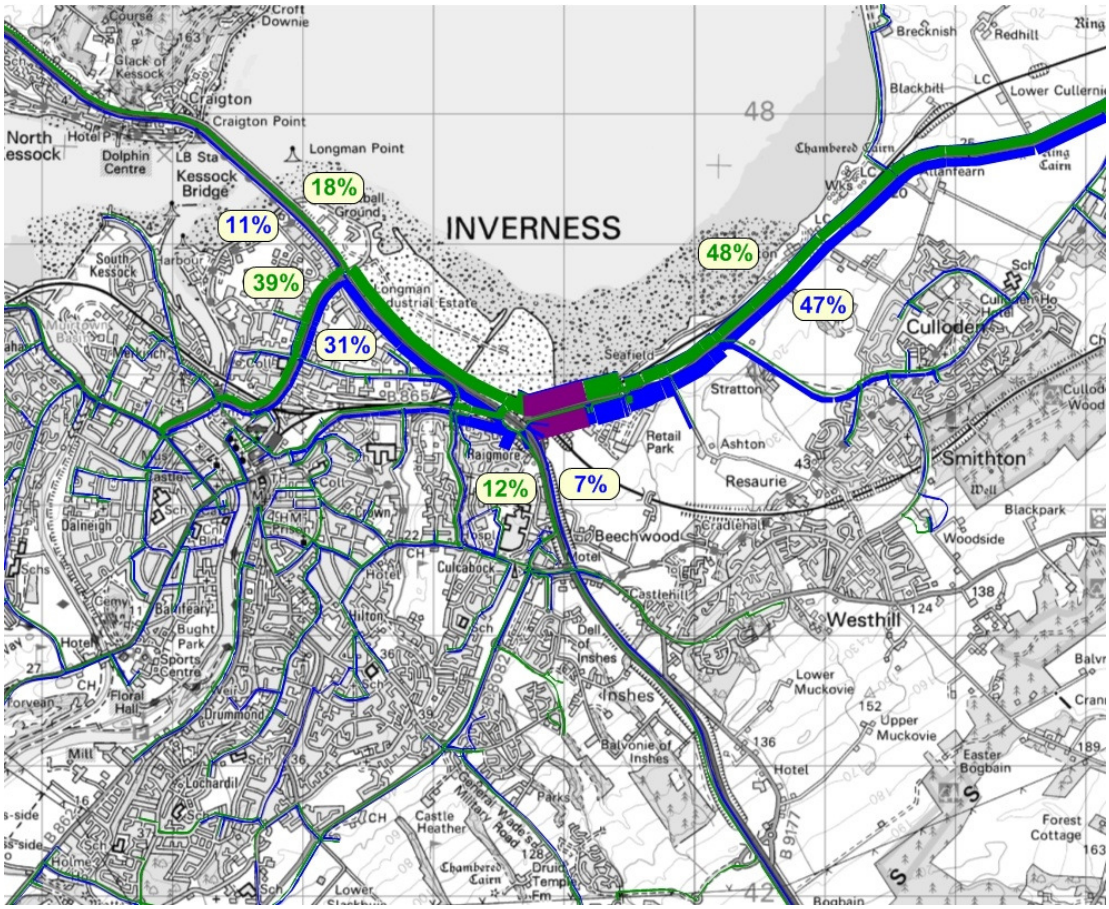
Appendix C Moray Firth Transport Model (MFTM)

A96 (East of Raigmore Interchange) – 2009 AM



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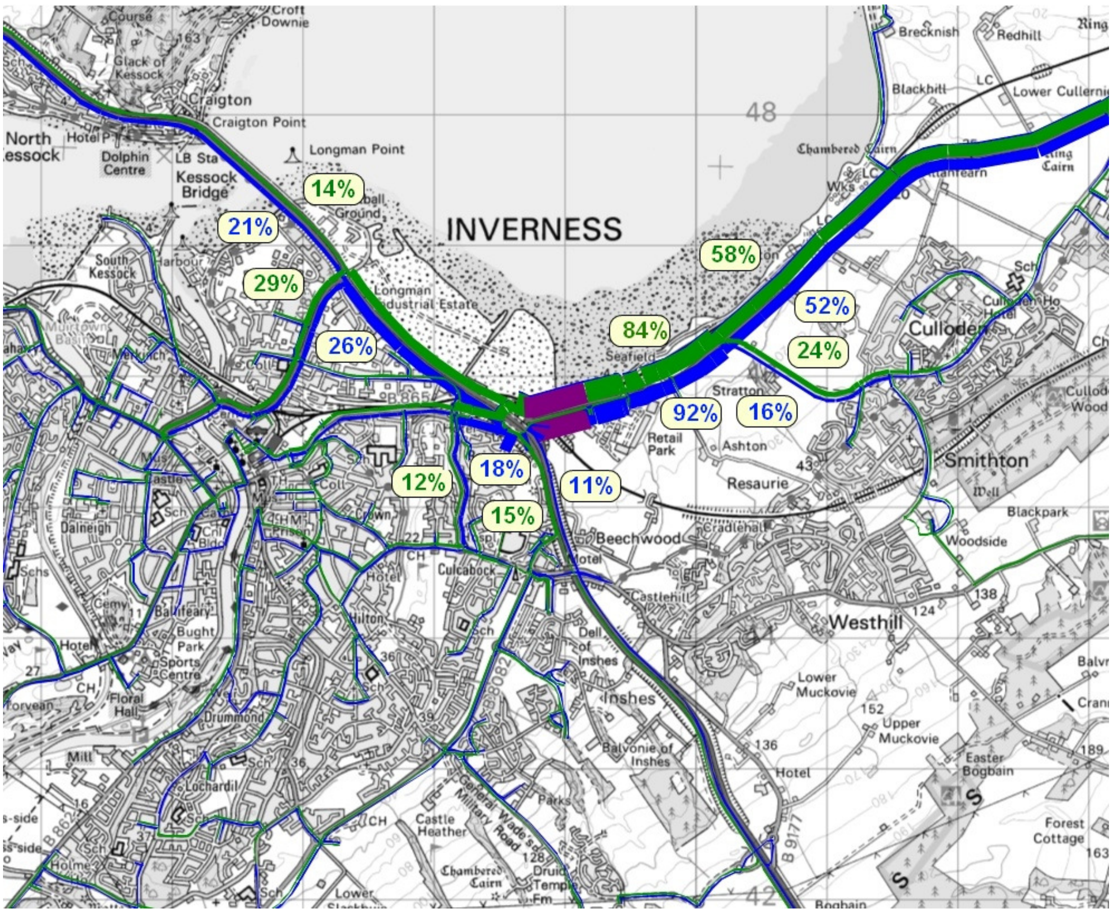
INVERNESS
14%
21%
29%
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58%
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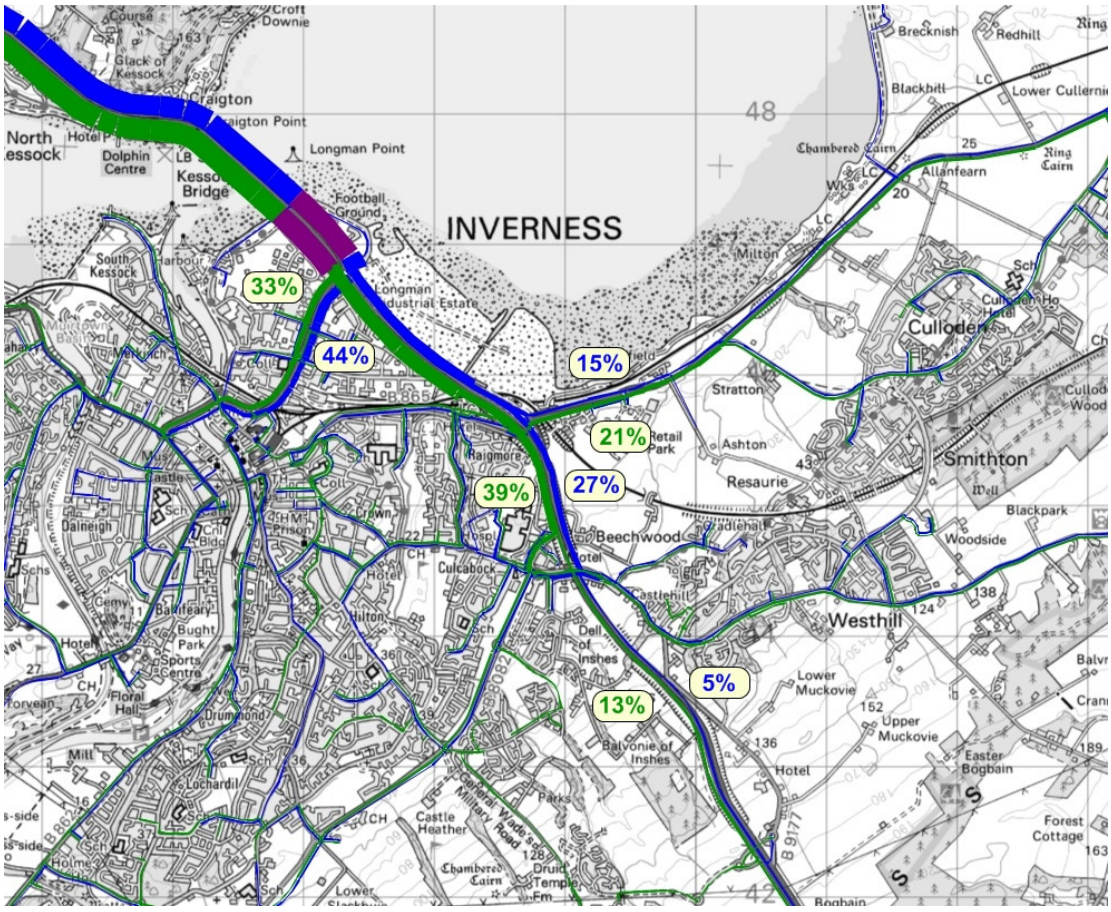
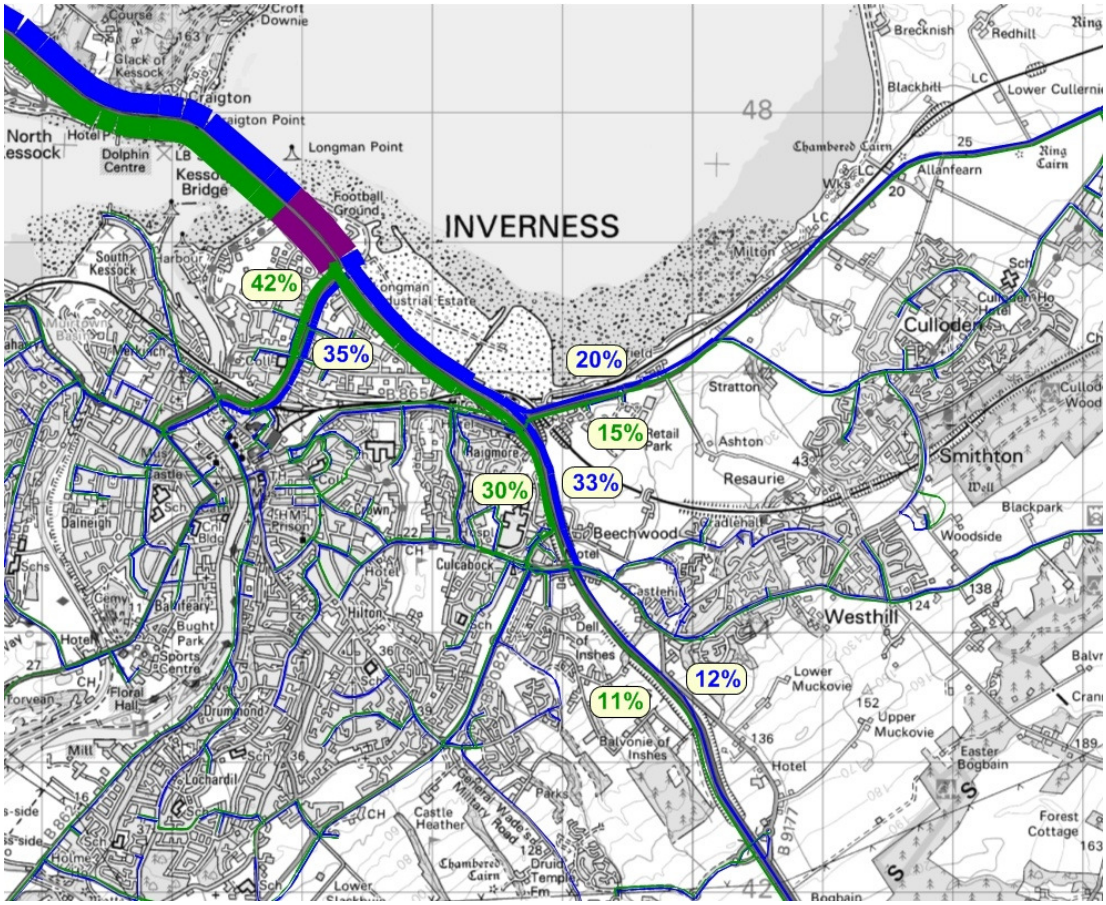
24%
92%
16%
12%
18%
11%
15%
Kessock Bridge
Culloden
Smithton
Westhill
Beechwood
Inshes
Longman Point
Craigton Point
North Kessock
South Kessock
Dalneigh
Lochardil
Resaurie
Ashton
Seafield
Stratton

