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AECOM

Project Name	:	Transnet Saldanha NMD Upgrade - New Ystervark S/S
Project ID	:	153272156
Job Name	:	Ystervark Branch Lines - Iscor/Blouwater 66kV Lines
Job ID	:	153272156-00001

Final Design Package: Book 1

Prepared for
TRANSNET GROUP CAPITAL

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				22/04/2020	
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Table of Contents

1. Abbreviations

The abbreviations as listed below shall be applicable throughout this document.

Abbreviation	Meaning Given to the Abbreviation
A	Ampere
AAC	All Aluminium Conductor
AAAC	All Aluminium Alloy Conductor
AASHTO	American Association of State Highway and Transportation Officials
AC	Alternating Current
ACSR	Aluminium Conductor Steel Reinforced
ADSS	All-dielectric Self-supporting
Al	Aluminium
AMSL	Above Mean Sea Level
BIL	Basic Insulation Level
BoM	Bill of Materials
BoQ	Bill of Quantities
CAD	Computer Aided Design
CAH	Conductor Attachment Height
CD	Compact Disc
CDEGS	Current Distribution, Electromagnetic Fields, Grounding and Soil Structure Analysis
Cu	Copper
ECSA	Engineering Council of South Africa
ENC	Eskom National Contract
dB	Decibel
FAT	Factory Acceptance Tests
FDP	Final Design Package
FO	Fibre Optic
GPR	Ground Potential Rise
Hz	Hertz
HAZOP	Hazard and Operability Study
HDD	Heavy Duty Duct

Abbreviation	Meaning Given to the Abbreviation
HV	High Voltage
ID	Inner Diameter
EA	Environmental Authorisation
IEC	Independent Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
EMPr	Environmental Management Programme
In	Nominal Current Rating
IP	Ingress Protection
ISO	International Standards Organisation
kA	Kilo Ampere
KIPTS	Koeberg Insulator Pollution Test Station
km	Kilometer
kN	Kilo Newton
kNm	Kilo Newton Meter
kPa	Kilo Pascal
kVA	Kilo Volt Ampere
kV	Kilo Volt
LAP	List of Accepted Products
LC	Lucent Connector
LV	Low Voltage
m	meter
mm	Millimetre
MPa	Mega Pascal
ms	Milliseconds
MS	Microsoft
MTS	Main Transmission Substation
MV	Medium Voltage
MVA	Mega Volt Ampere
MW	Mega Watt
Native	Original electronic file format of documentation

Abbreviation	Meaning Given to the Abbreviation
N	Newton
Nm	Newton meter
NMD	Notified Maximum Demand
OD	Outer Diameter
ODF	Optical Distribution Frame (or Patch Panel)
OEM	Original Equipment Manufacturer
OHL	Overhead Line
OHS	Occupational Health and Safety
O&M	Operating and Maintenance
OPGW	Optical Ground Wire
ºC	Degree Celsius
PCD	Pitch Circle Diameter
PFC	Power Factor Correction
p.u.	Per Unit
PVC	Polyvinyl Chloride
QA	Quality Assurance
QoS	Quality of Supply
r.m.s	Route-Mean Square
s	seconds
SA	Surge Arrestor
SABS	South African Bureau of Standards
SANS	South African National Standards
SAT	Site Acceptance Tests
SC-APC	Standard Connector - Angled Polished Connector
SEA	Sacrificial Earth Anode
SED	Station Electric Diagram
SHE	Safety, Health and Environment
SHEQ	Safety, Health and Environment and Quality
SLD	Single Line Diagram
SIL	Surge Impedance Loading

Abbreviation	Meaning Given to the Abbreviation
SOC	State Owned Company
SWA	Steel Wire Armour
uPVC	Unplasticized Polyvinyl Chloride
UV	Ultra-violet
V	Volt
VA	Volt Ampere
W	Watt
XLPE	Cross Linked Polyethylene
Z_nO	Zinc Oxide

2. Volume 3 Documentation Checklist

The Eskom Major Line Volume 3 Checklist was used for the order creation of this document, with certain alterations made to the layout to suit the FDP application where applicable. The checklist below is the aforementioned template in order to confirm the information included, and those not included due to applicability (**Note: Template checklist added**).

BOOK 1

Item	Description	Applicable and Included	Not Applicable
1.	Cover Sheet	✓	
2.	Detailed Scope of Work	✓	
3.	Form 15		✓
4.	Locality Map	✓	
5.	TEF Recommendations	✓	
6.	Line Design Philosophy	✓	
7.	Geotechnical Data (**Note: Included in separate document**)	✓	
8.	Substation Hardware	✓	
9.	Foundation Designs	✓	
10.	Final BoM	✓	
11.	Credit BoM	✓	
12.	Final BoQ	✓	
13.	Pole Numbering	✓	
14.	Construction Drawings	✓	
15.	Sag & Tension Charts	✓	
16.	Templated Profile	✓	
17.	Line Design Summary	✓	

18.	Construction Notes	✓	
19.	Design Calculations	✓	
20.	Technical Specifications (Buy-out Items)	✓	
21.	Applicable (imported) standards	✓	
22.	Contact Persons / Key Role Players	✓	
23.	Design Correspondence	✓	
24.	Major Lines Vol. 3 Checklist	✓	
25.	Quality Check List (Separate document)	✓	

3. Technical Team

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4. Assumptions, Agreements, Acceptances and Additional Notes

The following should be noted with regards to the submission of this FDP document:

1.) This FDP submission should be viewed on the basis that the Contractor is already on-site, which typically would not have been the case for a project of this nature ie. the FDP submission & acceptance thereof would have been concluded prior to the Contractor being appointed & commencing with construction activities.

    The Contractor is responsible to produce certain portions of the final design information (as outlined in the document). The information which is already available has been included in the document for reference. It should also be noted that the information for which the Consultant is responsible to produce, forming the basis from which the Contractor had to work off in order to produce their final design information, is also included, this in order to provide a clear comprehensive overview of the design requirements.

2.) The current EA & EMPr do not cover the newly required sleeve / manhole system, and associated works. At present the process is underway to amend the EA & EMPr respectively in order to address the aforementioned. Design verification of the new sleeve / manhole system, and associated works for environmental compliance, including the commencement of the construction thereof, is subject to the finalisation & conditions of the amended EA & EMPr.

3.) The current project geotechnical studies do not include the sleeve / manhole system, as these were concluded well in advance before the decision was taken by Eskom for the aforementioned system to be implemented. A separate study is underway & will be provided to Eskom once completed.

4.) As regional geological conditions have been well documented in previous geotechnical reports undertaken at Saldanha (refer to FDP document 'Ystervark Branch Lines - Iscor/Blouwater 66 kV Lines - Book 2, Job no. 153272156-00001'), it was decided at the time not to undertake trial holes at each foundation position.

    It should also be noted that these trial holes could not have been undertaken at the time due to the fact that the branch line route & structure positions were not finalised when the abovementioned geotechnical studies were undertaken.

    However, the Contractor was required to undertake final soil type nominations at each foundation location, in order to finalise their foundation designs. The results obtained from the Contractor have been included in the document.

5.) The Contractor has been appointed by Transnet on a re-measurable contract, hence the BoM BoQ quantities may not reflect the final quantities installed. The Contractor shall, as part of the final as-built handover pack, provide a comprehensive & detailed list of all new installed equipment / material, including those existing which have been removed respectively & returned to Eskom stores (including proof of delivery).

6.) The servitude finalisation on Sunrise Energy property, including Transnet wayleaves to Eskom, do not form part of this FDP submission & is dealt with separately, although they will ultimately be required as part of the project.

5. Project Details

5.1. Introduction

Transnet SOC Ltd is undertaking a major programme of projects in Cape Town, Saldanha and Postmasburg to upgrade and expand the capacity of their infrastructure, as part of their Market Demand Strategy.

The purpose of the Tippler 3 project at the Port of Saldanha is to sustain the materials handling capacity at the Port of Saldanha by the addition of a third tippler. As part of the Tippler 3 project, new bulk electrical supply infrastructure is to be provided to increase the capacity of the existing power supply to meet current and future demands at the Port of Saldanha.

In order to facilitate the abovementioned increase in capacity, there is a requirement for the provision of new infrastructure for Eskom, including upgrades & modifications to their existing 66 kV supply network in the region. The works has been registered with Eskom as a self-build project and subdivided into four jobs respectively, which are as follows:

<u>**Project Name**</u>	<u>**Project ID**</u>
Transnet Saldanha NMD Upgrade - New Ystervark S/S	153272156
<u>**Job Name**</u>	<u>**Job ID**</u>
Ystervark Branch Lines - Iscor/Blouwater 66 kV Lines	153272156-00001
Blouwater Substation - Ystervark Feeder Control Plant	153272156-00002
Ystervark 66 - 132 kV Substation	153272156-00003
Iscor 66 kV Breakers & Protection Upgrade	153272156-00004

This final design package covers the design principles and approach for the new ± 300 m long 66 kV branch line between the existing Blouwater-Iscor 66 kV OHL and Ystervark Substation. It also includes the installation of a new ± 6.6 km sleeve / manhole system, with fibre optic cabling inside, routed from Blouwater Substation to Iscor / Ystervark Substations for communications purposes.

The document must be read in conjunction with the other abovementioned jobs' FDPs. ***Each FDP document consists of three books respectively.***

The Fig overleaf depicts the location of the new 66 kV branch line, existing Blouwater-Iscor 66 kV OHL, and include Blouwater / Iscor / Ystervark Substations. The new sleeve / manhole system's route shall be within the existing servitude / reserve areas of the existing Blouwater-Iscor 66 kV OHL & new 66 kV branch line.

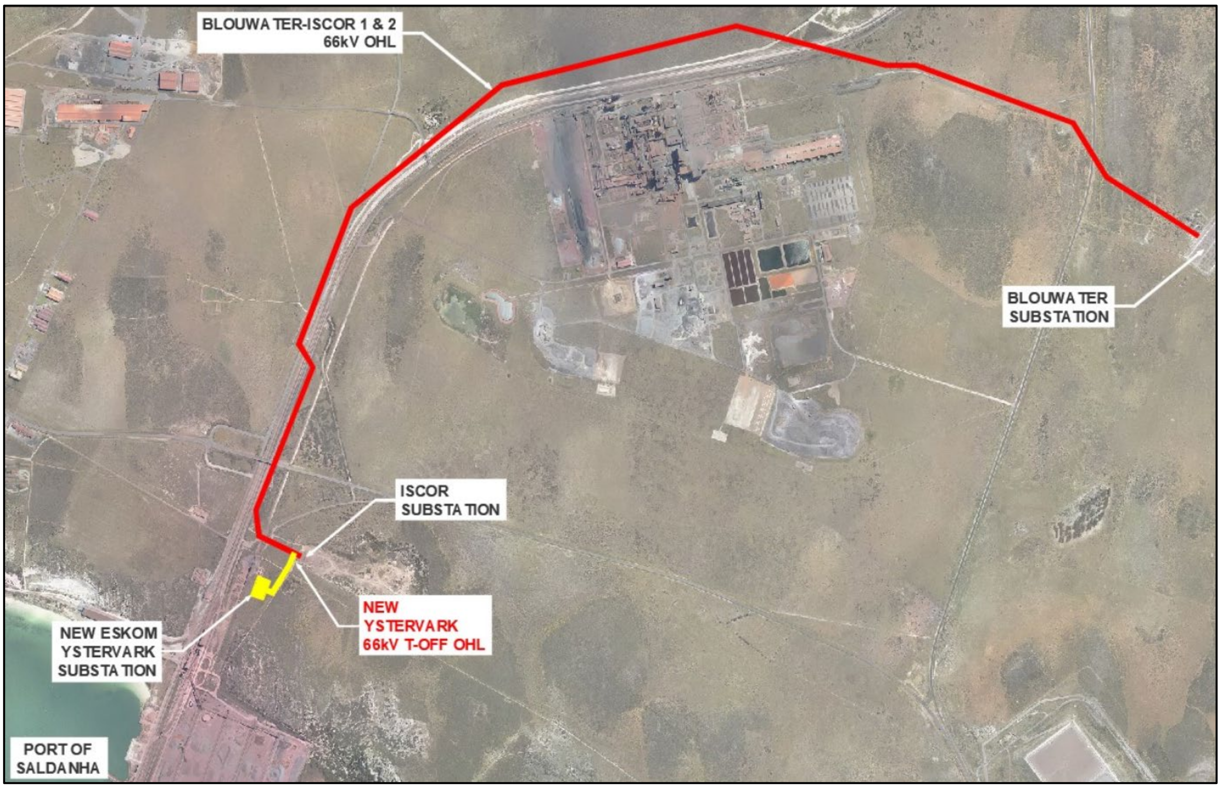

Figure 1: New Branch Line & Existing Blouwater-Iscor 66 kV OHL Route

5.2. Scope of Works

The Contractor's scope of works shall include the detailed design (as applicable), fabrication, supply, installation, construction, testing and commissioning of the entire new ± 300m of 66 kV branch line, including for the new ± 6.6 km sleeve / manhole system, with fibre optic cabling inside, from Blouwater Substaton to Iscor / Ystervark Substations for communications purposes.

These works shall include, but are not limited to, the following:

- Detailed design, supply and installation of the steel monopoles and associated concrete foundations.
- Detailed design, provision and construction of any temporary steel structures that may be required for the purposes of correctly and safely stringing conductors over roads or other infrastructure, including dismantling and removing of temporary steel structures upon completion of all works.
- Provision of all new overhead line material, i.e. single and double circuit monopoles, phase conductors, shield wires, concrete and steel re-enforcing for foundations, hardware assemblies, and the like.
- Installation of new self-supporting strain single circuit T-off structures 1 BLO / ISC 32 and 2 BLO / ISC 32, with associated hardware assemblies, foundations and earthing.

- Installation of a new self-supporting strain double circuit structure 1 & 2 BLO / ISC 32/1, with associated hardware assemblies, foundation and earthing.

Note: 1 & 2 BLO / ISC represents a single structure with 2 x 3-phase circuits.

- Installation of new self-supporting strain single circuit terminal structures 1 BLO / ISC 32/2 and 2 BLO / ISC 32/2 at the new Ystervark substation, with associated hardware assemblies, foundations and earthing.

- Installation of new ± 6.6 km underground sleeves & associated manholes, for HDD FO cabling housing, from Blouwater Substation to Iscor / Ystervark Substations, along the route of the existing Blouwater-Iscor 66 kV OHL and new 66kV branch line.

- Re-labelling of the existing terminal structures at ISCOR substation:
  - 1 BLO / ISC 30 - (New Label: 1 BLO / ISC 33).
  - 2 BLO / ISC 30 - (New Label: 2 BLO / ISC 33).

- Back staying of respective structures as required, and removal after all stringing works.

- Disconnection of the existing 12 kA/1s 24 core OPGW at the dome joint on the existing structure 12 of the Duferco 66 kV OHL line.

- Removal of redundant OPGW between 2 BLO / ISC 13 and structure 12 of the Duferco 66 kV line, including redundant hardware assemblies, and make electrical connection on OPGW / shield wire at both sides of 2 BLO / ISC 13.

- Re-establish existing OPGW fibre optic connections at existing dome joint at structure 12 of the Duferco 66 kV OHL line.

- Remove existing Chicadee ACSR phase conductors on both circuit 1 and 2, from the Iscor Substation gantry to structures 1 BLO / ISC 31 and 2 BLO / ISC 31 respectively.

- Remove on circuit 2 existing 12 kA/1s 24 core OPGW, from Iscor Substation gantry to structure 2 BLO / ISC 31.

- Removing on circuit 2 existing OPGW hardware assemblies (for 12 kA/1s 24 core OPGW) on both sides of structure 2 BLO / ISC 31 with corresponding assembly on Iscor Substation gantry.

- Removal of existing phase hardware assemblies on eastern side of structures 1 BLO / ISC 31 and 2 BLO / ISC 31 respectively, including on Iscor Substation gantry.

- Installation of new phase hardware assemblies on eastern side of structures 1 BLO / ISC 31 and 2 BLO / ISC 31 respectively, including on structures 1 BLO / ISC 32 & 2 BLO / ISC 32 as well as on Iscor Substation gantry.

- Disconnecting of existing 16 kA/1s 48 core greased OPGW, on circuit 1, at Iscor Substation gantry dome joint, provide sufficient slack and re-string from structure 1 BLO / ISC 31 onto T-off structure 1 BLO / ISC 32 to Iscor Substation gantry including re-connection of fibre optics at dome joint (Note: Will act as shield wire only).

- Removal of existing ADSS FO cable from the above-mentioned gantry dome joint up until patch panel inside Iscor Substation relay house.
- Removal of, on circuit 1, the existing OPGW hardware assemblies (for 16 kA/1 s 48 core OPGW) on both sides of structure 1 BLO / ISC 31 with corresponding assembly on Iscor Substation gantry.
- Installation of new OPGW hardware assemblies on both sides of structure 1 BLO / ISC 31.
- Installation of new OPGW & Oak AAAC shield wire hardware assemblies on structure 1 BLO / ISC 32.
- Installation of new OPGW hardware assemblies on Iscor Substation gantry and ISCOR terminal structures.
- Installation of new Oak AAAC shield wire hardware assemblies on both sides of structure 2 BLO / ISC 31. Note: One side to cater for existing 12 kA / 1 s 24 core OPGW which acts as shield wire only.
- Installation of new Oak AAAC shield wire hardware assemblies on structure 2 BLO / ISC 32.
- Installation of new Oak AAAC shield wire assemblies on Iscor Gantry.
- Installation of new greased Chicadee ACSR phase conductors on circuit 1, from structure 1 BLO / ISC 31 onto T-off structure 1 BLO / ISC 32, then onto structure 1 BLO / ISC 33 and terminate at the Iscor Substation gantry.
- Installation of new greased Chicadee phase conductors on circuit 2, from structure 2 BLO / ISC 31 onto T-off structure 2 BLO / ISC 32 then onto 2 structure BLO / ISC 33 and terminate at the Iscor Substation gantry.
- Installation of new Oak AAAC shield wire on circuit 2, from structure 2 BLO / ISC 31 onto T-off structure 2 BLO / ISC 32 then onto 2 BLO / ISC 33 and terminate at the Iscor Substation gantry.
- Removal of second existing gantry point OPGW/fibre optic connection and termination infrastructure at Iscor Substation gantry, including associated equipment.
- Installation of new Oak AAAC shield wire hardware assemblies on Ystervark Substation gantry.
- Installation of new greased Chicadee ACSR phase conductors on circuit 1, from T-off structure 1 BLO / ISC 32 to 1 & 2 BLO / ISC 32/1 to terminal structure 1 BLO / ISC 32/2 to Ystervark Substation gantry, and make electrical connections as required.
- Installation of new greased Chicadee ACSR phase conductors on circuit 2, from T-off structure 2 BLO / ISC 32 to 1 & 2 BLO / ISC 32/1 to terminal structure 2 BLO / ISC 32/2 to Ystervark Substation gantry, and make electrical connections as required.
- Installation of new greased Kingbird ACSR phase conductors, from terminal structures 1 BLO / ISC 32/2 & 2 BLO / ISC 32/2 respectively, to Ystervark Substation gantry and make electrical connections as required.
- Installation of new Oak AAAC shield wire on circuit 1, from T-off structure 1 BLO / ISC 32 to structure 1 & 2 BLO / ISC 32/1 to terminal structure 1 BLO / ISC 32/2 onto Ystervark Substation gantry. Bifurcation of shield wires to be implemented at T-off structure 1 BLO/ISC 32, 1 & 2 BLO/ISC 32/1, including at terminal structure 1 BLO / ISC 32/2 onto Ystervark Substation gantry to ensure adequate lightning protection.

- Installation of new Oak AAAC shield wire on circuit 2, from T-off structure 2 BLO / ISC 32 to structure 1 & 2 BLO / ISC 32/1 to terminal structure 2 BLO / ISC 32/2 onto Ystervark Substation gantry. Bifurcation of shield wires to be implemented at T-off structure 2 BLO/ISC 32, 1 & 2 BLO/ISC 32/1, including at terminal structure 2 BLO / ISC 32/2 onto Ystervark Substation gantry to ensure adequate lightning protection.

- Installation of new HDD FO cables from Blouwater Substation relay house, in new sleeve / manhole system, into Iscor Substation relay house, & in turn to Ystervark Substation relay house (control building) and terminate at all three Substations' respective patch panels.

- Associated ancillary works.

Particular attention shall be given to works undertaken in close proximity to live power lines, as well as roads, bridges and rail crossings, taking account also of the permitting requirements of the responsible road, bridge and rail authorities etc. The Contractor shall appoint a full-time Eskom registered / authorised 'close proximity works' specialist for this project.

In addition, all other respective personnel of the Contractor shall be registered / authorised by Eskom as per their requirements. **Only Eskom approved installers shall be used to install all new fibre optic cables and associated works.**

5.3. Site/Environmental Conditions

5.3.1. Site & Access Routes

Referencing Fig 1, the site for the new 66 kV branch line including new sleeve / manhole system, is located on various properties respectively, which are as follows:

- Transnet.
- Sunrise Energy.
- ArcelorMittal.
- Eskom.
- Afrisam.

Main access routes to the different site areas is depicted in the figure below:

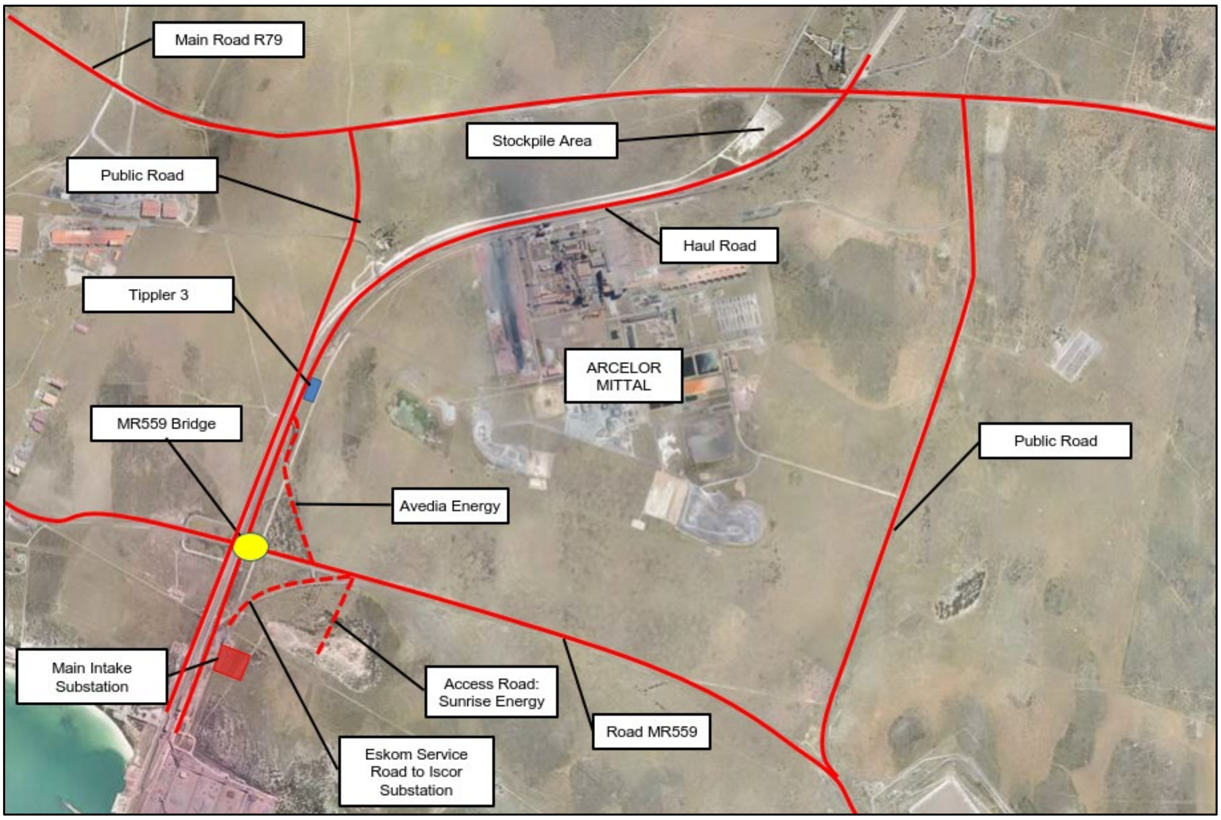

Figure 2: Main Access Routes

It is the responsibility of the Contractor to arrange with all property owners access as required to the different site areas & abide by their conditions.

5.3.2. Geotechnical

As mentioned in Section 4 of this document, the current project geotechnical studies do not include the sleeve / manhole system, as these were concluded well ahead of the decision being made by Eskom for the aforementioned system to be implemented. A separate study is underway & will be provided to Eskom once completed. However, it is not for seen at this stage that there is a technical risk without the study in place, but merely a potential cost implication.

Further to the above, specific trial hole studies were undertaken at the positions of the 5 x 66 kV branch line structures. The Contractor has undertaken final soil nominations at each of the new structure positions, in conjunction with Transnet & Eskom. These soil nominations have been used determine the final soil type in order for the Contractor to produce their final foundation designs (refer also to Sections 8.6.2, 8.6.3 & 13.3).

For the previous geotechnical reports undertaken at Saldanha, reference is to be made to FDP document 'Ystervark Branch Lines - Iscor/Blouwater 66 kV Lines - Book 2, Job no. 153272156-00001'.

5.3.3. Climatic Conditions

The climate in the area is defined as semi-arid Mediterranean, which is strongly influenced by the cold Benguela current and coastal berg wind conditions. The table below summarizes the climatic conditions on site:

Table 1: Site Climatic Conditions

Condition	Description
Altitude	Sea Level
Air Temperature	45 °C Maximum; -5 °C Minimum
Equipment Surface Temperature (from sun)	60 °C Maximum
Relative Humidity	50 % Minimum; 85 % Maximum; 60 % Average
Air Quality	Coastal salt-laden air with high concentration of iron ore dust
Air Pressure	101.3 kPa

Furthermore, the table below indicates the average monthly precipitation for the Saldanha area. The figure overleaf indicates the seasonal wind speeds and directions.

Table 2: Average Monthly Precipitation (mm): Saldanha

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	12	24	36	39	39	27	24	12	4	12

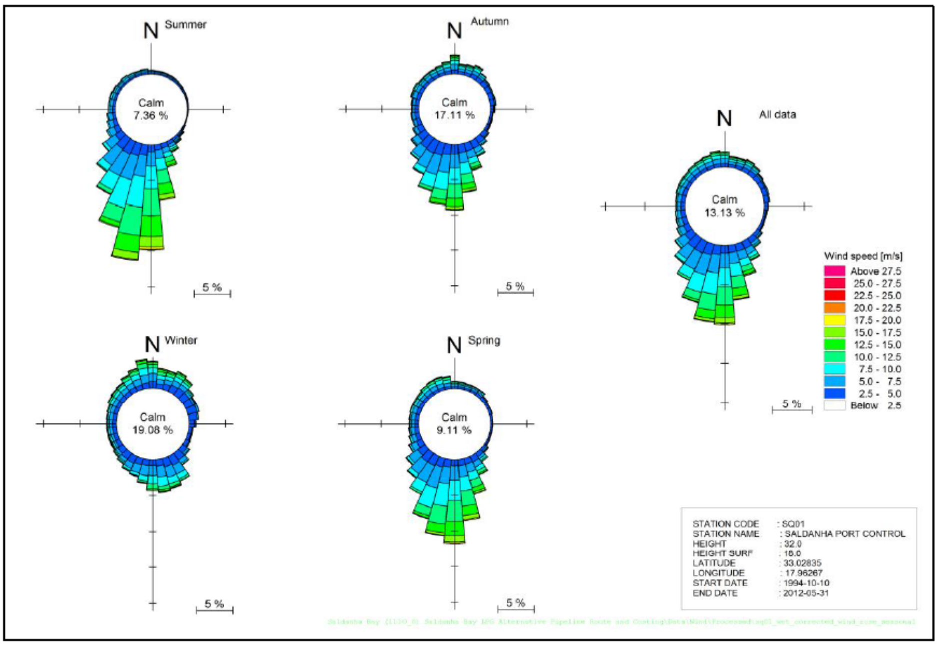

Figure 3: Seasonal Wind Roses for the Port of Saldanha

With regards to pollution levels and lightning activity in the area of the site, the two figures below have been used to guide the designer. The site has a high pollution level as a result of iron ore export activities at the Port, and heavy salt-laden air. All outdoor equipment shall have a 31 mm/kV creepage distance where applicable. The lightning activity in the area is minimal, with a ground flash density of less than 1 flash/km²/annum.

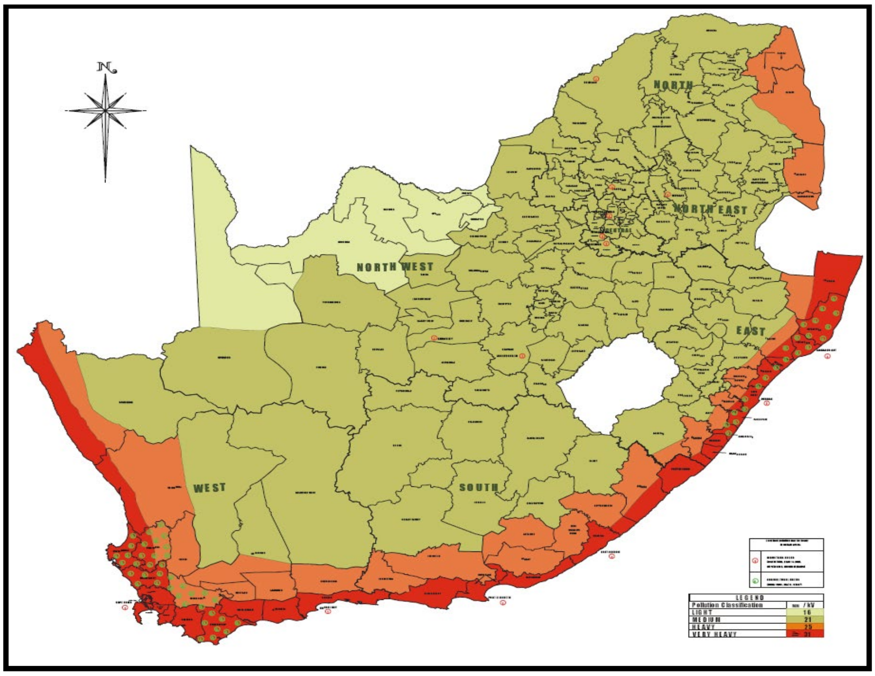

Figure 4: Pollution Map

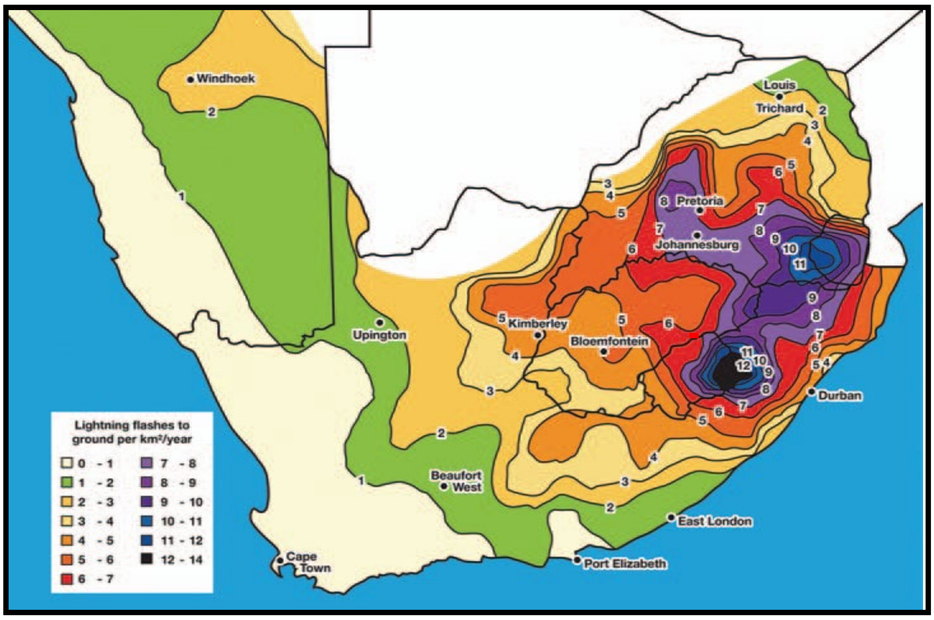

Figure 5: Lightning Ground Flash Density Map

5.3.4. Environmental

As discussed in Section 4 of this document, the current EA & EMPr does not cover the newly required sleeve / manhole system, and associated works. At present the process is underway to amend the EA & EMPr respectively in order to address the aforementioned.

Design verification of the new sleeve / manhole system, and associated works for environmental compliance, including the commencing of construction thereof, is subject to the finalisation & conditions of the amended EA & EMPr.

The 66kV branch line portion of the works, is however covered under the existing EA & EMPr. The figure overleaf depicts the environmental study layout map of project components conducted for the Transnet bulk power upgrade project at the Port of Saldanha (Note: Lighting forms part of a different package on the Tippler 3 project).

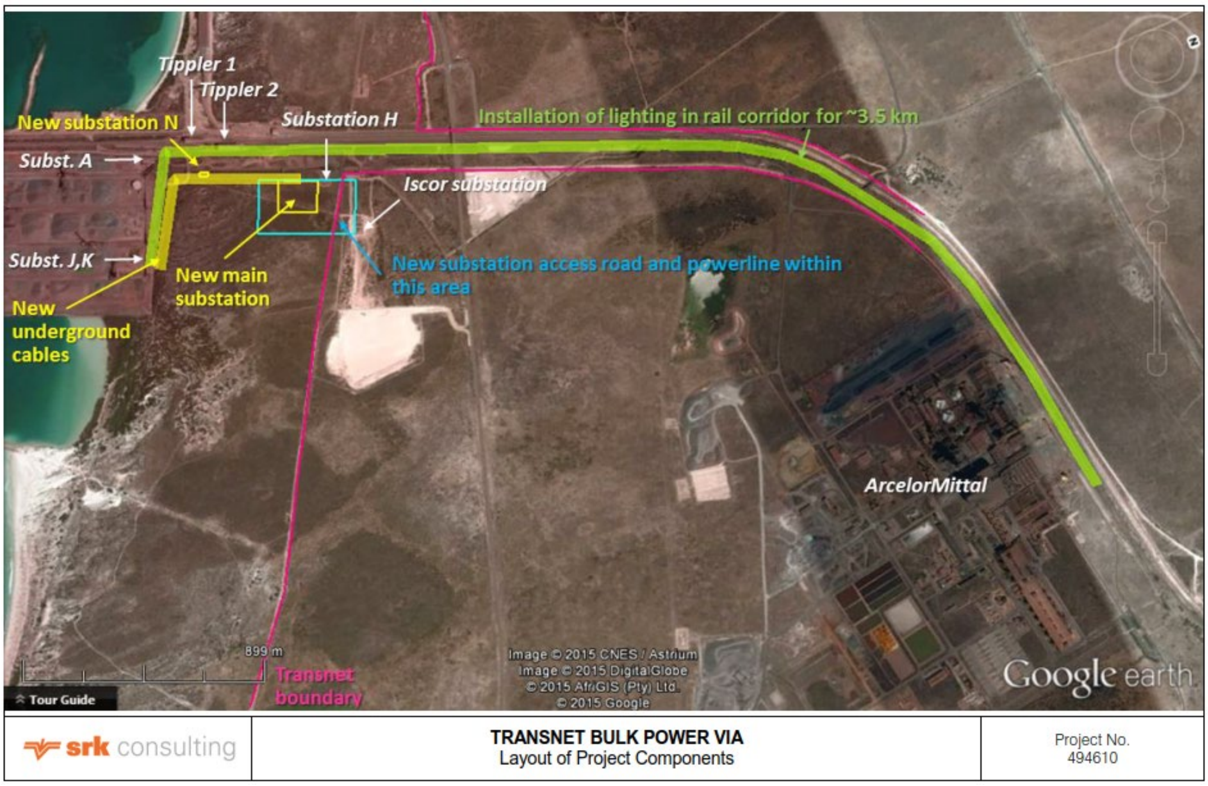

Figure 6: Environmental Study Layout Map of Project Components

According to the project EMPr (refer to FDP document 'Ystervark Branch Lines - Iscor/Blouwater 66 kV Lines - Book 2, Job no. 153272156-00001' for further details and associated environmental documentation), the following findings relates to Heritage, Vegetation, Aquatic Ecosystems and Avifauna:

Heritage

"No archaeological heritage was encountered during a field assessment undertaken on 21 October 2015. Buried archaeological material may occur on top of the calcrete or in crevices below the wind-blown surface sands in the core footprint area. Early and Middle Stone Age artefacts and associated fossil bones are sometimes found within and below the capping of calcrete that underlines the aelion sands in the core footprint area. Extinct terrestrial snail fossils (Trigonephrus) and fossil root stems were noted by the specialist in the soft limestone sediments in the old quarry near the proposed project area, as well as in the limestone cuttings alongside the Iscor Substation."

Vegetation

"The project is located in an area with sensitive calcrete vegetation that forms part of the Saldanha Strandveld vegetation. Calcrete shrublands are considered of conservation importance and are only formally protected in the West Coast National Park. Although degraded to some extent throughout the area as a result of previous grazing and/or clearing, the vegetation is deemed to be of medium to good quality east of the existing track bisecting the main new substation study area, while West of the track towards the railway line the vegetation is in poor to medium condition (see Figure 1-2)." ***Note: This figure is Fig 7 in this document.***

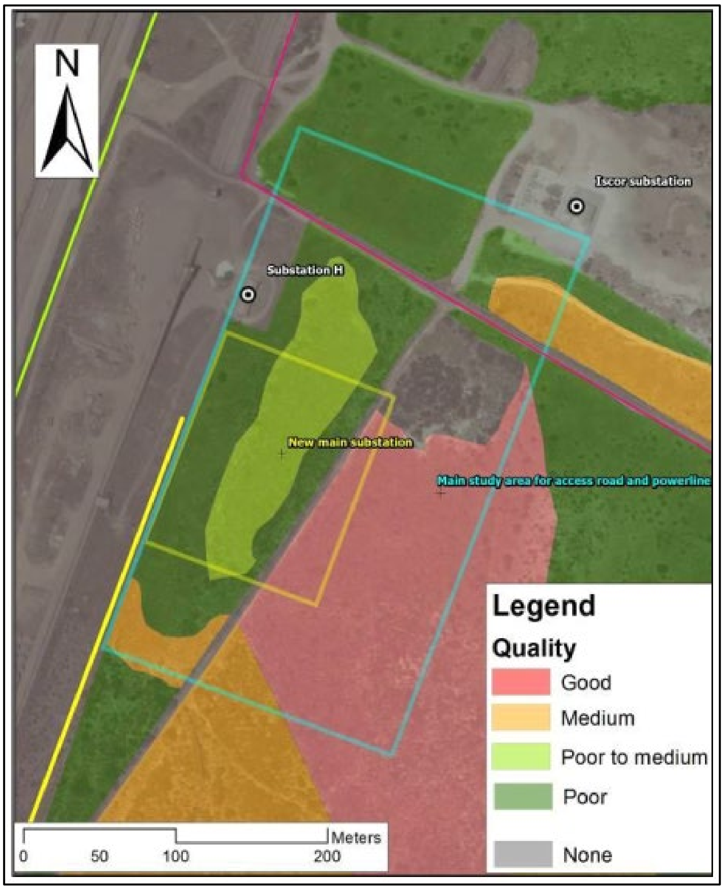

Figure 7: Vegetation Quality at the Main Intake Substation

Prior to commencement of any clearing and grubbing on site (site clearance), a nominated and suitably qualified / specialist subcontractor will undertake search and rescue activities of key plant species in the construction footprint where necessary. The rescued plant species shall be maintained and propagated in a nursery for the duration of construction, where after these shall be planted within areas identified by Transnet for rehabilitation. Areas rehabilitated shall provide for homogenous representativity of the surrounding vegetation. The aforementioned shall apply for the sleeve / manhole system as well where applicable.

Aquatic Ecosystems

“Two freshwater features were identified in the study area (see Figure 1-3):

- Previous infrastructure development and surcharge from the adjacent sewage pump station have created an artificial wetland to the East of the gravel road. Habitat integrity is largely modified and provides few ecosystem goods and services. The Ecological Importance and Sensitivity rating for the wetland is low; and

- A stormwater drain is located adjacent and parallel to the railway line. The stormwater feature is not considered to be ecologically significant and only serves the purpose of conveying stormwater.

No freshwater features occur within the main study area for the access road, powerline, substation and underground cables. There are no Freshwater Ecosystem Priority Areas or Critical Biodiversity Areas in the development footprint.” ***Note: Figure 1-3 is Fig 8 in this document.***

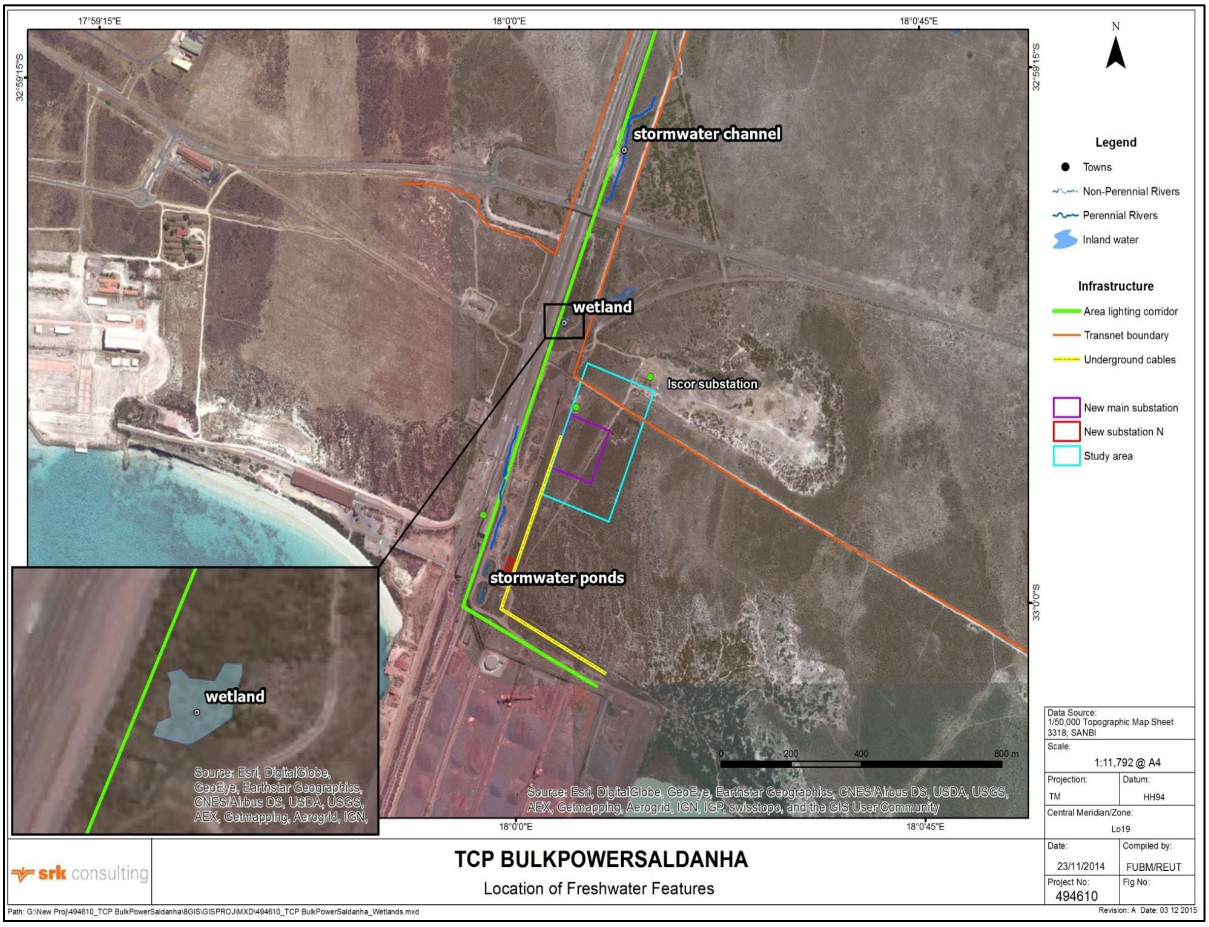

Figure 8: Location of Freshwater Features

Avifauna

“The project site is located near Important Bird Areas: the Langebaan Lagoon, Saldanha Bay Islands and Berg River Estuary. The close proximity of the study area to the West Coast National Park and Saldanha Bay Islands means that some Red Data species could potentially occur within the study area, including globally threatened species such as Cape Cormorant, Bank Cormorant, Crowned Cormorant, Black Harrier and Southern Black Korhaan and regionally threatened species such as Caspian Tern, African Marsh Harrier and Lanner Falcon. However, the main flight path of birds between these areas is expected to lie East of the study area.”

5.4. Existing Network Configuration

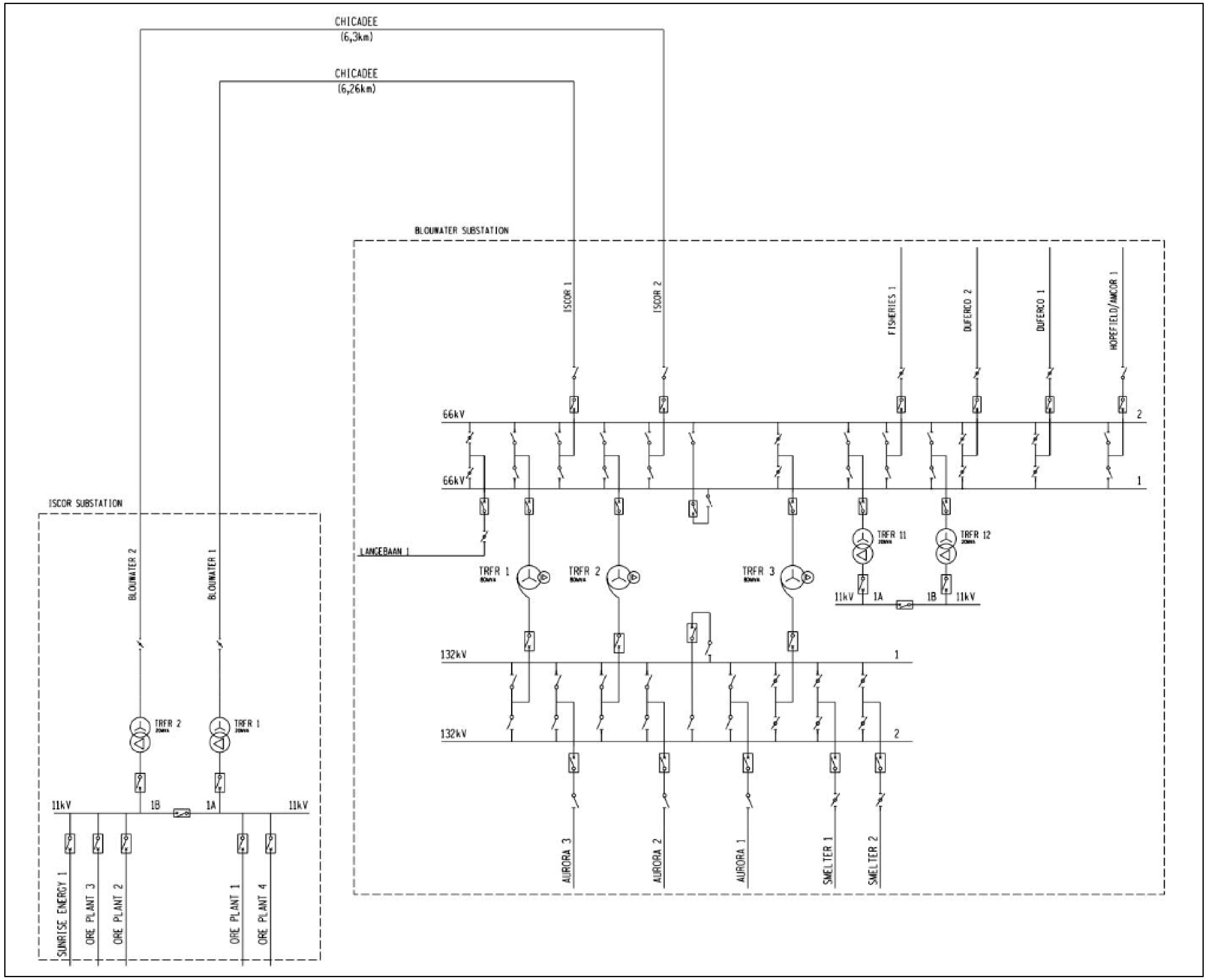

Figure 9: Existing Electrical Network Configuration - Blouwater to Iscor Substation

5.5. Proposed Network Configuration

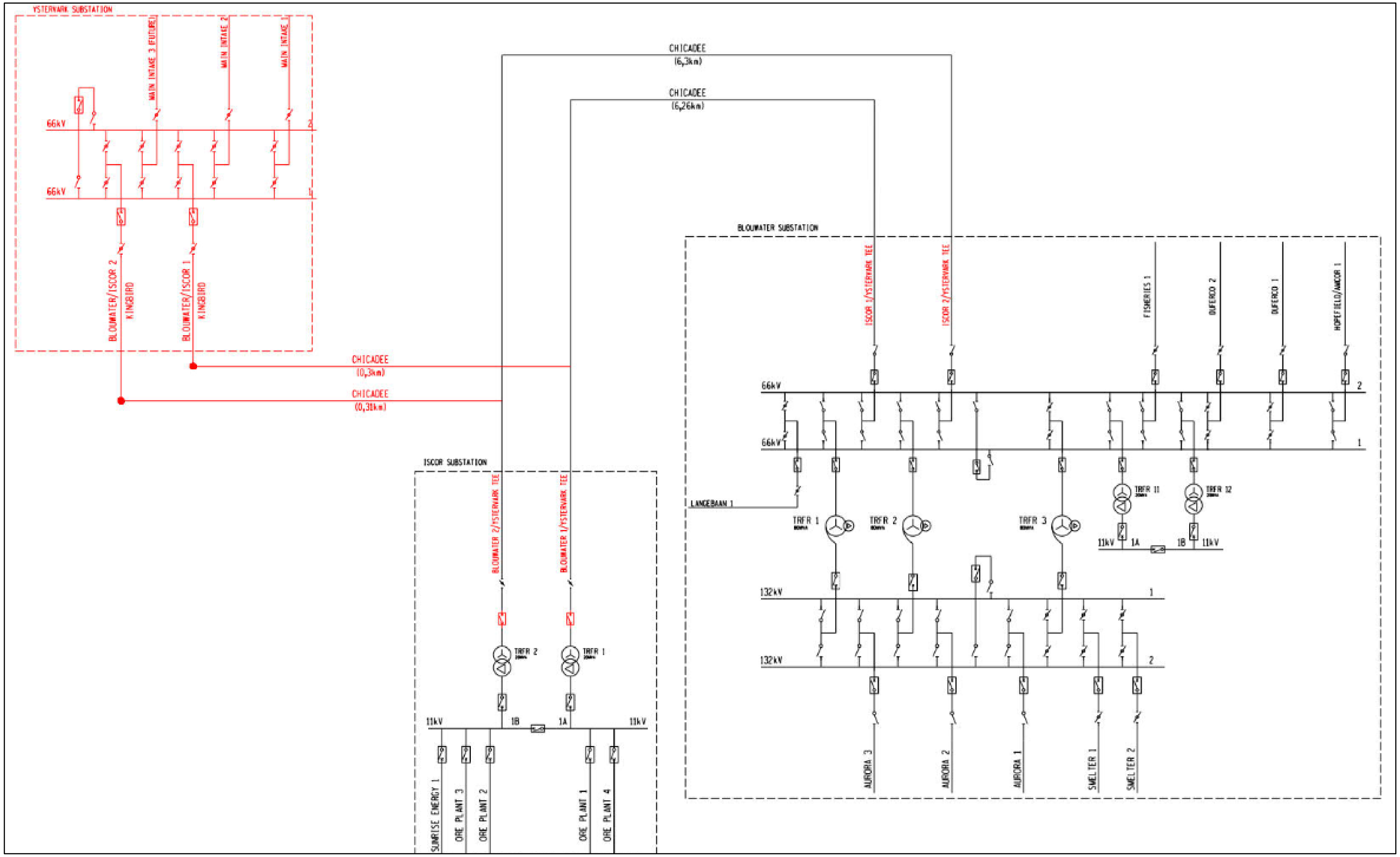

Figure 10: Proposed New Electrical Network Configuration - Blouwater to Iscor/Ystervark Substations

6. Sleeve / Manhole System

6.1. Overview

This section covers the design principles and approach for the new ± 6.6 km sleeve / manhole system, for required fibre optic cabling inside, from Blouwater Substation to Iscor / Ystervark Substations for communications purposes. All trenches are linked to one another and manholes, with various road, rail & bridge crossings along the route.

Further reference to be made to drawings 1924701-2-330-C-LA-0001-01 & 1924701-2-330-C-LA-0001-02 contained in Section 13.1 of this document.

6.2. Standards

All sleeve / manhole material & associated infrastructure must comply with the relevant Eskom standards / specifications, SANS, NRS as well as any other statutory regulations. The following, but not limited to, standards shall apply:

- 240-125010764 : Duct Fibre Installation Standard.
- NRS 088-2 : Duct and Direct-Buried Underground Fibre-Optic Cables.
- SANS 1200 : A, C, D, DB, L, LB and LD.

6.3. Specification for Sleeve / Manhole System

6.3.1. Site Clearance (SANS 1200 C)

Prior to the commencement of any clearing and grubbing on site, a nominated and suitably qualified / specialist botanist will undertake a search and rescue activity of key plant species in the construction footprint where necessary.

The rescued plant species shall be maintained and propagated in a registered nursery for the duration of construction, where after these shall be planted within areas identified by Transnet for rehabilitation. Areas rehabilitated shall provide for homogenous representativity of the surrounding vegetation.

All trees and shrubs within the site with a height exceeding 1 m shall be removed by hand and collected for further processing by grinding and mulching. The recovered chippings shall be placed in stockpile and carefully preserved for later mulching of areas where natural vegetation is to be re-established. The exposed surfaces of the stockpile shall be covered in hessian or equivalent approved matting and maintained free of weeds and alien or invader plants.

De-stumping of roots and stumps shall be done as part of the subsequent further clearing and grubbing of the site and removal of topsoil. Topsoil, including grass and other vegetation, shall be removed from within the footprint of the site to a depth of 200 mm. Enough quantities of topsoil shall be stockpiled on site for later re-use in the rehabilitation of exposed trenches and other disturbed areas.

The following measures shall be adopted during the removal and stockpiling of topsoil:

- Naturally occurring vegetation removed by site clearance operations may be grubbed in with the topsoil for stockpiling.

- Topsoil stripping shall not occur in wet weather.

- During stripping and stockpiling, the topsoil shall not be compacted or pushed for more than 50 m.
- Topsoil shall only be handled twice, i.e. once to strip and stockpile, and secondly to replace, level, shape and scarify.

All stockpiles of topsoil shall be managed as follows:

- Stockpile(s) shall not be higher than 2 m.
- The slopes of the stockpiles shall be no steeper than 1:2.
- Topsoil materials shall not be contaminated with any other granular materials, rubble or building material or be subjected to compaction or contamination by the Contractor’s vehicles and machinery.
- All stockpiles shall be protected from erosion due to wind or rain.
- All exposed stockpile surfaces shall be fully covered with hessian or similar approved matting.
- The topsoil stockpiles shall be kept damp by regular watering.
- The Contractor shall remove exotic/invasive species from the topsoil stockpiles.

6.3.2. Blasting of Rock

The blasting of rock shall only be allowed if approved by Transnet and confirmed by a geotechnical investigation to the presence, type & extent thereof. The investigation will be carried out by the Contractor, if not otherwise required by Transnet.

The transport, storage and the use of explosives shall comply with the provision of the relevant legislation, with all blasting permits issued to workmen, and permits issued to the Contractor to cover the purchase, storage and transport of explosives, to be in place. The Contractor shall make good at his own expense any additional excavation necessitated by the shattering of rock in excess of an over break.

6.3.3. Duct Trenches (SANS 1200 DB)

Trenches have been allowed for the full length of the route for the installation of the required ducts to house the new HDD duct type fibre optic cables. The trenches shall comply with the below & as per the figure overleaf.

Excavation of pipe trenches must be so, as to cater for the width of 4 x 32 mm dia. ducts (spaced 150 mm apart centre to centre), with 150 mm clearance from outer ducts to trench walls. All pipe trenches underneath roadways, parking areas and all hard-standing areas subject to road traffic or building loads shall be backfilled with sand up to the underside of the layer works in layers of not more than 150mm and compacted to 100% MOD AASHTO maximum density.

Sand is defined as non-plastic material and shall comply with the following sieve analysis:

% passing:	4.740 mm sieve	-	95% minimum.
	0.425mm sieve	-	50% minimum.
	0.75mm sieve	-	10% maximum.

The floor of a trench shall offer a firm base such as compacted soil and be free of stones. A 150 mm layer of compacted imported bedding soil shall be provided. Once the ducts have been installed, another layer of 150 mm imported padding soil shall be added & suitably compacted.

Only hand compaction tools shall be used to compact the padding soil. For trenches in road reserves, back-filling shall comply with local road agency requirements.

Bedding & padding material will consist of selected granular material. This is material of granular, non-cohesive nature that is singularly graded between 0,6 mm and 19 mm, is free-draining and has a compact ability factor not exceeding 0,4. Padding material is selected fill material which has a PI less than 6 and that is free from vegetation, lumps and stones exceeding 30mm in diameter. Backfill (blanket) material will be selected material from trench excavations on site.

Suitable concrete cover slabs / tiles shall be installed on the final compacted blanket / padding layer on-top of the ducts for the entire length. 450 mm wide, 150 micron thick PVC electrical danger warning tape shall be installed above all ducts 300 mm below finished ground level. The electrical warning / danger tape shall, as a minimum, include the wording “DANGER/INGOZI/GEVAAR” and shall have a black thunder flash symbol and be orange in colour.

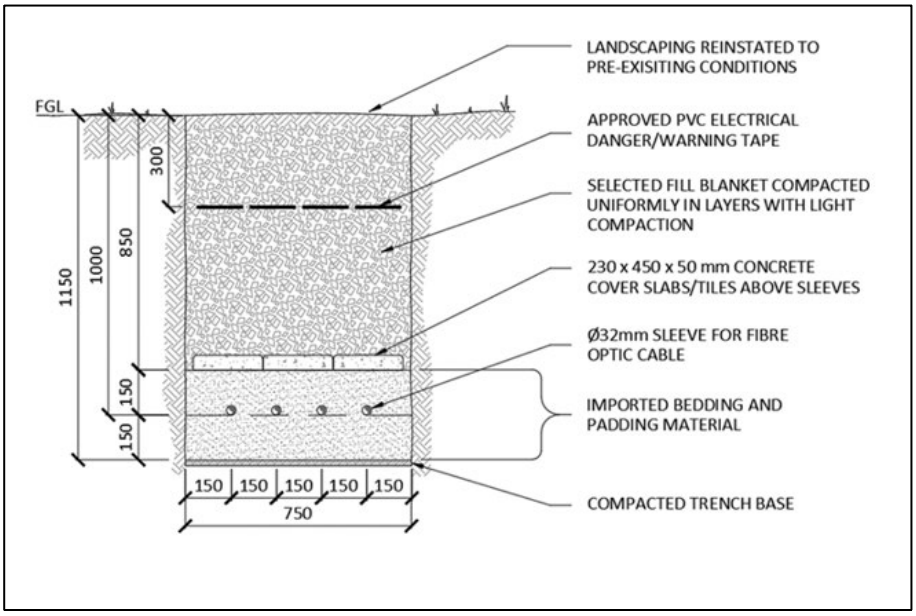

Figure 11: Typical Duct Trench Detail

6.3.4. Stormwater, Seepage & De-Watering

In addition to the Contractor’s responsibility for dealing with water, the Contractor may also be instructed to place a crushed stone bedding layer on a geofabric on the trench bottom.

6.3.5. Manholes

The manholes shall be constructed from reinforced concrete or bricks with at least a 15 MPa strength. The size of the manholes shall be 1500 mm x 1500 mm internal dimension as specified on the drawings (the figures overleaf also have references).

Heavy duty polymer covers shall be used and must be lockable. The depth of the cover relative to the final ground level shall be 250mm above ground. The maximum distance between manholes shall be 2400 m (for FO cable joints assuming standard cable drum length of 2500 m) and shall be determined by the method of installation of the duct cable.

Before installation commences, the Contractor shall establish that the routes defined on the drawings and specification are accessible and available in accordance with the installation program. The Contractor shall advise Transnet & Eskom of all proposed deviations, for acceptance.

Suitable concrete bollards shall be installed at each corner of all manholes, which are not located within a Substation, for added manhole protection against possible damage (see figure overleaf).

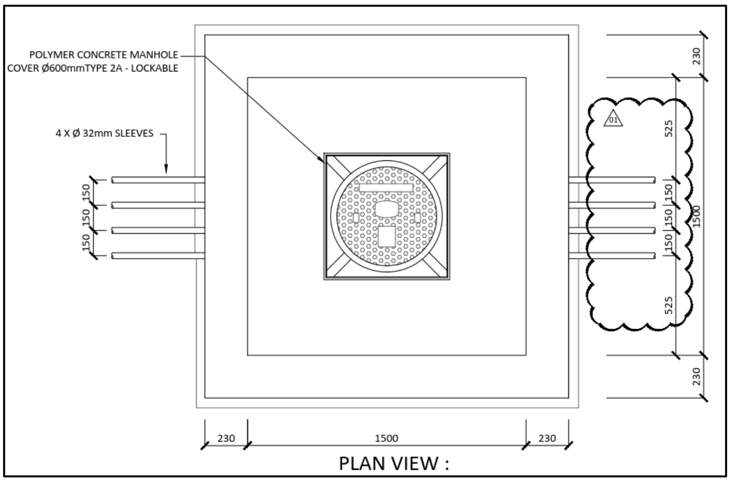

Figure 12: Manhole Plan View

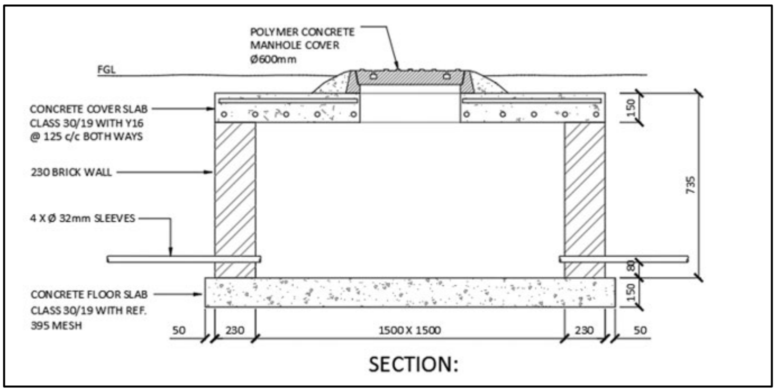

Figure 13: Manhole Section View

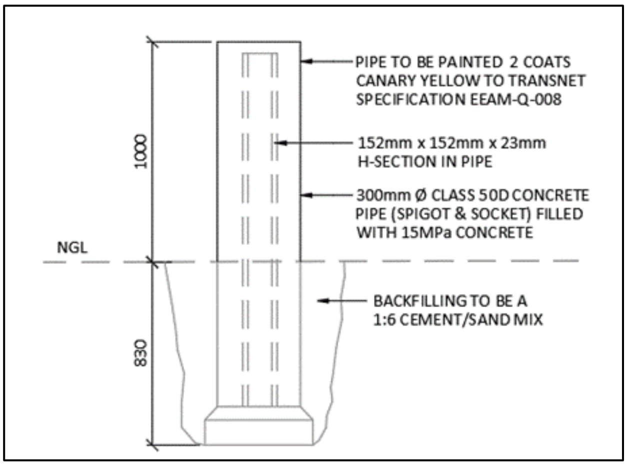

Figure 14: Typical Concrete Bollard Detail

6.3.6. Mandrill Test

The purpose of the mandrill test is to verify that 95 % of the inside diameter of the duct is available throughout the entire test section for the successful installation of an optical fibre cable. The procedure shall be followed as specified in the relevant specification.

6.3.7. Horizontal Directional Drilling

The works covered in this document include the installation of a new underground ducting system using the Horizontal Directional Drilling (HDD) method of installation where required. The works shall include all services, equipment, materials and labour for the complete and proper installation and testing of the new underground sleeve system.

The specifications cover a range of procedures and precautions necessary to ensure that directional drilling installations are adequately controlled. Adherence to the specifications contained herein, or Transnet approval of any aspect of the technology applied to these operations, shall in no way relieve the Contractor of his responsibility for the satisfactory completion of the works.

Unless otherwise specified, the pipes / sleeves to be used shall be as specified in this document or approved equivalent, which comply with the relevant requirements as set out in this document and the relevant project specification. The diameters of pipes supplied shall not be less than the nominal diameters (ND) given on the drawings or as stated in the bill of quantities.

The Contractor shall provide for acceptance to Transnet, comprehensive details of the type of materials to be used for the drilling mud, including all safety and environmental precautions as recommended by the suppliers. The method statements shall also describe the procedures to be followed for handling, mixing and disposing of the drilling mud.

The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback of the pipe, a drill-fluid mixing unit and delivery system of sufficient capacity to successfully complete the crossing and/or alignment, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system.

All equipment shall be in good, safe operating condition with sufficient supplies, materials, and spare parts on hand to maintain the system in good working order for the duration of the Contract. Prior to any excavations or drilling, the Contractor shall provide and use detection equipment that is suitable for the location of underground services, pipes, and cables without disturbance of the surface. The Contractor shall provide proof of the capability of the proposed equipment.

The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle, while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing, and rotating pressure required to complete the crossing and/or alignment of the pipeline. The hydraulic power system shall be self-contained with sufficient pressure and volume to power the drilling operations.

The hydraulic system shall be free of leaks. The rig shall have a system to monitor and record maximum pullback pressure during pullback operations. The machine shall be equipped to provide an impact/hammer action for use in rocky terrain.

The Contractor shall provide and use surveying equipment that is suitable for the surveying of the appropriated technology operation. The Contractor shall provide proof of the capability of the proposed equipment to meet the tolerance requirements for drilling and installation of the pipes. The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.

The guidance system shall be of a proven type and setup and shall only be operated by personnel that are properly trained and experienced in the use of the guidance system. The operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system.

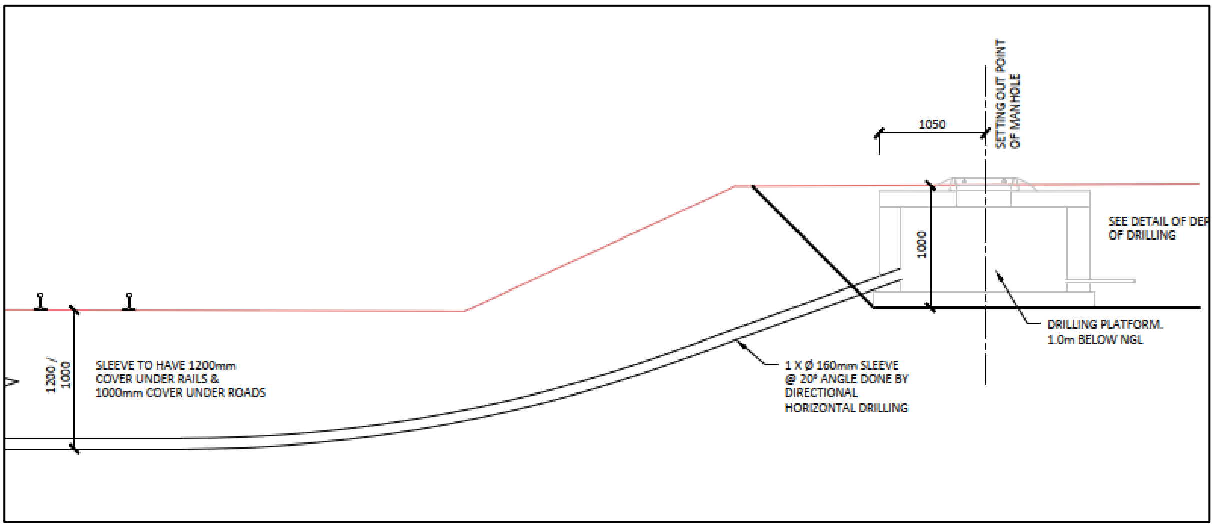

Figure 15: Horizontal Direction Drilling Typical Detail 1

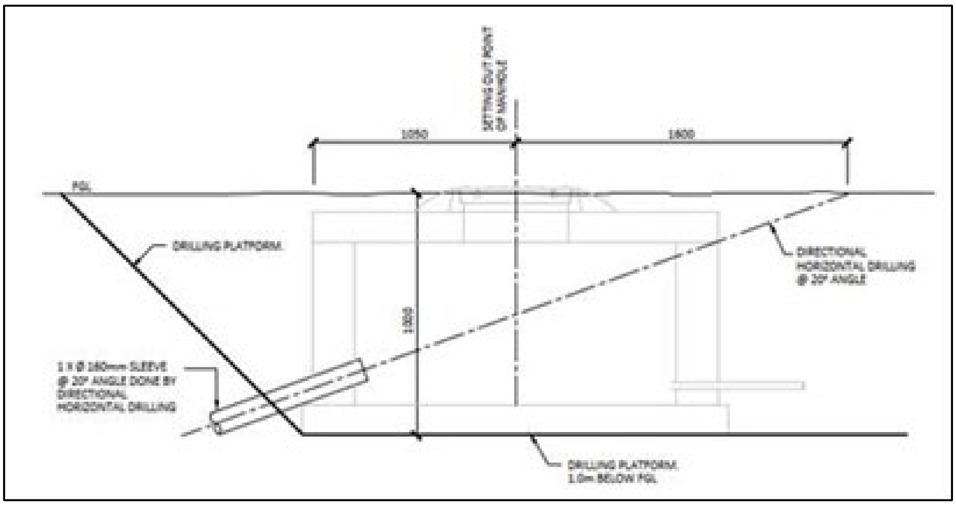

Figure 16: Horizontal Direction Drilling Typical Detail 2

The Employer must be notified 48 hours in advance before commencing drilling operations. The directional drilling shall not begin until the Employer has approved the preparations for the operation.

