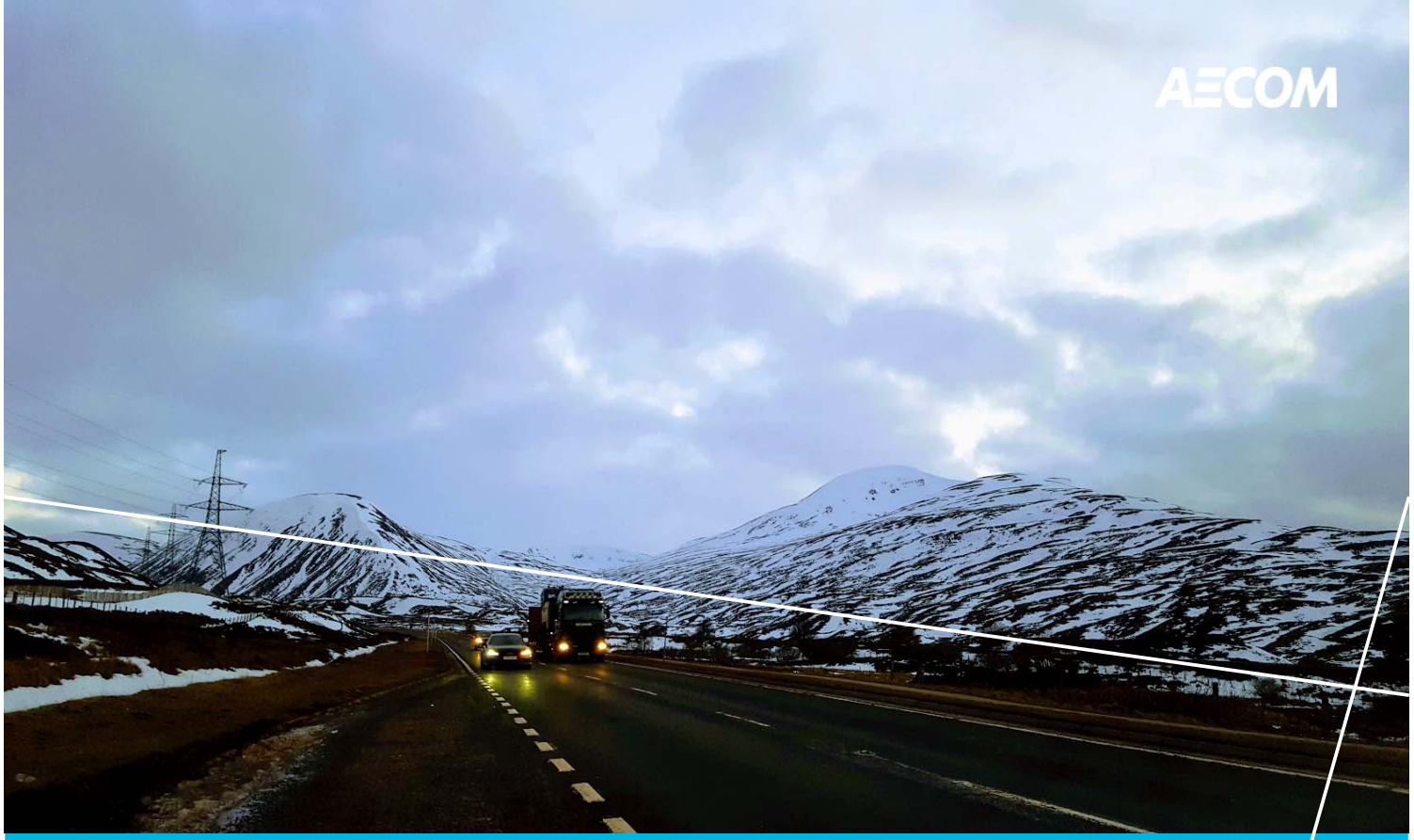

A9 HGV 50mph Speed Limit Pilot - Evaluation

Final Report

Project Reference: 60541545

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Quality information

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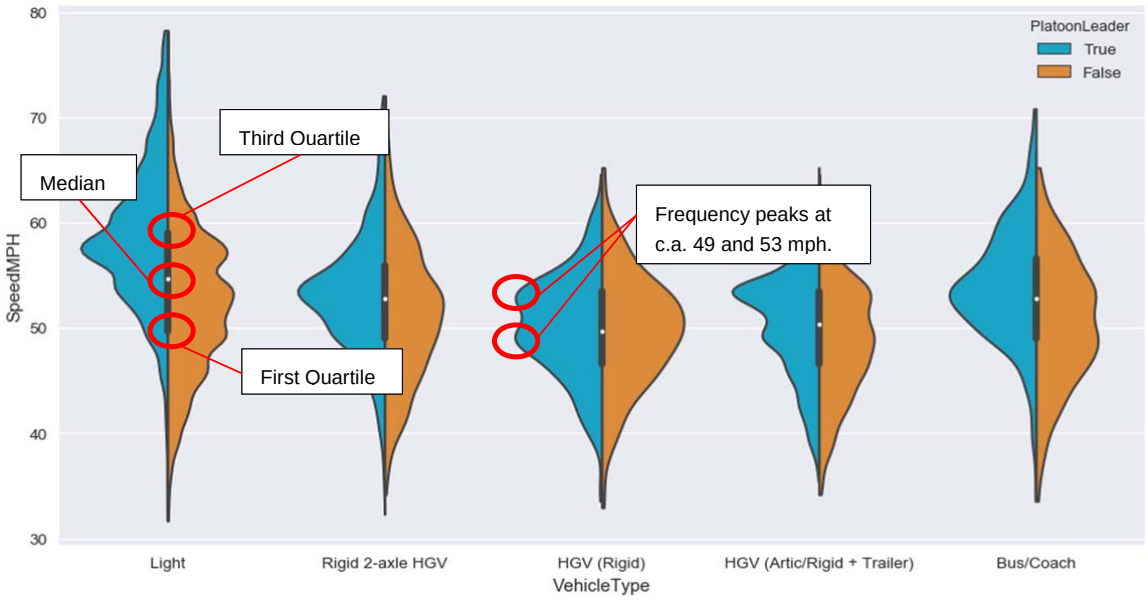
Glossary

Annual Average Daily Traffic (AADT)	This is an average measure of traffic flow for a given road or link. It represents the average amount of traffic using the road in a twenty four hour period.
Automatic Traffic Counter (ATC)	A device mounted within or on the carriageway to record information about the number of vehicles passing across it in a specific time period and often additional information such as vehicle classification and vehicle speed.
Ex-ante	Meaning 'before the event', this refers to the datasets or evaluation work from the period prior to the intervention which is being evaluated.
Ex-post	Meaning 'after the event', this refers to the datasets or evaluation work after the intervention being evaluated.
Heavy Goods Vehicle (HGV)	Any goods vehicle with a gross mass of over 3.5 tonnes. Within this report distinction is often made between those vehicles with a mass between 3.5 and 7.5 tonnes, and those over 7.5 tonnes to which the increased speed limit applies.
Impact Evaluation	The assessment of benefits/disbenefits of policy through the analysis of outturn indicators and metrics, including comparison with ex-ante forecasting.
Personal Injury Accident	Involves personal injury occurring on the public highway (including footways) in which at least one road vehicle or a vehicle in collision with a pedestrian is involved and which becomes known to the police within 30 days of its occurrence. One accident may give rise to several casualties.
Platoon	Defined as two or more vehicles travelling within 5 seconds headway of another.
STATS 19 Data	Road accidents on the public highway in Great Britain, reported to the police and which involve human injury or death, are recorded by police officers onto a STATS19 report form. The form collects a wide variety of information about the accident (such as time, date, location, road conditions) together with the vehicles and casualties involved and contributory factors to the accident (as interpreted by the police). The form is completed at either the scene of the accident, or when the accident is reported to the police.
Theory of Change	A theory-based evaluation approach that sets out the anticipated outcomes and impacts of a project or policy, and defines the causal pathways that will generate such change.
Vehicle by Vehicle (VbV)	Individual vehicle records outputs from Automatic Traffic Count sites, providing data information on a range of data including timestamp, direction of travel, vehicle classification and vehicle speeds for each vehicle passing the detector.
Violin Plot	A tool for displaying the distribution of numerical data, similar to a graph. Illustrated example below.

Violin Plots explained

Sections 5.2.2 and 6.3.4 use violin plots to aid the visualisation of speed distributions.This section provides some notes to aid the interpretation of these plots. An example is provided in the figure below.



A violin plot is a tool for displaying the distribution of numerical data. The inner section along the centre line of each plot provides the median and interquartile range as highlighted above. Each side of the violin plots represents a rotated kernel density plot showing the full frequency distribution of the data. In the above example the speed frequency distribution for platoon leaders is shown in blue to the left, and the frequency distribution of other vehicles in brown on the right.

Key Findings

Introduction

AECOM was commissioned by Transport Scotland in 2017 to carry out an ex-post evaluation of the three year pilot project to increase the speed limit for Heavy Goods Vehicles (HGVs) over 7.5 tonnes on single carriageway sections of the A9. From October 2014, the speed limit for HGVs over 7.5 tonnes was raised from 40mph to 50mph on single carriageway sections between Perth and Inverness. The decision to implement this speed limit increase was taken due to the particular characteristics of that specific route and incorporated an Average Speed Camera enforcement system in order to help mitigate risks. The evaluation considered the combined impact of the speed limit change and the Average Speed Cameras.

The evaluation approach

Ex-post evaluations seek to assess whether an intervention(s) achieved its objectives and to identify lessons to support future scheme designs. The scope of this evaluation, as set out in the client brief, was:

- To review the effectiveness of the A9 HGV speed limit pilot (over a period of November 2014 to October 2017) in respect to its specific objective of reducing driver frustration and casualties within the area of operation; and
- To consider the impact against the wider HGV collision and casualty performance across the trunk road network.

A theory-based approach was employed in this evaluation, including the use of Theory of Change techniques. A logic map was prepared that identified the key forecast/assumed changes that would occur over time as a result of the intervention. The evaluation explored evidence through which to assess the main causal pathways between the intervention and observed outcomes. Evidence included quantitative data, such as traffic counts, as well as qualitative research with route users and stakeholders. It should be noted that sample sizes for the qualitative research were relatively low, and the approach was not designed to generate quantitative data. Furthermore, the sample sizes for some quantitative indicators were also small, and such limitations were identified in the evaluation.

The study used a defined baseline period of 2011-2013 (complete years) for comparison against an ex-post evaluation period of November 2014-October 2017 (three full years).

The evaluation also considered contextual changes across the two periods, including the reduction in traffic flows nationally and on the route during the baseline period due to the economic recession, followed by growth in the ex-post evaluation period. The number of HGVs on the route followed a similar pattern of change, resulting in the proportion overall traffic classified as HGVs remaining relatively stable throughout the baseline and ex-post evaluation periods (between 11 and 12% of flow).

Key findings

Awareness of the pilot project was high amongst the haulier industry before it was implemented, with signs on the route and industry publicity being the main sources of information. There was also a high level of awareness amongst the general public interviewed as part of the evaluation. However, some car drivers indicated that there was some confusion over the applicable speed limit on different sections of the A9 route, particularly where the road type changes from single, to dual and back.

The baseline traffic speed data indicated that the average speed for HGVs over 7.5 tones (50.6mph) on single carriageway sections was 10mph above the 40mph speed limit. The introduction of the speed limit change and Average Speed Camera enforcement resulted in a minor change in average speeds for HGVs on single carriageway sections; the figure for 2015 was 50.0mph and for 2017 was 50.8mph. Furthermore, HGVs over 7.5 tonnes recorded a reduction in the distribution of speeds on single carriageway sections; the recorded top speeds reduced, which will have been influenced by the improved enforcement, and the lowest recorded speeds increased as a consequence of compliant drivers increasing their speed because of the speed limit change.

The average speed for light vehicles on single carriageway sections reduced from a baseline of 57.3mph to 53.4mph in 2017, and the distribution of speeds also reduced for light vehicles; the reduced top speeds were again due to the improved enforcement and increased lower speeds due to the reduced occurrence of slower moving HGVs. The average speed differential between HGVs over 7.5 tonnes and light vehicles therefore also decreased on single carriageway sections, from 6.7mph in 2013 to 2.7mph in 2017. The reduced speed

differential between HGVs and other traffic addressed one of the main causes of driver frustration reported in the baseline period, that of being stuck behind a slower moving HGV. However, the average journey times increased on the route for all vehicles as a consequence of the reduced speeds.

Traffic data indicated that HGV-led platoons were occurring at disproportionately high levels in the baseline period, with 25.6% of platoons being led by HGVs when they represented around 12% of vehicle flow. This decreased marginally to 22.8% in 2017. However, the proportion of slow-moving platoons (under 50mph) led by HGVs over 7.5 tonnes reduced from 44.3% in the baseline period to 35.5% in the ex-post period.

Within this context of changes in average speeds and the prevalence of HGV (over 7.5 tonnes)-led slow moving platoons, the evaluation considered the level of overtaking and road traffic accidents involving an overtaking manoeuvre. Surveys of overtaking on single carriageway sections indicated that fewer overtaking manoeuvres were taking place in the ex-post period; however, this dataset consisted of a small sample and should therefore be treated with caution.

Analysis of STATS19 data suggested that the changes in overtaking behaviour translated into safety improvements, resulting in a reduction in collisions involving dangerous overtaking manoeuvres. The annual average number of collisions involving HGVs over 7.5 tonnes where overtaking occurred reduced from 7.7 in the baseline (2011-13) to 5.0 in the ex-post (2014-17), a 35% change. The annual average number of collisions involving other vehicle groups where overtaking occurred reduced from 24.7 in 2011-13 to 21.0 in 2014-17, a 15% change. On balance the data analysis bears out the expected reductions in risky overtaking behaviour; however, the small sample sizes should be noted.

In terms of the overall change in safety on the A9, the data showed a steady reduction in the number of collisions and casualties in the pre-implementation period. Collisions and casualty numbers involving HGVs over 7.5 tonnes continued to reduce in the ex-post period, suggesting that the HGV speed limit may have had a beneficial impact on safety performance. Across all vehicle types the A9 reported a 10 percentage point net decrease in the number of accidents between the baseline and 2016, when taking into account national trends in accidents; personal injury accidents reduced by 23% on the A9 and by 13% nationally.

Market research indicated that HGV drivers perceived a reduction in non-HGV driver frustration following the implementation of the pilot, and HGV drivers felt less stressed as a result. Non-HGV drivers also said they felt the route was a better route to drive now. Market research also indicated that all drivers perceived there to be less risk-taking driving behaviour since the interventions came into place.

The number of incidents and their average duration on the A9 reduced in the ex-post evaluation period, compared to the baseline. However, attributing this observed change solely to the speed limit pilot and Average Speed Cameras was not considered robust due to reductions already occurring towards the end of the baseline period.

No data was available to demonstrate wider or operational impacts on hauliers, though anecdotally, hauliers are very supportive of the speed limit increase as they felt it had led to instances of journey time improvements. However, these were not sufficient to result in any operational or scheduling changes as yet. Hauliers also indicated that the pilot had assisted in improving the fuel efficiency of trips.

1. Introduction

1.1 The Evaluation

AECOM was commissioned by Transport Scotland in 2017 to carry out an ex-post evaluation of the three year pilot project to increase speed limits for HGVs over 7.5tonnes on single carriageway sections of the A9, from 40mph to 50mph (referred to as the A9 pilot).

Ex-post evaluations seek to learn from a scheme that has already been implemented, and to assess whether the intervention(s) achieved its objectives. The scope of this evaluation project as set out in the client brief was:

- To review the effectiveness of the A9 HGV speed limit pilot (October 2014 – October 2017) in respect to its specific objective of reducing driver frustration and casualties within the area of operation; and
- To consider the impact against the wider HGV collision and casualty performance across the trunk road network.

1.2 The Scheme Under Evaluation

The 2012 Scotland Act gave Scottish Ministers the power to determine the level of the national speed limits on dual carriageways and motorways (currently 70 mph) and single carriageway roads (currently 60 mph), The Act also gave powers to determine associated vehicle speed limits in Scotland e.g. HGV speed limits of 40 mph on single carriageways and 50 mph on dual carriageways. The 2016 Scotland Act devolved all remaining powers to amend speed limits to the Scottish Parliament, including the national urban speed limit of 30 mph.

The powers that have been devolved were utilised, with effect from October 2014, to allow the maximum speed limit for HGVs over 7.5 tonnes to be raised from 40 mph to 50 mph on single carriageway sections of the A9 between Perth and Inverness. The A9 is the longest trunk road in Scotland, providing a link between Central Scotland and Inverness/Northern Scotland. The road is 110 miles in length, of which 30 miles is currently dualled[1]. The yellow links in Figure 1-1 are dual carriageways, where the national speed limit is 70mph and the HGV speed limit is 50mph, and the blue links are single carriageways where the HGV speed limit was changed.

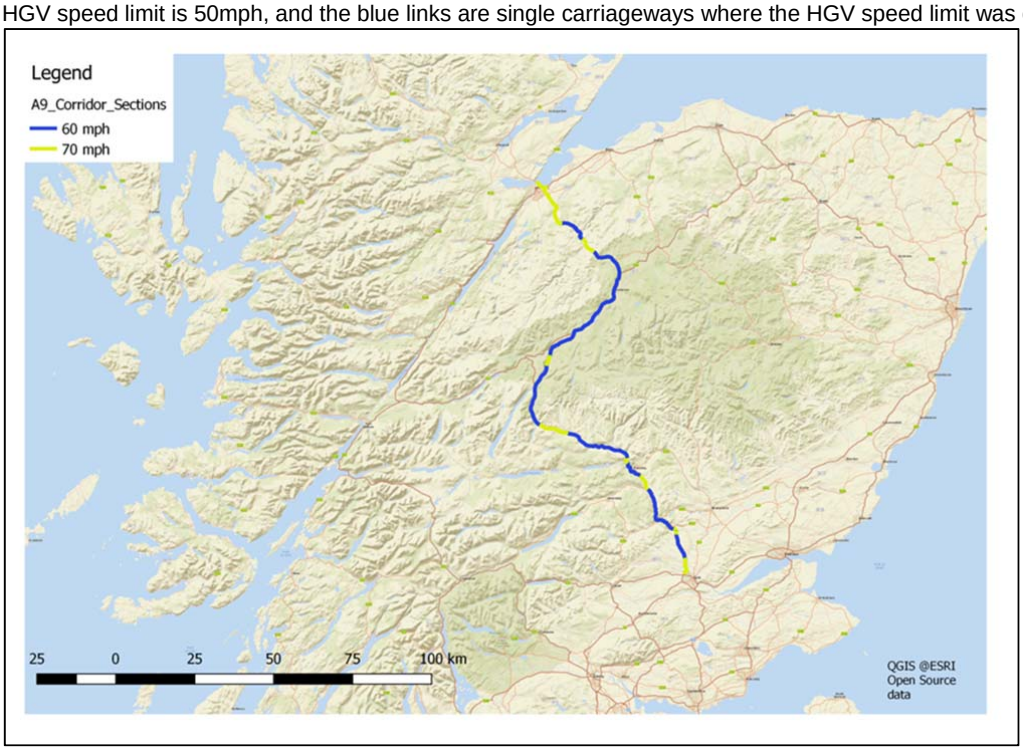


Figure 1-1: Map of A9 sections by speed limit (2017)

[1] 2017

The decision to implement this speed limit increase was taken due to the particular considerations applicable to that specific route and incorporated an Average Speed Camera enforcement system in order to mitigate risks. The original aim of the A9 pilot was "to reduce frustration on the route caused by HGV convoys travelling at the lower speed which encouraged poor driver behaviour"[2]. This was a reflection of the fact that HGV's were over represented in terms of being contributory factors in both collision and casualty statistics on the A9 compared to the trunk road nationally.

The A9 is the longest stretch of road monitored by Average Speed Cameras (ASCs) in the United Kingdom. These have been operational since October 2014 and form part of a three year pilot. There are a total of 27 ASCs located on the A9 between Perth and Inverness monitoring single carriageway sections. The Key Performance Indicators (KPIs) for the A9 ASC element of the scheme are as follows:

- Casualty reduction;
- Casualty severity reduction;
- Reduction in excessive speed/increased compliance;
- Reduced incidents of road closure; and
- Journey time reliability.

As the pilot 50mph speed limit for HGVs on the A9 was introduced at the same time as the ASC system, the ex-post evaluation had to consider the impacts of both changes. Moreover, the evaluation did not attempt to separate the impacts of these scheme elements. The evaluation of the A9 pilot has also been cognisant of the ongoing monitoring of the impacts of the ASC system by Transport Scotland and the A9 Safety Group[3].

1.3 Evaluation Approach

A theory-based approach to evaluation has been employed in this research, including the use of Theory of Change techniques. A logic map identifying key forecast changes over time as a result of the intervention has been prepared, and the evaluation has sought to explore evidence for each of these logical changes and outcomes. The approach to the evaluation involved the following tasks:

- Scoping the key evaluation questions to be addressed through the commission, applying a theory-based approach;
- Clarifying the precise baseline and the ex-post periods to be adopted, based on the availability of various datasets and reflecting the proposed programme of the A9 pilot;
- Interrogating comparable data for defined indicators for the baseline and ex-post period, and assessing for single carriageway and dual carriageway sections; and
- Market research with users of the route and engagement with the A9 Safety Group to understand perceived impacts of the scheme, and awareness of it. The qualitative market research for this study in 2017 gathered the views of user groups as follows:
    - Mini-focus groups and face to face depth interviews with HGV drivers; and
    - Focus group with non-HGV drivers.

The two mini-focus groups were undertaken with HGV drivers at a central location in Perth and a series of face to face depth interviews were undertaken with HGV drivers at Ballinluig Truck Stop on the A9 between Perth and Inverness. In total, 16 truck drivers participated across the two locations. A further focus group of six respondents was undertaken with non-HGV drivers who use part of or all of the A9 between Inverness and Perth to:

- Establish levels of awareness of the speed limit changes on the A9;
- Establish awareness of and the impact of the average speed cameras on the A9; and
- Understand the impact of the continued program of dualling of the A9.

It should be stressed that the qualitative research with drivers does not claim to be representative of the driver population, and constitutes a small sample of individuals. Instead, it provided an opportunity for deeper insight into how individuals think and act, and tested specific issues around perception and awareness of the interventions in question.

[2] Transport Scotland Brief for this research, 2017
[3] http://a9road.info/

In addition, four telephone interviews were carried out with hauliers who operate on the A9. This was a self-selecting sample as hauliers responded to a call for research participants issued by the Road Haulage Association on behalf of AECOM. Finally, a discussion group was held with members of the A9 Safety Group in January 2018 to obtain their views on the outcomes of the pilot.

1.4 Structure of the Report

This report presents the findings of the evaluation, and contains the following main sections:

- Section 2: Defining the evaluation;
- Section 3: Awareness and acceptance of the scheme;
- Section 4: Data Analysis - Approach and Context;
- Section 5: Outcomes – Speed;
- Section 6: Outcomes – Traffic flow characteristics and driver behaviour;
- Section 7: Outcomes – Road safety;
- Section 8: Outcomes – Wider impacts; and
- Section 9: Synthesis of evidence.

[4]

[4] Photo credit AECOM

2. Defining the Evaluation

2.1 Introduction

In this section, the scope of the evaluation is presented in terms of:

- Defining the overarching evaluation approach, including:
  - Logic mapping
  - Evaluation questions;
  - Consideration of comparator routes;
- Definition of baseline and ex-post periods; and
- Definition of A9 treatment points i.e. the physical sections and programme elements subject to evaluation.

2.2 Evaluation Approach

A combined evaluation approach has been adopted for the A9 pilot, to maximise the ability to detect changes in key metrics, and subsequently determine the contribution of the A9 pilot to such changes. A Theory of Change approach has been adopted, including the use of causal pathway analysis, logic mapping and contribution analysis. This has been supplemented by the consideration of comparator datasets, both at the national level and also at an individual route level.

2.2.1 Logic Mapping

To inform the generation of robust evaluation questions and to guide the evaluation, a logic map was prepared of the A9 pilot. This was prepared in 2017 so retrospectively to the A9 pilot. Applying logic mapping was a useful way of establishing when anticipated outcomes were forecast to be realised over time, which then informed the data analysis activities i.e. some outcomes may be instant whilst others require complex behaviour changes. Undertaking this temporal element of the causal pathways within the logic map assisted the analysis attribute observed outcomes to the A9 pilot. This approach also assisted in taking account of longer term impacts where the A9 pilot may make a contribution. Logic mapping has also been used to highlight any unintended consequences of project or programme.

Figure 2-1 presents the logic map for the A9 pilot, including where the two headline objectives were anticipated to be achieved; shown as blue numbered boxes. The logic map also shows:

- The key contextual factors that have been considered throughout the evaluation;
- The key characteristics of the A9 pilot route which may influence the analysis and interpretation of the data;
- The outcomes and impacts that were anticipated; and
- The data sets considered necessary to determine the achievement of each outcome.

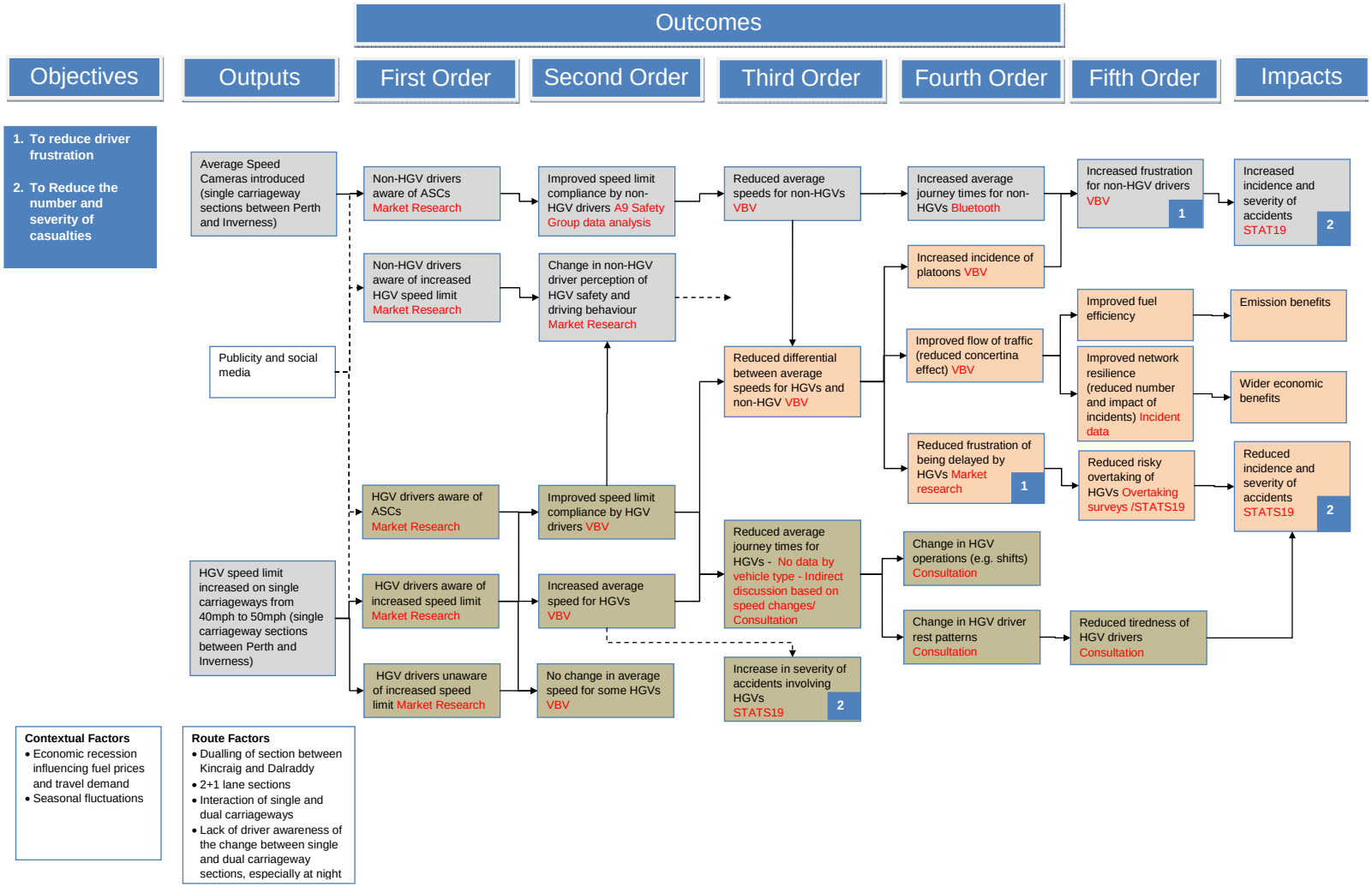


Figure 2-1 A9 HGV Speed Limit Pilot – Evaluation Logic Map (Source: AECOM)

2.2.2 Evaluation Questions

From this logic mapping process, the key evaluation questions that were explored in the evaluation were defined as:

1. What is the level of awareness of the speed limit change among HGV and non-HGV drivers?
2. What is the level of awareness of the ASC among HGV and non-HGV drivers?
3. How has the perception of HGVs, in terms of safety issues, changed among non-HGV drivers/road users?
4. How has the level of speed limit compliance changed for HGVs and non-HGVs:
    a. On single carriageway sections?
    b. On dual carriageway sections?
5. How has the average speed of HGVs and non-HGVs changed:
    a. On single carriageway sections?
    b. On dual carriageway sections?
6. How has the speed difference between HGVs and non-HGVs changed:
    a. On single carriageway sections?
    b. On dual carriageway sections?
7. How have average end-to-end journey times changed for HGV and non-HGVs:
    a. On single carriageway sections?
    b. On dual carriageway sections?
8. How has the operational characteristics of the route changed in terms of:
    a. Network resilience (incidents)?
    b. Platooning?
    c. Free flow conditions?
9. How have the levels of non-HGV driver frustration changed?
10. How has the level/occurrence of risky overtaking of HGVs changed:
    a. On single carriageway sections?
    b. On dual carriageway sections?
11. How has the incidence of road traffic accidents involving HGVs and not involving HGVs changed in terms of:
    a. Severity?
    b. Casualty numbers?
12. How has HGV fleet management procedures changed in terms of:
    a. Routing?
    b. Scheduling?
    c. Driver rest periods?
13. What are the longer term impacts of the pilot in terms of:
    a. Economic benefits?
    b. Environmental benefits?

