

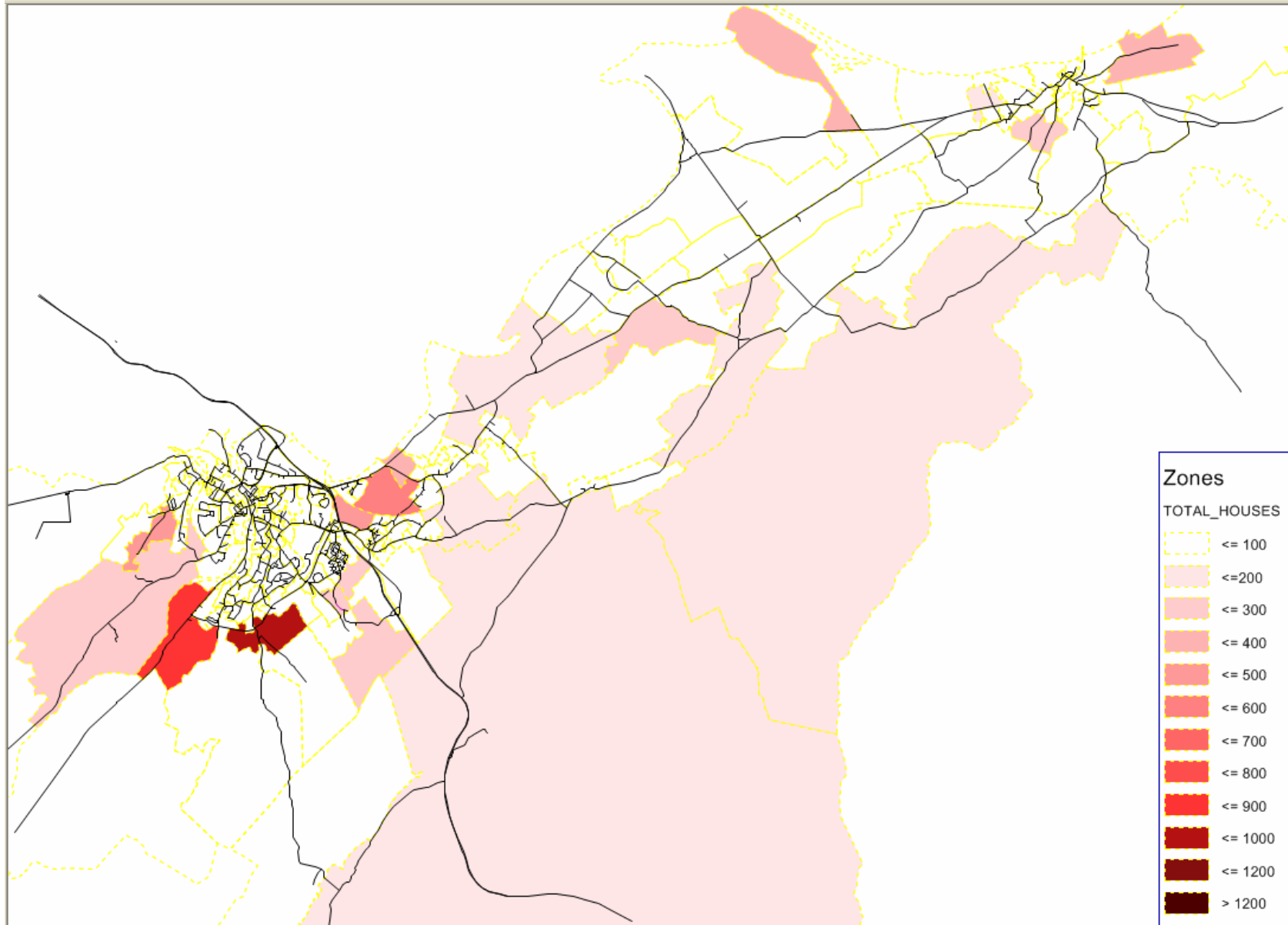
9. Appendices

1. Development growth
2. Traffic Flow Percentage Change on Links compared to the 'Do Nothing' scenarios;
3. Queues at the end of the period;
4. Journey times;
5. Links Volume of Capacity;
6. Select Link Analysis;

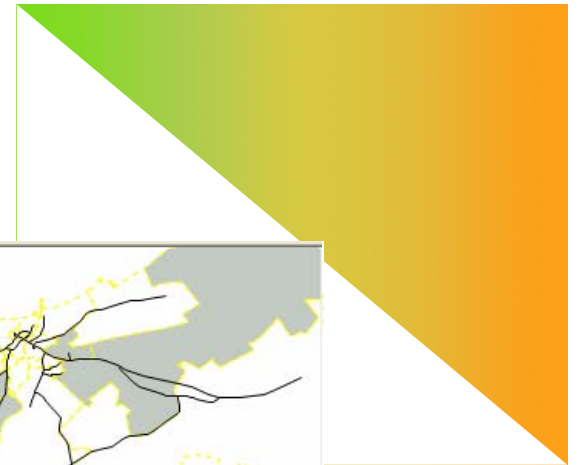
Increase in Housing between 2011 to 2021



2021



Increase in Employment between 2011 to 2021



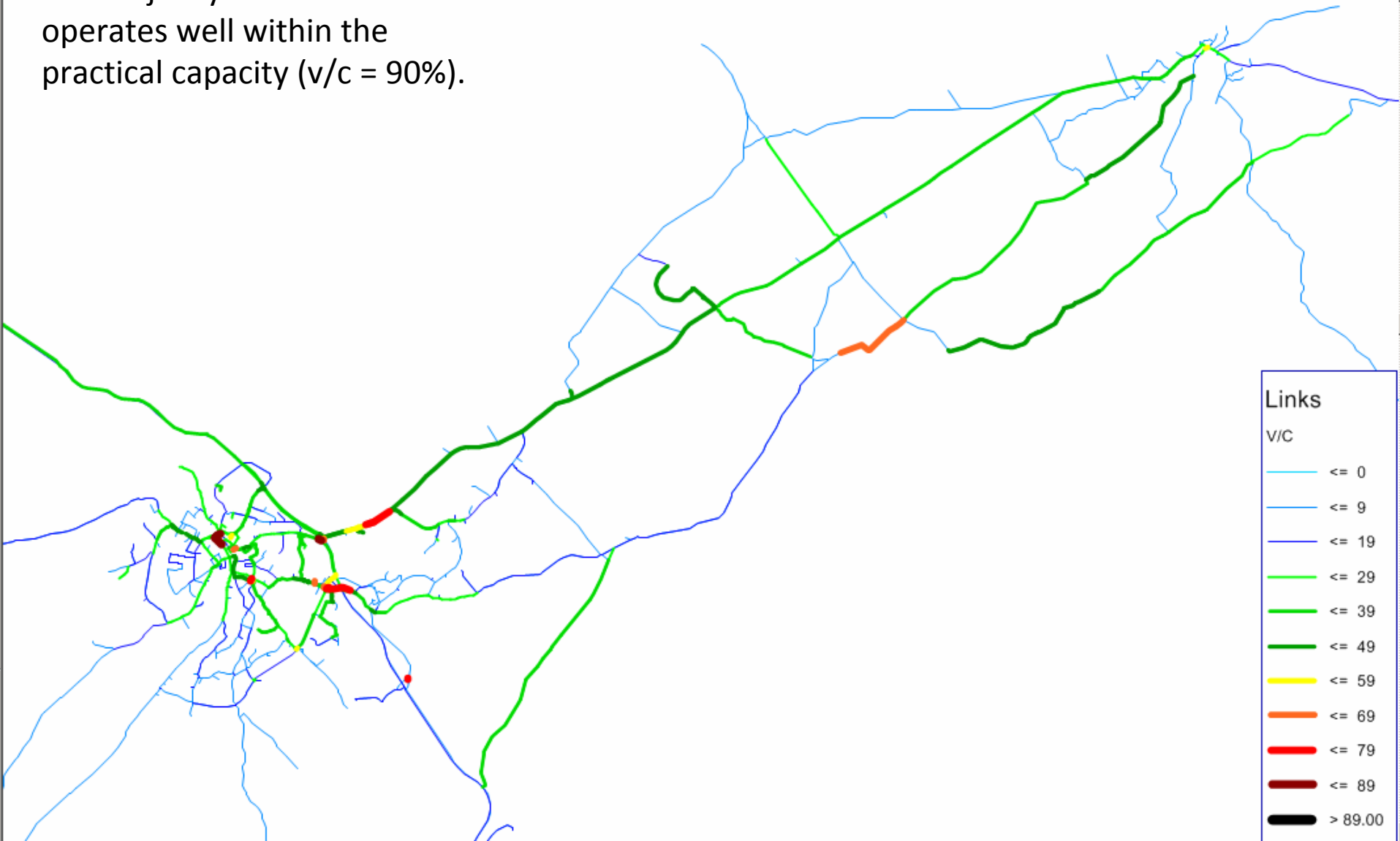
2021

AM Peak

Link Volume over Actual Capacity

AM 2009

The majority of the network operates well within the practical capacity ($v/c = 90\%$).

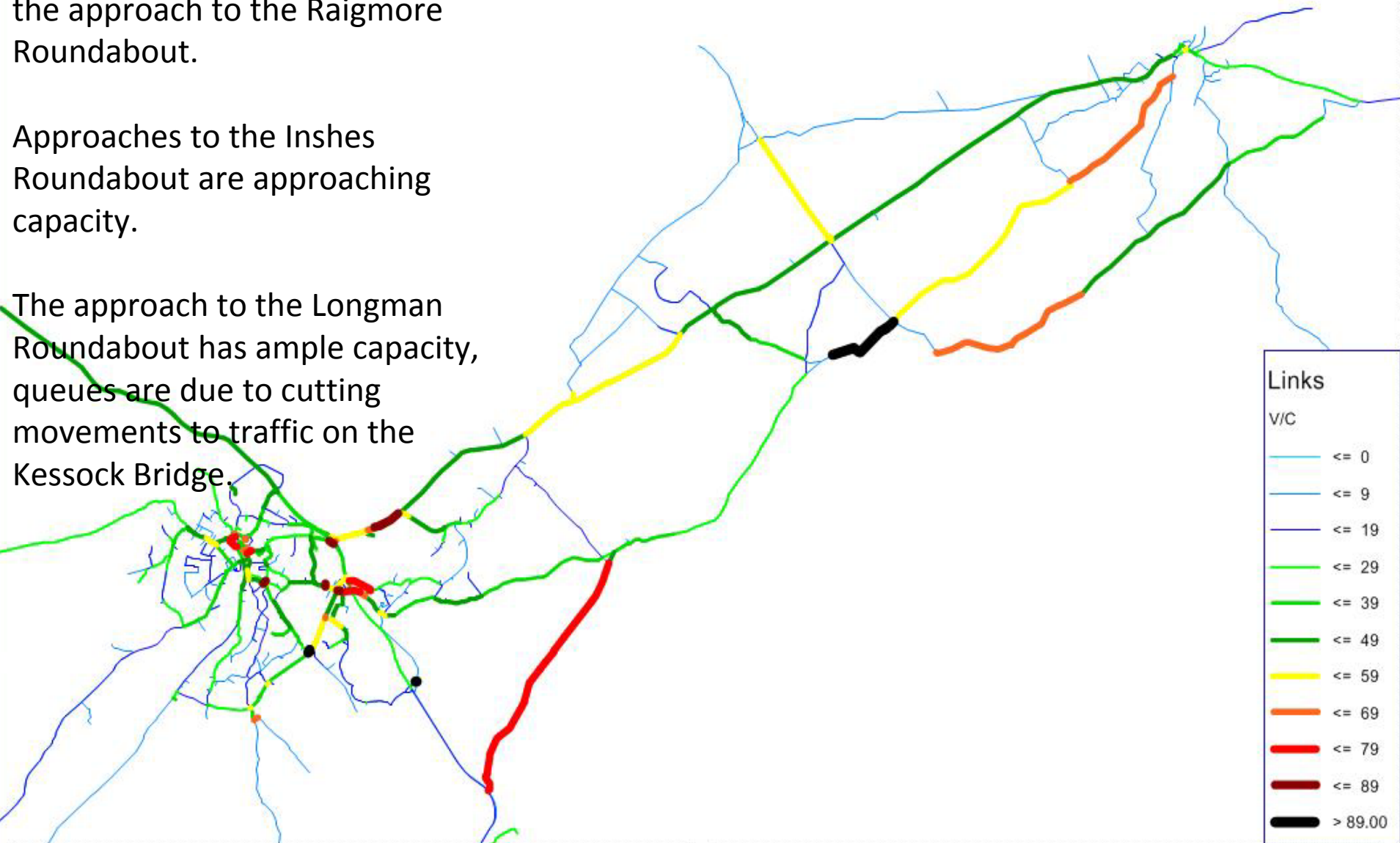


AM 2016

Increased capacity problems on the approach to the Raigmore Roundabout.

Approaches to the Inshes Roundabout are approaching capacity.

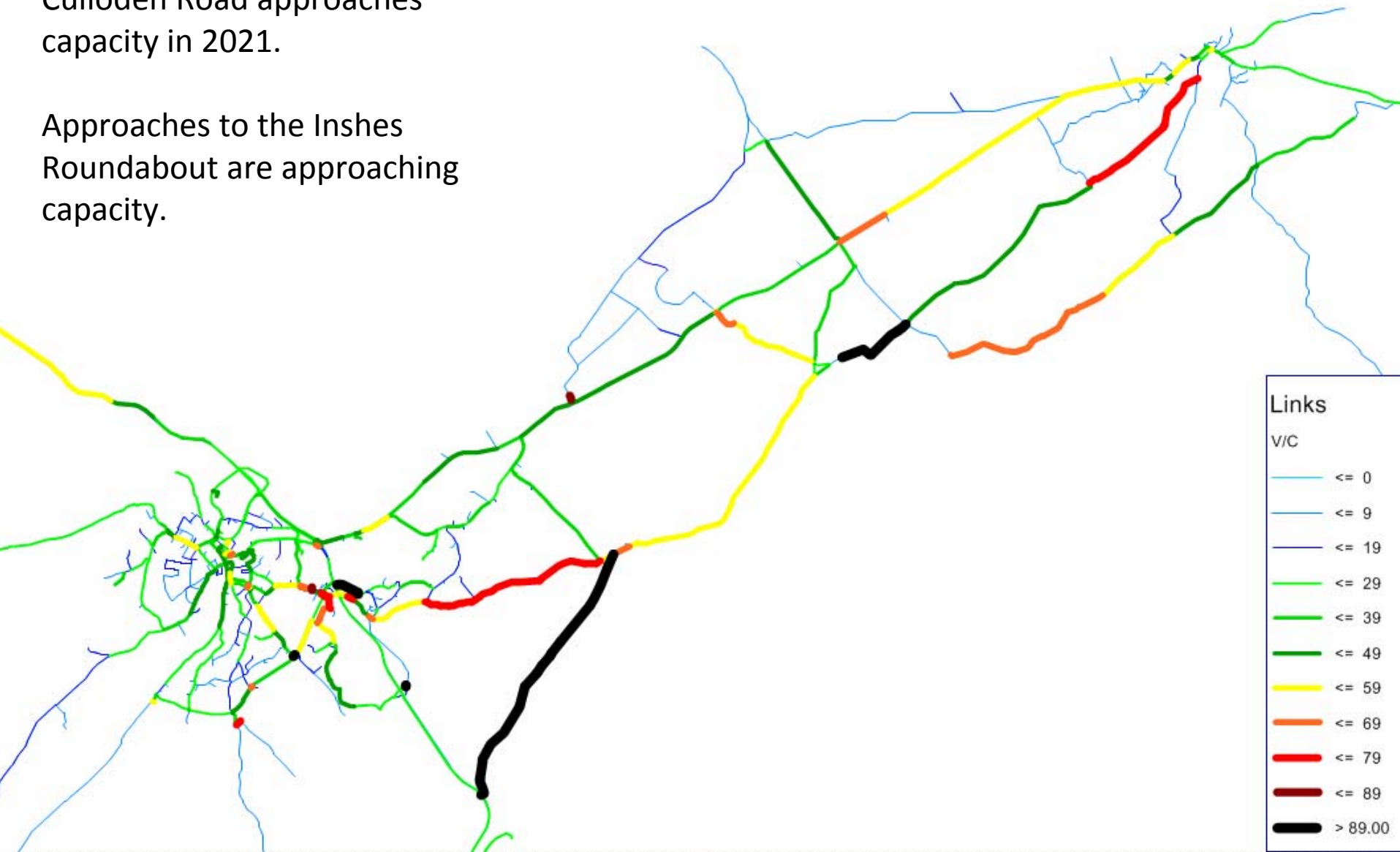
The approach to the Longman Roundabout has ample capacity, queues are due to cutting movements to traffic on the Kessock Bridge.



AM 2021

Culloden Road approaches capacity in 2021.

Approaches to the Inshes Roundabout are approaching capacity.



PM Peak

Link Volume over Actual Capacity

PM 2009

The A96 and the city centre exhibit capacity problems with several roads exceeding the practical capacity.

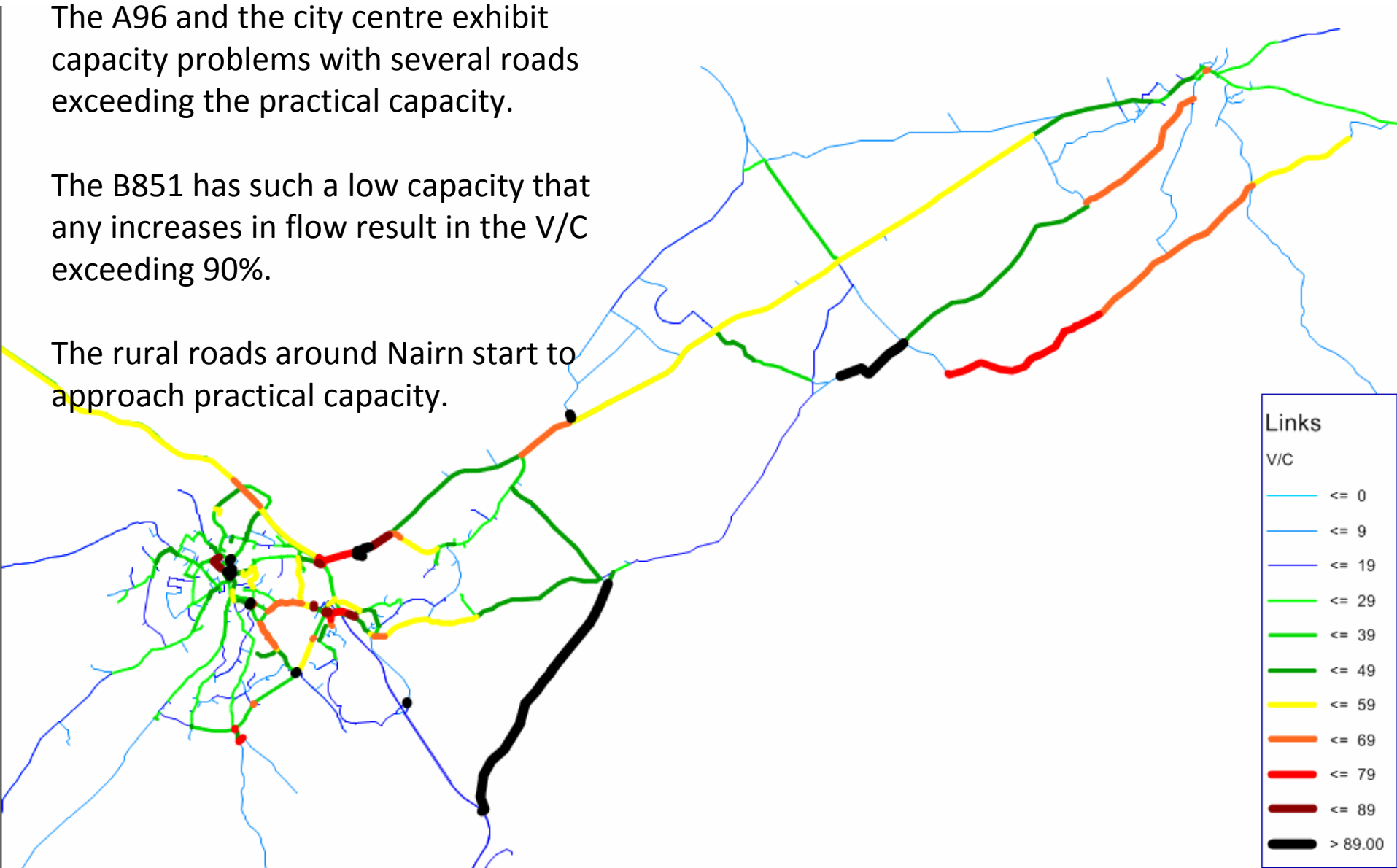


PM 2016

The A96 and the city centre exhibit capacity problems with several roads exceeding the practical capacity.

The B851 has such a low capacity that any increases in flow result in the V/C exceeding 90%.

The rural roads around Nairn start to approach practical capacity.

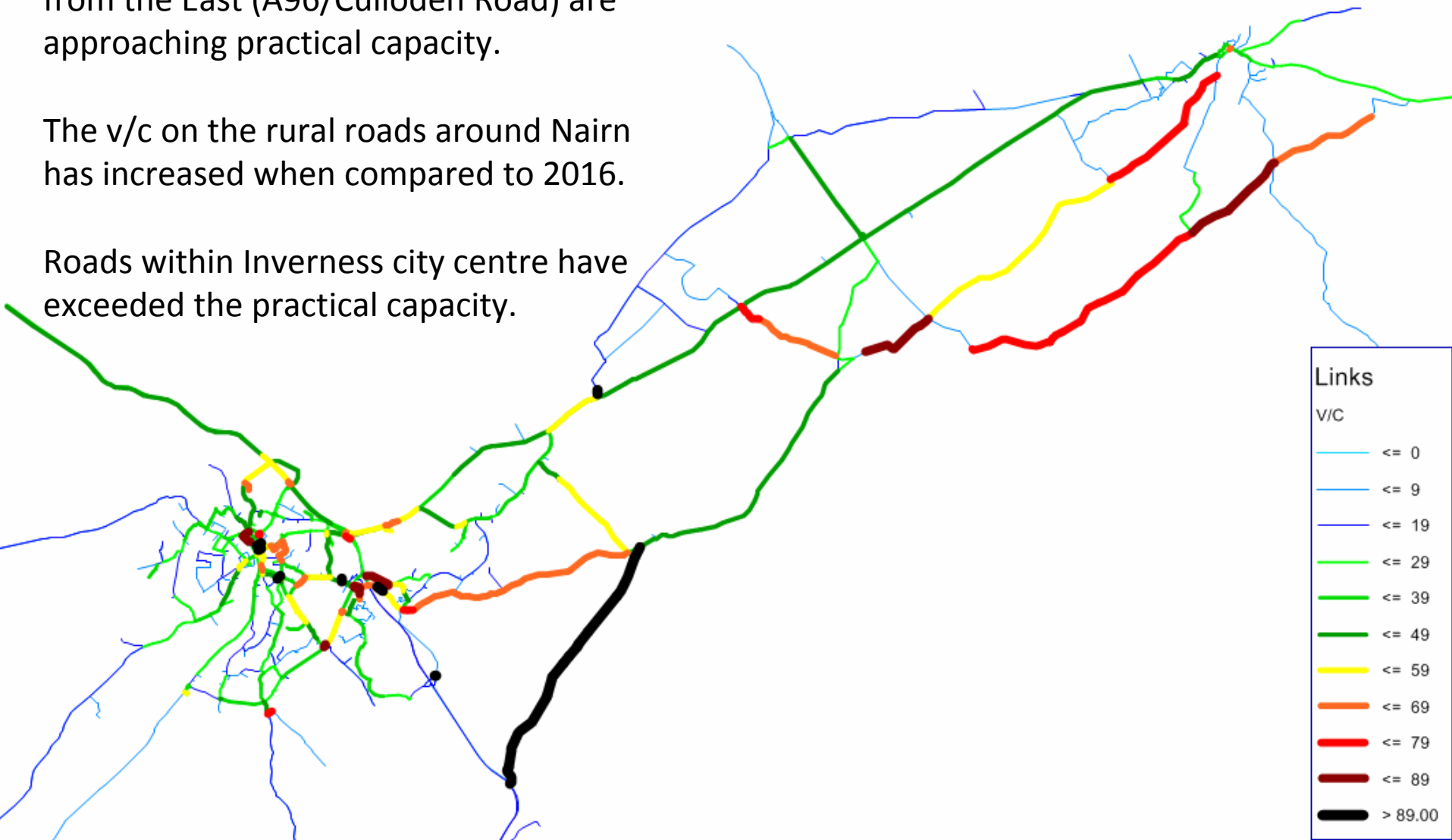


PM 2021

Both the access routes into Inverness from the East (A96/Culloden Road) are approaching practical capacity.

The v/c on the rural roads around Nairn has increased when compared to 2016.

Roads within Inverness city centre have exceeded the practical capacity.



Performance Indicators – Interventions Models

Performance Indicators

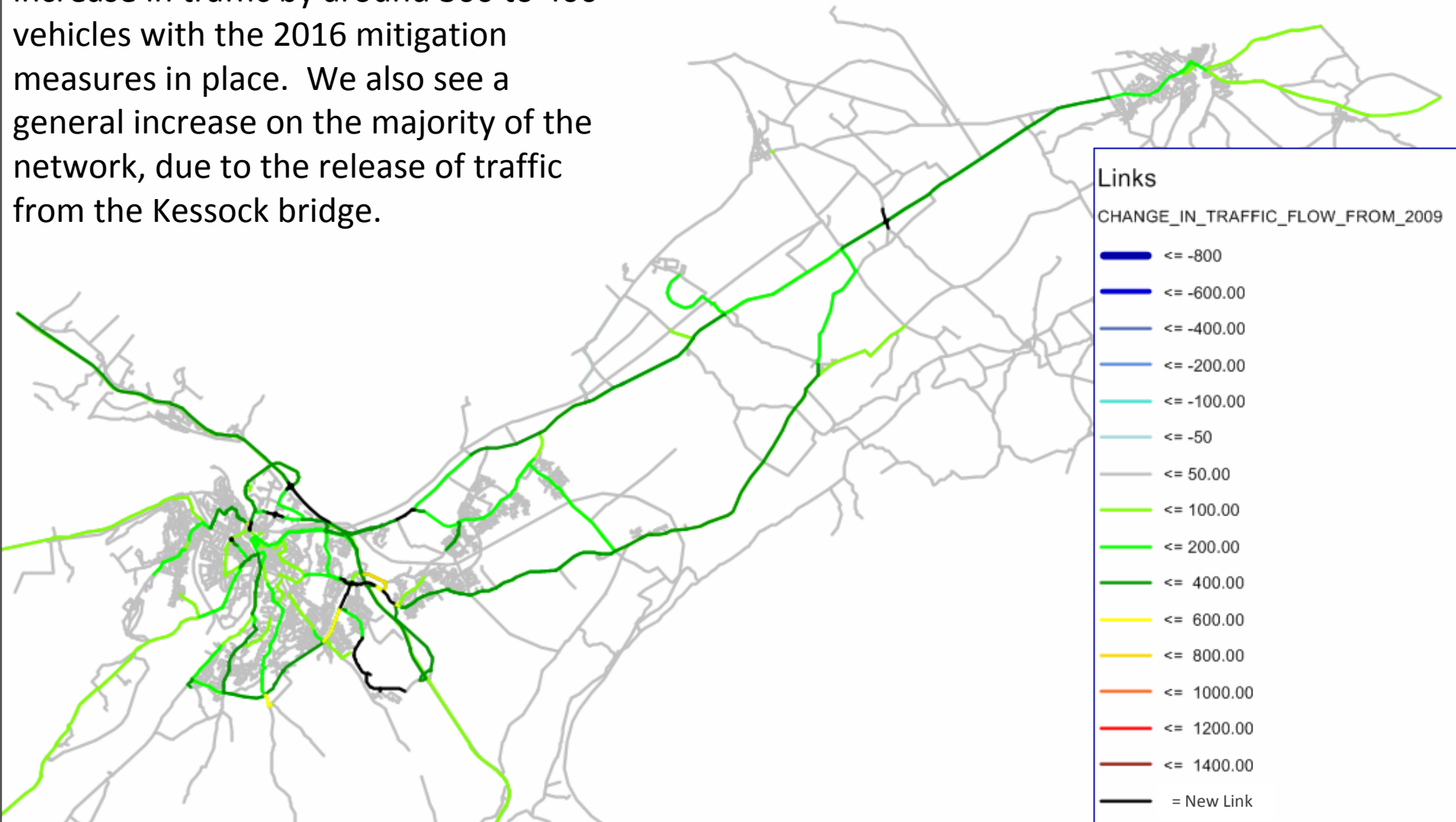
The following indicators were used to analyse model performance for each of the base as well as future models.

- Traffic Flow Percentage Change on Links compared to the 'Do Nothing' scenarios;
- Level Of Service (LOS);
- Queues at the end of the period;
- Journey times;
- Links Volume over Actual Capacity; and
- Select Link Analysis (for vehicles inbound to Inverness city centre in the AM and outbound from the city centre in the PM).

AM PEAK – Changes in flow
from 'Do Nothing' scenarios

AM 2016 (interventions) against 2009

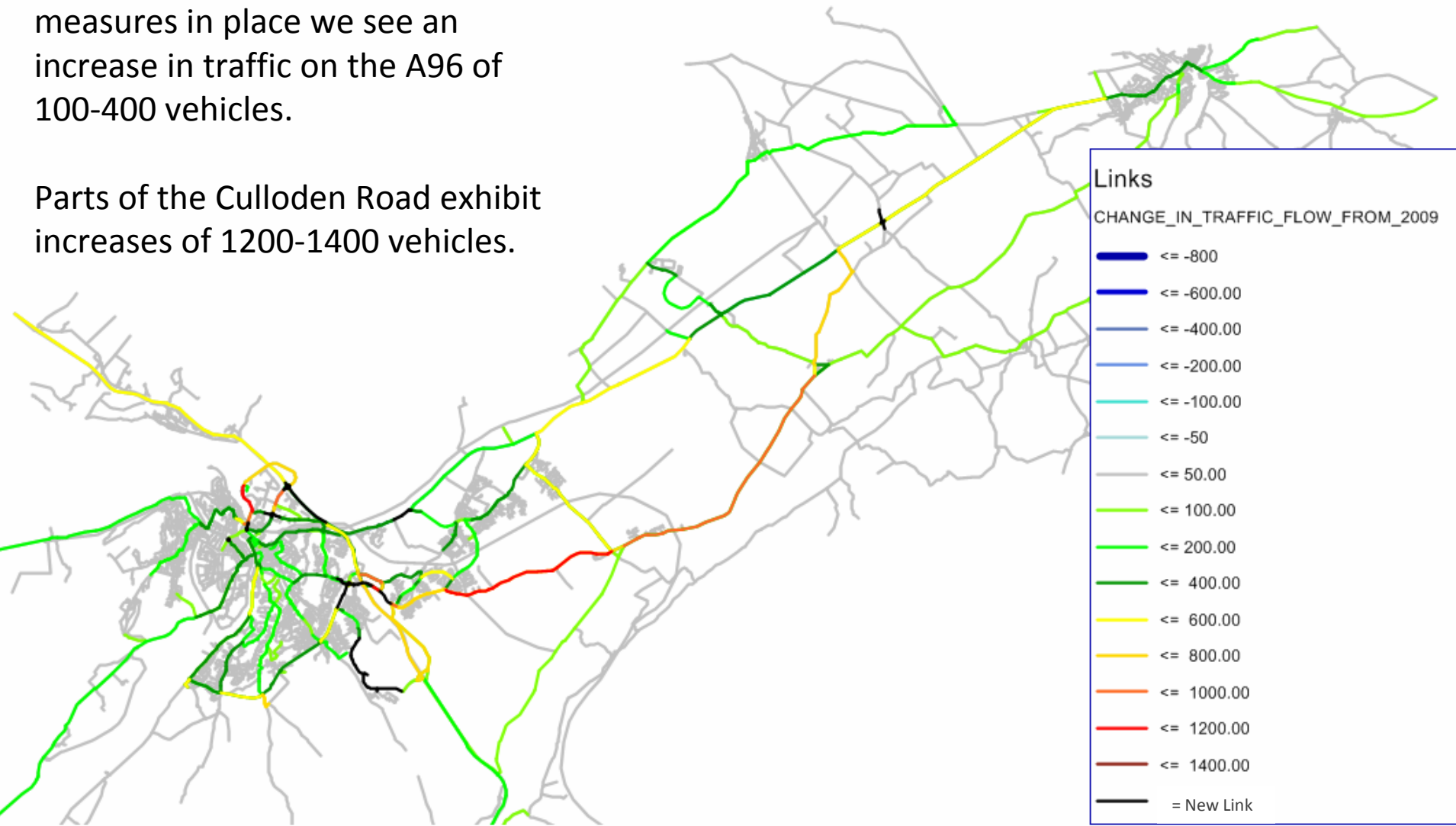
A96 and Culloden Road sees an increase in traffic by around 300 to 400 vehicles with the 2016 mitigation measures in place. We also see a general increase on the majority of the network, due to the release of traffic from the Kessock bridge.



AM 2021 with 2016 Interventions

In 2021 with the 2016 mitigation measures in place we see an increase in traffic on the A96 of 100-400 vehicles.

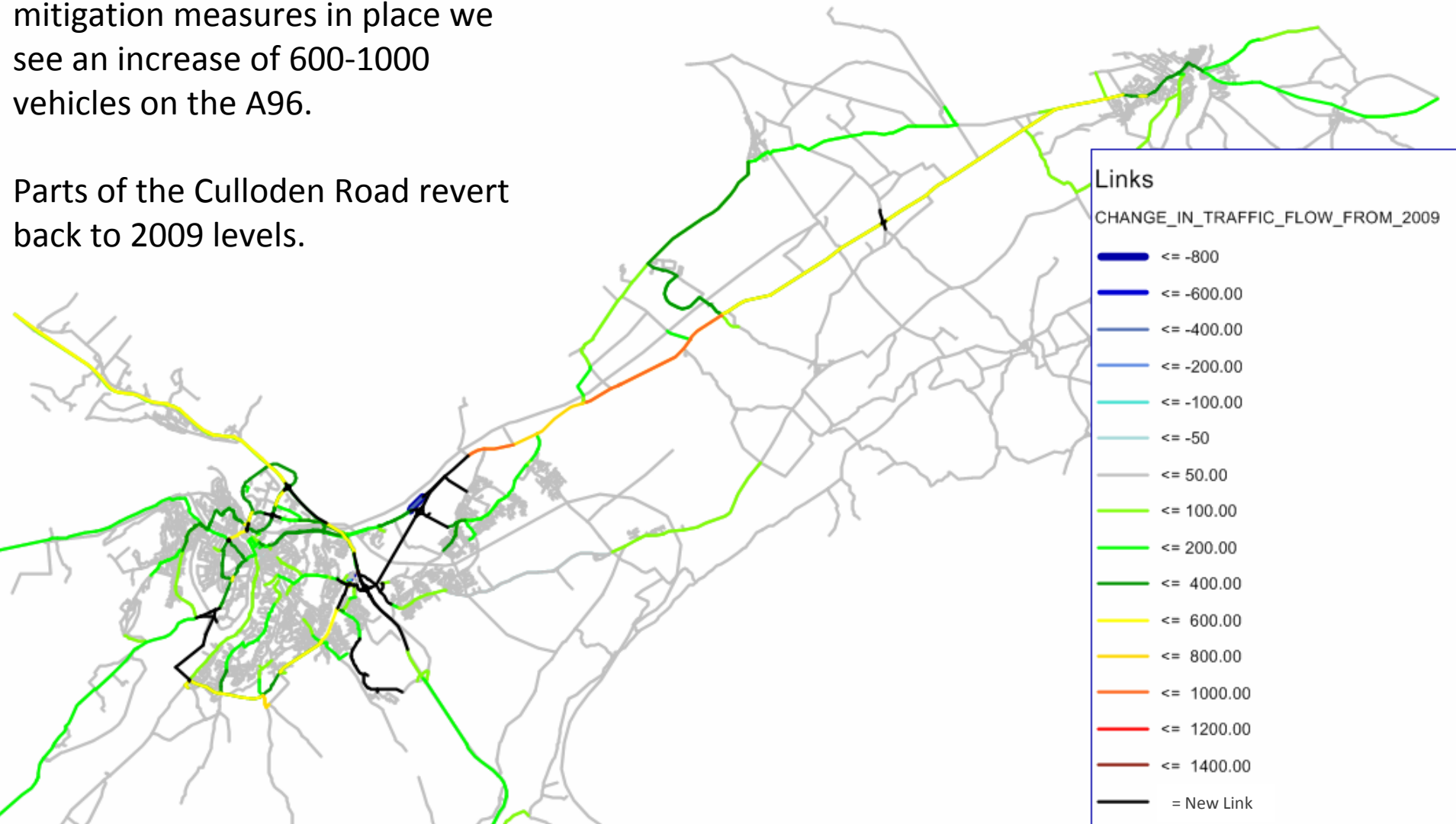
Parts of the Culloden Road exhibit increases of 1200-1400 vehicles.



