Smart motorways: Controlled motorways Generic safety report

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Approvals

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Executive summary

Introduction

The purpose of this safety report is to demonstrate that the appropriate level of safety management has been undertaken to assess the expected safety performance for the implementation of a generic controlled motorways (CM) scheme and that it should be able to achieve both its safety target and objective. This report also describes the approach taken and the outcomes achieved from conducting a safety risk assessment in accordance with GD04/12 'Standard for safety risk assessment on the strategic road network' of the CM concept including the demonstration of achievement of the safety target and objective for CM. Note: a stand-alone GD04 assessment document has not been produced for CM as has been done for ALR.

This document is applicable to both categories of generic CM scheme as defined in Interim Advice Note (IAN) 161/15 [1]:

1. A **category 1** CM scheme is the use of a signalling and signing layout in accordance with Figure 2.2.2 in IAN 161/15 (repeated in Figure 1-1) and has a similar layout to an all lane running (ALR) signalling and signing scheme. This can be split into two sub-categories: (1a) starting position of little or no signalling / message signs mark 1 (MS1) and (1b) starting position of a triple package scheme with cantilever MS3 or MS4.
2. A **category 2** CM scheme is the conversion of an existing advisory lane signalling scheme to CM, this generally includes the replacement of lane signalling and 2x12 message signs with a variable message sign (VMS) capable of displaying pictograms, wickets and messages similar to an ALR scheme. A category 2 scheme would also be in line with Figure 2.2.2 in IAN161/15 but existing portal gantries may be used to support VMS rather than using a cantilever structure.

Conclusion

The information presented in this report demonstrates that:

A safety target/objective has been set and can be achieved

- The road user safety baseline used to demonstrate the safety target has been met shall be the number (averaged per annum) of all fatal and weighted injury (FWI) casualties and the rate of FWI casualties per billion vehicle miles per annum averaged for the three years prior to the installation of any element of the scheme (including motorway incident detection and automatic signalling (MIDAS) queue protection) and prior to the start of construction.
- For road users the safety target is the achievement of an improvement in safety equivalent to that normally expected from the implementation of MIDAS queue protection (10%) [7] and CM (15%).
- There is no numerical safety objective or target for road worker and the risk must be managed in accordance with the 'so far as is reasonably practicable' principle. This is a legal requirement. Highways England's "Aiming for Zero" strategy must be applied for further positive action to reduce the risk to road workers during maintenance and operation.

- The safety target for road users can be achieved as it is expected that IAN161/15 compliant design CM schemes will achieve a safety benefit of 25% (10% for MIDAS queue protection and 15% for CM) compared to its baseline.
- The safety objective for road workers (maintainers) can be achieved through the use of safe taper locations/fixed taper points (where justified), remote access (remote monitoring) to technology equipment, reduced mandatory speed limits, and rationalisation of maintenance works for **category 1b and 2 schemes** (triple package or lane signalling scheme conversions respectively). **Category 1a schemes** may also need remotely operated temporary traffic management signs: this shall be determined by a scheme specific GD04 risk assessment. The safety objective can also be achieved for traffic officers and the National Vehicle Recovery Manager (NVRM).

An appropriate safety management process has been selected for the project and has been applied

- The result of the safety management system (SMS) selection process for the two categories of CM is the application of a **type A SMS** with some type B features. This represents a 'basic' level of safety management, complemented by additional assessment for the type B features.
- The project has been resourced with competent people to carry out the safety work.
- A robust safety approvals process is in place for safety documents.
- Highways England will monitor and evaluate the safety performance of each CM scheme.
- The generic CM safety report will be updated each time IAN 161 is updated. It will also be updated if there is a significant change in the operation of CM which requires an update to the safety assessment.

Safety risk is well managed

- The CM design will manage the risk to road users from queuing and from congestion, as well as speed related collisions.
- The risk to road workers will be managed:
    - Traffic officers and the NVRM will benefit from safety benefits to road users and the use of variable mandatory speed limits and VMS during incident management.
    - Mitigations have been identified (see above) to manage the maintenance required for the increase in the amount of technology.

Appropriate methods and processes have been used in delivering this assessment

- The generic CM design is compatible with standards.
- Good practice has been followed during this assessment.

