Road Safety Policy & Practice

Contemporary Guidance on Management of Road Safety Audits

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Key Findings

- Road safety audit remains one of main proactive techniques aiming to save lives and reduce severity
- New Austroads guide further incorporates Safe System thinking into road safety audit practice
- Focus on raising awareness of contemporary issues and techniques to promote effective audits
- Consistent with responsibility of road agencies to maximise alignment with Safe System principles

Abstract

Although there is good awareness of road safety audit as a proactive technique for identifying and mitigating road safety related risks throughout Australasia and internationally, local practices in procuring, managing and conducting audits can vary between jurisdictions. This paper provides an overview of recent policy developments and practical guidance in managing road safety audits in Australia and New Zealand

Based on the update (Austroads 2019) of *Austroads Guide to Road Safety Part 6* (AGRS), the guidance aims at maximizing alignment with Safe System principles by integrating them into the audit process. This is achieved through improved awareness of practitioners new to the principles and concepts (especially project clients and project managers) and promoting the conduct of audits to realise their harm minimisation benefits.

Keywords

Road Safety Audit; Safe System; Safe System Assessment Framework; Road Safety Management; Risk assessment; Crash Risk

Introduction

There is a good level of awareness throughout Australia, New Zealand and internationally of road safety audit (RSA) as a proactive technique for identifying and treating road-safety-related risks and hazards on roads with a view to their mitigation. However, local policies and practices in procuring, managing and conducting audits vary between jurisdictions at all level of government and between the public and private sectors, leading to sub-optimal road safety outcomes. A number of influences can be identified, including a lack of clarity in how and when audits and other tools fit within road safety management strategies and the understanding of pressing issues with regard to the procurement, commissioning and undertaking of audits.

As a peak organisation of Australasian road transport agencies, Austroads recognised these issues, and identified a need to revise the exiting guidance in the *Guide to Road Safety* (Austroads 2009) in order to provide practical and contemporary guidance for project managers and practitioners involving in RSA activities. ARRB was engaged by Austroads to scope and prepare a revision of the current Austroads guide as well as to facilitate the consultation process with road safety representatives from the Australian and New Zealand jurisdictions.

Project Objectives

Previous Austroads guidance on the conduct of audits was published nearly a decade ago (Austroads 2009) and it has been recognised that practitioner awareness of and expertise in RSA and the road safety and operational context have changed since then.

The objectives of a project to update the Austroads guide were identified as follows:

- To raise the awareness of practitioners new to the principles and concepts (especially project clients and project managers) and promote the conduct of audits and other assessments to maximise their benefits

- To ensure that practitioners have an awareness of contemporary operating environments and contexts (e.g. the Safe System approach to road safety) and recent developments in road safety risk assessments.

The current 2009 document will be retained in its entirety, but retitled and relaunched as Part 6A: Implementation of Road Safety Audits. The content for a new guide will assume the title of Part 6: Managing Road Safety Audits (Austroads 2019).

Methods and Approach

As shown in Figure 1, the contemprary guidance documented in the revised guide (AGRS Part 6: Managing Road Safety Audits) and in this paper was established by an extensive review of jurisdictional practices and stakeholder engagement, including workshops with the Australian and New Zealand road transport authorities.

Both Australia and New Zealand have commitments to the adoption and implementation of the Safe System approach through the *National Road Safety Strategy*

2011-2020 (Australian Transport Council 2011) and *Safer Journeys: New Zealand's Road Safety Strategy 2010 – 2020* (Ministry of Transport 2010), respectively. To honour this commitment, it is important for road safety policy and processes, including RSAs, to align well with Safe System principles.

Management of Road Safety Audits

This section provides a concise and practical illustration of how RSAs (and other tools) 'fit' within a policy framework and project cycles in a road safety strategy. It recognises the Safe System thinking as a major shift in road safety management, road transport management, road design and traffic management (Austroads 2017a, 2017b, 2017c). As RSAs are one of the most well-known and widespread road safety processes, integrating Safe System thinking into audits is a critical step in ensuring the design and implementation of forgiving road and roadside infrastructure with a safe and credible operating speed environment for any road transport network or initiative.