AM 2021 Nos. 1, 2 & 3A

With the 2021 Nos. 1, 2 & 3A mitigation measures in place we see an increase of 600-1000 vehicles on the A96.

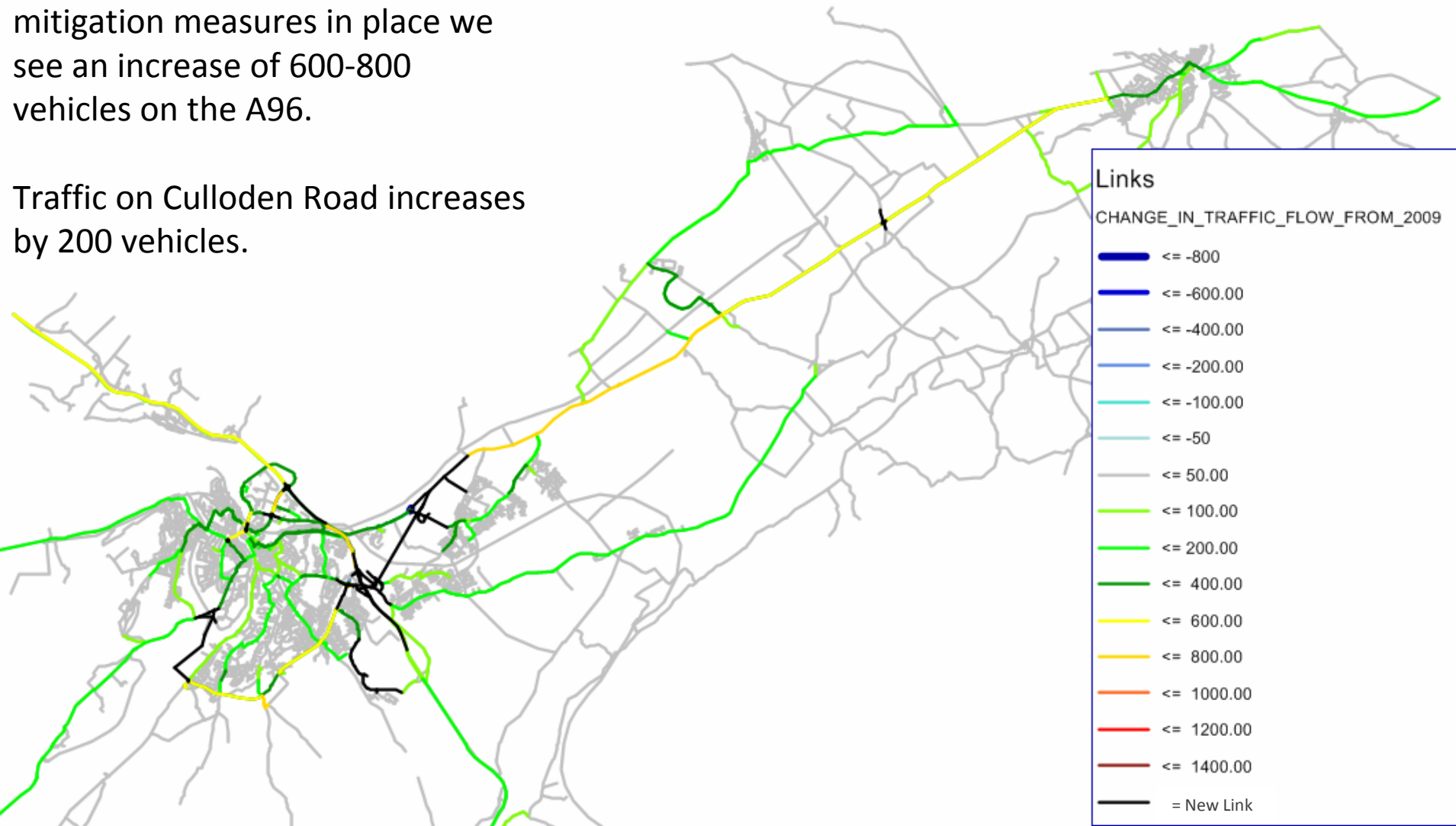
Parts of the Culloden Road revert back to 2009 levels.



AM 2021 Nos. 1, 2 & 3B

With the 2021 Nos. 1, 2 & 3B mitigation measures in place we see an increase of 600-800 vehicles on the A96.

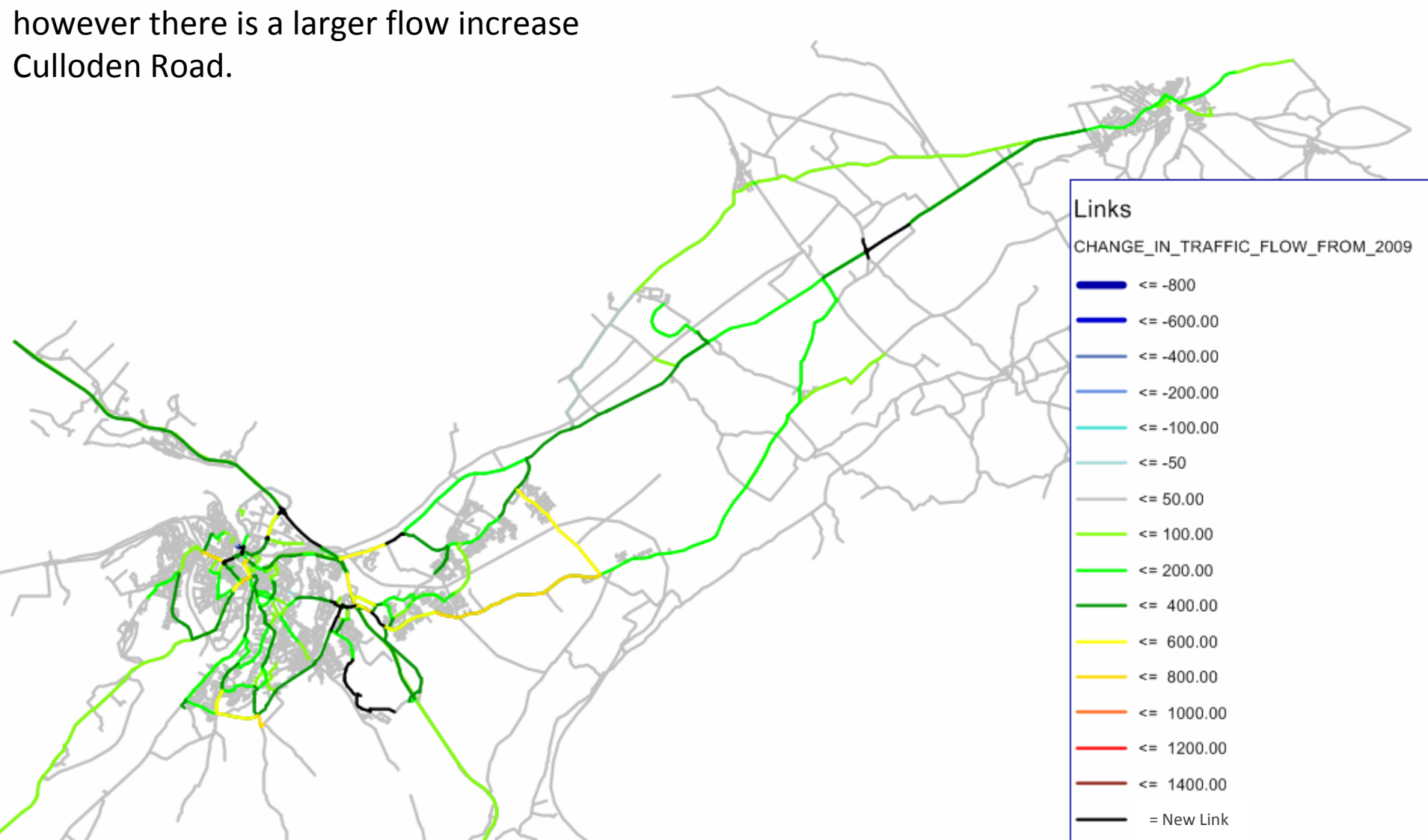
Traffic on Culloden Road increases by 200 vehicles.



PM PEAK – Changes in flow
from 'Do Nothing' scenarios

PM 2016 (interventions) against 2009

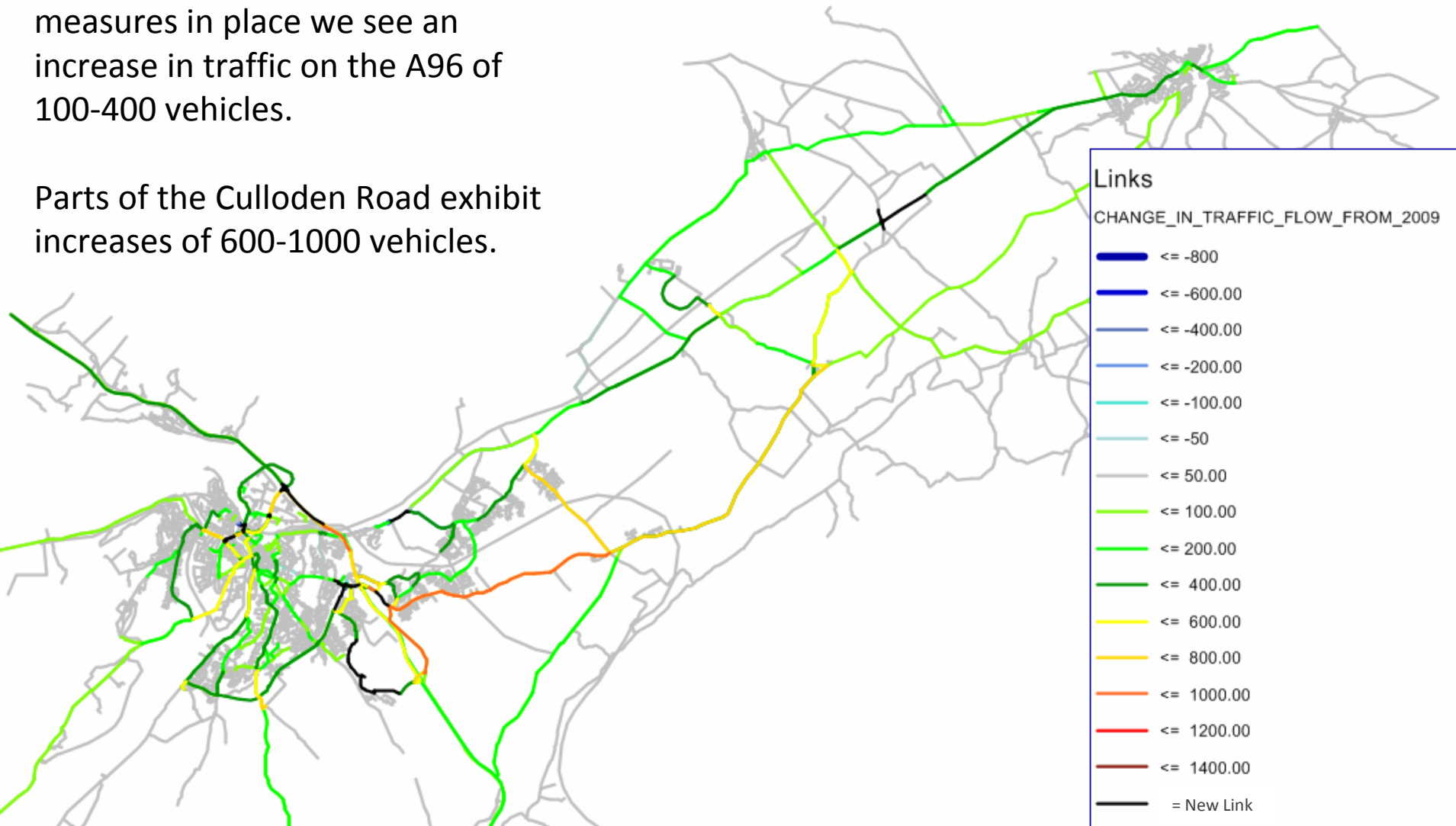
Similar picture to the AM peak,
however there is a larger flow increase
Culloden Road.



PM 2021 with 2016 Interventions

In 2021 with the 2016 mitigation measures in place we see an increase in traffic on the A96 of 100-400 vehicles.

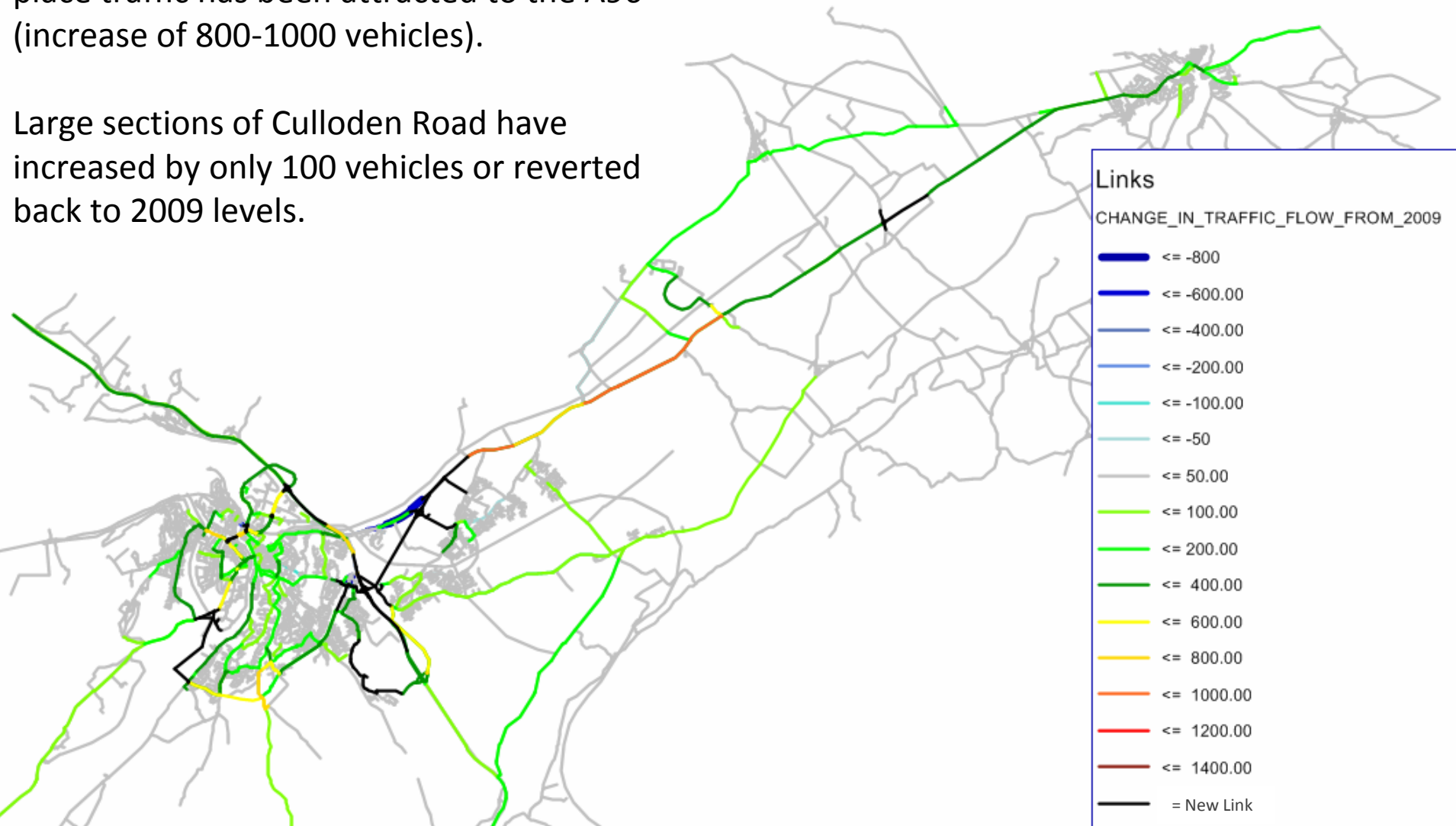
Parts of the Culloden Road exhibit increases of 600-1000 vehicles.



PM 2021 Nos. 1, 2 & 3A

With the Nos. 1, 2 & 3A interventions in place traffic has been attracted to the A96 (increase of 800-1000 vehicles).

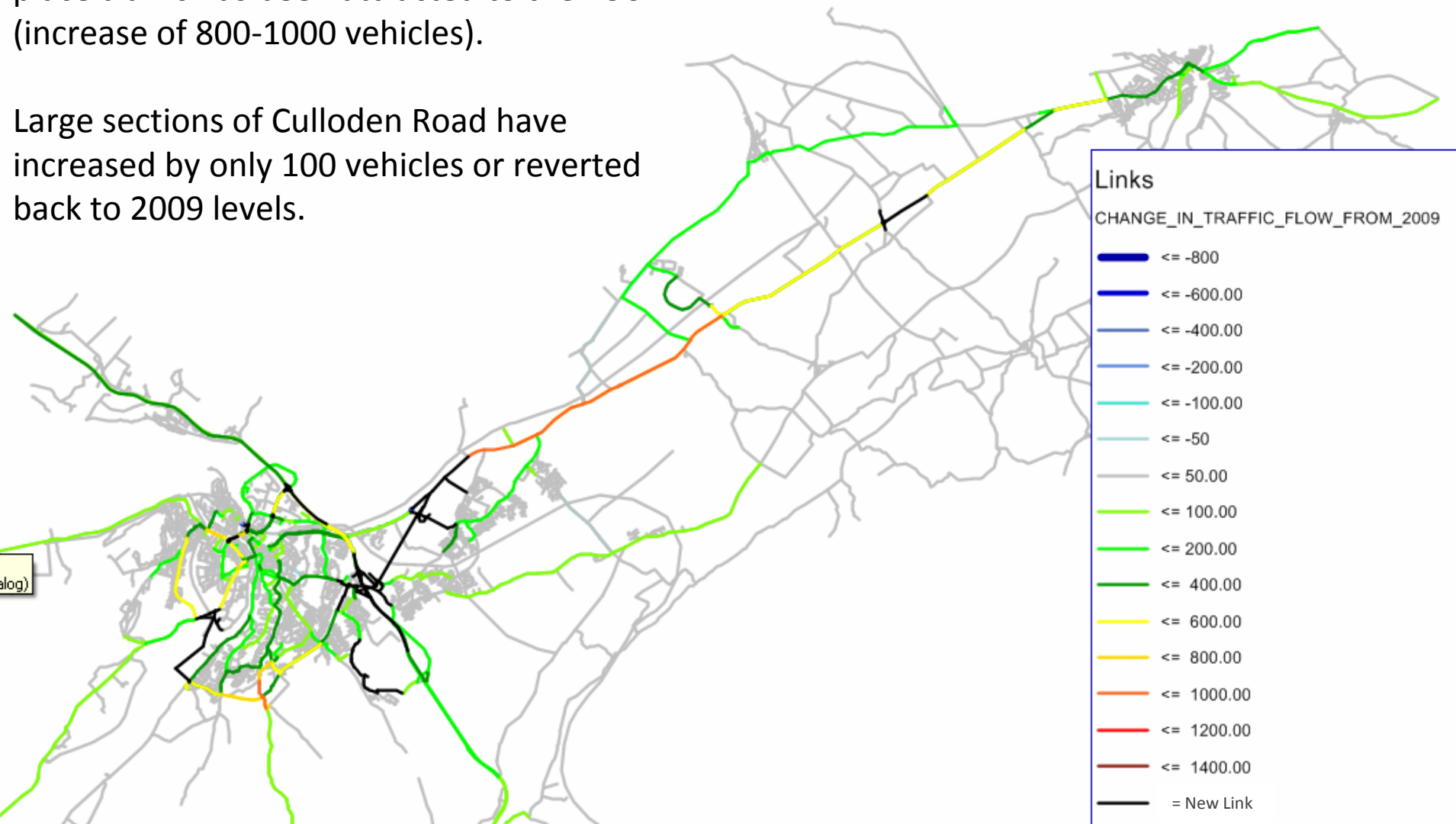
Large sections of Culloden Road have increased by only 100 vehicles or reverted back to 2009 levels.



PM 2021 Nos. 1, 2 & 3B

With the Nos. 1, 2 & 3B interventions in place traffic has been attracted to the A96 (increase of 800-1000 vehicles).

Large sections of Culloden Road have increased by only 100 vehicles or reverted back to 2009 levels.



AM PEAK – Queues

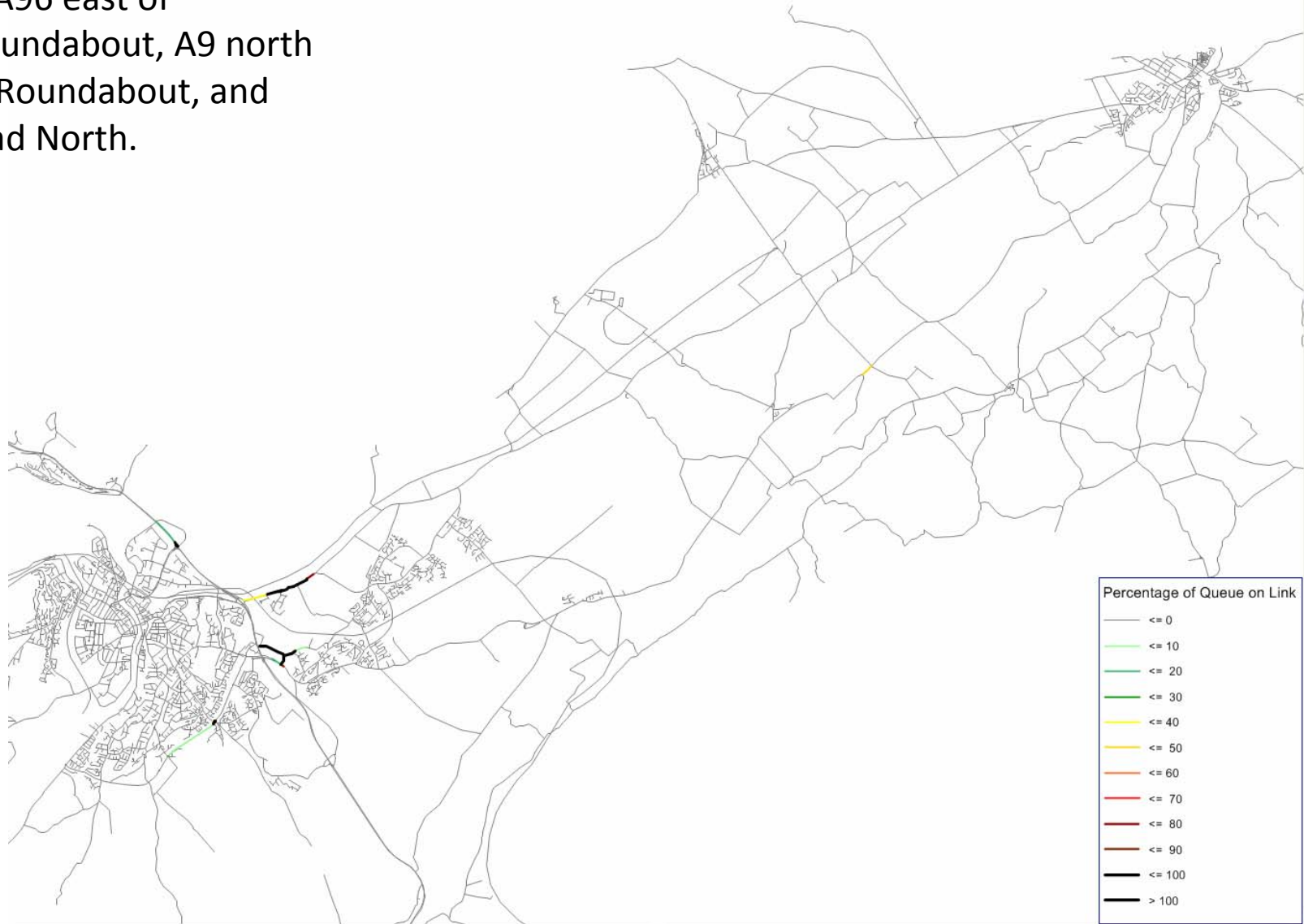
AM 2016 with Interventions

Model shows negligible queuing.



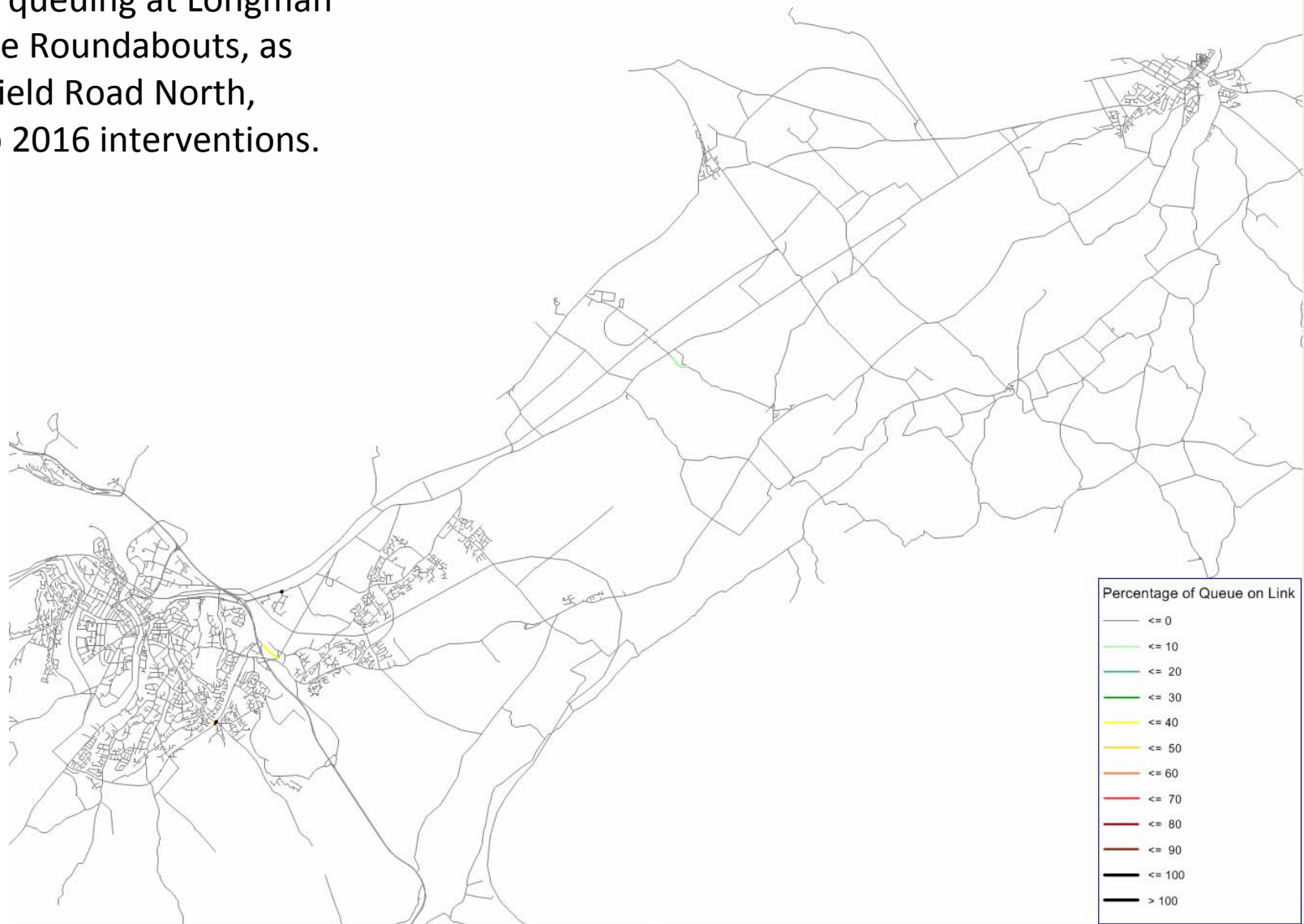
AM 2021 with 2016 Interventions

Queuing on A96 east of Raigmore Roundabout, A9 north of Longman Roundabout, and Caulfield Road North.



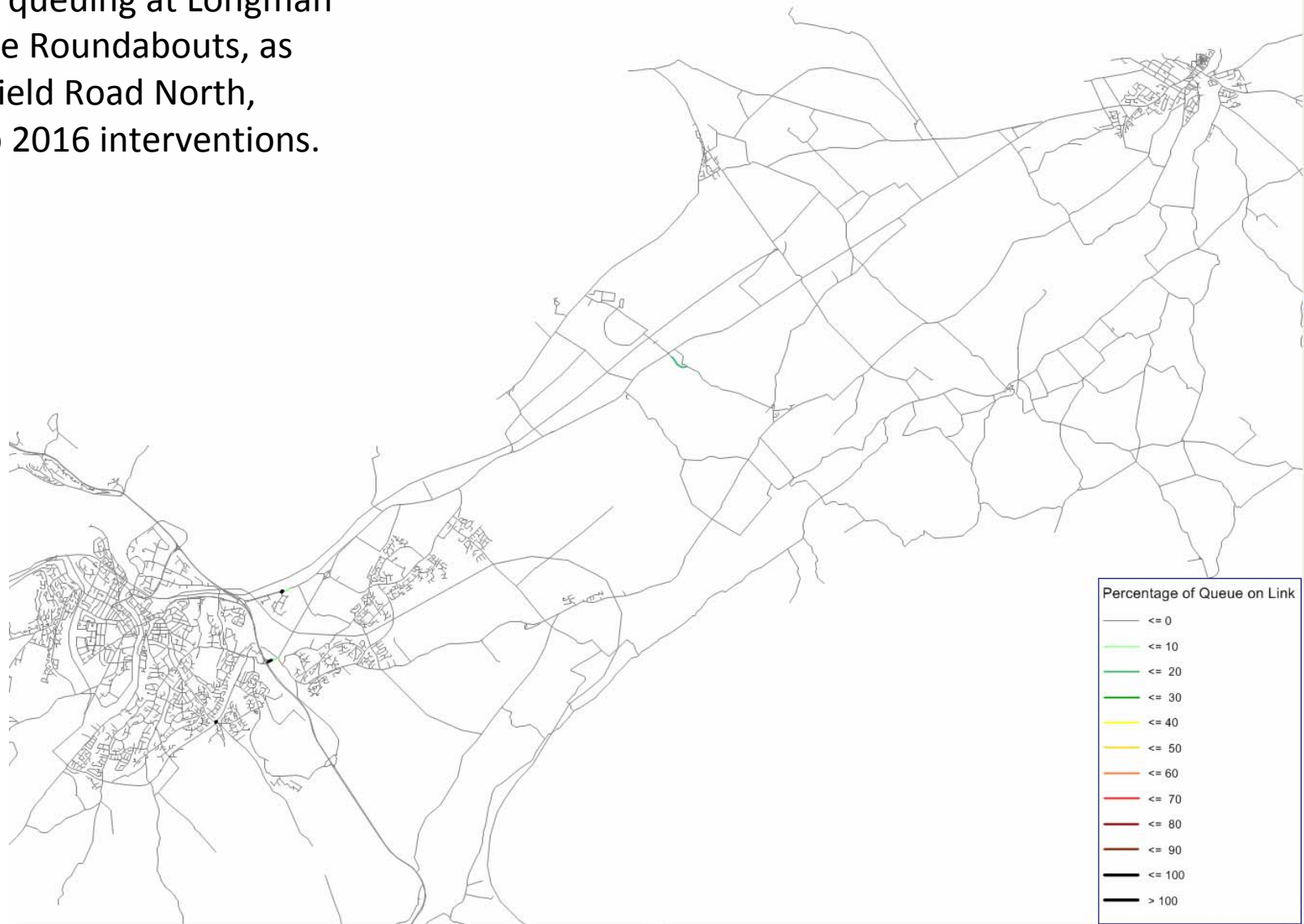
AM 2021 with 2021 Interventions Nos. 1, 2 & 3B

Reduction in queuing at Longman and Raigmore Roundabouts, as well as Caulfield Road North, compared to 2016 interventions.



AM 2021 with 2021 Interventions Nos. 1, 2 & 3A

Reduction in queuing at Longman and Raigmore Roundabouts, as well as Caulfield Road North, compared to 2016 interventions.



PM PEAK – Queues

PM 2016 with Interventions

Queuing on A96 eastbound at Retail Park.

A9 slip indicates queues from Culloden Road.

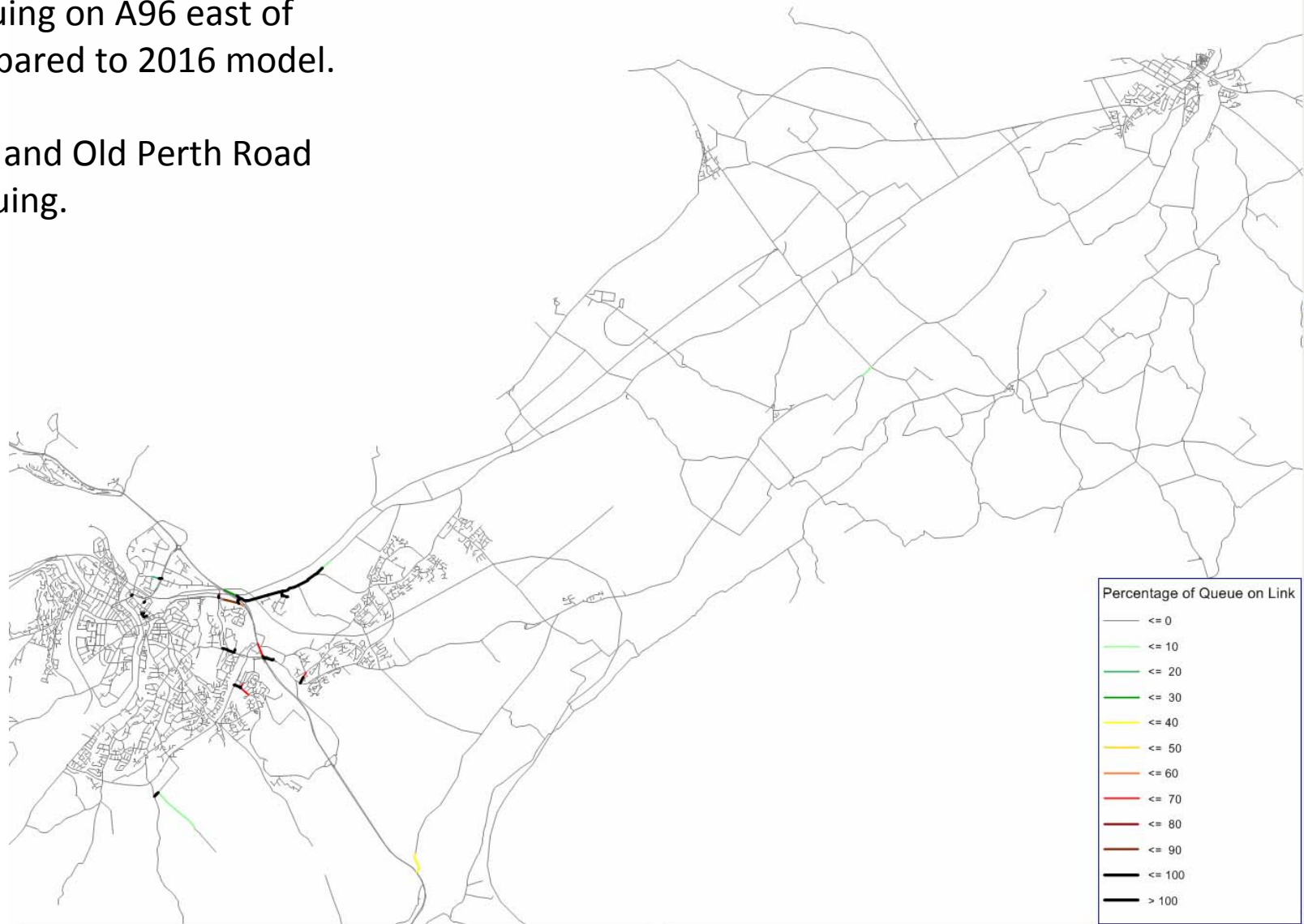
Queues on Longman Road and in the city centre.



