

# 60mph Through Roadworks

Safety risk assessment

7 June 2017

Issue: C

Document Reference:



Katherine Rogers  
Mouchel  
Export House  
Cawsey Way  
Woking  
GU21 6QX

For





## Document Control Sheet

Project Title            60mph through roadworks  
Report Title            Safety risk assessment  
Issue                    C  
Status                    Final  
Control Date            7 June 2017

### Record of Issue

Issue	Status	Author	Date	Check	Date	Authorised	Date
A2	Draft	A Phelps	22/11/16	K Rogers	22/11/16	A Kappeler	22/11/16
B1	Draft	H Steele	17/5/17	K Rogers	17/5/17	A Kappeler	17/5/17
C	Final	H Steele	7/6/17	K Rogers	7/6/17	A Kappeler	7/6/17

### Distribution

Organisation	Contact	Copies
Highways England	Darren Evans	1

## Contents

<b>1</b>	<b>Introduction</b> .....	<b>4</b>
1.1	Anticipated benefits .....	6
1.2	Contents of this report .....	9
<b>2</b>	<b>Determine the scope (stage 1)</b> .....	<b>10</b>
2.1	Objective of this safety risk assessment .....	10
2.2	Scope of this safety risk assessment.....	10
2.3	Characterisation .....	11
<b>3</b>	<b>Identify the hazards and populations affected (Stage 2)</b> .....	<b>13</b>
<b>4</b>	<b>Identify the relevant criteria for the populations (Stage 3)</b> .....	<b>15</b>
<b>5</b>	<b>Consider existing risk exposure for each population – Baseline 1 (stage 4)</b> .....	<b>17</b>
5.1	Road users .....	17
5.2	Road workers .....	22
<b>6</b>	<b>Consider existing risk exposure for each population – Baseline 2 (stage 4)</b> .....	<b>24</b>
6.1	Road users .....	24
6.2	Road workers .....	24
<b>7</b>	<b>Risk analysis assessment and evaluation (Stage 5)</b> .....	<b>26</b>
7.1	Semi-quantitative Assessment .....	26
7.2	Qualitative Assessment .....	26
<b>8</b>	<b>Risk control decisions (Stage 6)</b> .....	<b>33</b>
8.1	All scenarios .....	33
8.2	Scenarios 1a, 2a and 2b.....	33
8.3	Scenario 1b .....	33
8.4	Scenario 3 .....	33
<b>9</b>	<b>Maintaining the safety risk assessment</b> .....	<b>34</b>
9.1	Document the safety risk decision in the safety risk report (Stage 7) .....	34
9.2	Handover of safety risk report to operators (Stage 8).....	34
9.3	Update and refresh the safety risk report when change proposed (Stage 9).....	34
9.4	Monitor and review safety risk report assumptions (Stage 10) .....	34
<b>10</b>	<b>Conclusions</b> .....	<b>35</b>

## Executive Summary

The objective of this programme level safety risk assessment is to assess the safety risk for all relevant populations of rolling out a 60mph speed limit within roadworks based on the outcome of the trials that have been carried out during 2016/17.

It aims to answer the following questions:

1. ***“Was it acceptably safe to use a 60mph speed limit within the trial scenarios?”***
2. ***“Is it acceptably safe to roll out a 60mph speed limit within those scenarios?”***
3. ***“What conclusions can be drawn about the safety of using a 60mph speed limit more widely within roadworks?”***

The following three scenarios were trialled to assess the impact of increasing the speed limit from 50mph to 60mph:

- Scenario 1: On the lead-in to, and exit from, roadworks. This scenario has not been trialled in isolation as there is no clear benefit arising from it, but steps up and down in speed have been trialled as part of other scenarios
- Scenario 2: Where system reliability testing is being carried out after installing new technology
- Scenario 3: During a public holiday/weekend

Details of the trials and the scenarios that they cover are outlined in Table i.

Table i – 60mph trial details

Trial name	Trial date	Report date	Scenario covered
TRL simulator work	N/A	December 2016	Scenario 1a (step up in speed) and 1b (step down in speed) General roadworks scenario
M1 J32-35a scheme on-road trial and subsequent focus group	8 <sup>th</sup> November 2016 – 12 <sup>th</sup> December 2016	On-road trial report: December 2016 Focus group: May 2017	Scenario 2
A1 Leeming to Barton scheme on-road trial and subsequent focus group	Christmas period 23 <sup>rd</sup> December 2016 – 8 <sup>th</sup> January 2017	On-road trial report: February 2017 Focus group: May 2017	Scenario 1 (step up and step down in speed) Scenario 3
M5 J4a-6 scheme on-road trial and subsequent focus group	13 <sup>th</sup> March 2016 – 27 <sup>th</sup> March 2017	On-road trial report: May 2017	Scenario 1 (step down in speed) Scenario 2

Roadworks speed limits 50mph vs 60mph trial qualitative research (completed during the M5 J4-6 scheme on-road trial)	N/A	May 2017	Scenario 1b (step down in speed) Scenario 2
--	-----	----------	---

The decision has been categorised as ‘Type B’ as defined in General Direction 04 (GD04) [5].

This safety risk assessment is based on:

- A semi-quantitative assessment of the risk to road users, which considers the increase in incidents which would be required in order to make the risk unacceptable
- A qualitative assessment of the change in risk to all affected populations which has been updated to incorporate the findings from the trials

The semi-quantitative assessment found that the risk to road users will increase with speed but is likely to be acceptable. In order for the risk to change from ‘tolerable’ to ‘unacceptable’ (as defined by GD04 [5]) the number of fatal incidents within the roadworks would need to increase by a factor of 32. Increasing the speed limit from 50mph to 60mph is extremely unlikely to lead to this level of increase in fatal incidents. Therefore the risk to road users is likely to remain ‘tolerable’.

The outcome of the qualitative assessment is shown in table ii.

Table ii – Summary of acceptability of risk

Population	Scenario 1a – step up in speed	Scenario 1b – step down in speed	Scenario 2a – technology commissioning TTM <sup>1</sup> in place	Scenario 2b – technology commissioning no TTM	Scenario 3 – weekends & public holidays
Driver	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable
Emergency services	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable
Construction supplier	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable
TOS (Traffic Officer Service)	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable

<sup>1</sup> TTM: Temporary Traffic Management

Free recovery service	Site specific	Site specific and subject to suitable signing solution	Site specific	Site specific	Site specific
-----------------------	---------------	--	---------------	---------------	---------------

It is concluded that:

C1 – It was acceptably safe to trial the 60mph speed limit within these scenarios.

C2 – Based on the findings of the trials, it is acceptably safe to roll out a 60mph speed limit within these scenarios. The following restrictions apply:

- Steps down in speed must be supported by an appropriate signing strategy to alert drivers to the reduced speed limit.
- For scenario 2a, works that are not part of Stage D of IAN182 [2] should be completed prior to any increase in speed limit.

C3 - The trials minimised risk to populations by only increasing the speed limit in scenarios where there was no significant construction activity taking place in the closed lanes. The trials demonstrated that a 60mph speed limit can be used without significantly increasing the risk to any population. This evidence means that it is likely to be acceptably safe to trial a 60mph speed limit in a location where construction activities are taking place, subject to the outcome of a site specific safety risk assessment. Monitoring will be required in the same way as previous trials (both traffic and focus groups).

C4 – The results of this next trial are required before any decision can be made regarding wider roll out of 60mph within roadworks where construction activities are taking place.

C5 – Prior to the trials it was anticipated that the use of a 60mph speed limit through roadworks may deliver benefits in the following areas:

- Customer satisfaction
- Improved Heavy Goods Vehicle (HGV) driver behaviour
- Journey time benefits
- Improved speed compliance

The findings from the trials suggest that these benefits are likely to be achieved with rollout of the 60mph speed limit.

C6 – As ever, a site specific safety risk assessment will always be required to confirm that the proposed Temporary Traffic Management (TTM) arrangements and speed restrictions are appropriate for that site.

# 1 Introduction

With greater government investment in roads, the amount of roadworks taking place on the network has increased. As the amount of roadworks has increased, road user satisfaction with roadworks management has decreased. Highways England's National Road User Satisfaction Survey (NRUSS) [1] shows that satisfaction with roadworks management on the motorways has fallen from 70% to 67% over the last 4 years.

Figure 1a shows the latest NRUSS (2014/15) scores for Highways England's 5 key aspects, against a target of 90%.

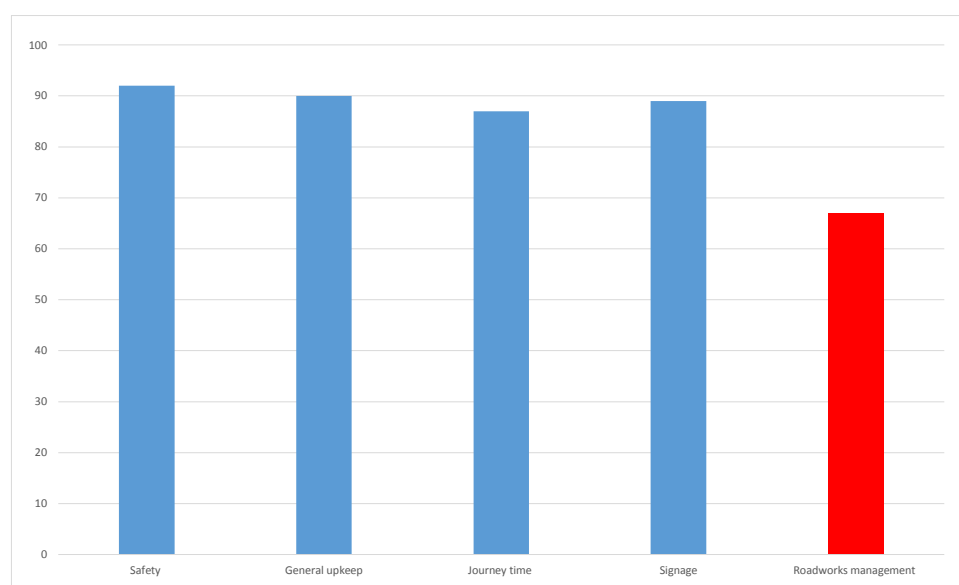


Figure 1a – Customer satisfaction scores (2014/15)

Highways England failed to reach its target of 90% and, as shown in figure 1a, roadworks management scored considerably lower than the other aspects. The NRUSS found that the second highest priority for road users was for improvements to be made to minimise delays through roadworks.

In response to this, in March 2016 it was announced via a Department for Transport (DfT) press release that Highways England will begin trialing the use of 60mph speed limits through roadworks. Several 60mph speed limit through roadworks trials have been carried out. The aim of the trials has been to assess the safety and benefits of raising the speed limit, and road user reaction and behaviour.

Highways England has trialled the increased speed limit in the following three scenarios:

- Scenario 1: Trial increasing the speed limit on the lead-in to and exit from roadworks from 50mph to 60mph. This scenario has not been trialled in isolation as there is no



clear benefit arising from it, but steps up and down in speed have been trialled as part of other scenarios.

- Scenario 2: Trial increasing the speed limit from 50 mph to 60mph where system reliability testing is being carried out after installing new technology. The trials did not take place until the white lining was in its permanent position and the varioguard had been removed. Lane 1 was coned off and the permanent verge safety fencing (where present) was in place. Proving system reliability takes a minimum of 2 weeks but can take considerably longer as contractors often use this period to complete other works within the temporary traffic management (TTM). The trials did not take place until all significant activity on Lane 1 had been completed.
- Scenario 3: Trial increasing the speed limit from 50 mph to 60mph during a public holiday/weekend. This only took place where the TTM was designed to the higher speed limit.

All three scenarios have been undertaken using existing standards.

Details of the 60mph trials are outlined in Table 1.

Table 1 – 60mph trial details

Trial name	Trial date	Report date	Scenario covered
TRL simulator work	N/A	December 2016	Scenario 1a (step up in speed) and 1b (step down in speed) General roadworks scenario
M1 J32-35a scheme on-road trial and subsequent focus group	8 <sup>th</sup> November 2016 – 12 <sup>th</sup> December 2016	On-road trial report: December 2016 Focus group: May 2017	Scenario 2
A1 Leeming to Barton scheme on-road trial and subsequent focus group	Christmas period 23 <sup>rd</sup> December 2016 – 8 <sup>th</sup> January 2017	On-road trial report: February 2017 Focus group: May 2017	Scenario 1 (step up and step down in speed) Scenario 3
M5 J4a-6 scheme on-road trial and subsequent focus group	13 <sup>th</sup> March 2016 – 27 <sup>th</sup> March 2017	On-road trial report: May 2017	Scenario 1 (step down in speed) Scenario 2
Roadworks speed limits 50mph vs 60mph trial qualitative research	N/A	May 2017	Scenario 1b (step down in speed)

(completed during the M5 J4-6 scheme on-road trial)			Scenario 2
---	--	--	------------

## 1.1 Anticipated benefits

Prior to the trials it was anticipated that the use of a 60mph speed limit through roadworks may deliver benefits in the following areas:

- Customer satisfaction – this is the main driver for the proposed increase in speed limit
- Improved Heavy Goods Vehicle (HGV) driver behaviour
- Journey time benefits
- Improved speed compliance

These are discussed below and comments have been added as to whether or not the trials found that the benefit was realised.

### 1.1.1 Customer satisfaction

As discussed above the NRUSS [1] has found that customer satisfaction with roadworks management is considerably lower than for the other aspects of Highways England's activities.

In order to gain further insight into this, in September 2016, Highways England carried out a separate Customer Panel survey [3] into roadwork speed restrictions which sought to investigate road users' attitudes to speed limits through roadworks. The survey consulted 471 panellists and the research highlighted the following:

- Only 50% of panellists are satisfied with how Highways England manages roadworks so as to minimise disruption to users of the network.
- However, 72% of panellists believe that the current speed limit is about right and 92% say that they obey restricted speed limits when driving through roadworks.
- 91% of panellists believe that speed restrictions through roadworks are important, with safety being a factor.
- 79% of panellists would support speed limits being tailored to the circumstances of the road works rather than a set speed limit nationwide.

Whilst a majority (72%) state that the current speed limit is about right, a slightly larger majority (79%) support the introduction of speed limits tailored to the conditions at each roadworks site. This indicates that there may be scope to increase customer satisfaction by increasing the speed limit where appropriate.

Most of the trials found that customer satisfaction improved with the 60mph speed limit through roadworks. The A1 Leeming to Barton scheme on-road trial found that the vast majority (90%) of drivers thought that the 60mph speed limit was about right, compared to only 64% who thought that the 50mph speed limit was appropriate. On the M1 J32-35a scheme on-road trial, all survey participants considered the 60mph speed limit to be about right. These results were reflected in the Highways England qualitative research, where participants generally preferred the 60mph driving experience.

The survey results from the M5 J4a-6 scheme were less positive than those seen for the previous two trials, where only 40% of drivers believed that the 50 and 60mph speed limits on the two links were about right and over 50% thought both were too slow. These results are likely to be due to the differences in the sample, which included more individuals from the local area who could be impacted by any delays and diversions.

### 1.1.2 HGV Driver Behaviour

There is anecdotal evidence of tailgating and weaving by HGVs within roadworks due to a speed differential between HGVs and other vehicles. Under the current 50mph speed limit, there is speculation that drivers of HGVs still regularly drive to the maximum of their speed limiter, which is 56mph. This may increase risk exposure on the network as cars driving at 50mph often find themselves being overtaken or tailgated by HGVs, particularly because car speedometers can under-read by up to 10%.

In 2013 a small-scale trial was carried out on the M6 J36-37 [4] looking into the impact of increasing the speed limit in roadworks to 60mph. It found that, at 60mph, the average speeds of the two lane converged closely, indicating that there was less lane changing. It concluded that, by increasing the speed to 60mph, there was potential to reduce the speed differential between HGVs and other vehicles within roadworks.

However, it is noted that speed differential is not the only reason for HGV collisions; they are also likely to be caused by other factors such as a lack of concentration, for example due to mobile phone use or other distractions. In such situations, raising the speed limit could lead to higher energy collisions.

The trials generally found an improvement in HGV driver behaviour with the increase in speed limit. In particular, the M5 J4a-6 scheme on-road trial (the only trial to measure headways) found that the introduction of the 60mph speed limit substantially reduced the amount of close following recorded for HGV drivers. There was also some evidence on the M5 trial that overtaking manoeuvres performed by HGVs was reduced in the 60mph speed limit. The Highways England qualitative research also found that participants preferred the 60mph speed limit as they were more able to overtake HGVs to avoid getting 'boxed in'.

### 1.1.3 Journey time

Reducing the speed limit from 70mph to 50mph increases free flow journey times by 21 seconds per mile. Highways England Traffic Appraisal, Modelling and Economics (TAME) identified that this equates to a journey time delay cost of £12,165 per mile per day [15].

TAME identified that, increasing the speed limit to 60mph, results in potential savings in journey time delay costs of £7,096 per mile per day. For example, on the M4 J3-12 (the longest of the proposed smart motorways schemes) this could equate to £3m over 2 weeks.

With rollout of the 60mph speed limit through roadworks, increased speed limits could significantly reduce journey time delays (and associated costs) at roadworks.

Journey time savings were found in all trials, at approximately 30-40 seconds per driver.

### 1.1.4 Speed compliance

Average speed cameras are generally installed at motorway roadworks and give the perception of enforcement, encouraging good speed compliance. Evidence from the M1 J32-35a scheme shows that the police are satisfied with the level of speed compliance being achieved. [5]

This is backed by the results of the customer panel survey [3], discussed in 1.2.1, which suggest that a majority of road users find a speed of 50mph acceptable and therefore likely to comply with speed limits. Indeed, 92% of panellists said that they obey restricted speed limits when driving through roadworks.