The Employer's approval for the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the works as authorized under the Contract. The Employer will provide inspection personnel at the appropriate times to avoid undue delays to the Contractor.

Prior to making any alterations to the Site, the Contractor shall photograph or video tape the entire area, a copy of which shall be given to the Employer and one copy to remain with the Contractor for a period of one year following the completion of the project.

The work areas shall be graded or filled to provide a level area. The Contractor shall confine all activities to the designated works areas. As far as this is possible air-, scour and isolating valve positions will be used for entry and exit points. The Contractor will determine how many access areas are necessary to complete the drilling process successfully.

The maximum bend radius shall be as specified. During the welding process of the sleeves, a beading is formed on the outside and the inside of the product, dependent on the class of product that is been used. The Contractor shall check that the mandrel is able to bend the radius of the pipe, considering the beading.

After completion of the installation of the pipeline, all open excavations shall be backfilled in 150 mm layers and compacted to 93% Mod AASHTO density or as stated in the specifications. Surplus excavated material shall be disposed of at an approved spoil site.

The design shall be carried out by a suitable qualified and experienced professional engineer. Calculations, specifications, method statements and drawings shall be signed by the Contractor's engineer and shall be subject to approval by the Employer.

The method statements shall include procedures to be adopted to prevent damage to the pipelines during the pullback operations, identification of any damages and measures to rectify such damages.

The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on the approved Contractor's method drawings. If the Contractor is using a magnetic guidance system, the drill path will be surveyed for any surface geo-magnetic variations or anomalies.

7. HDD Fibre Optic Cables

7.1. Fibre Optics

The proposed fibre optic cable to be installed inside the sleeve / manhole system, from Blouwater Substation to Iscor / Ystervark Substations, to be of the 48 multi-core un-armoured single mode HDD duct type suitable for the blowing/jetting installation method.

The FO cable shall be supplied & installed in accordance with the following, but not limited to, standards:

- 240-125010764 : Duct Fibre Installation Standard.
- NRS 088-1 : Duct and Direct-Buried Underground Fibre-Optic Cables Part 1 - Product Specification.
- NRS 088-2 : Duct and Direct-Buried Underground Fibre-Optic Cables Part 2 - Installation Guidelines.
- SANS 10340-2 : Installation of Telecommunication Cables Part 2: Outdoor Fibre Optic Cables.

The fibre optic cables shall also comply with the Eskom cable schedules attached in Section 7.3.

7.2. Connectors

The connectors to be used at the ODFs (or patch panels), at Blouwater / Iscor / Ystervark Substations, shall be of the SC-APC for use on single mode FO cables, in accordance with Eskom standard '240-70733995 - Optical Distribution Frame / Patch Panel / Patch Box'.

7.3. Eskom Fibre Optic Cable Schedule

ANNEX C

NRS 088-1:2007 Schedule A/B - Technical particulars (DUCT) Optical Fibres

DESCRIPTION	SCHEDULE A PARTICULARS OF ESKOM'S REQUIREMENTS	SCHEDULE B GUARANTEED TECHNICAL PARTICULARS OFFERED	REMARKS
1. No. of fibres	48		
2. Type of Fibres	Single Mode as per clause 2.1		
3. Mode field diameter (i) at 1300nm (ii) at 1550 nm	 9.2±0.4 μm 10.50±1.0 μm		
4 Cladding diameter	125 μm ± 1.0 μm		
5. Mode field concentricity error	≤ 0.5 μm		
6. Cladding non-circularity	≤ 1.0 %		
7. Cladding Configuration (depressed / matched / other)	 Specify		
8. Attenuation Coefficient (a) at 1290 - 1340 nm (b) at 1550 nm	 < 0,36 dB / km < 0,25 dB / km		
9. Chromatic dispersion coefficient (i) at 1300 nm (ii) at 1550 nm	 < 3,5 ps / nm.km <18 ps / nm.km		
10. Proof Test	≥ 1%		
11. Polarization mode dispersion (PMD)	≤ 0.5 ps / √ km		
12. Fibre Curl (ROC)	≥ 4.0 m		
13. Macrobending performance (clause 2.4.1.4) Additional attenuation at 1550nm	< 0.05 dB		

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ANNEX C(continued)

NRS 088-1:2007 Schedule A/B - Technical particulars (DUCT) Cable

DESCRIPTION	SCHEDULE A PARTICULARS OF ESKOM'S REQUIREMENTS	SCHEDULE B GUARANTEED TECHNICAL PARTICULARS OFFERED	REMARKS
1. Cable outer diameter (mm)	Specify		
2. Diameter of bedding layer (mm)	Specify		
3. Weight of Cable (kg/km)	Specify		
4. Ultimate Tensile Strength (N)	Specify		
5 Maximum short term load (maximum strain less than 33% fibre proof strain level) (a) Armoured Cable (N) (b) Metal-free Cable (N)	 Specify Specify		
6. Test Load (where fibre strain does not exceed 0.2% in the fibres) (a) Armoured Cable (N) (b) Metal-free Cable (N)	 Specify Specify		
7. Maximum Continuous Load (fibre under no strain) (a) Armoured Cable (N) (b) Metal-free Cable (N)	 Specify Specify		
8. Minimum Bending Radius (mm) (a) Armoured Cable (b) Metal-free Cable	 ≤ 250 mm ≤ 150 mm		
9. Crush Resistance See clauses 2.2.10 and 2.4.2.2 (a) Armoured Cable (b) Metal-free Cable	 ≥ 5000 N ≥ 2500 N		
10. Impact Resistance (a) Armoured Cable (b) Metal-free Cable	 ≥ 50 x 2 Nm ≥ 10x 2 Nm		
11. Cable Bending Comply with clause 2.4.2.4	Yes		
12. Temperature Cycling Comply with clause 2.4.2.5	Yes		
13. Water penetration	Yes		

Comply with clause 2.4.2.6			
14. Rodent Proof	Yes		
15. Maximum Cable Length available per drum (a) Armoured Cable (m) (b) Metal-free Cable (m)	Specify Specify		

ANNEX D
TSP 41-586 SCHEDULE A/B - TECHNICAL PARTICULARS

DESCRIPTION	COLUMN A PARTICULARS OF ESKOM'S REQUIREMENTS	COLUMN B GUARANTEED TECHNICAL PARTICULARS OFFERED	REMARKS
1. Glands	PVC		
2. Mounting Brackets	Position selectable?		
3. 12/24 holes	Specify.		
4. Hole Spacing	Punched to spec?		
5. ST Bulkhead Connectors with dust caps	Included?		
6. Pigtail Clips	Included?		
7. Fibre Clamps	Installed?		
8. Splice Organiser	Included?		
9. Bracket Bolts and Nuts	Supplied?		
10. Metal Finish and Paint Work	Completed to Spec?		

8. Line Design Philosophy

8.1. Conductors

Table 3: Phase Conductor Details - Chicadee ACSR

Characteristics	
Conductor overall diameter (mm)	18.87
Area aluminium (mm²)	200.93
Area total (mm²)	212.09
Aluminium wire stranding/diameter (mm)	18/1/3.77
Steel wire stranding/diameter (mm)	1/3.77
Conductor linear mass (kg/km)	643
Ultimate tensile strength (kN)	44.9
Resistance dc @ 20 °C (ohms/km)	0.1427
Modulus elasticity final (GPa)	66.2
Coefficient of linear expansion (1/°C)	21.44×10^{-6}
Greased conductor requirements	Greased

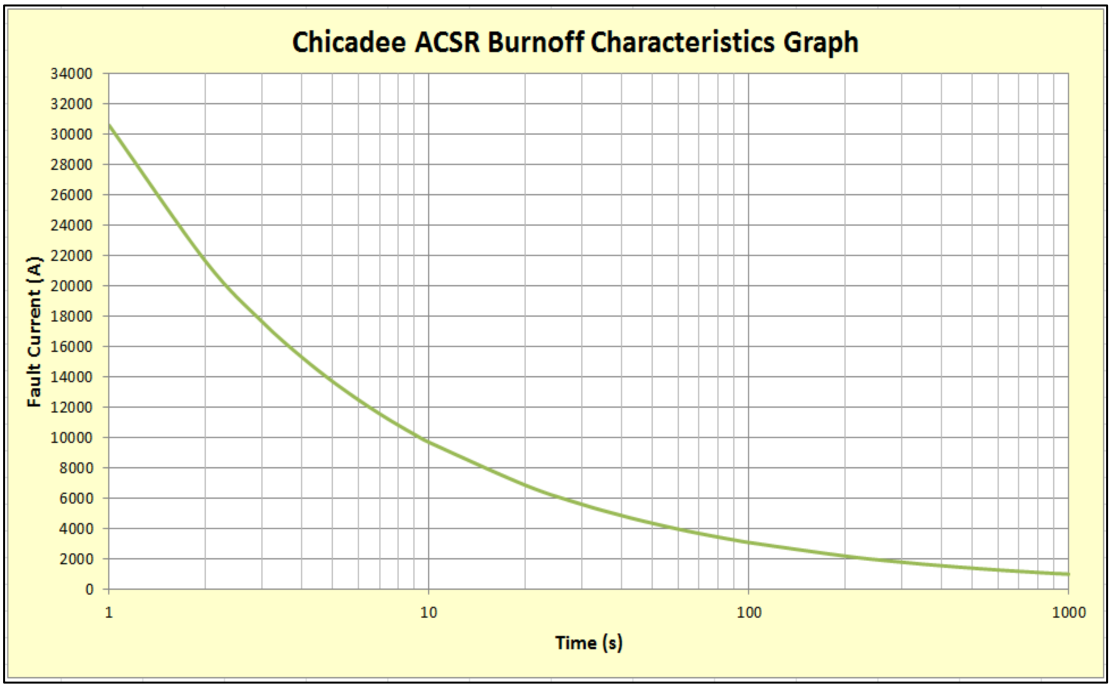

Figure 17: Conductor Burn-off Characteristics Graph - Chicadee ACSR

Table 4: Phase Conductor Details - Kingbird ACSR

Characteristics	
Conductor overall diameter (mm)	23.90
Area aluminium (mm²)	323.01
Area total (mm²)	340.96
Aluminium wire stranding/diameter (mm)	18/1/4.78
Steel wire stranding/diameter (mm)	1/4.78
Conductor linear mass (kg/km)	1038
Ultimate tensile strength (kN)	71.32
Resistance dc @ 20 °C (ohms/km)	0.0891
Modulus elasticity final (GPa)	66.2
Coefficient of Linear expansion (1/°C)	21.69×10^{-6}
Greased conductor requirements	Greased

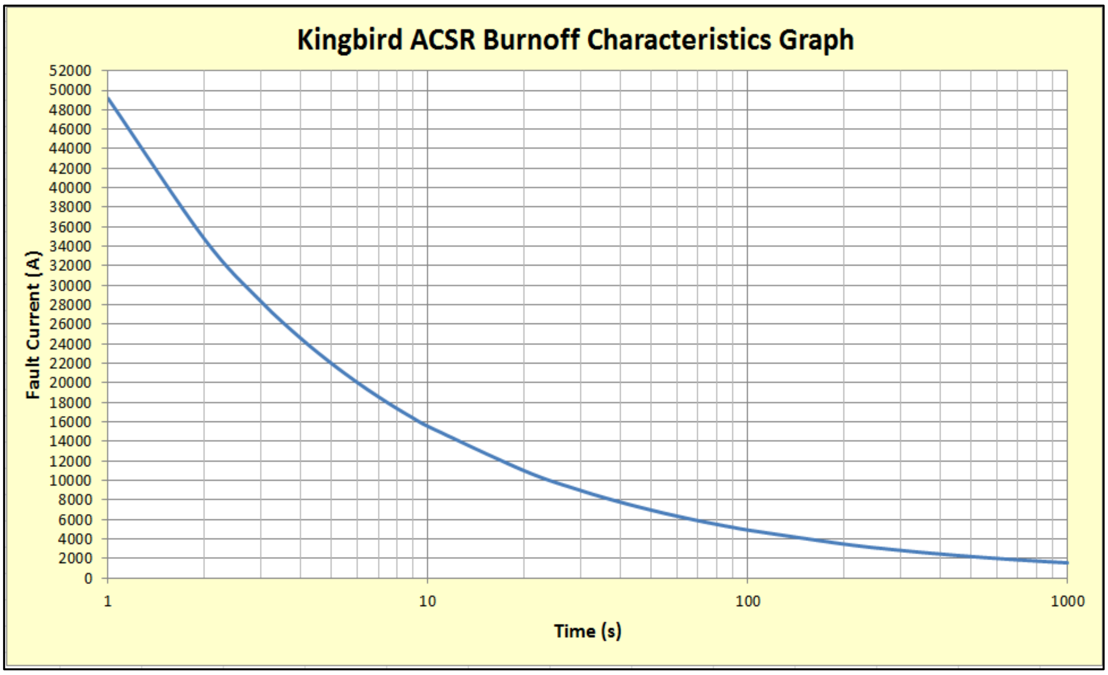

Figure 18: Conductor Burn-off Characteristics Graph - Kingbird ACSR

8.2. Shield Wires

Table 5: Shield Wire Details - Oak AAAC

Characteristics	
Conductor overall diameter (mm)	13.95
Area aluminium (mm²)	118.9
Aluminium wire stranding/diameter (mm)	7/4.65
Conductor linear mass (kg/km)	325
Ultimate tensile strength (kN)	33.33
Resistance dc @ 20 °C (ohms/km)	0.279
Modulus elasticity final (GPa)	61
Coefficient of linear expansion (1/°C)	23 x 10^{-6}
Greased conductor requirements	Greased

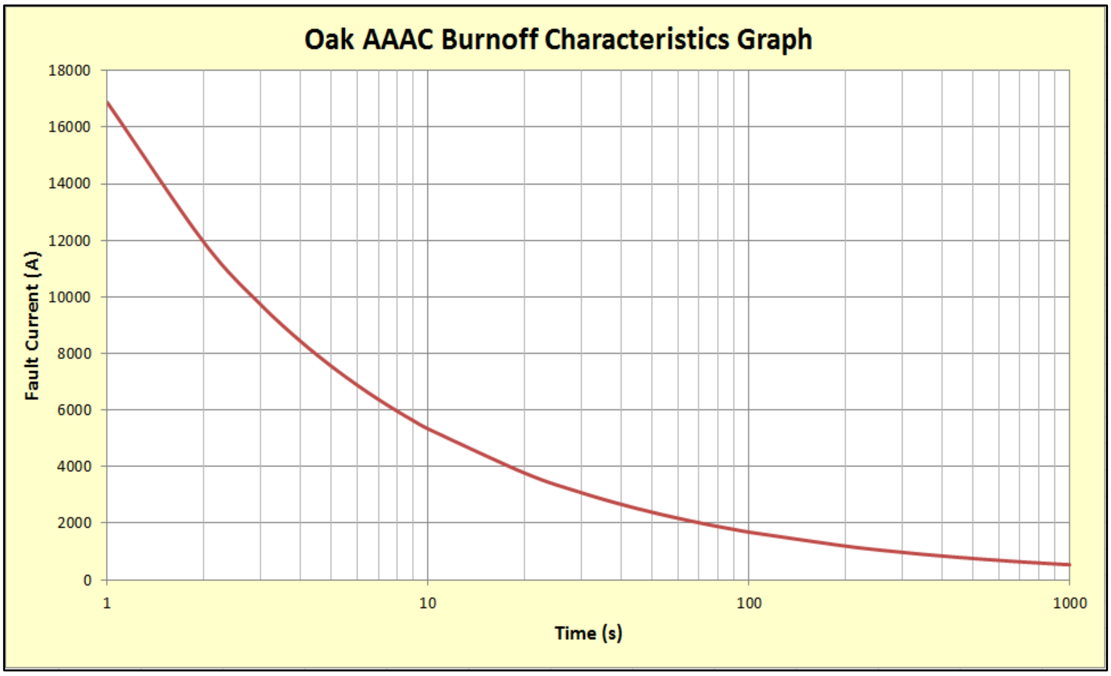

Figure 19: Conductor Burn-off Characteristics Graph - Oak AAAC

Note: Any and all aluminium conductors (i.e. ACSR and AAAC) utilized for the works, either as phase conductor or shield wire, shall bear the Eskom mark on the aluminium strands. The Contractor shall be responsible to obtain permission from Eskom for purposes of procurement of marked conductor.

8.3. OPGW (Existing)

Table 6: 16 kA/1s 48 Core OPGW Details (Existing)

Characteristics (Data based on Eskom approved ZTT OPGW Type ZTT201012011)		
Approximate cable diameter (mm)		16.9
Approximate cable weight (kg/km)		558
Ultimate tensile strength (kN)		66.2
Modules of elasticity (kN/mm²)		78.3
Thermal elongation coefficient (1/ºC)		19.8×10^{-6}
Permissible maximum working stress (40 % RTS) (N/mm²)		160.6
Everyday stress (EDS) (16 % ~ 25 % RTS) (N/mm²)		64.2 ~ 100.4
Ultimate exceptional stress (70 % RTS) (N/mm²)		281
DC resistance (Ω/km)		0.200
Short time current (1s, 20 ºC ~ 200 ºC) (kA)		16.21
Short time current capacity I²t (kA²s)		262.8
Minimum bending radius installation (mm):		338
	Operating (mm):	253
Ratio between pull & weight (km)		11.8
Temperature range	**Installation (ºC)**	- 10 ~ + 50
	Transportation & Operation (ºC)	- 40 ~ + 80

8.4. Earthing

8.4.1. Fault Levels

The fault levels at Ystervark Substation, which were provided by Eskom Western Cape Operating Unit's Network Planning Department, consists of two scenarios nl. the fault levels for the initial 66 kV voltage level supply and those for the future planned 132 kV supply.

The first scenario involves the following:

- Ystervark Substation @ 66 kV, connected via 2 x 66 kV ASH overhead lines to Blouwater Substation with the Blouwater 66 kV busbar supplied through 3 x 80 MVA 132/66 kV transformers.

Table 7: Scenario 1 - 66 kV Three Phase and Single Phase Fault Levels at Ystervark Substation

Busbar Name	Unom (kV)	I - 3 Ø (kA)	I - 1 Ø (kA)
Ystervark 132 kV BB1	66	8.2	8.8

The second scenario consists of the following:

- Ystervark Substation @ 132 kV, connected via 2 x 132 kV Kingbird overhead lines to Blouwater Substation's 132 kV busbar(s), with the future planned Bokkom MTS supplying Blouwater Substation via 3 x 500 MVA 400/132 kV transformers (with additional future generation feeds considered).

Table 8: Scenario 2 - 132 kV Three Phase and Single Phase Fault Levels at Ystervark Substation

Busbar Name	Unom (kV)	I - 3 Ø (kA)	I - 1 Ø (kA)
Ystervark 132 kV BB1	132	23.2	21.4

As the fault levels of interest will only be for the 66 kV supply, scenario 2 above will be ignored for the purposes of this FDP. Furthermore, the fault levels at Iscor Substation for scenario 1 (also as provided by Eskom Western Cape Operating Unit's Network Planning Department), are as follows:

Table 9: 66 kV Three Phase and Single Phase Fault Levels at Iscor Substation

Busbar Name	Unom (kV)	I - 3 Ø (kA)	I - 1 Ø (kA)
Iscor 132 kV BB1	66	6.9	6.4

8.4.2. Soil Resistivity

Multiple soil resistivity tests have been undertaken around the Tippler 3 site, including in close vicinity where the five new structures are to be located (Refer to test reports provided).

It can be seen that the resistivity of the native soil tends to be relatively constant and below 100 Ωm, hence it was deemed not necessary to conduct further additional soil resistivity tests at the positions of the five structures. Very low final structure footing resistances are expected.

It should however be noted that when soil has very low measured electrical resistivity, it tends to be very corrosive in nature towards metals. The below table is an extract from SANS 10199 depicting the relationship between the soil's electrical resistivity and its corrosiveness.

Table 10: Soil Resistivity vs Corrosiveness

Soil Resistivity (Ωm)	Corrosiveness
0 - 10	Very severe
10 - 100	Moderate to Severe
100 - 1000	Mild (If aerated)
> 1000	Probably not corrosive

For all Transnet's earthing material tinned copper has been allowed, to assist in combating premature corrosion. For Eskom's earthing material, no tinned copper was allowed as the standards do not call for it, however Eskom can on-site request, for Transnet's consideration, to include tinning of the associated copper material.

8.4.3. Earthing Methodology

The earthing of the new sub-transmission branch line structures shall be in accordance with the following Eskom standard and drawing(s), and associated others:

- 240-130615862 Rev 1 : Earthing of Transmission Line Towers.
- D-WC-7600-04-04 Rev 0 : Earthing Details HV Earth Electrodes for Steel Monopoles.
- 06TB-08 : Bifurcation (Splitting) of Shield Wires.

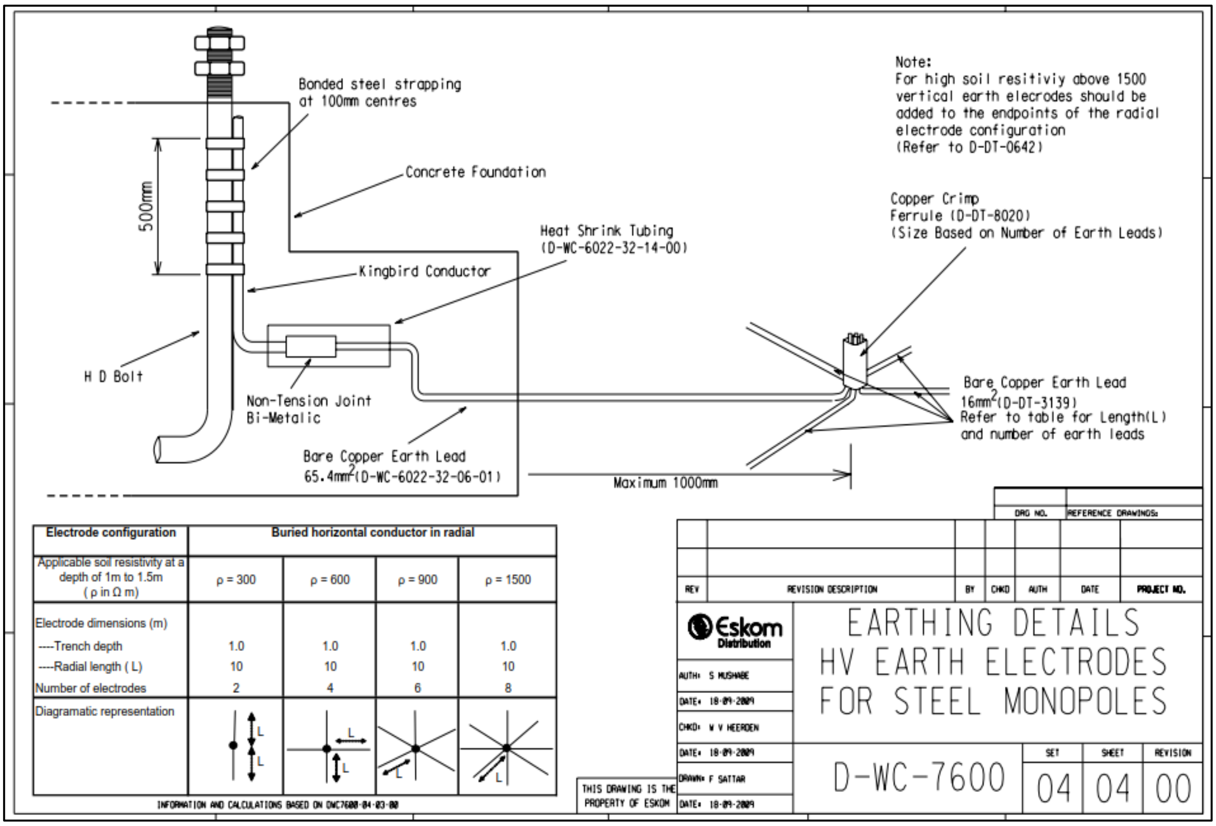

Figure 20: Steel Monopole Earthing

The shield wires and OPGW on the existing Blouwater-Iscor 66 kV line are all insulated from the steel structures. The reason for this is that most of line crosses or runs within 800 m parallel to railway tracks and other services, hence the need to reduce or eliminate the risk of stray currents flowing through the structure foundations that would cause galvanic corrosion on the foundations' rebar.

The same principle will be followed for the five new structures relating to the branch section of the line. Referring to Section 8.4.2 in this document, numerous tests undertaken on-site have shown very low soil resistivity values. Hence the footing resistance of the structures is expected to be very low (ie. under 10 Ω). The following structures as indicated in the below table, shall be bonded directly to the respective substation's earth grid:

Table 11: Structures to be Bonded to Substation Earth Grid

Structure Name	Structure Type	Bonding Conductor	Amount per Structure	To Substation Earth Grid
1 BLO / ISC 33	Terminal	50 mm x 3 mm flat copper strap	1	Iscor
2 BLO / ISC 33	Terminal	50 mm x 3 mm flat copper strap	1	Iscor
1 BLO / ISC 32/2	Terminal	50 mm x 3 mm flat copper strap	1	Ystervark
2 BLO / ISC 32/2	Terminal	50 mm x 3 mm flat copper strap	1	Ystervark

Given the site layout and positions of the abovementioned structures, it allows the earth electrodes of the steel monopoles to be connected directly to Iscor & Ystervark Substations earth grids respectively. Structure 1 & 2 BLO / ISC 32/1 will utilize the earthing method as indicated on drawing D-WC-7600-04-04 Rev 0 Earthing Details HV Earth Electrodes for Steel Monopoles (refer to Fig 20).

The existing OPGW & new shield wires at Iscor Substation, including the shield wires at Ystervark Substation, shall be bonded directly to the applicable gantries, however insulators will be allowed for should Eskom decide in future to remove the direct connections. The following two figures depicts the earthing of the structures, including the bonding of the shield wires and OPGW to the respective gantries:

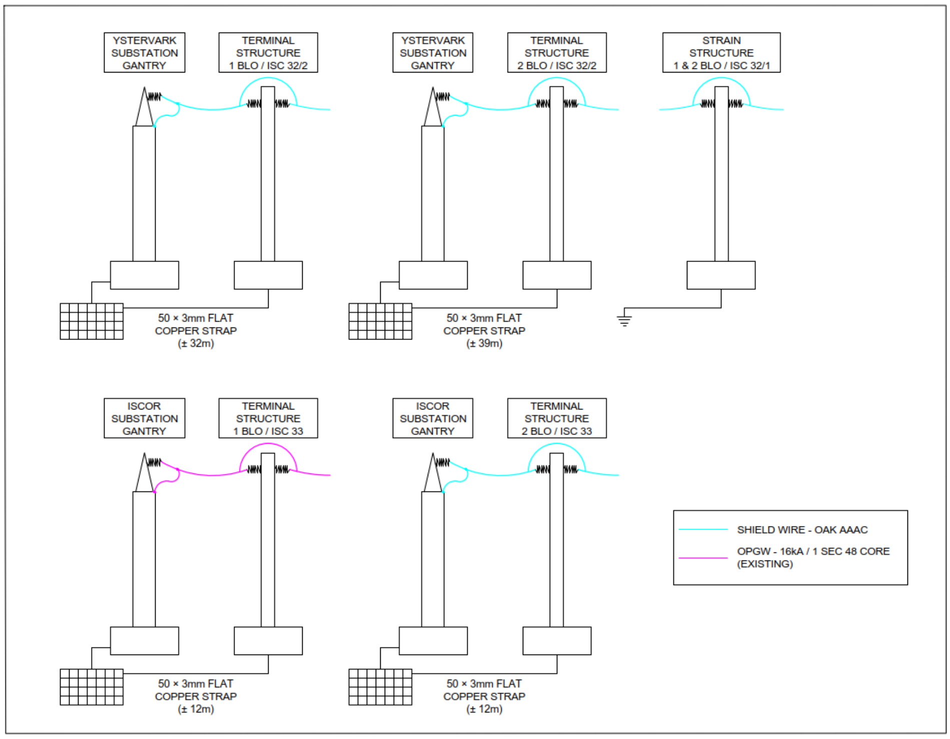

Figure 21: Structure Earthing and Shield Wire/OPGW Gantry Bonding Configurations - Elevation View

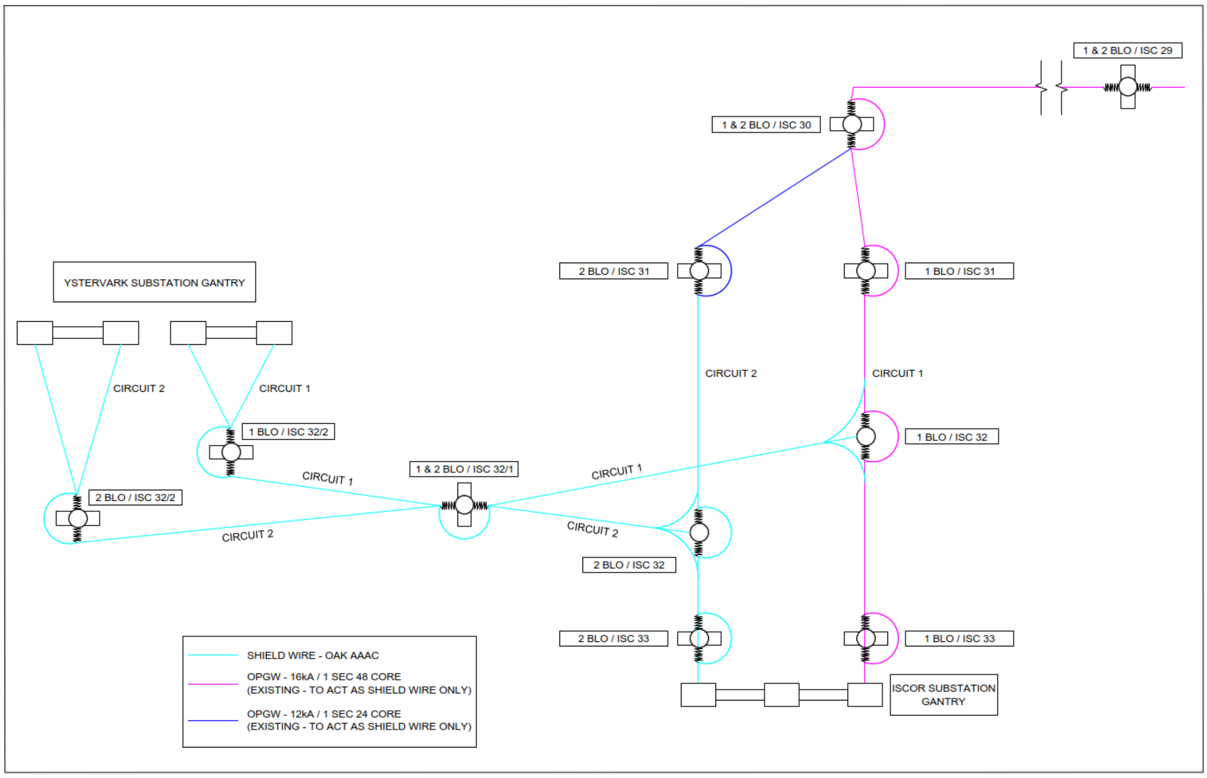

Figure 22: Structure Earthing and Shield Wire/OPGW Gantry Bonding Configurations - Plan View

8.5. Structures

8.5.1. General

The five new structures required for the branch section of the line, which will connect Ystervark Substation to the existing Blouwater-Iscor 66 kV OHL, will be of the self-supporting steel monopole strain types. These structures are similar to the typical Eskom Western Cape Operating Unit's type as depicting in drawing set DWC 7601 for 66 kV strain structures, except for the two terminal towers at Ystervark Substation which are similar to the drawing set DWC 7602 for 132 kV strain structures.

The structures have been modified to suit the specific application accordingly.

The abovementioned terminal structures are designed to 132 kV clearances in order to cater for the future 132 kV network in the region, which is to replace the existing 66 kV network, hence negating the need for any replacements.

As the exact entrance angle of the 132 kV future lines onto these two structures is unknown at this stage, including the types of conductor, shield wire and/or OPGW, certain assumptions had to be made for the end state case in order to finalize their designs.

The end state scenario assumed is as follows:

- Maximum conductor/shield wire/OPGW entry angle = 60^0
- Closing span onto gantry angle = 0^0
- Conductors per phase = Modelled with 2 x Tern ACSR.
- Shield wire = Modelled with weight of 1 x Kingbird ACSR.
- OPGW = Modelled with weight of 1 x Kingbird ACSR.

It is unlikely that the end state scenario will be as per the above assumptions, however by overdesigning the structures based on the assumptions made, it will provide Eskom with flexibility with regards to the entrance angle, phase conductor and OPGW / shield wire of the future 132 kV lines that is to connect onto these two terminal structures.

In addition, standard Eskom clearances for 132 kV monopole structures are:

- Vertical spacing between phases (m) = 2.2
- Vertical spacing between phase and earth wire/OPGW (m) = 2

For the two 132 kV terminal structures, additional clearance allowance was made, as follows:

- Vertical spacing between phases (m) = 2.35
- Vertical spacing between phase and earth wire/OPGW (m) = 2.7

The application for each of the 5 x new structures will be as listed in the table overleaf:

Table 12: Structure Application

Structure Name	Type	Circuit Arrangement
1 BLO / ISC 32	T-off Strain	Single
2 BLO / ISC 32	T-off Strain	Single
1 & 2 BLO / ISC 32/1	Strain	Double
1 BLO / ISC 32/2	Terminal Strain	Single
2 BLO / ISC 32/2	Terminal Strain	Single

The Contractor shall ultimately be responsible for the structures' final designs (final design drawings in Section 13.2). Manufacturing of the structures may not commence until such time the Contractor has obtained all relevant design approvals from Transnet and Eskom respectively.

Additionally, no manufactured structure or its applicable components will be permitted to be sent for galvanizing until such time Transnet and Eskom have completed their factory acceptance tests on the units and furnished approval.

It is to be noted that Transnet and Eskom reserve the right to undertake further factory acceptance tests as needed in order to verify any corrections made to defects, galvanizing and the like. The structures shall also not be dispatched to site until the Contractor has obtained all approvals from Transnet and Eskom.

The structures shall also be in accordance with the following Eskom standards and drawing(s), and associated others:

- 240-75884074 Rev 1 : Standard Sub Transmission Lines Section 9: Steel Mono Pole 132 kV Compact Line Tower Series.
- 240-75883378 Rev 1 : Specification for Steel Pole Overhead Line Supports.
- 240-75883830 Rev 1 : Steel Grades and Welding Requirements for Steelwork and Overhead Line Hardware Components.

8.5.2. New Structure Details

All structures have been modelled in PLS Pole using the criteria / loadings as stipulated in IEC 60826 / SANS 10280. The following table below depicts the associated weather cases:

8.5.2.2. Structure Designs – Weather Cases Applicable

Table 13: Weather Cases Applicable to Structure Designs

Description	Wind Velocity (m/s)	Wind Pressure (Pa)	Wire Ice Thickness (cm)	Wire Ice Density (N/m^3)	Wire Ice Load (N/m)	Wire Temp. (deg C)	Weather Load Factor	Wire Wind Height Adjust Model	Wire Gust Response Factor
70 °C Hot	0	0	0	0	0	70	1	None	1
60 °C Hot	0	0	0	0	0	60	1	None	1
50 °C Hot	0	0	0	0	0	50	1	None	1
40 °C Hot	0	0	0	0	0	40	1	None	1
35 °C Hot	0	0	0	0	0	35	1	None	1
30 °C Hot	0	0	0	0	0	30	1	None	1
25 °C Hot	0	0	0	0	0	25	1	None	1
20 °C Hot	0	0	0	0	0	20	1	None	1
15 °C EDT	0	0	0	0	0	15	1	None	1
15 °C 1050 Pa Wind	41.387	1050	0	0	0	15	1	None	1
15 °C 29 m/s IEC Wind 50y	29	515.533	0	0	0	15	1	IEC 60826:2003	IEC 60826:2003
15 °C 29 m/s IEC Wind 150y	29	515.533	0	0	0	15	1.21	IEC 60826:2003	IEC 60826:2003
15 °C 37 m/s Narrow Wind	37	839.197	0	0	0	15	0.9	IEC 60826:2003	IEC 60826:2003
15 °C 120 Pa Swing	13.9914		0	0	0	15	1	None	1
15 °C 575 Pa Swing	30.6269	575	0	0	0	15	1	None	1
-5 °C Uplift	0	0	0	0	0	-5	1	None	1
50 °C 575Pa Blowout	30.6269	575	0	0	0	50	1	None	1
-5 °C 0Pa Ice 10mm	0	0	1	9000	0	-5	1	IEC 60826:2003	IEC 60826:2003
-5 °C 120Pa Ice 10mm	13.9914	120	1	9000	0	-5	1	IEC 60826:2003	IEC 60826:2003

8.5.2.3. Structures Usage Graph

From the PLS CADD and PLS Pole models, a structure usage graph has been generated and included in the figure below. From this graphical representation it can be observed that all the structures operate well within their design parameters.

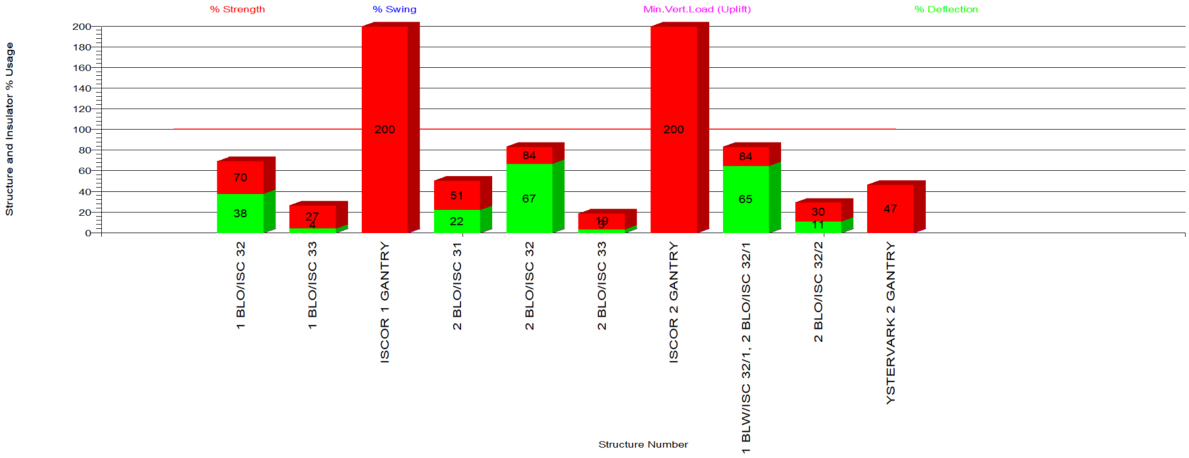

Figure 23: New Structures Usage Graph

Note: Method 1 structures were modelled for the substation gantries and therefore the usages do not represent the resultant structure usage on site and can be ignored.

8.5.2.4. New Structures Application Information

Table 14: New Mast Structure Details

Mast No.	1 BLO / ISC 32	2 BLO / ISC 32	1 & 2 BLO / ISC 32/1	1 BLO / ISC 32/2	2 BLO / ISC 32/2
Phase Conductor: Type 1	Chicadee ACSR	Chicadee ACSR	Chicadee ACSR	Chicadee ACSR (Modelled with 2 x Tern ACSR per phase for Future)	Chicadee ACSR (Modelled with 2 x Tern ACSR per phase for Future)
Phase Conductor: Type 2	-	-	-	Kingbird ACSR for Closing Span (Modelled with 2 x Tern ACSR per phase for Future)	Kingbird ACSR for Closing Span (Modelled with 2 x Tern ACSR per phase for Future)
OPGW Conductor:	16 kA/1 s 48 Core (Existing)	None	None	- (Modelled with weight of Kingbird ACSR for Future)	- (Modelled with weight of Kingbird ACSR for Future)
Shield Conductor:	Oak AAAC	Oak AAAC	Oak AAAC	Oak AAAC (Modelled with weight of Kingbird ACSR for Future)	Oak AAAC (Modelled with weight of Kingbird ACSR for Future)
Vertical Φ - Φ Spacing: (m)	1.5	1.5	1.5	2.35	2.35
Vertical ε - Φ Spacing: (m)	1.5	1.5	1.5	2.7	2.7
Conductor Attachment Height: (m)	14	24	22	11	13
Max. Wind Span (m)	300	300	300	300	300
Max. Weight Span (m)	350	350	350	350	350

Turnoff Angle (deg)	90	90	30	90 (Initial) 60 (Future)	90 (Initial) 60 (Future)
Tip Deflection Limit (%)	6%	6%	6%	6%	6%
Sides	12	12	12	16	16
Approximate Total Length: (m)	18.5	28.5	26.5	18.4	20.4
Tip Diameter: (mm)	300	350	350	350	350
Base Diameter: (mm)	950	1050	1050	1300	1450
Wall Thickness: (mm)	8	10	10	12	12
Base Plate O.D: (mm)	Manufacturer to confirm				
Base Plate I.D: (mm)	Manufacturer to confirm				
Base Plate Thickness: (mm)	Manufacturer to confirm				
H.D Bolts: (Qty)	Manufacturer to confirm				
H.D Bolts Diameter: (mm)	Manufacturer to confirm				
H.D Bolts PCD: (mm)	Manufacturer to confirm				
Working Tip Load: (kN)	67.3	77.8	84.1	210.16	217.70
Base g.l. Moment: (kNm)	1245	2217	2229.3	3867	4441
Baseline Eskom Standard Foundation Reference: (kNm)	2000	3000	3000	4500	5000
Approximate Mass: (tons)	2.66	5.51	5.51	4.70	5.66
Approximate Overall Mast Utilisation: (%)	70	84	84	26 (Initial) 94.5 (Future)	30.0 (Initial) 94.7 (Future)

8.5.3. Existing Structure Details

The following details below are related to existing structures 1 BLO / ISC 31 & 2 BLO / ISC 31.

Table 15: Existing Mast Structure Details (1 BLO / ISC 31 & 2 BLO / ISC 31)

Mast No.	1 BLO / ISC 31	2 BLO / ISC 31
Phase Conductor: Type 1	Chicadee ACSR	Chicadee ACSR
Phase Conductor: Type 2	-	-
OPGW Conductor:	16 kA/1 s 48 Core (Existing)	None
Shield Conductor:	None	Oak AAC
Vertical Φ - Φ Spacing: (m)	1.50	1.50
Vertical ε - Φ Spacing: (m)	1.50	1.50
Conductor Attachment Height: (m)	14.0	14.0
Max. Wind Span (m)	300	300
Max. Weight Span (m)	350	350
Turnoff Angle (deg)	21	41
Tip Deflection Limit (%)	6	6
Sides	Unknown	Unknown
Approximate Total Length: (m)	18.5	18.5
Tip Diameter: (mm)	420	420
Base Diameter: (mm)	990	990
Wall Thickness: (mm)	12	12
Base Plate O.D : (mm)	1250	1250
Base Plate I.D: (mm)	800	800
Base Plate Thickness: (mm)	45	45
H.D Bolts: (Qty)	32	32
H.D Bolts Diameter: (mm)	36	36
H.D Bolts PCD: (mm)	1100	1100
Working Tip Load: (kN)	67.6	67.6
Base g.l. Moment: (kNm)	688.65	974.85
Foundation Details: (kNm)	Unknown	Unknown
Approximate Mass: (tons)	4	4
Approximate Overall Mast Utilisation: (%)	51	47

8.6. Foundations

8.6.1. Specification

Once the soils have been nominated by the Contractor and approved by Transnet and Eskom, the final size and type of foundation shall be chosen (designed) for the specific structure type and loadings, in accordance with amongst others the Eskom classification ‘240-47172520: The Standard for the Construction of Overhead Powerlines’, as well as the geotechnical investigation report. The Contractor’s final soil nominations received have been attached in Section 8.6.2.

The Contractor shall provide a foundation record report, covering all mast foundations, which is to be signed off by a suitably qualified and experienced professionally registered engineer (to be approved by Transnet). The report shall verify that the soil was nominated and that the Contractor has assumed responsibility for the final foundation designs and construction.

The Contractor shall ultimately be responsible for the final foundation designs (final design drawings contained in Section 13.3). The foundations shall be designed to withstand the maximum combinations of induced factored moments, compression and torsion loads including any other applicable requirements imposed by Eskom and statutory regulations and standards. Construction of the foundations may not commence until such time the Contractor has obtained all relevant approvals from Transnet and Eskom respectively.

The standard Eskom foundation drawings as listed below can be used as a baseline to develop the final designs. It is to be noted that the foundations for terminal structures 1 BLO / ISC 32/3 and 2 BLO / ISC 32/3 shall cater for the future end state loads, as provided in Table 14.

These maximum loadings are envisaged to be imposed on the foundations once the future planned 132 kV overhead lines are implemented and the current 66 kV OHL system removed. The anticipated maximum future conductor entrance angle on the two terminal structures respectively is 60 degrees (with ± 300 m spans).

The above-mentioned angle shall be based on a 180 degree radius entrance allowance on the north - east - south axis of the terminal towers. At this stage the exact angle of entry of the future incoming lines (and subsequent forces to be imposed) is not known, therefore these masts and subsequently their foundations are to be designed to accommodate an incoming line at any angle within the 180 degree segment described. It should be noted that the strength of the foundations must be compared against in future incoming line designs, to ensure their suitability of the application.

Given this, these two foundations will most likely be square pads and not rectangular. Due to the criticality of these two foundations, special attention shall be given in order to ensure the correct final designs.

Table 16: Eskom Standard Foundations

Foundation	Eskom Drawing No.
2000 kNm for strain monopoles	D-WC-7602-07-02-03
2500 kNm for strain monopoles	D-WC-7602-07-11-01
3000 kNm for strain monopoles	D-WC-7602-07-03-03
4500 kNm for strain monopoles	D-WC-7602-07-05-03
5000 kNm for strain monopoles	D-WC-7602-07-06-01

The following figure below provides the indicative foundation orientation for the different new structures The Contractor's final foundation orientation information received has been attached in Section 8.6.3 in this document.

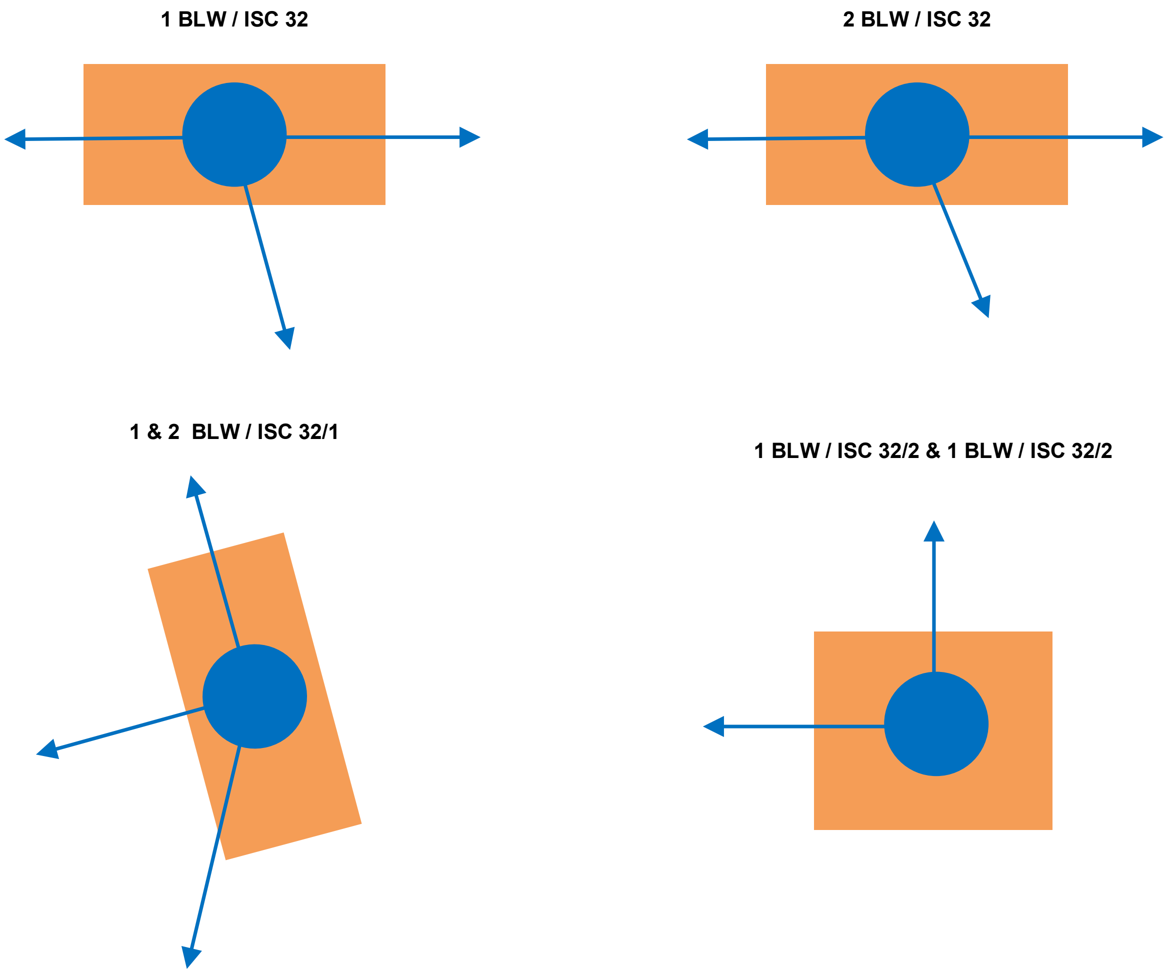

Figure 24: Foundation Orientation

8.6.2. Contractor Provided Soil Nomination Results

KHATO CIVILS / THENGA HOLDINGS JV	Document No.:	TRANSNET
QUALITY MANAGEMENT SYSTEM	KT-QMS-F-031	
	Rev. / Date	
CONTRACTOR'S SOIL NOMINATIONS LIST	14-Mar-17	
	Page	

Test Pit No.:	Tower No.:	Tower Type	Test Pit Nomonation (Average Soil profile)	Leg A		Comments	Leg B		Leg C	
				Foundation system & Drawing No.	Soil type		Foundation system & Drawing No.	Soil type	Foundation system & Drawing No.	Soil type
1	1 BLW/ ISC 32 1	Self Supporting	Cohesive soil	Isolated Footing FD2222/09/19	Type 3	DCP results proves that insitu condition is soil type 1, however, foundations were designed for worse case cenario (soil type 3)				
2	2 BLW/ ISC 32 1	Self Supporting	Cohesive soil	Isolated Footing FD2222/09/19	Type 3	DCP results proves that insitu condition is soil type 1, however, foundations were designed for worse case cenario (soil type 3)				
3	1 & 2 BLW/ ISC 32/ 2	Self Supporting	Cohesive soil	Isolated Footing FD2222/09/19	Type 3	DCP results proves that insitu condition is soil type 1, however, foundations were designed for worse case cenario (soil type 3)				
4	1 BLW/ ISC 32 3	Self Supporting	Cohesive soil	Isolated Footing FD2222/09/19	Type 3	DCP results proves that insitu condition is soil type 1, however, foundations were designed for worse case cenario (soil type 3)				
5	2 BLW/ ISC 32 3	Self Supporting	Cohesive soil	Isolated Footing FD2222/09/19	Type 3	DCP results proves that insitu condition is soil type 1, however, foundations were designed for worse case cenario (soil type 3)				

Project name:			
Contractor:	Khato Civils Thenga Holdings JV		
Contractor's Eng.:	Sandile Kunene	Date: 02/12/2019	Signature:
Client (TGC):	KOLIKA	Date: 4/12/19	Signature:
AECOM:	COBUS MEYER	Date: 09/12/2019	Signature:
ESKOM Engineer:	MASTURA BARODIEN	Date: 09/12/2019	Signature:

ESKOM APPROVAL STAMP

Foundation system	Soil Type
Pad	1, 2, 3, 4
Rock	Soft rock
Auger pile, Deadman	Hard Rock

1 BLO-ISC 32

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: **1 BLO/ISC32 - 1A**
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 445mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x\,(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x\,(dn)^{-1.09}$
0	0	0	0	0					
5	40	40	40	8.0	Dense	246	29	31	301
10	56	56	16	3.2	Very Dense	>400	94	104	816
15	70	70	14	2.8	Very Dense	>400	111	>110	944
20	80	80	10	2.0	Very Dense	>400	170	>110	1362
25	93	93	13	2.6	Very Dense	>400	122	>110	1023
30	107	107	14	2.8	Very Dense	>400	111	>110	944
35	120	120	13	2.6	Very Dense	>400	122	>110	1023
40	135	135	15	3.0	Very Dense	>400	102	110	876
45	146	146	11	2.2	Very Dense	>400	151	>110	1228
50	161	161	15	3.0	Very Dense	>400	102	110	876
55	177	177	16	3.2	Very Dense	>400	94	104	816
60	195	195	18	3.6	Very Dense	>400	81	89	718
65	215	215	20	4.0	Very Dense	400	70	77	640
70	239	239	24	4.8	Very Dense	357	56	61	525
75	264	264	25	5.0	Very Dense	347	53	57	502
80	290	290	26	5.2	Dense	337	51	54	481
85	319	319	29	5.8	Dense	311	44	47	427
90	351	351	32	6.4	Dense	290	39	41	383
95	380	380	29	5.8	Dense	311	44	47	427
100	405	405	25	5.0	Very Dense	347	53	57	502
105	422	422	17	3.4	Very Dense	>400	87	96	764
110	435	435	13	2.6	Very Dense	>400	122	>110	1023
115	445	445	10	2.0	Very Dense	>400	170	>110	1362

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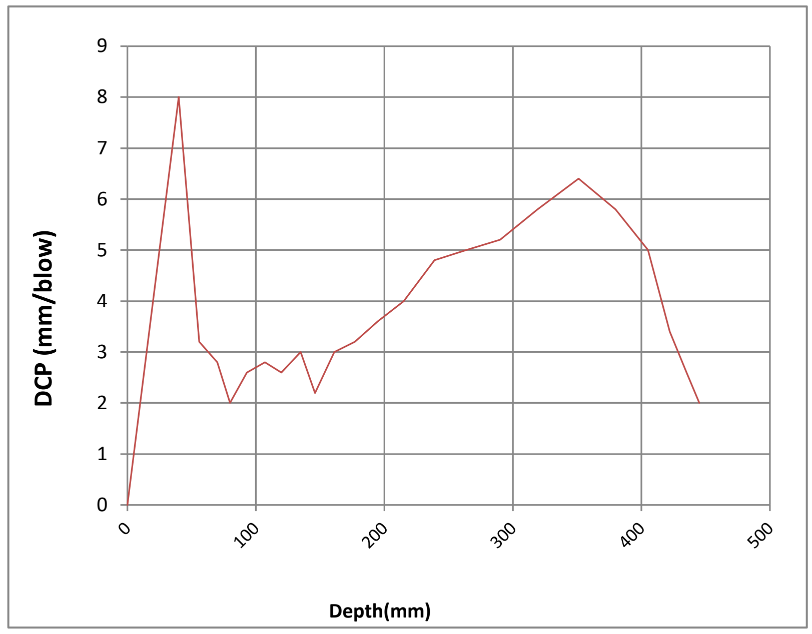
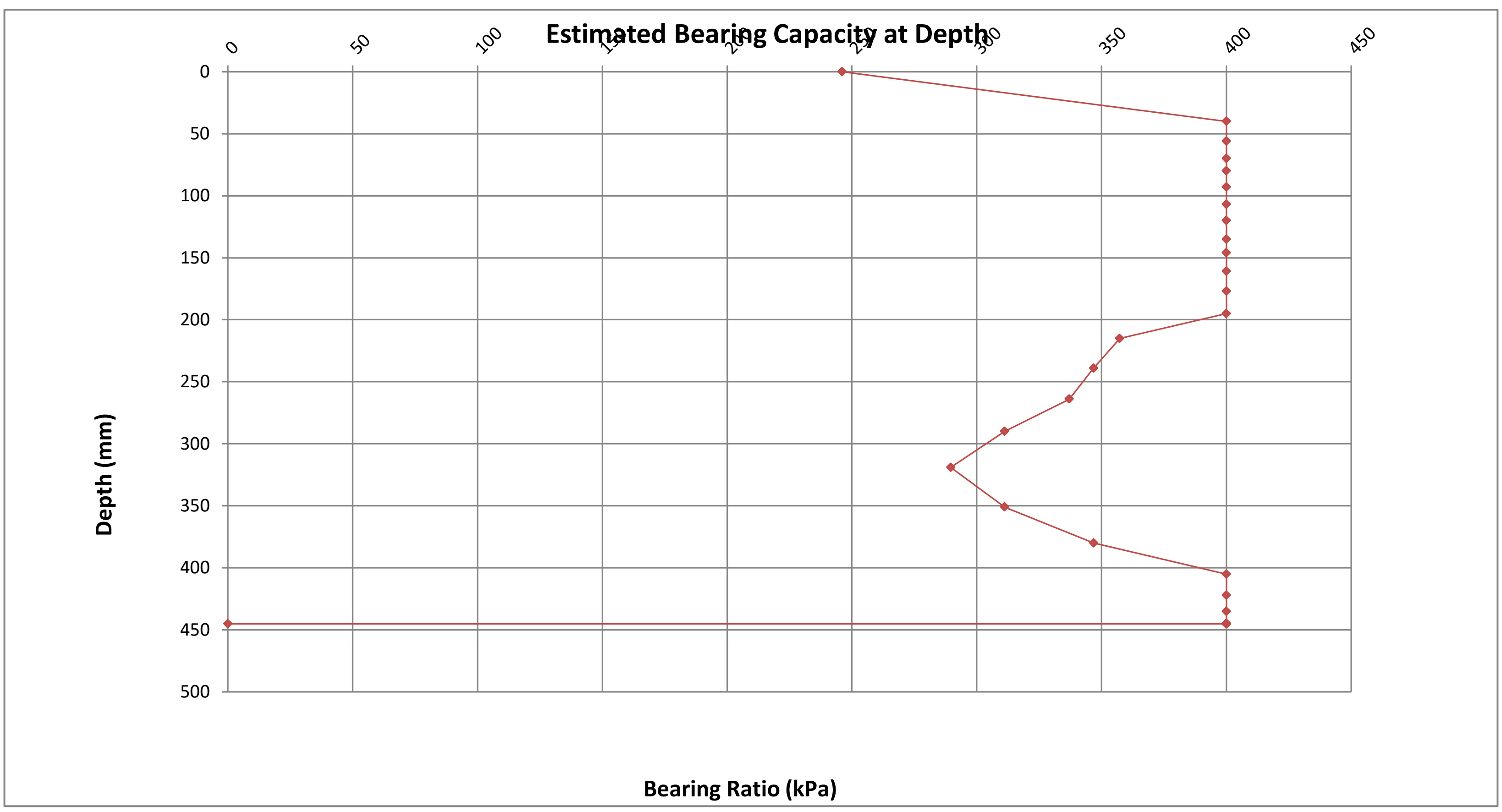
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**1 BLO/ISC32 - 1A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





Remarks:

1. The samples where subjected and analysed according to SANS / SABS.
2. The results reported relate only to the sample tested, Further use of the above information is not the responsibility or liability of Roadlab Laboratories - Saldanha.
3. This document is the correct record of all measurements made, and may not be reproduced other than with full written approval from the Technical Manager of Roadlab Laboratories - Saldanha
4. Measuring equipment is traceable to national standards (Where applicable).
5. Data Capture : Mrs. M. Swart

Mr A Engel
Lab Manager

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Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC32 - 1B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 398mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	52	52	52	10.4	Dense	203	21	21	226
10	64	64	12	2.4	Very Dense	>400	135	>110	1117
15	74	74	10	2.0	Very Dense	>400	170	>110	1362
20	84	84	10	2.0	Very Dense	>400	170	>110	1362
25	93	93	9	1.8	Very Dense	>400	194	>110	1528
30	103	103	10	2.0	Very Dense	>400	170	>110	1362
35	114	114	11	2.2	Very Dense	>400	151	>110	1228
40	128	128	14	2.8	Very Dense	>400	111	>110	944
45	142	142	14	2.8	Very Dense	>400	111	>110	944
50	154	154	12	2.4	Very Dense	>400	135	>110	1117
55	165	165	11	2.2	Very Dense	>400	151	>110	1228
60	175	175	10	2.0	Very Dense	>400	170	>110	1362
65	187	187	12	2.4	Very Dense	>400	135	>110	1117
70	201	201	14	2.8	Very Dense	>400	111	>110	944
75	216	216	15	3.0	Very Dense	>400	102	110	876
80	231	231	15	3.0	Very Dense	>400	102	110	876
85	248	248	17	3.4	Very Dense	>400	87	96	764
90	265	265	17	3.4	Very Dense	>400	87	96	764
95	280	280	15	3.0	Very Dense	>400	102	110	876
100	295	295	15	3.0	Very Dense	>400	102	110	876
105	308	308	13	2.6	Very Dense	>400	122	>110	1023
110	321	321	13	2.6	Very Dense	>400	122	>110	1023
115	333	333	12	2.4	Very Dense	>400	135	>110	1117
120	343	343	10	2.0	Very Dense	>400	170	>110	1362
125	354	354	11	2.2	Very Dense	>400	151	>110	1228
130	363	363	9	1.8	Very Dense	>400	194	>110	1528
135	372	372	9	1.8	Very Dense	>400	194	>110	1528
140	379	379	7	1.4	Very Dense	>400	267	>110	2010
145	384	384	5	1.0	Very Dense	>400	410	>110	2900
150	389	389	5	1.0	Very Dense	>400	410	>110	2900
155	392	392	3	0.6	Very Dense	>400	784	>110	5061
160	395	395	3	0.6	Very Dense	>400	784	>110	5061
165	398	398	3	0.6	Very Dense	>400	784	>110	5061

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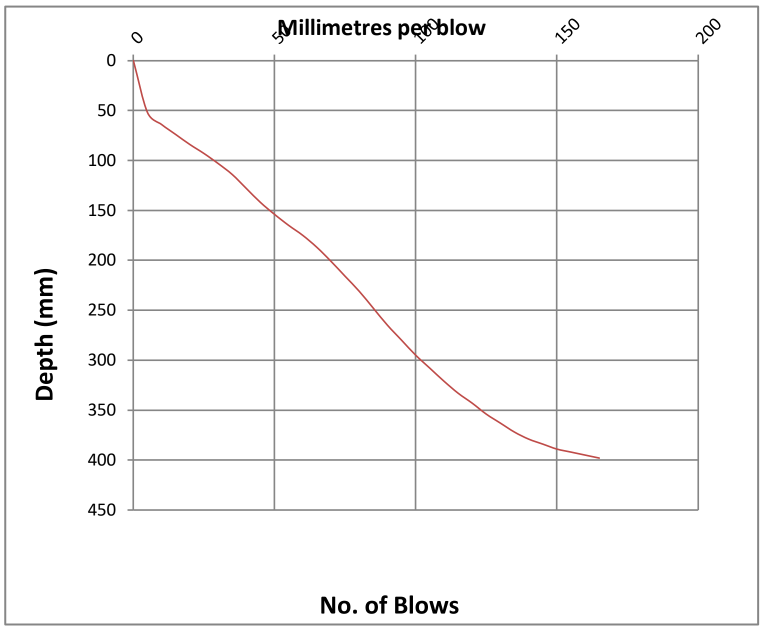
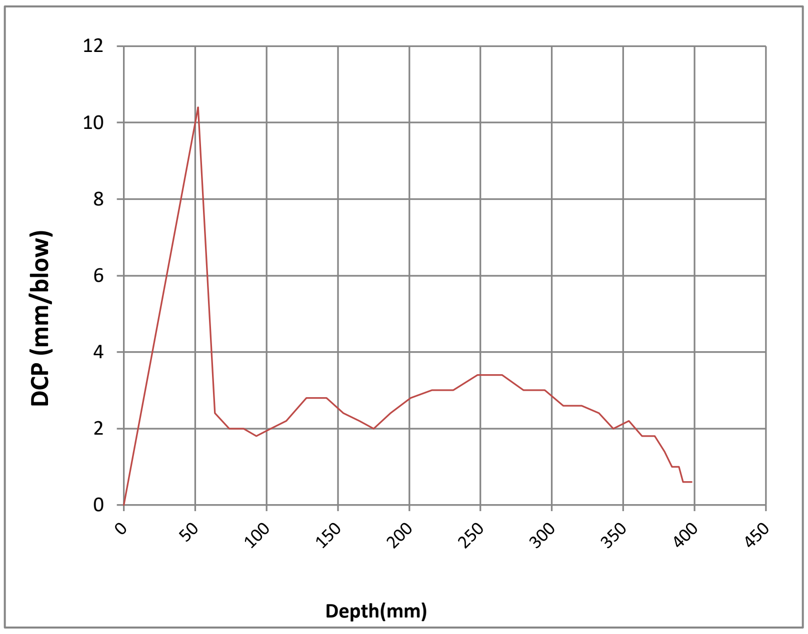
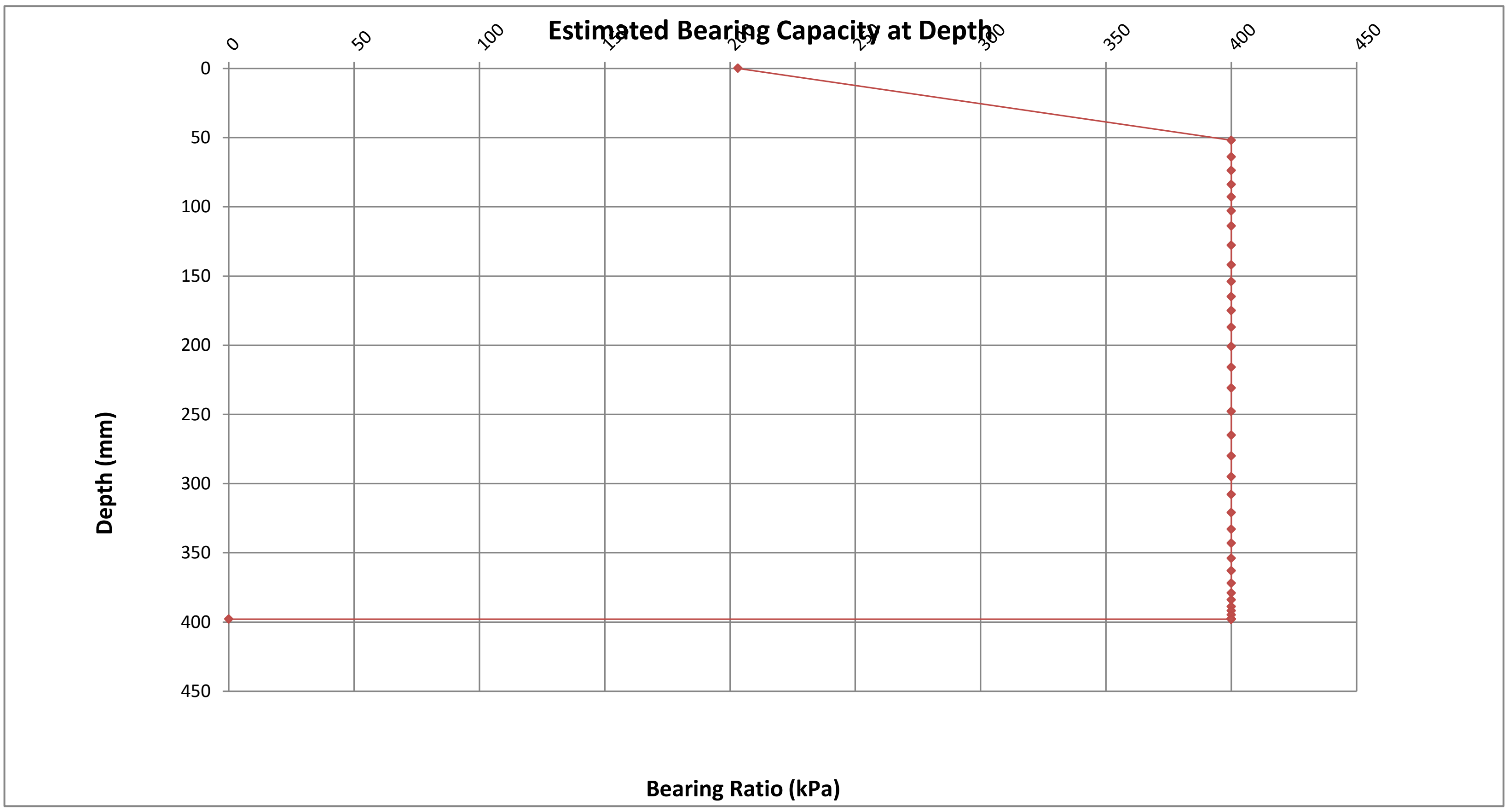
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV			Tel:	0
	Unit 10, Midway Industrial Park			Fax:	0
	Centurian				
	0157			**1 BLO/ISC32 - 1B**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC32 - 2A
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 190mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	65	65	65	13.0	Medium Dense	173	16	16	177
10	85	85	20	4.0	Very Dense	400	70	77	640
15	110	110	25	5.0	Very Dense	347	53	57	502
20	130	130	20	4.0	Very Dense	400	70	77	640
25	149	149	19	3.8	Very Dense	>400	75	83	677
30	165	165	16	3.2	Very Dense	>400	94	104	816
35	174	174	9	1.8	Very Dense	>400	194	>110	1528
40	185	185	11	2.2	Very Dense	>400	151	>110	1228
45	190	190	5	1.0	Very Dense	>400	410	>110	2900

