T1.1 Tender Notice and Invitation to Tender

Transnet SOC Ltd invites tenders for Transnet Freight Rail, Real Estate Management, Kimberley
Supply and installation of a radio high site mast at Koopmansfontein

Tenderers should have a CIDB contractor grading designation of 2 CE or higher.

The physical address for collection of tender documents is Transnet Freight Rail, Supply Chain Services, Real Estate Management Building, Room 1, Austen Street, Beaconsfield in Kimberley. A non-refundable tender fee of ***R250.00*** **(inclusive of Vat) is applicable per tender. Payment is to be made to Transnet Freight Rail, Standard Bank Account number *203158598*, Branch code *004805***. The deposit slip must reflect ***RFQ: KBY/54093*** and the contractor's company name. Proof of payment presented prior to the collection of the tender.

If Bidders intend to download the RFQ document from Transnet Freight Rail Portal at **http://www.transnetfreightrail-tfr.net/Supplier/Pages/Tenders.aspx** only the download RFQ document is issued free of charge. After the document has been downloaded, bidders are required to send their ***contact*** details to the following address: **kobie.nelson@transnet.net** by 05 February 2017 before 15H00. This is to ensure that any required communication (e.g. addenda to the RFQ) in relation to this RFQ reaches those intending to respond.

For enquiries regarding collection of documents, contract Ms Kobie Nelson (053) 838 3364

A **compulsory clarification** meeting with representatives of the Employer will take place at *the filling Station, at Koopmansfontein on 06 February 2017 starting at 10H00 hrs*. All bidders attending the site meeting must have their printed RFQ document with them before the meeting starts. ***Bidders who do not have their printed document will be excluded from the meeting, as well as their bids disqualified.***

The closing time for receipt of tenders is 10H00 hrs. On 21 February 2017. In the tender box and late tenders will not be accepted.

Tenders may only be submitted on the tender documentation that is issued.
Requirements for sealing, addressing, delivery, opening and assessment of tenders are stated in the Tender Data.
Transnet urges Clients, Suppliers and Service Providers to report any acts of fraud and/or instances of corruption to Transnet's TIP-OFFS ANONYMOUS on 0800 003 056 or Transnet@tip-offs.com.

TRANSNET FREIGHT RAIL
ENQUIRY NUMBER: KBY/54093
DESCRIPTION OF THE WORKS: SUPPLY AND INSTALLATION OF A RADIO HIGH SITE MAST AT KOOPMANSFONTEIN WITHIN A PERIOD OF 2 MONTHS

ACKNOWLEDGMENT OF RECEIPT OF DOCUMENTS

AND INTENTION TO TENDER

(To be returned within 3 days after receipt)

FAX TO: Transnet Freight Rail

Fax No. (053) 838 3007

Attention: Kobie Nelson

Tender No.: KBY/54093

Closing Date: 21 February 2016

For:

Supply and installation of a radio high site mast at Koopmansfontein within a period of 2 months

		Check
We:	**Do wish to tender** for the work and shall return our tender by the due date above	**Yes** ☐
	Do not wish to tender on this occasion and herewith return all your documents received	**No** ☐

REASON FOR NOT TENDERING:

_____

_____

_____

_____

_____

COMPANY'S NAME, ADDRESS, CONTACT, PHONE AND TELEFAX NUMBERS

_____

_____

_____

_____

_____

SIGNATURE: _____

TITLE: _____

NEC3 Engineering and Construction Contract (ECC)

entered into by and between

Transnet SOC Ltd
Registration Number 1990/000900/06
(hereinafter referred to as the "*Employer*")

and

Pending
Registration Number:
(hereinafter referred to as the "*Contractor*")

Contract Number	**KBY/54093**
Start Date	**To be advised**
Completion Date	**To be advised**

CONTRACT DOCUMENTS

Form of Offer and Acceptance

Contract Data

Part One – Data provided by the *Employer*

Part Two – Data provided by the *Contractor*

Conditions of Contract (3rd edition – available separately)

Pricing Data

Works Information

Site Information

Appendices

T1.2 Tender Data (Alternative Method 2)

The conditions of tender are the Standard Conditions of Tender as contained in Annex F of the CIDB Standard for Uniformity in Construction Procurement (January 2009) as published in Government Gazette No 31823, Board Notice 12 of 2009 of 30 January 2009, subsequently amended (May 2010), Board Notice 86 of 2010. (See www.cidb.org.za)

The Standard Conditions of Tender make several references to Tender Data for details that apply specifically to this tender. This Tender Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the Standard Conditions of Tender.

Each item of data given below is cross-referenced in the left hand column to the clause in the Standard Conditions of Tender to which it mainly applies.

Clause		Data
F.1.1	The *Employer* is	**Transnet SOC Ltd** **(Reg No. 1990/000900/30)**
F.1.2	The tender documents issued by the *Employer* comprise:	
	Part T: The Tender	
	Part T1: Tendering procedures	T1.1 Tender Notice and Invitation to Tender T1.2 Tender Data
	Part T2 : Returnable documents	T2.1 List of Returnable Documents T2.2 Returnable Schedules
	Part C: The Contract	
	Part C1: Agreements and contract data	C1.1 Form of Offer and Acceptance C1.2 Contract Data (Part 1 & 2)
	Part C2: Pricing data	C2.1 Pricing Instructions C2.2 Activity Schedules / Bill of Quantities
	Part C3: Scope of work	C3.1 Works Information
	Part C4: Site information	C4.1 Site Information
F.1.4	The Employer's agent is:	Regional Procurement Manager/Lead
	Name:	Christopher Williams
	Address:	Real Estate Management Building, Austen Street, Beaconsfield, Kimberley
	Tel No.	053 083-3477
	Fax No.	011 774 9787
	E – mail	Christopher.Williams@transnet.net

F.2.1 Only those tenderers who satisfy the following eligibility criteria are eligible to submit tenders:

1. Tender offers will only be considered if:

   a) An authorised representative of the tendering entity attends the compulsory clarification meeting in terms F.2.7 below

   b) Health and Safety Plan.

2. Only those tenderers who are registered with the CIDB, or are capable of being so prior to the evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations, for a 2CE or higher class of construction work, are eligible to have their tenders evaluated.

   Joint ventures are eligible to submit tenders provided that:

   1. every member of the joint venture is registered with the CIDB;
   2. the lead partner has a contractor grading designation in the 2CE or higher class of construction work; and
   3. the combined *Contractor* grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a *Contractor* grading designation determined in accordance with the sum tendered for a 2CE or higher class of construction work or a value determined in accordance with Regulation 25(1B) or 25(7A) of the Construction Industry Development Regulations

3. Pre-Qualifying Quality (Functionality) Criteria

Only those tenderers who attain the minimum number of evaluation points for Quality (functionality) will be eligible for further evaluation, failure to meet the minimum threshold will result in the tender being disqualified and removed from further consideration

Transnet will utilise the following criteria [not necessarily in this order] in choosing a Supplier/Service Provider, if so required:

3.1 Steps in Evaluation Methodology

Prequalification		**Stage 1**	**Stage 2**			
Step 1	**Step 2**	**Step 3**	**Step 4**	**Step 5**	**Step 6**	**Step 7**
Administrative Responsiveness  Returnable Documents & Schedules	**Substantive Responsiveness**  Pre-qualification	**Technical**  70% Technical Compliance	**Weighted Scoring 100 points**  Weighted Score	**Post tender negotiation** requesting Bidders to provide Best and Final Offer.	**Final Evaluation 90/10**	**Select preferred Bidder** & negotiate final **Conclude Contract** incorporating these commitments

3.2 Pre-Qualification

Step 1: Administrative Responsiveness: All Returnable Documents/Schedules provided: Mandatory and Essential.

Step 2: Substantive Responsiveness: All Mandatory documents complete and correct and acceptable response to any clarification on Essential documentation.

- Prequalifying Criteria met
- Validity of Mandatory Documents /Schedules
- Compliance to Transnet Specifications
- Pricing Schedule Submitted & All Items on Pricing Schedule Priced
- Structure design and commissioning to be certified by a registered Professional Civil Engineer (ECSA)

Stage 1 Step 3: Technical Evaluation Criteria: Test minimum threshold of **70%** for Technical (Quality) Criteria

1 Technical Scoring Matrix

Point	Interpretation
0	**No Response / Failed outright/unacceptable**
40	**Poor**
70	**Satisfactory**
90	**Good**
100	**Very Good**

Pre-qualifying criteria	Sub-criteria	Maximum number of points	Maximum threshold
Company's previous Experience	Relevance of experience	20	20
Management Arrangements and CV's of key persons	CV's of personnel	30	30
Quality Plan	Quality Plan	25	25
Health & Safety Plan	Health & Safety Plan	25	25
Maximum possible score for quality (WQ)			**100%**

The pre-qualifying Quality (functionality) criteria and maximum score in respect of each of the criteria are as follows:

Pre-qualifying Quality criteria	Sub-Criteria	Weight	Maximum number of points
Company's Previous Experience (T2.2-25)		**20**	**20**
Relevance of experience (Years of Experience project Specific) – (comparable/similar projects).			
No Experience	0		
'> 1 Month to 1 Year Experience	8		
1 to 2 Years' Experience	10		
2 to 3 Years' Experience	13		
'> 3 Years' Experience	20		
Management Arrangements and CV's of key persons (T2.2-7)		**30**	**30**
Organogram of Company	10		
General Experience and qualifications	10		
Adequacy for the assignment	5		
Knowledge of local issues pertinent to the project	5		
Quality Plan (T2.2-20)		**25**	**25**
General Practice & Procedures indicating clear understanding of intention to comply with legislation & meet Employer's requirements.	5		
Outline of procedures in relation to project specific challenges	5		

Resource allocation (people, costs)	15		
Health & Safety Plan (T2.2-22)		**25**	**25**
Safety File Index	4		
Safety Work method Statement and Risk Assessment	2		
Valid Letter of Good Standing (Labour, Insurance, SARS)	2		
SHE Management System	2		
Overview of RA process and examples	2		
Six months synopsis of SHE incidents, description, type and action taken.	2		
Safe Working Procedure for Hand Tools and Equipment	11		
Maximum possible score for pre-qualifying Quality			**100**

Pre-qualifying Quality shall be scored by not less than three evaluators and averaged in accordance with the following schedules: (*List applicable evaluation schedules and include such schedules in the returnable schedules)*

- T2.2-7 Management and CV's of Key Persons
- T2.2-22 Health and Safety Plan
- T2.2-25 Previous Experience
- T2.2-20 Quality Plan

The minimum number of evaluation points for quality is : 70

The persons named in the Schedule of Key Persons of tenderers who satisfy the minimum quality criteria may be invited to an interview. Tenderers who attain a score of less than 50% of the points allocated to the interview will be declared ineligible to tender.

Each evaluation criteria will be assessed in terms of Five indicators – no response, poor, satisfactory, good and very good. Scores of 0, 40, 70, 90 or 100 will be allocated to no response, poor, satisfactory, good and very good, respectively. The scores of each of the evaluators will be averaged, weighted and then totalled to obtain the final score for quality, unless scored collectively. (See CIDB Inform Practice Note #9)

Note: Any tender not complying with all three of the above mentioned stipulations, numbered 1 to 3, will be regarded as non-responsive and will therefore <u>not</u> be considered for further evaluation

F.2.7 The arrangements for a compulsory clarification meeting are as stated in the Tender Notice and Invitation to Tender.

Tenderers must sign the attendance list in the name of the tendering entity. Addenda will be issued to and tenders will be received only from those tendering entities appearing on the attendance list.

F.2.10.3 Provide rates and prices that are fixed for the duration of the contract and not subject to adjustment except as provided for in the conditions of contract identified in the contract data.

F.2.12 No alternative tender offers will be considered.

F.2.13.3 Parts of each tender offer communicated on paper shall be as an original.

F.2.13.5 The Employer's details and address for delivery of tender offers and identification details that are to be shown on each tender offer package are:

Location of tender box: Office No 2

Physical address: Transnet SOC Limited
Secretariat of the Acquisition Council, Admin support Office
Office No 2
Real Estate Management Building
Austen Street, Beaconsfield
Kimberley
8300

F.2.15.1 Identification details: The tender documents must be submitted in a sealed envelope labelled with:

- Name of Tenderer
- Contact person and details
- The Tender number: **KBY/54093**
- The Tender Description: **Supply and installation of a Radio High Site mast at Koopmansfontein.**

Documents must be marked for the attention of:
Christopher Williams

Prior arrangement on the submittal of large tender documents should be made with the Procurement Manager.

NO LATE TENDERS WILL BE ACCEPTED

F.2.13.9 Telephonic, telegraphic, facsimile or e-mailed tender offers will not be accepted.

F.2.15 The closing time for submission of tender offers is as stated in the Tender Notice and Invitation to Tender.

F.2.16 The tender offer validity period is 12 weeks

F.2.18 Provide, on request by the *Employer,* any other material information that has a bearing on the

tender offer, the tenderer's commercial position (including notarized joint venture agreements), preferencing arrangements, or samples of materials, considered necessary by the *Employer* for the purpose of a full and fair risk assessment. Should the tenderer not provide the material, or a satisfactory reason as to why it cannot be provided, by the time for submission stated in the *Employer's* request, the *Employer* may regard the tender offer as non-responsive.

F.2.20 If requested, submit for the *Employer's* acceptance before formation of the contract, all securities, bonds, guarantees, policies and certificates of insurance required in terms of the conditions of contract identified in the Contract Data. (The format is included in Part T2.2 of this procurement document).

F.2.22 Return all retained tender documents within 28 days after the expiry of the validity period

F.2.23 The tenderer is required to submit with his tender:

1. a valid **original** Tax Clearance Certificate issued by the South African Revenue Services;
2. A valid certified SANAS accredited or IRBA approved B-BBEE verification certificate or Bidders who qualify as EME's in terms of the Revised Codes of Good Practice issued on 11 October 2013 in terms of Government Gazette No. 36928 are only required to obtain a sworn affidavit on an annual basis confirming that the entity has an Annual Total Revenue of R10 million or less and the entity's Level of Black ownership, and
3. A completed Supplier Declaration Form (Stamped and signed by the commissioner of oaths)
4. Letter of Good Standing
5. Proof of CSD Registration

Note: Refer to Section T2.1 for List of Returnable Documents

F.3.4 The time and location for opening of the tender offers are:
Time 10:15 on Tuesday, 21 February 2017

Location: Ground Floor, Boardroom, Real Estate Management, Austen Street, Beaconsfield, Kimberley

F.3.11.3 The procedure for the evaluation of responsive tenders is Method 2.

F.3.11.7 The financial offer will be scored using Formula 2 (option 1) in Table F.1 where the value of W_1 is:

80 where the financial value inclusive of VAT of one or more responsive tender offers have a value that equals or is less than R 1,000 000

Up to 100 minus W_1 tender evaluation points will be awarded to tenderers who complete the preferencing schedule and who are found to be eligible for the preference claimed.

Should the BBBEE rating not be provided, Transnet reserves the right to award no points and/or declare the tender void. Transnet also reserves the right to carry out an independent audit of the tenderers scorecard components at any stage from the date of close of the tenders until completion of the contract. Tenderers with no accreditation will score zero points for preferencing.

Note:

In the event that, in the application of the 80/20 preference point system as stipulated, **all** tenders received exceed the estimated Rand value of R1 000 000, the tender invitation must be cancelled

F.3.13 Tender offers will only be accepted if:

a) the tenderer submits **an original valid** Tax Clearance Certificate issued by the South African Revenue Services or has made arrangements to meet outstanding tax obligations;

b) the tenderer submits a letter of intent from an insurer undertaking to provide the Performance Bond to the format included in Part T2.2 of this procurement document

c) the tenderer is registered with the Construction Industry Development Board in an appropriate contractor grading designation;

d) the tenderer or any of its directors/shareholders is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector;

e) the tenderer does not appear on Transnet list for restricted tenderers.

f) the tenderer has completed the Compulsory Enterprise Questionnaire and there are no conflicts of interest which may impact on the tenderer's ability to perform the contract in the best interests of the Employer or potentially compromise the tender process and persons in the employ of the state are permitted to submit tenders or participate in the contract;

g) the tenderer is registered and in good standing with the compensation fund or with a licensed compensation insurer;

h) the Employer is reasonably satisfied that the tenderer has in terms of the Construction Regulations, 2003, issued in terms of the Occupational Health and Safety Act, 1993, the necessary competencies and resources to carry out the work safely.

F.3.17 The number of paper copies of the signed contract to be provided by the Employer is 1 (one).

T1.3 CIDB Standard Conditions of Tender

January 2009 Edition

As published in Annexure F of the CIDB Standard for Uniformity in Construction Procurement in Board Notice 12 of 2009 in Government Gazette No 31823 of 30 January 2009

F.1 General

F.1.1 Actions

F.1.1.1 The employer and each tenderer submitting a tender offer shall comply with these conditions of tender. In their dealings with each other, they shall discharge their duties and obligations as set out in F.2 and F.3, timeously and with integrity, and behave equitably, honestly and transparently, comply with all legal obligations and not engage in anticompetitive.

F.1.1.2 The employer and the tenderer and all their agents and employees involved in the tender process shall avoid conflicts of interest and where a conflict of interest is perceived or known, declare any such conflict of interest, indicating the nature of such conflict. Tenderers shall declare any potential conflict of interest in their tender submissions. Employees, agents and advisors of the employer shall declare any conflict of interest to whoever is responsible for overseeing the procurement process at the start of any deliberations relating to the procurement process or as soon as they become aware of such conflict, and abstain from any decisions where such conflict exists or recuse themselves from the procurement process, as appropriate.

Note:
1) A conflict of interest may arise due to a conflict of roles which might provide an incentive for improper acts in some circumstances. A conflict of interest can create an appearance of impropriety that can undermine confidence in the ability of that person to act properly in his or her position even if no improper acts result.
2) Conflicts of interest in respect of those engaged in the procurement process include direct, indirect or family interests in the tender or outcome of the procurement process and any personal bias, inclination, obligation, allegiance or loyalty which would in any way affect any decisions taken.

F.1.1.3 The employer shall not seek and a tenderer shall not submit a tender without having a firm intention and the capacity to proceed with the contract.

F.1.2 Tender Documents

The documents issued by the employer for the purpose of a tender offer are listed in the tender data.

F.1.3 Interpretation

F.1.3.1 The tender data and additional requirements contained in the tender schedules that are included in the returnable documents are deemed to be part of these conditions of tender.

F.1.3.2 These conditions of tender, the tender data and tender schedules which are only required for tender evaluation purposes, shall not form part of any contract arising from the invitation to tender.

F.1.3.3 For the purposes of these conditions of tender, the following definitions apply:

a) **conflict of interest** means any situation in which:

i) someone in a position of trust has competing professional or personal interests which make it difficult to fulfill his or her duties impartially;

ii) an individual or organisation is in a position to exploit a professional or official capacity in some way for their personal or corporate benefit; or

iii) incompatibility or contradictory interests exist between an employee and the organisation which employs that employee.

b) **comparative offer** means the tenderer's financial offer after all tendered parameters that will affect the value of the financial offer have been taken into consideration in order to enable comparisons to be made between offers on a comparative basis

c) **corrupt practice** means the offering, giving, receiving or soliciting of anything of value to influence the action of the employer or his staff or agents in the tender process; and

d) **fraudulent practice** means the misrepresentation of the facts in order to influence the tender process or the award of a contract arising from a tender offer to the detriment of the employer, including collusive practices intended to establish prices at artificial levels

e) **organisation** means a company, firm, enterprise, association or other legal entity, whether incorporated or not, or a public body

f) **quality (functionality)** means the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs

F.1.4 Communication and employer's agent

Each communication between the employer and a tenderer shall be to or from the employer's agent only, and in a form that can be readily read, copied and recorded. Communications shall be in the English language. The employer shall not take any responsibility for non-receipt of communications from or by a tenderer. The name and contact details of the employer's agent are stated in the tender data.

F.1.5 The employer's right to accept or reject any tender offer

F.1.5.1 The employer may accept or reject any variation, deviation, tender offer, or alternative tender offer, and may cancel the tender process and reject all tender offers at any time before the formation of a contract. The employer shall not accept or incur any liability to a tenderer for such cancellation and rejection, but will give written reasons for such action upon written request to do so.

F.1.5.2 The employer may not subsequent to the cancellation or abandonment of a tender process or the rejection of all responsive tender offers re-issue a tender covering substantially the same scope of work within a period of six months unless only one tender was received and such tender was returned unopened to the tenderer.

F.1.6 Procurement procedures

F.1.6.1 General

Unless otherwise stated in the tender data, a contract will, subject to F.3.13, be concluded with the tenderer who in terms of F.3.11 is the highest ranked or the tenderer scoring the highest number of tender evaluation points, as relevant, based on the tender submissions that are received at the closing time for tenders.

F.1.6.2 Competitive negotiation procedure

F.1.6.2.1 Where the tender data require that the competitive negotiation procedure is to be followed, tenderers shall submit tender offers in response to the proposed contract in the first round of submissions. Notwithstanding the requirements of F.3.4, the employer shall announce only the names of the tenderers who make a submission. The requirements of F.3.8 relating to the material deviations or qualifications which affect the competitive position of tenderers shall not apply.

F.1.6.2.2 All responsive tenderers, or not less than three responsive tenderers that are highest ranked in terms of the evaluation method and evaluation criteria stated in the tender data, shall be invited in each round to enter into competitive negotiations, based on the principle of equal treatment and keeping confidential the proposed solutions and associated information. Notwithstanding the provisions of F.2.17, the employer may request that tenders be clarified, specified and fine-tuned in order to improve a tenderer's competitive position provided that such clarification, specification, fine-tuning or additional information does not alter any fundamental aspects of the offers or impose substantial new requirements which restrict or distort competition or have a discriminatory effect.

F.1.6.2.3 At the conclusion of each round of negotiations, tenderers shall be invited by the employer to make a fresh tender offer, based on the same evaluation criteria, with or without adjusted weightings. Tenderers shall be advised when they are to submit their best and final offer.

F.1.6.2.4 The contract shall be awarded in accordance with the provisions of F.3.11 and F.3.13 after tenderers have been requested to submit their best and final offer.

F.1.6.3 Proposal procedure using the two stage-system

F.1.6.3.1 Option 1

Tenderers shall in the first stage submit technical proposals and, if required, cost parameters around which a contract may be negotiated. The employer shall evaluate each responsive submission in terms of the method of evaluation stated in the tender data, and in the second stage negotiate a contract with the tenderer scoring the highest number of evaluation points and award the contract in terms of these conditions of tender.

F.1.6.3.2 Option 2

F.1.6.3.2.1 Tenderers shall submit in the first stage only technical proposals. The employer shall invite all responsive tenderers to submit tender offers in the second stage, following the issuing of procurement documents.

F.1.6.3.2.2 The employer shall evaluate tenders received during the second stage in terms of the method of evaluation stated in the tender data, and award the contract in terms of these conditions of tender.

F.2 Tenderer's obligations

F.2.1 Eligibility

F.2.1.1 Submit a tender offer only if the tenderer satisfies the criteria stated in the tender data and the tenderer or any of his principals, is not under any restriction to do business with employer.

F.2.1.2 Notify the employer of any proposed material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used by the employer as the basis in a prior process to invite the tenderer to submit a tender offer and obtain the employer's written approval to do so prior to the closing time for tenders.

F.2.2 Cost of tendering

Accept that, unless otherwise stated in the tender data, the employer will not compensate the tenderer for any costs incurred in the preparation and submission of a tender offer, including the costs of any testing necessary to demonstrate that aspects of the offer complies with requirements.

F.2.3 Check documents

Check the tender documents on receipt for completeness and notify the employer of any discrepancy or omission.

F.2.4 Confidentiality and copyright of documents

Treat as confidential all matters arising in connection with the tender. Use and copy the documents issued by the employer only for the purpose of preparing and submitting a tender offer in response to the invitation.

F.2.5 Reference documents

Obtain, as necessary for submitting a tender offer, copies of the latest versions of standards, specifications, conditions of contract and other publications, which are not attached but which are incorporated into the tender documents by reference.

F.2.6 Acknowledge addenda

Acknowledge receipt of addenda to the tender documents, which the employer may issue, and if necessary apply for an extension to the closing time stated in the tender data, in order to take the addenda into account.

F.2.7 Clarification meeting

Attend, where required, a clarification meeting at which tenderers may familiarise themselves with aspects of the proposed work, services or supply and raise questions. Details of the meeting(s) are stated in the tender data.

F.2.8 Seek clarification

Request clarification of the tender documents, if necessary, by notifying the employer at least five working days before the closing time stated in the tender data.

F.2.9 Insurance

Be aware that the extent of insurance to be provided by the employer (if any) might not be for the full cover required in terms of the conditions of contract identified in the contract data. The tenderer is advised to seek qualified advice regarding insurance.

F.2.10 Pricing the tender offer

F.2.10.1 Include in the rates, prices, and the tendered total of the prices (if any) all duties, taxes (except Value Added Tax (VAT), and other levies payable by the successful tenderer, such duties, taxes and levies being those applicable 14 days before theclosing time stated in the tender data.

F.2.10.2 Show VAT payable by the employer separately as an addition to the tendered total of the prices.

F.2.10.3 Provide rates and prices that are fixed for the duration of the contract and not subject to adjustment except as provided for in the conditions of contract identified in the contract data.

F.2.10.4 State the rates and prices in Rand unless instructed otherwise in the tender data. The conditions of contract identified in the contract data may provide for part payment in other currencies.

F.2.11 Alterations to documents

Do not make any alterations or additions to the tender documents, except to comply with Instructions issued by the employer, or necessary to correct errors made by the tenderer. All signatories to the tender offer shall Initial all such alterations. Erasures and the use of masking fluid are prohibited.

F.2.12 Alternative tender offers

F.2.12.1 Unless otherwise stated in the tender data, submit alternative tender offers only if a main tender offer, strictly in accordance with all the requirements of the tender documents, is also submitted as well as a schedule that compares the requirements of the tender documents with the alternative requirements that are proposed.

F.2.12.2 Accept that an alternative tender offer may be based only on the criteria stated in the tender data or criteria otherwise acceptable to the employer.

F.2.13 Submitting a tender offer

F.2.13.1 Submit one tender offer only, either as a single tendering entity or as a member in a joint venture to provide the whole of the works, services or supply identified in the contract data and described in the scope of works, unless stated otherwise in the tender data.

F.2.13.2 Return all returnable documents to the employer after completing them in their entirety, either electronically (if they were issued in electronic format) or by writing legibly in non-erasable ink.

F.2.13.3 Submit the parts of the tender offer communicated on paper as an original plus the number of copies stated in the tender data, with an English translation of any documentation in a language other than English, and the parts communicated electronically in the same format as they were issued by the employer.

F.2.13.4 Sign the original and all copies of the tender offer where required in terms of the tender data. The employer will hold all authorized signatories liable on behalf of the tenderer. Signatories for tenderers proposing to contract as joint ventures shall state which of the signatories is the lead partner whom the employer shall hold liable for the purpose of the tender offer.

F.2.13.5 Seal the original and each copy of the tender offer as separate packages marking the packages as "ORIGINAL" and "COPY". Each package shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

F.2.13.6 Where a two-envelope system is required in terms of the tender data, place and seal the returnable documents listed in the tender data in an envelope marked "financial proposal" and place the remaining returnable documents in an envelope marked "technical proposal". Each envelope shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

F.2.13.7 Seal the original tender offer and copy packages together in an outer package that states on the outside only the employer's address and identification details as stated in the tender data.

F.2.13.8 Accept that the employer will not assume any responsibility for the misplacement or premature opening of the tender offer if the outer package is not sealed and marked as stated.

F.2.13.9 Accept that tender offers submitted by facsimile or e-mail will be rejected by the employer, unless stated otherwise in the tender data.

F.2.14 Information and data to be completed in all respects

Accept that tender offers, which do not provide all the data or information requested completely and in the form required, may be regarded by the employer as non-responsive.

F.2.15 Closing time

F.2.15.1 Ensure that the employer receives the tender offer at the address specified in the tender data not later than the closing time stated in the tender data. Accept that proof of posting shall not be accepted as proof of delivery.

F.2.15.2 Accept that, if the employer extends the closing time stated in the tender data for any reason, the requirements of these conditions of tender apply equally to the extended deadline.

F.2.16 Tender offer validity

F.2.16.1 Hold the tender offer(s) valid for acceptance by the employer at any time during the validity period stated in the tender data after the closing time stated in the tender data.

F.2.16.2 If requested by the employer, consider extending the validity period stated in the tender data for an agreed additional period with or without any conditions attached to such extension.

F.2.16.3 Accept that a tender submission that has been submitted to the employer may only be withdrawn or substituted by giving the employer's agent written notice before the closing time for tenders that a tender is to be withdrawn or substituted.

F.2.16.4 Where a tender submission is to be substituted, submit a substitute tender in accordance with the requirements of F.2.13 with the packages clearly marked as "SUBSTITUTE".

F.2.17 Clarification of tender offer after submission

Provide clarification of a tender offer in response to a request to do so from the employer during the evaluation of tender offers. This may include providing a breakdown of rates or prices and correction of arithmetical errors by the adjustment of certain rates or item prices (or both). No change in the competitive position of tenderers or substance of the tender offer is sought, offered, or permitted.

Note: Sub-clause F.2.17 does not preclude the negotiation of the final terms of the contract with a preferred tenderer following a competitive selection process, should the Employer elect to do so.

F.2.18 Provide other material

F.2.18.1 Provide, on request by the employer, any other material that has a bearing on the tender offer, the tenderer's commercial position (including notarized joint venture agreements), preferencing arrangements, or samples of materials, considered necessary by the employer for the purpose of a full and fair risk assessment. Should the tenderer not provide the material, or a satisfactory reason as to why it cannot be provided, by the time for submission stated in the employer's request, the employer may regard the tender offer as non-responsive.

F.2.18.2 Dispose of samples of materials provided for evaluation by the employer, where required.

F.2.19 Inspections, tests and analysis

Provide access during working hours to premises for inspections, tests and analysis as provided for in the tender data.

F.2.20 Submit securities, bonds, policies, etc.

If requested, submit for the employer's acceptance before formation of the contract, all securities, bonds, guarantees, policies and certificates of insurance required in terms of the conditions of contract identified in the contract data.

F.2.21 Check final draft

Check the final draft of the contract provided by the employer within the time available for the employer to issue the contract.

F.2.22 Return of other tender documents

If so instructed by the employer, return all retained tender documents within 28 days after the expiry of the validity period stated in the tender data.

F.2.23 Certificates

Include in the tender submission or provide the employer with any certificates as stated in the tender data.

F.3 The employer's undertakings

F.3.1 Respond to requests from the tenderer

F.3.1.1 Unless otherwise stated in the tender Data, respond to a request for clarification received up to five working days before the tender closing time stated in the Tender Data and notify all tenderers who drew procurement documents.

F.3.1.2 Consider any request to make a material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used to prequalify a tenderer to submit a tender offer in terms of a previous procurement process and deny any such request if as a consequence:

a) an individual firm, or a joint venture as a whole, or any individual member of the joint venture fails to meet any of the collective or individual qualifying requirements;

b) the new partners to a joint venture were not prequalified in the first instance, either as individual firms or as another joint venture; or

c) in the opinion of the Employer, acceptance of the material change would compromise the outcome of the prequalification process.

F.3.2 Issue Addenda

If necessary, issue addenda that may amend or amplify the tender documents to each tenderer during the period from the date that tender documents are available until three days before the tender closing time stated in the Tender Data. If, as a result a tenderer applies for an extension to the closing time stated in the Tender Data, the Employer may grant such extension and, shall then notify all tenderers who drew documents.

F.3.3 Return late tender offers

Return tender offers received after the closing time stated in the Tender Data, unopened,(unless it is necessary to open a tender submission to obtain a forwarding address), to the tenderer concerned.

