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SOUTH AFRICA

# Sub discipline-specific Training Guide for Registration as a Road Safety Auditor in Specified Categories

## R-05-RS.Aud-SC

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ECSA

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## DEFINITIONS

**Engineering science:** A body of knowledge based on the natural sciences and using mathematical formulation where necessary that extends knowledge and develops models and methods to support its application, solve problems and provide the knowledge base for engineering specialisations.

**Engineering problem:** A problematic situation that is amenable to analysis and solution using engineering sciences and methods.

**Integrated performance:** An overall satisfactory outcome of an activity requires several outcomes to be satisfactorily attained. For example, a design requires analysis, synthesis, analysis of impacts, checking of regulatory conformance and judgement in decisions.

**Level descriptor:** A measure of performance demands at which outcomes must be demonstrated.

**Management of engineering works or activities:** The co-ordinated activities required to:

(a) direct and control everything that is constructed or results from construction or manufacturing operations

(b) operate engineering works safely and in the manner intended

(c) return the engineering works, the plant and the equipment to an acceptable condition by the renewal, replacement or mending of worn, damaged or decayed parts

(d) direct and control the engineering processes, systems, commissioning, operation and decommissioning of equipment

(e) maintain engineering works or equipment in a state in which it can perform its required function.

**OPC UA:** OPC Unified Architecture is a machine-to-machine communication protocol for industrial automation developed by the OPC Foundation.

**Over-determined problem:** A problem for which the requirements are defined in excessive detail, making the required solution impossible to attain in all its aspects.

**Outcome:** A statement of the performance that a person must demonstrate to be judged competent at the *professional* level.

**Practice area:** A generally recognised or distinctive area of knowledge and expertise developed by an engineering practitioner by virtue of the path of education, training and experience followed.

**Range statement:** The required extent of or limitations on expected performance stated in terms of situations and circumstances in which outcomes are to be demonstrated.

**Specified Category:** A category of registration for persons registered through the Engineering Profession Act, 46 of 2000 or through a combination of the Engineering Profession Act and external legislation who have specific engineering competencies at NQF Level 5 regarding an identified need to protect the safety, health and interest of the public and the environment in the performance of an engineering activity.

## ABBREVIATIONS

| | |
|---|---|
| **C&U** | Commitment and Undertaking |
| **DSRR** | Discipline-specific Requirements Report |
| **ECSA** | Engineering Council of South Africa |
| **NMT** | Non-motorised transport |
| **RSACs** | Road Safety Audit Candidates |
| **RSAud** | Road Safety Auditors |
| **SANRAL** | South African National Roads Agency Limited |
| **TERs** | Training and Experience Reports |
| **TES** | Training and Experience Summary |
| **VA** | Voluntary Association |
| **VRUs** | Vulnerable road users |

## BACKGROUND

The documents that define the Engineering Council of South Africa (ECSA) system for registration in professional categories are shown in Figure 1 below which also locates the current document.

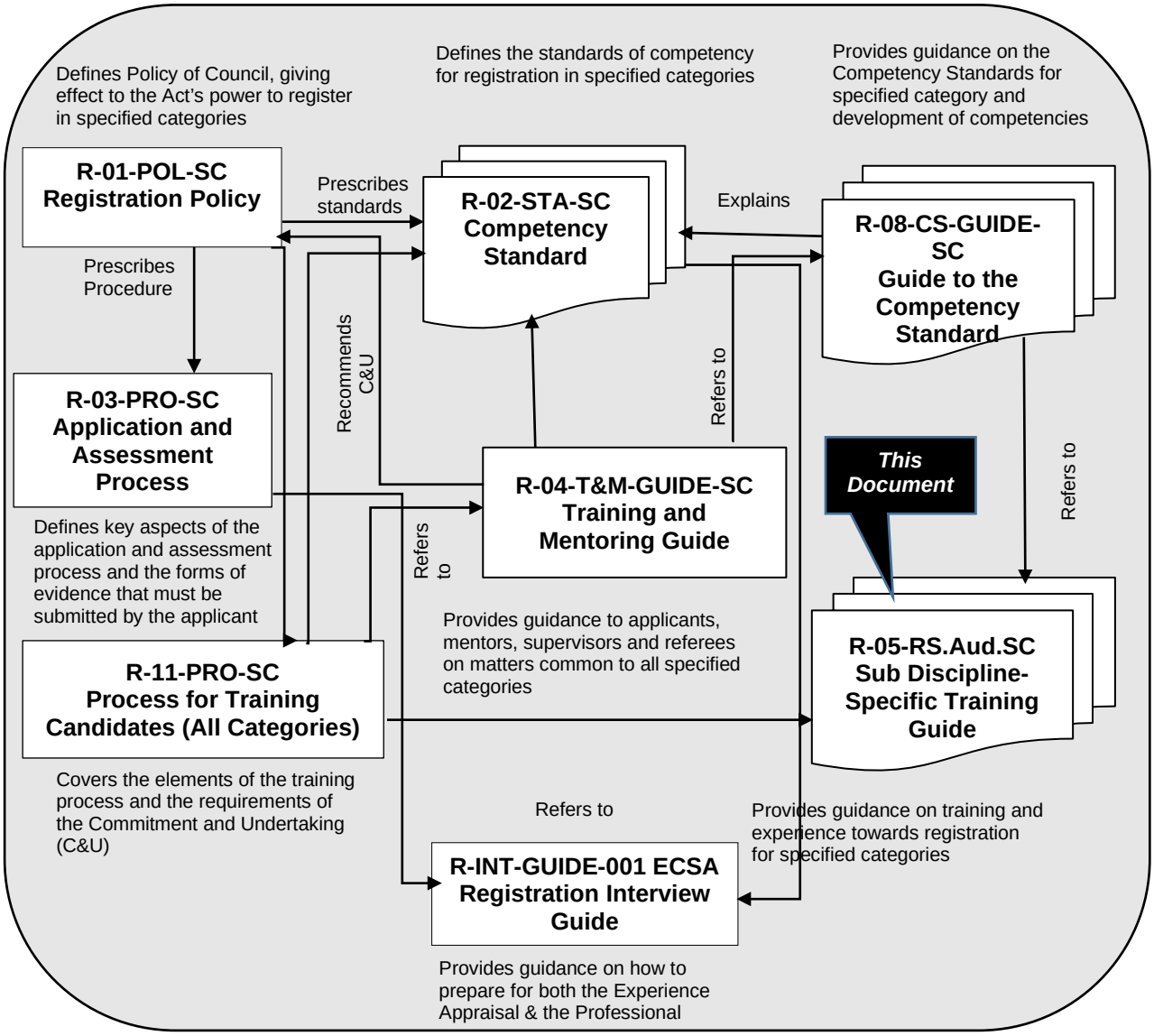


**Figure 1: Documents defining the ECSA registration system**

## 1. PURPOSE OF THIS DOCUMENT

All persons applying for registration as a professional Road Safety Auditor are expected to demonstrate the competencies specified in document **R-02-STA-SC** at the prescribed level, irrespective of the trainee's discipline, through work performed by the applicant at the prescribed level of responsibility.

This document supplements the generic *Training and Mentoring Guide* **R-04-T&M-GUIDE-SC** and the *Guide to the Competency Standards*, document **R-08-CS-GUIDE-SC**.

In document **R-04-T&M-GUIDE-SC**, attention is drawn to the following sections:

- Duration of training and period working at level required for registration
- Principles of planning training and experience
- Progression of training programme
- Documenting training and experience
- Demonstrating responsibility.

The second document, **R-08-CS-GUIDE-SC**, provides both a high-level and outcome-by-outcome understanding of the competency standards as an essential basis for this Discipline Specific Training Guide (DSTG).

This guide, as well as **R-04-T&M-GUIDE-SC** and **R-08-CS-GUIDE-SC**, are subordinate to the *Policy on Registration* (**R-01-POL-SC**), the *Competency Standard* (**R-02-STA-SC**) and the application process definition (**R-03-PRO-SC**).

## 2. AUDIENCE

This guide is directed to candidates and their supervisors and mentors in the sub-discipline of Road Safety Auditing including Senior Road Safety Auditors, Road Safety Auditors and Candidate Road Safety Auditors. Provision is made for non-engineering Road Safety Auditors through a separate registration process administered by the Road Traffic Management Corporation (RTMC). This guide is, however, also useful for the development of specialist non-engineering road safety audit team members.

The guide is intended to support a programme of training which the candidate will use to gain the necessary experience that incorporates best practice elements.

This guide applies to persons who:

- have completed the tertiary educational requirements in Civil Engineering related qualifications BSc Eng, BEng, B-Tech or NDip from a recognised tertiary university in South Africa, or a Washington Accord-recognised qualification, or through evaluation/assessment; and/or
- have registered with ECSA as Professional Engineers – Technologists or Technicians; and/or
- have embarked on a process of an acceptable training under a registered Commitment and Undertaking (C&U) programme, under the supervision of an assigned mentor guiding the professional development process at each stage.

