PRASA GROUP Norms, Guidelines and Standards

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GENERAL NOTES:

- This document is part of a set of documentation that forms the internal high-level specification and guidelines document to assist with the design of PRASA Railway Stations for both new and existing stations.
- Information, specifications and guidelines in it are subject to change
- All information in this document must be read in conjunction with Annexures A and B666

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Preface
Document Background

The original norms, guidelines and standards (NGS) document was finalized in 1997 as part of the then process of planning and executing the development of new stations, the upgrading / rehabilitation or expansion of existing stations and implementation of upgraded / new systems. The NGS was developed with the aim of integrating, standardizing, and accelerating the planning and feasibility studies and approval of station infrastructure projects, and was to be used in the planning, contracting, project management and execution of all station related projects for the South African Rail Commuter Corporation (SARCC) divisions and subsidiaries.

The newly-established Passenger Rail Agency of South Africa (PRASA), merges the operations, personnel and assets of the SARCC, Metrorail, Intersite Property Management Services, Shosholoza Meyl and the long distance bus company Autopax (Translux and City-to-City).

PRASA's primary responsibility is to effectively develop and manage rail and related transport infrastructure and to provide efficient rail and road based passenger transport services. This responsibility will be supported by a "total station management" approach that will be developed to enhance passengers' travelling experience.

As such there was a requirement to merge historic SARCC and Metrorail design and operations manuals into a single manual that will start to address all aspects of commuter, long distance rail and bus infrastructure and operations as well as their integration with other infrastructure and operations, e.g. minibus taxi ranks and their operations adjoining stations.

The scope of this project, i.e. Compile a new norms, guidelines and standard (NGS) documents for station facilities, was to merge the existing contents of the design and operations components of the following documents:

- SARCC Metro Station Acquisition: Norms, Guidelines and Standards (October 1997)
- SARCC Station Partial Design & Assessment Guideline for use on Metrorail commuter stations (March 2007)
- SARCC Design Guidelines to Improve Accessibility of Commuter Rail in South Africa (April 2008)
- Metrorail Operationalization Framework for Special Needs Passengers (subsequently excluded from the scope of work)
- Blueprint: Design Guidelines, Spatial Parameters and Generic Detailing Document

A large component of the information contained in these documents do not, however, represent Universal Accessibility (UA), current architectural practices and processes and international practice and procedures, or include any information related to Shosholoza Meyl and Autopax facilities. As a result this comprehensive update of the merged NGS document will provide a proper framework for the design, standards and implementation and maintenance of PRASA facilities and environments.

The Working Committee has agreed that this 'merged NGS document' will be updated as and when needed through internal PRASA processes, as well as selected outsourced studies. The current station modernization projects being undertaken countrywide will, amongst others, be used to provide feedback on the application and applicability of the historic information.

The objective of this document is three fold, namely to:

- Establish guidelines for uniform station planning process
- Establish norms and standards for station design
- Explain the PRASA station acquisition principles and environment

PRASA operates by means of its four regional areas (Eastern Cape, Kwa-Zulu Natal, Western Cape and Gauteng) with 468 rail stations.

The parameters that determine the effectiveness and efficiency of these stations are derivatives off:

- Transport demand requirements (origin / destination market, intermodal facilities, transport modes, land use, etc.)
- Passenger requirements (fare, comfort, convenience, safety and security)
- Operational requirements
- External interface requirements
- Property development requirements and universal access (UA) requirements

The stations are currently being investigated for relevance, rehabilitation and / or modification / upgrading. Planning and detail design of new / extended regional rail passenger lines is also incorporated.

In order to streamline and standardise the feasibility studies (conceptual design) of a station or a group of stations (on a line) it is necessary to set norms, guidelines and standards.

This document:
1. Defines PRASA stations in terms of schematic layout, passenger cycles, modes and station functions
2. Sets out the functional and physical requirements of the five station categories
3. Prescribes relevant norms, standards and guidelines
4. Defines the station acquisition environment

This document shall be used by project managers, UA access auditors, station hardware element designers, consultants, engineers and architects involved in station development.

The application of this document shall support and satisfy local development requirements. The reason is that the information collecting, design, standards and station acquisition project environment requirements within this document:

- Promote safe, affordable and co-ordinated public transport
- Ensure accountability through involvement
- Acknowledge people with disabilities and their specific requirements
- Support and ensure integrated land-use and transport planning
- Promote security and safety
- Improve transport related facilities for rural areas
- Ensure effective and efficient long-term transport planning

Prasa has a high count of stations that are not Universal Access compliant, because access to accommodate people with special needs was never a high priority. These requirements were not fully implemented and any new work to stations, UA is to be implemented and applied

Terms of reference:

Universal access means the removal of cultural, physical, social and other barriers that prevent people with disabilities from entering, using or benefiting from the various systems of society that are available to other citizens and residents. The absence of accessibility or the denial of access is the loss of opportunities to take part in the community on an equal basis with others.

Universal Access speaks directly to the United Nations Convention on the Rights of Persons with Disabilities (2006), to which South Africa is a signatory.

- There are broadly two aspects to Universal Access design:
    - **Direct Access:** This is strongly related to Universal Design and refers to direct adaptations to products, environments, services or system designs that significantly improve their accessibility
    - **Indirect Access:** This uses technology such as wheelchairs, screen readers etc., and refers to product, environment, service or system interfaces that enable an add-on assistive technology to provide the user with full access

- Universal Accessibility looks at the realistic picture, the population consist of people with varying ages, heights, weights, language skills, abilities etc.
- Principles of Universal Accessibility results in environments, services, products, systems etc. that benefit all levels of society.
- 'Universal Access' is to provide physical accessibility to all facilities present in a building. These groups include but are not limited to the following:
    - Children
    - Senior citizens & Elderly people
    - People with permanent limitations:
    - Physical Limitations e.g. Paraplegia, Quadriplegia, Hemiplegia
    - Cognitive Limitations e.g. Autism
    - Linguistic Limitations
    - Auditory Limitations e.g. Deafness
    - Visual Limitations e.g. Blindness, Myopia
    - Psychiatric Limitations e.g. Depression, Bipolar, Schizophrenia

    - People with temporary limitations:
        - Linguistic Limitations e.g. unfamiliarity with language
        - Cognitive Limitations e.g. unfamiliarity with the system
        - Physical Limitations e.g. difficulty walking
        - Auditory Limitations e.g. environments with loud noises
        - Visual limitations e.g. darkness
        - Psychiatric Limitations e.g. extreme shock
        - Pregnant Women
        - Inebriated Persons
        - Obese People
        - Persons of Shorter Stature
        - Those requiring Pram Access
        - Those requiring luggage accesses

Universal Design' principles are oriented to make constructed environments accessible to all people, both abled and disabled.

Information regarding level of accessibility of stations should cover the following areas:

- Car parking facilities
- Intermodal facilities (taxi, bus stops)
- Step-free entrances
- Ticket offices and vending machines
- Visual and spoken information
- Ramps, lifts and escalators
- Stairs and steps
- Platforms
- Boarding aids
- Accessible Toilets
- Seating and waiting rooms
- Commercial outlets
- Security services

Notes:

- Universal Access is a compliance item
- Each station is unique, to be evaluated individually for Universal Access requirements
- Any professional architectural and design institution must comply to code – SANS 10400 – for new and or refurbishing work which includes any disabled access requirements
- All new design has to be compliant to UA standards from the conceptual planning phase.

References

- SANS 10400 codes with specific reference to SANS 10400 – D, 10400 – M and 10400 – S
- SANS 784
- Prasa Blue Print – see Spatial Parameters and detail drawings
- National Building Regulations and Building Standards Act

Definitions and Abbreviations

Abbreviation	Description
AC	Alternating Current
AFV	Average Flow Volume
AIPS	Average Inter Person Spacing
AGC	Automatic Gain Control
APAO	Average Pedestrian Area Occupancy
APIS	Advanced Passenger Information System
BLC	Backlight Compensation
CCTV	Closed Circuit Television
CTC	Centralized Train Control
DC	Direct Current
FOV	Field of View
FPA	Focal Plane Array
IR	Infra-Red
IRPTN	Integrated Rapid Public Transport Network
IPTN	Integrated Public Transport Network
ISAMS	Integrated Station Access Management System
ITS	Integrated Ticket System
LCD	Liquid Crystal Display
NLTA	National Land Transport Act
NMT	Non-motorized Transport
NSIP	National Station Improvement Program
NSUP	National Station Upgrade Program
NTSC	National Television System Committee
NVR	Network Video Recorder
OCP	Over Current Protection
OSD	On Screen Display
PAL	Phase Alternating Line
PCB	Printed Circuit Board
PLZ	Pan Tilt Zoom
PSU	Power Supply Unit
RCS	Remote Cache Server / Reaction Control Sy
RDP	Re Construction and Development Program
SARCC	South African Rail Commuter Corporation
SARPS	South African Railway Police Service
SC	Side Clearance

Tables

Part 1	**Introduction**

1.1 Background

The station and intermodal facilities form an integral part of the infrastructure supporting the rail passenger service, including the Inter-City bus service infrastructure. It accommodates the integration of all functional and physical elements necessary for transferring passengers between the station and the train.

PRASA is responsible for the planning and development of new stations, the upgrading/rehabilitation or expansion of existing stations, including the implementation of upgraded or new systems, e.g. access control. PRASA is responsible for managing the design and construction of new stations, as well as the cost-effective management and operation of these stations in the four regional areas of the Eastern Cape, Kwa-Zulu Natal, Western Cape and Gauteng.

1.2 Purpose of the NGS

The purpose of this document is three-fold:

- To ensure cost-effective conformance in terms of:

Rail passenger transport and integration requirements
Rail passenger requirements with respect to comfort, convenience and safety Operational, maintenance and security requirements in any rail passenger station

- The consequential planning and conceptual designs will support the PRASA overall station development and implementation in terms of prioritization and budgeting.
- To ensure timeous and cost-effective integration with property development projects on or around rail passenger stations.
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In order to support the purpose of this document the guidelines within, identify technical processes, prescribe applicable standards and define preference to project management principles, supporting the planning process within the PRASA environment.

1.3 Status and application of the document

This document complies with the National Building Regulations or any applicable South African standard and does not release the professional team from their professional obligations to adhere to them.

PRASA uses this document to accelerate and streamline the planning, contracting and maintenance of rail station facilities. The application of this document will accelerate and promote communication during station development projects

The document is applicable to the upgrade or modify of any element of an existing rail station, or the planning, development and commissioning of a new station.

Refer to **Table 1 - 1** on the following page for the application matrix of this document

Table 1-1: Application Matrix

Application of this Document	Purpose of Application
As a request for tender	Appoint consultants (transport planning, project managers, station system designers. specialists, etc.) for feasibility studies, conceptual design, detail design, etc.
As a Project Management reference	To accelerate consultants orientation with respect to station projects: (a) Plan – station function, station project phases (b) Organize – responsibilities within PRASA, interface between relevant parties (c) Monitor/control – design reviews
As a Quality Assurance checklist	To qualify any conceptual design/detail design against PRASA standards
As a station facility design directive	To ensure: (a) Logical steps in the design of a functional Rail Station (b) Standardization (c) Conformance to standards
As a station development, implementation, planning and prioritization resource	The outputs of all of the above shall result in: (a) Cost/Income information per station (b) A prioritization list per station (c) Information per region

1.4 Quality Assurance Standards

In the execution of all phases applicable to the station facility development, the ISO 9000 quality standards are to be utilised as guidelines to ensure management, technical and project quality.

(a) ISO 9000 - provides the fundamentals and vocabulary used in the entire ISO 9000 standards. It sets the stage for understanding the basic elements of quality management as described in the ISO standards.

(b) ISO 9001 - provides a quality management system that provides confidence in an organization's ability to provide products that fulfil customer needs and expectations.

(c) ISO 9004 - provides the benefits obtained from ISO 9001 to all parties that are interested in or affected by operations. Interested parties include employees, owners, suppliers, partners and society in general.

Part 2	Station Design Process

During the design of a specific station, the following processes has been put in place to ensure that all functions and requirements are addressed.

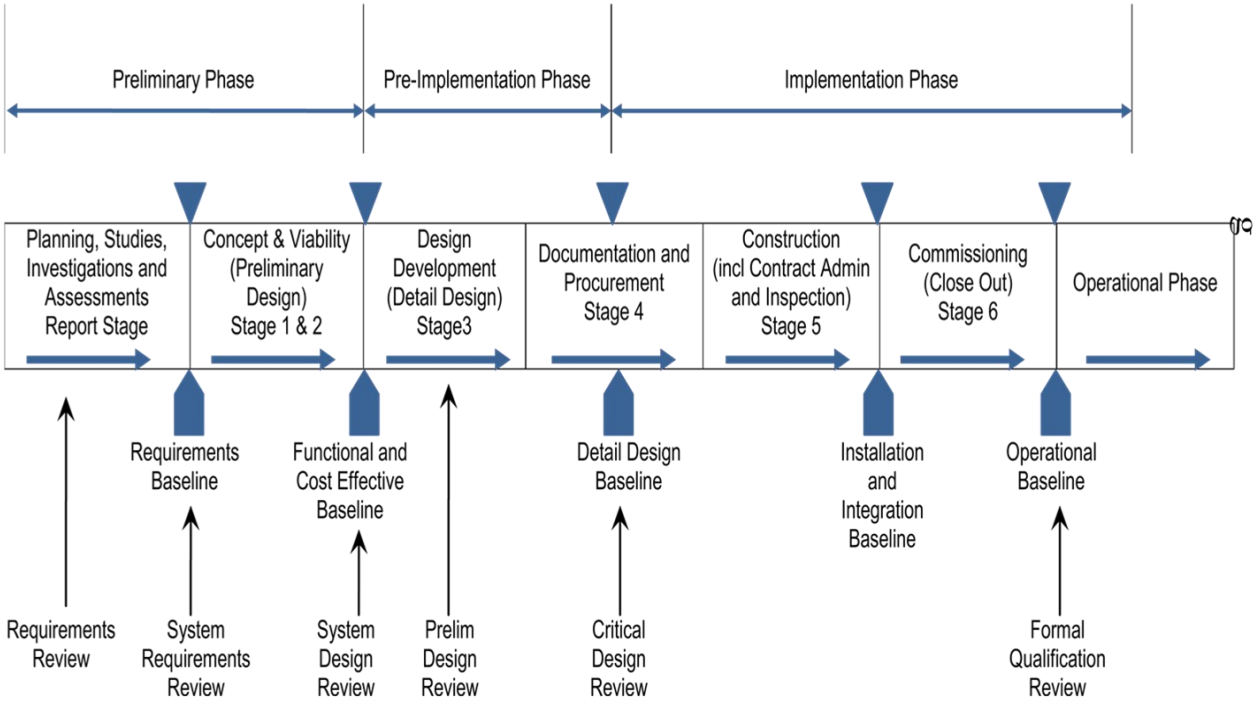
For project identification, isolation, integration planning and contracting purposes the following principles has been applied to each project. These principles support the ISO 9000–family of Quality Assurance standards.

To assist in the quality assurance process the design team is to provide a logical and chronical drawing register

2.1 Station Development Life Cycle Principle

All defined projects to be within an applicable station Development Life Cycle. Refer to the **Table 2 -1** below.

Table 2-1: Station Development Life Cycle



2.1.1 Stages

These are frames of work bordered by major milestones (baselines). Within these phases, unambiguous tasks can be isolated, grouped and logically integrated in order to support approval of completed work, and authorization of statements of work to commence with the next phase.

During concept and detail design stages Universal Access assessments will be carried out by PRASA as part of the signing off process, and payment will follow once approval has been given

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Purpose of using these stages: Standard current way of contracting in terms of Engineering Professions Act, 2000 (Act No 46 of 2000)

a) Baselines

Baselines are major contracting milestones, which describe approved information (designs, specifications)
Purpose of using these baselines: This information is under configuration management and changes are governed by formal change procedures.

b) Milestones

These are monitor and control points for decision making within or at the end of phases

It is of the utmost importance that PRASA and the designer/consultant know, in which stage a project is, as well as the associated baseline and baseline describing documentation (milestone deliverables of previous stage).

The application of all methods, processes and trade- offs used in the development and detail design will be well documented of any station in the design files according to the configuration management process contractually prescribed. This shall also be applicable to training manuals, operational manuals and maintenance manuals and documentation.

2.2 Planning, Studies, Investigations and Assessments

These services typically relate to carrying out studies, investigations and as the preparation and submission of reports including preliminary proposals and initial feasibility studies, these will be remunerated on a time and cost basis. Fees can only be charged in relation to the government-gazetted rates for specific professional services.

It includes:

- Consultation with the client or client's authorized representative
- Inspection of the site
- Preliminary investigation, route location, planning and a level of design appropriate to allow decisions on feasibility
- Consultation with authorities having rights or powers of sanction as well as consultation with the public and stakeholder groups
- Advice to the client on regulatory and statutory requirements, including environmental management, surveys, analyses, tests and site or other investigations, including approvals, where such are required for the completion of the report, and arranging for these to be carried out at the client's expense
- Searching , obtaining, investigating and collating available data and drawings relating to the projects
- Investigating financial and economic implications relating to the proposals or feasibility studies. (This does not necessarily apply to civil and structural services on Building Projects, where this service is provided by a Quantity Surveyor, except as far as the interpretation of cost figures the Engineer's scope of work is concerned.)

Deliverables will typically include:

- Collation of information
- Reports on technical, financial feasibility and related implications.
- List of consents and approvals.
- Schedule of required surveys, tests, analyses, site and other investigations.

At this stage of the station, acquisition concerns the rail transport need, (complete operator requirements, user requirements, and socio- political requirements) for a specific area, the rail corridor positioning to fulfil this need. The position of stations on the specific corridor, the train operational concept, train passenger throughput (integrate transport requirements) which is not discussed in this document and shall be given as an input to the design of a specific station.

2.3 Concept and Viability Stage, including Inspection

The inception component is defined as establishing the client requirements and preferences, assessing user needs and options, appointment of necessary consultants the project brief including project objectives, priorities, constraints, assumptions, aspirations and strategies.

The Concept and Viability Stage is defined as the preparation and finalization of the project concept in accordance with the brief, including project scope, scale, character, form and function, plus preliminary programme and viability of the project.

It includes:

- Agree on a documentation programme with principal agent and other consultants involved
- Attend design and consultants' meetings
- Establish the concept design criteria
- Prepare initial concept design and related documentation
- Advise the client regarding additional surveys, analyses, tests and investigations which may be required
- Confirm regulatory authorities' requirements and incorporate into the design
- Assess and refine the concept design to comply with all regulatory requirements and consents
- Establish access, utilities, services and connections required for the design
- Coordinate design interfaces with other consultants involved
- Prepare process designs (where required), preliminary designs, related documentation for approval by authorities and client
- Provide cost estimates and life cycle costs
- Liaise, co-operate and provide necessary information to the client, principal agent and other consultants involved

Typical deliverables will include:

- Agreed scope of work and services
- Signed agreement.
- Report on project, site and functional requirements
- Schedule of consents and approvals
- Concept and preliminary design
- Schedule of required surveys, tests, analyses, site, reports and other investigations
- Process design
- Cost estimates preliminary

2.3.1 Confirmation of Project goals and objectives

PRASA and the designer/consultant must confirm the project goals and objectives for the specific stage. This needs to be clarified and confirmed, to keep to the original goal, objectives and authorized brief

2.3.2 Obtain station design input data

The following data for each specific station is required before any station design can commence:

- Passenger/Commuter/Pedestrian volumes
  - Passenger quantities per day for the station (total passenger trips per day and count per 5 minutes, indicating the direction of passenger movement) and use of the existing facilities (take into account street-to-street pedestrian volumes as well as transfers)
  - Preferred routes (natural route passengers follow to the station) with quantities
  - Expected passenger growth for the next twenty years (Guided by PRASA Rail Customer Services)
- Passenger/Commuter/Pedestrian profile
  - Economic profile
  - UA design requirements
  - Luggage profile
  - Language profile

- Intermodal transport (buses, minibus-taxis, private vehicles, on -demand services, and Non-motorized transport)
    - Intermodal transport quantities per day the specific station (total intermodal transport trips per day and count per 5 minutes)
    - Distance between the different modes of transport to be as close and cost-effective as possible including UA requirements
    - Drop off facilities for public transport must be within 25 meters of the front entrance of the station.
    - Preferred routes (natural route passengers follow to the station) with quantities
    - Expected growth for the next twenty years (Guided by PRASA Rail Customer Services)

- Surroundings to station
    - Physical station surroundings layout (streets, residential/industrial, parks, etc.)
    - Community requirements at stations (shops, education or health facilities, housing, entertainment, work opportunities etc. in close vicinity)
    - Development potential of land surrounding the station and station precinct

- Climate (design influences)
    - Ambient temperature
    - Wind
    - Rain
    - Humidity
    - Air quality
    - Lightning activity

- Current station
    - Current station layout
    - Vertical and horizontal gap between the train and each platform
    - Current station condition

- Train (operational influences)
    - Current and future train capacity
    - Current and future service design
    - Current and future train frequency

- Ticket issues
    - Obtain current ticket issue data
    - Obtain future expected trends in ticket issues

- Integrated Network Development
    - Obtain possible future stations and lines from PRASA planning
    - Integration with other public transport services, including municipal services

2.3.3 Station types and categories

Refer to ANNEXURE C: Existing Station Classification by Region

The type of stations is determined by passenger/commuter needs:

- Trip generation / home stations – stations mainly in suburbs where passengers live
- City/industry stations – stations mainly in industrial areas or in the city with the passengers' working places nearby
- Transfer/junction stations – where passengers change between platforms for connecting services
- Intermodal stations – stations at which passengers /commuter transfer from one transport mode to another, e.g. minibus-taxi to train, to reach their destination

- Destination station – stations which attract passengers not just for the purpose of travel between home and the work place. This can be due to economic activities such as shops, hotels, sport stadiums, entertainment activities and/or tourism attractions
    - The PRASA stations classification are the following:
- Supercore: More than 40 000 commuters
- Core: 25 000 – 40 000
- Intermediate: 10 000 – 25 000
- Small: 2000 – 10 000
- Halt: Less than 2000 commuters

Stations ratings are based on the following criteria:

- Revenue
- Tickets issued
- Patronage
- Inter-modal Interchange
- Major Social Events around the Station (sports/music/tourist attraction, etc.)
- Institutions around stations, (schools, hospitals etc.)
- Business Express

2.3.4 High level conceptual design

- Utilize the existing station layout as a starting point and indicate by drawing all the functional areas required
- Any new station design to be informed by similar existing station layouts

2.3.5 Passenger and intermodal flow diagram

- The data obtained in the station design input, paragraph 2.3.2 is to be converted into flow volumes (passenger and intermodal transport) per functional area and presented in graphic format.
- Access and egress flow through all areas must be determined and areas where this may influence on space availability must be emphasized.
- Refer to Part 4 and Part 5 for detailed functional and physical requirements for each functional concept.

2.3.6 Develop the optimum station concept

The design shall accommodate all the functional and physical requirements for all passengers, e.g. safety, affordable transport, comfort and convenience. PRASA needs to provide a cost-effective/profitable station. Refer to Chapter 4 and Chapter 5 of this document for detailed requirements to be applied.

2.3.7 Trade off tools for optimization of station concept

The following factors/issues have an influence on the effectiveness of a station and need consideration during the optimization of the station concept:

- Station operational methodology and station procedures, including emergency egress
- Passenger management and flow, riot management and overcrowding
- The location and activities of the SA Railway Police Services
- Security deployment and equipment
- Maintenance philosophy
- Capital cost and Life Cycle costing

Station economic trade off tools:

- Hardware and operating personnel breakdown structure to ensure that all elements were addressed during each design
- Life Cycle Cost model using the hardware and operating personnel breakdown structure as its cost elements;
- In the Life Cycle Cost analysis, the following type of data to be analysed:
    - Professional teams' cost during the detail design and construction phase
    - Capital cost, this is the cost to construct the station or elements thereof, these costs must be subdivided into contractor furnished items and PRASA furnished items with PRASA furnished items including turnstiles, ticket verification devices, turnstile control computer and ticket issuing machines.
    - Operating cost, this cost is normally associated with the operating of the different scenarios, like different operating personnel requirements or services
    - Maintenance cost, the expected cost to maintain facilities per year Contingencies allowances percentage of the final capital cost, e.g. 5%
    - 15% VAT allowance.

