

	<p style="text-align: center;">Scope of Work</p>	<p style="text-align: center;">Technology</p>
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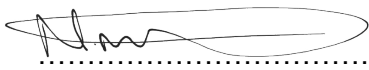
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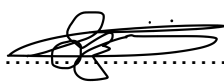
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Revision	Date	Brief details of updates	Approved by
1	November 2020	First issue	S. Natesan
2	February 2021	Updated template to include acceptance from Eskom Telecoms, fence, and gantry requirements	S. Natesan
3	November 2022	Changed from 65 m to 80 m	S. Nzama
4	August 2023	Updated to include trenching requirements inside HV yard, revised tower mass and antenna mounting brackets	S. Nzama

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1. INTRODUCTION

This document is to give detailed scope of work for construction of 80 m tower at Wapadskloof Substation site (SS) [coordinate 25 35 30.87 S, 29 51 28.14 E]. The tower is to be used to provide telecommunication network for purpose of SCADA RTU and Telephone lines.

2. SCOPE OF WORK

The document covers the general Scope of work needed to be done at Wapadskloof SS. It gives the guideline of the scope of work to be covered by appointed contractor for construction of 80 m Tower i.e. Supply, delivery and erection of 80 m Tower at Wapadskloof SS in the Mpumalanga operating unit (OU).

2.1 PHASE 1: PRODUCTION OF MANUFACTURING DRAWINGS

Eskom will provide

2.2 PHASE 2: DESIGN OF TOWER FOUNDATION

The construction of the foundation shall be in accordance with the following drawing:

"0.53/Wapadskloof: Concrete_Pad_Type_foundations_layout_and_details"

Should the soil conditions be unfavourable for the installation of this design, the contractor shall inform Eskom.

Contractor to allow for construction of concrete surface bed at the base area of the tower

2.3 PHASE 3: MANUFACTURING AND TOWER CONSTRUCTION

2.3.1 Material Quality

The following material grades shall be utilized:

Steel Sections	S355JR
Plates (less than 19mm thick)	S355JR
Plates (greater than 19mm thick)	S355J0 (for better workability)
Bolts	Grade 8.8 to ISO 898
Nuts	Grade 8
Washers and Packers	S275JR

Impact properties in the longitudinal direction of all structural materials shall be determined for grade S355JR material greater than 19mm in thickness in accordance with the Charpy V-notch test. Charpy V-notch requirements at a minimum, shall meet the requirements of 27 J absorbed energy at room temperature (21° Celsius)

Silicon and Phosphorous content of steel is limited as follows:

"Aluminium Killed Steel": Silicon (Si) = 0.01 to 0.04%, Phosphorous (P) < 0.015% max

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“Silicon Killed Steel” : Silicon (Si) = 0.15 to 0.25%, Phosphorous (P) < 0.02% max

2.3.2 Tower fabrication

Tower fabrication must be done as per general tower specification, 240-59967638

The supplier and his manufacturing facility shall employ a production process that has an integrated Quality Management System (QMS). The Quality Management System employed shall be based on the framework of SABS /ISO 9001 standards for Quality Management Systems or be an equivalent recognised system approved by Eskom Quality Assurance Division. Details of the QMS shall be provided.

2.3.3 Quality inspection of the supplied steel

The contractor to send an inspection notification to Eskom 7 days in advance for the inspection of the steel to be used in order for Eskom to verify the quality of the steel provided.

2.3.4 Prototype Assembly

- a) All structures shall be test assembled in the shop to the extent necessary to ensure accurate fit in the field. Prototype assembly shall include all structure components and accessories. Assembly procedure shall demonstrate that each section fits the adjacent section.
- b) A Prototype Assembly Report shall summarize the findings of the prototype assembly and all necessary modifications to the members.
- c) The prototype structure shall be assembled with the correct fasteners and bolts tightened to the correct torque.

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2.3.5 Corrosion levels

The position of the tower is about located in the Mpumalanga province which falls under the rural inland category as per **Figure 2.1**. The expected corrosion level in the region is less than 10 µm/year. Therefore, standard galvanizing is specified with a thickness of 85µm in order to carter for rate of corrosion on the tower steel.

