# Monitoring and evaluation of the 55/60mph pilots

## Interim report for the on-road trials of 55mph on the M1 Junction 45 scheme

**Date: 10 January 2018** **Version: 0.2**

## Document Control

| | |
|---|---|
| **Document Title** | Interim report for the on-road trials of 55mph on the M1 Junction 45 scheme |
| **Author** | Nick Nandhra |
| **Owner** | Nick Nandhra |
| **Distribution** | |
| **Document Status** | Final |

## Revision History

| Version | Date | Description | Author |
|---|---|---|---|
| 0.1 | 10 January 2018 | Draft | Nick Nandhra |
| 0.2 | 21 February 2018 | Final | Nick Nandhra |
| | | | |

## Reviewer List

| Name | Role |
|---|---|
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## Approvals

| Name | Signature | Title | Date of Issue | Version |
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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 by raising the perceived normal speed through roadworks of 50mph 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 intolerable increase in risk from the increased speed limit.

This report presents the finding from the on-road pilot of an increased speed limit at the M1 Jct 45 improvement scheme. The trial involved the implementation of 55mph speed limit on both the northbound and southbound; drivers travelling on this part of the scheme were experiencing a speed restriction of 50mph because of the junction improvement works. It was proposed that this 50mph speed restriction is increased to 55mph once carriageway restrictions on the slip roads were lifted. The aim was to understand whether the change in speed limit on both the northbound and southbound carriageways (to 55mph) impacted on the safety of the road users. In addition to the behavioural measures, surveys were carried out with drivers through the scheme to understand perceptions of the 55mph speed limit.

The key findings from this trial can be summarised as:

- The 55mph speed limit resulted in a 3mph increase in free-flow average speed to around 53mph (i.e. below the speed limit)
- The increased speed limit saved each road user approximately 5s in journey time
- Speed compliance was better with the 55mph speed limit than the 50mph speed limit
- Since there were very few breakdowns or collisions during the trial period, there is no evidence to suggest the increase in speeds has resulted in any extra collisions and/or severity.

# 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 way of improving customer satisfaction at roadworks is to challenge the approach to speed management that is usually taken. Typically, a 'blanket' speed reduction of 20mph is imposed throughout the scheme, resulting in a 50mph enforced speed limit in place for the entire length and duration of the roadworks.

Following consultation with stakeholders across Highways England and the Supply Chain, this project was set-up to support the monitoring and evaluation of the potential benefits of raising the speed limit through roadworks from 50mph 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 were defined for on-road trials:

- **Scenario 1:** Implementation of a 60mph speed limit on lead-in and exits to/from the works, with a 50mph speed limit through the works area
- **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. Study objectives

This report summarises the findings from an on-road pilot of 55mph on the M1 Jct 45 improvement scheme during late 2017. This is the fifth pilot which has been completed with the aim of understanding the impact of increasing the speed limit at roadworks. This pilot implemented a 55mph speed limit under the conditions of Scenario 2, during this phase, the hard shoulder remains closed.

The key objectives of the research were to gather evidence of the impact of increasing the speed limit on the M1 Jct 45 improvement scheme from 50mph to 55mph on:

1. Lane distribution
2. Average vehicle speed
3. The number of vehicles non-compliant with the speed limit
4. The number of incidents
5. Customer satisfaction

This report provides an overview of the scheme and the data collection methodology (Section 2), presents the results from the monitoring of driver behaviour (Section 3), summarises the conclusions from the pilot (Section 4).

# 2. Method

## 2.1. Overview of the scheme

The M1 Jct 45 improvement scheme commenced in January 2017 and was completed in December 2017. The scheme will widen the existing slip roads and add an extra lane to the roundabout to increase capacity at this junction, which is a major route in and out of Leeds. Although there are no works on the main carriageway of the M1, as a result of the roadworks on the slip roads and roundabout, a speed restriction of 50mph is imposed on the main carriageway.

The stretch of the M1 between marker post 307/0 and 308/9 is where the speed restriction is in place. An overview of the trial site is provided in figure 1.

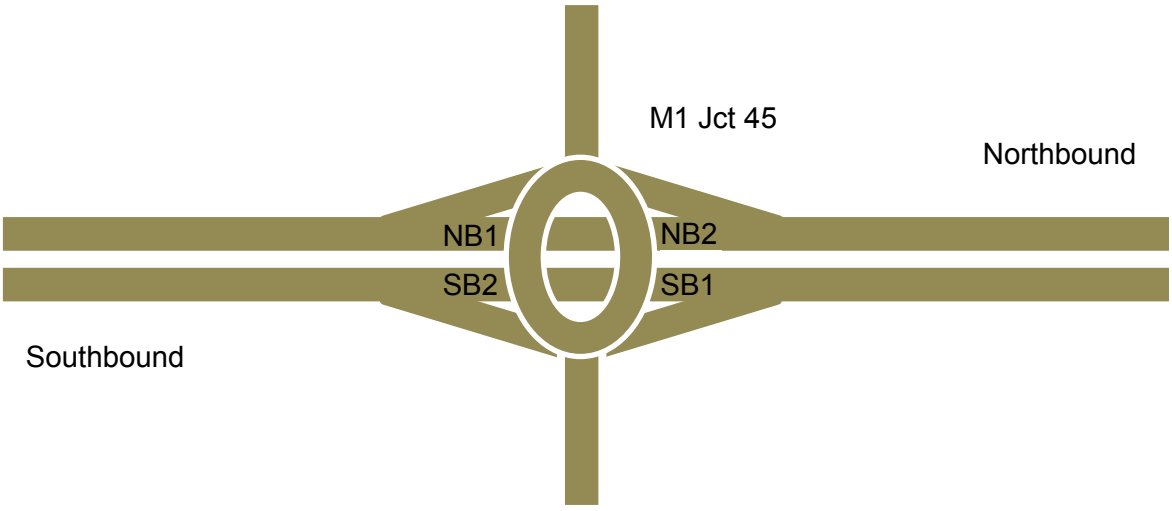


**Figure 1: Overview of trial site (NB1/NB2 & SB1/SB2 refer to location of monitoring equipment)**

## 2.2. Monitoring locations and signage

The monitoring covered two periods: the 'baseline' monitoring period during which both carriageways retained the 50mph speed limit and the 'trial' experimental period during which the speed on both carriageways was increased to 55mph.

During the trial period, drivers travelling towards junction 45 would enter the pilot area and travel through at a reduced speed of 50mph, before return to the nation speed limit. Two monitoring locations were setup (NB1/NB2 & SB1/SB2) as shown in figure 1.

Speed cameras and warning signs were in place throughout the scheme to provide drivers with the perception of enforcement.

## 2.3. Timelines

The monitoring took place between 30th November to 8th December. Between the 9th December and the 20th December, 55mph 'trial' experimental period was implemented. Table 1 outlines the monitoring timeline. Monitoring equipment was removed on the 20th December.

| Date | Description of activity | M1 | | |
|---|---|---|---|---|
| | | @ Jct 44 | @ Jct 45 | @ Jct 46 |
| 30/11/17 to 08/12/17 | Baseline monitoring period | 70 | 50 | 70 |
| 09/12/17 to 20/12/17 | Trial monitoring period | 70 | 55 | 70 |

**Table 1: Timeline for monitoring**

## 2.4. Lane use and widths

Full lane widths and available lanes (left lane, the middle lane and the right lane) were open for traffic and were not varied during the monitoring and trial periods.

Speed cameras and warning signs were in place throughout both periods to ensure that drivers perceived the limits to be enforced.

## 2.5. Risk assessment

Prior to commencing the pilot, the M1 Jct 45 improvement scheme team (Interserve) 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 scheme agreed that the pilot could commence, provided on-going monitoring and safety reviews were carried out and that a suitable abort process was in place (this is detailed in Section 2.6).

## 2.6. Safety reviews and abort process

Throughout the pilot, the scheme had overall responsibility for risk and retained the right to initiate the abort process (i.e. reverting the scheme back to 50mph) at any stage. However, TRL provided on-going monitoring during the pilot and other parties (TRL and Highways England) could also request that the scheme initiate the abort process should evidence be obtained that immediate termination of the pilot was necessary.

The abort process was formally documented by the scheme team as part of the GD04 risk assessment. The abort process was never used and the pilot was completed successfully without any concern for safety.

## 2.7. Data collection

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

- Traffic data (sourced through ANPR cameras)
- Incident data
- Survey data

### 2.7.1. Traffic data

In order to monitor vehicle flows, speed and compliance, 4 ANPR cameras were deployed, two in each direction. The locations of the cameras are shown in figure 1 and referenced as NB1/NB2 and SB1/SB2.

Data from the cameras was downloaded on a daily basis by Intelligent data and processed before being made available to Highways England. TRL were employed to carrying out an independent safety assessment during the trial period. Once the trial had been completed, Intelligent data provide a summary of vehicle counts, average speed, flow and compliance; the results are presented in section 3.

