national highways

Implementing the highest safe speed within road works

– Hazard assessment guidance

27 March 2024

Notice

This document and its contents have been prepared and are intended solely as information for National Highways and use in relation to Implementing the highest safe speed within road works.

AtkinsRéalis Jacobs Joint Venture assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 19 pages including the cover.

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
1.0	Final	SG		CF		16/03/2020
2.0	Update to include additional information from trials	CF		CF		21/09/2020
2.3	Minor updates including changes to template	KB	DTK	JPD	JC	24/03/2022
2.4	Addressing client comments	KB	DTK	JPD		
3.0	Final issue	KB	DTK	JPD	JC	17/05/2022
3.1	Updates to include all 8 GG104 steps and revision of the hazard identification and risk analysis table	KB	DTK	JPD		
3.3	Updates to address internal comments	KB	JPD	KC	JC	11/05/2023
3.4	Addressing client comments	KB	DTK	JPD	JH	11/08/2023
4.0	Periodic review and updates				JH	11/08/2023
4.1	Updates to reflect the requirements for large schemes	KB	AP	JPD	JC	01/12/2023
5.0	Updated with client's comment	KB		JC	JH	27/03/2024

Table of contents

1. Introduction

1.1. Foreword

This document was originally prepared by TRL (2020) and has been updated by AtkinsRéalis Jacobs Joint Venture (AJJV) (2024) on behalf of National Highways. As such, the narrative, tone and writing style have been positioned from the point of view of National Highways.

1.2. Primary definitions

In this document the word “must” is used to indicate a legal requirement which must be complied with. The word “shall” indicates an essential (or mandatory) course of action, and “should” indicates a course of action that is strongly recommended. The word “may” is used to indicate an option, which requires consideration depending on the circumstances.

1.3. Background

With the growing demand on the Strategic Road Network (SRN), safety of all road users and road workers remains our top priority. Satisfaction is also a key component of our vision for the future and we are committed to improving the experience of road users when they are travelling in our road works. This includes looking at changing the way we work to improve road user satisfaction..

Continuous monitoring of the uptake of 60mph as a highest safe speed has shown that the speed restriction within road works can be managed to maintain the safety of road workers and road users whilst having a positive effect on journey times. The evidence collected to date demonstrates that, for schemes greater than 15km, compliance with the posted speed restriction is higher for a 60mph speed restriction than 50mph.

One of the objectives when designing any temporary traffic management (TTM) is to select an appropriate speed restriction that maximises road user satisfaction, whilst ensuring the safety risks to road users, road workers and other parties is reduced to as low as reasonably practicable (ALARP) or so far as is reasonably practicable (SFAIRP)[1]. In practical terms this means that if a measure is reasonably practicable it should be introduced unless the cost and trouble to implement it is grossly disproportionate to the benefit gained. In accordance with GG 104 Requirements for safety risk assessment [2], this judgement shall be recorded and retained. Different speed restrictions may be required across different sections or phases of works within a scheme.

For motorways subject to the national speed limit, where safe to do so, the standard scheme TTM should consider highest safe speed (HSS), specifically 60mph as a minimum. The monitoring evidence for schemes greater than 15km is available at 60mph limit through road works and can be used to inform design risk assessments. The same evidence was not captured for schemes below 15km due to the limited uptake of 60 mph during the monitoring period. The requirements for HSS in road works are in Design Manual for Roads and Bridges (DMRB) GD 904 The use of highest safe speed limits including advice on using 60mph at/through road works [3].

1.4. Scope of this document

This document provides guidance on how to undertake appropriate safety risk assessments for standard schemes[2] undertaking road works. The assessment applies to all major schemes on the SRN. It should be used to support the process of considering appropriate speed restrictions through hazard identification, risk analysis and the selection of suitable mitigations to ensure safety risks are reduced SFAIRP for road users, road workers and other parties. It is recognised that such guidance,

[1] In the context of road and street works the term SFAIRP is used and can be taken as being equivalent to ALARP. SFAIRP is used in the Health and Safety at Work etc. Act 1974 [1] and ALARP is the normal parlance in the health, safety and risk domain. The two terms are interchangeable except when drafting formal legal documents when the correct legal phrase is to be used.

[2] Standard schemes are appropriate for works carried out in all weather, visibility and traffic conditions, as per Chapter 8 of the Traffic Signs Manual TSM Chapter 8.

as outlined within Traffic Signs Manual Chapter 8, cannot cover all situations and it is for the designer to adopt, adapt or develop the required safety risk assessments to suit the actual conditions.

All assessments shall be performed in line with GG 104 [2]. The National Highways Step-by-Step Guide [4] also provides support in documenting the safety risk assessment process in accordance with GG 104. It provides advice on the possible structure and content of a compliant document through commentary and examples to guide the user. Further guidance on the selection of HSS within road works can be found in the Implementing the highest safe speed within road works – Guidance document [5].

Work has been carried out to develop a Hazard Identification and Risk Analysis (HIRA) table with details of key hazards where the baseline is road layout with 50mph speed restriction during the road works. Project teams may use this when considering similar speed restrictions against the selected HSS prior to implementation. The HIRA table is provided in Appendix B and, for ease of use, the source of the table which is the hazard register can also be made available in an Excel format for scheme-specific use.

The HIRA table currently does not contain hazards for a scenario where the existing road layout does not have road works. Project teams/sponsors may use the HIRA table to support their assessments, however appropriate hazard and risk consideration will need to be made for the existing road layout scenario.

The documentation produced by National Highways is to capture learning and encourage consistency. Future updates will be made to the Excel hazard register by National Highways as data and experience emerges from the continued use of HSS. National Highways are responsible for the hazard register and therefore responsible for its content. Project teams are responsible for its use and application. The oversight process is as per GG 104 i.e. where a scheme categorisation outcome is a Type A, the National Highways Project Manager has to accept the safety work being done to manage risk.

Assumptions and conditions should be documented in the scheme-specific safety risk assessments, noting that the safety risk assessment will be subject to a review and/or update if any of these change.

1.5. Updates to the guidance document

This guidance document will be subject to future updates based on ongoing review of scheme-specific safety risk assessments and feedback from users of this document.

