Eskom	Scope of Work	Transmission

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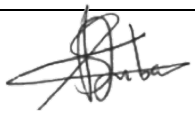
Siyabonga Dubazana	Chief Engineer	26/05/2023	

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Revision	Date	Brief details of updates	Approved by
1	May 2023	First issue	S. Nzama

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1. INTRODUCTION

This document is to give detailed scope of work for construction of 40 m tower at Fondwe radio site (RS) [coordinate 22°53’58.54"S, 30°15’8.82"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 Fondwe radio site. It gives the guideline of the scope of work to be covered by appointed contractor for construction of 40 m Tower i.e. the supply, delivery and erection of 40 m Tower at Fondwe RS in the Limpopo 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/ 40m FOND: Fondwe 40m_Microwave_Tower_Raft_Foundation_Layout_and_Details”

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

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

“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

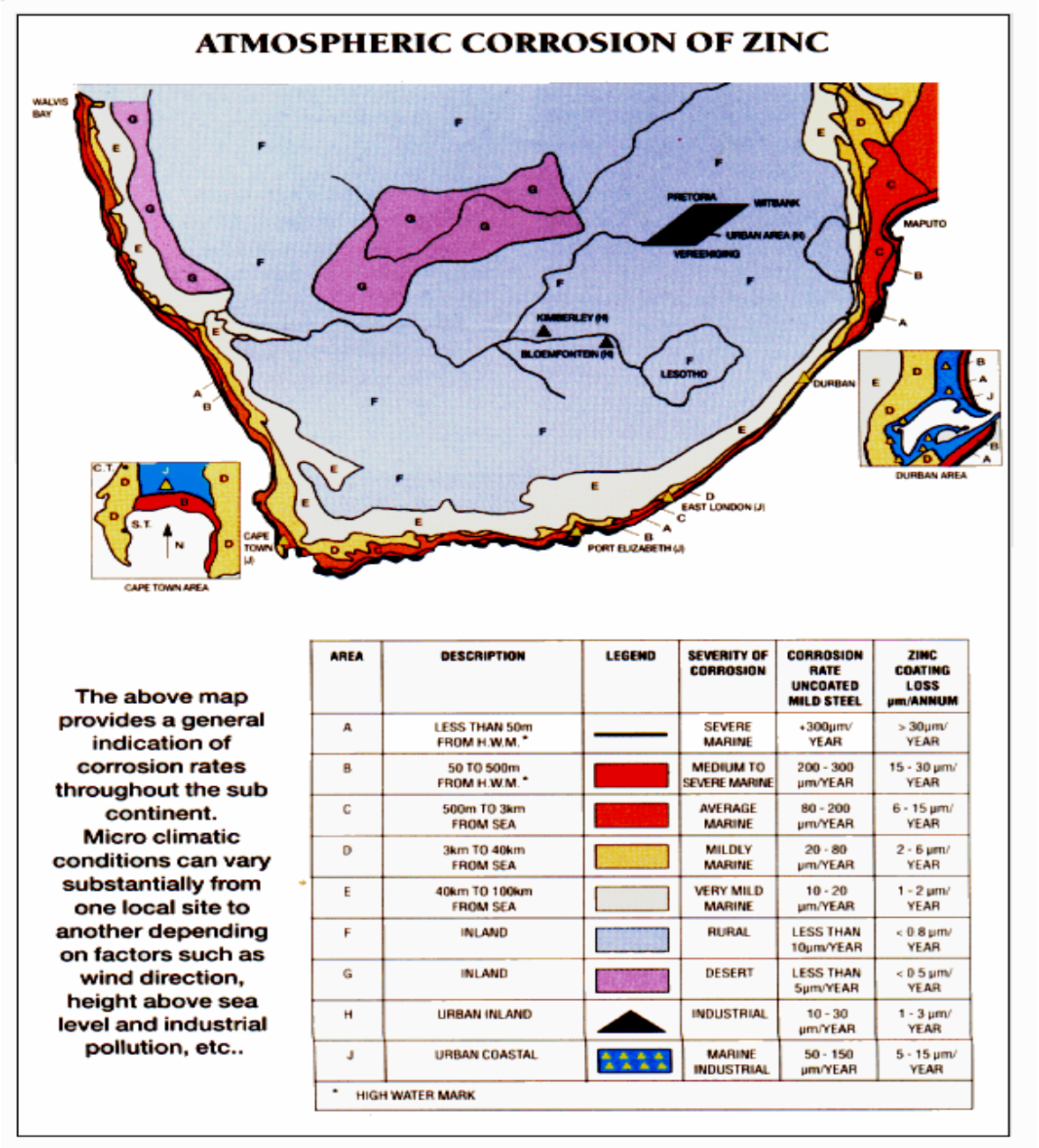
a) All structures shall be test assembled in the shop to the extent necessary to ensure accurate fit in the field. Prototype assembly shall include all structure components and accessories. Assembly procedure shall demonstrate that each section fits the adjacent section.