Summary

It can be concluded from the information summarised in this safety report that the objective to “demonstrate that the appropriate level of safety management has been undertaken to assess the expected safety performance for generic CM design guidance” has been met. For road users it can be demonstrated that the safety target is expected to be met and for road workers it can be demonstrated that the safety objective can be achieved. This report also demonstrates that the risk from CM has been suitably analysed in accordance with GD04.

1 Introduction

1.1 Document purpose

The purpose of this safety report is to demonstrate that the appropriate level of safety management has been undertaken to assess the expected safety performance for the implementation of a generic controlled motorways (CM) scheme and that it should be able to achieve both its safety target and objective. This report also describes the approach taken and the outcomes achieved from conducting a safety risk assessment in accordance with GD04/12 'Standard for safety risk assessment on the strategic road network' of the CM concept including the demonstration of achievement of the safety target and objective for CM. Note: a stand-alone GD04 assessment document has not been produced for CM as has been done for ALR.

1.2 Document scope

This document is applicable to both categories of generic CM scheme as defined in Interim Advice Note (IAN) 161/15 [1]:

3. A **category 1** CM scheme is the use of a signalling and signing layout in accordance with Figure 2.2.2 in IAN 161/15 (repeated below in Figure 1-1) and has a similar layout to an all lane running (ALR) signalling and signing scheme. This can be split into two sub-categories: (1a) starting position of little or no signalling / message signs mark 1 (MS1) and (1b) starting position of a triple package scheme with cantilever MS3 or MS4.
4. A **category 2** CM scheme is the conversion of an existing advisory lane signalling scheme to CM, this generally includes the replacement of lane signalling and 2x12 message signs with a variable message sign (VMS) capable of displaying pictograms, wickets and messages similar to an ALR scheme. A category 2 scheme would also be in line with Figure 2.2.2 in IAN161/15 but existing portal gantries may be used to support VMS rather than using a cantilever structure.