## 3. PERSONS NOT REGISTERED AS A CANDIDATE AND/OR NOT BEING TRAINED UNDER C&U

All applicants for registration as a road safety auditor must present relevant evidence of competence and be assessed against the same competency standards irrespective of the development path followed. Applicants for recognition as non-engineering members on road safety audit teams are administered separately by the RTMC through procedures to account for and record the relevant qualifications and experiences of such applicants that want to develop or contribute specialisation in road safety audit team collaboration with respect to relevant non-engineering road safety knowledge areas.

Mentorship and adequate supervision are, however, key factors in effective development to the level required for registration. A C&U indicates that the company is committed to mentorship and supervision.

If the trainee's employer has no C&U in place, the trainee should establish the level of mentorship and supervision the employer is able to provide. In the absence of an internal mentor, the services of an external mentor should be secured. The recognised Voluntary Association (VA) for the sub-discipline should be consulted for assistance in locating an external mentor.

A mentor should be in place through all stages of the road safety auditor development process. This guide is aimed primarily at the recent graduate who is training and gaining experience

toward registration. Concomitantly, mature applicants for registration may apply the guide to identify possible gaps in their development. Applicants who have not enjoyed mentorship are advised to request an experienced mentor (internal or external) to act as an application adviser while they prepare their application for registration.

This guide may also be applied in the case of a person moving into a candidacy programme at a later stage that is at a level below that required for registration (see **Section 9.3**).

## 4. ORGANISING FRAMEWORK FOR OCCUPATIONS

### 4.1 Road safety auditors

A road safety audit is a proactive road safety checking tool with proven international success. Road authorities obviously need not wait for the accumulation of serious injury and fatal accidents before positive steps can be taken to reduce such accident risk. Furthermore, road safety audits play a significant role in ensuring that the road environment provided is forgiving, self-explaining and provides for the needs of all road users aligned with the principles of contemporary road safety management practices, e.g., the Safe System approach.

Road safety audits may be conducted at any stages within the life cycle of a roads project (from conception to the final constructed project). However, given that South Africa is currently in a process of road safety audit capacity development, road authorities must endeavour to introduce road safety audits at specific stages of relevant projects which will provide the highest road safety return, for such investments. Therefore, road authorities, together with their partners and service providers, must endeavour to develop road safety auditing capacity through the initiation and promotion of recognised and accredited road safety audit courses, and the creation of opportunities to gain appropriate road safety audit experience. These organs of state need to put in place a programme whereby elected members of staff are trained with the specific goal of registration as road safety auditor. Ongoing work-based learning and industry courses need to be maintained so that accreditation is maintained through continuous professional development.

A road safety audit is conducted by a road safety audit team led by a road safety audit team leader. The size of the road safety audit team is dictated by the size, complexity and stage/s of the project to be audited. Generally, the road safety audit team will comprise a road safety

audit team leader and at least two additional audit team members. The audit team leader is the lead auditor that is responsible for compiling the road safety audit report and representing the audit team when engaging with the road authority/project owner (e.g., the client). The audit team members assist, collaborate and contribute to the road safety audit.

To promote road safety audit capacity development, a road authority may at its sole discretion allow an additional road safety audit team member who is under the direct employ of the road authority or the engineering service provider (normally the lead consultant), provided that the road safety audit member signs a declaration and undertaking that he/she is not and will not be directly involved in any stage of design of the project that is to be audited.

The organising framework for road safety auditor registration under the specific categories is depicted in the matrix of minimum requirements presented in the table in Section 11.

### 4.2 What is a road safety audit?

A road safety audit is defined as “the formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users”.

Road safety audits differ from conventional traffic safety studies in two important ways:

- Road safety audits are often pro-active investigations, rather than reactive investigations of sites with histories of complaints or poor safety performance.
- The investigation team is independent from the person that is designing the project or the organ that maintains the road.

A key feature of a road safety audit is the use of a team of professionals with varied expertise. The team should include members with experience as road safety engineers, road design engineers, maintenance personnel and other non-engineering road safety functionaries, e.g., law enforcement, road safety education, etc. Additional specialists may be added to the team as needed, e.g., road user behaviour specialists, public transport planners, etc. The team members must not have been or proceed to be involved in the design or maintenance of the facility being examined so the highest levels of objectivity are achieved.

The road safety audit may investigate overall safety conditions or it may focus on specific themes, concerns or users. Non-motorised transport (NMT) audits, for instance, concentrate on NMT user safety and spatial accommodation of pedestrians and cyclists, whereas transit audits focus on the safety of bus and train users. Another process to be employed is the use of audit techniques to recommend simple but effective safety improvements in conjunction with road resurfacing projects that help to prevent accident rate increases due to increased driving speeds immediately following road resurfacing or other road improvement projects.

Road safety audits attempt to avoid some of the limitations inherent to any accident history scoring system. Some of these limitations are as follows:

- Reactive systems – these require waiting for evidence (or a history) of accidents with accompanying damage, injuries and fatalities to develop.
- Accident frequencies are subject to regression toward the mean. It can be difficult to determine whether good or poor short-term safety performance is due to the inherent safety or hazards of the site, or random variation. Sites with high or low accident rates are likely to move towards the mean as a matter of course, even if nothing changes.
- Most procedures currently followed focus on sites that have experienced high accident statistics, which may or may not be the sites that could benefit most from safety improvements.
- Reactive systems – these are limited by the quality and timeliness of the data captured. Deficiencies in accident reporting limit the measure of effectiveness of these systems.

If historical accident data is available, the audit team could make use of them. However, one of the audit process strengths is that it can identify safety concerns before they contribute to accidents. Moreover, a lack of data is a good reason to implement the audit process, rather than an excuse not to.

There are three basic forms of road safety audit:

**Audit of an existing road or road network:**

- To check a road or a network for consistency to make sure that a road user does not encounter unexpected road safety issues.

**Audit of a roadworks project at various stages of development:**

- Feasibility stage or project scoping when the general nature of the project is determined.
- Preliminary design stage, when alternative courses of action for the project are analysed, and then either selected or discarded.
- Detailed design stage.
- Construction stage to ensure work zone traffic controls and the accommodation of traffic plans are effective in protecting road users and construction workers.
- Post construction stage, to make sure the completed project is performing as intended.

**Thematic audit:**

- Thematic audits focus on particular aspects of a road and/or road users. They may be used to investigate road safety issues brought up by road user groups, or audits conducted to support a land development application.

A key requirement before substantially upgrading road infrastructure safety is the implementation of a comprehensive programme for the improvement of road safety, as applies in a number of developed countries. An example of the institutionalisation of road safety audits in Europe is Directive 2008/96/EC through which road safety audits became compulsory for all road infrastructure improvement projects. Locally, there is some progression towards institutionalisation, for example, the South African National Roads Agency Limited (SANRAL) has requirements that road safety audits be conducted on road designs. The Department of Transport has introduced conditions regarding Provincial Road Maintenance Grant expenditure with requirements to report on the number of road safety audits conducted on new, upgrading and rehabilitation projects, the number of road safety appraisals conducted and the number of kilometres of road safety network level assessments. Given a road safety audit is only a road safety audit if:

- a client formally issues an instruction to an auditor to conduct a road safety audit
- the auditor records the findings and recommendations in a formal written report (signed by the lead auditor)
- the client informs the auditor in writing what action will be taken regarding the findings, which recommendations will be followed and which will not and why.

These three points reflect that institutionalisation of road safety audits in South Africa has some way to go to derive optimal benefit through the road safety audit, appraisal and assessment procedures. Integrated road infrastructure safety management concerns the obligations of those responsible for road infrastructure and traffic monitoring to conduct road safety audits (during the design and construction phases), as well as road safety inspections (during the operating phase) and the management of high-risk sites and road impact assessments. The aforementioned comprise the four core methodologies for identifying road safety concerns and their countermeasures in all the stages of design, through construction and throughout operation of the infrastructure, both proactively and correctively.

For the implementation of integrated road infrastructure safety management, it is necessary to define specific procedures related to the training and responsibilities of auditors, the data which are collected and utilised, as well as the relevant good practices that should be used to address the road safety issues that have been identified.

For the successful implementation of road safety audit, training and follow-up or refresher courses must be planned for road safety auditors and it is essential to develop a specific training curriculum, as well as educational material for candidate road safety auditors as well as for the continuous professional development (CPD) of road safety auditors and senior road safety auditors.

# 5. NATURE AND ORGANISATION OF THE INDUSTRY

## 5.1 Road safety audit objectives and benefits

A road safety audit is defined as “the formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team”. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users.

Road safety audits need to be conducted in the project stages defined by the South African Road Safety Audit Manual to promote the importance of traffic and road safety engineering in achieving a Safe System through the following related objectives:

- Eliminate high risk roads and hazardous locations.
- Improve the standards of road design to ensure that all road users are given adequate protection and information with special focus on vulnerable road users (VRUs), especially pedestrians.
- Ensure road design is forgiving, thus allowing motorists to recover from error or incur least harm when an accident is inevitable.
- Ensure the inherent safety (safety by design) in the provision of new and upgraded road infrastructure.
- Develop road safety auditor, road safety assessment and road safety engineering capacity.
- Develop a culture of road safety among those responsible for the delivery and maintenance of road infrastructure.