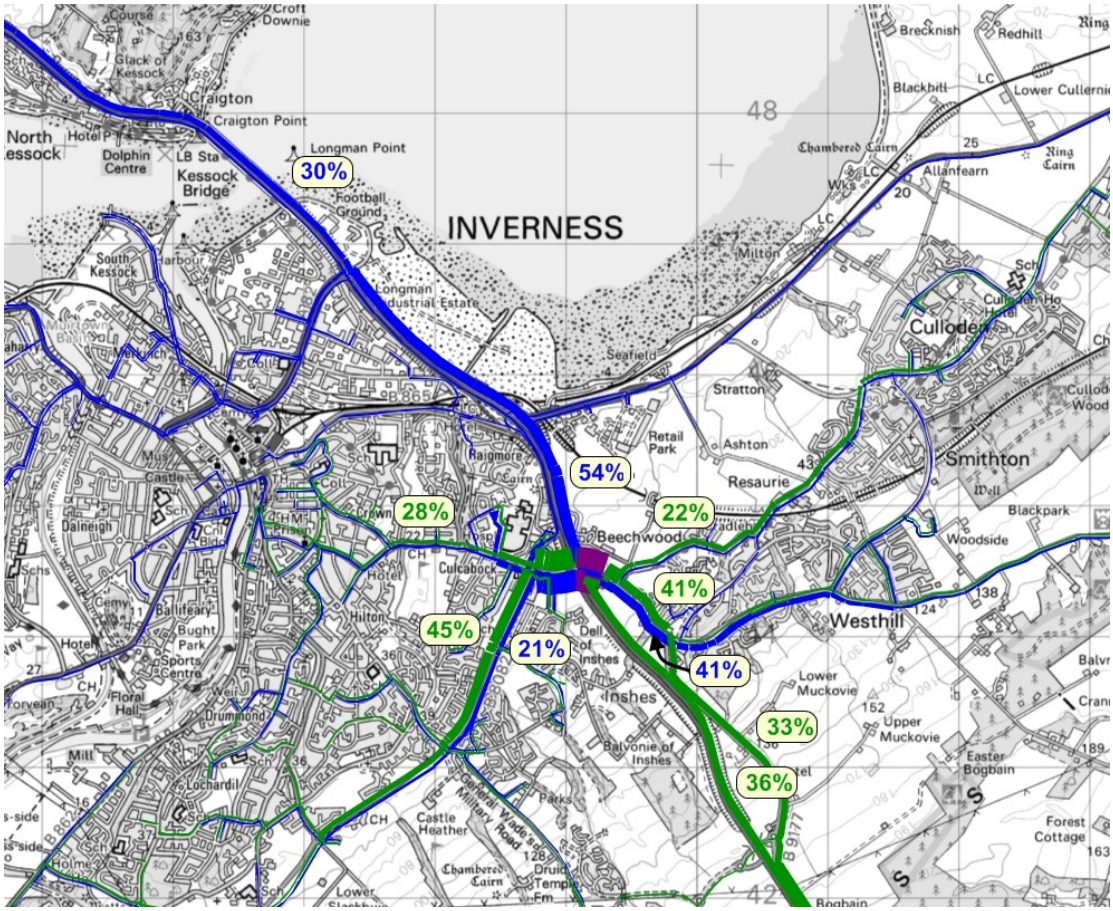
A9 Kessock Bridge – 2009 AM



A9 Kessock Bridge – 2009 PM



B9006 Overbridge at Inshes – 2009 AM



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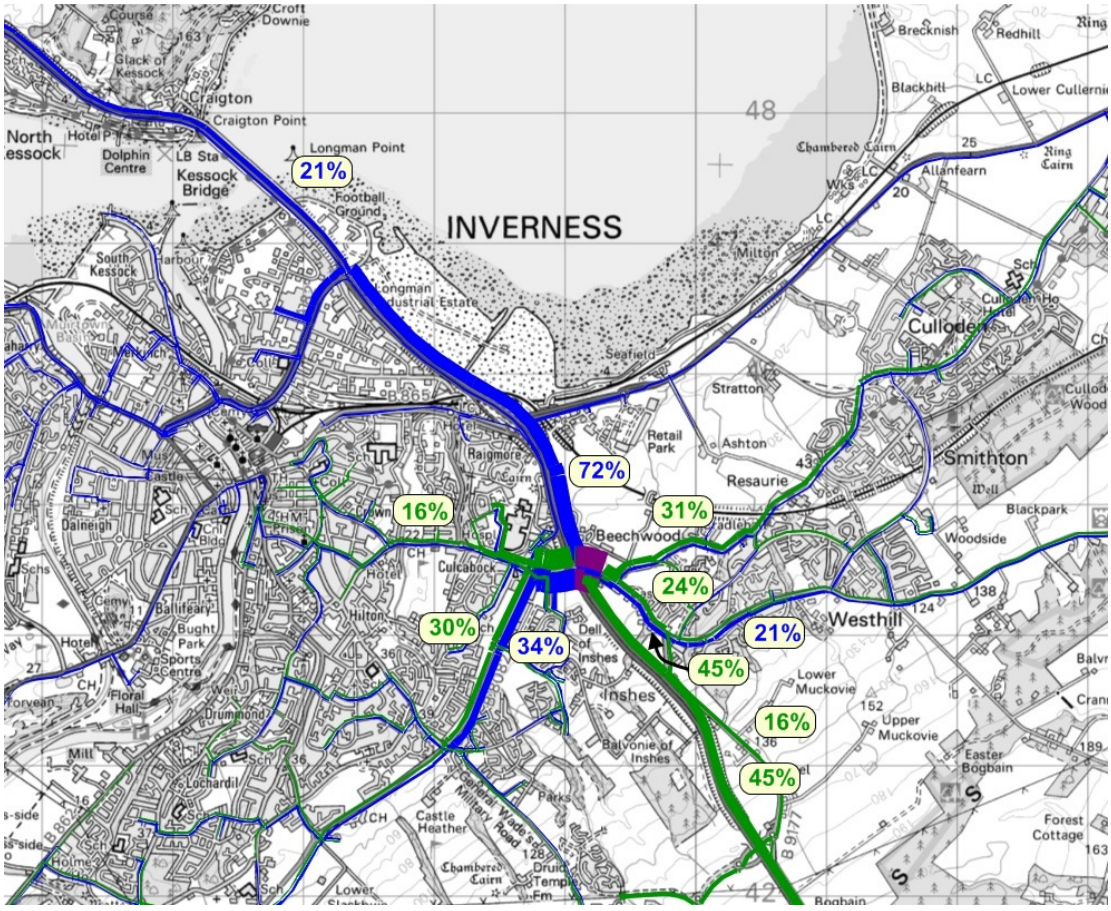
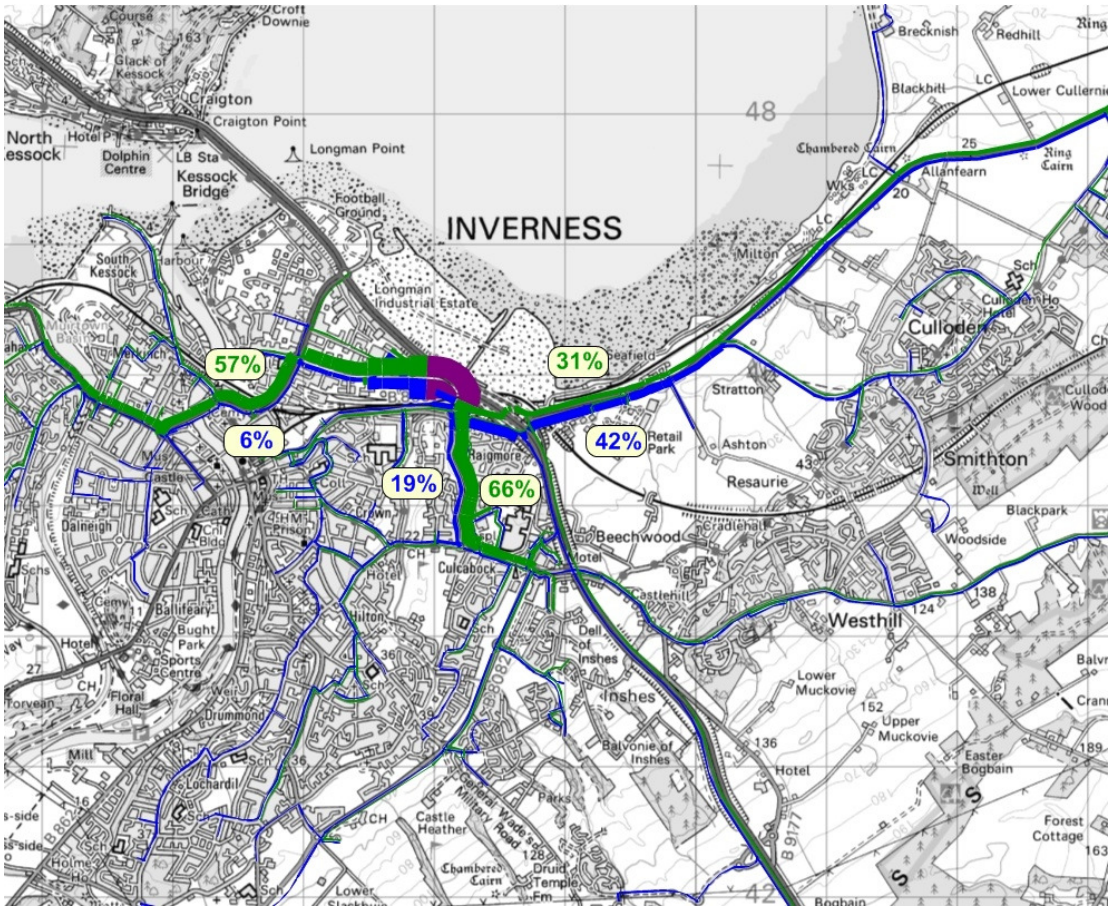
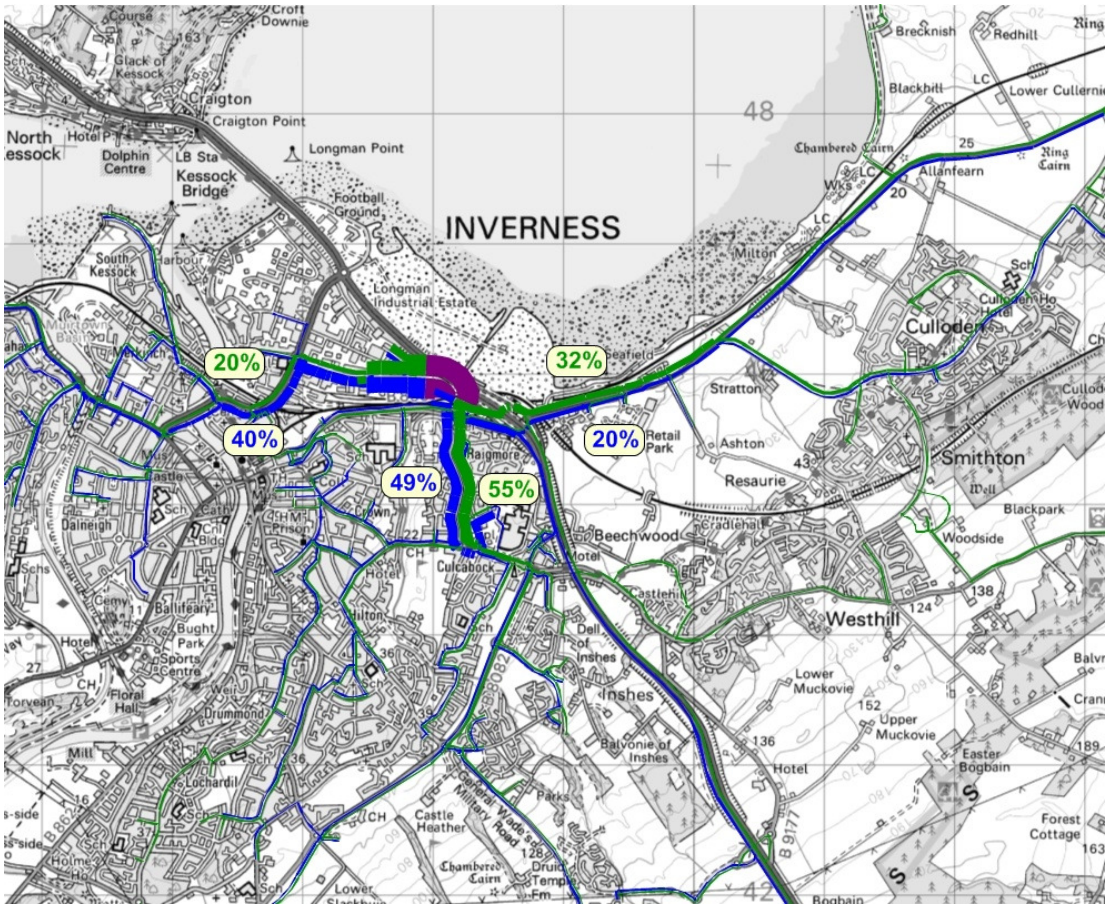


