Roads and Highways Department

Road Safety Audit Manual

2025

Roads and Highways Department

GOVERNMENT OF
THE PEOPLE'S REPUBLIC
OF BANGLADESH

Acknowledgements

This Manual was developed with funding assistance from Asian Development Bank (ADB). The success of this Manual is attributed to the efficient coordination of the RHD team led by (insert name here). The team consisted of the members listed below:

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ROADS AND HIGHWAYS
DEPARTMENT

ROAD SAFETY AUDIT MANUAL

2025

Abbreviations

ADB	Asian Development Bank
BOT	Build Operate Transfer
BRT	Bus Rapid Transit
BRTA	Bangladesh Road Transport Authority
CAREC	Central Asia Regional Economic Cooperation
CNG	Compressed Natural Gas
BOQ	Bills of Quantities
DB	Design and Build
DLP	Defects Liability Period
FAP	Foreign Aided Projects
FSI	Fatal & Serious Injury
GOB	Government of Bangladesh
IC	Independent Consultants
iRAP	International Road Assessment Programme
KSI	Killed and Seriously Injured
LHS	Left Hand Side
LMICS	Low and Middle Income Countries
NA	Not Applicable
NGO	Non-Governmental Organisation
NMT	Non-Motorized Traffic
NSR	Network Safety Ranking
PD	Project Director
PDO	Property Damage Only
PM	Project Manager
PPE	Personal Protective Equipment
PPP	Public Private Partnership
PWD	Persons With Disability
RHD	Roads and Highways Department
RHS	Right Hand Side
ROB	Road Over Bridge
RSA	Road Safety Audit
RSD	Road Safety Division
RSE	Road Safety Engineering
RSI	Road Safety Inspection
RSIA	Road Safety Impact Assessments
SMVT	Slow-moving vehicular traffic
TMP	Traffic Management Plan
TOR	Terms of Reference
TRL	Transport Research Laboratory
VRU	Vulnerable Road User
WB	World Bank
WH&S	Workplace Health and Safety

FOREWORD

This Road Safety Audit Manual, 2025 is for use by Roads and Highways Department (RHD) - Bangladesh personnel, consultants, and contractors in undertaking road safety audits. It provides policies and procedures for carrying out road safety audits on RHD network.

This Manual has been developed within the context of the operating safety environment of RHD Bangladesh. The management of the road safety auditing in this Manual is framed around the institutional arrangement of RHD. As much as possible, the Manual has included sample report layouts to standardize the reporting procedures on road safety audits, and exemptions are also provided where it can be justified.

RHD mission is to provide the people of Bangladesh with a safe, cost effective and well-maintained road network. Adoption and mainstreaming of the Manual in the day-to-day processes of RHD is expected to contribute to the collective delivery of safe, sustainable, and value for money road network to the People's Republic of Bangladesh.

FOREWORD

The Chief Engineer, Roads and Highways Department

FOREWORD

The Asian Development Bank

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This manual has been developed to be used as a reference document for RHD officials, designers and auditors while carrying out Road Safety Audits on the RHD network.

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01. Introduction

The road network managed by Roads and Highways Department (RHD) carries most of the passenger and commercial traffic in Bangladesh. Significant number of pedestrians and non-motorised vehicles use the road network, in addition to the cars, buses and trucks. A combination of mixed traffic, high speed, and inadequate infrastructure is resulting in significant numbers of road crashes which can lead to death and serious injury.

RHD has taken up a significant road expansion programme which is expected to continue in the future to support the social and economic growth of the country. RHD recognises that it is important to consider the safety of all road users for the country to have a road network safer for all. Given that so much scheme design and planning is either underway already or imminent, it is essential that effective proactive tools are applied at appropriate stages of the design and construction cycles to improve road safety.

Road Safety Audits (RSA) are accepted to be an essential good practice and pro-active tool. They can significantly improve the safety of road projects. They do this by identifying risky design elements, ideally from the early plans, which means the designers can eliminate / replace risky infrastructure elements before they are built.

Correction once the road is complete will always be far more costly and difficult to manage compared with identification of those risks during design.

RHD is implementing plans to institutionalise RSA as part of RHD's business processes, and is developing substantial road safety audit capacity in the country. One of the important aspects in implementing RSA is to have a reference document or manual to inform the industry of the processes involved.

This RSA Manual has been developed as a reference document for RHD officials, designers and auditors while carrying out road safety audits on the RHD network. It incorporates new safe system elements which aim to minimise the number of crashes and by decreasing the severity of injuries when crashes do occur.

An understanding of safe speeds is also a Safe System theme that is included. Speed is a particularly important factor in Bangladesh where the roads have a higher proportion of Vulnerable Road Users (VRU) and where vehicles have a much wider range of speeds than on roads in high income countries where RSA and Safe Systems were originally developed.

Importantly, this document also supports a framework of activities and required investment to make RSA an operational activity for RHD and its supply chain.

RHD recognises that it is important to consider the safety of all road users for the country to have a road network safer for all.

[1.1] Development, Scope & Purpose of this manual

This manual is developed by Transport Research Laboratory (TRL) through a technical assistance programme South Asia Subregional Economic Cooperation Dhaka-Sylhet Corridor Road Investment Project, funded by Asian Development Bank (ADB).

The manual details the RSA process. It includes support checklists for auditors to refer to while they carry out audits on the RHD network. The manual is intended to guide the conduct of road safety audits (RSAs) on the road network managed by RHD. However, the checklists provided are fundamental in nature and can be used for conducting road safety audits on other rural and urban roads in Bangladesh.

02. Key Features of an RSA

[2.1]

What is an RSA?

Road Safety Audits (RSA) evolved from the United Kingdom in the mid-1980s as a mitigation measure to reduce the risk of road traffic collisions on newly completed road projects. This followed the findings of a Road Safety Engineering (RSE) team in Southern England that blackspots were overrepresented on newly constructed roads[1]. A strategic approach was then devised by RSE to review the designs of roads before construction.

To guide this process, in 1990 the Institution of Highways and Transportation (UK) published the first RSA manual. Since then, RSAs have become internationally recognized as a 'proactive approach' to build safer roads.

The primary objective of an RSA is to identify potential safety hazards in a road project that could affect road users. It formulates recommendations for mitigating these hazards. This enables the designer to address identified safety issues as part of the design process, prior to construction.

WHAT IS AN RSA?
Technical safety check.
Systematic.
Independent team.
Covers planning to early operation project phases.
Formal with official report as output.

An RSA is defined as a formal and systematic safety check carried out by an independent team to review the design characteristics of a road infrastructure project. It can be carried out from planning phase to early operation.

An RSA is a standard and integrated safety check of a road project design carried out by an independent and suitably qualified team. It produces a report detailing specific safety concerns or deficiencies identified in the design. The report is given to the design team who need to demonstrate to the Client that the design has been modified to address any safety issues or to indicate clearly and with justification why any proposed change is not to be actioned.

RSA is a formal process. It follows a defined framework that leads to a formal report which becomes a required part of the record of the whole road project. This detailed examination requires time, knowledge, skill, judgement, versatility, depth, and detail.

It requires a team of independent auditors, which means there must be no professional or financial links to the design team (and/or their organisation) in a manner that may influence the findings. The main Audit team members need primarily to have adequate experience of incorporating safety in road engineering design practices. Ideally there should be diverse experience from within the team to cover the wide range of road system elements that influence the safety risk. Having a team of auditors (rather than an individual auditor) should provide a greater variety of experiences that increase the likelihood of potential safety issues being detected.

When aligned with the Safe System approach, RSA should focus on identifying issues on the design which can lead to potential crashes involving fatal and serious injuries, for example the installation of a zebra crossing on a high-speed, multi-lane highway. However, risks which may result in lesser injury severity should not be ignored, for example trip hazards on footways (sidewalks).

The extent of the network assessed by the Road Safety Audit is defined in the 'Audit Brief'. Despite the scope and extent of the audit area defined, the RSA process must acknowledge that a project can also influence the safety and operation of adjacent links and nodes.

The output of an RSA is a standard report that identifies road safety design issues and makes recommendations to address the identified risks. The Design team are required to respond to the RSA report, by agreeing to alter the scheme details or by stating the case for not making any change. The report forms a resource for a dialogue which should result

[1] CAREC Road Safety Engineering Manual 1.

in a safer design. Ultimately, as the owner of the facility, responsibility to implement or reject these recommendations remains with the concerned Road Authority. The response report must therefore be officially signed off by the official responsible in the concerned Road Authority.

RSA is a distinct process, but it can complement (and be complemented by) other tools relevant to road design and road safety management within an overarching Safe System approach (see Section 2.5 of this Manual).

Conducting an RSA does not prevent the concerned Road Authority staff from raising any other safety concerns that they may have identified on the same project road at any other time during the project implementation phase.

Ultimately the RSA process should contribute to a safer facility.

FIGURE 2.1 Mixed traffic conditions in Dhaka

[2.2]

What RSA is not

There is a general misconception that once a facility is audited, then it is considered safe and "approved". Sometimes, the role of auditors is not well understood such that the Audit team assumes a role that is not theirs, or the Client has expectations of the Audit team beyond their scope.

ROAD SAFETY AUDIT is not

- × A check of compliance with technical standards and/or guidelines. Where standards have not been adhered to and this impacts safety, these issues must be documented in the RSA report.
- × An opportunity for auditors to redesign a project or make changes to a design with no apparent link to safety issues.[2]
- × A substitute for regular design checks including quality assurance and control.
- × A check on structural safety of the roadway elements.
- × A process to condemn or endorse a project, or a way of rating a project as good or bad.
- × An in-depth crash data investigation. If reliable crash data is available, this may be used to identify locations of potential risk.
- × A black spot analysis or a crash analysis. These focus on crashes that have happened. RSA focuses on potential risks that could arise based on the design of the road. However, the tools are complementary to RSA (see Section 2.5 of this Manual.)
- × A name for more detailed site inspection.
- × A check or assurance of the Workplace Health and Safety (WH&S) of road workers during the construction and/or operation of the road.

RSAs have come to recognized worldwide as a 'proactive approach' to build safer roads.

[2] However, training designers in road safety auditing could be valuable as they could spot safety issues that designers who do not have RSA training may miss.

RSA AT A GLANCE

What is an RSA

- Detailed and systematic report
- Technical Road Safety check
- Related to Road Design schemes

Who audits?

- Independent team
- Qualified and accredited professionals with expertise in Road Design

At what stage?

- Planning and Design
- Construction and implementing
- Pre and Post Opening

Key output

- Standard RSA report
- List of potential safety issues
- Recommendations for risk mitigations
- Design modification

FIGURE 2.2 Key features of an RSA

[2.3]

Why an RSA is required

In most projects, it is expected that the designer carries out scheme designs in accordance with the relevant guidelines and standards. Ensuring that the scheme plan complies with the design standards can overcome a large proportion of potential safety issues on the project road.

Therefore, design standards, guidelines and associated codes of practice are an important starting point of safe design. However, experience has shown that adhering to standards alone does not always guarantee safety. This is due to the following reasons:

- The complexity of both the localised road environment and design task means that building to existing standard may not always be the safest approach.
- Available standards may be inappropriate for that particular type of road.
- The applicable design standards or guidelines may be obsolete so not including current good safety practices.
- The design team may employ use of more than one design standard/guideline. This is particularly possible in cases where the primary design standard may be inadequate or silent or lack detailed guidance for the design of specific road elements. However, combining various design standards on a single project road can lead to competing, overlapping or inconsistent safety aspects. This is particularly an issue in Bangladesh, where designers tend to use different international guidance in the absence of an updated and comprehensive national highway design standard.
- Design standards and guidelines assume the designer has adequate technical capacity and experience to also apply wider engineering judgement as required. Interpretation and application of the standards by practitioners who do not have adequate competency may compromise safety.
- While individual road elements designed to standards may be quite safe applied in isolation, a combination of such features together on a road stretch may not be the safest design. This is also because standards design for the minimum (safety) requirement.
- Standards and guidelines optimize design, in addition to safety aspects these will also consider other factors such as traffic capacity and cost. There may therefore be pressure to increase traffic capacity and speeds (or decrease costs) through design which reduce safety.
- Design standards may not be updated as frequently as the changing road environment. This means that there may be emerging road safety conflicts not sufficiently addressed by the (current) design standards. Some of these include provision for three wheelers, motorcycles, e-scooters etc.
- The RSA exercise should not be a check of adherence to the standards. This compliance check is undertaken as part of a technical audit, and it is out of scope of a RSA exercise. The auditors should instead assess the design through the eyes of the future road users, identifying if they may face any safety issues.

FIGURE 2.3
Section of N3 lacking safe crossing and walking facilities for pedestrians

In the context of Bangladesh and other Low and Middle Income Countries (LMICs) frequently provision for Vulnerable Road Users (footpaths and safe crossing points for pedestrians, segregated lanes for cyclists or Rickshaws, etc.) are often not provided in a road otherwise well-designed for motorized fast vehicles (e.g. geometry/Pavement design).

Elements which can decrease the risk of collisions, particularly to VRUs, are missed out since these are not covered by standards. A good RSA will pick up such safety issues and if addressed through interventions, the RSA process will improve the safety of the end product significantly.

FIGURE 2.4
Hazardous contraflow movement on National Highway due to land use and road design

REACTIVE METHODS

Rely on crashes occurring to indicate safety problems at a location.

PROACTIVE METHODS

Identify higher risk levels factors present on road stretches (even before crashes result)

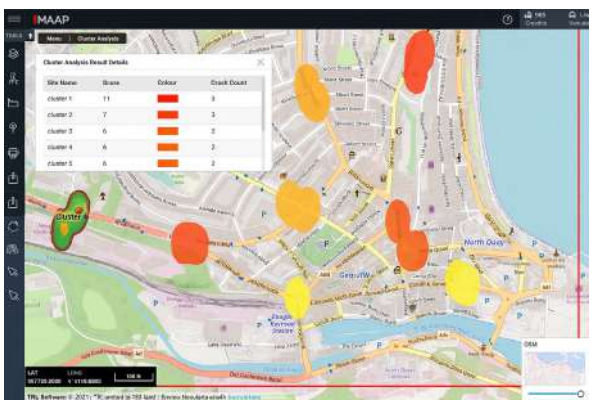
[2.4]

Aspects covered by RSA

The following aspects of the designed road environment are examples of aspects covered by a Road Safety Audit:

- General issues – how the design has addressed the safety of all road users
- Safety features provided to address the land use of the areas under consideration
- Geometric design – horizontal and vertical alignments, sight distance, visibility, etc.
- Adequacy of cross sections to address the safety of all road users
- Management of roadside hazards – embankment slope, height, removal of hazards, protection from barriers, etc.
- Bridge and culvert approaches
- Safety features to avoid collisions at U-turns & entry/ exit areas
- Safety features to prevent major collision types – single vehicle run-off, head-on, rear end collision, etc.
- Design of Intersections / junctions including the geometry and provisions for VRU and traffic control.
- Safety of railway level Crossings
- Adequacy of Traffic Signs and Road Markings
- Street lighting
- Provisions for Vulnerable Road Users and disabled/ differently abled
- Public Transport provisions
- Provisions for Drainage
- Speed management

FIGURE 2.5 Screenshot showing Cluster Analysis in iMAAP



[2.5]

Relationship of RSA with other safety management tools

RSA is one approach within a range of tools that make up road safety management. The various tools are complementary and all have an objective of improving overall road safety. However, each tool is distinct and most effective when applied in the right context. These tools can be divided broadly into 'Reactive' and 'Proactive' approaches.

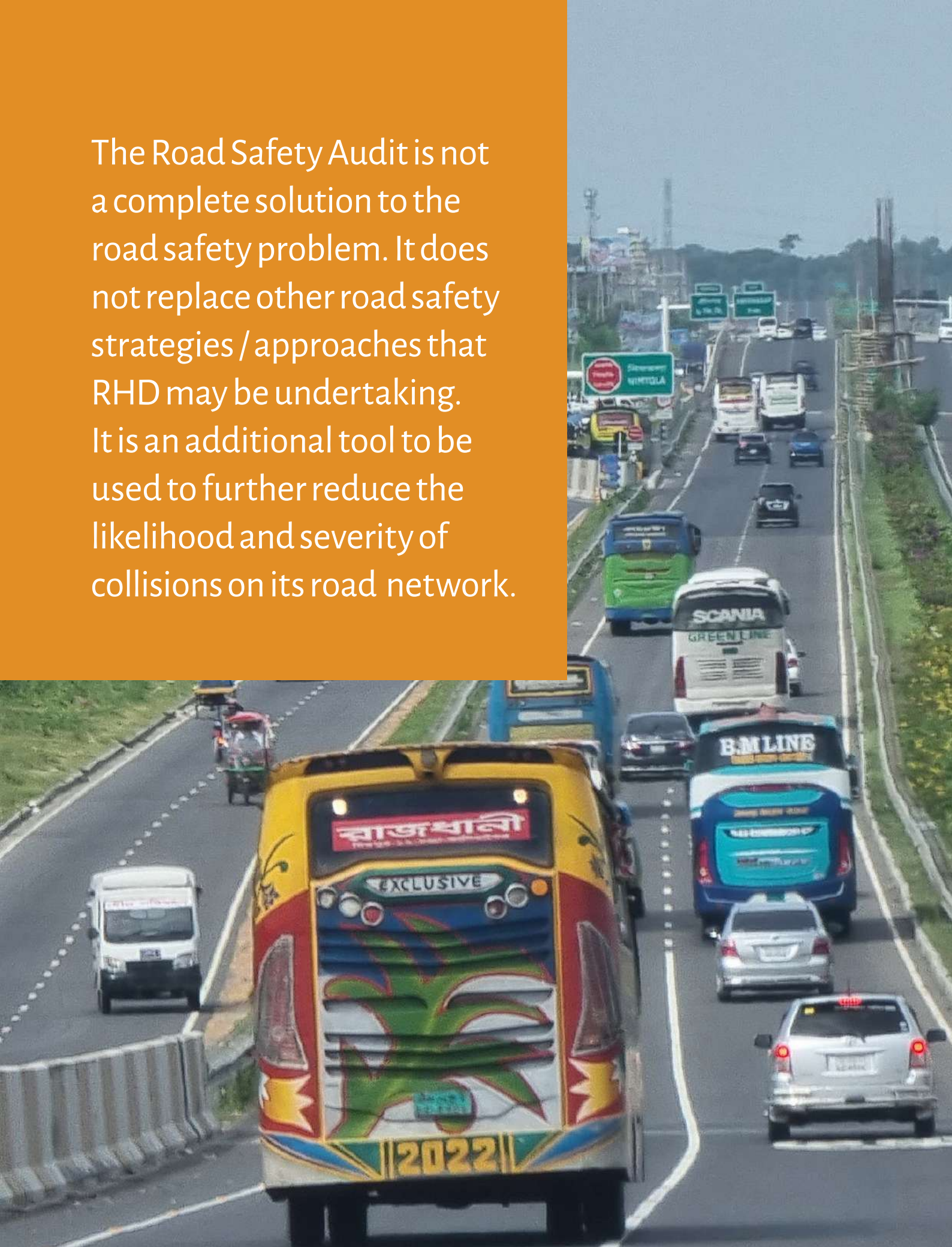
Reactive road safety processes rely on the analysis of where crashes have actually occurred after the road has been designed, built, and opened to the traveling public. Where higher densities of crashes occur 'clustered' in a location (e.g. a blackspot) this can indicate where higher risk factors may be causing excessive numbers of collisions. The sites are investigated and the safety risks contributing to the crashes are identified. These issues (such as maintenance problems) are then corrected to reduce both crash frequency and severity occurring at that location in future. Tools within this category traditionally include (i) blackspot analysis and (ii) network screening for longer sections with safety issues. Some of the limitations of reactive methods include:

Issues such as maintenance problems are then corrected to reduce both crash frequency and severity occurring at that location in future. Tools within this category traditionally include Blackspot analysis and Network Screening for longer sections with safety issues. Some of the limitations of reactive methods include:

- Can be costly since the improvements are made after the facility has been built.
- Relies heavily on the quality of crash data. Accurate diagnosis can only be carried out using reliable safety data.
- Needs crashes and injuries to occur to indicate where there may be problems. Solving problems before they result in casualties is always better.
- False Blackspots (with no treatable safety problems) could get identified, which result from the random nature of how and where road crashes occur

Despite these limitations, Reactive approaches remain a powerful tool for addressing existing safety problems.

The Road Safety Audit is not a complete solution to the road safety problem. It does not replace other road safety strategies / approaches that RHD may be undertaking. It is an additional tool to be used to further reduce the likelihood and severity of collisions on its road network.



The success of Road Safety Audits is optimized when carried out at the right phase of the project (from planning cycles to early operation phase). It works best when the design has enough detail so specific changes required can be identified.