Some of the advantages of road safety audits include:

- the production of designs that reduce the number and severity of accidents
- reduction of costs by identifying safety issues and correcting them before projects are built
- promoting awareness of safe design practices
- integrating multimodal safety concerns
- considering human factors in all facets of design
- reducing the number and severity of road-related accidents, increasing the economic benefit to cost benefit ratio of road projects

- costs saved on accidents that have been prevented following audit recommendations
- reducing the economic and social burden to society due to harm and damage caused by road accidents.

### 5.2 Principles for developing road safety audit training requirements

The road safety audit training requirements should be based on the following:

(a) The objectives, principles, process and scope of road safety auditing and the duties of road safety auditors.

(b) The area of expertise and the knowledge framework of road safety auditing, in accordance with international best practice and based on up-to-date research.

(c) The provisions of the institutional framework regarding the minimum qualifications, prerequisites and training of road safety auditors.

(d) Good practice from leading countries in the field of road safety auditing.

The content of the educational material and the related course topics must meet the following requirements:

- Reflect the role and job description of road safety auditors.
- Be adapted to candidates' professional profiles regarding their knowledge background and skills, especially their formal education and the way they practise their profession (e.g., use of guidelines).
- Incorporate modern international scientific literature and practice, in line with good training practice for road safety auditors. Such training typically covers:
    - the road safety audit process
    - road safety management and road traffic and transport regulatory framework
    - human factors in road design
    - safe system approach
    - road design standards
    - accident analysis and countermeasures.
- Have distinct training curriculum components (i.e., institutional framework of road safety management, road safety audits, human factors, identification and improvement of

hazardous locations, review of existing design guidelines, road traffic signing, roadside safety, vehicle restraint systems, etc.) that must work together as a combined unit delivered within a certain time (approximately 30 hours, excluding individual preparation).

- Enhance workforce understanding and application of traffic safety culture and a commitment to road safety, placing emphasis on the implementation of the principles of the Safe System approach and human factors in road design.
- Be effectively delivered to candidates requiring training.

### 5.3 Road safety auditor's role definition

In the field of road safety auditing, emphasis is placed on the proactive assessment of hazards or hazardous situations that might increase accident risk if left untreated. A road safety audit is not a check of compliance with the design guidelines, nor is it a substitute for design checks. Road safety audits aim at improving safety for all road users and in particular, vulnerable road users. Importantly, the road safety auditor should observe the road environment and endeavour to see things from the perspective of all users, especially those who are most at risk.

The implementation of a road safety audit from the initial stages of road design is an opportunity to support safe user behaviour by design, thereby ensuring safer road design that has been adjusted to take into account a broad spectrum of road user characteristics.

During the evaluation of a road design or the inspection of an existing road, the road safety auditor should address the following issues:

- Who might be injured in an accident on the specific section of road, and why? How might this happen?
- What types of accidents/collisions are most likely to occur?
- How might the likelihood of an accident be reduced or its consequences mitigated?

Professionals with experience in road safety engineering and accident investigation and with a good background knowledge of road and traffic engineering must be equipped appropriately to be able to provide plausible answers to these questions.

### 5.4 Road safety auditor skills

The road safety auditor is a trained professional engineer or technologist who evaluates the design of the road (conducted by another) with the main criterion being the safety of all road users. Appropriate training regimes for road safety auditors must be developed by taking the following into account:

1. Professional experience and knowledge in the area of road safety engineering and accident analysis and a thorough understanding of safety principles and human factors in road systems. Up-to-date knowledge and "best practice" experience regarding the road safety audit process while having experience in other areas of road safety engineering is needed.

2. Road safety culture. Road safety auditors must be characterised by self-criticism and a positive road safety outlook. This interrogative attitude will enhance their behaviour and ability to investigate the road project in depth and in detail.

3. Independence. Auditors may not conduct road safety audits on designs in which they have participated.

4. Training. Road safety auditors require training that complements their experience in road safety engineering and road safety auditing and it contributes to developing the desired knowledge and skills. In addition, periodic re-training is essential for auditors to remain current with modern practices in accident investigation and recent research in road safety engineering, including issues related to driver behaviour, as well as the latest technological developments in addressing the resulting risks to road users.

5. Other skills. Road safety auditors should have good knowledge of the design guidelines and control data, and also be capable of:

   (a) preparing clear concise reports

   (b) forming a clear picture of the on-site project from the design drawings and from the point of view of all road users

   (c) understanding complex layouts and paying attention to detail

   (d) assessing the likely frequency and severity of accidents and errors resulting from localised risk factors

(e) discussing and defending their point of view in a constructive and consensus-seeking way, without being arrogant, overbearing or intolerant

(f) examining innovative solutions.

### 5.5 Requirements for auditors

The demands regarding the qualification of auditors are substantial. Auditors do not only have to be able to read road layout/design plans/drawings, but also be able to detect their deficiencies and the safety implications emanating from those deficits. For this reason, auditors need to be experienced in road design and road safety engineering. They also need to demonstrate knowledge of road user behaviour.

Apart from a university degree or comparable education, the road safety auditors' participation in further education and training programmes and regular seminars and workshops is required to keep their knowledge current.

Regarding the required experience, most countries call for similar elements. Applicants should have worked for a number of years (minimum: 2 to 5 years, depending on the category of registration) in the field of road design and road safety engineering before applying for audit training. Although there are several working aids (normally in the form of checklists), these cannot replace the deep knowledge and experience of a road safety auditor and should simply applied as a reminder aid.

Another important requirement is participation in basic training courses and further training programmes, such as regularly offered seminars and workshops. The continued further training of road safety auditors is necessary to ensure the road safety auditor’s knowledge is relevant and current.

### 5.6 Directions for road safety auditor training

Internationally it is generally required that the initial training “should ensure that practitioners get the necessary up-to-date knowledge” and “that where road safety auditors carry out audit functions under prevailing directives, they undergo an initial training resulting in the award of a certificate of competence, and take part in periodic further training courses.” Auditors should, therefore, keep abreast of the latest developments in road safety research, road design and issues concerning human factors.

Candidate auditors must have the necessary formal education and experience, i.e., they must be qualified civil engineers (this is the main and most appropriate qualifications for background and experience in road safety engineering), with at least 5 years of experience in design, road safety engineering and road traffic accident analysis. After successfully completing an appropriate training course and examination, candidate road safety auditors will be permitted to conduct road safety audits as a member of the road safety audit team. A road safety audit team is headed by a road safety audit team leader who must be a senior road safety auditor. The minimum requirements needed to gain accreditation as a road safety auditor or a senior road safety auditor are as follows:

A Road Safety Auditor is required to:

- have been awarded a Certificate of Competence (ECSA registration) following a successful road safety audit training programme
- have had a minimum of 5 years of continuous (or a collective 5 years of) professional experience in road design, road safety engineering and accident analysis.

To retain accreditation, a Road Safety Auditor is required to have successfully completed a refresher course within the validity period of the last Certificate of Competence (3 years).

A Senior Road Safety Auditor is required to:

- have been awarded a “certificate of competence” following the successful undertaking of a road safety audit training programme
- have had a minimum of 8 years of experience in road design, road safety engineering and accident analysis, following the university degree
- have participated in at least two road safety audits within the validity period of the last certificate of competence (3 years) and have successfully completed a minimum of one training course
- have undertaken an accredited refresher course
- have contributed to the road safety audit knowledge base and capacity building with at least one publication or other contribution during the validity period of the Certificate of Competence.

### 5.7 Extent of training topics

The extent of the training topics is largely based on the training timeframe. In future, the extension of the duration of the training courses offered (if deemed necessary, e.g., as a result of course evaluation) may result in expansion of the range of topics to include more roadway design, operational and risk management issues.

Course topics and educational material should be chosen to aid and augment engineering judgement under audit conditions. The material should complement the experience of already experienced road designers and traffic engineers through the presentation of relevant information and featuring insights from the vast body of scientific literature in circulation. For example, “human factors” principles and concepts for the training of candidate road safety auditors must be based primarily on a review of available modern publications, which need to reflect current trends and bring into focus for the practitioner a holistic and anthropocentric approach to road safety.

Until now, experienced roadway and traffic engineers have been educated in the context of traditional road design courses and road design guidelines (concerned mainly with minimum standards). Existing South African roadway and roadside infrastructure design guidelines were developed several years ago and do not necessarily include sufficient discussion of concepts that reflect the new holistic and anthropocentric approach to road safety. Such discussion in turn, calls for relevant, fresh requirements in addition to the academic qualifications of civil engineers. Appropriate Road Safety Audit course material is designed and expected to be conveyed by those in the academic realm, but it is imperative that seasoned road safety professionals/field experts in road design, human factors, etc., are included in devising course material. Hands-on experience in road safety auditing is crucial for the effective delivery road safety audit education and training.

### 5.8 Road safety auditor education

One can generally distinguish between two different philosophies concerning training courses:

- The first comprises short training courses (typically 3 to 5 days) which mainly cover the audit procedures. These courses require candidates to be very experienced in road safety matters before entering the course.

- The second comprises a longer training period which covers general road safety issues, road safety audit procedures as well as practical training and requires at least 10 days of training with separate self-study phases and test audits.

