

Annexure 1.1:
General Technical Requirements
Optical Transmission Network

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1 GENERAL

1.1 Purpose of the Document

1.1.1 The purpose of this document is to provide the General Technical Requirements (“GTR”) which form part of the minimum Requirements of the Passenger Rail Agency of South Africa (“PRASA”) for the Optical Transmission Network (“OTN”) related Works that form part of the planning, design, supply, construction, installation, testing, commissioning and maintenance of a new fully integrated, functional, complete and future-proofed expanded PRASA OTN in PRASA’s Gauteng (“GP”) and Western Cape (“WC”) service regions (“the Project”) that the Bidder shall meet and deliver at the Bidder’s cost therefore within the Bid Price.

1.2 Executive Overview

1.2.1 Notwithstanding any other PRASA Requirements stated throughout the RFP, the Bidder shall uncompromisingly deliver the whole of the Works required to achieve successful delivery of the Project.

1.2.2 The OTN Component of the Works is, at a minimum, summarised as follows:

- a) Provide an expanded PRASA OTN to be used for at least interlocking Signalling remote monitoring and controls, tractions substations remote control and monitoring, telephone Systems, security surveillance System, access control, passenger information Systems and ICT services.
- b) Any other OTN Works, activities and resources required to achieve a fully integrated, functional, complete and future-proofed expanded PRASA OTN and meet any other requirements and specifications as requested throughout the RFP or as otherwise instructed in writing by PRASA.

2 MINIMUM SYSTEM REQUIREMENTS

2.1 OTN System Overview

2.1.1 The PRASA OTN System (the “System” in its entirety including, but not limited to, sub-Systems and Plant and Materials) shall, at a minimum, consist of the following elements:

- a) Direct Buried Fibre Optic Cable.
- b) Manholes.
- c) Dome Joints.
- d) Patch Panels.
- e) 42 RU Racks 600mm x 600mm

2.1.2 The Fibre Optic Cable shall be installed in-between Signal Equipment Rooms (“SER”), with dedicated tubes terminating at Ticket Offices, GSM-R Equipment Rooms and 3kV / 6.6kV Substations as illustrated in **Error! Reference source not found.**

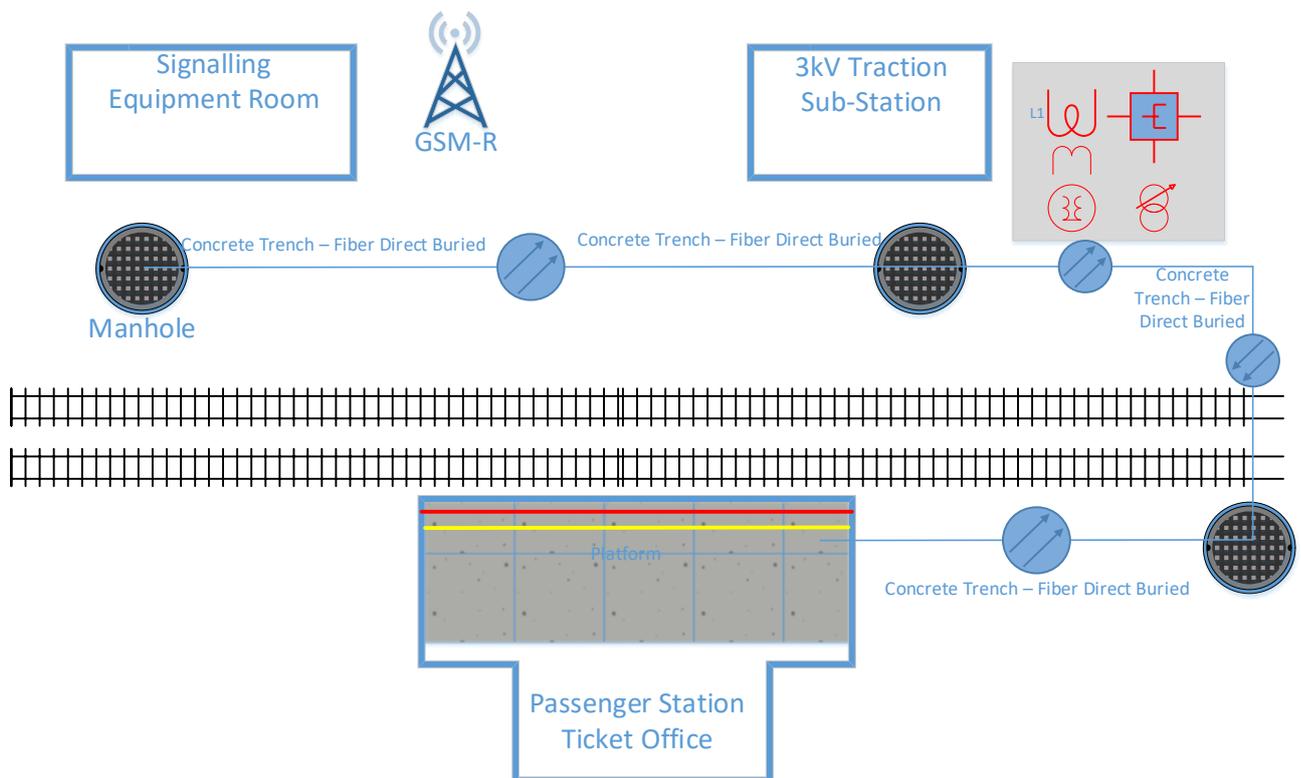


Figure 2.1.1: OTN Applications

2.2 OTN System Reliability

- 2.2.1 The OTN System, Equipment and Works shall, at a minimum, comply with all relevant Standards, Specifications, Regulations and Procedures as specified throughout the RFP.
- 2.2.2 The OTN shall be Designed to have very limited exposure to theft and vandalism.
- 2.2.3 The Bidder shall implement all necessary measures to protect the System, sub-Systems and all Equipment against at least the following threats:
- a) Theft and vandalism.
 - b) Continues exposure to extreme direct sunlight and elevated temperatures.
 - c) Continues exposure to high humidity.
 - d) Coastal environmental conditions causing damaged such as corrosion.
 - e) Incoming high voltages, spikes, Electromagnetic Compatibility (“EMC”) and fluctuating voltages.
 - f) Intermittent flash flooding in low laying areas.
 - g) Severe thunderstorms with extreme heavy lightning.
- 2.2.4 Reliability:
- a) The Bidder shall provide the predicted mean time to failure.
- 2.2.5 The mean time to repair of the Equipment shall be less than 3 hours during peak periods (05h00-09h00 and 14h00-19h00) including travel time and less than 4 hours for off-peak periods including travel time.
- 2.2.6 Where insufficient historical data is available, the Bidder shall state the methods used to determine the reliability performance.
- 2.2.7 The OTN System Component’s availability shall be 99.999% as a minimum with the following assumptions:
- a) The availability of any interconnecting communication Equipment or System supplied by others shall be assumed to be 100%.

2.3 Equipment Life Cycle:

- 2.3.1 The Equipment shall be capable of complying with this standard including performing its intended purpose for a minimum period of 20 years from the date of Supply.
- 2.3.2 The supplier shall indicate the following:
- a) The date at which the product was released for sale.
 - b) The anticipated date at which the product shall be withdrawn from sale, but support shall continue to be supplied.
 - c) The anticipated date that product support shall be withdrawn, i.e. Spares shall no longer be available and technical support is no longer provided.

2.3.3 Racks and Clearances

- a) All Telecommunications Equipment shall be mounted inside racks on rails.
- b) The minimum rack frame dimensions shall be 600 mm wide and 600 mm deep and provide 42 RU (Rack Unit = 44.45 mm).

2.3.4 A minimum access clearance of at least 1 m shall be maintained on the front and back of racks, where access is required for operations or Maintenance.

2.4 Optical Fibre Cable System

2.4.1 Cable route and cables shall be designed and constructed to provide capacity for both signalling and non-signalling communications services using two 96 core fibre cables.

2.4.2 The OTN shall consist of two separate 96 core cables, one dedicated to Signalling Systems, and one dedicated to other business services as shown below:

- a) OTN-1: Signalling services.
- b) OTN-2: Business services.

2.4.3 The OTN-1-96 Core Cable shall be sub-divided into 8 coloured tubes, 4 tubes dedicated per sub-System as shown below:

- a) Red, Yellow, Green, Blue Tube – Signalling Equipment Room.
- b) Violet, Brown, Black, Orange Tube – GSM-R Sites.

