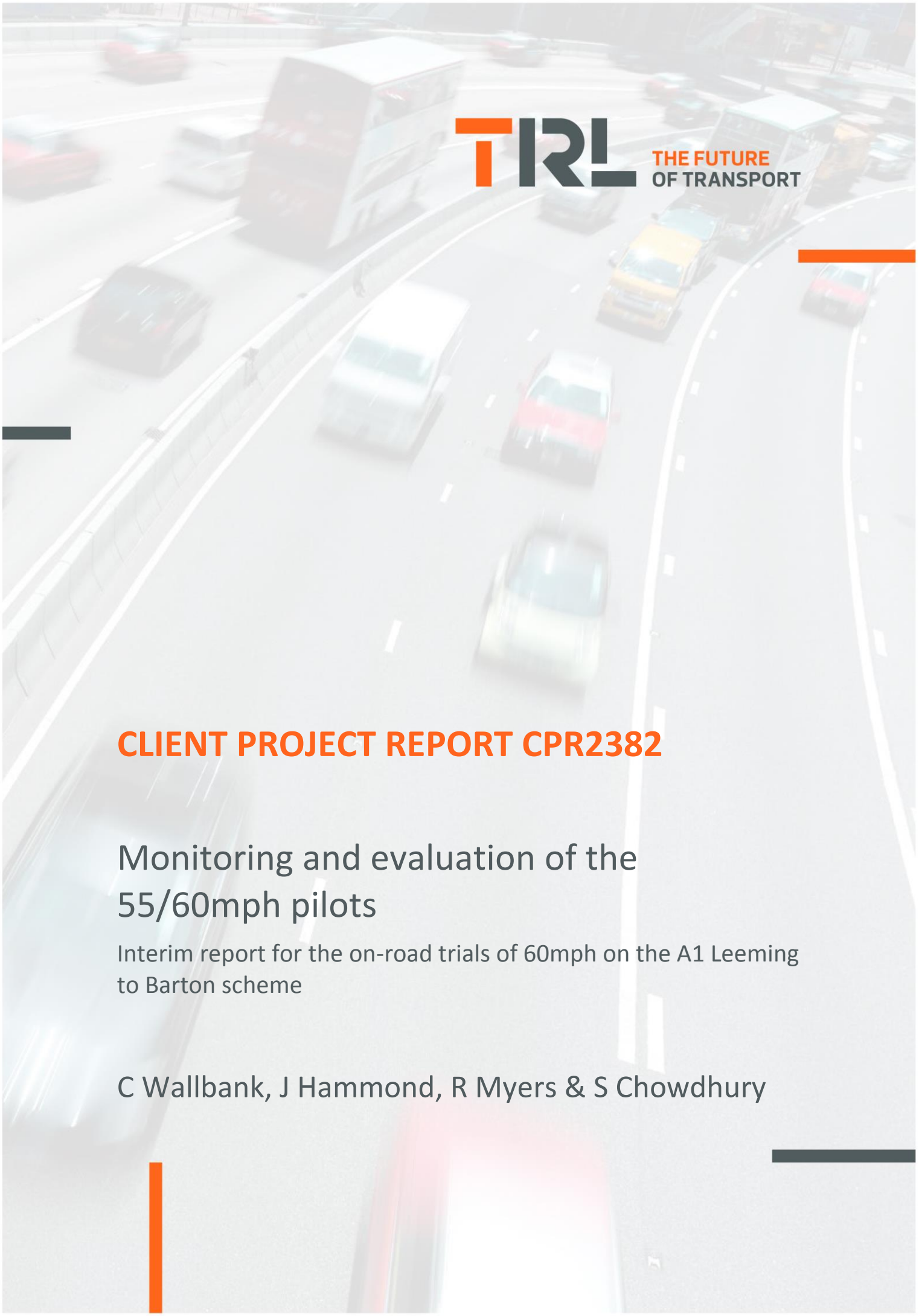

THE FUTURE OF TRANSPORT

CLIENT PROJECT REPORT CPR2382

Monitoring and evaluation of the 55/60mph pilots

Interim report for the on-road trials of 60mph on the A1 Leeming to Barton scheme

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Table of Contents

Executive Summary

Improving customer satisfaction, particularly through roadworks, is a priority for Highways England. One potential measure to achieve this is raising the speed limit through roadworks from the current 50mph limit to 55mph or 60mph. This approach aligns with recommendation 6 from the 'Incidents and roadworks – A road user perspective' report which suggests that *"Highways England should set speed limits in roadworks no lower than is required to maintain safety"* (Transport Focus, November 2016).

This project supports the monitoring and evaluation of trials which involve raising the speed limit through roadworks, where the scheme is designed in a way that makes it safe to do so, and when road workers will not be exposed to increased risk from the increased speed limit.

This report presents the findings from the on-road pilot of an increased speed limit of 60mph at the Al Leeming to Barton scheme over the 2016/17 Christmas embargo period. Driver behaviour was measured throughout the on-road trial to understand whether the change in speed limit to 60mph impacted upon the safety of road users. In addition, surveys were carried out at the nearest service station with drivers who had driven through the scheme, in order to understand their perceptions of increased speed limits through roadworks.

A 60mph speed limit was trialled for part of the scheme on both carriageways, resulting in a 'step down' from 60mph to 50mph for drivers travelling on the northbound carriageway and a 'step up' from 50mph to 60mph on the southbound carriageway. Vehicle Activated Signs (VAS) and Variable Message Signs (VMS) were used to improve driver awareness of reductions in the speed limit during and after the trial period.

The results show that there is no indication that the 60mph speed limit had a negative impact on road user safety. Free-flow average speeds did increase but were maintained at or below the speed limit across the trial period. Compliance with the speed limits was good, even a few hundred metres downstream of the step down from 60mph to 50mph on the northbound carriageway. Following the reimplementation of the 50mph speed limit once the trial was complete, speeds returned to pre-trial levels very quickly.

Average headway was unaffected by the change in speed limit and, in general, safe stopping distances were maintained between vehicles.

No road traffic collisions occurred within the areas subject to a 60mph speed limit and the number of incursions into the roadworks did not increase during the trial.

Journey time savings were approximately 30-40 seconds per driver, which equates to a 10-11% decrease in journey time over the 8km stretch of the scheme with a 60mph speed limit.

The survey results suggest that drivers are more satisfied with 60mph speed limits through roadworks than 50mph limits; although the results also suggest that changes in speed limit are not likely to be the only factors which contribute towards journey satisfaction. Feedback from people who were involved with the trial is being gathered.

Based on the results presented in this report, it is recommended that the pilots continue, with the next trial planned for the M5 Junction 4a-6 scheme in Spring 2017.

1 Introduction

1.1 Background

Customer satisfaction and safety are critical components of Highways England's vision for the future; as part of this vision, Highways England is committed to improving the customer experience through roadworks by maximising safety (for both road users and road workers) and minimising disruption caused by roadworks schemes.

One potential measure to achieve improvements in customer satisfaction at roadworks is challenging the approach to speed management that is usually taken for major schemes. This is to impose a 'blanket' speed reduction of 20mph, resulting in a 50mph enforced speed limit being in place for the entire length and duration of the roadworks.

As a result, and following consultation with stakeholders across Highways England and the Supply Chain, this project supports monitoring and evaluation of the benefits of raising the speed limit through roadworks to 55mph or 60mph where the scheme is designed in a way that makes it safe to do so, and when road workers will not be exposed to unacceptable risk from the increased speed limit.

Three specific scenarios have been defined and will be trialled on-road:

> **Scenario 1:** Implementation of a 60mph speed limit on lead-in and exits to/from the works, with a 50mph speed limit through the roadworks as at present
>
> **Scenario 2:** Changing the speed limit (to either 55mph or 60mph) during the operational testing (or 'pre-commissioning') phase of SMART motorway schemes
>
> **Scenario 3:** Changing the speed limit (either to 55mph or 60mph) throughout the works during a 'holiday period' when there are no road workers present.

1.2 Contents of this report

This report summarises the findings from the on-road pilot of 60mph at the A1 Leeming to Barton scheme during late 2016 and early 2017. This is the second pilot in a series of on-road trials aiming to understand the impact of increasing the speed limit to 55mph or 60mph at roadworks.

This scheme trialled Scenario 3 by increasing the speed limit to 60mph during a holiday period when the workforce is not present. During the trial, Lane 1 remained coned off to traffic and Lanes 2 and 3 were open. The speed limit, which was normally 50mph throughout the scheme, increased to 60mph within one 8km section of the works for the three weeks around the Christmas/New Year period when work was suspended. This defined the duration of the trial, with the location defined by availability of standard width lanes.

TRL were commissioned by Highways England to monitor driver behaviour (and customer satisfaction), to ensure that safety of road users and workers is not compromised by the increase in speed limit during this period and that customer satisfaction was likely to be improved by the increased speed. This report outlines the scheme and data collection

methodology (Section 2), presents the results from the monitoring (Section 3), summarises these findings (Section 4) and makes recommendations for the next steps (Section 5).

The key objectives for this research were to gather evidence for the impact of increasing the speed limit on the A1 L2B scheme from 50mph to 60mph on:

a) **Average vehicle speed**
b) **The number of non-compliant vehicles**
c) **Average vehicle headway**
d) **The number of incidents**
e) **Journey times**
f) **Customer satisfaction**

2 Method

2.1 Overview of the scheme

The A1 Leeming to Barton (L2B) scheme commenced in March 2014 and is due to finish in June 2017. This scheme is replacing the existing dual carriageway with a new three lane motorway, which will become part of the A1(M).

During the Christmas embargo period (23rd December 2016 to 8th January 2017) there were no works taking place on the scheme. This provided an opportunity to change the speed limit from 50mph to 60mph, but due to narrow lanes being used on some parts of the 20km scheme the 60mph limit could only be applied on one 8km stretch[1] (between Leeming and Catterick) where there were standard width lanes. The speed limit on both carriageways was increased to 60mph during the trial, meaning that drivers on the southbound carriageway experience a step up in speed from 50mph to 60mph and drivers on the northbound carriageway experienced a step down in speed from 60mph to 50mph.

In addition to the 8km 'experimental location', there was a 'control location' positioned approximately 5km downstream where the traffic management (TM) was similar (lane 1 closed) but the speed limit of 50mph remained unchanged for the duration of the trial. An overview of the scheme and the monitoring locations is provided in Figure 1.

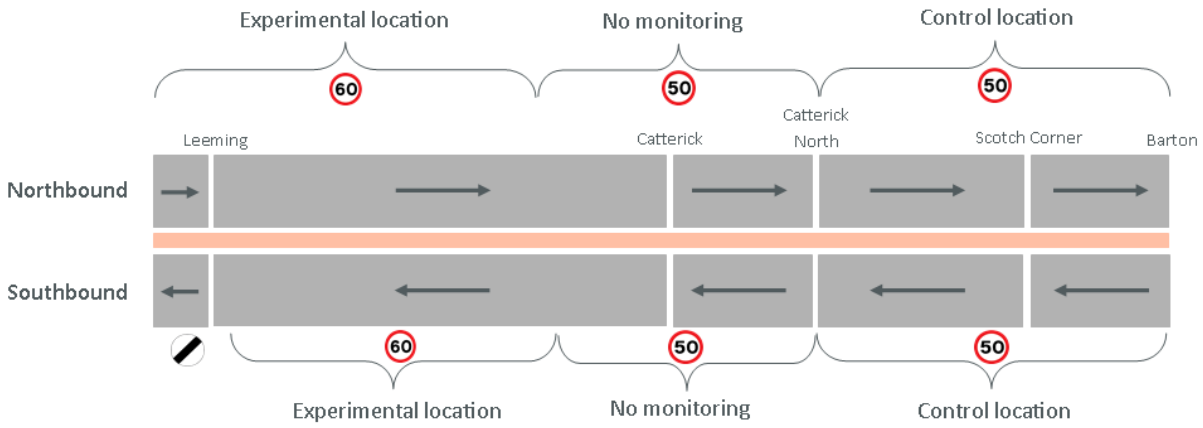

Figure 1: A1 L2B scheme monitoring locations

The on-road trial monitored the effect of the change in speed limit on driver behaviour and customer satisfaction. Monitoring took place between 14th December 2016 and 15th January 2017, with speed limits in place as shown in Table 1.

[1] Due to the layout of the scheme, the experimental section on the northbound carriageway is approximately 8.2km but only 6.5km on the southbound. This has been approximated to 8km for ease of reference throughout the report.

Table 1: Timelines and locations for monitoring

Dates	Description of activity	Experimental location	Control location
14th December – 22nd December 2016	Baseline monitoring period with TM in place	50	50
23rd December 2016 – 8th January 2017	Experimental monitoring period with TM in place	60	50
9th January – 10th January 2017	Post-trial monitoring period with TM in place but no works taking place	50	50
11th January - 15th January 2017	Post-trial monitoring period with TM in place (works commence if traffic behaviour has returned to 'normal')	50	50

Throughout the baseline, experimental and post-trial monitoring periods the TM remained the same with Lane 1 coned off and the remaining two lanes open. Pre-existing restrictions on HGVs travelling in the offside lane were continued throughout the duration of the trial.

Average speed cameras were already in place throughout the entire length of the scheme on both carriageways. The cameras in the trial area were live and enforcement took place.

In addition to the speed limit repeater signs being changed from 50mph to 60mph, Variable Message Signs (VMS) and Vehicle Activated Signs (VAS) were introduced at the speed limit change and at junction on-slips to advise motorists of the speed limit changes. Different combinations of these signs were displayed during the different stages of the trial (see Figure 2, Figure 3 and Figure 4).

Figure 2: Signage during the baseline monitoring period

During the baseline monitoring period before the trial commenced, the standard scheme roadworks 50mph speed limit signing was present. No VMS or VAS were activated.

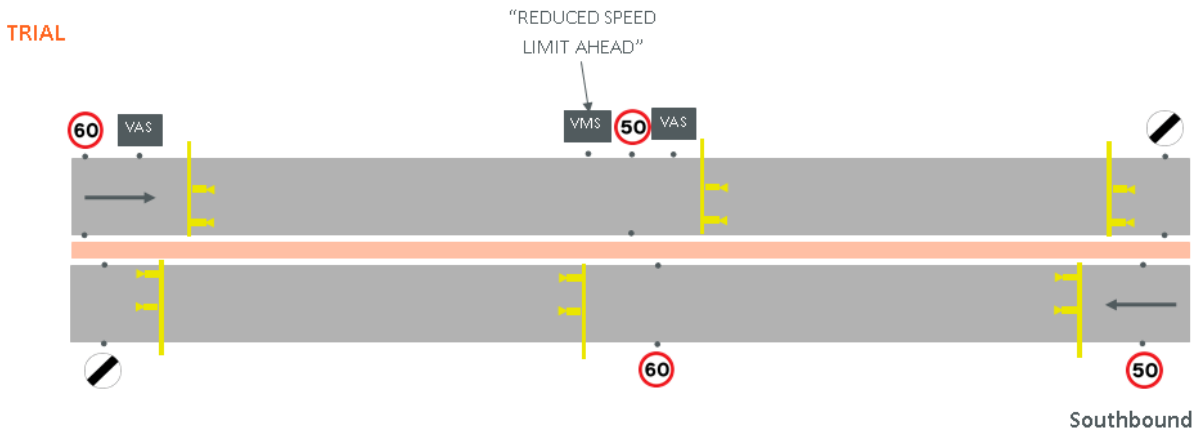

Figure 3: Signage during the experimental monitoring period

During the experimental period when the 60mph speed limit was in place, VMS and VAS were used on the northbound carriageway (where the speed limit stepped down from 60mph to 50mph). Drivers were advised of the reduction in speed limit from 60mph to 50mph by the use of a VMS displaying "REDUCED SPEED LIMIT AHEAD" upstream of the terminal signs (placed on each side of the carriageway) as per Chapter 8 guidance. This change in speed was emphasised by use of a VAS displaying the new speed limit (50mph) immediately downstream of the terminal signs; this sign was activated by vehicles travelling over 50mph.

On the southbound carriageway (where the speed limit stepped up from 50mph to 60mph), no additional signage (VMS / VAS) was used; the speed limit change was only signed using terminal signs (placed on each side of the carriageway) as per Chapter 8 guidance.

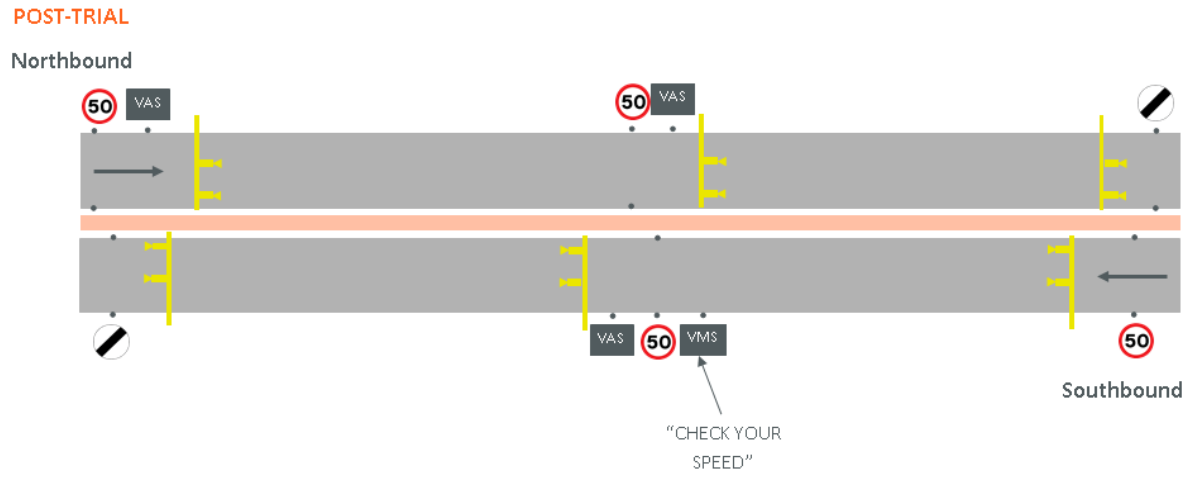

Figure 4: Signage during the post-trial monitoring period

After the trial (when the speed limit returned to 50mph on both carriageways) driver behaviour was monitored to determine whether driver behaviour had returned to pre-trial levels. VAS on the northbound carriageway were activated at the point where the speed had previously been increased to 60mph and at the location where the speed had been stepped down. In addition, a VMS on the southbound carriageway at the previous step up location read "CHECK YOUR SPEED" and was reinforced by a VAS downstream of the location where the speed had previously been increased from 50mph to 60mph.

2.2 Risk assessment

Prior to commencing the pilot, the A1L2B Scheme team carried out a scheme-specific GD04 risk assessment. This assessment examined the risks to road workers and road users from the increase in speed limit, detailing the mitigation measures required to address these risks and an assessment of the tolerability of any risk change. On the basis of this risk assessment the project board agreed the pilot could commence, provided on-going monitoring and safety reviews were carried out and that a suitable abort process was in place.