F.3.4 Opening of tender submissions

F.3.4.1 Unless the two-envelope system is to be followed, open valid tender submissions in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data. Tender submissions for which acceptable reasons for withdrawal have been submitted will not be opened.

F.3.4.2 Announce at the meeting held immediately after the opening of tender submissions, at a venue indicated in the tender data, the name of each tenderer whose tender offer is opened and, where applicable, the total of his prices, preferences claimed and time for completion for the main tender offer only.

F.3.4.3 Make available the record outlined in F.3.4.2 to all interested persons upon request.

F.3.5 Two-envelope system

F.3.5.1 Where stated in the tender data that a two-envelope system is to be followed, open only the technical proposal of valid tenders in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data and announce the name of each tenderer whose technical proposal is opened.

F.3.5.2 Evaluate the quality of the technical proposals offered by tenderers, then advise tenderers who remain in contention for the award of the contract of the time and place when the financial proposals will be opened. Open only the financial proposals of tenderers, who score in the quality evaluation more than the minimum number of points for quality stated in the tender data, and announce the score obtained for the technical proposals and the total price and any preferences claimed. Return unopened financial proposals to tenderers whose technical proposals failed to achieve the minimum number of points for quality.

F.3.6 Non-disclosure

Not disclose to tenderers, or to any other person not officially concerned with such processes, information relating to the evaluation and comparison of tender offers, the final evaluation price and recommendations for the award of a contract, until after the award of the contract to the successful tenderer.

F.3.7 Grounds for rejection and disqualification

Determine whether there has been any effort by a tenderer to influence the processing of tender offers and instantly disqualify a tenderer (and his tender offer) if it is established that he engaged in corrupt or fraudulent practices.

F.3.8 Test for responsiveness

F.3.8.1 Determine, after opening and before detailed evaluation, whether each tender offer properly received:

a) complies with the requirements of these Conditions of Tender,

b) has been properly and fully completed and signed, and

c) is responsive to the other requirements of the tender documents.

F.3.8.2 A responsive tender is one that conforms to all the terms, conditions, and specifications of the tender documents without material deviation or qualification. A material deviation or qualification is one which, in the Employer's opinion, would:

a) detrimentally affect the scope, quality, or performance of the works, services or supply identified in the Scope of Work,

b) significantly change the Employer's or the tenderer's risks and responsibilities under the contract, or

c) affect the competitive position of other tenderers presenting responsive tenders, if it were to be rectified.

F.3.8.3 Reject a non-responsive tender offer, and not allow it to be subsequently made responsive by correction or withdrawal of the non-conforming deviation or reservation.

F.3.9 Arithmetical errors, omissions and discrepancies

F.3.9.1 Check responsive tenders for discrepancies between amounts in words and amounts in figures. Where there is a discrepancy between the amounts in figures and the amount in words, the amount in words shall govern.

F.3.9.2 Check the highest ranked tender or tenderer with the highest number of tender evaluation points after the evaluation of tender offers in accordance with F.3.11 for:

a) the gross misplacement of the decimal point in any unit rate;

b) omissions made in completing the pricing schedule or bills of quantities; or

c) arithmetic errors in:

i) line item totals resulting from the product of a unit rate and a quantity in bills of quantities or schedules of prices; or

ii) the summation of the prices.

F.3.9.3 Notify the tenderer of all errors or omissions that are identified in the tender offer and either confirm the tender offer as tendered or accept the corrected total of prices.

F.3.9.4 Where the tenderer elects to confirm the tender offer as tendered, correct the errors as follows:

a) If bills of quantities or pricing schedules apply and there is an error in the line item total resulting from the product of the unit rate and the quantity, the line item total shall govern and the rate shall be corrected. Where there is an obviously gross misplacement of the decimal point in the unit rate, the line item total as quoted shall govern, and the unit rate shall be corrected.

b) Where there is an error in the total of the prices either as a result of other corrections required by this checking process or in the tenderer's addition of prices, the total of the prices shall govern and the tenderer will be asked to revise selected item prices (and their rates if bills of quantities apply) to achieve the tendered total of the prices.

F.3.10 Clarification of a tender offer

Obtain clarification from a tenderer on any matter that could give rise to ambiguity in a contract arising from the tender offer.

F.3.11 Evaluation of tender offers

F.3.11.1 General

Appoint an evaluation panel of not less than three persons. Reduce each responsive tender offer to a comparative offer and evaluate them using the tender evaluation methods and associated evaluation criteria and weightings that are specified in the tender data.

F.3.11.2 Method 1: Financial offer

In the case of a financial offer:

a) Rank tender offers from the most favourable to the least favourable comparative offer.

b) Recommend the highest ranked tenderer for the award of the contract, unless there are compelling and justifiable reasons not to do so.

c) Re-rank all tenderers should there be compelling and justifiable reasons not to recommend the highest ranked tenderer and recommend the highest ranked tenderer, unless there are compelling and justifiable reasons not to do so and the process set out in this subclause is repeated.

F.3.11.3 Methods 2: Financial offer and preference

In the case of a financial offer and preferences:

a) Score each tender in respect of the financial offer made and preferences claimed, if any, in accordance with the provisions of F.3.11.7 and F.3.11.8.

b) Calculate the total number of tender evaluation points *(TEV)* in accordance with the following formula:

TEV = NFO + NP

where: *NFO* is the number of tender evaluation points awarded for the financial offer made in accordance with F.3.11.7;

NP is the number of tender evaluation points awarded for preferences claimed in accordance with F.3.11.8.

c) Rank tender offers from the highest number of tender evaluation points to the lowest.

d) Recommend the tenderer with the highest number of tender evaluation points for the award of the contract, unless there are compelling and justifiable reasons not to do so.

e) Rescore and re-rank all tenderers should there be compelling and justifiable reasons not to recommend the tenderer with the highest number of tender evaluation points, and recommend the tenderer with the highest number of tender evaluation points, unless there are compelling and justifiable reasons not to do so and the process set out in this subclause is repeated

F.3.11.4 Method 3: Financial offer and quality

In the case of a financial offer and quality:

a) Score each tender in respect of the financial offer made and the quality offered in accordance with the provisions of F.3.11.7 and F.3.11.9, rejecting all tender offers that fail to score the minimum number of points for quality stated in the tender data, if any.

b) Calculate the total number of tender evaluation points *(TEV)* in accordance with the following formula:

TEV = NFO + NQ

where: *NFO* is the number of tender evaluation points awarded for the financial offer made in accordance with F.3.11.7;

NQ is the number of tender evaluation points awarded for quality offered in accordance with F.3.11.9.

c) Rank tender offers from the highest number of tender evaluation points to the lowest.

d) Recommend tenderer with the highest number of tender evaluation points for the award of the contract, unless there are compelling and justifiable reasons not to do so.

e) Rescore and re-rank all tenderers should there be compelling and justifiable reasons not to recommend the tenderer with the highest number of tender evaluation points and recommend the tenderer with the highest number of tender evaluation points, unless there are compelling and justifiable reasons not to do so and the process set out in this subclause is repeated.

F.3.11.5 Method 4: Financial offer, quality and preferences

In the case of a financial offer, quality and preferences:

a) Score each tender in respect of the financial offer made, preference claimed, if any, and the quality offered in accordance with the provisions of F.3.11.7 to

F.3.11.9, rejecting all tender offers that fail to score the minimum number of points for quality stated in the tender data, if any.

b) Calculate the total number of tender evaluation points *(TEV)* in accordance with the following formula, unless otherwise stated in the Tender Data:

$TEV = NFO + NP + NQ$

where: *NFO* is the number of tender evaluation points awarded for the financial offer made in accordance with F.3.11.7;
NP is the number of tender evaluation points awarded for preferences claimed in accordance with F.3.11.8.
NQ is the number of tender evaluation points awarded for quality offered in accordance with F.3.11.9.

c) Rank tender offers from the highest number of tender evaluation points to the lowest.

d) Recommend the tenderer with the highest number of tender evaluation points for the award of the contract, unless there are compelling and justifiable reasons not to do so.

e) Rescore and re-rank all tenderers should there be compelling and justifiable reasons not to recommend the tenderer with the highest number of tender evaluation points and recommend the tenderer with the highest number of tender evaluation points, unless there are compelling and justifiable reasons not to do so and the process set out in this subclause is repeated.

F.3.11.6 Decimal places

Score financial offers, preferences and quality, as relevant, to two decimal places.

F.3.11.7 Scoring Financial Offers

Score the financial offers of remaining responsive tender offers using the following formula:

$NFO = W1 \times A$

where: *NFO* is the number of tender evaluation points awarded for the financial offer.
W1 is the maximum possible number of tender evaluation points awarded for the financial offer as stated in the Tender Data.
A is a number calculated using the formula and option described in Table F.1 as stated in the Tender Data.

Table F.1: Formulae for calculating the value of *A*

Formula	Comparison aimed at achieving	Option 1[a]	Option 2 [a]
1	Highest price or discount	$A = (1 + (\frac{P - Pm}{Pm}))$	$A = P / Pm$
2	Lowest price or percentage commission / fee	$A = (1 + (\frac{P - Pm}{Pm}))$	$A = Pm / P$

[a] *Pm* is the comparative offer of the most favourable comparative offer.

P is the comparative offer of the tender offer under consideration.

F.3.11.8 Scoring preferences

Confirm that tenderers are eligible for the preferences claimed in accordance with the provisions of the tender data and reject all claims for preferences where tenderers are not eligible for such preferences. Calculate the total number of tender evaluation points for preferences claimed in accordance with the provisions of the tender data.

F.3.11.9 Scoring quality

Score each of the criteria and subcriteria for quality in accordance with the provisions of the Tender Data.

Calculate the total number of tender evaluation points for quality using the following formula:

$NQ = W2 \times SO / MS$

where: *SO* is the score for quality allocated to the submission under consideration;
MS is the maximum possible score for quality in respect of a submission; and
W2 is the maximum possible number of tender evaluation points awarded for the quality as stated in the tender data

F.3.12 Insurance provided by the employer

If requested by the proposed successful tenderer, submit for the tenderer's information the policies and / or certificates of insurance which the conditions of contract identified in the contract data, require the employer to provide.

F.3.13 Acceptance of tender offer

Accept the tender offer, if in the opinion of the employer, it does not present any unacceptable commercial risk and only if the tenderer:

a) is not under restrictions, or has principals who are under restrictions, preventing participating in the employer's procurement,

b) can, as necessary and in relation to the proposed contract, demonstrate that he or she possesses the professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience and reputation, expertise and the personnel, to perform the contract,

c) has the legal capacity to enter into the contract,

d) is not insolvent, in receivership, bankrupt or being wound up, has his affairs administered by a court or a judicial officer, has suspended his business activities, or is subject to legal proceedings in respect of any of the foregoing,

e) complies with the legal requirements, if any, stated in the tender data, and

f) is able, in the opinion of the employer, to perform the contract free of conflicts of interest.

F.3.14 Prepare contract documents

F.3.14.1 If necessary, revise documents that shall form part of the contract and that were issued by the employer as part of the tender documents to take account of:

a) addenda issued during the tender period,

b) inclusion of some of the returnable documents, and

c) other revisions agreed between the employer and the successful tenderer.

F.3.14.2 Complete the schedule of deviations attached to the form of offer and acceptance, if any.

F.3.15 Complete adjudicator's contract

Unless alternative arrangements have been agreed or otherwise provided for in the contract, arrange for both parties to complete formalities for appointing the selected adjudicator at the same time as the main contract is signed.

F.3.16 Notice to unsuccessful tenderers

F.3.16.1 Notify the successful tenderer of the employer's acceptance of his tender offer by completing and returning one copy of the form of offer and acceptance before the expiry of the validity period stated in the tender data, or agreed additional period.

F.3.16.2 After the successful tenderer has been notified of the employer's acceptance of the tender, notify other tenderers that their tender offers have not been accepted.

F.3.17 Provide copies of the contracts

Provide to the successful tenderer the number of copies stated in the Tender Data of the signed copy of the contract as soon as possible after completion and signing of the form of offer and acceptance.

F.3.18 Provide written reasons for actions taken

Provide upon request written reasons to tenderers for any action that is taken in applying these conditions of tender, but withhold information which is not in the public interest to be divulged, which is considered to prejudice the legitimate commercial interests of tenderers or might prejudice fair competition between tenderers.

T2.1 List of Returnable Documents

1. These schedules are required for eligibility purposes:

T2.2-15 **Eligibility Criteria Schedule:** Certification of attendance at a tender clarification meeting

2. These schedules will be utilised for the evaluation of Functionality Criteria

T2.2-2 Programme
T2.2.7 Management and CV's of Key Persons
T2.2-25 Previous Experience

3. Returnable Schedules

T2.2-3 Risk Elements
T2.2-4 Availability of equipment and other resources
T2.2-7 Management and CV's of key persons
T2.2-8 Schedule of proposed Subcontractors/consultants
T2.2-9 Insurance provided by the Contractor
T2.2-14 Authority to submit tender
T2.2-15 Certificate of attendance at tender clarification meeting
T2.2-16 Record of addenda to tender documents
T2.2-17 Compulsory Enterprise Questionnaire
T2.2-22 Health and Safety Plan
T2.2-24 Capacity and ability to meet delivery schedule
T2.2-25 Previous experience
T2.2-31 Supplier Code of Conduct
T2.2-34 Supplier Declaration Form
T2.2-36 RFQ Declaration Form
T2.2.43 Breach of Law
T2.2-50 B-BBEE Preference Points claim Form
T2.2-51 Certificate of Acquaintance with Tender Documents

4. **C1.1: Offer portion of Form of Offer & Acceptance**

5. **C1.2: Contract Data Part 2: Data by *Contractor***

6. **C2.2: Price List**

7. **C3.1: Works Information**

8. **C4.1: Site Information**

T2.2-3: Risk Elements

Tenderers to review the potential risk elements associated with the Project. The risk elements are to be listed separately in this Schedule. If No Risks are identified "No Risks" must be stated on this schedule.

Notwithstanding this information, all costs related to risk elements which are at the *Contractor's* risk are deemed to be included in the tenderer's offered total of the Prices.

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

T2.2-4: Availability of Equipment and Other Resources

Tenderers to submit a list of all Equipment and other resources that he proposes to use to execute the work as described in the Works Information, as well as the availability and details of ownership for each item. Amongst others, he needs to provide detailed schedules of the following:

- Material delivery schedule
- Plant schedule
- Labour schedule

Number of Equipment	Equipment Type – Description	Hourly Rate

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

T2.2-7: Management & CV's of Key Persons – ECC[1]

Please describe the management arrangements for the *works*.

Submit the following documents as a minimum with your tender document:

1. An organisation chart showing on site and off-site management (including the key people you have identified in the Contract Data Part two and identify the required legal appointments.)
2. CV's for people proposed for all identified posts including Safety Officer and Quality Assurance Representative.
3. Details of the location (and functions) of offices from which the *works* will be managed.
4. Details of the experience of the staff who will be working on the *works* with respect to:
   - Working with the NEC3 Engineering and Construction Contract Option chosen for this contract. If staff experience of these matters is limited, an indication of relevant training that they have attended would be helpful.
5. An explanation of how you propose to allocate adequate resources to enable you to comply with the requirements and prohibitions imposed on you by or under the statutory provisions relating to health and safety.

Attached submissions to this schedule:

.....

.....

.....

.....

.....

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

[1]NEC3 Engineering & Construction Contract (with amendments June 2006 and April 2013)

T2.2-8: Schedule of Proposed Subcontractors

We notify you that it is our intention to employ the following subcontractors / sub consultants for work in this contract.

If we are awarded a contract we agree that this notification does not change the requirement for us to submit the names of proposed Subcontractors in accordance with requirements in the contract for such appointments. If there are no such requirements in the contract, then your written acceptance of this list shall be binding between us.

	Name and address of proposed Subcontractor/ Consultant	Nature and extent of work	Previous experience with Subcontractor/ Consultant.	B-BBEEE Level Certificates to be attached	Value of subcontracted Work (excl. 14% Vat)	% Ownership Black Ownership
1.						
2.						
3.						
4.						
5.						
6.						

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

T2.2-9: Insurance provided by the *Contractor*

Clause 84.1 in NEC3 Engineering & Construction Contract (June 2005)(amended June 2006 and April 2013) requires that the *Contractor* provides the insurance stated in the insurance table except any insurance which the *Employer* is to provide as stated in the Contract Data.

Please provide the following details for insurance which the *Contractor* is still to provide. Notwithstanding this information all costs related to insurance are deemed included in the tenderer's rates and prices.

Insurance against (See clause 84.2 of the ECC)	**Name of Insurance Company**	**Cover**	**Premium**
Loss of or damage to the *works*, Plant and Materials			
Loss of or damage to Equipment			
Liability for loss of or damage to property (except the *works*, Plant and Materials and Equipment) and liability for bodily injury to or death of a person (not an employee of the *Contractor*) caused by activity in connection with this contract.			
Liability for death of or bodily injury to employees of the *Contractor* arising out of and in the course of their employment in connection with this contract			
(Other)			

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

T2.2-14: Authority to submit a Tender

Indicate the status of the tenderer by ticking the appropriate box hereunder. The tenderer must complete the certificate set out below for his category of organisation or alternatively attach a certified copy of a company / organisation document which provides the same information for the relevant category as requested here.

A - COMPANY	B - PARTNERSHIP	C - JOINT VENTURE	D - SOLE PROPRIETOR

A. Certificate for Company

I,_____, chairperson of the board of directors of _____ _____, hereby confirm that by resolution of the board taken on _____ (date), Mr/Ms _____, acting in the capacity of _____ _____, was authorised to sign all documents in connection with this tender offer and any contract resulting from it on behalf of the company.

Signed _____ Date _____

Name _____ Position Chairman of the Board of Directors

B. Certificate for Partnership

We, the undersigned, being the **key partners** in the business trading as _____ _____ hereby authorise Mr/Ms _____, acting in the capacity of _____ _____, to sign all documents in connection with the tender offer for Contract _____ _____ and any contract resulting from it on our behalf.

Name	Address	Signature	Date

NOTE: This certificate is to be completed and signed by the full number of Partners necessary to commit the Partnership. Attach additional pages if more space is required.

C. Certificate for Joint Venture

We, the undersigned, are submitting this tender offer in Joint Venture and hereby authorise Mr/Ms _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _, an authorised signatory of the company _, acting in the capacity of lead partner, to sign all documents in connection with the tender offer for Contract _ _ _ _ _ _ _ _ and any contract resulting from it on our behalf.

This authorisation is evidenced by the attached power of attorney signed by legally authorised signatories of all the partners to the Joint Venture.

Furthermore we attach to this Schedule a copy of the joint venture agreement which incorporates a statement that all partners are liable jointly and severally for the execution of the contract and that the lead partner is authorised to incur liabilities, receive instructions and payments and be responsible for the entire execution of the contract for and on behalf of any and all the partners.

Name of firm	**Address**	**Authorising signature, name (in caps) and capacity**

D. Certificate for Sole Proprietor

I, _____, hereby confirm that I am the sole owner of the business trading as _____.

Signed _____ Date _____

Name _____ Position Sole Proprietor

T2.2-15: Certificate of Attendance at Tender Clarification Meeting

This is to certify that

(Tenderer)

_____

of (address)

_____

was represented by the person(s) named below at the compulsory tender clarification meeting

Held at:	Koopmansfontein Filling Station	
On (date)	06 February 2017	Starting time: 10H00

As the tenderer we undertake that by said persons attending the clarification meeting we have made it our business to familiarise ourselves with all aspects of the works / service / supply specified in the tender documents in order for us to take account of everything necessary to provide a responsive tender offer and to compile our rates and prices included in the tender offer.

We further understand that in addition to any queries raised on behalf of us at the meeting we may still approach the *Employer / Purchaser*'s Representative to request clarification of the tender documents until no later then five working days before the tender closing time stated in the Tender Data.

Particulars of person(s) attending the meeting:

Name		Signature	
Capacity			
Name		Signature	
Capacity			

Attendance of the above persons at the meeting was confirmed by the procuring organisation's representative as follows:

Name		Signature	
Capacity		Date & time	

T2.2-16: Record of Addenda to Tender Documents

We confirm that the following communications received from the Employer before the submission of this tender offer, amending the tender documents, have been taken into account in this tender offer:

	Date	Title or Details
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Attach additional pages if more space is required.

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

T2.2-17 : Compulsory Enterprise Questionnaire

The following particulars must be furnished. In the case of a joint venture, separate enterprise questionnaires in respect of each partner must be completed and submitted.

Section 1: Name of enterprise: . . . . . .

Section 2: VAT registration number, if any: . . . . . .

Section 3: CIDB registration number, if any: . . . . . .

Section 4: Particulars of sole proprietors and partners in partnerships

Name	Identity number	Personal income tax number

* Complete only if sole proprietor or partnership and attach separate page if more than 3 partners

Section 5: Particulars of companies and close corporations

Company registration number . . . . . .

Close corporation number . . . . . .

Tax reference number . . . . . .

Section 6: Record in the service of the state

Indicate by marking the relevant boxes with a cross, if any sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months in the service of any of the following:

- ☐ a member of any municipal council
- ☐ a member of any provincial legislature
- ☐ a member of the National Assembly or the National Council of Province
- ☐ a member of the board of directors of any municipal entity
- ☐ an official of any municipality or municipal entity
- ☐ an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999)
- ☐ a member of an accounting authority of any national or provincial public entity
- ☐ an employee of Parliament or a provincial legislature

If any of the above boxes are marked, disclose the following:

Name of sole proprietor, partner, director, manager, principal shareholder or stakeholder	**Name of institution, public office, board or organ of state and position held**	**Status of service (tick appropriate column)**	
		Current	**Within last 12 months**

*insert separate page if necessary

Section 7: Record of spouses, children and parents in the service of the state

Indicate by marking the relevant boxes with a cross, if any spouse, child or parent of a sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months been in the service of any of the following:

- ☐ a member of any municipal council
- ☐ a member of any provincial legislature
- ☐ a member of the National Assembly or the National Council of Province
- ☐ a member of the board of directors of any municipal entity
- ☐ an official of any municipality or municipal entity
- ☐ an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999)
- ☐ a member of an accounting authority of any national or provincial public entity
- ☐ an employee of Parliament or a provincial legislature

Name of spouse, child or parent	**Name of institution, public office, board or organ of state and position held**	**Status of service (tick appropriate column)**	
		Current	**Within last 12 months**

*insert separate page if necessary

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise:

i) authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my / our tax matters are in order;

ii) confirms that the neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004;

iii) confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears, has within the last five years been convicted of fraud or corruption;

iv) confirms that I / we are not associated, linked or involved with any other tendering entities submitting tender offers and have no other relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest; and

v) confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief both true and correct.

Signed _____ Date _____

Name _____ Position _____

Enterprise name _____

T2.2-20: Quality Plan

Due consideration must be given to the deliverables required to execute and complete the contract as per the Quality Management Standard stated in the Works Information and should include but not be limited to:

1. Project Quality Plan for the contract.
2. The Contractor's Quality Policy.
3. Index of procedures to be used during the contract.
4. Audit Schedule for internal and external audits during the contract.
5. ISO 9001 certification.
6. Typical Quality Manual.
7. Typical Quality Control Plan.
8. Typical data book index.

Attached submissions to this schedule:

.....

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Signed _____ Date _____

Name _____ Position _____

Tenderer _____

T2.2-22: Health and Safety Plan

Submit the following documents as a minimum with your tender:

1. Valid letter of good standing with insurance body.
2. Roles and responsibilities of legal appointees.
3. Safety Officer's role and responsibility.
4. Safety, Health & Environmental Policies.
5. Overview of Tenderer's SHE system for project.
6. Overview of RA process and examples.
7. List of job categories for project and competencies required per category and plan to address and meet outstanding competencies.
8. Six months synopsis of SHE incidents, description, type and action taken.
9. Overview of selection process of subcontractors.
10. SHE challenges envisaged for the project and how they will be addressed and overcome.
11. Signed statement acknowledging receiving and budget provision for SHE pack requirements.
12. Complete and return with tender documentation the Contractor Safety Questionnaire (Attachment No 8) included in the Health and Safety Specification TCP-HAS-STD-0001 Rev 00 found in attached CD under Specifications folder.
13. Construction Safety File (Index)
14. Construction Safety Work Method Statement

Attached submissions to this schedule:

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Signed _____ Date _____

Name _____ Position _____

Tenderer _____

T2.2-24: Capacity and Ability to meet Delivery Schedule

Note to tenderers:

The Tenderer is required to demonstrate to the *Employer* that he has sufficient current and future capacity to carry out the work as detailed in the Works Information and that he has the capacity and plans in place to meet the required delivery schedule as required. To this end, the following must be provided by the Tenderer:

A schedule detailing the following:

- Maximum quantity of work concurrently performed by the Tenderer in the recent past in order to illustrate his potential capacity to design, fabricate and/or construct work of a similar nature
- Current and future work on his order book, showing quantity and type of equipment
- Quantity of work for which the Tenderer has tenders in the market or is currently tendering on
- The work as covered in this Works Information, planned and scheduled as per the Tenderer's capacities and methods but meeting the required delivery schedule.

Index of documentation attached to this schedule:

.....
.....
.....
.....
.....
.....
.....

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

T2.2-25: Previous Experience

Note to tenderers:

Tenderers are required to demonstrate their experience in the delivery of similar works, and to this end shall supply a sufficiently detailed reference list with contact details of existing customers and also indicate their previous experience of, their design, installation and commissioning capability.

Employer, contact person and telephone number	Description of contract	Value of work Inclusive of VAT (Rand)	Date Completed

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

T2.2-31: Supplier Code of Conduct

Transnet Limited aims to achieve the best value for money when buying or selling goods and obtaining services. This however must be done in an open and fair manner that supports and drives a competitive economy. Underpinning our process are several acts and policies that any supplier dealing with Transnet must understand and support. These are:

- The Transnet Procurement Policy – A guide for Tenderers.
- Section 217 of the Constitution - the five pillars of Public PSCM (Procurement and Supply Chain Management): fair, equitable, transparent, competitive and cost effective;
- The Public Finance Management Act (PFMA);
- The Broad Based Black Economic Empowerment Act (BBBEE)
- The Prevention and Combating of Corrupt Activities Act (PRECCA); and
- The Construction Industry Development Board Act (CIDB Act).

This code of conduct has been included in this contract to formally appraise Transnet Suppliers of Transnet's expectations regarding behaviour and conduct of its Suppliers.

Prohibition of Bribes, Kickbacks, Unlawful Payments, and Other Corrupt Practices

Transnet is in the process of transforming itself into a self-sustaining State Owned Enterprise, actively competing in the logistics industry. Our aim is to become a world class, profitable, logistics organisation. As such, our transformation is focused on adopting a performance culture and to adopt behaviours that will enable this transformation.

1. ***Transnet Limited will not participate in corrupt practices. Therefore, it expects its suppliers to act in a similar manner.***
    - Transnet and its employees will follow the laws of this country and keep accurate business records that reflect actual transactions with, and payments to, our suppliers.
    - Employees must not accept or request money or anything of value, directly or indirectly, from suppliers.
    - Employees may not receive anything that is calculated to:
        - Illegally influence their judgement or conduct or to ensure the desired outcome of a sourcing activity;
        - Win or retain business or to influence any act or decision of any person involved in sourcing decisions; or
        - Gain an improper advantage.

- There may be times when a supplier is confronted with fraudulent or corrupt behaviour of Transnet employees. We expect our Suppliers to use our "Tip-offs Anonymous" Hot line to report these acts. (0800 003 056).

2. ***Transnet Limited is firmly committed to the ideas of free and competitive enterprise.***

- Suppliers are expected to comply with all applicable laws and regulations regarding fair competition and antitrust practices.
- Transnet does not engage with non-value adding agents or representatives solely for the purpose of increasing BBBEE spend (fronting).

3. ***Transnet's relationship with suppliers requires us to clearly define requirements, to exchange information and share mutual benefits.***

- Generally, suppliers have their own business standards and regulations. Although Transnet cannot control the actions of our suppliers, we will not tolerate any illegal activities. These include, but are not limited to:
  - Misrepresentation of their product (origin of manufacture, specifications, intellectual property rights, etc);
  - Collusion;
  - Failure to disclose accurate information required during the sourcing activity (ownership, financial situation, BBBEE status, etc.);
  - Corrupt activities listed above; and
  - Harassment, intimidation or other aggressive actions towards Transnet employees.
- Suppliers must be evaluated and approved before any materials, components, products or services are purchased from them. Rigorous due diligence is conducted and the supplier is expected to participate in an honest and straight forward manner.
- Suppliers must record and report facts accurately, honestly and objectively. Financial records must be accurate in all material respects.

Conflicts of Interest

A conflict of interest arises when personal interests or activities influence (or appear to influence) the ability to act in the best interests of Transnet Limited.

- Doing business with family members.
- Having a financial interest in another company in our industry

Where possible, contracts will be negotiated to include the above in the terms of such contracts. To the extent such terms are not included in contractual obligations and any of the above code is breached, then Transnet reserves its right to review doing business with these suppliers.

I, _____ of _____

(insert name of Director or as per Authority Resolution from Board of Directors)

(insert name of Company)

hereby acknowledge having read, understood and agree to the terms and conditions set out in the "Transnet Supplier Code of Conduct."

Signed this on day _____ at _____

_____

Signature

TRANSNET

delivering freight reliably

SUPPLIER DECLARATION FORM

Transnet Vendor Management has received a request to load / change your company details on to the Transnet vendor database. Please return the completed Supplier Declaration Form (SDF) together with the required supporting documents as per Appendix V to the Transnet Official who is intending to procure your company's services / products, to enable us to process this request. Please only submit the documentation relevant to your request.

NB: Effective 1 April 2016 all organisations, institutions and individuals who wish to provide goods and/or services to Organs of the State must be registered on the National Treasury Central Supplier Database (CSD). This needs to be done via their portal at https://secure.csd.gov.za/ **before applying to Transnet.**

General Terms and Conditions:

Failure to submit the relevant documentation will delay the vendor creation / change process.

Where applicable, the respective Transnet Operating Division processing your application may request further information from you.

The Service Provider warrants that the details of its bank account ("the nominated account") provided herein, are correct and acknowledges that payments due to the Supplier will be made into the nominated account. If details of the nominated account should change, the Service Provider must notify Transnet in writing of such change, failing which any payments made by Transnet into the nominated account will constitute a full discharge of the indebtedness of Transnet to the Supplier in respect of the payment so made. Transnet will incur no liability for any payments made to the incorrect account or any costs associated therewith. In such event, the Service Provider indemnifies and holds Transnet harmless in respect of any payments made to an incorrect bank account and will, on demand, pay Transnet any costs associated herewith.

Transnet expects its suppliers to timeously renew their Tax Clearance and B-BBEE certificates (where applicable, as EMEs and QSEs are only expected to supply an affidavit as per Appendix III and IV), as well as all affidavits, annually. Failure to do so may result in the supplier's account being temporarily suspended.

TRANSNET

delivering freight reliably

SUPPLIER DECLARATION FORM

NB: Effective 1 April 2016 all organisations, institutions and individuals who wish to provide goods and/or services to Organs of the State must be registered on the National Treasury Central Supplier Database (CSD). This needs to be done via their portal at https://secure.csd.gov.za/ **before applying to Transnet.**

CSD Number (MAAA xxxxxxx):	

Company Trading Name	
Company Registered Name	
Company Registration No. Or ID No If a Sole Proprietor	
Company Income Tax Number	

Form of Entity	CC	Trust	Pty Ltd	Limited	Partnership	Sole Proprietor
	Non-profit	Personal Liability Co	State Owned Co	National Govt	Provincial Govt	Local Govt
	Educational Institution	Specialised Profession	Financial Institution	Foreign International	Foreign Branch Office	

Did your company previously operate under another name?	Yes		No	
If **YES** state the previous details below:				
Trading Name				
Registered Name				
Company Registration No Or ID No If a Sole Proprietor				

Form of Entity	CC	Trust	Pty Ltd	Limited	Partnership	Sole Proprietor
	Non-profit	Personal Liability Co	State Owned Co	National Govt	Provincial Govt	Local Govt
	Educational Institution	Specialised Profession	Financial Institution	Foreign International	Foreign Branch Office	

Your Current Company's VAT Registration Status	
VAT Registration Number	
If **Exempted from VAT registration,** state reason and submit proof from SARS in confirming the exemption status	
If your business entity is not VAT Registered, please submit a current original sworn affidavit (see example in Appendix I). Your Non VAT Registration must be confirmed annually.	

