TRANSNET
freight rail

A Division of Transnet Limited

INFRASTRUCTURE

SPECIFICATION CONTROL PAGE

CONTRACT

PROJECT SPECIFICATION FOR INFRARED THERMOGRAPHIC SCANNING OF OVERHEAD TRACK EQUIPMENT

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1. SCOPE

1.1 This project specification covers Transnet Freight Rail's requirements for infrared thermo graphic scanning of railway electrification equipment for the Iron Ore line, processing of data and the presentation of results for the purpose of preventative maintenance on 50kV AC overhead track equipment of Transnet Freight Rail under the control of the Depot Engineer's for Sishen- Saldanha line.

2. STANDARDS

	Specification no.	Description
2.1	E4E (August 2006)	Safety arrangements and procedural compliance with the Occupation Health and Safety Act, Act 85 of 1993 and regulations
2.2	BBD5814	Specification for Infra-red Thermographic Scanning of Overhead Track Equipment
2.3	E7/1	Specification for Works On-, Over-, Under- or Adjacent to Railway Lines and near High Voltage Equipment

3. DESCRIPTION OF WORK

3.1 The following contract shall be for a six (6) month period and will comprise of a total of 2 infrared scans. Each scan will be periodically spaced to cater for one scan in every three (3) months, in line with Transnet's heavy haul requirements.

3.2 The working area shall be the overhead track equipment owned and maintained by Transnet Freight Rail at any work location within the borders of the depot (Sishen – Saldanha).

3.3 The estimated total distance of overhead lines to be scanned on each run is **1722 km**. This caters for one run up the line (empty train) through all the loops and one run down the line (loaded train) main line.

3.4 The overhead lines will be scanned during the night. It is expected 420 km and 441km an average of eight to twelve hours can be scanned per night. The Technician will determine the working areas where the scanning of the overhead track equipment shall be done, and shall instruct the Contractor regarding the priorities and programme for performance of the Work with regular updates.

3.5 The Contractor shall perform the following within Transnet Freight Rail's depot area boundaries for Sishen-Saldanha according to the scope of work:

3.5.1 Mount and dismount under supervision, the infrared camera onto- or from the stationary locomotive.

3.5.2 Perform the job only during the night.

3.5.3 The Contractor shall test his/her equipment prior to starting a scanning trip.

3.5.4 The Contractor shall set the infrared camera to clearly view the Overhead track Equipment to be scanned.

3.5.5 The Contractor shall record the exception events and GPS co-ordinates continuously.

3.5.6 After every scan, the Contractor shall label the recordings according to the depot name, section and the Line scanned

3.5.7 The Contractor shall sign the site diary and site instruction book an every scanning trip.

4. CONTRACTUAL OBLIGATIONS

4.1 Over and above the conditions mentioned in the general conditions of contract, the Contractor shall also be responsible for the conditions mentioned hereunder.

4.1.1 The Contractor shall take full responsibility for and shall warrant the suitability and operational compliance of the equipment provided by him for performing the work in accordance with the contract specifications.

4.1.2 The Contractor shall be competent to perform the work required in terms of the contract and shall warrant the competence of persons appointed by them to perform the work.

4.1.3 The Contractor shall perform all the duties and functions required in terms of the contract and shall comply with all reasonable instructions and directions of the Supervisor or his duly authorised deputy in respect of performing the contract work and compliance with Transnet Freight Rail's health and safety requirements.

4.1.4 The Contractor shall not make use of any sub-contractor to perform the works or parts thereof without prior permission from the TFR Project Manager or Supervisor.

4.1.5 The Contractor shall supply a site diary (triplicate copies). This book shall be used to record daily happening such as identifying the sections scanned, and any unusual events during the period of the work. Any delays to the work shall also be recorded, such as delays caused by poor weather conditions, delays caused by scanning being cancelled, etc. The appointed Project Manager or Supervisor must be informed and such delays must be countersigned by the Transnet Freight Rail depot personnel accompanying the scan.

4.1.6 The Contractor shall supply a site instruction book (triplicate copies). This book shall be used to record any instructions to the Contractor regarding problems encountered on site – for example the quality of work or the placement of equipment. This book shall be filled in by the Project Manager, Supervisor or Supervisor deputy and must be countersigned by the Contractor.

4.1.7 Both books mentioned above shall be the property of Transnet Freight Rail and shall be handed over to the Project Manager or Supervisor on the very last day of submitting payment for work done.

4.1.8 Should a planned equipment scan be cancelled at short notice (less than 12 hours) through no fault of the Contractor, the Contractor may claim compensation for his staff at the agreed rate in the schedule of quantities and prices.

4.1.9 The Contractor is responsible for transport of his staff and equipment between centres/infra-areas.

4.1.10 All post-processed reports shall be submitted to the Maintenance Manager/Supervisor/Technical Officer/Project Manager within three (3) days after a successful scan. This may exclude sections that have to be rescanned for whatever reason, and which were done later or will still be done. Failure to comply with this clause will result in a 2.5% penalty per day calculated on the normal payment for sections represented in the delayed report.

4.1.11 Payment for reports shall be made after the information is verified. Transnet Freight Rail will, prior to payment but within ten calendar days from receiving the reports, performs verification of the physical defect

locations and of data format purity. Should quality shortcomings be identified, the Contractor will be expected to redo the post processing where after the Transnet Freight Rail will repeat the verification process. If there is no improvement, the non-performance clause, which forms part of the general conditions of contract shall govern or be enforced.

5. INSTALLATION

5.1 The Contractor shall design clamps and fasteners that will fit to all Transnet Freight Rail's locomotive consist. The design shall be such as to facilitate the equipment to be quickly and securely attached near "LIVE" equipment while stationery in a yard or station area, and in compliance with Transnet Freight Rail's safety requirements.

5.2 The contractor shall mount his/her equipment on the leading locomotive

5.3 No drilling or other method shall be used which cause damage to the locomotive.

5.4 The Contractor shall, under supervision, be responsible for mounting, connecting his/her equipment in such a way that the wires are not preventing the staff free movement and dismantling of the equipment from the locomotive.

6. WORK TO BE DONE BY TRANSNET FREIGHT RAIL

6.1 Transnet Freight Rail shall, subject to its access control, security and safety arrangements; provide to the Contractor such access as is required to perform the works.

6.2 Transnet Freight Rail will provide transport for the Contractor's staff between the point of rendezvous as agreed and the point of arrival or departure of the train within a maximum range of 20km.

6.3 Transnet Freight Rail's Electrical Officer shall be available to co-ordinate the Contractor's performance of the work and to supervise the Contractor performing work in close proximity to "LIVE" overhead electrical equipment, such as mounting or detaching the equipment onto- or from a locomotive.

6.4 The Supervisor or his deputy shall determine on which train and/or locomotive the infrared scanning equipment shall be mounted in order to optimise, as far as possible, the scanning time. He shall advise the Contractor seven (7) calendar days in advance of the section, time and rendezvous for accompanying the Contractor to the locomotive.

6.5 The Supervisor or his deputy shall do verification audits on each report, before making payments and dispatching reports to respective depots.

6.6 The Supervisor or his deputy accompanying the Contractor shall monitor and record all scanning operations and certify payment therefore in accordance with the contract.

6.7 The Supervisor or his deputy shall ensure that parties involved in making payments sign the site diary and instruction book accordingly.

6.8 Transnet authorization Category-C is required of any person who works on electrification equipment near (within 3-m of) "live" equipment. A Category-C authority certificate is issued on the successful completion of a training module and written test to persons who are working near "LIVE" equipments. The training module is presented over four days.

7. TENDERING PROCEDURE

7.1 The term of the Contract shall be six (6) months. Notwithstanding the conditions mentioned in the general conditions of contract.

7.2 Tenderers shall complete the attached "Schedule of Quantities and Prices". Items not reflected in this Schedule, but covered in the Project Specification or agreed at the inspection meeting shall all be added to the 'Schedule of Work and Prices' by the Tenderer and quoted for accordingly.

7.3 Tenderers shall indicate clause-by-clause (including sub clauses) compliance with the specification. This shall take the form of a separate document listing all the specifications clause numbers indicating the individual statement of compliance or non-compliance. This document can be used by Tenderers to elaborate on their clause.

7.4 Tenderers shall motivate a statement of non-compliance.

7.5 Where equipment offered does not comply with standards or publications referred to in the specification, Tenderers shall state which standards apply and submit a copy in English or certified translation.

7.6 Tenderers shall submit equipment type test certificates as specified with the Tender. These shall be in English or certified translation.

7.7 The quantities in the Schedule of Prices and Quantities are estimated and may be more or less than stated.

7.8 The Schedule of Prices makes provision for tenderers to quote the following unit prices:-

7.8.1 A rate per km to scan overhead track equipment. This rate shall include all costs associated with reports compiled per section.

