



**NEC3 Term Service Contract (TSC3)**

**Between ESKOM HOLDINGS SOC Ltd  
(Reg No. 2002/015527/30)**

**and .....  
(Reg No. \_\_\_\_\_ )**

**for Cape Coastal Cluster Powerline Engineering Survey**

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**CONTRACT No. ....**

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## **PART C1:      AGREEMENTS & CONTRACT DATA**

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<b>[to be inserted from Returnable Documents at award stage]</b>	
<b>C1.2a Contract Data provided by the <i>Employer</i></b>	<b>[12]</b>
<b>C1.2b Contract Data provided by the <i>Contractor</i></b>	<b>[1]</b>

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# C1.1 Form of Offer & Acceptance

## Offer

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract for the procurement of:

### Cape Coastal Cluster Powerline Engineering Survey

The tenderer, identified in the Offer signature block, has examined the documents listed in the Tender Data and addenda thereto 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.

Options A	The offered total of the Prices exclusive of VAT is	<b>Rates contract</b>
	Sub total	
	Value Added Tax @ 15%	
	The offered total of the amount due inclusive of VAT is <sup>1</sup>	
	(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:

<sup>1</sup> This total is required by the *Employer* for budgeting purposes only. Actual amounts due will be assessed in terms of the *conditions of contract*.

## 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: Service 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 and signed original copy of this document, including the Schedule of Deviations (if any).

Signature(s)

Name(s)        **Ms Nosipho Manyongo**

Capacity        **Asset Creation Manager, Cape Coastal Cluster**

**for the Employer**        **ESKOM HOLDINGS SOC LIMITED, Megawatt Park, Maxwell Drive, Sandton, Johannesburg**

*(Insert name and address of organisation)*

Name & signature of witness        Date

Note: If a tenderer wishes to submit alternative tenders, use another copy of this Form of Offer and Acceptance.

**Schedule of Deviations to be completed by the *Employer* prior to contract award**

Note:

1. 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	none	none

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 .....

**Ms Nosipho Manyongo**

Capacity .....

**Asset Creation Manager, Cape Coastal Cluster**

On behalf of *(Insert name and address of organisation)*

**ESKOM HOLDINGS SOC LIMITED,  
Megawatt Park, Maxwell Drive, Sandton,  
Johannesburg**

Name & signature of witness .....

.....

Date .....

.....

## C1.2 TSC3 Contract Data

### Part one - Data provided by the *Employer*

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

Clause	Statement	Data
1	<b>General</b>	
	The <i>conditions of contract</i> are the core clauses and the clauses for main Option:	
	dispute resolution Option and secondary Options	<b>A: Priced contract with price list</b> <b>W1: Dispute resolution procedure</b>  <b>X2 Changes in the law</b> <b>X17: Low service damages</b> <b>X18: Limitation of liability</b> <b>X19: Task Order</b> <b>X20: Key performance indicators</b> <b>Z: Additional conditions of contract</b>
	of the NEC3 Term Service Contract April 2013 <sup>1</sup> (TSC3)	
10.1	The <i>Employer</i> is (name):	<b>Eskom Holdings SOC Ltd (reg no: 2002/015527/30), a state owned company incorporated in terms of the company laws of the Republic of South Africa</b>
	Address	<b>Registered office at Megawatt Park, Maxwell Drive, Sandton, Johannesburg</b>
	Tel No.	011 800 4585
	Fax No.	011 800 5803
10.1	The <i>Service Manager</i> is (name):	<b>Mr Xolisa Songcaka</b>
	Address	<b>Cnr Bonza Bay &amp; Quenera Drive, Beacon Bay, East London</b>
	Tel	<b>051 404 2133</b>
	Fax	<b>TBA</b>
	e-mail	<b>songcaxh@eskom.co.za</b>
11.2(2)	The Affected Property is	<b>Cape Coastal Cluster sites</b>

<sup>1</sup> Available from Engineering Contract Strategies Tel 011 803 3008 Fax 086 539 1902 [www.ecs.co.za](http://www.ecs.co.za)

11.2(13)	The <i>service</i> is	<b>Cape Coastal Cluster Powerline Engineering Survey</b>
11.2(14)	The following matters will be included in the Risk Register	<b>Risk identified on site</b>
11.2(15)	The Service Information is in	<b>Part 3: Scope of Work and all documents and drawings to which it makes reference.</b>
12.2	The <i>law of the contract</i> is the law of	<b>the Republic of South Africa</b>
13.1	The <i>language of this contract</i> is	<b>English</b>
13.3	The <i>period for reply</i> is	<b>3 working days</b>
<b>2</b>	<b>The Contractor's main responsibilities</b>	<b>Data required by this section of the core clauses is also provided by the Contractor in Part 2 and terms in italics used in this section are identified elsewhere in this Contract Data</b>
21.1	The <i>Contractor</i> submits a first plan for acceptance within	<b>[1] one weeks of the Contract Date</b>
<b>3</b>	<b>Time</b>	
30.1	The <i>starting date</i> is.	<b>TBA</b>
30.1	The <i>service period</i> is	<b>36 months</b>
<b>4</b>	<b>Testing and defects</b>	<b>There is no reference to Contract Data in this section of the core clauses and terms in italics used in this section are identified elsewhere in this Contract Data</b>
<b>5</b>	<b>Payment</b>	
50.1	The <i>assessment interval</i> is	<b>between the 25 day of each successive month.</b>
51.1	The <i>currency of this contract</i> is the	<b>South African Rand</b>
51.2	The period within which payments are made is	<b>Depending on your BBB-EE Status</b>
51.4	The <i>interest rate</i> is	<b>the publicly quoted prime rate of interest (calculated on a 365 day year) charged by from time to time by the Standard Bank of South Africa Limited (as certified, in the event of any dispute, by any manager of such bank, whose appointment it shall not be necessary to prove) for amounts due in Rands and</b>  <b>(ii) the LIBOR rate applicable at the time for amounts due in other currencies. LIBOR is the 6 month London Interbank Offered Rate quoted under the caption "Money Rates" in The Wall Street Journal for the applicable currency or if no rate is quoted for the currency in question then the rate for United States Dollars, and if no such rate appears in The Wall Street Journal then the rate as quoted by the Reuters Monitor Money Rates Service (or such service as may replace the Reuters Monitor Money Rates Service) on the due date for the payment in</b>

		question, adjusted <i>mutatis mutandis</i> every 6 months thereafter (and as certified, in the event of any dispute, by any manager employed in the foreign exchange department of The Standard Bank of South Africa Limited, whose appointment it shall not be necessary to prove.
6	<b>Compensation events</b>	There is no reference to Contract Data in this section of the core clauses and terms in italics used in this section are identified elsewhere in this Contract Data
7	<b>Use of Equipment Plant and Materials</b>	There is no reference to Contract Data in this section of the core clauses and terms in italics used in this section are identified elsewhere in this Contract Data
8	<b>Risks and insurance</b>	
80.1	These are additional <i>Employer's</i> risks	1. 2. 3.
83.1	The <i>Employer</i> provides these insurances from the Insurance Table	as stated for "Format TSC3" available on <a href="http://www.eskom.co.za/Tenders/InsurancePolicies/Procedures/Pages/EIMS_Policies_From_1_April_2014_To_31_March_2015.aspx">http://www.eskom.co.za/Tenders/InsurancePolicies/Procedures/Pages/EIMS_Policies_From_1_April_2014_To_31_March_2015.aspx</a> (See Annexure A for basic guidance).
83.1	The <i>Employer</i> provides these additional insurances	as stated for "Format TSC3" available on <a href="http://www.eskom.co.za/Tenders/InsurancePolicies/Procedures/Pages/EIMS_Policies_From_1_April_2014_To_31_March_2015.aspx">http://www.eskom.co.za/Tenders/InsurancePolicies/Procedures/Pages/EIMS_Policies_From_1_April_2014_To_31_March_2015.aspx</a> (See Annexure A for basic guidance)
83.1	The <i>Contractor</i> provides these additional insurances:	[•]
83.1	The minimum amount of cover for insurance against loss and damage caused by the <i>Contractor</i> to the <i>Employer's</i> property is	the amount of the deductibles relevant to the event described in the "Format TSC3" insurance policy available on <a href="http://www.eskom.co.za/Tenders/InsurancePolicies/Procedures/Pages/EIMS_Policies_From_1_April_2014_To_31_March_2015.aspx">http://www.eskom.co.za/Tenders/InsurancePolicies/Procedures/Pages/EIMS_Policies_From_1_April_2014_To_31_March_2015.aspx</a>
83.1	The insurance against loss of or damage to the <i>works</i> , Plant and Materials is to include cover for Plant and Materials provided by the <i>Employer</i> for an amount of	[•]
83.1	The minimum amount of cover for insurance in respect of loss of or damage to property (except the <i>Employer's</i> property, Plant and Materials and Equipment) and liability for bodily injury to or death of a person (not an employee of the <i>Contractor</i> ) arising from or in connection with the <i>Contractor's</i> Providing the Service for any one event is:	whatever the <i>Contractor</i> deems necessary in addition to that provided by the <i>Employer</i> .

83.1	The minimum limit of indemnity for insurance in respect of death of or bodily injury to employees of the <i>Contractor</i> arising out of and in the course of their employment in connection with this contract for any one event is:	<b>As prescribed by the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993 and the <i>Contractor's</i> common law liability for people falling outside the scope of the Act with a limit of Indemnity of not less than R500 000 (Five hundred thousand Rands)..</b>
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<b>9</b>	<b>Termination</b>	There is no reference to Contract Data in this section of the core clauses and terms in italics used in this section are identified elsewhere in this Contract Data.
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<b>10</b>	<b>Data for main Option clause</b>
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<b>A</b>	<b>Priced contract with price list</b>
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20.5	The <i>Contractor</i> prepares forecasts of the final total of the Prices for the whole of the <i>service</i> at intervals no longer than	<b>2 weeks.</b>
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<b>11</b>	<b>Data for Option W1</b>
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W1.1	The <i>Adjudicator</i>	<b>the person selected from the ICE-SA Division (or its successor body) of the South African Institution of Civil Engineering Panel of Adjudicators by the Party intending to refer a dispute to him. (see <a href="http://www.ice-sa.org.za">www.ice-sa.org.za</a>). If the Parties do not agree on an Adjudicator the Adjudicator will be appointed by the Arbitration Foundation of Southern Africa (AFSA).</b>
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Address	<b>To be appointed When dispute arises.</b>
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Tel No.	
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Fax No.	
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e-mail	
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W1.2(3)	The <i>Adjudicator nominating body</i> is:	<b>the Chairman of ICE-SA a joint Division of the South African Institution of Civil Engineering and the Institution of Civil Engineers (London) (see <a href="http://www.ice-sa.org.za">www.ice-sa.org.za</a> ) or its successor body.</b>
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W1.4(2)	The <i>tribunal</i> is:	<b>arbitration</b>
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W1.4(5)	The <i>arbitration procedure</i> is	<b>the latest edition of Rules for the Conduct of Arbitrations published by The Association of Arbitrators (Southern Africa) or its successor body.</b>
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The place where arbitration is to be held is	<b>East London South Africa</b>
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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	<b>the Chairman for the time being or his nominee of the Association of Arbitrators (Southern Africa) or its successor body.</b>

<b>12</b>	<b>Data for secondary Option clauses</b>
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<b>X2</b>	<b>Changes in the law</b>	<b>There is no reference to Contract Data in this Option and terms in italics are identified elsewhere in this Contract Data.</b>
<b>X17</b>	<b>Low service damages</b>	
X17.1	The <i>service level table</i> is in	<b>2,5% of the Task Amount per day up until 10%</b>
<b>X18</b>	<b>Limitation of liability</b>	
X18.1	The <i>Contractor's</i> liability to the <i>Employer</i> for indirect or consequential loss is limited to	<b>R0.0 (zero Rand)</b>
X18.2	For any one event, the <i>Contractor's</i> liability to the <i>Employer</i> for loss of or damage to the <i>Employer's</i> property is limited to	<b>the amount of the deductibles relevant to the event</b>
X18.3	The <i>Contractor's</i> liability for Defects due to his design of an item of Equipment is limited to	<b>The greater of</b> <ul style="list-style-type: none"> <li>• the total of the Prices at the Contract Date and</li> <li>• the amounts excluded and unrecoverable from the <i>Employer's</i> insurance (other than the resulting physical damage to the <i>Employer's</i> property which is not excluded) plus the applicable deductibles</li> </ul>
X18.4	The <i>Contractor's</i> total liability to the <i>Employer</i> , for all matters arising under or in connection with this contract, other than the excluded matters, is limited to	<b>the total of the Prices other than for the additional excluded matters.</b> <b>The <i>Contractor's</i> total liability for the additional excluded matters is not limited.</b> <b>The additional excluded matters are amounts for which the <i>Contractor</i> is liable under this contract for</b> <ul style="list-style-type: none"> <li>• Defects due to his design, plan and specification,</li> <li>• Defects due to manufacture and fabrication outside the Affected Property,</li> <li>• loss of or damage to property (other than the <i>Employer's</i> property, Plant and Materials),</li> <li>• death of or injury to a person and</li> <li>• infringement of an intellectual property right.</li> </ul>
X18.5	The <i>end of liability date</i> is	<b>[•] months after the end of the <i>service period</i>.</b>
<b>X19</b>	<b>Task Order</b>	
X19.5	The <i>Contractor</i> submits a Task Order programme to the <i>Service Manager</i> within	<b>7 days of receiving the Task Order</b>
<b>Z</b>	<b>The <i>additional conditions of contract</i> are</b>	<b>Z1 to Z14 always apply.</b>

## **Z1 Cession delegation and assignment**

- Z1.1 The *Contractor* does not cede, delegate or assign any of its rights or obligations to any person without the written consent of the *Employer*.
- Z1.2 Notwithstanding the above, the *Employer* may on written notice to the *Contractor* cede and delegate its rights and obligations under this contract to any of its subsidiaries or any of its present divisions or operations which may be converted into separate legal entities as a result of the restructuring of the Electricity Supply Industry.

## **Z2 Joint ventures**

- Z2.1 If the *Contractor* constitutes a joint venture, consortium or other unincorporated grouping of two or more persons or organisations then these persons or organisations are deemed to be jointly and severally liable to the *Employer* for the performance of this contract.
- Z2.2 Unless already notified to the *Employer*, the persons or organisations notify the *Service Manager* within two weeks of the Contract Date of the key person who has the authority to bind the *Contractor* on their behalf.
- Z2.3 The *Contractor* does not alter the composition of the joint venture, consortium or other unincorporated grouping of two or more persons without the consent of the *Employer* having been given to the *Contractor* in writing.

## **Z3 Change of Broad Based Black Economic Empowerment (B-BBEE) status**

- Z3.1 Where a change in the *Contractor's* legal status, ownership or any other change to his business composition or business dealings results in a change to the *Contractor's* B-BBEE status, the *Contractor* notifies the *Employer* within seven days of the change.
- Z3.2 The *Contractor* is required to submit an updated verification certificate and necessary supporting documentation confirming the change in his B-BBEE status to the *Service Manager* within thirty days of the notification or as otherwise instructed by the *Service Manager*.
- Z3.3 Where, as a result, the *Contractor's* B-BBEE status has decreased since the Contract Date the *Employer* may either re-negotiate this contract or alternatively, terminate the *Contractor's* obligation to Provide the Service.
- Z3.4 Failure by the *Contractor* to notify the *Employer* of a change in its B-BBEE status may constitute a reason for termination. If the *Employer* terminates in terms of this clause, the procedures on termination are P1, P2 and P4 as stated in clause 92, and the amount due is A1 and A3 as stated in clause 93.

## **Z4 Confidentiality**

- Z4.1 The *Contractor* does not disclose or make any information arising from or in connection with this contract available to Others. This undertaking does not, however, apply to information which at the time of disclosure or thereafter, without default on the part of the *Contractor*, enters the public domain or to information which was already in the possession of the *Contractor* at the time of disclosure (evidenced by written records in existence at that time). Should the *Contractor* disclose information to Others in terms of clause 25.1, the *Contractor* ensures that the provisions of this clause are complied with by the recipient.
- Z4.2 If the *Contractor* is uncertain about whether any such information is confidential, it is to be regarded as such until notified otherwise by the *Service Manager*.
- Z4.3 In the event that the *Contractor* is, at any time, required by law to disclose any such information which is required to be kept confidential, the *Contractor*, to the extent permitted by law prior to

disclosure, notifies the *Employer* so that an appropriate protection order and/or any other action can be taken if possible, prior to any disclosure. In the event that such protective order is not, or cannot, be obtained, then the *Contractor* may disclose that portion of the information which it is required to be disclosed by law and uses reasonable efforts to obtain assurances that confidential treatment will be afforded to the information so disclosed.

Z4.4 The taking of images (whether photographs, video footage or otherwise) of the Affected Property or any portion thereof, in the course of Providing the Service and after the end of the *service period*, requires the prior written consent of the *Service Manager*. All rights in and to all such images vests exclusively in the *Employer*.

Z4.5 The *Contractor* ensures that all his subcontractors abide by the undertakings in this clause.

**Z5 Waiver and estoppel: Add to core clause 12.3:**

Z5.1 Any extension, concession, waiver or relaxation of any action stated in this contract by the Parties, the *Service Manager* or the *Adjudicator* does not constitute a waiver of rights, and does not give rise to an estoppel unless the Parties agree otherwise and confirm such agreement in writing.