Company Banking Details		Bank Name	
Universal Branch Code		Bank Account Number	

Company Physical Address			
		Code	
Company Postal Address			
		Code	
Company Telephone number			
Company Fax Number			
Company E-Mail Address			
Company Website Address			

Company Contact Person Name	
Designation	
Telephone	
Email	

Is your company a Labour Broker?			Yes		No	
Main Product / Service Supplied e.g. Stationery / Consulting / Labour etc.						
How many personnel does the business employ?	Full Time		Part Time			
Please Note: Should your business employ more than 2 full time employees who are not connected persons as defined in the Income Tax Act, please submit a sworn affidavit, as per Appendix II.						

Most recent Financial Year's Annual Turnover	<R10Million		>R10Million <R50Million		>R50Million	

Does your company have a valid BBBEE certificate?					Yes		No	
What is your broad based BEE status (Level 1 to 9)								
Majority Race of Ownership								
% Black Ownership		% Black Women ownership		% Black Disabled person(s) ownership		% Black Youth ownership		
Please Note: Please provide proof of BBBEE status as per Appendix V. If you qualify as an EME or QSE then provide an affidavit following the examples provided in Appendix III and IV respectively. If you have indicated Black Disabled person(s) ownership, then provide a **certified** letter signed by a physician, on the physician's letterhead, confirming the disability.								

By signing below, I hereby verify that I am duly authorised to sign for and on behalf of firm / organisation and that all information contained herein and attached herewith are true and correct			
Name		Designation	
Signature		Date	

Stamp And Signature Of Commissioner Of Oaths			
Name		Date	
Signature		Telephone No	

TRANSNET

Internal Transnet Departmental Questionnaire (For Office Use Only)

Company Trading Name	
Company Registered Name	

Operating Division

TFR		TFR RME		TE		TPT		TPL		TNPA		TRN PROP		TRN TCC		TRN FOUN		TRN TCP	

Create		Amend		Block		Unblock	
Extend		Delete		Undelete		Once-Off / Emergency	

Please indicate whether the Supplier has a contract with sourcing Transnet OD	Yes		No	
If yes, please submit a copy of the adjudication document / signed-off comparative schedule				

Transnet B-BBEE Department Contact Person		Signature	
Contact number		Email	

THE FOLLOWING IS TO BE COMPLETED BY THE TRANSNET REQUESTING/SOURCING DEPARTMENT. THE FULL SET OF VENDOR RELATED DOCUMENTS MUST THEN BE FORWARDED TO THE APPROPRIATE VENDOR APPROVAL OFFICIAL FOR APPROVAL

What is being procured from the supplier?

i. Products Only	Yes		No	
ii. Services Only	Yes		No	
iii. Labour Only	Yes		No	
iv. Mix of Products and Services	Yes		No	
v. Mix of Services and Labour	Yes		No	

If your answer is **YES** to any of the questions ii to v above and the applicant supplier has not submitted a sworn affidavit as per Appendix II, the matter should be further investigated in terms of the Tax Withholding Procedures. Where necessary you may approach your Operating Division's Procurement Department for guidance in this regard. Details of the appropriate Transnet decision-making body such as a Cross Functional Sourcing Team, should be indicated below. **A copy of the signed-off document by the mentioned decision-making body should also be attached.**

Type	Deduct Tax		If Tax should be deducted (Indicate % to be deducted)	Department Responsible for Payment (PROCUREMENT OR PAYROLL) * IF PAYROLL SHOULD EFFECT PAYMENT, THE DOCUMENTS SHOULD BE FORWARDED TO THEIR OFFICE
Service Provider	Yes	No		
Labour broker without IRP30 exemption certificate	Yes	No		
Labour broker with IRP30 exemption certificate	Yes	No		
Personal Service Provider	Yes	No		
Independent Contractor	Yes	No		
None of the above apply, state reason				

If PAYE is to be deducted, please indicate whether the applicant supplier has indicated in writing that it is prepared to comply with Transnet's PAYE conditions. **(Please attached a copy of the written communication)**

If the reply is "NO", the vendor application will be regarded as cancelled and another service provider should be sourced.

TRANSNET

CERTIFICATION AND APPROVAL OF PROPOSED VENDOR CREATION/VENDOR DETAILS UPDATE BY TRANSNET OFFICIAL WITH APPROPRIATE DELEGATED AUTHORITY.

I hereby certify that the Transnet Procurement Procedure Manual (PPM) / Procurement Mechanisms have in ALL RESPECTS been adhered to and therefore approve the proposed vendor creation/vendor details update.

Vendor Approval Official's Details										
Name		Designation								
Tel No		Fax No								
e-Mail										
Signature		Date	Y	Y	Y	Y	M	M	D	D

T2.2-36: TENDER DECLARATION FORM

NAME OF COMPANY: _____

We _____ do hereby certify that:

1. Transnet has supplied and we have received appropriate tender offers to any/all questions (as applicable) which were submitted by ourselves for tender clarification purposes;

2. we have received all information we deemed necessary for the completion of this Tender;

3. at no stage have we received additional information relating to the subject matter of this tender from Transnet sources, other than information formally received from the designated Transnet contact(s) as nominated in the tender documents;

4. we are satisfied, insofar as our company is concerned, that the processes and procedures adopted by Transnet in issuing this TENDER and the requirements requested from tenderers in responding to this TENDER have been conducted in a fair and transparent manner; and

5. furthermore, we acknowledge that a direct relationship exists between a family member and/or an owner / member / director / partner / shareholder (unlisted companies) of our company and an employee or board member of the Transnet Group as indicated below: *[Respondent to indicate if this section is not applicable]*

FULL NAME OF OWNER/MEMBER/DIRECTOR/

PARTNER/SHAREHOLDER: ADDRESS:

_____

_____

_____

Indicate nature of relationship with Transnet:

_____

_____

_____

_____

[Failure to furnish complete and accurate information in this regard may lead to the disqualification of your response and may preclude a Respondent from doing future business with Transnet]

We declare, to the extent that we are aware or become aware of any relationship between ourselves and Transnet (other than any existing and appropriate business relationship with Transnet) which could unfairly

advantage our company in the forthcoming adjudication process, we shall notify Transnet immediately in writing of such circumstances.

6. We accept that any dispute pertaining to this tender will be resolved through the Ombudsman process and will be subject to the Terms of Reference of the Ombudsman. The Ombudsman process must first be exhausted before judicial review of a decision is sought. (Refer "Important Notice to Tenderers" overleaf).

7. We further accept that Transnet reserves the right to reverse a tender award or decision based on the recommendations of the Ombudsman without having to follow a formal court process to have such award or decision set aside.

SIGNED at _____ on this _____ day of _____ 20____

For and on behalf of ..... duly authorised thereto	AS WITNESS:
Name:	Name:
Position:	Position:
Signature:	Signature:
Date:	
Place:	

T2.2-43: REQUEST FOR PROPOSAL – BREACH OF LAW

NAME OF COMPANY: _____

I / We _____ do hereby certify that ***I/we have/have not been*** found guilty during the preceding 5 (five) years of a serious breach of law, including but not limited to a breach of the Competition Act, 89 of 1998, by a court of law, tribunal or other administrative body. The type of breach that the Respondent is required to disclose excludes relatively minor offences or misdemeanours, e.g. traffic offences.

Where found guilty of such a serious breach, please disclose:

NATURE OF BREACH:

_____
_____
_____

DATE OF BREACH: _____

Furthermore, I/we acknowledge that Transnet SOC Ltd reserves the right to exclude any Respondent from the bidding process, should that person or company have been found guilty of a serious breach of law, tribunal or regulatory obligation.

SIGNED at _____ on this _____ day of _____ 20____

_____ _____

SIGNATURE OF WITNESS SIGNATURE OF RESPONDENT

T2.2-50: B-BBEE PREFERENCE POINTS CLAIM FORM (SBD 6.1)

This preference form contains general information and serves as a claim for preference points for Broad-Based Black Economic Empowerment [**B-BBEE**] Status Level of Contribution.

---

1. INTRODUCTION

1.1 A total of $\overline{20}$ preference points shall be awarded for B-BBEE Status Level of Contribution.

1.2 Failure on the part of a Tenderer to fill in and/or to sign this form and submit a B-BBEE Verification Certificate from a Verification Agency accredited by the South African Accreditation System [**SANAS**] or a Registered Auditor approved by the Independent Regulatory Board of Auditors [**IRBA**] or an Accounting Officer as contemplated in the Close Corporation Act [**CCA**] together with the Tender will be interpreted to mean that preference points for B-BBEE Status Level of Contribution are not claimed.

1.3 Transnet reserves the right to require of a Tenderer, either before a Tender is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by Transnet.

2. GENERAL DEFINITIONS

2.1 **"all applicable taxes"** include value-added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies;

2.2 **"B-BBEE"** means broad-based black economic empowerment as defined in section 1 of the Broad-Based Black Economic Empowerment Act;

2.3 **"B-BBEE status of contributor"** means the B-BBEE status received by a measured entity based on its overall performance using the relevant scorecard contained in the Codes of Good Practice on Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;

2.4 **"Tender"** means a written offer in a prescribed or stipulated form in response to an invitation by Transnet for the provision of goods, works or services;

2.5 **"Broad-Based Black Economic Empowerment Act"** means the Broad-Based Black Economic Empowerment Act, 2003 [Act No. 53 of 2003];

2.6 **"comparative price"** means the price after the factors of a non-firm price and all unconditional discounts that can utilised have been taken into consideration;

2.7 **"consortium or joint venture"** means an association of persons for the purpose of combining their expertise, property, capital, efforts, skills and knowledge in an activity for the execution of a contract;

2.8 **"contract"** means the agreement that results from the acceptance of a Tender by Transnet;

2.9 **"EME"** means any enterprise with an annual total revenue of R5 [five] million or less as per the 2007 version of the B-BBEE Codes of Good Practice and means any enterprise with an annual total

revenue of R10 [ten] million or less as per the Revised Codes of Good Practice issued on 11 October 2013 in terms of Government Gazette No. 36928;

2.10 **"firm price"** means the price that is only subject to adjustments in accordance with the actual increase or decrease resulting from the change, imposition, or abolition of customs and excise duty and any other duty, levy, or tax, which, in terms of the law or regulation, is binding on the contractor and demonstrably has an influence on the price of any supplies, or the rendering costs of any service, for the execution of the contract;

2.11 **"functionality"** means the measurement according to predetermined norms, as set out in the Tender documents, of a service or commodity that is designed to be practical and useful, working or operating, taking into account, among other factors, the quality, reliability, viability and durability of a service and the technical capacity and ability of a Tenderer;

2.12 **"non-firm prices"** means all prices other than "firm" prices;

2.13 **"person"** includes reference to a juristic person;

2.14 "**QSE**" means any enterprise with an annual total revenue between R5 [five] million and R35 [thirty five] million as per the 2007 version of the B-BBEE Codes of Good Practice and means any enterprise with an annual total revenue of between R10 [ten] million and R50 [fifty] million as per the Revised Codes of Good Practice issued on 11 October 2013 in terms of Government Gazette No. 36928

2.15 "**rand value**" means the total estimated value of a contract in South African currency, calculated at the time of Tender invitations, and includes all applicable taxes and excise duties;

2.16 **"subcontract"** means the primary contractor's assigning or leasing or making out work to, or employing another person to support such primary contractor in the execution of part of a project in terms of the contract;

2.17 **"total revenue"** bears the same meaning assigned to this expression in the Codes of Good Practice on Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Empowerment Act and promulgated in the Government Gazette on 9 February 2007;

2.18 **"trust"** means the arrangement through which the property of one person is made over or bequeathed to a trustee to administer such property for the benefit of another person; and

2.19 **"trustee"** means any person, including the founder of a trust, to whom property is bequeathed in order for such property to be administered for the benefit of another person.

3. ADJUDICATION USING A POINT SYSTEM

3.1 The Tenderer obtaining the highest number of total points for the evaluation criteria as enumerated in Section 2 of the RFP will be awarded the contract, unless objective criteria justifies the award to another Tenderer.

3.2 Preference points shall be calculated after prices have been brought to a comparative basis taking into account all factors of non-firm prices and all unconditional discounts.

3.3 Points scored will be rounded off to 2 [two] decimal places.

3.4 In the event of equal points scored, the Tender will be awarded to the Tenderer scoring the highest number of preference points for B-BBEE.

3.5 However, when functionality is part of the evaluation process and two or more Tenders have scored equal points including equal preference points for B-BBEE, the successful Tender will be the one scoring the highest score for functionality.

3.6 Should two or more Tenders be equal in all respect, the award shall be decided by the drawing of lots.

4. POINTS AWARDED FOR B-BBEE STATUS LEVEL OF CONTRIBUTION

4.1 In terms of the Preferential Procurement Regulations, 2011, preference points shall be awarded to a Tenderer for attaining the B-BBEE status level of contribution in accordance with the table below: ***[delete either column "Maximum 10" or "Maximum 20"]***

B-BBEE Status Level of Contributor	Number of Points [Maximum 10]	Number of Points [Maximum 20]
1	10	20
2	9	18
3	8	16
4	5	12
5	4	8
6	3	6
7	2	4
8	1	2
Non-compliant contributor	0	0

4.2 Tenderers who qualify as EMEs in terms of the 2007 version of the Codes of Good Practice must submit a certificate issued by an Accounting Officer as contemplated in the CCA or a Verification Agency accredited by SANAS or a Registered Auditor. Registered auditors do not need to meet the prerequisite for IRBA's approval for the purpose of conducting verification and issuing EME's with B-BBEE Status Level Certificates.

4.3 Tenderers who qualify as EMEs in terms of the Revised Codes of Good Practice issued on 11 October 2013 in terms of Government Gazette No. 36928 are only required to obtain a sworn affidavit on an annual basis confirming that the entity has an Annual Total Revenue of R10 million or less and the entity's Level of Black ownership.

4.4 In terms of the 2007 version of the Codes of Good Practice, Tenderers other than EMEs must submit their original and valid B-BBEE status level verification certificate or a certified copy thereof, substantiating their B-BBEE rating issued by a Registered Auditor approved by IRBA or a Verification Agency accredited by SANAS.

4.5 The Department of Trade and Industry recently revised the Codes of Good Practice on 11 October 2013 [Government Gazette No. 36928]. The Revised Codes will replace the Black Economic Empowerment Codes of Good Practice issued on 9 February 2007. The Revised Codes provide for

a transitional period ending 30 April 2015. During the transitional period, companies may elect to be measured in terms of the Revised Codes or the 2007 version of the Codes. Companies which are governed by Sector-specific Codes will be measured in terms of those Sector Codes.

4.6 As such, Transnet will accept B-BBEE certificates issued based on the Revised Codes. Transnet will also continue to accept B-BBEE certificates issued in terms of the 2007 version of the Codes provided it was issued before 1 May 2015. Thereafter, Transnet will only accept B-BBEE certificates issued based on the Revised Codes.

4.7 In terms of the Revised Codes of Good Practice, Tenderers who qualify as QSEs must comply with all the elements of B-BBEE for the purposes of measurement. QSEs that are at least 51% or 100% Black owned are only required to obtain a sworn affidavit on an annual basis confirming that the entity has an Annual Total Revenue of R50 million or less and the entity's Level of Black ownership. Large enterprises must submit their original and valid B-BBEE status level verification certificate or a certified copy thereof, substantiating their B-BBEE rating issued by a Registered Auditor approved by IRBA or a Verification Agency accredited by SANAS.

4.8 A trust, consortium or joint venture will qualify for points for its B-BBEE status level as a legal entity, provided that the entity submits its B-BBEE status level certificate.

4.9 A trust, consortium or joint venture will qualify for points for their B-BBEE status level as an unincorporated entity, provided that the entity submits their consolidated B-BBEE scorecard as if they were a group structure and that such a consolidated B-BBEE scorecard is prepared for every separate Tender.

4.10 Tertiary institutions and public entities will be required to submit their B-BBEE status level certificates in terms of the specialised scorecard contained in the B-BBEE Codes of Good Practice.

4.11 A person will not be awarded points for B-BBEE status level if it is indicated in the Tender documents that such a Tenderer intends subcontracting more than 25% [twenty-five per cent] of the value of the contract to any other enterprise that does not qualify for at least the same number of points that such a Tenderer qualifies for, unless the intended subcontractor is an EME that has the capability and ability to execute the subcontract.

4.12 A person awarded a contract may not subcontract more than 25% [twenty-five per cent] of the value of the contract to any other enterprise that does not have an equal or higher B-BBEE status level than the person concerned, unless the contract is subcontracted to an EME that has the capability and ability to execute the subcontract.

4.13 Tenderers are to note that in terms of paragraph 2.6 of Statement 000 of the Revised Codes of Good Practice issued on 11 October 2013 in terms of Government Gazette No. 36928, any representation made by an entity about its B-BBEE compliance must be supported by suitable evidence or documentation. As such, Transnet reserves the right to request such evidence or documentation from Tenderers in order to verify any B-BBEE recognition claimed.

5. B-BBEE STATUS AND SUBCONTRACTING

5.1 **Tenderers who claim points in respect of B-BBEE Status Level of Contribution must complete the following:**

B-BBEE Status Level of Contributor _____ = _____ [maximum of 10 / 20 points]

Note: Points claimed in respect of this paragraph 5.1 must be in accordance with the table reflected in paragraph 4.1 above and must be substantiated by means of a B-BBEE certificate issued by a Verification Agency accredited by SANAS or a Registered Auditor approved by IRBA or a sworn affidavit in the case of an EME or QSE.

5.2 **Subcontracting:**

Will any portion of the contract be subcontracted? YES/NO [delete which is not applicable]

If YES, indicate:

(i) What percentage of the contract will be subcontracted? .....%

(ii) The name of the subcontractor .....

(iii) The B-BBEE status level of the subcontractor .....

(iv) Is the subcontractor an EME? YES/NO

5.3 Declaration with regard to Company/Firm

(i) Name of Company/Firm.....

(ii) VAT registration number.....

(iii) Company registration number.....

(iv) Type of Company / Firm [TICK APPLICABLE BOX]

□Partnership/Joint Venture/Consortium

□One person business/sole propriety

□Close Corporations

□Company (Pty) Ltd

(v) Describe Principal Business Activities

.....

.....

(vi) Company Classification [TICK APPLICABLE BOX]

□Manufacturer

□Supplier

□Professional Service Provider

□Other Service Providers e.g. Transporter, etc.

(vii) Total number of years the company/firm has been in business.....

TENDER DECLARATION

I/we, the undersigned, who warrants that he/she is duly authorised to do so on behalf of the company/firm, certify that points claimed, based on the B-BBEE status level of contribution indicated in paragraph 4 above, qualifies the company/firm for the preference(s) shown and I / we acknowledge that:

(i) The information furnished is true and correct.

(ii) In the event of a contract being awarded as a result of points claimed as shown in paragraph 6 above, the contractor may be required to furnish documentary proof to the satisfaction of Transnet that the claims are correct.

(iii) If the B-BBEE status level of contribution has been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, Transnet may, in

addition to any other remedy it may have:

(a) disqualify the person from the Tenderding process;

(b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;

(c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;

(d) restrict the Tenderer or contractor, its shareholders and directors, and/or associated entities, or only the shareholders and directors who acted in a fraudulent manner, from obtaining business from Transnet for a period not exceeding 10 years, after the *audi alteram partem* [hear the other side] rule has been applied; and/or

(e) forward the matter for criminal prosecution.

WITNESSES:

1. .....

2. .....

SIGNATURE OF TENDERER

DATE:.....

COMPANY NAME: .....

ADDRESS:.....

T2.2-51: Certificate of Acquaintance with Tender Documents

NAME OF TENDERING ENTITY:

_____

1. I/we do hereby certify that I/we acquainted myself/ourselves with all the documentation comprising this TENDER and all conditions contained therein, as laid down by Transnet SOC Ltd for the carrying out of the proposed supply/service/works for which I/we submitted my/our Tender.

2. I/we furthermore agree that Transnet SOC Ltd shall recognise no claim from me/us for relief based on an allegation that I/we overlooked any TENDER/contract condition or failed to take it into account for the purpose of calculating my/our offered prices or otherwise.

3. I/we understand that the accompanying Tender will be disqualified if this Certificate is found not to be true and complete in every respect.

4. For the purposes of this Certificate and the accompanying Tender, I/we understand that the word "competitor" shall include any individual or organisation, other than the Tenderder, whether or not affiliated with the Tenderder, who:

   a) has been requested to submit a Tender in response to this Tender invitation;

   b) could potentially submit a Tender in response to this Tender invitation, based on their qualifications, abilities or experience; and

   c) provides the same Services as the Tenderder and/or is in the same line of business as the Tenderder

5. The Tenderder has arrived at the accompanying Tender independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium will not be construed as collusive Tenderding.

6. In particular, without limiting the generality of paragraph 5 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:

   a) prices;

   b) geographical area where Services will be rendered [market allocation]

   c) methods, factors or formulas used to calculate prices;

   d) the intention or decision to submit or not to submit, a Tender;

   e) the submission of a Tender which does not meet the specifications and conditions of the TENDER; or

   f) Tenderding with the intention not winning the Tender.

7. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the Services to which this TENDER relates.

8. The terms of the accompanying Tender have not been, and will not be, disclosed by the Tenderder, directly or indirectly, to any competitor, prior to the date and time of the official Tender opening or of the awarding of the contract.

9. I/We am/are aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to Tenders and contracts, Tenders that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and/or may be reported to the National Prosecuting Authority [NPA] for criminal investigation. In addition, Tenderders that submit suspicious Tenders may be restricted from conducting business with the public sector for a period not exceeding 10 [ten] years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

SIGNED at _____ on this _____ day of _____20___

_____ _____

SIGNATURE OF WITNESS

C1.1 Form of Offer & Acceptance

Offer

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract for Supply and Installation of a Radio High Site Mast at Koopmansfontein.

The tenderer, identified in the Offer signature block, has examined the documents listed in the Tender Data and addenda thereto as listed in the Returnable Schedules, and by submitting this Offer has accepted the Conditions of Tender.

By the representative of the tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance the tenderer offers to perform all of the obligations and liabilities of the *Contractor* under the contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the *conditions of contract* identified in the Contract Data.

The offered total of the Prices exclusive of VAT is	**R**
(in words)	

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document including the Schedule of Deviations (if any) to the tenderer before the end of the period of validity stated in the Tender Data, or other period as agreed, whereupon the tenderer becomes the party named as the *Contractor* in the *conditions of contract* identified in the Contract Data.

Signature(s) _____ _____

Name(s) _____ _____

Capacity _____ _____

For the tenderer: _____

(Insert name and address of organisation)

Name & signature of witness _____ Date _____

Tenderer's CIDB registration number: _____

Acceptance

By signing this part of this Form of Offer and Acceptance, the Employer identified below accepts the tenderer's Offer. In consideration thereof, the Employer shall pay the Contractor the amount due in accordance with the *conditions of contract* identified in the Contract Data. Acceptance of the tenderer's Offer shall form an agreement between the Employer and the tenderer upon the terms and conditions contained in this agreement and in the contract that is the subject of this agreement.

The terms of the contract, are contained in:

Part C1	Agreements and Contract Data, (which includes this Form of Offer and Acceptance)
Part C2	Pricing Data
Part C3	Scope of Work: Works Information

and drawings and documents (or parts thereof), which may be incorporated by reference into the above listed Parts.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Returnable Schedules as well as any changes to the terms of the Offer agreed by the tenderer and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Form of Offer and Acceptance. No amendments to or deviations from said documents are valid unless contained in this Schedule.

The tenderer shall within two weeks of receiving a completed copy of this agreement, including the Schedule of Deviations (if any), contact the Employer's agent (whose details are given in the Contract Data) to arrange the delivery of any securities, bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the *conditions of contract* identified in the Contract Data at, or just after, the date this agreement comes into effect. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this agreement.

Notwithstanding anything contained herein, this agreement comes into effect on the date when the tenderer receives one fully completed original copy of this document, including the Schedule of Deviations (if any).

Unless the tenderer (now *Contractor*) within five working days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this agreement, this agreement shall constitute a binding contract between the Parties.

Signature(s) _____ _____

Name(s) _____ _____

Capacity _____ _____

for the Employer Transnet SOC Ltd

_____

(Insert name and address of organisation)

Name & signature of witness _____ Date _____

Schedule of Deviations

Note:

1. To be completed by the Employer prior to award of contract. This part of the Offer & Acceptance would not be required if the contract has been developed by negotiation between the Parties and is not the result of a process of competitive tendering.
2. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender.
3. A tenderer's covering letter must not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid be the subject of agreement reached during the process of Offer and Acceptance, the outcome of such agreement shall be recorded here and the final draft of the contract documents shall be revised to incorporate the effect of it.

No.	Subject	Details
1		
2		
3		
4		
5		
6		
7		

By the duly authorised representatives signing this Schedule of Deviations below, the Employer and the tenderer agree to and accept this Schedule of Deviations as the only deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules, as well as any confirmation, clarification or changes to the terms of the Offer agreed by the tenderer and the Employer during this process of Offer and Acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the tenderer of a completed signed copy of this Form shall have any meaning or effect in the contract between the parties arising from this Agreement.

	For the tenderer:	**For the Employer**
Signature		
Name		
Capacity		
On behalf of	*(Insert name and address of organisation)*	*(Insert name and address of organisation)* Transnet SOC Ltd
Name & signature of witness		
Date		

C1.2 Contract Data

Part one - Data provided by the *Employer*

Please read the relevant clauses in the conditions of contract before you enter data. The number of the principal clause is shown for each statement however other clauses may also use the same data.

Rows containing the statement and data for options in the core clauses and for the main & secondary option clauses, according to the options chosen, are identified by shading in the left-hand column.

Completion of this data in full, according to the Options chosen, is essential to create a complete contract.

Clause	Statement	Data
1	**General**	
	The *conditions of contract* are the core clauses and the clauses for main Option	
[redacted]		**A:** **Priced contract with activity schedule**
	dispute resolution Option	**W1:** **Dispute resolution procedure**
	and secondary Options	
[redacted]		**X7:** **Delay damages**
		X16: **Retention**
		Z: ***Additional conditions of contract***
	of the NEC3 Engineering and Construction Contract June 2005 (with amendments June 2006)[1]	
10.1	The *Employer* is:	**Transnet SOC Ltd** **(Registration No. 1990/00090/06)**
	Address	Registered address: **Carlton Centre** **150 Commissioner Street** **Johannesburg** **2001**
	Having elected its Contractual Address for the purposes of this contract as:	**Transnet Freight Rail** **Supply Chain Services** **Kimberley**
	Tel No.	**(053) 838 3477**
	Fax No.	**(011) 774 9787**

[1] Available from Engineering Contract Strategies Tel 011 803 3008, Fax 011 803 3009

10.1	The *Project Manager* is: (Name)	**Jan Fourie**
	Address	**Kimberley**
	Tel	**053 838-2066**
	Fax	
	e-mail	**Jan.fourie@transnet.net**
10.1	The *Supervisor* is: (Name)	**Lucinda Brits**
	Address	**Transnet Freight Rail**
	Tel No.	**053 838-3017**
	Fax No.	
	e-mail	**Lucinda.brits@transnet.net**
11.2(13)	The *works* are	Supply and Installation of a Radio High Site Mast at Koopmansfontein
11.2(15)	The *boundaries of the site* are	Koopmansfontein
11.2(19)	The Works Information is in	**Part C3**
12.2	The *law of the contract* is the law of	**the Republic of South Africa subject to the jurisdiction of the Courts of South Africa.**
13.1	The *language of this contract* is	**English**
13.3	The *period for reply* is	**2 weeks**
3	**Time**	
11.2(3)	The *completion date* for the whole of the *works* is	**To be advised**
31.2	The *starting date* is.	**To be advised**
4	**Testing and Defects**	
42.2	The *defects date* is	**52 (fifty two) weeks after Completion of the whole of the *works*.**
5	**Payment**	
50.1	The *assessment interval* is monthly on the	**10th (tenth) day of each successive month.**
51.1	The *currency of this contract* is the	**South African Rand.**
51.2	The period within which payments are made is	**Payment will be effected on or before the last day of the month following the month during which a valid Tax Invoice and Statement were received.**
51.4	The *interest rate* is	**The prime lending rate of the Standard Bank of South Africa.**
7	**Title**	**No additional data is required for this section of the *conditions of contract*.**
8	**Risks and insurance**	

80.1	These are additional *Employer*'s risks	**1. None**
84.2	The minimum limit of indemnity for insurance in respect of loss of or damage to property (except the *works*, Plant, Materials and Equipment) and liability for bodily injury to or death of a person (not an employee of the *Contractor*) caused by activity in connection with this contract for any one event is	**Whatever the *Contractor* requires in addition to the amount of insurance taken out by the *Employer* for the same risk.**
	The minimum limit of indemnity for insurance in respect of death of or bodily injury to employees of the *Contractor* arising out of and in the course of their employment in connection with this contract for any one event is	**Whatever the *Contractor* deems desirable in addition to which is prescribed by the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993 as amended.**
84.2	The insurance against loss of or damage to the *works*, Plant and Materials as stated in the insurance policy for contract works and public liability selected from: Blanket Principal Controlled Insurance (BPCI), Principal Controlled Insurance (PCI), Principal Controlled Contractors Liability Insurance, Principal Controlled Insurance One-off; and Project Specific Insurance	**R** **Select one** | **BPCI** | **PCI** | **X** | **PCI Liab only** | **PCI One Off** | **PSI** |
84.1	The *Employer* provides these insurances from the Insurance Table	
	1 Insurance against:	**Loss of or damage to the *works*, Plant and Materials is as stated in the selected Insurance policy for Contract Works/ Public Liability.**
	Cover / indemnity:	**to the extent as stated in the selected insurance policy for Contract Works / Public Liability**
	The deductibles are:	**as stated in the selected insurance policy for Contract Works / Public Liability (Principal Controlled Insurance)**
	2 Insurance against:	**Loss of or damage to property (except the *works*, plant, materials & equipment) and liability for bodily injury to or death of a person (not an employee of the *Contractor)* arising out of or in connection with the performance of the Contract as stated in the selected insurance policy for Contract Works / Public Liability**
	Cover / indemnity	**Is to the extent as stated in the selected insurance policy for Contract Works / Public Liability**

	The deductibles are	**as stated in the selected insurance policy for Contract Works / Public Liability**
84.1	3 Insurance against:	**Loss of or damage to Equipment (Temporary Works only) as stated in the selected insurance policy for contract Works and Public Liability**
	Cover / indemnity	**Is to the extent as stated in the selected insurance policy for Contract Works / Public Liability**
	Cover / indemnity:	**Cover / indemnity is to the extent provided by the SASRIA coupon**
	The deductibles are:	**The deductibles are in respect of each and every theft claim 0,1% of contract value subject to a minimum of R2,500 and a maximum of R25,000**
84.1	The *Contractor* provides these additional insurances.	

1. Where the contract requires that the design of any part of the *works* shall be provided by the *Contractor* he shall satisfy the Employer that professional indemnity insurance cover in connection therewith has been affected

2. Where the contract involves manufacture, and/or fabrication of Plant & Materials, components or other goods to be incorporated into the *works* at premises other than the site, the *Contractor* shall satisfy the *Employer* that such plant & materials, components or other goods for incorporation in the *works* are adequately insured during manufacture and/or fabrication and transportation to the site.