PM 2021 with 2016 Interventions

Increased queuing on A96 east of Raigmore compared to 2016 model.

Culloden Road and Old Perth Road also show queuing.



PM 2021 with 2021 Interventions Nos. 1, 2 & 3B

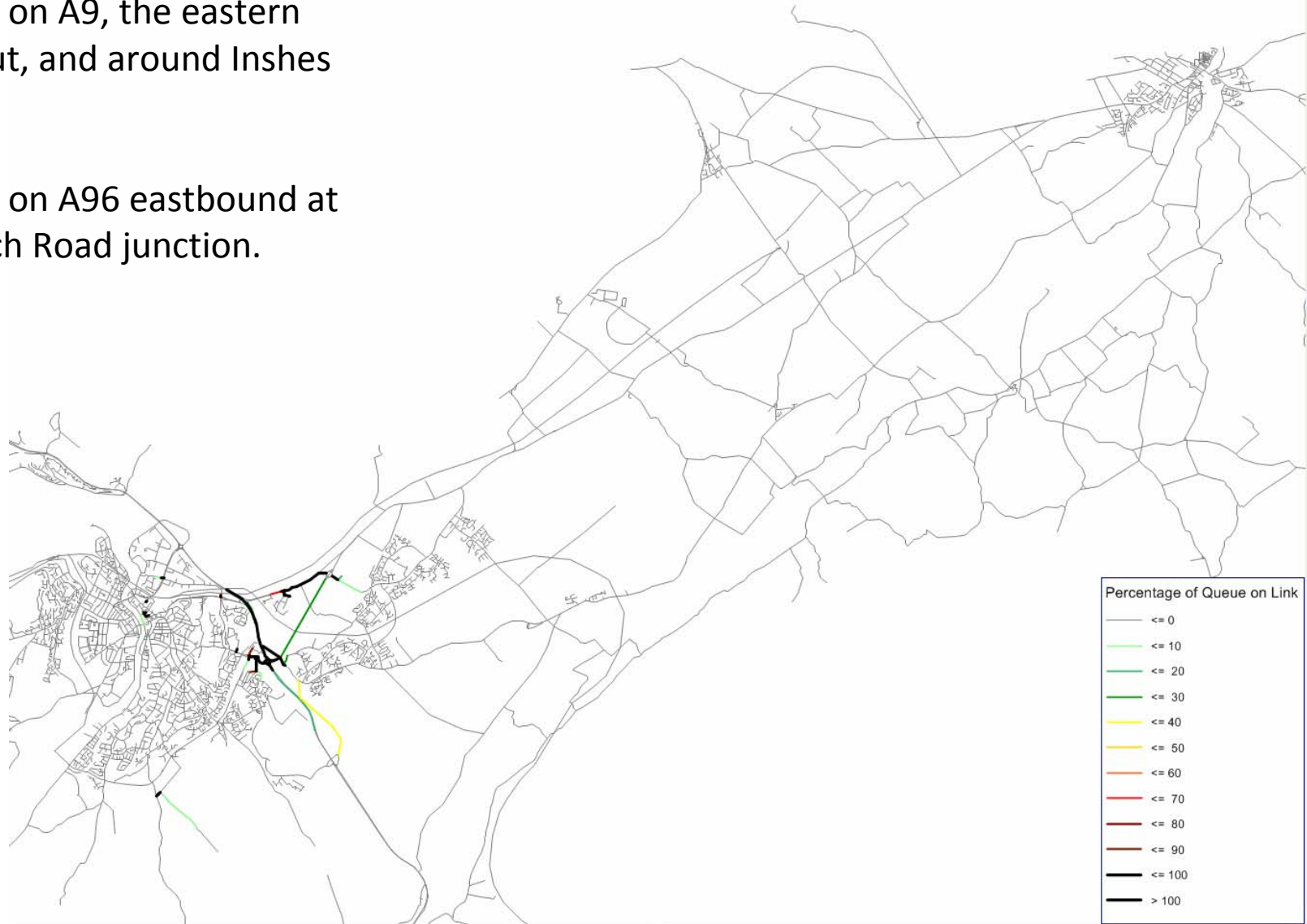
Queues have been dispersed by the interventions.



PM 2021 with 2021 Interventions Nos. 1, 2 & 3A

Major queuing on A9, the eastern link roundabout, and around Inshes Roundabout.

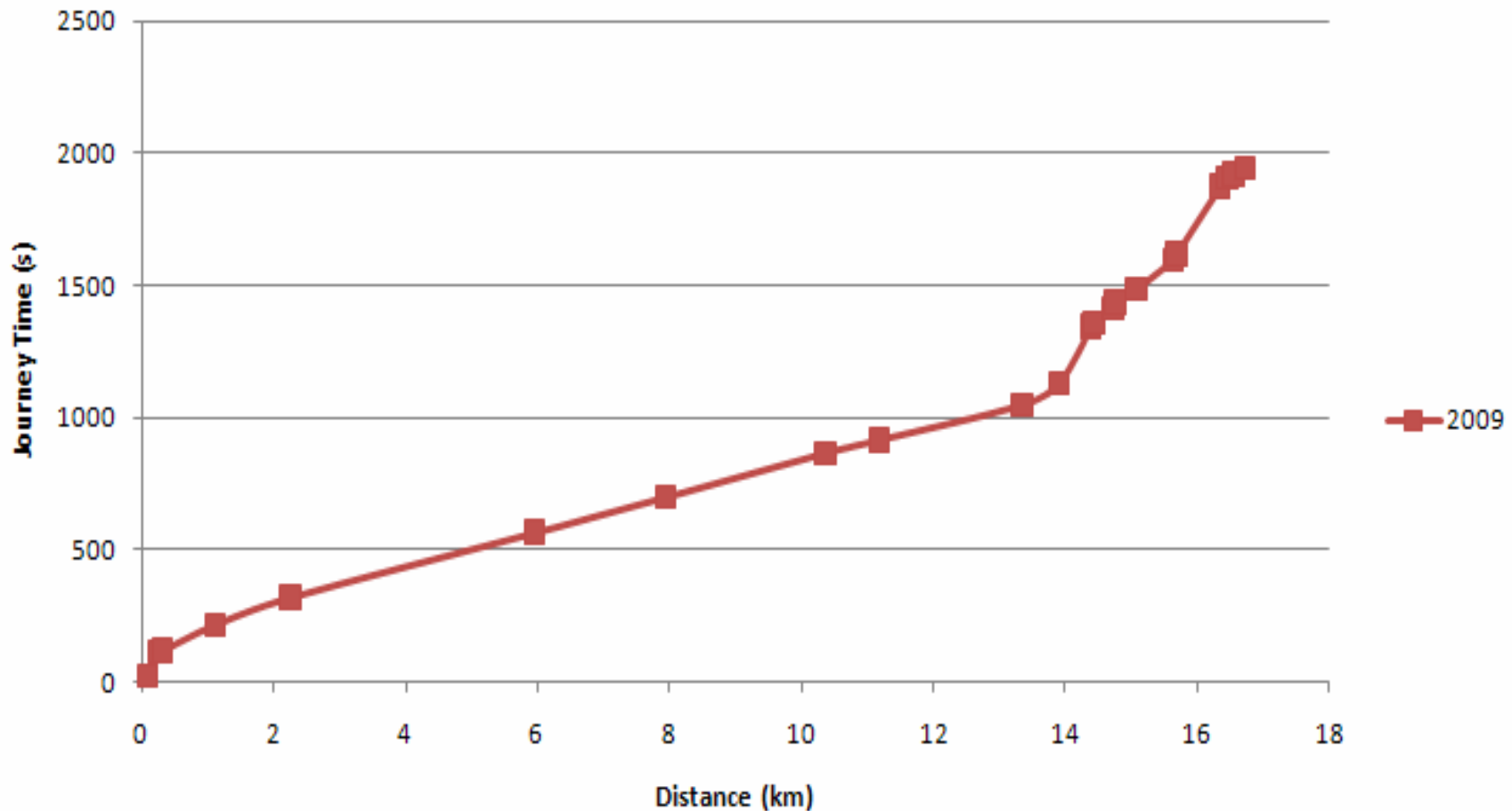
Major queuing on A96 eastbound at the Barn Church Road junction.



