

COMPARISON OF THE UPDATED SOUTH AFRICAN ROAD SAFETY ASSESSMENT METHODS (SARSAM 2022) WITH THE SOUTH AFRICAN ROAD SAFETY MANUAL (SARSAM 2012)

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ABSTRACT

The South African Road Safety Assessment Methods of 2022 (SARSAM 2022) replaced the previous South African Road Safety Audit Manual of 2012 (SARSAM, 2012). The SARSAM 2022 is part of the Technical Recommendations for Highways compiled under auspices of the Committee of Transport Officials (COTO), TRH 29.

The Safe System Approach incorporates the principle that humans are frail and that the human body cannot withstand the kinetic energy that is transferred if a collision occurs without being killed or seriously injured. As such it is the responsibility of the road designer (authority) to design a road and road environment that is inherently safe. SARSAM 2012 was updated to incorporate the Safe System principles.

The updated document now consists of three volumes which deals with Road Network Screening, Road Safety Inspections and Road Safety Audits. The accreditation of auditors by Engineering Council of South Africa (ECSA) has progressed and has now been incorporated in the updated methods.

This paper highlights the substantial changes that occurred with the updated document.

1. INTRODUCTION

The South African Road Safety Assessment Methods of 2022 (SARSAM, 2022) replaced the previous South African Road Safety Audit Manual of 2012 (SARSAM 2012). This paper highlights the substantial changes that occurred with the updated document.

The paper is structured with Section 2 providing the history of road safety manuals in South Africa. The Safe System Approach is the rationale behind the updated SARSAM 2022 and an overview of the Safe System Approach is given in Section 3. Section 4 provides an overview of the content of SARSAM 2012 versus the SARSAM 2022 document. The SARSAM 2022 adopted the term accidents instead of crashes and some explanation hereof is given in Section 6. Section 7 deals with changes to the Risk Assessment and the proposed six-step method. Lastly the changes regarding Road Safety Audits are reviewed.

2. HISTORY OF ROAD SAFETY MANUALS IN SOUTH AFRICA

In 1999 the Department of Transport published the first South-African Road Safety Manual that consisted of seven volumes namely:

- Volume 1: Principles and Policies.
- Volume 2: Road Safety Engineering Assessment on Rural roads.
- Volume 3: Road Safety Engineering Assessment on Urban Roads.
- Volume 4: Road Safety Audits.
- Volume 5: Remedial measures and evaluation.
- Volume 6: Roadside Hazard Management.
- Volume 7: Design for Safety.

In 2012 the RTMC developed Volume 4 Road Safety Audits into a standalone document, the SARSAM 2012.

In 2022 the RTMC published the SARSAM 2022. The SARSAM 2022 is incorporated into the Technical Recommendations for Highways (TRH) series of documents, as TRH 29 which is under the auspices of the Committee of Transport Officials (COTO).

3. SAFE SYSTEM APPROACH

The Safe System Approach has developed from the Zero Vision and Sustainable Safety and has been adopted worldwide as the method to manage and develop road safety (iRAP, US DoT, Turner 2016). South Africa's National Road Safety Strategy 2016 to 2030 adopted the Safe System Approach to improve the road safety of South Africa's Road network with the aim to reduce road accident fatalities.

The Safe System Approach accepts that accidents will occur due to human error, but the outcome should not be fatal or result in serious injury. Four components provide a holistic view of road safety namely:

- Safe roads and roadsides.
- Safe speeds.
- Save vehicles.
- Save road users (trained, alert, and compliant).

The Safe System Approach incorporates the principle that humans are frail and that the human body can withstand limited kinetic energy that is transferred if a collision occurs without being killed or seriously injured.

As such it is the responsibility of the road designer (authority) to design a road and road environment that is inherently safe. A critical aspect of the approach is appropriate speeds, speed is not only a factor in the accident potential but also the severity of the accident.

The SARSAM 2012 was based on three strategies namely the Three E model consisting of Education, Engineering and Enforcement, the Haddon Matrix and the Safe Road System. The SARSAM 2022 is based on the principals of the Safe System.

The Safe System principals are death and serious injuries is unacceptable, humans make mistakes, humans are vulnerable, responsibility is shared between stakeholders namely

road users and road authorities, safety is pro-active and redundancy is critical to provide a safe road environment.

4. CONTENTS OVERVIEW

The SARSAM 2012 was structured with three main parts.

