ECSA

ENGINEERING COUNCIL OF SOUTH AFRICA

An Effective Regulator Assuring Engineering Excellence

Sub Discipline-specific Training Guide for Registration as a Railway System Specialist in Specified Category

R-05-RSS-SC

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INTRODUCTION

All persons applying for registration as a Professional Engineer, Technologist or Technician are expected to demonstrate the competencies specified in document **R-02-STA-PE/PT/PN** through work performed at the prescribed level of responsibility, irrespective of the trainee's discipline.

The *Training and Mentoring Guide for Professional Categories* (**R-04-T&M-GUIDE-PC**) provides key aspects of training:

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

It is therefore important to standardise the framework for all engineering disciplines to ensure that all ECSA registration categories are aligned

DEFINITIONS

Alternative Route means an applicant who aspires to become registered in a Candidate or Professional Category but does not have the accredited or recognised qualifications and who proposes to meet the educational requirement through further study and assessment.

Applicant: A person applying to the ECSA for registration in any of the categories according to Section 18 of the Engineering Profession Act, 46 of 2000.

Candidate: A person who is registered with ECSA in a Candidate Category of registration.

Benchmark Route means the normal process required to attain registration that consists of the completion of an accredited, recognised or evaluated equivalent qualification and a well-

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structured and effectively executed programme of training and experience for the category of registration.

Competency area means the performance area where all the outcomes can be demonstrated at the level prescribed in a specific technology in an integrated manner.

Engineering science means a body of knowledge, based on the natural sciences, 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 means a problematic situation that is amenable to analysis and solution using engineering sciences and methods.

Ill-posed problem means a problem whose requirements are not fully defined or may be defined erroneously by the requesting party.

Integrated performance means that 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 means a measure of performance demands at which outcomes must be demonstrated.

Management of engineering works or activities means coordinated 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 engineering works, plant and equipment to an acceptable condition by the renewal, replacement or mending of worn, damaged or decayed parts;

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

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

Network means a system of railway infrastructure elements, including track, civil infrastructure, train control and signalling systems and electric traction infrastructure, which constitutes running lines and any part of a railway yard, marshalling yard, siding, freight terminal, depot or station on which those elements are situated;

Over-determined problem means a problem whose requirements are defined in excessive detail, making the required solution impossible to attain in all its aspects.

Outcome at the specified category level means a statement of the performance that a person must demonstrate to be judged competent.

Practice area means 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 means the required extent of or limitations on expected performance stated in terms of situations and circumstances in which outcomes are to be demonstrated in a particular competency area.

Specified Category means a category of registration for persons who must be registered through the Engineering Profession Act or a combination of the Engineering Profession Act and external legislation as having specific engineering competencies normally at NQF Level 5 related to an identified need to protect the public safety, health and interest or the environment, in relation to an engineering activity.

Sustainable development means development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

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ABBREVIATIONS

APP	Approved Professional Person
ATP	Automatic Train Protection
BDEP	Broadly defined engineering problem
BIFSA	Building Industries Federation South Africa
C&U	Commitment and Undertaking
CESA	Consulting Engineers South Africa
CPD	Continuing Professional Development
CTC	Centralised Traffic Control
DoR	Degree of Responsibility
DSRR	Discipline-specific Requirements Report
DSTG	Discipline-specific Training Guide
DWS	Department of Water and Sanitation
EA	Experience Appraisal
ECSA	Engineering Council of South Africa
EPA	Engineering Profession Act, 46 of 2000
IPD	Initial Professional Development
NEMA	National Environmental Management Act
NWA	National Water Act, 36 of 1998
OHTE	Overhead traction equipment
PE	Professional Engineer
PN	Professional Engineering Technician
PR	Professional Review
Pr Cert Eng	Professional Certificated Engineer
Pr Eng	Professional Engineer
Pr Tech Eng	Professional Engineering Technologist
Pr Techni Eng	Professional Engineering Technician

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RSR	Railway Safety Regulator
SAICE	South African Institution of Civil Engineering
SC	Specified Category
SIL	Safety integrity level
SMS	Safety Management Systems
SOE	State-owned enterprise
SDSRR	Sub Discipline-specific Requirements Report
TER	Training and Experience Report
TES	Training and Experience Summary
VA	Voluntary Association

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BACKGROUND

The illustration in Figure 1 defines the documents that comprise the Engineering Council of South Africa (ECSA) system for registration in professional categories. The illustration also locates the current document.

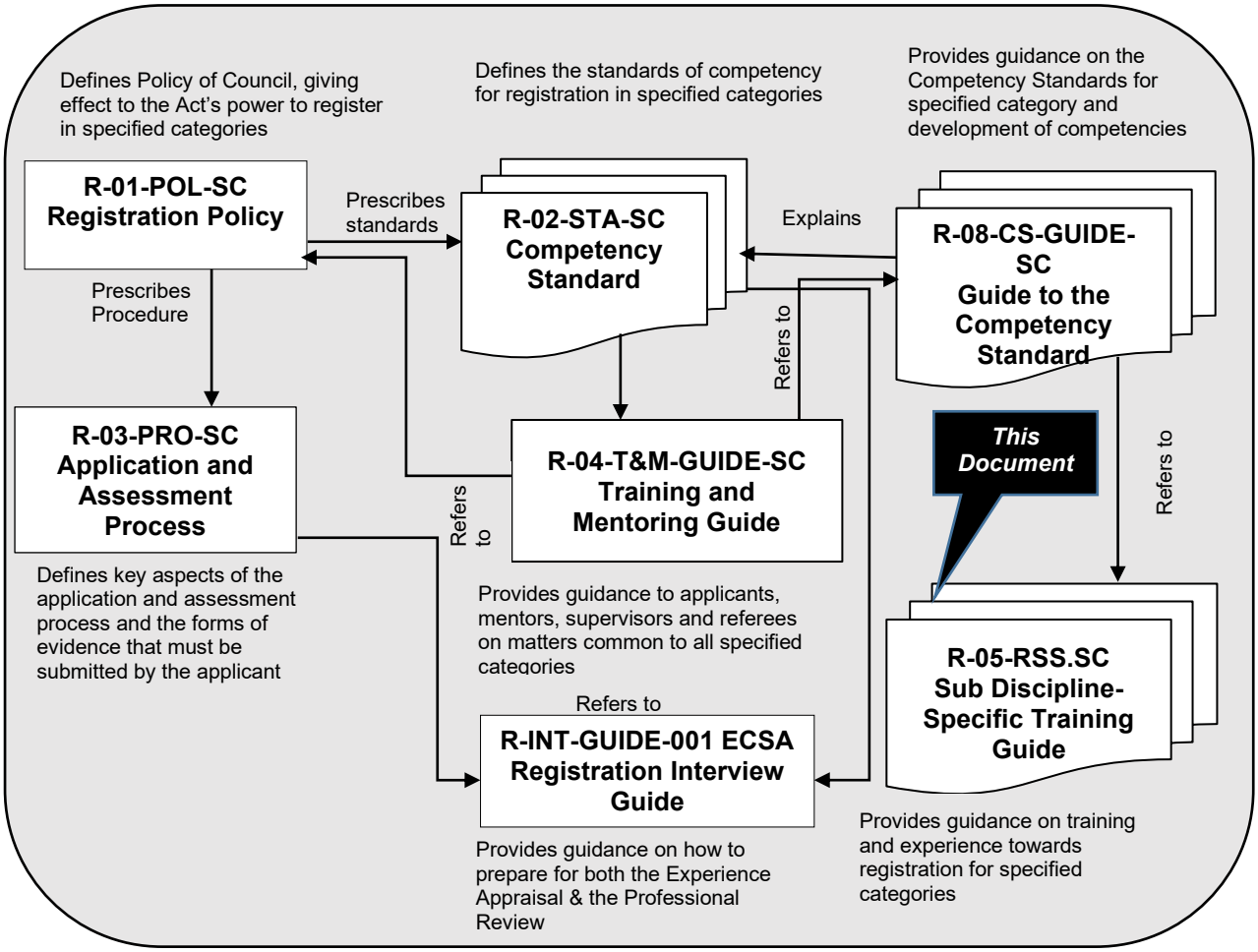

Figure 1: Documents defining the ECSA registration system

1. PURPOSE OF THE DOCUMENT

This document provides a Discipline-specific Training Guide (DSTG), structured on an outcome-by-outcome basis, for all persons applying for registration in the Specified Category of Railway System Specialists and which is guided by the following policies and standards:

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- **R-01-POL-SC**-:Policy on Registration of Practitioners
- **R-02-STA-SC** : Competency Standard for Registration
- **R-03-PRO-SC**: Processing of Applications for Registration of Candidates and Professionals.
- **R-04-T&M-GUIDE-SC**: Training and Mentoring Guide for Specified Category
- **R-08-CS-GUIDE-SC**: Guide to the Competency Standards for Registration in Specified Category.
- **R-11-PRO-SC**: Process for Training Engineering Candidates towards Specified Category Registration

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.

