RSR 00-2-7:2016
Edition 1.0

REGULATOR STANDARD

RAILWAY SAFETY MANAGEMENT

Part 2-7: Technical requirements for systemic engineering and operational standards – Railway stations

ISBN 978-0620687232

RSR 00-2-7:2016

Edition 1.1

REGULATOR STANDARD

Railway Safety Management

Part 2-7: Technical requirements for systemic engineering and operational standards – Railway stations

Regulator Standards are updated by amendment or revision. Users of Regulator Standards should ensure that they possess and are using the latest amendments or editions.

This Regulator Standard was researched and developed by the *Railway Safety Regulator's Standards Technical Committee* (TC RSR-001) and *Working Group on Railway Stations* (WG RSR 00-2-7).

Edition 1.1: August 2016

ISBN 978-0-620-68723-2

Published by:
Railway Safety Regulator South Africa
Lake Buena Vista Building
1 Gordon Hood Ave
0157 Centurion, South Africa
Telephone: +27 12 848 3000
Website: *http://www.rsr.org.za*

RSR 00-2-7:2016
Edition 1.0

REGULATOR STANDARD
Railway Safety Management

Part 2-7: Technical requirements for systemic engineering and operational standards – Railway stations

NOTE: It is essential that this standards document is read together with the South African National Standards, SANS 3000-1 and SANS 3000-4.

Table of changes

Edition and version number	Date	Scope
1.0	2016.03.17	First published edition

Acknowledgements

The Railway Safety Regulator wishes to acknowledge the invaluable assistance of the following organizations during the preparation of this document:

Bombela Operating Company (Pty) Ltd (BOC)

Heritage Railway Association of Southern Africa (HRASA)

Passenger Rail Agency of South Africa (PRASA)

Railroad Association of South Africa (RRA)

South African Bureau of Standards (SABS)

South African Government, Department of Transport (DoT)

Transnet Freight Rail (TFR), a division of Transnet SOC Ltd

Foreword

This Regulator Standard was developed and approved by the Technical Committee for the Development of Regulator Standards for Railway Safety (TC RSR-001), in accordance with the National Railway Safety Regulator Act (Act 16, 2002), the Safety Standards Development Regulations, 2006 and the RSR Procedure for the Development of Regulator Standards.

This document extends and augments the “SANS 3000” series of standards pertaining to railway safety management that are published by the South African Bureau of Standards on behalf of the Railway Safety Regulator and in particular SANS 3000 series of standards.

This document also extends and augments the “RSR 00” series of standards pertaining to railway safety management that are published by the Railway Safety Regulator This document should be read in conjunction with those various standards.

The SANS 3000 series of standards presently consists of the following parts, under the general title of *Railway Safety Management*:

Part 1: Railway Safety management – General (in course of revision).

Part 2-1: Technical requirements for engineering and operational standards – General.

Part 2-2: Technical requirements for engineering and operational standards – Track and associated civil infrastructure and installations.

Part 2-2-1: Technical requirements for engineering and operational standards – Track and associated civil infrastructure and installations – Level crossings.

Part 2-3: Technical requirements for engineering and operational standards – Rolling stock.

Part 2-4: Technical requirements for engineering and operational standards – Train authorization, 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 – Interoperability, and interface and intrafaces management.

Part 3: Railway occurrence management (in course of preparation).

Part 4: Human factors management.

The RSR 00 series of standards presently consists of the following parts, under the general title of *Railway Safety Management:*

Part 2-3-1: Technical requirements for engineering and operational standards – Rolling stock – Wheels, axles and bearing (in course of preparation).

Part 2-7: Technical requirements for systemic engineering and operational safety standards – Railway stations (this document).

Part 3: Railway occurrence management (in course of preparation).

Part 4-1: Human factors management – Fatigue management (in course of preparation).

Where reference is made to a specific published date, version or edition of a document, then that version of the document shall apply. Where reference is made to a document without specifying a date, version or edition, then it should be assumed that the latest published version shall apply.

Where reference is made in clauses 1.2, 4.1.3, 5.1(b), and 5.3 in this document to the "relevant national railway safety regulator", in South Africa this shall mean the "Railway Safety Regulator" as established in terms of *National Railway Safety Regulator Act (*Act No. 16 of 2002).

Where reference is made in clauses 7.1(e), 7.3.1, 7.3.9, 7.3.11, 7.3.27, 7.3.29, 7.4.10, 7.5.3, 7.5.17, 7.5.19, 7.5.20(f), 7.5.21(i), 7.5.22, 7.5.23, 7.5.24(b), 7.6.1, 7.6.3(a), 7.6.4, 7.6.7, 7.6.10, 7.6.11, 7.5.12, 7.6.12(b), 7.7.12, 7.7.27, 8.2, 8.3(b)(7), 8.3(b)(8), 9.1.2, and 13.1(f) in this document to the "relevant national legislation", in South Africa this shall mean the *National Railway Safety Regulator Act* (Act No. 16 of 2002), the *Occupational Health and Safety Act* (Act No. 85 of 1993), the *National Building Regulations and Building Standards Act* (Act No.103 of 1977).and the *National Environmental Management Act* (Act 107 of 1998) including their respective amendments, regulations and schedules.

Annexes A and B form an integral part of this document (diagrams and tables courtesy of Transnet Freight Rail).

Contents

1 Scope

1.1 This standard describes the minimum requirements to be met by railway station operators, and where relevant, by network and train operators and other affected parties to accomplish the required levels of safety and performance for those station operations throughout their life-cycle.

1.2 This standard applies to operators as defined in the *National Railway Safety Regulator Act* (Act 16 of 2002 as amended) (NRSR Act) (see *Foreword*).

1.3 This standard amplifies the necessary requirements for the relevant operator's Safety Management Systems (SMS) in compliance with the relevant national legislation (see *Foreword*) and to meet the requirements of SANS 3000-1 and related standards including RSR guidance documents for the various types of safety permit.

1.4 This standard shall be read in conjunction with other applicable national and railway regulator safety standards and regulations (see *Foreword*).

2 Normative references

2.1 The following referenced documents are indispensable for the application of this document. For undated references, the latest edition of the referenced document (including any amendments) shall apply. Information on currently valid national and international standards can be obtained from the SABS Standards Division. Information on currently valid regulator standards can be obtained from the Railway Safety Regulator.

SANS 3000-1: *Railway safety management – Part 1: General*.

SANS 3000-2-2: *Railway safety management – Technical requirements for systemic engineering and operational safety standards – Part 2-2: Track and associated civil Infrastructure*.

SANS 3000-2-2-1: *Railway safety management – Technical requirements for engineering and operational standards – Track, civil and electrical infrastructure – Part 2-2-1: Level crossings.*

SANS 3000-4: *Railway safety management – Part 4: Human factors management.*

SANS 3000-2-5: *Railway safety management – Part 2-5: Technical requirements for engineering and operational standards – Operational principles for safe movement on rail*.

SANS 3000-2-6: *Railway safety management – Part 2-6: Technical requirements for engineering and operational standards – Interoperability and interface and intrafaces management*.

SANS 10400:2011: *The application of the National Building Regulations*

SANS 10007/ISO 10007: *Quality management systems – Guidelines for configuration management*.

3 Definitions and abbreviations

3.1 Definitions

3.1.1 For the purposes of this document, the definitions given in SANS 3000-1 and the following definitions and abbreviations shall apply:

NOTE: In the case of duplicated or differing definitions, the definitions provided in this standard shall prevail.

Approval
written consent by a regulatory body to proceed with a requested activity, without in any way diminishing the applicant's obligation to meet the standard or specified requirements

Ballastless track
track that is supported by a rigid or fixed slab or beams so as to keep its horizontal and vertical alignment constant in relation to any external fixed structure.

Bypass infrastructure
network which is provided to primarily route non-passenger or in-transit trains through or around the station without passing a platform.

Halt
minor stopping place on the rail line.

Island platform
single platform serving two tracks, passing on either side, effectively creating an island which can normally only be accessed by a bridge or subway or by crossing a track.

Manned station
station where operational activities are performed by the station operator’s staff who are located at the station during normal operating hours.

Operational activities
railway operational activities performed by a network, station or train operator or a combination thereof.

Passenger
person, other than the crew or staff, who travels or intends to travel on a commuter, suburban or mainline passenger train and who is within the precinct of a station or train (or both).

Passenger platform height
height of the platform above the closest rail of the adjacent track.

Passenger platform horizontal clearance
distance measured from the edge of the platform to the centre line of the adjacent track.

Platform screen doors
platform edge screens or barriers that are normally glazed and form part of a platform edge screen.

Ponding
process of damming-up water or restricting water-flow resulting in the formation of a pond of water.

Side-platform
see single-face platform.

Single-face platform
platform serving only a single track and which can normally be accessed from one side without having to cross the track.

Station
railway facility comprising platforms, buildings and access arrangements where trains stop to load and unload passengers and freight (where applicable), including a railway passenger terminal and a passenger halt and that may include facilities for passenger modal transfer, commercial activities (including freight) or operational activities (or a combination thereof), but excludes those elements running through the station that form part of the network infrastructure and its operation.

NOTE 1: This definition recognizes and amplifies, but does not conflict with, the definition of "station" in the *National Railway Safety Regulator Act*, (Act No.16 of 2002).

NOTE 2: Stations may consist of ground-level (at grade), sub-surface, or elevated structures or a combination of such structures.

NOTE 3: Commercial activities may include retail facilities and associated public thoroughfares.

NOTE 4: Operational activities may include the processes and procedures associated with the operation of a station.

Station precinct
area encompassing the station, the network infrastructure relating to the station, and all other infrastructure elements, services and facilities affecting or affected by the station operation both within the rail reserve as well as adjacent to it where applicable.

Station operator
person in control of a station and the management of a station including one or more of the following:

a) the safety and security of a station or part thereof including the proper design, construction, operation, maintenance and integrity of the station;
b) ensuring the interoperability of the station with the relevant train and network operations; or
c) for the facilitating and the directing of the safe movement of the public and passengers in, on or at the station.

Tactile surface
horizontal or vertical surface which is treated and can be tactilely-sensed by visually impaired persons.

Terminal station
station at the end of a line or route.

Through station
station where a train is not normally scheduled to stop.

Unmanned station
station where operational activities are performed from remote, where applicable, and where the station operator's staff are not usually located at the station.

Validation
confirmation that the system, sub-system or component is appropriate for its intended use.

Verification
testing and evaluation of the system, sub-system or component to assure compliance with its specification or other requirements.

Vortex effect
partial vacuum or draught (or both) generated by the swirling mass of air generated by a moving train as it passes through a station.

3.2 Abbreviations

3.2.1 For the purposes of this document, the abbreviations provided in the *National Railway Safety Regulator Act* (NSRA), SANS 3000-1, RSR 00-3 and the following shall apply:

NOTE: In the case of duplicated or differing abbreviations, the abbreviations provided here shall prevail.

