M5 Junction 10 Improvements Scheme

Safety Report

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Safety Report

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Name Date Signature	Chris Gunney MP Project Manager	I endorse confirmation that: • the scope and content of the attached deliverable are correct and fit for purpose given the current stage of the project. • the attached deliverable complies with the requirements for guidance for the safety governance of National Highways projects, in as far as is reasonably practicable
Name Date Signature	Mark Arberry Operations Directorate Senior User	I accept that in relation to the project operating regime the scope and content of the attached deliverable are correct and fit for purpose given the current stage of the project.
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Signature		• the attached deliverable complies with the requirements for guidance for the safety governance of National Highways projects, in as far as is reasonably practicable • that all required signatures for this product have been obtained.

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Executive Summary

Introduction

This document is the first version of the Safety Report for the implementation of the M5 Junction 10 Improvements scheme at Stage Gate Assessment Review (SGAR) 3.

The purpose of the document is to demonstrate, at SGAR 3, that the appropriate level of safety management has been undertaken to assess the expected safety performance for the implementation of the M5 Junction 10 scheme.

At Stage 3, the following existing safety issues have been identified along with opportunities to address these through the proposed improvements scheme:

- Congestion and collisions at junctions 9 and 11 and along local routes (which will be bypassed by the creation of new south-facing slip roads at junction 10)
- Congestion-related collisions involving southbound vehicles exiting the M5 at Junction 10 towards the A4019 (which will be addressed through creation of the new gyratory and southbound off slip)
- The poor safety record along the A4019 east of the M5 junction. (New pedestrian, cycle and equestrian facilities introduced by the scheme are aimed at reducing KSIs and pedestrian and cycle collisions)

New potential safety challenges introduced by the scheme include:

- The introduction of two additional slip roads will create additional merge and diverge movements on the mainline and potential vehicle conflicts associated with these layouts
- Increased traffic flows at Junction 10 and at junctions along the A4019 could lead to an increase in vehicle movements and the potential for conflicts
- The creation of a new junction on the B4634 Old Gloucester Road at the West Cheltenham

The scheme affects sections of the Strategic Road Network (SRN) and the local road network and ownership responsibilities are therefore shared between National Highways and Gloucestershire County Council (GCC).

Conclusions

The information presented in this report demonstrates that:

Safety challenges have been identified and addressed

The key safety challenges introduced or addressed by the scheme are listed above and have been addressed through mitigation measures.

An appropriate scheme categorisation has been selected for the project and has been applied

Following the processes outlined in GG 104, the scheme activity has been categorised overall as 'Type A'.

Safety objectives have been set for the scheme and are likely to be achieved. The safety objectives are:

- the annual average FWI casualty rate per 100 million vehicle miles along the M5 between a point 500m north of Elmstone Hardwick Bridge and a point 500m south of Staverton Twin Culvert is better than the baseline (Parameter 1);
- the annual average FWI casualty rate on each of the 4 (two new and two existing) M5 slip roads is better than the baseline (Parameter 2);

- the annual average number of FWI casualties in the scheme area (includes M5, M5 slip roads, A4019 between Manor Road (not inclusive of) and Stanboro Lane and the B4634 in the vicinity of the new West Cheltenham Link Road) is better than the baseline (Parameter 3)

For each link, no population (e.g. car drivers, pedestrians, heavy goods vehicle (HGV) drivers and motorcyclists) is disproportionately adversely affected in terms of safety and risk to each population remains tolerable.

See Appendix F for plan showing baseline extents.

Safety risks for all affected populations have been identified, assessed and mitigated

In accordance with GG104, affected populations have been identified. Hazard identification and risk assessments have been undertaken for the scheme and provided in Appendix A with appropriate control measures for the hazards identifed to manage safety risk to an acceptable level.

Initial operational safety performance of the scheme will be monitored

The following monitoring activities are expected to be used:

- Implementation of the Plan for Monitoring Operations (PfMO)[5]
- Scheme assessment to be undertaken after an appropriate period of operation and covered through Benefits Realisation and Evaluation activities.
- Stage 4 road safety audit at 12 months of operation
- Assessment of operational monitoring reports, for example from the Traffic Officer Service or maintainers

Appropriate safety governance arrangements have been followed

The M5 Junction 10 scheme design is compatible with standards, guidelines and regulations. Good practice and project wide systems have been and will be followed during project execution. Stakeholder engagement will form a key part of the scheme and will continue throughout the design process.

Summary

It can be concluded from the information summarised in this Safety Report that the objectives are likely to be met and the M5 Junction 10 Improvements scheme can be operated in a safe manner.

1. Introduction

1.1.1 This introduction sets out the purpose of the Safety Report, its scope, and presents the document structure along with a summary of each chapter.

1.2 Report purpose

1.2.1 The purpose of the document is to demonstrate at SGAR 3, that:

- The scheme is capable of being operated in an acceptably safe manner
- A proportionate safety risk assessment has been undertaken
- Safety challenges have and will be addressed
- The safety objectives can be achieved
- Risk management has been continually applied through scheme development and delivery
- Appropriate safety risk governance has been applied.

1.3 Scheme description

1.3.1 The M5 junction 10 is located 48 miles to the south of Birmingham, five miles to the south of Tewkesbury, four miles to the north-west of Cheltenham, and eight miles to the north-east of Gloucester. It is the northernmost of four junctions serving the Gloucester and Cheltenham urban areas.

1.3.2 This places the junction in a strategically important location for the region, particularly as northern and western Cheltenham are the sites of a number of large retail parks and employment areas, and the location of planned future housing and nationally-significant business development.

1.3.3 The scheme introduces an all-movements junction enabling traffic to both enter and exit the M5 and A4019 in all directions. These improvements are expected to relieve congestion at adjacent junctions (9 and 11) along the M5 and also along local routes used to bypass the junction.

1.3.4 The scheme has been developed to address and cater for the forecast increase in traffic at the M5 junction 10 by installation of a large, elongated signal controlled roundabout as well as new signal controlled junctions and widening along the A4019. Dualling of the A4019 will increase capacity and create a safer road environment by the separation of opposing traffic flows through installation of a central reserve.

1.3.5 New service roads will be constructed parallel to the A4019 to maintain access to properties along the route.

1.3.6 The construction of the new West Cheltenham Link Road will provide greater connectivity between the reconfigured M5 junction 10 and both the West Cheltenham Strategic Allocation, Safeguarded Land and the Proposed Cyber Park.

1.3.7 Provision of new or improved pedestrian, cycle and horse riding facilities along the A4019 and West Cheltenham Link Road will encourage sustainable travel and improve the safety of vulnerable road users in the scheme area.

1.4 Report scope and structure

1.4.1 The M5 Junction 10 Improvements scheme will be implemented at junction 10 where north-facing slip roads only are currently provided connecting the A4019 with the motorway network. The scheme involves modifications to both the Strategic Road Network (SRN) and local roads with ownership responsibilities shared between National Highways

and Gloucestershire County Council (GCC)[1]. This document is the Safety Report for the implementation of M5 Junction 10 Improvements scheme at SGAR 3.

1.4.2 This document is applicable to all of the project lifecycle stages of the M5 Junction 10 Improvements scheme including operations and decommissioning. The document will evolve as the scheme progresses, with more detail being added as more information becomes available.

1.4.3 This version of the Safety Report covers the preliminary design stage of the scheme (SGAR3). Future versions will be required for development stage (SGAR5), construction and handover stage (SGAR6) and closeout stage (SGAR7).

1.4.4 The structure of this document is summarised below:

Table 1-1 - Document Structure

Chapter	Title	Description
1	Introduction	Introduction - this section
2	Determine whether the safety objectives have been agreed and can be achieved	Sets out the safety baselines and safety objectives for the scheme and the demonstration that the safety objectives can be achieved.
3	Safety governance	This section demonstrates that an appropriate safety risk assessment process has been selected and applied; that the project has been resourced with competent people to carry out the safety work; a robust safety approvals process is in place; that plans are to be put in place to monitor project safety performance; and that the Safety Report will be maintained.
4	Have operational safety risks been well managed	This section demonstrates that, for all affected populations, an appropriate safety risk assessment methodology has been used, and that all reasonably foreseeable hazards have been identified and analysed and suitable safety risk mitigations have been implemented
5	Conclusion	Conclusions
Appendices	Appendix A	Hazard Identification and Risk Analysis tables – Demonstration of application of GG104
	Appendix B	Risk Matrix
	Appendix C	References
	Appendix D	Glossary of terms and abbreviations
	Appendix E	Scheme overview plan
	Appendix F	Baseline extents

[1] Further detail of these shared responsibilities is set out in the Maintenance and Repair Statement[4] (ref: GCCM5J10-ATK-GEN-ZZ-PC-CH-000011) which includes maintenance responsibilities and asset ownership

2 Determine whether the safety objectives have been agreed and can be achieved

2.1.1 This section demonstrates that:

- The safety baseline for the project safety objectives has been agreed
- The safety objectives have been agreed for both road users and road workers
- The methodology for demonstrating the safety objectives has been developed and agreed
- Achievement of the safety objective can be demonstrated

2.2 Safety baseline for the M5 Junction 10 Improvements scheme

2.2.1 The Safety Plan[1] produced during Stage 3 sets out the safety baseline and safety objectives for the scheme.

2.2.2 The safety baseline for the M5 Junction 10 Improvements scheme is shown in Table 2-1. The baseline has been defined in three parameters to capture the casualty rate on the M5 motorway, the casualty rate on the M5 junction 10 slip roads and the number of casualties within the whole scheme area.

2.2.3 The baseline and objective refer to Fatal and Weighted Injuries (FWI), which is a formula used to reflect the approximate ratios between the costs of fatal, serious and slight injuries as given by DfT's Web Technical Advisory Group (TAG) and is defined as:

- (Number of fatalities) + 0.1 x (number of serious casualties) + 0.01 x (number of slight casualties).

Table 2-1 - Safety baseline

Data Source	Period	Parameter 1	Parameter 2	Parameter 3
Road User				
STATS 19 (Validated)	3 years prior to commencement of Start of Works (start of construction)	The average annual FWI casualty rate per 100 million vehicle miles on the M5*	The average annual FWI casualty rate on the M5 slip roads	The average annual number of FWI casualties in the scheme area**
Road Workers				
There is no numerical objective or target for road worker safety on major schemes and the risk must be managed to reduce risk in accordance with the 'as low as reasonably practicable' (ALARP) principle.				

* between a point 500m north of Elmstone Hardwick Bridge and a point 500m south of Staverton Twin Culvert

**includes M5 (between a point 500m north of Elmstone Hardwick Bridge and a point 500m south of Staverton Twin Culvert, M5 slips roads (new and old), the A4019 (between Homecroft Drive and Stanboro Lane and the B4634 in the vicinity of the new West Cheltenham Link Road junction)

2.2.4 See Appendix F for a plan showing baseline extents.

2.3 Safety objectives for the M5 Junction 10 Improvements scheme

2.3.1 The M5 Junction 10 scheme will satisfy the road user safety objective if it is demonstrated for a period of three years after becoming fully operational that:

- The average annual FWI casualty rate per 100 million vehicle miles along the M5 between a point 500m north of Elmstone Hardwick Bridge and a point 500m south of Staverton Twin Culvert is better than the baseline (Parameter 1);
- The average FWI casualty rate on each of the 4 (two new and two existing) M5 slip roads is better than, the baseline (Parameter 2);
- the average annual number of FWI casualties in the scheme area is better than the baseline (Parameter 3).
- For each link, no population (e.g. car drivers, pedestrians, HGV drivers and motorcyclists) is disproportionately adversely affected in terms of safety and risk to each population remains tolerable.