2.4.4 The OTN-2-96 Core Cable shall be sub-divided into 8 coloured tubes, 2 tubes dedicated per sub-System as shown below:

- a) Red, Yellow Tube – Security Systems.
- b) Green, Blue Tube – Ticket Office Equipment Room (IT Services).
- c) Violet, Orange Tube – 3kV / 6.6kV Traction Sub-Station.
- d) Black, Brown Tube – Fibre Monitoring and Management Systems.

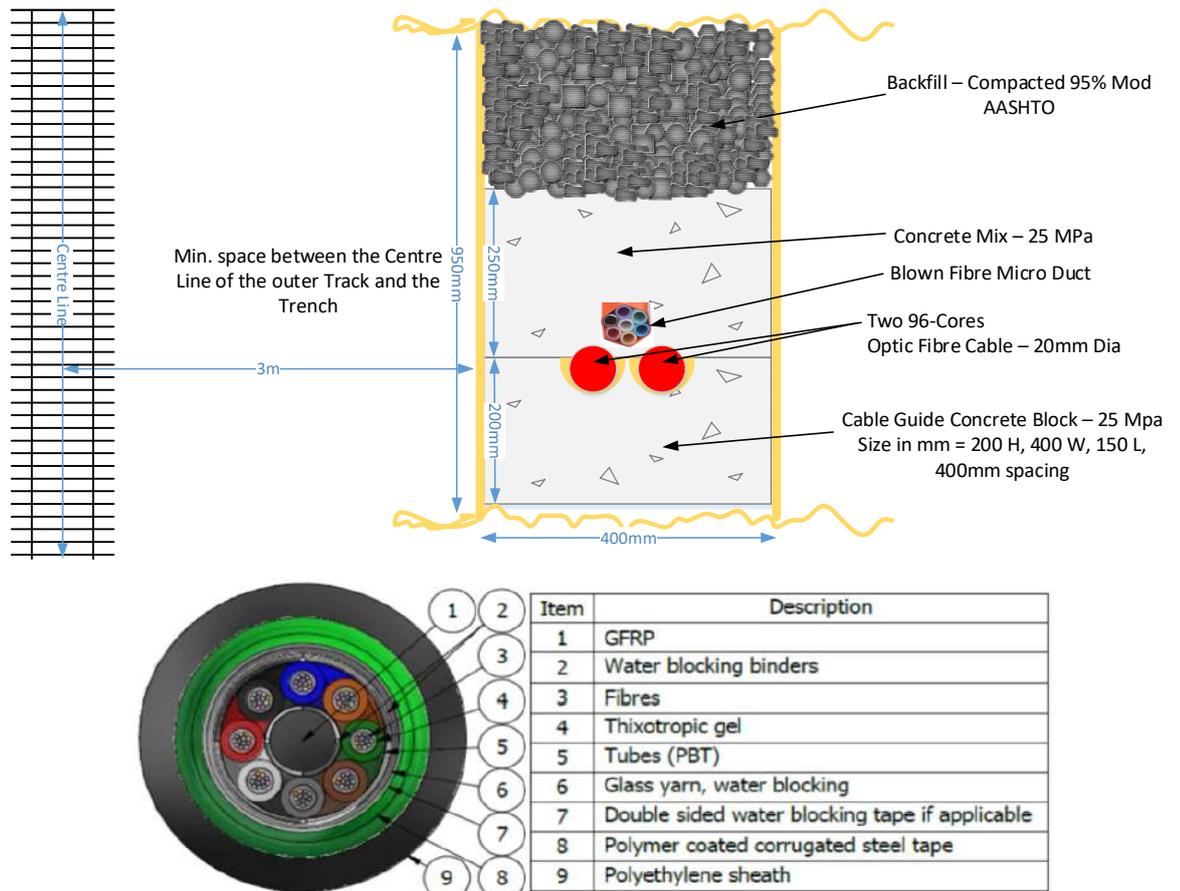
2.4.5 Fibre Optical Cable shall be installed between Manholes with respective termination per sub-System, i.e.:

- a) The OTN-1-Signalling tubes shall terminate at the SER Manhole and Patch Panel as well as at the Central Traffic Control room.
- b) The GSM-R tubes shall terminate at the GSM-R Equipment Room and Patch Panel as well as at the GSM-R core centre and the Central Traffic Control room.
- c) The 3kV Traction Sub-Station tubes shall terminate at the Sub-Station Equipment Room Manhole and Patch Panel as well as at the Central Traffic Control room.
- d) The Ticket Office tubes shall terminate at the Ticket Office Equipment Room Manhole and Patch Panel as well as at the Central Traffic Control room and the IT services control centre.

- e) The Security tubes shall terminate at all Equipment Rooms, Central Traffic Control room and Security Control centre.
- f) The Fibre Monitoring and Management System tubes shall terminate at the branching sites where all fibre cables are present.

2.4.6 All new fibre installations shall be buried directly in an encased concrete trench to at least 950mm in depth and 400mm wide.

2.4.7 The Fibre Optical Cable (“FOC”) shall be raised by at least 200mm from the trench floor using proposed means to balance the cable throughout the trench as shown in



2.4.8 Figure 2.4.1.

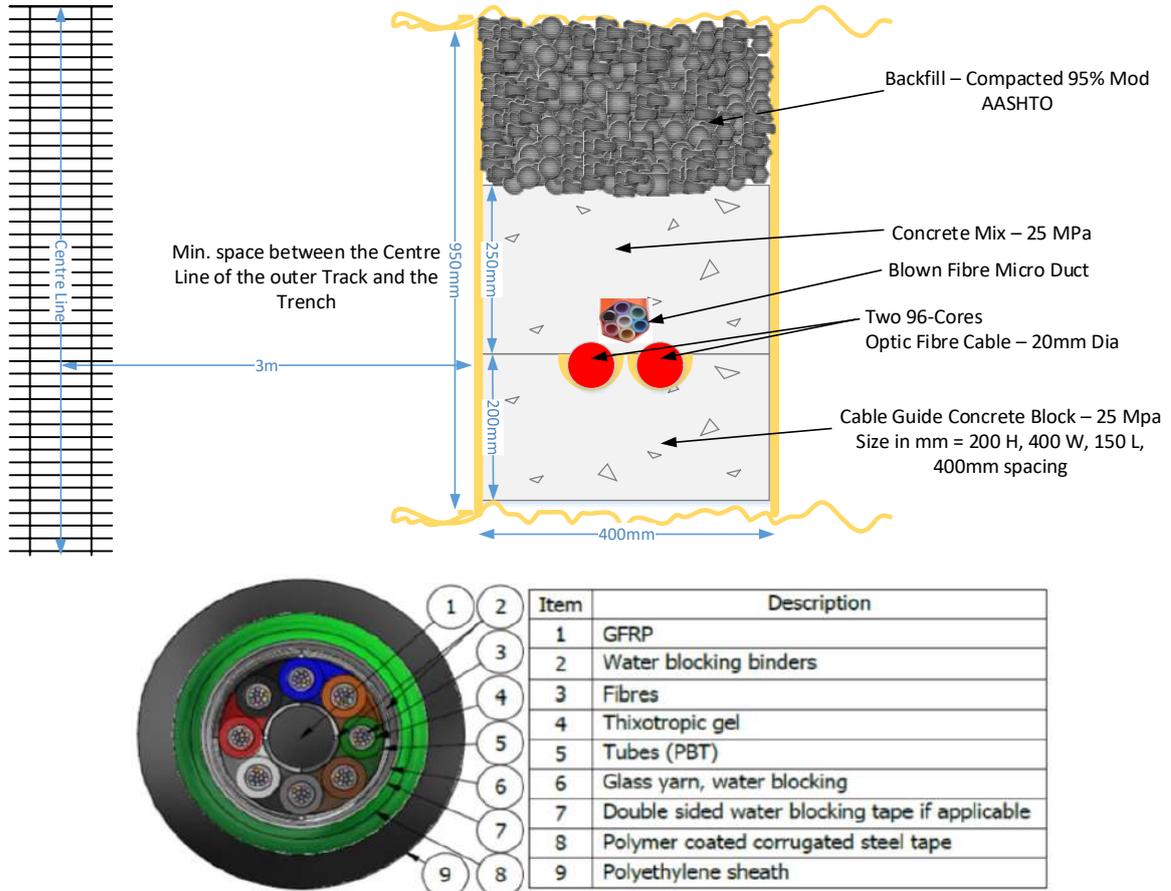
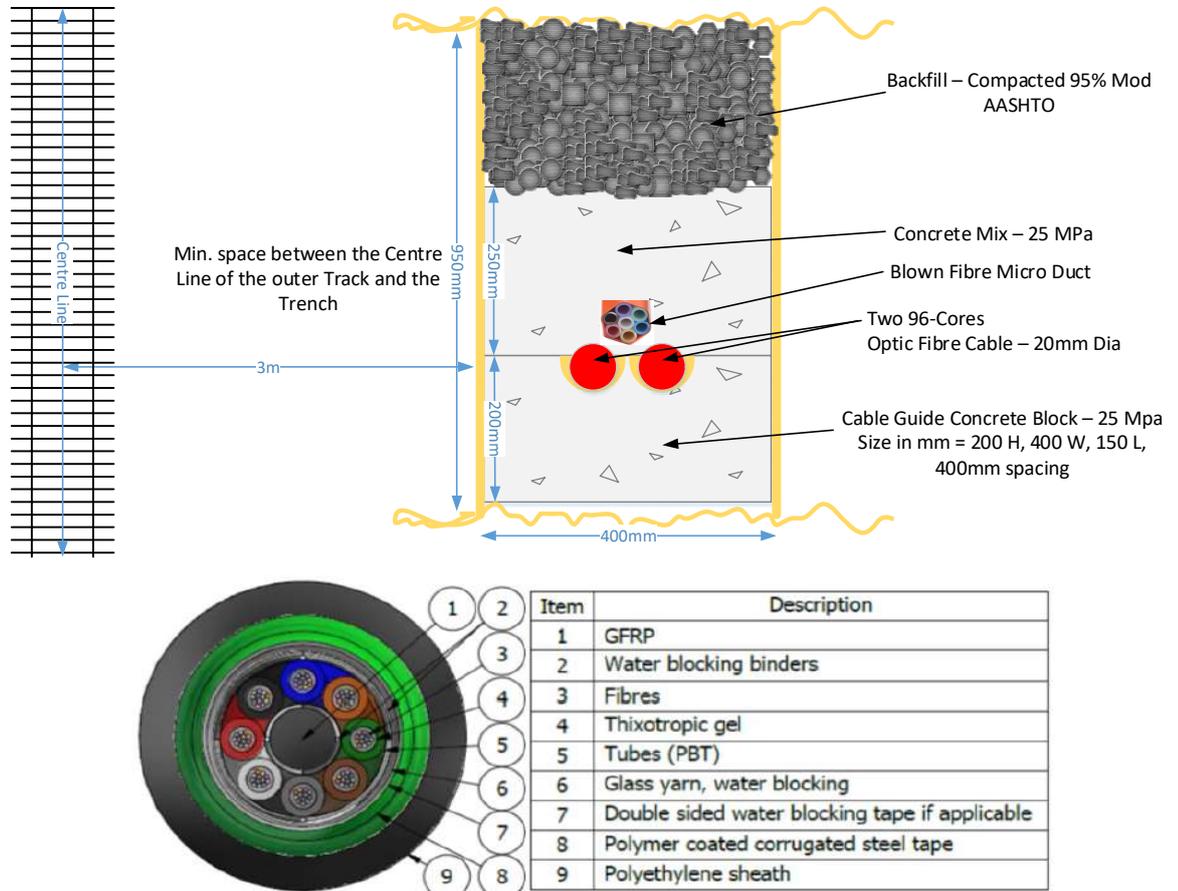