ALARP	as low as reasonably practicable.
CCTV	closed-circuit television.
g	gravity (the acceleration of objects under the influence of the Earth's gravitational field)
MTBF	mean time between failures.
MTTR	mean time to repair.
RAMSS	reliability, availability, maintainability, safety and sustainability.
SIP	Safety Improvement Plan.
SMS	Safety Management System.

4 General

4.1 Risk management

4.1.1 The operator shall develop or adopt, document, implement and maintain policies and procedures for risk management in accordance with SANS 3000-1 during each life-cycle phase and which shall include:

a) identification of hazards including those arising from:
   1) station operations;
   2) the railway network as a structure of infrastructure elements running through stations;
   3) the railway layout and condition;
   4) development within and adjoining the railway reserves including structures, changes in land use, lighting and interference;
   5) environmental considerations, including geographic, physical, biological, social, economic and cultural aspects of the environment;
   6) interfaces and interoperability requirements between the relevant operators including, requirements for dangerous goods and abnormal loads; and
   7) human resources including a sufficient number of persons with the required certification, and competencies and skills, including communication abilities (see SANS 3000-4);
   8) evaluation of the hazards identified in (a) (i.e. quantified according to likelihood and severity, resulting in a ranking of risk);

   NOTE 1: Geographical considerations include cuttings and embankments, track gradients and curves, and geological factors.

   NOTE 2: The term “likelihood” is synonymous with “probability”.

b) determination of the accountability for and level of control required to mitigate the risks to acceptable levels (ALARP); and
c) implementation of the controls and monitoring of the effectiveness thereof in accordance with the information obtained from risk assessments with full appreciation of the need to balance safety, costs, benefits and opportunities.

4.1.2 Risk assessments shall be conducted jointly by all the relevant and affected operators including their line managers and employees who undertake or are involved in safety-related work.

4.1.3 The records of all risk assessments shall be retained by the operator for review by the relevant national railway safety regulator (see *Foreword*).

4.2 Prioritizing and funding

4.2.1 The operator shall develop or adopt, document, implement, maintain and apply processes and procedures for the prioritizing and funding of new stations, for the modification and for the decommissioning of existing stations to address the requirements of risk assessments (see clause 4.1) and the SANS 3000 series of standards.

4.3 Life-cycle phases

4.3.1 The operator shall establish, develop or adopt, document and maintain processes and procedures addressing each life-cycle phase for:

a) the provision of new stations;
b) the upgrading or modification of existing stations; or
c) the elimination or decommissioning of existing stations.

4.3.2 The life-cycle phases to be addressed shall comprise the following:

a) concept (see section 6);
b) design (see section 7);
c) execution (see section 8);
d) testing and commissioning (see section 9);
e) railway operations (see section 10);
f) monitoring and maintenance (see section 11);
g) modification (see section 12); and
h) decommissioning or disposal (see section 13).

NOTE: The life-cycle phases that comprise monitoring and maintenance, modification, decommissioning and disposal are an integral part of the operational phase of the life-cycle. However, for clarity each will be dealt with separately.

4.3.3 The operator shall establish, develop or adopt processes and procedures for the validation and verification by competent persons, authorized by the operator (see SANS 3000-4) and agreed to by the parties affected thereby for the relevant life-cycle phases, including:

a) the conceptual design;
b) the detail design;
c) the execution;
d) testing and commissioning;
e) all other life-cycle phases;
f) all systems, subsystems and components;
g) the methodologies and procedures associated with (a) to (f) above; and
h) the applicable portions of national, regulator, industry and local standards, specifications and related documents that shall, as a minimum, comply with the requirements of this standard.

4.3.4 This shall be done in order to ensure that the appropriate safety requirements are met in accordance with the relevant National and Regulator standards and regulations.

5 Common essential requirements: all life-cycle phases

5.1 The following common essential requirements for all life-cycle phases of any proposal for a new station or for its systems, subsystems, components, processes or procedures (or a combination thereof), or to modify or decommission an existing station or system, subsystem component, processes or procedures (or combination thereof) shall be addressed before the proposal shall be considered:

a) common essential requirements for all life-cycle phases as outlined in clause 4.3.2 and set out in SANS 3000-1, including:
   1) stakeholder and interested and affected party involvement;
   2) elicitation of information from users, stakeholders and interested and affected parties;
   3) project management practices;
   4) hazard identification and risk assessment;

   NOTE: The degree of confidence in the hazards identified and the risks assessed and mitigated to acceptable levels should increase through each subsequent phase of the life-cycle;

   5) configuration management;
   6) decision-gates for each phase;
   7) validation and verification by recognised competent persons;
   8) refinement of the outcomes for successive phases of the life-cycle;
   9) concepts for execution of all succeeding life-cycle phases;
   10) plans and exit criteria for each next-phase;
   11) satisfaction of the exclusion and exit criteria for each phase of the life-cycle; and
   12) interface and intraface management requirements for interoperability throughout the life-cycle where an interface or intraface (or both) exists or is created (see SANS 3000-2-6); and
b) receipt from the relevant national railway safety regulator (see *Foreword*) of a “approval” certificate to proceed to the next phase of the life-cycle, with or without conditions.

5.2 The proposed new station or the modification of an existing station shall be interoperable with current and future railway operations and systems as well as other related systems and subsystems throughout the life-cycle where an interface or intraface (or both) exists or is created anywhere within the station precinct.

5.3 Once approved by the board of the relevant national railway safety regulator (see *Foreword*), the operator shall prepare anew, or review and, where necessary, amend or replace all its existing railway station standards.

6 Concept

6.1 The concept phase includes the preliminary evaluation of a concept which incorporates risk assessments and evaluation of the safety implications of all affected parties. This also includes evaluation of business imperatives such as time, cost, benefits and performance implications and the generation of preliminary system requirements and alternative feasibility design solutions.

6.2 The concept proposal for a new station or the modification of an existing station (or both) shall take into account the results of the assessment of the common essential requirements (see section 5) and shall include or confirm the following;

a) the identification of new concepts that offer new capabilities, enhanced overall performance, including safety and security or reduced stakeholders' total costs over the life-cycle;
b) an assessment of feasibility concepts and solutions, including enabling systems, subsystems and components over the entire life-cycle to meet safety, security, technical and business objectives;
c) a preliminary estimate of the resources required to ensure the reliability, availability, maintainability, sustainability and safety (RAMSS) of the station over the entire life-cycle as described in section 4.
d) an assessment of the environmental implications to determine the effect of the geographic, physical, biological, social, economic and cultural aspects on the environment;
e) the preparation of stakeholder requirements and preliminary system , sub-system and component requirements including technical specifications for the selected solutions and usable specifications for the envisaged human-system interaction;
f) identification and initial specification of the services needed from enabling systems, sub-systems and components throughout the life-cycle of the system;
g) development of chosen solution or solutions to a 60% budgetary and project execution confidence level;
h) cost-benefit analyses of the solutions over the full project life-cycle; and
i) approval in principle by all stakeholders to proceed to the design phase.

6.3 The following exclusion criteria for any concept proposal for a new station or its systems, subsystems or components (or a combination thereof), or to modify or decommission an existing station, or system, subsystem or component (or combination thereof) shall be resolved before the concept proposal shall be considered:

a) where the physical properties of the network (for example, track curvature, cant and gradient) and geographical considerations may render the construction or modification of a station unsuitable;
b) where the environmental conditions and considerations are not suitable for the construction of a station;

c) where the provision or modification of the station does not fit in with the systemic design of the line and route; and
d) where a line or route is operated or utilised by more than one operator who will be affected by the proposed station and its systems, subsystems, or components and which is not in accordance with the interoperability interface and intraface management requirements of the relevant parts of the SANS 3000 series with specific emphasis on SANS 3000-2-6.

7 Design

7.1 Common essential design requirements

7.1.1 The design of a new station or the design of the modification (or both) of an existing station shall take into account the results of the concept phase and include or confirm the following:

a) compliance with the requirements of the SANS 3000 series, with specific emphasis on SANS 3000-2-5 and SANS 3000-2-6;
b) compliance with the requirements of SANS 10400 (National Building Regulations);
c) an acceptable level of risk in accordance with clause 4.1.1 (risk management) and section 12 (modification);
d) compliance with the systemic design of the railway operation for the affected line or route on which the station is to be built or modified;
e) the integration of the station operation with the relevant network and train operations into a seamless safe working system with the necessary integrity as defined in the relevant national legislation (see *Foreword*);

NOTE: "Integrity" refers to a condition where the individual components of a system and the total system as a whole are unified, consistent and fit for purpose

f) current and future passengers and public movement patterns and volumes (demand analysis and travel pattern) that affect or are affected by the station with regard to the broader land use, spatial and transport planning requirements of the area or region (or both) in which the station is located or is to be located;
g) current and future patterns and volumes of passengers and the public in the station;
h) the current and predicted future mixed rail traffic patterns and volumes where applicable;
i) the current and predicted future modal and intermodal requirements for passengers or freight (or both) in the area or region (or both);
j) unrestricted and safe movement of passengers and public during peak and off-peak hours;
k) unrestricted and safe movement of passengers and public during normal, abnormal and degraded operations (as defined in SANS 3000-2-5) or under emergency conditions;
l) provision for persons with disabilities including persons with reduced mobility or with visual or audio impairment;
m) the train and network operating parameters including provision for bi-directional traffic or "wrong road' working (or both);
n) current and probable future train lengths;
o) current and predicted future network capacity and service density;
p) current and predicted future train speeds;
q) the number of interacting train movements;
r) the speed, mass, acceleration and braking performance of trains;

s) the safety of public and passengers, and personnel and equipment on the platforms;
t) the safety of personnel and equipment on or near the track within the station precinct;
u) the amount of train information required for commercial, operational and technical purposes;
v) communication (as defined in SANS 3000-2-5) with passengers at the station or on the train where relevant including:
    1) the current date and time;
    2) the destination, scheduled and expected time of arrival of the next train;
    3) the stations served by the arriving train;
    4) major connections that require boarding of the train;
    5) the position of a specific coach if passenger seating is assigned or reserved;
    6) where the train will stop along the platform (in the case of trains of differing lengths);
    7) destinations that are served from the station and from which platform;
    8) other ways of finding information; and
    9) information regarding abnormal, or degraded operations, or emergency conditions.
w) communication (as defined in SANS 3000-2-5) with the train crew, with workers at the track-side and other workers in the station precinct;
x) the provision and positioning of restroom and toilet facilities for the public, passengers and employees;
y) the reliability, availability, maintainability, sustainability and safety (RAMSS) of station equipment and systems to a level defined in the station and railway system specification;
z) environmental impact assessments in terms of the relevant national legislation (see *Foreword*);
aa) the applicable human factors in particular “human factors in design” and the “physical environmental factors” (see SANS 3000-4 and SANS 3000-2-5);
bb) resources and competencies required to operate and maintain the station systems (see SANS 3000-4 and SANS 3000-2-5);
cc) where active protection is provided at vehicle and pedestrian level crossings or access walk-ways, provision of clear and unambiguous warning of the approach of trains in conjunction with the network operator;
dd) adequate arrangements for managing passenger flow at the station;
ee) safety and security of the public, passengers, employees, contractors and service providers and assets in the station precinct; and
ff) the provision of suitable monitoring and CCTV equipment in all relevant station areas.