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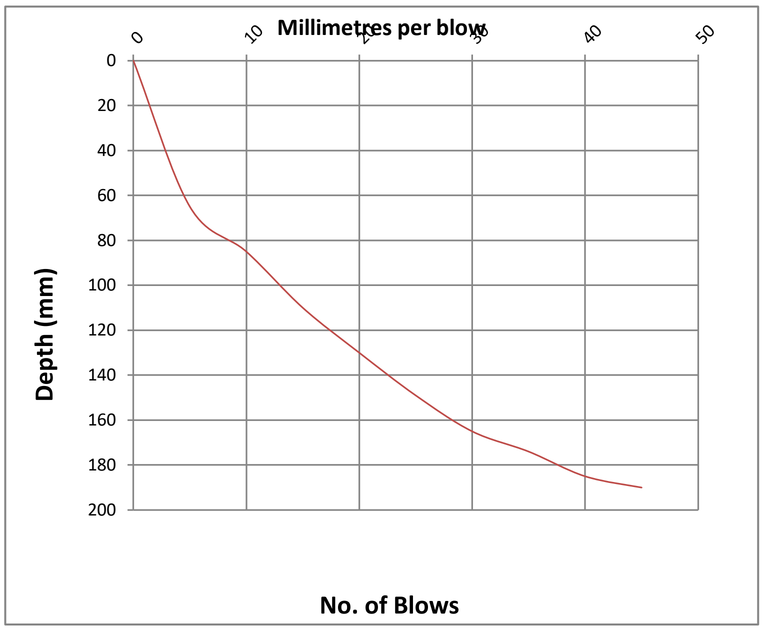
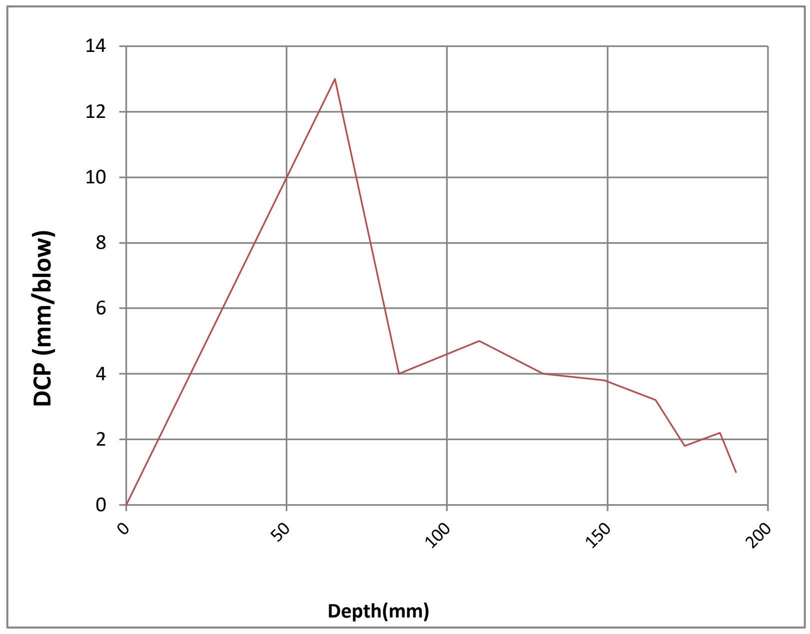
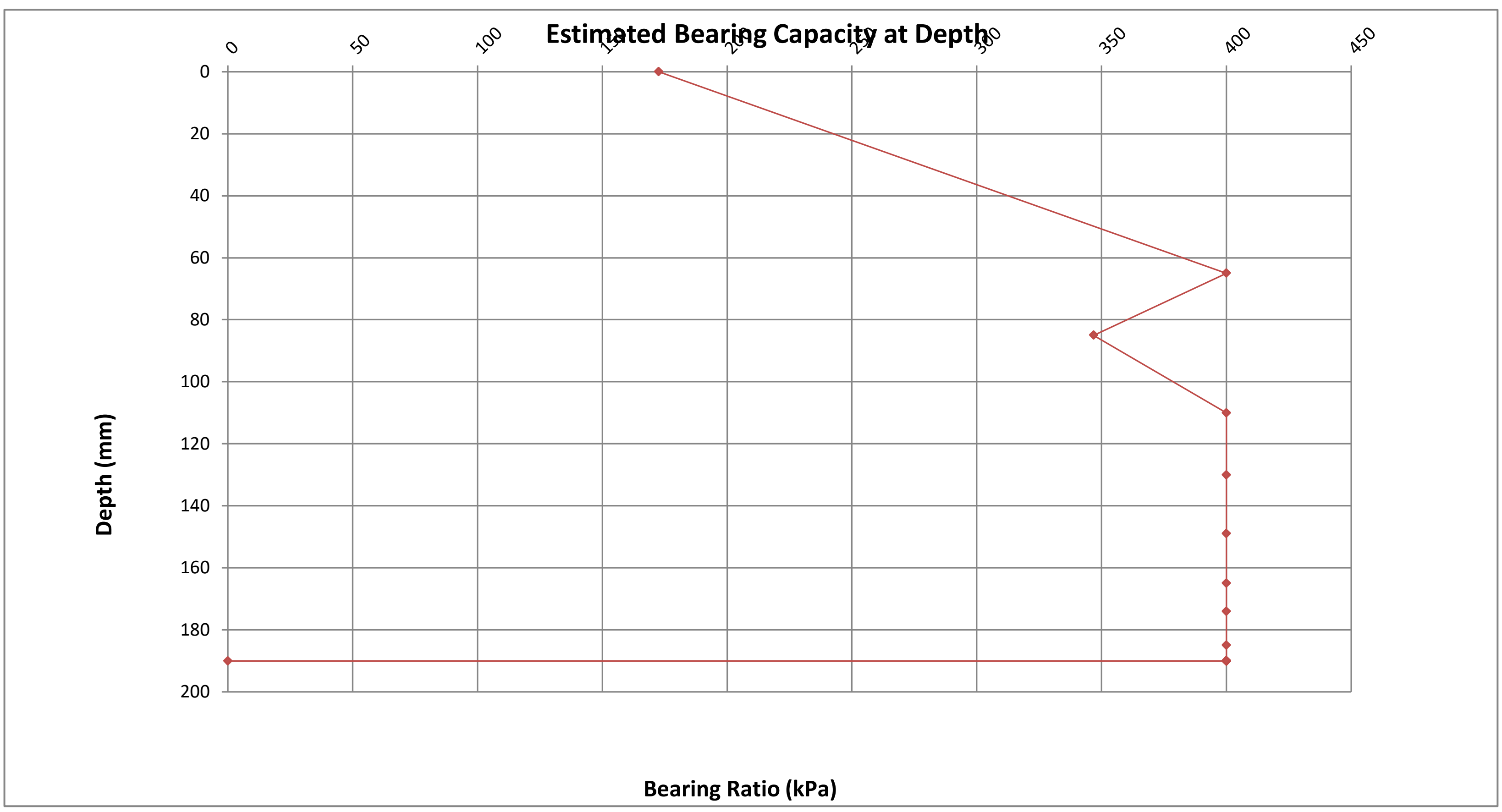
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV			Tel:	0
	Unit 10, Midway Industrial Park			Fax:	0
	Centurian				
	0157			**1 BLO/ISC32 - 2A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
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Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC32 - 2B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 204mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x\,(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x\,(dn)^{-1.09}$
0	0	0	0	0					
5	44	44	44	8.8	Dense	230	26	27	271
10	56	56	12	2.4	Very Dense	>400	135	>110	1117
15	68	68	12	2.4	Very Dense	>400	135	>110	1117
20	82	82	14	2.8	Very Dense	>400	111	>110	944
25	99	99	17	3.4	Very Dense	>400	87	96	764
30	116	116	17	3.4	Very Dense	>400	87	96	764
35	131	131	15	3.0	Very Dense	>400	102	110	876
40	144	144	13	2.6	Very Dense	>400	122	>110	1023
45	155	155	11	2.2	Very Dense	>400	151	>110	1228
50	165	165	10	2.0	Very Dense	>400	170	>110	1362
55	175	175	10	2.0	Very Dense	>400	170	>110	1362
60	178	178	3	0.6	Very Dense	>400	784	>110	5061
65	183	183	5	1.0	Very Dense	>400	410	>110	2900
70	187	187	4	0.8	Very Dense	>400	544	>110	3699
75	190	190	3	0.6	Very Dense	>400	784	>110	5061
80	193	193	3	0.6	Very Dense	>400	784	>110	5061
85	195	195	2	0.4	Very Dense	>400	1313	>110	7873
90	198	198	3	0.6	Very Dense	>400	784	>110	5061
95	200	200	2	0.4	Very Dense	>400	1313	>110	7873
100	204	204	4	0.8	Very Dense	>400	544	>110	3699

Compiled By: M.Steyn Approved By: J.Steyn

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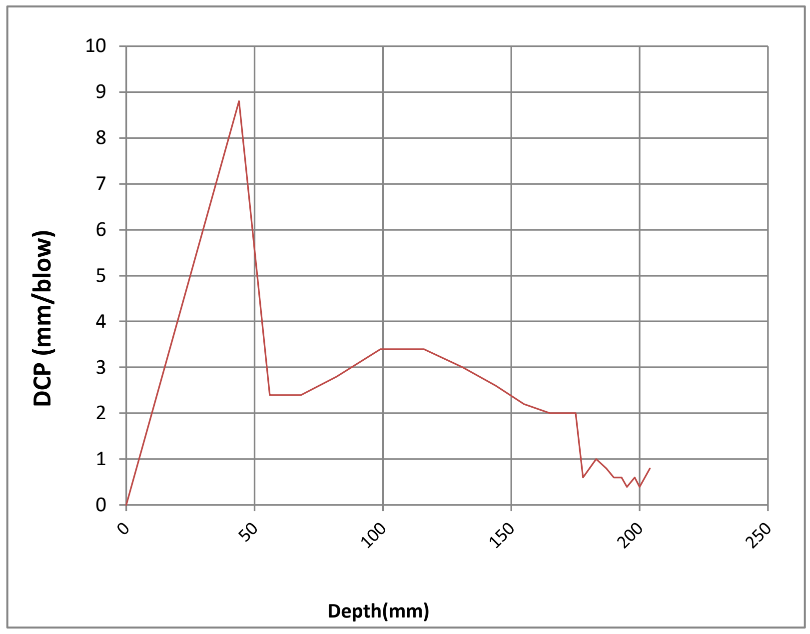
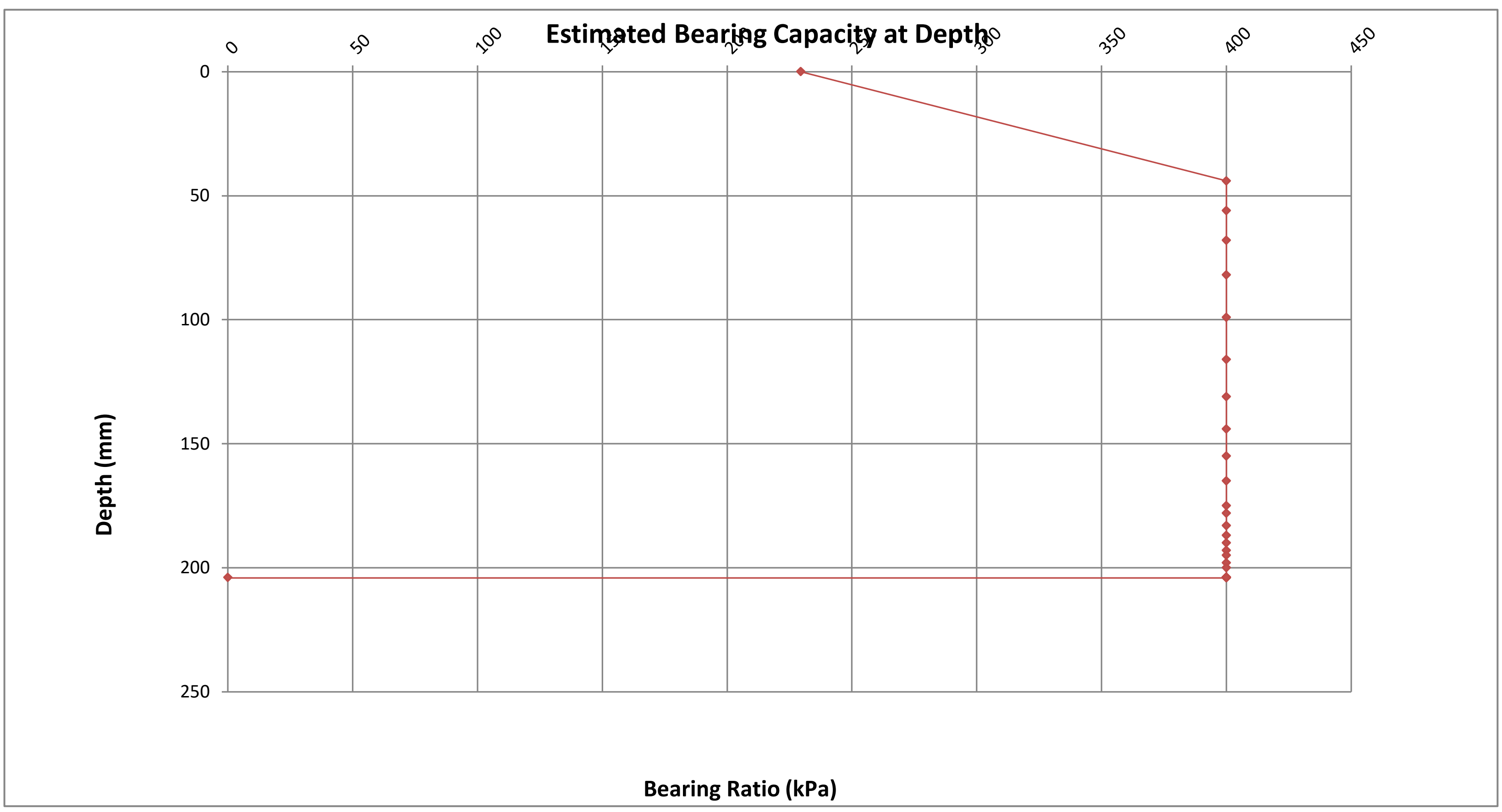
Client	KHATO CIVILS THENGA HOLDINGS JV	Tel:	0		
	Unit 10, Midway Industrial Park	Fax:	0		
	Centurian				
	0157		1 BLO/ISC32 - 2B		
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	Tippler - Saldanha	**MATERIALS TECHNICIAN:**	Mike
TEST POSITION:	**1 BLO/ISC32 - 3A**	**ASSISTANT**	Thabang
TEST DEPTH:	DCP 1 m (This is a standard accreditated Method)	**STARTING DEPTH:**	0mm
MATERIAL TYPE:	Sandy Materials	**INSTRUMENT (DCP) SET No:**	28596
CONSTRUCTION TYPE:	Road Construction	**Max. penetration depth:**	1000 mm
Enviromental Conditions	23'C	**LEVEL:**	@ NGL
REFUSAL:	277mm	**FOUNDATION:**	@ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	110	110	110	22.0	Medium Dense	118	8	8	100
10	155	155	45	9.0	Dense	226	25	26	264
15	196	196	41	8.2	Dense	242	28	30	293
20	226	226	30	6.0	Dense	304	42	45	411
25	248	248	22	4.4	Very Dense	381	62	68	577
30	250	250	2	0.4	Very Dense	>400	1313	>110	7873
35	270	270	20	4.0	Very Dense	400	70	77	640
40	277	277	7	1.4	Very Dense	>400	267	>110	2010

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JOB No:	**N/A**	**Ref. No:**	**N/A**		**Date:**	**07-02-2020**
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	Unit 10, Midway Industrial Park			Fax:	0	
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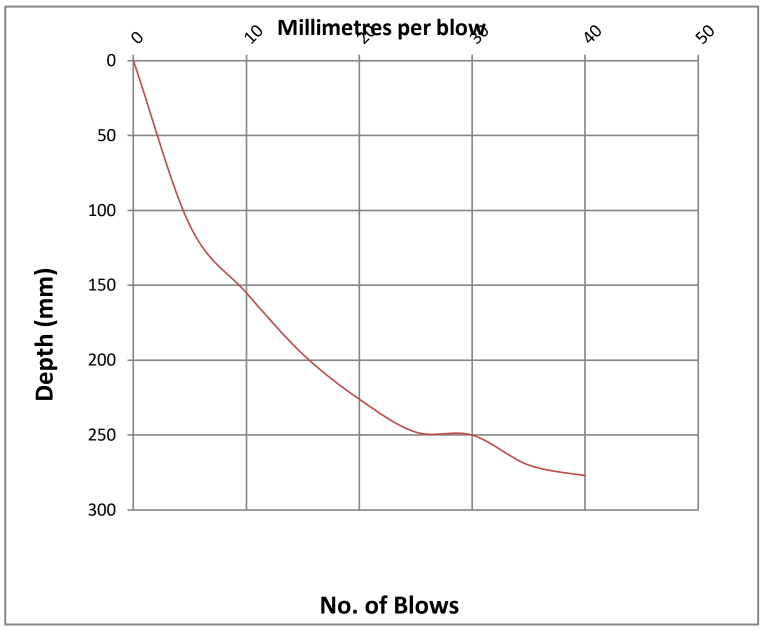
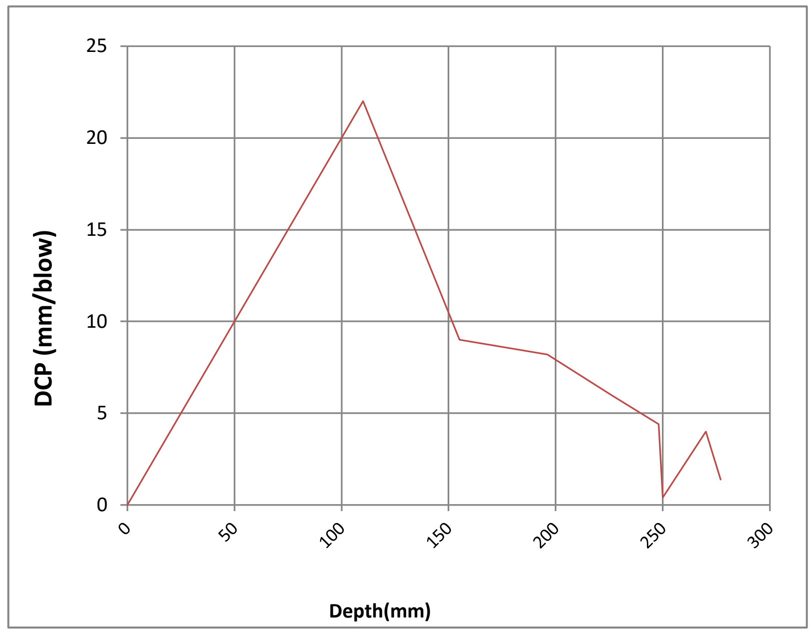
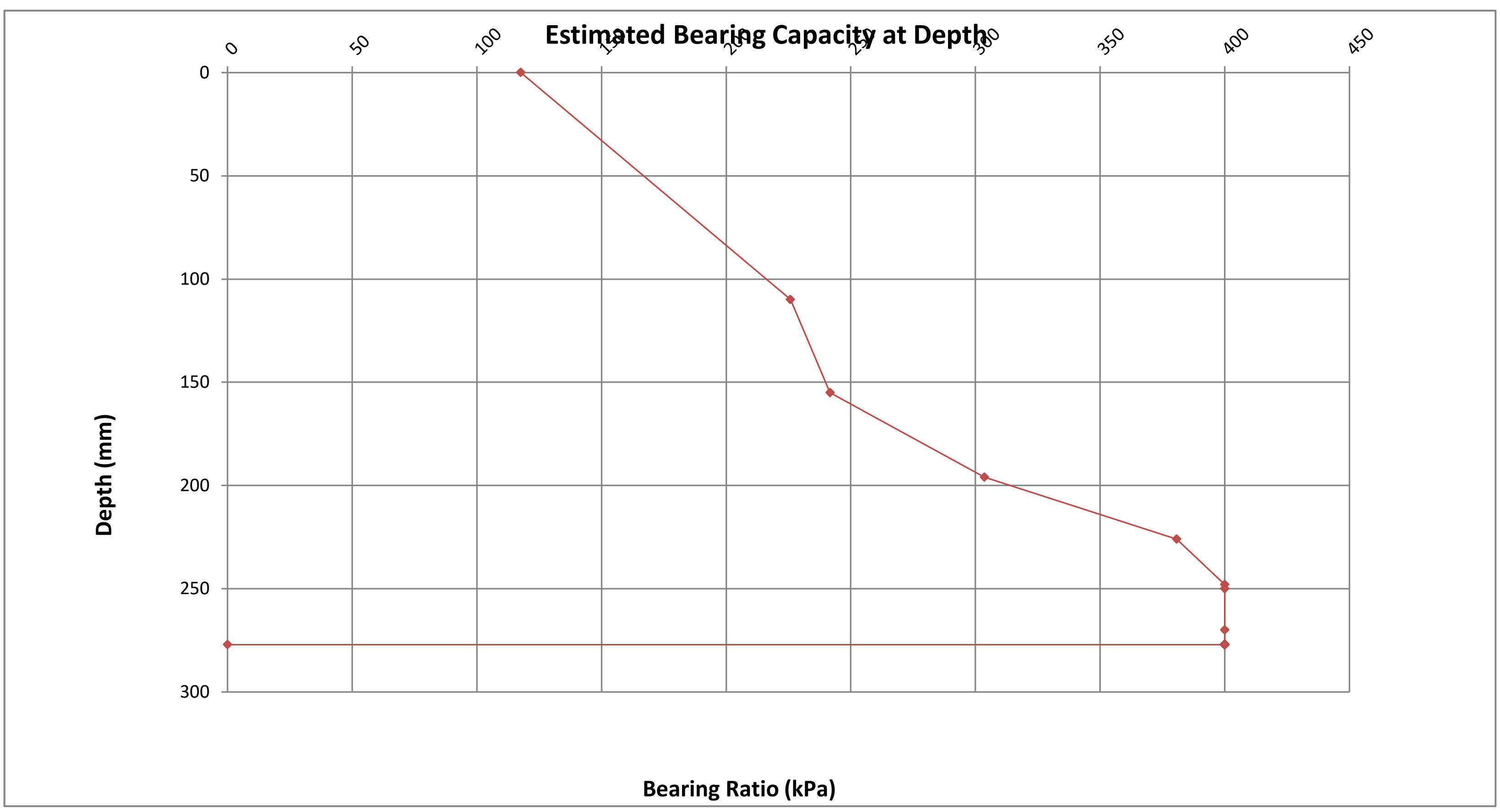
	0157				**1 BLO/ISC32 - 3A**	
Attention:	Mr Sandile Kunene					

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: **1 BLO/ISC32 - 3B**
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 318mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	104	104	104	20.8	Medium Dense	123	9	8	106
10	147	147	43	8.6	Dense	233	27	28	278
15	178	178	31	6.2	Dense	296	40	43	397
20	207	207	29	5.8	Dense	311	44	47	427
25	231	231	24	4.8	Very Dense	357	56	61	525
30	253	253	22	4.4	Very Dense	381	62	68	577
35	271	271	18	3.6	Very Dense	>400	81	89	718
40	288	288	17	3.4	Very Dense	>400	87	96	764
45	298	298	10	2.0	Very Dense	>400	170	>110	1362
50	307	307	9	1.8	Very Dense	>400	194	>110	1528
55	313	313	6	1.2	Very Dense	>400	325	>110	2377
60	316	316	3	0.6	Very Dense	>400	784	>110	5061
65	318	318	2	0.4	Very Dense	>400	1313	>110	7873

Compiled By: M.Steyn Approved By: J.Steyn

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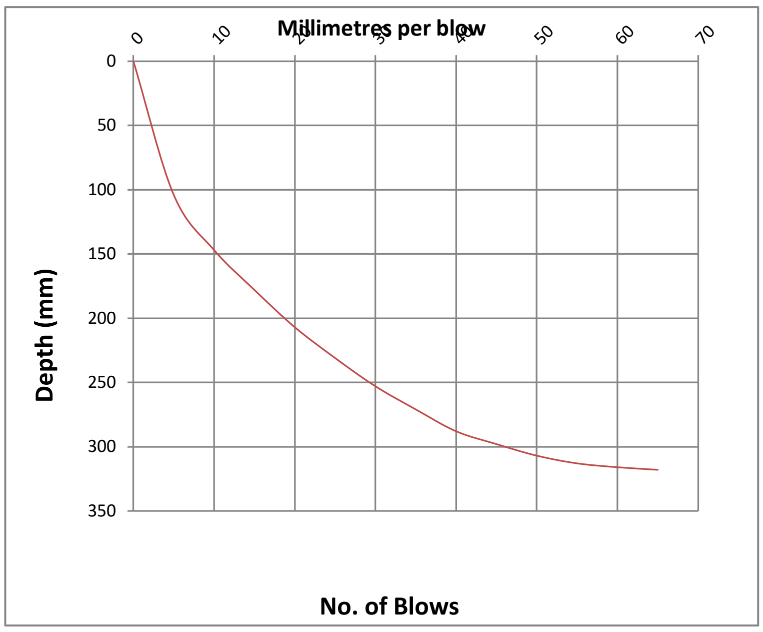
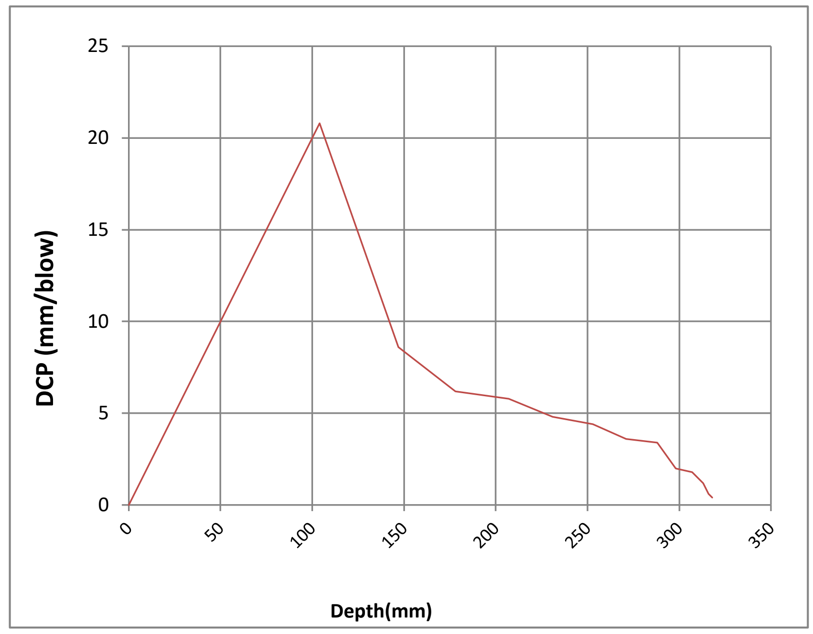
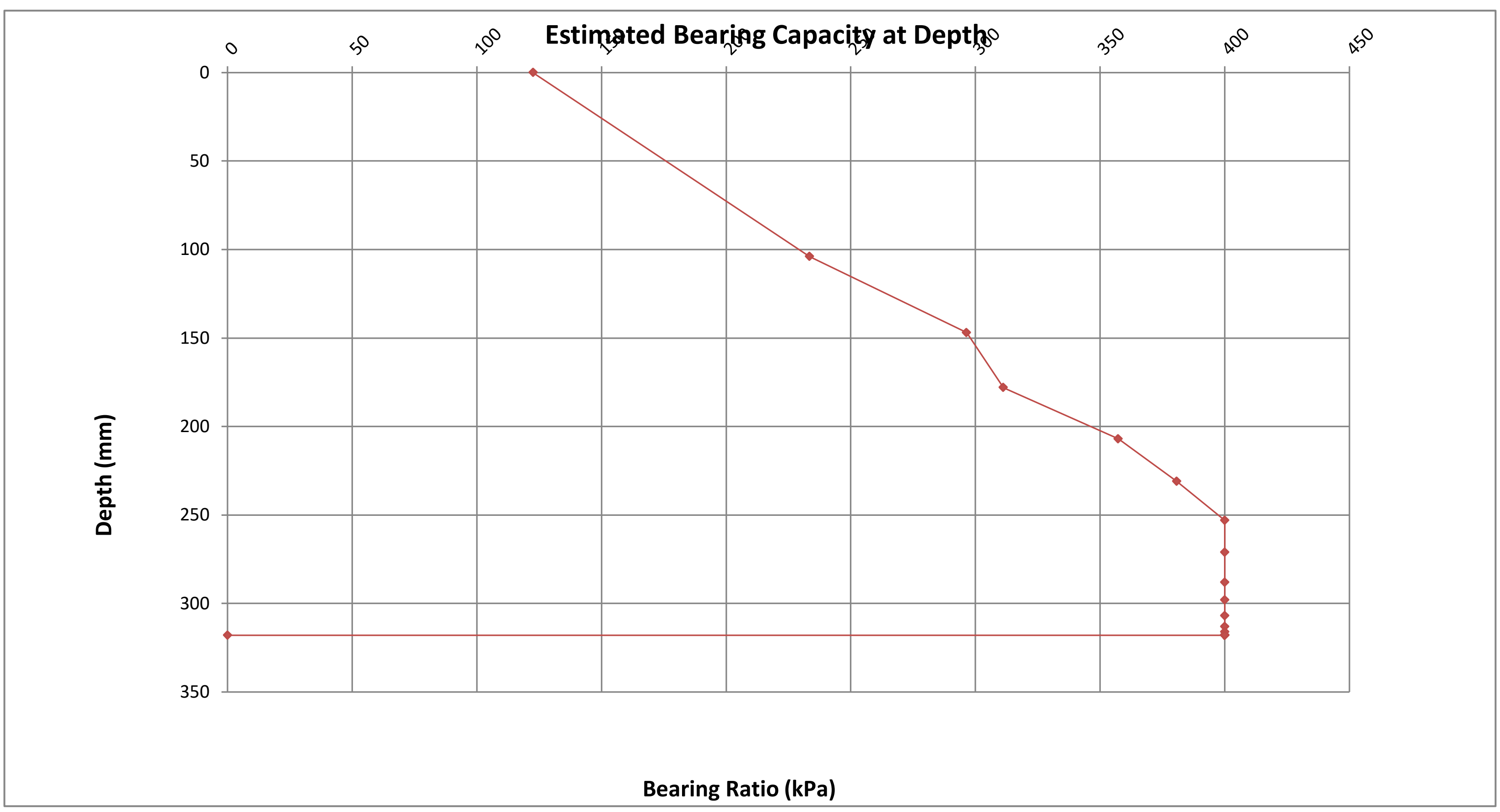
JOB No:	**N/A**	**Ref. No:**	**N/A**		**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV			Tel:	0	
	Unit 10, Midway Industrial Park			Fax:	0	
	Centurian					
	0157				**1 BLO/ISC32 - 3B**	
Attention:	Mr Sandile Kunene					

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

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0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC32 - 4A
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 267mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	35	35	35	7.0	Dense	271	35	37	348
10	54	54	19	3.8	Very Dense	>400	75	83	677
15	74	74	20	4.0	Very Dense	400	70	77	640
20	84	84	10	2.0	Very Dense	>400	170	>110	1362
25	99	99	15	3.0	Very Dense	>400	102	110	876
30	110	110	11	2.2	Very Dense	>400	151	>110	1228
35	125	125	15	3.0	Very Dense	>400	102	110	876
40	135	135	10	2.0	Very Dense	>400	170	>110	1362
45	150	150	15	3.0	Very Dense	>400	102	110	876
50	161	161	11	2.2	Very Dense	>400	151	>110	1228
55	174	174	13	2.6	Very Dense	>400	122	>110	1023
60	186	186	12	2.4	Very Dense	>400	135	>110	1117
65	199	199	13	2.6	Very Dense	>400	122	>110	1023
70	207	207	8	1.6	Very Dense	>400	226	>110	1737
75	215	215	8	1.6	Very Dense	>400	226	>110	1737
80	224	224	9	1.8	Very Dense	>400	194	>110	1528
85	227	227	3	0.6	Very Dense	>400	784	>110	5061
90	237	237	10	2.0	Very Dense	>400	170	>110	1362
95	245	245	8	1.6	Very Dense	>400	226	>110	1737
100	250	250	5	1.0	Very Dense	>400	410	>110	2900
105	267	267	17	3.4	Very Dense	>400	87	96	764

Compiled By: M.Steyn Approved By: J.Steyn

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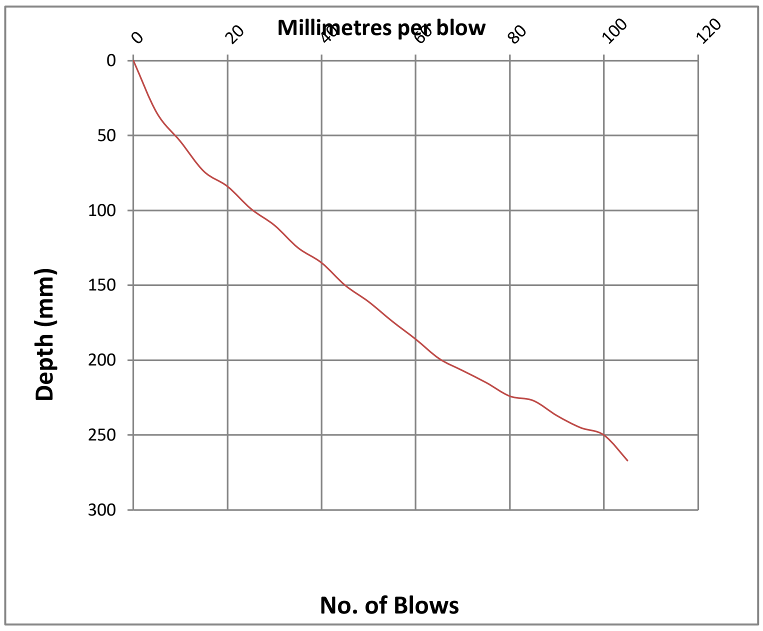
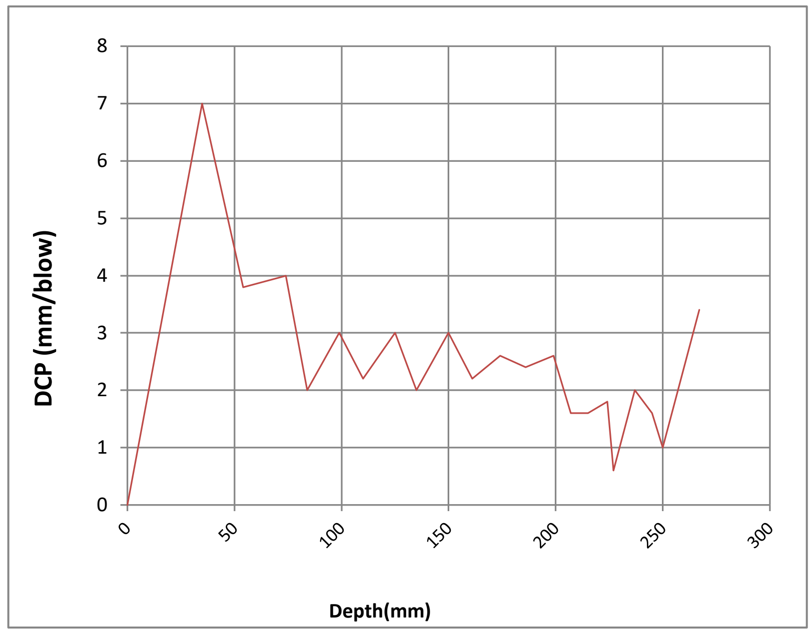
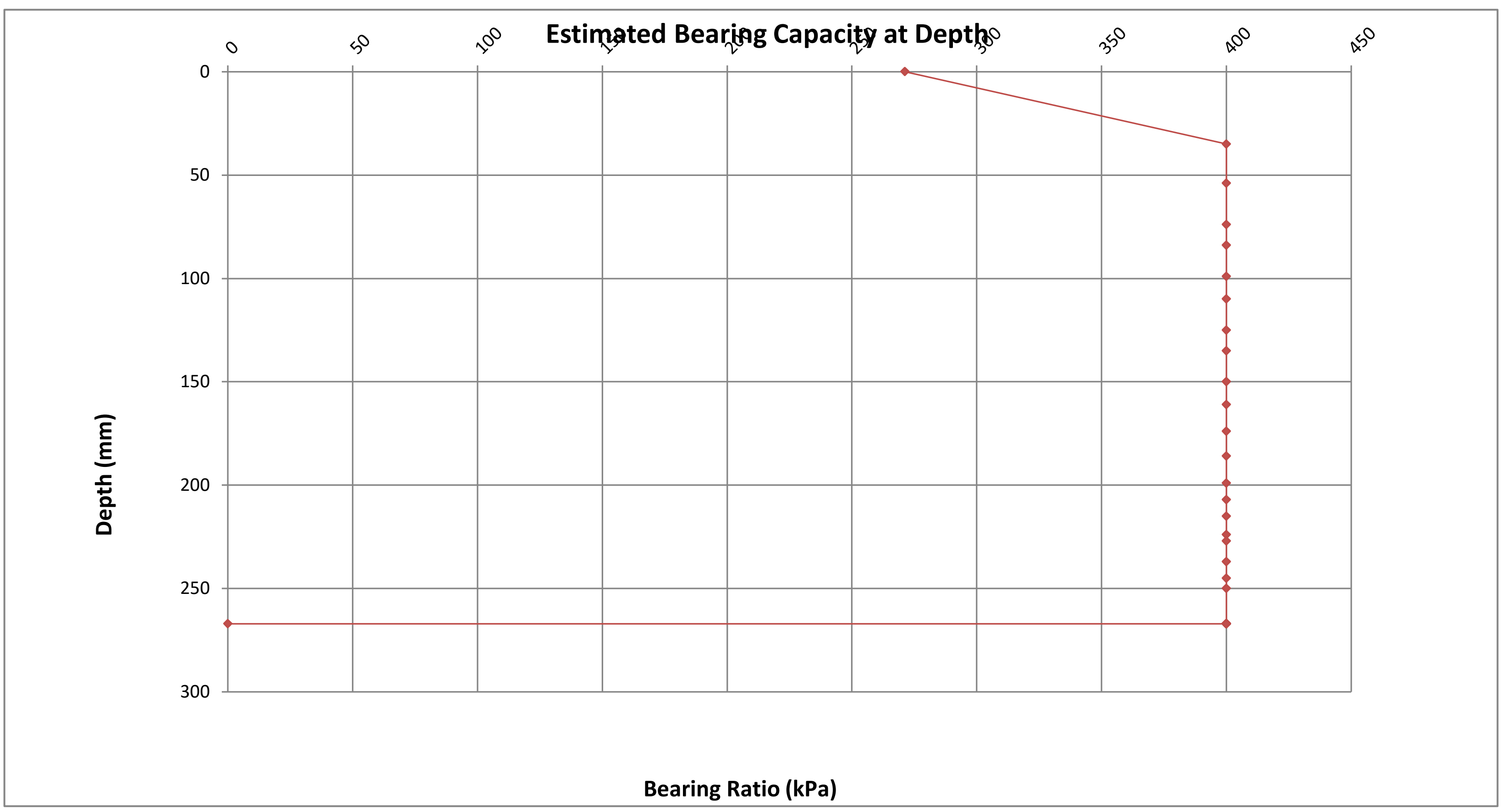
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**1 BLO/ISC32 - 4A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC32 - 4B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 288mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	46	46	46	9.2	Dense	222	24	25	258
10	84	84	38	7.6	Dense	255	31	33	318
15	103	103	19	3.8	Very Dense	>400	75	83	677
20	123	123	20	4.0	Very Dense	400	70	77	640
25	138	138	15	3.0	Very Dense	>400	102	110	876
30	152	152	14	2.8	Very Dense	>400	111	>110	944
35	165	165	13	2.6	Very Dense	>400	122	>110	1023
40	178	178	13	2.6	Very Dense	>400	122	>110	1023
45	192	192	14	2.8	Very Dense	>400	111	>110	944
50	203	203	11	2.2	Very Dense	>400	151	>110	1228
55	214	214	11	2.2	Very Dense	>400	151	>110	1228
60	224	224	10	2.0	Very Dense	>400	170	>110	1362
65	236	236	12	2.4	Very Dense	>400	135	>110	1117
70	248	248	12	2.4	Very Dense	>400	135	>110	1117
75	257	257	9	1.8	Very Dense	>400	194	>110	1528
80	263	263	6	1.2	Very Dense	>400	325	>110	2377
85	269	269	6	1.2	Very Dense	>400	325	>110	2377
90	273	273	4	0.8	Very Dense	>400	544	>110	3699
95	276	276	3	0.6	Very Dense	>400	784	>110	5061
100	279	279	3	0.6	Very Dense	>400	784	>110	5061
105	281	281	2	0.4	Very Dense	>400	1313	>110	7873
110	284	284	3	0.6	Very Dense	>400	784	>110	5061
115	288	288	4	0.8	Very Dense	>400	544	>110	3699

Compiled By: M.Steyn Approved By: J.Steyn

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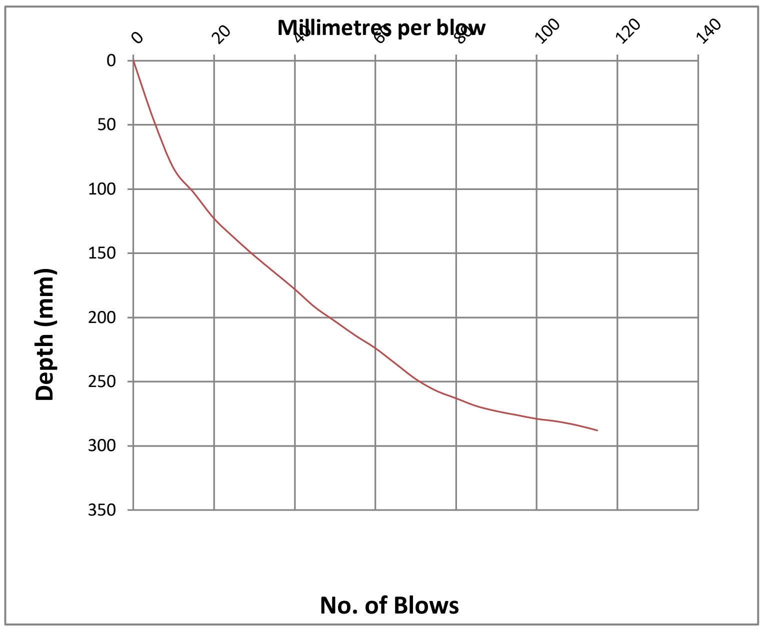
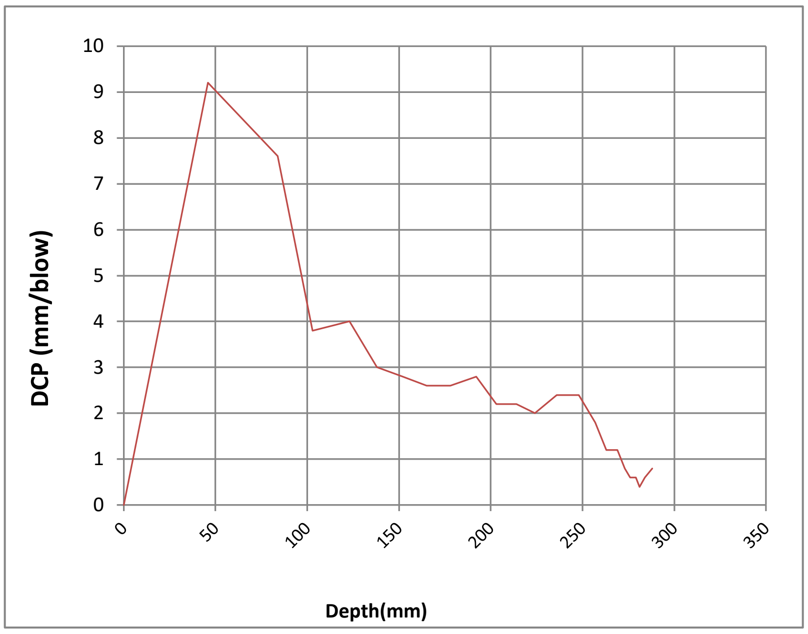
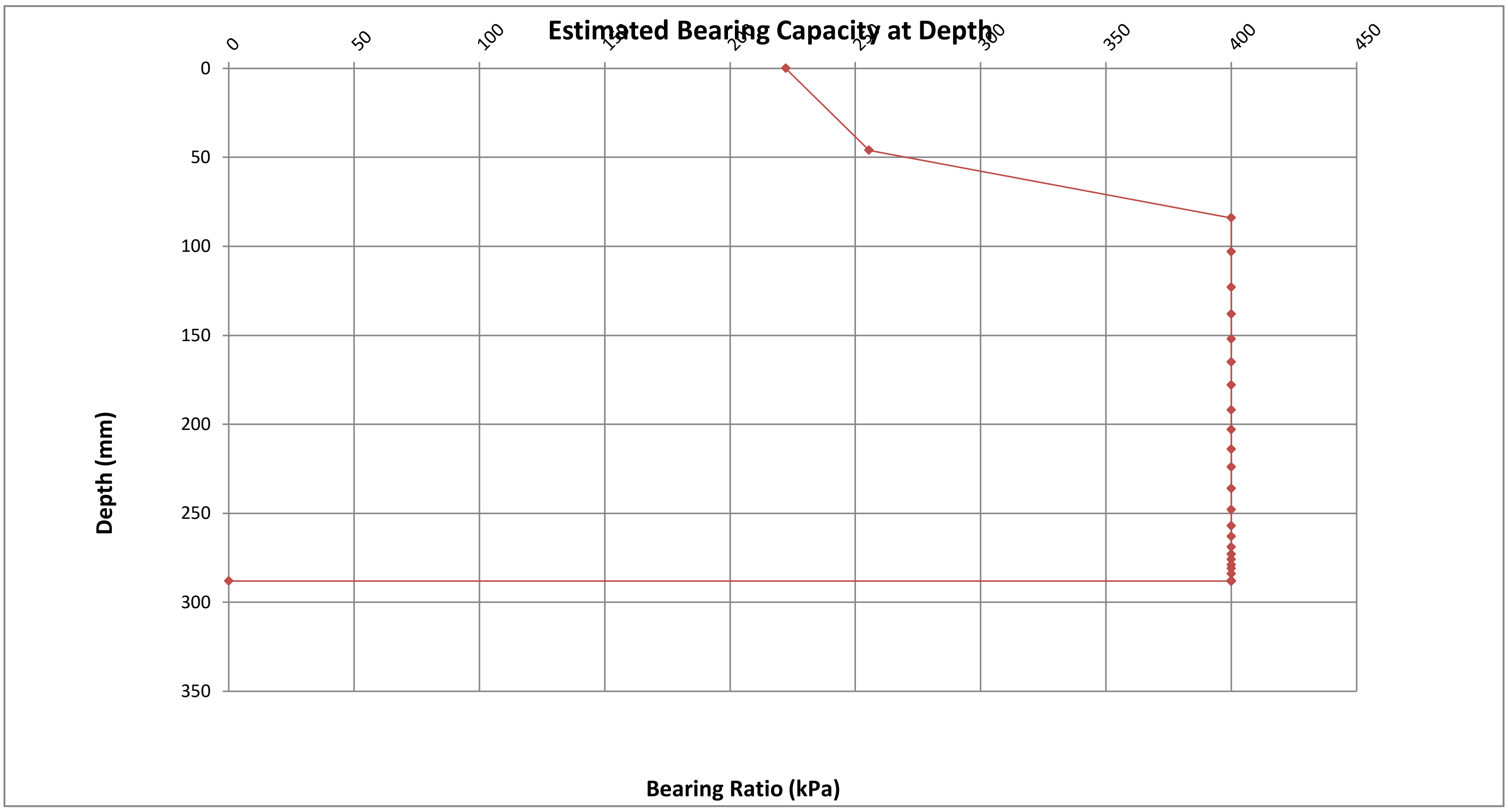
Client	KHATO CIVILS THENGA HOLDINGS JV	Tel:	0		
	Unit 10, Midway Industrial Park	Fax:	0		
	Centurian				
	0157		**1 BLO/ISC32 - 4B**		
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC32 - 5A
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 100mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	40	40	40	8.0	Dense	246	29	31	301
10	48	48	8	1.6	Very Dense	>400	226	>110	1737
15	56	56	8	1.6	Very Dense	>400	226	>110	1737
20	65	65	9	1.8	Very Dense	>400	194	>110	1528
25	75	75	10	2.0	Very Dense	>400	170	>110	1362
30	79	79	4	0.8	Very Dense	>400	544	>110	3699
35	89	89	10	2.0	Very Dense	>400	170	>110	1362
40	94	94	5	1.0	Very Dense	>400	410	>110	2900
45	100	100	6	1.2	Very Dense	>400	325	>110	2377

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JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
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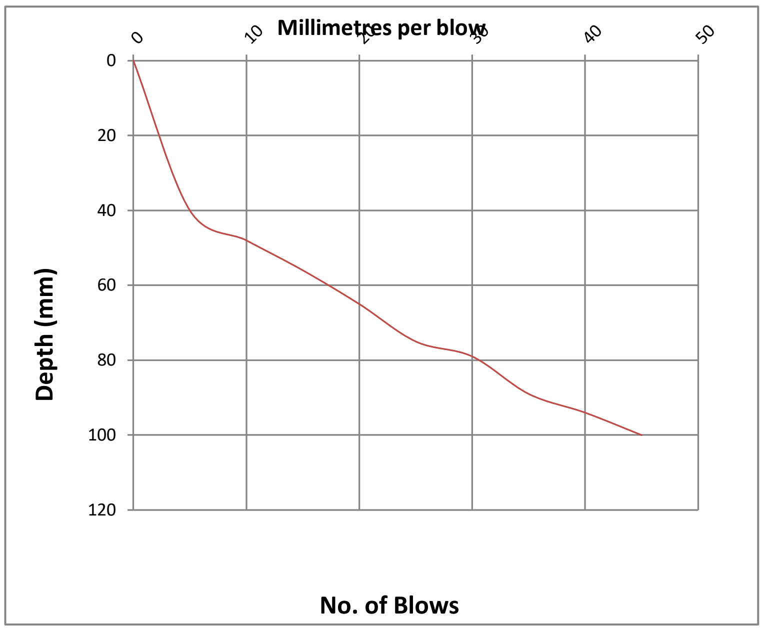
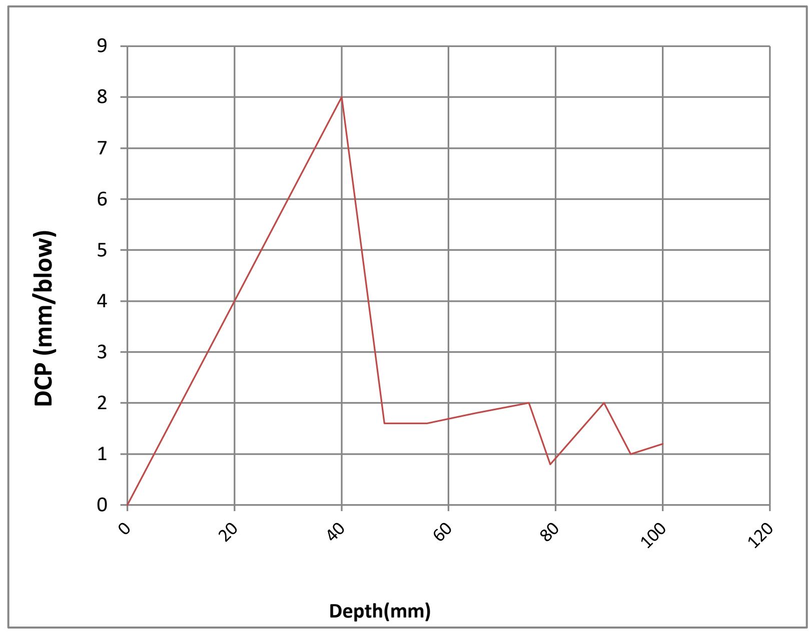
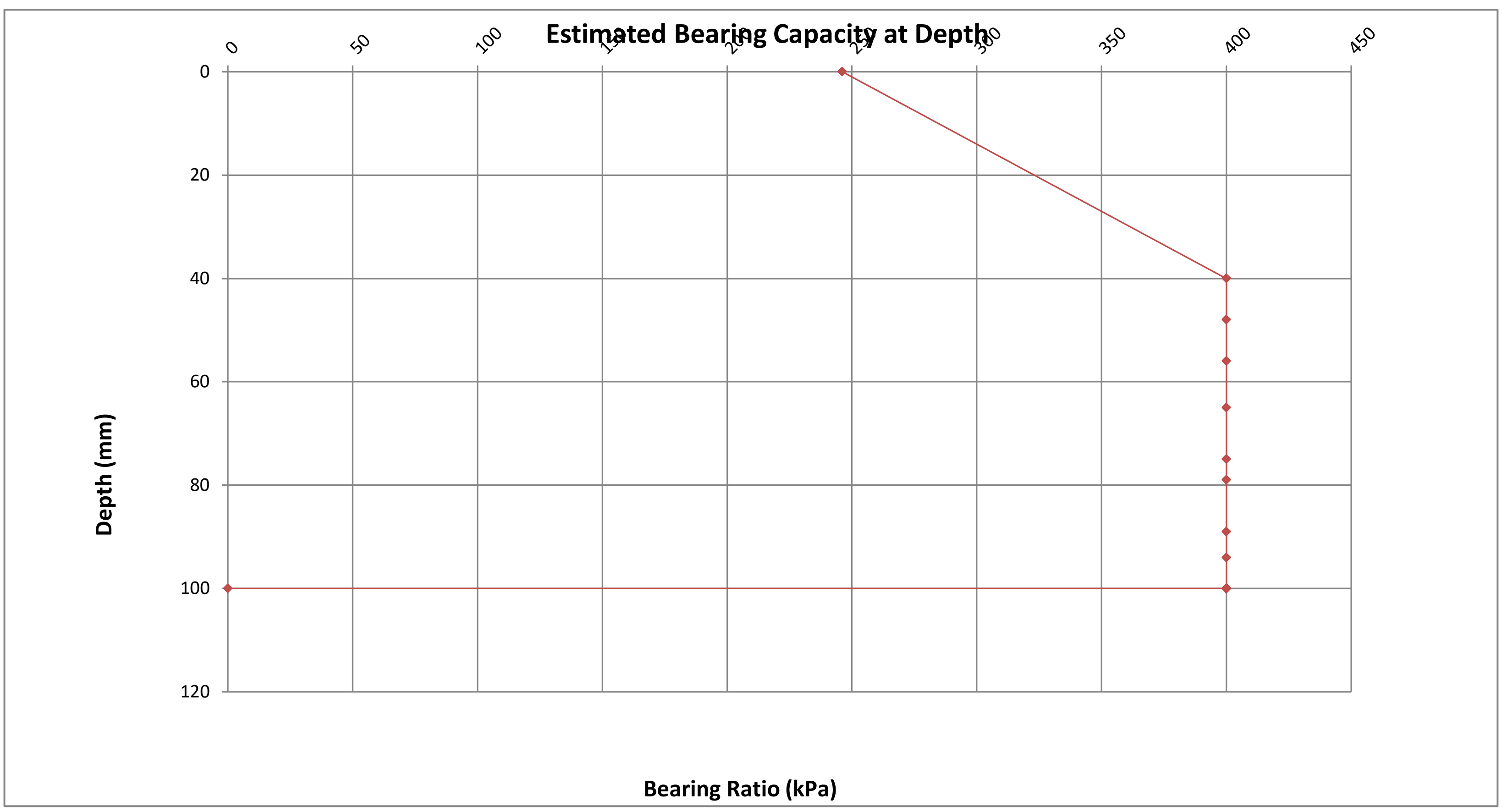
	Centurian				
	0157			**1 BLO/ISC32 - 5A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

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Lab Manager

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
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0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC32 - 5B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 112mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	37	37	37	7.4	Dense	261	32	34	327
10	46	46	9	1.8	Very Dense	>400	194	>110	1528
15	52	52	6	1.2	Very Dense	>400	325	>110	2377
20	58	58	6	1.2	Very Dense	>400	325	>110	2377
25	63	63	5	1.0	Very Dense	>400	410	>110	2900
30	69	69	6	1.2	Very Dense	>400	325	>110	2377
35	74	74	5	1.0	Very Dense	>400	410	>110	2900
40	78	78	4	0.8	Very Dense	>400	544	>110	3699
45	83	83	5	1.0	Very Dense	>400	410	>110	2900
50	87	87	4	0.8	Very Dense	>400	544	>110	3699
55	91	91	4	0.8	Very Dense	>400	544	>110	3699
60	94	94	3	0.6	Very Dense	>400	784	>110	5061
65	96	96	2	0.4	Very Dense	>400	1313	>110	7873
70	99	99	3	0.6	Very Dense	>400	784	>110	5061
75	104	104	5	1.0	Very Dense	>400	410	>110	2900
80	109	109	5	1.0	Very Dense	>400	410	>110	2900
85	112	112	3	0.6	Very Dense	>400	784	>110	5061

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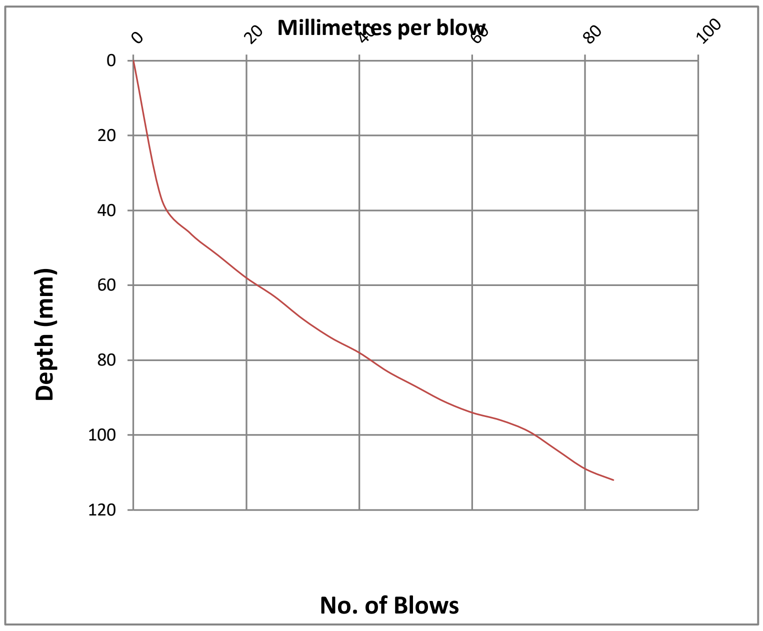
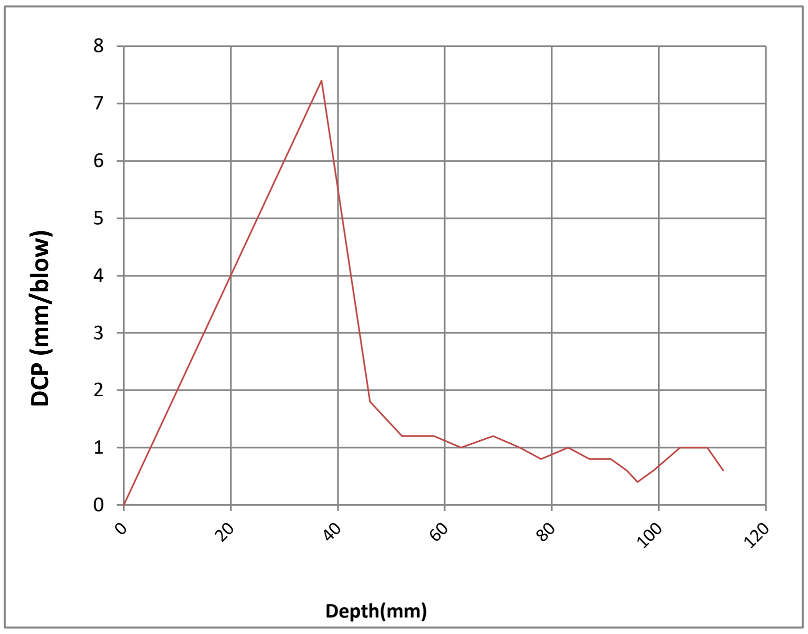
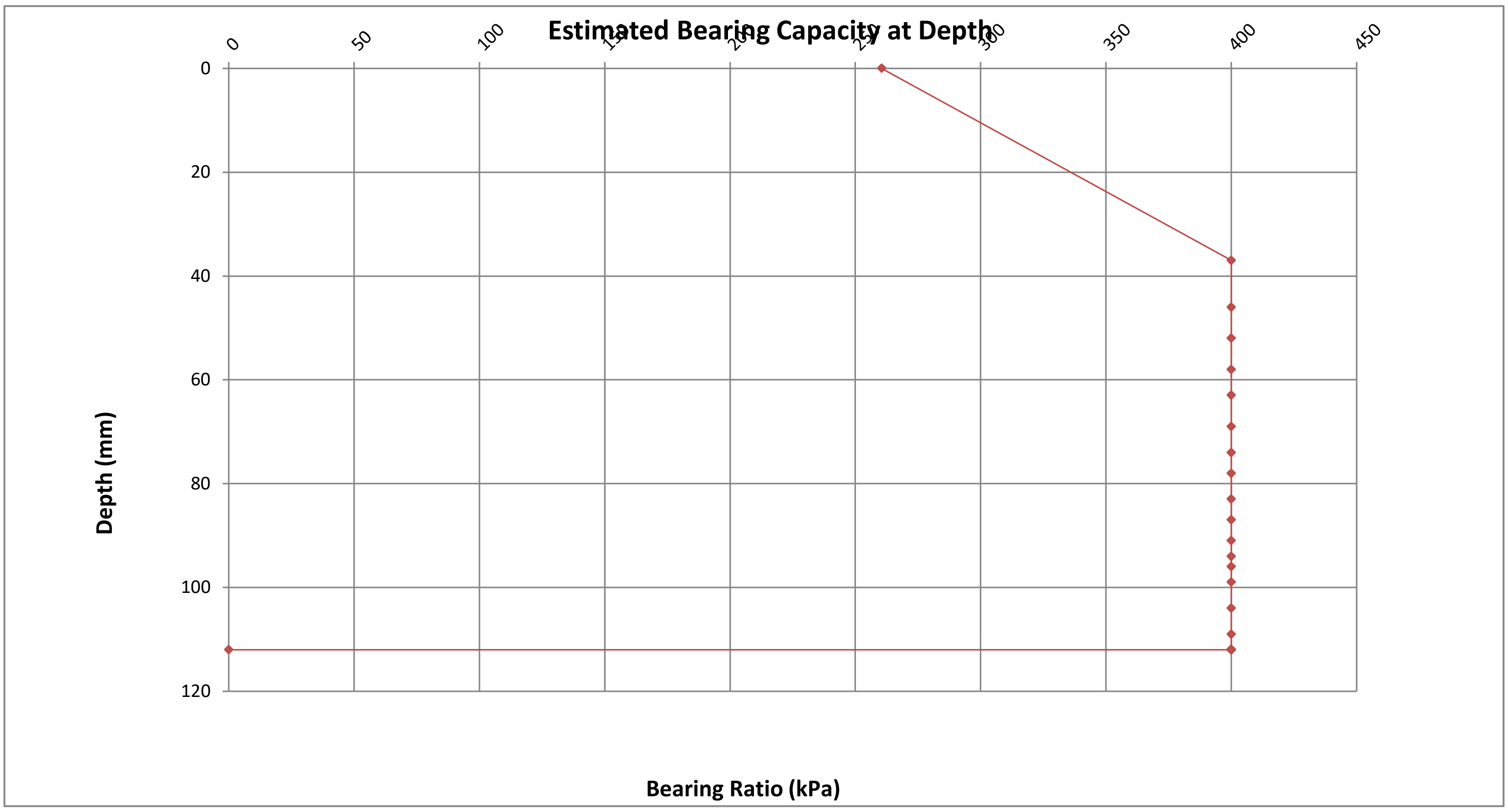
	0157		**1 BLO/ISC32 - 5B**		
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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Mr A Engel
Lab Manager

2 BLO-ISC 32

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
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Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Alfred
TEST POSITION: 2 BLO/ISC 32 - 1 RHS
ASSISTANT
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 710mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	110	110	110	22.0	Medium Dense	118	8	8	100
10	165	165	55	11.0	Dense	195	20	20	212
15	190	190	25	5.0	Very Dense	347	53	57	502
20	205	205	15	3.0	Very Dense	>400	102	110	876
25	215	215	10	2.0	Very Dense	>400	170	>110	1362
30	225	225	10	2.0	Very Dense	>400	170	>110	1362
35	235	235	10	2.0	Very Dense	>400	170	>110	1362
40	245	245	10	2.0	Very Dense	>400	170	>110	1362
45	250	250	5	1.0	Very Dense	>400	410	>110	2900
50	272	272	22	4.4	Very Dense	381	62	68	577
55	275	275	3	0.6	Very Dense	>400	784	>110	5061
60	289	289	14	2.8	Very Dense	>400	111	>110	944
65	295	295	6	1.2	Very Dense	>400	325	>110	2377
70	305	305	10	2.0	Very Dense	>400	170	>110	1362
75	310	310	5	1.0	Very Dense	>400	410	>110	2900
80	318	318	8	1.6	Very Dense	>400	226	>110	1737
85	325	325	7	1.4	Very Dense	>400	267	>110	2010
90	335	335	10	2.0	Very Dense	>400	170	>110	1362
95	344	344	9	1.8	Very Dense	>400	194	>110	1528
100	350	350	6	1.2	Very Dense	>400	325	>110	2377
105	360	360	10	2.0	Very Dense	>400	170	>110	1362
110	410	410	50	10.0	Dense	209	22	23	236
115	455	455	45	9.0	Dense	226	25	26	264
120	511	511	56	11.2	Dense	193	19	19	208
125	600	600	89	17.8	Medium Dense	137	11	10	126
130	635	635	35	7.0	Dense	271	35	37	348
135	650	650	15	3.0	Very Dense	>400	102	110	876
140	655	655	5	1.0	Very Dense	>400	410	>110	2900
145	670	670	15	3.0	Very Dense	>400	102	110	876
150	690	690	20	4.0	Very Dense	400	70	77	640
155	710	710	20	4.0	Very Dense	400	70	77	640