2. Safety risk assessment supporting the selection of the HSS in road works

The safety risk assessment shall demonstrate that the safety objectives can be met. To improve road user experience, National Highways recommends that a safety objective is set to select the highest possible safe speed within road works. A suitable safety baseline and safety objective shall be set. It must also be demonstrated that the level of risk posed to road workers and road users is SFAIRP. Safety remains a priority whilst determining and implementing the speed restriction.

All reasonably foreseeable hazards associated with the implementation of temporary traffic management (TTM) and the associated speed restriction(s) will need to be evaluated and documented. It may be necessary to separately assess phases or sections of the scheme that utilise different TTM layouts. Guidance associated with assessing the selection of HSS for road works is provided in the following sections for the eight steps which are to be followed when producing a scheme-specific safety risk assessment.

1. **Planning:** Essential to a robust safety risk assessment is a clear statement of the context of the question or decision that is being made (section 2.1).

2. **Categorisation of activity type:** To determine the level of rigour required for a safety risk assessment, and to identify the parties who will validate its findings, the 'activity' is categorised as A, B or C (section 2.2).

3. **Identification of affected populations:** GG 104 requires the populations affected; users, workers or others, to be identified (section 2.3).

4. **Scope:** Clarifications of what is covered by the safety risk assessment and what activities or decisions are excluded (section 2.4).

5. **Safety baseline and safety objective:** To assist decision making and determine acceptability it is required to set objectives for each population for the activities and projects subject to safety risk assessment. This objective is usually developed based on a review of baseline data (section 2.5).

6. **Hazards and risk:** The formal risk assessment stage that documents the hazards relevant to the activity and scope including an appropriate level of risk quantification. At this point control measures are considered and those deemed suitable based on risk criteria, for example, 'so far as is reasonably practicable', are confirmed. The evaluation part of this stage is critical in terms of responding to the question being considered in the safety risk assessment (section 2.6).

7. **Update requirements:** The possible circumstances under which the safety risk assessment would become invalid and require review or update (section 2.7).

8. **Validation and monitoring requirements**: Confirmation of any further work required to validate assumptions or monitor the activity to validate the safety objectives (section 2.8).

2.1. Planning

This section outlines the background information of the scheme describing the current layout right through to the road works operating regime and the requirement of the safety risk assessment.

The planning step is critical to the safety risk assessment process being completed successfully. It helps those involved in the safety decision making for the activity understand what is being considered and what safety risk governance will be applied. The HSS safety risk assessment should clearly define and record its purpose. This is best articulated as a question that the safety risk assessment is seeking to address, for example: *Is the use of the selected 70mph as HSS in/through road works acceptable in terms of safety risk?*

It should be noted that each safety risk assessment has a specific question which means that an HSS specific safety risk assessment is likely needed. The scheme proposer should not assume that scheme designers have covered this aspect.

2.2. Categorisation of the activity type

This section determines the safety risk categorisation and gives clear, systematic rationale as to the reasons why the specific category has been identified.

Categorising the activity requires the activity owner to understand what level of safety concern may exist with the activity in question and identify the appropriate amount of effort required to manage the challenge. This step helps in determining the amount of rigour required to carry out a safety risk assessment and the overall outcome of this step has a significant bearing on what is required in the subsequent steps.

In accordance with GG 104, an overall categorisation of Type A requires approval by the person responsible for managing the activity. A safety control review group (SCRG) will need to be convened for activities categorised as Type B and Type C. Activities categorised as Type C will need to be escalated to the national safety control review group (NSCRG).

A description of the role of SCRG and NSCRG in the safety risk assessment process can be found in the Management Arrangement of Safety Risk for National Highways Activities [8].

2.3. Identification of affected populations

GG 104 requires that the risk to all populations affected are managed. Section 2.6.4 sets out how the risks are to be managed. The populations should be further broken-down into sub-populations in order to ensure that all affected groups are considered. Identification of the populations affected and their justifications should be documented.

This step is important to ensure that the activity manager is clear on the effect and can consult, via a SCRG or by other means, with the correct stakeholders and specialists to come to a decision.

The populations that are affected by the HSS in/through road works are outlined in Table 1, in accordance with GG 104.

Table 1: GG 104 populations, sub-population and description

Population	Sub-population	Description
Workers	Traffic Officers	Traffic Officers directly employed by National Highways to attend and manage incidents on the schemes.
	National vehicle recovery contract operatives	Operatives providing free vehicle recovery services within the road works on a highway scheme
	Traffic management operatives	Operatives setting out, maintaining and taking down (temporary traffic management (TTM) equipment
	Maintenance operatives	Operatives undertaking routine or reactive maintenance of infrastructure within the scheme area
	Construction operatives	Operatives engaged in the construction of the scheme and present in the working areas; operatives accessing and exiting the TTM
	Other personnel	Personnel contracted by National Highways i.e. incident support units, personnel carrying out survey and inspection work
Users	Customers	Road users including drivers and their passengers travelling through the road works and those walking, cycling and riding (as permitted). This includes users driving for work or commuting (i.e. salesperson or delivery driver), but not at work on the relevant part of the road network (i.e. HGV driver who is driving on a specific part of the road network or taxi driver who is taking passengers around)
	Emergency services	Police, ambulance and fire and rescue services that may be required to attend and manage incidents on the scheme
	Private vehicle recovery operatives	Private vehicle recovery operatives recovering stranded vehicles from the highway network
Other parties	Where applicable, consider rail network, local authority roads, farms, residential areas etc.	

2.4. Scope

The scoping step allows the hazard identification and risk analysis to focus on the relevant safety risk aspects of the activity and ensure the process is effective and produces a robust and meaningful outcome. Schemes should review the criteria set out in Table A1.8 in TSM – Chapter 8 Part 3 [7] when considering the TTM features.

This section should also outline any assumptions that have been made to support the HSS safety risk assessment.

2.5. Safety baseline and safety objective

National Highways is committed to Home Safe and Well for users, workers and other parties as set out in section 2.3. The vision is *"for no one to be killed or seriously injured while travelling on or working on our network"*. Setting safety objectives is how the safety risk assessment process can drive continual improvement.