The duration and content of the training received determines whether an auditor is permitted to be accountable for audit schemes directly after successfully completing the course. If not, he or she will have to participate as an audit team member or observer in a certain minimum number of audits.

Regarding the structure of audit education and training courses, the following basic stages are recommended:

**1 Prerequisites**

- Appropriate engineering degree or comparable education; and/or
- Experience in road design, road safety engineering and road user behaviour.

**2 Road safety audit training**

- Phase 1 (if no knowledge has been acquired and demonstrated in advance): General infrastructural road safety, duration 1–2 weeks
    - Accident analysis and statistics
    - Accident causation
    - Road safety impact assessment
    - Road safety engineering measures

- Phase 2 (compulsory): Road safety audit procedures, duration: 2 days–1 week:

    **Theory of road safety auditing**

    - Road safety audit-procedures
    - Participants and their responsibilities during auditing
    - Road safety audit process

- Data requirements and tools
- Legal aspects pertaining to audit findings

**Road safety practice**

- Characteristics of the different audit stages and road types
- Exercises covering different audit stages (including site visits)
- Reporting
- Evaluation and discussion

**3 Final test and certification of candidates**

**4 Further education programme/Renewal of certification**

- Exchange of knowledge in regular seminars or workshops
  - Recent road safety topics
  - Presentation of audit examples
  - Discussion on audit experiences.

Certification will lapse should ongoing proof of competence not be provided. Participation in annual seminars and verification that a certain minimum number of audits have been performed per period (e.g., 5 audits over 3 years) will be required. Participation in refresher courses also forms part of the CPD requirements.

## 6. TRAINING OBJECTIVES

To achieve ECSA registration as a road safety auditor, the candidate's employer needs to expose the candidate to a customised training programme that includes the following:

- Exposure to project material and training that enables him/her to apply graduate engineering theory to practical field situations over the prescribed period.
- An increasing level of responsibility to enable the applicant to submit evidence in the training and experience reports (TERs) that demonstrates (under audit conditions) both

the duration and level of competency attained against established standard (Section 9.1 contains a summary thereof).

- Develop the engineering competency of the applicant to cover the eleven outcomes in the five major groups referred to in **R-02-PE/PT/PCE/PN: Competency Standards**.

## 7. DISCIPLINE SPECIFIC ELEMENTS

The following elements cover the technical field which **Road Safety Audit Candidates (RSACs)** must be exposed to when training for registration as professional **road safety auditors (RSAs)**.

- Road Incident Management System Data
- Geometric Design
- Road Furniture Specification and Design
- Traffic Accommodation under Construction – Planning, Implementing and Monitoring
- Accident Scene Investigation and SAPS Reporting
- Roadside Hazard Identification and Mitigation
- Road Surfacing Seal Types and their effect on vehicle operation under atypical conditions.
- Hazardous location identification and improvement.

## 8. BASIC TRAINING

The requirement for basic training stems from the need to understand the basic principles of civil engineering, road design, traffic flow and operation, construction, quality control and maintenance. In the case of already professionally registered engineers, technologists and technicians, these basic principles are deemed to be entrenched in the candidate by virtue of their gaining professional registration within the field of road engineering. Before **RSACs** can reasonably be expected to execute or assume responsibility for professional functions in engineering, a benchmarking process is conducted whereby the aforementioned competencies and understanding will be verified.

The following activities are considered to fall under basic training prior to becoming an **RSAC**:

### 8.1 Engineering competence – investigation, problem contextualisation and definition

Engineering competence in the civil engineering field includes the understanding of an assignment leading to the development of an engineering brief. Essential to this function is the active participation of the **RSAC** in researching, compiling and assessing basic data, background information and purpose of the assignment. To ensure all-encompassing solutions to the problems encountered, in developing the brief, all aspects relevant to devising an optimal solution need to have been taken into account. These include an understanding and experience in implementation of national and international standards and codes of practice, in compliance with environmental impact requirements.

### 8.2 Engineering design and documentation

This aspect requires the logical and professional compilation of all relevant data acquired during the investigation period, which would, by necessity, involve the technical and financial evaluation of alternatives. This competency is demonstrated by covering aspects such as concepts and precedents, sources of information, estimates and budget quotations, quick design methods, implementation of feasibility report findings, and carrying out briefs for detail design. The choice of construction materials forms an integral part of this procedure and requires deep knowledge of relevant specifications for civil engineering materials, whether natural occurring, processed or manufactured. All alternatives (in order of preference) should be listed.

The **RSACs** should have written new specifications, amended existing specifications for implementation of proposed engineering solutions and prepared cost-effective solutions to such problems by having done budget estimates.

Safety aspects should have been included in existing reports, whether by description, limitations on the scope of work, site investigation appraisal or other cause. Applicable regulations, including the criteria that have been considered, need to be in evidence. Knowledge of how all parties to a contract exercise their duties and responsibilities is essential, as well as knowledge of the procedures for issuing, receiving and control of work instructions.

Inception meeting participation is essential to understand the challenges faced and the risks posed by the proposed design or inherent to the existing road.

Crucial to all the above is a thorough understanding of the fundamental engineering principles involved and the ability to use them in design, without reference to computers. The **RSAC** nevertheless must be highly proficient at using computers for processing data and must possess the ability to discern between valid and meaningless computing outputs.

Typical activities for RSACs include the following at Design and Documentation Stage:

- Understanding and use of national/provincial/municipal Road Safety Master Plans and the Road Safety Manuals.
- Involvement in **Pre-Construction Road Safety Audits** at feasibility/preliminary design, draft design and detail design stage.
- Involvement in **Construction and Pre-opening Road Safety Audits**.
- Applying knowledge of the use of **predictive models** to identify and rectify road safety deficiencies by revising engineering drawings for new road projects (greenfield or brownfield types).
- Involvement in **Post-Construction Road Safety Assessments,** whether Road Safety Engineering Assessments, Road Safety Audits or Road Safety Appraisals for existing roads.
- Involvement in evaluation of road safety audits (peer review).

### 8.3 Implementation of safety improvement projects

The **RSAC** must have a good working knowledge of drawing up an enquiry (call for bids) document to be used at the tender stage of a project's execution with emphasis on writing a thorough project specification.

Participation during both the tendering period and the bid evaluation stage leading to adjudication and recommendation is essential. This ensures that the **RSAC** possesses the necessary competency in contributing to procurement protocols and is conversant with the contract requirements. **RSACs** should acquaint themselves with safety-critical aspects of construction, site management, application of specifications, participation in dimensional control, commissioning and monitoring the build quality/accuracy of the works. Knowledge

should be gained on the use, performance and cost of construction equipment, plant and labour resources as well as planning and programming various sections and phases associated with roadworks. Involvement in progress monitoring and reporting needs to be in evidence.

Typical activities for RSACs include the following at the Implementation Stage:

- Involvement in road safety site inspections, field data collection (accident data), network screening, key plans, geometric layouts and cross sections (both typical and specific).
- Compilation of road safety audit findings, reviews of road safety inspection proceedings used to compile road safety appraisals, recommendations and response reports.
- Economic appraisal and prioritisation of implementation of proposed safety improvements.
- Safety improvement project prioritisation.
- Involvement in service provider procurement and implementation of road safety improvement infrastructure projects.

### 8.4 Management and monitoring of road safety improvements

The work of **RSACs** includes the integration of engineering knowledge with control of manpower and finances as well as time management. It is therefore important that **RSACs** are exposed to these engineering processes and that they demonstrate adequate knowledge and experience in project or construction management. **RSACs** must demonstrate that they have increasingly applied these management principles throughout their careers.

As they progress through their training period, **RSACs** must be given increasing responsibility towards independent execution of engineering work. Applicants must satisfy ECSA that they have been able to deal adequately with such increased responsibility by having taken significant control of projects or major parts of large projects.

Typical activities for RSACs include the following at this management stage:

- Involvement in monitoring of road safety improvement projects and programmes.
- Performing “before-and-after” studies where such data is available.
- Comparing accident data with predictive models for new projects.

### 8.5 Research and development

Research and development work is typically carried out either in commercial research and product development centres or at various tertiary academic institutions. **RSACs** should have participated in research and development work that is predominantly of a civil engineering nature, and this work must include the application of the various aspects of road safety engineering. It should also include recent developments related to:

- hazardous location identification and improvement
- traffic impact assessments
- traffic studies, including measure, method, and technology
- product or system testing
- human factor and road user behavioural studies under controlled experimental conditions.

## 9. DEVELOPING COMPETENCY: ELABORATING ON SECTIONS (R-08-CS-GUIDE-SC)

Applicants are required to demonstrate the insight and ability to use and interface/integrate various aspects through verifiable performance in providing engineered solutions to practical, problems experienced in their operating work environment. In addition, applicants must develop the skills required to demonstrate the use of applicable engineering knowledge in optimising the efficiency of operations.

### 9.1 Functions performed

Special consideration in the Road Safety Audit environment must be given to the competencies contained within the following areas of practice:

- A: Knowledge-based problem solving
- B: Management and Communication
- C: Identifying and mitigating the impacts of engineering activity
- D: Judgement and responsibility
- E: Independent learning.

