


## **PROJECT REPORT MIS8**

# Monitoring and evaluation of the 60mph trials

Report for the on-road trials of 60mph on the M49 Avonmouth

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## Executive Summary

The application of temporary mandatory speed restrictions are considered for road works on high-speed roads in order to limit the risks posed to road users from specific traffic management features. Current guidance recommends a speed reduction of 20mph for many traffic management features. Where safe to do so, a change in the recommended speed reduction could bring about potential benefits to road users in the form of improved journey times and increased satisfaction.

This report presents the findings from the on-road investigation of a 60mph speed restriction on the M49 Avonmouth scheme. A 60mph speed restriction was implemented across a single carriageway within the road works. The impact of this change on driver behaviour, customer satisfaction and scheme costs and delivery was monitored over an 8 week period.

Analysis of the data collected during this monitoring period suggested that the change from a 50mph to a 60mph speed restriction had the following impacts:

- Road users responded to the change in speed restriction by increasing the travelling speed of their vehicles; average speeds at the trial location increased from about 51mph before the speed limit change, to 56mph after the speed limit change. This resulted in an estimated journey time reduction of approximately 13 seconds per road user.
- This increase in average speed had a positive effect on the levels of speed compliance shown by road users, compliance observed with the 60mph restriction was higher than with the 50mph speed restriction.
- The distribution of vehicles across the two running lanes was not greatly affected by the change in speed restriction; whilst overall numbers were small, the proportion of HGVs travelling in the offside lane remained similar in 50mph and 60mph conditions.
- A sample of the scheme's workforce, 8 out of the 15 individuals who responded to surveys, indicated that the change in driver behaviour was generally considered to have no impact on their feelings of safety. However 7 out of the 11 individuals who indicated that they worked within the road works or on the carriageway reported that overall the change in speed restriction did make them feel unsafe, reporting that they felt the speed restriction was 'too high'.
- A sample of road users suggested that the increased speed restriction had little impact on their feelings of safety, or their levels of satisfaction when travelling through the scheme.
- No negative impacts to delivery schedule were reported by the scheme, however it was noted that additional resources were required to implement the investigation.

A small number of survey responses were received during the investigation, and technical issues with traffic monitoring radar resulted in a loss of individual vehicle data. These limitations meant that the impact of the change in speed restriction on driver behaviour (in particular, close following) and customer satisfaction could not be robustly assessed in this investigation.

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Based on the findings from this investigation, the scheme subsequently changed the remaining 50mph speed restriction on the northbound carriageway to a 60mph speed restriction.

Other investigations, summarised later in this report, undertaken by Highways England at the scheme indicated that:

- Customer audits concluded that whilst signage was easy to see not all of the auditors noticed the 60mph speed restriction, despite being briefed.
- These same audits also concluded that auditors stated they were satisfied with both 50mph and 60mph speed restrictions, with the higher speed not generally feeling like a significant change. One auditor noted that the increase in speed felt unsafe. Otherwise there was no difference observed.
- A review of social media ‘conversations’, provided insufficient evidence to assess whether there was a change in customer satisfaction as a result of the change in speed restriction.

At the time of writing, further investigations into the use of 60mph speed restrictions are underway. Findings from these additional investigations will be collated with the current findings in a Final Project Report.

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# 1 Introduction

## 1.1 Background

Safety and customer satisfaction are critical components of Highways England's vision for the future. As part of this vision, Highways England is committed to improving road user experience through road works by ensuring that road works are implemented with appropriate speed restrictions to minimise disruption for customers, whilst also ensuring risk to road users and road workers is as low as reasonably practicable.

Following on from previous investigations into varying speed restrictions within road works, consultation with stakeholders from across Highways England and the Supply Chain, this project was established to support the safe implementation and monitoring of three new trial scenarios. A key defining feature of many of these scenarios is the trial implementation of a 60mph speed restriction in road works with narrowed lane width restrictions.

## 1.2 Contents of this report

This report summarises the findings from the on-road trial of a 60mph speed restriction on the M49 Avonmouth scheme during late 2018 / early 2019.

This investigation trialled the use of a 60mph speed restriction on the southbound carriageway of the M49, across the entire length of the scheme's traffic management. TRL was commissioned by Highways England to monitor driver behaviour (along with customer satisfaction and scheme cost/delivery) to ensure that the safety of road users and road workers was not compromised by the increase in speed limit during the investigation.

This report outlines the scheme and data collection methodology, presents the results from the monitoring, summarises these findings and outlines the next steps required.

## 1.3 Study objectives

The key objectives of the research were to gather evidence of the impact of changing the speed restriction on the M49 Avonmouth scheme from 50mph to 60mph on:

- a) Lane distribution
- b) Vehicle speeds
- c) The number of non-compliant vehicles
- d) The number of incidents
- e) The levels of close following (vehicle headway)
- f) Customer satisfaction
- g) Scheme delivery and cost

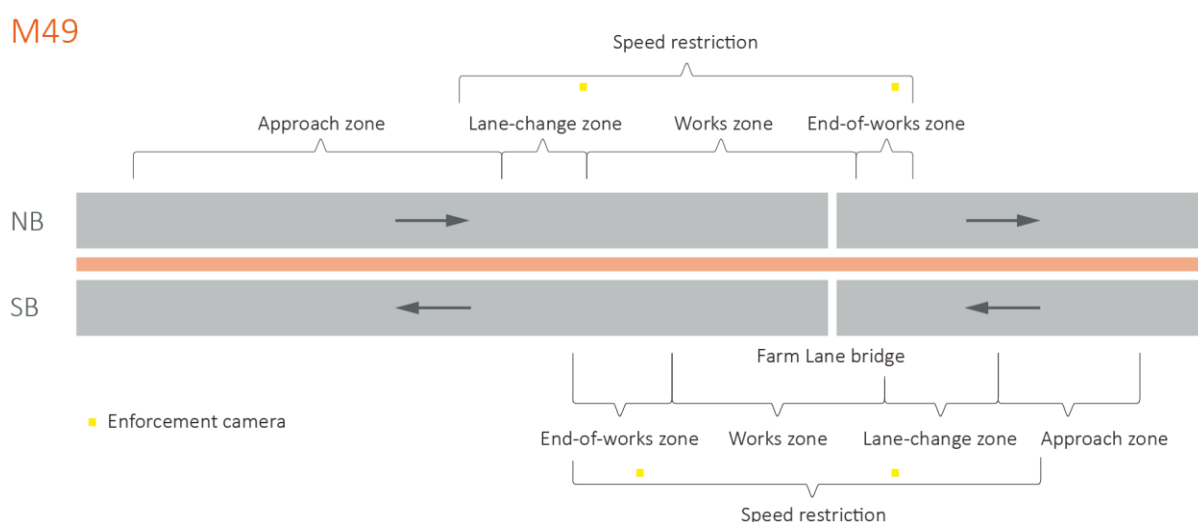
## 2 Method

### 2.1 Overview of the scheme

Preparatory work on the scheme began in December 2017, with the main construction phase running from the summer of 2018 until December 2019. The scheme works included the creation of a new junction on the M49, opening up the Avonmouth Severnside Enterprise Area to the west of Bristol. The new junction hopes to ease congestion in the area and help contribute to anticipated economic growth in the region (Highways England, n.d.)<sup>1</sup>.

Due to the nature and characteristics of the scheme an opportunity to change the existing speed restriction in place at the scheme from 50mph to 60mph was investigated. The speed restriction on the southbound carriageway was changed to 60mph as part of this investigation, with the speed restriction on the northbound carriageway remaining at 50mph.

An overview of the scheme used in the investigation can be seen in Figure 1 below.



**Figure 1: Overview of M49 Avonmouth scheme**

### 2.2 Monitoring approach

The on-road investigation sought to monitor the effect of the change in speed restriction on driver behaviour and customer satisfaction. Monitoring took place between 27<sup>th</sup> November 2018 and 6<sup>th</sup> February 2019, with speed restrictions in place as shown in Table 1.

<sup>1</sup> <https://highwaysengland.co.uk/projects/m49-avonmouth-junction/>



**Table 1: Timelines for monitoring**

Dates	Description of activity	Control location (NB carriageway)	Experimental location (SB carriageway)
27 <sup>th</sup> Nov 2018 22 <sup>nd</sup> Dec 2018	Baseline monitoring period	50	50
10 <sup>th</sup> Jan 2019 6 <sup>th</sup> Feb 2019	Trial monitoring period	50	60

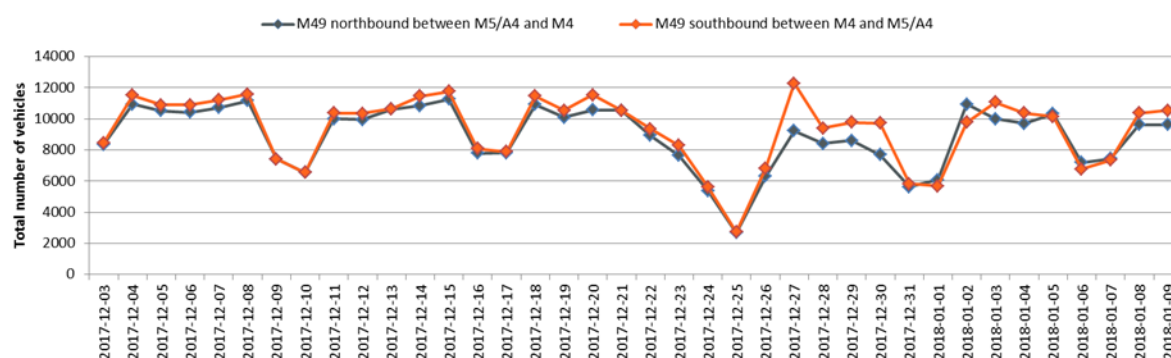
In order to limit the impact of these seasonal traffic patterns on the trial, initiation of the trial monitoring phase was delayed until the 10th January 2019. Monitoring equipment was onsite during the time between periods but the data over Christmas was excluded from the final analysis.

Throughout the baseline and experimental monitoring periods the traffic management at the scheme remained the same. The number of lanes open to traffic and the width of those lanes remained constant. The traffic management was comprised of two narrowed running lanes, 3.25m and 2.75m nearside and offside respectively, on both carriageways. Delineation between the work zone and the carriageway was provided by a mixture of cones and temporary vehicle restraint systems. The set-back between the restraint system and the nearside traffic lanes was 600mm.

Due to the short length of the scheme, access and egress to the work zone was limited to a single access point on each carriageway. Egress for the work zone was provided by a single end or works merge.

**2.2.1 Seasonal traffic and impact on trial**

The timeline of the investigation encompassed the 2018 Christmas and New Year’s period. The make-up and behaviour of traffic typically differs over these holiday periods as normal weekly patterns change. This change in flow is outlined below in Figure 2, which shows the same period in 2017/18.



**Figure 2: M49 seasonal vehicle count**

These data suggest that the motorway had similar levels of traffic across both its northbound and southbound carriageways, across a weekly cycle, with the southbound carriageway

seeing a slightly higher number of vehicles than the northbound carriageway. The overall number of vehicles reduced at weekends compared with weekdays. However, it can be seen that typical weekly cycle was broken over the 2017 Christmas period, with the number of vehicles on both carriageways dropping off in the days leading up to Christmas, increasing again from Boxing Day onwards, before returning to the regular weekly cycle in the New Year.

## 2.3 Risk assessment

As part of the proposed risk management approach and safety governance for the trialling of 60mph speed restrictions within road works, a programme level safety risk assessment was produced by TRL. This assessment was informed by previous relevant on-road trials, simulator trials, and associated GG 104 risk assessment (formerly GD04/12) and would be used to feed into the scheme specific risk assessments carried out by participating schemes (Fordham & Glaze, 2019).

Prior to implementing the change in speed restriction, Arup carried out a scheme-specific safety risk assessment in line with GG104 standards. This assessment examined the risks posed to all affected parties from the change in speed restriction, detailing required mitigation measures to address the potential increase in risks posed from the anticipated increase in vehicle speed.

Safety objectives were set. They outlined that the safety hazard and safety risk profiles for road users shall be no worse than the baseline, a 50mph speed restriction. For road workers, the safety risks shall be managed so far as is reasonably practicable.

In accordance with the safety governance requirements outlined within GG104, a project safety control review group (PSCRG) was established to review the scheme-specific assessment. This group determined that, from a safety perspective, the trial application of a 60mph speed restriction through the scheme's road works could proceed.

The PSCRG is a cross-functional group that reviews 'safety work' to agree that the safety risks are correctly identified, reviewed and managed appropriately (Highways England, 2015). The group is required to comprise of principal and specialist members. Principal members collectively determine decisions taken and endorse evidence presented to the group. Specialist members provide additional subject matter specialism experience to the group. A list of required roles for each member type can be seen in Appendix A.

### 2.3.1 *Scheme specific mitigations*

Several additional mitigations, above those already outlined within the programme level risk assessment, were identified as being required to manage risks as part of the scheme specific risk assessment. These additional mitigations were implemented on the scheme prior to the start of the on-road investigations; they are outlined below.

#### 2.3.1.1 *Speed enforcement*

The number of drivers travelling in excess of the 60mph speed restriction needed to be minimised. The scheme specific risk assessment concluded that average speed enforcement

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camera infrastructure and signs were to be provided on both carriageways and applied speed limits to be enforced (Arup, 2018).

By providing speed enforcement as mitigation, the scheme specific risk assessment anticipated a reduction in the number of vehicles travelling in excess of the posted speed restriction.

#### *2.3.1.2 Portable variable message signs*

Portable variable message signs (VMS) were deployed by the scheme upstream of the works to provide warning of stranded vehicles in live lanes. Responsibility for activation of these signs was shared between the scheme's Traffic Safety and Control Officers (TSCOs) and the Regional Control Centre (RCC). The scheme's TSCOs had the ability to remotely activate the signs for the purpose of incident management.

It was anticipated that by providing advanced warning of incidents to approaching drivers a reduction in risks posed to road users from collisions between a stopped and moving vehicle would be seen, offsetting any increase in incident severity associated with higher speed differentials in the 60mph speed limit conditions.