7.8.2 A rate per night/day for accommodation. This rate shall cover all costs of accommodation associated expenses for the Contractor's personnel while away from their headquarters.

7.8.3 A rate per kilometre for travelling. This rate shall cover the costs per kilometre travelled by the Contractor's personnel between the Contractor's headquarters and the departure site in an Infrastructure Area. The A rate per day to compensate the Contractor for cancellation of trains at short notice.

7.8.4 A rate per hour for waiting for trains will only be in effect if the minimum of five hours of scanning is not achieved.

7.9 Tenderers shall quote unit prices that shall be applied in the Schedule of Prices and Quantities to determine the approximate tender price.

7.10 The contract price shall be ascertained as the sum of all scanning costs, report costs, overtime costs, travelling, accommodation and other associated costs.

7.11 Tenderers shall submit proposals of how they will operate to achieve the specified results and also submit specimens of reports to be produced.

7.12 Tenderers shall submit a proof of previous experiences of Infra-red scanning runs.

8. ANNEXURE 1: SCHEDULE OF QUANTITIES AND PRICES (Per Infrared Scan Run)

N.B 1. The below quoted price (equating to subtotal) shall be the total price per infrared scan. This contract makes provision for four (4) runs in the specified 12 month period. The full amount (for 4 runs in 12 months) should be reflected under the gross and final totals for the tender.

2. The full value of the contract shall not be paid up front, but will be released by the depot per run (based on the quoted subtotal value) upon completion of each successful thermographic scan.

No.	ACTIVITY DESCRIPTION	Estimated QTY	UNIT	RATE	AMOUNT
1	Scanning and compilation of exception reports(Processing// completion of exception report // dispatch by courier)	1722	Km		
2	Accommodation	14	Days		
3	Travelling by Road to Depot	2980	Km		
4	Train cancellation by Transnet Freight Rail	6	Per cancellation		
5	Waiting time for train	60	Hr		
6	Waiting time for rail/ train delays	14	P/HRS		
7	Overtime for day time (06:00 AM to 18:00 PM)	18	P/HRS		
8	Overtime for weekends/ Public holidays	48	P/HRS		
9	Software installation/ licence	5	Computers/depot		
10	Hard drive-1TB drive	2	Each		
11	Training on how to use the software, etc.	2	Course		
12	Feedback session (Presenting/ reviewing the report at depot)	2	Each		
	Subtotal (1 run)				
	Grand total (4 runs)				
		GROSS TOTAL		**R**	
		VAT (14%)		**R**	
		TOTAL		**R**	

9. ANNEXURE 2: INFRASTRUCTURE AREAS Iron Ore Line

Depot	Approximate Sections	Scan	Month's to be scanned	Frequency	Approx. km's per scan	Elect Type	Methods of Scanning
Saldanha	Sadanha yard-Halfweg	4 times	July - November 2022	3 monthly	441 (empty train)	50kv AC	Heavy Haul
Halfweg	Halfweg-Erts yard	4 times	July - November 2022	3 monthly	420 (empty train)	50kv AC	Heavy Haul
Sishen	Erts yard-Halfweg	4 times	July - November 2022	3 monthly	420 (Loaded Train)	50kv AC	Heavy Haul
Halfweg	Halfweg- Saldanha	4 times	July - November 2022	3 monthly	441 (Loaded Train)	50kv AC	Heavy Haul

Depot	Approximate Sections	Scan	Month's to be scanned	Frequency	Approx. km's per scan	Elect Type	Methods of Scanning
Saldanha	Sadanha yard-Halfweg	4 times	December - March 2023	3 monthly	441 (empty train)	50kv AC	Heavy Haul
Halfweg	Halfweg-Erts yard	4 times	December - March 2023	3 monthly	420 (empty train)	50kv AC	Heavy Haul
Sishen	Erts yard-Halfweg	4 times	December - March 2023	3 monthly	420 (Loaded Train)	50kv AC	Heavy Haul
Halfweg	Halfweg- Saldanha	4 times	December - March 2023	3 monthly	441 (Loaded Train)	50kv AC	Heavy Haul

Transnet Freigt Rail

OHTE IRT

Depot Project Specification

TFR INFRASTRUCTURE DEPOT technical requirements for OHTE IRT Survey Solution / Programme - in addition to Transnet Freight Rail Technical BBD 8514 (Requirements for Infrared Thermo Graphic Scanning of Overhead Track Equipment)

Objectives of the OHTE IRT Survey Solution and Services:

Transnet Freight Rail Infrastructure Maintenance recognizes Infrared (IRT) technology in general as critical resources (utility) – and the application for OHTE as a very specialized and dedicated service and unique solutions (applications), with unique requirements, to ensure the exact desired outcomes.

The Solution (and Service) required - should clearly constitute a total OHTE IRT Survey solution / Programme – for OHTE Condition Monitoring, for condition based monitoring, indicative of all the aspects involved such as: Personnel qualifications and OHYE IRT related experience, TQM (Total Quality Control), data integrity, service deliverable capacity, adequate equipment and legally licensed applicable software, standardized processes and operational protocols to guarantee of dependable and reliable reporting (information) with sustainable repetition, with redeemable warrantees to information / reporting.

The objective: Practical OHTE IRT Fault Report (information) - with classifications and failure predictions of infrastructure components, condition indicators and standard responses. (Not a linear hotspot data record / index, the thermal indicator data must be presented (report / information) and in relation to the actual (perceived) severity and standard response on field inspection. Simple "hotspot" data indicators as – High, Medium, Low is undesirable).

The purpose of the IRT OHTE survey is expressly to –

- **Generate an Infrastructure Quality Index (IQI)**
  (Note - which implies functionalities - display data as visual representations to provide quantitive and qualitative data mining, referenced maps / graphs etc)
  - **IRT Report 3 Elements (segments) should include:**
    - OHTE(C) Overhead Track Equipment Components
    - OHTE(P) Overhead Track Equipment Pantograph Interface
    - OHTE(S) Overhead Track Equipment Components Thermal Stagger
- **Survey System / Software / Information (Data) – for a Preventative Maintenance Programme**
  - (Note – which implies functionalities – managed information over time / according to priority (Information classification))

  TFR Technical Specification: BBD5814 – 1. Scope: ... "results for the purpose of preventative maintenance..."

  - Specifically classify faults / risk in 5 categories – including Category 3 – PREVENTATIVE.
  - The survey system: THERMATRACK 3.01, or similar – with the following primary components: On-board recording device (Survey unit / THERMATRACK Recorder), the office (desktop) software Report Management Tool RMT (THERMATRACK Reporter), with mobile data tools (THERMATRACK MOLIBE (Android App. / GPS Export (GeoThermal images, etc)

Data

Electronic format

Visual Data (VD / images)

The primary report / rendered format for should be of this nature – Optimized Moving Image Format (OMIF) – with the relevant Look-up Data (LD) to each frame (image) hardcoded (embedded).

The coded Look-up Data (LD) for each image frame SHOULD include – positioning data: The GPS position, and -

- Survey Data (SD) – is a requirement and includes the following: Image frame number, date and time stamp each frame, positioning data, a pixel cursor temperature map,
- Where applicable after processing - the thermal incident highest temperature and the base reference temperature.
- Facility to add / edit component references – for each incident.
- Facility to add / edit general remarks – for each incident.

with a requirement –

- Infrastructure Data (ID) including: The line name, the section (network) ID and the OHTE mast post references.
- Operational Data (OD) including: Train number, type and quantity of locomotives, number of axles, and tonnage.
- Each surveyed section data series – should be partitioned in manageable frame / report sequence volumes (due to basic TFR Laptop / PC technical specifications)

Excel Sheets / Statistics

- Reflect / include all the information above / except image

Hard copy / Print format

- Reflect / include all the information above / including image

Equipment / System –

Onboard Camera

The single sensor system will record – image of -

- the required rear view infrastructure and –
- the additional Pantograph –
  - Preferably inclusive of all the relevant Look-up Data (LD) for the Optimized Moving Image Format (OMIF) Data.
- At maximum wide angles in relation to the infrastructure, retaining maximum pixel definition (value).
- With the physical installations not exceeding footplate restrictions (regulations).
  - Mounting combinations various locomotives - non-intrusive

- **Sensor specifications** – will be evaluated on the following criteria:

  - Minimum camera requirements:
  - IR Resolution: 680x480 (minimum requirement)
  - Emissivity correction: Variable from 0.01 to 1.0
  - Thermal sensitivity/ NETD: <0.05°C @ + 30°C/ 50mK
  - Capacity: 50 Hz / 100 frames
  - FOV: wide angle, near focus without distortion, maximum pixel definition (value). (contractor to innovate, info to be supplied and motivated).

  - Spectral range: (contractor to innovate, info to be supplied and motivated).
  - Detector time constant: (contractor to innovate, info to be supplied and motivated).