Part A provided background to road safety audits in terms of the management, concept of Road Safety Audit's and the Road Safety Audit process.

Part B provided detail description on how to conduct road safety audits on road projects, road appraisals on existing roads and other road safety audits.

Part C described the legal environment pertaining to road safety.

SARSAM 2022 consist of three volumes. The first two volumes, namely Network Screening and Road Safety Assessment have been added to the SARSAM 2022.

The SARSAM 2022 Volume 3 is structured in two parts. Part A deals with the policy and procedures and Part B provide details on the conducting of Road Safety Audits.

The content of volume 3 is shown below.

Part A: Policy and Procedures –

Chapter 1: Introduction.

Chapter 2: Road Safety Audit Process.

Chapter 3: Stages of Road Safety Audit.

Chapter 4: Road Safety Audit Team.

Chapter 5: Administration and Management of Road Safety Audits.

Appendix V3-A which include the legal section of SARSAM 2012.

Part B: Conducting Road Safety Audits –

Chapter 6: Principals for conducting road safety audits.

Chapter 7: Conducting road Safety Audits.

Chapter 8: Road Safety Audit Process.

Chapter 9: Road Safety Audit Stages.

Chapter 10: Thematic road safety audits.

Chapter 11: Road Safety Audit Reporting.

Appendix V3-B.

5. NETWORK SCREENING AND ROAD SAFETY ASSESSMENT

The first two volumes, namely Network Screening and Road Safety Assessment have been added to the SARSAM 2022. These methods were not part of the SARSAM 2012 but are critical tools for road authorities. These two volumes provide curative methods for identification and improvement of hazardous locations, roads, and routes.

The term “Curative” has been adopted in the SARSAM 2022 instead of “reactive approach”. The term suggests a pro-active approach to identify and learn from existing issues on the road network instead of the term “reactive” which suggests waiting for a road safety issue to reveal itself as explained in volume 1 chapter 2.

Volume 1 deals with Network Screening, the process to review the road network with the aim to identify and rank sites in terms of accident potential.

Volume 2 deals with Road Safety Assessment and focus on the proactive approach, the Network Level Assessments, and Road Safety Inspections.

The Network Screening analyses the number of accidents on a road network. The importance of accurate data is highlighted in Chapter 4 as this is the basis of the analysis. This Volume further elaborates on the investigation and analysis of a location, route, or area to identify accident causation factors and the development of countermeasures and a treatment plan. The requirements and methods of monitoring after the implementation of a treatment plan is discussed in Chapter 8.

The Road Safety Assessment, Volume 2 introduces the pro-active approach which is to identify locations where there is a high risk of severe accidents and to address these prior to any accident happening. This volume elaborates on the Institutionalisation of the Proactive Approach as well as the personnel, equipment, and safety requirements. In Chapter 4 the three steps of the proactive approach namely, the network level assessment, the road safety inspection, and the development of a treatment plan, are detailed. The volume concludes with monitoring and evaluation. The monitoring and evaluation are important since knowledge on the effectiveness of road safety treatments in South Africa is limited.

6. ACCIDENTS VERSUS CRASHES

The SARSAM 2012 used the term “crashes”. A crash was defined as “A rare random multifactor event always preceded by a situation in which one or more road users have failed to cope with the road environment.” *SARSAM2012, page 9*. The term “accidents” was not used in SARSAM 2012.

The SARSAM 2022 use the term “accidents”. The change to the accidents has been motivated in the literature review. The intend is that Road Safety Audit (RSA) will become a regulated function and therefore needs to be in line with the National Road Traffic Act, Act 93 of 1996. The South African Traffic Impact and Site Traffic Assessment Manual, TMH 16 of 2012 and South African Road Traffic Signs Manual Volume 2, Chapter 22 used the term “accident” (Roux, 2012).

The term “accidents” according to the Collins internet dictionary means:

“An unforeseen event without an apparent cause, anything that occurs unintentionally or by chance, a misfortune or mishap especially one causing injury or death”.

An accident happens when a vehicle hits a person, an object, or another vehicle, causing injury or damage.

If someone has an accident, something unpleasant happens to them that was not intended, sometimes causing injury or death.” Synonyms are crash, collision.

In conclusion the change to the term “accident” is normally used by the public and is in line with the legislation.

7. RISK ASSESSMENT

Risk assessment is conducted to quantify the potential road safety risk. The risk assessment used with Road Safety Inspections differ significantly from the Road Safety Audits. The differences are detailed in the next sections.