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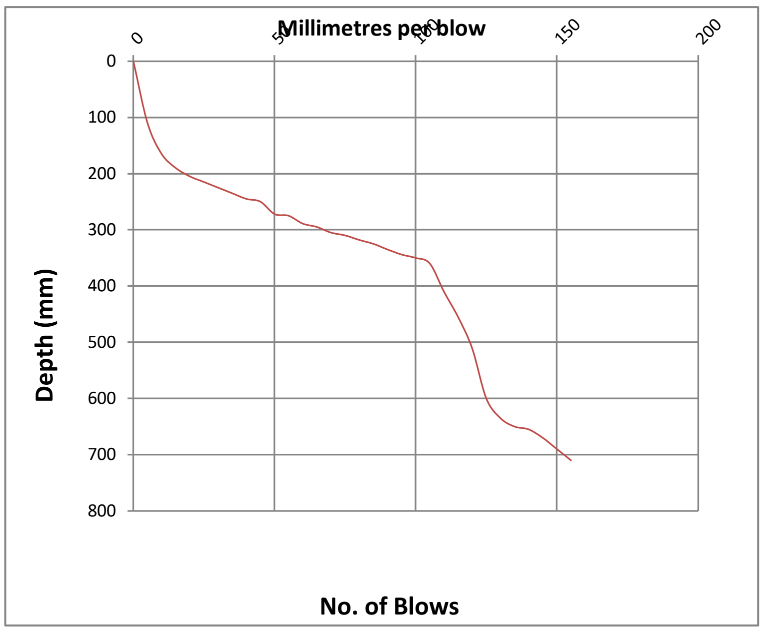
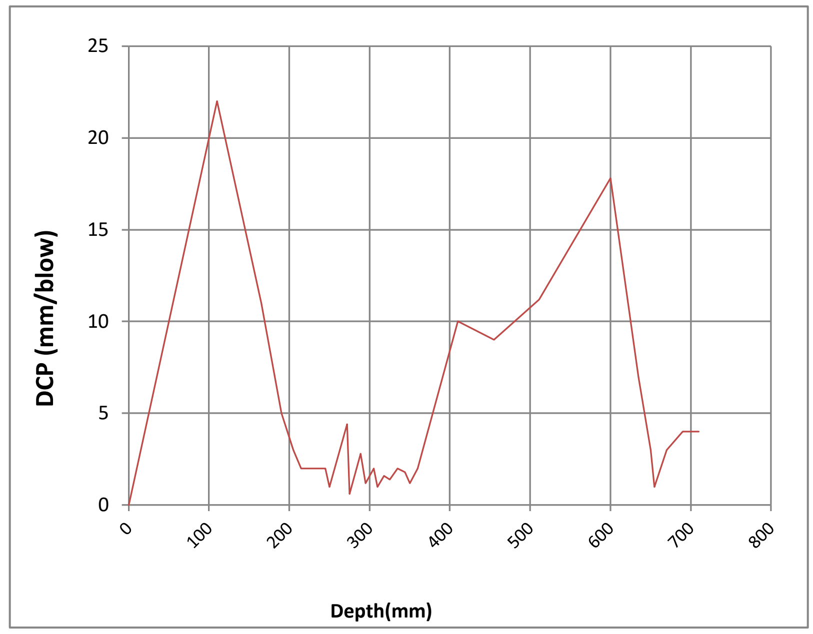
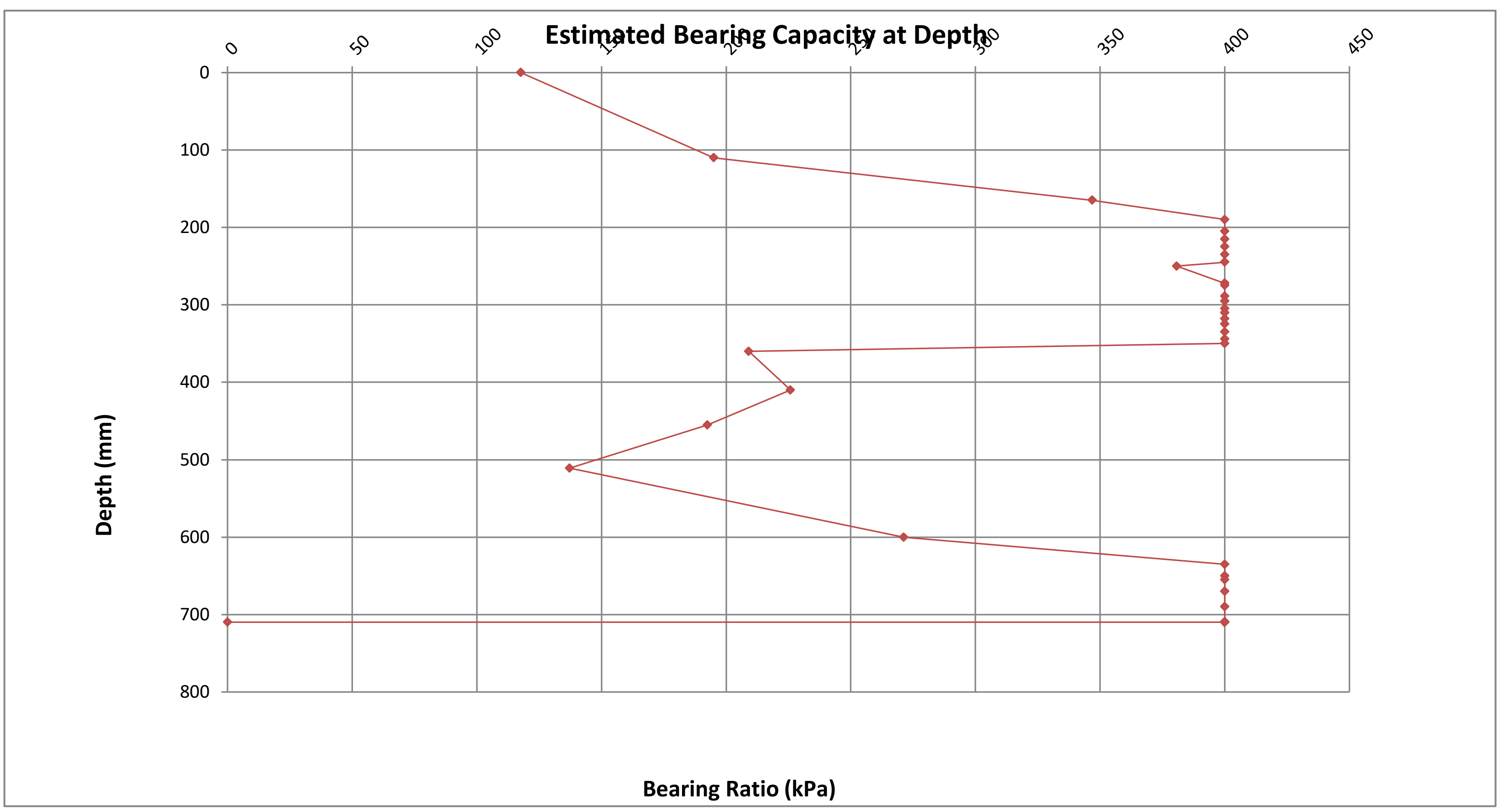
	Unit 10, Midway Industrial Park			Fax:	0
	Centurian				
	0157				**2 BLO/ISC 32 - 1 RHS**
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

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Lab Manager

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
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Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Alfred
TEST POSITION: 2 BLO/ISC 32 - 2 RHS
ASSISTANT
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 740mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	105	105	105	21.0	Medium Dense	122	9	8	105
10	140	140	35	7.0	Dense	271	35	37	348
15	160	160	20	4.0	Very Dense	400	70	77	640
20	181	181	21	4.2	Very Dense	394	66	72	607
25	205	205	24	4.8	Very Dense	357	56	61	525
30	245	245	40	8.0	Dense	246	29	31	301
35	271	271	26	5.2	Dense	337	51	54	481
40	290	290	19	3.8	Very Dense	>400	75	83	677
45	310	310	20	4.0	Very Dense	400	70	77	640
50	335	335	25	5.0	Very Dense	347	53	57	502
55	361	361	26	5.2	Dense	337	51	54	481
60	390	390	29	5.8	Dense	311	44	47	427
65	395	395	5	1.0	Very Dense	>400	410	>110	2900
70	405	405	10	2.0	Very Dense	>400	170	>110	1362
75	435	435	30	6.0	Dense	304	42	45	411
80	450	450	15	3.0	Very Dense	>400	102	110	876
85	480	480	30	6.0	Dense	304	42	45	411
90	510	510	30	6.0	Dense	304	42	45	411
95	535	535	25	5.0	Very Dense	347	53	57	502
100	589	589	54	10.8	Dense	198	20	20	217
105	603	603	14	2.8	Very Dense	>400	111	>110	944
110	610	610	7	1.4	Very Dense	>400	267	>110	2010
115	621	621	11	2.2	Very Dense	>400	151	>110	1228
120	640	640	19	3.8	Very Dense	>400	75	83	677
125	662	662	22	4.4	Very Dense	381	62	68	577
130	693	693	31	6.2	Dense	296	40	43	397
135	706	706	13	2.6	Very Dense	>400	122	>110	1023
140	723	723	17	3.4	Very Dense	>400	87	96	764
145	740	740	17	3.4	Very Dense	>400	87	96	764

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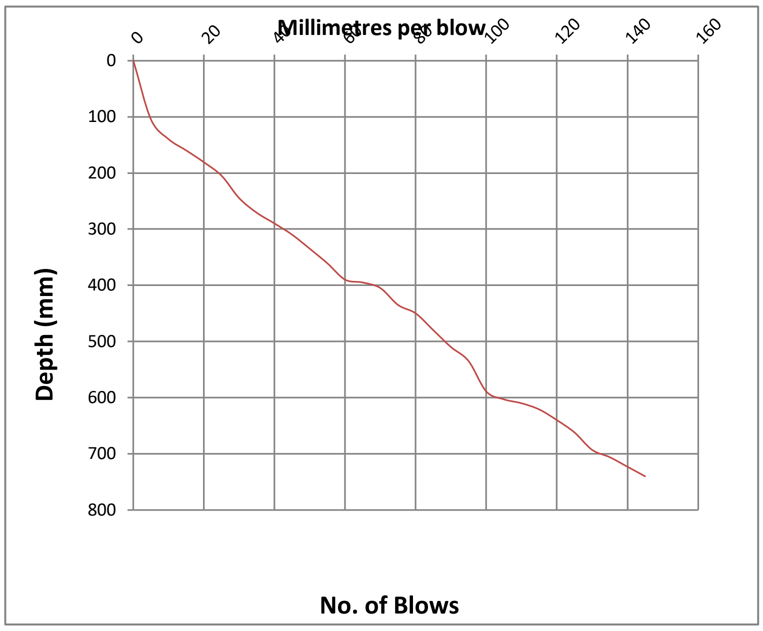
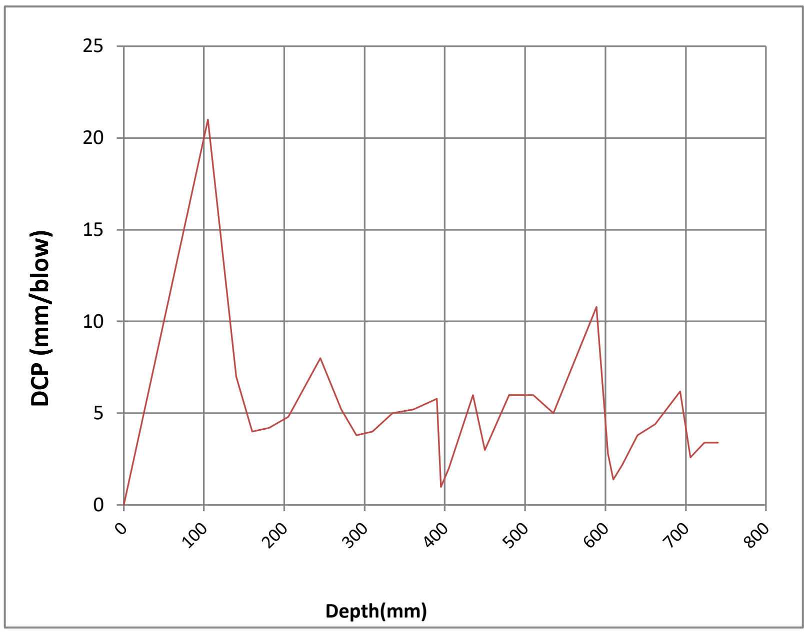
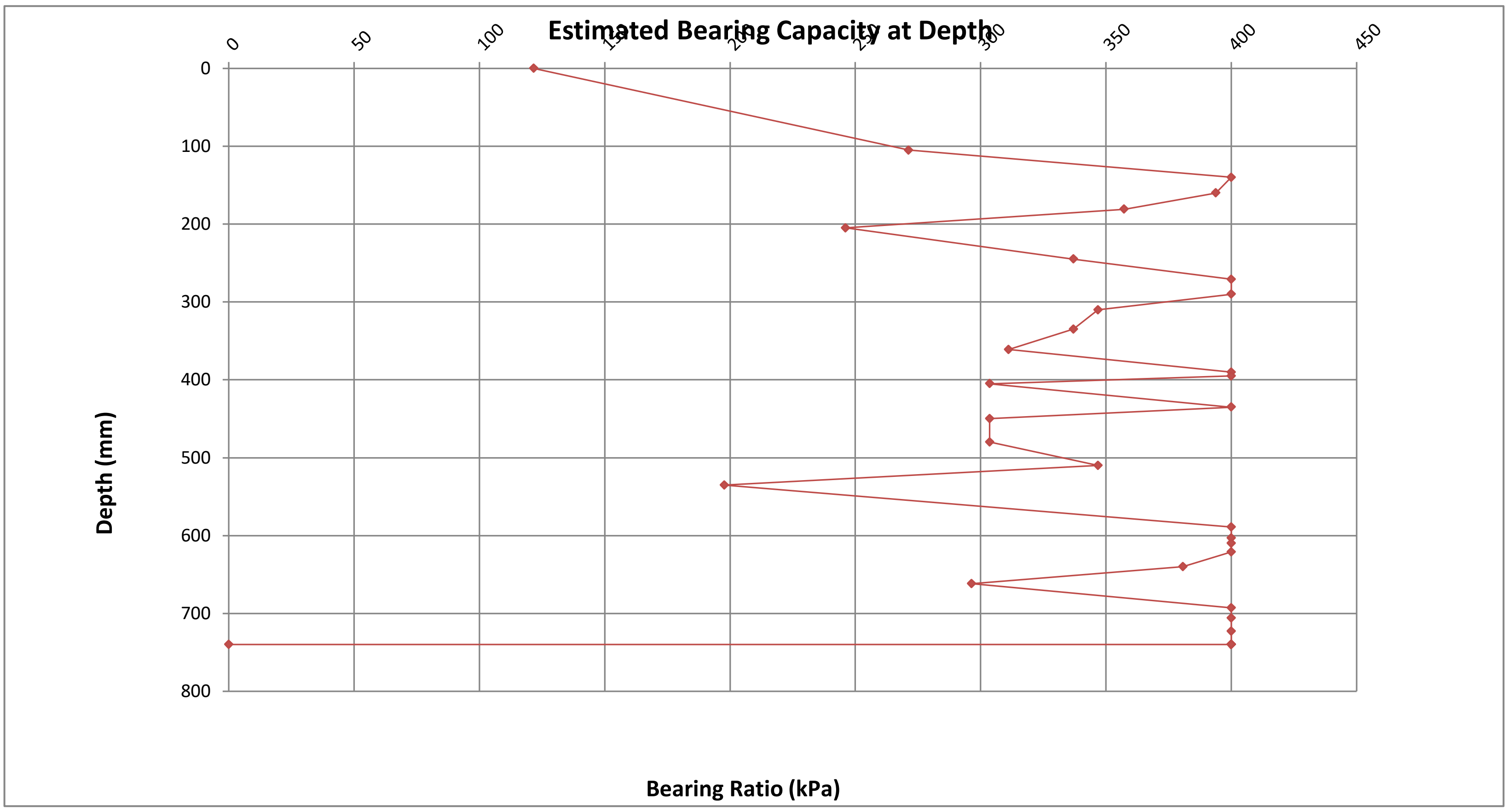
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV			Tel:	0
	Unit 10, Midway Industrial Park			Fax:	0
	Centurian				
	0157				**2 BLO/ISC 32 - 2 RHS**
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Alfred
TEST POSITION: 2 BLO/ISC 32 - 3 RHS
ASSISTANT
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 718mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	95	95	95	19.0	Medium Dense	131	10	10	117
10	120	120	25	5.0	Very Dense	347	53	57	502
15	149	149	29	5.8	Dense	311	44	47	427
20	175	175	26	5.2	Dense	337	51	54	481
25	189	189	14	2.8	Very Dense	>400	111	>110	944
30	203	203	14	2.8	Very Dense	>400	111	>110	944
35	225	225	22	4.4	Very Dense	381	62	68	577
40	263	263	38	7.6	Dense	255	31	33	318
45	290	290	27	5.4	Dense	328	48	52	461
50	315	315	25	5.0	Very Dense	347	53	57	502
55	345	345	30	6.0	Dense	304	42	45	411
60	362	362	17	3.4	Very Dense	>400	87	96	764
65	389	389	27	5.4	Dense	328	48	52	461
70	408	408	19	3.8	Very Dense	>400	75	83	677
75	415	415	7	1.4	Very Dense	>400	267	>110	2010
80	440	440	25	5.0	Very Dense	347	53	57	502
85	445	445	5	1.0	Very Dense	>400	410	>110	2900
90	479	479	34	6.8	Dense	277	36	38	359
95	500	500	21	4.2	Very Dense	394	66	72	607
100	509	509	9	1.8	Very Dense	>400	194	>110	1528
105	518	518	9	1.8	Very Dense	>400	194	>110	1528
110	540	540	22	4.4	Very Dense	381	62	68	577
115	588	588	48	9.6	Dense	215	23	24	246
120	605	605	17	3.4	Very Dense	>400	87	96	764
125	619	619	14	2.8	Very Dense	>400	111	>110	944
130	643	643	24	4.8	Very Dense	357	56	61	525
135	690	690	47	9.4	Dense	219	24	25	252
140	695	695	5	1.0	Very Dense	>400	410	>110	2900
145	699	699	4	0.8	Very Dense	>400	544	>110	3699
150	703	703	4	0.8	Very Dense	>400	544	>110	3699
155	709	709	6	1.2	Very Dense	>400	325	>110	2377
160	710	710	1	0.2	Very Dense	>400	3166	>110	16760
165	715	715	5	1.0	Very Dense	>400	410	>110	2900
170	718	718	3	0.6	Very Dense	>400	784	>110	5061

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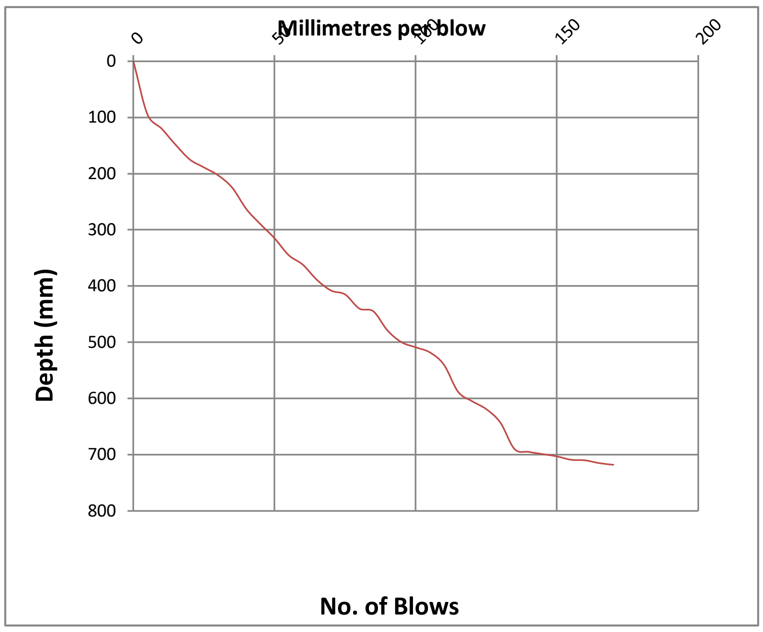
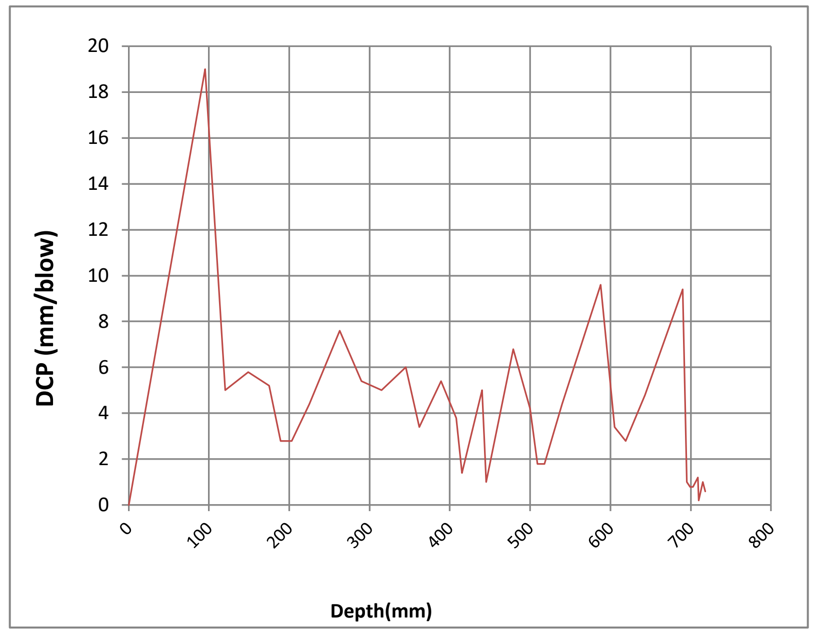
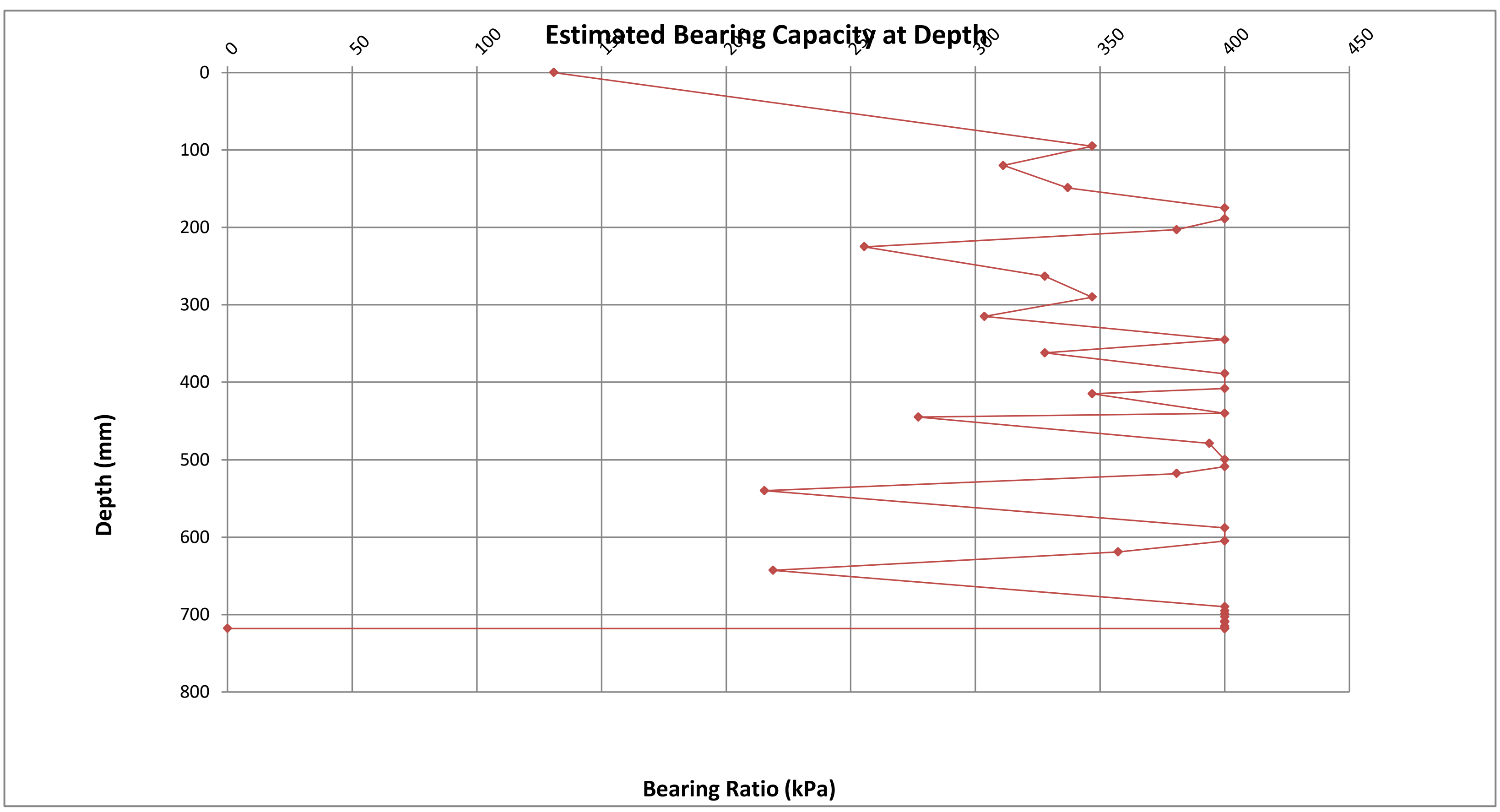
JOB No:	**N/A**	**Ref. No:**	**N/A**		**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV			Tel:	0	
	Unit 10, Midway Industrial Park			Fax:	0	
	Centurian					
	0157				**2 BLO/ISC 32 - 3 RHS**	
Attention:	Mr Sandile Kunene					

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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Client: KHATO CIVILS THENGA HOLDINGS JV
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0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	Tippler - Saldanha	**MATERIALS TECHNICIAN:**	Alfred
TEST POSITION:	**2 BLO/ISC 32 - 4 CL**	**ASSISTANT**	
TEST DEPTH:	DCP 1 m (This is a standard accreditated Method)	**STARTING DEPTH:**	0mm
MATERIAL TYPE:	Sandy Materials	**INSTRUMENT (DCP) SET No:**	28596
CONSTRUCTION TYPE:	Road Construction	**Max. penetration depth:**	1000 mm
Enviromental Conditions	23'C	**LEVEL:**	@ NGL
REFUSAL:	645mm	**FOUNDATION:**	@ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	45	45	45	9.0	Dense	226	25	26	264
10	70	70	25	5.0	Very Dense	347	53	57	502
15	85	85	15	3.0	Very Dense	>400	102	110	876
20	95	95	10	2.0	Very Dense	>400	170	>110	1362
25	105	105	10	2.0	Very Dense	>400	170	>110	1362
30	115	115	10	2.0	Very Dense	>400	170	>110	1362
35	128	128	13	2.6	Very Dense	>400	122	>110	1023
40	135	135	7	1.4	Very Dense	>400	267	>110	2010
45	155	155	20	4.0	Very Dense	400	70	77	640
50	181	181	26	5.2	Dense	337	51	54	481
55	200	200	19	3.8	Very Dense	>400	75	83	677
60	225	225	25	5.0	Very Dense	347	53	57	502
65	260	260	35	7.0	Dense	271	35	37	348
70	297	297	37	7.4	Dense	261	32	34	327
75	305	305	8	1.6	Very Dense	>400	226	>110	1737
80	337	337	32	6.4	Dense	290	39	41	383
85	390	390	53	10.6	Dense	200	20	21	221
90	425	425	35	7.0	Dense	271	35	37	348
95	489	489	64	12.8	Medium Dense	175	16	16	180
100	505	505	16	3.2	Very Dense	>400	94	104	816
105	536	536	31	6.2	Dense	296	40	43	397
110	600	600	64	12.8	Medium Dense	175	16	16	180
115	611	611	11	2.2	Very Dense	>400	151	>110	1228
120	630	630	19	3.8	Very Dense	>400	75	83	677
125	643	643	13	2.6	Very Dense	>400	122	>110	1023
130	645	645	2	0.4	Very Dense	>400	1313	>110	7873

Compiled By: M.Steyn Approved By: J.Steyn

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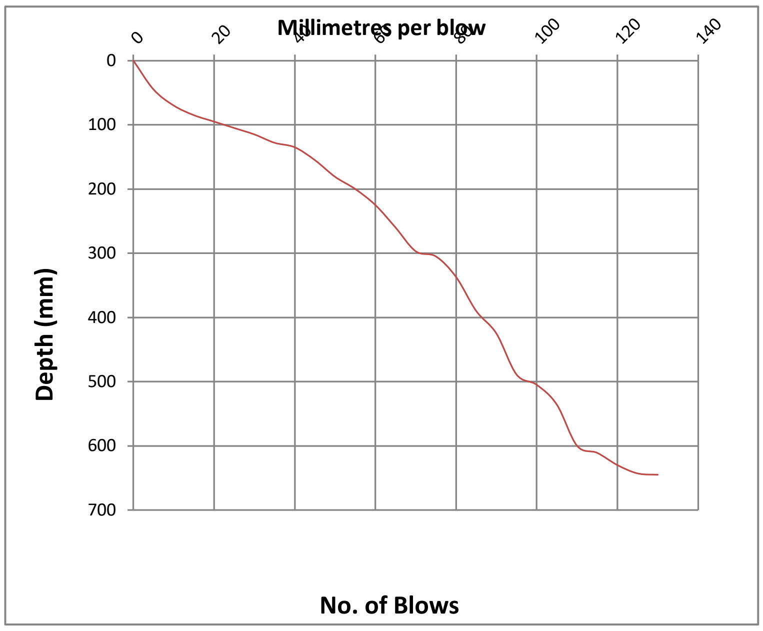
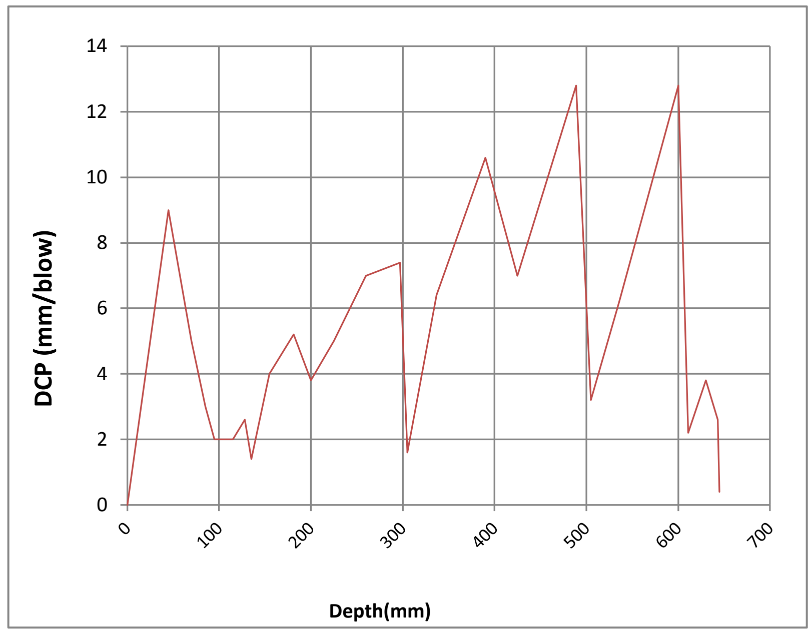
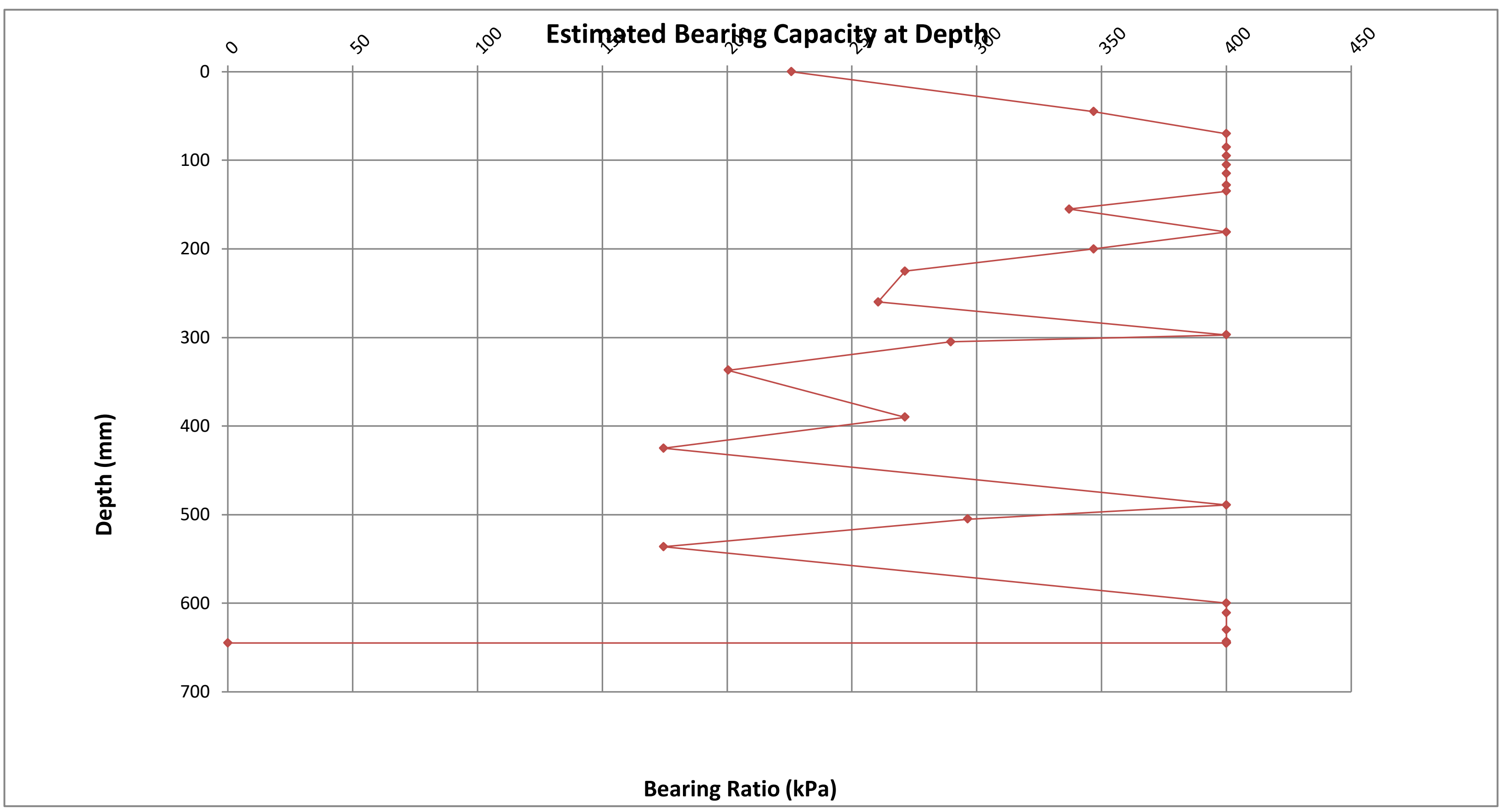
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**2 BLO/ISC 32 - 4 CL**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
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Centurian
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Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Alfred
TEST POSITION: 2 BLO/ISC 32 - 5 CL
ASSISTANT
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 670mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	35	35	35	7.0	Dense	271	35	37	348
10	42	42	7	1.4	Very Dense	>400	267	>110	2010
15	55	55	13	2.6	Very Dense	>400	122	>110	1023
20	68	68	13	2.6	Very Dense	>400	122	>110	1023
25	79	79	11	2.2	Very Dense	>400	151	>110	1228
30	90	90	11	2.2	Very Dense	>400	151	>110	1228
35	100	100	10	2.0	Very Dense	>400	170	>110	1362
40	115	115	15	3.0	Very Dense	>400	102	110	876
45	136	136	21	4.2	Very Dense	394	66	72	607
50	163	163	27	5.4	Dense	328	48	52	461
55	175	175	12	2.4	Very Dense	>400	135	>110	1117
60	190	190	15	3.0	Very Dense	>400	102	110	876
65	199	199	9	1.8	Very Dense	>400	194	>110	1528
70	209	209	10	2.0	Very Dense	>400	170	>110	1362
75	245	245	36	7.2	Dense	266	33	35	337
80	293	293	48	9.6	Dense	215	23	24	246
85	330	330	37	7.4	Dense	261	32	34	327
90	392	392	62	12.4	Dense	179	17	17	186
95	430	430	38	7.6	Dense	255	31	33	318
100	475	475	45	9.0	Dense	226	25	26	264
105	500	500	25	5.0	Very Dense	347	53	57	502
110	550	550	50	10.0	Dense	209	22	23	236
115	573	573	23	4.6	Very Dense	369	59	64	550
120	590	590	17	3.4	Very Dense	>400	87	96	764
125	616	616	26	5.2	Dense	337	51	54	481
130	640	640	24	4.8	Very Dense	357	56	61	525
135	650	650	10	2.0	Very Dense	>400	170	>110	1362
140	670	670	20	4.0	Very Dense	400	70	77	640

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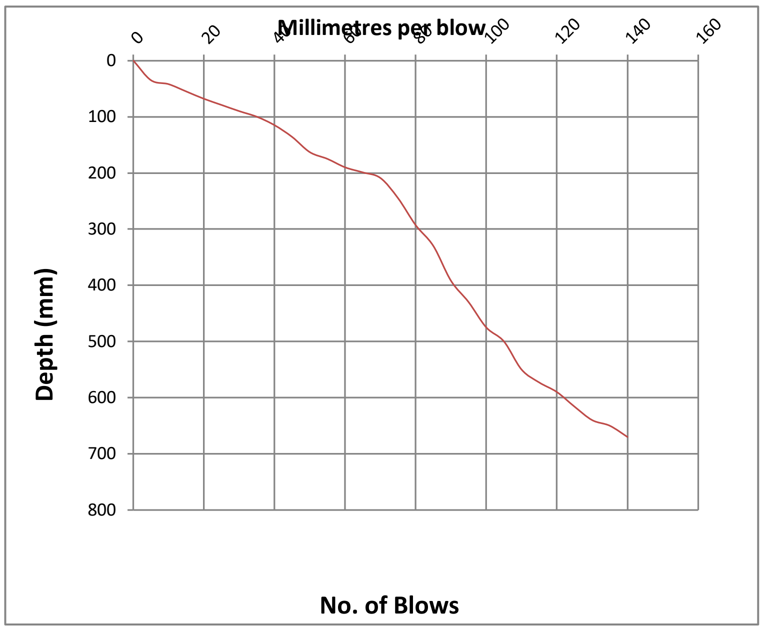
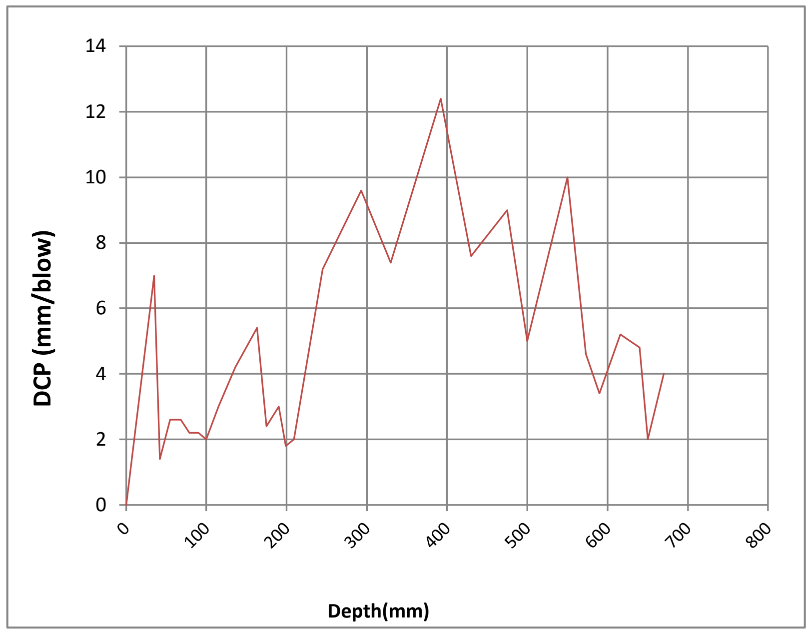
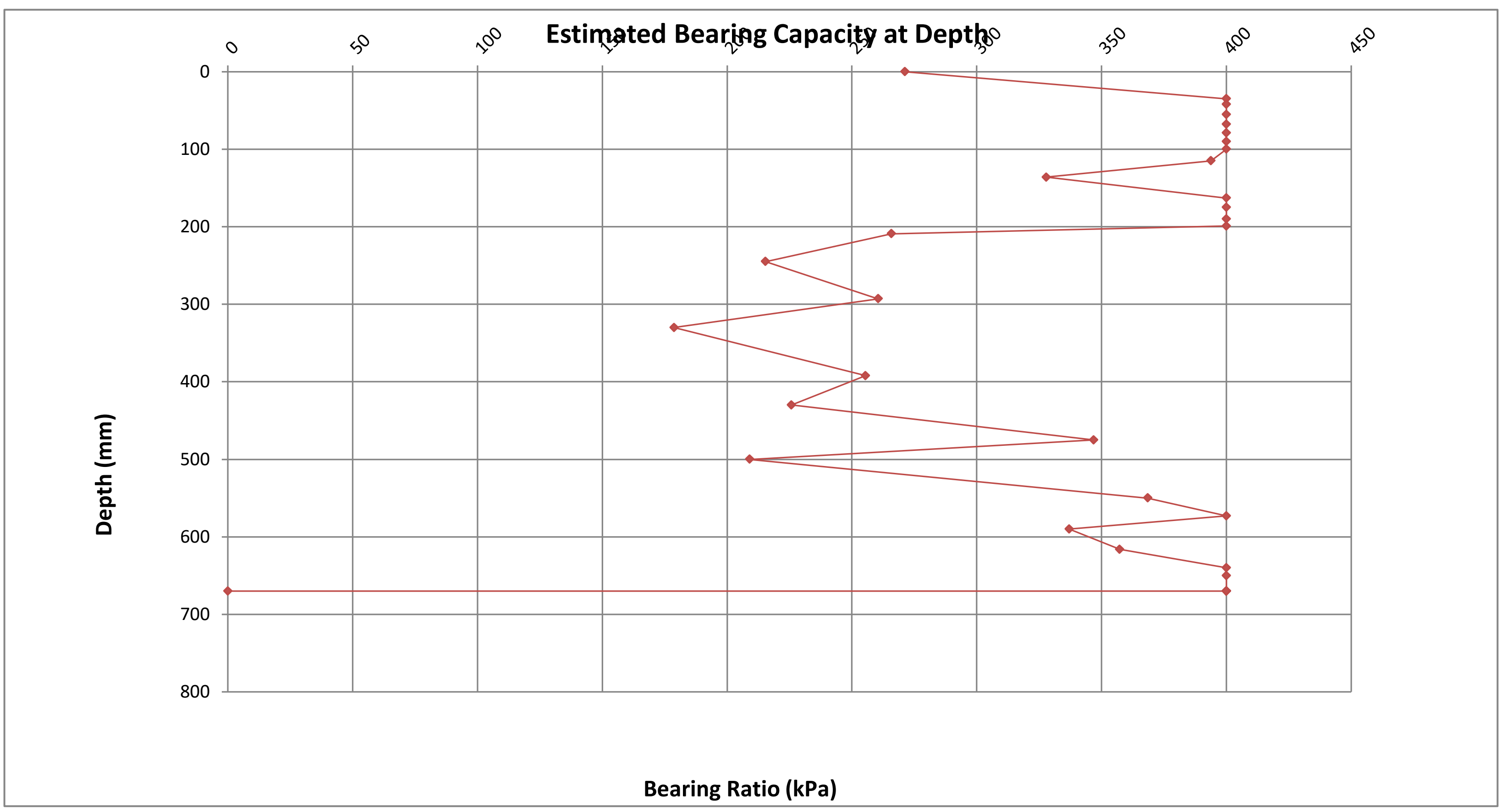
JOB No:	N/A	Ref. No:	N/A	Date:	07-02-2020
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			2 BLO/ISC 32 - 5 CL	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
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Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	Tippler - Saldanha	**MATERIALS TECHNICIAN:**	Alfred
TEST POSITION:	2 BLO/ISC 32 - 6 CL	**ASSISTANT**	
TEST DEPTH:	DCP 1 m (This is a standard accreditated Method)	**STARTING DEPTH:**	0mm
MATERIAL TYPE:	Sandy Materials	**INSTRUMENT (DCP) SET No:**	28596
CONSTRUCTION TYPE:	Road Construction	**Max. penetration depth:**	1000 mm
Enviromental Conditions	23'C	**LEVEL:**	@ NGL
REFUSAL:	720mm	**FOUNDATION:**	@ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	48	48	48	9.6	Dense	215	23	24	246
10	53	53	5	1.0	Very Dense	>400	410	>110	2900
15	63	63	10	2.0	Very Dense	>400	170	>110	1362
20	75	75	12	2.4	Very Dense	>400	135	>110	1117
25	93	93	18	3.6	Very Dense	>400	81	89	718
30	110	110	17	3.4	Very Dense	>400	87	96	764
35	120	120	10	2.0	Very Dense	>400	170	>110	1362
40	136	136	16	3.2	Very Dense	>400	94	104	816
45	150	150	14	2.8	Very Dense	>400	111	>110	944
50	172	172	22	4.4	Very Dense	381	62	68	577
55	192	192	20	4.0	Very Dense	400	70	77	640
60	201	201	9	1.8	Very Dense	>400	194	>110	1528
65	220	220	19	3.8	Very Dense	>400	75	83	677
70	263	263	43	8.6	Dense	233	27	28	278
75	294	294	31	6.2	Dense	296	40	43	397
80	310	310	16	3.2	Very Dense	>400	94	104	816
85	339	339	29	5.8	Dense	311	44	47	427
90	420	420	81	16.2	Medium Dense	147	12	12	139
95	454	454	34	6.8	Dense	277	36	38	359
100	511	511	57	11.4	Dense	190	19	19	204
105	598	598	87	17.4	Medium Dense	140	11	11	129
110	631	631	33	6.6	Dense	283	37	40	371
115	649	649	18	3.6	Very Dense	>400	81	89	718
120	682	682	33	6.6	Dense	283	37	40	371
125	710	710	28	5.6	Dense	319	46	49	443
130	715	715	5	1.0	Very Dense	>400	410	>110	2900
135	720	720	5	1.0	Very Dense	>400	410	>110	2900

Compiled By: M.Steyn Approved By: J.Steyn

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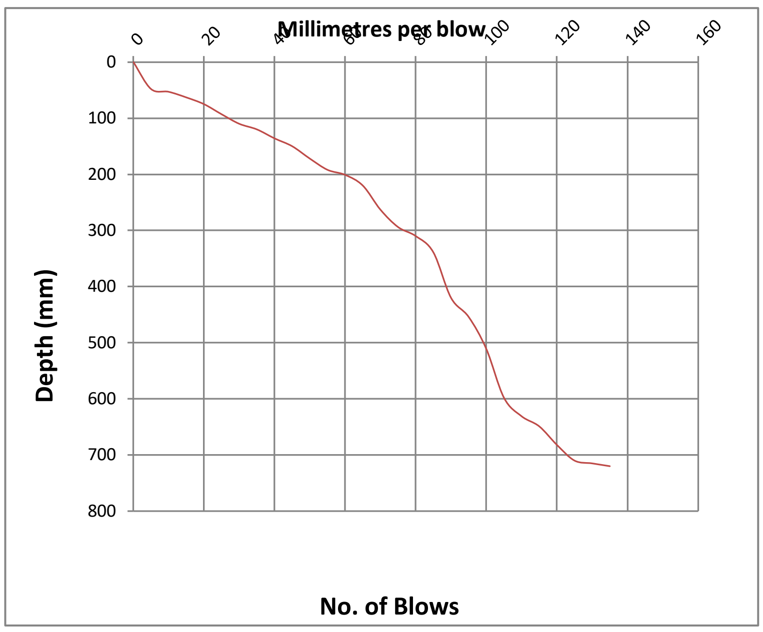
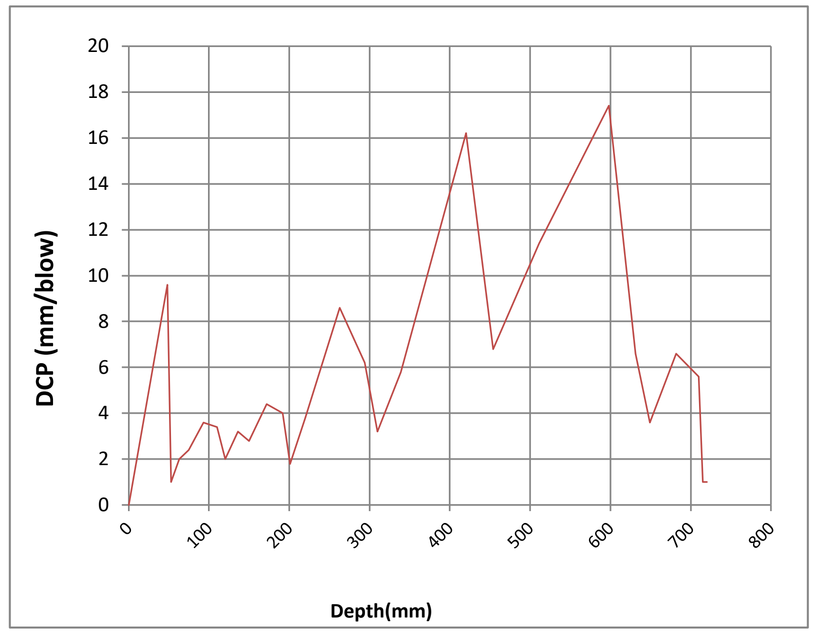
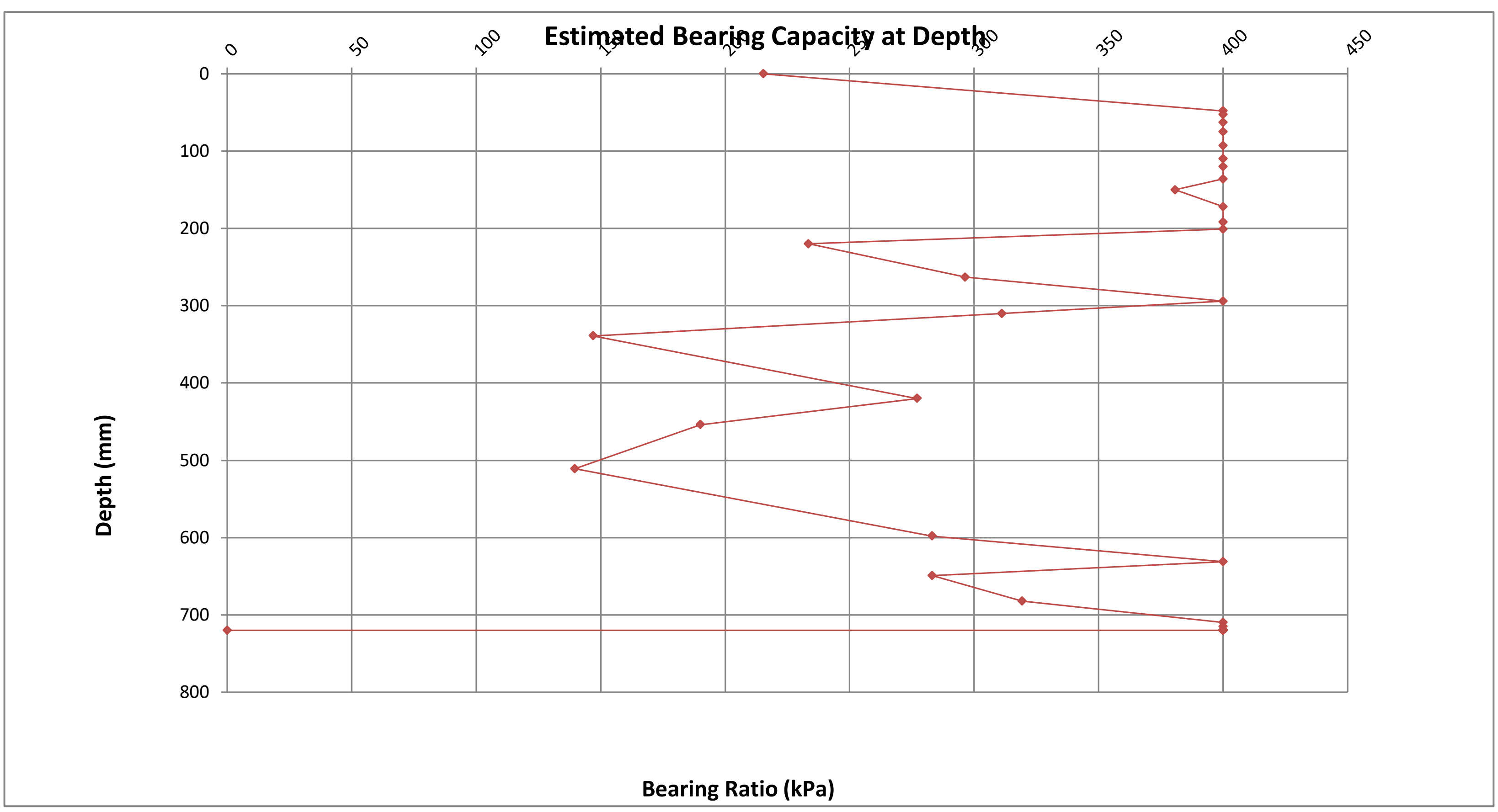
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV	Tel:	0		
	Unit 10, Midway Industrial Park	Fax:	0		
	Centurian				
	0157			**2 BLO/ISC 32 - 6 CL**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

Mr A Engel
Lab Manager

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Vat Reg No: 4670261090

JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	Tippler - Saldanha	**MATERIALS TECHNICIAN:**	Alfred
TEST POSITION:	**2 BLO/ISC 32 - 7 CL**	**ASSISTANT**	
TEST DEPTH:	DCP 1 m (This is a standard accreditated Method)	**STARTING DEPTH:**	0mm
MATERIAL TYPE:	Sandy Materials	**INSTRUMENT (DCP) SET No:**	28596
CONSTRUCTION TYPE:	Road Construction	**Max. penetration depth:**	1000 mm
Enviromental Conditions	23'C	**LEVEL:**	@ NGL
REFUSAL:	715mm	**FOUNDATION:**	@ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	30	30	30	6.0	Dense	304	42	45	411
10	35	35	5	1.0	Very Dense	>400	410	>110	2900
15	47	47	12	2.4	Very Dense	>400	135	>110	1117
20	58	58	11	2.2	Very Dense	>400	151	>110	1228
25	75	75	17	3.4	Very Dense	>400	87	96	764
30	85	85	10	2.0	Very Dense	>400	170	>110	1362
35	99	99	14	2.8	Very Dense	>400	111	>110	944
40	110	110	11	2.2	Very Dense	>400	151	>110	1228
45	140	140	30	6.0	Dense	304	42	45	411
50	165	165	25	5.0	Very Dense	347	53	57	502
55	183	183	18	3.6	Very Dense	>400	81	89	718
60	205	205	22	4.4	Very Dense	381	62	68	577
65	215	215	10	2.0	Very Dense	>400	170	>110	1362
70	228	228	13	2.6	Very Dense	>400	122	>110	1023
75	249	249	21	4.2	Very Dense	394	66	72	607
80	276	276	27	5.4	Dense	328	48	52	461
85	300	300	24	4.8	Very Dense	357	56	61	525
90	319	319	19	3.8	Very Dense	>400	75	83	677
95	352	352	33	6.6	Dense	283	37	40	371
100	389	389	37	7.4	Dense	261	32	34	327
105	411	411	22	4.4	Very Dense	381	62	68	577
110	462	462	51	10.2	Dense	206	21	22	231
115	493	493	31	6.2	Dense	296	40	43	397
120	513	513	20	4.0	Very Dense	400	70	77	640
125	552	552	39	7.8	Dense	251	30	32	309
130	579	579	27	5.4	Dense	328	48	52	461
135	601	601	22	4.4	Very Dense	381	62	68	577
140	635	635	34	6.8	Dense	277	36	38	359
145	690	690	55	11.0	Dense	195	20	20	212
150	699	699	9	1.8	Very Dense	>400	194	>110	1528
155	701	701	2	0.4	Very Dense	>400	1313	>110	7873
160	713	713	12	2.4	Very Dense	>400	135	>110	1117
165	715	715	2	0.4	Very Dense	>400	1313	>110	7873

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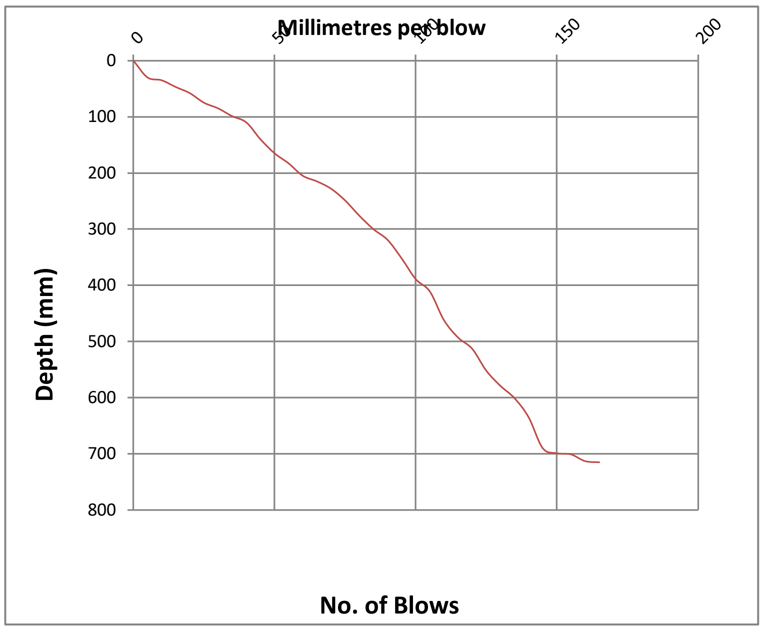
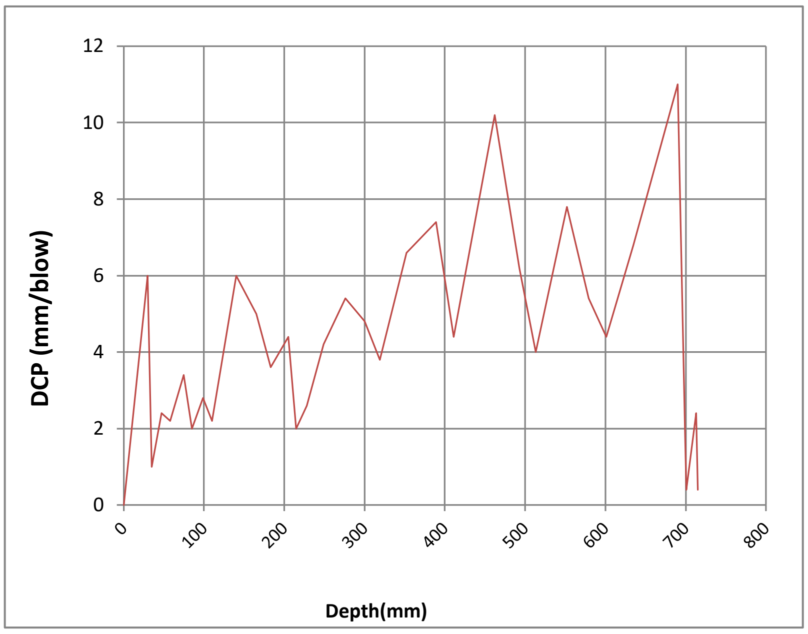
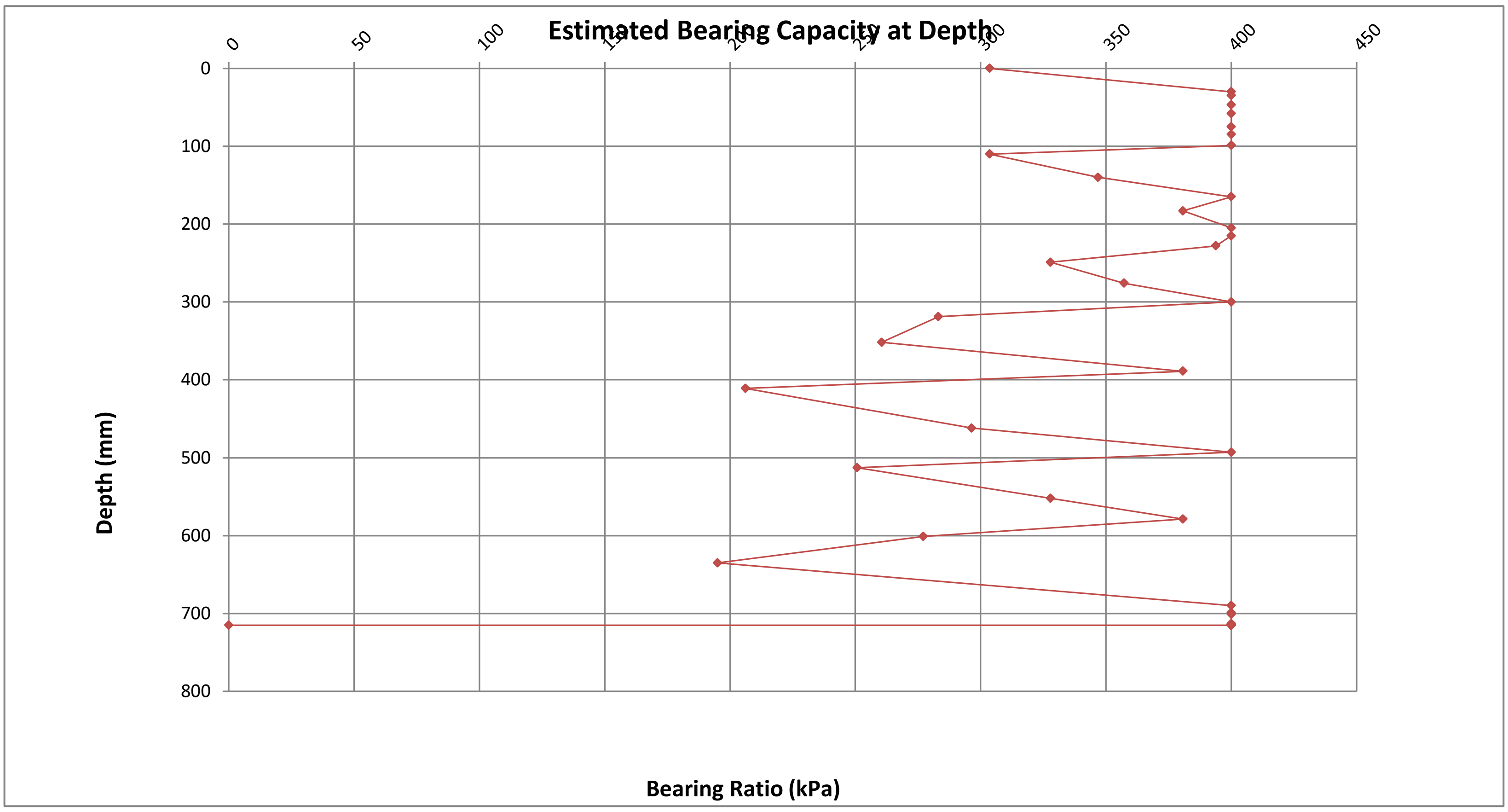
JOB No:	N/A	Ref. No:	N/A	Date:	07-02-2020
Client	KHATO CIVILS THENGA HOLDINGS JV	Tel:	0		
	Unit 10, Midway Industrial Park	Fax:	0		
	Centurian				
	0157		2 BLO/ISC 32 - 7 CL		
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Alfred
TEST POSITION: 2 BLO/ISC 32 - 8 LHS
ASSISTANT
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 670mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	40	40	40	8.0	Dense	246	29	31	301
10	60	60	20	4.0	Very Dense	400	70	77	640
15	75	75	15	3.0	Very Dense	>400	102	110	876
20	95	95	20	4.0	Very Dense	400	70	77	640
25	115	115	20	4.0	Very Dense	400	70	77	640
30	120	120	5	1.0	Very Dense	>400	410	>110	2900
35	135	135	15	3.0	Very Dense	>400	102	110	876
40	155	155	20	4.0	Very Dense	400	70	77	640
45	180	180	25	5.0	Very Dense	347	53	57	502
50	195	195	15	3.0	Very Dense	>400	102	110	876
55	210	210	15	3.0	Very Dense	>400	102	110	876
60	225	225	15	3.0	Very Dense	>400	102	110	876
65	235	235	10	2.0	Very Dense	>400	170	>110	1362
70	250	250	15	3.0	Very Dense	>400	102	110	876
75	270	270	20	4.0	Very Dense	400	70	77	640
80	280	280	10	2.0	Very Dense	>400	170	>110	1362
85	301	301	21	4.2	Very Dense	394	66	72	607
90	315	315	14	2.8	Very Dense	>400	111	>110	944
95	328	328	13	2.6	Very Dense	>400	122	>110	1023
100	342	342	14	2.8	Very Dense	>400	111	>110	944
105	360	360	18	3.6	Very Dense	>400	81	89	718
110	375	375	15	3.0	Very Dense	>400	102	110	876
115	390	390	15	3.0	Very Dense	>400	102	110	876
120	410	410	20	4.0	Very Dense	400	70	77	640
125	430	430	20	4.0	Very Dense	400	70	77	640
130	470	470	40	8.0	Dense	246	29	31	301
135	520	520	50	10.0	Dense	209	22	23	236
140	530	530	10	2.0	Very Dense	>400	170	>110	1362
145	590	590	60	12.0	Dense	183	17	18	193
150	600	600	10	2.0	Very Dense	>400	170	>110	1362
155	630	630	30	6.0	Dense	304	42	45	411
160	655	655	25	5.0	Very Dense	347	53	57	502
165	660	660	5	1.0	Very Dense	>400	410	>110	2900
170	670	670	10	2.0	Very Dense	>400	170	>110	1362