- Atmosphere transmission correction: (contractor to innovate, info to be supplied and motivated).
- Reflected apparent temperature correction: (contractor to innovate, info to be supplied and motivated).
- Focus: (contractor to innovate, info to be supplied and motivated).

The single enclosed carry-on unit, containing IRT sensor units and an integrated GPS system, the lowest possible DC voltage operating system, with an operational endurance of 12 hours.

- The secure enclosed carry case MUST be a single person operated unit, to facilitate non-platform embark and disembark at ease - and be able to carry over reasonable distance.
- When the system is deployed, clutter in the cabin such as cables, must be limited, and installations in accordance with the footplate regulations.
- Power supply should be completely independent and isolated from the locomotive – preferably 12V DC or lower, integrated / incorporated into the system.
- The GPS system tracking functions should exceed 7 satellite signals on average –
- Display functions SHOULD include a monitor for the TFR Infra observer.
- The system should offer a 12 hours idle / standby,
- The system data recording functionalities MUST be automated for - pause - stop – start.

Equipment / System –

DESKTOP Analytical Report Tool (ART)

Software Application – for the end user (desktop in depot) to review the Optimized Moving Image Format (OMIF) – should be licensed to Transnet Freight Rail for the duration of the validity / relevance of the data.

The Software Functionalities SHOULD include – 2 primary features:

(A) Executive reporter - providing features and tools for line survey overview of data plot on maps and satellite images, with statistics and elevation chart.

(B) Report viewer:

- The minimum required basic features for viewing of the actual - Moving Data Images:

  (The TFR operator – explores the OMIF on the hard drive with the desktop software, every frame contains all referenced info (LD) – the basic video play functions, but the report (fault frames) is already pre-identified (flagged frames) to be viewed and reviewed separately – AND in the context of the actual recording)

  - EVERY IMAGE (recorded frame) – must display all information embedded – according to Tech Spec BBD5814 (Mast locations / section ID / fault values / etc.)
  - Quick view slider, -
  - play forward, -
  - play backward, -
  - frame-by-frame,
  - still image (with SD functions - pixel cursor temperature,)
  - auto temperature range pan view,
  - manual temperature range pan view,
  - colour and grayscale palette switch,
  - incident identifier and temperature highlighter,
  - search function – by frame, and GPS, and Mast pole.

- Simultaneous geo-referenced interpolation viewer (map / Ortho images) with spatial presentation of incident data (including track and mast data - is an absolute requirement.

- Review flagged frames (frames with faults) - by frame, with the following minimum features:

- Reselection of affected infrastructure, severity, fault (incident) temperature and reference (base) temperature, and –
- comments add / edit,
- components add / edit,

- Report management and review – with minimum functions:
  - All reports must be processed and present –
    - OHTE C (components) 5 Level Classification of incidents and –
    - OHTE S (Stagger) and -
    - OHTE P (Pantograph interaction)
  - Categorize / prioritize actions, and – and accordingly selectively generate:
    - Excel spreadsheets,
    - Excel Soft copies
    - PDF Soft and hardcopies,
    - MSWord soft copies,
    - Statistics generator,
    - GPS export (info and image),
    - GPS import (info and image)
    - Search functions.
  - Integrated Report GPS export functions (image and data) to GPS
  - Generate various data information sharing tool – such as Quick Report / Video report (includes all the info – such as mast locations, etc.)

- Analytical features:
  - All reports must be processed and present –

- New reports - functions should include: Easy integrated functions to create a new report per frame - with coded Look-up Data (LD), requirement is a 1 step function.
  - Select any frame – 1 click generate a 1 report page (with edit options,)
  - Select any frame and generate a sequence report – frames before and after
  - Export in various print formats – including windows default video player.

- Required Advanced functions:
  - Video report (embedded positioning /mast locations),
  - Inquiry report (multi image report print – with all embedded LD information
  - Analytical component – generate temperature graphs – and report output with embedded LD information.
  - Geo image – GPS Application / Android Application – of importing and generating reports.

Notes: The electronic report format – should have a direct link to the moving file format. The information format / architecture for the Analytical Report Tool (ART) SHOULD not be database driven – in the interest of simplicity and technical considerations. The ART application should be Window XP, Service Pack 2 supported, for PC (Desktop / Laptop) – and Windows 7.

Equipment / System –
Mobile data (Mobi)

- Mobile data Android based Application – to export data from the desktop ART – to the field and report back and import data easily to the desktop ART.

- The Application should have all the required functions to manage data in the field – to take photos and display mast locations, edit information and GPS guide facility to the fault location.

- The Application preferred function is a trolley inspection – NEW REPORT function to generate digital fault reports.

Data Integrity Protocol

- It is a requirement that (initial) data processing is computer / software automated – as to avoid human intervention.
  - The process should include - quality control methodology / protocol

- Original data properties should remain evident – after end user / Analytical Report Tool intervention.

The survey solution requirements

The O H T E IRT survey service is viewed as an integrated TFR function / services solution - the contractor MUST be able to demonstrate – the capacity (with reserve) and competency to provide a reliable onsite service and offsite outcome based standardized result.

- Success is highly dependent on integrated workflow processes – from survey planning to executions, in conjunction and dependent on TFR systems / protocols, hence - the contractor / supplier must be able do demonstrate all inter-related aspects to facilitate co-operations –
    - Protocols and Methodology
        - Analytical Standards / classification ratios, etc.
    - documents,
        - Planning documents / Site Diaries integration, etc.
    - equipment,
    - infrastructure and personnel,
    - total quality management (TQM) throughout the operations / process to ensure the outcome based objectives.

- The contractor service review requirement includes an on-site proficiency demonstration and off-site presentation / review of the entire process – to appraise the value proposition, in terms of service integration, quality control, capacity and competency. Once approved – the contractor will be issued a letter of authority to conduct the survey.
- The contractor must have a level 3 IRT qualification appropriate to OHTE with relevant experience demonstrated.

Guarantees / Warrantees:

- Service delivery (report warrantee) - money back (as a free of cost per km "re-survey") of any line:
    - if a fault was recorded in the survey data (and not reported in the report) – in Categories 1 (Critical) / 2 (Immanent)
    - If – a Cat 3 Preventative fault (OHTE component) fails in the Report validity period – as determined / agreed - in the OHTE IRT Preventative Programme for that particular line / section.

- The contractor must proof professional workmanship insurance: R 10 Mil ZAR
- The contractor must proof public liability insurance of R 5 Mil ZAR.
- The contractor must proof workmanship compensation in access of R3 mil ZAR

Experience / Qualifications

- The survey / report must be released / signed off by –
    - An approved person with a proven record of 3 years of OHTE IRT survey experience (or 30 OTHE IRT Surveys and report presentations) / and hold a dedicated OHTE IRT level 3 qualification.

Economic & Technical policies:

- Local (RSA) developed equipment and software content and ownership by the contractor is preferred.
- Adequate replacement equipment, in case of failure is a major advantage.

Required documentation:

1. The contractor approved person, must supply a proven record of 3 years of TFR OHTE IRT survey experience (or 30 TFR OTHE IRT Surveys and report presentations).
2. The contractor approved person must supply a dedicated IRT level 3 qualification for TFR OHTE IRT Survey.
3. The contractor approved person should have a LOA Letter of Authority (from the TFR chief engineer) – under who authority the contractor will perform the duties.
4. The contractor operating personnel should have valid C-Green
5. The contractor operating personnel should have Valid Class 4 medical
6. The contractor should provide proof of their ownership of the equipment.
7. The contractor should provide proof of their replacement equipment – if available.
8. The contractor should provide proof of the legal software ownership or the reseller licensing agreement to TFR Infrastructure for the DESKTOP Analytical Report Tool (ART).
9. The contractor should provide proof of the legal software ownership or the reseller licensing agreement to TFR Infrastructure for the Mobile Android Application (Mobi).
10. The contractor operator should provide proof (and / or may be required to demonstrate competency) - that they are well familiar with the operations and use of the equipment.
11. The contractor must supply proof of an TFR Approved dedicated Hazards and Safety plan pertaining to the work environment of TFR Operations on Locomotives.
12. The contractor must proof professional workmanship insurance: R 10 Mil ZAR
13. The contractor must proof public liability insurance of R 5 Mil ZAR.
14. The contractor must proof workmanship compensation in access of R3 mil ZAR
15. The contractor must have a SAFTY FILE – with Hazzards / Fall plan / General operational procedures approved by TFR Operations Risk management.

----------TFR end

TRANSNET LIMITED

(Registration no. 1990/00900//06)

SAFETY ARRANGEMENTS AND PROCEDURAL COMPLIANCE WITH THE OCCUPATIONAL HEALTH AND SAFETY ACT (ACT 85 OF 1993) AND APPLICABLE REGULATIONS

1. General

1.1 The Contractor and Transnet Limited (hereinafter referred to as "Transnet") are individual employers, each in its own right, with their respective duties and obligations set out in the Occupational Health and Safety Act, Act 85 of 1993 (the Act) and applicable Regulations.