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.

2.3.5 Corrosion levels

The position of the tower is about located in the Limpopo 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.



AREA	DESCRIPTION	LEGEND	SEVERITY OF CORROSION	CORROSION RATE UNCOATED MILD STEEL	ZINC COATING LOSS µm/ANNUM
A	LESS THAN 50m FROM H.W.M.*		SEVERE MARINE	+300µm/ YEAR	> 30µm/ YEAR
B	50 TO 500m FROM H.W.M.*		MEDIUM TO SEVERE MARINE	200 - 300 µm/YEAR	15 - 30 µm/ YEAR
C	500m TO 3km FROM SEA		AVERAGE MARINE	80 - 200 µm/YEAR	6 - 15 µm/ YEAR
D	3km TO 40km FROM SEA		MILDLY MARINE	20 - 80 µm/YEAR	2 - 6 µm/ YEAR
E	40km TO 100km FROM SEA		VERY MILD MARINE	10 - 20 µm/YEAR	1 - 2 µm/ YEAR
F	INLAND		RURAL	LESS THAN 10µm/YEAR	< 0.8 µm/ YEAR
G	INLAND		DESERT	LESS THAN 5µm/YEAR	< 0.5 µm/ YEAR
H	URBAN INLAND		INDUSTRIAL	10 - 30 µm/YEAR	1 - 3 µm/ YEAR
J	URBAN COASTAL		MARINE INDUSTRIAL	50 - 150 µm/YEAR	5 - 15 µm/ YEAR

* HIGH WATER MARK

FIGURE 2.1: CORROSION LEVELS EXPERIENCED IN REGIONS OF SOUTH AFRICA

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 the contractor 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 (MK21/600/rev.00- *Interpretive geotechnical investigation report*)