#### *2.3.1.3 Briefing adjacent schemes of trial*

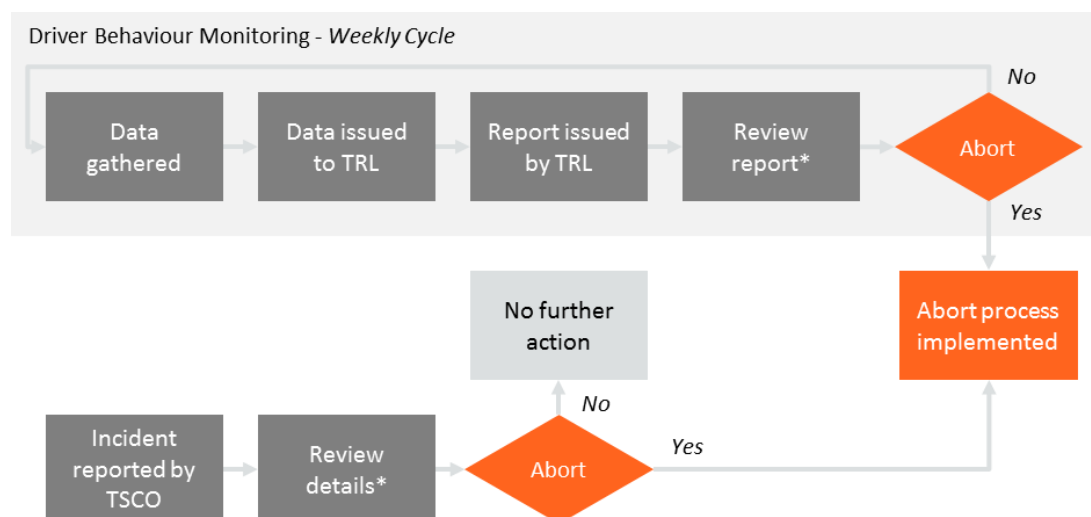
During the time of this investigation several other road works schemes were in place on and around the M49. This included works south of the M49 Avonmouth scheme around junction 18A with the M5. This scheme along with other adjacent road works schemes were briefed with information about the investigation. These briefings included dates of the investigation and the schemes were requested to report any unusual changes in driver behaviour or reported incidents to the monitoring team as part of the monitoring process.

## **2.4 Safety reviews and abort process**

During the trial monitoring period, weekly safety reports were provided outlining changes in the average speed of vehicles during free-flow<sup>2</sup> periods, the proportion of vehicles over the posted speed limit during free-flow periods and the proportion of vehicles over the enforcement threshold during free-flow periods. These weekly reports fed into an agreed abort process. The details of this process are outlined in the scheme specific safety risk assessment; Figure 3 below provides a summary.

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<sup>2</sup> 'Free-flow' was defined as any period where the one-minute averaged speed of all vehicles across the carriageway was greater or equal to 40mph.



\*Review Group – Highways England Project Manager, Principal Contractor, Traffic Management Supplier, Risk Contractor, Monitoring Consultant, Highways England Speed Trials Team.

**Figure 3: Abort process summary**

One-minute averaged data from the radar units (outlined later in Section 2.5.1) were issued weekly to TRL (Thursdays mornings) and the Safety Reports were created and issued by TRL before end of the working day. A scheduled review call was carried out the following day (Fridays) and during this call the review group discussed the reported safety proxies and any weekly incidents. These review calls acted as the abort decision points outlined within Figure 3 above. An emphasis was placed on any feedback from the Traffic Management Supplier and work crews.

During the four-week trial monitoring period, the abort process was not implemented at any point.

## 2.5 Data collection and statistical comparisons

In order to achieve the objectives of this research (see Section 1.3), a number of different data sources were used:

- Radar data
- Incident data
- Survey data
- Workshop data

These data sources, and any statistical comparisons made, are outlined in more detail in the following sections. Suitable statistical comparisons were undertaken only when sufficient samples of data were available.

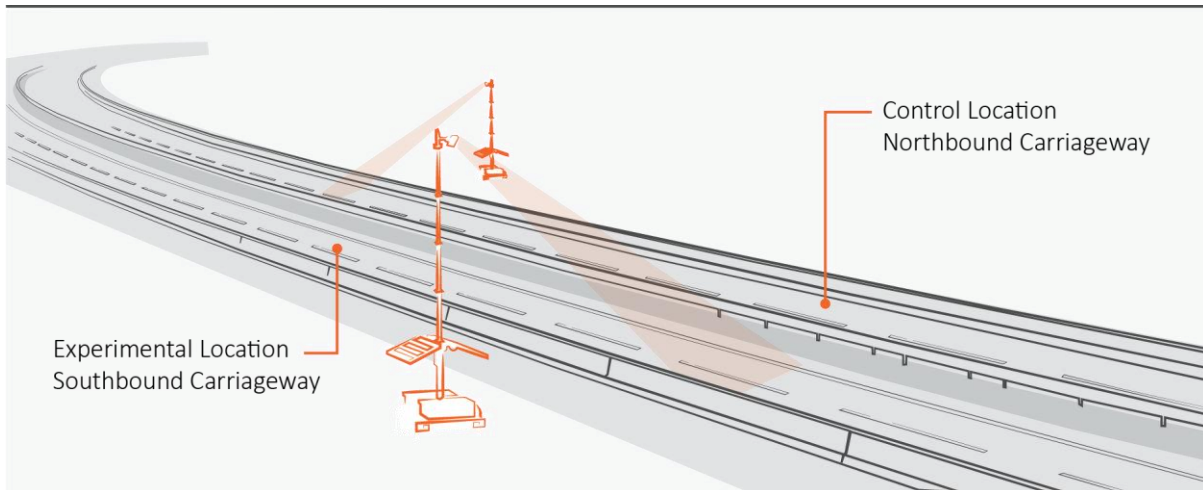
### 2.5.1 Radar data

In order to monitor speed, flow, headway and lane choice during the baseline and trial phases, two temporary radar installations were installed at the scheme. Each radar installation was capable of monitoring traffic on a single carriageway, down to the level of individual vehicles.

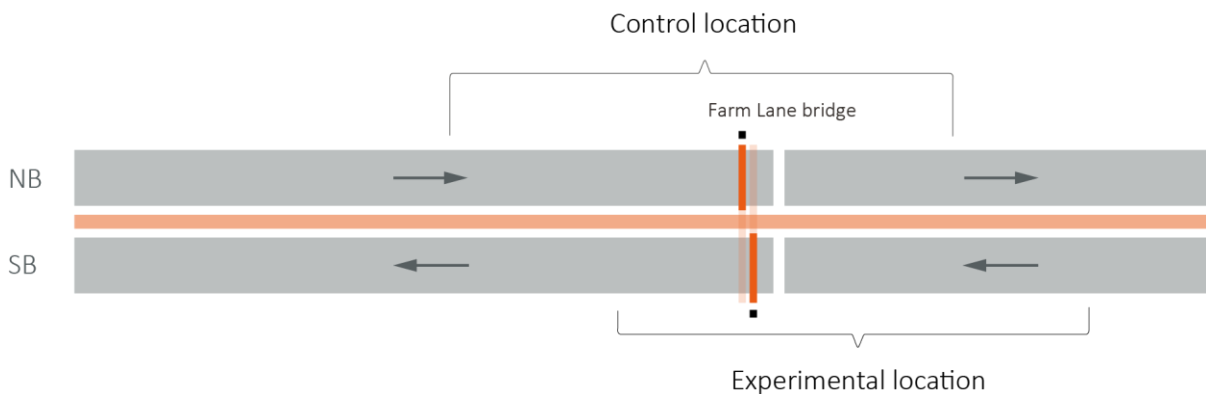
For this investigation two separate installations were used to monitor the control and experimental locations.

2.5.1.1 Location of radar installations

Both radar installations were situated on the side of their respective carriageways, on the top of access ramps within the work zone. These positions were used by the scheme prior to the trials for collection of speed data as part of a separate investigation. These positions are depicted in Figure 4 below.



M49



**Figure 4: Location of radar installations**

Placement of the radar installations was limited due to the short nature of the scheme. Sites were chosen to be at least 2km from the start of the speed restrictions on both carriageways. This ensured that drivers’ choice of speed and following distances would not be overly influenced by the start of the traffic management, allowing the study of the behaviour of drivers in response to the changes in speed limit.

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### 2.5.1.2 Data collected

The radar installations provided data on vehicle flow, average speed and average headway<sup>3</sup> for each carriageway and lane. These metrics were recorded and averaged across one-minute intervals.

Vehicle flow data were split by vehicle class:

- Class 1 ( $\leq 18$ ft)
- Class 2 ( $>18 - 22$ ft)
- Class 3 ( $>22 - 38$ ft)
- Class 4 ( $>38 - 120$ ft)

HGVs were defined as all vehicles in class 4 plus half of those in class 3.

In addition to one-minute average speed, the radars provided a count of vehicles in each of the following speed bins:

- 0 - 40mph
- $>40 - <45$ mph
- $\geq 45 - <50$ mph
- $\geq 50 - \leq 56$ mph
- $>56 - <60$ mph
- $\geq 60 - <68$ mph
- $\geq 68 - <70$ mph
- $\geq 70 - <79$ mph
- $\geq 79 - 145$ mph

These bins were used to identify the number of drivers who were driving over the speed limit and those who were non-compliant with enforcement guidelines (i.e.  $10\% + 2$ mph above the speed limit<sup>4</sup>). The enforcement thresholds were above 57mph in the 50mph speed limit and 68mph in the 60mph speed limit.

### 2.5.1.3 Data processing

In order to understand the potential impact of the speed restriction change on vehicle speeds, driver behaviour would need to be investigated when drivers were free to choose their own speed. This required conditions with free-flowing traffic; congested traffic was defined as periods when the average speed of vehicles was lower than 40mph. This resulted in the removal of less than 1% of the available data.

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<sup>3</sup> Average headway was defined as the time separation between vehicles, measured from the front bumper of the first vehicle to the front bumper of the following vehicle, averaged over one-minute intervals.

<sup>4</sup> 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  $10\% + 2$ mph 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).

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Many of the statistical tests used require the assumption of independence to hold, meaning the value of one observation does not influence or affect the value of other observations. However, data collected from the radar are not necessarily independent; average flow or speed data during one-minute intervals are likely to be correlated from one minute to the next. As such, to avoid the problem of dependence between measurements, data from each radar unit were randomly sampled by selecting one minute from each ten minute period. This process produced a dataset consisting of six randomly sampled one-minute periods within each hour, per radar unit. The duration of the monitoring periods used allowed for an appropriate amount of data to remain after this sampling was undertaken. In total, around 113 hours of data were used from each of the monitoring locations.

#### *2.5.1.4 Issues with data collection*

Due to technical issues with the supplied radar installations, Individual Vehicle Data (IVD) could not be extracted and used in this investigation. Instead, the analysis was dependent on the on-minute averaged data only.

When headway data is averaged across a minute, it removes the ability to identify and explore the individual following distances between vehicles. For this reason, comparisons of headway across both monitoring periods and locations were not possible in the absence of IVD. The following comparisons could be made.

#### *2.5.1.5 Comparison of flow*

As changes in vehicle flow can affect the behaviour of road users and impact their speed, it was essential to understand how vehicle flow changed between the baseline and trial periods. The following comparisons were made:

1. A comparison of overall and daily average vehicle flows between the baseline and trial periods at both experimental and control locations.
2. A comparison of average vehicle flow split by vehicle class between the baseline and trial periods.
3. A comparison of average vehicle flow composition by lane at the experimental location.

The results of these comparisons are presented in Section 3.1.1.

#### *2.5.1.6 Comparison of speed*

The following comparisons were made using the one-minute average speed data collected from the radars:

1. A comparison of average speed between the baseline and trial periods by monitoring location.
2. Comparison of average speed by lane between the baseline and trial periods at the experimental location.

3. A comparison of compliance with the posted speed limit between the baseline and trial periods by monitoring location.

The results of these comparisons are presented in Section 3.1.2.

#### *2.5.1.7 Comparison of congestion*

Data collected during periods of congestion were removed from the comparisons of flow and vehicle speed. This allowed for the impact of the speed restriction change to be explored, since comparisons were focused on free-flow conditions where drivers had free choice of speed. It was however also important to understand the impact of the speed restriction change on the levels of congestion seen at the scheme. A comparison of average daily periods of congestion between the baseline and trial periods by monitoring location was made. The results of this comparison are presented in Section 3.1.3.

#### *2.5.1.8 Statistical comparisons*

Appropriate statistical tests were used to test for significant differences between data recorded during the baseline and trial periods (i.e. to determine if driver behaviour changed following the implementation of the increased speed limit). Two types of statistical tests were used, depending on the type of data available:

- **Chi-squared tests** were used to test for a difference in the distribution of categorical data, for example to test for a difference in the distribution of vehicle flows 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 were classified as 'statistically significant' if the p-value was less than 0.05 (a common standard in behavioural sciences). The p-value is a measure of probability, and a value of less than 0.05 implies that any differences between the groups being tested has a less than 5% chance that the difference occurred at random.

#### *2.5.2 Incident data*

Throughout both the baseline and trial phases of the investigation incidents which occurred within the confines of the scheme traffic management were documented and collated by the scheme's traffic management contractor. These logs identified the type of reported incidents (traffic management activities, breakdowns or cone strikes) along with the location of the incident (carriageway) and the date it took place.

Comparisons of the number of incidents between the baseline and trial phase were made and a summary of these data is presented in Section 3.2.

#### *2.5.3 Workforce survey data*

In order to provide further insight into the potential impact of changing the speed limit at the scheme from 50mph to 60mph, a workforce survey was conducted during the trial monitoring



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period. The survey focused on capturing insight from project managers, site workers and members of the workforce who operate within the carriageway environment.

A summary of the responses to this survey are presented in Section 3.3.

## **2.5.4**      *Customer satisfaction survey data*

### *2.5.4.1*      *Online survey*

Throughout the on-road investigation, surveys were used to collect information on the impact of increasing the speed limit on the satisfaction levels of road users travelling through the scheme. These surveys were administered to individuals who had identified themselves as having travelled through the scheme during either the baseline and trial periods.

Targeting of these individuals was achieved through the use of a social media advertising campaign, with individuals within a 40km radius of Avonmouth targeted to take part in the study. The adverts were also shared with multiple special interest groups on social media platforms. This approach ensured the recruitment of individuals who regularly drove the route over the duration of the investigation.

The surveys collected data on customer's feelings of safety affected by both the posted speed restriction and the width of the scheme's lanes. Levels of journey satisfaction and how they were affected by the posted speed restriction and the width of the lanes were also captured.

Comparisons of the survey responses between the baseline and trial periods are presented in Section 3.5.

## **2.5.5**      *Delivery and cost impacts*

In order to understand the impact of the change in speed restriction on the scheme's delivery and costs, a lessons-learned workshop was held after the monitoring periods had ended. The session sought to capture details on any impacts to the scheme associated with implementing the change in speed restriction. Attendees included the scheme's Highways England Project Manager, Principal Contractor, Traffic Management Supplier and Risk Contractor.