3. Should the *Employer* have an insurable interest in such items during manufacture of fabrication, such interest shall not be noted by endorsement to the *Contractor's* policies of insurance as well as those of any subcontractor

4. Motor Vehicle Liability Insurance comprising (as a minimum) "Balance of Third Party" Risks including Passenger and Unauthorised Passenger Liability indemnity with a minimum indemnity limit of

5. Marine Craft Hull insurance in respect of all marine craft or vessels utilised in performance of the Works for a sum sufficient to provide for their replacement

[redacted]		6 Protection and Indemnity Insurance in respect of all marine craft or vessels utilised in performance of the Works extended for Specialist Operations with a minimum indemnity limit of R (to be determined by risk assessment of the potential risk exposure) 7 The insurance coverage referred to in 1, 2, 3, 4, 5 and 6 above shall be obtained from an insurer(s) in terms of an insurance policy approved by the *Employer.* The *Contractor* shall arrange with the insurer to submit to the *Project Manager* the original and the duplicate original of the policy or policies of insurance and the receipts for payment of current premiums, together with a certificate from the insurer or insurance broker concerned, confirming that the policy or policies provide the full coverage as required. The original policy will be returned to the *Contractor*
9	**Termination**	**There is no Contract Data required for this section of the *conditions of contract.***
10	**Data for main Option clause**	
A	**Priced contract with activity schedule**	**No additional data is required for this Option**
11	**Data for Option W1**	
W1.1	The *Adjudicator* is	**Both parties will agree as and when a dispute arises. If the parties cannot reach an agreement on the *Adjudicator*, the chairman of the Association of Arbitrators will appoint an *Adjudicator.***
W1.2(3)	The *Adjudicator nominating body* is: If no *Adjudicator nominating body* is entered, it is:	**The Chairman of the Association of Arbitrators (Southern Africa)** **the Association of Arbitrators (Southern Africa)**
W1.4(2)	The *tribunal* is:	**Arbitration**
W1.4(5)	The *arbitration procedure* is The place where arbitration is to be held is	**The Rules for the Conduct of Arbitrations of the Association of Arbitrators (Southern Africa)** **Bloemfontein**

	The person or organisation who will choose an arbitrator - if the Parties cannot agree a choice or - if the arbitration procedure does not state who selects an arbitrator, is	**The Chairman of the Association of Arbitrators (Southern Africa)**	
X7	**Delay damages (but not if Option X5 is also used)**		
X7.1	Delay damages for Completion of the whole of the *works* are	**R 200.00**	**per day**
X16	**Retention (not used with Option F)**		
X16.1	The *retention free amount* is	**N/A**	
	The *retention percentage* is	**10%**	

C1.2 Contract Data

Part two - Data provided by the *Contractor*

The tendering contractor is advised to read both the NEC3 Engineering and Construction Contract - June 2005 (with amendments June 2006) and the relevant parts of its Guidance Notes (ECC3-GN)[2] in order to understand the implications of this Data which the tenderer is required to complete. An example of the completed Data is provided on pages 152 to 154 of the ECC3 Guidance Notes.

Completion of the data in full, according to Options chosen, is essential to create a complete contract.

Clause	Statement	Data
10.1	The *Contractor* is (Name):	
	Address	
	Tel No.	
	Fax No.	
11.2(8)	The *direct fee percentage* is	____%
	The *subcontracted fee percentage* is	____%
11.2(18)	The *working areas* are the Site	
24.1	The *Contractor's* key persons are:	
	1 Name:	
	Job:	
	Responsibilities:	
	Qualifications:	
	Experience:	
	2 Name:	
	Job	
	Responsibilities:	
	Qualifications:	
	Experience:	
		CV's (and further key persons data including CVs) are in T2.2-7
11.2(3)	The *completion date* for the whole of the *works* is	**To be advised**
11.2(14)	The following matters will be included in the Risk Register	T2.2-3

[2] Available from Engineering Contract Strategies Tel 011 803 3008, Fax 011 803 3009

11.2(19)	The Works Information for the *Contractor's* design is in:	C3
31.1	The programme identified in the Contract Data is	To be supplied within 7 (seven) days
A	**Priced contract with activity schedule**	
11.2(20)	The *activity schedule* is in	C3
11.2(30)	The tendered total of the Prices is	**(in words), excluding VAT**
	Data for Schedules of Cost Components	*Note "SCC" means Schedule of Cost Components starting on page 56 of ECC3, and "SSCC" means Shorter Schedule of Cost Components starting on page 59 of ECC3.*
A	**Priced contract with activity schedule**	**Data for the Shorter Schedule of Cost Components**

TRANSNET

C2 Pricing Data

C2.1 Pricing Instructions

Entries in the first four columns in the Price List are made either by the *Employer* or the tenderer.

If the *Contractor* is to be paid an amount for the item which is not adjusted if the quantity of work in the item changes, the tenderer enters the amount in the Price column only; the Unit, Quantity and Rate columns being left blank.

If the *Contractor* is to be paid an amount for the item of work which is the rate for the work multiplied by the quantity completed, the tenderer enters the rate which is then multiplied by the expected quantity to produce the Price, which is also entered.

All Prices are to be shown excluding VAT unless instructed otherwise by the *Employer* in Tender Data or in an instruction the *Employer* has given before the tenderer enters his Prices.

If there is insufficient space in the Price List which follows, state in which document the Price List is contained.

C2.1: Pricing Instructions

1. The Tenderer is deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices stated in the priced Price List in the works information. The rates and prices (except in so far as otherwise provided in the Tender) collectively cover full payment for the discharge of all his obligations under the Contract and all matters and things necessary for the proper completion of the works.

2. Any additional costs foreseen by the Tenderer for items not included in the Price List shall be included in the List to be submitted, under the item "P's & G's". These items must be specified.

3. It will be assumed that prices included in the Price List are based on Acts, Ordinances, Regulations, Bylaws, International Standards and National Standards that were published 28 days before the closing date for tenders.

4. Reference to any particular trademark, name, patent, design, type, specific origin or producer is purely to establish a standard for requirements. Products or articles of an equivalent standard may be substituted but will be subject to approval by the Employer.

5. The amount of the Preliminaries to be included in each monthly payment certificate shall be assessed as an amount prorated to the value of the work duly executed in the same ratio as the preliminaries bears to the total of prices excluding any contingency sum, the amount of the Preliminaries and any amount in respect of contract price adjustment provided for in the contract.

6. The following abbreviations are used in the Price List: Ea = Each

7. The prices and rates in this Price List are fully inclusive prices for the work described under the items. Such prices and rates cover all costs and expenses that may be required in and for the execution of the work described in accordance with the provisions of the scope of work and shall cover liabilities and obligations set forth or implied in the Contract data, as well as profit.

8. Where the Works Information requires detailed drawings and designs or other information to be provided, all costs associated therewith are deemed to have been provided for and included in the unit rates and sum amount tendered for such items.

9. Where no quantity has been provided against an item in the Price List, the Contractor shall use their discretion and provide the quantity.

10. The short descriptions of the items of payment given in this Price List are only for purposes of identifying the items. More details regarding the extent of the work entailed under each item appear in the Works information.

11. For each item I the Price List, including Preliminaries, the Contractor shall provide in the appropriate column the portion of the tendered sum (inclusive of labour and material).

12. The total in the Price List shall be exclusive of VAT, and shall be transferred to Contractor's Offer.

13. Additional work not covered in the Price List shall be listed and quoted for by the tenderers in a separate sheet.

14. Payment Certificates – On or after the assessment date, the Supervisor and the Contractor will together assess the quantities of the progress on each item in the Price List and complete the Progress Assessment Detail Form, where after the Progress Assessment Certificate will be issued.

15. The Contractor shall then submit a VAT invoice and attach the Progress Certificate mentioned in clause 14 of this section for payment by the Employer.

16. Contractor shall provide the Employer with the necessary details and documentation as required in order to enable the Employer to make electronic payments.

C2.2 Price List

SUPPLY AND INSTALLATION OF 100M ARIAL SPUN BUNDLE CONDUCTOR CABLE FROM 16KVA ESCOM TRANSFORMER TO OLIFANTHOEK HIGH SITE

SCHEDULE OF RATES:

Item:	Technical Requirements	Unit of Measure	Qty	Unit Price Excl. VAT	Total Price Excl. VAT
Lattice Structure: Angle Iron Mast and Foundation	Please see attached Specifications (BBF0939 Tower Generic Spec) Mast Height: 15m	EA	1		
Installation of Mast and Foundation	Please see attached Specifications (BBF0939 Tower Generic Spec, and High Site Engineering Practice version 3.2)	EA	1		
P & G's	n/a	EA	1		
			SUB TOTAL:		
			VAT 14 %:		
			GRAND TOTAL:		

C3: Scope of Work

C3.1 Works Information

TRANSNET

freight rail

TFR INFRASTRUCTURE

TELECOMMUNICATIONS SPECIFICATION

GENERIC RADIO TOWER

TFR BPF-0939

JUNE 2011

Table of Contents

I. Document Authorisation

Function	Name	Title and Division	Signature	Date
Compiled by:	ML Nuttall	Divisional Manager, Transmission		
Reviewed by:	PJ du Plessis	Technologist, Quality Assurance		
Reviewed by:	G Daly	HOD Access		
Reviewed by:	E van der Merwe	Senior Technologist, Transmission		
Reviewed by:	F Nel	Divisional Manager, Technical Execution		
Authorised by:	ML Nuttall	Divisional Manager, Transmission		

II. Distribution

To be registered in TFR's document management system – Projectwise

Emailed to all TFR Telecommunications specialists

Provided to relevant Project Managers, Tenderers and Contractors

III. Change History

Issue No.	Date	Issued by	Change Summary
1.00	2011-05-20	Transmission	Compilation from old RFPs

IV. Changes since Last Revision

Clause	Description

V. Abbreviations and Acronyms

Acronym	Description
AGL	Above ground level
TFR	Transnet Freight Rail

VI. Definitions

Term	Definition

VII. Relevant Documentation

Document	Description and Relevance
MAN 00009	Radio High Site Engineering Practice 4.2 Supporting Structures 4.4 Site Grounding 4.6 Coaxial Cable 4.7 Antenna Location and Support Structure 5 Antenna Types 10 Health and Safety

1. Scope

1.1 This is a generic specification for the provision of a telecommunications tower on Transnet land, or on land upon which Transnet has secured a lease.

1.2 The specific details will be provided in the associated Bill of Quantities, Schedule of Requirements and / or Design Document

1.3 The general requirement is for a tapered steel lattice tower with either a square or triangular base.

1.4 The onus is on the Contractor's registered Professional Engineer to design, build and certify the structures, foundation, earthing and electrical reticulation.

2. Design Parameters

2.1 The height of the tower will be 5 metres higher than the design height AGL of the highest antenna specified in the design.

2.2 The orientation of the tower will either be specified in the Site Diagram of the Design Document or,

2.2.1 In the case of an existing established site, the tower and foundation will be aligned with existing structures, or

2.2.2 In a green fields scenario, the corner of the tower will be aligned to the azimuth of the antenna.

2.3 The tower must withstand wind speeds of 160 km/h. In such conditions, and with the antennae loading planned, it must not twist or bend more than 1 degree.

2.4 The tower must be made of steel, corrosion and electrolysis protected, suitable for the environment and terrain in which it shall be installed, and certified for a design life span of at least 50 years.

2.5 To comply with this life span, extreme weather and natural conditions must be taken into account, including snow, icing and probable seismic movement.

2.6 The construction of the tower and associated civil works must comply with all relevant South African codes of practice, standards and legislation, including health and safety.

2.7 The dimensions, materials and design of the tower will be included in the contractor's offer, which will be certified by a registered Professional Engineer. The tower design may be subject to verification by TFR's own structural engineers.

3. Features

3.1 Earthing and Lightning Protection

3.1.1 Site grounding and protection must comply with MAN00009 "Radio High Site Engineering Practice".

3.1.2 A 1200 mm long galvanized lightening spike must be installed at the very top of the tower. The spike shall be bolted to the tower spine or leg. This spike can be a M12 or M16 rod or a 38 mm x 38 mm angle iron with a sharpened point.

3.2 Where the antenna is not protected against lightning strikes (the antenna is not within the protection zone), then the length of the lightning spike must be increased accordingly. When the lengthening of the spike is not an acceptable solution, horizontally mounted lightning rods must be installed above and below the antennae.

3.3 Platforms

3.3.1 A crows nest or platform shall be installed 4 to 6 m from the top of a lattice tower. The crows nest must be designed to accommodate the antennae load specified. The deflections of the expanded mesh floor shall be less than span / 360 when carrying a 100 kg load at mid-span. A trapdoor must be fitted at the cat ladder exit. Provision must be made for feeders to pass through the floor.

3.3.2 Lattice towers shall have a full internal working platform fitted at the intermediate aircraft warning light level. This platform must be installed halfway (+/- 3 m) up towers which total length exceeds 45.7 m. The deflections of the expanded mesh floor shall be less than span/360 when carrying a 100 kg load at mid-span. A trap door must be fitted at the cat ladder exit.

3.3.3 All crows nests and platforms must be installed with a 50 mm +- 10 mm wide x 5 mm thick kick plate facing up around the edges of the crows nest / platform and feeder exit openings.

3.3.4 Safety hand and knee rails are to be mounted all the way around the perimeter of the crows nest / platforms at a height of 1200 mm and 600 mm respectively from the expanded mesh floor. The rails must be fixed to the tower structure with no gaps to ensure that slings do not accidentally slip off. The rail must be a minimum angle iron of 50 x 50 x 3 mm.

3.3.5 Trapdoors shall be configured to ensure that they do not slam shut under gravity. A minimum opening angle of 95º is required. The trapdoor shall not open forward towards the cat ladder. The hinge of the trapdoor shall have a proper hinge pin or if a bolt is used the bolt shall have an unthreaded shank within the hinge and shall have a lock-nut. The trapdoor deflections shall be less than span / 360 when carrying a 100kg load at mid-span.

3.4 Cat Ladder

3.4.1 A 300 mm wide cat ladder must be extended the full length of the tower to the highest point of the tower and allow access to the top aviation lights.

3.4.2 Cat ladder rungs must be spaced at 295 mm intervals to allow comfortable climbing and will be between 12 mm to 16 mm in diameter.

3.4.3 Both sides of the cat ladder will allow for cable runs. The cables will not impede climbing.

3.4.4 Safety hoops or a TFR approved fall arrest system must be installed on cat ladders that extend higher than 2.5 m from the ground, platform or crows nest.

3.4.5 Horizontal safety hoops must be spaced 1 m apart with a diameter of 700 mm (± 50 mm). Vertical stringers must also be installed but spaced to ensure that the cat ladder can be exited at any height to perform inspections.

3.4.6 Safety hoops must also be installed on the cat ladder inside mono poles starting 2.5 m from the bottom until the inside diameter of the pole reaches 700 to 800 millimetres. Where the safety hoop and stringers are bolted together with M8 or smaller bolts, stainless steel grade 304 bolts must be used.

3.4.7 Safety hoops on the spine of mono poles are not practical therefore a TFR approved fall arrest system must be installed by a certified person on all spines that are longer than 2.5 m.

3.4.8 Cat ladder offsets must meet the latest occupational health and safety act requirements that will allow unobstructed climbing. An off set of 150 mm is required.

3.5 Cable feeders

3.5.1 Provision must be made for feeders to pass through the platform/s floor on either side of the cat ladder offsets / cable runway. Feeder cables must be routed alongside the cat ladder and not behind the cat ladder climbing rungs.

3.5.2 Since it is not known at the time of manufacture which side the cables will be routed, the feeder cable access holes must be made on both sides of the cat ladder. The unused cable access hole can be fitted with a dummy cover that can be moved to either side of the platform.

3.5.3 The cable runway will allow for a cable run of 300 mm wide x 150 mm deep and will allow cable clamps to be attached to the offset and / or dummy offset brackets the full height of the tower at 1m spacing. (From the foundation level to the highest point) The bottom 3m dummy offset brackets must always be supplied but they must be removable.

3.6 Navigation Lights

3.6.1 All rural towers shall have night navigational markings as required by the South African Civil Aviation Authorities (SACAA). Towers shall only have daytime navigational markings (international orange and white) when specifically required by the SACAA. Navigation lights on urban tower will only be installed on instruction from the SACAA or on the request from the Project Manager in the site survey.

4. Safety Factors

4.1 TFR requires that proper suitably experienced supervision is present on the site at all times during erection and reserves the right to request that supervision be replaced if they are dissatisfied with the performance and or experience of the supervision provided.

4.2 Safety harnesses (whilst on the tower), safety shoes, and hard hats must be used at all times by the full rigging crew. Only proper rigging slings and rigging equipment must be used for the tower erection. All harnesses must have at least two tails and one tail must always be connected at any given time. No chain link slings are to be used as these cause damage to the tower galvanising or paint work.

4.3 All rigging equipment is to be checked for signs of wear or fatigue prior to use on site.

4.4 Under no circumstances can persons other than authorised riggers and workmen be permitted on the ground within a 30 m radius of the tower whilst workmen are on the tower.

4.5 A responsible person is to be appointed for each site and must be on site at all times during erection.

4.6 In residential areas prior arrangement shall be made, to have the local authorities cordon off any access road(s) that could be affected while the tower is placed into position.

4.7 When hoisting pole type towers no person other than authorised riggers and workmen shall be allowed within the tower height equivalent radius of the erection site, until such time as the tower has been secured on the foundation.

4.8 Occupants of any building(s) adjacent to the construction site shall be timeously notified of the intent to erect a tower, and where deemed necessary requested to evacuate the building(s) during placement of the tower.

5. Site Establishment

5.1 No open fires are allowed on any site.

5.2 No alcohol is allowed on any site

5.3 Special arrangements must be made during the site survey for on site camping.

5.4 The main contractor must make waste bins available during the site build life cycle for rubbish.

5.5 Portable toilet facilities must be on site for the whole duration of the site build. This must be arranged by the main contractor but must be insisted upon if there are no alternative toilet facilities.

5.6 After completion of the works, excavated soil must be used to level the complete site area and the excess / unusable soil must be removed from site and discarded appropriately. The levelled area must be compacted.

5.7 All excess material must be removed from site. This includes excess aggregate.

6. Transport and Erection

6.1 The tower must be suitably protected from damage during transport. Suitable spacing material (wooden planks or thick cardboard) must be used as spacers to ensure that the tower members do not scuff and thereby cause damage to the galvanising.

6.2 Unloading of the tower on site must be supervised to ensure that the correct tower has arrived for that site and that the members are not thrown of the truck but unloaded with care.

6.3 The tower members must be packed out on site clear from the ground as per the packing list and checked that there are no missing components.

7. Conformance Certification

7.1 The Contractor's responsible engineer with a Pr. Eng. certification must certify that he has inspected the tower and satisfied himself that the site conditions and the tower erection is in accordance with his design and his design assumptions. The engineer could use a representative under his guidance to report back to him but this will in no way take away responsibility from the Professional Engineer that represents the tower manufacturer. The certificate is to be submitted as part of the as-built documentation.

7.2 The following minimum information must be supplied on the certificate:

a. The Professional Engineer's full name, signature and registration number.

b. The manufacturer's name and company address.

c. The site name and number if applicable.

d. The terrain category and false datum height for wind calculations of the site.

e. The tower type and designed terrain category of the tower on site.

f. The reference to this specification and his compliance thereto.

g. The designed load as per this specification.

h. The foundation bearing pressure obtained and required as per his design.

i. Certification of the foundation.

j. Certification of the erection.

k. Special maintenance instructions.

8. As-built Documentation

8.1 A full set of tower erection and foundation drawings must be provided for each tower type, foundations, etc. These drawings are to be on site before work commences and they must be supplied to TFR on completion of the tower.

8.2 The drawings must include at least overall structure sizes, member sizes, bolt sizes, bolt torque's, material specifications, antennae brackets, platforms, cat-ladders, concrete mixes (by volume) loading assumptions, tower type and any other items of relevance that may be needed to identify the conditions for which the said tower is intended.

8.3 A paper copy of the documentation must be submitted to the site owner and another copy left at TFR's building on site. Electronic copies of the documentation must be submitted to the site owner.

TRANSNET
freight rail

RAIL NETWORK TELECOMS

STANDARD

RADIO HIGH SITE ENGINEERING PRACTICE

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		Date:	19 July 2012

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TABLE OF CONTENT

I Distribution

Once updated, a copy of the latest revision will be published in the document management system in use. An e-mail to this effect will be sent to the relevant personnel or heads of department.

II Document Change History

ISSUE NO.	DATE ISSUED	ISSUED BY	HISTORY DESCRIPTION
2.00	February 2008	Rail Network Telecoms, Quality Assurance	Revision
3.00	February 2010	QA	New format & revision
3.10	June 2011	QA	Revision
3.20	July 2012	QA	Revision

III Changes Since Last Revision

CLAUSES	DESCRIPTION
4.7.2.2; 4.8.5; 5.2; 5.3; 5.4; 5.5; 5.6 & 5.7	Add information

IV List of Abbreviations and Definitions

ABBREVIATIONS	DESCRIPTION
CTCSS	Continuous Tone Coded Squelch System
EIA	Environmental Impact Assessment
EM	Electro Magnetic
ERP	Effective Radiated Power
dB	Decibel
fc	Carrier frequency or Centre frequency
Hz	Hertz
kA	Kilo Ampere
Lr	Return Loss
RF	Radio frequency
Rx	Radio receiver
SHERQ	Safety, Health, Environment, Risk and Quality
Tx	Radio transmitter
UHF	Ultra High Frequency
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

DEFINITIONS	DESCRIPTION
Decibel	The decibel is 1/10 of a Bel. Decibel is the logarithm of the ratio between a measured quantity and an agreed reference level.
dBc	The absolute power in decibel with reference to the carrier power.
dBd	The power gain of an antenna in decibel with reference to a Dipole antenna.
dBm	The absolute power in decibel with reference to 1 mW.
Land Mobile Radio service	Radio communication from fixed radio stations to mobile radio stations carried in surface vehicles or portable radio stations, and between mobile and portable radio stations.
Portable Radio Station	A radio station designed to be carried by or on a person.
Mobile Radio Station	A radio station designed for installation in a surface vehicle and capable of operating while the vehicle is in motion and while it is stationary.
Fixed Radio Station	It is a fixed radio station installed in an office or control room, fitted with an external antenna.
Base Station	A radio station designed to be installed in a fixed location and performing the function of a repeater/enhancer.

Receiver	
Spurious Response Attenuation/ Rejection	The ability of a radio receiver to discriminate between the standard input signal frequency and an undesired signal at any other frequency to which it is also responsive, excluding the two adjacent channels.
Intermodulation Spurious Response Attenuation/ Rejection	The ability of a radio receiver to receive a modulated standard input signal, in the presence of two interfering signals of which the carrier frequencies are so separated from the standard input signal frequency and from each other that n'th order mixing of the two undesired signals can occur in the non-linear elements of the receiver, producing a third signal whose frequency is equal to that of the standard input signal frequency, or intermediate frequency (IF).
Co-channel Rejection Ratio	The capability of a radio receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.
Blocking	The reduction in the wanted audio output power of a radio receiver, or a reduction in the SINAD ratio, owing to an unwanted signal on another frequency.
Desensitisation	A condition where off-channel transmitting energy passes through the front-end of the receiver, causing a reduction in receiver gain.
High RF Signal Level Interference	The ability of a radio receiver to oppose high RF signal levels at frequencies other than the selected frequency.

Transmitter	
Conducted Spurious Emissions	Are emissions at the antenna terminal of a radio transmitter on a frequency or frequencies that are outside the channel on which the transmitter is operating.
Effective Radiated Power (ERP)	It is the mean power radiated by the antenna in the direction of maximum radiation.
Intermodulation Attenuation	The ability of a radio transmitter to attenuate signals generated in its non-linear elements by the presence of the carrier and a parasitic signal arriving at the transmitter through its antenna.

1. INTRODUCTION

This document provides guidance for engineers, suppliers and contractors concerned with the design, specification, construction, installation, operation and maintenance of Land Mobile Radio systems. It is particularly directed towards radio systems working in the UHF band.

SECTION A: DEFINITION OF WORK TO BE PERFORMED

2. CHOICE OF SITE

2.1 **Aim** – to provide coverage in the required service area.

2.1.1 The highest available site is not always the best decision due to co-channel interference that could occur.

2.1.2 A compromise must be reached between the signal coverage requirements, technical requirements and economic constraints.

2.2 **Procedure**

2.2.1 Examination of user requirements, service area, frequency, licence power limits and mode of operation.

2.2.2 Inspection of service area to identify preferred locations for sites.

2.2.3 Search for existing sites in the preferred areas.

2.2.4 Location chosen by propagation analysis – check the suitability of an existing site or to decide the exact location for the construction of a new radio site.

2.2.5 Analytical information to be used:

2.2.5.1 The co-ordinates of the site and the true North reference.

2.2.5.2 Effective radiated power of high site, mobile and radio link.

2.2.5.3 Frequency band.

2.2.5.4 Antenna type and gain.

2.2.5.5 Antenna polarisation & beam width.

2.2.5.6 Antenna height.

2.2.5.7 Type of mast/tower – the effect of the mast/tower on the radiation pattern.

2.2.5.8 Terrain clutter e.g. buildings and trees.

2.2.5.9 Type of system to be used – minimum signal level required for reliable operation.

2.2.5.10 The receiver noise, EM noise, and multipath propagation must be taken into account.

2.2.5.11 For a normal grade of service the minimum signal level must be exceeded for 90 % of the coverage area and for a high grade of service 99 %.

2.2.6 Where a radio link or links are required; they must be included in the propagation analysis.

2.2.7 The location chosen must not be closer than 500 m from a busy road to avoid the reception of vehicle ignition noise and to prevent interference from passing mobile radio transmitters.

2.2.8 Analyse suitability of existing sites and the feasibility of site sharing.

2.2.8.1 Availability of capacity at existing sites e.g. space on mast/tower, equipment accommodation and mains power.

2.2.8.2 Site compatibility including adjacent sites:

2.2.8.2.1 RF aspects that may cause interference to or from proposed system (the isolation between radio systems).

2.2.8.2.2 The level of the electromagnetic noise.

2.2.8.3 The ability of the site to be re-developed.

2.2.9 The planning of a new site must include the possibility of future TFR expansion – space on tower/mast, space in equipment room and power capacity.

2.2.10 Obtain an Environmental Impact Assessment. The footprint requirement stated in the EIA application must be large enough to include the accommodation of another operator outside the TFR fence.

2.2.11 In order to obtain a positive Record of Decision from the EIA, allowance must be made for the future collocation of at least one other operator on the mast and in a separate equipment building/container.

2.2.12 Obtain a Security Risk Assessment and recommendations.

2.2.13 Establish a test station at the proposed site location and conduct a radio signal strength survey in the area of interest.

2.2.14 Formulate proposals for new sites where necessary.

2.2.15 Where radiating cables are used in tunnels, the coupling loss is affected by the reflections from the surrounding walls. The coupling loss could vary ±5 dB in the cross section of the tunnel.

3. RADIO SYSTEM REQUIREMENTS

3.1 The equipment must comply with the Transnet freight rail radio standard BBD8635 TECHNICAL SPECIFICATION AND METHODS OF MEASUREMENT FOR ANGLE MODULATED RADIO EQUIPMENT. The latest version of the standard will apply.

3.2 A list of the equipment and quantities required must be compiled.

4. INSTALLATION ON SITE

4.1 Working arrangements

4.1.1 Operations on site must follow safe working practices.

4.1.2 Only one contractor must work on a structure at any one time.

4.2 Supporting Structures

4.2.1 Competent persons must manage and perform the design and construction of support structures (masts/towers).

4.2.2 During the design and construction of support structures the following must be considered:

4.2.2.1 Protection of metal components.

4.2.2.1.1 Hot dip galvanizing of steel components.

4.2.2.1.2 Spin galvanizing of steel threads.

4.2.2.1.3 Use of lock nuts, spring washers and other locking devices.

4.2.2.1.4 Anodizing of aluminium components. Note: Anodizing on aluminium is likely to insulate the components, causing difficulties in terms of earthing and conductivity of the structure.

4.2.2.1.5 Use of protective paints.

4.2.2.1.6 The cutting or drilling of protective coated items must not be permitted.

Rather use clamps. When it is unavoidable consideration must be given to possible structural weakening and the affected areas must be treated with a recommended protective coating.

4.2.2.2 Wind loading.

4.2.2.2.1 The structural design must take into account the wind loading of all the components on the structure e.g. antennae, feeders and associated hardware. Refer to the antenna specification for the wind loading figures.

4.2.2.2.2 The twisting and tilting limitations for parabolic antennae.

4.2.2.2.3 The design of new structures must where possible take into account the probability of future development.

4.2.3 Use of dissimilar metals.

4.2.3.1 All metals used in contact with each other shall be of the same series e.g. copper, brass, silver, nickel or gold. Iron and steel must be avoided at all times as their oxides, forming non-linear junctions and can cause intermodulation. The ideal combinations are brass to copper using nickel-plated nuts and bolts.

4.2.3.2 The contact area between dissimilar metals tends to corrode, forming electrical resistance.

4.2.4 The structural integrity of support structures e.g. masts and towers must be established by a competent structural engineer.

4.2.5 Where security is a concern or it is a requirement, provision must be made in the foundation structure for under ground cable ducts between the supporting structure and the equipment room. Coaxial cables and electrical cables must run in separate ducts.

4.3 Equipment Room

The construction must adhere to the following:

4.3.1 The construction of the installation must provide security against vandalism.

4.3.2 An alarm system must be fitted.

4.3.3 The cables in and out of the equipment room must be hidden or protected in such a way that they cannot easily be damaged.

4.3.4 Where the coaxial cables enter the equipment room an entry plate must be provided.

4.3.5 An air-conditioning system must be provided to keep the ambient temperature inside the equipment room at an acceptable level of 21 °C ±3 °C.

4.3.6 A lighting system must be provided in the equipment room to facilitate maintenance.

4.3.7 The size of the room must provide sufficient space to allow for reasonable expansion.

4.3.8 Where non-sealed batteries are used for emergency supplies, the batteries must be housed in a separate cubicle with ventilation to the outside atmosphere. This is to ensure that no explosive gases or corrosive fumes are present within the equipment room.

4.3.9 The design of the equipment room must be such to prevent pests and vermin to enter it.

4.4 Site Grounding (earthing)

4.4.1 Lightning effects.

4.4.1.1 With a lightning strike the magnitude of current flow is such that high transient voltages could be induced in adjacent conductors although these may be insulated.

4.4.1.2 Side flashing at cable bends could occur. To prevent this, a direct grounding path must be provided at these points to divert the strike current.

4.4.1.3 Due to the local high potential gradient developed during the dissipation of strike energy, cables interconnecting to other sites or equipment outside of the affected site will transfer the potential difference to the distant end where the transient effects may cause damage.

4.4.1.4 In addition to direct strikes, cloud-to-cloud strikes can cause high potentials to be induced in cable runs at ground level. This effect is enhanced by the horizontal polarization.

4.4.1.5 Other effects are:

4.4.1.5.1 Step potential: Is where the potential gradient along the ground and radially away from the point of strike is sufficient to cause a lethal potential difference.

4.4.1.5.2 Touch potential: Is where a person is touching metalwork that is connected to the point of strike, will experience an electric shock.

4.4.1.5.3 Transferred potential: Is where potential differences between the area struck and cable connected to remote locations may cause hazardous conditions at these locations.

4.4.2 Theoretical zone of protection for radio installations

4.4.2.1 For structures up to 20 m in height the zone is bounded by an imaginary cone, subtending an angle of 45 ° (α) from the top of the structure.

For a structure of 30 m in height α = 35 °.
For a structure of 45 m in height α = 25 °.