However, road users are known to object to speed restrictions where no visible work is taking place and this can be a particular problem for those schemes where most of the work takes place at night. The NRUSS for 2014-15 [1] found that, of those surveyed, only 44% of those driving through roadworks had seen work in progress. Where there is no visible work taking place, the credibility of the speed limit may be eroded resulting in reduced levels of compliance. Increasing the speed limit to 60mph may appear more credible at locations where no visible work is taking place.

Increasing the speed limit to 60mph would achieve 100% compliance by HGVs as their speed is limited to 56mph.

Compliance on all schemes improved with the introduction of a 60mph speed limit. Average speeds on all schemes remained below 60mph, indicating good compliance. On the M5 J4a-6 scheme on-road trial only 18% of drivers were travelling above the speed limit, compared to 54% in the 50mph baseline. This was also found on the A1 Leeming to Barton scheme, where only around 30% of drivers were travelling above the speed limit, compared to 60% in the 50mph baseline.

## 1.2 Contents of this report

The contents of this report are set out below:

- Section 2 – Objective, scope and categorisation (stage 1)
- Section 3 – Hazards and populations affected (stage 2)
- Section 4 – Relevant criteria for populations (stage 3)
- Section 5 – Existing risk exposure – Baseline 1 (stage 4)
- Section 6 – Existing risk exposure – Baseline 2 (stage 4)
- Section 7 – Risk analysis assessment and evaluation (stage 5)
- Section 8 – Risk control decisions (stage 6)
- Section 9 – Maintaining the safety risk assessment (stage 7 – 10)
- Section 10 – Conclusions and recommendations

## 2 Determine the scope (stage 1)

### 2.1 Objective of this safety risk assessment

The objective of this safety risk assessment is to determine the safety risk for all relevant populations of implementing 60mph speed limit within roadworks, taking account of the 60mph trials that were carried out during 2016/17.

It aims to answer the following questions:

1. ***“Was it acceptably safe to use a 60mph speed limit within the trial scenarios?”***
2. ***“Is it acceptably safe to roll out a 60mph speed limit within those scenarios?”***
3. ***“What conclusions can be drawn about the safety of using a 60mph speed limit more widely within roadworks?”***

### 2.2 Scope of this safety risk assessment

This is a safety assessment. Non-safety benefits are noted; however this assessment does not consider whether or not they outweigh any potential increase in safety risk to any populations due to the increase in speed limit, and hence whether or not the rollout should go ahead. It does however comment on whether or not the potential benefits were observed during the trials (contained in Section 1).

The safety risk assessment uses the results from the 60mph through motorway roadworks trials which took place between November 2016 and March 2017. It uses these results to consider whether or not the safety risk associated with raising the speed limit through roadworks to 60mph is acceptable for the scenarios that have been trialled and for wider roll out. Details of the trials that have been undertaken are outlined in Table 1.

The safety risk assessment considers the three scenarios described in the introduction to this report. A number of different situations exist within the scenarios and these are listed below:

- Scenario 1 – Increased speed in the lead in or exit to roadworks
  - Scenario 1a – Step up in speed
  - Scenario 1b – Step down in speed
- Scenario 2 – Technology commissioning
  - Scenario 2a – Lane 1 is closed with cones. It is assumed that no work is taking place in the closed lane 1, commissioning work takes place on the verge behind permanent safety fencing.
  - Scenario 2b – all lanes are open for operational regime testing
- Scenario 3 – Increased speed limit during weekends/public holidays

In order to identify the baseline for each scenario, the features of each existing scenario site have been assessed. These are shown in table 2a.

Table 2a – Features of the various scenarios

Feature	Scenario 1a	Scenario 1b	Scenario 2a	Scenario 2b	Scenario 3
TTM is designed for the increased speed limit	Y	Y	Y	n/a	Y
There is no TTM in place	N	N	N	Y	N
Full width lanes are provided	Y	Y	Y	Y	Y
No work is taking place in the closed lanes*	Y	Y	Y	n/a	Y
Average speed enforcement is in place	Y	Y	Y	Y	Y

\* For the trials, a key assumption was that no significant work is taking place within the closed lane. IAN 182 provides guidance to all those involved in the delivery of major schemes and their acceptance into operation and maintenance. IAN 182 defines a number of stages of scheme delivery; operational regime testing takes place under Stage D – it is this stage that is covered by scenario 2a. IAN 182 describes the activities taking place within Stage D: “At this stage, full coverage of CCTV can be demonstrated, and SAT3 tests carried out under TTM for Signs, Signals, and ERTs. Testing of the Motorway incident detection and automatic signalling (MIDAS) queue protection system in the lanes remaining open to traffic (lanes 2-4) can also be completed.” Therefore, within Stage D, minimal work should be taking place within the closed lane.

Table 2a shows that two baselines are required:

- Baseline 1 – 50mph running with a lane closed with cones (for use with scenarios 1a, 1b, 2a and 3)
- Baseline 2 – 50mph running with all 4 lanes open (for use with scenario 2b)

## 2.3 Characterisation

The decision for rolling out a 60mph speed limit during roadworks has been assessed in accordance with General Direction (GD) 04/12 Standard for Safety Risk Assessment on the Strategic Road Network [6]. The results of the characterisation of the decision features are:

- Three features categorised as type B (size of decision, lifetime of decision and stakeholder interest)
- Two features categorised as type A (safety risk and cost implications)

GD04 states that “where three or more decision features are classified as Type B and the remainder are Type A, then the entire decision shall be of Type B”.

On this basis the decision has been categorised as ‘**Type B**’. Details of this categorisation are provided in **Error! Reference source not found.C**.



### 3 Identify the hazards and populations affected (Stage 2)

The populations affected have been identified as:

- Road users (drivers and emergency services)
- Road workers (construction workers, traffic officers and the recovery operators providing free recovery during roadworks)

During major roadworks, maintenance activities are carried out by the scheme construction supplier, therefore the Asset Support Contractors (ASC) are not expected to be affected by the implementation of a 60mph speed limit through roadworks.

Hazards have been identified through:

- A review of the hard shoulder running (HSR) hazard log, which was used to assess the hazards associated with increasing the speed limit for HSR from 50 to 60mph (see Appendix D for more details). This was selected as it provides a good overview of the general hazards that populations are exposed to that are sensitive to a change in speed limit.
- Discussions with staff experienced in motorway operations and road safety auditing to identify the hazards that are specific to the three scenarios. This included discussions with the staff who are preparing the site specific safety risk assessment for the M1 J32-35 trial.

Table 3a below identifies the hazards associated with each population.

Table 3a: Hazards and populations affected

Population		Hazard	Is there a hazard identified and associated with this Baseline?	
			Baseline 1 – 50mph running with a lane closed with cones (for use with scenarios 1a, 1b, 2a and 3)	Baseline 2 – 50mph running with all 4 lanes open (for use with scenario 2b)
Road users	Drivers	General hazards affected by speed	Yes, detailed assessment contained in Appendix D	Yes, detailed assessment contained in Appendix D
		Road user vehicle not complying with speed limits through roadworks.	Yes. A speed limit will be in operation	Yes. A speed limit will be in operation
		Road user vehicles striking TTM	Yes. TTM will be in place but only minimal construction activities will be undertaken by construction workers from the closed off lane	No. TTM removed. All commissioning and testing activities will be undertaken remotely.
		Vehicles tailgating	Yes. Vehicles will be using the sites	Yes. Vehicles will be using sites

Population		Hazard	Is there a hazard identified and associated with this Baseline?	
			Baseline 1 – 50mph running with a lane closed with cones (for use with scenarios 1a, 1b, 2a and 3)	Baseline 2 – 50mph running with all 4 lanes open (for use with scenario 2b)
		Vehicles changing lanes	Yes. Vehicles will be using the sites	Yes. Vehicles will be using sites
	Emergency Services	Exposure to traffic when responding to incidents in live lanes.	Yes. Attending accidents in live lanes.	Yes. Attending accidents in live lanes.
		Exposure to construction activities when responding to incidents within the work site.	Yes. Although minimal activities should be taking place.	No. TTM removed.
Road workers	Recovery Operators	Exposure to traffic when responding to incidents in live lanes.	Yes. Attending accidents in live lanes.	Yes. Attending accidents in live lanes.
		Exposure to construction activities when responding to incidents within the work site.	Yes. Although minimal activities should be taking place.	No. TTM removed.
	Construction workers	Exposure to traffic when setting up TTM	Yes. Exposed to traffic when TTM is set up.	Yes. Exposed when the main TTM is removed and then again when the fixed plate signs are being removed.
		Exposure to traffic when working in closed lane.	Yes. But, only minimal construction activities will be undertaken by construction workers from the closed lane.	No. All commissioning and testing activities will be undertaken remotely
		Exposure attending and relocating cones that have been struck by traffic	Yes. Cones will be in place.	No. No TTM in place.
		Construction vehicles entering and leaving the work site from the main carriageway.	Yes. Construction workers entering and exiting the work site.	No. No TTM in place
		Traffic officers implementing a rolling road block (RRB)	Yes. Traffic officers will use RRB to attend incidents	Yes. Traffic officers will use RRB to attend incidents
	Traffic officers on foot when a RRB is in place	Yes. Traffic officers will use RRB to attend incidents	Yes. Traffic officers will use RRB to attend incidents	
	Traffic officers attending live lane incidents (breakdowns and road traffic collisions (RTCs)).	Yes. Traffic officers will attend some live lane incidents	Yes. Traffic officers will attend some live lane incidents	

## 4 Identify the relevant criteria for the populations (Stage 3)

There is currently no specific safety objective for road users during roadworks. Highways England's vision, set out in their Strategic Business Plan for 2015-2020 [7], is that no one should be harmed when travelling or working on the Strategic Road Network.

The Tolerability of Risk Triangle from GD04 [6], shown in figure 4a, sets out the levels of individual risk which are considered unacceptable, tolerable with mitigation and broadly acceptable. The limits are set out below.

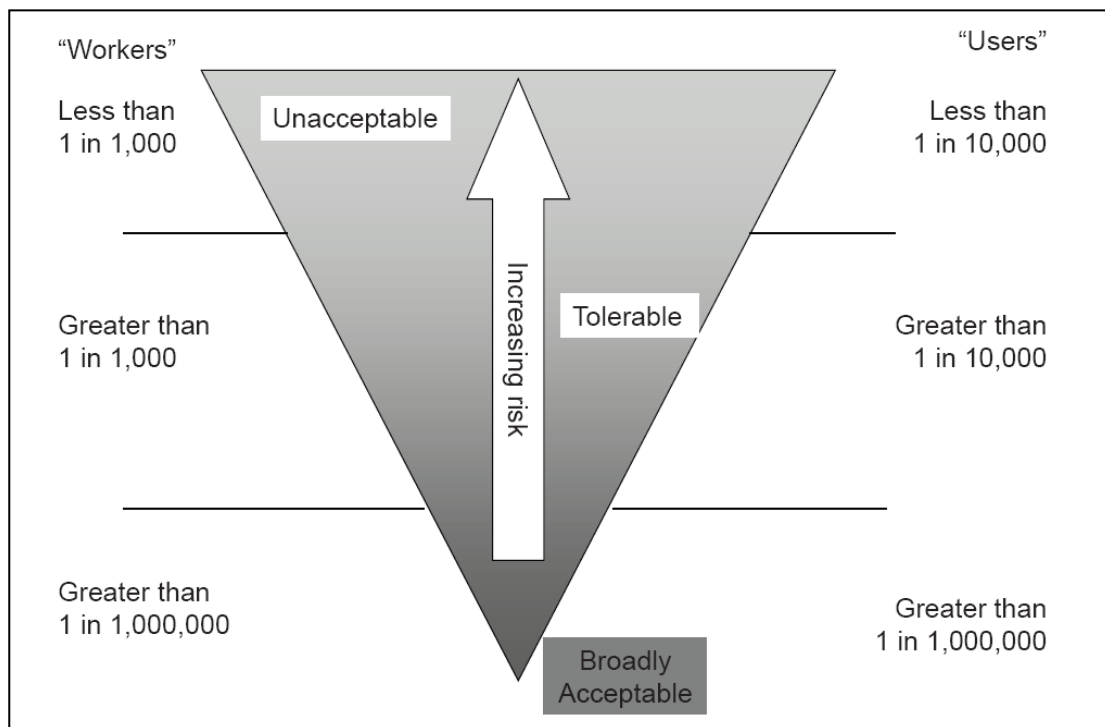


Figure 4a: GD04 Tolerability of Risk triangle (ToR)

The **road worker** safety risk within this assessment will be managed so far as is reasonably practicable (SFAIRP), in line with the legal requirement. Highways England's 5 Year Health and Safety Plan [16] introduces specific initiatives for road worker safety including reducing the number of near misses related to TTM, embedding the zero carriageway crossings initiative and reducing the number of incursions at roadworks.

## 5 Consider existing risk exposure for each population – Baseline 1 (stage 4)

This section considers the existing risk exposure for each population driving through roadworks at 50mph with one lane closed with TTM.

### 5.1 Road users

#### 5.1.1 Road traffic collisions through roadworks

A number of different sources have been used to assess the current level of road traffic collisions within motorway roadworks including:

- GD04 [6] – individual risk
- Highway England’s Safety Risk Model (based on STATS 19 data) [18]
- Detailed STATS19 data for Area 3

The findings are summarised at the end of 5.1.1.

#### GD04 – Individual Risk

The most extensive piece of research identified into the risks associated with roadworks is Transport Research Laboratory’s report “Safety Performance of Traffic Management at Major Motorway Roadworks” (2004) [8]. This looked at 29 major motorway roadworks sites and concluded that, “... the risk (in terms of PIAs) when roadworks are present is similar to the risk when no roadworks are present.”

GD04 [6] Annex B gives the average annual risk of fatality when driving on a motorway as 1 in 320,000. On the basis of GD04 it would seem reasonable to assume that the current risk of driving in roadworks will be of a similar order of magnitude. If so, this is well within the ‘tolerable’ range as defined by GD04.

#### Evidence from Safety Risk Model

Evidence from the Safety Risk Model [18] (based on STATS19 data) is shown in tables 5a and 5b.

Table 5a – Casualties within roadworks on motorways

Year	Fatalities	Serious	Slight	FWI
2011	3	15	402	8.52
2012	5	14	323	9.63
2013	2	23	338	7.68
2014	3	18	405	8.85
2015	5	29	400	11.90

Table 5a shows that the FWI does not vary greatly from year to year. It is higher in 2015 which could be attributable to the increased quantity of roadworks on the motorway network.

This would seem to be a reasonable assumption, but without looking into the detail of the incidents, it is not possible to rule out that the FWI for 2015 has been skewed by a small number of significant incidents within roadworks (for example the incident involving a bus/coach which is discussed below).

Table 5b – FWI per billion vehicle miles of the specified vehicle class

Year	Car	HGV	LGV	Bus/coach	PTW
2011	0.12	0.22	0.17	0.09	1.16
2012	0.14	0.36	0.21	0.00	1.67
2013	0.12	0.22	0.06	0.05	1.47
2014	0.13	0.38	0.07	0.05	1.64
2015	0.19	0.11	0.30	3.16	0.51

HGV refers to Heavy Goods Vehicles over 7.5 tonnes, LGV refers to Light Goods Vehicles under 7.5 tonnes and PTW refers to motorcycles.

Table 5b shows that the risk to HGV occupants is generally higher than for car or LGV occupants. This may corroborate the suggestion that there is an issue with HGV behaviour within roadworks and is investigated further in section 5.1.2

The FWI for motorcycles is considerably higher than for other vehicle types – this is in line with what would be expected elsewhere on the network for these vulnerable users and does not appear to be linked to the presence of roadworks. The 2015 FWI figure for buses/coaches is considerably higher than for other years. This is due to a single incident which resulted in 16 casualties, where driver error was given as a contributory factor. The incident occurred within roadworks but these were not given as a contributory factor and the 2015 figure is not thought to be indicative of any longer term trend.

The data has been used to provide a crude estimate the individual risk of fatality for road users driving through roadworks. The calculation of individual risk depends on the proportion of the motorway network occupied by roadworks. Highways England’s Operational Metrics Manual [17] gives a target for lane availability of 97%. Only those lanes closed by TTM are classed as ‘unavailable’; lanes carrying traffic through roadworks (including narrow lanes) are classed as ‘available’. Table 5c gives the lane availability for 2013 to 2015.

Table 5c – Lane availability on the motorway network

	2013	2014	2015
Lane availability	98.82%	98.60%	98.38%

The figure has dropped slightly as the amount of roadworks on the network has increased.

If the average lane availability is 98.5%, then 1.5% of lanes are closed for roadworks. Table 5d shows the individual risk of fatality when driving through roadworks.

Table 5d – Individual risk of fatality (average for 2011 to 2015)

	Whole motorway network	Roadworks (98.5% network availability)
Average million vehicle miles per year	53,987	1,619 *
Average number of fatalities per year	135	3.6
Average million vehicle miles per fatality (a)	395	449
1 in x risk of fatality (b)	<b>1 in 320,000</b>	<b>1 in 364,447 **</b>

\* Assuming that an average of 2 lanes of traffic are passing each closed lane (i.e. 3% of the total network)

\*\* It is assumed that the ratio of values for the 1 in x risk of fatality (b) is the same as the ratio of values for (a).

This shows that, at 98.5% network availability, the individual risk of fatality is slightly lower within roadworks than on the motorway network as a whole and is within the 'tolerable' range set out in GD04.