NOTE: Reference to “trains” shall apply to both train and shunting movements where relevant.

7.1.2 Factors to be considered:

a) the number, position and types of stations;
b) whether the station is a through or a terminal station;
c) whether side or island platforms (or both) are required;
d) whether the station is a surface (at grade), a sub-surface or an elevated structure (or a combination thereof);
e) whether the station is to be manned, or unmanned and its hours of operation;
f) commuter or main-line passenger or mixed-train operation (or a combination thereof);
g) bypass infrastructure for freight traffic where applicable;
h) unidirectional or bi-directional traffic (or both);
i) provision for staging trains at the station;
j) resistance to theft and malicious damage that impact on station structure and system;
k) RAMSS;
l) operations; and
m) methodology for verification and independent validation of the design.

7.2 Station design requirements

7.2.1 The operator shall develop or adopt, document, implement and maintain relevant conceptual and detailed specifications, rules, schedules, testing and commissioning documents and procedures necessary to give effect to its requirements in respect of station design.

7.2.2 Where a platform is built adjacent to a running line, and the through speed past the platform exceeds 30 km/h, the platform shall be equipped with suitable measures dependant on the level of risk, including screens, barriers, demarcated areas, tactile surfaces or passenger communication. These measures are intended to mitigate the risks to passengers on the platform from passing trains to acceptable levels.

7.2.3 Stations shall be constructed on tangent track (straight platforms) and on the level or on a track gradient not steeper than 1 in 800 (0,125% gradient). Minor stations or halts, at which trains do not terminate or reverse, may be built on steeper track gradients or on a curve where suitable arrangements can be made to mitigate the risks to passengers to acceptable levels. The platform-train interface shall at all times provide safe entrance from the platform into the train or exit from the train onto the platform (or both) for all persons including the elderly, children, persons with limited visual ability and persons with limited mobility (also see clause 7.2.22).

7.2.4 The location of buildings, platform canopies and infrastructure elements or other objects on platforms shall not interfere with the sighting of railway signals and information displays.

7.2.5 Platforms shall be long enough to accommodate the longest train scheduled to stop at the station plus an allowance for inaccurate stopping, normally 2 metres (5 metres at main-line stations and terminals). Exceptions for shorter platforms shall only be made provided that risks to passengers shall be mitigated to acceptable levels (see SANS 3000-1).

7.2.6 Where special situations exist, such as Automatic Train Operation (ATO) or platform screen doors, measures for the necessary stopping allowance and platform length shall be determined to ensure the correct functioning of the system and to mitigate risks to passengers to acceptable levels.

7.2.7 The width of platforms shall be adequate for the greatest number of passengers likely to use the platform at any time. Platform buildings or other obstructions shall not cause undue restrictions to the movement of passengers.

7.2.8 Where necessary additional width shall be provided if the platform is to be used by passengers as a route between one part of the station precinct and another. At busy stations, barriers may be required to prevent platforms from becoming overcrowded.

7.2.9 The minimum width of single-face platforms shall be such that there is at least 3000 mm from the platform edge to the nearest building or structure. Island platforms shall not be less than 9000 mm wide.

7.2.10 Where it is not reasonably practicable to maintain a constant width of a single-face platform throughout its length, the platform may be reduced in width at its ends. The full width shall be provided over the centre one-third of the platform length or longer as necessary to include any main access provided that risks to passengers can be mitigated to acceptable levels.

7.2.11 All columns or other obstructions shall be at least 3000 mm clear of the platform edge or shall comply with the provisions of clause 7.2.4 (or both).

7.2.12 Platforms shall have clear headroom of at least 2300 mm under platform signs and other overhead station infrastructure elements for a width of at least 3000 mm from the platform edge over the platform's whole length. This dimension should to be increased where the floor level of any train is high relative to the platform. At distances greater than 3000 mm from the platform edge, the clear headroom to suspended equipment and signs may be reduced to 2200 mm.

7.2.13 Information displays or mirrors provided at the end of the platform to assist the train crew shall be at least 450 mm clear of the dynamic structure gauge and at a sufficient height, or otherwise positioned so as not to restrict the movement of people.

7.2.14 Information displays, way-finding displays or mirrors provided at intermediate locations along the platform shall conform to the requirements of clause 7.2.12.

7.2.15 New platforms on main lines shall only be constructed alongside ballastless track (see Annex A, figure A.1 for the 1065 mm gauge).

7.2.16 Existing platforms identified to be upgraded shall be raised in accordance with Annex A, figure A.1 where the track is reconstructed onto a ballastless track.

7.2.17 The ballastless track passenger platform horizontal clearance shall be in accordance with the requirements given in Annex A for the 1065 mm gauge.

7.2.18 The ballastless track passenger platform height (vertical clearance) shall be in accordance with the requirements given in Annex A for the 1065 mm gauge.

7.2.19 In the case of the design of platforms in curved track it is essential that provision be made for the so-called "theoretical super-vehicle" to pass through the station with a minimum clearance of 40 mm between the vehicle and the platform edge.

NOTE: For 1065 mm gauge, this “super-vehicle” has an overall length of 21,2 metres, a bogie centre distance of 15 metres and a vehicle width of 3050 mm (see Annex B).

7.2.20 Platforms shall have a clearance of at least 40 mm to the dynamic structure gauge as set out in Annexes A and B. The platform level shall be determined taking into account all rolling-stock that makes use of the platform.

7.2.21 Clearances for gauges other than 1065 mm shall be adapted accordingly to minimize risks to an acceptable level.

7.2.22 The floor or footboards of passenger rolling stock shall be as close as practicable to the platform. In the case of ballasted track that is not in accordance with clauses 7.2.9 and 7.2.10, the distances between the platform edge and the floor or footboards of the passenger rolling-stock shall not exceed any of the following dimensions: 250 mm vertically, 275 mm horizontally and 350 mm on the diagonal. These dimensions may only be exceeded if the risk so incurred can be mitigated by the operator to an acceptable level. The platform-train interface shall at all times allow safe entrance from the platform into the train, or exit from the train onto the platform for all persons including the elderly, children, persons with disabilities (sensory or mobility (or both)).

7.2.23 A 300 mm wide recess shall be formed beneath the platform coping and shall be kept clear of cables and other obstructions so as to provide an emergency refuge.

NOTE: A wider recess may be necessary where there is a platform or other obstruction on both sides of a track.

7.2.24 All single platforms shall slope away from the adjacent track and possess an anti-slip surface.

7.2.25 All island platforms shall slope towards the centre and away from both adjacent tracks.

7.2.26 Where access at the end of the platform is required, platforms shall be terminated with ramps at a gradient not steeper than 1 in 8 (12,5%). Platform ramps shall be not less than 2000 mm wide.

7.2.27 Platform edges shall be clearly defined with a strip of a lighter-colour material.

7.2.28 A durable tactile surface shall indicate the approach to the platform edge to visually-impaired people.

7.2.29 All station platforms to which people have access shall be adequately lit for all station operations.

7.2.30 Areas to which passengers and the public have access, including footbridges, subways and passages where there is no natural light shall be adequately lit.

7.2.31 Lighting levels shall be graduated as required for comfort, safety, security and monitoring. Abrupt changes in illumination level shall be avoided.

7.2.32 The level of illumination shall enable the train crew to have an unrestricted view of platforms both on approach and departure, through monitors and mirrors where provided.

7.2.33 Emergency lighting shall be provided in accordance with the relevant legislation (see *Foreword*).

7.2.34 The name of the station shall be conspicuously shown at intervals along all platforms and shall be clearly visible and legible to passengers both on the train and on the platform when the station is operation.

7.2.35 Luggage, trolley, barrow or maintenance equipment track crossings shall only be considered for lightly-used stations where the line-speed does not exceed 60 km/h and no alternative arrangements are reasonably practicable. An indication that it is safe to cross shall be provided when the available visual distance gives less than 30 seconds warning of an approaching train travelling at normal speeds. In this case, a suitable red and green signal with a warning notice shall be provided at the crossing. This shall be in accordance with the requirements of SANS 3000-2-2-1.

NOTE: The warning notice could read “Caution – Cross only when the green light is showing” or similar wording. In addition an audible warning should be provided if the crossing may be used by unaccompanied, visually-impaired people.

7.2.36 The rear edge of platforms shall be protected by a fence, wall or similar barrier to a minimum height of 1500 mm above platform height.

7.2.37 Protection shall also be provided at parts of the end of a platform where there is no ramp or other access.

7.2.38 Energy-absorbing buffer stops shall be provided at terminal stations or bay platforms. The buffer stop shall be designed to stop the heaviest train from its determined impact speed without the risk of serious injury to people on the train while avoiding excessive deceleration of other, lighter trains.

7.2.39 Buffer stops shall be compatible with the train design and shall be designed to bring a train to a halt in a controlled manner with a deceleration rate not exceeding 0,15 g (1,47 m/s^2). The likely impact speed shall be determined based on a consideration of track layout, approach speed, any automatic train protection (ATP), visibility and any foreseeable misjudgement.

7.2.40 A permanent red signal or a pair of fixed red lights or reflective markers shall be provided at fixed buffer stops.

7.2.41 Buildings or rooms, including kiosks and ticket collectors' booths, which are normally occupied by staff or the public shall not be positioned within 20 metres of the face of terminal buffer stops or within a line 3000 mm back from the platform edge and shall also be in compliance with the requirements of clause 7.2.11. This provision may be relaxed if the train control and signalling system is designed to guard against buffer impact and the risks are mitigated to acceptable levels.

7.2.42 Where a sub-surface railway terminates at a station, an adequate length of overrun tunnel shall be provided.

7.2.43 Factors to be considered:

a) the systemic compatibility with the trains;
b) arrangements to control access to platforms;
c) facilities for train crew to observe passengers boarding and alighting from the trains;
d) provision including seating and shelters for people who wait on the platforms;
e) the movement of people on and between platforms particularly where such movement entails the crossing of tracks (see SANS 3000-2-2-1 where applicable);
f) the need to avoid overcrowding and congestion points at platform entrances and exits;
g) the effect of platform edge screen doors on the station and other systems of the railway where applicable;
h) the positioning of vending and refreshment facilities;
i) the positioning of restroom and toilet facilities;
j) arrangements to prevent trespassing from platforms onto unauthorised areas;
k) surface treatment and drainage of platforms to prevent ponding and avoid person tripping and slipping;
l) the need for platforms to be easily cleaned and the avoidance of places where debris can accumulate in order to avoid fire and health hazards;
m) the vortex effects generated by trains that pass through stations;
n) ventilation arrangements during normal, abnormal and emergency situations;

o) in the case of dead-end or terminal tracks at platforms:
   1) overrun and flow control provisions and the type of arresting device (devices) provided;
   2) protection that can be gained from automatic train operation or train stop systems;
   3) the effect on braking performance of the environment and the covering or otherwise of the track; and
   4) the balance of risk between damaging the train and injury to its passengers and damaging the station and injury to the people using the station;

p) the positioning of structural and other critical supports including mast poles, roof supporting columns and bridge supports.