AM Journey Times 2009 Base

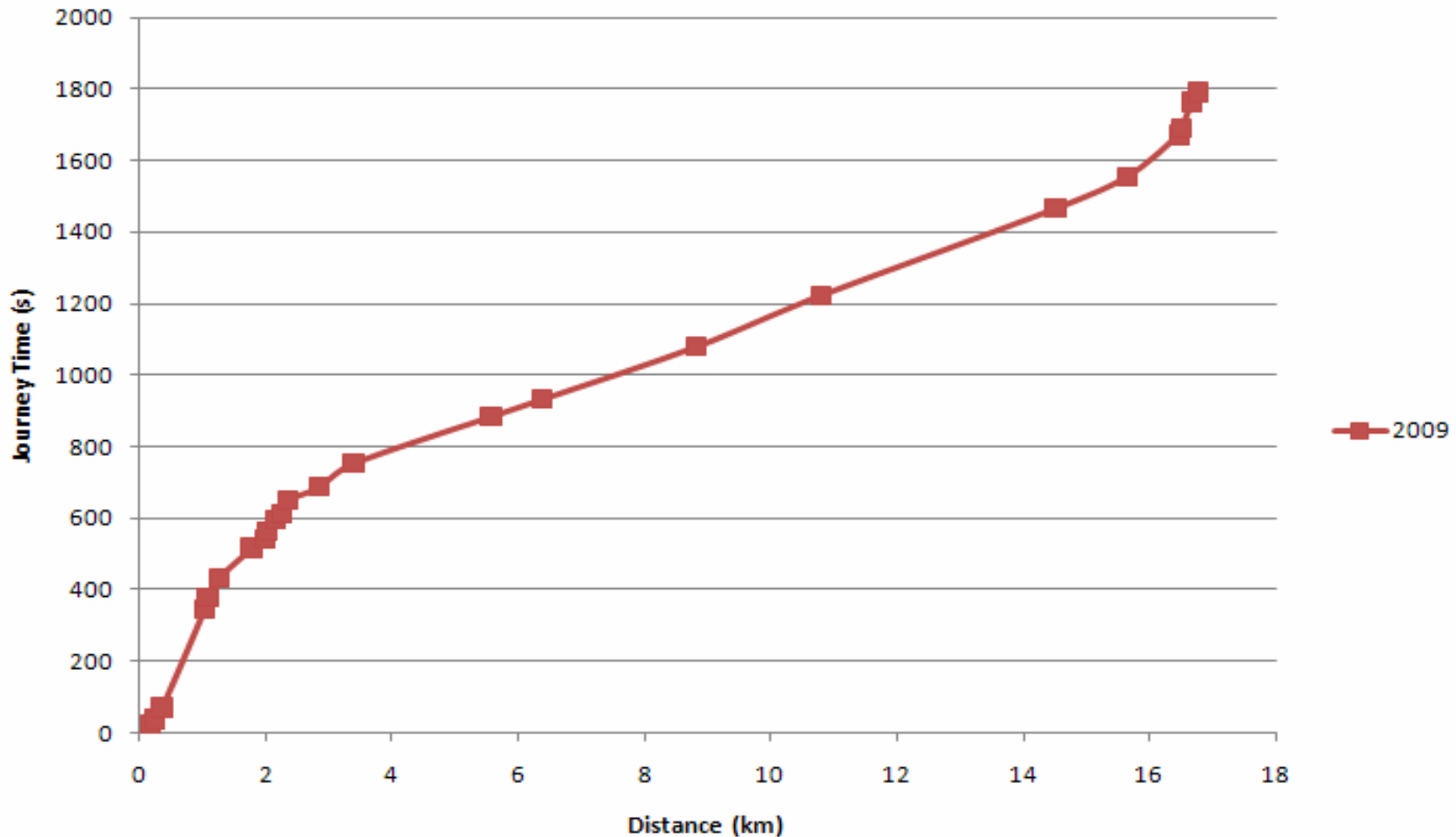
2009 AM Peak Journey Times

2009 AM Nairn To Inverness Via Raigmore



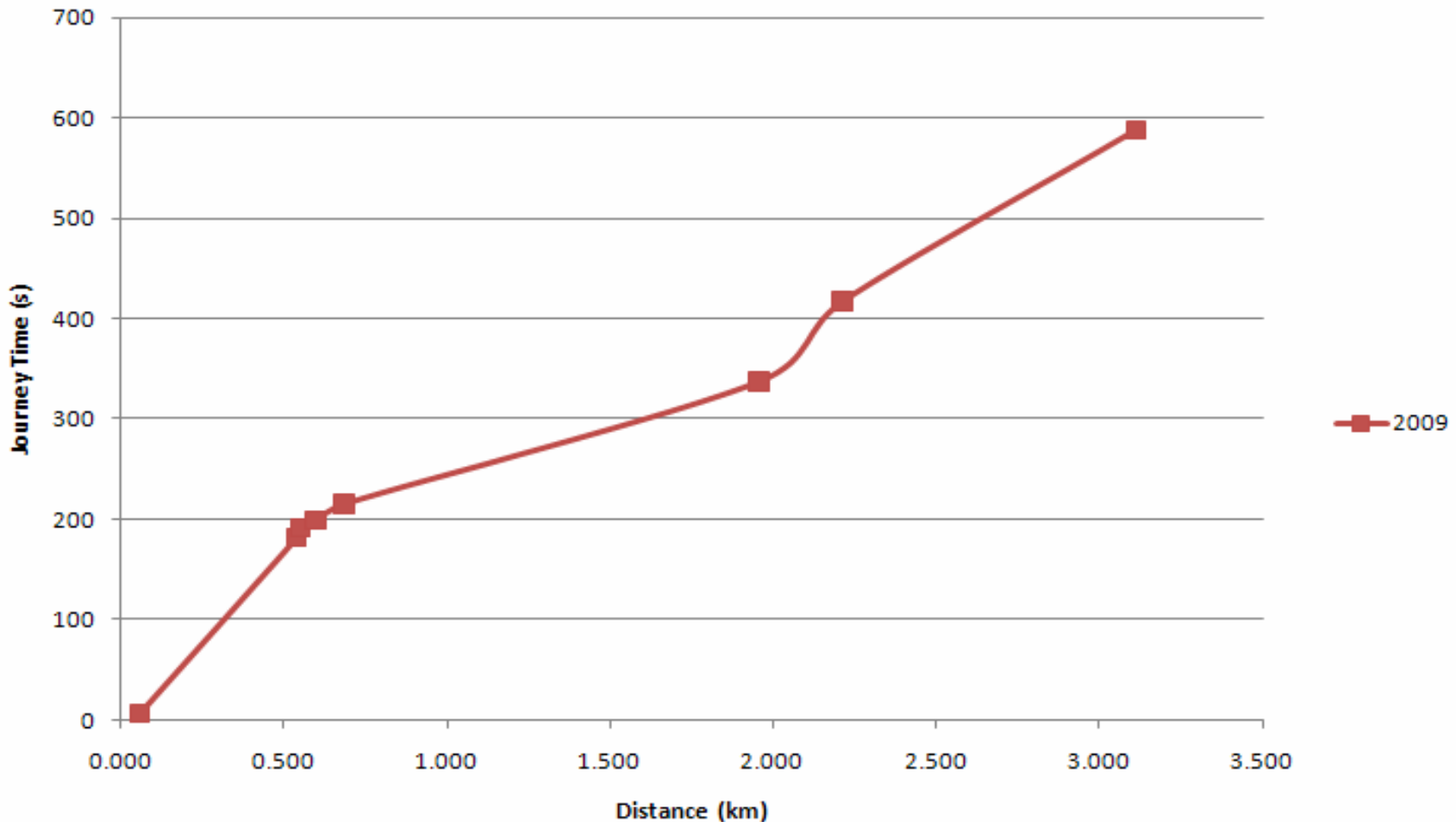
2009 AM Peak Journey Times

2009 AM Inverness to Nairn Via Raigmore AM



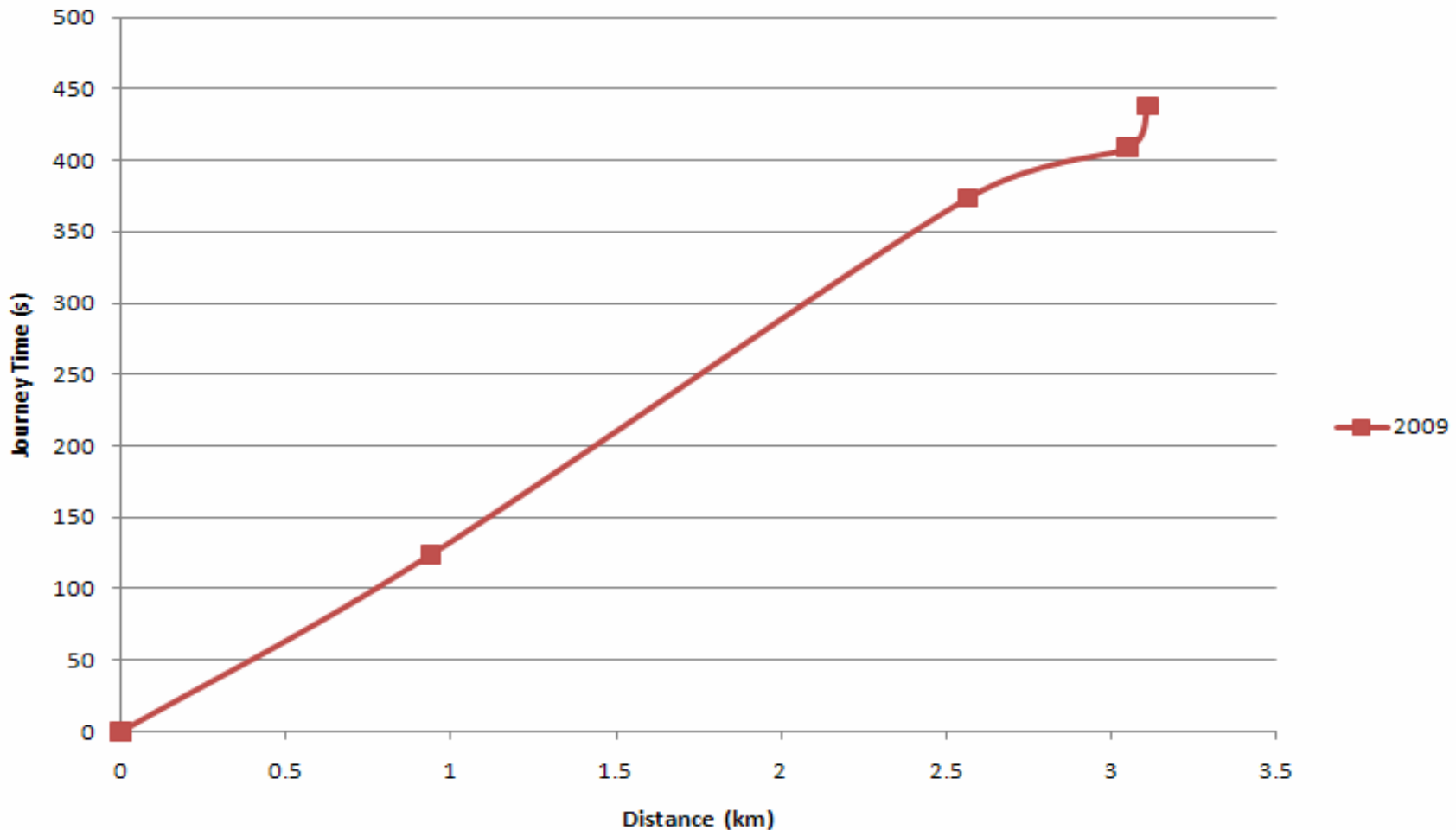
2009 AM Peak Journey Times

2009 AM WB Inv Retail to Kenneth St Via Longman



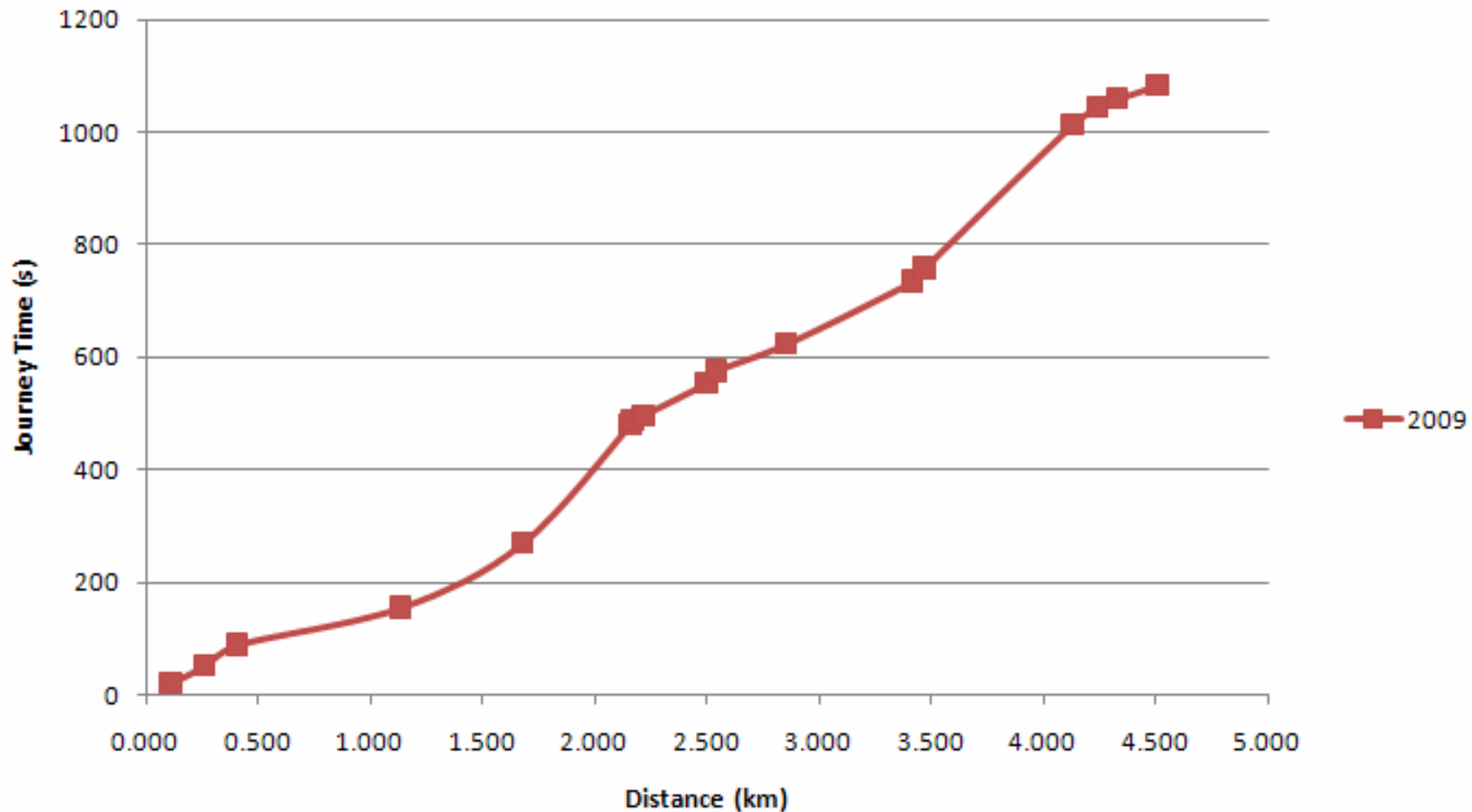
2009 AM Peak Journey Times

2009 AM EB Kenneth St to Inv Retail Via Longman



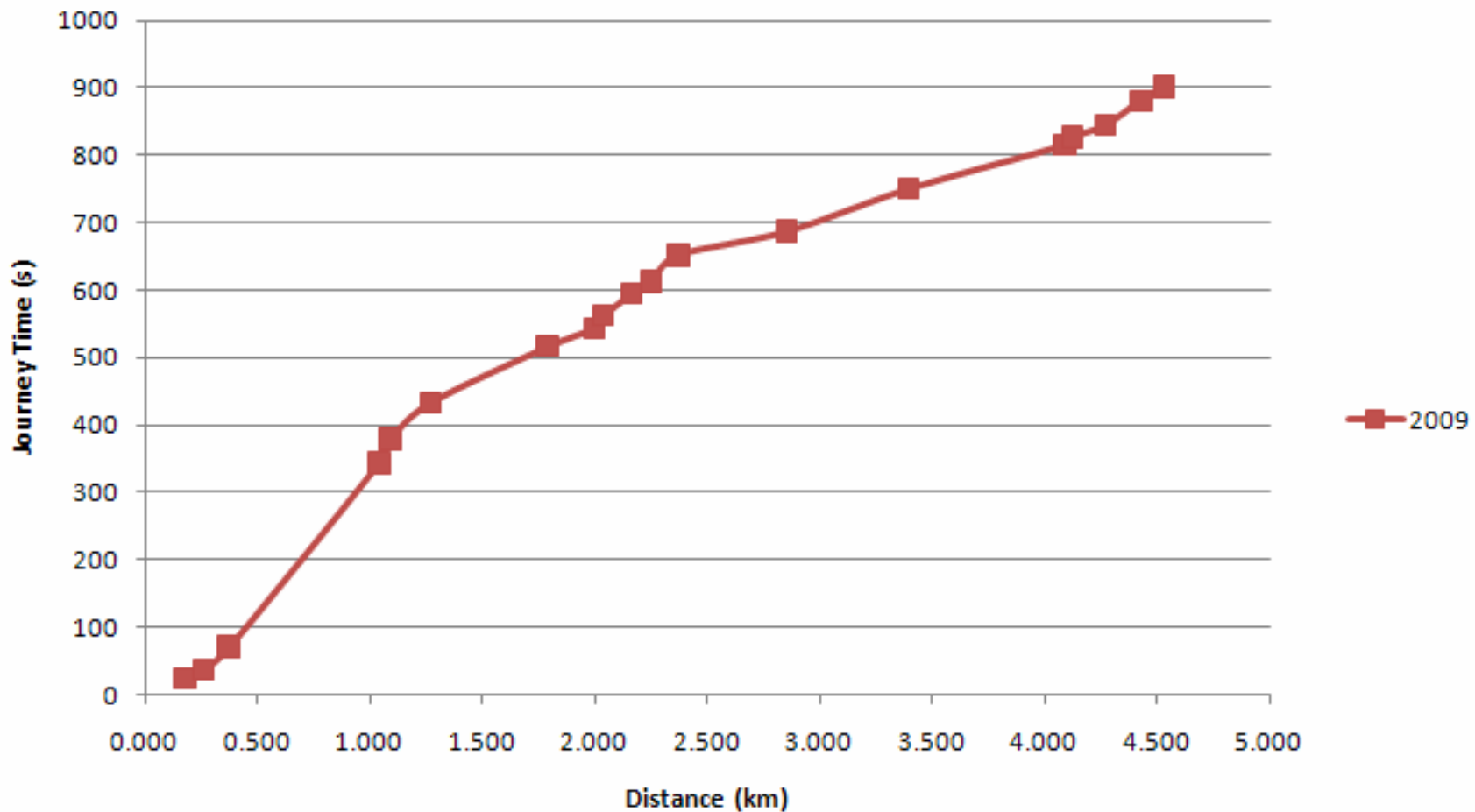
2009 AM Peak Journey Times

2009 AM Smithton to Inverness Via Raigmore



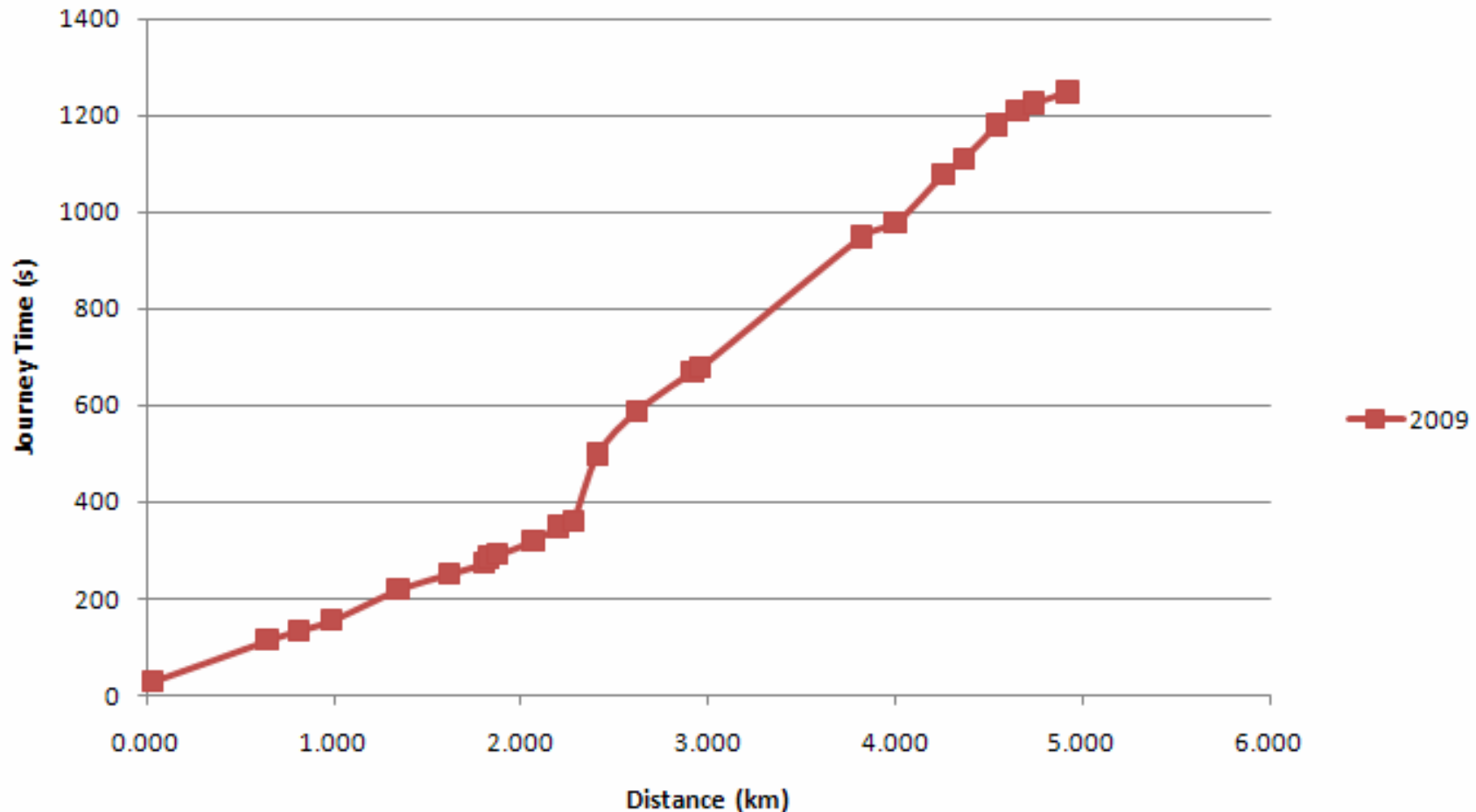
2009 AM Peak Journey Times

2009 AM Inverness to Smithton Via Raigmore



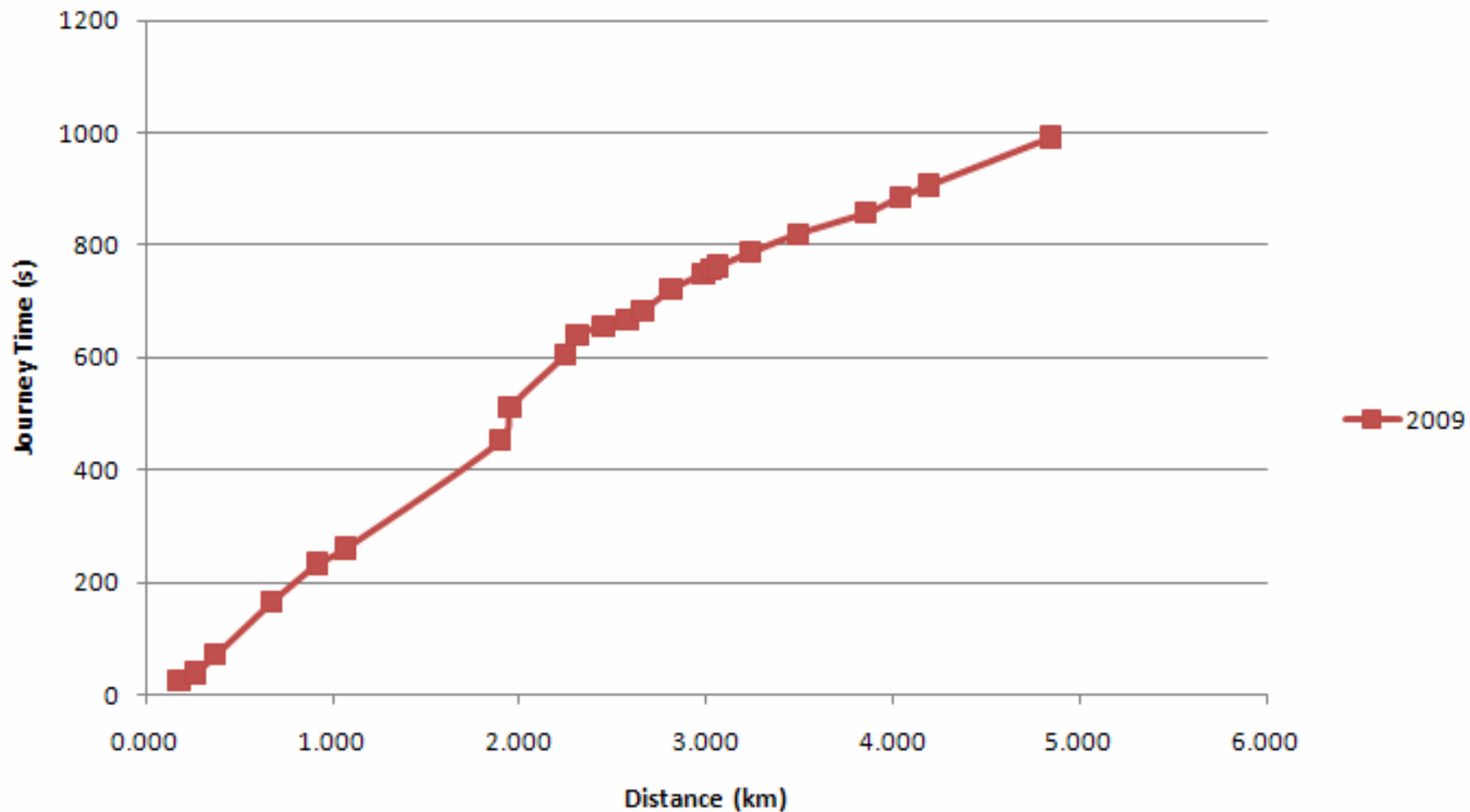
2009 AM Peak Journey Times

2009 AM Smithton to Inverness Via Inshes



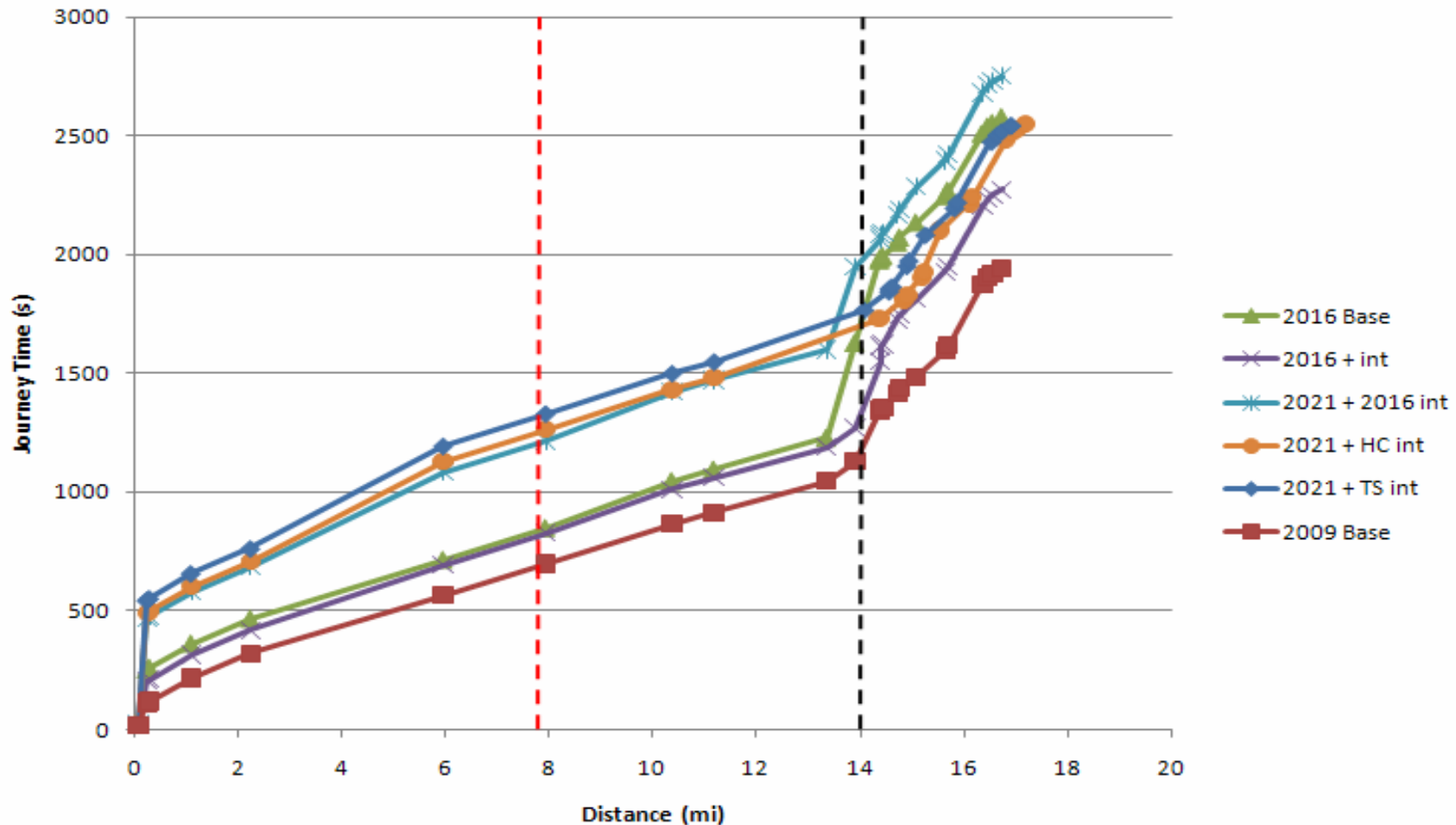
2009 AM Peak Journey Times

2009 AM Inverness to Smithton Via Inshes



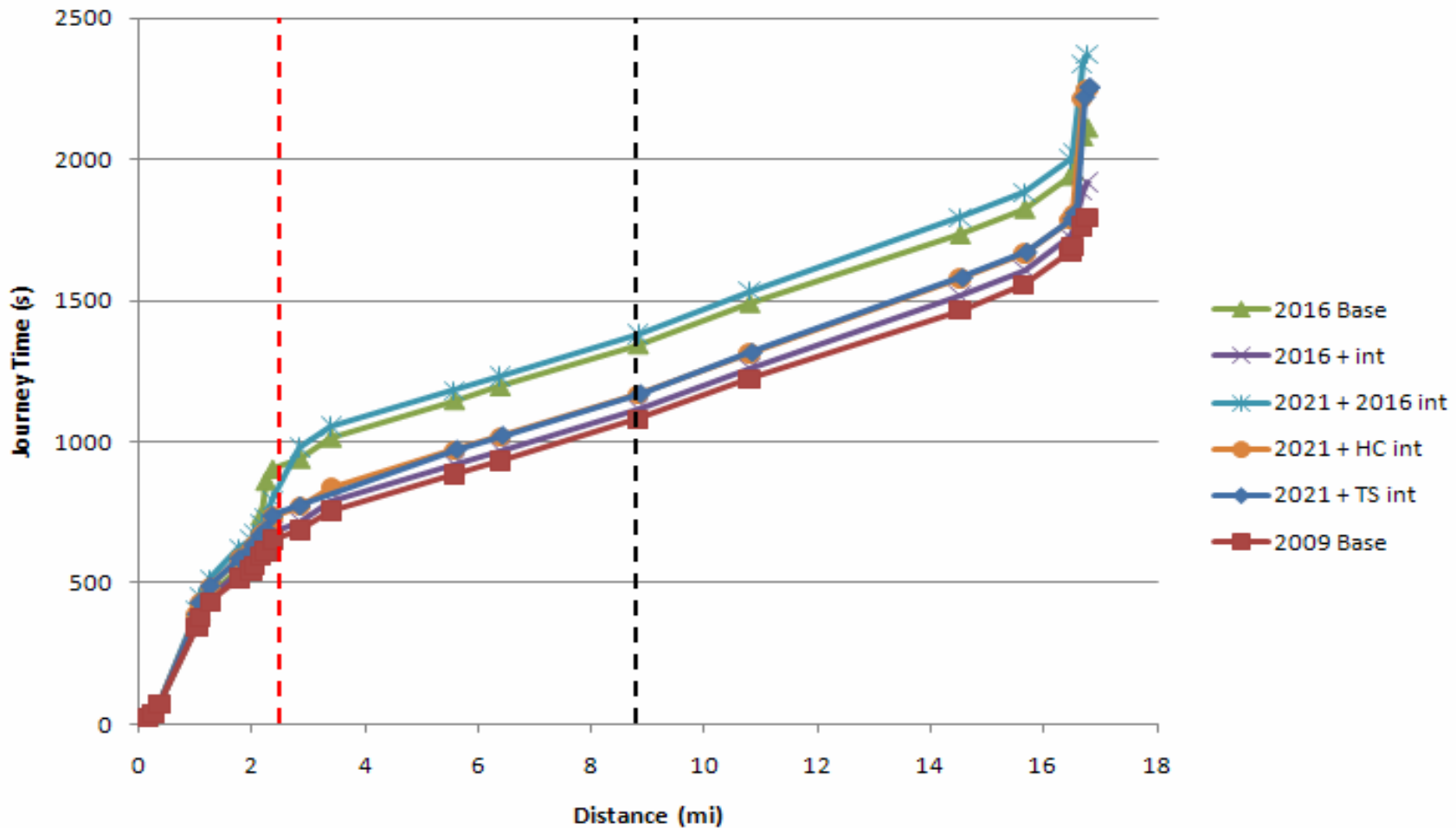
2009 AM Peak Time Summary

Nairn To Inverness Via Raigmore



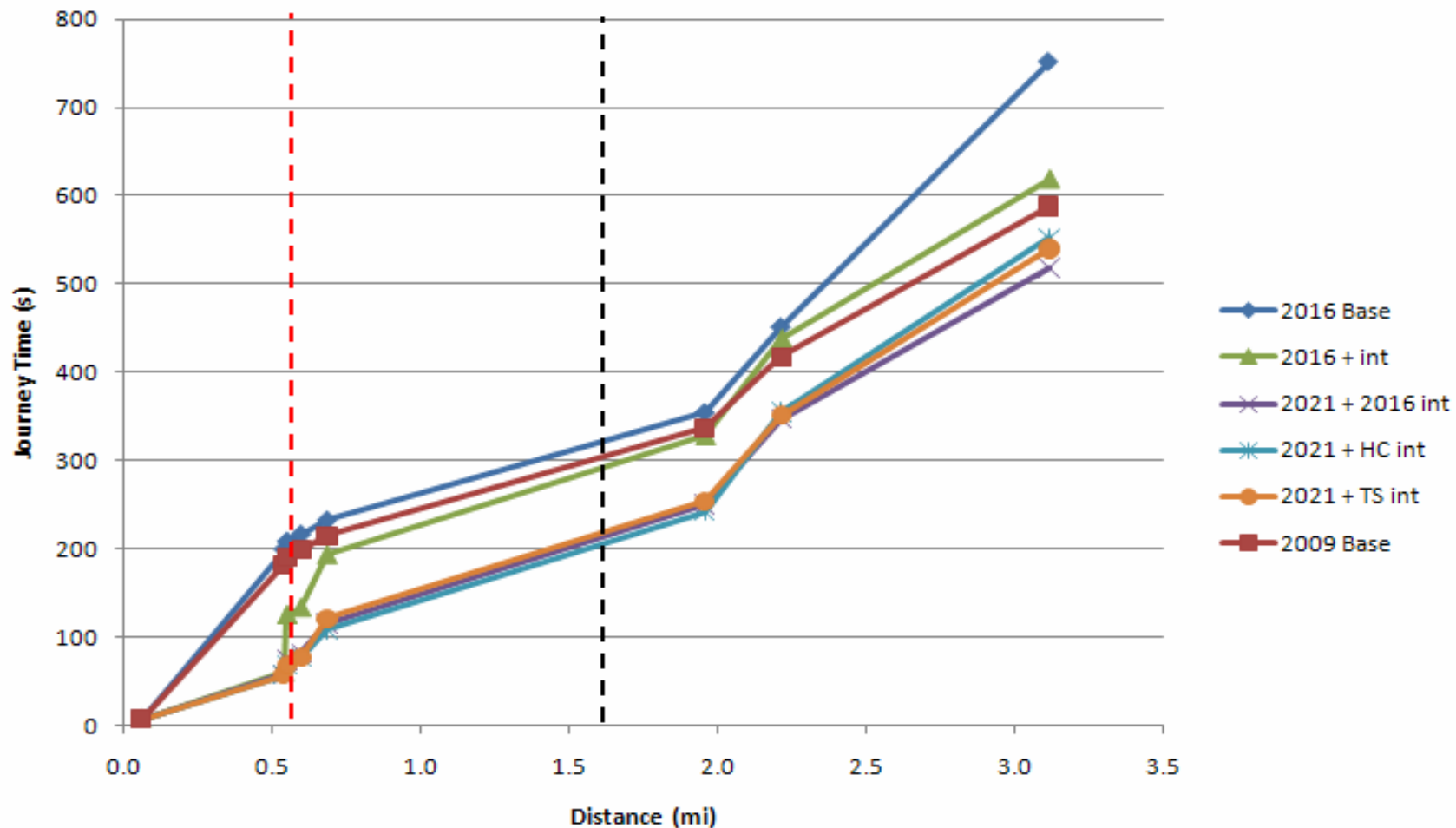
2009 AM Peak Time Summary

Inverness to Nairn Via Raigmore AM



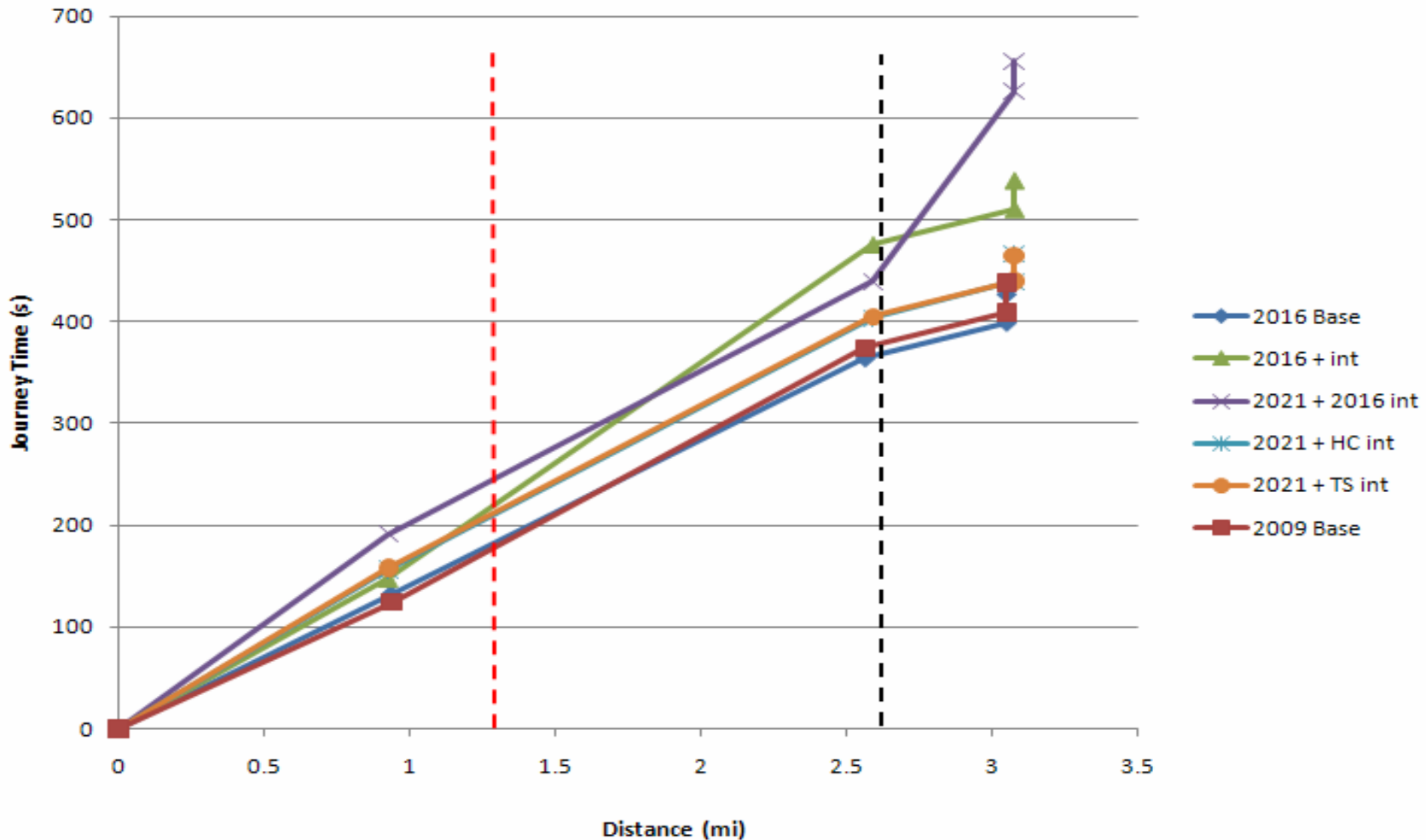
2009 AM Peak Time Summary

WB Inv Retail to Kenneth St Via Longman



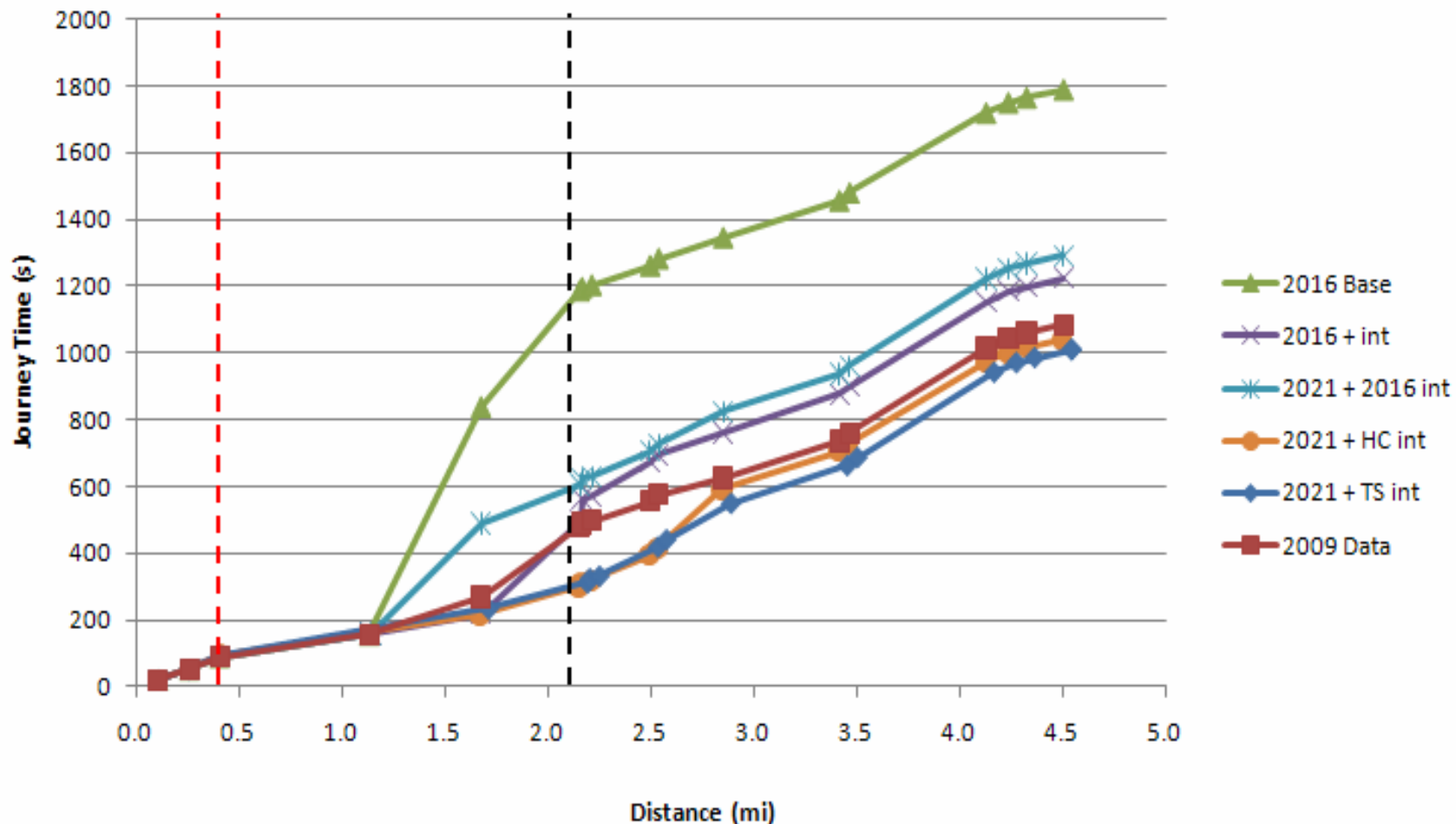
2009 AM Peak Time Summary

EB Kenneth St to Inv Retail Via Longman



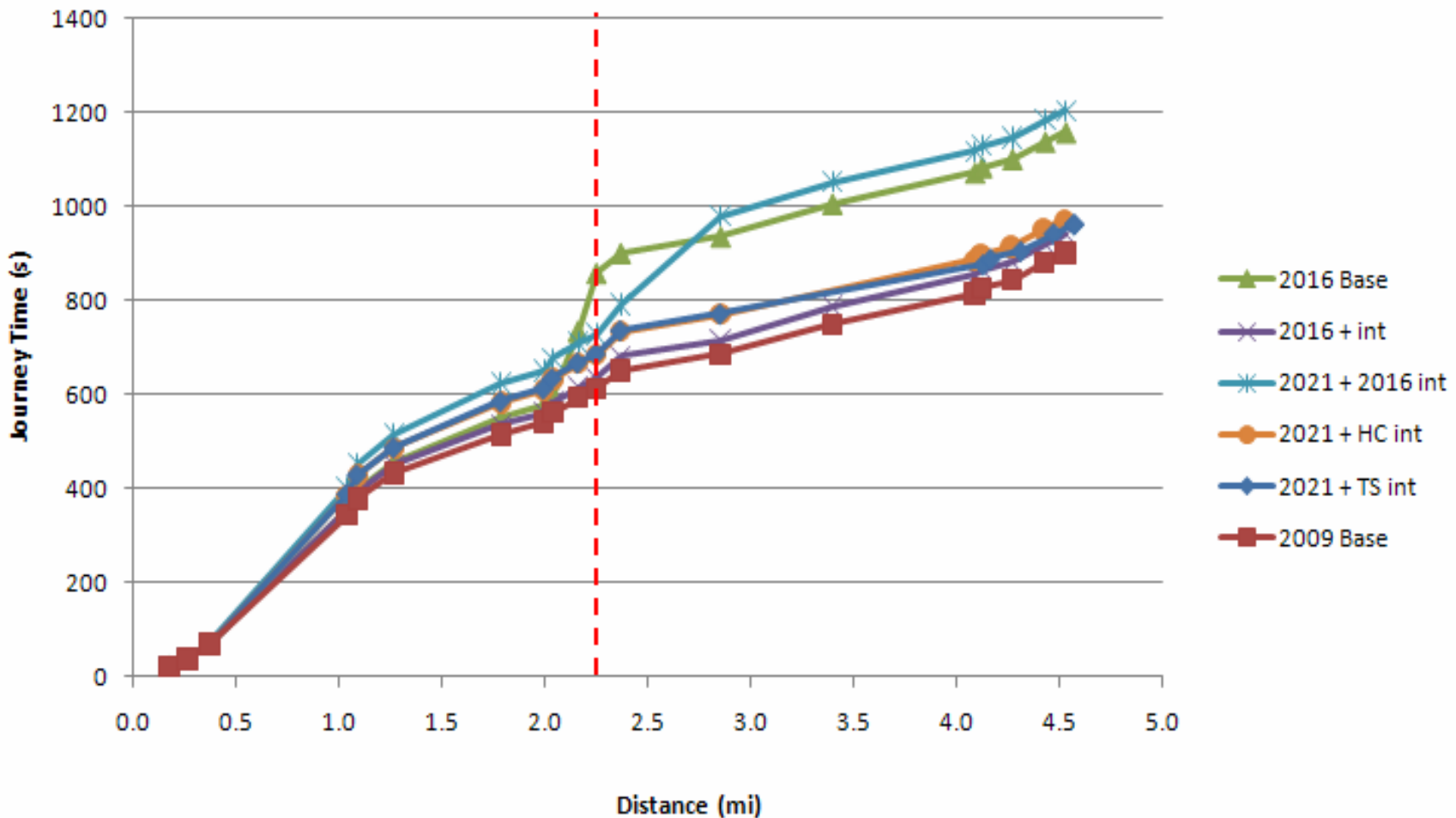
2009 AM Peak Time Summary

Smithton to Inverness Via Raigmore



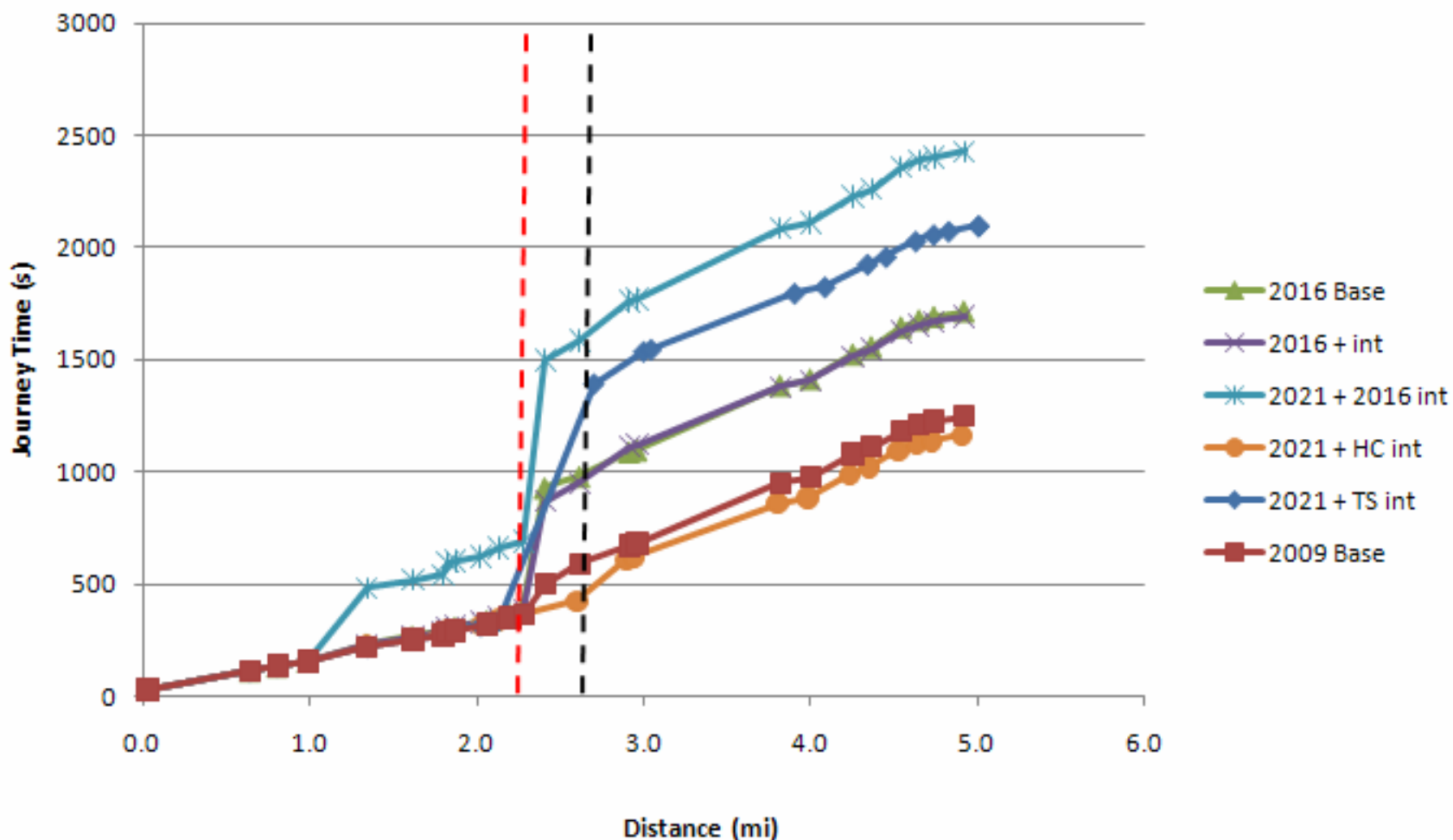
2009 AM Peak Time Summary

Inverness to Smithton Via Raigmore



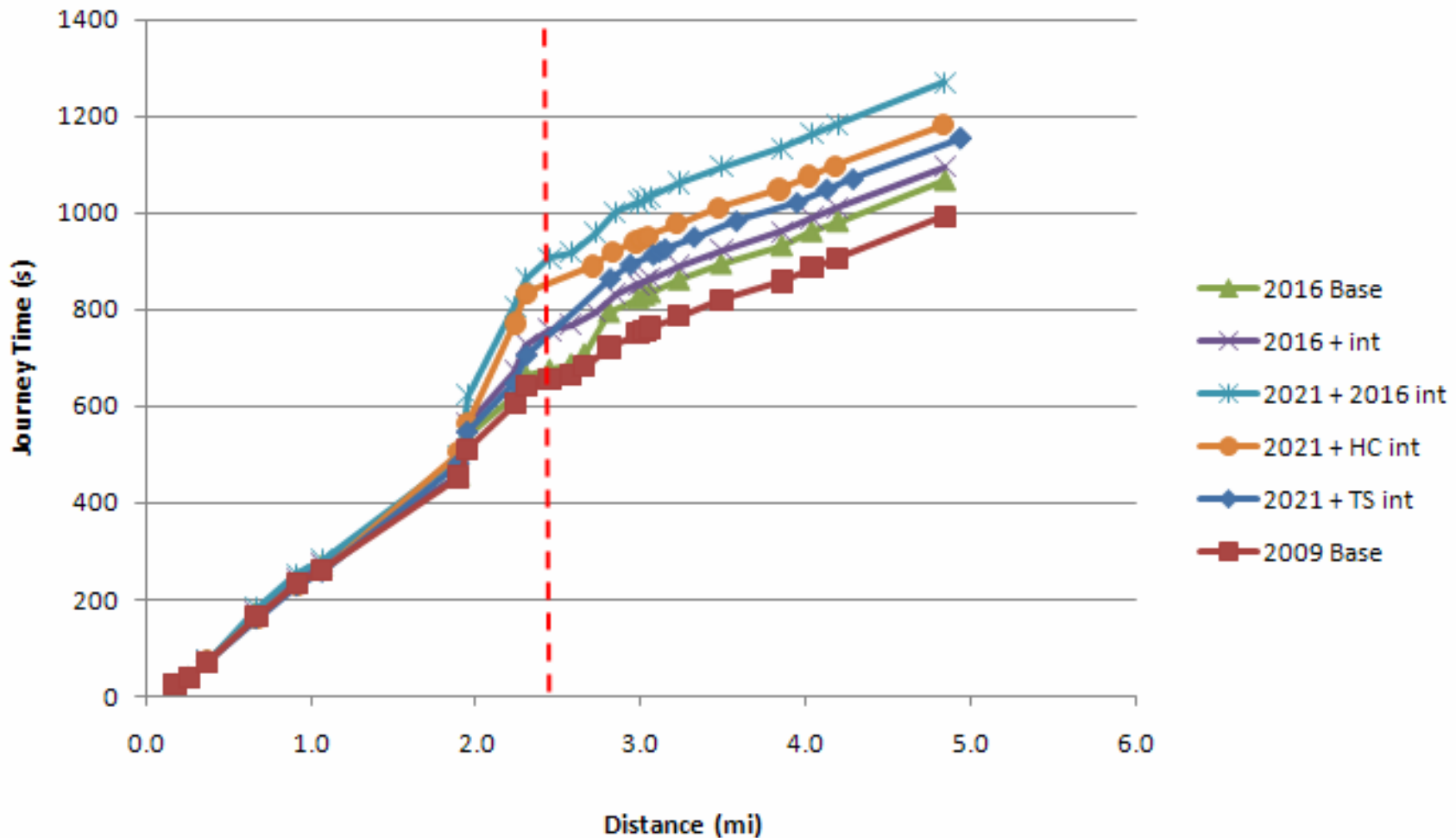
2009 AM Peak Time Summary

Smithton to Inverness Via Inshes



2009 AM Peak Time Summary

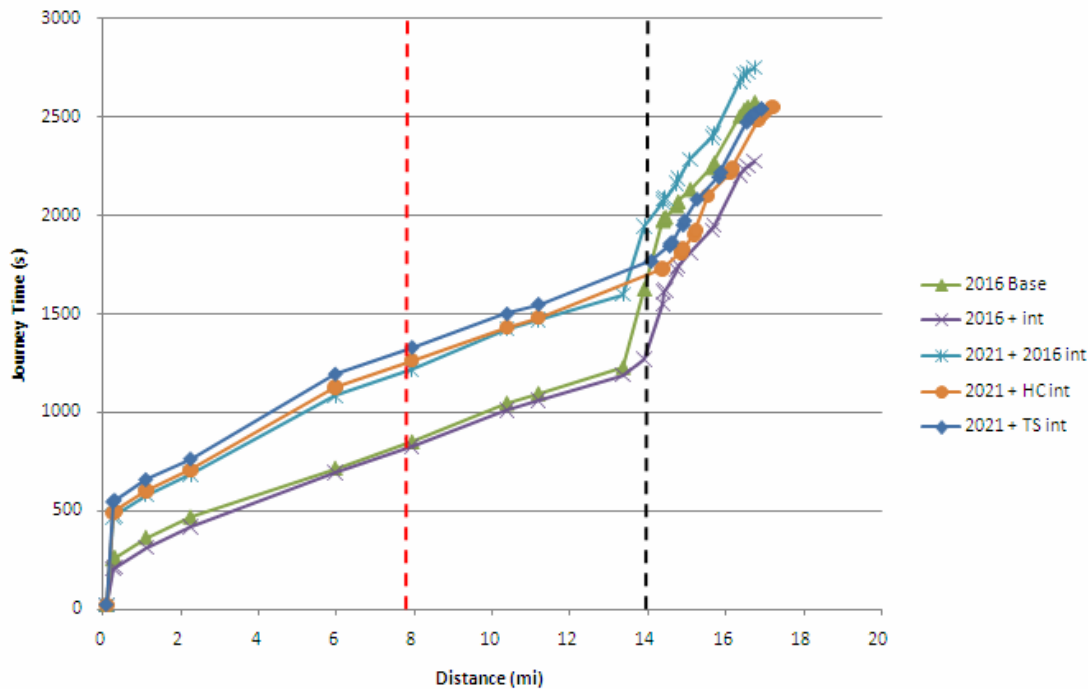
Inverness to Smithton Via Inshes



AM Journey Times

Journey Times Performance Summary

Nairn To Inverness Via Raigmore



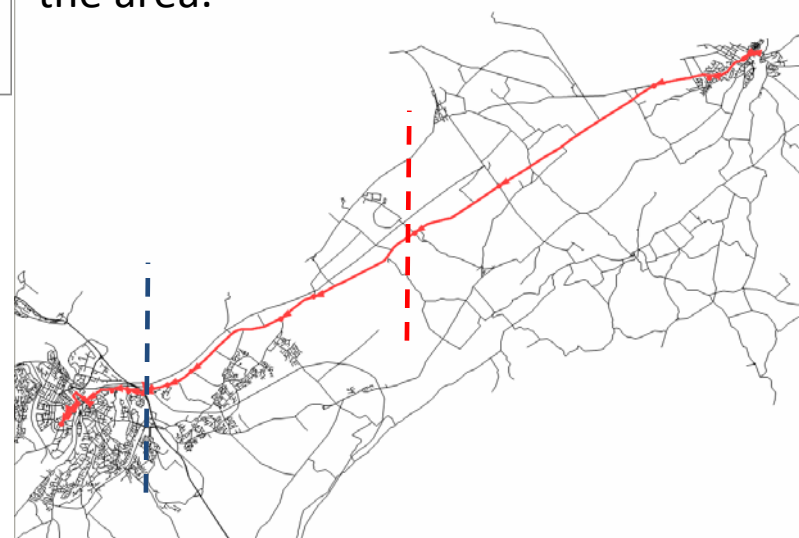
Interventions improve the journey time in both 2016 and 2021 (for both the 3A and 3B schemes).

The Eastern Link results in less traffic travelling through Raigmore therefore the junction operates better.

Journey times through Nairn are unchanged due to no interventions being put in place but also no real change in traffic demand/profile in the area.

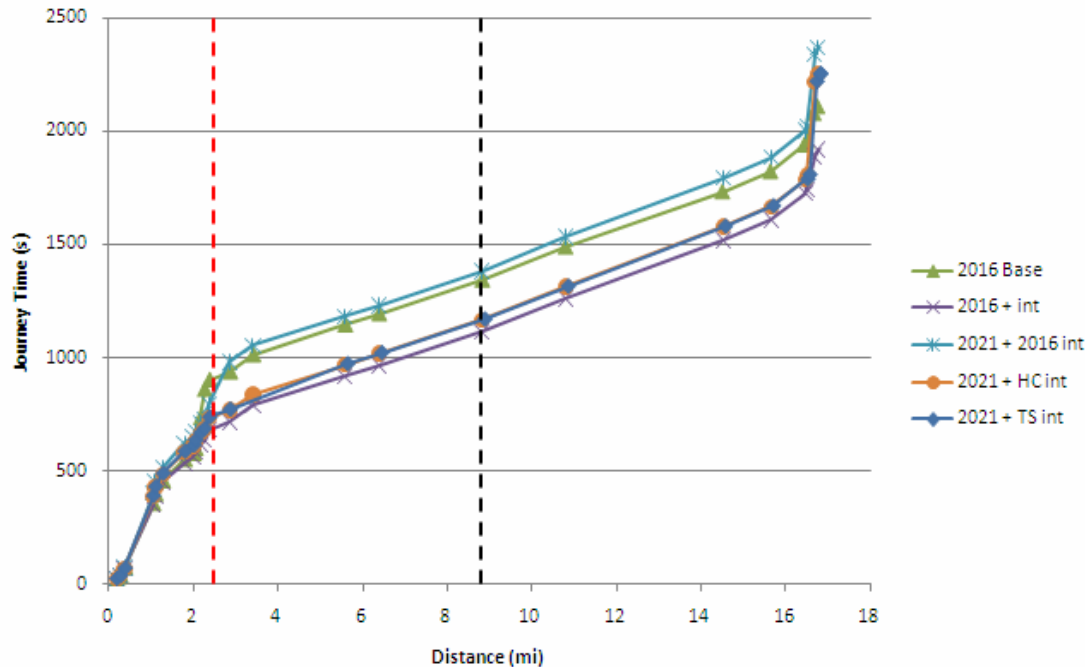
From Nairn to Inverness Via Raigmore

AM PEAK



Journey Times Performance Summary

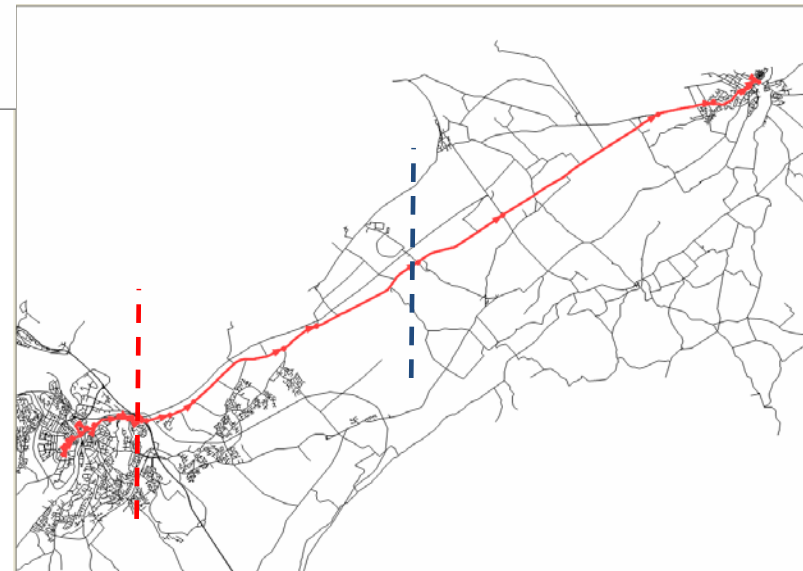
Inverness to Nairn Via Raigmore AM



Interventions improve the journey time in both 2016 and 2021 scenarios. The interventions improve the operation of the Raigmore junction and as a result the journey times through this area improve. Again journey times through Nairn are unchanged due to no interventions/little change in traffic demand/profile.