2.2.3 Consideration of Comparator Routes

To provide a more robust analysis of the A9 pilot outcomes, consideration was given to the use of a comparator route. The route needed to be similar to the A9 during the baseline period in terms of its profile of vehicle use (e.g. similar volume of HGVs) and have a similar road casualty profile. The route also needed to remain relatively stable in terms of investment, so that any changes in its core metrics could be contributed to contextual factors i.e. the wider economy. The comparator route could therefore be used as an approximation of the counterfactual for the A9 i.e. the situation had the pilot not been implemented. The A75 in Dumfries and Galloway was identified as a suitable comparator route based on discussions with Transport Scotland. However, due to the unavailability of key data, including vehicle by vehicle data in the baseline period, it was concluded that no comparator route could be used. National data from trunk roads has been used wherever possible to assist in accounting for background trends.

2.3 Defining Baseline and Ex-post Periods

The Average Speed Camera system and the change to the HGV speed limit began concurrently on 28th October 2014[5]. As agreed at the client inception meeting for this work, the pre-scheme baseline period against which change has been assessed is 2011-2013 (January – December i.e. complete years)[6]. The remainder of 2014 (pre-scheme) does not form part of the baseline as the A9 was subject to disruption during initial construction activities linked to the installation of camera equipment and other works.

It was a stated intention to evaluate the A9 pilot once it had been in operation for three years i.e. as of the end October 2017. Normal practice in ex-post evaluations is to match the ex-post period to the baseline. However, at the evaluation inception meeting, the period to be subject to evaluation was suggested by Transport Scotland to be from November 2014 to October 2017 i.e. three full years. This was recommended because of the standard lag in road safety data becoming available and the increased delay that would be incurred whilst awaiting data up to December 2017.

The scoping activity considered various options for the ex-post period. This included the use of November and December 2014 as an initial post-implementation settling period for the A9 pilot. It is common place for there to be a short term period of adjustment following scheme or policy implementation, before behaviour starts to normalise again. It was anticipated that outcomes such as average speeds and speed limit compliance would have changed significantly during this time as drivers adjusted to the new policy.

Figure 2-2 [7], showing speed limit compliance for all vehicles, suggests a large reduction initially in speeds in excess of 60mph before more consistent pattern starts in January 2015. Although this change is integral to the evaluation, the inclusion of the anticipated large initial change within annual averages may not represent an accurate picture of the normal operation of the A9 within the pilot period.

An alternative approach would have been to adopt January 2015 to December 2017 (i.e. three full years following implementation), matching precisely with the 2011 to 2013 baseline period. However, as noted above it was recognised that this approach would incur delay to the evaluation. It was therefore agreed with Transport Scotland to use the period November 2014 through to the end of October 2017 as the full three year ex-post evaluation period.

[5] http://a9road.info/safety-statistics/speed-limit-information/
[6] Client inception meeting held at Buchanan House on 3rd May 2017, attended by Transport Scotland and AECOM project team
[7] Taken from the March 2017 A9 Monitoring Report.

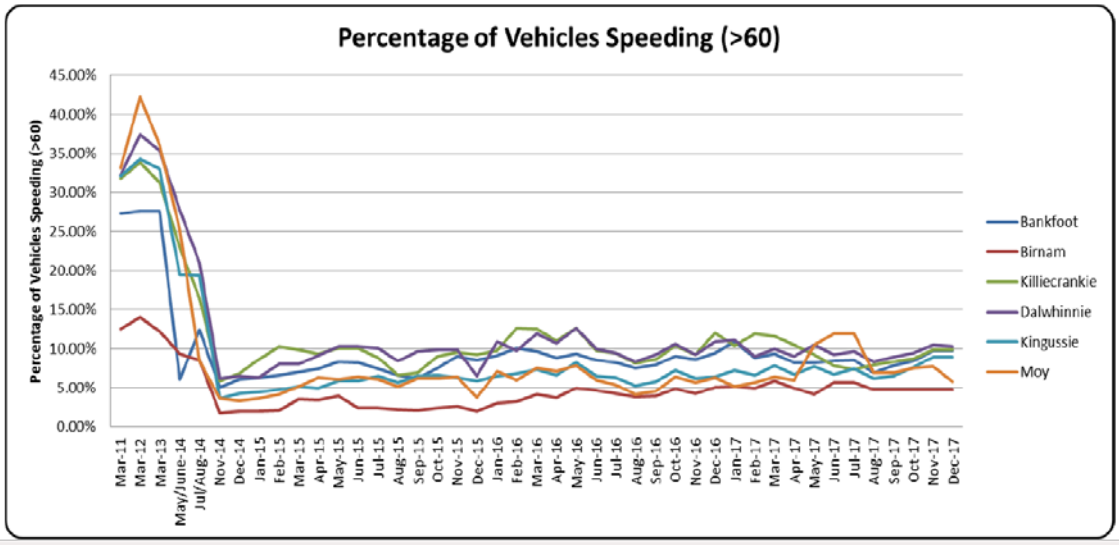


Figure 2-2 Percentage of Vehicles Speeding >60 mph (Source: A9 Safety Group)

2.4 Definition of A9 Treatment Points

As noted in the introduction, the A9 pilot was introduced on the single carriageway sections between Perth and Inverness, where the 40mph speed limit for HGVs (>7.5t) was increased to 50mph. The speed limit for non-HGVs and those below 7.5t was, and continues to be, 60mph. The ASCs were also introduced on single carriageway sections of the A9 between Perth and Inverness. At the evaluation inception meeting it was stated that the reporting of the evaluation should be at the A9 pilot level i.e. covering the full route from Perth to Inverness. However, it is also recommended by AECOM that the evaluation consider the change in key outcomes separately for single and dual carriageway sections. This would provide an additional level of understanding of the outcomes, and provide the best approach to identifying any unintended outcomes e.g. the re-location of accidents or different changes in speed profiles along the route. Single carriageway sections of the A9 (Perth to Inverness) which have a national speed limit of 60mph for non-HGVs (50mph for HGVs as of October 2014) are shown in blue in Figure 2-3. The national speed limit of 60mph (50mph for HGVs) also applies to dual carriageway overtaking sections (formally known as WS2+1s), and these sections tend to be uni-directional at various points on the A9. The yellow links in Figure 2-3 are dual carriageways, where the national speed limit is 70mph and the HGV speed limit is 50mph.

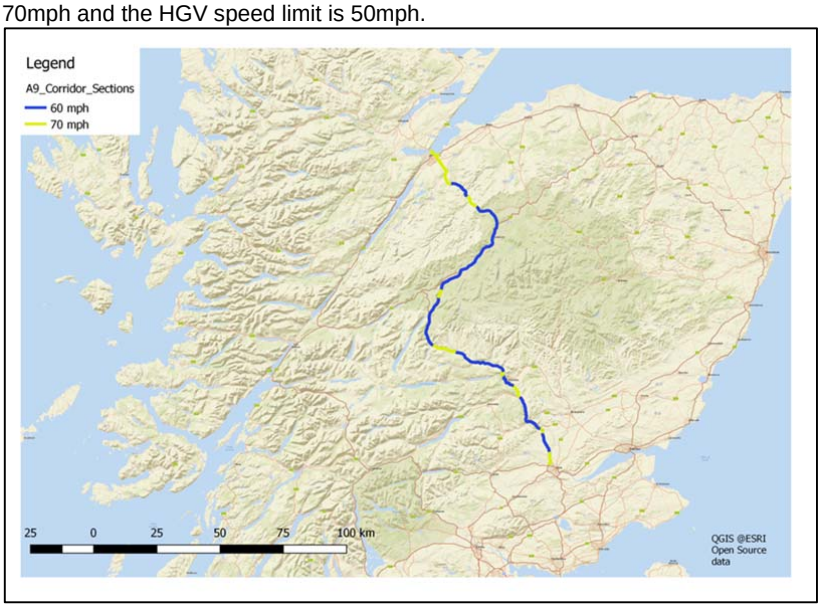


Figure 2-3 Map of A9 sections by speed limit (Source: AECOM A9 modelling, 2017 – note this map shows the A9 pre-Project 10, Kincraig to Dalraddy dualling)

3. Awareness and Acceptance of the Scheme

3.1 Introduction

This section of the report presents evidence on the awareness of the A9 pilot amongst road users, and stakeholders with a relevant role or responsibility. The logic map highlighted the first order outcomes relating to HGV driver and non-HGV driver awareness, which were assumed to be precursory factors to changes in driving behaviour such as speed and overtaking propensity. The evaluation questions addressed in this section are:

- Question 1: What is the level of awareness of the speed limit change among HGV and non-HGV drivers?
- Question 2: What is the level of awareness of the ASC among HGV and non-HGV drivers?

As set out in Section 1, market research was carried out for this project to gather evidence for a number of evaluation questions including those on awareness and perceptions of the scheme. The topic of awareness of the scheme prior to implementation, and then during, was raised in telephone interviews with hauliers, a focus group with non-HGV drivers and discussions with HGV drivers on-route. The research also considered awareness of other non-pilot interventions, such as national behaviour change programmes, which could have influenced the outcomes.

3.2 What was the level of awareness of the speed limit change among HGV and non-HGV drivers?

3.2.1 HGV Drivers

The majority of HGV drivers became aware of the speed limit change pilot before it become operational through simply talking to other drivers.

> "Everyone was talking about it. This was quite a big change in our world. It made the news too so everyone knew about it in advance of it starting"

In addition, some drivers also identified that they had read about it in trade magazines, either on their travels, when they were in the depots or calling in at the truck stops.

> "I remember reading about it in the trade magazines, I remember that. Car drivers were less aware I think"

A few of the drivers also said they had seen information about the speed change pilot on media channels, mainly local radio and television prior and during the beginning of the pilot.

> "It was all on the television and in the newspapers"

However, some HGV driver respondents did not think awareness of the changes were universal amongst non-HGV drivers.

> "Don't think the general public know it has changed. There are signs but I don't think they take notice of them"

> "Some of the older members of the public still sit on the road at 40 and that is frustrating for us as drivers because we can now go faster than that but they don't seem to realise it"

3.2.2 Non-HGV Drivers

Everyone who attended the focus group was aware that the scheme was underway where HGV drivers could now travel at 50mph instead of 40mph. It should again be noted that the focus group was not representative of the wider driving population. However, it provided an indication that the level of awareness was high among non-HGV drivers. This is important as it influences how drivers behaviour around HGVs and, for example, driver's tendency to overtake HGVs.

> "The national speed limit for Lorries is 40 but for the A9 they have made it 50 on an experimental basis because of the single carriageway to try and improve the traffic flow"

3.2.3 Hauliers

All the hauliers spoken to for this research had a good level of awareness of the pilot 50mph scheme on the A9 before it commenced. It was referred to as being a significant change in their industry, and was well communicated by trade organisations such as the Road Haulage Association and Freight Transport Association in advance. These organisations also provided promotional material for hauliers to use to communicate the change to drivers.

Haulier organisations made their staff aware of the change through a number of mechanisms. This included toolbox talks, posters on noticeboards. Hauliers also commented on the profile of the scheme in the media, which helped to raise awareness amongst drivers also.

3.3 What is the level of awareness of the ASC among HGV and non-HGV drivers?

3.3.1 HGV Drivers

All the HGV drivers involved in this research were aware of the implementation of ASCs on the A9. All of the HGV drivers were aware of the ASCs simply by driving through them and seeing the signage on route. Some HGV drivers were very positive about their introduction.

> "The best thing that happened to the A9 is the introduction of cameras, as people used to sit at 80 and the road is not suitable for 80 and they have got to keep the cameras there"

3.3.2 Non-HGV Drivers

Non-HGV focus group participants mentioned that there were a lot of signage along the A9 to identify the new ASCs and the new speed limit change, and this helped make them aware of the changes. This reflected a high level of awareness amongst participants.

> "It says on an actual fixed sign as you approach the road"

3.3.3 Hauliers

As with the speed limit change, hauliers were aware of the ASC system in advance of implementation through trade organisations, word of mouth and general media profile. In slight contrast to the positive reaction to the revised speed limit, not all hauliers interviewed had welcomed the prospect of the ASC system with one stating they did not feel it was necessary. That said, all felt it had helped to improve non-HGV driver behaviour which was positive for HGV drivers.

3.4 Awareness of other behaviour change programmes

The A9 Road Safety Group provides an overview of the A9, with statistics, route information, driving tips and road campaigns8. The Group aims to provide up to date and accurate information on the A9. The Group consists of a range of partners, including BEAR Scotland, Freight Transport Association, Road Safety Scotland, The Highland and Perth & Kinross Councils and Police Scotland, amongst others. The A9 Road Safety Group website details a number of campaigns which it promotes in conjunction with a number of other stakeholders, including Road Safety Scotland and Police Scotland. There are multiple campaigns with a primary aim of improving safety on the A9, supported by behaviour change programmes.

A number of these programmes have been running throughout the ex-post evaluation period and therefore have the potential to influence driver behaviour and some of the KPIs analysed for this study. These campaigns have included an overtaking campaign and driver distraction campaign.

Awareness of these campaigns was explored in the mini-discussion groups with HGV drivers as well as the non-HGV driver focus group. For the most part, the HGV drivers interviewed were not interested in the Driver

[8] http://a9road.info/

Behaviour Campaigns that were shown to them. They felt that non-HGV drivers needed to pay attention to these campaigns but that they did not.

> "People driving cars need to take note of them, you see all sorts from up in the cab and it is crazy when you see people doing their makeup, making calls, texting, reading whilst driving."

The majority of the non-HGV driver focus group participants were aware of national driver behaviour campaigns but no one particularly was aware of any A9 specific campaigns such as the examples that were shown to them during the focus group.

> "I don't think people pay attention to it very much"

The conclusion from the research is that the low level of awareness of supporting road safety campaigns on the A9 indicated that such activities may not have contributed significantly to any observed changes in outcome metrics.

3.5 A9 Signs

Signs exist on the A9 communicating the speed limit for HGVs on single carriageway sections as part of the pilot, and this has also helped with awareness by the HGV driver community and the general public. The issue of signage on the A9 is a topic that has come up several times in the qualitative research for this evaluation, with some querying why there are not routine speed limit signs for all drivers at different points along the route depending on road type. There have been suggestions by hauliers and HGV drivers in our market research that non-HGV drivers can get confused as to which speed limit they should be driving at on the A9, particularly as the route varies between single, dual and Wide Single 2+1 carriageway.

There is no easy solution to this as national UK Department for Transport guidance on road traffic signs states that repeater signs for the national speed limit are only used on roads with street lighting (other than motorways).

3.6 Summary

Amongst the HGV driver community and haulier industry, the pilot speed limit increase on the A9 was well known about in advance of its implementation in 2014. Key industry bodies including the Road Haulage Association and Freight Transport Association communicated the change to their members. The pilot also received press attention at the time. Signs on-route about the pilot had also played a role in awareness amongst all drivers.

4. Data Analysis (VBV) – Approach and Context

4.1 Introduction

This section sets out some important contextual information which influenced the evaluation of data-based indicators, as well as assumptions used in data processing. Sections 5 to 8 in this report present the detailed analysis of outcome metrics to understand changes between the baseline and ex-post periods. However, contextual factors such as wider economic conditions can influence factors such as travel demand, mode choice and therefore traffic flows. This in turn could have influenced the defined A9 pilot outcomes. The first stage of the evaluation was therefore to review changes in the contextual data, in order to allow identification of those changes which are a result of the speed limit change alone. This section also discusses the methodology followed in processing the data including any assumptions made.

4.2 Approach to Vehicle Classification

Vehicle by vehicle (VbV) outputs from the Automatic Traffic Counts (ATC) maintained as part of the National Traffic Data System (NTDS) underpin much of the analysis presented in Sections 5 and 6. A number of different vehicle classification systems are used by the A9 NTDS sites:

- Euro 6: six categories including two HGV categories;
- CA10: ten categories including six HGV categories; and
- WiM18: eighteen categories including thirteen HGV categories.

A table was established to map each of the above systems (Table 4-1) so that reporting could be undertaken consistently. With the exception of the WiM18 classification, the vehicle type information recorded by the counters does not permit classification by weight; this is a requirement to identify HGVs >7.5 tonnes. The HGV class was therefore divided into Rigid HGVs and a class capturing articulated HGVs and rigid HGVs with trailers. Whilst the categorisation used by the Euro6 and CA10 counters does not provide sufficient detail to distinguish vehicles of over 7.5 tonnes, the HGV (Artic/Rigid +Trailer) exclusively consists of vehicles in this weight category and data for these categories is presented separately in order to permit examination of the impacts of the speed limit change on affected vehicle groups.

Where possible Rigid 2-axle (<7.5 tonnes) have been reported separately, but it should be noted that data to assess this class was only available for one site on the A9 between Perth and Inverness. In order to maintain clarity regarding the applicability of the speed limit change to the HGV categories discussed, the labels in the report reference column have been used to identify the categories in the subsequent text. Results that isolate impacts on HGVs >7.5 have been shaded light green.

Table 4-1 Vehicle classification

	HGV Weight categories	Report reference	Euro 6	CA10	WiM18
Light		Light	Motorbike, car & small van classes	Motorbike, car & small van classes	Motorbike, car & small van classes
Heavy		Bus/Coach	Other heavy	Other heavy	Other heavy
Rigid 2-axle (<7.5 tonnes)	<7.5 tonnes	Rigid 2-axle (<7.5 tonnes)	N/A	N/A	Rigid 2-axle (<7.5 tonnes)
HGV (Other Rigid)	Mixed weight categories	HGV Rigid (mixed weight)	Rigid HGV classes	Rigid HGV classes	Other rigid HGV classes
HGV (Artic/Rigid + Trailer)	>7.5 tonnes	HGV (>7.5 tonnes)	Articulated HGV classes	Articulated HGV classes	Articulated HGV classes

4.3 Data processing

This section provides an overview of the main challenges and assumptions made during the processing of the VbV data which influenced the ability to evaluate some of the outcome metrics discussed in Sections 5 and 6.

4.3.1 Data availability

A range of impact areas, including impacts on speed, platooning and driver frustration, were assessed based on vehicle by vehicle data from Transport Scotland's NTDS sites. VbV records are output by ATCs, and provide a timestamp together with vehicle class and speed information for each vehicle passing an ATC site. It should be noted that the NTDS does not hold vehicle by vehicle data for dates prior to 2014, which was required to enable assessment of the vehicle speeds before the implementation of the speed limit change. AECOM held data for the A9 sites for one week in June 2013 from a previous study and this has been used where possible. June was therefore chosen as a representative neutral month for both the baseline and ex-post periods based on a review of traffic flow the seasonality of ATC data from the A9 NTDS sites. Data processing therefore included the first two weeks in June. A map showing site locations and data available is shown in Figure 4-1.

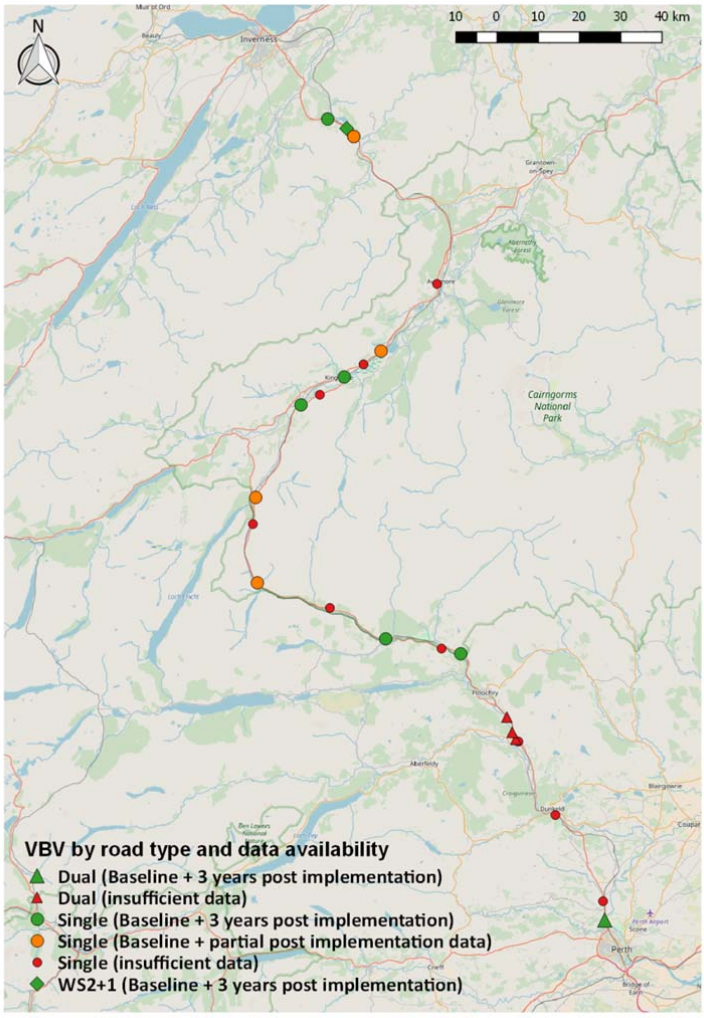


Figure 4-1 A9 Vehicle by Vehicle data availability[9]

The raw data was received uncleaned (so could include machine errors, data from congested periods or roadworks) and additionally the calibration status of sites was not known. Prior to processing to assess the impacts of the HGV speed limits changes, the data was therefore cleaned through inspection of the traffic flow profiles at each site. Vehicle speeds were then cleaned based on thresholds defined by the standard deviation by vehicle type. The impact of various thresholds on the range of data reflected in the dataset was reviewed prior to setting a suitable threshold giving consideration to the ability to:

[9] "Insufficient data" denotes sites with nil data availability either during the baseline or during the ex-post period.

- Remove unrealistic outliers; and
- Retain sufficient data to give a fair reflection of the variability of traffic speeds along the corridor.

Based on these considerations, vehicle speeds within a range defined by three standard deviations from the mean speed by vehicle type were accepted.

To mitigate for the varying representation of weekdays, Saturdays and Sundays in the dataset, the analysis of vehicle speeds was limited to weekday data. Furthermore, to limit distortion due to geographic location, only sites where data was available in 2013 and at least one of the years in the post-implementation period were included in the averages. This limited data availability to twelve sites, including one dual carriageway location to the north of Inveralmond, one site on the WS2+1 section near Moy and ten single-carriageway sites.

4.4 Context - Traffic Flows and Composition

Changes in traffic growth are closely linked with many of the impact areas discussed in the following sections including traffic speeds, platooning and road safety. To provide context for the interpretation of these impacts this section provides a discussion of trends affecting the level of traffic on the A9 between Perth and Inverness.

Figure 4-2 and Table 4-2 show Average Annual Daily Traffic Statistics based on ATC data sourced from the National Traffic Data System (NTDS), which were prepared to inform the development of the Case for Investment for the A9 Dualling. All count sites included are located on single carriageway sections. It should be noted that there are some gaps in the data due to inconsistencies in the availability of ATC data along the corridor.

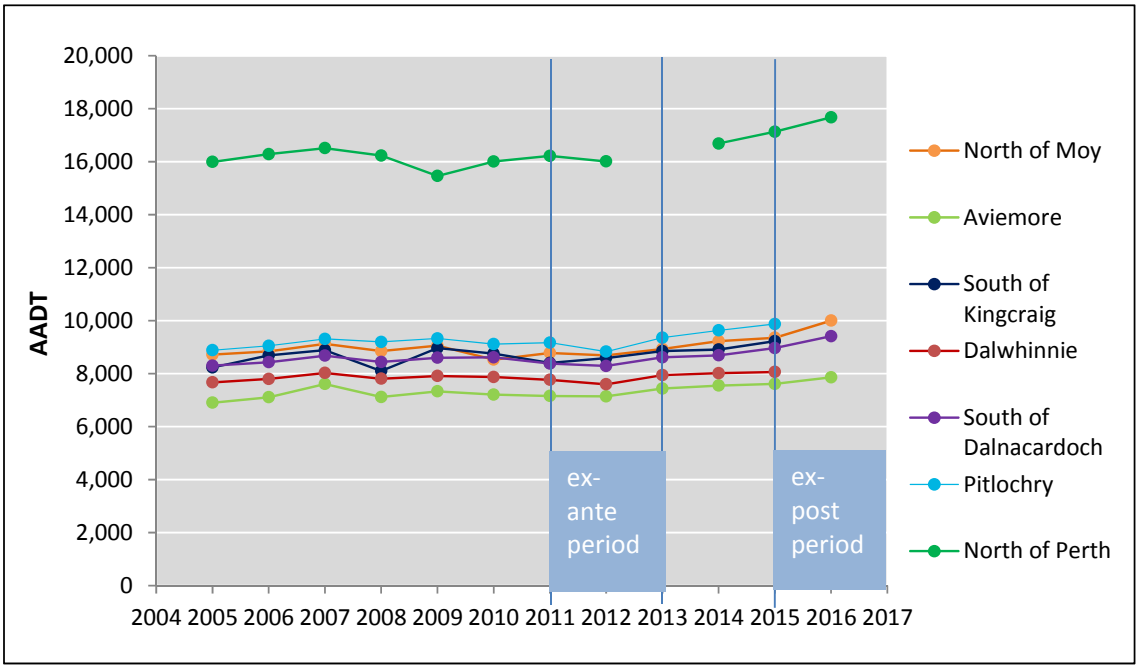


Figure 4-2 A9 Perth to Inverness, AADT growth 2005-2016

Table 4-2 A9 Perth to Inverness, AADT growth 2010-2016 (% change from previous year)

	Year						
Site	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
North of Moy	8,500 (-5.8%)	8,800 (3.0%)	8,700 (-1.1%)	8,900 (2.8%)	9,200 (3.3%)	9,400 (1.4%)	10,000 (6.9%)
Aviemore	7,200 (-1.7%)	7,200 (-0.8%)	7,100 (-0.2%)	7,400 (4.1%)	7,500 (1.5%)	7,600 (0.8%)	7,900 (3.3%)
South of Kingcraig	8,800 (-2.3%)	8,400 (-4.0%)	8,600 (2.2%)	8,900 (3.1%)	8,900 (0.7%)	9,200 (3.5%)	
Dalwhinnie	7,900 (-0.5%)	7,800 (-1.3%)	7,600 (-2.2%)	7,900 (4.6%)	8,000 (0.9%)	8,100 (0.6%)	
South of Dalnacardoch	8,600 (0.2%)	8,400 (-2.7%)	8,300 (-1.1%)	8,600 (3.9%)	8,700 (0.8%)	9,000 (3.2%)	9,400 (5.0%)
Pitlochry	9,100 (-2.3%)	9,200 (0.6%)	8,800 (-3.7%)	9,400 (6.0%)	9,600 (2.9%)	9,900 (2.5%)	
South of Pitlochry	13,700 (-0.2%)	13,300 (-2.7%)	12,700 (-4.2%)			14,100	
North of Perth	16,000 (3.5%)	16,200 (1.3%)	16,000 (-1.3%)		16,700	17,100 (2.6%)	17,700 (3.2%)

The data shows a year on year reduction in traffic flows at most sites in the years between 2010 and 2012. To some extent traffic flows immediately to the north of Perth were exempt from this trend based on available data, although 2012 data also suggested a decline in demand at this site. This has to be seen in the wider context of reduced travel demand at the national level following the recession in 2008/9, which is reflected in the reductions in the number of vehicle kilometres travelled on Scottish trunk A-roads in rural areas to 2012, which is shown in Table 4-3 and Figure 4-3. The earlier part of the baseline period, between 2011 and 2012 fell during the period of negative traffic growth, and this may impact on the interpretation of observed changes between the baseline and ex-post periods.