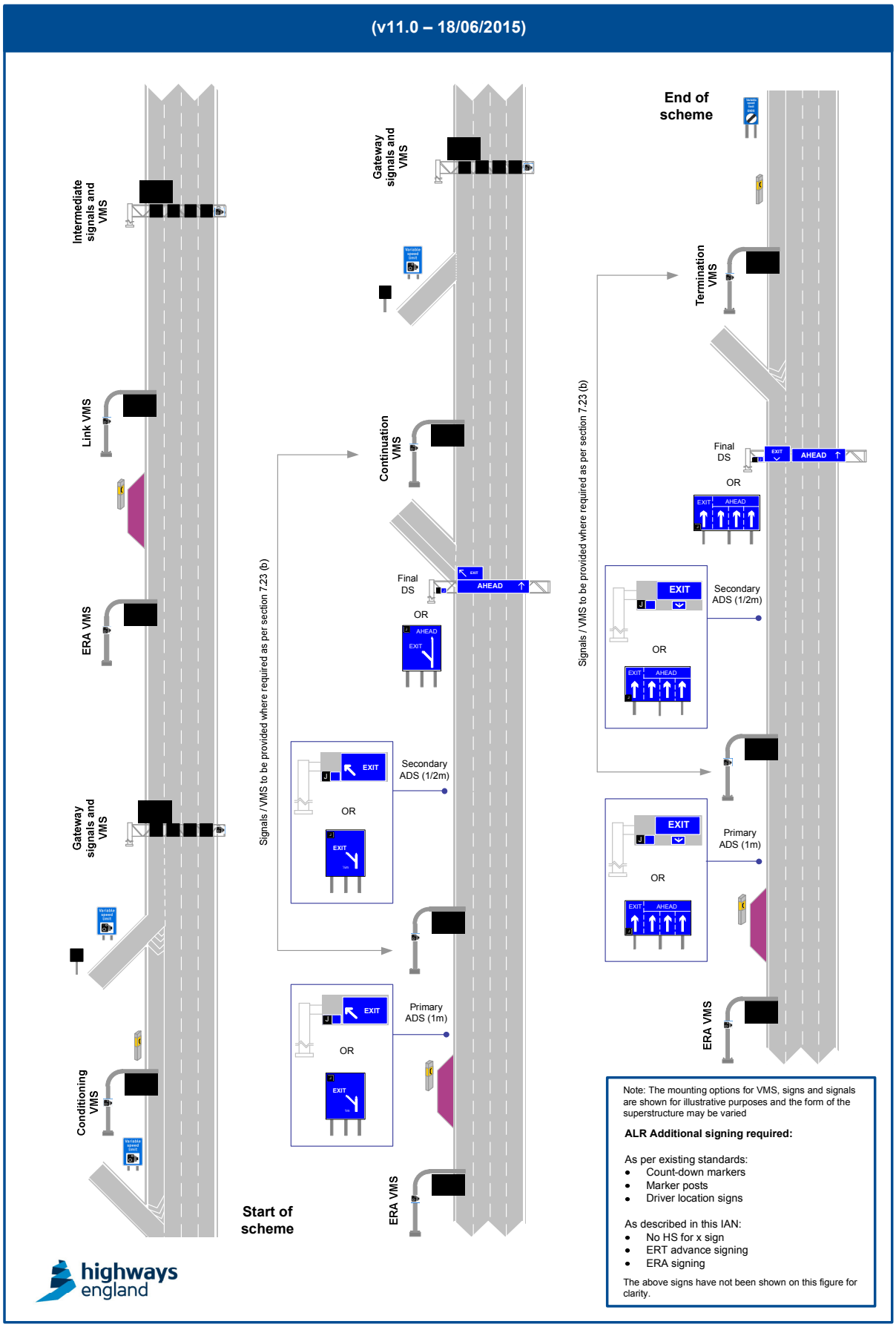

Figure 1-1: Illustrative drawing of a category 1 CM scheme

1.3 Document structure

The structure of this document is summarised below.

Chapter 1: **Introduction** - this chapter

Chapter 2: **Has the safety objective/target been agreed and can it be achieved?** – sets out the safety target for road users, safety objective for road workers and safety baseline for a generic CM scheme and demonstrates that the safety objective/target can be achieved

Chapter 3: **Has an appropriate safety management process been selected for CM and applied?** – describes how an appropriate safety management system (SMS) has been selected and applied, and shows that the project has been resourced with competent people for the safety work, a robust safety approvals process is in place, there are plans in place to monitor safety performance, and that the safety report will be updated as required

Chapter 4: **Has safety risk been well managed?** – demonstrates that hazards on a CM scheme for road users and road workers have been suitably managed. This chapter also demonstrates that the risk from CM has been suitably analysed in accordance with GD04 [5]

Chapter 5: **Have appropriate methods and processes been followed during the assessment?** – shows that the assessment of CM has followed standards, guidelines, regulations, and good practice

Chapter 6: **Conclusion**

Appendices: **References, glossary of terms and abbreviations**

2 Has the safety target/objective been agreed and can it be achieved?

This chapter demonstrates that:

- The safety baseline for the project has been agreed
- The safety target for road users and safety objective for road workers have been agreed
- Achievement of the safety target and objective can be demonstrated

2.1 Safety baseline, target and objective for CM design guidance

The safety baseline, target and objective listed below were agreed with the Design Workstream, Professional and Technical Solutions Directorate Project Sponsor and recorded in the CM safety plan [1]. Sign off of this safety report confirms that agreement.

2.1.1 Safety baseline

Road users: validated STATS19 personal injury collision (PIC) data covering the scheme extent, including merge and diverge slips shall be used to determine the road user safety baseline. The road user safety baseline used to demonstrate the safety target has been met shall be the number (averaged per annum) of all fatal and weighted injury (FWI)[1] casualties and the rate of FWIs casualties per billion vehicle miles per annum averaged for the three years prior to the installation of any element of the scheme (including motorway incident detection and automatic signalling (MIDAS) queue protection) and prior to the start of construction.

This is the same as for ALR.

2.1.2 Safety target for CM

Road users: the safety target is the achievement of an improvement in safety equivalent to that normally expected from the implementation of MIDAS queue protection (10%) [7] and CM (see sections 2.2.1 and 4.1).

The designer shall determine if additional safety mitigation measures could be justifiably deployed (that are not contained in IAN 161/15) that would provide a greater contribution to Highways England's safety targets.

2.1.3 Safety objective

Road workers: there is no numerical safety objective or target for road workers and the risk must be managed in accordance with the 'so far as is reasonably practicable (SFAIRP)' principle. This is a legal requirement. Highways England's "Aiming for Zero" strategy must be applied for further positive action to reduce the risk to road workers during maintenance and operation. One part of the strategy aims to eliminate all fatalities

[1] FWI is defined as: (Number of fatalities) + 0.1 x (number of serious casualties) + 0.01 x (number of slight casualties).

and serious injuries to road workers maintaining Highways England's road network. Highways England no longer permits live lane crossings on the motorway network and has an overarching ambition of having zero killed or serious injuries (KSI) on the strategic road network (SRN).