RSA Practice in Road Safety Management

RSA policy and practice play an important role in road safety management (RSM). RSM at a global level is one of the five pillars of the Global Plan for the Decade of Action for Road Safety (United Nations Road Safety Collaboration 2011), and is integrated into the ISO 39001 Road Traffic Safety Management System (Austroads 2015c, International Organization for Standardization 2012).

RSM places an emphasis on the 'production' of road safety, and just like other goods and services, safety can be produced. The process is viewed as a management system with three levels: institutional management functions, which produce interventions that in turn produce desired results. Day-to-day road safety debate often revolves

Figure 1. Project methods and key milestones (Karndacharuk and Hiller 2018)
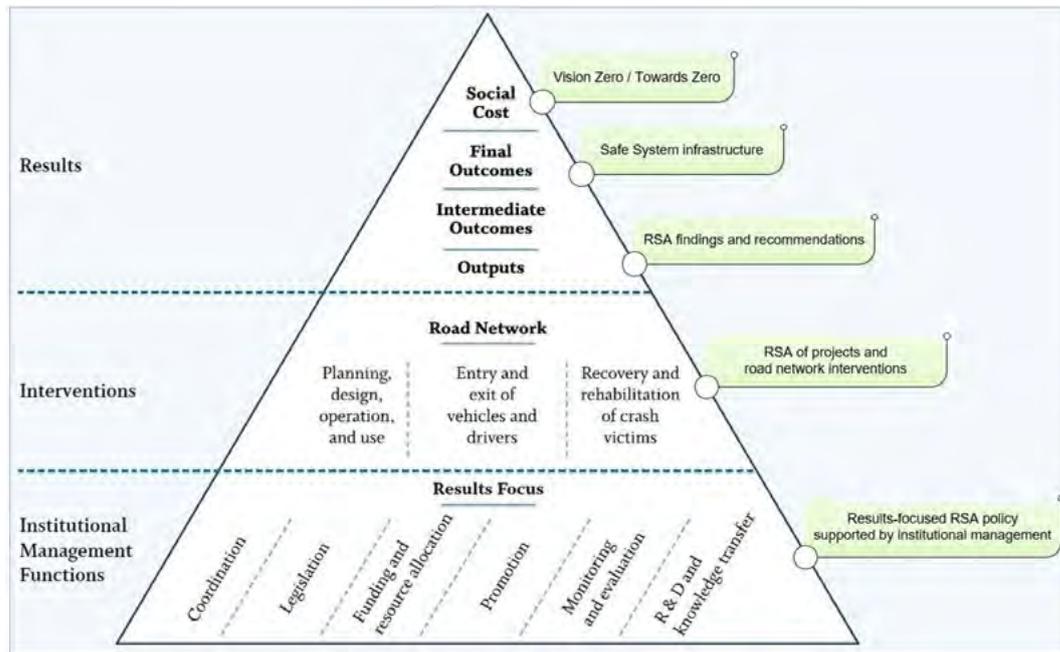
Figure 2. RSA practice in road safety management system (Based on Bliss and Breen 2013)

around interventions alone, and largely ignore the issues of institutional ownership and accountability for results (Bliss and Breen 2013). Figure 2 shows how RSA activities fit within the RSM system.

With the 'Vision Zero' objectives of long-term elimination of deaths and serious injuries, the audit of road transport projects to ensure the safe planning, design, operation and use of the road network is a product of an institute (or jurisdiction) with a Safe System result focus. To align with the RSM system, the key objectives of an effective intervention (World Road Association 2015) for the RSA practice and policy development can be outlined as follows:

• Shifting of focus from crash prevention to death and serious injury prevention;

• Placing an emphasis on the implementation of evidence based approaches to:

  - Reduce exposure to the fatal and serious injury (FSI) risk;

  - Prevent FSI;

  - Mitigate the severity of injury when a crash occurs;

  - Reduce the consequence of injury.

In other words, the jurisdictional policy framework for RSA with effective institutional management (through coordination, legislation, funding and resource allocation, promotion, monitoring and evaluation and research and development, and knowledge transfer) will contribute to the ultimate goal of a Safe System where road users are no longer exposed to death or serious injury on the road network.