NOTE: Particular attention needs to be paid to vulnerability and special needs of persons with disabilities during derailments or to obstructions (or both)

7.3 Public areas other than platforms

7.3.1 The public areas of stations shall allow the unrestricted movement of passengers and members of the public. These areas which include passageways and stairways shall be designed, subject to the minimum dimensions given in this standard and in relevant national legislation (see *Foreword*), for the foreseeable peak passenger and public usage with due allowance for operational difficulties in abnormal, degraded or emergency conditions;

7.3.2 Provision shall be made for smooth passenger flow including:
a) the surge of passengers who enter or leave trains;
b) the presence and movement of passengers who carry luggage;
c) passengers that are accompanied by children; and
d) passengers with disabilities or special needs (or both).

7.3.3 Changes in the width or direction of passageways which could cause constriction of passenger and public flow routes or congestion shall be avoided.

7.3.4 Temporary or permanent obstructions which could cause constriction of passenger and public flow routes or congestion shall be avoided.

7.3.5 Vehicles and plant shall be separated from the passenger and public areas as far as is reasonably practicable.

7.3.6 Stations shall be durable and easy to inspect, maintain and clean. Where it is intended to clean any part of a station while the station is in use, then adequate provision shall be made to ensure that this does not disrupt the functioning of the station.

7.3.7 All floors, steps, treads and public walkways shall be designed taking into account environmental conditions, contamination and cleaning to minimise the risks of slipping and tripping.

7.3.8 All areas open to the outside environment shall have adequate means for draining water and prevention of ponding.

7.3.9 The headroom in all public and passenger areas of stations shall be in accordance with relevant national legislation (see *Foreword*) but shall not be less than 2300 mm. Where permitted, overhead equipment or signs shall not reduce headroom to below 2200 mm.

7.3.10 Fixed obstructions in public areas including columns, posts, and seats shall be clearly visible and minimize the risks of accidental injuries to the visually impaired.

7.3.11 Where passengers with disabilities or special needs are to have access to stations, provision shall comply with universal accessibility requirements and relevant national legislation (see *Foreword*).

7.3.12 The dispersal patterns of passengers and members of the public outside the station shall be considered, as well as assembly points for evacuated staff, passengers and public.

7.3.13 Station forecourts and approaches shall include:

a) safe access to the station for people;
b) safe access to the station for intended road vehicles including special purpose vehicles and emergency services;
c) safe boarding and alighting from road vehicles;
d) segregation of road traffic, pedestrians and trains; and
e) adequate parking with unhindered access to the station.

7.3.14 A designated meeting point for the emergency services shall be identified in a place of safety which shall be readily accessible to the emergency services' vehicles. The meeting point shall be conspicuously marked and have means of communication with the station control room (where applicable).

7.3.15 Plans and layouts of the station shall be available and provided for use by emergency services where required.

7.3.16 All entrance and exit doors and routes shall be clearly designated and signed. Normal entrances may be suitably signed and designated as emergency exits.

7.3.17 All exits shall be designed to ensure their suitability as a means of escape to allow the station to be evacuated safely.

7.3.18 Escape routes shall discharge to a place of safety capable of being used during any emergency and, where reasonably practicable, outside the station premises. Where required, exit routes shall be protected from the effects of fire and smoke.

7.3.19 Doors shall be avoided in all main passenger and public circulation areas and passenger and public flow routes.

7.3.20 Doors shall be used where required to control passenger flow and environmental conditions in other areas such as passenger waiting rooms, and catering and retail areas.

7.3.21 Doors shall not be provided adjacent to escalators, passenger conveyors and exits from lifts.

7.3.22 Where doors are provided, due consideration shall be given to:

a) the unrestricted flow of passengers and the public under normal, abnormal, degraded and emergency conditions;
b) bi-directional flow; and
c) the failure modes of power-operated doors;

7.3.23 glass screens and doors shall be suitably marked to ensure visibility to all users including the visually-disabled persons. Where trolleys or mechanical plant are to be used, suitable barriers shall be provided to protect glass screens;

7.3.24 All station premises to which people have access at night shall be adequately lit.

7.3.25 Areas to which passengers and the public have access including footbridges, subways, passages, stairways, steps, ramps and escalators where there is no natural light shall be adequately lit.

7.3.26 Lighting levels shall be graduated as required for comfort, safety, security and monitoring. Abrupt changes in illumination level shall be avoided.

7.3.27 Emergency lighting shall be provided in accordance with the relevant national legislation (see *Foreword*).

7.3.28 The name of the station and way-finding information shall be conspicuously shown and shall be generally visible, legible, or observable to passengers and public in the station at all times.

7.3.29 The means of ventilation shall be capable of maintaining a supply of fresh air and an air temperature in the public areas of the station in accordance with the relevant national legislation (see *Foreword*).

7.3.30 Station ventilation shall, as appropriate, include:

a) means of maintaining a safe environment and escape routes for a sufficient period of time to enable evacuation of the station;
b) means of removing smoke from public and non-public areas once evacuation has been completed; and
c) operation from a central service control room and also locally at the station where required.

7.3.31 Where complex ventilation systems are installed, and computer-aided decision-making as to the most appropriate mode of operation is provided, such systems shall be fail safe and have adequate and reliable fail-safe, fall-back mechanisms (see SANS 3000-2-4).

7.3.32 Passenger and public-information displays and way-finding displays shall be clearly visible and public address systems shall be clearly audible to all passengers and public. These shall be provided in accordance with the requirements of SANS 3000-2-4.

7.3.33 Information displays shall be located in such a position that passengers who stop to seek information from them do not restrict the flow of other passengers and public.

7.3.34 Factors to be considered:

a) the movement and location of people within and around a station in normal, abnormal, or degraded operating conditions or emergencies;
b) provisions to control overcrowding;
c) the behaviour of people in enclosed areas;
d) the size and treatment of surfaces of concourses, passageways, ramps, stairs, escalators and platforms;
e) the suitability of escalators, lifts and passenger conveyors for the number of people they are to carry under all conditions;
f) the number, size and spacing of exits;
g) the positioning of facilities including ticket offices, information counters, rest rooms, ablution facilities and retail outlets;
h) the provision of communication equipment and signs;
i) the provision of lighting;
j) the provision of emergency lighting in the event of loss of power supply;
k) main and standby ventilation arrangements;
l) main and standby power supply arrangements;
m) the RAMSS of the station structure, infrastructure and its ability to survive emergency situations;
n) the security of passengers, the public, employees, contractors and service providers at or in the station and the station precinct;
o) special arrangements necessary for sub-surface stations including the additional risks presented by fire and the need to segregate evacuation routes and provide ventilation control systems; and
p) the positioning of structural and other critical supports.

NOTE: Particular attention needs to be paid to the vulnerability of persons with disabilities or special needs (or both) during derailments or to obstructions (or both).

7.4 Non-public areas, operational facilities and staging

7.4.1 Non-public areas shall be segregated from public areas and appropriate arrangements shall be made to prevent unauthorised access.

7.4.2 All major surface (on grade), all sub-surface (including underground) and elevated stations shall be provided with a control room or point from which the activities of the operation of the station can be co-ordinated.

7.4.3 The following facilities shall be included:

a) an emergency procedure system with the relevant plans, documents and procedures;
b) a means of monitoring fire detection systems including audible and visual alarms and means of co-ordinating and controlling all other fire safety features provided for the station;
c) a means of summoning the emergency services;
d) a means of communication between station staff, other parts of the railway system and external agencies, including the emergency services at common meeting points;
e) provision of appropriately-zoned public address equipment;
f) a means of monitoring the operation and controlling of escalators, passenger conveyors, lifts, ticket barriers and other equipment which could influence the free-flow of passengers and the public;
g) a means of selecting and controlling the various ventilation modes; and closed-circuit television (CCTV) monitoring of all public places in the station, including emergency exit staircases not normally used; and
h) emergency overhead and traction electrical power disconnection in accordance with the requirements of SANS 3000-2-1.

7.4.4 The station control room or point shall be easily accessible to the emergency services through a protected route from the outside and be located, designed and constructed so that it can continue to function during an emergency. If this cannot be achieved, some duplication of facilities will be required at another point that is easily accessible and is in a safe location.

7.4.5 Where operating conditions permit, more than one station may be supervised from a single station control room, but sufficient facilities shall be provided at all stations to enable an emergency to be effectively and unambiguously managed.

7.4.6 Machine rooms, including escalator inclines and lift shafts shall be adequately lit and include emergency lighting.

7.4.7 An effective means of communication with the control room or control point shall be provided in machine rooms, escalator inclines and lift shafts.

7.4.8 Appropriate fire detection and suppression systems shall be provided in machine rooms, escalator inclines and lift shafts. All fire detection systems shall be linked to the main station fire alarm system.

7.4.9 An effective means of alerting staff inside a machine room or other operational facility to the activation of a fire alarm or another emergency on the station shall be provided where relevant.

7.4.10 Appropriate safeguards shall be provided to prevent people from coming into contact with the dangerous moving parts of machinery in accordance with national legislation (see *Foreword*).

7.4.11 Factors to be considered:

a) the means of co-ordinating other activities of the railway operation with those within the station so they do not cause additional risks to each other;
b) interfaces and intrafaces with adjacent or connecting railway operations and systems and activities adjacent to the railway;
c) the level and diversity of surveillance, communication and information required to control the activities within the station complex and the relevant competencies required by SANS 3000-4;
d) the means of communication with and the provision of information and instructions to employees, contractors or service providers (or combination thereof);
e) the liaison arrangements at the station for the emergency services;
f) the availability of control facilities during emergency situations;
g) the segregation of the staging, marshalling and maintenance areas from the running lines;
h) the protection of people in these areas from dangers presented by moving trains;
i) the position and condition of any electric traction system, its sectioning and its means and securing of isolation to facilitate maintenance and repairs;
j) protection of the station area from activities adjacent to the railway operation;
k) the need for adequate clearances and walkways;
l) the need for and protection of identifiable crossing places;
m) security of staged trains from malicious damage and theft;
n) segregation of road vehicles in the staging area from trains and people;
o) the arrangements for the control of train movements within, into and from the station area; and
p) the provision of adequate lighting for the safety of operational activities.

7.5 Access facilities and mechanisms

7.5.1 Stairways, steps and ramps shall be of uniform and adequate width to avoid overcrowding, and shall not be obstructed by any transverse barrier. The available width between handrails shall not be reduced in any way by any erection or obstruction. Stairways, steps and ramps shall have anti-slip surfaces.

7.5.2 Where a stairway or a ramp leads directly towards a platform edge, a safety barrier shall be provided beyond the run-off landing if the distance to the platform edge is less than 5000 mm.

7.5.3 The steps of all stairways shall be of uniform design in accordance with national legislation (see *Foreword*). However, they shall have a rise or vertical portion of between 100 mm and 180 mm, with an optimum rise of 150 mm. The width of the tread or horizontal portion of the step shall be between 280 mm and 350 mm. The optimum tread width is 300 mm. The calculated value of twice the rise height plus the horizontal tread width shall be greater than 550 mm and shall not exceed 700 mm. The optimum value is 600 mm. The edges of all treads shall be conspicuously marked.