- Life Cycle Income model using the amount of passengers per station, fare evasion figures per station and the corridor's mean trip cost as its basis;
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    - During the Life Cycle Income analysis income is calculated from the quantity of passengers that use the station, the fare evasion of that specific station and the mean trip cost per corridor.
    - From this the current income, new income and income gain can be calculated, which is mainly achieved by reducing the fare evasion by for instance the introduction of new automatic turnstiles.
    - The capital cost and operating and maintenance cost required during the station Life Cycle is added.
    - All the above figures are adjusted with a percentage cost of capital as well as a percentage inflation rate where applicable.
    - These adjusted costs and incomes are then used to determine the Current Profit (without reducing the fare evasion), New Profit (after the fare evasion were reduced) and the Profit Gain which can now be used to pay for the additional capital operating and maintenance cost per station.
    - With the life cycle cost and cost benefit economic tools the station concepts can be optimized.

- Benefit analysis for each station, comparing the Life Cycle Income (additional to current income) versus the Life Cycle Cost by means of Internal Rate of Return (IRR) or Net Present Value (NPV) to develop an implementation strategy.

2.3.8 Design review

The professional team must present PRASA with the documented concept design and design report for approval. The PRASA station design agents/approval body will approve the concept design by carrying out an access appraisal. The designer will be required to make changes to incorporate

The design review shall take the format of a presentation, during which the professional team under leadership of the project manager, shall present the design to the station design agents/approval body. The presentation shall also highlight the differences of the proposed concept design with the approved system requirement (output of planning stage) with the reasons behind the change.

This review shall not take away the responsibility of the professional team but shall only ensure that PRASA approved the overall station concept and functionality and that the professional team has conformed to the system requirements as well as the laid down norms, guides and standards (this document)

2.3.9 Approval of station concept by PRASA

The appointed PRASA station design agents/approval body will approve the final concept design after scrutinizing the design report and drawings. The professional team will be informed if additional work is required and or incorporate recommendations for approval

2.4 Design Development (Detail Design) Stage

This component is defined as the development of the approved concept to finalise the design, specifications, costing, financial viability and programme for the project.

It includes:

- Review documentation programme with principal consultant and other consultants involved
- Attend design and consultants' meetings
- Incorporate the client's and authorities' detailed requirements into the design
- Incorporate other consultant's designs and requirements into the design
- Prepare design drawings, technical details and specifications
- Review and evaluate design and outline specification and exercise cost control
- Prepare detailed estimates of construction cost
- Liaise, co-operate and provide necessary information to the principal consultant and other consultants involved
- Submit the necessary design documentation to local and other authorities for approval

Typical deliverables will include:

- Design drawings and specifications
- Local and other authority submission drawings and reports
- Detailed cost estimates of construction
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This stage of the station acquisition process includes the following:

2.4.1 Master plan

Develop a building and facility master plan for the proposed station

2.4.2 Architectural design

Develop sketch plans and detail design to conform to the station design specification, norms, guides and standards. Transfer data to other members of the

2.4.3 Civil design

Detail design of all earthwork, foundations, drainage, sewerage, and so forth to conform to the Station concept design specification, norms, guides and standards and applicable civil engineering standards. Transfer data to other members of the professional team for their specific tasks

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2.4.4 Structural design

Detailed design of all structural elements to conform to the station concept design specifications, norms, guides and standards and applicable structural engineering standards. Transfer data to other members of the professional team for their specific tasks.

2.4.5 Mechanical design

Detail design of all ventilation/ air-conditioning, fire protection and water pipe network elements to conform to the station concept design specification, norms, guides and standards and applicable mechanical engineering standards. Transfer data to other members of the professional team for their specific tasks.

2.4.6 Electrical design

Detail design of all electricity distribution, control system, telephone network, telephone exchange, intercom network, lighting system, CCTV system, PA system, fire general alarm, PC cabling and other electrical elements to conform to the station concept design specification, norms, guides and standards and applicable electrical engineering standard. Transfer data to other members of the professional team for their specific tasks.

2.4.7 Visual information system design

Detail design of all visual information system, including wayfinding signage, fixed signage, train schedule information, advertising boards, etc. to conform to the PRASA Blue Print: Signage application Version 9, Annexure 1 Transfer data to other members of the professional team for their specific tasks.
All potential dangerous positions/situations shall be brought to the attention of the:

- Operational staff
- Passengers
- Intermodal traffic
- Any other persons with applicable and adequate warning signs.

2.4.8 Quantity surveying/costing

Determining the final material quantities required for constructing, calculating the final life cycle cost and initial cost of the facility.

2.4.9 Review detail designs

Present PRASA with the documented detail design and report for approval. The design review shall take the format of a presentation, during which the professional team under leadership of the project manager, shall present the new detailed design to the PRASA station design agents/approval body. The presentation shall highlight the differences of the detail design with the approved conceptual design (output of conceptual design stage) with the reasons. This review will not take away the responsibility of the professional team but shall only ensure that PRASA approved the overall station layout and functionality and that the professional team has conformed to the concept design as well as the laid down norms, guides and standards.

2.4.10 Approve detail design

The PRASA station design agents/approval body will approve the detailed design by carrying out an access appraisal. The designer will be required to make changes to incorporate recommendations from this appraisal. The design of any component and part of the station shall reflect a reliability centred approach, i.e.:

- Improved life time cycle design
- Universal Access design
- Predictive maintenance
- Cost-effectiveness

The primary objective of reliability of any station commissioned is to ensure that PRASA shall be capable of successfully performing a reliable and available assigned passenger business during the full life cycle. By improving reliability, the need for repair is reduced. This will also improve preventative maintenance frequencies resulting time saving and costs. Any reliability circumstances shall be met in the environmental conditions as specified in this document and applicable to the specific region.

Reliability critical items shall be identified and treated in terms of:

- Maintenance tasks planning
- Supply planning
- Training maintenance personnel

2.5 Documentation and Development Areas

This part is the preparation of procurement and construction documentation, confirmation and implementation of the procurement strategies and procedures for effective and timeous procurement of the required resources for execution of the project.

It includes:

- Attend design and consultants' meetings
- Prepare specifications and preambles for the work
- Accommodate services design
- Formulate the procurement strategy for contractors or assist the principal consultant where relevant
- Prepare documentation for contractor procurement
- Review designs, drawings and schedules for compliance to remain within the approved budget
- Assist in calling for tenders and/or negotiation of prices and/or assist the principal consultant where relevant
- Liaise, co-operate and provide necessary information to the principal consultant and the other consultants as required
- Assist in the evaluation of tenders
- Assist with the preparation of contract documentation for signature
- Assess samples and products for compliance and design intent

Typical deliverables will include:

- Specifications
- Services co-ordination
- Working drawings
- Budget construction cost
- Tender documentation
- Tender evaluation report
- Tender recommendations
- Priced contract documentation

With the approval of the detail design, the professional team shall proceed to prepare the final tender documentation.

The detail design is to be converted into working drawings as required for the tender process. Also the preparation of other tender documentation as required by the tenderer, as well as the transfer and handover of data and relevant information to other members of the professional team for their specific tasks.

The tender process is not discussed in this document and is managed by SCM.

2.6 Construction, including Contract Administration and Inspection, Stage

This component is defined for the project team as the management, administering and monitoring of the construction contracts and processes including
preparation and coordination of procedures and documentation to facilitate the practical completion of the project.

- Attend site handover.
- Issue construction documentation in accordance with the documentation schedule including the case of structural engineering, reinforcing bending schedules and detailing and specifications of structural steel sections and connections.
- Carry out contract administration procedures in terms of the contract.
- Prepare schedules of predicted cash flow.
- Prepare pro-active estimates of proposed variations for client decision making.
- Attend regular site, technical and progress meetings.
- Inspect works for conformity to contract documentation.

- Adjudicate and resolve financial claims by contractor(s).
- Assist in the resolution of contractual claims by the contractor.
- Establish and maintain a financial control system.
- Clarify details and descriptions during construction as required.
- Prepare valuations for payment certificates to be issued by the principal agent.
- Witness and review of all tests and mock ups carried out both on and off site.
- Check and approve contractor drawings for design intent.
- Update and issue drawings register.
- Issue contract instructions as and when required.
- Review and comment on operation and maintenance manuals, guarantee certificates and warranties.
- Inspect the works and issue practical completion and defects lists.
- Arranging for the delivery of all test certificates, including the Electrical Certificate of Compliance statutory and other approvals, as built drawings and operating manuals.
- Typical deliverables will include:
- Schedules of predicted cash flow.
- Construction documentation
- Drawing register
- Estimates for proposed variations
- Contract instructions
- Financial control reports
- Valuations for payment certificates
- Progressive and draft final account(s)
- Practical completion and defects list
- Electrical Certificate of Compliance
-

Where a quantity surveyor is included in the project team in building works, not all the above items and related deliverables will be required from the engineer

2.7 Commissioning Stage

This part is defined as the fulfilment and completion of the project closeout including necessary documentation to facilitate effective completion, handover and operation of the project.

It includes:

- Inspect and verify the rectification of defects
- Receive, comment and approve relevant payment valuations and completion certificates
- Prepare and/or procure as-built drawings and documentation
- Conclude the final accounts where relevant

Typical deliverables will include:

- Valuations for payment certificates
- Works and final completion lists
- Operations and maintenance manuals, guarantees and warranties
- As-built drawings and documentation
- Final accounts

The logistic support system for stations shall be developed on an integrated basis within the rail service operator and the property agent environment. It shall be ready for implementation at the time of commissioning of any:

- Upgrading
- Modification
- New station
- Or element thereof, and shall include:
    - Maintenance tasks for each element
    - Personnel necessary

- Supply support
- Support equipment/accessories
- Documentation/manuals
- Training
- Facilities

The station designer / architect must therefore contact the regional rail service operator and property agent to obtain the region's logistic support policies, standards and guidelines, to ensure that the new / modified / upgraded station conforms to these requirements and the regions' support systems.

2.8 Operational Stage

The station designer / architect must therefore contact the regional rail service operator and property agent to obtain the region's logistic support policies, standards and guidelines, to ensure that the new / modified / upgraded station conforms to these requirements and the regions' support systems.

2.9 Review Process

The project management, market research, socio- involvement and technical design processes applicable to projects involves various disciplines from various institutions. Orderly decision making and authenticating in this project environment during acquisition can only be done by means of formal and structured information sessions

.

In the acquisition process of stations these information sessions can be done effectively and efficiently by means of planned reviews and technical audits at specific milestones.

These milestones are defined as baselines at the end of each well defined stage within the acquisition process. Elements of work during each stage culminate in an integrated product to be reviewed and authenticated by PRASA before the next stage could be commenced.

Refer to **Table 2-1**: Station Development Life Cycle, for specific reviews and their orientation with respect to the station development life cycle. For a definition of each design review refer to Table below. The contents and procedures of typical reviews and technical audits to be performed in the acquisition of a station are shown in **Table 2-3** to **Table 2-9**.

Table 2-2: Design Review Definitions

Review	Definition	Contents
Rail Commuter Service Requirements Review	Event to evaluate work done during the initial part of the planning stage and to authenticate the user requirement	Table 2-4
Station System Requirements Review	Event to evaluate work done during the initial part of the planning stage and to authenticate the user requirement	Table 2-5
Station System Design Review	Event to evaluate work done during the detail feasibility stage and to authenticate the functional and cost effective baseline, including the access appraisal	Table 2-6
Preliminary Design Review	Event to evaluate work done during the detail design stage and to authenticate the detail design process	Table 2-7
Critical Design Review	Event to evaluate work done during the detail design stage and to authenticate the detail design baseline	Table 2-8
Formal Qualification Review	Event to evaluate and accept all integrated hardware elements during the commissioning stage and to authenticate the operational baseline	Table 2-9

Table 2-3: Structured approval process

Item	Responsibility	Organization	Requirement	Comment / Action	Approved	Date
1	Project Management	Rail Service operator / implementing agent	Technical quality			
			Cost			
			Schedule			
2	Capex Reservation	Prasa	Project Authorization			
			Cost Allocation Schedule			
3	Planning	Prasa	Location wrt master plan			
			Property ownership			
			Integration with mainline modes			
4	Planning	Prasa	Integration with passenger modes			
			Integration with TPT planning			
			Universal Access appraisal			
5	Planning	Municipality /Local government / Telecommunication	Integration with: Telephones Power supply Sewerage Storm water Fresh water Approach to station (Pedestrian walkways, access roads, signage)			
6	Marketing	Prasa	Location wrt identified			
7	Operational	Region	Integration with infrastructure: Track Bridges / structures Integration with overhead Integration with rolling stock Integration with ISAMS Integration with ticket facilities Integration with information equipment Integration with communication Station operation wrt staff and procedures			
	Logistics	Region / Property Agent	Logistical support wrt: Maintenance tasks Maintenance schedules Stores Equipment facilities Maintenance manuals			
8	Security	PRASA	Board security requirements			
		Region	Specific security requirements			
9	Configuration management	PRASA / Region	Configuration requirements wrt: Design data Documentation / drawing			

Table 2-4: Rail Passenger Service Requirement Review

Design Review	Rail Passenger Service Requirement Review
Purpose	**The purpose of this review is to determine the project and progress / completeness of:** • Determination potential rail passenger market • Establishment of PRASA requirements • Establishment of other transport planning requirements and integration • Establishment of intermodal integration • Establishment of the integration with settlement development and the IRPTN/IPTN • Establishment of RDP implementation program • Preliminary Establishment of the route and alignment • Preliminary Establishment of the property agent requirements and possible interfaces with this
Items to be reviewed	**Representative items to be reviewed shall include the results of the following:** • Strategic and historic reports, studies on the proposed rail passenger service (rail corridor reports) • Market research results, quantifying the potential rail passengers and the quality of service preferred • Local council requirements • Regional government requirements • PRASA requirements • Central government requirements
	The following PRASA requirements shall be established: • PRASA strategic requirements, representing those requirements of strategic nature for the project to ensure the prosperous survival of Prasa • PRASA market requirements, dealing with specific requirements regarding the target market, passenger volumes, passenger travel patterns, geographic areas, etc. which must be accommodated within the project • PRASA requirements for passenger services, which is the PRASA interpretation of what the passenger requires of the service, and what must be addressed in the project • PRASA operating requirements, dealing with specific train operating and other operational issues, which must be considered within the project • PRASA logistics support requirements, which include requirements pertaining to a reliability centred maintenance approach and other maintenance and supply issues • PRASA security requirements, giving special attention to security, resulting from the high profile that security has in the current political and social climate • PRASA financial and acquisition requirements within which the project must be carried out • PRASA regional network requirements • RDP and PIP planning documents and implementation reports • Applicable management plans (configuration control, quality assurance, etc.)
Review Form	PRASA
	Rail service operator / PRASA Region
	Property agent
	Consultants

Table 2-5: Station System Requirement Review

Design Review	Station System Requirement Review
Purpose	**The purpose of this review is to determine the project's direction and completeness of:** • Translating market research analysis into an origin destination matrix • Determining 5 min rail passenger travel patterns • Establishing medium and long term trends in demand • Development of train schedules • Development of the operational concept • Route and alignment establishment • Determination of station positioning • Functional design of all station elements • Intermodal integration requirements • Preliminary development of the maintenance and support concept • RDP and PIP implementation • Land and property expropriation • Trade-offs • Life cycle cost studies
Items to be reviewed	**Representative items to be reviewed shall include the results of the following:** **Origin destination analysis:** • Train schedules • Route and alignment drawings • Operational concept (including logistic support analysis) • Functional analysis • Universal access and egress • Synthesis of all of the above in a rail passenger service • **Requirements allocation to:** • Stations • Access control • Ticket verification and authorization • Security • Maintenance • Supply support • Training • Information • Intermodal facilities • Access routes • **Life cycle cost studies:** • System cost effectiveness studies • Interface allocation • Generation of specifications for pre-implementation stage contracting • Project risk analysis • Safety studies • Human factor analysis • Environmental studies • Geo-technical studies • Hydrological studies • Configuration management plans
Review Form	To be determined

Table 2-6: Station System Design review

Design Review	Station System Design Review
Purpose	**This review shall be conducted as the final review prior to detail design and the purpose is to:** Ensure that the complete regional rail passenger service specification is adequate and cost effective in satisfying validated requirements Ensure that the allocated requirements represent a complete and optimal synthesis of the system requirements **Ensure that the technical program risks are identified, ranked, avoided and reduced through:** • Adequate trade-offs feasibility to satisfy the anticipated market quantities (origin destination) of corresponding performance requirements • RCS hardware element adequacy • Implementation of comprehensive engineering disciplines (e.g. worst case analysis, failure mode and effects analysis, maintainability analysis, predictability analysis and standardization) Identify how the final combination of operations, construction, maintenance and support requirements have affected overall program concepts, quantities and types of equipment, unit cost, personnel and facilities Ensure that a technical understanding of requirements has been reached and technical
Items to be reviewed	**This review shall include a review of the following items (preferably condensed into a hardware development specification for each contractible element):** **Technical design process** • Requirements analysis of the RCS system • Functional analysis • Requirements allocation to all hardware elements • System / cost effectiveness • Synthesis of the above into the specific RCS system • Reliability and maintainability • Electromagnetic compatibility • Logistic support analysis (to address, as appropriate, integrated logistic support including logistics support concept, maintenance, supply, software support facilities, etc.) • System safety (emphasis shall be placed on system hazard analysis) • Security requirements • Human factor requirements • Standardization • Growth capability • Program risk analysis • Life cycle cost / design to cost goals • Quality assurance program • Induced and external environmental conditions (temperature, humidity, noise, etc.) • Training and training support • Milestone schedules **Results of significant trade e.g.:** • Sensitivity of selected RCS requirements vs realistic performance parameters and cost estimates • Operations design vs maintenance design • System centralization vs decentralization (CTC) • Automated vs manual operation (CTC) • Reliability and maintainability • Commercial available items vs new developments • Size and quantity of rolling stock (train sets, signalling, access control, stations, ticket verification, etc.) • Performance / logistic trade studies • Functional allocation between hardware, software, firmware and personnel / procedures

	• Life cycle cost / system performance trade studies to included sensitivity of performance parameters to cost • Sensitivity of performance parameters vs cost • Cost vs performance • Make vs buy - Updated design requirements for operations / maintenance functions and items - Updated requirements for construction methods and processes - Allocate requirements from geo-technical, hydrological and environmental studies
Review Form	To be determined

Table 2-7: Preliminary Design Review

Design Preview	**Preliminary Design Review**
Purpose	To review the basic design approach for a hardware element.
Items to be reviewed	**Hardware elements:** • Preliminary design synthesis of the hardware development specification for the item being reviewed • Trade-studies and design studies results • Functional flow requirements, allocation data, and schematic diagrams • Equipment layout drawing and preliminary drawings including any proprietary of restricted design / process / components / and information • Environment control design aspects • Electromagnetic compatibility of the preliminary design • Allocation and design for hydrological, geo-technical and environmental requirements • Power distribution and grounding design aspects • Safety engineering considerations • Security engineering considerations • Survivability / vulnerability considerations • Preliminary lists of materials, parts and processes • Pertinent reliability / maintainability data • Interface requirements contained in configuration item development • Configuration item development schedule • Value engineering considerations • Human engineering considerations • Standardization considerations • Description and characteristic of commercially available equipment, including any optional capabilities such as special features, interface units, special instructions, controls, formats, etc. (include limitations of commercially available equipment such as failure to meet human engineering, safety and maintainability requirements of the specification and identified deficiencies) • Existing documentation (technical, commercial manuals, etc.) for commercially available equipment and copies of contractor specifications used to procure equipment shall be made available for review by PRASA - Life cycle cost analysis • Corrosion prevention / control considerations • Status of quality assurance program **Evaluation of Civil, Electrical and Mechanical Designs - The documentation related to the above shall:** • Determine that the preliminary detail provides the capability of satisfying the performance characteristics paragraph of the hardware element development specifications • Establish compatibility of the hardware element operating characteristics in each mode with overall system design requirements if the hardware element • is involved in multi-mode functions • Establish the existence and nature of physical and functional interfaces • between the hardware element and other items of equipment, computer software and facilities **Electromagnetic compatibility** • Review hardware element design for compliance with electromagnetic compatibility / electromagnetic interference requirements

Design reliability

- Identify the quantitative reliability requirements specified in the hardware development specifications
- Review failure rate, departing policies and prediction methods
- Describe planned actions when predictions are less than specified requirements
- Identify and review parts and components which have a critical life requirement special considerations and general plan handling. Agencies so affected shall present planned actions to deal with these components or parts
- Review critical signal paths to determine that a fail-safe / fail-soft design has been provided
- Revise margins of safety for hardware elements between functional requirements and design provisions for elements such as: power supplies, transmitter modules, motor and hydraulic pumps. Similarly, review structural elements random to determine that adequate margins of safety shall be provided between operational stresses and design strengths.
- Review reliability design guidelines for hardware elements to insure that design reliability concepts shall be available and used by equipment designers. Reliability design guidelines shall include as a minimum part application guidelines (electrical derating, thermal derating, part parameter tolerance), part selection prior of preference, prohibited parts / materials, reliability appointments / predictions and management procedures to ensure compliance with the guidelines.

Design maintainability

- Identify the quantitative maintainability requirements specified in the
- hardware development and specification: if applicable, compare preliminary
- predictions with specified requirements
- Review hardware element preventative maintenance schedules in terms of
- frequencies, durations and compatibility with system schedules
- Review planned actions when predictions indicate that specified
- requirements will not be attained

Human factor

- Review design data, design descriptions and drawings on system
- operations, equipment and facilities to ensure that human performance
- requirements of the hardware development requirement specifications are
- met. These must be presented in sufficient detail to allow PRASA personnel
- to judge accuracy from a human usability standpoint and design personnel
- to know what is required.
- Make recommendation to update the hardware element requirement
- specification and interface requirement specifications, in case where
- requirements for human performance need to be more detailed
- Review man / machine functions to ensure that man's capability are utilised
- and that his limitations are not exceeded

Maintenance and maintenance data

- Describe system maintenance concept for impact on design and SE. Review adequacy of maintenance plans. Coverage shall be provided for on equipment (organizational), off equipment – on site (intermediate), off equipment – off site (depot) level maintenance of PRASA furnished equipment and contractor furnished equipment
- Review transportability analysis to determine the transportation conditions have been evaluated and that these conditions are reflected I the design of protective shipping and handling devices. In addition to size and weight characteristics, determine that analysis includes provisions for temperature and humidity controls, minimization of sensitivity, susceptibility to shock and transmit damage characteristics, determine that analysis includes provisions for temperature and humidity controls, minimization of sensitivity, susceptibility to shock and transmit damage

System safety

- Review results of hardware elements safety analysis and quantitative hazard analysis (if applicable)
- Review results of system safety interfaces and trade-off studies affecting the hardware element
- Review safety requirements levied on sub-contractors
- Review known special areas of safety, peculiar to the nature of the system (eg fuel handling, fire protection, high levels of radiated energy, high voltage protection, safety interlocks, etc)
- Generally review adequacy and completeness of hardware elements from design safety viewpoint
- Review compliance of commercially available configuration items of configuration item components with system safety requirements and identify modifications to such equipment, if required

Standardization

- Review current and planned actions to determine that equipment or components for which standards or specifications exists shall be used whenever practical (standard item with PRASA standards must have first preference)
- Review specific trade-offs or modification that may be required or existing designs or existing items are, or will be incorporated in the hardware element
- Existing designs will be reviewed for used or non-use based on the potential impact on the overall program in the following areas:
  - Performance
  - Cost
  - Time
  - Weight
  - Size
  - Reliability
  - Maintainability
  - Supportability
  - Construction and predictability
- Review hardware element design to identify areas where a practical design change would materially increase the number of standard items that could be incorporated
- Ensure the critical item specifications shall be prepared for hardware items identified as engineering or logistics critical
- Identify potential changes that will permit a greater use or standard or preferred parts and evaluate the trade-offs
- Review status of all non-standard parts identified

Maintenance and maintenance data

- Describe system maintenance concept for impact on design and SE. Review adequacy of maintenance plans. Coverage shall be provided for on equipment (organisational), off equipment – on site (intermediate), off
- equipment – off site (depot) level maintenance of PRASA furnished equipment and contractor furnished equipment
- Determine degree of understanding of the background, purpose, requirements and usage of maintenance (failure) data
- Describe method of providing

Technical manuals

- Review status of the “technical manual publications plan” to ensure that all aspects of the plan have been considered to the extent that all concerned agencies are apprised of the technical manual coverage to be obtained under this rail passenger service procurement. The suitability of available commercial manuals and / or modifications thereto shall also be determined