7.1 Risk Assessment for Road Safety Inspections

The risk assessment used for Road Safety Inspections (RSI) as recommended in Volume 2, is determined by a matrix relating frequency of a potential accident and the severity of the potential accident. The rating of the frequency and severity has been amended as shown in the tables below.

The changes in rating means the risk rating of a safety issue will differ between SARSAM 2012 and SARSAM 2022.

Table 1: Accident frequency rating

FREQUENCY	DEFINITION (SARSAM 2022) Volume 2 Table 4.3	DEFINITION (SARSAM 2012) Chapter 3.10.2
Frequent	More than once per year	<i>Once or more per month</i>
Probable	Once every one to three years	<i>Once or more per year (but less than once a month)</i>
Occasional	Once every three to ten years	<i>Once in three years</i>
Remote	Less than once in 10 years	<i>Less frequent than once in three years</i>

Table 2: Accident severity rating

SEVERITY OF OUTCOME	EQUIVALENT ACCIDENT OUTCOME (SARSAM 2022) Volume 2 Table 4.4	EQUIVALENT CRASH OUTCOME (SARSAM 2012) Chapter 3.10.2
Catastrophic	Results in at least one fatality (fatal)	<i>Likely multiple deaths</i>
Serious	Results in at least one serious casualty (serious)	<i>Likely death or serious injury requiring hospitalisation</i>
Minor Marginal	Results in at least one slight casualty (slight)	<i>Likely minor injury</i>
Negligible	Damage-only accident	<i>Likely trivial injury to property damage only</i>

7.2 Risk Assessment for Road Safety Audits

The SARSAM 2022 in Volume 3, Chapter 6.3 adopted a six-step procedure, as summarised and detailed below. The six-step procedure was developed in Australia to comply with the Safe System Approach with a focus on accident severity, accident likelihood and road user exposure:

Step 1: Determine the degree of safety concern.

Step 2: Determine the extent of the safety concern.

Step 3: The Intrinsic Risk is based on the degree and extent of the safety concern.

Step 4: Determine the road user vulnerability.

Step 5: The Road user Risk is based on the Intrinsic Risk and vulnerability.

Step 6: Determine course of treatment or the remedial action.

The Degree of the safety concern is the level of injury that exposure to the safety concern could lead to. The assessment requires the determination of the potential injury that might be caused by the safety concern when using the road with reasonable conditions. The five rating of severe, significant, moderate, minor, or negligible is the anticipated level of injury with a reference to the Maximum Abbreviated Injury Scale (MAIS) classification. The MAIS has been used to define serious road traffic injuries and is standardised terminology to rank the severity of injuries in the medical field, with more details provided in Appendix V3B8.

The Extent of the safety concern is the frequency of the occurrence of the concern or the scale of exposure to the concern. Five categories are available from rare to extensive.

The Intrinsic Risk is the basic risk level of the safety concern and a matrix determined risk level based on the degree of safety concern and the extent of the safety concern. The Intrinsic Risk is a five-category ranking from low risk, moderate, to high risk.

Step 4 is the determination of road user vulnerability. Road user vulnerability introduce the correlation between speed and the risk of fatality (RoF). The RoF in the SARSAM 2022 is based on the Wramborg curves which present the relation between collision speed and the RoF.

The Road-User Risk is the matrix result of the Intrinsic Risk and the Road User Vulnerability. The Intrinsic Risk is adjusted by the speed related Vulnerability to determine the Road-user risk, which is a four-category rating from low risk to very high risk. This step concludes the risk assessment process.

Step 6 is to determine remedial action with substantial scope during the design stages of the project and lesser options during the construction and pre-opening stages.

The six-step method has a good theoretical support and support the Safe System Approach. The concept has been accepted as correct but there are challenges to the correct relationship between speed and RoF has been studied and alternative relations than Wramborg curves has obtained (Jurewicz, 2015; SARSAM 2022, Volume 3 Ch 6.2).

The risk rating should provide the necessary motivation for implementing suitable mitigation measures. The risk assessment of RSA and Road Safety Investigations are currently different, without any known substantiation.