Figure 2.4.1: Underground Optic Fibre Cable Trench Layout

2.4.9 The minimum space between precast cable guidance blocks inside the 400mm wide trench shall be 400mm apart to allow of any manual labour required for pulling of the cable, cable sagging shall be avoided at all times.

2.4.10 A Fibre Optic Duct with a minimum of four-way Microducts shall be installed in the trench is illustrated in



2.4.11 Figure 2.4.1 for Blowing future required Fibre.

2.4.12 Cleaning of the Microduct shall be conducted by means of blowing an appropriately sized sponge through the micro duct, which will also help in removing any accumulated water.

2.4.13 The installed micro ducts shall be tested using a round proofing ball or pellet that is 80% of the size of the Microduct blown through the duct to ensure there is no obstruction in the duct.

2.4.14 The Bidder shall comply with all the relevant Standards, Specifications and implement the early warning underground cable intrusion detection system and ensure the following minimum requirements are defined in detail and met:

- a) Mechanical Requirements:
 - Sensor cable
 - Sensor unit equipment
- b) Environment Requirements
- c) Reliability and Maintenance Requirements
- d) Electrical Requirements

- e) Detection Capabilities
 - f) Network Capabilities
 - g) Event Management
- 2.4.15 The two 96 core single mode optical cables shall comply with the ITU-T G.652.D standard and the following attributes shall be used:
- a) Double Jacket.
 - b) Corrugated Steel Tape Armouring.
- 2.4.16 The single mode optical cable shall provide protection to:
- a) Strain from both cable tension and bending.
 - b) Crush and impact both during installation and operational life.
 - c) Hydrogen gas generated by the presence of moisture and metallic elements.
 - d) Moisture permeation.
 - e) Water penetration.
 - f) Lightning damage.
 - g) Biological attacks.
 - h) Biotic damage.
 - i) Vibrations from railways.
 - j) South African temperature variations.
 - k) Chemical attack.
 - l) Mechanical aggression.
- 2.4.17 A minimum length of 5 metres from each end shall be implemented when splicing takes place inside the manhole.
- 2.4.18 A minimum length of 10 metres shall be achieved when splicing takes place outside the manhole.
- 2.4.19 Inside the manhole, the splice box shall be fixed directly on the wall or using an appropriate support, depending on the box design.
- 2.4.20 The installed manhole shall be:
- a) Corrosion resistant.
 - b) UV resistant.
 - c) Slack management mechanism.
 - d) Impact resistant.
 - e) PRASA branded with a PRASA LOGO.
- 2.4.21 The installed fibre cables shall comply with the following latest standard specifications:

- a) ITU-T G.651.1 - Characteristics of a 50/125 μm multimode graded index optical fibre cable for the optical access Network.
- b) ITU-T G.652 - Characteristics of a single-mode optical fibre and cable [6].
- c) ITU-T G.653 - Characteristics of a dispersion-shifted, single-mode optical fibre and cable.
- d) ITU-T G.654 - Characteristics of a cut-off shifted single-mode optical fibre and cable [8].
- e) ITU-T G.655 - Characteristics of a cut-off shifted single-mode optical fibre and cable.
- f) ITU-T G.657 - Characteristics of a bending-loss insensitive single-mode optical fibre and cable.

2.4.22 The fibre optic cable splicing procedure shall be accordance with the ITU-T standard L.12 - Optical fibre splices.

2.4.23 All splicing shall be Electric arc-fusion method to make reliable optical splices using specially developed splicing machines.

2.5 Patch Panels

2.5.1 The Bidder shall provide, at a minimum, the following size patch panels in the Equipment:

- a) Signal Equipment Rooms: 1 x 48 core and 1 x 12 core.
- b) GSM-R Equipment Rooms: 1 x 48 core and 1 x 12 core.
- c) Ticket Offices: 2 x 12 core.
- d) Sub-stations: 2 x 12 core.
- e) GSM-R core centre: 2 x 48 core.
- f) IT Services Control centre: 2 x 48 core.
- g) Security Control Centre: 2 x 48 core.
- h) Branching sites: 4 x 48 core.

2.5.2 The Bidder shall terminate and/or patch through all cores in a specific tube going to a specific Equipment Room.

2.6 Racks and Clearances

2.6.1 All OTN Equipment shall be mounted inside existing racks on rails.

2.6.2 Bidder's to make provision for 50 Racks/Cabinets on their pricing to be used on the location where the installation of patch panels will not be possible due to unavailability of the existing rack. The minimum rack dimension shall be 600mm wide x 600mm deep and provide 42RU (Rack Unit = 44.45 mm)

- 2.6.3 Surveys shall be done to specify the required space inside provided racks for new patch panels.