# 3. Results

## 3.1. Vehicle flow

Figure 3 shows the average daily vehicle flow for the control (NB & SB) and experimental (NB & SB) locations, during the baseline and trial monitoring periods.

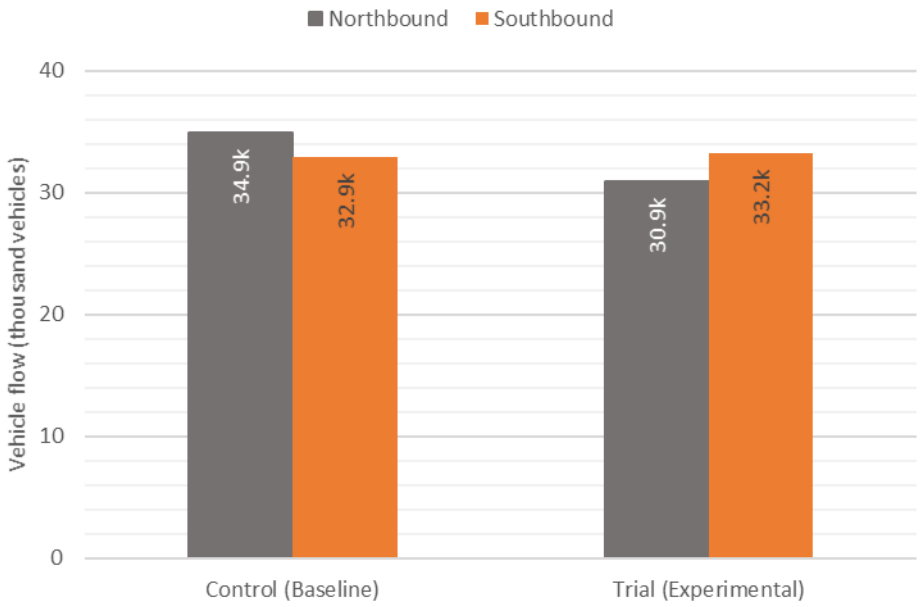


**Figure 3: Average daily vehicle flow by location and monitoring period**

The figure shows that, on average vehicle flow in the southbound direction was similar between the baseline and trial monitoring periods, whereas the average vehicle flow in the northbound fell by approx. 4000 vehicles during the same period.

Figure 4 shows how the flow changes by day.

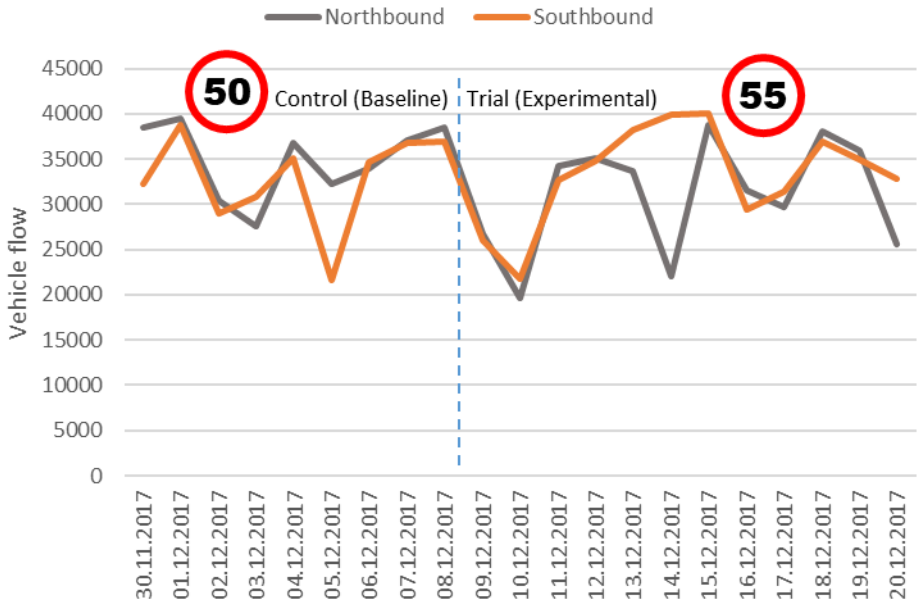


**Figure 4: Average daily vehicle flow by date**

There is no clear trend in the daily flows; however, there is some suggestion that the flows appear to be lower at the weekends (2nd / 3rd, 9th / 10th and 16th / 17th) than during the week. The reduction in daily flow on the 5th and 14th were due to planned overnight closures and these would influence vehicle flow.

In addition to overall vehicle flow, differences in the distribution of vehicles by vehicle class could also influence average speed. Figure 5 shows how the proportion of HGVs changed over the monitoring period.

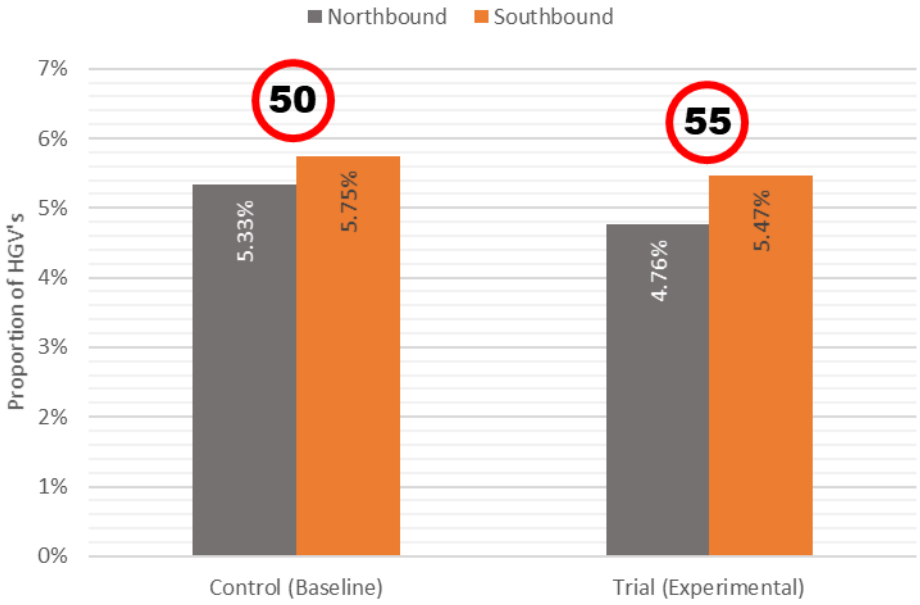


**Figure 5: Proportion of HGVs by carriageway and monitoring period**

The change in the proportion of HGVs between baseline and trial period fell by 0.28% in the southbound direction and 0.57% in the northbound direction. Generally, a reduction of 1% of HGV vehicles was seen in lane 1 in the southbound direction compared to a 2% reduction in lane 1 of the northbound direction between the baseline and trial periods.

Figure 6 shows how the proportion of HGVs varied by date.

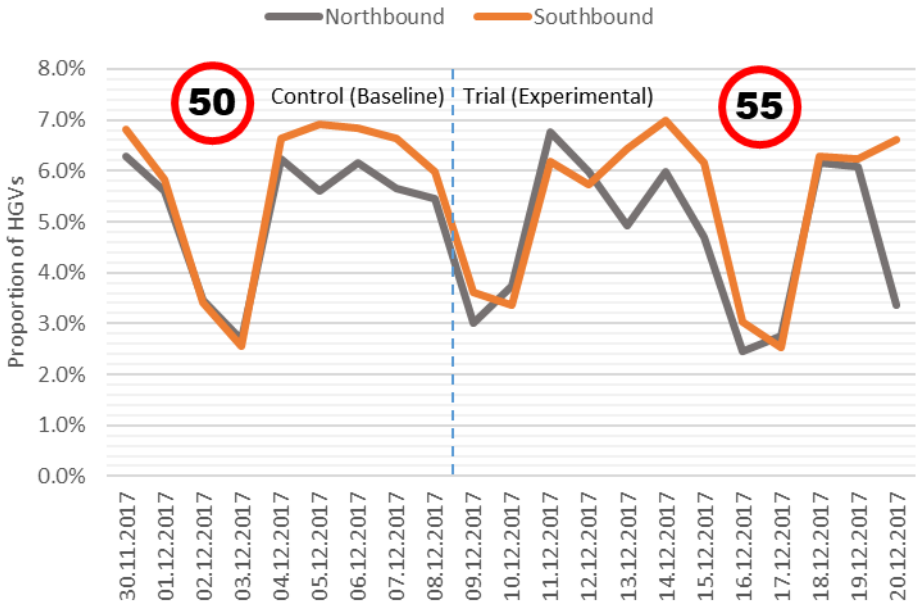


**Figure 6: Proportion of HGVs by date**

Figure 6 shows that the proportion of HGVs were broadly similar between the baseline and trial periods. In addition, the proportion of HGVs is substantially lower at weekends (2nd / 3rd, 9th / 10th and 16th / 17th) than during weekdays.