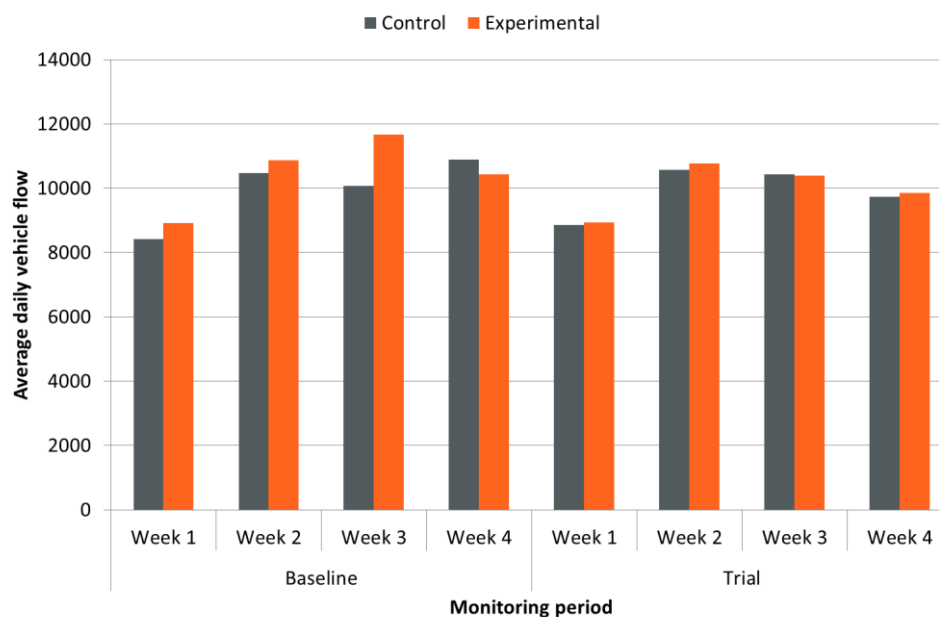
A summary of the findings of this workshop is presented in Section 3.6.

## 3 Results

### 3.1 Driver behaviour

#### 3.1.1 Vehicle flow

Figure 5 shows the average daily vehicle flow for the baseline and trial monitoring periods between the control and experimental monitoring locations.

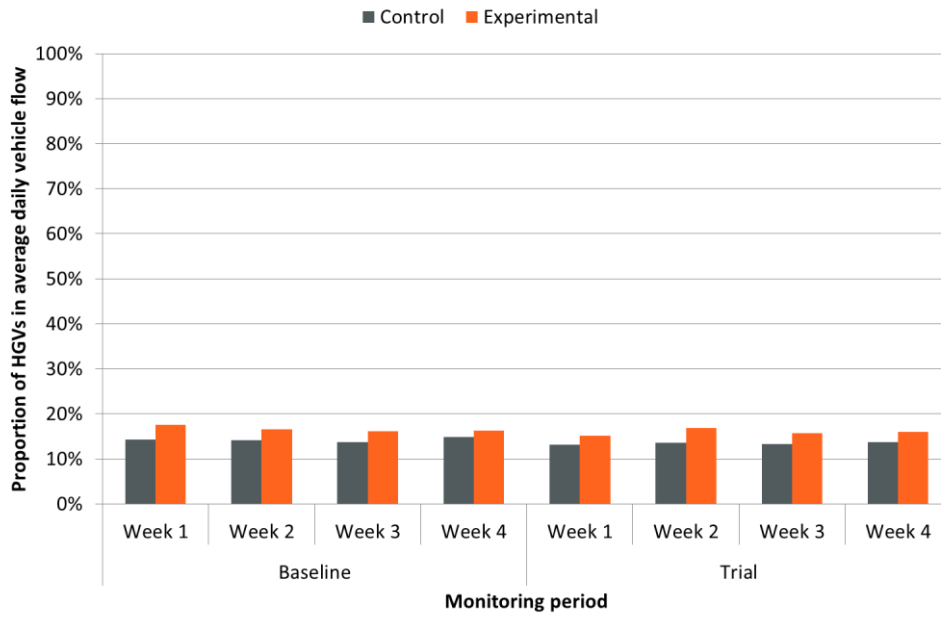


**Figure 5: Average daily vehicle flow by location and monitoring period**

The average daily vehicle flow between the baseline and trial monitoring periods, at both the control and experimental locations, varied over the course of the study. The control location had an average daily flow of around 10,400 during the baseline period and 10,200 during the trial period. The experimental location had similar average daily flows of around 10,800 during the baseline period and around 10,400 during the trial period. These values align with the expected combined average daily flow of approximately 22,000 for both locations documented in the scheme specific safety risk assessment (Arup, 2018).

A Chi-square test was conducted to test for statistical significance between the average daily vehicle flow by monitoring period and location. The p-value was calculated at 0.13 verifying that there was no significant difference in vehicle flow between the monitoring periods and monitoring locations. This suggests that any changes seen in average speed between the monitoring periods are unlikely to have been influenced by differences in vehicle flow.

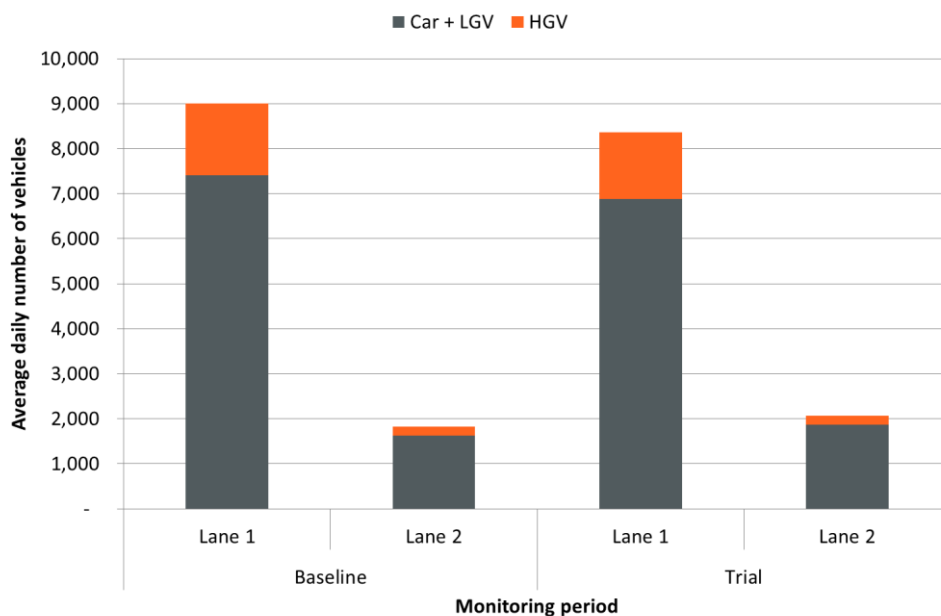
A comparison of the proportion of HGVs by monitoring location and period is presented in Figure 6. Here it can be seen that the proportion of HGVs remained reasonably consistent across both monitoring periods over the course of the investigation. At the control location, the average proportion of HGVs was 14% during the baseline period and 13% during the trial period. At the experimental location, proportions were 17% during the baseline period and 16% during the trial period.



**Figure 6: Proportion of HGVs by week and location**

A chi-square test indicated that there was no significant difference ( $p=0.12$ ) in the distribution of HGV proportions across the baseline and trial periods between the control and experimental locations. This indicates that any changes in average speed between the monitoring phases are unlikely to have been influenced by differences in the HGV proportion.

The distribution of vehicles between Lane 1 and Lane 2 within the experimental location is shown in Figure 7.



**Figure 7: Distribution of vehicle by lane and monitoring period at the experimental location**

As outlined previously, there was no statistically significant difference in the daily flows observed during both the baseline and trial periods of the investigations. As a result, the total number of vehicles across both lane 1 and lane 2 varied little from the baseline to trial monitoring periods.

The composition of vehicles in Lane 1 remained stable between the baseline and trial monitoring periods, at about 18% HGVs and 82% cars and LGVs. A chi-square test showed no significant difference ( $p=0.99$ ) in vehicle composition in Lane 1 between the monitoring periods. Likewise, the composition of vehicles in Lane 2 remained fairly constant across the monitoring periods, with no significant differences in the proportion of cars or HGVs in Lane 2 between the baseline and trial period.

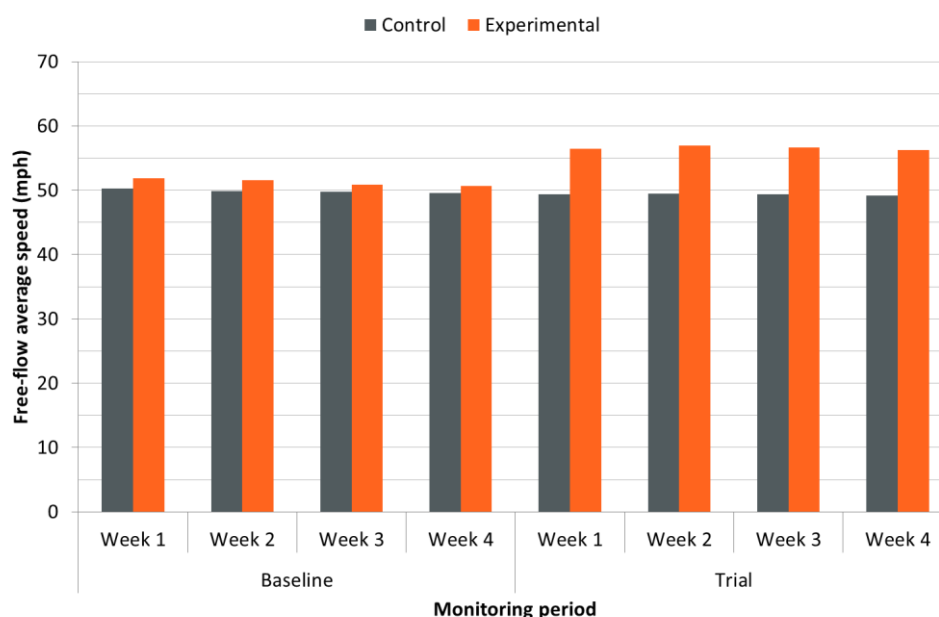
Taken together these data indicate that the 60mph speed restriction did not appear to have a significant effect on vehicle flow or vehicle composition.

### 3.1.2 Vehicle speed

To ensure that comparisons of vehicle speed were not conflated by the presence of small numbers of high speed vehicles, the one-minute average speed data were weighted by vehicle flow. This ensured that more weight was given to data from periods when the flow was higher, compared to times when there were fewer vehicles (low flow), since averages calculated from small numbers of vehicles may be more greatly biased by high speed outliers.

Comparisons were made between control and experimental locations to account for background factors (aside from the speed restriction change) which may have influenced driver behaviour between the two monitoring periods.

Figure 8 shows the free-flow average speeds on the control and experimental locations across the two monitoring periods.



**Figure 8: Free-flow average speed during the monitoring period by location**

Free-flow average speed remained fairly stable at the control location, at around 49mph. At the experimental location, however, an increase in free-flow average speed was observed from approximately 51mph in the baseline period to 56mph in the trial period.

A statistical test (ANOVA) showed that the interaction between location and monitoring period was significant ( $p < 0.01$ ). This indicates that the change in free-flow average speed across the monitoring period was significantly different between the control and experimental locations. Since there were no differences in flow or vehicle composition between monitoring periods, and there were no significant differences at the control site, the increase in speeds at the experimental location can be attributed to the increase in speed limit.

Free-flow average speeds by lane are shown in Table 2.

**Table 2: Free-flow average speed (mph) by monitoring period and lane at the experimental location**

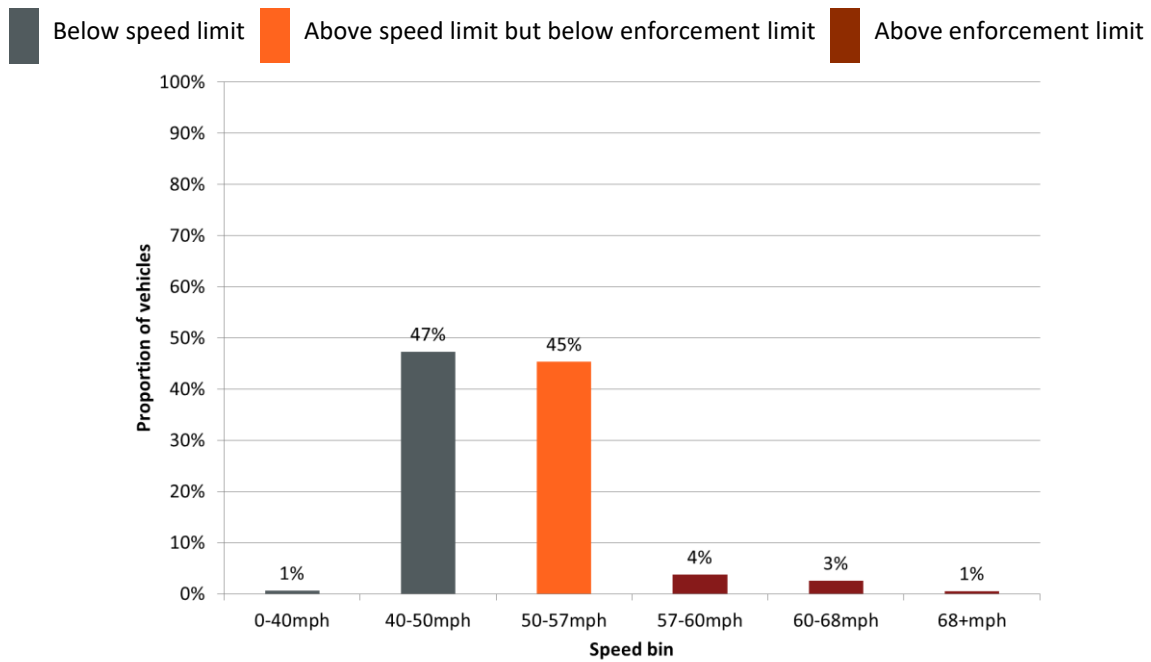
Monitoring period	Lane 1	Lane 2
<b>Baseline period</b>	50.3	51.7
<b>Trial period</b>	55.8	56.2

In both periods, speeds were slightly higher in Lane 2 than in Lane 1. Comparison between the monitoring periods indicates that average speeds increased in both lanes between the baseline and trial periods. Lane 1 increased by 5.5mph while Lane 2 increased by 4.5mph. Although not shown here, there was little change in the average speeds by lane at the control location.