Proactive road safety processes focus on identifying risk factors at the planning and design stages which could lead to collisions and injuries. This means that measures / changes to reduce or eliminate the risks can be incorporated into the design before the scheme gets built. The aim is to specify engineering changes (but also enforcement or other measures) which reduce the risks present so that fewer crashes will occur on affected road stretches. Examples of proactive tools are:

- Road Safety Audits (RSA).
- Road Safety Impact Assessments (RSIA).
- Road Safety Inspections (RSI).
- Star Rating assigned to the existing road (iRAP is an example).

The key road safety management tools are shown in Figure 2.6 and described in Table 2.1.

RSA is regarded as the most effective proactive tool since it identifies unsafe elements in designs before they are constructed. This ensures that they are eliminated before causing harm. However, if available, crash data should also be used to support the RSA process. The crash data analysis can be used to identify existing problem locations on the project road, so design modification can be made at such locations. Nevertheless, if the proposal is for major upgrade, for example, upgrade from an undivided two lane to a divided four lane road, crash data will not serve much purpose in a road safety audit as the road characteristics (for example - cross sections), before and after construction will be very different.

It is also important that other Road Safety Management tools (Table 2.1) are not misunderstood to be Road Safety Audit exercises. Where this has happened, organizations have ended up with ineffective and inconsistent indicators of safety without reaping the benefits of road safety audits.

[2.6]

Groups involved in RSA

Road safety auditing is a specialised service; RHD may either:

A Outsource the services to external consultants, or
B Engage internal staff with expertise in road safety auditing.

The main functions of the key groups involved in the Road Safety Audit exercise are summarized in Table 2.2, and the main functions of non-key groups are outlined in Table 2.3.

Proactive Road Safety processes identify risk factors at the design stage itself, and reduce or eliminate them before the scheme gets built

Table 2.1 Road Safety Management Tools

ROAD SAFETY MGT TOOLS	DESCRIPTION
Road Safety Impact Assessment (RSIA)	These are undertaken at the start of the development of a project scheme. RSIA are a practical assessment of the likely impacts that a new road or a major modification to the existing network will have on injury crash occurrence, injury severities and also damage crashes. The output of an RSIA influences alignment selection for the design. The key benefit of RSIA is that it minimises the risk of crashes occurring in the future as a result of planning decisions.
Road Safety Audit (RSA)	Please see 2.1 What is an RSA?
Road Safety Inspection (RSI)	These are route focused. The key difference to Road Safety Audits is that an RSI is carried out on existing operational roads. It is a regular check of the general safety of road sections from a visual inspection and also the identification of defects that typically require maintenance to correct. RSI should be carried out by independent, trained experts with the findings and recommendations being recorded in detail. Similar to RSA, crash data analysis is not mandatory for RSI; however, if reliable data is available, it can supplement the field review. Star Rating tools (iRAP, for example, which systematically identify risk factors and levels) falls within this category.
Network Safety Ranking (NSR)	Network Safety Rankings are carried out at network level. It is a method for analysing the existing road network based on potential for crash reduction and cost savings. NSR is generally based on crash data, using the safety data to define the safety performance metric (e.g., crash rate[3], crash density, severity ranking[4] etc). The segmented network is then analysed, and the safety performance of each homogenous section calculated. The score is compared against the critical threshold for the safety metric of the reference population- a set of roads with similar characteristics to the candidate section. Depending on the parameters used to define the safety metric, additional data, such as traffic or infrastructure data are required. Different sections of a road network can be ranked and prioritized for safety investment based on the potential for saving crashes and reducing the economic losses due to crashes.
Ranking of High Crash Locations	Ranking of High Crash Location sections is a method to identify, analyse and rank sections of the road network at which excessive Killed and Seriously Injured (KSI) crashes have happened, taking differences in traffic flow into account[5]. Typically, three or five full years of consistent crash data is required.
Blackspot mapping	Similar approach to High Crash Location sections, but focus is on short or point locations where excessive crashes are identified rather than sections of the road.

[3] Dividing by length but also traffic volumes.

[4] Fatal serious and slight crashes/casualties have different monetary values for their prevention, these values being used in economic appraisal. These costs decrease greatly as the incident severity reduces. The cost per section is the crash numbers x their costs (by severity), divided by the section length

[5] A rule of thumb is that crashes occur in direct proportion to traffic flows – doubling the flow is expected to double the crashes occurring if the risk factors present are the same on road sections.

FIGURE 2.6 Road Safety Management tools

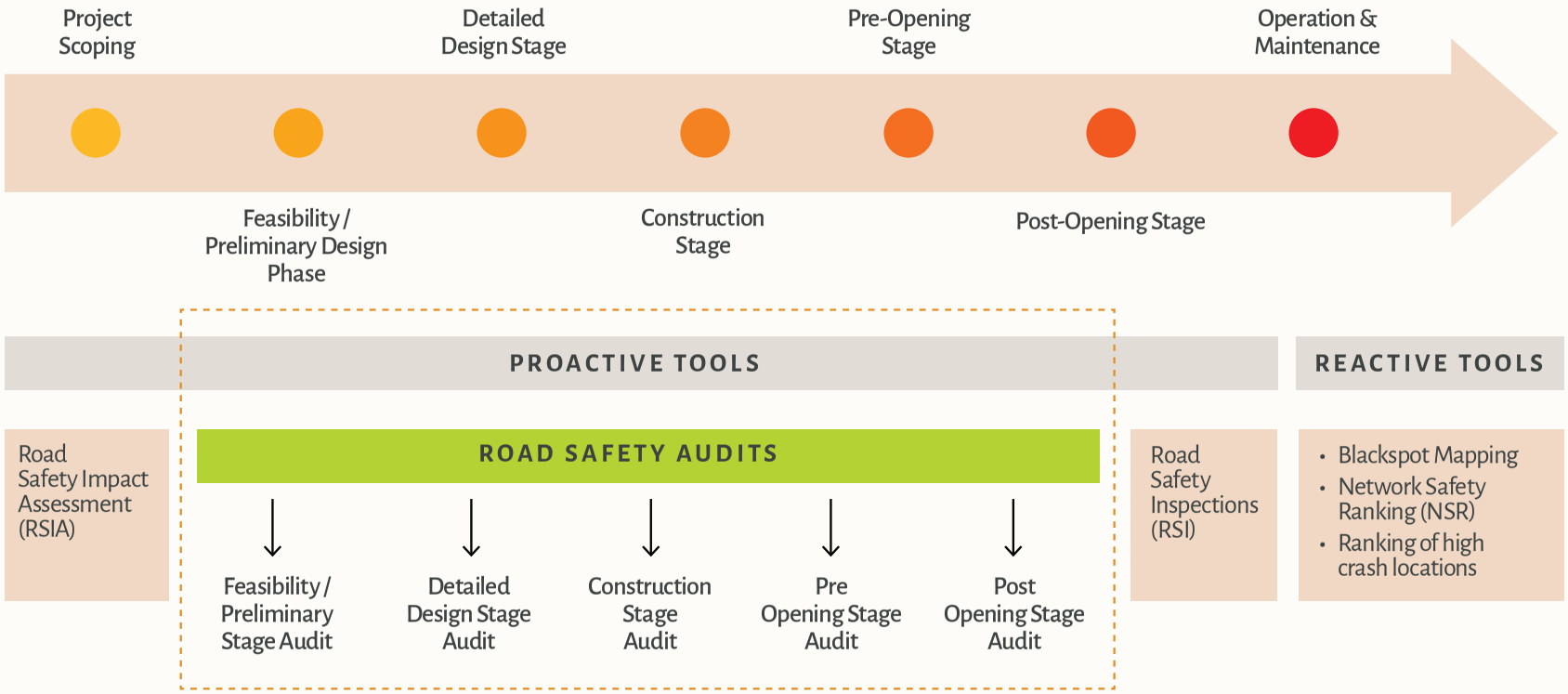


Table 2.2 Main functions of the key groups involved in RSA

PLAYER	DESCRIPTION	ROLES
Client	The Client shall be RHD, the owner of the road network on behalf of Government of Bangladesh. RHD shall be responsible for management of the Road Safety Audit process, including any services, if used. Toll roads or Public Private Partnerships (PPP) funded schemes have different financing models which mean the Client may not be RHD but instead be an investor or concessionaire. Even for these projects, RHD shall remain the overall Client, and will be responsible for the ultimate decisions arising from RSA reports (For more details on PPP see Appendix B). The Project Director shall be the day-to-day representative of the Client and therefore the lead of the RSA exercise. For effective mainstreaming of RSA, there must be clear commitment by RHD from the highest level. This sense of commitment must be understood by all parties involved in the RSA management. Without this high-level endorsement, the integrity of the RSA process can be undermined. The Project Director must ensure key requirements of the RSA are adhered to. These include making sure that: → The RSA teams are independent of the design team, → The RSA teams consist of multi-disciplinary and qualified individuals, → The structure and layout of the RSA report is as specified, → The Design team provides all required information to the auditors → The process takes into account the safety of all road users.	**Determining the need for an audit.** This shall be guided by the policy of RHD on RSA as detailed in Section 3.1 of this Manual. **Financing of the audit services:** The cost of audit services must be built into the overall project cost. Failure to allow for the cost of the RSA services at the initial stages of project costing is one of main barriers to effective operationalization of RSA in organizations. **The Project Director** shall ensure that the cost allowable for RSA aligns with the policy on the audit stages to be audited over the project phases. **Preparation of tender doc for audit services:** Tender documentation shall be required if the audit services are outsourced. The Project Director must ensure that the RHD staff charged with preparing the tender documentation have a good understanding of the RSA policy, guidance, and practical requirements. **Appointment of audit team:** The Project Director shall appoint the Audit team based on criteria defined by RHD. Over time, as part of the RSA policy, the process can be streamlined by establishing a standard criteria for selection. **Commissioning of audit:** This is undertaken when the Project Director holds a commencement meeting which shall be the start of the technical audit exercise. **Acceptance of report:** The client must accept the Audit Report if it meets the mandates listed in this Manual. **Signing off of the response report:** The Project Director, as the representative of the Client, must review and sign off on the Response Report prepared by the Design team. Since some of the recommendations would impact costs, the Project Director must discuss with the Design team before issue of final Response Report. **Administration of the RSA exercise:** The Client must create an environment that prevents conflicts between the Design and Audit teams and define how any that arise will be resolved. The Client must also set ground rules for handling information requests. It should also be clear how the RSA timetable aligns with the overall project plan, and how suggested solutions are incorporated by the Design team and implemented by the Contractor. **Monitoring of effectiveness of measures:** The Client must set up a framework to monitor the effectiveness of the recommendations implemented following audit exercises. This will be an ongoing activity after the completion of the RSA exercise.

PLAYER	DESCRIPTION	ROLES
Design Team	This is the team commissioned by the Project Manager (on behalf of the Client) to design and develop the road scheme. The Design team can be a part of the Client organization or externally sourced, such as a private consulting/contracting company. One of the main roles of the Designer is to provide clear background information that is required by the RSA team and to support the Audit Team leader in organizing the field visit. Requests for information from the RSA team must be actioned fully and quickly by the Design team.	**Design of the scheme plan.** The Design team shall adhere to all relevant standards and guidance; but also going beyond these to ensure safety will be optimised taking account of localized road conditions and the need and vulnerability of all road user groups. **Preparation of an Audit Brief:** The Design team, supported by the Client, shall prepare the Audit Brief. **Preparation of a Response Report:** The Design team shall prepare a Response Report following the receipt of an Audit Report (received via the PM). The Response Report must first be shared with the Client for review and feedback. It is the Client who signs off on the final Response Report. **Undertaking design modifications:** The Design team shall undertake design modifications based on the intervention measures approved in Response Report. **Attendance at meetings:** The Design team shall attend the Commencement and Completion meetings and any other meeting upon the request of the Client.
Audit Team	The Audit team shall be appointed by the Client. The Audit team will have a specified Team leader with responsibility for the audit exercise. Their contractual role for each stage of audit shall begin at the commencement meeting (following contract signing) and shall end upon acceptance of a satisfactory Road Safety Audit report by the Client. In the case of internal RSA, such that the Audit team is RHD employees, the Audit team must be independent of the project design team.	**Review of information of the Audit Brief:** The Audit team shall review the Audit brief for completeness of information required to inform the exercise. The Team Leader shall inform the Design team of any additional information required. **Collection and analysis of safety data:** If this data is not provided in the Audit Brief, the Audit Team will be responsible for obtaining and analysing it. The cost of collecting and analysing safety data must be included in the RSA costs by the Project Director at the tender stage. **Undertaking field visits:** The Team leader is responsible for organizing field visits. She / He may liaise with the Client and the Design team but the final responsibility rests with the Team leader. **Preparation RSA Report:** The Audit team, led by the Team Leader, shall prepare an RSA report in the structure defined in this Manual (see Appendix H). **Attendance at meetings:** The Audit team shall attend the Commencement and Completion meetings organized by the Client. However, the Team Leader may inform the Project Director to call the Commencement meeting after reviewing the Audit Brief. The Completion meeting will be held after the Client approves the Audit Report.

Table 2.3 Non-key groups involved in RSA

PLAYER	DESCRIPTION
Contractor	While not a critical player during the audit, the Contractor is responsible for the civil works (design implementation). Their main role in RSA shall be to understand the agreed modifications to the design following the recommendations of the audit. They should be supplied with the correct final plans. In the case of Design and Build (DB) projects, both Design team and Contractor would be one entity.
Traffic Police	The Traffic Police is a universally important stakeholder in improving road safety. The Project Director must facilitate collaborative working between the Audit Team and the Traffic Police during the conduct of the RSA. The Traffic Police may have critical knowledge of high crash risk locations on the RHD network, knowledge of common crash characteristics, and/or road user behaviour. This information can assist the RSA team. The Traffic Police can be represented as a specialized team member for the audit exercise. Local Police may also provide helpful input to the Audit team during field visits.
Nominated Members	The Client may nominate RHD officers as counterpart staff to the Audit team. The officers may be involved in the field review and attached to the Audit team during the Audit report exercises for capacity building. This, carried out over a period of time, can help improve the technical capacity of RHD officers to carry out audits and with safety awareness. If the Client deems it important, RHD may nominate specialist advisers to provide expert input to the Audit team. For example, auditing a Bus Rapid Transit (BRT) corridor, a project road with signalized intersections, tunnelling projects etc, expert opinion may be helpful to the Audit team if such expertise is not available within the core Audit team. Nomination of additional team members to the Audit team shall be at the discretion of the Client.

03. Elements of the Road Safety Audit process

[3.1]

Type of roads to be audited

The need to carry out an audit shall be driven by the RSA policy adopted by RHD. However, the Project Director shall determine the need for an audit and the stages of auditing based on:

A Hierarchical classification of the road;
B Complexity of the design; and
C Potential road safety issues.

For example, on a regional corridor, the RSA policy in Appendix A states that it is mandatory that an audit be carried out at both the design and pre-opening stages of the project. However, based upon engineering judgement, the Project Director may decide if another stage of audit is also required. The need for an audit must be determined at the planning/scoping stage of the project cycle. This to ensure that the cost of RSA is included in the overall project budget and the time allocation for RSA is also incorporated into the project schedule.

NOTE
If the Project Director has determined that there is no requirement for an RSA, she / he shall prepare an Exemption Note providing justification. A sample outline is provided under Appendix F.

[3.2]

Stages of RSA

RSA can be conducted at different project stages of planning, design, implementation, and early operation. The stages and the types of roads to be audited shall be guided by the RSA Policy (see Appendix A).

3.2.1 Stage 1: Feasibility or Preliminary Design Stage

This is the first stage of audit and shall be carried out upon completion of feasibility/ preliminary design. Undertaking RSA at this stage provides the first opportunity for incorporating safety into the design therefore reducing costs and lost time associated with making changes that could be identified at a later stage. Stage 1 RSA can provide an opportunity for the Design team to review the design criteria or the land acquisition requirements to improve safety.

Audit on the feasibility or preliminary design shall examine aspects of design criteria, design speeds, route choice and continuity with the linked wider network, facility classification, access management, alignment, and intersection layouts.

NOTE

Stage 1 audit can be carried out either at feasibility or the preliminary design stage. The Project Director shall determine the optimal stage for a specific project road.

3.2.2 Stage 2: Detailed Design Stage

A Stage 2 audit shall be carried out on the detailed road design before the preparation of contract documents. Based on the project delivery approach of RHD, this is the most critical stage of audit.

Key aspects for consideration at this stage include geometric layout, horizontal and vertical alignment, cross section, drainage, roadside safety, intersection details, traffic signals, signing, markings, and provision for VRUs.

Attention to detail at the detailed design stage can reduce the cost and disturbance associated with changes that may be identified during a pre-opening audit. The detailed RSA process for stages 1 and 2 is shown in Figure 4.1.

3.2.3 Stage 3: Construction Stage

The audit shall take place during construction. The Project Director may initiate this stage audit either at 25% or 50% construction completion. Also, if deemed necessary, more than one construction audit can be carried out. This stage audit shall examine the safety of the general and specific traffic management plans, and provisions for road safety at the work site. Typical issues examined include provision for VRUs through work zones, work zone layout, delineation, lighting at night, worker safety, advanced warning zones, deviations, excavations and pits, adequate transition zone lengths and effective numbers of reflective signs, safe delineation, credible speed limits, temporary crash barriers, lighting, and diversions.

NOTE

The Audit Team may make recommendations on improvement of the Traffic Management plans, but it is not the responsibility of the Audit Team to revise or redevelop the plans. This shall remain the responsibility of the Contractor.

3.2.4 Stage 4: Pre-Opening Stage

The audit involves a detailed inspection of the new road project prior to its opening. The focus of the audit is to ensure that the implemented design is safe and the agreed recommendations of the previous audits were incorporated. The stage 4 audit should be carried out at substantial completion, prior to issuance of the Taking Over Certificate.

The new road should be driven, ridden, and walked (as appropriate) by the Audit team to ensure that the safety needs of all road users are provided for. A night-time inspection is particularly important at this stage to check installation and visibility of signs, markings, delineation, lighting, and any other night-time/low light related issues.

The Audit also evaluates provisions for road safety at the work site.

For a competent audit, it is key that the Audit team members must be independent of the Design team

3.2.5 Stage 5: Post-Opening Stage

This audit should be undertaken within a short period, typically the first 12 months, of the opening of a fully completed project. This means any mitigation measures implemented in response to a pre-opening audit can be assessed. This stage of RSA also assesses how the road is being used by the various traffic and road users present in order to identify any safety issues.

NOTE

Stage 5 RSA is useful to identify the residual safety risk during the operation stage of the project. Any safety deficiencies identified at this stage can be addressed through an appropriate contracting mechanism (for example: defects liability period, maintenance contracts etc.).

[3.3]

Cost Allocation for RSA

The total cost of undertaking the full RSA exercise will depend on the length of project road, the length of each audit section, the stages of audit and the complexity of the design. As a guide, the maximum length of corridor to be audited under one audit exercise should be 60 km. For longer lengths, the Audit team may be overwhelmed by the task, resulting in them focusing on general issues only. Specific and non-generic safety deficiencies may be missed. However, RHD can decide on the length of road package to be audited considering the overall contract realities. It must be ensured by RHD that sufficient resources (number of audit team members) and time to undertake an audit is allocated for the specified length of the road(s) to be audited.

The contracting and payment of the Audit team should remain the responsibility of RHD to ensure independence of the auditors.

04. Road Safety Audit Process

The standard RSA process to be followed in all stages is shown in Figure 4-1.

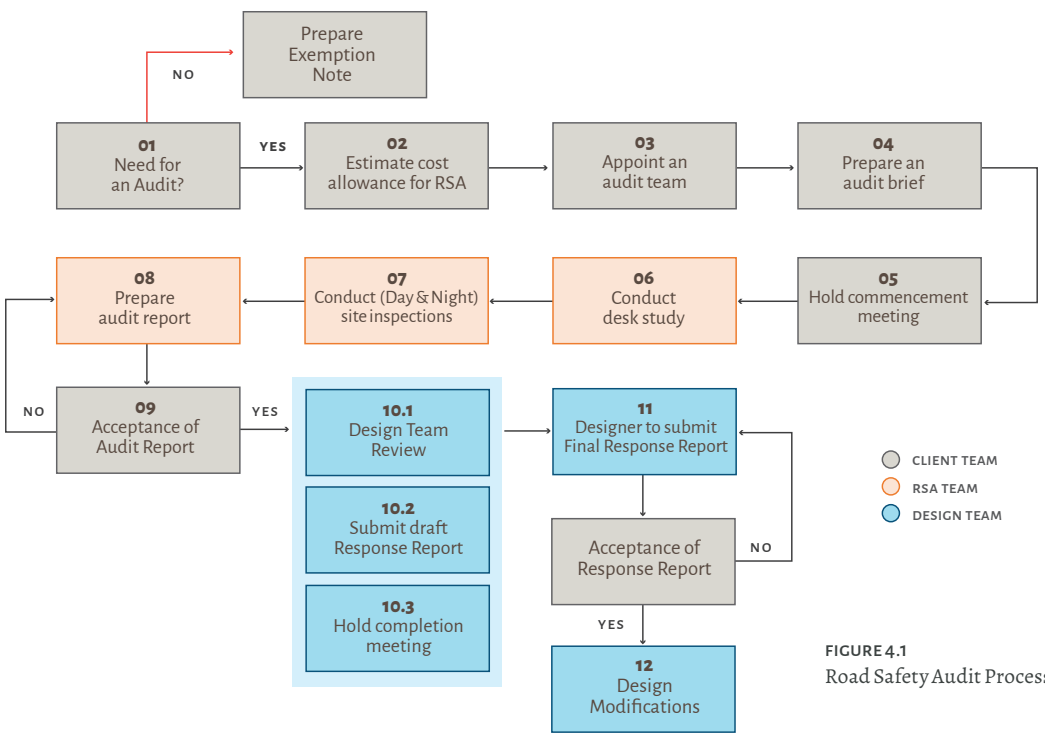


FIGURE 4.1
Road Safety Audit Process

[4.1]

Appoint an Audit Team

Responsibility: Client - Project Director

The Project Director shall appoint an Audit Team that meets the qualifications specified under Chapter 5 of this Manual. The composition of the audit team shall also be guided by the requirements set out under Section 5.1.