Key findings

- Vehicle flow decreased during the trial period.
- Vehicle flow and distribution of vehicles by class varied by day with fewer HGVs at the weekend than during the week.

## 3.2. Lane distribution

Figure 7a show the proportion of vehicles in each lane travelling southbound at each monitoring location SB1 & SB2, and during the baseline and trial period.

Little difference in the distribution of vehicles by lane between the baseline and trial monitoring periods at SB1 was noted. A 3% reduction in the left lane at SB2 was recorded with a similar increase in the middle lane and a 1% increase in the right lane at SB2.

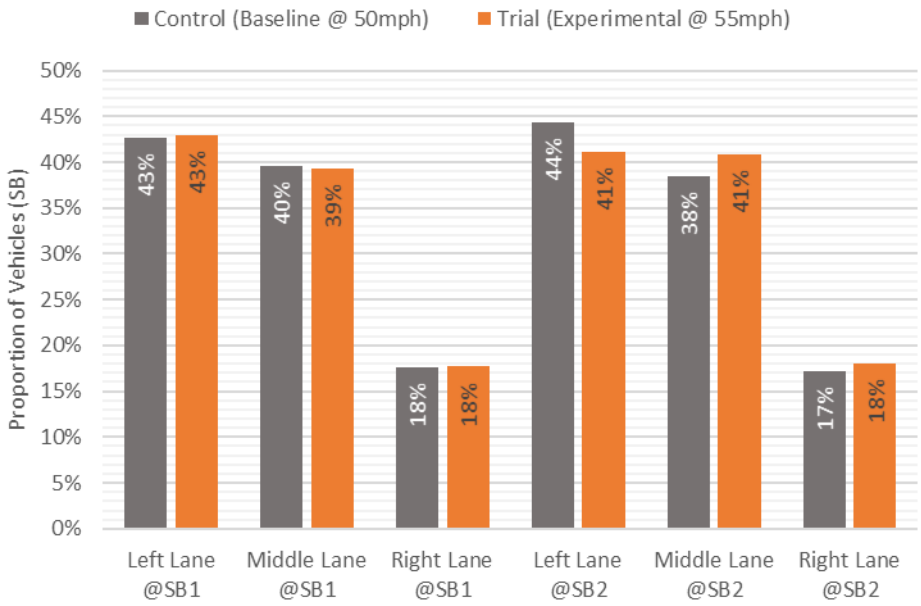


**Figure 7a: Proportion of vehicles by lane and monitoring location (SB1 and SB2)**

Figure 7b show the proportion of vehicles in each lane travelling southbound at each monitoring location NB1 & NB2, and during the baseline and trial period.

Again, a 3% reduction was noted in the left lane at NB1, with a similar increase in the middle lane and a 1% increase in the right lane during the trial period. In contrast, a 4% reduction was noted in the left lane at NB2, with a 2% and 1% increase in the middle and right lanes at NB2.

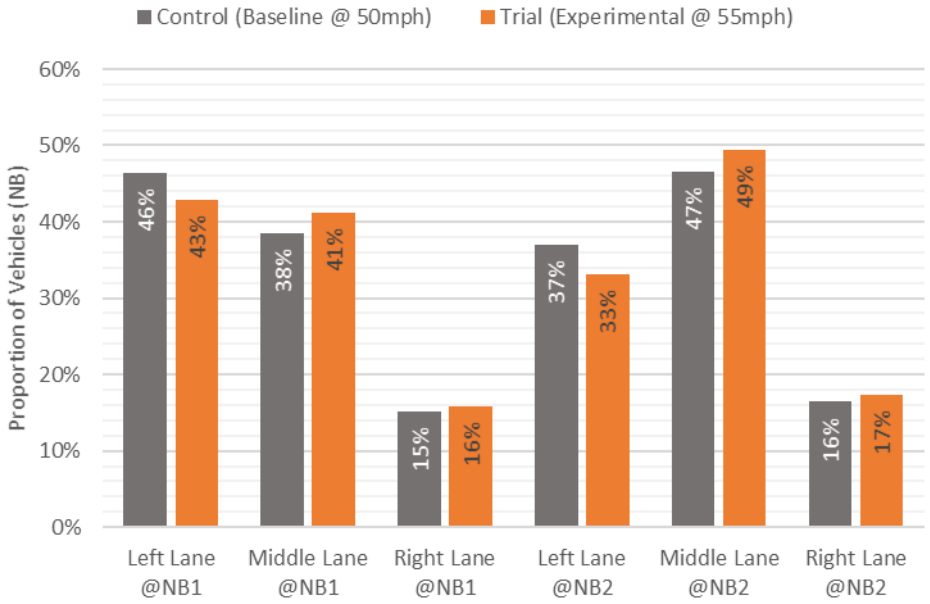


**Figure 7b: Proportion of vehicles by lane and monitoring location (NB1 and NB2)**

Figures 8a to 8d shows the distribution of vehicle types by lane at monitoring locations (NB1/NB2 and SB1/SB2).