7.5.4 Intermediate landings shall be provided between flights of steps in stairways. The maximum number of steps in each flight shall normally not exceed 16. However in cases of difficulty, a single flight of steps with an overall rise of 3000 mm is acceptable. The length of the top, intermediate and bottom landings shall be at least equal to the width of the widest section of the staircase between handrails.

7.5.5 Stairways and ramps shall be provided with continuous handrails on both sides, fixed at a height of not less than 850 mm and not more than 900 mm, measured vertically above the pitch line. Handrails shall present a round surface between 45 mm and 50 mm in diameter for ease of use.

7.5.6 Handrails shall extend beyond the last step or the end of a ramp and they shall be suitably terminated, provide clear passage of the hand from end to end and be at least 50 mm clear of any obstruction.

7.5.7 Stairways and ramps shall be at least 1200 mm wide between handrails to accommodate passengers with luggage. Wider stairways and ramps shall have intermediate handrails so that the distance between handrails is not less than 1200 mm and not more than 2400 mm.

7.5.8 Ramps for passenger access shall be constructed at a gradient not steeper than 1 in 20. In case of difficulty however and where ramps are not to be regularly used by passengers and the public, they may be at a slope of 1 in 12 and shall be suitably marked. Ramps shall be provided with landings at intervals of not more than 10 metres. Such landings shall be of a length not less than the width of the ramp.

7.5.9 A change in direction or an offset shall be provided at every second landing for ramps with a gradient not steeper than 1 in 20 and at every landing for ramps steeper than 1 in 20.

7.5.10 Lifts, escalators, and people conveyors shall be installed so that the ambient environmental conditions of all machinery and controls are maintained within the working limits specified by the manufacturer. If not within a building they shall be protected against the effects of the environment.

7.5.11 The positioning of lifts, escalators, and people conveyors shall be integrated with passenger flows throughout the station.

7.5.12 The layout of escalators and people conveyors shall be designed to avoid passengers and public being transported into an area already blocked by other passengers and public.

7.5.13 Particular care shall be required where failure of ticket barriers or other devices may cause congestion, or where failure of an onward escalator may cause congestion of an intermediate landing.

7.5.14 Sufficient waiting areas shall be provided at lifts and escalators to avoid obstruction of other passenger flows. There shall be no change of direction of any passageway within 2000 mm of lift doors.

7.5.15 Escalator landings with multiple exits shall be able to accommodate passengers and the public who need to locate direction signs (way-finding) before proceeding.

7.5.16 Under normal circumstances, lift doors and escalator and conveyor landings shall not face a platform edge. Where lifts, escalators and conveyors are required to discharge directly towards a platform edge closer than 5000 mm, barriers shall be provided.

7.5.17 Lifts, escalators and conveyors shall be supplemented by alternative non-mechanical means of entrance to or exit from any part of a station, in compliance with national legislation (see *Foreword*).

7.5.18 Status information, including alarms for lifts, escalators and people conveyors shall be displayed in the appropriate station control room or control point. For escalators and people conveyors this shall comprise indications of the direction of running, whether they are stopped and if an emergency stop device has been operated. For lifts, an indication shall be given of the operation of the passenger alarm button.

7.5.19 All escalators and people conveyors shall comply with the relevant national legislation (see *Foreword*) for the construction and installation of escalators and people conveyors.

7.5.20 The special requirements specified for public service application apply to all escalators and people conveyors that form part of the passenger and public flow routes. In addition, the following specific options and interpretations shall apply:

a) the angle of inclination shall not exceed 30 degrees for escalators, and 5 degrees for conveyors;
b) the width of tread-ways for escalators and people conveyors shall not be less than 1000 mm. The width for conveyors where passenger trolleys are permitted shall not be less than 1400 mm;
c) where an escalator is installed in a shaft with a curved roof, the overhead clearance at the centre of the nose of the steps shall be at least 2300 mm, but where necessary, a clearance over the ends of the steps of 2200 mm may be permitted. On reconstructed escalators some reduction of these clearances may be permitted provided that the risk is mitigated to acceptable levels (see SANS 3000-1);

d) the horizontal distance between the outer edges of the handrail and an adjacent wall shall be not less than 150 mm. The horizontal clearance shall be maintained up to a height of at least 1700 mm above step level. The emergency stop buttons may be situated within this width, but shall not be within 80 mm of the handrail;
e) all escalators, regardless of the rise, shall be equipped with an auxiliary brake;
f) the emergency stop devices, provided in accordance with relevant national legislation (see *Foreword*), shall only stop the escalator or conveyor to which they refer except when a second escalator or conveyor is directly cascading passengers toward the stationary escalator or conveyor. In this case, the second escalator or conveyor shall also be stopped. It shall be clear to which escalator or conveyor each stop device refers;
g) all equipment necessary to release trapped people or animals shall be provided near to each escalator or people conveyor, or each group of escalators or people conveyors, and shall be easily accessible to station staff;

NOTE: Animals will include domestic pets and guide dogs.

h) where an escalator or conveyor can be used as a means of escape in an emergency, barriers shall be equipped with an emergency push-through facility;
   1) whenever an escalator is made unfit for use as a stairway, barriers to prevent access shall be provided;
   2) any operational starting or any unplanned stoppage of an escalator or people conveyor shall give an audible alarm;

NOTE: Escalators or passenger conveyers should not be started when occupied unless they are equipped with a soft-start mechanism.

i) escalators and passenger conveyors shall be fitted with effective fire detection or suppression equipment (or both). The equipment shall be in accordance with the relevant national legislation (see *Foreword*);
j) access shall be provided to the underside of escalators to facilitate maintenance inspection and cleaning;
k) where the stationary escalator is to be used as fixed stairs, access to inspection chambers or equipment rooms shall not block the end of the escalator or obstruct parallel escalators or stairs that are in use; and
l) where alternative routes exist and sufficient capacity for passenger flows is provided or where there is time for maintenance to be undertaken while the station is closed, different arrangements may be acceptable which shall be included in and form part of the operational procedures.

7.5.21 All passenger lifts shall comply with the relevant parts of the relevant national legislation (see *Foreword*) for the construction and installation of lifts and service lifts.

7.5.22 Where lifts are provided for evacuation in the case of fire or to provide access for emergency services, the lifts shall comply with the specific parts of the relevant national legislation (see *Foreword*) for fire precautions in the design, construction and use of buildings. Other lifts shall not be used for evacuation in case of fire.

7.5.23 All passenger lifts shall comply with the relevant national legislation (see *Foreword*) for the safe working on lifts and allow for the emergency release of lift passengers.

7.5.24 The following specific interpretation of the emergency release requirements shall be adopted:

a) each lift shall be provided with an alarm button at such a height that it can be reached by children and people with disabilities and a means of two-way speech communication, both connected to a location which is continuously manned at all times when passengers may be using the lift. These devices shall be powered from a supply that is independent of the main lift supply. Where the lift is provided with dual supplies, this shall be an acceptable alternative; and
b) emergency lighting of a duration as specified in relevant national legislation (see *Foreword*) or of such extended period as may be required to permit complete evacuation shall be provided in all access facilities including lifts, escalators, people conveyers, connecting corridors, subways, and bridges. These access facilities shall be illuminated automatically on failure of the main supply.

7.5.25 Factors to be considered:

a) the capacity of main and alternate access routes and their associated stairways, ramps, lifts and conveyors for passengers and the public during normal, abnormal, degraded and emergency conditions;
b) the capacity of main and alternate access routes and their associated stairways, ramps, lifts and conveyors for emergency services during normal, abnormal, degraded and emergency conditions;
c) the provision of dedicated lifts for emergency services, or operating staff (or both);
d) the required testing and maintenance requirements for all access equipment, and whether this can be locally or remotely controlled (or both);
e) remote or local control (or both) of access equipment, and the integration thereof into the overall seamless operation of the station and the overall railway operation; and
f) the integration of the access equipment and arrangements into the overall design of the station to ensure a seamless flow of passengers and the public (where applicable) through the station, or from the parking and drop-off areas to the public area or forecourt, to the platforms as appropriate.

7.6 Fire prevention and evacuation

7.6.1 The passenger and public areas of the station and the choice of materials to be used in these areas shall be in accordance with the relevant national legislation (see *Foreword*).

7.6.2 The fire prevention materials shall be such that in the event of a fire, the fire-load and the generation of smoke and toxic gas will be kept to a reasonably practicable minimum.

7.6.3 Passenger and public areas shall be segregated from non-public areas and shall include:

a) arrangements for means of escape from fire at all surface (on grade) stations shall be in accordance with national legislation (see *Foreword*) for certifiable and non-certifiable premises in as far as it is applicable to stations; and
b) smoke or fire doors shall not reduce the widths of exits or otherwise impede means of escape during evacuation. Appropriate means shall be provided where required to prevent the closing of such doors while evacuation is in progress.

NOTE: The sub-division of the public area by devices such as smoke or fire doors, whether normally open or closed, is not normally considered an appropriate method for the control of smoke during evacuation of passengers and the public, but may be appropriate to help in protection of escape routes.

7.6.4 An electrical fire alarm shall be provided which is capable of manual operation by passengers, members of the public, employees, contractors or service providers, and is installed in accordance with the relevant national legislation (see *Foreword*).

7.6.5 Passenger and the public areas of the station shall have an effective system of surveillance and public address. Public address systems shall be protected as far as possible from the effects of fire or other emergencies.

NOTE: Minor surface (on grade) stations may be exempt from this provision where the risks can be mitigated to acceptable levels (see SANS 3000-1).

7.6.6 Radio or telephone networks (or both) for communication between station control points and staff on the station shall be provided. The network shall be compatible with communications equipment for emergency services where applicable.

7.6.7 Fire and evacuation requirements for retail outlets, if provided, shall be in accordance with the relevant national legislation (see *Foreword*) and SANS 3000-2-6 (Interface and intraface requirements).

7.6.8 The following conditions shall be used for the design of escape capacity from a fire in the station structure:

a) occupancy at the time of evacuation shall be based on peak usage with an allowance for the delay to the scheduled train services in the busiest direction, occupancy shall be based on an appropriate risk analysis.
b) the exit route of the greatest capacity shall be discounted, as it could be blocked by fire;
c) passengers who are waiting to board and those who are expected to alight from the next train from both directions shall be evacuated; and
d) passengers shall be able to clear each platform through the remaining exits and reach a protected route to safety within 10 minutes or within such other specified time determined by the risk to an acceptable level from receiving the instruction to evacuate.