3 ENGINEERING

3.1 Design and Build Risk Assessment

- 3.1.1 All Designs shall comply with all relevant Standards, Specifications, Regulations and Procedures as specified throughout the RFP.
- 3.1.2 The OTN System shall comply and be supported predominantly by the following assessments, which shall be part of the safety case:
- a) System Safety Assessment – SANS 3000-2-5.
 - b) Human Factors Integration – SANS 3000-4 Standard.
- 3.1.3 The Bidder shall keep these analyses updated during the life cycle of the Systems Installation, Commissioning and operations cycles.
- 3.1.4 The Bidder shall, in conjunction with PRASA, conduct cable trench surveys for the Detailed Design of the cable routes.
- 3.1.5 The Detailed Design shall be approved prior to any site implementation is executed. The pre-survey report shall at a minimum include:
- a) GPR (Ground Penetrating Radar) report.
 - b) Construction method.
 - c) Tools required.
 - d) Characteristics of the ground.
 - e) Location of Manholes (GPS coordinates with accuracy of 4 meters or better).
 - f) Distance between Manholes.
 - g) All required rail crossings.
 - h) All drainages avoided.
 - i) Location of all Signalling apparatus cases and Equipment.
 - j) 72 hours' notice to all other departments for marking or indications of any other cables that maybe buried underground (i.e. Perway, Signalling, Electrical and Facilities).
- 3.1.6 The OTN cable design shall be drawn using AutoCAD with Google Earth background to indicate the cable routes.
- 3.1.7 The Manhole coordinates shall be indicated on the Google Earth Drawing with 4-meters accuracy or better.

3.2 Process Model

- 3.2.1 PRASA Rail Engineering Services has adopted the V-Model Design methodology as a basis for managing System Design process.

- 3.2.2 The Design process with outputs shall be followed in alignment to the V-Model as shown in Figure 3.2.1.
- 3.2.3 The processes on Figure 3.2.2-to-Figure 3.2.6 shall be adopted for execution guideline process to develop required documents in alignment to the V-Model.
- 3.2.4 Site surveys shall be conducted by the Bidder and PRASA for detail Design.
- 3.2.5 During the Design and Installation process, the Bidder shall review and revise the requirements and proposed solution with PRASA to ensure the delivered System achieves its aims and objectives.