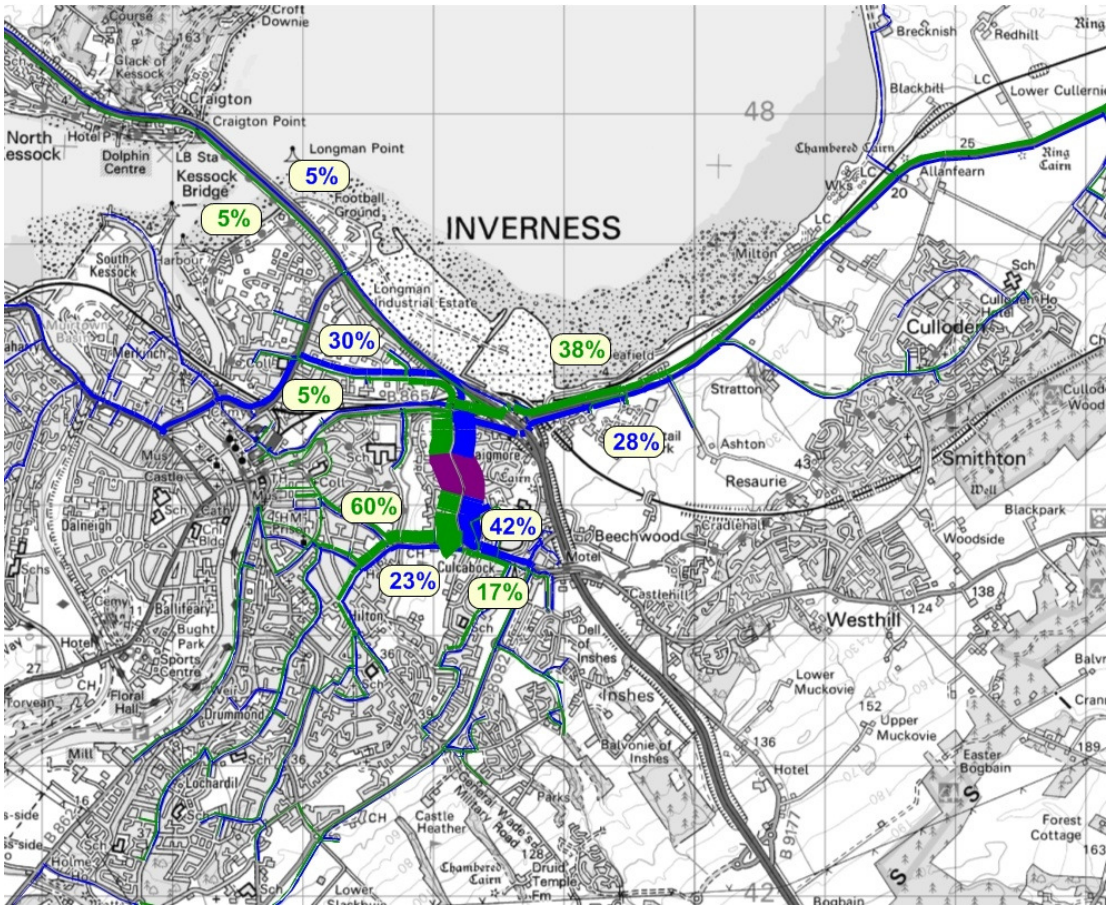
Harbour Road – 2009 AM



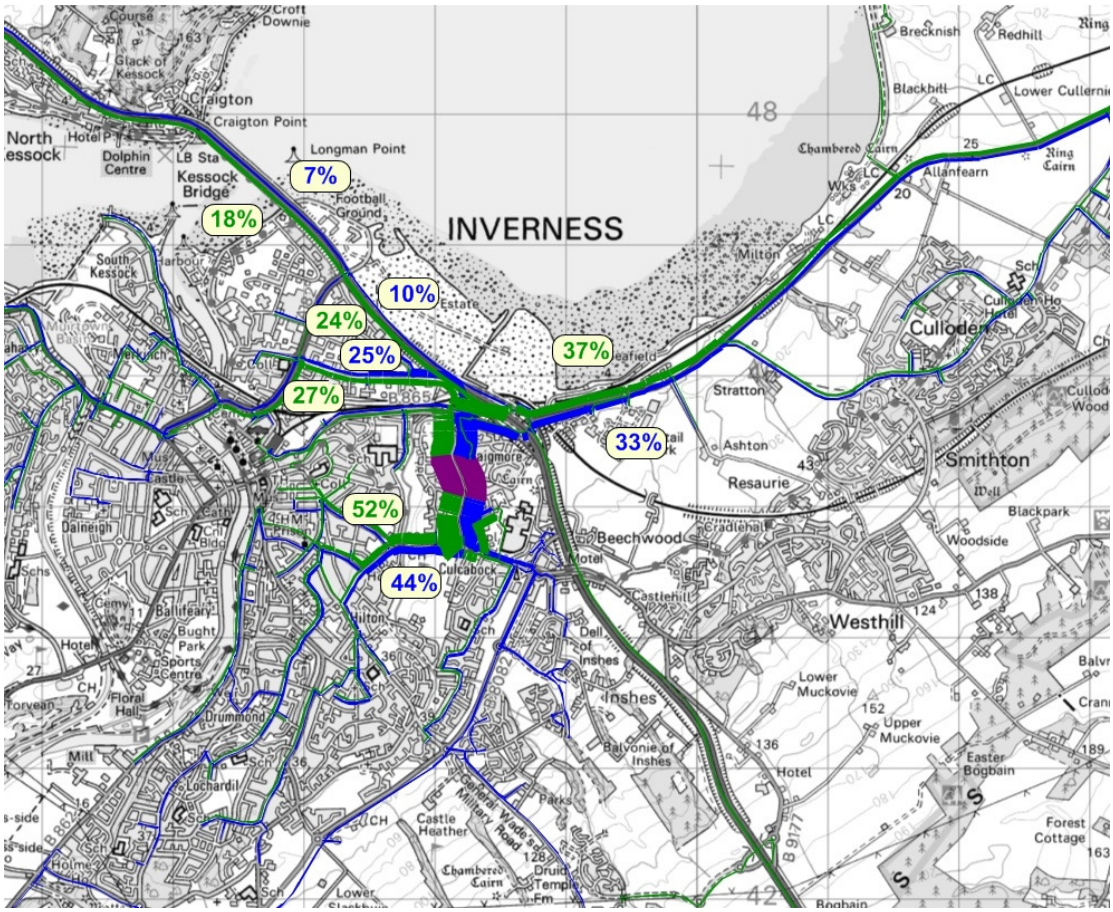
Harbour Road – 2009 PM



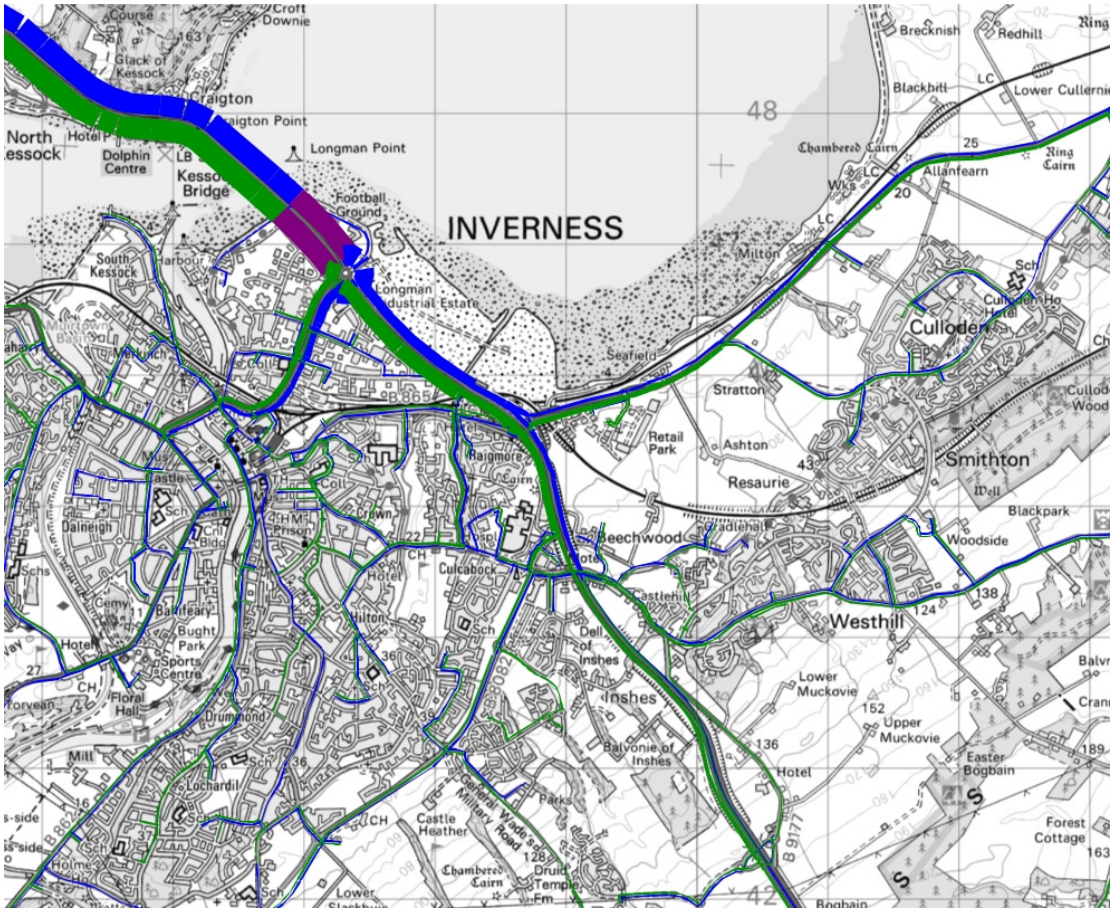
B9006 Old Perth Road – 2009 AM



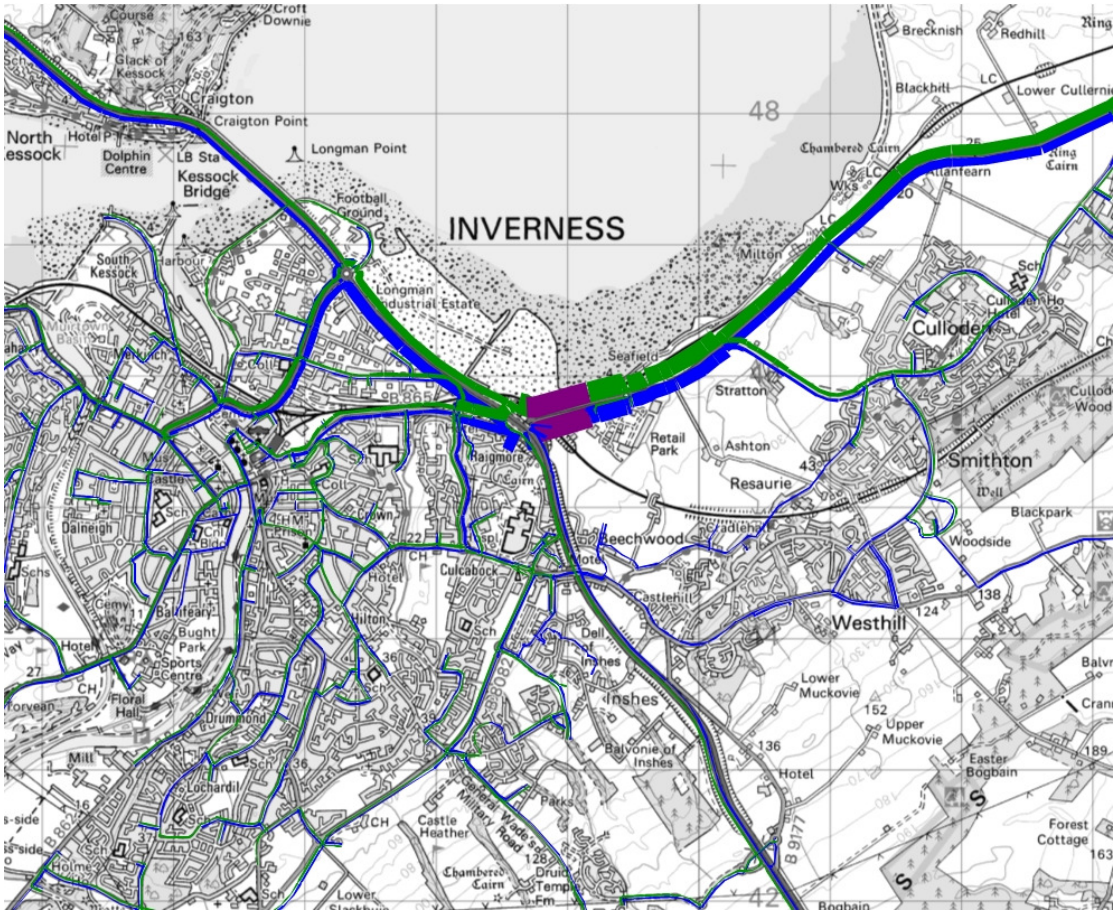