Auditors shall be selected from the RHD registry of qualified/ accredited auditors. In the absence of such a registry, RHD shall align the Terms of Reference (ToR) of the services to the specifications given in Table 5.2; while Table 5.3 gives the training and experience required by Team Leaders and Members, as well as the experience they should have for undertaking a road safety audit.

Table 5.3 of this Manual shall be used as a guide by the Client when defining the criteria for evaluation of competency of the Audit team during the development of the ToR. One of the most important criteria for a competent Audit team is that the team members must be independent of the project Design team (Section 5.5).

Generally, RHD will engage a firm/company to provide RSA services rather than engaging individual auditors. RHD must then make the technical eligibility criteria clear to the firm, and the individual team members must comply. This is covered in Section 6.2.

[4.2]

Prepare an Audit Brief

Responsibility: Design team

The objective of preparing an Audit brief is to provide the Audit team with all the necessary information to allow a comprehensive safety assessment of the project. Preparing an effective Audit brief requires a good understanding of the objective and process of the RSA. Incomplete or vague Audit briefs will be confusing to the Audit Team and may result in poor quality of the RSA.

Following the instruction, by the Project Director, the Design team shall prepare an Audit Brief for review by the Client. This Audit Brief will then be supplied to the Audit Team. It is a requirement that the Project Director signs off the Audit Brief before submission to the Audit Team leader.

An outline of the Audit Brief is included in Appendix G. The level of detail required by the Audit team for different stages of audits will vary, but it is essential that a set of all relevant documents and required information is supplied for each case. The general content of an Audit brief is listed in Table 4.1.

Table 4.1 Contents of an audit brief

General Information

- Project context and background, project objectives, photographs of the project site, list and contact details of key persons (Client, Designer, Contractor, Traffic Police).
- Specify the audit stage.

Technical Information

- Account of the design principles and standards that were used (e.g., design speed, standards for radii of horizontal curves, super-elevation, standards for crest and sag curves, stopping sight distance, overtaking sight distance, percentage of route where safe overtaking is obtainable, etc.).
- Full set of drawings showing details of the horizontal and vertical alignment and other features.
- Design reports.
- Signing and marking plans (essential for Detailed Design audits).
- Copy of the previous audit reports (if any) and an account of any changes made since the previous audit (if any).

Safety Data

- Traffic flow data and traffic forecasts.
- Speed data.
- Data on NMTs (pedestrians, cyclists and Rickshaws.), Crash reports / history.
- Information on public transport services, including the location of stopping places.
- Locations of parking demand.

Other information

- Definition of how the Audit team should notify the Client team if it identifies any risks or hazards that pose immediate safety risk. These are risks that must then be addressed immediately before completion of the RSA process.

  How the Audit team should record: Any risks or hazards that are present off the designed scheme; and A non-typical risk or hazard type, but which has the potential to adversely affect safety outcomes at the location being audited.

[4.3]

Initiate Commencement Meeting

Responsibility: Project Director
(attendance of Audit and Design teams)

The Project Director shall organize the commencement meeting and provide the agenda. Key aspects to be discussed during the commencement meeting shall include:

A Confirmation of audit scope and objectives.

B Any safety concerns on the project road that the Client considers critical.

C Confirmation of the audit team members and the time frame of the RSA process. The Audit team shall confirm timelines of the RSA report and highlight any issues that may affect the schedule such as delay in receiving required information etc.

D Report format/outline.

E Documents and information received with the Audit brief. If drawings have not been provided, these must be provided at or within a week from the meeting.

All required design changes shall be made by the Design team, not by the Audit team

The commencement meeting is an opportunity for the Client to ensure the key groups of the RSA process understand their roles and responsibilities. This will prevent misunderstanding or overlap of duties during the RSA exercise. It is important the Project Director reiterates some of these critical considerations. These include:

- Audit team must make safety recommendations in a formal report.
- All required design changes shall be made by the Design team, and not by the Audit team. It is important that the Audit team maintains its independence and does not get involved in redesigning elements of the scheme.
- RHD, the Client, shall take the final decision on design changes.

NOTE

Where possible, commencement meetings should be face-to-face and ultimately be combined with a site visit. However, this is only practicable if the Audit team has had ample time to review the Audit brief prior to the meeting.

Commencement meetings could also be conducted over the phone or better by an internet meeting as a practical and more cost-effective solution. If viable, this may be adopted as standard for conducting RSAs on the RHD network.

If issues and further questions arise following the commencement meeting, the Team leader should arrange to resolve these with the Project Director immediately so they do not delay the RSA process.

[4.4]

Perform Desk Review

Responsibility: Audit Team

All drawings and documents should be reviewed before the initial site visit, and then continuously through the audit. This is because while the background information and documents are important in planning and during the site visit, they are also likely to be consulted when compiling the RSA report.

The Audit team will review the plans, profiles, and other drawings to make preliminary assessments of items of interest or concern.

If there are previous audits which have been conducted at an earlier or equivalent stage, the reports must be reviewed comprehensively. This is to identify any outstanding safety issues previously raised that must be restated during the current audit.

The background information that should be provided to the Audit team at each stage of the audit is given in Table 4 2.

This is a critical step in RSA and the Client should ensure the Audit Team is given ample time for desk review. It is likely that the Audit team will be able to identify potential problem areas/issues at this stage.

[4.5]

Undertake Site Inspection (Day and Night)

Responsibility: Audit Team

In planning for the site visit, the Team Leader must discuss and agree on the schedule of the visit with the Project Director. The site visit may include the attendance of Traffic Police and nominated audit members by the Client.

Prior to the site inspection, the Team Leader must undertake a risk assessment to be aware of any particular conditions or restrictions that might affect the safety operations during the inspection. In undertaking the assessment, the Team leader must consider:

A The type and classification of the road, project length and road width.
B Approaches to the site and visibility for traffic.
C The volume and type of traffic (including pedestrian activity).
D The speed limit.
E Road surfacing.
F Weather conditions.
G Lighting.
H Security.

The risk assessment should not focus only on the safety of the Audit Team, but also the safety of road workers, road users and local roads adjoining the project road. It is recommended that the Team Leader inform the Design Team and the Traffic Police prior to the site visit as they might be able to arrange for transport and security.

The site-specific risk assessment will inform the equipment and Personal Protective Equipment (PPE) needed for the site inspection. At a minimum, high visibility jackets must be worn by all members of the Audit team during the exercise. Equipment should include drawings and maps, measurement devices, markers, pens, writing material, digital recorders, cameras, and lighting devices for nighttime use.

During the inspection, the Audit Team should focus on risks and hazards that directly influence safety outcomes. These factors include traffic volumes, speeds and the type of infrastructure planned/constructed.

Other aspects that do not impact safety outcomes, such as how the road design affects the 'look' of the area or perceptions of the surrounding community, need not be covered during the audit. The site inspection must be undertaken during both daylight and night time conditions. While inspecting the site, auditors need to assess whether day and night light conditions, and adverse weather (e.g., fog, heavy rain) may lead to increased safety risk on the completed road.

The Audit team must consider the safety of adjacent sections of road in the audit. Transition zones, where the new road merges with the existing road system, can often be locations of increased risk. Higher traffic speeds may be acceptably safe on the new sections but could be inappropriate on the existing road sections either side. Additional delineation can be recommended on the existing road sections adjacent to the new, as a way of transitioning road users safely between these sections with potentially different features or standards.

During pre-opening or post-opening stage audits, or if the road is open to traffic, it is recommended that an initial observation of the traffic operations be made prior to the formal audit. Safer vantage points to observe the traffic can be overpasses or embankments, and ideally, locations as far as possible from the running lanes should be used.

Many photographs should be taken during the site visit as they can be used in the audit report to illustrate points. The photos also serve as a record of the site inspection.

When taking site photographs, the Audit team should focus on the safety issues or deficiencies. This can help the Audit team to remember specific safety concerns when back in the office preparing the RSA report.

To help with communication within the team, the Team Leader can create a WhatsApp group (or alternative platform) to be used by audit members to share photographs while on site with a short description of the safety issue. A digital recorder or phone can also be used by the team members to record their observations. These approaches mean more detailed observations can be recorded efficiently, while providing a digital record for later use.

FIG 4.2
Audit team inspecting site

Table 4.2 Background information to RSA

Feasibility and detailed design stage

- Plan and profile drawings
- Standard drawings
- Intersection design drawings
- Cross-sections and roadside design details
- Traffic Signs and Road Markings layout
- Traffic analysis include volumes and speed data.
- Environmental constraints
- Design reports
- Previous audits with response reports
- Crash history / data if redesign / rehabilitation of existing corridor
- Crash maps and blackspot maps, if available.

Construction stage

- Traffic management plans
- Record of crash data during construction- contractor data

Pre-opening and Post-opening stage

- Previous audits reports with Response reports
- As built drawings
- Traffic and speed data analysis (post opening)

[4.6]

Prepare Audit Report

Responsibility: Team Leader

Writing the RSA report is the responsibility of the Audit Team Leader, although other team members should support him/her. The Audit Team Leader shall sign the completed RSA report and submit it to the Project Director.

The audit report shall be concise, with technically clear descriptions of each of the safety concerns identified. It should follow a standard format as indicated in Appendix H. It is best practice for RSA reports to follow an agreed format or template. This will assist the Team Leader to keep the reporting brief and consistent. An agreed template can also help the Project Director assess the adequacy and completeness of the report.

When preparing the Audit Report, the Team Leader shall bear in mind:

1. The report on findings and recommendations shall be concise and to the point, using clear wordings.
2. The checklists used during the audit exercise shall not be appended as part of the report.
3. The Team Leader shall not append copies of documents received from the Design team as part of the Audit report.
4. The language used in the audit report shall not be critical of the design team, rather the report should focus on identifying risks/ hazards and suggestions for mitigating the risks.
5. The report shall not include comments on road safety issues which are not affected by the infrastructure or outside the scope of the project road, unless this was agreed with the Client to be part of the scope of the ToR.
6. The report shall not include comments on road safety issues that are unrelated to the infrastructure or fall outside the scope of the project road, unless it was explicitly agreed with the Client to include them as part of the Terms of Reference (ToR).
7. Even if they were part of the site inspection team, the Team Leader shall not include comments of the Design team or Client as part of the RSA report.

4.6.1 Expressing and Prioritizing Risks and Hazards

The language of the report must be technical, concise, and written in a way that assists the Client to understand the issues.

The most important point is that the report must be constructive, clear, and practical about how the safety concern might be eliminated or reduced. The report must clearly describe each safety concern and give its location by chainage.

The report of findings shall be structured into two sections, General Findings (Appendix H 7) and Specific Findings (Appendix H 8). General findings cut across the entire or most of the length of the project road and are not related to specific location with localised safety issues. Some of these can include safety risks such as discoloured traffic sign sheeting, roadside vending etc. Specific findings are those risks identified at a particular chainage.

General findings shall be presented first, followed by specific findings.

There are various logical approaches of presenting the specific findings and the Team leader is at liberty to adopt any of the approaches:

A. Sequential reporting of the findings by increasing chainage of the project road.
B. Reporting of the findings in a hierarchical manner based on perceived risk from highest to lowest. This is most appropriate for small schemes such as audit of an individual Grade Separator.
C. Grouping of the findings into similar risk/ elements. e.g., risks pertaining to cross section, alignment, pedestrian issues, intersection layout etc.

There is a need to be realistic in making recommendations – consideration of the level of risk associated with the safety concern is important for the priority level.

The following points must be considered while making recommendations:

- Add photographs if they can clarify or better illustrate a safety concern or recommendation.
- Avoid being too specific with the recommendations unless certain that a specific recommendation is the only feasible mitigation to address a road safety concern.
- Avoid redesigning any part of the project—that is for the Design team to do.
- Evidence of research reports or appropriate data may be included if they support and strengthen the audit finding and recommendations.

4.6.2 Risk Assessment of safety concerns and prioritization of recommendations

During the audit process, the audit team will identify several safety concerns, and the audit team must assist the client with prioritization of these concerns and associated recommendations. Hence a risk assessment should be performed for all identified safety risks and hazards. Risk assessment involves examining ways in which the hazard can influence a crash occurring, and if the crash occurs, the possibility of it leading to a fatal or serious injury.

Risk is often defined as the likelihood of a potential issue multiplied by the severity of the consequence from the worst-case scenario outcome from that same potential issue. The risk assessment process is done in four steps:

1. Make an Estimate of Possible Crash Frequency (see Table 4.3)
2. Make an Estimate of Crash Severity (see Table 4.4)
3. Determine the Severity of a Safety Issue (see Table 4.5)
4. Determine a Course of Action (see Table 4.6)

The risk assessment options are presented in the following tables (Table 4.3 to Table 4.6), which will assist the audit team in assigning the estimated level of risk to the safety issues identified in the audit.

Table 4.3 Estimate of likelihood of crash occurrence

Likelihood	Description
5 FREQUENT	One crash or more occurring per month
4 LIKELY	One crash or more occurring every year*
3 OCCASIONAL	Once every 3 years
2 UNLIKELY	Once every 5 years
1 RARE	Less often than once every 5 years

* but less than one per month.

Table 4.4 Estimate of severity rating

Severity	Description	Examples
5. Catastrophic	Multiple deaths are likely.	High-speed, multi-vehicle crashes on expressways. A bus collision at high speed with a bridge abutment.
4. Critical	A death and/or serious injuries are likely.	High/medium speed vehicle/vehicle collisions. High/medium speed collisions with a fixed roadside object. Pedestrian crashes on rural highways.
3. Major	Major first aid and/or presents to hospital (not admitted)	Medium speed vehicle- vehicle collisions. Medium speed motorcycle- motorcycle collision.
2. Minor	Minor injuries only are likely.	Low impact collisions, such as a three-wheeler colliding with a cyclist, or a through vehicle colliding with a turning vehicle at low speeds in urban areas.
1. Negligible	Property Damage only crashes are likely.	Very low speed vehicle collisions. Car Collides with a median island at low speed .

Table 4.5 Determine the Severity of a Safety Issue through a Risk matrix

	SEVERITY				
LIKELIHOOD	1. Negligible	2. Minor	3. Major	4. Critical	5. Catastrophic
5. Frequent	Medium	High	High	Extreme (FSI)	Extreme (FSI)
4. Likely	Medium	Medium	High	Extreme (FSI)	Extreme (FSI)
3. Occasional	Low	Medium	High	High (FSI)	Extreme (FSI)
2. Unlikely	Negligible	Low	Medium	High (FSI)	Extreme (FSI)
1. Rare	Negligible	Negligible	Low	Medium (FSI)	High (FSI)

Table 4.6 Determine a course of action

RISK	RECOMMENDED COURSE OF ACTION
Negligible	No action required
Low	Should be corrected or the risk reduced if the treatment cost is low.
Medium	Should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high.
High	Should be corrected or the risk significantly reduced, even if the treatment cost is high
Extreme	Must be corrected regardless of cost

[4.7]

Review and Acceptance of the Audit Report

Responsibility: Project Director

Once complete, the Audit team shall submit the RSA report to the Project Director. The Client will assess if the RSA report conforms to the scope of the Audit brief and the specifications laid out in the Road Safety Audit Manual. This first review is not a technical review. Rather, it assesses the extent to which the RSA report satisfies the Terms of Reference in terms of scope, format, layout, and the RSA process. For acceptance of the RSA report, the Client shall check:

- → Format and content of the RSA report is in accordance with the agreed outline.
- → Audit process adopted was as stipulated, including evidence of site inspections.
- → The Audit team conformed with the Audit brief and used the site inspections and drawings to identify safety issues.
- → Composition of the team, including a signed copy of the declaration of the Team Leader.

If the report is found inadequate, the Client shall ask the Audit team to either:

1. Review the structure / content of the report.
2. Repeat the whole or part of the audit process.

The Project Director may also initiate a repeat audit but with a different Audit team for a "fresh look".

[4.8]

Initiate Completion Meeting

Responsibility: Project Director

The completion meeting shall be organized by the Project Director, following the acceptance of the RSA report.The completion meeting provides an opportunity for the Audit Team, the Project Director, and the Design team to discuss all the audit findings raised in the report. This will usually involve a discussion of each safety concern, its risk rating, priority, and recommendations to mitigate identified road safety issues.

The meeting should be held in a professional and co-operative manner with all parties

working together to enhance the safety of road users. It must not be about apportioning blame, and there should be no serious disputes. All parties must accept that the RSA is a positive activity that helps to improve road safety by highlighting potential safety concerns before they become problems.

The Project Director may ask for an RSA report to be altered or to have some safety concerns removed. While this rarely happens, it is neither professional nor ethical and the Team Leader must not entertain any suggestion of altering a report to "soften" the audit findings. Completion meetings can be face-to-face or virtual.

[4.9]

Preparation of a Response Report

Responsibility: Design team

The Design team is required to review the RSA report and respond in writing to each recommendation in the report. When the Design team receives the audit report, it is treated as another input that must be considered when optimizing the design. As a general guide, when reviewing the recommendations of the audit, the Design team should consider:

1. Is the identified safety concern within the scope of the project road?
2. How often might crashes occur (daily, weekly, or yearly)? How serious might such crashes be (fatal, resulting in injury or property damage only)?
3. Would the recommendation made in the RSA report mitigate the safety issue, reducing the probability of occurrence and/or its severity?
4. What will it cost to remedy or reduce the problem? Could a different more cost-effective solution be used?
5. Will the recommendation lead to other non-safety issues, for example mobility or environmental issues?

In responding to the Audit recommendations, the Design team can:

- → Accept the report completely (and develop solutions to overcome or reduce the safety concern);
- → Accept the safety concern but not agree to the recommendations. In these cases, the response should set out alternative ways to resolve the safety concern; or
- → Not accept the recommendation (explaining clearly why this decision has been taken).

Extreme or high-risk rated problems within an audit report should obviously be prioritised by the Design team.

Upon development of the Response report (outline of report under Appendix I), the Design team shall submit it to the Project Director for review and authorization. The eventual ownership of the Response report lies with the Client, RHD. The Project Director must therefore review in detail the proposed design modifications suggested by the Design team to ensure that the Client agrees with the proposed actions and that these achievable within the budget.

It is important to remember that it is not mandatory for RHD to accept any findings or recommendations within an RSA report. Treatment of audit recommendations that are either expensive, complex, or involving sensitive environmental or socio-economic impacts may require careful consideration, compared to implementing low cost recommendations.

To provide useful feedback, the Project Director should send a copy of the Response Report to the RSA Team Leader for their information. The Audit Team should note the responses and where possible learn from them. The Audit Team should be aware that they should not create a dispute over which recommendations have or have not been accepted. The Audit Team provides guidance, but it is the Project Director and the Design Team who are responsible for the final decisions on which design modifications are incorporated.

[4.10]

Carry out Design Modifications

Responsibility: Design team, Project Director

A Road Safety Audit achieves nothing for the road users until its recommendations are discussed, agreed, and implemented. Implementation of the recommendations closes the loop of the audit process.

In many audits, particularly while the project is still in the design stage, the changes can be made at low cost.

However, an audit may reveal safety concerns that require difficult decisions to be made by the Project Director, usually because the cost of remedial action is high.

The audit process can direct the Design Team towards a safer alternative, but the onus lies on the Project Director to ultimately decide on the course of action and its implementation.

05. Road Safety Audit Team

The success of the RSA process highly depends on the characteristics of the auditors, both individually and as a team.

The team needs a broad range of safety knowledge, skills, and experience to be able to review all safety aspects of the project design comprehensively. A skilled and experienced team will be able to get the most from field visits and communicate well within the team and externally to the Client and Design team.

The communications structure of the Audit team is as shown in Figure 5.1.

[5.1]

Size of Audit Team

The ideal size of an Audit team depends on the type, size, and complexity of the scheme/ design being reviewed. For larger schemes, if the Audit team have to slowly drive through the site in a vehicle, a team of four auditors (Team Leader and three members) can conveniently hold discussions whilst in the vehicle. If the scheme is simple widening of existing road, one senior auditor would be enough. In a complex large project (for example, a four or six lane dual carriageway with large structures and service roads), the audit shall be best performed by a team of auditors having varying experiences.