2.3.2 There is no numerical objective or target for road worker accidents for major schemes and the risk must be managed in accordance with the ALARP principle. This is a legal requirement. One part of the strategy aims to eliminate all fatalities and serious injuries to road workers maintaining the National Highways road network.

2.4 Specific user groups

2.4.1 The safety impact of the scheme for the following specific user groups is considered by this document:

- Users
  - Pedestrians
  - Cyclists
  - Equestrian riders
  - Motorcyclists
  - HGV drivers
  - Disabled drivers or passengers
  - Recovery organisations
  - Emergency services
- Workers
  - On Road Resources (ORR): e.g. Traffic Officers; recovery organisations
  - Maintenance workers

2.4.2 This approach, in line with GG 104[2] - Requirements for Safety Risk Assessment, will outline how safety risk tolerance can be used to optimally balance safety risk between affected populations.

2.4.3 The impact of the scheme on key stakeholders which include National Highway (and their Traffic Officer Service), GCC, maintenance service providers and the emergency services is being evaluated through ongoing regular and detailed discussions and workshops.

2.5 Demonstration of meeting the safety objective

Road Users

2.5.1 The options used to demonstrate that the safety objective can be achieved are described in detail in GG 104[2].

2.5.2 The scheme is likely to meet its safety objectives for road users on the M5 and slip roads as it will improve existing provision at junction 10 and create additional capacity to cater for the forecast increase in traffic flows. The removal of the current northbound on slip which loops around from the A4019 onto the M5 and introduction of a more conventional slip road layout will improve safety for road users who are at increased risk of losing control due to the alignment of the current slip road.

2.5.3 Increased capacity on the southbound off slip will help to reduce congestion on the motorway at the diverge leading to a reduction in congestion-related collisions including nose-to-tails and side swipes.

2.5.4 The scheme as a whole will improve provision for walkers, cyclists and horse riders at the gyratory and along the A4019 either side of the junction with segregated facilities and new crossing points. It will also create an off-carriageway route connecting the A4019 with the B4634 Old Gloucester Road. Improved facilities for these vulnerable groups will help to reduce the number of KSI (Killed and Serious Injured) collisions along the local road network which was identified as a key challenge in the Safety Plan[1].

2.5.5 The A4019 will be subject to capacity improvements through dualling of the link which will reduce the risk of collisions associated with single carriageways such as overtaking using the opposing traffic lane and congestion. The new West Cheltenham Link Road will provide for traffic which had previously used Withybridge Lane with a more suitable, safer route to travel between the A4019 and the B4634 Old Gloucester Road.

2.5.6 Safety risk assessments (SRA) to GG 104 are provided in Appendix A regarding the following safety challenges:

The introduction of two additional slip roads

2.5.7 The M5 Junction 10 Improvements scheme will provide an all movements junction allowing traffic to enter and exit the M5 from the north and south of the junction. The introduction of two additional slip roads and re-configuration of the existing north facing slip roads will increase capacity and remove some of the burden from adjacent junctions along the motorway.

2.5.8 However, the construction of additional slip roads has the potential to introduce new conflicts along the M5 at the proposed northbound diverge and at the proposed southbound merge. These conflicts include vehicles braking in lane 1 to exit the motorway or changing lanes to enter lane 1 to prepare to exit and vehicles merging from the slip road onto the mainline forcing lane changes and braking on the mainline. Common collision types associated with slip roads include nose-to-tail and side swipe collisions caused by late or unexpected braking and late or unexpected lane changes.

2.5.9 Refer to the qualitative safety risk assessment in Table A.11 in Appendix A.

Pedestrian and cycle KSI collisions

2.5.10 There are currently no formal crossing facilities along the A4019 and no provision for cyclists. Bus stops and Public Rights of Way (PRoW) along the route generate pedestrian movements across the A4019. Collision analysis undertaken as part of the scheme's Safety Plan revealed a high percentage of collisions along the A4019 involved pedestrians or cyclists and resulted in serious injury. Of 15 collisions along the A4019 link in the five year period to 31st December 2020, 5 involved pedestrians or cyclists which equates to an average of one a year.

2.5.11 The scheme will provide off-carriageway facilities for cyclists and crossing points to improve safety and connectivity.

2.5.12 Crossing facilities will be introduced on the north side of the new gyratory across the top of the southbound off slip and northbound on slip to provide a continuous route along the north side of the A4019. This new route could lead to an increase in pedestrian and cyclist east-west movements and their exposure to traffic.

2.5.13 Refer to Table A.12 in Appendix A.

Increased traffic flows at Junction 10 and along local routes

2.5.14 The scheme has been designed to cater for the forecast increase in traffic flow at junction 10 and along the A4019. An increase in traffic flow can lead to an increase in traffic movements and potential conflicts.

2.5.15 The scheme increases capacity on the southbound off-slip by providing two exit lanes rather than one and increases capacity along the A4019 through dualling.

2.5.16 The two additional slip roads provided by the scheme will relieve congestion at adjacent junctions and improve capacity at junction 10.

2.5.17 The linking of signal controlled junctions along the A4019 will regulate traffic flow and reduce queuing.

2.5.18 Refer to Table A.13 in Appendix A.

New junction at A4019/ B4635 increasing turning movements

2.5.19 As part of the M5 Junction 10 Improvements scheme, a new link road will be introduced between the A4019 and the B4634 Old Gloucester Road. A new signal controlled junction is proposed at the south end of the link road on the B4634. As there is currently no junction at this location, the increase in turning movements and speed variations as vehicles approach the junction could lead to conflicts with nose-to-tail and side impact collisions a possibility.

2.5.20 To reduce the potential for collisions associated with the new junction, appropriate speed limits will be set and lighting provided to highlight the junction and encourage safe approach speeds.

2.5.21 Refer to Table A.14 in Appendix A.

Road Workers (maintainers)

2.5.22 Although a numerical objective has not been set for road workers, the scheme has been designed in accordance with guidance contained in GG 304 Designing health and safety into maintenance [3] with methods of hazard elimination and reduction considered according to the ‘As Low As is Reasonably Practicable’ (ALARP) principle.

2.5.23 Safe methods of access for maintainable features have been included in the design, with dedicated parking areas provided for maintainers.

2.5.24 New signal controlled junctions and lighting will be introduced as part of the scheme which will increase maintenance demand. New landscaping areas will also require regular maintenance as well as new attenuation ponds and the extended culvert at Piffs Elm.

2.5.25 The new slip roads will introduce new sections of carriageway which will need to be maintained in terms of pavement, drainage, road markings, signs and technology.

2.5.26 Maintenance of assets along the M5 will continue to take place from the hard shoulder however, on the gyratory, along the A4019 and on the B4634, maintenance hardstandings (MHS) are proposed to provide maintainers with a safe and convenient location to park in order to undertake the required activities.

2.5.27 Further details are available in the Maintenance and Repair Statement (MRS) PCF product [4].

Road Workers (on road resources)

2.5.28 Consultation has taken place with National Highways and GCC operational staff in the form of a maintenance and repair workshop held on 23rd March 2022 to establish the impact of the scheme on current working practices. There will be some additional winter maintenance to consider as a result of the new slip roads, widened A4019 and new link road, but this will be discussed with the maintainer and is not a significant undertaking.

Other specific road user groups

2.5.29 The scheme has considered the feasibility of improving provision for equestrian riders or at least taking their needs into account. For example, an underpass will be provided under the A4019 to connect an existing bridleway with Withybridge Lane. This will improve the safety of equestrian riders who currently cross the A4019 informally at-grade.

3 Safety Governance

3.1.1 This section demonstrates that:

- An appropriate safety risk assessment process 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
- Plans are to be put in place to monitor project safety performance
- The Safety Report will be maintained.

3.2 Safety risk assessment process selection

Categorisation

3.2.1 The categorisation of activity type been selected in accordance with guidance in GG 104[2]. The M5 Junction 10 Improvements scheme has been classified as a 'Type A' scheme. An explanation of the selection process is detailed in Table 3 1 below.

3.2.2 'Type A' activities are considered to require a 'basic' level of safety management and is applicable to projects / interventions that are routine, familiar and without operational implications. As such, these will be largely satisfied by the application of existing standards and guidance. Presentation at the Safety Control Review Group (SCRG) is not required for a 'Type A' scheme.

3.2.3 Type A activities are likely to include the following:

- Completion of a simple hazard analysis to support the production of a safety plan
- Safety Report (this document)
- Specific safety risk assessments as required

3.2.4 The scheme was presented to the Operations Technical Leadership Group (TLG) on 9th February 2022 and a certificate of compliance awarded for SGAR3 with a number of actions to be addressed before proceeding to the next stage.

Table 3-1 - Results of the characterisation process

Feature	Type A	Type B	Type C	Categorisation for activity	Reason for categorisation selection
Extent of prior experience of activity The degree of knowledge available from undertaking the activity previously or the degree to which knowledge is available from the activity being undertaken by other industries or organisations	Activities for which there is significant experience within National Highways. Previous safety studies and data are available, and some activity features are codified in a standard or formal procedure.	Activities for which there is limited experience within National Highways but there is transferable experience elsewhere in the UK or internationally. Activities for which there is limited experience in National Highways but there is experience elsewhere in the UK or internationally, including in different industries, which is deemed sufficiently similar to the activity in question to be deemed relevant. Activities for which there is experience within National Highways but that experience is in a different application of the activity and some adaptation will be required. There might also be local and site-specific issues to take into account that can affect the relevance of the available experience.	Activities for which there is no previous applicable experience from either National Highways or other industries.	A	National Highways and those involved in the execution of the project have experience of a large number of similar schemes encompassing this type of junction design and operation.
Statutory and formal processes and procedures (including standards and legislation).	The activity is substantially or entirely within the scope of existing standards, guidance	The activity is largely within the scope of existing standards, guidance, formal processes or procedures. There can be some safety	Activities that are not within the scope of existing standards, formal processes or procedures and require new ones to be developed.	A	Current standards apply, although some departures from standard will be required such as the

Feature	Type A	Type B	Type C	Categorisation for activity	Reason for categorisation selection
Consideration of the applicability of current standards, formal processes or procedures, guidance and legislation	formal processes or procedures and applicable legislation. The activity requires minimal or no safety related departures from standard or safety related changes to formal processes or procedures (including any legislation)	related departures from standards needed and/or safety related changes to formal processes or procedures. The activity can need minor changes to existing legislation	Activities for which significant departures from standards, formal processes or procedures are required. Activities which require significant changes to existing legislation or new legislation to be written. Whilst the number of safety departures from standards, formal processes or procedures can affect the categorisation, the most important element in determining this is the nature and type of the departures. For example, a large number of safety departures that can be addressed straightforwardly will have less impact on feature type than a single safety departure that cannot and requires a detailed risk assessment to support it.		merge and diverge types on the M5 slip roads (four DfS in total for merges/diverges). No significant departures impacting on safety have been identified at this stage.
Impact on the organisation. The effect that the activity will have on current National Highways processes, procedures, structure, roles and responsibilities, competencies, policies and strategy, in addition to contractual	The activity has no impact on National Highways The activity has a minor impact on any of these for a finite period of time. Length of time National Highways is affected by decision to undertake the activity is short term.	The activity can lead to permanent minor changes to any of these. These minor changes can introduce new roles and responsibilities, policies, contractual and workforce arrangements. The activity can require a change to organisational arrangements. Length of time National Highways is affected by decision to undertake the activity is medium term.	The activity has significant impact on any of these. The activity can change core safety roles and responsibilities. Length of time National Highways is affected by decision to undertake the activity is long term	A	No changes to the organisational structure or competencies of staff have been identified. No additional staffing requirement has been identified.