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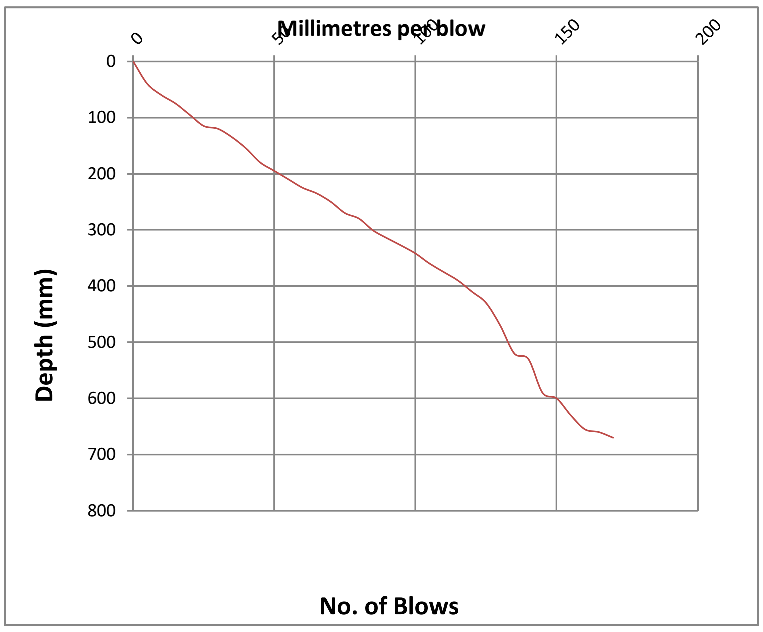
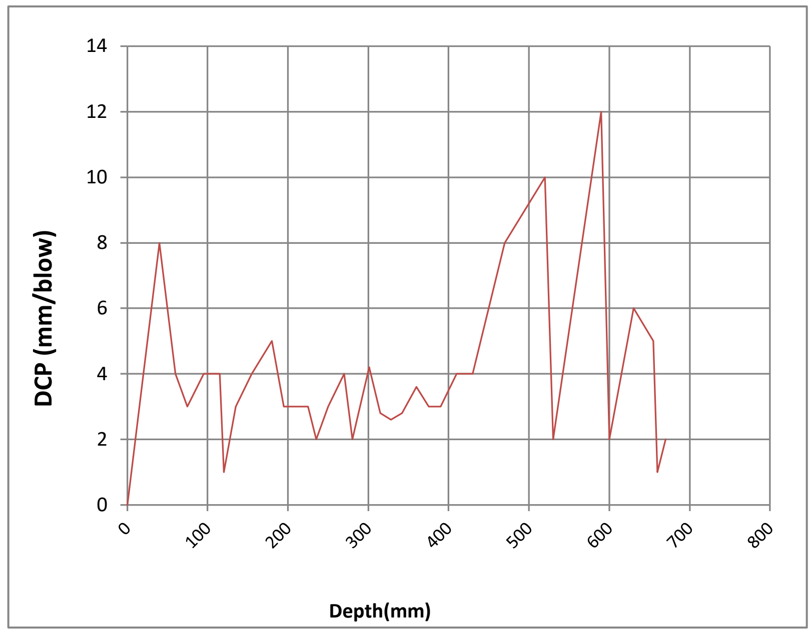
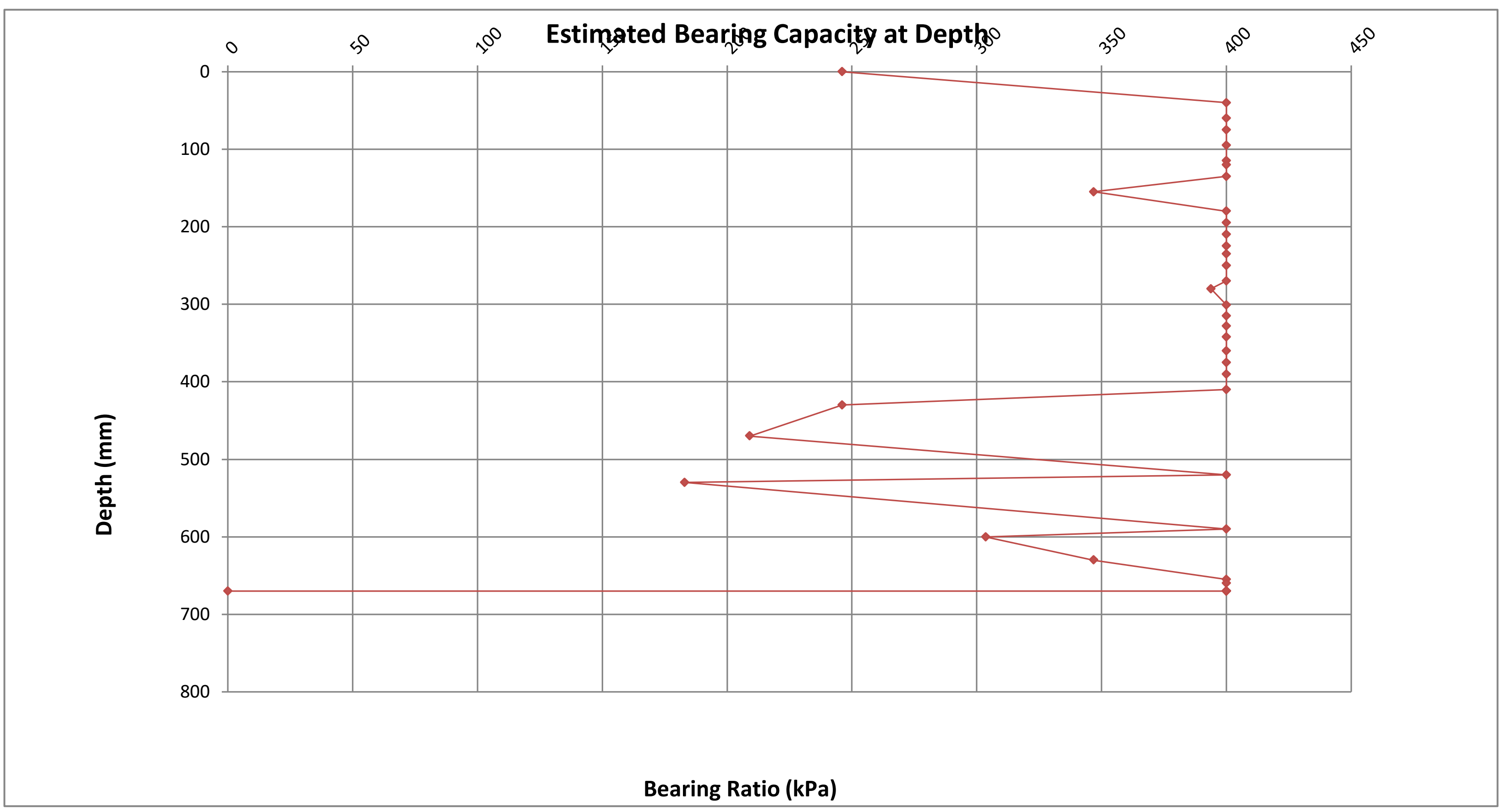
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**2 BLO/ISC 32 - 8 LHS**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
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0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha **MATERIALS TECHNICIAN:** Alfred
TEST POSITION: **2 BLO/ISC 32 - 9 LHS** **ASSISTANT**
TEST DEPTH: DCP 1 m (This is a standard accreditated Method) **STARTING DEPTH:** 0mm
MATERIAL TYPE: Sandy Materials **INSTRUMENT (DCP) SET No:** 28596
CONSTRUCTION TYPE: Road Construction **Max. penetration depth:** 1000 mm
Enviromental Conditions 23'C **LEVEL:** @ NGL
REFUSAL: 690mm **FOUNDATION:** @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	25	25	25	5.0	Very Dense	347	53	57	502
10	35	35	10	2.0	Very Dense	>400	170	>110	1362
15	45	45	10	2.0	Very Dense	>400	170	>110	1362
20	53	53	8	1.6	Very Dense	>400	226	>110	1737
25	68	68	15	3.0	Very Dense	>400	102	110	876
30	79	79	11	2.2	Very Dense	>400	151	>110	1228
35	86	86	7	1.4	Very Dense	>400	267	>110	2010
40	95	95	9	1.8	Very Dense	>400	194	>110	1528
45	105	105	10	2.0	Very Dense	>400	170	>110	1362
50	124	124	19	3.8	Very Dense	>400	75	83	677
55	137	137	13	2.6	Very Dense	>400	122	>110	1023
60	168	168	31	6.2	Dense	296	40	43	397
65	205	205	37	7.4	Dense	261	32	34	327
70	234	234	29	5.8	Dense	311	44	47	427
75	263	263	29	5.8	Dense	311	44	47	427
80	290	290	27	5.4	Dense	328	48	52	461
85	304	304	14	2.8	Very Dense	>400	111	>110	944
90	339	339	35	7.0	Dense	271	35	37	348
95	350	350	11	2.2	Very Dense	>400	151	>110	1228
100	376	376	26	5.2	Dense	337	51	54	481
105	392	392	16	3.2	Very Dense	>400	94	104	816
110	405	405	13	2.6	Very Dense	>400	122	>110	1023
115	410	410	5	1.0	Very Dense	>400	410	>110	2900
120	435	435	25	5.0	Very Dense	347	53	57	502
125	456	456	21	4.2	Very Dense	394	66	72	607
130	490	490	34	6.8	Dense	277	36	38	359
135	506	506	16	3.2	Very Dense	>400	94	104	816
140	535	535	29	5.8	Dense	311	44	47	427
145	545	545	10	2.0	Very Dense	>400	170	>110	1362
150	592	592	47	9.4	Dense	219	24	25	252
155	615	615	23	4.6	Very Dense	369	59	64	550
160	670	670	55	11.0	Dense	195	20	20	212
165	685	685	15	3.0	Very Dense	>400	102	110	876
170	690	690	5	1.0	Very Dense	>400	410	>110	2900

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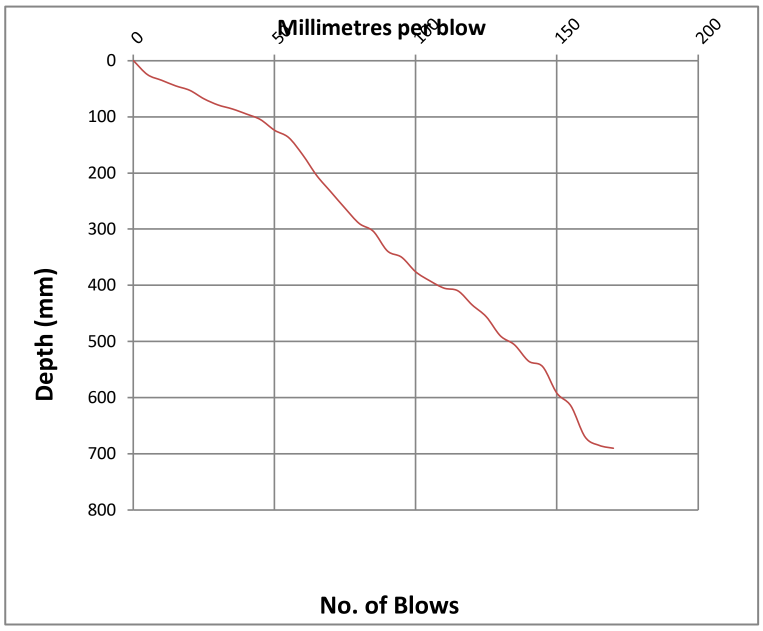
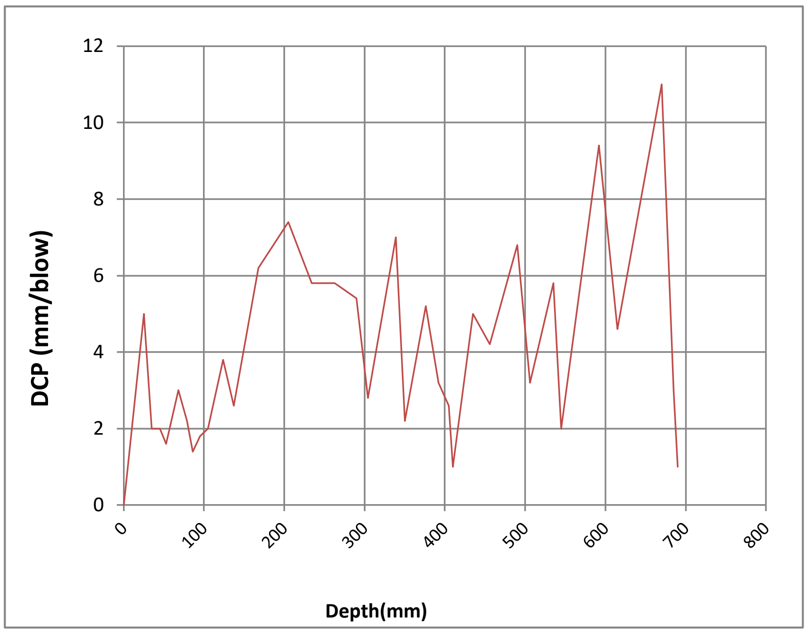
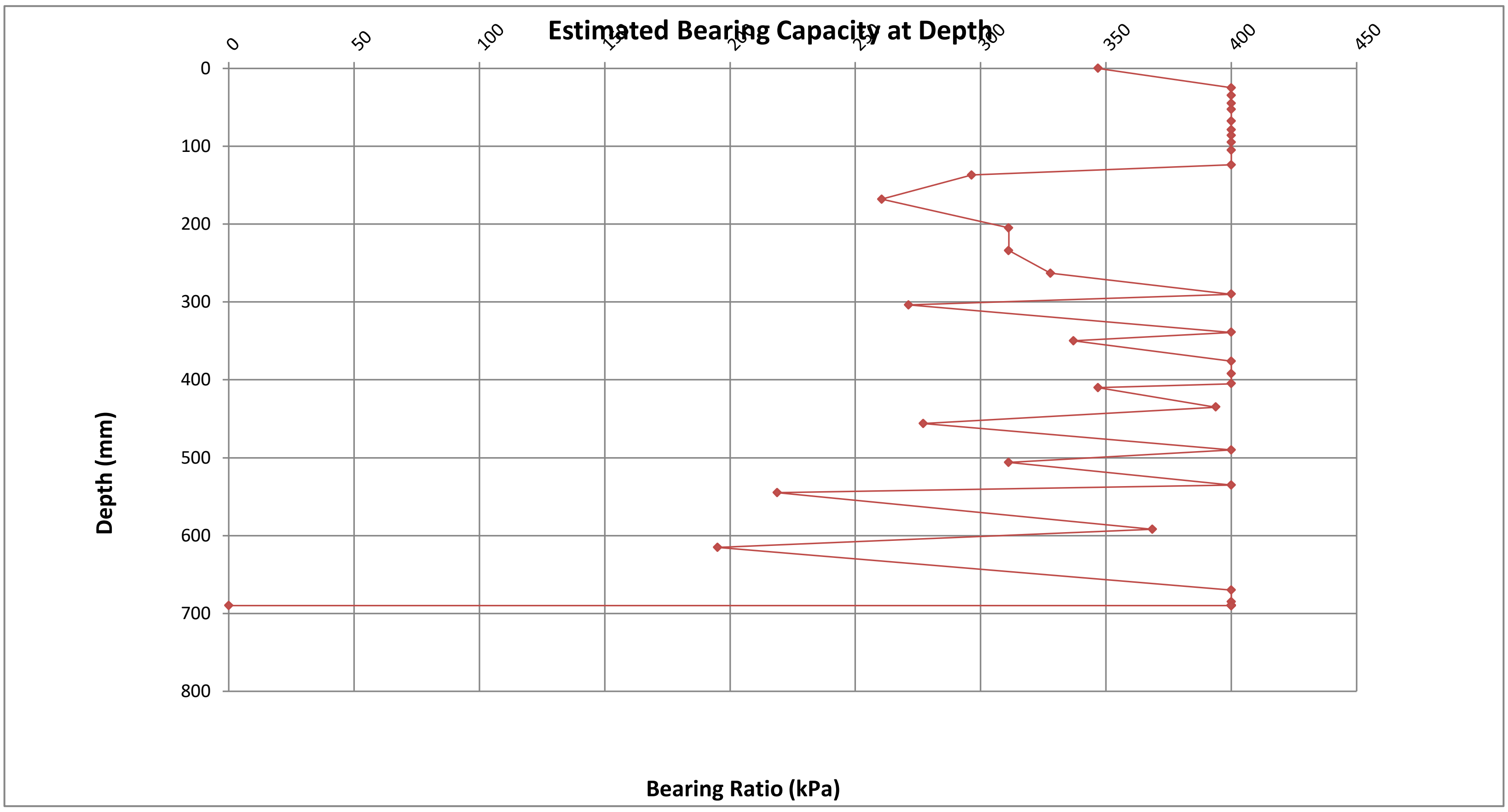
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV	Tel:	0		
	Unit 10, Midway Industrial Park	Fax:	0		
	Centurian				
	0157			**2 BLO/ISC 32 - 9 LHS**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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Centurian
0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Alfred
TEST POSITION: **2 BLO/ISC 32 - 10 LHS**
ASSISTANT
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 622mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	38	38	38	7.6	Dense	255	31	33	318
10	48	48	10	2.0	Very Dense	>400	170	>110	1362
15	52	52	4	0.8	Very Dense	>400	544	>110	3699
20	61	61	9	1.8	Very Dense	>400	194	>110	1528
25	79	79	18	3.6	Very Dense	>400	81	89	718
30	86	86	7	1.4	Very Dense	>400	267	>110	2010
35	93	93	7	1.4	Very Dense	>400	267	>110	2010
40	105	105	12	2.4	Very Dense	>400	135	>110	1117
45	137	137	32	6.4	Dense	290	39	41	383
50	144	144	7	1.4	Very Dense	>400	267	>110	2010
55	155	155	11	2.2	Very Dense	>400	151	>110	1228
60	173	173	18	3.6	Very Dense	>400	81	89	718
65	192	192	19	3.8	Very Dense	>400	75	83	677
70	215	215	23	4.6	Very Dense	369	59	64	550
75	230	230	15	3.0	Very Dense	>400	102	110	876
80	245	245	15	3.0	Very Dense	>400	102	110	876
85	296	296	51	10.2	Dense	206	21	22	231
90	318	318	22	4.4	Very Dense	381	62	68	577
95	333	333	15	3.0	Very Dense	>400	102	110	876
100	369	369	36	7.2	Dense	266	33	35	337
105	400	400	31	6.2	Dense	296	40	43	397
110	419	419	19	3.8	Very Dense	>400	75	83	677
115	439	439	20	4.0	Very Dense	400	70	77	640
120	467	467	28	5.6	Dense	319	46	49	443
125	501	501	34	6.8	Dense	277	36	38	359
130	506	506	5	1.0	Very Dense	>400	410	>110	2900
135	515	515	9	1.8	Very Dense	>400	194	>110	1528
140	518	518	3	0.6	Very Dense	>400	784	>110	5061
145	590	590	72	14.4	Medium Dense	160	14	14	158
150	614	614	24	4.8	Very Dense	357	56	61	525
155	619	619	5	1.0	Very Dense	>400	410	>110	2900
160	622	622	3	0.6	Very Dense	>400	784	>110	5061

Compiled By: M.Steyn Approved By: J.Steyn

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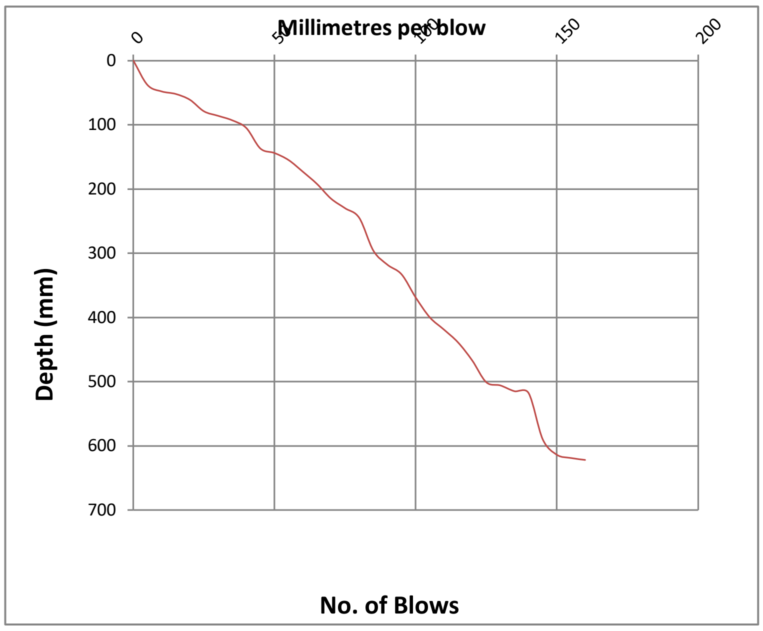
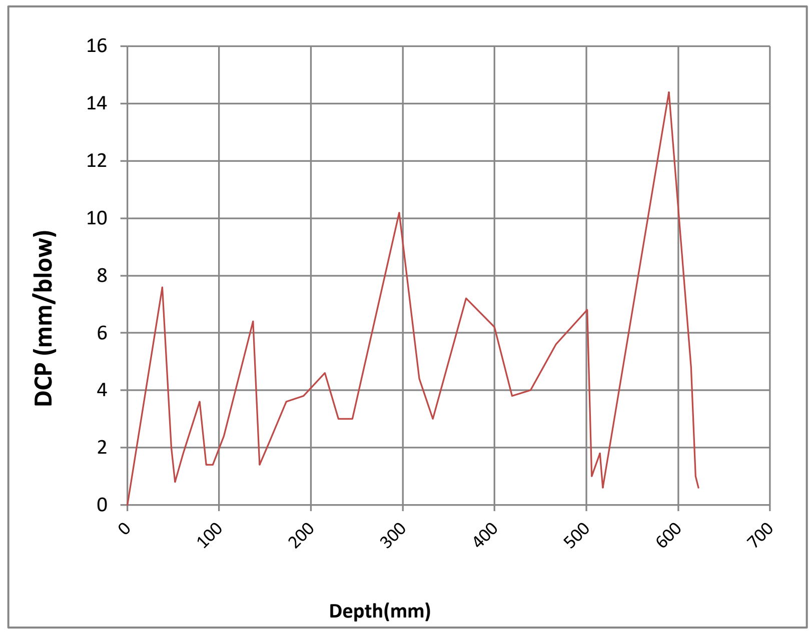
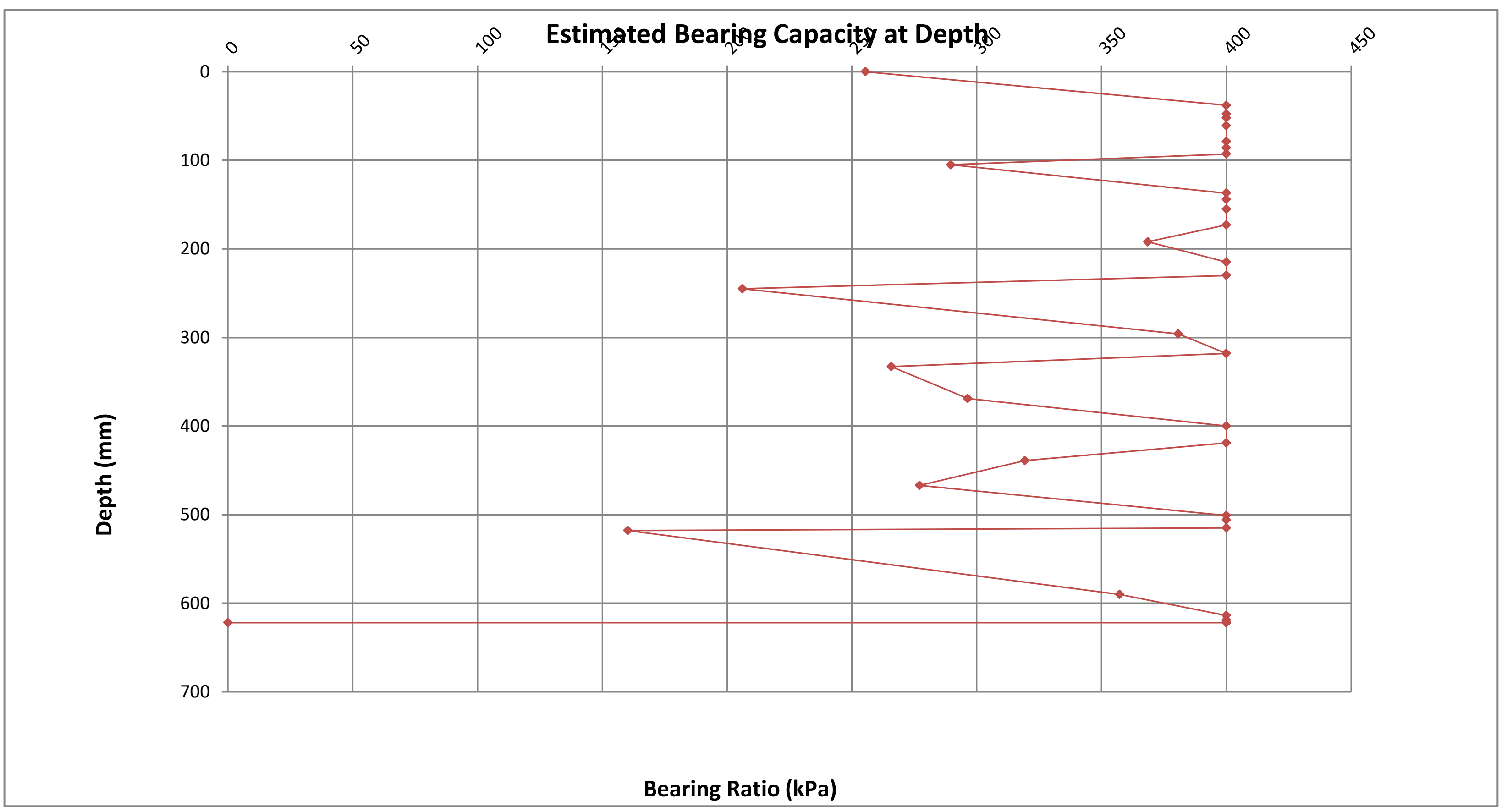
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**2 BLO/ISC 32 - 10 LHS**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







Remarks:

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5. Data Capture : Mrs. M. Swart

Mr A Engel
Lab Manager

1 & 2 BLO-ISC 32-1

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Vat Reg No: 4670261090

JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 & 2 BLO/ISC/32/1-1A
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 759mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	55	55	55	11.0	Dense	195	20	20	212
10	105	105	50	10.0	Dense	209	22	23	236
15	152	152	47	9.4	Dense	219	24	25	252
20	194	194	42	8.4	Dense	237	27	29	285
25	247	247	53	10.6	Dense	200	20	21	221
30	310	310	63	12.6	Medium Dense	177	16	17	183
35	384	384	74	14.8	Medium Dense	157	13	13	154
40	410	410	26	5.2	Dense	337	51	54	481
45	424	424	14	2.8	Very Dense	>400	111	>110	944
50	440	440	16	3.2	Very Dense	>400	94	104	816
55	450	450	10	2.0	Very Dense	>400	170	>110	1362
60	466	466	16	3.2	Very Dense	>400	94	104	816
65	474	474	8	1.6	Very Dense	>400	226	>110	1737
70	485	485	11	2.2	Very Dense	>400	151	>110	1228
75	499	499	14	2.8	Very Dense	>400	111	>110	944
80	510	510	11	2.2	Very Dense	>400	151	>110	1228
85	533	533	23	4.6	Very Dense	369	59	64	550
90	545	545	12	2.4	Very Dense	>400	135	>110	1117
95	555	555	10	2.0	Very Dense	>400	170	>110	1362
100	565	565	10	2.0	Very Dense	>400	170	>110	1362
105	579	579	14	2.8	Very Dense	>400	111	>110	944
110	590	590	11	2.2	Very Dense	>400	151	>110	1228
115	600	600	10	2.0	Very Dense	>400	170	>110	1362
120	612	612	12	2.4	Very Dense	>400	135	>110	1117
125	635	635	23	4.6	Very Dense	369	59	64	550
130	640	640	5	1.0	Very Dense	>400	410	>110	2900
135	650	650	10	2.0	Very Dense	>400	170	>110	1362
140	660	660	10	2.0	Very Dense	>400	170	>110	1362
145	670	670	10	2.0	Very Dense	>400	170	>110	1362
150	679	679	9	1.8	Very Dense	>400	194	>110	1528
155	690	690	11	2.2	Very Dense	>400	151	>110	1228
160	700	700	10	2.0	Very Dense	>400	170	>110	1362
165	709	709	9	1.8	Very Dense	>400	194	>110	1528
170	715	715	6	1.2	Very Dense	>400	325	>110	2377
175	720	720	5	1.0	Very Dense	>400	410	>110	2900
180	730	730	10	2.0	Very Dense	>400	170	>110	1362
185	735	735	5	1.0	Very Dense	>400	410	>110	2900
190	740	740	5	1.0	Very Dense	>400	410	>110	2900
195	745	745	5	1.0	Very Dense	>400	410	>110	2900
200	750	750	5	1.0	Very Dense	>400	410	>110	2900
205	759	759	9	1.8	Very Dense	>400	194	>110	1528

Compiled By: M.Steyn Approved By: J.Steyn

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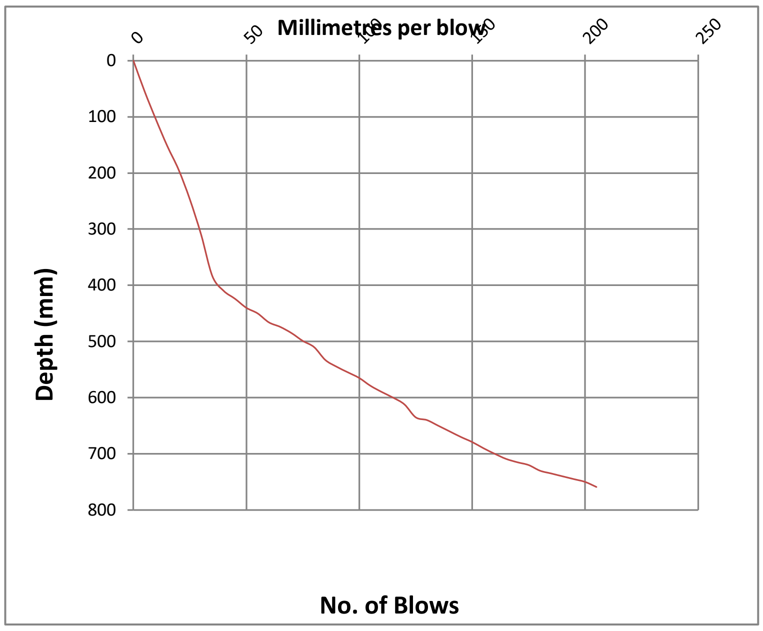
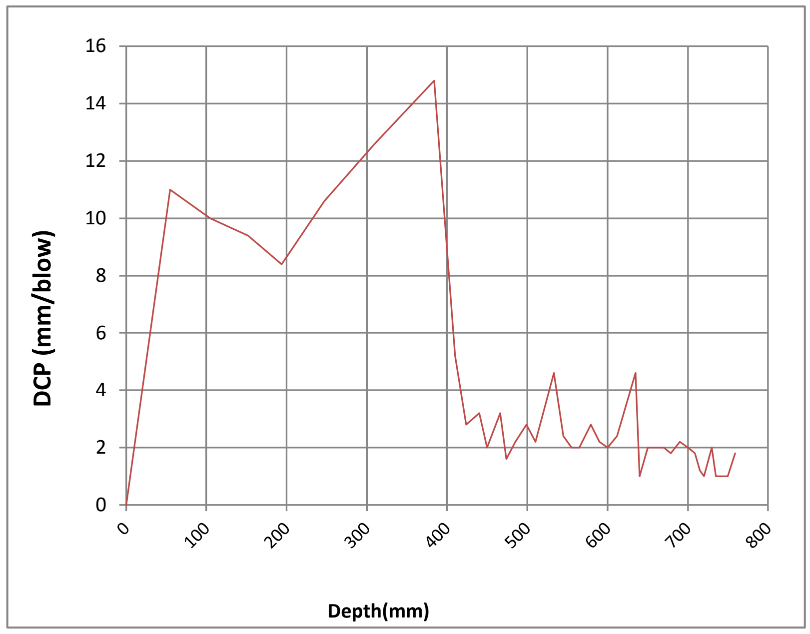
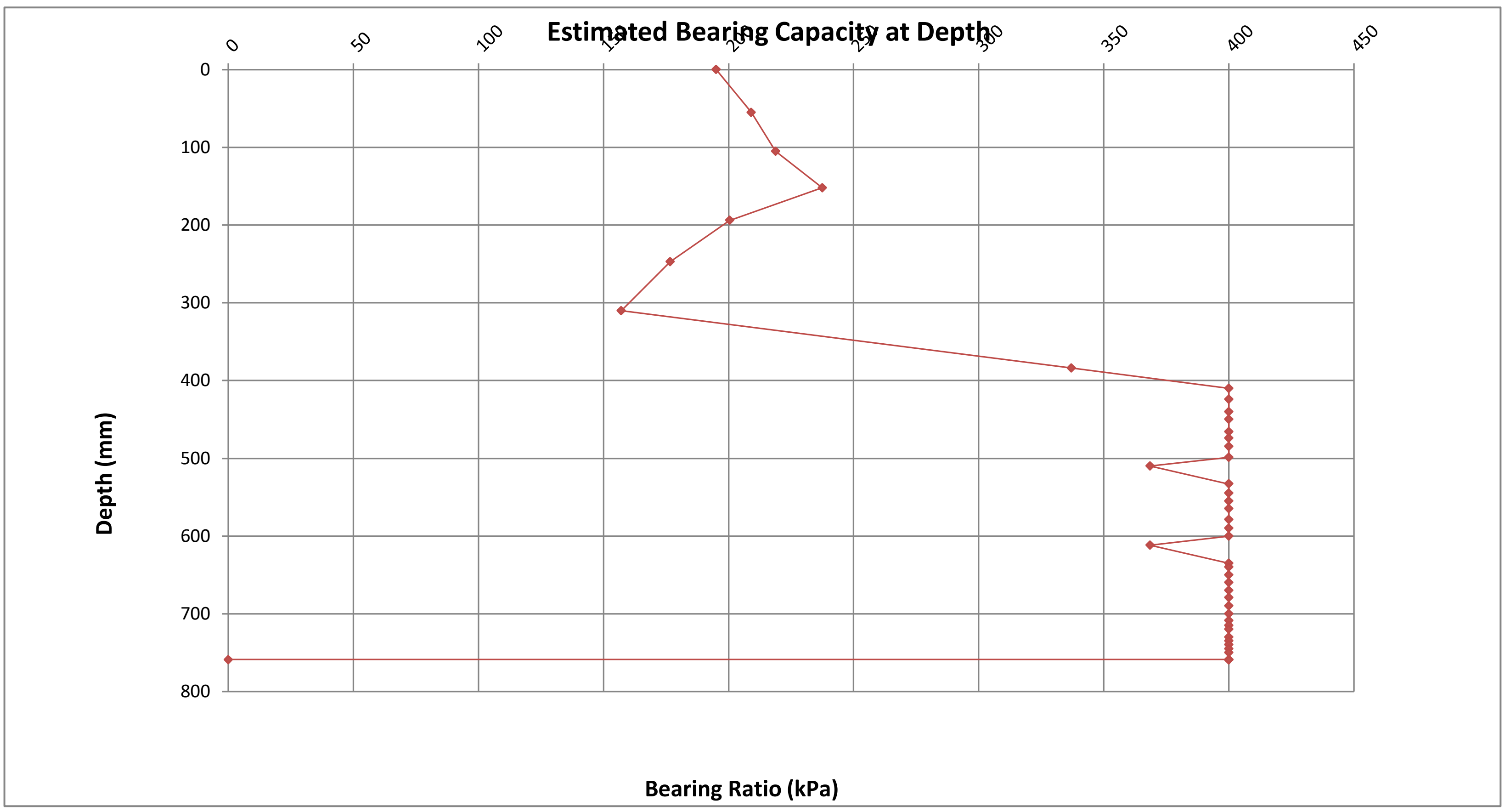
Client	KHATO CIVILS THENGA HOLDINGS JV	Tel:	0		
	Unit 10, Midway Industrial Park	Fax:	0		
	Centurian				
	0157		**1 & 2 BLO/ISC/32/1-1A**		
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 & 2 BLO/ISC/32/1-1B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 320mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	70	70	70	14.0	Medium Dense	164	14	14	163
10	95	95	25	5.0	Very Dense	347	53	57	502
15	105	105	10	2.0	Very Dense	>400	170	>110	1362
20	120	120	15	3.0	Very Dense	>400	102	110	876
25	139	139	19	3.8	Very Dense	>400	75	83	677
30	155	155	16	3.2	Very Dense	>400	94	104	816
35	161	161	6	1.2	Very Dense	>400	325	>110	2377
40	179	179	18	3.6	Very Dense	>400	81	89	718
45	190	190	11	2.2	Very Dense	>400	151	>110	1228
50	200	200	10	2.0	Very Dense	>400	170	>110	1362
55	210	210	10	2.0	Very Dense	>400	170	>110	1362
60	225	225	15	3.0	Very Dense	>400	102	110	876
65	235	235	10	2.0	Very Dense	>400	170	>110	1362
70	254	254	19	3.8	Very Dense	>400	75	83	677
75	265	265	11	2.2	Very Dense	>400	151	>110	1228
80	285	285	20	4.0	Very Dense	400	70	77	640
85	295	295	10	2.0	Very Dense	>400	170	>110	1362
90	305	305	10	2.0	Very Dense	>400	170	>110	1362
95	310	310	5	1.0	Very Dense	>400	410	>110	2900
100	315	315	5	1.0	Very Dense	>400	410	>110	2900
105	320	320	5	1.0	Very Dense	>400	410	>110	2900

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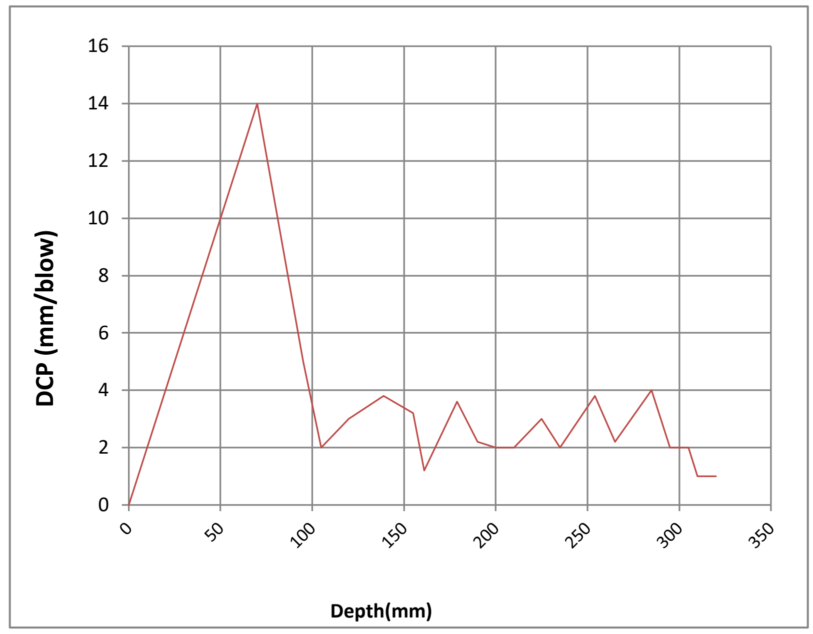
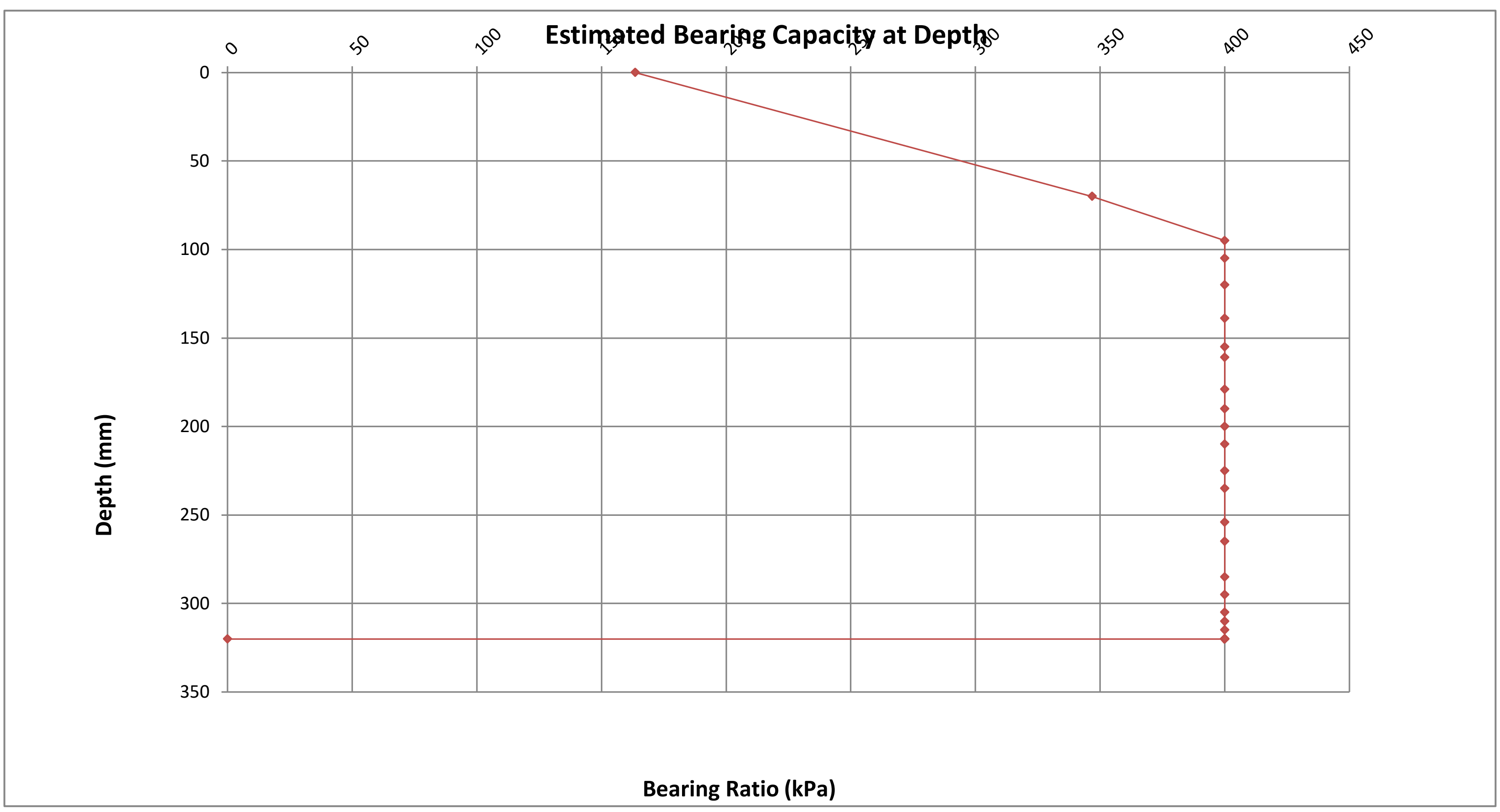
JOB No:	**N/A**	**Ref. No:**	**N/A**		**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV			Tel:	0	
	Unit 10, Midway Industrial Park			Fax:	0	
	Centurian					
	0157				**1 & 2 BLO/ISC/32/1-1B**	
Attention:	Mr Sandile Kunene					

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





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5. Data Capture : Mrs. M. Swart

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha **MATERIALS TECHNICIAN:** Mike
TEST POSITION: 1 & 2 BLO/ISC/32/1-1C **ASSISTANT** Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method) **STARTING DEPTH:** 0mm
MATERIAL TYPE: Sandy Materials **INSTRUMENT (DCP) SET No:** 28596
CONSTRUCTION TYPE: Road Construction **Max. penetration depth:** 1000 mm
Enviromental Conditions 23'C **LEVEL:** @ NGL
REFUSAL: 308mm **FOUNDATION:** @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	49	49	49	9.8	Dense	212	23	23	241
10	143	143	94	18.8	Medium Dense	132	10	10	118
15	168	168	25	5.0	Very Dense	347	53	57	502
20	190	190	22	4.4	Very Dense	381	62	68	577
25	207	207	17	3.4	Very Dense	>400	87	96	764
30	224	224	17	3.4	Very Dense	>400	87	96	764
35	241	241	17	3.4	Very Dense	>400	87	96	764
40	254	254	13	2.6	Very Dense	>400	122	>110	1023
45	267	267	13	2.6	Very Dense	>400	122	>110	1023
50	278	278	11	2.2	Very Dense	>400	151	>110	1228
55	287	287	9	1.8	Very Dense	>400	194	>110	1528
60	296	296	9	1.8	Very Dense	>400	194	>110	1528
65	299	299	3	0.6	Very Dense	>400	784	>110	5061
70	302	302	3	0.6	Very Dense	>400	784	>110	5061
75	305	305	3	0.6	Very Dense	>400	784	>110	5061
80	308	308	3	0.6	Very Dense	>400	784	>110	5061

Compiled By: M.Steyn Approved By: J.Steyn

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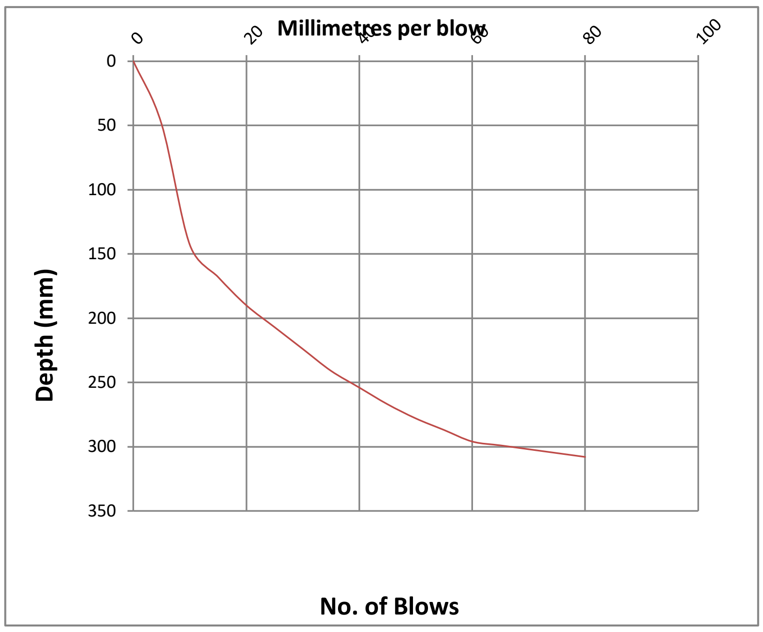
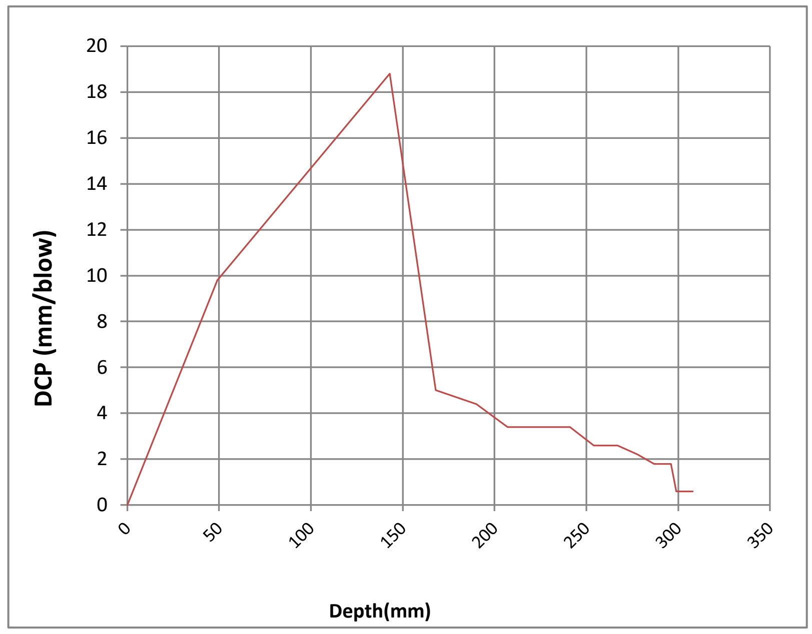
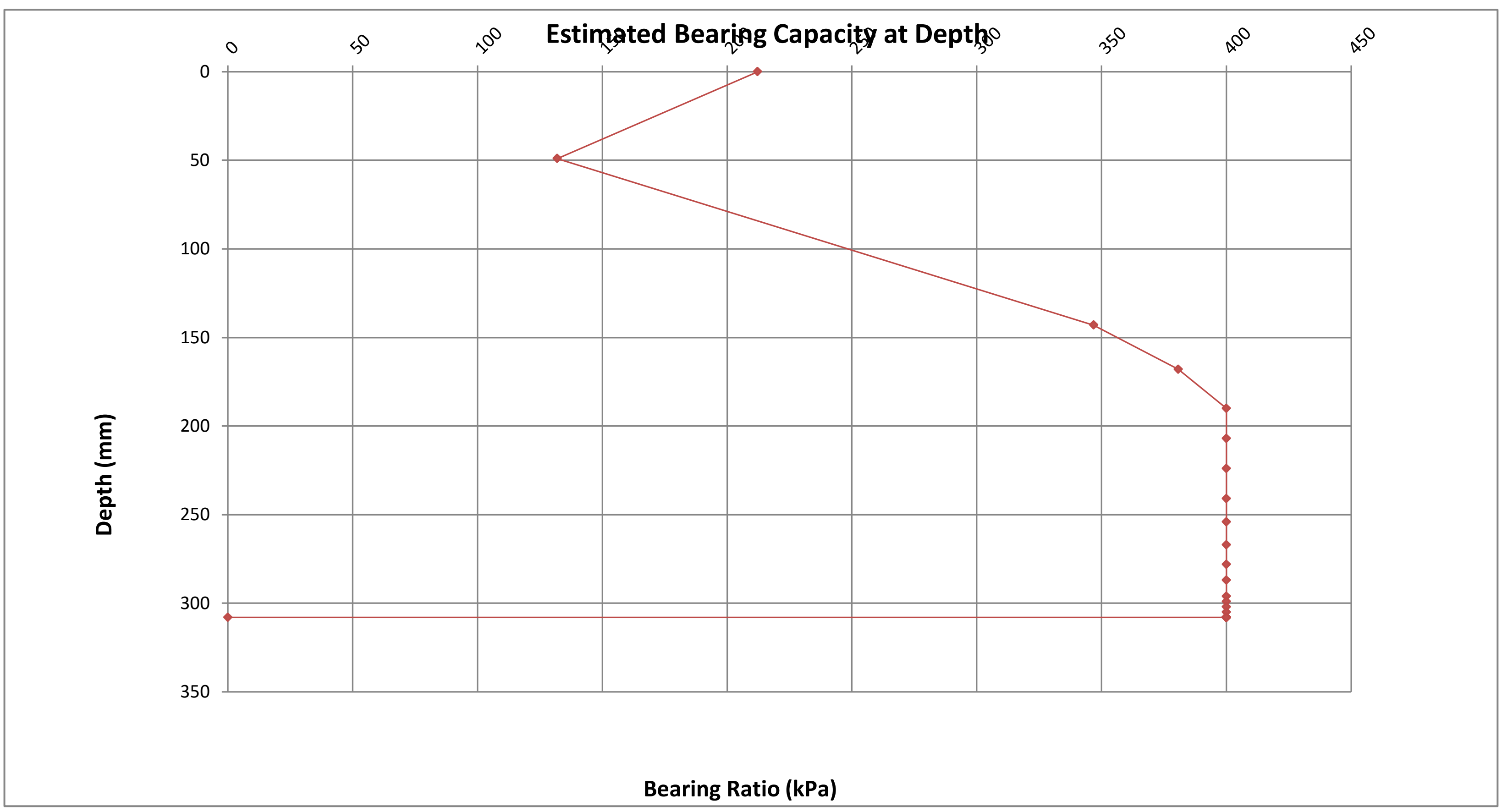
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV			Tel:	0
	Unit 10, Midway Industrial Park			Fax:	0
	Centurian				
	0157				**1 & 2 BLO/ISC/32/1-1C**
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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Lab Manager

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	Tippler - Saldanha	**MATERIALS TECHNICIAN:**	Mike
TEST POSITION:	**1 & 2 BLO/ISC/32/1-2A**	**ASSISTANT**	Thabang
TEST DEPTH:	DCP 1 m (This is a standard accreditated Method)	**STARTING DEPTH:**	0mm
MATERIAL TYPE:	Sandy Materials	**INSTRUMENT (DCP) SET No:**	28596
CONSTRUCTION TYPE:	Road Construction	**Max. penetration depth:**	1000 mm
Enviromental Conditions	23'C	**LEVEL:**	@ NGL
REFUSAL:	295mm	**FOUNDATION:**	@ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	80	80	80	16.0	Medium Dense	148	12	12	141
10	120	120	40	8.0	Dense	246	29	31	301
15	159	159	39	7.8	Dense	251	30	32	309
20	195	195	36	7.2	Dense	266	33	35	337
25	235	235	40	8.0	Dense	246	29	31	301
30	266	266	31	6.2	Dense	296	40	43	397
35	295	295	29	5.8	Dense	311	44	47	427

Compiled By: M.Steyn Approved By: J.Steyn

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JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
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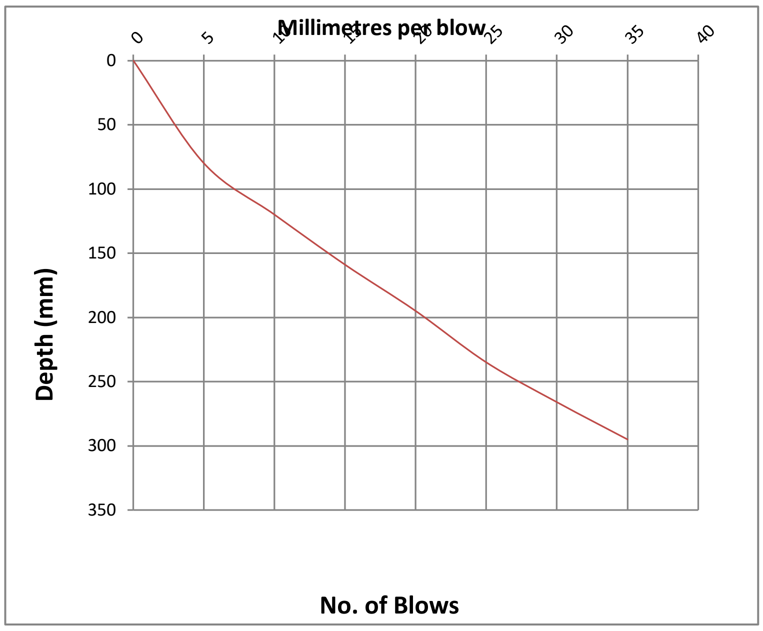
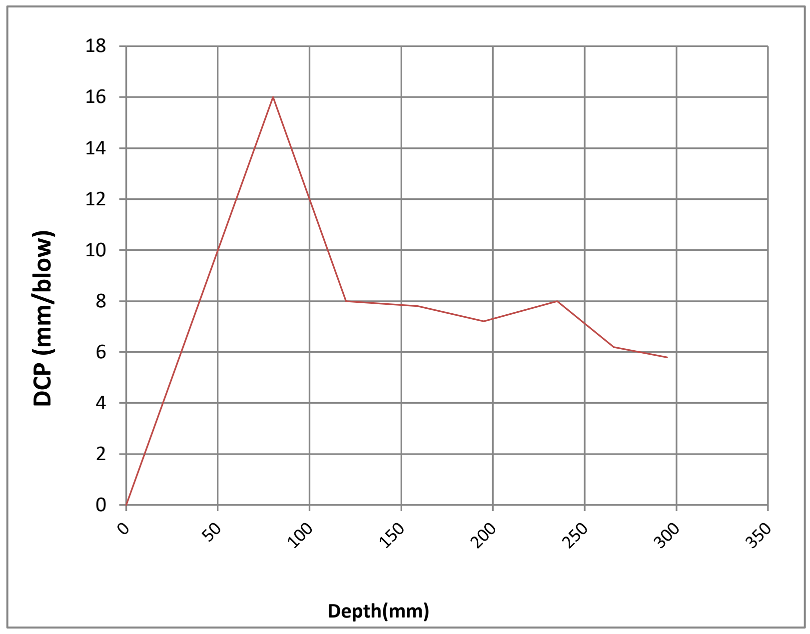
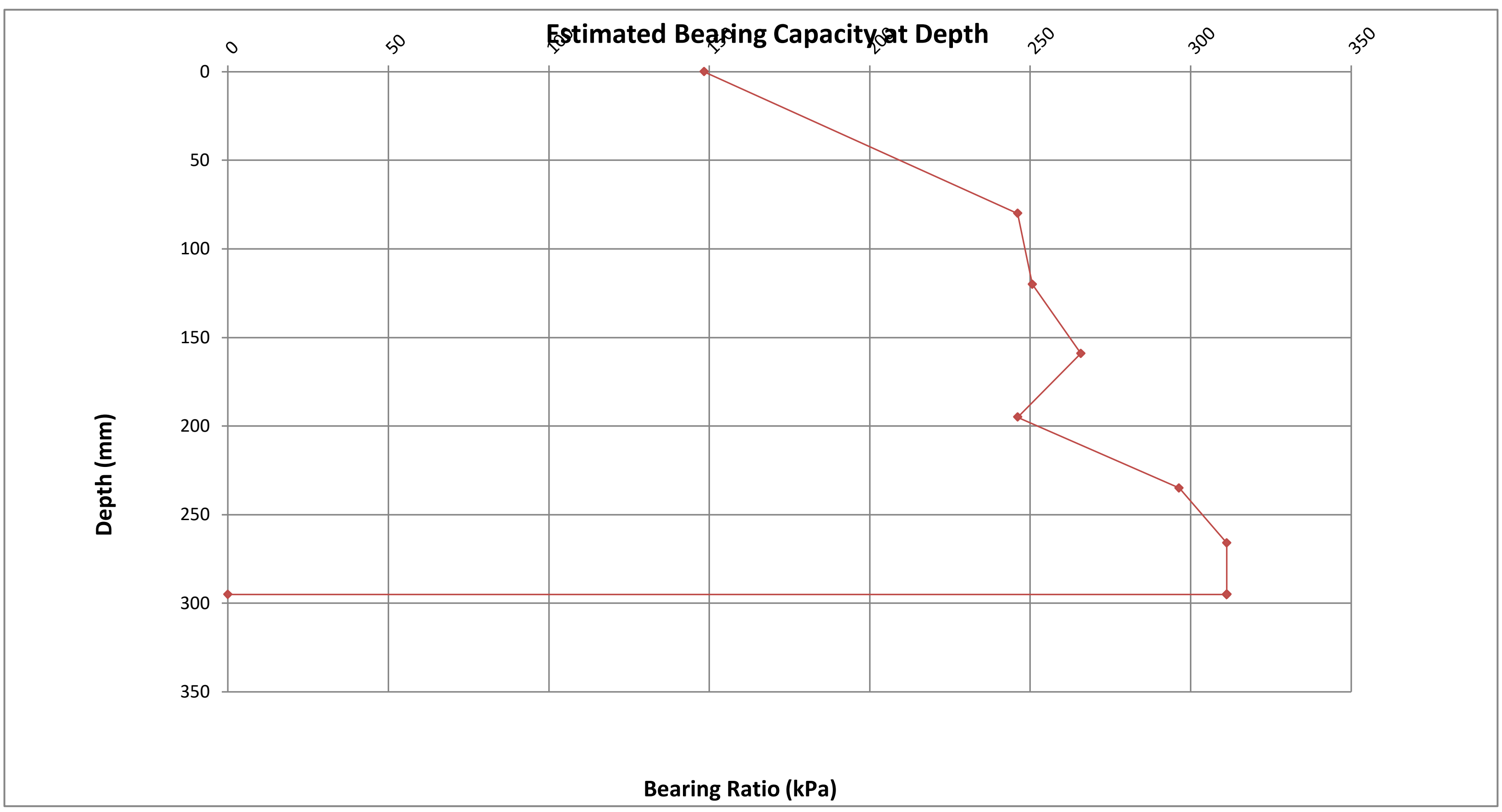
	Centurian				
	0157			**1 & 2 BLO/ISC/32/1-2A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: **1 & 2 BLO/ISC/32/1-2B**
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 325mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	74	74	74	14.8	Medium Dense	157	13	13	154
10	111	111	37	7.4	Dense	261	32	34	327
15	148	148	37	7.4	Dense	261	32	34	327
20	181	181	33	6.6	Dense	283	37	40	371
25	214	214	33	6.6	Dense	283	37	40	371
30	231	231	17	3.4	Very Dense	>400	87	96	764
35	246	246	15	3.0	Very Dense	>400	102	110	876
40	260	260	14	2.8	Very Dense	>400	111	>110	944
45	273	273	13	2.6	Very Dense	>400	122	>110	1023
50	284	284	11	2.2	Very Dense	>400	151	>110	1228
55	294	294	10	2.0	Very Dense	>400	170	>110	1362
60	301	301	7	1.4	Very Dense	>400	267	>110	2010
65	307	307	6	1.2	Very Dense	>400	325	>110	2377
70	313	313	6	1.2	Very Dense	>400	325	>110	2377
75	317	317	4	0.8	Very Dense	>400	544	>110	3699
80	320	320	3	0.6	Very Dense	>400	784	>110	5061
85	323	323	3	0.6	Very Dense	>400	784	>110	5061
90	325	325	2	0.4	Very Dense	>400	1313	>110	7873

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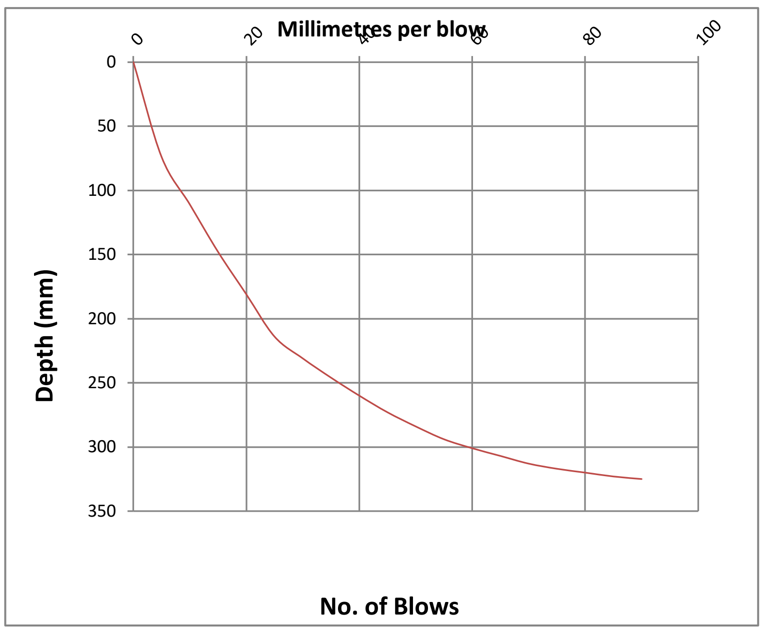
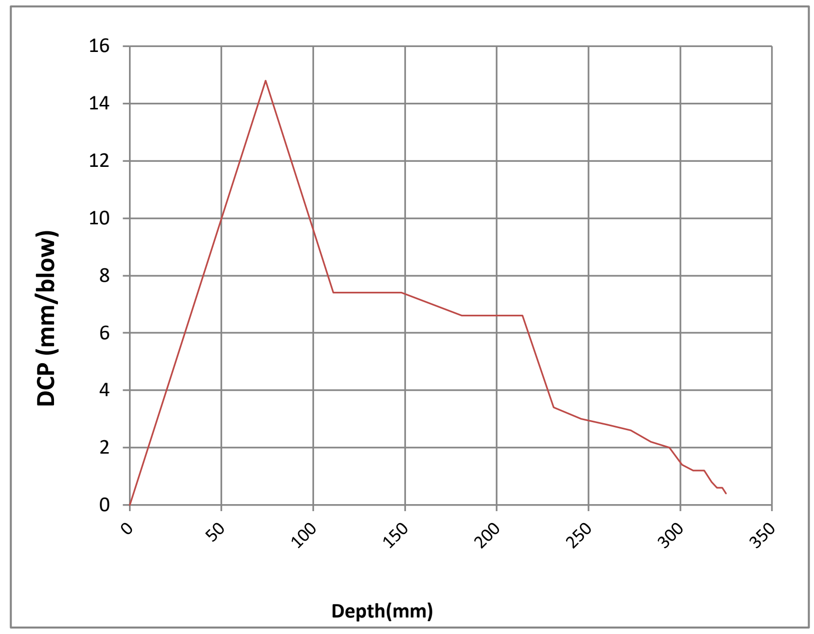
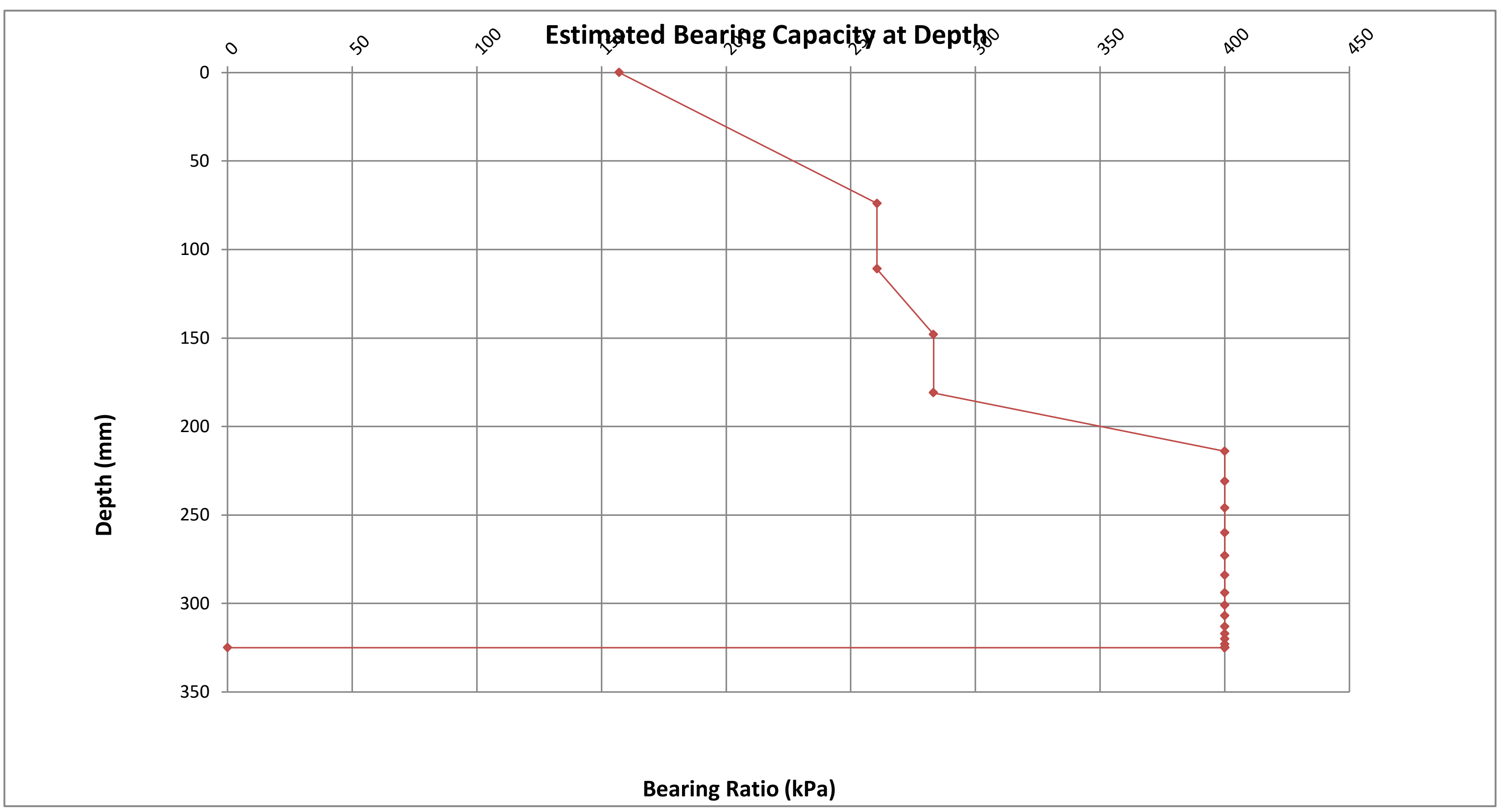
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**1 & 2 BLO/ISC/32/1-2B**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

Mr A Engel
Lab Manager

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Vat Reg No: 4670261090

JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: **1 & 2 BLO/ISC/32/1-3A**
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 322mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	90	90	90	18.0	Medium Dense	136	10	10	124
10	131	131	41	8.2	Dense	242	28	30	293
15	171	171	40	8.0	Dense	246	29	31	301
20	210	210	39	7.8	Dense	251	30	32	309
25	246	246	36	7.2	Dense	266	33	35	337
30	279	279	33	6.6	Dense	283	37	40	371
35	303	303	24	4.8	Very Dense	357	56	61	525
40	308	308	5	1.0	Very Dense	>400	410	>110	2900
45	312	312	4	0.8	Very Dense	>400	544	>110	3699
50	316	316	4	0.8	Very Dense	>400	544	>110	3699
55	317	317	1	0.2	Very Dense	>400	3166	>110	16760
60	322	322	5	1.0	Very Dense	>400	410	>110	2900