1.2 The Contractor accepts, in terms of the General Conditions of Contract and in terms of the Act, his obligations as an employer in respect of all persons in his employ, other persons on the premises or the Site or place of work or on the work to be executed by him, and under his control. He shall, before commencement with the execution of the contract work, comply with the provisions set out in the Act, and shall implement and maintain a Health and Safety Plan as described in the Construction Regulations, 2003 and as approved by Transnet, on the Site and place of work for the duration of the Contract.

1.3 The Contractor accepts his obligation to complying fully with the Act and applicable Regulations notwithstanding the omission of some of the provisions of the Act and the Regulations from this document.

1.4 Transnet accepts, in terms of the Act, its obligations as an employer of its own employees working on or associated with the site or place of work, and the Contractor and Project Manager or his deputy shall at all times, co-operate in respect of the health and safety management of the site, and shall agree on the practical arrangements and procedures to be implemented and maintained during execution of the Works.

1.5 In the event of any discrepancies between any legislation and this specification, the applicable legislation will take precedence.

2. Definitions

2.1 In this Specification any word or expression to which a meaning has been assigned in the Construction Regulations, shall have the meaning so assigned to it, unless the context otherwise indicates: -

2.2 The work included in this Contract shall for the purposes of compliance with the Act be deemed to be **"Construction Work"**, which, in terms of the Construction Regulations, 2003 means any work in connection with: -

(a) the erection, maintenance, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure;

(b) the installation, erection, dismantling or maintenance of fixed plant where such work includes the risk of a person falling;

(c) the construction, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or any similar civil engineering structure; or

(d) the moving of earth, clearing of land, the making of an excavation, piling, or any similar type of work;

2.3 **"competent person"** in relation to construction work, means any person having the knowledge, training and experience specific to the work or task being performed: Provided that where appropriate qualifications and training are registered as per the South African Qualifications Authority Act, 1995 these qualifications and training shall be deemed to be the required qualifications and training;

2.4 **"contractor"** means principal contractor and "subcontractor" means contractor as defined by the Construction Regulations, 2003.

2.5 **"fall protection plan"** means a documented plan, of all risks relating to working from an elevated position, considering the nature of work undertaken, and setting out the procedures and methods applied to eliminate the risk;

2.6 **"health and safety file"** means a file, or other record in permanent form, containing the information required to be kept on site in accordance with the Act and applicable Regulations;

2.7 **"Health and Safety Plan "** means a documented plan which addresses the hazards identified and include safe work procedures to mitigate, reduce or control the hazards identified;

2.8 **"Risk Assessment"** means a programme to determine any risk associated with any hazard at a construction site, in order to identify the steps needed to be taken to remove, reduce or control such hazard;

2.9 "**the Act"** means the Occupational Health and Safety Act No. 85 of 1993.

3. Procedural Compliance

3.1 The Contractor who intends to carry out any construction work shall, before carrying out such work, notify the Provincial Director in writing if the construction work:-

(a) includes the demolition of a structure exceeding a height of 3 metres; or

(b) includes the use of explosives to perform construction work; or

(c) includes the dismantling of fixed plant at a height greater than 3m,

and shall also notify the Provincial Director in writing when the construction work exceeds 30 days or will involve more than 300 person days of construction work and if the construction work:-

(a) includes excavation work deeper than 1m; or

(b) includes working at a height greater than 3 metres above ground or a landing.

3.2 The notification to the Provincial Director shall be on a form similar to Annexure A of the Construction Regulations, 2003, also shown in Annexure 1 of this Specification. The Contractor shall ensure that a copy of the completed notification form is kept on site for inspection by an inspector, Project Manager or employee.

3.3 The Contractor shall, in accordance with the Act and applicable Regulations, make all the necessary appointments of competent persons in writing on a form similar to Annexure 2 of this Specification and deliver copies thereof to the Project Manager. Copies should also be retained on the health and safety file.

3.4 Subcontractors shall also make the above written appointments and the Contractor shall deliver copies thereof to the Project Manager.

3.5 In the case of a self-employed Contractor or any subcontractor who has the appropriate competencies and supervises the work himself, the appointment of a construction supervisor in terms of regulation 6.1 of the Construction Regulations, 2003 will not be necessary. The Contractor shall in such a case execute and sign a declaration, as in Annexure 3, by which he personally undertakes the duties and obligations of the "Chief Executive Officer" in terms of section 16(1) of the Act.

3.6 The Contractor shall, before commencing any work, obtain from the Project Manager an access certificate as in Annexure 4 executed and signed by him, permitting and limiting access to the designated site or place of work by the Contractor and any subcontractors under his control.

3.7 Procedural compliance with Act and Regulations, as above, shall also apply to any subcontractors as employers in their own right. The Contractor shall furnish the Project Manager with full particulars of such subcontractors and shall ensure that they comply with the Act and Regulations and Protekon's safety requirements and procedures.

4. Special Permits

Where special permits are required before work may be carried out such as for hotwork, isolation permits, work permits and occupations, the Contractor shall apply to the Project Manager or the relevant authority for such permits to be issued. The Contractor shall strictly comply with the conditions and requirements pertaining to the issue of such permits.

5. Health and Safety Programme

5.1 The Tenderer shall, with his tender, submit a Health and Safety Programme setting out the practical arrangements and procedures to be implemented by him to ensure compliance by him with the Act and Regulations and particularly in respect of: -

(i) The provision, as far as is reasonably practical, of a working environment that is safe and without risk to the health of his employees and subcontractors in terms of section 8 of the Act;

(ii) the execution of the contract work in such a manner as to ensure in terms of section 9 of the Act that persons other than those in the Contractor's employment, who may be directly affected by the contract work are not thereby exposed to hazards to their health and safety;

(iii) ensuring, as far as is reasonably practical, in terms of section 37 of the Act that no employee or subcontractor of the Contractor does or omits to do any act which would be an offence for the Contractor to do or omit to do.

5.2 The Contractor's Health and Safety Programme shall be based on a risk assessment in respect of the hazards to health and safety of his employees and other persons under his control that are associated with or directly affected by the Contractor's activities in performing the contract work and shall establish precautionary measures as are reasonable and practical in protecting the safety and health of such employees and persons.

5.3 The Contractor shall cause a risk assessment contemplated in clause 5.2 above to be performed by a competent person, appointed in writing, before commencement of any Construction Work and reviewed during construction. The Risk Assessments shall form part of the Health and Safety programme to be applied on the site and shall include at least the following:

(a) The identification of the risks and hazards that persons may be exposed to;

(b) the analysis and evaluation of the hazards identified;

(c) a documented Health and Safety Plan, including safe work procedures to mitigate, reduce or control the risks identified;

(d) a monitoring and review plan.

5.4 The Health and Safety Plan shall include full particulars in respect of: -

(a) The safety management structure to be instituted on site or place of work and the names of the Contractor's health and safety representatives and members of safety committees where applicable;

(b) the safe working methods and procedures to be implemented to ensure the work is performed in compliance with the Act and Regulations;

(c) the safety equipment, devices and clothing to be made available by the Contractor to his employees;

(d) the site access control measures pertaining to health and safety to be implemented;

(e) the arrangements in respect of communication of health and safety related matters and incidents between the Contractor, his employees, subcontractors and the Project Manager with particular reference to the reporting of incidents in compliance with Section 24 and General Administrative Regulation 8 of the Act and with the pertinent clause of the General Conditions of Contract forming part of the Contract and

(f) the introduction of control measures for ensuring that the Safety Plan is maintained and monitored for the duration of the Contract.

5.4 The Health and Safety programme shall be subject to the Project Manager's approval and he may, in consultation with the Contractor, order that additional and/or supplementary practical arrangements and procedures be implemented and maintained by the Contractor or that different working methods or safety equipment be used or safety clothes be issued which, in the Project Manager's opinion, are necessary to ensure full compliance by the Contractor with his obligations as an employer in terms of the Act and Regulations. The Project Manager or his deputy shall be allowed to attend meetings of the Contractor's safety committee as an observer.

5.5 The Contractor shall take reasonable steps to ensure that each subcontractor's Health and Safety Plan is implemented and maintained on the construction site: Provided that the steps taken, shall include periodic audits at intervals mutually agreed to between the them, but at least once every month.

5.6 The Contractor shall stop any subcontractor from executing any construction work, which is not in accordance with the Contractor's, and/or subcontractor's Health and Safety Plan for the site or which poses a threat to the health and safety of persons.

5.7 The Contractor shall ensure that a copy of the Health and Safety Plan is available on site for inspection by an inspector, Project Manager, agent, subcontractor, employee, registered employee organisation, health and safety representative or any member of the health and safety committee.