RSA in Network-level Road Safety Management

Road safety practitioners emphasise the need to consciously plan to achieve road safety and have traditionally set out to consider and address all crash types and severities (minor, serious and fatal injury) through a blend of reactive and proactive/predictive approaches, where:

• **Reactive** policies and associated activities focus on the analysis of crashes which have occurred to prevent the same/similar crash mechanisms and severities from occurring again at that same location. Activities within this category traditionally include crash investigation and the identification and treatment of crash locations (Austroads 2015a).

• **Proactive** policies and associated activities focus on identifying and/or predicting risks and hazards at a location with the potential to result in crashes. The aim is to mitigate (eliminate or reduce) the risks such that foreseeable crashes do not occur at a location. The commissioning and conduct of an RSA of a design plan or at an operational location falls within this category.

Mass action treatment programs on existing homogeneous lengths of road would also fall within this category. The development of predictive tools, including most recently Australian National Risk Assessment Model (ANRAM), as summarised in Austroads (2018b), now permit risk profiles to be determined. These techniques enable the identification of locations where certain crashes can be reasonably expected to occur and allow mitigation to take place before the crashes occur.
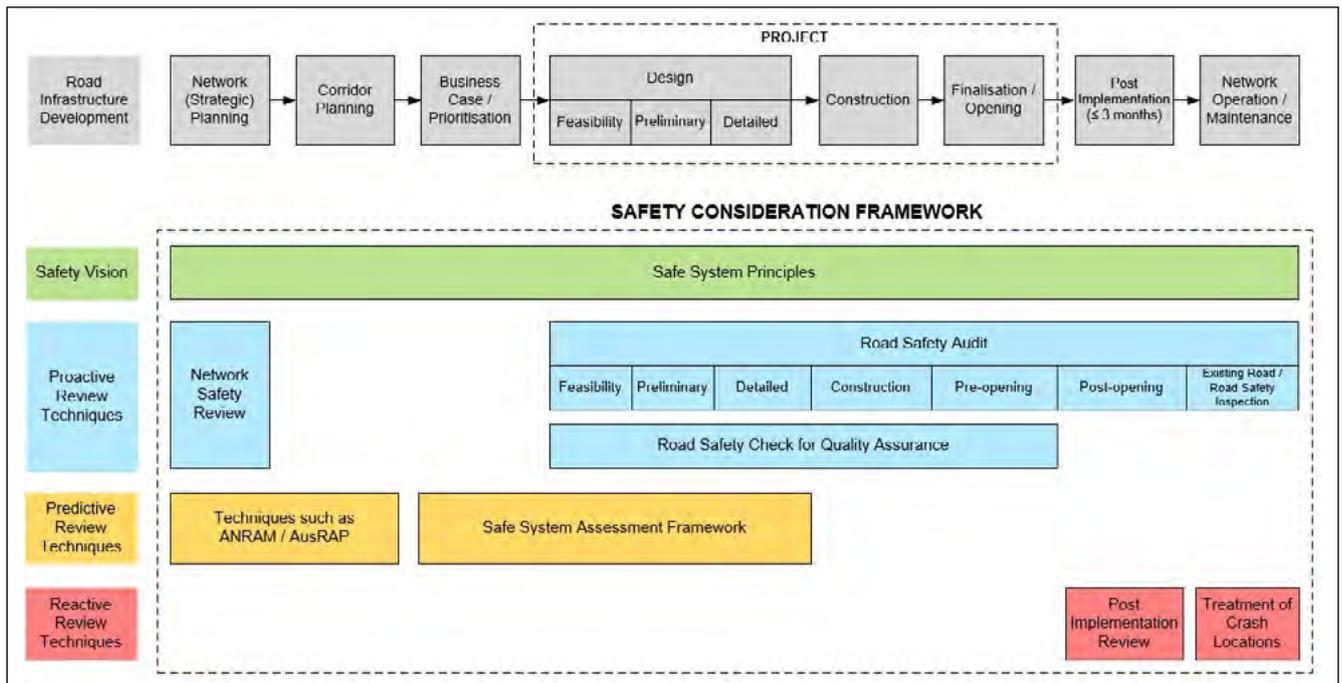
Figure 3. Various approaches and techniques for network and project level road safety management in road infrastructure development life cycle (Austroads 2019)

This traditional approach continues to serve road agencies well and has evolved significantly with time. Rather than contemplating on all types and severities of crashes, the focus now is on eliminating and preventing fatal and serious injury crashes. This concept is often linked to an aspirational, longer-term target of achieving zero fatalities or serious injuries across a road network guided by the Safe System approach to road safety.