R-08-CS-GUIDE-SC is applicable to Alternative Route applicants. It provides both a high-level and an outcome-by-outcome understanding of the Competency Standards as an essential basis for this Discipline-specific Training Requirements document.

R-11-PRO-SC elaborates on the elements of the training process and the requirements of the Commitment and Undertaking (C&U).

This training requirements documents **R-04-T&M-GUIDE-SC, R-08-CS-GUIDE-SC** and **R-11-PRO-SC** are subordinate to the Policy on Registration (**R-01-POL-SC**), the Competency Standards (**R-02-STA-SC**) and the application process definition (**R-03-PRO-SC**).

2. AUDIENCE

The DSTG is directed towards applicants, including their supervisors and mentors in the discipline-specific category for Railway System Specialists. The guide is intended to support the applicants' training programmes in gaining experience through incorporating elements of good

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practice, also indicated in the **R-02-COP-XXX**: *Code of Practice for the Performance of Railway Engineering Work*.

The guide applies to persons who:

- have completed the education requirements by obtaining at least an accredited Higher Certificate Engineering qualification at NQF level 5, or by obtaining substantially equivalent qualification and through evaluation or assessment
- have registered as Candidate Specified Category Railway Engineering
- hold an ECSA-accredited qualification or acceptable combination of accredited qualifications prescribed for the category

3. PERSONS NOT REGISTERED AS A CANDIDATE OR NOT BEING TRAINED

Irrespective of the development path followed, all applicants for registration in the Railway Specified Category must present equivalent evidence of competence and will be assessed against the same standards.

It should be noted that application for registration as a Specified Category Railway Practitioner is permitted without prior registration as a Candidate Railway Practitioner and without necessarily training under a C&U agreement. However, mentorship and adequate professional supervision remain key factors in achieving the level of competence required for registration. A C&U signifies that the organisation is formally committed to providing structured mentorship and supervision.

If the trainee's employer does not hold a C&U, the trainee should determine 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 registered in the relevant railway specified category should be secured. Alternatively, the recognised Voluntary Association (VA) for the railway discipline may be approached for assistance in locating an appropriate external mentor. The mentor should remain actively engaged and informed throughout all stages of the trainee's professional development.

This DSTG is written for recent graduates or applicants who have achieved the relevant educational qualifications and who are in training or gaining experience toward registration as

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specified in Schedule 3 of policy document **R-01-SC**. Mature applicants for registration may also apply the guidance retrospectively to identify potential gaps in their developmental experience.

Any applicant who has completed a mentorship programme is encouraged to request an experienced mentor (either internal or external) to act as an application adviser during the preparation of their registration submission. This DSTG also applies to individuals entering a candidacy or structured development programme at a later stage where their current experience level falls below that required for registration

4. TRAINING OBJECTIVE

Railway System Specialist is a multi-disciplinary field that integrates various traditional engineering disciplines to create efficient, safe and sustainable railway systems. It encompasses the planning, design, construction, operation and maintenance of rail infrastructure and rolling stock, ensuring the seamless movement of people and goods across vast networks. This discipline draws on civil engineering principles for track and structural design, mechanical engineering expertise for locomotives and wagons, and electrical engineering knowledge for signalling, traction power and communication systems. The role of a railway engineer is therefore diverse, requiring a holistic understanding of these interconnected systems and the ability to innovate and apply engineering solutions that meet rigorous safety, operational and environmental standards. Ultimately, railway engineering plays a critical role in supporting economic growth and societal mobility by delivering reliable and sustainable transport solutions.

The Specified Category of Railway System Specialist is a multi-discipline field of Engineering which deals with the following sub-disciplines:

- **Track Systems:** Railway engineers plan design, build and maintain the physical track infrastructure, including rails, sleepers (ties), ballast and subgrade. This system forms the foundation for train movement and requires precise engineering to ensure alignment, stability and durability under dynamic loads.
- **Train Control and Authorisation Systems**: These systems manage train movements to ensure safety and efficiency. They include track vacancy detection systems track circuits, and axle counters signals, interlocking, automatic train protection (ATP) and centralised

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traffic control (CTC). Engineers plan develop and maintain these to prevent collisions, control train spacing and optimise network capacity.

- **Rolling Stock Systems:** This encompasses locomotives, passenger coaches, freight wagons and specialised maintenance vehicles. Engineers focus on the mechanical, electrical and control systems within these vehicles to ensure safe, reliable and efficient operations.
- **Electrification and Power Supply Systems:** Railway electrification includes overhead catenary systems or third-rail power supplies, substations and traction power distribution networks. Engineers design and maintain these to deliver continuous, stable, electrical energy for electric trains.
- **Communication Systems:** Vital for operational coordination, communication systems include radio networks, fibre-optic cables and data transmission infrastructure. These support train control, safety systems and operational management.
- **Structural Systems:** Railway engineers work on bridges, tunnels, viaducts, culverts, retaining walls and station structures that support railway operations. These structures must withstand heavy dynamic loads and environmental stresses over long periods.
- **Geotechnical Systems:** These systems involve soil and rock foundations supporting track and structures, embankments, cuttings and drainage systems to manage ground stability and water flow.
- **Safety Management Systems:** Integrated systems that include hazard detection, risk assessment tools, incident reporting mechanisms and emergency response coordination to maintain a safe railway environment.
- **Environmental Control Systems:** These include noise barriers, vibration dampening measures, pollution control installations and habitat conservation initiatives integrated into railway projects to minimise environmental impact.

5. ORGANISATIONAL FRAMEWORK FOR RAILWAY SPECIALISTS

The practice of railway engineering and safety management in South Africa is governed by a comprehensive regulatory framework designed to ensure the safe, efficient and sustainable operation of the national railway system. The cornerstone of this framework is the Railway Safety Act, 30 of 2024, which came into effect in August 2025. This Act introduces enhanced provisions for Safety Management Systems (SMS), strengthens the role and accountability of the Safety

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Permit Holder, and expands the regulatory oversight powers of the Railway Safety Regulator (RSR).

For Railway System Specialists, the Act has a direct impact on the nature and scope of professional responsibilities. It requires that all engineering and operational activities be carried out within a formal, risk-based safety management framework aligned with the principles of continuous improvement and assurance. Practitioners are expected to demonstrate competence not only in technical design and maintenance, but also in hazard identification, risk assessment, safety assurance and incident investigation within the SMS environment. Compliance with the Act places a strong emphasis on professional accountability, system integration and collaboration across disciplines such as infrastructure, rolling stock, signalling and operations.

Complementing the Act, the *SANS 3000: Railway Safety Management Standard* provides detailed guidance on the structure, implementation and auditing of SMS. It outlines the requirements for safety planning, operational control, competence management and performance monitoring – thereby serving as the operational benchmark against which compliance with the Railway Safety Act is measured. Railway specialists must be fully conversant with the SANS 3000 standard, as well as any applicable RSR directives, technical standards and circulars.

In addition to the Railway Safety Act and SANS 3000, several other legislative instruments and standards influence the work of railway professionals. These include the Engineering Profession Act, 46 of 2000, which establishes ECSA's regulatory authority, the Occupational Health and Safety Act, 85 of 1993 and, where applicable, the National Railway Policy White Paper (2022) and relevant environmental legislation such as the National Environmental Management Act, 107 of 1998 (NEMA). Together, these instruments create an integrated framework that defines the organisational, technical and ethical context within which railway specialists must operate.

6. NATURE AND ORGANISATION OF THE RAILWAY INDUSTRY

Railway System Specialists may be employed in both the private and the public sector. Typically, in the private sector, they would be involved in inspection, consulting or contracting, or in supplier or manufacturing organisations. Consultants are responsible for planning, designing, documenting and supervising the construction and/or operation of projects on behalf of their clients. Contractors are responsible for project implementation and activities, including planning,

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construction, labour and resource management. Those working in supply or manufacturing companies could be involved in research and development and would be involved in production, supply and quality control.

The public sector is responsible for service delivery and is usually the client, though in some departments, design and construction are also carried out. Railway System Specialists are required at all levels of the public sector, including at national, provincial and local government level, state-owned enterprises (SOEs) and public utilities. The Railway System Specialist in the public sector largely handles planning, specifying, overseeing implementation, operations and maintenance of infrastructure.