	Spares and PRASA furnished property • Review logistics and provisioning planning to ensure full understanding of scope of requirements in these areas and that a reasonable time-phased plan has been developed for accomplishment **Transportability** • Review hardware element to determine if design meets contracts requirements governing size and weight to permit economical handling, loading, security, transporting and disassembly for shipment within existing capabilities of PRASA and commercial carriers. Identify potential outsized and overweight items. Identify system / items defined as being hazardous. • Ensure packaging afforded hazardous items complies with hazardous material regulations. • Identify hardware elements requiring special temperature and humidity control or those possessing sensitive and shock susceptibility characteristics. • Determine special transportation requirements and availability for use with these hardware • elements • Review transportability analysis to determine the transportation conditions have been evaluated and that these conditions are reflected I the design of protective shipping and handling devices. In addition to size and weight • characteristics, determine that analysis includes provisions for temperature and humidity controls, minimisation of sensitivity, susceptibility to shock and transmit damage **Rail station system allocation document** • Review the draft system allocation document for completeness and technical adequacy to extend completeness • The format shall provide the following minimum information: • Drawing number Issue • Number of sheets • Location • Configuration item number • Title • Part number • Serial number • Specification number • Equipment nomenclature • Configuration • item quantity • Assembly drawing **Design construction** • The contractor shall provide evidence of performing productivity analysis on development hardware trading off design requirements against manufacturing risk, cost, production, volumes and existing • Evidence of such analysis may be in the contractor's own format but must conclusively demonstrate that in-depth analysis were performed by qualified organization / individuals and the results of those analysis • Preliminary construction / manufacturing engineering and production planning demonstration shall
Review Form	To be determined

Table 2-8: Critical Design Review

Design Review	Critical Design Review
Purpose	The purpose of this review is to ensure that the detail solution and engineering drawings of each hardware element satisfy
Review Form	To be determined

Table 2-9: Formal Qualification Review

Design Review	
Purpose	Formal acceptance of the Regional Rail passenger service will be covered under multiple final reviews for each commissioned hardware element
Review Form	To be determined

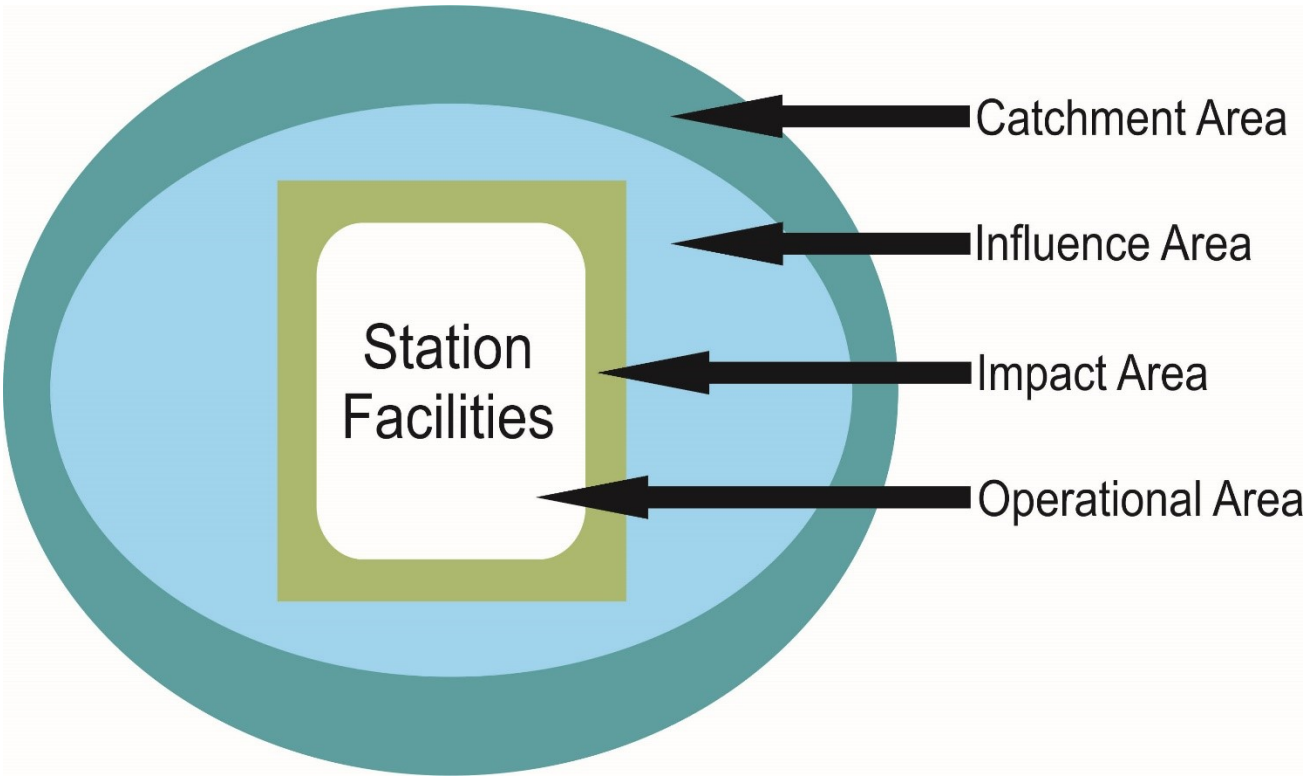
Part 3	Station Operation Characteristics

All requirements in this document are applicable to stations as defined by this chapter.

3.1 Transport, Planning and Development Characteristics

In order to develop a market orientated cost-effective functional station precinct, the practical characteristics of four distinct transport planning and development areas must be considered, see **Table 3-1** below.

Table 3-1: Transport Planning and Development Areas



3.1.1 Catchment Area (Planning)

This is the area within the demand for a rail passenger service justifies a station (new or upgraded) and within which the potential rail passengers using this station reside. This area is defined by means of market surveys and integrated transport planning in terms of:

- Modes of transport
- Origin/destination information
- Geographic information
- Demographic information
- Socio-economic information

3.1.2 Influence Area (Planning)

This area (within the catchment area) facilitates all social and economic feeder transport services and activities influenced by the rail station and includes:

- Feeder routes
- Modal interchanges
- Ticket selling points

3.1.3 Impact Area (Planning)

This area accommodates all social and economic activities directly influenced by the rail station and includes the area where development of PRASA owned property adjacent to the station occurs. Pedestrian bridges/subways allowing for traditional routes blocked due to rail activities (street-to-street access), are also included.

3.1.4 Station Area (Operational)

This area accommodates all rail passenger related activities and the relevant facilities at an origin station from where rail passengers enter through access control with a ticket, boards a train and leaves. The reverse process applies at the destination station.

This area includes the area surrounding the station. This area provides for feeder transport facilities, commercial activities and intermodal facilities. Ownership of the surrounding area could be public or private.

The influence of the catchment, influence and impact areas on a specific station are restricted to the distribution of passenger activities (rail, feeder transport and intermodal) and the interface with socio-economic development. The variables that influence passenger experience at a station are illustrated below in **Table 3-2**

The quantification of these activities into design requirements need to be concluded and authorized by PRASA before the detailed functional requirements for a specific station can be quantified.

Table 3-2: Variables that influence Passenger experience at Stations

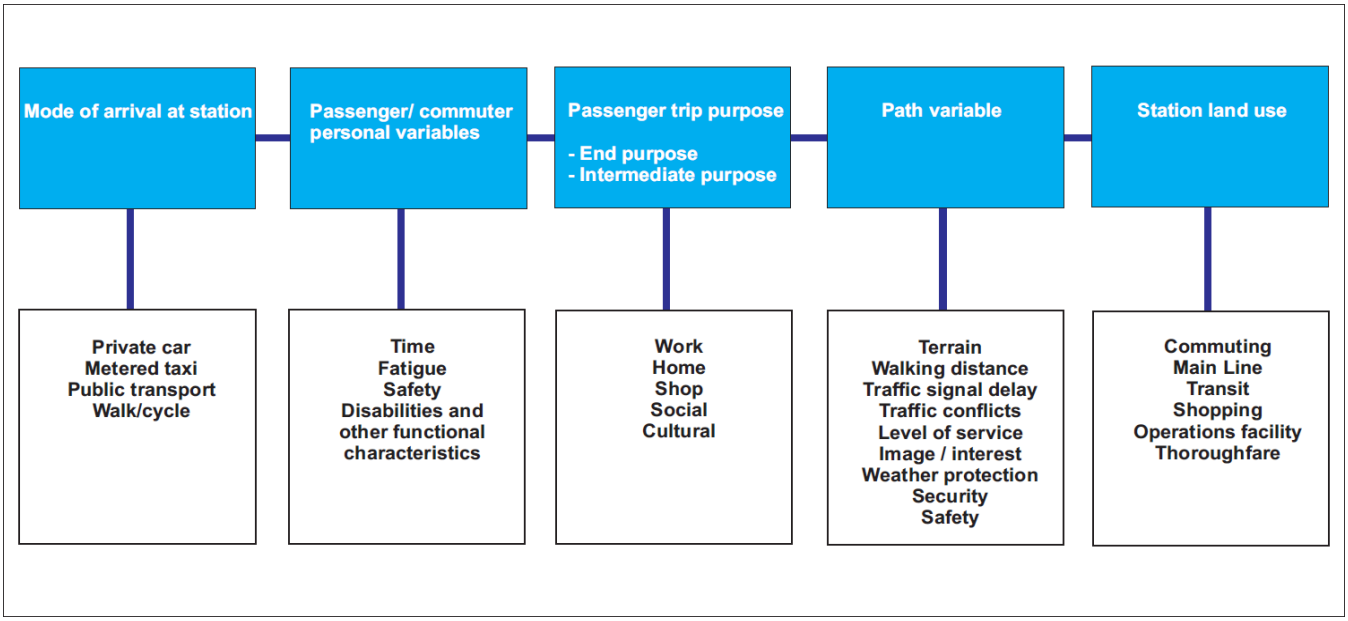
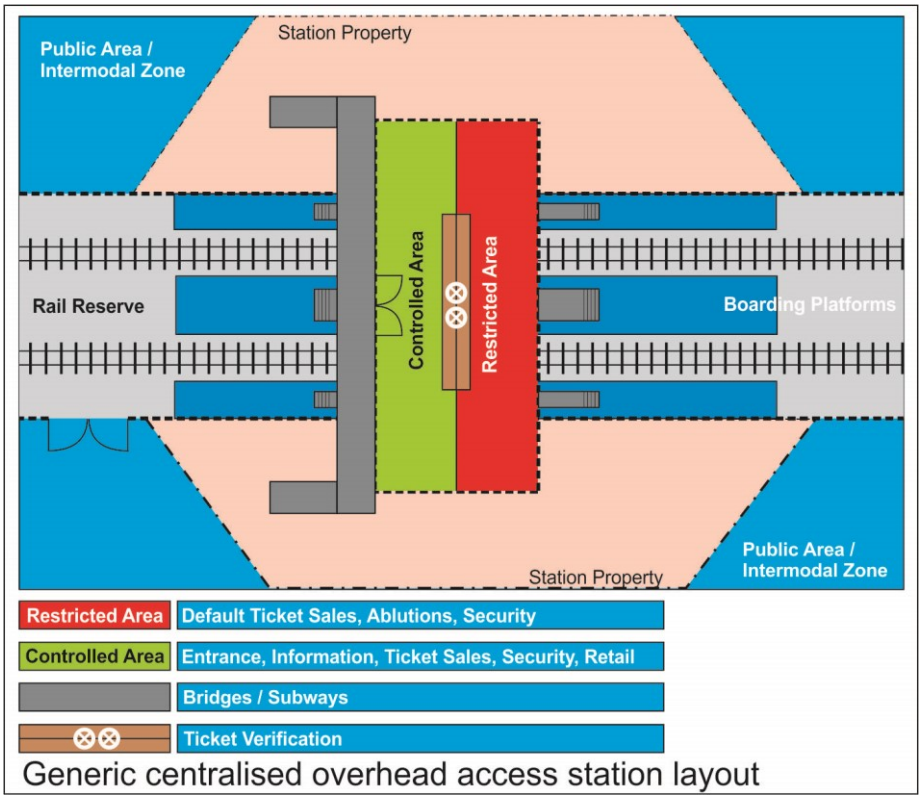
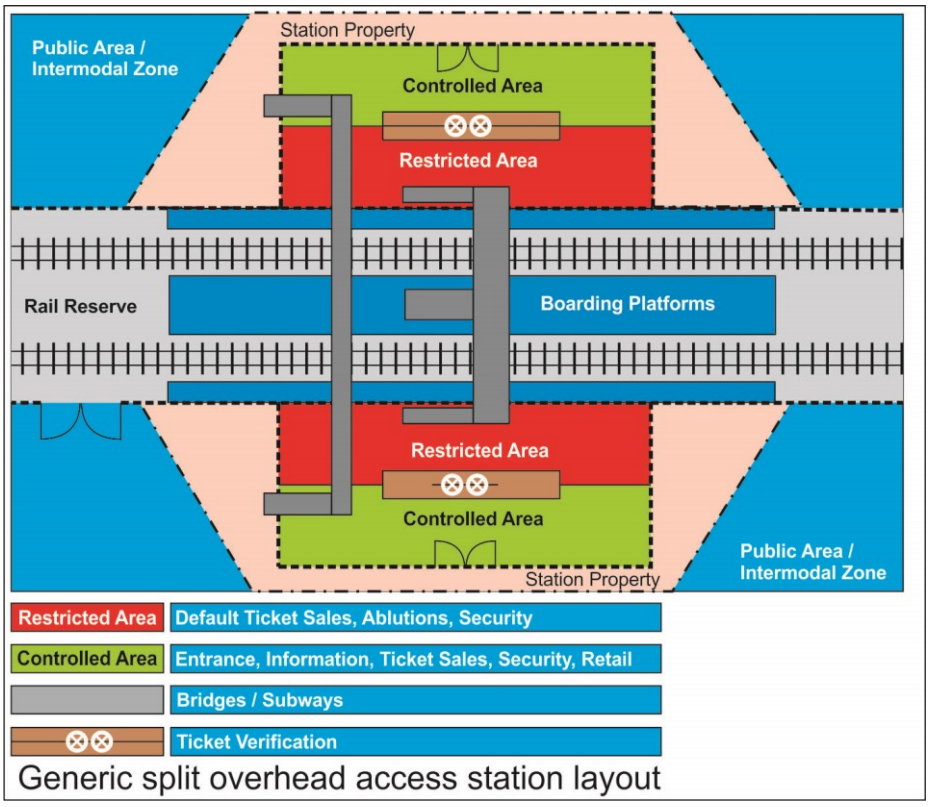


Table 3-3: Schematic Representation of Stations



Generic centralised overhead access station layout



Generic split overhead access station layout

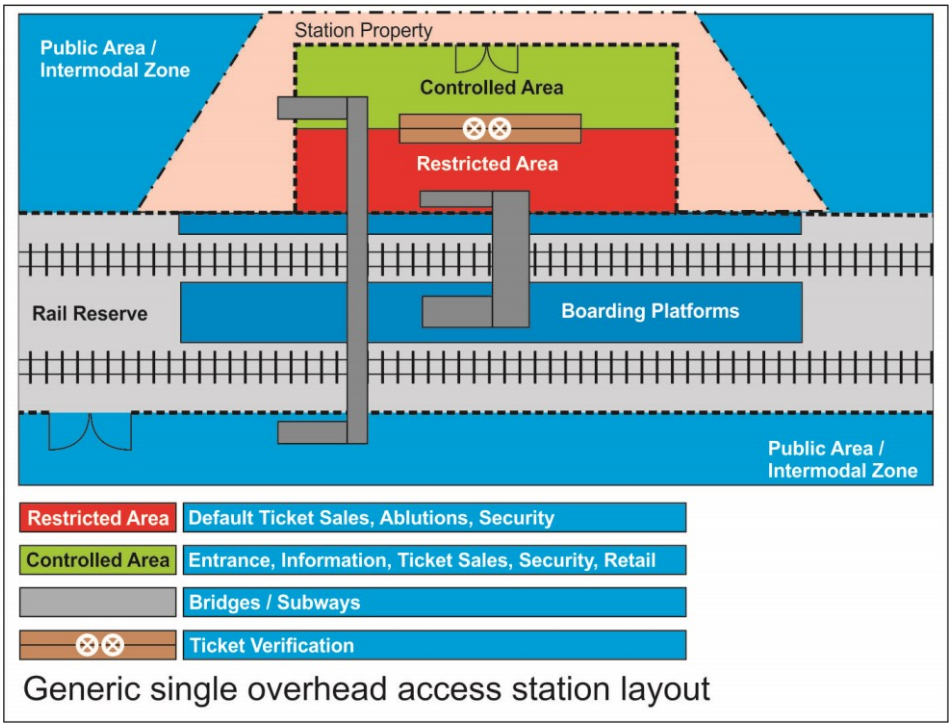


Table 3-4: Station System breakdown

Passenger	Intermodal facility	Station	Access Control	Ticket Issuing	Maintenance
		Entrances Corridors Walkways Stairs Elevators Lifts Platforms Lighting Information Ablution			

Cleaning	Operational Managemenr	Information	Security	Internal Interfaces	External Interfaces
			Access Control Observation Investigation	Ablutions Routing signs Information signs Corporate ID Pictograms Lighting Emergency services Rail Infrastructure	Electricity Stormwater Sewerage Freshwater Security Roads Infrastructure Thoroughfare Communication

3.3 Functional Flow

In order to serve as an effective and efficient component of the rail passenger service the station design shall comply with the full extent of the following functions:

- Accommodate arriving passengers
- Accommodate departing passengers
- Accommodate travel authorisation
- Secure passenger/personnel (security concept)
- Support Service (maintenance, supply support, training and cleaning shall be integrated with all of the above.)

All projects (from conceptual design to detail design) shall characterise these functions in terms of attributes and dimensions. This process results in functional and physical requirements as per the following parts to this document. Compliance to these dimensions shall be in terms of relevant standards.

Comfort and safety of the rail passenger is the top priority and any other facility, i.e. commercial or private must be such that it does not in any way negatively influence this.

All passengers must be provided with all components that they require to make their journey with ease of access, comfort and dignity. This can be achieved within the passenger rail system through the provision of:

- Fully accessible station facilities
- Level access to rolling stock
- Fully accessible rolling stock

Supported by:

- Appropriately trained assistance from passenger rail staff
- The availability of accessible active and passive communication and information
- Systems and material encapsulated within the prevailing rail operational environment

Passengers to be considered include all of the following:
(Categories of the National Land Transport Act)

- Children
- Those accompanying children
- Senior citizens and elderly people
- People with disabilities
- Pregnant women
- Obese people

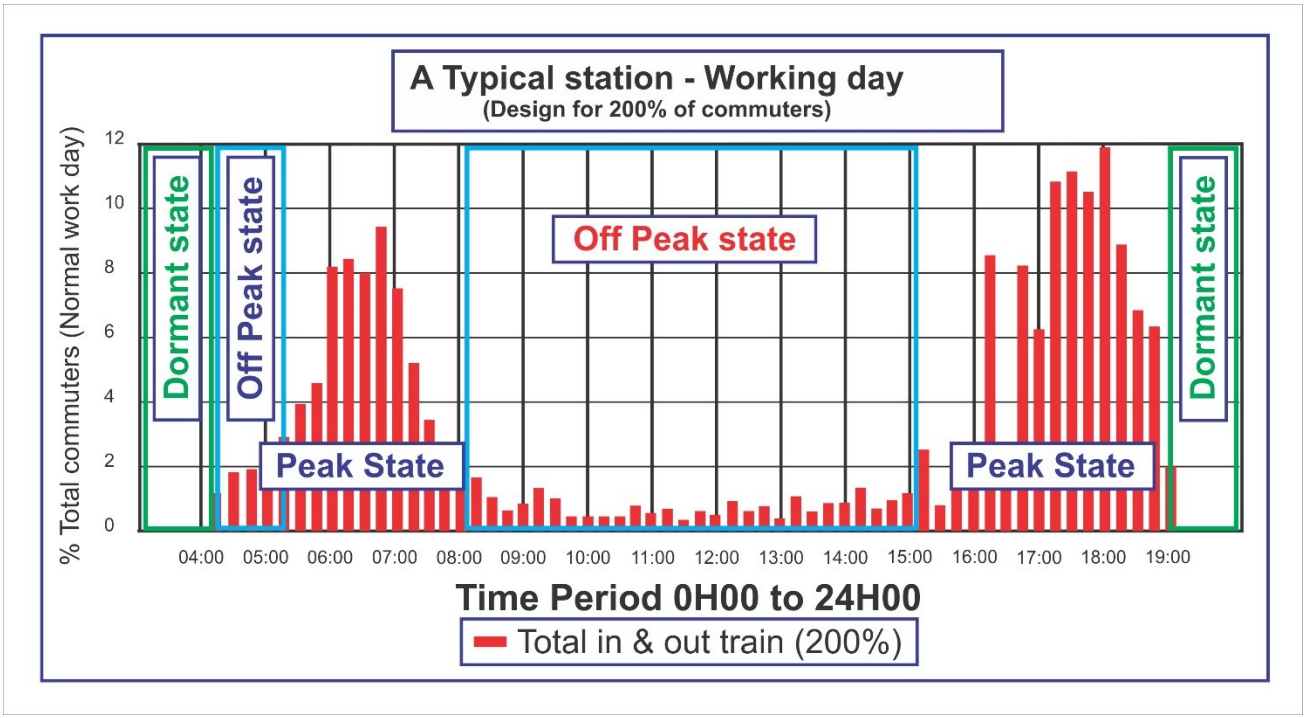
Research carried out by the Department of Transport also indicates that provision must be made for the following in transport environments:

- People with luggage
- Tourists and people who are new to an area
- People with bicycles

3.4 Rail Passenger Cycle

Refer to **Table 3-5** below for the typical regional rail passenger cycles at a specific station. During these cycles the characteristics of the functions, as mentioned in paragraph 3.3, must be accommodated and dimensioned.

Table 3-5: Rail Passenger Cycle



3.4.1 Periods

- Peak Period (early morning and late afternoon peak service demand with a 1 to 5 minute super-peak for urban passenger rail)
- Off-peak Period (during day time and before and after peaks)
- Dormant Period (no service)

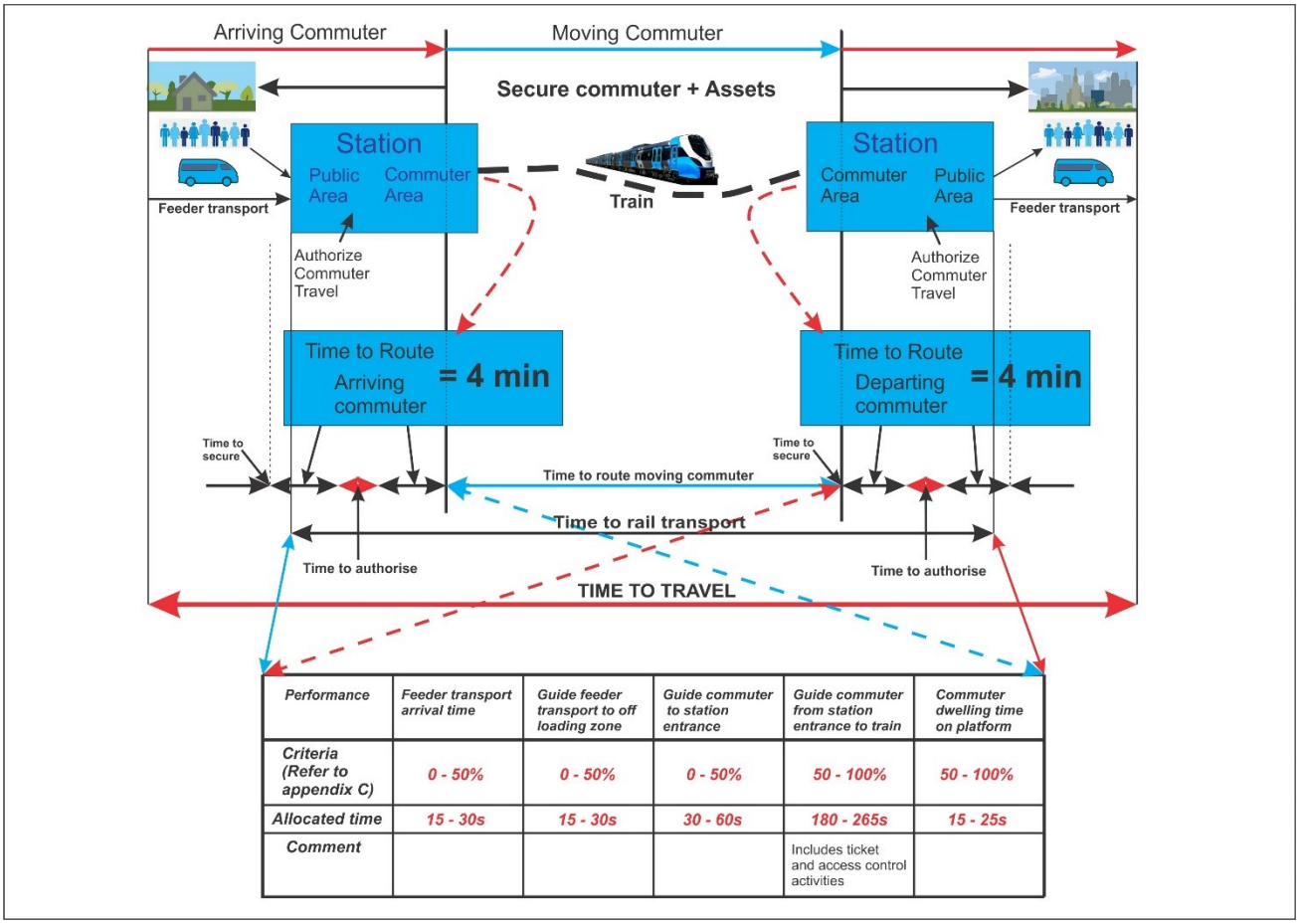
3.4.2 Modes

- Normal mode (can be planned for (normal service) in terms of time and quantity and is recurrent).
- Abnormal mode (can be planned for major events, e.g. sports events, in terms of time and quantity but is not recurrent; sometimes on short notice, e.g. political events etc.).
- Emergency mode (can be planned for in terms of quantity but occurrence is unknown, e.g. fire, unrest, etc.)