B9006 Old Perth Road – 2009 PM



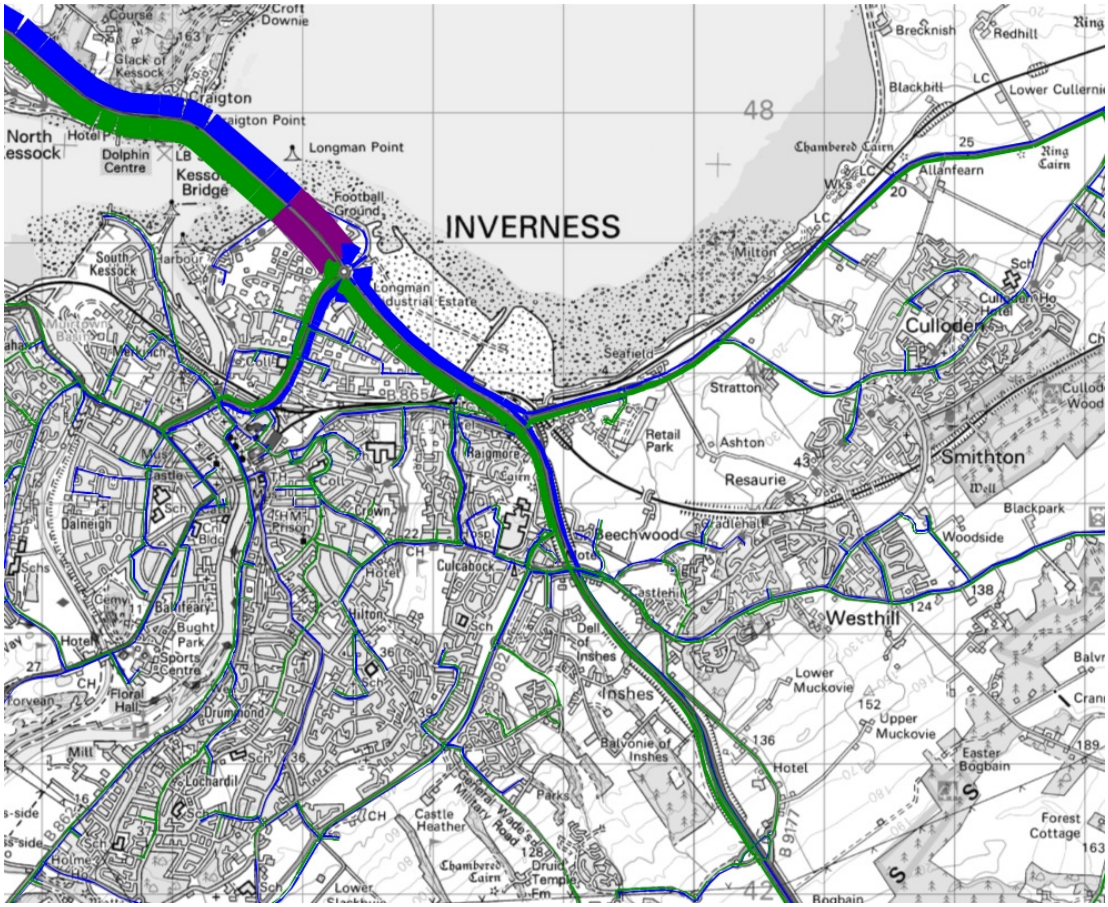
A96 (East of Raigmore Interchange) – 2031 AM



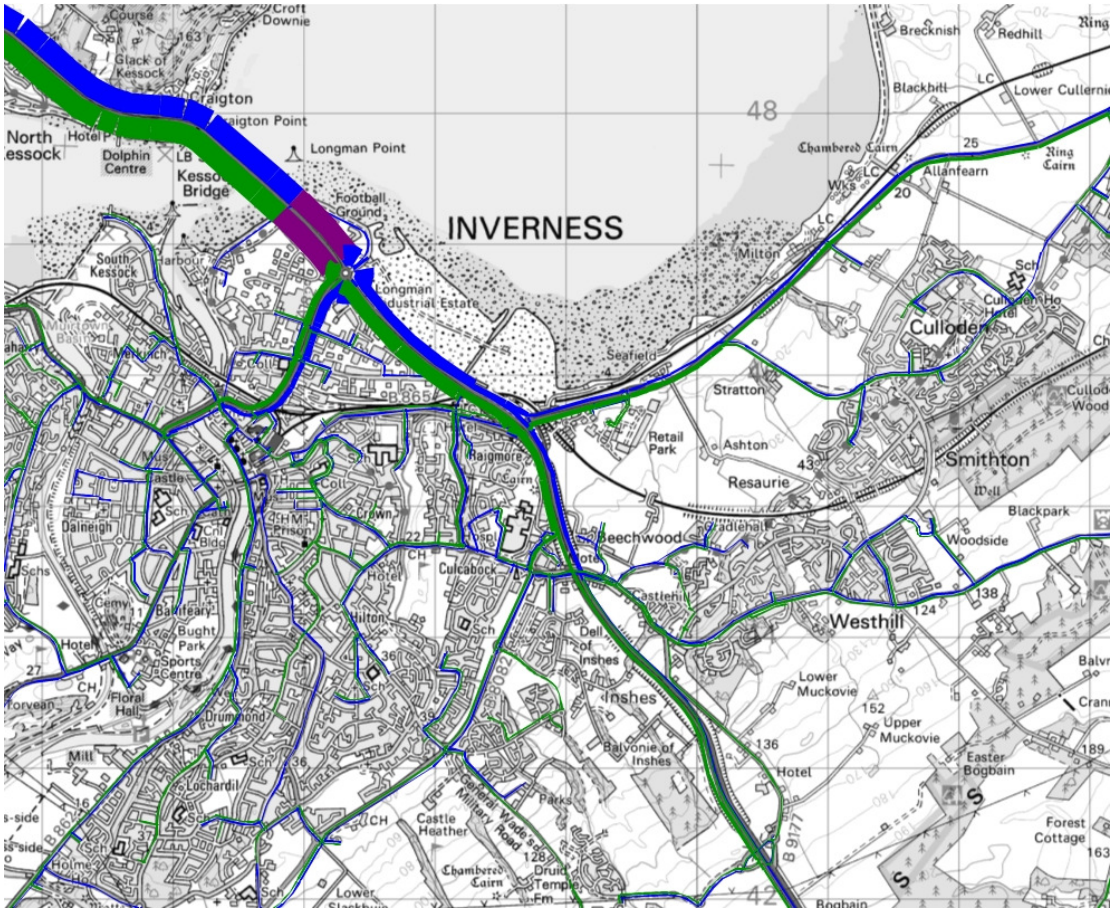
A96 (East of Raigmore Interchange) – 2031 PM