This is the same as for ALR.

2.2 Demonstration of meeting safety target and objective

2.2.1 Road users safety target

MIDAS queue protection has a known safety benefit of 10% [7] with wider spaced signalling and advisory speed limits. The CM design with closer spaced signalling, some lane signalling and variable mandatory speed limits (VMSL) should achieve the 10% safety benefit for queue protection.

The "Review of safety benefit for Controlled Motorways with verge signalling" [9] considers whether the full safety benefit of controlled motorways of 15% [8] would be achieved with a signalling and signing layout similar to ALR. It is primarily based on the report that details the findings from the *Managed Motorways 2 Concept Development Tasks 2,3,4,5* that were conducted by TRL (some of the tasks used simulator studies). It concludes that:

- Both category 1a and 2 schemes are expected to achieve the full CM benefit as per M25 as the anticipated nominal spacing of CM (950m) with IAN161/15 signalling is similar to that of the M25 CM signalling (1000m) where the 15% safety benefit was assessed and demonstrated to have been achieved. If a category 1b scheme achieves a signal spacing beyond 1000m due to retention of existing MS4s (which is likely to need departures from standard) the full CM benefit as per M25 CM may not be achieved.
- The difference between overhead lane signalling and verge mounted signalling is likely to be insignificant in terms of the benefit of CM.

Therefore it is expected that IAN161/15 compliant design CM schemes will achieve a safety benefit of 25% compared to its baseline (10% for MIDAS queue protection and 15% for CM).

It is the designer's responsibility to determine if additional safety mitigation measures may be justifiably deployed in accordance with GD04 [5]. The adoption of any such measures shall be endorsed by the Highways England Project Manager and the Project Safety Control Review Group (PSCRG).

2.2.2 Road workers safety objective

Use of the Highways England road worker safety assessment tool (RWSAT) [11] provides evidence that a generic CM scheme will reduce the risk to maintainers and hence the road worker safety objective can be achieved for maintainers through implementation of the following mitigations [12]:

- Use of safe taper locations/fixed taper points, remote access (remote monitoring) to technology equipment, reduced mandatory speed limits, and rationalisation of maintenance works for **category 1b and 2 schemes**
- Use of safe taper locations/fixed taper points, remote access (remote monitoring) to technology equipment, reduced mandatory speed limits, and

rationalisation of maintenance works**, plus** the use of remotely operated temporary traffic management (TTM) signing for a **category 1a scheme** (starting position of little or no signalling/message signs mark 1 (MS1)).

A GD04 [5] risk assessment must be undertaken by each CM scheme to determine whether or not remotely operated TTM signing is required. It will also be necessary for each CM scheme to undertake a GD04 risk assessment to determine the reasonable practicability of the inclusion of a rigid concrete barrier (RCB) in the central reserve, that is does it considerably outweigh the likely benefit to the maintainer (and other benefits such as preventing crossover collisions)? The residual life of the existing central reserve restraint system should also be determined to understand whether RCB can be justified as part of asset renewal integration within the scheme, or Highways England's requirement for a 5 year renewal free period after construction.

CM does not introduce any new hazards for traffic officers and the national vehicle recovery manager (NVRM). Part of their risk profile will be in line with that for road users. In addition VMSL and VMS can be used during incident management to improve the safety of staff working in the live carriageway. Hence the safety objective can be achieved for these road workers.

It is the designer's responsibility to determine if additional safety mitigation measures may be justifiably deployed. The adoption of any such measures shall be endorsed by the Highways England Project Manager and the PSCRG.

[2] The longer term ambition for Highways England is to use the variable message signs and signals to advance sign lane closures for maintenance, which will have a significant benefit for maintenance road worker safety. This would eliminate the need for remotely operated TTM signs reducing the asset by the roadside that needs maintenance.

3 Has an appropriate safety management process been selected for CM and applied?

This chapter demonstrates that:

- An appropriate SMS has been selected and applied
- The project has been resourced with competent people to carry out the safety work
- A robust safety approvals process is in place
- Safety performance will be monitored
- The safety report will be maintained

3.1 Project safety management system

3.1.1 Categorisation

IAN 139/11 Managed Motorways Project Safety Risk Work Instructions [3] describes the process by which the SMS is selected for a project or other activity affecting safety on the strategic road network, however does not have work instructions for a type A scheme. IAN151/11, Safety Risk Management Guidance for Network Delivery and Development Directorate (NDDD) [4] includes guidance for a type A SMS and non-smart motorway (traditional) major improvement schemes.