3.4.3 Modes

Stations must be designed so that it is possible for passengers/ commuters/ pedestrians transfer between platforms or to connect to other modes of transport within 4 minutes. This includes passengers/ commuters/ pedestrians with disabilities. See **Table 3-6** on the following page

Table 3-6: Station Transfer timeline



Performance	*Feeder transport arrival time*	*Guide feeder transport to off loading zone*	*Guide commuter to station entrance*	*Guide commuter from station entrance to train*	*Commuter dwelling time on platform*
Criteria (Refer to appendix C)	*0 - 50%*	*0 - 50%*	*0 - 50%*	*50 - 100%*	*50 - 100%*
Allocated time	*15 - 30s*	*15 - 30s*	*30 - 60s*	*180 - 265s*	*15 - 25s*
Comment				Includes ticket and access control activities	

3.5 Emergency Evacuation and Passenger Flow Management

The same 4 min rules applies to evacuation time for all passengers and joint evacuation plans are required for commercial and station operational areas.

The design of the station shall allow for any emergency event and the relevant requirement for emergency vehicle access (fire, ambulance, security, etc.), including access to platforms.

3.6 Fare Evasion and Revenue Protection

Fare evasion and revenue protection are important aspects of ensuring PRASA's sustainability.

3.6.1 Fare evasion reduction concept

The cost-effectiveness analysis referred to in the 1997 NGS document showed that given the fare strategy at the time, it was cost effective to check tickets at the origin and destination station.

The concept adopted was therefore to check tickets at the entrance of origin, expiry date and remaining trips in the case of a weekly or return ticket. Tickets were also to be validated at the exit station for destination, expiry date and remaining tickets (weekly or return). The aim was that at the embarking station, the actual origin is magnetically written to the ticket (which can differ to the origin on the ticket) and on the disembarking station this is checked to ensure that the commuter does not buy short tickets.

The proposed concept is optimised if all the stations along the line are equipped with the automated ticket verification system and if all passengers on trains feeding into this line (external interface) have tickets that have been verified magnetically at their origin station.

The proposed concept also includes the automatic verification of tickets, by means of a ticket reader that will verify whether the ticket is valid and then automatically allow the passenger through the turnstile. If the ticket is not inserted properly or if the ticket is not valid or damaged the passenger shall be assisted by a barrier attendant who will inspect his ticket visually and then assist him/her with the proper usage of the automatic turnstile or refer him/her to the ticket office or the turnstile controller/defaulter to replace the faulty ticket or buy a new valid ticket.

3.6.2 Revenue Protection principles

The following principles are adopted:

- To ensure the optimum profit, automatic gates (turnstiles with automatic ticket readers) shall be used.
- This gate system will be controlled (direction of gates, emergency operation, resetting, locking, bypass gates, etc.) by a turnstile central controller who will also issue defaulters tickets and ensure, in general, the proper functioning of access control (one controller per shift with two shifts).
- As passengers cannot use the system without tickets, tickets must always be available. The system shall therefore make provision to sell tickets during all operating hours on all stations.
- Tickets mostly to be sold by manned ticket selling points in the Customer Service Centre at all stations.
- In order to ensure the cost-effective deployment of staff, the following methods were used to optimise ticket selling staff:

    - Due to a PRASA management decision, stations shall not be equipped with Automatic Ticket Issuing Machines (ATM's), resulting in all tickets being sold by ticket selling staff.
    - At small stations the central controller/defaulter shall also sell "normal" tickets to the commuters, as it is not economical for a ticket officer during some shifts.
    - As stations are upgraded and more automatic access control systems is used per corridor, the passengers' buying patterns are expected to change to weekly or monthly tickets. This will result in the buying of tickets during weekdays moving towards Friday afternoons, Monday mornings and the end of the month. PRASA must therefore investigate the possibility of either using staff with other functions to help with ticket sales during these peak ticket selling hours or making use of temporary staff during these periods.

- Security personnel shall ensure the general order in the station, but must also ensure that access takes place through the access control points.
- Barrier attendants shall assist passengers in the use of the automatic turnstiles, if any problem must arise with a passenger's ticket (damaged, in- valid, etc.) or with the card readers or other automatic turnstile equipment (equipment failure, interface problem, etc.).

Note:

The movement towards an automatic access control system shall not decrease the amount of staff required, the system shall only ensure that all passengers have valid tickets, which must force the operators to sell tickets during all operational hours at all stations.

3.7 Security

Security is securing and safeguarding against criminal acts and protection of the rail station infrastructure, personnel and passengers.

Station design must promote the visible presence of station police or security, both in terms of the office and their presence on the station. Special attention shall be given to the layout of corridors, entrances, service passages to minimise dangerous space and take into account CCTV camera positioning and monitoring.

The locations where ticket vending machines, vending machines and / or auto banks are allowed, and the specific positioning thereof must be carefully considered.

Sufficient provision shall be made for the safe and secure removal of cash from the ticket selling facilities. This shall not interfere with peak passenger activities and shall minimize and induced security hazards for passengers / personnel.

The main purpose of the Perimeter Protection System is to restrict access to or from the rail station area, except through formal access control points and reduce the safety risk inside the station area. The degree of restriction also varies depending on the specific area in the station, **Table 3 – 7** below. Refer also to 5.11.1 Perimeter Protection Design notes.

Table 3 – 7: Perimeter Protection

Station Operations area	Restriction
Public area	Accessible for the public (the right of admission reserved), with security
Feeder transport area	Accessible for the public (the right of admission reserved), with security
Internal commercial area	Accessible for the public (the right of admission reserved), with security
Internal controlled area	Accessible for the public, but no informal traders (the right of admission reserved), with high security presence
Passenger restricted area	Access only to legal passengers or the operator's authorised personnel, with high security presence
Rail corridor	Access only for trains and the operator's authorised personnel, with high security presence

The abovementioned restrictions are necessary to minimise:

- Fare evasion
- Theft and malicious damage to the passenger as well as PRASA property
- The effects of assault, terror actions and riot actions on stations
- PRASA's liability in terms of safety legislation

To enforce these restrictions per station area, perimeter protection for each area is required to assist the security personnel and other station personnel with their task. Buildings, walls, and mesh fences form part of the perimeter protection system.

The philosophy behind the perimeter protection system is to ensure that people access or exit the station or station areas (mentioned in the table above), via a few well positioned access control points. With the access control points the people can be controlled to validate their tickets and to limit the risk factor. Maximising the risk for an offender being detected, as well as minimising the workload of security personnel and ticket verification personnel by ensuring that the public/passengers pass the personnel in a small well controlled area. Whenever an alarm is raised for some kind of threat occurring; only the access control points need to be "closed" to prevent the threat of entering the station or by confining the culprit inside the station, where he can easily be arrested.

People accessing the station through any other route/point except from a formal authorised access control point, can be detected and the relevant actions can be taken.

The type of perimeter protection needed, depend on the difference in the security/safety situations, the number of passengers being handled by the station and the economic potential of the area surrounding the station. For example in a high risk area a solid wall of 4 meter high with razor wire and an alarm or motion detection system may be required to conform to the need. On the other hand in a low security risk area it is only necessary to indicate the different functional areas in which the architectural integration of the 2.7 m high Mesh fence without any razor wire, alarms and motion detection systems can be good enough, the indication of the perimeter and the aesthetics may be the only requirements.

3.8 Maintenance

The primary objective of the maintainability of a station is to ensure that the station, the station precinct and all components of both shall be ready for use when needed and capable of successfully performing its assigned functions throughout the commuting cycle (peak, off-peak and dormant period as well as normal, abnormal and emergency-modes). A failure of any component of a station can be prevented or corrected by means of corrective maintenance or preventative maintenance.

Therefore:

- Information on maintenance schedules/cycles
- Maintenance tasks/descriptions
- Related spare/supply support policies
- Related maintenance manpower planning/outsourcing
- Related maintenance equipment and facility planning/outsourcing forms a part of the detail design of any station and must be available at the final design review.

All failures that could lead to catastrophic consequences (during peak, off-peak or dormant period of the passenger cycle), major consequences (during the peak state of the passenger cycle) shall be identified, classified and preventative maintenance schedules drawn up accordingly.

The maintenance of any element of a station shall take cognizance of the rail passenger cycles, as per paragraph 3.4. Maintenance (preventative, corrective, scheduled) cycles, schedules and duration shall be integrated with the comfort, convenience and safety level of applicable regional passenger
Maintenance methods shall comply with PRASA maintenance guidelines (personnel, equipment and facilities).

Maintenance activities which influence the passenger comfort and safety shall only be allowed during the dormant and off-peak passenger periods. Only emergency maintenance is allowed during the peak passenger periods.

As such the following maintenance activities are allowed on platforms, within concourses, passenger toilets, the complex, at access control and ticket selling facilities.

- Emergency maintenance only can take place during the peak passenger period
- Corrective and scheduled maintenance shall take place in off-peak period (duration less than 6 hours)
- Corrective and scheduled maintenance shall take place in dormant period (duration less than 10 hours)

The design of the station shall allow for emergency and maintenance service vehicles. It must also relate to facilities management schedules (maintenance, cleaning, passenger flow management and means of escape schedules).

3.9 Cleaning

Sufficient provision shall be made to collect, store and remove the following categories of waste:

- Wet waste (fruit, peels, food, water, etc.)
- Dry waste (tins, glass, paper, cartons, etc.)

The removal cycles, times and duration shall take cognizance of the passenger and operational cycles as well as hygiene and health threats. The design of any component for waste shall comply with the station waste management concept.

All possible environmental and system induced health and hygiene hazards shall be eliminated / reduced to an acceptable standard. If this cannot be designed, applicable cleaning methods and schedules shall be developed.

The cleaning of any element of a station shall take cognizance of the passenger cycles, as per Paragraph 3.4. Cleaning cycles, schedules and duration shall be integrated with the comfort, convenience and safety levels of service applicable to the regional rail passenger service. Cleaning methods shall comply with PRASA cleaning concepts (personnel, equipment and facilities).

3.9.1 Platform

To be cleaned to an acceptable standard within 2 hours after each peak passenger activity.

3.9.2 Concourse

To be cleansed to an acceptable standard within 2 hours after each peak passenger activity.

3.9.3 Passenger Toilets and Changing Facilities

Due to high peak usage the passenger toilets shall be cleaned after each peak. That is during the off-peak and dormant periods

- Following the morning peak an acceptable level of cleanliness (from a service, hygiene and health point of view) shall be attained within a 30 minute cleaning duration (starting within 10 minutes after the peak passenger activity). Some stations may require a more frequent cleaning frequency due to the extensive usage of the facilities.
- A combination of disinfectant and high pressure spray cleaning is preferred. The design shall therefore allow for rapid drainage and water, rust and chemical resistant components (eg mirrors, ceilings, finishes, doors, locks, light fittings, etc)
- Following the afternoon peak the cleaning shall be the same as above but shall allow for inspection and corrective cleaning if necessary

3.9.4 Complex

To be cleaned to an acceptable standard within 2 hours after each peak passenger activity.

3.9.5 Access Control Facilities

To be cleaned to an acceptable standard within 30 minutes after each peak passenger activity.

3.9.6 Ticket Selling Facilities

To be cleaned to an acceptable standard within 30 minutes after each peak passenger activity.

The design of the station shall allow for emergency and maintenance service vehicles. It must also relate to facilities management schedules (maintenance, cleaning, passenger flow management and means of escape schedules).

Part 4	Technical Considerations

4.1 Background

All design characteristics shall be identified and the determination of the specific parameter per station shall be according to the prescribed method or any acceptable transport method. Some of these methods (models/procedures) may however be in the process of normalisation and finalisation and the developer/designer of a specific station must contact PRASA for information on such possible amendments.

4.2 Level of Service

The dimensional design of passenger / pedestrian spaces involves the application of traffic engineering principles plus the consideration of human convenience and the design environment. Different environments logically require the application of different qualitative, as well as quantitative, design standards. Each station site has its own traffic patterns, physical constraints, and individual environmental requirements.

Crowding results in significant reduction in passenger / pedestrian convenience as normal human locomotion speeds are restricted due to a loss of freedom to manoeuvre within the traffic stream. Human convenience is a primary consideration in station design and pedestrian / passenger design standards must be applied.

The Level of Service concept provides a useful model for the design of passenger / pedestrian spaces.

Level of Service standards provides the designer with a useful means of determining the environmental quality of a pedestrian space, but they are no substitute for judgement. The designer must examine all elements of the design, including such traffic characteristics as the magnitude and duration of peaks, surging of platooning caused by traffic light, cycle or transit arrivals, and all the economic ramifications of space utilization. When designing for extreme peak demands of short duration, the designer may apply a lower quality level of service standard to obtain a more economical design. However, caution must be exercised in selecting design standards near maximum capacity levels, since the critical pedestrian / passenger density at these levels are likely to be exceeded intermittently. This would cause flow volumes to actually fall below the specified design level, resulting in passenger delay and / or crowding.

The following attributes are used to define the service levels:

- Average Pedestrian Area Occupancy (APAO), measured in square meter per person
- Average Inter Person Spacing (AIPS), measured in meter
- Average Flow Volume (AFV), measured in person per meter per minute or quantity of persons that can comfortably walk through a one-meter gap within one minute.

Calculation of entrance and corridor widths is based on:

- Corridor / entrance width = 5 min total peak flow times 30% divided by the AFV plus B times side clearance where:

  - 5 min total peak flow throughout the day at any specific moment for a specific corridor / entrance
  - AFV for specific corridor / entrance as described in **Table 4-1**
  - B = 3 for two-way flow conditions and 2 for one-way flow conditions
  - Side clearance (SC) is the closest distance a normal person walks from a wall, with SC = 450 mm for new corridors and 300 mm for existing corridors
  -

The Level of Service standards shown in **Table 4-1** on the following page are based on a range of passenger / pedestrian occupancies or zone identifications and shall be used in the relevant design areas as discussed hereafter.

Table 4-1: Level of Service Standards applicable to any Station

Zone identification and description	Zone occupancy characteristic	Required Level of Service	Special requirements
Corridor	Window shopping free circulation	APAO=1.40-2.33m2/p AFV=33-50p/m/m	
Corridor and queuing	Window shopping, standing free circulation	APAO=0.93-1.40m2/p AFV=50-66p/m/m	
Walkway	Window shopping, street furniture standing, free circulation	APAO=2.33-3.3m2/p AFV=23-33p/m/m	
Entrance / exit	Free circulation	APAO=0.93-1.21m2/p AFV=40-55p/m/m	Emergency provision
Access control queuing	Standing (access), free circulation	APAO=0.65-0.93m2/p AIPS=0.9-1.0m	
Ticket selling queuing	Standing (ticket buying), free circulation	APAO=0.65-0.93m2/p AIPS=0.9-1.0m	
Internal entrance / exit queuing	Free circulation, standing (internal access)	APAO=0.28-0.65m2/p AIPS=0.61-0.92m	
External entrance / exit queuing	Free circulation, standing (external access)	APAO=0.28-0.65m2/p AIPS=0.61-0.92m	Emergency provision
Landing areas	Free circulation, standing (stair lobbies)	APAO=0.65-0.93m2/p AIPS=0.9-1.0m	
Platform queues	Free circulation, platform furniture, standing (platforms)	APAO=0.93-1.21m2/p AIPS=1.07-1.22m	
Stairs to platforms	Free circulation	APAO=0.65-0.93m2/p AIPS=32-43p/m/m	
Escalator to platforms	Free circulation	APAO=0.19-0.28m2/p AIPS=0.6m	
Ablution (concourse)	Free circulation	APAO=0.93-1.21m2/p AIPS=1.07-1.22m	
Ablution (public)	Free circulation	APAO=0.93-1.21m2/p AIPS=1.07-1.22m	
Lifts	Emergency	APAO=0.28-0.65m2/p AIPS=0.61-0.92m	Emergency provision

Notes:

- **p/m/m – persons/meter/minute**
- **m2/p – square meter/person**
- **APAO – average pedestrian area occupancy**
- **AIPS – average inter person spacing**
- **AFV – average flow volume**

For ease of calculation of the spatial parameters please refer to the PRASA example spreadsheet (Annexure A: Blue Print Index Section 1.3).

4.3 STATION LAYOUT

	Supercore	Core	Interme-diate	Small	Halt
Car parking - Staff	y	y	y	y	n
Car parking - Commuters	y	y	y	y	y
Drop and go facilities	y	y	y	y	y
Taxi/bus access within 50 meters	y	y	y	y	y
Step free access to the station	y	y	y	y	y
Information desk	y	y	y	n	n
Ticket office	y	y	y	n	n
Ticket office: one counter min with a hearing loop facility	y	y	y	n	n
Litter bins	y	y	y	y	y
Police (SAPS contact point)	y	n	n	n	n
Charge office, Holding Cells managed and occupied by SARPS	y	n	n	n	n
Emergency contact board	y	y	y	y	y
Security	y	y	y	y	y
Passenger seating	y	y	y	y	y
Luggage storage facility	y	n	n	n	n
Lifts (including emergency, stretchers)	y	y	y	n	n
Lifts / Hoists for disabled	n	y	y	y	n
Footbridge/subway	y	y	y	y	y
Platform shelters	y	y	y	y	y
Platform water fountains	y	y	y	y	y
Toilets/ablutions	y	y	y	y	n
Unisex Accessible Toilets/ablutions	y	y	y	y	n
Baby changing facilities	y	n	n	n	n
Adult changing facilities	y	n	n	n	n
Lighting	y	y	y	y	y
PA system	y	y	y	y	y
Electronic display boards	y	y	y	y	n
Access control	y	y	y	y	y
Speed gates	y	y	y	n	n
HD CCTV	y	y	y	y	y
Intrusion detection	y	y	y	y	n
Smoke detection (buildings and structures)	y	y	y	y	n
Help point	y	y	y	y	y
Bicycle storage facilities	y	y	y	y	y
Traders kiosks (external to the station precinct, space provided)	y	y	y	y	y

Refer to ANNEXURE A Blue Print PART A, Space Utilisation, 1.1 Spatial Parameters and 1.3 Room Requirement Schedules

4.4 Safety

The design of the station shall reflect applicable components and staff safety, including the minimization of potential human error with respect to:

- Operational personnel
- Passengers
- Intermodal traffic
- Any other persons in the operation and maintenance of the station precinct and the station itself.

Regarding the safety requirements, specific requirements with regards to limiting health or safety hazards shall apply:

- Height and width restrictions
- Doors and windows
- Protrusions
- Gas concentrations
- Warning signs
- Electricity

All potentially dangerous positions and situations must be brought to the attention of the operational staff, passengers, intermodal traffic and any other people with applicable and adequate warning signs.

4.5 Ergonomics

All ergonomic / human engineering principles and procedures will be applied throughout the detail design, manufacture, testing and installation of all equipment and facilities on stations as specified in this document.

- Ergonomic / human engineering goals shall be to maximize the use / effectiveness of operating personnel and in doing so shall minimize staffing, operator error, task complexity and task time.
- Ergonomic / human engineering goals shall be to maximize the comfort and convenience for passengers and therefore minimize effort, error, passenger activities and travel time

National minimum standards published by the South African Bureau of Standards apply.

4.6 Interface Requirements

Due to various contractual and design configuration, control implications during the planning, detail design, development, procurement and construction stages, a distinction is made between external (services supplied by municipalities, Eskom, Telkom, etc.) and internal station interfaces (all relevant station hardware components, wiring, ducting, etc.).

All role-players and interfaces must be identified, defined and controlled at an early stage to allow for effective parallel design and parallel construction.

External interfaces:

External interfaces are the interfaces between a specific station and other configuration items (items of which the form, fit and function is prescribed standards or law enforced design parameters).

The Station external interfaces include:

- Rolling stock
- Electricity
- Storm water
- Track
- Sewerage
- Fresh water
- Security
- Formal / informal commercial
- Roads
- Overhead power supply
- Infrastructure
- Signals
- Access Control
- Communication
- Operating Personnel
- Parking facilities

- Logistics
- Information
- Ticket Office
- Modal interchange
- Public (free) through flow
- Ancillary public facilities
- Bridges

Internal interfaces:

Internal interfaces are the interfaces between the identified major components within the station.
The station internal interfaces include:

- Ablutions and amenities
- Pictograms
- Passages
- Lighting
- Routing Signs
- Passenger commercial
- Bridges and Infrastructure facilities
- Roads
- Infrastructure
- Shelters
- Security
- Corporate ID
- Logistics
- Platform furniture
- Platforms
- Parking
- Subways
- Offices / buildings
- Access control
- Ticket offices

The design of platforms, buildings and any other relevant structures on stations shall comply with the interface tolerance as prescribed in the following (as per **Table 4-2**)

- Approach to the station
- Egress from the station
- Vertical clearances
- Horizontal clearances
- Platform clearances
- Vehicle gauges

The clearances as specified above shall also be applicable for any structure that serve as a functional or other interface that could interfere with any train, e.g. platform ends or station / rail boundary.

No new station shall be developed around a track radius of less than 1000m.

- Station and Rail Interface;
  Any structure in and outside the station shall adhere to the clearances as specified in **Table 4-2**. This shall also take cognizance of the ballast formation and the dynamic change in it caused by train operations.

- Station and Overhead Power Supply Interface;
  Any structure (bridges, roofs, etc) that could interfere with the horizontal or vertical dimensions of overhead power supply structures shall adhere to clearances as specified in **Table 4-2**

- Station and signalling interface;

  The design of the station or any structure thereof shall not interfere with the physical placing and operation of any signalling equipment.

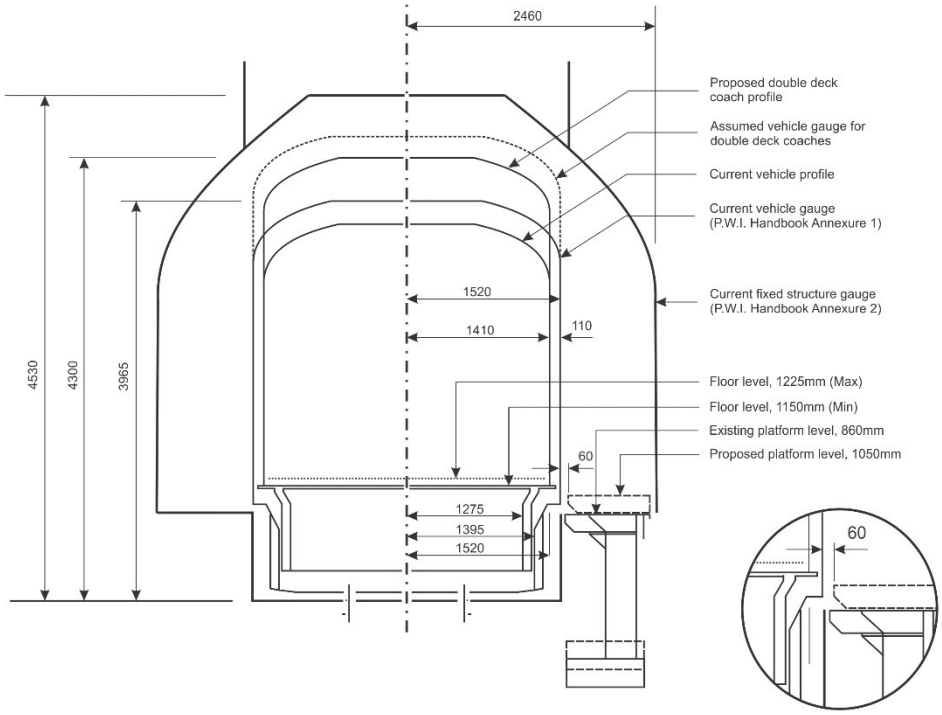
- Station and information interface;

  The design of the station and any structure thereof shall comply with the physical interface and functional performance requirements of any visual and audio information components as prescribed.