7.6.9 The following conditions shall be used for the design of escape capacity from the station platforms in the event of an emergency:

a) the occupancy at the time of evacuation shall be based on peak usage with allowance for any delays to the scheduled train services in the busiest direction, occupancy shall be based on an appropriate risk analysis;
b) the number of passengers to be evacuated from the station shall be the sum of:
    1) all the occupants as defined in sub-clause (a) above,
    2) plus all the occupants of a crush-loaded train (that must be assumed to be on fire),
    3) plus those passengers normally expected to alight from the next train in another direction or stopping on another line;
c) all exit routes may be counted as available for use but escalators shall be regarded as continuing to run in the same direction as they were before the emergency and thus potentially unusable;
d) the passenger escape arrangements shall assume passengers cannot pass along the platform or through any stationary train to bypass the source of the fire;
e) all the passengers identified in sub-clause (b) above shall, after receiving the instruction to evacuate, be able to reach a protected route to safety within 10 minutes or within such other specified time as determined by the mitigation of the risk to an acceptable level; and
f) the size of escape routes to meet the objectives shall be based on appropriate data on flow-rates, the source and calculation of which shall be documented.

NOTE: A train is the most likely source of fire that will require evacuation of the greatest number of people through the station. If the fire is elsewhere, it is assumed that the train may be used evacuate those on board.

7.6.10 Station compartmentalisation, fire detection and fire suppression shall be in accordance with the relevant national legislation (see *Foreword*). Smoke from any such fire shall be contained or controlled by ventilation or other suitable means, at least for the duration of any evacuation.

7.6.11 The arrangements for means of escape from fire at all sub-surface stations shall be in accordance with the relevant national legislation (see *Foreword*) for certifiable and non-certifiable premises in as far as it is applicable to stations.

7.6.12 Fire precautions and fire-fighting provisions at all sub-surface stations shall be not less than those required in by relevant national legislation (see *Foreword*) with the following additions:

a) a fire-fighting shaft and, where passengers with disabilities have access to the station, a means of escape for the people with disabilities shall be provided to all levels of the station. Such a shaft may also be considered as part of the means of escape for passengers;
b) a falling fire-main in accordance with national legislation (see *Foreword*) for fire extinguishing installations and equipment on premises;

c) where a train fire could create a high fire-loading, a suitable system to minimise the intensity and rate of propagation of a train fire, such as a water-drenching system installed above the location of a train at each platform, shall be installed, such installation shall be based on a risk analysis;
d) where a water-drenching system is installed above the location of trains at platforms, the discharge heads shall be operable only on command from the station control room or at platform level. Discharge may be zoned so only the appropriate heads are opened; and
e) the operation of the water-drenching system shall be compatible with and interlocked to the electrical distribution and overhead traction systems (ED and OHTS) where applicable.

7.6.13 Factors to be considered:
a) the time taken to complete evacuation of the station;
b) the protection of evacuation routes;
c) access for emergency services, especially in sub-surface stations;
d) information systems and appropriate signage for evacuation of the station;
e) the zoning of public address systems;
f) the management and control of all ventilation systems under main, standby and emergency conditions;
g) fire, smoke and fume prevention (including the choice of materials) and control measures commensurate with the fire risk and evacuation arrangements;

NOTE: This factor may not be applicable to halts or similar structures that are not included in measures to minimize the fire-load.

h) the segregation of public areas of stations from non-public areas and high-fire - risk areas;
i) the provision of fire detection and warning systems and fire suppression systems;
j) ventilation and zoning for smoke and fume extraction systems to limit smoke and fumes from a fire spreading to other parts of the station;
k) the vortex effects generated by trains passing through restricted spaces;
l) the provision and identification of initial fire-fighting equipment;
m) facilities and systems for fire-fighters; and their equipment;
n) the location of a suitable pre-agreed common meeting point where station staff will meet with emergency services;
o) the additional risks caused by fire in a sub-surface station and the need to segregate evacuation routes and provide ventilation control systems; and

7.6.14 The non-public areas of stations shall require a warning or communication system.

7.6.15 An effective means shall be provided to alert staff inside plant and machine rooms to the activation of any station fire alarm particularly where an automated fire extinguishing system is installed.

7.7 Additional considerations for elevated or sub-surface stations or other station structures

7.7.1 The passenger and public areas of the station shall be designed for the unrestricted movement of passengers and members of the public. The width of platforms, passageways, stairways, escalators and passenger conveyors shall be designed subject to the minimum widths given in previous clauses for the foreseeable peak passenger usage with due allowance to prevent congestion being caused by extended intervals between trains.

7.7.2 Appropriate congestion control measures which shall apply in the event abnormal, degraded or emergency conditions.

7.7.3 Provision shall be made for passengers with disabilities, including those in wheelchairs, such as lifts to all public levels.

7.7.4 Adequate arrangements shall be in place for evacuation in an emergency.

7.7.5 Access to platforms shall be in accordance with requirements for platforms (see clause 7.2).

7.7.6 The flows of arriving and departing passengers shall be separated as far as is reasonably practicable.

7.7.7 Passengers that move from one part of the station to another shall not be routed along any platforms.

7.7.8 Means to warn passengers and to prevent them from entering either in an emergency or to prevent congestion shall be provided at all entrances and exits to the station.

7.7.9 All rooms, platforms, escalators, lifts and stairways shall have conspicuous and unique identification and route signs (way-finding).

7.7.10 All passenger routes to and from platforms shall be clearly signed.

7.7.11 Retail outlets shall not be located lower than the first ticket hall or concourse level accessible to the public and shall not be sited so as to cause congestion or obstruction of the passenger flows.

7.7.12 Retail outlets shall have a fire detection system and fire-fighting equipment automatically operated by outbreak of fire in that part of the premises in accordance with the relevant national legislation (see *Foreword*).

7.7.13 Subject to the minimum dimensions in clauses 7.2.9 to 7.2.13, platforms shall accommodate all the passengers waiting to board a train with an allowance for a delay to the planned train service in the peak period.

7.7.14 The width of a single-face platform shall not be less than 3000 mm.

7.7.15 The width of an island platform shall not be less than 6000 mm.

NOTE: As an exception, the minimum width from any obstruction of 2000 mm may be permitted near to the extreme ends of the platforms provided that risks can be mitigated to acceptable limits.

7.7.16 The main structure of the station shall provide a headroom of at least 3000 mm over the whole length and width of platforms.

7.7.17 Separate entrances and exits shall be provided and arranged to facilitate even passenger distribution on the platforms and rapid passenger exit with minimum congestion or conflicting flows.

7.7.18 Normal entrances may be signed as emergency exits where appropriate, and counted as such in evacuation calculations.

7.7.19 At least two alternative escape routes shall be provided from each platform with a travel distance of not more than 90 metres between any two exits.

7.7.20 The length of a platform shall be adequate for the longest train or applicable portion of the train used on the line and include an allowance for the accuracy with which trains can be stopped at the platform.

7.7.21 An additional length beyond the stopping tolerance shall be provided at both ends of the platform to allow access to and from the track while a train is stopped at the platform.

7.7.22 A track adjacent to a platform accessible from the platform side only shall have an emergency pit accessible from either end when a train is in the platform. Otherwise platform edge screen doors shall be provided, or there shall be a clearance of at least 450 mm between the track bed and all under-train equipment over a width of 600 mm.

7.7.23 Platforms shall be straight or, if unavoidable, curved at a radius not less than 1000 metres.

7.7.24 Platform edge screens and doors (where applicable) shall be compatible with the rolling-stock.

7.7.25 Platform screen-doors shall be designed to withstand crowd crush loading and shall be of sufficient height to prevent climbing. All platform edge screens should include means of access and exit from the track and adjacent tunnels.

7.7.26 The station shall be sufficiently illuminated in accordance with clauses 7.2.31 to 7.2.33 when occupied and shall be provided with an adequate illumination system for emergency evacuation fed by either a main and backup power supply or two independent power supplies.

7.7.27 In the case of sub-surface stations emergency lighting shall be in accordance with relevant national legislation (see *Foreword*) for sub-surface structures.

7.7.28 Station ventilation systems shall include the following as appropriate:

a) a means to control smoke from retail premises;
b) a means to accommodate the vortex effects generated by trains passing through restricted spaces; and
c) a smoke extraction system along the length of the platform railway tracks, designed to prevent smoke from a train fire from spreading to the other parts of the station.

7.7.29 Factors to be considered:

a) additional width of platforms adjacent to entrances to and exits from the platform may be required to avoid congestion at these places;
b) the provision of self-closing doors for escape chambers or passages; and
c) the ease of operation of all station facilities which may need to be operated by unskilled personnel or the public or persons with disabilities (or combination of these) under abnormal, degraded or emergency conditions.

8 Execution (construction)

8.1 The operator shall establish, develop or adopt, document, implement and maintain processes and procedures for the construction of new stations or the modification of existing stations (or both).

8.2 The operator shall ensure that such stations are constructed in accordance with the relevant national legislation (see *Foreword*) and relevant parts of the national standard: Railway Safety Management (SANS 3000 Series), in particular with the aspects of engineering, human factors, interoperability and operations.

8.3 The processes and procedures to be developed or adopted shall include the following:

a) compliance with the approved design, drawings and specifications;
b) work-site management and operation during construction activities, including:
    1) safeguarding of existing railway operations,
    2) safeguarding of the public and passengers and employees from station construction activities,
    3) clear demarcation of construction and functional or operational areas (or both),
    4) safeguarding of construction train operations,
    5) safeguarding of construction personnel,
    6) access control to and protection of the worksite(s),
    7) compliance with construction regulations in the relevant national legislation (see *Foreword*),
    8) environmental management in accordance with the relevant national legislation (see *Foreword*), and
    9) appropriate process management in accordance with SANS 3000-1, and SANS 10007/ISO 10007;
c) any temporary work or phases of construction (stage works) shall comply with the requirements of both section 7 (Design) and section 9 (Testing and commissioning);
d) interface and intraface management requirements for any temporary works or phases of construction (stage works), which shall also comply with the requirements of both section 7 (Design) and section 9 (Testing and commissioning);
e) conclusion of the necessary interface or intraface agreements between the affected parties including construction and construction train safety permits, where required;
f) any new but un-commissioned or non-operational equipment that could cause confusion with the existing station or train operations (or both) or any other activities shall be clearly marked as such prior to and up to its commissioning;

g) compliance with the interface and intraface management, and interoperability requirements of the approved design, drawings and specifications for interoperability; and
h) risk assessments shall be conducted for all types of occupations (possessions) and other work permissions.

8.4 Any deviation from the approved design during construction shall result in a new risk assessment being conducted and the design revised, verified and validated accordingly.

9 Testing and commissioning

9.1 General

9.1.1 The operator shall establish, develop or adopt, document, implement and maintain processes and procedures for the testing and commissioning of new or modified stations (or both).

9.1.2 The operator shall ensure that such stations are tested and commissioned in accordance with the relevant national legislation and standards (see *Foreword*), including the relevant parts of the national standard, Railway Safety Management (SANS 3000 series), in particular with the aspects of engineering, human factors, interoperability and operations.

9.1.3 Testing and commissioning procedures shall complement and shall not substitute for quality-control of the design, execution, production and installation of the station and its associated systems, sub-systems and components.

NOTE: Testing and commissioning of railway stations are essential elements in ensuring the “integrity” of the station as a system.