The baseline and the baseline parameters are used to determine whether the safety objective is likely to be met. Two possible baselines are:

- Existing layout without road works (this can be established from available sources of information)
- Existing layout with road works

A safety objective shall be set to demonstrate that the safety performance for road users is no worse than the baseline.

For workers, no numerical safety objective is required and the safety risk criteria is to reduce risks in accordance with the SFAIRP principle. Furthermore, the SFAIRP principle is applied to road users and other parties.

2.6. Hazards and risk

This is the formal hazard identification and risk assessment step in the process, including explaining the potential risks and undesirable outcomes and detailing the mitigations. This can be the most involved part of the process and determines the outcome of the overall safety risk assessment.

2.6.1. Hazard identification and risk analysis

Scheme proposers need to develop their own hazard and risk analysis to demonstrate they can meet the objectives and safety risk criteria. The HIRA table provided in Appendix B can be used as a starting point for schemes that have existing road works with a lower speed restriction and comparing with the proposed higher speed restriction (i.e. 50mph vs 60mph).

Appendix B captures hazards related to a scenario with road works on the SRN as the baseline and considers a typical HSS. The following assumptions were taken into account:

- Safe and sufficient TTM design in the baseline
- Long-term road works as per TSM Chapter 8
- Baseline speed restriction of 50mph being evaluated against a higher speed restriction of 60mph

The HIRA table is intended to be used as a prompt and is not scalable. Schemes will need to re-adjust the risk analysis to suit their scheme specifications, taking into account the speed restriction proposed and their TTM proposals. For ease of use, the Microsoft Excel hazard register can also be made available.

Alternatively, the HIRA table may be used to support schemes where the existing road layout does not have road works, noting that appropriate hazard and risk consideration will need to be made for this scenario / baseline.

The HIRA table does not constitute an exhaustive assessment of all TTM layouts, temporary situations or scheme circumstances. Schemes may benefit from undertaking the HIRA in a workshop session, including safety risk assessment specialists, TTM contractors and any other identified relevant parties. This could also include a high level assessment of the TM design.

2.6.2. Other considerations

As part of the analysis, consideration of network wide causation factors and potential location specific risk factors that may impact safety on schemes should be made. For simplicity the factors can be broken down into three categories:

- design or nature of the TTM,
- driver behaviour, and
- other factors.

Design or nature of temporary traffic management related factors

The following design aspects of the TTM may impact safety, but are not limited to:

- Unclear, insufficient or confusing lane markings, studs and/or ghost markings

- Performance specification of traffic management devices
- Changing nature of the road works
- Surface quality
- Inadequate signposting and lighting
- Excessive, insufficient, conflicting or confusing signage
- No alternative safe place to stop in the event of a breakdown
- Location of works access or exit points

Within the design of the traffic management the following conditions or occurrences may also impact safety:

- Poor or extreme weather conditions and / or visibility
- Water on the surface
- Reduction in time or distance to react to a hazard
- Speed differential between vehicles
- High traffic flow
- Merging or joining traffic
- Queuing traffic
- Vehicle fault / runs out of fuel / power
- Use of works areas resulting in driving and stopping/parking of vehicles facing live traffic where works headlights or vehicle mounted task lighting may dazzle drivers (This is an elevated problem for older drivers who are more glare-susceptible)

Driver behaviour related factors

The following driver behaviours which occurs within normal driving conditions or are exacerbated as a reaction to the road work environment may impact safety, but not limited to:

- Confusion, distraction, frustration, fatigue or drug and alcohol use
- Driver behaves hesitantly
- Poor lane discipline
- Non-compliance with speed limits or speed restrictions / driver mis-reads the speed signs
- Overtaking or weaving due to speed differentials between road users
- Loss of control
- Driving too fast for conditions
- Driver waits until the last minute to merge to the correct lane
- Driver fails to anticipate a downstream queue

Other factors

Factors not included in the categories above but may also have an impact on safety include;

- Road worker compliance with working practices
- Emergency services personnel compliance with working practices
- Theft of speed restriction signs
- Error where one or more speed restriction signs are not changed correctly, this may be as a result of human error or due to faulty remotely operated signs.

2.6.3. Undesirable outcomes

This section outlines some of the key undesirable outcomes that may result from the realisation of the hazards outlined in Appendix B. The undesirable outcomes are organised for ease of understanding and the structure does not indicate a priority or severity.

2.6.3.1. Collisions between vehicles

Collisions between vehicles can encompass a number of undesirable outcomes covering a combination of both moving and stationary vehicles. The list below gives some examples.

Collisions between two or more moving vehicles where all vehicles are road users

All categories of road users that are permitted within the road works. This may include pedal cycles and motorcycles in addition to cars, Heavy Goods Vehicles (HGVs), emergency service and breakdown recovery vehicles (that do not have a contractual relationship with National Highways). The level of risk and corresponding mitigations for different categories of road users may differ and therefore would require separate consideration in the HIRA.

Collisions between two or more moving vehicles including works vehicles

Collisions involving works vehicles could include collisions between a road user and a works vehicle (that may have, for example, slowed down to enter the works site or be joining the carriageway from the works site), or between works vehicles within the road works due to the reduced working space. Works vehicles can include:

- Any vehicle used by those permanently employed in activities on the SRN, such as Traffic Officers.
- Parties contracted to work on the TTM including permanent works contract employees/suppliers/Clients as TTM changes occur within stages of permanent works.
- Supporting services such as vehicle recovery or impact protection where a contractor is engaged in the scheme.

Collisions between moving and stationary vehicles

Undesirable outcomes that can occur between moving and stationary vehicles include collisions due to the presence of traffic, or an incident such as a breakdown or road traffic collision. Respective mitigations may be required.

2.6.3.2. Collisions between vehicles and pedestrians

Collisions between road users and road workers

A collision between a road user and road worker could occur due to the incursion of a road user into the road works or during live lane working, for example, changing traffic signs or recovery of a vehicle (where the scheme employs a vehicle recovery contractor).

Collisions between road user and pedestrian, cyclist or equestrian

The scope of this document covers all high speed roads on the SRN and as such there may be roads with a pedestrian, cyclist or equestrian presence. A pedestrian in this instance can also be taken to include road users outside of their vehicle due to an incident, emergency services and recovery personnel.