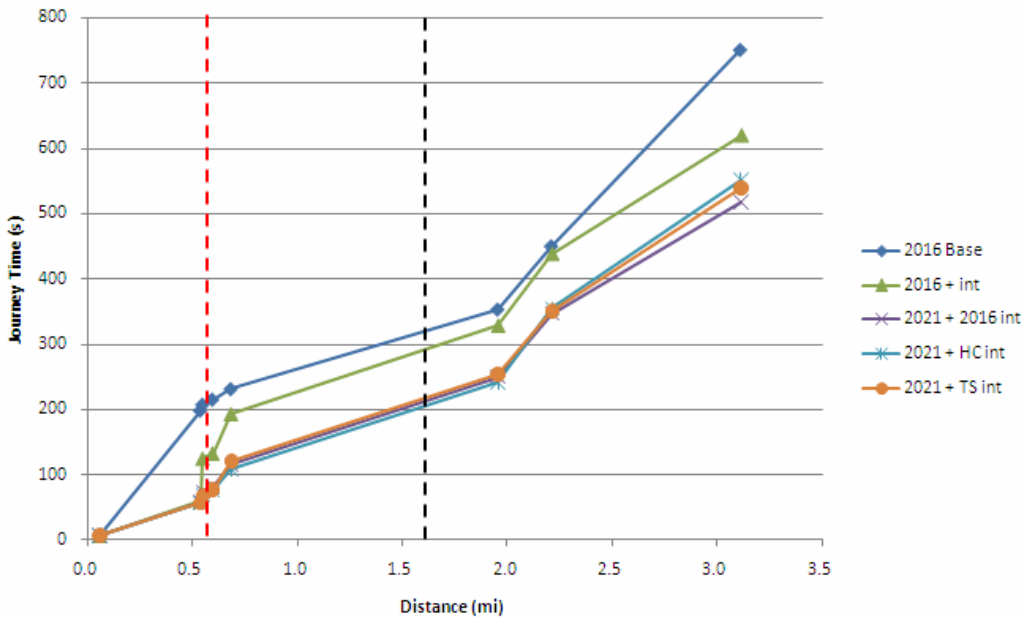
From Inverness to Nairn Via Raigmore

AM PEAK



Journey Times Performance Summary

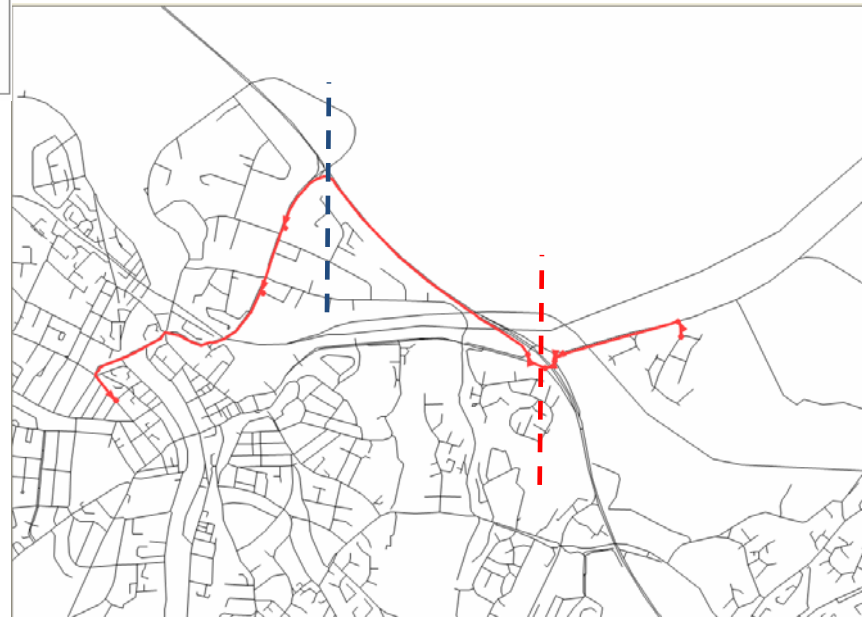
WB Inv Retail to Kenneth St Via Longman



Marginal variation in the 2021 scenarios due to increased traffic movements in the city centre. The improvements to the operation of the Raigmore junction result in a major reduction in the journey time when interventions are in place.

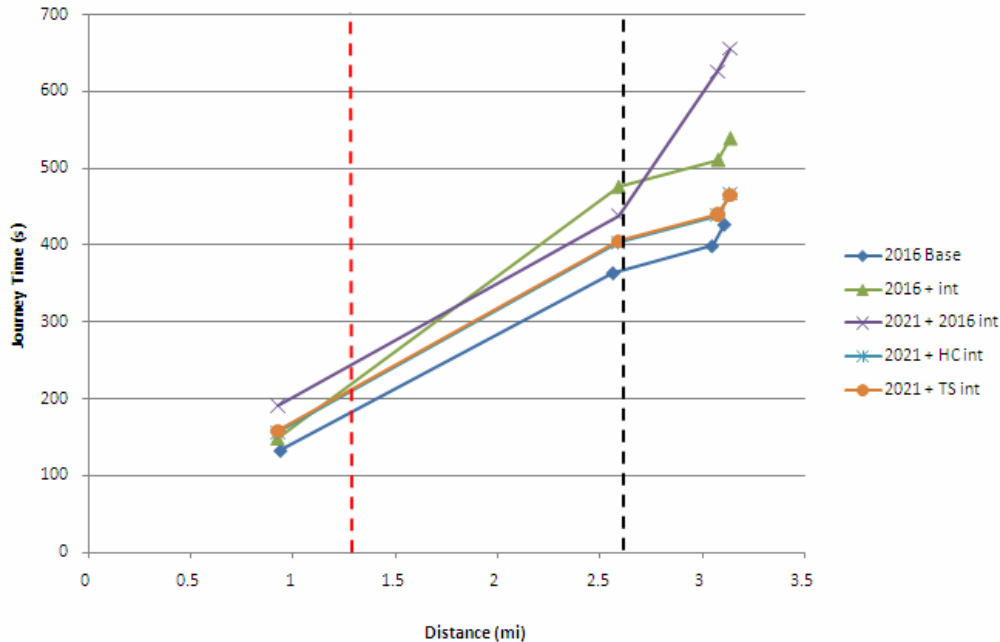
From Inverness Retail Park to Kenneth Street Via Longman

AM PEAK



Journey Times Performance Summary

EB Kenneth St to Inv Retail Via Longman

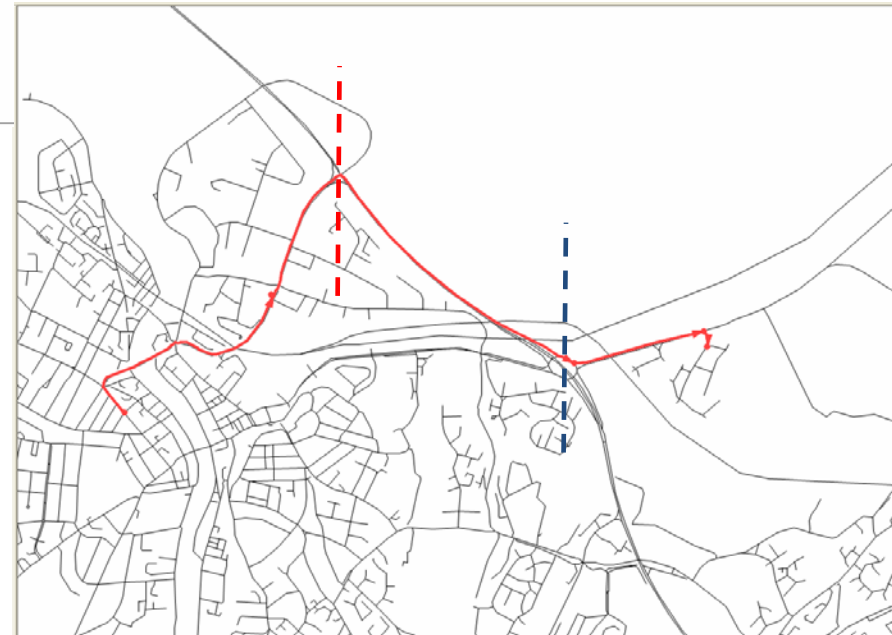


Interventions improve the journey time in the 2021 scenarios.

In 2016 the signals along Longman Road have resulted in an increase in the journey time, however a more detailed signal plan could eradicate this delay.

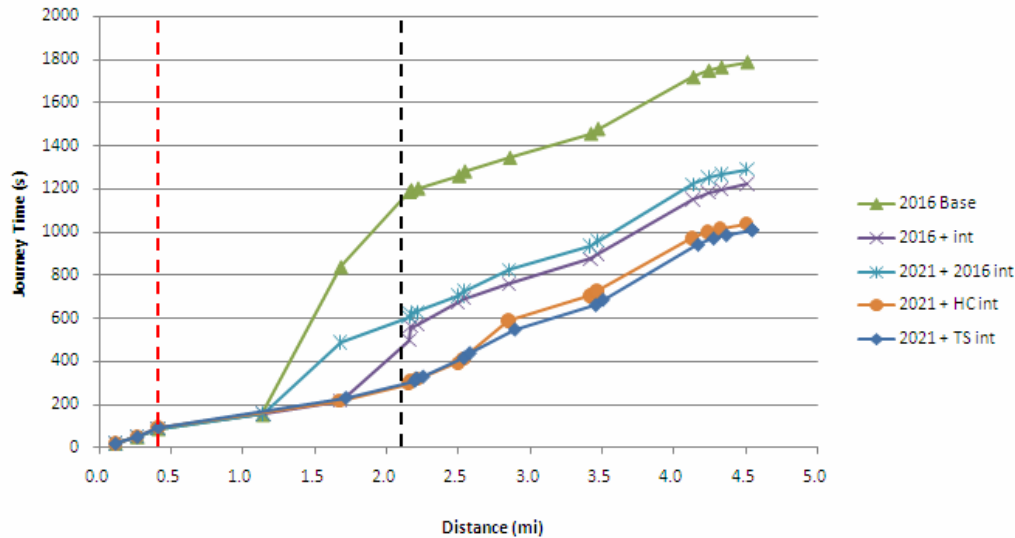
From Kenneth Street to Inverness Retail Park Via Longman

AM PEAK



Journey Times Performance Summary

Smithton to Inverness Via Raigmore



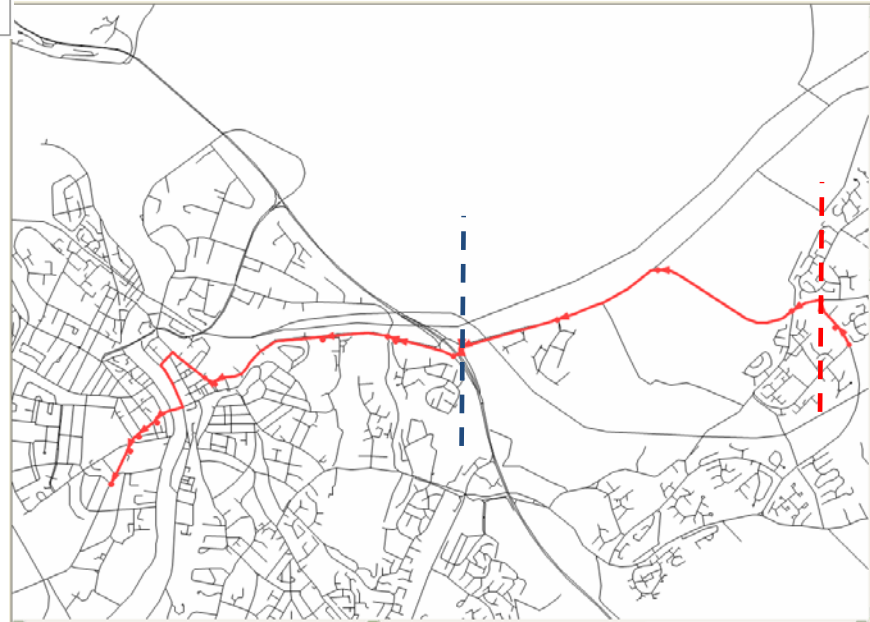
Interventions improve the journey time in the 2016 and 2021 scenarios.

In 2016 the reduction in delay for vehicles turning left from Barn Church Road onto the A96 improves the journey time.

The intervention measures in 2021 remove the queues on the A96, as a result the journey times greatly improve.

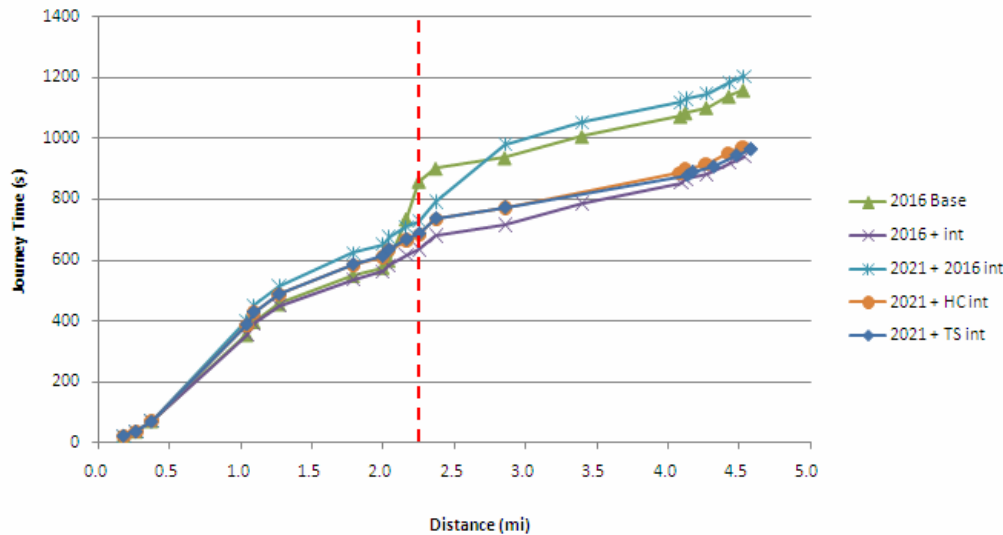
From Smithton to Inverness Via Raigmore

AM PEAK



Journey Times Performance Summary

Inverness to Smithton Via Raigmore

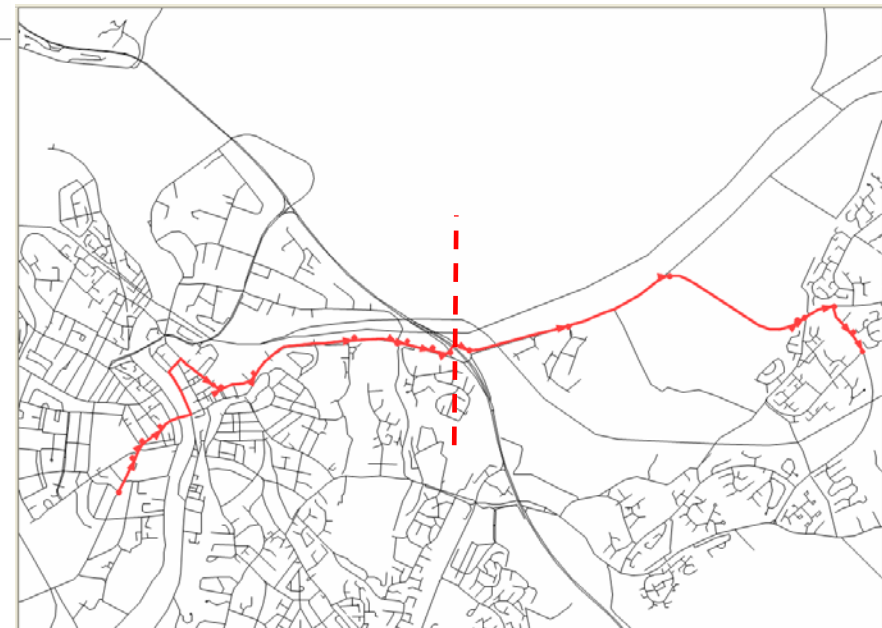


Interventions improve the journey time in the 2016 and 2021 scenarios.

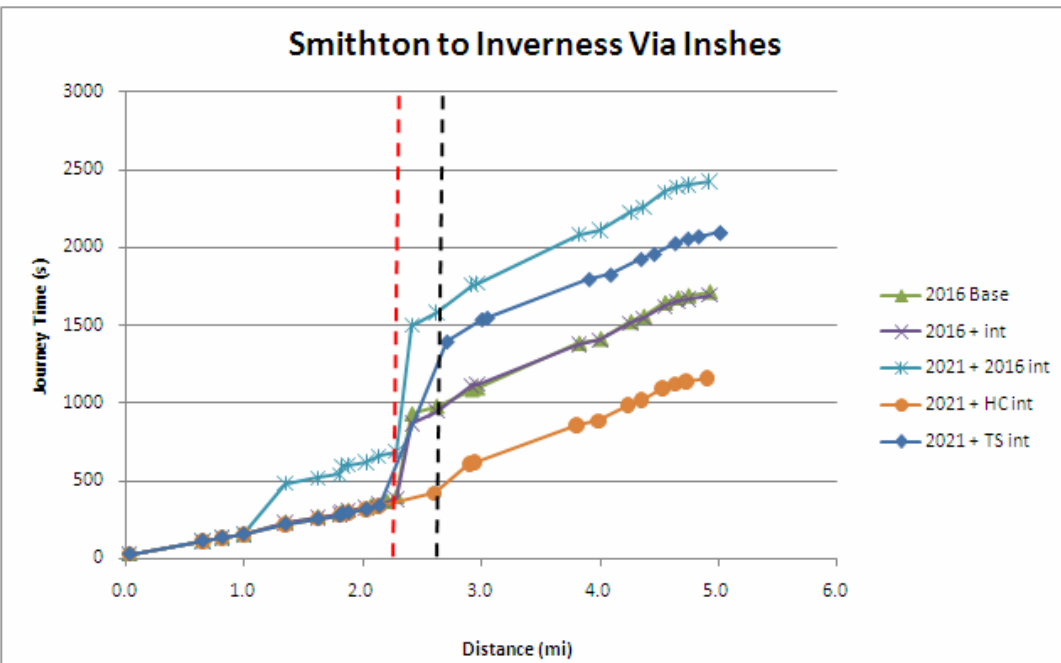
The journey times are marginally improved throughout the route, improvements at Raigmore especially reduce the journey times.

From Inverness to Smithton Via Raigmore

AM PEAK



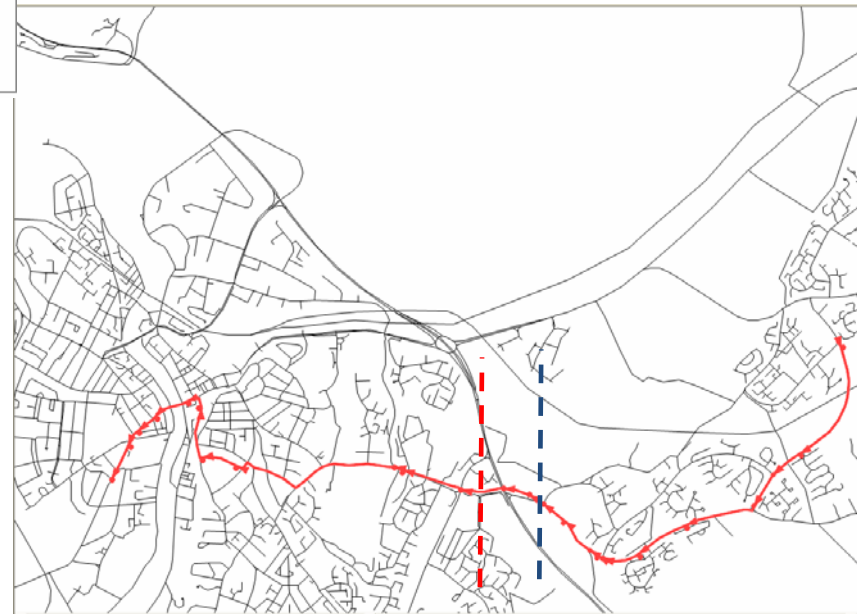
Journey Times Performance Summary



Interventions have little effect on the 2016 journey times. The Highland Council interventions show a major reduction in the journey time for 2021 whereas the TS interventions show less of an improvement.

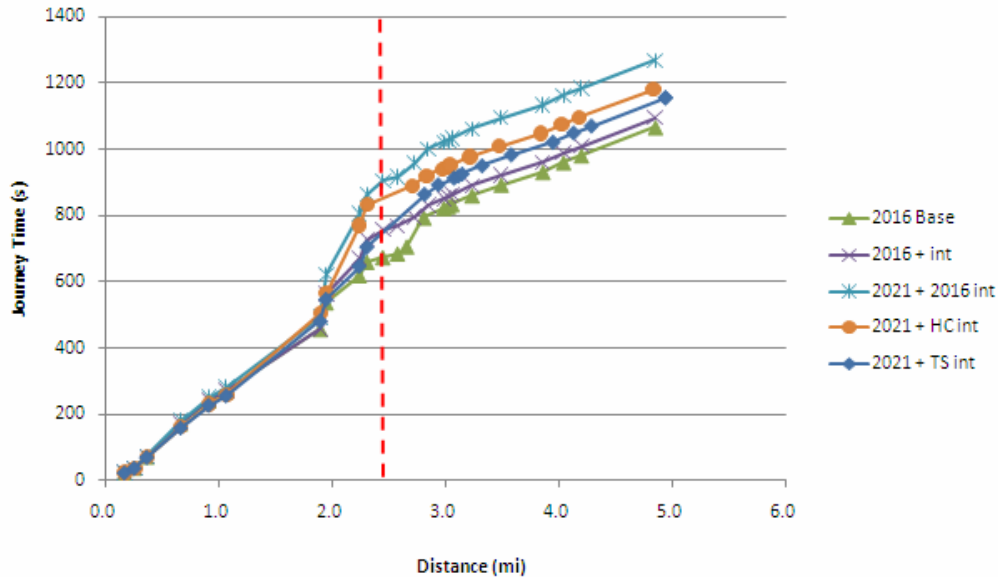
From Smithton to Inverness Via Inshes

AM PEAK



Journey Times Performance Summary

Inverness to Smithton Via Inshes

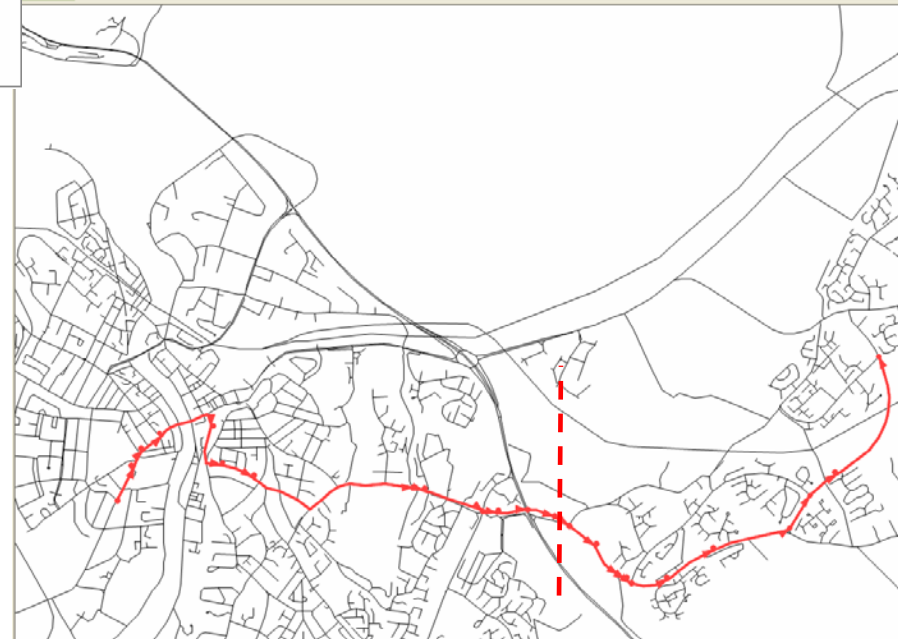


Marginal difference in the 2016 journey times whereas both the 3A and 3B schemes improve on the 2021 base times.

The improvements to the Inshes junction operation contribute to the reduction in journey times.

From Inverness to Smithton Via Inshes

AM PEAK



Journey Times Performance Summary

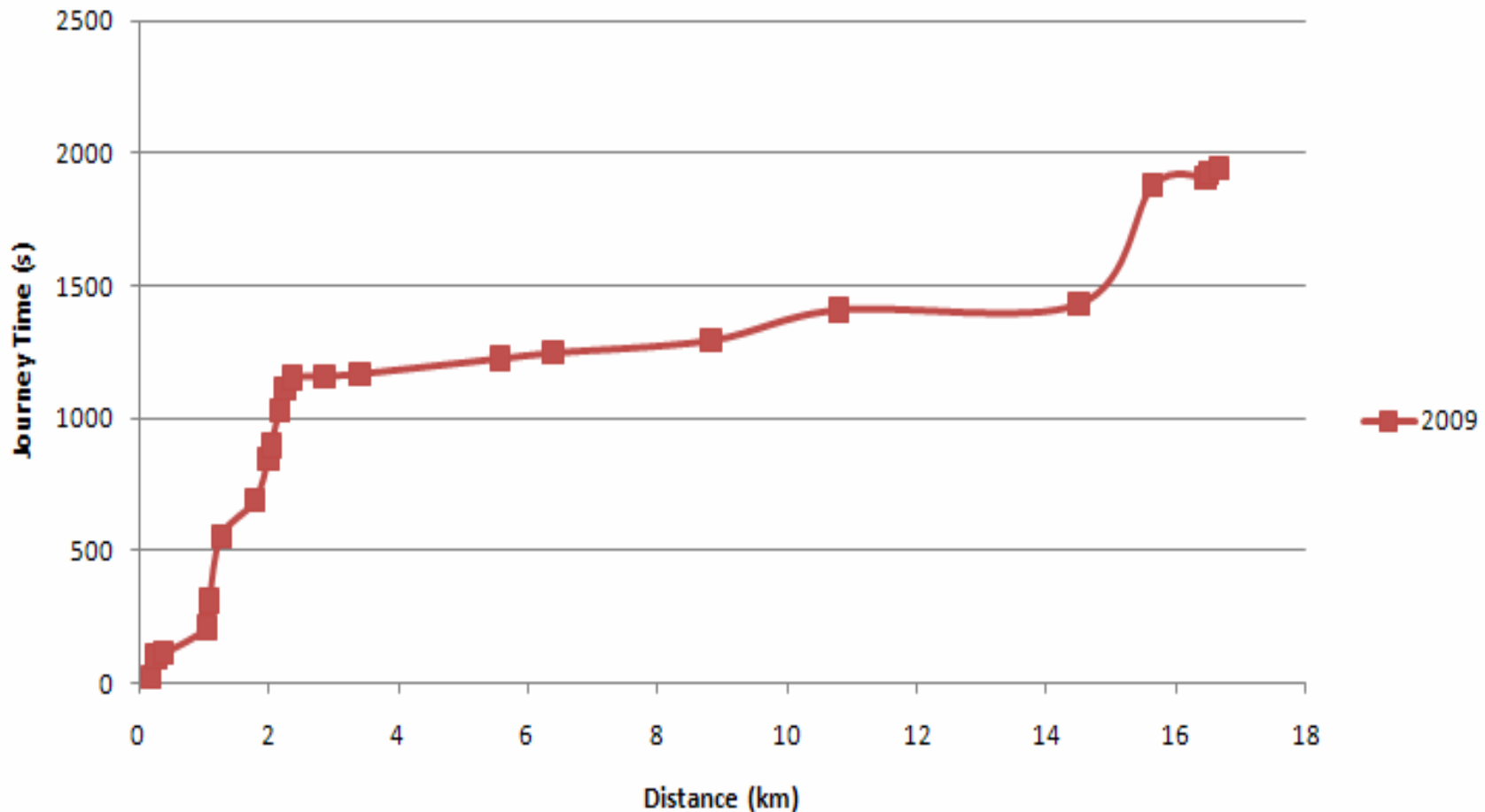
AM PEAK Summary

Journey Route	2016	2021 incl 3B	2021 incl 3A
From Nairn to Inverness Via Raigmore	✓	✓	✓
From Inverness to Nairn Via Raigmore	✓	✓	✓
From Inverness Retail Park to Kenneth Street Via Longman	✓	✗	✗
From Kenneth Street to Inverness Retail Park Via Longman	✗	✓	✓
From Smithton to Inverness Via Raigmore	✓	✓	
From Inverness to Smithton Via Raigmore	✓	✓	✓
From Smithton to Inverness Via Inshes	✓	✓	✓
From Inverness to Smithton Via Inshes	✗	✓	✓