5.8 The Contractor shall consult with the health and safety committee or, if no health and safety committee exists, with a representative group of employees, on the development, monitoring and review of the Risk Assessment.

5.9 The Contractor shall ensure that all employees under his control are informed, instructed and trained by a competent person regarding any hazard and the related work procedures before any work commences, and thereafter at such times as may be determined in the Risk Assessment.

5.10 The Contractor shall ensure that all subcontractors are informed regarding any hazard as stipulated in the Risk Assessment before any work commences, and thereafter at such times as may be determined in the Risk Assessment.

5.11 The Contractor shall ensure that all visitors to a construction site undergoes health and safety induction pertaining to the hazards prevalent on the site and shall be provided with the necessary personal protective equipment.

6. Fall Protection Plan

6.1 In the event of the risk and hazard identification, as required in terms of clause 5.3 of this Specification, revealing risks relating to working from an elevated position the contractor shall cause the designation of a competent person, responsible for the preparation of a fall protection plan;

6.2 The Contractor shall implement, maintain and monitor the fall protection plan for the duration of Contract. The Contractor shall also take such steps to ensure the continued adherence to the fall protection plan.

6.3 The fall protection plan shall include:-

(a) A Risk Assessment of all work carried out from an elevated position;

(b) the procedures and methods to address all the identified risks per location;

(c) the evaluation of the employees physical and psychological fitness necessary to work at elevated positions;

(d) the training of employees working from elevated positions; and

(e) the procedure addressing the inspection, testing and maintenance of all fall protection equipment.

7. Hazards and Potential Hazardous Situations

The Contractor and the Project Manager shall immediately notify one another of any hazardous or potentially hazardous situations which may arise during performance of the Contract by the Contractor or any subcontractor and, in particular, of such hazards as may be caused by the design, execution and/or location and any other aspect pertaining to the contract work.

8. Health and Safety File

8.1 The Contractor shall ensure that a health and safety file is opened and kept on site and shall include all documentation required as per the Act and applicable regulations, and made available to an inspector, the Project Manager, or subcontractor upon request.

8.2 The Contractor shall ensure that a copy of the both his Health and Safety Plan as well as any subcontractor's Health and Safety Plan is available on request to an employee, inspector, contractor or the Project Manager.

8.3 The Contractor shall hand over a consolidated health and safety file to the Project Manager upon completion of the Construction Work and shall in addition to documentation mentioned in the Act and applicable Regulations include a record of all drawings, designs, materials used and other similar information concerning the completed structure.

ANNEXURE 1

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993

Regulation 3(1) of the Construction Regulations

NOTIFICATION OF CONSTRUCTION WORK

1(a) Name and postal address of principal contractor:

_____

(b) Name and tel. no of principal contractor's contact person:

_____

2. Principal contractor's compensation registration number: _____

3.(a) Name and postal address of client:

_____

(b) Name and tel no of client's contact person or agent:

_____

4.(a) Name and postal address of designer(s) for the project:

_____

(b) Name and tel. no of designer(s) contact person:

_____

5. Name and telephone number of principal contractor's construction supervisor on site appointed in terms of regulation 6(1).

_____

6. Name/s of principal contractor's construction sub-ordinate supervisors on site appointed in terms of regulation 6(2).

_____

7. Exact physical address of the construction site or site office:

_____

8. Nature of the construction work:

_____

_____

_____

_____

_____

9. Expected commencement date: _____

10. Expected completion date: _____

11. Estimated maximum number of persons on the construction site: _____

12. Planned number of contractors on the construction site accountable to the principle contractor:

_____

13. Name(s) of contractors already chosen.

_____
_____
_____
_____
_____
_____
_____

_____ _____

Principal Contractor **Date**

_____ _____

Client **Date**

* THIS DOCUMENT IS TO BE FORWARDED TO THE OFFICE OF THE DEPARTMENT OF LABOUR **PRIOR TO COMMENCEMENT** OF WORK ON SITE.

* **ALL PRINCIPAL CONTRACTORS** THAT QUALIFY TO NOTIFY MUST DO SO EVEN IF ANOTHER PRINCIPAL CONTRACTOR ON THE SAME SITE HAD DONE SO PRIOR TO THE COMMENCEMENT OF WORK.

ANNEXURE 2

(COMPANY LETTER HEAD)

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993 (ACT 85 OF 1993) :

SECTION/REGULATION: _____

REQUIRED COMPETENCY: _____

In terms of _____ I, _____

representing the Employer) do hereby appoint _____

As the Competent Person on the premises at _____

(physical address) to assist in compliance with the Act and the applicable Regulations.

Your designated area/s is/are as follows :-

_____

_____

_____

Date : _____

Signature :- _____

Designation :- _____

ACCEPTANCE OF DESIGNATION

I, _____ ***do hereby accept this Designation and acknowledge that I understand the requirements of this appointment.***

Date : _____

Signature :- _____

Designation :- _____

ANNEXURE 3

(COMPANY LETTER HEAD)

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993 (ACT 85 OF 1993) :

DECLARATION

In terms of the above Act I, _____ am personally assuming the duties and obligations as Chief Executive Officer, defined in Section 1 of the Act and in terms of Section 16(1), I will, as far as is reasonably practicable, ensure that the duties and obligations of the Employer as contemplated in the above Act are properly discharged.

Signature :- _____

Date : _____

ANNEXURE 4

(LETTER HEAD OF BUSINESS DIVISION OR UNIT OF TRANSNET LIMITED)

SITE ACCESS CERTIFICATE

Access to : _____ (Area)
Name of Contractor/Builder :- _____
Contract/Order No.: _____

The contract works site/area described above are made available to you for the carrying out of associated works

In terms of your contract/order with
(company) _____

Kindly note that you are at all times responsible for the control and safety of the Works Site, and for persons under your control having access to the site.

As from the date hereof you will be responsible for compliance with the requirements of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended, and all conditions of the Contract pertaining to the site of the works as defined and demarcated in the contract documents including the plans of the site or work areas forming part thereof.

Signed : _____ ***Date :*** _____
PROJECT MANAGER

ACKNOWLEDGEMENT OF RECEIPT

Name of Contractor/Builder :- _____ ***I,***
_____ ***do hereby acknowledge and accept the duties and obligations in respect of the Safety of the site/area of Work in terms of the Occupational Health and Safety Act; Act 85 of 1993.***

Name : _____ ***Designation :*** _____

Signature : _____ ***Date :*** _____

TRANSNET
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A division of Transnet limited

RAIL NETWORK

SPECIFICATION

REQUIREMENTS FOR INFRARED THERMOGRAPHIC SCANNING OF OVERHEAD TRACK EQUIPMENT.

Author:	Chief Engineering Technician Rail Network	D.G. Naidoo	.....
Recommended:	Acting Senior Engineer Rail Network	K. Motupa	.....
Approved:	Principal Engineer Rail Network	S. Mathebula	.....

Date: 31 May 2017

Circulation restricted to: Rail Network Infrastructure Maintenance
Rail Network Technical

This page is for control purposes only and does not form part of any tender or contract documentation.

TRANSNET
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RAIL NETWORK

TECHNICAL SPECIFICATION

REQUIREMENTS FOR INFRARED THERMOGRAPHIC SCANNING OF OVERHEAD TRACK EQUIPMENT.

This specification covers the requirements for infrared thermal scanning of 3kV DC, 11kV AC, 25kV AC and 50kV AC railway electrification equipment, the processing of the data and presentation of results for the purpose of preventative and corrective maintenance.

INDEX

1.0 SCOPE

This specification covers the technical requirements for infrared thermographic scanning of overhead railway electrification equipment, the pantograph contact wire interaction, processing of data and the presentation of the reports for the purpose of Condition Monitoring as the basis of Preventive Maintenance on 3kV DC, 25kV AC and 50kV AC overhead traction equipment and 6.6/11kV Power Line Equipment of Transnet Freight Rail.

2.0 GENERAL REQUIREMENTS

2.1 Transnet Freight Rail requires condition assessment information of the current carrying performance of its overhead traction equipment. The Contractor shall provide a condition assessment service comprising the following functions:

(a) Infrared recording survey for overhead infrastructure from a moving train consisting of electrical locomotives and wagons loaded to the maximum allowable ton/axle for the section.

(b) Pre- and post-processing and submission of exception reports in hard copy and electronic format.

(c) Provide all the necessary report review graphical analysis application software which has the functionality to review moving and stationary recorded images and to edit and create fault reports.

2.2 The Contractor shall use infrared imaging sensors to detect thermal radiation signatures associated with electrical infrastructure component deterioration relative to a reference temperature of electrification infrastructure equipment, to predict and identify impending and developing failures.

2.3 The contractor shall use infrared imaging sensors to detect thermal radiation signatures associated with the pantograph-contact wire severe interactions (impacts).

2.4 Scanning shall be done at night to eliminate as far as possible the effect of equipment heating due to solar radiation.