The work undertaken on this project also aligns to the direction provided within the Standard for Safety Risk Assessment on the Strategic Road Network (GD04) [5].

The results of the categorisation process for the scheme are summarised and presented in Table 3.1. Each assessment will be on a region by region basis and the scheme SMS categorisation for operation and technology will depend on experience with ALR signalling within the region and what existing technology is present. The SMS categorisation has identified the need for a type A SMS with type B features for a generic CM scheme. However additional type B features may be applicable on specific schemes.

Table 3.1: Reasoning for classification decisions

Feature	Category 1a	Category 1b	Category 2
1. Stakeholder interest	**Type A** A number of stakeholders are involved whose influence will be limited. This will be determined from initial liaison upon the scheme design. Stakeholders include: • NDDD and Customer Operations (CO) • Maintenance operatives • Emergency services • Local Authorities and Statutory Environmental Bodies	**Type A** A number of stakeholders are involved whose influence will be limited. This will be determined from initial liaison upon the scheme design. Stakeholders include: • NDDD and CO • Maintenance operatives • Emergency services • Local Authorities and Statutory Environmental Bodies	**Type A/B** Stakeholder interest will be greater as it might be converting from lane signalling to a design including verge MS4s. A number of stakeholders are involved whose influence will be limited. This will be determined from initial liaison upon the scheme design. Stakeholders include: • NDDD and CO • Maintenance operatives • Emergency services • Local Authorities and Statutory Environmental Bodies
2. Operational experience	**Type A** Experience with MIDAS and MS4s will have been gained within the regional control centre (RCC) from other parts of the region.	**Type A** Experience with MIDAS and MS4s will have been gained within the RCC from other parts of the region.	**Type A** Smaller change as moving from an advisory signalling environment with MIDAS queue protection to a mandatory signalling environment with CM.
3. Technology	**Type A** Experience of technology through application on previous schemes. It is noted that ALR signalling will be introduced on other schemes.	**Type A** Experience of technology through application on previous schemes. It is noted that ALR signalling will be introduced on other schemes.	**Type A** Experience of technology through application on previous schemes. Most of the infrastructure is already in place but would be replaced by newer AMIs and MS4s.

Feature	Category 1a	Category 1b	Category 2
4. Standards and legislation	**Type B** The design requirements for ALR signalling are available through IAN 161/13 but no specific CM IAN until IAN161/15 is published. New legislation (statutory instrument) will be required for VMSL.	**Type B** The design requirements for ALR signalling are available through IAN 161/13 but no specific CM IAN until IAN161/15 is published. There may be significant numbers of departures from standard if the existing signal spacing for MS4s is retained. New legislation (statutory instrument) will be required for VMSL.	**Type B** The design requirements for ALR signalling are available through IAN 161/13 but no specific CM IAN until IAN161/15 is published. New legislation (statutory instrument) will be required for VMSL.
5. Impact on Organisation	**Type B** Some impact as there will be more signals to operate, and more equipment to maintain. Will be more significant where no ALR signalling is present in a region.	**Type A** No real impact upon Highways England; limited additional equipment to operate and maintain.	**Type A** No real impact upon Highways England; limited additional equipment to operate and maintain.
6. Project Scale	This will depend on the scale of the scheme[3].	This will depend on the scale of the scheme.	This will depend on the scale of the scheme.

[3] It is noted that in terms of this project it is a type B, possibly leaning towards a type C, as the potential for roll-out is significant.

3.1.2 Proposed project safety management process

Table 3.1, modified from project safety risk management (PSRM) work instruction 003 [3], summarises the safety risk management activities for type A projects. This is also aligned to the process set out in IAN 151/11 [4].