An extension of the public sector includes tertiary academic institutions and research organisations. Depending on where the candidate is employed, there may be situations where opportunities in-house are insufficiently diverse to develop all the competencies required in both Groups A and B, noted in document **R-02-STA-SC**. For example, the opportunity to develop problem-solving competence (including design or developing solutions) and manage engineering activities (including implementing or constructing solutions) may not both be available to the candidate. In such cases, employers are encouraged to put a secondment system in place.

It has been fairly common practice that where an organisation is unable to provide training in certain areas, secondments are arranged with other organisations, so the candidate is able to develop all the competencies required for registration.

These secondments are usually reciprocal, so both employers and their respective employees get the mutual benefit from the other party. Secondments between consultants and contractors, and between the public and private sector should be possible.

Typical tasks that may be undertaken in the Specified Category of Railway System Specialist include the following:

- Conducting research and developing new or improved methods and technologies related to railway engineering disciplines such as track design, signalling, rolling stock and electrification systems.

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- Advising on and designing railway infrastructure including track layouts, signalling systems, stations, bridges, tunnels, overhead electrification and maintenance facilities.
- Determining and specifying construction methods, materials and quality standards specific to railway projects and overseeing their implementation on site.
- Establishing control systems and procedures to ensure efficient operation of railway infrastructure, with particular focus on safety, reliability and environmental compliance.
- Organising and directing routine maintenance, inspections and repairs of railway assets to maximise operational availability and minimise safety risks.
- Analysing the interaction between rolling stock and track components to optimise performance, reduce wear and prevent failures.
- Assessing the structural integrity and stability of railway bridges, tunnels and earthworks, and recommending appropriate strengthening or remediation measures.
- Managing project budgets, preparing cost estimates, monitoring expenditures and ensuring financial accountability throughout railway engineering projects.
- Overseeing the implementation of design specifications during construction and commissioning phases, ensuring compliance with regulatory standards and engineering best practice.

Practising Railway System Specialists generally concentrate in one or more of the following areas:

- **Track Engineering:** Track engineering involves the plan, design, construction and maintenance of the railway track system, including rails, sleepers, ballast and subgrade. It ensures the track alignment, geometry and structural integrity meet operational and safety requirements. Track engineers manage the complex interaction between the track infrastructure and rolling stock to provide smooth and reliable train movement.
- **Train Control, Authorisations and Telecommunication Engineering:** This discipline focuses on the systems and technologies that control train movements and ensure safe operations. It includes signalling systems, train detection, interlocking and communication networks that facilitate real-time train control and management. Engineers in this field develop and maintain authorisation protocols to regulate train movements and prevent collisions or derailments.

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- **Rolling Stock Engineering:** Rolling stock engineering covers the plan design, manufacturing, maintenance and overhaul of locomotives, passenger coaches, freight wagons and other rail vehicles. It involves mechanical, structural and systems engineering to ensure reliability, performance, safety and compliance with standards throughout the lifecycle of the vehicles.
- **Railway Operations and Management:** This area focuses on the planning, scheduling and management of railway services and assets. It involves coordinating train movements, managing crew and resources, ensuring compliance with safety regulations and optimising operational efficiency to meet customer and stakeholder demands.
- **Structural Engineering:** Structural engineering in railways concerns the design and maintenance of bridges, tunnels, stations and other supporting infrastructure. It ensures these structures can safely withstand loads from trains, environmental forces and long-term wear, while adhering to stringent safety and durability standards.
- **Transportation Engineering:** Transportation engineering addresses the planning, design and optimisation of the entire railway transport system. It involves passenger flow management, freight logistics, network capacity analysis and integration with other transport modes to provide efficient and sustainable mobility solutions.
- **Railway Electrification:** Railway electrification engineering involves the design, installation and maintenance of electrical power supply systems for trains, including overhead lines, substations and related infrastructure. It ensures reliable, safe and efficient delivery of electrical energy to traction systems, supporting operational demands and reducing environmental impact.
- **Geotechnical Engineering:** Geotechnical engineering focuses on the behaviour and stability of soil and rock that support railway infrastructure. It includes ground investigations, foundation design, slope stability and ground improvement techniques to ensure safe and durable construction in diverse geological conditions.
- **Safety and Security Engineering:** Safety engineering in railways involves the development and implementation of systems, standards and procedures to minimise risk and ensure the well-being of passengers, staff and the public. It covers hazard identification, risk assessments, safety management systems and compliance with regulatory frameworks.

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- **Environmental Engineering:** Environmental engineering addresses the assessment and mitigation of the railway's impact on the natural environment. It involves managing noise, vibration, air quality, water runoff and habitat preservation, ensuring sustainable development and adherence to environmental legislation.

7. TRAINING FOR REGISTRATION AS A RAILWAY ENGINEERING PRACTITIONER

The knowledge aspect of competency comprises skills and understanding gained through engineering education that are further developed through specialised engineering tasks in the workplace and ongoing Continuing Professional Development (CPD). To qualify for professional registration, candidates/applicants must show competence across all 11 required outcomes.

- A set of level descriptors for a complex engineering problem.
- The level descriptors that allow an engineering activity to be classified within complex engineering activities.
- Solving complex engineering problems and performing complex engineering activities.

The Degree of Responsibility (DoR) has levels of responsibility varying from "Being Exposed" at Level A to "Performing" at Level E, as detailed in the Training and Mentoring Guide, document **R-04-T&M-GUIDE-SC** (Table 1):

Table 1: Degrees of Responsibility

A: Being Exposed	B: Assisting	C: Participating	D: Contributing	E: Performing
Undergoes induction, observes processes, work of competent practitioners.	Performs specific processes, under close supervision.	Performs specific processes as directed with limited supervision.	Performs specific work with detailed approval of work outputs.	Works in team without supervision, recommends work outputs, responsible but not accountable.
Responsible to supervisor	Limited responsibility for work output.	Full responsibility for supervised work.	Full responsibility to supervisor for immediate quality of work.	Level of responsibility to supervisor is appropriate to a registered person.

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A: Being Exposed	B: Assisting	C: Participating	D: Contributing	E: Performing
				Supervisors are accountable for an applicant's decisions under their direct supervision.

7.1 Define, investigate and analyse engineering problems

Railway engineering professionals are often required to address complex technical challenges that directly affect the safety, efficiency and sustainability of rail transport systems. This outcome focuses on the ability of candidates to recognise, frame and rigorously analyse engineering problems within the railway context.

In the railway discipline, these problems may range from infrastructure failures and rolling stock performance issues to power supply interruptions, safety risks, operational inefficiencies or environmental impacts. The ability to approach such challenges systematically ensures that solutions are not only technically sound but also economically viable, safe and aligned with regulatory and societal expectations.

The definition, investigation and analysis of complex engineering problems is typified by:

- defining the engineering problems and procedures for solving the problems
- investigating and evaluating pertinent information and identifying systems and sub-systems of complex problems, including collecting, organising and evaluating information from all applicable sources including in-situ investigations where appropriate
- analysing relevant assumptions, inputs and required outputs of a complex engineering problem.

To evaluate and analyse the engineering problem, applicants should:

- identify and formulate the problem, which leads to an agreed definition of the problem to be addressed
- collect, organise and evaluate information

- use conceptualisation, abstraction and modelling
- identify and justify assumptions, limitations, constraints and premises
- use both mathematical and non-mathematical analytical methods
- evaluate the results of the analysis, using judgement
- express understanding of the results emerging from the analysis.

7.2 Design or develop solutions to engineering problems

Designing or developing solutions to complex engineering problems based on engineering knowledge is at the centre of other engineering activities such as planning, research, development and technology transfer, quality assurance, risk analysis, domain-specific project management, managing engineering processes, safe work practices, environmental protection, sustainability analysis and systems engineering.

The design and development of solutions to engineering problems represents one of the most critical competencies of a professional in the railway sector. Candidates are expected to demonstrate the ability to generate, evaluate and implement solutions that address complex and diverse challenges within the railway environment.

This outcome requires the integration of engineering knowledge, analytical skills, innovation and sound professional judgement to ensure that solutions are technically robust, economically feasible, environmentally responsible and compliant with applicable legislation and standards.

An example approach for the candidate is given below:

- Analyses the requirements for the design/planning/solution and draws up a detailed requirements specification.
- Synthesises a range of potential solutions to the problem or a range of approaches to developing a solution that is consistent with assumptions, premises, limitations and constraints.
- Evaluates the potential approaches against the requirements and includes cost and impacts outside the requirements.
- Presents reasoned arguments and a proposal for the preferred option.
- Fully develops the design of the selected option.