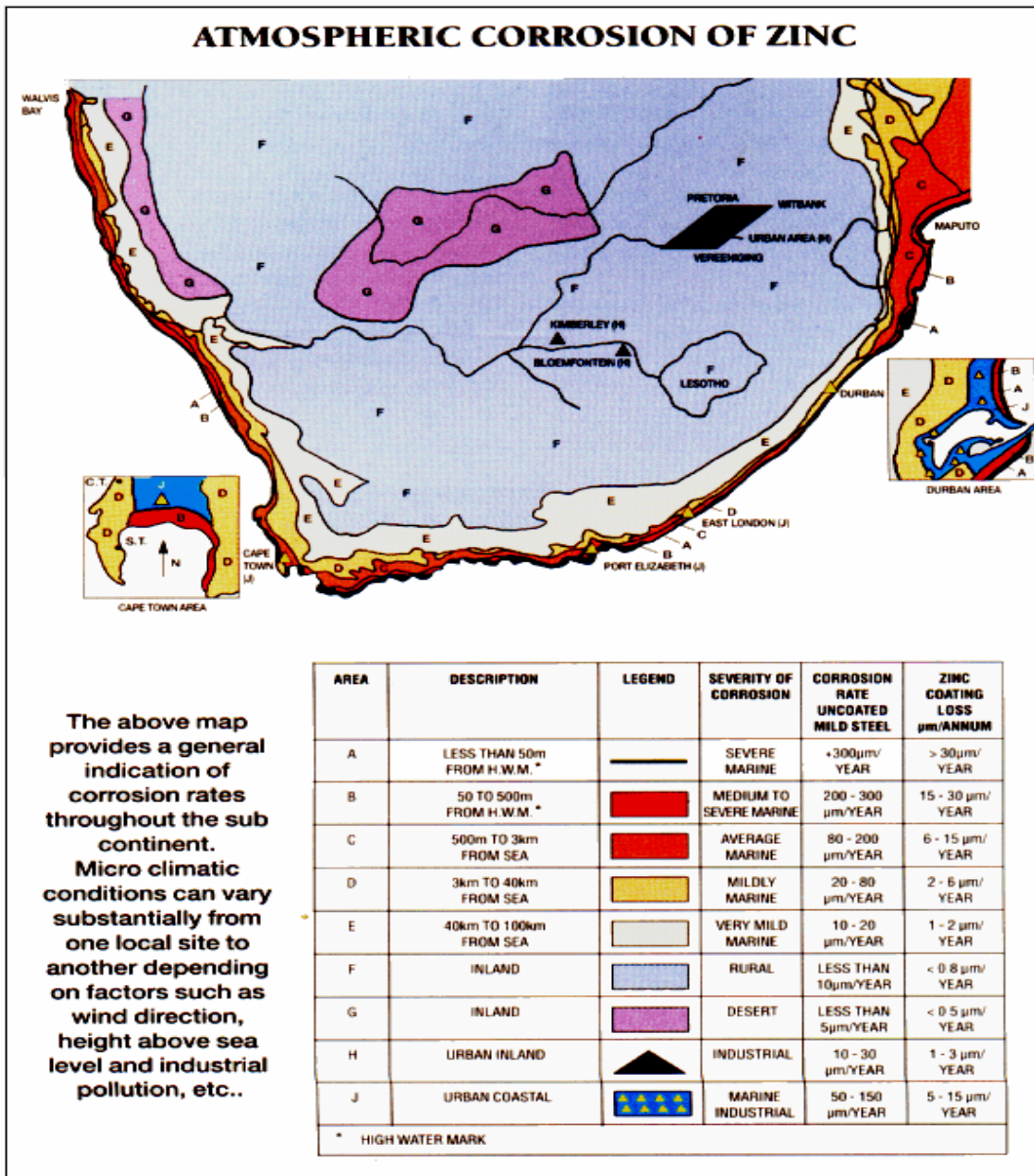


FIGURE 2.1: CORROSION LEVELS EXPERIENCED IN REGIONS OF SOUTH AFRICA

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2.3.6 Other pre-construction activities