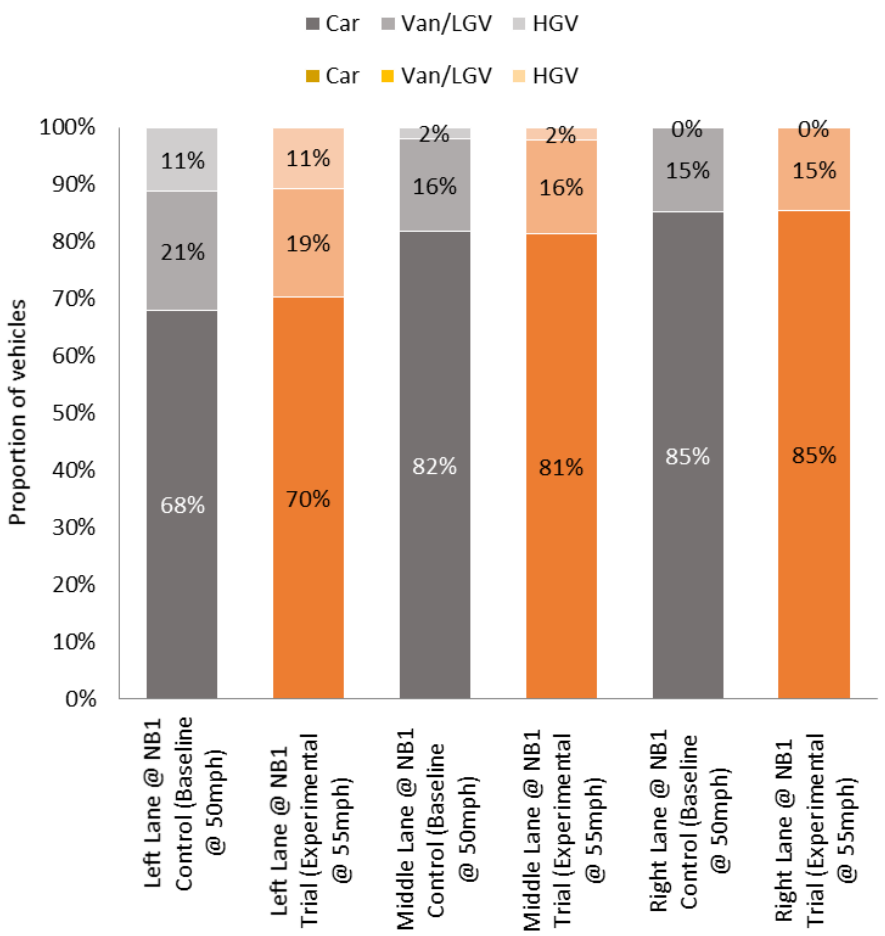


**Figure 8a: Proportion of vehicles by lane and monitoring location at NB1.**

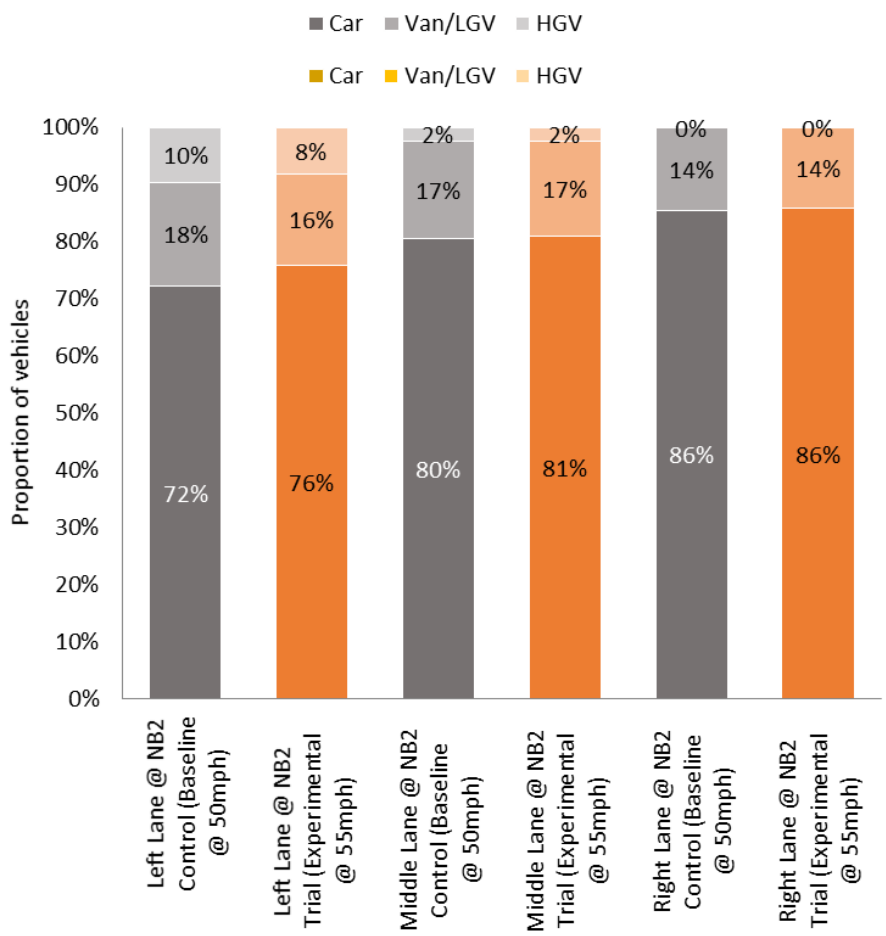


**Figure 8b: Proportion of vehicles by lane and monitoring location at NB2.**

Figure 8a and 8b show the distribution of vehicle types by lane at monitoring location NB1 and NB2. Generally, an increase in the proportion of cars was noted in the left lane at both monitoring locations and a 1% increase in the middle lane at NB2. A reduction in the percentage of vans/LGVs was noted in left lane at both monitoring locations.

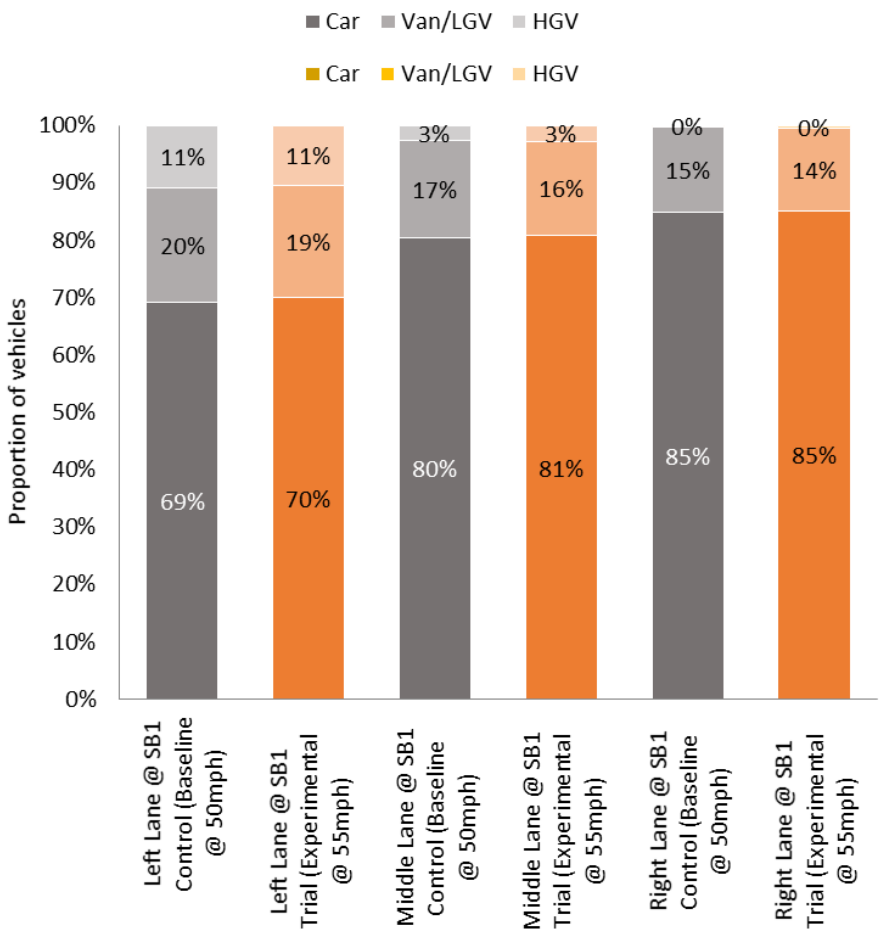


**Figure 8c: Proportion of vehicles by lane and monitoring location at SB1.**

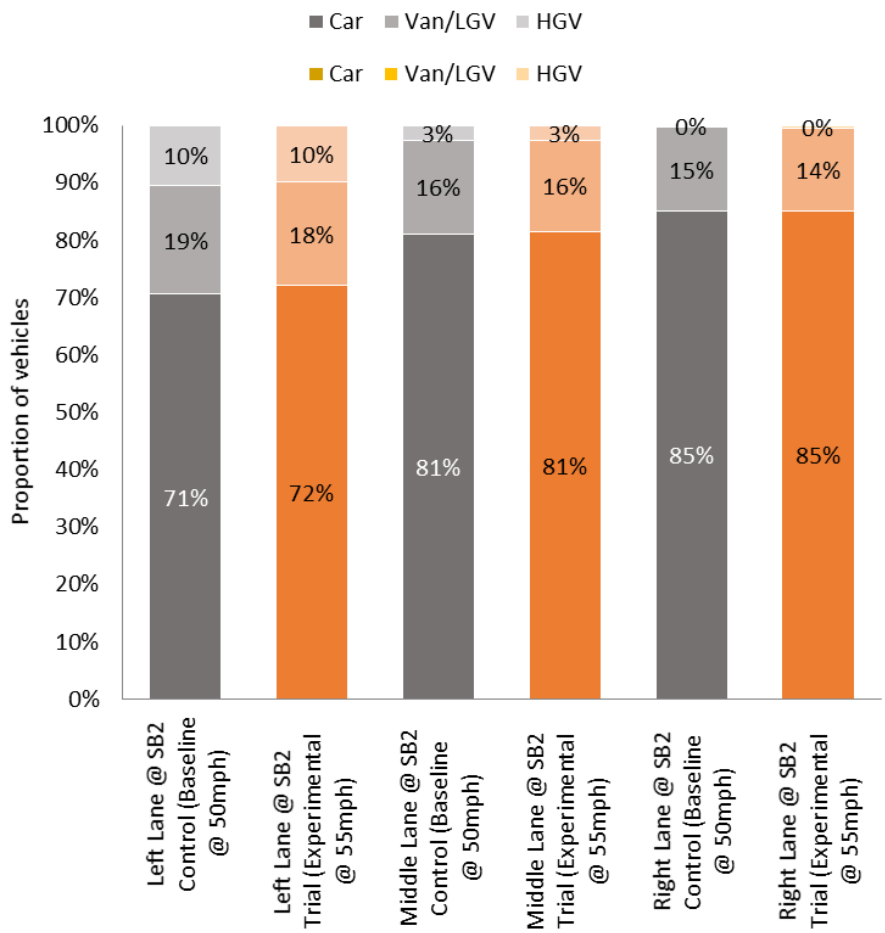


**Figure 8d: Proportion of vehicles by lane and monitoring location at SB2.**

Figure 8c and 8d show the distribution of vehicle types by lane at monitoring location SB1 and SB2. Generally, an increase in the proportion of cars was noted in the left and middle lanes at SB1 and a 1% increase in the left lane at SB2. A reduction in the percentage of vans/LGVs was also noted in all lanes at both monitoring locations.

## 3.3. Average vehicle speed

Figure 9 shows the free-flow average speeds on the control and experimental link during monitoring periods.