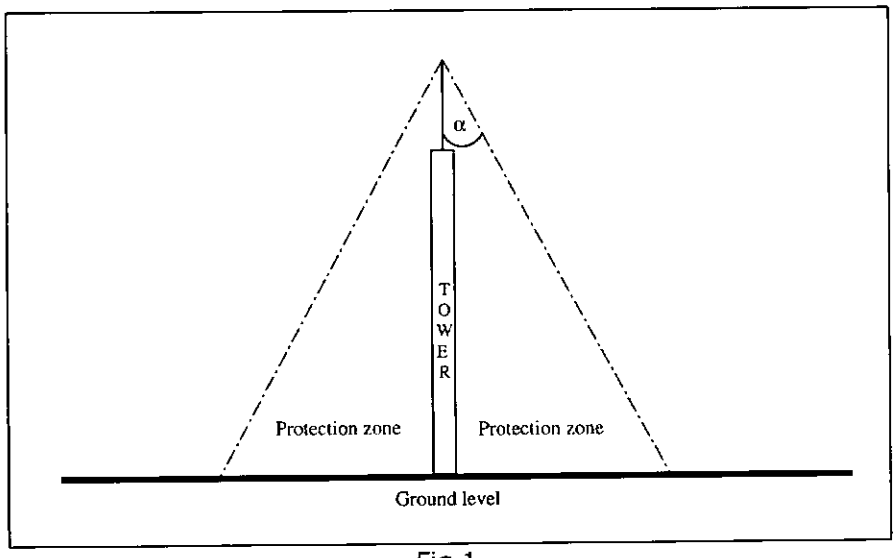

Fig 1

4.4.2.2 For structures greater than 45 m in height the concept takes the form of the imaginary rolling spheres of radius (R), defining the protection zone.

Where the sphere touches an object, that specific point is not protected against a direct lightning strike. Any object beneath the sphere and not touched by the sphere, is protected against lightning strikes.

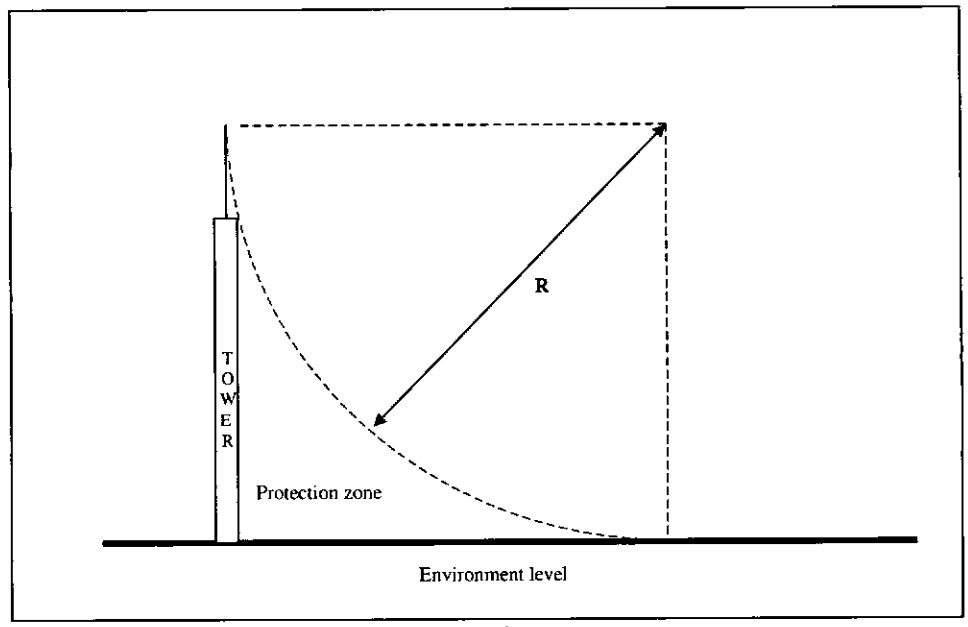

Fig 2

The radius (R) of the sphere can be calculated: $0.84h^{0.6}I^{0.74}$

Where: h = height of the structure.
I = peak lightning current in kA.

For radio installations the radius (R) of the sphere should be 45 m.

4.4.2.3 Telecommunication buildings with large roof areas can be protected against lightning with a roof grid of conductors spaced 15 m apart.

4.4.2.4 Antenna position

4.4.2.4.1 Antennae being mounted on the side of masts/towers are not necessarily protected against all lightning strikes when taking *side effects* into account.
The rolling sphere theory show that in some cases the antenna could be struck by lightning, depending on the relative positioning of the antenna below the lightning rod on the top of the tower. A clearance distance **Dc** and **d** has to be taken into account.

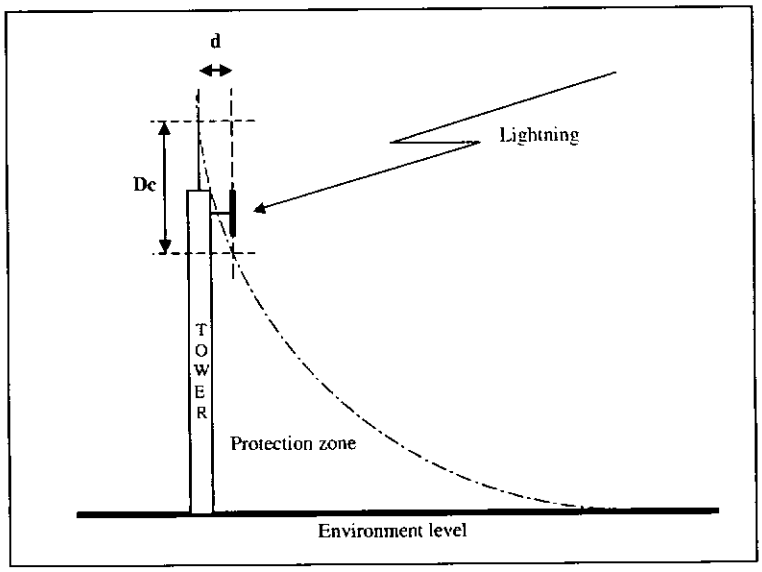

Fig 3

4.4.2.4.2 In cases as shown in the above example, additional protection should be provided by installing horizontal rods 300 mm above and below the antenna. The rods must protrude, not less than 150 mm, past the antenna.

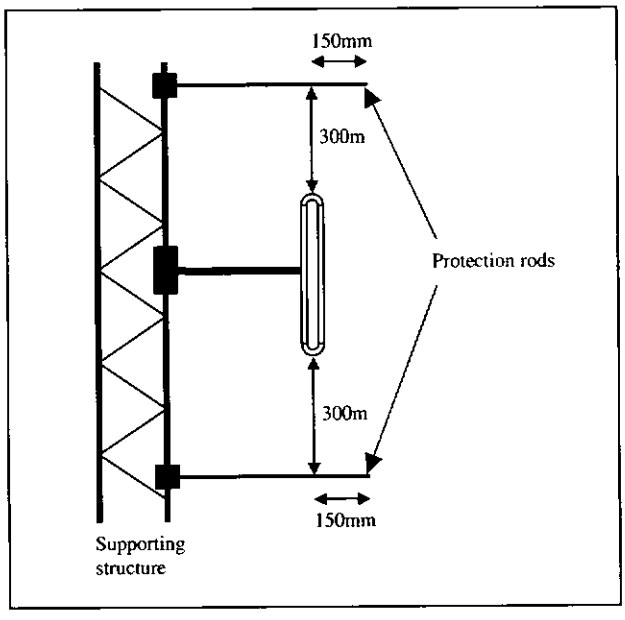

Fig 4

4.4.3 Measurement of Soil Resistivity

Soil resistivity is the electrical resistance of the soil.

The soil resistivity is the geological and physical quantity for calculation and design of earthing systems.

4.4.3.1 An important factor influencing the impedance of the grounding system is the impedance of the soil in which the ground electrodes are situated.

The value of the grounding resistance is directly proportional to the soil resistivity. Therefore, it is important that the resistivity is assessed as accurately as possible.

4.4.3.2 Dry soil has a higher resistivity than moist soil and frozen ground has a

higher resistivity than dry, warm sand.

An increase in water content in the soil causes a steep reduction in resistivity until the 20 % level is reached when the effect begins to level out.

4.4.3.3 The soil resistivity measuring procedure applied is the four electrode Wenner method.

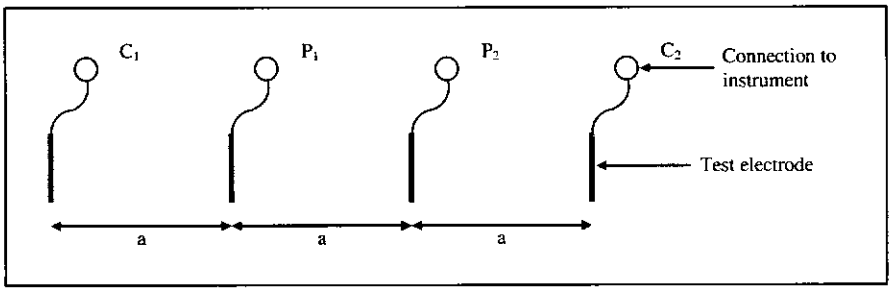

Fig 5

4.4.3.3.1 A known current from a constant current generator is passed between the outer electrodes C_1 and C_2. The potential drop is than measured between the two inner electrodes P_1 and P_2.

4.4.3.3.2 Soil resistivity = $\rho = 2\pi ar$ Ohm-meters.

where: $a > 20b$
a = distance between electrodes in m.
b = electrode depth in m.
r = resistance in Ω.

4.4.3.3.3 The four electrodes are driven into the ground, spaced at a distance of "a" metres apart.

4.4.3.3.4 The depth to which each electrode is driven should not exceed a/20 and is not normally greater than 0.3 m.

4.4.3.3.5 It is important to ensure that the test electrodes are not inserted in line with buried metal pipes or cables, as these would introduce errors.

To ensure an accurate reading, additional measurements should be made at 90° to the electrode axis (electrodes in line).

4.4.3.3.6 The Wenner method determines the soil resistivity down to a depth of approximately the distance "a" between the electrodes. By increasing "a" deeper strata could be measured and checked for homogeneity.

By changing "a" several times (between 2 m and 30 m), a profile could be measured from which a suitable ground electrode could be determined.

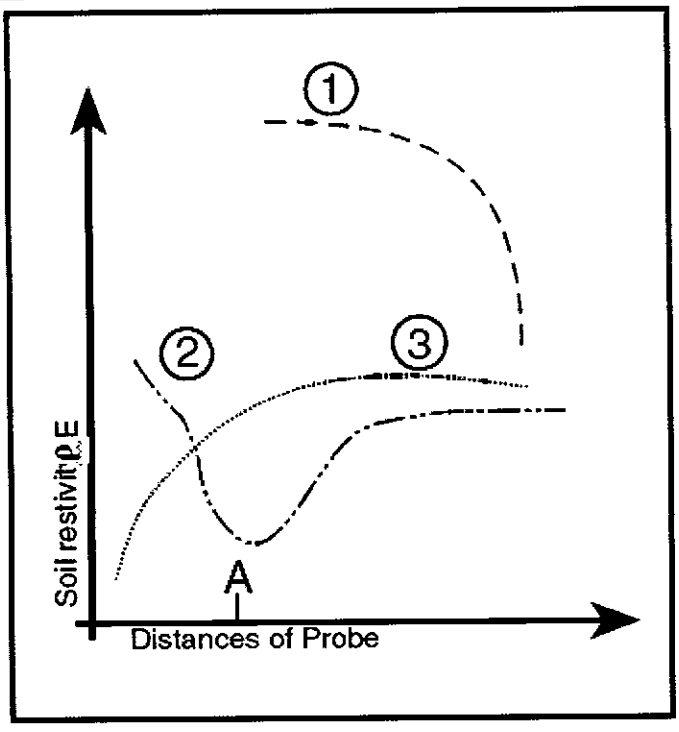

Fig 6

Curve 1 As the soil resistivity decreases with increasing depth, a deep ground electrode is advisable.

Curve 2 As the soil resistivity decreases down to point A, a ground electrode exceeding this depth would not improve the grounding resistance.

Curve 3 As the soil resistivity increases with increasing depth, a strip conductor grounding electrode is advisable.

4.4.4 Measuring the Grounding (earthing) Resistance

It is also called the dissipation resistance: the resistance between the grounding electrode and soil potential.

4.4.4.1 Three Pole measuring method

The block diagram below (fig 7) shows the basic measuring method.

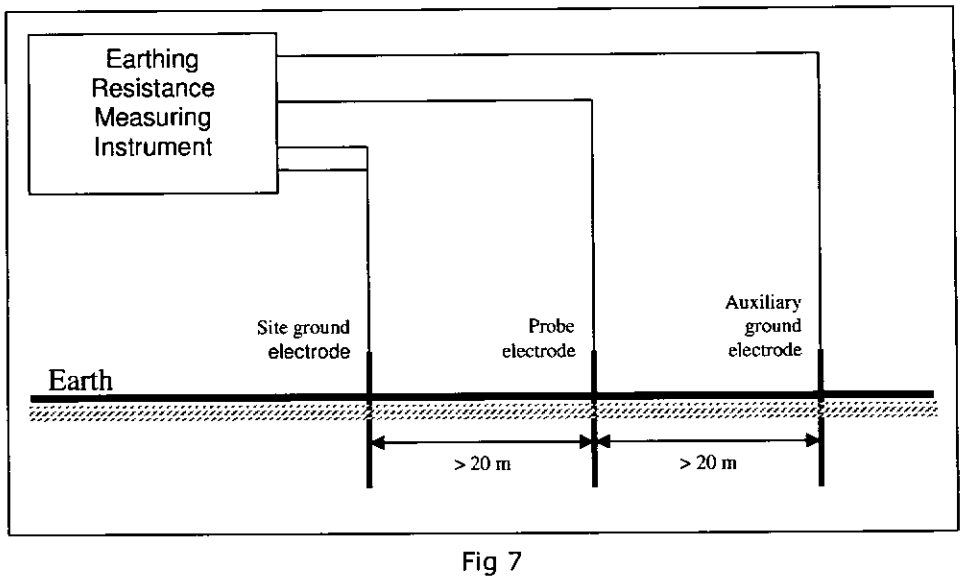

Fig 7

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4.4.4.1.1 Follow the instructions of the ground resistance measuring instrument when making the measurement.

4.4.4.1.2 Use the ground resistance measuring instrument on voltage free systems only.

4.4.4.1.3 It must be ensured that the probe electrode and the auxiliary ground electrode are set outside each other's potential gradient as well as all connected site ground electrodes. This is normally reached by allowing a distance of >20 m between the electrodes.

An accuracy test could be made by the repositioning of the auxiliary ground electrode. When the reading stay the same, the distances between the electrodes are sufficient. When the reading changes the probe and auxiliary ground electrode must be repositioned until the reading stay constant.

4.4.4.1.4 The connection wires to the electrodes should not run too close to each other.

4.4.4.1.5 Connecting wires to the electrodes that are on a spool should be unwounded completely.

4.4.4.1.6 When the instrument has the function to compensate for the resistance in the electrode connecting leads, compensate by proceeding as described in the instrument operating manual.

4.4.4.1.7 Direct the probe electrode and the auxiliary ground electrode away from interlinked grounding networks. Do not position them in parallel with the grounding networks or within the networks.

4.4.4.1.8 The spacing between the electrodes should be equal and the positions in line.

4.4.5 Site Grounding (earthing) System

4.4.5.1 Grounding connections where corrosion may be unavoidable shall be made by means of a sacrificial anode of a material compatible with the structure being grounded.

4.4.5.2 Where the grounding bar or cable is subject to chemical attack, it must be protected by none reactive past or tape.

4.4.5.3 All non-welded/bonded joints on the site grounding arrangements must be suitably protected against moisture by the use of none reactive and none setting pastes and tapes.

4.4.5.4 Down conductors, welded/bonded interconnections, grounding rings and radial bars must be of un-insulated solid copper or multi-stranded cables with a minimum cross sectional area of 60 mm^2.

4.4.5.5 Down conductors must be installed on the outside of the supporting structure (mast, tower) and coupled to it.

4.4.5.6 Down conductors must not be painted, since this will increase the impedance, causing high volt-drops along the down conductor, increasing the probability of side flashes to adjacent objects.

4.4.5.7 All bends in the lightning conductors must have a minimum radius of 200 mm, and the angle must not be less than 90°. This is to prevent flashover.

4.4.5.8 The design of the grounding system must be such that it provides an equipotential across the whole site.

4.4.5.9 The resistance to earth must be kept to a minimum and the value must be ≤10 Ω.

4.4.5.10 Where authorities and service providers (the sharing of sites) prescribe the practices, it must be followed.

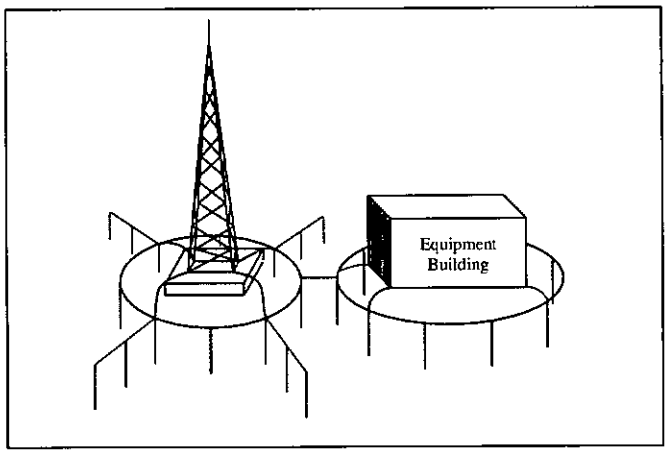


Fig 8: Typical grounding arrangement of a remote site.

4.4.5.11 The grounding ring could also follow the shape of the structure foundation.

4.4.5.12 It is conventional practice to ground each leg of a tower to provide multiple ground connections. This is to divide the lightning current flow.

4.4.5.13 Each tower leg should be directly connected to a grounding mat or ring of vertical ground electrodes around the tower, buried at approximately 500 mm to reduce the risk of step potential at ground level in the event of a strike and also to install the electrodes beneath the freezing line. Ice has a very high resistivity (10 000 to 100 000 Ω/m).

4.4.5.14 At each tower leg connecting point there should be a removable link to enable routine testing of the earth system.

4.4.5.15 The vertical grounding electrodes should be not more than 2.5 m apart and driven to a depth of at least 2 m (depending on the soil resistivity). The minimum amount of electrodes per ring is three.

4.4.5.16 All the vertical electrodes must be welded/bonded to the grounding ring.

4.4.5.17 The radial conductors of a grounding mat should be at least 20 m in length.

4.4.5.18 Where possible the grounding mat connections or spike terminations should be placed in pits to facilitate inspections and measurements.

4.4.5.19 Where towers are of the welded or bolted construction and present a continuous metal path to ground level, no separate conduction path is required for lightning (down conductor bar or cable).

4.4.5.20 Where a tower consist of sleeved sections that are not welded or bolted together, then external bridging bonds must be installed between each section to minimize the risk of side flashing due to impedance discontinuities.

4.4.5.21 The steel guy wires of masts, whether plastic coated or not, must be grounded separately.

4.4.5.22 A similar grounding system as for the mast/tower should be made for the equipment building or enclosure and each of the grounding rings must be interconnected to form an equipotential earth system.

4.4.5.23 Where reinforcing is used as part of the foundation, walls and/or roof construction it is recommended that connecting points been made available to include it as part of the overall grounding system.

4.4.5.24 Where prefabricated buildings, constructed of fibreglass or moulded plastic are used, suitable conductors should be connected between the site grounding system and any metal framework in the building.

4.4.5.25 All ancillary equipment external to buildings, such as air conditioning enclosures, must be bonded separately to the building grounding system.

4.4.5.26 Where a close metal fence is within 2.5 m of a building or tower grounding system, it must be directly bonded between a contact point and the grounding ring.

4.4.5.27 All horizontal grounding bars must be buried or concealed in concrete or suitable material for security. The removable links to enable routine testing of the earth system must be accessible.

4.4.5.28 A master ground connection must be provided where the grounding system of the site and the electrical AC mains earth are connected too. This is to ensure that there is no potential difference between the various grounding systems.

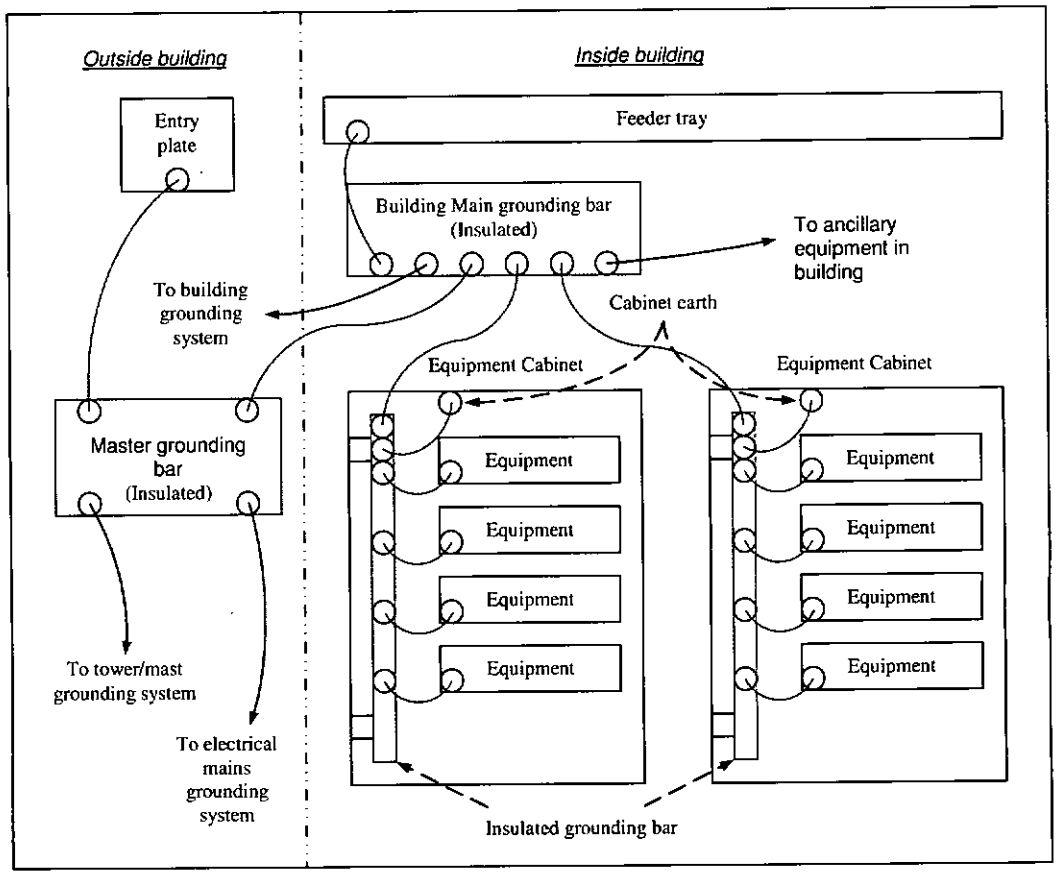


Fig 9: Typical grounding arrangement of a telecommunication site.

4.4.5.29 The above grounding system has three zones:

1. Grounding system of the mast/tower.
2. Grounding system of the building.
3. Grounding system of the equipment.

The systems are interlinked to form one equipotential system. It provides a path for the high current of the lightning to pass to earth and preventing it from entering the building. However, lightning arresters must be employed to prevent induced voltages into conductors to damage the equipment.

4.4.5.30 For an installation on top of a building, where a grounding system does not exists, it must be provided first before installation work commences.

4.4.5.31 All the brackets, bracing stays, etc. must be bonded to the building's grounding system when the installation is on top of a building.

4.4.6 Antenna systems

4.4.6.1 It is not necessary to ground the antenna support structures (brackets), as they will generally act as their own lightning conductor. However, the connections between the antenna supporting structures and the main supporting structure (tower or mast) must not be isolated.

4.4.6.2 A lightning finial (rod) should extend at least one metre above the equipment that must be protected on top of a supporting structure. The finial must be bonded to the down conductor or the tower/mast.

4.4.6.3 Where antennae protrude above the highest point of the conducting path, a lightning finial projecting above the highest antenna must be installed.

4.4.6.4 Metal cable trays must be separately connected via direct conductor at the point where the tray is fastened to the tower. The grounding conductor must follow the shortest route to the tower's grounding system.

4.4.6.5 Where possible, feeder cables must be mounted as far as possible from the tower legs and other high current paths, to minimize induction potentials. When the cables are mounted close to one of these paths, the high transient currents passing to earth during lightning strikes will induce substantial voltages in the feeder cables although these may be insulated from direct metallic contact. The safest route being directly down the centreline of the structure. In this position feeders are separated from high current paths and are also effectively within a Faraday cage at near ground potential.

4.4.6.6 For the reason mentioned in 4.4.6.5 the feeder trays should be mounted as far as possible from tower legs and other high current paths.

4.4.6.7 All antenna feeders must be earthed to the supporting structure or down conductor at the upper and lower ends (at the bends) and it must be grounded at the point of entry (entry plate) into the equipment room. Additional grounding bonds must be added when the distance between bonded points exceeds 20m. All feeders must be grounded individually. The grounding connection must be by means of an external clamp on the outer copper conductor. The grounding cable must be taken via the most direct route to earth. The grounding kits must be fitted in accordance with the manufacturer's instructions. Fitting must be carried out in dry surroundings.

4.4.6.8 Fast acting surge arrestors must be installed at the point of entry into the equipment room.

4.4.6.9 In the case of RF radiating cables or RF cables in tunnels the outer conductor must be grounded at the point of entry into the equipment rooms.

4.4.7 Equipment cabinet

4.4.7.1 All the equipment in the cabinet must be grounded to the common point grounding bar in the cabinet.

4.4.7.2 The cabinet grounding bar must be grounded to the main ground bar (common point) of the building/equipment container. This common point must be grounded directly to the site master grounding bar.

4.4.7.3 The common point grounding system is used to prevent different grounding paths (earth loops) through which high lightning discharge currents could flow (see Fig 9).

4.4.8 Electrical Supply Grounding (earthing)

4.4.8.1 The incoming electrical mains cable must incorporate an overall mains earth screen that is grounded to the supply source.

4.4.8.2 Please see clause 4.4.5.27.

4.5 Electrical Supply

Transnet Freight Rail must appoint a qualified electrical contractor.

4.5.1 Alternating Current (AC)

4.5.1.1 Sub-division of the electrical supply, to provide power separately to each user function, must be employed. This ensures that individual trips protecting sub-sections of the site installation cannot interrupt the supply of other users or systems.

4.5.1.2 Transformer isolation must be provided to isolate the mains side and the equipment side supplies.

4.5.1.3 Surge arrestors must be provided on all the mains side wiring to prevent over-voltage conditions due to lightning and switching surges.

4.5.1.4 All extended lengths of cabling connected to the mains termination equipment must be housed in conduit.

4.5.2 Direct Current (DC)

4.5.2.1 Surge arrestors must be provided on the equipment side wiring to prevent uncontrolled surges damaging the equipment.

4.5.2.2 Where DC supplies, in the form of large capacity batteries, are used to power equipment, the batteries must be charged continuously by means of "float charge" systems.

4.6 Coaxial Cable

4.6.1 The cable connector must be fitted to the upper end before the installation of the cable.

4.6.2 All the connectors including the earthing connectors exposed to the weather must be wrapped with PolyIsoButylene (PIB) self-amalgamating tape. Over-wrapping with petroleum jelly impregnated waterproof tape must be avoided since PIB is attacked and gradually dissolved by petroleum-based products. Another product that could be used to protect the connections against ingress or moisture is non-setting paste.

4.6.3 When installing, the feeder cable must be lifted and be secured in accordance with the manufacturer's recommendation.

4.6.4 The cable must form a dripping loop at the entrance to the equipment room/container.

4.7 Antenna location and the support structure.

4.7.1 Mechanical

4.7.1.1 The structural design of antennae and supports must comply with the relevant National Standards.

4.7.1.2 The electrolytic contact potentials between dissimilar metals must be less than 0.25V even for encapsulated assemblies.

4.7.1.3 It must conform to a chosen environmental test specification.

4.7.2 Location of Antennae

4.7.2.1 When determining the mounting positions for antennae each antenna must be mounted in a manner, which does not impair its performance.

4.7.2.2 The spacing between antennae must be chosen to provide sufficient isolation between them.

4.7.2.2.1 Vertical Separation

The distance between two vertical polarized antennae, positioned one below the other, must not be less than 4 wavelengths (≥ 2.64 m for 455 MHz). The wave length is that of the lowest frequency in use. The distance is based on transmitting power of 20 W ERP.

4.7.2.2.2 Horizontal Separation

The distance between two vertical polarized antennae, positioned on the horizontal plane, must not be less than 26.5 wavelengths (≥ 17.37 m for 455 MHz). The distance is based on transmitting power of 20 W ERP.

This separation is not always possible and other means could be considered to obtain isolation between the antennae.

4.7.2.3 Radiation Pattern

Antennae of moderate front to back ratio such as Yagi type antennae must be mounted with their rear element at least one wavelength from the supporting tower. When mounted too close to the supporting structure it loses forward gain as the side and rear lobes would increase.

4.7.2.4 Antenna mounting positions

4.7.2.4.1 Yagi antenna

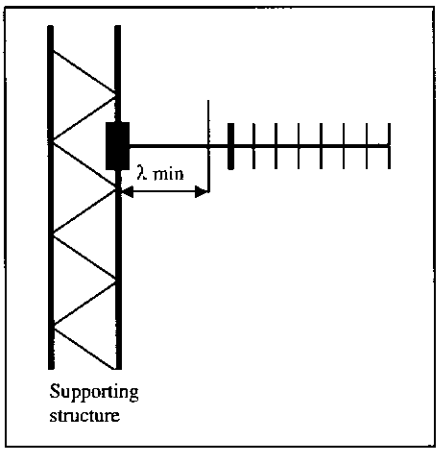


Fig 10

Acceptable mounting position.
Little gain or pattern change.
Good cross-polar performance.
Good Intermodulation performance.

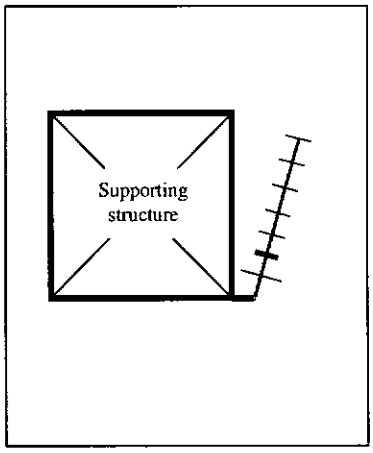


Fig 11

Unacceptable mounting position.
The antenna is too close to the supporting structure.
Loss of directivity.
Impedance and cross-polar performance is affected.

λ = Lambda = Wavelength

4.7.2.4.2 Dipole antenna

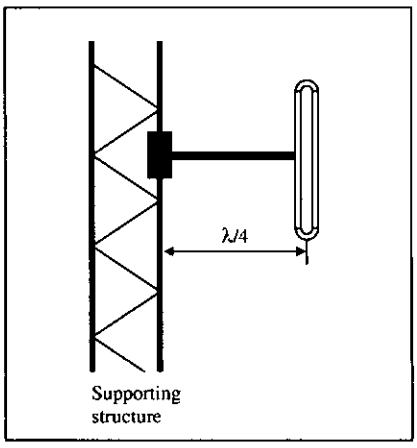


Fig 12

When omni directional antennae (dipoles, stacked dipoles and collinear arrays) have to be mounted on the side of the supporting structure the distortion of the radiating pattern must be taken into account. The probability of an intermodulation product that could be generated due to non-linear joints between structure members or mast sections must be taken into consideration.

4.7.2.5 Wind Vibration

4.7.2.5.1 All antennae, mounting steelwork, feeder and ancillary mounting structures must be securely clamped to protect feeders and other semi flexible items from damage by vibration.

4.7.2.5.2 Manufacturer's recommended feeder clamp and the spacing between them must be applied, with particular attention to exposed areas and transitions from antenna to tower, tower to gantries and gantries into buildings.