The contractor to supply the following documents to Eskom for review and acceptance before construction commences:

- a) All the Safe Work Procedures to be used detailing step by step methodology that will be used by during construction to ensure that the tower is safely constructed.
- b) The contractor to note that ORVHS authorization is required for all the sites that are located within the substation yard
- c) The contractor to provide Eskom with a quality, inspection and test plan (QITP) for acceptance before any construction can take place. An example of this will be provided to the contractor once the contract has been awarded

2.3.7 Construction activities

The construction of the tower must be done in accordance to the Eskom standard 240 – 59967638.

2.3.8 Geo-Technical information

Eskom will provide the report

2.3.9 Total tower mass

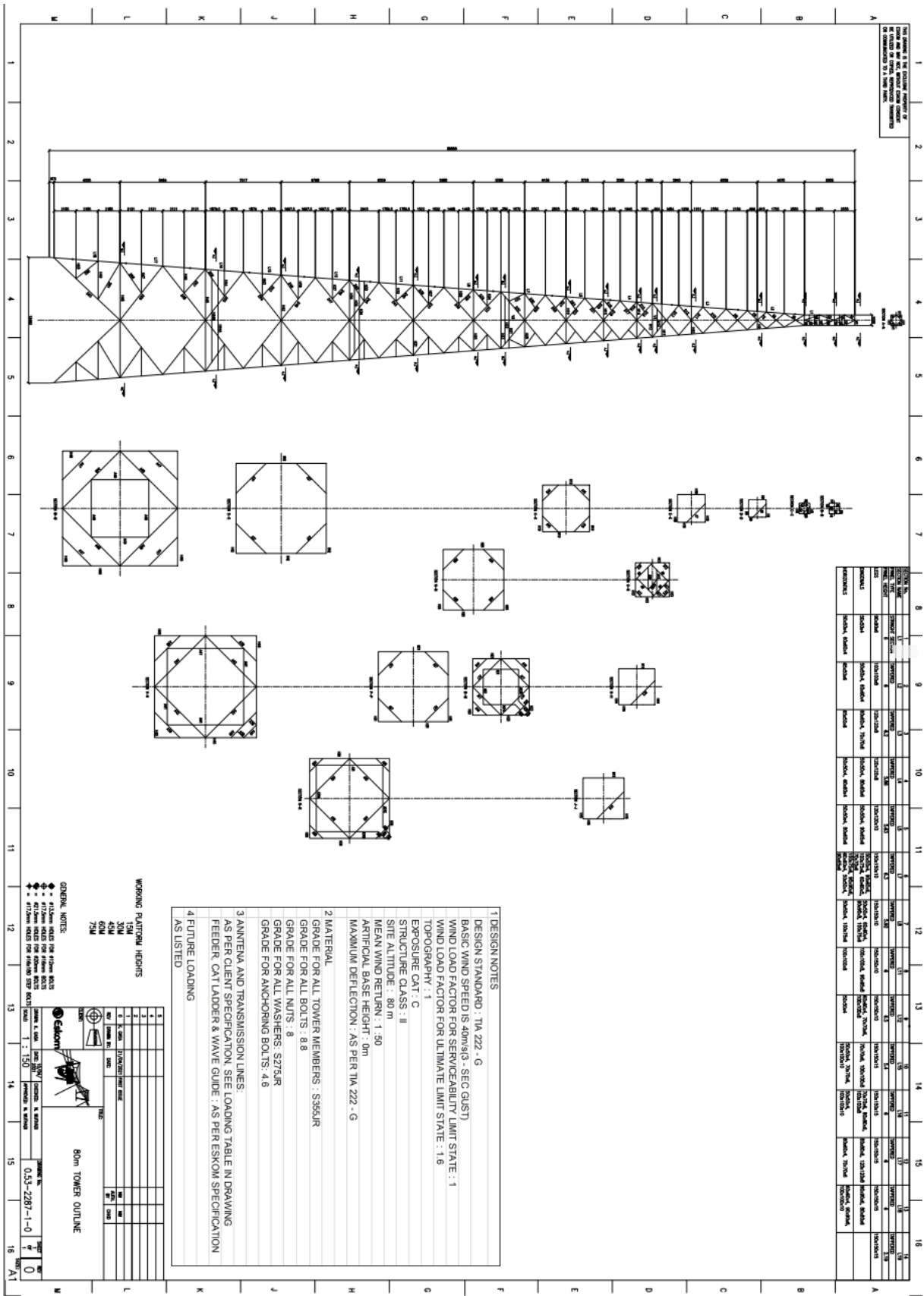
The total tower steel mass including the plates, bolts platforms, and ladders = **32057 kg. This should be used when costing as well.**