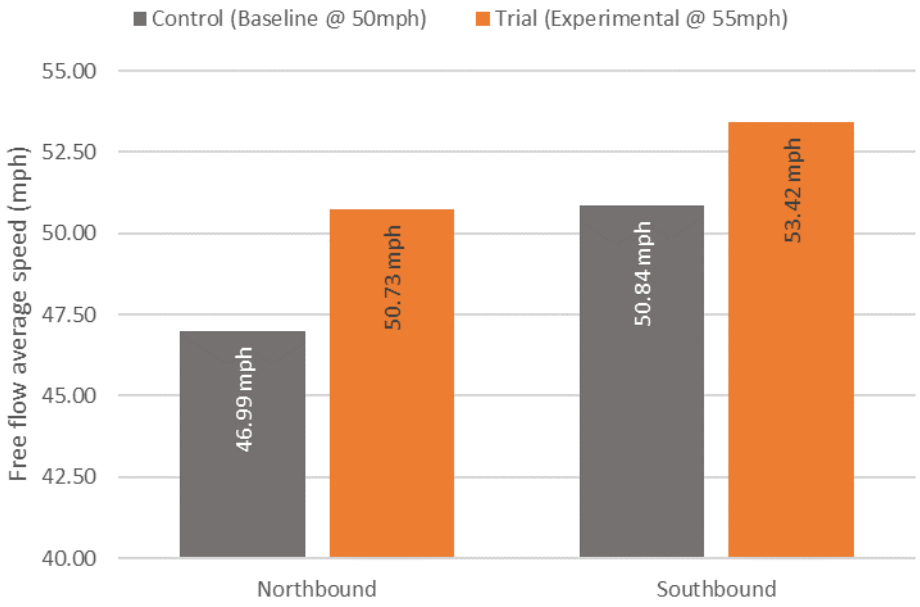


**Figure 9: Free-flow average speed by radar location and monitoring period**

Average speed recorded during the control period in the northbound direction was 49.99mph and 50.84mph in the southbound direction. During the trial period, average speeds increased to 50.73mph for the northbound direction and 53.42mph for the southbound, an increase of 3.86mph and 2.69mph respectively. This suggests that at least some drivers noticed the speed limit change and increased their speed accordingly.

Figure 10 shows how the free-flow average speed varied by date.

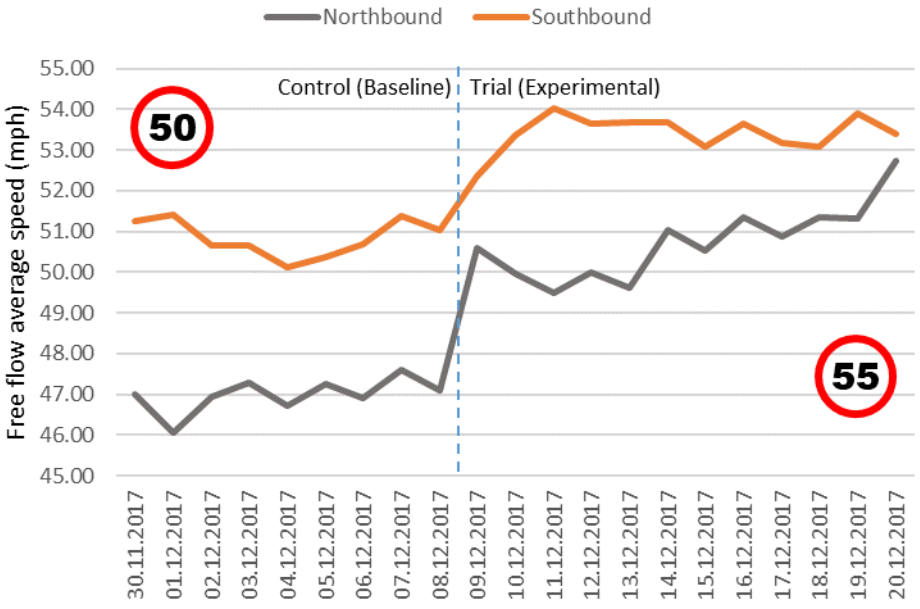


**Figure 10: Free-flow average speed by date**

On average, speed gradually increased following the change in speed limit, suggesting that the number of drivers who noticed the speed limit change and adapted their speed accordingly.

Differences in the average speed by lane during the control and experimental periods are shown in Figure 11. Topography of the junction was also taken into consideration. The southbound approach has a steeper descent on the approach to junction 45 then the northbound approach and this would influence the recorded speeds.

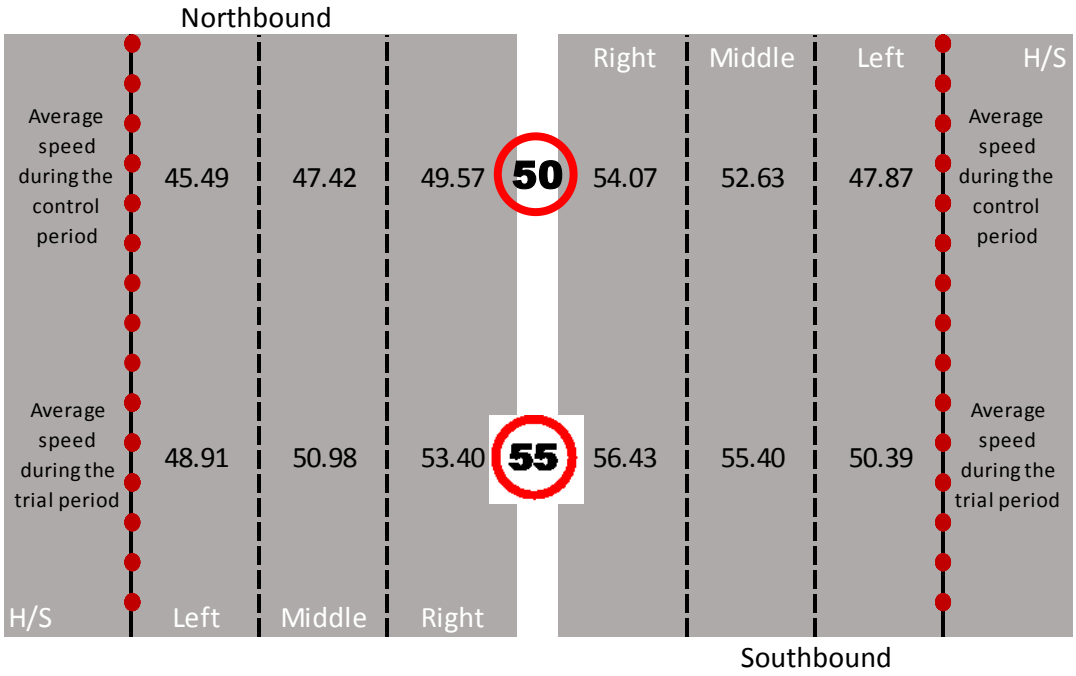


**Figure 11: Free-flow average speed (in mph) by monitoring period and lane at the experimental location**

In the control period when the speed limit was 50mph, average speeds were below this limit in all lanes in the northbound direction. However, in the southbound direction the average speed recorded was higher in the middle and right lanes. In contrast, during the experimental period of 55mph, the average speeds in the northbound direction for all lanes was less then 55mph and slightly higher in the middle and right lanes in the southbound direction at 55mph and 56mph.

Figure 12a shows the free-flow average speed of cars, vans/LGVs and HGVs in the northbound direction during the control and trial periods and figure 12b shows the free-flow average speed of cars, vans/LGVs and HGVs in the southbound direction during the same period.