9.2 Requirements for testing and commissioning

9.2.1 Requirements for testing and commissioning shall include:

a) ensuring the appropriate level of competency of the commissioning organization or the individual (or both) for the type of system or installation, based on complexity and risk (see SANS 3000-1 and SANS 3000-4);
b) demonstrating the level of independence of the commissioning organization or the individual (or both) from the design and execution (construction) organizations or individuals for the type of system or installation, based on complexity and risk;
c) ensuring compatibility of the new or modified systems (or both) with the existing station, infrastructure and rolling stock systems, sub-systems and components;
d) validation and verification of the station design, execution (construction) and functioning;

NOTE 1: “Validation” means confirmation that the system, sub-system or component is appropriate for its intended use.

NOTE 2: “Verification” means testing and evaluation of a system, sub-system or component to assure compliance with its specification or other requirements.

NOTE 3: Verification is a compliance test and does not address the adequacy of the specification.

NOTE 4: Test and measuring equipment should be suitably calibrated and certified.

e) validation and verification shall include:

1) the conducting of suitable simulations of public and passenger access, capacity and flow under normal, abnormal, degraded and emergency conditions, and
2) the conducting of suitable emergency management services interface and co- coordination exercises and testing of related equipment;

f) the operator and persons participating in such simulations shall conclude the necessary indemnity agreements in terms of the operator's test and commissioning permit;
g) the assurance of safe transition during any commissioning or system change (or both);
h) the handover processes to the relevant operators, including formalized operator training and material for the use and maintenance, where applicable of the new or modified facilities, systems, sub-systems or components (or a combination of these) (see SANS 3000-1 and SANS 3000-4);
i) the provision of all relevant documentation (see SANS 3000-1) including as-built plans, maintenance manuals and operating procedures and the recording in the configuration management system; and
j) conclusion of the necessary interface and intraface agreements between the affected parties where testing and commissioning safety permits are required.

10 Operation

10.1 The operator shall establish, develop or adopt, document, implement and maintain processes and procedures for the operation of the new or modified stations (or both) which shall include the following:

a) the amendment of the operator's SMS to reflect the changes resulting from the new or modified stations and systems, sub-systems or components (or combination thereof), including the confirmation of risk assessment and amendment thereof where relevant and necessary;
b) the compliance with the train operational principles described in SANS 3000-2-5;
c) the appropriate operational and technical resourcing of the station and its systems in accordance with the approved design and as constructed, tested and commissioned;
d) the education and awareness of users which shall include the affected public, passengers, employees, contractors, and service providers; and
e) the development and implementation of relevant operating and emergency procedures.

11 Monitoring and maintenance

11.1 General

11.1.1 The appropriate level of competency of the maintenance organization or the individual (or both) and the associated standards and procedures shall be ensured for the type of system or installation, based on complexity and risk.

11.2 Monitoring

11.2.1 The operator shall establish, develop or adopt, document, implement and maintain standards, processes and procedures for the monitoring and assessment, auditing and inspection and the prevention of railway occurrences at stations which shall include the following:

a) structure and system availability and integrity;
b) faults and incidents;
c) structure, system, sub-system and component condition;
d) compliance with and performance against the approved design, applicable railway safety standards and fail-safe principles;
e) maintenance practices and testing procedures;
f) in-service inspections which shall be considered as and when required and at least as specified in the operator's SMS and Safety Improvement Plan (SIP);
g) conditions and events which are likely to result in reduced safety, operating performance or increased risk (or a combination thereof); and
h) railway occurrences.

11.2.2 Factors to be considered:

a) compliance with the train operating principles in accordance with SANS 3000-2-5;
b) generally accepted system availability measurements: "mean time between failures" (MTBF) and "mean time to repair" (MTTR);

NOTE: MTTR comprises the period from the time that a fault appears for the first time until the time when the system, sub-system or component is reintroduced into service.

c) fault and incident reporting system and analysis;
d) effectiveness of maintenance procedures;
e) frequency of scheduled inspections and requirements for special inspections;
f) condition monitoring and analysis;
g) unsafe or ineffective maintenance practices (or both) and testing procedures;
h) determination and mitigation of conditions and events which are likely to result in reduced operating performance and safety;
i) methods of detection and reporting of the onset of sub- standard conditions; and
j) analysis of the causes and consequences of railway occurrences due to substandard acts or conditions or procedures (or a combination thereof), and where appropriate the implementation of corrective actions.

11.3 Maintenance

11.3.1 The operator shall establish, develop or adopt, document, implement and maintain standards, processes and procedures for maintenance of stations and their associated systems, sub-systems and components and which shall include the following:

a) preventative or corrective maintenance plan (or both) to maintain or restore performance to the approved design or specifications or standards (or a combination thereof);
b) carrying out of preventative or corrective action, including the following:
    1) work site operation and management;
    2) access control and protection of the public, passengers, employees and contractors or service providers;
    3) maintenance or restoration to the approved design or specifications or standards (or a combination thereof);
    4) repair or replacement (or both) of faulty equipment; and
    5) periodic training or re-training of technical and operational personnel.

11.3.2 Factors to be considered include:

a) process management in accordance with SANS 3000-1;
b) procedures for configuration management in accordance with SANS 3000-1 and SANS/ISO 10007;
c) the use and effectiveness of appropriate maintenance practices and procedures;
d) RAMSS philosophy and methodology;
e) processes and procedures for the timely adjustment of equipment to maintain safety and performance and prevent faults;
f) availability of manuals and other related documentation such as those that cover operating, maintenance and repair of the station systems, sub- systems and components;
g) availability of spare parts, resources, facilities, and appropriate certified and calibrated test and repair equipment;
h) management of the risk of subsequent exposure that follows a railway occurrence or system failure (or both) and prior to remedial action being performed; and
i) fault history or shortcomings in performance that may indicate the need for redesign.

12 Modification

12.1 The operator shall establish, develop or adopt, document, implement and maintain standards, processes and procedures for the modification of existing stations and which shall include the following:

a) the design, execution (construction), testing and commissioning of the modification in accordance with clauses 5 to 11 (inclusive);
b) the effects of the proposed modification on the safety of the public, passengers, employees, contractors or service providers located within the station precinct during the execution (construction), testing and commissioning of the modification to the station and its systems, sub-systems and components; and
c) the communication of changes, modifications and transitional arrangements to all interested and effected parties during the construction, testing and commissioning phases.

12.2 Factors to be considered:

a) process management in accordance with SANS 3000-1;
b) procedures for configuration management in accordance with SANS 3000-1 and SANS/ISO 10007;
c) short comings in existing performance or requirements for increased or improved safety functionality or performance (or combination thereof);
d) fault and incident history;
e) availability of resources, spare parts, facilities and appropriately calibrated and certified test and repair equipment; and
f) recommendations or findings that arise from occurrence investigations following occurrences in the passenger, public, operational and technical areas of the station precinct.

13 Decommissioning and disposal

13.1 The operator shall establish, develop or adopt, document, implement and maintain processes and procedures for the decommissioning or disposal of stations and their associated systems, sub-systems, components and, where relevant, the means of preventing inappropriate re-usage thereof. The following shall be included:

a) the identification of persons authorized to decommission, and where relevant remove and dispose of such decommissioned structures, systems, sub-systems and components;

b) appropriate marking of each decommissioned structure, system, sub-system and component for identification purposes for disposal and to avoid operational and technical confusion during decommissioning;

c) ensuring safe operations during decommissioning and where applicable, the demolition or removal of structures, systems, sub-systems and components ensuring safe work site operation and management including access control and protection in accordance of national relevant legislation (see *Foreword*);

d) ensuring that the condition of decommissioned material and equipment is clearly identified and marked either for re-use or to prevent inappropriate re-use;

e) minimization of environmental risks, including health, safety and pollution hazards associated with the demolition or disposal (or both), of decommissioned structures, systems, sub-systems and components, considering both short-term and long-term impact in accordance of national relevant legislation (see *Foreword*);

f) restoration of the environment to the required standards in terms of relevant national legislation (see *Foreword*) following such demolition or disposal (or both);

g) a database of decommissioned stations and their status including whether demolished, moth-balled or re-used; and

NOTE: Moth-balled means suitably preserved for possible future re-use.

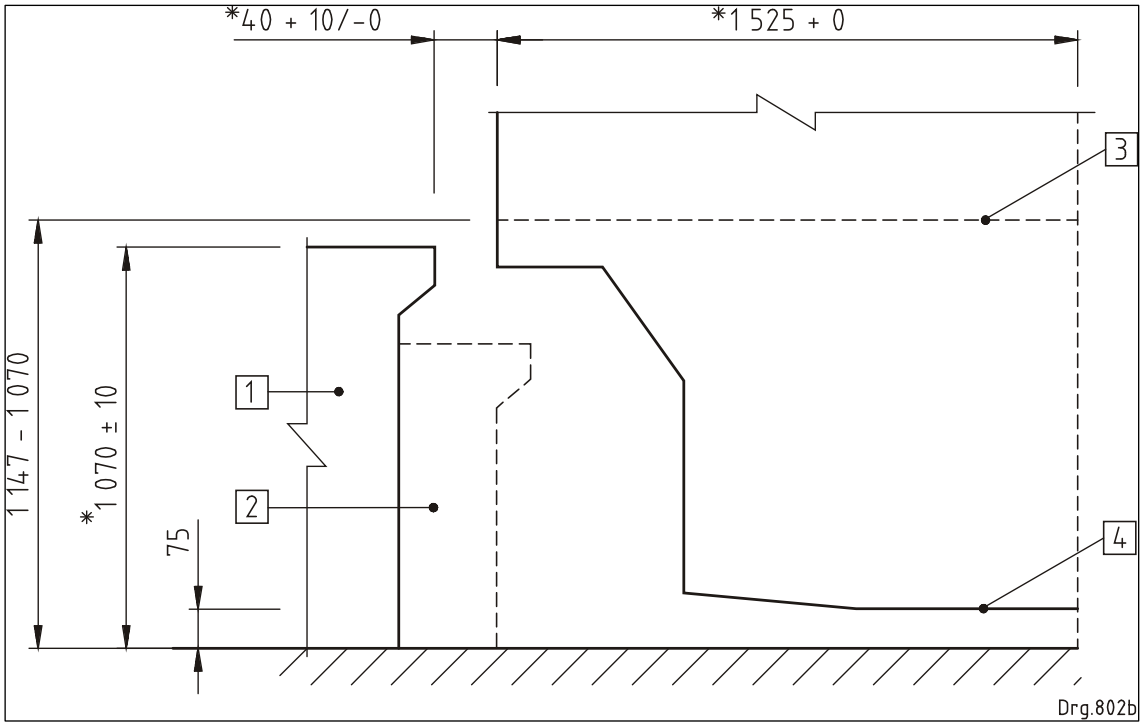
h) where a station is to be moth-balled, appropriate steps shall be taken to protect the station from deterioration, theft and malicious damage to property.

Annexure A

Normative

A.1 Platform dimensions and clearances

Clearances for ballastless track on 1065 mm gauge.