### Area 3 STATS19 data

A further analysis of STATS19 data for Area 3 showed that only 0.6% of incidents on motorways in that region occur in roadworks. Data from 'Reported road casualties Great Britain: annual report 2015' [9] found the figure to be around 1%. Experience suggests that there is likely to be some under-reporting as the STATS19 figures are dependent on how incidents are categorised by police forces. If the police force does not assign roadworks as a contributing factor then that incident will not be picked up with the roadworks statistics. However, given that network availability tends to be between 97 and 99%, these accident rates do not suggest that a disproportionate amount of incidents occur within roadworks. This supports the findings of 'Reported Road Casualties Great Britain: Annual Report 2014' [9].

Within this limited sample:

- 57% of incidents in roadworks were rear end shunts
- 31% of incidents in roadworks were associated with vehicles changing lane

In order to put this into context with normal motorways, figures were obtained from the SRN Casualty Report 2014 [14]; this showed that 51% of casualties arose from rear end shunts and 9% of casualties were due to overtaking manoeuvres.

Whilst there is not a direct correspondence between numbers of incidents and number of casualties, these figures do allow us to consider whether the types of incidents occurring at roadworks appear to be different to those on normal motorways.

This limited data suggests that incident rates within roadworks are not significantly higher than elsewhere on the motorway network. However the breakdown of accident type shows that a greater proportion of incidents are rear end shunts or due to lane changing. This supports the anecdotal evidence that incidents within roadworks are often due to tailgating and weaving by vehicles.

## Summary

The risk associated with driving in roadworks does not appear to be significantly different to the risk of driving elsewhere on the motorway network. Assuming 97% network availability, the individual risk of fatality is slightly lower within roadworks than on the motorway network as a whole. Even at 99% network availability, the individual risk of fatality is within the 'tolerable' range set out in GD04.

The FWI per billion vehicle miles is fairly constant over time. There is a slight rise in 2015 could be attributed to the greater length of roadworks on the motorway network.

The breakdown of incidents by incident type supports the anecdotal evidence that incidents within roadworks are often due to tailgating and weaving by vehicles. It appears that the risk to HGV occupants is higher than that to car or LGV occupants. This is investigated further in section 5.1.2 below.

### 5.1.2 HGV related RTCs

A study by David Solomon entitled "Accidents on main rural highways related to speed, driver, & Vehicle" (1964) [10] demonstrated the link between speed differential and accident rates. Vehicles travelling faster or slower than the mean traffic speed were more likely to be involved in incidents. Whilst this study is rather old, the principle remains that incidents are more likely when there is a greater speed differential.

At 50mph, there is anecdotal evidence that there can be a significant speed differential between HGVs, who often drive to their speed limiter at 56mph, and cars, who often comply with the 50mph speed limit. Table 5e (based on RCC Command and Control logs) shows the proportion of incidents in roadworks that involve an HGV. It shows that between 11 and 19% of incidents involve an HGV. The Department for Transport's report, "Road Traffic Estimates in Great Britain: 2014" [11] reports that, in 2014, HGVs formed 11% of the proportion of traffic on motorways by vehicle type. Therefore HGVs appear to be involved in a disproportionate number of incidents. In addition, the proportion of incidents involving an HGV appears to be increasing over the 5 year period.



Table 5e – Percentage of incidents in roadworks involving an HGV

Percentage of Incidents in Roadworks involving a HGV					
	2010	2011	2012	2013	2014
Jan	14%	14%	13%	18%	18%
Feb	15%	13%	15%	15%	17%
Mar	15%	13%	15%	14%	17%
Apr	14%	12%	14%	15%	18%
May	13%	12%	14%	16%	16%
June	13%	12%	14%	18%	16%
July	14%	11%	12%	17%	19%
Aug	12%	12%	13%	14%	15%
Sept	12%	11%	13%	18%	19%
Oct	12%	13%	13%	17%	
Nov	14%	12%	14%	17%	
Dec	16%	12%	17%	14%	

Road Traffic Estimates in Great Britain: 2014 [11] also comments on headways between HGVs and other vehicles. It reports that headways between HGVs have reduced slightly over the period from 2009 to 2014, with only 57% leaving the recommended 4 second gap. This is further evidence of tailgating by HGVs.

There is no quantitative data available to determine current levels of speed compliance by HGVs at 50mph. However, the National Enforcement Co-ordinator for Highways England provided the following quote:

*“I can confirm that I’ve seen a number of Highways Agency Information Lines (HAILS) relating to close following HGVs and also have personal experience of this. We know HGVs are limited to 56mph and so will not be detected speeding as the National Police Chiefs’ Council (NPCC) guidance for enforcement is 10% +2mph so in a 50mph limit this would be 57mph. We also know average vehicle speeds in enforced roadworks is about 48mph and this leads to conflict with HGVs and a percentage of them moving into Lane 2.”*

It is noted that speed differential is not the only reason for HGV collisions; they are also likely to be caused by other factors such as a lack of concentration, for example due to mobile phone use or other distractions. Data from the Safety Risk Model [18] indicates, across all vehicles, lack of concentration is a greater cause of collisions than aggressive driving or inappropriate speed. Unfortunately, it has not been possible to disaggregate the data for HGVs so no conclusion can be drawn as to the reasons behind HGV collisions.

### 5.1.3 Speed compliance

The NRUSS 2014-15 [1] shows that road users are frustrated by speed limits at roadworks, particularly when no work is taking place. This frustration could reasonably be expected to translate into poor levels of speed compliance.

However, the Highways England Customer Panel Survey [3] showed that 92% of panellists state that they obey restricted speed limits when driving through roadworks on the network.

This is backed by average speed camera data from the M1 J32 to 35a scheme [5] where a 50mph speed limit is in place for roadworks, and the police have stated that they are satisfied with the level of compliance.

There is no quantitative evidence available to demonstrate whether or not speed compliance by HGVs is worse than with other groups of users.

## 5.2 Road workers

### 5.2.1 Construction workers

The Safety Risk Model has been used to obtain evidence of the current level of risk to construction workers. The type of work being carried out on the road during the trials was similar in nature to maintenance works; i.e. works largely on the verge, without the need for specialist plant. However, the Safety Risk Model does not separate incidents involving construction workers from those involving maintenance workers. Therefore, both are included for the purposes of this report. The output from the Safety Risk Model is not separated into those incidents occurring within roadworks and those occurring elsewhere on the motorway network. Table 5f shows the number of injury accidents affecting members of the supply chain (including construction and maintenance workers but excluding traffic officers) on the motorway network as a whole.

Table 5f – Incidents involving the supply chain on the motorway network

	3 year period				
	2013-15	2012-14	2011-13	2010-12	2009-11
<b>Fatal</b>	0	1	1	4	4
<b>Serious</b>	11	8	7	20	28
<b>Slight</b>	91	96	108	172	198
<b>FWI</b>	0.20	1.90	2.78	7.72	8.78
<b>% FWI attributed to road users</b>	4%	4%	4%	23%	26%

Overall, it appears that the number and severity of incidents has decreased over time.

Since 2011, the proportion of incidents where road users are a contributory factor has remained stable at around 4%.

For all scenarios, it is assumed that minimal construction activity will be taking place within the closed lanes. During technology commissioning, workers will generally be behind permanent safety fencing apart from when entering and exiting their vehicles, which will be parked within the coned off lane. This is similar to the way technology maintenance activities are carried out on normal motorways where vehicles are parked for short stops on the hard shoulder. If anything the presence of cones reduces the risk to workers. However with

rollout, the level of risk will need to be determined by site specific risk assessment, taking account of the actual activities being carried out within the site.

### 5.2.2 Traffic officers

There is limited evidence available on the risk to traffic officers of operating within roadworks. An assessment was carried out on the M1 northbound between Junction 34 to 35a, from May 2015 to August 2016, when roadworks were in place. The results from the assessment of traffic officer attended incidents are as follows:

- A total of 560 incidents were recorded during this time period
- Traffic officers attended 55 of the incidents
- 8 incidents attended by traffic officers ended up in the roadworks site

The analysis of the current risk exposure of traffic officers concludes that traffic officers will be exposed to some risk from attending incidents within roadworks. However, traffic officers are able to mitigate this risk, in line with their work procedures, by managing traffic; this includes implementing rolling road blocks (RRB).

### 5.2.3 Recovery operators

With regard to the recovery of vehicles, M1 recovery data from junction 32 to 35a between 13/05/2015 and 27/08/2016 when roadworks were in place [12] shows that there were 2813 recoveries. On average this represents about 6 incidents per day. Of this around 34% of recoveries (961 recoveries) involved vehicles which were recovered from the lanes closed for works.

Free recovery operators each have their own method statements. The method statement for the M1 J32-35a [5] notes that recovery operatives will not carry out recoveries in live lanes unless the work area is deemed safe. This is achieved by creating a safe working environment with one or more impact protection vehicles (IPV), a Highways England traffic officer vehicle, or a Police vehicle.

For the majority of recoveries, the loss of one or more lanes caused by the breakdown will slow traffic significantly, mitigating the risk of the recovery operatives being in a live lane. It is only with low traffic flows, such as those encountered in the early hours of the morning, that traffic may be free flowing past the vehicle that is being recovered. Fortunately, breakdowns correlate with traffic flow, therefore, the percentage of recoveries will be low in this period.

The existing level of risk is dependent on the free recovery operator's method statement and will need to be examined as part of the site specific safety risk assessment.

## 6 Consider existing risk exposure for each population – Baseline 2 (stage 4)

This section highlights the difference in risk exposure for Baseline 2 compared to that previously discussed for Baseline 1.

### 6.1 Road users

The assessment of the current risk exposure of road users for 4 lane running during technology commissioning sets baseline 2. The risk to road users will be similar to the risk associated with ALR operation. However, this risk is likely to be lower for a 50mph speed limit in comparison to ALR operating at national speed limit (70mph).

### 6.2 Road workers

#### 6.2.1 Construction workers

The assessment of the current risk exposure of construction workers during 4 lane running during technology commissioning sets baseline 2. No construction activities are expected to be undertaken during technology commissioning, apart from possibly some technology fault maintenance, which will be carried out under TTM at night. The risk will be similar to that of maintainers under ALR operation, but is likely to be reduced by the lower speed limit of 50mph.

#### 6.2.2 Traffic officers

The assessment of the current risk exposure of traffic officers for 4 lane running during technology commissioning sets baseline 2. The risk to traffic officers will be similar to risk associated with ALR operation but is likely to be reduced by the lower speed limit of 50mph.

The primary protection for traffic officers is their vehicle and the cones that they set out when dealing with incidents. However, during scenario 2b signs and signals will be operational and the Regional Control Centre (RCC) would set a lane closure(s) and a 40mph speed limit to create a safer working environment. There is a small risk associated with traffic officers, on patrol or attending another incident, stopping in a running lane to set up emergency traffic management (ETM) for the incident before signals for a lane closure(s) have been set by control room operators. Traffic officers have procedures for dealing with incidents in live lanes.

#### 6.2.3 Recovery operators

The current risk exposure for the free recovery operator is similar to baseline 1. There are two differences:

- There will be 4 lanes of traffic rather than 3, so there may be more times when traffic is free flowing past the vehicle being recovered
- As a benefit, signals and variable message signs (VMS) will be available to set a lane closure and lower speed limits (40mph).

## 7 Risk analysis assessment and evaluation (Stage 5)

This section considers how the risk to each population is likely to be affected by an increase in speed limit to 60mph. It takes two different approaches to the evaluation:

- A semi-quantitative assessment of the risk to road users, which considers the increase in incidents which would be required in order to make the risk unacceptable
- A qualitative assessment of the change in risk to all affected populations, which takes account of the findings from the trials

### 7.1 Semi-quantitative Assessment

As discussed in Section 5.1, the current level of risk to road users is likely to be similar to that experienced on a normal motorway. GD04 Annex B [6] gives an average annual risk of fatality when driving on a motorway as 1 in 320,000, which is within the tolerable range. In order for the risk to fall into the unacceptable range, the number of fatal incidents would need to increase by a factor of 32.

The proposed increase in speed is extremely unlikely to lead to this level of increase in fatal incidents. Therefore the risk to road users is likely to remain 'tolerable'.

### 7.2 Qualitative Assessment

This section assesses the potential impact of increasing the speed limit within roadworks from 50mph to a 60mph on each of the relevant populations. It first considers the outcomes of the trials and then looks at what conclusions can be drawn with regard to wider use of 60mph speed limits within roadworks.

A separate qualitative assessment has been carried out for each of the proposed scenarios. Table 7a provides a summary of acceptability of risk for each population under each of the proposed scenarios; the reasons are explained in the sections that follow. The full results of these assessments are included in Appendix E.

In summary, the findings from the trials confirm that it was acceptably safe to trial the 60mph speed limit within the three scenarios. Further, the evidence from the trials suggests that it is likely to be acceptably safe to roll out a 60mph speed limit within these scenarios so long as no significant construction activity is taking place.

The trials minimised risk to populations by only increasing the speed limit in scenarios where there was no significant construction activity taking place in the closed lanes. The trials demonstrated that a 60mph speed limit can be used without significantly increasing the risk to any population. This evidence means that it is likely to be acceptably safe to trial a 60mph speed limit in a location where construction activities are taking place, subject to the outcome of a site specific safety risk assessment.

The results of this next trial are required before any decision can be made regarding wider roll out of 60mph within roadworks.

Table 7a – Summary of acceptability of risk

Population	Scenario 1a – step up in speed	Scenario 1b – step down in speed	Scenario 2a – technology commissioning TTM in place	Scenario 2b – technology commissioning no TTM	Scenario 3 – weekends & public holidays
Driver	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable
Emergency services	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable
Construction supplier	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable
TOS (Traffic Officer Service)	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable
Free recovery service	Site specific	Site specific and subject to suitable signing solution	Site specific	Site specific	Site specific

## 7.2.1 Scenario 1a – Step up in speed limit

### Road users

The results of the qualitative assessment conclude that for road users there is likely to be an increase in risk associated with general speed related hazards if speed is increased from 50mph to 60mph. Table 7b shows the stopping distances given by the Highway Code [13].

Table 7b – Stopping distances

Speed (mph)	Thinking distance	Braking distance	Total stopping distance
50	15m	38m	53m
60	18m	55m	73m

Stopping distances increase significantly with speed, increasing the likelihood of collisions. Higher speeds also lead to greater momentum which is likely to increase the severity of collisions. However, drivers would typically accept this risk when driving on a D3M (Dual 3 Lane Motorway) at 70mph.

On the A1 Leeming to Barton scheme, there was no evidence to suggest that any of the speed related hazards were significantly affected. There was no change in the number of incursions with the increase in speed and no RTCs on the 60mph section. This evidence suggests that the risk remains acceptable.



In general, speed compliance is already fairly good. However, there may be some safety benefit associated with a reduced speed differential due to improved speed compliance by HGVs. This is reflected in the results from the A1 Leeming to Barton scheme on-road trial, where compliance was at 70% in the 60mph section, compared to only 40% in the baseline 50mph section.

The findings from the trials confirm that it was acceptably safe to trial the 60mph speed limit within this scenario. Further, the evidence from the trials suggests that it is likely to be acceptably safe to use steps up in speed from 50 to 60mph within roadworks where no significant construction activity is taking place.

### **Road workers**

The original safety risk assessment found that there would be a small increase in risk for construction workers. It concluded that this risk associated with carrying out the trials is likely to be acceptable so long as minimal work takes place in the closed sections of carriageway. Evidence from the trials did not show any increase in risk to construction workers.

The risk to free recovery operators is dependent on their specific method statement. Where protection is required, prior to removing vehicles from the carriageway, the risk is likely to be acceptable.

The risk to the TOS is unlikely to change significantly with the increase in speed. This was reflected in all of the trials undertaken.

The findings of the trials indicate that it was acceptably safe to trial the 60mph speed limit within this trial scenario. Further, the evidence from the trials suggests that it is likely to be acceptably safe to use steps up in speed from 50 to 60mph within roadworks where no significant construction activity is taking place.

## **7.2.2 Scenario 1b – Step down in speed limit**

### **Road users**

The results of the qualitative assessment conclude that for road users there may be an increase in risk associated with drivers failing to notice the step down in speed. Without a suitable solution, that clearly alerts drivers to the step down in speed, the risk is unlikely to be acceptable.

In order to mitigate this risk, two different signing solutions were used on the trials. The A1 Leeming to Barton scheme on-road trial had a VMS, terminal sign and VMS combination at the step down and average speeds returned to 49mph. This was slightly more compliant than during the 50mph baseline period, where speeds were recorded at 50mph. In comparison, the M5 J4a-6 scheme on-road trial had less signage and average speeds at the step down were around 51-53mph, so not as good as on the A1 trial.



The findings from the trials confirm that it was acceptably safe to trial the 60mph speed limit within this scenario. Further, the evidence from the trials suggests that it is likely to be acceptably safe to use steps down in speed from 60 to 50mph within roadworks where not significant construction activity is taking place so long a suitable signing strategy is in place.

## **Road workers**

The original safety risk assessment found that safety risk to construction workers, recovery workers and TOS is increased due to the possibility that drivers will not notice the step down in speed limit, and therefore fail to comply. Without a suitable solution, that clearly alerts drivers to the step down in speed, the risk is unlikely to be acceptable.

As discussed above, the trials went ahead with two different signing strategies in place. The signing strategy used on the A1 Leeming to Barton trial appears to have been more effective, and good compliance was achieved, with average speeds recorded at 49mph compared to 50mph in the 50mph baseline period.

The findings of the trials indicate that it was acceptably safe to trial the 60mph speed limit within this trial scenario. Further, the evidence from the trials suggests that it is likely to be acceptably safe to use steps down in speed from 60 to 50mph within roadworks where no significant construction activity is taking place.