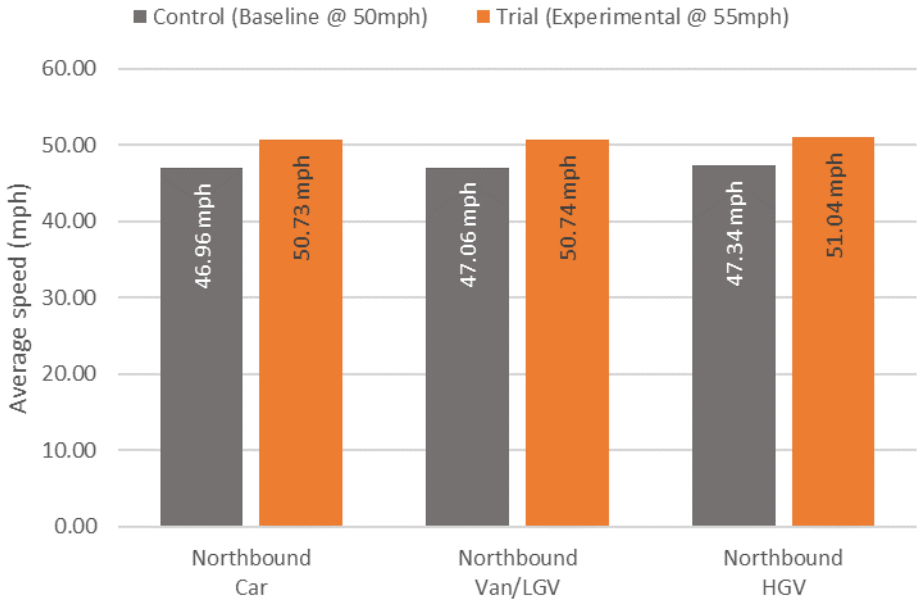


**Figure 12a: Free-flow average speed (in mph) by vehicle type in the northbound direction**

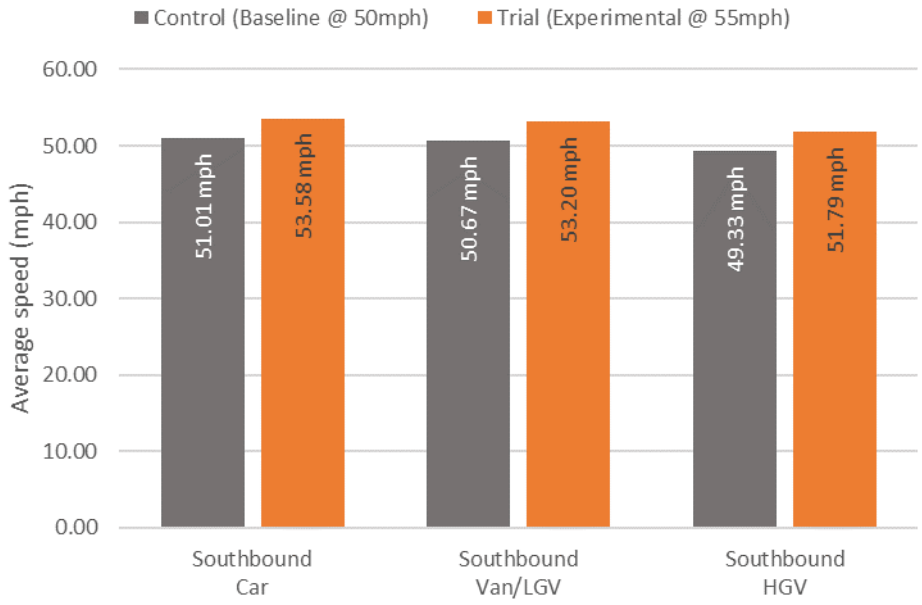


**Figure 12b: Free-flow average speed (in mph) by vehicle type in the southbound direction**

The results show that all vehicle types had a higher average speed in the 55mph speed limit than at 50mph. Average speed differentials are relatively small with 3.60mph for the northbound and 2.55mph for the southbound. This suggests that, although vehicles were typically travelling faster during the trial, speeds did not increase by large amounts and there is very little difference in average speed between vehicle types.

Key findings

- Free-flow average speeds increased significantly (by around 3mph) following implementation of the 55mph speed limit, suggesting that some drivers noticed and responded to the change in speed limit.
- Throughout the trial, the average speed of all vehicles travelling northbound was 51mph and southbound was 54mph, below the speed limit of 55mph.
- There was very little difference in the speed increase between vehicle types.

## 3.4. Speed limit compliance

Figure 13a to 13d shows the proportion of vehicles recorded in each speed bin across the two monitoring periods. The grey bars show the proportion of vehicles travelling below the speed limit in each period; the dark orange bars show vehicles travelling above the speed limit but below the enforcement threshold and the lighter orange bars indicate the proportion of vehicles travelling above the enforcement threshold.

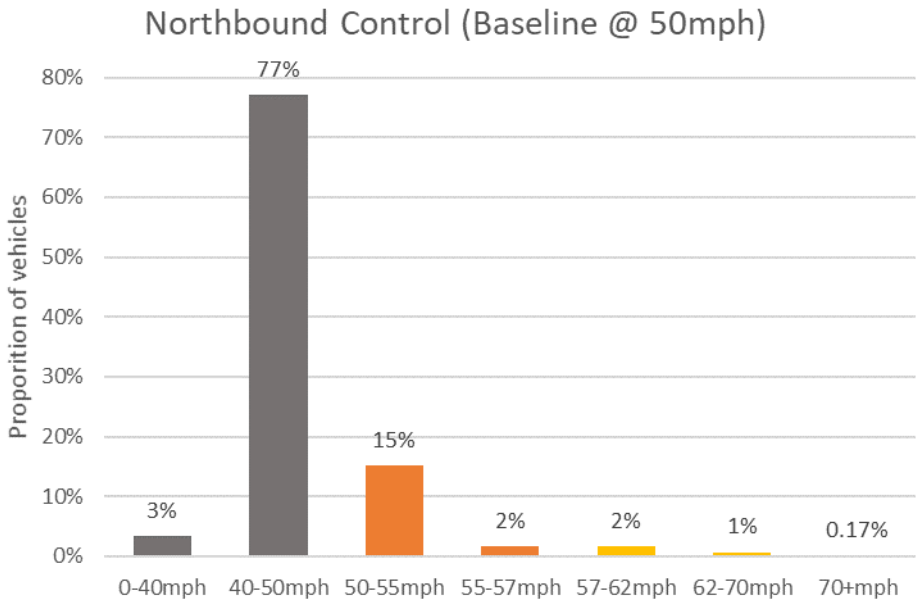


**Figure 13a**

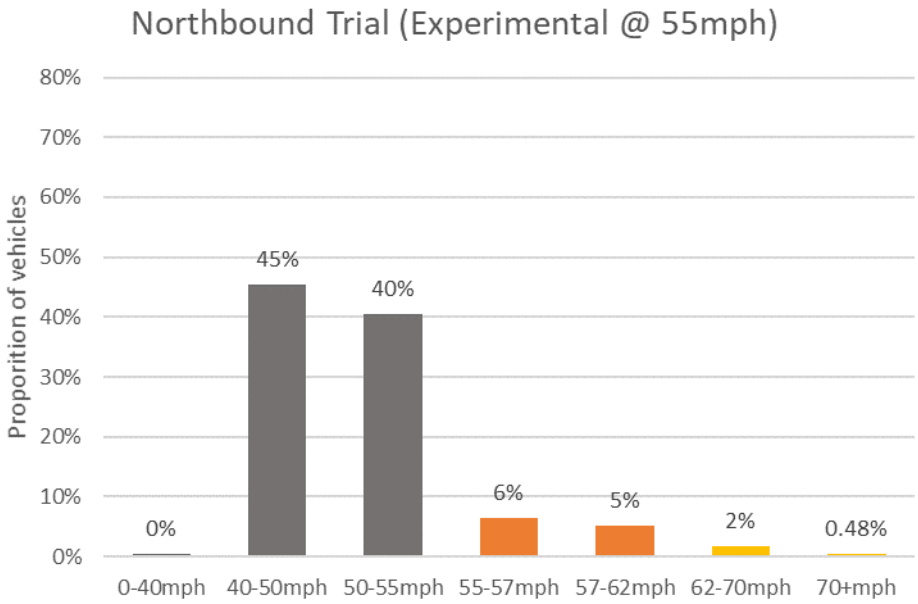


**Figure 13b**

The proportion of vehicles complying with the speed limit travelling northbound was 80% in the baseline period (50mph speed limit) and 85% in the trial period (55mph speed limit), suggesting that overall compliance with the 55mph speed limit was better than compliance with the 50mph speed limit.

The lightest orange bars represent the drivers who travelled above the enforcement threshold in each speed limit (57mph in the 50mph limit and 62mph in the 55mph limit). The proportion of vehicles above the enforcement threshold was 3.17% in the baseline period, 2.48% in the trial period, suggesting that the number of vehicles who would have been prosecuted for speeding would have slightly decreased during the trial in the northbound direction.