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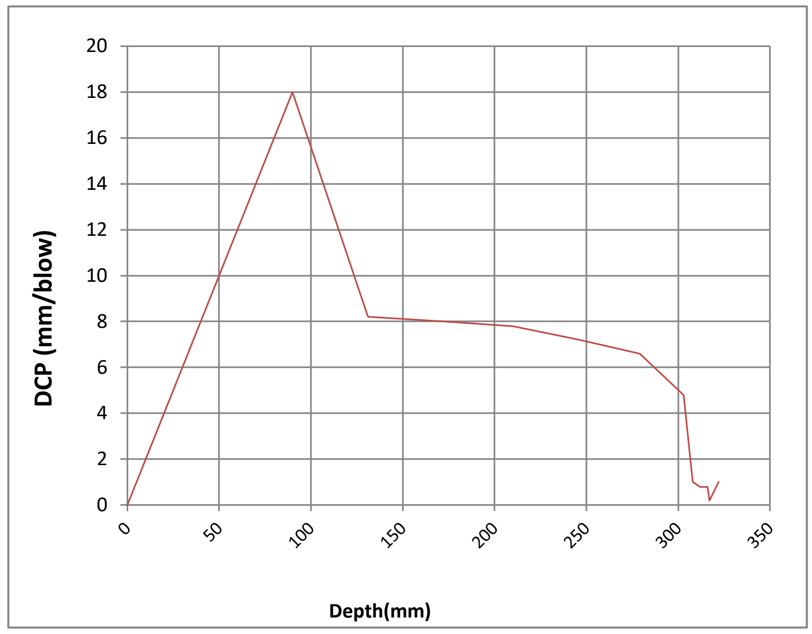
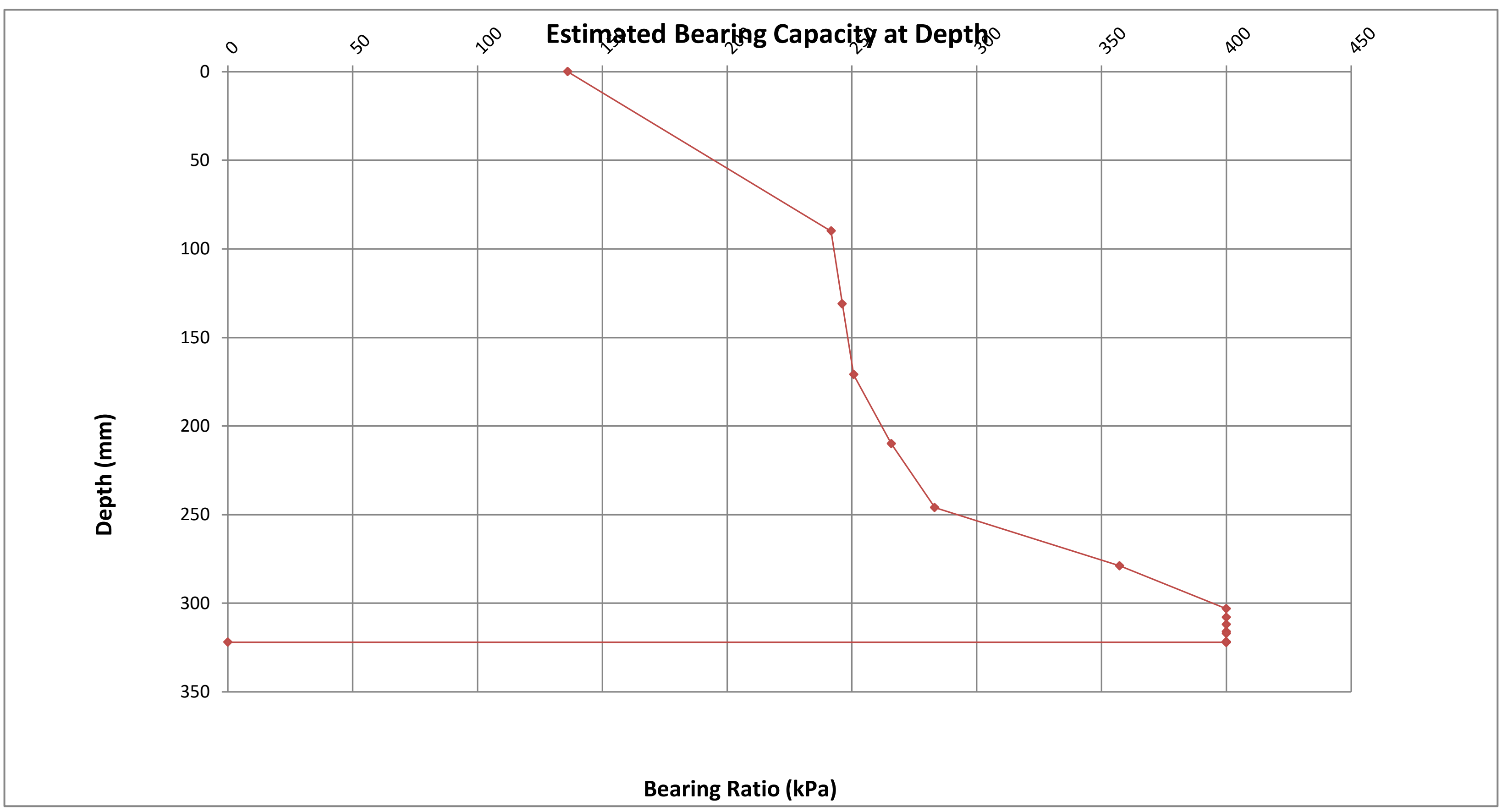
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**1 & 2 BLO/ISC/32/1-3A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 & 2 BLO/ISC/32/1-3B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 409mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	66	66	66	13.2	Medium Dense	171	15	16	174
10	113	113	47	9.4	Dense	219	24	25	252
15	160	160	47	9.4	Dense	219	24	25	252
20	200	200	40	8.0	Dense	246	29	31	301
25	236	236	36	7.2	Dense	266	33	35	337
30	266	266	30	6.0	Dense	304	42	45	411
35	291	291	25	5.0	Very Dense	347	53	57	502
40	311	311	20	4.0	Very Dense	400	70	77	640
45	327	327	16	3.2	Very Dense	>400	94	104	816
50	337	337	10	2.0	Very Dense	>400	170	>110	1362
55	348	348	11	2.2	Very Dense	>400	151	>110	1228
60	357	357	9	1.8	Very Dense	>400	194	>110	1528
65	366	366	9	1.8	Very Dense	>400	194	>110	1528
70	372	372	6	1.2	Very Dense	>400	325	>110	2377
75	379	379	7	1.4	Very Dense	>400	267	>110	2010
80	385	385	6	1.2	Very Dense	>400	325	>110	2377
85	391	391	6	1.2	Very Dense	>400	325	>110	2377
90	395	395	4	0.8	Very Dense	>400	544	>110	3699
95	400	400	5	1.0	Very Dense	>400	410	>110	2900
100	404	404	4	0.8	Very Dense	>400	544	>110	3699
105	406	406	2	0.4	Very Dense	>400	1313	>110	7873
110	409	409	3	0.6	Very Dense	>400	784	>110	5061

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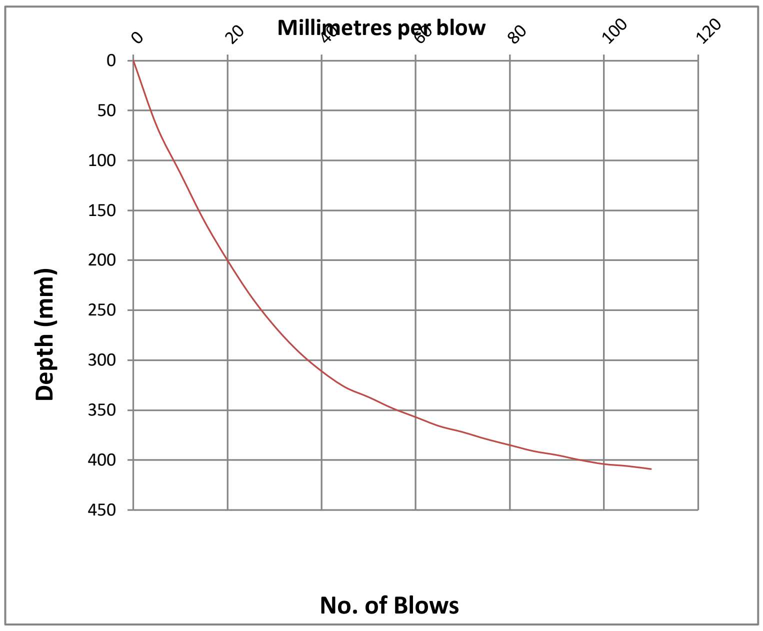
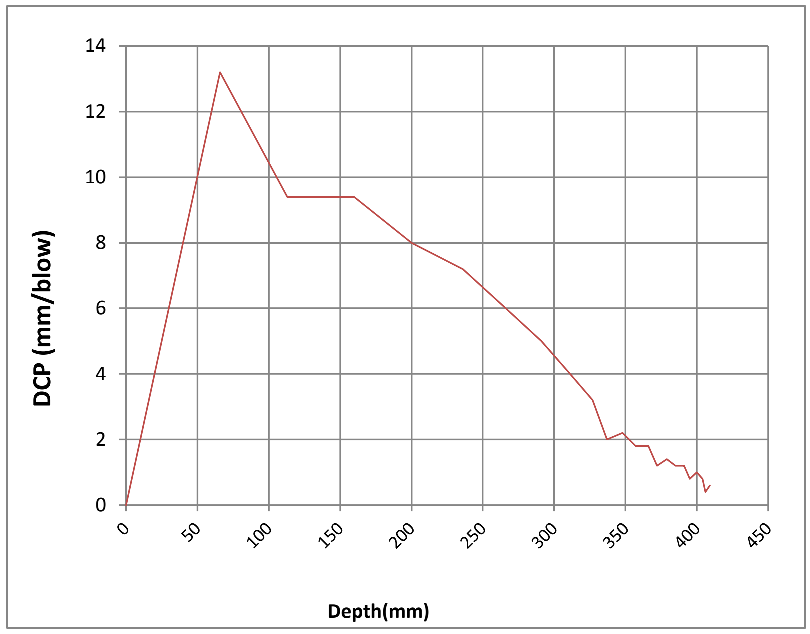
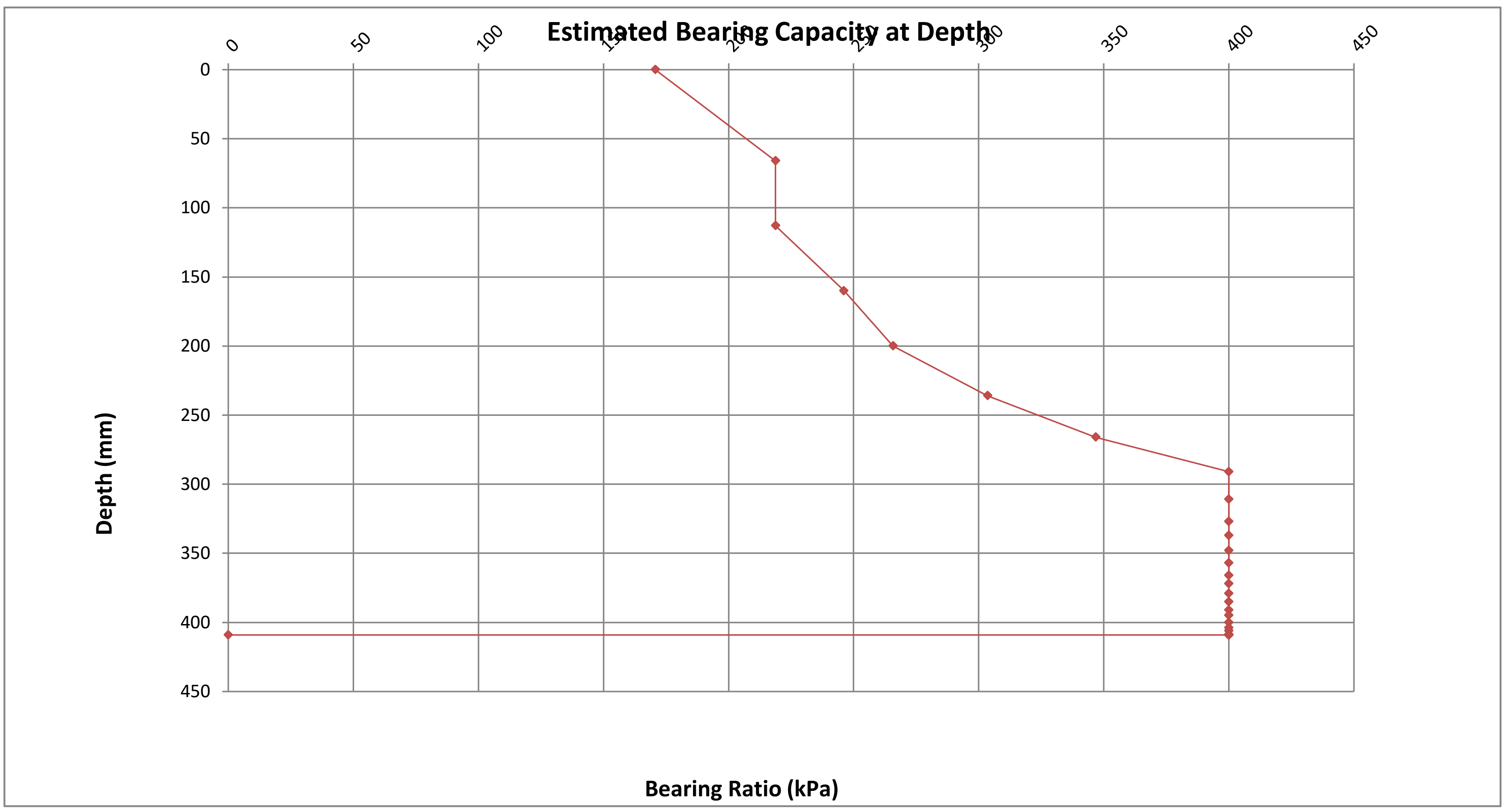
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**1 & 2 BLO/ISC/32/1-3B**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	Tippler - Saldanha	**MATERIALS TECHNICIAN:**	Mike
TEST POSITION:	**1 & 2 BLO/ISC/32/1-4A**	**ASSISTANT**	Thabang
TEST DEPTH:	DCP 1 m (This is a standard accreditated Method)	**STARTING DEPTH:**	0mm
MATERIAL TYPE:	Sandy Materials	**INSTRUMENT (DCP) SET No:**	28596
CONSTRUCTION TYPE:	Road Construction	**Max. penetration depth:**	1000 mm
Enviromental Conditions	23'C	**LEVEL:**	@ NGL
REFUSAL:	379mm	**FOUNDATION:**	@ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	72	72	72	14.4	Medium Dense	160	14	14	158
10	109	109	37	7.4	Dense	261	32	34	327
15	148	148	39	7.8	Dense	251	30	32	309
20	184	184	36	7.2	Dense	266	33	35	337
25	220	220	36	7.2	Dense	266	33	35	337
30	254	254	34	6.8	Dense	277	36	38	359
35	287	287	33	6.6	Dense	283	37	40	371
40	317	317	30	6.0	Dense	304	42	45	411
45	344	344	27	5.4	Dense	328	48	52	461
50	352	352	8	1.6	Very Dense	>400	226	>110	1737
55	363	363	11	2.2	Very Dense	>400	151	>110	1228
60	369	369	6	1.2	Very Dense	>400	325	>110	2377
65	373	373	4	0.8	Very Dense	>400	544	>110	3699
70	376	376	3	0.6	Very Dense	>400	784	>110	5061
75	379	379	3	0.6	Very Dense	>400	784	>110	5061

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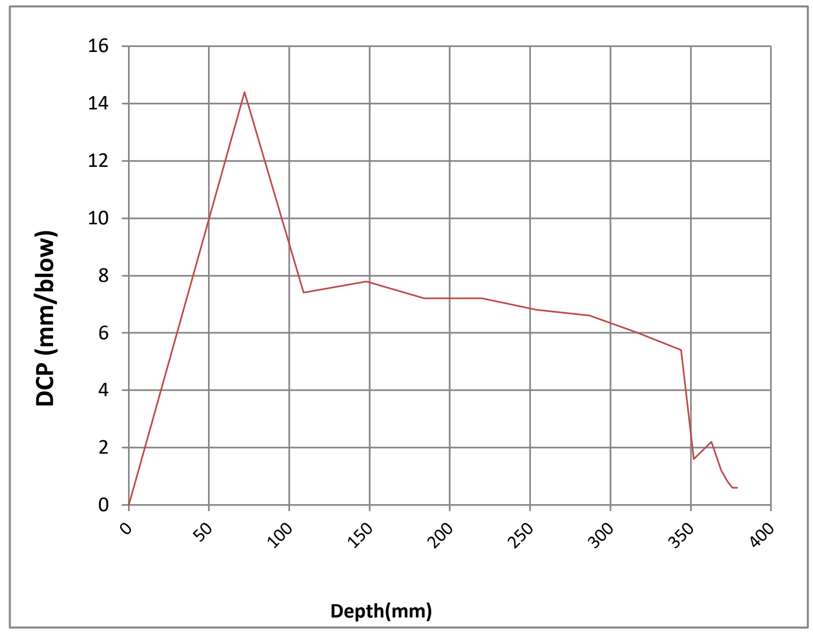
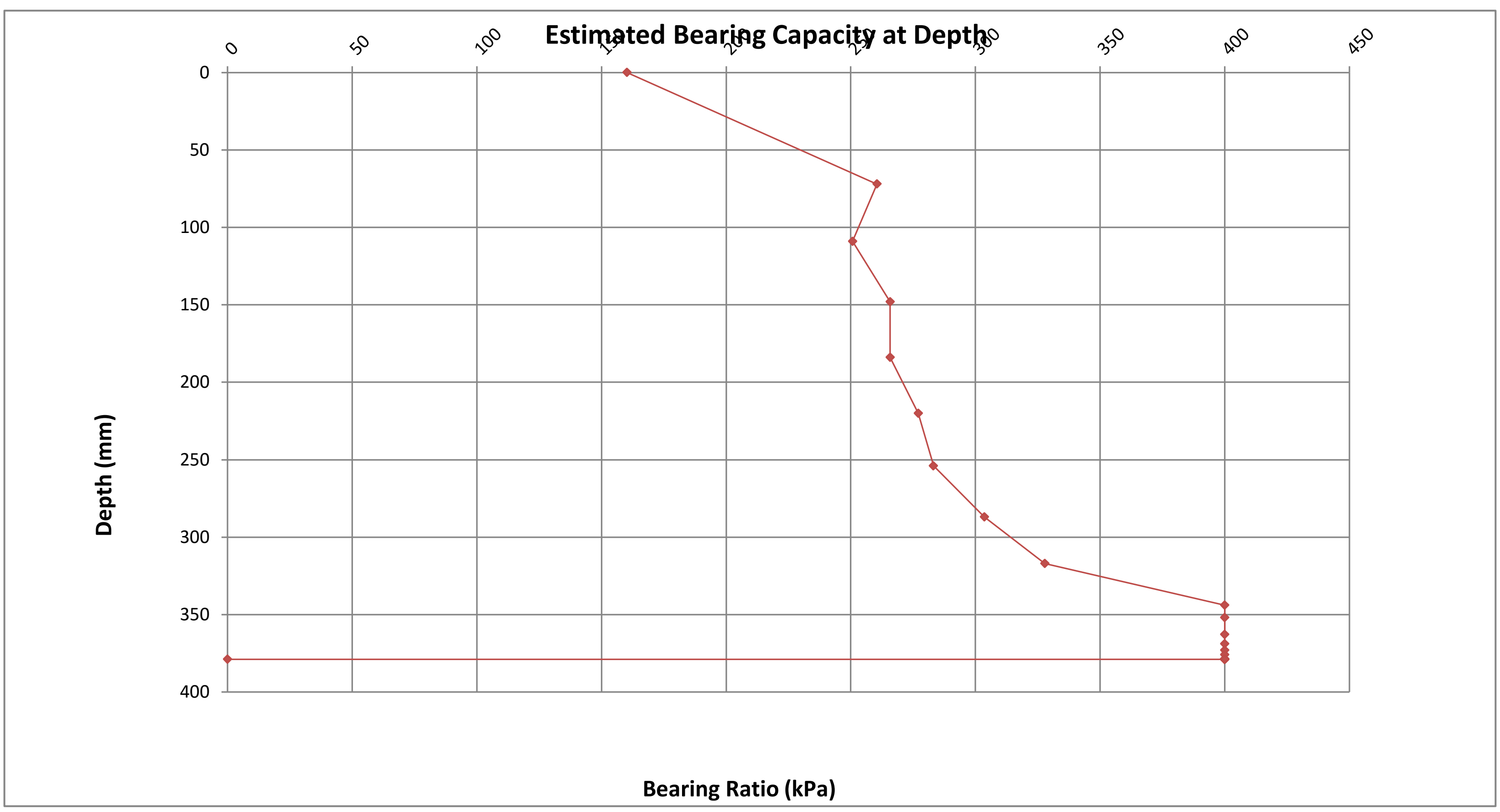
	Centurian				
	0157			**1 & 2 BLO/ISC/32/1-4A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





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Lab Manager

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Vat Reg No: 4670261090

JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 & 2 BLO/ISC/32/1-4B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 266mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	99	99	99	19.8	Medium Dense	127	9	9	112
10	128	128	29	5.8	Dense	311	44	47	427
15	154	154	26	5.2	Dense	337	51	54	481
20	176	176	22	4.4	Very Dense	381	62	68	577
25	193	193	17	3.4	Very Dense	>400	87	96	764
30	207	207	14	2.8	Very Dense	>400	111	>110	944
35	220	220	13	2.6	Very Dense	>400	122	>110	1023
40	226	226	6	1.2	Very Dense	>400	325	>110	2377
45	230	230	4	0.8	Very Dense	>400	544	>110	3699
50	233	233	3	0.6	Very Dense	>400	784	>110	5061
55	239	239	6	1.2	Very Dense	>400	325	>110	2377
60	245	245	6	1.2	Very Dense	>400	325	>110	2377
65	252	252	7	1.4	Very Dense	>400	267	>110	2010
70	257	257	5	1.0	Very Dense	>400	410	>110	2900
75	260	260	3	0.6	Very Dense	>400	784	>110	5061
80	266	266	6	1.2	Very Dense	>400	325	>110	2377

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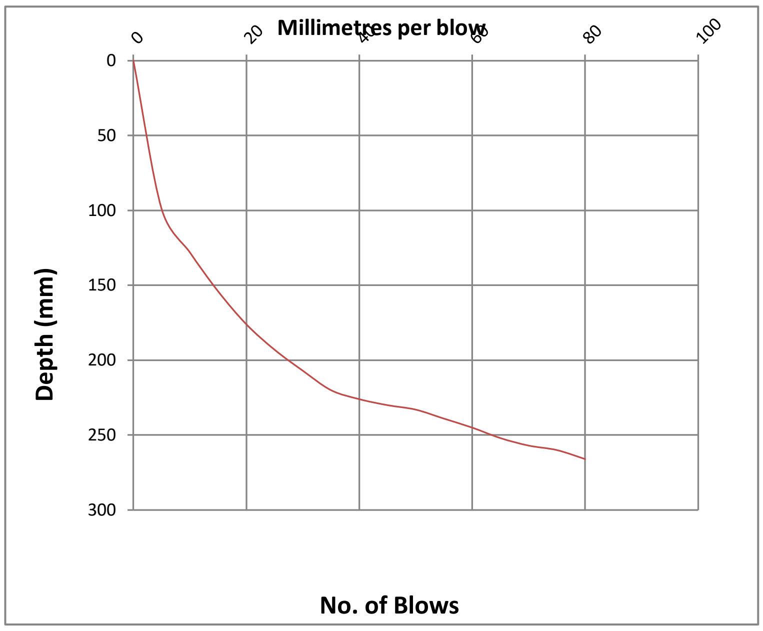
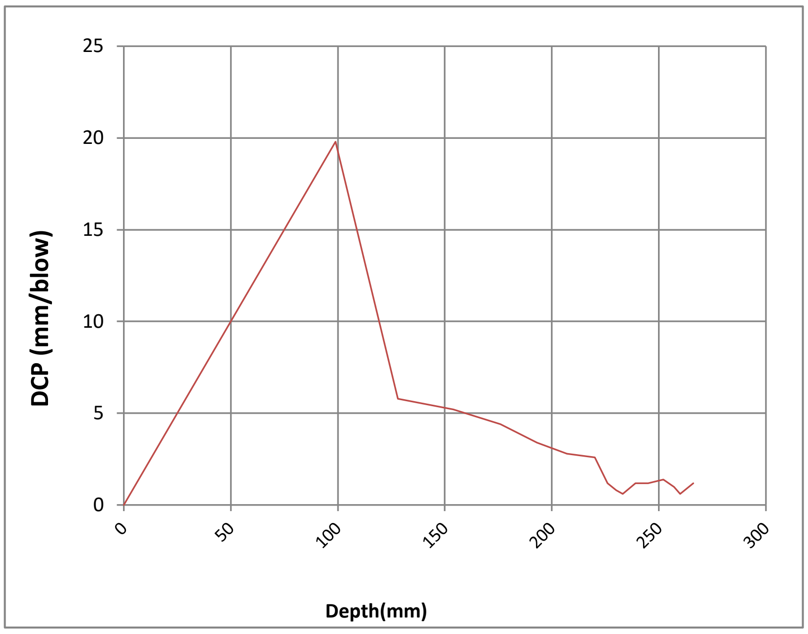
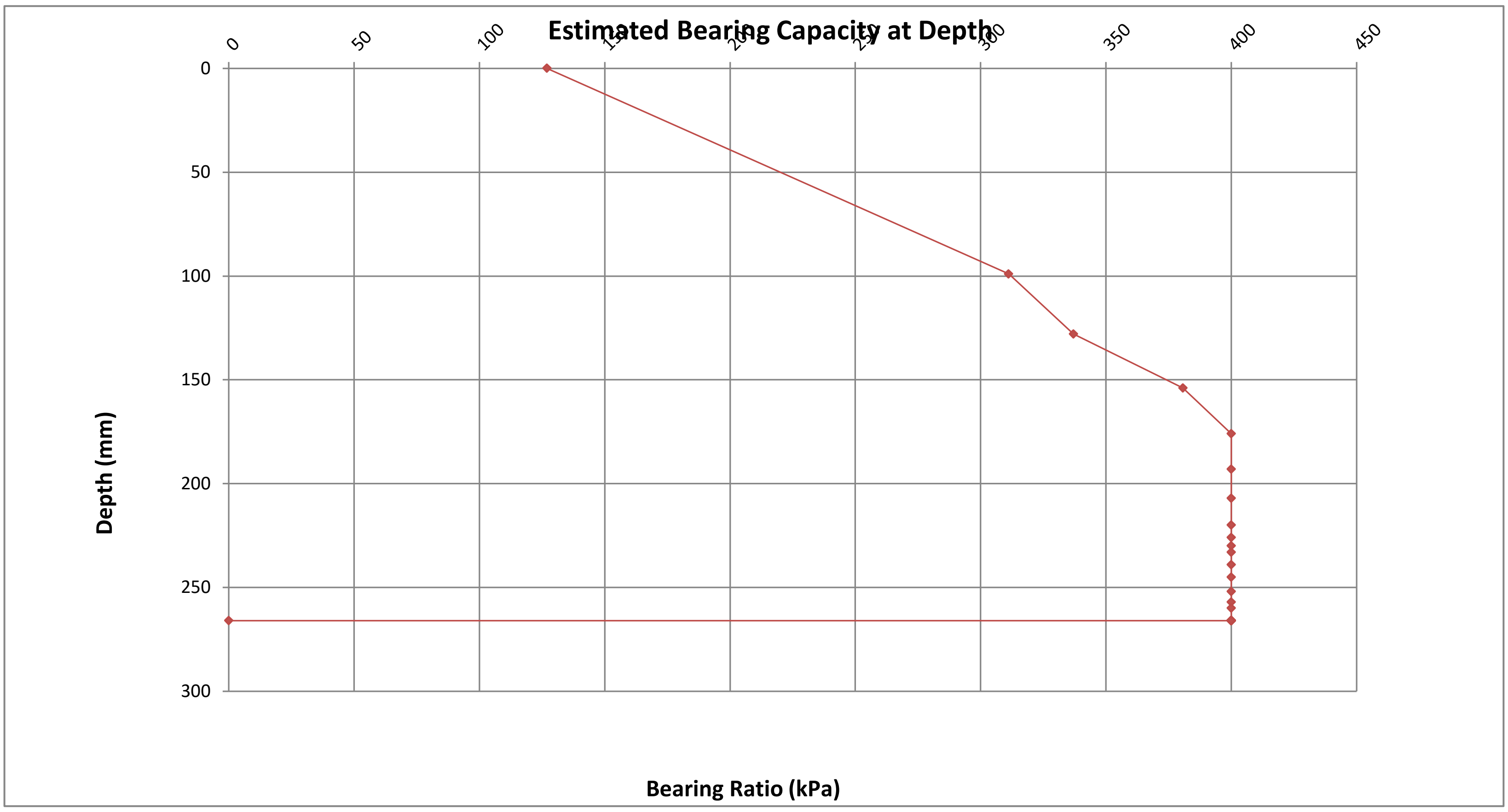
	Centurian				
	0157			**1 & 2 BLO/ISC/32/1-4B**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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Mr A Engel
Lab Manager

1 BLO-ISC 32-2

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
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Centurian
0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha **MATERIALS TECHNICIAN:** Mike
TEST POSITION: 1 BLO/ISC/32/2-1A **ASSISTANT** Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method) **STARTING DEPTH:** 0mm
MATERIAL TYPE: Sandy Materials **INSTRUMENT (DCP) SET No:** 28596
CONSTRUCTION TYPE: Road Construction **Max. penetration depth:** 1000 mm
Enviromental Conditions 23'C **LEVEL:** @ NGL
REFUSAL: 689mm **FOUNDATION:** @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x\,(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x\,(dn)^{-1.09}$
0	0	0	0	0					
5	90	90	90	18.0	Medium Dense	136	10	10	124
10	130	130	40	8.0	Dense	246	29	31	301
15	160	160	30	6.0	Dense	304	42	45	411
20	199	199	39	7.8	Dense	251	30	32	309
25	250	250	51	10.2	Dense	206	21	22	231
30	295	295	45	9.0	Dense	226	25	26	264
35	330	330	35	7.0	Dense	271	35	37	348
40	365	365	35	7.0	Dense	271	35	37	348
45	395	395	30	6.0	Dense	304	42	45	411
50	420	420	25	5.0	Very Dense	347	53	57	502
55	450	450	30	6.0	Dense	304	42	45	411
60	477	477	27	5.4	Dense	328	48	52	461
65	502	502	25	5.0	Very Dense	347	53	57	502
70	525	525	23	4.6	Very Dense	369	59	64	550
75	565	565	40	8.0	Dense	246	29	31	301
80	584	584	19	3.8	Very Dense	>400	75	83	677
85	609	609	25	5.0	Very Dense	347	53	57	502
90	625	625	16	3.2	Very Dense	>400	94	104	816
95	640	640	15	3.0	Very Dense	>400	102	110	876
100	650	650	10	2.0	Very Dense	>400	170	>110	1362
105	655	655	5	1.0	Very Dense	>400	410	>110	2900
110	660	660	5	1.0	Very Dense	>400	410	>110	2900
115	665	665	5	1.0	Very Dense	>400	410	>110	2900
120	670	670	5	1.0	Very Dense	>400	410	>110	2900
125	679	679	9	1.8	Very Dense	>400	194	>110	1528
130	684	684	5	1.0	Very Dense	>400	410	>110	2900
135	689	689	5	1.0	Very Dense	>400	410	>110	2900

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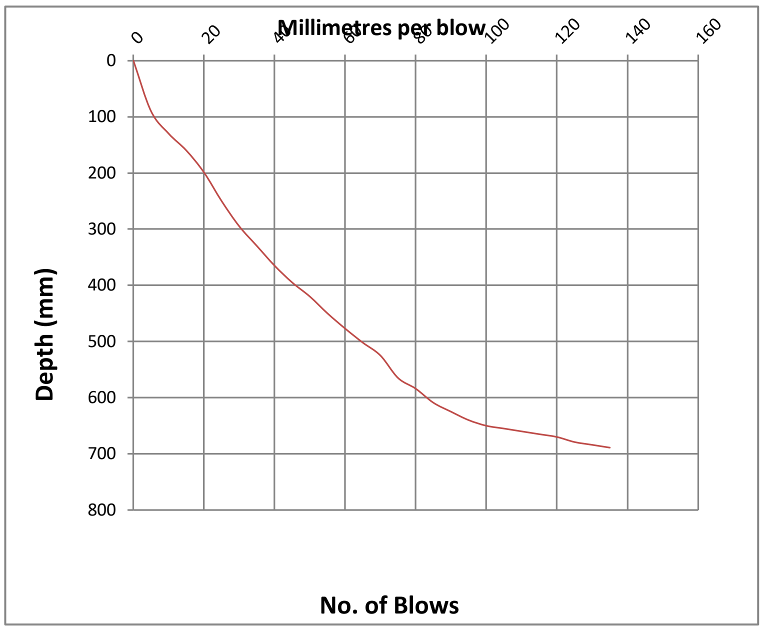
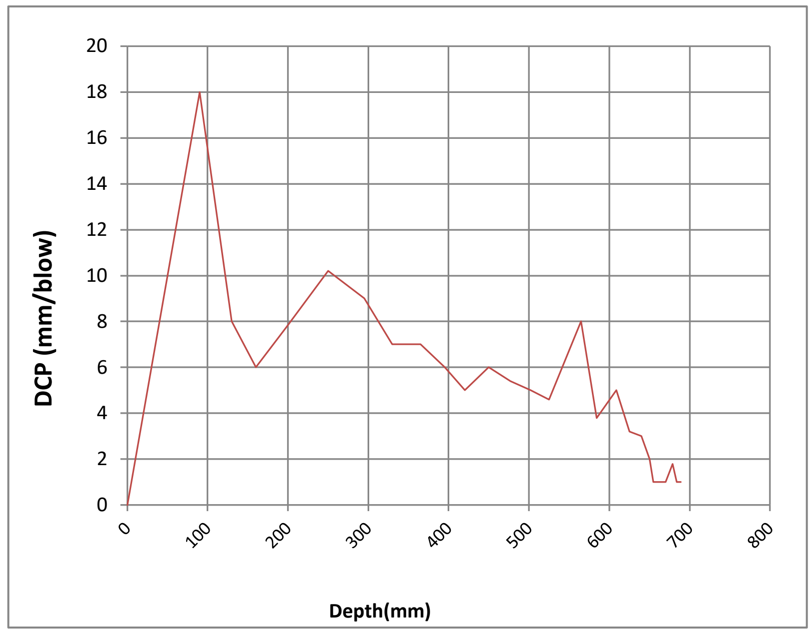
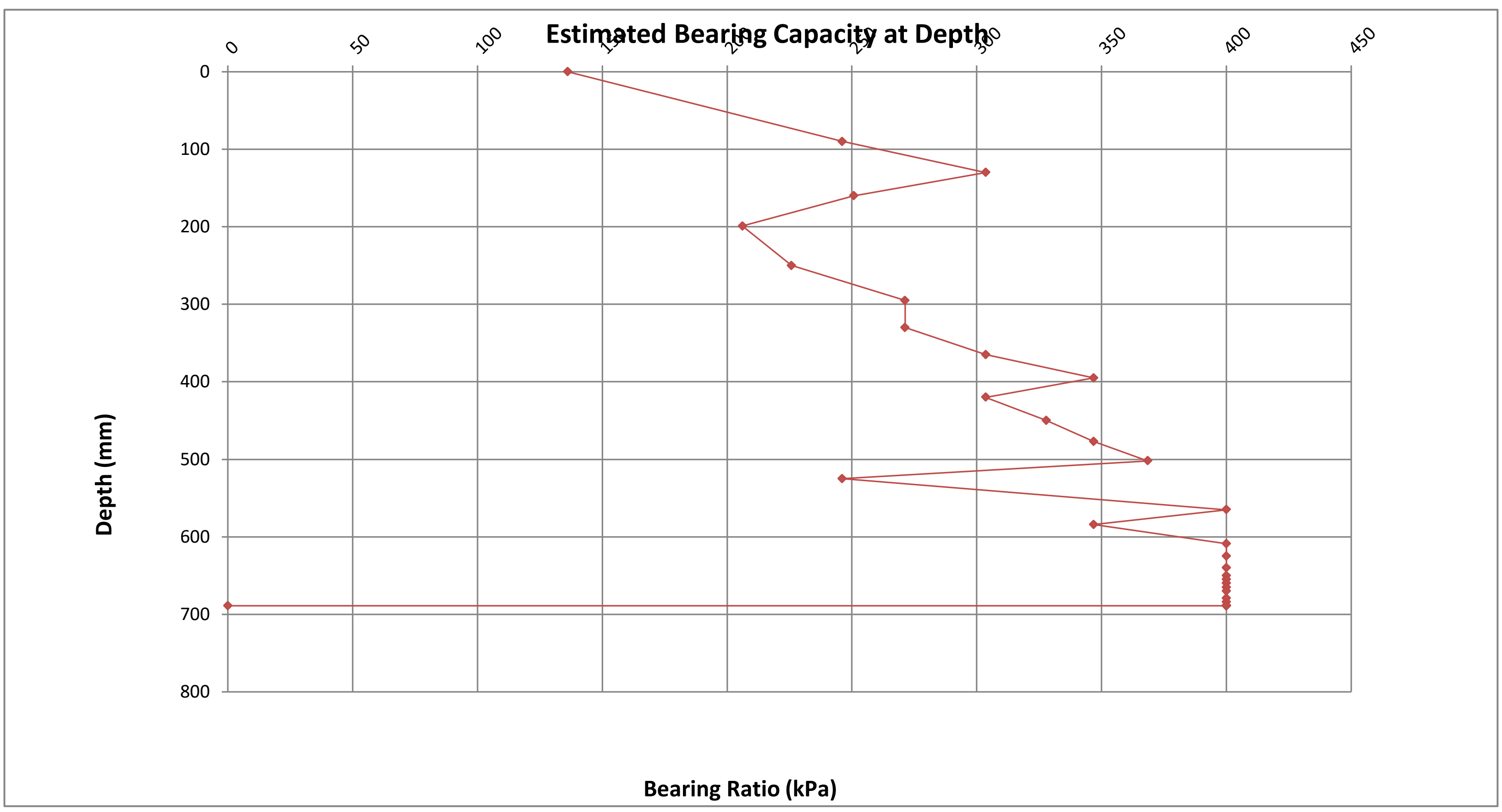
Client	KHATO CIVILS THENGA HOLDINGS JV	Tel:	0		
	Unit 10, Midway Industrial Park	Fax:	0		
	Centurian				
	0157			**1 BLO/ISC/32/2-1A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

Mr A Engel
Lab Manager

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Vat Reg No: 4670261090

JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC/32/2-1B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 674mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	84	84	84	16.8	Medium Dense	143	11	11	134
10	126	126	42	8.4	Dense	237	27	29	285
15	167	167	41	8.2	Dense	242	28	30	293
20	211	211	44	8.8	Dense	230	26	27	271
25	255	255	44	8.8	Dense	230	26	27	271
30	296	296	41	8.2	Dense	242	28	30	293
35	333	333	37	7.4	Dense	261	32	34	327
40	368	368	35	7.0	Dense	271	35	37	348
45	404	404	36	7.2	Dense	266	33	35	337
50	437	437	33	6.6	Dense	283	37	40	371
55	466	466	29	5.8	Dense	311	44	47	427
60	493	493	27	5.4	Dense	328	48	52	461
65	525	525	32	6.4	Dense	290	39	41	383
70	551	551	26	5.2	Dense	337	51	54	481
75	575	575	24	4.8	Very Dense	357	56	61	525
80	597	597	22	4.4	Very Dense	381	62	68	577
85	614	614	17	3.4	Very Dense	>400	87	96	764
90	627	627	13	2.6	Very Dense	>400	122	>110	1023
95	643	643	16	3.2	Very Dense	>400	94	104	816
100	655	655	12	2.4	Very Dense	>400	135	>110	1117
105	660	660	5	1.0	Very Dense	>400	410	>110	2900
110	666	666	6	1.2	Very Dense	>400	325	>110	2377
115	671	671	5	1.0	Very Dense	>400	410	>110	2900
120	674	674	3	0.6	Very Dense	>400	784	>110	5061

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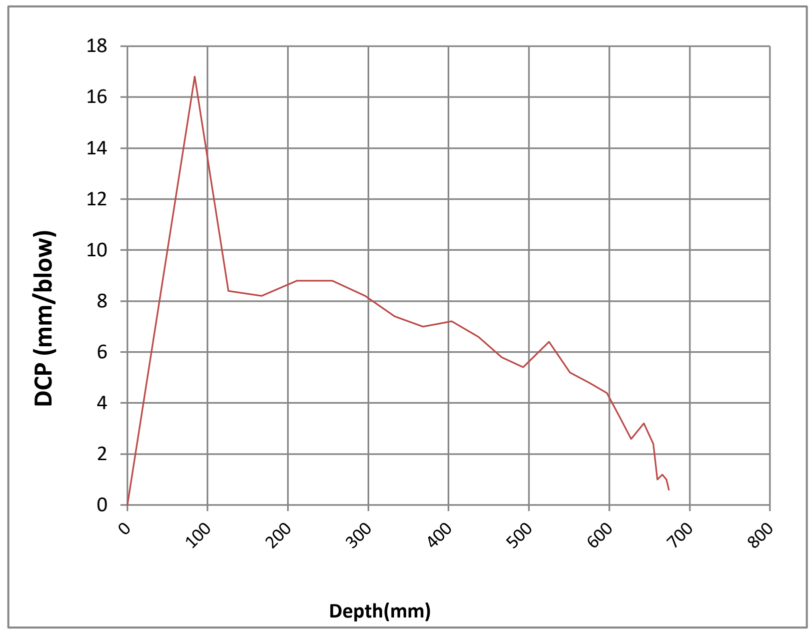
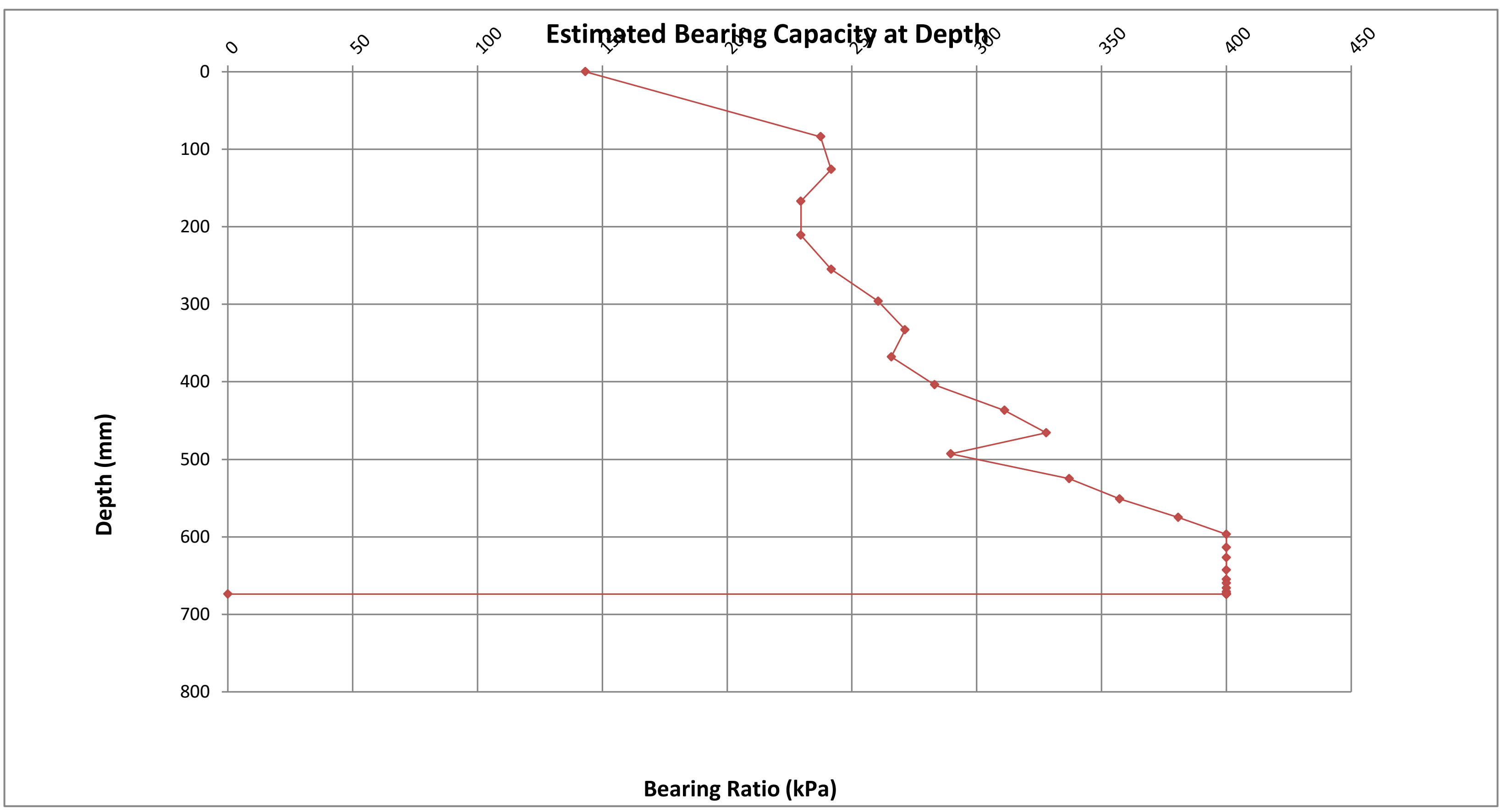
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV			Tel:	0
	Unit 10, Midway Industrial Park			Fax:	0
	Centurian				
	0157			**1 BLO/ISC/32/2-1B**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





Remarks:

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC/32/2-2A
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 999mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	80	80	80	16.0	Medium Dense	148	12	12	141
10	124	124	44	8.8	Dense	230	26	27	271
15	160	160	36	7.2	Dense	266	33	35	337
20	190	190	30	6.0	Dense	304	42	45	411
25	210	210	20	4.0	Very Dense	400	70	77	640
30	230	230	20	4.0	Very Dense	400	70	77	640
35	260	260	30	6.0	Dense	304	42	45	411
40	285	285	25	5.0	Very Dense	347	53	57	502
45	310	310	25	5.0	Very Dense	347	53	57	502
50	340	340	30	6.0	Dense	304	42	45	411
55	365	365	25	5.0	Very Dense	347	53	57	502
60	396	396	31	6.2	Dense	296	40	43	397
65	421	421	25	5.0	Very Dense	347	53	57	502
70	445	445	24	4.8	Very Dense	357	56	61	525
75	470	470	25	5.0	Very Dense	347	53	57	502
80	490	490	20	4.0	Very Dense	400	70	77	640
85	510	510	20	4.0	Very Dense	400	70	77	640
90	534	534	24	4.8	Very Dense	357	56	61	525
95	555	555	21	4.2	Very Dense	394	66	72	607
100	579	579	24	4.8	Very Dense	357	56	61	525
105	604	604	25	5.0	Very Dense	347	53	57	502
110	630	630	26	5.2	Dense	337	51	54	481
115	655	655	25	5.0	Very Dense	347	53	57	502
120	680	680	25	5.0	Very Dense	347	53	57	502
125	710	710	30	6.0	Dense	304	42	45	411
130	740	740	30	6.0	Dense	304	42	45	411
135	780	780	40	8.0	Dense	246	29	31	301
140	820	820	40	8.0	Dense	246	29	31	301
145	854	854	34	6.8	Dense	277	36	38	359
150	880	880	26	5.2	Dense	337	51	54	481
155	905	905	25	5.0	Very Dense	347	53	57	502
160	925	925	20	4.0	Very Dense	400	70	77	640
165	940	940	15	3.0	Very Dense	>400	102	110	876
170	955	955	15	3.0	Very Dense	>400	102	110	876
175	970	970	15	3.0	Very Dense	>400	102	110	876
180	989	989	19	3.8	Very Dense	>400	75	83	677
185	999	999	10	2.0	Very Dense	>400	170	>110	1362

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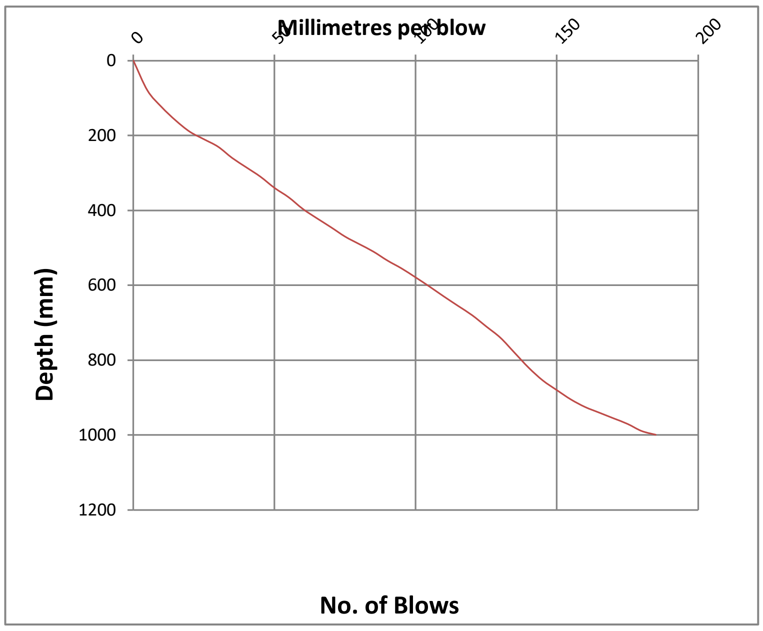
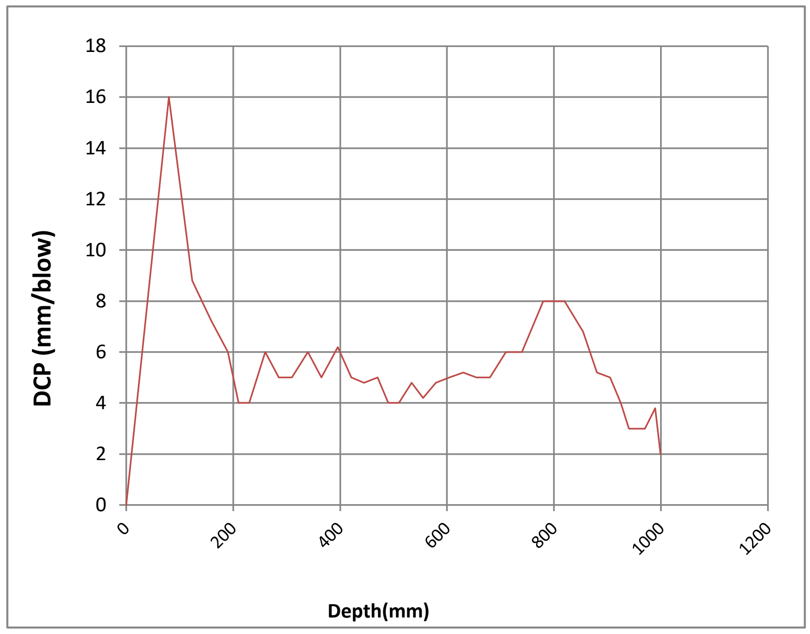
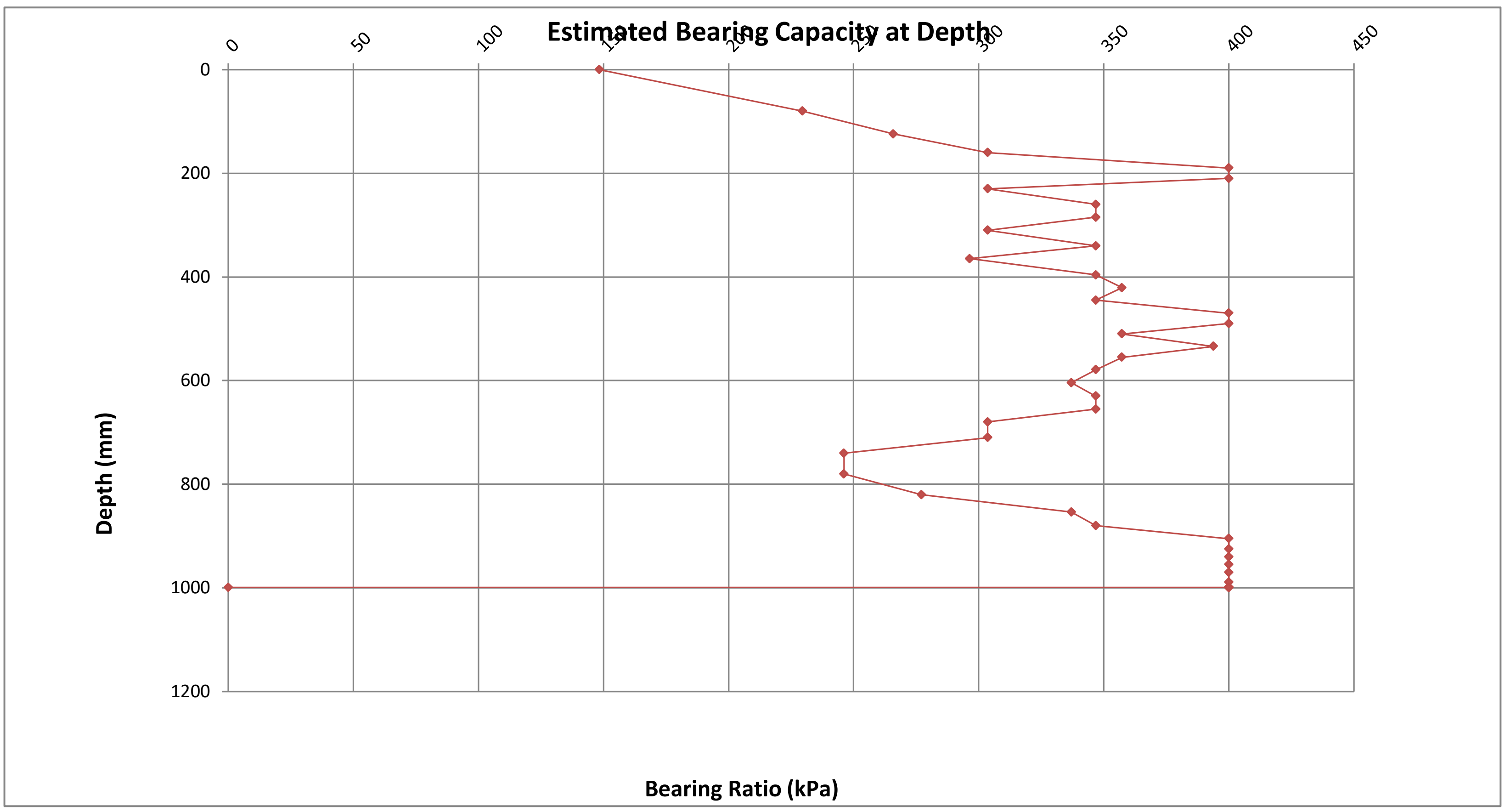
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**1 BLO/ISC/32/2-2A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC/32/2-2B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 780mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	85	85	85	17.0	Medium Dense	142	11	11	132
10	145	145	60	12.0	Dense	183	17	18	193
15	195	195	50	10.0	Dense	209	22	23	236
20	242	242	47	9.4	Dense	219	24	25	252
25	295	295	53	10.6	Dense	200	20	21	221
30	336	336	41	8.2	Dense	242	28	30	293
35	377	377	41	8.2	Dense	242	28	30	293
40	417	417	40	8.0	Dense	246	29	31	301
45	455	455	38	7.6	Dense	255	31	33	318
50	490	490	35	7.0	Dense	271	35	37	348
55	525	525	35	7.0	Dense	271	35	37	348
60	560	560	35	7.0	Dense	271	35	37	348
65	591	591	31	6.2	Dense	296	40	43	397
70	620	620	29	5.8	Dense	311	44	47	427
75	642	642	22	4.4	Very Dense	381	62	68	577
80	665	665	23	4.6	Very Dense	369	59	64	550
85	688	688	23	4.6	Very Dense	369	59	64	550
90	710	710	22	4.4	Very Dense	381	62	68	577
95	729	729	19	3.8	Very Dense	>400	75	83	677
100	749	749	20	4.0	Very Dense	400	70	77	640
105	765	765	16	3.2	Very Dense	>400	94	104	816
110	780	780	15	3.0	Very Dense	>400	102	110	876

Compiled By: M.Steyn Approved By: J.Steyn

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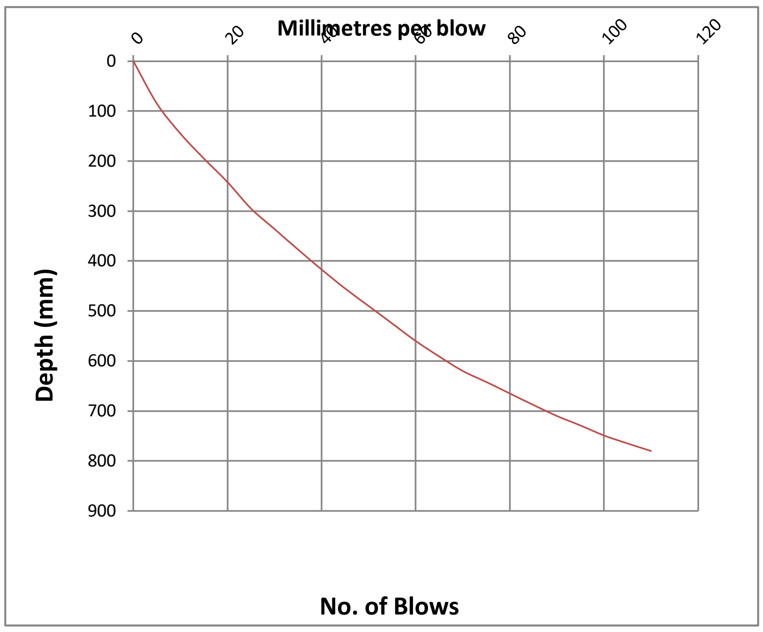
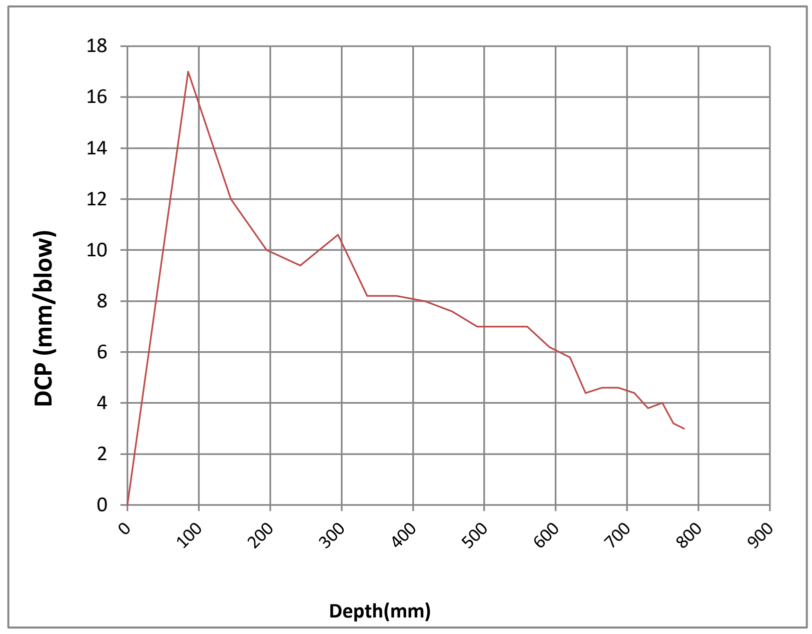
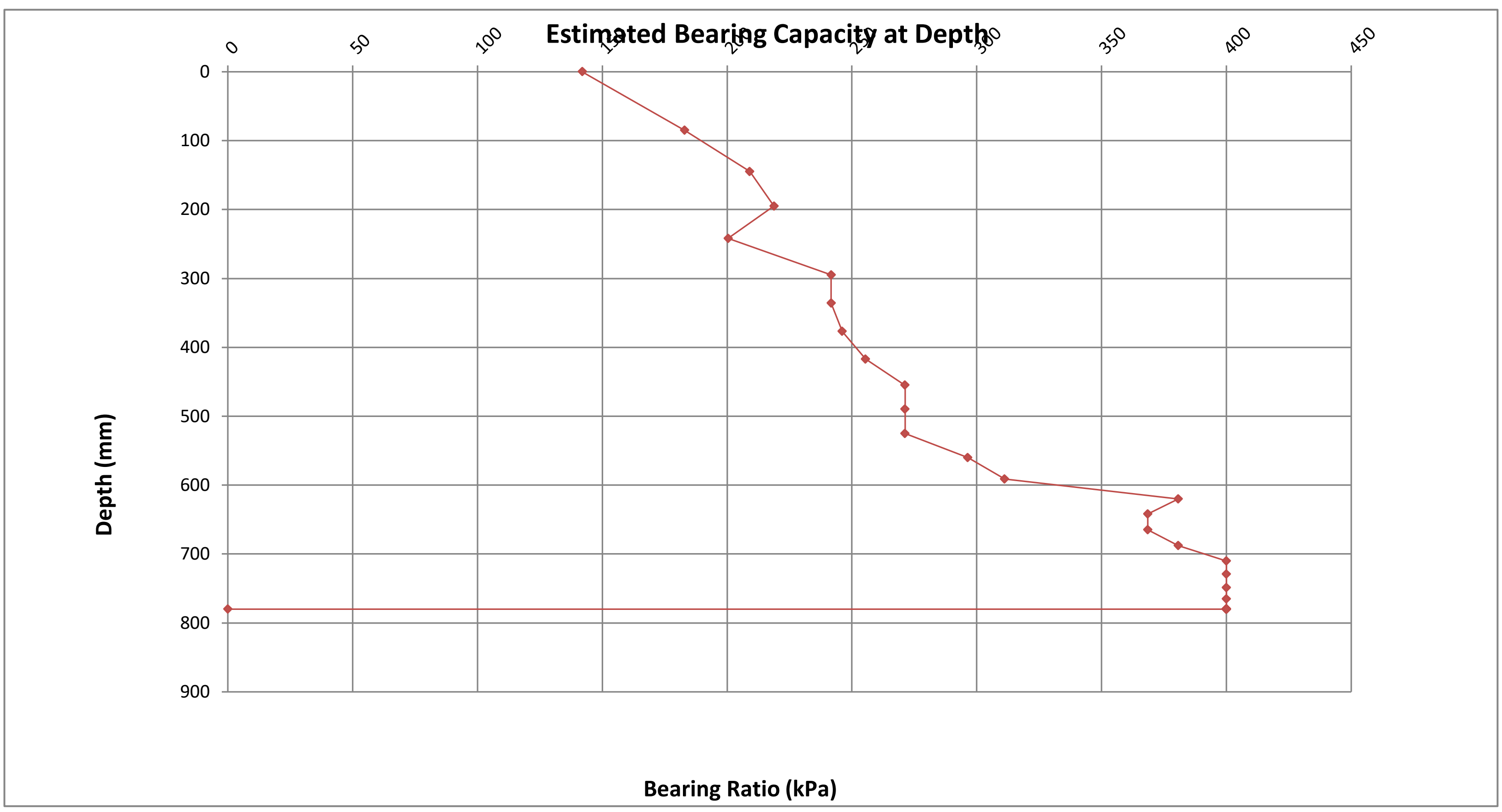
Client	KHATO CIVILS THENGA HOLDINGS JV			Tel:	0
	Unit 10, Midway Industrial Park			Fax:	0
	Centurian				
	0157				**1 BLO/ISC/32/2-2B**
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha **MATERIALS TECHNICIAN:** Mike

TEST POSITION: **1 BLO/ISC/32/2-3A** **ASSISTANT** Thabang

TEST DEPTH: DCP 1 m (This is a standard accreditated Method) **STARTING DEPTH:** 0mm

MATERIAL TYPE: Sandy Materials **INSTRUMENT (DCP) SET No:** 28596

CONSTRUCTION TYPE: Road Construction **Max. penetration depth:** 1000 mm

Enviromental Conditions 23'C **LEVEL:** @ NGL

REFUSAL: 788mm **FOUNDATION:** @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	99	99	99	19.8	Medium Dense	127	9	9	112
10	151	151	52	10.4	Dense	203	21	21	226
15	194	194	43	8.6	Dense	233	27	28	278
20	236	236	42	8.4	Dense	237	27	29	285
25	280	280	44	8.8	Dense	230	26	27	271
30	325	325	45	9.0	Dense	226	25	26	264
35	370	370	45	9.0	Dense	226	25	26	264
40	416	416	46	9.2	Dense	222	24	25	258
45	459	459	43	8.6	Dense	233	27	28	278
50	499	499	40	8.0	Dense	246	29	31	301
55	535	535	36	7.2	Dense	266	33	35	337
60	571	571	36	7.2	Dense	266	33	35	337
65	604	604	33	6.6	Dense	283	37	40	371
70	633	633	29	5.8	Dense	311	44	47	427
75	660	660	27	5.4	Dense	328	48	52	461
80	686	686	26	5.2	Dense	337	51	54	481
85	709	709	23	4.6	Very Dense	369	59	64	550
90	725	725	16	3.2	Very Dense	>400	94	104	816
95	747	747	22	4.4	Very Dense	381	62	68	577
100	760	760	13	2.6	Very Dense	>400	122	>110	1023
105	771	771	11	2.2	Very Dense	>400	151	>110	1228
110	780	780	9	1.8	Very Dense	>400	194	>110	1528
115	784	784	4	0.8	Very Dense	>400	544	>110	3699
120	786	786	2	0.4	Very Dense	>400	1313	>110	7873
125	788	788	2	0.4	Very Dense	>400	1313	>110	7873