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- Evaluates the resulting solution.
- Produces design documentation for review and implementation.

In the railway context, design or development activities may range from upgrading track and signalling layouts, developing energy-efficient traction systems and improving rolling stock performance, to implementing digital technologies, designing safe stations or creating integrated transport solutions.

This outcome also recognises that design is not an isolated activity; it is interconnected with planning, research, development, technology transfer, quality assurance, project management, systems engineering and sustainability analysis. The professional's role is therefore to ensure that design solutions not only meet immediate technical requirements but also contribute to the long-term growth, safety and efficiency of the railway industry.

7.3 Contextual knowledge

This outcome requires applicants to demonstrate they have comprehended and applied both advanced and local knowledge of the principles underpinning good engineering practice, specifically within the jurisdiction in which they operate.

In railway engineering, contextual knowledge is essential because solutions must not only be technically sound but also legally compliant, operationally practical and socially responsible. Candidates must show that they can integrate contextual understanding into their decision-making and professional practice.

The application of engineering knowledge as an outcome is normally demonstrated during design, investigation or operations. The applicant:

- displays mastery in the understanding of engineering principles, practices and technologies in the practice area
- applies general and underpinning engineering knowledge to support analysis and to provide insight
- uses an analytical approach based on fundamentals and first principles in building models as required

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- displays working knowledge of areas that interact with the practice area
- applies related financial, statutory, safety and management knowledge
- calculates at theoretical level confirming the correct application and utilisation of equipment, materials and systems
- understands complex procedures and techniques that must be based on fundamental mathematical, scientific, and engineering knowledge, as part of personal contribution within the engineering team
- displays the ability to manage the resources within legal and financial constraints.

7.4 Engineering project management

During this stage, applicants develop competence in managing part or all of one or more complex engineering activities, which can be displayed by:

- managing self, people, work priorities, processes and resources when performing complex engineering activities
- planning, organising, leading and controlling complex engineering activities
- managing contracts and other agreements and the ability to establish and maintain professional and business relationships
- resources management, availability and controlled by a work breakdown structure and scheduling to meet deadlines; quality, safety and environment management are important aspects
- the basic elements of management being applied to complex engineering work.

In line with the progression of levels of engineering work and the DoR defined in ECSA document **R-04-T&M-GUIDE-PC**, this outcome requires applicants to demonstrate competence in applying the principles and practices of project management to engineering activities.

Applicants are expected to use various phases of project-related activities that build their ability to plan, organise, lead and control. These functions must be demonstrated both when working independently and when participating in teams.

Within the railway engineering context, project management extends across the lifecycle of infrastructure and operational projects: from feasibility studies and design to construction,

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commissioning and maintenance. Effective project management in this field requires balancing safety, cost, schedule and quality while complying with regulatory requirements and ensuring long-term sustainability.

By achieving this outcome, applicants prove their readiness to manage engineering tasks and projects in a structured and professional manner, demonstrating both technical competence and leadership potential appropriate to their level of registration.

7.5 Professional communication

During this stage, applicants should demonstrate competence in how to communicate clearly using multiple media and collaborate inclusively with a broad range of stakeholders in the course of engineering activities. Communication with respect to complex engineering problems relates to the technical aspects and the wider impacts of professional work. The applicant should develop the ability to:

- write clear, concise, and effective technical, legal and editorially correct documentation
- issue clear and concise instructions and/or guidance, being cognisant of the audience and various skill levels
- execute oral presentations using structure, style, language, visual aids and supporting documents appropriate to the audience and the purpose.

Moreover, applicants should display effective communication which can be demonstrated by the ability to write clear, concise and effective reports that are technically, legally and editorially correct using a structure and style that meets communication objectives and user/audience requirements.

7.6 Impact of engineering activities and risk mitigation

This outcome requires applicants to demonstrate the ability to recognise and evaluate the reasonably foreseeable economic, social, cultural and environmental impacts of complex engineering activities, while striving to achieve long-term sustainability.

In the railway engineering context, this may involve evaluating how projects affect land use, energy consumption, noise and vibration levels, community safety, employment opportunities or

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broader economic development. It also includes proactive risk management to address hazards such as derailments, system failures or environmental damage.

By achieving this outcome, applicants demonstrate professional responsibility, ethical awareness and the ability to integrate technical competence with societal and environmental stewardship in the delivery of engineering solutions.

Applicants should be allowed to study, analyse and recommend measures for:

- social/cultural impacts
- community/political considerations
- environmental impact
- sustainability analysis
- regulatory conditions
- potential ethical dilemmas.

7.7 Statutory & regulatory requirements

During this stage, applicants develop the ability to meet all legal and regulatory requirements and protect the health and safety of persons during all complex engineering activities.

Applicants are expected to have a working knowledge of the following Acts:

- Engineering Profession Act, 46 of 2000, its Rules, specifically the Code of Conduct
- Occupational Health and Safety Act, 85 of 1993 and its relevant regulations pertaining to the industry, as amended by Act 181 of 1993
- Railway Safety Act, 30 of 2024
- Construction Regulations.

Moreover, depending on their area of practice, applicants should have a working knowledge of the following Acts and Standards:

- Railway Safety Management, SANS 3000:2016
    - Part 1: General.

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- Part 2-1: Requirements for systemic engineering and operational safety standards – Electrical distribution and overhead traction systems.
- Part 2-2: Requirements for systemic engineering and operational safety standards – Track and associated civil infrastructure and installations.
- Part 2-2-1: Technical requirements for engineering and operational standards – Track, civil and electrical infrastructure – Level crossings.
- Part 2-3: Requirements for systemic engineering and operational safety standards – Rolling stock.
- Part 2-4: Technical requirements for engineering and operational standards – Train authorisation and control, and telecommunication.
- Part 2-5: Technical requirements for engineering and operational standards – Operational principles for safe movement on rail.
- Part 2-6: Technical requirements for engineering and operational standards –Interface and intraface management, and interoperability.
- Part 4: Human factors management.

- National Building Regulations and Building Standards Act, 103 of 1977, as amended by Act 49 of 1995
- Environment Conservation Act, 73 of 1989, as amended by Act 52 of 1994 and Act 50 of 2003
- CENELEC standards for railways (EN 50126, EN 50128, EN 50129) form the mandatory safety, reliability, and interoperability framework for rail applications.

The candidate is expected to have a basic knowledge of the Acts and Standards applicable to their area of practice. This list is not exhaustive.

7.8 Ethics of engineering

During this stage, applicants are expected to conduct engineering activities ethically. Applicants should be capable of handling ethical issues, adopting a systematic approach to resolve ethical issues, which is typified by:

- identifying the central ethical problem

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- identifying affected parties and their interests
- searching for possible solutions to the dilemma
- evaluating each solution using the interests of those involved and according to suitable priorities
- selecting and justifying the solution that most appropriately resolves the dilemma.

Applicants are expected to demonstrate both knowledge of and compliance with the ECSA Code of Conduct for Registered Persons. Ethical practice is at the core of professional engineering, ensuring that the safety, health and welfare of the public are always placed above personal or organisational interests.

Within railway engineering, ethical issues may emerge in areas such as safety compliance, procurement practices, environmental protection, reporting of risks or balancing commercial pressures with public interest. Applicants must show that they are prepared to act with integrity, even in the face of competing demands or potential personal disadvantage.

By achieving this outcome, applicants prove that they can uphold the trust placed in the profession, act in the public interest and contribute to the credibility and advancement of engineering in South Africa.

7.9 Exercising sound engineering judgement

This outcome requires applicants to demonstrate the ability to exercise sound professional judgement when engaged in complex engineering activities. Judgement in this context refers to the capacity to evaluate outcomes, assess impacts and consider viable alternatives before making or recommending decisions.

The indication that a candidate/applicant exhibits engineering judgement is typically demonstrated by the following:

- Considering several factors, some of which may be ill-defined or unknown.
- Considering the interdependence, interactions and relative importance of factors.
- Foreseeing consequences of actions.
- Evaluating a situation in the absence of full evidence.

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- Drawing on experience and knowledge.

In railway engineering, application of sound judgement may involve decisions such as determining the most effective track rehabilitation method, selecting between signalling technologies, weighing the trade-offs of energy efficiency versus capital cost or making safety-critical calls in operational contexts.

By achieving this outcome, applicants demonstrate they can integrate technical expertise, contextual awareness and ethical responsibility into their decision-making, ensuring that recommendations are well-founded, transparent and in the public interest.