2.4 PHASE 4: DISMANTLING AND SCRAPPING OF EXISTING TOWER

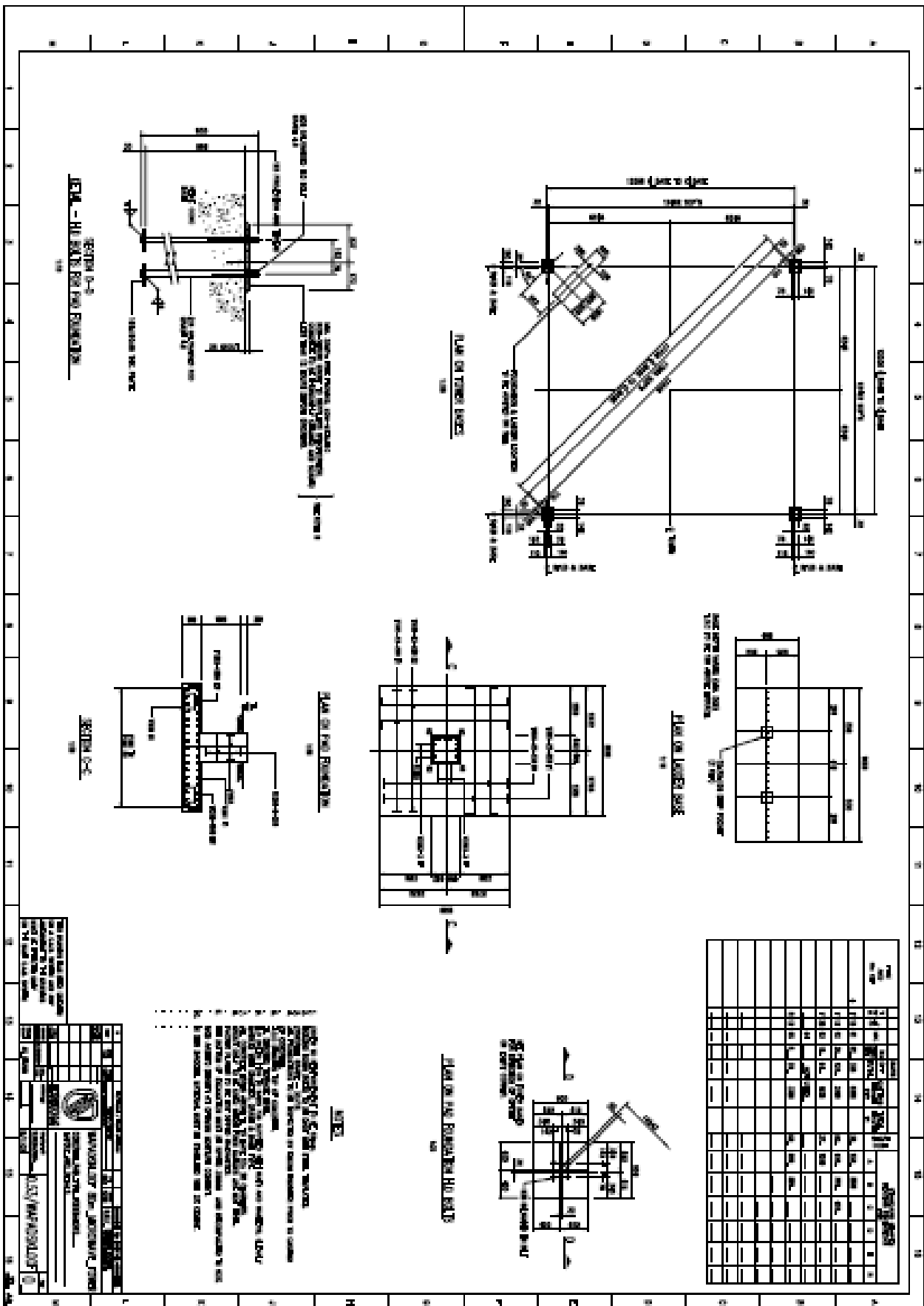
No dismantling scope of work is required.