Feature	Type A	Type B	Type C	Categorisation for activity	Reason for categorisation selection
and workforce arrangements					
Activity Scale Consideration of the size and/or scale of the activity. Does or can the activity have an impact on the motorway and all-purpose trunk roads, either directly or indirectly	The impact of the activity is limited in nature or scale	The impact of the activity is significant in nature or scale.	The impact of the activity is wide ranging across the network, and/or significantly impacts infrastructure, interventions or workforce	A	The scheme involves changes to the M5 slip roads at the junction rather than the mainline and therefore the impact on National Highway's network will be minimal
Technical Measure of technical and/or technological novelty and/or innovation the activity involves	An activity where any processes, techniques, methodologies and/or technologies involved are currently in widespread use and re-examination is unlikely to be needed.	There can be some experience of the processes, techniques, methodologies and/or technologies. The experience can be from use in either another application, or by another road authority, supplier, industry or perhaps from overseas in which case some additional work can be required to adapt them and/or to demonstrate that safety can be assured for the intended application.	Activities that use new processes, techniques, methodologies and/or technologies for which there is no previous experience in the UK or elsewhere	A	The technologies proposed for this scheme are in widespread use and there will be no unique technology features.
Stakeholder impact and interest The quantity and/or impact of stakeholders, their interest in and resulting ability to	Activities for which the quantity and/or impact of stakeholders, their interest in and resulting ability to	Activities that have only a single or a few stakeholders but their impact, in terms of their attitude towards, or ability to influence, and/or interest in the successful	Activities for which there are a large number of stakeholders and their impact in terms of their attitude towards, or ability to influence can be significant.	A	Several stakeholders have an interest in the scheme including Gloucestershire County Council, Maintenance Service Providers, Traffic Officer Service

Feature	Type A	Type B	Type C	Categorisation for activity	Reason for categorisation selection
influence or/impact on the activity. The degree to which the safety issues, as perceived, are capable of being understood and fully addressed	influence or impact the activity is low.	achievement of the activities aim can be significant. Alternatively, it will represent an activity that has several stakeholders but the amount, or type, of safety issues involved are limited.	Stakeholders with a strong interest in the potential safety impact of the activity on themselves. Activities where there are conflicting needs arising from different stakeholders or stakeholder groups.		(TOS) and the Emergency Services.

3.2.5 The summarised results of the activity categorisation selection process with respect to the main scheme features, are shown in Table 3-2.

Table 3-2 - Scheme activity categorisation results

	A	B	C
No. of features	6	0	0
Overall classification	A		

3.2.6 Comparing these results with guidance in GG 104 gives a classification of category 'A' for the scheme requiring a business as usual approach to the activity.

3.3 Good practice

3.3.1 Good practice and project wide systems have been and will be followed for this scheme.

3.3.2 The Atkins Collaborative Delivery Framework (CDF) Quality Plan ensures that the project outputs align to National Highways requirements. In addition, the following measures have been implemented to ensure sharing of good practice and lessons learnt:

- Clear identification and creation of products at every stage that become a benchmark for all other products delivered;
- The collaborative use of significant tools notably Building Information Modelling (BIM) and 3D CAD standards;
- Use of the DMRB [6], Interim Advice Notes, Chief Engineers Interim Advice Notes and other specified National Highways standards;
- Application of the National Highways Competency requirements within GG 102 [7].

3.4 Competence of resources

3.4.1 The key safety related roles specified are listed below.

Table 3-3 - Scheme governance roles and responsibilities

Role	Responsibilities
Project Director (Project Consultant)	The Project Consultant is accountable for ensuring the quality and timeliness of all of the operational safety products as defined in the PCF matrix.
Principal Designer	The Principal Designer's responsibility, outlined in the Construction (Design and Management) Regulations 2015, is to influence how risks to health and safety are managed in the pre-construction phase and to liaise with the Principal Contractor to inform them of any risks which need to be controlled in the construction phase.
Principal Contractor	The Principal Contractor's role is to manage health and safety risk during the construction phase.
Operations and Safety Lead	The operational design program lead will provide oversight and consistency across schemes, ensuring that lessons learnt and good practice are disseminated.
Subject matter expert (SME)	The operational design subject matter expert will liaise directly with discipline leads and provide safety support to the scheme as required.

Role	Responsibilities
Safety Risk Requirements Team	The Safety Risk Requirements Team will provide safety support to the scheme as required.
Safety Control Review Group (SCRG)	The SCRG provides a forum for checking and endorsing safety work before it is submitted for any wider approval. It is not a requirement for Type A schemes.
National Safety Control Review Group (NSCRG)	The NSCRG oversees the safety governance process for all schemes and is available where safety decisions require escalation to the highest level.
Operations Technical Leadership Group (Ops TLG)	The Operations TLG provides a forum for specialists from the various organisations to share information, good practice and design solutions; and to review/assess and solve key issues affecting schemes. It is a requirement for all major projects to obtain a certificate of compliance from the group.

3.5 Stakeholder engagement

3.5.1 The scheme is actively engaging with stakeholders with regards to the safety aspects of the scheme.

3.5.2 A Safe by Design workshop was held with Atkins discipline design leads on 27th January 2022 followed by a Maintenance and Repair workshop on 23rd March 2022 which incorporated elements of Safe By Design held with representatives from National Highways and GCC.

3.5.3 An operational safety workshop attended by representatives from the fire service, police and Traffic Officers was held on 4th February 2022. No major issues were raised during this workshop which involved sharing the design of the scheme with the attendees.

3.6 Monitoring

3.6.1 The following monitoring activities are expected to be used:

- Implementation of the Plan for Monitoring Operations (PfMO)[5]
- Scheme assessment to be undertaken after an appropriate period of operation and covered through Benefits Realisation and Evaluation Plan (BREP).
- Stage 4 road safety audit at 12 months of operation
- Assessment of operational monitoring reports, for example from the Traffic Officer Service or maintainers

3.6.2 Safety monitoring requirements will be incorporated within the PfMO undertaken at SGAR 5 and will be available before operation commences for the project.

3.6.3 This activity can therefore only be concluded after the scheme is completed.

3.7 Compatibility of design with standards and legislation

3.7.1 The M5 Junction 10 Improvements scheme design is compatible with standards, guidelines and regulations.

3.7.2 The design of the scheme has been carried out in accordance with the guidance and requirements contained in relevant design standards within the Design Manual for Roads and Bridges (DMRB) [6]. Where the design does not comply with standards a Departure from Standards (DfS) has been produced.

3.7.3 Four DfS which relate to the non-standard merges and diverges on the new slip roads at junction 10 have been submitted to National Highways Safety Engineering and Standards (SES) and have provisional agreement.

3.8 Summary of safety-related departures

3.8.1 Table 3-4 outlines the Departures from Standard which have been identified as affecting National Highways or GCC routes.

Table 3-4 - Safety-related Departures from Standard

Location	Internal Ref	Type	Standard	Description	Comments, key mitigations and status
National Highways DfS					
M5 J10 Southbound Diverge	DFS.1	Diverge type	DMRB - CD 122 Cl 3.26.2	Provide a Layout B Option 1 - Ghost island diverge rather than a Layout C (lane drop from 4-lanes upstream to 3-lane downstream)	The existing M5 mainline is 3-lanes, so a lane drop from 4-lanes to 3-lanes is not feasible under the current M5 mainline layout and it is not proposed that the mainline be widened to 4-lanes between J10 and J9. Provisional Agreement
M5 J10 Northbound Diverge	DFS.2	Diverge type	DMRB - CD 122 Cl 3.26.2	Provide a Layout B Option 1 - Ghost island diverge rather than a Layout C (lane drop from 4-lanes upstream to 3-lane downstream)	The existing M5 mainline is 3-lanes, so a lane drop from 4-lanes to 3-lanes is not feasible under the current M5 mainline layout and it is not proposed that the mainline be widened to 4-lanes between J10 and J11. Provisional Agreement
M5 J10 Southbound Merge	DFS.3	Merge type	DMRB - CD 122 Cl 3.12.2	Provide a Layout B - parallel merge rather than a Layout D - lane gain (from 3-lane upstream to 4-lane downstream)	The existing M5 mainline is 3-lanes and it is not proposed that this will be widened to 4-lanes between M5 J10 and J11. Provisional Agreement
M5 J10 Northbound Merge	DFS.4	Merge type	DMRB - CD 122 Cl 3.12.2	Provide a Layout B - parallel merge rather than a Layout D - lane gain (from 3-lane upstream to 4-lane downstream)	The existing M5 mainline is 3-lanes and it is not proposed that this will be widened to 4-lanes between M5 J10 and J9. Provisional Agreement
GCC DfS (To be submitted to GCC for provisional agreement as part of Design Fix 3 submission)					
A4019 West Approach to Junction 10	DFS.5	Cycle track gradient	DMRB - CD 195 Cl E/3.9 and	The maximum gradient for a cycle track within CD 195 and LTN 1/20 is 5% at a maximum length of 30m. The proposed cycling facilities	This gradient is required in order to reduce the level of the proposed A4019 in advance of the Stanboro Lane junction and hence avoid the need for

Location	Internal Ref	Type	Standard	Description	Comments, key mitigations and status
			LTN 1/20 Cl 5.9.7	at the A4019 west of M5J10 follow the proposed carriageway which has a maximum gradient of 5.9% for 6m.	departures to steepen the Stanboro Link and impact upon existing vegetation which would be desirable to retain.
A4019 West Approach to Junction 10	DFS.6	Reduced buffer between shared use route and carriageway	DMRB - CD 143 Cl E/3.5.1	A minimum separation from carriageway for a shared use route should be 1.5m where the speed limit is greater than 40mph. Where the proposed shared use path (SUP) has been extended to the Stoke Road junction there is one area where the proposed separation is reduced to 1m. Speed limit is 50mph.	Existing verge width and formal property boundary at back of verge prevents compliance with requirements. Realigning carriageway to the south in order to provide a wider verge on the north would be expensive and possibly introduce the need for land acquisition along the southern boundary in order to retain a southern verge. The section over which the separation reduces below 1.5m is limited to 14m in length.
The Green	DFS.7	Reduced footway width	DMRB - CD 143 Cl E/1.2	An absolute minimum width of 2m is required for walking routes (footways and footpaths) where no vertical features are present either side. An additional 0.5m width is required where a vertical feature on one side is greater than or equal 1.2m height. Where short lengths of footway are proposed from the service roads on the northern side of the A4019 to the existing footways on The Green the proposed footway width is less than 2m.	Existing formal property boundaries and hedges at back of verge prevents compliance with requirements. Realigning the A4019 carriageway to the south in order to provide the service road further south and as such provide room for a wider footway to The Green would be expensive and introduce the need for additional land acquisition along the southern boundary. The lengths of footway at reduced width are limited to 25m on both the western and eastern sides of The Green. The proposed width matches the width of the existing footway provision (approx. 1.5m) on The Green so does not worsen the current provision.
Homecroft Drive	DFS.8	Reduced footway width	DMRB - CD 143 Cl E/1.2	An absolute minimum width of 2m is required for walking routes (footways and footpaths) where no vertical features are present either side. An additional 0.5m width is required where a vertical feature on one side is greater than or equal 1.2m height. Where short lengths of footway are proposed from the service roads on the southern side of the	Existing formal property boundaries and hedges at back of verge prevents compliance with requirements. Realigning the A4019 carriageway to the north in order to provide the service road further north and as such provide room for a wider footway to Homecroft Drive would be expensive and introduce the need for additional land acquisition along the northern boundary.