**Z6 Health, safety and the environment: Add to core clause 27.4**

Z6.1 The *Contractor* undertakes to take all reasonable precautions to maintain the health and safety of persons in and about the execution of the *service*. Without limitation the *Contractor*:

- accepts that the *Employer* may appoint him as the "Principal Contractor" (as defined and provided for under the Construction Regulations 2014 (promulgated under the Occupational Health & Safety Act 85 of 1993) ("the Construction Regulations") for the Affected Property;
- warrants that the total of the Prices as at the Contract Date includes a sufficient amount for proper compliance with the Construction Regulations, all applicable health & safety laws and regulations and the health and safety rules, guidelines and procedures provided for in this contract and generally for the proper maintenance of health & safety in and about the execution of the *service*; and
- undertakes, in and about the execution of the *service*, to comply with the Construction Regulations and with all applicable health & safety laws and regulations and rules, guidelines and procedures otherwise provided for under this contract and ensures that his Subcontractors, employees and others under the *Contractor's* direction and control, likewise observe and comply with the foregoing.

Z6.2 The *Contractor*, in and about the execution of the *service*, complies with all applicable environmental laws and regulations and rules, guidelines and procedures otherwise provided for under this contract and ensures that his Subcontractors, employees and others under the *Contractor's* direction and control, likewise observe and comply with the foregoing.

**Z7 Provision of a Tax Invoice and interest. Add to core clause 51**

Z7.1 Within one week of receiving a payment certificate from the *Service Manager* in terms of core clause 51.1, the *Contractor* provides the *Employer* with a tax invoice in accordance with the *Employer's* procedures stated in the Service Information, showing the amount due for payment equal to that stated in the payment certificate.

Z7.2 If the *Contractor* does not provide a tax invoice in the form and by the time required by this contract, the time by when the *Employer* is to make a payment is extended by a period equal in time to the delayed submission of the correct tax invoice. Interest due by the *Employer* in terms of core clause 51.2 is then calculated from the delayed date by when payment is to be made.

Z7.3 The *Contractor* (if registered in South Africa in terms of the companies Act) is required to comply with the requirements of the Value Added Tax Act, no 89 of 1991 (as amended) and to

include the *Employer's* VAT number 4740101508 on each invoice he submits for payment.

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**Z8 Notifying compensation events**

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Z8.1 Delete the last paragraph of core clause 61.3 and replace with:

If the *Contractor* does not notify a compensation event within eight weeks of becoming aware of the event, he is not entitled to a change in the Prices.

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**Z9 *Employer's* limitation of liability**

Z9.1 The *Employer's* liability to the *Contractor* for the *Contractor's* indirect or consequential loss is limited to R0.00 (zero Rand)

Z9.2 The *Contractor's* entitlement under the indemnity in 82.1 is provided for in 60.1(12) and the *Employer's* liability under the indemnity is limited to compensation as provided for in core clause 63 and X19.11 if Option X19 Task Order applies to this contract.

**Z10 Termination: Add to core clause 91.1, at the second main bullet point, fourth sub-bullet point, after the words "against it":**

Z10.1 or had a business rescue order granted against it.

**Z11 Ethics**

For the purposes of this Z-clause, the following definitions apply:

**Affected Party** means, as the context requires, any party, irrespective of whether it is the *Contractor* or a third party, such party's employees, agents, or Subcontractors or Subcontractor's employees, or any one or more of all of these parties' relatives or friends,

**Coercive Action** means to harm or threaten to harm, directly or indirectly, an Affected Party or the property of an Affected Party, or to otherwise influence or attempt to influence an Affected Party to act unlawfully or illegally,

**Collusive Action** means where two or more parties co-operate to achieve an unlawful or illegal purpose, including to influence an Affected Party to act unlawfully or illegally,

**Committing Party** means, as the context requires, the *Contractor*, or any member thereof in the case of a joint venture, or its employees, agents, or Subcontractors or the Subcontractor's employees,

**Corrupt Action** means the offering, giving, taking, or soliciting, directly or indirectly, of a good or service to unlawfully or illegally influence the actions of an Affected Party,

**Fraudulent Action** means any unlawfully or illegally intentional act or omission that misleads, or attempts to mislead, an Affected Party, in order to obtain a financial or other benefit or to avoid an obligation or incurring an obligation,

**Obstructive Action** means a Committing Party unlawfully or illegally destroying, falsifying, altering or concealing information or making false statements to materially impede an investigation into allegations of Prohibited Action, and

**Prohibited Action** means any one or more of a Coercive Action, Collusive Action Corrupt Action, Fraudulent Action or Obstructive Action.

Z11.1 A Committing Party may not take any Prohibited Action during the course of the procurement

of this contract or in execution thereof.

- Z11.2 The *Employer* may terminate the *Contractor's* obligation to Provide the Services if a Committing Party has taken such Prohibited Action and the *Contractor* did not take timely and appropriate action to prevent or remedy the situation, without limiting any other rights or remedies the *Employer* has. It is not required that the Committing Party had to have been found guilty, in court or in any other similar process, of such Prohibited Action before the *Employer* can terminate the *Contractor's* obligation to Provide the Services for this reason.
- Z11.3 If the *Employer* terminates the *Contractor's* obligation to Provide the Services for this reason, the amounts due on termination are those intended in core clauses 92.1 and 92.2.
- Z11.4 A Committing Party co-operates fully with any investigation pursuant to alleged Prohibited Action. Where the *Employer* does not have a contractual bond with the Committing Party, the *Contractor* ensures that the Committing Party co-operates fully with an investigation.

**Z12 Insurance**

**Z 12 .1 Replace core clause 83 with the following:**

**Insurance cover 83**

- 83.1 When requested by a Party, the other Party provides certificates from his insurer or broker stating that the insurances required by this contract are in force.
- 83.2 The *Contractor* provides the insurances stated in the Insurance Table A from the *starting date* until the earlier of Completion and the date of the termination certificate.

**INSURANCE TABLE A**

<b>Insurance against</b>	<b>Minimum amount of cover or minimum limit of indemnity</b>
Loss of or damage caused by the <i>Contractor</i> to the <i>Employer's</i> property	The replacement cost where not covered by the <i>Employer's</i> insurance.  The <i>Employer's</i> policy deductible as at Contract Date, where covered by the <i>Employer's</i> insurance.
Loss of or damage to Plant and Materials	The replacement cost where not covered by the <i>Employer's</i> insurance.  The <i>Employer's</i> policy deductible as at Contract Date, where covered by the <i>Employer's</i> insurance.
Loss of or damage to Equipment	The replacement cost where not covered by the <i>Employer's</i> insurance.  The <i>Employer's</i> policy deductible as at Contract Date, where covered by the <i>Employer's</i> insurance.
The <i>Contractor's</i> liability for loss of or damage to property (except the <i>Employer's</i> property, Plant and Materials and Equipment) and liability for bodily injury to or death of a person (not an employee of the	<b><u>Loss of or damage to property</u></b> The replacement cost  <b><u>Bodily injury to or death of a person</u></b> The amount required by the applicable law.

<i>Contractor</i> ) arising from or in connection with the <i>Contractor's</i> Providing the Service	
Liability for death of or bodily injury to employees of the <i>Contractor</i> arising out of and in the course of their employment in connection with this contract	The amount required by the applicable law

**Z 12.2 Replace core clause 86 with the following:**

**Insurance by the Employer** 86

86.1 The *Employer* provides the insurances stated in the Insurance Table B

**INSURANCE TABLE B**

<b>Insurance against or name of policy</b>	<b>Minimum amount of cover or minimum limit of indemnity</b>
Assets All Risk	Per the insurance policy document
Contract Works insurance	Per the insurance policy document
Environmental Liability	Per the insurance policy document
General and Public Liability	Per the insurance policy document
Transportation (Marine)	Per the insurance policy document
Motor Fleet and Mobile Plant	Per the insurance policy document
Terrorism	Per the insurance policy document
Cyber Liability	Per the insurance policy document
Nuclear Material Damage and Business Interruption	Per the insurance policy document
Nuclear Material Damage Terrorism	Per the insurance policy document

**Z13 Nuclear Liability**

Z13.1 The *Employer* is the operator of the Koeberg Nuclear Power Station (KNPS), a nuclear installation, as designated by the National Nuclear Regulator of the Republic of South Africa, and is the holder of a nuclear licence in respect of the KNPS.

Z13.2 The *Employer* is solely responsible for and indemnifies the *Contractor* or any other person against any and all liabilities which the *Contractor* or any person may incur arising out of or resulting from nuclear damage, as defined in Act 44 of 1999, save to the extent that any liabilities are incurred

due to the unlawful intent of the *Contractor* or any other person or the presence of the *Contractor* or that person or any property of the *Contractor* or such person at or in the KNPS or on the KNPS site, without the permission of the *Employer* or of a person acting on behalf of the *Employer*.

Z13.3 Subject to clause Z13.4 below, the *Employer* waives all rights of recourse, arising from the aforesaid, save to the extent that any claims arise or liability is incurred due or attributable to the unlawful intent of the *Contractor* or any other person, or the presence of the *Contractor* or that person or any property of the *Contractor* or such person at or in the KNPS or on the KNPS site, without the permission of the *Employer* or of a person acting on behalf of the *Employer*.

Z13.4 The *Employer* does not waive its rights provided for in section 30 (7) of Act 44 of 1999, or any replacement section dealing with the same subject matter.

Z13.5 The protection afforded by the provisions hereof shall be in effect until the KNPS is decommissioned.

## Z14 Asbestos

For the purposes of this Z-clause, the following definitions apply:

<b>AAIA</b>	means approved asbestos inspection authority.
<b>ACM</b>	means asbestos containing materials.
<b>AL</b>	means action level, i.e. a level of 50% of the OEL, i.e. 0.1 regulated asbestos fibres per ml of air measured over a 4 hour period. The value at which proactive actions is required in order to control asbestos exposure to prevent exceeding the OEL.
<b>Ambient Air</b>	means breathable air in area of work with specific reference to breathing zone, which is defined to be a virtual area within a radius of approximately 30cm from the nose inlet.
<b>Compliance Monitoring</b>	means compliance sampling used to assess whether or not the personal exposure of workers to regulated asbestos fibres is in compliance with the Standard's requirements for safe processing, handling, storing, disposal and phase-out of asbestos and asbestos containing material, equipment and articles.
<b>OEL</b>	means occupational exposure limit.
<b>Parallel Measurements</b>	means measurements performed in parallel, yet separately, to existing measurements to verify validity of results.
<b>Safe Levels</b>	means airborne asbestos exposure levels conforming to the Standard's requirements for safe processing, handling, storing, disposal and phase-out of asbestos and asbestos containing material, equipment and articles.
<b>Standard</b>	means the <i>Employer's</i> Asbestos Standard 32-303: Requirements for Safe Processing, Handling, Storing, Disposal and Phase-out of Asbestos and Asbestos Containing Material, Equipment and Articles.
<b>SANAS</b>	means the South African National Accreditation System.
<b>TWA</b>	means the average exposure, within a given workplace, to airborne asbestos fibres, normalised to the baseline of a 4 hour continuous period, also applicable to short term exposures, i.e. 10-minute TWA.

Z14.1 The *Employer* ensures that the Ambient Air in the area where the *Contractor* will Provide the Services conforms to the acceptable prescribed South African standard for asbestos, as per the regulations published in GNR 155 of 10 February 2002, under the Occupational Health and Safety Act, 1993 (Act 85 of 1993) ("Asbestos Regulations"). The OEL for asbestos is 0.2 regulated

asbestos fibres per millilitre of air as a 4-hour TWA, averaged over any continuous period of four hours, and the short term exposure limit of 0.6 regulated asbestos fibres per millilitre of air as a 10-minute TWA, averaged over any 10 minutes, measured in accordance with HSG248 and monitored according to HSG173 and OESSM.

- Z14.2 Upon written request by the *Contractor*, the *Employer* certifies that these conditions prevail. All measurements and reporting are effected by an independent, competent, and certified occupational hygiene inspection body, i.e. a SANAS accredited and Department of Employment and Labour approved AAIA. The *Contractor* may perform Parallel Measurements and related control measures at the *Contractor's* expense. For the purposes of compliance the results generated from Parallel Measurements are evaluated only against South African statutory limits as detailed in clause Z14.1. Control measures conform to the requirements stipulated in the AAIA-approved asbestos work plan.
- Z14.3 The *Employer* manages asbestos and ACM according to the Standard.
- Z14.4 In the event that any asbestos is identified while Providing the Services, a risk assessment is conducted and if so required, with reference to possible exposure to an airborne concentration of above the AL for asbestos, immediate control measures are implemented and relevant air monitoring conducted in order to declare the area safe.
- Z14.5 The *Contractor's* personnel are entitled to stop working and leave the contaminated area forthwith until such time that the area of concern is declared safe by either Compliance Monitoring or an AAIA approved control measure intervention, for example, per the emergency asbestos work plan, if applicable.
- Z14.6 The *Contractor* continues to Provide the Services, without additional control measures presented, on presentation of Safe Levels. The contractually agreed dates to Provide the Services, including the Completion Date, are adjusted accordingly. The contractually agreed dates are extended by the notification periods required by regulations 3 and 21 of the Asbestos Regulations, 2001.
- Z14.7 Any removal and disposal of asbestos, asbestos containing materials and waste, is done by a registered asbestos contractor, instructed by the *Employer* at the *Employer's* expense, and conducted in line with South African legislation.

## C1.2 Contract Data

### Part two - Data provided by the *Contractor*

Clause	Statement	Data
10.1	The <i>Contractor</i> is (Name): Address Tel No. Fax No.	
11.2(8)	The <i>direct fee percentage</i> is The <i>subcontracted fee percentage</i> is	% %
11.2(14)	The following matters will be included in the Risk Register	
11.2(15)	The Service Information for the <i>Contractor's</i> plan is in:	
21.1	The plan identified in the Contract Data is contained in:	
24.1	The key people are: 1 Name: Job: Responsibilities: Qualifications: Experience: 2 Name: Job: Responsibilities: Qualifications: Experience:	
		CV's (and further key person's data including CVs) are in _____ .
<b>A</b>	<b>Priced contract with price list</b>	
11.2(12)	The <i>price list</i> is in	<b>Price list Activities (attached)</b>
11.2(19)	The tendered total of the Prices is	<b>Rates contract</b>

## PART 2: PRICING DATA

### TSC3 Option A

<b>Document reference</b>	<b>Title</b>	<b>No of pages</b>
C2.1	Pricing assumptions: Option A	2
C2.2	The <i>price list</i>	3

## C2.1 Pricing assumptions: Option A

### 1. How work is priced and assessed for payment

Clause 11 in NEC3 Term Service Contract (TSC3) core clauses and Option A states:

<b>Identified and defined terms</b>	11	
	11.2	(12) The Price List is the <i>price list</i> unless later changed in accordance with this contract.
		(17) The Price for Services Provided to Date is the total of
		<ul style="list-style-type: none"><li>• the Price for each lump sum item in the Price List which the <i>Contractor</i> has completed and</li><li>• where a quantity is stated for an item in the Price List, an amount calculated by multiplying the quantity which the <i>Contractor</i> has completed by the rate.</li></ul>
		(19) The Prices are the amounts stated in the Price column of the Price List. Where a quantity is stated for an item in the Price List, the Price is calculated by multiplying the quantity by the rate.

This confirms that Option A is a priced contract where the Prices are derived from a list of items of service which can be priced as lump sums or as expected quantities of service multiplied by a rate or a mix of both.

### 2. Function of the Price List

Clause 54.1 in Option A states: "Information in the Price List is not Service Information". This confirms that instructions to do work or how it is to be done are not included in the Price List but in the Service Information. This is further confirmed by Clause 20.1 which states, "The *Contractor* Provides the Service in accordance with the Service Information". Hence the *Contractor* does **not** Provide the Service in accordance with the Price List. The Price List is only a pricing document.

### 3. Link to the *Contractor's* plan

Clause 21.4 states "The *Contractor* provides information which shows how each item description on the Price List relates to the operations on each plan which he submits for acceptance". Hence when compiling the *price list*, the tendering contractor needs to develop his first clause 21.2 plan in such a way that operations shown on it can be priced in the *price list* and result in a satisfactory cash flow in terms of clause 11.2(17).

### 4. Preparing the *price list*

Before preparing the *price list*, both the *Employer* and tendering contractors should read the TSC3 Guidance Notes pages 14 and 15. In an Option A contract, either Party may have entered items into the *price list* either as a process of offer and acceptance (tendering) or by negotiation depending on the nature of the *service* to be provided. Alternatively the *Employer*, in his Instructions to Tenderers or in a Tender Schedule, may have listed some items that he requires the *Contractor* to include in the *price list* to be prepared and priced by him.

It is assumed that in preparing or finalising the *price list* the *Contractor*:

- Has taken account of the guidance given in the TSC3 Guidance Notes relevant to Option A;
- Understands the function of the Price List and how work is priced and paid for;
- Is aware of the need to link operations shown in his plan to items shown in the Price List;
- Has listed and priced items in the *price list* which are inclusive of everything necessary and incidental to Providing the Service in accordance with the Service Information, as it was at the time of tender, as well as correct any Defects not caused by an *Employer's* risk;
- Has priced work he decides not to show as a separate item within the Prices or rates of other listed items in order to fulfil the obligation to complete the *service* for the tendered total of the Prices.
- Understands there is no adjustment to items priced as lump sums if the amount, or quantity, of work within that item later turns out to be different to that which the *Contractor* estimated at time of tender. The only basis for a change to the (lump sum) Prices is as a result of a compensation event.

#### **4.1. Format of the *price list***

(From the example given in an Appendix within the TSC3 Guidance Notes)

Entries in the first four columns in the *price list* in section C2.2 are made either by the *Employer* or the tendering contractor.

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 tendering contractor enters the amount in the Price column only, the Unit, Expected Quantity and Rate columns being left blank.

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

If the *Contractor* is to be paid a Price for an item proportional to the length of time for which a service is provided, a unit of time is stated in the Unit column and the expected length of time (as a quantity of the stated units of time) is stated in the Expected Quantity column.