PM Journey Times 2009 Base

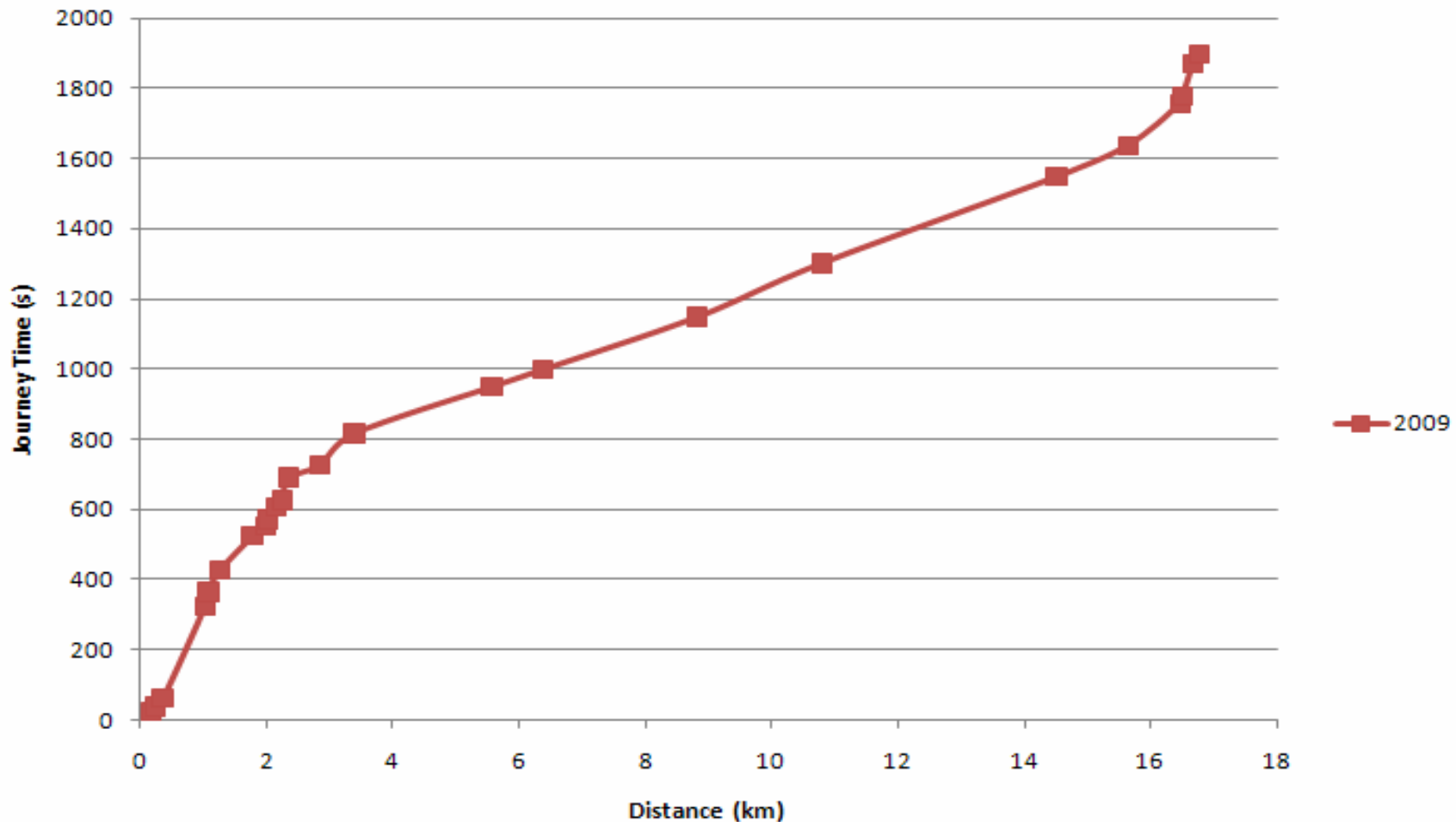
2009 PM Peak Journey Times

2009 PM Nairn To Inverness Via Raigmore



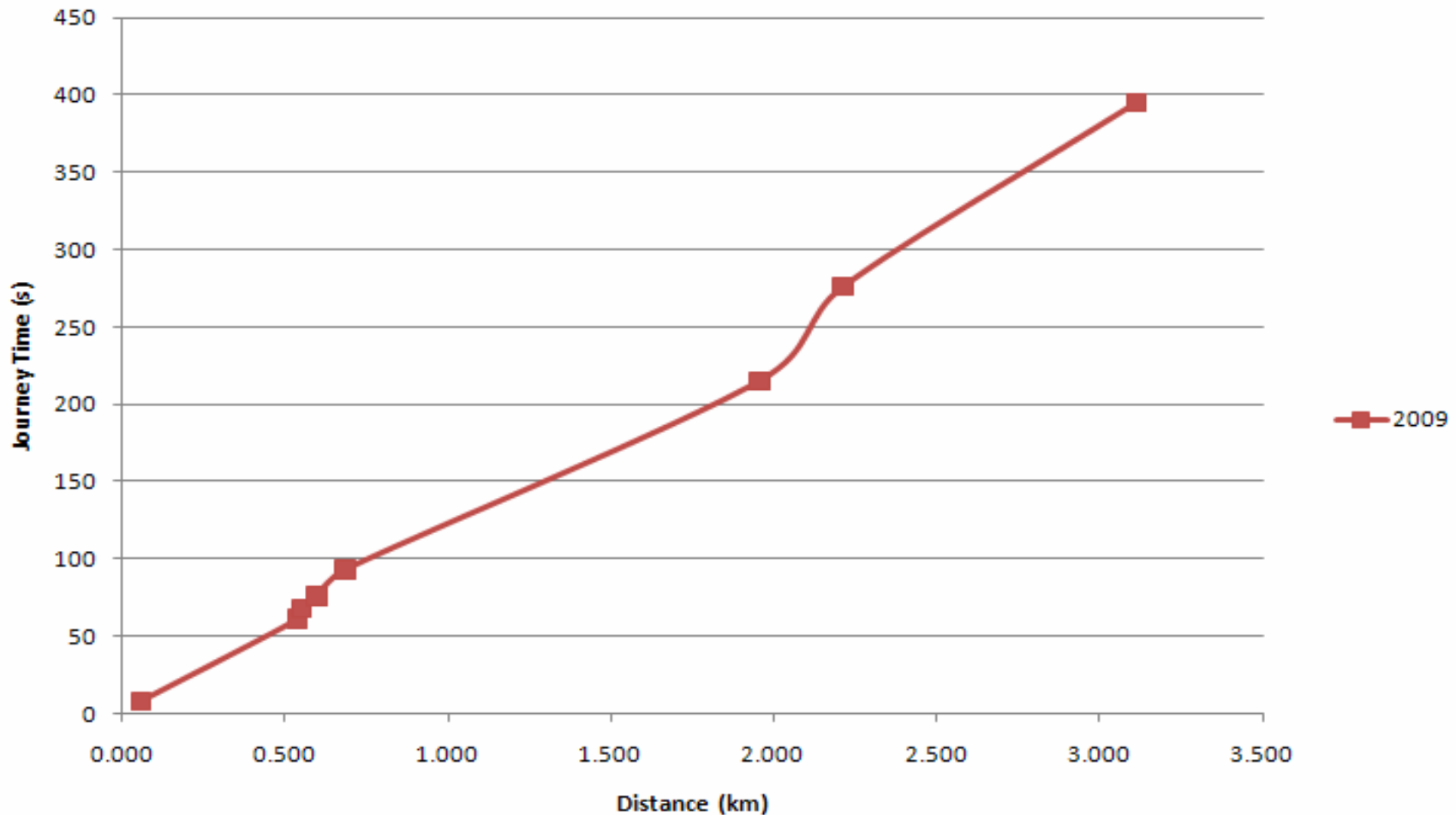
2009 PM Peak Journey Times

2009 PM Inverness to Nairn Via Raigmore AM



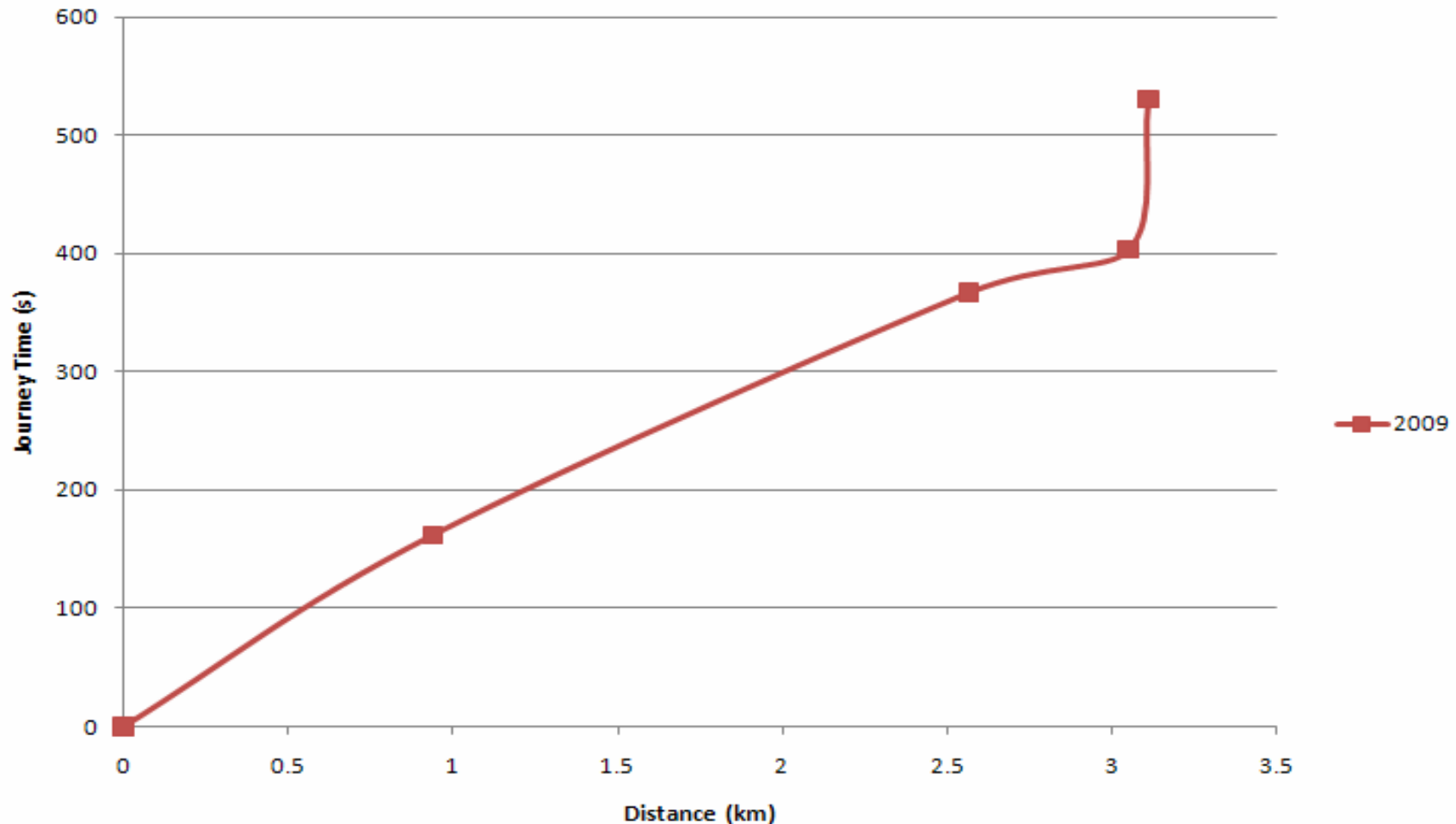
2009 PM Peak Journey Times

2009 PM WB Inv Retail to Kenneth St Via Longman



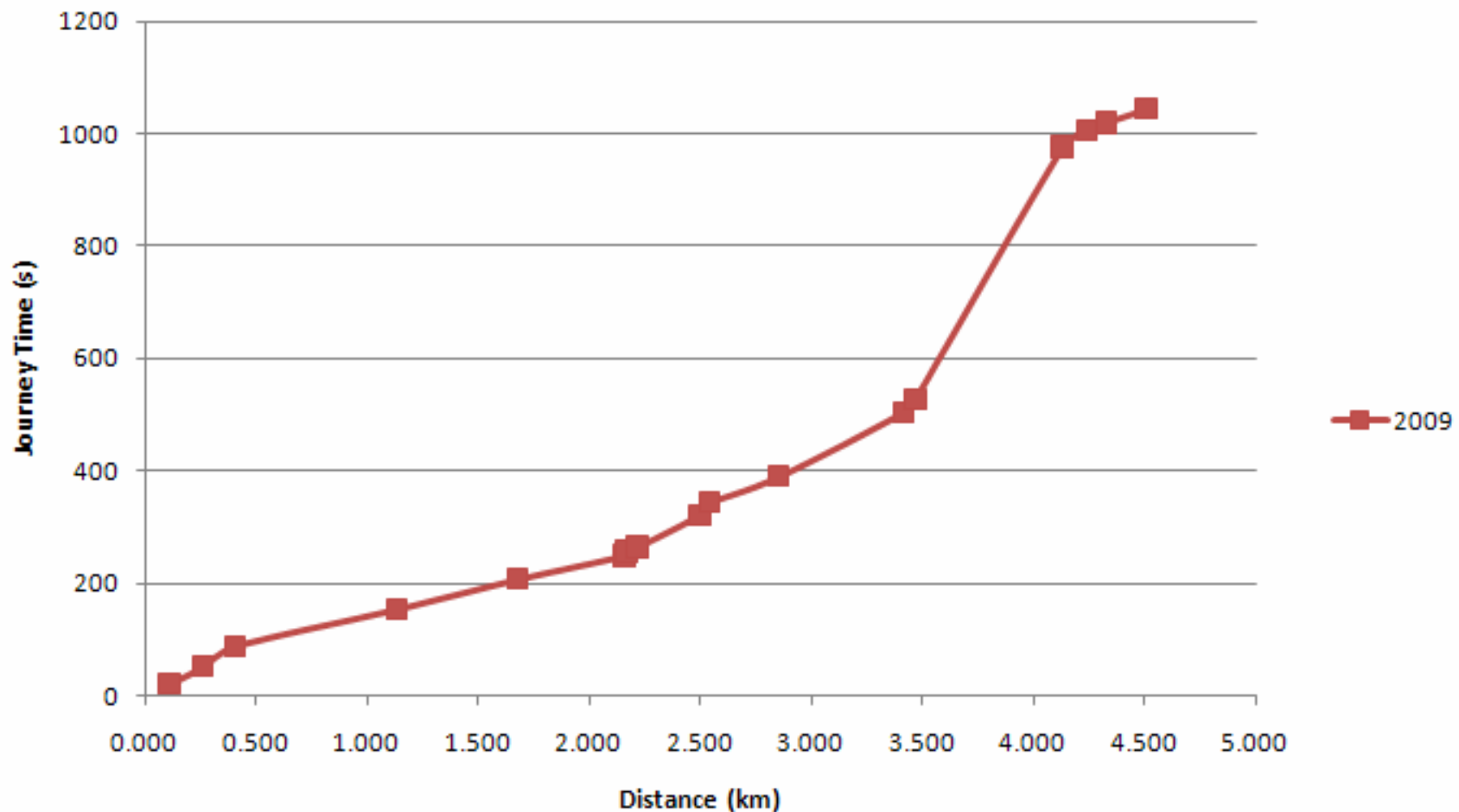
2009 PM Peak Journey Times

2009 PM EB Kenneth St to Inv Retail Via Longman



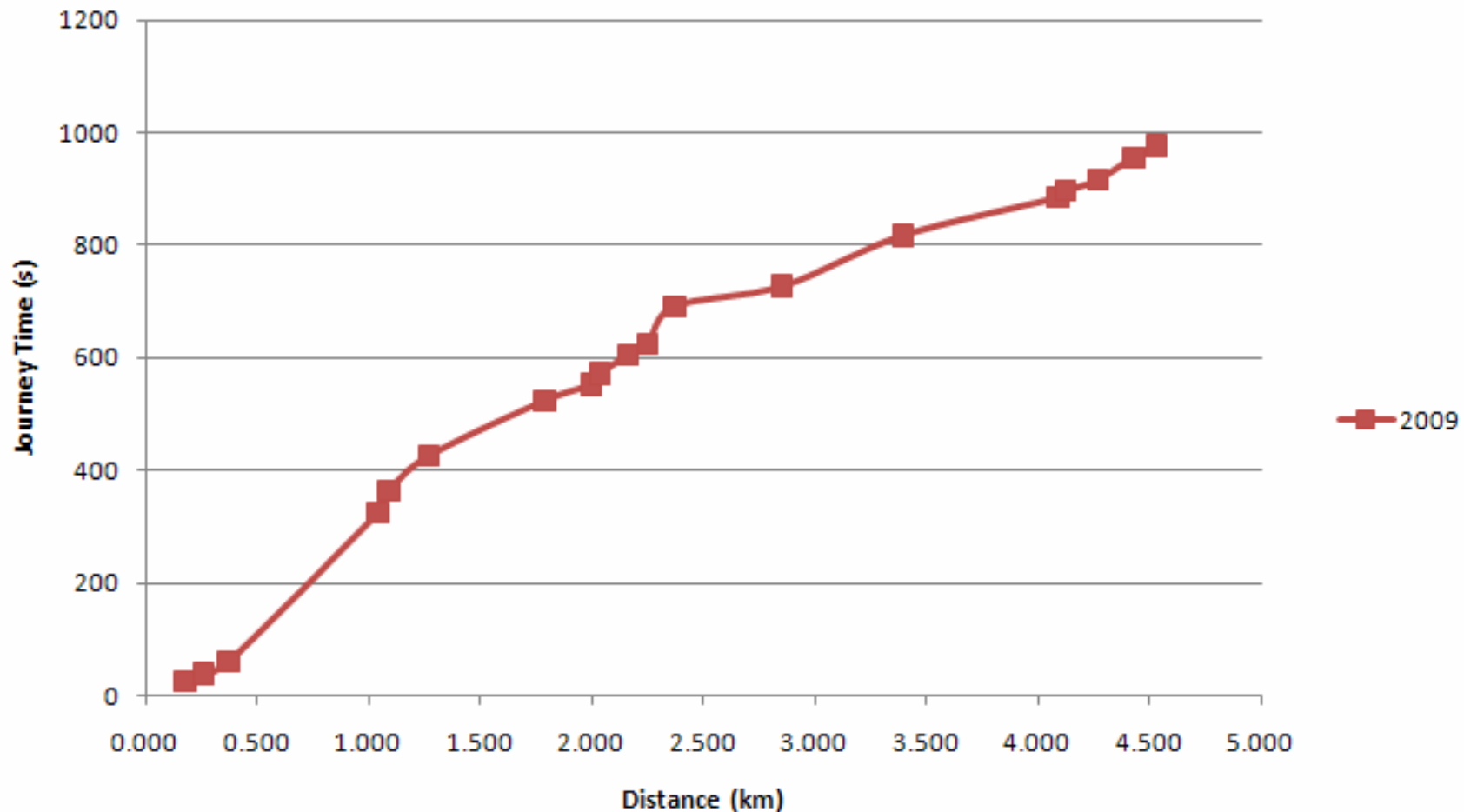
2009 PM Peak Journey Times

2009 PM Smithton to Inverness Via Raigmore



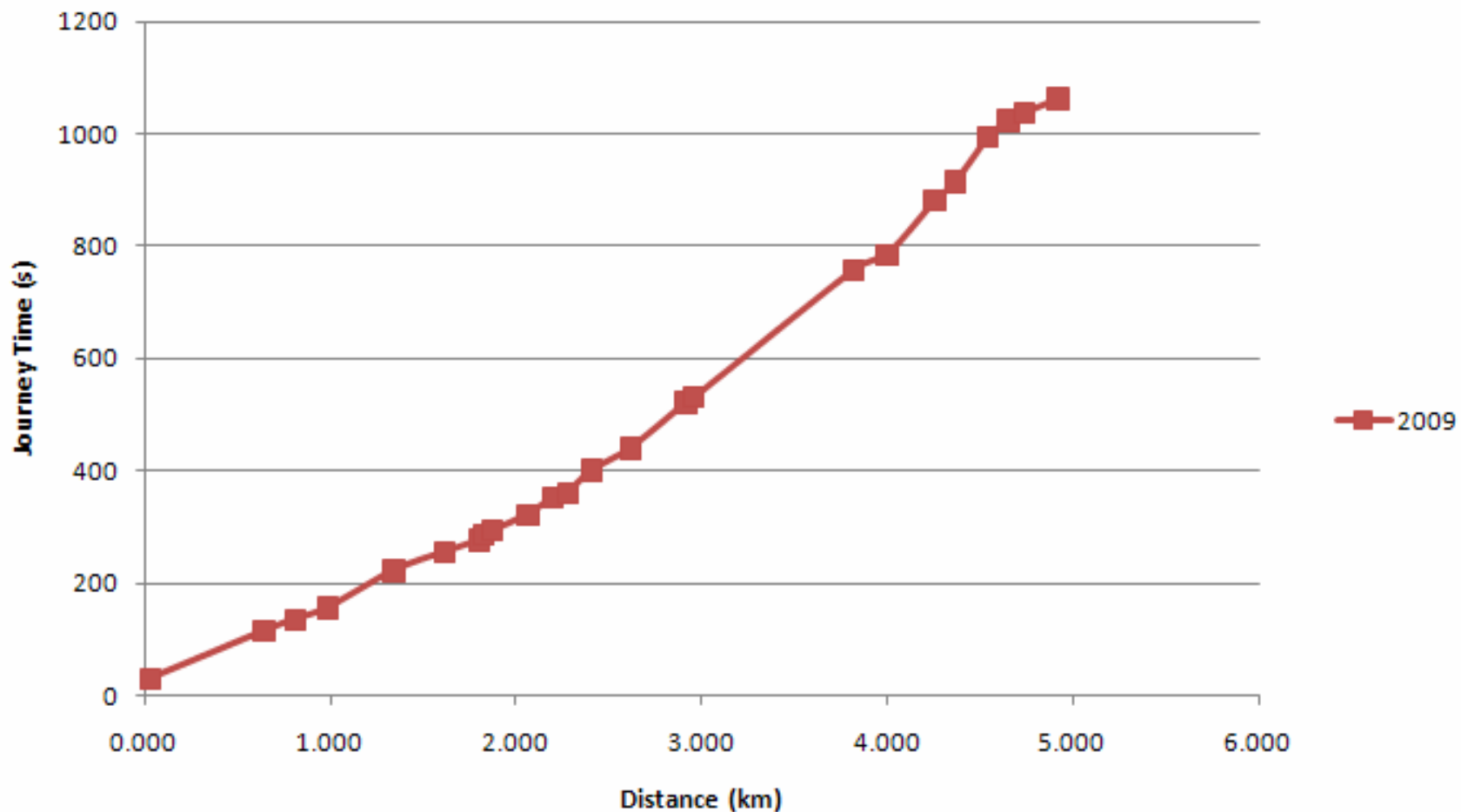
2009 PM Peak Journey Times

2009 PM Inverness to Smithton Via Raigmore



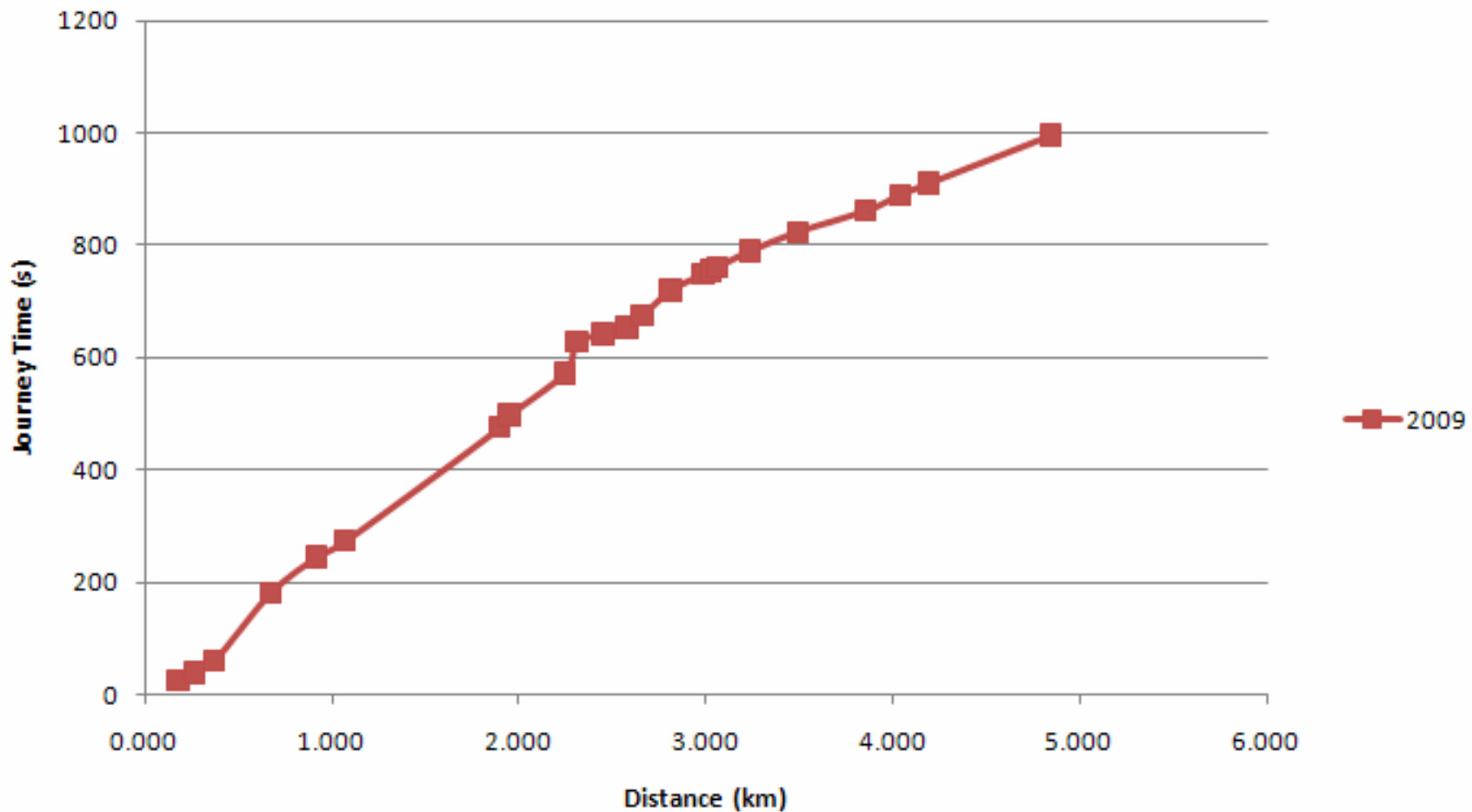
2009 PM Peak Journey Times

2009 PM Smithton to Inverness Via Inshes



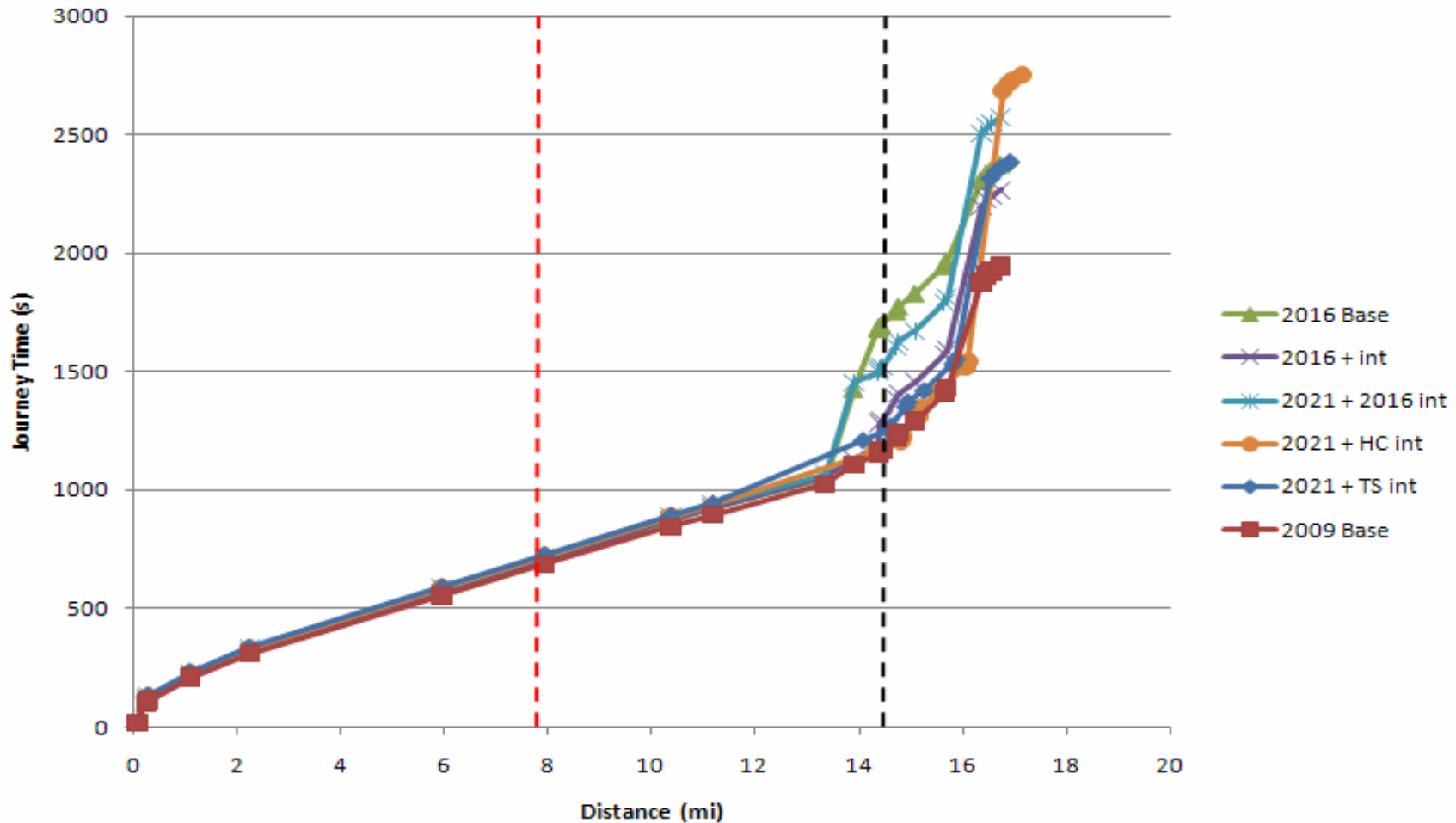
2009 PM Peak Journey Times

2009 PM Inverness to Smithton Via Inshes



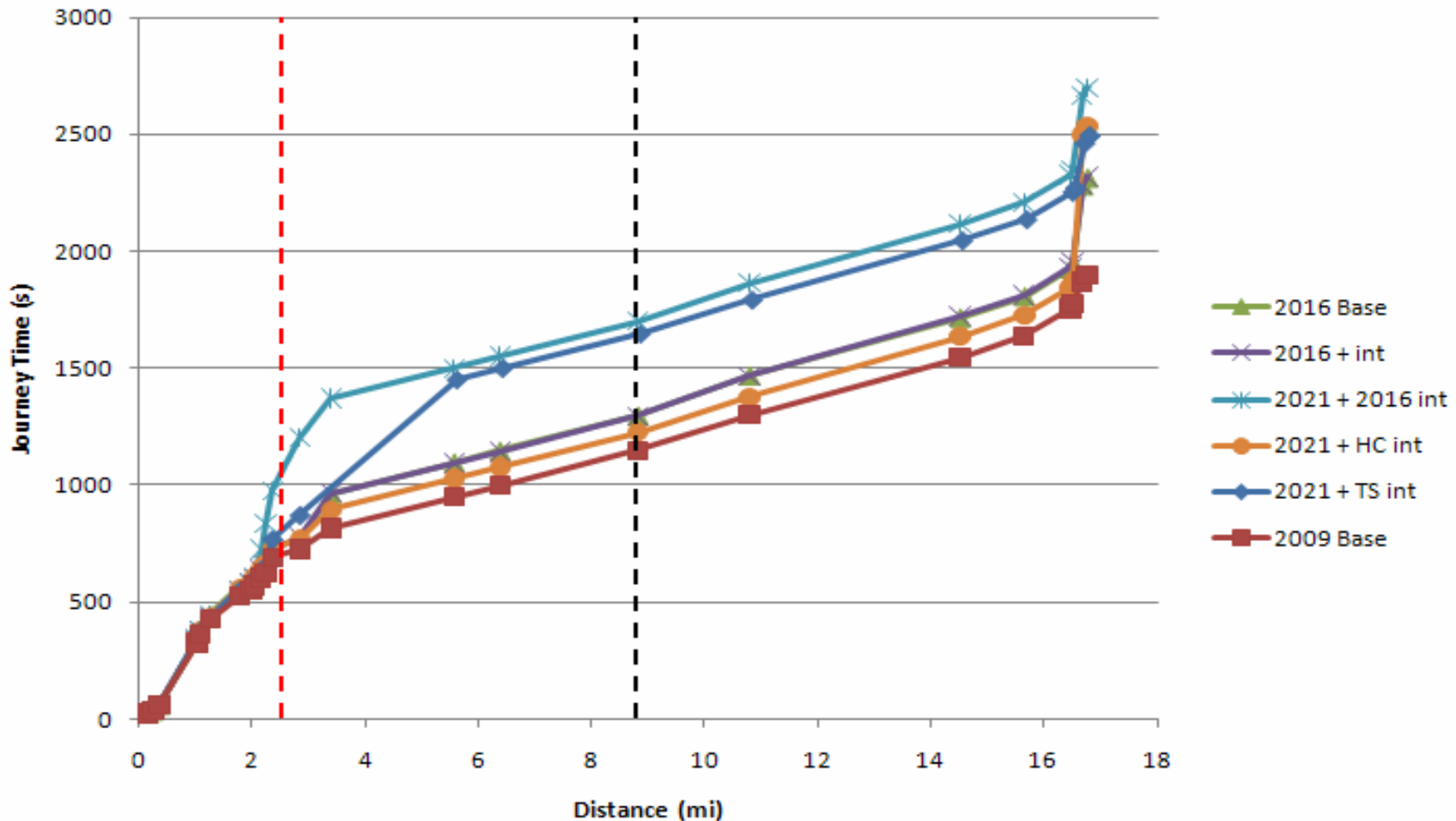
2009 PM Journey Time Summary

Nairn To Inverness Via Raigmore



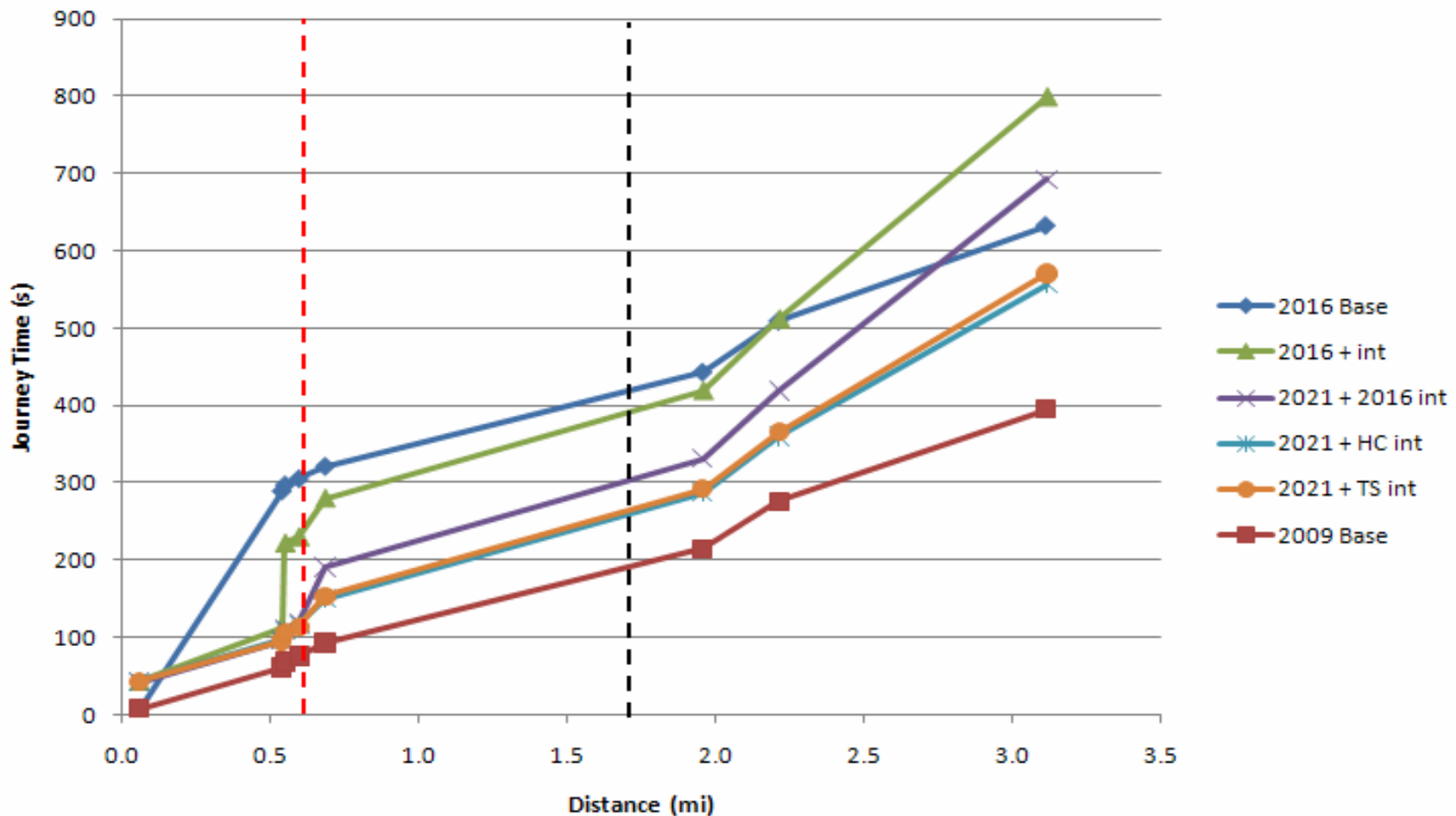
2009 PM Journey Time Summary

Inverness to Nairn Via Raigmore



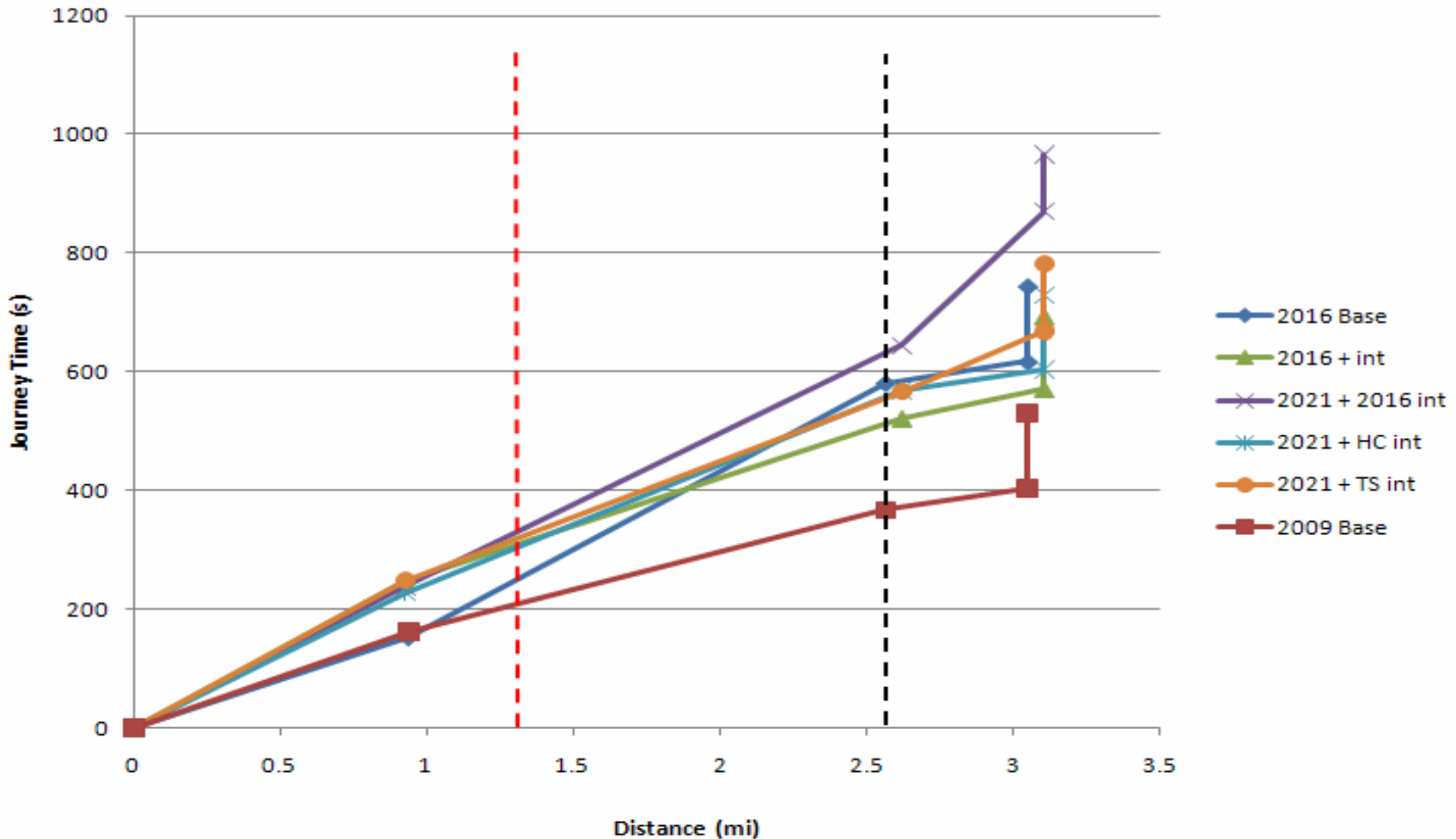
2009 PM Journey Time Summary

WB Inv Retail to Kenneth St Via Longman



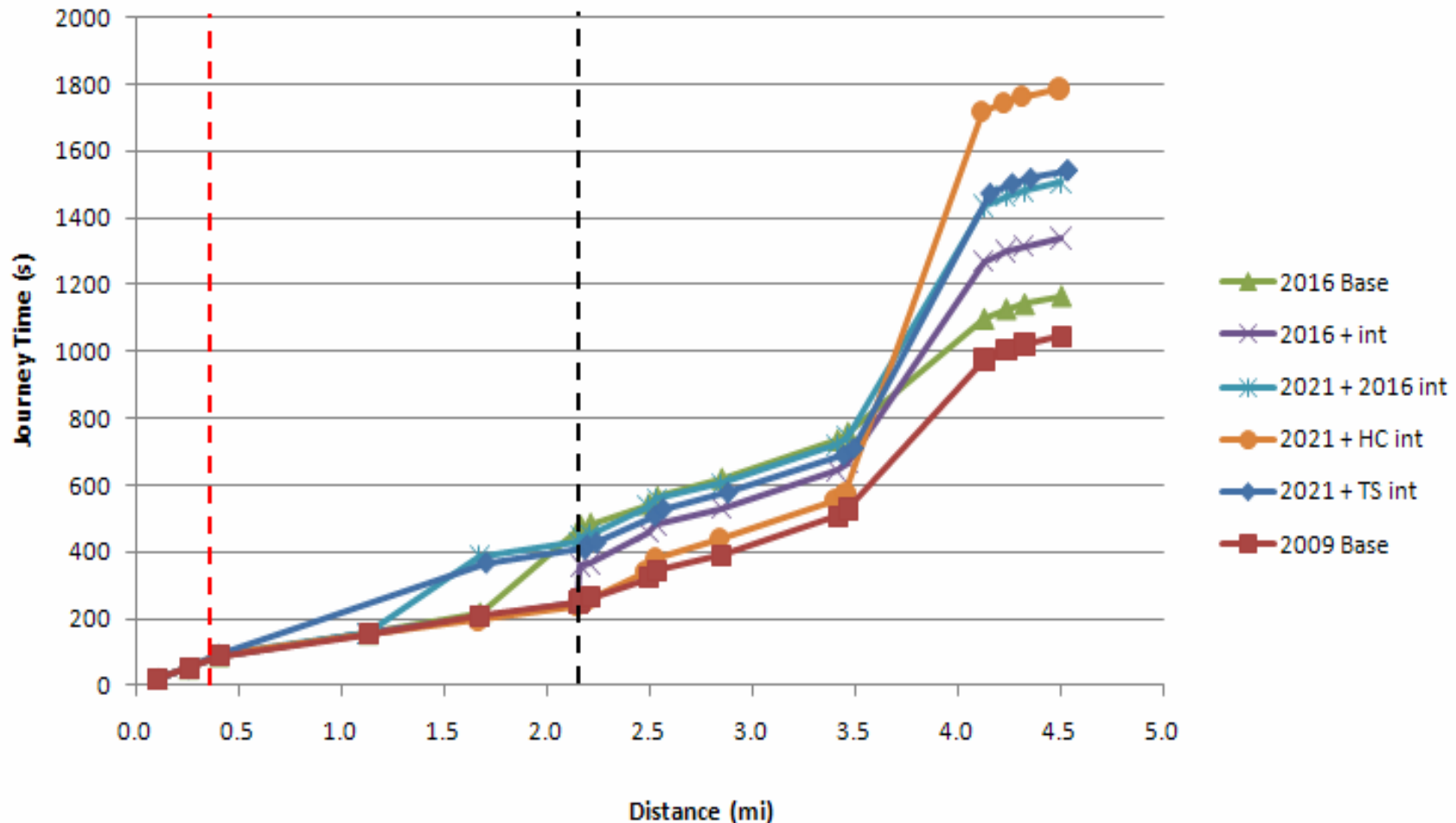
2009 PM Journey Time Summary

EB Kenneth St to Inv Retail Via Longman



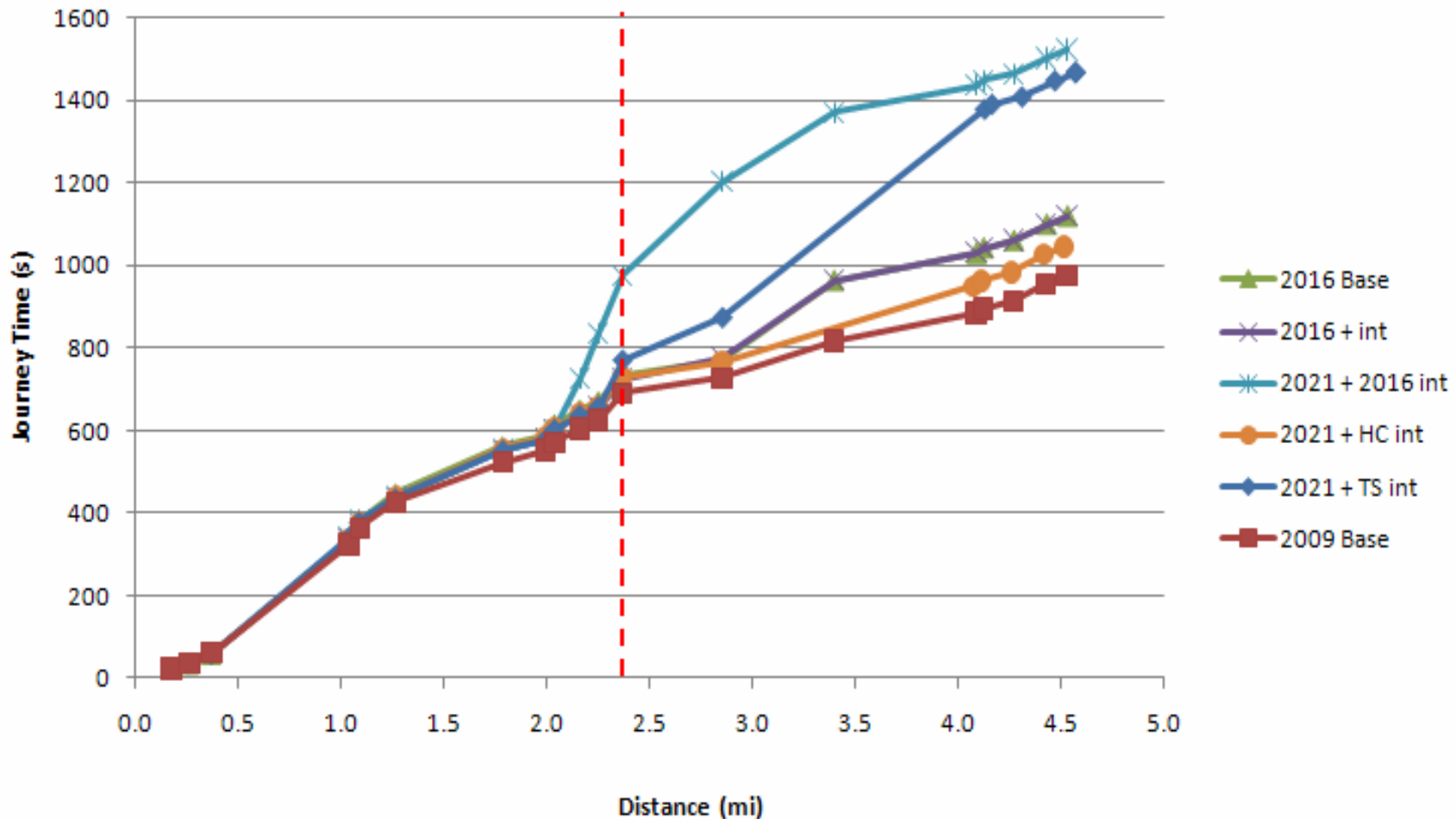
2009 PM Journey Time Summary

Smithton to Inverness Via Raigmore



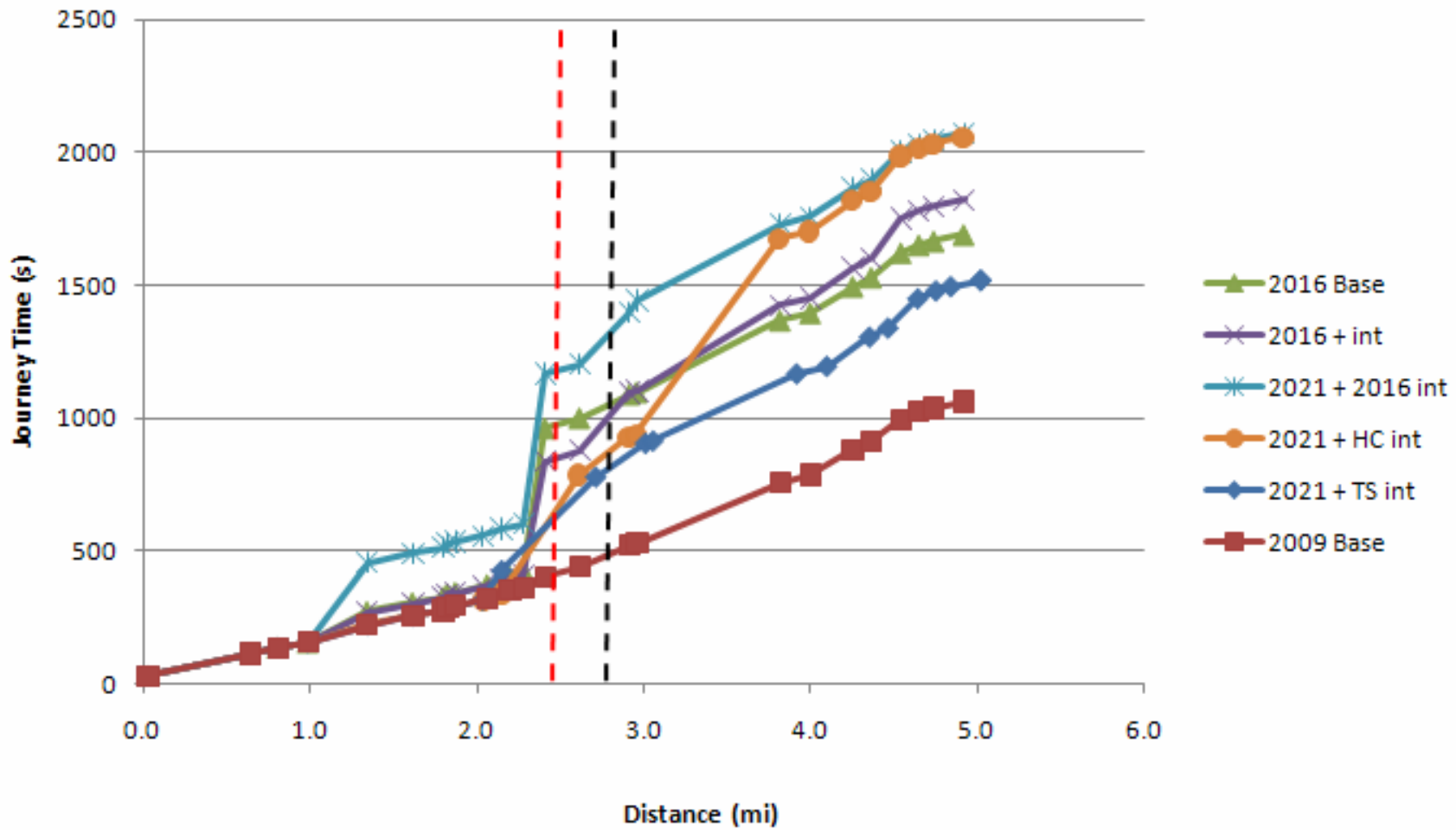
2009 PM Journey Time Summary

Inverness to Smithton Via Raigmore



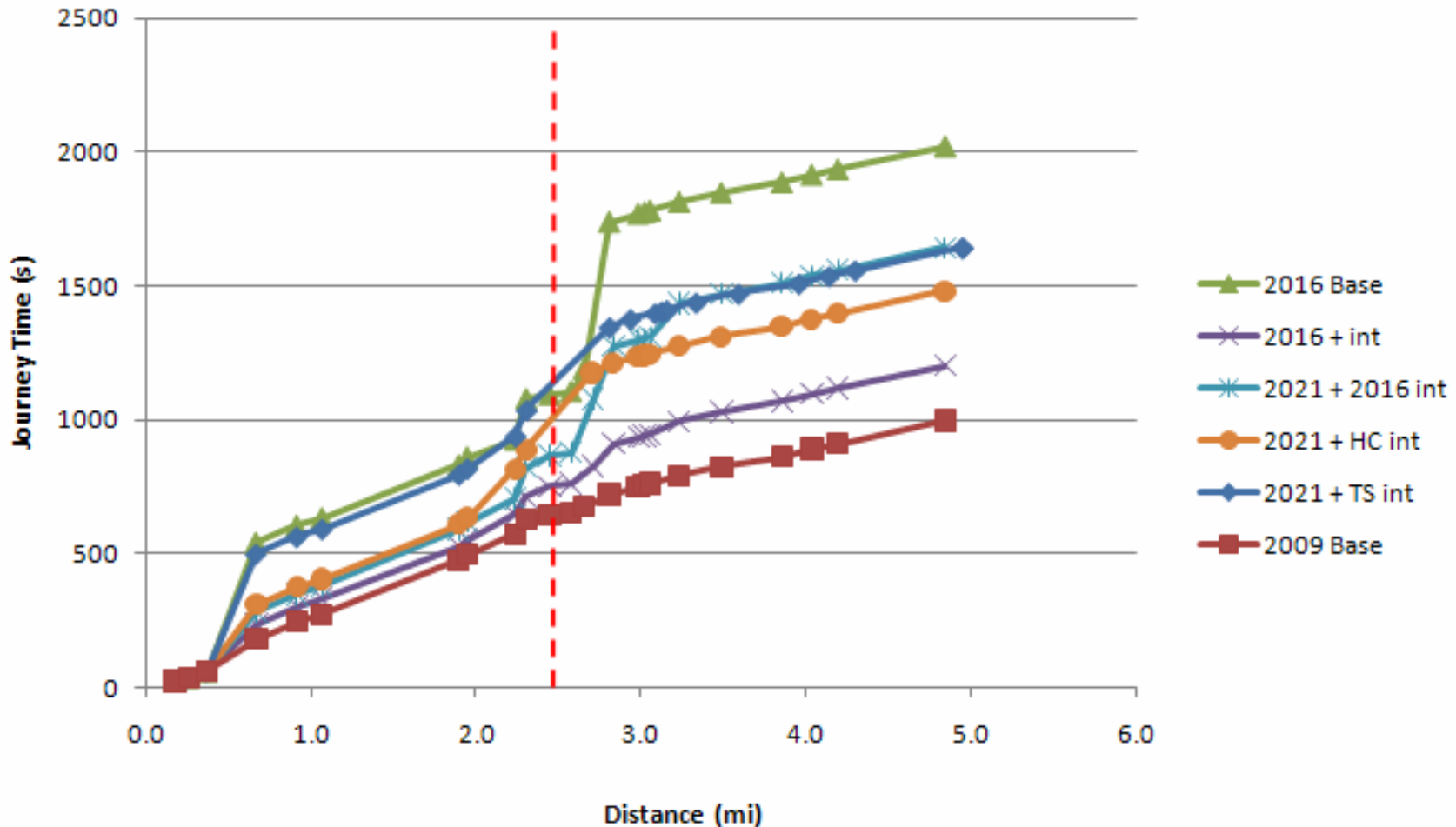
2009 PM Journey Time Summary

Smithton to Inverness Via Inshes



2009 PM Journey Time Summary

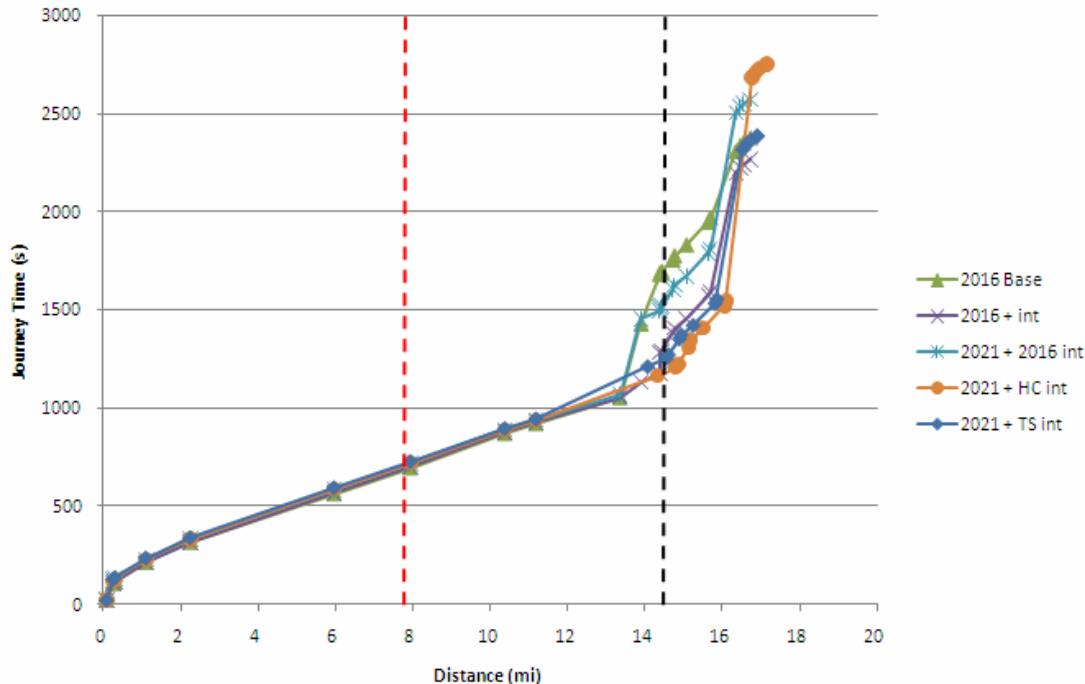
Inverness to Smithton Via Inshes



PM Journey Times

Journey Times Performance Summary

Nairn To Inverness Via Raigmore



The overall journey times are marginally different. Any reductions in the journey times are negated by a delay at Young Street / Bank Street. This is due to the signals remaining unchanged despite the demand and traffic distribution changing. Similar to the AM times there is very little change to journey times through Nairn, again due to no interventions /no change in traffic demand.