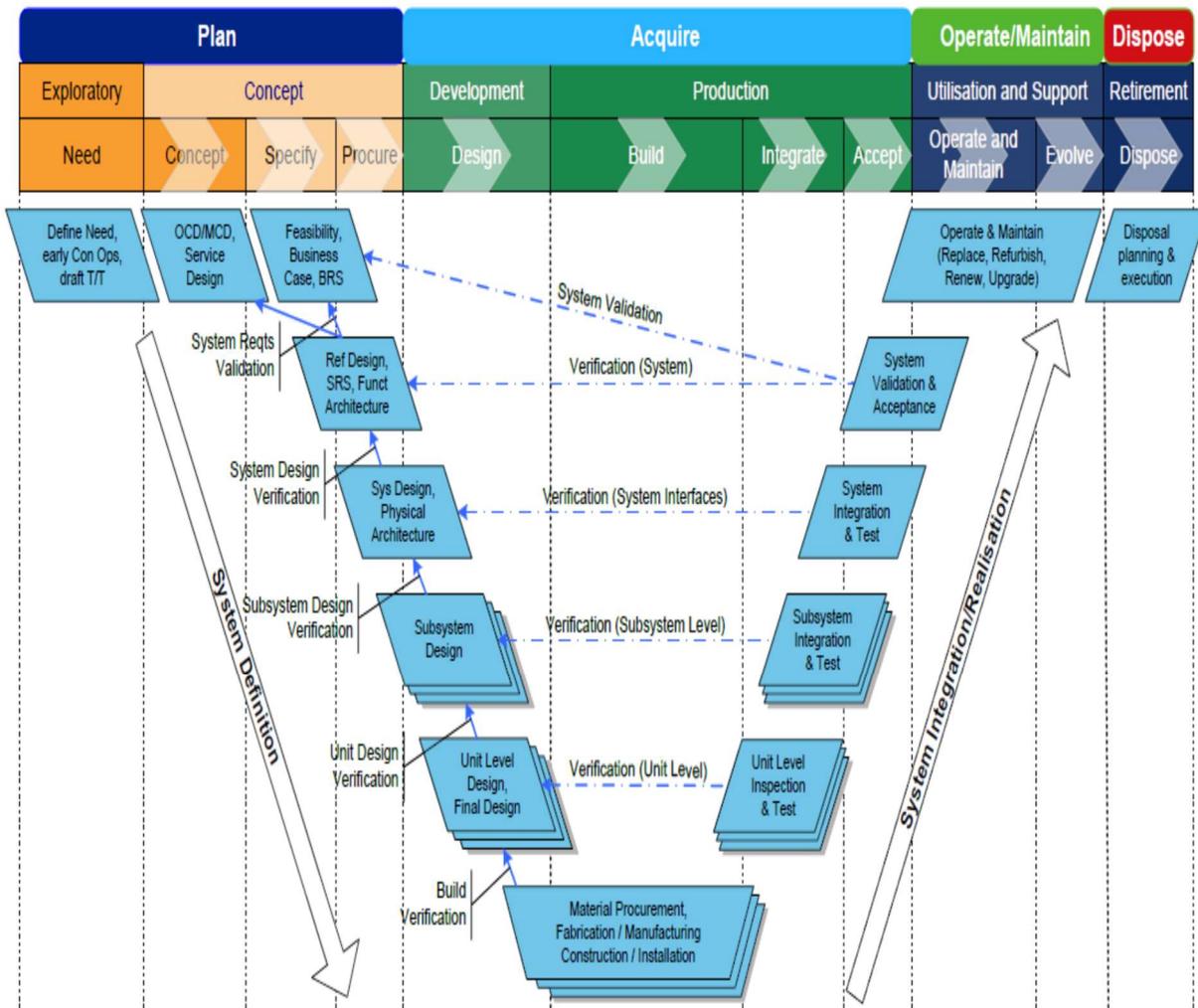


Figure 3.2.1: System Design V-Model

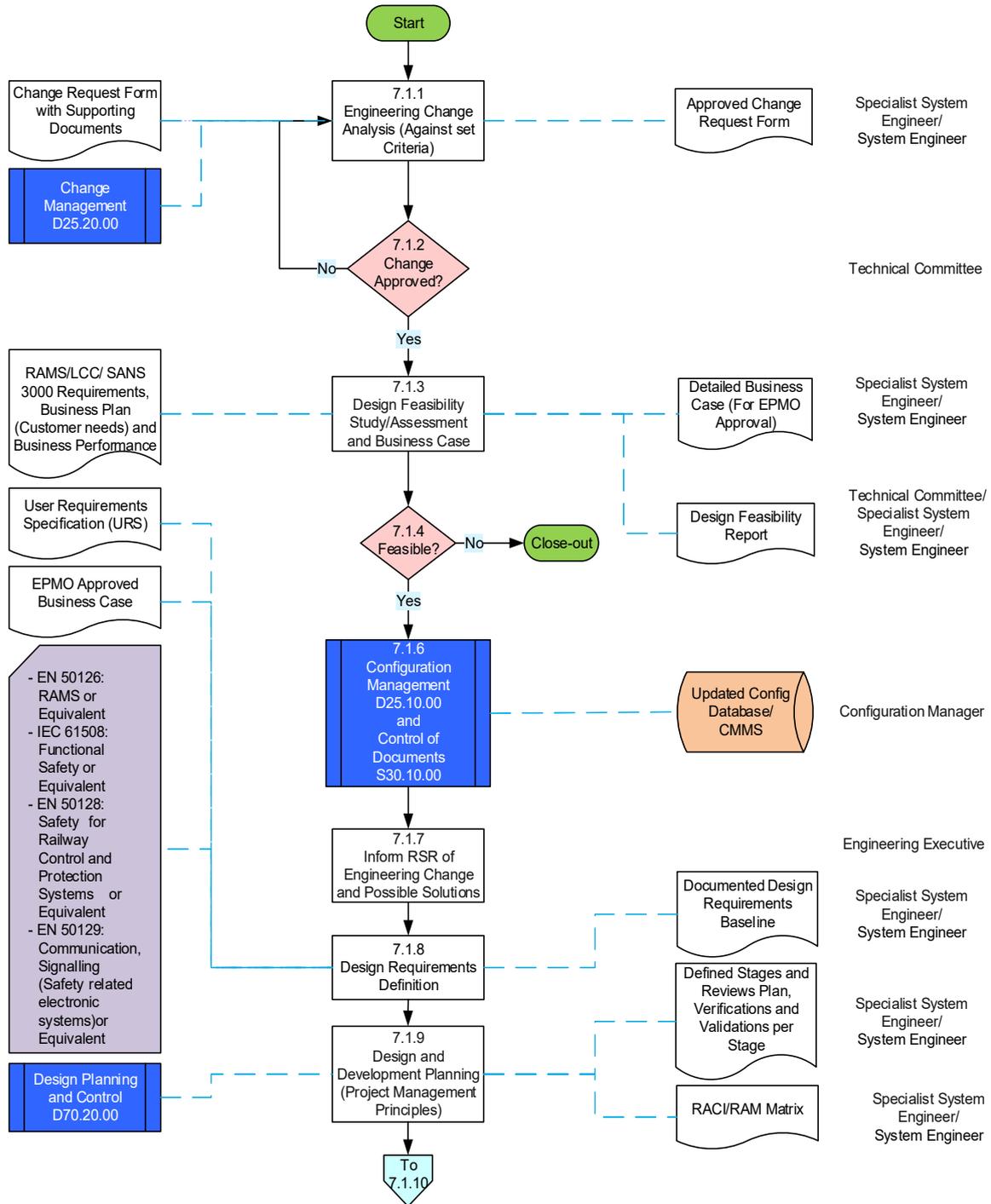


Figure 3.2.2: ENGINEERING_LIB-#134-v1-Design_and_Development_Process.VSD_P1

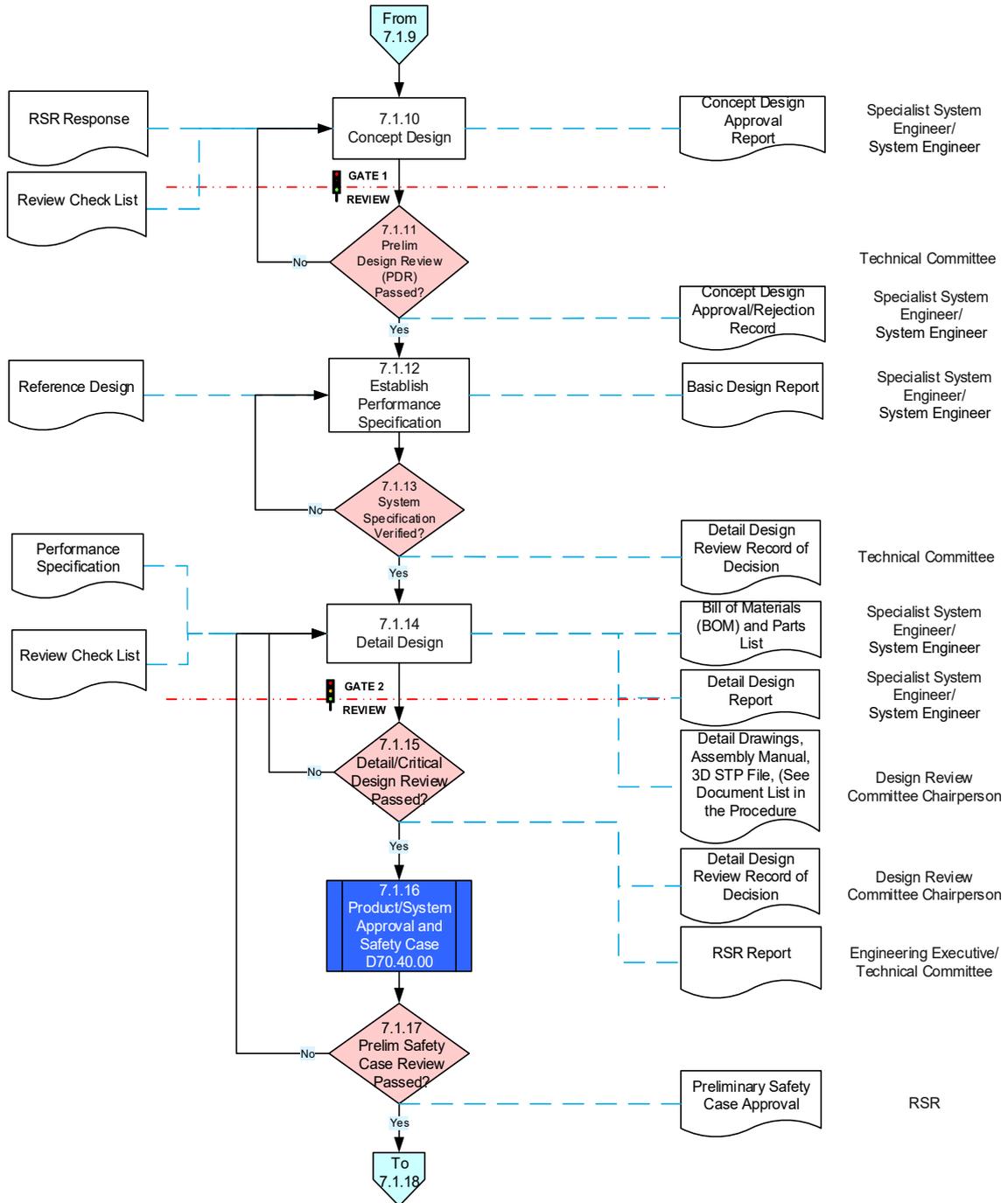


Figure 3.2.3: ENGINEERING_LIB-#134-v1-Design_and_Development_Process.VSD_P2

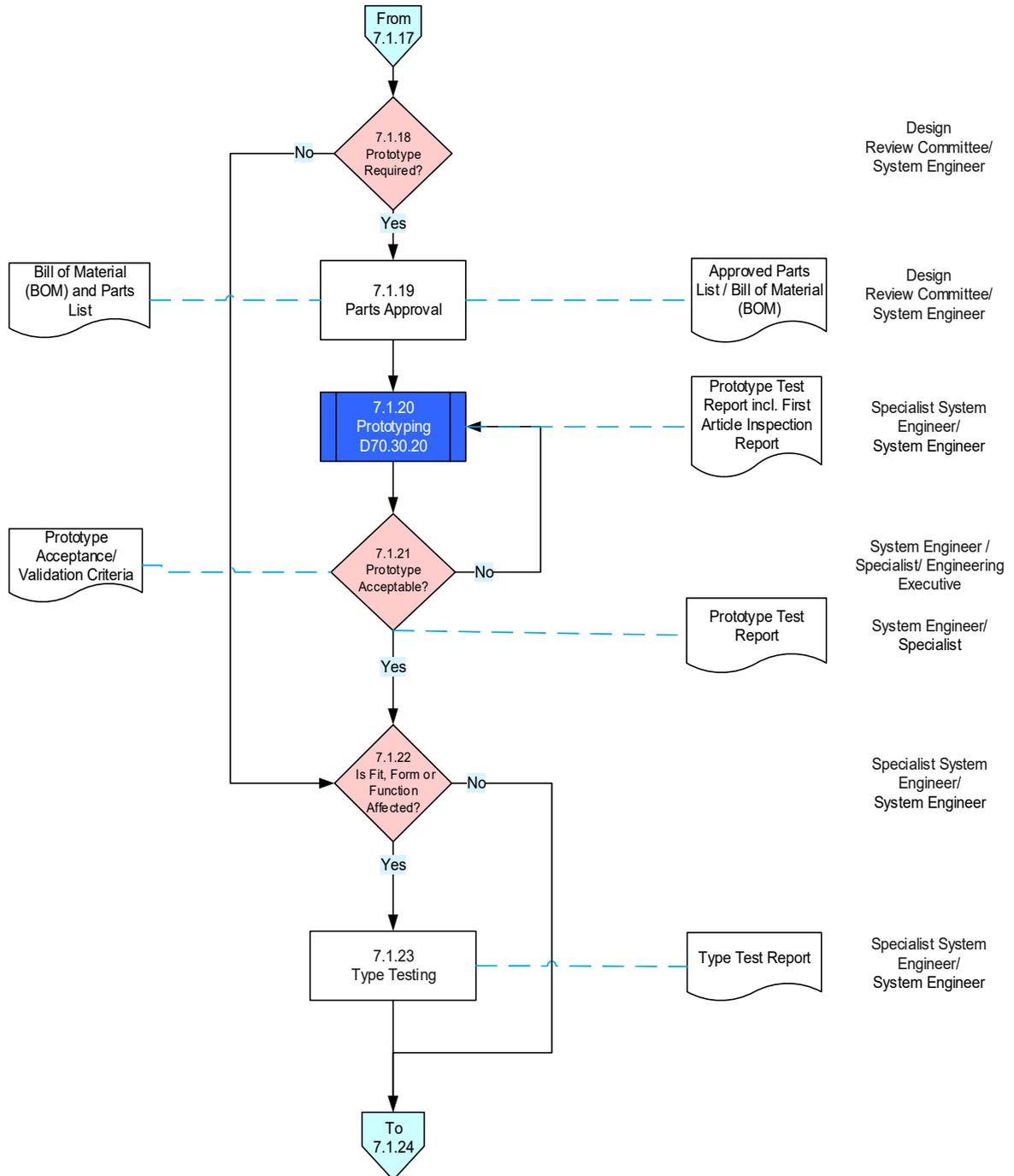


Figure 3.2.4: ENGINEERING_LIB-#134-v1-Design_and_Development_Process.VSD_P3

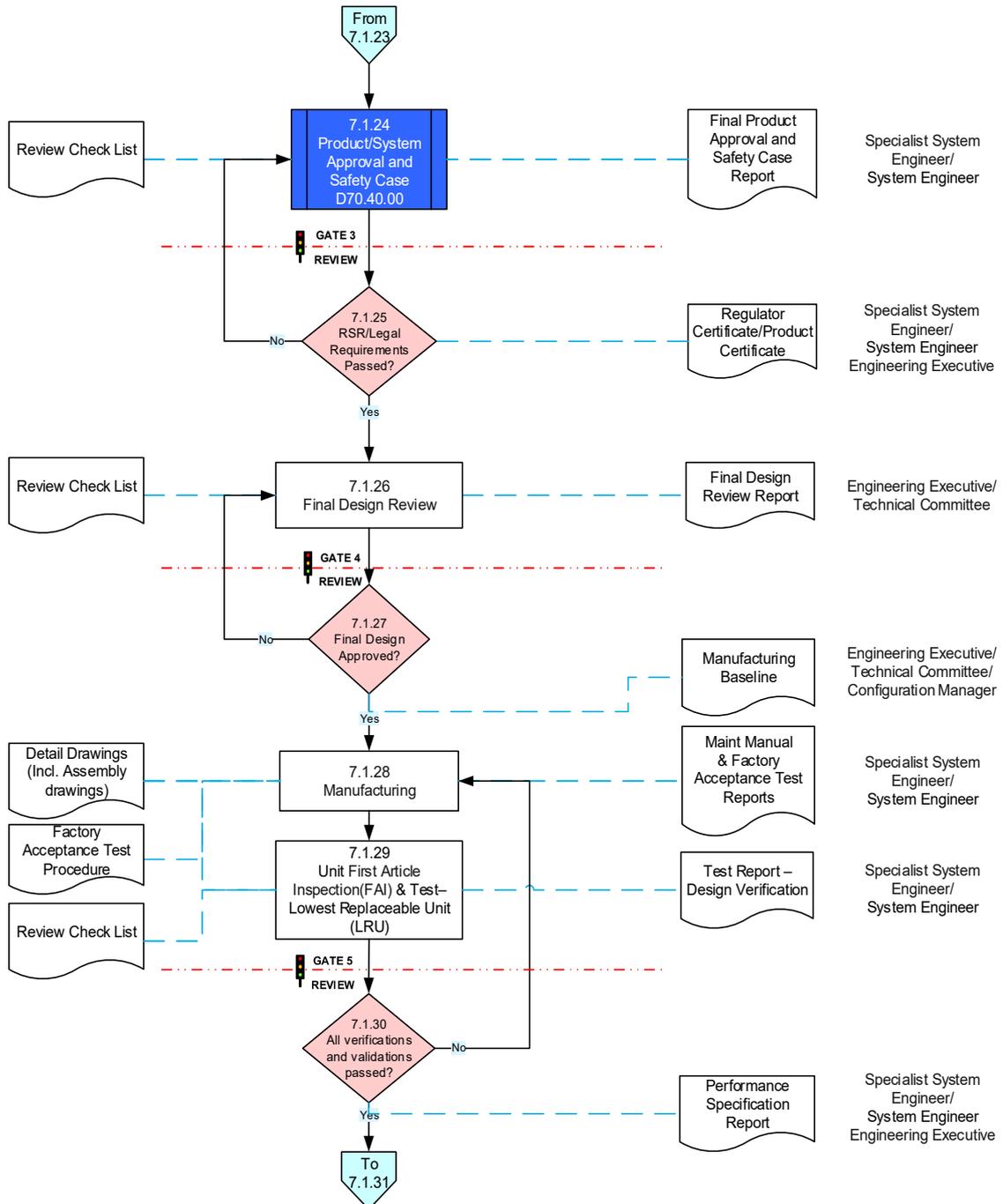


Figure 3.2.5: ENGINEERING_LIB-#134-v1-Design_and_Development_Process.VSD_P4

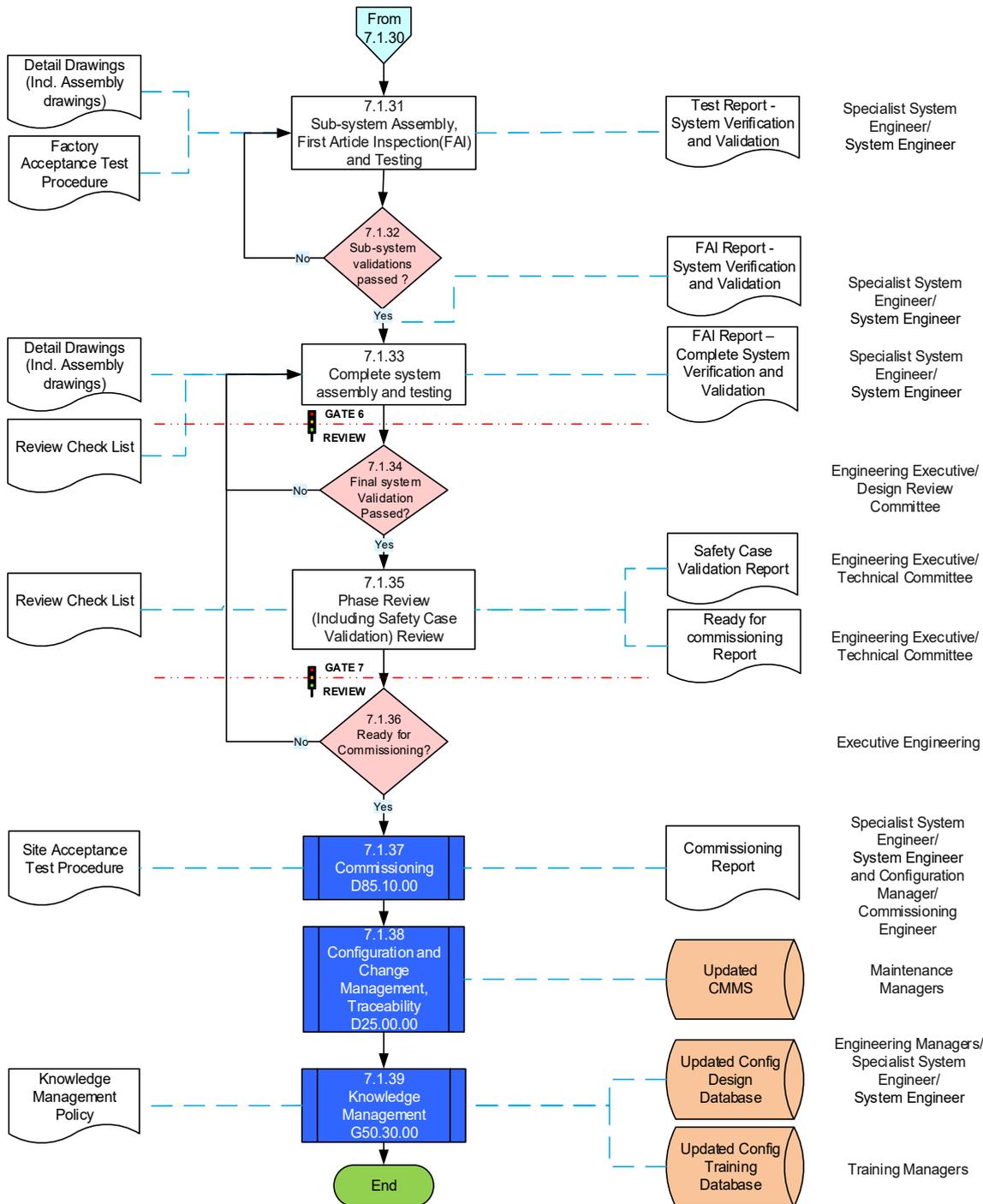


Figure 3.2.6: ENGINEERING_LIB-#134-v1-Design_and_Development_Process.VSD_P5

4 CONSTRUCTION

4.1 General

- 4.1.1 The Bidder shall submit method statements for all OTN construction work to be performed to PRASA for review and approval before commencement of the work.
- 4.1.2 All Construction work on or near the railway line shall be performed under Occupation-between-trains ("OBT") or Total Occupation conditions.
- 4.1.3 The cable shall be visually inspected by PRASA for any damages whilst being buried in concrete. The Bidder shall state in their installation method statement state how will this process be achieved.
- 4.1.4 The maximum pulling tension of 2700 Newtons / 600lbF shall not be exceeded when installing the cable, the pulling tension shall be verified by PRASA as part of the installation procedure. The installation procedure shall be developed and approved by PRASA prior to any installations being carried out.
- 4.1.5 The cable bending radius shall be verified by PRASA to comply with the OEM datasheet.
- 4.1.6 The Bidder per team shall provide at least three fully trained flagmen.
- 4.1.7 Precaution shall be put in place when trenching close to the ballast Material to protect it from the trenched soil, and from falling into the trench.
- 4.1.8 All personnel executing the trench work shall be competent person who have done PRASA Induction and is PRASA C-Green certified.
- 4.1.9 No Equipment used shall come within a radius of 3m of the Over Head Track Equipment ("OHTE") or the 3kV Track Line.
- 4.1.10 All the trenching work shall be executed under a supervision of a competent Track Master with appropriate protection.
- 4.1.11 Trench should not be left open for more than 48 hours and the contractor should deposit the spoils at the specified place in agreement between the contractor and PRASA personnel.