## C2.2 the *price list*

The *Works* is subject to the following:

- A request for services/works will be given to the Consultant by the Employer, in its total discretion and on an 'as and when needed' basis, in the form of a Task Order/Instruction. Signatories of both parties on the Task Order/Instruction are required prior to any obligation being created for commencement of or payment for services/works.
- The Consultant should not commence with any services/works regarding any Task Order/Instruction without receiving the purchase order number (45# number) from the contract custodian.
- A Task Order/Instruction is an order/instruction by the Employer to perform services/works as nominated by the Employer from the skills and services/works category, in terms of the above Price List, for which the Consultant has been found by the Employer, in its total discretion, to have the relevant and present competency and capacity and no serious misconducts by key persons of the Consultant, alleged or otherwise."
- This contract is the only contract which can be used to request the services/works deemed to be survey services/works."
- The project duration is 36 months period. The rates will be Fixed and Firm in the First Year and thereafter the rates will be re-viewed based on market conditions
- Transportation costs will be adjusted either up or down on a six monthly basis based on the Market Price for Fuel.
- Services – refers to Employer's requirements and the Task Instruction. A signatory of both parties on the Task Instruction is required prior to any work being commenced

**CONSULTANT:**

.....  
PRINT NAME

.....  
SIGNATURE

.....  
DATE

**NB: For information purpose do not price, rates will be shared with successful tenders.**

<b>Cape Coastal Cluster Powerline Engineering Survey</b>					
<b>ITEM</b>	<b>DESCRIPTION</b>	<b>UNIT</b>	<b>Area A</b>	<b>Area B</b>	<b>Area C</b>
1.0	<b><u>HIGH VOLTAGE LINE SURVEYS</u></b>				
1.1	Route selection & fixing	km			
1.2	Obtaining signed option agreements	each			
1.3	Profiling + ASCII files	km			
1.4	Optimizing + spanning sheets	km			
1.5	Bill of Structures (.xls format)	km			
1.6	Pegging	km			
2.0	<b><u>MEDIUM &amp; LOW VOLTAGE LINE SURVEYS</u></b>				
2.1	Route selection & fixing	km			
2.2	Signed wayleave / Distr. Enviro. screening document & Consent	each			
2.3	Profiling + ASCII files	km			
2.4	Optimizing + spanning sheets	km			
2.5	Update of as pegged plan	km			
2.6	Pegging	km			
2.7	Pegging of MV/LV structure & stay positions , checking clearances & generation of as pegged drawings	each			
3.0	<b><u>TOPOGRAPHICAL SURVEYS</u></b>				
3.1	Site identification & selection	each			
3.2	Obtaining of signed Option	each			
3.3	Topographical survey , control & generation of ASCII files	ha			
3.4	Generation of contour plans & .dxf file	ha			
3.5	Placing of site boundary pegs , X & Y axis and bench mark	each / peg			
4.0	<b><u>MISCELLANEOUS CHARGES</u></b>		<b>All areas</b>		
4.10	Crossing profiles of services- (excluding Telkom)	each			
4.20	Statutory approvals (Telkom , Roads etc excluding spoornet)	each			
4.30	Mapping of Stands per dwelling	each			
4.40	Surveying of additional houses using a GPS ( Electrification )	hour			
4.50	Labour (per surveyor) Registered Surveyor*	each			
4.60	Labour (per assistant)	hour			
4.70	Travelling time surveyor & assistant/s	hour			
4.80	Transport cost (Office to site & return , base to site & return daily)	km			
4.90	Accommodation cost per surveyor per night	night			
4.10	Accommodation cost per surveyor and assistant/s per night	night			
5.0	Penalty at 2.5 % of the Invoice amount	day			

**Registered = As Surveyor/Technologist with  
SAGC**

**Area A : Open grassland with very limited bush , limited settlement.  
Area B : Undulating terrain , grassland with scattered bush , medium settlement.  
Area C : Rugged terrain, dense bushy areas , dense settlement.**

**For MV and LV surveys the minimum distance will be calculated at 500m  
No wayleave / DESD / Consent Document required for < 100m in built environments  
Obtain a wayleave if a pole / stay or transformer is erected within a fenced off area in  
close proximity to a dwelling  
Actual travelling time to be claimed.**

**NB: For information purpose do not price, rates will be shared with successful tenders.**

## PART 3: SCOPE OF WORK

<b>Document reference</b>	<b>Title</b>	<b>No of pages</b>
	This cover page	1
C3.1	<i>Employer's Scope</i>	
C3.2	<i>Consultant's Scope</i>	
	Total number of pages	

## **C3.1: EMPLOYER'S SCOPE**

## 1 Description of the *services*

### 1.1 Executive overview

To ensure Engineering Survey Service for Eskom Distribution in the **Cape Coastal Cluster** for a period of 3 years.

### 1.2 Interpretation and terminology

The following abbreviations are used in this Scope:

Abbreviation	Meaning given to the abbreviation
ECSA	Engineering Council of South Africa
SACPCMP	South African Council for Project and Construction Management Professionals
PLATO	South African Council for Professional and Technical Surveyors
ECOU	Eastern Cape Operating Unit
WCOU	Western Cape Operating Unit

## 2 Specification and description of the services

- Only natural persons who are Professional Surveyors or Surveyors that are approved by the South African Council for Professional and Technical Surveyors will be appointed for any survey task in this contract.
- All project to be given via “task order”, Surveyor to commit on deliverables and dates.
- All survey work undertaken must comply with the ECOU and WCOU standards and specifications.
- The minimum required equipment’s are: 1xRTK GPS, 1x Handheld GPS, 1x Total station, 1x bakkie. and the relevant survey software’s.
- Eskom reserve the right to conduct performance appraisals to all survey contractors whenever the need arises.
- The surveyors may not claim for pegging any lines if they are not pegged as yet.
- This Scope can be overwritten by any technical communication sent out by the representative of the Employer agent at any point during the contract.
- Contractors will be subjected to comply with section 37-2 agreement (Occupation health and safety).
- Cadastral: It is the survey consultant’s responsibility to find out cadastral data of the place that they are working on. The cadastral data should be part of the survey package
- **Each contractor must have an Office in the Eastern Cape or Western Cape:**
- **Time travelled will only be claimed from relevant Office/Base to site and back to the Office/Base on completion of project.**
- **Project business travel kilometres will be claimed based on the submission of the logbook (daily records on the fixed rates).**

## 2.1 Stage 1 Preparation

- 1 **Power line:** means an overhead line of whatever voltage, erected for the conducting of electricity.
- 2 **Tree and building restriction:** means the horizontal distance measured perpendicularly from the centre line (on either side) within which no trees and buildings may encroach. Note that: use of the centre line, which is a visible physical feature to define the width of the building and tree restrictions in servitude and Wayleave agreements, has been made here. The types of supporting structures and method of constructing Eskom power lines render the physical definition of the centre line of a power line easily recognisable
- 3 **Separation distance:** means the horizontal distance between centre lines measured perpendicularly between any two power lines running parallel to each other. Due to the fact that a number of variables (such as the worst case weather conditions which are likely to be encountered) have to be considered, guidelines for distances only can be laid down. The present ruling in Eskom is that when two lines of dissimilar voltages are running parallel, the separation distance is determined by the separation requirements of the higher voltage line
- 4 **Clearance:** means the radial distance from any electrical power distribution or transmission conductor and other wires of power lines to other manmade or natural features. The Occupational Health and Safety Act 85 of 1993 and its regulations lay down the minimum clearances of electric conductors and other wires of power lines away from buildings and other structures. Non-compliance with the Act is non-negotiable.
- 5 **Right / Wayleave:** means the right to traverse or occupy land and includes inter alia servitudes, surface right permits, wayleaves, exercised options, licences and permissions to occupy. These are sometimes described as Rights-of-Way
- 6 **Consent agreement:** means an unregistered personal contract conferring electric power transmission rights to Eskom, which is generally regarded as being binding on successors in the title who have knowledge of the right.
- 7 **Servitude:** means a parcel of electric power transmission rights granted to Eskom over the immovable property of another and registered or to be registered against the title deed of the land in question and usually involves the payment of compensation.

Eskom's minor power lines, which are rural and urban reticulation lines, are covered by wayleave/Consent agreements. These are not secured by registration in the Deeds Office. Eskom's security relies largely on the fact that power supplies are or can be made available from these lines. No compensation is paid for these rights because their presence is generally regarded as being an advantage to the property.

## 2.2 Stage 2 Concept

### 2.2.1 Clearances and Restrictions

#### Introduction

The question of the width of Eskom's power line servitudes over privately owned land is a very sensitive issue and has both legal as well as emotional connotations attached to it. This is even more so in areas with high land values or where there are buildings in close proximity to the selected route; the latter being the critical areas. The final decision taken on the width of the servitude will ultimately determine how effectively Eskom can exercise its rights over the property in its effort to supply affordable electrical power whilst maintaining good relations with property owners, and taking all safe clearance Regulations and other risks into account.

This information is intended to be used as a guideline for the determination of separation distances between parallel power lines, tree and building restriction distances of various voltages of power lines, as well as the height clearance of various voltages of power lines over man-made and natural objects.

The Electrical Machinery Regulations, promulgated under Section 43 of the Occupational Health and Safety Act 85 of 1993, specifies statutory clearances.

Regulation 15(1) published in Government Gazette No 11458 of 12 August 1988 includes the following: "The electric conductors and other wires" as set out in aforementioned regulation are not stationary and hang in catenary curves which vary by a considerable amount depending on a number of factors."

Factors such as wind pressure and ambient - and conductor temperature are some.

Eskom's separation, tree and building restriction distances, as currently interpreted, are constant along the longitudinal length of the power line. These constant horizontal distances must therefore take into account of the worst case conditions, thus at the lowest sag point and swinging out of the conductor. The width of the servitude could thus limit the length of the spans. This is an important factor to remember in urban areas where the potential of development is higher.

In many of the older servitudes the building restriction is referred to as a distance from the outside conductors of the power line. In most cases the figure of 30 feet was used as the distance from the outside conductor. The majority of the above servitudes refer to 88kV and lower voltage power lines, the figure of 11 metres can be used to describe the building restriction from the centre line in these cases. The outside conductor was usually less than 1,86 metres (6,1 feet) from the centre phase on these types of structure [9,14m + 1,86m = 11,00m]. This being true without taking swing into consideration.

#### Overhead Lines

The question of servitude widths, tree and building restriction distances has been central to long discussions and studies. Problems often arise due to stay positions of the angle strain structure at the bends falling outside the restriction area, commonly referred to as the "servitude area" in the Deed of servitude as well as the options to acquire rights.

It is apparent from the discussions that the tree and building restriction distance and parallel line separation distance should be determined for each individual project. Based on theoretical and practical principles, the servitude width is a function of the following:

- A = Horizontal conductor spacing at the structure (Generically a family of structures, e.g. self-supporting monopoles, having roughly the same horizontal spacing between conductors for all types of structures; the standoff insulators are 1.2m long and the strain cross arms about the same.
- B = Conductor swing at 500Pa wind (Insulator length and sag must be considered)
- C = OHS Act Clearance to buildings, as a minimum, or Eskom requirements which might be more than the OHS Act regulations.

Therefore, required servitude width =  $A + 2 \times (B+C)$

This approach has been used very successfully in high-cost or critical areas (e.g. buildings close to a proposed servitude). A good example is where the land value is very high, through Stellenbosch vineyards, in that project, R700 000 in servitude costs was saved by acquiring a narrower strip of land. On this project single wood pole compact design was used. Technically, the compact monopole 132kV lines can be accommodated on smaller servitude than 31.0m, cognisance must just be take that the stay wires will fall outside the "servitude area".

We can summarize the above by saying that one could have a scenario where your line servitude width changes depending on span length and cost of land. This means that it will depend on the span and the

basic structure width (i.e. the horizontal conductor separation) as that defines the servitude width, the other two (conductor and swing out span) being constant for a particular line. One could have shorter spans for narrower servitude width and balance the cost of more structures against the cost of the servitude cost saved. It may be cost effective to use more compact or varied structures through areas with high land values.

The problem of stays extending beyond the servitude area can be eliminated, and should be negotiated and agreed upon with the landowner. From the Notarial Deeds of Servitudes as well as the Option documents it could be interpreted that Eskom's rights are limited to activity **within** the servitude area except when it comes to the right of entry, egress and the right to use existing roads. This is true since a servitude provides only a limited rights, which is also another reason why it is necessary to frame a servitude diagram in order to indicate the extent of these rights over the property concerned.

The normal clause in a deed for the rights acquired **used to** read as follows:

The servitude/each of the servitudes shall include the following -

the right to erect such structures and works on the property or to erect or lead such conductors or appliances or other equipment on or over the property as may be necessary or convenient in exercising the right of servitude;

the right to enter and be upon the property at any time in order to construct, erect, operate, use, maintain, repair, re-erect, alter or inspect the structures, works, appliances, conductors or cables on the property or in order to gain access to any adjacent property in the exercise of similar rights;

the right to use existing roads giving access to the property or roads running across the property and gates on the property and to erect in any fence such gates as may be necessary or convenient to gain access to or egress from the property and to gain access to any power line or accessory equipment;

the right to remove any trees, bush, material, grass or structures within the restricted area defined in clause 3 hereof and the right to cut or trim any tree in order to comply with the restrictions referred to in clause 3 hereof;

the right to utilise various conductors, installations and apparatus in the servitude area for radio-/microwave and telecommunication and other related purposes.

every ancillary right necessary or convenient for the proper exercise of the servitude to convey electricity across the property”.

None of the above specifically mentions ‘supporting mechanisms’, that is, stays. Sub-clauses 1.1 and 1.6 above come close to solving the problem but they could be interpreted to limit those rights within the servitude area only. It is for that reason that the standard clause 1.1 was changed in July 2002 to read as follows:

the right to erect such structures and works on the property or to erect or lead such conductors, cables or appliances or other equipment on or over the property as may be necessary or convenient in exercising the right of servitude; and **the right to erect such supporting mechanisms for structures and works with the possibility that it may reasonably extend beyond the servitude area as may be necessary or convenient to safely secure the structures or works.**

The above, will eliminate the problem of stays falling outside the servitude area. The need to register a servitude at the strain points for, say, a circle with a radius of 20m from the centre peg at the bends, will also not be necessary. This clause can be justified to the landowner by the fact that Eskom pays for 100% of the land and even 10% solatium (tranegeld) as compensation for the servitude rights and does allow the landowner to co-use the servitude within certain limits. Should it be evident that stays falling outside the servitude area would adversely affect the property, an increase in compensation could be considered during the servitude acquisition phase and widths adjusted accordingly.

Over and above the rights mentioned above, the following restrictions are placed on the owner:

Extract from the official document.

*With regard to the owner the following special restrictions are placed on the use of the property/ properties namely -*

*No building or structure may be erected or installed above or below the surface of the ground within ..... metres of the centre line of any power line or within ... metres from any structure supporting mechanism.*

*No tree shall be planted within the servitude area nor be allowed to grow to a height in excess of the horizontal distance of that tree from the nearest conductor of any power line or to grow in such a manner as to endanger that line should it fall or be cut down.*

*No material which may in the opinion of Eskom endanger the safety of any power line shall be placed within ..... metres of the centre line of any power line.*

*No mining activities or blasting operations shall be carried out within 500 metres of the centre line of any power line, without the prior written permission of Eskom”.*

*All the above distances must be determined prior to servitude acquisition phase.*

### **2.2.2 Building restrictions**

As illustrated in the foregoing discussion on overhead lines, the following applies:

- For a number of reasons, one of which is that the clearance distance to a building in mid-span of power line would be different to the distance near a support structure due to conductor swing, Eskom has laid down servitude widths in excess of the minimum clearances stipulated by the OHS Act.
- These building restrictions are constant throughout the length of power line of a particular voltage - conductor size, type of construction and route permitting. These may be reduced in accordance with the above where land values are very high.

Current practice within Eskom is that each Province/Operating Unit has its own standard building restrictions, which are applicable throughout that region. The guidelines given below are generally being used by the majority of the provinces with the others not differing more than 1 – 2 metres.

Table 1 on the next page gives the building line restriction distances as proposed as a norm and be used. It is intended to lay down standard building restrictions that will be applicable to all Distribution Regions in Eskom. The building restriction distances given below are perpendicular from the centreline of the power line to the edge of the building restriction on one side of the power line. In order to obtain the total building restriction of a single power line the figures should thus be multiplied by two.

### **2.2.3 Separation distances**

Separation distances between power lines that run parallel are necessary in order to avoid excessive induction. The separation distance between two parallel lines is measured perpendicularly from the centre of the one line to the centre of the other line. Rule of thumb separation distances for different operating voltages are also shown in Table 1.

Note that lines running parallel for long distances might require an increased separation distance; this separation distance must be determined by an electrical systems specialist. The separation distances given in the table below can thus not always be used. Induction issues can also be addressed through proper earthing.

The table serves as a guide for separation distances, as previously mentioned, other factors have to be taken into consideration, i.e. length of parallel distance, phase configuration, fault levels and maintenance practices. The final separation distance has to be determined before the negotiation phase.

Note also the ruling that when two lines of dissimilar voltages are running parallel, is that the separation distance is defined by the requirement of the higher voltage of the two.

### 2.3 Stage 3: Design development

- **Table 1 – Guidelines for different voltages and requirements used by Eskom Distribution & Transmission**

Voltage	Building restriction on each side of centre line	Separation distance between parallel lines (Guide only)
1) All voltages below 22kV	9 metres	12 metres
2) 22kV	9 metres	12 metres
3) 33kV	11 metres	14 metres
4) 44kV	11 metres	14 metres
5) 66kV	11 metres	14 metres
6) 88kV	11 metres	14 to 15 metres
7) 132kV and Delta construction 275kV	18 metres (15.5 - 20)	15 metres (21 - 24)
8) 220kV	23.5 metres (19.5 - 21.0)	32 metres (25m)
9) 275kV (Horizontal)	23.5 metres	32 metres
10) 400kV	27.5 metres (Stayed) (23.5 m Self-supporting)	35 metres
11) 765kV	40 metres	46 metres

*Note:* The information above is quoted from the *Rights of Way Manual (Module 15979)* and the information in brackets, where the two are different and inconsistent, is quoted from *the Land Survey Manual*. The information in brackets serves as information on historical practices. The building restrictions also depend on the height of poles used other than the default, the taller the poles the more the separation distance required.