Compiled By: M.Steyn Approved By: J.Steyn

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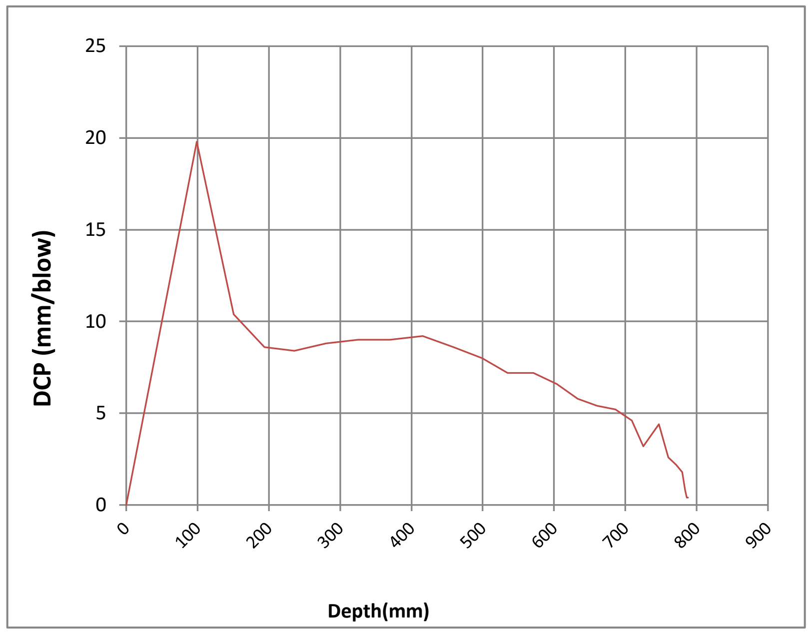
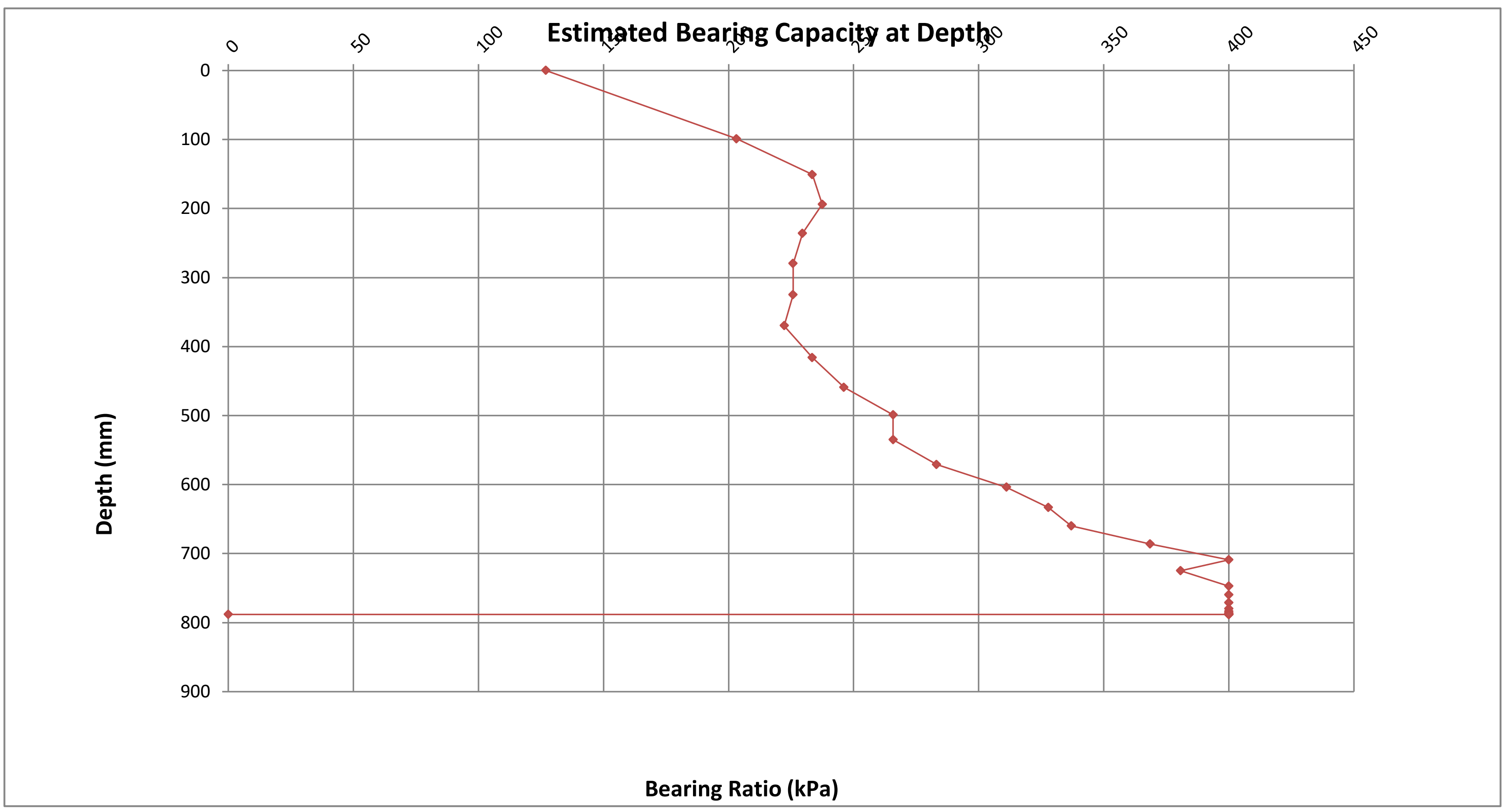
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**1 BLO/ISC/32/2-3A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC/32/2-3B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 859mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	77	77	77	15.4	Medium Dense	153	13	13	147
10	124	124	47	9.4	Dense	219	24	25	252
15	169	169	45	9.0	Dense	226	25	26	264
20	216	216	47	9.4	Dense	219	24	25	252
25	262	262	46	9.2	Dense	222	24	25	258
30	311	311	49	9.8	Dense	212	23	23	241
35	361	361	50	10.0	Dense	209	22	23	236
40	413	413	52	10.4	Dense	203	21	21	226
45	468	468	55	11.0	Dense	195	20	20	212
50	521	521	53	10.6	Dense	200	20	21	221
55	568	568	47	9.4	Dense	219	24	25	252
60	612	612	44	8.8	Dense	230	26	27	271
65	650	650	38	7.6	Dense	255	31	33	318
70	686	686	36	7.2	Dense	266	33	35	337
75	719	719	33	6.6	Dense	283	37	40	371
80	747	747	28	5.6	Dense	319	46	49	443
85	771	771	24	4.8	Very Dense	357	56	61	525
90	794	794	23	4.6	Very Dense	369	59	64	550
95	812	812	18	3.6	Very Dense	>400	81	89	718
100	825	825	13	2.6	Very Dense	>400	122	>110	1023
105	835	835	10	2.0	Very Dense	>400	170	>110	1362
110	841	841	6	1.2	Very Dense	>400	325	>110	2377
115	849	849	8	1.6	Very Dense	>400	226	>110	1737
120	855	855	6	1.2	Very Dense	>400	325	>110	2377
125	859	859	4	0.8	Very Dense	>400	544	>110	3699

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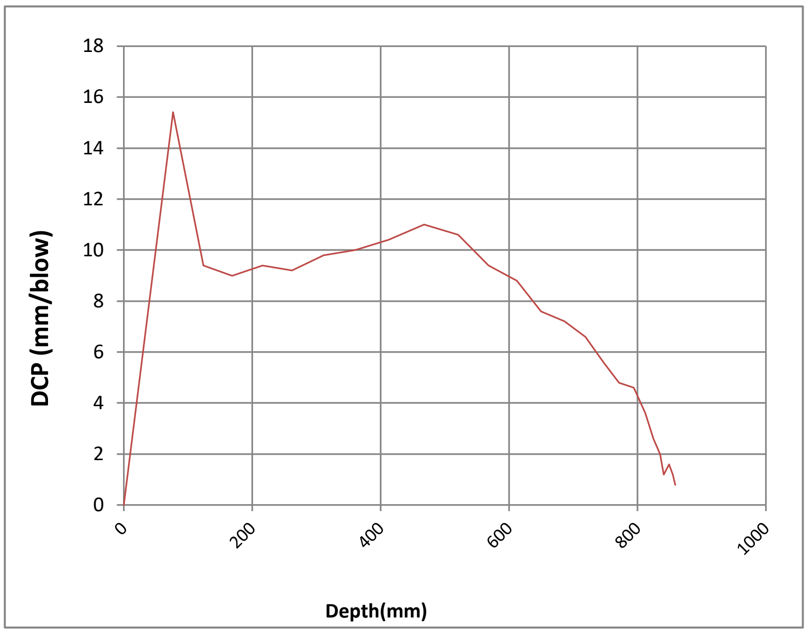
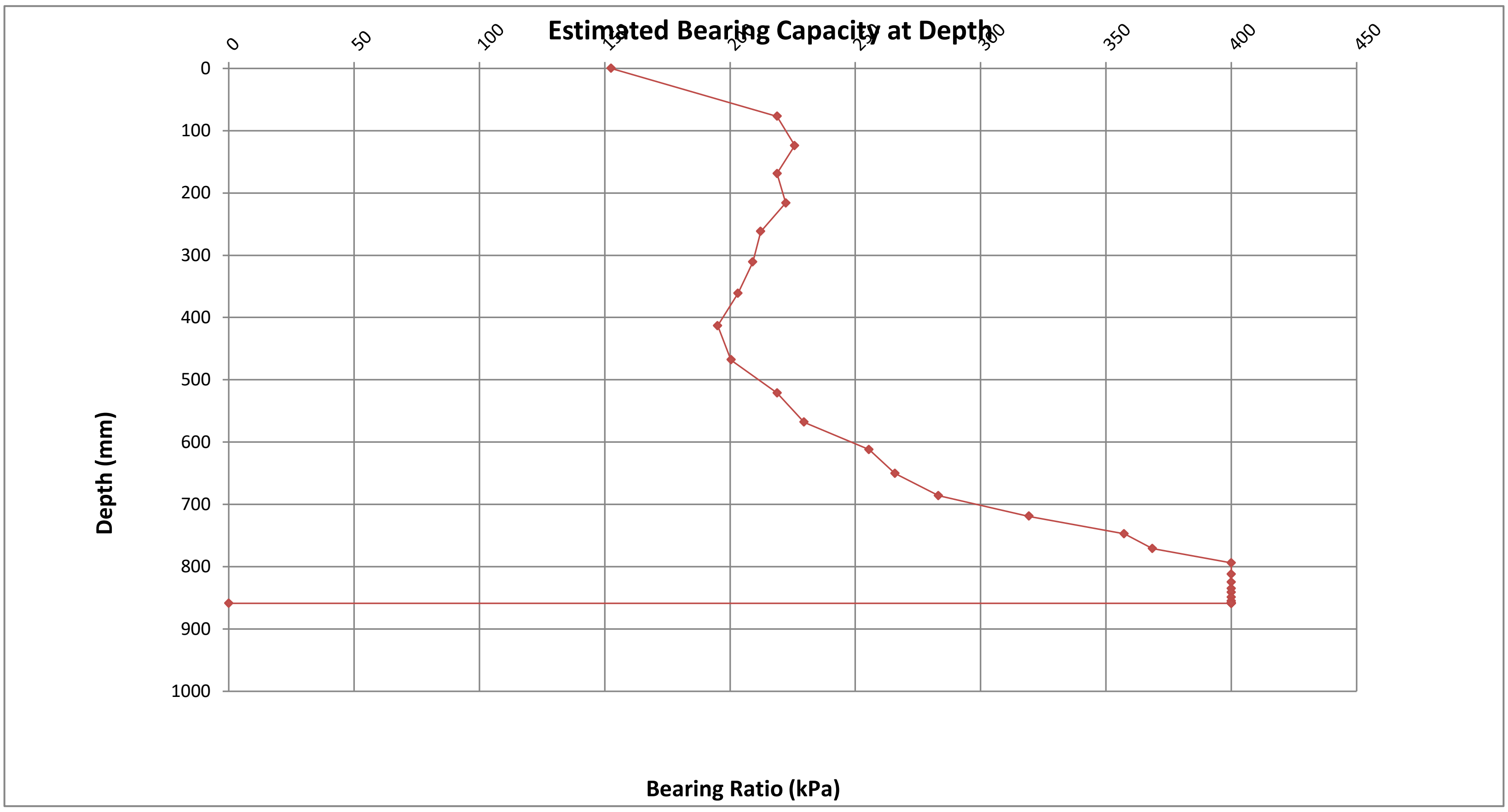
Vat Reg No: 4670261090

JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**1 BLO/ISC/32/2-3B**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





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5. Data Capture : Mrs. M. Swart

Mr A Engel
Lab Manager

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Vat Reg No: 4670261090

JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC/32/2-4A
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 709mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	84	84	84	16.8	Medium Dense	143	11	11	134
10	126	126	42	8.4	Dense	237	27	29	285
15	171	171	45	9.0	Dense	226	25	26	264
20	216	216	45	9.0	Dense	226	25	26	264
25	256	256	40	8.0	Dense	246	29	31	301
30	296	296	40	8.0	Dense	246	29	31	301
35	334	334	38	7.6	Dense	255	31	33	318
40	371	371	37	7.4	Dense	261	32	34	327
45	407	407	36	7.2	Dense	266	33	35	337
50	443	443	36	7.2	Dense	266	33	35	337
55	473	473	30	6.0	Dense	304	42	45	411
60	501	501	28	5.6	Dense	319	46	49	443
65	530	530	29	5.8	Dense	311	44	47	427
70	556	556	26	5.2	Dense	337	51	54	481
75	579	579	23	4.6	Very Dense	369	59	64	550
80	604	604	25	5.0	Very Dense	347	53	57	502
85	622	622	18	3.6	Very Dense	>400	81	89	718
90	637	637	15	3.0	Very Dense	>400	102	110	876
95	652	652	15	3.0	Very Dense	>400	102	110	876
100	665	665	13	2.6	Very Dense	>400	122	>110	1023
105	675	675	10	2.0	Very Dense	>400	170	>110	1362
110	684	684	9	1.8	Very Dense	>400	194	>110	1528
115	690	690	6	1.2	Very Dense	>400	325	>110	2377
120	694	694	4	0.8	Very Dense	>400	544	>110	3699
125	697	697	3	0.6	Very Dense	>400	784	>110	5061
130	700	700	3	0.6	Very Dense	>400	784	>110	5061
135	704	704	4	0.8	Very Dense	>400	544	>110	3699
140	707	707	3	0.6	Very Dense	>400	784	>110	5061
145	709	709	2	0.4	Very Dense	>400	1313	>110	7873

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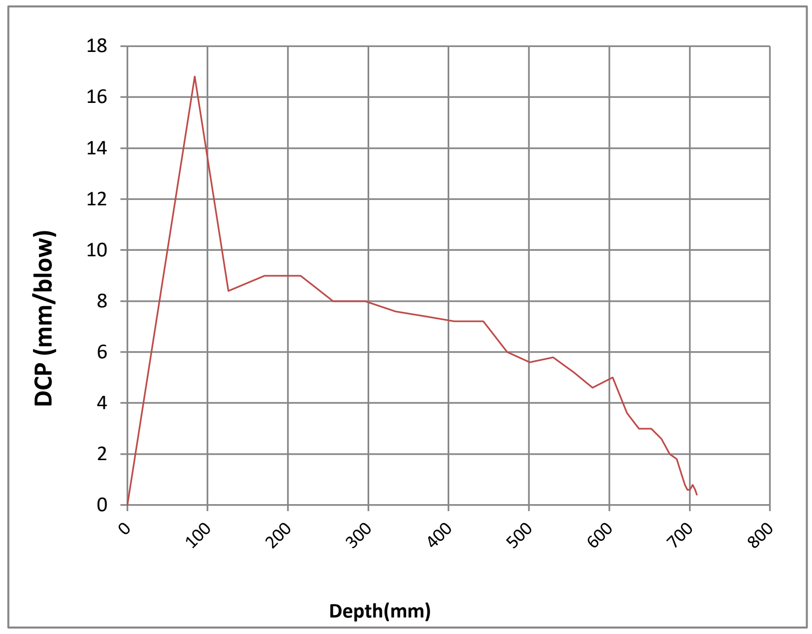
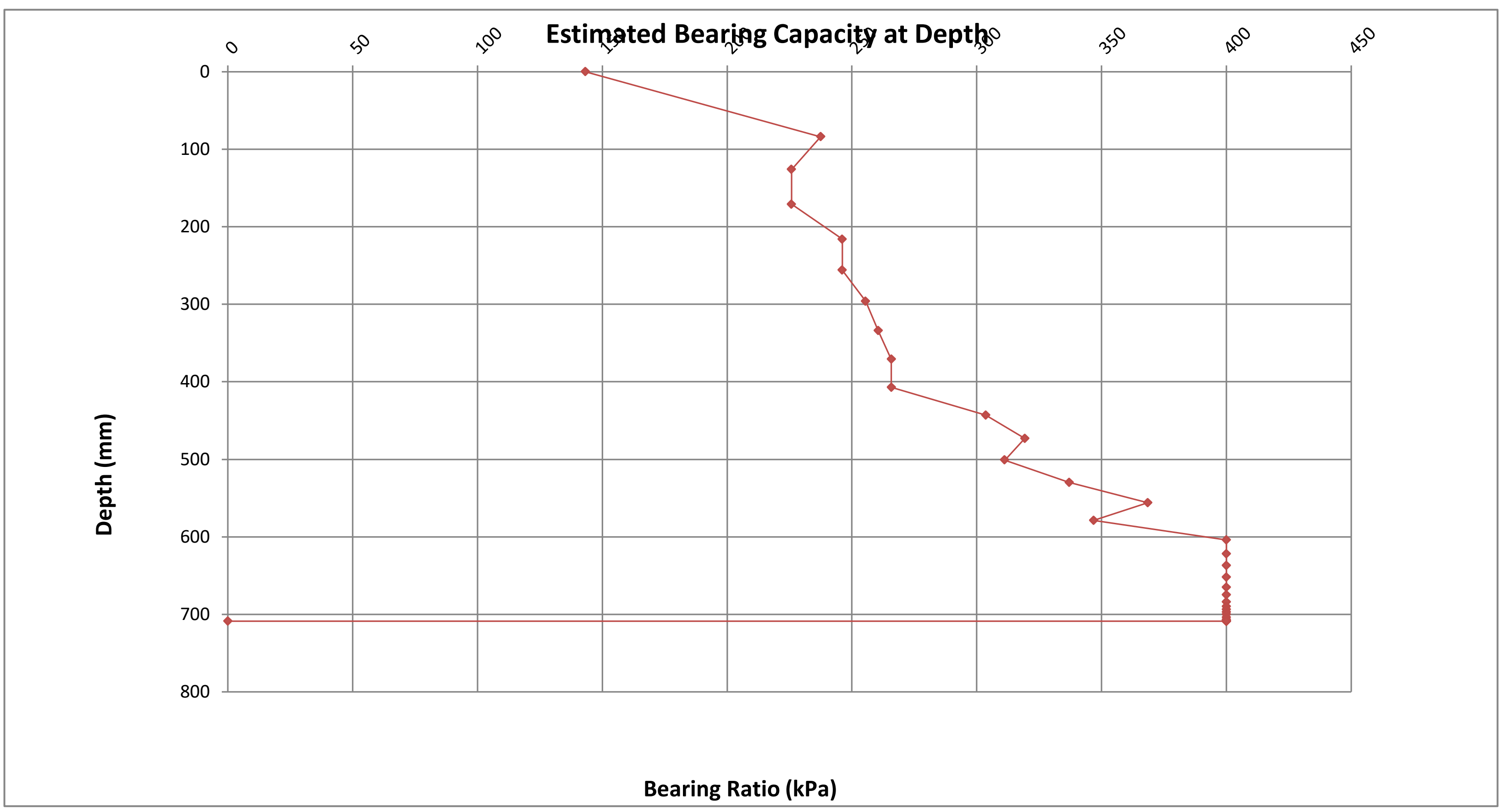
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**1 BLO/ISC/32/2-4A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 1 BLO/ISC/32/2-4B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 710mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	92	92	92	18.4	Medium Dense	134	10	10	121
10	136	136	44	8.8	Dense	230	26	27	271
15	180	180	44	8.8	Dense	230	26	27	271
20	222	222	42	8.4	Dense	237	27	29	285
25	264	264	42	8.4	Dense	237	27	29	285
30	306	306	42	8.4	Dense	237	27	29	285
35	345	345	39	7.8	Dense	251	30	32	309
40	381	381	36	7.2	Dense	266	33	35	337
45	414	414	33	6.6	Dense	283	37	40	371
50	444	444	30	6.0	Dense	304	42	45	411
55	471	471	27	5.4	Dense	328	48	52	461
60	498	498	27	5.4	Dense	328	48	52	461
65	523	523	25	5.0	Very Dense	347	53	57	502
70	548	548	25	5.0	Very Dense	347	53	57	502
75	571	571	23	4.6	Very Dense	369	59	64	550
80	590	590	19	3.8	Very Dense	>400	75	83	677
85	607	607	17	3.4	Very Dense	>400	87	96	764
90	623	623	16	3.2	Very Dense	>400	94	104	816
95	636	636	13	2.6	Very Dense	>400	122	>110	1023
100	647	647	11	2.2	Very Dense	>400	151	>110	1228
105	657	657	10	2.0	Very Dense	>400	170	>110	1362
110	664	664	7	1.4	Very Dense	>400	267	>110	2010
115	671	671	7	1.4	Very Dense	>400	267	>110	2010
120	680	680	9	1.8	Very Dense	>400	194	>110	1528
125	686	686	6	1.2	Very Dense	>400	325	>110	2377
130	691	691	5	1.0	Very Dense	>400	410	>110	2900
135	694	694	3	0.6	Very Dense	>400	784	>110	5061
140	697	697	3	0.6	Very Dense	>400	784	>110	5061
145	699	699	2	0.4	Very Dense	>400	1313	>110	7873
150	702	702	3	0.6	Very Dense	>400	784	>110	5061
155	705	705	3	0.6	Very Dense	>400	784	>110	5061
160	708	708	3	0.6	Very Dense	>400	784	>110	5061
165	710	710	2	0.4	Very Dense	>400	1313	>110	7873

Compiled By: M.Steyn Approved By: J.Steyn

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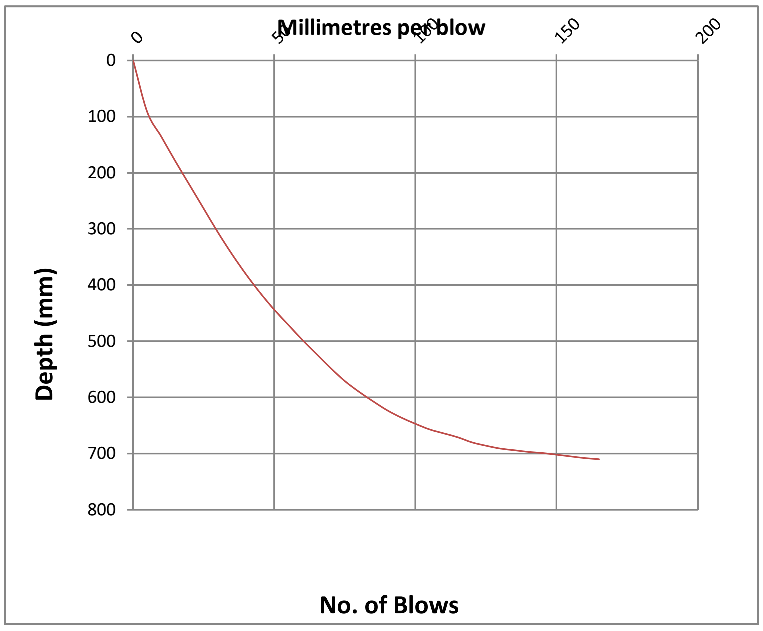
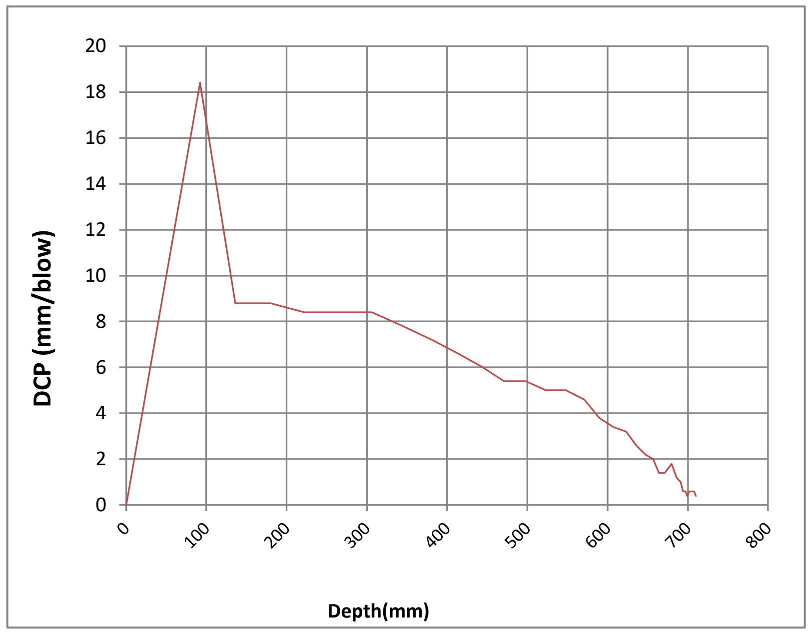
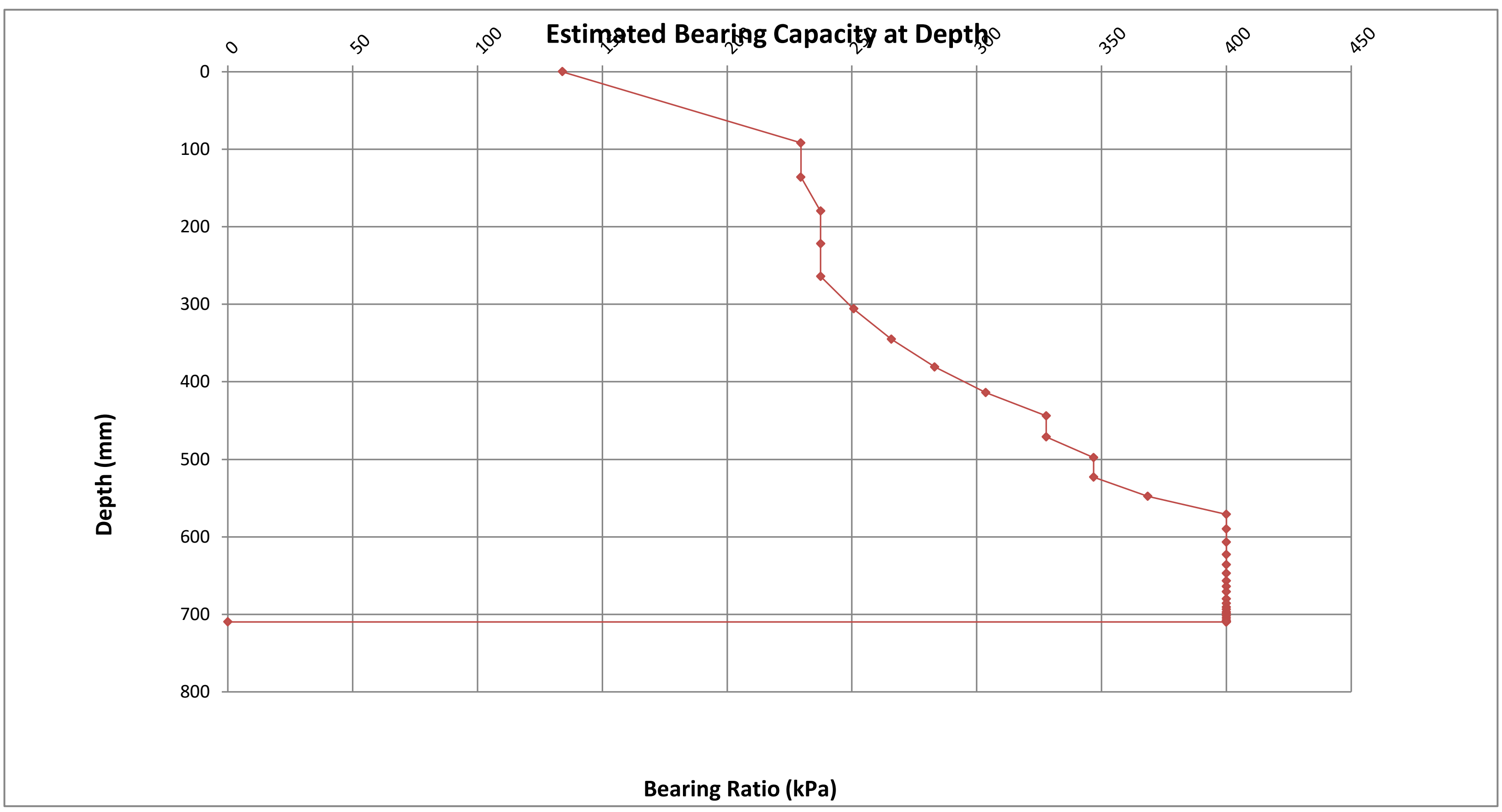
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**1 BLO/ISC/32/2-4B**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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5. Data Capture : Mrs. M. Swart

Mr A Engel
Lab Manager

2 BLO-ISC 32-2

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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 2 BLO-ISC32-2-1A
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 609mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	65	65	65	13.0	Medium Dense	173	16	16	177
10	85	85	20	4.0	Very Dense	400	70	77	640
15	100	100	15	3.0	Very Dense	>400	102	110	876
20	115	115	15	3.0	Very Dense	>400	102	110	876
25	130	130	15	3.0	Very Dense	>400	102	110	876
30	145	145	15	3.0	Very Dense	>400	102	110	876
35	155	155	10	2.0	Very Dense	>400	170	>110	1362
40	170	170	15	3.0	Very Dense	>400	102	110	876
45	180	180	10	2.0	Very Dense	>400	170	>110	1362
50	195	195	15	3.0	Very Dense	>400	102	110	876
55	230	230	35	7.0	Dense	271	35	37	348
60	245	245	15	3.0	Very Dense	>400	102	110	876
65	265	265	20	4.0	Very Dense	400	70	77	640
70	285	285	20	4.0	Very Dense	400	70	77	640
75	300	300	15	3.0	Very Dense	>400	102	110	876
80	330	330	30	6.0	Dense	304	42	45	411
85	357	357	27	5.4	Dense	328	48	52	461
90	380	380	23	4.6	Very Dense	369	59	64	550
95	410	410	30	6.0	Dense	304	42	45	411
100	440	440	30	6.0	Dense	304	42	45	411
105	478	478	38	7.6	Dense	255	31	33	318
110	506	506	28	5.6	Dense	319	46	49	443
115	533	533	27	5.4	Dense	328	48	52	461
120	570	570	37	7.4	Dense	261	32	34	327
125	585	585	15	3.0	Very Dense	>400	102	110	876
130	590	590	5	1.0	Very Dense	>400	410	>110	2900
135	595	595	5	1.0	Very Dense	>400	410	>110	2900
140	601	601	6	1.2	Very Dense	>400	325	>110	2377
145	606	606	5	1.0	Very Dense	>400	410	>110	2900
150	609	609	3	0.6	Very Dense	>400	784	>110	5061

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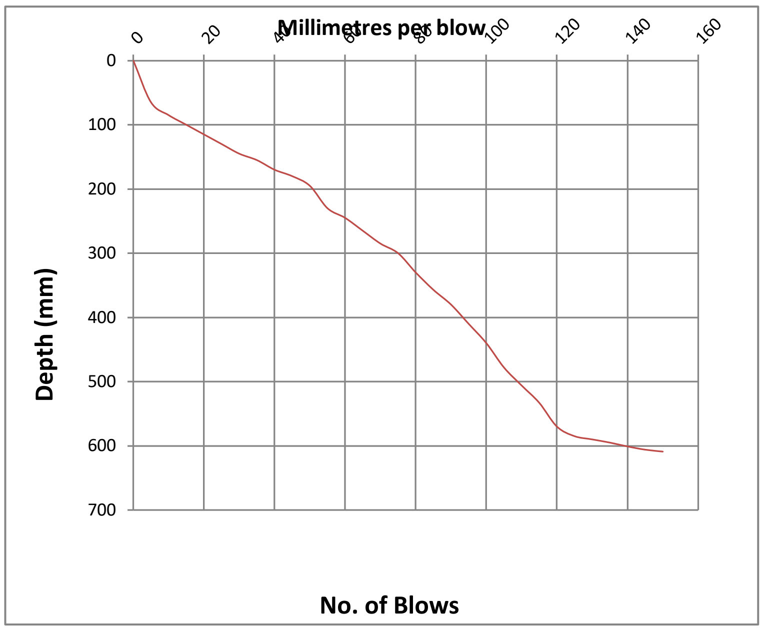
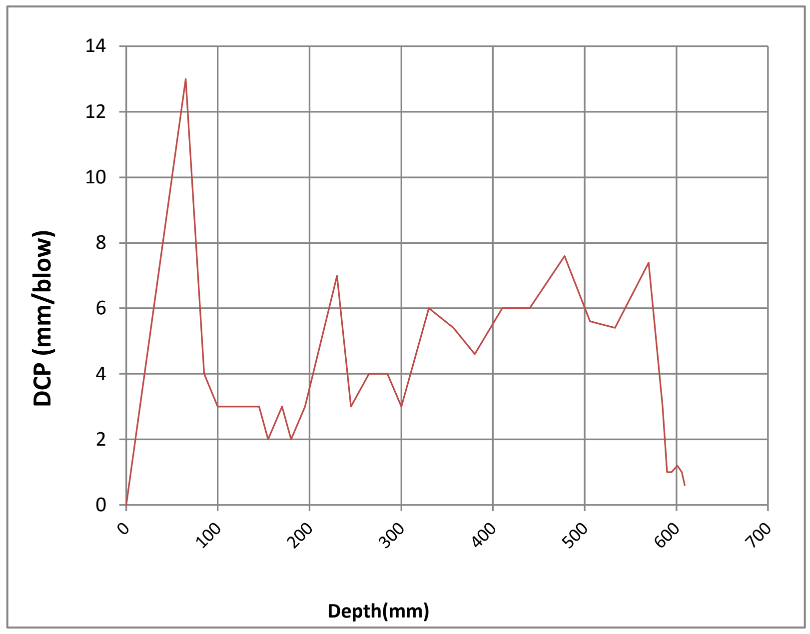
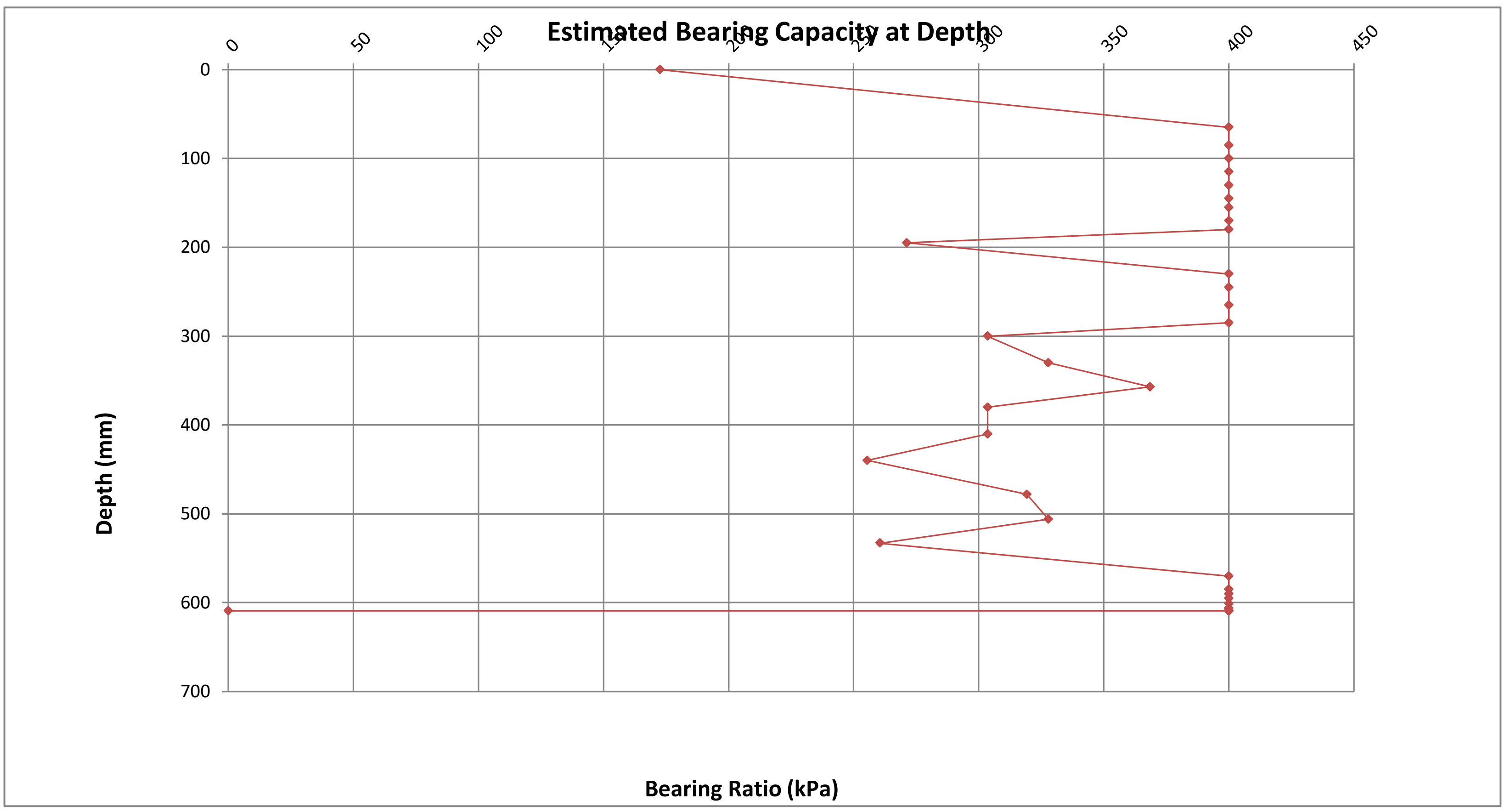
JOB No:	N/A	Ref. No:	N/A	Date:	07-02-2020
Client	KHATO CIVILS THENGA HOLDINGS JV	Tel:	0		
	Unit 10, Midway Industrial Park	Fax:	0		
	Centurian				
	0157			**2 BLO-ISC32-2-1A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	Tippler - Saldanha	**MATERIALS TECHNICIAN:**	Mike
TEST POSITION:	2 BLO-ISC32-2-1B	**ASSISTANT**	Thabang
TEST DEPTH:	DCP 1 m (This is a standard accreditated Method)	**STARTING DEPTH:**	0mm
MATERIAL TYPE:	Sandy Materials	**INSTRUMENT (DCP) SET No:**	28596
CONSTRUCTION TYPE:	Road Construction	**Max. penetration depth:**	1000 mm
Enviromental Conditions	23'C	**LEVEL:**	@ NGL
REFUSAL:	515mm	**FOUNDATION:**	@ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	74	74	74	14.8	Medium Dense	157	13	13	154
10	92	92	18	3.6	Very Dense	>400	81	89	718
15	110	110	18	3.6	Very Dense	>400	81	89	718
20	130	130	20	4.0	Very Dense	400	70	77	640
25	152	152	22	4.4	Very Dense	381	62	68	577
30	175	175	23	4.6	Very Dense	369	59	64	550
35	197	197	22	4.4	Very Dense	381	62	68	577
40	220	220	23	4.6	Very Dense	369	59	64	550
45	239	239	19	3.8	Very Dense	>400	75	83	677
50	256	256	17	3.4	Very Dense	>400	87	96	764
55	273	273	17	3.4	Very Dense	>400	87	96	764
60	288	288	15	3.0	Very Dense	>400	102	110	876
65	303	303	15	3.0	Very Dense	>400	102	110	876
70	316	316	13	2.6	Very Dense	>400	122	>110	1023
75	326	326	10	2.0	Very Dense	>400	170	>110	1362
80	338	338	12	2.4	Very Dense	>400	135	>110	1117
85	352	352	14	2.8	Very Dense	>400	111	>110	944
90	367	367	15	3.0	Very Dense	>400	102	110	876
95	376	376	9	1.8	Very Dense	>400	194	>110	1528
100	391	391	15	3.0	Very Dense	>400	102	110	876
105	401	401	10	2.0	Very Dense	>400	170	>110	1362
110	412	412	11	2.2	Very Dense	>400	151	>110	1228
115	421	421	9	1.8	Very Dense	>400	194	>110	1528
120	430	430	9	1.8	Very Dense	>400	194	>110	1528
125	441	441	11	2.2	Very Dense	>400	151	>110	1228
130	451	451	10	2.0	Very Dense	>400	170	>110	1362
135	462	462	11	2.2	Very Dense	>400	151	>110	1228
140	473	473	11	2.2	Very Dense	>400	151	>110	1228
145	482	482	9	1.8	Very Dense	>400	194	>110	1528
150	491	491	9	1.8	Very Dense	>400	194	>110	1528
155	501	501	10	2.0	Very Dense	>400	170	>110	1362
160	507	507	6	1.2	Very Dense	>400	325	>110	2377
165	511	511	4	0.8	Very Dense	>400	544	>110	3699
170	513	513	2	0.4	Very Dense	>400	1313	>110	7873
175	515	515	2	0.4	Very Dense	>400	1313	>110	7873

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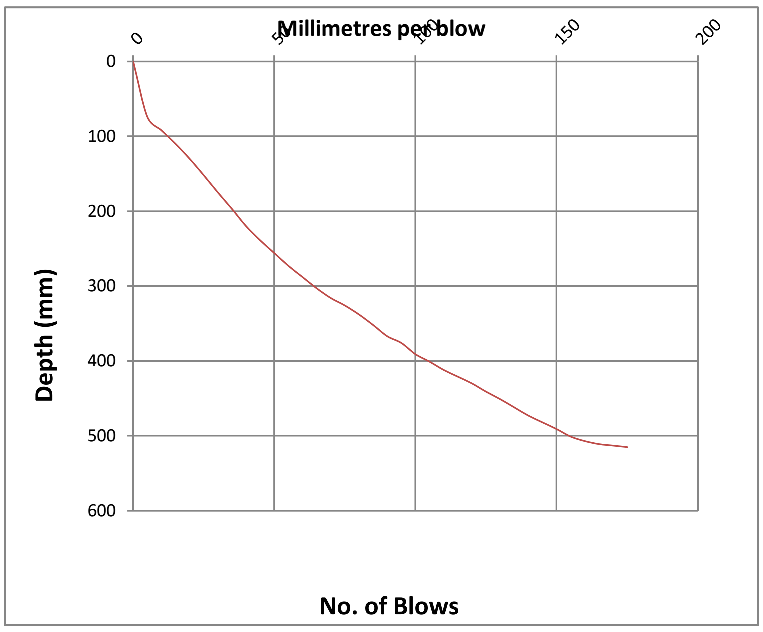
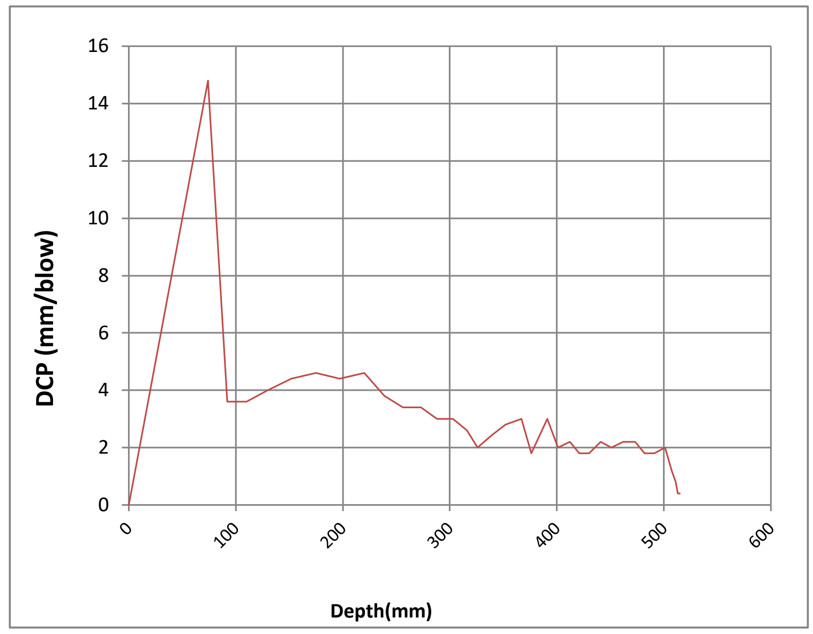
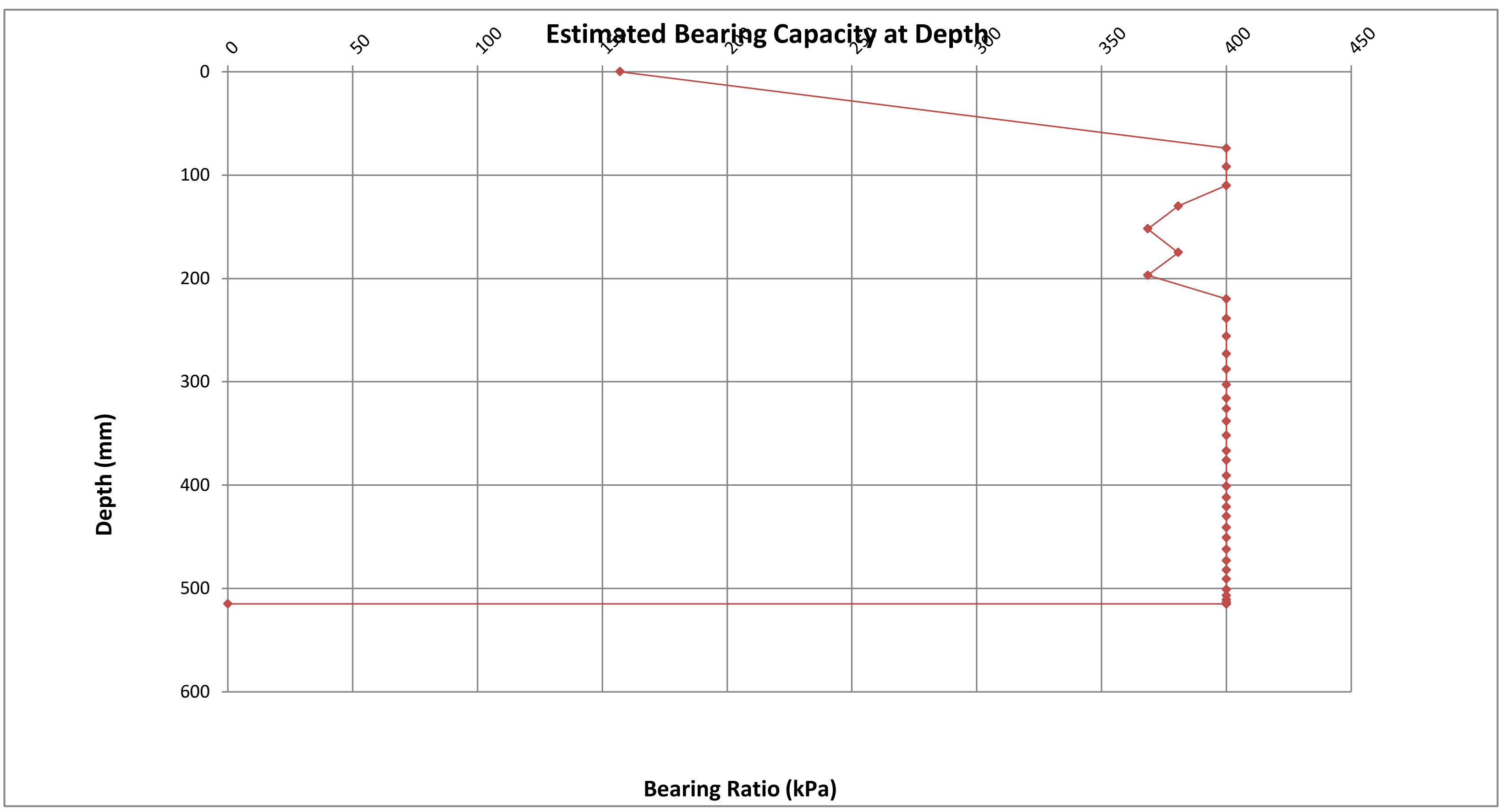
JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**2 BLO-ISC32-2-1B**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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Mr A Engel
Lab Manager

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Vat Reg No: 4670261090

JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 2 BLO-ISC32-2-2A
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 814mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	45	45	45	9.0	Dense	226	25	26	264
10	70	70	25	5.0	Very Dense	347	53	57	502
15	79	79	9	1.8	Very Dense	>400	194	>110	1528
20	130	130	51	10.2	Dense	206	21	22	231
25	157	157	27	5.4	Dense	328	48	52	461
30	190	190	33	6.6	Dense	283	37	40	371
35	220	220	30	6.0	Dense	304	42	45	411
40	259	259	39	7.8	Dense	251	30	32	309
45	299	299	40	8.0	Dense	246	29	31	301
50	340	340	41	8.2	Dense	242	28	30	293
55	385	385	45	9.0	Dense	226	25	26	264
60	440	440	55	11.0	Dense	195	20	20	212
65	500	500	60	12.0	Dense	183	17	18	193
70	575	575	75	15.0	Medium Dense	156	13	13	152
75	630	630	55	11.0	Dense	195	20	20	212
80	645	645	15	3.0	Very Dense	>400	102	110	876
85	675	675	30	6.0	Dense	304	42	45	411
90	699	699	24	4.8	Very Dense	357	56	61	525
95	715	715	16	3.2	Very Dense	>400	94	104	816
100	795	795	80	16.0	Medium Dense	148	12	12	141
105	799	799	4	0.8	Very Dense	>400	544	>110	3699
110	804	804	5	1.0	Very Dense	>400	410	>110	2900
115	809	809	5	1.0	Very Dense	>400	410	>110	2900
120	812	812	3	0.6	Very Dense	>400	784	>110	5061
125	814	814	2	0.4	Very Dense	>400	1313	>110	7873

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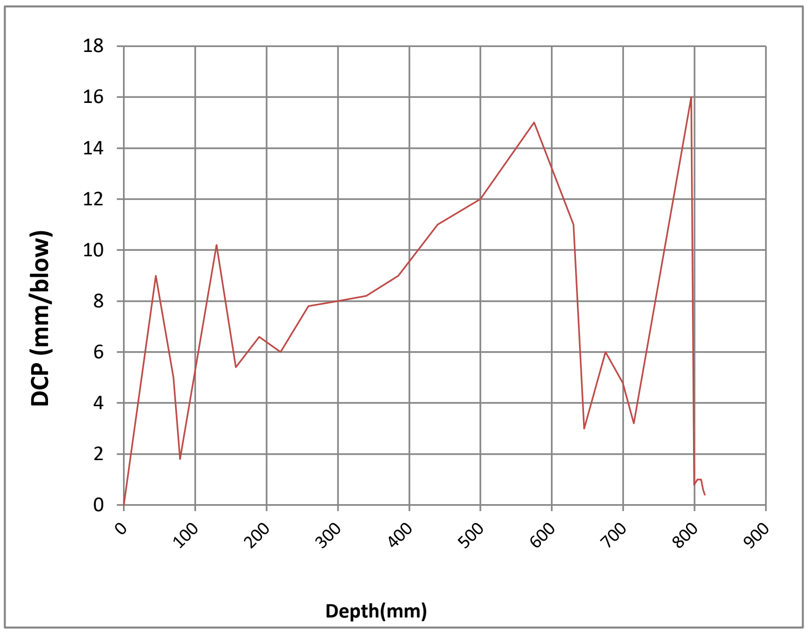
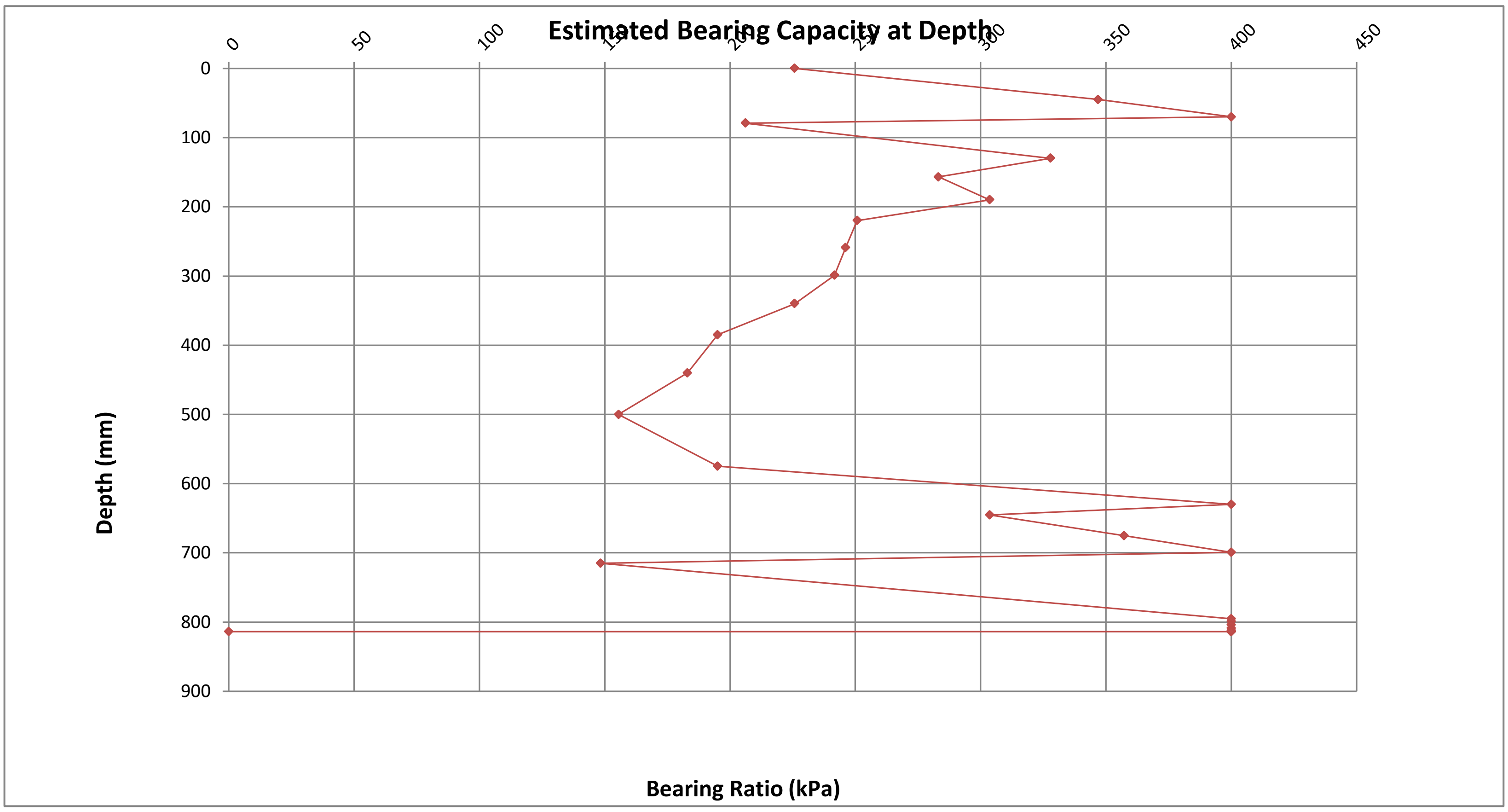
Vat Reg No: 4670261090

JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**2 BLO-ISC32-2-2A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





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JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client: KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 2 BLO-ISC32-2-2B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 834mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	55	55	55	11.0	Dense	195	20	20	212
10	80	80	25	5.0	Very Dense	347	53	57	502
15	107	107	27	5.4	Dense	328	48	52	461
20	134	134	27	5.4	Dense	328	48	52	461
25	164	164	30	6.0	Dense	304	42	45	411
30	193	193	29	5.8	Dense	311	44	47	427
35	223	223	30	6.0	Dense	304	42	45	411
40	250	250	27	5.4	Dense	328	48	52	461
45	281	281	31	6.2	Dense	296	40	43	397
50	314	314	33	6.6	Dense	283	37	40	371
55	349	349	35	7.0	Dense	271	35	37	348
60	385	385	36	7.2	Dense	266	33	35	337
65	425	425	40	8.0	Dense	246	29	31	301
70	466	466	41	8.2	Dense	242	28	30	293
75	509	509	43	8.6	Dense	233	27	28	278
80	553	553	44	8.8	Dense	230	26	27	271
85	597	597	44	8.8	Dense	230	26	27	271
90	637	637	40	8.0	Dense	246	29	31	301
95	674	674	37	7.4	Dense	261	32	34	327
100	709	709	35	7.0	Dense	271	35	37	348
105	739	739	30	6.0	Dense	304	42	45	411
110	768	768	29	5.8	Dense	311	44	47	427
115	795	795	27	5.4	Dense	328	48	52	461
120	814	814	19	3.8	Very Dense	>400	75	83	677
125	818	818	4	0.8	Very Dense	>400	544	>110	3699
130	824	824	6	1.2	Very Dense	>400	325	>110	2377
135	830	830	6	1.2	Very Dense	>400	325	>110	2377
140	834	834	4	0.8	Very Dense	>400	544	>110	3699

Compiled By: M.Steyn Approved By: J.Steyn

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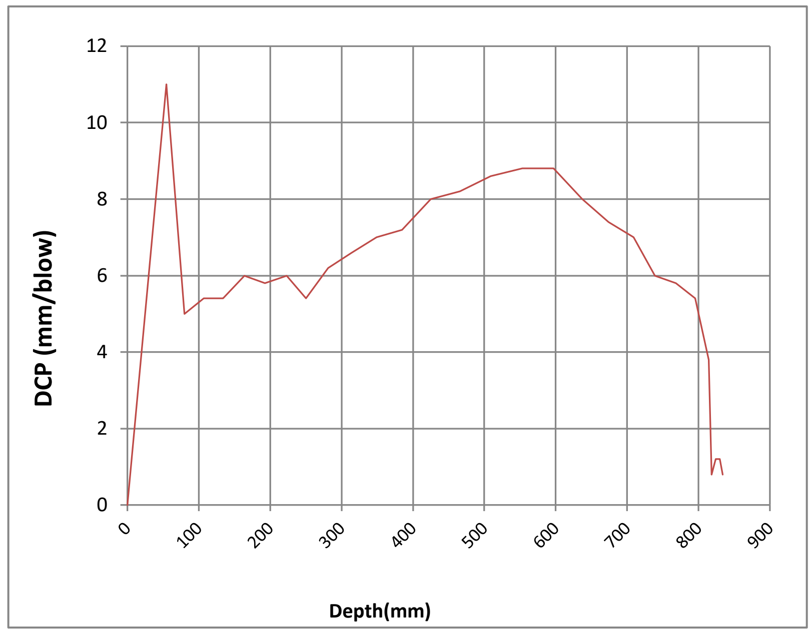
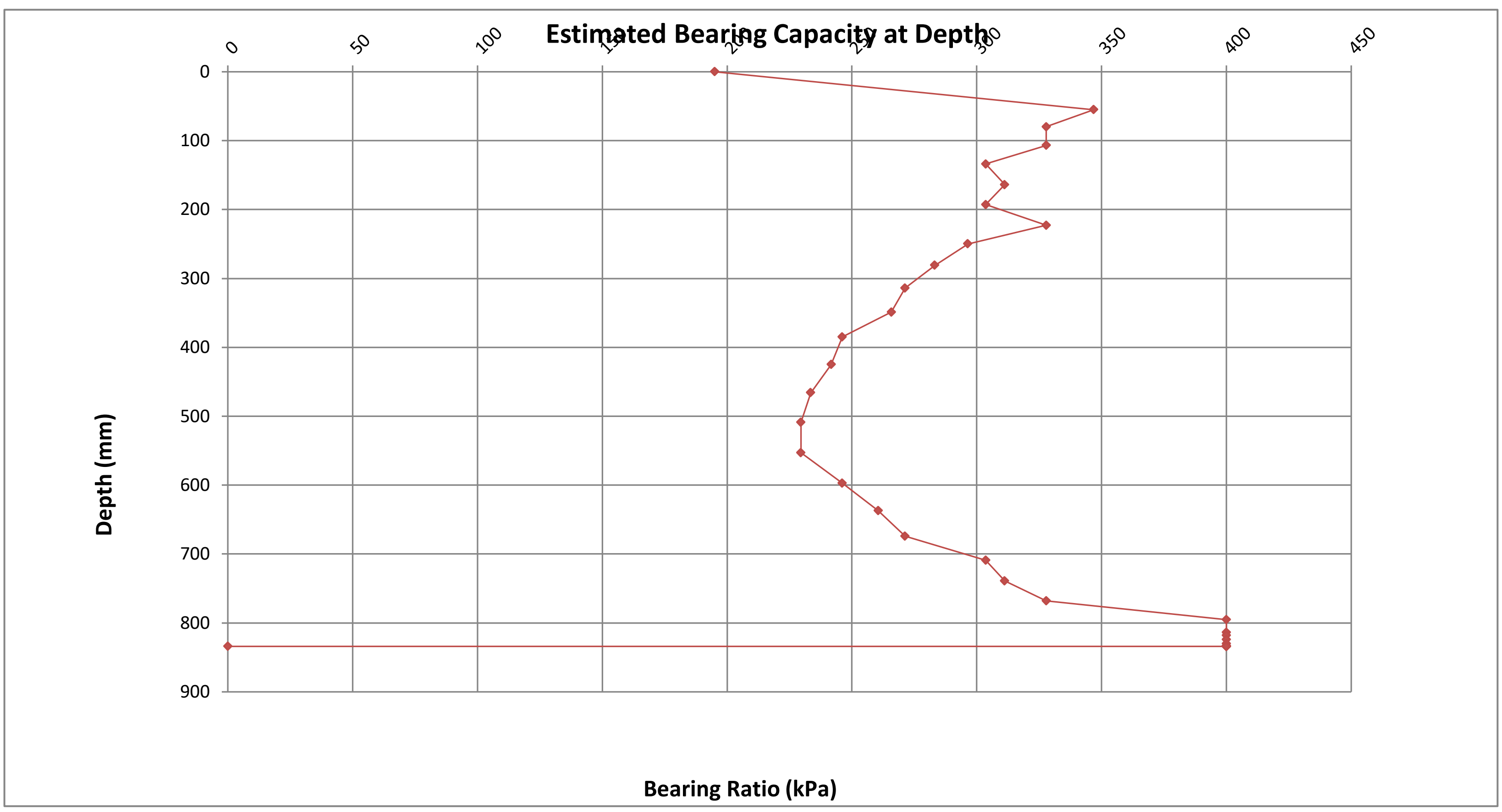
	Centurian				
	0157			**2 BLO-ISC32-2-2B**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





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Unit 10, Midway Industrial Park
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0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	Tippler - Saldanha	**MATERIALS TECHNICIAN:**	Mike
TEST POSITION:	**2 BLO-ISC32-2-3A**	**ASSISTANT**	Thabang
TEST DEPTH:	DCP 1 m (This is a standard accreditated Method)	**STARTING DEPTH:**	0mm
MATERIAL TYPE:	Sandy Materials	**INSTRUMENT (DCP) SET No:**	28596
CONSTRUCTION TYPE:	Road Construction	**Max. penetration depth:**	1000 mm
Enviromental Conditions	23'C	**LEVEL:**	@ NGL
REFUSAL:	716mm	**FOUNDATION:**	@ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	85	85	85	17.0	Medium Dense	142	11	11	132
10	125	125	40	8.0	Dense	246	29	31	301
15	145	145	20	4.0	Very Dense	400	70	77	640
20	184	184	39	7.8	Dense	251	30	32	309
25	199	199	15	3.0	Very Dense	>400	102	110	876
30	210	210	11	2.2	Very Dense	>400	151	>110	1228
35	240	240	30	6.0	Dense	304	42	45	411
40	274	274	34	6.8	Dense	277	36	38	359
45	305	305	31	6.2	Dense	296	40	43	397
50	335	335	30	6.0	Dense	304	42	45	411
55	389	389	54	10.8	Dense	198	20	20	217
60	402	402	13	2.6	Very Dense	>400	122	>110	1023
65	434	434	32	6.4	Dense	290	39	41	383
70	463	463	29	5.8	Dense	311	44	47	427
75	489	489	26	5.2	Dense	337	51	54	481
80	537	537	48	9.6	Dense	215	23	24	246
85	560	560	23	4.6	Very Dense	369	59	64	550
90	585	585	25	5.0	Very Dense	347	53	57	502
95	605	605	20	4.0	Very Dense	400	70	77	640
100	630	630	25	5.0	Very Dense	347	53	57	502
105	650	650	20	4.0	Very Dense	400	70	77	640
110	670	670	20	4.0	Very Dense	400	70	77	640
115	691	691	21	4.2	Very Dense	394	66	72	607
120	699	699	8	1.6	Very Dense	>400	226	>110	1737
125	706	706	7	1.4	Very Dense	>400	267	>110	2010
130	709	709	3	0.6	Very Dense	>400	784	>110	5061
135	712	712	3	0.6	Very Dense	>400	784	>110	5061
140	716	716	4	0.8	Very Dense	>400	544	>110	3699

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JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
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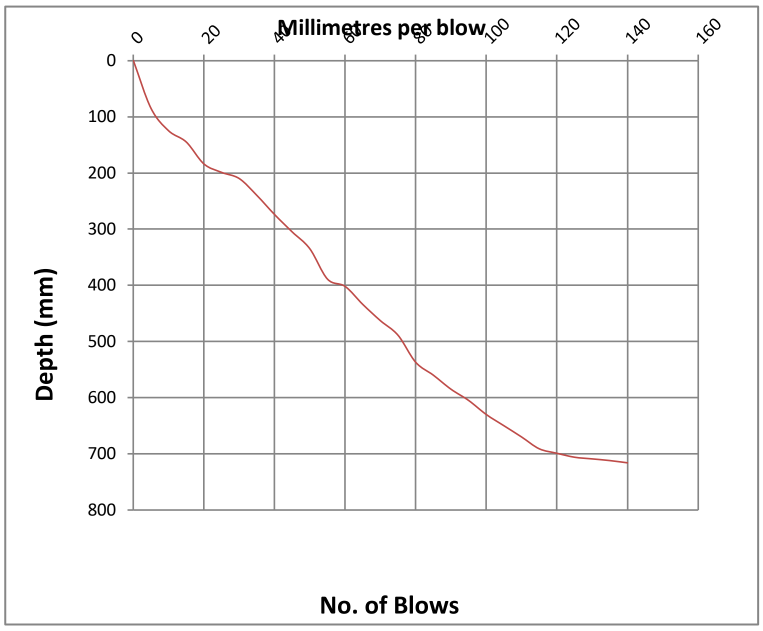
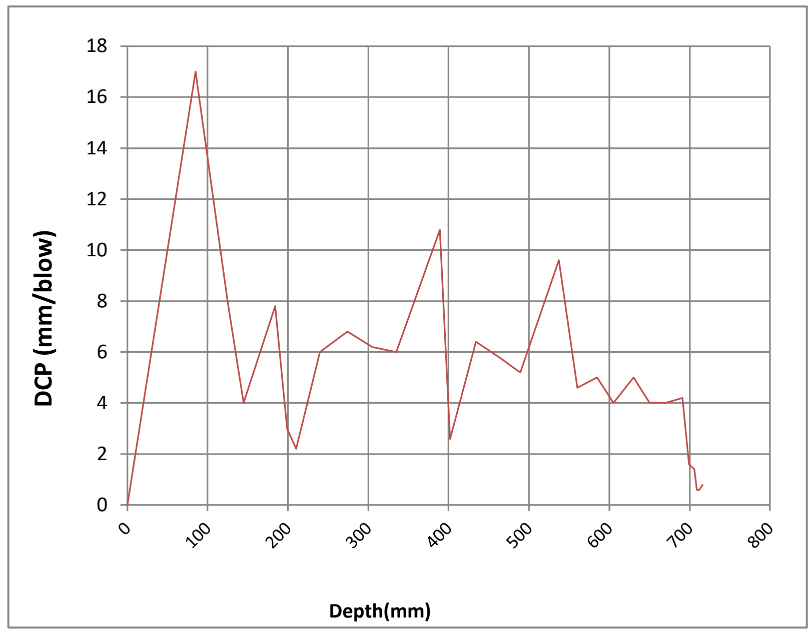
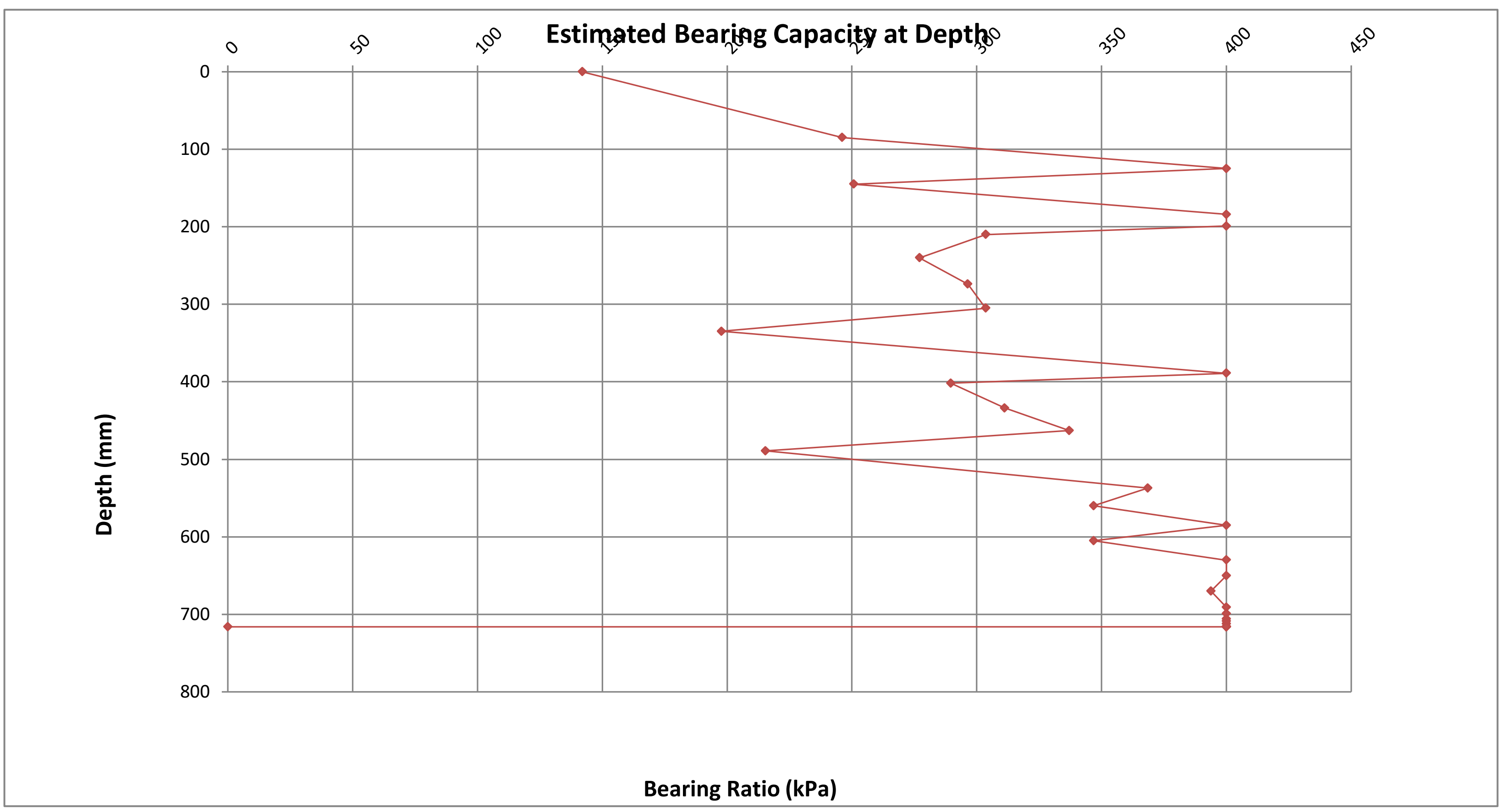
	Centurian				
	0157			**2 BLO-ISC32-2-3A**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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Client KHATO CIVILS THENGA HOLDINGS JV
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Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 2 BLO-ISC32-2-3B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 709mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x(dn)^{-1.09}$
0	0	0	0	0					
5	104	104	104	20.8	Medium Dense	123	9	8	106
10	137	137	33	6.6	Dense	283	37	40	371
15	173	173	36	7.2	Dense	266	33	35	337
20	210	210	37	7.4	Dense	261	32	34	327
25	247	247	37	7.4	Dense	261	32	34	327
30	283	283	36	7.2	Dense	266	33	35	337
35	317	317	34	6.8	Dense	277	36	38	359
40	352	352	35	7.0	Dense	271	35	37	348
45	388	388	36	7.2	Dense	266	33	35	337
50	422	422	34	6.8	Dense	277	36	38	359
55	457	457	35	7.0	Dense	271	35	37	348
60	490	490	33	6.6	Dense	283	37	40	371
65	523	523	33	6.6	Dense	283	37	40	371
70	552	552	29	5.8	Dense	311	44	47	427
75	579	579	27	5.4	Dense	328	48	52	461
80	605	605	26	5.2	Dense	337	51	54	481
85	625	625	20	4.0	Very Dense	400	70	77	640
90	642	642	17	3.4	Very Dense	>400	87	96	764
95	656	656	14	2.8	Very Dense	>400	111	>110	944
100	668	668	12	2.4	Very Dense	>400	135	>110	1117
105	679	679	11	2.2	Very Dense	>400	151	>110	1228
110	688	688	9	1.8	Very Dense	>400	194	>110	1528
115	697	697	9	1.8	Very Dense	>400	194	>110	1528
120	703	703	6	1.2	Very Dense	>400	325	>110	2377
125	706	706	3	0.6	Very Dense	>400	784	>110	5061
130	709	709	3	0.6	Very Dense	>400	784	>110	5061