2.3 Safety reviews and abort process

Throughout the trials, the A1 L2B scheme had overall responsibility for risk and retained the right to initiate the abort process at any stage. Other parties to the trial (TRL and Highways England) could also request that the scheme initiate the abort process should evidence be obtained that indicated immediate termination of the trial was necessary.

The abort process was formally documented by the A1 L2B Scheme team as part of the GD04 risk assessment and the Traffic Management Toolbox Talk (dated 7th September 2016). If needed, the abort process would have followed these instructions but it was never used as the trial was completed successfully without issue.

Following the return of the speed limit to 50mph on 9th January 2017, the data were reviewed to understand whether the behaviour of drivers had returned to 'normal' (i.e. to see if the average speeds were comparable to those observed in the baseline monitoring period) before work recommenced in the closure. This preliminary analysis and their own on-site observations led the A1 L2B Scheme team to allow road workers to enter the closure and re-commence works from the 11th January, 48 hours after the speed limit had been changed.

2.4 Data collection and statistical comparisons

In order to achieve the objectives of this research (see Section 1.2), a number of different data sources were used:

- Radar data
- Incident data
- Data collected from a survey carried out at the nearest motorway service area with road users who had driven through the scheme.

These data sources, and the statistical comparisons made in the analysis, are outlined in more detail below.

2.4.1 Radar data

2.4.1.1 Location of radar installations

Four temporary radar installations (two at each of the control and experimental locations) were used to monitor speed, flow and headway during the baseline and experimental

periods. Each radar installation was capable of monitoring traffic on both northbound and southbound carriageways.

Radar installations were located at least 1km from entry or exit slip roads. This ensured that drivers' speed and following distance choice was not overly influenced by other drivers changing lanes to enter or exit from a slip, allowing study of the behaviour of drivers in response to the changes in speed limit.

Within the experimental location, one of the two radar installations was positioned towards the middle of the 60mph section (at marker post 124/2), in order to monitor speeds and headway once drivers had settled into their preferred behaviour. The other (at 126/7) was positioned to monitor speeds just after the step down on the northbound carriageway and just after the step up on the southbound carriageway. Figure 5 shows these positions.

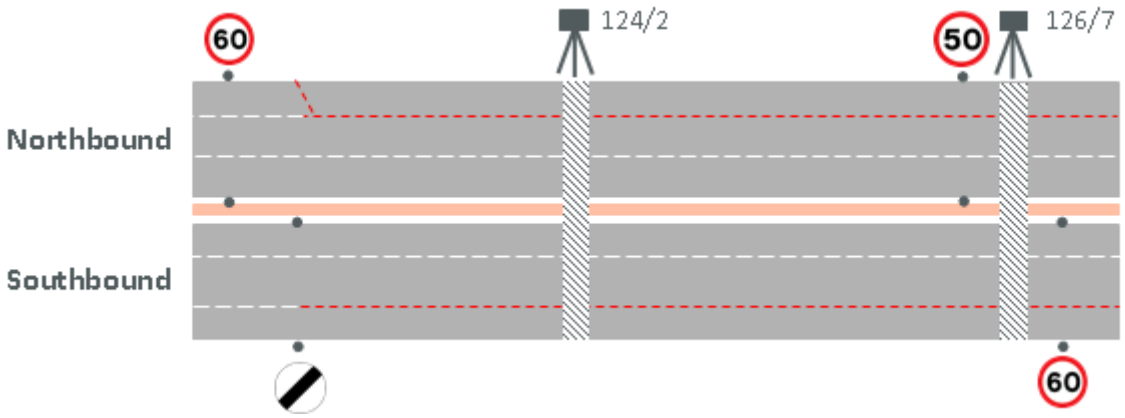

Figure 5: Position of radar within the experimental location

The control location had two radar installations (located at suitably convenient locations within the trial site, which were at marker posts 133/5 and 134/0).

2.4.1.2 Data collected

The radar provided average speed and average headway (defined as the average time separation between vehicles, measured from the front bumper to the front bumper of the following vehicle) which was recorded at one minute intervals. Vehicle flow was recorded by lane and separately by vehicle class (class 1 - up to 17ft, class 2 - 17-22ft, class 3 - 22-38ft and class 4 - 38-120ft)[2]. For analysis, HGVs were defined as all vehicles in the '38-120ft' category plus half those in the '22-38ft' category.

Average speed and headway data were not available by vehicle class; therefore, no specific information on how HGV or car driver behaviour changed following the increase in speed limit can be obtained from analysis of these data.

In addition to average speed, a count of vehicles in speed bins was provided. Speed data was split into the following bins: 0-40mph, 40-50mph, 50-57mph, 57-60mph, 60-68mph and

[2] These classes align with those used by the permanent MIDAS radars installed on the scheme, which when commissioned are used to monitor traffic flow and sense incidents or congestion. The MIDAS radars were not operational during the trial of this scheme so temporary radar had to be installed to monitor driver behaviour.

68+mph. These bins were selected to allow analysis of the number of drivers who were non-compliant with enforcement guidelines (i.e. 10% + 2mph above the speed limit[3]). For example, this enabled analysis of the number of vehicles travelling more than 57mph in the 50mph speed limit and 68mph in the 60mph limit.

2.4.1.3 Data processing

In order to understand the potential impact of the speed limit change on vehicle speeds, driver behaviour must be investigated when drivers are free to choose their speed. This requires conditions with free-flowing traffic; congested traffic was defined as periods when average speed of vehicles was lower than 40mph. This resulted in a small[4] number of periods being removed from the dataset.

Many statistical tests assume that data are independent, that is that individual data points are not related to or influenced by each other. However, consecutive data points from radar data may not necessarily be truly independent since the average speed or flow during one minute is likely to be closely related to the average speed or flow of the previous minute. This problem with the data from each radar location was managed by random sampling: one minute was selected from each 10 minute interval, which produced a dataset containing six randomly sampled minutes from each hour for each radar location.

It was assumed that data from the different locations were independent as there is a sufficient time delay between a car passing the first radar location and when the same car would pass the second radar location within a link to assume that the speeds are unrelated.

2.4.1.4 Flow comparisons

During the baseline and experimental periods, by-lane vehicle flow data was collected every minute by the radar. Data was split by vehicle classification (based on the vehicle's length).

Changes in vehicle flow could have an impact on average speed or headway. As a result, it is important to understand whether or not there were significant changes in vehicle flow between the baseline and experimental periods. Specifically, the following comparisons were made:

1) Comparison of average vehicle flow between the baseline and experimental periods
2) Comparison of average vehicle composition between the baseline and experimental periods

The results of these comparisons are presented for the northbound and southbound carriageways separately in Sections 3.1.1 and 3.2.1.

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[33] This is based on the National Police Chiefs Council/Association of Chief Police Officers (ACPO) Speed Enforcement Policy Guidelines 2011-2015 (ACPO, 2013) which suggest that a Fixed Penalty or speed awareness education may be appropriate when the speed is 10% +2mph above the speed limit (see paragraph 9.6). These are only guidelines and a police officer/ force can decide to enforce at a speed lower than this limit assuming they have considered the tolerance of the measurement equipment (paragraph 9.7).

[4] Across the radar, fewer than 1% of data recorded were classified as congested and removed from the dataset.

2.4.1.5 *Average speed and speed non-compliance comparisons*

Average speed data was collected every minute at each of the radar; these were split by lane. In addition, speed bin data was provided to enable analysis of speed limit non-compliance.

The following comparisons were made:

1) Comparison of average speed (and speed limit non-compliance) between the baseline and experimental periods at the control location (i.e. when the speed limit remained at 50mph)
2) Comparison of average speed (and speed limit non-compliance) between the baseline and experimental periods at the experimental location (i.e. when the speed limit changed from 50mph to 60mph)
3) Comparison of average speed (and speed limit non-compliance) between the two radar at the experimental location (i.e. to determine whether drivers adjusted their speed through the trial)

The results of these comparisons are presented in Sections 3.1.2, 3.1.3, 3.2.2 and 3.2.3.

2.4.1.6 *Average headway comparison*

Average vehicle headway (i.e. the average distance between vehicles in the same lane) was also collected for each lane using the radar.

The following comparisons were made:

1) Comparison of average headway between the baseline and experimental periods at the control location (i.e. when the speed limit remained at 50mph)
2) Comparison of average headway between the baseline and experimental periods (i.e. when the speed limit changed from 50mph to 60mph)

The results of these comparisons are presented in Sections 3.1.4 and 3.2.4.

2.4.2 Incident data

Records containing information on all incidents recorded by the CCTV were provided by the scheme. The scheme provided data for road traffic collisions (RTCs) and breakdowns occurring in the works. The reporting protocol for these data recorded whether it was a live lane incident, intentional incursion or unintentional incursion. These data were analysed to understand the number and type of incidents that occurred at the control and experimental locations during the baseline and experimental monitoring periods.

The following comparisons were made:

1) Comparison of the number of RTCs between the baseline and experimental periods
2) Comparison of the number of other incidents (e.g. breakdowns) between the baseline and experimental periods

A summary of these data are presented in Sections 3.1.5 and 3.2.5.

The Traffic Safety and Control Officer (TSCO) reports for the scheme, which detail TSCO daily activities and comments relating to the TM, were also reviewed to identify any incidents or unusual events which were not picked up by the CCTV records. Nothing of note was identified from this source.

2.4.3 Journey time

Data on Journey Time Reliability (JTR) were not available for this scheme. Instead, estimates of the average journey time were calculated based on the length of the experimental link and the average speed of vehicles observed in the baseline and experimental monitoring periods. These estimates were compared between baseline and experimental periods to ascertain whether the change in speed limit resulted in a change in average journey time. Whilst not as informative as JTR, these estimates will provide an indication for customer journey times (and therefore, customer satisfaction) through the roadworks scheme. The findings from these calculations are presented in Sections 3.1.6 and 3.2.6.

2.4.4 Customer satisfaction survey data

During the experimental monitoring period, surveys were carried out at the Scotch Corner Motorway Service Area (MSA) located at the junction of the A1 and A66. The survey targeted drivers who had driven northbound through the scheme and asked questions about their experience of the journey, what they thought the posted speed limit on each link was and the speed that they travelled.

Participants were also asked about how they felt the three different scenarios (Scenario A where the speed limit is 50mph throughout the works, Scenario B where part of the works is 60mph and Scenario C where the speed limit is 60mph throughout the works) would affect their journey time, satisfaction and feelings of safety. The Motorway Service Area questionnaire is included in Appendix A.

Responses from the MSA surveys were used to answer the following questions:

1) Did drivers notice the change in speed limit between Junction 51 (Leeming) and Catterick?
2) How fast did drivers think they travelled through each link?
3) How satisfied or dissatisfied would drivers feel travelling through Scenario A? Scenario B? Scenario C?

The results from this survey are presented in Section 3.4.

2.4.5 Statistical comparisons

Appropriate statistical tests[5] were used to test for significant differences in data recorded during the baseline and trial periods (i.e. to determine whether driver behaviour changed

[5] Where required, data were transformed to meet the assumptions required by the statistical test.

following implementation of the increased speed limit). Two types of statistical test were used, the choice of which is dependent on the type of data:

- **Chi-squared tests** are used to test for a difference in the distribution of categorical data, for example to test for a difference in the distribution of incidents between the baseline and trial periods.
- **Analysis of variance (ANOVA)** was used to test for a difference in the mean response between groups, for example to test for a difference in the average speed between the baseline and trial periods.

Results are classified as 'statistically significant' if the *p*-value is less than 0.05 (a common standard in the behavioural sciences). The *p*-value is a measure of probability and, in the context of the tests carried out in this report, a value of less than 0.05 can be interpreted as meaning that there is a difference between the groups being tested; for example, a difference in the average speed between the baseline and trial periods. Where this occurs, the results are described as 'significant'.

3 Results

As described in Section 2.1, the 60mph speed limit was implemented on both carriageways in one 8km section of the scheme. As a result, drivers on the northbound carriageway experienced a 'step down' in speed limit from 60mph to 50mph, whereas those travelling southbound experienced a 'step up' from 50mph to 60mph.

Within the analysis presented in this section, the results have been split by carriageway to explore the different driver responses observed for a 50mph to 60mph step up and a 60mph to 50mph step down. The results from the northbound carriageway step down trial are presented in Section 3.1 and the southbound carriageway step up trial in Section 3.2. Comparisons between the results for the two carriageways are made in Section 3.3.

Whilst data were collected from four temporary radars (located at marker posts 124/2, 126/7, 133/5 and 134/0 within the scheme), the results presented here only include data from three of these due to a technical fault with one radar (located at 134/0) between 26th December 2016 and 10th January 2017. This radar was within the control section of the scheme which remained at 50mph throughout. The lack of data from this radar does not affect the results since the radar unit positioned at marker post 133/5 provides comparable data, which is used to understand any background trends in behaviour.

3.1 Northbound carriageway

Drivers travelling along the northbound carriageway experienced a 'step down' in speed limit during the trial period. Assuming they joined the roadworks at the beginning of the scheme, they will have driven through a stretch of works where the speed limit was 60mph and then experienced a drop in speed to 50mph for the remainder of the scheme.

On approach to the step down, drivers saw a light-emitting VMS displaying "REDUCED SPEED LIMIT AHEAD" before passing the 1500mm diameter terminal signs informing them of the new speed limit. Beyond the terminal signs, any vehicle that was exceeding the new 50mph speed limit would have triggered a vehicle activated sign (VAS) to display a light-emitting 50mph speed limit sign to act as a reminder to the driver of the reduced speed limit.

Data were collected from three radar units: the unit at 124/2 was located towards the middle of the 60mph speed limit stretch, that at 126/7 was located a few hundred metres downstream of the step within the 50mph limit and that at 133/5 was located within the 50mph control section.

3.1.1 Vehicle flow

As discussed in Section 2.4.1.4, changes in vehicle flow could impact on the results for average speed or headway. As a result, it is important to understand whether or not there were significant changes in vehicle flow between the baseline and trial periods before commencing the analysis.

Figure 6 shows how the average daily vehicle flow changed between the three monitoring periods (baseline, trial and post-trial) at each of the three radar locations. Note that radar

124/2 was not operational from 13th-15th January due to technical issues; as a result, the 'post-trial' period is based on four days of data for this radar instead of seven.

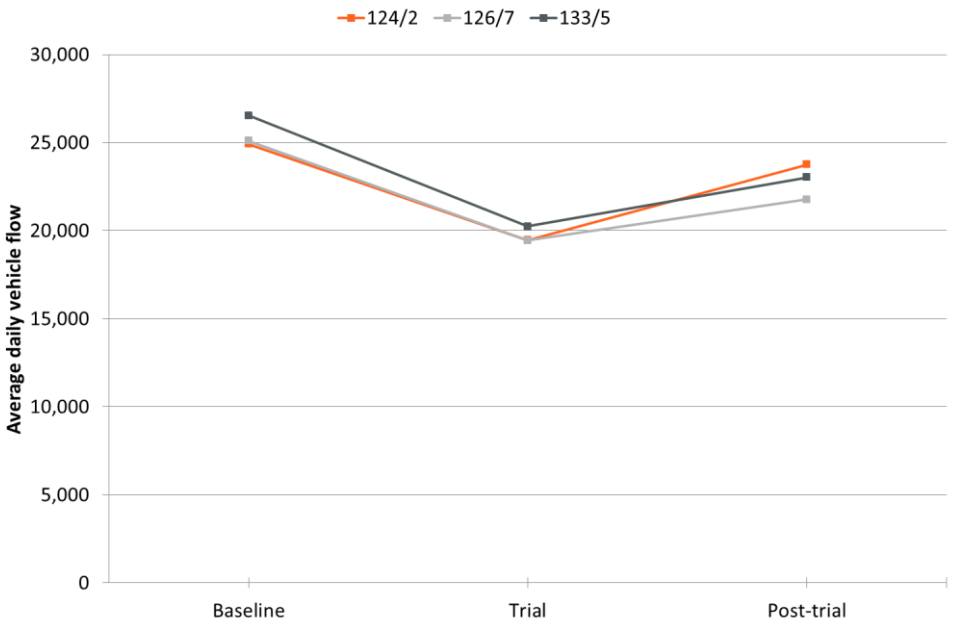


Figure 6: Average daily vehicle flow by radar location and monitoring period (northbound)

At all three radar, there was a decrease in flow during the trial period which is likely to be due to reduced travel over the Christmas period. Compared to the baseline period, average daily flow remained lower in the post-trial period than in the pre-trial period. This could be due to traffic volumes being inflated during the pre-trial period by increased travel prior to Christmas or traffic volumes not having returned to 'normal' following the Christmas/New Year break.

The average daily vehicle flows at radars 126/7 and 133/5 were similar throughout the monitoring period. However, the average flow recorded at 124/2 was noticeably different to the other radars during the post-trial period, due to the missing data from the weekend of 13th-15th January. Weekend vehicle flows are typically lower than those on weekdays; therefore daily average flow calculated using only weekday figures will generally be higher than for a typical week.

Excluding the post-trial period, statistical tests show that there was no significant difference (p = 0.204) in the distribution of vehicle flow across the baseline and trial periods between the three different radar locations. This suggests that any changes in average vehicle speed or headway between the three radar locations are likely to be the result of the change in speed limit, rather than due to difference in vehicle flow.

In addition to overall vehicle flow, differences in the distribution of vehicles by vehicle class could also influence the results for average speed and headway. Figure 7 shows the proportion of vehicles that were classed as HGVs split by radar location and monitoring period.

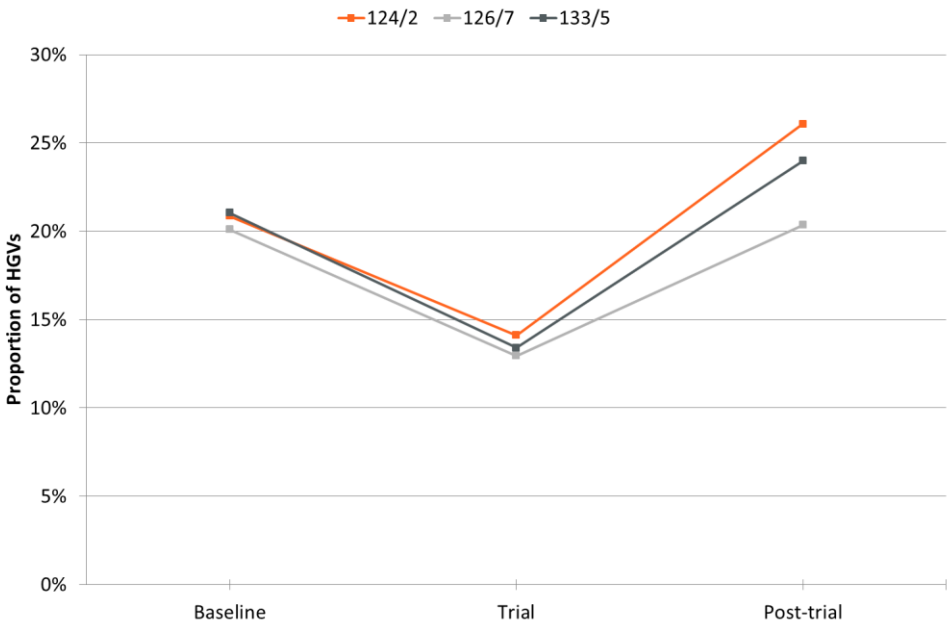


Figure 7: Proportion of HGVs by radar location and monitoring period (northbound)

The proportion of HGVs was similar across all three radars between the baseline and trial periods but was more varied between the trial and post-trial periods. As before, some of this difference is likely to be due to the missing data from the radar at marker post 124/2.