Further - It is strongly advised that the restriction distances for a particular voltage line should not be assumed to be as given above but that the question be discussed prior to commencing with route planning. Furthermore, in the context of this document, the following classification applies to the operating voltages shown in Table 1 above:

- 1) – 3) are classified as Reticulation Lines (LV / MV),
- 4) – 7) are classified as Distribution Lines (or Sub-transmission Lines, HV) , and
- 8) – 11) are classified as Transmission Lines (HV).

#### 2.3.1 Caution on line separation distance

The separation distance between parallel lines for 132kV of 15m will not be a problem when two monopole 132kv lines run parallel to each other but could become a problem when a monopole 132kv line runs parallel to a 132kv line supported by lattice structures.

Therefore it should be considered that the 15m separation distance should only apply to monopole type construction lines running parallel to each other and dependant on span lengths and swing.

When it comes to monopoles running adjacent to lattice type structures it should be remembered that each lattice line has its own variables and therefore each line should be looked at individually so that these variables can be determined before deciding on the separation distance when a proposed monopole line is planned adjacent to a lattice line. (Or the past separation distance of 21m should still apply). These variables being the following:

1. The cross-arm length of the lattice suspension structure.
2. The insulator length
3. The type of conductor, conductor thickness and mass
4. The longest span between two structures
5. The maximum sag

The last four variables will have a major impact on the perpendicular distance that the conductor will swing out under heavy wind conditions.

The formula to calculate the separation distance would be as follows:

$$\text{Line Separation} = L + S1 + M + C + S2$$

Where:

L = Horizontal distance from Centre line of pole to insulator attachment point.

S1 = Blow out distance of conductor from monopole stand off insulator

M = Minimum safety distance as per the OHS Act

C = Length from centre of structure to insulator

S2 = Blow out distance of insulator and conductor from lattice structure

- 
- Details on calculations for all structures covered under “swing” in this manual.
- Stay arrangements must also be taken into consideration.
- It is also advisable, to space structures on parallel lines perpendicularly aligned.
- **Statutory Line safety clearances**
- **The Occupational Health and Safety Act 85 of 1993**
- The Occupational Health and Safety Act 85 of 1993 (the OHS Act), as mentioned previously, provides for **statutory clearances** – see Schedule for details. Eskom and a number of other authorities (Roads Department, Transnet Telkom, etc.) have laid down minimum clearances to their works, which are in excess of those required by the OHS Act. In addition Eskom has an agreement with Telkom to increase clearances between power lines and the Telkom telephone lines due to induction caused on telecommunication lines – see “*Clearances as per agreement with Telkom*”.

### 2.3.2 Crossings

Where a power line crosses a proclaimed road, railway or tramway or a communication line proclaimed by Telkom, the supplier or user shall cause the clearance to comply with the requirements or [regulation 15](#) and shall further cause -

every structure supporting a crossing span to be designed in such a manner that it will be able to withstand the loads that may be imposed upon it should a breakage of any phase conductor or earth conductor occur;  
every structure supporting a crossing span, as far as is reasonably practicable, to be located so that it will not touch the service crossed, should it overturn;

subject to the restrictions in paragraph (1.2), one of the structures supporting a crossing span to be located as close to the point of crossing as is reasonably practicable;

the clearance of the crossing span where it crosses a proclaimed road to be not less than 4.5 m in the case of a broken phase conductor in a span other than the crossing span;

armour rods or arching horns to be fitted at the live ends of suspension and rigid insulators on at least the first three structures on each side of the crossing if the maximum [voltage](#) for which the power line is designed exceeds 1.1 kV r.m.s.; alternatively, duplicate conductors, tied together at intervals of not more than 1.5 m shall be provided in the crossing span and shall be supported by duplicate parallel insulators, and for lines on rigid insulators the duplicate conductors shall extend at least 1.5 m beyond the supports on each side of the crossing span;

the deviation from a right angle crossing over a communication line of the Department communications, Transnet or the Dept. of Transport to be not greater than 30 degrees for lines with a voltage of 48 kV r.m.s. and above, and not greater than 45 degrees for lines below 48 kV r.m.s.; and  
the clearance at (1.6) above to comply with the requirements of regulation 15 and with paragraphs (1.2) and (1.3) of this subregulation in cases where a power line crosses another power line:

Provided that the chief inspector may approve any deviation of these requirements as specified in this sub regulation subject to such conditions as he may determine.

The [supplier](#) or user shall cause every overhead service connection which crosses over bare communication lines of the Department of communications to have minimum clearances between the overhead service connection and the communication lines at the points of crossing of 1.8 m and the overhead service connection shall not cross below bare communication lines.

**2.4 Stage 4: Production information**

**2.4.1 Electrical Machinery Regulations, 1988  
 Regulation 15. Clearances of power lines**

The [supplier](#) or user shall cause -

The minimum clearances of electric conductors and other wires of power lines, excluding [overhead service connections](#) and line conductors having a [voltage](#) not exceeding 1.1 kV r.m.s. consisting of [insulated](#) wire of a type which complies with a safety standard incorporated for this purpose in these regulations under [section 36](#) of the Act, to be not less than the clearances indicated in the following table:

Max voltage for which insulation is designed kV r.m.s phase to phase cradles.	Minimum safety clearance	Minimum clearance in metres				
		Above ground outside townships	Above ground in townships	Above roads, railways, tramways	To communication lines, power lines,	To buildings & structures not part of power lines.
1.1 or less	-	4.9	5.5	6.1	0.6	3.0
7.2	0.15	5.0	5.5	6.2	0.7	3.0
12	0.20	5.1	5.5	6.3	0.8	3.0
24	0.32	5.2	5.5	6.4	0.9	3.0
36	0.43	5.3	5.5	6.5	1.0	3.0
48	0.54	5.4	5.5	6.6	1.1	3.0
72	0.77	5.7	5.7	6.9	1.4	3.2
100	1.00	5.9	5.9	7.1	1.6	3.4
145	1.45	6.3	6.3	7.5	2.0	3.8
245	1.85	6.7	6.7	7.9	2.4	4.2
300	2.35	7.2	7.2	8.4	2.9	4.7
362	2.90	7.8	7.8	9.0	3.5	5.3
420	3.20	8.1	8.1	9.3	3.8	5.6
800	5.50	10.4	10.4	11.6	6.1	8.5
533 kV d.c.*	3.70	8.6	8.6	9.8	4.3	6.1

\* Maximum voltage to earth for which insulation is designed.

Provided that these figures are base on the assumption that clearances shall be determined for a minimum conductor temperature of 50°C and a swing angle corresponding to wind pressure of 500 Pa for MV:

Provided further that where under normal conditions power line conductors operate at a temperature above 50°C, the clearance at the higher temperature at which the conductors operate shall be in accordance with the clearance indicated in the table;

the clearances of conductors and other wires over the normal high-water level of power lines crossing over water to be not less than the values for power lines above the ground outside townships: Provided that if the owner of the land on which the water is situated requires a greater clearance and no agreement can be reached, the dispute shall be referred to the chief inspector for a decision; and

the distance of any power line from an explosives magazine to comply with the requirements of the Explosives Act, 1956 (Act 26 of 1956).

- 1 No person shall construct any road, railway, tramway, communication line, other power line, building or structure or place any material or soil under or in the vicinity of a power line which will encroach on the appropriate minimum clearances prescribed in terms of subregulation (1).
2. No person shall encroach in person or with objects on the minimum safety clearances prescribed in sub-regulation (1) or require or permit any other person to do so except by permission of the [supplier](#) or user operating the power line.
4. The supplier or user, of power lines shall control vegetation in order to prevent it from encroaching on the minimum safety clearance of the power lines and the owner of the vegetation shall permit such control.

**2.4.2 Easy reference table for a various clearances**

Table 2 below gives the minimum clearances as adopted and used for various operating voltages and various structures or objects:

**Table 4 — Clearance (at maximum sag or swing as applicable)**

1	2		3	4	5	6	7	8	9	10	11
	Ground		Above	Above	Along	Across	Across	Telkom	Buil	Other	
	Outside towns	Inside towns	Railways and main roads	Township roads	Roads parallel with entry/exit	Com-munal land	Private property	Insula- ted	-dings and structures not forming part of power lines	Power lines	
	(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m)		(m)	
MV											
24 kV	5,2	5,5	6,4	5,5	5,5	5,5	5,5	0,9	3,0	0,9	
12 kV	5,1	5,5	6,3	5,5	5,5	5,5	5,5	0,9	3,0	0,8	
7,2 kV	5,0	5,5	6,2	5,5	5,5	5,5	5,5	0,9	3,0	0,7	
LV bare wire											
420 V/230 V	4,9	5,5	6,1	5,5	5,5	5,5	5,5	0,6	3,0	0,8	
LV insulated											
ABC 420 V/230 V	-	3,3	5,1	4,7	3,5	3,3	3,3	0,2	3,0	0,8	
Concentric 230 V	-	3,0	5,1	4,7	3,0	3,0	2,5	0,2	3,0	0,8	

An LV or Telkom pole position at a MV midspan is considered to be a separate structure, hence 3 m clearance required.

**NOTES**

- 1 Column 2 is the minimum clearance of conductor to ground outside built-up areas.
- 2 Column 3 is the minimum clearance of conductor to ground inside built-up areas.
- 3 Column 4 is the minimum clearance to railway lines and proclaimed roads.
- 4 Column 5 is the minimum clearance to unproclaimed roads used by vehicles such as delivery vans and buses.
- 5 Column 6 is the minimum clearance to ground where lines run parallel to any road used by vehicles and vehicle entries/exits to the road cross underneath the line.
- 6 Column 7 is the minimum clearance to ground in areas used by the community such as tracks or walkways.
- 7 Column 8 is the minimum clearance to ground in an area owned by one owner.
- 8 Column 9 is the minimum clearance to Telkom cable supported on the same structures.
- 9 Column 10 is the minimum clearance to buildings and structures not forming part of the network, including a LV/Telkom pole installed midspan underneath a MV line.
- 10 Column 11 is the minimum clearance to other power lines excluding the conditions listed in column 9.

**2.5.2** Sag and ground clearances shall be calculated using the conductor operating temperature and this can be assumed to be 50 °C, unless the operating temperature is more than this value.

**2.5.3** A minimum conductor temperature of 50 °C shall be used to determine clearances under conductor swing conditions. The swing angle shall be that corresponding to 500 Pa of wind pressure. These separation distances shall apply under all operating and environmental conditions.

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Table 4 — Clearance (at maximum sag or swing as applicable)

1	2	3	4	5	6	7	8	9	10
Highest system r.m.s. voltage  kV	System nominal r.m.s. voltage  kV	Safety clearance phase-to-earth  m	Safety clearance phase-to-phase  m	Minimum vertical clearances		Roads in townships, and proclaimed roads, railways	Minimum clearances any direction m	Minimum vertical and horizontal clearances m	Tower-top clearances at maximum insulator swing and minimum clearances at extreme wind conductor blowout  m
				Ground clearance	To tele-communication lines and between power lines		To buildings, poles, structures not part of power lines and vegetation m		
<1	–	–	–	4,9 <sup>a</sup>		6,1	0,6 <sup>a</sup>	3,0 <sup>a</sup>	0,1 <sup>a</sup>
7,2	6,6	0,15	0,2	5,5		6,2	0,7	3,0	0,1
12	11	0,20	0,3	5,5		6,3	0,8	3,0	0,1
24	22	0,32	0,4	5,5		6,4	0,9	3,0	0,1
36	33	0,43	0,5	5,5		6,5	1,0	3,0	0,1
48	44	0,54	0,61	5,5		6,6	1,1	3,0	0,15
72	66	0,77	0,89	5,7		6,9	1,4	3,2	0,20
100	88	1,00	1,14	5,9		7,1	1,6	3,4	0,24
145	132	1,45	1,68	6,3		7,5	2,0	3,8	0,35
245	220	2,1	2,7	7,0		8,2	2,7	4,5	0,6
300	275	2,5	3,6	7,4		8,6	3,1	4,9	0,7
362	330	2,9	4,3	7,8		9,0	3,5	5,3	0,86
420	400	3,2	4,8	8,1		9,3	3,8	5,6	1,0
800 <sup>b</sup>	765	5,5	8,9	10,4		11,6	6,1	8,5	1,9
d.c. 533 kV <sup>c</sup>	–	3,7	–		8,6	9,8	4,3	6,1	

NOTE The assumption on which the values are based, is given in C.2.

<sup>a</sup> For insulated power lines complying to SANS 1418-1 and SANS 1418-2 (Aerial bundled conductor systems) or SANS 1507-6 (concentric cable) no minimum safety clearances are required here. The same will apply to technologies for which compulsory SANS safety standards may be developed.

Sag and ground clearances shall be calculated using the conductor operating temperature and this can be assumed to be 50 °C, unless the operating temperature is more than this value.

A minimum conductor temperature of 50 °C shall be used to determine clearances under conductor swing conditions. The swing angle shall be that corresponding to 500 Pa of wind pressure. These separation distances shall apply under all operating and environmental conditions.

ABC with a bare neutral is classified as a fully insulated system, notwithstanding designers are to be cognizant of risks associated with broken neutrals regardless of the technology, where dangerous voltages will occur on exposed fallen neutral conductors as well as all customer installations where a neutral conductor breaks. One method to mitigate against this risk, is to connect all LV feeder neutrals in the same transformer zone, by means of neutral line interconnectors.

While not normally practicable, unless neutrals are connected to conductive poles which are part of a meshed neutral systems, the conductive path including footing resistance of conductive poles needs to be such as to prevent dangerous touch potentials.

Whenever a part of an insulated conductor is bare at the structure (e.g. a bare terminal) then the bare conductor separation distances shall apply.

Bare conductor clearances above water shall comply with the requirements set out in SANS 10280.

**2.4.3 Table 2 – Clearances (all distances are given in metres)**

Description of Service	Reticulation				Distribution				Transmission					
	6.6kV	11kV	22kV	33kV	44kV	66kV	88kV	132kV	220kV	275kV	400kV	533kV	765kV	
Outdoor earth: minimum safety clearance	0.2	0.2	0.3	0.4	0.5	0.8	1.0	1.5	1.9	2.4	3.2	3.7	5.5	
Phase to phase	0.2	0.3	0.4	0.6	0.7	1.0	1.2	1.7	2.3	3.0	4.0	N/A	6.1	
Ground clearance inside and outside townships	in	5.5	5.5	5.5	5.5	5.7	5.9	6.3	6.7	6.7	7.2	8.1	8.6	15.0
	out	5.0	5.1	5.2	5.3									
Building structures not part of power line	3.0	3.0	3.0	3.0	3.0	3.2	3.4	3.8	4.2	4.7	5.6	6.1	10.0	
Transnet walkways and foot bridges	4.7	4.8	4.9	5.0	5.1	5.3	5.6	6.0	6.6	6.9	7.8	8.3	15.0	
Powerlines other than Transnet	0.7	0.8	0.9	1.0	1.1	1.4	1.6	2.0	2.4	2.9	3.8	4.3	7.5	
Transnet electrification wires and track earth wires	2.0	2.1	2.2	2.3	2.4	2.6	2.8	3.3	3.7	4.2	5.0	5.5	7.5	
Above roads in townships, proclaimed roads including Transnet	6.2	6.3	6.4	6.5	6.6	6.9	7.1	7.5	7.9	8.4	9.3	9.8	15.0	
Telkom telephone lines	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.0	2.4	3.0	3.9	4.3	7.5	
Transnet telephone lines	1.4	1.4	1.5	1.7	1.8	2.0	2.2	2.7	3.2	3.6	4.5	4.9	7.5	
Spoornet tracks	9.6	9.7	9.8	9.9	10.0	10.2	10.4	10.9	11.4	11.8	12.7	13.2		
Spoornet electrification structures	3.0	3.0	3.0	3.0	3.0	3.2	3.4	3.8	4.3	4.8	5.6			
Transnet power lines	1.4	1.4	1.5	1.7	1.8	2.0	2.2	2.7	3.2	3.6	4.5			
Natal & Transvaal (TVL): abnormal load routes and TVL freeways: minimum	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5						
National roads and Natal: minimum	6.5	6.5	6.5	6.5										

Also refer to SANS10280

**Timber restrictions:**

The distance at which a single tree or a row of trees may grow in the vicinity of a power line is set out in the servitude agreements signed by each landowner. This distance is dependent on the height of the tree, the extent of foliage and the manner in which the tree grows. The main purpose of the clause in the servitude agreement is to preclude any danger to the power line.

When power lines are planned and constructed through known forestry areas i.e an area designated for the commercial production of timber, the servitude area is increased to the figures given in Table 3 below.

**Table 3 – Timber areas (all distances are given in metres)**

Voltage	Building restriction distance on each side of the centre line	Total servitude width paid for at 100%
1) 11, 22 and 33kV	25	50
2) 42 and 66kV	33	66
3) 88kV	33.5	67
4) 132kV	36	72
5) 275kV	38.5	77
6) 400kV	40	80

**No trees should be permitted within the servitude area given above. Existing firebreaks in the timber areas should be used as far as possible to mitigate costs.**

**Explosive magazines**

Note - Power Lines must not be constructed in the close proximity of explosive magazines.