Collisions between road workers and works vehicle

Collisions between road workers and works vehicles due to the available working space within the road works.

Collisions with temporary traffic management or roadside furniture

The risk of collisions with the implemented TTM, such as safety barriers, will be related to the speed restriction implemented and could affect road users and road workers. The design objective will influence the TTM design and therefore may introduce an atypical design with new or different hazards. For example, the preference for the use of a contraflow operation would place road users adjacent to roadside furniture but further away from road workers.

2.6.4. Safety risk mitigations

As part of the safety risk assessment when the hazards are understood, mitigations should be identified and implemented to ensure all risks are eliminated or controlled to be SFAIRP and in line with the safety objectives. The following sub-sections outline factors to consider when proposing mitigations in response to the risks encountered during the implementation of a speed restriction. Investigations have shown that the use of appropriate design features and control measures can

enable the implementation of the highest safe speed restriction within TTM whilst achieving the safety objectives.

New technology or development of processes that become established and shape best practice could be introduced in the future to help identify and implement further mitigations. This includes increasing prevalence of vehicle technology such as Autonomous Emergency Braking and Intelligent Speed Assistance, especially if mandated in the UK as in the EU by General Safety Regulation amendments.

2.6.4.1. Factors to consider when proposing mitigations

Design and layout mitigations

The TTM should be designed in a systematic and comprehensive way adhering to current standards and guidance. Possible mitigations that can be incorporated into the design of the TTM include:

1. **Clear demarcation of lane markings |** Implementation of appropriate lane design with appropriate setback, between lanes and work demarcation, and widths for the speed restriction in conjunction with clear and appropriate road markings and/or studs. Lane widths (demarcating a wider kerbside lane) may be appropriate in conjunction with restriction on lane usage to allow extra space for larger vehicles and encourage appropriate lane distribution between vehicle types.
2. **Consideration of works access and egress points |** Careful consideration of works access and egress points with suitable locations that ensure good sightlines. The use of appropriate egress merging lengths designed to correspond with the implemented speed restriction. Particular care is needed in the approach to junction diverge points where drivers might misread works access as diverge at a junction, especially when unlit. Similarly works egress near merge and diverge points increase likely conflict so needs particular care.
3. **Suitable signage strategy |** The use of a suitable signage strategy (including, where applicable, implementing clear and sufficient contraflow guidance and signage, careful consideration when designing works in close proximity of junctions etc.) that is clear and coherent without causing road user confusion. The use of additional signage around any changes in speed restriction within the road works. Furthermore, clear and timely diversion routes and advance direction signs to help the groups with light sensitivity/older drivers.
4. **Gates/emergency access points within the safety barrier |** Inclusion of ‘gates’/emergency access points within the safety barrier to allow stricken vehicles/debris to be removed from a live lane.
5. **Suitable barriers |** Safety barrier specification, including appropriate impact attenuators (crash cushions) suitable for containing high speed errant vehicles. It may also be appropriate to consider the use of ‘smart’ barriers equipped with sensors to improve incident response times.
6. **TTM in accordance with Chapter 8 of the TSM |** The use of traffic management devices that complies with visibility guidelines outlined in Chapter 8 Parts 1, 2 and 3 of the Traffic Signs Manual.
7. **Suitable buffer zone between the safety barrier and work zone |** Suitable buffer zone between the safety barrier and work zone to ensure activities within the works zone are carried out away from potential incursion locations (e.g. works access points). Logistics planning should look to ensure that the movement of vehicles and use of access and egress points within the works reduce interactions with road users.

Operational mitigations

The following mitigations may be incorporated into the planning or implementation activities of the traffic management for the implemented speed restriction;

1. **Existing or portable variable message signs |** Use of variable speed restrictions or communications via existing or portable signs (e.g. Variable Message Signs) to warn approaching road users of road workers in the carriageway or when live lane working is required such as in a response to an incident, including in adverse conditions (e.g. bad weather or reduced visibility etc.).
2. **CCTV cameras and stopped vehicle detection systems |** Implementation of measures to identify stricken/stranded vehicles such as the use of CCTV cameras and stopped vehicle detection systems supported by signing to provide advanced warning.

3. **Vehicle recovery |** Support by on-call incident support and impact protection vehicles (with suitable crash cushions) who are able to respond promptly to any requests from emergency services or vehicle recovery.
4. **Methodology for placing and changing signs |** Development and implementation of a specific methodology for placing and changing signs that is in line with the speed restriction (e.g. RAMS).
5. **Appropriate sign checks |** Implementation of appropriate checks when signs are displaying the correct speed restriction or to ensure all signs have been changed correctly. This should be considered regardless of the type of signs used.
6. **Speed enforcement |** Implementation of a speed enforcement strategy to promote compliance with the speed restriction where practicable.

Communications mitigations

National Highways recognises that communication is a key element to successful risk management. The following mitigations may be considered, and if implemented, should be included in the scheme's communications plan:

1. Implementation of clear speed restrictions signs to inform road users of temporary or variable speed restriction.
2. The use of VMS and targeted communication strategies as communication tools to inform and warn road users of temporary or variable speed restrictions. This may include the use of online and offline media to inform road users about impending works on the network and implemented speed restrictions.
3. Communication with Traffic Management Operatives, vehicle recovery operators, emergency services and Traffic Officers to trigger a review of working practices and method statements to ensure they are in line with the implemented speed restriction and reflect the change in risks for live lane working.
4. Communication of speed restriction to road workers including any updates of relevant documentation and procedures.
5. Identification of and engagement with all appropriate stakeholders.

Other generic considerations

1. Understanding of the activities to ensure there is sufficient working area.
2. Optimising the length of road works to minimise disruption to the road user and ensure the risk to all affected parties are SFAIRP.
3. Ensuring appropriate clearance to roadside furniture or traffic management devices in line with relevant regulations and appropriate for the implemented speed restriction. It is further advised that prior to the installation of temporary traffic management, a Road Restraints Risk Assessment Process be undertaken to identify and mitigate the risk posed to road users by roadside furniture and unsafe roadsides.
4. In line with good practice, schemes may wish to conduct a road safety audit to help identify scheme-specific safety risks, and controls, and to inform the safety risk assessment process.
5. Plans for checking to ensure resilience is incorporated into the use of remotely operated signs (e.g. batteries regularly checked, signs regularly checked, spare signs in the event of any fault/damage/theft). Specific methodology for placing and changing signs to be developed and documented in contractor's risk assessment and method statement (RAMS).
6. Review of current working practices including the incident management plan to ensure it is as safe as reasonably practicable to operate at the speed restriction.
7. Planning/managing of vehicles routing and parking locations within works and workforce awareness of the issue.
8. All work undertaken by competent and appropriately trained road workers.