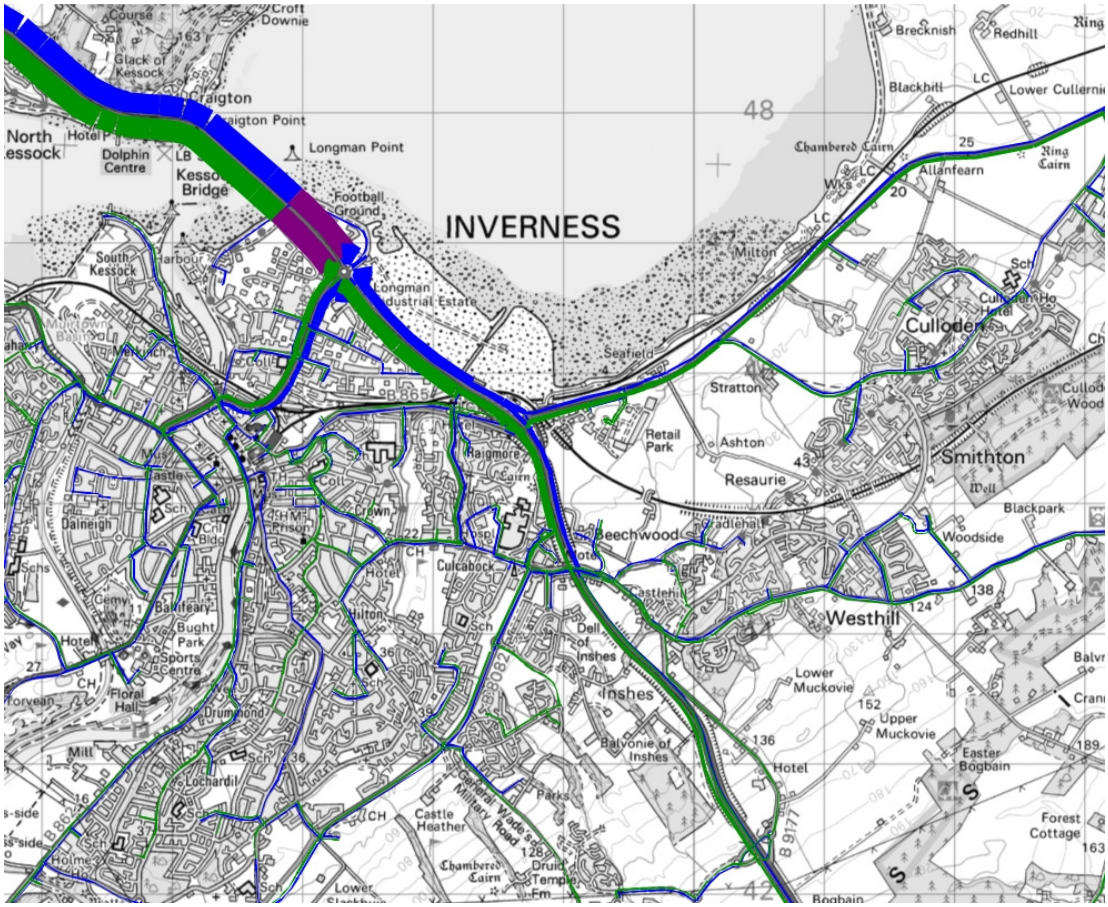
A9 Kessock Bridge – 2031 AM



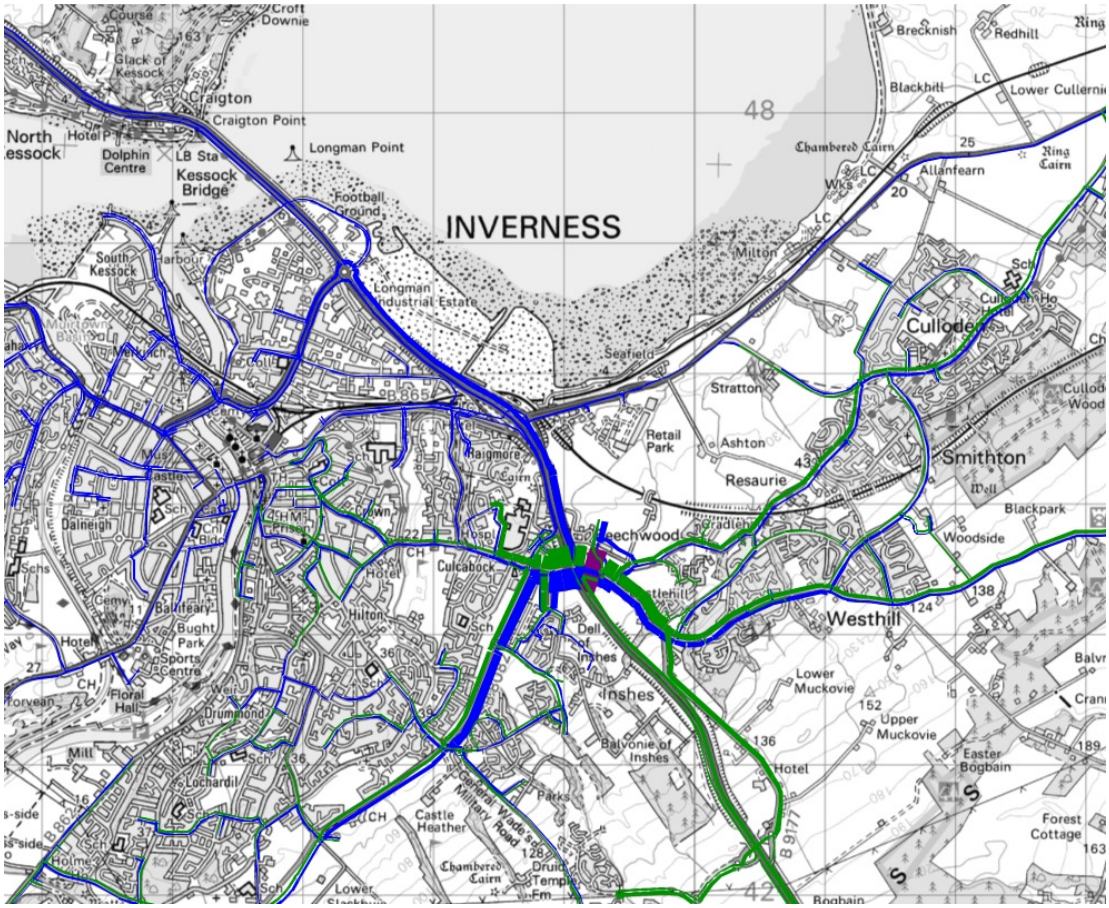
A9 Kessock Bridge – 2031 PM



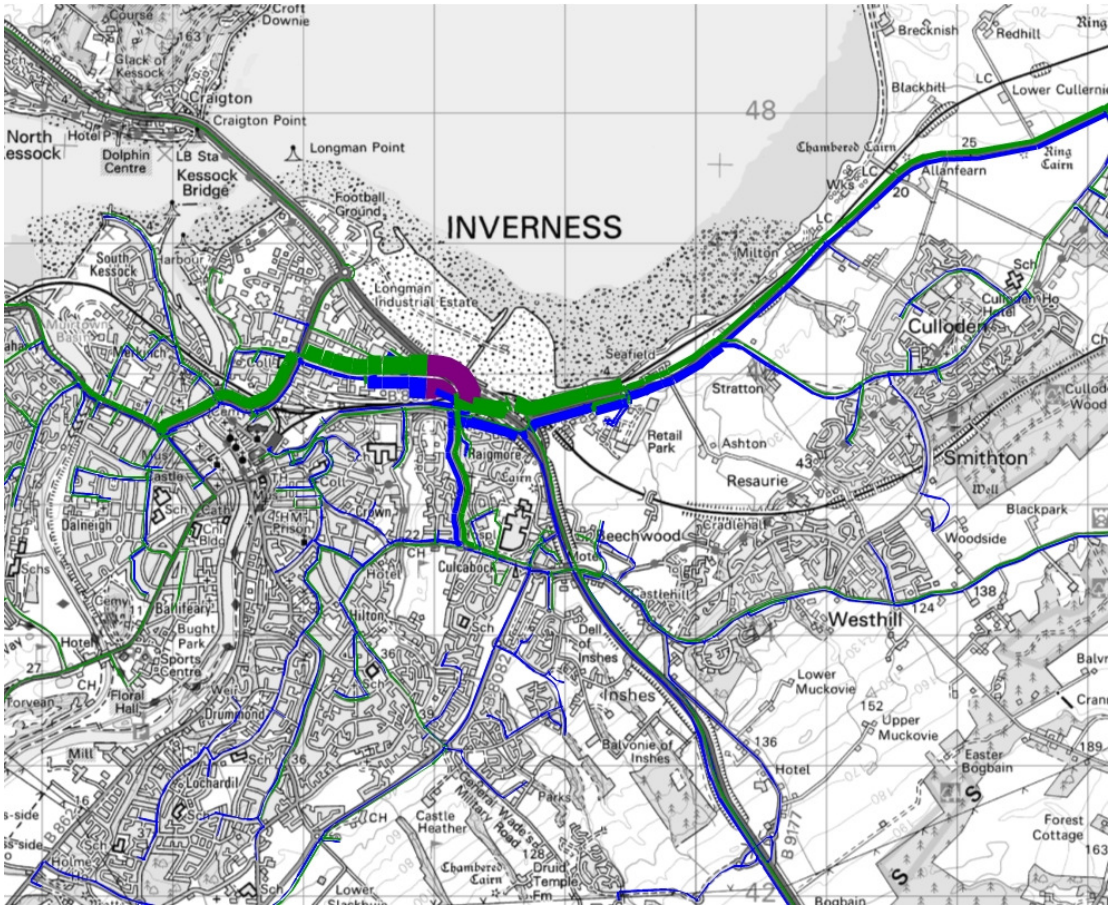
B9006 Overbridge at Inches – 2031 AM