Table 3.1: Summary of safety management activities for a type A project

Safety management activity	Brief description of activity	Reason for carrying out the activity
Safety plan including safety baseline and objectives	Defining the current level of safety and the level to which the scheme will work to achieve.	Supports the planning of safety activities and demonstrates that a defined safety management approach is being used. A baseline is required to be able to measure achievement of the safety objective/target.
Risk assessment activities: a) Review of safety benefit for CM with verge signalling	Determine the safety benefits of a verge based signalling approach to CM.	Identify the safety benefits expected from each category for a CM intervention.
Risk assessment activities: b) road worker safety assessment	Assesses the change in risk and the appropriate mitigation measures required for the risk to be reduced SFAIRP.	The road worker safety assessment tool allows the designer to determine the level of risk to maintainers and what mitigation measures are needed to reduce risk SFAIRP.
Safety report	Documenting the safety work that has been carried out.	Provides documented evidence of if and how the safety objectives/targets were achieved.
Hazard elimination and management schedule [13]	Identifying hazards or hazardous activities and any associated risk.	To meet Construction Design and Management (CDM) requirements as a designer.

3.2 Competence of resources

The work presented in this document has been carried out by the same team that carried out the hazard assessment work on the following Highways England projects:

- M42 Active Traffic Management Pilot scheme
- Birmingham Box phases 1, 2 & 3 schemes
- M1 J28-35a smart motorway ALR scheme
- M4 J3-12 smart motorway ALR scheme

This team has competency consistent with the guidance contained in the remit for organisation and governance - National Safety Control Review Group and project safety control review group as well as GD04 [5].

3.3 Safety acceptance and approval process

The safety acceptance and approvals process of the generic CM safety deliverables will be as follows:

- The safety report will be approved by the Professional and Technical Solutions, Asset and Operational Development Group Manager as senior responsible owner for this project and the Chief Highway Engineer
- Other deliverables will be approved by the Highways England Project Sponsor
- All deliverables will be reviewed by the SMP CDM-Advisor.

3.4 Safety monitoring

Highways England will monitor and evaluate the safety performance of each CM scheme. This will be used to update this safety assessment and IAN161 as necessary in accordance with GD04.

3.5 Maintaining the safety report

The generic CM safety report and supporting documentation will be updated each time IAN 161 is updated. It will also be updated if there is a significant change in the operation of CM which requires an update to the safety assessment. This is in accordance with GD04.

4 Has safety risk been well managed?

As a type A SMS has been selected a formal hazard log and hazard log report are not required for a generic CM scheme. This chapter demonstrates that the risk from CM has been suitably analysed in accordance with GD04 [5].

4.1 Road user safety risk

This section covers population 3 – 'users' as defined in GD04. The safety benefit for queue protection is well defined [7] and is expected to be a 10% reduction in safety risk. This is because the reduced speed limits protect queuing traffic by giving advance warning of the queue, reducing the speed of vehicles; giving road users more time to react to slowing / stationary vehicles, and reducing the consequences of any collision.

The "Review of safety benefit for controlled motorways with verge signalling" [9] assessed the evidence in a number of papers and reports relevant to the CM benefit and ALR signalling benefits. The review considered the effect of varying the spacing of VMS / signal gantries on driver behaviour, in terms of speed and lane choice and the effect of the type of VMS or signal used; in this case gantry or verge mounted. It is primarily based on the report that details the findings from the Managed Motorways 2 Concept Development Tasks 2,3,4,5 that were conducted by TRL. The findings are noted in section 2.2.1.

The congestion management benefit works by reducing the speed differential between vehicles and minimising the stop / start nature of congestion traffic. By reducing the likelihood of some drivers braking heavily on reaching congestion, the algorithm allows traffic to flow more smoothly, reducing in particular the number and severity of nose to tail collisions. This is further assisted as the VMSL help to reduce the speed of impact of any collision.

The VMSL and related speed enforcement will reduce the risk from speed related collisions.

The designer shall determine if additional safety mitigation measures may be justifiably deployed (that are not mentioned in this safety report) that would provide an improved contribution to Highways England's safety target for road users. The adoption of any such measures shall be endorsed by the Highways England Project Manager and PSCRG.

4.2 Road worker safety risk

GD04 defines the populations that should be considered in the assessment of risk. Workers are defined as follows:

- Population 1 – People directly employed by Highways England and who work on the SRN, e.g. traffic officers
- Population 2 – People in a contractual relationship with Highways England, e.g. NVRM and maintainers.

These populations are considered in the sub-sections below.

4.2.1 Traffic officers and NVRM

The risk to traffic officers and the NVRM will be mitigated as for road users. In addition the VMSL and VMS can be used to provide better information to road users on lane closures, improving the safety of people dealing with incidents in live lanes.