### **7.2.3 Scenario 2a – Technology commissioning, 1 lane closed**

#### **Road users**

The results of the qualitative assessment conclude that for road users there is likely to be an increase in risk associated with general speed related hazards if speed is increased from 50mph to 60mph. However, drivers would typically accept this risk when driving on a D3M at 70mph.

In general, speed compliance is already fairly good. However, there may be some safety benefit associated with a reduced speed differential due to improved speed compliance by HGVs.

The two trials undertaken within scenario 2 (M5 J4a-6 scheme and M1 J32-35a scheme on road trials) found that compliance improved with the increase in speed and there was no evidence to suggest that any of the speed related hazards were significantly affected. On the M5 J4a-6 scheme, only 18% of drivers were travelling above the speed limit, compared to 54% in the 50mph baseline. On the M1 J32-35a scheme, average speeds remained below 60mph, whereas in the baseline period, average speeds were recorded at the speed limit of 50mph. They also found that instances of tailgating and vehicles changing lanes decreased.

The findings from the trials confirm that it was acceptably safe to trial the 60mph speed limit within this scenario. Further, the evidence from the trials suggests that it is likely to be

acceptably safe to use a 60mph speed limit during the commissioning phase of smart motorways, when there is no significant construction activity taking place.

## Road workers

The results of the original safety risk assessment concluded that there will be a small increase in risk for construction workers. This risk is likely to be acceptable so long as minimal work takes place in the closed sections of carriageway. Monitoring was put in place during the trials to ensure that the risks associated with replacing TTM following strikes and access/egress from the work site remain acceptable. Evidence from the trials did not show any increase in risk to construction workers.

The risk to free recovery operators is dependent on their specific method statement. Where protection is required, prior to removing vehicles from the carriageway, the risk is likely to be acceptable.

The risk to the TOS is unlikely to change significantly with the increase in speed. This was reflected in all of the trials undertaken.

The findings of the trials indicate that it was acceptably safe to trial the 60mph speed limit within this trial scenario. Further, the evidence from the trials suggests that it is likely to be acceptably safe to adopt a 60mph speed limit during technology commissioning so long as no significant construction activity is taking place.

### 7.2.4 Scenario 2b – Technology commissioning, all lanes open

#### Road users

The results of the qualitative assessment conclude that for road users there is likely to be an increase in risk associated with general speed related hazards if speed is increased from 50mph to 60mph. However, drivers would typically accept this risk when driving on a D3M at 70mph.

In general, speed compliance is already fairly good. However, there may be some safety benefit associated with a reduced speed differential due to improved speed compliance by HGVs.

The two trials undertaken within scenario 2 (M5 J4a-6 scheme and M1 J32-35a scheme on road trials) found that compliance improved with the increase in speed and there was no evidence to suggest that any of the speed related hazards were significantly affected. On the M5 J4a-6 scheme, only 18% of drivers were travelling above the speed limit, compared to 54% in the 50mph baseline. On the M1 J32-35a scheme, average speeds remained below 60mph, whereas in the baseline period, average speeds were recorded at 50mph. They also found that instances of tailgating and vehicles changing lanes decreased.

The findings from the trials confirm that it was acceptably safe to trial the 60mph speed limit within this scenario. Further, the evidence from the trials suggests that it is likely to be acceptably safe to use a 60mph speed limit during the commissioning phase of smart motorways, when there is no significant construction activity taking place.

## **Road workers**

The results of the qualitative assessment conclude that there is no increase in risk for construction workers as no physical works will be taking place on site. Signing for the increased speed limit will already be in place from scenario 2a so there is no additional risk associated with changing the signing of the speed limit.

The risk to free recovery operators is dependent on their specific method statement. Where protection is required, prior to removing vehicles from the carriageway, the risk is likely to be acceptable.

The risk to the TOS is unlikely to change significantly with the increase in speed. This was reflected in all of the trials undertaken.

The findings of the trials indicate that it was acceptably safe to trial the 60mph speed limit within this trial scenario. Further, the evidence from the trials suggests that it is likely to be acceptably safe to adopt a 60mph speed limit during technology commissioning so long as no significant construction activity is taking place.

### **7.2.5 Scenario 3 – weekends, public holidays, etc**

#### **Road users**

The results of the qualitative assessment conclude that for road users there is likely to be an increase in risk associated with general speed related hazards if speed is increased from 50mph to 60mph. However, drivers would typically accept this risk when driving on a D3M at 70mph.

In general, speed compliance is already fairly good. However, there may be some safety benefit associated with a reduced speed differential due to improved speed compliance by HGVs.

The A1 Leeming to Barton scheme on-road trial found that compliance improved with the increase in speed and there was no evidence to suggest that any of the speed related hazards were significantly affected. Compliance was at around 70% on the 60mph section, which was much better compared to the 50mph baseline, where compliance was at around 40%. The trial also found that instances of tailgating and vehicles changing lanes decreased, particularly with regards to HGVs.

The findings from the trials confirm that it was acceptably safe to trial the 60mph speed limit within this scenario. Further, the evidence from the trials suggests that it is likely to be acceptably safe to use a 60mph speed limit within roadworks during weekends and public holidays where no significant construction activity is taking place.

## **Road workers**

The results of the qualitative assessment conclude that there is an increased risk to construction workers associated with changing the fixed plate speed limit signs from 50mph to 60mph. The risk to construction workers is dependent on their specific method statement. On the M1 J34-35a trial [5], a closure was implemented using a police rolling road block. With the closure in place, two crews drove through the site swapping the 50mph signs for 60mph signs, with one crew replacing the verge side signs and the other crew replacing the central reserve signs.

The risk to free recovery operators is dependent on their specific method statement. Where the method statement requires that protection is in place prior to vehicles being recovered from the carriageway, the risk is likely to be acceptable.

The risk to the TOS is unlikely to change significantly.

There was no evidence from the A1 Leeming to Barton scheme on-road trial to suggest that the risk to any road worker population increased with the increase in speed limit.

The findings from the trials confirm that it was acceptably safe to trial the 60mph speed limit within this scenario. Further, the evidence from the trials suggests that it is likely to be acceptably safe to use a 60mph speed limit within roadworks during weekends and public holidays where no significant construction activity is taking place. However, given that the increased speed limit will only be in place for a few days, the benefits may not justify the risk associated with changing the signing. This will need to be determined on a site by site basis.

## 8 Risk control decisions (Stage 6)

### 8.1 All scenarios

The following risk controls should be implemented to minimise the risk increase to construction workers:

- Minimise the work being carried out in closed lanes. For scenario 2a, works that are not part of Stage D of IAN182 [2] should be completed prior to any increase in speed limit.

### 8.2 Scenarios 1a, 2a and 2b

The safety risk assessment has demonstrated that the risks associated with rolling out a 60mph speed limit during roadworks are likely to be acceptable for road users and the traffic officer service.

The risk to the free recovery service is dependent on their local method statement and will need to be assessed on a case by case basis. The safety risk assessment for all three on-road trials found that the risk to the free recovery service was acceptable.

### 8.3 Scenario 1b

The safety risk assessment has demonstrated that, with roll out of the 60mph speed limit through roadworks, a suitable signing solution needs to be in place to clearly alert drivers to the step down in speed.

### 8.4 Scenario 3

The safety risk assessment has demonstrated that the risks associated with rolling out a 60mph speed limit through roadworks are likely to be acceptable for road users, traffic officer service and free recovery operators.

There is additional risk to construction works associated with changing the signing from 50mph to 60mph. This is likely to be acceptable if safe methods of working are used to change the speed limit signs. This is subject to a scheme specific safety risk assessment and the development of a safe system of work.

## 9 Maintaining the safety risk assessment

### 9.1 Document the safety risk decision in the safety risk report (Stage 7)

This report documents the programme level safety risk assessment for rolling out a 60mph speed limit through roadworks.

### 9.2 Handover of safety risk report to operators (Stage 8)

The safety risk assessment report will be handed over to Highways England (Roadworks & Asset Investment Division) RAID team, who will use it as part of the evidence for roll out of 60mph speed limits through roadworks.

### 9.3 Update and refresh the safety risk report when change proposed (Stage 9)

Highways England will need to review, and if necessary update, this report should there be any further trials of a 60mph speed limit or if it is proposed to adopt it in any additional scenarios.

If the proposals are extended to include All Purpose Trunk Roads (APTR) as well as motorways, then the scope of the safety risk assessment will need to be extended accordingly.

### 9.4 Monitor and review safety risk report assumptions (Stage 10)

A monitoring contract was in place for the trials. This monitored a range of indicators including vehicle speeds, headways, incidents and journey times. It also looked at the impact of the increased speed on customer satisfaction. The outcomes of the monitoring contract have been used to inform this safety risk assessment.

Further monitoring is not required for rollout of the 60mph speed limit for the scenarios already tested in the 60mph trials. However, if any concerns arise with the rollout then this safety risk assessment must be revisited. Monitoring will need to be in place for any further 60mph trials that test additional scenarios not previously tested, e.g. trial a 60mph speed limit in a location where construction activities are taking place.

## 10 Conclusions

The objective of this safety risk assessment is to answer the following questions:

1. ***“Was it acceptably safe to use a 60mph speed limit within the trial scenarios?”***
2. ***“Is it acceptably safe to roll out a 60mph speed limit within those scenarios?”***
3. ***“What conclusions can be drawn about the safety of using a 60mph speed limit more widely within roadworks?”***

Table 10a provides a summary of the qualitative assessment of the impact of the 60mph speed limit on safety risk and goes towards answering the questions posed above.

Table 10a – summary of the qualitative assessment

Population	Scenario 1a – step up in speed	Scenario 1b – step down in speed	Scenario 2a – technology commissioning TTM in place	Scenario 2b – technology commissioning no TTM	Scenario 3 – weekends & public holidays
Driver	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable
Emergency services	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable
Construction supplier	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable
TOS	Acceptable	Acceptable subject to suitable signing solution	Acceptable	Acceptable	Acceptable
Free recovery service	Site specific	Site specific and subject to suitable signing solution	Site specific	Site specific	Site specific

The general conclusions of this safety risk assessment are as follows:

C1 – It was acceptably safe to trial the 60mph speed limit within the three scenarios:

- Scenario 1: On the lead-in to, and exit from, roadworks
- Scenario 2: Where system reliability testing is being carried out after installing new technology
- Scenario 3: During a public holiday/weekend

C2 – Based on the findings of the trials, it is acceptably safe to roll out a 60mph speed limit within these scenarios. The following restrictions apply:

- Steps down in speed must be supported by an appropriate signing strategy to alert drivers to the reduced speed limit.



- For scenario 2a, works that are not part of Stage D of IAN182 [2] should be completed prior to any increase in speed limit.

C3 - The trials minimised risk to populations by only increasing the speed limit in scenarios where there was no significant construction activity taking place in the closed lanes. The trials demonstrated that a 60mph speed limit can be used without significantly increasing the risk to any population. This evidence means that it is likely to be acceptably safe to trial a 60mph speed limit in a location where construction activities are taking place, subject to the outcome of a site specific safety risk assessment. Monitoring will be required in the same way as previous trials (both traffic and focus groups).

C4 – The results of this next trial are required before any decision can be made regarding wider roll out of 60mph within roadworks where construction activities are taking place.

C5 – Prior to the trials it was anticipated that the use of a 60mph speed limit through roadworks may deliver benefits in the following areas:

- Customer satisfaction
- Improved Heavy Goods Vehicle (HGV) driver behaviour
- Journey time benefits
- Improved speed compliance

The findings from the trials suggest that these benefits are likely to be achieved with rollout of the 60mph speed limit.

C6 – As ever, a site specific safety risk assessment will always be required to confirm that the proposed TTM arrangements and speed restrictions are appropriate for that site.



## Appendix A - References

1	Highways England National Road User Satisfaction Survey (NRUSS)
2	INTERIM ADVICE NOTE (IAN) 182/14 Major Schemes: Enabling Handover into Operation and Maintenance (April 2014)
3	Highways England Customer Panel Survey Report “Roadwork Speed Restrictions” (September 2016)
4	Managing Speed in Roadworks - End of Task Report (ARUP/URS) (04/11/2014)
5	GD04 Risk Assessment of Trialling a 60 mph Speed Limit during roadworks on M1 J34 to 35a northbound (04/11/2016)
6	General Direction (GD) 04/12 Standard for Safety Risk Assessment on the Strategic Road Network (November 2012)
7	Highways England Strategic Business Plan Overview 2015 – 2020
8	Safety Performance of Traffic Management at Major Roadworks, Transport Research Laboratory (2004)
9	Reported Road Casualties Great Britain: Annual Report 2015 (Department for Transport)
10	M1 J32-35a Smart Motorway Recovery Data, June 2016
11	Accidents on main rural highways related to speed, driver, & Vehicle (1964) (US Department of Commerce / Bureau of Public Roads)
12	Road Traffic Estimates in Great Britain: 2014 (Department for Transport)
13	The Highway Code (last updated 31 October 2016)
14	Reported Road Casualties on the Strategic Network 2014 (Highways England)
15	TAME Calculations of disbenefits associated with speed restrictions (email 7/10/16)
16	Highways England 5 Year Health and Safety Plan
17	Highways England Operational Metrics Manual (June 2016)
18	Highways England Safety Risk Model

## Appendix B – Glossary

ALR	All lane running
APTR	All Purpose Trunk Road
ASC	Asset support contract
D3M	Dual 3-lane Motorway
DfT	Department for Transport
HAIL	Highways Agency Information Line
HGV	Heavy Goods Vehicle
IAN	Interim Advice Note
LGV	Light Goods Vehicle
MIDAS	Motorway incident detection and automatic signalling
NPCC	National Police Chiefs' Council
NRUSS	National Road User Satisfaction Survey
PTW	Powered Two Wheeler
RAID	Roadworks & Asset Investment Division
RCC	Regional Control Centre
RRB	Rolling road block
RTC	Road traffic collisions
SFAIRP	So Far As Is reasonably Practicable
TAME	Traffic Appraisal, Modelling and Economics
TOS	Traffic Officer Service
TTM	Temporary traffic management
VMS	Variable message signs



## Appendix C – Classification

Feature	Type A Specialist Technical/ Coordinator Roles	Type B Professional Safety Advisors	Type C Professional Roles
1. What is the size of the decision impact?	Local, low density	Local, high density or national, low density	National, high density
2. What are the cost implications of the decision for Highways England?	Low	Medium	High
3. What is the lifetime of the decision? (how long will Highways England be affected by the decision)	Rest of the day	Months to a few years	Decades
4. What is the level of safety risk or uncertainty associated with the decision?	Low	Medium	High
5. What is the policy or stakeholder interest level? (how sensitive is it?)	Low	Medium	High

Feature	Current classification	Justification
1. What is the size of the decision impact?	Type B	The decision will be limited to the scenarios covered by the trials and a possible future trial of 60mph where construction activities are taking place..
2. What are the cost implications of the decision for Highways England?	Type A	There may potentially be a minor cost associated with introduction of 60mph plate signs (assuming these are not already in stock). Another (potential) minor cost if any modifications will need to be made to average speed enforcement.
3. What is the lifetime of the decision? (how long will Highways England be affected)	Type B	The decision is likely to have implications for a number of years..

Feature	Current classification	Justification
by the decision)		
4. What is the level of safety risk or uncertainty associated with the decision?	Type A	<p>The trials have provided evidence of the impact of increased speed limits on a number of indicators including safety.</p> <p>For road workers this is classed as Type A. 60mph speed limits will only be used where the TTM is designed to the higher speed limit. Minimal works will take place in the closed lane. Commissioning works will take place on the verge behind permanent safety fence. There are some potential increases in risk associated with setting out signs to change the speed limit and replacing cones following impact by vehicles.</p> <p>For road users this is classed as Type A – again the trials will only take place where the TTM is designed to the higher speed limit. It will not include narrow lanes. There are possible benefits arising from reduced speed differential resulting in less tail gating and weaving. Compliance may also be improved.</p>
5. What is the policy or stakeholder interest level? (how sensitive is it?)	Type B	<p>Desire for increased speed limits from DfT and Highways England to address customer dissatisfaction regarding roadworks management.</p> <p>Likely to be some interest from the public and media following the press release earlier this year.</p> <p>Police likely to have some interest, particularly around enforcement.</p> <p>Contractors will be interested in the potential impact on their workers.</p> <p>TOS and recovery operators may have some interest as incident management and recovery of vehicles will be taking place at a higher speed, although this is not dissimilar to normal motorway conditions.</p>

## Appendix D – General hazards affected by speed

The assessment considers qualitatively the change in risk for each of the general hazards affected by speed.

Decrease in risk	No Change	Increase in risk
------------------	-----------	------------------

Hazard ID	Description	Difference between 50mph to 55/60mph
H13	Driver loses control of vehicle	The likelihood and severity is likely to increase as the speed increases to 55/60mph. [13] states that the stopping distance increases from 53 metres at 50mph, to 73 metres at 60 mph. However the hazard is unlikely to be higher than on a normal motorway at 70mph.
H54	Motorcycle filters through traffic	<p>Increasing the maximum speed through roadworks from 50mph to 55 or 60mph is expected to reduce congestion. This is expected to decrease the frequency of the hazard as it has been shown that motorcycle weaving decreases as traffic becomes free flowing, i.e. less congested.</p> <p>The severity of an incident increases marginally with the higher speed limits of 55/60.</p> <p>Overall the hazard is kept as “neutral”.</p>
H67	Pedestrian on live carriageway (lanes 1, 2 or 3) during 3-lane running	There could be a small increase in likelihood and severity due to the increased speeds. However the overall risk is unlikely to be greater than on a normal motorway at 70mph.