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2.5 TOWER DRAWINGS

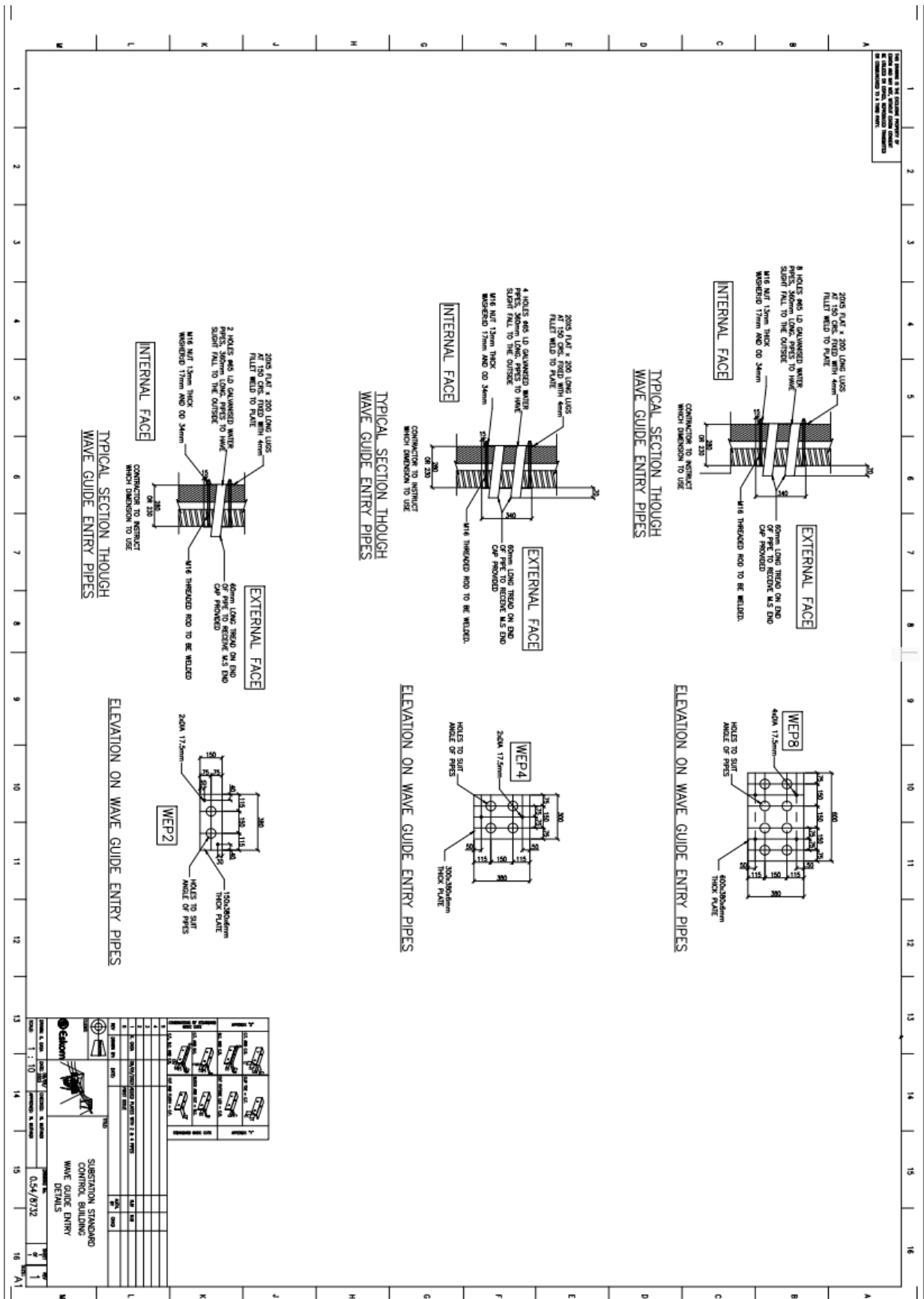


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2.6 TOWER EARTHING AND BONDING

The tower earthing and bonding must be done in strict accordance to the radio station earthing and bonding standard - **240-56872313**

2.7 OTHER USER DEFINED REQUIREMENTS

1. The contractor shall provide AS-built document such as engineering Certificate signed off by contractor professional engineer to declare that tower is safe, earth test certificate, site drawing and any other documents that deemed applicable by them and Eskom telecommunication and/or Provide documentation related to 80 m tower.
2. The tower shall have platform (full landing zone) with trap doors as specified on the manufacturing drawings.

Notes:

- Trap door should be lockable on open and closed position.
 - Ensure kick plates are minimum 150 mm x 2.5 mm thick.
 - Ensure resting stations or platforms do not interfere with the direct routing paths of the feeder ladder
 - Provide earthing terminal plates at each landing with brass bolts for terminating equipment earthing leads. This must be bonded to main tower down earth or structural steel if a down conductor was nor required.
3. Tower shall have cat ladder to its full length with guard rails as per Eskom standard.
 4. Provide earthing terminal plates with brass bolts as per *Eskom Telecommunications General Tower Specification (240-59967638)* and *Radio station Earthing and Bonding standard (240-56872313)* for terminating equipment earthing leads. This must be bonded to main tower earthing system.

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5. The contractor must supply and Install universal microwave antenna brackets (**see drawing no 0.53/2083**) per Table 2-1: **Table 2-1**