5 TESTING AND COMMISSIONING

5.1 General

5.1.1 All Testing and Commissioning activities to comply with all relevant Standards, Specifications, Regulations and Procedures as specified throughout the RFP.

5.2 Factory Acceptance Testing (“FAT”)

5.2.1 The Bidder shall be responsible for all FAT.

5.2.2 All FAT of each System shall be conducted at factory(s) at which the original Plant and Materials are manufactured and assembled.

5.2.3 The Factory Acceptance Test using an OTDR shall be conducted prior to cable being delivered to Site.

5.2.4 The Bidder shall submit a FAT Method Statement to PRASA for acceptance before any FAT commences. The Method Statement shall clearly indicate:

- a) All Systems, sub-Systems and Equipment that shall be included in the FAT and which shall be omitted.
- b) Specification against which the FAT shall be conducted.
- c) Method of conducting the FAT for each System, sub-System and Equipment.
- d) Details, including experience reports, of people which shall be conducting the FAT.

5.2.5 All FATs shall include but not be limited to:

- a) Point to point wiring check for impedance and continuity.
- b) Serial numbers of all cards and modules shall be listed in an Excel spreadsheet.
- c) Confirmation of all modules from the field terminal through to the diagnostic laptop.
- d) Confirmation of control functions from the diagnostic laptop to the field terminals including exercising the dummy circuit breaker and the controls isolate switch.
- e) Confirmation of effective communications between the Systems and other devices using the specified protocols
- f) All powered Tests shall be carried out at the specified power Supply rating of the System

5.2.6 The Bidder shall invite PRASA to all FAT taking place at least 40 working days prior to commencing of the FAT. Should PRASA not be able to attend, PRASA shall give the Bidder permission to continue or request the dates for the FAT to be changed. PRASA shall not be held liable for any delays caused by this unavailability.

5.2.7 The Bidder shall submit all duly signed FAT Test certificates and associated Test sheet to PRASA for information purposes, prior to Commissioning.

- 5.2.8 Test results for each System showing Tests undertaken, results and any corrective action taken shall be provided in an approved format and shipped with the System.
- 5.2.9 Colour photographs shall be included in the Test results to record the Equipment layout.
- 5.2.10 PRASA accepts no accountability nor liability for any FAT conducted, despite any checks done or inputs given by any of PRASA's agents.

5.3 Site Acceptance Testing (“SAT”)

- 5.3.1 All relevant OTN Systems, sub-Systems and Plant and Material shall undergo and pass SAT before Commissioning.
- 5.3.2 The Bidder shall be responsible for SAT.
- 5.3.3 The SAT shall be conducted by a Transmission Engineer or technologist, registered with the Engineering Council of South Africa (“ECSA”) as a professional Engineer or professional technologist and who has undergone training for the specific System, sub-System or Equipment and have experience in SAT.
- 5.3.4 The person(s) responsible for the SAT shall not have been involved in any Design, FAT or Installation activities relating to the System, sub-System or Equipment to be tested.
- 5.3.5 The Bidder shall submit a SAT Method Statement to PRASA for acceptance before any SAT commence. The Method Statement shall clearly indicate:
 - a) All Systems, sub-Systems and Equipment shall be included in the SAT and which shall be omitted.
 - b) Specification against which the SAT shall be conducted.
 - c) Method of conducting the SAT for each System, sub-System and Equipment.
 - d) Details, including experience reports, of people which shall be conducting the SAT.
- 5.3.6 Where practical, all SAT shall be done under OBT conditions, prior to the final Testing and Commissioning Occupation.
- 5.3.7 The Bidder shall invite PRASA to all SAT taking place at least 40 working days prior to commencing of the SAT. Should PRASA not be able to attend, PRASA shall give the Bidder permission to continue or request the dates for the SAT to be changed. PRASA shall not be held liable for any delays caused by this unavailability.
- 5.3.8 The Bidder shall submit all duly signed SAT Test certificates and associated Test sheet to PRASA for information purposes, prior to Commissioning.
- 5.3.9 The PRASA accepts no accountability nor liability for any SAT conducted, despite any checks done or inputs given by any of PRASA's agents.

5.4 Final Testing and Commissioning

- 5.4.1 Final Testing and Commissioning shall be done by a PRASA approved Test and Commissioning Engineer provided by the Bidder.

- 5.4.2 Once the Bidder is convinced the Bidder shall be ready for Final Testing and Commissioning, he shall agree with PRASA on a suitable date for the activity, at least 90 working days prior to proposed date.
- 5.4.3 The Bidder shall submit a comprehensive Final Testing and Commissioning Method Statement to PRASA for approval before any Commissioning commence.
- 5.4.4 The Bidder shall be responsible to provide a complete Testing and Commissioning team as per the Method Statement, as well as all Tools and Equipment required for introducing, Testing and Commissioning of the System.
- 5.4.5 The members of the Bidder's Testing team shall have not been involved in any Design, FAT or SAT activities relating to the System, sub-System or Equipment for which that member is responsible during the final Testing and Commissioning.

6 MAINTENANCE

6.1 Overview

- 6.1.1 The Bidder shall Design the System in such a manner to minimize Maintenance requirements and ensure overall maintainability.
- 6.1.2 The System shall continue to function properly if maintained according to the current Maintenance strategy.
- 6.1.3 The Bidder shall develop a new improved Maintenance strategy. The new Maintenance strategy shall require less Maintenance and less Maintenance personnel.
- 6.1.4 Test instruments and Centralized Management Tools shall be provided to support Condition Based Maintenance philosophy.
- 6.1.5 The Maintenance Tool shall provide the overall and detailed view of the status of OTN Systems and its sub-Systems to monitor their status in real time and locate and identify issues as quickly and accurately as possible when an incident occurs
- 6.1.6 The mean down time of the OTN System as a whole shall not be greater than 40 hours per year on an average.
- 6.1.7 The following parameters shall be set for OTN Systems so that the availability and reliability requirements set can be fulfilled, which shall be supported with evidence-based analysis:
- a) Mean time between Maintenance, both corrective and preventative.
 - b) Mean time to maintain, both corrective and preventative.
- 6.1.8 OTN System shall provide the Maintenance functionalities, including but not limited to the following:
- a) Fault detection facilities.
 - b) Fault isolation facilities.
 - c) Secure remote management.
 - d) Predictive and preventative Maintenance based on the performance history of the assets.
- 6.1.9 Required Maintenance personnel to maintain and service all proposed Systems in accordance with this code of practice shall be defined by the Bidder.
- 6.1.10 Preventative Maintenance procedures shall be developed by the Bidder as per the OEM Maintenance requirements.
- 6.1.11 Routine Testing shall be scheduled, and Planning shall be developed by the Bidder to ensure that the Equipment maintained to required System availability of 99.9999 percentile level.
- 6.1.12 The Maintenance procedure shall include repetition of some or all of the Commissioning Tests, or a spot check based either on random selection or on some other means of determination.