Hazard ID	Description	Difference between 50mph to 55/60mph
H37	Individual vehicle drives too fast	There will still be instances where driver deliberately exceeds speed limits and this will be no different at 55/60mph speed limits.  However, some drivers exceed the speed limit because they believe the speed limits are unnecessarily restrictive – this is supported by Highways Agency Information Line enquiries. Hence, more credible speed limits should encourage better speed compliance.
H36	Incidents or congestion caused in other lanes or carriageway due to rubber-necking	Whilst the severity of this hazard does increase with speed the overall risk is not anticipated to increase significantly. The overall risk is unlikely to be greater than on a normal motorway at 70mph.
H91	Tail gating (driving too close to the vehicle in front)	Evidence from the M6 J36-37 trial [4] suggests that increasing the speed limit will reduce the amount of tailgating by HGVs. At 60mph speed limit HGVs will all be travelling at the same speed so may still tailgate each other, not cars. That risk is present anyway and is no different at the increased speed limit.  Even with the potential for accidents with a higher severity under 60mph it is still expected that the smoothing of flow will reduce the risk from this hazard.
H137	Debris in running lane (including h/s while open, but not while opening)	There could be a small increase in likelihood and severity due to the increased speeds. However the overall risk is unlikely to be greater than on a normal motorway at 70mph.
H135	Vehicle stops in running lane	There could be a small increase in likelihood and severity due to the increase speeds. However the overall risk is unlikely to be greater than on a normal motorway at 70mph.
H122	Vehicle reversing back to exit slip	There could be a small increase in likelihood and severity due to the increase speeds. However the overall risk is unlikely to be greater than on a normal motorway at 70mph. The frequency is likely to be very low so the overall risk is not expected to change significantly.
H95	On-road resource crosses running lane	This hazard is not applicable as there will be no crossing of a live carriageway.

Hazard ID	Description	Difference between 50mph to 55/60mph
H112	Vehicle enters main carriageway unsafely	At 55/60mph all of the lorries will be travelling at the constant speed in lanes 1 and 2 whereas at 50mph some lorries will be overtaking in lane 2. This can have an effect of creating a wall of lorries in lane 1 making it be difficult for the vehicles to join the motorway. However, this is no different to a normal motorway at 70mph.
H76	Rapid change of general vehicle speed	Initial braking on entering roadworks may be smoother from 70mph to 55/60mph rather than from 70 to 50mph. May even out. In roadworks, higher speed means more likelihood of collision.
H113	Vehicle exits hard shoulder (including an ERA) hazardously during 3-lane running	This hazard is not applicable as there is no hard shoulder.
H0099	Vehicle drifts off carriageway	At higher speeds there is less time to correct errors caused by lapses in concentration and any resulting impact is likely to be greater.
H0207	Vehicle reversing along exit slip	Whilst the severity of this hazard does increase with speed it is a low frequency event which therefore the overall risk is not anticipated to increase significantly.



## Appendix E - Risk analysis assessment and evaluation

The assessment considers qualitatively the change in risk for each of the populations using the following key:

Small benefit (-)	Neutral impact (=)	Small disbenefit (+)
Larger benefit (- -)		Larger disbenefit (++)

Each of the scenarios is considered in turn.

## Scenario 1a: Step up in speed

### Road users

Population	Hazard	Risk assessment for Scenario 1a – Step up in speed from 50mph to 60mph	Is risk acceptable?
Road user - Drivers	General speed related hazards	<p>(+) There is likely to be an increase in risk for the speed related hazards noted in Appendix D. However, this risk is unlikely to exceed that experienced on a D3M at the national speed limit of 70mph. The level of risk is acceptable since road users would typically accept the higher risks associated with driving on a D3M at the national speed limit (70mph).</p> <p>Although average speeds increased on the A1 Leeming to Barton scheme on-road trial from around 50mph to 56mph, they were compliant and there is no evidence to suggest that any of the speed related hazards were significantly affected.</p> <p>If the 60mph speed limit is rolled out within roadworks, it is likely that speeds will be compliant. The risk is likely to increase for the speed related hazards, but this is unlikely to exceed that experienced on a D3M at 70mph, reflecting the findings of the trials. This risk is therefore acceptable.</p>	Yes
	Road user vehicle not complying with speed limits through roadworks.	<p>(-) Increasing speed limits may lead to increased credibility and hence better speed compliance. Credibility is thought to be a particular problem where there is no visible construction activity taking place, such as those targeted by the trials.</p> <p>There is little evidence of poor speed compliance within roadworks and [3] found that 92% of those questioned stated that they comply with speed limits within roadworks. The one area of concern is around HGV speed compliance. Increasing the speed limit to 60mph would result in 100% compliance of HGV vehicles as they will be limited to 56mph.</p> <p>It should be noted that average speed enforcement systems can only enforce a single speed limit. Additional cameras and infrastructure would be required to enforce two different speed limits. Any perception of reduced enforcement is likely to reduce compliance.</p> <p>The TRL simulator trials found that the average distance at which the new speed limit was reached after encountering the speed limit change was 526m.</p> <p>The on-road trial on the A1 Leeming to Barton scheme found that average speeds increased to around 56mph at the radar located a few hundred meters after the step up to 60mph. This suggests that compliance was generally good and the majority of drivers did notice the step up in speed and immediately adjusted their behaviour. Further into the 60mph section, compliance was at around 70%, which was much better compared to the 50mph baseline, where compliance was at around 40%.</p>	Yes

Population	Hazard	Risk assessment for Scenario 1a – Step up in speed from 50mph to 60mph	Is risk acceptable?
		Based on these findings, compliance is likely to improve with rollout of the 60mph speed limit through roadworks.	
	Road user vehicles striking road workers' equipment including TTM	<p>(=) At higher speeds drivers have less reaction time. An increase in speed from 50 to 60mph increases thinking and breaking time by approximately 38% (53m to 73m). [13] This is likely to result in an increase in the number of TTM strikes. This is likely to be acceptable as road users will be getting a benefits from the speed increase.</p> <p>During the on-road trial on the A1 Leeming to Barton scheme there was no change in the number of incursions due to the increase in speed limit and no road traffic collisions in the 60mph section of the scheme.</p> <p>Based on these findings, road workers' equipment strikes (including TTM) are likely to remain the same as at 50mph with rollout of the 60mph speed limit through roadworks.</p>	Yes
	Vehicles tailgating	<p>(-) Tailgating, in particular that amongst HGV drivers that regularly drive to the maximum of their 56mph speed limit during 50mph speed restrictions, would be expected to reduce significantly with speed limits increased to 60mph. This notion is supported by the findings from the M6 J36-37 trial. [4]</p> <p>There was no evidence that average headways were compromised on the on-road trial on the A1 Leeming to Barton scheme. Although not evidence from a step up in speed trial, the on-road trial on the M5 J4a-6 scheme found that the introduction of the 60mph speed limit had little impact on close following by car drivers, but substantially reduced the amount recorded for HGV drivers. Based on these findings, instances of tailgating are likely to decrease with the rollout of the 60mph speed limit through roadworks.</p>	Yes
	Vehicles changing lanes	<p>(-) The M6 J36-37 trial [4] found positive changes in drivers' behaviour at 60mph. Improved speed harmonisation between different types of vehicles led to decreased overtaking and lane changing which in turn contributed to better convergence of lanes and improved flow of movement.</p> <p>During the on-road trial on the A1 Leeming to Barton scheme there was less overtaking reported in the 60mph section in the customer satisfaction survey.</p> <p>Although not evidence from a step up in speed trial, the M5 J4a-6 scheme on-road trial found that there was some evidence that overtaking manoeuvres performed by HGVs was reduced through the 60mph speed limit. The change in speed limit did not change the overall lane choice of vehicles, however HGVs generally stayed in lanes 1 and 2 at 60mph, whereas HGVs used lane 3 more frequently at 50mph.</p> <p>This evidence suggests that with a rollout of the 60mph speed limit through roadworks, there will likely be less overtaking and lane changing.</p>	Yes
Road User - Emergency Services	General speed related hazards	<p>(+) There is likely to be an increase in risk for the speed related hazards noted in Appendix D. However, this risk is unlikely to exceed that experienced on a D3M at the national speed limit of 70mph. The level of risk is acceptable since emergency services would typically accept the higher risks associated with driving on a D3M at the national speed limit (70mph).</p> <p>Although average speeds increased on the A1 Leeming to Barton scheme on-road trial from around 50mph to</p>	Yes

Population	Hazard	Risk assessment for Scenario 1a – Step up in speed from 50mph to 60mph	Is risk acceptable?
		<p>56mph, they were compliant and there is no evidence to suggest that any of the speed related hazards were significantly affected.</p> <p>If the 60mph speed limit is rolled out within roadworks, it is likely that speeds will be compliant. The risk is likely to increase for the speed related hazards, but this is unlikely to exceed that experienced on a D3M at 70mph, reflecting the findings of the trials. This risk is therefore acceptable.</p>	
	<p><b>Road user vehicle not complying with speed limits through roadworks.</b></p>	<p>(-) With improved compliance there may be fewer incidents that require the emergency services to attend. Improved compliance also reduces the risk to emergency services attending incidents on the road.</p> <p>On the on-road trial on the A1 Leeming to Barton scheme, speed compliance was better than at 50mph and there were no road traffic collisions within the areas subject to a 60mph speed limit.</p> <p>These findings suggest that there will be fewer incidents that require the emergency services to attend with the rollout of 60mph through roadworks.</p>	Yes
	<p><b>Vehicles tailgating</b></p>	<p>(-) There may be fewer incidents to attend due to fewer instances of tailgating.</p> <p>On the on-road trial on the A1 Leeming to Barton scheme there was no evidence to suggest that average headways were compromised and there were no road traffic collisions within the areas subject to a 60mph speed limit. Although not evidence from a step up in speed trial, the on-road trial on the M5 J4a-6 scheme found that the introduction of the 60mph speed limit had little impact on close following by car drivers, but substantially reduced the amount recorded for HGV drivers.</p> <p>These findings suggest that there will be fewer incidents that require the emergency services to attend with the rollout of 60mph through roadworks.</p>	Yes
	<p><b>Vehicles changing lanes</b></p>	<p>(-) There may be fewer incidents to attend due to fewer instances of vehicles changing lanes.</p> <p>On the on-road trial on the A1 Leeming to Barton scheme there was less overtaking and no road traffic collisions within the areas subject to a 60mph speed limit. Although not evidence from a step up in speed trial, the M5 J4a-6 scheme on-road trial found that there was some evidence that overtaking manoeuvres performed by HGVs was reduced through the 60mph speed limit. The change in speed limit did not change the overall lane choice of vehicles, however HGVs generally stayed in lanes 1 and 2 at 60mph, whereas HGVs used lane 3 more frequently at 50mph.</p> <p>These findings suggest that there will be fewer incidents that require the emergency services to attend with the rollout of 60mph through roadworks.</p>	Yes
	<p><b>Exposure to traffic when responding to incidents in live</b></p>	<p>(=) Emergency Services exposed to higher speed traffic when responding to incidents in live lanes. However, at high flows, the loss of a lane is likely to slow the traffic in adjacent lanes so the risk is unlikely to be greater than in the baseline. At low flows (e.g. at night) the risk is increased but is unlikely to be higher than on a normal motorway at 70mph.</p> <p>There was no evidence found during the A1 Leeming to Barton scheme on-road trial to suggest that the risk to</p>	Yes

Population	Hazard	Risk assessment for Scenario 1a – Step up in speed from 50mph to 60mph	Is risk acceptable?
	lanes.	emergency services increased.	
	Exposure to construction activities when responding to incidents within the work site.	(=) Minimal construction work will be taking place within the site.	Yes

The results of the qualitative assessment conclude that for road users there is likely to be an increase in risk associated with general speed related hazards if speed is increased from 50mph to 60mph. However, drivers would typically accept this risk when driving on a D3M at 70mph. In general speed compliance is already fairly good. However, there may be some safety benefit associated with a reduced speed differential due to improved speed compliance by HGVs.

Overall the level of risk is likely to be acceptable.

### Road workers

Population	Hazard	Risk assessment for Scenario 1a – Step up in speed from 50mph to 60mph	Is risk acceptable?
Road workers - construction workers	Construction workers' exposure to traffic when setting up TTM	(+) Depending on the scenario that the step up in speed is part of, construction workers may have to carry out an additional activity of changing the speed limit signs from 50mph to 60mph. The risk is likely to be acceptable so long as a safe method of working is adopted. For example on the M1 J34-35a trial, signs were changed during a carriageway closure, implemented using a police rolling road block.  On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported.  If the 60mph speed limit is rolled out through roadworks, the risk is likely to remain acceptable so long as a safe method of working is adopted.	Yes, so long as a safe method of working is adopted
	Construction workers' exposure to traffic when working in	(=) Increase speed increases the risk of vehicles colliding with the TTM and encroaching on the work site. However, it is assumed that there will be minimal work taking place in the closed lane. Therefore, so long as this assumption is valid, the risk to construction workers is unchanged.  On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported. There was also no change in the number of incursions due to the increase in speed limit.	Yes, so long as minimal work takes place in closed lane

Population	Hazard	Risk assessment for Scenario 1a – Step up in speed from 50mph to 60mph	Is risk acceptable?
	closed lane.	This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks associated with vehicles colliding with the TTM and encroaching on the work site are likely to remain acceptable. There was minimal work taking place on the site, so this would need to be taken into account with rollout.	
	Construction workers' exposure attending and relocating cones that have been struck by traffic	(+) Road user vehicles travelling at higher speeds have less time to react to road environment or take evasive action, therefore potentially increasing the likelihood of collisions with road workers who are replacing struck cones. However, there does not appear to be a history of near misses for this activity.  It is possible that vehicles travelling at higher speed (60mph) will increase the frequency of cone strikes. This needs to be monitored to ensure the risk remains acceptable.  On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported and no change in the number of incursions.	Yes
	Construction vehicles entering and leaving the work site from the main carriageway.	(=) Access to and exit from the work site will be more difficult and hazardous at higher speed. In addition, at 60mph all of the lorries will be travelling at the constant speed in lanes 1 and 2 whereas at 50mph some lorries will be overtaking in lane 2. This can have an effect of creating a wall of lorries in lane 1 making it be difficult for works vehicles to re-join the main carriageway.  However, on the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported. There was no evidence to suggest that access to and exit from the work site was compromised.  This evidence suggests that if the 60mph speed limit is rolled out through roadworks, the risk to roadworkers entering and leaving the roadworks site is likely to remain acceptable.	Yes
Road workers – Traffic Officer Service	Traffic officers implementing a RRB	(=) The risks associated with implementing a RRB will increase slightly with speed. However the risk will be lower than on a normal motorway at 70mph. Therefore the risk is likely to be acceptable.  On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported.  This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks associated with Traffic Officers implementing an RRB are likely to remain acceptable.	Yes
	Traffic officers on foot when a RRB is in place	(=) Once the RRB is in place, vehicles should not be in proximity to the location of the traffic officer on foot. Overall the risk is likely to be acceptable.  On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported.  This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks to Traffic Officers on foot when an RRB is in place are likely to remain acceptable.	Yes
	Traffic officers	(=) In most cases congestion caused by the incident will reduce speeds. However at low flows, vehicles will be able	Yes

Population	Hazard	Risk assessment for Scenario 1a – Step up in speed from 50mph to 60mph	Is risk acceptable?
	attending live lane incidents	to travel past the incident at higher speeds. In most cases, traffic officers will be working under the protection of a RRB or lane closure, in line with their procedures. Overall the risk is likely to be acceptable. On the on-road trial on the A1 Leeming to Barton scheme, Traffic Officers reported an improvement in time taken to respond to incidents within and outside of the road works scheme. There were no incidents or near misses reported. This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks to Traffic Officers attending live lane incidents are likely to remain acceptable.	
Road workers - Free recovery operator	Recovery Operators will be exposed to traffic when responding to incidents in live lanes.	(=) Recovery operators will be exposed to higher speed traffic. However the recovery operator's method statement may include appropriate means of working (such as only recovering vehicles when protection is provided by an Impact Protection Vehicle, TOS or police). A review of local arrangements will be required to determine whether the risk to recovery operators is acceptable. There was no evidence found during the A1 Leeming to Barton scheme on-road trial to suggest that the risk to free recovery operators increased.	Depends on local method statement
	Recovery Operators being exposed to construction activities when responding to incidents within the work site.	(=) Minimal construction work will be taking place within the site. Therefore the risk is likely to be acceptable. There was no evidence found during the A1 Leeming to Barton scheme on-road trial to suggest that the risk to free recovery operators increased.	Yes

The results of the qualitative assessment conclude that there will be a small increase in risk for construction workers. This risk is likely to be acceptable so long as minimal work takes place in the closed sections of carriageway and a safe method of working is adopted.

The risk to free recovery operators is dependent on their specific method statement. Where protection is required, prior to removing vehicles from the carriageway, the risk is likely to be acceptable.

The risk to the TOS is unlikely to change significantly with the increase in speed.