4.7.2.5.3 Feeders must not be laid loose on gantries.

4.7.3 Antenna Clamps, Brackets and Bolts

4.7.3.1 Cross Over Plate

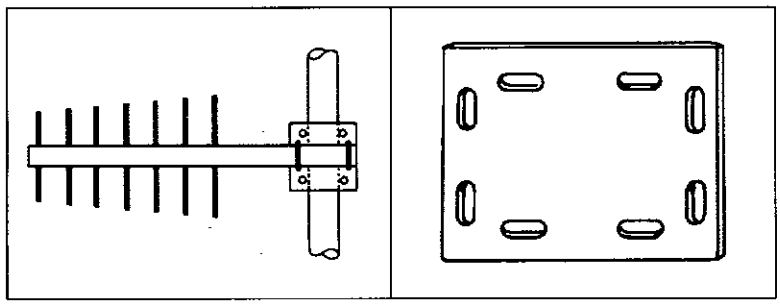


Fig 13

4.7.3.2 Cross Over Clamp

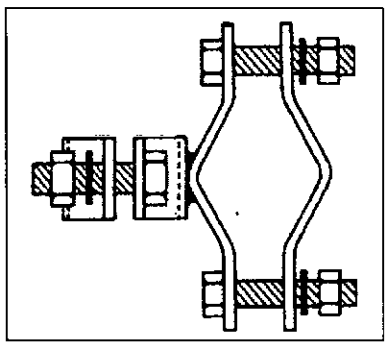


Fig 14

4.7.3.3 Parallel Clamp

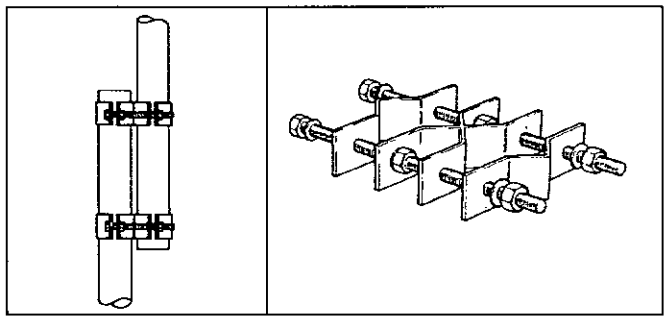


Fig 15

4.7.3.4 Universal Clamp

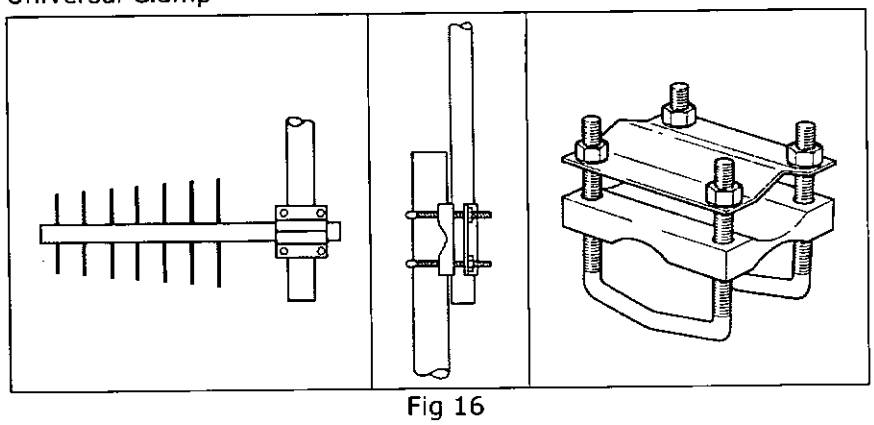


Fig 16

4.7.3.5 Offset Brackets

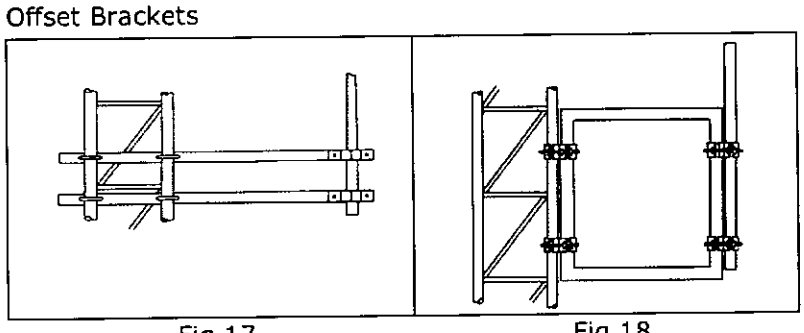


Fig 17 Fig 18

4.7.3.6 Elbow Bracket

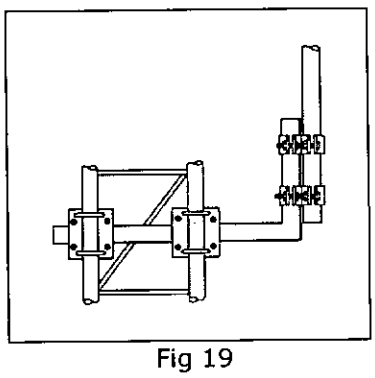


Fig 19

4.7.3.7 Bolts

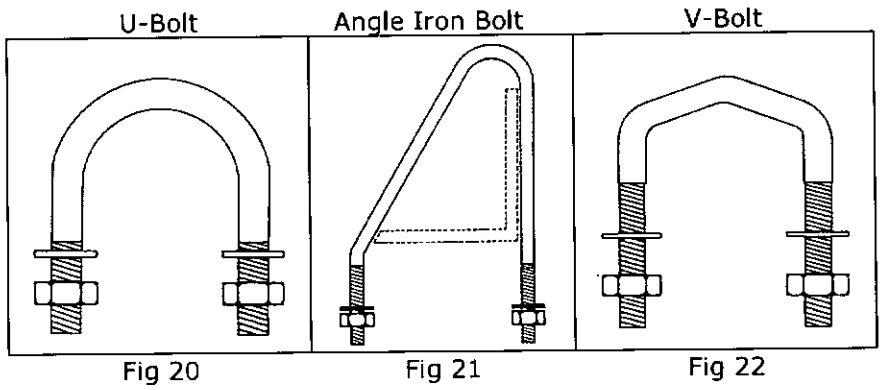


Fig 20 Fig 21 Fig 22

4.8 **Coaxial Cables, Cable Routes and Connectors**

4.8.1 Where possible, solid, semi-rigid or double-screened cables must be used for all RF connections to provide maximum screening between adjacent cables and to reduce coupling between equipment.

Cables to consider:
Similar to LMR ⅞" Low Density Foam coaxial cable between the entry plate and the antenna.
Similar to LMR 400 between the entry plate and the equipment and at the antenna if flexibility is required (fly lead).

4.8.2 The direct and shortest route must be used to minimize the radiation from feeders and the insertion loss.

4.8.3 High quality connectors with a minimum standard, referring to a silver-plated N-type connector, must be used.

4.8.4 All connectors must be fitted in compliance with the manufacturer's instructions to ensure proper sealing and electrical uniformity and should be tightened to the manufacturer's recommended torque settings.

4.8.5 Between the tower and equipment room, the cable tray must be installed with the open face down, to protect the cables against hailstones and falling ice. Alternatively, protective covers must be provided.

On top of buildings the cable trays must be installed with the open face up, and protective covers fitted.

4.8.6 Where security is a concern or it is a requirement, under ground cable ducts between the supporting structure (mast/tower) and the equipment room must be provided. Electrical cables must not run in the same duct as the coaxial cables.

4.8.7 Where radiating cables are used, they must be mounted on stand-offs, not less than $\lambda/2$ from the mounting surface. Wall stand-offs less than half a wavelength lead to an increase of the longitudinal loss; the amount depends on the frequency. The minimum distance from the mounting surface is 65 mm.

4.9 **Feeder Identification**

Feeder cables should be uniquely and permanently identified at each end and at point of exit from the equipment room/container.

4.10 **Security Fence**

The security fence must be as recommended in the Security Risk Assessment.

SECTION B

5. ANTENNA TYPES

5.1 Choice of antenna type

5.1.1 The principle which governs the choice of antennae must be that only the minimum necessary Effective Radiated Power (ERP) must be radiated in each desired azimuth direction.

5.1.2 Omni directional antennae should be used only when necessary for the service requirements.

5.1.3 The minimum antenna gain for a point-to-point radio link is 9 dBd.

5.2 **Half-wave Dipole antenna**

Antenna gain = Unity

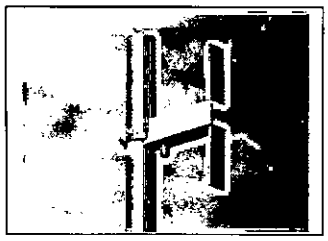


Fig 23

Half-wave Folded Dipole antenna

Antenna gain = Unity

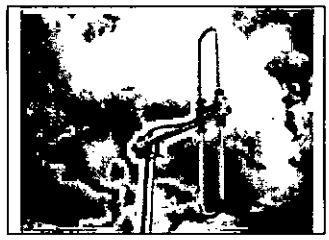


Fig 24

Typical radiation pattern of a Half-wave Dipole antenna (Fig 25 & 26)

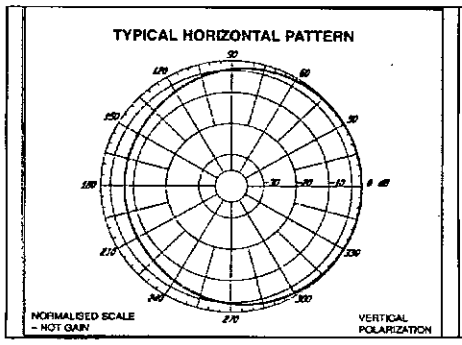


Fig 25

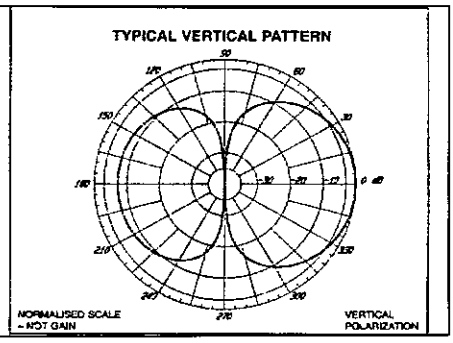


Fig 26

Typical H plane 3 dB beam width is 180° - 190°.

Typical V plane 3 dB beam width is 66° - 70°.

5.3 **Two-stack Dipole antenna**

Antenna gain = 3 dBd

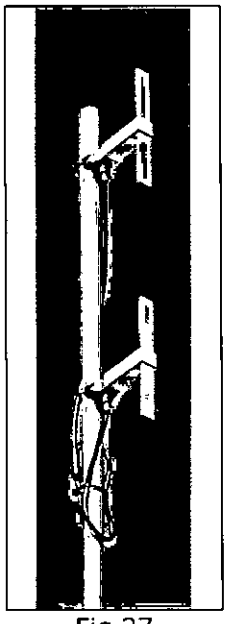


Fig 27

Two-stack Folded Dipole antenna

Antenna gain = 3 dBd

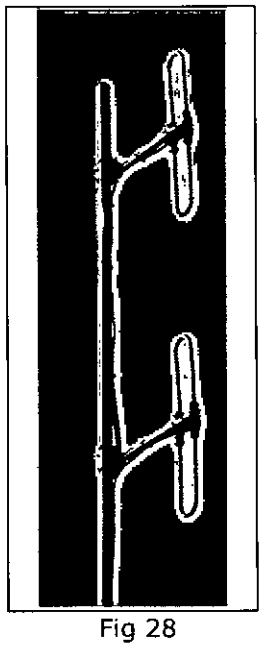


Fig 28

Typical radiation pattern of a Two-stack Dipole antenna (Fig 29 & 30)

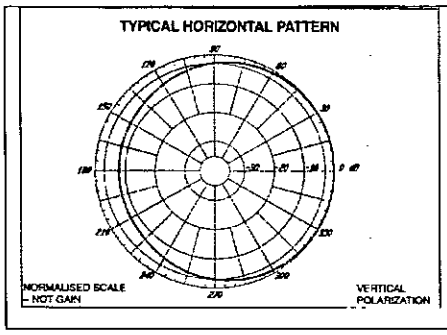


Fig 29

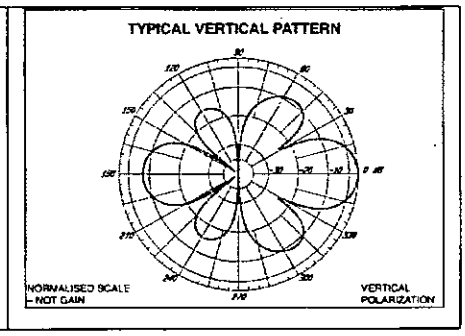


Fig 30

Typical H plane 3 dB beam width is 190° - 230°.

Typical V plane 3 dB beam width is 30° - 32°.

5.4 **Four-stack Dipole antenna**

Antenna gain = 6 dBd

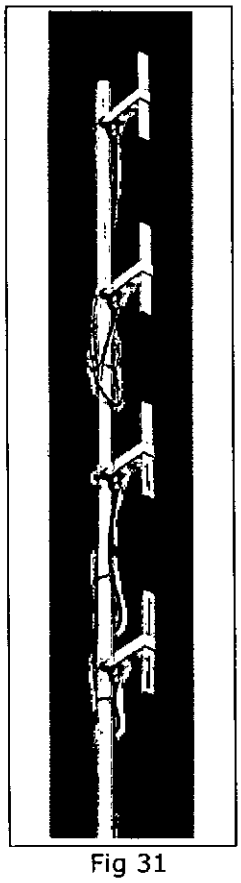


Fig 31

Four-stack Folded Dipole antenna

Antenna gain = 6 dBd

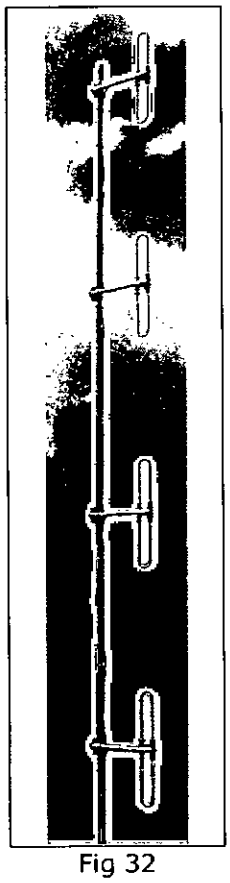


Fig 32

Typical radiation pattern of a Four-stack Dipole antenna (Fig 33 & 34)

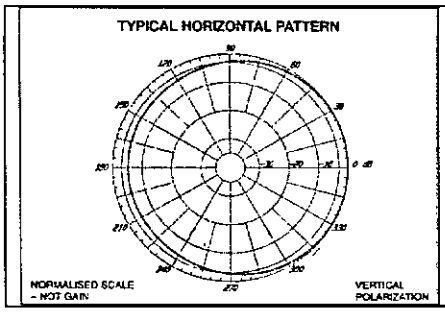


Fig 33

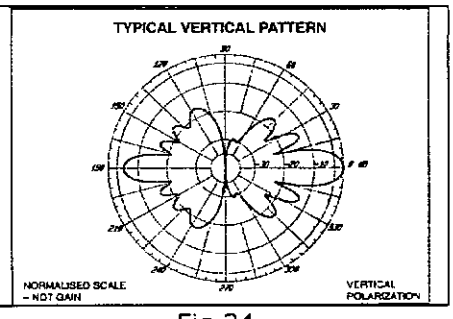


Fig 34

Typical H plane 3 dB beam width is 190° - 230°.

Typical V plane 3 dB beam width is 16°.

5.5 Collinear antenna

Antenna gain = Unity to 6 dBd

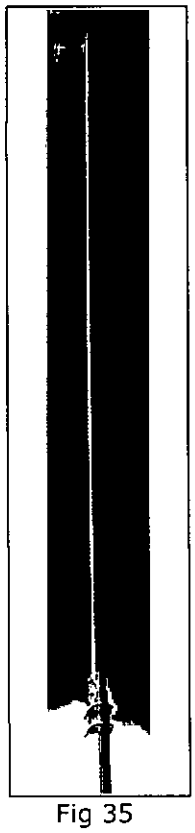
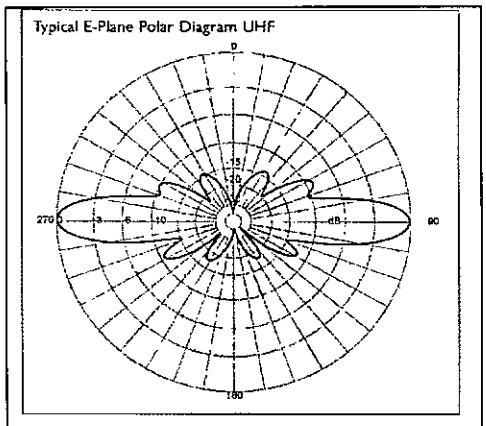


Fig 35

Typical vertical radiation pattern for 5 dBd gain



The typical H-Plane Polar Diagram is omni directional.

Fig 36

0 dBd gain Collinear antenna

Typical H plane 3 dB beam width is 360°.

Typical V plane 3 dB beam width is 78°.

3 dBd gain Collinear antenna

Typical H plane 3 dB beam width is 360°.

Typical V plane 3 dB beam width is 30° - 36°.

5 dBd gain Collinear antenna

Typical H plane 3 dB beam width is 360°.

Typical V plane 3 dB beam width is 16°.

6 dBd gain Collinear antenna

Typical H plane 3 dB beam width is 360°.

Typical V plane 3 dB beam width is 14° - 15°.

5.6 **Three Element Yagi antenna**

Antenna gain = 3 dBd to 5 dBd

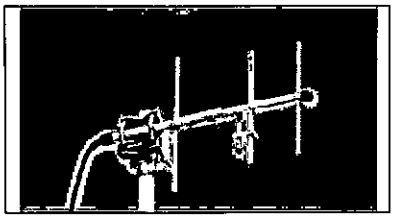


Fig 37

Twelve Element Yagi antenna

Antenna gain = 12 dBd

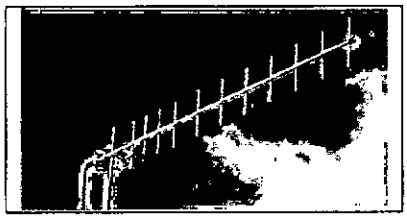


Fig 38

The typical antenna gain of a Seven Element Yagi antenna is 9 dBd.

Typical radiation pattern of a Three Element Yagi antenna (Fig 39 & 40)

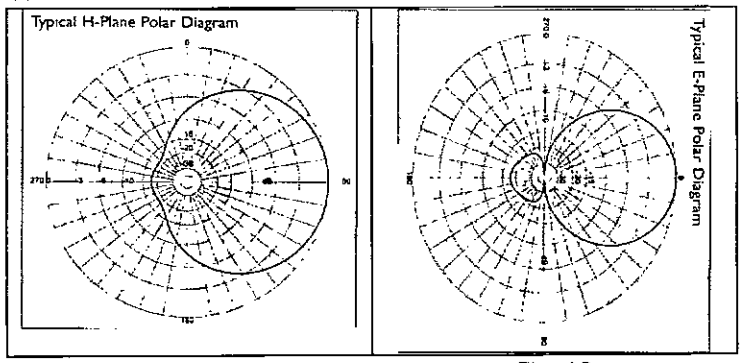


Fig 39 Fig 40

Typical radiation pattern of a Twelve Element Yagi antenna (Fig 41 & 42)

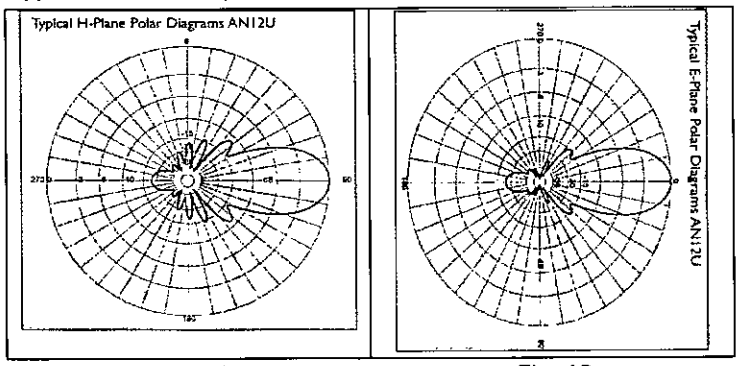


Fig 41 Fig 42

3 - 5 dBd gain Yagi antenna

Typical H plane 3 dB beam width is 120°.

Typical V plane 3 dB beam width is 70°.

9 dBd gain Yagi antenna

Typical H plane 3 dB beam width is 60°.

Typical V plane 3 dB beam width is 50°.

12 dBd gain Yagi antenna

Typical H plane 3 dB beam width is 40°.

Typical V plane 3 dB beam width is 34°.

Typical Front-to-Back ratio is 15 dB.

5.7 Corner Reflector antenna

Antenna gain = 9 dBd

Fig 43

Typical radiation pattern of a Corner Reflector antenna (Fig 44 & 45)

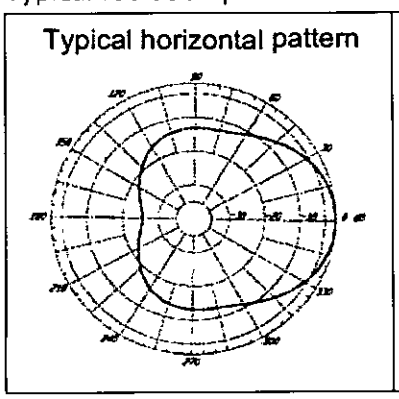


Fig 44

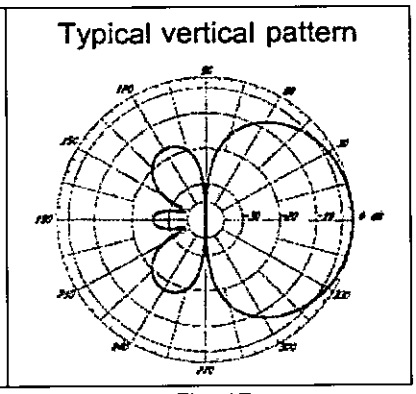


Fig 45

Typical H plane 3 dB beam width is 54°.

Typical V plane 3 dB beam width is 72°.

Typical Front-to-Back ratio is 25 dB.

5.8 Antenna Specification

The following parameters must be specified when procuring or selecting antennae:

5.8.1 Electrical

5.8.1.1 Gain – Specify in dB relative to an isotropic radiator (dBi) or a half-wave dipole (dBd).

5.8.1.2 Voltage Standing Wave Ratio (VSWR) or Return Loss – Specify the maximum value, that is 1.5:1 and –14 dB respectively.

5.8.1.3 Radiation Pattern – Specify the beam width in the azimuth and elevation planes, together with any necessary restrictions on side and/or rear lobe levels.

5.8.1.4 Input Power – Specify both the mean and peak powers.

5.8.1.5 Intermodulation Performance – The following specifications are desirable:

5.8.1.5.1 For single frequency transmit and receiving applications: –100 dBc.

5.8.1.5.2 For multiple frequency transmission: –130 dBc.

5.8.1.5.3 For multiple frequency transmission and reception on a single antenna: –43 dBc.

5.8.1.6 Bandwidth – Specify the frequency band over which the antenna is to be used and all the parameters that must be met.

5.8.1.7 Type of termination.

5.8.2 Mechanical

5.8.2.1 Maximum wind velocity in km/h.

5.8.2.2 Wind load in kg @ km/h.

5.8.2.3 Type of material.

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5.8.2.4 Mounting clamp.

SECTION C

6. AVOIDING RF PROBLEMS

6.1 Intermodulation products

At communal sites intermodulation product calculations must be made with all the frequencies used on the site, before a frequency is allocated.

6.2 Antenna distribution networks

6.2.1 In the case of a filter system, combining network or receiver distribution network, it is important that the cables are treated with care and that the distribution network should be mounted away from the transmitters and receivers whenever possible. Ideally the filters or distribution network should be mounted on the wall adjacent to the antenna incoming feeders and the transmitter section should be connected as far away from the receiver section as possible.

6.2.2 The power supply associated with setback amplifiers can operate either from mains supply or batteries. The reliability of the supply is essential for maintaining the service and it is usual to provide back-up in the event of mains failure.

6.3 Antenna positioning

6.3.1 The effect of the supporting structure on the horizontal polar diagram and the VSWR of a vertical side-mounted antenna depend upon the spacing between the structure and the antenna and on the diameter of the structure.

6.3.2 The VSWR and horizontal polar plots for a number of antenna-to-structure spacing are shown in Fig 46 to 50. The acceptable VSWR is ≤1.5:1. The diagrams illustrate the effect that a supporting structure, having a 51mm outside diameter, has on a Dipole antenna.

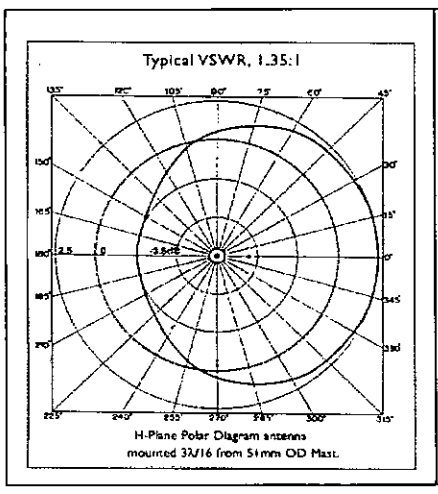


Fig 46

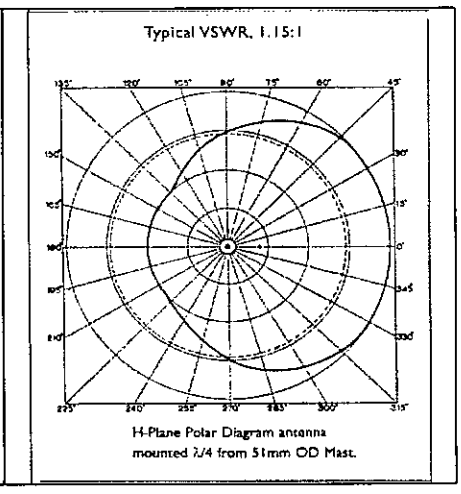


Fig 47

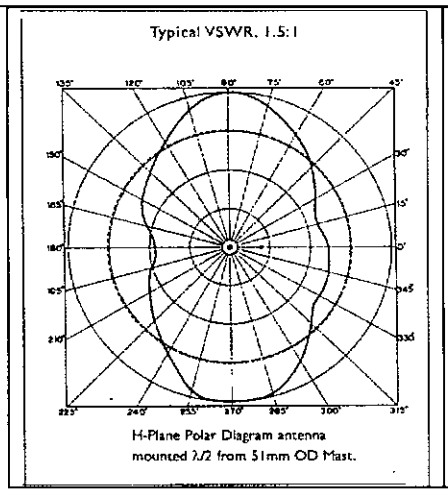


Fig 48

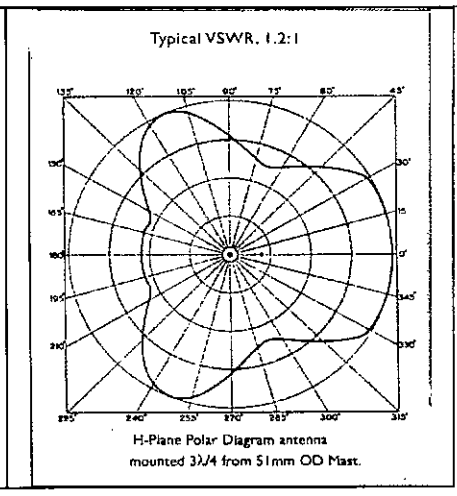


Fig 49

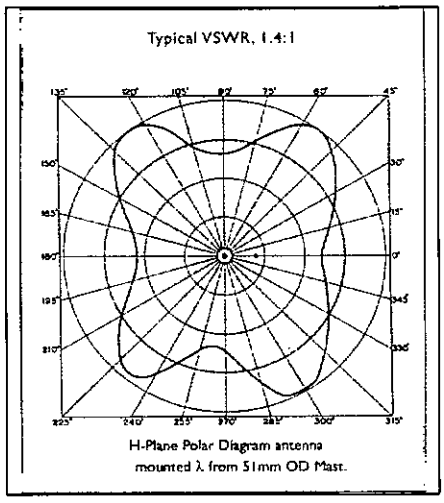


Fig 50

6.4 Receiver distribution network

This is applicable where many receiver systems operating in the same frequency band are required to be installed at the same radio site.

6.4.1 It would be appropriated to fit a receiver distribution network comprising one antenna input, feeding a suitable band-pass filter, followed by a low noise set-back amplifier which then distributes its output, usually by a passive network, to the receivers.

6.4.2 The low noise setback amplifier must be carefully chosen to have a very good signal to noise performance to minimize degradation of the overall system signal-to-noise performance.

6.4.3 The setback amplifier needs also to be chosen for large signal handling together with an inherent protection against damage by transient impulse voltages.

6.5 Transmitter-Receiver isolation

6.5.1 To obtain a ≤ 1 dB degradation in receiver sensitivity, the Tx-Rx isolation should be ≥ 55 dB. This is applicable for a duplex frequency spacing of >2 %.

6.5.2 If more than one station is installed on a site the isolation between each station have to be increased by 10Log(n) where n = number of stations. This assumes that all the stations have similar characteristics and are within the same frequency band.

6.5.3 If the duplex Tx-Rx frequency spacing is ≤2 % of the operating frequency and a degradation of ≤1 dB is permitted, then the required isolation will be at least 15 dB more than the value quoted in 6.5.1.

6.5.4 The signal level limit for receiver blocking/desensing specified by ETSI is −23 dBm. Therefore, for a single system the Tx-Rx isolation must be ≥ 66 dB when a 20 W (+43 dBm) transmitter is used.

6.5.5 If intermodulation at the receiver input between a local Tx signal and a strong external signal with a frequency which gives a third order product at the exact Rx frequency, an additional 14 dB (referring to the value quoted in 6.5.4) of filtering would be required at the Rx input.

6.6 Filters and couplers

6.6.1 Ferrite isolator

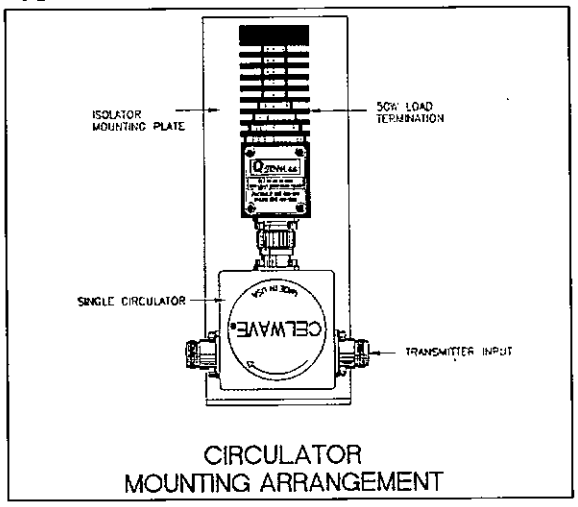
The ferrite isolator is a practical component, which can be utilized to provide directional isolation at the output stage of the transmitter.

6.6.1.1 A ferrite isolator has directional properties that typically result in additional isolation of between 20 dB and 40 dB. The isolation parameter has to be considered in conjunction with the insertion loss and bandwidth.

6.6.1.2 For isolation in excess of 40 dB, a dual circulator version may be fitted.

6.6.1.3 The third port of the ferrite isolator is terminated in a matched load; the power rating that must withstand the maximum return power that is envisaged in the worst fault condition that can arise on the antenna system.

6.6.1.4 Typical isolator



CIRCULATOR
MOUNTING ARRANGEMENT

Fig 51

6.6.2 Cavity resonator

The cavity resonator is a band-pass circuit.

6.6.2.1 A system using a cavity resonator gives protection to co-sited receivers by reducing the radiation of wide-band noise.