While not prescribed, it is useful to incrementally measure progression of the candidate's competency using the Degree of Responsibility scales as specified in **R-04-T&M-GUIDE-SC**. These should be monitored against specific areas of knowledge so that candidates are assessed holistically through their progression towards registration.

### 9.2 Industry-related statutory and other requirements

Candidates are expected to have a working knowledge of the following acts, standards and guidelines, and how they affect their working environment:

- The Constitution of the Republic of South Africa
- National Road Traffic Act, 93 of 1996
- National Land Transport Act
- SANRAL Act
- Spatial Planning and Land Use Management Act
- Provincial Road and Transport Acts

- Municipal Systems Act
- Occupation Health and Safety Act, 85 of 1993 (OHS Act), as amended by Act 181 of 1993.
- Environment Conservation Act, 73 of 1989, as amended by Act 52 of 1994 and Act 50 of 2003
- Labour Relations Act
- National Transport Policy
- National Road Safety Strategy
- Road Traffic Signs Manuals
- Technical methods for highways (TMH), Technical recommendations for highways (TRH) and other industry specific work instructions
- SANS and other relevant international standards such as ISO, EN, DIN or US Federal Standards
- Road Safety Policy
- Road Safety Manuals
- Road Safety Audit Manuals
- Engineering Profession Act, 46 of 2000.

Several acts not listed above are also pertinent to the RSAC's work environment, and knowledge thereof needs to be gained in the workplace.

### 9.3 Recommended formal learning activities

The following formal learning topics are a non-exhaustive schedule of course types currently on offer through various industry bodies:

- CPD courses on road safety-related subjects
- Road safety legal issues, regulation and policy
- Accident hazardous location ("black spot") identification and improvement
- Accident investigations
- Road safety audits
- Road safety engineering and road design
- Risk analysis
- Quality systems

- Occupation health and safety
- Report writing and communication.

Formal learning is an important facet of the development of professional competency – not only in the form of course material but by virtue of insights gained from interaction with members of the road safety industry, whether in the private sector, public sector or the manufacturing environment. Standards-generating bodies also form a vital component of the road safety environment.

## 10. PROGRAMME STRUCTURE AND SEQUENCING

### 10.1 Best Practice

No ideal training programme structure or unique sequencing constitutes best practice. The training programme for each RSAC depends on prevailing work opportunities assigned by their employer.

It is suggested that the RSAC work closely with mentors to gain the ability to select appropriate situational project material to gain exposure to eventually take responsibility for conducting road safety audit work at an appropriate level before applying for professional registration.

The training programme should be such that the RSAC progresses through increasing levels of capability, further described in **R-04-T&M-GUIDE-SC**. By the end of the training period, the RSAC must perform (depending on registration type) on an individual basis and as a team member meeting the engineering outcomes and the discipline-specific requirements at the level required for registration as well as exhibiting the required degree of responsibility.

The nature of work and degrees of responsibility defined in document **R-04-T&M-GUIDE-SC** are used here (and in Appendix B below)**.**

The mentor and RSAC must identify at which level of responsibility an activity offers compliance with the demonstration of competency in the various outcomes. Evidence of the candidate's activities is recorded on an appropriate system such that it accurately depicts the level of responsibility demonstrated against the requirements of all the outcomes needed. ECSA specifies the applicable recording system in the Application for Registration form (usually an Engineering Report together with associated material that demonstrates that the

candidate has worked independently and performed at the required level of responsibility to be recognised as worthy for professional registration within one of the 5 sub-categories).

### 10.2 The realities of workplace learning and development

It is unlikely that 3 years is an adequate period of training – this is a theoretical minimum required by ECSA, primarily as a means of ensuring that a road-safety audit career path has been of sufficient duration to have covered a sufficiently broad spectrum of work in the road safety practitioner environment. In most cases, it takes longer than 3 years and is largely determined by, among others, the availability of suitable assignments and material in the workplace. In this regard, candidates are encouraged to actively seek secondment opportunities.

Each candidate undertakes a unique programme where the various activities carried out at the discipline-specific level are linked to the generic competency requirements of **R-08-CS-GUIDE-SC** and the compulsory discipline-specific requirements to be met during the candidacy.

### 10.3 Considerations for generalists, specialists, researchers and academics

Section 10 of document of **R-08-CS-GUIDE-SC** adequately describes what is expected of persons whose formative development has not followed a conventional career path. Many academics, researchers, specialists, generalist road engineers may not have followed a candidate training programme, particularly in the initial stages of their civil engineering careers.

The overriding consideration is that, irrespective of the route followed, the applicant must provide evidence of competence against the standard and the discipline-specific requirements.

### 10.4 Moving into or changing candidacy programmes

This guide assumes that the RSAC enters a programme shortly after graduation and continues with the programme until ready to submit an application for registration. It also assumes that the RSAC is supervised and mentored by persons who meet the requirements in document **R-04-T&M-GUIDE-SC**.

In the case of a person changing from one candidacy programme to another or moving into a candidacy programme from a less structured environment, it is essential that the following steps are completed:

- The RSAC must complete the Training and Experience Summary (TES) and Training and Experience Reports (TER) that adequately portray the previous programme or unstructured work-based experience. In the latter case, it is important to reconstruct the experience as accurately as possible. The TERs need to be verified by the respective supervisors for each period. Such supervisor needs to be registered in an appropriate category with ECSA.
- On entering the ECSA-guided programme, the assigned mentor and supervisor should regularly review the RSAC's development in the context of their past experience so that opportunities are seized that fall within the requirements of the new programme. Initial planning and revisions to such planning towards the next phase of the candidate's programme is required of the mentor.
- The candidate must complete the Discipline-Specific Requirements Report on necessary elements that may have already been covered before registering as an RSAC.

## 11. COMPULSORY DISCIPLINE-SPECIFIC GUIDELINES TO BE MET DURING THE CANDIDACY

During candidacy, the RSAC, assisted by mentors and supervisors, must ensure that he or she covers the minimum practical and theoretical knowledge outlined in the table below:

| Proposed Minimum Requirements for Specified Category: 'Road Safety Auditor' | | | |
|---|---|---|---|
| **Sub Category:** | **Senior Auditor - Team leader and/or team member** (Engineering) | **Auditor - Team Member** (Engineering) | **Candidate Member** (Engineering) # |
| ***Accreditation Abbreviation:*** | *RSAud(S)* | *RSAud* | *RSAud(C)* |
| **Minimum requirements** | | | |
| **(a) Professional** (Registered with ECSA), which is divided into: | | | |
| i. Professional Engineer; or | ***x*** | | |
| ii. Professional Engineering Technologist; or | | | |
| iii. Professional Certificated Engineer; or | | | |
| iv. Professional Engineering Technician. | | | |
| **(b) Candidate**, (Registered with ECSA) which is divided into: | | | |
| i. Candidate Engineer; or | | ***x*** | ***x*** |
| ii. Candidate Engineering Technologist; or | | | |
| iii. Candidate Certificated Engineer; or | | | |
| iv. Candidate Engineering Technician. | | | |
| **Qualification** (Engineering) | | | |
| BSc Eng, or BEng, BSC (HONS) Transport or higher | ***x*** | ***x*** | |
| B-Tech | ***x*** | ***x*** | |
| National Diploma | ***x*** | ***x*** | |
| **Number of Years Relevant Experience** | | | |
| 1 to 3 Years | | | ***x*** |
| 3 to 8 Years | | ***x*** | |
| > 8 Years | ***x*** | | |
| **Completion of Relevant Courses (with last 5 years)** | | | |
| Road Safety Audit Course (5 CPD) | ***x*** | ***x*** | ***x*** |
| Road Safety Engineering Course | ***x*** | ***x*** | ***x*** |
| Human Factors in Road Safety Engineering | ***x*** | ***x*** | ***x*** |
| Traffic Engineering / Geometric Course | ***x*** | ***x*** | ***x*** |
| **Other Relevant Experience / Qualifications (as supplementary and/or for non-engineering collaboration on a road safety audit team) inter alia: ##** | | | |
| Social Scientist (such as Behavioural, Social etc.); or | | | |
| Accident Investigation; or | | | |
| Traffic Law Enforcement; or | | | |
| Road Safety Officer; or | | | |
| Town Planning; or | | | |
| Public Transport; or | | | |
| Universal Access; or | | | |
| Vulnerable Road Users; or | | | |
| Other relevant | | | |

*# Observers that are not required to be registered under the Road Safety Auditor Category is allowed. Such Observers are, e.g., Road Safety Practitioners that wish to become one of the specified Categories road safety auditors and/or may observe road safety auditing for reasons of Capacity Building in the Road Safety Environment*

*## Registering of Non-engineering Road Safety Audit Team Members will be administered by the Road Traffic Management Corporation (RTMC)*

## 12. REVISION HISTORY

| Revision number | Revision date | Revision details | Approved by |
|---|---|---|---|
| Rev 0 Draft 1 | 10 Apr 2018 | Document development | RTMC- Deon Le Roux |
| Rev 0 Draft 2 | 17 Jun 2018 | Incorporation of comments from the Stakeholders | RTMC- Deon Le Roux |
| Rev 0 | 22 Aug 2018 | Proofreading and addition of omitted content | Working Group – Ms G Soko and M Thamae |
| Rev 1 | 11 Sep 2018 | Approval | PDSGC |
| Rev 1 Draft A | 19 Aug 2020 | Review for inclusion of other key stakeholders | Working Group |
| Rev 1 Draft B | 09 Oct 2020 | Review of final draft by Registration Department and WG | Working Group & Registration BU |
| Rev 1 Draft C | 19 Jan 2021 | Review and recommendation for approval | Executive RPS |
| Rev 1 | 13 April 2021 | Approval | RPSC |

The sub discipline-specific Training Guideline for:

**Road Safety Auditor in Specified Categories**

Revision 1 dated 13 April 2021 and consisting of 36 pages has been reviewed for adequacy by the Business Unit Manager and is approved by the Executive: Research Policy and Standards.