Notes:

- *The Supplier is allowed to submit alternative antenna mounting brackets to ESKOM for review and approval were necessary.*
- *Contractor is required to verify the slope of the mounting brackets to ensure they fit the slope of the tower before manufacturing.*

Table 2-1: Antenna Mounting Brackets Schedule

Attachment level	Bracket Type	Quantity
4 x @Working platform #5(75 m level)	B2	4
2 x @Working platform #2(30 m level)	B1	2

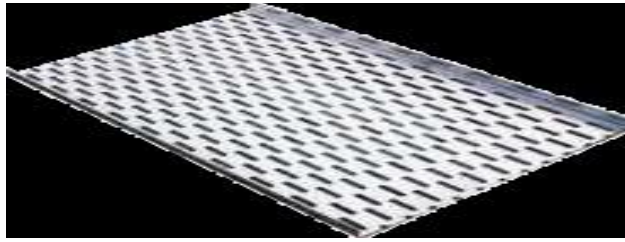
6. Tower Cable Tray /Feeder entry panel:

- Contractor to install a 15 m **horizontal cable tray/racking** from the tower to the interface with the new cable trench to the control room.
- The cable tray must be installed upside down to prevent feeder cable from hail damage.
- The cable tray shall be a **heavy-duty** cable tray pre galvanised standard finish and the splicing method must be overlap with M6 gutter bolts and square nuts. Where bends are required it shall be of horizontal bend (**see example** of horizontal cable tray and horizontal bend below)



Horizontal bend

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Straight cable tray heavy duty pre-Galvanised.

- Additional criteria for cable Tray

Width (mm)	304
Height (mm)	19
Finish fasteners	Electro - Galvanised
Number of Gutter bolts and square nuts per joint	3

7. Cable trench

There is an existing concrete cable trench that does not reach the tower location. It is therefore required for construction of an extension to the existing trench to allow the laying of cables to the control room. The new trench required is approximately 20m. The trench shall consist of 2x 40mm PVC pipes buried in trench.