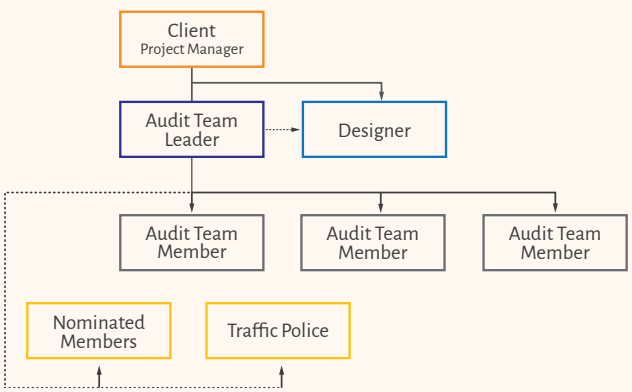
The right team with complementary skills and technical understanding will perform far better to identify issues working as a unit than individually. To optimise technical quality and cost, this Manual proposes that the Audit team should comprise of a maximum of three members supporting the Team Leader (see Section 5.2).

Each auditor in the team should make a meaningful contribution to the audit process. It can become more difficult to manage and coordinate an Audit team with more than four members. For smaller projects, such as for zilla roads or individual intersections, the audit can be carried out by an experienced individual auditor.

Additional to the audit team, the Client may also invite Traffic Police and nominate RHD officers as observers during site inspection, particularly on larger schemes. The team should not be so big as to impact the quality of discussion on site. A maximum of one Traffic Police Officer and two nominated members is recommended.

Advice of experts might be needed on specific audits, for example, the Audit team may seek expert advice from a traffic/signals engineer when auditing a complicated signalized junction. The Audit Team may wish to hold a discussion with a support organization when checking for issues affecting Persons with Disability (PWDs).

FIGURE 5.1
Audit team structure



[5.2]

Roles of the Audit Team

TEAM LEADER

- The most experienced member of the Audit team.
- The lead of the Audit team providing technical guidance to the other members.
- Represents the Audit team in communications through the audit process.
- Attends the commencement meeting, including recording and confirming the outcomes and actions.
- Seeks clarification from the Client regarding any technical questions or issues identified, including obtaining additional documentation/data.
- Plans, schedules, leads/manages/ delegates the overall RSA , including site inspection.
- Undertakes/participates in the RSA , leading discussions regarding risks and hazards identified, their prioritization and recommendations to be made.
- Conducts completion meeting, including recording and confirming the outcomes and actions.
- Oversees the production, finalization (including signing off by all Audit team members) and submission of the RSA report to the Client.
- Receives the Response Report from the Client.
- Provides feedback if asked regarding the RSA process for monitoring and evaluation.

TEAM MEMBERS

- Attend the commencement and completion meetings.
- Undertake / Participate in the RSA process including review of design, background information and field review.
- Assist in preparing the RSA report.

[5.3]

Competency of the Audit Team

An Audit Team is only as good as their combined competencies. The Audit Team should therefore represent a group of individuals that combined, possess a set of skills that will cover most of the safety aspects of the project road. A combination of skills in several different areas will help ensure that no aspect of the RSA is overlooked.

At minimum, RSA team members should have competencies in the areas indicated in Table 5.1.

Table 5.1 Key competencies of an Audit Team

ROAD SAFETY AND SAFE SYSTEM

Causal factors/risks that lead to crashes and linked to knowledge of effective treatments/ corrections that will remove or minimise the identified risks.

Safe System approach including its principles and application.

TRAFFIC OPERATIONS

Principles of traffic flow, the relationship between capacity and demand, and causes of congestion.

Relationship between traffic flow, speed, and safety outcomes.

Proper placement and use of signs, pavement markings, traffic signal operations (for inter-urban corridors) and the impact of different treatments on traffic operations.

ROAD DESIGN

Road/highway design and supervision of works.

National/international road design standards that apply to the concerned network.

Contributory factors of different roadway and roadside design elements to the risk of road users, including both vehicular traffic and VRU (motorcyclists, pedestrians, bicyclists, and rickshaw operators).

LOCAL KNOWLEDGE

Geological/geographical challenges for roads in Bangladesh.

OTHER AREAS OF SPECIALTY

Human factors contributing to road safety, maintenance, enforcement, grade separated intersection design, road-rail crossings etc.

[5.4]

Training and Experience of Audit Team

Table 5.2 gives the training and experience required by Team Leaders and Members, as well as the experience they should have for undertaking road safety audits.

If more than one stage of audit is required, RHD may contract one Audit team to carry out all the stages of audit on the same project road. This does not impact the independence of the Audit team. This continuity can be beneficial as it makes keeping a record of issues raised in previous audits simpler. On the other hand, RHD may decide to contract different set of auditors for each stage of audit if there is need to have a "fresh look" at the scheme.

[5.5]

Independence of Audit Team

The Audit Team must be independent of the Design Team. This enables a completely unbiased review of the scheme design. This is regarded as being an essential requirement of the process (Austroads, 2022).

This Manual recommends that when outsourcing audit services, RHD must not procure an Audit team from the same organization as the Design team. For independent consultants, Audit Team members shall not have taken part in the design of the project road being audited.

For internal audits, the rationale behind the independence of the RSA must be well understood by the Project Director. RHD officers undertaking the audit must not be involved in the design of the same scheme. Internal controls must be instituted to eliminate vested interest.

NOTES

Table 5.2 and Table 5.3 give the training and experience required by Team Leaders and Members, as well as the experience they should have for undertaking road safety audit.

Table 5.3 shall be used as a guide by the Client when defining the criteria for evaluation of competency of the Audit team during the development of the ToR.

Table 5.2 Training and experience requirements of the Audit Team

Position	Training	Experience
Team Leader	Background in civil engineering or transport planning. Undertaken training for at least ten days in road safety auditing delivered by an accredited auditor. Accredited auditor by Bangladesh Government or a recognised international institution.	Experience of at least 8 years in road design/ supervision projects. Experience of at least 5 years in road design/ highway engineering. Undertaken at least 2 road safety audits in the last 3 years. One of the audits must have been at the Detailed Design stage.
Team Member	Background in civil engineering or transport planning Undertaken training for at least ten days in road safety auditing.	Experience of at least 3 years in road design/ supervision projects

06. Road Safety Audit Management

This chapter provides guidance to RHD on the best way to successfully mainstream RSA processes into the operational framework of the organization.

[6.1]

Terms of Reference (ToR) for conducting RSA

The Terms of Reference for an RSA defines the need and structure of the study. It should include clear objectives, a statement of scope, and a verification process to demonstrate if / how the objectives have been met.

The ToR must clearly indicate that the bidder should align the exercise to the requirements under this Road Safety Audit Manual for RHD.

It is expected that if the RSA services are outsourced, RHD will engage a firm to provide the consultancy services.

The consulting firm will propose an Audit team. The ToR shall therefore be the basis on which to evaluate the consulting firm for adequacy to provide the services, and the proposed Audit team for competency.

As a minimum the ToR must cover the items listed in Table 6.1.

Table 6.1 Terms of Reference for selection of Audit firm

OBJECTIVE OF THE EXERCISE

Clear objective of the audit indicating the name of road and specific length/section.

SCOPE OF SERVICES

Outline the services to be completed under the audit.

While the scope of the services can cover more than the audit itself, care should be taken not to have a very broad and ambitious scope, as it may impact the quality of the audit services.

Some of the complementary services that can be added to audit services include training or review/development of policy, strategy, manual or guidelines related to the task. The scope must indicate the stages of audit required.

QUALIFICATION CRITERIA FOR AUDIT FIRM AND AUDIT TEAM

If RHD outsources a firm to undertake the audit, the requirements for the firm must be set out additional to the audit team. The firm must have undertaken previous Road Safety Audits / Assessment/ Inspections or road safety studies. The criteria should be based on local capacity of firms. For the audit team, the requirements for the Team Leader and Team Members must be in accordance with this RSA manual.

LENGTH OF SERVICES:

The length of service is dependent on the length of network to be audited. It is generally considered that the maximum length of corridor to be audited under one package should be 60km. A Road Safety Audit for a 60km section should take no longer than 3 months. However, RHD can decide on the package length based on the realities of the contract management. RHD must ensure that sufficient time and resources (audit team members) are allocated to complete the audits for the length specified by RHD.

The time input (person-month) for the various experts should be distributed based on tasks. It is expected that the Team Leader will be most involved.

Team Leader: 2- 2.5 person-months | Audit members: 1-2 person-months

[6.2]

Register for Road Safety Auditors

The Project Director should have ready access to a registry of suitably qualified/ experienced road safety auditors that are available within Bangladesh. It ensures RHD can obtain adequate auditor skills and will assist with identifying the need to upskill local consultants where there are gaps.

To be registered as a skilled road safety auditor, the requirements for experience, qualifications and training need to be met. These requirements are given in Chapter 5.

The register kept by RHD should detail:

- Name of auditor,
- Accreditation status/ level, organisation affiliation,
- Relevant trainings undertaken,
- Availability to work,
- Relevant professional expertise, and specific expertise that the authority can call upon on specific projects such as toll roads, Vulnerable Roads Users, signalized intersections etc.

[6.3]

Registry of RSA related reports

The Project Director must submit the following RSA documents in electronic form, for filing to the Road Safety Division.

01 ToR documents used to engage Audit Team.
02 Audit brief submitted by the Design Team.
03 Audit report submitted by the Audit Team authorized by the Project Director.
04 Response report as compiled by the Design Team and authorized by the Project Director.

Keeping a registry aids planning, performance, and review of road safety auditing management; it documents the extent to which the recommendations of RSAs are acted upon; facilitates third party reviews; provides a basis for assuring the quality of RSA; and demonstrates compliance with road safety guidelines and practice. The registry also helps to prevent unnecessary duplication of audits.

NOTE

This register of auditors can also be used for selection of experts for undertaking road safety inspections at the Zonal level.

As RSA mainstreaming strengthens at RHD, with time, filing an RSA report in an online database can be considered as fulfilment of step 'Acceptance of RSA report' in the RSA process. This filing can be regarded as a completion of the road safety audit.

[6.4]

Cost and Value of RSA

The benefits of conducting RSA are derived from it being a proactive tool - meaning identification and mitigation of risks can be achieved before crashes occur. The greatest value of RSA is that the hazards and safety risks can be identified and mitigated while the scheme is still at the feasibility and design stages. This will avoid expensive remedial intervention of the infrastructure post implementation.

Although various research has substantiated that RSAs are cost effective, the motivation to undertake RSA by RHD should not be the need to meet a target benefit/cost ratio. While RSA benefits are substantial, they are largely immeasurable.

Some of the key benefits of RSA include:

- Substantial reduction or avoidance of costs to reconstruct the project road or correct the safety deficiencies at a later date when the roads are in operation.
- Reduced whole life costs of road construction since safer designs often carry lower maintenance costs.
- Reduced societal burden of crashes due to fewer and less severe crashes occurring.
- A general improvement in safer design for VRUs over time. An intentional and inclusive approach to safer design for pedestrians, cyclists, motorcyclists, and riders of three-wheelers.
- The brainstorming sessions with the Client, Audit team and Design team can contribute to a collaborative approach to design.

NOTE

The earlier the project is audited within the design and development processes; the more effects and benefits are achieved.

Appendices

Appendix A
Road Safety Audit Policy

This section contains recommended policy for RHD in the conduct of Road Safety Audits (RSA). The RSA policy should be "living" or "fluid", meaning that at no time is the policy to be considered finished or "set in stone."

Rather, it should be reviewed and updated as experiences with the road safety audit process grow within the RHD and wider Bangladesh.

Table A.1 identifies the type of road project to be audited, and the stage(s) of audit to be undertaken. These are the minimum requirements.

The Project Director may commission an RSA at any other stage in addition to those listed, based on engineering judgement.

Table A.1 Stages at which RSA should be conducted on different classes of road

PROJECT PHASE	Express-way	National Highways 4/6 lane	Regional Highways 4 lane	National Highways 2 lane	Regional Highways 2 lane	Zilla Roads
Stage 1 Feasibility / Prelim.	Yes	Yes	Yes	Optional	Optional	Optional
Stage 2 Detail design	Yes	Yes	Yes	Yes	Yes	Yes
Stage 3 Construction	Yes	Yes	Optional	Optional	Optional	Optional
Stage 4 Pre-Opening	Yes	Yes	Yes	Yes	Optional	Optional
Stage 5 Post-Opening	Yes	Yes	Optional	Optional	Optional	Optional
Operation	Road Safety Inspections (Existing Roads)					

Appendix B
Road Safety Audits under Public-Private Partnership (PPP)

The Government of Bangladesh under the jurisdiction of RHD has adopted Build-Operate-Transfer (BOT) project financing as one of the road development solutions.

PPP projects often have multiple players involved and as such the reporting lines may not be well defined as compared to project delivery under GoB and FAP delivery. It is therefore important to define the RSA process under a PPP arrangement.

A typical RSA under PPP project will have, at a minimum, the following parties involved:

- Project owner (RHD)
- Developer consortium / concessionaire
- Financiers
- Independent consultants (IC)
- RSA team

Process for RSA under PPP Financing Framework is:

01 Pre-feasibility and feasibility study of possible projects should be carried out by RHD, by engaging design consultants. Independent external RSA consultants are to be appointed by RHD for auditing at these stages. The appointment of the RSA shall be done by the Project Director of PIU following the process defined in this manual.

02 Once a concessionaire is engaged to design and construct the project, the PD-PIU shall appoint an RSA consultant who shall then be responsible for auditing the design of the concessionaire, and also, to take up construction stage audits to check adherence to work zone safety and effectiveness of traffic management plan.

03 The PD shall accept the audit reports or ask for revision of recommendations and get the recommendations implemented by the concessionaire through the IC.

04 To start the auditing services, the commencement meeting should be called by the PD-PIU and attended by the design team of the concessionaire and the IC. The audit should be done as per this manual and a report submitted.

05 The closing meeting should be called by the PD-PIU. The participants should be the same as in the commencement meeting. The process of accepting the report should be as given in section 4.7 of this manual.

Important considerations for conducting RSA in PPP projects:

01 Design, construction and pre-opening are the important stages of audit for PPP projects.

02 PPP framework is generally preferred for high hierarchy roads, so some projects may not sufficiently address the needs of VRU. When auditing a PPP project, it is critical that the RSA team provides attention to the VRU.

03 RHD should subject the Design- Build (DB) Agreement of the PPP to an RSA prior to issuance to consortia developing their bids. This is because typically, by the time the audit team is brought into the project, the base parameters have already been established by the DB Agreement. Project costs can escalate if there are safety deficiencies to be addressed, that were not considered at DB Agreement stage.

04 In PPP, the concessionaire's interest is in preserving profitability, which can impede the adoption of safety improvements recommended in the RSA report. The concessionaire may reject RSA recommendations based on the contractual terms. While not all RSA recommendations have an incremental cost, many do. It is imperative for RHD to implement RSA on all PPP project at early stage of development.

05 To address some of the impediments discussed, RHD can set up a contingency fund under the contract, for implementing the safety countermeasures. If the concessionaire is constrained in implementation of the countermeasures, the contingency fund can be utilized.

Appendix C
Collision Risk on the RHD Network

[C1]

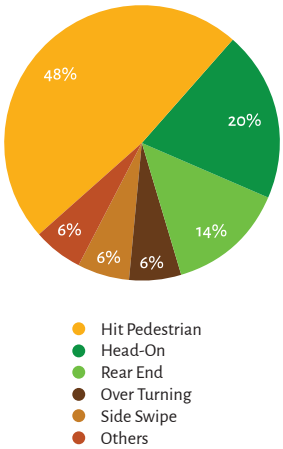
Introduction

This appendix provides an outlook on the typical crash profile on the RHD network. It is meant as a guide to the road safety audit team on the potential risks on the project road when undertaking audits. It is not in any way intended to replace comprehensive assessment by the audit team, and while using this guide, the auditor must be aware that the crash profile might change over time.

The major causes of road traffic collisions in Bangladesh as reported by police are related to speeding. These include pedestrian-involved crashes, overtaking, competition with other vehicles, control failure of vehicles and sudden stopping of vehicles. Other factors highlighted are driver fatigue, overloading of both goods and public transport (passenger) vehicles and risk at rail level-crossings. Buses, trucks, cars, three-wheelers, and motorcycles are the most predominant vehicle types in collisions.

In Bangladesh up to 88% of fatal crashes fall among the following crash types: hit-pedestrian, head-on; rear-end; and over-turning. Out of these crashes, 'Hit pedestrian' is the most dominant impact type, contributing to 44% of total fatal crashes and 48% of total crashes (shown in Figure C.1). About 60% of crashes observed in Bangladesh were single vehicle crashes, among which hit pedestrian, loss of control, and hit object were the most common categories.

FIGURE C.1
Distribution of road crashes by impact types



About 60% of crashes observed in Bangladesh were single vehicle crashes, among which hit pedestrian, loss of control, and hit object were the most common categories.

On national highways, truck and bus traffic is predominant, with trucks and buses comprising up to 43% of the traffic on some sections. This is followed by cars, autorickshaws, and motorcycles at 18%, 31% and 8% respectively.

Based on the recent data published by Bangladesh Road Transport Authority (BRTA), motorcycle and slow-moving vehicular traffic (SMVT) including NMT are involved in more than 50% of all road crash fatalities. Buses and trucks are also major contributor to road crash fatalities contributing to a quarter of all fatalities.

When auditing schemes, road safety auditors must assess the pedestrian activity along the highways and whether the designer has included adequate infrastructure for pedestrian safety in the design. Pedestrian infrastructure includes footpaths and footways, controlled and uncontrolled crossings, segregated pedestrian facilities, etc.

[C2]

Major collision types Impact type descriptions

C2.1 Hit-pedestrian

Pedestrians are classed as VRU. In Bangladesh collisions with pedestrians are a leading cause of death and injury with 40% of all road deaths caused by collisions between vehicles and pedestrians. The International Road Assessment Programme (iRAP) notes how pedestarians are struck by vehicles in a number of situations. These include:

- Trying to cross the road.
- Walking along the roadside, or on the road.
- Playing or working on the road.
- On driveways or footpaths.
- While boarding or leaving public transport vehicles.

Vehicle speeds is a key factor in determining the severity of crashes which involve pedestrians. Studies shows that the likelihood of a pedestrian surviving an impact with a motorised vehicle reduces substantially above 30 km/h.

The design efficiencies and potential safety risks associated with hit-pedestrian crashes are shown below in Table B.1.

Bangladesh is densely populated and the land fronting the highways is frequently occupied by residential dwellings and commercial establishments. These land uses generate high levels of pedestrian activity, particularly crossing movements.

In the absence of good-quality walking and pedestrian crossing facilities this mix can contribute to 'hit pedestrian' type collisions.

C2.2 Head-on collisions

Head-on crashes are generally the most severe of all vehicle crash types. Research shows that the likelihood of surviving a head-on crash at speeds above 70 km/h are substantially reduced even if the vehicles involved are modern. For countries such as Bangladesh, where the vehicle fleet comprises of older vehicles and vehicles of vastly varying sizes (i.e., it's common to see large goods vehicles sharing the road with rickshaws), the likelihood of surviving head-on crashes is less likely at far lower speeds.

Head-on crashes occur when a vehicle leaves its path and strays into the path of an oncoming vehicle. Driver fatigue and steering wheel overcorrection are often primary causes of head-on crashes.

The design efficiencies and potential safety risks associated with head-on crashes are shown below in Table B.1.

More than 50% of the national highways in Bangladesh are undivided roads with little to no protection provided for road users to mitigate against head-on collisions. The risk is further increased due to the traffic mix, in particular the contra-flow movement (against largely motorised traffic) of motorcyclists, bicyclists and three-wheelers, auto rickshaws and rickshaw operators.

On road sections where the speed environment may generate operational speeds greater than 70km/h, road safety auditors need to identify whether opposing traffic flows will be separated with a median or in the absence of a median, designers have put in provisions to manage vehicle speeds.

Some recommended infrastructure provisions to reduce head-on collisions
Central medians.
Wide central line hatch-markings coupled with no overtaking lane.
Extra width for inside lanes on curves with centre line hatch marking.
Implementation of safe system speed limits (50 km/hr on undivided carriageways).

C 2.3 Rear-end

A rear-end crash involves one vehicle or road user running into the back of another vehicle or road user. This can be due to the sudden deceleration of the upstream vehicle or because the downstream vehicle is travelling at excessive speeds or following too closely (tailgating). This type of crash is common but usually does not result in serious injuries.

This is because the relative speeds of vehicles involved in a rear-end crash are generally lower, as they travel in the same direction.