**Scenario 1b: Step down in speed**

**Road users**

Population	Hazard	Risk assessment for Scenario 1b – Step down in speed from 60mph to 50mph	Is risk acceptable?
Road user - drivers	General speed related hazards	<p>(+) There is likely to be an increase in risk for the speed related hazards noted in Appendix D. However, this risk is unlikely to exceed that experienced on a D3M at the national speed limit of 70mph. The level of risk is acceptable since road users would typically accept the higher risks associated with driving on a D3M at the national speed limit (70mph).</p> <p>Although average speeds slightly exceeded the speed limit on the M5 J4a-6 scheme on-road trial (speeds were recorded at between 51-53mph) at the step down point, there is no evidence to suggest that any of the speed related hazards were significantly affected. Average speeds on the A1 Leeming to Barton scheme on-road trial were lower and within the speed limit at 49mph. On this scheme at the step down there was a VMS, a terminal sign and a VMS combination, which could have contributed to the better compliance.</p> <p>If the 60mph speed limit is rolled out within roadworks, it is likely that speeds will be compliant if the appropriate signing strategy is in place. The risk is likely to increase for the speed related hazards, but this is unlikely to exceed that experienced on a D3M at 70mph, reflecting the findings of the trials. This risk is therefore acceptable.</p>	Yes
	Road user vehicle not complying with speed limits through roadworks.	<p>(+) Whilst increased speed limits may lead to increased credibility and hence better speed compliance, there is a risk that drivers may not notice a step down in speed and, therefore, not comply with the reduced speed limit. Without a suitable solution, that clearly alerts drivers to the step down in speed, the risk is unlikely to be acceptable.</p> <p>Additionally, average speed enforcement cameras can only enforce a single speed limit. Additional cameras would be required to enforce two different speed limits. Any perception of reduced enforcement is likely to reduce compliance.</p> <p>The on-road trial on the M5 J4a-6 scheme found that compliance worsened after the step down in speed limit (from 60mph to 50mph), where average speeds were recorded at around 51-53mph. This suggests that drivers either missed the '50mph' VMS and terminal signs or deliberately continued to drive at above 50mph. This was also found in the survey results. Average speeds in the 50mph control location were 50mph, so speeds at the step down were slightly higher. This finding was reflected in the Highways England qualitative research on the M5 trial, where the step down in speed resulted in higher stress levels, confusion and unnecessary braking.</p> <p>Compliance on the A1 Leeming to Barton scheme was better, with average speeds reducing to 49mph at the radar located a few hundred meters downstream of the speed limit reduction. It was observed that compliance with the step down was better than in the 60mph speed limit in the middle of the scheme, suggesting that the VMS, terminal sign and VMS combination was noticed by drivers and was very effective at influencing them to reduce their speed. On the 60mph section compliance was at around 70%, which was much better compared to the 50mph baseline,</p>	Yes, with appropriate signage



Population	Hazard	Risk assessment for Scenario 1b – Step down in speed from 60mph to 50mph	Is risk acceptable?
		<p>where compliance was at around 40%.</p> <p>The TRL simulator trials found that for a step down in speed, the average distance at which the new speed limit was reached after encountering the speed limit change was 297m. It is therefore likely that on the M5 J4a-6 scheme on-road trial, drivers were still slowing down at the point that they were monitored.</p> <p>With the appropriate signage (as on the A1 Leeming to Barton scheme), road user speed limit compliance is likely to be acceptable if the 60mph speed limit is rolled out within roadworks, reflecting the findings from the on-road trials.</p>	
	<p>Road user vehicles striking road workers' equipment including TTM</p>	<p>(=) At higher speeds drivers have less reaction time. An increase in speed from 50 to 60mph increases thinking and breaking time by approximately 38% (53m to 73m). [13] This is likely to result in an increase in the number of TTM strikes. However, this is likely to be acceptable as road users will be getting a benefit from the speed increase.</p> <p>There were two incursions on the M5 J4a-6 scheme on-road trial in total throughout both the baseline and 60mph periods, but neither were identified by the scheme as having resulted from the change in speed limit. During the on-road trial on the A1 Leeming to Barton scheme there was no change in the number of incursions due to the increase in speed limit.</p> <p>Based on these findings, risks associated with vehicle striking road workers' equipment strikes (including TTM) are likely to remain acceptable.</p>	<p>Yes</p>
	<p>Vehicles tailgating</p>	<p>(-) Tailgating, in particular that amongst HGV drivers that regularly drive to the maximum of their 56mph speed limit during 50mph speed restrictions, would be expected to reduce significantly with speed limits increased to 60mph. This notion is supported by the findings of the M6 J36-37 trial. [4]</p> <p>There was no evidence that average headways were compromised on on-road trial on the A1 Leeming to Barton scheme.</p> <p>The on-road trial on the M5 J4a-6 scheme found that the introduction of the 60mph speed limit had little impact on close following by car drivers, but substantially reduced the amount recorded for HGV drivers.</p> <p>Based on these findings, instances of tailgating are likely to decrease with the rollout of the 60mph speed limit through roadworks.</p>	<p>Yes</p>
	<p>Vehicles changing lanes</p>	<p>(-) The M6 J36-37 trial [4] found positive changes in drivers' behaviour at 60mph. Improved speed harmonisation between different types of vehicles led to decreased overtaking and lane changing which in turn contributed to better convergence of lanes and improved flow of movement.</p> <p>During the on-road trial on the A1 Leeming to Barton scheme there was less overtaking reported in the 60mph section in the customer satisfaction survey.</p> <p>There was some evidence during the on-road trial on the M5 J4a-6 scheme that overtaking manoeuvres performed by HGVs was reduced through the 60mph speed limit. The change in speed limit did not change the overall lane choice of vehicles, however HGVs generally stayed in lanes 1 and 2 at 60mph, whereas HGVs used lane 3 more</p>	<p>Yes</p>

Population	Hazard	Risk assessment for Scenario 1b – Step down in speed from 60mph to 50mph	Is risk acceptable?
		<p>frequently at 50mph.</p> <p>This evidence suggests that with a rollout of the 60mph speed limit through roadworks, there will likely be less overtaking and lane changing.</p>	
Road User - Emergency Services	General speed related hazards	<p>(+) There is likely to be an increase in risk for the speed related hazards noted in Appendix D. However, this risk is unlikely to exceed that experienced on a D3M at the national speed limit of 70mph. The level of risk is acceptable since emergency services would typically accept the higher risks associated with driving on a D3M at the national speed limit (70mph).</p> <p>Although average speeds slightly exceeded the speed limit on the M5 J4a-6 scheme on-road trial (speeds were recorded at between 51-53mph) at the step down point, there is no evidence to suggest that any of the speed related hazards were significantly affected. Average speeds on the A1 Leeming to Barton scheme on-road trial were lower and within the speed limit at 49mph. On this scheme at the step down there was a VMS, a terminal sign and a VMS combination, which could have contributed to the better compliance.</p> <p>If the 60mph speed limit is rolled out within roadworks, it is likely that speeds will be compliant if the appropriate signing strategy is in place. The risk is likely to increase for the speed related hazards, but this is unlikely to exceed that experienced on a D3M at 70mph, reflecting the findings of the trials. This risk is therefore acceptable.</p>	Yes
	Road user vehicle not complying with speed limits through roadworks.	<p>(=) Reduced compliance (due to drivers failing to notice the step down in speed) may result in more incidents that require the emergency services to attend. Reduced compliance also increases the risk to emergency services attending incidents on the road. Without a suitable solution, that clearly alerts drivers to the step down in speed, the risk is unlikely to be acceptable.</p> <p>Compliance on both the A1 Leeming to Barton scheme was better than the M5 J4a-6 scheme – this is thought to be due to the signing strategy deployed on the A1 scheme. On the on-road trial on the A1 Leeming to Barton scheme there were no road traffic collisions within the areas subject to a 60mph speed limit. Six minor road traffic collisions were reported during the monitoring on the M5 J4a-6 scheme on-road trial; three in the baseline period and three in phase 2, however it was not possible to determine whether the change in speed limit was a contributory factor in any of these collisions.</p> <p>These findings therefore suggest that there will no change to the number of incidents that require the emergency services to attend with the rollout of 60mph through roadworks.</p>	Yes
	Vehicles tailgating	<p>(-) There may be fewer incidents to attend due to fewer instances of tailgating.</p> <p>For both the A1 Leeming to Barton scheme and the M5 J4a-6 scheme on-road trials there were fewer instances of tailgating. For the incidents that were reported during these trials, there was no indication that vehicles tailgating was the cause.</p> <p>These findings suggest that there will be fewer incidents that require the emergency services to attend with the rollout of 60mph through roadworks.</p>	Yes

Population	Hazard	Risk assessment for Scenario 1b – Step down in speed from 60mph to 50mph	Is risk acceptable?
	Vehicles changing lanes	(-) There may be fewer incidents to attend due to fewer instances of vehicles changing lanes. For both the A1 Leeming to Barton scheme and the M5 J4a-6 scheme on-road trials there were fewer instances of overtaking. For the incidents that were reported during these trials, there was no indication that vehicles changing lanes was the cause. These findings suggest that there will be fewer incidents that require the emergency services to attend with the rollout of 60mph through roadworks.	Yes
	Exposure to traffic when responding to incidents in live lanes.	(=) Emergency Services exposed to higher speed traffic when responding to incidents in live lanes. However, at high flows, the loss of a lane is likely to slow the traffic in adjacent lanes so the risk is unlikely to be greater than in the baseline. At low flows (e.g. at night) the risk is increased but is unlikely to be higher than on a normal motorway at 70mph. There was no evidence found during the A1 Leeming to Barton scheme on-road trial and M5 J4a-6 scheme on-road trial to suggest that the risk to emergency services increased.	Yes
	Exposure to construction activities when responding to incidents within the work site.	(=) Minimal construction work will be taking place within the site.	Yes

The results of the qualitative assessment conclude that for road users there is likely to be an increase in risk associated with drivers failing to notice the step down in speed. Without a suitable solution, that clearly alerts drivers to the step down in speed, the risk is unlikely to be acceptable. This finding was reflected in the trials. The A1 Leeming to Barton scheme on-road trial had a VMS, terminal sign and VMS combination at the step down and compliance was very good on that scheme. In comparison, the M5 J4a-6 scheme on-road trial had less signage and compliance was worse.

Note – this problem does not apply to scenario 1a, where there is a step up in speed, and any failure to notice the change only results in drivers travelling at less than the speed limit.

### Road workers

Population	Hazard	Risk assessment for Scenario 1b – Step down in speed from 60mph to 50mph	Is risk acceptable?
Road workers - construction workers	Construction workers' exposure to traffic when setting up TTM	<p>(+) Construction workers will have to carry out an additional activity of changing the speed limit signs from 50mph to 60mph. The risk is likely to be acceptable so long as a safe method of working is adopted. For example on the M1 J34-35a trial, signs were changed during a carriageway closure, implemented using a police rolling road block.</p> <p>On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported.</p> <p>If the 60mph speed limit is rolled out through roadworks, the risk is likely to remain acceptable so long as a safe method of working is adopted.</p>	Yes
	Construction workers' exposure to traffic when working in closed lane.	<p>(=) A step down in speed might be used as traffic approaches a section of the scheme where works are taking place within the closed lanes. There is a risk that drivers will not notice the step down in speed, and therefore not comply with the lower speed limit. This could lead to higher speeds within sections where the TTM is not designed to accommodate them (e.g. narrow lanes) increasing the risk of vehicles colliding with the TTM and encroaching on the work site.</p> <p>On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported. There was also no change in the number of incursions due to the increase in speed limit.</p> <p>This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks associated with vehicles colliding with the TTM and encroaching on the work site. There was minimal work taking place on the site are likely to remain acceptable. There was minimal work taking place on site, so this would need to be taken into account with rollout.</p>	Yes, so long as minimal work takes place in closed lane
	Construction workers' exposure attending and relocating cones that have been struck by traffic	<p>(+) Road user vehicles travelling at higher speeds have less time to react to road environment or take evasive action, therefore potentially increasing the likelihood of collisions with road workers who are replacing struck cones. However, there does not appear to be a history of near misses for this activity.</p> <p>It is possible that vehicles travelling at higher speed (60mph) will increase the frequency of cone strikes. This needs to be monitored to ensure the risk remains acceptable. In addition, following a step down in speed, poor non-compliance is likely to increase both the likelihood and severity of TTM strikes.</p> <p>On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported and no changes in the number of incursions.</p>	No
	Construction vehicles entering and leaving the work site from the main carriageway.	<p>(=) Access to and exit from the work site will be more difficult and hazardous at higher speed. In addition, at 60mph all of the lorries will be travelling at the constant speed in lanes 1 and 2 whereas at 50mph some lorries will be overtaking in lane 2. This can have an effect of creating a wall of lorries in lane 1 making it be difficult for works vehicles to re-join the main carriageway. This needs to be monitored to ensure the risk remains acceptable.</p> <p>However, on the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported. There was no evidence to suggest that access to and exit from the work site was compromised.</p> <p>This evidence suggests that if the 60mph speed limit is rolled out through roadworks, the risk to roadworkers</p>	Yes

Population	Hazard	Risk assessment for Scenario 1b – Step down in speed from 60mph to 50mph	Is risk acceptable?
		entering and leaving the roadworks site is likely to remain acceptable.	
Road workers – Traffic Officer Service	Traffic officers implementing a RRB	(=) The risks associated with implementing a RRB will increase slightly with speed. However the risk will be lower than on a normal motorway at 70mph. Therefore the risk is likely to be acceptable. On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported. This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks associated with Traffic Officers implementing an RRB are likely to remain acceptable.	Yes
	Traffic officers on foot when a RRB is in place	(=) Once the RRB is in place, vehicles should not be in proximity to the location of the traffic officer on foot. Overall the risk is likely to be acceptable. On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported. This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks to Traffic Officers on foot when an RRB is in place are likely to remain acceptable.	Yes
	Traffic officers attending live lane incidents	(=) In most cases congestion caused by the incident will reduce speeds. However at low flows, vehicles will be able to travel past the incident at higher speeds. In most cases, traffic officers will be working under the protection of a RRB or lane closure, in line with their procedures. There is a risk that, if speed compliance following a step down in speed is poor, the risk to TOS attending live lane incidents will increase. Without a suitable solution, that clearly alerts drivers to the step down in speed, the risk is unlikely to be acceptable. On the on-road trial on the A1 Leeming to Barton scheme, Traffic Officers reported an improvement in time taken to respond to incidents within and outside of the road works scheme. There were no incidents or near misses reported. This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks to Traffic Officers attending live lane incidents are likely to remain acceptable.	Yes
Road workers - Free recovery operator	Recovery Operators will be exposed to traffic when responding to incidents in live lanes.	(=) Recovery operators will be exposed to higher speed traffic. However the recovery operator's method statement may include appropriate means of working (such as only recovering vehicles when protection is provided by an Impact Protection Vehicle, TOS or police). A review of local arrangements will be required to determine whether the risk to recovery operators is acceptable. There was no evidence found during the A1 Leeming to Barton scheme on-road trial to suggest that the risk to free recovery operators increased.	Depends on local method statement
	Recovery Operators being exposed to construction activities when responding to incidents within	(=) Minimal construction work will be taking place within the site where the 60mph speed limit is in force. Therefore the risk is likely to be acceptable. There was no evidence found during the A1 Leeming to Barton scheme on-road trial to suggest that the risk to free recovery operators increased.	Yes

Population	Hazard	Risk assessment for Scenario 1b – Step down in speed from 60mph to 50mph	Is risk acceptable?
	the work site.		

The safety risk to construction workers and TOS is increased due to the possibility that drivers will not notice the step down in speed limit, and therefore fail to comply. Without a suitable solution, that clearly alerts drivers to the step down in speed, the risk is unlikely to be acceptable. This finding was reflected in the trials. The A1 Leeming to Barton scheme on-road trial had a VMS, terminal sign and VMS combination at the step down and compliance was very good on that scheme. In comparison, the M5 J4a-6 scheme on-road trial had less signage and compliance was worse.