8. ROAD SAFETY AUDITS

8.1 Definition

The RSA definition as per SARSAM 2022, with changes from the SARSAM 2012 is as follows:

Road Safety Audit is a formal *technical assessment* of a new *road* or *traffic* project, where interaction with road users takes place, in which an independent and qualified team *pro-actively* identifies potential road safety problems and suggest measures to mitigate those problems *applying the Safe System principles*. (SARSAM 2022, volume 3 chapter 2; SARSAM 2012, page 5)

The revised definition confirmed that the Safe System principals need to be applied when conducting RSAs in a pro-active manner.

The importance of using technical assessment techniques in the audits is highlighted.

The scope of RSA's has been increased to include traffic related projects.

8.2 Stages of Road Safety Audit

The SARSAM 2012 identified the following stages in a project when an RSA should be conducted.

- Stage 1 Feasibility Design Audit.
- Stage 2 Draft Design Audit.
- Stage 3 Detail design Audit.
- Stage 4 Work Zone Audit.
- Stage 5 Pre-opening Audit.

SARSAM 2022, Chapter 3, and Chapter 9 define the stages when RSA can be conducted. These stages have not changed in the SARSAM 2022, but the description of Stage 1 was changed to Concept Design Audit and Stage 2 to Preliminary Design Audit.

SARSAM 2022 includes a sample Road Safety Audit policy for road authorities to stipulate their requirements regarding which stages to be subjected to RSA.

The SARSM 1999 had a Stage 6 Road Safety Audit on existing facilities which was amended in SARSAM 2012 to Road Safety Appraisal or Road Safety Audit on Existing Roads (SARSAM 2012, chapter 5). In SARSAM 2022 audits on existing roads are known to a Road Safety Investigation (RSINV). (SARSAM 2022, Volume 3, chapter 3.5.3).

8.3 Road Safety Audit Team

The RSA team should consist of an Audit Team Leader and a minimum of one Audit Team Member, thus two persons, as detailed in SARSAM Volume 3, Chapter 4. The requirement of the Team Leader and Team Member for an interim period remains the same as specified in SARSAM 2012. The interim period is three years or as indicated by the road authority.

The future requirement for RSA Team leader will be registered as a Senior Auditor by the Engineering Council of South Africa with post-nominal accreditation RSAud(S) or a holder of a recognised international certificate of competence and experience of road safety auditing in South Africa.

The accreditation of auditors by Engineering Council of South Africa (ECSA) has progressed. The registration of Road Safety Auditors is located under the Specified Categories. The ECSA training guide date 30 April 2021 and the registration document dated 9 February 2022 is available on the ECSA webpage. The minimum requirements needed to gain accreditation as a road safety auditor is registration as a Candidate with the supporting qualification, as least three years of relevant experience and the completion of training courses within the last five years. The requirement for a Team leader is a registration as a Professional Engineer, Technologists or Technicians with the supporting qualification, eight years of relevant experience and the completion of the training courses (Mtshali, 2021).

8.4 Road Safety Audit Reporting

The SARSAM 2022, Chapter 11 is less prescriptive on the format of the RSA report and the recommended report content is similar to SARSAM 2012, but sample proforma's are provided in the Appendix.

SARSAM 2022 requires that the design team shall respond to all the road safety concerns raised in the RSA and the decision for implementation or close-out recorded on behalf of the client organization. In SARSAM 2012 the responsibility to respond was left to be decided by the client and design team. SARSAM 2022, Chapter 5.4 provide more details and guidance for the client and design team on the close out of the RSA.

9. CONCLUSION

The South African Road Safety Assessment Methods of 2022 (SARSAM 2022) replaced the previous South African Road Safety Audit Manual of 2012 (SARSAM 2012). This paper highlights the substantial changes that occurred with the updated document.

Section 2 provided the history of road safety manuals in South Africa.

The Safe System Approach is the rationale behind the updated SARSAM 2022 and an overview of the Safe System Approach is given in Section 3. The Safe System Approach requires a Mindshift in terms of our road network and the operation thereof.

Section 4 provides an overview of the content of SARSAM 2012 versus the SARSAM 2022 document.

The SARSAM 2022 adopted the term accidents instead of crashes and motivation thereof is explained.

Changes to the Risk Assessment was introduced with SARSAM 2022 and the introduction of the six-step method required some elaboration.

Changes to Road Safety Audits were reviewed including the new accreditation of road safety auditors with ECSA.

The SARSAM 2022 is currently in draft format and will be reviewed in two years' time prior to the issue of the final version. Practitioners have an opportunity to comment on the document.

10. REFERENCES

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