Over the last decade, Austroads has researched and published extensively on the principles of how to deliver a Safe System, culminating with the publication of *Towards Safe System Infrastructure – A Compendium of Current Knowledge* (Austroads 2018b). It is important to note that the traditional and contemporary approaches can complement each other, and this is reflected in the compendium where the conduct of RSAs and adoption of a risk assessment tool known as the Safe System Assessment (SSA) within a Safe System Assessment Framework (SSAF) is recommended.

Figure 3 illustrates the traditional and contemporary approaches to network-level road safety management, showing reactive, proactive and predictive safety review techniques and how they can interrelate.

The diagram illustrates the various stages of road infrastructure development activities in the top components (grey boxes), setting out network-level decisions (e.g. the planning of a network and corridors within it) preceding and influencing project-level processes (i.e. from design to construction and to opening) and then on-going operational and maintenance demands. The top components are then aligned vertically with the following road-safety-related activities:

- The application of a safety vision (green boxes) – and the Safe System approach, which applies throughout the process;

- Proactive (blue boxes) – network safety reviews, road safety audits and road safety checks;

- Predictive (orange boxes) – risk assessment models/ tools, including the Australian National Risk Assessment Model (ANRAM) and SSAF;

- Reactive (red boxes) – including post-implementation reviews and treatment of crash locations (blackspot engineering).

Design stage audits and SSAF are shown independently, but can also be applied concurrently, and have been found to complement each other. The SSAF enables the assessment of major crash types in relatoin to key sources of risk i.e. crash severity, exposure and likelihood (Austroads 2016).

Safe System Integration

While RSAs are proven to reduce road trauma, they have traditionally focused on identifying risks and hazards associated with all crash types and severities. The contemporary management approach that prioritises eliminating FSI crashes, recognises the limits of the human body to withstand crash forces and clearly acknowledges human fallibility.

Practical and anecdotal evidence is that many of the planning and network decisions that affect road safety have often already been made even prior to conducting RSAs at the earliest design stages, often without inputs from a road safety and traffic management specialist. This is in contrast to Safe System principles, which can and should be applied throughout the network lifespan.

The additional annotation "**IMPORTANT**" shall be used to provide emphasis to any road safety audit finding that has the potential to result in fatal or serious injury or findings that are likely to result in the following crash types above the related speed environment: head-on (>70 km/h), right angle (>50 km/h), run off road impact object (>40 km/h), and crashes involving vulnerable road users (>30 km/h), as these crash types are known to result in higher severity outcomes at relatively lower speed environments.

The exposure and likelihood of crash occurrence shall then be considered for all findings deemed "**IMPORTANT**" and evaluated based on an auditors professional judgement. Auditors should consider factors such as, traffic volumes and movements, speed environment, crash history and the road environment, and apply road safety engineering and crash investigation experience to determine the likelihood of crash occurrence. The likelihood of crash occurrence shall be considered either "**VERY HIGH**", "**HIGH**", "**MODERATE**" or "**LOW**" and this additional annotation shall be displayed following the "**IMPORTANT**" annotation on applicable findings.

Figure 4. Western Australia's system to rate RSA findings based on crash severity, exposure and likelihood (Main Roads Western Australia 2015)

Embedding Safe System Principles in RSA Practice

For any project, there is a responsibility on the road authority and project manager to maximise alignment with Safe System principles. This can be achieved by applying the principles to the existing RSA processes. The focus of the audit will be on key crash types (leading to fatal and serious injuries) and kinetic energy generation and their management (whereby critical speed thresholds, also known as Safe System speeds, are introduced). The predominant crash types that result in deaths and serious injuries in Australia and New Zealand (Austroads 2016, Marsh & De Roos 2016, Tate & Brodie 2014) are:

- head-on (crashes that occur when one vehicle crosses onto the opposing side and impacts another vehicle, including head-on crashes at intersections);

- intersection (crashes at intersections including side-impacts involving vehicles from adjacent directions, turning vehicles crashes);

- run-off-road (crashes that occur when a vehicle leaves the carriageway without impacting another vehicle, including run-off-road crashes at intersections);

- vulnerable road user (crashes involving pedestrians, cyclists, motorcyclists, the elderly, children and people with special needs).