**Regulation 7.3 of the Explosives Act 26 of 1956 lays down that no power line shall be erected or alternatively no magazine may be erected unless the following minimum horizontal distances are adhered to:**

**Table 4 – Explosive magazines (all distances are given in metres)**

Length of power line span	Clearance to magazine
1) Under 30metres	15 metres
2) 30 – 150 metres	20 metres
3) Over 150 metres	30 metres

The distances given above are to any part of the power line not just the centre line. No reduction of these distances is allowed.

**Vertical clearances over navigable waters**

Generally, normal ground clearances should be provided to the normal summer water level of a river and the spillway level of a dam. Care should be taken not to place support structures of transmission and distribution lines in the 50 and 100-year flood plains.

If crossings are proposed over rivers, dams or lakes (which are or could be used as navigable, particularly by yachts with high masts) then a clearance of 2,5 metres plus the relevant minimum outdoor clearance should be provided over the tallest mast likely to be encountered on such water under conditions of spillway level and maximum conductor sag. The tallest mast likely to be encountered on inland waters should not exceed 15 metres (measured from the water level).

Finally, regulation 15(1)(b) of the Electrical Machinery Regulation states that: the clearances of conductors and other wires over the normal high-water level of power lines crossing over water shall not be less than the values for power lines above the ground outside townships with the proviso that if the owner of the land on

which the water is situated requires a greater clearance and no agreement can be reached, the dispute shall be referred to the chief inspector for a decision.

Other structures

Boreholes and Windmills should be treated in the same manner as a building. The sweep of the tail of the windmill should not be closer than the building restriction distances set out in Table 2.

Clearances as per Eskom / Telkom agreement.

Where an overhead non insulated electrical supply line (except overhead service mains) crosses an existing or projected overhead telecommunications line, the electricity supplier or user must provide minimum clearances as follows:

1) in accordance with the regulations in terms of the Occupational Health and Safety Act, 85 of 1993, and as agreed with Telkom and set out in Distribution Engineer Manager's memo of 12 July 1990. Table 5, which follows below, sets out these clearances.

**Table 5 – Clearances: Telkom agreement**

Nominal voltage (kV phase to phase)	Minimum vertical clearance in metres to telecommunication lines	Clearance in metres to poles and structures on which a person cannot stand	Clearance in metres above ground
Earthed and up to 1.1	1.8	3.0	5.5
7.2	1.8	3.0	5.5
12	1.8	3.0	5.5
24	1.8	3.0	5.5
36	1.8	3.0	5.5
48	1.8	3.0	5.5
72	1.8	3.2	5.7
100	1.8	3.4	5.9
145	2.0	3.8	6.3
245	2.4	4.2	6.7
300	2.9	4.7	7.2
362	3.5	5.3	7.8
420	3.8	5.6	8.1
533	4.3	6.1	8.6
800	6.1	8.5	10.4

Note: A good rule of thumb practice on clearances for Fibre Optic networks are the same as low voltage lines up to 1000 volts. Other factors to be taken into consideration are the impact on veldt fires, clashing and the optimum position with respect to electrical field strength.

High load roads/routes

The requirements of the Occupational Health and Safety Act (OHS Act) 85 of 1993 must be strictly adhered to when crossing over high load roads. Table 2 (under 'abnormal load routes') gives the clearances as adopted and used in this regard.

It is essential that the Engineering Surveyor should be knowledgeable regarding abnormal road (super load) routes in his operational area and that all specific requirements / agreements are taken into consideration.

National roads & Provincial roads

NOTE: whatever applies to national roads also applies for provincial roads

With regards to national roads the following are some of the standard conditions for clearances that are applicable to power lines and/or cables parallel to or across national roads:

No tower, pole or stay pipe or cable shall be erected or laid within a distance of, 20 or 60 metres as applicable, measured from the national road reserve boundary, if such tower, pole or stay, pipe or cable is erected or laid parallel to the national road.

No tower, pole or stay shall be erected within a distance of, 20 or 60 metres as applicable, measured from the national road reserve boundary, if such tower, pole or stay is erected for the purpose of establishing a power line across the national road.

No manhole shall be erected within a distance of 20 metres, measured from the national road reserve boundary, if such a manhole is erected for the purpose of laying an underground cable underneath the national road unless another position for the manhole has been previously determined in consultation with the Regional Engineer

A vertical clearance of not less than 6,5 metres, measured from the crown of the national road to the lowest wire, shall be observed for lines operating at a phase voltage of 33kV and below.

The underground cable pipe shall be laid inside a sleeve pipe, which shall extend across the full width of the national road reserve and the top convex of which shall be at least one metre below the surface of the national road and the natural ground level. Eskom shall ensure that in the process of laying an underground cable or sleeve pipe across the national road, the surface of the road shall not be interfered with.

ESKOM shall undertake to maintain any tower, pole, stay or overhead wire, cable or pipe at all times at its own cost and to take all necessary precautions to ensure the safety of road users.

ESKOM shall undertake to shift or relocate, at its own cost and without compensation, any overhead or underground power line at the intersection of such power line with the existing national road if such shifting or relocation becomes necessary as a result of road widening work, road construction work or road maintenance work: Provided that such widening, construction or maintenance shall not involve any re-routing of the national road.

Another standard condition of importance to remember is that: No permanent entrance to or exit from a National Road shall be permitted.

The 20 metres referred to in clauses (1) and (2) is applicable to those power lines of which the voltages are below 40kV. The 60 metres distance refers to power lines of which the voltages are 40kV or higher.

The clearance given in clause (4) is a minimum for road purposes only. The Occupational Health and Safety Act 85 of 1993 requires clearances in excess of 6.5 metres for all voltages above 40kV, and these additional clearances must be abided by.

The SA National Roads Agency Limited and National Roads Act 7/1998 require that no crossing should be within 500 meters of the point of intersection at a junction but this restriction may be waived with special application with motivation. No fee is payable for any application to National Roads.

With regards to Provincial roads the following applies: the Provinces use clauses in the Advertising on Roads and Ribbon Development Act 21 of 1940 to impose building restrictions for a distance outside the road reserve boundaries. The clauses in the Advertising on Roads and Ribbon Development Act preclude without approval, any building or structure within 300 Cape feet (95m) each side of the centre line of any proclaimed building restriction road. By common usage the 300 Cape feet has been converted to 95 metres.

The jurisdiction of any provincial roads department does not extend beyond the 190 metre wide strip whose centre line is the centre line of the proclaimed road reserve. Eskom has agreed to apply to the relevant provincial road authority for all new Eskom services so that Eskom can be advised of future road plans and other special conditions that must be observed.

The following serves as a checklist for road crossing surveys and the detail must be indicated on Engineering drawings:

- Road number and destinations.
- Nearest kilometer pole or road chainage at crossing.
- Readings must be taken at road reserve boundaries, edge of shoulders, edge of surface and centre line.
- Crossing angle.
- Sequential structure numbers or line/pole reference number.
- Type of structure (drawing number, pole length, planting depth, lowest conductor attachment height, structure chainage, line deviation angle, and any structure specific notes).
- Conductor type.
- Templating temperature.
- Equivalent span and template constant (C-value) for templating temperature.
- Line name and voltage.
- Surveyed by: "Name & signature of designer".
- Checked by: Name & signature.
- Approved by: Name & signature.
- Horizontal and Vertical scale.
- Revision number and date of the revision.
- Name of the electronic file – if applicable.

Note: It is a responsibility of the surveyor / designer to liaise with the Technical Service Centres/CNC of Field Services concerning the local agreements pertaining to special road clearance requirements.

## **BROKEN CONDUCTOR CONSIDERATIONS FOR CROSSINGS**

The consideration of broken conductor conditions in a strain section and the resulting unsafe conductor clearances over roads or railway lines crossed in such a strain section are often obviated by playing safe and positioning strain structures on either side of such a crossing - this is, however, a costly practice.

The Occupational Health and Safety Act (OHS Act) 85 requires:

### **REGULATION R(s) 20 CROSSINGS**

(a) Structures supporting a crossing span shall be designed in such a manner that they will be able to withstand the loads that may be imposed upon them should a breakage of any phase conductor or earth conductor occur.

(d) Where a power line crosses a proclaimed road the supplier or user shall cause the clearance of the crossing span above the road to be not less than 4,5m for the condition of broken phase conductor in a span other than the crossing span.

If the structures on either side of a crossing are both strain structures, then broken conductor conditions in either of the adjacent spans is assumed to have no effect on the sag of the crossing span. However, if one of the structures is a suspension structure then upon the occurrence of a break in a span on the same side as the suspension structure, the suspension insulator string will swing over towards the crossing and in doing

so result in increased sag in the crossing span. This condition, namely the existence of a suspension structure on the other side of the crossing, constitutes the condition under which the greatest increase in sag will result. If the structures on both sides of the crossing are suspension structures the resulting increase in sag in the crossing span will be less than in the case referred to above.

The computations necessary to determine the final sag in the crossing span for the general case of a crossing supported on suspension structures with the nearest strain structure located one or more spans away from the crossing, are extremely involved and are therefore not normally carried out.

However, the computation required in the case of a strain structure on one side with a suspension structure on the other side of a crossing, i.e. for the worst case, are less complex and it is therefore normal to make the simplifying assumption that one of the crossing structures is a strain structure and to calculate the sag of the crossing span under broken conductor conditions in one of the adjacent spans, accordingly. This is, still a very conservative way of handling this exercise since in practice the clearance will be considerably greater than the calculated clearance with resulting cost implications.

The simplified calculation to determine the new sag under broken conductor conditions in an adjacent span, is by use of the formula:

$$D = \sqrt{d^2 + \frac{3PL}{8}}$$

Where:

D = Final sag under broken conductor conditions

d = Sag under healthy conductor conditions

P = Length of suspension insulator string

L = Length of crossing span

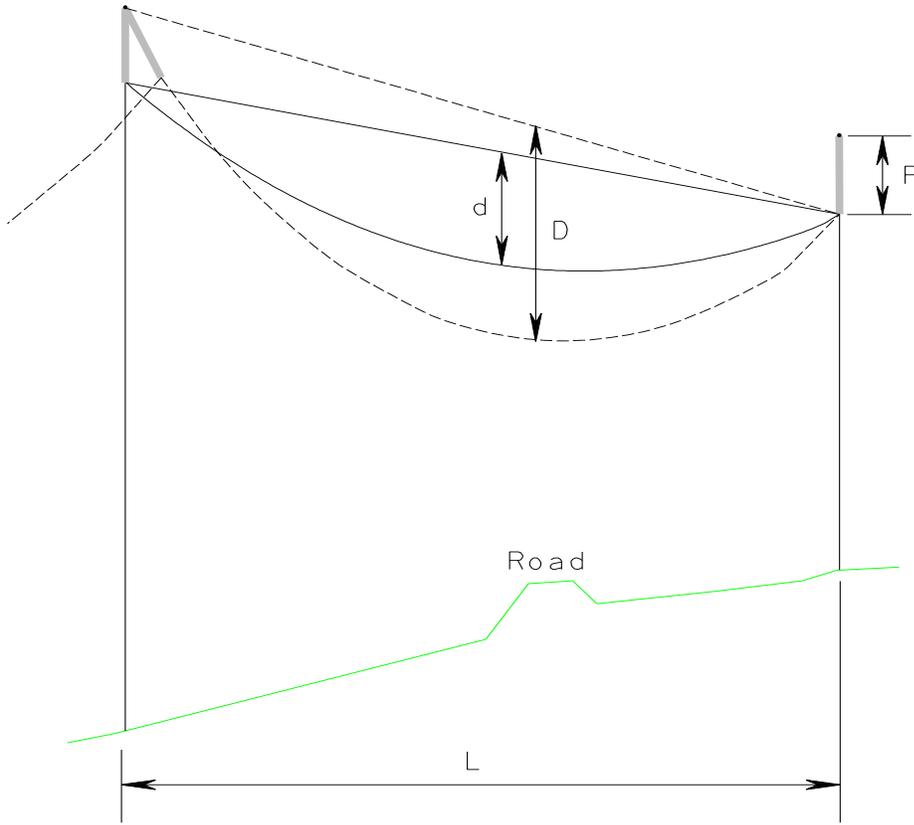
with the provision that:-

Whereas the sag under healthy conductor conditions is measured relative to the straight line joining the conductor attachment points, i.e. the conductor clamp in the case of a suspension structure, and the point of attachment of the insulator string to the structure in the case of a strain structure.

Whereas under broken conductor conditions, allowance must be made for the fact that the effective attachment points on the suspension structure moves up to the point of attachment of the insulator string to the structure. This means that final sag "D" is measured relative to the straight lines joining the points of attachment of the insulator string to their respective structure, i.e. the point of attachment of the conductor in the case of a suspension structure is assumed to move upward by the amount of length of the suspension insulator string.

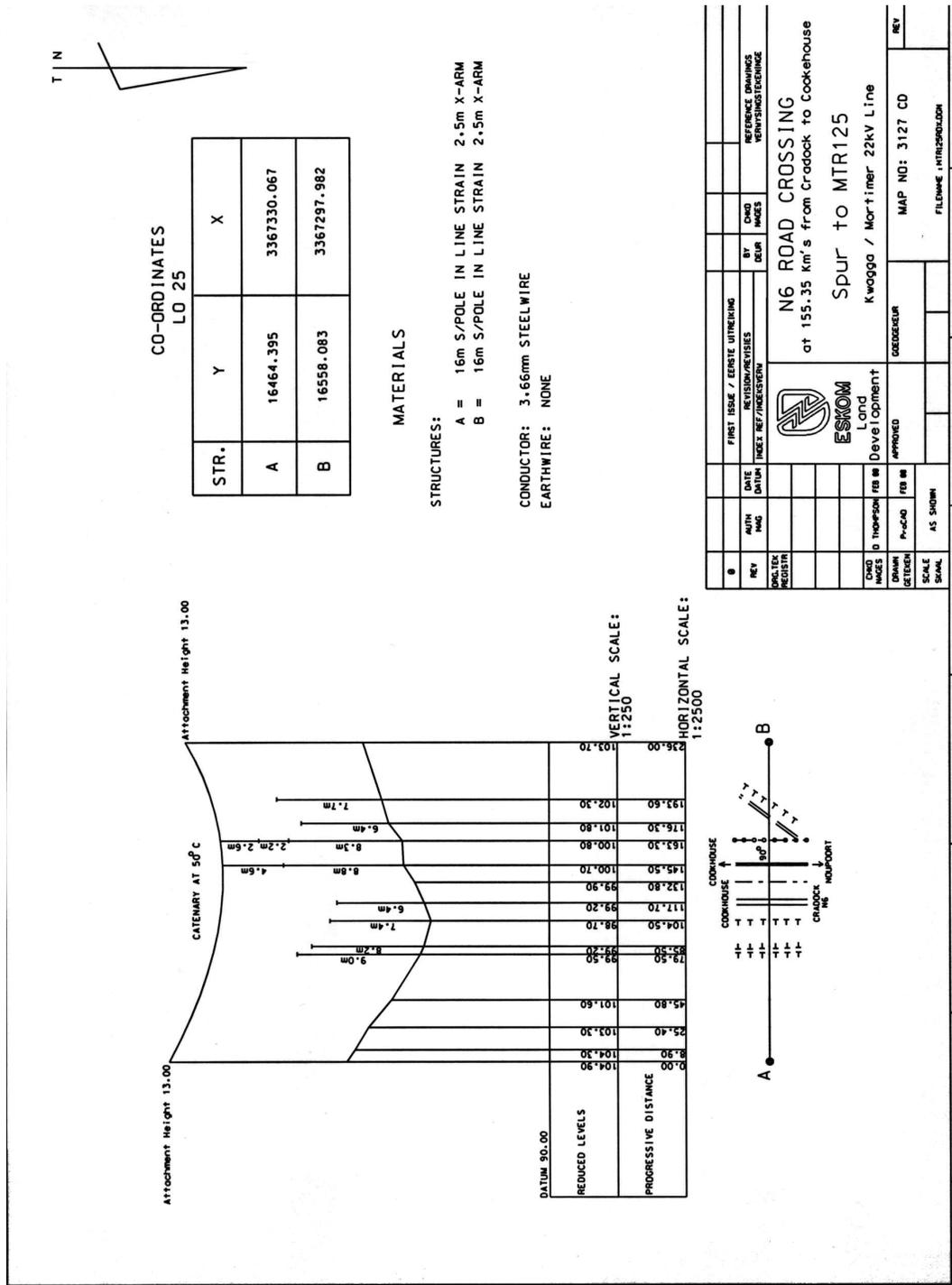
NOTE: Broken conductor condition must be checked assuming a break, first on the one side of the crossing and then on the other side.

The drawing below depicts a situation with broken conductor situation on the one side of the crossing.



- $d$  = Sag under healthy conditions.
- $P$  = Length of Suspension insulator string.
- $L$  = Length of Crossing Span.
- $D$  = Final sag under broken conductor conditions.

**Typical National Road crossing application plan**



Final detailing, performance definition, specification, sizing and positioning of all systems and components enabling either construction or the production of manufacturing and installation information.

## **2.5 Stage 5: Manufacture, Installation and Construction Information:**

### **SURVEY REQUIREMENTS & TOLERANCES**

#### **2.5.1 INTRODUCTION AND GENERAL**

This chapter sets out the general requirements for profile surveys of power line routes, as well as the purpose of a profile survey.

The various methods of obtaining the data to plot a profile are outlined and tolerances stated but the details of survey methods are not given.

In all the methods of profiling set out in the Overhead Power Line design Manual the results are reduced using computer techniques and programs. The surveyor should familiarise himself with the reduction methods because this will determine the way the field data is recorded.

In the interest of safety no metal, un-insulated prism rod shall be used when profiling near power lines, furthermore NO prism rod or gps rod shall be used in excess of 2.0m within 15 meters to the power line.

#### **Purpose of survey and obligations to land owners**

The purpose of the survey is to enable the positions for tower/supporting structures to be determined on a profile and these positions to be set out on site so that all the requirements for power line design (e.g. ground clearance, uplift, windspan, etc) are satisfied. The economic factors of the power line construction are also considered when the design of the line is being done.