.....  ..07 May 2021.....

Business Unit Manager  Date

.....  ...2021/05/07.....

Executive: **RPS**  Date

This definitive version of this policy is available on our website

## APPENDIX A: TRAINING ELEMENTS

**Synopsis:** A candidate specified category practitioner should achieve specific competencies at the prescribed level during his/her development towards registration, at the same time accepting more and more responsibility as experience is gained. The outcomes achieved and established during the candidacy phase should form the template for all engineering work performed after registration regardless of the level of responsibility or particular stage of an engineering career:

1. Confirm understanding of instructions received and clarify if necessary.
2. Use theoretical training to develop possible approaches to do the work: select the best and present to the recipient.
3. Apply theoretical knowledge to justify decisions taken and processes used.
4. Understand role in the work team, and plan and schedule work accordingly.
5. Issue complete and clear instructions and report comprehensively on work completed.
6. Be sensitive about the impact of the engineering activity and take action to mitigate this impact.
7. Consider and adhere to legislation applicable to the task and the associated risk identification and management.
8. Adhere strictly to high ethical behavioural standards and ECSA's Code of Conduct.
9. Display sound judgement by considering all factors, their interrelationship, consequences and evaluation when all evidence is not available.
10. Accept responsibility for own work by using theory to support decisions, seeking advice when uncertain and evaluating shortcomings.
11. Become conversant with employer's training and development programme and develop own lifelong development programme within this framework.

Specifically defined engineering work is usually restricted to applying standard procedures, codes and systems, i.e., work that was done before within the narrow field of application.

Responsibility Levels: A = Being Exposed; B = Assisting; C = Participating; D = Contributing; E = Performing.

| Competency Standards for Registration as a Specified Category Practitioner | Explanation and Responsibility Level |
|---|---|
| **1. Purpose**<br>This standard defines the competence required for registration as a Specified Category Practitioner. Definitions of terms having particular meaning within this standard are given in text at the end of this annexure and in document **R-01-POL-SC**. | Discipline Specific Training Guides (DSTGs) give context to the purpose of the Competency Standards. Registered Specified Category Practitioners operate within the nine disciplines recognised by ECSA. Each discipline can be further divided into sub-disciplines and finally into specific workplaces or competency areas. DSTGs are used to facilitate experiential development towards ECSA registration and assist in compiling the required portfolio of evidence (Specifically the Engineering Report in the application form).<br>**NOTE:** The training period must be utilised to develop the trainee's competence towards achieving the standards below at a responsibility level E, i.e., Performing. (Refer to R-04-SC, Table 4). |
| **2. Demonstration of competence**<br>Competence must be demonstrated within specifically defined engineering activities, defined below, by integrated performance of the outcomes defined in section 3 below at the level defined for each outcome. Required contexts and functions may be specified in the applicable DSTGs.<br>**Level Descriptor:** Specifically defined engineering activities have several of the following characteristics:<br>a) Scope of specific practice area is defined by specific techniques applied; change by adopting new specific techniques into current practice.<br>b) Practice area is located within a wider, complex context, with specifically defined working relationships with other parties and disciplines.<br>c) Work involves specific familiar resources, including people, money, equipment, materials, technologies. | Engineering activities can be divided into (approximately):<br>• 5% Complex (Professional Engineers)<br>• 5% Broadly Defined (Professional Engineering Technologists)<br>• 10% Well-defined (Professional Engineering Technicians)<br>• 15% Specifically defined (Registered Specified Categories)<br>• 20% Skilled Workman (Engineering Artisan)<br>• 45% Unskilled Workman (Artisan Assistants)<br>The activities can be in-house or contracted out; evidence of integrated performance can be submitted irrespective of the situation.<br>**Level Descriptor:** Specifically defined engineering activities in the specific discipline are characterised by several or all of:<br>a) Scope of practice area does not cover the entire field of the specific discipline (exposure limited to the relevant components of the specific discipline and specific workplace). Techniques applied are largely well established and change by adopting new specific techniques into current practice is the exception. |

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| d) Require resolution of interactions manifested between specific technical factors with limited impact on wider issues.<br>e) Are constrained by operational context, defined work package, time, finance, infrastructure, resources, facilities, standards and codes, applicable laws.<br>f) Have risks and consequences that are locally important but are specifically defined. Activities include but are not limited to planning; investigation and problem resolution; improvement of materials, components, systems or processes, engineering operations, maintenance, project management, development and commercialisation. | b) Practice area varies substantially with unlimited location possibilities and an additional responsibility to identify the need for complex, broadly defined and/or well-defined advice to be included in the specifically defined working relationships with other parties and disciplines.<br>c) The bulk of the work involves familiar, defined range of resources, including people, money, equipment, materials and technologies.<br>d) Most of the impacts in the specific discipline are on wider issues, and although occurring frequently, are specifically defined and can be resolved by following established procedures.<br>e) The work packages and associated parameters are constrained by operational context with variations limited to different locations only. (Cannot be covered by laws, standards and codes only.)<br>f) Even locally important minor risks can have far reaching consequences.<br>Activities include but are not limited to design; planning; investigation and problem resolution; improvement of materials, components, systems or processes; engineering operations; maintenance; project management and general management. For Specified Category Practitioners, research, development and commercialisation happen more frequently in some disciplines and are seldom encountered in others. |
| **3.Outcomes to be satisfied:** | **Explanation and Responsibility Level** |
| **Group A: Engineering Problem Solving Activity** | |
| **Outcome 1:**<br>Define, investigate and analyse specifically defined engineering problems (tasks). | **Responsibility level E**<br>Analysis of an engineering problem means the “separation into parts possibly with comment and judgement”. |
| **Level Descriptor:** Specifically defined engineering problems have the following characteristics:<br>a) Can be solved mainly by specific practical engineering knowledge, underpinned by related theory; and one or more of: | a) Practical problems for Specified Category Practitioners mean the problem encountered cannot be solved by artisans because theoretical calculations and engineering decisions are necessary to substantiate the solution proposed. |

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| b) are fully defined but require feedback<br>c) are discrete, specifically focused tasks within engineering systems<br>d) are routine, frequently encountered and in familiar specified context; and one or more of:<br>e) can be solved by standardised or prescribed ways<br>f) are encompassed by specific standards, codes and documented procedures; require authorisation to work outside limits<br>g) information is concrete, specific and largely complete, but requires checking and possible supplementation<br>h) involve specific issues but few of these imposing conflicting constraints and a specific range of interested and affected parties; and one or both of:<br>i) requires practical judgement in specific practice area in evaluating solutions, considering interfaces to other role-players<br>j) have consequences which are locally important but within a specified category (wider impact are dealt with by others). | b) Further investigation to identify the nature of the problem is seldom necessary.<br>c) Discrete means individually distinct. The problem is easily recognised as part of the larger engineering task, project or operation.<br>d) Recognised that the problem is within the specific scope and occurred in the past or the work to be done is a standard operation – seldom something new.<br>e) Solving the problem does not require the development of a new solution – find out how it was solved/done before.<br>f) Encompassed means encircled. The standards, codes and documented procedures must be obtained to solve the problem and authorisation from professionals responsible must be obtained to wave the stipulations.<br>g) The responsibility lies with the Specified Category Practitioner to check that the information received as part of the instruction is correct and added to as is necessary to ensure the correct and complete execution of the work.<br>h) The problem handled by an Specified Category Practitioner must be limited to well-known specific matters needing standardised solutions without possible complications.<br>i) Practical solutions to problems include knowledge of the skills displayed by Practical Specialists and Engineering Artisans without sacrificing theoretical engineering principles and / or cutting corners to satisfy parties involved.<br>j) Specified Category Practitioners must realise that their engineering actions might seem to be of local importance only but may develop into further problems where support from Engineering Professionals might be needed to deal with the consequences. |
| **Competency Indicators:** A structured analysis of specifically defined problems typified by the following performances within the competency area is expected:<br>1.1 State how you interpreted the work instruction received, checking with your client or supervisor if your interpretation is correct. | To perform an engineering task a Specified Category Practitioner typically receives an instruction from a senior person (customer) to do this task, and must:<br>1.1 Make very sure that the instruction is complete, clear and within his/her capability and that the person who issued the instruction agrees with his/her interpretation.<br>1.2 Ensure that the instruction and information to do the work is fully understood and is complete, including the engineering theory needed to understand the task and to carry out |