2.7. Update requirements

This step is intended to consider and confirm the validity of the safety risk assessment. The safety risk assessment is a live document and should be updated when there are changes to designs and assumptions.

2.8. Validation and monitoring requirements

This step is required to confirm arrangements for validation of the safety objective and consider the need for other monitoring when the safety risk assessment suggests there is a need.

If qualitative data is used to inform the analysis, key assumptions made in the scheme-specific safety risk assessment need to be validated during the period in which a reduced speed restriction is implemented. The performance can also be validated against the baseline and objectives set by the scheme.

References

[1]	Health and Safety at Work etc Act 1974
[2]	DMRB GG 104 - Requirements for Safety Risk Assessment, Revision 0
[3]	DMRB GD 904 - The use of highest safe speed limits including advice on using 60mph at/through road works, Revision 0
[4]	A Step by Step Guide to using GG104 Requirements for Safety Risk Assessment
[5]	Implementing the highest safe speed within road works - Guidance, 2023
[6]	Safety and Benefits Realisation Reports, AJJV (2023)
[7]	Traffic Signs Manual – Chapter 8, Traffic Safety Measures and Signs for Road Works and Temporary Situations, Part 3: Update, 2020
[8]	Management_Arrangement_of_Safety_Risk_for_Highways_England_Activities (November 2021)

Appendix A Risk scoring matrix

The scoring matrix is an adaptation of the example included in GG104.

All identified hazards are scored for likelihood of occurrence and severity of harm using the matrix below. The Likelihood and Severity scores are multiplied to get the Risk value (R). The risk value is then ranked as Low, Medium or High, which then correlates to a required action as shown below:

Likelihood (L) x Severity (S) = Risk Value (R)		**Severity (S)**				
		Minor harm; Minor damage or loss no injury	Moderate harm; Slight injury or illness, moderate damage or loss	Serious harm; Serious injury or illness, substantial damage or loss	Major harm; Fatal injury, major damage or loss	Extreme harm; Multiple fatalities, extreme loss or damage
Likelihood (L)	Very unlikely; highly improbably, not known to occur.	**1**	**2**	**3**	**4**	**5**
	Unlikely; Less than 1 per 10 years.	**2**	**4**	**6**	**8**	**10**
	May Happen; Once every 5-10 years	**3**	**6**	**9**	**12**	**15**
	Likely; Once every 1-4 years	**4**	**8**	**12**	**16**	**20**
	Almost certain; Once a year or more.	**5**	**10**	**15**	**20**	**25**

Appendix B Hazard identification and risk analysis (HIRA)

Table B-1 sets out the hazards identified and the risk analysis for the consideration of HSS. Hazards were identified and then scored during two sessions of the HSS hazard workshops. The attendees included internal subject matter experts, technical reviewers and safety risk consultants. The workshops were based on previous schemes which have run at 50/60mph and previous HSS assessments. The hazard identification focussed both on typical events that would occur at the location and potential new events that result directly from the operation of the scheme. The list is limited to reasonably foreseeable hazards that may occur. As part of the analysis the risks to safety, likely outcomes of injury and reasonable control measures have been listed for each potential hazard.

The hazards have been rated on the likelihood of harm occurring, the severity of any potential harm and then rated as high, medium, or low overall in accordance with GG 104. Appendix A shows the matrix used for scoring hazards.

Specific mitigations are also identified for each hazard in this table. Further mitigations and considerations to control risk to road users and road workers are detailed further in section 2.6.4. Schemes shall carry out a scheme-specific risk assessment prior to applying a speed restriction within temporary traffic management. The HIRA table outlined below is not exhaustive. Furthermore, the risk ratings applied to each of the below events are based on HSS evaluation done to date and evidence from the trials. This should be updated to suit each specific scheme.