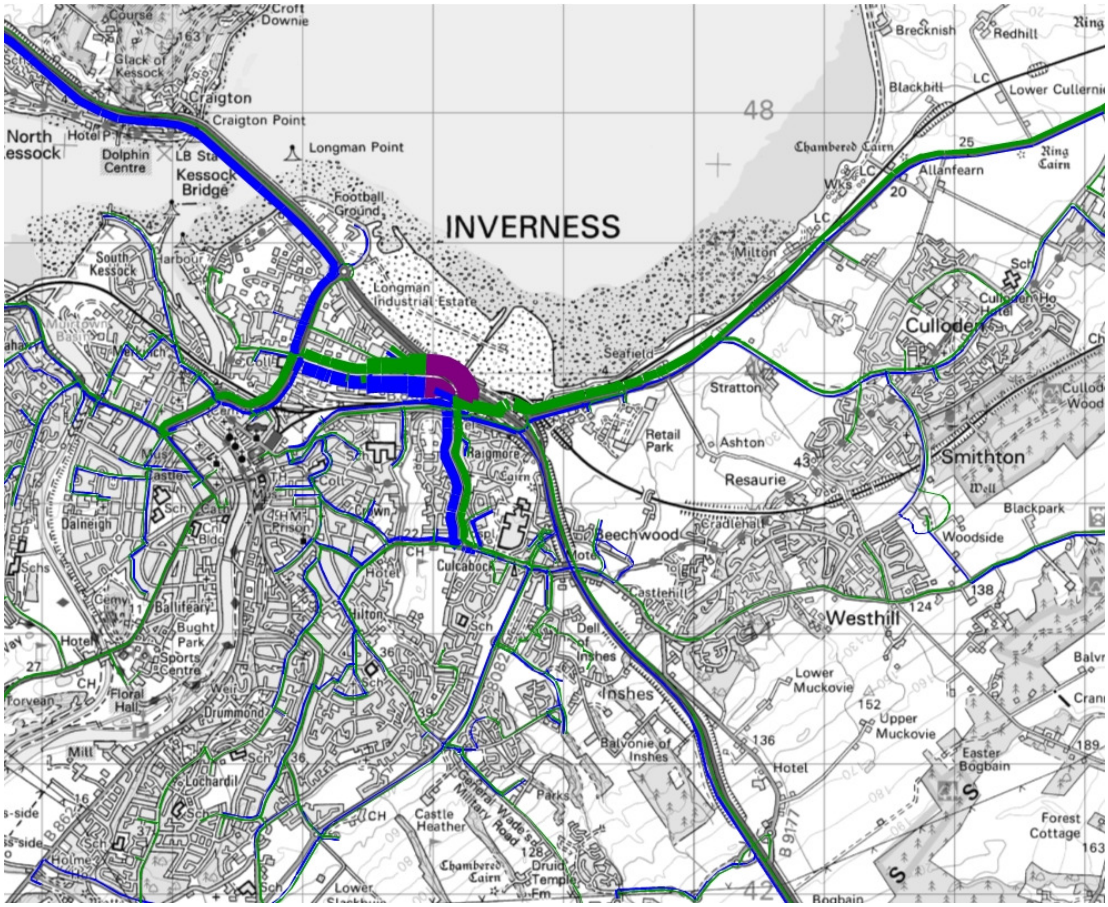
B9006 Overbridge at Inches – 2031 PM



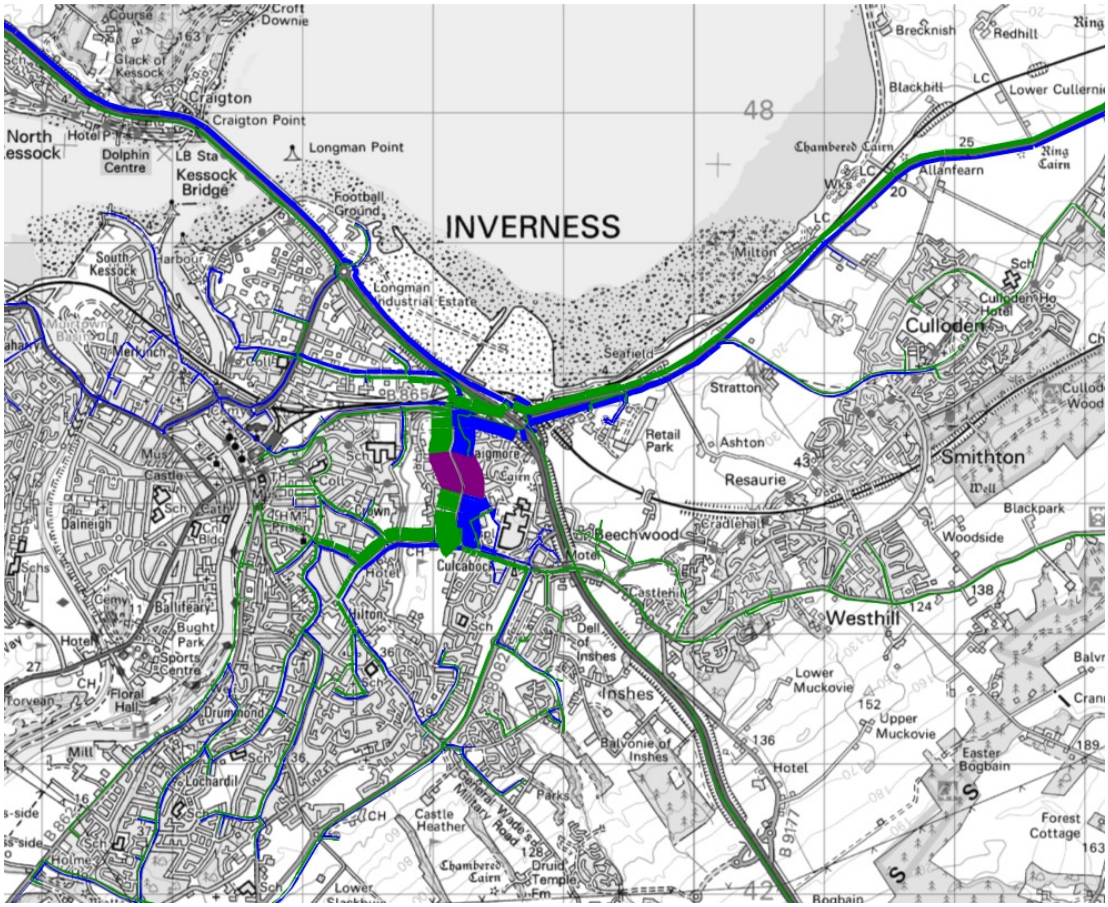
Harbour Road – 2031 AM



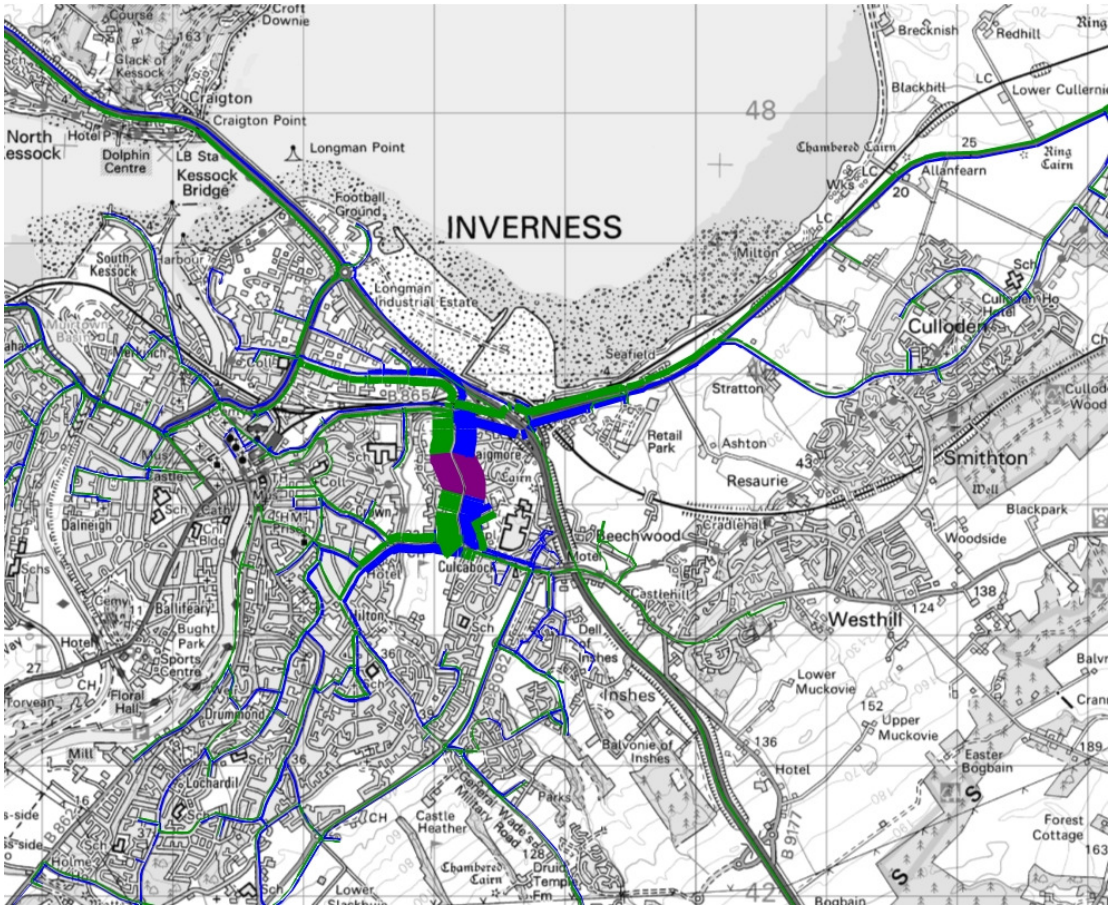
Harbour Road – 2031 PM



B9006 Old Perth Road – 2031 AM