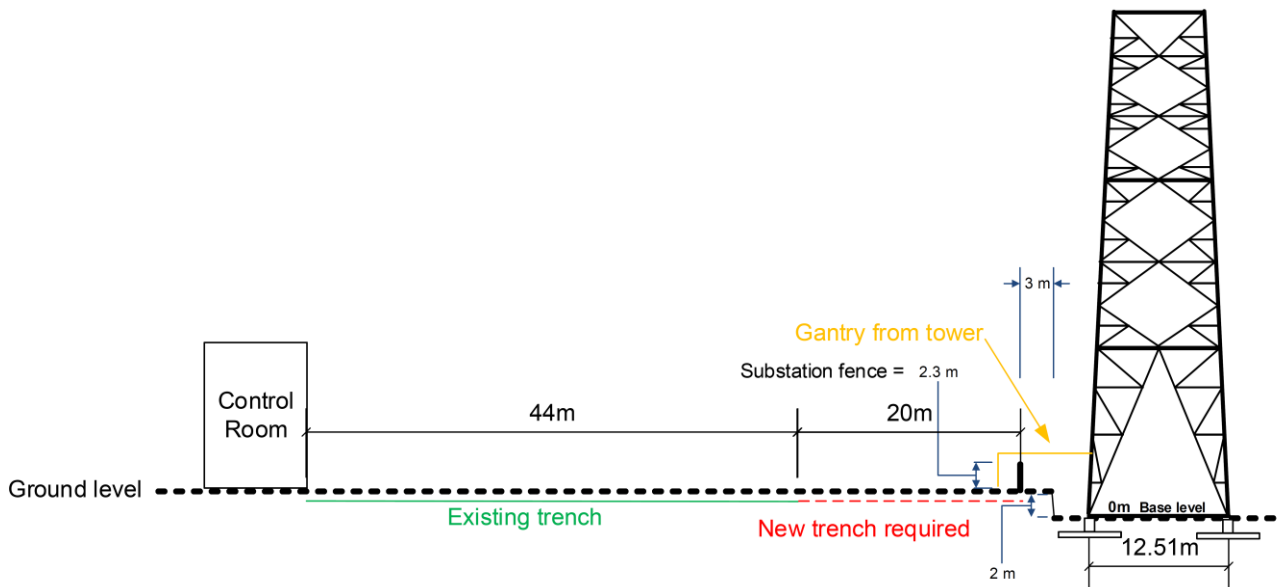


Figure 7.1: Proposed new cable trench location

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Additional criteria for cable trench extension are as follows:

Width (mm)	200
Height (mm)	200
Finish fasteners	Electro - Galvanised
Number of Gutter bolts and square nuts per joint	3

The trench scope shall consist of:

- Clearing of approximately 20x0.3m crushed stone
- Excavate 20x0.2x0.2m soil.
- Lay and connect the PVC pipes with bends and draw wires.
- Backfill the topsoil and compact
- Reinststate the crushed stone.

8. Wave guide plate details

Waveguide entry plate shall be installed as per drawing no "0.54/8732-1 Control building wave guide entry details"

9. Fence around the Tower

Fencing requirements are listed as per below

- 18 x 18 x 18 x 2.4 m standard galvanised steel palisade fence is required around the tower (with a pedestrian gate). A 3-side fence required as the other area will be covered by the existing SS fence.
- The fenced floor area to be covered with 19 – 25 mm granite crusher stone.
- Area under the tower to be surfaced with concrete bed.

2.8 SITE INFORMATION

The tower is to be constructed at the Wapadskloof SS, which is located in Mpumalanga.

GPS Coordinate: **25 35 30.87 S, 29 51 28.14 E**

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2.9 BILL OF MATERIALS (BOM)

The table below shows high level bill of material required for the tower and not meant to nullify other items that are specified on the Eskom standard 240 – 59967638.