Location	Internal Ref	Type	Standard	Description	Comments, key mitigations and status
				A4019 to the existing footways on Homecroft Drive the proposed footway width is less than 2m	The lengths of footway at reduced width is limited to 8m on the western side and immediately at tie in on the eastern sides of Homecroft Drive. The proposed width matches the width of the existing footway provisions (approx. 1.6m) on Homecroft Drive so does not worsen the current provision
A4019 - Gallagher Junction	DFS.10	Cross-section	DMRB - CD 127 Table 2.28	The rate of change of cross section width of CR of the eastern arm of the junction is 1:14 which is less than the required rate of 1:35 as required by CD 127	Providing the required rate of change of cross section on the new eastbound alignment would require the additional acquisition of land currently occupied by a Sainsbury's store, which would be introduce further costs and likely objections. The proposed reduced rate of change minimises the additional land requirement and avoids the need to demolish part of the existing store.
B4634 Hayden Hill Farm Access	DFS.11	Restricted visibility	DMRB - CD 123 Rev 2 Cl 3.4	CD 123 Clause 3.4 requires that from a setback of 2m into the access, visibility corresponding to the desirable minimum SSD for the speed of the major road (70kph – 120m) shall be provided. This is achieved to the west of the access but to the east, visibility is limited to 95m.	The position of the existing access and visibility to the east is not affected by the proposed scheme. This is an existing departure where the visibility splay is obstructed by an existing boundary hedge. The introduction of the proposed signalised junction and associated signing should assist with speed control at this location.
B4634	DFS.12	Reduced SSD	DMRB - CD 109 Cl 2.13	CD 109 Clause 2.13 requires that relaxations below desirable minimum in stopping sight distance shall not be used on the immediate approaches to junctions. For the proposed 70kph design speed, SSD is 120m. On the westbound approach to the Hayden Lane junction, SSD is reduced to 90m.	This is an existing departure where the visibility splay is obstructed by an existing boundary fence and vegetation belonging to Orchard House. The proposed alignment slightly reduces the current level of visibility at this location due to the slight curvature of the proposed route to the south of the existing road in order to provide a shared use path in the proposed northern verge without impacting the existing boundary of the property Elm Cottage.

Location	Internal Ref	Type	Standard	Description	Comments, key mitigations and status
					The introduction of the proposed signalised junction and associated signing should assist with speed control at this location.
B4634 Hayden Lane Junction	DFS.13	Reduced SSD	DMRB - CD 123 Rev 2 Cl 3.4	CD 123 Clause 3.4 requires that from a setback of 2.4m into Hayden Lane, visibility corresponding to the desirable minimum SSD for the speed of the major road (70kph – 120m) shall be provided. This is achieved to the west of the access but to the east, visibility is limited to 60m.	This is an existing departure where the visibility splay is obstructed by an existing boundary fence and vegetation belonging to Orchard House. Existing junction and visibility splay are outside the extents of the proposed scheme. Details have been included because of its proximity to the scheme and association with DFS 16. The introduction of the proposed signalised junction and associated signing should assist with speed control at this location.
Access road from Link Road to small group of properties including The Forge	DFS.14	Reduced horizontal radii	Manual for Streets	For a 50kph design speed (30mph speed limit) MfS recommends a desirable minimum horizontal radii of 44m. This proposed access road includes two individual radii of 30m.	Proposed access road is 5.5m wide. Swept paths for two HGV's passing on these radii have been widened to suit these requirements. MfS SSD is achieved.
Uckington Junction – The Green	DFS.15	Highways	Aspects not covered by standards	Specific departures have not been identified at this arm of the junction. However the design at this location comprises a non-typical layout. Due to the proximity of the proposed service roads to the stop line on The Green there is the potential for temporary obstruction to the flow of traffic on this arm of the junction by the conflict of traffic to/from the service roads with that on The Green.	Additional primary signal has been provided. These signals have been positioned for visibility to main side road carriageway but should be visible to access road traffic without causing confusion as to where the right of way applies. 'Keep Clear' markings will also be added to prevent vehicles blocking the entry width into the access to the eastern service road. The available space between the stop line and the start of the 'Keep Clear' marking would be approximately 5m and sufficient for a standard car to enter.

3.9 Maintaining the Safety Report

3.9.1 The purpose of the Safety Report is to summarise the evidence demonstrating that the project safety objectives can be met and all of the required safety work has been completed. In doing so, the Safety Report facilitates the safety approval of the scheme.

3.9.2 The anticipated versions of the Safety Report are:

- **SGAR 3** version (THIS REPORT): The purpose of the SGAR 3 version is to provide a suitable level of confidence that the preliminary design is able to meet the required level of safety to progress through to the development phase.
- **SGAR 5** version: The purpose of the SGAR 5 version of the Safety Report is to provide a suitable level of confidence at the construction preparation stage, that the proposed design, as far as it has been developed, is able to meet the required level of safety. A further purpose is to highlight any areas where further design work needs to be undertaken, outline the actions proposed to finalise the design and highlight any safety implications of the proposed design options.
- **Pre-operation (SGAR 6)** version : The purpose of this version is to demonstrate that the scheme is able to meet the required level of safety prior to commencement of operation. This includes demonstrating that the infrastructure, technology and equipment have been designed, constructed, installed and commissioned correctly and that suitable procedures for operation and maintenance are in place. **It is noted that SGAR 6 occurs several months after road opening. The SGAR 6 version of the Safety Report needs to be prepared and signed off by all required persons in advance of Open for Traffic.**
- **Final (SGAR 7)** version: The purpose of the 'final' version of the Safety Report is to close out the safety work for the scheme. It confirms that either the safety activities have been completed or, if they are not completed, that the safety risk associated with them is acceptable. This version is produced after significant operating experience has been gained. Typically this experience would be of the order of a year. The final version of the Safety Report should also include a plan for handing over the safety work to the relevant team (i.e. Operations Directorate). Although this Safety Report is titled "final", future versions of the report will be needed if:
  - An additional hazard is identified that needs mitigation
  - Substantive changes are made to the scheme to which the Safety Report relates

3.10 Safety acceptance and approvals process

3.10.1 A safety acceptance and approvals process for a project is defined to provide a clear route for:

- Scheme safety documentation approval (including the approval of the Safety Reports)
- Final scheme approval, hence, a means of obtaining the consent that is needed to commence operation

3.10.2 National Highways has specified the acceptance process for PCF deliverables. It also specified the additional safety acceptance process for 'safety' PCF deliverables within GG 104. This approach for sign off is captured in the 'document control sheet' and the sign-off sheet at the front of this Safety Report.

3.11 Plan for handover of safety work

3.11.1 Project handover will be undertaken in accordance with GG182 [9] at SGAR 6. At this stage (3), the operational and maintenance activities provide a framework which can define activities later in the life-cycle.

4 Have operational safety risks been well managed?

4.1.1 This section demonstrates that, for all affected populations:

- An appropriate risk assessment methodology has been used
- All reasonably foreseeable scheme hazards have been identified and analysed and suitable safety risk mitigations have been implemented
- The project safety requirements will be identified before construction starts.

4.2 Hazard and risk assessment methodology

Generic methodology

4.2.1 As a Type A scheme, the scheme does not require completion of a hazard log.

4.2.2 A qualitative safety risk assessment of the significant hazards and determination of the impact they will have on the scheme has been carried out. The methodology involves the following:

- Identification of hazards
- Determination of assumptions to inform the assessment
- Qualitative assessment of the significant hazards and determination of the impact they will have on this scheme
- Review of any key scheme operational safety challenges and identification of new hazards that may apply to the scheme
- Utilisation of the 5 by 5 risk matrix from the GG 104 appendix D to determine the risk score of the significant and any new hazards relative to the operating regime in the ‘before case’
- Determine risk score for the ‘after case’ by looking at the improvements
- Risk comparison of the ‘before case’ and ‘after case’
- Utilisation of a RAG status to highlight the impact of the hazards on the scheme. Furthermore, this will help focus on the hazards that may need additional review and/or mitigation
- Document the safety risk assessment in this document.

4.2.3 In addition to considering the impact of the scheme on the safety of all road users, the safety risk assessment methodology considers the impact of the M5 Junction 10 scheme for the following specific user groups:

Users

- Pedestrians, cyclists, equestrians, motorcyclists, HGV drivers, disabled drivers or passengers, private recovery organisations and emergency services.

Workers

- On-road resources and maintenance workers.

4.2.4 The methodology includes reviewing the key design features to determine the impact on population groups. These are reviewed and recorded within the Atkins Project (Health and Safety) Risk Register, with the ERIC principal allied to reduced risk during construction and operation to ensure risks are ALARP.

4.3 Analysis of hazards

Issues

4.3.1 The key safety challenges introduced and addressed by the scheme have been considered in safety risk assessments – refer to Appendix A. A summary of the results of these is shown in Table 6-2 of Appendix A.

4.3.2 The hazard identification has 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. Table C-1 of Appendix C shows the matrix used for scoring hazards. The risks posed by all hazards have been scored against the baseline and compared.

4.3.3 Over and above normal design identified, at Stage 3, the following **existing safety issues** have been identified along with opportunities to address these through the proposed improvements scheme:

- Congestion and collisions at junctions 9 and 11 and along local routes (which will be bypassed by the creation of new south-facing slip roads at junction 10)
- Congestion-related collisions involving southbound vehicles exiting the M5 at Junction 10 towards the A4019 (which will be addressed through creation of the new gyratory and southbound off slip)
- The poor safety record along the A4019 east of the M5 junction. (New pedestrian, cycle and equestrian facilities introduced by the scheme are aimed at reducing KSIs and pedestrian and cycle collisions)

4.3.4 **New** potential **safety challenges** introduced by the scheme include:

- The introduction of two additional slip roads will create additional merge and diverge movements on the mainline and potential vehicle conflicts associated with these layouts
- Increased traffic flows at Junction 10 and at junctions along the A4019 could lead to an increase in vehicle movements and the potential for conflicts
- The creation of a new junction on the B4634 Old Gloucester Road at the West Cheltenham

4.3.5 These issues have been subject of a safety risk assessment and this is detailed in Appendix A.

Overview of significant hazard assessment

4.3.6 A summary of the semi-quantitative risk assessment tables attached at Appendix A.11, A.12, A.13, and A.14 is provided below in Table 4-1.