7.10 Responsibility in decision-making

During this stage, applicants are responsible for making decisions on part or all complex engineering activities. Competence in responsible decision-making is typified by:

- systematic gathering of related information and checking of facts and inputs required for the decision-making process
- making the final decision, based on knowledge, past experience and seeking advice on matters falling outside the applicant's education and experience
- recording the decision-making process and the reasons for the final decision
- taking responsibility and being prepared to be held accountable for far-reaching and significant consequences (whether positive or negative).
- continuous self-evaluation to ascertain the task given is done correctly, on time and within budget.

7.11 Professional development

Professional development involves taking ownership and independently planning, selecting, undertaking and recording appropriate activities to extend competence. Applicants undertake sufficient professional development activities to maintain, extend competence and enhance the ability to adapt to emerging technologies and the ever-changing nature of work. Competence in self-development is typified by:

- explaining awareness and a strategy to independently enhance professional development

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- evidence of self-development in chosen and new areas of expertise and personal development
- taking responsibility for one's own development
- reflecting on strengths and weaknesses, recognising needs and planning
- executing development activities and overcoming obstacles.

8. DEVELOPING COMPETENCY: ELABORATING ON SECTIONS IN THE GUIDE TO THE COMPETENCY STANDARD (R-08-SC)

8.1 Degrees of Responsibility

Throughout the professional development journey – from the graduate stage to fulfilling the competency requirements for registration – candidates progress through various levels of work capability. This progression reflects the gradual development of expertise, practical skills and professional judgement as candidates gain experience in the field.

As candidates advance, they take on increasingly complex tasks and broader responsibilities, enabling them to meet the standards expected for professional registration. This staged growth ensures that candidates are exposed to a range of real-world engineering challenges, fostering the ability to integrate technical knowledge with sound professional decision-making.

The progression during the candidacy period is carefully structured and outlined in document **R-04-T&M-GUIDE-PC**, and is summarised in Table 2 and Table 3. It represents a deliberate increase in the scope and level of responsibility assigned to candidates, providing opportunities to apply their knowledge in practical, operational and project-related contexts.

By the time candidates apply for registration, they are expected to have demonstrated not only technical proficiency, but also the capacity to exercise professional judgement, manage engineering tasks independently and assume accountability for their work. This systematic development of competence ensures that registered professionals are prepared to meet the demands of the railway engineering environment, balancing safety, operational efficiency, regulatory compliance and stakeholder considerations in their daily work.

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Table 2 summarises the functions, responsibilities and decision-making for candidates pursuing registration as Engineers, Technologists, Certificated Engineers, Technicians or Specialist in a specified category in the railway engineering environment.

Table 2: Different categories of registration

Registration level	Scope of work	Complexity of tasks	Decision-making responsibility	Examples of functions in railway engineering
Professional Engineer (Pr Eng) – EPA Section 18(1)(a)(i)	System-level design, integration, and strategic oversight	Complex and often novel problems; requires advanced technical knowledge	High-level professional judgement with long-term, far-reaching consequences	Designing new track alignments, developing signalling systems, conceptualising rolling stock or traction power solutions, leading large infrastructure projects
Professional Engineering Technologist (Pr Tech Eng) – EPA Section 18(1)(a)(ii)	Broadly defined engineering problems and projects; implementation -focused	Moderately complex problems requiring applied engineering knowledge	Moderate judgement; responsible for practical solutions and adherence to standards	Supervising track construction, implementing signalling upgrades, retrofitting rolling stock, overseeing traction power installations, managing mid-level projects
Professional Certificated Engineer – EPA Section 18(1)(a)(iii)	System-level design, integration, and strategic oversight	Complex and often novel problems; requires advanced technical knowledge	High-level professional judgement with long-term, far-reaching consequences	Designing new track alignments, developing signalling systems, conceptualising rolling stock or traction power solutions, leading large infrastructure projects
Professional Engineering	Well-defined engineering	Routine to moderately	Limited judgement;	Performing track inspections and

Registration level	Scope of work	Complexity of tasks	Decision-making responsibility	Examples of functions in railway engineering
Technician (Pr Techni) – EPA Section 18(1)(a)(iv)	tasks; practical execution and operational support	complex tasks; primarily procedural	decisions confined to established procedures and guidance	maintenance, installing or calibrating signalling equipment, conducting rolling stock servicing, assisting in traction power maintenance
Specified Category Specialist – EPA Section 18(1)(c)	Well-defined engineering tasks; practical execution and operational support in specific categories	Routine to moderately complex tasks; primarily procedural	Limited judgement; decisions confined to established procedures and guidance	Performing track inspections and maintenance, installing or calibrating signalling equipment, conducting rolling stock servicing, assisting in traction power maintenance

The progression in Table 3 aligns with the principles outlined in document **R-04-T&M-GUIDE-SC**, highlighting the increasing scope, complexity, autonomy and accountability expected at each registration level. The table provides a practical reference for candidates and assessors, demonstrating how professional competence is developed through structured exposure to real-world engineering challenges.

Table 3 outlines the levels of responsibility expected of candidates during their professional development and candidacy period. It illustrates how responsibility progresses in line with the complexity of tasks, the degree of autonomy and the level of decision-making required at each stage.

This framework provides a clear reference for candidates and assessors, ensuring that professional growth is structured and that individuals are exposed to appropriate levels of responsibility before applying for registration. It also aligns with the staged development approach

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described in document **R-04-T&M-GUIDE-PC**, supporting the systematic acquisition of competence, judgement and accountability.

Table 3: Progression throughout the candidacy period

Degree of Responsibility	Nature of work	Activities/duties to be undertaken during training
A: Being Exposed	The Candidate undergoes induction and observes processes and work of competent practitioners.	Candidates/applicants should be exposed to: • scope of service in line with ECSA guideline scope of services and tariff of fees • the applicable legal and regulation • managing finance, material and resources • engineering forms of contracts and condition
B: Assisting	The Candidate performs specific processes under close supervision.	Candidates/applicants should: • assist in identifying the social, cultural and environmental effects of their engineering activities • assist in developing or designing a solution within a team • assist in drawing up terms of reference • operate engineering modelling software • assist with the identification of stakeholders
C: Participating	The Candidate performs specific processes as directed, with limited supervision.	Candidates/applicants should: • develop or design solutions to engineering problems • draw up detailed specifications (construction drawings) • develop tender documents • define the channel of communication • issue clear instructions to stakeholders in technical report writing and oral presentation
D: Contributing	The Candidate performs specific work with detailed approval of work outputs.	Candidates/applicants should: • develop evaluation criteria and methods of analysis while developing and designing a solution • manage part or all of the engineering activities by managing materials, machines, manpower, methods or money and contracts • develop the conditions and operation of contractors and the ability to establish and

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Degree of Responsibility	Nature of work	Activities/duties to be undertaken during training
		maintain professional and business relationships • own professional development sufficient to maintain and extend competence
E: Performing	The Candidate works in a team without supervision, recommends work outputs and is responsible but not accountable.	Candidates/applicants should: • define, investigate and analyse engineering problems • conduct research and apply the knowledge embodied in widely accepted and applied engineering procedures and processes, systems or methodologies, and those specific to the jurisdiction in which he or she practises • meet all legal and regulatory requirements and protect the health and safety of persons in the course of his or her engineering activities

The responsibility levels outlined in Table 3 directly inform the scope of functions and the outcomes candidates are expected to achieve during their professional development. As candidates progress through increasing levels of responsibility, they are exposed to broader, more complex and higher-stakes engineering tasks as well as the level of responsibility, enabling them to develop the technical proficiency, professional judgement and leadership capabilities required for registration.

This structured approach ensures that by the time candidates apply for registration, they have demonstrated competence across all required outcomes, effectively managed engineering activities and assumed accountability appropriate to their registration level.

8.2 Candidate training programmes

The structure and content of a training programme for each candidate largely depend on the specific work opportunities the employer can provide at any given time. Effective and best practice training programmes are those carefully designed to develop the full range of competencies required for candidates to successfully achieve professional registration, whether as a Professional Engineer, Professional Engineering Technologist or Professional Engineering Technician.

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Such training programmes should enable candidates to progressively advance through defined levels of work capability, as outlined in the document **R-04-T&M-GUIDE-PC**. By the conclusion of the training period, candidates are expected to perform both independently and collaboratively within teams, demonstrating the problem-solving skills and engineering activities at the level necessary for registration. Additionally, candidates should exhibit the level of responsibility classified as “E”, reflecting their readiness to operate with professional autonomy and accountability.

Given the variability in the nature and scope of work available at different employers, some organisations may be able to offer training programmes that encompass the full range of work functions detailed in Section 7.1 of this document. However, there may be cases where an employer can provide experience only in a subset of these functions. In such instances, it is essential that the employer and candidate collaborate to establish appropriate arrangements, also described in Section 7.1, to ensure the candidate gains exposure to all necessary areas of competency through supplementary training opportunities or external placements.