#### **Obligations to land owners and entry to property**

Eskom is dependent on the continued goodwill of land owners for the acquisition of power line servitudes. A courtesy call on the resident owners, farm managers or lessees by the surveyor/negotiator is considered essential to explain the work is about to commence. Alternatively, owners may be advised in writing that work is due to commence on a given date, that crops or trees might be damaged in order to complete the work and that compensation for such damage will be paid.

Details of the affected properties as well as the names and addresses of the registered owners and owner's special conditions, if any, must be obtained from the negotiator by the surveyor at the commencement of such a profile survey.

#### **Damage to crops**

The surveyor/negotiator should complete a Crop Compensation Form and report the incident to EGIF (Eskom General Insurance Fund) **verify** as soon as possible after the damage to crops, trees or lands has occurred. It is advisable to report any intentional damage to the land owner before commencement. i.e. cutting of line of site through planted crops.

The report shall detail the following:-

- Name and address of the owner of the damaged crop and the description of the property.
- The type(s) of crop(s) damaged.
- The length and width of the area of each type of crop damaged. (The length is important as many owners have a complete misconception of length particularly if lands are crossed at an angle).
- The number of trees of each type cut.

## 2.5.2 SUMMARY OF REQUIREMENTS AND SURVEY RESULTS

- The setting out, marking and fixing on the national co-ordinate system of all points on the ground defining the bends of the power lines will have been done as part of the setting out survey.
- For Engineering surveys a series of line flags placed at intervals, not exceeding 500m inter-visible, along each straight between the bends which are then also used in the ultimate pegging of tower/structure positions and negotiations. Line pegs should comprise iron standards, fence droppers or wooden sticks that are clearly visible. **Time frame will be based on the scope and that will be determined during task order awarding.**
- A profile of the ground along the centre line of the determined route and where necessary, as required by the degree of slope, the profile of the ground surface along the projected position of the outer conductor on the higher side of the route.
- If at this late stage the line route is found to be within a specified distance of windmills, boreholes, buildings or any other obstruction, not previously discovered, the Eskom negotiator/surveyor must be notified immediately.
- A strip plan which is to be a vertical projection of the profile and showing all the topographical detail within a specified distance from each power line, shall be framed.

## 2.5.3 PROFILE REQUIREMENTS

The profile shall be determined from spot heights which are surveyed either by obtaining heights using direct levelling or vertical angle and distance measurements or GPS techniques. Spot heights shall be taken at all changes of slope and at intervals not exceeding 30 metres if the slope is constant.

### TOLERANCES

Distances and height differences between control points shall be measure to the following tolerances:-

Distance closure - 0,15% with a maximum of 1,0m.

Height closure - 0,2m + 0,1m/km with a maximum of 0,3m.

### SCALES

The profile shall be plotted on a medium of specified type to a scale of 1:250 vertical and 1:2500 horizontal. A clear space of at least 10cm should be left above the profile and between successive straights.

### PARALLEL LINES

Two parallel lines shall be plotted in different colours on the same datum. If more than two parallel lines are profiled at the same time, the profiles shall be plotted separately.

### SIDE SLOPE

The "side slopes" or outer conductor profile of a line parallel to, and a specified distance from the centre line on the higher side must be shown as a dotted line in the same colour as the corresponding centre line profile and dimensioned to the centre line. This side slope must be shown wherever the slope from the centre line equals or exceeds 1:50. (i.e. 0,5m at 10m from the centre line).

### CROSSING OF POWER LINES

At crossings of existing power lines it is necessary to:-

- Obtain a profile of the existing power line. Where no such profile exists, the span being crossed must be profiled showing structure positions and the span length.
- Ascertain the heights of the conductors and earth wires at attachment points on each of the adjacent structures to the crossing span.
- Ascertain the heights of the conductors, conductor attachment heights and earth wires at ambient temperature of the existing line at the point of crossing. The ambient temperature and time of observation should be noted.
- These heights and positions must be determined by angular and distance measurements from two separate stations to provide confirmation of the first survey as a "check".
- Alternatively when a cable height meter (CHM, i.e. "Suparule") is used measurements must be taken to all three conductors. This applies to both a horizontal configuration and a vertical configuration of

transmission line design. A consistency check for CHM measurements requires that attachment heights at each of the adjacent supporting structures be measured as well.

- Equivalent / Ruling span - In the case where no profile exists it is also required to measure the span length of each individual span to the next strain structure on either side of the crossing.

**2.5.4 The following serves as a checklist for power line crossings and the detail must be indicated on Engineering drawings:**

- Name and voltage of existing line.
- Structure numbers between which the line crosses the existing line.
- Existing line structure types and their position in relation to the new route.
- Existing conductor attachment heights, conductor heights at crossing as well as conductor heights at two more points along conductor.
- Ambient temperature during heights measurements of the existing line conductor.
- Angle of crossing.
- Sequential structure numbers or line/pole reference number.
- Type of structure (drawing number, pole length, planting depth, lowest conductor attachment height, structure chainage, line deviation angle, and any structure specific notes).
- Conductor type
- Templating temperature.
- Equivalent span and template/catenary constant (C-value) for templating temperature.
- Line name and voltage.
- Surveyed by: "Name & signature of line designer.
- Checked by: Name & signature.
- Approved by: Name & signature.
- Horizontal and Vertical scale.
- Revision number and date of the revision.
- Name of the electronic file – if suitable.

**CROSSING OF OTHER SERVICES**

The height and position of telephone lines and all railway track structures, conductors and communication lines at railway crossings must be determined and shown on the profile. Such heights must be measured for the fixing of position of the centre conductor or one of the outside conductors depending on where the existing overhead service is the highest. These heights must be subject to an independent check. The angle of crossing must be shown and in the case of a railway track the distance to the nearest kilometre plate must be shown.

**OTHER FEATURES AFFECTED**

The heights of any other relevant features such as huts, kraal walls, dam walls, embankments, roadways, high boulders etc, shall be determined and shown on the profile.

**UNDERGROUND SERVICES**

The position of any underground service such as a sewer water pipe line shall be surveyed if evidence of these services can be seen in the field.

**SKETCHES**

In the hand recording of topography sufficient space should be used in the field book to do clear and unambiguous sketches.

**ELECTRONIC FIELD DATA RECORDING**

In the event of electronic field data recording during survey, the feature codes in the electronic data recording device must be in sync with the feature codes in the line design application which will be utilised

In the event of abbreviations i.e. "Rd" for a road being utilised by the surveyor, lookup tables which are designed based on the line design application feature codes must be used to replace abbreviations with full description i.e. road.

These measures will prevent data editing errors during the design phase.

Field data downloaded to the line design application must preferably be space delimited, or as alternative, tab delimited data can be utilised.

Should own resources or contractors be used for the surveying of power line routes, by any method, the following minimum electronic data requirements are set. Hard copy plans and field book information must be specified per job requirement.

The minimum information required for electronic field data in the line design application is:

**a) Tache data files.**

1	Point Description
2	X - Easting
3	Y- Northing
4	Z Elevation
5	Height of objects
6	Feature code

**b) Long section data files.**

1	Point Description
2	Station (Chainage)
3	Offset
4	Elevation
5	Height of object
6	Feature code
7	Plan comment
8	Profile comment
9	Line angle (Degrees, + = right)
10	Line angle (Minutes)
11	Line angle (Seconds)
12	1 <sup>st</sup> side profile elevation (side slope)
13	1 <sup>st</sup> side profile off set (+ = right) – side slope
14	2 <sup>nd</sup> side profile elevation (side slope)
15	2 <sup>nd</sup> side profile off set (+ = right) – side slope

### 2.5.5 Environmental requirements

**Crossings over environmental sensitive areas, distance from heritage site (e.g. graves, shell middens, etc.) wetlands and flood line restrictions should be determined. Dominant vegetation types along the line route should also be indicated.**

- **For Graves:** Photo of the grave (close range) – date (determine the age of grave)
  - Photo of the grave (wide range) – fenced or not.
  - Outline Aerial route of powerline from the grave
  - Produce a 1:50 000 map
  - Obtain consent from the villages, not just the chief signed register.
- **Bushclearing:** Indicate the type of vegetation (whether indigenous)
  - Indicate the quantity.
  - Produce a 1:50 000 map.
- **Game Farms:** Indicate the type of vegetation (whether indigenous)
  - Indicate the type of game (giraffes, rhinos & elephants ext.)
  - Requirements from Reserve owners.

### Field Data recording and plotting of profile

The profile shall be plotted to an accuracy which corresponds to 0,5 metres at a scale of 1:250 and indicates the required accuracy of the final profile when done manually. It is therefore essential that surveys should be performed at the appropriate level of accuracy. Theoretically, electronic generation of the profile from Ascii files should be 100% accurate.

All line points and, if applicable, control points shall be indicated by a vertical line below the profile against which their heights and progressive totals from the beginning of each straight are recorded. For two or more adjacent parallel line routes, the progressive distances of corresponding line points are to be given relative to one of the lines as reference line. In this way all line points placed at right angles to one another will have the same progressive distance.

When changes in datum are necessary to accommodate the profile in the space available, these datum shifts should be to the nearest convenient 10m and a lateral overlap of 400m provided.

No topography shall be shown on the long section, only power lines, telephone lines, roads, rail and other features affecting clearance shall be shown plotted at their correct height.

Unnecessary information congests the space when span details are to be recorded and these elements will be shown on the plan view below the profile.

### STRIP PLAN PLOTTING.

The plan view of the power line route/routes shall be a projection of the profile and there should be a clear space of 10cm below such strip plan to the edge of the paper.

The topographical coverage should extend a specified distance (dependent on the voltage of the line) on each side of each power line and show all topographical detail which may have a bearing on the positioning of towers with particular attention to the following details.

### Abnormal Side Slope

If the slope of the ground increases sharply beyond the stated side slope distance then this should be noted on the plan. The additional side slope must be indicated by a series of spot heights taken at the changes of slope.

### All Structures

All visible structures such as windmills, boreholes, reservoirs and buildings shall be shown if their position could have a bearing on the design of the power line.

### Angle of Deviation

The angle of deviation at each bend shall be recorded to the nearest minute of arc. Please note – (+) = to the right and (-) = to the left

### **Property Boundaries**

All property boundaries which intersect or run parallel to the centre line of the power line shall be shown at the correct angle to the centre line. If a property boundary is not fenced (i.e. no visible evidence in the field) an accurate as possible position by scaling from existing maps, plans, compilations or aerial photographs, must be plotted.

Critical beacon and boundary positions which were calculated during the setting out survey must be plotted.

The portion/subdivision/holding/lot or erf number together with the farm/township name and number must be given between the relevant property boundaries. When very large properties are traversed it might be necessary to repeat the portion number and farm name and number several times to achieve clarity.

### **Cultivated and Fallow Lands**

All lands, gaps in land, contour walls, types of existing crops, no tower zones etc. shall be recorded.

Potential for errors in clearance and flash over is greater where centre pivot irrigation is used. Great care must be taken and detail surveys done.

Irrigation of lands where pipes are moved manually increases the risk of electrocution of the public. In the past people were electrocuted, carrying the pipes vertically, bringing these pipes in close proximity to the conductors and even making contact with conductors.

In areas where crop dusters are used for the application of herbicides and fertiliser, all details regarding the practice such as landing strips, approach direction etc. must be recorded and taken into account. In these instances the lines must be marked.

It might be required to lift the lines to such an extent that it ensures safe flying below the conductors.

### **Fences**

All existing fences shall be shown with approximate angle of crossing, and a statement made if such fence is known to be a property boundary fence. If the fence comprises anything other than the standard five strand wire fence, this fact should be noted e.g. jackal-proof fencing, security fencing 3m high etc. This information is important for scoping the work in terms of gates to be installed.

### **Power Lines**

The positions and descriptions of the supporting structures on either side of the crossing point shall be shown. The type of power line, tower numbers, voltage, the angle of crossing and the heights of the attachment point of conductors and earth wires as determined shall be recorded, or alternatively this information can be obtained from existing profiles. Refer to "CROSSING OF POWER LINES"

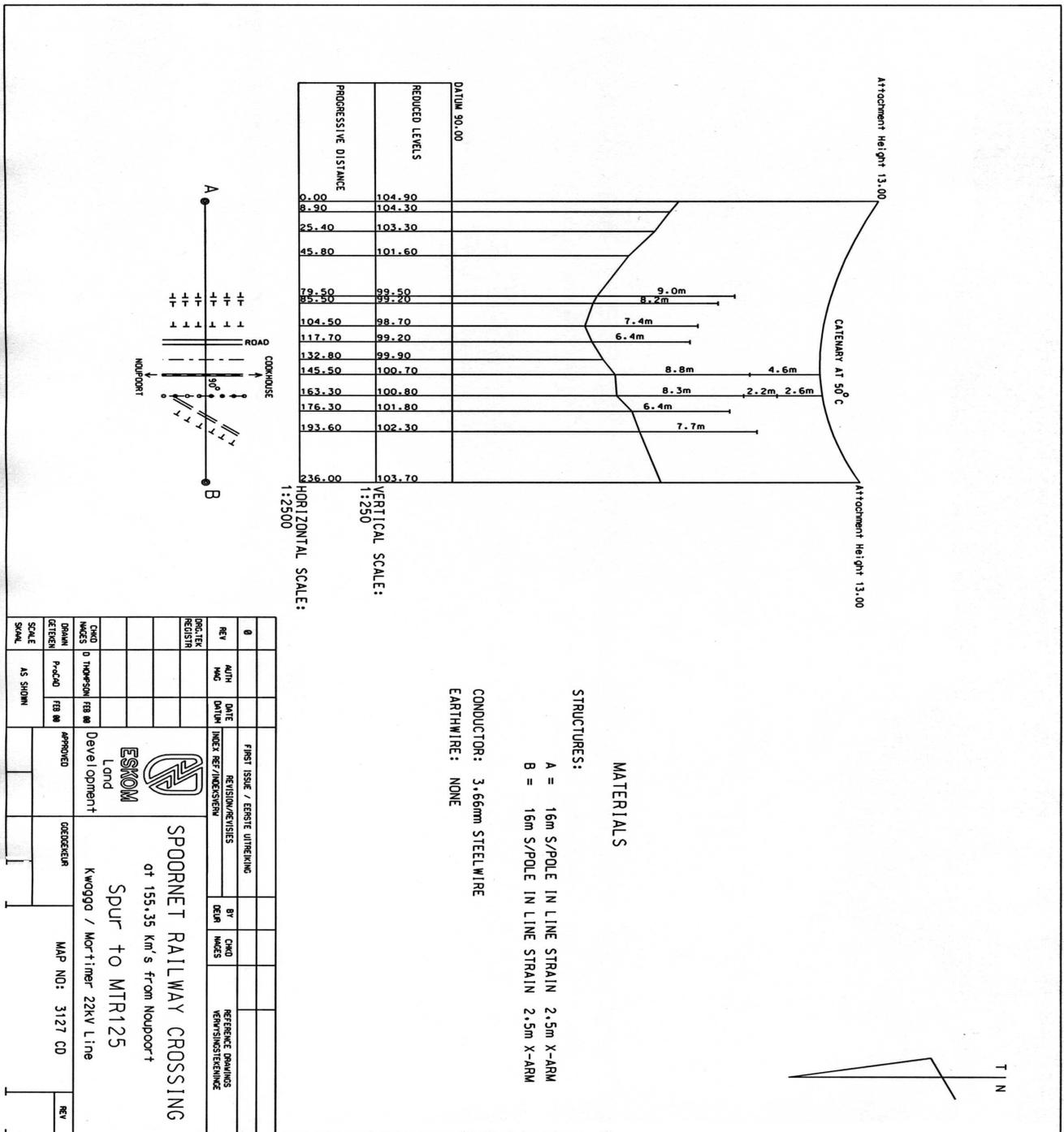
### **RAILWAY LINES**

All detail of rail tracks, electrification structures and communication lines within 25m of the point of crossing shall be surveyed with sufficient accuracy to provide for the preparation of a detailed plan and profile of the crossing to a scale suitable for submission to Transnet for approval of the crossing. Destination of tracks must be given and the kilometre distance measured from the nearest kilometre plate must be shown.

**2.5.6 The following serves as a check list for field data collection and this information must be included on engineering drawings:**

1. Railway line destinations.
2. Nearest kilometer mark.
3. Gantry numbers between which the line crosses.
4. Show all Spoornet equipment accurately (attached single line sketch of the gantry arrangement will be appreciated).
5. Angle of crossing.
6. Sequential structure numbers or line/pole reference number.
7. Type of structure (drawing number, pole length, planting depth, lowest conductor attachment height, structure chainage, line deviation angle, and any structure specific notes).
8. Conductor type
9. Design temperature.
10. Equivalent span and template constant (C-value) for design temperature.
11. Line name and voltage.
12. Surveyed by: "Name & signature.
13. Checked by: Name & signature.
14. Approved by: Name & signature.
15. Horizontal and Vertical scale.
16. Revision number and date of the revision.
17. Name of the electronic file – if applicable.

**Typical rail crossing application plan**



## **2.5.7 Rivers and Other Water Features**

Rivers, water courses, dams, marshes, possible swampy ground, dongas and eroded areas shall be shown. If a flood level can be determined, this must be shown.

### **Rock Outcrops**

Rock outcrops, boulders or other features likely to affect tower positioning must be shown.

### **Suitable Tower Positions & No Tower Zones**

In rugged or uneven areas, positions which are suitable for a supporting structure should be indicated. In some instances land or service owners specify where structures may be erected, such as on the contours between planted fields.

Likewise, positions which are totally unsuitable for tower positions should be indicated. Starting and end points of these zones to be clearly defined, this could include features such as soil erosion, rocks and wetlands.