Traffic flows on the A9 have seen a steady recovery from 2013 onwards, slightly earlier than nationally where stable growth has been recorded again from 2015 onwards.

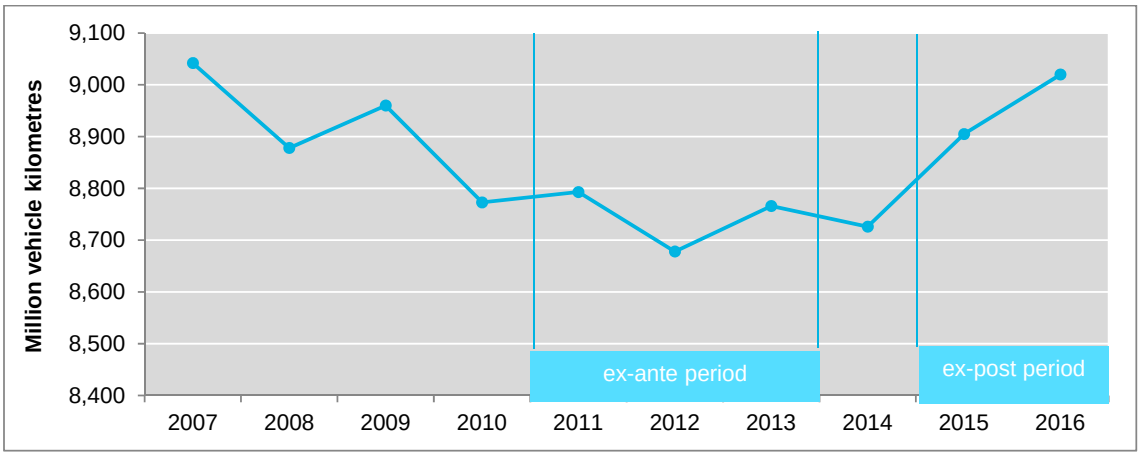


Figure 4-3 Million vehicle kilometres travelled, rural trunk A-roads in Scotland (Source: Scottish Transport Statistics No 36, 2017 edition)[10]

Table 4-3 Million vehicle kilometres travelled, rural trunk A-roads[10]

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Million vehicle km	9,042	8878	8960	8773	8793	8678	8766	8726	8905	9020
Year on year percentage change		-1.8%	0.9%	-2.1%	0.2%	-1.3%	1.0%	-0.5%	2.1%	1.3%

Another contextual factor that could influence the A9 pilot, or indeed could be influenced by the pilot, was the composition of traffic i.e. the percentage of HGVs. The A9 weekday traffic composition by year and road type as extracted from the VBV data, described in Section 4.3, is presented in Table 4-4. Whilst this dataset does not fully represent annual traffic, as it only covers part of the year, it directly relates to the data period used in the analysis of traffic speeds and platooning and therefore provides useful context. Traffic at the single carriageway sites was made up of between 71% and 73% light vehicles, 1% buses and 26-28% HGVs, including 11% and 12% in the Articulated and Rigid +Trailer categories (>7.5 tonnes), which consist entirely of vehicles affected by the speed limit change, and has therefore been isolated to consider its impacts (in-scope rows are shaded).

The proportion of light vehicles was higher at the dual carriageway (86%-88%) and WS2+1 (70-74%) sites, probably due to their relative proximity to Perth and Inverness, respectively. The proportions of HGVs >7.5tonnes at all count sites therefore remained relatively constant between 2013 and 2017.

Table 4-4 A9 Traffic composition, weekdays in June

Road type	Vehicle type	2013[11]	2015	2016	2017
Single Carriageways					
Single	Light	71%	71%	73%	72%
Single	HGV Rigid (mixed weights)	16%	16%	15%	16%
Single	HGV (>7.5 tonnes)	12%	12%	11%	11%
Single	Bus/Coach	1%	1%	1%	1%
Dual Carriageways					
Dual	Light	86%	86%	88%	88%
Dual	Rigid 2-axle (<7.5 tonnes)	0%	0%	0%	0%
Dual	HGV Rigid (mixed weights)	8%	9%	6%	6%
Dual	HGV (>7.5 tonnes)	5%	5%	5%	5%
Dual	Bus/Coach	1%	1%	1%	1%
WS2+1					
WS2+1	Light	73%	74%	74%	70%
WS2+1	Rigid 2-axle (<7.5 tonnes)	0%	0%	0%	0%
WS2+1	HGV Rigid (mixed weights)	17%	17%	17%	21%
WS2+1	HGV (>7.5 tonnes)	8%	8%	7%	8%
WS2+1	Bus/Coach	1%	1%	1%	1%

[10] https://www.transport.gov.scot/publication/scottish-transport-statistics-no-36-2017-edition/chapter-5-road-traffic/#Table5.1
[11] Data for 2014 was not analysed as this is not covered by the evaluation.

5. Outcomes – Speed

5.1 Introduction

This section reviews the observed impact of the speed limit changes on average speeds and speed limit compliance. Observed traffic speeds were analysed to measure changes between speeds in the baseline and ex-post periods, and so assess the impact of the increase in speed limits of HGVs. Statistical tests have been undertaken in order to establish the confidence level in the results. Various metrics are presented to produce an understanding of the impact on speeds, in terms of:

- Average speeds;
- The speed difference between HGVs >7.5t and other traffic;
- The proportion of vehicles exceeding the speed limit (speed limit compliance); and
- Market research into perceptions of speed.

5.2 Average Speed

The potential impacts of raising the speed limits for HGVs over 7.5 tonnes on the A9 were assessed in a study carried out by SIAS Limited and TRL, on behalf of Transport Scotland in May 2012. This involved the development of a microsimulation model of the A9(T) between Dalwhinnie and Moy. As part of this assessment, a scenario was modelled with increased speed limits for HGVs over 7.5 tonnes to 50mph on single and 60mph on dual carriageways. The assessment demonstrated the following potential impacts as a result of the limit increase when implemented together with ASC:

- A slight increase in average HGV speeds and consequently a reduction in journey times; and
- The average speed of all vehicles would remain lower than the baseline, primarily because of the camera enforcement.

This section examines to what extent the observed impacts on average speeds match up with expectation.

5.2.1 Evaluation questions

The evaluation question and metrics used to quantify results and allow for comparison between ex-ante and ex-post data are shown below:

Evaluation Question	Metric or Approach
Q5. How has the average speed of HGVs and non-HGVs changed: a. On single carriageway sections? b. On dual carriageway sections?	Change in average speed by vehicle type and road type
Q6. How has the speed difference between HGVs and non-HGVs changed: a. On single carriageway sections? b. On dual carriageway sections?	Change in average speed by vehicle type and road type

5.2.2 Average Speed Results

As outlined in Section 4, average speeds were assessed based on VbV data as available for the first two weeks of June in each year. This included data from ten sites located on single carriageway sections, one dual carriageway and one WS2+1 site. Average vehicle speeds by classification are summarised by road type in Table 5-1. The plots in Figure 5-1 to Figure 5-3 show the impacts of the two interventions on the distribution of traffic speeds. It should be noted that the white mark within each distribution represents the median speed.

Table 5-1 Change in average vehicle speeds by road type

	Pre Limit Increase (2013)	Year 1 (2015)		Year 2 (2016)		Year 3(2017)	
Vehicle Class	Average Speed (mph)	Average Speed (mph)	Measured Change in Average Speed [95% Confidence Interval] (mph)	Average Speed (mph)	Measured Change in Average Speed [95% Confidence Interval] (mph)	Average Speed (mph)	Measured Change in Average Speed [95% Confidence Interval] (mph)
Single carriageway							
Light	57.3	53.9	-3.41 [-3.44 to -3.38]	53.7	-3.64 [-3.67 to -3.61]	53.4	-3.9 [-3.94 to -3.87]
Rigid 2-axle (<7.5 tonnes)	52.5	49.3	-3.18 [-3.43 to -2.94]	49.9	-2.59 [-2.83 to -2.35]	50.7	-1.78 [-2.03 to -1.54]
HGV Rigid (mixed weight)	55.6	52.2	-3.39 [-3.45 to -3.33]	52.4	-3.18 [-3.24 to -3.11]	52.6	-3.06 [-3.12 to -3]
HGV (>7.5 tonnes)	50.6	50.0	-0.61 [-0.66 to -0.57]	50.5	-0.14 [-0.19 to -0.09]	50.8	0.15 [0.1 to 0.2]
Dual carriageway							
Light	62.0	62.8	0.76 [0.71 to 0.82]	63.2	1.23 [1.15 to 1.31]	62.1	0.12 [0.06 to 0.17]
HGV Rigid (mixed weights)	56.9	57.2	0.31 [0.14 to 0.47]	56.4	-0.54 [-0.8 to -0.27]	55.5	-1.43 [-1.61 to -1.26]
HGV (>7.5 tonnes)	53.0	52.4	-0.57 [-0.69 to -0.44]	53.0	0.04 [-0.14 to 0.22]	52.8	-0.2 [-0.33 to -0.08]
WS2+1							
Light	56.2	53.4	-2.81 [-2.89 to -2.74]	53.8	-2.45 [-2.53 to -2.37]	54.5	-1.67 [-1.76 to -1.59]
HGV Rigid (mixed weights)	54.8	51.3	-3.53 [-3.68 to -3.38]	52.0	-2.86 [-3 to -2.71]	53.9	-0.97 [-1.13 to -0.8]
HGV (>7.5 tonnes)	50.9	49.8	-1.16 [-1.31 to -1.01]	50.6	-0.35 [-0.51 to -0.19]	51.3	0.33 [0.15 to 0.52]

Single Carriageways

Based on available data the single carriageway average speed of HGVs over 7.5 tonnes was approximately 50.6 mph in the ex-ante period (2011-13), exceeding the legal speed limit by approximately 10 mph. Following the introduction of the increase speed limit and ASC there were relatively small changes, with departures from the 2013 baseline remaining within 1 mph throughout the ex-post period. In 2015, the mean speed of HGVs of over 7.5 tonnes decreased marginally, by 0.6mph in comparison with 2013, probably as a result of improved enforcement. This is in contrast to the slight increased forecast using transport modelling. HGV >7.5t average speeds increased slightly in subsequent years. By 2017 this trend amounted to a slight increase (0.2mph) in HGV speeds in comparison to the 2013 baseline. The average speed for vehicle classes not affected by the intervention experienced more substantial reductions. This included a 3.4 mph reduction for light vehicles between 2013 and 2015, and 3.2mph reduction for HGVs in the Rigid 2-axle (<7.5 tonnes) category. On single carriageway sections of the A9, the plots highlight a reduction in the variability of traffic speeds alongside the reduction of the median speed for all vehicle types, demonstrated by the reduced range of speeds recorded and intensified clustering of speeds around the frequently observed values. This impact is particularly visible for HGV (>7.5 tonnes) which experienced a reduction in the frequency of top speeds as a result of improved enforcement and in frequency of lower speed values through compliant drivers increasing the speed they are driving at.

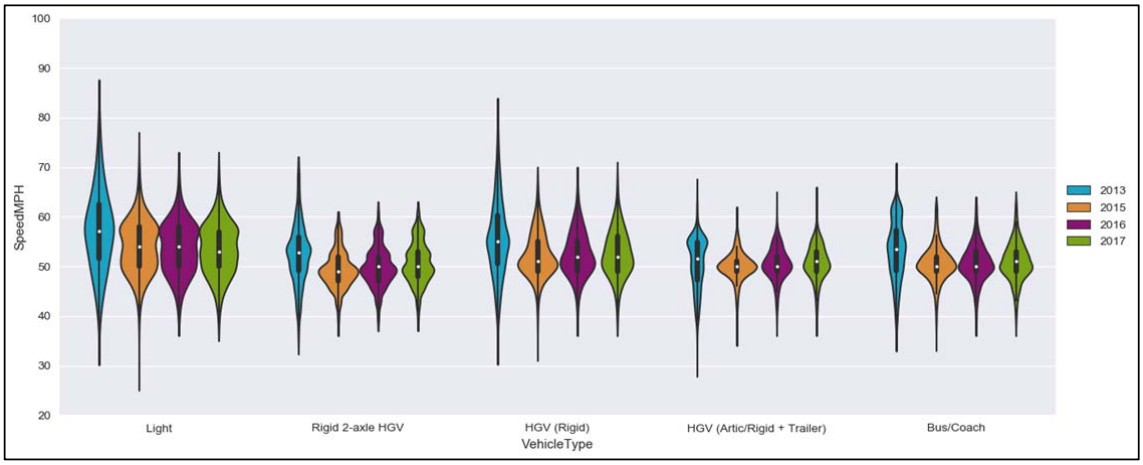


Figure 5-1 Change in vehicle speeds on single carriageway sections (violin plot)

Dual Carriageways

Impacts on the average speed of HGVs (>7.5 tonnes) at the dual carriageway site, where no change in speed limit was implemented, were similar in magnitude to the single carriageway sections. A marginal reduction by 0.6mph was noted in 2015, followed by return to 2013 average speeds in 2016 and a decrease by 0.2mph in 2017, in comparison with the 2013 baseline. Light vehicle average speeds increased marginally on the dual carriageway sections which were not subject to changes in the enforcement through introduction of ASCs. A reduction in the range of observed speeds was also recorded at the dual carriageway site although the change is much more subtle.

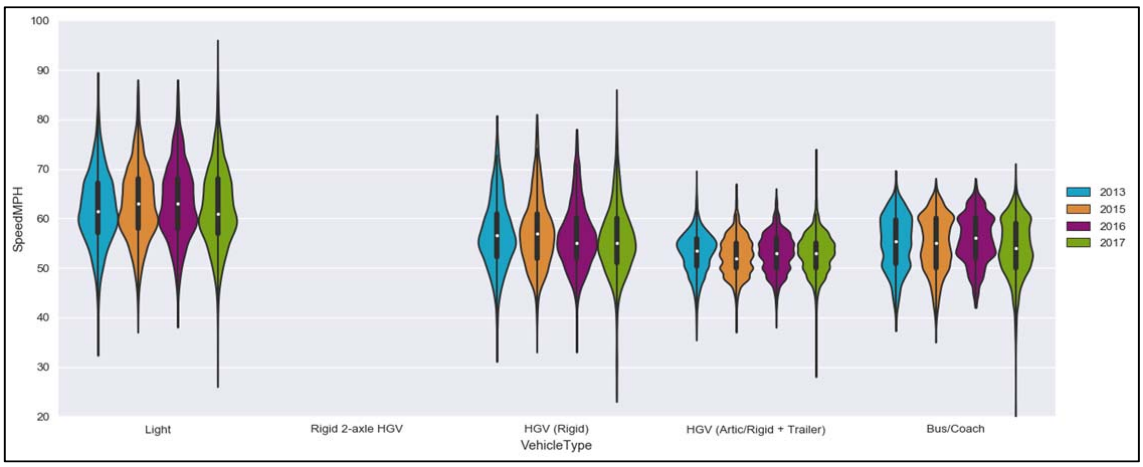


Figure 5-2 Change in vehicle speeds on dual carriageway section (violin plot)

WS2+1

Vehicle speeds recorded on the WS2+1 site showed similar trends to the single carriageways sections. Reductions in the average speed of HGVs (>7.5 tonnes) by 1.2mph and 0.35mph are noted in 2015 and 2016, followed by a slight increase of 0.3mph in 2017, when compared to the 2013 baseline. However, this data was from one site and should therefore be viewed with caution.

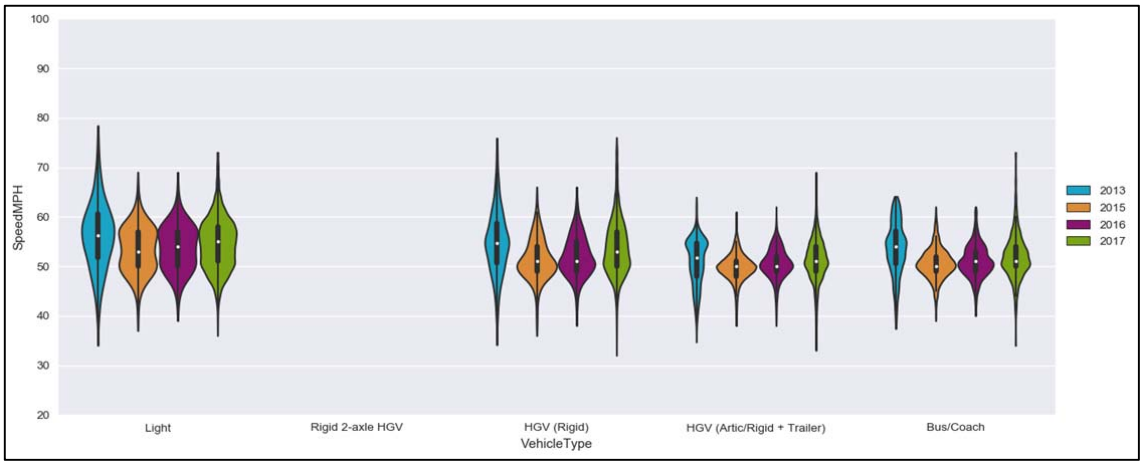


Figure 5-3: Change in vehicle speeds on WS2+1 carriageway sections (violin plot)

5.2.3 Average Speeds - Context

The UK Department for Transport (DfT) Impact Assessment for the 2015 HGV speed limit change[12] (from 40-50mph on single carriageways and 50-60mph on dual carriageways) in England and Wales indicated that an increase in average speeds for HGVs and a reduction in speed variability would be expected on single carriageways, but not dual carriageways. The results of the year one ex-post analysis of the HGV speed limit change in England and Wales confirmed that average speeds for HGVs over 7.5 tonnes on single carriageway roads increased between 2014 and 2015 by approximately 1.5mph, calculated across a range of flow conditions. The increase on dual carriageways was limited to 0.5mph. This is in contrast to the observed changes in Scotland (between 2013 and 2015) which comprised a decrease in average HGV speeds by 0.6mph in 2015 on single carriageway sections, most likely as a result of improved enforcement.

5.2.4 Speed Difference Results

The impact of the introduction of the HGV speed limit change and ASC system on the average speed differential between HGVs and light vehicles was assessed based on VbV data. The changes in speed difference have been assessed for each road type and the results are shown in Table 5-2.

There was no evidence that the speed differential between the rigid HGV classes, which were only partially affected by the speed limit change, and light vehicles changed in 2015 immediately after the implementation. Average speeds for these vehicle categories reduced to the same extent following the introduction of the average speed cameras. However, as a result of the reductions in light vehicle speeds which were much larger than those for HGVs of over 7.5 tonnes, the speed differential between these categories changed noticeably. The data suggested reductions by 2.8 and 1.7mph on single carriageway and WS2+1 sections, respectively. On the single carriageway sections the speed differential for all HGV classes decreased in 2016 and 2017 as HGV speeds increased and light vehicle speeds decreased slightly.

At the dual carriageway site the speed differential between HGVs and light vehicles reduced in the post-implementation period.

[12] DfT Impact Assessment for Single and Dual Carriageways:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/336315/hgv-single_-carriageway-impact-assessment.pdf
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/380984/Annex_D_-_Impact_Assessment_-_dual_carriageway_speed_limits_FINAL.pdf

Table 5-2 Change in speed difference (HGV-Light) by road type

	Pre Limit Increase (2013)	Year 1 (2015)		Year 2 (2016)		Year 3 (2017)	
Vehicle Class	Speed difference (mph)	Speed difference (mph)	Change in Speed difference (mph)	Speed difference (mph)	Change in Speed difference (mph)	Speed difference (mph)	Change in Speed difference (mph)
Single carriageway							
Rigid 2-axle (<7.5 tonnes)	-4.8	-4.6	-0.22 [-0.47 to 0.02]	-3.8	-1.05 [-1.3 to -0.81]	-2.7	-2.12 [-2.36 to -1.88]
HGV Rigid (mixed weights)	-1.7	-1.7	-0.02 [-0.08 to 0.05]	-1.2	-0.47 [-0.54 to -0.4]	-0.9	-0.84 [-0.91 to -0.77]
HGV (>7.5 tonnes)	-6.7	-3.9	-2.79 [-2.85 to -2.74]	-3.2	-3.5 [-3.56 to -3.45]	-2.7	-4.05 [-4.11 to -3.99]
Dual carriageway							
HGV Rigid (mixed weights)	-5.1	-5.5	0.45 [0.28 to 0.63]	-6.9	1.77 [1.49 to 2.04]	-6.6	1.55 [1.37 to 1.73]
HGV (>7.5 tonnes)	-9.0	-10.3	1.33 [1.19 to 1.46]	-10.2	1.19 [1 to 1.39]	-9.3	0.32 [0.18 to 0.45]
WS2+1							
HGV Rigid (mixed weights)	-1.4	-2.1	0.72 [0.55 to 0.89]	-1.8	0.41 [0.24 to 0.57]	-0.7	-0.7 [-0.89 to -0.52]
HGV (>7.5 tonnes)	-5.3	-3.6	-1.65 [-1.82 to -1.48]	-3.2	-2.1 [-2.27 to -1.92]	-3.3	-2 [-2.21 to -1.8]

5.3 Speed compliance

Market research[13] to assess the impact of the ASC system and HGV 50 mph speed limit on the A9 was carried out in March / April 2014 to establish a baseline and repeated in February 2015 after the implementation. The research undertook face-to-face quantitative interviews with respondents at towns and villages along the A9 between Perth and Inverness and in the two cities, with respondents who had driven on the A9 between Perth and Inverness for at least 15 minutes over the preceding 24 hour period. The results are not broken down by vehicle type. During the "After" market research 70% of drivers agreed that the ASCs made them less likely to speed, although there are potential caveats regarding the accuracy of self-reported levels of non-compliance. An increase in the proportion of drivers who said they 'never' exceeded the speed limit by 15 mph when travelling along the A9 increased from 43% to 75% in 2015 was also recorded. The proportion of drivers never exceeding the speed limit by 10 mph increased from 37% before to 56% after, and the corresponding proportions for 3mph were 27% before and 36% after.

Based on the findings of the research a substantial decrease in speeding, resulting in improved speed limit compliance, would be expected in the ex-post period. This section presents data analysis to test whether observation confirms these expected outcomes.

5.3.1 Evaluation question

The evaluation question and metrics used to quantify results and allow for comparison between ex-ante and ex-post data are shown below:

Evaluation Question	Metric or Approach
Q4. How has the level of speed limit compliance changed for HGVs and non-HGVs? c. On single carriageway sections? d. On dual carriageway sections?	Proportion of HGVs that complied with the speed limit by HGV class and road type

[13] A9 Average Speed Cameras – "After" Market Research, 2014, Transport Scotland

5.3.2 Speed compliance – Offences

Prior to the introduction of the ASCs, enforcement on the A9 encompassed the following approaches:

- Fixed safety cameras;
- Mobile safety cameras; and
- Regular police patrols.

This was replaced by the ASCs in October 214; although there were still some mobile safety cameras along the route, but mostly focused on the non-ASC dual carriageways. Speed compliance data was provided by Transport Scotland in the form of the total number of offences recorded in 2012 and quarterly summaries for the period from October 2014 to September 2017. Offences in 2012 represent data for single carriageway sections between Dunblane and Inverness. A summary is provided in Table 5-3. The ex-post data presented in Table 5-3 was recorded by the ASC system. As a consequence of the change in detector locations and enforcement methods, the two datasets do not present a like for like comparison and must therefore be viewed with caution.

The data shows a high baseline in 2012 and also a high level of offence during the first two quarters of 2015. It can be assumed that this was during the initial period of ASC operation, a period in which drivers would become accustomed to their presence leading to a change in driving behaviour. There is a notable reduction in offences in the second half of 2015 and through 2016 as people's behaviour normalises.

Table 5-3 Number of offences

Annual summary	
Year	Offences
2012[14] Total	**6,377**
Q4 2014	232
Q1 2015	1,178
Q2 2015	2,459
Q3 2015	1,839
Q4 2015	613
2015[15] Total	**6,089**
Q1 2016	638
Q2 2016	1,048
Q3 2016	949
Q4 2016	572
2016[15] Total	**3,207**
Q1 2017	750
Q2 2017	1,051
Q3 2017	743

[14] A9 Safety Group, Vehicle Speeds and Speed Enforcement Summary Report, August 2013
[15] Offence Data for Average Speed Camera Systems, Safety Cameras Scotland, October 2017

5.3.3 Speed compliance – Percentage of Vehicles Exceeding

Compliance was also assessed based on the number of vehicles exceeding the speed limit as extracted from VbV data. The analysis presented in this section is focused on data from ten single carriageway sites; data from the one dual carriageway and one WS2+1 location are also provided. A discussion of the data availability and processing methodology was provided in Section 4. Table 5-4 shows the proportion of HGVs that were within the defined speed categories on single carriageway sites by HGV type.

Table 5-4 shows that compliance for HGVs (>7.5 tonnes), which were subject to the change in speed limit improved radically. The data suggests an increase in compliance by 56 percentage points (pp), from 3% in 2013 to 59% in 2015 following the introduction of the speed limit change. This increase in compliance was in part due to a reduction in speeding; the proportion of vehicles travelling faster than 50 mph dropped by 17pp, and in part due to the legalisation of vehicle speeds in the 40-50 mph bracket. In subsequent years, compliance in this group deteriorated to some extent from its high of 59% in 2015 to 51% in 2016 and 47% in 2017. This is in contrast to recent trends in compliance for general traffic undertaken as part of the ASC monitoring (and presented in Figure 2-2), which found that the proportion of traffic travelling below 60mph has remained relatively stable since November 2014.

Compliance for the HGV Rigid (mixed weights) and Rigid 2-axle (<7.5 tonnes) groups has also improved, increasing by 18pp and 37pp between 2013 and 2015 respectively. This can be attributed to the ASC and slower general traffic speeds in the ex-post period.