The designer shall determine if additional safety mitigation measures may be justifiably deployed (that are not mentioned in this safety report) that would provide an improved contribution to Highways England's safety target for road workers. The adoption of any such measures shall be endorsed by the Highways England Project Manager and PSCRG.

4.2.2 Maintainers

Implementation of CM increases the risk to maintainers through the increase of technology that needs to be maintained. The risk to maintainers will be managed through the implementation of the following [12]:

- **Safe taper locations** allow the safest areas on the network to deploy TTM to be determined in advance of maintenance works being deployed and used each time TTM is required. This is standard practice for maintainers and guidance is provided in Chapter 8 of the Traffic Signs Manual. It is only when remotely operated TTM signs are implemented that there is a need to determine fixed taper points.
- The introduction of **remote access to VMS and signals** will reduce site visits linked with diagnostics of equipment; evidence from the trialling of the equipment has shown a reduction in maintenance visits to equipment covered by the remote access.
- **Reduced mandatory speed limits (40mph) will be utilised during the set up and take down of TTM;** this reduces risk to operatives through a more controlled environment compared with the 'before' case (existing situation). The mandatory speed limits will support the lane closures put in through the signalling.
- As part of national and scheme specific liaison with NDDD it has been determined that periodic maintenance will allow for **rationalisation of maintenance works**. This will contribute to minimising exposure to workers by reducing the number of deployments of TTM. To a large extent this is already done in the 'before' case.
- **Remotely operated TTM signs** located at designated fixed taper points mitigate the highest scoring hazard associated with maintainer operations (H52 - Maintenance workers setting up and taking down work site) by removing the need for an operative to be present on the network to set out advanced TTM signing. A GD04 [5] risk assessment must be undertaken for each CM scheme to determine whether or not remotely operated TTM signing is required for the CM scheme (most likely for a **category 1a scheme**).
- RCB results in reduced maintenance activities associated with barrier strikes in the central reserve, and in the elimination of inspection and re-tensioning of steel barrier therefore lowering risk to maintainers not having to be on the network as often. However it is expected that the inclusion of RCB is more likely to be driven by the integration of asset renewal works in to the CM scheme. A GD04 risk assessment is required for each scheme to determine the reasonable practicability of providing RCB in the central reserve for the CM scheme.

The designer shall determine if additional safety mitigation measures may be justifiably deployed (that are not mentioned in this safety report) that would provide an improved contribution to Highways England's safety target for road workers. The adoption of any such measures shall be endorsed by the Highways England Project Manager and PSCRG.

5 Have appropriate methods and processes been followed during the assessment?

This chapter demonstrates that:

- CM is compatible with standards
- Good practice and project wide systems have been followed during this safety assessment

5.1 Compatibility of design with design requirements and legislation

The revised CM signing, signalling and technology requirements are aligned to ALR as defined in IAN 161. Other design requirements not covered in IAN161 are compatible with the relevant standards in the Design Manual for Roads and Bridges and other relevant Interim Advice Notes. The main difference from current IAN 149/11 CM signalling is the use of carriageway based signalling and revised visibility parameters and there is good evidence that these requirements are appropriate for CM [9].

A statutory instrument will be required for VMSL. The design is compliant with all legislation.

5.2 Good practice

Good practice has been demonstrated as follows:

- **Document review and approval** – All documents formally issued on the project go through a review and approval process. Each document is signed by the author, checker, reviewer and the person who authorises it for issue, who must be a senior / suitably experienced and competent member of the project team. These documents are then passed to Highways England for review. If changes are requested, a new issue of the document is prepared and the review and approval cycle is repeated.
- **Document management** – All documents formally issued on the project are collated within the project directory hosted by Mouchel. Documents relevant to other team members are distributed either by e-mail, our document management systems or as paper copies.
- **Quality system** – Mouchel operates a quality management system to ISO 9001, against which it is regularly audited. A quality plan is produced for each contract with Highways England [10].
- **Safety risk management** – IAN 139/11 [3] and IAN 151/11 [4] have been applied for selecting a project SMS and determining what activities to undertake. In addition the principles of GD04 [5] have been applied and the RWSAT [11] used.
- **CDM input –** this has been achieved through the review of safety documentation by the SMP CDM-Advisor and the production of a hazard elimination schedule.