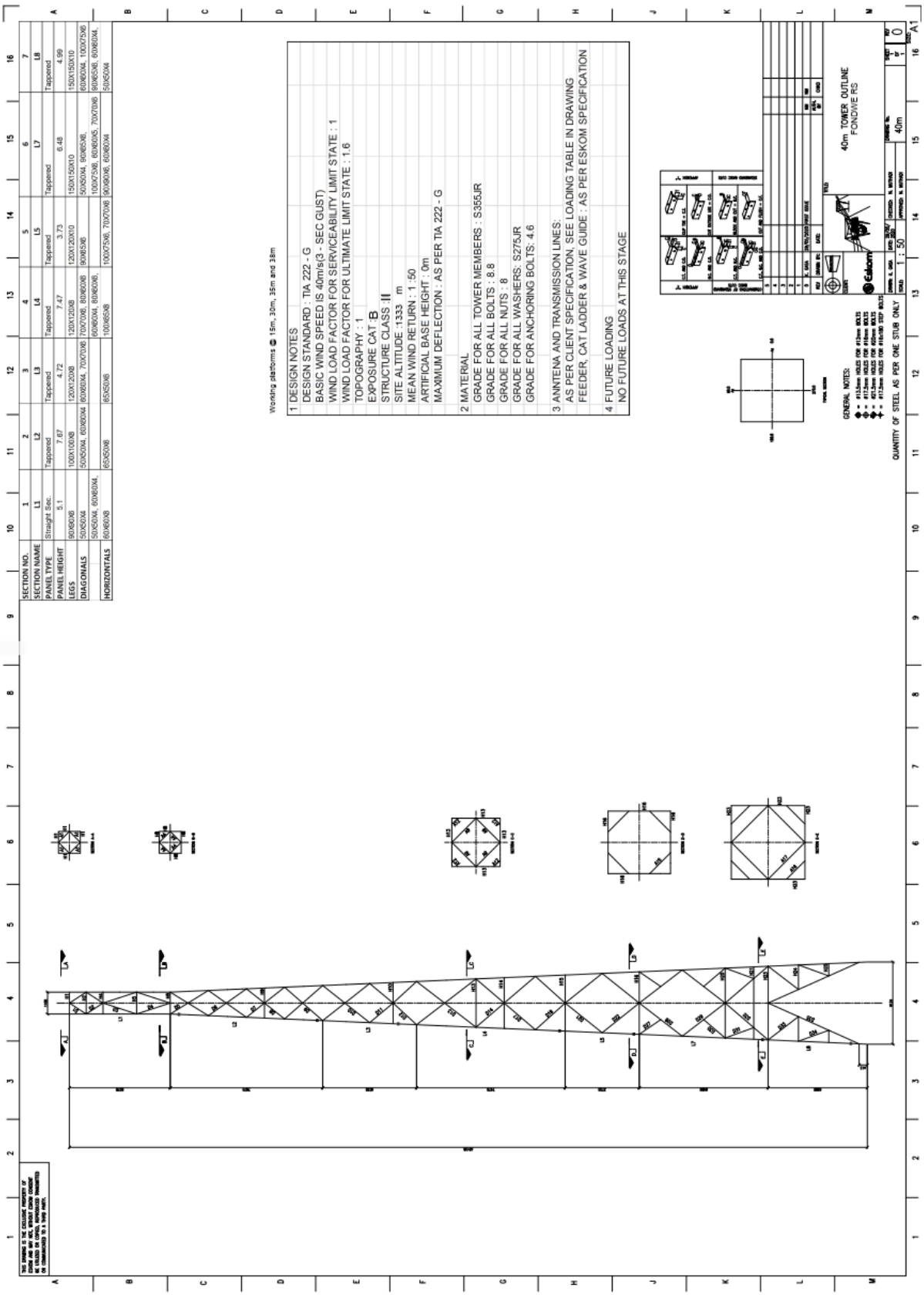
2.3.9 Total tower mass

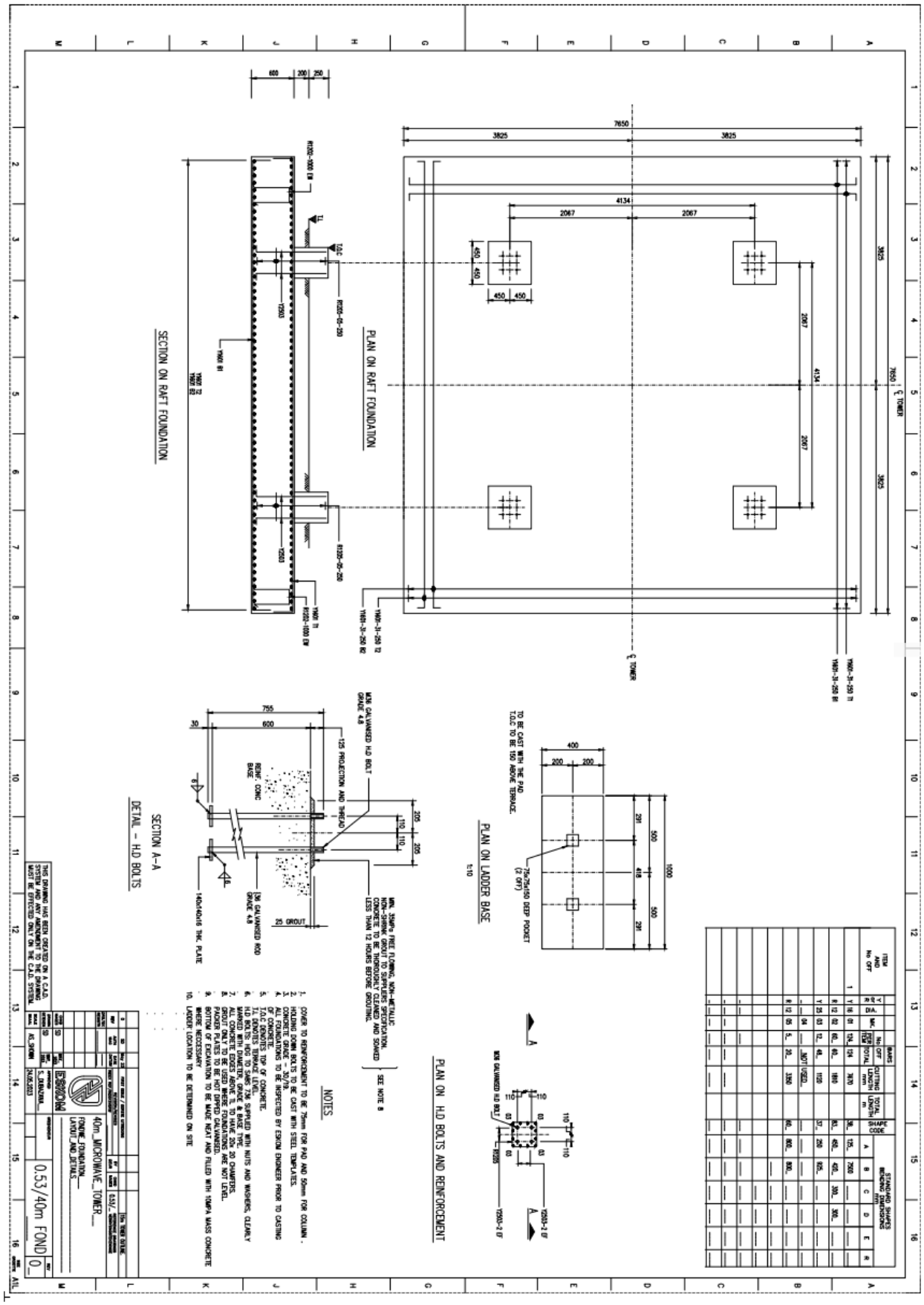
The total tower steel mass including the plates, bolts platforms, and ladders = **8391 kg. This should be used when costing as well.**