Table 4-1 - Hazard analysis

Road user hazards				Road worker hazards				Total no. of hazards
No. hazards	Increase	No change	Decrease	No. hazards	Increase	No change	Decrease	
The introduction of two additional slip roads at junction 10 will create additional merge and diverge movements on the M5								
7	5	1	1	0	0	0	0	7
A high proportion of collisions along the A4019 involve pedestrians and cyclists.								
3	0	1	2	0	0	0	0	3
Increased traffic flows at Junction 10 and at junctions along the A4019								
2	0	0	1	0	0	0	0	2
The creation of a new junction on the B4634 Old Gloucester Road at the West Cheltenham Link Road								
5	5	0	0	1	1	0	0	6
TOTAL								
17	11	1	4	1	1	0	0	18

4.3.7 The hazards which have higher risk scores under the existing layout relate to pedestrians and cyclists in the carriageway. Resultant injuries are likely to be of a serious nature and the likelihood of occurrence is also relatively high with 5 pedestrian and cycle collisions recorded in 5 years along the A4019 east of junction 10.

4.3.8 Although the majority of the hazards associated with the new merges and diverges show an increase in risk, this is offset by the capacity benefits of providing an all movements junction.

4.3.9 All 6 hazards associated with the new junction on the B4634 also show an increase in risk however this is because there is no junction at that location under the current layout. The hazards associated with the signal controlled junction are offset by the benefit to road users of a junction connecting the new link road with the A4019 and B4634. A signal controlled junction provides a safer environment for right turning movements and for pedestrians and cyclists than a priority crossroads for example.

4.4 Safety risk mitigations

4.4.1 Mitigation measures to be introduced by the scheme to reduce risk associated with the hazards identified from the key safety challenges are outlined in the Safety Risk Assessment tables in Appendix A. A summary of these mitigations is provided in Table 4-2 below.

Table 4-2 - Safety risk mitigations

Key safety challenge	Hazard	Scheme mitigation
The introduction of two additional slip roads creating will create additional merge and diverge movements on the mainline	Merge conflicts	• Road marking and signing renewed • Pavement renewed • MS4 signs
	Queuing on the slip road/ mainline	
	Late lane changes on junction approach	
	Late swooping movements to access diverge	• Tiger tail prevents late movements into lane 1 of slip road

Key safety challenge	Hazard	Scheme mitigation
		• Road marking and signing renewed • Pavement renewed • MS4 signs
Improving the safety record along the A4019 east of the M5 junction with a focus on reducing KSI and pedestrian and cycle collisions	Pedestrian in carriageway	• Crossing facilities provided at junctions at regular intervals along the A4019 east of junction 10
	Cyclist in carriageway	• Off-carriageway cycle facility provided
	Pedestrian crossing	• Skid resistant surface on junction approaches • New lighting
Increased traffic flows at junction 10 and at junctions along the A4019	Queuing traffic	• Increased capacity through construction of a gyratory at junction 10 • Increased capacity through dualling of A4019 • MS4 signs on M5 • New lighting provision on A4019
The creation of a new junction on the B4634 Old Gloucester Road at the West Cheltenham Link Road	Queuing traffic	• Lighting provision at junction • Traffic signals highlight presence of junction • Skid resistant surface on approaches • Reduced speed limit
	Right turn movements	
	Pedestrian crossing	
	Cyclist crossing	
	Errant vehicle leaves carriageway	
	Maintenance of traffic signals	• MHS provided

4.5 Safety risk evaluation

4.5.1 Based on the hazards identified, design proposals (including increased capacity) and the mitigation measures provided, it is likely that the safety objectives will be achieved. In addition, the interventions can be considered to be managing risk to an ALARP level for workers. The activity has been deemed to be acceptable in safety risk terms.

5 Conclusion

5.1.1 This document is the Safety Report (SGAR 3 version) for the M5 Junction 10 Improvements scheme. The purpose of the document is to demonstrate at SGAR 3 that the appropriate level of safety management has been undertaken to assess the expected safety performance for the implementation of the M5 Junction 10 scheme.

5.1.2 The information presented in this report demonstrates that:

5.1.3 Appropriate safety baselines and safety objectives have been set and can be achieved

- The average annual FWI casualty rate per 100 million vehicle miles along the M5 between a point 500m north of Elmstone Hardwick Bridge and a point 500m south of Staverton Twin Culvert is better than the baseline (Parameter 1);
- The average FWI casualty rate on each of the 4 (two new and two existing) M5 slip roads is better than, the baseline (Parameter 2);
- the average annual number of FWI casualties in the scheme area is better than the baseline (Parameter 3)
- For each link, no population (e.g. car drivers, pedestrians, HGV drivers and motorcyclists) is disproportionately adversely affected in terms of safety and risk to each population remains tolerable.

5.1.4 There is no numerical objective or target for road worker accidents for major schemes and the risk must be managed in accordance with the ALARP principle. This is a legal requirement. One part of the strategy aims to eliminate all fatalities and serious injuries to road workers maintaining the National Highways road network.

5.1.5 An appropriate scheme categorisation has been selected for the project and has been applied

5.1.6 The application of the activity categorisation within GG104, has resulted in application of a Type A approach. Type A requires a basic level of safety management, with a commitment to produce a Safety Plan and an appropriate level of risk assessment.

5.1.7 Safety risks for all affected populations have been identified, assessed and mitigated. Although the scheme introduces new conflict points with two new slip roads, particularly at the merges, it also increases capacity at the junction and provides more flexibility in terms of local strategic movements.

5.1.8 MS4s provided on the mainline mitigate the risk of conflict at merge points by informing drivers of traffic conditions ahead. This, combined with the improved northbound on-slip, will help to ensure that the overall, the objectives are met.

5.1.9 At PCF stage 3, it has been demonstrated that an appropriate risk assessment methodology for a Type A scheme has been applied and that hazards for all affected populations are well managed.

5.1.10 Initial operational safety performance of the scheme will be monitored

5.1.11 The following monitoring activities are expected to be used:

- Implementation of the Plan for Monitoring Operations (PfMO)[5]
- Scheme assessment to be undertaken after an appropriate period of operation and covered through Benefits Realisation and Evaluation activities.
- Stage 4 road safety audit at 12 months of operation
- Assessment of operational monitoring reports, for example from the Traffic Officer Service or maintainers

5.1.12 Appropriate safety governance arrangements have been applied

5.1.13 The scheme categorisation has been developed in accordance with GG 104[2] and safety risk assessments have followed this guidance. A review of standards has been conducted

and is detailed in the Implementation Report for New Standards[8] which was completed at Stage 3. The design team is working collaboratively, both internally and with external stakeholders through bespoke workshops and consultations will continue as the design progresses.

Appendices

Appendix A. Hazard Review- Demonstration of GG 104 application

A.1.1. This is a safety risk assessment of the key safety challenges introduced and addressed by the M5 Junction 10 scheme. These have been identified as:

- The introduction of two additional slip roads creating will create additional merge and diverge movements on the mainline and potential vehicle conflicts associated with these layouts
- The poor safety record along the A4019 east of the M5 junction. (New pedestrian, cycle and equestrian facilities introduced by the scheme are aimed at reducing KSIs and pedestrian and cycle collisions)
- Increased traffic flows at Junction 10 and at junctions along the A4019 which could lead to an increase in vehicle movements and the potential for conflicts
- The creation of a new junction on the B4634 Old Gloucester Road at the West Cheltenham Link Road which will lead to an increase in turning movements along the route

A.2. Step 1 – Planning

A.2.1. The 8 steps which have been followed to produce this SRA are documented in the following sections:

1. **Planning**: Essential to a robust SRA is a clear statement of the context of the question or decision that is being made.
2. **Categorisation of activity type**: To determine the level of rigour required for an SRA, and to identify the parties who will validate its findings, the 'activity' is categorised as A, B or C.
3. **Affected populations**: GG 104[2] requires the populations affected i.e. users, workers or others, to be identified.
4. **Scope**: Clarifications of what is covered by the SRA and what activities or decisions are excluded.
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 SRA. This objective is usually developed based on a review of baseline data.
6. **Hazards and risk**: The formal risk assessment stage that documents the hazards relevant to the activity and scope including an appropriate level of quantification. At this point control measures are considered and those deemed suitable based on risk criteria, e.g. ALARP, are confirmed.
7. **Update requirements**: The possible circumstances under which the SRA would become invalid and require review or update.
8. **Validation and monitoring requirements**: Confirmation of any further work required to validate assumptions or monitor the activity to validate the safety objectives.

A.3. Step 2 – Categorisation of activity type

A.3.1. The safety activities for the M5 Junction 10 Improvements scheme have been considered within this report (see para 3.1).

A.3.2. The M5 Junction 10 scheme has been classed as Type A, therefore according to GG 104, the scope and complexity of this SRA overall, has been defined as a Type A.

A.4. Step 3 – Affected populations

A.4.1. The populations set out in Table 1.3 of GG 104 have been reviewed, road workers and road users have been deemed to be impacted by the implementation of the M5 Junction 10 Improvements scheme:

- Workers: New assets requiring maintenance and access modifications to various assets as well as the modifications to junction 10 to allow all movements will impact on maintainers and traffic management operatives
- Users: The proposed upgrades to junction 10, dualling of the A4019 as well as the new Link Road and revised accesses to land and property will impact on this population group and therefore hazards affecting users have been assessed in the Safety Risk Assessment

A.5. Step 4 – Scope

A.5.1. The scope of this SRA is to consider the risk associated with the key safety challenges introduced by the M5 Junction 10 Improvements scheme. These have been identified as:

- The introduction of two additional slip roads will create additional merge and diverge movements on the M5 mainline. All four merges/diverges are non-standard and subject to Departures from Standard (DfS). The scope of this SRA will consider the risk associated with these four SRN Departures from Standard which have received provisional agreement from National Highways. The baseline for these DfS considers a compliant layout. These DfS have been identified as:

A.5.2. DFS.1 – Southbound diverge - Provide a Layout B Option 1 - Ghost island diverge rather than a Layout C (lane drop from 4-lanes upstream to 3-lane downstream)

A.5.3. DFS.2 – Northbound diverge - Provide a Layout B Option 1 - Ghost island diverge rather than a Layout C (lane drop from 4-lanes upstream to 3-lane downstream)

A.5.4. DFS.3 – Southbound merge - Provide a Layout B - parallel merge rather than a Layout D - lane gain (from 3-lane upstream to 4-lane downstream)

A.5.5. DFS.4 – Northbound merge - Provide a Layout B - parallel merge rather than a Layout D - lane gain (from 3-lane upstream to 4-lane downstream)

- Improving the safety record along the A4019 east of the M5 junction with a focus on reducing KSI and pedestrian and cycle collisions
- Increased traffic flows at Junction 10 and at junctions along the A4019
- The creation of a new junction on the B4634 Old Gloucester Road at the West Cheltenham Link Road

A.5.6. General Arrangement drawings are included in Appendix E.

A.6. Step 5 – Safety baseline and safety objective

A.6.1. The safety baseline and objective for the M5 Junction 10 Improvements scheme is described in the Safety Plan PCF product and steps taken to achieve those objectives are detailed in the Safety Report (this document).