Rear-end crashes are also an important cause of serious injury based on an analysis of all injuries from road crashes in Australia and New Zealand between 2001 and 2010 (Austroads 2015b).

When undertaking an audit, the following key questions should be raised for each of the safety risks or hazards identified. An affirmative response reflects a high severity risk, and as such is the focus of the subsequent risk assessment (Main Roads Western Australia 2015, Marsh & De Roos 2016):

- Is it possible to have a head-on crash at a speed greater than 70 km/h?

- Is it possible to have an intersection (right-angle) crash at a speed greater than 50 km/h?

- Is it possible to have a run-off-road (side-on) crash at a speed greater than 40 km/h?

- Is it possible to have a vulnerable road user (pedestrian, cyclist and motorcyclist) crash at a speed greater than 30 km/h?

A ranking or scoring system (e.g. high/medium/low) that considers crash severity, crash exposure and crash likelihood can be developed to rate the risks identified in an RSA considering Safe System principles. An example from Main Roads Western Australia (2015) is provided in Figure 4.

Safe System Assessment (SSA)

The SSA is an assessment tool which considers and quantifies the degree of alignment of a particular design or concept with Safe System principles with the objective of minimising fatal and serious injury (Austroads 2016). It is also sometimes referred to as a measure of Safe System compliance.

The SSA is founded on the Safe System Assessment Framework (SSAF) which in turn has a Safe System Matrix as its 'engine room'. This ensures consistent consideration of major crash types and prompts an assessment of the three components of risk management as they apply to each crash type, namely **crash severity, road user exposure** and **crash likelihood**.

When SSAs are undertaken at the early planning and design stages, the need for feasibility stage RSAs (and to a lesser degree preliminary design stage) is lessened. It is possible that an SSA can replace a feasibility or preliminary design RSA. If that is the case, the SSA should follow the key principles of undertaking RSAs. Key principles such as utilising an independent and qualified team and providing a detailed brief are discussed in the following sections of this paper.

It is also important for the subsequent RSAs undertaken at the later stages in the project development and network
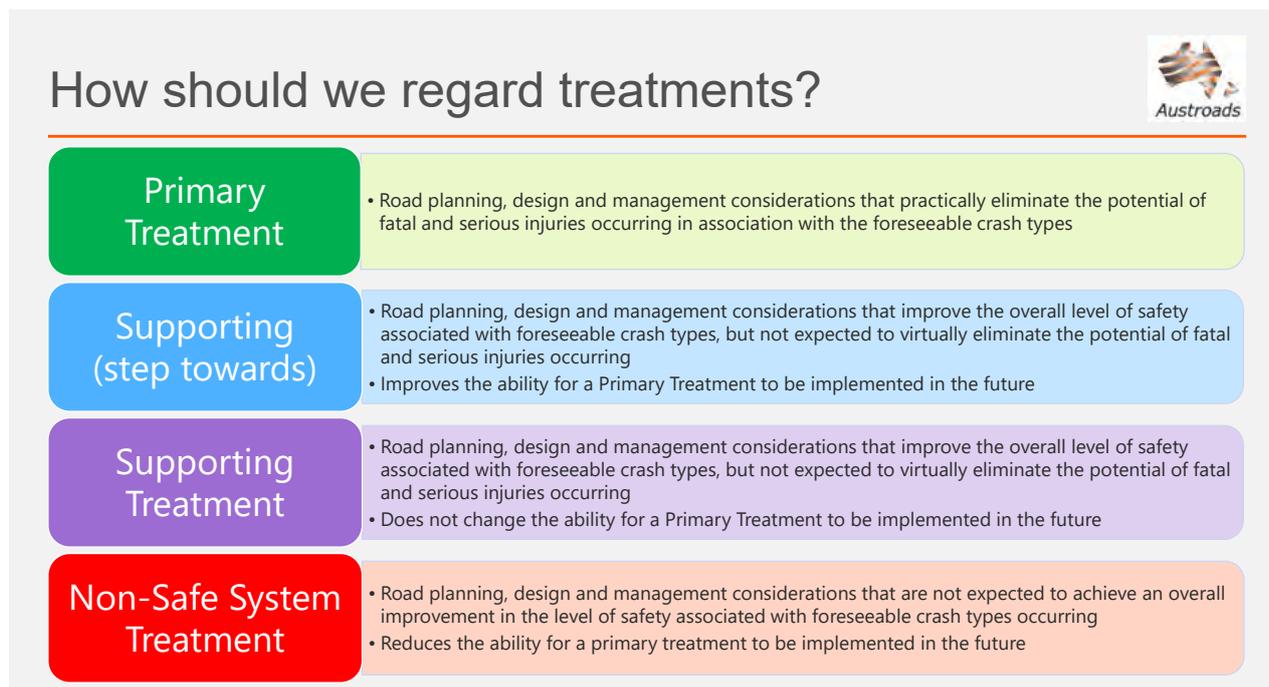
Figure 5. Hierarchy of primary and supportive treatment options (Austroads 2018a)