However, they may still result in fatal or serious injuries if two vehicles with a substantial difference in size collide (e.g. car and rickshaw or large goods vehicle and a car).

iRAP study notes how on motorways, broken-down vehicles can cause a rear-end crash. iRAP study further notes how maintenance vehicles and road workers are also prone to rear-end crashes, particularly if road works are carried out at night with a lane closure.

On the national highway network, rear-end crashes are likely to occur due to roadside activity and poorly managed parking, particularly on urban corridors.

Roadside activities and ribbon developments can contribute to the occurrence of rear-end crashes due to speed differentials caused by vehicles decelerating to perform parking manoeuvres.

Road safety auditors need to identify whether designers have put in place measures to mitigate against rear-end crashes at these and other high-risk locations (i.e. approaches to intersections, merges, etc).

People including children crossing a busy road with high risk of hit-pedestrian collision.

SOURCE
The Financial Express, Bangladesh.

Three killed in a truck and pickup-van head-on collision on Mymensingh-Sherpur highway, on 23rd January 2024.

SOURCE
Bangladesh Sangbad Sangstha

Rear-End Collision between a passenger bus and a private car in the Karnaphuli tunnel in Chattogram.

SOURCE
The Business Standard, Bangladesh.

C 2.4 Over-turning

An over-turning crash occurs when a vehicle is tipped onto its side or onto its roof. Over-turning crashes may involve multiple vehicles but may often be limited to single vehicle. Research suggests that these crashes are likely to be caused by speeding, particularly around bends and due to the overloading of haulage vehicles.

Public transport vehicles running off the road can result in multiple severe casualties due to increased tendency of turn-over. Passengers in these vehicles are often unrestrained and the bodies of these vehicles are relatively fragile (particularly in Bangladesh where the passenger transport fleet is older). Catastrophic secondary events can happen if dangerous goods vehicles are involved in an over-turning crash.

A high proportion of the over-turning crashes on the national highway network is caused by overloaded vehicles. This includes large goods vehicles carrying freight as well as passenger transport vehicles such as buses overloaded with passengers.

Some of the infrastructure provisions to review to avoid overturning crashes:

Adequacy of superelevation – both on curves and mid blocks

Appropriate speed limits for the provided curve radius

Though, Bangladesh has regulations to control overloaded vehicles, this type of crash is still quite common.

The road safety audits must verify designs to mitigate against over-turning crashes and create a forgiving road environment. This includes ensuring the designer has considered skid resistance, speed management and delineation, particularly on sharp bends.

C 2.5 Run-off road

Run-off road crashes are common, especially in high-speed areas and are likely to occur at bends. They can have severe outcomes with a high likelihood of fatal or serious injury if rigid, non-frangible objects (i.e. trees and power poles, etc.) are hit at a high speed or there is a steep embankment or cliff with no protection.

Research shows that the survival rate for a vehicle striking an object substantially reduces above 70 km/h, while a vehicle side impact into a pole or tree is greatly reduced at speeds above 30 km/h. The survival rate for motorcyclists can be severe at even lower speeds.

Bangladesh is prone to heavy rainfall which can cause aquaplaning and lead to run-off road crashes.

[C3]

Contributing factors

The design efficiencies and potential safety risks associated with the five impact types are provided in Table C.1 (See Page 46)

A picnic bus crash killed 3 and injured 15 people in Dhaka, on 24.12.2010.

Source: The Daily Star Bangladesh

17 killed and 12 seriously injured after a bus plunged into a roadside pond in Jhalakathi.

Source: The Dhaka Tribune, Bangladesh

Road safety auditors, therefore, need to ensure designers have taken reasonable steps to mitigate these types of crashes on new projects. Infrastructure provisions to reduce the incidence of run-off crashes and associated casualties are:

- The provision of adequate drainage
- Good delineation of the road
- Sufficient skid resistance
- Speed management on curves
- Provision of crash barriers on curves where embankments are high or passing through areas where fatalities are likely in the event of run-off crashes.
- Provision of clear zones, wherever possible
- Relocation of roadside hazards

Table C.1 Design inefficiencies and potential safety risk

Factors affecting impact type	Hit-Pedestrian	Head-on crashes	Rear-end	Over-turning	Run-off road
Road Geometry Issues					
Wider or multi-lanes (added risk of crossing)	•				
Lack of median separation or poor centreline delineation		•			
Inadequate safe overtaking opportunities		•			
Sharp curves		•		•	
Poor intersection visibility			•		
Inappropriate speeds including approach speeds at intersections	•	•	•	•	•
Poor intersection siting- at the bottom of vertical grades			•		
Vertical and horizontal alignment deficiencies				•	•
Poor delineation				•	•
Traffic and pedestrian movement issues					
No footpaths, or if present inadequate, discontinuous or obstructed footpath	•				
No pedestrian crossings or poorly designed or Inadequate pedestrian crossings	•				
No separation of pedestrian from live traffic	•				
Unsafe roadside				•	•
Poor management of roadside activity including ribbon development, vending, parking, public transport stops			•		
Non-uniform traffic flow characterised by free-flow with expected stops			•		
Conflicting intersection movements	•				
Road surface and pavement condition issues					
Road surfacing – Poor pavement skid resistance especially on curves and particularly during inclement weather		•	•	•	•
Unpaved shoulders – oversteering when the driver tries to correct departure from roadway		•		•	•
Poor drainage and water ponding on the roadway, especially at curves				•	•

The design of road infrastructure should start with the needs of the most vulnerable users and then progress through to the safety needs of the least vulnerable.

Appendix D
A Safe System Approach

[D1]

Introduction

The Audit team should consider Safe System approach while auditing road projects. This approach is based on the premise that deaths and injuries due to road traffic crashes are unacceptable and are avoidable.

It seeks to ensure that no road user is subjected to kinetic energy exchange in a crash which will result in death or serious long-term disabling injury. Safe System principles represent a fundamental shift from traditional road safety thinking, reframing the way in which traffic safety is viewed and managed.

[D2]

Principles

Safe System principles are:

01 People make mistakes that can lead to road crashes.

02 The human body has a limited physical ability to tolerate crash forces before harm occurs.

03 A shared responsibility exists among those who design, build, manage and use roads and vehicles and provide post-crash care to prevent serious injury or death.

04 All parts of the system must be strengthened to multiply their effects; if one part fails, road users are still protected.

[D3]

Elements and Application of Safe System Approach

D 3.1 SAFER INFRASTRUCTURE

Safety treatments can reduce crash likelihood. Some examples of high-performing infrastructure treatments are:

- Well-designed roundabouts are able to reduce deaths.
- Grade separated pedestrian crossings reduce casualty crashes.
- Forgiving roadsides redirect errant drivers back to the road reduce likelihood of KSI crashes.

All road users need to be considered when designing or upgrading road infrastructure. This includes:

- A road design and corridor planning exercise that progresses through the needs of pedestrians, cyclists, animal drawn carts, motorcycles, cars, trucks, and buses will ensure that appropriate function, speed, road space allocation, and design features are incorporated to deliver the best safety outcomes.
- This is not only a critical step in planning new roads, but it is a particularly challenging issue for safety review and retrofitting of existing networks over time.
- Traffic management measures can play a significant role in influencing the road safety situation.
- In situations where the traffic mix is highly diverse, user compliance levels are usually low, and regulations and rules are often set by a transport department that is separate from the road authority, resulting in many co-ordination challenges.
- The opportunities for controlling the operation of vehicles on certain roads by type or space, or by day/night use to improve safety outcomes, warrants further examination.

[D4]

Speed Management

The principle of safe travel speed underpins a Safe System Approach. Speed is a key risk factor influencing both risk of crash as well as severity. From principles of physics, severity of injury during a crash is related to the kinetic energy released in a crash that increases with the square of the speed. Speed is particularly critical in crashes involving NMT due to difference in 'Mass' between a motor vehicle and a pedestrian that ranges from a minimum factor of 10.

Speed influences increase in crash risk in three ways;

01 At higher speeds, motorists may fail to anticipate road users' behaviour,

02 Road users especially VRUs may misjudge speed of oncoming vehicle; and

03 The distance required for a driver to react to an unsafe situation is longer at high speeds.

Critical speed threshold levels in traffic crashes differ depending upon the type of crash being considered.

When undertaking road safety audits, the RSA team should consider speed management for the following aspects:

A If there is considerable presence of VRUs, risk of KSI crash is minimized if there is either be a physical separation from live traffic or risk of death or serious injury is minimised at speeds of 30km/h or less for VRUs, or when there is physical separation of VRUs from live traffic.

B For opposing traffic streams that are not physically separated (single carriageway roads), speeds of 70km/h or less minimize injury for vehicle occupants.

C At intersections with risk of speed impact, risk is minimized at speeds of 50km/h or less.

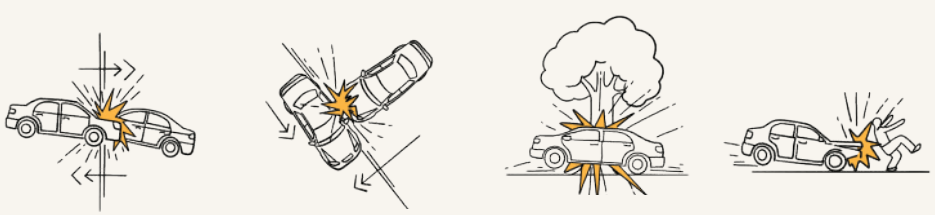
D When roadside hazards are not mitigated, the risk of KSIs is minimized at speeds of 30km/h or less.

From the below figure, it is apparent that even when a vehicle is fitted with the safest features, the road system still cannot support operating speeds above 50-70 km/h.

If the roadside hazards are mitigated, the travel speeds of opposing flows on singles carriageways must still be 70 km/h or less. Separation of the traffic by means of a median enable higher speeds.

When a median-separated corridor has a considerable presence of motorcycle or rickshaw traffic, then the operating speeds should be 30 km/h or less.

FIGURE D.1 Survival impact speeds



Head-On	Side Impact	Side Impact with Tree	Pedestrian
70 km/h	50 km / h	30 km / h	30 km / h

● CRASH TYPE ● IMPACT SPEED

In instances where infrastructural safety cannot yet be improved, as an immediate measure, review of speed limits combined with appropriate enforcement for compliance should be considered. It is important to acknowledge that targeted infrastructure improvements for speed management delivers better safety outcomes.

FIGURE D.2
Bollards to prevent NMT space encroachment. (London) *

FIGURE D.3
Tabletop pedestrian crossing (London) *

* Source: TRL

D 4.1 Compliance and Human Error

Maximising road user compliance with road rules remains an important issue. Safer road design should ensure that the road system is compatible with human capabilities, limitations, and needs. It should also eliminate or reduce the opportunity to make mistakes or the need to use the facility incorrectly. Some of these design considerations include:

- Aligning pedestrian crossings with pedestrian desire lines to reduce inconvenient deviations.
- Tabletop crossings to reduce approach speed of vehicles.
- Using bollards or other facilities to prohibit vehicles from using NMT space.

Some of these infrastructure improvements may require the presence and active implementation of effective legislative arrangements; data systems for vehicles, driver licensing and offences (and their linkage); enforcement; justice system support; and offence processing, as well as follow-up capacities. Human error and sometimes deliberate illegal behaviour is a key contributor to KSI crashes. Clear consistent guidance and reasonable information processing demands upon the road users along a route is necessary to reduce hazardous behaviour, uncertainty and indecision.

D 4.2 Roadside Safety

Roadside hazards are a major road safety risk. A roadside hazard is any road feature or an object on the roadside that may contribute to the likelihood or increased severity of a crash when a vehicle leaves the roadway.

POINT HAZARDS

Individual hazards and located in isolation. Criteria must be minimum 100mm in width. They include:

Trees, 100mm or wider

Non-frangible signposts, signposts, poles etc. 100mm or wider.

Gantries, masts.

Isolated jersey concrete barriers left by the roadside.

Monuments

Large planters including concrete planters.

Headwalls

Bridge piers including pedestrian bridge priers and stairs.

Isolated stall set up close to the road.

Rock outcrops.

Unsafe barrier ends.

CONTINUOUS HAZARDS

Continuous hazards extend over length of road. Because of the continuation over a length of section, they are more difficult to relocate. Also, they have higher crash risk than point hazards of the same type. Such as a row of trees on the roadside has higher risk than an individual tree. They include:

Rows and forests of large trees;

Uncovered drains;

Retaining walls;

Steep embankments;

Rock cuttings or cliffs;

Lakes, streams, channels over 0.6 m deep:

Unshielded hazards (such as cliffs) beyond the clear zone, but within reach of an errant vehicle;

Curbs with a vertical face more than 100 mm high on roads with operating speeds above 80 kilometres per hour (km/h)

Fences with horizontal rails that can spear vehicles.

Discontinuous concrete barriers or barriers with gaps.

The RSA team should adopt the Five-step strategy as suggested by CAREC RSA Manual as a guide when assessing roadside risk and development of recommendations to mitigate risk.

STEP 1

Keep vehicles on the road: Audit at feasibility stage can focus on safe geometric design to keep vehicles on the road. This includes improving vertical and horizontal curves and their combination, sealing shoulders, tactile pavement, guideposts, chevron alignment markers and improved sight distances.

STEP 2

Remove fixed objects from within the *Clear Zone* of the road: Some of the audit recommendations can include underground utility lines, combining services on a single pole to reduce the number of objects, demolishing kiosks, and stalls on the roadside, removing trees and poles etc.

STEP 3

Relocate hazards to locations outside the clear zone: If it is not possible to remove the hazard, then the next step is to relocate it to outside the clear zone.

Research indicates that relocating roadside hazards within 1m from the roadside to 5m can reduce injury crashes by 22% and relocating from within 5m to 9m reduces injury crashes by 44%.

STEP 4

Alter the hazard to reduce the severity of a collision: The RSA recommendations can include flattening of steep slopes, use of frangible lighting and signposts, as well as drivable end walls for culverts to reduce injury.

STEP 5

Install crash barrier to shield errant vehicles from the hazard: when the above first four steps are not feasible, installation of crash barriers should be considered.

However, as an RSA recommendation, the audit team needs to understand that safety barriers are themselves fixed objects and carry a risk factor too.

Poor installation, unsafe terminals, transition etc can result into the barriers being a greater danger to the vehicle occupant than the initial hazard that the barrier was intended to correct. Also, traffic attenuators can be provided to shield a hazard at the gore area.

D 4.3 Vulnerable Road Users (VRU)

An audit team needs to consider the safety needs of all pedestrians, cyclists and in particular the safety needs of high-risk groups such as school-age, elderly and the disabled pedestrians. The audit team should walk the site (during day and night) to check for pedestrian and cyclist issues.

Pedestrians and cyclists need to be able to clearly see where they should go. While this may be clear to engineers on a plan, it is not always obvious on the ground.

- → Provide a pedestrian and cyclist crossing phase at signalised crossings to give time separation from vehicles to cross busy roads.
- → Use medians or refuges to give them spatial separation from vehicles.
- → Overpasses and subways are not popular and should only be used as a "last resort" to segregate pedestrians and vehicles on roads with high speed and high traffic volumes.

Footpaths and cycle ways provide pedestrians and cyclists a space to walk and cycle. Auditors should check to ensure that paths are wide enough for the expected volumes and are continuous. Proper ramps should be provided to cater to the elderly and disabled people. The audit should check whether kerb crossings are provided and whether the footpaths are clear of obstacles. The Audit should check whether kerb crossings are provided and whether the footpaths are clear of obstacles.

In rural areas, wherever there is considerable pedestrian movement (near villages, schools etc.) paved shoulders will give pedestrians their own space to walk.

They can be used by cyclists, motorcyclists, and animal-drawn carts. Auditors should check the cross-section drawings to see if paved shoulders are proposed for such stretches and if not ask why?

A highway passing through a settlement should have space for pedestrian movement along and across the carriageway.

Pedestrians should be able to cross the traffic way via the shortest distance. Medians should be wide enough to serve as a refuge space. Considering the mix of traffic on urban roads, lane width can be reduced to give proper width for the pedestrian ways.

Footpaths and Cycle-ways provide pedestrians and cyclists a space to walk and cycle. Auditors should check to ensure that paths are wide enough for the expected volumes and are continuous. Proper ramps should be provided to cater to the elderly and disabled people. The audit should check whether kerb crossings are provided and whether the footpaths are clear of obstacles.The audit should check whether kerb crossings are provided and whether the footpaths are clear of obstacles.

Appendix E
Checklists

Checklists are recognised as a useful practical tool in assisting auditors in the identification of risks and hazards during various stages of audit and across a range of scenarios.

They are only intended to be an aid and should not be relied upon to be inclusive, nor is all of the standard content applicable to all projects. Rigidly auditing to checklists serves no value to an RSA exercise. The checklists provided below are guides and can be expanded as and when necessary.

The RSA team can photocopy the checklists to use on site. The filled in checklists need not be attached to an RSA report or to be passed to the Client. The RSA report is the necessary deliverable from an audit exercise.

It is suggested that the Team Leader uses the checklists as follow:

01 The applicable checklist should be checked against the stage of audit.

02 The checklists only cover common areas of safety. The RSA team are encouraged to think about safety issues beyond those listed on the checklists.

03 For specific projects, certain aspects on the checklist may not be relevant, the RSA team should make judgement on what is relevant.

04 The auditor should tick the (YES) column if the issue has been examined but it is not considered likely to be a safety issue.

05 The (NO) column should be ticked by the auditor if the safety issue is present and should be include in the report.

06 The (Not Applicable) column will allow room for issues that the auditor may not consider relevant to the specific project under audit.

07 Under the (Comments) column, the auditor should add any additional notes on the safety issues including location, type of risk, etc.

The Team Leader is at liberty to decide the method of recording notes: the RSA team can write notes on the checklists or record the notes on a digital recorder or on mobile phones. The latter can be useful say for night-time audits or audits under rainy conditions.

E.1 Feasibility Stage Audit

No.	ASPECTS TO AUDIT –FEASIBILITY	YES	NO	NA	COMMENTS
	General				
01	What is the objective of the road project?				
02	Is the project consistent with the road hierarchy/classification and adjacent land use?				
03	What is the proposed design speed, existing operational speeds, and speed limits along the corridor? Confirm if the speeds are in harmony.				
04	Is the project expected to cater for all modes of traffic? (cars, buses, goods vehicle, pedestrians, cyclists, motorcyclists, NMT such as rickshaws). Consider provision for each mode that it will cater for. Will the conflict between different modes create road safety issues, i.e. contra-flow movement of rickshaws?				
	Road Design Standards				
05	Has the designer adopted a consistent design standard for the corridor. If not, check if this has an impact on safety.				
06	Is the design standard adopted consistent with the road hierarchy for RHD network, traffic volumes and mix along the corridor?				
07	Is the design speed adopted in line with the road hierarchy?				
08	Has the appropriate traffic volume, traffic type and mix, pedestrian volume been used?				
	Alignment				
09	Check for vertical and horizontal alignment; are they safe, practical, and consistent with required sight distances?				
10	Check if the sight lines are generally satisfactory at intersections, entry and exit ramps.				
11	Does the alignment allow for speed consistency?				
12	If the route follows an existing alignment, are there existing facilities that obstruct sight lines? If it is in a green-field, are there physical restraints that may impact sight lines.				
	Cross Section				
13	Check the cross section against the road hierarchy of the project road. Is it in accordance with the hierarchy and the function of the road?				
14	Will the width of the lanes, shoulders and median be safe for the expected volume and traffic mix?				
15	Is the cross section wide enough to provide sheltered turn lanes within the median?				

E.1 FEASIBILITY STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT – FEASIBILITY	YES	NO	NA	COMMENTS
	Cross Section				
16	Will the median be wide enough for safe installation of streetlighting and U-turns, if applicable?				
17	Are the median wide enough for an adequate pedestrian refuge?				
18	Are there provisions for emergency stops, breakdown vehicles, etc.?				
19	Are the shoulders paved?				
20	Is the cross section of the project road consistent along the project length? Note: any inconsistency and potential impacts on safety at transitions.				
21	Do bridges and culverts have the same cross section as project road including footpaths and shoulders? Note: For safety, it is desirable to continue full width shoulders across bridges and other narrow areas.				
22	Are shoulder widths adequate?				
23	Does the cross section have adequate provision for VRUs? (a) Pedestrians: Have paved footpath, adequate refuge width on median and accessibility ramps been provided? (b) Cyclists: Have segregated areas (e.g., paved shoulders) been provided where numbers are significant.				
24	Is there enough and adequate provisions for drainage?				
25	Are overtaking lanes provided?				
26	Are climbing lanes provided on sections where it is required?				
27	Have descending lane and escape ramps been provided?				
	Roadside Hazards				
28	Have safety barriers been provided to protect users from roadside hazards? Note: Safety barrier include crash barriers provided on the edge of embankment and crash cushions provided to mitigate the injury severity resulting from impact into objects such as piers, gantries, media openings, etc.				
	Intersections				
29	Is the type of intersection (crossroads, T, roundabout, and signals) appropriate and safe? Check against movements, speeds, and flows.				