6.6.2.2 Cavity resonators may be connected together to provide additional isolation when used to combine several transmitters to a single antenna.

6.6.2.3 When used in conjunction with ferrite isolators, cavity resonators provide the necessary isolation to combine several transmitters into a single antenna configuration. Typical isolation is up to 60 dB between adjacent transmitters.

6.6.2.4 With high performance cavities the separation can be reduced to 0.25 % and still give isolations greater than 20 dB.

6.6.3 Spectrum dividing filter

6.6.3.1 When the outputs of several transmitters are to be considered as a combined signal, it is convenient that each antenna should have the frequency spectrum coupled to it, defined by a filter having a comparatively broad, flat-topped response. This enables any transmitter to be operated within the specified band without excessive filter insertion loss and ensures the attenuation of signals outside the defined frequency band. This system defines the band edges and controls spurious emissions.

6.6.3.2 Spectrum dividing filters can be coupled together by means of a precisely dimensioned cable harness to other similar filters, to provide duplex and combiner facilities for multiple bands to a single antenna system.

6.6.4 Control of interfering signals by filter protection

A common source of receiver problems is that incoming signals outside the band of interest arrive at the receiver front end at an amplitude, which could cause blocking, intermodulation and distortion of the wanted signals. This situation is most likely to occur when the receiver is connected to an antenna, which may be in close proximity to other antennae.

6.6.4.1 An improvement in this situation could be obtained by positioning the receiver antenna well away from any other installation and in particular from other transmitting antennae.

6.6.4.2 An alternative procedure is to connect band-pass filters between the antenna and the receiver input. These filters need to have the necessary shape factor to limit the bandwidth to that which is required for the receiver system.

A single small cavity resonator providing about 20 dB isolation at the offending frequency, would often resolve the problem. However, when the interfering signal is closer than ±1 % of the centre frequency of resonance, to the wanted signal, then multiple section filters or large cavity resonators may be required.

6.6.5 Filter Requirements

6.6.5.1 The resonator must be robust, simple to tune, highly efficient in terms of transmission loss, and provide a high degree of isolation at the required frequencies.

6.6.5.2 Resonators for use with transmitters should have a low temperature coefficient and good thermal conductivity, so that their performance is not affected by changes in ambient temperature or through being heated by transmission losses.

6.6.5.3 Physical robustness is necessary to avoid changes in technical parameters from being caused by mechanical shock or deformation.

6.6.5.4 The physical and mechanical design should also prevent the formation of electrical discharges or corona.

6.6.6 Typical filters

6.6.6.1 Duplexer

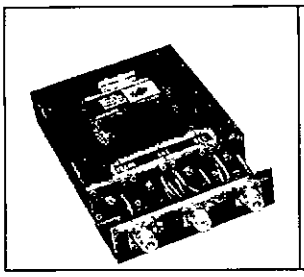


Fig 52

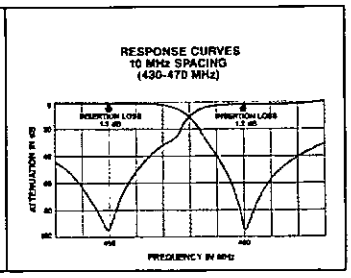


Fig 53

6.6.6.2 Band Pass Filter

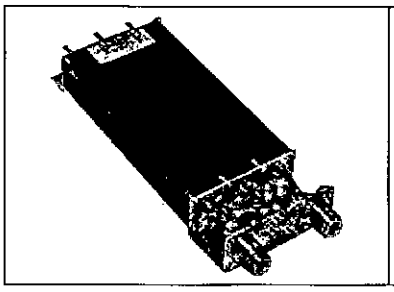


Fig 54

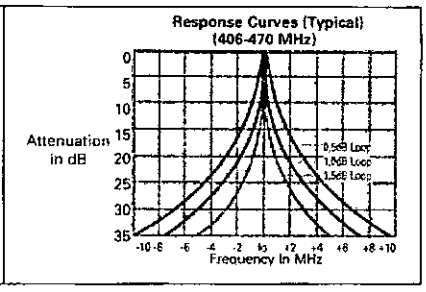


Fig 55

6.7 Co-Channel interference

Using continuous tone signalling (CTCSS), the receiver will operate only in the presence of this signalling tone. It is then only necessary to ensure that the level of the wanted signal is 15 dB greater than the interfering signal for speech and 20 dB for data.

6.8 Radiating cables

Where radiating cables are used in tunnels, it must be inspected annually and cleaned with water or steam.

7. PROBLEMS IDENTIFIED ON SITE

7.1 Noise considerations

7.1.1 The noise floor of present generation transmitters may be expected to be approximately –140 dBc/Hz within 1 % of f_c and –150 dBc/Hz elsewhere.

7.1.2 To safeguard a receiver from a single transmitter (transmitting power +43 dBm) by ensuring that the sensitivity degradation during transmission is less than 1 dB, where the frequency separation is within 1 % of f_c, requires a minimum isolation of 68 dB.

7.1.3 For multiple transmitters the noise power is additive, i.e. the noise power of N identical transmitters at the same frequency spacing from the carrier is greater by a factor of 10.log(N) dB. e.g. the noise power from four 20 W (+43 dBm) transmitters within 1 % of f_c is –52 dBm and the minimum isolation required would be 74 dB.

7.2 Ambient EM noise levels

7.2.1 Ambient EM noise includes atmospheric (static), sky noise and man-made electrical noise.

7.2.2 Any ambient EM noise measurement is only an approximate indication, since it is strictly applicable to the antenna employed and the noise conditions at the time.

7.3 Intermodulation products between several source frequencies

7.3.1 These products are caused by the mixing of two or more source frequencies, which produce well-defined signals, which may be of a high level. They are usually the result of inadequate isolation between transmitter output stages (transmitter coupling), which allows coupling of RF energy between them and the generation of products by a mixing process.

7.3.2 The intermodulation factor facilitates a calculation method to determine the level of third order Intermodulation products:

(Z – XT) – Y = 3rd order intermodulation product power level = P

P – XR = disturbing signal level at the Rx = D

W – D = protection ratio in dB.

Where: Z = Tx power in dBm
XT = Isolation, Tx-to-Tx
Y = Equipment intermodulation factor
XR = Isolation, Tx-to-Rx
W = Wanted Rx signal

7.3.3 The design target for Private Mobile Radio (PMR) systems is a protection ratio of 10 dB.

7.3.4 The protection ratio can be improved by increasing the Tx-to-Tx isolation, the Tx-to-Rx isolation and/or the equipment intermodulation factor. The Intermodulation factor (intermodulation attenuation) must be ≥ 40 dB.

Example:
Two transmitters each having a power output of +43 dBm are operated on neighbouring sites with a total port-to-port isolation of 70 dB. The output stage of each therefore receives an unwanted signal level of +43 – 70 = –27 dBm. The level of the resulting third order intermodulation product is –27 – 40 = –67 dBm.

Assuming that a receiver exists in the vicinity, tuned to the frequency of the Intermodulation product, and the Tx-to-Rx isolation is also 70dB:

The transmitters give a disturbing product of –67 – 70 = –137 dBm.

7.3.5 It is vital to conduct intermodulation calculations when determining frequency planning.

7.4 Intermodulation products caused by external effects

The metallic contacts of dissimilar metals in masts and antenna hardware can be a source of problems when high signal levels occur on the site and cause them to radiate intermodulation products which disturb equipment at the same site, or at a neighbouring site.

7.5 Spurious emissions from transmitters

7.5.1 It is the emission from the radio transmitter on a frequency or frequencies that are outside the channel on which the transmitter is operating.

7.5.2 Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products. The conducted spurious emissions must not exceed –36 dBm up to 1GHz and –30 dBm above.

7.5.3 For a receiver operating at a frequency below 1GHz, the minimum isolation required from a transmitter having an on channel spurious emission at the maximum allowable level (–36 dBm) is 88 dB.

7.5.4 For multiple fixed stations it is necessary to check the isolation from both co-sited transmitters and from those of neighbouring sites. In this case the use of combining systems to communal antennae, offering 10 dB to 15 dB minimum isolation improvement by filtering, would increase the total isolations sufficiently.

7.5.5 If the product is $2f_1 - f_2$, the mixing is occurring within or close to the transmitter operating on f_1. Conversely, if the product is $2f_2 - f_1$, the mixing is occurring within or close to the transmitter operating on f_2.

7.5.6 In the case of FM or PM emissions, the deviation caused by modulation is doubled when a second harmonic is generated. If the modulation on one of the intermodulation products appears to be excessive, this modulation is probably transferred from the f_1 signal in the case of $2f_1 - f_2$ mixing.

7.5.7 The standard ITU-R Recommendation SM.329-10 [16] gives full detail of methods of measurements of spurious and out-of-band emissions and the different categories of permitted levels for several different classes of radio communications equipment.

7.6 Intermodulation between received signals

7.6.1 It is the ability of a radio receiver to receive a modulated standard input signal, in the presence of two interfering signals of which the carrier frequencies are so separated from the standard input signal frequency and from each other that n'th order mixing of the two undesirable signals can occur in the non-linear elements of the receiver, producing a third signal whose frequency is equal to that of the standard input signal frequency, the intermediate frequency (IF) or submultiples of the IF frequency.

7.6.2 The reception of high-level signals, within the bandwidth of the first RF filter, is the worst case of intermodulation in a receiver system. The bandwidth and out of band attenuation of this filter is therefore very important.

7.6.3 On a communal site, a high performance pre-selector filter is generally placed at the antenna input to define the operational frequency band.

7.6.4 The ratio between an on-frequency wanted signal and two off-frequency unwanted signals must be ≥70 dB. The two unwanted signals must be displaced such to cause a third order intermodulation product on the wanted channel.

7.6.5 Due to the presence of these off-frequency signals, the receiver sensitivity may be degraded by 3 dB.

7.6.6 The minimum isolation from the other transmitters, transmitting powers at +43 dBm (20 W), is 80 dB and for transmitters transmitting +30 dBm (1W) is 67 dB.

7.6.7 When considering transmitters on the same site, appropriate frequency planning in conjunction with filtering can achieve the isolation figures required by the design aim. When the site is situated close to the road/railway line the mobile radios must also being considered.

7.6.8 When the required isolation cannot be achieved critical attention to the bandwidth of the receiver systems must be given.

7.6.9 Attenuation at the input of the receiver could be used to reduce the level of an intermodulation product. The levels of these products are related to the levels of the signals that produce them, in such a way that the attenuation (in dB) of each "n^{th}" order product will, in most cases, be n times the attenuation (in dB) of the wanted signal e.g. a 3 dB attenuator will reduce a 3^{rd} order product by 9 dB, while reducing the wanted signal by 3 dB.

7.7 Saturation of receiver front end

7.7.1 The consequence of very high-level received signals will be that the front end active devices of the receiver will have a gain reduction resulting in a degradation of sensitivity.

7.7.2 The minimum isolation between the source and receiver must be at least 66 dB.

7.7.3 Although this problem is basically independent of frequency, great care should be taken to identify all critical signals within the response of the front end filtering of the equipment.

7.7.4 The maximum receiver desensitisation is 1 dB.

7.8 Selectivity of the receiver

7.8.1 It is the ability of a radio receiver to receive the modulated standard input signal in the presence of modulated signals that differ in frequency from the standard input signal frequency by the spacing of one channel.

7.8.2 The selectivity figure not only depends on the characteristic of the intermediate frequency (IF) filter but also on the spectral performance of the local oscillator.

7.8.3 Great care should be taken with the frequency planning.

7.8.4 The signal levels measured at the receiver should not be higher than −47 dBm on adjacent channels and −37 dBm in close frequency proximity (up to 5 x channel spacing).

7.9 **Spurious response of the receiver**

7.9.1 It is the ability of a radio receiver to discriminate between the standard input signal frequency and an undesired signal at any other frequency to which it is also responsive, excluding the two adjacent channels.

7.9.2 The possible spurious signals of the local oscillators from other radio systems may be the source of the interfering signal.

7.9.3 The ElectroMagnetic Compatibility (EMC) standards for non-radio equipment used on radio sites do not guarantee sufficient protection to radio receivers.

7.9.4 The same comments as for Intermodulation apply.

7.10 **Radiating cables**

Where radiating cables are used in tunnels, the coupling loss could increase due to water ingress (salts & chemicals) and/or metal dust deposits from rail vehicles.

8. TROUBLESHOOTING INTERFERENCE ON RADIO SITES

A logical sequence of steps should be followed:

8.1 Check that the receiver front end is not being overloaded. A notch filter installed at the antenna input to the receiver, and tuned to the interfering signal, will normally solve an overload problem.

Increasing the antenna isolation between antennae could also be considered.

8.2 Check that mixing is not taking place in the front end of the receiver. If the unwanted received signals are within ±1 % of the wanted frequency, a notch filter tuned to the interfering frequency installed at the antenna input to the receiver will normally solve the problem.

Increasing the antenna isolation between antennae could also be considered.

8.3 If the interference is not generated in the receiver then the direction of the interference may be traced by using a directional antenna connected to a receiver with signal level indication.

8.4 If the interference is caused by a co-channel, different antenna types or a frequency change should be considered.

8.5 Where the transmission of spurious signals from a transmitter is suspected, the signal spectrum could be monitored with a spectrum analyzer.

Do not tamper with any equipment. First obtain permission from the owner of the equipment.

8.6 When interference has been traced back to a site and the signals causing the interference have been identified, it will be necessary to determine where the mixing occurs.

Mixing can occur in a transmitter output stage, due to the carrier frequency mixing with another signal being fed back via the antenna and feeder. Fitting an isolator or band pass filter in the antenna feeder close to the transmitter output can normally solve this problem.

When making measurements with sensitive measuring instruments, particularly when tracing intermodulation products in the transmitter output, appropriate precautions must be taken, such as inserting a notch filter, attenuator or directional coupler at the instrument input.

8.7 In extreme cases it may be necessary for one of the users to change sites or frequency, to overcome the interference problems.

SECTION D: SHERQ

9. ENVIRONMENTAL EFFECTS

9.1 **Corrosion and climatic effects**

Deterioration could take the following forms:

9.1.1 Corrosion of metallic components will cause structural weakening.

9.1.2 Corrosion will be accelerated at bi-metallic contacts and will give rise to non-linear conduction with consequent generation of intermodulation products.

9.1.3 A rise in contact resistance at connections will increase ohmic losses.

9.1.4 Water ingress into insulating materials will cause changes in permittivity and will increase dielectric losses, especially if the water is polluted or has run off metallic components.

9.1.5 Water ingress into feeders and connectors produces mismatch and increases loss.

9.1.6 Wind-induced vibration causes antenna elements to break by fatigue failure and accelerates corrosion at element clamps.

9.1.7 Snow and ice cause temporary increase in VSWR and losses of antenna gain and polarization.

9.1.8 Freezing splits components into which water would penetrate.

9.1.9 Falling ice could cause damage to antennae, feeders and buildings.

9.2 **Ultraviolet degradation**

9.2.1 Products liable to degradation by ultraviolet rays should not be used in external situations where there is an acceptable alternative.

9.2.2 Where the life of an item is known to be limited, its periodic replacement should be included in the site maintenance programme. Replacement only on failure is not acceptable.

10. HEALTH AND SAFETY

10.1 The safety of the working environment on and in the vicinity of radio sites must always be a priority.

10.2 It is essential that in the construction and operation of radio sites, professional advice be obtained on the legislative requirements.

10.3 **Physical safety**

10.3.1 A working policy should be in force for all staff, especially those engaged on work external to the equipment room.

10.3.2 Only qualified personnel should be allowed to climb the antenna support structures. They should have had training on all aspects of climbing procedures, particularly the emergency procedures pertaining to these activities.

10.3.3 The site layout should take into account the icing on the supporting structures, which could fall and damage ground structures and injured personnel.

10.3.4 Inside the equipment room care should be taken to ensure that sharp projections are avoided and that the common walkways remain clear and unhindered. This is particularly important when additional services are added and equipment rooms become crowded.

10.3.5 Where un-sealed lead acid battery power supplies are installed the first aid aspect of acid splashes must be considered and in particular the requirement for eye wash solution in first aid kids.

10.4 **Electrical safety**

10.4.1 Emphasis should be placed on the importance of electrical safety and correct earthing procedures on radio sites.

10.4.2 Anyone who regularly works in a radio site environment must be aware of the procedures for the first aid treatment of personnel suffering electrical shock.

10.4.3 The electrical design requirements must adhere to the national electrical standard.

10.5 **Fire hazards**

10.5.1 The storage of paper, cardboard boxes, paint and other inflammable goods on sites is not desirable.

10.5.2 The number and type of extinguishers that are required at a site should be decided in consultation with the appropriate fire authority.

10.6 **Radio frequency hazards**

10.6.1 Radio sites need to be designed and operated to limit the exposure of both the general public and workers to RF emission.

10.6.2 The national standard that prescribes the maximum allowable RF exposure must be adhered too.

SECTION E

11. SITE ADMINISTRATION

11.1 Efficient administration of radio sites relies on precise details of physical facilities, the site users and emissions.

11.2 The information should be kept centrally, as well as being displayed in a useful form on the site.

11.3 Where the site security considerations does not allow detailed information a master outline of each structure, referring to detailed drawings and relevant information that are locked up in a cabinet, must be made available.

11.4 The site file must contain the following information:

11.4.1 On multiple user sites, records must be kept of each user with contact details for both the owner and maintenance contractor for the equipment.

11.4.2 Physical information

11.4.2.1 Antenna types

11.4.2.2 Feeder lengths

11.4.2.3 Connector types and sex

11.4.2.4 Distribution harness details

11.4.2.5 Details of mounting hardware

11.5 Electrical information established at system commissioning and acceptance

11.5.1 VSWR measurements on the complete antenna systems for the appropriate frequency band.

11.5.2 The attenuation of feeder cables and filters for the appropriate frequency band.

11.5.3 The power output of each transmitter measured at the transmitter output port and at points along the antenna system.

11.5.4 The calculated ERP of each system.

11.5.5 RF signal level measurements in the far field to record the performance of all the systems. The exact position/s where the measurement was made and the measuring method must be recorded.

11.5.6 All Tx, Rx and peripheral alignment levels and measurement.

11.6 Orientation of support structure and antennae

The orientation should be based on an agreed reference e.g. true North.

SECTION F

12. MAINTENANCE ON SITE

A maintenance inspection must be undertaken at least once annually.

12.1 **Support structure**

12.1.1 The structural installation of the mast/tower as well as the earthing system and lightning protection must be inspected.

12.1.2 The inspection must include the general deterioration of the surface, protection against corrosion, the tension in guy assemblies and mechanical parts for corrosion beneath the external surface. Particular note should be taken of earth bondings, lugs, straps or connections, that these are free from corrosion.

12.1.3 When any defects are found, they must be recorded and reported immediately so that corrective action could be taken.

12.1.4 Any corrosion should be removed and the material then prepared for protective coating. An undercoat and a topcoat of suitable protective material must then be applied. Micaceous oxide is regarded as a suitable ingredient.

12.1.5 Any surfaces that are normally lubricated must not be painted.

12.1.6 On completion of the work a full inspection should be undertaken to ensure that the standard of material and work is such that a further year of protection is guaranteed.

12.2 **Equipment room**

12.2.1 Cleaning

12.2.1.1 The site should be regularly cleaned of all fragments of cable, braid, cable ties and other rubbish, which are removed from the site.

12.2.1.2 The interior must be vacuum cleaned and not brushed. No dust should be raised that could pollute the equipment.

12.2.1.3 Equipment must be vacuum cleaned or lightly wiped with a moist cloth.

12.2.1.4 The generation of static charges must be avoided and therefore the manufacturer's recommendation should be applied to all cleaning processes.

12.2.2 Tidiness

12.2.2.1 It should not be allowed that superfluous material, cables, wire connections, etc. clutter the radio equipment rooms. A particular danger exists when faulty or unreliable assemblies for cables and wiring are lift on site as it could cause further problems in due course. All doubtful components should be removed from the radio sites.

12.2.2.2 A minimum of spares should be held on a radio site and these should be locked away in a cupboard that is clearly identifiable.

12.2.2.3 All equipment on the site that does not relate specifically to the equipment in use should be removed from the site.

12.2.3 Feeders, connections and terminations within the equipment room.

12.2.3.1 All feeders, connections and terminations should be examined for cleanliness, tidiness and corrosion and appropriate action should be taken if problems are encountered.

12.2.3.2 Connectors should not be opened or removed unless a specific fault is found.

12.2.3.3 Measurements should be taken of the feeder and antenna parameters on an annual basis. The results of any measurements taken must be recorded.

12.2.3.4 Any filters or multi-couplers on the site must be examined for condition and if necessary test measurements taken to ensure that the parameters

are as defined. No adjustments must be made without the appropriated test equipment.

12.2.3.5 When there is obvious damage to any part of the antenna system e.g. resulting from a lightning strike, that part or unit must be replaced.

12.2.3.6 Check that all feeders are labelled.

12.2.3.7 During routine maintenance it may be appropriate to make checks on the overall performance of the radio site.

12.2.4 Filters and couplers within the equipment room.

12.2.4.1 The impedance matching and insertion loss must be measured.

12.2.4.2 In the event of discrepancies being found in the measured figures, a careful analysis and interpretation of the results should be carried out before any adjustments of the filter system is undertaken. It must be remembered that a passive band pass filter system has a transparency to VSWR or Return Loss and that a problem at the antenna can be sent back through the system and cause very confusing results.

12.2.4.3 Passive filter coupling systems should be left alone unless there is evidence of severe deterioration or a technical problem.

12.2.4.4 In very severe environments, e.g. corrosive atmosphere, the visual inspection can be a guide to the internal condition of the components.

12.2.5 Electrical supply and lightning protection

12.2.5.1 A physical examination of the installation should be made annually.

12.2.5.2 When additional equipment is installed it must be ensured that the rating of the cables, fuses, trips and ancillaries are all within the loading placed upon them. This could be detected with a temperature probe and any part of the installation running at 10 °C above ambient could become dangerous in causing a fire.

12.2.5.3 The voltage should be measured at various points within the system and should be within 5 % of the normal figure when under load.

12.2.5.4 The electrical earth system must be annually measured to ensure that the earth impedance (resistance) has not risen above 10 Ω.

12.2.5.5 The capacity of the standby batteries must be checked.

12.2.5.6 The standby power plant must be checked for good order and operation.

12.2.5.7 An electrician should check each trip switch by passing the normal current from live to the earth connection, at which current the trip should come out. This test must only be conducted in the presence of radio engineers who will ensure that no adverse effect on any of the equipment on site will be produced.

13. RELEVANT DOCUMENTATION

APPLICABLE

DOCUMENT NO.	DESCRIPTION	LOCATION
BBD8635	TECHNICAL SPECIFICATION AND METHODS OF MEASUREMENT FOR ANGLE MODULATED RADIO EQUIPMENT.	Quality Assurance, National Test Centre

RELEVANT

DOCUMENT NO.	DESCRIPTION	LOCATION
ETSI EG 200 053 v1.5.1 (2004-06)	Radio Site Engineering for Radio Equipment and Systems (ERM).	Quality Assurance, National Test Centre
Specification No. RI/01/1001	MTN BTS Site Infrastructure Specification Nov. 2003.	Quality Assurance, National Test Centre

END OF DOCUMENT

E7/1 (July 1998)

SPECIFICATION FOR WORKS ON, OVER, UNDER OR ADJACENT TO RAILWAY LINES AND NEAR HIGH VOLTAGE EQUIPMENT

(This Specification shall be used in Transnet Contracts)

CONTENTS

ANNEXES

1 DEFINITIONS

The following definitions shall apply:

Authorised Person. A person whether an employee of Transnet or not, who has been specially authorised to undertake specific duties in terms of Transnet's publication SAFETY INSTRUCTIONS: HIGH-VOLTAGE ELECTRICAL EQUIPMENT, and who holds a certificate or letter of authority to that effect.

Barrier. Any device designed to restrict access to "live" high-voltage electrical equipment.

Bond. A short conductor installed to provide electrical continuity.

Contractor. Any person or organisation appointed by Transnet to carry out work on its behalf.

Dead. Isolated and earthed.

Electrical Officer (Contracts). The person appointed in writing by the responsible Electrical Engineer in Transnet as the person who shall be consulted by the Contractor in all electrical matters to ensure that adequate safety precautions are taken by the Contractor.

Executive Officer. The person appointed by Transnet from time to time as the Executive Officer to act according to the rights and powers held by and obligations placed upon him in terms of the Contract.

High-Voltage. A voltage normally exceeding 1 000 volts.

Live. A conductor is said to be "live" when it is at a potential different from that of the earth or any other conductor of the system of which it forms a part.

Near. To be in such a position that a person's body or the tools he is using or any equipment he is handling may come within 3 metres of live exposed high-voltage electrical equipment.

Occupation. An authorisation granted by Transnet for work to be carried out under specified conditions on, over under or adjacent to railway lines.

Occupation Between Trains. An occupation during an interval between successive trains.

Project Manager. The person or juristic person appointed by Transnet from time to time as the Project Manager, to administer the Contract according to the powers and rights held by and obligations placed upon him in terms of the Contract.

Responsible Representative. The responsible person in charge, appointed by a contractor, who has undergone specific training (and holds a certificate) to supervise staff under his control to work on, over, under or adjacent to railway lines and in the vicinity of high-voltage electrical equipment.

Technical Officer. The person or juristic person appointed by Transnet from time to time as the Technical Officer, to administer the Contractor's performance and execution of the Works according to the powers and rights held by and obligations placed upon the Technical Officer in terms of the Contract.

Total Occupation. An occupation for a period when trains are not to traverse the section of line covered by the occupation.

Work on. Work undertaken on or so close to the equipment that the specified working clearances to the live equipment cannot be maintained.

Work Permit. A combined written application and authority to proceed with work on or near dead electrical equipment.

PART A - GENERAL SPECIFICATION

2. AUTHORITY OF OFFICERS OF TRANSNET

2.1 The Contractor shall co-operate with the officers of Transnet and shall comply with all instructions issued and restrictions imposed with respect to the Works which bear on the existence and operation of Transnet's railway lines and high-voltage equipment.

2.2 Without limiting the generality of the provisions of 2.1, any duly authorised representative of Transnet, having identified himself, may stop the work if, in his opinion, the safe passage of trains or the safety of Transnet assets or any person is affected. **CONSIDERATIONS OF SAFETY SHALL TAKE PRECEDENCE OVER ALL OTHER CONSIDERATIONS**.

3. CONTRACTOR'S REPRESENTATIVES

3.1 The Contractor shall nominate Responsible Representatives of whom at least one shall be available at any hour for call-out in cases of emergency. The Contractor shall provide the Technical Officer with the names, addresses and telephone numbers of the representatives.

3.2 The Contractor guarantees that he has satisfied himself that the Responsible Representative is fully conversant with this specification and that he shall comply with all his obligations in respect thereof.

4. OCCUPATIONS AND WORK PERMITS

4.1 Work to be done during total occupation or during an occupation between trains or under a work permit shall be done in a manner decided by the Technical Officer and at times to suit Transnet requirements.

4.2 The Contractor shall organise the Works in a manner, which will minimise the number and duration of occupations and work permits required.

4.3 Transnet will not be liable for any financial or other loss suffered by the Contractor arising from his failure to complete any work scheduled during the period of an occupation or work permit.

4.4 The Contractor shall submit to the Technical Officer, in writing, requests for occupations or work permits together with details of the work to be undertaken, at least 14 days before they are required. Transnet does not undertake to grant an occupation or work permit for any particular date, time or duration.

4.5 Transnet reserves the right to cancel any occupation or work permit at any time before or during the period of occupation or work permit. If, due to cancellation or change in date or time, the Contractor is not permitted to start work under conditions of total occupation or work permit at the time arranged, all costs caused by the cancellation shall be born by the Contractor except as provided for in clauses 4.6 to 4.8.

4.6 When the Contractor is notified less than 2 hours before the scheduled starting time that the occupation or work permit is cancelled, he may claim reimbursement of his direct financial losses caused by the loss of working time up to the time his labour and plant are employed on other work, but not exceeding the period of the cancelled occupation or work permit.

4.7 When the Contractor is notified less than 2 hours before the schedule starting time, or during an occupation or work permit, that the duration of the occupation or work permit is reduced, he may claim reimbursement of his direct financial losses caused by the loss of working time due to the reduced duration of the occupation or work permit.

4.8 Reimbursement the Contractor for any loss of working time in terms of 4.6 and 4.7, shall be subject to his claims being submitted within 14 days of the event with full details of labour and plant involved, and provided that the Technical Officer certifies that no other work on which the labour and plant could be employed was immediately available.

4.9 Before starting any work for which an occupation has been arranged, the Contractor shall obtain from the Technical Officer written confirmation of the date, time and duration of the occupation.

4.10 Before starting any work for which a work permit has been arranged, the Responsible Representative shall read and sign portion C of form No. T.1276 signifying that he is aware of the limits within which work may be undertaken. After the work for which the permit was granted has been completed, or when the work permit is due to be terminated, or if the permit is cancelled after the start, the same person who signed portion C shall sign portion D of the T.1276 form, thereby acknowledging that he is aware that the electrical equipment is to be made "live". The Contractor shall advise all his workmen accordingly.

5. SPEED RESTRICTIONS AND PROTECTION

5.1 When speed restrictions are imposed by Transnet because of the Contractor's activities, the Contractor shall organise and carry out his work so as to permit the removal of the restrictions as soon as possible.

5.2 When the Technical Officer considers protection to be necessary the Contractor shall, unless otherwise agreed, provide all protection including flagmen, other personnel and all equipment for the protection of Transnet's and the Contractor's personnel and assets, the public and including trains. Transnet will provide training free of charge of the Contractor's flagmen and other personnel performing protection duties. The Contractor shall consult with the Technical Officer, whenever he considers that protection will be necessary, taking into account the minimum permissible clearances set out in appendixes 1 to 4.

5.3 The Contractor shall appoint a Responsible Representative to receive and transmit any instruction, which may be given by Transnet personnel providing protection.

6. ROADS ON TRANSNET PROPERTY

The provision of clause 25 of the E.5, General Conditions of Contract, or clause 23 of the E.5 (MW), General Conditions of Contract for Maintenance Works, shall apply to the use of existing roads on Transnet's property.

7. CLEARANCES

7.1 No temporary works shall encroach on the appropriate minimum clearances set out in Annexure 1 BE97-01 Sheets 1,2, 3 and 5 of 5.

8. STACKING OF MATERIAL

8.1 The Contractor shall not stack any material closer than 3 m from the centre line of any railway line without prior approval of the Technical Officer.

9. EXCAVATION, SHORING, DEWATERING AND DRAINAGE

9.1 Unless otherwise approved by the Technical Officer any excavation adjacent to a railway line shall not encroach on the hatched area shown in Figure 1.

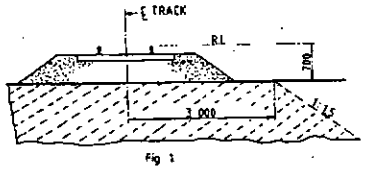


Fig 1

9.2 The Contractor shall provide at his own cost any shoring, dewatering or drainage of any excavation unless otherwise stipulated elsewhere in the Contract.

9.3 Where required by the Technical Officer, drawings of shoring for any excavation under or adjacent to a railway line shall be submitted and permission to proceed obtained, before the excavation is commenced.

9.4 The Contractor shall prevent ingress of water to the excavation but where water does enter, he shall dispose of it as directed by the Technical Officer.

9.5 The Contractor shall not block, obstruct or damage any existing drains either above or below ground level unless he has made adequate prior arrangements to deal with drainage.

10. FALSEWORK FOR STRUCTURES

10.1 Drawings of falsework for the construction of any structure over, under or adjacent to any railway line shall be submitted to the Technical Officer and his permission to proceed obtained before the falsework is erected. Each drawing shall be given a title and a distinguishing number and shall be signed by a registered professional engineer certifying that he has checked the design of the falsework and that the drawings are correct and in accordance with the design.