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| 1.2 Describe how you analysed, obtained and evaluated further clarifying information, and if the instruction was revised as a result. | and/or check calculations, and the acceptance criteria. If needed supplementary information must be gathered, studied and understood. |
| **Range Statement:** The problem (task) may be part of a larger engineering activity or may be stand alone. The design (planning) problem is amenable to solution by specific techniques practiced regularly. This outcome is concerned with the understanding of a problem: Outcome 2 is concerned with the solution. | Please refer to clauses 4 to 7 of the applicable DSTG, document R-05-nnn-SC. |
| **Outcome 2:**<br>Design or develop (plan) sustainable solutions to specifically defined engineering problems (tasks). | **Responsibility level C**<br>Design means “drawing or outline from which something can be made”.<br>Develop means “come or bring into a state in which it is active or visible”. |
| **Competency Indicators:** This outcome is normally demonstrated after a problem analysis as defined in Outcome 1. Working systematically to synthesise a solution to a well-defined problem, typified by the following performances is expected:<br>2.1 Describe how you designed or developed and analysed alternative approaches to do the work – impacts and sustainability checked and calculations attached.<br>2.2 State what the final solution to perform the work was; client or your supervisor in agreement. | The task given must be fully understood and interpreted; solutions developed (designed) to execute. To synthesise a solution means “the combination of separate parts, elements, substances, etc. into a whole or into a system” by:<br>2.1 The development (design) of more than one way to do an engineering task or solve a problem should always be done, including the costing and impact assessment for each alternative. All the alternatives must meet the requirements set out by the instruction received, and the theoretical calculations to support each alternative must be done and submitted as an attachment. The alternatives must be within the legal boundaries imposed.<br>2.2 The Specified Category Practitioner will in some cases be unable to support proposals with the complete theoretical calculation to substantiate every aspect, and must in these cases refer his / her alternatives to a professional for scrutiny and support. The alternatives and alternative recommended must be convincingly detailed to win customer support for the alternative recommended. Selection of alternatives might be based on tenders submitted with alternatives submitted deviating from those specified. |
| **Range Statement:** The solution conforms to specific established methods, techniques or procedures within the | Applying theory to *specifically defined engineering* work is done in a way that has been used before, probably developed by professionals in the past, and documented in written procedures, |

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| specifically defined competency area. Engineering should not look only to decrease impacts, but also to restore and regenerate through design. | specifications, drawings, models, examples, etc. Specified Category Practitioners must seek approval and engineering verification for any deviation from these established methods. |
| **Outcome 3:**<br>Comprehend and apply knowledge embodied in established specific engineering practices and knowledge specific to the field in which he/she practises. | **Responsibility level E**<br>Comprehend means "to understand fully". The jurisdiction in which a Specified Category Practitioner practices is given in Clauses 4 to 7 of the applicable DSTG, document R-05-nnn-SC. |
| **Competency Indicators:** This outcome is normally demonstrated in the course of design, investigation or operations, confined to the competency area.<br>3.1 State what HCert level engineering standard procedures and systems you used to execute the work, and how HCert level theory was applied to understand and/or verify these procedures.<br>3.2 Give your own HCert level theoretical calculations and/or reasoning on why the application of this theory is considered to be correct (actual examples). | Design (development) work for Specified Category Practitioners is mostly to utilise, configure, certify, test, verify, etc. manufactured components or proven engineering or management systems, and repetitive design (development) work using an existing design (development) as an example. Specified Category Practitioners apply existing codes, policies and procedures in their design (development) work. Investigations into specifically defined incidents and condition monitoring and operations are mostly on controlling, maintaining and improving engineering systems and operations.<br>3.1 The understanding of specifically defined procedures and techniques must be based on fundamental mathematical, scientific and engineering knowledge. Specific procedures and techniques applied to do the work accompanied by the underpinning theory must be given.<br>3.2 Calculations confirming the correct application and utilisation of equipment and/or systems listed in the DSTG R-05-nnn-SC must be done on practical *specifically defined* activities. Reference must be made to standards and procedures used and how it was derived from HCert level theory. |
| **Range Statement:** Applicable knowledge includes:<br>a) Technical knowledge that is applicable to the practice area irrespective of location, supplemented by locally relevant knowledge, for example established properties of local materials. | a) The specific location of a task to be executed is the most important determining factor in the layout design and utilisation of equipment and/or systems. A combination of educational knowledge and practical experience must be used to substantiate decisions taken, including a comprehensive study of laws, policies, procedures, standards, environment, manpower, materials, components and projected customer requirements and expectations.<br>b) In spite of having a working knowledge of interacting disciplines, Specified Category Practitioners must appreciate the importance of working with specialists like civil engineers |

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| b) A working knowledge of interacting disciplines confined to the competency area. Codified knowledge in related areas: financial, statutory, safety, management and sustainability.<br>c) Jurisdictional knowledge includes legal and regulatory requirements as well as prescribed codes of practice. | on structures and roads, mechanical engineers on fire protection equipment, architects on buildings, electrical engineers on communication equipment, etc. The codified knowledge in the related areas means working to and understanding the requirements set out by specialists in the areas mentioned.<br>c) Jurisdictional in this instance means "having the authority", and Specified Category Practitioners must adhere to the terms and conditions associated with each task undertaken. They may even be appointed as the "responsible person" for specific duties in terms of the OHS Act. |
| **Group B: Managing Engineering Activities** | **Explanation and Responsibility Level** |
| **Outcome 4:**<br>Manage part or all of one or more *specifically defined* engineering activities. | **Responsibility level E**<br>Manage means "control". |
| **Competency Indicators:** The display of personal and work process management abilities within the competency area is expected:<br>4.1 State how you managed yourself, priorities, processes and resources in doing the work (e.g., bar chart).<br>4.2 Describe your role and contribution in the work team. | In engineering operations and projects Specified Category Practitioners are typically given the responsibility to carry out specific tasks and/or complete projects.<br>4.1 Resources are usually subdivided based on availability and controlled by a work breakdown structure and scheduling to meet deadlines. Quality, safety and environment management are important aspects.<br>4.2 Depending on the task, Specified Category Practitioners can be the manager, team leader, a team member, or can supervise appointed contractors. |
| **Outcome 5:**<br>Communicate clearly with others in the course of his or her specifically defined engineering activities | **Responsibility level E** |
| **Competency Indicators:** Demonstrates effective communication by the following: | 5.1 Refer to Range State for Outcome 4 above and 5 below. Presentation of point of view mostly occurs in meetings and discussions with immediate supervisor. |

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| 5.1 State how you presented your point of view and compiled reports after completion of the work.<br>5.2 State how you compiled and issued instructions to entities working on the same task | 5.2 Refer to Range State for Outcome 4 and 5 below. |
| **Range Statement for Outcomes 4 and 5:** Management and communication in specifically defined engineering involves:<br>(a) Planning activities<br>(b) Organising activities<br>(c) Leading activities<br>(d) Implementing activities<br>(e) Controlling activities.<br>Communication relates to technical aspects and wider impacts of professional work. Audience includes peers, other disciplines, clients and stakeholder audiences. Appropriate modes of communication must be selected. The Specified Category Practitioner is expected to perform the communication functions reliably and repeatedly confined to the competency area. | (a) Planning means "the arrangement for doing or using something, considered in advance".<br>(b) Organising means "put into working order; arrange in a system; make preparations for".<br>(c) Leading means to "guide the actions and opinions of; influence; persuade".<br>(d) Implementing means to "carry out an undertaking, agreement, or promise into effect".<br>(e) Controlling means the "means of regulating, restraining, keeping in order; check".<br>Specified Category Practitioners participate in writing or adhere to specifications for the purchase of materials and/or work to be done, recommend on tenders received, place orders and variation orders, write work instructions, report back on work done, draw, correct and revise drawings, compile test reports, use operation and maintenance manuals to write or apply work procedures, write inspection and audit reports, write commissioning reports, prepare and present motivations for new projects, compile budgets, report on studies done and calculations carried out, report on customer requirements, report on safety incidents and risk analysis, report on equipment failure, report on proposed system improvement and new techniques, report back on cost control, report on environmental impact and sustainability, etc. |
| **Group C: Impacts of Engineering Activity** | **Explanation and Responsibility Level** |
| **Outcome 6:**<br>Recognise the foreseeable social, cultural, environmental and sustainability effects of *specifically defined* engineering activities generally | **Responsibility level D**<br>Social means "people living in communities; of relations between persons and communities". Cultural means "all the arts, beliefs, social institutions, etc. characteristic of a community". Environmental means "surroundings, circumstances, influences". Sustainable is defined in the definitions below. |