E.1 FEASIBILITY STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT – FEASIBILITY	YES	NO	NA	COMMENTS
	Intersections				
30	Does the intersection design provide for flow and movement of the traffic mix expected on the project road?				
31	Is the proposed intersection the safest alternative?				
32	Is there a need to have a grade separated junction?				
	Roundabouts				
33	Is the roundabout geometry simple and easily understood by drivers on the approach to the roundabout?				
34	Is the roundabout of adequate size for all vehicular movements				
35	Is the central island conspicuous and of adequate size? For high volume flows, a conspicuous and large central island ensure that drivers cannot take a straight line across the roundabout.				
	Grade Separators				
36	Is sufficient land identified to be acquired to design diverging and merging lanes at the approaching and leaving side of the grade separator? Note: Usually, land is acquired in a linear manner for highway expansion. However, due the roadside land use pattern in Bangladesh, more land acquisition would be required to design and implement safe junction layouts along the highway.				
37	Are the proposed grade separators on the project road simple in layout?				
38	Are all features of the grade separators designed in a safe manner?				
39	Is the spacing between grade separators adequate?				
40	Will the design and positioning of grade separators contribute towards weaving (rapid and sudden lane changes) by road users?				
41	Is the entry to and exit from grade separators designed in a safe manner?				
42	Is sufficient visibility available at junction of side roads with underpasses?				
	Vulnerable Road Users (VRUs)				
43	Is safety of VRUs specifically targeted for the scheme? Has an NMT lane been provided on the project road? Is the route continuous?				

E.1 FEASIBILITY STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT – FEASIBILITY	YES	NO	NA	COMMENTS
	Vulnerable Road Users (VRUs)				
44	Has an NMT lane (e.g. for cyclists and rickshaws) been provided on the project road?				
45	Is the width proposed adequate for the traffic volumes expected and mix of traffic?				
46	Have necessary installation being put in place to minimise possible collisions? Such as dedicated NMT facilities, pedestrian fences, pedestrian overbridges etc.				
	Parking & Public Transport				
47	Are provisions allocated for catering to parking demand – commercial, personal vehicles and Rickshaws?				
48	Are provisions allocated for bus stops & lay-bys?				
	Service roads				
49	Are the width of service roads enough to cater for safe movement of traffic? Note: Ideally, the width of service road shall be minimum 7 m.				
50	Have footpaths/ pedestrian space been provided on the service road? Note: Service roads must have footpaths if the same is passing through a built-up/ semi built-up area.				
51	Are parking spaces provided on the service roads? Note: Service roads must be provided with parking spaces, if there is a parking demand. This must be without compromising the space required for footpaths.				
52	Are the entry/exit between service road and carriageway safe? Note: There must be sufficient offset between main carriageway and service road. It must be ensured that vehicles from service road shall not enter main carriageway at the approach side (in the case of a grade separator) and vehicles from the main carriageway shall not enter the service road from the leaving side (in the case of a grade separator).				
	Emergency Service Vehicle Access				
53	Has provision been made for safe access and egress by emergency vehicles? (e.g. do turning radii at intersection allow for the movement of large fire trucks?)				

E.1 FEASIBILITY STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT – FEASIBILITY	YES	NO	NA	COMMENTS
	Lighting				
54	Have provisions been made for street lighting at junctions and other warranted locations?				
	Drainage				
55	Have drainage been provided both for main carriageway and service road (if applicable) Note: Drains shall be covered, and the type of drain shall be less maintenance intensive. Has consideration been given to mitigating flood events in areas susceptible to high-intensity rainfall (heavy monsoons)?				
	Railway Crossing				
56	Are all features of the grade separators designed in a safe manner?				
57	Is the type of railway crossing (ROB, Controlled or Uncontrolled) safe and appropriate?				
	Bridges				
58	Are the approaches to bridges clearly demarcated?				
59	Have hard shoulders or maintenance lanes been provided on bridges?				
60	Have provisions been allocated for pedestrian safety?				
61	Have separate lanes been provided for NMT?				
	Toll Plazas				
62	Have provisions been made for road workers (toll booth operatives) to safely access the site?				
63	Are measures in place to manage vehicle speeds?				
64	Has the design considered mitigations to improve driver awareness and reduce driver confusion?				
65	Can motorists merge and change lanes safely?				

E.2 Detailed Design Stage

No.	ASPECTS TO AUDIT–DETAILED DESIGN	YES	NO	NA	COMMENTS
	General Aspects				
01	Was an RSA carried out at feasibility stage? If yes, are the circumstances since the last RSA the same? (traffic volume, mix, new development).				
02	Is the design mitigating the typical crash types occurring on the corridor? Note: This check is applicable only if the road is improved from a single lane/ intermediate lane to two lane. In the case of major improvements, for e.g., from single carriageway to dual carriageway, the check referring to the existing crash data would be irrelevant.				
03	Are there identified blackspot locations along the corridor? If yes, what are the typical crashes occurring at these locations? Have they been addressed in the design? Note: See the note in serial number 3.				
04	Are the speed limits provided on the road align with safe system speeds? Note: Refer to section on Safe Systems in this manual.				
05	Does the design provide safety features to mitigate potential crash and injury risks to all road users (including all VRUs and NMTs) expected to use the road?				
	Road Design Standards				
06	Has the designer adopted a consistent design standard for the corridor. If not, check if this has an impact on safety.				
07	Has the appropriate traffic volume, traffic type and mix, pedestrian volume been used?				
	Alignment				
08	Check for vertical and horizontal alignment; are they safe and consistent with required sight distances (particularly check for stopping sight distance)? Are SSD matching the design speed available?				
09	Check for combination of vertical and horizontal alignments such as a sharp bend immediately after a summit curve, and sag curve within a bend. Are these provided correctly?				
10	Does the alignment allow for speed consistency?				
11	Are the vertical alignment safe especially for movement of trucks and buses at grades? Note: In the case of two-lane roads, longer vertical grades will significantly slow down trucks and buses and this encourage hazardous overtaking. To avoid this risk, many road agencies add a 'Climbing Lane' for the heavier vehicles				
12	Is appropriate super- elevation provided at curves?				

E.2 DETAILED DESIGN STAGE (CONT.)

No.	ASPECTS TO AUDIT–DETAILED DESIGN	YES	NO	NA	COMMENTS
	Alignment				
13	Has the design provided for sufficient and safe overtaking? Note: Longer and frequent 'no overtaking zones' are not desirable. Drivers tend to ignore such zones, if provided at regular intervals.				
14	Have adequate and safe provision for transition curves and super-elevation provided?				
15	Does the horizontal curves have extra width where required for vehicles to negotiate the curves in a safe manner? Note: Applicable for single carriageways.				
16	Has the vertical alignment been designed so that the maximum grades are interspersed with recovery grades?				
17	Are railway crossings, bridges, and all hazards conspicuous?				
	Cross Section				
18	Check the cross section against the road hierarchy of the project road. Is it in accordance with the hierarchy and the function of the road?				
19	Are the width of the lanes, shoulders and median safe for the expected volume and traffic mix at locations of junctions and U-turns? Note: In the case of dual carriageway where U-turns are allowed, sufficient median width shall be provided for vehicles to stay on the median opening without obstructing the traffic on the main carriageway. The ideal width shall be not less than 6m. However, the width of the median in such cases shall be determined by the length of the predominant vehicles expected to use the U-turns.				
20	Is the median width enough to provide sheltered turn lanes within the median? Check this against the design vehicle at intersections and turns.				
21	If median barriers are required, is the median wide enough for safe installation? Check against the flexibility of the safety barriers provided in the design. Note: Safety barriers should not be installed behind raised kerbs in the median. If the safety barriers have to be provided in the median, then the median shall be flat, not raised.				
22	Will the median be wide enough for an adequate pedestrian refuge? Note: The designs shall not force pedestrians to cross more than two lane width at locations of uncontrolled crossings.				

E.2 DETAILED DESIGN STAGE (CONT.)

No.	ASPECTS TO AUDIT –DETAILED DESIGN	YES	NO	NA	COMMENTS
	Cross Section				
23	Are there safe provision for emergency stops, broken down vehicles, etc.? Note: It is a practice in some countries to provide a 3m wide hard shoulder (in the case of high speed dual carriageways) for emergency stops for maintenance. However, this may create unsafe situations in Bangladesh, since drivers may use this space as a travel lane. Therefore, Lay-bys would be ideally provided at frequent intervals on high speed highways for stops for emergency repairs.				
24	Are the shoulders paved? Has the design eliminated shoulder drop-off? Note: Elimination of drop-off can reduce the rate of driver overcorrection, head-on, and run-off road crashes.				
25	Is the cross section of the project road consistent along the project length? Note any inconsistency and potential impacts on safety at transitions. Are transitions safe (length, width, and layout)?				
26	Do bridges and culverts have the same cross section as project road including footpaths and shoulders? Note: For safety, it is desirable to continue full width shoulders across bridges and other narrow areas.				
27	Are shoulder widths adequate? Note: Shoulders shall be paved and should have a minimum width of 1m. If the width of the shoulder is more than 2m and the surface type is similar to the main carriageway, vehicles tend to use the shoulder as a running lane creating hazardous overtaking situations. If the shoulder provided are more than 2m, the surface type of shoulders shall be different (concrete or block paving) to the main carriageway.				
28	Have the side slopes been designed to a safe standard? Note: If land is available, side slopes shall ideally be flatter on high-speed roads to allow for recovery in the case of a single vehicle run-off.				
29	Have the side drains been designed to a safe standard? Note: Side drains shall not be left open and shall be covered.				
30	Does the cross-section have adequate provision for VRU including persons with disabilities? Pedestrians: is there provision for footpaths or paved shoulder space to walk along the roadside? Pedestrians: Is there sufficient median width available for pedestrians to wait in the median before they cross to the other side in the case of dual carriageways? Pedestrians: Is there a pedestrian refuge provided in the case of high-speed single carriageway roads? Cyclists: Is there a cycle lane provided for safe passage of cyclists on those highways / roads where cyclists are permitted? Rickshaws: Is there a segregated facility for Rickshaws on high-speed highways where they are permitted to use?				
31	Are overtaking lanes provided? Note: Longer and frequent 'no overtaking zones' are not desirable. Drivers tend to ignore such zones, if provided at regular intervals.				

E.2 DETAILED DESIGN STAGE (CONT.)

No.	ASPECTS TO AUDIT–DETAILED DESIGN	YES	NO	NA	COMMENTS
	Cross Section				
32	Are climbing lanes provided on sections where a climbing lane is required? Note: In the case of two-lane roads (single carriageway), longer vertical grades will significantly slow down trucks and buses and this encourage hazardous overtaking. To avoid this risk, many road agencies add a 'Climbing Lane' for the heavier vehicles.				
33	Have the interfaces between the existing and proposed roads been designed in a safe manner for all road users, where applicable?				
	Roadside Hazards				
34	Are clear zones provided in the design? Note: A Clear Zone is an unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. The width of the clear zone should be based on risk (also called exposure). Key factors in assessing risk include traffic volumes, speeds, and slopes. Clear roadsides consider both fixed objects and terrain that may cause vehicles to rollover.				
35	Are there any roadside hazards which appear to have been unintentionally left in the design? Check for trees, objects, cliffs, rock outcrops, water bodies etc within the clear zone.				
36	Is there need for safety barriers to protect users from roadside hazards?				
37	Do the safety barriers provided give adequate protection? Check the type against desired flexibility. Note: Safety barrier include crash barriers provided on the edge of embankment and crash cushions provided to mitigate the injury severity resulting from impact into objects such as piers, gantries, media openings, etc.				
38	Are the safety barriers provided long enough? Check against length of need.				
39	Are the barrier transitions safe? Also check for direction of overlapping.				
40	If concrete barriers, check for continuity of the system. Note: Points of discontinuity or weakness in the system are a risk to motorists when hit.				
41	Has the design provided adequate deflection length for the type of barrier?				
42	Is the end treatment design safe? Also check for safety risks at gore areas.				
43	Check the standard drawings for the height of barriers against the type of vehicle mix. Note: Trucks and buses can roll over on shorter barriers especially on ramps.				

E.2 DETAILED DESIGN STAGE (CONT.)

No.	ASPECTS TO AUDIT–DETAILED DESIGN	YES	NO	NA	COMMENTS
	Intersections				
44	Is the type of intersection (crossroads, T, roundabout, and signals) appropriate and safe? Check against movements, speeds, and flows.				
45	Does the intersection design provide for flow and movement of the traffic mix expected on the project road and the side roads?				
46	Is there a need to have a grade separated junction?				
47	Are the median opening/junctions designed to avoid contraflow?				
48	Are there sufficient intersections and U-turn openings (in the case of dual carriageways) in the design to avoid contraflow movements?				
49	Is the visibility sufficient on all junction approaches?				
50	Has a Y intersection been avoided?				
51	Does the intersection layout encourage controlled speed at the approach to Stop / Give Way and other critical decisions?				
52	Is adequate street lighting provided at the intersection?				
53	Are storage lanes provided at the intersection, where it is required? Note: Check for safety based on the storage length and width of inner lane.				
54	Have adequate facilities been provided for pedestrians and NMT to use the intersection?				
55	Are all pedestrian crossings marked and pedestrians channelised to the crossings?				
56	Are the type of pedestrian crossing (uncontrolled, controlled, grade separated) adequate for the junction traffic flow?				
57	Is traffic control established at the intersection through STOP, Give Way or Signs?				
58	Is the traffic control visible while approaching the junction?				
59	Are Stop/Give Way signs shown and located for maximum visibility?				
60	Is there adequate visibility for an approaching driver to see a pedestrian waiting to cross the road?				
61	Check if the restriction on turning at any locations has no adverse safety impacts on adjacent intersections.				

E.2 DETAILED DESIGN STAGE (CONT.)

No.	ASPECTS TO AUDIT–DETAILED DESIGN	YES	NO	NA	COMMENTS
	Signalized Intersections				
62	Are the traffic signal controls at the intersection(s) clearly seen and understood?				
63	Are the traffic signal phasing safe? Have adequate phase times been allocated for VRUs?				
64	Are traffic signal poles located appropriately? Note: Designer has to ensure that traffic signal poles do not pose as hazard in the road environment.				
65	Is adequate time proposed for all traffic and pedestrian movements at the signals?				
66	Do pedestrians have push buttons to activate the signals, together with suitable pedestrian signals on each corner of the intersection?				
67	Are there 'Free left' provided in 4-arm intersections? Note: Free Left shall not be allowed unless a dedicated left turning lane is available at junction approaches.				
	Roundabouts				
68	Is the roundabout geometry simple and easily understood by drivers on the approach to the roundabout?				
69	Has the roundabout been designed to safely accommodate all vehicular movements? Are swept paths adequate?				
70	Does the roundabout design deflect entering traffic sufficiently to ensure that entry speeds are no greater than 50 km/h?				
71	Is sufficient parking restriction applied near the roundabout? Note: It is desirable to restrict parking on minimum of 50m from all entry/ exit points on the roundabout.				
72	Is the central island sufficiently conspicuous and of adequate size? For high volume flows, a conspicuous and large central island ensure that drivers cannot take a straight line across the roundabout.				
73	Are sufficient visibility available for vehicles approaching the roundabout? Note: It is important to ensure that the approaching vehicle has visibility through the central island to the third arm of the roundabout. Care must be taken to ensure than the raised kerb of the central island is not more than 150mm and there are no objects (trees, buildings, statues, etc.) in the central island obstructing visibility.				

E.2 DETAILED DESIGN STAGE (CONT.)

No.	ASPECTS TO AUDIT –DETAILED DESIGN	YES	NO	NA	COMMENTS
	Roundabouts				
74	Does the roundabout design deflect entering traffic sufficiently to ensure that entry speeds are no greater than 50 km/h? Note: It is important to provide angle of deflection as per the standards.				
75	Has the design provided for a clear, safe crossing for pedestrians and cyclists? Is there a conspicuous refuge area?				
	Grade Separators				
76	Are the proposed Grade Separator on the project road simple in layout?				
77	Are the changes in design speeds obvious to drivers and riders?				
78	Can drivers readily identify the direction with minimal need for lane changing?				
79	Are all features of the Grade Separator designed in a safe manner?				
80	Is the spacing between Grade Separator adequate?				
81	Are sight lines open and free of obstruction at all merges and diverges of the Grade Separator? Are the designed lengths of acceleration and deceleration adequate for safety?				
82	Are the distances between decision making points of the Grade Separator sufficient for safety?				
83	Does the design ensure reduced speed on connecting roads to drivers leaving the mainline?				
84	Is directional signing correct, clear and designed to commence well in advance of diverging areas?				
85	Is the signing scheme for each Grade Separator clear and will it be easily understood by road users?				
86	Are all roadside hazards in the Grade Separator identified and safely protected?				
	Intersections				
87	In urban areas –Is there sufficient distance available between (i) the leaving end of grade separator and the merge point of service road to main carriageway; and (ii) between the leaving point of main carriageway to the service road and entry point of grade separator? Note: If sufficient distance is not available in both of the above cases, side-angle or rear-end collision will occur.				
88	In rural areas: Have auxiliary lanes been provided to diverge and merge to the main carriageway at the approaching and leaving end of the grade separator?				

E.2 DETAILED DESIGN STAGE (CONT.)

No.	ASPECTS TO AUDIT – DETAILED DESIGN	YES	NO	NA	COMMENTS
	Roundabouts				
89	Is sufficient visibility towards slip roads available for vehicles coming out of vehicular underpasses? Note: Slip roads must be deflected from the point of exit from the main carriageway until the mouth of vehicular underpass to ensure sufficient visibility and thus safety.				
	Vulnerable Road Users (VRU) – Pedestrians				
90	Have footpaths (raised or at-grade) been provided for safe walking on sections where pedestrians are expected to use the road?				
91	Have street lighting been provided at those locations where pedestrians are expected during dark hours?				
92	Have marked pedestrian crossings been provided? Are they provided at locations where pedestrians are expected to cross the road?				
93	Are the provided pedestrian crossing type appropriate for the class of highway and traffic conditions? Note: Uncontrolled (zebra) crossings are more suited at locations where traffic flows and speeds are low. Where traffic volume and speeds are high, it is advisable to provide controlled (by signals) or grade separated crossings (foot over bridge or underpasses). Uncontrolled crossings shall not be provided at locations where crossing distance is more than 2-lane width.				
94	Are the pedestrian routes clear of obstructions such as signposts, lamp columns, etc?				
95	Are tactile paving and flush kerbs proposed at crossing points?				
96	Will pedestrians be able to cross the road safely? Note: Check particularly for children, old people, persons with disabilities, women, and those carrying children or luggage.				
97	Has an NMT lane (e.g. for cyclists and rickshaws) been provided on the project road? Is the route continuous? Check if the scheme is likely to be used by VRUs.				
98	Is the width of the NMT lane proposed adequate for the traffic volumes expected and mix of traffic?				
99	On sections where VRUs may conflict with motorised traffic, has consideration been given to speed management? Will these sections be low-speed zones (e.g. 30km/h) in accordance with the Safe System Approach?				
100	Are these routes clear of obstructions such as signposts, lamp columns etc.?				

E.2 DETAILED DESIGN STAGE (CONT.)

No.	ASPECTS TO AUDIT –DETAILED DESIGN	YES	NO	NA	COMMENTS
	Vulnerable Road Users (VRUs) –General				
101	Are there speed calming installations in areas with high VRU presence? Note: Particular attention to locations with adjacent residences, market centres or ribbon development.				
102	Check if VRU facilities have been provided at intersections? Are the widths adequate, are the lanes continuous? If signalized intersection, check for adequacy of pedestrian phase.				
	Traffic Signs, Road Markings & Delineation				
103	Do all signs (regulatory, warning, and direction) shown in the design accord with the 8Cs of good signage?				
104	Will sign posts and supports wider than 100 mm in diameter be located outside of clear zone or else be frangible?				
105	Has the design provided for good delineation (curve warning signs, advisory speed signs, guideposts, and chevron alignment markers) where required?				
106	Do the drawings indicate the sheeting material for the traffic signs retroreflective?				
107	Would signs be clearly visible to the traffic? Note: Signs must be provided in an environment free of other distractions (e.g. ad boards). Care shall be taken to ensure that signs are not cluttered.				
108	Is the proposed road marking clear and consistent through the project road?				
	Parking and Public Transport				
109	Has the design provided for bus stops, bus bays, Lay-bys, etc.?				
110	Are there speed calming measures proposed at locations where there will be parking?				
111	Will parking be adequate and safe? Check for adequacy of parking lengths, widths.				
112	Have paved and marked areas been provided for parking? Would they obstruct sight lines?				
113	Are there parking or bus stops proposed at intersections? Check impact on safety.				
114	Is the design for bus stops adequate and safe?				
115	Is the design for rickshaw stops adequate and safe?				

E.2 DETAILED DESIGN STAGE (CONT.)