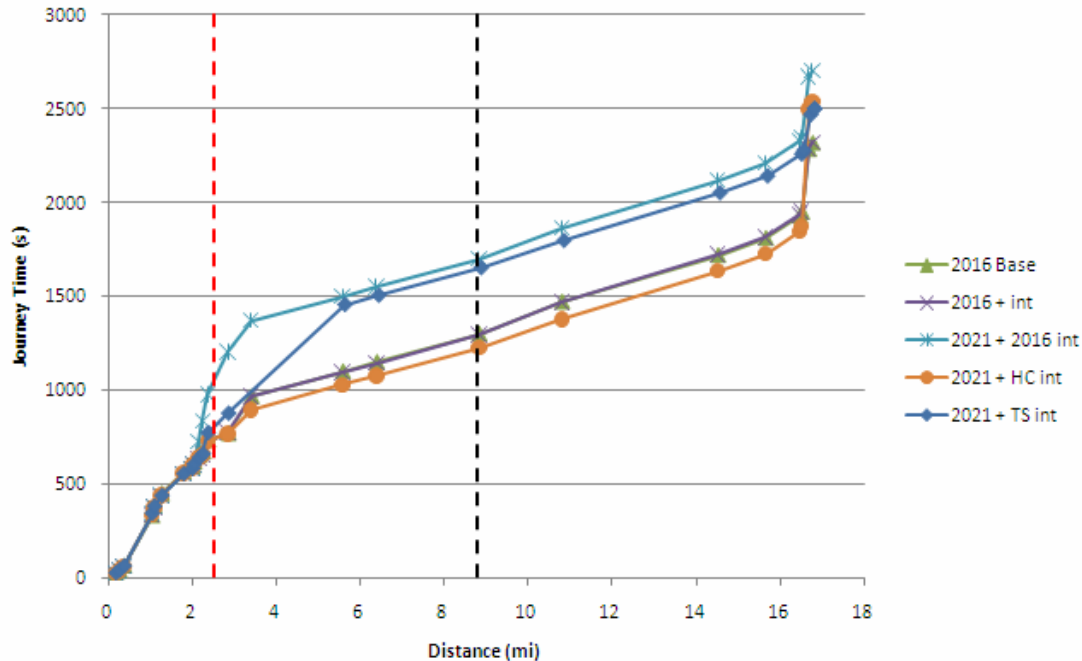
From Nairn to Inverness Via Raigmore

PM PEAK



Journey Times Performance Summary

Inverness to Nairn Via Raigmore AM

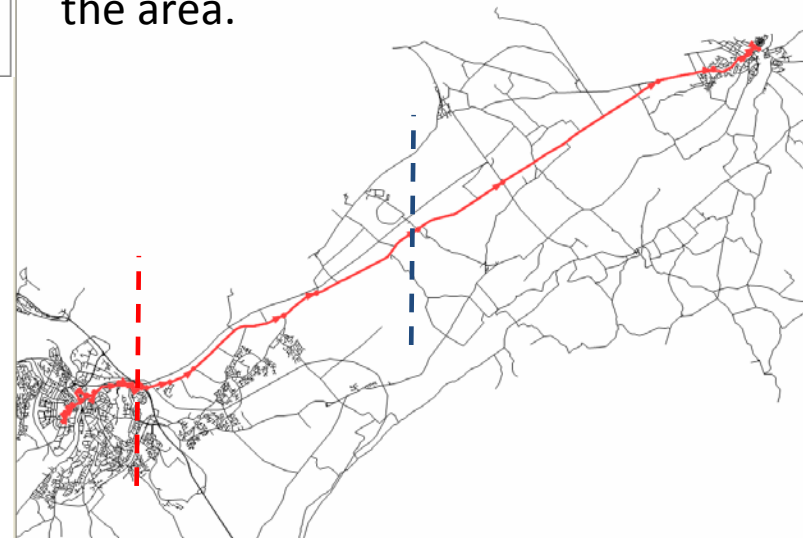


The journey times for 2016 show marginal differences. The interventions in 2021 improve the journey time with the 3B scheme showing the biggest reduction in journey time.

Journey times through Nairn are unchanged due to no interventions being put in place but also no real change in traffic demand/profile in the area.

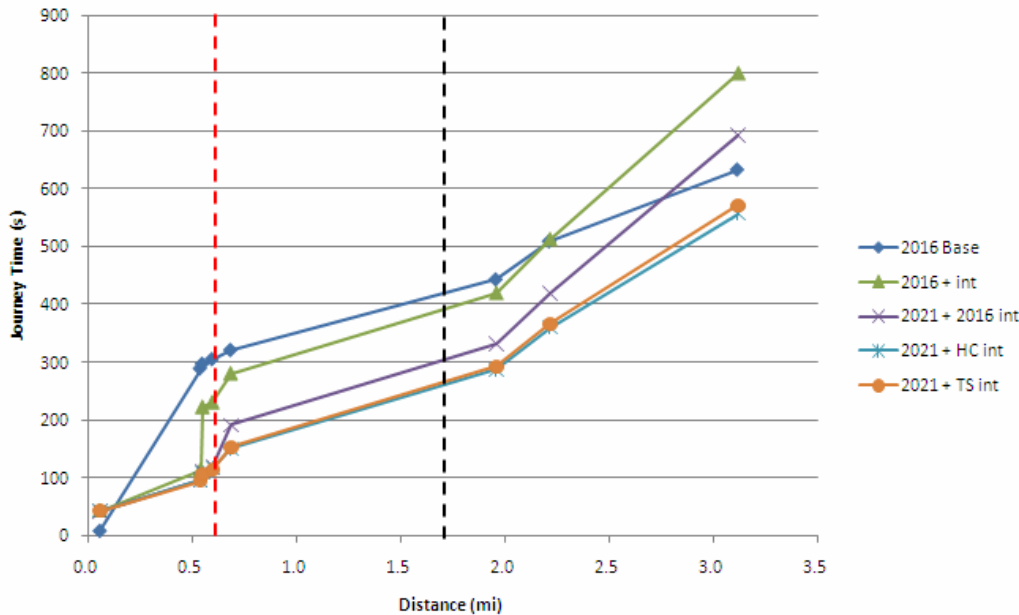
From Inverness to Nairn Via Raigmore

PM PEAK



Journey Times Performance Summary

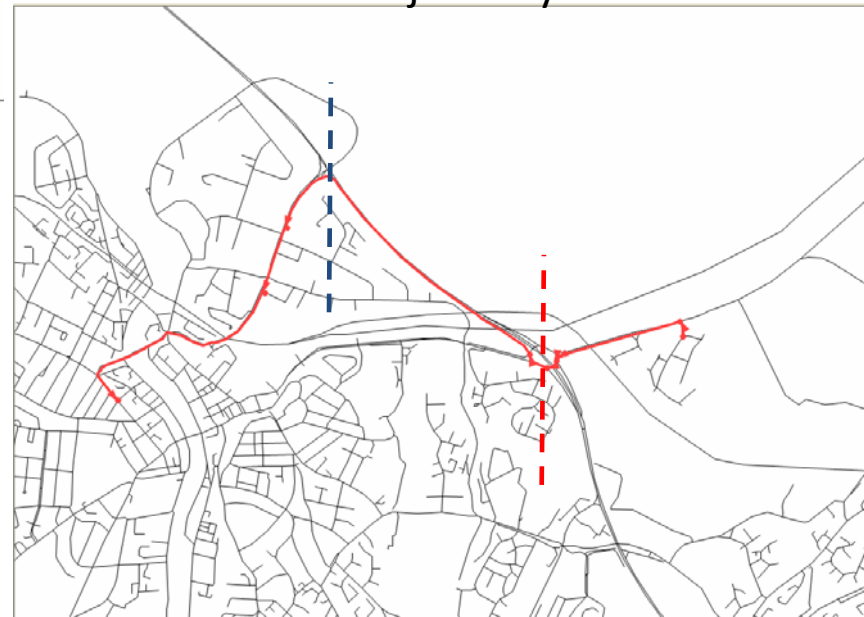
WB Inv Retail to Kenneth St Via Longman



The 2016 intervention time is worse than the base due to increased delay resulting from the signalisation of the junctions on Longman Road. The interventions in 2021 improve the journey time with the both schemes showing a similar reduction in the journey time.

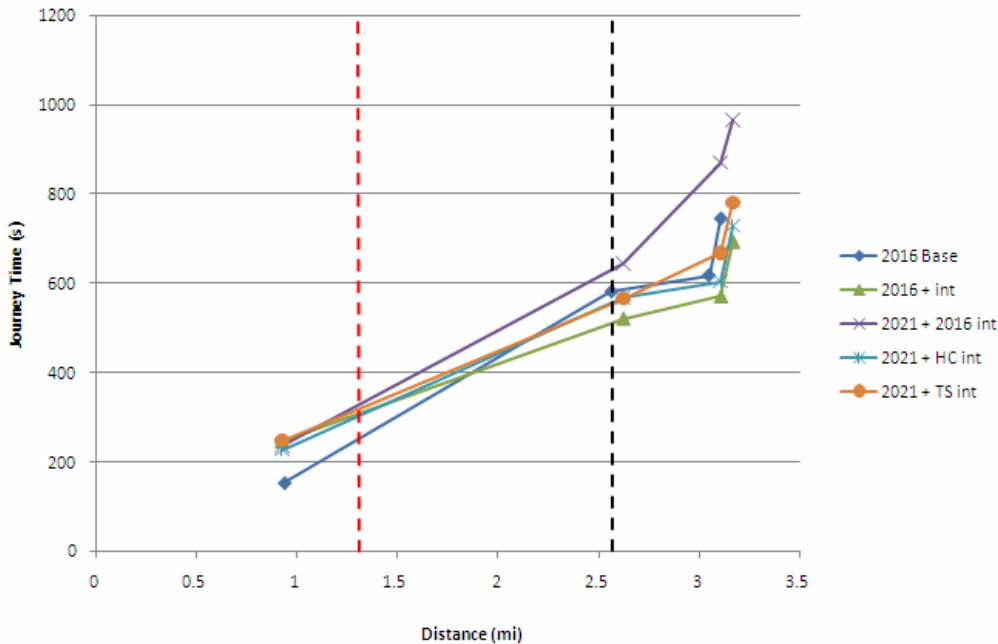
From Inverness Retail Park to Kenneth Street Via Longman

PM PEAK



Journey Times Performance Summary

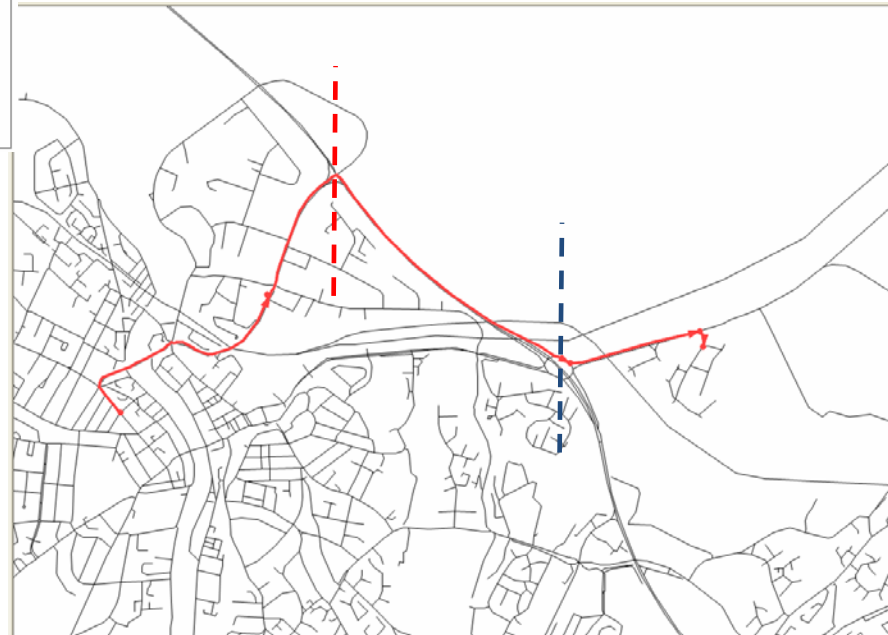
EB Kenneth St to Inv Retail Via Longman



Marginal difference in the 2016 journey times with improvements to Raigmore in 2021 resulting in reductions in the journey time for both schemes.

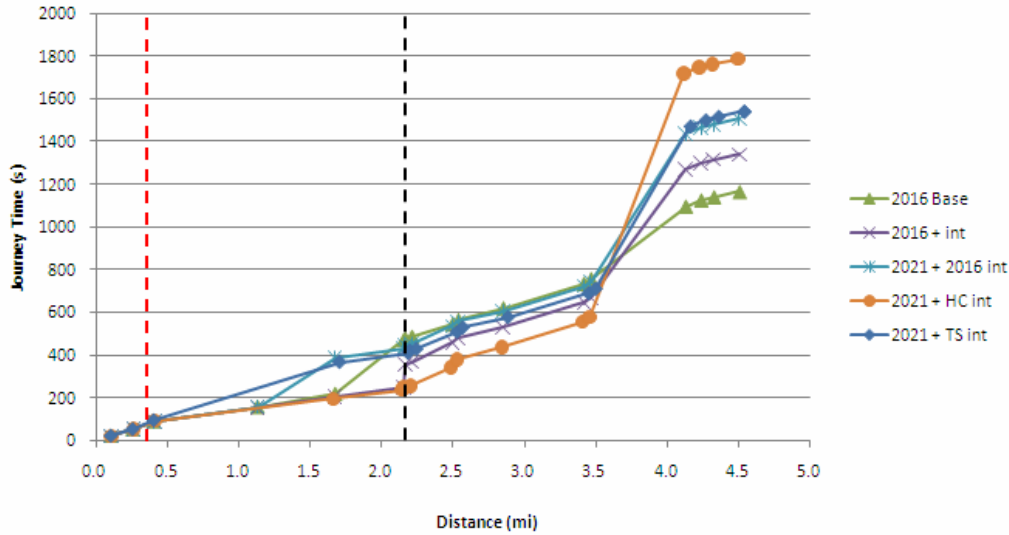
From Kenneth Street to Inverness Retail Park Via Longman

PM PEAK



Journey Times Performance Summary

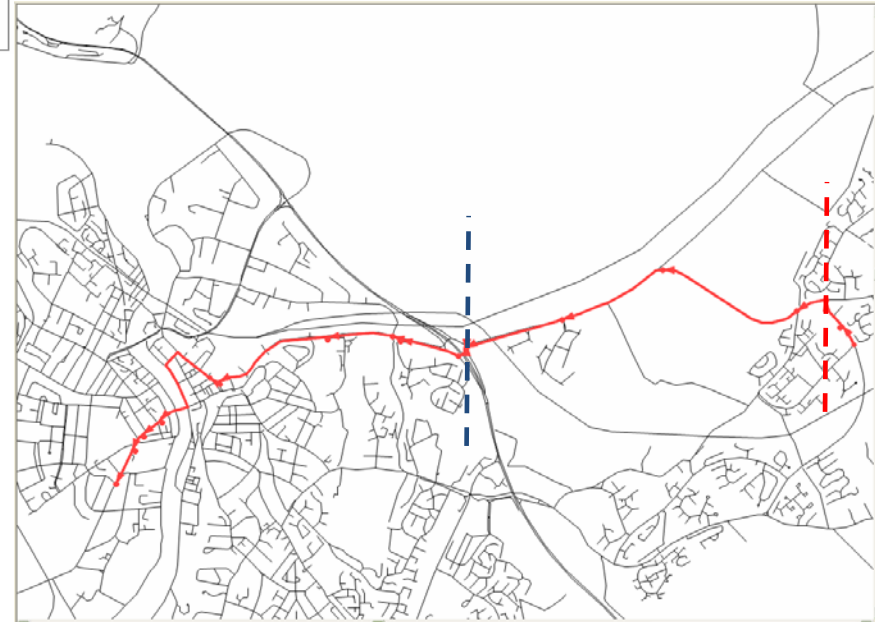
Smithton to Inverness Via Raigmore



The journey times with the interventions in place increase. This is due to a major delay at Young Street / Bank Street due to the unmodified signal timings.

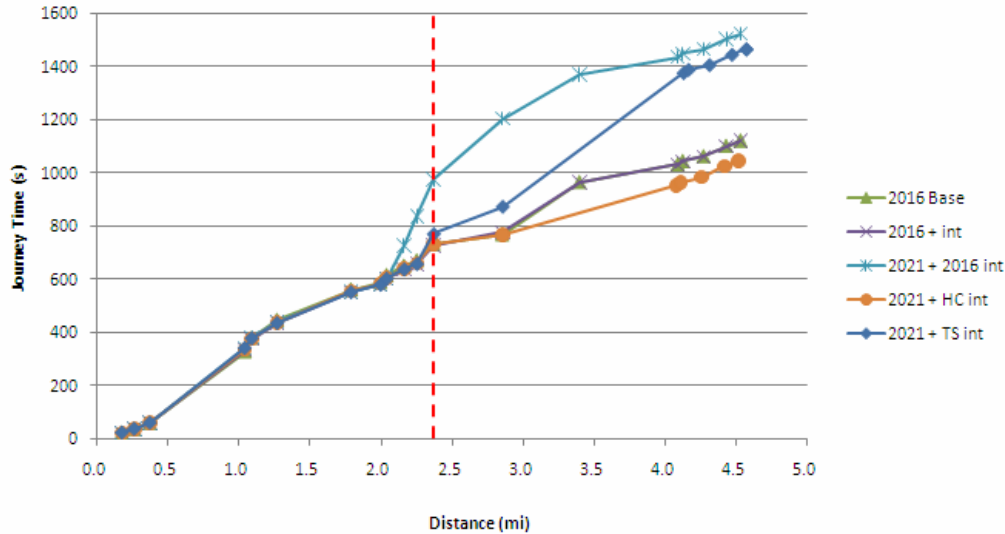
From Smithton to Inverness Via Raigmore

PM PEAK



Journey Times Performance Summary

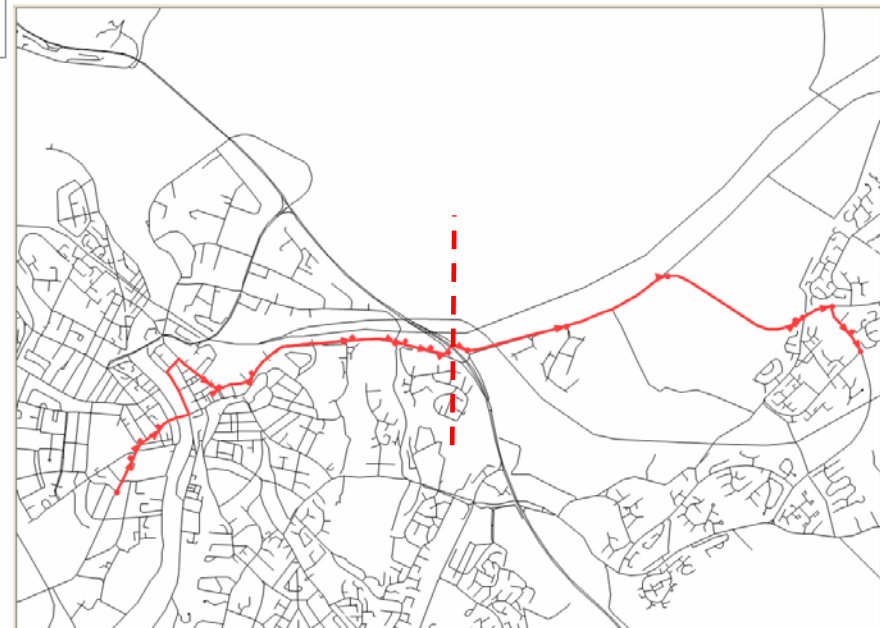
Inverness to Smithton Via Raigmore



The 2016 journey times illustrate marginal differences between base and intervention schemes. The 2021 intervention schemes both improve on the base scenario with the HC scheme showing the greatest improvement.