Table B-1: Hazard identification and risk analysis table

No.	Hazard	Primary affected population	Primary sub-population	Network wide causation factors	Location specific risk factors	Undesirable outcome (collisions)	Typical Risk (road works)				Comments	Layout mitigations	Operational mitigations
							L	S	R	Class.			
1	Single stationary vehicle in running lane	Road users	All	- Vehicle fault - Vehicle runs out of fuel/power - Driver discretionary stop - Driver taken ill - Failure to look - Loss of control - Driving too fast for conditions - Driver distraction due to road works - Reduced forward visibility due to weather conditions	- Speed limits and restrictions - Actual vehicle speeds - Availability and useability of street lighting - Availability and useability of ERTs - Availability and useability of electronic messaging signs - Variation in conditions between peak and off-peak periods - Proximity of service areas and fuel - Availability and useability of places of relative safety/gaps in the safety barriers - Traffic signing and road markings and their condition	- Moving and stationary vehicles - Two or more moving vehicles where all are road users (i.e. nose to tail and side swipe)	4	3	12	Medium	A broken down or stationary vehicle in a live lane during TTM restrictions is at risk of being struck by other vehicles, therefore is a hazard. If any impact was to occur, collisions are likely to be nose-to-tail collisions with the stationary vehicle, likely resulting in serious collisions. This is because during TTM restrictions, places of relative safety are limited and vehicle occupants may have to wait in the vehicle until assistance arrives. Other type of collisions might be side swipes between moving vehicles due to a driver trying to avoid colliding with the stationary vehicle.	None	- Existing or portable variable message signs - CCTV cameras and SVD - Vehicle recovery - Speed enforcement
2	Incident in running lane e.g. multi-vehicle collision	Road users	All	- Earlier collision - Failure to look - Loss of control - Driving too fast for conditions - Driver distraction due to road works - Reduced forward visibility due to weather conditions	- Speed limits and restrictions - Variation in conditions between peak and off-peak periods - Traffic signing and road markings and their condition	- Two or more moving vehicles where all are road users (i.e. nose to tail and side swipe) - Moving vehicle and obstruction	3	3	9	Low	The risk is anticipated to be lower than hazard 1 because it is anticipated that this hazard is likely to cause a flow breakdown, essentially causing vehicles to slow down and allowing drivers more time to react. Various TTM features over a short distance (e.g. narrow lanes) may also increase driver alertness subsequently reducing likelihood of collisions.	None	- Existing or portable variable message signs - CCTV cameras and SVD - Vehicle recovery - Speed enforcement
3	Debris in running lane	Road users	All	- Failure to look - Reduced time to react to the obstruction ahead - Loss of control - Non-compliance with speed limit or speed restriction - Driver distraction due to works	- Speed limits and restrictions - Variation in conditions between peak and off-peak periods- Signing (informing and updating customers)	- Two or more moving vehicles where all are road users (i.e. nose to tail and side swipe) - Moving vehicle and obstruction	4	2	8	Low	It is anticipated that debris may increase in running lanes during road works, which could pose a risk of injury if a vehicle strikes the debris or swerves to avoid the object. This is likely to lead to a slight injury should a collision occur.	None	- Existing or portable variable message signs - Speed enforcement
4	Vehicle drifting out of lane	Road users	All	- Poor lane markings or studs/ghost markings (including lane keep technology not being able to identify lines) - Reduced visibility due to adverse weather conditions (including mist, fog, ice and snow) - Psychology safely level (affected by geometry, alignment) - Poor lane discipline - Driver fatigue - Driving under the influence	- Long length of works / TTM - Narrow lanes widths - Geometry, alignment - Ghosting / removing and replacing road marking (still visible to drivers and therefore causing confusion) - Placement of access and egress points - Placement of road restraint systems (RRS) and relevant departures from standard - Orientation of the road (affected by low winter sun)	- Two or more moving vehicles where all are road users - With temporary traffic management or roadside furniture - Road user and road worker	3	3	9	Low	This hazard is considered to be unintentional. This hazard could be made worse by for example long TTM and/or long journey times affecting driver attention and concentration. Vehicle occupants are at risk of being injured if the vehicle leaves the carriageway or strikes another vehicle/roadside furniture.	- Clear demarcation of lane markings - Consideration of works access and egress points - Suitable signage strategy - Suitable barriers	- Existing or portable variable message signs
5	Tailgating	Road users	All	- Non-compliance with speed limit or speed restriction - Human behaviour, frustration from speed restriction - Perception of safety	- Free flowing traffic - Speed target - Reduced time to react to changes in road user behaviour, a collision or changes to road condition	- Two or more moving vehicles where all are road users	3	3	9	Low	The speed restriction during road works will likely have an impact on the difference in speed between HGVs and other traffic. For example, the larger the headway the less likely drivers are going to tailgate.	- Suitable signage strategy	- Existing or portable variable message signs - Speed enforcement

No.	Hazard	Primary affected population	Primary sub-population	Network wide causation factors	Location specific risk factors	Undesirable outcome (collisions)	Typical Risk (road works)				Comments	Layout mitigations	Operational mitigations
							L	S	R	Class.			
					- Length of road works - Information/lack of information to drivers - Automatic vehicle braking system (specifically active during low speeds)						With the 60mph speed restrictions, HGVs will be limited to 56mph and cars can travel at 60mph resulting in less tailgating. Where a collision may occur, the severity of injuries are likely to be serious.		
6	Undertaking	Road users	All	- Sudden/poor lane change manoeuvre due to reduced time to respond to a hazard - Queuing - Non-compliance with speed limit or speed restriction	- Narrow lanes restricting which lane vehicles can drive in - Dedicated lanes for diverges either as a lane drop or dedicated lane drop - Low speed restrictions - Conflicting signing - Failure to tail standard layout to road works/sites	- Two or more moving vehicles where all are road users	2	3	6	Low	A vehicle undertaking may not be seen by other drivers, particularly when undertaking an HGV. As the action is not always expected, speed is anticipated to be higher than lane changing (hazard 7) thus the severity of injury is likely to be serious.	- Suitable signage strategy - TTM in accordance with Chapter 8 of the TSM	- Existing or portable variable message signs - Speed enforcement
7	Lane changing at drivers discretion	Road users	All	- Poor or extreme weather conditions and/or visibility - Unavoidable vehicle or debris - Queuing - Drivers wait until the last minute to merge to the correct lane - Left hand driving - Lane keep assist technology - Weaving	- Close junction spacing - Conflicting signing and road markings - Work access / frequency of them - Contraflow	- Two or more moving vehicles where all are road users	5	2	10	Medium	This hazard is considered to be intentional. The differences in speed between the HGVs and other traffic will be affected by the speed restriction. Where a collision occurs, the severity is likely to be slight. Evidence from the monitoring found that speed compliance with the posted speed limit was higher for 60mph than 50mph. Although the monitoring did not find a link with safety, it is considered that this could lead to a reduction in unsafe lane changing.	- Clear demarcation of lane markings - Suitable signage strategy	- Existing or portable variable message signs - Speed enforcement
8	Lane changing due to the road layout or conditions	Road users	All	- Queuing traffic - Merging or joining traffic - Failure to look - Loss of control - Driving too fast for conditions - Driver distraction due to road works - Reduced forward visibility due to weather conditions	- Forced merge / taper - Difference between permanent and temporary TTM / longer merge / change in provision - Chicanes - Contraflow and proximity to junctions - Narrow lane widths	- Two or more moving vehicles where all are road users	4	2	8	Low	This is not likely to be throughout the scheme but at certain locations therefore, occurrence is not likely to be as high as hazard 7. Furthermore, drivers are informed on upcoming merges, whereas for hazard 7, a driver can decide at any time to change lanes without much knowledge to other drivers.	- Clear demarcation of lane markings - Suitable signage strategy	- Existing or portable variable message signs - Methodology for placing and changing signs - Speed enforcement
9	Sudden loss of control	Road users	All	- Poor lane markings or studs/ghost markings - Water on the surface - Driver not paying attention and misses the message - Driver does not see speed signs (i.e. due to theft of TM equipment (e.g. remotely operated signs)) - Driver fails to adopt or notice speed restriction or are confused due to the changing nature of the road works - Surface quality (i.e. broken surface / potholes etc.) - Obstruction up ahead - Reduced visibility due to adverse weather conditions - Excessive speed (including driving at speed that is unsuitable for the conditions) - Driver fail to anticipate a downstream queue - Driver behaves hesitantly - Lane keep assist technology	- Ghosting / removing and replacing road marking (still visible to drivers and therefore causing confusion) - Traffic signing and road markings and their condition - Additional equipment which could potentially move into the lane - Speed limit detection in vehicles	- Two or more moving vehicles where all are road users - With temporary traffic management or roadside furniture - Road user and road worker	3	3	9	Low	A collision ‘may happen’ and injuries are likely to be serious.	- Clear demarcation of lane markings - Suitable signage strategy - Suitable barriers	- Existing or portable variable message signs - Speed enforcement
10	Rapid deceleration	Road users	All	- Vehicle technology fault - RRS misaligned due to being struck by another driver/incident in running lane - Rolling road block being implemented - Surface quality (i.e. broken surface / potholes etc.) - Inadequate signposting and lighting - Queuing - Driver/vehicle mis-reads the speed signs - Conflicting speed signs	- Proximity of infrastructure / roadside assets (may cause overreaction by autonomous vehicles / CAV braking - TM affects capacity - Traffic signing and road markings and their condition - Implementation of rolling road block	- Moving and stationary vehicles - Two or more moving vehicles where all are road users - Moving vehicle and obstruction - With temporary traffic management or roadside furniture	3	2	6	Low	When a lead vehicle suddenly decelerates, there is a risk the driver following behind is not able to respond or make safe manoeuvres in time, resulting in a collision or evasive action. If any impact was to occur, the injuries are expected to be slight due to the reduction in speed.	- Clear demarcation of lane markings - Suitable signage strategy - Suitable barriers	- Existing or portable variable message signs - Speed enforcement
11	Rapid acceleration	Road users	All	- Linked to rapid deceleration, tidal waves - Loss of control - Driver/vehicle mis-reads the speed	- End of speed restriction / lane restriction - Speed limits and restrictions	- Two or more moving vehicles where all are road users	2	3	6	Low	This hazard is less likely to occur than hazard 10 hence the lower likelihood. However, the severity is likely to be serious due to the increasing of speed.	- Clear demarcation of lane markings - Suitable signage strategy	- Existing or portable variable message signs