- Station and services interface;

  The functional and physical integration of communication lines, municipal electricity, fresh water, sewerage and storm water shall comply with the applicable design standards. This shall also include the local by-laws with respect to building and related structures.

Table 4-2: Required Clearances to Structural elements



With respect to communication, the following specific requirements exist:

- In buildings, internal cables must be provided for e.g. hollow skirting, channels, cable ducts, inter-floor risers linked together to enable services to be provided where they are required.

- Before installation and or construction of roads, etc. sleeves, manholes and or inspection points need to be provided. Telecommunication cables, control cables, data cables and power cabling would be required at the following points:

    - Display boards (also lighting)
    - Cameras (also lighting)
    - Station loudspeakers
    - Clocks
    - Public telephones
    - Ticket vending machines
    - Automatic Teller Machines for banks

- Adequate provision is required for ticket issuing machines, with provision for modems and un-interruptible power supplies. The design of the counters to include the modem machines with power points and cable channels to each window with provision for Transtel and Telkom cables

4.7 System Electromagnetic Compatibility

The system and all associated sub-systems/equipment needs to be designed to achieve electromagnetic compatibility. All requirements to meet these necessities during initial stages rather than after the fact. Taking into account the following:

- Degradation of equipment
- Interference and susceptibility control
- Wiring and cabling
- Electrical power
- Bonding and grounding
- Lightning protection
- Personnel hazards
- External environment
- Suppression components

All sub systems to be compatible to specific requirements during modes of operation, while all sub systems are individually or collectively operated. The contractor will establish the degradation criteria for all sub systems/equipment. The criteria will be utilized to evaluate malfunctions, unacceptable and unwanted responses.

Adequate design provisions to eliminate undesirable responses missions from all electronic and electrical subsystems shall control interference and susceptibility within the system.

Wiring and cabling shall as such be to minimize coupling and obtain optimum separation and use of the wire space and route. Cable design shall include provisions for adequate termination. Procedures shall be established to categorize each wire or cable according to its interference and susceptibility characteristics. Wire shall be marked in such a manner that personnel can visually identify the EMC category for each wire or cable.

The subsystem / equipment shall not malfunction nor have any unacceptable responses with applied electrical power on stations. This includes surges, ripples, voltages and other types of systems shall be included in the systems' specification.

Refer to the Specification for the Installation of earthing (Spoornet) No CSE-1155515 for spikes, bonding and grounding and lightning protection. The system shall be designed to prevent static electricity from degrading system effectiveness.

The prime of integration contractor designated in the contract shall establish and overall electromagnetic compatibility program for the system. The overall program shall include the necessary approach, planning, technical criteria and management controls, the statement of work, system specifications and other applicable

documents. Each vendor, subcontractor, associate contractor involved shall establish a technical effort and necessary management and controls to accomplish their individual part.

The contractors are responsible for the proper installation engineering of all subsystem / equipment to achieve a compatible installation. Where it is demonstrated that interference caused by Customer furnished equipment cannot be implemented either by proper installation, control of the system electromagnetic environment, or by reasonable modifications to the subsystem / equipment as permitted by the contract, the procuring activity may consider waiving the requirement applicable upon request from the contractor.

5.1 Parking

5.1.1 Parking – Intermodal

Purpose

Intermodal facilities provide for the optimum use of other modes to serve passengers / pedestrians accessing the station precinct

Key points

- The passenger / pedestrian market and transport mode information per station shall be used as a guideline per specific project
- The entrance(s)and routes to and from the station shall be sufficient to accommodate the volumes and rates of arriving and departing pedestrians, minibus-taxis and metered, buses and other vehicles as determined by the transport mode model for the specific station
- Entrance(s) to the station shall be orientated to accommodate the major desire lines of:
  - pedestrians
  - minibus-taxis
  - buses
  - other vehicles
  - Commercial layouts to the station environment perimeter as determined by the major desire lines for the specific station environment.
- This shall include the possible influence of commercial development in and around the station
- Parking facilities shall be sufficient to accommodate relevant rates of the following categories of parking:
  - -drop off/pick-up areas
  - holding areas
  - service area
  - passenger day parking
  - personnel parking
  - tenant parking
  - other parking
  - delivery vehicles (loading zone)
- The above mentioned parking facilities shall be orientated to accommodate the major desire lines for the specific station
- The following typical parking facilities can be required at various stations. The designers must determine the need for these facilities:
  - -drop off zone
  - pick-up zone
  - park and ride
  - public parking
  - shelters
- Finishes for the following related to the above facilities need to be determined:
  - structure
  - fencing
  - street furniture
  - Surfaces within or on the station parking facilities shall be integrated with the total architectural character.

References

SANS 10400

5.1.2 Parking Facilities - Drop Off Zone

Purpose

Stop--and drop facilities allow a person to be dropped / picked up at an entrance to a facility without the need for the vehicle to be parked.

Key Points

- Stop--and drop facilities must be within 50 meters to the nearest accessible entrance
- The accessible route should be at road level and near to a kerb cut so that it is safe as possible to get quickly to the footpath
- Where the accessible route is not at road level, the alignment of the kerb must allow vehicles to park hard against it
- No level or height constraints should -impede the use of the stop -and drop facility
- Kerbside stop -and drop facilities should be sited where road gradients and 1:5 camber are reasonably level, e.g., as a road with a steep camber causes difficulties for people using wheelchairs who have a side lift in their vehicle

Design Notes

- Minimum length for an accessible route is 6600 mm
- Minimum route width is 1000mm preferably with a vehicle bay width of 3500 mm
- Accessible route on footpath width must be a minimum of 1500 mm, enough to allow transfer to and from a wheelchair without being obstructed by other pedestrians

References

SANS 10400 Part S

5.1.3 Parking Facilities - Accessible Parking Bays – General

Purpose

Accessible parking bays are required within close proximity to an accessible entrance to enable authorized users to park near the entrance. There should be an adequate number of accessible parking bays.

Key Points

- In buildings with multiple entrances and an associated parking areas, accessible parking bays should be distributed and located closest to the accessible entrances
- In parking areas that do not serve a particular building, accessible parking bays should be located within 50 meter of the accessible entrance
- The maximum acceptable height of vehicles should be shown on the approach to the parking area as some vans or high people make use of - roof cars, others use cars with the wheelchair stowed on top of the vehicle
- Accessible parking bays should be clearly marked and signed
- Access to any accessible parking bay should never be restricted, e.g. by the use of cones or moveable objects to control abuse
- Abuse of accessible parking bays should be actively discouraged by measures such as policing, wheel clamping, signage, etc.

Design Notes

- The distance between the closest accessible entrance and parking bays should not be greater than 50 meter. Minimum vertical clearance from entering the parking area to the accessible bay **2000** mm should be - this height allows for deployment of the hoisting equipment for a car carrying a wheelchair on its roof

The minimum required number of accessible bays compared to the total number of parking bays is shown in **Table 5 – 1** below

Table 5 – 1: Accessible Parking

Total number of bays	Minimum required number of accessible parking bays
1 – 25	1
26 – 50	2
51 – 75	3
76 – 100	4
101 – 150	5
151 – 200	6
201 – 300	7
301 – 400	8
401 – 500	9
501–1000	2% of total
1000 & over	20 + 1 for every 100 over 1000

- The minimum number of accessible parking bays should be increased if the user profile of the parking area indicates additional usage

References

SANS 10400 Part S

5.1.4 Parking Facilities - Accessible Parking Bays - Perpendicular (90 degree) Parking Bay dimensions

Purpose

Perpendicular parking bays are at 90º to the general direction of travel and allow easy entry / exit

Key Points

- Perpendicular parking bays are preferable to angled bays.
- The dimensions of accessible parking bays should allow for transfers from a wheelchair on either ide, or the rear of vehicle unto the vehicle
- If a kerb exists, dropped kerbs and ramps should be provided to link accessible parking bays to the accessible pathway
- Wheel-stops can also be used to demarcate the vehicular area from the access aisle
- Bollards may be used to provide adjacent access areas without the need to modify the layout of existing parking areas
- Bollards may be used to block a central parking space to create two accessible parking spaces
- Bollards may be used to block an end parking bay to create one accessible parking space

Design Notes

- Minimum bay width of 3000mm
- Minimum access aisle width of 1000mm
- There should be at least 1000mm wide safety zone at the vehicle access end of each bay to provide boot access or for use of a rear hoist
- The levels of accessible parking bays should be no steeper than 1:50, with no changes of level

References

SANS 10400 Part S

5.1.5 Parking Facilities - Accessible Parking Bays - Angled Parking Bay dimensions

Purpose

Angled parking bays are provided at an angle to the direction of travel, generally off a one-way road and with limited width to manoeuvre out of bays

Key Points

- Perpendicular parking bays are preferred to angled parking bays
- The dimensions of accessible parking bays should allow for transfers from a wheelchair on either side, or the rear of the vehicle unto the vehicle
- Extra space at the end of an angled parking row can be used as an accessible parking bay/aisle
- If a kerb exists, dropped kerbs and ramps should be provided to link accessible parking bays to the accessible pathway

Design Notes

- Dimensions are provided in the SANS 10400 Part S

References

SANS 10400 Part S

5.1.6 Parking Facilities - Accessible Parking Bays - Markings and signage

Purpose

Bay markings show the limits of a parking bay and its intended use

Key Points

- Accessible parking bays should be indicated by signs in accordance with the Road Traffic Regulations and specifically the South African Road Traffic Signs Manual (SARTSM)
- The “accessible parking bay” symbol for use in accessible parking bays (RM17.3 as per SARTSM should be painted in the centre of the bay
- Each bay should have a raised sign -(R323 P) at the head of the bay to ensure that if the road markings are obscured, e.g. by fallen leaves, the purpose of the bay is still apparent
- Signs should be provided at the entrance to the area to direct authorised parking motorists to designated parking bays
- Signs inside the parking area should show the most convenient way to the facilities served by the area, including an approximate distance to those facilities
- Family parking can be provided in Supercore stations where space allows

References

SANS 10400 Part S

5.2 Circular Paths - Walkways

5.2.1 Circular Paths - Walkways – General

Purpose

Footpaths and walkways provide a dedicated space for pedestrians to walk

Key Points

The following terms are used to describe various features of footpaths and walkways:

- The curb zone is designed for drainage, and to isolate pedestrians from the street
- The furnishings zone buffers pedestrians from the street, and is the proper place for furniture, i.e. utility poles, signs, waste bins, etc. The furnishings zone is also the place to plant trees or shrubs
- The space adjacent to the property line that is not part of the normal walking surface is called frontage zone surface
- What's left in the middle of the sidewalk corridor is the through pedestrian zone
- Parked vehicles on footpaths / walkways are of specific concern to blind and visually impaired people. Every effort must be made to ensure that it does not occur or that, if it does, appropriate enforcement action is taken.

Design Notes

- The through pedestrian zone, where you actually walk, should be at least 2000mm (minimum 1525mm) wide, and free of both permanent and temporary obstructions
- The minimum clearance width where obstructions occur, such as benches, sign posts, hawker stands, etc., should be 1000mm (minimum 915mm)
- Vertical clearance above all walkways to all overhead obstructions, including signage, roofs of shelters, etc. must be a minimum of 2130mm
- The turning or corner should have a minimum 762mm inside radius or no occupy zone
- The sidewalk surface may be a patterned concrete, brick and concrete or stone paving or asphalt with a coarse aggregate finish
- Surfaces must be firm so as to resist indentation from forces applied by walking and reduces rolling resistance by a wheelchair and other wheeled vehicles
- Surfaces must be firm so as to resist indentation from forces applied by walking and reduces rolling resistance by a wheelchair and other wheeled vehicles
- Concrete surfaces should have a broom (brushed) finish
- Cobbled finishes must be avoided as they increase the amount of work required to enable mobility, whilst also presenting tripping hazards
- Where manhole covers are used these should be flush with the surrounding
- -surface and non-slip even when wet
- Where gratings are installed apertures should not exceed 13mm wide
- Colour changes and tactile clues should be provided to assist the visually impaired and the blind to establish the boundaries of the sidewalk and the presence of obstructions
- Change in level of less than 5 mm are not viewed as a level change - however such level changes should be avoided
- Obstacles should not protrude from walls more than 305 mm into the walkway and should not be mounted lower than 685 mm from ground level. This applies especially to blind and visually impaired pedestrians
- Obstacles protruding from walls with the leading edge between 685 mm and 2030 mm high should not protrude further than 100 mm into the corridor

References

SANS 10400 Part S

5.2.2 Circular Paths - Walkways - Cross Gradients

Purpose

Cross gradients (that slope across the width of a footpath or walkway) are generally provided for drainage

Key Points

- It is essential to minimise any cross gradients as it makes it difficult for wheelchair or crutch users to maintain lateral balance
- The forces of gravity tend to pull the wheelchair, pushchair (or the person with walking aids) towards the kerb or lower pathway edge / street
- For people using wheelchairs, the pushing forces required to counteract these effects will be different on each wheel rim – small on the high side, large on the low side of the pathway. Forward momentum towards the kerb may require unequal hand braking on the wheels, leading to possible loss of control and balance

References

SANS 10400 Part S

5.2.3 Circular Paths - Walkways -Dropped Curbs

Purpose

Curb cuts allow people using wheelchairs, push prams or people with mobility impairments to negotiate the change in level between a footpath / walkway and the road

Key Points

Dropped kerbs are predominantly used in three areas:

- accessible parking spaces or passenger zone areas
- street corner pedestrian crossings and
- mid-block pedestrian crossings
- Changes in level between the pavement, sidewalk or pathway and road surface, specifically at street or road corners should be safe and accessible
- The accessible route should by-pass dropped kerbs, i.e. dropped kerbs should preferably be located in the furnishings zone
- All dropped kerbs should have a landing at the top and bottom of the ramp and tactile warnings should be provided
- It is not recommended that ramps are located diagonally at corners

Design Notes

- Maximum height difference between road and footpath / walkway level of 100 mm
- Minimum gradient 1:12 (8%), ideally 1:15 (6.6%)
- Flared sides should have a slope of 1:10 or less
- The transition from the dropped kerb to the pathway / sidewalk and to the roadway or gutter should be flush and free from abrupt level changes, i.e. not greater than 5 mm
- The approach may be slightly graded if the landing level is below the elevation of the adjoining sidewalk

References

SANS 10400 Part S

5.2.4 Circular Paths - Walkways -Corridors – General

Purpose

Corridors enable people to move around a facility by connecting spaces together

Key Points

- Corridors should be simple and safe to negotiate, as they provide both access to spaces and form part of escape routes Dropped kerbs are predominantly used in three areas:
- In a well-planned building, corridors convey information about a building and assist with circulation around it
- Corridor clear widths should be unobstructed
- Wherever possible equipment such as fire extinguishers should be recessed as these projecting items are hazardous to people with sight impairments

- Columns and other projections into the passenger circulation area should be avoided if at all possible; if not they should be highlighted using contrasting colour and tone
- Floors must be slip resistant even when wet as they are hazardous to stick and crutch users as well as passages with hasty and heavy traffic

Design Notes

- Avoid colour schemes with little tonal contrast
- Doors, floors, walls and ceilings should be defined using tonal contrast
- Wall and floor surfaces should be chosen to minimise light reflection and sound reverberation which can be confusing for people with sensory impairments
- Lighting should be located where it does not create glare or silhouettes

References

SANS 10400 Part S

5.2.5 Circular Paths - Walkways -Corridors - Dimensions

Purpose

The height and width of a corridor must provide adequate space for persons to move and pass other persons / objects

Key Points

- The height and width of a corridor must exceed the space required to accommodate all pedestrian and combination movements thereof
- If the recommended width cannot be provided passing places should be provided at regular intervals
- Guide strips should be provided to create a cane detectable environment

Design Notes

- An unobstructed width of a low-traffic corridor should not be less than 2200 mm for bi-directional traffic and 1800 mm -for one directional traffic
- The recommended corridor widths allows manoeuvrability around corners, i.e. changes in direction of less than 180 º , and U bends, i.e. changes in direction of 180 º or more
- The unrestricted height of a corridor should be no less than 2100 mm
- No protrusions of more than 5 mm from the floor surface level measured over a distance of 610 mm

- Where manhole covers are used these should be flush with the surrounding surface and non-slip even when wet
- Where grating is installed apertures should not exceed 13mm wide

References

SANS 10400 Part S

5.2.6 Circular Paths - Walkways -Corridors - Passing places

Purpose

Passing places are provided in corridors to allow a user to pass another user where the width of the corridor is inadequate.

Design Notes

- If the route, circulation path or corridor is less than 2200 mm wide, passing opportunities should be provided at intervals along the corridor – these could be intersecting corridors or specific passing places T
- Passing places of at least 900 mm wide by 2000mm long, preferably 1100 mm by 2000 mm, should be provided at intervals not exceeding 30 m and in direct line of sight

References

SANS 10400 Part S

5.2.7 Circular Paths - Walkways – Stairs – Corridors – Platform edges - Tactile Indicators

Purpose

Tactile guide strips are used to give people, especially those with visual impairments, advance warning of hazards, e.g. in corridors, stairs, roads or the **edge of the platform**, as well as to guide users where natural guidelines are not present

Key Points

- Ribbed tiles should be used to direct people along a route
- Blister tiles should be used to warn people of hazards or changes in direction
- The strip conveys the message “hazard, proceed with caution”
- A tactile warning strip should be provided at the top and bottom of a flight of stairs but not on intermediate landings

Design Notes

- Tactile indicators to be designed in terms of SANS 784:2008 (Design for access –and mobility Tactile indicators), or other applicable guidelines as directed by the Department of Transport
- Where normal or natural guidelines are not available, or have gaps more than 10 m in length, guidance should be an urban provided by a tactile guide strip, design feature or surface constructed alongside the accessible route, to ensure continuity of the accessible route edge. The guide strips should be of a contrasting colour.
- The guide strips should highlight the presence of pedestrian crossings or kerb drops for partially sighted or blind pedestrians
- The back edge of the tactile surface should be at right angles to the direction of crossing

References

SANS 10400 Part S

SANS 784 : 2008

ANNEXURE A Blue Print, PART A, Space Utilization, 1.1 Spatial Parameters, Doc 1.7 Platform design, 1.1.17

ANNEXURE A Blue Print, PART B, Specification list, 2.2 General List of finishes and specifications, A13 & A14

ANNEXURE A Blue Print, PART C, Drawings, sketches and details 3.1 General details drawing index, 600 Series, 600A to 600P

5.3 External and Internal floor surfaces

5.3.1. Surfaces General hard flooring

Purpose

Surfaces provide a non-slip and friction free environment in which to manoeuvre

Key Points

- The design, build and layout of all surfaces should not cause any impediment to users
- Main thoroughfares within buildings should have consistent floor surfaces
- Floor surfaces should be firm, easily cleaned and
- slip-resistant when wet or dry, preventing shoes or crutch tips from sliding across the surface while bearing weight even when wet
- Hazard Warning and Directional tactile surfaces must be provided in accordance with SANS documents and the PRASA station blue print
- Floor surfaces should be properly and regularly maintained

Design Notes

- Surfaces should have a matt or semi-matt finish wherever possible to avoid specular (un-diffused) reflection and glare
- The surface shall be resistant to marks and indentations
- Dirt and marks are less conspicuous on a pointed or patterned surface than on a plain surface
- Surface colour should be intermediate rather than too dark or too light
- Changes in colour and texture should be used to mark the edges of thoroughfares and any impending hazards such as projecting obstacles and stairways
- Slip ratings for external surfaces, R10 to R12, rating for internal surfaces R9 to R10 for hard type floor finish

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART B, Specification list, 2.2 General List of finishes and specifications, AA01 to A17

5.3.2. Surfaces - Paving materials

Purpose

Paving provides a hard weather resistant surface covering on which people can walk

Key Points

- Uneven surfaces, gaps between paving slabs etc., whether within or outside buildings, can cause problems for people using crutches, those with visual impairments and users of wheelchairs

- When small paving bricks (pavers) are used, particular care should be taken to ensure that they are evenly laid, and without bevelled edges
- Surfaces should be firm and non- slip in wet and dry conditions
- Dished channels (for drainage) should not be incorporated within pedestrian routes
- Cobbled surfaces are banned as they can cause some people using wheelchairs to get spasms and can be a tripping hazard for people with visual impairments

Design Notes

- Joints between flags and pavers should not be less than 2mm and not more than 5mm wide
- For pedestrian only footways, flags can be laid with wider joints (6-10mm) filled with compacted mortar
- The maximum deviation of the footway surface under a 1m straight edge should not exceed 3mm
- Cross falls should not exceed 1:50

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART B, Specification list, 2.2 General List of finishes and specifications, A08, A16 and A17

5.3.3. Surfaces - Manhole covers and gratings

Purpose

Covers and gratings are part of the built infrastructure and are essential elements of storm water and sewer systems. Uneven surfaces, gaps, etc.as a result of the provision of covers or gratings can cause problems for people using crutches, those with visual impairments and users of wheelchairs

Key Points

- Covers and gratings can cause problems and may be mistaken by blind people as a tactile surface
- Wherever possible gully covers and drainage slots should be positioned as far as possible from main pedestrian flows
- Inspection chamber covers should be flush with the adjacent surface
- Inspection chamber covers must be Polymer or concrete and not metal

Design Notes

- The maximum size of openings should be 13mm and if openings are elongated they should be placed at right angles to the predominant direction of travel
- The openings should not be more than 150 mm long

References

SANS 10400 Part S

5.3.4. Surfaces - General soft flooring

Purpose

Carpets provide a soft surface covering on which people can walk indoors and are not normally provided in passenger areas, except in exceptional circumstances. Office environment

Key Points

- Carpets or carpet tiles should be securely attached to the floor, have a firm cushion, pad or backing or no cushion or pad and have a level loop, textured loop, level cut pile or level cut / uncut pile texture
- Exposed edges of carpet should be fastened to floor surfaces and have trim along the entire length of the exposed edge
- Maximum pile height for cut pile carpets to be 13mm

Design Notes

- Coir dirt mats and mats with directional weave are not recommended as they can impede access for people with walking difficulties and people using wheelchairs

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART B, Specification list, 2.2 General List of finishes and specifications, A04

5.3.5. Surfaces - General Walk off mats

Purpose

Walk off mats prevent dirt and moisture from being brought into a building which can cause floors to become slippery

Key Points

- Rubber backed Walk off mats placed on top of the existing floor finishes can ruck and present a trip hazard, and should not be used
- Walk off mats should be recessed into the floor surface in order to be flush with the adjacent floor finish.
- All-Walk off mats should be regularly and effectively maintained to avoid mats pulling away from the edges and leaving a gap.
- All-Walk off mats should be cleaned (vacuumed) twice daily

References

ANNEXURE A Blue Print, PART B, Specification list, 2.2 General List of finishes and specifications, A05

5.4 Entrances and Exits

5.4.1. Entrances - Station - General

Purpose

Entrances shall be provided to accommodate the relevant peak passenger / pedestrian flow as determined by the station flow model, taking the desire lines into consideration

Key Points

- Station entrances for security control of a secondary level should be kept at a minimum, but large enough to accommodate the peak flow with optional entrances which can be closed after peak times
- Station entrance(s) shall be orientated to facilitate passenger desire lines for effective station and station environs integration as determined by the design line model for the specific station.
- This should include the optimum position to allow for the maximization commercial/informal market exposure for passengers which are potential commercial customers. Arrival / exist area shall be provided to accommodate passengers outside the passenger restricted area

- An integrated entrance/exit area shall take into account the influence of bi-directional flow of entering and existing commuters as well as station holding and potential commercial activities (shopping mode)
- Where entrance doors are needed, these should be automatic, linked to a weight sensor or to mounted sensors above the door special
- Where revolving door, turnstiles and other barriers are installed, an alternative means of access to be provided
- Doors made of glass, should have a contrast colour banding or a logo or other decorative symbol with minimum dimensions of 150 x 150mm set at eye level, i.e. approximately 1500 mm above floor level
- Doors shall not have a threshold as it is a trip hazard
- A threshold is not required on a door. Water ingress should be dealt within the design of the station prior to the entrances
- An automatically operated roller shutter door to be installed to the entrance doors to stations for after hours

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART C, Generic detail door schedules, 3.2 800 Series

5.4.2. Entrances - Station - Gates

Purpose

Doors provide a buffer between noisy and quiet areas and provide also access control for for pedestrian flows. Furthermore do doors offer an alternative to revolving doors. All doors to be correctly dimensioned to be used by all. Any approach to hinged doors must provide space for users to open and close the doors whilst keeping clear of the swing. Hinged doors are preferred for door mechanics, acoustics, thermal insulation, cost and fire protection