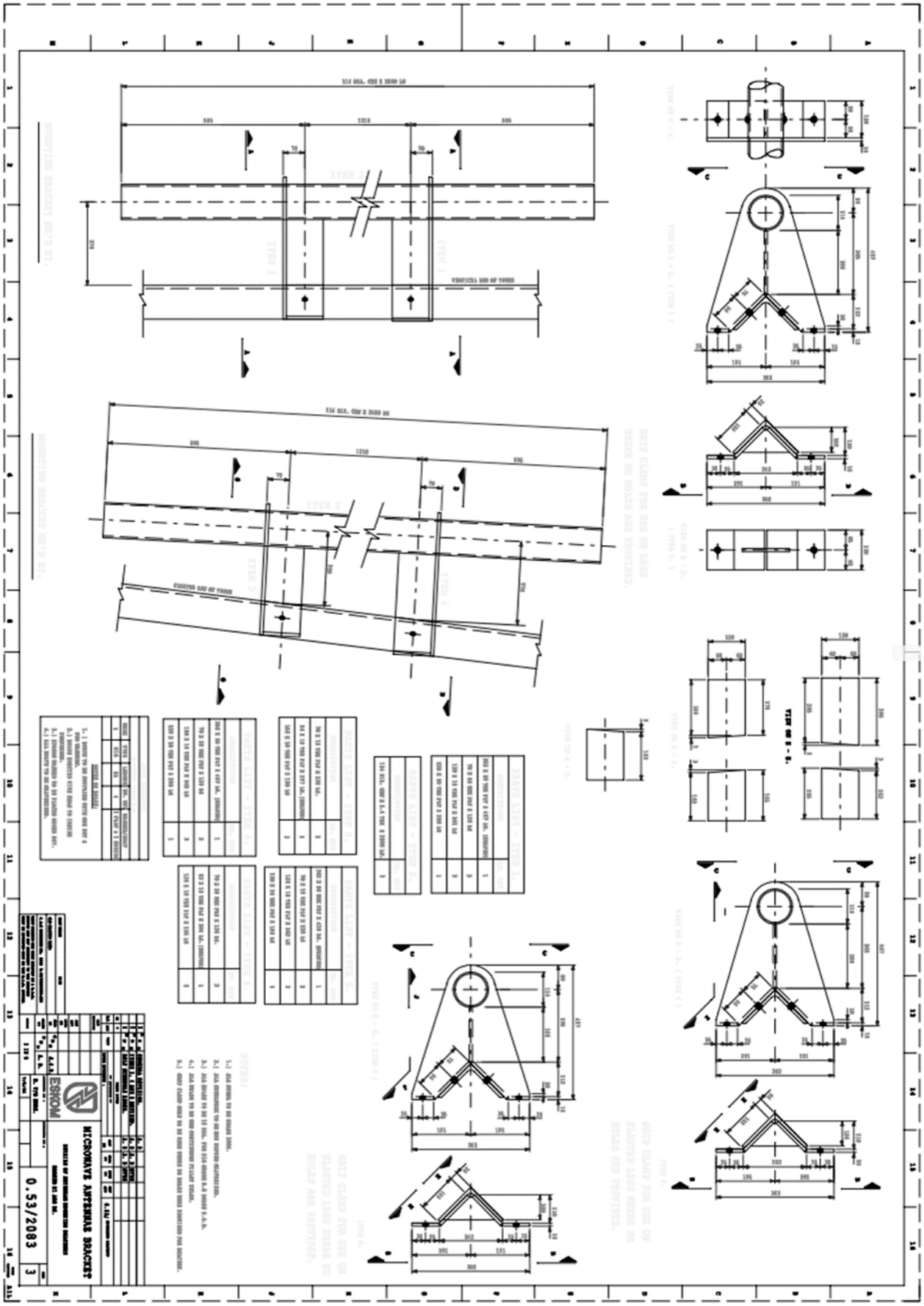
2.4 PHASE 4: DISMANTLING AND SCRAPPING OF EXISTING TOWER

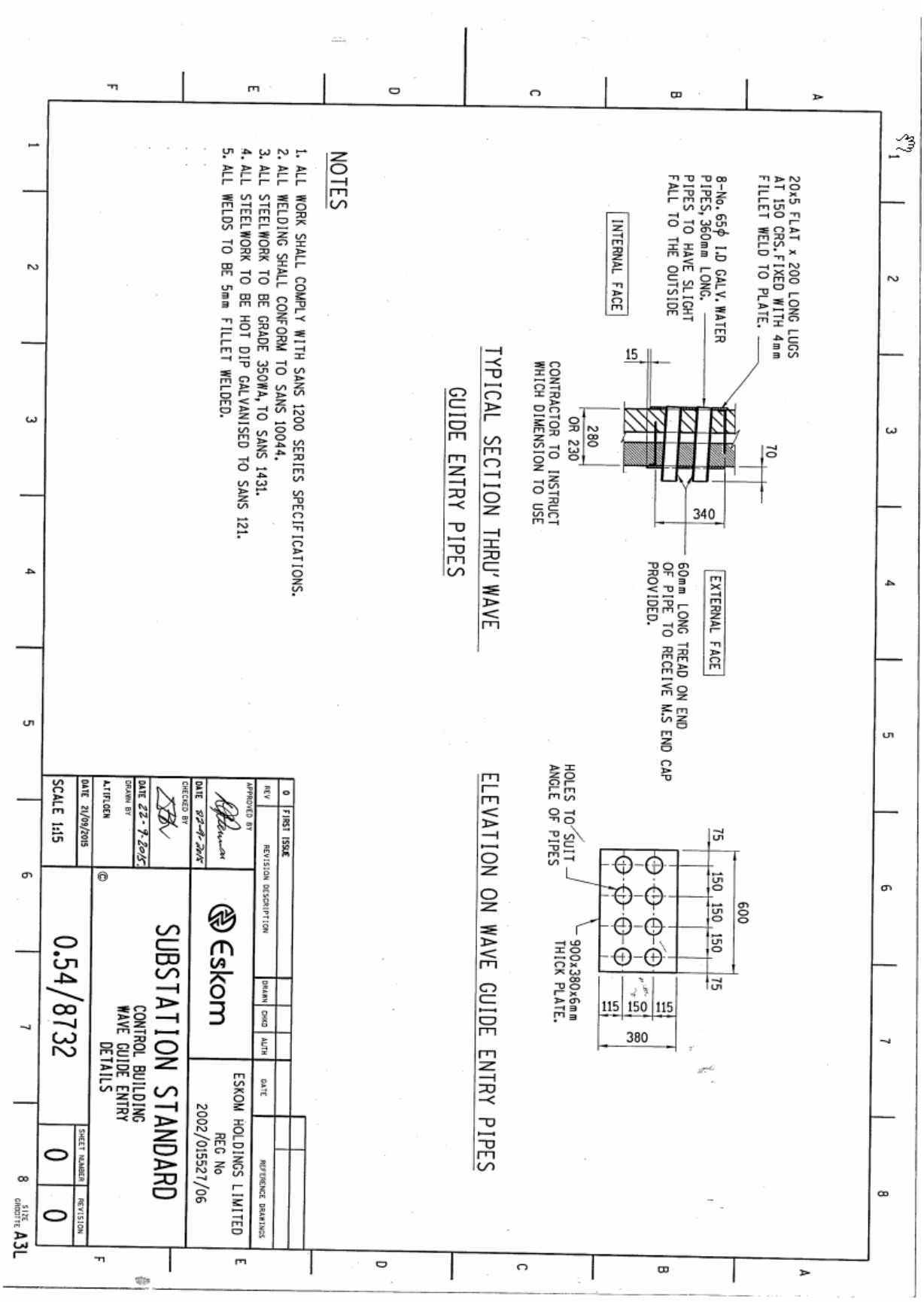
No dismantling scope of work is required.