No.	ASPECTS TO AUDIT–DETAILED DESIGN	YES	NO	NA	COMMENTS
	Emergency Service Vehicle Access				
116	Has provision been made for safe access and movements by emergency vehicles? (e.g. do turning radii at intersections allow for the movement of large fire trucks?)				
117	Are median openings frequent, visible, and well-signed?				
	Lighting				
118	Are the critical locations (intersections, pedestrian facilities, bus stops, Toll plazas) proposed to be lit?				
119	Do the standard drawings indicate the lamp posts will be frangible?				
120	If the columns are not frangible, are other actions proposed to make these safe for road users?				
121	Are lighting columns located in the best positions e.g. behind safety fences and not obstructing walking, cycling and rickshaw routes?				
	Drainage				
122	Does the design provide adequate drainage? Do drainage facilities (e.g. gully spacing, gully locations, flat spots, cross fall, ditches) appear to be adequate? Has consideration been given to mitigating flood events in areas susceptible to high-intensity rainfall (heavy monsoons)?				
123	Will drains be covered, located outside the clear zone, or shielded behind safety barriers?				
124	Are features such as utility covers or gullies located within footpaths or cycle routes?				
125	Are features such as utility covers or gullies located in the likely wheel tracks for motorcyclists or cyclists? Will they cause stability issues for riders?				
	Railway Crossing				
126	Is the railway crossing provided with automatic signalling system?				
127	Are gates operated manually?				
128	Is a central median provided for traffic control?				
129	Do all signs (regulatory, warning, and direction) shown in the design accord with the 8Cs of good signage?				

E.2 DETAILED DESIGN STAGE (CONT.)

No.	ASPECTS TO AUDIT –DETAILED DESIGN	YES	NO	NA	COMMENTS
	Bridges				
130	Has adequate protection been provided to protect road users from roadside hazards on the approach to the bridges?				
131	Are the bridge designed for same cross section as the approaching road?				
132	Are footpaths provided on the bridge? Are these clear of obstructions such as lamp posts and sign poles? Note: Space shall be provided on the bridge for safe walking and standing while undertaking bridge maintenance.				
133	Are parapet heights appropriate for the adjacent road user groups?				
134	Have provisions been made for adequate drainage?				
135	Have hard shoulders or emergency stopping areas been provided on bridges?				

E.3 Contruction Stage Audit

No.	ASPECTS TO AUDIT - CONSTRUCTION STAGE	YES	NO	NA	COMMENTS
	General Aspects				
01	Is a qualified safety officer in charge of traffic management during construction?				
02	Does the Contractor keep a record of crashes on site during construction? Note: Crashes that occur on stretches open to traffic and on the entire project road need to be recorded.				
	Traffic Management Plans				
03	Is there an approved general Traffic Management Plan (TMP) for the project corridor?				
04	Has the Contractor prepared specific TMPs for complicated sites? Note: This includes major bridges and Grade Separators.				
05	Has the TMP been modified from time to time? Note: Specific TMP needs to be updated from time to time as the work area moves.				
06	Does the TMPs (General and Specific) provide adequate and correct signage, delineation, and work site protection (barriers) for all road users under all traffic conditions?				
07	Advance warning zone: are there adequate signs to alert approaching road users of the ongoing road works?				

E.3 CONSTRUCTION STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT - CONSTRUCTION STAGE	YES	NO	NA	COMMENTS
	Traffic Management Plans				
08	Transition zone: are there correct and adequate signs and delineation to guide approaching road users into their correct path?				
09	Are appropriate controls in place at the work zone to ensure traffic is kept safely out of it and away from the workers? Particularly check for safety near deep pits, unstable ground etc.				
10	Does the termination zone have adequate signs to advise road users they are past the road works, and may return to normal road and/or highway speeds?				
11	Are the number of flagmen / traffic controllers on a work zone sufficient?				
12	Are the flagmen conspicuous and placed where they can give clear instructions to approaching road users in advance of the work site?				
13	Are the work zones inspected at day and night?				
14	Are inspection reports maintained?				
	Speed Management				
15	Has the maximum speed through roadworks been spelt out in the TMP? Check if the recommended speed limit is safe. Also align this with the traffic mix and volumes through the roadworks.				
16	Are the speed restriction signs conspicuous and sufficiently installed in the work zone?				
17	Are the guideposts for sign speeds properly fixed to withstand weather and minor disturbances?				
18	Is the sheeting material for speed signs retroreflective? Check for visibility at night.				
19	Are the speed management measures safe, adequate, and practical? Note: These may include enforcement, road humps, signage, etc.				
20	Are the operating speeds through roadworks safe?				
	Roadside Safety				
21	Have the deep pits and excavations been protected so that those do not become a safety hazard for road users?				
22	Have roadside concrete barriers, blocks been removed away from the travel path so that those do not become a safety hazard to the road users?				

E.3 CONSTRUCTION STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT - CONSTRUCTION STAGE	YES	NO	NA	COMMENTS
	Roadside Safety				
23	Are the temporary safety barriers safely installed? Check for end treatments, continuity of the barriers, embedment of the barriers when used to shield deep pits and excavations.				
24	Have safe terminals suitable for the operating speeds through the work site been placed on the end of each section of barrier?				
	Signs, signals, road markings and delineation				
25	Are all necessary warnings, directions, and regulatory signs in place as shown in the General and Special TMPs?				
26	Do all signs satisfy the 8Cs of good signage practice?				
27	Are all unnecessary existing road signs during the works covered to avoid distraction or misinformation?				
28	Have the temporary signs been removed or covered in the road sections where those are not required?				
29	Is delineation through the site safe for all road users under all anticipated conditions? Check particularly during night and rainy weather conditions.				
	Diversions and Detours				
30	Is the work zone fully and clearly closed off to all traffic?				
31	If traffic is to be diverted from one carriageway onto the other, do the advance warning signs provide clear guidance of the diversion ahead?				
32	Are the diversion signs well-located to alert approaching road users?				
33	Is the transition zone delineated (with plastic cones and other forgiving devices)?				
34	Are diversions/ detours of sufficient width for the traffic mix?				
35	Are the diversions adequately maintained to ensure safety is not compromised? Check for maintenance during rains or dry season (dust).				
36	For works that will take several months to complete, has a suitable paved surface been provided along with correct lane markings to guide drivers and/or riders through diversions?				
37	For complicated work zones (Grade Separators, busy intersections etc) have potential safety risks to road users and road workers been assessed and mitigation measures taken? Check for this under Specific TMPs.				

E.3 CONSTRUCTION STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT - CONSTRUCTION STAGE	YES	NO	NA	COMMENTS
	Diversions and Detours				
38	For work-zones with live traffic on the adjacent lanes, have signing, delineation and barricading of excavations been done for safe passage of traffic?				
39	For two-way traffic through work zones, is it safe for all road users, in both day and night-time?				
40	Have adequate merge lengths been provided?				
	Surfacing				
41	Is the road surface suitable for safe movement by all road users, especially small vehicles (including three wheelers)?				
42	Are paved surfaces swept and kept free of loose material including dust, gravel, mud, and sand?				
43	Is the surfacing free of excessive defects such as roughness, potholes, rutting, loose material etc that may impact safety?				
44	Are unpaved surfaces graded regularly to provide a suitable surface commensurate with the posted speed limit? Observe the operational speed of vehicles within the section.				
45	Are surfacing of NMT lanes within work zones paved? If unpaved, are they graded and maintained?				
46	At locations where asphalt surfacing ends, or there is sharp change in level of surfacing, has adequate warning signs been provided?				
	Safety at Night				
47	Are the signs clearly visible at night?				
48	Is the sheeting for the signs retroreflective?				
49	Are the lanes clearly delineated with well-lit/ visible arrow boards that point road users to the lanes to take?				
	Site Access and Road Worker Safety				
50	Are there adequate sight distances at locations of entering and exiting work sites?				
51	Are all access points to work site closed off to public traffic?				
52	Are there appropriate traffic controls measures where works traffic and public traffic interact? Check particularly for conflict points of work traffic with VRUs.				

E.3 CONSTRUCTION STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT - CONSTRUCTION STAGE	YES	NO	NA	COMMENTS
	Site Access and Road Worker Safety				
53	Are all workers and supervisors at the works site wearing good quality reflective vests and/or jackets at all times?				
54	Is there a suitable safety zone in advance of and beside the work site?				
	Vulnerable Road Users (VRU)				
55	Have safe paths been provided for pedestrians and NMT?				
56	Is the path continuous and free of squeeze points and gaps?				
	Drainage				
57	Is the pavement free of depressions or areas where water ponds or sheet-flow of water happens that may impact safety?				

E.4 Pre Opening Stage Audit

No.	ASPECTS TO AUDIT - PRE-OPENING STAGE	YES	NO	NA	COMMENTS
	General Safety Aspects				
01	Is the project road of the same hierarchy as the existing road? If not, has the potential safety risks been addressed?				
02	Where the project road joins an existing road, have the potential safety risks been addressed?				
	Visibility and Sight Distances				
03	Are all sight distances adequate for the road's operating speed?				
04	Are safe overtaking opportunities provided?				
05	Have overgrown trees/ shrubs been trimmed so that signs and sightline are clear?				
06	Is the vertical and horizontal alignment of the project road suitable for the operational speeds?				
07	At locations where alignment is found to be not suitable for the operating speed, have warning signs, speed advisory signs been provided?				

E.4 PRE OPENING STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT - PRE-OPENING STAGE	YES	NO	NA	COMMENTS
	Visibility and Sight Distances				
08	Have adequate warning signs been provided at locations with compromised sight lines?				
09	Have repeated speed advisory signs been provided?				
	Traffic Signs				
10	Do the road signs clearly define routes and priorities?				
11	Are the road signs as per the hierarchy of the project road?				
12	Do all signs satisfy the 8Cs of good signage practice?				
13	Have all superseded signs have been removed?				
14	Are the signs located well advance to the hazard, warning, or intended purpose?				
15	Have too many signs at one location been avoided? Note: Too many signs confuse road users or result into information overload.				
16	Is the sheeting of the signs retroreflective? Are there any early signs or wearing, rusting, peeling?				
17	Where previous signs have been kept, are the signs proper to use? Check if the signs show signs of peeling, rusting, wear and tear.				
18	Is installation of sign proper in terms of embedment and height?				
19	Are signposts, gantry and support placing such that those do not impede the movement of pedestrians and NMT?				
	Traffic Signals				
20	Have traffic signals been located where it can be seen by an approaching motorist at an appropriate distance?				
21	Are there any unnecessary delays on any of the approach legs of the intersection?				
22	Are the Stop and Give Way signs located at appropriate locations so that it is clear to the motorist about who should stop or give way?				
23	Is the pedestrian green phase time adequate for safe crossing of the road by pedestrians?				
	Pavement Marking				
24	Are pavement markings consistent in entire project road and according to guidelines?				

E.4 PRE OPENING STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT - PRE-OPENING STAGE	YES	NO	NA	COMMENTS
	Pavement Marking				
25	Are centrelines and edge lines provided along the entire corridor? Check at no overtaking zones.				
26	Are the markings likely to be effective under adverse light and weather conditions?				
27	Are road studs provided at all critical sections?				
28	Have all superseded road markings been removed adequately?				
29	Are the pavement markings visible at night and provide adequate delineation?				
	Roadside Safety				
30	Have all posts, poles and columns removed / relocate or protected in the clear zone?				
31	Are safety barriers provided at all critical locations? Check for appropriateness of the safety barrier type against the potential risk.				
32	Has appropriate end treatment of barriers been provided?				
33	Are the transitions, continuity, length, height, direction of lapping, spacing of posts, and joining proper in the safety barriers?				
34	Have trees, overgrown bushes, earth embankments and other objects that obscure sightlines?				
35	Are open drains protected in the clear zone?				
36	Are culvert headwalls located such that they are not a roadside hazard?				
	Cross-section and Drainage				
37	Are the shoulders wide enough for emergency parking?				
38	Have shoulder drop offs been removed? Note: Shoulder drop is the vertical height difference between the paved surface and the unpaved shoulder.				
39	Is the condition of pavement surface such that water will drain off after rains instead of accumulating? Check if surface drainage is available.				

E.4 PRE OPENING STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT - PRE-OPENING STAGE	YES	NO	NA	COMMENTS
	Vulnerable Road Users (VRU)				
40	Do VRUs have continuous, adequate connectivity along the project road? Check for points where the road narrows or breaks.				
41	Is there intentional design to deter other road users from using the NMT lane?				
42	Are the pedestrian facilities adequate and safe for the potential pedestrian volumes?				
43	On dual carriageway, have refuge islands been provided at points of pedestrian crossing?				
44	Will pedestrians be able to cross the road safely, based on the design speed?				
45	Are there traffic calming measures where speeds are high, for pedestrians to cross?				
46	Are bus stops located where passengers will use them?				
47	Are the bus stops well-lit and paved?				
	Intersections and Interchanges				
48	Has adequate intersection sight distance been provided from all approach legs? Check for visibility splays and any obstructions including trees, building.				
49	Are priorities clearly understandable at STOP and GIVE WAY intersections?				
50	Are the islands of roundabouts free from objects that obstruct visibility of the approach legs?				
51	Are the merging and diverging areas in a Grade Separator clearly visible?				
52	Are the direction markings and signs on the Grade Separator easily understood?				
53	Is the height of barrier on the ramps at Grade Separators suitable for trucks?				
54	Are the gore areas of ramps passively safe? Note: 'Passively safe' means crash-friendly roadside products, such as lightweight supports for signs, lighting and other roadside items that offer a lower risk of personal injury when struck by a vehicle				

E.5 Post Opening Stage Audit

No.	ASPECTS TO AUDIT – POST OPENING STAGE	YES	NO	NA	COMMENTS
	General Safety Aspects				
01	Have crash data been collected and analysed since completion date?				
02	Is the project road of the same hierarchy as the existing road? If not, has the potential safety risks been addressed?				
03	Have the potential safety risks been addressed at locations where the project road joins an existing road?				
	Visibility and Sight Distances				
04	Are all sight distances adequate for the prevailing speed of traffic using the road?				
05	Are safe overtaking opportunities provided?				
06	Have overgrown trees/ shrubs that prevent visibility of signs and sightlines been removed?				
07	Have adequate warning signs been provided at locations with compromised sight lines?				
08	Have repeated speed advisory signs been provided?				
09	Are the advisory speed limits at curves appropriate?				
10	Are the advisory speed limit signs at intersections near vertical and horizontal curves appropriate?				
	Traffic Signs				
11	Do the road signs clearly define routes and priorities?				
12	Are the road signs as per the hierarchy of the project road?				
13	Do all signs satisfy the 8Cs of good signage practice?				
14	Are the signs located well in advance of the hazard?				
15	Is the sheeting of the signs retroreflective? Check if there are signs that show wearing, rusting, peeling.				
16	Is installation of sign proper in terms of embedment and height?				
17	Are signposts, gantry and support placing such that those do not impede the movement of pedestrians and NMT?				

E.5 POST-OPENING STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT – POST OPENING STAGE	YES	NO	NA	COMMENTS
	Traffic Signals				
18	Are the traffic signals operating as intended?				
19	Is the signal time sufficient to clear traffic queues?				
20	At Stop and Give Way controlled intersections, is it clear which leg of traffic flow should give way or stops? Check for compliance.				
21	Is the pedestrian green phase adequate for safety?				
	Pavement Marking				
22	Are pavement markings provided as required on the entire project road?				
23	Are the markings consistent on the entire project road?				
24	Are centrelines and edge lines provided along the entire corridor? Check at no overtaking locations.				
25	Are the markings likely to be effective under adverse light and weather conditions? Consider rain, night-time etc.				
26	Are road studs provided at all critical sections of the project road? Check for any studs that have come off or are not reflective at night.				
27	Are the pavement markings visible at night? Check if markings are wearing off.				
	Roadside Safety				
28	Have all posts, poles and columns been removed in the clear zone? If not, are they passively safe?				
29	Are safety barriers provided at all critical locations? Check for appropriateness of the safety barrier type against the potential risk.				
30	Are all safety barriers in proper order? If some of them have been hit, check if there are damages that impact performance of the system.				

E.5 POST OPENING STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT – POST OPENING STAGE	YES	NO	NA	COMMENTS
	Roadside Safety				
31	Has appropriate end treatment of barriers been provided?				
32	Are the transitions, continuity, length, height of barrier, direction of lapping, spacing of posts, and joining of barriers proper?				
33	Have trees, overgrown bushes, earth embankments and other objects that obscure sightlines been cleared?				
34	Is the clear zone safe from safety hazards like open drains and side drains? Check for damaged, or missing covers to drains and open sewer holes that are a potential safety risk.				
	Cross-section and Drainage				
35	Are the shoulders wide enough and paved to allow for vehicles to park due to emergency?				
36	Have shoulder drop offs been removed? Note: Shoulder drop is the vertical height difference between the paved surface and the unpaved shoulder.				
37	Is there potential that water may collect on the road when it rains? (Lacking or inadequate drainage facilities). Has consideration been given to mitigating flood events in areas susceptible to high-intensity rainfall (heavy monsoons)?				
38	Is the condition of pavement surface such that water will drain off after rains instead of accumulating? Check if surface drainage is available.				
	Vulnerable Road Users (VRUs)				
39	Do VRUs have continuous and adequate connectivity on the project road? Check for locations where the road narrows or discontinues.				

E.5 POST-OPENING STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT – POST OPENING STAGE	YES	NO	NA	COMMENTS
	Vulnerable Road Users (VRU)				
40	Is there intentional design to deter other road users from using the NMT lane?				
41	If NMT lane is provided over drains, are the drains covered along the entire route?				
42	Are pedestrians using the over and under bridges? Check for pedestrians crossing at grade at locations of pedestrian bridges.				
43	Have refuge islands been provided on dual carriageways? Check if there is spillage of pedestrians on the live traffic lane at the refuge islands.				
44	Do the operating speeds allow safe crossing for pedestrians?				
45	Are there traffic calming measures where speeds are high?				
46	Are bus stops located where passengers will use them?				
47	Are the bus stops well-lit and paved?				
	Intersections				
48	Are all intersections operating efficiently? Note: Check for queues and turning movements at the intersections.				
49	Are the Stop and Give Way intersections operating as intended?				
50	Are the islands of roundabouts free from objects that obstruct visibility of the approach legs?				
51	Do all merging and diverging areas of the Grade Separator have clear visibility?				

E.5 POST-OPENING STAGE AUDIT (CONT.)

No.	ASPECTS TO AUDIT – POST OPENING STAGE	YES	NO	NA	COMMENTS
	Intersections				
52	Check for the decision-making points at the Grade Separator and if they are adequate from safety perspective. This should be checked against operating speeds.	|	|	|	|
53	Are the direction markings and signs on the Grade Separator easily understood?	|	|	|	|
54	Is the height of barrier on the ramps at Grade Separators suitable for trucks?	|	|	|	|
55	Are the gore areas of ramps passively safe? Note: 'Passively safe' means crash friendly roadside products, such as lightweight supports for signs, lighting and other roadside items that offer a lower risk of personal injury when struck by a vehicle.	|	|	|	|
56	Check for the decision-making points at the Grade Separator and if they are adequate from safety perspective. This should be checked against operating speeds	|	|	|	|

E.6 Design and Implementation of Toll Plazas

No.	ASPECTS TO AUDIT	YES	NO	NA	COMMENTS
	Feasibility Stage				
01	Have provisions been provided for road workers (toll booth operatives) to safely access the site?	|	|	|	|
02	Are measures in place to manage vehicle speeds?	|	|	|	|
03	Has the design considered mitigations to improve driver awareness and reduce driver confusion?	|	|	|	|
04	Can motorists merge and change lanes safely?	|	|	|	|

E.6 DESIGN AND IMPLEMENTATION OF TOLL PLAZAS (CONT.)

No.	ASPECTS TO AUDIT	YES	NO	NA	COMMENTS
	Detailed Design Stage				
05	Have provisions been provided for road workers (toll booth operatives) to safely access the site? Note: There may be a need for dedicated crossing facilities for operatives to safely access toll booths?				
06	Are measures in place to manage vehicle speeds? Note: The use of low speed limits (e.g. 20km/h) is advised on the approach to toll booths. There may be a need to gradually decrease the speed limit and use traffic calming measures.				
07	Has the design considered mitigations to improve driver awareness and reduce driver confusion? Note: This includes the appropriate application of signs and markings without the creation any sign clutter.				
08	Can motorists merge and change lanes safely?				
09	Are approach lane alignment, adequate taper length, lane widths, shoulders and clear zones maintained in the Toll Plaza geometry?				
10	Are pavement markings and signage, including overhead signs, speed reduction zone signs, advance toll-rate and payment information, and advance warnings of toll plaza approaches; present and compliant with relevant design standards and recommended spacing? This includes both dynamic message signs and fixed signage.				
11	Are the stopping- and decision-sight distances to the first toll booth unobstructed by structures, landscaping or queuing traffic?				
12	Check that crash cushions or impact attenuators are installed at all leading ends of toll booths, traffic islands, and barriers. Ensure that longitudinal barriers appropriately tie into attenuators, eliminating any exposed blunt ends. Confirm that booth canopies, lighting columns, and equipment bases are either protected by barriers or positioned beyond the shy-line to minimise collision risk.				
13	Are the signs, pavement markings and booth fascias illuminated or retro-reflective? Do they prevent glare to approaching drivers?				