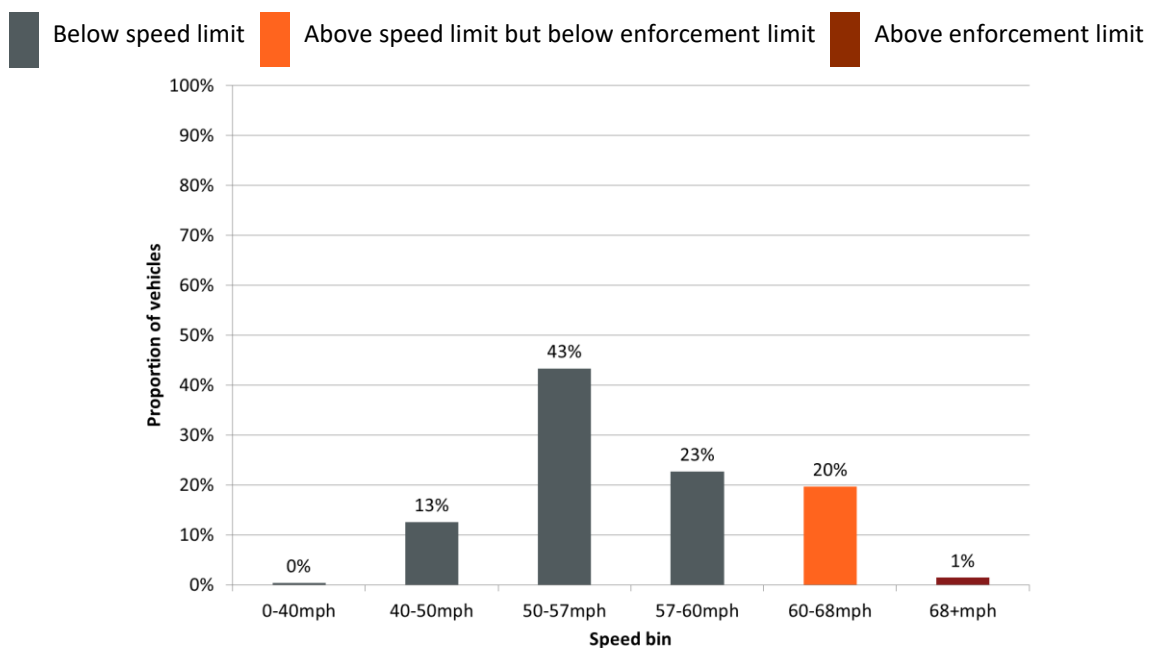
In order to understand the compliance of road users with the posted speed, data were separated into speed bins. These speed bins (0-40, 40-50, 50-57, 57-60, 60-68, 68+mph) allow for vehicles to be identified as travelling: below the speed limit, above the speed limit but below the enforcement limit, and above the enforcement limit (10% of speed limit +2mph).

Figure 9 and Figure 10 show the proportion of vehicles recorded in each speed bin across the two monitoring periods at the experimental location.

The grey bars show the proportion of vehicles travelling below the speed limit; the dark orange bars show the proportion of vehicles travelling above the speed limit but below the enforcement threshold (10% of speed limit +2 mph); and the dark red bars show vehicles travelling above the enforcement threshold.



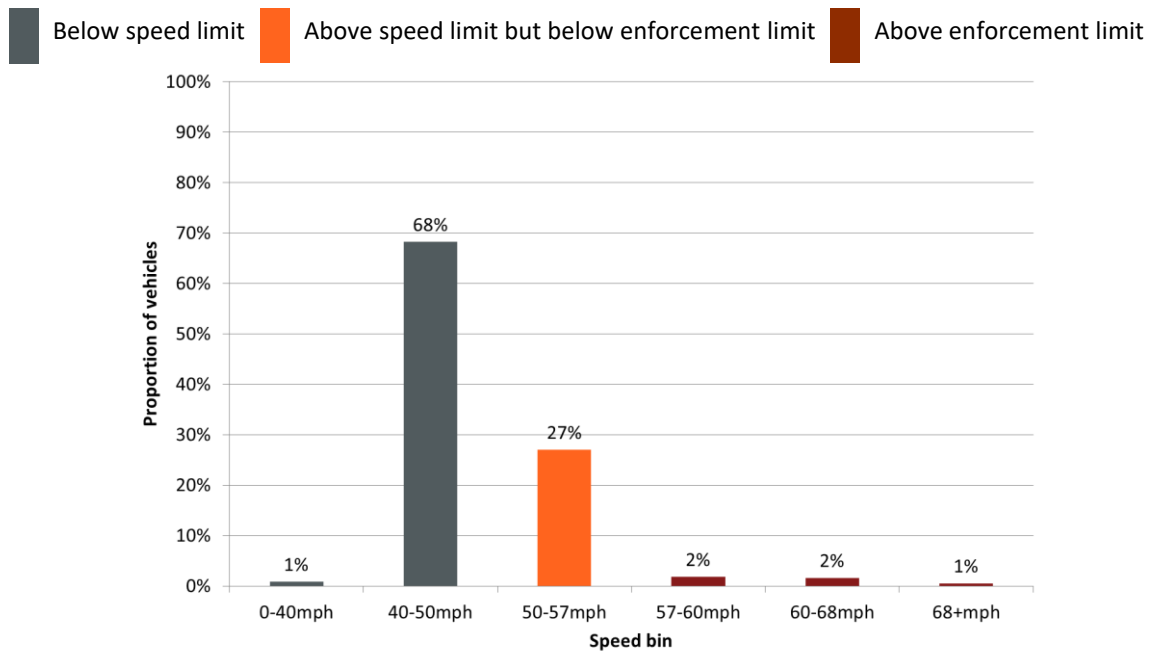
**Figure 9: Proportion of vehicles in each speed bin during the baseline period at the experimental location**



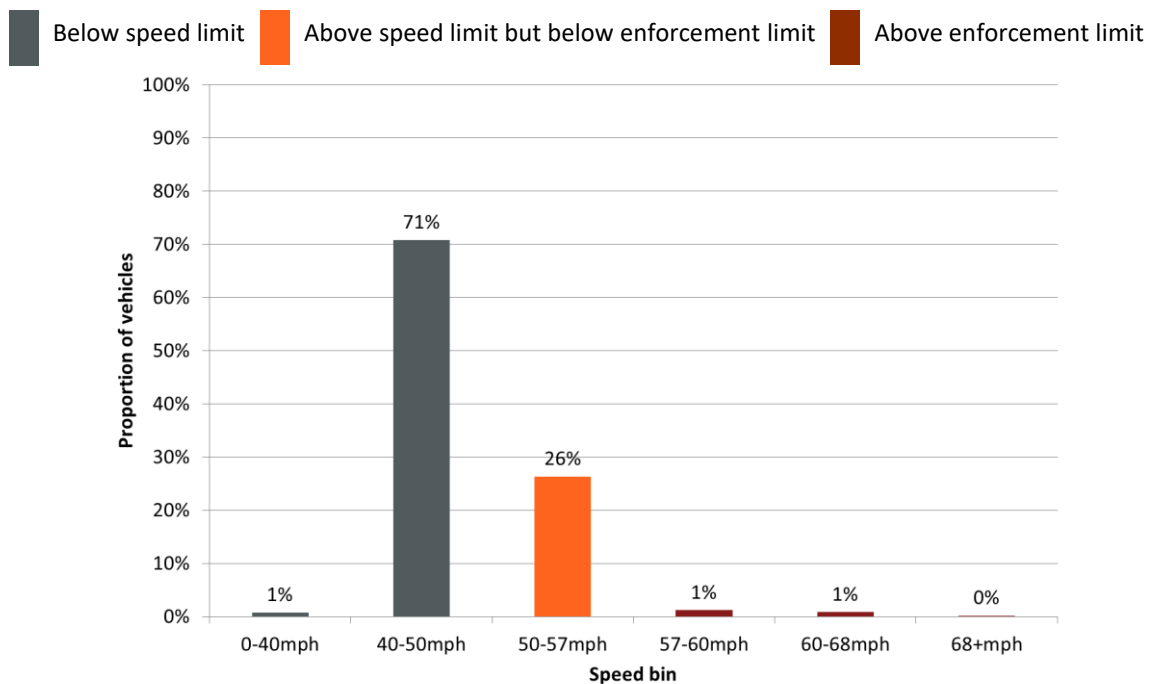
**Figure 10: Proportion of vehicles in each speed bin during the trial period at the experimental location**

The proportion of vehicles travelling above the posted speed limit changed considerably between the baseline and trial periods, dropping from 53% of vehicles to 21% of vehicles. A similar trend can be seen with the proportion of vehicles travelling above the enforcement limit, decreasing between the two monitoring periods from 8% to 1%.

Figure 11 and Figure 12 show the proportion of vehicles recorded in each speed bin across the two monitoring periods at the control location.



**Figure 11: Proportion of vehicles in each speed bin during the baseline period at the control location**



**Figure 12: Proportion of vehicles in each speed bin during the trial period at the control location**

There appears to be little change in the proportions of vehicles travelling over the posted speed restriction and enforcement limits at the control location. This is expected as the speed restriction at this location remained consistent across the two monitoring periods.

### 3.1.3 Congestion

A check was conducted on the total duration of congestion observed during the study. In total less than 0.1% of the total time monitored was classified as congested; defined as any period where the one-minute averaged speed of all vehicles across the carriageway was less than 40mph. Figure 13 outlines the average speeds per hour of the day, by monitoring period and location.

There was a slight reduction in average hourly vehicle speeds during both the morning and evening, around 07:00 and 17:00. This pattern appears consistent across both monitoring locations and monitoring periods. As, on average, the hourly average speed did not fall below 40mph, it can be concluded that there was minimal routine congestion at the scheme. As such, the introduction of a 60mph speed restriction did not appear to have an impact on the amount of congestion seen through the scheme.

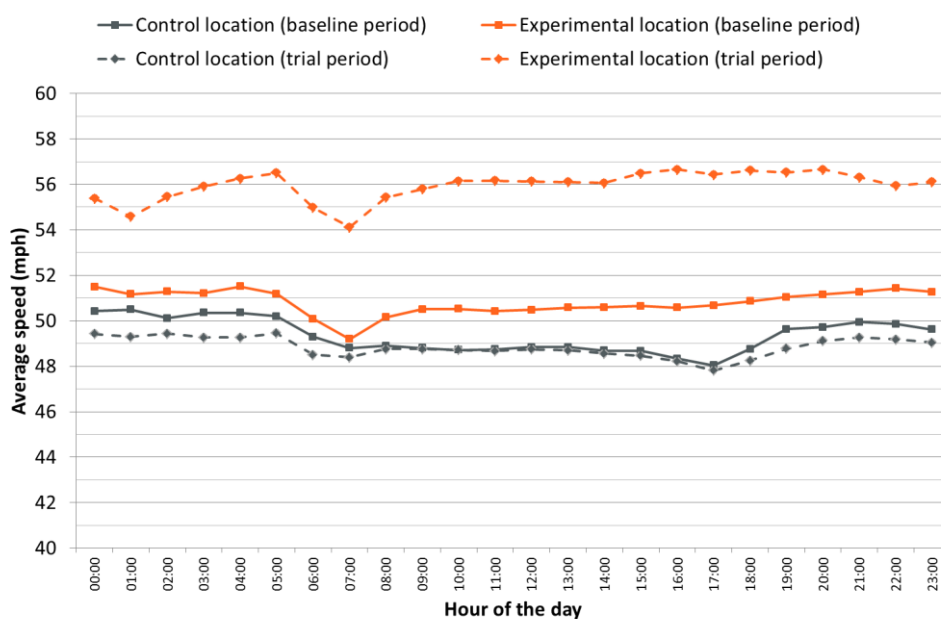
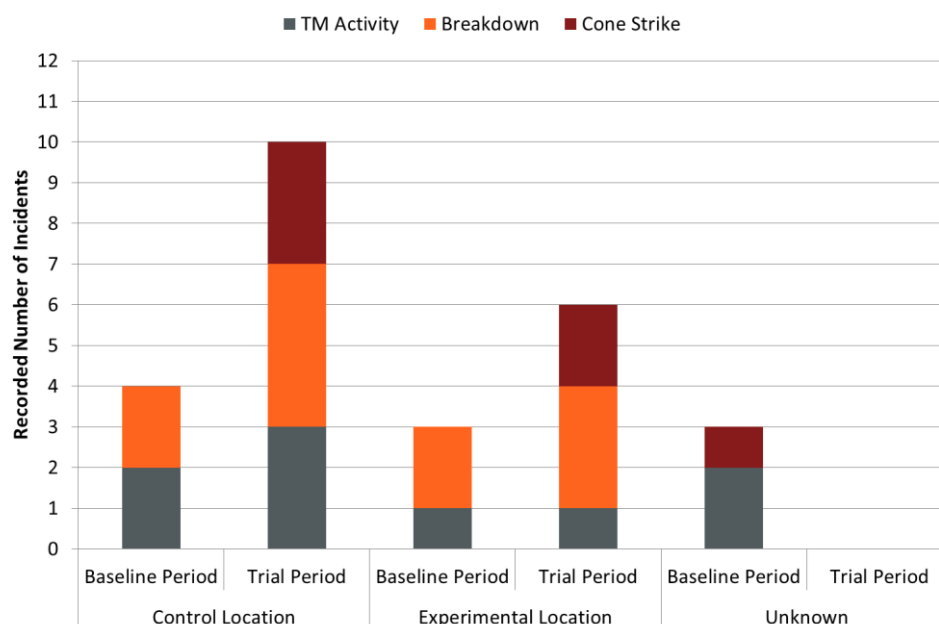


Figure 13: Average hourly vehicle speed by location and monitoring period

### 3.2 Reported incidents

In total, 26 incidents were reported by the schemes traffic management contractor, 10 of which were in the baseline phase, and 16 in the trial phase. A summary of these reported incidents are presented in Figure 14. Several of the reported incidents could not be assigned to either carriageway as key identification information was missing from reports; these have been outlined as ‘Unknown’.





**Figure 14: Reported incidents**

The number of breakdowns, traffic management activities<sup>5</sup> and cone strikes across both monitoring locations varied through the study, however the number of incidents of any given type were similar across the monitoring periods and locations. A total of six incidents were reported at the experimental location during the trial phase, up marginally from the three reported incidents in the baseline phase. The number of reported incidents at the control location also increased between the two monitoring periods; from four reported incidents during the baseline period to 10 in the trial period.