2.5 TOWER DRAWINGS









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 40 m tower.

2. The tower shall have platform (full landing zone) with trap doors at the positions as per 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.

5. The contractor must supply and Install universal microwave antenna brackets **(*see drawing no 0.53/2083/3*)** per Table 2-1: **Table 2-1**

Notes:

- *The Supplier can 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.*

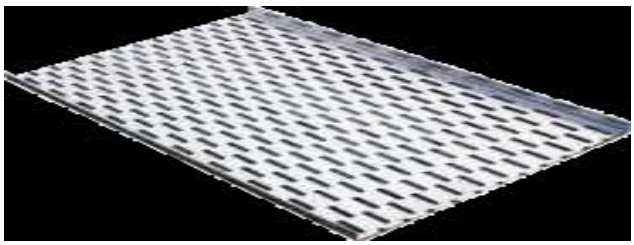
Table 2-1: Antenna Mounting Brackets Schedule

Attachment level	Bracket Type	Quantity
4 x @Working platform #4 (38 m level) 4 x @Working platform #3 (35 m level)	B1	8
4 x @Working platform #2 (30 m level) 4 x @Working platform #1 (15 m level)	B2	8

6. **Tower Cable Tray /Feeder entry panel:**

- Contractor to install a 6 m **horizontal cable tray/racking** from the tower to the wall of 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



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. Wave guide plate details

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

8. Fence around the Tower

Fencing requirements are listed as per below

- This will be done separately

2.8 SITE INFORMATION

The tower is to be constructed at the existing Fondwe RS, which is located in Limpopo OU.

GPS Coordinate: **22°53'58.54"S, 30°15'8.82"E**

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 0.53/40m FOND: Fondwe Foundation Layout and Details**				
1.1	Reinforcement steel weight	kg	1900		
1.2	Concrete volume	m^3	37		
1.3	Excavation volume	m^3	47		
1.4	Formwork Surface	m^2	20		
1.5	Backfill	m^3	10		
1.6	35Mpa Non-Metallic No shrink grout	m^3	0.023		
1.7	M36 GRADE 755mm LONG 4.8 GALVANIZED H.D BOLTS WITH 140 x140x16 THK PLATES	No	16		
2	**Main tower - See drawing no 40 m Tower outline – Fondwe RS**				
2.1	Supply tower detailed manufacturing drawing package for the tower as per Eskom standard 240 – 59967638	Unit	1		
2.2	Supply steel – **including** plates, cat ladder, working platforms galvanised at **85 µm**	kg	7560		
2.3	**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	831		
2.4	Tower Assembly	hr	24		
2.5	Tower Erection	hr	12		
3	**Working/resting platforms - supply and install**				
3.1	Already included under 2.2				
4	**Antenna Mounting Brackets - Supply and install**				
4.1	8 x Antenna Mounting brackets **B1**	Unit	8		
4.2	8 x Antenna Mounting brackets **B2**	Unit	8		

5	**Miscellaneous - Supply and install**				
5.1	Cat ladder and cage – covered under section 2.2				
5.2	Earthing terminating plates (@ 15 m , 30m, 33 m , 38 m and one at gantry)	Unit	5		
5.3	Horizontal cable tray/racking-heavy duty including supports and wave guide entry plate	m	6		
5.4	Supply and install waveguide entry plate – 600 x 380 x mm THK plate see drawing no no *"0.54/8732 Control building wave guide entry details"*	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)	Unit	2		
5.6	Tower painting as per CAA	m^2	245		
6	**Equipment - hire**				
6.1	Use of specialized equipment i.e. Crane	hr	12		
7	**Fencing –Supply and Install**				
7.1	Will be actioned separately	N/A	N/A		
8	**Dismantling work**				
8.1	N/A	Rate	N/A		

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

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

Controlled Disclosure: the information is readily available to Eskom employees (internal use). Information may also be accessed by or disclosed to third parties with specific authorisation or consent (either enforced by law or discretionary).

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