No.	Hazard	Primary affected population	Primary sub-population	Network wide causation factors	Location specific risk factors	Undesirable outcome (collisions)	Typical Risk (road works)				Comments	Layout mitigations	Operational mitigations
							L	S	R	Class.			
				signs - Conflicting speed signs - Cruise control (adaptive cruise control)		- With temporary traffic management or roadside furniture						- Suitable barriers	- Speed enforcement
12a	Driver enters road works intentionally (to gain progress / advantage)	Road users	All	- No alternative safe place to stop in the event of a breakdown - Congestion - Driver frustration - Motorist drives right up to the last second and then try to force themselves in. If other drivers don't let them in, they may enter the work zones and endanger the lives of workers	- Availability of places of relative safety/gaps in the safety barriers - Contraflow system - Junction closures	- Two or more moving vehicles including works vehicles	3	2	6	Low	Most incursions are intentional (e.g. to gain an advantage or to seek refuge due to vehicle breakdown). The hazards is often driven by frustration and stress. If this hazard is realised the severity is likely to result in slight injuries to road users.	- Suitable signage strategy - Gates / emergency access points within the safety barrier - Suitable barriers - Suitable buffer zone between the safety barrier and work zone	- Existing or portable variable message signs
12b	Driver enters road works intentionally (to gain progress / advantage)	Road workers	Construction operatives on foot, maintainers on foot	- No alternative safe place to stop in the event of a breakdown - Congestion - Driver frustration - Motorist drives right up to the last second and then try to force themselves in. If other drivers don't let them in, they may enter the work zones and endanger the lives of workers	- Availability of places of relative safety/gaps in the safety barriers - Contraflow system - Junction closures	- Road user and road worker	3	4	12	Medium	A vehicle may strike an operative on foot which may result in fatal injuries. The combination of the vehicle's speed and the vulnerability of the pedestrian significantly raises the risk of a fatal outcome.	- Suitable signage strategy - Gates / emergency access points within the safety barrier - Suitable barriers - Suitable buffer zone between the safety barrier and work zone	- Existing or portable variable message signs
13a	Driver enters road works unintentionally (i.e. does not understand the layout)	Road users	All	- Safety barrier design insufficient for HSS - Loss of control - Drivers follow worker vehicles into the works access - Sudden/poor lane change manoeuvre - Poor lane markings/studs - Driver confusion due to speed restriction signs - Driver confusion due to poorly marked worked access and exit points - Drivers are distracted	- Narrow lane widths - Traffic signing and road markings and their condition - Contraflow system - Ghosting / removing and replacing road marking (still visible to drivers and therefore causing confusion)	- With temporary traffic management or roadside furniture - Two or more moving vehicles including works vehicles	2	3	6	Low	Unintentional incursions are less likely to occur in comparison to intentional incursions. However, unintentional incursions are likely to lead to a more severe outcome due to users entering the work area in error or as a result of confusion which may impact their awareness of other hazards. Overall the risk classification is considered the same as hazard 12a.	- Clear demarcation of lane markings - Suitable signage strategy - Gates / emergency access points within the safety barrier - Suitable barriers - Suitable buffer zone between the safety barrier and work zone	- Existing or portable variable message signs
13b	Driver enters road works unintentionally (i.e. does not understand the layout)	Road workers	Construction operatives on foot, maintainers on foot	- Safety barrier design insufficient for HSS - Loss of control - Drivers follow worker vehicles into the works access - Sudden/poor lane change manoeuvre - Poor lane markings/studs - Driver confusion due to speed restriction signs - Driver confusion due to poorly marked worked access and exit points - Drivers are distracted	- Narrow lane widths - Traffic signing and road markings and their condition - Contraflow system - Works access near junction diverge	- Road user and road worker	2	4	8	Low	A vehicle may strike an operative on foot which may result in fatal injuries. The combination of the vehicle's speed and the vulnerability of the pedestrian significantly raises the risk of a fatal outcome.	- Clear demarcation of lane markings - Suitable signage strategy - Gates / emergency access points within the safety barrier - Suitable barriers - Suitable buffer zone between the safety barrier and work zone	- Existing or portable variable message signs
14	Workers entering or exiting work site	Road users	All	- Loss of control - Reduced time to react to a traffic management vehicle diverging or merging with traffic - Poor or extreme weather conditions and/or visibility - Non-compliance with speed limit or speed restriction - Poorly located works access or exit points relative to the HSS - Works access/exit points located adjacent to lane 3 where vehicles travelling at or in excess of HSS is more likely	- Insufficient design of works access or exit points relative to the HSS - Location of works access and egress - Verge / central reserve works - Sufficient space for access and egress points - Frequency / number of access points - Number of closed lanes - Proximity of junctions may affect how other drivers are behaving - Proximity of conflict zones - The higher the speed the more deceleration required and following drivers may not anticipate it - Training instruction on use (could be site specific)	- Two or more moving vehicles including works vehicles - Road users and traffic management or construction vehicles entering or exiting the works site	2	2	4	Low	The increased speed differential between road works vehicles and road users at works access and exit points may affect the likelihood and severity of a collision. As works vehicles are likely to be Chapter 8 livery on vehicles, the likelihood of a collision is considered to be 'unlikely'.	- Consideration of works access and egress points - Suitable signage strategy - TTM in accordance with Chapter 8 of the TSM - Suitable buffer zone between the safety barrier and work zone	- Existing or portable variable message signs - Speed enforcement
15a	Live carriageway working	Road users	Ex-vehicle pedestrian,, Emergency services on foot, private recovery	- Vehicle recovery - Poor or extreme weather conditions and/or visibility - Loss of control - Non-compliance with speed limit or speed restriction - Exposure to traffic when awaiting	- Speed limits and restrictions - Variation in conditions between peak and off-peak periods - Traffic signing and road markings and their condition - Narrow lane widths	- Moving and stationary vehicles - Two or more moving vehicles where all are road users	3	4	12	Medium	The risk posed to emergency services / private recovery service (on foot) from live lane working is classified as 'medium'. An increase in incidents and the severity that may occur means that they may need to attend more incidents. A vehicle may strike an operative working in a live	- Suitable signage strategy - Gates / emergency access points within the safety barrier	- Existing or portable variable message signs - CCTV cameras and SVD - Vehicle recovery