3.0 DEFINITIONS

(a) TFR - Transnet Freight Rail

(b) OHTE – Overhead Track Equipment

(c) Reference Temperature - the temperature against which "overheating" components are compared, a calculated weighted average temperature at multiple reference temperature sampling points of the running conductor – and/or the component to which the overheating component is electrically/mechanically connected, considering similar components as that affected in general reference to predict and prevent infrastructure failure.

(d) "Hotspot" - An OHTE Component thermal radiation signature defect as associated with the levels of OHTE electrical infrastructure component deterioration of electrification infrastructure equipment which shall be reported whenever the temperature of the component is ≥5°C above that of the associated Reference Temperature.

(e) IRT – Infra red thermography

(f) Exceptions – An abnormality measured/recorded with a thermal imaging camera that can result in failure of infrastructure.

(g) Thermographer Level 1 – A person certified in terms of a recognised industry standard, who is qualified is to gather high-quality data through thermographic scanning and sort the data based pass/fail criteria.

(h) Thermographer Level 2 – A person certified in terms of a recognised industry standard, who is qualified is to set up and calibrate thermographic equipment, interpret data, create reports and supervise Level 1 Thermographers.

4.0 SERVICE CONDITIONS

The infrared scanning shall be done under the following conditions:

Altitude	: 0 - 1800m above sea level.
Ambient temperature	: -10 °C to +45 °C.
Real feel / wind temp. :	15 to + 60
Relative humidity	: 10% to 90%.
Lightning conditions	: 11 flashes per square km per annum.

5.0 TECHNICAL REQUIREMENTS

5.1 GENERAL EQUIPMENT REQUIREMENTS

The following equipment will be required to provide the full service:

5.1.1 Infrared imaging sensors, 640 X 480 pixel resolution, lens angle between 45 and 60 degrees, mounted on the locomotive in a position providing the area required for the OHTE and the other for the pantograph - contact wire interaction.

5.1.2 Recording equipment - Processor which performs the recording of continuous imaging stream at a minimum rate of 10 frames per second and which sorts the data for identification efficient recovery per section that is defined by kilometre section beacons.

5.1.3 A DC battery based power supply capable of operating all the equipment for a minimum of 10 hours. No power will be sourced from the locomotive.

5.1.4 Processors and software capable to interrogate recorded data and prepare exception reports.

5.2 Software and memory devices are to be made available to Transnet Freight Rail Engineering staff to interrogate the scanned recordings and reports as further described herein.

5.3 SPECIFIC EQUIPMENT REQUIREMENTS.

5.3.1 Equipment installations shall not exceed the footplate restrictions.

5.3.2 The On-Board recording unit on the locomotive
Image recording equipment shall be provided - Infrared sensors / recording device / power supply / software / etc.

5.3.3 The single sensor system must record images of :-

(a) the rear view infrastructure

(b) the Pantograph contact wire interaction

(c) all the relevant look-up data for the optimized moving image format data.

5.3.4 Infrared imaging sensonr specification:

(a) Operating/Spectral range: Long wave (7 - 14µm)
(b) Minimum Resolution: 680 x 480
(c) Accuracy: ± 2°C or ± 2% of reading
(d) Emissivity correction: Variable from 0.01 to 1.0
(e) Ambient / Atmosphere transmission correction: Automatic
(f) Reflected temperature correction: Automatic
(g) Thermal sensitivity/ NETD: <0.05°C @ + 30°C / 50mK
(h) Frame Rate: 100 Hz / minimum recording speed 10 frames per second.
(i) Spatial Resolution / FOV: 45 ° - 60 °
(j) Focus: Automatic

5.3.5 Recording equipment

(a) When the system is set up in the locomotive cabin, clutter in the cabin such as cables must be limited and installations must comply with the footplate regulations.
(b) Power supply to the recording equipment and any associated equipment shall be completely independent from the locomotive with an operational endurance exceeding 10 hours and has to be isolated from the locomotive.
(c) The GPS system tracking functions must exceed 7 satellite signals on average.
(d) Display functions must include a monitor for the Transnet Infrastructure representative / observer.
(e) The recording functionality for stop, start and pause must be automated.

5.3.6 The Viewer Unit

(a) A Software Application shall be made available to the client for the purpose of end user review of all or a part of the thermal recording of the section or report.
(b) The viewer application software will be used by Rail Network engineering staff and installed on computers at multiple locations at the depot concerned.
(c) The software shall comply with the security and other requirements set by Transnet's ICT Department. Approval by ICT must be obtained.

5.3.7 Basic features for viewing/reviewing of the thermal recording/repots are to include the following functionalities:

(a) Quick view slider , play forward , play backward , image stream frame-by-frame, still image, auto temperature range pan view, manual temperature range pan view, colour and grayscale palette toggle.
(b) Search functions by frame, GPS co-ordinates, Mast pole, incident identifier and temperature highlighter,
(c) Simultaneous geo-referenced interpolation viewer (eg. Google Earth) with flagged representation of the incidents/faults data must be provided.

(d) A functionality to review detected faults frame by frame, with the functionality to reselect affected infrastructure by severity, fault temperature and base reference temperature as well as an annotation function for labeling of components.

(e) A Report Management which is to include review functionality for the classified faults so that it can be edited if the need arises for the change in Category / priority actions. It should also be able to selectively generate Excel spreadsheets, PDF copies, Statistics, GPS information and image and create AVI files. Search function options must be made available.

(f) The electronic report format of the thermal defects must have a direct link to the thermal recorded images. The information format / architecture must not be database driven. The application must be Windows 7 based.

5.4 The viewer system must be made available to run on any Rail Network stand-alone or network computer connected on the Transnet Freight Rail information technology platform.

5.5 All the captured thermal recording data must be made available on a portable device.

5.6 All the recorded data must be stored for a minimum of 1 year or as agreed to during repetitive surveys.

5.7 The ""Hotspot" faults are to be categorised according to a 5 level index system as stated below:

Hotspot Classification Threshold Table

The classifications indicated in the following table must be used to indicate severity of exceptions:

Fault Level	Fault Category	Relative Temperature Classification ^{0}C	Colour Code	Repair Response Priority
5	Critical Fault	≥48		Critical
4	Emergency Fault	37 to 47		Emergency
3	Urgent Fault	32 to 36		Urgent
2	Corrective Fault	27 to 31		Short term
1	Preventative Fault	5 to 26		Medium term

Note: Level 5 fault classification is the highest priority corrective action.

5.8 Hotspot temperature range classifications must be structured according to the thermal radiation signatures associated with the OHTE levels of electrical infrastructure component deterioration and must be differentiated between the component relative temperatures in relation to the reference temperature.

5.9 A Pantograph interaction defect shall be reported whenever there's a flash/arc due to the following:

a) hard striking point of the pantograph interacting with the OHTE components or when interfacing with the contact wire.

b) overheating contact wire or pantograph due to "no-stagger" of the contact wire.

c) any excessive arcing / flashing due to interaction abnormalities.

All pantograph interaction defects will be classified as critical priority faults.

5.10 For the purpose of OHTE IRT scanning of the overhead track equipment, the thermal imaging equipment shall be mounted in a position so as to capture "hotspots" and pantograph – contact wire defects.

5.11 The thermal recording equipment shall be capable of reliable operation under the electrically and electromagnetic noisy environment and the mechanical vibration normally associated with electric railway traction locomotives pulling loaded wagons.

5.12 Scanning will be undertaken at night, normally 1 hour after sunset up to 1 hour before sunrise.

5.13 Only under exceptional appropriate atmospheric conditions such as low cloud base, cool evening temperatures, low atmospheric thermal radiation (i.e. no direct sunlight) it can be agreed by the Thermographer, who has to ensure report consistency and reliability and the Transnet Freight Rail Representative that scanning can take place.

5.14 All defect reports must be made available so that it can be easily downloaded to portable devices such as a hand held GPS unit and other mobile devices (e.g. Smartphones, Tablets, etc.). This is to ensure flexible efficiency in locating the defects.

5.15 The system should use IRT recording software to record continuous IRT floating data and save it to an on-board data memory device while capturing all the required related data such as continuous GPS positioning.

5.16 The GPS coordinates must be provided in two formats:

5.16.1 Decimal Degrees: DDD.DDDDD° - Latitude and Longitude for IAMM system.

5.16.2 Degrees Decimal Minutes: DDD° MM.MMM' - 'S' and 'E' for normal hand held GPS devices.

6.0 REPORT REQUIREMENTS

6.1 GENERAL

This section describes the format in which the defects which are identified are in the format of reports as required by Transnet Freight Rail for purposes of post analysis, verifications, corrective actions and locations of the defects.

6.2 TRANSNET FREIGHT RAIL INFORMATION REQUIREMENTS

6.2.1 It is a requirement that all initial data processing is computer or software automated so as to avoid human error or oversight. The process should include quality control methodology and protocols to eliminate false reporting. The original data properties should remain evident for the use of end user.