10.2 After the falsework has been erected and before any load is applied, the Contractor shall submit to the Technical Officer a certificate signed by a registered professional engineer certifying that he has checked the falsework and that it has been erected in accordance with the drawings. Titles and numbers of the drawings shall be stated in the certificate. Notwithstanding permission given by the Technical Officer to proceed, the Contractor shall be entirely responsible for the safety and adequacy of the falsework.

11. PILING

11.1 The Technical Officer will specify the conditions under which piles may be installed on Transnet property.

12. UNDERGROUND SERVICES

12.1 No pegs or stakes shall be driven or any excavation made before the Contractor has established that there are no underground services, which may be damaged thereby.

12.2 Any damage shall be reported immediately to the Technical Officer, or to the official in charge at the nearest station, or to the traffic controller in the case of centralised traffic control.

13. BLASTING

13.1 The provisions of clause 23 of the E.5, General Conditions of Contract or clause 21 of the E.5 (MW), General Conditions of Contract for Maintenance Work, shall apply to all blasting operations undertaken in terms of the Contract.

13.2 The Contractor shall provide proof that he has complied with the provisions of clauses 10.17.1 to 10.17.4 of the Explosives Regulations (Act 26 of 1956 as amended).

13.3 Blasting within 500m of a railway line will only be permitted during intervals between trains. A person appointed by the Technical Officer, assisted by flagmen with the necessary protective equipment, will be in communication with the controlling railway station.
Only this person will be authorised to give the Contractor permission to blast, and the Contractor shall obey his instructions implicitly regarding the time during which blasting may take place.

13.4 The flagmen described in 13.3, where provided by Transnet, are for the protection of trains and Transnet property only, and their presence does not relieve the Contractor in any manner of his responsibilities in terms of Explosives Act or Regulations, or any obligation in terms of this Contract.

13.5 The person described in 13.3 will record in a book provided and retained by Transnet the dates and times -

(i) when each request is made by him to the controlling station for permission to blast;

(ii) when blasting may take place;

(iii) when blasting actually takes place; and

(iv) when he advises the controlling station that the line is safe for the passage of trains.

13.6 Before each blast the Contractor shall record in the same book, the details of the blast to be carried out. The person appointed by the Technical Officer and the person who will do the blasting shall both sign the book whenever an entry described in 13.5 is made.

13.7 The terms of clause 27 hereof shall be strictly adhered to.

14. RAIL TROLLEYS

14.1 The use of rail trolleys or trestle trolleys on a railway line for working on high voltage equipment will be permitted only if approved by the Technical Officer and under the conditions stipulated by him.

14.2 All costs in connection with such trolley working requested by the Contractor shall, unless otherwise agreed, be borne by the Contractor, excluding the costs of any train protection services normally provided free of charge by Transnet.

15. SIGNAL TRACK CIRCUITS

15.1 Where signal track circuits are installed, the Contractor shall ensure that no material capable of conducting an electrical current makes contact between rails of a railway line/lines.

15.2 No signal connections on track-circuited tracks shall be severed without the Technical Officer's knowledge and consent.

16. PENALTY FOR DELAYS TO TRAINS

16.1 If any trains are delayed by the Contractor and the Technical Officer is satisfied that the delay was avoidable, a penalty will be imposed on the Contractor of R5 000 per hour or part thereof for the period of delay, irrespective of the number of trains delayed.

PART B - ADDITIONAL SPECIFICATION FOR WORK NEAR HIGH-VOLTAGE ELECTRICAL EQUIPMENT

17. GENERAL

17.1 This specification is based on the contents of Transnet's publication SAFETY INSTRUCTIONS, HIGH-VOLTAGE ELECTRICAL EQUIPMENT, as amended, a copy of which will be made available on loan to the Contractor for the duration of the contract. These instructions apply to all work near live high-voltage equipment maintained and/or operated by Transnet, and the onus rests on the Contractor to ensure that he obtains a copy.

17.2 The Contractor's attention is drawn in particular to the contents of Part I, Sections 1 and 2 of the Safety Instructions : High-Voltage Electrical Equipment.

17.3 The Safety Instructions : High-Voltage Electrical Equipment cover the minimum safety precautions which must be taken to ensure safe working on or near high-voltage electrical equipment, and must be observed at all times. Should additional safety measures be considered necessary because of peculiar local conditions, these may be ordered by and at the discretion of the Electrical Officer (Contracts).

17.4 This specification must be read in conjunction with and not in lieu of the Safety Instructions : High-Voltage Electrical Equipment.

17.5 The Contractor shall obtain the approval of the Electrical Officer (Contracts) before any work is done which causes or could cause any portion of a person's body or the tools he is using or any equipment he is handling, to come within 3 metres of any live high-voltage equipment.

17.6 The Contractor shall regard all high-voltage equipment as live unless a work permit is in force.

17.7 Safety precautions taken or barriers erected shall comply with the requirements of the Electrical Officer (Contracts), and shall be approved by him before the work to be protected is undertaken by the Contractor. The Contractor shall, unless otherwise agreed, bear the cost of the provision of the barriers and other safety precautions required, including the attendance of Transnet staff where this is necessary.

17.8 No barrier shall be removed unless authorised by the Electrical Officer (Contracts).

18. WORK ON BUILDINGS OR FIXED STRUCTURES

Before any work is carried out or measurements are taken on any part of a building, fixed structure or earthworks of any kind above ground level situated within 3 metres of live high-voltage equipment, the Electrical Officer (Contracts) shall be consulted to ascertain the conditions under which the work may be carried out.

18.2 No barrier erected to comply with the requirements of the Electrical Officer (Contracts) shall be used as temporary staging or shuttering for any part of the Works.

18.3 The shuttering for bridge piers, abutments, retaining walls or parapets adjacent to or over any track may be permitted to serve as a barrier, provided that it extends at least 2,5 metres above any working level in the case of piers, abutments and retaining walls and 1,5 metres above any working level in the case of parapets.

19. WORK DONE ON OR OUTSIDE OF ROLLING STOCK, INCLUDING LOADING OR UNLOADING

19.1 No person shall stand, climb or work whilst on any platform, surface or foothold higher than the normal unrestricted places of access, namely -

(i) the floor level of trucks;

(ii) external walkways on diesel, steam and electric locomotives, steam heat vans, etc. and

(iii) walkways between coaches and locomotives.

When in these positions, no person may raise his hands or any equipment or material he is handling above his head.

19.2 In cases where the Contractor operates his own rail mounted equipment, he shall arrange for the walkways on this plant to be inspected by the Electrical Officer (Contracts) and approved, before commencement of work.

19.3 The handling of long lengths of material such as metal pipes, reinforcing bars, etc should be avoided, but if essential they shall be handled as nearly as possible in a horizontal position below head height.

19.4 The Responsible Representative shall warn all persons under his control of the danger of being near live high-voltage equipment, and shall ensure that the warning is fully understood.

19.5 Where the conditions in 19.1 to 19.3 cannot be observed the Electrical Officer (Contracts), shall be notified. He will arrange for suitable Safety measures to be taken. The Electrical Officer (Contracts), may in his discretion and in appropriate circumstances, arrange for a suitable employee of the Contractor to be specially trained by Transnet and at its costs, as an Authorised Person to work closer than 3 metres from live overhead conductors and under such conditions as may be imposed by the Senior responsible Electrical Engineer in Transnet.

20. USE OF EQUIPMENT

20.1 Measuring Tapes and Devices

20.1.1 Measuring tapes may be used near live high-voltage equipment provided that no part of any tape or a person's body comes within 3 metres of the live equipment.

20.1.2 In windy conditions the distance shall be increased to ensure that if the tape should fall it will not be blown nearer than 3 metres from the live high-voltage equipment.

20.1.3 Special measuring devices longer than 2 metres such as survey staves and rods may be used if these are of non-conducting material and approved by the responsible Electrical Engineer in Transnet, but these devices must not be used within 3 metres of live high-voltage equipment in rainy or wet conditions.

20.1.4 The assistance of the Electrical Officer (Contracts) shall be requested when measurements within the limits defined in 20.1.1 to 20.1.3 are required.

20.1.5 The restrictions described in 20.1.1 to 20.1.3 do not apply on a bridge deck between permanent parapets nor in other situations where a barrier effectively prevents contact with the live high-voltage equipment.

20.2 Portable Ladders

20.2.1 Any type of portable ladder longer then 2 metres may only be used near live high-voltage equipment under the direct supervision of the Responsible Representative. He shall ensure that the ladder is always used in such a manner that the distance from the base of the ladder to any live high-voltage equipment is greater than the fully extended length of the ladder plus 3 metres. Where these conditions cannot be observed, the Electrical Officer (Contracts) shall be advised, and he will arrange for suitable safety measures to be taken.

21. CARRYING AND HANDLING MATERIAL AND EQUIPMENT

21.1 Pipes, scaffolding, iron sheets, reinforcing bars and other material, which exceeds 2 metres in length, shall be carried completely below head height near live high-voltage equipment. For maximum safety two or more persons so as to maintain it as nearly as possible in a horizontal position should carry such material. The utmost care must be take to ensure that no part of the material comes within 3 metres of any live high-voltage equipment.

21.2 Long lengths of wire or cable shall never be run out in conditions where a part of a wire or cable can come within 3 metres of any live high-voltage equipment unless the Electrical Officer (Contracts) has been advised and has approved appropriate safety precautions.

21.3 The presence of overhead power lines shall always be taken account of especially when communications lines or cables or aerial cables, stay wires, etc. are being erected above ground level.

22. PRECAUTIONS TO BE TAKEN WHEN ERECTING OR REMOVING POLES, ANTENNAE, TREES ETC.

22.1 A pole may be handled for the purpose of erection or removal near high-voltage equipment under the following conditions:

(i) If the distance between the point at which the pole is to be erected or removed and the nearest live high-voltage equipment is more than the length of the pole plus 3 metres, the work shall be supervised by the Responsible Representative.

(ii) If the distance described in (i) is less than the length of the pole plus 3 metres, the Electrical Officer (Contracts) shall be consulted to arrange for an Authorised Person to supervise the work and to ensure that the pole is earthed where possible. The pole shall be kept in contact with the point of erection, and adequate precautions shall be taken to prevent contact with live high-voltage equipment.

22.2 The cost of supervision by an Authorised Person and the provision of earthing shall, unless otherwise agreed, be borne by the Contractor.

22.3 The provisions of clauses 22.1 and 22.2 shall also apply to the erection or removal of columns, antennae, trees, posts, etc.

23. USE OF WATER

23.1 No water shall be used in the form of a jet if it can make contact with any live high-voltage equipment or with any person working on such equipment.

24. USE OF CONSTRUCTION PLANT

24.1 "Construction plant" entails all types of plant including cranes, piling frames, boring machines, excavators, draglines, dewatering equipment and road vehicles with or without lifting equipment.

24.2 When work is being undertaken in such a position that it is possible for construction plant or its load to come within 3 metres of live high-voltage equipment, the Electrical Officer (Contracts) shall be consulted. He will arrange for an Authorised Person to supervise the work and to ensure that the plant is adequately earthed. The Electrical Officer (Contracts) will decide whether further safety measures are necessary.

24.3 The cost of any supervision by an Authorised Person and the provision of earthing shall, unless otherwise agreed, be borne by the Contractor.

24.4 When loads are handled by cranes, non-metallic rope hand lines shall be used, affixed to such loads so as to prevent their swinging and coming within 3 metres of live high-voltage equipment.

24.5 Clauses 24.1 to 24.4 shall apply mutatis mutandis to the use of maintenance machines of any nature.

25. WORK PERFORMED UNDER DEAD CONDITIONS UNDER COVER OF A WORK PERMIT

25.1 If the Responsible Representative finds that the work cannot be done in safety with the high-voltage electrical equipment live, he shall consult the Electrical Officer (Contracts) who will decide on the action to be taken.

25.2 If a work permit is issued the Responsible Representative shall -

(i) before commencement of work ensure that the limits within which work may be carried out have been explained to him by the Authorised Person who issued the permit to him, and that he fully understands these limits.

(ii) sign portion C of the permit before commencement of work;

(iii) explain to all persons under his control the limits within which work may be carried out, and ensure that they fully understand these limits;

(iv) care for the safety of all persons under his control whilst work is in progress; and

(v) withdraw all personnel under his control from the equipment on completion of the work before he signs portion D of the work permit.

26. TRACTION RETURN CIRCUITS IN RAILS

26.1 DANGEROUS CONDITIONS CAN BE CREATED BY REMOVING OR SEVERING ANY BOND.

26.2 Broken rails with an air gap between the ends, and joints, at which fishplates are removed under "broken bond" conditions, are potentially lethal. The rails on either side of an air gap between rail ends on electrified lines shall not be touched simultaneously until rendered safe by Transnet personnel.

26.3 The Contractor shall not break any permanent bonds between rails or between rails and any structure. He shall give the Technical Officer at least 7 days written notice when removal of such bonds is necessary.

26.4 No work on the track which involves interference with the traction return rail circuit either by cutting or removing the rails, or by removal of bonds shall be done unless the Electrical Officer (Contracts) is consulted. He will take such precautions as may be necessary to ensure continuity of the return circuit before permitting the work to be commenced.

27. BLASTING

27.1 The Contractor shall obtain the permission of the Electrical Officer (Contracts) before blasting, and shall give at least 14 days notice of his intention to blast.

27.2 No blasting shall be done in the vicinity of electrified lines unless a member of Transnet's electrical personnel is present.

27.3 The terms of clause 13 hereof shall be strictly adhered to.

28. HIGH-VOLTAGE ELECTRICAL EQUIPMENT NOT MAINTAINED AND/OR OPERATED BY TRANSNET

Where the work is undertaken on or near high-voltage electrical equipment which is not maintained and/or operated by Transnet, the Occupational Health and Safety Act No. 85 of 1993, and Regulations and Instructions, or the Mines Health and Safety Act (Act 29 of 1996), shall apply.

Such equipment includes: -

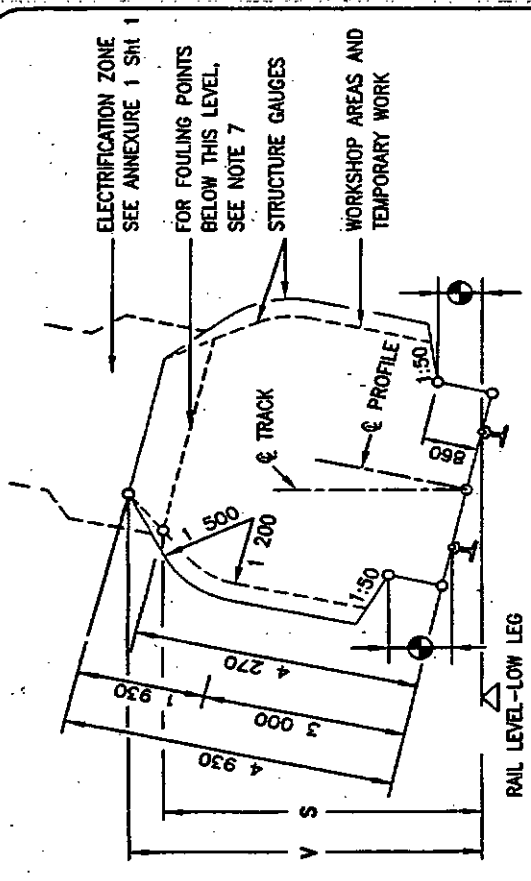
(i) Eskom and municipal equipment;

(ii) the Contractor's own power supplies; and

(iii) electrical equipment being installed but not yet taken over from the Contractor.

ANNEXURE 1
SHEET 2 of 5
AMENDMENT

VERTICAL CLEARANCES : 1 065mm TRACK GAUGE



LOCATION		NOT ELECTRIFIED	ELECTRIFIED (PRESENT OR FUTURE)		
			3KV & 25KV	50KV	
	RADIUS (mm)	S (mm)	V (mm)	V (mm)	
ALL AREAS OTHER THAN THOSE INDICATED BY * BELOW	100	4 470	5 050	5 400	
	300	4 410	5 020	5 370	
	600	4 370	5 000	5 350	
	1 000	4 350	4 990	5 340	
	1 500	4 310	4 960	5 310	
	2 000	4 290	4 940	5 290	
	>3 000	4 270	4 930	5 280	
* OVER OR NEAR POINTS AND CROSSING IF REQUIRED BY ELECTRICAL IRRESPECTIVE OF RADIUS			5 650	6 000	

REMARKS:

1. V IS THE REQUIRED VERTICAL CLEARANCE EXCEPT WHERE REDUCED CLEARANCE S APPLIES.
2. S IS THE MINIMUM VERTICAL CLEARANCE FOR STRUCTURES AND TEMPORARY WORK OVER NON-ELECTRIFIED LINES.
3. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
4. FOR APPLICATION AT CURVES
   - 4.1 APPLY INCREASED CLEARANCES FOR CURVES TO POINTS 3m BEYOND THE ENDS OF THE CIRCULAR CURVE.
   - 4.2 REDUCE CLEARANCES AT A UNIFORM RATE OVER THE REMAINDER OF THE TRANSITION CURVE.
   - 4.3 FOR NON-TRANSITIONED CURVES REDUCE AT A UNIFORM RATE OVER A LENGTH OF 15m ALONG STRAIGHTS.
5. NEW STRUCTURES: SEE BRIDGE CODE.
6. TUNNELS: SEE DRAWING BE 82-35.
7. FOULING POINTS: SEE CLAUSE 8.1.
8. CLEARANCES ARE BASED ON 15m BOGIE CENTRES AND 21,2m VECHILE BODY LENGTH.
9. ◔ SEE ANNEXURE 1 SHEET 3 FOR PLATFORM CLEARANCES.

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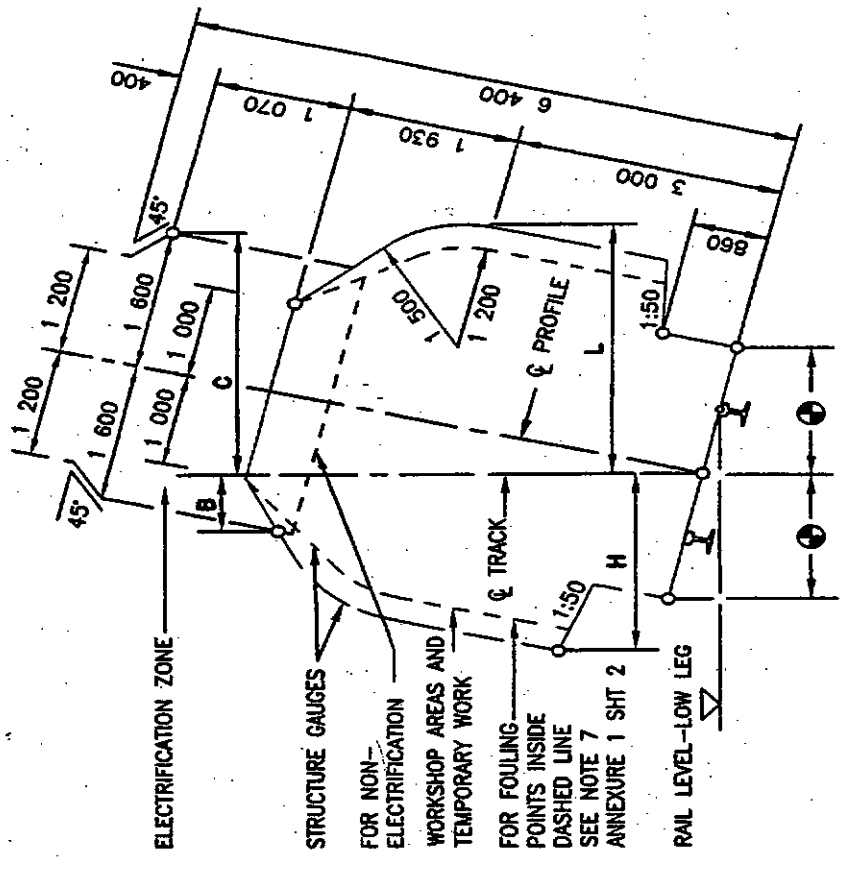
ANNEXURE 1
SHEET 1 of 5
AMENDMENT

HORIZONTAL CLEARANCES : 1 065mm TRACK GAUGE



RADIUS (m)	WITH CANT H (mm)	WITH CANT L (mm)	NO CANT H & L	WITH CANT B (mm)	WITH CANT C (mm)
90	2 730	3 090	2 780	1 130	2 100
100	2 700	3 030	2 750	1 140	2 050
120	2 650	2 970	2 700	1 160	2 010
140	2 620	2 920	2 660	1 175	1 990
170	2 590	2 870	2 630	1 190	1 970
200	2 570	2 820	2 600	1 205	1 950
250	2 550	2 790	2 580	1 230	1 920
300	2 540	2 760	2 560	1 250	1 900
350	2 530	2 730	2 540	1 270	1 890
400	2 520	2 710	2 530	1 290	1 875
500	2 510	2 680	2 520	1 320	1 850
600	2 500	2 660	2 510	1 340	1 830
800	2 490	2 620	2 500	1 365	1 790
1 000	2 480	2 600	2 490	1 380	1 760
1 200	2 480	2 580	2 490	1 200	1 730
1 500	2 480	2 550	2 480	1 415	1 700
2 000	2 480	2 500	2 480	1 440	1 660
3 000	2 470	2 470	2 470	1 500	1 600
>5 000	2 460	2 460	2 460	1 600	1 600

REMARKS:

1. **H** AND **B** IS THE REQUIRED HORIZONTAL CLEARANCE ON THE OUTSIDE OF THE CURVE BASED ON MINIMUM CANT.
2. **L** AND **C** IS THE REQUIRED HORIZONTAL CLEARANCE ON THE INSIDE OF THE CURVE BASED ON MAXIMUM CANT.
3. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
4. FOR WORKSHOP AREAS AND TEMPORARY WORK, CLEARANCES **H** AND **L** MAY BE REDUCED BY 300mm.
5. ❶ SEE ANNEXURE 1 SHEET 3 FOR PLATFORM CLEARANCES.
6. ALSO REFER TO REMARKS 4 TO 8 OF ANNEXURE 1 SHEET 2.

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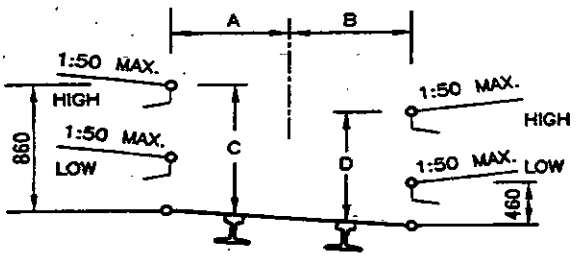
ANNEXURE 1
SHEET 3 of 5
AMENDMENT

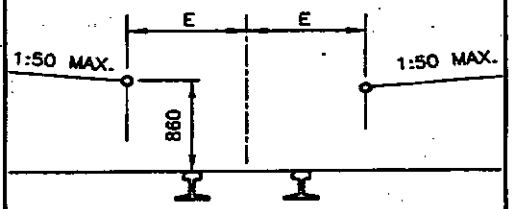
CLEARANCES : PLATFORMS

PLATFORMS : TRACK GAUGE 1 065mm

PASSENGERS



GOODS



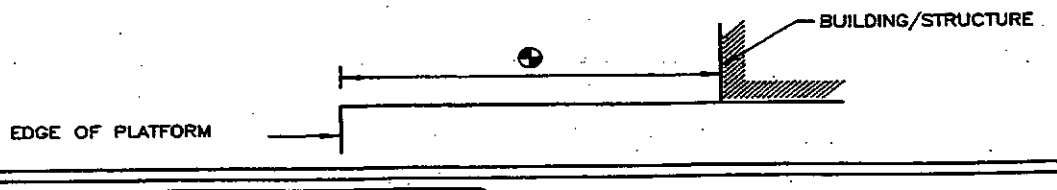
(NO CANT)

RADIUS (m)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
90	1 690	1 820	890	810	1 840
100	1 650	1 790	890	810	1 810
120	1 610	1 740	890	810	1 760
140	1 580	1 700	890	810	1 720
170	1 550	1 660	890	810	1 690
200	1 530	1 630	890	820	1 670
250	1 520	1 600	890	820	1 640
300	1 520	1 580	890	830	1 620
350	1 520	1 560	880	830	1 600
400	1 520	1 550	880	840	1 590
500	1 520	1 540	880	850	1 580
600	1 520	1 530	870	850	1 570
800	1 520	1 520	860	860	1 560
1 200	1 520	1 520	860	860	1 550
2 000	1 520	1 520	860	860	1 540
3 000	1 520	1 520	860	860	1 530
STRAIGHT	1 520	1 520	860	860	1 520

REMARKS:

1. NO CANT TO BE APPLIED EXCEPT WHEN THE GOODS PLATFORM IS ON A RUNNING LINE.
2. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
3. ⊕ 8m TO MAIN STATION-BUILDINGS AND 3m TO ALL OTHER STRUCTURES.
4. TOLERANCES : SEE CLAUSE 8.0.10.

STRUCTURES ON PLATFORMS : 1 065mm AND 610mm TRACK GAUGE



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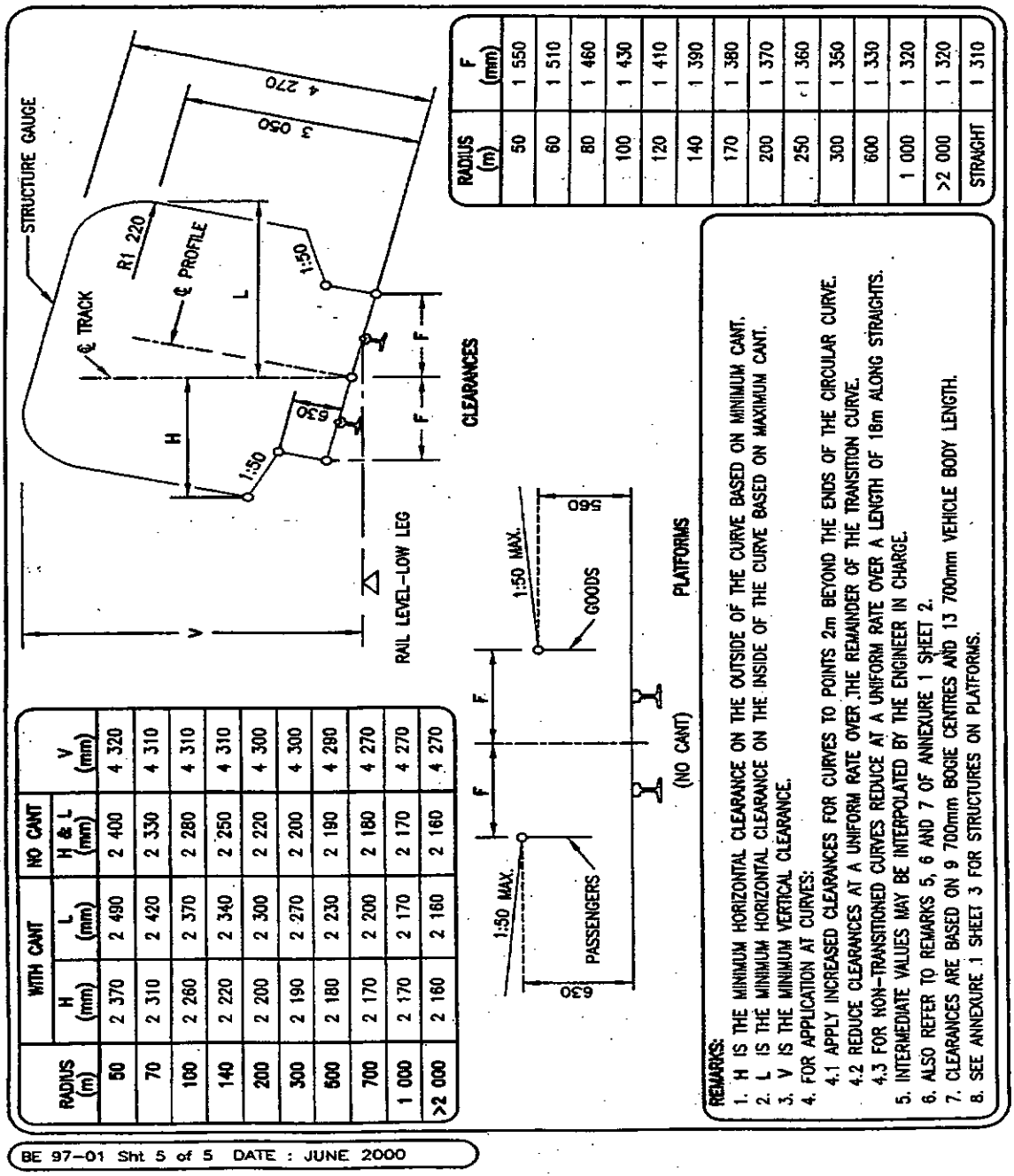
ANNEXURE 1
SHEET 5 of 5
AMENDMENT

CLEARANCES : 610mm TRACK GAUGE



RADIUS (m)	WITH CANT H (mm)	WITH CANT L (mm)	NO CANT H & L (mm)	V (mm)
50	2 370	2 480	2 400	4 320
70	2 310	2 420	2 330	4 310
100	2 260	2 370	2 280	4 310
140	2 220	2 340	2 250	4 310
200	2 200	2 300	2 220	4 300
300	2 190	2 270	2 200	4 300
600	2 180	2 230	2 190	4 280
700	2 170	2 200	2 180	4 270
1 000	2 170	2 170	2 170	4 270
>2 000	2 160	2 160	2 160	4 270

RADIUS (m)	F (mm)
50	1 550
60	1 510
80	1 460
100	1 430
120	1 410
140	1 390
170	1 380
200	1 370
250	1 360
300	1 350
600	1 330
1 000	1 320
>2 000	1 320
STRAIGHT	1 310

REMARKS:
1. H IS THE MINIMUM HORIZONTAL CLEARANCE ON THE OUTSIDE OF THE CURVE BASED ON MINIMUM CANT.
2. L IS THE MINIMUM HORIZONTAL CLEARANCE ON THE INSIDE OF THE CURVE BASED ON MAXIMUM CANT.
3. V IS THE MINIMUM VERTICAL CLEARANCE.
4. FOR APPLICATION AT CURVES:
   4.1 APPLY INCREASED CLEARANCES FOR CURVES TO POINTS 2m BEYOND THE ENDS OF THE CIRCULAR CURVE.
   4.2 REDUCE CLEARANCES AT A UNIFORM RATE OVER THE REMAINDER OF THE TRANSITION CURVE.
   4.3 FOR NON-TRANSITIONED CURVES REDUCE AT A UNIFORM RATE OVER A LENGTH OF 18m ALONG STRAIGHTS.
5. INTERMEDIATE VALUES MAY BE INTERPOLATED BY THE ENGINEER IN CHARGE.
6. ALSO REFER TO REMARKS 5, 6 AND 7 OF ANNEXURE 1 SHEET 2.
7. CLEARANCES ARE BASED ON 9 700mm BOGIE CENTRES AND 13 700mm VEHICLE BODY LENGTH.
8. SEE ANNEXURE 1 SHEET 3 FOR STRUCTURES ON PLATFORMS.

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PART 4: SITE INFORMATION

C4.1: Information about the *site* at time of tender which may affect the work in this contract

1. Description of the Site and its surroundings

1.1. General description

Supply and installation of a Radio High Site Mast at Koopmansfontein.

1.2. Access Limitations

The areas are restricted and the contractor must ensure he complies with the regulations of Transnet in every way. Contractor and/or any sub-contractors shall be required to arrange with the Transnet Freight Rail Real Estate project Manager Mr Jan Fourie contact numbers 053 838-2066 or Lucinda Brits 053 838-3017 for permission to enter the restricted area.

1.3. Ground conditions in areas affected by work in this contract

Rocky Terrain / Hard Ground.

1.4. Hidden and other services within site

Project Manager will communicate any ground conditions if necessary