Key Points

- All accessible functional spaces should have at least one accessible door
- Double leaf doors can provide a wider clear opening than single doors
- The second leaf of all double doors should be unlocked at the same time as the first
- Doors should be hinged on the most appropriate side, thus facilitating access by providing sufficient approach areas by providing sufficient approach areas
- Hinged doors must be able to be left open at 90 degrees or more
- A physical barrier, to indicate the extent of the open door that is parallel to the swing side of the open door should be used to prevent the door swinging into people
- The leading edge of any door that is likely to be held open should contrast background against which it will be viewed
- The space immediately before and after for users a door is important as it allows to stand clear if the door opens towards them and for users of wheelchairs to manoeuvre
- The minimum space between two hinged or pivoted doors in series should be 1300mm, plus preferably 2000mm plus the width of any door swinging into the space
- Doors that follow each other should swing either in the same direction or away from the space between the doors
- Doors to ablution and water chambers must swing inward to open position

Design Notes

- All accessible functional spaces should have at least one accessible door
- The door's operation should be light, i.e. < 6 N (maximum initial force 15 N)
- All doors should have appropriate furniture and fittings to improve accessibility

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART C, Generic detail door schedules, 3.2 800 Series

5.4.4. Entrances and Exists - Sliding doors - General

Purpose

Sliding doors are used where it is important to keep approaches to the doors clear .They may be used in stations where the weather conditions are windy or where there is driving rain. These sliding doors would normally be used in Super Core and Core stations. Approach space is required on both sides of sliding and folding doors so that people can manoeuvre through the door

Key Points

- Sliding doors may be manual or automatic
- Approach space is required on both sides of sliding and folding doors so that people can manoeuvre through the door

Design Notes

- All doors 50mm coloured band (in a contrasting colour / tone) at eye level, i.e. 1450 mm to 1500 mm
- The minimum clear width of a sliding door should be 900 mm, preferably 1200 mm
- Front approaches to sliding doors and folding doors should have manoeuvring space that is the same width as the door opening and should extend a minimum of 1250 mm perpendicular to the doorway
- Slide side approaches to sliding and folding doors should have a minimum 1400 mm manoeuvring space mm of parallel to the doorway, and a minimum of 1100 mm perpendicular to the doorway
- Latch side approaches to sliding and folding doors should have a manoeuvring space that extends a minimum of 600 mm beyond the latch side of the door and should extend a minimum of 1100 mm perpendicular to the doorway
- Front approaches to sliding doors and folding doors should have manoeuvring space that is the same width as the door opening and should extend a minimum of 1250 mm perpendicular to the doorway
- Slide side approaches to sliding and folding doors should have a minimum 1400 mm manoeuvring space mm of parallel to the doorway, and a minimum of 1100 mm perpendicular to the doorway
- Latch side approaches to sliding and folding doors should have a manoeuvring space that extends a minimum of 600 mm beyond the latch side of the door and should extend a minimum of 1100 mm perpendicular to the doorway
- The distance between two sets of automatic doors that follow each other should be a minimum of 2000mm
- Photoelectric cell operated doors should have a Z layout of light beams to ensure that doors remain open if traffic moves slowly
- Automatic doors must open no faster than 3 s and remain open minimum of 6s, preferably 9 s
- The pressure required to stop automatic doors closing should not be more than 66.6 N i.e. should safeguard against someone being injured by closing doors
- Push button controls should be located 1000mm from floor level and similar distance from the side of the door with appropriate luminance and colour contrast

References

SANS 10400 Part S

5.4.5. Entrances and Exists - Doors - Vision panels and door furniture

Purpose

This enables people to view each other on either side of the door

Key Points

- Doors in frequent use should have viewing panels. This enables people either side of the door to see and be seen whether seated or standing.
- The height of the viewing panel should allow short people and people using wheelchairs to be seen
- Doors should have colour and tonal contrast with the wall around them to help visually impaired people

Design Notes

- The contrasting feature should be repeated at a lower level of between 800 mm and 1000mm above floor level
- Glass used in a door must be safety glass to avoid any injuries
- Measurements for viewing panels should be between 900 mm to 1500mm from floor level

References

SANS 10400 Part S

5.4.6. Entrances and Exists - Doors - Kick plates

Purpose

Kick plates assist people with sight impairments, and also people in wheelchairs, to open and close doors, while protecting the door at the same time

Key Points

- All doors should be fitted with a kick plate
- Door protection is required where doors are used in a corridor with heavy traffic

Design Notes

- Side hung doors must receive kick plates on the trailing face of the door to a height of 0.4 m from floor level
- Doors that are used for wheelchair access should receive a kick plate to a height of 1 m from floor level
- Door protection is to be in the form of heavy duty stainless steel sheeting which is durable and impact resistant and secured with contact adhesive

References

SANS 10400 Part S

5.4.7. Entrances and Exists - Doors - Handles and Controls

Purpose

Appropriate handles and controls enable a person to open and close doors and gates

Key Points

- All handles, pulls, latches, locks and other devices on doors should have a shape that is easy to grasp with one hand and does not require tight grasping, tight pinching or twisting of the wrist to operate
- Lever operated mechanisms, push type mechanisms and U-shaped handles are acceptable designs
- There should be sufficient space between the inside of the handle or rail and the surface of the door to avoid people catching their knuckles on the door

Design Notes

- No handles or controls should be mounted higher than 1200 mm from floor level
- Handles and controls fitted horizontally should be at a height of 900 mm and with a minimum length of 120 mm
- If the door has a vertical bar rather than a lever handle, this should stretch between 700 mm and 1400 mm above floor level.
- The diameter of the door handle or bar is recommended to 30 to 35 mm
- There should be a gap of 45 mm between the inside of any handle and the door/ gate

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART C, Generic detail Door schedules, 3.2 800 Series
ANNEXURE A Blue Print, PART B, Specification list, 2.5 General List of Ironmoongery Specifications, Q01, Q02 and Q03

5.5 Ramps

5.5.1 Ramps and gradients

Purpose

Ramps provide a means for changing levels and are an alternative to stairs and lifts. Ramps are also required for the transportation or movement of goods weighing in excess of 13 kg. There is a relationship between the length of a ramp and the gradient that people can access the entrance or exit with more ease.

Key Points

- Ramps are pathways that have a gradient of between 1:12 and 1:20, 1:15 is preferred
- Stairs should always be provided as an alternative to a ramp when the level change exceeds 450 mm, as many people with walking difficulties find steps or stairs easier than a long ramp
- Where both ramps and stairs are provided, the two routes should reflect equal importance
- A lift is recommended rather than a very long ramp - ideally, where a height difference of more than 2 m is to be accessed
- Care should be exercised in the design to ensure that no part of the ramp is more than 20 m from any other part of the facility for surveillance / security reasons

Design Notes

- Ramp sizes for general use must be calculated based on the daily peak commuter volume
- For general purpose the minimum surface width of a ramp is to be 1.8 m, but preferably 2 m
- • For short ramps where there are alternative steps and no passing traffic, the width shall be minimum 1.5 m for a maximum of 300 mm. This will normally apply to alterations to existing buildings to create step free access where single steps are unavoidable

- All landings on ramps at the top and bottom of the flight and intermediate landings must be LEVEL i.e., with a gradient no more than 1:50 - 1:60

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART A, Space Utilisation, 1.1 Spatial Parameters Document, 1.3 Ramps

5.5.2 Ramps - Landings and surfaces

Purpose

Landings (rest places) provided at regular intervals along a ramp allow for rest areas and minimise the stamina needed to move up and down the ramp. Ramp surfaces should be slip resistant and non-reflective to avoid becoming hazardous, especially when wet

Key Points

- Where a ramp is provided for both pedestrian and moving vehicle traffic, the vehicle bearing surface is to be located in the middle of the ramp, with pedestrian surface next vehicle surface divided by handrails, providing enough space for two way movement for the pedestrian flow

Design Notes

- A landing should be provided every 500 mm vertical rise, maximum every 600 mm vertical rise
- A landing of 1500 mm long, minimum 1200 mm, should be provided with a width not less than that of the ramp
- A landing of at least 1.8 m long shall be provided at the top of any general-purpose ramp
- Where a ramp starts or ends at a doorway, a landing of minimum 1.8 m is to be provided where the door opens away from the ramp and 2 m minimum where the door opens towards the ramp
- A landing of not less than 1.8 m long is to be provided at the foot of any ramp with a gradient in excess of 1:20
- A landing of minimum 1.8 m long is to be provided at the foot of any ramp where the ramp ends at a blind corner
- The cross gradient of a landing should be a maximum of 1.5% (1:65)
- If the overall ramp length is more than 50 m then more landings need to be provided
- A textured finish with coarse aggregate not finer than 10 mm is to be used. If asphalt is used a roughened finish is preferred to sandpaper finish
- Where concrete ramps are cast in situ, a herringbone pattern should be incorporated to provide a non-slip surface
- Internal ramps are also to be non-slip and a grooved rubber tile or sheet is suitable. Grooves should run at right angles to the direction of movement
- There shall be no protrusions or depressions in excess of 30 mm for ramps which are exclusively used for wheelchairs and vehicles
- Where ramps are for general use, there should be no protrusions of more than 13mm from the mean floor surface level measured over a distance of 0.61 m
- Where protrusions are between 6.5 mm and 13mm the transition step shall be graded at 50%
- Where manhole covers are used these should be flush with the surrounding surface
- Where gratings are installed apertures should not exceed 13mm wide

References

SANS 10400 Part S

BS 8300

ANNEXURE A Blue Print, PART A, Space Utilisation, 1.1 Spatial Parameters Document, 1.3 Ramps

5.6 Handrails

5.6.1 Handrails - General

Purpose

Handrails provide support to people whilst walking or going up / down stairs or ramps. Handrails also provide tactile information to many people with sight impairments. A balustrade is not a handrail, and a handrail must always be provided on either side of a flight of stairs for support. The size, shape and positioning of handrails should provide people with a safe and easy to hold support

Key Points

- Handrails should be continuous and uninterrupted along the entire length of the facility
- Handrails should be provided at two heights to allow for both tall and short people as well as people using wheelchairs
- Handrails located at flights of one or two steps will assist in indicating the hazard more than contrasting colours at floor level
- The ends of handrails should be rounded or returned smoothly to the floor, wall or post
- Handrail materials should be contrasted, rust-free, warm to touch, not containing nickel, rubber or chromium (metal handrails should preferably be protected with thermoplastic covering for comfort)
- The handrail must contrast with its surround.
- Where a flight of stairs has an open side, balustrading must be provided to prevent accidents.
- The dimension and size of the handrail should be readily accessible to most people
- Handrails should be parallel to the to the facility / centre of stair treads

Design Notes

- Handrails must be provided where the gradient of a walkway exceeds 5° with the horizontal
- Handrails should withstand a minimum lateral force of 100 kg
- Handrails must be provided on both sides of the stair or ramp
- The clear width between handrails should be 1200 mm or 1500 mm where people are carrying luggage
- Where concurrent two way flow occurs, with a width of 2.4 m and more, an intermediate handrail is required. Double handrails at the same height ease two way flow
- Handrails should extend between 300 mm and 600 mm beyond the start and end of the facility, preferably 500 mm
- Diagonal bracing from handrails to floor should not protrude into the walkway
- The lower handrail height should be between 500 mm and 550 mm for children and short people
- Brackets to wall handrails will be fixed to the underside of the rail
- Where handrails projecting from the wall surface are considered undesirable for safety reasons, the rail is to be recessed into the wall
- Uncomfortable joints in handrails for hands to pass over should be avoided

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART B, Specification list, 2.2 General List of Specifications, J01, J02 and J03

5.7 Lifts and Escalators

5.7.1 Lifts - General

Purpose

Lifts provide a means of changing levels for those who do not wish to or cannot use stairs or escalators. All lifts must be able to accommodate a stretcher for emergency services, regardless the size of the station

Key Points

- Finding the lift location can be a problem for blind, deaf-blind and partially sighted people
- There should be an obvious standardised way of showing an intending user if the lift is not operational / out of order
- An emergency call system inside the lift is essential and, should it be used, there must be a swift response
- Lift locations should be clearly sign posted from the main pedestrian route and recognizable through design and location
- Where it is possible to fit them, walk through lifts, i.e. with doors on opposite sides, are preferable to single door lifts
- There should also be an external communication system on all lift landings to enable communication with a central controller should a lift not be operational
- Lifts should be provided in preference to very long ramps

Design Notes

- Passenger lifts that are provided to evacuate people with disabilities in an emergency should have an independent power supply and meet the relevant codes and standards
- A clear approach area in front of the lift doors of 1200 mm x 1200 mm should be provided, preferably 1500 mm x 1500 mm
- This floor area should contrast with its surroundings
- Visual, tactile and audio displays confirming user actions, lift door status and lift location must be provided

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 1.5 Lifts

5.7.2 Lifts - Car dimensions, gap tolerance and car layout

Purpose

Lift cars form the enclosure in which people are carried between substantial changes in level

Key Points

- Lift cars must be large enough to accommodate all users, including wheelchair users with reclining, or particularly large motorised wheelchairs, wheelchair users and their carers or some wheelchair users who may have a limb(s) extended
- Where possible any gap (horizontal or vertical) between the lift car and the floor should be minimised or removed completely to avoid it becoming a trip hazard for users
- It is vital that there is a regular (monthly) and effective maintenance programme to check these gaps (to be confirmed by PRASA).
- Minimum usable door widths must be 915mm
- Where wall mirrors are installed, fit above the handrail only; care should be taken to avoid creating optical confusion for users with impaired vision

- Where glass is used it must be safety glass, but in general it is better to have internal walls with non-reflective, matt finish
- All lift cars must have handrails on at least two of the walls, especially the non-opening sides of the car
- Handrails must be provided around the sides of the lift at a height of 850 mm to 1000 mm
- A clear tonal and colour contrast between the flooring and the walls will assist many people with sight impairments
- Ideally a tip up seat should be provided in lift cars where the dimensions are generous
- Lift controls must be located at between 900 mm and 1200 mm from ground level

Design Notes

- The vertical and horizontal gap between the lift car and the floor must not exceed 6 mm for the vertical & 15 mm for the horizontal gap
- Each car should be equipped with a self-levelling feature that will automatically bring the car to floor landings within this tolerance under all loading conditions
- CCTV cameras must be provided in all lifts for safety reasons of lift

A. Type of lift OFFICE BLOCK ONLY Minimum dimension: 1100 mm wide x 1400 mm deep Accessibility level: Lift car accommodates one wheel chair user and one accompanying person
B. Type of lift ALL STATION ENVIRONMENTS IN THE PASSENGER INTERFACE Minimum dimension: 2000 mm wide x 1400 mm deep Accessibility level: Lift car accommodates one wheel chair user and several other passengers. It also allows for a wheel chair to be rotated

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 1.5 Lifts

5.7.3 Lifts - Door delay and door protective / re-opening device

Purpose

Some people, especially people with ambulant disabilities, sometimes require more time to enter the lift than provided. For this reason there needs to be a re-opening mechanism

Key Points

- The door leading edge must have an additional contact, which operates without causing a large force on any obstruction, which could otherwise cause a person with mobility impairments to be pushed and fall
- Doors must be provided with a re-opening mechanism that will stop and re-open a lift car door automatically if the door becomes obstructed by an object or person
- Doors must open and close automatically

Design Notes

- The minimum time for lift doors to remain fully open in response to a car call should be 5 seconds
- The control system should allow for the door dwell time to be adjusted up to 20 seconds: the means of adjustment should not be accessible to users
- The re-opening device should be photo-eye or infra-red not pressure sensitive door edges

- The sensors should be provided at heights of 125 mm, eg assistance animal, and between 700 mm and 800 mm, e.g. person, from the floor
- Door re-opening devices should remain effective for at least 20 seconds

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 1.5 Lifts

5.7.4 Lifts - Buttons and controls

Purpose

Buttons and controls allow a person to call a lift and instruct its direction of movement

Key Points

- Controls should be simple and intuitive to operate
- Control panels should be on the flank wall of the lift car rather than the front wall
- The control panel should be located on the right hand side when entering the lift car. With side opening doors, it should be on the closing side
- There should be no fittings or objects between the control panel and the floor
- Buttons should allow for operation by an elbow, fist or palm of a hand
- Buttons should have a positive action, i.e. not be touch sensitive
- There should be a confirmation to any request, i.e. an audible sound and illumination
- A light and audible sound need to be emitted when the emergency button is pressed to inform the passenger(s) that a signal has been sent because of the emergency situation

Design Notes

- Control buttons used to call a lift should be positioned between 900 mm and 1200 mm above the floor level
- Emergency buttons should be placed at the bottom of the control panel, not less than 890 to 900 mm above the floor
- Two way voice communication should be at a height of 1200 to 1220 mm
- Buttons should not be positioned closer than 400 mm to an internal corner or other obstruction
- The buttons should be a minimum of 10 mm apart and be large, protrude slightly from the wall, and contrast in tone and colour with the backing panel
- Embossed markings and Braille (15 mm in size) should be used to identify each button
- The force needed to press the buttons should be between 2.5 N and 5 N

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 1.5 Lifts

5.7.5 Lifts - Audible and visual indicators

Purpose

It is important for people with visual impairments to be informed of the positioning and arrival of the lifts. Visual indicators are required for people with hearing impairments

Key Points

- Controls should be simple and intuitive to operate
- Control panels should be on the flank wall of the lift car rather than the front wall
- The control panel should be located on the right hand side when entering the lift car. With side opening doors, it should be on the closing side
- There should be no fittings or objects between the control panel and the floor
- Buttons should allow for operation by an elbow, fist or palm of a hand
- Buttons should have a positive action, i.e. not be touch sensitive
- There should be a confirmation to any request, i.e. an audible sound and illumination
- A light and audible sound need to be emitted when the emergency button is pressed to inform the passenger(s) that a signal has been sent because of the emergency situation

Design Notes

- Control buttons used to call a lift should be positioned between 900 mm and 1200 mm above the floor level
- Emergency buttons should be placed at the bottom of the control panel, not less than 890 to 900 mm above the floor
- Two way voice communication should be at a height of 1200 to 1220 mm
- Buttons should not be positioned closer than 400 mm to an internal corner or other obstruction
- The buttons should be a minimum of 10 mm apart and be large, protrude slightly from the wall, and contrast in tone and colour with the backing panel
- Embossed markings and Braille (15 mm in size) should be used to identify each button
- The force needed to press the buttons should be between 2.5 N and 5 N

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 1.5 Lifts

5.7.6 Escalators

Purpose

Escalators transport people vertically without the need for them to walk nor wait for a lift

Key Points

- People using wheelchairs or with guide dogs should not use escalators
- Stairs, and preferably a lift, should always be provided as an alternative to an escalator
- The first two to four steps at either end of the escalator should be flat, like a moving walkway, to give passengers extra time to orient themselves when boarding, and more level time to maintain balance when exiting

Design Notes

- For the purpose of design and assessment for escalators, should refer to SANS 21 and SANS 1543 respectively.
- Where through floor lifts are required refer to SANS 1545-4
- For rises above 6 m, the angle of inclination of an escalator shall not exceed 30°
- For rises below 6 m, the angle of inclination may be increased to 35° but with rated speed limited to 0. /s
- Balustrades must be installed on each side of the escalator
- A handrail shall be provided on top of the balustrade which moves at the same speed as the escalator stairs
- Handrails should extend at least 300 mm beyond the entry and exit to the escalator

- The handrail shall be between 0.9 m and 1.1 m above the escalator tread
- Minimum width of 580 mm and maximum 1100 mm, preferably 1000mm, for inclination angles exceeding 6°.
- Maximum height of risers 240 mm or 210 mm escalator is to be used as an emergency ex stationary (minimum 127 mm)
- Treads shall not exceed 0.38 m and may not be less than 0.25 m
- Steps should be capable of carry an uniformly distributed load of 6000 N/m2 without deforming to the extent that
- Steps at the end of an escalator are required to move horizontally for a minimum of 2000mm and 1600 mm at the top and bottom respectively with a max vertical difference in height of 4 mm between consecutive steps
- Escalator “steps” should be slip-resistant and non-reflective
- 900 mm colour contrasted strip should be provided at the entry and exit to the escalator
- Approaches to and from the entry and exit to the escalator should be a minimum of 1200 mm
- Audible warnings should be given at the entry and just before the exit to the escalator for people with visual impairments
- A minimum height clearance of 2300 mm should be provided along the full length of the escalator / moving walkway
- 0.5 m/s ≤ speed ≤ 0.75 m/s, see table 5 – 2 below
- Braking of the system shall occur automatically in the event of power failure
- Emergency stop buttons must be provided at conspicuous and easily accessible positions at the escalator landings
- For escalators with a rise in excess of 12 m additional stop devices shall be provided with a minimum distance of 15 m between devices
- Sufficient expansion area is to be provided at the escalator exit point to avoid congestion with adjacent pedestrian circulation areas

Table 5 – 2: Escalator speed

Normal Width (m)	**Rated Speed (m/s)**		
	0.5	**0.65**	**0.75**
0.6 m	4500 pax/h	5850 pax/h	6750 pax/h
0.8 m	6750 pax/h	8775 pax/h	10125 pax/h
1.0 m	9000 pax/h	11700 pax/h	13500 pax/h

Assuming:
- 1 pax at a nominal width of 0.6 m
- 1.5 pax at a nominal width of 0.8 m
- 2 pax at a nominal width of 1.0 m

References

SANS 10400 Part S
SANS 1545 – 4 Safety Rules for the construction and installation of Lifts Part 4. Lifts for persons with disabilities (Vertical lifting platforms)

5.8 Ablutions

5.8.1 Ablution Facilities - Toilets

Purpose

Toilets/Ablution facilities should be provided for all users, i.e. both male and female, and unisex facilities shall be provided for people with disabilities, etc.

Key Points

- Disabled ablution facilities to be provided at all stations except for Halt stations
- Baby change facilities to be provided at Core and Super Core stations

Design Notes

- All exterior walls to be 220 mm brickwork, all interior walls to be 2.1 m high 110 mm brick walls (lintel tied on top and bottom), dry walling or enamelled panel type
- Toilets shall be vandal resistant or as advised by the Project Manager, no stainless steel units are allowed. Metered self-flushing units to be installed where possible and or concealed vandal resistant push button flush valves
- Urinals shall be vandal resistant or as advised by the Project Manager, no stainless steel units are allowed. Metered self-flushing units to be installed where possible and or concealed vandal resistant push button flush valves
- Wash basins shall be of the sloped granite type which is preferred. Vandal resistant WHB`s may be installed where sloped units are not ideal, no stainless steel units are allowed. Metered self-flushing units to be installed where possible and or concealed vandal resistant push button flush valves. Only cold water taps to be provided
- Paper towel dispensers shall be provided
- Mirrors shall be of polished stainless steel and with a minimum 500 mm x 500 mm in dimension above wash hand basins
- Doors must have a minimum 800 mm usable width and a height of 2.1 m and shall be lockable. Doors to water closets must be 300 mm minimum clear of the floor
- Floors to be durable for 20 years of life washable by hose and brush and shall be chemical resistant. Allowance is to be made for rapid drainage with an easy cleanable “filter” type (fat trap) to catch coarse materials
- Windows shall be provided in accordance with statutory requirements and extractor fans must be provided
- Windows must be burglar proofed
- Rust resistant fittings to be used throughout
- One soap dispenser shall be provided for every three wash basins
- A mixture of left and right handed accessible WC facilities should be provided where possible
- Accessible facilities should be provided in a separate unisex facility to allow for those users getting assistance from the opposite sex
- Accessible facilities in the men’s and women’s facilities respectively can be provided in addition to the above provision
- Fittings such as vending machines, sanitary disposal units and waste paper bins should be recessed where possible so as not to obstruct people flow or manoeuvrability.
- The boxing in of pipes must be considered so as not to compromise manoeuvre space and difficult access for maintenance purposes
- All facilities should display adequate tonal contrast between the floor, wall, fittings, etc.
- People with disabilities should have to travel no further to an accessible WC than any other person.
- When upgrading a existing ablution facility, the design must take the status of the ablution accessories into consideration, as well as the vandalism nature of the area.
- The ease of cleaning and maintenance have high priority

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART A, Space Utilisation. 1.1, Spatial Parameters Document: 2. Station Management office and administration 2.1.10
ANNEXURE A Blue Print, PART A, Space Utilisation. 1.1, Spatial Parameters Document: 2. Station Management office and administration 2.3.10
ANNEXURE A Blue Print, PART A, Space Utilisation. 1.1, Spatial Parameters Document: 2. Station Management office and administration 2.4.3
ANNEXURE A Blue Print, PART A, Space Utilisation. 1.1, Spatial Parameters Document: 2. Station Management office and administration 2.5.8
ANNEXURE A Blue Print, PART A, Space Utilisation. 1.1, Spatial Parameters Document: 2. Station Management office and administration 2.6
ANNEXURE A Blue Print, PART A, Space Utilisation. 1.1, Spatial Parameters Document's. Site design and Intermodal requirements 3.1.17
ANNEXURE A Blue Print, PART B, Specification list, 2.4 General List of Sanitary fittings and specifications, T01 -T21, U01 - U09, V01 - V32, W01 - W15, X01 - X12, Z01 - Z04

5.8.2 Ablutions Facilities - Accessible toilets

Purpose

The layout of the toilet facility should allow for its use by people with differing abilities

Key Points

- The dimensions of the ablution facilities and exact location and orientation of grab bars are critical, especially those of accessible facilities
- Locking arrangements which require a pinching and / or twisting movement should be avoided

Design Notes

- The cubicle locking arrangement can be a large revolving handle, that can be operated without gripping
- The size of an accessible cubicle shall be at least 1800 mm x 1800 mm, clear of all surfaces finishes, with a door that shall open outwards or a sliding door. • An sliding door is preferred
- An inward opening door can be provided where there is at least a 1200 mm internal diameter clear of all fittings, fixtures and the line of the door swing.