6.2.2 In addition to kilometric beacons with deviations of long and short km-references, masts are numbered sequentially with reference to the kilometric beacon positions, e.g. "23/14" will be the mast number for the 14th mast between km-23 and km-24 beacons.

6.2.3 Transnet Freight Rail shall provide the Contractor with the basic information of the mast locations by soft copy format.

6.2.4 The contractor shall provide proof of data utilization integrity and technical capability to integrate the data for the mast locations. (be able to do a demonstration application).

6.2.5 Transnet Freight Rail does not guarantee the suitability or integrity of the data provided.

6.2.6 Any information provided and utilised may only be distributed in a secure encrypted format and may not form part of a commercial reseller product.

6.2.7 All spread sheets to be in EXCEL format and no merged cells are allowed.

6.3 FORMAT OF REPORTS

6.3.1 The information shall be supplied in three media formats namely hard copy A4 size, compact disc and portable storage device.

6.3.2 Hard Copy - Executive Report must consist of the following:

(a) a post-processed printout report on all Critical and Emergency defects on completion of a depot's area that provides a purified version as to the probable component that is the source of the "hot-spot" as identified,

(b) a post-processed printout report on completion of a depot's area that provides a purified version on all pantograph interaction arcing / flashes / thermal defects as identified,

(c) the report cover page displaying depot name, survey date and release date and line name / reference,

(d) report interpretation guidelines,

(e) a control Excel database of all fault categories in the format required,

(f) copy of the site diary,

(g) Quality Line Index (QLI) calculations defined as for "Hotspots" and Pantograph interaction defects per km per section,

6.3.3 Compact Disc and Digital Video Disc format's shall consist of the following:

(a) contain all of the above including EXCEL spreadsheets (no merged cells allowed),

(b) PDF printable documents of all 5 of the category fault classifications,

(c) PDF printable documents of all pantograph interaction defects,

(d) the electronic image files (JPEG and MPEG/AVI format) of all "hotspot" and pantograph interaction arcing / flashes / thermal discharges for each defect detected a 6 second image sequence file on CD shall be provided, starting 4 seconds before- and ending 2 seconds after the defect.

6.3.4 Mobile Portable storage device shall contain:

(a) all the required information as stated in in 6.3.1 (a) and (b) above,

(b) the complete thermal recording for the depot for the purpose of reviewing, report management, etc.

6.4 DATA VERIFICATION

6.4.1 Transnet may require a verification of the data before acceptance and these details will be described in the project specification.

6.4.2 Transnet Freight Rail may prior to payment, sample and perform field verification audit according to technical standards with regards to the faults reported on the physical defect location confirmation (positioning) and the data format compliance.

7.0 PERSONNEL REQUIREMENTS

7.1 QUALIFICATIONS, ROLES AND RESPONSIBILITIES

7.1.1 The themographic survey shall be conducted by a minimum Level 1 Thermographer or higher. The Contractor shall indicate on the report the ID of the Thermographer responsible for the scanning and the post processing. The Contractor shall provide certified copies of the Thermographer's certification.

7.1.2 The Themographer conducting the survey shall have a valid Category C (Green License) prior to commencement of the Project. This training for the License shall be obtained from Transnet's School of Rail, and the Category C (Green License) through examination by the Examining officer on the respective region. The Contractor shall be responsible for all costs associated with obtaining the License.

7.1.3 The pre- and post-processing shall be conducted by minimum Level 2 Thermographer or higher.

7.1.4 The Thermographer(s) shall have sufficient knowledge of the components, construction and theory of electrical systems to understand observations.

8.0 TENDER PROCEDURE

8.1 The Tenders shall be submitted in accordance with Transnet's tendering method as stated in the Project Specification.

8.2 A fully functional system must be available immediately on acceptance of the offer.

8.3 No product or prototype testing of any system will be allowed.

8.4 The Tenderers may be required to demonstrate the system which they have to offer prior to being awarded the scanning campaign.

8.5 The Tenderers must submit all traceable work references or experience related to thermography.

8.6 The Tenderers must submit proof of qualification for all their Thermographers who will be conducting the Works as per this Specification.

8.7 The Tenderer is required to submit a clause by clause compliance statement with their offer.

9.0 ANNEXURES FORMING PART OF THIS SPECIFICATION.

Annexure 1: INFORMATION REQUIRED IN DATABASE FORMAT

Annexure 2: FORMAT FOR HARD COPY EXCEL HOTSPOT REPORT-1

Annexure 3: FORMAT FOR HARD COPY EXCEL INTERACTION REPORT- 2.

Annexure 4: FORMAT FOR THERMAL HOTSPOT REPORT 1

Annexure 5: FORMAT FOR THERMAL INTERACTION REPORT 2

Annexure 6: STANDARD DESCRIPTIONS OF COMPONENTS.

END

ANNEXURE 1. INFORMATION REQUIRED IN DATABASE FORMAT

Microsoft Excel file format for viewing with Microsoft Office software, and for importing into IAMM viewer:

Parameter	***Format, e.g.***
Record no.	*0001*
Date	*2004-03-12*
Scan no.	*1*
FIN YEAR	*14/15*
REGION	*Central*
BUSINESS UNIT	*CAB*
DEPOT	*Ladysmith*
GPS Lattitude	*-27.33911629*
GPS Longitude	*29.84803401*
GPS Altitude	*1707.22*
Section ID	*E1H13VC*
Line code	*C02 – L028*
Section description Node 1	*Newcastle*
Section description Node 2	*Ladysmith*
Mast location (before fault)	*45/2*
Mast location (after fault)	*45/3*
Line (up/down/yard)	*Up*
Timer display	*01:24:34*
Kilometer	*45*
Meter	*0.0102*
Linked bitmap	***LDS_0034 .JPEG***
Linked video clip	***LDS_0034 .MPEG***
Infra red Defect Type	*OHTE / Pantograph*
Defective component	*Catenarysplice / arcing*
Relative temperature	*16°C*
Fault temperature	*36°C*

ANNEXURE 2. FORMAT OF HARD COPY EXCEL REPORT-1 – INFRA RED HOTSPOT DEFECTS

DEPOT:VRYHEID VRYHEID TO ERMELO LINE 2		HOTSPOT DEFECTS 10 JUNE 2014			
RECORD DATA	RECORD No.	1	2	3	4
	DATE	2014/06/09	2014/06/09	2014/07/18	2014/07/18
	SCAN No.	1	1	1	1
	FIN YEAR	14/15	14/15	14/15	14/15
	REGION	Eastern	Eastern	Eastern	Eastern
	BUSINESS UNIT	COAL	COAL	COAL	COAL
	DEPOT	Vryheid	Vryheid	Vryheid	Vryheid
	RECORD NO.	VHD-EMO-2_0001_00000	VHD-EMO-2_0001_00000	VHD-EML-L2_0001_00000	VHD-EML-L2_0014_00002
DDD° MM.MMM'	LATITUDE	S27'45.87098	S27'45.998736	S27'46.110643	S26'34.437541
	LONGITUDE	E030'50.773463	E030'50.778342	E030'50.776301	E030'1.640368
DDD.D DDDD°	LATITUDE	-27.76451634	-27.7666456	-27.76851072	-26.57395902
	LONGITUDE	30.84622438	30.84630571	30.84627169	30.02733947
	ALTITUDE	1146	1140	1139	1702
SECTION LOCATION	LINE NAME	Vryheid 2 Ermelo L2	Vryheid 2 Ermelo L2	Vryheid 2 Ermelo L2	Vryheid 2 Ermelo L2
	SECTION ID (Database)	R05A (NEW) No1 VRYHEID OOS - NHLAZATSHE (Excl.)	R05A No1 VRYHEID OOS - NHLAZATSHE (Excl.)	R05A (NEW) No1 VRYHEID OOS - NHLAZATSHE (Excl.)	R03A (NEW) No1 ERMELO - PIET RETIEF
	LINE CODE (Database)	CO5-L208	508	208	204
	LINE FROM	Vryheid	Vryheid	Vryheid	Vryheid
	LINE TO	Ermelo	Ermelo	Ermelo	Ermelo
	LINE(Up/Down/Yard)	Up Vryheid Depot	Up Vryheid Depot	Up Vryheid Depot	Up Vryheid Depot
FAULT DATA	MAST LOC. BEFORE	0/14 (Distance: 4.54m Bearing: 319.6deg)	0/19 (Distance: 11.12m Bearing: 353.15deg)	0/23 (Distance: 37.56m Bearing: 358.95deg)	0/26 (Distance: 9.32m Bearing: 12.68deg)
	MAST LOC. AFTER	0/15 (Distance: 38m Bearing: 180.16deg)	0/20 (Distance: 51.41m Bearing: 179.59deg)	1/1 (Distance: 4.44m Bearing: 167.79deg)	0/26 (Distance: 0.64m Bearing: 188.84deg)
	LINKED BITMAP	VHD-EMO-2_0001_00000.bmp	VHD-EMO-2_0001_00000.bmp	VHD-EML-L2_0001_00000.bmp	VHD-EML-L2_0014_00002.bmp
	LINKED VIDEOCLIP	VHD-EMO-2_0001_00000.avi	VHD-EMO-2_0001_00000.avi	VHD-EML-L2_0001_00000.avi	VHD-EML-L2_0014_00002.avi
	COMPONENT	C Jumper			FCC Jumper
	CATEGORY	D / Minor CF	D / Minor CF	D / Minor CF	B / Critical CF
	Temp of Fault	22.1	16.38	21.27	45.26
	Reference Temp	17.19	11.68	13.04	3.86