management cycle to refer to the earlier SSA findings. This is to ensure that the project has not been adjusted or new design features have not been included to lessen alignment with Safe System principles.

Treatment Options

Most jurisdictions and project managers request the audit team to provide RSA recommendations (often in the form of physical infrastructure treatments) to eliminate or reduce the risks identified. It is essential that the treatment option(s) recommended are clearly identified and designed to mitigate a specific risk. Further guidance and options are provided in Austroads (2016) and practitioner tools such as the Road Safety Engineering Toolkit.

It is important to distinguish treatments that provide a high alignment with Safe System outcomes from those that assist in delivering general safety improvements. As shown in Figure 5, a hierarchy of primary and supportive treatment options has been developed (Austroads 2018a). If recommended treatment options are provided in an audit report, the treatments should be categorised into the four Safe System categories. Austroads guidance provides a comprehensive list of treatment options for various key crash types and whether the option affects severity, exposure or likelihood.

Contemporary Guidance in the Audit Process

This section provides clarity on the pressing (contemporary) issues as identified throughout the Austroads project with

regard to the procurement, commissioning and undertaking of audits. These issues also apply to the conduct of emerging risk assessment tools such as SSAs.

The focus of the guidance is for those who perform a 'client' or asset owner role in the audit and risk assessment process. Further information about the guidance can be found in Austroads (2019).

Clearly Defining Roles and Responsibilities

Participants in the RSA process can be generally divided into two groups as shown in Figure 6. The **client team** represents the organisation that commissions a transport infrastructure development project, most typically a state or local road transport agency. The client team can identify a **project sponsor** that is ultimately responsible for the financing of the project delivery and as a result often represents the asset owner or asset manager. The **project manager** is also responsible for procuring, administering and managing the RSA component of the project, which includes