Statistical tests showed that there was a statistically significant difference (p = 0.039) in proportion of HGVs across the three radars between the baseline and trial periods, in particular for radar 124/2. However, since there are no junctions between radar 124/2 and 126/7 these small differences are likely to be due to differences in the accuracy of the individual radar units and their identification and recording of vehicle class[6].

The differences are small, relative to the quantity of data collected and so are unlikely to influence the results to any great extent.

3.1.2 Average vehicle speed

Figure 8 shows how free-flow speed varied over the three monitoring periods and between radar locations. Note that the vertical axis on the chart is compressed and displays data from 45mph to 60mph.

[6] The radar supplier indicates that the radar units are 95-98% accurate.

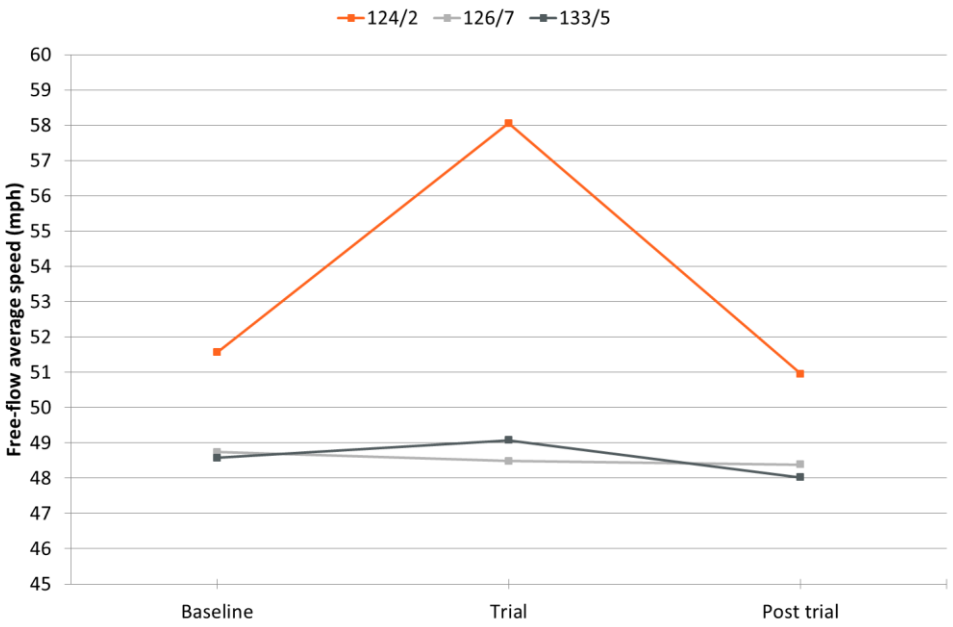


Figure 8: Free-flow average speed by radar location and monitoring period (northbound)

During the baseline period, where the speed limit was 50mph across the entire scheme, the free-flow average speeds were similar (within 3mph) at the three radar unit locations.

During the trial period, the speed limit increased to around 58mph within the 60mph speed limit (measured by the radar unit at 124/2) but remained fairly stable immediately downstream of the step down (126/7) and at the control location (133/5). This suggests that drivers did notice and react to the 60mph speed limit and, following the step-down, returned to travelling at a compliant average speed of approximately 49mph within a few hundred metres of the VMS, terminal signs and VAS notifying them of the change in speed limit.

Following the trial and reinstatement of the 50mph speed limit throughout the whole scheme, speeds returned to levels very similar to those seen during the baseline period prior to the speed increase.

A statistical test (ANOVA) shows that the interaction between monitoring period and radar location is significant ($p < 0.01$). This means that the changes in speed between the three monitoring periods are significantly different across the three radars. It is possible that some of the change in speed between the baseline and trial periods (and subsequently between the trial and post-trial periods) can be attributed to the changes in vehicle flow (Figure 6) and traffic composition (Figure 7). However, since the magnitude of these differences is much larger at the radar unit with the change in speed limit to 60mph in the trial period (124/2), than at the other two radars which remain with a 50mph speed limit throughout all three periods, this suggests that the vast majority of the changes can be attributed to the change in speed limit at this radar.

In order to investigate the change in average speed at a higher level of granularity, free-flow average speed by date is shown in Figure 9.

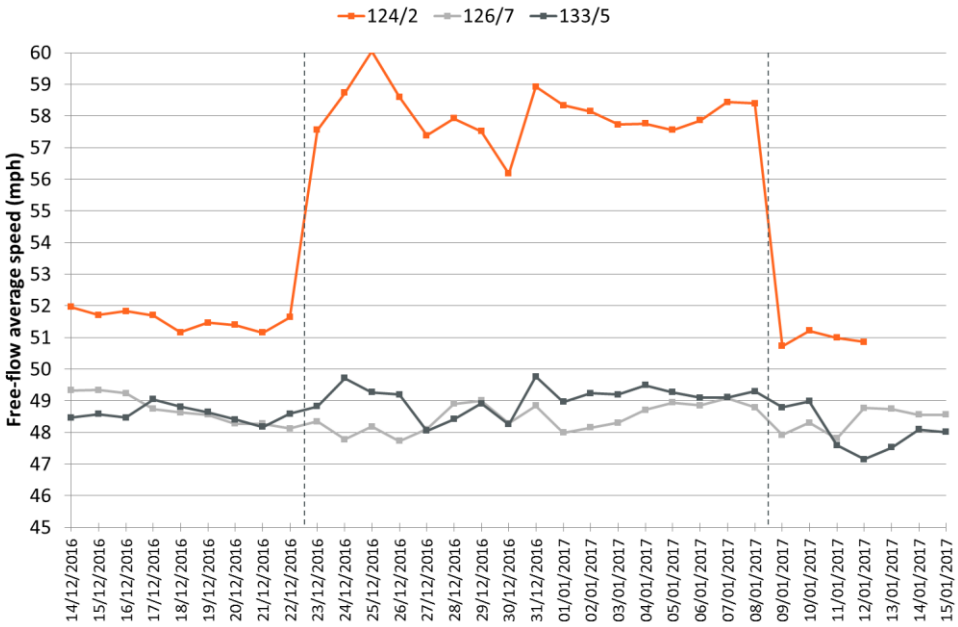


Figure 9: Free-flow average speed by radar location and date (northbound)

The increase in speed limit, which was implemented overnight on 22nd December, had an immediate effect on average vehicle speed in the section of the scheme in which it was implemented (124/2). However, there was no carry over effect to other areas of the scheme (126/7 and 133/5) where the 50mph speed limit remained unchanged.

Throughout the trial, speeds remained substantially above the speeds observed in the baseline period but below the 60mph speed limit; the maximum daily average speed was approximately 60mph on Christmas Day. When the speed limit returned to 50mph on 9th January, the average speed dropped from around 58mph to around 51mph, which was very similar to the average speed observed in the period up until the speed limit was increased.

Figure 10 shows the free-flow average speed breakdown by lane for the radar located in the middle of the 60mph experimental location (124/2).

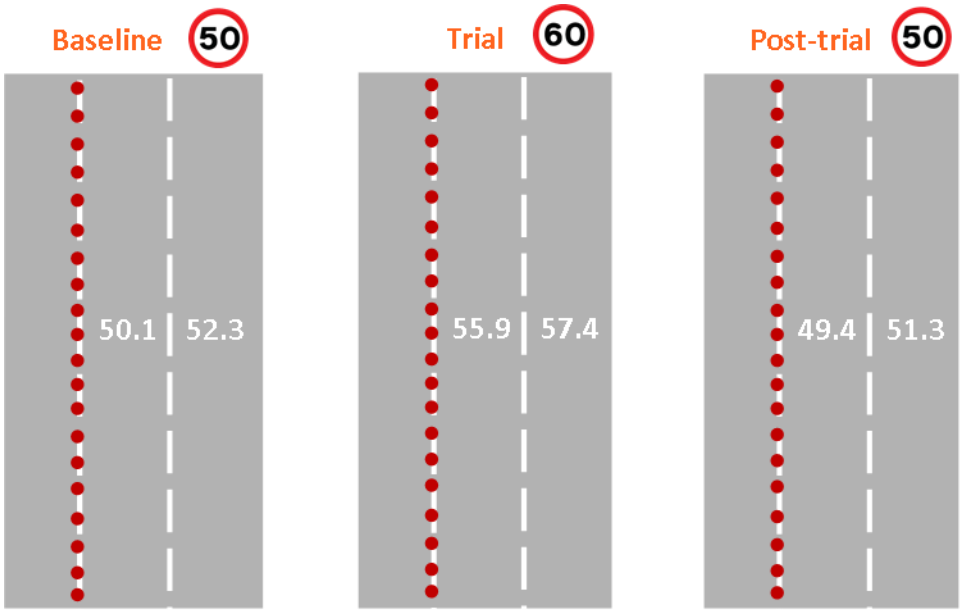


Figure 10: Free-flow average speed (mph) by lane and montitoring period, radar location 124/2 only (northbound)

In all three periods, speeds were typically 1-2mph higher in Lane 3 than in Lane 2. A comparison between the baseline and trial periods indicates that average speeds increased slightly more in Lane 2 (+5.8mph) than in Lane 3 (+5.1mph).

The overall and differential speed increases are likely to be related to the lower flows in Lane 3, absence of HGVs (due to the vehicle restrictions in place that excluded HGVs from the outer lane) and the use of the outer lane for overtaking manoeuvres.

3.1.3 Speed limit compliance

In addition to average vehicle speeds, the radar data also included a count of vehicles in each of six speed bins. As discussed in Section 2.4.1.2, the speed bins were chosen to reflect the speed limit enforcement thresholds (speed limit + 10% + 2mph) at the different speed limits used in the trial.

Figure 11 shows the proportion of vehicles recorded in each category across the three different monitoring periods at the first radar, 124/2 (located within the 60mph speed limit).

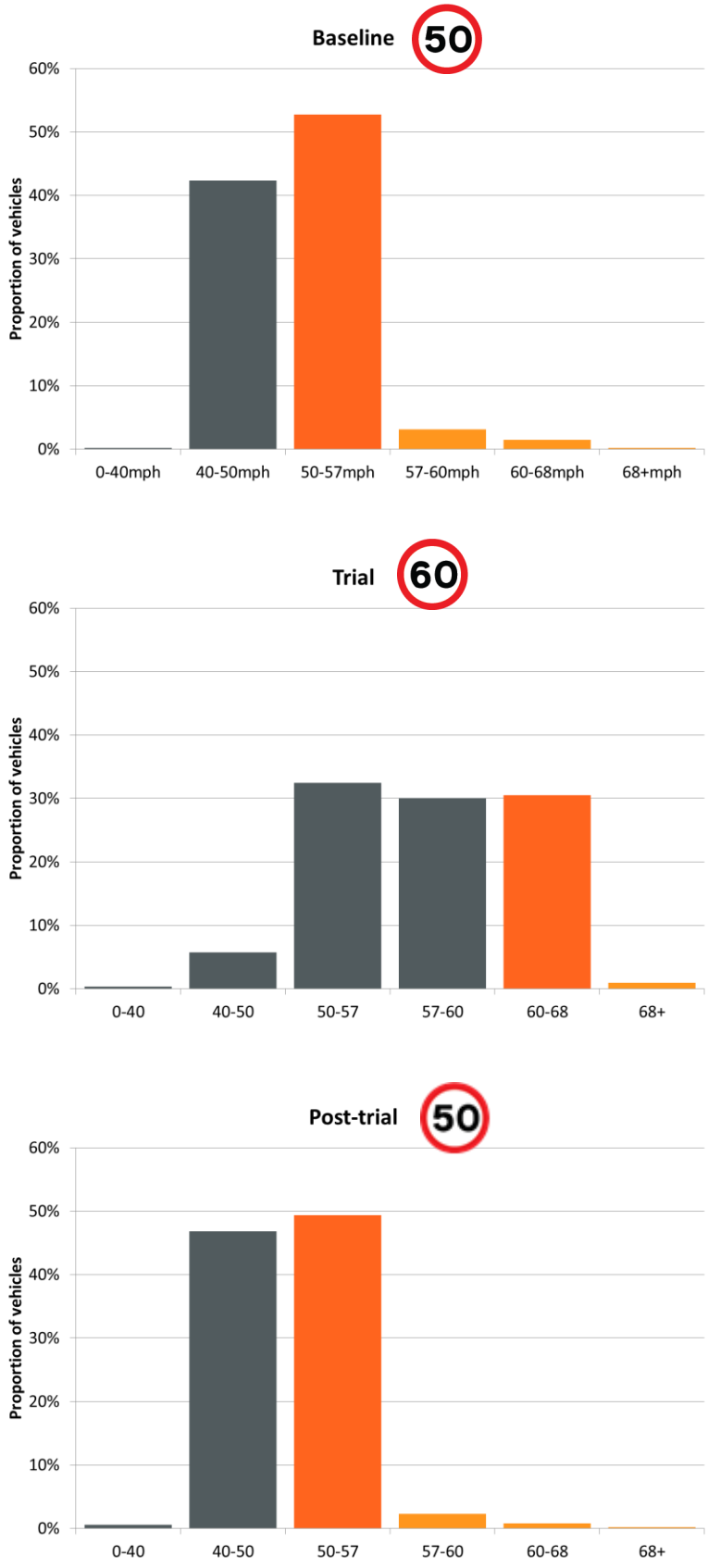


Figure 11: Proportion of vehicles in each speed category at radar 124/2 by monitoring period (northbound)

The grey bars show the proportion of vehicles travelling below the speed limit in each period; the dark orange bar shows vehicles travelling above the speed limit but below the enforcement threshold and the lighter orange bars indicate the proportion of vehicles travelling above both the speed limit and the enforcement threshold.

The proportion of drivers complying with the speed limit was 43% in the baseline period, 69% in the trial period and 47% in the post-trial period, suggesting that overall compliance with the 60mph speed limit was actually better than compliance with the 50mph speed limit. However, although not shown in Figure 11 it was observed that compliance with the new 50mph speed limit a few hundred metres downstream of the step (at 126/7) was better than in the 60mph limit in the middle of the scheme (75% compared to 69%), strongly suggesting that the VMS, terminal sign and VAS combination was noticed by drivers and was very effective at influencing them to reduce their speed to 50mph or less.

The distribution of vehicles across the different speed categories is very similar between the baseline and post-trial periods but differs in the trial period. Unsurprisingly, there was a higher proportion of vehicles recorded in the 57-60mph and 60-68mph categories during the trial period due to the increase in speed limit.

The lighter orange bars represent the drivers who are travelling above the enforcement threshold in each speed limit. The proportion of vehicles above the enforcement threshold was small (<5%) in all three periods (5%, 1% and 3% in the baseline, trial and post-trial periods respectively).

The darkest orange bar represents the proportion of drivers travelling faster than the speed limit but slower than the enforcement threshold. This proportion is larger during the baseline and post-trial periods (53% and 49% respectively) than during the trial period. This suggests that a proportion of drivers were prepared to travel slightly faster than 50mph during the baseline and post-trial periods (at speeds up to 57mph), risking enforcement action, but when the 60mph limit was in force they were content to travel at a speed that was below the posted speed limit and so were compliant. One potential reason for this behaviour may be frustration with the 50mph speed limit; another may be better credibility associated with a 60mph speed limit within roadworks.

3.1.4 Average vehicle headway

Average headway measures the average time separation between vehicles. This is linked to vehicle flow since headway will naturally increase when the flow is lower. In addition, there is likely to be some relationship between headway and speed, since some drivers will leave more distance between their vehicle and the vehicle front as speeds increase, due to the increased stopping distances required when speeds are higher.

Within the trial, it could be expected that headway would increase for the 60mph trial site (124/2) but remain the same where the 50mph speed limit remained unchanged. However, Figure 12 shows that, compared to the baseline period, average headway was typically higher during the trial period when traffic flows were lower (as shown in Figure 6). In the post-trial period, when traffic flows were higher, average headway was lower.

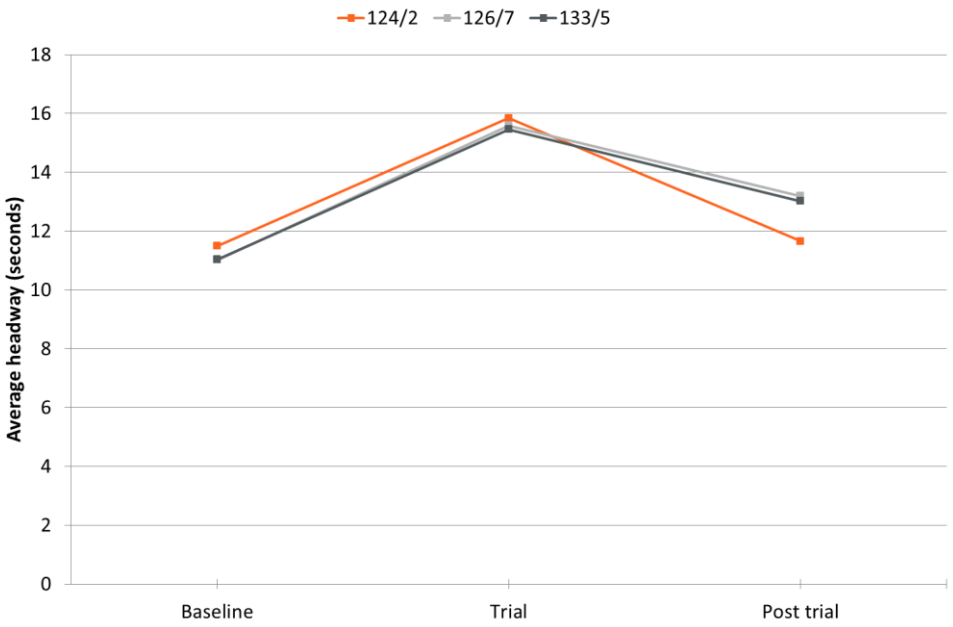


Figure 12: Free-flow average vehicle headway by radar location and monitoring period (northbound)

The three days of missing data from radar 124/2 means that the average headway recorded was lower than that recorded by the other two radars.