Safety baseline

A.6.2. The scheme area has been defined for the purposes of setting the safety baseline shown in Table A-1 below.

Table A-1 - Safety baseline

Data Source	Period	Parameter 1	Parameter 2	Parameter 3
Road User				
STATS 19 (Validated)	3 years prior to commencement of Start of Works (start of construction)	The average annual FWI casualty rate per 100 million vehicle miles on the M5*	The average annual FWI casualty rate on the M5 slip roads	The average annual number of FWI casualties in the scheme area**
Road Workers				
There is no numerical objective or target for road worker safety on major schemes and the risk must be managed to reduce risk in accordance with the 'as low as reasonably practicable' (ALARP) principle.				

* between a point 500m north of Elmstone Hardwick Bridge and a point 500m south of Staverton Twin Culvert

**includes M5 (between a point 500m north of Elmstone Hardwick Bridge and a point 500m south of Staverton Twin Culvert, M5 slips roads (new and old), the A4019 (between Homecroft Drive and Stanboro Lane and the B4634 in the vicinity of the new West Cheltenham Link Road junction)

A.7. Safety objective

A.7.1. The M5 Junction 10 scheme will satisfy the road user safety objective if it is demonstrated for a period of three years after becoming fully operational that:

- The average annual FWI casualty rate per 100 million vehicle miles along the M5 between a point 500m north of Elmstone Hardwick Bridge and a point 500m south of Staverton Twin Culvert is better than the baseline (Parameter 1);
- The average FWI casualty rate on each of the 4 (two new and two existing) M5 slip roads is better than, the baseline (Parameter 2);
- the average annual number of FWI casualties in the scheme area is better than the baseline (Parameter 3)
- For each link, no population (e.g. car drivers, pedestrians, HGV drivers and motorcyclists) is disproportionately adversely affected in terms of safety and risk to each population remains tolerable.

A.7.2. There is no numerical objective or target for road worker accidents for major schemes and the risk must be managed in accordance with the ALARP principle. This is a legal requirement. One part of the strategy aims to eliminate all fatalities and serious injuries to road workers maintaining the National Highways road network.

A.8. Step 6 – Hazards and risk

Hazard identification

A.8.1. Relevant hazards for the key safety challenges have been identified as:

- The introduction of two additional slip roads at junction 10 will create additional merge and diverge movements on the M5 and potential vehicle conflicts associated with these layouts. In addition all 4 merges/diverges are non-standard and subject to Departures from Standard.
- A high proportion of collisions along the A4019 involve pedestrians and cyclists. The scheme introduces a number of new signal controlled junction with pedestrian crossing facilities which should reduce pedestrian collisions. The proposed shared footway/ cycle route along the A4019 should help to reduce cycle collisions.
- Increased traffic flows at Junction 10 and at junctions along the A4019 could lead to an increase in vehicle movements and potential conflicts
- The creation of a new junction on the B4634 Old Gloucester Road at the West Cheltenham Link Road will lead to an increase in turning movements along the route and potentially increase conflicts on the B4634 involving vehicles slowing and turning.

A.8.2. A semi-quantitative risk assessment table is attached at Appendix A.11, A.12, A.13, and A.14 below. Collision data for the five year period to 31st December 2020 has been used to establish a likelihood risk score for the baseline.

Hazard analysis

A.8.3. A summary of the semi-quantitative risk assessment tables attached at Appendix A.11, A.12, A.13, and A.14 is provided below in Table A-2 for the key safety challenges.

Table A-2 - Hazard analysis

Road user hazards				Road worker hazards				Total no of hazards
No road user hazards	Increase	No change	Decrease	No worker hazards	Increase	No change	Decrease	
The introduction of two additional slip roads at junction 10 will create additional merge and diverge movements on the M5								
7	5	1	1	0	0	0	0	7
A high proportion of collisions along the A4019 involve pedestrians and cyclists.								
3	0	1	2	0	0	0	0	3
Increased traffic flows at Junction 10 and at junctions along the A4019								
2	0	0	2	0	0	0	0	2
The creation of a new junction on the B4634 Old Gloucester Road at the West Cheltenham Link Road								
5	2	3	0	1	1	0	0	6
TOTAL								
17	7	5	5	1	1	0	0	18

A.8.4. The summary table shows that a total of 17 road user hazards and 1 road worker hazard have been identified from the key challenges. Overall, 7 road user hazards show an increase in risk and 5 show a decrease. 5 hazards show no change in risk. Just one worker hazard was identified which shows an increase in risk.

Analysis of safety risk

A.8.5. All hazards associated with the identified key challenges have been categorised as 'low' risk under the proposed design with 3 reducing from medium to low risk as a result of the proposals. Hazards relating to pedestrians or cyclists being struck by vehicles in the carriageway are significantly reduced in risk as a result of the proposals to provide signal controlled crossings and off-carriageway pedestrian/cycle facilities.

A.8.6. Although there is an increase in risk forecast for some of the hazards, the scheme introduces benefits to the wider road network through the creation of an all movements junction and the proposed improvements are required to cater for the increase in traffic volumes and pedestrian and cycle activity as a result of the new developments in the area.

Evaluation of safety risk

A.8.7. Based on the hazards identified and the mitigation measures provided, it is likely that the safety objectives will be achieved. The objectives for the SRN (M5 and slip roads) are based on 'rate' which acknowledges and takes into account the predicted increase in traffic flows at the junction. Although the scheme introduces new conflict points with two new slip roads, particularly at the merges, it also increases capacity at the junction and provides more flexibility in terms of local strategic movements. MS4s provided on the mainline mitigate the risk of conflict at merge points by informing drivers of traffic conditions ahead. This, combined with the improved northbound on-slip will help to ensure that the overall, the objectives are met.

A.8.8. The measures introduced by the scheme along the A4019 and new West Cheltenham Link Road will help to achieve a lower number of FWI casualties particularly amongst pedestrians and cyclists. In addition, the interventions can be considered to be managing risk to an ALARP level for workers. One hazard affecting road workers has been identified amongst the safety challenges however MHS are proposed for use by maintainers at traffic signal junctions and, with other Chapter 8 controls in place, risk to road workers can be considered to be ALARP. The activity has been deemed to be acceptable in safety risk terms.

A.9. Step 7 – Update requirements

A.9.1. This SRA will be reviewed as the project progresses and any material changes to the design will be subject to the appropriate safety risk assessment process.

A.10. Step 8 – Validation and monitoring requirements

A.10.1. Validation will determine whether the safety benefits anticipated by the project are being achieved in practice and whether assumptions made within the risk assessments are correct. This should be undertaken after an appropriate period of operation and covered through Benefits Realisation and Evaluation activities

A.10.2. Key safety challenges are included as monitoring requirements in the Plan for Monitoring Operations [5]. Monitoring activity will be carried out during the first six months of operations.

A.11. Semi-quantitative risk assessment table

A.11.1. The introduction of two additional slip roads at junction 10 will create additional merge and diverge movements on the M5. Furthermore, the 4 merges/diverges are non-standard layouts.

Hazard Identification							Risk Analysis									Evaluation and next steps	
Ref	Hazard/Hazardous event	Population	Sub-group (s)	Location (s)	Injury outcome (s)	Causes (s)	Risk – Baseline				Risk - Proposal				Commentary on analysis	Confirmed control measure(s)	Additional control measures required?
							L	S	R	Class.	L	S	R	Class.			
1	Merge conflict between slip road and mainline traffic	Users	All road users	M5 J10 merges	Nose-to-tail or lane change collision	Insufficient merge provision Injudicious action by driver Congestion	3	2	6	Low	4	2	8	Low	Baseline risk is based on collisions at the existing northbound merge as there is currently no southbound slip road. Only 1 collision potentially related to northbound merge alignment in 5 years although 'impaired by alcohol' was assigned to the collision as a possible contributing factor hence low baseline score. No lane gain in proposed design introduces requirement to merge and potential conflicts Outside of the peak period the mainline will operate within the advised maximum vehicles per lane. New all movements junction will offer benefits to the wider road network.	Road marking and signing renewed Pavement renewed MS4 signs capable of providing congestion alerts and lane advice	None required as risk remains in the low category
2	Merge conflict between slip road and mainline traffic causes braking on mainline	Users	All road users	M5 J10 approach to merges	Nose-to-tail or lane change collision	Conflict ahead caused by merging Injudicious action by driver Driver error or reaction Congestion	3	2	6	Low	4	2	8	Low	Baseline risk is based on collisions at the existing northbound merge as there is currently no southbound slip road. Only 1 collision potentially related to northbound merge alignment in 5 years although 'impaired by alcohol' was assigned to the collision as a possible contributing factor hence low baseline score. No lane gain in proposed design introduces requirement to merge and potential conflicts Outside of the peak period the mainline will operate within the advised maximum vehicles per lane. New all movements junction will offer benefits	Road marking and signing renewed Pavement renewed MS4 signs capable of providing congestion alerts and lane advice	None required as risk remains in the low category

Hazard Identification							Risk Analysis									Evaluation and next steps	
Ref	Hazard/Hazardous event	Population	Sub-group (s)	Location (s)	Injury outcome (s)	Causes (s)	Risk – Baseline				Risk - Proposal				Commentary on analysis	Confirmed control measure(s)	Additional control measures required?
							L	S	R	Class.	L	S	R	Class.			
															to the wider road network.		
3	Merge conflict between slip road and mainline traffic causes braking on slip road	Users	All road users	M5 J10 merge slip roads	Nose-to-tail collision	Conflict ahead caused by merging Injudicious action by driver Driver error or reaction Congestion	2	2	4	Low	3	2	6	Low	Baseline risk is based on collisions at the existing northbound merge as there is currently no southbound slip road. Only 1 collision potentially related to northbound merge alignment in 5 years although 'impaired by alcohol' was assigned to the collision as a possible contributing factor hence low baseline score. No lane gain in proposed design introduces requirement to merge and potential conflicts Less likely than merge collisions (Ref 1 and 2) as it requires a merge hazard and then a secondary event e.g. Too close follow or distraction. Outside of the peak period the mainline will operate within the advised maximum vehicles per lane. New all movements junction will offer benefits to the wider road network.	Road marking and signage renewed Pavement renewed MS4 signs capable of providing congestion alerts and lane advice	None required as risk remains in the low category
4	Queuing on the slip road	Users	All road users	M5 J10 approaches to diverges	Nose-to-tail or lane change collision	Insufficient diverge provision Congestion Injudicious action by driver Driver distraction	3	2	6	Low	4	2	8	Low	Baseline risk considers collisions at the existing southbound diverge which has a substandard exit taper and therefore a compliant layout is assumed to experience fewer collisions than under the existing substandard layout. One collision on the southbound diverge in five years which was a nose-to-tail in queuing traffic. Sub-standard diverge type in proposed design introduces potential conflicts hence a slight increase in likelihood of a collision occurring	Road marking and signage renewed Pavement renewed MS4 signs capable of providing congestion alerts and lane advice	None required as risk remains in the low category