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART C, Drawings, sketches and details 3.1, Generic details drawings, 650 A to 650 H
ANNEXURE A Blue Print, PART B, Specification list, 2.4 General List of Sanitary fittings and specifications, T04, T05, T06, T07, T15 and T16, V12 and V13 -T21, W04, W05, W06, W07, W13, W14 and W15, Z01 to Z04

5.8.3 Ablutions Facilities - Provision for guide dogs

Purpose

It is important that all stations provide an area, preferably outdoors, for guide dogs to relieve themselves

Key Points

- An area must be provided close to station buildings with a step-free access route
- This area must be linked to the accessible footpath / walkway network

5.9 Lighting

Lighting - General

Purpose

Good lighting is important from several points of view: personal security, safety, as well as the ability to see signs and instructions. Bright, well-lit premises will encourage the use of public transport and lighting that eliminates dark areas or corners will give a greater feeling of security to passengers. Good light levels are particularly important in potentially hazardous areas such as stairwells or changes in level along a route.

People with visual impairments require clarity from a lighting system. Reflections, glare, shadows and large variations in lighting levels, i.e. pools of light and dark requiring swift reactions from the eye, generate visual confusion and, in some cases, discomfort.

Lighting within the station should enable a gentle transition the exterior and interior. The correct level of luminance is required to allow a person to see. This minimum acceptable luminance level depends on the tasks to be performed in the respective areas

Key Points

- Wherever possible, buildings should be designed to make maximum use of natural lighting, though care must be taken to minimize glare and strong reflections off surfaces
- Avoid positioning service desks in front of windows where bright sunshine will cause the user's face to be in a shadow and hence difficult to lip-reading
- Similarly, avoid confusing backgrounds such as strong patterns, maps, etc.
- Reflections can be minimized with the careful use of non-reflective finishes on internal surfaces
- Glare can be reduced by the thoughtful positioning of lights out of the line of vision - uplighters placed above a standing person's eye level can deliver a comfortable, glare- free illumination
- Strobe light effect, irregular flashes of light, should be avoided as these may cause problems for people with epilepsy
- In any outdoor installation, light sources are seen against a strongly contrasting background of a dark sky and the glare resulting from this excessive contrast of luminance in the field of view may cause mild discomfort and/or impairment of the ability to see
- Appropriate light distribution, aiming of luminaires and mounting height are important in restricting glare and particular care should be taken in avoiding glare to train drivers approaching the station
- Glare from daylight can be reduced with adjustable blinds on windows
- Shadows can be avoided by increasing the level of ambient light and ensuring spotlights are not used on their own
- Passive infrared sensors can be used to detect dim light and activate booster lighting
- Feature lighting, such as down lighters should be located where they will not cause shadows to fall across people's faces, making lip reading difficult
- White artificial light is more effective than yellow artificial light in terms of its colour rendering properties and to create true colour appearance
- Any change in lighting levels should be gradual
- Key considerations for lighting designs: Energy efficiency, economic viability & low maintenance, easily accessible installations

Design Notes

- The maximum glare rating as stated in SANS should be complied to with and only luminaires that can achieve these ratings should be used
- The optimal lighting design solutions to achieve the optical and mechanical illumination to be provided
- Intelligent and sustainable lighting solution to be implemented to reduce energy consumption
- Sustainable LED solution luminaires to be utilised

References

SANS 10114 – 1
SANS 10389 – 1
SANS 10098
SANS 10499 - O

ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 1.7 Platform design parameters and accommodation, 1.1.15
ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 3.1 Station site and Intermodal requirements, 3.13, 3.1.18
ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 4.2 Lighting, 4.2.1,
ANNEXURE A Blue Print, PART B, Specification list, 2.3 General List of Lighting specifications, L01 to L19
ANNEXURE A Blue Print, PART B, Specification list, 2.3a General List of Lighting specifications, Lu01 - Lu28

5.9.2 Lighting - Location

Key Points

- See the various luminaire fittings to be utilized and installed per specific areas required and ensure the relevant lux levels to be complied as stated in the Blue print. Refer to Reference as shown below
- It should be noted that these are merely guidelines aimed at achieving at least some level of standardization between station lighting designers in the application of lamps, luminaires and mounting methods.
- A suitably qualified lighting designer should be appointed as a member of the station design team who shall decide which lighting configurations should be used and where they should be located.
- Planning to meet the lighting design objectives and aesthetic appeal should involve close liaison with architects and other service providers such as air conditioning, fire protection, etc. to ensure accommodation of luminaires and supply systems within the space available for use by providers of all building services.
- Luminaires for the lighting of interiors should be mounted on the roof structure, ceiling or walls of buildings with easy access for maintenance purposes.
- Luminaires in exterior areas shall be mounted on free standing masts of various heights, on hinged masts mounted on traction structures or on the exterior façade or structural components of buildings.
- The choice of mounting height depends on the relative importance of various factors such as the visual task, the restriction of glare, the importance of minimizing obstructions, safety hazard, vandalism, installation costs, cost of the maintenance and any local site limitations and requirements.
- Vandal resistant luminaires to be installed if within reach of possible damage

Design Notes

- Lighting designers should adhere to SANS 10389-1:2003

- Clearance between lighting structures and high voltage traction equipment once mounted and during installation, must meet requirements of safety instructions: High Voltage Electrical Equipment, as issued by Transnet

References

SANS 10389 - 1

ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 1.7 Platform design parameters and accommodation, 1.1.15
ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 4.2 Lighting, 4.2.1,
ANNEXURE A Blue Print, PART B, Specification list, 2.3 General List of Lighting specifications, L01 to L19
ANNEXURE A Blue Print, PART B, Specification list, 2.3a General List of Lighting specifications, Lu01 - Lu28

5.9.3 Lighting - Emergency

Purpose

The purpose of emergency lighting is to provide sufficient illumination to enable persons to identify an escape route leading to an exit from the station in the event of an interruption to the power supply.

Key Points

- Determination of the necessity for emergency lighting and the method used will depend on the following;
  - reliability of power supply
  - consequences of a power failure
  - the prevailing site conditions
  - An alternative power source to that of normal lighting is required for emergency lighting, namely;
  - a central generator system
  - a central battery system
  - self-contained single point luminaire

- The choice of centralized vs self-contained power source will depend largely on the available infrastructure on the station which will usually be related to the size of the station. It may be generally accepted, that centralized power will only be available on larger stations.
- For most stations therefore, emergency lighting will occur in the form of self-contained luminaires. These luminaires should be strategically place along all walkways from the boarding platform area to the escape exit, and which should provide illumination for the emergency exit sign.
- Alternatively, the sign should be a lens on a light box with self-contained emergency power supply.
- The emergency light should be positioned so as to provide an escape route linking all areas of the station where major activities occur.

Design Notes

- Lighting designer should ensure layout compliance with SANS 10114-2:2002 Interior lighting part 2: Emergency lighting(there is no equivalent standard for exterior areas)

References

SANS 10400 Part S

5.9.4 Lighting - Masts

Purpose

- Lighting masts also referred to as poles or columns are required to support luminaires safely and securely

Key Points

- Masts are classified as following;
  - High masts- >25 m
  - Medium masts- 10 to 15 m
  - Low masts- <10 m

- All low masts may be unhinged whilst medium to high masts must be hinged in order to facilitate maintenance activities.
- In the case of low masts, these may be constructed from concrete, Glass fibre-reinforced Polyester (GRP), galvanized mild steel or 3CR12 depending on the prevailing environment.
- For coastal applications, mild steel may be substituted with 3CR12 and GRP poles.
- The hinged mast shall be constructed to form a continuously tapered, totally enclosed, octagonal shaft.
- The hinge must be made from stainless steel.
- The conventional hinged mast must consist of a lower part and a moving part hinged to the fixed part at approximately half the height of the mast.
- The moving portion shall consist of sections fitted together on site by slip-joints. No welding on site is permitted.
- An alternative to the above is a mast unit which is mounted to the overhead power cable support structures, as is currently in use in the Western Cape region
- The moving part of the mast shall have the floodlight cross-arm mounted on it and must be adequately counterbalanced
- The mast must be lowered and raised with a lightweight, manually operated but robust portable winch that can be stored in the base compartment.
- The winch unit must be securely attached to the fixed lower part of the mast and the winch cable to the movable part
- A spring-loaded gravity ratchet must ensure that when the operating handle is released during the raising and lowering operation, the moving part stops in whatever position it is in
- The ratchet must be fitted with a lever, which must be depressed with a constant pressure during the whole operation of lowering the mast. A round bracket must be welded into the top fixed part of the mast to prevent damage to the trailing cable while lowering or raising the mast
- The luminaires must be permanently connected to the supply cable, to facilitate testing when the mast is in the lowered position. No additional cable or connections are permissible
- The mast must not require any form of power disconnection while being lowered.
- Unhinged masts are used to support either floodlight or post-top type luminaires, whilst hinged type masts carry one or two floodlight type luminaires.
- The design of the mast will depend on the prevailing site conditions.

Design Notes

- Figures 1-5 show typical hinged masts available in standard heights of 10, 15, 18, 20 and 25 m.
- The hot dip galvanized mast must be manufactured from Grade 300 WA steel having a minimum tensile strength of 430 N/mm square with a minimum wall thickness of 4 mm at any point in the mast structure.
- The mast, when fully equipped with the luminaires, must be designed to withstand a wind velocity appropriate to the site condition. During raising and lowering and while in the horizontal position, the mast must withstand the wind forces from any direction as well as its own weight and any internal effects due to sudden stoppage.

- An opening shall be provided in the base of the mast for access to the electrical distribution board. The opening shall only be accessible after the mast lid section has been hinged open. A safety chain must be provided which will ensure safe working conditions while work is being conducted on the distribution board.
- The mast manufactured shall be ISO 9001 2000 certified and the installation of the mast is to be certified by a professional engineer registered with the Engineering Council of South Africa
- As a rough guide, medium masts shall be used in yards of widths of ± 75 m.
- Other types of medium masts also available, i.e. walk down or winch down GRP 8-12 meter poles, may be used but are subject to approval before implementation
- Masts must be engineered to withstand a wind pressure of 500 Pa inclusive of 0.20 m2 luminaire area with less than a 5% deflection of the mounting height. This relates to a wind speed of 103.9 km/h. Any other wind speeds must be calculated separately.

References

SANS 10160

5.9.5 Lighting - Types of Luminaires

Purpose

To create a pleasing environment that is conducive to a sense of well being and contributes towards the safety, security, convenience and comfort of commuters as well as PRASA operations, through the use of standardized components which ensure designed efficiency

Key Points

- The lighting system must function as an integral part of its environment and lighting requirements must be known early in the design process
- Day and night-time functions of lighting equipment should be addressed together and not in isolation
- Illuminance should be adequately uniform
- Increased lighting levels should be provided at high risk areas such as platform edges.
- Lighting should not be located in close proximity to signals and the effects of glare must be avoided in order to avoid confusion by train drivers
- The lighting system should support the following functions;
  - Purchasing of tickets(reading & cash handling)
  - Easy identification of information and warning signage -
- Reading of literature whilst waiting for trains;
  - Reading of tickets at verification points
  - Negotiation of stairs, escalators, footbridges, subways etc.
  - Transient adaptation when entering or leaving the train
  - The use of amenities
  - Location and use of emergency facilities under emergency condition
- Lighting must be provided in optimal quantities and to optimal performance standards so as to promote energy efficiency on stations.
- Safe and easy access to luminaires should be ensured for maintenance purposes

Design Notes

- LED luminaires;
  - LED luminaire lamps last far longer than any other lamps available, they are designed to operate for an average of 35,000 plus hours
  - LEDs are the most energy-efficient way of lighting, they have an 80-90% energy turned into light efficiency
  - LEDs don’t contain any toxic compounds or elements like mercury, being 100% recyclable; and reduces the carbon footprint .

- LEDs are made with very sturdy materials and components that can stand up to harsh weather, shocks, vibrations and abrasion.
- LEDs produce very little infra-red light -
- LEDs are UV and heat friendly with extremely low emissions
- LED light arrays can be placed and combined in an infinite number of ways to produce efficient – but also controllable – illumination.
- LEDs work instantly
- LED lights are bright immediately
- LED lights work on low-voltage power, along with solar energy source they can function in remote areas

• Vandal resistant luminaires;
  - These luminaires are surface mounted. They are used in closed areas such as concourses, under platform shelter and in subways and are not used at heights in excess of 5 m from floor level. The unit should have the option of an emergency battery backup for emergency lighting.

• Open tube luminaires;
  - These luminaires are surface mounted. They are used in closed areas such as store rooms, warehousing, workshops general or canopy lighting. Avoid coastal usage due to accelerated corrosion. LED T* tubes to be used.

• Floodlight luminaires;
  - These luminaires are suitable for exterior lighting such as platforms and parking areas, and may be mast, wall or roof mounted

• Bulkhead luminaires;
  - These luminaires are surface mounted vertically or horizontally and are generally used along
  - walkways such as bridges and subways.

• High bay luminaires;
  - These luminaires are used in indoor, high application such as indoor concourses higher than 6 meters

• Low bay luminaires;
  - These luminaires are used in indoor, high application such as indoor concourses lower than 6 meters

• Down lighter luminaires;
  - These luminaires are for indoor use, in areas where localized lighting is required, such as above work surface such as ticket counters.

• Post top luminaires;
  - These luminaires are used in outdoor applications for the illumination of walkways including pedestrian bridges and parking areas.

References

SANS 10400 Part S

ANNEXURE A Blue Print, PART B, Specification list, 2.3 General List of Lighting specifications, L01 to L19
ANNEXURE A Blue Print, PART B, Specification list, 2.3a General List of Lighting specifications, Lu01 - Lu28

5.9.6 Lighting - Photo Electric switches

Purpose

Photo controls or Photo Electric Control Units (PECUs) are light responsive switches that can be paired with traditional lighting solutions to provide automatic illumination during periods of relative darkness

Key Points

- The use of a photo-electric control unit in conjunction with contactors is recommended for automatic switching at dusk and dawn of exterior lighting of certain interior and undercover locations
- Photo-electric control switches must be protected against mechanical and wilful damage and be positioned where they will not receive illumination from artificial lighting systems, but be accessible for maintenance and repair purposes.
- They should not be mounted inside enclosed luminaires as the dirty lenses may affect the operation of the photo cell.
- The correct operation of a photo-electronic control unit ensures optimum utilization of electrical energy. It is therefore essential to monitor the unit after installation to detect any abnormalities, secured facilities for manual overriding of automatic switching system must be provided in substations, control room, signal cars or other suitable locations.
- A time switch is a clock controlled switching device which may have one or more cycles in 24 hours. The use of time switches is not normally recommended as the principle of operation does not match that of a photoelectric control unit from an energy efficiency viewpoint as they do not automatically compensate for seasonal change in the time of sunrise and sunset.
- Time switches, if used, should be of the type that the real time and time setting are not affected by power disruptions.
- 100 to 300 Watt units should have the options of a timed power switch. This may be used provided the required lux levels are met for the applicable time in the operational cycle in the operational cycle in accordance with SANS 10389-1:2003.

Design Notes

- All photo-electric cells must comply with SANS regulations

References

SANS 1777:2004

5.9.7 Lighting - Energy Efficiency

Purpose

Energy efficient lighting saves the electricity while maintaining good quality and quantity of the light. Energy efficient lighting involves in replacement (or re-lamping) of traditional lamps (such as incandescent lamps, vapour lamps) with that of energy efficient such as LED lamps

Key Points

- The luminous efficiency of the selected light source i.e. Lumens per watt
- Lumens measure how much light you are getting from a bulb. More lumens means it's a brighter light; fewer lumens means it's a dimmer light.
- The efficiency of the optics of the luminaire that is defined by the light output ratio. The ratio is the lumens emitted by the luminaire divided by the lumens emitted by the lamp and the distribution of the lumens in the relevant directions.
- The efficiency of the driver that minimizes the circuit (watt) losses and drives the lamp at full power.

- The operational management of the control switches.
- Lumens let you buy the amount of light you want

References

SANS 1777:2004

5.10 Platforms

5.10.1 Platforms - General

Purpose

The platform is a section of pathway, alongside rail tracks at a railway station, at which passengers board or alight from trains. All platforms must be level a level entrance into the train off the platform all new platforms should be constructed to allow for this intention.

Key Points

- Passenger platforms should be built on a straight section of track so that the horizontal gap between the platform and the train is minimised
- If platforms are built on a curve, the smallest radius of curvature should be 600 m, and if possible, at least part of the platform should be on a straight section of track
- Drainage gullies should if possible be avoided on platforms as they can cause problems for people using wheelchairs
- All cabling and conduits must be fitted in the roof structure wherever possible NOT in the platform surface to maintain an obstacle free surface
- All platform furniture should be placed within a specific zone, to enable passenger flow and to provide an unobstructed accessible path of travel

Design Notes

- The width of platform is influenced by the maximum number of passengers using it at any one time, but should have a minimum of 2000 mm clear space in addition to the width of the safety zone(s) and a further 1000mm for service traffic
- An area 1200 mm from the platform edge is considered to be unsafe for commuter use except when embarking and disembarking the train
- PRASA to include guidelines re platform heights and develop guidelines
- Bridging the gap (between platform and train) during the rolling stock recapitalisation implementation period. - Prasa Tech• The horizontal distance from the edge of the platform to main buildings shall be 8 m and all other structures 3 m (updated from Perway standards for the design of new infrastructure)
- Any equipment such as vending machines should be placed clear of the unobstructed space along the platform and should have a contrasting colour and tone
- Columns and other projections into the passenger circulation area should be avoided if at all possible; if not possible they should be highlighted using contrasting colour/tone
- Back to back, benches are provided throughout areas under shelter. The benches shall be comfortable to sit on, yet uncomfortable to sleep upon
- Shelters shall provide ground cover of at least 30% of the maximum volume of commuters per 5 min peak (PRASA to confirm criteria to be used and the target year for the 5 min peak demand volume, including requirement for shelter roofs to extend to platform edges and screens to be installed at all coastal and windy regions)
- Materials for the benches shall be corrosion resistant, fire proof and must be fixed so as to be theft and vandal proof
- No benches must be provided apart from those in the shelters
- The floor is to be finished with concrete coping and slurry
- All unexpected gradients or steps shall be properly marked to warn commuter of the danger
- Refer to drawings in terms of platform shelter length relating to 50 m and 100

References

ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 1.7 Platform design parameters and accommodation, 1.1.15
ANNEXURE A Blue Print, PART C, Sketches and details 3.1, Generic Details, dwg no 600-A to 600-P

5.10.2 Platforms - Platform Edge Warning

Purpose

Warnings must be provided to passengers that the front of the platform is being approached. Warnings must be provided to passengers that an open back or end of a platform is being approached. Warnings should also be provided to show the safe distance from the platform edge to wait, especially on platforms where express trains do not stop

Key Points

PRASA to reassess guidelines for the rear & end treatment of platforms, especially as it relates to emergency evacuation, including persons with disabilities, as well as fare evasion / access control

- Where the end or rear of the rail platform is open rails or fencing must be provided, with a raised kerb or kicking board
- The raised kerb can be used as a tapping rail by long cane users
- Front platform edge warnings should be provided along the full length of the platform

References

ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 1.7 Platform design parameters and accommodation, 1.1.15
ANNEXURE A Blue Print, PART C, Sketches and details 3.1, Generic Details, dwg no 600-A to 600-P

5.11 Perimeter Protection

5.11.1 Perimeter Protection - Fencing / Walling General

Purpose

Fencing / walling is aimed at establishing a physical boundary to certain defined risk areas for the purpose of controlling access to these areas in order to ensure public safety, protection of PRASA assets and to curb fare evasion. It outlines areas and barriers requiring fencing within the station precinct

Key Points

- The fencing / walling system/ layout must function as an integral part of its environment, i.e. the use of architecture and natural barriers to compliment fencing is most cost effective.
- Fencing / walling requirements should be acknowledged as early in the design process as possible in order to effectively achieve the above
- Fencing / walling should be erected to keep passengers and the public from accessing areas which pose a risk to their health and safety or which may be life threatening such as, railway tracks, overhead traction equipment, power distribution points and / or substations, vertical drops/ embankments
- Fencing /walling is to be used to secure the boundaries of the restricted area limiting access to via the ticket control points only
- Fencing / walling should be used to protect PRASA assets from vandalism and theft. This could include such functions as cash in transit (although this should be designed as a functional system in accordance with the station facility layout)
- Fencing /walling should be used to establish clear boundaries to the station property where functional areas such as staff parking or storage yards require protection
- The boundaries of the rail reserve must be continuously fenced / walled on either side.