B9006 Old Perth Road – 2031 PM



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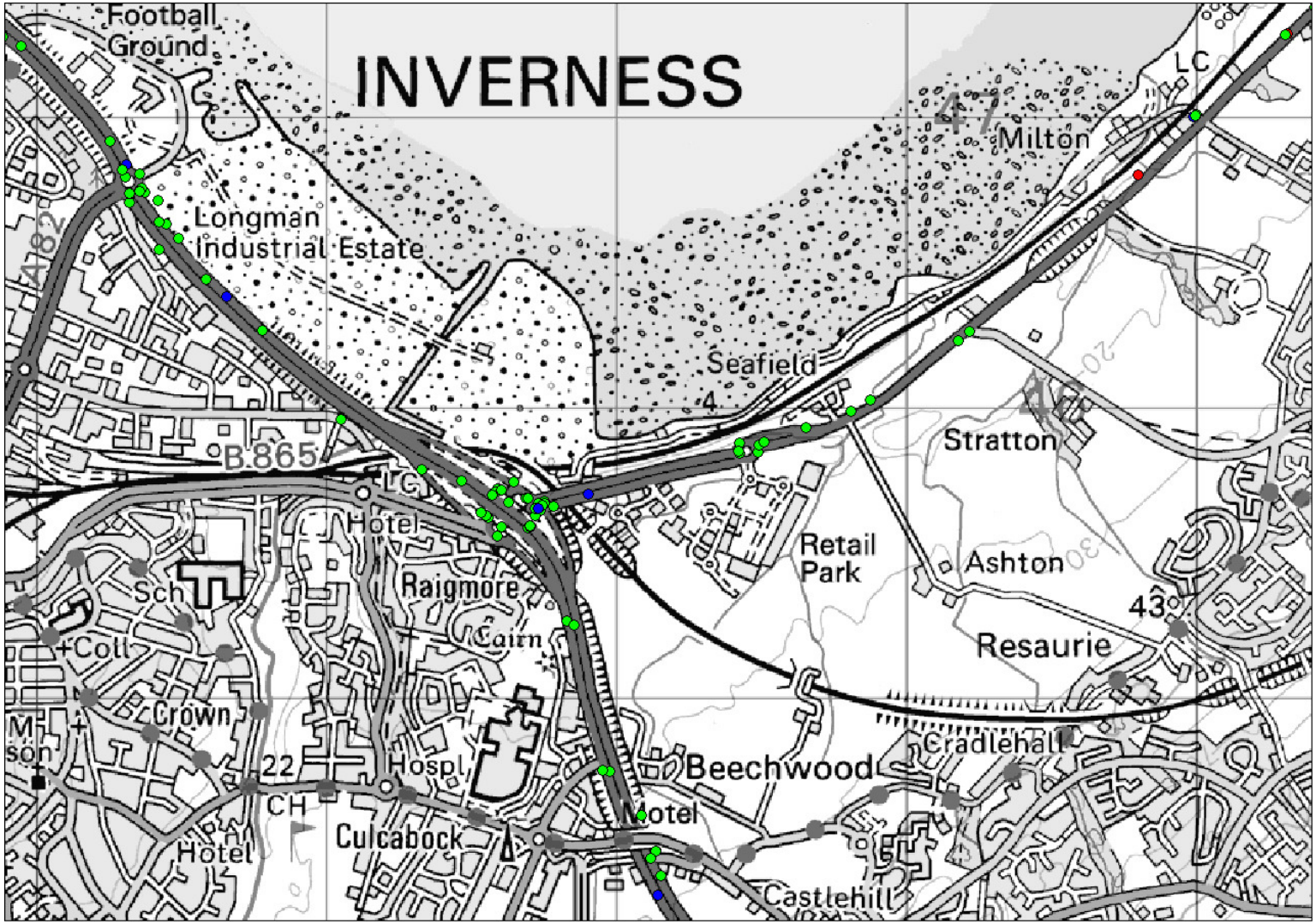
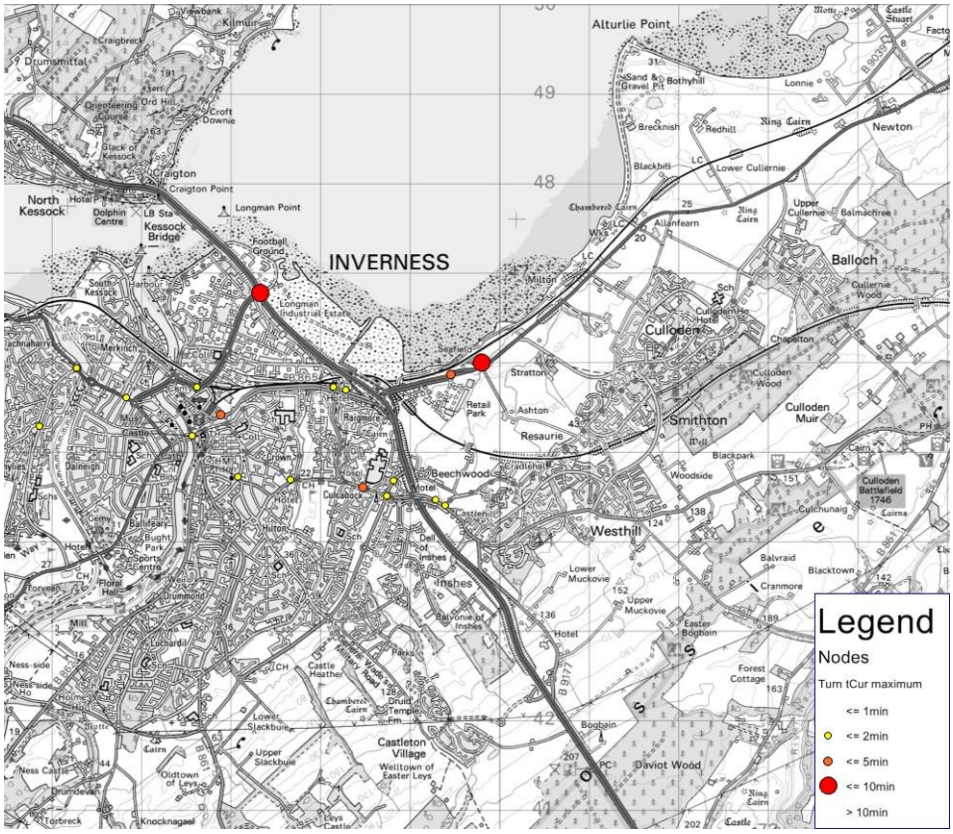
Appendix D Bus Service Provision Route Map