Hazard Identification							Risk Analysis									Evaluation and next steps	
Ref	Hazard/Hazardous event	Population	Sub-group (s)	Location (s)	Injury outcome (s)	Causes (s)	Risk – Baseline				Risk - Proposal				Commentary on analysis	Confirmed control measure(s)	Additional control measures required?
							L	S	R	Class.	L	S	R	Class.			
															compared to a compliant layout. Outside of the peak period the mainline will operate within the advised maximum vehicles per lane. New all movements junction will offer benefits to the wider road network.		
5	Queuing on the mainline	Users	All road users	M5 J10 approaches to diverge	Nose-to-tail or lane change collision	Insufficient diverge provision Congestion Injudicious action by driver Driver distraction	3	2	6	Low	4	2	8	Low	Baseline risk considers collisions at the existing southbound diverge which has a substandard exit taper and therefore a compliant layout is assumed to experience fewer collisions than under the existing substandard layout. No lane drop in proposed design reduces capacity which could lead to congestion and potential conflicts hence a slight increase in likelihood of a collision occurring compared to a compliant layout. Outside of the peak period the mainline will operate within the advised maximum vehicles per lane. New all movements junction will offer benefits to the wider road network.	Road marking and signage renewed Pavement renewed MS4 signs capable of providing congestion alerts and lane advice	None required as risk remains in the low category
6	Late ‘swooping’ movements to access diverge	Users	All road users	M5 J10 approaches to diverges	Nose-to-tail or lane change collision	Insufficient diverge provision Congestion Injudicious action by driver Driver distraction	2	2	4	Low	2	2	4	Low	Baseline risk considers collisions at the existing southbound diverge which has a substandard exit taper and therefore a compliant layout is assumed to experience fewer collisions than under the existing substandard layout. Negligible increase in likelihood of a collision occurring compared to compliant layout due to presence of tiger tail. Outside of the peak period the mainline will operate within the	Tiger tail prevents late movements into lane 1 of slip road Road marking and signage renewed Pavement renewed MS4 signs capable of providing congestion alerts and lane advice	None required as risk remains in the low category

Hazard Identification							Risk Analysis									Evaluation and next steps	
Ref	Hazard/Hazardous event	Population	Sub-group (s)	Location (s)	Injury outcome (s)	Causes (s)	Risk – Baseline				Risk - Proposal				Commentary on analysis	Confirmed control measure(s)	Additional control measures required?
							L	S	R	Class.	L	S	R	Class.			
															advised maximum vehicles per lane.		
7	Late lane changes on approach to the junction	Users	All road users	M5 J10 approaches to diverge	Nose-to-tail or lane change collision	Lane drop in compliant design Injudicious action by driver Driver distraction	3	2	6	Low	1	2	2	Low	Lane drop in compliant design can result in users in lane 1 making late lane changes to stay on the mainline. This is commonly seen on the wider network. Increased likelihood of a collision involving late lane changes under a compliant layout compared to proposed design as a result of lane drop in compliant design. Outside of the peak period the mainline will operate within the advised maximum vehicles per lane.	Road marking and signage renewed Pavement renewed MS4 signs capable of providing congestion alerts and lane advice	None required as risk remains in the low category

A.12. Semi-quantitative risk assessment table

A.12.1. A high proportion of collisions along the A4019 involve pedestrians and cyclists.

Hazard Identification							Risk Analysis									Evaluation and next steps	
Ref	Hazard/ Hazardous Event	Population	Sub-group (s)	Location (s)	Injury outcome (s)	Causes (s)	Risk – Baseline				Risk - Proposal				Commentary on analysis	Confirmed control measure(s)	Additional control measures required?
							L	S	R	Class.	L	S	R	Class.			
1	Pedestrian/ equestrian rider in carriageway	Users	Pedestrians and equestrian riders	A4019 east of Junction10	Pedestrian/ equestrian rider struck by vehicle	Lack of crossing facilities Bus stops creating desire lines Pedestrians crossing obstructed by bus	4	3	12	Med	2	3	6	Low	3 collisions in 5 years involved pedestrians and 2 resulted in serious injury. None involving equestrians.	Crossing facilities provided at junctions at regular intervals along the A4019 east of junction 10 Underpass provided for use by equestrian riders using the bridleway	None required as risk remains in the low category
2	Cyclist in carriageway	Users	Cyclists	A4019 east of Junction10	Cyclist struck by vehicle	Poor visibility Inconspicuous cyclist Passing too close to cyclist	4	3	12	Med	2	3	6	Low	2 collisions in 5 years involved cyclists with one resulting in serious injury.	Off-carriageway cycle facility provided	None required as risk remains in the low category
3	Pedestrian crossing	Users	Pedestrians	A4019 east of Junction10	Pedestrian struck by vehicle	Vehicle enters crossing on a red signal/ crossing overshoot Pedestrian crosses before ped phase	2	3	6	Low	2	3	6	Low	There have been no collisions at existing crossings in 5 years. New crossing locations could increase the risk of a driver entering a crossing on a red signal however, the overall safety of pedestrians will be improved by the scheme and with the mitigation measures in place there is no increase in risk.	Skid resistant surface on crossing approaches. New lighting	None required as risk remains in the low category

A.13. Semi-quantitative risk assessment table

A.13.1. Increased traffic flows at Junction 10 and at junctions along the A4019.

Hazard Identification							Risk Analysis									Evaluation and next steps	
Ref	Hazard/ Hazardous Event	Population	Sub-group (s)	Location (s)	Injury outcome (s)	Causes (s)	Risk – Baseline				Risk - Proposal				Commentary on analysis	Confirmed control measure(s)	Additional control measures required?
							L	S	R	Class.	L	S	R	Class.			
1a	Queuing traffic	Users	Vehicle occupants, cyclists	Junction 10 and A4019	Nose-to-tail collisions	Driver inattention Poor visibility Late braking Congestion	5	2	10	Med	4	2	8	Low	5 collisions along the A4019 east of J10 were nose-to-tail collisions. 7 collisions on the M5 and slip roads were nose-to-tail collisions.	Increased capacity through construction of a gyratory at junction 10 Increased capacity through dualling of A4019 MS4s to warn drivers on the M5 of congestion ahead New lighting provision on A4019	None required as risk remains in the low category

Hazard Identification							Risk Analysis									Evaluation and next steps	
Ref	Hazard/ Hazardous Event	Population	Sub-group (s)	Location (s)	Injury outcome (s)	Causes (s)	Risk – Baseline				Risk - Proposal				Commentary on analysis	Confirmed control measure(s)	Additional control measures required?
							L	S	R	Class.	L	S	R	Class.			
1b	Queuing traffic	Users	Vehicle occupants, motorcyclist, cyclists	A4019	Head-on collision/ collision with central island	Overtaking Congestion/weaving Slow-moving vehicle ahead	4	3	12	Med	2	3	6	Low	2 collisions involved motorcyclists (1 serious and 1 slight) overtaking on the A4019 and colliding with a traffic island.	Increased capacity through dualling of A4019 will allow safer overtaking opportunities New lighting provision on A4019	None required as risk remains in the low category

A.14. Semi-quantitative risk assessment table

A.14.1. The creation of a new junction on the B4634 Old Gloucester Road at the West Cheltenham Link Road

Hazard Identification							Risk Analysis									Evaluation and next steps	
Ref	Hazard/ Hazardous Event	Population	Sub-group (s)	Location (s)	Injury outcome (s)	Causes (s)	Risk – Baseline				Risk - Proposal				Commentary on analysis	Confirmed control measure(s)	Additional control measures required?
							L	S	R	Class.	L	S	R	Class.			
1	Queuing traffic	Users	Vehicle occupants, cyclists	B4634 junction with new West Cheltenham Link Road	Nose-to-tail collisions	Driver inattention Poor visibility Late braking Congestion	2	2	4	Low	3	2	6	Low	No junction on the B4634 under current layout. The new West Cheltenham Link Road and signal controlled junction will provide an alternative more suitable route to cater for the forecast increase in traffic volumes than Withybridge Lane which runs parallel to the route and its priority junction with the B4634. Although the risk of a collision increases compared to the existing layout with no signal controlled junction the existing layout could lead to an increase in collisions along Withybridge Lane and at its junction with B4634.	Lighting provision at junction Traffic signals highlight presence of junction Skid resistant surface on approaches Potential reduced speed limit	None required as risk remains in the low category
2	Right turn movements	Users	Vehicle occupants, cyclists	B4634 junction with new West Cheltenham Link Road	Right turn/ side impact collisions	Driver disobeys red signal Poor visibility	-	-	-	-	2	3	6	Low	No junction on the B4634 under current layout. The new West Cheltenham Link Road and signal controlled junction will provide an alternative more suitable route to cater for the forecast increase in traffic volumes than Withybridge Lane which runs parallel to the route and its priority junction with the B4634. Although the risk of a collision increases	Lighting provision at junction Traffic signals highlight presence of junction Potential reduced speed limit	None required as risk remains in the low category

Hazard Identification							Risk Analysis									Evaluation and next steps	
Ref	Hazard/ Hazardous Event	Population	Sub-group (s)	Location (s)	Injury outcome (s)	Causes (s)	Risk – Baseline				Risk - Proposal				Commentary on analysis	Confirmed control measure(s)	Additional control measures required?
							L	S	R	Class.	L	S	R	Class.			
															compared to the existing layout with no signal controlled junction the existing layout could lead to an increase in collisions along Withybridge Lane and at its junction with B4634.		
3	Pedestrian crossing	Users	Pedestrians	B4634 junction with new West Cheltenham Link Road	Pedestrian struck by vehicle	Driver disobeys red signal Poor visibility Pedestrian crosses before ped phase	2	3	6	Low	2	3	6	Low	No crossings on the B4634 under current layout. An increase in pedestrian activity as a result of the new developments and Link Road is forecast. In the absence of pedestrian crossing facilities there could be more pedestrian collisions. No increase in risk of a collision due to mitigation measures proposed.	Lighting provision at junction Skid resistant surface on approaches Potential reduced speed limit	None required as risk remains in the low category
4	Cyclist crossing	Users	Cyclists	B4634 junction with new West Cheltenham Link Road	Cyclist struck by vehicle	Driver disobeys red signal Poor visibility Cyclist crosses before ped/cycle phase	2	3	6	Low	2	3	6	Low	No crossings on the B4634 under current layout. An increase in cyclist activity as a result of the new developments and Link Road is forecast. In the absence of cycle crossing facilities there could be more cycle collisions. No increase in risk of a collision due to mitigation measures proposed.	Lighting provision at junction Skid resistant surface on approaches Potential reduced speed limit	None required as risk remains in the low category
5	Errant vehicle leaves carriageway	Users	Vehicle occupants	B4634 junction with new West Cheltenham Link Road	Loss of control collision	Excessive approach speeds Slippery road surface	2	3	6	Low	2	3	6	Low	No junction on the B4634 under current layout. No increase in risk of a collision due to mitigation measures proposed.	Skid resistant surface on approaches Potential reduced speed limit	None required as risk remains in the low category
6	Maintenance of signals	Workers	Maintainers	B4634 junction with new West Cheltenham Link Road	Maintainer struck by vehicle	TM incursion Driver inattention	-	-	-	-	1	4	4	Low	No signals on the B4634 under current layout.	Maintenance Hardstanding provided at signal locations Maintenance activities will be subject to Chapter 8 Traffic Management controls	ALARP

Appendix B. Risk Scoring Matrix

B.1.1. All identified hazards were scored for likelihood of occurrence and severity of harm as shown in the matrix below. The Likelihood and Severity scores are then 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

Risk Value (R)	**Required Action**
Low/Broadly Acceptable (1-9)	Apply best practice in design and operation and maintain control measures already in place.
Medium/Tolerable (10-19)	Additional control measures needed to reduce risk in accordance with the safety risk criteria for the population concerned.
High/Unacceptable (20-25)	Activity not permitted. Hazard to be avoided or risk to be reduced to tolerable.