Item	Description	Unit	Qty.	Labour rate	Total
1	Foundation (all 4 legs)- See drawing no 0.53/Wapadskloof: Concrete_Pad_Type_foundations_layout_and_details				
1.1	Reinforcement steel weight	kg	4205		
1.2	Concrete volume	m ³	66		
1.3	Excavation volume	m ³	188		
1.4	Formwork Surface	m ²	61		
1.5	Backfill	m ³	122		
1.6	35Mpa Non-Metallic No shrink grout	m ³	0,0212		
1.7	M36 GRADE 4.8 GALVANIZED H.D BOLTS WITH 160 x160x16 THK PLATES	n/a	16 X 955 mm LONG		
1.8	Concrete surface bed 100mm THK, complete with the necessary joints	m ²	156		
2	Main tower - See drawing no 80 m Tower outline – Wapadskloof SS galvanised at 85 µm				
2.1	Supply steel – including plates, cat ladder, working platforms galvanised at 85 µm	kg	28851		
2.2	Supply bolts – After final tightening of all nuts, they shall be fixed in position by punching three indentations at approximately 120-degree intervals around the threads with a round pointed centre punch. The nuts and exposed bolt thread shall be painted with a single pack waterborne anti corrosive paint with a life expectancy of 20 years	kg	3206		
2.3	Tower Assembly	hr	40		
2.4	Tower Erection	hr	20		
3	Working/resting platforms - supply and install				
3.1	Already included under 2.1				
4	Antenna Mounting Brackets - Supply and install				
4.1	4x Antenna Mounting brackets B1	Unit	4		
4.2	2x Antenna Mounting brackets B2	Unit	2		

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5	Miscellaneous - Supply and install				
5.1	Cat ladder and cage – already covered under section 2.1				
5.2	Earthing terminating plates, with brass bolts . (@ 15 m , 30m, 45 m, 60 m, 75 m and one at gantry)	Unit	6		
5.3	Horizontal cable tray/racking-heavy duty including supports	m	15		
5.4	Supply and install waveguide entry plate (including earthing) – 600 x 380 x mm THK plate see drawing no “0.54/8732-1 Control building wave guide entry details” – WEP8	n/a	1		
5.5	Tower lights as per Eskom standard 240-138048594				
5.5.1	Double low intensity lights at tower top – Type B(32cd) – including power cable	Unit	2		
5.5.2	four low intensity lights per leg @ half tower height - Type B(32cd) – including power cable	Unit	4		
5.5.3	Power supply cable clamps	Unit	100		
5.6	Tower painting as per CAA requirements – (red and white, equal spacing with red band on top)	m ²	715		
6	Equipment - hire				
6.1	Use of specialized equipment i.e. Crane	hr	12		
7	Fencing –Supply and Install				
7.1	18 x 18 x 18 x 2.4 m 3-side galvanised steel palisade fence (including pedestrian gate)	Unit	1		
7.2	Fenced off area layered with 19 - 25 mm granite crusher stone	m ³	15		
8	Dismantling work				
8.1	No dismantling work at Wapadskloof SS	Rate	N/A		
9	Cable trench				
9.1	Excavate trench	m ³	0.8		
9.2	50mm PVC pipe	m	44		
9.3	50mm PVC long 100mm radius bend	Unit	6		
9.4	Draw wires	m	44		
9.5	Backfill, including compaction	m ³	0.8		

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2.10 APPLICABLE STANDARDS

Mast/Tower must comply with Eskom Telecommunication specification as listed.

240-59967638 General Tower Specification

240-56872313 ET Radio Station Earthing and Bonding

240-103616544 Aviation requirements Towers rev 1

240-138048594 LED Aircraft Warning Light for Eskom Telecommunication Towers

Informative references

SANS 10160-3 Basis of structural design and actions for buildings

and industrial structures Part 3 Wind actions

ETSP 0459 ET Tower Lights Specification_rev1

SCSASACF6 Power lines and telecommunications tower Aviation regulations

The civil Aviation Act relating to Obstacles (RSA)

ETPN 1490 Environmental Impact Assessment principles

D-DT-5237 Security Fence

Documents available on request or at <http://dt.eskom.co.za/> or Hyperwave

Latest revision must always be applied.

2.11 DEFINITIONS

2.11.1 Disclosure Classification

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