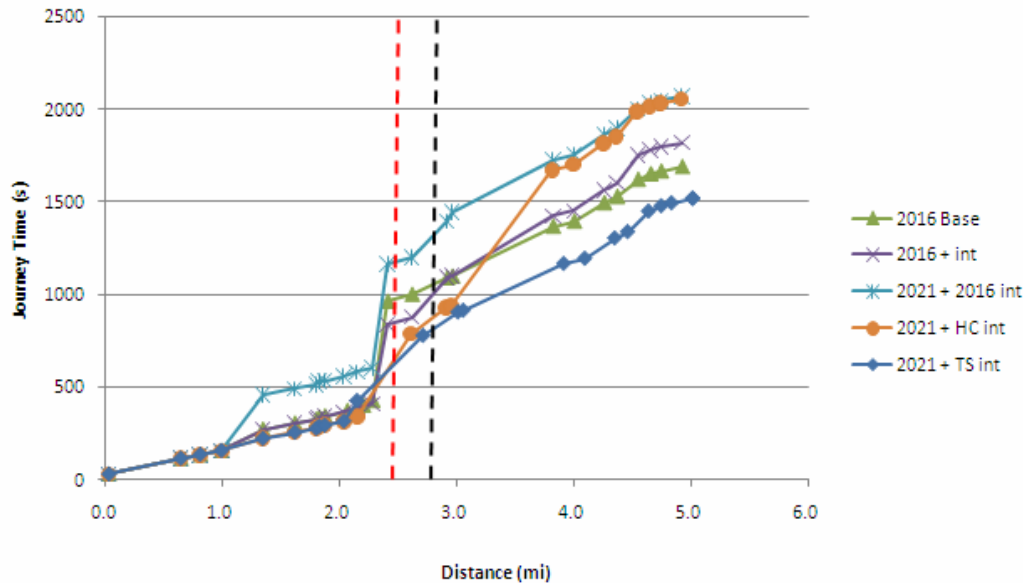
From Inverness to Smithton Via Raigmore

PM PEAK



Journey Times Performance Summary

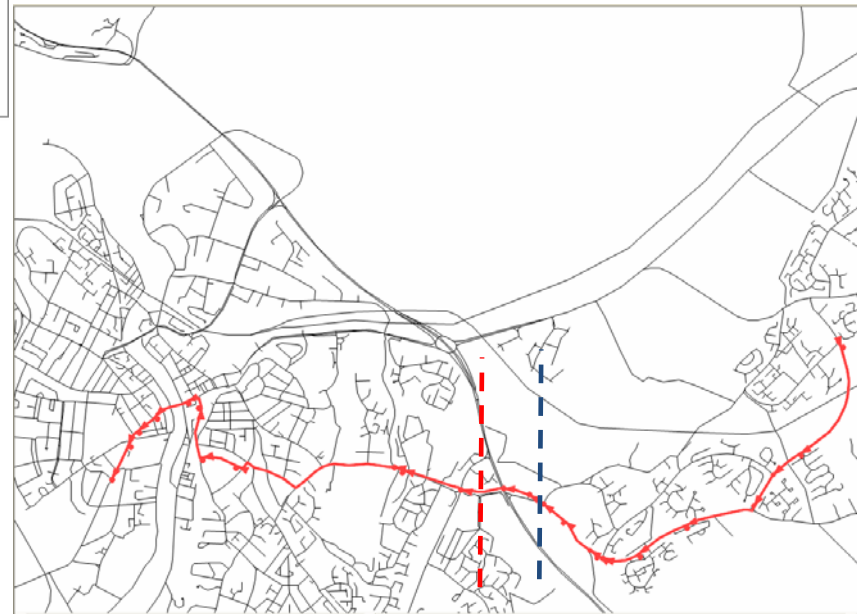
Smithton to Inverness Via Inshes



In 2016 there are marginal differences between the intervention and base times. The 3A scheme markedly improves the 2021 times whereas the 3B scheme shows only a slight improvement.

From Smithton to Inverness Via Inshes

PM PEAK



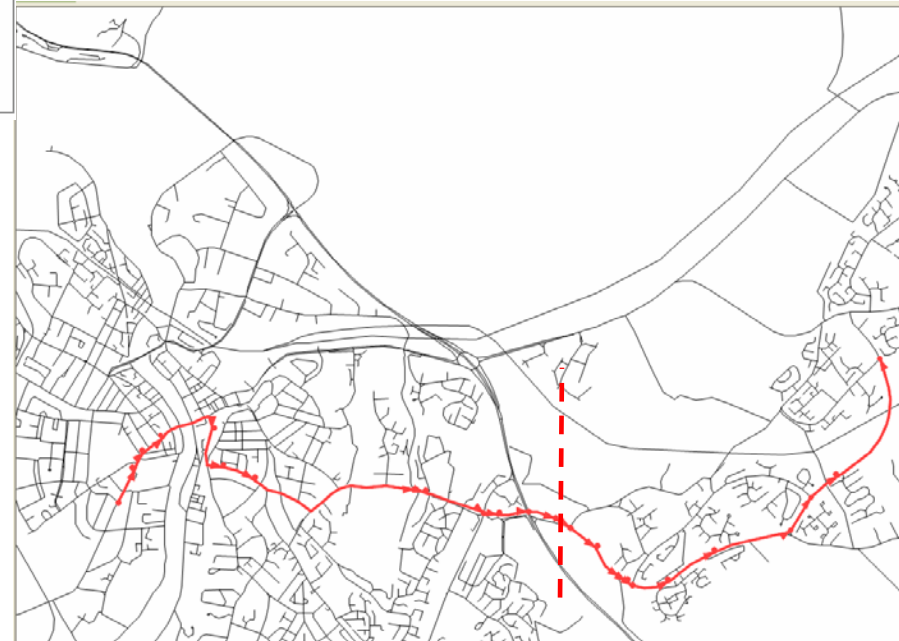
Journey Times Performance Summary



The interventions improve the journey time in both 2016 and 2021 schemes. The improvement to the operation of the Inshes junction leads to reduced journey times in each scenario.

From Inverness to Smithton Via Inshes

PM PEAK



Journey Times Performance Summary

PM PEAK Summary

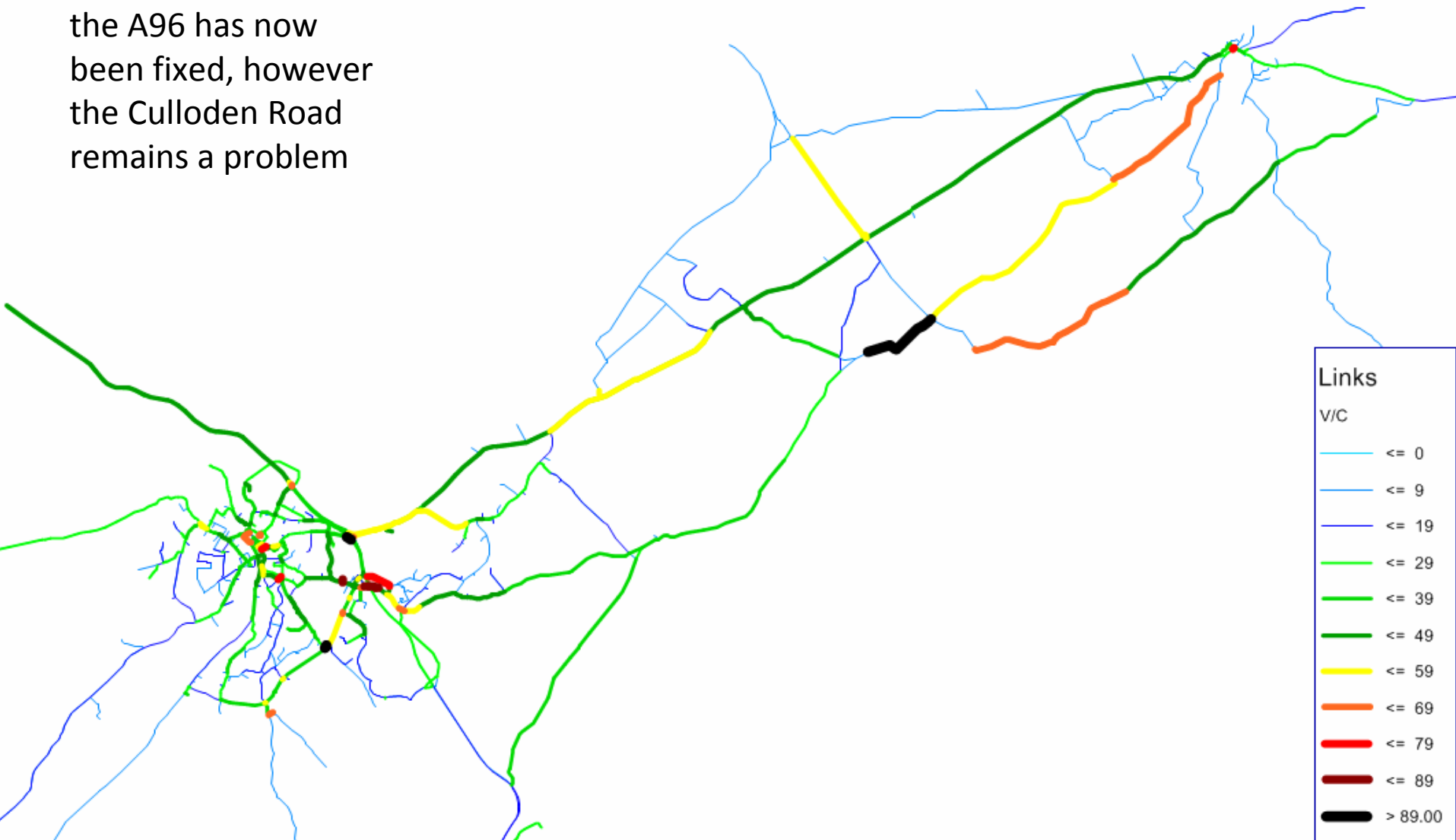
Journey Route	2016	2021 incl 3B	2021 incl 3A
From Nairn to Inverness Via Raigmore	✓	✓	✓
From Inverness to Nairn Via Raigmore	✗	✓	✓
From Inverness Retail Park to Kenneth Street Via Longman	✓	✗	✗
From Kenneth Street to Inverness Retail Park Via Longman	✗	✓	✓
From Smithton to Inverness Via Raigmore	✓	✓	✓
From Inverness to Smithton Via Raigmore	✗	✓	✓
From Smithton to Inverness Via Inshes	✓	✓	✗
From Inverness to Smithton Via Inshes	✓	✓	✓

AM Peak

Link Volume over Actual Capacity

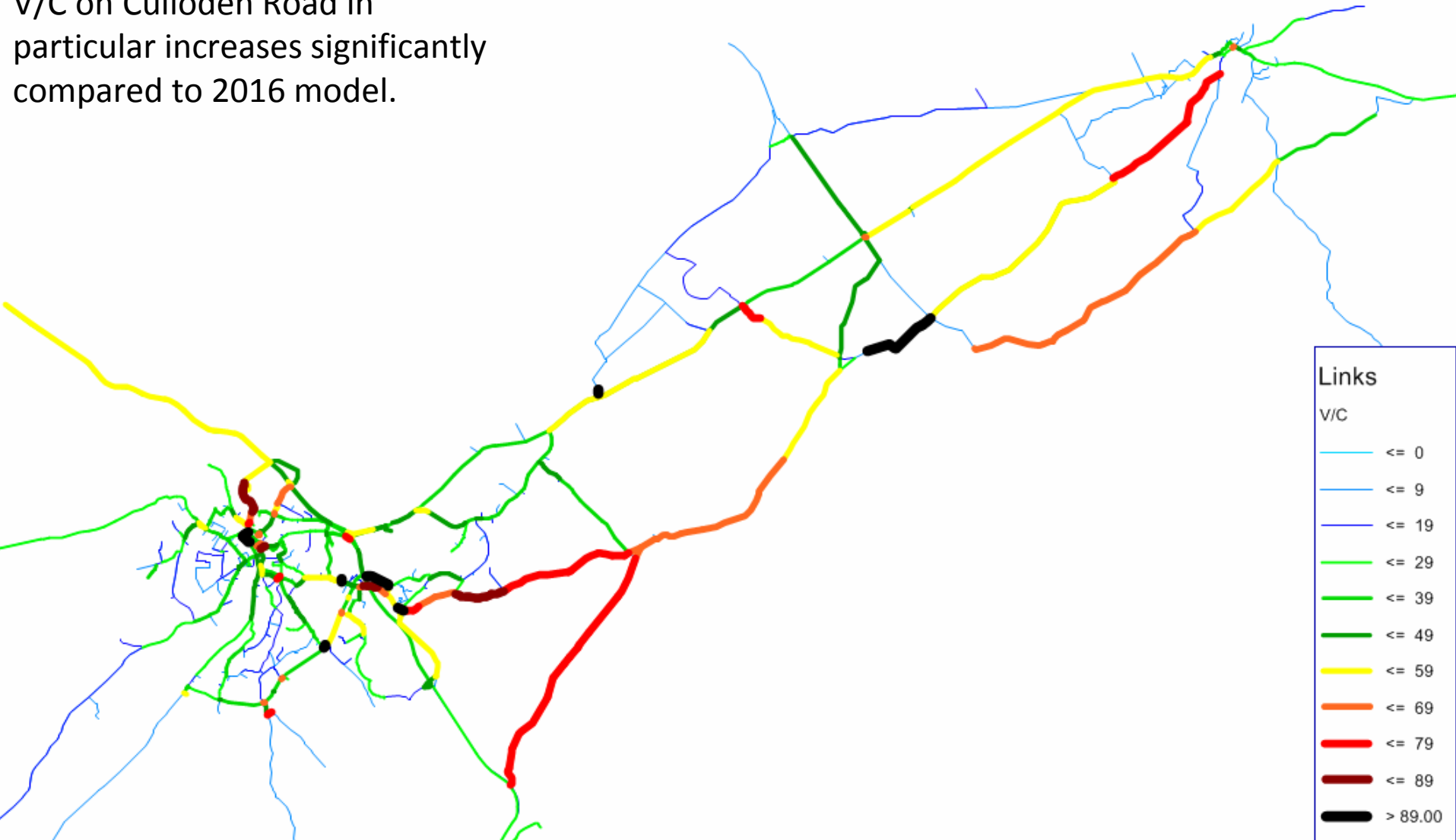
AM 2016 with Interventions

The capacity issue on the A96 has now been fixed, however the Culloden Road remains a problem



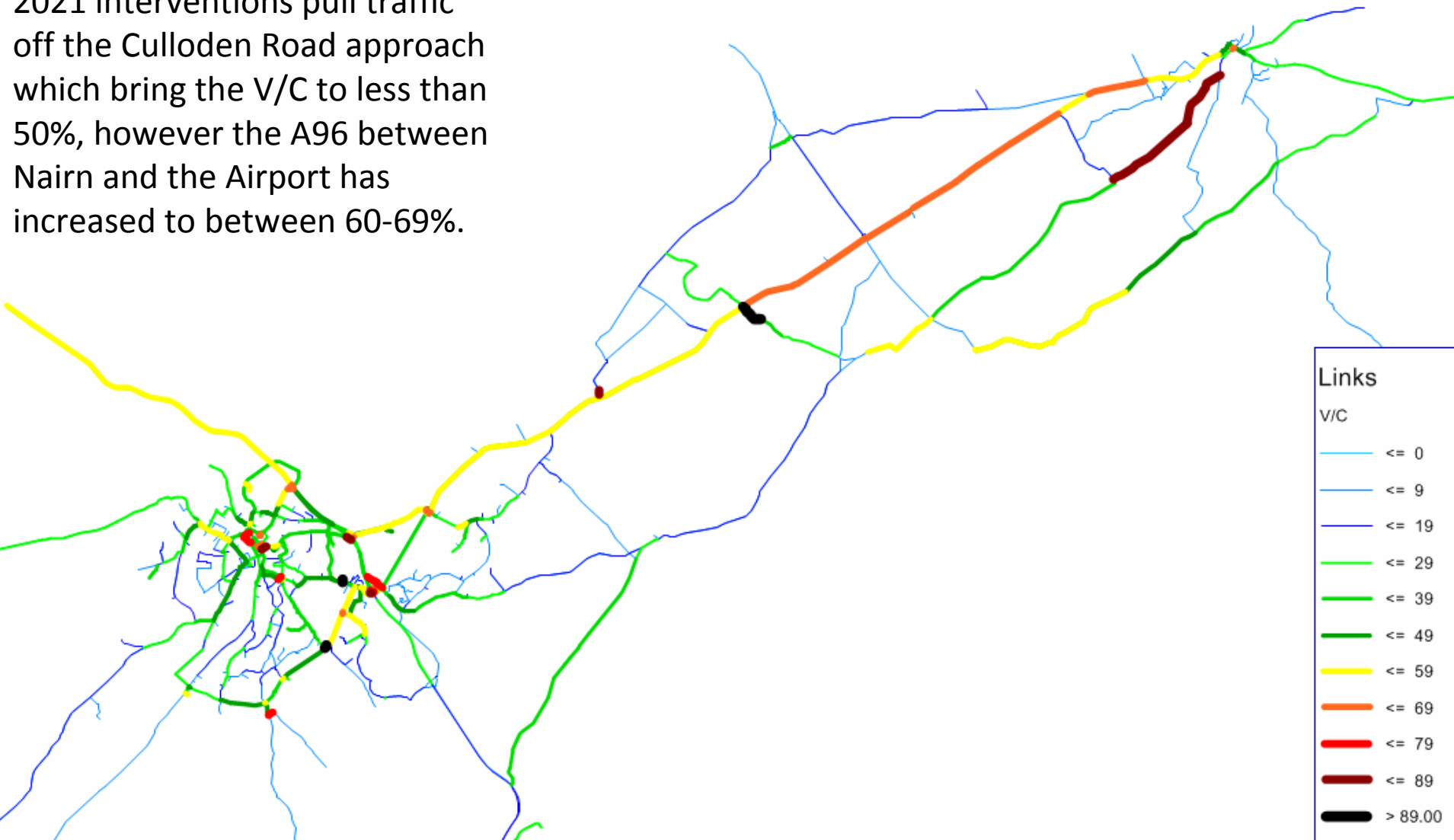
AM 2021 with 2016 Interventions

V/C on Culloden Road in particular increases significantly compared to 2016 model.



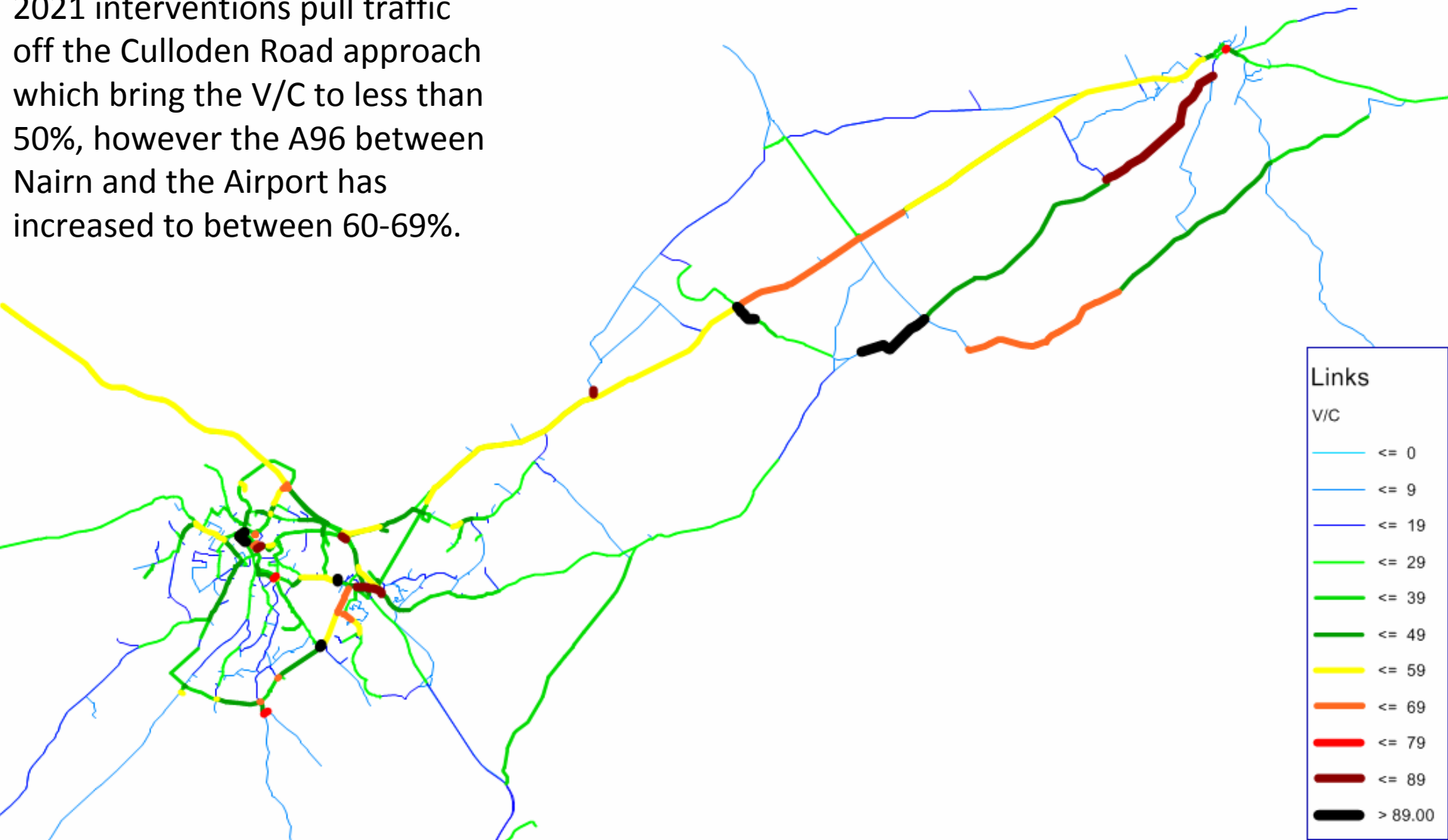
AM 2021 with Nos. 1, 2 & 3A Interventions

2021 interventions pull traffic off the Culloden Road approach which bring the V/C to less than 50%, however the A96 between Nairn and the Airport has increased to between 60-69%.



AM 2021 with Nos. 1, 2 & 3B Interventions

2021 interventions pull traffic off the Culloden Road approach which bring the V/C to less than 50%, however the A96 between Nairn and the Airport has increased to between 60-69%.

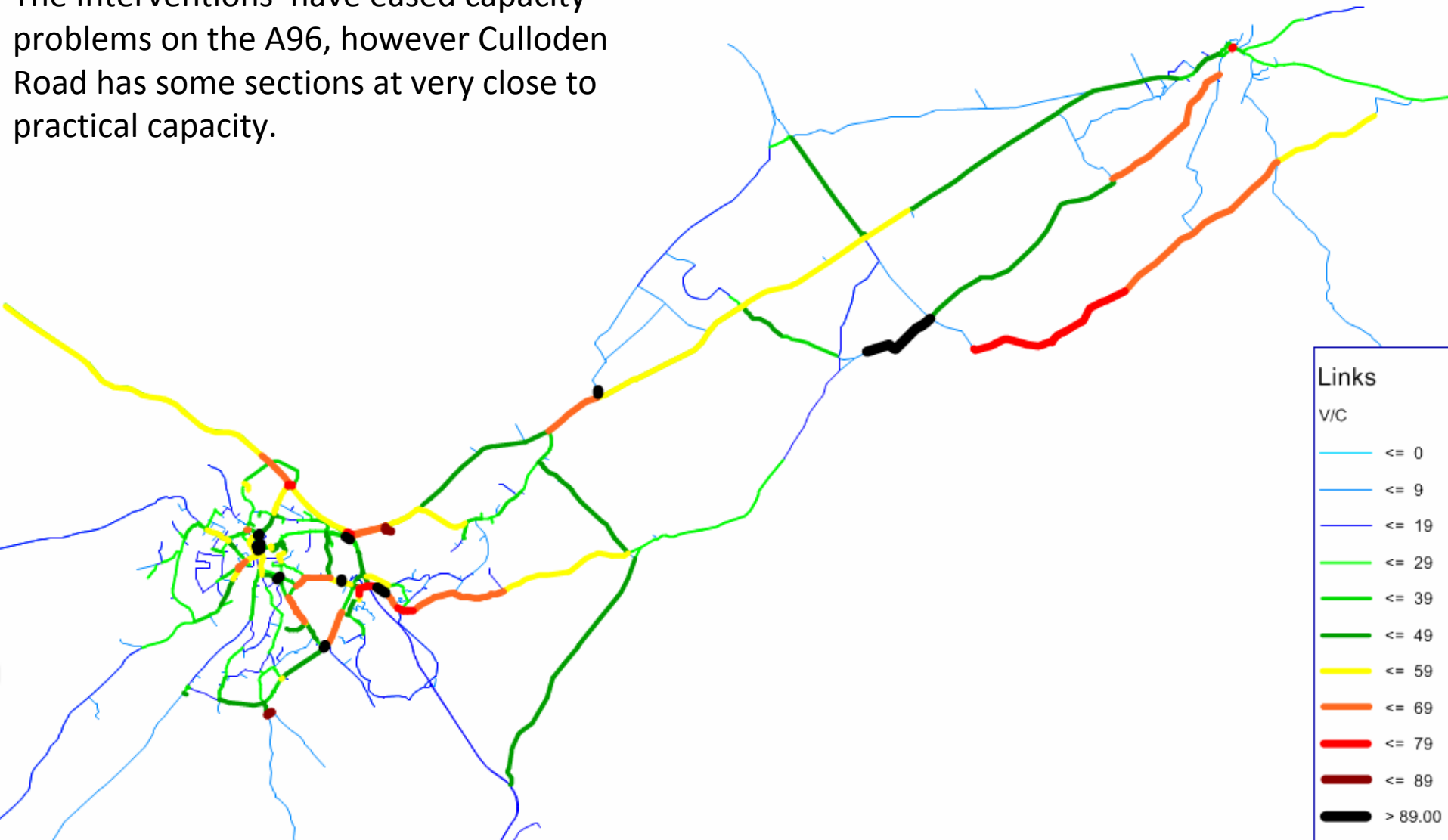


PM Peak

Link Volume over Actual Capacity

PM 2016 with Interventions

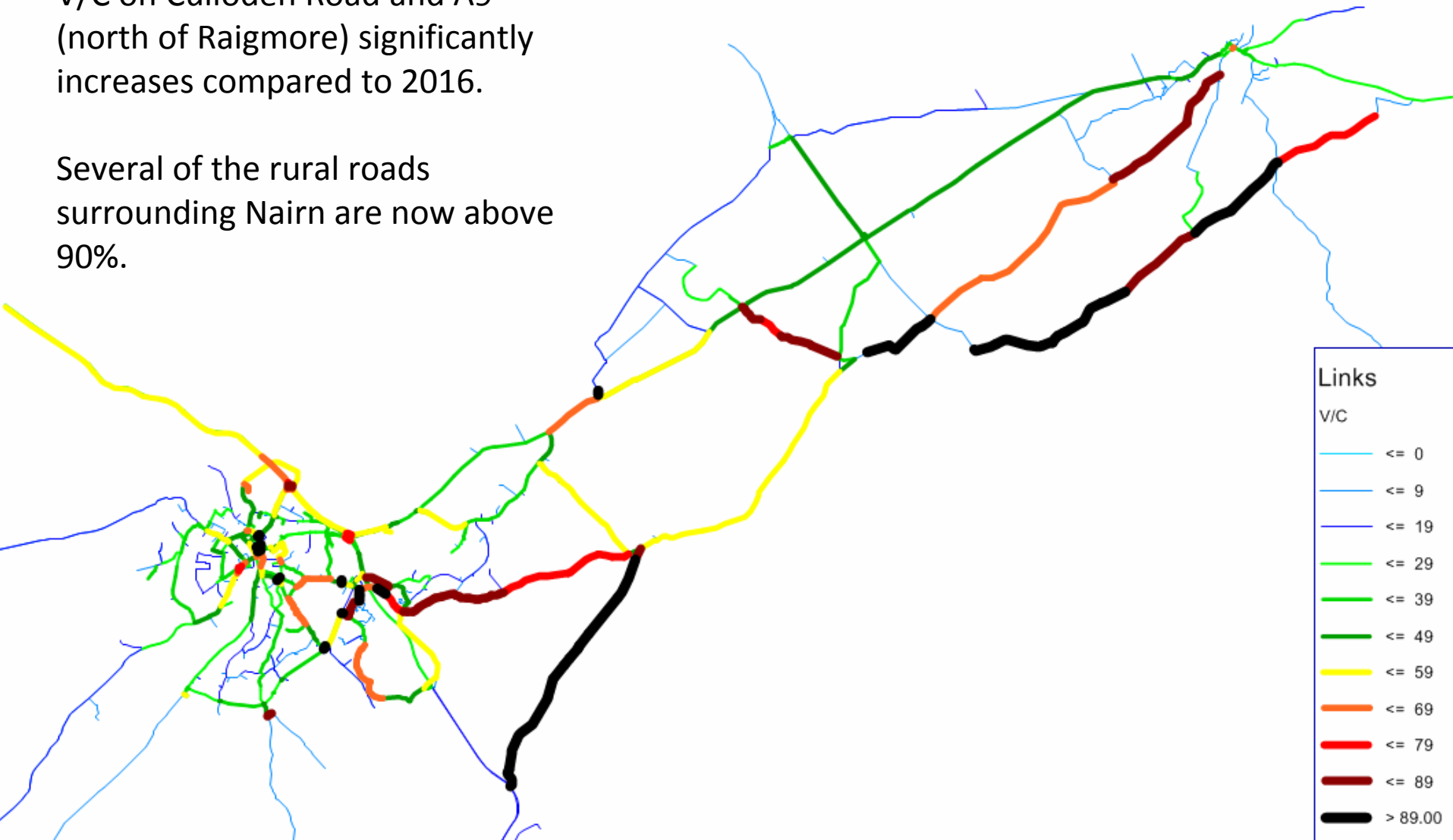
The Interventions have eased capacity problems on the A96, however Culloden Road has some sections at very close to practical capacity.



PM 2021 with 2016 Interventions

V/C on Culloden Road and A9 (north of Raigmore) significantly increases compared to 2016.

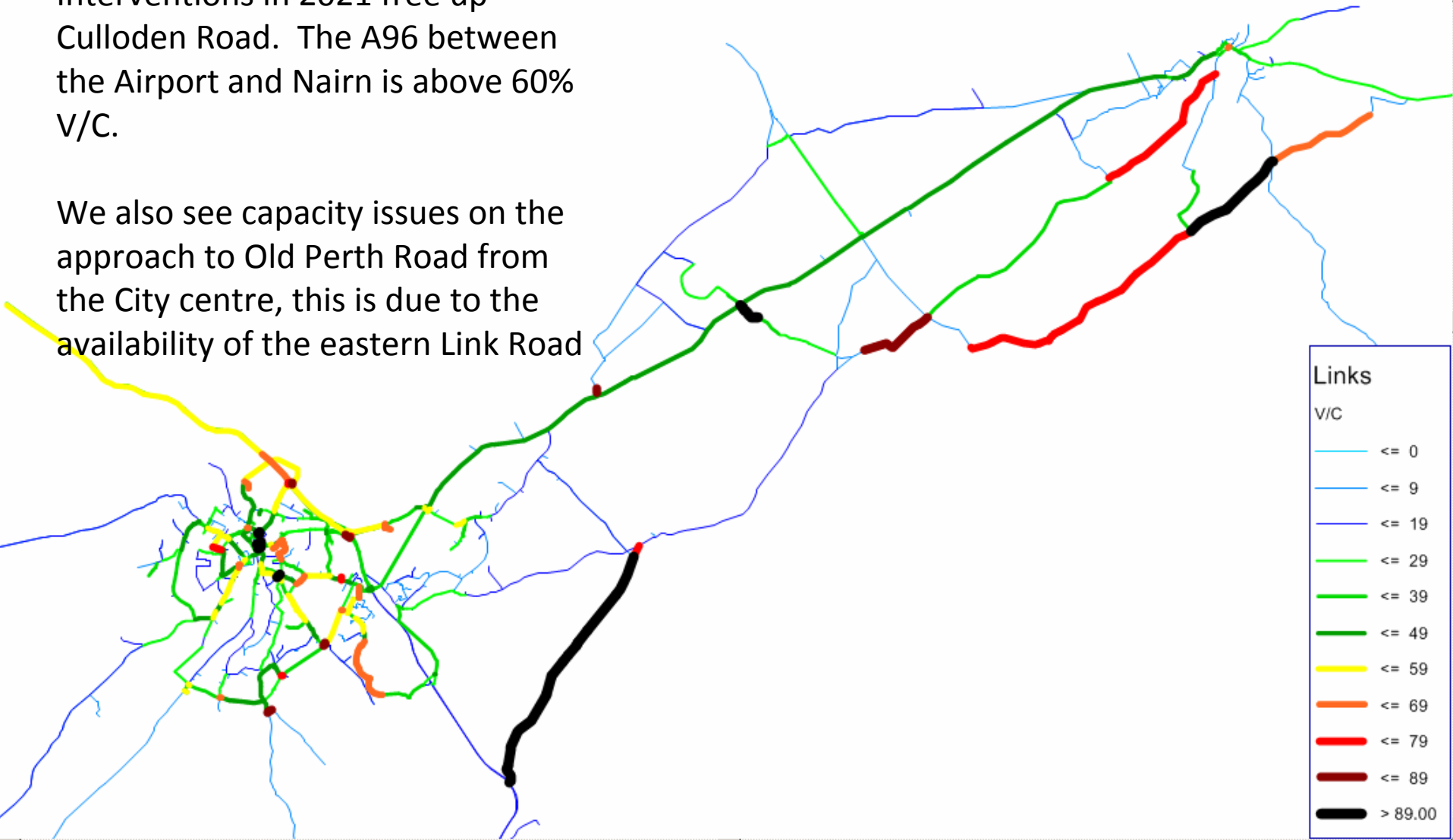
Several of the rural roads surrounding Nairn are now above 90%.



PM 2021 with Nos. 1, 2 & 3A Interventions

Interventions in 2021 free up Culloden Road. The A96 between the Airport and Nairn is above 60% V/C.

We also see capacity issues on the approach to Old Perth Road from the City centre, this is due to the availability of the eastern Link Road



PM 2021 with Nos. 1, 2 & 3B Interventions

Interventions in 2021 free up Culloden Road. The A96 between the Airport and Nairn is above 60% V/C.

We also see capacity issues on the approach to Old Perth Road from the City centre, this is due to the availability of the eastern Link Road