- 6.1.13 A detailed list of Spares to be held in stock shall be supplied by the Bidder (installer) to cover the period of a 3 years Maintenance cycle based on failure mode analysis.
- 6.1.14 All electronic OTN Systems shall require no routine or planned Maintenance, therefore, no fans or moving parts shall be used in the Systems to avoid any need for Maintenance.
- 6.1.15 The OTN System shall be constructed to resist the entry of dust with a minimum IP code of IP5X.
- 6.1.16 The OTN Equipment's shall be installed in such a way that a single technician is able to remove and replace for repair purposes, all special Tools and test Equipment shall be supplied.
- 6.1.17 Restoration of Equipment to full operational use shall be possible within 60 minutes (nominally) of repairs being completed.
- 6.1.18 It shall not be necessary to dismantle (remove multiple pieces of) the Equipment to replace a module.
- 6.1.19 The Spares list shall include the following:
- a) Name and address of the local agent for each item of Equipment.
 - b) list giving the name and address of the manufacturer of each item of Equipment.
 - c) a copy of all Test certificates received with the System.
 - d) a preventative Maintenance programme for all Equipment.
 - e) operating instructions for each item of Equipment.
- 6.1.20 PRASA has implemented a Network Quality Monitoring System utilizing stand-alone Remote Test Units ("RTUs") that enables live monitoring of fibre cables. The Bidder shall evaluate the existing System installed in the regions and propose an applicable upgrade of the System to implement a complete monitoring solution.
- 6.1.21 The maintenance-monitoring Tool shall provide google earth view of the fibre optics routes and its sub-Systems, which will all be monitored in a real time with accurate Global Positioning System ("GPS"), coordinates locations of any cable break or damages.
- 6.1.22 The Bidder shall supply all maintenance test Equipment required to maintain the System according to the developed maintenance strategy, including, but not limited to:
- 6.1.23 At least two Ground Penetrating Radar System capable of detecting Coper and Fibre Optics Cables
- 6.1.24 At least two Laptops with at a minimum complying with the following specifications:

Display	
Screen Size	39.6 cm (15.6")
Resolution	1920 x 1080 pixels
HD type	Full HD
Processor	

Processor cores	4
Processor frequency	1.90 GHz
Memory	
Memory	8 GB
Internal memory type	DDR4-SDRAM
Memory clock speed	2400 MHz
Hard Drive	
Hard drive type	SSD
Hard drive capacity	1000 GB
Compatible memory cards	MicroSD (TransFlash)
Graphics	
On-board graphics adapter model	Intel® UHD Graphics 620
Discrete graphics adapter memory	4 GB
Discrete graphics memory type	GDDR5
Audio	
Number of built-in speakers	2
Built-in microphone	Yes
Camera	
Front camera	Yes
Front camera HD type	HD
Networking	
Wi-Fi standards	802.11a,Wi-Fi 5 (802.11ac),802.11b,802.11g,Wi-Fi 4 (802.11n)
Ports & Interfaces	
Bluetooth	Yes
Keyboard	
Pointing device	Touchpad
Windows keys	Yes
Software	
Operating System	Windows 10 Pro
Operating System architecture	64-bit
Battery	
Battery Technology	Lithium-Ion (Li-Ion)
Battery capacity (Watt hours)	48 Wh
Power Supply	
220 AC adapter power	65 W

6.2 First Level Maintenance

6.2.1 The Bidder shall perform First Level Maintenance for each Section that has been tested, commissioned and handed over to PRASA from the date of interim hand over to the Completion Date thereafter for 730 calendar days commencing on the Completion Date for the whole of the Works until PRASA issuance of the Performance Certificate thereafter PRASA shall take over Maintenance.

6.2.2 First Level Maintenance shall, at a minimum consist of:

- a) A detailed Maintenance and lifecycle financial model.
- b) Pre-defined preventative Maintenance.
- c) Pre-defined corrective Maintenance based on visual inspection of faulty Equipment.

6.3 Second Level Maintenance

6.3.1 The Bidder shall perform Second Level Maintenance for each Section that has been tested, commissioned and handed over to PRASA from the date of interim hand over to the Completion Date thereafter for 730 calendar days commencing on the Completion Date for the whole of the Works until PRASA issuance of the Performance Certificate thereafter PRASA shall take over Maintenance.

6.3.2 Second Level Maintenance shall, at a minimum, consist of:

- a) A detailed Maintenance and lifecycle financial model.
- b) Pre-defined corrective Maintenance based on System diagnostics.
- c) Equipment replacement, with the need for basic Software or hardware configuration.
- d) Condition assessment by means of diagnostic Tools and Equipment.

6.3.3 The Bidder shall ensure that the transition of Maintenance responsibilities from the Bidder to PRASA (commencing 90 working days prior to the expiry of the Bidder's total Maintenance period) shall be effortless, that there shall be enough training of PRASA personnel. The Bidder shall further ensure that all documentation, policies, procedures and the like relating to the successful continuation of Maintenance, by PRASA, is transparently and effectively handed over to PRASA.

6.4 Third Level Maintenance

6.4.1 The Bidder (with assistance from PRASA) and the Original Equipment Manufacturer ("OEM") (under management of the Bidder and for whom the Bidder shall ensure availability and compliance), shall perform Third Level Maintenance for each Section that has been tested, commissioned and handed over to PRASA from the date of interim hand over to the Completion Date thereafter for 730 calendar days commencing on the Completion Date for the whole of the Works until PRASA issuance of the Performance Certificate thereafter PRASA shall take over Maintenance.

- 6.4.2 Third Level Maintenance shall, at a minimum, consist of:
- a) A detailed Maintenance and lifecycle financial model.
 - b) Undefined and irregular corrective Maintenance based on advanced System diagnostics.
 - c) Modular replacement, with the need for advanced Software or hardware configuration.
 - d) System configuration changes to accommodate infrastructure upgrades and layout changes.
- 6.4.3 The Bidder shall do local Supplier Development, training and certifying local Suppliers to perform third level Maintenance on the System further ensuring comprehensive inclusion of the OEM throughout the process.
- 6.4.4 The Bidder shall train and develop a minimum of 2 local suppliers further ensuring comprehensive inclusion of the OEM throughout the process.
- 6.4.5 The Bidder (with direct support from the OEM) shall ensure that the transition of Maintenance responsibilities from the Bidder and the OEM to PRASA (commencing 90 working days prior to the expiry of the Bidder's total Maintenance period) shall be effortless, that there shall be enough training of PRASA personnel. The Bidder shall further ensure that all documentation, policies, procedures and the like relating to the successful continuation of Maintenance, by PRASA, is transparently and effectively handed over to PRASA.
- 6.4.6 Training shall require on all supplied System for both Engineering and Maintenance.
- 6.4.7 The training shall cover aspects of the System Design enough for the Engineering and Maintenance to manage the System over its Design life.
- 6.4.8 Operators requirements shall be covered fully in the training process to ensure correct operation of the System, this training shall be provided by the System OEM.
- 6.4.9 Maintenance training contents shall include:
- a) System operation and data communications
 - b) Diagnostic Tools provided with the System and Test Equipment to fault find
 - c) System Failure modes
 - d) Configuration of the System

6.5 Fourth Level Maintenance

- 6.5.1 The Bidder and the OEM (under management of the Bidder and for whom the Bidder shall ensure availability and compliance), shall perform Fourth Level Maintenance for each Section that has been tested, commissioned and handed over to PRASA from the date of interim hand over to the Completion Date thereafter for 730 calendar days commencing on the Completion Date for the whole of the Works until PRASA issuance of the Performance Certificate thereafter the OEM shall take over Maintenance (under supervision from PRASA).

- 6.5.2 Fourth Level Maintenance shall, at a minimum, consist of:
- a) System upgrades
 - b) Changes to the System's core Software
 - c) Component level corrective Maintenance
- 6.5.3 The Bidder shall ensure that the OEM contractually commits to having representation, and providing all necessary Maintenance and/or support, in South Africa for a minimum period of at 240 calendar months post the Bidder's Maintenance, Warranty and Defects Liability period.

7 WARRANTIES

7.1 General

- 7.1.1 The Bidder shall, take interim Warranty responsibility and liability for each Section of that has been tested, commissioned and handed over to PRASA from the date of interim hand over to the Completion Date.
- 7.1.2 The Bidder's full Warranty responsibility and liability period shall be 730 calendar days commencing on the Completion Date for the whole of the Works until PRASA issuance of the Performance Certificate.
- a) Warranties shall, for all Telecommunications related Works, at a minimum, be valid and cover:
 - Replacement of all faulty Plant and Materials, Components and labour for all Maintenance Levels described elsewhere in this document
 - Tracking and tracing and correcting of any Software faults
 - b) Failures caused by the environmental and infrastructure conditions as specified throughout the RFP including, but not limited to:
 - Any Plant and Materials or Components damaged due to exposure to extreme direct sunlight and elevated temperatures
 - Any Plant and Materials or Components damaged due to continues exposure to high humidity
 - Any Plant and Materials or Component failure due to corrosion