No.	Hazard	Primary affected population	Primary sub-population	Network wide causation factors	Location specific risk factors	Undesirable outcome (collisions)	Typical Risk (road works)				Comments	Layout mitigations	Operational mitigations
							L	S	R	Class.			
			service on foot	incident support (i.e. Traffic management and/or impact protection vehicle)		- Moving vehicle and obstruction					lane. Where a collision occurs, the severity of injury is likely to be fatal due to the operative likely being on foot.		- Speed enforcement
15b	Live carriageway working	Road workers	Traffic officer on foot, recovery service vehicle on foot	- Vehicle recovery - Stationary vehicle in a live lane - Poor or extreme weather conditions and/or visibility - Loss of control - Non-compliance with speed limit or speed restriction - Exposure to traffic when awaiting incident support (i.e. Traffic management and/or impact protection vehicle) - Incident management	- Speed limits and restrictions - Variation in conditions between peak and off-peak periods - Traffic signing and road markings and their condition - Narrow lane widths	- Moving and stationary vehicles - Two or more moving vehicles where all are road users - Moving vehicle and obstruction - Road user and road worker	2	4	8	Low	Traffic officers on foot and vehicle recovery operatives are at risk of being struck by vehicles when working in a live lane. If any impact was to occur, injuries are likely to be fatal due to the operative likely being on foot.	- Suitable signage strategy - Gates / emergency access points within the safety barrier	- Existing or portable variable message signs - CCTV cameras and SVD - Vehicle recovery - Speed enforcement
15c	Live carriageway working	Road workers	Maintainers on foot, TM operatives on foot	- Poor or extreme weather conditions and/or visibility - Loss of control - Non-compliance with speed limit or speed restriction - Installation/ removal of traffic management - Maintenance of barriers and TM signs and cones following barrier strikes	- Speed limits and restrictions - Variation in conditions between peak and off-peak periods - Traffic signing and road markings and their condition - Narrow lane widths	- Moving and stationary vehicles - Two or more moving vehicles where all are road users - Moving vehicle and obstruction - Road user and road worker	2	4	8	Low	Workers on foot are at risk of being struck by vehicles when installing/removing TM. The risk posed to workers from live lane working is considered to be lower than the risk posed to road users. This is due to the procedures workers follow and the liveried vehicles and Chapter 8 TTM. Where a collision occurs, the severity of injury is likely to be fatal due to the operative working on foot.	- Suitable signage strategy - Gates / emergency access points within the safety barrier - TTM in accordance with Chapter 8 of the TSM	- Existing or portable variable message signs - CCTV cameras and SVD - Vehicle recovery - Speed enforcement
16	Driver struggles to adjust to variable lighting levels or dazzled while driving	Road users	All	- Short sections of lit and unlit carriageway / transition to unlit from a lit section - Works vehicle headlights driving or stationary facing oncoming traffic - Vehicle mounted task lighting positioned to affect passing drivers - Poorly positioned static task lighting - Position/placement of signs and size (i.e. too late or bad location) - High proportion of older/light sensitive drivers	- Adjacent roads - local or private roads parallel to site route (road lighting and headlights) - Transverse lit routes over site route - Adjacent lit properties include static or reactive security lights - Contraflow	- Moving and stationary vehicles - With temporary traffic management or roadside furniture - Two or more moving vehicles including works vehicles	2	3	6	Low	Driver struggles to adjust to variable lighting levels or dazzled while driving. Older drivers and drivers with neurological conditions are disproportionately affected by this hazard. Approximately 20% of the population are especially light sensitive.	None	- Existing or portable variable message signs - Methodology for placing and changing signs - Appropriate sign checks