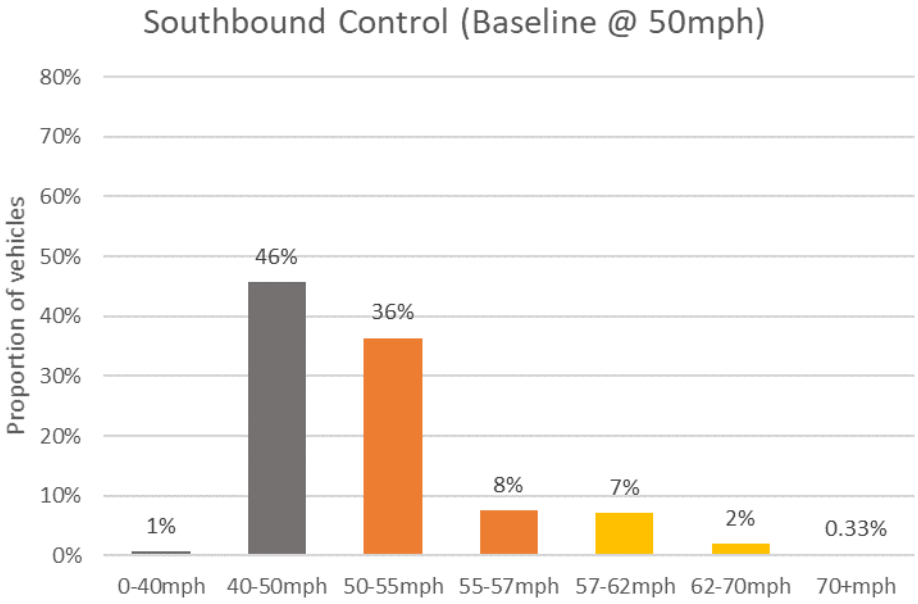


**Figure 13c**

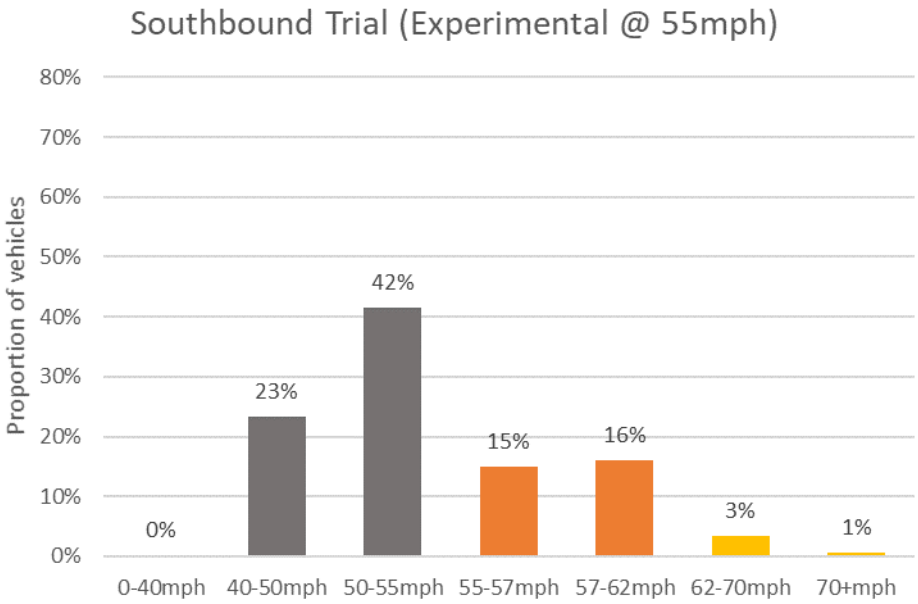


**Figure 13d**

The proportion of vehicles complying with the speed limit travelling southbound was 47% in the baseline period (50mph speed limit) and 65% in the trial period (55mph speed limit), suggesting that overall compliance with the 55mph speed limit was better than compliance with the 50mph speed limit.

The lightest orange bars represent the drivers who travelled above the enforcement threshold in each speed limit (57mph in the 50mph limit and 62mph in the 55mph limit). The proportion of vehicles above the enforcement threshold was 9.33% in the baseline period, 4% in the trial period, suggesting that the number of vehicles who would have been prosecuted for speeding would have slightly decreased during the trial in the southbound direction.

The monitoring equipment was also used to investigate the difference in compliance between vehicle types. Figure 14a to 14f shows the distribution across speed categories for cars, vans/LGVs and HGVs at the experimental location during the trial period.

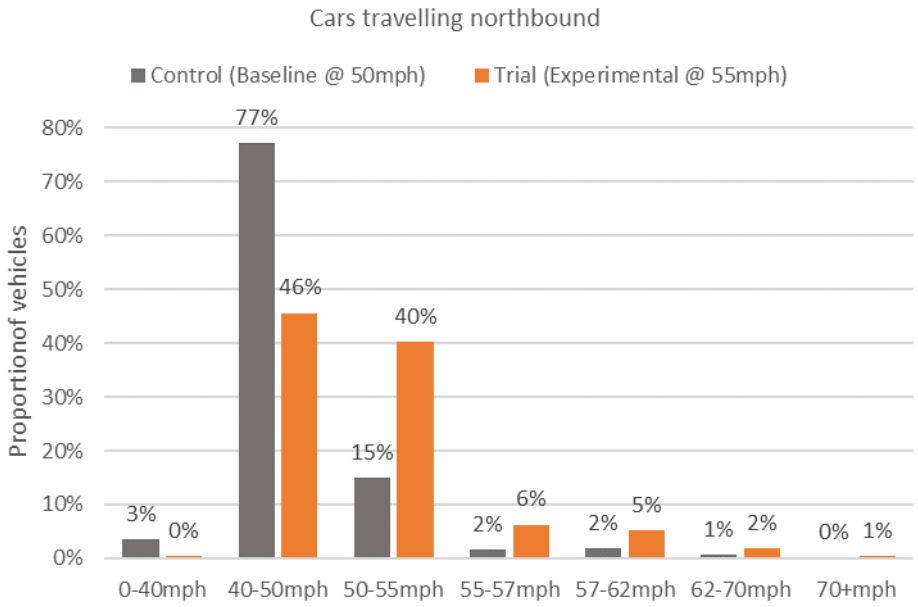


Figure 14a

| | Cars | | | |
|---|---|---|---|---|
| | % complying with posted speed limit | Improved by | % exceeding enforcement | Reduced by |
| **Control (Baseline @ 50mph)** | 80% | | 3% | |
| **Trial (Experimental @ 55mph)** | 86% | 6% | 3% | 0% |

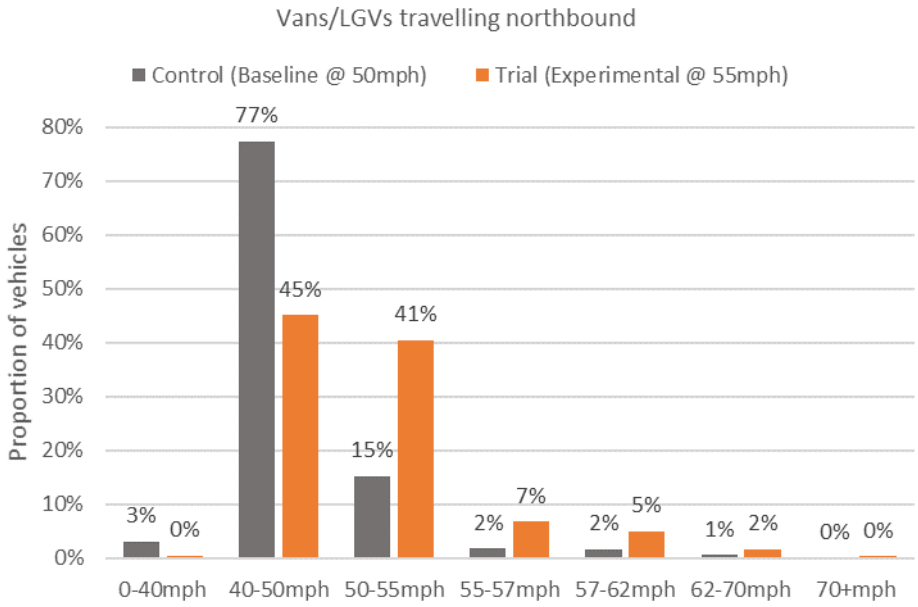


Figure 14b

| | Vans/LGVs | | | |
|---|---|---|---|---|
| | % complying with posted speed limit | Improved by | % exceeding enforcement | Reduced by |
| **Control (Baseline @ 50mph)** | 80% | | 3% | |
| **Trial (Experimental @ 55mph)** | 86% | 6% | 2% | 1% |

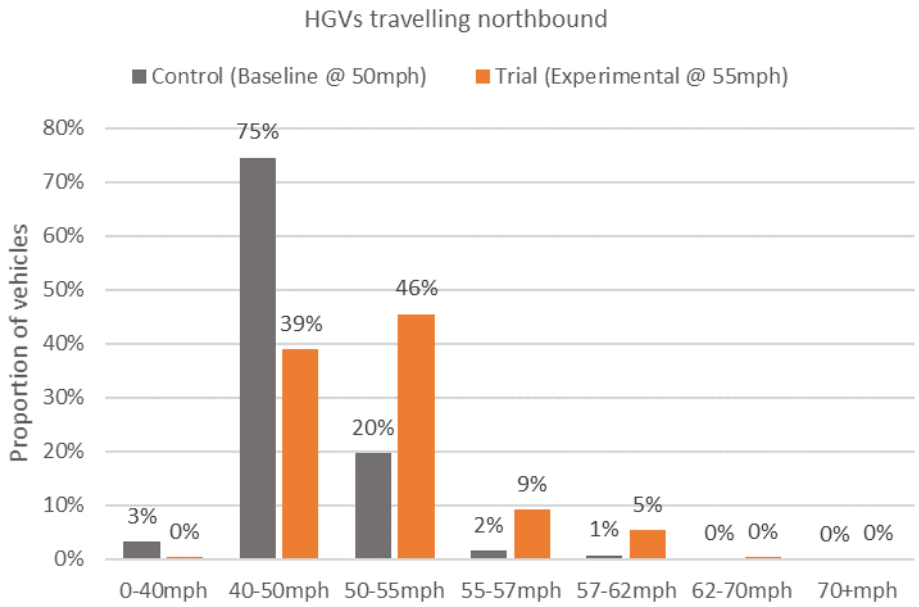


Figure 14c

| | HGVs | | | |
|---|---|---|---|---|
| | % complying with posted speed limit | Improved by | % exceeding enforcement | Reduced by |
| **Control (Baseline @ 50mph)** | 78% | | 1% | |
| **Trial (Experimental @ 55mph)** | 85% | 7% | 0% | 1% |

Overall, the distribution across speed categories in the northbound direction was similar between vehicle types. The proportion of vehicles complying with the speed limit during the trial period improved on average by 7%. There was also a reduction of 1% for all vehicle types exceeding the enforcement threshold of 62mph, hence an improvement in compliance.