Due to the limited number of reported instances, no statistical analysis could be undertaken. The short length of the scheme (around 3.15km), the relatively low daily traffic flows of around 10,000 vehicles (when compared to levels seen at previous trial schemes), and the limited duration of the monitoring period (8 weeks) may have contributed to the low number of reported incidents.

During the trial no safety concerns were raised (by the contractor, the scheme and any adjacent schemes) around the number of reported incidents. As no further detail was provided concerning contributory factors it was therefore not possible to determine whether the change in speed limit may have been a contributory factor in any of the incidents reported by the scheme.

<sup>5</sup> Includes emergency activates and unplanned lane or carriageway closures. Excludes any planned lane or carriageway closures for general works activities.

### 3.3 Journey time

Estimates of the average journey time were calculated based on the length of the road works and a single aggregated free-flow average speed of vehicles, for each four week monitoring period, was calculated from the radar data. Table 3 shows the estimated average journey time during the baseline and trial periods. Both monitoring locations have been included for the purposes of comparison.

**Table 3: Journey time estimates by monitoring location**

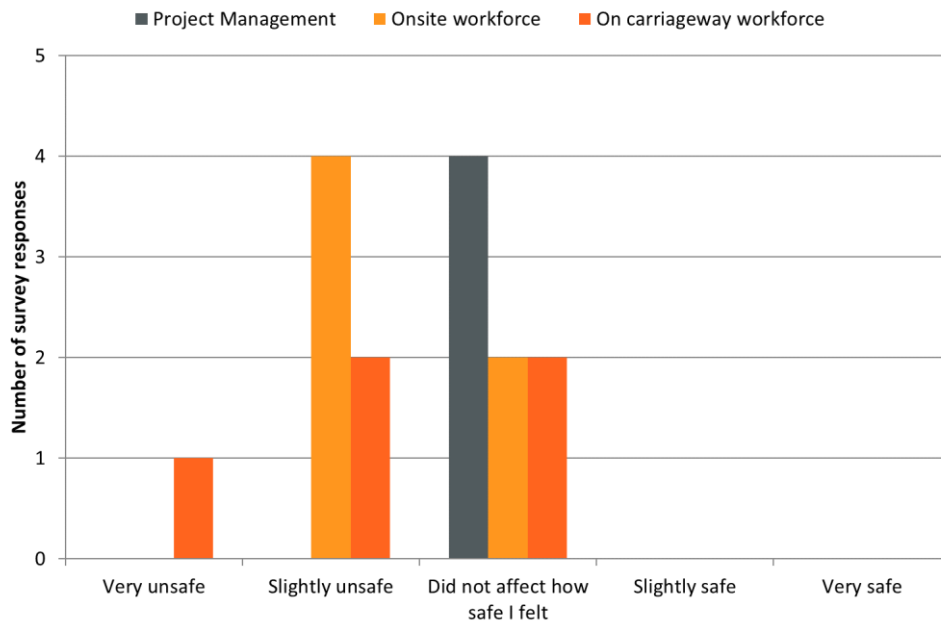
Monitoring location	Length (km)	Average vehicle speed (mph)		Journey time (seconds)		Difference (seconds)
		Baseline	Trial	Baseline	Trial	
Control	3.45	49.9	49.4	154.7	156.4	1.7 (1%)
Experimental	3.25	51.3	56.6	141.8	128.6	13.3 (-9%)

The results suggest that changing the speed restriction from 50mph to 60mph decreased the estimated average journey time at the experimental location by approximately 13 seconds. No large differences in estimated journey time were observed at the control location, where the speed restriction remained consistent throughout both monitoring periods.

### 3.4 Workforce surveys

In total, 15 individuals completed the workforce survey. A summary of their responses is presented below. Due to the limited number of responses, caution should be taken when interpreting these results.

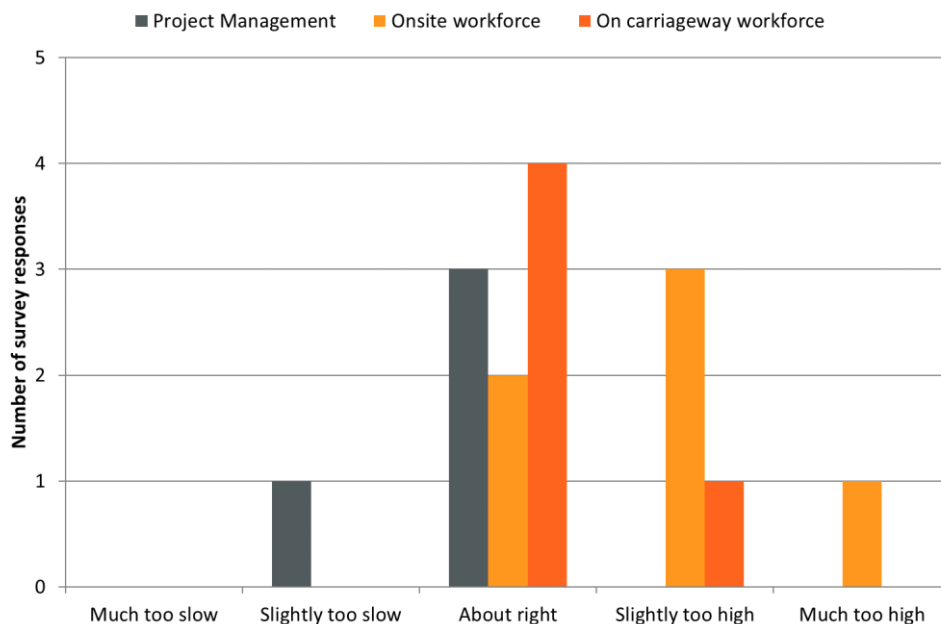
Participants were asked to rate how they thought the change in speed restriction affected their safety. Responses are shown in Figure 15.



**Figure 15: Responses to question “How do you think the change in speed restriction affected your safety? Did it make you feel...” (split by workforce role)**

The change in speed restriction was generally considered to have no impact on participants’ feelings of safety, with 8 respondents indicating the change in speed restriction did not affect how safe they felt. However some participants who worked within the road works or on the carriageway indicated that overall the change in speed restriction made them feel unsafe.

Participants were asked to rate how appropriate they thought the speed restriction was, in terms of their own safety. Responses are shown in Figure 16.



**Figure 16: Responses to question “In terms of your safety, do you think the speed restriction was...” (split by workforce role)**

The change in speed restrictions was perceived overall as appropriate by the survey respondents, with 9 respondents outlining they felt the speed restriction was about right. Around a third of individuals reported that they felt the speed restriction was too high, in terms of safety. All of these individuals worked either within the road works or on the carriageway.

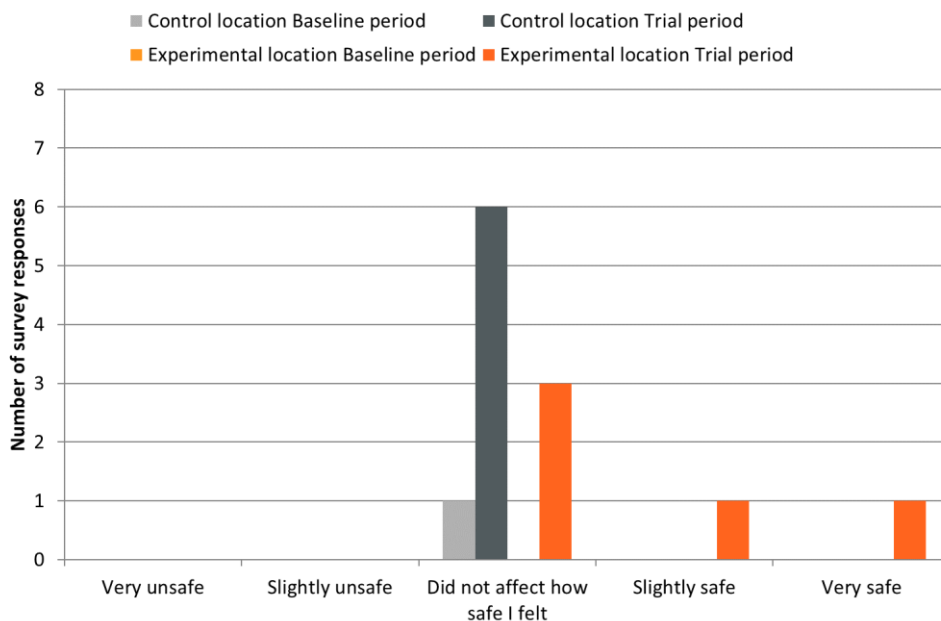
### 3.5 Customer satisfaction

In total, 12 respondents were identified from the customer satisfaction survey as eligible for inclusion in the investigation; one whose last journey through the scheme was in the baseline period, and 11 who reported their last journey during the trial period. A summary of their responses is presented below. Other survey respondents were not deemed to be eligible for the analysis and so their responses were excluded.

Due to the limited number of responses, caution should be taken when interpreting the results presented in this section.

#### 3.5.1 Feelings of safety

Participants were asked to rate how they thought the speed restriction affected their safety. Responses are shown in Figure 17.

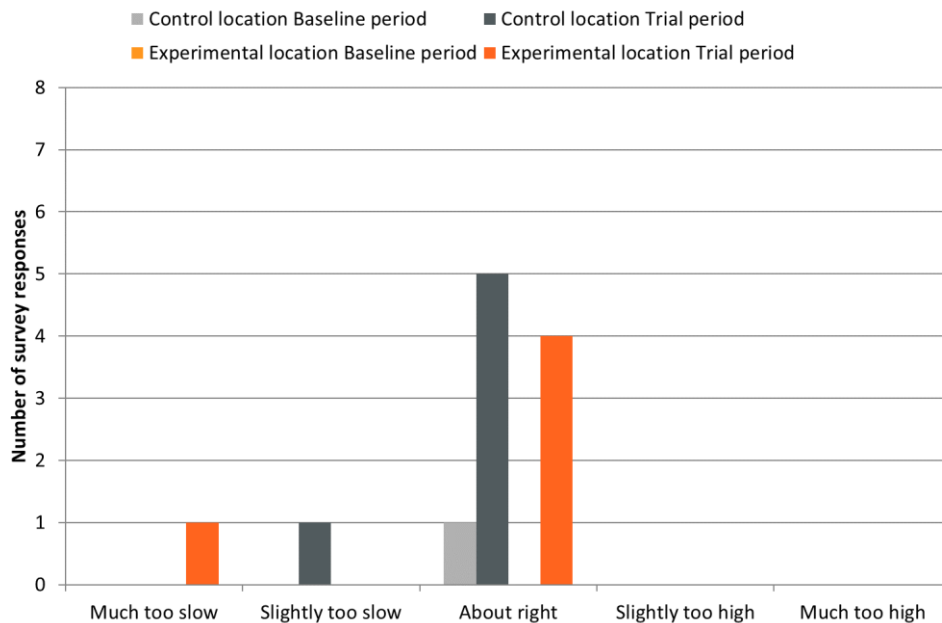


**Figure 17: Responses to question: “How do you think the speed restriction affected your safety? Did it made you feel...” (split by monitoring period and location)**

The 60mph speed restriction was generally considered to have no impact on drivers’ feelings of safety. At the experimental location, three out of the five drivers traveling through during the trial period indicated the speed limit did not affect how safe they felt. The remaining two participants reported that they felt either slightly or very safe.

Overall at both locations no individual reported that they felt either speed restriction made them feel unsafe during either monitoring period.

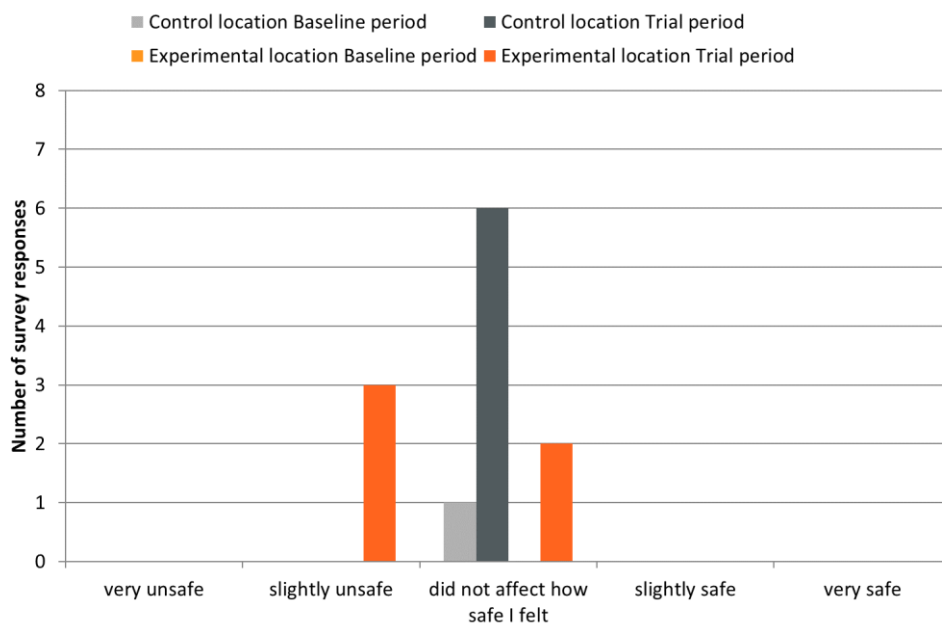
Participants were also asked to rate how appropriate they thought the speed restriction was in terms of their own safety. Responses are shown in Figure 18.