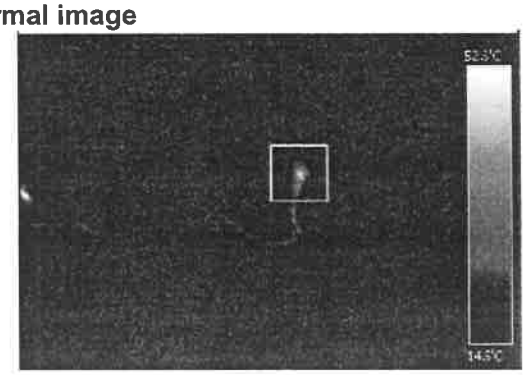
ANNEXURE 3. FORMAT OF HARD COPY EXCEL REPORT-2 – INFRA RED PANTOGRAPH INTERACTION DEFECTS

DEPOT:VRYHEID VRYHEID TO ERMELO LINE 2		PANTOGRAPH / CONTACT WIRE INTERACTION DEFECTS 10 JUNE 2014			
RECORD DATA	RECORD No.	1	2	3	4
	DATE	2014/06/09	2014/06/09	2014/07/18	2014/07/18
	SCAN No.	1	1	1	1
	FIN YEAR	14/15	14/15	14/15	14/15
	REGION	Eastern	Eastern	Eastern	Eastern
	BUSINESS UNIT	COAL	COAL	COAL	COAL
	DEPOT	Vryheid	Vryheid	Vryheid	Vryheid
	RECORD NO.	VHD-EMO-2_0001_00000	VHD-EMO-2_0001_00000	VHD-EML-L2_0001_00000	VHD-EML-L2_0014_00002
DDD° MM.MMM'	LATITUDE	S27'45.87098	S27'45.998736	S27'46.110643	S26'34.437541
	LONGITUDE	E030'50.773463	E030'50.778342	E030'50.776301	E030'1.640368
DDD.D DDDD°	LATITUDE	-27.76451634	-27.7666456	-27.76851072	-26.57395902
	LONGITUDE	30.84622438	30.84630571	30.84627169	30.02733947
	ALTITUDE	1146	1140	1139	1702
SECTION LOCATION	LINE NAME	Vryheid 2 Ermelo L2	Vryheid 2 Ermelo L2	Vryheid 2 Ermelo L2	Vryheid 2 Ermelo L2
	SECTION ID (Database)	R05A (NEW) No1 VRYHEID OOS - NHLAZATSHE (Excl.)	R05A No1 VRYHEID OOS - NHLAZATSHE (Excl.)	R05A (NEW) No1 VRYHEID OOS - NHLAZATSHE (Excl.)	R03A (NEW) No1 ERMELO - PIET RETIEF
	LINE CODE (Database)	CO5-L208	508	208	204
	LINE FROM	Vryheid	Vryheid	Vryheid	Vryheid
	LINE TO	Ermelo	Ermelo	Ermelo	Ermelo
	LINE(Up/Down/Yard)	Up Vryheid Depot	Up Vryheid Depot	Up Vryheid Depot	Up Vryheid Depot
FAULT DATA	MAST LOC. BEFORE	0/14 (Distance: 4.54m Bearing: 319.6deg)	0/19 (Distance: 11.12m Bearing: 353.15deg)	0/23 (Distance: 37.56m Bearing: 358.95deg)	0/26 (Distance: 9.32m Bearing: 12.68deg)
	MAST LOC. AFTER	0/15 (Distance: 38m Bearing: 180.16deg)	0/20 (Distance: 51.41m Bearing: 179.59deg)	1/1 (Distance: 4.44m Bearing: 167.79deg)	0/26 (Distance: 0.64m Bearing: 188.84deg)
	LINKED BITMAP	VHD-EMO-2_0001_00000.bmp	VHD-EMO-2_0001_00000.bmp	VHD-EML-L2_0001_00000.bmp	VHD-EML-L2_0014_00002.bmp
	LINKED VIDEOCLIP	VHD-EMO-2_0001_00000.avi	VHD-EMO-2_0001_00000.avi	VHD-EML-L2_0001_00000.avi	VHD-EML-L2_0014_00002.avi
	COMPONENT	Section Insulator	Contact Splice	Neutral Section	Overlap
	Temp of Fault	22.1	16.38	21.27	45.26
	Reference Temp	17.19	11.68	13.04	3.86

ANNEXURE 4. FORMAT OF HARD COPY REPORT-1 OHTE HOTSPOT DEFECT

Images of the overhead wires must be combined in a graphic picture, and the location text superimposed on the graphic. The file must be in the JPEG format. An example of the graphic format is provided as guideline:

Thermal image



NOTES / ACTIONS

DATE		2009/03/18
REPORT NO.		DBN_0013
GPS CO-ORDINATES	LATITUDE	S-29,522230
	LONGITUDE	E31,182785
	ALTITUDE	30
IAMM CO-ORDINATES Decimal degrees	LATITUDE	-29,652301
	LONGITUDE	31,485671
SECTION DESCRIPTION	LINE NAME	Durban To Stanger
	LINE FROM Node 1	Durban
	LINE TO Node 2	Stanger
	LINE TYPE	DC / AC
MAST LOC. BEFORE		45/2
MAST LOC. AFTER		45/3
LINKED BITMAP		DBN_0013
LINKED VIDEO CLIP		DBN_0013
COMPONENT		FCC JUMPER
CATEGORY		5
LINE (Up/ Down/Yard)		UP
Temp. of Fault (°C)		56.9
ReferenceTemp. (°C)		20.9
Repairs Undertaken:		

Name: _____ Signature: _____ Date: _____

ANNEXURE 5. FORMAT OF HARD COPY REPORT-2 - PANTOGRAPH ARCING

Thermal image **NOTES / ACTIONS**

DATE		2009/03/18
REPORT NO.		DBN_0013
GPS CO-ORDINATES	**LATITUDE**	S-29,522230
	LONGITUDE	E31,182785
	ALTITUDE	30
IAMM CO-ORDINATES Decimal degrees	**LATITUDE**	-29,652301
	LONGITUDE	31,485671
SECTION DESCRIPTION	**LINE NAME**	Durban To Stanger
	LINE FROM Node 1	Durban
	LINE TO Node 2	Stanger
	LINE TYPE	DC / AC
MAST LOC. BEFORE		45/2
MAST LOC. AFTER		45/3
LINKED BITMAP		DBN_0013
LINKED VIDEO CLIP		DBN_0013
COMPONENT		Pantograph flash
LINE (Up/ Down/Yard)		UP
Temp. of Fault (°C)		56.9
ReferenceTemp. (°C)		20.9
Repairs Undertaken:		

Name: Signature: Date:

ANNEXURE 6. STANDARD DESCRIPTIONS OF COMPONENTS

The standard defect descriptions are to be used for compatibility with the IAMM system and have a standard word length with underscore characters for word breaks. No other description may be used. Pick-list compiling is recommended. The information is available to the successful tenderer in electronic format from Transnet Freight Rail.

1 Bond_Mast_Rail_Mast_side
2 Bond_Mast_Rail_Rail_side
3 Bond_Rail_continuity
4 Booster_wire_clamp
5 Clamp_ FCC catenary_side
6 Clamp_Catenary_Suspension
7 Clamp_Contact
8 Clamp_Earth_wire
9 Clamp_FCC_ contact_side
10 Clamp_FCC_ feeder_side
11 Clamp_Feeder_Suspension
12 Distribition_switch_contacts
13 Distribution_line_clamp
14 Distribution_line_insulator
15 Dropper
16 Insulator_Cross_Span
17 Insulator_Feeder
18 Insulator_Strain
19 Insulator_Strutt
20 Insulator_Suspension
21 Insulator_Top
22 Jumper _FCC
23 Jumper_Contact_Contact
24 Jumper_Track_switch
25 Multiple_components
26 Phase_break
27 Pantograph bounce
28 Pantograph flash
29 Section_insulator
30 Splice_Contact
31 Splice_Feeder
32 Track_switch_contacts
33. Uncertain_Investigate futher

END