B.2. Change in Risk

When comparing the risk values (R) before and after the proposed activity, the changes are classed as follows:

Changes in risk outcome value	Classification of Change
Large improvement in risk terms (lower risk) vs the current road use	Improvement
Small improvement in risk terms (lower risk) vs the current road use	Minor improvement
Risk remains as before	No Change
Slight worsening of risk vs current road use, small or no mitigation deemed necessary to meet safety objective	Minor deterioration
Significant worsening of risk vs current road use – mitigation required to meet safety objective	Deterioration

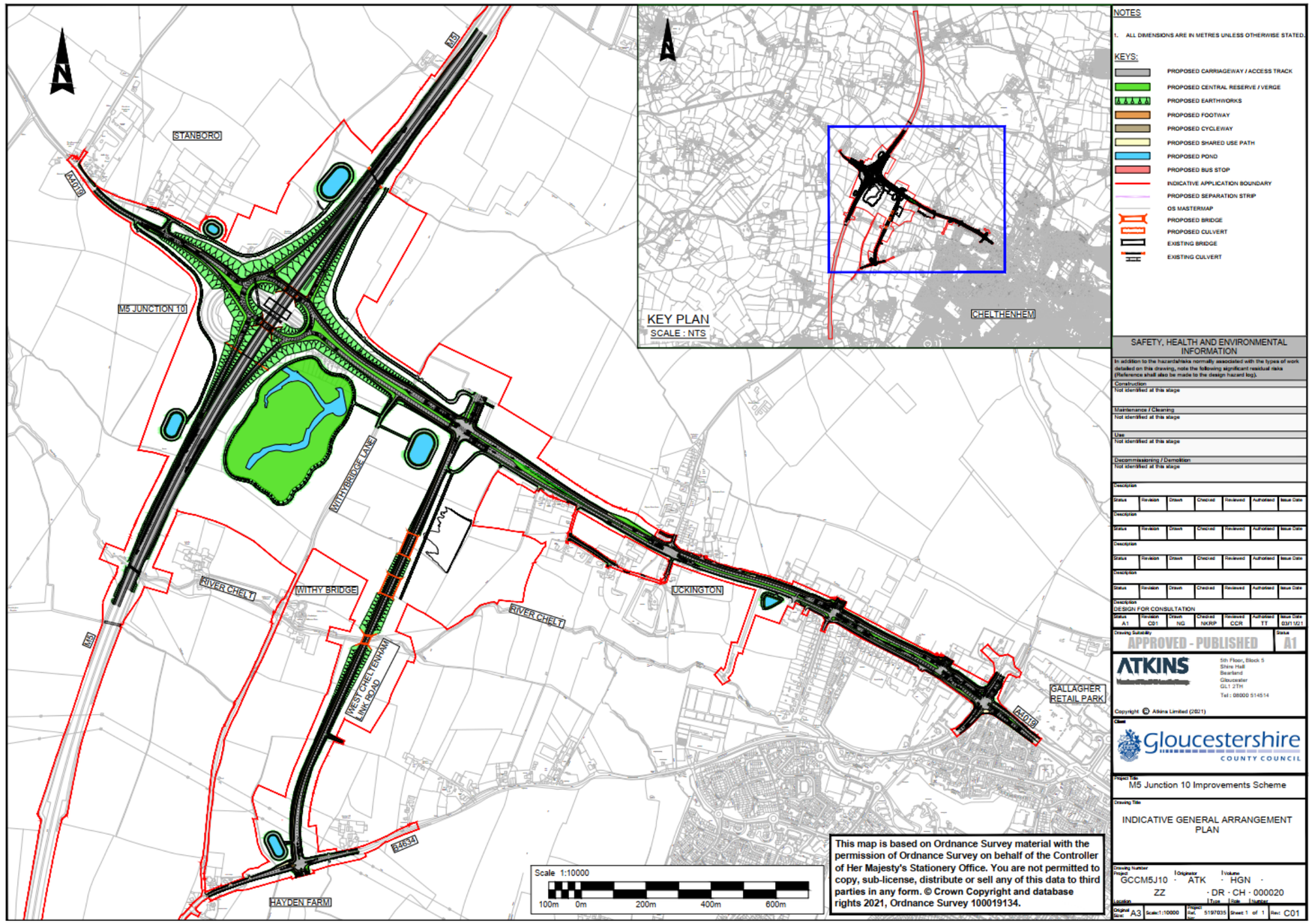
Appendix C. References

[1] GCCM5J10-ATK-GEN-ZZ-PC-CH-000010 Safety Plan
[2] GG 104 Requirements for Safety Risk Assessment
[3] GD 304 Designing health and safety into maintenance
[4] GCCM5J10-ATK-GEN-ZZ-PC-CH-000011 Maintenance and Repair Statement (MRS)
[5] Plan for Monitoring Operations
[6] DMRB Design Manual for Roads and Bridges
[7] GG 102 National Highways Competency requirements
[8] GCCM5J10-ATK-GEN-ZZ-PC-CH-000005 Implementation Report for New Standards
[9] GG 182 Major schemes: Enabling handover into operation and maintenance

Appendix D. Glossary of terms and abbreviations

Acronym	Description
ALARP	As low as reasonably practicable
BREP	Benefits Realisation Evaluation Plan
CDF	Collaborative Delivery Framework
DF	Design Fix
DfS	Departure from standard
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
ERIC	Eliminate. Reduce, Isolate, Control
FWI	Fatal and Weighted Injuries
GCC	Gloucestershire County Council
GG	General guidance
KSI	Killed and seriously injured
MHS	Maintenance hard standing
MRS	Maintenance and repair statement
MS4	Message sign mark 4
NSCRG	National Safety Control Review Group
PCF	Project control framework
PRoW	Public Right of Way
PfMO	Plan for Monitoring Operations
SCRG	Safety Control Review Group
SES	Safety Engineering and Standards
SGAR	Stage gate assessment review
SRA	Safety Risk Assessment
SRN	Strategic Road Network
TLG	Technical leadership group
TM	Traffic management
TOS	Traffic Officer Service
TSM	Traffic Signs Manual
TTM	Temporary traffic management

Appendix E. General Arrangement drawings



NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED.

KEYS:

- PROPOSED CARRIAGEWAY / ACCESS TRACK
- PROPOSED CENTRAL RESERVE / VERGE
- PROPOSED EARTHWORKS
- PROPOSED FOOTWAY
- PROPOSED CYCLEWAY
- PROPOSED SHARED USE PATH
- PROPOSED POND
- PROPOSED BUS STOP
- INDICATIVE APPLICATION BOUNDARY
- PROPOSED SEPARATION STRIP
- OS MASTERMAP
- PROPOSED BRIDGE
- PROPOSED CULVERT
- EXISTING BRIDGE
- EXISTING CULVERT

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made to the design hazard log).

Construction
Not identified at this stage

Maintenance / Cleaning
Not identified at this stage

Use
Not identified at this stage

Decommissioning / Demolition
Not identified at this stage

Description	Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
DESIGN FOR CONSULTATION	A1	C01	NG	NKRP	CCR	TT	03/11/21

Drawing Suitability: APPROVED - PUBLISHED — Status: A1

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Client: Gloucestershire County Council

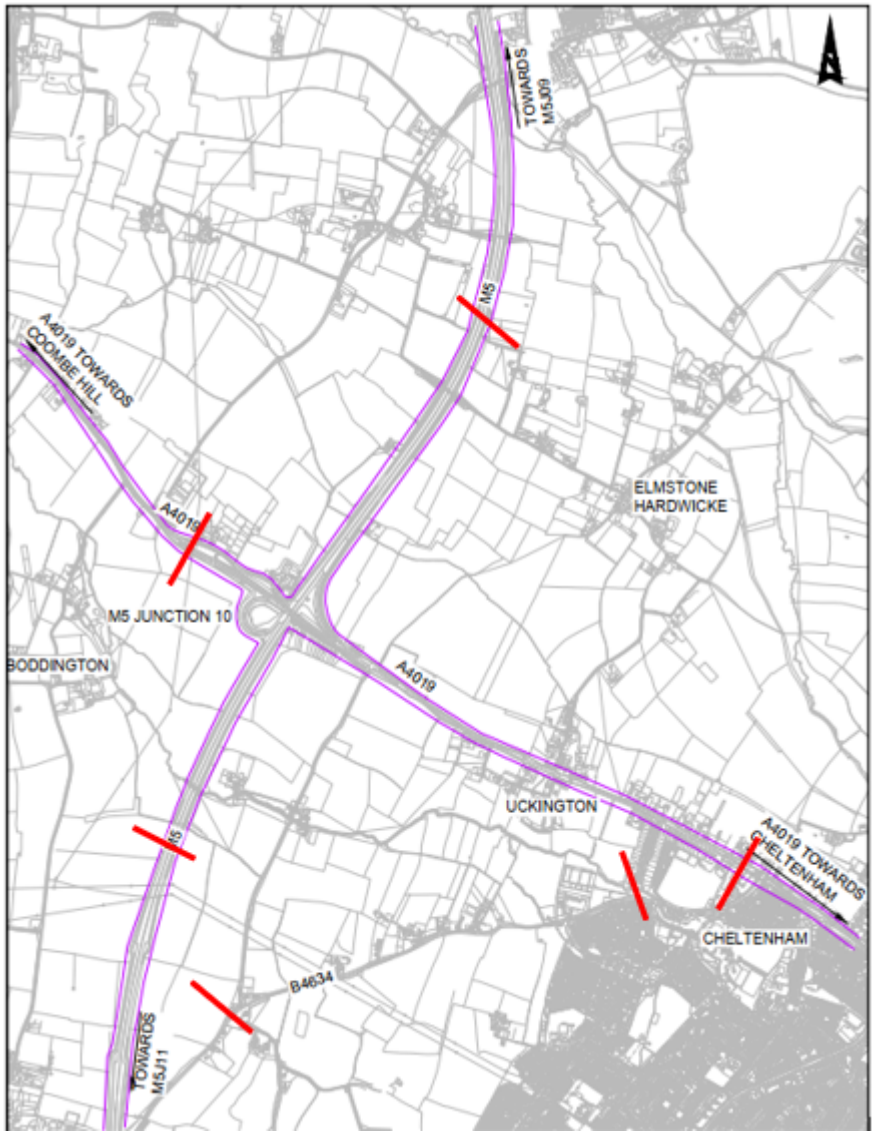
Project Title: M5 Junction 10 Improvements Scheme

Drawing Title: INDICATIVE GENERAL ARRANGEMENT PLAN

Drawing Number	Originator	Volume	Location	Type	Role	Number
GCCM5J10	ATK	HGN	ZZ	DR	CH	000020

Original Size: A3 — Scale: 1:10000 — Project Ref.: 5197035 — Sheet: 1 of 1 — Rev: C01

Appendix F. Baseline extents



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