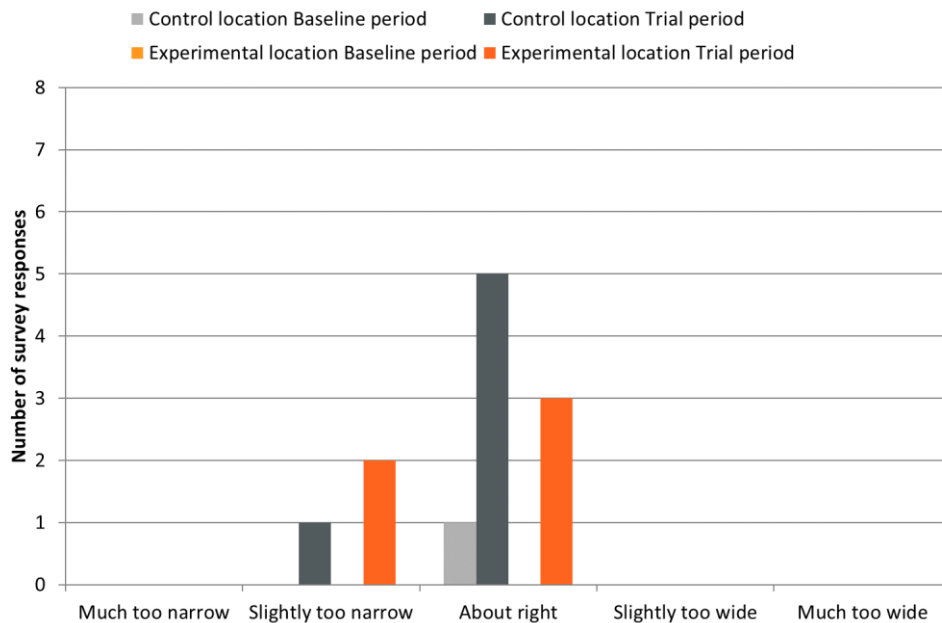
**Figure 18: Responses to question “In terms of safety, do you think the speed restriction was...” (split by monitoring period and location)**

Overall at both monitoring locations most respondents indicated that they felt the 50mph and 60mph speed restrictions were appropriate (‘about right’) during both baseline and trial periods. No individual reported that they felt the speed restriction was ‘too high’.

As well as the effect of the speed restriction on perceived safety, participants were asked to comment on how the width of the running lanes within the scheme’s road works affected their feelings of safety. Responses are shown in Figure 19 and Figure 20.



**Figure 19: Responses to question: “How do you think the lane widths affected your safety? Did it made you feel...” (split by monitoring period and location)**

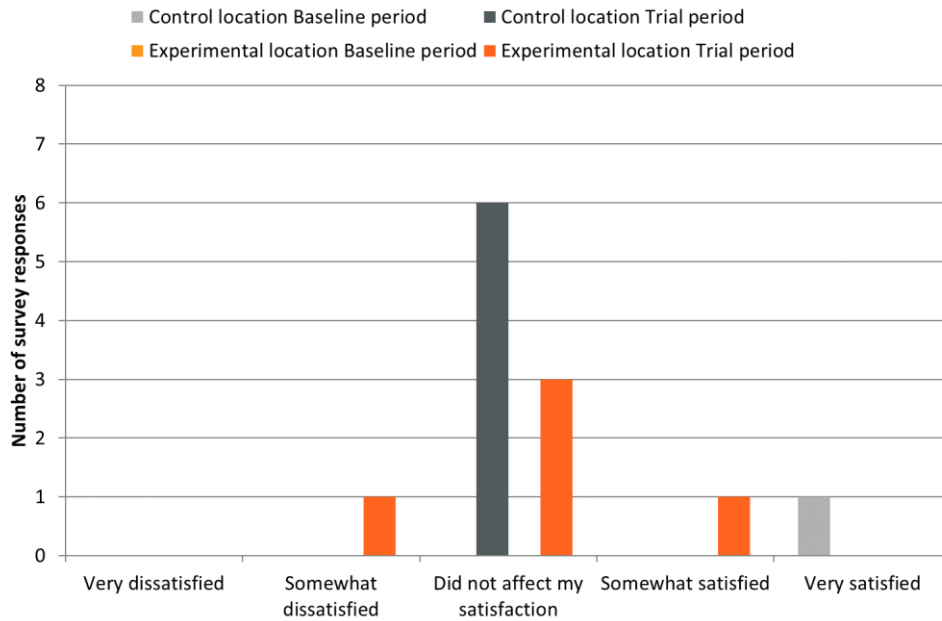


**Figure 20: Responses to question: “In terms of safety, do you think the width of the lanes was...” (split by monitoring period and location)**

Overall, the lane widths in both the 50mph and 60mph speed restrictions were perceived by most participants as appropriate (‘about right’). Some individuals reported that the lane widths were ‘slightly too narrow’; no further comments were provided about why they felt the lane widths were slightly too narrow. This response was reported by at least one individual at both monitoring locations during the trial period.

**3.5.2 Journey satisfaction**

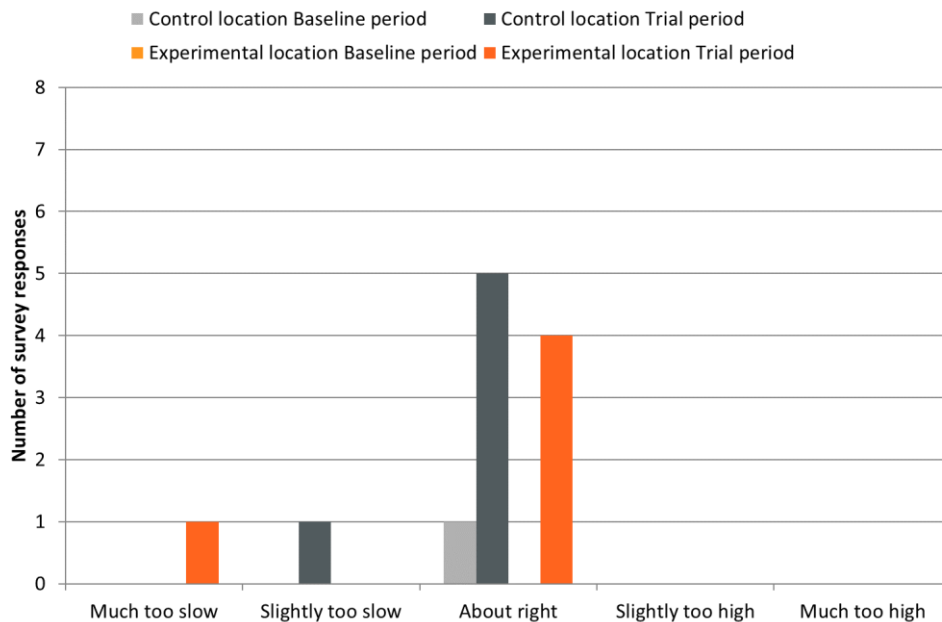
Participants were asked to rate how they thought the speed restriction affected their journey satisfaction. Most participants indicated that the speed restriction did not affect their levels of satisfaction, those individuals who did indicate an effect did not provide further insight or comment. Responses are shown in Figure 21.



**Figure 21: Responses to question: “How satisfied or dissatisfied were you with the speed restriction...” (split by monitoring period and location)**

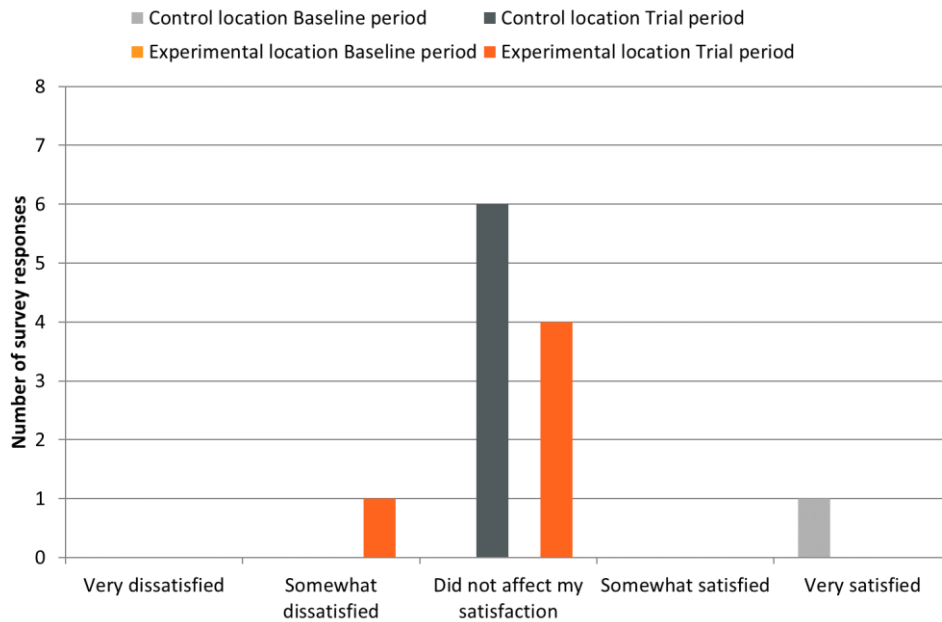
Participants were also asked to rate how appropriate they thought the speed restriction was in terms of their own journey satisfaction. Responses are shown in Figure 22.

Overall the 50mph and 60mph speed restrictions were perceived by most participants as appropriate (‘about right’). No individual reported that they felt the speed restriction was ‘too high’; however two individuals indicated that they felt the speed restriction was ‘too slow’.



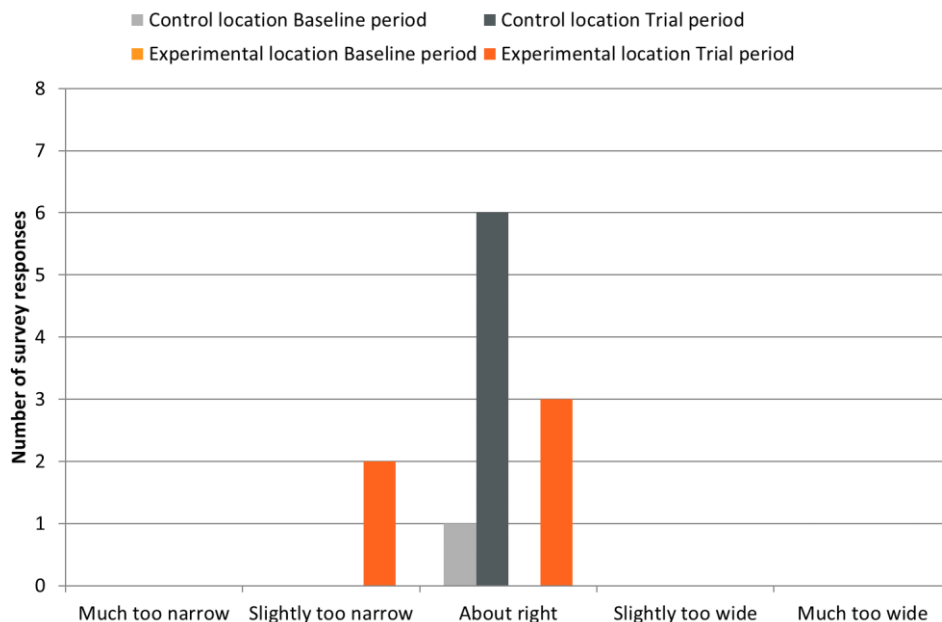
**Figure 22: Responses to question: “In terms of journey satisfaction, do you think the speed restriction was...” (split by monitoring period and location)**

Participants were asked to rate how they thought the lane widths affected their satisfaction. Responses are shown in Figure 23. As with previous responses, the majority of drivers indicated that the lane widths used within the scheme did not have an effect on their levels of satisfaction.



**Figure 23: Responses to question: “How satisfied or dissatisfied were you with the lane widths...” (split by monitoring period and location)**

Participants were also asked to rate how appropriate they thought the lane widths were in terms of their own journey satisfaction. Responses are shown in Figure 24.



**Figure 24: In terms of journey satisfaction, do you think the lane widths were...**



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The lane widths in both the 50mph and 60mph speed restrictions were perceived by most participants as appropriate ('about right'). Two individuals reported that the lane widths were 'slightly too narrow'; no further comments were provided however.

### **3.6 Scheme delivery and cost**

#### **3.6.1 Delivery**

Overall the scheme indicated that the delivery of the works activities was not impacted by the implementation of the 60mph speed restriction. Discussions recorded as part of the lessons learned workshop outlined that although "no tangible impact was experienced" (Principal Contractor), implementation of the investigation by the scheme was quite "onerous in terms of man-hours" (Principal Contractor and Traffic Management Supplier). It required key scheme staff to experience an approximate "20% increase in workload" (Principal Contractor) as a result.

#### **3.6.2 Cost**

In order to safely implement the 60mph speed restriction several additional key mitigations and activities were required. Many of these additional mitigations were outlined and implemented when the scheme first began its activities on-road, and included:

- Higher containment vehicle restraint systems and end terminals
- Enforcement camera systems
- Mobile VMS used for incident management
- Additional static signing (speed limit signs)
- Increased TSCO site patrols and tool box training and talks

Along with the costs of these additional mitigations, several other additional costs were incurred by the scheme in order to implement the 60mph speed restriction. These included:

- Additional staff resource
- Consultancy of technical experts to undertake scheme specific safety risk assessment
- Radar installations used for the investigations monitoring

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## 4 Conclusions

This section summarises the conclusions which can be drawn from the data summarised in this report. As previously mentioned in section 2.5.1.4, the quantity of data collected on-road which was used to answer several of the research questions posed in this investigation was limited.

These conclusions are based on the findings from a single investigation undertaken at a specific scheme. Both the design and implementation of the scheme's traffic management and trial mitigations impact greatly on the behaviours identified. As such, caution should be taken when using these conclusions to inform decisions about implementing future 60mph speed restrictions on schemes with different designs.

As part of the final project report, the conclusion from this report will be brought together with those from other participating schemes. This final report has been outlined later in section 6.2.

### 4.1 Impact of change in speed restriction on driver behaviour

Analysis of driver behaviour during periods of free-flowing traffic showed that, on average, drivers appeared to respond to the increase in speed restriction from 50mph to 60mph by increasing their travelling speed (from about 51mph in the baseline period to 56mph in the trial period, on average). The increase in average vehicle speed was consistent across both carriageway lanes. This increase in average vehicle speed resulted in an estimated average journey time reduction of approximately 13 seconds per driver.

Whilst average speeds increased, they did not increase to the point of negatively impacting compliance. In fact, overall compliance with the posted speed limit was higher in the 60mph condition than the 50mph condition. A proportion of drivers were travelling above 50mph in the baseline period, but a lower proportion chose to travel above 60mph in the trial period.

Unfortunately, due to issues with the radar installations, it was not possible to assess compliance or changes in speeding behaviour between vehicle types, nor was it possible to assess the impact on headway (or close following).

The distribution of cars and HGVs across the two running lanes was not greatly affected by the change in speed restriction. This suggests that the change in speed restriction did not alter the number of HGVs travelling in the offside lanes (albeit only a small number were observed in the data).

Due to a small sample size, the impact of the speed restriction change on the number of incidents and breakdowns could not be determined.

This change in driver behaviour generally had little impact on worker's feelings of safety, with 8 out of the 15 individuals who responded to surveys, indicating that the change in driver behaviour was generally considered to have no impact on their feelings of safety.