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| **Competency Indicators:** This outcome is normally displayed in the course of analysis and solution of problems within the competency area, by typically the following:<br>6.1 Describe the social, cultural, environmental impact and long-term sustainability of this engineering activity.<br>6.2 State how you communicated mitigating measures to affected parties and acquired stakeholder engagement. | 6.1 Engineering impacts heavily on the environment e.g., servitudes, expropriation of land, excavation of trenches with associated inconvenience, borrow pits, dust and obstruction, street and other crossings, power dips and interruptions, visual and noise pollution, malfunctions, oil and other leaks, electrocution of human beings, detrimental effect on animals and wildlife, dangerous rotating and other machines, demolishing of structures, etc.<br>6.2 Mitigating measures taken may include environmental impact studies, environmental impact management, community involvement and communication, barricading and warning signs, temporary crossings, alternative supplies (ring feeders and bypass roads), press releases, compensation paid, etc. |
| **Outcome 7:**<br>Meet all legal and regulatory requirements, protect the health and safety of persons and adhere to sustainable practices in the course of his or her specifically defined engineering activities. | **Responsibility level E** |
| **Competency Indicators:**<br>7.1 List the major laws and regulations applicable to this particular activity and how sustainability practices and health and safety matters were handled.<br>7.2 State how you obtained advice in doing risk management for the work and elaborate on the risk management system applied. | 7.1 The OHS Act is supplemented by a variety of parliamentary acts, regulations, local authority by-laws, standards and codes of practice. Places of work might have standard procedures, instructions, drawings and operation and maintenance manuals available. These documents, depending on the situation (emergency, breakdown, etc.) are consulted before work is commenced and during the activity.<br>7.2 It is advisable to attend a Risk Management (Assessment) course, and to investigate and study the materials, components and systems used in the workplace. The Specified Category Practitioners seek advice from knowledgeable and experienced specialists if any doubt exists that safety and sustainability cannot be guaranteed. |
| **Range Statement for Outcomes 6 and 7:** Impacts and regulatory requirements include:<br>a) Impacts to be considered are generally those identified within the established methods, techniques or procedures used in the specific practice area. | a) The impacts vary substantially with the location of the task, e.g., the impact of laying a cable or pipe in the main street of a town is entirely different to construction in a rural area. The methods, techniques or procedures differ accordingly, and are identified and studied by the Specified Category Practitioners before starting the work.<br>b) The Safety Officer and/or the Responsible Person appointed in accordance with the OHS Act usually confirms or checks that the instructions are in line with regulations. The Specified |

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| b) Regulatory requirements are prescribed.<br>c) Apply prescribed risk management strategies.<br>d) Effects to be considered and methods used are defined.<br>e) Prescribed safe and sustainable materials, components and systems.<br>f) Prescribe maintenance protocols.<br>g) Persons whose health and safety are to be protected are both inside and outside the workplace. | Category Practitioner is responsible to see to it that this is done, and if not, establishes which regulations apply, and ensure that they are adhered to. Usually, the people working on site are strictly controlled w.r.t. health and safety, but the Specified Category Practitioner checks that this is done. Tasks and projects are mostly carried out where contact with the public cannot be avoided, and safety measures like barricading and warning signs must be used and maintained.<br>c) Risks are mostly associated with elevated structures, subsidence of soil, electrocution of human beings, moving parts on machinery, fraud and corruption and theft. Risk management strategies are usually done by more senior staff but are understood and applied by the Specified Category Practitioner.<br>d) Effects associated with risk management are mostly well known if not obvious, and methods used to address, clearly defined.<br>e) Usually the safe and sustainable materials, components and systems are prescribed by Professionals or other specialists. It is the responsibility of the Specified Category Practitioner to use his/her knowledge and experience to check and interpret what is prescribed and report anything that he/she is not satisfied with.<br>f) Draw up maintenance systems and procedures from Codes of Practice and Manufacturer's Instructions.<br>g) Staff working on the task or project as well as persons affected by the engineering work being carried out. |
| **Group D: Exercise judgment, take responsibility, and act ethically.** | **Explanation and Responsibility Level** |
| **Outcome 8:**<br>Conduct engineering activities ethically. | **Responsibility level E**<br>Ethically means "science of morals; moral soundness".<br>Moral means "moral habits; standards of behaviour; principles of right and wrong". |

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| **Competency Indicators:** Sensitivity to ethical issues and the adoption of a systematic approach to resolving these issues is expected, typified by:<br>8.1 State how you identified ethical issues and affected parties and their interest and what you did about it when a problem arose.<br>8.2 Confirm that you are conversant and in compliance with ECSA's Code of Conduct and why this is important in your work. | Systematic means "methodical; based on a system".<br>8.1 Ethical problems that can occur include tender fraud, payment bribery, alcohol abuse, sexual harassment, absenteeism, favouritism, defamation, fraudulent overtime claims, fraudulent expenses claimed, fraudulent qualifications, misrepresentation of facts, etc.<br>8.2 ECSA's Code of Conduct, as per ECSA's website, is known and adhered to. Applicable examples given. |
| **Outcome 9:**<br>Exercise sound judgement in the course of *specifically defined* engineering activities | **Responsibility level E**<br>Judgement means "good sense: ability to judge". |
| **Competency Indicators:** Exhibition of judgement is expected by:<br>9.1 State the factors applicable to the work, their interrelationship and how you applied the most important factors.<br>9.2 Describe how you foresaw work consequences and evaluated situations in the absence of full evidence. | 9.1 The extent of a project or task given to a junior Specified Category Practitioner is characterised by the limited number of factors and their resulting interdependence. He/she will seek advice if educational and/or experiential limitations are exceeded. Examples of the main engineering factors applied must be given.<br>9.2 Taking risky decisions will lead to equipment failure, excessive installation and maintenance cost, damage to persons and property, bankruptcy, poor service delivery, etc. Give examples. |
| **Range Statement for Outcomes 8 and 9:** Judgement is expected both within the application of the candidate's category specific methods, techniques and specific procedures and in assessing their immediate impacts. Judgement in decision making involves:<br>a) taking limited risk factors into account some of which may be ill- defined; or<br>b) consequences are in the immediate work contexts; or | In engineering about 15% of the activities can be classified as *specifically defined* where the Specified Category<br>Practitioner uses standard procedures, codes of practice, specifications, etc. Judgement must be displayed to identify any activity falling outside the *specifically defined* range, as defined above by:<br>a) Seeking advice when risk factors exceed his/her capability.<br>b) Consequences outside the immediate work contexts, e.g., long-term, not normally handled. |

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| c) identified set of interested and affected parties with defined needs to be taken into account. | c) Interested and affected parties with defined needs outside the *specifically defined* parameters to be taken into account. |
| **Outcome 10:**<br>Be responsible for making decisions on part or all of all of one or more *specifically defined* engineering activities. | **Responsibility level E**<br>Responsible means "legally or morally liable for carrying out a duty; for the care of something or somebody in a position where one may be blamed for loss, failure, etc." |
| **Competency Indicators:** Responsibility is displayed by the following performance:<br>10.1 Show how you used HCert level theoretical calculations to justify decisions taken in doing engineering work. Attach actual calculations.<br>10.2 State how you took responsible advice on any matter falling outside your own education and experience.<br>10.3 Describe how you took responsibility for your own work and evaluated any shortcoming in your output. | 10.1 The calculations, for example fault levels, load calculations, losses, return on investment, etc. are done to ensure that the correct material and components are utilised.<br>10.2 The Specified Category Practitioner does not operate on tasks at a higher level than *specifically defined* and consults professionals if elements of the tasks to be done are beyond his/her education and experience, e.g., power system stability, legal actions, etc.<br>10.3 This is in the first instance continuous self-evaluation to ascertain that the task given is done correctly, on time and within budget. Continuous feedback to the originator of the task instruction, and corrective action, if necessary, forms an important element. |
| **Range Statement:** Responsibility must be discharged for significant parts of a one or more *specifically defined* engineering activity. | The responsibility is mostly allocated within a team environment with an increasing designation as experience is gathered. |
| **Note 1:** Responsibility for the evaluation of work in a supervisory capacity. | |
| **Group E: Initial Professional Development (IPD)** | **Explanation and Responsibility Level** |
| **Outcome 11:**<br>Undertake independent learning activities sufficient to maintain and extend his or her competence. | **Responsibility level D** |
| **Competency Indicators:** Self-development managed by typically the following: | 11.1 If possible, a specific field of the sub-discipline is chosen, available developmental alternatives established, a program drawn up (in consultation with the employer if costs are involved), and options open to expand knowledge into additional fields investigated. |

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| 11.1 Provide your strategy adopted independently to enhance professional development. (IPD report).<br>11.2 Be aware of the philosophy of an employer in regard to professional development. | 11.2 Record keeping must not be left to the employer or anybody else. The trainee must manage his/her own training independently, taking initiative and be in charge of experiential development towards Specified Category Practitioner registration level. Knowledge of the employer's policy and procedures on training is essential. |
| **Range Statement:** Professional development involves:<br>a) Taking ownership of own professional development.<br>b) Planning own professional development strategy.<br>c) Selecting appropriate professional development activities.<br>d) Recording professional development strategy and activities, while displaying independent learning ability. | a) This is your professional development, not that of the organisation you work for.<br>b) In most places of work, training is seldom organised by some training department. It is up to the Specified Category Practitioner to manage his/her own experiential development. Specified Category Practitioners frequently end up in a 'dead-end street' being left behind doing repetitive work. If self-development is not self-driven, success is unlikely.<br>c) Preference must be given to engineering development rather than developing soft skills.<br>d) Developing a learning culture in the workplace environment of the Specified Category Practitioner is vital to his / her success. Information is readily available, and most senior personnel in the workplace are willing to mentor, if approached. |