6 Conclusion

6.1 Review of chapters

The information presented in this report demonstrates that:

A safety target/objective has been set and can be achieved

- The road user safety baseline used to demonstrate the safety target has been met shall be the number (averaged per annum) of all FWI casualties and the rate of FWI casualties per billion vehicle miles per annum averaged for the three years prior to the installation of any element of the scheme (including MIDAS queue protection) and prior to the start of construction.
- For road users the safety target is the achievement of an improvement in safety equivalent to that normally expected from the implementation of MIDAS queue protection (10%) [7] and CM (15%).
- There is no numerical safety objective or target for road workers and the risk must be managed in accordance with the SFAIRP principle. This is a legal requirement. Highways England's "Aiming for Zero" strategy must be applied for further positive action to reduce the risk to road workers during maintenance and operation.
- The safety target for road users can be achieved as it is expected that IAN161/15 compliant design CM schemes will achieve a safety benefit of 25% (10% for MIDAS queue protection and 15% for CM) compared to its baseline. The safety objective for road workers (maintainers) can be achieved through the use of safe taper locations/fixed taper points, remote access (remote monitoring) to technology equipment, reduced mandatory speed limits, and rationalisation of maintenance works for **category 1b and 2 schemes** (triple package or lane signalling scheme conversions respectively). **Category 1a schemes** may also need remotely operated TTM signs: this shall be determined by a scheme specific GD04 risk assessment. The safety objective can also be achieved for traffic officers and the NVRM.

An appropriate safety management process has been selected for the project and has been applied

- The result of the SMS selection process for the two categories of CM is the application of a **type A SMS** with some type B features. This represents a 'basic' level of safety management, complemented by additional assessment for the type B features.
- The project has been resourced with competent people to carry out the safety work.
- A robust safety approvals process is in place for safety documents.
- Highways England will monitor and evaluate the safety performance of each CM scheme.
- The generic CM safety report will be updated each time IAN 161 is updated. It will also be updated if there is a significant change in the operation of CM which requires an update to the safety assessment.

Safety risk is well managed

- The CM design will manage the risk to road users from queuing and from congestion, as well as speed related collisions.
- The risk to road workers will be managed:
    - Traffic officers and the NVRM will benefit from safety benefits to road users and the use of VMSL and VMS during incident management.
    - Mitigations have been identified (see above) to manage the maintenance required for the increase in the amount of technology.

Appropriate methods and processes have been used in delivering this assessment

- The generic CM design is compatible with standards.
- Good practice has been followed during this assessment.

6.2 Summary

It can be concluded from the information summarised in this safety report that the objective to "demonstrate that the appropriate level of safety management has been undertaken to assess the expected safety performance for generic CM design guidance" has been met. For road users it can be demonstrated that the safety target is expected to be met and for road workers it can be demonstrated that the safety objective can be achieved. This report also demonstrates that the risk from CM has been suitably analysed in accordance with GD04.

Appendices

A1 – References

[1]	Controlled Motorways Generic Safety Plan, 1065017-WP017-DOC001
[2]	IAN 161/15 Smart Motorways All Lane Running
[3]	Project Safety Risk Management - Work Instructions 001-004, IAN139/11
[4]	IAN 151/11 Safety Risk Management Guidance for NDDD
[5]	GD04/12 Standard for safety risk assessment on the strategic road network
[6]	HADECS Implementation Guidance
[7]	TRL Report: *Evaluating the benefits of MIDAS queue protection*
[8]	Report: *Safety Benefits of the M25 Controlled Motorway: 1990 to 2006 data*
[9]	Review of safety benefit for Controlled Motorways with verge signalling, 1065017-WP017-DOC003
[10]	Work Package 239(4/45/12)ARPS, Smart Motorways - Call Off Technical Support, Quality Plan
[11]	Road worker (maintainer) safety assessment tool (RWSAT), MPI-19-112013
[12]	GD04 assessment - meeting the road worker (maintainer) safety objective, 1065017-WP017-DOC004
[13]	Hazard Elimination and Management Schedule, 1065017-WP017-DOC002

A2 – Glossary of terms and abbreviations

Acronym	Description
CDM	Construction Design and Management
CM	Controlled motorways
FWI	Fatal and weighted injury
IAN	Interim advice note
MIDAS	Motorway incident detection and automatic signalling
MS4	Message sign, mark 4
NVRM	National vehicle recovery manager
NDDD	Network Delivery and Development Directorate
RCC	Regional control centre
SFAIRP	So far as is reasonably practicable
SMP	Smart Motorways Programme
SMS	Safety management system
VMS	Variable message sign
VMSL	Variable mandatory speed limits