- Drafting and issuing an audit brief
- Identifying and commissioning an audit team
- Liaising with the project designer and the audit team
- Keeping the project sponsor informed, especially with respect to any concerns
- Seeking specialist input, where required, from other disciplines (e.g. strategic planners, network operators, safety engineers, traffic management engineers, asset managers), either within their own organisation or
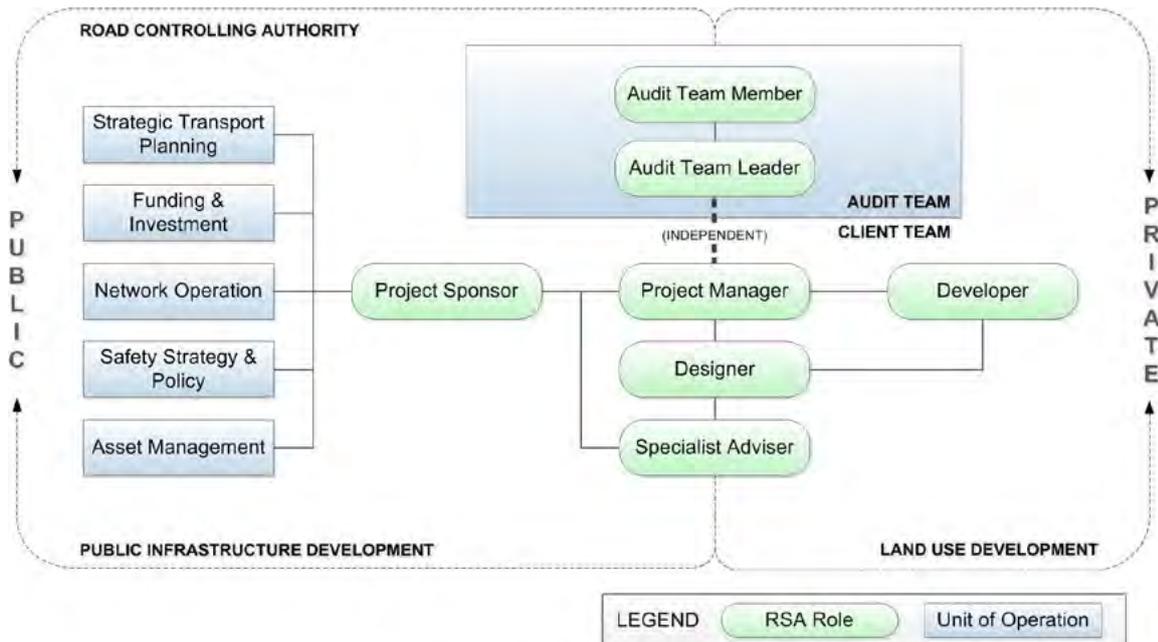
Figure 6. Key roles of client and audit teams in the RSA process (Karndacharuk and Hiller 2018)

procured externally, including in the implementation of the Safe System

- Considering and respond to the audit findings
    - Closing out the RSA by implementing agreed actions to address the identified risks
    - Monitoring the performance of the RSA process
    - Keeping and retaining records of the audit and its findings.

With larger, complex projects commissioned by the public sector or development banks, the client team's project manager can be an externally appointed professional.

The **audit team** consists of at least two members who understand the Safe System approach and meet the requirements of the local RSA policy in terms of professional scope, knowledge, skills and experience (as a minimum, experience in road safety engineering or crash investigation, and knowledge of road design or traffic engineering principles), which often includes a formal accreditation requirement. An **audit team leader** is appointed and is ultimately responsible for the undertaking of the audit and its completion, which includes liaison with the client team.

Private commercial land-use developments often involve the design and provision of new roads or modification of existing roads. While in such instances the developer is effectively the client for the RSA process, involvement of delegates from the road transport authority (e.g. road safety engineer or consent specialist) is required given so that the audit findings are responded to from the perspective of the ultimate asset owner.

Independence of an RSA

What constitutes the independence of audit teams and the process in general, and how to ensure this, have been the subject of recent consideration and debate. This is because the integrity of the audit team must be safeguarded so that it is capable and unhindered in providing objective, impartial and credible judgement in the conduct of an RSA. Potential risks if auditors are not independent and/or have a vested interest can be as follows:

- Risks and hazards are ignored or not properly identified (in terms of exposure, likelihood and severity) and subsequently mitigated.
- Unethical behaviour, breaches of confidentiality and malpractice are not reported.
- Explanations are accepted without checking.
- Undeserved positive feedback is given.
- Records are falsified, incomplete or not kept.

While the concept of auditors being independent of the design team is recognised, in practice, the following signs of dependence can exist in the relationship between the audit team and the client team, which should be recognised and addressed:

- The audit team promotes certain positions held by the project manager or project sponsor/developer.
- The audit team applies limited professional scepticism due to over sympathy.
- The audit team is requested or pressured to effectively design/re-design countermeasures in response to preferred treatment recommendations.