- Station fencing / walling will extend to form part of the rail reserve fencing up to a distance of 300 m from either ends of the train boarding platforms.
- The station facility may be seen as an integral part of the rail reserve fence, except that it provides access to the train boarding platforms by passengers.
- A gate is to be provided allowing vehicle access to the Perway for maintenance and emergency purposes
- The boundaries of the station property site are not generally fenced, unless dead space has been put to functional use such as a staff parking area, which will require a secure boundary
- The restricted areas of all stations must be secured with fencing or walling so as to curb fare evasion. In many instances this is achieved by using the station building design to form a solid barrier
- The controlled area is generally open to the public during working/ operation hours but should be fenced or walled such that it may be locked up during non-working hours

PRASA PROTECTION SERVICES TO BE CONSULTED FOR ANY CURRENT RISK RATING OF A STATION AND PRECINCT BEFORE ANY DESIGN AND DECISION IS AGREED UPON ON THE TYPE OF FENCING AND OR WALLING TO BE INSTALLED

Design Notes

- Types of fences should be implemented in accordance with prevailing levels of risk in an area. These risk areas are categorized as shown in **Table 5 -3** below and **Table 5 – 7,** or as per the direct assessment by PROTECTION SERVICES

Table 5 – 3: Risk Areas

Risk Category	Risk Area
High Risk	Informal settlement, Schools and Stations, Sport and Recreation
Medium Risk	Industrial, Formal settlement
Low Risk	Urban, Sub-urban and Rural

- It should be noted that the risk areas referred to above are only guidelines
- For the purpose of this document, all stations must be considered high risk areas
- Fencing / walling should be provided with adequate gates for vehicles and pedestrians respectively for the provision of maintenance and/ or emergency services.
- These gates must be secured by means of padlocks and thus require a key management system.
- For maintenance access to Perway and other stations facilities it is best that a universal key is used per maintenance service area/ line or corridor in a region
- Keys for pedestrians and emergency access should be held by the station manager.
- The following tables, **Table 5 – 4, 5 – 5 and Table 5 - 6** indicate where fenced boundaries as well as gates are required between the station operational areas

Table 5 – 4: Fencing Barriers required between station areas

Station Areas	Rail Reserve	Boarding Platform	Restricted area	Controlled area	Station Property
Public Area					
Station Property					
Controlled Area					
Restricted Area					
Boarding Platform					

Table 5 – 5: Lockable Gates required between station areas

Station Areas	Rail Reserve	Boarding Platform	Restricted Area	Controlled Area	Station Property
Public Area	**M**				
Station Property			**P**	**P**	
Controlled Area			**P**		
Restricted Area					
Boarding Platform					

M = Motor Vehicle access
P = Pedestrian access

Table 5 – 6: Free movement required between station areas

Station Areas	Rail Reserve	Boarding Platform	Restricted Area	Controlled Area	Station Property	Public Area (across track)
Public Area						
Station Property						
Controlled Area						
Restricted Area						
Boarding Platform						
Rail Reserve						

References

ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 3 Site design and Intermodal facilities , 3.1.1
ANNEXURE A Blue Print, PART B, General list of Finishes and Specifications 2.2, N01 to N05

5.11.2 Perimeter Protection - Risk Areas

Purpose

A type of fence should be implemented in accordance with the prevailing level of risk in an area. Refer to Table 5 - 3

Key Points

- Type of fence per risk area as per **Table 5 – 7** on the following page

Table 5 – 7: Type of fence

Risk Category	Type of Fence
High Risk areas PRASA Protection Services to be consulted for type of walling to be installed	• Solid Concrete Wall – 4000 mm height above ground level and 600 mm below natural ground level. . • Reinforced precast concrete slab wall – 4000 mm height above ground level and 600 mm below natural ground level. Optional: - Razor mesh panels 600 mm high or - Shark tooth spike rails or
Medium Risk areas PRASA Protection Services to be consulted for type of walling to be installed	• Reinforced precast concrete slab wall – 4000 mm height above ground level and 600 mm below natural ground level. • High density reinforced steel mesh fencing, min height above ground 3000mm with Anti burrow option from 300 mm to 600 mm below natural ground level Illegal walkways over rail lines between stations Optional: - Razor mesh panels 600 mm high or - Shark tooth spike rails or - 100 mm Castle type spike rails can be installed on top
Low Risk areas PRASA Protection Services to be consulted for type of walling to be installed	• Face brick Brick wall, 3000mm above ground level • High density reinforced steel mesh fencing, min height above ground 3000mm with Anti burrow option from 300 mm to 600 mm below natural ground level Illegal walkways over rail lines between stations Optional: - Razor mesh panels 600 mm high or - Shark tooth spike rails or - 100 mm Castle type spike rails can be installed on top of wall

References

ANNEXURE A Blue Print, PART A, Space Utilisation 1.1, Spatial Parameters Document, 3 Site design and Intermodal facilities , 3.1.1
ANNEXURE A Blue Print, PART B, General list of Finishes and Specifications 2.2, N01 to N05

5. 12 Station Furniture

5.12.1 Station Furniture - General

Purpose

Indoor and outdoor station furniture are part of the urban environment and include such items as lighting, bollards, poles and seating. Poorly placed station furniture can easily become an obstruction or even a hazard to pedestrians and should therefore be carefully placed and / or signed to make pedestrians aware of such an obstruction

Key Points

- It is essential, taking account of heritage issues, to consider both the position of any furniture and the means of making it apparent to people who are blind or partially sighted
- It helps visually impaired people if, within an area, the positioning of posts etc. is consistent and away from general lines of movement
- Posts, poles, bollards etc. should be positioned to leave at least the minimum required clear walkway widths
- Lamps (and signs) should be mounted on walls or buildings whenever possible; if not, then placing them at the back of the walkway as near the building line as possible is acceptable
- Tapering obstructions, i.e. narrowing of pedestrian flow, are usually inside buildings, but can also be found in the outside environment, for example where there is a pedestrian bridge over rail tracks
- In some circumstances (where there is sufficient space) protection can be given by a warning surface that extends out

Design Notes

- A reaction distance of 1500 mm should be allowed for pedestrians to an obstruction as they take time to come to a halt
- If furniture is placed near the building line the maximum distance from the building line to the outer edge of the object should be 275 mm
- Station furniture shall not be placed within the accessible path of travel, but within its own ‘street furniture’ zone

References

ANNEXURE A Blue Print, PART B, General IIst of Finishes and Specifications 2.2, M03 to M09
ANNEXURE A Blue Print, PART C, Sketches and details 3.1, Generic Details, dwg no 608-A and 608-B

5.12.2 Station Furniture - Seating

Purpose

Seating should be provided at regular intervals along pedestrian routes to allow resting points for persons with walking difficulties such as the elderly as well as anywhere where people may have to wait, e.g. platforms, information areas, etc.

Key Points

- Seating should always be offered in a range of heights, both with, and without, armrests
- Seating should be comfortable to sit on, yet uncomfortable to sleep on
- All seating should be stable and fixed so as to be theft and vandal proof
- Backrests should always be provided
- Priority seating for the elderly and people with disabilities should be clearly identified
- Adequate space for users of wheelchairs to pull up alongside seated colleagues should be provided

Design Notes

- Typical designs for seating to be used in stations
- Material shall be corrosion resistant and fire proof
- Typical seats should be offered in a range of heights between 400 mm and 500 mm from floor level to seat level
- Armrests should be positioned 180 mm above the seat level
- Armrests should be designed to take a force of 100 N along their length
- Fold-up seats should have a height of 500 mm ± 20 mm from floor level to seat level
- Fold-up seats should have a depth of between 300 mm and 400 mm and a width of between 400 and 500 mm
- Fold-up seats should be able to support a mass of 100 kg
- Perching seats should be between 650 mm and 700 mm from floor level to seat level
- Perching seats should have a minimum depth of 300 mm
- Recommended minimum number of wheelchair spaces in public places with fixed seating, see **Table 5 – 8**

Table 5 – 8: Wheelchair spaces

Number of fixed seats	Number of Wheelchair spaces
4 to 25	1
26 to 50	2
51 and more	4
or the greater of 2% or 5% of capacity	

References

ANNEXURE A Blue Print, PART B, General llst of Finishes and Specifications 2.2, M03 to M09
ANNEXURE A Blue Print, PART C, Sketches and details 3.1, Generic Details, dwg no 608-A and 608-B

5.12.3 Station Furniture - Tables

Purpose

Tables provide a surface on which people can place objects, write, etc.

Key Points

- Where tables are provided they should also be suitable for use by people using wheelchairs
- Colour contrasted seating and tables will assist people with visual impairments, as will a contrast with wall and floor

Design Notes

- Seating used at tables must either be loose, or sufficient space for a wheelchair/pushchair must be provided
- Table knee heights should be a minimum of 720 mm above floor level
- The tops of tables to be used by wheelchair users should be between 750 mm and 800 mm above floor level
- Table tops should be a minimum of 600 mm x 500 mm
- Gangways between tables should be a minimum of 1300 mm wide to allow for the passage of people using wheel chairs or with assistance dogs, though a narrower width of 900 mm may be acceptable in circumstances where space is very limited

References

SANS 10400 - S

5.12.4 Station Furniture - Waste Bins

Purpose

Waste bins provide a place for people to place their litter for later disposal by others

Key Points

- Bins shall not be positioned in the walkways or in areas where they could pose as a health hazard
- Waste bins should be colour and tonally contrasted to their surroundings
-

Design Notes

- Waste bins should be of a rounded design, approximately 1300 mm in height and should continue down or close to ground level The bin opening should be approximately 1000mm above ground level (postage type)
- Bins shall have a minimum volume of 50 L
- Bins must be theft proof and washable by hand, corrosion proof and fire proof

References

ANNEXURE A Blue Print, PART B, General list of Finishes and Specifications 2.2, M03 to M09

5.12.5 Station Furniture - Pole Supports

Purpose

Poles are used to support items such as signs, light fittings, information displays and so forth.

Key Points

- Under no circumstances should adjacent poles be linked with chain or rope as this is a hazard for people who are blind or partially sighted
- Colour contrasted and reflective bands on poles will help partially sighted people, but the choice of colour for the overall post or bollard also affects visibility

Design Notes

- Unless grouped, there should be a minimum clear width of 1000mm between adjacent poles / objects
- Poles should be marked by a coloured band, 140 mm to 160 mm wide with the lower edge at 1400 mm to 1500 mm
- An additional lower band is also required to mark them as a hazard
- Signage poles should include a tapping rail between supporting posts to aid identification of the hazard by long cane users

References

ANNEXURE A Blue Print, PART B, General list of Finishes and Specifications 2.2, M03 to M09

5.12.6 Station Furniture - Bollards

Purpose

Bollards are used to mark the edge of a path or a road or to block vehicular access to an area

Key Points

- Under no circumstances should adjacent bollards be linked with chain or rope as this is a hazard for people who are blind or partially sighted
- Bollards and poles should contrast with their surroundings so as to make them more visible
- The incorporation of a light at the top of bollards is also an effective way of making them more visible

Design Notes

- Bollards are recommended to be at least 1000mm in height
- Colour contrasted and reflective bands (140 mm to 160 mm wide) on poles and colour contrast on the tops of bollards will help partially sighted people
- Unless grouped, there should be a minimum clear width of 1000mm between adjacent bollards / poles / objects, 900 mm may be acceptable in circumstances where space is very limited
- Bollards should be rounded at the top to prevent injury and also include banding near the top so that they can be seen during daylight and night time hours

References

ANNEXURE A Blue Print, PART C, Sketches and details 3.1, Generic Details, dwg no 608-B

5.12.7 Station Furniture - Barriers

Purpose

Barriers are used to control the movement of people so that they follow a desired route

Key Points

- Barriers should be avoided if possible as they can become obstructions to people and increase the distance to be travelled
- Barriers should not be placed within the path of travel and should have rounded edges to prevent injury
- Where provided, visibility should be afforded through the railings so that advance warning of the presence of people behind the railing is provided
- Flexible rails should be avoided as they do not provide any resting or leaning against

Design Notes

- Where it is necessary to provide staggered barriers across footpaths in order to prevent conflict with other forms of traffic (for example at intersections with main roads) the barriers should be constructed of vertical bar sections 1200 mm high and colour contrasted with their surroundings
- An offset between the two barriers of 1200 mm allows users of wheelchairs convenient passage

References

ANNEXURE A Blue Print, PART C, Sketches and details 3.1, Generic Details, dwg no 608-B

5.12.8 Station Furniture - Help Point

Purpose

A “help point” enables people to make easy contact with management of a facility to request assistance

Key Points

- The help point should be placed clear of the unobstructed space along a walkway / platform and should be marked by contrasting colour and tone
- Wherever possible the help point should provide both visual and audible communication
- The adjacent area should be a secure area preferably monitored by CCTV
- The Help point must be manned so that there is a direct response alternatively have ambassadors providing assistance.

Design Notes

- The area should be a secure area preferably monitored by CCTV
- The Help point must be manned so that there is a direct response alternatively have ambassadors providing assistance.

- Design Notes
- The controls and communication link should be at an appropriate height of 1200 mm so as to be reachable by a person using a wheelchair

6.1 Specification Elements

Elements

1. Public Address System
2. Display Boards
3. Help Points
4. Intruder detection alarm system
5. Video Surveillance System
6. Access Control System
7. Smoke detection
8. Fire Detection
9. Structured Cabling
10. Pipe and chamber system
11. Access Speed Gates
12. Intermodal facilities provide for the optimum use of other modes to serve passengers / pedestrians accessing the station precinct

CCTV Surveillance System

The CCTV system will be interfaced to the PRASA central automated messaging system, the APIS (Automatic Passenger Information System). The APIS is made possible with the new RAILCOM system currently being rolled out to all stations.

The DALLMEIER equipment specified in the schedule of quantities provides the digital interface to the APIS. As the RAILCOM system is dependent on certain manufacturer products, model name and manufacturer have specified these.

Operations

Cameras shall be positioned as shown on the drawings. Some of these are PTZ's in the concourse.

The cameras will be connected to 24 channel NVR’s in the Server Room. The monitors will be mounted in a CCTV console.

The monitors in the security room shall be 46 inch LCD monitors with suitable brackets for wall mounting.

As the CCTV system will be used for both Surveillance, Access Control, Smoke Detection and Intrusion Detection, it shall be possible to interface to all the systems for automatic view of selected areas.

6.2 CCTV

6.2.1 CCTV - General

Purpose

CCTV is used for both proactive and reactive safety and security purposes within the station precinct area and wherever Prasa deems necessary to monitor both fixed and moving assets including the passage of its commuters.

Key Points

- The camera positions are dependent on the final station layout
- Cameras shall be positioned strategically to provide coverage of the relevant area

Platforms

- The amount of cameras are determined and finalised for installation through efficient coverage based on the engineering specification of cameras.
- On average between 20 and 25 cameras are envisaged per platform.
- The cameras should be mounted in such a fashion that they view the entire length of the platform.
- 4 to 8 of these camera images will be relayed to the train driver in future so that he can determine whether it is safe to close the doors and depart without the aid of a conductor.
- The cameras can be mounted on the underside of the platform shelters or if limited platform shelters exist on concrete or rigid poles mounted on the platform
- Cognizance shall be taken of possible CCTV installation when considering horticulture. Large trees or shrubs should not be used within detection areas

Concourses

- The access control area within the concourse should be covered by CCTV
- Additional cameras may be used to view the stairs to and from the platform and the entrance to these concourses.

Design Notes

- The concourses on either side of the track must be equipped with cameras. These would be used for observing general commuter movement.
- Particular attention shall be paid in viewing the exterior of the ticket office sales windows and entrance to the ticket office as well as the entrance to the station
- Ticket Office and Station Buildings
- Cameras can especially be mounted in ticket offices point of sale for dormant state monitoring.
- Station Entrance
- A pan tilt and zoom camera could be used to view the station concourse and the adjacent area (including intermodal facilities).
- This PTZ camera would probably be mounted above the entrance to the station depending on the engineering spec and/if a structure is to be provided or on a dedicated concrete pole planted at the entrance.

References

Piping and Trenching Requirements
Control Room

6.2.2 CCTV - Piping and Trenching Requirements

Key Points

- A piping and trenching layout for CCTV cables should be prepared on completion of the architectural and civil design of the station and for minimal (rational) piping Platforms
- The pipe and chamber system can be provided to each shelter with a chamber at the shelter. Further reticulation for cameras can occur on the shelter structure later.
- If cameras are not to be fixed to shelters, HDPE piping (in trenches) can be provided for the full length of each platform with draw pits pitched at approximately 36 m in the most suited positions keeping fixed structures in mind

Concourse

- Piping (in trenches) or fixed standard PRASA approved wire way can be provided from the Telecoms equipment room (either at the turnstile control room or at the station building) to each concourse
- The chamber shall be positioned in such a fashion that future reticulation can occur with minimal damage to new surface already finished

Ticket Office

- The reticulation for the ticket office cameras can occur within the ceiling of the station building
- Piping shall therefore be provided from the equipment room (either at the turnstile control room or the station building) to the ceiling of the station building

Station Entrance

- Piping shall be provided from the equipment room to the station entrances

Control Room

- The detail designer shall decide on the optimal routing of the wire way be it through the Control Room's ceiling or floor. Ideally the conduiting / trunking should be provided in such fashion as to allow flexibility of camera positions and also cater for future capacity.
- Trunking / conduiting but not limited shall be provided from the Control Room to the equipment room to carry all the cabling

Design Notes

- Fibre optic cable shall be routed from the turnstile control room's power skirting (CCTV channel) to each camera position. This cable shall be routed inside conduiting / trunking provided for this purpose
- All CCTV equipment shall be supplied with UPS power, both 220 V and 24 V AC from the UPS systems in the Telecoms equipment room.
- The UPS system shall be supplied by the suppliers of the CCTV system
- Low voltage cables run from the battery room to the local distribution boards at the cameras.
- Power cables shall be provided from the circuit breakers in the distribution board within the battery room (equipment room) to dedicated plug points on the power skirting in the Control Room..
- Depending on the distance to cater for an electrical installation, a feed, 4 to 6 mm² two core earth cable is used and according to SANS 10142.
- Piping for cable shall be typically be:
- 3 X 110 mm HDPE pipe to each platform from the equipment room.
- One 110 mm and one 50 mm to each station building
- 3 X 110 mm and one 50 mm to each station entrance.
- 3 X 110 mm and one 75 mm to each concourse.
- 3 X 110 m from the equipment room to the Transtel data communication or Signals data communication between stations. This is to be used to transfer images and data between the station and the Area Control Centre

References

Also see Prasa Telecoms installation manual

6.2.3 CCTV - Control Room

Key Points

- The local station monitoring room can be integrated into the access control room, which will be accommodating the CCTV system
- In order to adhere to the principles of the observation system demonstrator the Area Control Centre(s) shall have a ratio of ten "satellite" stations to one "area" station

Design Notes

- The control room shall be minimum 40 m2 in size
- Raised flooring of the control room shall be fitted with 600 x 600 mm universal super conductive floor tiles

6.3 Audible Communication

6.3.1 Audible Communication - Announcements

Purpose

Audible announcements assist users but particularly provide information to those with visual impairments, as they may not be able to make use of visual information displays

The use of audible announcements also provides regular assurance to users, including those with cognitive impairments, of the correctness of their actions

Key Points

- It is essential that there is a significant difference between the level of background noise (ambient noise) and the level of the signal or announcement
- The higher the signal to noise ratio (the difference in decibels (at least 60 dB) between signal and ambient) the better for communication
- In environments that are noisy, any spoken information should be repeated at least once
- Induction loops allow users with hearing aids to better hear announcements and staff at information and ticket counters

6.3.2 Audible Communication - Pre-recorded Messages

Purpose

To provide travel and other information with minimal staff input and in audible and visual formats

To provide the information in audible and visual formats for users with sensory impairments

Key Points

- Pre-recorded messages should be regularly updated so that accurate information is always given
- A consistent format should be used for messages
- Used for predictable exceptions
- No advertising or playing of music over the PA system
- There should be consistency between audible and visual messages
- Clear, well – pronounced audible messages
- Should be regularly repeated
- All audio information shall be available in English and two regional languages

6.3.3 Audible Communication - Loud Speakers

Purpose

To broadcast audio announcements.

Key Points

- Speech must be transmitted and reproduced faithfully
- Articulation losses, particularly loss of consonants, should be kept to a minimum

Design Notes

- Many users with hearing impairments are better able to hear in the frequency range 800 to 2000 Hz
- The loudspeakers should produce an even spread of sound
- Audio signals should reach all intended areas with appropriate strength and clarity

- Loudspeakers should be a maximum of 15 m apart and be positioned so as to avoid the creation of insufficiently high volume areas or as recommended by Sound Specialist./ Engineer
- Signals should be audible above any background noise
- Comfortable listening level: Sound pressure level (SPL) 80 dB
- Speech Transmission Index: Best 10-15 % ALcons (minimum 15-30 %ALcons)
- Articulation Loss: 0,5-0,458 RASTI
- Frequency response minimum 400- 5000 Hz
- Total Harmonic Distortion < 10
- Maximum noise levels shall not exceed 85 dBA
- Communication levels shall not exceed 65 dB above background noise, e.g. with a background noise of 15 dBA the communication level may not exceed 80 dBA and with a background noise of 25 dBA the communication level may not exceed the 8 5 dBA limit
- Users with hearing impairments require at least a +5 dB signal to noise ratio
- Audible alarm systems should operate at least 15 dB over the background noise level, with a maximum of 120 dB
- There should be an information counter with an operator who can speak sign language to accommodate people who cannot hear the sound over the PA system

6.3.4 Audible Communication - Induction Loops

Purpose

Induction loops allow users with hearing aids, to better hear announcements and people at ticket counters, etc.

Key Points

- The type of induction loop should be appropriate to the specific environment in which they are installed, e.g.;
  - perimeter loops for general announcements;
  - cancellation loops for a row of ticket offices; and
  - phased array loops where magnetic signal strength losses occur due to metalwork contained within the loop area
- Type and location of induction loop within the station precincts to be designed by Sound; Specialist / Engineer
- All new ticket windows

Design Notes

- The location of induction loops should be well signed with the international symbol
- Induction loops should be available at all information and ticket positions and at waiting areas for public address systems
- Guidelines for the design and application of induction loops to be developed by Sound; Specialist / Engineer per station

6.4 Access Control

6.4.1 Access Control - General

Purpose

Barriers control the free flow of movements so as only to allow authorised passengers to pass into the controlled area

Key Points

- Barriers should be usable by everyone, including passengers with disabilities, those with bulky luggage, etc.
- The use of aisles and 'flap' gates are preferred to turnstiles
- The approaches to a barrier should direct users to pass through the control in a safe and orderly manner
- The number and orientation of the access control system shall provide for bi-directional commuter flow as needed for the specific station
- Barriers should be staffed at all times. If unstaffed the barrier should be left fully open.
- Ticket checking points should be located in large expansion areas which allow passing pedestrian traffic as well as queuing without obstruction
- Positioning of ticket checking points immediately at the top or bottom of staircases and ramps presents a hazard to commuters in a stampede situation with the risk of being crushed
- Wherever turnstiles and narrow aisles are provided, by-pass or auxiliary gates should also be provided
- The route and position of the auxiliary gates should be clearly indicated and close to the barriers
- Handrails which force single file queuing can be used to guide the commuter into the ticket checking lane
- Barriers should contrast with the surroundings and barrier controls should contrast with the barriers

Design Notes

- Barrier controls should be able to be used by people with limited manual dexterity (max pressure 15N)
- PRASA to indicate use of turnstiles vs automatic ticket control gates

6.4.2 Access Control – Turnstiles

Purpose

Turnstiles allow for the verification of tickets as the access to the controlled area of the station.

Design Notes

- Turnstiles should be arranged so as to fill a building aperture forming a secure barrier between the secure and public areas of the station building
- A flat level surface is to be provided for the mounting of the turnstile hardware
- Floor finish shall be suitable for high traffic environment (30 000 to 130 000 people/day depending on the station category)
- Floor finish should have a minimum life span of 20 years
- Floor should be capable of withstanding the forces generated by bolting the turnstiles down after installation
- The floor shall not present any uneven protrusions in the path of traffic
- Floor finish colour shall be in accordance with the corporate identity
- The inner face of the boundary wall, i.e. the face adjacent to the turnstile barriers, are to be finished with smooth plaster or wall tiles of a level of durability suitable for the traffic volumes and is to be washable
- Painted and tiled walls should have a minimum lifespan of 5 and 20 years respectively
- The wall is to be coloured in accordance with the Corporate Identity
- The roof shall form part of the roof which covers the entire concourse and other areas
- Turnstile hardware includes the turnstile structure or framework, the glass fibre cubicles, the hand railings and steel bypass gates
- Hardware should all be fastened to the floor surface of the station building by means of raw bolts
- A series of turnstiles are to be installed adjacent to one another forming a battery of turnstiles together with a bypass gate
- One bypass should be provided for every 4 double turnstiles
- The by-pass or auxiliary gates should have a minimum clear width of 900 mm, preferably 1200 mm.
- The entire floor area covered by the access control hardware should not deviate more than 5 mm in

3 m

- The floor concrete slab shall have a minimum strength of 25 Mpa and a minimum thickness of 150 mm to accommodate the raw bolt fixings (M12 and M16)
- Ceiling above the turnstiles should have minimum height of 3 m
- If the ceiling height is not achievable a removable panel shall form part of the ceiling which shall span the entire length of the ticket verification point with a minimum width of 1m centred about the turnstile barrier centre line
- The battery of turnstiles is to be powered via 220 V AC power, which is to be sourced from a distribution board in the central control room.
- The power cable from the distribution board to the turnstile is to be carried in the trunking provided for this purpose.
- This cable is also to be routed through a single division of the trunking dedicated to the power cables.
- Power supply and communication cables shall have separate trunking or trunking channels screened from each other.

- **Quality of electrical supply:**
  - Lightning and surge protection is to be provided in accordance with SABS-171 and SABS-034 where applicable.

- **Power distribution cable:**
  - Cable shall comply with the relevant SABS specification. Cable or wiring used for power distribution shall have a minimum conductor area of 2.5 mm2. Wiring sizes shall be determined in accordance with SABS 0142. Under no circumstances shall a 220 V AC cable be installed in the same trunking section as the coaxial or communication cables.

- **Power Consumption:**
  - Maximum power demand per unit is as follows:
    - Double turnstile (manual) 1300 W
    - Double turnstile (automated) 1100 W
    - Bypass gate 400 W

6.4.3 Access Control - Automatic ticket control gates

Purpose

Automatic ticket control gates allow for the access to the controlled area of the station associated with electronic ticket verification. PRASA to give direction on the use of automatic ticket control gates within the station environment

Design Notes

- Minimum barrier clear width of 900 mm, preferably 1200 mm, between speed gates (PRASA to include guidelines for design of automatic ticket control gates)
- Recommended height for ticket slot between 750 mm and 900 mm
- One bypass should be provided for every 4 substandard barrier clear widths
- The by-pass or auxiliary gates should have a minimum clear width of 900 mm, preferably 1200 mm
- If gates are glazed, use a single marking in a solid contrasting colour
- 'Flap' gates should be made from or covered with soft material

References

6.4.4 Access Control - Queuing Area

Purpose

Sufficient space should be provided to accommodate the amount of access control system needed to service the peak commuter flo

Design Notes

- A clear area extending 6 m (9 m2/lane) from the approach side of a double turnstile and accompanying accessible gate should be provided, whilst in the case of crush pens this should increase to 9.6 m (6.5 m2/lane)
- Should an expansion area be available on either side of the ticket checking barrier, the queuing area could be shortened and widened if necessary
- Special care should be taken to provide queuing area at passages or confined areas
- Queuing area should not be provided at the top or at the foot of staircases
- Handrails should not extend further than 1.5 m from the entrance to turnstile/crush lane
- There should be no protrusions from the floor surface exceeding 5 mm