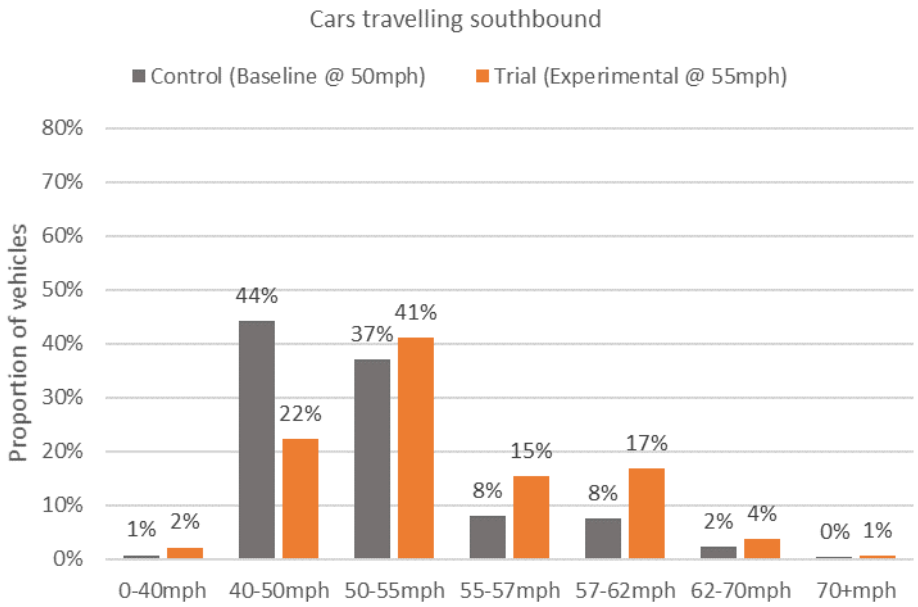


**Figure 14d**

| | Cars | | | |
|---|---|---|---|---|
| | % complying with posted speed limit | Improved by | % exceeding enforcement | Reduced by |
| **Control (Baseline @ 50mph)** | 45% | | 10% | |
| **Trial (Experimental @ 55mph)** | 65% | 20% | 5% | 5% |

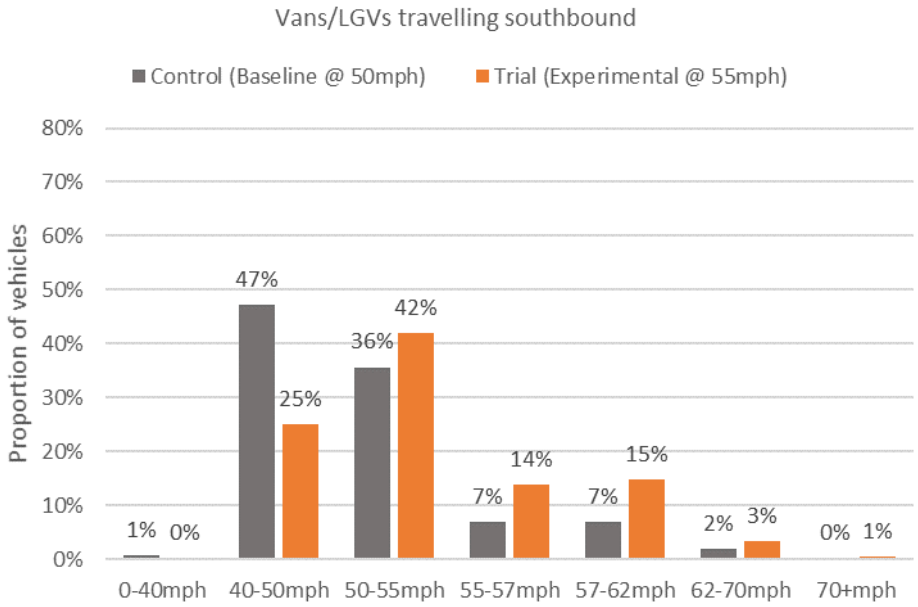


**Figure 14e**

| | Vans/LGVs | | | |
|---|---|---|---|---|
| | % complying with posted speed limit | Improved by | % exceeding enforcement | Reduced by |
| **Control (Baseline @ 50mph)** | 48% | | 9% | |
| **Trial (Experimental @ 55mph)** | 67% | 19% | 4% | 5% |

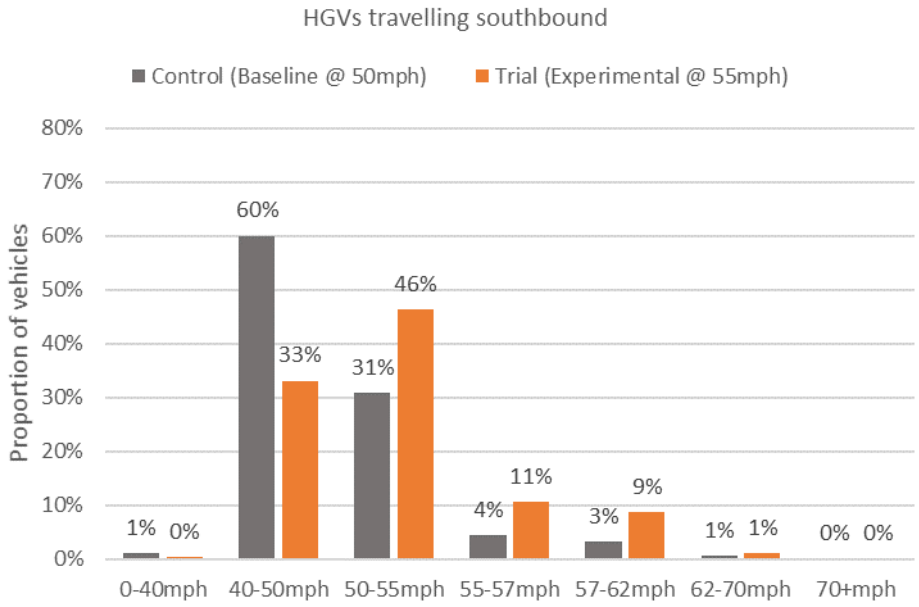


**Figure 14f**

| | HGVs | | | |
|---|---|---|---|---|
| | % complying with posted speed limit | Improved by | % exceeding enforcement | Reduced by |
| **Control (Baseline @ 50mph)** | 61% | | 4% | |
| **Trial (Experimental @ 55mph)** | 79% | 18% | 1% | 3% |

Overall, the distribution across the speed categories in the southbound direction was similar between cars and vans/LGVs. A greater number HGVs were recorded during the baseline period. The proportion of vehicles complying with the speed limit during the trial period improved on average by 19%. The number of vehicles exceeding the enforcement threshold of 62mph reduced by 5% for cars, 5% for vans/LGVs and 3% for HGVs.

## 3.5. Incidents and incursions

There were two incidents reported in the baseline period and one broken down vehicle during the trial period. TRL were employed to carry out an independent assessment into safety and it was concluded that these incidents did not pose a risk to the pilot.

## 3.6. Customer satisfaction

The customer survey and stakeholder engagement was carried out by TRL and details of the findings can be found in the Monitoring and evaluation of the 55/60mph pilots – Interim report for the on-road trials of 55mph on the M1 J45 scheme - customer survey and stakeholder engagement by L Durrell, C Wallbank, R Ramnath, & E Delonte (project report CPN2534).

# 4. Summary

The aim of the monitoring carried out as part of this on-road pilot was to determine the impact of increasing the speed limit on the M1 Jct 45 improvement scheme from 50 to 55mph during the final stages of the delivery of the scheme and commission of newly installed gantries.

Monitoring took place on both the northbound and southbound carriageways at junction 45 over 30 days. Baseline data at 50mph was collected for the first 18 days, followed by 12 days of traffic data at 55mph.

Comparison of the vehicle flows between the baseline and trial periods showed that flow increased following the change of speed limit.

Free-flow average speeds increased significantly (by around 3mph) following implementation of the 55mph speed limit at the experimental location, suggesting that some drivers noticed and responded to the change in speed limit.

Speed compliance also improved during the trial phase and when compared to the post speed limit of 55mph. In the northbound, compliance in the posted speed improved by 6% on average. The southbound saw the greatest improvement in compliance with the posted speed limit of and average of 19%. In addition, the southbound had a 5% reduction of cars and vans/LGVs exceeding the enforcement threshold of 62mph.

Average speed at the experimental location remained around 53mph throughout the trial, below the speed limit of 55mph.

Using the average speeds and the length of the trial, it is estimated that the 55mph speed limit saved each road user around 6 seconds in journey time travelling northbound and 4 seconds travelling southbound. Using the average daily flows this equates to journey time saving of 51.50 hrs for vehicles travelling northbound and 36.88 hrs for vehicles travelling southbound.

There were relatively few incidents (breakdowns or collisions) during the trial and thus no robust conclusions can be drawn about the impact of the increased speed limit on this measure of safety.