In the context of a public infrastructure project (undertaken by a government agency), the relationship between the project manager and the audit team leader is of particular importance. This is because of the central role the project manager plays in representing the interests of the client organisation (road transport agency authority) in the project development lifecycle and, at the same time, engaging with the audit team leader in a transparent and unbiased manner. It follows that a public-sector project client/sponsor should typically ensure that it has the final say or a right of veto over the appointments within the audit team. As well as supporting the independence principles of audits, this ensures that crash risks are responded to from the perspective of the ultimate asset owner and given the duty of care they ultimately assume.

Preparing an Effective Brief

Preparing an effective brief, including a clear statement of the audit scope and the desired outputs, is critical in the process of procuring and managing audits. The audit brief needs to set out:

- general information
    - Stage (timing) of the audit (e.g. preliminary design, pre-opening)
    - Project location and descriptions
    - Contact details of the client and audit teams
- Project background
    - List of relevant documents (e.g. plans, drawings and visualisation)
    - List of previous audits, SSAs and corrective action reports
    - Key road and traffic characteristics (e.g. volumes, speed environment and crash data)
- Project requirements
    - A clear requirement that the audit should be carried out with a focus on Safe System principles
    - An instruction to carry out the audit in accordance with a recognised guidance document and/or local policy
    - On-site inspections to cover relevant road conditions and/or specific road user groups (e.g. thematic audits)
    - Timeframe and milestones (including provision for commencement and completion meetings)
- Specific considerations
    - Out-of-scope items
    - Audit team composition and particular expertise (e.g. additional expertise required in human factors or a vulnerable road user group)
    - Use of control data, namely evidence-based sources such as Austroads guidelines and research publications, to support the audit findings

A template of the typical brief should be developed to ensure consistency in engaging the audit team. The brief template should identify whether recommendations for treatment options to address issues are required. If so, the recommendations are to be presented in accordance with their alignment with Safe System principles.

Responding to Findings and Closing Out the RSA

When considering the results of an audit, it is critical for the project manager to consider each finding, the importance assigned to it and its alignment with the Safe System principles. For each finding, the project manager must document the rationale and decision-making process in all the decisions ultimately reached. In doing so, the project manager may seek input from the design team and specialist advisors. Any contentious or outstanding issues should be identified for discussion during an interactive completion meeting.

This is an identified area of much concern and poor practice. There are three general options for a client in responding to an audit finding and the associated recommendation/s:

1. Accept the finding and recommendation in its entirety – the next step is straightforward and involves documenting the proposed action(s) in a corrective action report and implementing the agreed changes accordingly.

2. Accept the finding and recommendation in part only – the project manager reaches this decision by undertaking a local context and risk assessment, considering

    - Outcomes from the audit team
    - The project sponsor and designer's assessment of the risk
    - Severity of the harm and effectiveness of the suggested treatments (including improving on the recommendation)
    - Cost and effectiveness of potential alternative treatments.

        Often, due to constraints, only certain aspects of the risk can be addressed through the implementation of the selected treatment(s) in stages (e.g. short, medium and long term). As such, the project manager is required to recognise and document the residual risk associated with the design or certain elements of the road network.

3. Reject the finding and take no action – a project manager may decide to reject the finding and take no action, but should do so cautiously. In these circumstances, it is the project manager's responsibility to justify and document the decision with supporting rationale and evidence.

With regard to the keeping of risk registers to formally log unaddressed risks and issues identified during audits, the

concept is likely to receive further consideration in the future consolidation of the RSA guidance. Formally recording unaddressed risks is considered to be a much more positive outcome than having a number of audit reports that are not being closed out and ultimately ignored.

Conclusions

This paper presents recently collated guidance to road safety practitioners in commissioning and managing audits, primarily through energy management considerations and the SSA method. The guidance places the responsibility of maximising alignment with Safe System principles on the road transport agency through the development of a policy framework and regulatory procedures in utilising the RSA and the interrelated proactive and reactive road safety management techniques.

Clarity in the roles, relationships and independence of the client team, project sponsor, project manager, audit team and audit team leader, together with advice on the important factors in managing an RSA (e.g. the brief and closing out the audit) will help encourage the deligent conduct of all audits, including those in a recent road safety paradigm, to achieve Safe System outcomes.

Acknowledgements

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