## Scenario 2a – Technology commissioning, lane 1 closed with cones

### Road users

Population	Hazard	Risk assessment for Scenario 2a – Technology commissioning with TTM in place	Is risk acceptable?
Road user - Drivers	General speed related hazards	<p>(+) There is likely to be an increase in risk for the speed related hazards noted in Appendix D. However, this risk is unlikely to exceed that experienced on a D3M at the national speed limit of 70mph. The level of risk is acceptable since road users would typically accept the higher risks associated with driving on a D3M at the national speed limit (70mph).</p> <p>Although average speeds increased on the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials, they were compliant and there is no evidence to suggest that any of the speed related hazards were significantly affected. The Highways England qualitative research on the M5 trial found that more people showed a decrease in average heart rate as they experienced travelling in a 60mph zone rather than 50mph, suggesting that drivers are calmer at 60mph.</p> <p>If the 60mph speed limit is rolled out within roadworks, it is likely that speeds will be compliant. The risk is likely to increase for the speed related hazards, but this is unlikely to exceed that experienced on a D3M at 70mph, reflecting the findings of the trials. This risk is therefore acceptable.</p>	Yes
	Road user vehicle not complying with speed limits through roadworks.	<p>(-) Increasing speed limits may lead to increased credibility and hence better speed compliance. Credibility is thought to be a particular problem where there is no visible construction activity taking place, such as those scenarios targeted by the trials.</p> <p>There is little evidence of poor speed compliance within roadworks and [3] found that 92% of those questioned stated that they comply with speed limits within roadworks. The one area of concern is around HGV speed compliance. Increasing the speed limit to 60mph would result in 100% compliance of HGV vehicles as they will be limited to 56mph.</p> <p>It should be noted that average speed enforcement systems can only enforce a single speed limit. Additional cameras and infrastructure would be required to enforce two different speed limits. Any perception of reduced enforcement is likely to reduce compliance.</p> <p>The on-road trial on the M5 J4a-6 scheme found that average speeds increased to around 55-57mph, so compliance was generally good. HGV driver compliance was better than that observed for car drivers (probably due to the speed limiter devices in HGVs). In this scenario, only 18% of drivers were travelling above the speed limit, compared to 54% in the 50mph baseline.</p> <p>On the M1 J32-35a scheme on-road trial, average speeds increased to around 53.5mph, suggesting that some drivers noticed the change in speed limit. Throughout the monitoring period the average speed remained below</p>	Yes

Population	Hazard	Risk assessment for Scenario 2a – Technology commissioning with TTM in place	Is risk acceptable?
		<p>60mph indicating that there was good compliance. In the baseline 50mph scenario, compliance was worse, with average speeds of 50mph being recorded.</p> <p>Based on these findings, compliance is likely to improve with rollout of the 60mph speed limit through roadworks.</p>	
	<p><b>Road user vehicles striking road workers' equipment including TTM</b></p>	<p>(=) At higher speeds drivers have less reaction time. An increase in speed from 50 to 60mph increases thinking and breaking time by approximately 38% (53m to 73m). [13] This is likely to result in an increase in the number of TTM strikes. However, this is likely to be acceptable as road users will be getting a benefit from the speed increase.</p> <p>There were two incursions on the M5 J4a-6 scheme on-road trial in total throughout both the baseline and 60mph periods, where neither were identified by the scheme as having resulted due to the change in speed limit. The number of incursions on the M1 J32-35a scheme remained fairly stable across the monitoring period.</p> <p>Based on these findings, road workers' equipment strikes (including TTM) are likely to remain the same as at 50mph with rollout of the 60mph speed limit through roadworks.</p>	Yes
	<p><b>Vehicles tailgating</b></p>	<p>(-) Tailgating, in particular that amongst HGV drivers that regularly drive to the maximum of their 56mph speed limit during 50mph speed restrictions, would be expected to reduce significantly with speed limits increased to 60mph. This notion is supported by the findings of the M6 J36-37 trial. [4]</p> <p>The on-road trial on the M5 J4a-6 scheme found that the introduction of the 60mph speed limit had little impact on close following by car drivers, but substantially reduced the amount recorded for HGV drivers. The Highways England qualitative research on the M5 trial found that participants felt safer and reported less tailgating at 60mph compared to 50mph.</p> <p>On the M1 J32-35a scheme on-road trial average headway was typically much larger than the 2 second rule, suggesting that generally safe stopping distances were maintained between vehicles.</p> <p>Based on these findings, instances of tailgating are likely to decrease with the rollout of the 60mph speed limit through roadworks.</p>	Yes
	<p><b>Vehicles changing lanes</b></p>	<p>(-) The M6 J36-37 trial [4] found positive changes in drivers' behaviour at 60mph. Improved speed harmonisation between different types of vehicles led to decreased overtaking and lane changing which in turn contributed to better convergence of lanes and improved flow of movement.</p> <p>There was some evidence during the on-road trial on the M5 J4a-6 scheme that overtaking manoeuvres performed by HGVs was reduced in the 60mph speed limit. The change in speed limit did not change the overall lane choice of vehicles, however HGVs generally stayed in lanes 1 and 2 at 60mph, whereas HGVs used lane 3 more frequently at 50mph. The Highways England qualitative research on the M5 trial found that participants felt safer and reported less lane changing at 60mph compared to 50mph.</p> <p>On the M1 J32-35a scheme on-road trial, overtaking by lorry drivers through the roadworks as reported as making survey participants feel unsafe. Overtaking was reported less in the 60mph section than in the 50mph section of</p>	Yes



Population	Hazard	Risk assessment for Scenario 2a – Technology commissioning with TTM in place	Is risk acceptable?
		<p>roadworks, suggesting an improvement with the 60mph speed limit.</p> <p>This evidence suggests that with a rollout of the 60mph speed limit through roadworks, there will likely be less overtaking and lane changing.</p>	
Road User - Emergency Services	General speed related hazards	<p>(+) There is likely to be an increase in risk for the speed related hazards noted in Appendix D. However, this risk is unlikely to exceed that experienced on a D3M at the national speed limit of 70mph. The level of risk is acceptable since emergency services would typically accept the higher risks associated with driving on a D3M at the national speed limit (70mph).</p> <p>Although average speeds increased on the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials, they were compliant and there is no evidence to suggest that any of the speed related hazards were significantly affected.</p> <p>If the 60mph speed limit is rolled out within roadworks, it is likely that speeds will be compliant. The risk is likely to increase for the speed related hazards, but this is unlikely to exceed that experienced on a D3M at 70mph, reflecting the findings of the trials. This risk is therefore acceptable.</p>	Yes
	Road user vehicle not complying with speed limits through roadworks.	<p>(-) With improved compliance there may be fewer incidents that require the emergency services to attend. Improved compliance also reduces the risk to emergency services attending incidents on the road.</p> <p>Speed compliance on both the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials was better than at 50mph. Six minor road traffic collisions were reported during the monitoring on the M5 J4a-6 scheme on-road trial; three in the baseline period and three in phase 2, however it was not possible to determine whether the change in speed limit was a contributory factor in any of these collisions. There were four road traffic collisions reported during the monitoring on the M1 J32-35a scheme on-road trial in the 60mph period, compared to three collisions in the 50mph baseline period. There was no indication that these collisions were due to the increased speed limit.</p> <p>These findings suggest that there will be fewer incidents that require the emergency services to attend with the rollout of 60mph through roadworks.</p>	Yes
	Vehicles tailgating	<p>(-) There may be fewer incidents to attend due to fewer instances of tailgating.</p> <p>On both the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials there was less tailgating observed and for the incidents that were reported on the both on-road trials, there was no indication that vehicles tailgating was the cause.</p> <p>These findings suggest that there will be fewer incidents resulting from tailgating that require the emergency services to attend with the rollout of 60mph through roadworks.</p>	Yes
	Vehicles changing lanes	<p>(-) There may be fewer incidents to attend due to fewer instances of vehicles changing lanes.</p> <p>On both the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials there was less overtaking and lane changing. For the incidents that were reported, there was no indication that vehicles changing lanes was the cause.</p> <p>These findings suggest that there will be fewer incidents resulting from lane changing that require the emergency</p>	Yes

Population	Hazard	Risk assessment for Scenario 2a – Technology commissioning with TTM in place	Is risk acceptable?
		services to attend with the rollout of 60mph through roadworks.	
	Exposure to traffic when responding to incidents in live lanes.	(=) Emergency Services exposed to higher speed traffic when responding to incidents in live lanes. However, at high flows, the loss of a lane is likely to slow the traffic in adjacent lanes so the risk is unlikely to be greater than in the baseline. At low flows (e.g. at night) the risk is increased but is unlikely to be higher than on a normal motorway at 70mph. There was no evidence found during the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials to suggest that the risk to emergency services increased.	Yes
	Exposure to construction activities when responding to incidents within the work site.	(=) Minimal construction work will be taking place within the site.	Yes

The results of the qualitative assessment conclude that for road users there is likely to be an increase in risk associated with general speed related hazards if speed is increased from 50mph to 60mph. However, drivers would typically accept this risk when driving on a D3M at 70mph. In general speed compliance is already fairly good. However, there may be some safety benefit associated with a reduced speed differential due to improved speed compliance by HGVs.

### Road workers

Population	Hazard	Risk assessment for Scenario 2a – Technology commissioning with TTM in place	Is risk acceptable?
Road workers - construction workers	Construction workers' exposure to traffic when setting up TTM	(+) Construction workers will have to carry out an additional activity of changing the speed limit signs from 50mph to 60mph. The risk is likely to be acceptable so long as a safe method of working is adopted. For example on the M1 J34-35a trial, signs were changed during a carriageway closure, implemented using a police rolling road block. None of the participants in the focus group for the M1 J32-35a scheme on-road trial reported any events or experiences that diminished their safety during the trial. If the 60mph speed limit is rolled out through roadworks, the risk is likely to remain acceptable so long as a safe method of working is adopted.	Yes, with a safe method of working

Population	Hazard	Risk assessment for Scenario 2a – Technology commissioning with TTM in place	Is risk acceptable?
	Construction workers' exposure to traffic when working in closed lane.	<p>(=) Increased speed increases the risk of vehicles colliding with the TTM and encroaching on the work site. However, it is assumed that there will be minimal work taking place in the closed lane. Therefore, so long as this assumption is valid, the risk to construction workers is unchanged.</p> <p>None of the participants in the focus group for the M1 J32-35a scheme on-road trial reported any events or experiences that diminished their safety during the trial. The number of incursions on the M1 J32-35a scheme remained fairly stable across the monitoring period.</p> <p>This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks associated with vehicles colliding with the TTM and encroaching on the work site will remain acceptable. There was minimal work taking place on the site, so this would need to be taken into account with rollout.</p>	Yes, so long as minimal work takes place in closed lane
	Construction workers' exposure attending and relocating cones that have been struck by traffic	<p>(+) Road user vehicles travelling at higher speeds have less time to react to road environment or take evasive action, therefore potentially increasing the likelihood of collisions with road workers who are replacing struck cones. However, there does not appear to be a history of near misses for this activity.</p> <p>It is possible that vehicles travelling at higher speed (60mph) will increase the frequency of cone strikes. This needs to be monitored to ensure the risk remains acceptable.</p> <p>None of the participants in the focus group for the M1 J32-35a scheme on-road trial reported any events or experiences that diminished their safety during the trial.</p>	Yes, with monitoring
	Construction vehicles entering and leaving the work site from the main carriageway.	<p>(=) Access to and exit from the work site will be more difficult and hazardous at higher speed. In addition, at 60mph all of the lorries will be travelling at the constant speed in lanes 1 and 2 whereas at 50mph some lorries will be overtaking in lane 2. This can have an effect of creating a wall of lorries in lane 1 making it be difficult for works vehicles to re-join the main carriageway. This needs to be monitored to ensure the risk remains acceptable.</p> <p>However, none of the participants in the focus group for the M1 J32-35a scheme on-road trial reported any events or experiences that diminished their safety during the trial.</p> <p>This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks associated with roadworkers entering and leaving the roadworks site are likely to remain acceptable.</p>	Yes
Road workers – Traffic Officer Service	Traffic officers implementing a RRB	<p>(=) The risks associated with implementing a RRB will increase slightly with speed. However the risk will be lower than on a normal motorway at 70mph. Therefore the risk is likely to be acceptable.</p> <p>There was no evidence found during the M1 J32-35a scheme on-road trial to suggest that the risk to Traffic Officers increased when implementing an RRB.</p>	Yes
	Traffic officers on foot when a RRB is in place	<p>(=) Once the RRB is in place, vehicles should not be in proximity to the location of the traffic officer on foot. Overall the risk is likely to be acceptable.</p> <p>There was no evidence found during the M1 J32-35a scheme on-road trial to suggest that the risk to Traffic Officers increased when on foot when an RRB is in place.</p>	Yes

Population	Hazard	Risk assessment for Scenario 2a – Technology commissioning with TTM in place	Is risk acceptable?
	Traffic officers attending live lane incidents	(=) In most cases congestion caused by the incident will reduce speeds. However at low flows, vehicles will be able to travel past the incident at higher speeds. In most cases, traffic officers will be working under the protection of a RRB or lane closure, in line with their procedures. Overall the risk is likely to be acceptable. There was no evidence found during the M1 J32-35a scheme on-road trial to suggest that the risk to Traffic Officers increased when attending live lane incidents.	Yes
Road workers - Free recovery operator	Recovery Operators will be exposed to traffic when responding to incidents in live lanes.	(=) Recovery operators will be exposed to higher speed traffic. However the recovery operator's method statement may include appropriate means of working (such as only recovering vehicles when protection is provided by an Impact Protection Vehicle, TOS or police). A review of local arrangements will be required to determine whether the risk to recovery operators is acceptable. There was no evidence found during the M1 J32-35a scheme on-road trial to suggest that the risk to free recovery operators increased.	Depends on local method statement
	Recovery Operators being exposed to construction activities when responding to incidents within the work site.	(=) Minimal construction work will be taking place within the site. Therefore the risk is likely to be acceptable. There was no evidence found during the M1 J32-35a scheme on-road trial to suggest that the risk to free recovery operators increased.	Yes

The results of the qualitative assessment conclude that there will be a small increase in risk for construction workers. This risk is likely to be acceptable so long as minimal work takes place in the closed sections of carriageway and a safe method of working is adopted.

The risk to free recovery operators is dependent on their specific method statement. Where protection is required, prior to removing vehicles from the carriageway, the risk is likely to be acceptable.

The risk to the TOS is unlikely to change significantly with the increase in speed.

**Scenario 2b – Technology commissioning, all TTM removed**

**Road users**

Population	Hazard	Risk assessment for Scenario 2b – Technology commissioning with no TTM in place	Is risk acceptable?
Road user - Drivers	General speed related hazards	<p>(+) There is likely to be an increase in risk for the speed related hazards noted in Appendix D. However, this risk is unlikely to exceed that experienced on a D3M at the national speed limit of 70mph. The level of risk is acceptable since road users would typically accept the higher risks associated with driving on a D3M at the national speed limit (70mph).</p> <p>Although average speeds increased on the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials, they were compliant and there is no evidence to suggest that any of the speed related hazards were significantly affected. The Highways England qualitative research on the M5 trial found that more people showed a decrease in average heart rate as they experienced travelling in a 60mph zone rather than 50mph, suggesting that drivers are calmer at 60mph.</p> <p>If the 60mph speed limit is rolled out within roadworks, it is likely that speeds will be compliant. The risk is likely to increase for the speed related hazards, but this is unlikely to exceed that experienced on a D3M at 70mph, reflecting the findings of the trials. This risk is therefore acceptable.</p>	Yes
	Road user vehicle not complying with speed limits through roadworks.	<p>(-) Increasing speed limits may lead to increased credibility and hence better speed compliance. Credibility is thought to be a particular problem where there is no visible construction activity taking place, such as those targeted by the trials.</p> <p>There is little evidence of poor speed compliance within roadworks and [3] found that 92% of those questioned stated that they comply with speed limits within roadworks. The one area of concern is around HGV speed compliance. Increasing the speed limit to 60mph would result in 100% compliance of HGV vehicles as they will be limited to 56mph.</p> <p>It should be noted that average speed enforcement systems can only enforce a single speed limit. Additional cameras and infrastructure would be required to enforce two different speed limits. Any perception of reduced enforcement is likely to reduce compliance.</p> <p>The on-road trial on the M5 J4a-6 scheme found that average speeds increased to around 56-58mph, so compliance was generally good. HGV driver compliance was better than that observed for car drivers (probably due to the speed limiter devices in HGVs). Compliance was worse in this scenario compared to phase 1 (scenario 2a), with 26% of drivers travelling above the speed limit. This was still better than the 50mph baseline, where 54% of drivers were travelling above the speed limit.</p> <p>On the M1 J32-35a scheme on-road trial average speeds increased to around 58-59mph. Throughout the</p>	Yes

Population	Hazard	Risk assessment for Scenario 2b – Technology commissioning with no TTM in place	Is risk acceptable?
		<p>monitoring period the average speed remained below 60mph indicating that there was good compliance. In the baseline 50mph scenario, compliance was worse, with average speeds of 50mph being recorded.</p> <p>Based on these findings, compliance is likely to improve with rollout of the 60mph speed limit through roadworks.</p>	
	<p>Road user vehicles striking road workers' equipment including TTM</p>	<p>Not applicable – no TTM present</p>	<p>n/a</p>
	<p>Vehicles tailgating</p>	<p>(-) Tailgating, in particular that amongst HGV drivers that regularly drive to the maximum of their 56mph speed limit during 50mph speed restrictions, would be expected to reduce significantly with speed limits increased to 60mph. This notion is supported by the findings of the M6 J36-37 trial. [4]</p> <p>The on-road trial on the M5 J4a-6 scheme found that the introduction of the 60mph speed limit had little impact on close following by car drivers, but substantially reduced the amount recorded for HGV drivers. The Highways England qualitative research on the M5 trial found that participants felt safer and reported less tailgating at 60mph compared to 50mph.</p> <p>On the M1 J32-35a scheme on-road trial average headway was typically much larger than the 2 second rule, suggesting that generally safe stopping distances were maintained between vehicles.</p> <p>Based on these findings, instances of tailgating are likely to decrease with the rollout of the 60mph speed limit through roadworks.</p>	<p>Yes</p>
	<p>Vehicles changing lanes</p>	<p>(-) The M6 J36-37 trial [4] found positive changes in drivers' behaviour at 60mph. Improved speed harmonisation between different types of vehicles led to decreased overtaking and lane changing which in turn contributed to better convergence of lanes and improved flow of movement.</p> <p>There was some evidence during the on-road trial on the M5 J4a-6 scheme that overtaking manoeuvres performed by HGVs was reduced in the 60mph speed limit. The change in speed limit did not change the overall lane choice of vehicles, however HGVs generally stayed in lanes 1 and 2 at 60mph, whereas HGVs used lane 3 more frequently at 50mph. The Highways England qualitative research on the M5 trial found that participants felt safer and reported less lane changing at 60mph compared to 50mph.</p> <p>On the M1 J32-35a scheme on-road trial, overtaking by lorry drivers through the roadworks as reported as making survey participants feel unsafe. Overtaking was reported less in the 60mph section than in the 50mph section of roadworks, suggesting an improvement with the 60mph speed limit.</p> <p>This evidence suggests that with a rollout of the 60mph speed limit through roadworks, there will likely be less overtaking and lane changing.</p>	<p>Yes</p>