A statistical test (ANOVA) comparing the average headway across monitoring periods and radar shows that the interaction was not significant (p = 0.188). This indicates that the change in headway across the three periods was not significantly different across the three radar, suggesting that any changes between monitoring periods were not due to the increase in speed limit. This in turn suggests that free-flow headway is more likely to be influenced by vehicle flow than speed limits.

The Highway Code suggests that drivers should allow at least 2 seconds gap between themselves and the vehicle in front on roads carrying faster moving traffic, with this distance doubled on wet or icy roads. The average free-flow headway was typically much larger than this (although there was some variation in this figure with lower headways associated with times of day during which there was more traffic). As a result, there is no evidence to suggest that safety was compromised by either the 50mph or 60mph speed limits or the change between them.

3.1.5 Incidents

For the purposes of this analysis, the control location was defined as the 7.2km section from Catterick North to Barton and the experimental section defined as the 8km section of the works where the 60mph speed limit was implemented.

On the northbound carriageway, a total of 36 incursions were reported by CCTV operators across both sections (21 in the control section and 15 in the experimental). Figure 13 shows how these figures split between the baseline, trial and post-trial monitoring periods.

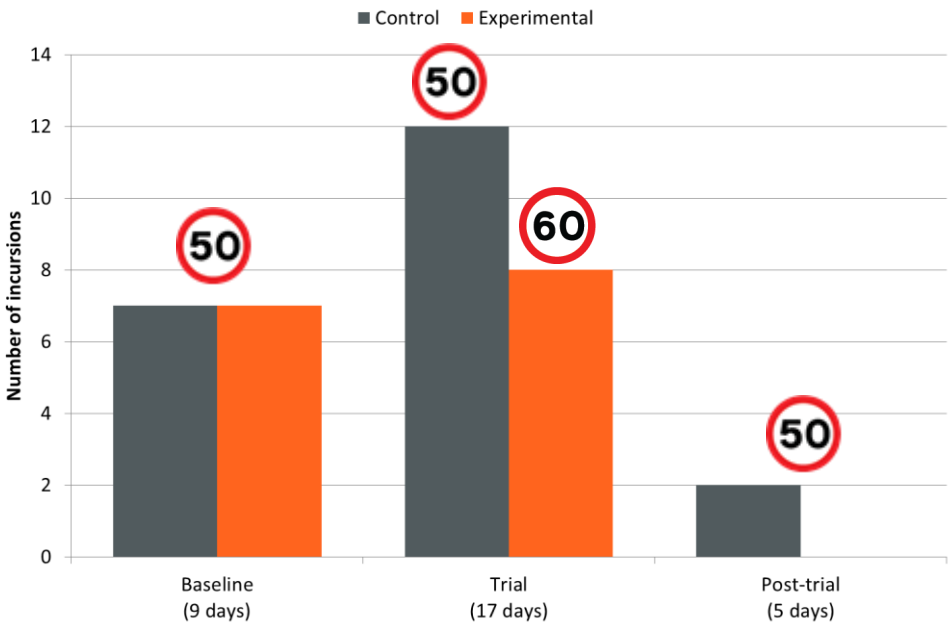


Figure 13: Incursions (northbound)

Within the section of works which increased to 60mph, there were a similar number of incursions during the trial period as seen in the baseline period (despite the former being almost twice as long in length: 17 days compared to nine). This suggests that there was no noticeable change in the number of incursions due to the increase in speed limit.

Table 2 shows how the number of incursions is broken down by type.

Table 2: Incidents reported by CCTV operators by incident type (northbound)

Cause of incursion	Number of incursions
Breakdown	25
Road Traffic Collision	3
Other[7]	8
Total	**36**

The majority of incursions (70%) were the result of breakdowns and are therefore unlikely to be related to the change in speed limit. On the northbound carriageway, there were three road traffic collisions during the monitoring period. None of these occurred in the 60mph section.

3.1.6 Journey time

Estimated journey times through the 60mph speed limit were calculated using the length of the section and the average vehicle speed recorded by the radar at 124/2 (experimental location) and 133/5 (control location). Table 3 shows the journey time estimates for the

[7] 'Other' includes vehicle fires, illnesses and tacho breaks by lorry drivers.

northbound carriageway. These estimates were calculated for the baseline, trial and post-trial periods; the difference between journey times in the baseline and trial periods gives an estimate of the journey time savings as a result of the increase in speed limit.

Table 3: Journey time estimates by monitoring period (northbound)

	Length of section (miles)	Journey time (seconds)			Difference between baseline and trial periods in seconds (percent change)
		Baseline	Trial	Post-trial	
Experimental location	5.10	355.8	316.0	360.0	39.8 (-11%)
Control location	4.47	331.6	328.2	335.4	3.4 (-1%)

The results suggest that changing the speed limit from 50mph to 60mph decreased the average journey time at the experimental location by nearly 40 seconds; this is equivalent to an 11% reduction in journey time through this part of the scheme for each driver. No substantial change in journey time was observed at the control location where the speed limit remained at 50mph throughout both periods; the difference was approximately a 3.4 second improvement, probably due to the lower flows during the trial period.

3.1.7 Summary

- Drivers travelling along the northbound carriageway experienced a 'step down' in speed limit from 60mph to 50mph during the trial period.
- VMS displaying "REDUCED SPEED LIMIT AHEAD", 1500mm diameter terminal signs and VAS were used to inform drivers of the step down.
- Average speeds remained below 60mph throughout the trial period.
- Following the step down, drivers were generally compliant with the new 50mph speed limit within a few hundred metres of the change, suggesting that the VMS, terminal sign and VAS combination was noticed by drivers and was effective at influencing them to reduce their speed to 50mph or less.
- The proportion of vehicles travelling faster than the enforcement threshold (speed limit + 10% + 2mph) was less 5% throughout the monitoring period.
- Following the trial and reinstatement of the 50mph speed limit throughout the whole scheme, speeds returned to levels very similar to those seen during the baseline period prior to the speed increase.
- There was no evidence that average headways were compromised as a result of the 60mph speed limit. In fact, the results for headway suggest that this measure is more likely to be influenced by changes to vehicle flow than the speed limit.
- There was no change in the number of incursions due to the increase in speed limit and no road traffic collisions in the 60mph section of the scheme.
- The average journey time through the 60mph section of the works decreased by nearly 40 seconds (equivalent to an 11% reduction).

3.2 Southbound carriageway

Drivers travelling along the southbound carriageway experienced a 'step up' in speed limit during the trial period. Assuming they joined the roadworks at the Barton junction, they will have driven through a long stretch of roadworks with a 50mph speed limit and then, towards the end of the works, through a shorter 8km stretch with a 60mph limit.

No VAS or VMS were operational on the southbound carriageway during the trial so the driver's only warning of the speed limit change was the terminal signs indicating the change in speed limit, plus the repeater signs that ran throughout the 60mph section.

Once the 60mph speed limit was removed and the speed limit returned to 50mph, VAS were used to emphasise the change back to 50mph and a VMS (displaying 'CHECK YOUR SPEED') was situated at the location where the 60mph speed limit had previously started.

On the southbound carriageway, radars at 124/2 and 126/7 were located within the stretch of roadworks which increased to 60mph (126/7 was located a few hundred metres downstream of the step up and 124/2 was positioned close to the middle of the 8km stretch). Radar 133/5 was located in a section of works which remained at 50mph throughout the duration of the monitoring.

3.2.1 Vehicle flow

Figure 14 shows the average daily vehicle flow across the three monitoring periods as measured at each of the three radar locations. As with the northbound carriageway, data from 124/2 were missing for the period 13th-15th January so the post-trial figures for this radar are based on data from four days instead of seven.

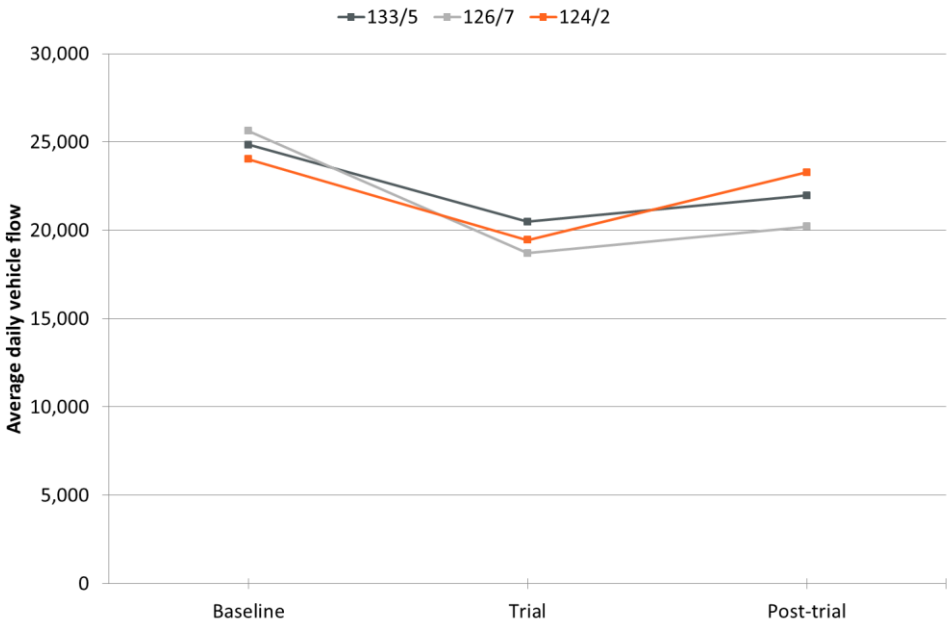


Figure 14: Average daily vehicle flow by radar location and monitoring period (southbound)

As discussed previously, differences in vehicle flow between the three periods are likely to be related to the changes in travel immediately before and over the Christmas period.

As seen in the graph, the missing data from 124/2 again influenced the vehicle flow in the post-trial period. Since flow is typically lower at the weekend, the missing weekend data has inflated average daily flow estimates in the post-trial period, relative to the other radar. In addition, an error was identified early in the baseline monitoring period with the southbound carriageway flows being recorded by the radar unit at 126/7. This was subsequently rectified by the radar supplier, but resulted in a small overestimation of flows on the southbound carriageway at the beginning of the monitoring.

As a result of these anomalies in the data collection, statistical tests indicate some significant differences in vehicle flow between radar and monitoring periods. However, the errors introduced into the trial data by these issues are small, relative to the large quantity of data collected for the monitoring. Their impact is therefore considered unlikely to influence the results presented in this report. This view is supported by tests performed on the radar and data points with no missing or erroneous data (i.e. 124/2 and 133/5 baseline and trial periods) which show no significant differences (p = 0.16), suggesting that changes in average vehicle speed or headway between these radars are likely to be the result of the change in speed limit rather than due to any difference in vehicle flow.

On this basis, the analysis was carried out with no adjustments made to the vehicle flows provided by the radar. Where these results are likely to have had a small impact on the findings, this is highlighted in the text.

Figure 15 shows the proportion of HGVs on the southbound carriageway by radar location and monitoring period.

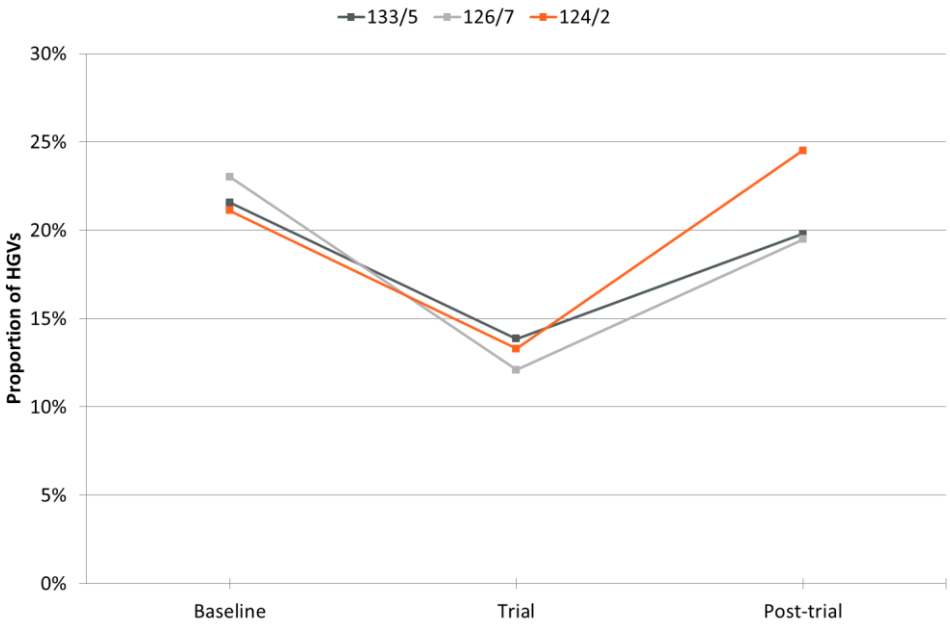


Figure 15: Proportion of HGVs by radar location and monitoring period (southbound)

Similar to the flow data presented in Figure 14, these results are affected by the missing data from radar 124/2 at the end of the post-trial period and the technical issue with data collection on the southbound carriageway by radar 126/7 at the beginning of the baseline period. As discussed previously and for the data from the northbound carriageway, these small differences are unlikely to have any great influence on the results from this analysis.

3.2.2 *Average vehicle speed*

Figure 16 shows the free-flow average speed on the southbound carriageway throughout the monitoring period. Note that the vertical axis on the chart is compressed and displays data from 45mph to 60mph.

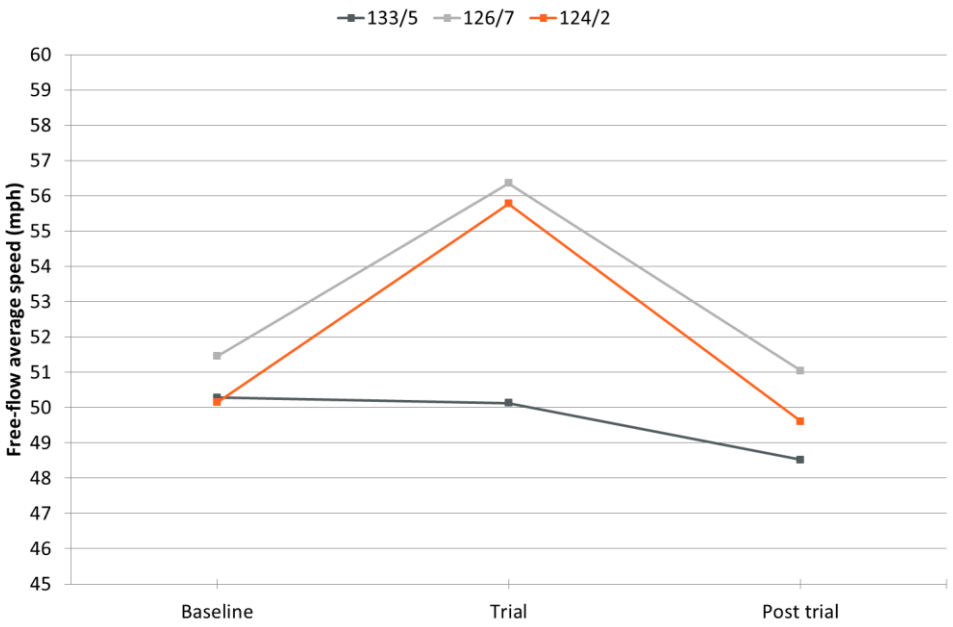


Figure 16: Free-flow average speed by radar location and monitoring period (southbound)

During the baseline period, where the speed limit was 50mph across the entire scheme, the free-flow average speeds were similar (within 2mph) at the three radar unit locations.

Following implementation of the increased speed limit for the trial period, average speeds remained stable at around 50mph at the control location (133/5). Speeds increased to around 56mph at the radar located a few hundred metres after the step up to 60mph (126/7) and within the 60mph speed limit (124/2). This suggests that the majority of drivers did notice the step up in speed limit and immediately adjusted their behaviour, even in the absence of VMS/VAS notifying them of this change.

Following the trial, speeds returned to levels slightly lower (1-2mph) than those seen in the baseline period.

A statistical test (ANOVA) shows that the interaction between monitoring period and radar location is significant ($p < 0.01$). This means that the changes in speed between the three monitoring periods are significantly different across the three radars. It is possible that some of the change in speed between the baseline and trial periods (and subsequently between the trial and post-trial periods) can be attributed to the changes in vehicle flow (Figure 14) and traffic composition (Figure 15). However, since the magnitude of these differences is much larger at two radar unit with the change in speed limit to 60mph in the trial period (124/2 and 126/7), than at the other radar (133/5) which retains the 50mph speed limit throughout all three periods, this suggests that the vast majority of the changes can be attributed to the change in speed limit at these radar.

Figure 17 shows average vehicle speed by radar location and date.

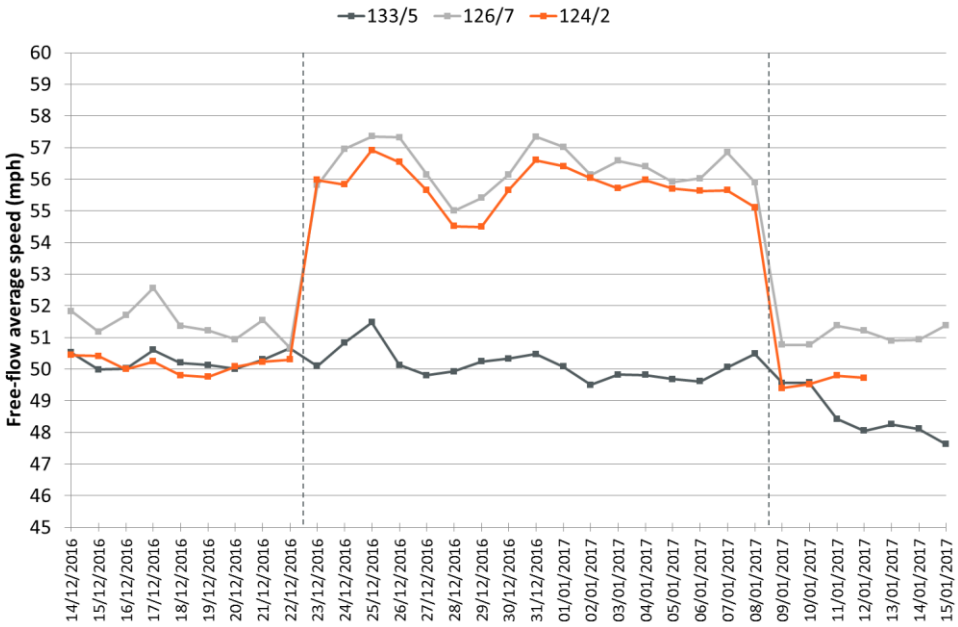


Figure 17: Free-flow average speed by radar location and date (southbound)

Similarly to the northbound carriageway, there was a noticeable increase in average speed from 23rd December to 8th January when the speed limit was increased to 60mph at 124/2 and 126/7. The radar located within the control section (133/5) showed little change over this period.