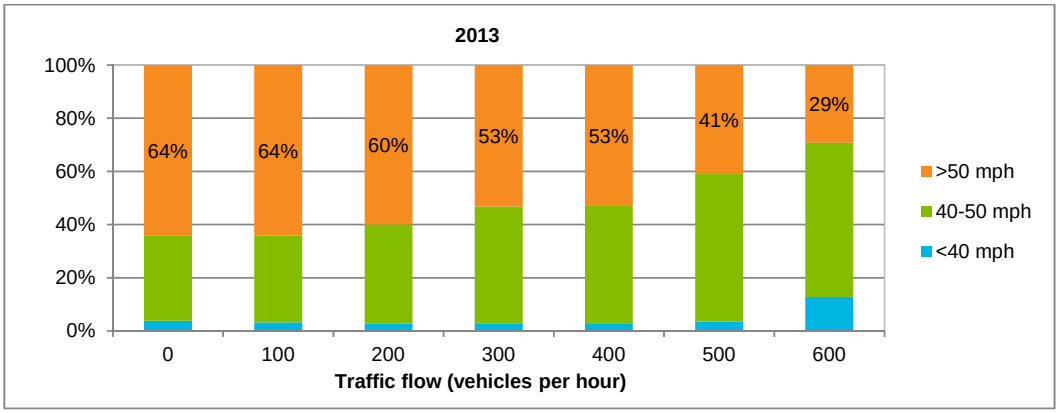
Table 5-4 Speed limit compliance by HGV type, Single carriageway sections[16]

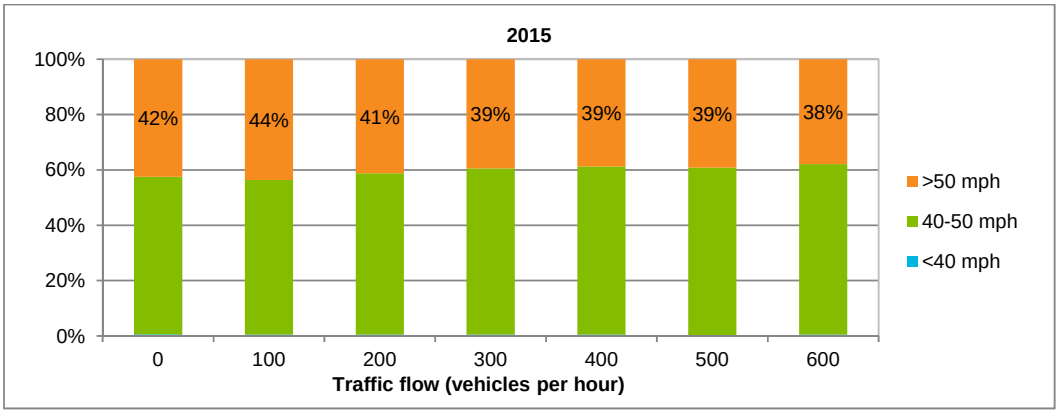
Year	HGV type	<40 mph	40-50 mph	>50 mph	Proportion compliant
2013	HGV (>7.5 tonnes)	3%	39%	58%	3%
2015				41%	59%
2016				49%	51%
2017				53%	47%
2013	HGV Rigid (mixed weights)	21%	1%	77%	21%
2015				61%	39%
2016				64%	36%
2017				65%	35%
2013	Rigid 2-axle (<7.5 tonnes)	31%	2%	67%	33%
2015				30%	70%
2016				38%	62%
2017				46%	54%

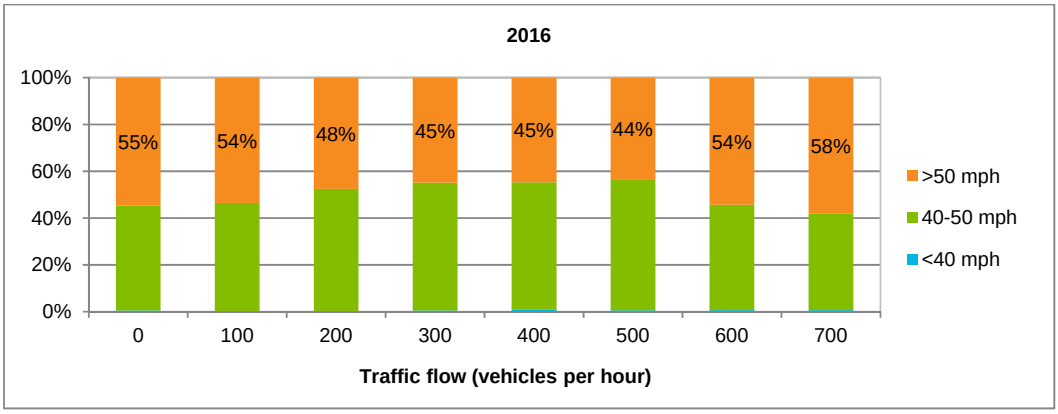
[16] It should be noted that in 2013 outlier cleaning removed around 20% of vehicles with speed <40 mph on single carriageways. However, review the 5th percentile speed for HGVs in the HGV (>7.5 tonnes) classes in 2013 moved from 40.6 to 41.0 mph after cleaning was applied, while the 50th percentile speed moved from 51.4 to 51.5 mph. In 2015, the 5th percentile speed moved from 44.6 to 45mph and the 50th percentile speed remained at 50 mph. The removal of speed outliers does therefore not substantially change the conclusion regarding the extent of speeding for HGVs in this category prior to the limit change.

Figure 5-4 shows the change in the proportion of HGVs (>7.5 tonnes) that travelled at speeds <40 mph, between 40 and 50mph and > 50mph at a range of different flows. In 2013 the graphs show that the proportion of HGVs>7.5t travelling at speeds over 50 mph decreased with traffic flow. In 2015, immediately after the introduction of the speed limit change the proportion of HGV>7.5 tonnes driving at speeds in this range (i.e. that were speeding) was around 40% across all flow bands This appears to be the result of a reduction of non-compliance in the lower flow bands, due to improved enforcement, together with an increase in non-compliance where hourly traffic flows are 600 vehicles or more, potentially as a result of the reduced speed differential and greater consistency in flow conditions discussed in Section 5.2. 2016 and 2017 data suggests a reduction in compliance across all flow bands in comparison to the situation just after the limit change.

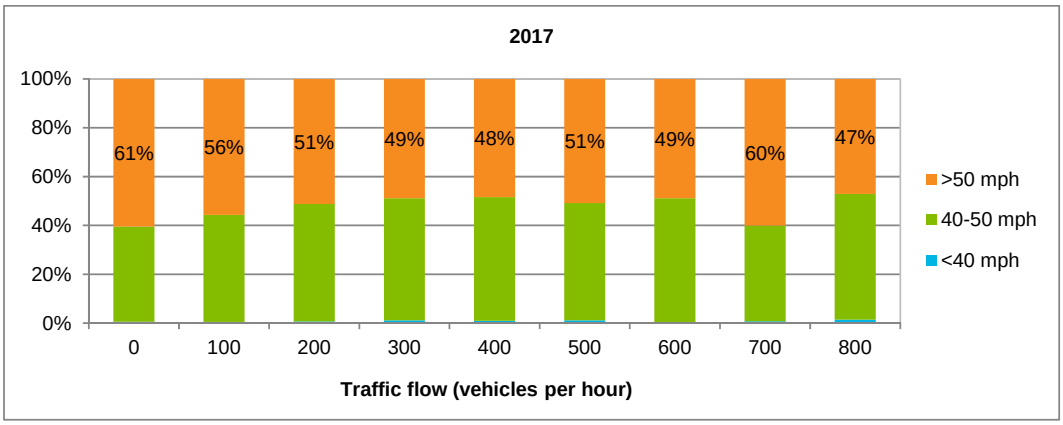
Figure 5-4 Change in speed limit compliance by flow range – Single carriageway, HGV (>7.5 tonnes)[17]







[17] It should be noted that no hourly flows of over 700 vehicles were recorded in the 2013 and 2015 datasets.



Based on available data, improved HGV speed limit compliance extended to the dual carriageway section where speed limits remained unchanged and there are no ASCs. Improvements in compliance amounted to around 14pp, between 2013 and 2015, and applied to both HGVs (>7.5 tonnes) which were subject to the limit change on single carriageway sections, and HGVs in the rigid (mixed weight) classes where applicability of the change was mixed.

Although, the conclusions regarding the dual carriageway sections rely on data from a single site located on the dual carriageway section to the north of Perth, it is possible that the introduction of the ASC system and 50mph speed limits on single carriageway sections of the A9 has resulted in a wider change in driver behaviour in terms of improved speed limits observance.

Table 5-5 Change in speed limit compliance by HGV type, Dual carriageway

Year	HGV type	<50 mph	>50 mph	Proportion of compliant vehicles
2013	HGV (>7.5 tonnes)	22%	78%	22%
2015		36%	64%	36%
2016		30%	70%	30%
2017		30%	70%	30%
2013	HGV Rigid (mixed weights)	14%	86%	14%
2015		18%	82%	18%
2016		19%	81%	19%
2017		23%	77%	23%

5.3.4 Speed limit compliance - Context

Improvements in speed limit compliance on the A9 have been considered against changes in compliance recorded in England and Wales where the HGV speed limit was increased without contemporal changes in enforcement.

Speed limit compliance statistics by road and vehicle type are published by the DfT. These are calculated from a sample of its network of automatic traffic counters, and are available up to 2016. Data for national speed limit single carriageways is shown in Table 5-6; data for dual carriageways is not published separately.

It should be noted that whilst the statistics in the table consider roads throughout Great Britain, heavy goods vehicles are calculated for England and Wales only to ensure consistency across time, as HGV speed limits on single-carriageway roads in England and Wales increased in 2015, but not in Scotland. It should be noted that the DfT compliance statistics do not include HGV classes of less than 7.5 tonnes laden weight.

Table 5-6 Proportion of vehicles exceeding speed limit on single carriageways (DfT England and Wales data)[18]

Speed limit compliance	Cars and LGVs	Rigid HGVs (>7.5 tonnes only)	Articulated HGVs (>7.5 tonnes)
2013	8%	60%	65%
2014	8%	59%	65%
2015	8%	27%	21%
2016	8%	28%	24%

Note: Results for national speed limit single carriageways based on 26 sites

Speed limit compliance on single carriageway roads in England and Wales improved by approximately 32pp for Rigid HGVs (>7.5 tonnes) and by 41pp for Articulated HGVs (>7.5 tonnes). This compares to a 56pp improvement on the A9 single carriageway sections, highlighting the additional gains in compliance made through the introduction of the ASC system on the A9.

[18] Source: https://www.gov.uk/government/statistical-data-sets/spe01-vehicle-speeds

5.4 Market research on perceived impacts on speed

5.4.1 HGV driver discussions

The majority of respondents in the small sample of HGV drivers on the A9; self-reported that in the past they had generally driven within the 40mph speed limit on the A9. Exceeding the limit occurred due to traffic conditions or road type e.g. coming downhill to give the momentum to get up a hill in most cases but now felt less under pressure now that the speed limit was 50mph.

While all drivers had stated they had increased their speed to travel at 50mph, they did not feel this had affected any other aspects of their driving behaviour. Drivers stated they drove within the current 50mph limit the majority of the time, noting they couldn't get much higher due to speed limiters.

> "Messing with the tachographs used to be a lot more common whereas now you can't really do it and it is a lot less common and possible due to the way the tachograph is designed"

5.4.2 Non-HGV driver focus group

Most focus group participants felt HGVs had previously adhered to the 40mph the majority of the time; with speeding noted as the exception rather than the norm. This highlights the difference between perceptions and observed data and the responses given in the focus groups. Respondents stated that HGVs did appear to travel at 50mph on the A9, and this helped the traffic flow.

Most respondents felt that the cameras and the number of people caught speeding should be advertised more as it was often mentioned that people thought they were not on or the cameras were not working.

> "Yeah, I think it should be publicised a wee bit more because I'd never heard about people being caught for speeding. I think they should publish it in our local papers or even nationally"

Now that the ASCs are in place, the window for overtaking was perceived to have reduced especially if the person in front is doing a similar speed.

> "If someone is doing 55 you don't feel you can overtake"

5.5 Summary

This section has considered the impacts of the 50 mph HGV speed limit on vehicle speeds, including speed limit compliance.

In 2013, average speeds for HGVs (>7.5 tonnes) were approximately 50.6mph, therefore exceeding the legal speed limit by around 10 mph. Vehicle speeds in this category decreased slightly by 0.6mph, in 2015. This is in contrast to the increase of around 1mph observed in England and Wales, where Average Speed Cameras were not introduced simultaneously. Based on this evidence the impact of the speed limit change was largely to legalise the status quo rather than increase HGV speeds. Average speeds for HGVs of over 7.5 tonnes increased slightly in 2016 and 2017 and by 2017 exceeded baseline values by approximately 0.2mph.

The combined impact of the two interventions on the A9 has been to reduce the range of traffic speeds for all vehicle types, at the upper end of the speeds range through improved enforcement and the lower end through raising speeds for those HGVs over 7.5 tonnes that complied with the speed limit. This is in line with the results for England and Wales which highlighted a reduction in the variability of traffic speeds.

Based on the available dataset, the average speeds of HGVs of over 7.5 tonnes on the dual carriageway sections was subject to reductions of a similar magnitude, in 2015 immediately after the introduction of the speed limit change. Light vehicle speeds increased marginally in the ex-post period. It should be noted however, that data availability in this group was limited to one site to the north of Perth.

The speed differential between cars and HGVs of over 7.5 tonnes was subject to sustained reductions by between 2.7 and 3.5mph in the ex-post years, further demonstrating the increased consistency of traffic speeds. However, this is a result of the combined impact of a reduction in light vehicle speeds by over 3mph due to improved compliance and the retention of formerly non-compliant HGV speeds. At the dual carriageway site where neither change applied, the speed differential increased slightly.

Market research on driver perceptions of the impacts of the speed limit change pointed to improvements in compliance. These perceptions were borne out by the data analysis which suggested that on single carriageways, the intervention resulted in large improvements in speed limit compliance in the target group by 56pp in year one of the ex-post period; although some reduction was recorded in subsequent years. These improvements are in part through the legalisation of previously illegal vehicle speeds and in part a result of improved enforcement, and exceed the gains suggested by similar data for England and Wales.

Improved speed limit compliance extended to the dual carriageway section where speed limits remained largely unchanged, indicating that the ASCs may have resulted in wider changes in driver behaviour in terms of improved speed limit observance.

6. Outcomes – Traffic Flow Characteristics and Driver Behaviour

6.1 Introduction

This section considers the impact of increasing the speed limit for HGVs on single carriageway sections of the A9 between Perth and Inverness on defined operational characteristics of the network and driver behaviour. Analysis of a number of datasets is presented to answer the evaluation questions. These questions aimed to understand whether the increase in the speed limit has had an impact on factors such as journey times, network resilience, platoon formation and driver frustration.

6.2 Journey times

6.2.1 Evaluation question

The evaluation question and metrics used to quantify results and allow for comparison between ex-ante and ex-post data are shown below:

Evaluation Question	Metric or Approach
Q7. How have average end-to-end journey times changed for HGV and non-HGVs: a. On single carriageway sections? b. On dual carriageway sections?	End to end journey times for all traffic

6.2.2 Journey Times - Results

Transport Scotland operates permanent Bluetooth receptors north of Inveralmond roundabout near Perth and south of Raigmore junction near Inverness. Journey times based on data from these receptors are presented as part of the periodic data analysis and monitoring reports by the A9 Safety Group. It should be noted it is not possible to classify vehicle type from this dataset. No breakdown by route section is available to enable separate consideration of the impacts on the single and dual carriageway sections.

Data from the March 2018 report is presented in Table 6-1 and a plot showing the year on year change is shown in Figure 6-1. During the pre-implementation period, the ASC monitoring report provides journey times for June 2013 only. To provide a like for like comparison the analysis presented in Table 6-1 was therefore based on data for June in each year. The weekday journey time averages include data for the first week of each month and a filter has been applied to restrict the data points included to the hours between 07:00 and 19:00, to represent normal traffic conditions.

Table 6-1 Change in average weekday journey times, Perth to Inverness (June)

Indicator	Pre-Limit-Increase (2013)	Post Limit-Increase (Average of 2015 to 2017)	Measured Change	Percentage Change
Average weekday journey times (minutes)				
Northbound	117	125	+8	7%
Southbound	118	124	+6	5%

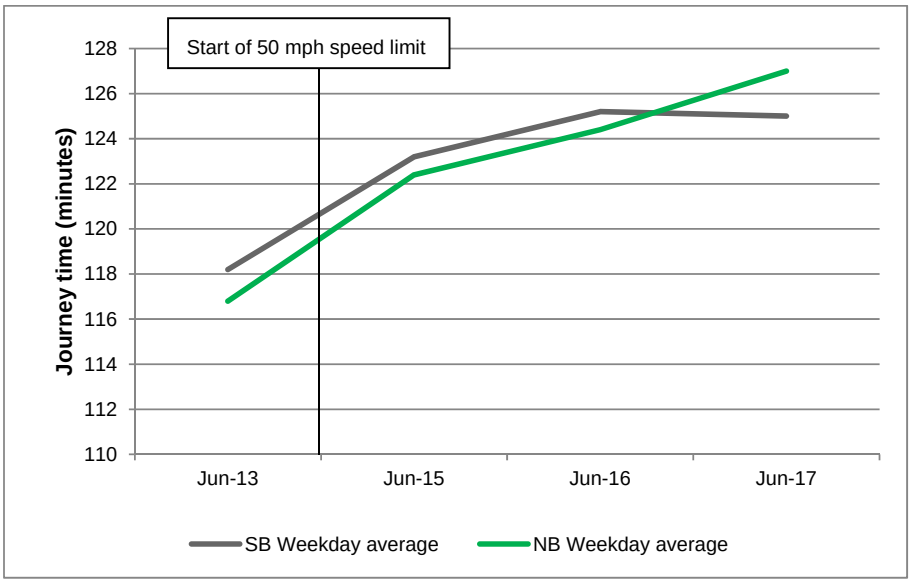


Figure 6-1 Change in average weekday journey times, Perth to Inverness (June to August)

The data highlights an increase in weekday average end to end route journey time for all vehicles, by approximately 5-7%. Increased journey times will have been intrinsically related to, and a result of, the general reduction of traffic speeds discussed in Section 5.

For HGVs (>7.5 tonnes) the data on average speeds presented in Section 5 suggested only a marginal decrease in vehicle speeds and any related impacts on journey times are likely to be insubstantial.

6.2.3 Market research findings on journey times

Feedback on journey times was obtained from both hauliers and drivers during the HGV driver discussion groups. Hauliers engaged with in this study were asked if they had observed any substantial improvement to journey times over the period of the pilot scheme. The prevailing view was that there may have been some journey time savings for vehicles using the A9, though these were not significant enough on the whole to translate into specific changes to scheduling or operations. One haulier also noted that the presence of roadworks on the route during the pilot scheme period and associated delay may have balanced out any journey time savings.

During the HGV driver discussion groups most drivers said it was their perception that their journeys felt quicker now. Some had noted on occasion that they were getting to their destinations quicker when using the A9 but this was not always the case with all the drivers. Again, this perception was not substantiated by the data other than the fact that some HGVs could now be driving faster up to the 50mph limit. Only a couple of HGV drivers said their managers now expected quicker journeys, and this could put pressure on them to push on further in to their journey.

> "Journey time has improved a lot now. The company will sometimes push a bit more now"

The remaining drivers said that nothing had changed for them and expected journey times had stayed the same despite the changes on the A9 as they can never plan for any problems on the route. Some drivers noted that while on certain stretches journey time had improved, on others, there are still roadworks to slow them down. Until all work is complete on the route, there will still be variability and they cannot tell for definite how long the journey is going to take.

> "On a good run, it is quicker now, however there are stretches of roadworks which does slow you down so you know to expect that on your route"

In general HGV drivers felt that the A9 is now a quicker road and their speed is more consistent. However, unplanned disruption on the route is still common and cannot be planned for.

> "It has become a quicker road, a better road, but there are still bits that are not dualled which means they are still vulnerable for accidents"

6.3 Operational Characteristics

6.3.1 Evaluation question

The evaluation question and metrics used to quantify results and allow for comparison between ex-ante and ex-post data are shown below:

Evaluation Question	Metric or Approach
Q8. How has the operational characteristics of the route changed in terms of: a. Network resilience (incidents)? b. Platooning? c. Free flow conditions?	Platoon leaders by vehicle type Leader speed for platoons led by HGVs Number and duration of incidents

6.3.2 Network resilience - incidents

The introduction of the ASC system and 50 mph limit was expected to result in safety benefits in terms of reductions in the number and severity of accidents. These specific impacts are discussed in detail in Section 7. Fewer and less serious accidents would be expected to result in improved network operation in terms of reducing the frequency and duration of associated road closures. This assumption was tested through a review of incident data.

Statistics describing the frequency and cumulative duration of incidents on the A9 between Perth and Inverness were provided by Transport Scotland. This data was extracted from Traffic Scotland's incident management database, which holds information relating to all incidents resulting in a carriageway closure or restriction. The system does not record weather related closures or planned closures such as roadworks. Data was provided as quarterly totals for the period between Q1 2013 and Q4 2017; it should be noted that similar statistics for 2011-12 were not available. Summaries by incident type or vehicles involved are not routinely prepared and the specific consideration of incidents involving HGVs was therefore not possible.

A summary of the frequency and average duration of restrictions during the pre-and post-implementation period are shown in Table 6-2. Figure 6-2 shows how the frequency of incidents and their duration have changed over time.

Table 6-2 Change in number and duration of incidents recorded

Indicator	Pre-Limit-Increase (2013)	Post Limit-Increase (Average of 2015-2017)	Measured Change	Percentage Change
Average Number of Incidents per annum				
Number of incidents p.a.	117	69	-48	-41%
Average duration of restriction per incident				
Average duration (hours)	2.4	2.3	-0.1	-5%

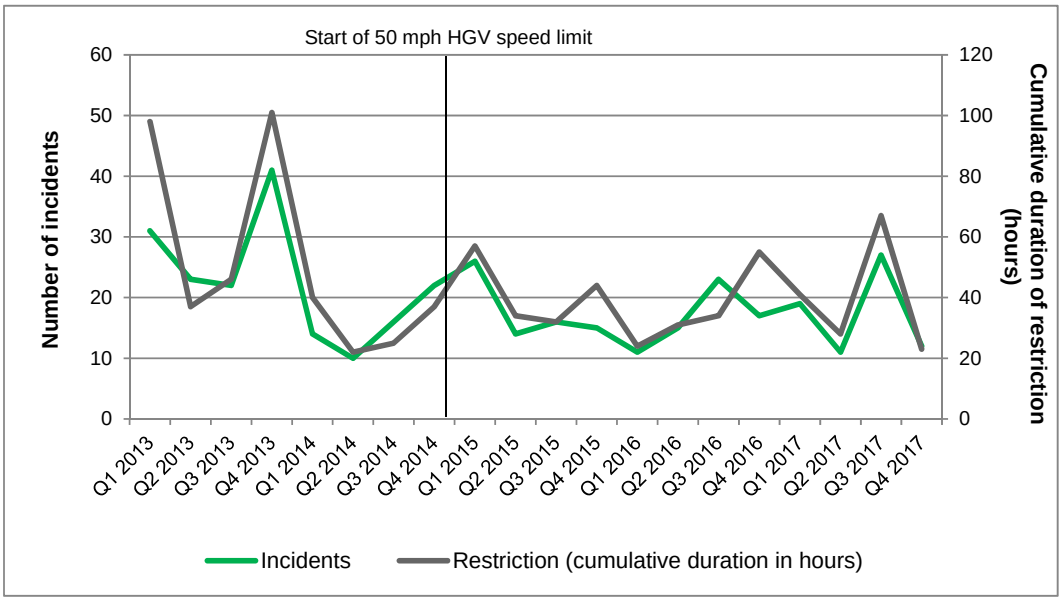


Figure 6-2 Change in number of incidents and cumulative duration of restrictions

The indicator values suggest a substantial drop in the number of incidents recorded and a small reduction in the average duration of the corresponding restriction in the ex-post period in comparison with 2013. However, the reduction in incident frequency dates back to the first quarter of 2014. This date precedes the implementation of both the ASC system and the 50mph speed limit for HGVs suggesting that the changes may not be related to the intervention.

It should be noted that it is possible that there have been changes to how incident data is recorded and classified over the period of the evaluation, and it is therefore difficult to draw conclusions from this dataset. Police Scotland's professional opinion confirmed the findings from the data. However, attributing this to the A9 pilot is more difficult.

The market research found that most non-HGV drivers in the associated focus group felt that traffic flow had improved along the A9 and reduced congestion, tailbacks and the number of accidents. This was retrospectively attributed to the change in speed limit and the addition of average speed cameras combined. However it was still felt that it only took one problem for journey time to be disrupted.

> "It's still hit and miss though because it is a main artery and it just takes one accident and it is queued right back and if you are on it nowhere to go like a lot of roads there's nowhere to go. But sometimes even though there's been an accident and you've had the report on your phone or whatever you have no choice. We know that we've got half an hour to sit and wait. But you just have to get on with it because there is no other route to Inverness or anywhere in-between. It's not worth zigzagging your way up or anything like that, you just have to grin and bear it"

6.3.3 Platooning

Data analysis to explore the improvements of traffic flow conditions with respect to platooning are explored in this section.

The ASC "After Market Research linked platooning on the A9 to speeding, high levels of driver frustration due to lack of overtaking opportunities and a range of risky overtaking behaviours. Driver perceptions recorded during the research suggest that pressures felt by drivers due to high incidence of platooning on the A9 decreased in the post-implementation period. This is reflected in the reasons for exceeding the speed limit given by drivers. The proportion of respondents speeding because they were feeling pressured after overtaking slower moving traffic decreased from 83% 'before' to 47% 'after'. Similarly the proportion of respondents speeding to make up for time being stuck behind a slow moving vehicle decreased from 85% to 61%. The surveys did not specifically explore perceptions related to platooning caused by HGVs. A reduction in drivers feeling frustrated by the lack of opportunity to overtake, and reduced incidence of a range of dangerous overtaking behaviours were also recorded.

These behaviours could in turn impact adversely on road safety performance of the route, which is discussed in more detail in Chapter 7. As such, changes in platooning are of particular relevance to the evaluation of performance of the ASCs and HGV speed limit change with respect to their objectives.

Changes in platooning behaviour and free flow conditions at single carriageway sites along the A9 between Perth and Inverness were assessed based on VbV data from Transport Scotland's permanent ATC sites. The data availability and processing for this dataset were discussed in Section 4. In line with previous analysis undertaken in the context of the A9 Case for Investment, platooning was assessed based on a five second headway gap to the preceding vehicle. Impacts on the leader type and speed of platoons were also assessed.

Figure 6-3 shows the change in the proportion of vehicles travelling in a platoon. At most sites the proportion of vehicles travelling in a platoon decreased between 2013 and 2015, although an exception was noted at Moy. Viewed in the context of the traffic flow increases over the same period, highlighted in Section 4, this suggests that the observed changes in the speed distribution led to more consistent traffic flow following the introduction of the ASCs and 50 mph speed limits. In 2017, most sites registered an increase in platooning in comparison to the preceding year. This is likely to be linked to the recovery of traffic growth on the A9 in recent years, analysis of ATC data presented in Section 4.4 showed that in 2016 percentage growth returned to levels between 3.2% and 6.9% at the sites where long-term ATC data was available.

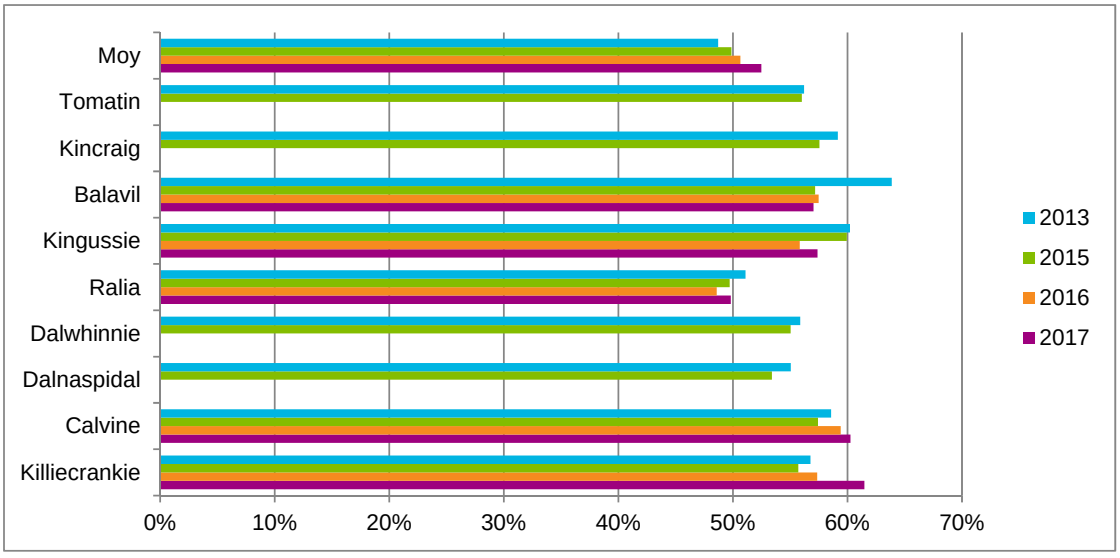


Figure 6-3 Change in proportion of vehicles travelling in a platoon, single carriageway sections

The change in the platoon leader distribution by vehicle type is summarised in Table 6-3, and Table 6-4 summarises the proportion of platoons led by slow moving vehicles (defined as <50 mph) by leader type. The analysis of the platoon lead vehicle type shows that over half of all platoons in both the baseline and ex-post periods were led by light vehicles, highlighting that much of the platooning recorded by this method may be due to general traffic conditions or lack of overtaking opportunities rather than due to queues forming behind slower moving HGVs.