However 7 out of the 11 individuals who indicated that they worked within the road works or on the carriageway reported that overall the change in speed restriction did make them feel unsafe, reporting that they felt the speed restriction was 'too high'.

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## 4.2 Impact of change in speed restriction on customer satisfaction

The small number of eligible survey responses received during the study means that the impact of the speed restriction on customer perceptions cannot be robustly assessed. However, of the 12 responses that were received, the majority suggested that the increased speed restriction had little impact on drivers' feelings of safety, or satisfaction when travelling through the scheme. The survey responses also suggested that most participants felt the speed restrictions were appropriate ('about right').

## 4.3 Impact of change in speed restriction on scheme cost and delivery

Feedback from the scheme suggested that the introduction and application of a 60mph speed restriction had no negative impact on the schedule and delivery of the works. However, it was reported that substantial additional resource was required to implement the investigation as part of this pilot.

Several large fixed costs were also incurred in order to implement additional risk mitigations, such as higher containment vehicle restraint systems.

This information will be used to inform a future use of 60mph speed restrictions within road works and will be presented alongside future guidance material.

# 5 Other investigations

## 5.1 Highways England customer audits

Separate to this investigation, Highways England's insight team investigated the impact of the change in speed restriction on customer satisfaction by undertaking customer audits of the scheme. For ease of reference, and with permission from Highways England, a copy of the report can be seen in Appendix C.

These customer audits, undertaken by Ipsos and Pell Frischmann, utilised briefed 'Auditors' (i.e. members of the public) who lived in the vicinity of the scheme. These Auditors were given a full written brief detailing where they needed to go, what they needed to look out for, and a preview of the survey questionnaire. Auditors were instructed to drive through the scheme and undertake a survey within 24 hours. These surveys sought to identify the impact of the speed restriction change on both customer safety and customer satisfaction. In total 50 surveys were completed by separate Auditors; 25 whilst the scheme was in the baseline trial phase and 25 during the trial phase.

Survey responses were then reviewed via a quality control process by a validation team. This team looked for contradictions and irregularities within the responses of each survey. If completed surveys were deemed to be of poor quality, they were removed from sample. No surveys were reported to have failed this quality control process for the investigations on the M49.

The headline findings from these customer audits are summarised below. Some caution is advised in the extrapolation of these results since a small sample of Auditors was used (25 in the control phase and 25 in the trial phase). In addition, no details are provided in the "Top

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Line Results” report with regard to whether statistically significant differences were identified between the 50mph and 60mph phases; therefore it is not possible to draw robust conclusions from these data regarding the impact of the increase speed restriction.

Key points noted in the “Top Line Results” report (Appendix C) are as follows:

- 21/25 Auditors (84%) noticed that the speed limit had increased in the trial phase.
- 22/25 Auditors (88%) felt 50mph was appropriate for the conditions, and 24/25 Auditors (96%) felt 60mph was appropriate.
- 22/25 Auditors (88%) reported that the signage was easy to see in the control (50mph) phase, and 25/25 (100%) reported it was easy to see in the trial (60mph) phase.
- 25/25 Auditors (100%) indicated that they felt safe in 50mph, and 24/25 (96%) said they felt safe in 60mph.
- 25/25 Auditors (100%) were very satisfied with the 50mph speed limit, and 23/25 (92%) were very satisfied with 60mph.
- 12/25 Auditors (90%) felt 50mph was about right, and 3 Auditors (10%) felt it was too slow. 24/25 Auditors (96%) felt 60mph was about right, and 1 Auditor (4%) felt it was too fast.

The report concluded that one auditor noted that the increase in speed felt unsafe. Otherwise there was no difference observed.

## 5.2 Highways England social media listening

Separate to this investigation, Highways England’s insight team investigated the impact of the change in speed restriction on customer satisfaction by monitoring social media postings.

During the course of the investigation, only limited amounts of data from social media listening were identified as relevant to the M49 scheme. Of 10 relevant mentions on social media, only one directly referenced the speed restriction itself (Highways England, 2019). This mention expressed concern and confusion as to the correct speed restriction at the scheme; Highways England responded directly to this individual.

Overall, the limited sample of data from social media, representing less than 1% of Highways England’s social media ‘conversations’, provides insufficient evidence to assess whether there was a change in customer satisfaction as a result of the change in speed restriction.

## 6 Next steps

### 6.1 Continued use of 60mph at the M49 scheme

Upon completion of the trial of 60mph on the southbound carriageway, a review and validation exercise was undertaken by the scheme in order to determine if the 60mph speed restriction could be implemented on the northbound carriageway of the scheme. In line with the agreed monitoring process, detailed in the scheme specific risk assessment, available data were reviewed in order to determine if the safety objectives had been met during the trial.

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Based on this review, the scheme concluded that there was no robust evidence of an increase in risk resulting from the change in speed restriction on the southbound carriageway during the monitoring periods (other than the inherent increased risk associated with the increase in average vehicle speeds).

A 60mph speed restriction on the northbound carriageway was implemented from 11<sup>th</sup> February, with speed restriction signs being changed along with enforcement thresholds. Further on-going monitoring of reported incidents will be undertaken by the scheme moving forward, these activities will be carried out by the scheme and fall outside of this investigation.

## **6.2 Implementation of 60mph at other schemes**

This is the first investigation of a 60mph speed restriction within narrow lanes at road works as part of this project. TRL is working closely with Highways England to implement 60mph speed restrictions at other schemes on the Strategic Road Network. Several additional lessons learned were captured as part of this investigation; these have been outlined in Appendix B and should be considered when implementing the 60mph speed restriction on other schemes in the future.

The results from future investigations (each to be presented in their own Interim Report) will be collated together (in a Final Report) once the monitoring programme is complete.

The Final Report will enable robust recommendations to be made on the basis of a large and substantial evidence base, with findings being used to inform guidance material into the use of appropriate speed restrictions within road works.

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## Acknowledgements

The following individuals (or organisations) contributed directly to the investigation of a 60mph speed restriction with the M49 Avonmouth road works:

- Andy Jeffries and Joe McGlynn - GallifordTry
- Tom Jewell - HW Martin (Traffic Management) Limited
- Nick Pinnington - Arup
- Sharon Kostanjsek - Avon and Somerset Police
- Kevin Hughes – Caldicot Group
- Colin Bird, Mohsin Shareef and Luis Palacios – Highways England

## References

Arup. (2018). *M49 Avonmouth Junction - 50-60mph Through Road Works Trials - Safety Risk Assessment*.

Department of Transport. (2015). *Provision of market research for value of travel time savings and reliability - non-technical summary report*.

Fordham, C., & Glaze, S. (2019). *Programme level GG 104 risk assessment for 60mph trials through road works*.

Glaze, S., Chowdhury, S., Fleetwood, R., & Lodge, C. (2018). *Narrow Lanes Simulations 55mph and 60mph*.

Highways England. (2015). *NSCRG and PSCRG Remit for Organisation and Governance*.

Highways England. (2018). *Design Manual for Roads and Bridges GG 104 Requirements for safety risk assessment*.

Highways England. (2019). *M49 Avonmouth 50/60mph speed trials - Social media listening and highview survey*.

Highways England. (n.d.). *Improvements and major road projects*. Retrieved March Friday 29th, 2019, from Highways England: <https://highwaysengland.co.uk/projects/m49-avonmouth-junction/>

Ipsos. (2019). *Customer audits - speed trials - M49 Top line results*.

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## Appendix A PSCRG Members

### Principal members:

- A senior Highways England Project Manager and/or Senior Responsible Owner
- Lead consultancy support, with relevant risk assessment knowledge, competence, design understanding and experience with Highways England safety governance procedures
- Network Delivery and Development Senior User
- Customer Operations Senior User
- Competent Designer Safety / Operations Expert
- Project Construction, Design and Management Coordinator
- Contractor representative (when appointed)
- Professional and Technical Solutions Safety Risk and Governance representative

### Specialist members:

- Additional technical support (Professional and Technical Solutions specialists or external subject matter experts (SME's)) as required
- The Design Team Project Manager
- Asset Support Contract representative
- Maintenance representative, including technology
- Stakeholder representative (e.g. other RCC/Traffic Officer Service representatives)

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## Appendix B Lessons learned

In order to understand the impact of the change in speed restriction on the scheme's delivery and costs, a lessons-learned workshop was held after the monitoring periods had ended. The session sought to capture details on any impacts to the scheme associated with implementing the change in speed restriction. Attendees included the scheme's Highways England Project Manager, Principal Contractor, Traffic Management Supplier and Risk Contractor.

As part of the investigation into the impact of the change in speed restriction at the M49 Avonmouth road works scheme, a 'lessons learned' session was undertaken. The following questions were posed to attendees.

**Question: How do you feel that the investigation went on a general level? What worked well? What didn't? Why?**

Summary of key points made:

- The scheme's original contract did not consider the requirement of a 60mph speed restriction, this provide several challenges. The availability of designated funds helped to achieve the change in speed restriction but the change to the original contract provided challenges with contractors.
- There was a perceived view that the process to move to 60mph speed restriction, was more complicated than it actually is. It would be beneficial to supplement the programme level risk assessment and monitoring plans with a concise process chart. Individuals within the industry come from various technical backgrounds. The use of a common presentation method, such as flowcharts, would aid any future communication.
- The process needs someone to guide and lead it from the outset. This takes a lot of time; far more time than the scheme initially thought.
- Feedback from other schemes participating in the wider programme of investigations indicated a lack of consistency in the delivery of safety risk assessments across schemes. Scheme-specific hazards along with assessment methods varied. In the future, the approach adopted with scheme-specific safety risk assessments should be outlined in more detail at a programme-level by Highways England.
- The assistance of both the traffic management supplier (H W Martins) and the monitoring organisation (TRL) was most helpful for the principal contractor in the safe implementation of the 60mph speed restriction. The traffic management supplier went above and beyond with their assistance to the scheme. It is pivotal that the Supply Chain is involved and that their thoughts are considered early on in the process, since it is individuals in the Supply Chain who could be most affected by any changes in driver behaviour.
- Although several of the key mitigations and design decisions had already been implemented prior to the start of the process, the additional challenges brought about by introducing speed camera enforcement were considerable.
- Several challenges arose on the scheme around the collection of driver behaviour data. Due to the limited number of parties able to offer the required monitoring equipment,



issues with this equipment led to only partial datasets being used to inform the results of the investigation. A specific and detailed list of the data required for monitoring could mitigate future problems.

- Guidance on suitable abort thresholds should be provided. During the trial, the monitoring process was fairly generic and the decision on aborting felt subjective.

**Question: Early on some potential concerns in relation to changing the speed restriction for this scheme were raised. Were any of them realised? If so, how?**

Summary of key points made:

- The expected low levels of road user compliance with speed restrictions were not realised during the investigation.
- An expected increase in the volume of traffic due to the Severn Bridge tolls being lifted during period of the investigation was not realised.
- During the investigation several other road works schemes were implemented downstream of the M49 Avonmouth works. These schemes did not raise any concerns.
- Concerns were originally raised that the scheme was situated at a 'nasty location' with high speeds, and poor conditions in winter months with mist and fog due to proximity to river. During the investigation there appeared to be no real materialisation of these factors. Although average speeds, prior to the start of the investigation, appeared high at the scheme with the introduction of enforcement cameras levels reduced and remained tolerable during the investigation. Significant snow occurred in early 2019, but with no notable detriment to safety on the scheme.
- Prior to the start of the investigations the scheme had no existing speed enforcement systems on site and had limited CCTV. Enforcement systems were installed as part of the risk management process. Several challenges arose during this process which required effort from the scheme and traffic management suppliers. Challenges included:
  - Lack of experience in the application of such systems from the scheme.
  - Contact with policing authority, regional enforcement coordinators.
  - Power for the camera systems, ensuring sufficient capacity in the network
  - The connection and set ups for enforcement systems requiring closures and power outages, impacting on site work.
- Space within the carriageway to deal with incidents or breakdowns was initially a concern, but in reality the number and locations of breakdowns experienced raised no issues. The available carriageway space appeared appropriate. Onsite recovery would have made very little difference to response times.
- Incident management and support was provided by the Regional Operations Centre and Traffic Officers, it was pivotal to the success of the investigations. Future success would be dependent on receiving the same level of support.

**Question: What could have helped you overcome those challenges? What would you have liked to do? (Prompts given: financial/ publicity/ support)**

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Summary of key points made:

- Process management and clear senior-level ownership is critical to ensuring delivery. Collaboration with multiple stakeholders was required throughout the process. Bringing in those individuals who were not within the nucleus of the project team earlier would have helped change mind-sets earlier.

**Question: Was any additional traffic management equipment required to make schemes suitable for 60mph speed restrictions? If so, what? E.g. new signage, changes to barrier and crash cushions, variable message signs etc.**

Summary of key points made:

- The layout on the M49 scheme lent itself to safe access/egress. This would be very much different on a long scheme where site vehicles may be required to pull into a live lane at a much slower speed than other traffic on the live carriageway. Road layout and TM layout could be critical on other schemes. The M49 scheme traffic management design involved a fixed layout which had already been developed with 60mph in mind; this facilitated the completion of the safety risk assessment process. By contrast other schemes are seeking to progress risk assessments without firm traffic management proposals in place - this alternative approach results in uncertainty about what is being assessed and extends the timescales for the risk assessment process.

**Question: Were any additional maintenance activities undertaken during the use of a 60mph speed restriction? What were they? How much time/effort/additional cost did these activities take?**

Summary of key points made:

- The traffic management supplier was required to undertake two additional lane closures to change the speed restriction signs on the scheme. One at the start of the trial period on the southbound carriageway and a second at the conclusion of the investigation on the northbound carriageway.
- As a result of the introduction of speed enforcement, prior to the start of the investigation, additional traffic management reviews and subsequent paper work was required.

**Question: Did you have to make any modifications to risk assessments or method statements? What about equipment?**

Summary of key points made:

- Minimal changes were required to site specific risk assessments as the traffic management supplier has method statements for working on roads with higher vehicle speeds.
- Time was spent (around half a day) with the recovery operator to update method statements.
- A scheme specific safety risk assessment, specifically about the implementation of the 60mph speed restriction was required for the investigation. Procurement of a

consultant was problematic. During the creation of the assessment the identification of hazards in a consistent way was challenging. Although the programme level assessment outline hazardous events a hazard log approach (similar to the one used for Smart Motorway work) could result in a more consistent approach.