It is suggested that candidates/applicants work with their mentors to determine appropriate projects to gain exposure to elements of the asset cycle and ensure their designs are constructive, operable and designed considering life cycle costing and long-term sustainability.

To attain registration as a Railway System Specialist, candidates/applicants must meet the educational requirements for the specific category and demonstrate competency against the prescribed standard for the registration category. Demonstrating competency is achieved by meeting requirements for the 11 ECSA outcomes. Candidates or persons willing to be registered as professionals must ensure, together with their mentors, that the training being provided is geared towards achieving the ECSA competency outcomes. Focusing on one training aspect for the entire duration of training will not assist candidates/applicants to achieve the necessary skills to demonstrate all the standard competency outcomes.

The DSTG assumes that applicants enter a programme after graduation and continue with the programme until they are ready to apply for professional registration. The guide also assumes that applicants are supervised and mentored by persons who meet the requirements stated in document **R-04-T&M-GUIDE-PC**.

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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:

- Applicants must complete the Training and Experience Summary (TES) and the Training and Experience Reports (TERs) for the previous programme or the unstructured experience. Regarding the latter, it is important to reconstruct the experience as accurately as possible. The TERs must be signed off by the relevant supervisor or mentor.
- On entering the new programme, the mentor and supervisor should review an applicant's development while being mindful of the past experience and the opportunities and requirements of the new programme. At a minimum, the mentor and supervisor must plan the next phase of the applicant's programme.

9. PROGRAMME STRUCTURE AND SEQUENCING

9.1 Best practice

Best practice is a structured developmental process designed to assist candidates in progressing toward registration as Specified Category Railway System Specialists. It represents a process of continuous professional development that integrates both formal learning and workplace experience. Candidates are required to attend a range of technical, safety, and management courses that contribute to the Initial Professional Development (IPD) points required for registration. This formal learning complements on-the-job experiential training within the organisation in which the candidate is employed.

Candidates are encouraged to engage with recognised railway professional bodies such as the RSR, the Railway Engineering Committee of the South African Institution of Civil Engineering (SAICE), or other relevant VAs affiliated with ECSA for example African society for Railway Engineering. These organisations provide valuable resources including technical seminars, industry updates and networking opportunities with experienced railway professionals.

It is recommended that Candidate Railway System Specialists work closely with their mentors to select appropriate areas of exposure across the various functional domains of the railway system, such as infrastructure, signalling and train control, rolling stock, electrical traction, safety

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management and operations to gain well-rounded experience leading to eventual professional accountability within their chosen specialisation. A structured reporting and review system should be implemented, with the regular recording of evidence of progress against the competency outcomes defined in document **R-08-SC** and the Sub Discipline-specific Requirements outlined in this DSTG.

No single ideal training structure or universal sequencing constitutes best practice. The nature and duration of the training programme depends on the range of opportunities available within the candidate's organisation. Each candidate effectively undertakes a unique development pathway in which the practical activities and responsibilities within the railway environment are mapped to the generic and discipline-specific competency requirements prescribed by ECSA.

9.2 Realities

In practice, and irrespective of the sub-discipline (e.g., signalling, track, rolling stock or operations), it is unlikely that the full spectrum of required experience will be achieved within the minimum period of 3 years stipulated by ECSA. The actual duration of the training period is typically longer and depends on the complexity, scale and availability of functions in the candidate's workplace.

Each candidate therefore follows an individualised development plan in which the range of railway engineering and operational activities is aligned with the competency standards of **R-08-CS-GUIDE-SC** and the Compulsory Sub Discipline-specific Requirements defined for the railway category.

9.3 Generalists, specialists, researchers and academics

Document **R-08-CS-GUIDE-SC** also accommodates applicants whose formative development has not followed a conventional candidacy path – such as academics, researchers or domain specialists – and those who may have acquired equivalent professional experience outside of a structured programme.

Regardless of the development route followed, all applicants must provide evidence of competence against the prescribed ECSA standards and demonstrate that they meet the railway sub discipline-specific requirements established for registration.

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9.4 Multidisciplinary exposure

Modern railway systems are inherently multidisciplinary. Effective interface management among the various engineering and operational disciplines such as civil, mechanical, electrical, signalling, telecommunications, operations and safety is essential to ensure system integration and safety assurance. Candidates must be exposed to and actively participate in multidisciplinary coordination processes. Documentation of such interfaces, including signed-off interface management records or safety assurance documentation, must form part of the candidate's training evidence.

9.5 Orientation requirements

At the commencement of the candidacy programme, candidates should complete a structured orientation programme that familiarises them with the organisation's operational, safety and ethical framework. The orientation should include the following:

- Company Railway Safety Management System (aligned with the Railway Safety Act, 2024 and SANS 3000)
- Company Safety Regulations and Permit Conditions
- Company Code of Conduct and Ethics
- Company Staff Code and Regulations
- Record-keeping and documentation protocols
- Typical functions and activities within the railway organisation
- Hands-on exposure to major company divisions, such as infrastructure, rolling stock, train operations and safety management.

9.6 Moving into or changing Candidacy Programmes

This DSTG assumes the Candidate Railway System Specialist enters a structured development programme after achieving the relevant educational qualifications and continues under supervision and mentorship until ready to apply for registration. Mentorship must be provided by persons meeting the requirements of document **R-04-SC**.

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9.7 Compulsory Sub Discipline-specific requirements to be met during Candidacy

The railway industry requires professionals who are competent to perform the technical and safety-critical functions necessary to ensure efficient and safe railway operations. This competence underpins the integrity and reliability of the national railway system and contributes to broader economic, environmental and social objectives.

Accordingly, each Candidate Railway System Specialist, assisted by their mentor and supervisor, must ensure they gain comprehensive exposure to the core functional areas of the railway discipline as outlined in **Appendix A**. Evidence of this exposure and achievement must be submitted as part of the SDSRR accompanying the final Application for Registration.

10. CONCLUSION

Generally, no matter the discipline, it is unlikely that the training period will be limited to the minimum three years required by ECSA. In practice, the duration is often longer and depends on factors such as the availability of functions in the actual work environment, the breadth and complexity of tasks and the opportunities for exposure to the full range of engineering activities.

No single ideal training programme structure or unique sequence constitutes best practice. Instead, effective programmes are tailored to the candidate's specific context, structured to progressively develop technical competence, professional judgement and the ability to work independently and collaboratively. The focus should be on ensuring comprehensive coverage of all ECSA competency outcomes, while providing real-world experience across the railway engineering asset lifecycle.

Ultimately, the goal of a well-designed training programme is to prepare candidates to operate with professional autonomy and accountability, demonstrating not only technical proficiency but also sound judgment and ethical responsibility. Such a programme must ensure that candidates are equipped to manage engineering tasks safely, efficiently and sustainably within the complex and highly regulated railway environment.

To achieve this, the training journey should strike a deliberate balance between structured guidance, close mentoring, exposure to a wide range of engineering disciplines and the gradual assumption of responsibility. This approach enables candidates to build confidence while

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deepening their technical knowledge and problem-solving capacity. By engaging with both operational and strategic aspects of railway engineering, they gain an appreciation of the broader system in which their work contributes, including safety management, asset reliability, regulatory compliance and long-term sustainability.

Over time, candidates will cultivate the critical thinking, leadership and communication skills necessary to operate as trusted professionals. The outcome is a well-rounded engineer who possesses not only the technical competence required for professional registration but also the ability to add tangible value to projects, teams and the wider railway industry. In this way, the training programme becomes more than a pathway to professional recognition – it is a platform for shaping the next generation of railway engineers who will drive innovation, uphold safety and contribute meaningfully to the future of the profession.

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REVISION HISTORY

Revision number	Revision date	Revision details	Approved by
Rev 0 Draft A	17 Nov 2025	The working group submitted the first draft	Working Group
Rev 0 Draft B	1Dec 2025	Draft submitted to Registration BU for comments	Registration BU
Rev 0 Draft C	19 Jan 2026	The document was shared with stakeholders for inputs and comments	RID BU
Rev 0 Draft D	29 Jan 2026	The RID BU hosted a webinar with industry stakeholders to solicit inputs and comments	RID BU & Working Group
Rev 0 Draft E	06 Feb 2026	The RID BU and Working Group reviewed the comments received from stakeholders	RID BU & Working Group
Rev 0 Draft F	16 Feb 2026	Review and recommendation for Approval	Acting Executive RSIR: Ms NM Mtshali
Rev 0	18 Feb 2026	Approval	RPSC

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The Discipline-specific Training Guide for

Registration as a Railway System Specialist in Specified Category

Revision 0 dated 18 February 2026 and consisting of 42 pages reviewed for adequacy by the Business Unit Assistant Manager and is approved by the Acting Executive: Regulatory Services & International Relations **(ERSIR)**.