Table 6-3 Change in platoon leader vehicle type distribution, single carriageways

	Pre Limit Increase (2013)	Year 1 (2015)		Year 2 (2016)		Year 3 (2017)	
Platoon leader vehicle type	Proportion of platoons	Proportion of platoons	Measured Change [95% Confidence Interval]	Proportion of platoons	Measured Change [95% Confidence Interval]	Proportion of platoons	Measured Change [95% Confidence Interval]
Light	54.4%	50.6%	-3.8% [-4.2%, -3.4%]	54.4%	0.0% [-0.4%, 0.4%]	53.4%	-1.0% [-1.5%, -0.6%]
Rigid 2-axle (<7.5 tonnes)	1.0%	1.3%	0.2% [0.1%, 0.3%]	1.8%	0.7% [0.6%, 0.8%]	2.2%	1.1% [1.0%, 1.2%]
HGV Rigid (mixed weights)	17.0%	20.7%	3.7% [3.4%, 4.0%]	19.1%	2.1% [1.8%, 2.4%]	19.3%	2.3% [2.0%, 2.6%]
HGV (>7.5 tonnes)	25.6%	25.7%	0.0% [-0.3%, 0.4%]	22.6%	-3.1% [-3.4%, -2.7%]	22.8%	-2.8% [-3.2%, -2.4%]
Bus/Coach	1.9%	1.8%	-0.1% [-0.2%, 0.0%]	2.1%	0.2% [0.1%, 0.3%]	2.4%	0.4% [0.3%, 0.6%]

Table 6-4 Change in the proportion of platoons that are slow moving (<50 mph) by leader type, single carriageways

	Pre Limit Increase (2013)	Year 1 (2015)		Year 2 (2016)		Year 3 (2017)	
Platoon leader vehicle type	Proportion of platoons	Proportion of platoons	Measured Change [95% Confidence Interval]	Proportion of platoons	Measured Change [95% Confidence Interval]	Proportion of platoons	Measured Change [95% Confidence Interval]
Rigid 2-axle (<7.5 tonnes)	33.5%	59.8%	26.4% [22.7%, 30.0%]	52.0%	18.5% [14.9%, 22.1%]	45.5%	12.1% [8.5%, 15.6%]
HGV Rigid (mixed weights)	18.9%	30.6%	11.8% [11.0%, 12.5%]	28.9%	10.0% [9.2%, 10.8%]	26.2%	7.4% [6.5%, 8.2%]
HGV (>7.5 tonnes)	44.3%	41.6%	-2.8% [-3.6%, -2.0%]	38.9%	-5.4% [-6.3%, -4.6%]	35.5%	-8.8% [-9.7%, -8.0%]

However, the data also shows that around 26% of platoons in 2013 were led by HGVs (>7.5 tonnes), and this substantially exceeded their representation as a proportion of general traffic which was approximately 11-12%. This confirms the scope for alleviating platooning through increasing the speed limit for HGV >7.5t, which was one of the central rationales for the change.

The proportion of platoons led by (>7.5 tonnes) did not change substantially in 2015, immediately after the speed limit change; although it fell by approximately 3% compared with the baseline in subsequent years. Part of the reduction can be attributed to a 1% reduction in the representation of HGVs in this group as a proportion of general traffic in 2016, in comparison with the baseline situation. However, the emergence of more platoons being led by a range of vehicles due to the impact of traffic growth, could also have contributed particularly towards the end of the ex-post period.

An increase in the proportion of platoons led by rigid HGVs is noted, in both the 2-axle category, which was not subject to the speed limit, and the HGV Rigid (mixed weights) category which was partially subject to the change.

A plot of the data in Table 6-4, showing the proportion of platoons travelling at less than 50 mph for each leader type, is provided in Figure 6-4. Based on available data the proportion of those platoons with leaders in the HGV (>7.5 tonnes), that moved at speeds less than 50 mph, fell by 2.8% between 2013 and 2015 with further reductions in subsequent years. By contrast, the proportion of platoons with leaders in the rigid HGV classes which travelled at slow speeds increased between 2013 and 2015 by approximately 26% where the platoon was led by a 2-axle rigid HGV (exempt from the limit change) and by around 12% where the leader was a general rigid HGV (mixed weights). This is likely to be the impact of reduction in average speeds for vehicle groups not subject to the speed limit change, resulting in a higher proportion of the platoons forming behind them travelling at less than 50mph, and is a result of the ASCs.

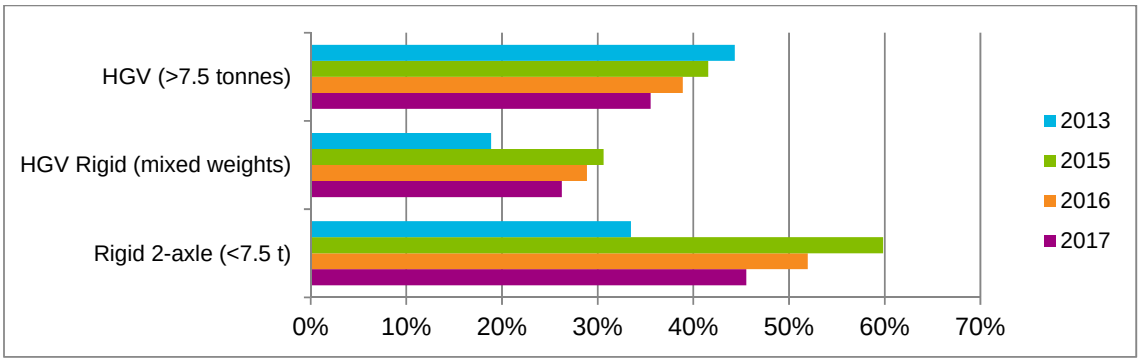


Figure 6-4 Change in the proportion of platoons travelling at 50 mph or less by leader vehicle type, single carriageways

6.3.4 Free-flow conditions vs platooning – The speed profiles

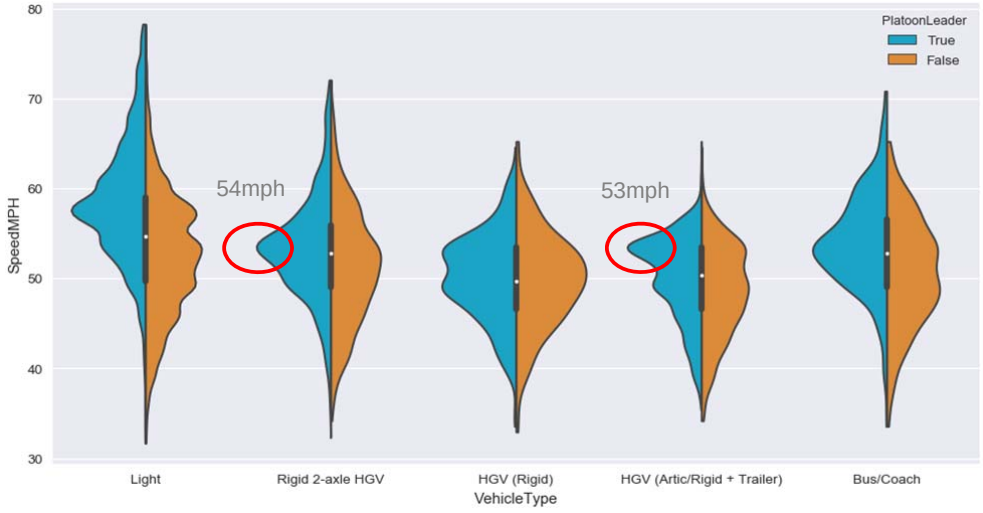
Figure 6-5 presents plots showing the impacts of the interventions on the speeds of vehicles travelling in a platoon compared with those vehicles that are unconstrained by traffic ahead, at Tomatin (site 104480). Similar plots for the remaining single carriageway sites are shown in Appendix B. The comparison of speed profiles for free-flow and platoon traffic permits conclusions regarding the consistency of flow conditions. It is also of relevance to the discussion of driver frustration as a result of platooning, as frustration arises in situations where the experience of drivers falls short of their expectation in terms of the conditions they would experience when unobstructed by other traffic. It should be noted that the "Platoon leader = False" category includes all vehicles whose behaviour represents "free flow conditions" i.e. all vehicles whose behaviour is unconstrained by traffic ahead, regardless of whether they are leading a platoon or otherwise.

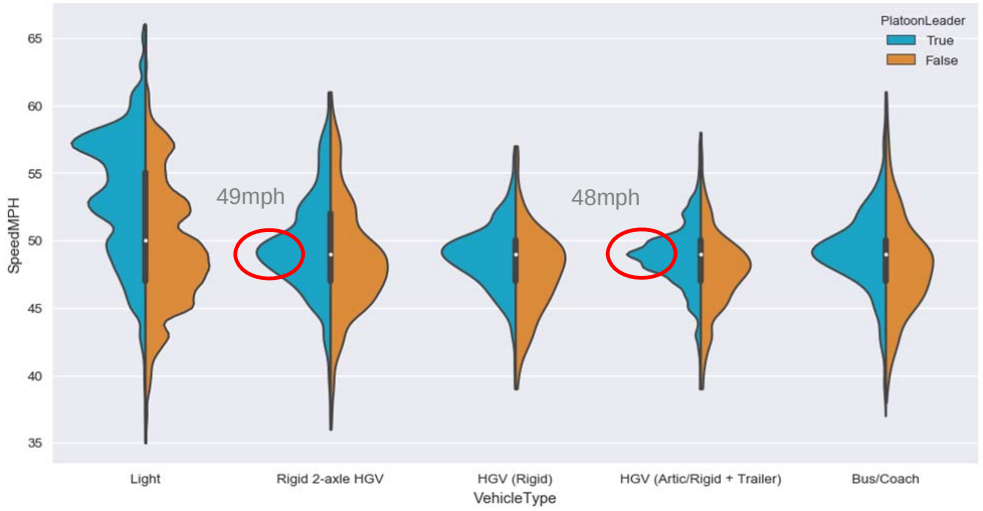
Based on the figures the following changes affected the distribution of vehicle speeds for HGVs over 7.5 tonnes, isolated by the HGV (Artic/ Rigid + Trailer) classes:

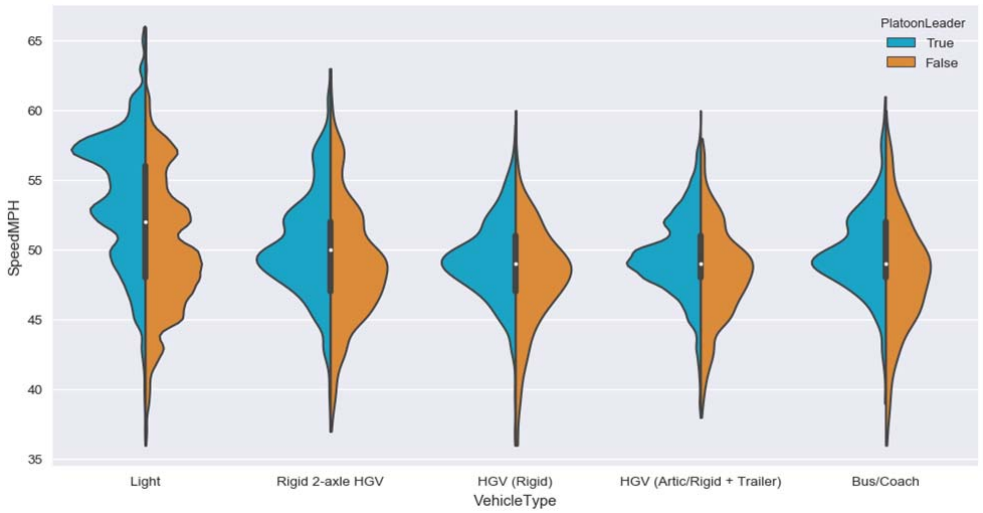
- The frequency distributions for both unconstrained vehicles and those travelling in a platoon have tightened at lower speed values i.e. the number of vehicles travelling below 45mph fell. This shows the impact of compliant vehicles travelling at faster speeds as a result of the speed limit change. Both vehicles travelling in platoons and under free-flow conditions benefited. However, the impact is more noticeable for vehicles travelling in free flow. The impact on frequencies in this speed range for Rigid 2-axle HGVs was marginal when travelling in free-flow, since this group was exempt from the limit change;
- The reduced range of observed speeds points towards more consistent flow conditions following the speed limit change, benefiting both those travelling in platoons and in free-flow;
- In 2015, the frequency distribution of free flow speeds (i.e. defined as platoon leaders in the analysis) peaked at approximately 48mph, around 5mph below the 2013 value. In free-flow condition the speed drivers most frequently choose to travel at had dropped below the legal speed limit of 50 mph, where before the change it was substantially above the legal limit at the time and indeed approximately 3mph above the new legal limit. This highlights the impact of the ASCs. Similar reductions were observed for Rigid 2-axle HGVs (<7.5 tonnes), which were equally affected by improved enforcement; and
- Review of similar plots across different sites, included in Appendix B, suggests that the distribution around and values of the peak frequency speeds for free-flow and platoon traffic looked much more similar in 2015 than in 2013.

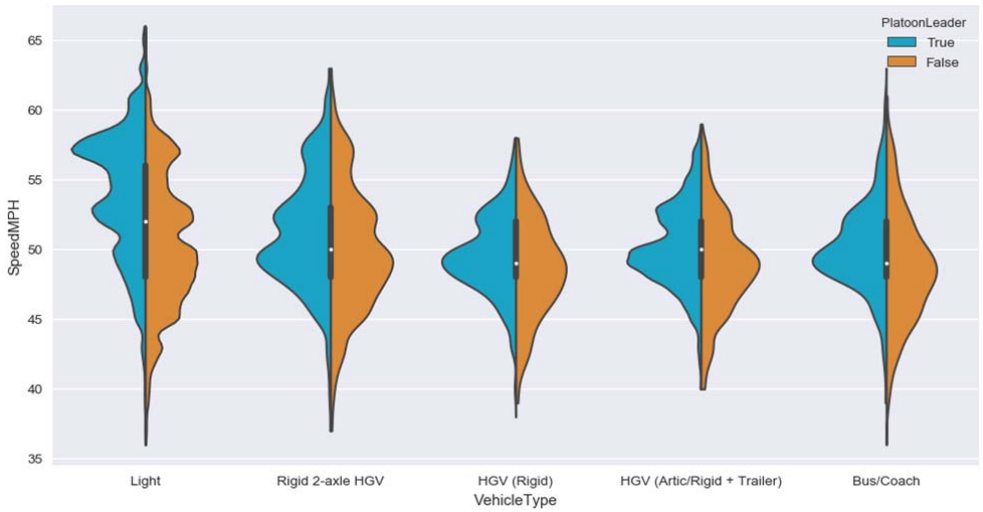
In 2016 and 2017 the top end of the speeds range for both unconstrained and platoon traffic increased slightly, and this is likely to be the result of drivers testing the limits of the enforcement regime.

Figure 6-5 Speed profile for vehicles travelling in platoon vs "unconstrained" vehicles, Tomatin (Site 104480), from top to bottom: 2013, 2015, 2016, 2017




PlatoonLeader
True
False
49mph
48mph
SpeedMPH
65
60
55
50
45
40
35
Light
Rigid 2-axle HGV
HGV (Rigid)
HGV (Artic/Rigid + Trailer)
Bus/Coach
VehicleType


PlatoonLeader
True
False
SpeedMPH
65
60
55
50
45
40
35
Light
Rigid 2-axle HGV
HGV (Rigid)
HGV (Artic/Rigid + Trailer)
Bus/Coach
VehicleType


PlatoonLeader
True
False
SpeedMPH
65
60
55
50
45
40
35
Light
Rigid 2-axle HGV
HGV (Rigid)
HGV (Artic/Rigid + Trailer)
Bus/Coach
VehicleType

6.4 Driver Frustration

One of the objectives of the introduction of the ASC system and 50mph speed limit for HGVs of over 7.5 tonnes was to reduce driver frustration, and relevant impacts are discussed in this section. The analysis presented in Section 5 identified benefits in terms of more consistent traffic flow, due to the reduction in the speed differential between HGVs of over 7.5 tonnes and general traffic. Under conditions where overtaking opportunities are restricted this may be expected to result in a reduction in platooning (as evidenced earlier in this section) and hence reduced driver frustration.

Transport Scotland commissioned Stated Preference Research to quantify the factors that impact on driver frustration, and the experimental study carried out in this context highlighted that frustration is closely linked to speed. The reduction of general traffic speeds due to ASCs on the A9 may therefore have the opposite effect and increase driver frustration. The research also highlighted statistically significant impacts on the frustration levels perceived by drivers due to the presence of ASCs. This section reviews the change in driver frustration following the introduction of the ASCs and HGV speed limit change, and investigates to what extent the changes can be linked specifically to changes in the speed of HGV traffic.

6.4.1 Evaluation question

The evaluation question and metrics used to quantify results and allow for comparison between ex-ante and ex-post data are shown below:

Evaluation Question	Metric or Approach
Q9. How have the levels of non-HGV driver frustration changed?	Driver frustration Value of time multiplier and contributory factors

6.4.2 Driver Frustration - Methodology

The stated preference driver frustration research explored the link between various platooning conditions and driver frustration, and hence quantified driver frustration in terms of Value of Time uplifts as perceived by car drivers. This work included:

- An experimental study, conducted by TRL in 2014 (and therefore before the A9 intervention), to investigate the factors that influence driver frustration; and
- A stated preference exercise to quantify the value that drivers place on frustration in order to provide relative Values of Time (VoT) or time multipliers for use in scheme evaluation.

The initial research identified three factors that impact on driver frustration:

- The presence of oncoming traffic (assessed based on a maximum average headway of 10 seconds in the opposite direction);
- The degree to which travel speed was below desired speed; and
- The number of HGVs in the platoon ahead.

Subsequent research highlighted statistically significant impacts associated with the number of cars in the platoon ahead and the presence of the ASC system. It should be noted that the research explored frustration perceived by light vehicle drivers only and that the concept applies to single carriageways only.

VbV data has been analysed to assess the change in driver frustration following the speed limit change. The assessment included single carriageway sites shown in Table 6-5 and Figure 6-6.

In the first instance, light vehicles travelling in a platoon were identified based on a headway of five seconds. For vehicles identifies as travelling in platoons, the following items were extracted from the data:

- Number of cars in the platoon ahead;
- Number of HGVs in the platoon ahead;
- Difference of vehicle speeds and desired speeds (assumed to be 60 mph); and

- Average headway in the opposite direction.

In line with the parameters defined in the application of the research to quantify driver frustration benefits for the A9 Case for Investment, value of time multipliers were applied based on the above items. These multipliers quantify driver frustration in terms of drivers' perception of the journey time uplift due to frustration.

As noted above, driver frustration is in part a result of platoon formation in locations where overtaking opportunities are restricted and as such is likely to be impacted by site specific characteristics. Care was therefore taken to ensure the assessment was undertaken on a site by site basis, at sites where data is available for the baseline and post-implementation period.

6.4.3 Driver Frustration - Results

Driver frustration was assessed based on available data at nine single carriageway sites for the ex-ante and ex-post periods, the results are shown in Table 6-5 and Figure 6-6. The values provided in the table represent the perceived journey time uplift due to driver frustration. Based on the analysis of the proportion of traffic travelling in platoons presented in Section 6.3.3, the prevalence of platooning decreased between 2013 and 2015, with the exception of the site near Moy. This would be expected to reduce driver frustration. However, the results suggest that driver frustration increased in the ex-post period, in comparison with the baseline. The contributory factors have been considered to explore the reasons for the increase and the results are provided in Figure 6-7. Key points are:

- Frustration perceived due to travelling below the desired speed (assumed to be the legal speed limit of 60 mph) is the largest contributor in the baseline period. This element of frustration increased in the ex-post in line with the reduction in general traffic speeds, due to the ASCs;
- The driver frustration stated preference research identified statistically significant frustration levels associated with the presence of ASCs, resulting in a substantial increase in driver frustration levels in the ex-post period;
- Changes in frustration due to the number of cars and HGVs ahead were small in magnitude although a reduction is noted at most sites in 2015. This may point to a reduction in platoon length; and
- The contribution of impaired overtaking opportunities due to the presence of oncoming traffic increased consistently. This contradicts the findings of the ASC After Market Research, which recorded a reduction in drivers feeling frustrated by the lack of opportunities to overtake, albeit based on a small sample of drivers. However, it may be the case that the perceived reduction recorded by the Market Research is related to a reduction in the perceived need to overtake due to a drop in the speed differential, which is not identified by the quantitative approach.

It should be noted that these observations describe driver frustration in general, and are not specific to platoons caused by HGVs.

Table 6-5 Change in Driver Frustration, single carriageway sections

Site	2013	2015	2016	2017
JTC00307 Killiecrankie	1.18	1.23	1.24	1.27
JTC00308 Calvine	1.17	1.24	1.24	1.24
JTC00310 Dalnaspidal	1.15	1.20	No data	No data
JTC00311 Dalwhinnie	1.16	1.23	No data	No data
JTC00352 Ralia	1.11	1.16	1.15	1.16
JTC00312 Kingussie	1.19	1.28	1.23	1.24
JTC00355 Kincraig	1.16	1.22	No data	No data
104480 Tomatin	1.17	1.25	No data	No data
JTC00368 Moy	1.10	1.19	1.19	1.19

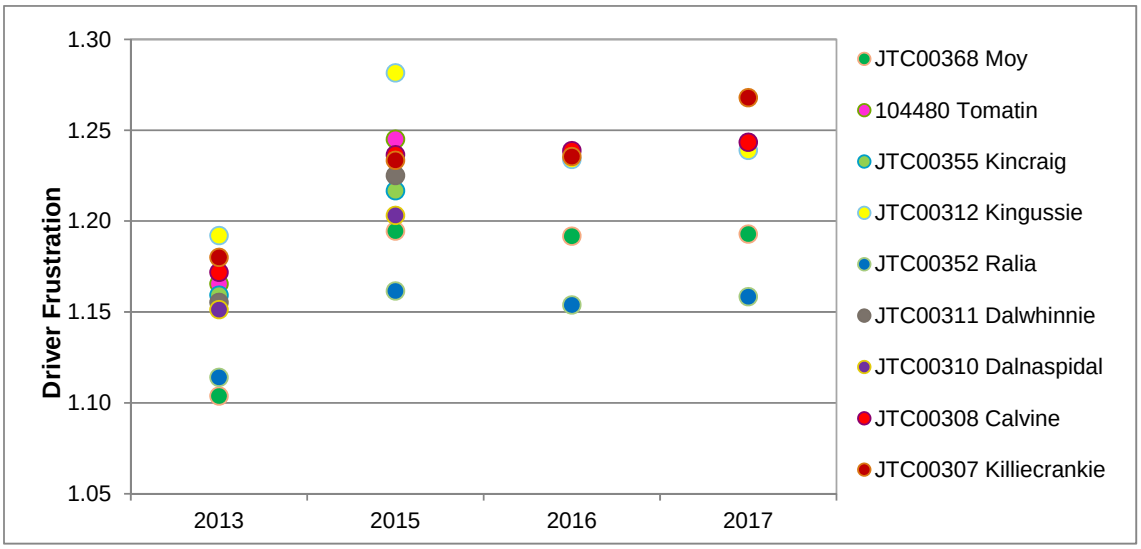
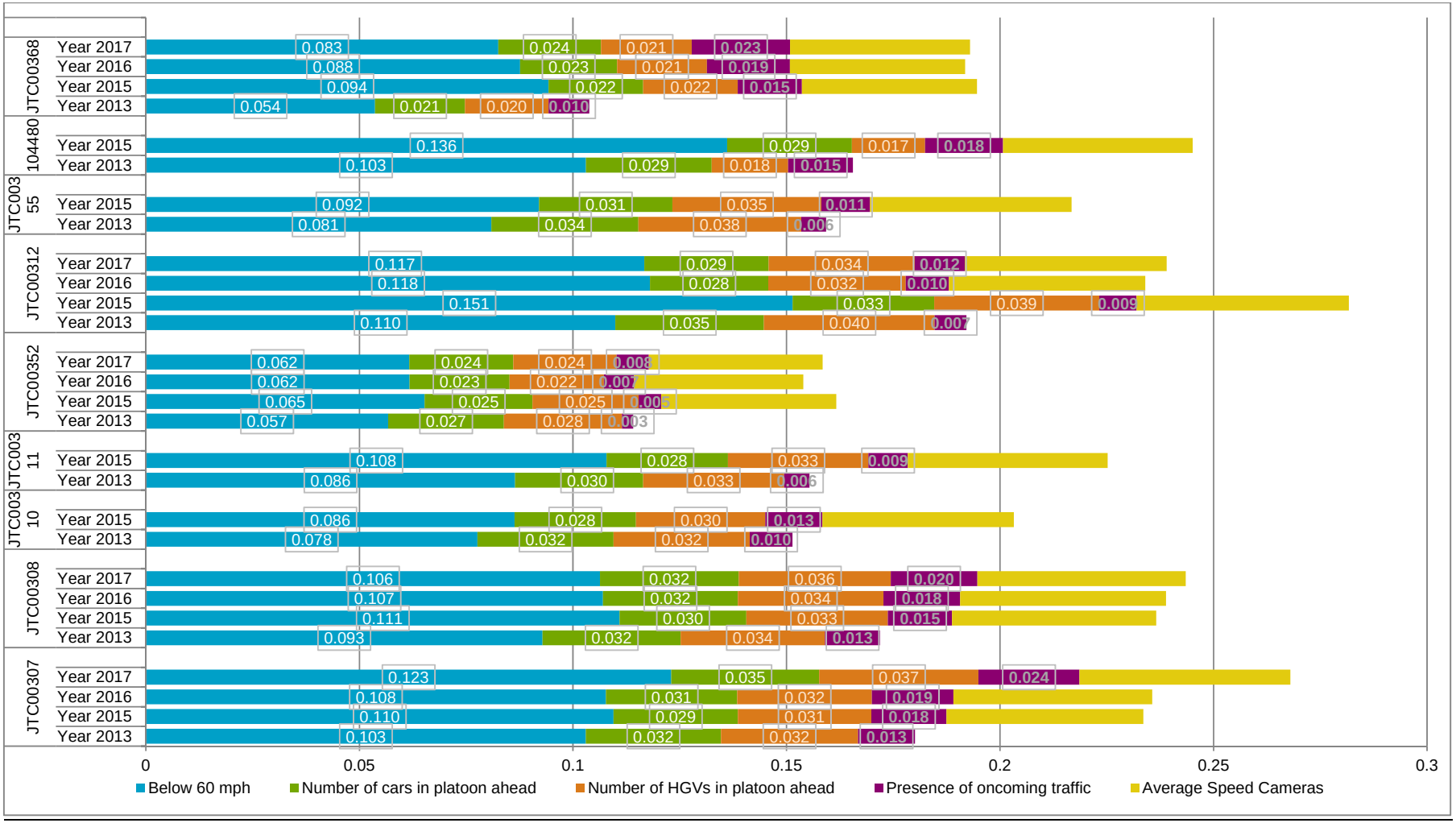


Figure 6-6 Change in Driver Frustration, single carriageway sections

Figure 6-7 Change in Driver Frustration Contributory Factors



6.5 Market research findings on the topic of driver behaviour

6.5.1 HGV drivers

In terms of HGV drivers' perspectives on driver behaviour on the A9 since the ASC and pilot speed limit increase were implemented, most felt it had improved. Many of the drivers felt that the speed cameras and the speed limit increase improve non HGV drivers' behaviour on the A9 and this in turn means their journey is a lot more straightforward.