The maximum average daily speed recorded on the southbound carriageway was 57.4mph, approximately 2.5mph below the speed limit. This may suggest that some drivers did not change their speed and continued to drive around 50mph, meaning that the overall average speed was lower than the speed limit. This may have been by deliberate choice, by habit or due to a failure to notice the speed limit had been increased from 50mph to 60mph.

Figure 18 shows the average speed by lane at the radar located in the middle of the 60mph section (124/2).

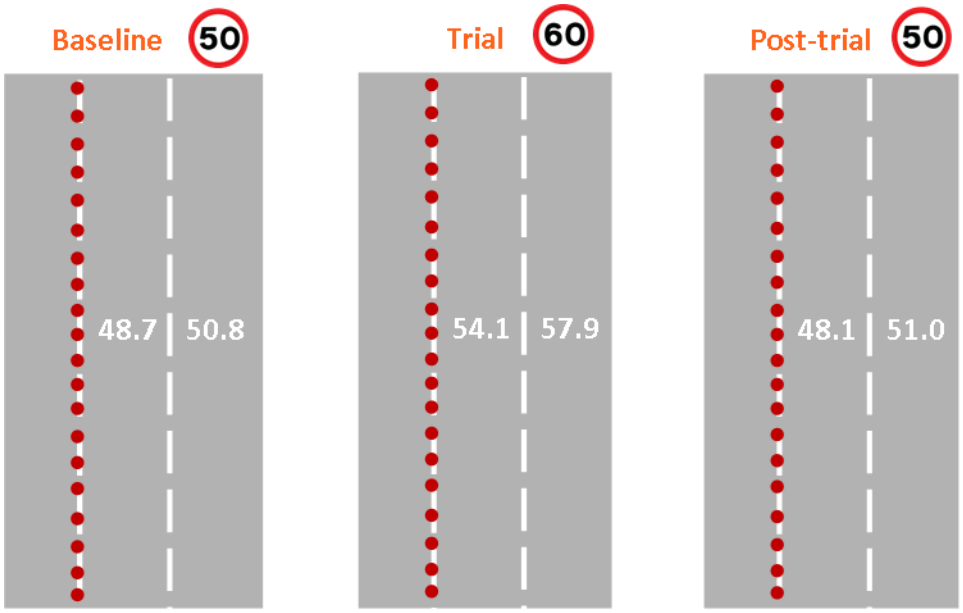


Figure 18: Free-flow average speed (mph) by lane and monitoring period, radar location 124/2 only (southbound)

There was a slightly larger difference in average speed between the two lanes in the trial period (a difference between lanes of 3.8mph) compared with the baseline period (a difference of 2.1mph). It is possible that this difference is due to drivers using Lane 3 to overtake any drivers who did not increase their speed in response to the increased speed limit.

3.2.3 Speed limit compliance

As described in Section 2.4.1.2, vehicle speeds were grouped into six different speed categories. Figure 19 shows the proportion of vehicles in each category.

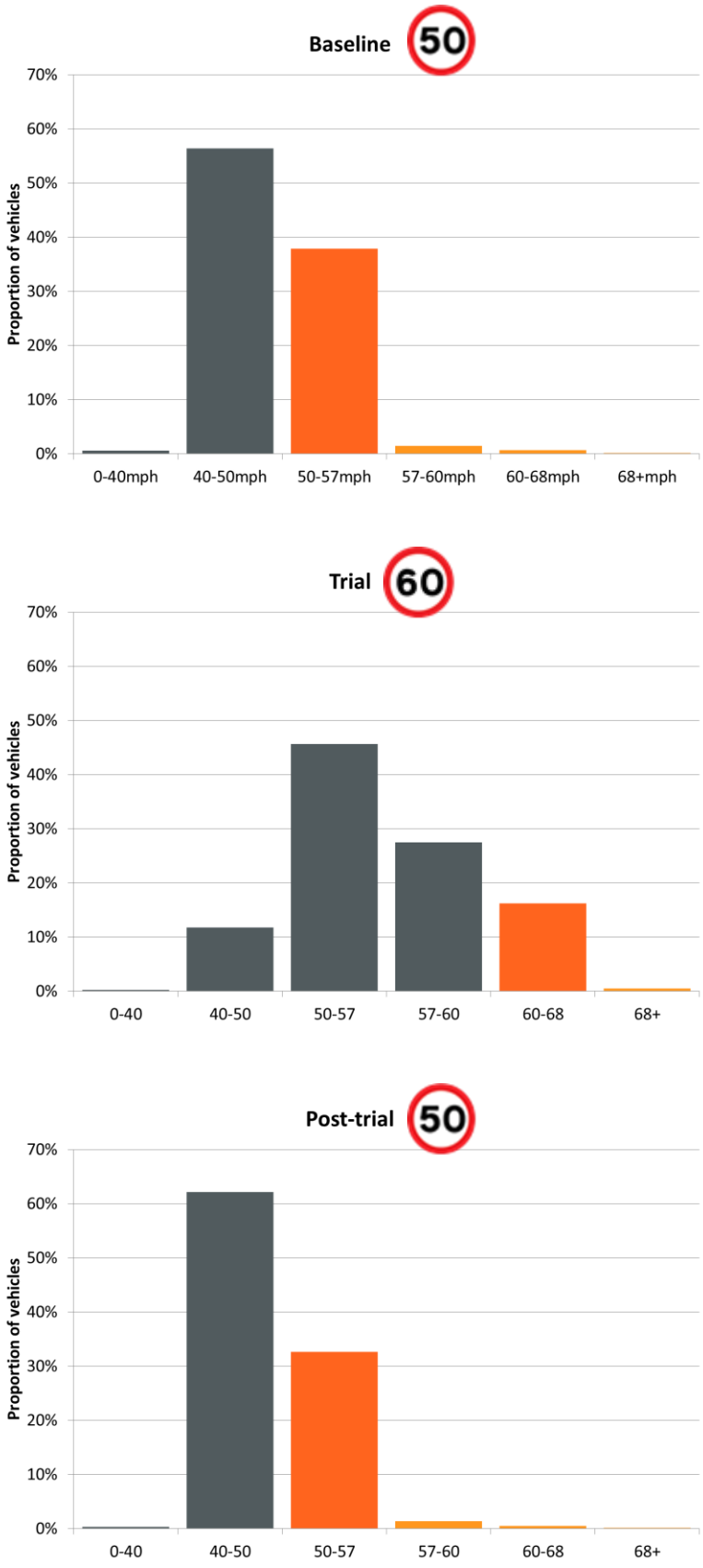


Figure 19: Proportion of vehicles in each speed category at radar 124/2 by monitoring period (southbound)

As before with the results for the northbound carriageway, the grey bars show the proportion of vehicles travelling below the speed limit in each period (compliance), whilst the orange bars indicate the proportion of vehicles travelling above the speed limit.

Compliance with the speed limit was better in the 60mph condition compared to when the speed limit was 50mph (85% of vehicles travelling below 60mph in the trial compared to 57% and 62% below 50mph in the baseline and post-trial periods).

The distribution across the different speed categories was similar across the baseline and post-trial periods and differed in the trial period, with more drivers travelling between 57-68mph due to the increase in speed limit.

The proportion of vehicles over the enforcement threshold (lighter orange bars) was small (<3%) across all three periods but was smallest during the 60mph trial (0.5% compared to 2.4% and 2.1% in the baseline and post-trial periods respectively).

The proportion of vehicles above the speed limit but below the enforcement threshold (the darkest orange bar) was around a third in the baseline and post-trial periods (38% and 33% respectively), but around half of this (16%) during the trial of the 60mph speed limit. This implies that drivers were more compliant with the higher speed limit, suggesting that they may have been happier with the 60mph speed limit and/or considered it more credible than the 50mph speed restriction.

3.2.4 Average vehicle headway

Figure 20 shows the average headway at each of the radar during the three monitoring periods.

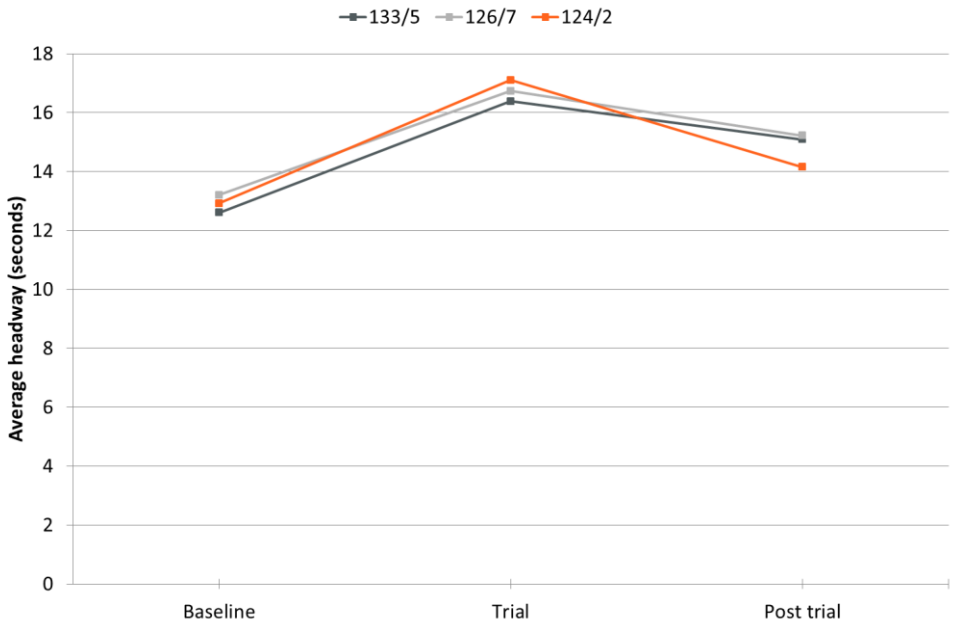


Figure 20: Free-flow average vehicle headway by radar location and monitoring period (southbound)

In each monitoring period, average headway at the three radars was quite similar. The exception to this was the average headway recorded by radar 124/2 during the post-trial

period which was slightly lower than observed at the other radar (due to the three days of missing data).

As discussed previously, the higher average headway in the trial period is likely to be linked to the lower levels of flow observed during the trial period (as shown in Figure 14).

A statistical test (ANOVA) shows no significant difference in the change in headway between periods across the three radar (p = 0.486). This suggests that differences between monitoring periods were not due to the increase in speed limit and were more likely to be a result of the differences in flow.

As on the northbound carriageway, average headway was typically much larger than the 2 second rule suggested by the Highway Code. No evidence was seen that suggested either safety or headway were adversely affected by the increase to 60mph during the trial.

3.2.5 Incidents

On the southbound carriageway, a total of 35 incursions were reported by CCTV operators across both sections (21 in the control section and 14 in the experimental). Figure 21 shows how these figures split between the baseline, trial and post-trial monitoring periods.

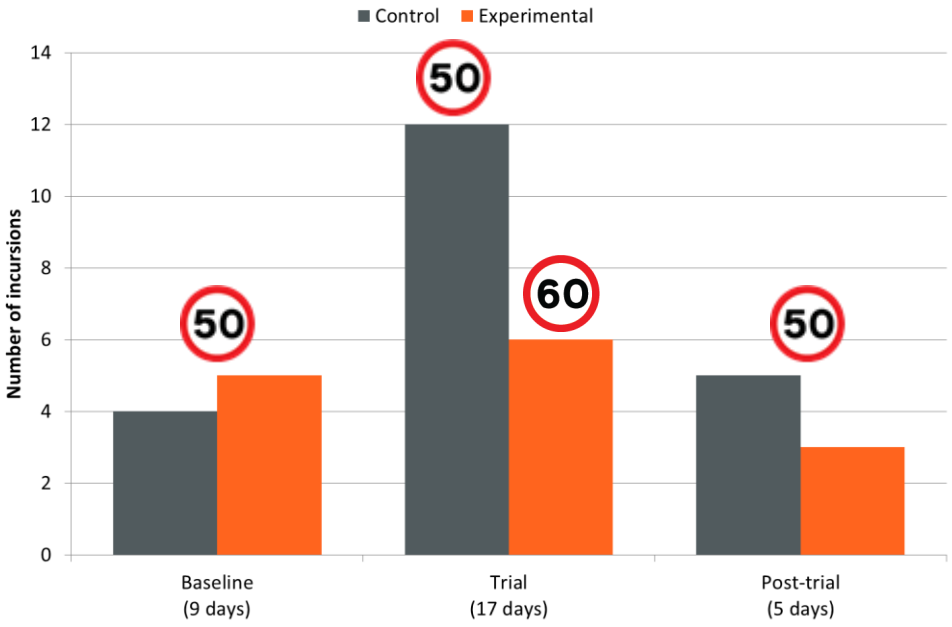


Figure 21: Incursions (southbound)

Within the section of works which increased to 60mph, there were a similar number of incursions during the trial period as seen in the baseline period (despite the former being almost twice as long in length: 17 days compared to nine). This suggests that there was no noticeable change in the number of incursions due to the increase in speed limit.

Table 4 shows how the number of incursions was broken down by type.

Table 4: Incidents reported by CCTV operators by incident type (southbound)

Cause of incursion	Number of incursions
Breakdown	30
Road Traffic Collision	4
Other[7]	1
Total	**35**

The majority of incursions (86%) were the result of breakdowns and are therefore unlikely to be related to the change in speed limit. There was only one road traffic collision which occurred during the monitoring. This incident did not occur in the 60mph section.

3.2.6 Journey time

Estimated journey times through the 60mph speed limit were calculated using the length of the section and the average vehicle speed recorded by the radar at 124/2 (experimental location) and 133/5 (control location). Table 5 shows the journey time estimates for the southbound carriageway.

Table 5: Journey time estimates by monitoring period (southbound)

	Length of section (miles)	Journey time (seconds)			Difference between baseline and trial periods in seconds (percent change)
		Baseline	Trial	Post-trial	
Experimental location	4.04	290.0	260.7	293.1	-29.3 (-10%)
Control location	4.47	320.3	321.3	332.0	1.0 (0%)

The results suggest that changing the speed limit from 50mph to 60mph decreased the average journey time at the experimental location by nearly 30 seconds; this is equivalent to a 10% reduction in journey time through this part of the scheme for each driver. No noticeable change in journey time was observed at the control location where the speed limit remained at 50mph throughout both periods.

3.2.7 *Summary*

- Drivers travelling along the southbound carriageway experienced a 'step up' in speed limit from 50mph to 60mph during the trial period.
- No VAS or VMS were operational on the southbound carriageway during the trial so the driver's only warning of the speed limit change was the terminal signs indicating the change in speed limit, plus the repeater signs that ran throughout the 60mph section.
- Average speeds remained below 60mph throughout the trial period.
- Average speeds increased to around 56mph at the radar located a few hundred metres after the step up to 60mph, suggesting that the majority of drivers did notice the step up in speed limit and immediately adjusted their behaviour.
- Compliance with the speed limit was better in the 60mph condition compared to when the speed limit was 50mph (85% of vehicles travelling below 60mph in the trial compared to 57% and 62% below 50mph in the baseline and post-trial periods).
- The proportion of vehicles travelling faster than the enforcement threshold (speed limit + 10% + 2mph) was less 3% throughout the monitoring period and lowest during the 60mph speed limit (0.5%).
- Following the trial and reinstatement of the 50mph speed limit throughout the whole scheme, speeds returned to levels slightly lower (1-2mph) than those seen in the baseline period.
- There was no evidence that average headways were compromised as a result of the 60mph speed limit. The differences observed between the three monitoring periods are likely to be due to differences in flow over the Christmas/New Year period.
- There was no change in the number of incursions due to the increase in speed limit and no road traffic collisions in the 60mph section of the scheme.
- The average journey time through the 60mph section of the works decreased by nearly 30 seconds (equivalent to a 10% reduction).

3.3 Carriageway comparisons

This section compares the results between the northbound and southbound carriageways to determine if there were differences in driver behaviour between the step-down and step-up scenarios. Figure 22 shows how the average speed recorded during the trial period differed between the northbound and southbound carriageways. As demonstrated by the arrows, when travelling northbound drivers encountered the radar locations in the sequence 124/2, 126/7, 133/5. The reverse was true for drivers travelling southbound.

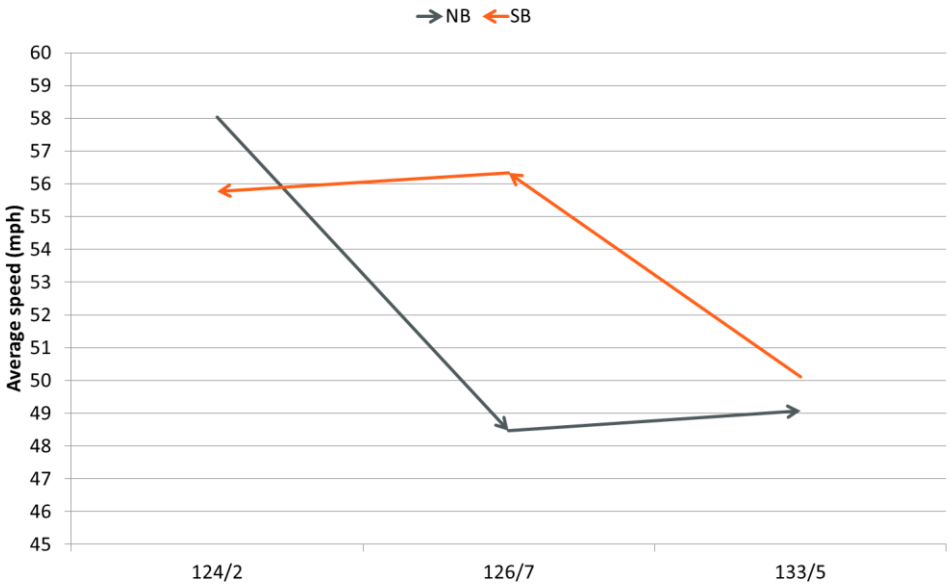


Figure 22: Free-flow average speed by carriageway and radar location (trial period only)

Comparing the speeds at 124/2 (where the speed limit was 60mph on both carriageways) shows that drivers travelling northbound were travelling, on average, approximately 2mph faster than southbound drivers. At this point in their drive, those travelling north will have passed at least one vehicle activated sign informing them of the speed they are travelling, whereas those travelling south will only have seen the 60mph roundels but no additional signs. The difference in average speed might suggest that more drivers on the southbound carriageway missed the change to the 60mph speed limit.

On the northbound carriageway, 126/7 was a few hundred metres downstream of the step down (i.e. within the 50mph speed limit). On the southbound carriageway, this radar was located downstream of the step up (i.e. within the 60mph section). This difference in the positioning of the radar explains the differences in speed at this location.