Appendix E Accident Locations 2000 – 2010

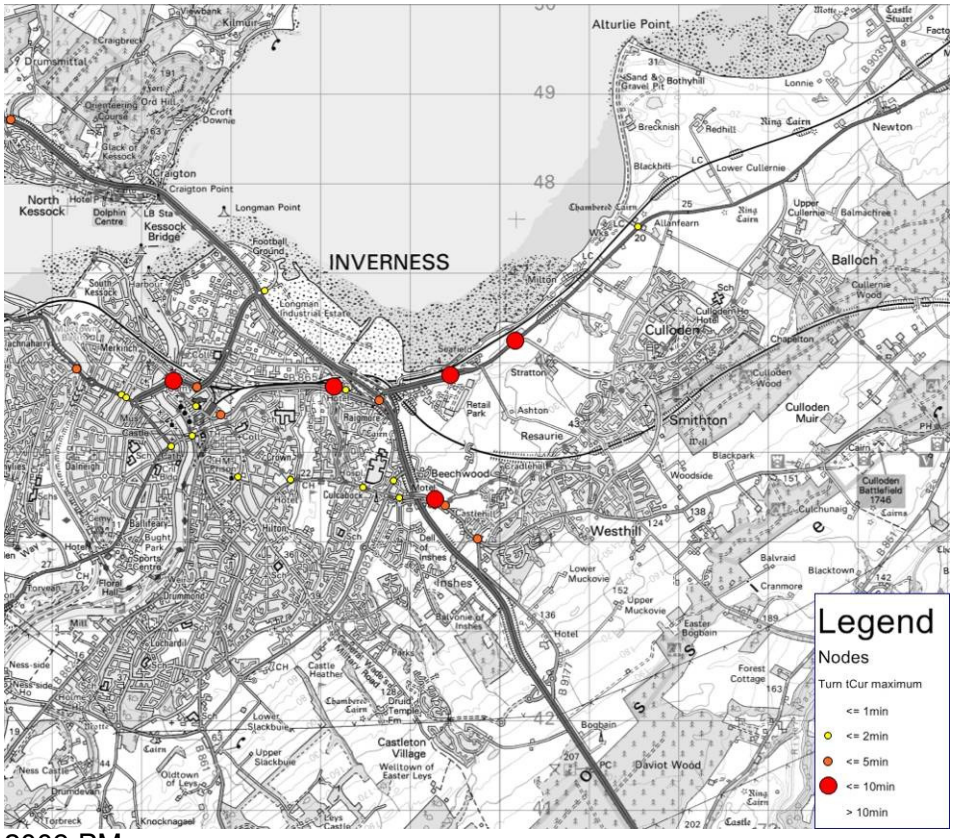


Appendix F Maximum Junction Delays (MFTM)

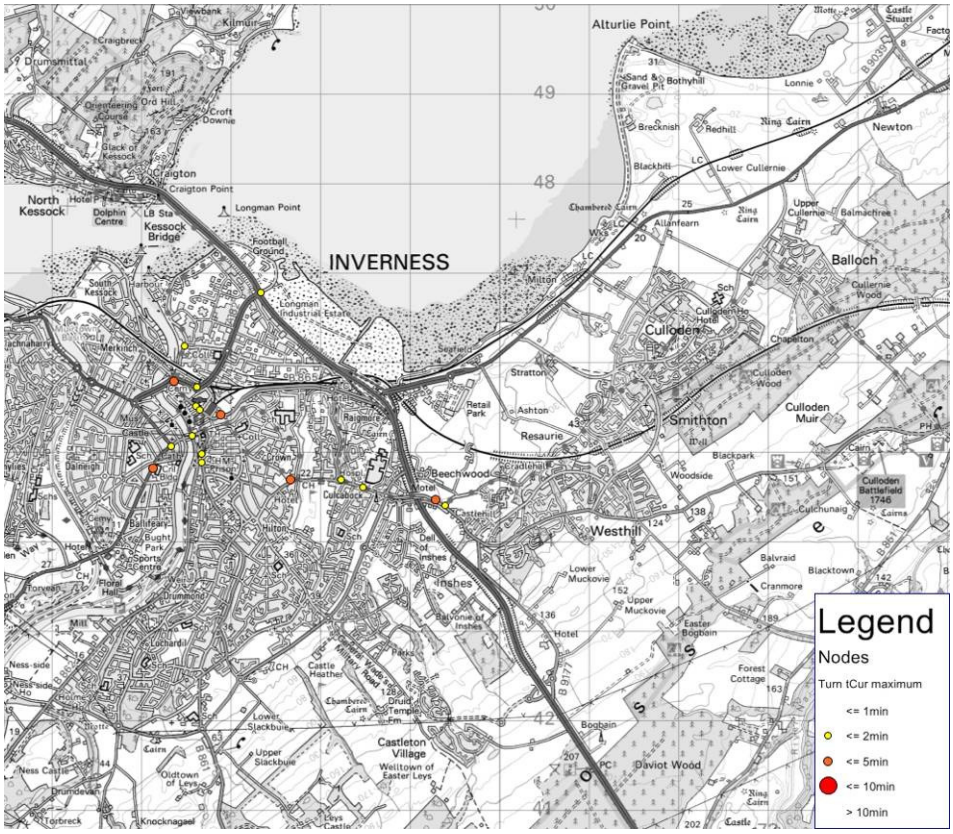
2009 AM



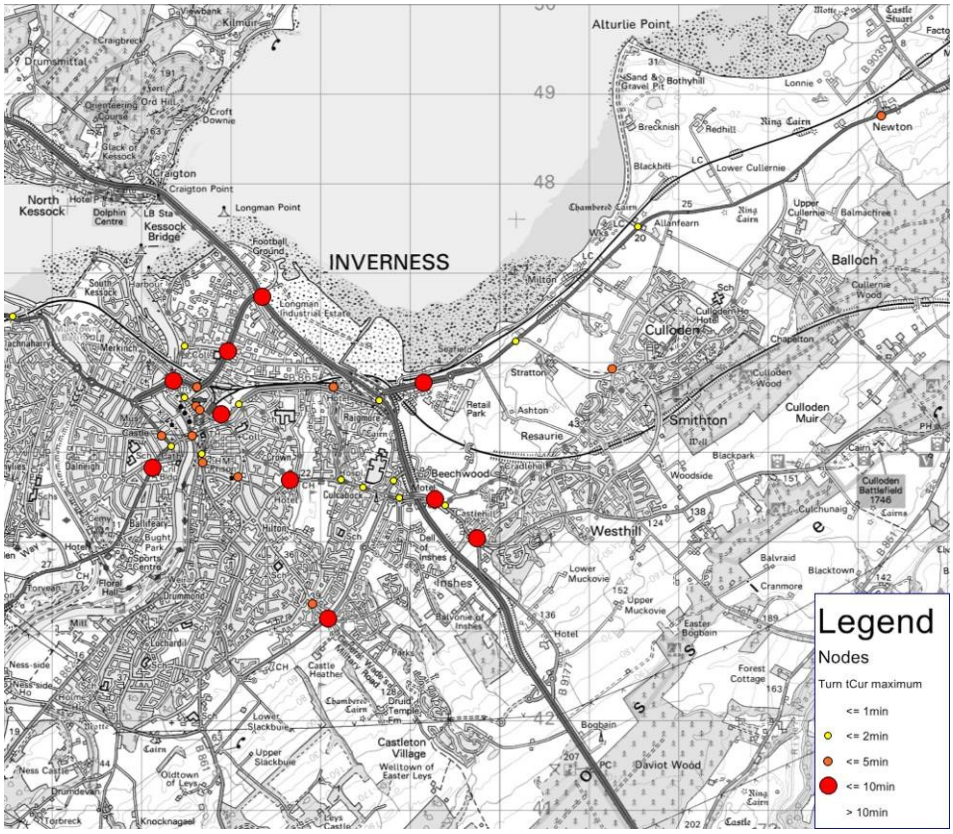
2031 AM



2009 PM


INVERNESS
Alturlie Point
Newton
Balloch
Culloden
Smithton
Culloden Muir
Westhill
Beechwood
Inshes
Castleton Village
Daviot Wood
North Kessock
Kessock Bridge
Longman Point
Craigton
Legend
Nodes
Turn tCur maximum
<= 1min
<= 2min
<= 5min
<= 10min
> 10min

2031 PM


INVERNESS
Alturlie Point
Newton
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Culloden
Smithton
Culloden Muir
Westhill
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Castleton Village
Daviot Wood
North Kessock
Kessock Bridge
Longman Point
Craigton
Legend
Nodes
Turn tCur maximum
<= 1min
<= 2min
<= 5min
<= 10min
> 10min

Appendix G Objective Mapping