### **Telephone Lines**

The positions of telephone poles on either side of the crossing span and the number of pairs and/or number of communication cables shall be shown. The angle of crossing shall be measured for telecommunication lines. It is very important to observe the telephone pole position and height if it falls under the future power line conductors. Telephone lines parallel to the proposed power line must be plotted.

### **Trees and plantations**

Trees and plantations shall be noted and the type of tree recorded.

### **True North**

A True North direction arrow shall be shown at the beginning of each straight, and at intervals of approximately 0,5 metres along the plan.

### **Underground Services**

The underground services surveyed in shall be plotted. Information regarding underground services obtained from other sources (e.g. during negotiation) shall be plotted.

### **Owner's names and Requirements**

The completed profile and strip plan should be given to the person whom negotiated the original route so that names and any requirements agreed to with the owners along the route can be noted and added to the plan. This should be done before any positioning of structures is commenced. This also serves to confirm the route negotiated in relation to cadastral property boundaries.

## **SURVEY RECORDS**

All field books, computations, plans and schedules of closures or copies thereof shall be retained. If profiling is done by contractor all records must be submitted to Eskom. Use of standard field books for the particular method of profiling selected is essential. If an electronic field book is used a printout of the entries must be provided and kept on file.

A report on the survey and the checks used shall be supplied and kept on file.

Records must include an index or other suitable means of referencing the bends and numbered points with the field book pages.

The recording of measurements may be specified according to the method of survey used.

## **Responsibilities.**

- Land Development is the custodian of the legal documentation concerning power line routes and design in Distribution.
- Land Development is responsible to obtain all necessary information and produce design profiles of the line crossing within constraints of the statutory requirements and Distribution standard practices.

- Persons signing as “Checked by:” is responsible to check adherence to Survey best practice with respect to templating principles, clearances, servitude width, structure position, Statutory conditions, acquired route and land owner conditions, position of other services and approval conditions etc.
- Person signing as “Approved by:” is responsible to check adherence to Distribution Technology Standards with respect to best practice, utilisation of appropriate standard structure, standard attachments, standard pole length, etc.

Land Development is responsible to redistribute and file the final profiles of the crossings. This entails: Submission to relevant authorities for approval (acceptance) and filing approved by statutory authorities copies in an appropriate filing system.

Adding the profile for the crossing to the spanning plan for the relevant line.

Submitting copies of the spanning plan (including profiled crossings) together with the project package to the Project Engineer.

Filing of both electronic- and hard copy spanning plan and engineering drawings.

2)

- 3) Technology & Quality (T&Q) section is responsible to provide most up-to-date information on Distribution practice and Standards pertaining to lines. T&Q is also there to assist with more demanding projects, where abnormal conditions need to be considered and where a non-standard structure needs to be designed.

**The official engineering drawing / profile plan inclusive of line design.**

The final profile plan will be exported from the line design application into an appropriate CAD program such as Micro Station.

This official engineering drawing will be kept in both electronic and hard copy format for record purposes.

Note: all responsible parties must be noted on the final hard copy plan by name and designation. The plan must be signed by each of these individuals.

**Summary of profile plan requirements:**

1	<b>Cadastral information:</b>
1.1	Cadastral boundaries
1.2	Farm names and portions
1.3	Land owner name and special conditions
1.4	Fences and gate requirements
2	<b>Other services</b>
2.1	Water pipe lines
2.2	Gas pipe lines
2.3	Sewer services etc.
3.	<b>Topographical features</b>
3.1	Trees and plantations
3.2	Rock Outcrops
3.3	Roads and Tracks
3.4	Rivers and other Water features
3.5	Cultivated and Fallow Lands

3.6	Abnormal Side Slope
3.7	Suitable Tower Positions & No Tower Zones All Structures
3.8	All Structures such as buildings, bore holes, windmills etc.
4	<b>Railway lines</b>
4.1	Railway line destinations.
4.2	Nearest kilometer mark
4.3	Gantry numbers between which the line crosses
4.4	Show all Spoornet equipment accurately (attached single line sketch of the gantry arrangement will be appreciated).
4.5	Angle of crossing
4.6	Sequential structure numbers or line/pole reference number
4.7	Type of structure (drawing number, pole length, planting depth, lowest conductor attachment height, structure chainage, line deviation angle, and any structure specific notes).
5	<b>Existing power lines crossed</b>
5.1	Name and voltage of existing line
5.2	Structure numbers between which the line crosses the existing line
5.3	Existing line structure types and their position in relation to the new route.
5.4	Existing conductor attachment heights, conductor heights at crossing as well as conductor heights at two more points along conductor.
5.5	Ambient temperature during heights measurements of the existing line conductor.
5.6	Angle of crossing of existing power line
5.7	Sequential structure numbers or line/pole reference number
5.8	Type of structure (drawing number, pole length, planting depth, lowest conductor attachment height, structure chainage, line deviation angle, and any structure specific notes).
5.9	Conductor type
5.10	Templating temperature (if not available it must be determined in the line design application)
5.11	Equivalent span and template/catenary constant (C-value) for templating temperature.
6	<b>Telecommunication lines</b>
6.1	Number of pairs or fibre optic
6.2	Crossing angle of telecommunication line
6.3	Clearance over telecommunication line
7.	<b>Road crossings</b>

7.	Road number and destinations.
7.1	Nearest kilometer pole or road chainage at crossing.
7.2	Crossing angle of road, road reserve boundary, edge of shoulder, edge of surface.
7.3	Clearance over road.
8	<b>New power line data:</b>
8.1	Type of structure (drawing number, pole length, planting depth, lowest conductor attachment height, structure chainage, line deviation angle, and any structure specific notes).
8.2	Conductor type.
8.3	Angle of Deviation
8.4	Sequential structure numbers or line/pole reference number.
8.5	Templating temperature.
8.6	Equivalent span and template constant (C-value) for templating temperature.
9.	<b>Plan Scale</b> 1:250 vertical and 1:2500 horizontal
10	<b>True North</b>
11	Surveyed by: Name & signature
12	Designed by: Name & signature and capacity
13	Checked by: Name & signature and capacity
14	Approved by: Name & signature and capacity
15	Revision number and date of the revision.
16	Name of the electronic file

## **2.6 Stage 6: Post Practical Completion**

### **2.6.1 Survey methods**

#### **Side Slope**

Side slope must be measured by taking additional spot heights at the specified distance from the centre line. It may be measured directly by traversing the telescope to prism held in the side slope position and recording the height difference relative to the corresponding position on the centre line.

The side on which side slope occurs must be indicated by Left or Right as the case may be, relative to the forward direction.

In the event of severe side slope, at bends a tache survey has to be done for the determination of leg extensions. Post line design phase it might be required to perform this survey at individual intermediate structure positions as well.

#### **EDM METHOD**

The profile is produced from spot heights taken from on-line stations in a traverse between control points. Spot heights are determined by vertical angles and distances measured with electronic distance measuring equipment.

#### **OUTLINE OF METHOD**

The angular and distance measurement to fix spot heights should include checks. For example:-

- observing vertical angle on prism using two or three stadia hairs (Angle subtended between central crosshair and upper and lower stadia hairs is a constant angle equal to  $0.17'.11''$  (0,005 Radians)

These checks are to prevent recording errors when measurements are manually recorded. Use of electronic recorders should eliminate this need.

Due to the large distance between observer and prism holder who identifies topography or change of slope, it is essential that there is close co-ordination between observer and prism holder. This will involve portable radio communication.

On-line stations must be chosen to ensure complete spot height coverage of the section to be observed from the station.

Spot height distances must be limited to the capability of the equipment utilised but not exceeding 1000m, under exceptional topographical difficulties (gorge or a steep valley) and provided visibility is good, the limit may be extended to 1500m.

Additional off-centre line spot shots will be necessary to determine directions of linear topography such as fences, telephone lines, roads etc. Isolated topography such as boulders should also be surveyed by this method.

Side slope which is in excess of the height difference specified, must be determined by the taking of additional spot heights at the specified distance from centre line of the power line and the recording of the related E.D.M. distance and the corresponding vertical and horizontal angle readings. Direct reading of the side slope is acceptable provided it is measured and not estimated.

Tolerances:-

Distance closure : 0,15% with a maximum of 1,0 metres

Height closure : 0,2m + 0,1m/km with a maximum of 0,3 metres.

#### **GPS Method**

Profile surveys using GPS techniques are undertaken to generate long section profile data of terrain undulations between successive bend positions of proposed or existing power line routes. This data in conjunction with appropriate software is used to determine optimum positions for tower/supporting structures for Distribution's HV and MV networks. Results are reduced and profiles generated using computer techniques with appropriate software. The surveyor must familiarise himself/herself with the software and reduction techniques in order to generate profile plans for templating purposes.

The subsequent setting out of the structure positions *shall* result in satisfying the requirements for good power line design viz. meeting statutory ground clearance tolerances, complying with uplift and windspan restrictions etc.

GPS is a complete three-dimensional tool where heights are determined at the same time as horizontal positions.

When it comes to heighting however the GPS system has inherent weaknesses. The geometry is weak for absolute positioning since satellites cannot be observed below the horizon whereas for horizontal positioning the satellites can be observed at any azimuth. Unlike horizontal positioning therefore the effect of systematic refraction biases cannot be reduced by symmetrical observations. Although these weaknesses apply to single point positioning and navigation they do not apply to GPS surveying where differential techniques are used. The assumption therefore that GPS surveyed heights are less accurately determined than GPS surveyed horizontal positions is incorrect. (*Merry 1993*).

GPS surveying uses carrier phase measurements in a differential mode and the very fact that the geometry and refraction biases are systematic is an advantage in that they tend to cancel each other.

The stronger the spatial correlation of these biases the better the differential result. Obviously there is a limit and the further apart the stations are, the more likely it is that the height differences will be less accurate than the horizontal position differences (*Merry 1993*).

For base lines under 20 kilometres in length there should be no practical differences in the accuracies (*Beutler et al., 1986; D'Arcy Evans and Merry, 1992*). There are however special cases (weather front between the two stations; large height differences) where the heights may be somewhat more weakly determined (*Gurtner et al., 1989*).

For power line profile surveys the centre line profile is produced from on-line position fixes (x, y and z) observed and logged with the GPS receiver (rover) of a dual frequency geodetic type instrument using real time kinematic (RTK) mode. RTK mode allows the rover receiver to maintain its on-line position between two bends whilst geo-positions from satellite data are recorded.

### **Outline of GPS method**

Under normal circumstances (and it is recommended) the bend positions along a power line route will have been fixed before a profile survey is undertaken. It is essential (*absolutely mandatory!*) that all bend positions are fixed using at least two baseline measurements or some other means of independent check for their geo-position determinations.

Once the bend co-ordinates have been punched into the rover receiver firmware and RTK mode selected the field operator is able to navigate with relative ease to on-line positions with centimetre accuracy between any two consecutive bend points.

Position fixes recording change of slope, topographical detail and side slope, where necessary, *shall* be observed and measured. In flat terrain the maximum limit between on-line position fixes of 30 metres must still be applied.

Most modern geodetic receivers allow the field operator to make use of an automatic profiling algorithm whereby the rover receiver will capture an automatic on-line position (x, y and z) along a centre line. The field operator has the choice of programming any desired capture distance into the rover firmware for his automatic profiling exercise. To opt in and out of the automatic profiling algorithm for capturing topographical and other detail positions (off-line and on-line) whilst moving down the centre line is a triviality.

If only two GPS receivers are used for the profile survey then the start and end bend positions (beacons) for each straight must be occupied, their positions observed and logged in RTK mode for consistency checking purposes. It is worth mentioning that a further consistency check on the profile survey takes place during the tower staking-out survey process. In this exercise the field operator will have armed himself with a PLSCAD spreadsheet printout on which the progressive distances of the towers and the minimum clearance positions (midspan) of the conductors down each straight are listed. These midspan positions (or minimum clearance positions) x, y and z captured during the tower staking out survey must agree with the profile data geo-positions.

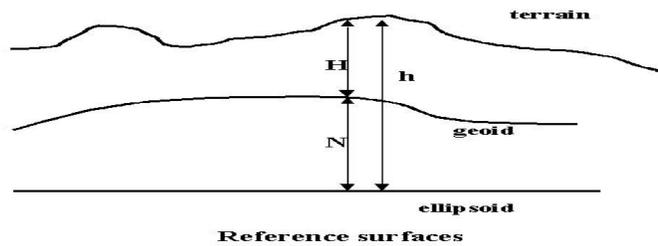
The use of three receivers for a more rigorous checking process whereby two base lines are measured for each spot-shot is an additional option. This can be done using:

- a) two RTK base lines or using
- b) one RTK base line together with a post processing kinematic base line.

In this latter case an additional static post processing reference station capturing raw satellite data would be an essential requirement. Longer occupation times (for the post processing kinematic method) at each spot shot are required – 4 epochs as opposed to 1 epoch for the RTK baseline. Loss of lock situations must be carefully monitored.

### Height systems

There are special problems associated with using GPS for height determinations and a knowledge of the difference between the ellipsoid (WGS84) and the geoid which is an equipotential surface corresponding closely to mean sea level is necessary. Heights measured with respect to the geoid are known as orthometric heights.



**h = ellipsoidal height**  
**H = orthometric height**  
**N = geoidal height**

$$H = h - N$$

Strictly speaking, the height system of the national trigonometrical system in use in South Africa uses a modified form of normal height (*Merry 1977*) which refers to a surface known as the quasi geoid. The quasi geoid coincides with the geoid at sea level and can depart from it by some tens of centimetres at high elevations. For all practical purposes the subtle difference between the geoid and the quasi-geoid can be ignored.

GPS heighting provides heights above the ellipsoid whilst the usual reference surface for heights is the geoid. For most surveying and engineering purposes the GPS ellipsoidal heights must be converted to orthometric heights. For tower design purposes however where a templating exercise is undertaken it is the relative differences of height along a centre line that are important. The choice of datum is not 'cast in concrete.'

The geoid – ellipsoid separation, or geoidal height is not insignificant and can reach some tens of metres. However it is not so much its magnitude as its slope which is the cause of concern to surveyors undertaking this conversion. In the Eastern Transvaal and the Drakensberg this slope reaches 20 seconds of arc which translates into a metre over 10 kilometres (*Merry 1993*).

The conversion of ellipsoidal height to orthometric height is seen as complex due to the additional amount of fieldwork that geoidal modelling of an area would require for such a conversion e.g. Geometric modelling,

gravity field modelling or deflection of the vertical determinations by gravimetric, astronomic or GPS/levelling means.

When the engineering surveyor punches in an orthometric height into his GPS receiver for profiling he is effectively setting the geoidal height to zero at his position. Nevertheless GPS receivers are still measuring ellipsoidal height differences as opposed to orthometric height differences. If the geoidal height is constant however then these two differences are equal and the geoid may be ignored.

Nevertheless, depending on the slope of the geoid in the vicinity, GPS measured height differences can and will deviate from orthometric differences at a particular position location.

It is emphasised therefore that GPS profile height differences are based on the ellipsoid as a reference surface and are not orthometric height differences.

### **The avoidance of heighting inconsistencies in GPS profiling**

The national trigonometrical network has been heighted using trigonometrical levelling procedures and has an accuracy level of one metre or worse (*Merry 1993*).

GPS heighting procedures are therefore analogous to the previous horizontal positioning situation that existed prior to the readjustment and Hartebeesthoek94 conversion of the national geodetic network. Currently we are able to measure heights to a precision that far exceeds the accuracy of the existing geodetic heighting system.

The first step in rectifying this situation has already been taken since the GPS survey of the national network has long since been completed. Ellipsoidal heights on WGS84 can therefore be accurately determined since the Hartebeesthoek94 origin is precisely related to the WGS84 system by means of very long base line interferometry (VLBI). The connection of the national precise levelling routes to the trigonometrical beacons used in the South African GPS survey would assist in providing a further link in determining the parameters required for a precise mathematical model of a national geoid (*Merry 1993*).

Until such time as a precise national geoid has been determined there are two rules that must be applied to surveys being undertaken using real-time GPS techniques for profiling purposes. They are:

- 1) Each straight long-section must be surveyed as an entity with no re-location of a GPS reference station taking place until the end bend-point (of the relevant straight) has been occupied and its position observed and logged for a consistency check (see 5.1). Repeater radio communications are thus necessary for 'dead' areas (deep valleys and hill 'shadows').
- 2) Where a different trigonometrical reference beacon is chosen for the profiling survey as opposed to the trigonometrical beacons used in the previous determination (2 x base lines) of bend positions, height variations in height determinations for the bends may be experienced. Logically the latest heights for the bend positions measured during the GPS profile survey should be used. In other words a 4-dimensional coordinate should be used where time provides the fourth dimension. This will avoid spikes appearing in the profile plot at each bend point position.

In this manner height inconsistencies in long-section profile generation arising from inaccuracies in the trigonometrical heighting network can be avoided.

### **DTM METHOD**

All the above methods involve the determination of a single centre line profile with side slope measurements where required. The increase in voltage of transmission lines results in an increased distance between the centre and outer conductors e.g. for 765kV the centre to outside conductor is 20m. This distance is very difficult to estimate in the field. The DTM method overcomes this problem by measuring the heights across a strip from just outside each outer conductor e.g. from 22m left to 22m right for the example quoted above.

## OUTLINE OF DTM METHOD

Measurements are taken to three prism positions spaced:

1. short distance outside the left outer conductor
2. at the centre conductor position (or close to it)
3. a short distance outside the right outer conductor.

The fieldwork is otherwise done as for the EDM profiling methods but it is an absolute requirement to record the data electronically.

### 2.6.2 CALCULATION OF PROFILE

A suitable survey software program is used to generate the Y, X and Z co-ordinates of each point.

A DTM is produced from these co-ordinates using suitable DTM software. Using this software, profiles of the centre and two outer conductor lines are generated and superimposed thus yielding the final required profile. Please note that problems in intervisibility may occur in areas with high vegetation.