**Question: Were there any additional enforcement requirements for enforcing the use of a 60mph speed restriction on your scheme? If so, what?**

Summary of key points made:

- Prior to the investigation the scheme had no provision for enforcement across the road works. Systems were installed to facilitate the investigation.
- There were quite a few challenges implementing the systems on the scheme. Individuals involved had no previous exposure to the required process as enforcement on these types of scheme is uncommon. Providing a power supply to the systems was problematic.
- The enforcement cameras provided reassurance and seemed appropriate for this scheme.

**Question: Were additional staff required to implement the use of a 60mph speed restriction? If so, what was the impact of this on budget compared to if the scheme had not been running at 60mph?**

Summary of key points made:

- Both the Principal Contractor and Traffic Management Supplier spent at least one day a week managing the changes for 60mph. This work was in addition to their existing roles on the scheme. The additional works include coordinating teams and ordering equipment, it was quite onerous in terms of man hours etc.
- There was no tangible impact on the scheme but definitely had an impact on staff involved.

**Question: In summary, what were your feelings on the impact of using a speed limit of 60mph, rather than 50mph, within scheme on: the safety of both road users and road worker? The satisfaction of customers? The delivery schedule of the scheme?**

Summary of key points made:

- There appeared to be no detriment to safety - the introduction of speed enforcement at the scheme probably brought about an increased safety level.
- The evidenced reviewed weekly indicated no detriment to safety.
- No questions were received by scheme concerning the 60mph speed restriction.
- Any impact the implementation of the 60mph speed restriction had on the scheme's cost and delivery didn't set back the scheme's delivery.

## Appendix C Ipsos Customer Audits



17-041629-01\_HE\_January 2019\_Report\_Internal Client Use Only

1

# Contents

- Introduction & Methodology
- Results
- Conclusions & Recommendations



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# Research Methodology



## Schemes

### Customer Audits conducted across the following schemes:

- M49 over the December to February Period
- Highways England have been trailing a new 60mph speed limits whilst going through the M49 scheme. Auditors were specifically briefed to undertake the usual customer audit but also look out for/observe the speed limit and provide their perception on the limits.



## Measurement

### Scheme audits assessing:

- The auditors perception of the 50mph/60mph speed limit that was in place.
- The audits were split evenly to gain an understanding of a customers perception of both speed limits



## Sample Base

M49 n=50

50mph Tests n=25  
60mph Tests n=25



This work was carried out in accordance with the requirements of the international quality standard for market research, ISO 20252 and with the Ipsos MORI Terms and Conditions.

# Results



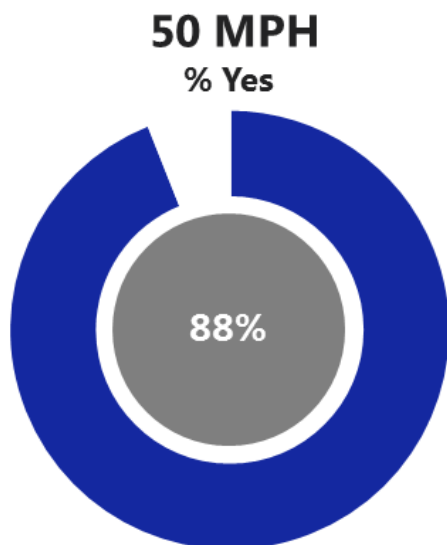
17-041629-01\_HE\_January\_2019\_Report\_Internal\_Client Use Only

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## Auditors stated that both the 50mph and 60mph speed were suitable

Did you feel the speed limit in place was appropriate for the conditions?

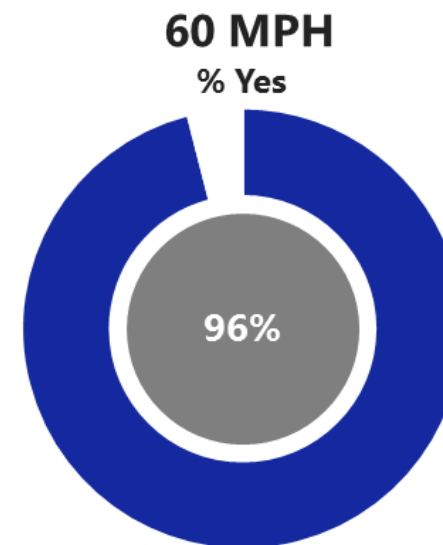


*"Good speed giving time to adjust to lane changes and read signs."*



Ipsos

Base: n=25



*"The speed limit of 60 mph was suitable."*

Base: n=25



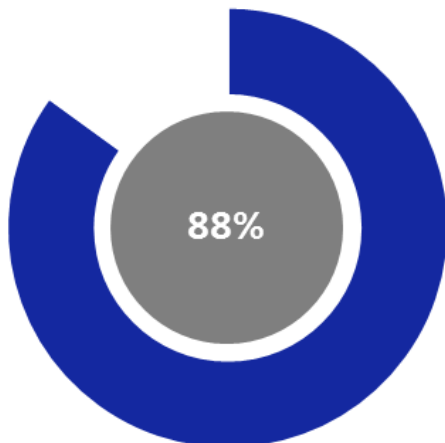


## In addition the signage was easy to see



Was the signage easy to see?

**50 MPH**  
% Yes

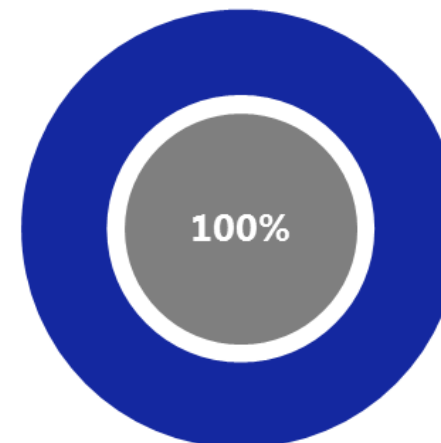


*"There was a lot of signage."*



Base: n=25

**60 MPH**  
% Yes

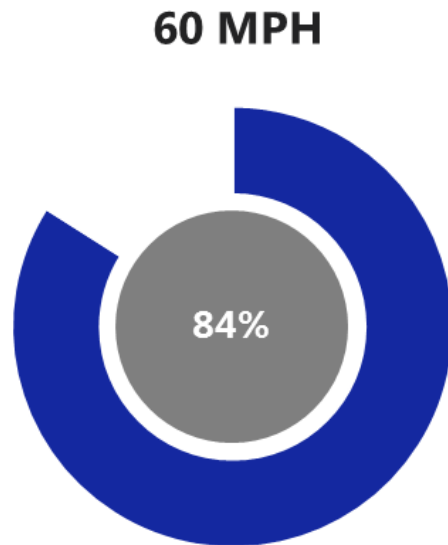


*"All the signs were plentiful, clear and obstruction free."*

Base: n=25

# 84% of auditors noticed an increased speed limit

Did you notice the speed limit had changed? (60mph tests only - % Yes)



Base: n=25



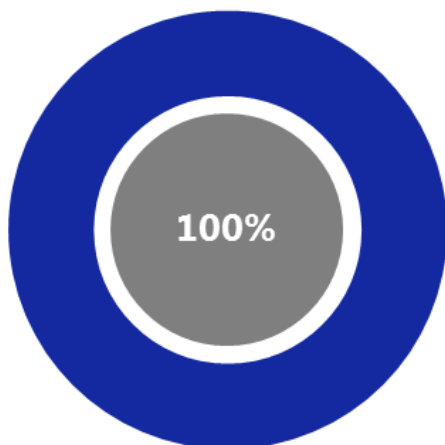
“  
The speed limit has not changed it is still 50mph.”

“  
The speed limit felt right for the length of the roadworks. The first set of roadworks with 2 lanes was at 60 mph and when it went down to one lane the speed limit was reduced to 50 mph.”

# The higher speed limit did lead to one auditor feeling unsafe

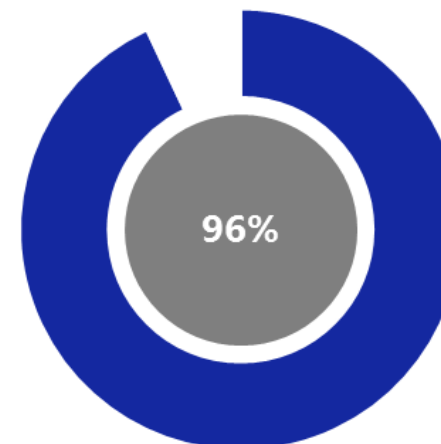
Did you feel safe travelling at the speed limit through the scheme?

**50 MPH**



Base: n=25

**60 MPH**



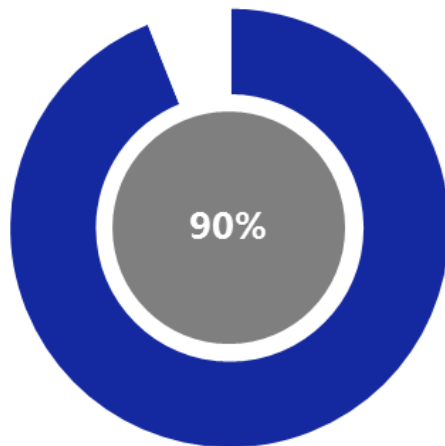
*"I felt a little uneasy when I was close to other vehicles."*

Base: n=25

Auditors stated that both the 50mph and 60mph speed limits were suitable

Did you think the speed limit was too high / too low / about right? % About right

### 50 MPH



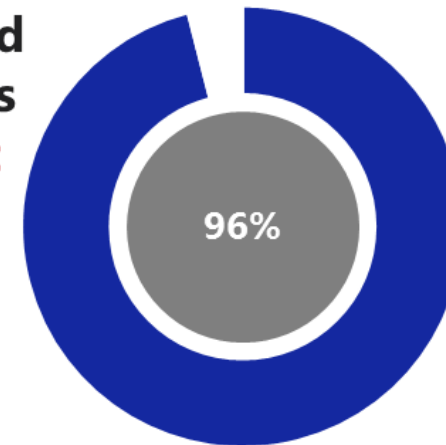
**10% stated the speed limit was too slow**

*"Good speed, giving enough time to adjust to lane changes and read signs."*



Base: n=25

### 60 MPH



**4% stated the speed limit was too fast**

*"The speed limit of 60 mph was suitable"*

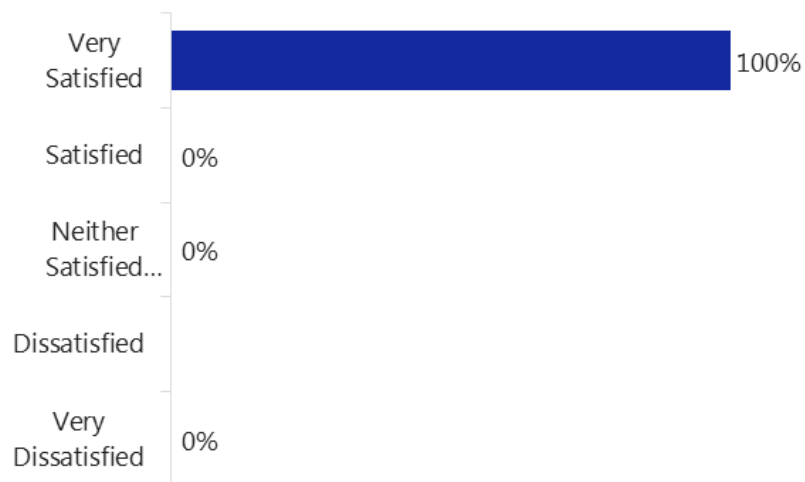
Base: n=25



The satisfaction mirrored the safety results with a couple of auditors feeling that the higher speed didn't feel as safe and therefore were only satisfied

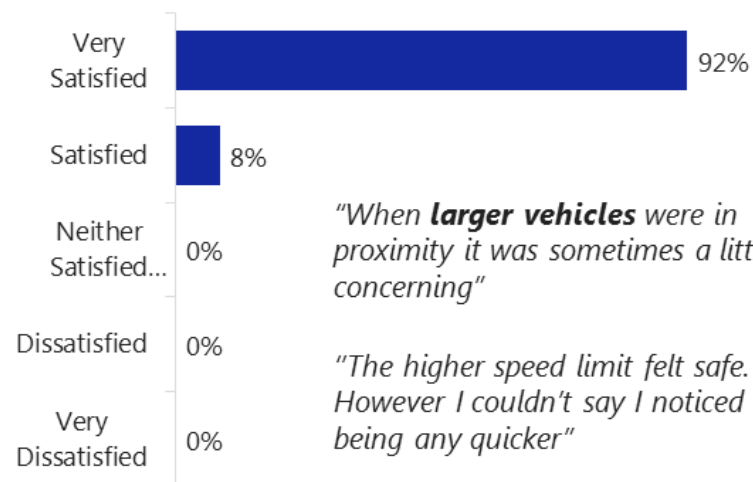
How satisfied were they with the speed limit?

### 50 MPH



Base: n=25

### 60 MPH



Base: n=25

# Recommendations & Conclusions



## Recommendations & Conclusions



### One auditor noted that the increase in speed felt unsafe. Otherwise there a no difference observed

Auditors noted large vehicles made it feel like was slightly unsafe at times. Whilst this was also mentioned at 50mph the auditors didn't mark the speed down for safety concerns. Auditors stated that they were satisfied with both speeds. The higher speed didn't generally feel like a significant change to the auditor.

### Just 84% of the auditors noticed the 60mph speed limit

Whilst signage was easy to see and the auditors were briefed that they were travelling at the 60mph trial dates, there were still 16% that didn't notice the speed limit change. However, when it was noticed 100% of the auditors thought the signage was easy to see.



## Monitoring and evaluation of the 60mph trials



The purpose of this trial was to understand the impact of changing the speed restriction within the M49 Avonmouth scheme from 50mph to 60mph on driver behaviour, customer satisfaction and the scheme's cost and delivery. The findings from this investigation will be used, along with other investigations, to inform the development of guidance material for future road works design.

The investigation involved monitoring of data from 'control' and 'experimental' locations positioned within the road works scheme. A number of different data sources were used for both locations across a 'baseline period' (when both locations were subject to a 50mph speed restriction) and a 'trial period' (when the control location was subject to a 50mph speed restriction and the experimental location was subject to a 60mph speed restriction). These data sources included road side radar data, scheme incident logs, and online surveys from both customers and the scheme workforce. Feedback from the workforce was also gathered during workshops with scheme representatives.

The change in speed restriction at the scheme had a significant impact on road user behaviour, with road users typically increasing their speed, resulting in noticeable benefits in terms of journey time reductions and speed limit compliance. A sample of road users suggested that the change in speed restriction had little impact on their levels of satisfaction. Further findings are detailed within the report.

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