Population	Hazard	Risk assessment for Scenario 2b – Technology commissioning with no TTM in place	Is risk acceptable?
Road User - Emergency Services	General speed related hazards	<p>(+) There is likely to be an increase in risk for the speed related hazards noted in Appendix D. However, this risk is unlikely to exceed that experienced on a D3M at the national speed limit of 70mph. The level of risk is acceptable since emergency services would typically accept the higher risks associated with driving on a D3M at the national speed limit (70mph).</p> <p>Although average speeds increased on the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials, they were compliant and there is no evidence to suggest that any of the speed related hazards were significantly affected.</p> <p>If the 60mph speed limit is rolled out within roadworks, it is likely that speeds will be compliant. The risk is likely to increase for the speed related hazards, but this is unlikely to exceed that experienced on a D3M at 70mph, reflecting the findings of the trials. This risk is therefore acceptable.</p>	Yes
	Road user vehicle not complying with speed limits through roadworks.	<p>(-) With improved compliance there may be fewer incidents that require the emergency services to attend. Improved compliance also reduces the risk to emergency services attending incidents on the road.</p> <p>Speed compliance on both the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials was better than at 50mph. Six minor road traffic collisions were reported during the monitoring on the M5 J4a-6 scheme on-road trial; three in the baseline period and three in phase 2, however it was not possible to determine whether the change in speed limit was a contributory factor in any of these collisions. There were four road traffic collisions reported during the monitoring on the M1 J32-35a scheme on-road trial. There was no indication that these collisions were due to the increased speed limit.</p> <p>These findings suggest that there will be fewer incidents associated with poor speed compliance that require the emergency services to attend with the rollout of 60mph through roadworks.</p>	Yes
	Vehicles tailgating	<p>(-) There may be fewer incidents to attend due to fewer instances of tailgating.</p> <p>On both the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials there was less tailgating observed and for the incidents that were reported on the both on-road trials, there was no indication that vehicles tailgating was the cause.</p> <p>These findings suggest that there will be fewer incidents associated with tailgating that require the emergency services to attend with the rollout of 60mph through roadworks.</p>	Yes
	Vehicles changing lanes	<p>(-) There may be fewer incidents to attend due to fewer instances of vehicles changing lanes.</p> <p>On both the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials there was less overtaking and lane changing. For the incidents that were reported, there was no indication that vehicles changing lanes was the cause.</p> <p>These findings suggest that there will be fewer incidents associated with lane changing that require the emergency services to attend with the rollout of 60mph through roadworks.</p>	Yes
	Exposure to traffic when	<p>(=) Emergency Services exposed to higher speed traffic when responding to incidents in live lanes. However, at high flows, the loss of a lane is likely to slow the traffic in adjacent lanes so the risk is unlikely to be greater than in</p>	Yes



Population	Hazard	Risk assessment for Scenario 2b – Technology commissioning with no TTM in place	Is risk acceptable?
	responding to incidents in live lanes.	the baseline. At low flows (e.g. at night) the risk is increased but is unlikely to be higher than on a normal motorway at 70mph. There was no evidence found during the M5 J4a-6 scheme and M1 J32-35a scheme on-road trials to suggest that the risk to emergency services increased.	
	Exposure to construction activities when responding to incidents within the work site.	(=) No construction work will be taking place within the site.	Yes

The results of the qualitative assessment conclude that for road users there is likely to be an increase in risk associated with general speed related hazards if speed is increased from 50mph to 60mph. However, drivers would typically accept this risk when driving on a D3M at 70mph. In general speed compliance is already fairly good. However, there may be some safety benefit associated with a reduced speed differential due to improved speed compliance by HGVs.

### Road workers

Population	Hazard	Risk assessment for Scenario 2b – Technology commissioning with no TTM in place	Is risk acceptable?
Road workers - construction workers	Construction workers' exposure to traffic when setting up TTM	(=) The fixed plate speed limit signs will already have been changed from 50mph to 60mph during scenario 2a. Therefore there is no additional exposure for workers during this scenario.	Yes
	Construction workers' exposure to traffic when working in closed lane.	Not applicable – there are no closed lanes	n/a
	Construction workers'	Not applicable – there is no TTM in place	n/a



Population	Hazard	Risk assessment for Scenario 2b – Technology commissioning with no TTM in place	Is risk acceptable?
	exposure attending and relocating cones that have been struck by traffic		
	Construction vehicles entering and leaving the work site from the main carriageway.	Not applicable – there is no work site	n/a
Road workers – Traffic Officer Service	Traffic officers implementing a RRB	(=) The risks associated with implementing a RRB will increase slightly with speed. However the risk will be lower than on a normal motorway at 70mph. Therefore the risk is likely to be acceptable. There was no evidence found during the M1 J32-35a scheme on-road trial to suggest that the risk to Traffic Officers increased when implementing an RRB.	Yes
	Traffic officers on foot when a RRB is in place	(=) Once the RRB is in place, vehicles should not be in proximity to the location of the traffic officer on foot. Overall the risk is likely to be acceptable. There was no evidence found during the M1 J32-35a scheme on-road trial to suggest that the risk to Traffic Officers increased when on foot when an RRB is in place.	Yes
	Traffic officers attending live lane incidents	(=) In most cases congestion caused by the incident will reduce speeds. However at low flows, vehicles will be able to travel past the incident at higher speeds. In most cases, traffic officers will be working under the protection of a RRB or lane closure, in line with their procedures. Overall the risk is likely to be acceptable. There was no evidence found during the M1 J32-35a scheme on-road trial to suggest that the risk to Traffic Officers increased when attending live lane incidents.	Yes
Road workers - Free recovery operator	Recovery Operators will be exposed to traffic when responding to incidents in live lanes.	(=) Recovery operators will be exposed to higher speed traffic. However the recovery operator's method statement may include appropriate means of working (such as only recovering vehicles when protection is provided by an Impact Protection Vehicle, TOS or police). A review of local arrangements will be required to determine whether the risk to recovery operators is acceptable. There was no evidence found during the M1 J32-35a scheme on-road trial to suggest that the risk to free recovery operators increased.	Depends on local method statement
	Recovery	(=) Minimal construction work will be taking place within the site. Therefore the risk is likely to be acceptable.	Yes

Population	Hazard	Risk assessment for Scenario 2b – Technology commissioning with no TTM in place	Is risk acceptable?
	Operators being exposed to construction activities when responding to incidents within the work site.	There was no evidence found during the M1 J32-35a scheme on-road trial to suggest that the risk to free recovery operators increased.	

The results of the qualitative assessment conclude that there is no increase in risk for construction workers as no physical works will be taking place on site.

The risk to free recovery operators is dependent on their specific method statement. Where protection is required, prior to removing vehicles from the carriageway, the risk is likely to be acceptable.

The risk to the TOS is unlikely to change significantly with the increase in speed.

### Scenario 3

#### Road users

Population	Hazard	Risk assessment for Scenario 3 – Weekends and public holidays	Is risk acceptable?
Road user - Drivers	General speed related hazards	<p>(+) There is likely to be an increase in risk for the speed related hazards noted in Appendix D. However, this risk is unlikely to exceed that experienced on a D3M at the national speed limit of 70mph. The level of risk is acceptable since road users would typically accept the higher risks associated with driving on a D3M at the national speed limit (70mph).</p> <p>Although average speeds increased on the A1 Leeming to Barton scheme on-road trial to 56mph, they were compliant and there is no evidence to suggest that any of the speed related hazards were significantly affected.</p> <p>If the 60mph speed limit is rolled out within roadworks, it is likely that speeds will be compliant. The risk is likely to increase for the speed related hazards, but this is unlikely to exceed that experienced on a D3M at 70mph, reflecting the findings of the trials. This risk is therefore acceptable.</p>	Yes
	Road user vehicle not complying with speed limits through roadworks.	<p>(-) Increasing speed limits may lead to increased credibility and hence better speed compliance. Credibility is thought to be a particular problem where there is no visible construction activity taking place, such as at weekends and public holidays, so this may be a particular benefit within scenario 3.</p> <p>There is little evidence of poor speed compliance within roadworks and [3] found that 92% of those questioned stated that they comply with speed limits within roadworks. The one area of concern is around HGV speed compliance. Increasing the speed limit to 60mph would result in 100% compliance of HGV vehicles as they will be limited to 56mph.</p> <p>The perception of speed enforcement will need to be maintained.</p> <p>The on-road trial on the A1 Leeming to Barton scheme found that average speeds remained below 60mph throughout the trial. On the northbound carriageway, average speeds were recorded at 58mph and on the southbound carriageway, average speeds were recorded at 56mph. The proportion of vehicles travelling faster than the enforcement threshold was less than 1%. Compliance was at around 70% on the 60mph section, which was much better compared to the 50mph baseline, where compliance was at around 40%.</p> <p>Based on these findings, compliance is likely to improve with rollout of the 60mph speed limit through roadworks.</p>	Yes – so long as the perception of speed enforcement is maintained
	Road user vehicles striking road workers' equipment	<p>(=) At higher speeds drivers have less reaction time. An increase in speed from 50 to 60mph increases thinking and braking time by approximately 38% (53m to 73m). [13] This is likely to result in an increase in the number of TTM strikes. However, this is likely to be acceptable as road users will be getting a benefits from the speed increase.</p> <p>During the on-road trial on the A1 Leeming to Barton scheme there was no change in the number of incursions due</p>	Yes

Population	Hazard	Risk assessment for Scenario 3 – Weekends and public holidays	Is risk acceptable?
	including TTM	to the increase in speed limit and no road traffic collisions in the 60mph section of the scheme. Based on these findings, risks associated with road workers' equipment strikes (including TTM) are likely to remain acceptable.	
	Vehicles tailgating	(-) Tailgating, in particular that amongst HGV drivers that regularly drive to the maximum of their 56mph speed limit during 50mph speed restrictions, would be expected to reduce significantly with speed limits increased to 60mph. This notion is supported by the findings of the M6 J36-37 trial. [4]  There was no evidence that average headways were compromised on on-road trial on the A1 Leeming to Barton scheme. Although not evidence from a 'holiday period' trial, the on-road trial on the M5 J4a-6 scheme found that the introduction of the 60mph speed limit had little impact on close following by car drivers, but substantially reduced the amount recorded for HGV drivers.  Based on these findings, instances of tailgating are likely to decrease with the rollout of the 60mph speed limit through roadworks.	Yes
	Vehicles changing lanes	(-) The M6 J36-37 trial [4] found positive changes in drivers' behaviour at 60mph. Improved speed harmonisation between different types of vehicles led to decreased overtaking and lane changing which in turn contributed to better convergence of lanes and improved flow of movement.  During the on-road trial on the A1 Leeming to Barton scheme there was less overtaking reported in the 60mph section in the customer satisfaction survey.  Although not evidence from a 'holiday period' trial, the M5 J4a-6 scheme on-road trial found that there was some evidence that overtaking manoeuvres performed by HGVs was reduced through the 60mph speed limit. The change in speed limit did not change the overall lane choice of vehicles, however HGVs generally stayed in lanes 1 and 2 at 60mph, whereas HGVs used lane 3 more frequently at 50mph.  This evidence suggests that with a rollout of the 60mph speed limit through roadworks, there will likely be less overtaking and lane changing.	Yes
Road User - Emergency Services	General speed related hazards	(+) There is likely to be an increase in risk for the speed related hazards noted in Appendix D. However, this risk is unlikely to exceed that experienced on a D3M at the national speed limit of 70mph. The level of risk is acceptable since emergency services would typically accept the higher risks associated with driving on a D3M at the national speed limit (70mph).  Although average speeds increased on the A1 Leeming to Barton scheme on-road trial to 56mph, they were compliant and there is no evidence to suggest that any of the speed related hazards were significantly affected.  If the 60mph speed limit is rolled out within roadworks, it is likely that speeds will be compliant. The risk is likely to increase for the speed related hazards, but this is unlikely to exceed that experienced on a D3M at 70mph, reflecting the findings of the trials. This risk is therefore acceptable.	Yes

Population	Hazard	Risk assessment for Scenario 3 – Weekends and public holidays	Is risk acceptable?
	Road user vehicle not complying with speed limits through roadworks.	(-) With improved compliance there may be fewer incidents that require the emergency services to attend. Improved compliance also reduces the risk to emergency services attending incidents on the road. On the on-road trial on the A1 Leeming to Barton scheme, speed compliance was better than at 50mph and there were no road traffic collisions within the areas subject to a 60mph speed limit. These findings suggest that there will be fewer incidents associated with poor speed compliance that require the emergency services to attend with the rollout of 60mph through roadworks.	Yes
	Vehicles tailgating	(-) There may be fewer incidents to attend due to fewer instances of tailgating. On the on-road trial on the A1 Leeming to Barton scheme there was no evidence to suggest that average headways were compromised and there were no road traffic collisions within the areas subject to a 60mph speed limit. These findings suggest that there will be fewer incidents associated with tailgating that require the emergency services to attend with the rollout of 60mph through roadworks.	Yes
	Vehicles changing lanes	(-) There may be fewer incidents to attend due to fewer instances of vehicles changing lanes. On the on-road trial on the A1 Leeming to Barton scheme there was less overtaking and no road traffic collisions within the areas subject to a 60mph speed limit. These findings suggest that there will be fewer incidents associated with lane changing that require the emergency services to attend with the rollout of 60mph through roadworks.	Yes
	Exposure to traffic when responding to incidents in live lanes.	(=) Emergency Services exposed to higher speed traffic when responding to incidents in live lanes. However, at high flows, the loss of a lane is likely to slow the traffic in adjacent lanes so the risk is unlikely to be greater than in the baseline. At low flows (e.g. at night) the risk is increased but is unlikely to be higher than on a normal motorway at 70mph. There was no evidence found during the A1 Leeming to Barton scheme on-road trial to suggest that the risk to emergency services increased.	Yes
	Exposure to construction activities when responding to incidents within the work site.	(=) No construction work will be taking place within the site.	Yes

The results of the qualitative assessment conclude that for road users there is likely to be an increase in risk associated with general speed related hazards if speed is increased from 50mph to 60mph. However, drivers would typically accept this risk when driving on a D3M at 70mph.

In general, speed compliance is already fairly good. However, there may be some safety benefit associated with a reduced speed differential due to improved speed compliance by HGVs.

Overall the level of risk is likely to be acceptable.

### Road workers

Population	Hazard	Risk assessment for Scenario 3 – Weekends and public holidays	Is risk acceptable?
Road workers - construction workers	Construction workers' exposure to traffic when setting up TTM	<p>(+) Construction workers will have to carry out an additional activity of changing the speed limit signs from 50mph to 60mph. The risk is likely to be acceptable so long as a safe method of working is adopted. For example on the M1 J34-35a trial, signs were changed during a carriageway closure, implemented using a police rolling road block. In scenario 3, the increased speed limit will only be in place for a few days (weekend or public holiday). This may not justify the risk of changing the signs.</p> <p>On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported.</p> <p>If the 60mph speed limit is rolled out through roadworks, the risk is likely to remain acceptable so long as a safe method of working is adopted.</p>	Yes, so long as a safe method of working is adopted
	Construction workers' exposure to traffic when working in closed lane.	Not applicable – no work will be taking place	n/a
	Construction workers' exposure attending and relocating cones that have been struck by traffic	<p>(+) Road user vehicles travelling at higher speeds have less time to react to road environment or take evasive action, therefore potentially increasing the likelihood of collisions with road workers who are replacing struck cones. However, there does not appear to be a history of near misses for this activity.</p> <p>It is possible that vehicles travelling at higher speed (60mph) will increase the frequency of cone strikes. This needs to be monitored to ensure the risk remains acceptable.</p> <p>On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported and no change in the number of incursions.</p>	Yes, with monitoring
	Construction vehicles entering and	Not applicable – no work will be taking place.	n/a

Population	Hazard	Risk assessment for Scenario 3 – Weekends and public holidays	Is risk acceptable?
	leaving the work site from the main carriageway.		
Road workers – Traffic Officer Service	Traffic officers implementing a RRB	(=) The risks associated with implementing a RRB will increase slightly with speed. However the risk will be lower than on a normal motorway at 70mph. Therefore the risk is likely to be acceptable. On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported. This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks associated with Traffic Officers implementing an RRB are likely to remain acceptable.	Yes
	Traffic officers on foot when a RRB is in place	(=) Once the RRB is in place, vehicles should not be in proximity to the location of the traffic officer on foot. Overall the risk is likely to be acceptable. On the on-road trial on the A1 Leeming to Barton scheme, there were no incidents or near misses reported. This evidence suggests that if the 60mph speed limit is rolled out through roadworks risks to Traffic Officers on foot when an RRB is in place are likely to remain acceptable.	Yes
	Traffic officers attending live lane incidents	(=) In most cases congestion caused by the incident will reduce speeds. However at low flows, vehicles will be able to travel past the incident at higher speeds. In most cases, traffic officers will be working under the protection of a RRB or lane closure, in line with their procedures. Overall the risk is likely to be acceptable. On the on-road trial on the A1 Leeming to Barton scheme, Traffic Officers reported an improvement in time taken to respond to incidents within and outside of the road works scheme. There were no incidents or near misses reported. This evidence suggests that if the 60mph speed limit is rolled out through roadworks, risks to Traffic Officers when attending live lane incidents are likely to remain acceptable.	Yes
Road workers - Free recovery operator	Recovery Operators will be exposed to traffic when responding to incidents in live lanes.	(=) Recovery operators will be exposed to higher speed traffic. However the recovery operator's method statement may include appropriate means of working (such as only recovering vehicles when protection is provided by an Impact Protection Vehicle, TOS or police). A review of local arrangements will be required to determine whether the risk to recovery operators is acceptable. There was no evidence found during the A1 Leeming to Barton scheme on-road trial to suggest that the risk to free recovery operators increased.	Depends on local method statement
	Recovery Operators being exposed to construction activities when responding to	Not applicable – no construction work will be taking place	n/a

Population	Hazard	Risk assessment for Scenario 3 – Weekends and public holidays	Is risk acceptable?
	incidents within the work site.		

The results of the qualitative assessment conclude that there is an increased risk to construction workers associated with changing the fixed plate speed limit signs from 50mph to 60mph. Given that the increased speed limit will only be in place for a few days, the benefits may not justify the risk associated with changing the signing.

The risk to the TOS and recovery operators is unlikely to change significantly with the increase in speed.