..... 24 March 2026

Business Unit Assistant Manager Date

..... 27 March 2026

Acting Executive: RSIR Date

This definitive version of this policy is available on our website.

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APPENDIX A: SUB DISCIPLINE-SPECIFIC KNOWLEDGE AND EXPERIENCE REQUIREMENTS

A.1 Purpose

This annexure provides guidance on the minimum technical knowledge areas, experiential learning and exposure that a Candidate Railway System Specialist or Practitioner must obtain during the candidacy period. The purpose is to ensure that candidates develop competence across the multidisciplinary domains that collectively support safe, efficient and sustainable railway operations in accordance with the Railway Safety Act, 30 of 2024 and relevant standards such as SANS 300: Railway Safety Management.

A.2 Core Functional Areas

Candidates are expected to demonstrate technical and contextual understanding in the following core sub-disciplines of the railway system. The level of depth in each area depends on the candidate's intended field of specialisation.

A.2.1 Railway Safety Management Systems (SMS)

- Understanding the structure, principles and implementation of a Safety Management System as required by the Railway Safety Act, 2024.
- Application of **SANS 3000** in the development, monitoring and auditing of SMS processes.
- Hazard identification, risk assessment and control within railway operations.
- Incident investigation, root cause analysis and corrective action management.
- Competence management and continuous improvement within the safety assurance framework.
- Understanding RSR directives, technical standards and compliance requirements.

A.2.2 Infrastructure and Permanent Way (Track and Civil)

- Principles of railway alignment, geometry and track structure design.
- Materials selection, ballast performance and maintenance regimes.
- Rail stress management, track welding and inspection techniques.
- Civil works including bridges, culverts, embankments and drainage systems.

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- Maintenance planning, asset management and life-cycle costing.
- Interface between track infrastructure and rolling stock dynamics.

A.2.3 Signalling, Train Control and Telecommunications

- Fundamentals of railway signalling principles, interlocking and fail-safe design.
- Block systems, control tables and route-setting logic.
- Train detection systems (track circuits, axle counters) and points operation.
- Communication-based Train Control (CBTC), European Train Control System.(ETCS), and centralised train control systems.
- Integration among signalling, telecommunications and train operations.
- Safety integrity levels (SIL) and functional safety requirements.

A.2.4 Rolling Stock and Mechanical Systems

- Overview of traction and rolling stock systems (locomotives, wagons, EMUs/DMUs).
- Principles of vehicle dynamics, and train dynamics braking systems couplers and wheel-rail interaction.
- Maintenance planning, condition-based monitoring and reliability engineering.
- Material properties, fatigue and failure analysis.
- Interface with track and traction power systems.
- Application of standards for rolling stock safety and performance certification.
- Interface and technological compatibility requirements

A.2.5 Electrical and Traction Power Systems

- Fundamentals of railway electrification (AC and DC systems).
- Overhead traction equipment (OHTE) design, construction and maintenance.
- Substations, return circuits and earthing and bonding requirements.
- Energy supply, distribution and protection systems.
- Electrical safety and compliance with SANS and IEC standards.
- Energy efficiency and sustainability in traction power systems.

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A.2.6 Railway Operations and Control

- Understanding train operations, dispatching and scheduling processes.
- Operating rules, driver communication protocols and route management.
- Performance management and delay attribution analysis.
- Human factors in railway operations and safety-critical communication.
- Interface between operations, maintenance and asset management.
- Emergency response, contingency planning and disaster management.

A.2.7 Systems Engineering and Integration

- Application of systems engineering principles to railway projects.
- Integration of sub-systems (track, rolling stock, signalling, power, operations).
- Requirements management, configuration control and validation processes.
- System assurance, RAMS (Reliability, Availability, Maintainability, Safety).
- Change control and configuration management.
- Verification and validation at system, subsystem and component levels.

A.2.8 Project, Asset, and Risk Management

- Planning and delivery of railway projects in accordance with safety and quality standards.
- Asset management frameworks (aligned with ISO 55000 and SANS 300 principles).
- Risk identification, assessment and mitigation in engineering projects.
- Contract management, procurement and stakeholder communication.
- Application of cost-benefit analysis and lifecycle costing.
- Interface with environmental and social impact assessments (aligned with NEMA).

A.3 Complementary Knowledge Areas

In addition to the core technical competencies, candidates must gain exposure to complementary areas that influence railway safety and performance:

- Legal and regulatory framework governing railways (Railway Safety Act, Engineering Profession Act, OHS Act).
- Quality management systems and continuous improvement processes.

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- Leadership, communication and ethical practice within a multidisciplinary team.
- Research and innovation in railway technologies and safety enhancement.
- Understanding of sustainability principles and climate resilience in railway design and operation.

A.4 Practical Training and Evidence of Competence

During the candidacy period, the Candidate Railway Systems Specialist or Practitioner must:

- maintain detailed TERs reflecting the scope, duration, and outcomes of experiential learning
- record evidence of participation in safety audits, inspections, investigations, or project reviews
- demonstrate competence in applying theoretical knowledge to real-world railway challenges.
- participate in at least one multidisciplinary project involving cross-functional integration
- submit a comprehensive SDSRR as part of the final application for registration.

A.5 Expected Outcomes

By the conclusion of the candidacy, the candidate must demonstrate the ability to:

- apply advanced railway engineering principles to ensure system safety and reliability
- manage risk and assure compliance with the Railway Safety Act, 2024 and SANS 300
- integrate technical and operational disciplines to achieve safe, efficient railway performance
- exercise professional judgement, autonomy and accountability in railway practice
- Contribute to the ongoing improvement of railway safety, sustainability and performance.

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APPENDIX B: RAILWAY SPECIALISTS AND PRACTITIONERS' KNOWLEDGE AND EXPERIENCE REQUIREMENTS

Knowledge area	Minimum exposure/Developmental activities	Evidence of competence	Relevant standards/references
A.1 Railway Safety Management Systems (SMS)	Participate in development, implementation, and review of Safety Management Systems. Conduct hazard identification, risk assessments, and safety audits. Assist in preparation of RSR permit documentation and compliance submissions.	Demonstrated understanding of SMS framework; completed risk assessments and safety audits; participation in incident investigations or corrective action plans.	Railway Safety Act, 30 of 2024 SANS 300: Railway Safety Management RSR Directives & Guidelines
A.2 Infrastructure & Permanent Way (Track and Civil)	Exposure to track design principles, maintenance planning, welding and inspection practices, and civil works (bridges, culverts, drainage). Participate in condition assessments and asset management.	Reports, drawings, or calculations showing understanding of track geometry, rail wear, or ballast management; participation in inspection or rehabilitation projects.	SANS 300 Transnet and PRASA technical standards TMH and SADC Railway Engineering Standards
A.3 Signalling, Train Control & Telecommunications	Participate in design, maintenance, or fault-finding activities on signalling systems. Gain exposure to interlocking logic, block systems, train detection and control centres.	Demonstrated knowledge of signalling principles; participation in testing, commissioning or system upgrades; signed-off work experience reports.	IEC 61508 / 62278 (RAMS) SANS 300 Railway Safety Act, 2024 RSR Technical Standards
A.4 Rolling Stock & Mechanical Systems	Gain exposure to maintenance, inspection and testing of locomotives, wagons or	Evidence of participation in rolling stock maintenance, brake testing	SANS 300 EN 14363 (Running Behaviour)

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Knowledge area	Minimum exposure/Developmental activities	Evidence of competence	Relevant standards/references
	EMUs/DMUs. Participate in failure investigations, overhaul planning and condition monitoring.	and wheel–rail interface investigations; technical reports.	RSR Rolling Stock Standards OEM maintenance manuals
A.5 Electrical & Traction Power Systems	Participate in traction power system design, overhead traction equipment (OHTE) maintenance, substation work and electrical safety compliance.	Demonstrated competence in fault analysis, substation operations, earthing & bonding checks, or OHTE maintenance planning.	SANS 10142 SANS 300 IEC 60850 (Railway Electrification) Railway Safety Act, 2024
A.6 Railway Operations & Control	Gain exposure to train operations, dispatching, scheduling and emergency procedures. Understand rule books, communication protocols, and human factors.	Evidence of participation in operational reviews, safety briefings, or control room shifts; operational performance analysis	Railway Safety Act, 2024 General Operating Rules (RSR) Company-specific operating manuals
A.7 Systems Engineering & Integration	Participate in multidisciplinary projects involving infrastructure, signalling, rolling stock and operations. Apply systems engineering principles including requirements management, validation and RAMS.	Signed-off project participation in integration or assurance roles; documentation of interface management and configuration control.	IEC 62278 / 62279 (RAMS) EN 50126 SANS 300 RSR Interface Management Guidelines