Finally, at 133/5 the average speeds were similar northbound and southbound; both were very close to the 50mph speed limit.

The trends by date (see Figure 9 and Figure 17) show that speeds on the two carriageways tend to peak and trough on the same days. Daily average speed was highest on both carriageways on Christmas Day (when flows were lowest), but was slightly higher northbound than southbound (60mph compared to 57mph). This could be an artefact of site conditions (sightlines, vertical/horizontal alignment etc.) or due to the presence of the VAS northbound.

Across all three monitoring periods, the proportion of drivers travelling above the enforcement threshold (57mph in a 50mph speed limit or 68mph in a 60mph speed limit) was slightly higher on the northbound carriageway than southbound (see Figure 11 and Figure 19). For example, when the speed limit was 60mph 0.9% of drivers were observed travelling above 68mph northbound, whilst southbound this figure was 0.5%. In addition, the proportion of drivers travelling below the speed limit was higher southbound than northbound (85% compared to 69% during the trial). This suggests that in general, drivers

were more compliant southbound than northbound. This could again be an artefact of site conditions (sightlines, vertical/horizontal alignment etc.) but is also likely to have been influenced by the signing of the works (VMS and VAS were present northbound during the trial period but not southbound) and differences in approach to the 60mph section. For example, drivers travelling southbound have travelled through roadworks for a while before reaching the 60mph step-up section, whereas those travelling northbound entered from a motorway with national speed limit and no roadworks; this is likely to impact on drivers level of frustration, their feelings of progress and subsequent speed choice.

Average headway was slightly lower (1-2 seconds) on the southbound carriageway than on the northbound; this is likely to be related to the slightly lower flows.

The number of incursions was comparable between both carriageways (36 and 35 on the northbound and southbound respectively) and no RTCs occurred within the 60mph speed limit on either carriageway.

The estimated journey time savings per driver on the northbound carriageway was around 10 seconds more than the savings on the southbound carriageway (40 seconds vs. 29 seconds). There are two possible reasons for this; firstly, during the trial period, there was a greater increase in average speed on the northbound carriageway (6.5mph increase compared to 5.6mph). Secondly, the 60mph section on the northbound carriageway was a mile longer so the 60mph speed limit is likely to have a greater effect on journey savings.

3.3.1 Summary

- Within the 60mph section, drivers travelling northbound were travelling, on average, approximately 2mph faster than southbound drivers. This may be linked to the presence of VAS informing drivers northbound of the speed they are travelling; whilst southbound the only indication of the new speed limit is the 60mph speed roundels.
- In general, drivers were more compliant southbound than northbound. For example, the proportion of drivers travelling above the enforcement threshold (68mph in a 60mph speed limit) was slightly higher on the northbound carriageway than southbound (0.9% compared to 0.5%).
- Average headway was slightly lower (1-2 seconds) on the southbound carriageway than on the northbound; this is likely to be related to the slightly lower flows.
- No RTCs occurred within the 60mph speed limit on either carriageway.
- The estimated journey time savings per driver on the northbound carriageway was around 10 seconds more than the savings on the southbound carriageway (40 seconds vs. 29 seconds). This is likely to be related to the greater increase in average speed on the northbound carriageway when the 60mph speed limit was implemented and the longer length of the 60mph speed limit.

3.4 Customer satisfaction

The customer satisfaction survey, carried out at the Scotch Corner service station, was completed by ninety drivers who had driven through the scheme. The survey comprised of multiple questions on speed limits, safety, driver behaviour and benefits of the roadworks.

The survey was carried out in early January so the 60mph speed limit had been in place for over two weeks. Due to the location of the service station relative to the scheme, the survey was targeted at those who had travelled Northbound through the roadworks (i.e. those who experienced a step down is speeds from 60mph to 50mph).

3.4.1 Participant sample

The sample consisted of 19 (21%) females and 67 (74%) males. The distribution of their ages, compared with the whole population of full car (Category B) driving licence holders in Great Britain in March 2016 (data.gov.uk, 2016), can be seen in Figure 23.

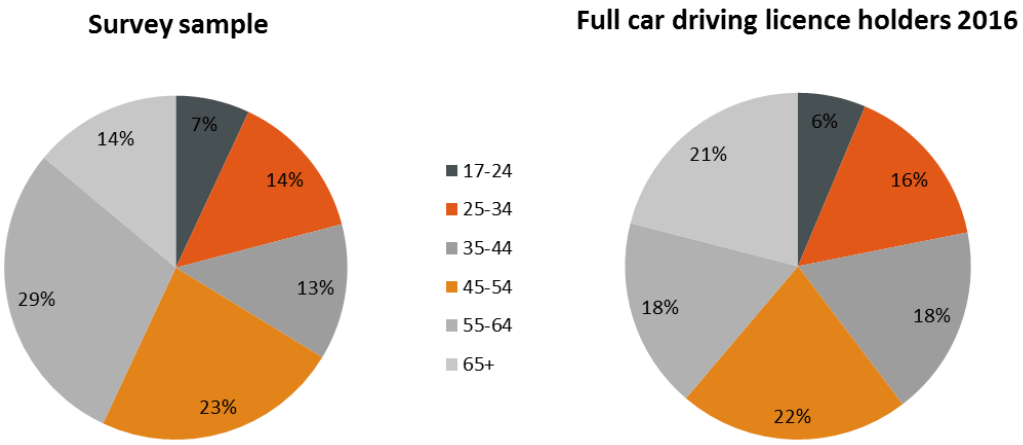


Figure 23: Distribution of age of the sample compared to car driving license holders in GB

Licence holders aged from 35 to 44 years and over 65 years seem to be underrepresented in the sample, and license holders aged from 55 to 64 years seem overrepresented. However, while GB licence holder data is a good indication of the distribution of age of all drivers, it may not be exactly representative of drivers using the Strategic Road Network (SRN). In particular, older drivers (65 years or over) tend not to drive as often as younger drivers, hence the under-representation of older drivers is not a cause for concern.

It is therefore possible to be relatively confident that the sample of drivers surveyed is a reasonable reflection of the general driving population.

Of 90 drivers who participated in the survey, 86 travelled by car, one by HGV, two by LCV and one by motorcycle. 96% (86 drivers) were travelling over 50 miles during their journey and 83 drivers (92%) travelled through this section of M1 a few times a month or less, suggesting that the majority of drivers were not local to the area. However, 66 drivers (73%) were aware of the roadworks taking place before embarking on their journey.

Due to the timing of the survey, which took place in early January during the holiday period, a large proportion of those travelling were visiting friends/family (34%) or on holiday (10%). Travelling on business was also a common reason (36%).

Participants were asked to recall what aspects of the roadworks they saw on their drive (see Figure 24).

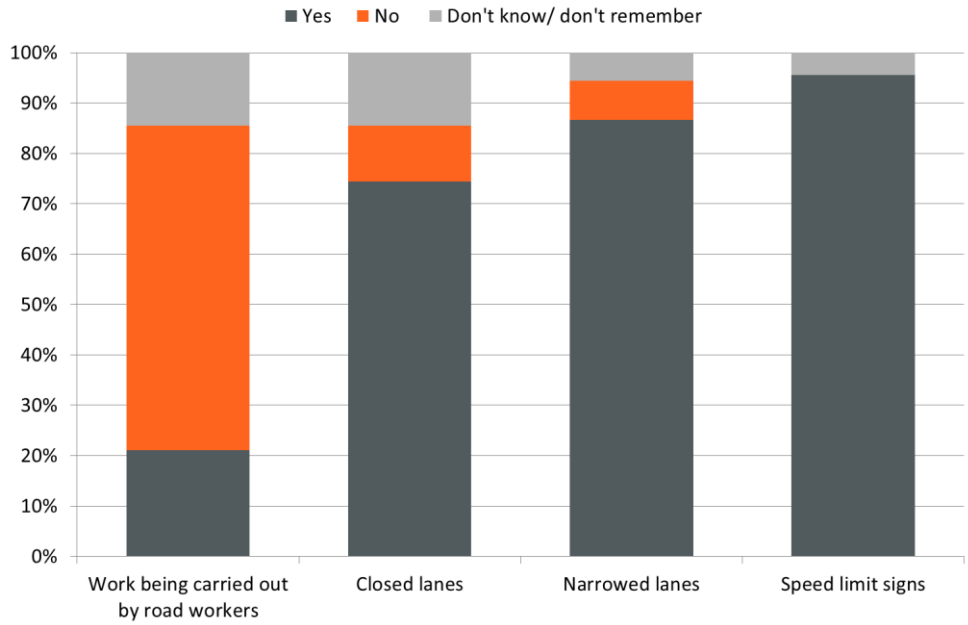


Figure 24: Participants' recall of aspects of their drive

Since the trial took place during the holiday embargo period, the vast majority of drivers (64%) reported seeing no work being carried out by road workers. However, many drivers did report seeing closed lanes, narrowed lanes and speed limit signs whilst driving through the roadworks.

Drivers were asked the extent to which they agreed or disagreed with the three statements regarding long term benefits of the roadworks (see Figure 25).

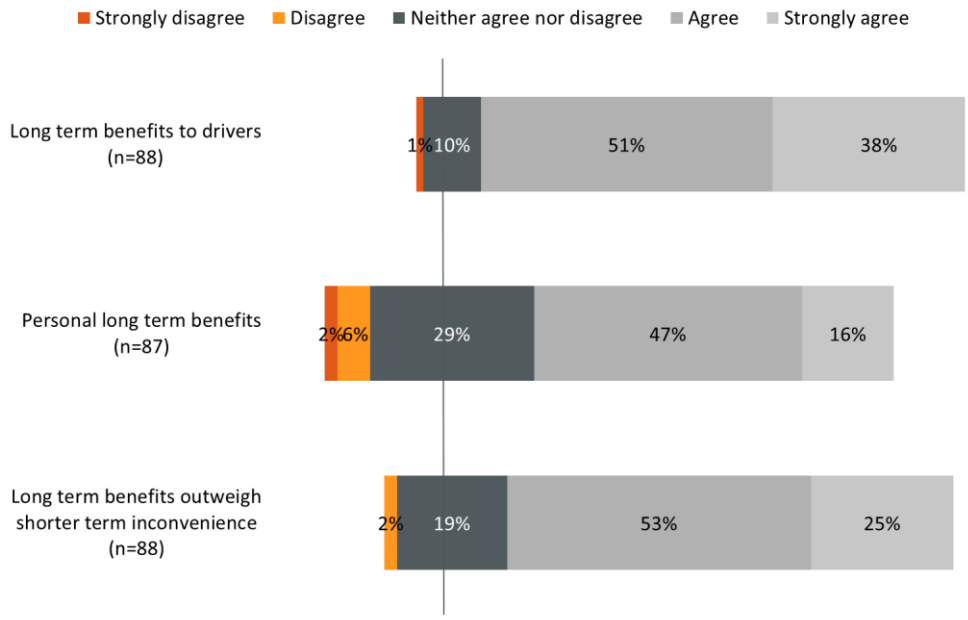


Figure 25: Responses to questions about long-term benefits of roadworks

Over 90% of the participants were either neutral or agreed to some extent with the three statements. However, 1% disagreed to the long term benefits, 8% disagreed to their personal long term benefits, and 2% disagreed that long term benefits outweigh shorter term inconvenience. Given that a vast majority (92%) of drivers travelled through the link a few times a month and were probably not local to the area, it can be assumed that they were less inclined to consider the roadworks to have personal long term benefits.

Participants were also asked to state how much the presence of roadworks affected their overall level of satisfaction. This is presented in Figure 26.

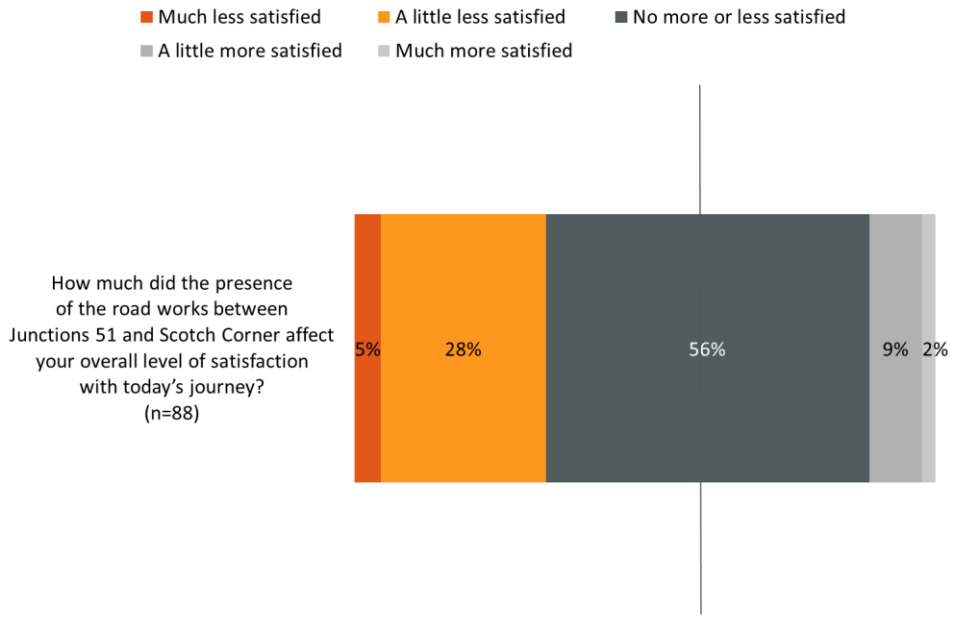


Figure 26: Participants' overall level of satisfaction with their journey

Over half of the drivers in the sample (56%) were neutral about their level of satisfaction with the journey in the presence of roadworks and 11% were satisfied. However, 28% were slightly less satisfied and 5% were much less satisfied with their overall journey through the roadworks. Some of the reasons for lower levels of satisfaction included:

- Long duration of roadworks: *"Roadworks have been going on for two years. Very frustrating as I travel through this route frequently."*
- Absence of road workers: *"No evidence of roadworks being carried out."*
- Speed limit: *"Speed limit too slow."*

3.4.2 Understanding of the speed limit

Table 6 shows the drivers' recall of the speed limits on the two links (between Junction 51 and Catterick and Catterick and Scotch Corner).

Table 6: Recall of speed limits (actual speed limit signs as shown)

		Catterick to Scotch Corner (50)			
		50mph	55mph	60mph	Don't know/no answer
Junction 51 to Catterick (60)	50mph	31	0	1	0
	60mph	51	1	4	1
	Don't know/no answer	1	0	0	0

More than half of the drivers (56%) correctly stated the speed limit was 60mph between Junction 51 and Catterick and 50mph between Catterick and Scotch Corner. 31 drivers (34%) suggested the speed limit was 50mph on both the links and four (4%) suggested the speed limit was 60mph on both links. These figures suggest that despite the VMS and VAS activated during the trial, a few drivers still missed the step down in speed limit.

Drivers who identified the speed limits correctly were asked to provide their opinion on the suitability of the speed limits during the roadworks. The results are presented in Figure 27.

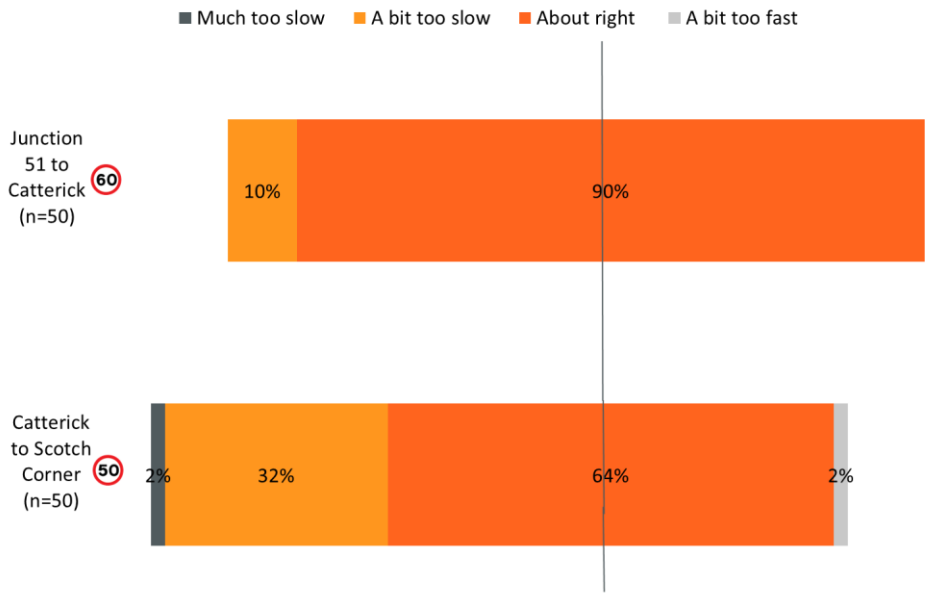


Figure 27: Appropriateness of the speed limit[8]

The vast majority (90%) of drivers thought the speed limit of 60mph through the first part of the roadworks was about right compared to only 64% who thought the 50mph speed limit further north was appropriate.

Drivers were asked to recall the speed at which they were driving on the two links. For the 51 drivers who correctly identified the speed limits, the speeds reported are given in Table 7.

Table 7: Reported speeds on both links (n=51)[9]

	Average speed reported	Minimum speed reported	Maximum speed reported
Junction 51 to Catterick 60	59.3mph	50mph	65mph
Catterick to Scotch Corner 50	49.7mph	40mph	60mph

On average, participants reported driving below the given speed limits on both the links. There were a small number of people who reported travelling faster than the limit.

When asked if the presence of other vehicles affected the speed at which the participants drove, 35 drivers (out of 51) stated that they were able to drive at their preferred speed; this is likely to be linked to the low levels of reported congestion (approximately 75% of participants reported the conditions to be free-flowing).

[8] One person did not respond to this question.

[9] One participant could not recall his speed and was not included in these calculations. In cases where the range was given, for instance 50-60mph, the mid-point value, 55mph, was used.

3.4.3 *Driver behaviour*

Participants were also asked about whether there were any times where the behaviour of other drivers made them feel less safe. Driver behaviours asked about included overtaking, close following, speeding and mobile phone use. Participants were also given the opportunity to comment on other behaviours which made them feel less safe.

Figure 28 shows the number of times at least one concern was raised regarding the behaviour of a particular driver type. For instance, if a participant stated that overtaking and close following by van drivers made them feel less safe, then this was only counted once in Figure 28 (but twice in Figure 29).