### AERIAL LASER MAPPING METHOD (Informative)

This method generates a DTM from a laser sensor instrument and a digital camera both mounted in a helicopter where differential GPS techniques are used to provide geo-referenced orthophotos and a real time navigation ability for the aircraft whilst in the air. Colour digital orthophotos can then be directly related to the laser generated DTM and used to provide the topographical detail normally associated with the profile strip-plan plot.

The system can operate at heights varying from 100 metres to 1000 metres above ground level which in turn result in swathe widths varying from 50 metres to 700 metres along the centre line of a corridor route. The size of the laser footprint at 1000 metres is 25 centimetres.

The laser sensor instrument has a maximum measuring capacity of 7500 Hz. In other words 7500 position (x y z) measurements per second. File sizes are large but discrete editing by means of proprietary software can reduce the file sizes to manageable limits:

- A strip area of 1 km x 0.3km containing 132000 laser points generates an ASCII file size of 6 Mb.
- A strip 10 Km long flown at an altitude of 400 m above ground level and at an airspeed of 100Km/h will generate 45 digital photo images which result in a filesize of some 200 Mb in size.

Powerful workstations are therefore required in order to process the DTM data for subsequent templating manipulation in TLCADD or PLSCADD or ModelMaker. Processing software to manipulate the data can be hired from Eskom Enterprises. Microstation and other Bentley/Intergraph modules are used for data enhancement.

Some of the advantages of laser sensing include :

- Vegetation penetration of the terrain – laser can see through bush and "shadows".
- No ground control required
- Secure – surveys can be performed in hazardous areas
- Even powerline conductors are detected
- Ground and non-ground strikes can be viewed in side-view showing existing pylons, conductor catenaries and vegetation growth in a servitude area.

The accuracy of the laser product in WGS84, ellipsoidal co-ordinates relative to the base stations, is in the order of:

- $\pm 0.05\text{m}$  ( $\pm 3\text{ppm}$ ) of GPS base line length for flying heights below 300 metres
- $\pm 0.10\text{m}$  ( $\pm 3\text{ppm}$ ) of GPS base line length for flying heights from 300m to 1000m

**Important to note that should this method be used, the contractor scope of work must include accuracies and formats as described in this manual.**

### 2.6.3 SUMMARY

#### SCOPE

Land Rights acquisition, completion of the DESD, survey and optimizing of the power line as determined in the contract.

The contractor shall operate from a specified address.

The contractor shall deliver the completed work in accordance with the specifications and to the total satisfaction of Eskom in regard to the clarity, quality, accuracy and neatness.

#### **CONTRACTOR'S RESPONSIBILITY** (to be agreed on before commencement of work)

##### **To handle the project in respect of:**

- All routes to be selected in conjunction with Eskom Surveyors/Environmentalist.
- Wayleave negotiations with property owners.
- Compiling of a schedule of affected properties and registered owners (including owner's conditions).
- Co-ordinating in x, y & z of all T-offs bend points and terminal positions and operating points (Poles with equipment on them) to an accuracy of < 5 metres.
- Profiling and Optimizing
- Pegging of pole positions and stay and strut directions.
- Preparation of route, spanning plans and structure schedules.
- Application for Statutory Approvals other than Spoornet.

##### **Data to be supplied by contractor:-**

- Wayleaves
- Distribution Environmental Screening Document
- Property/Owner schedule (approved electronic format)
- Survey records – field books, computations & schedule of closures or copies thereof.
- Profile and Optimizing data (approved electronic format)
- Co-ordinates (approved electronic format)
- Spanning sheets (approved electronic format)
- Bill of Quantities (approved electronic format)
- Special drawings (approved electronic format)
- Statutory Approvals

### 2.6.4 **STANDARDS**

The route of the rural transmission line shall be pegged such that Eskom's requirements for minimum separating distances between adjoining parallel power lines are strictly adhered to.

The route of the rural transmission line shall also be selected, and the pole positions pegged such that the rural transmission line can be erected in strict accordance with the **CODE OF PRACTICE FOR OVERHEAD POWER LINES** and the relevant sections of the **OCCUPATIONAL HEALTH AND SAFETY ACT, ACT 85 OF 1993**, and any regulations which may apply.

The route of the rural transmission line shall also be selected, and the pole positions pegged in accordance with standard conditions mutually agreed upon with Eskom. Special conditions of property of owners, agreed to at the wayleave negotiations, must be complied with.

The wayleave forms, spanning sheets and route plans are to be prepared and completed strictly in accordance with the specification.

## 2.6.5 DETAILS OF ESKOM'S REQUIREMENTS

### NEGOTIATIONS & ROUTE SELECTION

The contractor shall select and negotiate the most economical and environmental friendly route with the property owner and have a wayleave document signed prior to any work being carried out on the property.

### WAYLEAVE

- The contractor shall obtain the signature of the property owner or his legal representative.
- A sketch plan on scale of 1 : 25 000 indicating the property boundaries (in green) and the negotiated rural transmission line route (in red), shall be signed by the property owner or his legal representative and is to form an annexure to the wayleave. The sketch plan shall indicate separation distances from parallel power lines, roads, telephone lines, property boundaries and any other relevant physical features.

### APPROVAL FROM AUTHORITIES:

The necessary approvals are to be obtained prior to the construction of the power lines:

- Telkom
- Road (Provincial and National)
- Consult Dept Environment Affairs and Tourism with the complete screening document (see attached documents) for a pre-application consultation.
  - Eskom will apply for Transnet approvals upon receipt of special drawings.

### BUSH CLEARING

- All bush clearing requirements must be included in the initial screening document. The contractor shall obtain permission to clear bush and/or trees before any work is carried out in consultation with Authority.
- If approved at pre-application consultation, the contractor shall open a "line of sight" for survey purposes only.

### FENCES

- The contractor shall not flatten or cross over any fences without prior approval in writing being obtained from the property owner.
- The contractor shall repair all fences damaged by him to the satisfaction of the property owner.

### SURVEY AND PEGGING OF THE LINE ROUTE

- The contractor shall set out the line route with its angle, tee-off, terminal and transformer pole positions in accordance with the negotiated route.
- The contractor shall co-ordinate bend points, Tee-offs and terminal points to the required accuracy as well as record the angle at each bend and tee-off point.
- The contractor shall peg all pole and stay positions.
- The span lengths shall be determined by profiling and templating the power line route. It is important to take note of topographical features and any special owner's request in the positioning of pole, stay and/or strut positions.
- The contractor shall take any additional measurements required to enable to correct plotting of the line route in relation to property boundaries on the spanning and route plans.

## **ROUTE PLANS**

On the plans supplied by Eskom the contractor shall indicate the following:

- The line route (in red).
- All other important and relevant features crossed or affected which are not shown on the supplied plans.
- All transformer pole positions denoted by a closed circle with the transformer (installation) number.

## **CADASTRAL SERVICES**

### **Receivables**

The provision of supervision, materials, labour and transport required to undertake cadastral survey work in terms of the Land Survey Act No 8 of 1997.

Cadastral survey is not unique to Eskom and the Professional Land Surveyors are expected to carry these duties according to the industry best practice and guided by all relevant laws that thereof.

### **Activity List**

Acquisition of all necessary plans and Data.

The provision of necessary supervision, materials, labour and transport to undertake the survey work.

Obtaining necessary statutory approvals required for the cadastral surveys.

Drafting of all necessary plans and approval thereof.

Demarcation and pointing out of necessary cadastral boundaries.

Rezoning of properties

### **Deliverables**

Approved Surveyor General Diagrams necessary for the registration of servitudes or acquisition of land, together with other relevant plans.

Where applicable, the placing and pointing out Cadastral boundaries.

### **2.6.7 PRECAUTIONS AGAINST DAMAGE**

Eskom is committed to causing as little damage as practicably possible to the natural environment and in this context the Contractor is required to exercise extreme care that no unnecessary damage or removal is caused to grass, topsoil, trees and indigenous bush.

The surveyor shall submit to Eskom a written report as soon as possible of any damage to crops or trees necessitated by this survey to enable Eskom to pay compensation.

The report shall detail the following:-

- Name and address of the owner of the damaged crop and the description of the property.
- The type(s) of crop(s) damaged.
- The length and width of the area of each type of crop damaged. (The length is important as many owners have a complete misconception of length particularly if lands are crossed at an angle).
- The number of trees of each type cut. (For natural bush a reference to type, area and density is useful).
- Particular care shall be taken to avoid damage to crops or private farm roads, littering of the veld or the starting of fires.
- The contractor shall be held liable for all damage arising from negligence on the part of himself and his employees.
- Protection of the environment should at all times be adhered to.

## **THE RESPONSIBILITIES OF ESKOM**

- The supply of the survey request with a proposed route plan.
- The supply of 1:25 000 or 1:50 000 map.
- Blank Wayleave forms and an example of a completed form with sketch.
- Provide examples of spanning plans (on request).
- Provide an example of a drawing of a crossing (on request).
- Eskom statutory and legal requirements regarding separation distances clearance requirements (on request).
- Structure/Templating parameters (on request).
- Eskom statutory and legal environmental requirements.

### **2.6.8 GENERAL**

Obligation to Property Owners and Entry on to Properties.

Eskom is dependent on the continued goodwill of property owners for the acquisition of rights for powerlines. A courtesy call on the resident owners, farm managers or lessees by the surveyor is considered essential to explain the work that is commencing. Alternatively, owners may be advised by postcard that work is due to commence on a given date; that crops or trees may be damaged in order to complete the work, and that compensation for such damage would be paid.

Wayleave document to be signed by all property owners.

The following are a number of important points to be remembered while working on a farmer's property.

- Notify the farmer at least 24 hours before you move onto
- His property, informing him of how long you expect to be on property.
- Where possible, remain on all roads and tracks.
- Do not drive at excessive speed.
- Close all gates. (Except gates that were found open).
- Do not interfere with stocks and crops.
- Request permission for the user of water.
- Do not interfere with the farmer's staff.
- Do not make fires.
- Do not shoot any game.
- Leave the area clean and tidy.

**Useful additional sources of information on this subject**

The following documents contain information which, through reference in the text, constitute requirements of this guide. All Acts, standards and specifications are subject to revision, and parties to this manual are encouraged to use the most recent editions of the documents listed below.

- Advertising on Roads and Ribbon Development Act 21 of 1940
- Eskom Conversion Act 13/2001
  
- Electricity Act 41 of 1987
  
- Explosives Act 26 of 1956
  
- SA National Roads Agency Limited and National Roads Act 7/1998.
- National Environmental Management Act, Act 107 of 1998
- Environment Conservation Act, Act 73 of 1989
- National Forest Act, Act 84 of 1989
- Rights of way Manual: *Negotiator's Handbook* (Module Number 15979)
  
- Occupational Health and Safety Act 85 of 1993
  
- SCSASAAV1, Rev.2, Distribution Standard Part 6: Sub-transmission Lines, Section 1: General.
  
- SCSASAAZ9, Clearing and maintenance of servitude routes
  
- SCSASABE7, Rev.1, Distribution Standard Part 4: Medium Voltage Reticulation, Section 0: General information and requirements for overhead lines up 33kV with conductors up to HARE/OAK.
  
- SCSPVQBA41: Rev.0, Procedure for the approval of work where Eskom's rights might be encroached upon and/or services/assets placed at risk.
  
- ESKAMAAC3 - Guide for the co-use of Eskom Servitudes
  
- ESKASABG3: Standard for Bush Clearance and Maintenance within overhead powerline servitude
  
  
- Land Survey Act No. 8 of 1997
- Plato Act 40 of 1984
- 34-333 DISADABQ9 : Health & Safety requirements to be met by Principal Contractors employed by Eskom Distribution Procedure
- ESKPVAAZ1 : Environmental Management Programme (EMP) Procedure
- ESKPAAD6 : Environmental Management Policy
- Quality Requirements for the Procurement of Assets, Goods and Services
- SCSPVABP43 : Management of Substance Abuse
- ESKADABD7 : Suspending Suppliers from Eskom's Supplier Lists
- Eskom Business Conduct Policy and Guidelines

### 3 Constraints on how the *Consultant* Provides the Services.

#### 3.1 Management meetings

Regular meetings of a general nature may be convened and chaired by the *Employer's Agent* as follows:

Title and purpose	Approximate time & interval	Location	Attendance by:
Risk register and compensation events	Weekly on _____ at _____		
Overall contract progress and feedback	Monthly on _____ at _____		<i>Employer's Agent , Consultant and</i>

Meetings of a specialist nature may be convened as specified elsewhere in this Scope or if not so specified by persons and at times and locations to suit the Parties, the nature and the progress of the *services*. Records of these meetings shall be submitted to the *Employer's Agent* by the person convening the meeting within five days of the meeting.

All meetings shall be recorded using minutes or a register prepared and circulated by the person who convened the meeting. Such minutes or register shall not be used for the purpose of confirming actions or instructions under the contract as these shall be done separately by the person identified in the *conditions of contract* to carry out such actions or instructions.

#### 3.2 *Consultant's key persons*

Solicit an organogram from the Consultant showing his people and their lines of authority / communication.

#### 3.3 Provision of bonds and guarantees

No performance bond or guarantees required – only retention as specified under secondary option X16.

#### 3.4 Documentation control and retention

##### 3.4.1 Identification and communication

All contractual communications will be in the form of properly compiled letters or forms attached to e mails and not as a message in the e mail itself.

##### 3.4.2 Retention of documents

The time period for which the Consultant is to retain such documents is the period for retention stated in the Contract Data.

#### 3.5 Records and forecasting of *expenses*

The project duration is 36 months period. The rates will be Fixed and Firm in the First Year and thereafter the rates will be adjusted to incorporate Cost Price Inflation (CPI) based on market conditions.

Transportation costs will be adjusted either up or down on a three monthly basis based on the Market Price for Fuel.

### 3.6 Invoicing and payment

The following details shall be shown on or attached to each Invoice to show how the amount due has been assessed:

The *Consultant* shall address the tax invoice to

**ESKOM HOLDINGS SOC LIMITED**  
**Reg No: 2002/015527/06**

and include on it the following information:

- Name and address of the *Consultant* and the *Employer's Agent*;
- The contract number and title;
- *Consultant's* VAT registration number;
- The *Employer's* VAT registration number 4740101508;
- Total amount invoiced excluding VAT, the VAT and the invoiced amount including VAT;
- (add other as required)

### 3.7 Contract change management

For any compensation event refer to clauses under section 6 of the core clauses of the NEC3

### 3.8 Inclusions in the programme

The consultant shall submit his construction program in terms of the conditions of contract. This program shall be submitted according to Part one – Data provided by the Employer (Time).

This program shall contain at least the following activities with scheduled start and completion dates:

Every activity on the programme will be clearly linked to a labour resources and equipment required to perform the specific activity.

Weather delays based on the rainfall data, must be included in the programme. Only weather delays over and above the specified number of rain days will qualify for evaluation as delays.

Completion and hand-over dates for formal inspection by the site supervisor must be indicated.

Project expenditure (cash flow) on a monthly basis for the entire duration of the contract must be indicated.

The Contract Program will be on display in the Consultants Site Offices and will be updated weekly.

In addition to the maintaining of this programme, the Consultant will report progress to the Project Manager on a weekly basis.

Should any deviations to the program be found, the Consultant shall submit a revised program to the Project Manager within one week.

Acceptance of any program by the Project Manager shall have no contractual status other than an indication that the Project Manager is satisfied as to the order in which the work is to be carried out, and that the Consultant undertakes to perform all work in accordance with the accepted program.

The Project Manager retains the right to alter the accepted program should circumstances on site necessitate such a change.

The following Statutory non-working days are included within the contract period:

- All Public Holidays for the duration of the contract.
- The programme must clearly indicate the working days for the entire construction period or alternatively all the non-working days within the construction period.

### 3.9 Quality management

An approved Quality Control Programme is to be implemented in conjunction with, and to the approval of, the Project Manager

### **3.10 The Parties use of material provided by the *Consultant***

#### **3.10.1 Transfer of rights if Option X 9 applies**

The Consultant shall not challenge or assist any other party challenging at any time the validity or ownership of any of the intellectual property rights relating to the material created and developed for this contract.

### **3.11 Health and safety**

If the Consultant is required to work on Eskom premises, then whatever requirements which personnel working in those premises need to comply with.

The *Consultant* shall at all times comply with the health and safety requirements prescribed by law as they may apply to the *services*.

The *Consultant* shall comply with the health and safety

- Section 37(2) Agreements with Eskom
- SRSPEC002 - SAFETY HEALTH AND ENVIRONMENTAL SPECIFICATION FOR CONSULTANTS
- SAFETY SPECIFICATION – FDP DOCUMENT
- DPC 34-333

### **3.12 Procurement**

#### **3.12.1 BBBEE and preferencing scheme**

PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2011

#### **3.12.2 Preferred sub consultants**

Sub consultant is not promoted

Any appointment of a sub consultant by the Consultant is to be approved by the Project Manager.

The Sub Consultant must be CIDB registered.

### **3.13 Correction of Defects**

The Consultant corrects a Defect whether or not the Employer notifies him of it. The Consultant corrects Defects within a time which minimises the adverse effect on the Employer or Others.

### **3.14 Working on the *Employer's* property**

### **3.15 Cooperating with and obtaining acceptance of Others**

The Consultant is responsible to ensure that the landowners and/or local authority have been informed before any work is carried out on site.

### **3.16 Things provided by the *Employer***

Access to Eskom premises

## 4 List of drawings

### 4.1 Drawings issued by the *Employer*

This is the list of drawings issued by the *Employer* at or before the Contract Date and which apply to this contract.

Drawing number	Revision	Title
Task Instruction		

## 5 Powerlines and Telecommunication Towers with regards to aviation



Aviation -  
240-103616544.pdf