E.6 DESIGN AND IMPLEMENTATION OF TOLL PLAZAS (CONT.)

No.	ASPECTS TO AUDIT	YES	NO	NA	COMMENTS
	Detailed Design Stage (Continued)				
14	Is there potential that water may collect on the road when it rains? Check if drainage facilities are designed adequately. Has consideration been given to mitigating flood events in areas susceptible to high-intensity rainfall (heavy monsoons)?				
15	Is there a provision for a bypass or emergency lane that ensures access for ambulances, fire services, and enforcement vehicles? Does the design include a gate or removable barrier to allow maintenance vehicles to enter safely without the need to reverse onto live traffic lanes?				
	Post Opening Stage				
16	Are the approach lane alignment, adequate taper length, lane widths, shoulders and clear zones maintained in the geometry of the Toll Plaza design?				
17	Are all pavement markings and signs, including overhead signs, speed reduction zones, toll rate/payment info, and advance toll plaza warnings, present and compliant with design standards and spacing guidelines? This includes both dynamic and fixed signage.				
18	Are the stopping- and decision-sight distances to the first toll booth unobstructed by structures, landscaping or queuing traffic?				
19	Check that crash cushions or impact attenuators are installed at all leading ends of toll booths, traffic islands, and barriers. Ensure that longitudinal barriers appropriately tie into attenuators, eliminating any exposed blunt ends. Confirm that booth canopies, lighting columns, and equipment bases are either protected by barriers or positioned beyond the shy-line to minimise collision risk.				
20	Are the signs, pavement markings and booth fascias illuminated or retro-reflective? Do they prevent glare to approaching drivers?				
21	Is there potential that water may collect on the road when it rains? Check if adequate drainage facilities are provided. Has consideration been given to mitigating flood events in areas susceptible to high-intensity rainfall (heavy monsoons)?				
22	Is there a provision for a bypass or emergency lane that ensures access for ambulances, fire services, and enforcement vehicles? Does the design include a gate or removable barrier to allow maintenance vehicles to enter safely without the need to reverse onto live traffic lanes?				

Appendix F
Exemption Note

Date

ROADS AND HIGHWAYS DEPARTMENT

Contract Name

Project Name

F1. PROJECT DETAILS

Project Name _____

Client Name _____

Client Address* _____

Project Director _____

Project Location _____

Project Extents and length _____

Project Duration _____

Financing _____

Project Cost _____

Exception of RSA Stage ☐ *Feasibility* ☐ *Design* ☐ *Construction*
☐ *Pre-opening* ☐ *Post-opening*

* Indicate Wing

BRIEF PROJECT DESCRIPTION

_____

_____

_____

_____

_____

_____

_____

_____

Exemption Note

F2. REASONS FOR EXEMPTION

The Road Safety Division (RSD) has reviewed the details of the project scheme [insert name of project] in accordance with the Road Safety Audit Manual for RHD, 2025 and the Road Safety Audit Policy for RHD.

For the reason(s) set out below, the project road will be exempt from an RSA at stage [insert stage of audit]. Potential safety impacts on road user behaviour of the project have been carefully considered by RSD.

Signature

NAME ↗

DESIGNATION ↗

DATE ↗

Appendix G
Audit Brief

Contract: _____

Contract number: _____

Project name: _____

G 1. AUTHORIZING DETAILS

Brief prepared by _____

Signature _____

Designation _____

Organization _____

Prepared on behalf of _____

Project Director _____

Signature _____

Prepared for _____

Team leader _____

G 2. CONTACT DETAILS

Designer Representative _____

Email _____ Tel. _____

Project Director (RHD) _____

Email: _____ Tel. _____

Traffic Police Representative _____

Email _____ Tel. _____

Audit Brief

G 3. PROJECT DETAILS

Project name _____

Project location _____

Project extent & length _____

Project duration _____

Project completion (%) _____

Financing _____

Project cost _____

RSA stage ☐ *Feasibility* ☐ *Design* ☐ *Construction*
☐ *Pre-opening* ☐ *Post-opening*

Brief project description _____

. _____

G 4. SAFETY DATA

Is crash data provided? ☐ *Yes* ☐ *No*

Speed data provided? ☐ *Yes* ☐ *No*

Existing and forecast traffic flows ☐ *Yes* ☐ *No*

Any other safety data _____

_____

G 5. DESIGN DETAILS

Is design completed?: ☐ *Feasibility* ☐ *Detailed design*

Design report (s) attached? ☐ *Yes* ☐ *No*

Engineering drawings attached: ☐ *Yes* ☐ *No*

As-built drawings: ☐ *Yes* ☐ *No*

Traffic management plans: ☐ *Yes* ☐ *No*

List other documents provided: _____

Audit Brief

G 6. PREVIOUS RSAs

Previous RSA undertaken? ☐ *Yes* ☐ *No*

Which stages of RSA? ☐ *Feasibility* ☐ *Design* ☐ *Construction*
☐ *Pre-opening* ☐ *Post-opening*

RSA report provided? ☐ *Yes* ☐ *No*

Team leader of RSA team: ☐ *Yes* ☐ *No*

Organization _____

. _____

G 7. NOMINATED MEMBERS OF RSA TEAM

NAME ↗ _____ CONTACT DETAILS ↗ _____

DESIGNATION ↗ _____ ORGANIZATION ↗ _____

NAME ↗ _____ CONTACT DETAILS ↗ _____

DESIGNATION ↗ _____ ORGANIZATION ↗ _____

NAME ↗ _____ CONTACT DETAILS ↗ _____

DESIGNATION ↗ _____ ORGANIZATION ↗ _____

G 8. ADDITIONAL INFORMATION

_____

_____

_____

_____

_____

_____

Appendix H
RSA Report Outline

TABLE OF CONTENTS

[H1]
Introduction

Include a brief description of the project, the objectives, major project components. Include the project map and show project extents.

Describe the objectives of this road safety audit, indicate the stage of audit. Describe the approach that will be adopted in undertaking the audit exercise.

Refer to the ToR and the scope of the audit. Indicate that the audit scope has focused only on the opportunities for safety improvements and was not intended to undertake design, consider trade-offs or to endorse specific operational procedures or design.

Include a brief discussion on the need and benefits of the audit scheme. However, this should not be a textbook or manual copy of the audit process.

[H2]
Audit Team

This section should be a maximum of two (2) pages.

List the audit team as appointed by the Project Director. Also include any other member of the team such as the traffic police, counterpart staff or peer auditors that took part in the audit exercise.

Indicate the names, designation, and organizations of the members.

.

Sl No	Name	Designation	Organization
1		Team Leader	
2		Member	
3			

[H3]
Previous Road Safety Audits

This section should be a maximum of four (4) pages.

Report any previous audits carried out on the corridor. Note if the audit report(s) and response report(s) of previous audits were provided as part of the Audit Brief documents.

Indicate if there were any follow up actions on the previous RSA's (as per the response report). If no response report was provided, the Team leader should assume there were no follow up actions unless the Client, RHD has provided any other information.

Highlight key findings raised in the previous audits that have been considered by the RSA team.

Stage of RSA	
Organization	
Team leader	
Month/Year	
RSA report provided?	☐ Yes ☐ No
RSA response report provided?	☐ Yes ☐ No

[H4]
Background Information

This section should be between three to five (3-5) pages. The Team leader to discuss the information received from the Design team as part of the Audit Brief.

Review the documents and information received from the Design team such as design reports, departure from standards report, construction monitoring reports, site photos, etc.

Describe the project corridor, indicating the adjacent land use, main urban centres, major intersections, population, key amenities along the corridor etc.

[H5]

Safety Data Analysis

This section should be between ten to fifteen pages. The length will depend on the data available and length of corridor.

Report on the process of data collection of traffic flow, speed, and crash data. If the data was provided as part of the Audit brief, indicate.

Report on the analysis of the data. Correlate traffic flow and speed data and how the two data sets potentially influence crash risk and severity on the project road.

Correlate with the road geometry on locations that will potentially have higher operating speeds. Review safety operations of the major intersections based on design and flow.

Analyse the crash data to establish crash frequencies and rates. On rehabilitation projects, if historical data is available, use the last three complete years to undertake a reactive safety analysis and identify hazardous locations. Compared with the design and to check if the safety risks persist. For green development, there may not be any safety data analysis for RSA at feasibility and detailed design stages.

For RSA at construction stages, review crashes that have occurred during construction isolating crashes within work zones. Traffic and speed flow data should also be obtained within the open work fronts.

Prioritize typical crashes on the project road as discussed in Appendix B.

Establish the crash rates (per km, per ADT etc.) for sections with high traffic flow, high operational speeds, locations with high volumes of VRU, locations of pedestrians crossing or other factors the Team leader considers may adversely influence safety.

[H6]

Site Inspection

This section should not exceed seven pages. Details of the dates of field visits, duration of the site visit, weather conditions during the exercise and also if both daytime and night time visits were carried out.

List the team that undertook the field review by name, designation, and organization. Photos of the team can be attached as part of the report.

Describe the risk assessment undertaken prior to the field visit and report on precautions, or control measures put in place to minimize, or eliminate, the level of risk identified.

Materials used on site; maps, crash diagrams, measurement gadgets, cameras etc. Describe the field visit process (carried out by increasing chainage, by section etc.) and the method of capturing data/information on site.

Indicate if there were any other visits made during the field work such as visits to engineer's/contractor's site offices, or traffic police offices.

Report on the project construction status as at the time of the field visit. Sections where construction has begun, completed black top, dust, and other environmental conditions etc.

[H7]

General Findings and Recommendations

This section should detail the findings that cut across the project road, or findings that cannot be detailed by chainage or specific location. Some of these can include:

01 Pedestrian crossings lacking at intersections.
02 Width of lanes either too narrow or too wide based on safety considerations.
03 Bus stops or emergency stops absent in the design, yet the traffic mix has public transport vehicles.
04 Traffic signs are rusted, defaced, not reflective, or located within the clear zone the entire project road.
05 Apparent safety risk along the project road at locations with ribbon developments.

The layout of presentation of the section should be as shown in Table G.1.

[H8]

Specific Findings and Recommendations

The layout for specific findings is similar to general findings. However, the findings are specific to the location, with chainage and side of the road (RHS or LHS) indicated if applicable. These are also shown in Table H.1.

Table H.1 Findings and recommendations of an audit

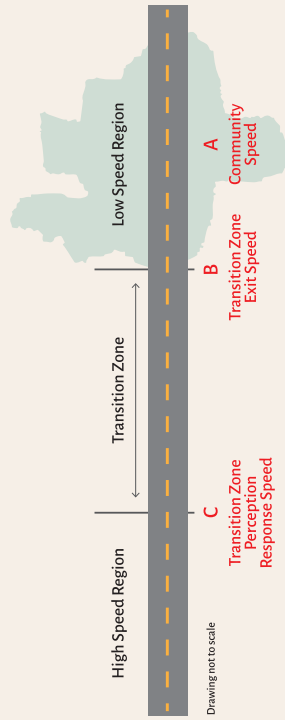
Chainage/Km	Safety Concern	Crash Rating	Severity Rating	Risk	Photo	Recommendation
General	G001: Design speed within urban centres Finding: There are several urban centres and bazaars along the existing project road. Potentially, these locations will have considerable pedestrian traffic when the project road is complete and open to traffic. The adopted design speed is 90 km/h with 50 km/h within the urban centres. Most vehicle-pedestrian crashes along highways occur within built-up areas when pedestrians are crossing the road. Risk: Sharp reduction in speed from 90 to 50 km/h within a short distance is not feasible and potentially, the operating speeds within the urban centres and bazaars may be above the design speed of 50 km/h. At higher speeds, the likelihood and severity of pedestrian crashes greatly increases.	Frequent	Critical	Extreme		1. Within larger urban centres, the design to incorporate well-designed transition zones with explicit traffic control devices and roadway design features that convey the need to reduce speeds and encourage reduction in speeds. At approach to all centres, the design to adopt a stepdown/ intermediate speed from 90 to 70 to 50 km/h.

Table H.1 Findings and recommendations of an audit (Cont.)

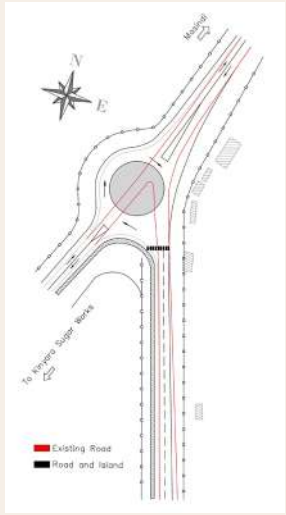
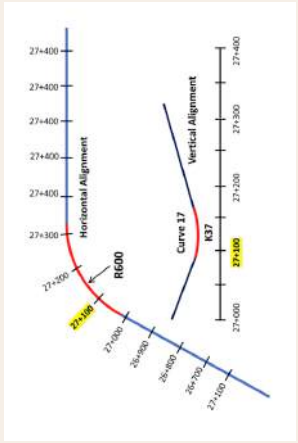
Chainage/Km	Safety Concern	Crash Rating	Severity Rating	Risk	Photo	Recommendation
Specific Section name: Chainage: KM 3+ 400 LHS	S001: Skew angle of intersection [xxx] Finding: This is a three-leg skewed intersection with roundabout control. The road environment at this intersection is characteristically of an urban area. The project road [xxx] intersects with road [xxx]. No traffic data was available, but by the road hierarchy, it is expected there will be considerable traffic and high operational speeds. Risk: Limited sight distance at the skewed intersection will lead to increased risk of side-impact crashes. At skewed intersections, drivers need more time to cross an intersection increasing the exposure time to conflicting traffic and also intersection sight distance.	Likely	Critical	High		Revise the alignment of the approach leg to the intersection to reduce the degree of skewness. This would also help in defining which approach leg has priority. Introduce milled rumble strips at 50m before the roundabout to the roundabout or other measures to reduce approach speeds. Install traffic signs for "crossing pedestrians" and alert the motorists to yield to pedestrians.

Table H.1 Findings and recommendations of an audit (Cont.)

Chainage/Km	Safety Concern	Crash Rating	Severity Rating	Risk	Photo	Recommendation
Specific Section name: Chainage: KM 27+100	S002: Poor combination of sag curve and horizontal curve Finding: At KM 27+100, Curve No.17 is a sag curve with inadequate sight distance (K=37) located within the horizontal curve of radius 600. The design speed for the project road section is 80 km/h. Risk: The sharp horizontal curve at the low point of the sag curve assumes an undesirably distorted appearance. Further, vehicular speeds, particularly of trucks, will tend to be high at the bottom of the grade and erratic operation may result, especially at night.	Likely	Critical	High		Increase the K value of the sag curve and the horizontal curve radius. Install curve warning signs on both sides of the road. Consider installing slope warning signs at approaches to the descent. No overtaking within the curve section.

[H 9]

Conclusion

This section should be maximum of two (2) pages.

Reiterate the scope of the audit exercise.

Highlight to the Client and Design team some of the key risks on the project road based on findings. Indicate if there any findings the Audit team considers for prioritization.

Indicate if there are any findings that have been included that are out of scope (either is terms of geographic scope of audit, or they are infrastructure related).

Indicate the expected next steps following the submission of the RSA report.

[H 10]

Audit Team Declaration

Audit team declaration underscores the following:

01 Confirms that the audit was undertaken in accordance with the guidelines stipulated by the Client, RHD.

02 Confirms the audit team that undertook the exercise.

03 Confirms the scope of the audit, and indicates any disclaimer or aspects not covered in the audit.

A sample audit statement is provided below. However, the Team leader is at liberty to use a different format.

AUDIT TEAM DECLARATION

This RSA report has been prepared to identify opportunities to improve safety on [insert project road]. The role of the RSA team was to complete a safety-focused review of the project road and identify safety issues or concerns that have the potential to improve the safety of the facility under review.

This RSA exercise focused exclusively on opportunities for safety improvements and was not intended to undertake design, consider trade-offs or to endorse specific operational procedures or design earlier adopted. It is acknowledged that some recommendations, upon further investigation, may not be cost effective or feasible, and others may require a long timeframe for implementation.

Ultimately, the implementation of any of these recommendations will require the review and approval of the responsible agencies and stakeholders. It is recommended that the Design Team and the Client review this report, document their responses to the issues identified in a formal response, and track their progress towards the implementation of safety improvements prompted by this assessment.

This report does not preclude the identification of additional issues pertaining to safety or the emergence of new issues over time. The RSA Team believes it has been thorough and diligent in its work, based on the information provided in the Audit Brief, safety data available and field reviews undertaken. The RSA Team notes that, while every attempt is made to be as thorough as possible, no guarantee is made or implied that every issue, deficiency, or hazard has been identified. Furthermore, if all recommendations in this report were followed, this would not ensure that the highway is completely "safe"; rather, incorporating some or all of the recommendations has the potential to improve the overall safety performance of the project road.

We certify that this audit has been undertaken in accordance with the [Road Safety Audit Manual, 2025].

Appendix I
RSA Response Report Outline

Date

Contract: _____

Contract number: _____

Project name: _____

I 1. AUTHORIZING DETAILS

(DESIGN TEAM)

Response report prepared by (Design Team _____

Signature _____

Designation _____

Organization _____

Prepared on behalf of _____

Project Director _____

Signature _____

RSA Team leader: _____

Organization _____

I 2. QUALITY ASSURANCE / QUALITY CONTROL

Date of RSA report _____

RSA report format ☐ Hard copy ☐ Soft copy

RSA stage _____

RSA approved by Client ☐ *Yes* ☐ *No*

Approved on behalf of ROADS AND HIGHWAYS DEPARTMENT, GOVERNMENT OF BANGLADESH

Project Director _____

Signature _____

I 3. RESPONSE TO AUDIT FINDINGS

Finding	Recommendation	Design team's comments	Client's comment	Timeline of implementation

References

01 Road Safety Inspection Guidelines for Safety Check of Existing Roads, 2012. World Road Association (PIARC). *https://www.piarc.org/ressources/publications/7/18718,2012R27-EN-Road-Safety-World-Road-Association.pdf*

02 ADB, Road Safety Improvement Programmes Report, 2014

03 AUSTROADS, Guide to Road Safety Part 6: Road Safety Audit, 2022

04 Canadian Road Safety Audit Guide, Transportation Association of Canada, 2001

05 CAREC Road Safety Engineering Manual 1: Road Safety Audit, March 2018

06 Delivering Road Safety in Bangladesh, 2020

07 Detailed Road Safety Audit of Road Sections of Joydebpur–Mymensingh (N3), Kanchpur-Daudkandi (N1) and Chattogram–Cox's Bazar (N1), Kashinathpur–Rajshahi (N6) and Dhaka–Aricha (N5), 2017 -2018

08 Geometric Road Design Standards, 2005

09 GG 119 Road Safety Audit, United Kingdom, DMRB, January 2020

10 Guidelines for Road Safety Audit, 2005

11 Guide to Road Safety Part 6: Road Safety Audit, Austroads 2022

12 iRAP Road Attribute and Risk Safer Roads Investment Plan Report 2013

13 Manual on Road Safety Audit, Indian Road Congress, November 2010

14 Procedure Note 1: Identifying Hazardous Locations in Bangladesh – Site Selection Technique, 2000

15 Procedure Note 2: Treating Accident Blackspots in Bangladesh, 2000

16 Procedure Note 3: Route Studies in Bangladesh, 2000

17 Procedure Note 5: Area Wide Road Safety Measures, 2000

18 Procedure Note 6: Manual for Road Safety Audit in Bangladesh

19 Procedure Note 7: Monitoring and Evaluating Implemented Schemes in Bangladesh, 2000

20 Procedure Note 8: Accident Studies in Bangladesh, 2000

21 Procedure Note 9: Special Studies in Bangladesh, 2000

22 RHD Management Plan, Volume 4, Technical Services Wing Management Manual, 2003

23 Road Safety Audit Guidelines for Safety Checks of New Road Projects, PIARC 2011

24 Road Safety Audit Manual, Nepal, April 1997

25 South African Road Safety Audit Manual, Second Edition: May 2012

26 Road Safety Audit And Safety Impact Assessment August 1997, European Transport Safety Council. *https://archive.etsc.eu/documents/roadaudit.pdf*

27 Road Safety and Highway Design in Public-Private Partnerships. Hildebrand, Wilson, Morrall. Proceedings of the 18th Canadian Multidisciplinary Road Safety Conference, Whistler, British Columbia, June 8-11, 2008. *https://www.unb.ca/research/transportation-group/_assets/documents/road-safety-and-highway-design-in-public-private-partnerships.pdf*

28 Public-Private Partnerships in Roads. World Bank. October 2021. *https://PPP.worldbank.org/public-private-partnership/sector/transportation/roads-tolls-bridges/road-concessions*