> "It is better now. You get used to the speed cameras and the cars in the main adhere to the cameras. The speed limit change makes it much better though"

That said, some HGV drivers stated that you can upgrade any road, but you can never fully predict or prevent certain driver behaviour on any road.

> "You can upgrade the A9 but there will still be accidents due to driver behaviour"

In terms of driver frustration, most HGV drivers highlighted that it would be impossible to reduce driver frustration altogether on the A9 especially as sections are still single carriageways, and there are roadworks taking place to convert single sections to dual. This in turn affects traffic flow and journey time reliability.

However, all respondents recognised that overtaking by other vehicles had definitely reduced and this was considered to be due to a combination of the increase in speed limit for HGV drivers and a perception that some drivers wait for a dualled section before overtaking. This is a key finding in relation to the potential contribution of the intervention to improving safety on the route.

> "With the speed limit change, less maniacs overtaking the lorries now"

Many of the drivers felt that this must have reduced the number of accidents along the A9 as fewer drivers seem to be taking risks while overtaking.

> "I haven't seen the statistics but it must have brought the numbers down"

However a couple of the drivers pointed out that because the A9 is a mixture of single and dual sections, they had seen situations where they felt some non HGV drivers were confused as to whether they were in a dualled section or a single carriageway section and were hesitant about overtaking, especially at night.

> "Sometimes I think the change from single to dual is quite confusing, especially to the foreign driver"

A few of the drivers also noted that now a frustration of theirs is that sometimes they observe non-HGV drivers sitting in their cars at 40mph which in turn makes them frustrated as they cannot pass them that easily.

> "There's still some people, specifically older car drivers who still drive down at 40, which makes that frustrating for both non HGV drivers and HGV drivers"

Interviews with hauliers highlighted improvements in driver experience, with companies believing the A9 was generally less stressful for HGV drivers as there was less driver frustration amongst non-HGV drivers, and less risk-taking driving behaviour. Hauliers also echoed the issue of HGV drivers sometimes getting stuck now behind slow-moving non-HGV drivers. This can be an issue for fuel efficiency and journey times.

6.5.2 Non-HGV drivers

There was a mixed response from the non-HGV driver focus group participants regarding the ASCs and the effect on driver behaviour of both non HGV and HGV drivers. Some felt that the ASC deterred drivers from speeding whilst driving through the camera sections but then they sped up afterwards.

> "People won't work it like the average speed or whatever, they will just come to the last bit and then they put on the brakes and you are right into the cameras"

It was sometimes felt that the cameras cause drivers to bunch up together more, especially whilst going through the cameras as drivers are still frustrated and get too close to each other.

> "They drive too close to one another, maybe some chevrons on the road just spaces because what happens is that if someone gets up to 70mph and you are all at 70mph and you're all too close together"

Overtaking on the single carriageway sections along the A9 was something highlighted by most of the respondents as an issue. Participants felt that the ASCs give drivers less opportunities to overtake without going over the speed limit so drivers are more likely just to sit in the traffic flow and become frustrated at the car/vehicle in front.

> "And there's less point now because you can't go faster than the average speed"

Restricted overtaking opportunities contributed heavily to driver frustration on the A9 and respondents felt this was more common amongst non HGV drivers as they would get stuck behind HGV drivers and slow moving vehicles such as tractors or horse boxes.

> "No, I think since they put it up to 50 it's safer, when they are driving at 40 it was actually unsafe because people were driving too slow and people were getting frustrated and there was lines of traffic behind them and that's when people take chances"

Some respondents pointed out that sometimes it was quite difficult to know which part of the A9 was single carriageway and which part was dual, especially at night.

> "That's fine if you can see the dual, there's a good part of the A9 that all the other roads down here and roads up there where you can't see it"

> "And you keep thinking is this the bit that's dualled but you have to wait until you don't see any traffic go by, see cars passing you, then you know oh it's this bit, I'm fine. There should be a little more warning or signs"

6.6 Summary

This section has discussed the impacts of the ASC and HGV speed limit change on network operation and driver behaviour.

End to end journey times recorded in the ex-post period increased by 5 to 7% on average in comparison with the baseline. This is likely to be linked to a reduction in general traffic speeds due to improved enforcement. The discussion of traffic speeds in Section 5 suggested that the speed limit change resulted in only a marginal reduction in average speeds recorded for the affected HGV classifications, which had previously been non-compliant by around 10 mph, which is likely to have negligible impacts on overall journey times.

A substantial reduction in the number of unplanned incidents was recorded between the baseline and ex-post periods. However, on closer inspection of the dataset the reduction dates back to the first quarter of 2014 suggesting it may have been unrelated to the speed limit change.

Market research to assess changes in driver experience following the introduction of the ASCs and HGV 50mph speed limit indicated that drivers felt less pressurised as a result of reduced platooning, in general. Observed data confirmed that the proportion of traffic travelling in platoons did indeed reduce in 2015 in comparison with the 2013 baseline.

Analysis of platooning identified a large proportion (over 50%) of platoons led by light vehicles. These platoons are likely to be linked to general traffic conditions. However, the analysis also showed that around 26% of platoons in 2013 were led by HGVs in the Artic and Rigid with trailer categories, which were subject to the speed limit change, exceeding their representation in general traffic by 14-15%. The data shows that whilst the change in the proportion of platoon leaders made up by HGVs (>7.5 tonnes) varied across the ex-post years between no change and a reduction by 3%, there was a consistent reduction in the proportion of platoons led by vehicles in this category which were slow moving (defined as <50mph), by between around 3 and 9%.

Driver frustration quantified as a perceived journey time uplift, increased in the ex-post period despite the reduced prevalence of platoons following the implementation of the ASCs and 50 mph speed limit. Analysis of contributory factors showed that the increase was driven by three factors: the inclusion in the assessment of driver frustration of statistically significant frustration levels associated with the presence of Average Speed Cameras, which were identified by the Stated Preference Research that developed the methodology; an increase in frustration as a result of the reduced speed of general traffic; and an increase linked to reduced overtaking opportunities due to the presence of oncoming traffic.

In most locations a smaller reduction in relation to frustration due to the number of cars and HGVs ahead was identified, and this could point towards reduced platoon length. It should be noted that the changes identified are the combined impacts of the ASC introduction and HGV speed limit change.

It should also be noted that the quantitative approach does not permit isolating driver frustration as a result of slow moving HGVs. Some discussion of changes affecting frustration caused by this vehicle group were provided by the market research with A9 users, who voiced a mixture of views regarding the ASCs but generally appeared to feel that driver frustration due to slow moving freight vehicles had reduced alongside less risk-taking driver behaviour, although some issues unrelated to the interventions were highlighted, in particular in relation to variable road standards along the route. Moreover, participants in the ASC After Market Research, recorded a reduction in frustration due to the lack of opportunities to overtake, albeit based on a small sample of drivers. Potential reasons are highlighted by the discussion of the methodology for assessing driver frustration.

7. Outcomes – Road Safety

7.1 Introduction

Road safety was a central consideration in the introduction of the ASC system and HGV speed limit. The intention to achieve improvements in this area was emphasized by the objectives of the interventions which include commitment to "Reduc[ing] the number and severity of casualties" in the corridor. Whilst accident rates on the road have historically been below national averages, accidents are on average more severe and result in a higher proportion of fatalities. Figure 7-1 shows a comparison for the key trunk roads in Scotland of the proportion of collisions that resulted in fatalities during the baseline period and the ex-post period to 2016. The analysis demonstrates that prior to the ASC introduction the proportion of collisions on the A9 that were fatal (14%) was higher than on other trunk roads in Scotland. The data also suggests that substantial gains in terms of fatality reduction have been made on the A9 since (below 10% fatalities).

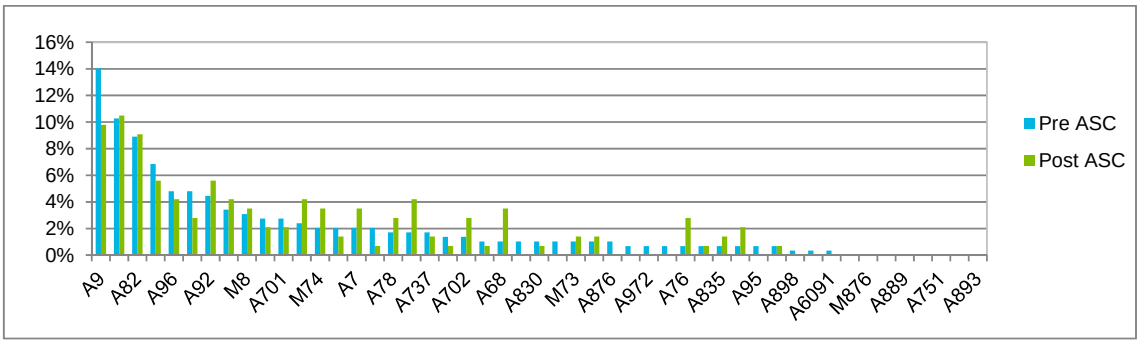


Figure 7-1 Proportion of fatal accidents by road, Impact of the ASC implementation and HGV speed limit reduction

The potential impacts on safety of introducing 50mph speed limits for HGVs in connection with the introduction of an ASC system on the A9 between Perth and Inverness were investigated by TRL[19] in 2014. The report undertook modelling to assess the potential impacts of two scenarios: the introduction of ASCs on single carriageway sections; and the introduction of ASCs together with an increase of the legal speed limit for HGVs of more than 7.5 tonnes. The analysis indicated that increasing the legal maximum speed for HGVs would limit the advances in terms of accident reduction made by the ASC implementation from between 3 and 9 to between 1 and 7 per year. The report also suggested that the speed limit increase would reduce the number of overtaking manoeuvres, and as a consequence the number of collisions associated with risky overtaking. This section considers to what extent the change in HGV speed limit has influenced the changes in road safety that were observed following the introduction of the ASCs.

The ASC monitoring[20] looked more closely at changes in road safety on the section between Perth and Inverness, highlighting the following improvements across all vehicle types, based on a comparison of annual averages representing the three-year period from 1st January 2011 to 31st December 2013 and from 1st November 2014 to 31st October 2017, for the ex-ante and ex-post periods respectively:

- The number of 'fatal and serious' collisions between Perth and Inverness is down by 10%, with 'fatal and serious' casualties reduced by over 32%, compared to the baseline; and
- The number of fatal collisions between Perth and Inverness fell by 20% with fatal casualties down by over 40%.

[19] Increasing the A9 HGV Speed Limit: Impact on Safety, TRL, 2014

[20] A9 Data Monitoring and Analysis Report, A9 Safety Group, March 2018

7.2 Evaluation questions

The following evaluation questions relating to safety were established during the scoping phase:

Evaluation Question	Metric or Approach
Q10. How has the level/occurrence of risky overtaking of HGVs changed: a. On single carriageway sections? b. On dual carriageway sections?	• Proportion of vehicles overtaking • Number of accidents involving overtaking manoeuvres
Q11. How has the incidence of road traffic accidents involving HGVs and not involving HGVs changed in terms of: a. Severity? b. Casualty numbers?	• Number of accidents; • Severity of accidents; • HGVs in accidents;

7.3 Results Road Safety

This section considers what impact the HGV speed limit increase and ASCs have had on the number and severity of accidents and casualties. To inform this analysis, collision data were provided by Transport Scotland in the form of STATS19 records. It should be noted that this dataset records personal injury accidents on public roads that are reported to the police only, and the terms “collision” or “accidents” was used accordingly in the following sections. Data was provided for the period between January 2010 and October 2017 and covered the A9 between Perth and Inverness.

Figure 7-2 shows the change in the number of collisions and Killed and Seriously Injured (KSI) accidents involving at least one HGV of over 7.5t recorded on the A9 between Perth and Inverness over the period between January 2010 and December 2016. Data to the end of December 2017, to allow presentation of annual statistics for 2017, was not available at the time of writing. Similar statistics of non-HGV accidents are given for comparison. Casualty statistics are provided in Figure 7-3. The figures show a steady reduction in the number of collisions and casualties in the pre-implementation period. For accidents not involving HGVs (>7.5 tonnes) this trend appears to level off in the post-implementation period. Collisions and casualty numbers involving HGVs > 7.5 tonnes continued to reduce in recent years, suggesting that the HGV speed limit may have had a beneficial impact on safety performance.

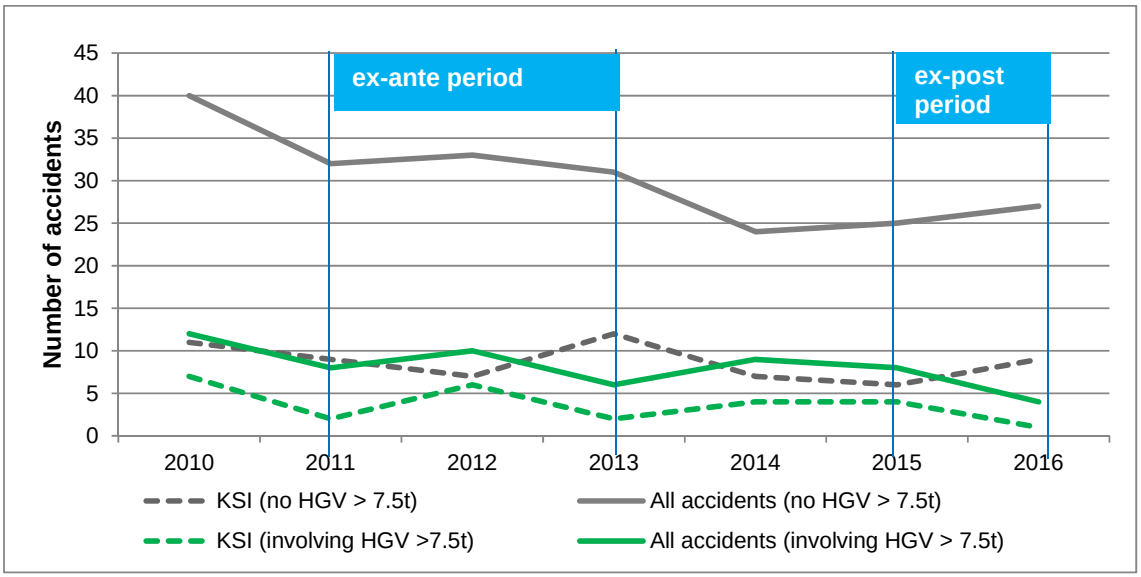


Figure 7-2 Change in number of accidents

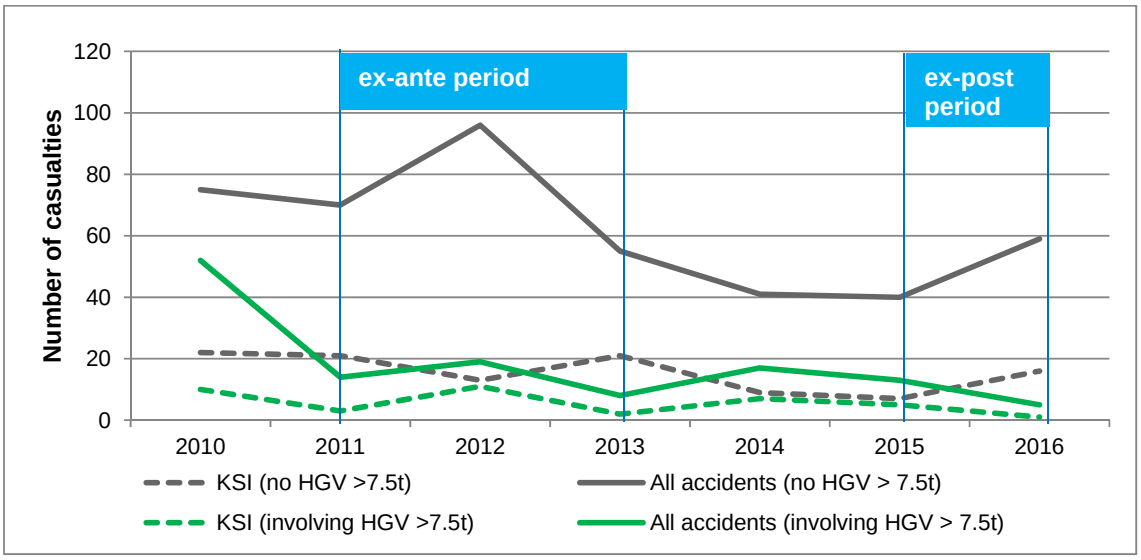


Figure 7-3 Change in number of casualties

7.3.1 Accidents

Data describing the change in the number of collisions by severity are shown in Table 7-1, presented as the annual average for both the baseline (2001-13) and ex-post (2014-17) periods; note that this is not the number of individuals killed, seriously injured or slightly injured but the number of accidents where such injuries were recorded. Overall, the average number of accidents fell by 7.7 between the baseline and ex-post periods, including a reduction of 2 accidents that involved an HGV of over 7.5 tonnes; there was an annual average of 8 in the baseline and 6 in the ex-post period. In percentage terms this represents a 25% reduction in the number of HGV accidents, compared with a 18% reduction for accidents not involving HGVS (>7.5 tonnes). These figures suggest a net reduction in HGV accidents by 7pp, once safety improvements equally affecting other vehicle groups have been excluded.

7.3.2 Accident Severities

In the ex-post period, on average 3.0 KSI accidents involving an HGV (>7.5 tonnes) occurred each year, a marginal decrease from 3.3 in the baseline period. The number of KSIs not involving an HGV (>7.5 tonnes) fell from 9.4 to 8. In percentage terms the percentage of KSIs as a proportion of accidents of all severities increased

from 42% to 50% for HGVs, a larger increase than in the statistic for other accidents, which changed from 29% to 30%. This suggests an increase in accident severity, although it should be stressed that the number of accidents fell in all categories. There are also some uncertainties associated with the conclusions due to the small sample size.

Table 7-1 Change in Personal Injury Accidents (by severity)

Indicator	Pre-Limit-Increase (Annual average of 2011-2013)	Post Limit-Increase (Annual average of 11/2014 - 10/2017)	Measured Change	Percentage Change
Number of accidents (Severity split)				
Fatal	5 (13%)	4 (12%)	-1 (0pp)	-20%
Serious	7.7 (19%)	7 (22%)	-0.7 (2pp)	-9%
Slight	27.3 (68%)	21.3 (66%)	-6 (-2pp)	-22%
Total	40.0	32.3	-7.7	-19%
% of accidents involving HGVs	20%	19%	-1pp	
Accidents involving HGVs >7.5 t (Severity split)				
Fatal	1.3 (17%)	2.3 (39%)	1 (22pp)	75%
Serious	2 (25%)	0.7 (11%)	-1.3 (-14pp)	-67%
Slight	4.7 (58%)	3 (50%)	-1.7 (-8pp)	-36%
Total	8.0	6.0	-2.0	-25%
Accidents not involving HGVs >7.5 t (Severity split)				
Fatal	3.7 (11%)	1.7 (6%)	-2 (-5pp)	-55%
Serious	5.7 (18%)	6.3 (24%)	0.7 (6pp)	12%
Slight	22.7 (71%)	18.3 (70%)	-4.3 (-1pp)	-19%
Total	32.0	26.3	-5.7	-18%

7.3.3 Casualties

Table 7-2 shows the change in the number of casualties by severity. The average annual number of casualties resulting from collisions involving an HGV of over 7.5 tonnes decreased by 5.7 between the baseline and ex-post periods, a reduction of 41%. This was compared to a reduction of 21.7 (29%) in casualties from other accidents. This resulted in a net decrease in casualties resulting from HGV (>7.5 tonnes) accidents of 12% in comparison to the change for vehicle classes that were not affected by the speed limit change.

Table 7-2 Change in casualties (by severity)

Indicator	Pre-Limit-Increase (Annual average of 2011-2013)	Post Limit-Increase (Annual average of 11/2014-10/2017)	Measured Change	Percentage Change
Casualties in all accidents (by severity)				
Fatal	7.3	4.3	-3.0	-41%
Serious	16.3	11.7	-4.7	-29%
Slight	63.7	44.0	-19.7	-31%
Total	87.3	60.0	-27.3	-31%
% of accidents involving HGVs	16%	13%	-2%	-15%
Casualties in accidents involving HGVs >7.5 t (by severity)				
Fatal	1.7	2.3	0.7	40%
Serious	3.7	1.0	-2.7	-73%
Slight	8.3	4.7	-3.7	-44%
Total	13.7	8.0	-5.7	-41%
Casualties in accidents not involving HGVs >7.5 t (by severity)				
Fatal	5.7	2.0	-3.7	-65%
Serious	12.7	10.7	-2.0	-16%
Slight	55.3	39.3	-16.0	-29%
Total	73.7	52.0	-21.7	-29%

7.4 National context

Data in this section must be viewed in the context of national trends. Data on accidents and road casualties in Scotland are published in the Road Casualties Statistical Bulletin[21]. The observed changes on the A9 have been compared with national figures in order to remove the impact of background trends and establish the net change due to the interventions.

The change in the number of accidents observed at national level has been compared with the observed changes on the A9 and the results are shown in Figure 7-4 and Table 7-3. Data detailing the number of accidents involving HGVs are not published separately and the comparison is therefore presented for all accidents.

7.4.1 Accident Severity

Figure 7-4 shows a comparison of the total number of accidents on the A9 between Perth and Inverness and for the whole of Scotland. To facilitate comparison of the trends the number of accidents has been indexed against 2010 values. The data indicates that the number of collisions on the A9 has decreased faster over the period between 2010 and 2016 than at the national level; data is available at the time of writing for 2017 for the A9 but not for Scotland. This trend appears to have been largely consistent throughout the ex-ante and ex-post periods, despite the observed traffic growth in recent years.

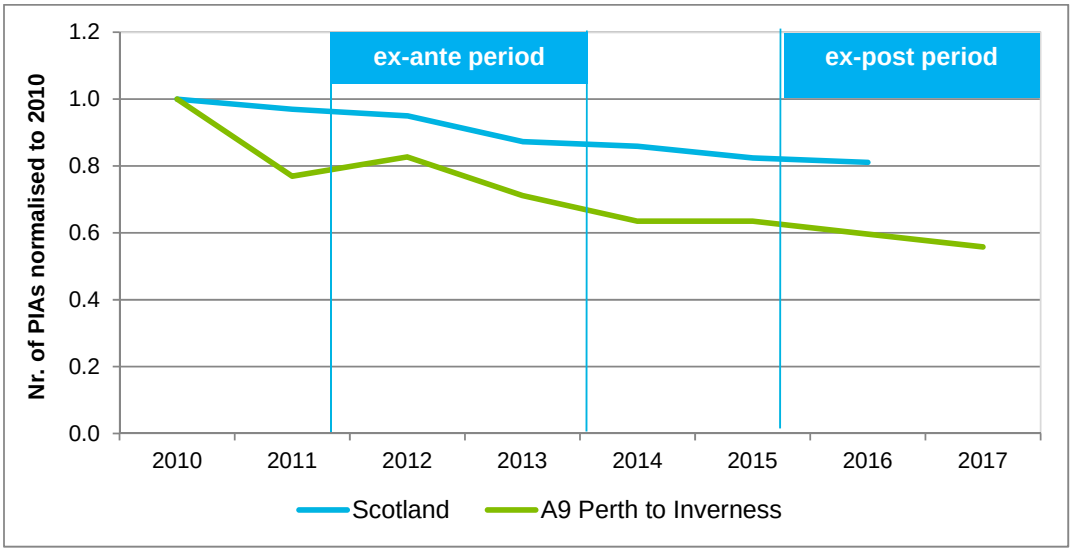


Figure 7-4 Comparison of A9 and national statistics, Change in the total number of accidents

[21] Statistical Bulletin, Transport Series, Key reported Road Casualties Scotland 2016, Transport Scotland, June 2017

Table 7-3 presents a comparison of the change in accidents by severity. Safety data for the A9 between Perth and Inverness suggest a larger decrease between the baseline and the ex-post periods than at national level. The calculated net decrease in accidents on the A9, when background changes in the number of collisions are removed was 6pp in 2015 and 10pp in 2016, compared with the baseline average. The results by severity show that the largest net gains were made in the fatal group.

These improvements are likely to be the result of the combined impact of the ASCs and HGV speed limit change. The consideration of impacts specific to accidents involving HGVs is not possible due to the lack of published analysis on accidents involving HGVs at national level.

Table 7-3 Comparison of A9 and national statistics, Net change in accidents by severity

Accidents by severity (Scotland)					
	Fatal	Serious	Fatal and Serious	Slight	All Severities
Baseline average 2011-2013	165	1,614	1,779	7,804	9,583
2015 total	157	1,420	1,577	6,903	8,480
2015 change to baseline	-8 (-5%)	-194 (-12%)	-202 (-11%)	-901 (-12%)	-1,103 (-12%)
2016 total	175	1,428	1,603	6,743	8,346
2016 change to baseline	10 (+6%)	- 186 (-12%)	-176 (-10%)	-1,061 (-14%)	-1,237 (-13%)
Accidents by severity (A9)					
Baseline average 2011-2013	5	8	13	27	40
2015 total	4	6	10	23	33
2015 change to baseline	-1 (-20%)	-2 (-22%)	-3 (-21%)	-4 (-16%)	-7 (-18%)
2016 total	4	6	10	21	31
2016 change to baseline	-1 (-20%)	-2 (-22%)	-3 (-21%)	-6 (-23%)	-9 (-23%)
Net change (A9 - Scotland)					
2015 % change	-15pp	-10pp	-10pp	-4pp	-6pp
2016 % change	-26pp	-10pp	-11pp	-10pp	-10pp

7.4.2 Casualty Numbers

A comparison of the change in casualty numbers on the A9 between Perth and Inverness and across Scotland was undertaken and the results are presented in Figure 7-5 and Table 7-4. Figure 7-5 shows a comparison of the change in the number of casualties recorded on the A9 between Perth and Inverness between 2010 and 2016, against Scotland wide data. Annual data have been normalised against 2010 figures to facilitate comparison of the trends. The results of a comparison by severity are shown in Table 7-4.

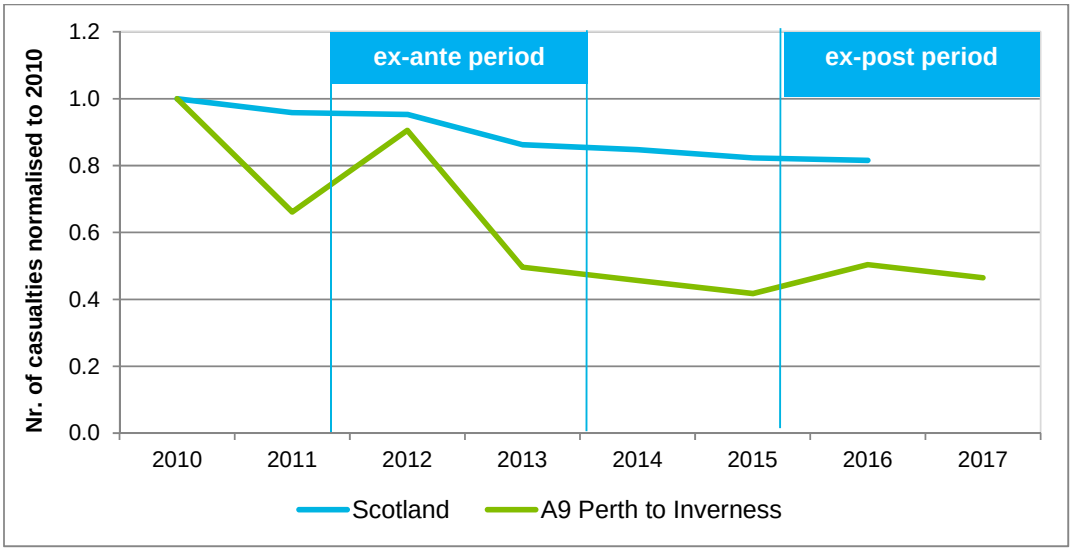


Figure 7-5 Comparison of A9 and national statistics, Change in the total number of casualties

Casualty reductions have been larger on the A9 than at national level. The net changes in casualties on the A9 when excluding national trends amounted to 28pp (2015) and 15pp (2016) in comparison with the baseline average. The fluctuations in the A9 statistics are likely to be linked to the small sample size. However, Figure 7-5 also suggests that a noticeable drop in casualties took place during the ex-ante period, and that the numbers have been fairly stable since 2013. Separate casualty statistics for accidents involving HGVs are not published at national level.