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Knowledge area	Minimum exposure/Developmental activities	Evidence of competence	Relevant standards/references
A.8 Project, Asset & Risk Management	Participate in project planning, risk assessment, and lifecycle management of railway assets. Apply cost-benefit and risk-based decision-making.	Demonstrated competence in asset management plans, risk registers, and project documentation; signed-off supervisor reports.	ISO 55000 (Asset Management) ISO 31000 (Risk Management) SANS 300 Railway Safety Act, 2024
A.9 Quality & Compliance Assurance	Participate in internal audits, safety verifications, and inspection activities. Apply quality management principles to railway projects or maintenance.	Audit checklists, NCR records, and continuous improvement actions documented; mentor sign-off.	ISO 9001 SANS 300 RSR Safety Permit Conditions.
A.10 Research, Innovation & Sustainability	Contribute to continuous improvement projects, technical investigations, or sustainability initiatives within the railway sector.	Report or presentation showing application of innovation or research to improve safety or performance.	National Railway Policy (2022) NEMA SANS 300 ECSA Code of Conduct
A.11 Professional Conduct & Ethical Practice	Demonstrate understanding of ethical, legal, and professional responsibilities as a railway specialist. Apply professional judgement in safety-critical decisions.	Evidence of adherence to company code of conduct, safety culture initiatives, and ECSA ethical standards.	Engineering Profession Act, 2000 ECSA Code of Conduct Railway Safety Act, 2024

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APPENDIX C: COMPETENCY STANDARD FOR RAILWAY SPECIALISTS AND PRACTITIONERS

Outcome	Competency standard	Typical evidence	Range of activities/examples
Outcome 1 – Problem Analysis	Identify, define and analyse railway engineering or operational problems to reach a sound diagnosis and propose practical solutions.	Fault or incident investigation reports, condition assessment reports, failure analyses.	Analysis of track geometry defects, root-cause investigation of signalling failure, rolling-stock brake malfunction investigation, assessment of derailment or near-miss events.
Outcome 2 – Application of Engineering Knowledge	Apply theoretical and practical railway engineering and safety management knowledge to solve defined and ill-defined problems	Design calculations, method statements, technical evaluations, risk assessments.	Track rehabilitation designs, OHTE earthing studies, safety case preparation, modification of train control systems, asset management improvement plans.
Outcome 3 – Engineering Design and Development of Solutions	Develop and implement safe, cost-effective and sustainable engineering solutions for railway systems.	Design documentation, feasibility studies, construction or modification drawings, validation reports.	Design of signalling circuits or interlocking logic, redesign of drainage for embankment stability, development of new maintenance strategies, retrofit of rolling-stock safety systems.
Outcome 4 – Investigation and Testing	Plan and conduct investigations, inspections, and tests to verify the functionality, performance, and safety of railway systems.	Test plans, commissioning certificates, verification records, inspection checklists.	Rail flaw testing, traction-power substation commissioning, rolling-stock brake-test verification, site validation of train detection systems
Outcome 5 – Risk Assessment and	Identify, assess and manage technical and operational risks	Risk registers, hazard logs, mitigation plans, safety	Risk review for new works, hazard analysis for station upgrades, interface risk

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Outcome	Competency standard	Typical evidence	Range of activities/examples
Management	within the railway environment.	assurance documentation.	management between track and signalling, operational safety briefings.
Outcome 6 – Legal and Regulatory Compliance	Demonstrate knowledge and application of relevant legislation, standards and regulatory requirements affecting railway engineering and operations.	Compliance checklists, RSR submissions, safety permit documentation, audit results	Application of the Railway Safety Act 2024, adherence to SANS 300 requirements, implementation of RSR technical standards, compliance with OHS Act and Environmental Acts.
Outcome 7 – Project Management and Implementation	Plan, manage, and execute engineering or operational projects effectively, applying quality, safety, cost, and time control.	Project schedules, progress reports, cost control documents, quality assurance records.	Signalling upgrade project, track renewal programme, fleet maintenance overhaul, SMS improvement implementation.
Outcome 8 – Professional and Ethical Conduct	Display professional, ethical and responsible conduct in all railway engineering and operational activities.	Signed code-of-conduct acknowledgements, ethics training records, supervisor evaluations.	Ethical decision-making in safety-critical situations, reporting of safety breaches, leadership in promoting safety culture.
Outcome 9 – Communication	Communicate effectively with multidisciplinary technical teams, management, regulators and the public.	Meeting minutes, correspondence, presentations, technical and incident reports.	Safety briefings, multidisciplinary coordination meetings, technical report writing for RSR submissions, training presentations to operational staff.
Outcome 10 – Lifelong Learning and Professional	Engage in continuous professional development (CPD) and remain abreast of emerging railway	Training certificates, CPD logs, professional membership evidence, conference	Attendance at RSR or SAICE railway seminars, publication of technical papers, completion of railway safety or systems

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Outcome	Competency standard	Typical evidence	Range of activities/examples
Development	technologies, standards and best practice.	participation.	engineering courses.
Outcome 11 – Responsibility, Judgement and Impact of Engineering Activity	Demonstrate increasing responsibility, sound engineering judgement and awareness of the broader social, economic and environmental impact of railway engineering decisions.	Mentor assessments, task logs, project evaluations, sustainability reports.	Acting as responsible person for inspections, approving engineering work within competence, contributing to NEMA compliance, implementing energy-efficiency measures, assessing societal impact of safety interventions.

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ANNEXURE D: TRAINING AND EXPERIENCE RECORDING TEMPLATE

This template provides a structured format for candidates to record and track their training, experience and professional development during the candidacy period. Each entry should reflect the candidate's participation, level of responsibility and evidence of competence against the ECSA outcomes outlined in **Appendix C**. All entries must be verified and signed by the mentor and supervisor registered in the relevant railway category.

Candidate Information

Name:	
ECSA Candidate No.:	
Employer / Organisation:	
Mentor / Supervisor:	
Period Covered:	
Department / Division:	
Specialisation Area:	

D.1 Summary of Training and Experience Periods

Period (From–To)	Organisation / Project	Functional Area	Main Responsibilities / Role	Mentor's Signature

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D.2 Detailed Training and Experience Report by Outcome

Outcome no.	Competency standard	Description of activities and experience	Level of responsibility (Assist / Perform / Lead)	Evidence / documents attached	Mentor verification & comments
1. Problem Analysis	Identify and analyse railway engineering or operational problems to diagnose causes and develop practical solutions.				
2. Application of Engineering Knowledge	Apply engineering and operational knowledge to address railway system challenges				
3. Engineering Design / Development of Solutions	Develop, evaluate and implement technical or safety solutions for railway systems.				
4. Investigation and Testing	Conduct tests, inspections, and verifications to confirm				

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Outcome no.	Competency standard	Description of activities and experience	Level of responsibility (Assist / Perform / Lead)	Evidence / documents attached	Mentor verification & comments
	system performance or compliance.				
5. Risk Assessment and Management	Apply structured risk assessment and control measures in railway engineering and operations.				
6. Legal and Regulatory Compliance	Demonstrate compliance with Railway Safety Act, 2024 and applicable standards.				
7. Project Management and Implementation	Participate in planning, scheduling, and execution of railway projects or operational initiatives.				
8. Professional and Ethical Conduct	Demonstrate professional integrity, accountability,				

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Outcome no.	Competency standard	Description of activities and experience	Level of responsibility (Assist / Perform / Lead)	Evidence / documents attached	Mentor verification & comments
	and ethical decision-making.				
9. Communication	Communicate effectively with technical teams, management, and regulators.				
10. Lifelong Learning and Development	Engage in continuous professional development and maintain current railway knowledge.				
11. Responsibility and Impact of Engineering Activity	Demonstrate responsibility, judgement, and awareness of social, environmental and economic impacts.				

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D.3 Summary of Evidence Submitted

Document / File name	Type of evidence	Outcomes supported	Date

D.4 Mentor and Supervisor Sign-off

Name	ECSA Reg. No.	Role	Signature	Date
		Mentor		
		Supervisor		

D.5 Candidate Declaration

I, the undersigned, declare that the information contained in this Training and Experience Report is true and correct, and that the work and evidence submitted reflect my personal learning and experience under appropriate supervision.

Candidate name	Signature	Date

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