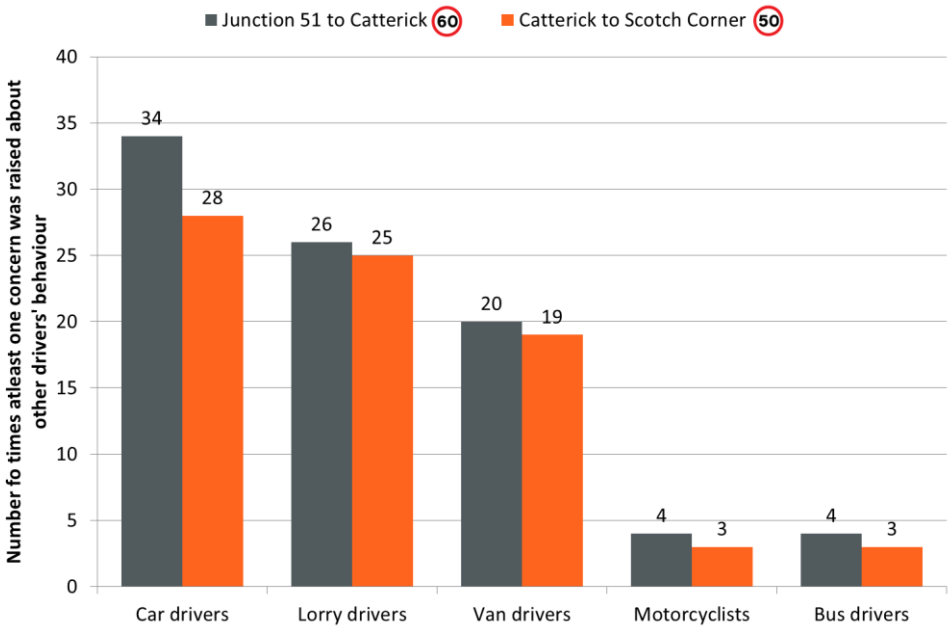


Figure 28: Count of times each driver type was recorded as having made the participant feel less safe

Across all driver types, more concerns were raised about the behaviour of other drivers in the 60mph section than in the 50mph section. Car, lorry and van drivers typically caused the most concern and are investigated further in Figure 29.

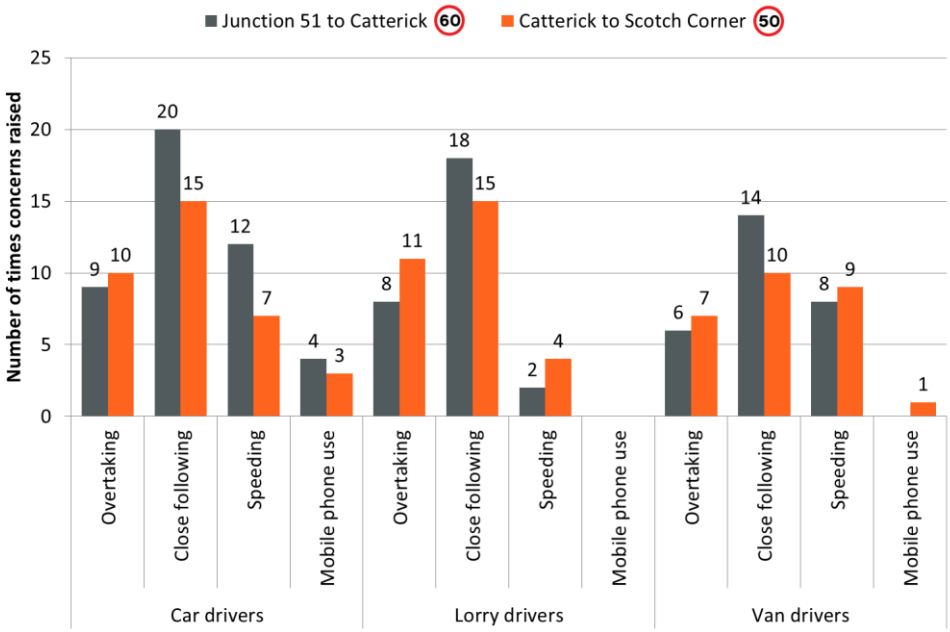


Figure 29: Unsafe behaviour of car, lorry and van drivers

Across all three driver types, participants were most concerned about close following and least concerned about mobile phone use.

Although there were some differences between the two links, with more close following and less overtaking reported in the 60mph section, the number of concerns raised was relatively small, meaning it is hard to draw robust conclusions about the influence of the speed limit on driver behaviour.

Other behaviours which caused safety concerns for some drivers included:

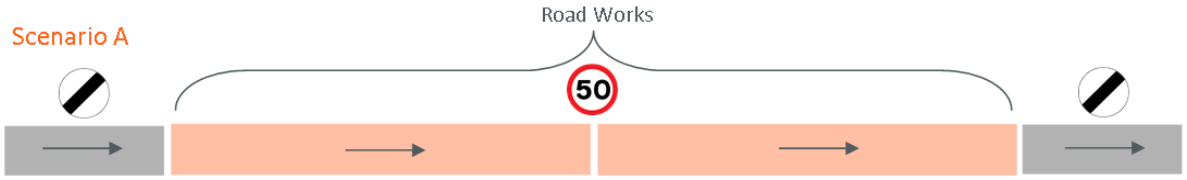
- The impact of speed cameras: *"Speeding up and then slowing down before the next speed camera pod."* [10]
- Undertaking: *"Vans and cars were undertaking and switching lanes."*
- Driving too slow: *"Lorry drivers driving at 40-50mph were much too slow for road conditions and made people frustrated."*

3.4.4 Stepped speed through roadworks

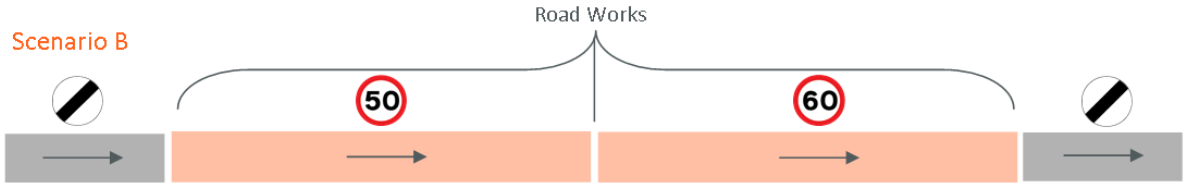
Towards the end of the survey, participants were provided with three alternate scenarios. Scenario A involved a section of roadworks with a speed limit of 50mph throughout. Scenario B involved a section of roadworks with an initial 50mph speed limit, followed by a speed limit of 60mph. Scenario C involved a section of roadworks with 60mph speed limit throughout (see Figure 30).

[10] This statement suggests that some drivers may not understand how average speed cameras work.

Scenario A involves a section of road works with a 50mph speed limit throughout:



Scenario B involves a section of road works with an initial 50mph speed limit, followed by a 60mph speed limit in the second part of the road works:



Scenario C involves a section of road works with a 60mph speed limit throughout:

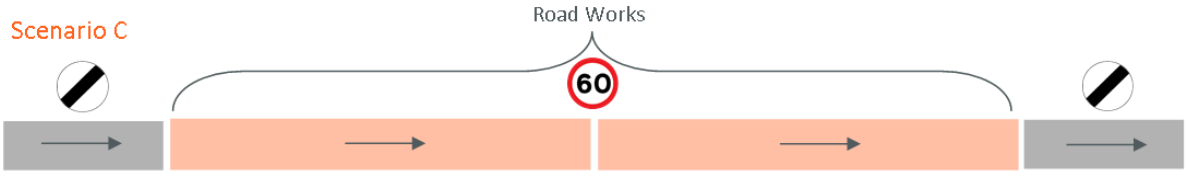


Figure 30: Scenarios presented in the survey

Participants were asked to rate their journey satisfaction (Figure 31), perceived impact on journey time (Figure 32) and feelings of safety (Figure 33) in each of the three scenarios.

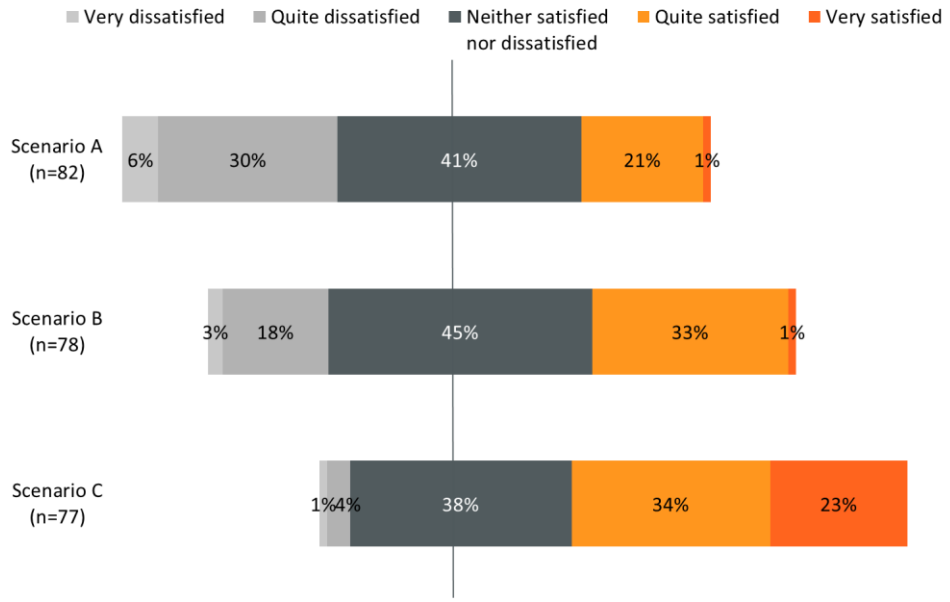


Figure 31: Drivers' journey satisfaction when travelling through scenarios A, B and C

More than half (57%) of the respondents stated that they would be quite or very satisfied in Scenario C (60mph limit throughout), compared to 34% for Scenario B and 22% for Scenario

A. Interestingly, a large proportion of respondents (38 to 45%) remained neutral suggesting that changes in speed limit are not the only factors which contribute towards journey satisfaction.

Figure 32 shows how the three scenarios are perceived to affect journey time, compared to if there were no roadworks in place.

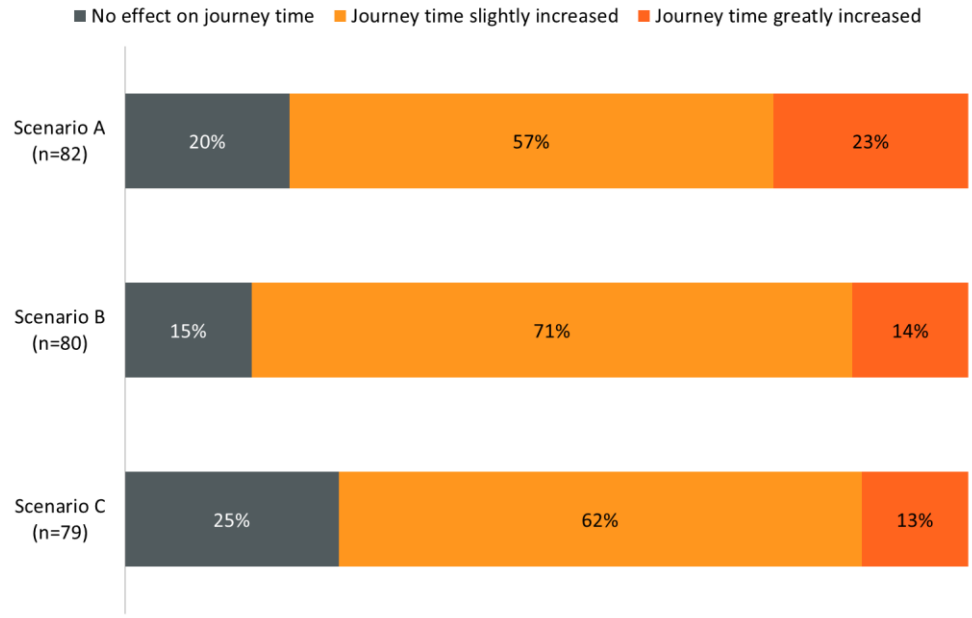


Figure 32: Participants' perception of journey times in scenarios A, B and C

A higher proportion of participants (23%) of participants said their journey time would be greatly increased in Scenario A compared to 14% and 13% in Scenario B and C, respectively. A larger proportion (57% to 71%) stated that the speed limit would slightly increase their journey time.

Interestingly, the stepped speed limit (Scenario B) resulted in fewer people believing the works will have no effect on journey time than a constant 50mph speed limit (15% compared to 20% in Scenario A). This might suggest the some drivers do not understand average speed properly.

Feelings of safety for the three scenarios are shown in Figure 33.

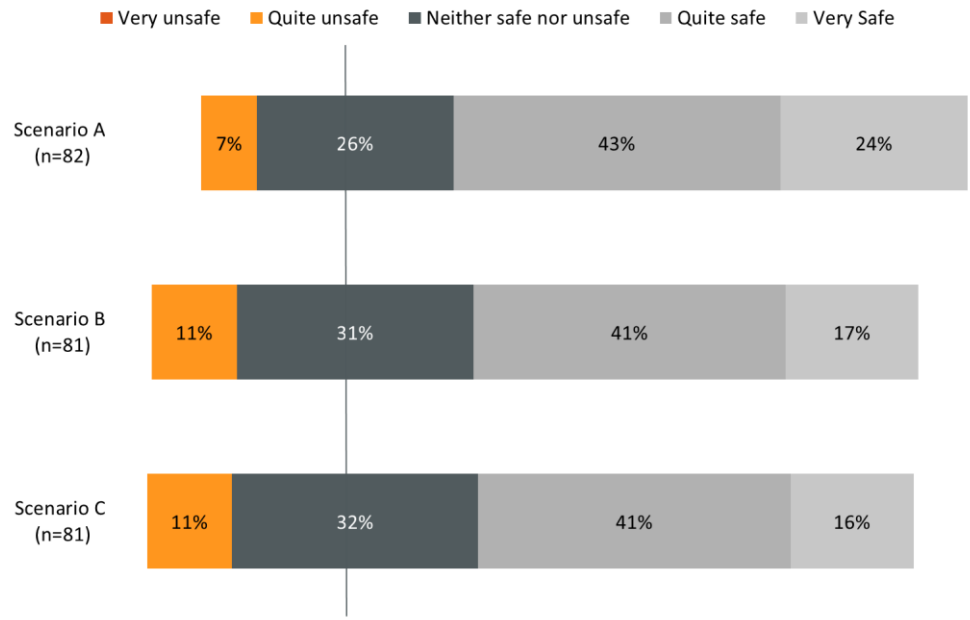


Figure 33: Participants' feelings of safety in scenarios A, B and C

A small proportion of drivers (7% in Scenario A and 11% in Scenarios B and C) said that they would feel quite unsafe driving through the roadworks; nobody suggested that the three scenarios would result in them feeling very unsafe. This suggests that majority of participants perceived the 60mph speed limit to have a similar level of safety to the 50mph speed limit.

3.4.5 General comments

At the end of the survey, participants were given the opportunity to provide some general comments. These comments covered two main topic areas.

Comments regarding the on-going nature of the roadworks:

- *"I think that the speed of the roadworks progression should be sped up to minimize disruption, i.e., roadworks being carried out 24/7 until completion."*
- *"I've been travelling on the A1 for the last 8 years and there are always roadworks somewhere on it (from Newark). Question about short term inconvenience isn't really relevant as it seems never ending."*
- *"Lack of work going on, on a weekday in good weather, when everyone else in back at work."*
- *"Please open the motorway soon. There is no need to have such a long distance of inside lane closure when there is no activity either side of Catterick. It is frustrating that you have to be through this area before 8pm daily."*

Comments regarding changes in the speed limit:

- *"The latest increase in the speed limit has helped this journey time to decrease."*
- *"I hope I didn't miss the limit change. Wish more places tried this."*

- *"Would make more sense to increase speed limits to 60mph through roadworks if there are no workers on the road."*

3.4.6 Summary

- The customer satisfaction survey, carried out at the Scotch Corner service station, was completed by ninety drivers who had driven northbound through the step down in speed limit.
- A third of drivers were less satisfied with their journey due to the presence of the roadworks. Some of the reasons quoted were the long duration of works, the absence of road workers and the speed limit.
- More than half of the drivers (56%) correctly identified that the speed limit had stepped down from 60mph to 50mph. However, despite the VMS and VAS activated during the trial, these figures suggest that a few drivers still missed the change in speed limit and incorrectly recalled that the limit was 50mph throughout.
- The vast majority (90%) of drivers thought the speed limit of 60mph was about right, compared to only 64% who thought the 50mph speed limit was appropriate.
- Over one third of respondents said that they would be 'neither satisfied nor dissatisfied' with three theoretical scenarios (50mph speed limit throughout the works, initial 50mph speed limit followed by a speed limit of 60mph, and a 60mph limit throughout), suggesting that changes in speed limit are not the only factors which contribute towards journey satisfaction.
- The majority of participants perceived the 60mph speed limit to have a similar level of safety to the 50mph speed limit.

4 Conclusions

The on-road trial of 60mph at the A1 Leeming to Barton scheme was the second trial of increased speed limits at roadworks planned as part of this study. The scheme trialled a 60mph speed limit during the three week Christmas roadworks embargo period, starting on 23rd December 2016.

The 60mph speed limit was implemented for part of the scheme on both carriageways with drivers on the northbound carriageway experiencing a 'step down' in speed limit from 60mph to 50mph and those travelling southbound experiencing a 'step up' from 50mph to 60mph. Following the trial, speeds returned to 50mph throughout the scheme on 9th January, with monitoring continuing until 15th January to ensure that speeds had returned to the pre-trial levels and that it was safe for workers to return to working in the closure.

Data from temporary radars were used to monitor average speed, compliance with speed limits and headway during the trial. The results show that free-flow average speeds increased significantly (from around 51mph to 58mph on the northbound and from 50mph to 56mph southbound) as the speed limit increased from 50mph to 60mph. The slightly larger increase seen northbound has been attributed to the presence of VAS on this carriageway, highlighting the speeds that drivers are travelling as they enter the 60mph speed limit.

Compliance with the step down in speed limit was good with average speeds having reduced to below 49mph at the radar located only a few hundred metres downstream of the speed limit reduction. The change in speed limit was highlighted by a VMS displaying the message "reduced speed limit ahead" and VAS shortly after the step, both of which are likely to have contributed to high levels of compliance with the new speed limit.

Despite the absence of VMS or VAS highlighting the step up in speed limit on the southbound carriageway, there was still a 5mph increase in average speed at the radar located a few hundred metres downstream of the step, suggesting that the majority of drivers did notice the change in speed limit.

Overall, the proportion of drivers travelling below the speed limit was higher on the southbound carriageway than northbound (85% compared to 69%) and the proportion of drivers travelling above the enforcement threshold (68mph) was slightly higher on the northbound carriageway (0.9% compared to 0.5%), suggesting that drivers southbound were more compliant with the speed limit. This might be due to the site conditions, the signing of the works and/or differences in approach to the 60mph section (step up from 50mph to 60mph southbound vs. step down from national speed limit to 60mph northbound).