NOTE 1: All dimensions in millimetres

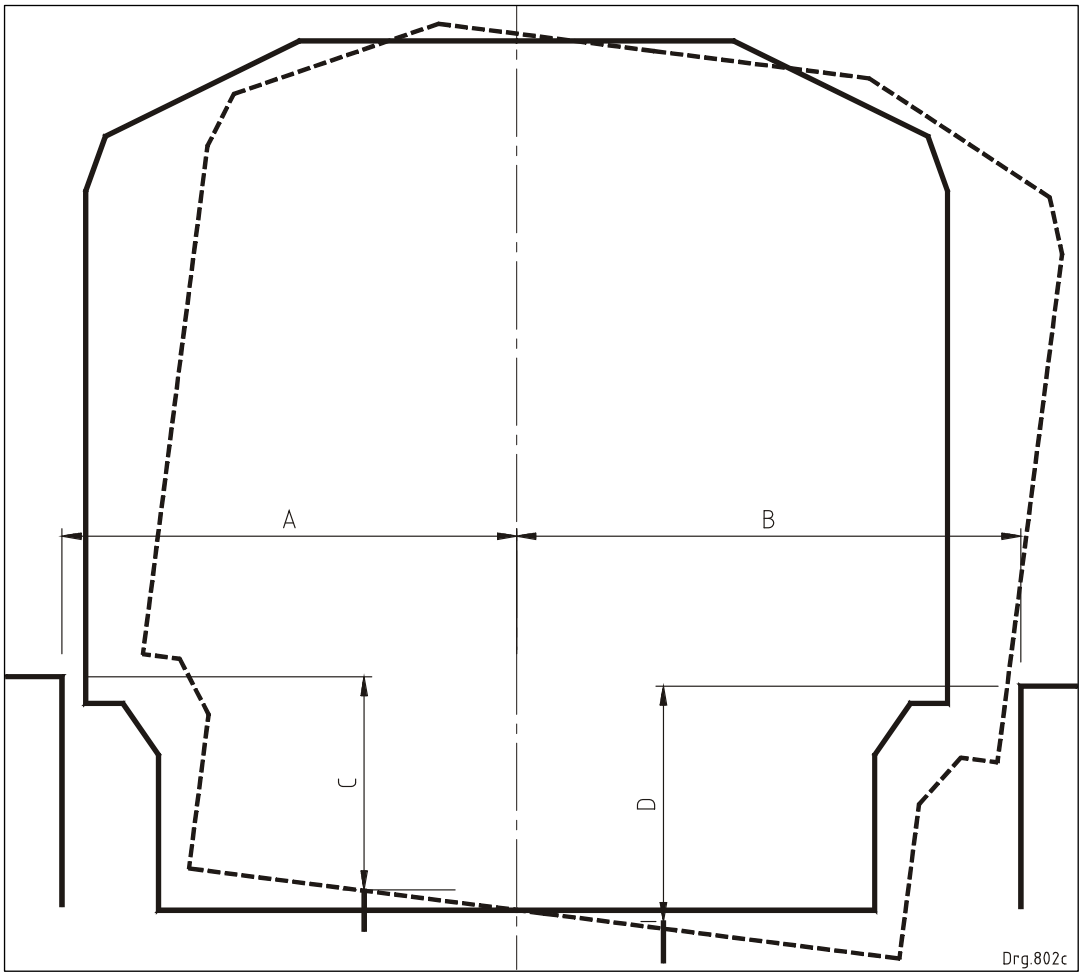
NOTE 2: Drawing is not to scale.

Key:

1 Ballastless track high-level passenger platform
2 Current high-level passenger platform on ballasted track
3 Floor level of commuter coaches
4 Vehicle gauge (see annex B)
* Ballastless track passenger platform dimensions.

A.2 Platform clearances (rounded-up)

Clearances (rounded-up) for ballastless tangent and curved track 1065 mm gauge.



See table A.3 for dimensions.

Key

A	Horizontal clearance on outside of curve
B	Horizontal clearance on inside of curve
C	Vertical clearance on outside of curve
D	Vertical clearance on inside of curve

A.3 Table of clearances for platforms

For ballastless tangent and curved track on 1065 mm gauge

Curve radius	Cant	A	B	C	D	Zero cant			
r	c					A	B	C	D
metres	mm	mm	mm	mm	mm	mm	mm	mm	mm
90	100	1 770	1 970	1 165	970	1 880	1 880	1 070	1 070
100	100	1 740	1 940	1 165	970	1 850	1 850	1 070	1 070
110	90	1 725	1 905	1 155	980	1 825	1 820	1 070	1 070
120	90	1 705	1 885	1 155	980	1 800	1 800	1 070	1 070
140	80	1 685	1 845	1 145	990	1 770	1 770	1 070	1 070
160	80	1 660	1 820	1 145	990	1 745	1 745	1 070	1 070
180	70	1 650	1 790	1 140	1 000	1 725	1 725	1 070	1 070
200	70	1 635	1 775	1 140	1 000	1 710	1 710	1 070	1 070
220	70	1 620	1 760	1 140	1 000	1 695	1 695	1 070	1 070
240	70	1 610	1 750	1 140	1 000	1 685	1 685	1 070	1 070
270	60	1 610	1 730	1 130	1 015	1 670	1 670	1 070	1 070
300	60	1 600	1 720	1 130	1 015	1 660	1 660	1 070	1 070
350	60	1 585	1 705	1 130	1 015	1 650	1 650	1 070	1 070
400	60	1 580	1 695	1 130	1 015	1 640	1 640	1 070	1 070
450	50	1 580	1 680	1 120	1 025	1 630	1 630	1 070	1 070
500	50	1 575	1 670	1 120	1 025	1 625	1 625	1 070	1 070
550	40	1 575	1 660	1 110	1 035	1 620	1 620	1 070	1 070
600	40	1 575	1 655	1 110	1 035	1 615	1 615	1 070	1 070
700	30	1 575	1 635	1 100	1 045	1 610	1 610	1 070	1 070
800	30	1 575	1 630	1 100	1 045	1 605	1 605	1 070	1 070
850	30	1 575	1 630	1 100	1 045	1 600	1 600	1 070	1 070
900	20	1 575	1 620	1 090	1 055	1 600	1 600	1 070	1 070
1 000	20	1 575	1 615	1 090	1 055	1 595	1 595	1 070	1 070
1 200	10	1 575	1 600	1 080	1 065	1 590	1 590	1 070	1 070
1 500	10	1 575	1 595	1 080	1 065	1 585	1 585	1 070	1 070
1 700	10	1 575	1 595	1 080	1 065	1 585	1 585	1 070	1 070
2 000	10	1 575	1 590	1 080	1 065	1 580	1 580	1 070	1 070
3 000	0	1 575	1 575	1 070	1 070	1 575	1 575	1 070	1 070
Tangent	0	1 565	1 565	1 070	1 070	1 565	1 565	1 070	1 070

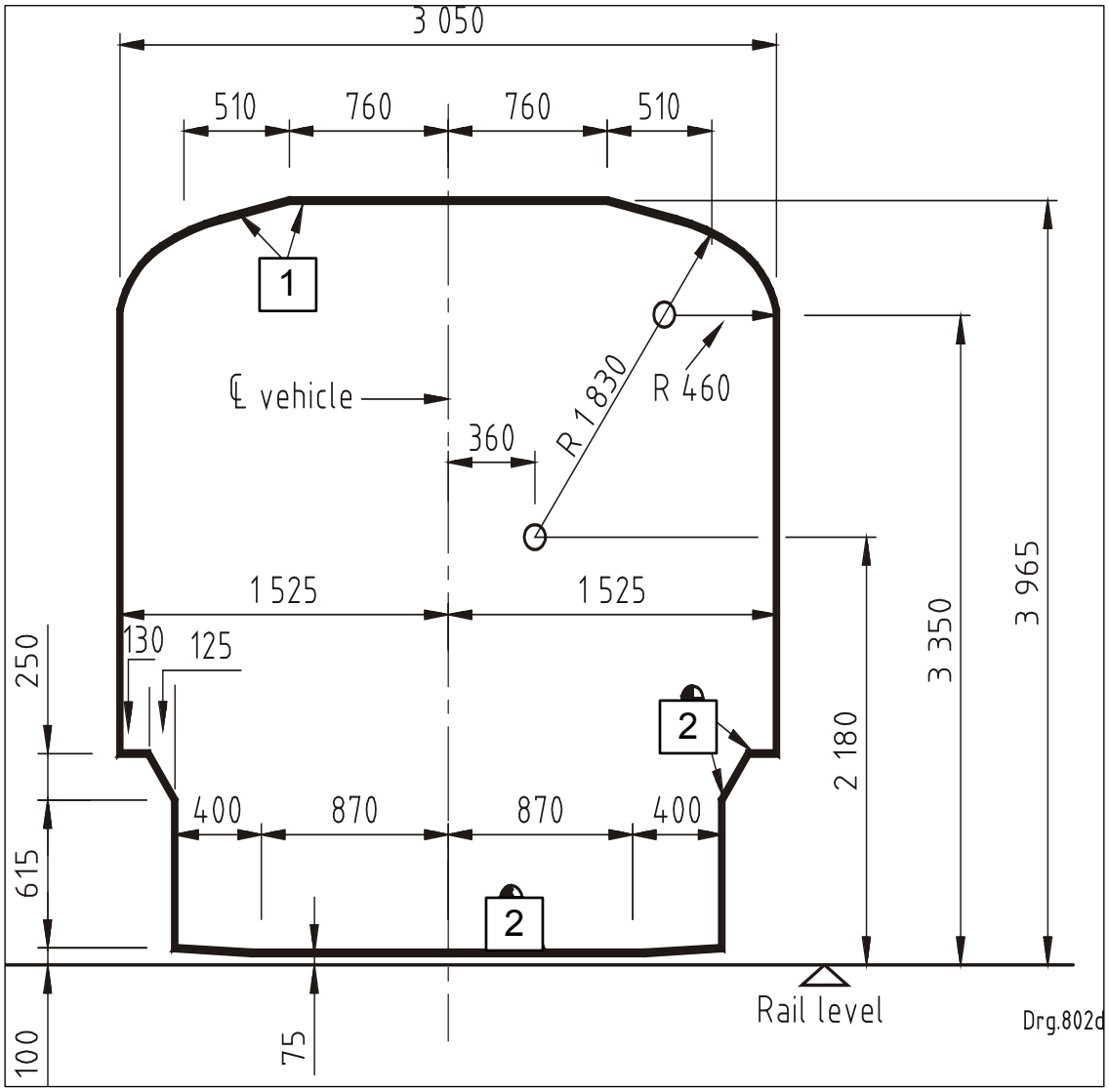
NOTE1: Not recommended where shaded grey.

NOTE 2: An engineer is permitted to interpolate for values not found in this table.

Annexure B

Normative

B.1 Vehicle size gauge for track gauge of 1065 mm



NOTE: All dimensions in millimetres

Key:

1 without load and new tyres, vehicle shall not be higher than this outline

2 with full load and worn tyres, vehicle shall not be lower than this outline

End of Document