Table 7-4 Comparison of A9 and national statistics, Net change in casualties by severity

Number of casualties (Scotland)					
	Fatal	Serious	Fatal and Serious	Slight	All Severities
Baseline annual average 2011-2013	178	1,844	2,022	10,312	12,333
2015 total	168	1,600	1,768	9,206	10,974
2015 change to baseline	-10 (-5%)	-244 (-13%)	-254 (-13%)	-1,106 (-11%)	-1,359 (-11%)
2016 total	191	1,693	1,884	8,997	10,881
2016 change to baseline	13 (+7%)	-151 (-8%)	- 138 (-7%)	-1,315 (-13%)	- 1,452 (-12%)
Number of casualties (A9)					
Baseline annual average 2011-2013	7	16	24	64	87
2015 total	5	7	12	41	53
2015 change to baseline	-2 (-32%)	-9 (-57%)	-12 (-49%)	-23 (-36%)	-34 (-39%)
2016	4	13	17	47	64
2016 change to baseline	-3 (-45%)	-3 (-20%)	-7 (-28%)	-17 (-26%)	-23 (-27%)
Net change (A9)					
2015	-26pp	-44pp	-37pp	-25pp	-28pp
2016	-52pp	-12pp	-21pp	-13pp	-15pp

7.4.3 HGVs in accidents

The road casualties bulletin does not include summaries of accidents and casualties resulting from accidents involving HGVs. However, the bulletin includes details of KSI casualties by mode of transport, including statistics for Goods Vehicles (GVs). Whilst these statistics include all GVs, including LGVs and HGVs and do not include impacts on other transport users involved in GV accidents, they do provide some indication in the change in accidents involving HGVs. A comparison of the change in GV casualties on the A9 between Perth and Inverness and Scotland wide is shown in Table 7-5.

The data shows a reduction by one GV casualty in 2015 and in 2016 in comparison with the baseline average. This equates to a net reduction in GV KSI casualties 27pp (2015) and 30pp (2016) in comparison with Scotland-wide trends, indicating that the reductions in KSI casualties involving GVs may have outstripped national background trends.

Table 7-5 Change in KSI casualties by mode of transport (statistics for Goods Vehicles, including LGV and HGV

Change on baseline (Scotland)	
	KSI
Baseline average 2011-2013	68
2015	59
2015 change	-9 (-13%)
2016	61
2016 change	-7 (-10%)
Change on baseline (A9)	
Baseline average 2011-2013	3
2015	2
2015 change	-1 (-40%)
2016	2
2016 change	- 1 (-40%)
Net change (A9)	
2015	-27pp
2016	-30pp

7.5 Results – Risky Overtaking

Risky overtaking is a contributory factor to road traffic accidents. The observed reduction on general traffic speeds, and thereby the speed differential between light vehicles and HGVs, as well as the more consistent flow of traffic could lead to a reduction in the need for risky overtaking. This section considers this potential outcome of the intervention.

Participants in the ASC Market Research Before surveys recorded that a range of risky overtaking behaviours were commonly observed on the A9. Whilst the surveys were based on a small sample of drivers and are based on driver perception, the results suggest that these behaviours reduced following the introduction of the ASCs and speed limit change. The A9 ASC – "After" Market Research Report[22] notes the following increases in the number of respondents stating that they had never seen specific risky overtaking manoeuvres on their most recent journey on the A9:

- Overtaking when risky (4% to 13%);
- Other drivers being cut up (2% to 19%);
- A vehicle being tailgated (4% to 14%);
- Road rage or aggressive behaviour (6% to 19%); and
- Vehicles failing to complete an overtaking manoeuvre (4% to 14%).

[22] A9 Average Speed Cameras – "After" Market Research, AECOM, March 2015

The surveys also recorded an increase in the proportion of drivers who said they never overtake when travelling on the A9 on single and dual carriageway sections and a decrease in the number of drivers who abandoned overtaking manoeuvres or felt frustrated by the lack of overtaking opportunities. This section summarises data analysis undertaken to verify and quantify these impacts based on available data, and investigate to what extent they specifically implicate changes in overtaking involving HGVs.

7.5.1 Overtaking surveys

Automatic Number Plate Recognition surveys to assess the frequency of overtaking manoeuvres on the A9 were undertaken in May 2013 and April 2015. Overtaking was assessed by recording the vehicle's position in relation to other vehicles within its proximity. Registering the vehicle's number plate at the entry and exit point of the monitoring site allowed an estimate of the number of overtaking manoeuvres that occurred, by reviewing the changes in position between the two points.

Whilst the results of the surveys provide some additional context to aid the understanding of the impact of changed overtaking behaviour on road safety following the implementation, some caveats should be noted:

- The overtaking surveys were commissioned to understand overtaking behaviour on sections of the A9 where barriers to overtaking such as reduced visibility through road geometry and other factors is minimal. Overtaking accidents often occur in locations where this is restricted. However, the results of the surveys illustrate general changes in the incidence of overtaking where this is unrestricted, during the pre-and post-implementation period; and
- The surveys provide a single day snapshot of overtaking only and variations in conditions on the day, such as traffic flows and the weather, may have had substantial impacts on the results.

The surveyed change in the proportion of traffic overtaking is summarised in Table 7-6; represent overtaking behaviour between 10:00 and 16:00. The survey results are in line with the driver perceptions recorded during the ASC "After" Market Research which suggested that overtaking reduced on both the single and dual carriageway sections. The magnitude of the reduction ranged between 2pp and 10pp depending on the site and direction of travel, although the above caveats regarding the representativeness of the data apply.

Table 7-6 Change in proportion of traffic overtaking

	Observed proportion of traffic overtaking		
Site	**Pre Limit increase (2013)**	**Post Limit Increase (2015)**	**Change**
Crubenmore D2 NB	66%	56%	-10pp
Crubenmore D2 SB	61%	58%	-3pp
Ralia Straight S2 NB	20%	11%	-10pp
Ralia Straight S2 SB	16%	8%	-8pp
Insh WS2 +1 NB	44%	42%	-2pp
Ralia WS2 +1 SB	58%	51%	-6pp

7.5.2 Overtaking accidents

This section investigates to what extent the suggested reduction in overtaking, particularly risky overtaking behaviours, resulted in safety improvements. The change in overtaking accidents was analysed, and the results are summarised in Table 7-7. For the purposes of this analysis, overtaking accidents were defined as accidents involved in the following manoeuvres identified within the STATS19 dataset:

- Overtaking on nearside;
- Overtaking a stationary or moving vehicle on its offside; and
- Going ahead other.

It should be noted that in order to ensure consistency in the presentation of results by road type, accidents which occurred on the section of the A9 between Kincraig and Dalraddy were excluded as this section was upgraded to dual carriageway during the analysis period.

The average annual number of accidents involving overtaking behaviours reduced in the ex-post period, by 2.7 and 3.7 collisions for accidents involving HGVs of over 7.5 tonnes and other accidents respectively. In percentage terms the decrease for HGVs of over 7.7 tonnes (35%) outstripped the equivalent figure for other accidents (15%) by 20pp. Looking at single carriageway sections only the net reduction in HGV accidents involving risky overtaking was 27pp once reductions in overtaking accidents affecting vehicle groups which were not affected by the speed limit change are removed. This could point towards benefits resulting from the speed limit increase, however, some caution is advised to account for the potential impact of year on year fluctuations due to the small sample sizes.

Table 7-7 Accidents involving HGVs>7.5 tonnes – incidence of overtaking manoeuvres[1]

Indicator	Pre-Limit-Increase (Annual average 2011-2013)	Post Limit-Increase (Annual average 11/2014-10/2017)	Measured Change	Percentage Change
All accidents involving HGVs >7.5 tonnes				
Number of overtaking accidents p.a.	7.7	5.0	-2.7	-35%
All accidents not involving HGVs >7.5 tonnes				
Number of overtaking accidents p.a.	24.7	21.0	-3.7	-15%
Single carriageway (accidents involving HGVs >7.5 tonnes)				
Number of overtaking accidents p.a.	6.7	4.0	-2.7	-40%
Single carriageway (accidents not involving HGVs >7.5 tonnes)				
Number of overtaking accidents p.a.	18.7	16.3	-2.3	-13%
Dual carriageway (accidents involving HGVs >7.5 tonnes)				
Number of overtaking accidents p.a.	1.0	1.0	0.0	0%
Dual carriageway (accidents not involving HGVs >7.5 tonnes)				
Number of overtaking accidents p.a.	6.0	4.7	-1.3	-22%

[1] Results exclude accidents on the section of the A9 between Kincraig to Dalraddy as this was dualled during the analysis period.

7.6 Summary

This section has discussed the potential impacts of the HGV speed limit change and ASC on road safety. Intentions to improve road safety were emphasized by the objectives of the ASC and HGV speed limit change, which included commitment to “Reduc[ing] the number and severity of casualties” in the corridor.

A TRL investigation into the potential safety impacts of raising the speed limit suggested that this would reduce gains in terms of collisions reduction made due to the introduction of the ASC system by approximately 2 collisions per year. However, the study also suggested that the number of collisions associated with risky overtaking behaviours would fall.

In the event, the data analysis presented in this section, suggested that the HGV speed limit change and ASC may have resulted in improvements. The annual average number of collisions fell by 7.7, including a reduction by 2 in accidents involving HGV (>7.5t). This resulted in a net reduction in HGV (>7.5t) accidents of 7pp once safety improvements equally affecting other vehicle groups have been excluded; similarly casualties resulting from these accidents decreased by an average 5.7 or 41% compared with a 29% reduction for other vehicle classes.

Analysis of severities concluded that the annual average number of KSI accidents which involved HGVs of over 7.5 tonnes reduced, from 3.3 in the baseline period to 3 and from 9.4 to 8 for other accidents.

Safety statistics on HGV involvement in accidents were not available at Scotland level, however published data on casualties by vehicle type includes statistics for Goods Vehicles (GV). Whilst these statistics include all Goods Vehicles including LGVs and HGVs in all weight classes, they provide some indication of the involvement of HGVs in accidents. Net reductions in KSI casualties amongst GV drivers and passengers in comparison with

national figures also hint towards safety improvements for GVs on the A9 once the impacts of national trends in road traffic growth have been discounted, although statistics of the impacts of GV accidents on other road users were not available at national level. However, due to the small sample sizes involved in the period considered these results must be considered provisional.

The identified safety improvements are consistent with user perceptions recorded during the market research, which highlighted perceptions that there have been less casualties and that there was less press coverage of safety issues on the A9. In summary, lifting the HGV speed limit to 50 mph has not resulted in the expected squeeze on the ASC related safety improvements, and progress in terms of casualty reductions are noted in all severity categories, although advances in accident severity remain a priority.

The ASC “After” Market research documented the result of driver surveys which suggested that the incidence of a range of risky overtaking behaviours, including other drivers being cut up, tailgating, aggressive behaviour and failure to complete overtaking manoeuvres decreased following the ASC introduction. The surveys also recorded perceived reductions in general levels of overtaking. These perceptions confirmed by the result of snapshot overtaking surveys which recorded a reduction between 2pp and 10pp depending on location, at sites including WS2+1, single and dual carriageway sections.

Analysis of STATS19 data suggests that the changes in overtaking behaviour translated into safety improvements, resulting in a reduction of collisions involving dangerous overtaking manoeuvres by 2.7 and 3.7 collisions p.a. for accidents involving HGVs (> 7.5 tonnes) and those exclusively involving other vehicle group, respectively. In percentage terms this equates to a larger reduction in accidents involving HGVs of over 7.5 tonnes (35%) than in other accidents (15%). Caveats due to the sample size apply. However, on balance the data analysis bears out the expected reductions in risky overtaking behaviour.

8. Outcomes – Wider Impacts

8.1 Introduction

This section explores any wider impacts of the HGV 50mph pilot on the A9. Through telephone interviews with hauliers and discussions with HGV drivers, the topic of operational impacts was explored. Inferred economic and environmental impacts are also discussed through the observed changes on indicators discussed in sections 5 to 7 above.

8.2 Evaluation questions

The evaluation questions explored in this section are shown below.

Evaluation Question	Metric or Approach
Q12. How has HGV fleet management procedures changed in terms of a. Routing? b. Scheduling? c. Driver rest periods?	Qualitative feedback through market research
Q13. What are the longer term impacts of the pilot in terms of: a. Economic benefits? b. Environmental benefits?	Qualitative feedback through market research Inference from outcomes

8.3 Operational impacts on hauliers' business

Whilst all hauliers spoken to stated that they perceived it likely they had saved time on their end-to-end journey on the A9 Perth to Inverness, the scale of this journey time saving varied in terms of estimates – from 10 minutes to half an hour. One haulier was confident they had been able to build more deliveries into their day through time savings on this route, due to much of their travel being between the Highlands and the Scottish Borders. Another who carried livestock noted that the travelling time for their operation was not their biggest time pressure, with the loading and unloading of stock at their destination being the bigger pressure. Conversely, one haulier stated that whilst they had seen journey time improvements during the day, their vehicles were taking slightly longer overnight due to the scheme changes on the A9.

One haulier noted however that any time savings due to the pilot may have been affected by disruption linked to the ongoing dualling programme on the A9 and associated traffic management.

Some who operated vehicles across both England and Scotland stated it would be difficult to calculate any impact of the HGV 50mph pilot on their fleet as the same vehicles travelled across multiple road networks with differing speed limits. All hauliers spoken to used mainly motorway or A roads.

All hauliers reported more consistent driving conditions on the A9 since the speed limit increase was introduced, and noted that their vehicles tended to operate more efficiently driving at 50mph compared to 40mph. One haulier stated that it was a challenge for a truck to stay at 40mph and the driver would struggle to drive in top gear in such conditions, which affects fuel efficiencies.

The Road Haulage Association had suggested that hauliers may be running higher-cost vehicles on the A9 (Euro 6) due to more efficient driving conditions. Discussions with hauliers for this research stated a general move towards newer, cleaner engines within the industry as a whole.

8.4 Indirect impacts on haulage industry

A theme that emerged from conversations with hauliers was the improvement of relations with the public and communities on-route. Several hauliers noted that they had received less complaints from the driving public in recent years on the A9 due to their vehicles being able to drive at a slightly higher speed. They perceived that they were less involved in leading slow platoons which has previously led to complaints (and at times aggressive behaviour) from the public.

The Road Haulage Association also noted that the schemes on the A9 Perth to Inverness had improved relationships between the haulage industry and government and local authorities. The HGV 50mph pilot was a welcomed change, and it was felt that this had built a level of goodwill in dealings with government that had benefitted other working areas.

The topic of less stressful driving conditions was a common theme in discussions with hauliers and HGV drivers, and whilst difficult to quantify, this would be regarded as a mental health benefit to an extent.

One haulier suggested the difference in speed limits for HGVs between England and Scotland on A-roads was potentially a distortion in the marketplace and offered an unfair competitive advantage to hauliers operating mainly on non-Scottish roads. The issue of differential speed limits between England and Scotland was also raised as a concern by the Freight Transport Association in terms of potential confusion amongst drivers not used to the network (e.g. originating from Europe).

The Freight Transport Association, who represent both road and rail freight in the UK, suggested there was no evidence that the HGV 50mph pilot had led to any transfer of rail freight to road during the scheme period.

8.5 Environmental Impacts

It is possible that the enhanced efficiency of flow and more consistent average speeds for HGV drivers has led to fuel efficiency which has environmental benefits in terms of fuel used. This is purely anecdotal however and no quantitative data on fuel efficiency has been available in this study.

9. Synthesis of Evidence

9.1 Introduction

This final section draws together the evidence of change and associated outcomes across all indicators assessed in this study. It also considers the issue of scheme acceptance, and how this may have changed over time.

9.2 Synthesis of evidence across all indicators

The logic map initially designed to guide this evaluation has been updated to demonstrate actual/observed outcomes from the interventions evaluated in this study (Figure 9-1).

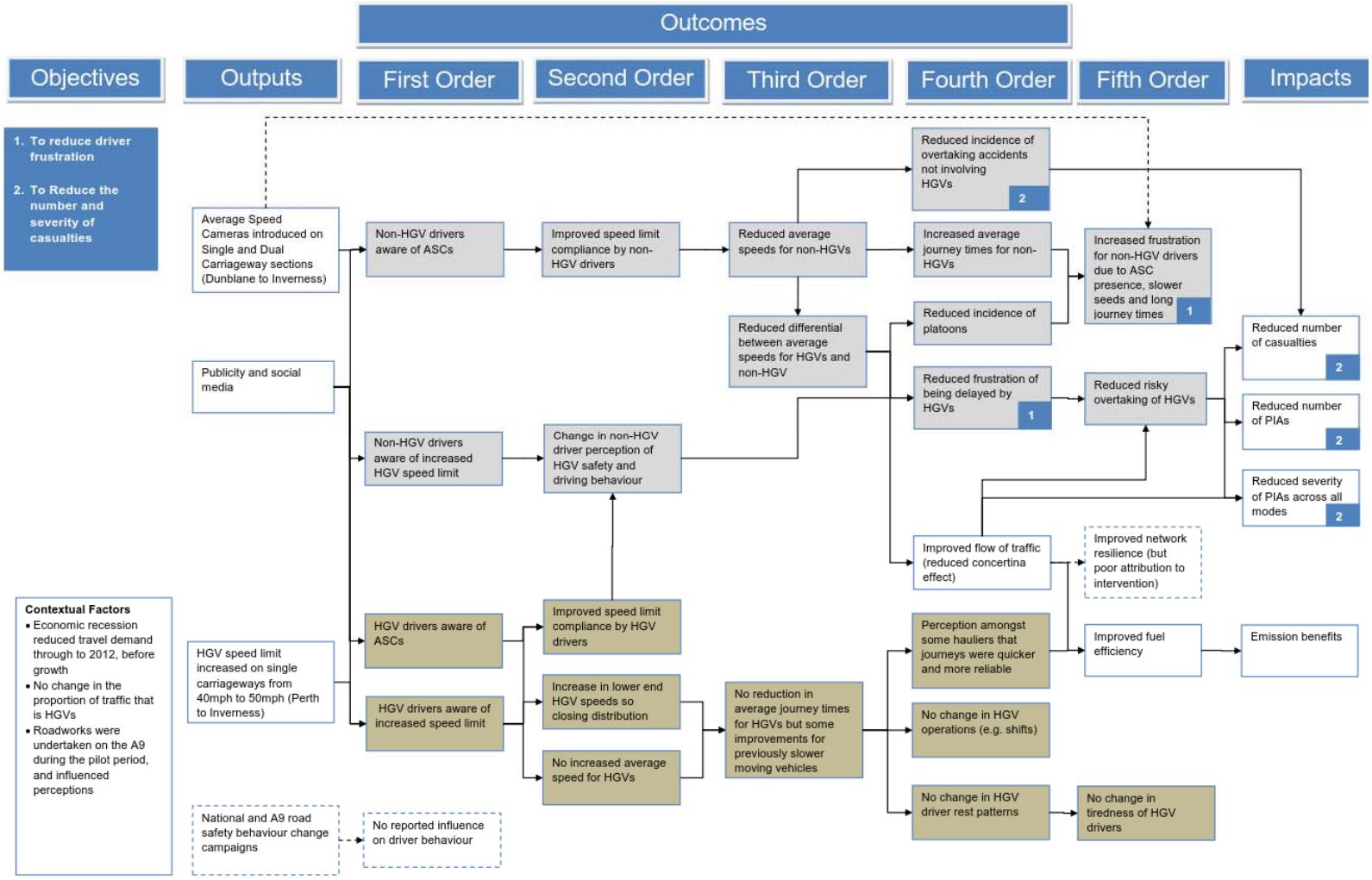


Figure 9-1 Outturn Logic Map

9.3 Acceptance of the scheme

Whilst not a specific evaluation question, the theme of acceptance of the scheme emerged strongly through the market research for this study. Organisations involved in the freight and haulage industry showed a high level of acceptance of the HGV 50mph pilot on the A9 prior to its implementation, with the Road Haulage Association and the Freight Transport Association both seeing it as a positive move. The Road Haulage Association had lobbied for some time to increase the speed limit on the A9 to 50mph and so was very supportive of the trial. Hauliers engaged with also welcomed the scheme. The Freight Transport Association had some initial concerns over how the A9 pilot would be managed and enforced on the A9, and how awareness of the scheme would be achieved. However, they were content that the ASC fulfils the role of enforcement and significant effort by the Police and Transport Scotland and other organisations had enhanced awareness.

There were mixed levels of acceptance of the need for ASCs on the A9 from organisations and individuals interviewed in the research. Some hauliers welcomed it as a means to reduce risk-taking driving behaviour from the general public which put their drivers under stress, whilst others questioned whether it was needed. The Federation of Small Businesses expressed concerns about the introduction of the ASC system on the A9 prior to its implementation, citing slower average speeds, more platoons and risk-taking driving behaviour. These fears have largely been allayed post-implementation however.

On the whole, the level of acceptance of ASCs across all participants of the research seems to have risen since their implementation as people have observed benefits of more consistent driving conditions.

It was suggested at the A9 Safety Group discussion that the perceived success of the ASC system on the A9 has paved the way for the introduction of the ASC system on other routes in Scotland including the A90, though this view may vary by audience. It should be noted that ASCs were already in place on the A77 prior to the A9, but have since also been put in place on A90.

Appendix A Market Research – supporting information

A.1 Methodology

The qualitative research gathered the views of user groups as follows:

- Mini-focus groups with HGV drivers ;
- Focus group with non HGV drivers; and
- Face to face depth interviews with HGV drivers.

Two mini-focus groups were undertaken with HGV drivers at a central location in Perth and a series of face to face depth interviews were undertaken with HGV drivers at Ballinluig Truck Stop on the A9 between Perth and Inverness. In total, 16 truck drivers participated across the two locations.

A further focus group of six respondents was undertaken with non-HGV drivers who use part of or all of the A9 between Inverness and Perth to:

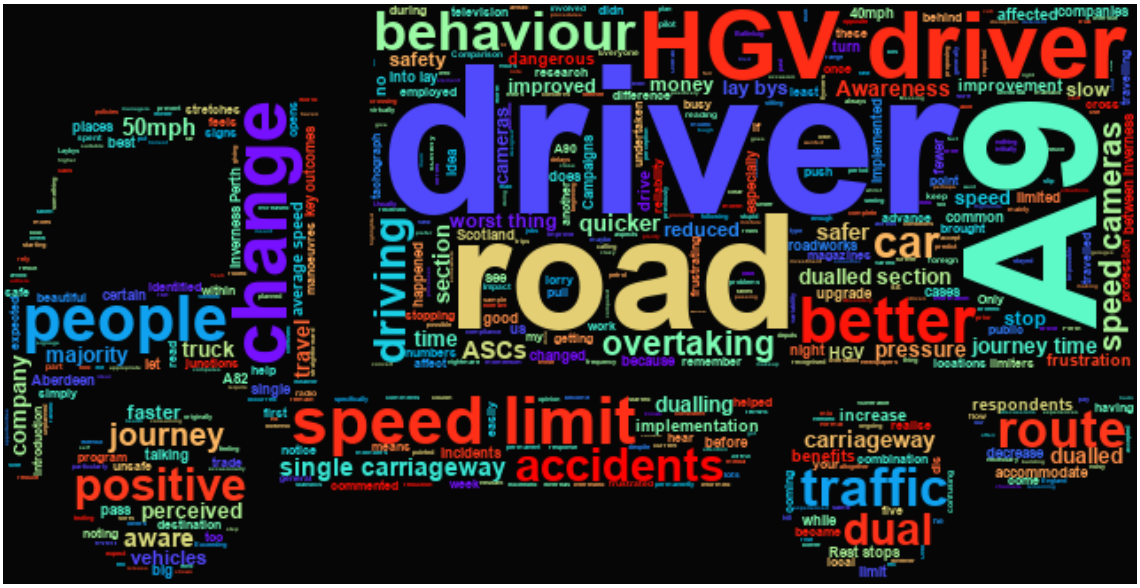
- establish levels of awareness of the speed limit changes on the A9;
- establish awareness of and the impact of the average speed cameras on the A9; and
- understand the impact of the continued program of dualling of the A9.

The research programme also included four telephone depth interviews with logistical and operational management at Hauliers who transport items on the A9 between Inverness and Perth to understand the implications on the business as a result of the developments on the A9.

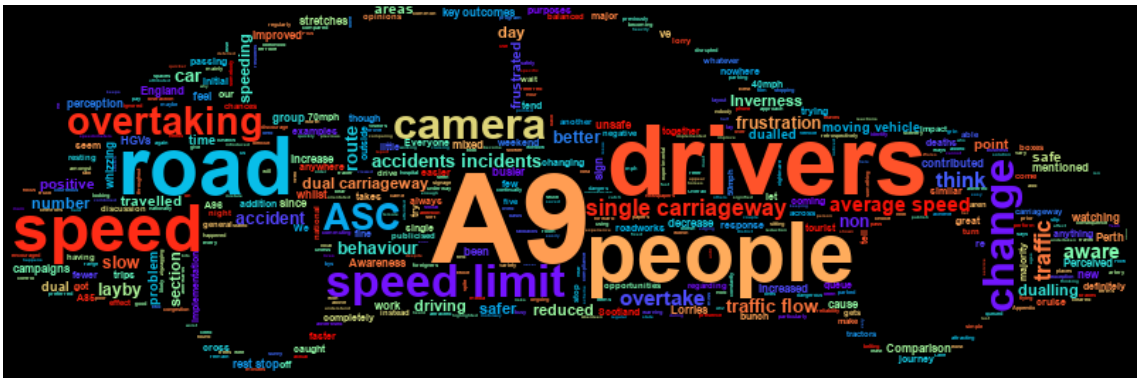
A short screening survey was used to ensure HGV drivers were in scope for the research:

- Drivers of vehicles of 7.5 tonnes or over;
- Used the A9 over the sections where ASCs and speed limit changes had been implemented;
- Had used the A9 before the changes were implemented.

Similarly for the non-HGV group, respondents were in scope if they had used the A9 more than 3 years ago as well as currently and had driven on both singles and dual carriageway sections. They also must have used other single carriageways roads in Scotland. Quotas were set to ensure a mix of drivers using the A9 for business/leisure, time critical/not time critical trips, employed/not employed, male/female, and a range of age groups.