Following the trial and reimplementation of the 50mph speed limit on 9th January, average speeds quickly returned to pre-trial levels. During this period VAS were active on both carriageways and a VMS displaying "check your speed" was operational on the southbound carriageway at the location of the previous step up in speed limit. On the basis of subject assessment of the risk and some preliminary analysis of the average speed data, the scheme made the decision to return workers to the closure and re-commence works on 11th January.

Average headway (the distance between successive vehicles) increased between the baseline and trial periods; however, this change was replicated at all three radar suggesting that it was not a result of the increase in speed limit. The changes in headway observed during the monitoring are likely to be related to the changes in vehicle flow over the Christmas period: as vehicle flow reduces, headway tends to increase. On average, headway was typically much larger than the 2 second rule, suggesting that, in general, safe stopping distances were maintained between vehicles.

A total of 71 incursions were reported by CCTV operators during the monitoring period; the majority of these (70% northbound and 86% southbound) were breakdowns and therefore unlikely to be related to the increase in speed limit. There were four road traffic collisions, none of which occurred within the 60mph scheme.

Based on the average speed and length of the 60mph section, it is estimated that introduction of the 60mph speed limit saved drivers travelling northbound, on average, 40 seconds in journey time. Savings were slightly less southbound (29 seconds), but both equate to around a 10% reduction in journey time across the length of the scheme that implemented 60mph.

In addition to the data on driver behaviour, a survey was carried out at the motorway service area at Scotch Corner with drivers who had driven northbound through the scheme. The aim of this survey was to understand whether drivers noticed the change in speed limit and to find out how satisfied or dissatisfied they were with increases in speed through roadworks.

Over 90% of customers were either neutral or agreed that the roadworks would provide some long term benefits. However, a large proportion (33%) stated that they were much or a little less satisfied with their journey due to the presence of the scheme. Some reasons for feeling dissatisfied included the long duration of the works, the absence of road workers and the speed limits.

More than half of drivers (56%) correctly recalled the speed limits through the scheme, with 90% of these saying that the 60mph speed limit felt ‘about right’ compared to only 64% who felt the 50mph speed limit further north within the scheme was appropriate.

When asked about three theoretical scenarios (50mph throughout roadworks, 50mph for half of the works and 60mph for the remainder, and 60mph throughout), more than half (57%) of the respondents stated that they would be satisfied with a 60mph limit throughout, compared to 34% with a change in speed limit and 22% with 50mph throughout. However, over a third of drivers remained neutral in each scenario, suggesting that changes in speed limit are not the only factors which contribute towards journey satisfaction.

In summary, there is no indication that the 60mph speed limit had a negative impact on road user safety and drivers reported being more satisfied with the faster speed limit. The next step is to understand road workers opinions of the trial, to determine whether they felt there were any safety concerns due to the increased speed limits (the methodology for this is outlined in Section 5.1).

5 Next steps

5.1 Focus groups

In addition to engaging with customers on the Strategic Road Network through the motorway service area survey, it is important that the first-hand views of people who were involved with the trial are collected, understood and used to advise any further trial or roll-out. The next step is therefore to engage with individuals who have experience of working during the 60mph pilot, to understand any challenges faced during the trial and any concerns or risks that would need further management in order for increased speed limits at roadworks to be used across the network.

TRL will host a focus group in late February/early March with representatives from the scheme, the TM maintenance crew, the Traffic Officer Service, police and recovery operations. Results from the on-road trials will be included in the focus group agenda to aid discussions on the potential implications for safety. The topic guide will be developed and agreed with Highways England to ensure all relevant subject areas are covered.

5.2 Implementation of 55/60mph at other schemes

This is the second pilot of 60mph at roadworks as part of this project. The first trial, on the M1 J32-35a scheme in late 2016, was a success and is reported on in full in Wallbank *et. al.* (2017).

TRL is working closely with Highways England to implement increased speed limits at other schemes. At the time of writing, the M5 J4a-6 scheme is planning to increase the speed limit to 60mph during the operational testing phase of this scheme. This is currently expected to take place in Spring 2017.

In addition, simulation trials are on-going to determine the feasibility of a pilot of 55mph on-road.

The results from each of the trials will be reported once monitoring is complete. A final report, collating all the findings from the trials and simulations, will be provided at the end of the project.

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Appendix A Motorway Service Area Survey

MOTORWAY USER SURVEY

- This research is being carried out by TRL *(the Transport Research Laboratory)* on behalf of Highways England.
- We would be very grateful for your help with the survey *(it should only take 5-10 minutes)* but you are under no obligation to do so and you may stop at any time.
- The research aims to improve understanding of driver perceptions of road works.
- There are no 'right' or 'wrong' answers – we are interested in what you think.
- We do not ask for any personal details, so all of your answers will be anonymous.
- If you have any questions about the survey, please ask one of the researchers.
- This survey is conducted in accordance with the Market Research Society Code of Conduct.

IF YOU COMPLETE THE SURVEY AND RETURN IT TO US TODAY, YOU WILL RECEIVE £5 IN CASH

Please confirm: have you just driven (as a driver, **not** a passenger) through the roadworks from Junction 51 (on the A1(M), Leeming Bar) and Scotch Corner?

- ☐ Yes
- ☐ No – sorry, we are only looking for drivers who have just driven between Junctions 51 on the A1(M) and Scotch Corner to complete this survey
- ☐ Don't know – please speak to a researcher

1. Approximately how many miles are you going to travel on your current journey?

- ☐ 1-50
- ☐ 51-100
- ☐ 101-150
- ☐ 151-200
- ☐ 201-250
- ☐ 251+
- ☐ Don't know

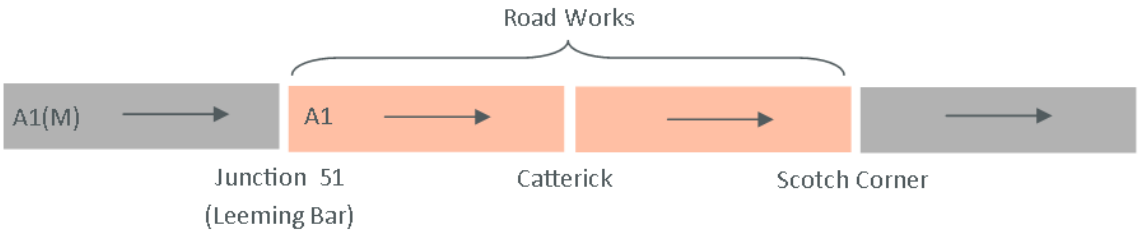
2. What type of vehicle are you driving today?

- ☐ Car (includes car-derived vans)
- ☐ Heavy goods vehicle (over 7.5 tonnes)
- ☐ Light commercial vehicle (up to and including 7.5 tonnes)
- ☐ Motorcycle
- ☐ Bus/coach
- ☐ Other (please specify)_____

3. What is the main purpose of your current journey?

- ☐ Commuting
- ☐ Business
- ☐ Education (incl. escorting others)
- ☐ Shopping
- ☐ Other personal business
- ☐ Visiting friends/family
- ☐ Holiday
- ☐ Other (please specify)_____

The diagram below illustrates where road works are located on the A1:



4. Did you know about these road works in advance of your trip?

- ☐ Yes
- ☐ No

5. When you drove through the road works between Junctions 51 and Scotch Corner today was it…

- ☐ Daylight
- ☐ Dark

6. What was the weather like when driving between Junctions 51 and Scotch Corner today? *(Please tick all that apply)*

- ☐ Dry
- ☐ Light rain
- ☐ Heavy rain
- ☐ Foggy
- ☐ Other *(please specify)*_____

7. Typically, how often have you driven between Junctions 51 and Scotch Corner (northbound only) over the last year?

- ☐ Every day/every weekday
- ☐ A few times a week
- ☐ A few times a month
- ☐ Once a month or less
- ☐ This is the first time in the last year I have driven between these junctions
- ☐ Don't know

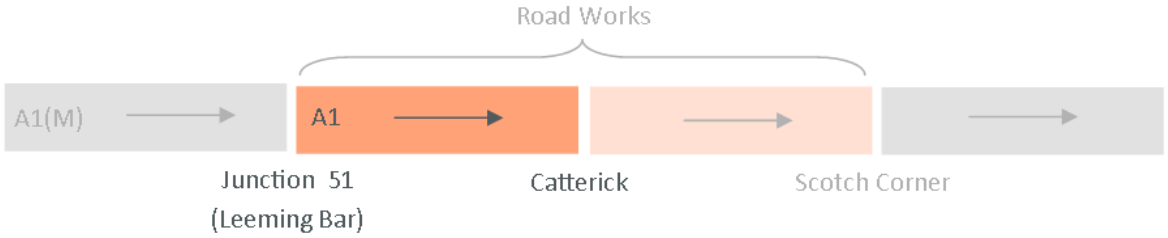
8. Did you notice any of the following when driving between Junctions 51 and Scotch Corner today?

	Yes	No	Don't know / don't remember
a) Work being carried out by road workers	☐	☐	☐
b) Closed lanes	☐	☐	☐
c) Narrowed lanes	☐	☐	☐
d) Speed limit signs	☐	☐	☐

9. To what extent do you agree or disagree with the following statements?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
a) The road works will provide long term benefits to drivers	☐	☐	☐	☐	☐
b) The road works will provide long term benefits to me personally	☐	☐	☐	☐	☐
c) The long term benefits of the roadworks outweigh the shorter term inconvenience	☐	☐	☐	☐	☐

Questions 11 to 17 relate to the road works only between Junctions 51 and Catterick (as shown in the diagram below). Please try to think back to when you drove this section of road when answering these questions.



10. How would you describe the traffic conditions between Junction 51 and Catterick today?

- ☐ Heavily congested
- ☐ Slightly congested
- ☐ Free-flowing
- ☐ Don't know/don't remember

11. What do you think the speed limit between Junction 51 and Catterick was?

☐ mph

12. Thinking about the conditions when you drove between Junctions 51 and Catterick just now, do you think the speed limit was…

☐ Much too slow	☐ A little bit too slow	☐ About right	☐ A little bit too fast	☐ Much too fast

13. What speed do you think you drove between Junctions 51 and Catterick?

☐ mph OR ☐ Don't know/don't remember

14. Did the presence or speed of other vehicles affect the speed at which you drove between Junctions 51 and Catterick?

- ☐ Yes – I drove **more slowly** than I would have liked
- ☐ Yes – I drove **faster** than I would have liked
- ☐ No – I was able to drive at the speed that I wanted to drive at

15. When you drove between Junctions 51 and Catterick, were there any times where the behaviour of other drivers made you feel less safe? *(Please tick all that apply)*

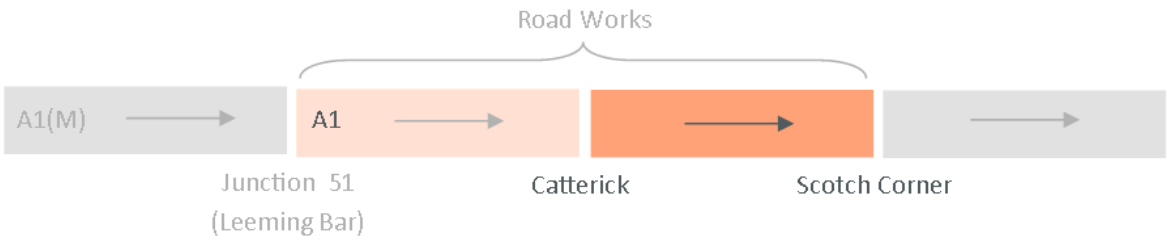
	Overtaking	Close following	Speeding	Using a mobile phone or other device	Other (please specify below)
Car drivers	☐	☐	☐	☐	☐
Lorry drivers	☐	☐	☐	☐	☐
Van drivers	☐	☐	☐	☐	☐
Motorcyclists	☐	☐	☐	☐	☐
Bus/coach drivers	☐	☐	☐	☐	☐

Other behaviours/road users that made you feel less safe:

16. Did you notice any speed cameras between Junctions 51 and Catterick?

- ☐ Yes
- ☐ No
- ☐ Don't know

Questions 18 to 24 relate to the section of road works only between Catterick and Scotch Corner (as shown in the diagram below). Please try to think back to when you drove this section of road when answering these questions.



17. How would you describe the traffic conditions between Catterick and Scotch Corner today?

- ☐ Heavily congested
- ☐ Slightly congested
- ☐ Free-flowing
- ☐ Don't know/don't remember

18. What do you think the speed limit between Catterick and Scotch Corner was?

☐ mph

19. Thinking about the conditions when you drove between Catterick and Scotch Corner just now, do you think the speed limit was…

☐	☐	☐	☐	☐
Much too slow	A little bit too slow	About right	A little bit too fast	Much too fast

20. What speed do you think you drove between Catterick and Scotch Corner?

☐ mph OR ☐ Don't know/don't remember

21. Did the presence or speed of other vehicles affect the speed at which you drove between Catterick and Scotch Corner?

- ☐ Yes – I drove **more slowly** than I would have liked
- ☐ Yes – I drove **faster** than I would have liked
- ☐ No – I was able to drive at the speed that I wanted to drive at

22. When you drove between Catterick and Scotch Corner, were there any times where the behaviour of other drivers made you feel less safe? *(Please tick all that apply)*

	Overtaking	Close following	Speeding	Using a mobile phone or other device	Other (please specify below)
Car drivers	☐	☐	☐	☐	☐
Lorry drivers	☐	☐	☐	☐	☐
Van drivers	☐	☐	☐	☐	☐
Motorcyclists	☐	☐	☐	☐	☐
Bus/coach drivers	☐	☐	☐	☐	☐

Other behaviours/road users that made you feel less safe:

23. Did you notice any speed cameras between Catterick and Scotch Corner?

☐ Yes

☐ No

☐ Don't know

24. Please indicate how clearly you remember the part of your journey between Junction 51 (Leeming Bar) and Scotch Corner *(the two sections which you have just been asked about)*

Not at all clearly	Not very clearly	Quite clearly	Very clearly
I had to guess most of my answers	*I had to guess some of my answers*	*I am confident in most of my answers*	*I am confident in all of my answers*
☐	☐	☐	☐

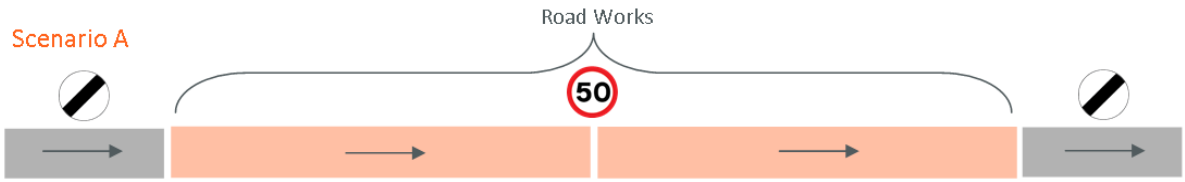
25. How much did the presence of the road works between Junctions 51 and Scotch Corner affect your overall level of satisfaction with today's journey so far?

☐	☐	☐	☐	☐
Much less satisfied	A little less satisfied	No more or less satisfied	A little more satisfied	Much more satisfied

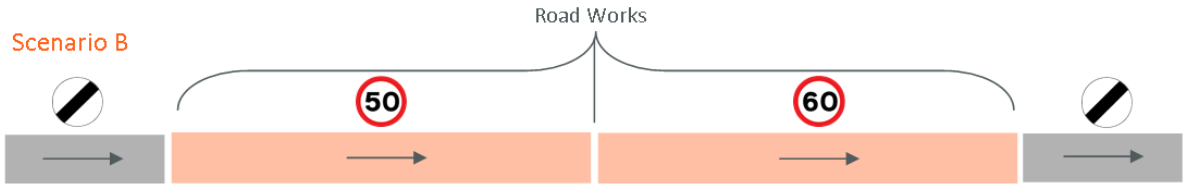
Please give a reason for your answer to the above question:

The final set of questions is related to three alternative scenarios:

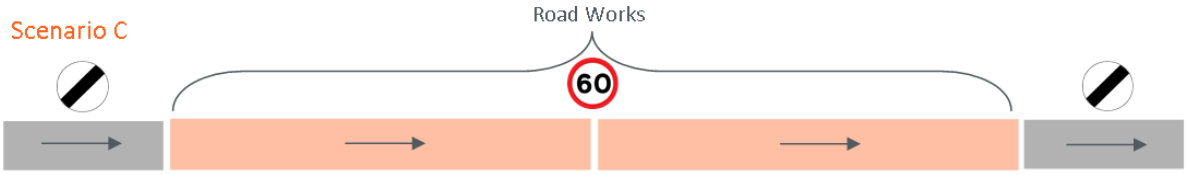
Scenario A involves a section of road works with a 50mph speed limit throughout:



Scenario B involves a section of road works with an initial 50mph speed limit, followed by a 60mph speed limit in the second part of the road works:



Scenario C involves a section of road works with a 60mph speed limit throughout:



26. Assuming traffic conditions are normal, please indicate how you expect Scenario A, Scenario B and Scenario C would affect your:

a) Journey satisfaction

	Very dissatisfied	Quite dissatisfied	Neither satisfied nor dissatisfied	Quite satisfied	Very satisfied	Don't know
Scenario A	☐	☐	☐	☐	☐	☐
Scenario B	☐	☐	☐	☐	☐	☐
Scenario C	☐	☐	☐	☐	☐	☐

b) Journey time (compared to if there were no road works in place)

	Journey time **greatly increased**	Journey time **slightly increased**	**No effect** on journey time	Don't know
Scenario A	☐	☐	☐	☐
Scenario B	☐	☐	☐	☐
Scenario C	☐	☐	☐	☐

c) Feelings of safety

	Very unsafe	Quite unsafe	Neither safe nor unsafe	Quite safe	Very safe	Don't know
Scenario A	☐	☐	☐	☐	☐	☐
Scenario B	☐	☐	☐	☐	☐	☐
Scenario C	☐	☐	☐	☐	☐	☐

27. And finally, what is your…

a) Gender

- ☐ Male
- ☐ Female
- ☐ Prefer not to say

b) Age

- ☐ 17-24
- ☐ 25-34
- ☐ 35-44
- ☐ 45-54
- ☐ 55-64
- ☐ 65-74
- ☐ 75-84
- ☐ 85+
- ☐ Prefer not to say

c) Ethnic group

- ☐ White (includes English, Welsh, Scottish, Northern Irish, British, Irish, Gypsy, Irish Traveller, any other white background)
- ☐ Asian / Asian British (includes Indian, Pakistani, Bangladeshi, Chinese, other Asian)
- ☐ Black / African / Caribbean / Black British
- ☐ Any other ethnic group (includes Arab and any other ethnic group)
- ☐ Prefer not to say

If you have any other comments relating to this survey, please write them here:

Thank you for taking the time to complete this survey.

Please return it to one of the researchers, who will give you £5 (provided you have responded to all questions).

Monitoring and evaluation of the 55/60mph pilots

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