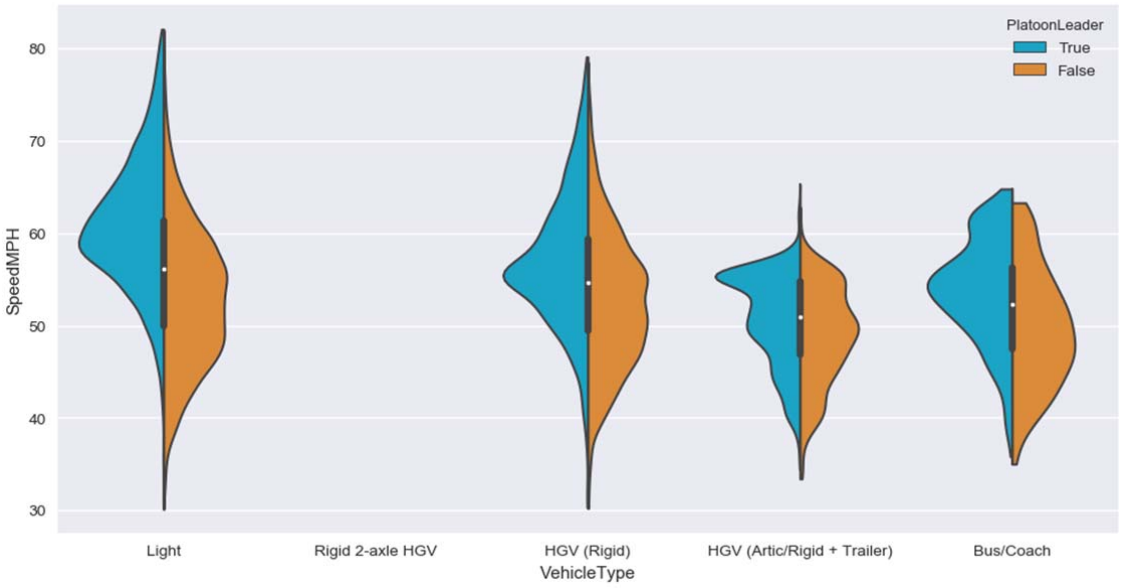
Wordcloud from engagement with HGV drivers

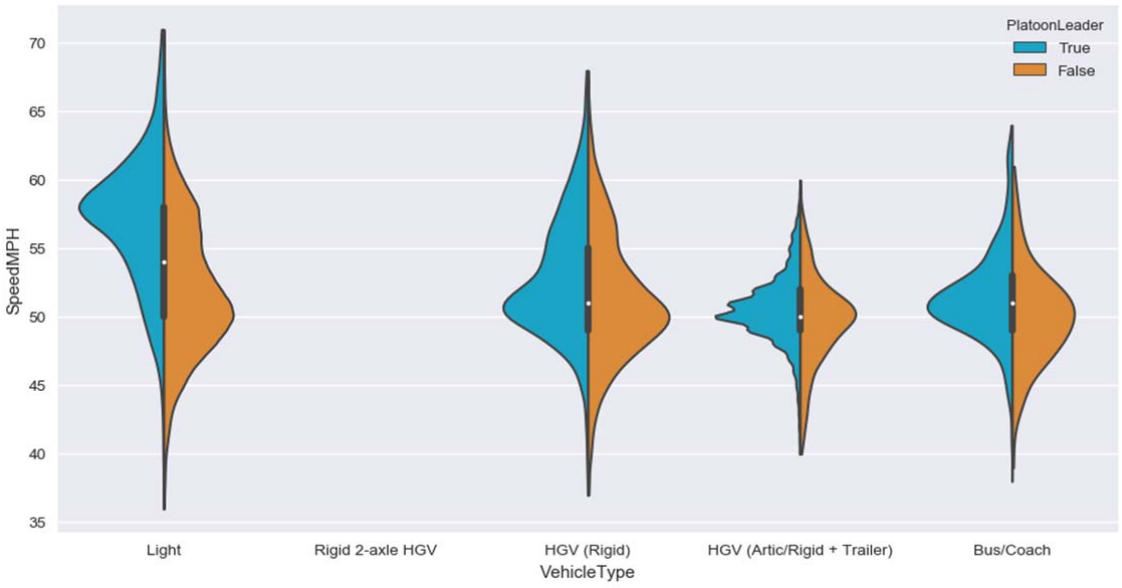


Wordcloud from engagement with non-HGV drivers

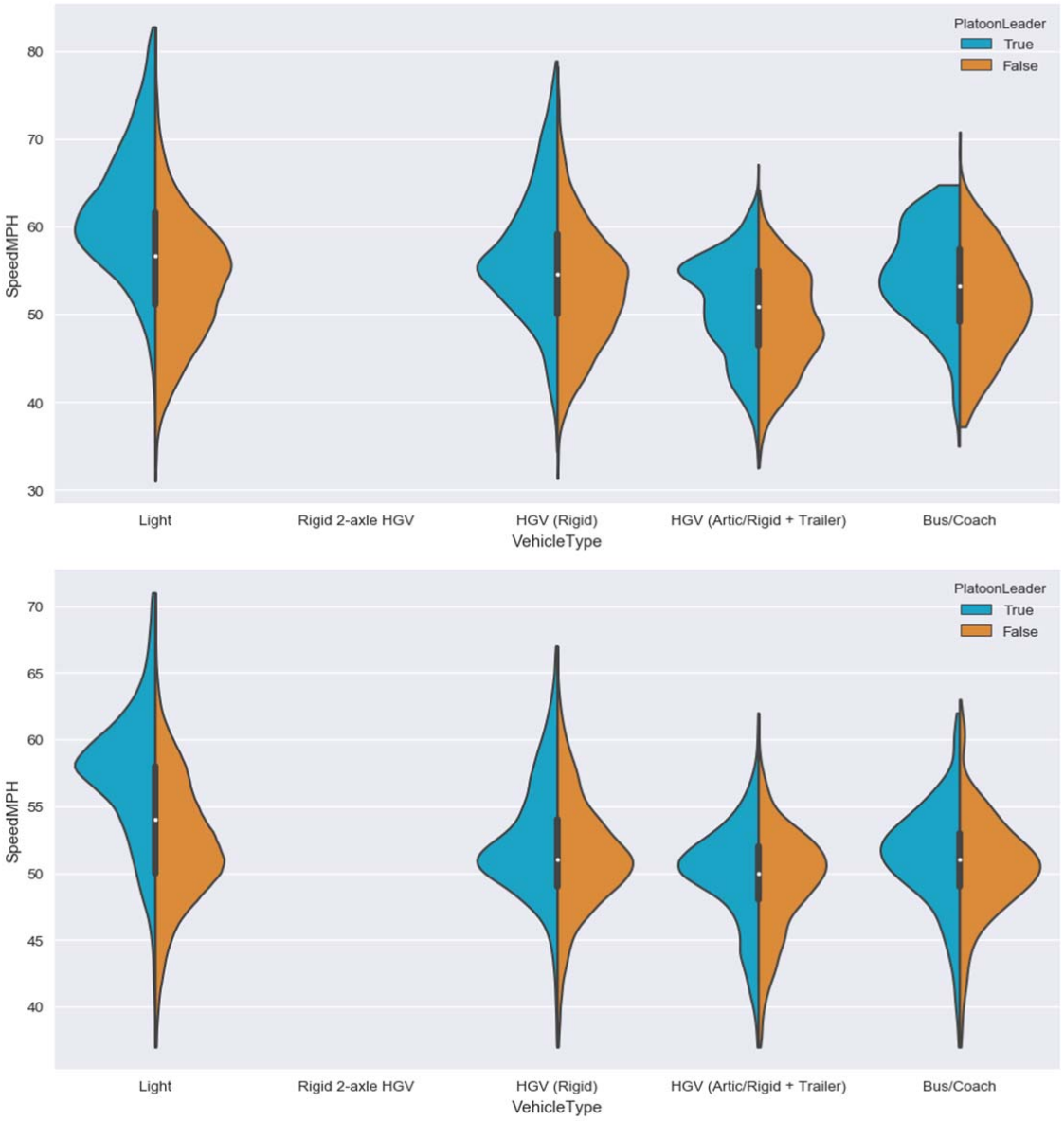
Appendix B Speed Profiles Platoon vs Free-flow traffic, Single carriageway sites

B.1 Speed profile for vehicles travelling in platoon vs “unconstrained” vehicles, Killiecrankie (Site JTC00307), from top to bottom: 2013 and 2015

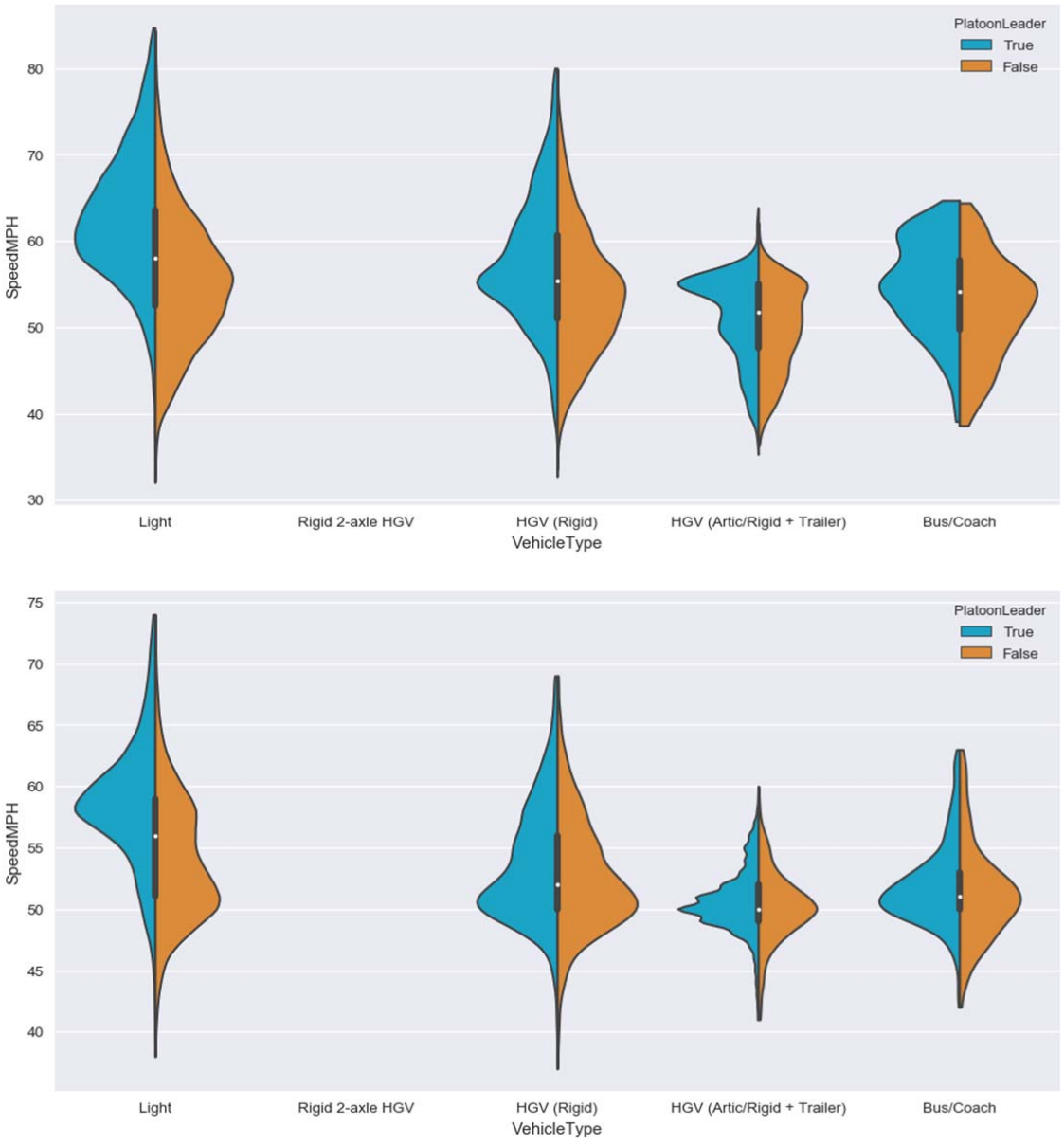




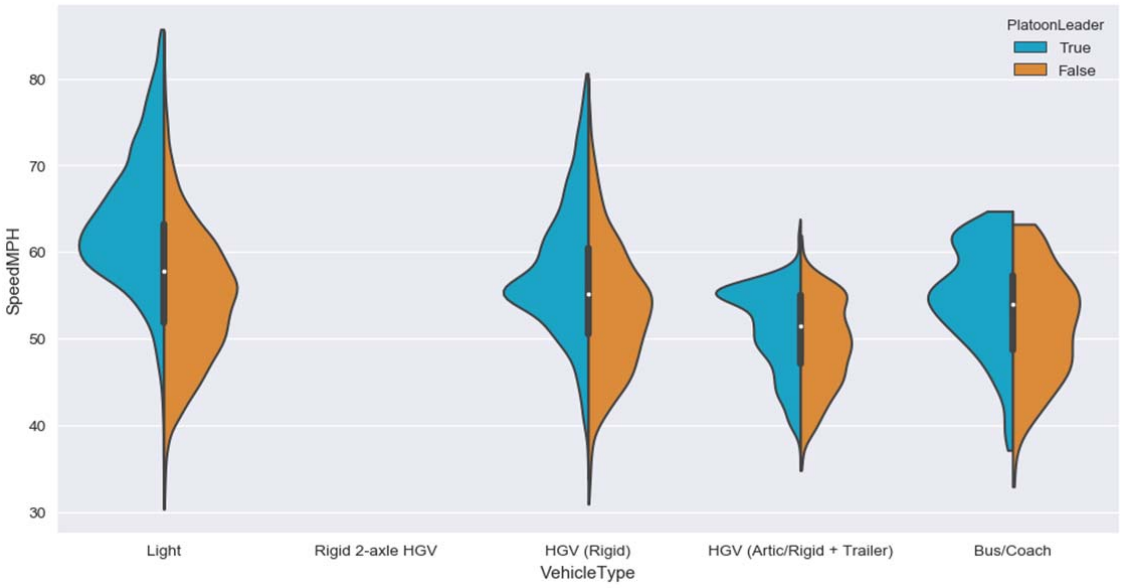
B.2 Speed profile for vehicles travelling in platoon vs “unconstrained” vehicles, Calvin (Site JTC00308), from top to bottom: 2013 and 2015

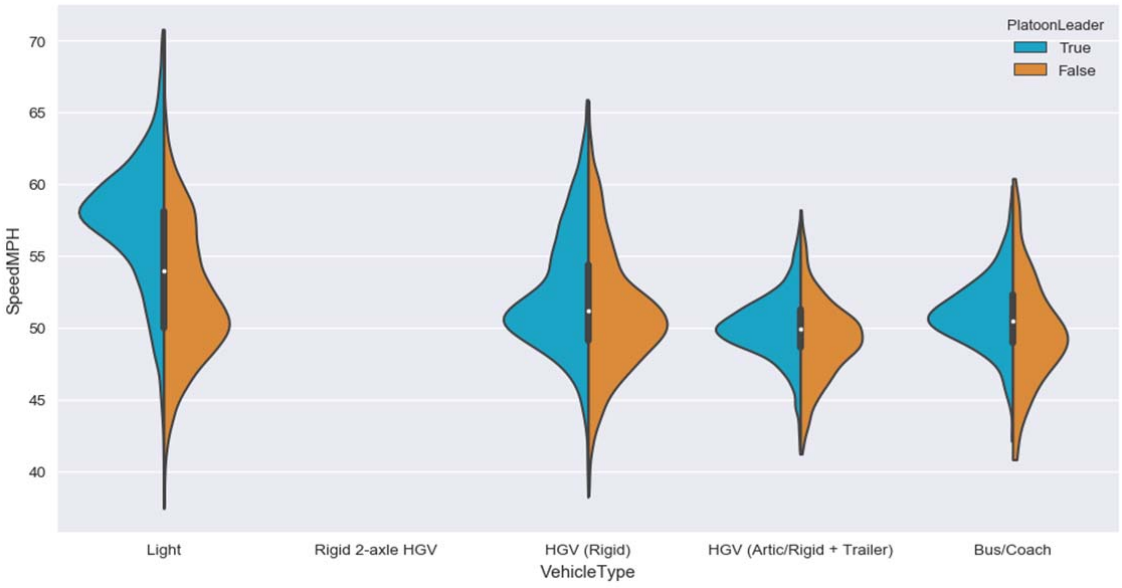


B.3 Speed profile for vehicles travelling in platoon vs “unconstrained” vehicles, Dalnaspidal (Site JTC00310), from top to bottom: 2013 and 2015

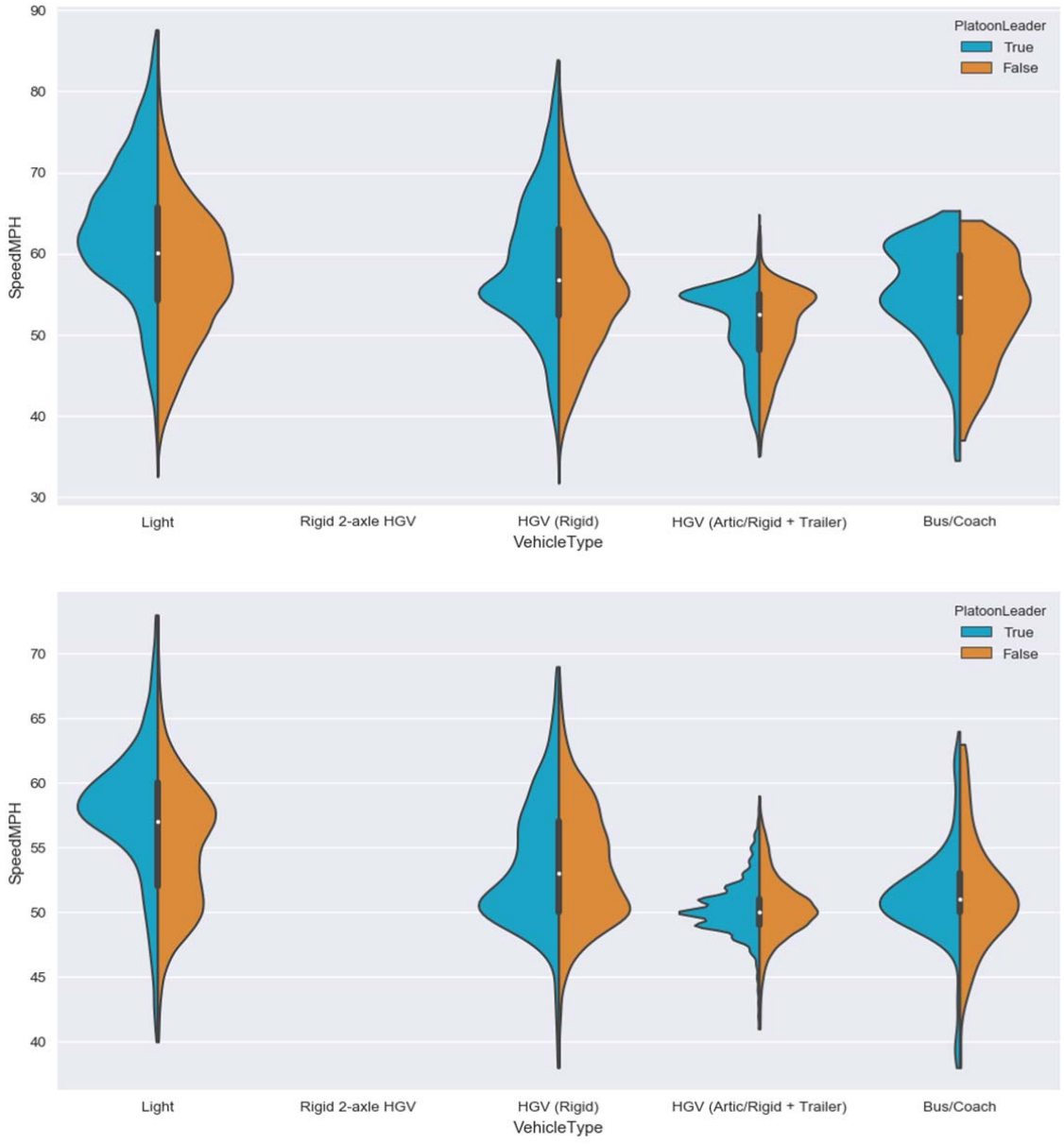


B.4 Speed profile for vehicles travelling in platoon vs “unconstrained” vehicles, Dalwhinnie (Site JTC00311), from top to bottom: 2013 and 2015

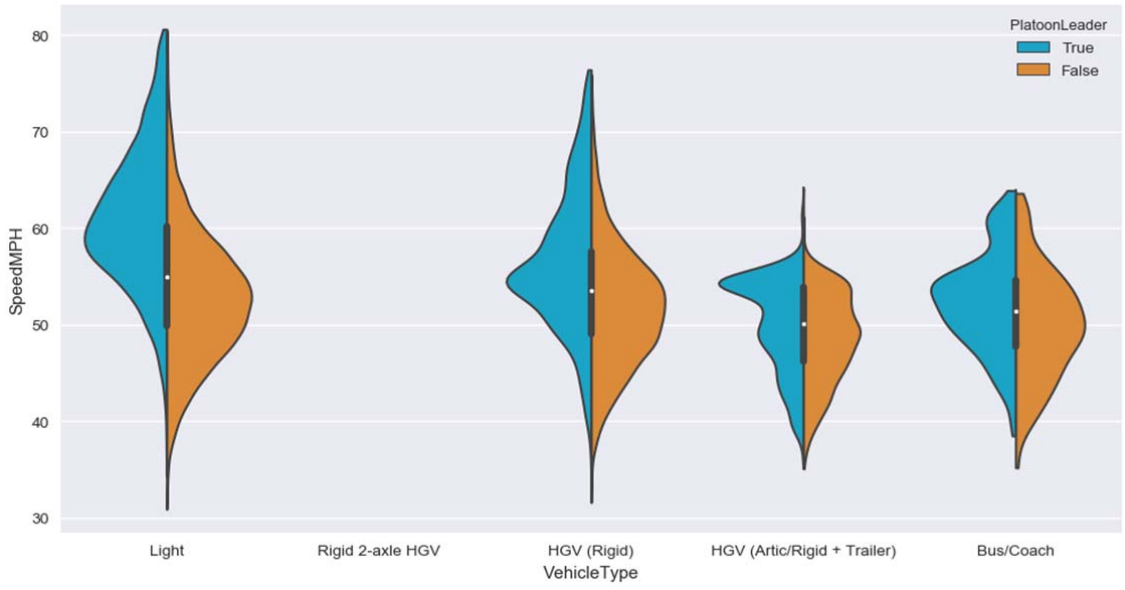


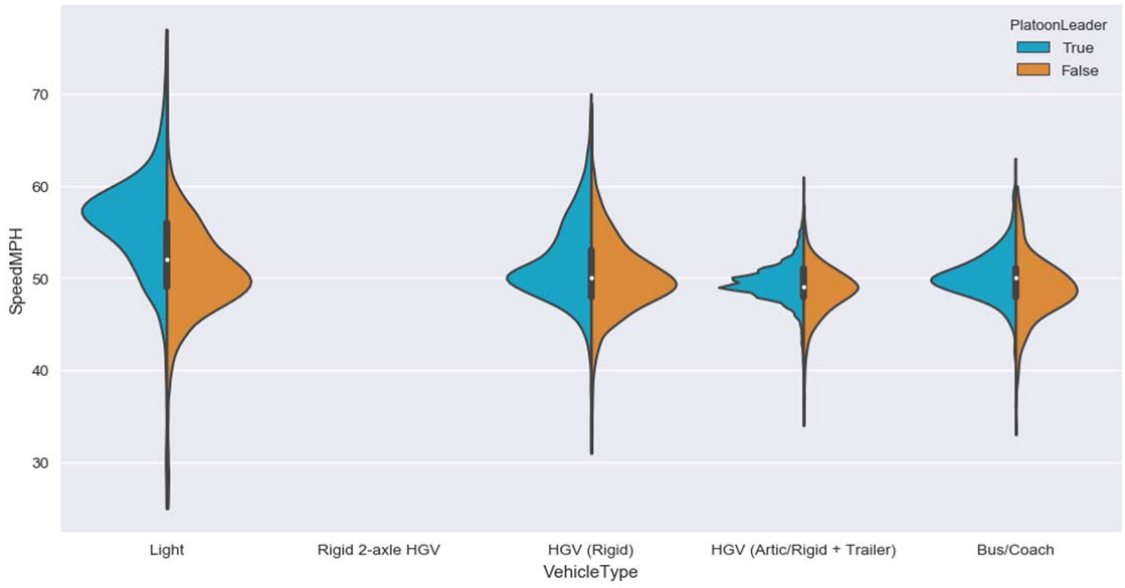


B.5 Speed profile for vehicles travelling in platoon vs “unconstrained” vehicles, Ralia (Site JTC00352), from top to bottom: 2013 and 2015

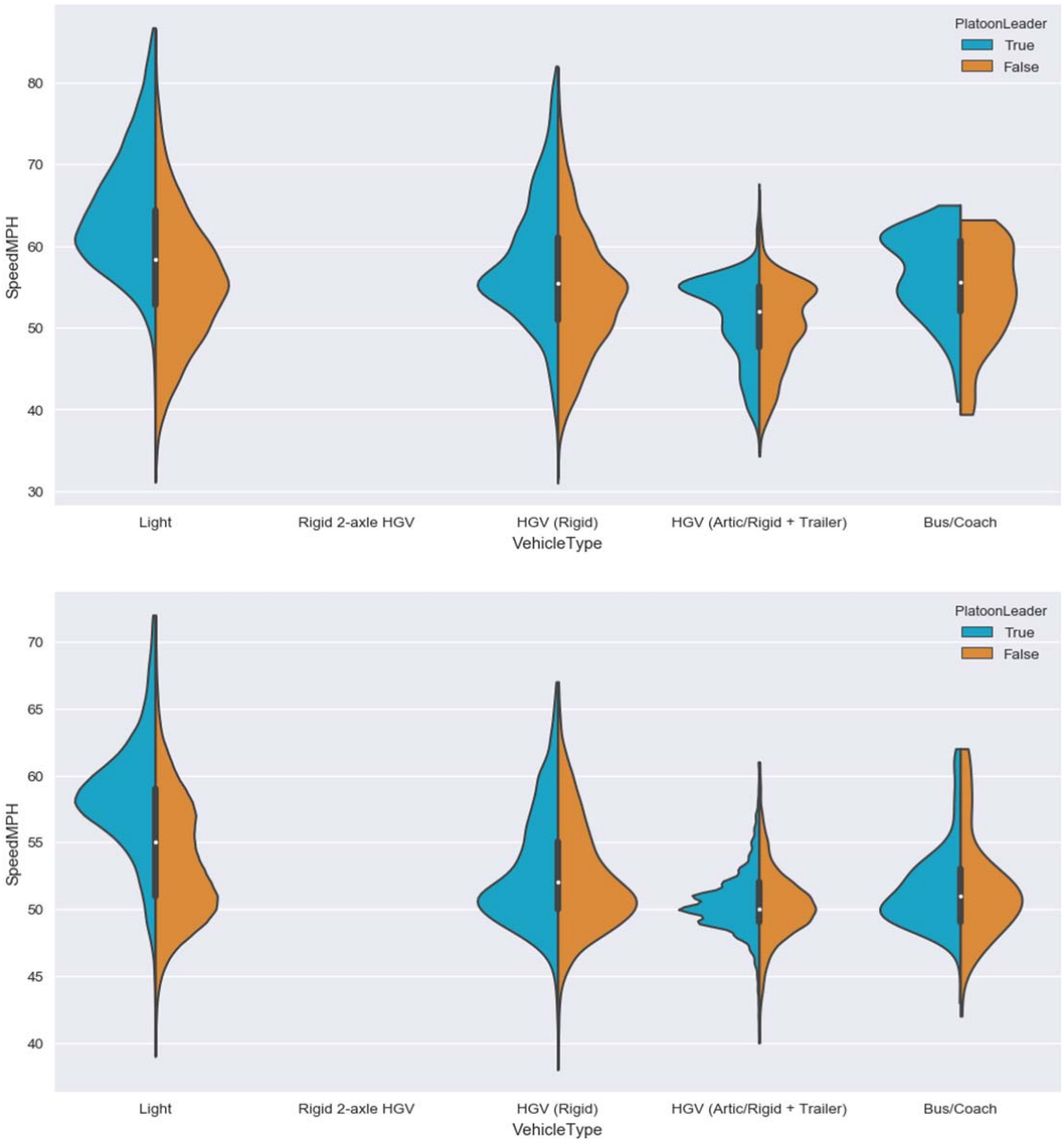


B.6 Speed profile for vehicles travelling in platoon vs “unconstrained” vehicles, Kingussie (Site JTC00312), from top to bottom: 2013 and 2015





B.7 Speed profile for vehicles travelling in platoon vs “unconstrained” vehicles, Kincraig (Site JTC00355), from top to bottom: 2013 and 2015



B.8 Speed profile for vehicles travelling in platoon vs “unconstrained” vehicles, Moy (Site JTC00368), from top to bottom: 2013 and 2015