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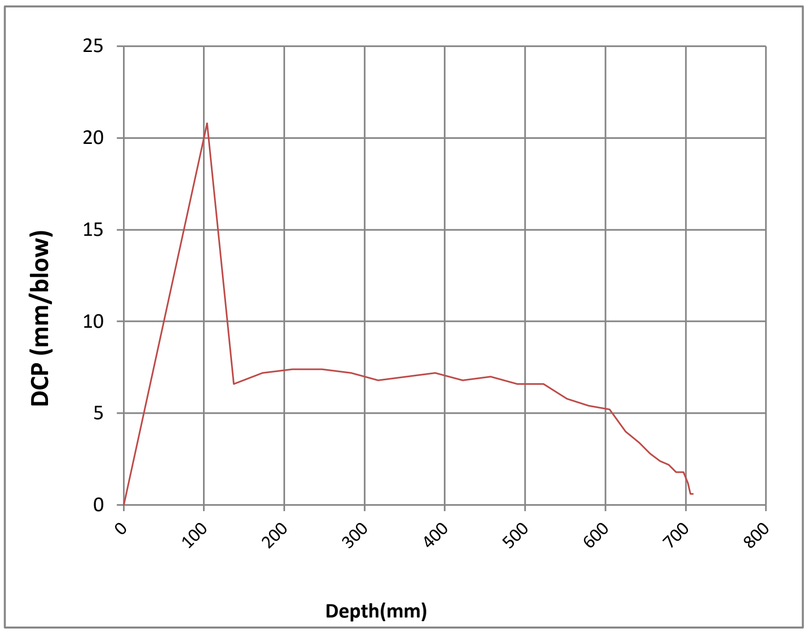
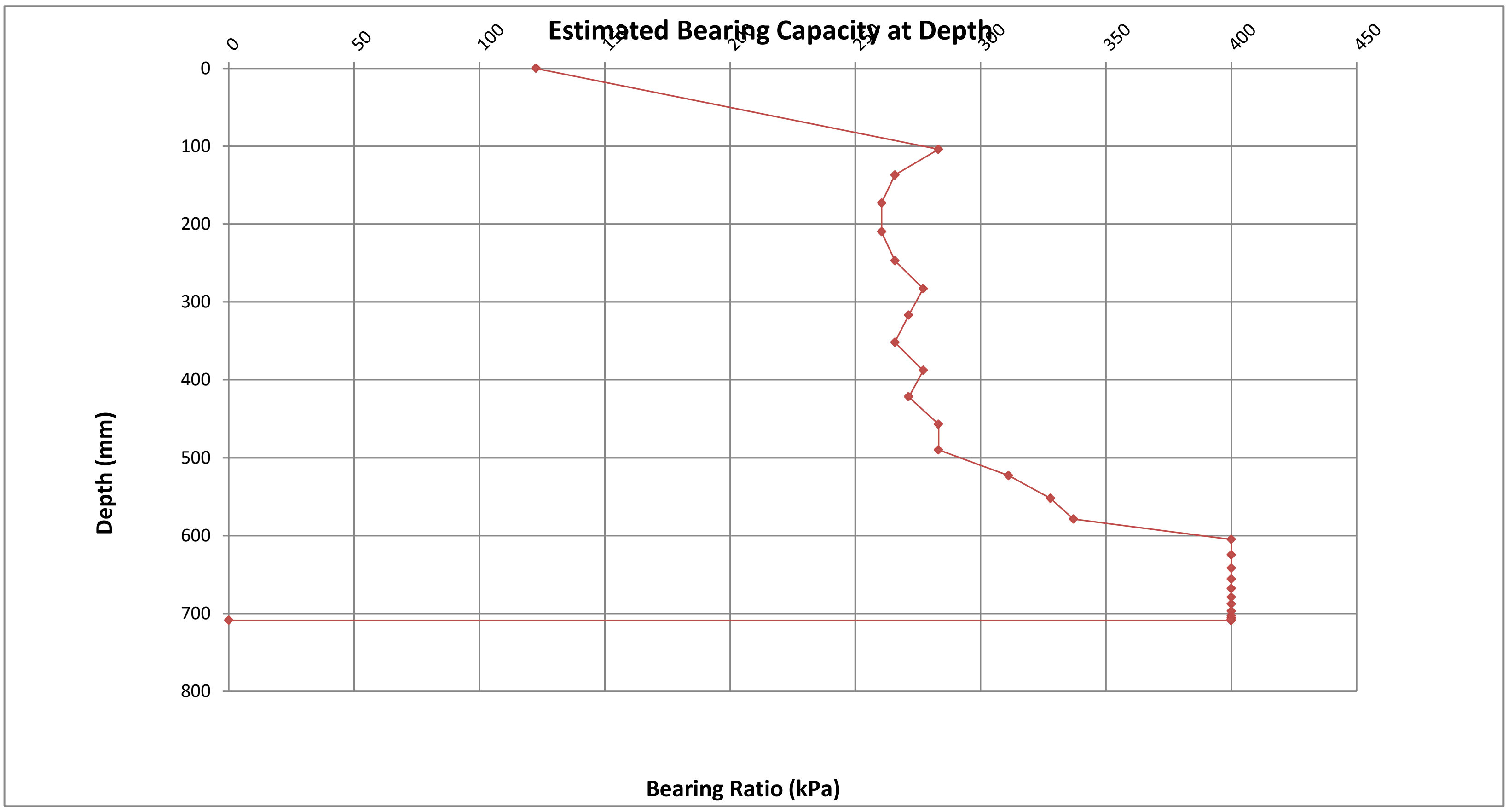
Client	KHATO CIVILS THENGA HOLDINGS JV	Tel:	0		
	Unit 10, Midway Industrial Park	Fax:	0		
	Centurian				
	0157		**2 BLO-ISC32-2-3B**		
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6





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0157
Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT:	Tippler - Saldanha	**MATERIALS TECHNICIAN:**	Mike
TEST POSITION:	**2 BLO-ISC32-2-4A**	**ASSISTANT**	Thabang
TEST DEPTH:	DCP 1 m (This is a standard accreditated Method)	**STARTING DEPTH:**	0mm
MATERIAL TYPE:	Sandy Materials	**INSTRUMENT (DCP) SET No:**	28596
CONSTRUCTION TYPE:	Road Construction	**Max. penetration depth:**	1000 mm
Enviromental Conditions	23'C	**LEVEL:**	@ NGL
REFUSAL:	706mm	**FOUNDATION:**	@ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x\,(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x\,(dn)^{-1.09}$
0	0	0	0	0					
5	20	20	20	4.0	Very Dense	400	70	77	640
10	34	34	14	2.8	Very Dense	>400	111	>110	944
15	79	79	45	9.0	Dense	226	25	26	264
20	140	140	61	12.2	Dense	181	17	17	190
25	197	197	57	11.4	Dense	190	19	19	204
30	224	224	27	5.4	Dense	328	48	52	461
35	259	259	35	7.0	Dense	271	35	37	348
40	290	290	31	6.2	Dense	296	40	43	397
45	325	325	35	7.0	Dense	271	35	37	348
50	365	365	40	8.0	Dense	246	29	31	301
55	405	405	40	8.0	Dense	246	29	31	301
60	434	434	29	5.8	Dense	311	44	47	427
65	460	460	26	5.2	Dense	337	51	54	481
70	480	480	20	4.0	Very Dense	400	70	77	640
75	499	499	19	3.8	Very Dense	>400	75	83	677
80	515	515	16	3.2	Very Dense	>400	94	104	816
85	530	530	15	3.0	Very Dense	>400	102	110	876
90	545	545	15	3.0	Very Dense	>400	102	110	876
95	565	565	20	4.0	Very Dense	400	70	77	640
100	575	575	10	2.0	Very Dense	>400	170	>110	1362
105	595	595	20	4.0	Very Dense	400	70	77	640
110	610	610	15	3.0	Very Dense	>400	102	110	876
115	625	625	15	3.0	Very Dense	>400	102	110	876
120	645	645	20	4.0	Very Dense	400	70	77	640
125	655	655	10	2.0	Very Dense	>400	170	>110	1362
130	660	660	5	1.0	Very Dense	>400	410	>110	2900
135	665	665	5	1.0	Very Dense	>400	410	>110	2900
140	669	669	4	0.8	Very Dense	>400	544	>110	3699
145	706	706	37	7.4	Dense	261	32	34	327

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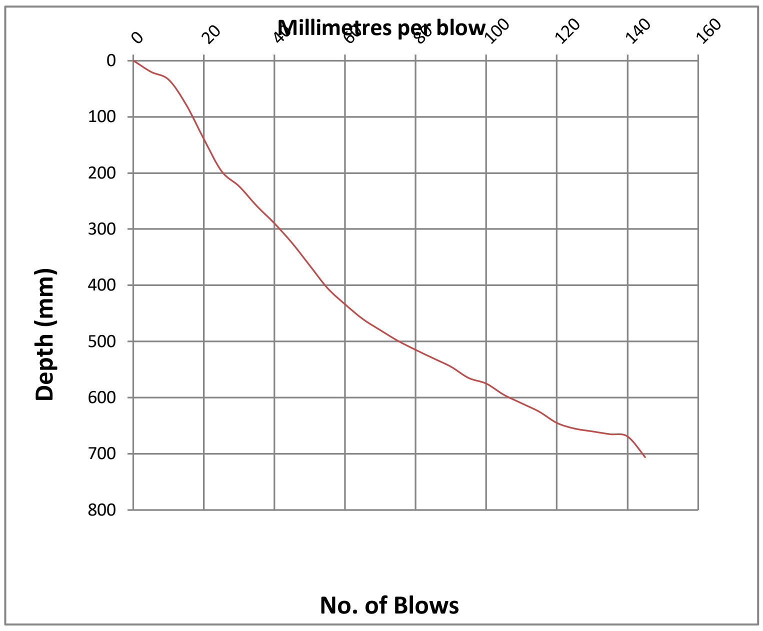
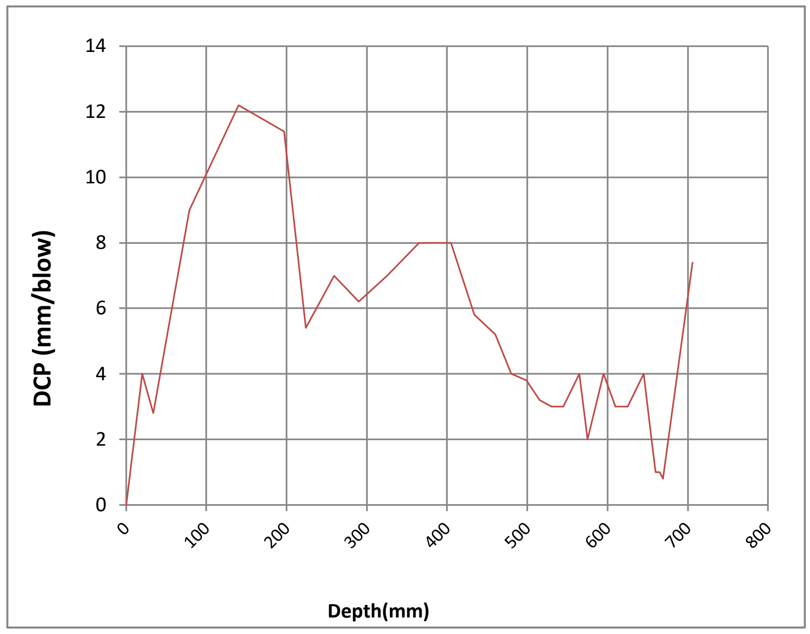
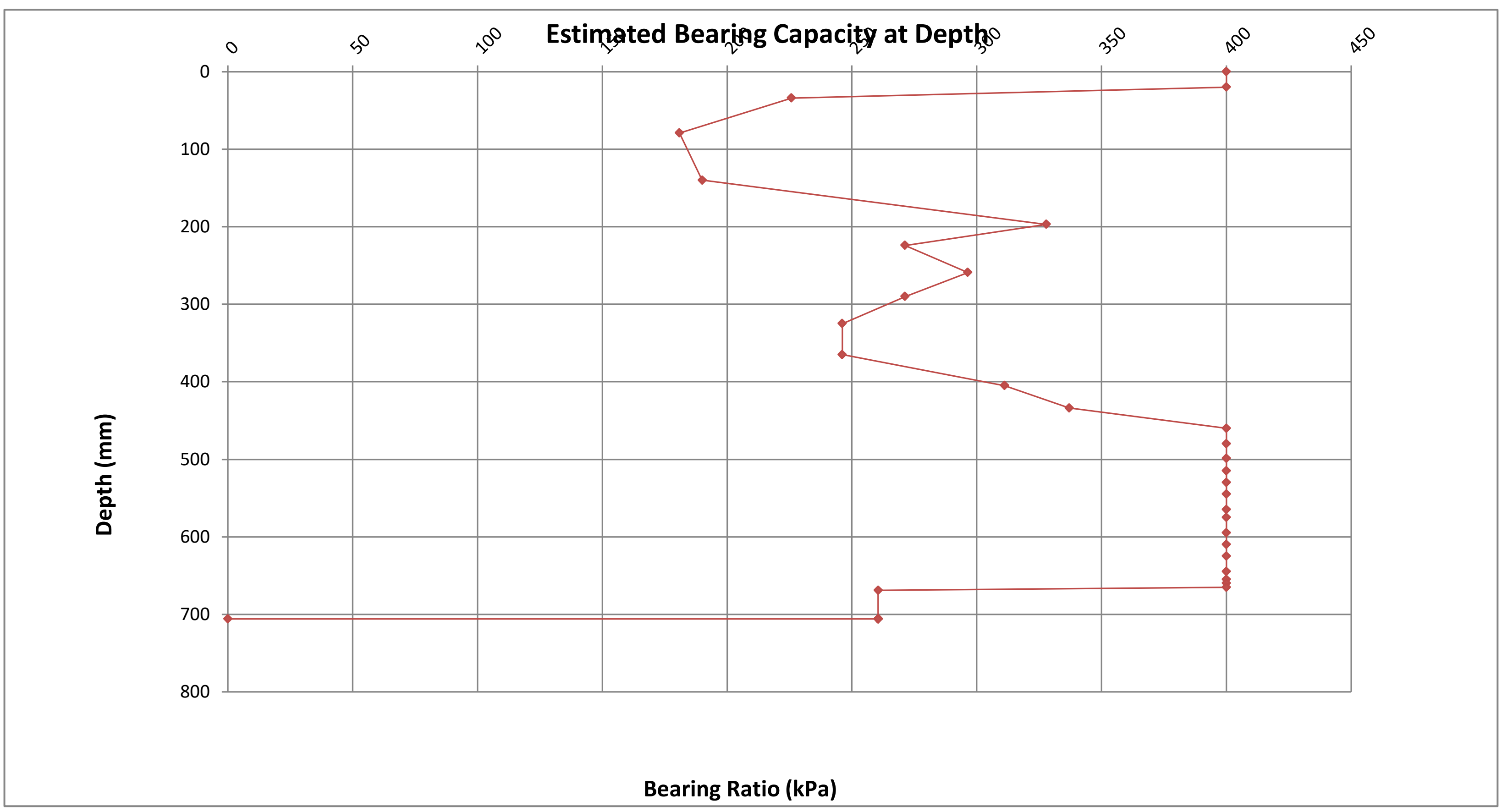
JOB No:	N/A	Ref. No:	N/A	Date:	07-02-2020
Client	KHATO CIVILS THENGA HOLDINGS JV	Tel:	0		
	Unit 10, Midway Industrial Park	Fax:	0		
	Centurian				
	0157		**2 BLO-ISC32-2-4A**		
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







Remarks:

1. The samples where subjected and analysed according to SANS / SABS.
2. The results reported relate only to the sample tested, Further use of the above information is not the responsibility or liability of Roadlab Laboratories - Saldanha.
3. This document is the correct record of all measurements made, and may not be reproduced other than with full written approval from the Technical Manager of Roadlab Laboratories - Saldanha
4. Measuring equipment is traceable to national standards (Where applicable).
5. Data Capture : Mrs. M. Swart

Mr A Engel
Lab Manager

ROADLAB
Civil Engineering Materials Laboratory
Laboratories (Pty) Ltd.

1 Palmiet str
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Vat Reg No: 4670261090

JOB No: N/A **Ref. No:** N/A **Date:** 07-02-2020

Client KHATO CIVILS THENGA HOLDINGS JV
Unit 10, Midway Industrial Park
Centurian
0157

Attention: Mr Sandile Kunene

DYNAMIC CONE PENETROMETER TMH6 ST6

PROJECT: Tippler - Saldanha
MATERIALS TECHNICIAN: Mike
TEST POSITION: 2 BLO-ISC32-2-4B
ASSISTANT Thabang
TEST DEPTH: DCP 1 m (This is a standard accreditated Method)
STARTING DEPTH: 0mm
MATERIAL TYPE: Sandy Materials
INSTRUMENT (DCP) SET No: 28596
CONSTRUCTION TYPE: Road Construction
Max. penetration depth: 1000 mm
Enviromental Conditions 23'C
LEVEL: @ NGL
REFUSAL: 749mm
FOUNDATION: @ Not Applicable

Number of Blows	Depth (mm)	Corrective Depth (mm)	Penetration Tempo	Structure Nr (dn) mm/blow	Consistency	Estimate Bearing Ratio	In Situ CBR $410x\,(dn)^{-1.27}$	In Situ CBR (TMH 6)	In Situ UCS $290x\,(dn)^{-1.09}$
0	0	0	0	0					
5	44	44	44	8.8	Dense	230	26	27	271
10	88	88	44	8.8	Dense	230	26	27	271
15	131	131	43	8.6	Dense	233	27	28	278
20	172	172	41	8.2	Dense	242	28	30	293
25	212	212	40	8.0	Dense	246	29	31	301
30	252	252	40	8.0	Dense	246	29	31	301
35	294	294	42	8.4	Dense	237	27	29	285
40	338	338	44	8.8	Dense	230	26	27	271
45	382	382	44	8.8	Dense	230	26	27	271
50	427	427	45	9.0	Dense	226	25	26	264
55	467	467	40	8.0	Dense	246	29	31	301
60	506	506	39	7.8	Dense	251	30	32	309
65	543	543	37	7.4	Dense	261	32	34	327
70	579	579	36	7.2	Dense	266	33	35	337
75	612	612	33	6.6	Dense	283	37	40	371
80	639	639	27	5.4	Dense	328	48	52	461
85	664	664	25	5.0	Very Dense	347	53	57	502
90	689	689	25	5.0	Very Dense	347	53	57	502
95	706	706	17	3.4	Very Dense	>400	87	96	764
100	712	712	6	1.2	Very Dense	>400	325	>110	2377
105	718	718	6	1.2	Very Dense	>400	325	>110	2377
110	722	722	4	0.8	Very Dense	>400	544	>110	3699
115	728	728	6	1.2	Very Dense	>400	325	>110	2377
120	734	734	6	1.2	Very Dense	>400	325	>110	2377
125	738	738	4	0.8	Very Dense	>400	544	>110	3699
130	741	741	3	0.6	Very Dense	>400	784	>110	5061
135	744	744	3	0.6	Very Dense	>400	784	>110	5061
140	747	747	3	0.6	Very Dense	>400	784	>110	5061
145	749	749	2	0.4	Very Dense	>400	1313	>110	7873

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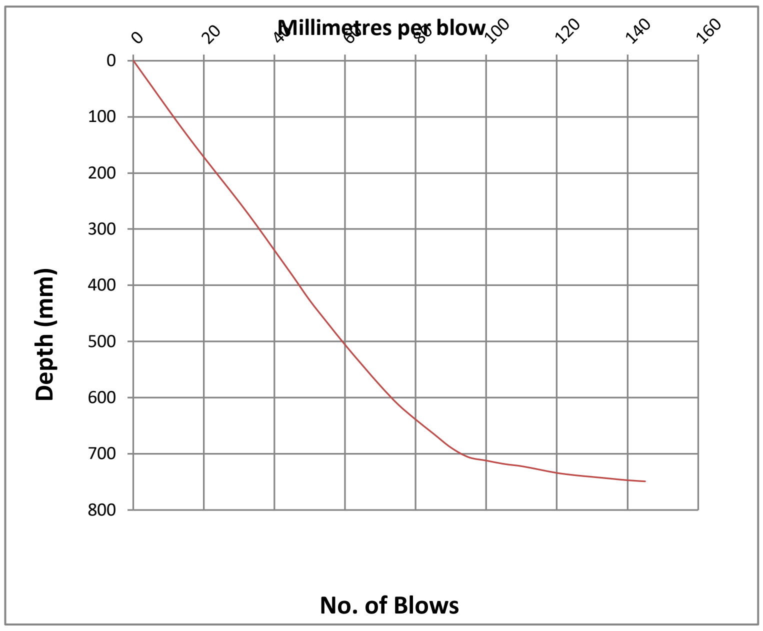
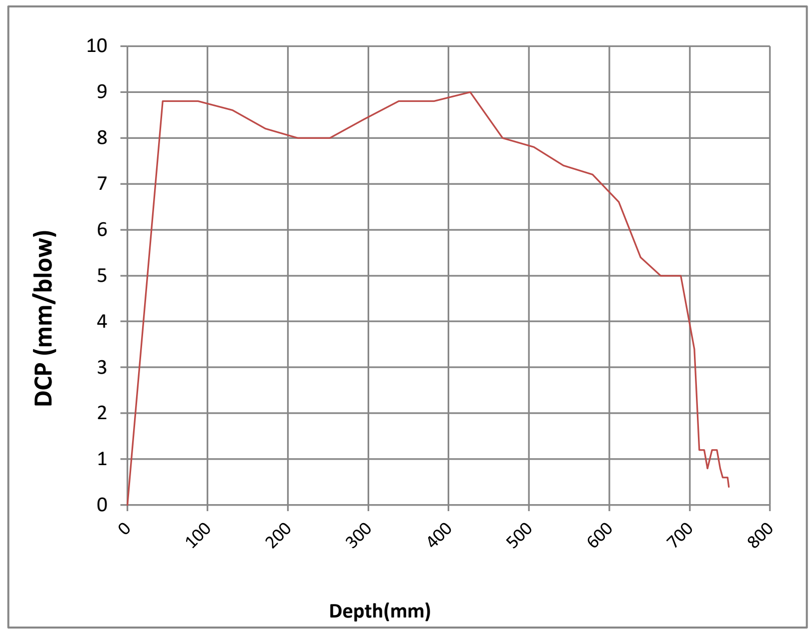
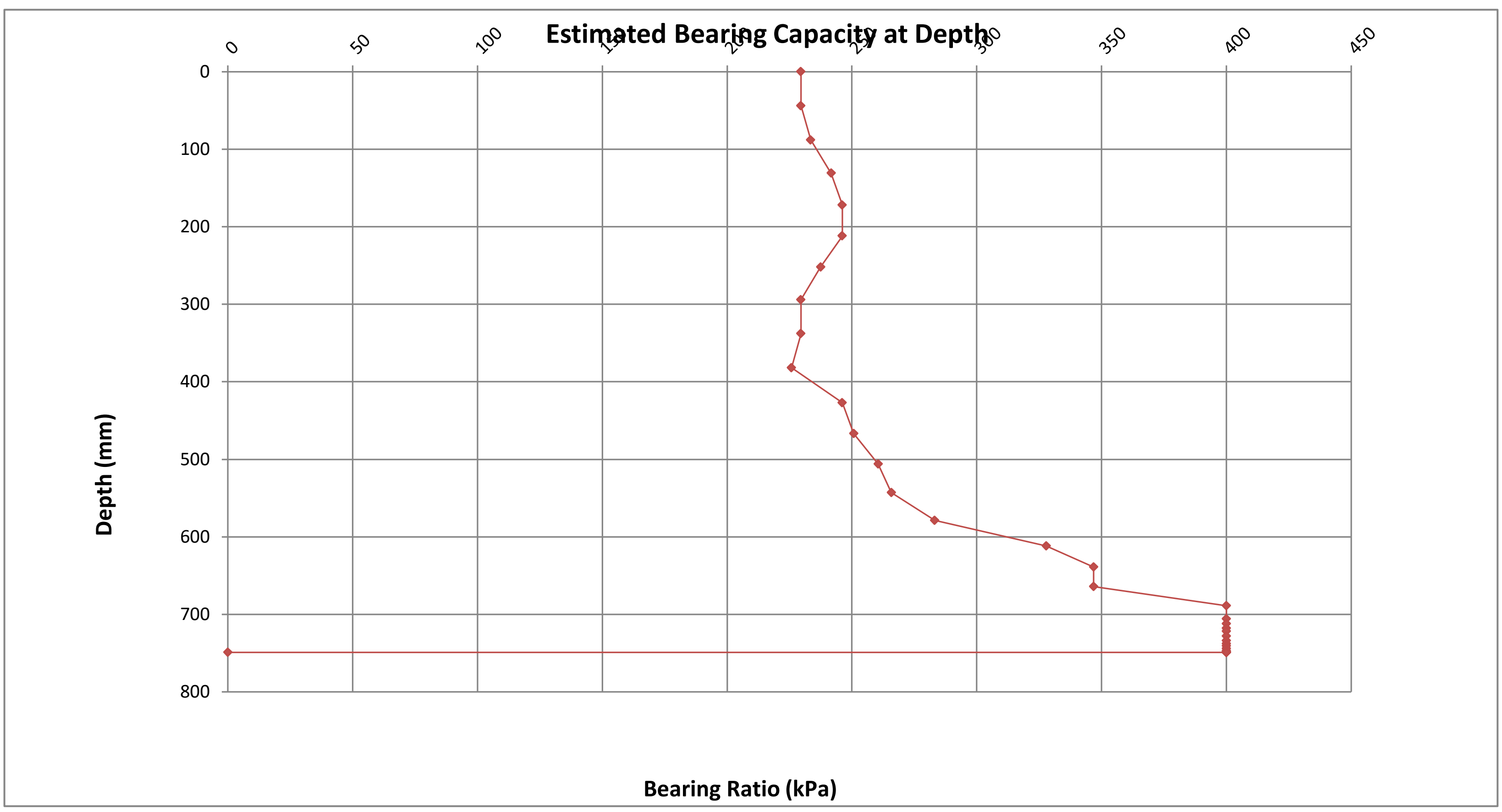
Vat Reg No: 4670261090

JOB No:	**N/A**	**Ref. No:**	**N/A**	**Date:**	**07-02-2020**
Client	KHATO CIVILS THENGA HOLDINGS JV		Tel:	0	
	Unit 10, Midway Industrial Park		Fax:	0	
	Centurian				
	0157			**2 BLO-ISC32-2-4B**	
Attention:	Mr Sandile Kunene				

GRAPHICAL REPRESENTATION / DYNAMIC CONE PENETROMETER TMH6 ST6







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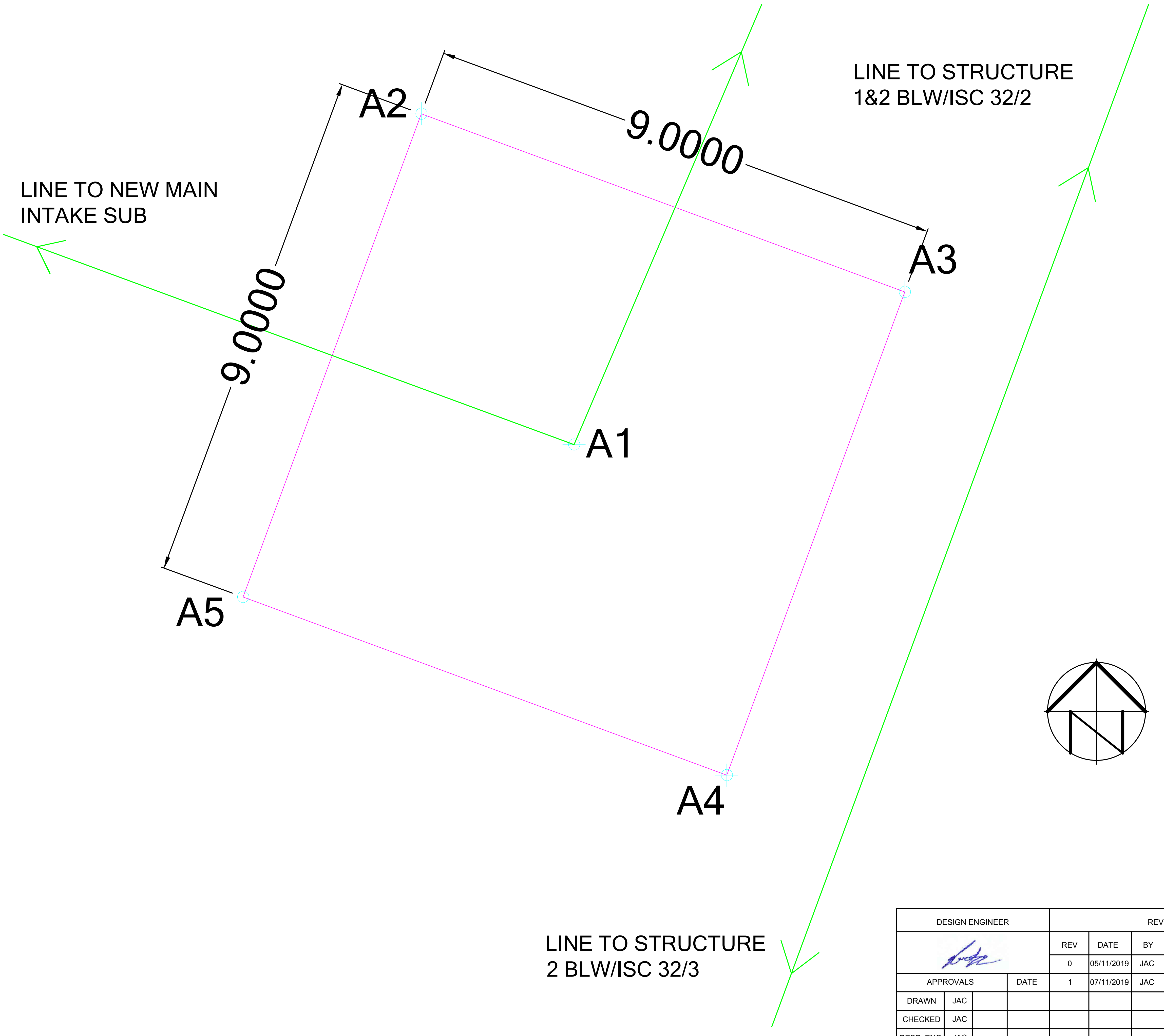
3. This document is the correct record of all measurements made, and may not be reproduced other than with full written approval from the Technical Manager of Roadlab Laboratories - Saldanha
4. Measuring equipment is traceable to national standards (Where applicable).
5. Data Capture : Mrs. M. Swart

Mr A Engel
Lab Manager

8.6.3. Contractor Provided Final Foundation Orientation



LEGEND:

- NEW ESKOM 66KV OVERHEAD LINE
- NEW ESKOM 66KV OVERHEAD LINE MAST & FOUNDATION STRUCTURE
- EXISITNG ESKOM 66KV OVERHEAD LINE
- SETTING OUT POINTS FOR NEW ESKOM 66V OVERHEAD LINE MAST & FOUNDATION

FOUNDATION STAKING TABLE		
COORDINATES (WGS 84 Lo 19)		
POINT NUMBER	X - EASTING	Y - NORTHING
A1 - 1 BLW/ISC 32/3	-93 180.4700	-3 652 819.0800
A2	-93 183.1368	-3 652 813.3017
A3	-93 174.6917	-3 652 816.4132
A4	-93 177.8032	-3 652 824.8583
A5	-93 186.2483	-3 652 821.7468

NOTE:

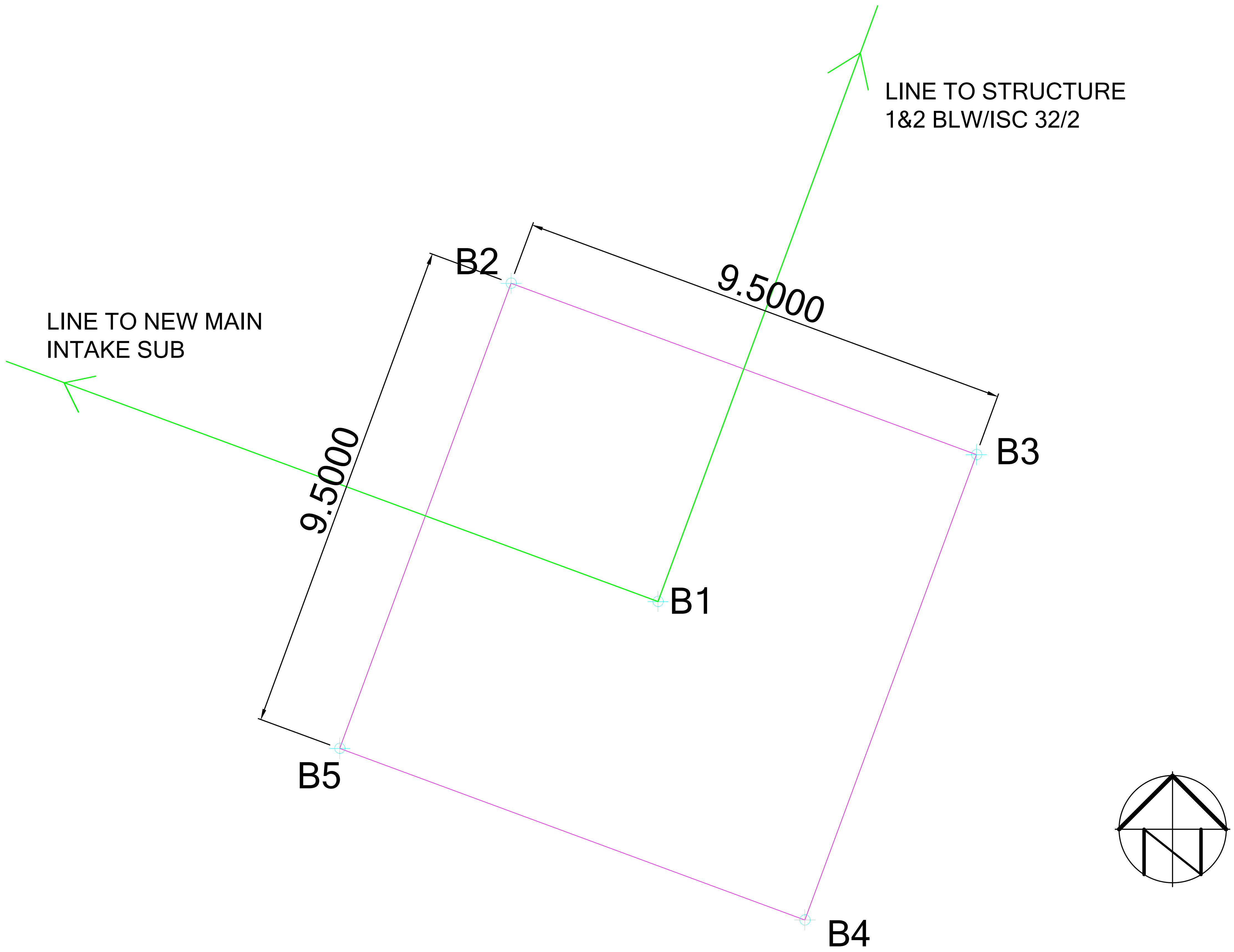
ALL DATA POINTS WERE EXTRACTED FROM DATA GENERATED BY SOUTH ZAMBEZI & SHOULD THEREFORE BE VERIFIED BY SOUTH ZAMBEZI BEFORE STAKES ARE PLANTED

STRUCTA konsult

DESIGN ENGINEER				REVISIONS			
				REV	DATE	BY	DESCRIPTION
				0	05/11/2019	JAC	SETTING OUT DETAILS
APPROVALS			DATE	1	07/11/2019	JAC	2 BLW/ISC 32/1 FOUNDATION POSITION CHANGED
DRAWN	JAC						
CHECKED	JAC						
RESP. ENG.	JAC						

STRUCTAKONSULT (PTY) LTD

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE					
TITLE	SETTING OUT DETAILS FOR 1 BLW/ISC 32/3					
ENG. REF. NO	FD2222/09/19	SCALE: NTS	DWG NO		DWG SIZE	REV NO.
CLIENT	ASCENG		1	6	A3	1



LEGEND:

- NEW ESKOM 66KV OVERHEAD LINE
- NEW ESKOM 66KV OVERHEAD LINE MAST & FOUNDATION STRUCTURE
- EXISITNG ESKOM 66KV OVERHEAD LINE
- SETTING OUT POINTS FOR NEW ESKOM 66V OVERHEAD LINE MAST & FOUNDATION

FOUNDATION STAKING TABLE		
COORDINATES (WGS 84 Lo 19)		
POINT NUMBER	X - EASTING	Y - NORTHING
B1 - 2 BLW/ISC 32/3	-93 182.5900	-3 652 844.3800
B2	-93 185.4049	-3 652 838.2807
B3	-93 176.4907	-3 652 841.5651
B4	-93 179.7751	-3 652 850.4793
B5	-93 188.6893	-3 652 847.1949

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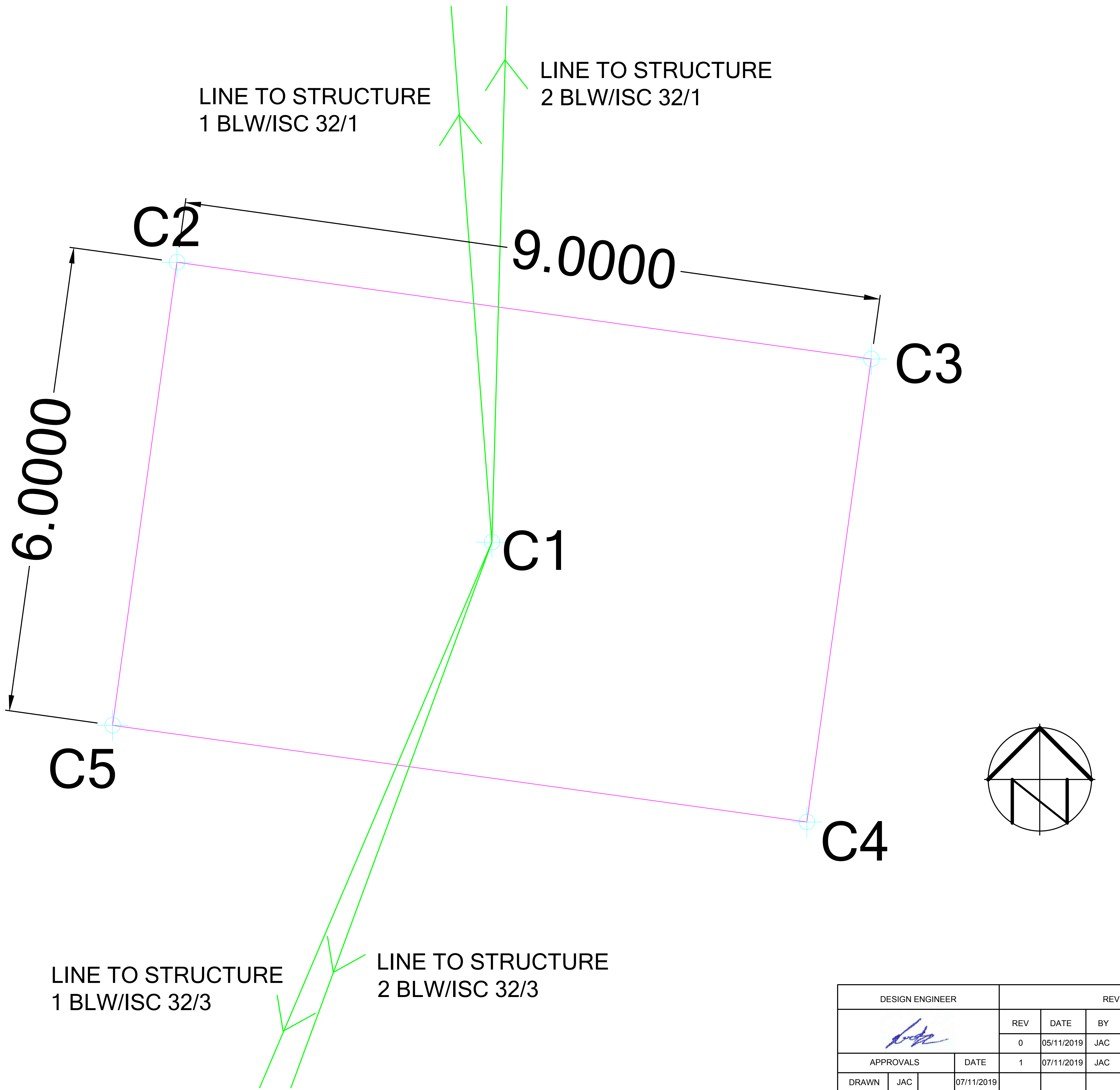
STRUCTA konsult

DESIGN ENGINEER				REVISIONS			
				REV	DATE	BY	DESCRIPTION
				0	05/11/2019	JAC	SETTING OUT DETAILS
APPROVALS			DATE	1	07/11/2019	JAC	2 BLW/ISC 32/1 FOUNDATION POSITION CHANGED
DRAWN	JAC		07/11/2019				
CHECKED	JAC		07/11/2019				
RESP. ENG.	JAC		07/11/2019				

STRUCTAKONSULT (PTY) LTD

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE					
TITLE	SETTING OUT DETAILS FOR 2 BLW/ISC 32/3					
ENG. REF. NO	FD2222/09/19	SCALE: NTS	DWG NO		DWG SIZE	REV NO.
CLIENT	ASCENG		2	6	A3	1



LEGEND:

- NEW ESKOM 66KV OVERHEAD LINE
- NEW ESKOM 66KV OVERHEAD LINE MAST & FOUNDATION STRUCTURE
- EXISITNG ESKOM 66KV OVERHEAD LINE
- SETTING OUT POINTS FOR NEW ESKOM 66V OVERHEAD LINE MAST & FOUNDATION

FOUNDATION STAKING TABLE		
COORDINATES (WGS 84 Lo 19)		
POINT NUMBER	X - EASTING	Y - NORTHING
C1 - 1&2 BLW/ISC 32/2	-93 127.1100	-3 652 693.8000
C2	-93 131.1527	-3 652 690.2074
C3	-93 122.2389	-3 652 691.4500
C4	-93 123.0673	-3 652 697.3926
C5	-93 131.9811	-3 652 696.1500

NOTE:

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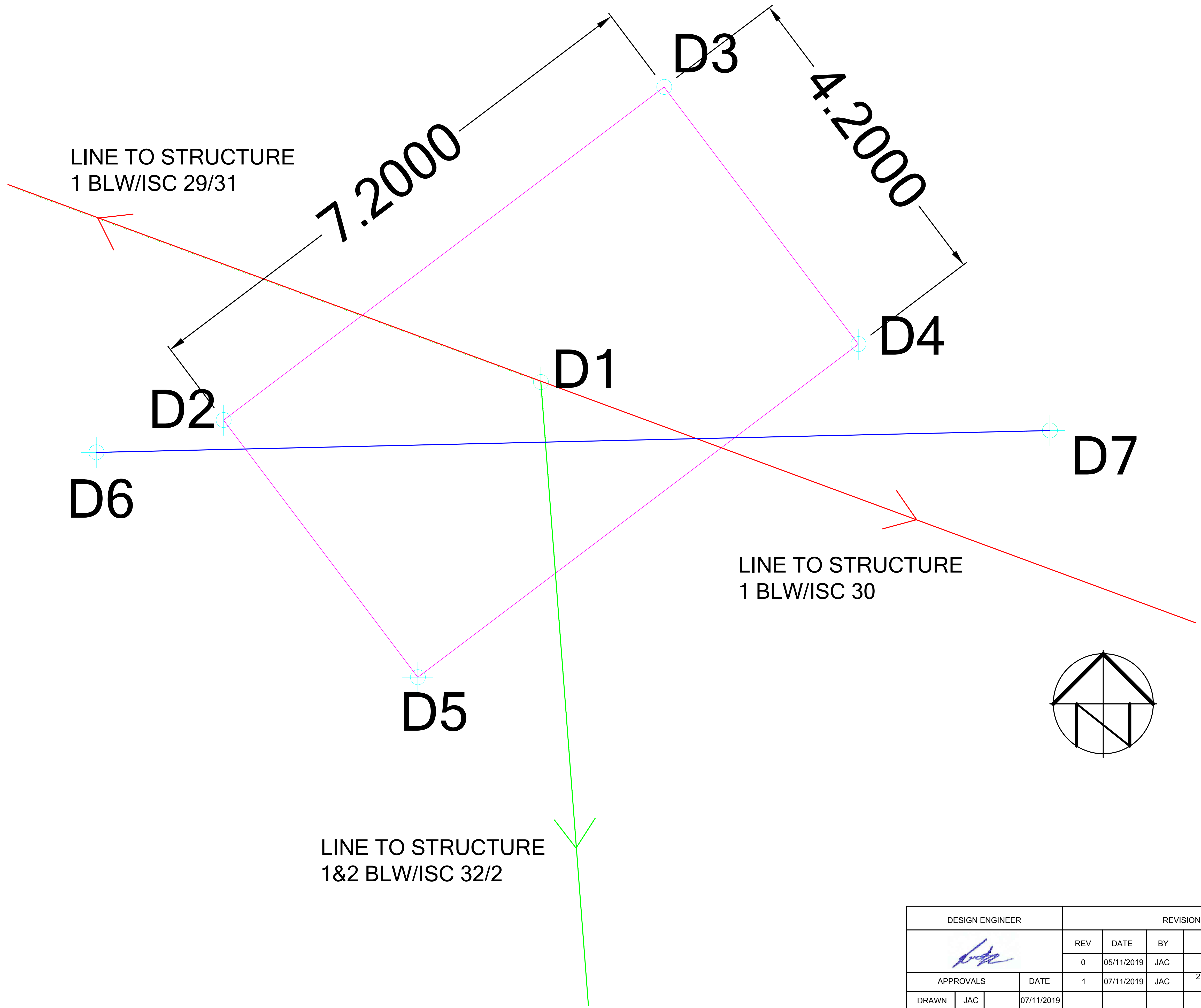
STRUCTA konsult

STRUCTAKONSULT (PTY) LTD

DESIGN ENGINEER				REVISIONS			
				REV	DATE	BY	DESCRIPTION
				0	05/11/2019	JAC	SETTING OUT DETAILS
APPROVALS			DATE	1	07/11/2019	JAC	2 BLW/ISC 32/1 FOUNDATION POSITION CHANGED
DRAWN	JAC		07/11/2019				
CHECKED	JAC		07/11/2019				
RESP. ENG.	JAC		07/11/2019				

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE				
TITLE	SETTING OUT DETAILS FOR 1&2 BLW/ISC 32/2				
ENG. REF. NO	FD2222/09/19	SCALE: NTS	DWG NO	DWG SIZE	REV NO.
CLIENT	ASCENG		3 6	A3	1



LEGEND:

- NEW ESKOM 66KV OVERHEAD LINE
- NEW ESKOM 66KV OVERHEAD LINE MAST & FOUNDATION STRUCTURE
- EXISITNG ESKOM 66KV OVERHEAD LINE
- EXISITNG 80mm WATER PIPE THRU FOUNDATION
- SETTING OUT POINTS FOR NEW ESKOM 66V OVERHEAD LINE MAST & FOUNDATION

FOUNDATION STAKING TABLE		
COORDINATES (WGS 84 Lo 19)		
POINT NUMBER	X - EASTING	Y - NORTHING
D1 - 1 BLW/ISC 32/1	-93 136.1600	-3 652 574.9200
D2	-93 140.2984	-3 652 575.4140
D3	-93 134.5530	-3 652 571.0745
D4	-93 132.0216	-3 652 574.4260
D5	-93 137.7670	-3 652 578.7655
D6	-93 141.9560	-3 652 575.8350
D7	-93129.5260	-3 62 575.5520

NOTE:

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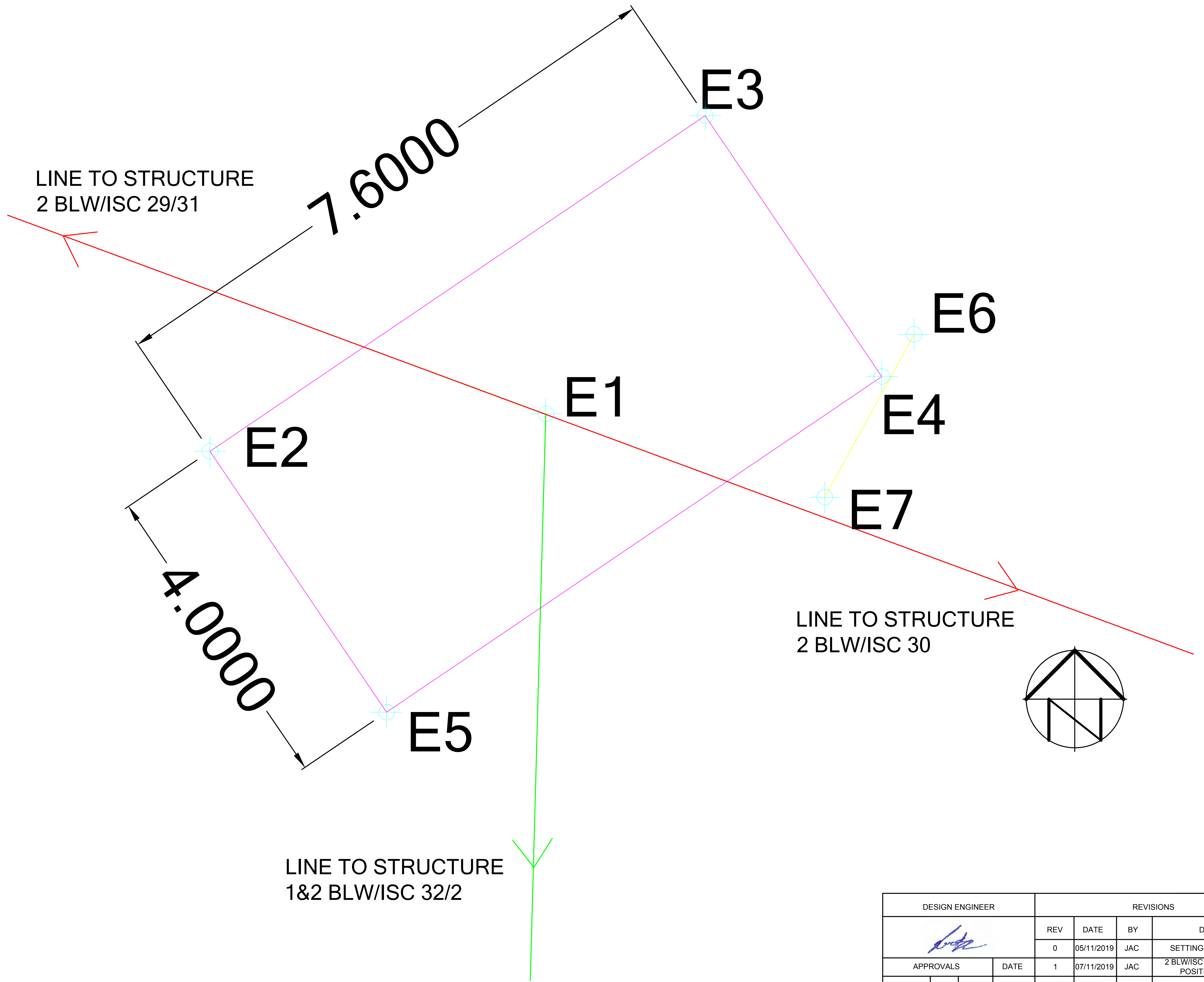
DESIGN ENGINEER			REVISIONS			
			REV	DATE	BY	DESCRIPTION
			0	05/11/2019	JAC	SETTING OUT DETAILS
APPROVALS		DATE	1	07/11/2019	JAC	2 BLW/ISC 32/1 FOUNDATION POSITION CHANGED
DRAWN	JAC	07/11/2019				
CHECKED	JAC	07/11/2019				
RESP. ENG.	JAC	07/11/2019				

STRUCTAKONSULT (PTY) LTD

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE
TITLE	SETTING OUT DETAILS FOR 1 BLW/ISC 32/1
ENG. REF. NO	FD2222/09/19
SCALE:	NTS
CLIENT	ASCENG

DWG NO		DWG SIZE	REV NO
4	6	A3	1



LEGEND:

- NEW ESKOM 66KV OVERHEAD LINE
- NEW ESKOM 66KV OVERHEAD LINE MAST & FOUNDATION STRUCTURE
- EXISITNG ESKOM 66KV OVERHEAD LINE
- EXISITNG ELECTRIC CABLE THRU FOUNDATION
- SETTING OUT POINTS FOR NEW ESKOM 66V OVERHEAD LINE MAST & FOUNDATION

FOUNDATION STAKING TABLE		
COORDINATES (WGS 84 Lo 19)		
POINT NUMBER	X - EASTING	Y - NORTHING
E1 - 2 BLW/ISC 32/1	-93 124.3600	-3 652 594.2300
E2	-93 128.6279	-3 652 594.7040
E3	-93 122.3344	-3 652 590.4436
E4	-93 120.0921	-3 652 593.7560
E5	-93 126.3856	-3 652 598.0164
E6	-93 119.6788	-3 652 593.2206
E7	-93 120.8160	-3 652 595.2870

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STRUCTAKONSULT (PTY) LTD

DESIGN ENGINEER			REVISIONS			
			REV	DATE	BY	DESCRIPTION
			0	05/11/2019	JAC	SETTING OUT DETAILS
APPROVALS		DATE	1	07/11/2019	JAC	2 BLW/ISC 32/1 FOUNDATION POSITION CHANGED
DRAWN	JAC	07/11/2019				
CHECKED	JAC	07/11/2019				
RESP. ENG.	JAC	07/11/2019				

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE
TITLE	SETTING OUT DETAILS FOR 2 BLW/ISC 32/1
ENG. REF. NO	FD2222/09/19
SCALE:	NTS
CLIENT	ASCENG
DWG NO	6 6
DWG SIZE	A3
REV NO	1

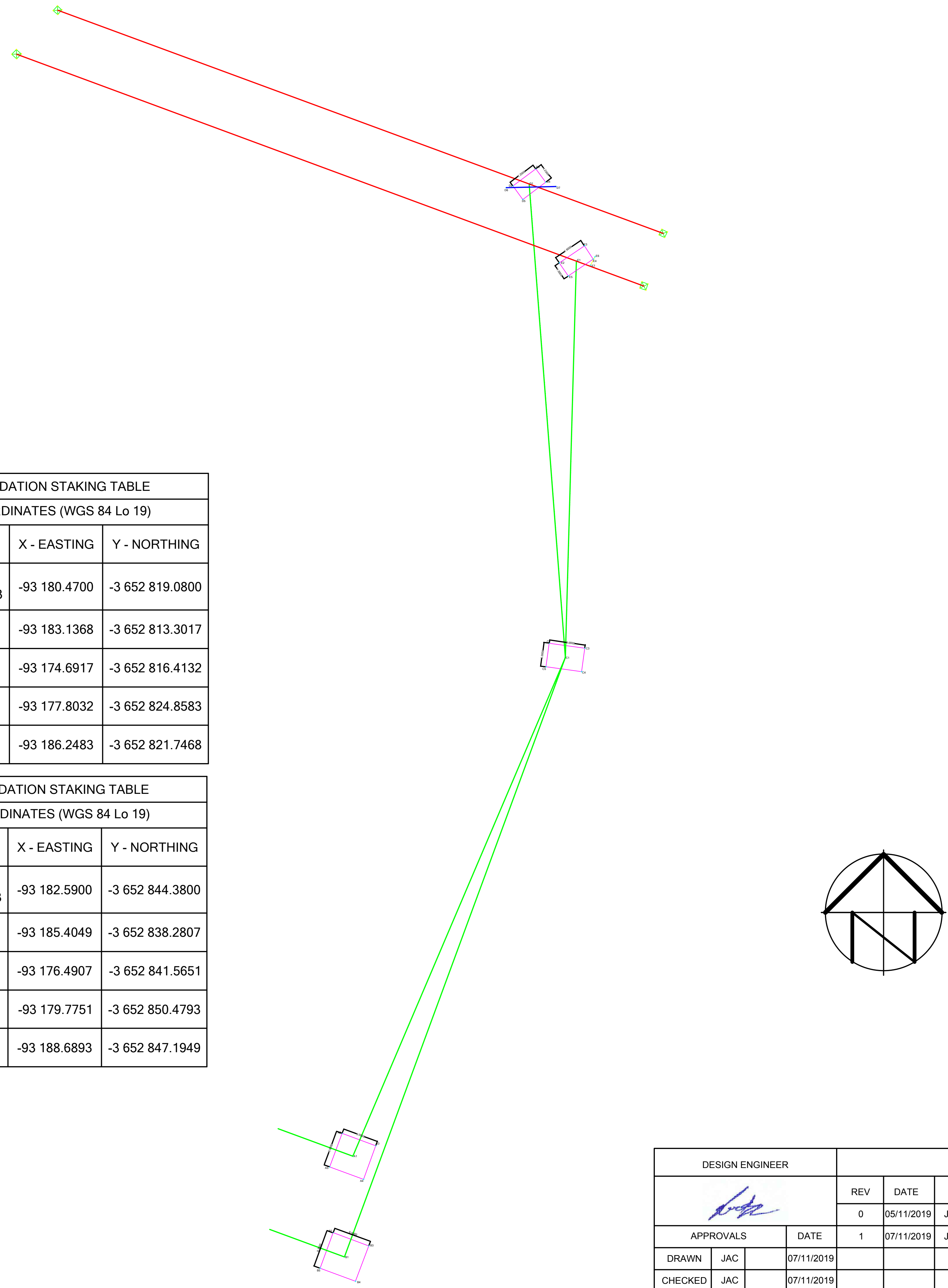
FOUNDATION STAKING TABLE		
COORDINATES (WGS 84 Lo 19)		
POINT NUMBER	X - EASTING	Y - NORTHING
E1 - 2 BLW/ISC 32/1	-93 124.3600	-3 652 594.2300
E2	-93 128.6279	-3 652 594.7040
E3	-93 122.3344	-3 652 590.4436
E4	-93 120.0921	-3 652 593.7560
E5	-93 126.3856	-3 652 598.0164
E6	-93 119.6788	-3 652 593.2206
E7	-93 120.8160	-3 652 595.2870

FOUNDATION STAKING TABLE		
COORDINATES (WGS 84 Lo 19)		
POINT NUMBER	X - EASTING	Y - NORTHING
D1 - 1 BLW/ISC 32/1	-93 136.1600	-3 652 574.9200
D2	-93 140.2984	-3 652 575.4140
D3	-93 134.5530	-3 652 571.0745
D4	-93 132.0216	-3 652 574.4260
D5	-93 137.7670	-3 652 578.7655
D6	-93 141.9560	-3 652 575.8350
D7	-93129.5260	-3 62 575.5520

FOUNDATION STAKING TABLE		
COORDINATES (WGS 84 Lo 19)		
POINT NUMBER	X - EASTING	Y - NORTHING
A1 - 1 BLW/ISC 32/3	-93 180.4700	-3 652 819.0800
A2	-93 183.1368	-3 652 813.3017
A3	-93 174.6917	-3 652 816.4132
A4	-93 177.8032	-3 652 824.8583
A5	-93 186.2483	-3 652 821.7468

FOUNDATION STAKING TABLE		
COORDINATES (WGS 84 Lo 19)		
POINT NUMBER	X - EASTING	Y - NORTHING
C1 - 1&2 BLW/ISC 32/2	-93 127.1100	-3 652 693.8000
C2	-93 131.1527	-3 652 690.2074
C3	-93 122.2389	-3 652 691.4500
C4	-93 123.0673	-3 652 697.3926
C5	-93 131.9811	-3 652 696.1500

FOUNDATION STAKING TABLE		
COORDINATES (WGS 84 Lo 19)		
POINT NUMBER	X - EASTING	Y - NORTHING
B1 - 2 BLW/ISC 32/3	-93 182.5900	-3 652 844.3800
B2	-93 185.4049	-3 652 838.2807
B3	-93 176.4907	-3 652 841.5651
B4	-93 179.7751	-3 652 850.4793
B5	-93 188.6893	-3 652 847.1949



LEGEND:

- NEW ESKOM 66KV OVERHEAD LINE
- NEW ESKOM 66KV OVERHEAD LINE MAST & FOUNDATION STRUCTURE
- EXISITNG ESKOM 66KV OVERHEAD LINE
- EXISITNG ELECTRIC CABLE THRU FOUNDATION
- EXISITNG 80mm WATER PIPE THRU FOUNDATION
- SETTING OUT POINTS FOR NEW ESKOM 66V OVERHEAD LINE MAST & FOUNDATION

NOTE:

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STRUCTA konsult

DESIGN ENGINEER			REVISIONS			
			REV	DATE	BY	DESCRIPTION
			0	05/11/2019	JAC	SETTING OUT DETAILS
APPROVALS		DATE	1	07/11/2019	JAC	2 BLW/ISC 32/1 FOUNDATION POSITION CHANGED
DRAWN	JAC	07/11/2019				
CHECKED	JAC	07/11/2019				
RESP. ENG.	JAC	07/11/2019				

STRUCTAKONSULT (PTY) LTD

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE
TITLE	SETTING OUT DETAILS FOR ALL
ENG. REF. NO	FD2222/09/19
SCALE:	NTS
DWG NO	6
DWG SIZE	A3
REV NO	1
CLIENT	ASCENG

8.7. Hardware Assemblies

8.7.1. General

All hardware assemblies must comply with the relevant Eskom standards / specifications, SANS 10280-1: Overhead power lines for conditions prevailing in South Africa - Part 1: Safety, as well as any other statutory regulations. The following, but not limited to, Eskom standards shall apply:

- 240-75883896 Rev 1 : Outdoor Post and Long Rod Insulators for New and Refurbished Powerlines
- for 66 kV and 132 kV Standard.
- 240-75883154 Rev 1 : Current Carrying Compression Fittings for Overhead Sub-Transmission Systems.
- 240-75884092 Rev 1 : Sub-Transmission Lines Section 14: Assembly and Informative Drawings For 66 kV and 132 kV Lines Standard.
- 240-110403330 Rev 2 : OPGW Hardware and Installation Requirements for Overhead Lines.

Prior to commencement of the final hardware installations, a sample of each type of assembly shall be made up on-site, for review and approval by Transnet and Eskom. Additional samples of each type of assembly shall also be provided for the FAT inspection(s) of the structures, in order to fit them onto the structures to confirm correctness.

8.7.2. Insulation Requirements

Composite silicone rubber long rod and post stand-off insulators for 66 kV overhead lines will be used, except for the terminal structures 1 BLO / ISC 32/2 and 2 BLO / ISC 32/2, which will have 132 kV long rod insulators on the closing span side. The creepage distance of the long rod & post stand-off insulators shall be 31mm/kV for high polluted areas (coastal areas).

The minimum insulation levels, and creepage requirements, for overhead lines is depicted in the figure below:

1	2	3	4	5	6	7	8	9	10	11	12
Highest system r.m.s. voltage kV	System nominal r.m.s. voltage kV	System fault level kA	Rated peak lightning impulse withstand voltage kV	Rated peak switching impulse withstand voltage (phase-to-earth) kV	Phase-to-phase ratio to the phase-to-earth peak value	Rated peak switching impulse withstand voltage (phase-to-phase) kV	60 s r.m.s. power-frequency withstand voltage (phase-to-earth) kV	Creepage distance over external insulation for line, in accordance with SABS IEC 60815 mm			
								Lightly polluted areas	Medium polluted areas	Heavily polluted areas	Very heavily polluted areas
12	11	–	75[1)]	–	–	–	28	192	240	300	372
24	22	–	125[1)]	–	–	–	50	384	480	600	744
36	33	–	170[1)]	–	–	–	70	576	720	900	1 116
48	44	20	250	–	–	–	95	770	960	1 200	1 500
72	66	20	350	–	–	–	140	1 150	1 400	1 800	2 200
100	88	25	380	–	–	–	150	1 600	2 000	2 500	[illegible]
145	132	40	550	–	–	–	230	2 320	2 900	3 600	4 500
245	220	40	850	–	–	–	360	3 920	4 900	6 100	7 000
300	275	50	1 050	850	1,5	1 300	–	4 800	6 000	7 500	9 000
362	330	50	1 300	950	1,5	1 425	–	5 800	7 200	9 000	11 000
420	400	50	1 425	1 050	1,5	1 550	–	6 700	8 400	10 500	13 000
800	765	50	2 100	1 550	1,6	2 400	–	12 800	16 000	20 000	25 000

1) For unearthed lines with nominal system voltages of 11 kV, 22 kV and 33 kV, current practice is to achieve an insulation level of 300 kV.

Figure 25: Minimum Insulation Levels for Overhead Lines

8.7.3. Lightning Impulse Withstand Level (BIL)

With reference to the SANS 1019: Standard voltages, currents and insulation levels for electricity supply, and in conjunction with the 66 kV design criteria applied to the new sub transmission line the insulation co-ordination range can be defined as "Range B" - 52 kV < Um < 300 kV.

For "Range B" the standard voltages and insulation levels are summarized in the figure below from the referenced SANS 1019 code.

Table 3 — Standard voltages and insulation levels for range B*

1	2	3	4	5	6
Highest voltage for equipment U_m, r.m.s.	Nominal system voltage U_n, r.m.s.	Base for p.u.+ values, $U_m \cdot \frac{\sqrt{2}}{\sqrt{3}}$	Rated lightning impulse withstand voltage, peak		Rated short duration power-frequency withstand voltage, r.m.s.
kV	kV	kV	p.u.+	kV	kV
52 #	44	42,5	5,88	250	95
72,5	66	59	5,93	350	140
100	88	82	4,63 5,49	380 450	150 185
145	132	118	4,66 5,50	550 650	230 275
245	220	200	4,25 4,75	850 950	360 395

* Insulation levels for highest voltage for equipment U_m < 100 kV are based on an earth fault factor equal to $\sqrt{3}$ and for $U_m \geq$ 100 kV, on an earth fault factor equal to $0,8\sqrt{3}$.

+ p.u. = per unit value of $U_m \cdot \frac{\sqrt{2}}{\sqrt{3}}$ kV.

Where creepage distances are based on millimetres per kilovolt of highest voltage for equipment, the value of 48 kV should be used.

Figure 26: Standard Voltages & Insulation Levels - Range B

From the table above the minimum lightning impulse withstand insulation level required for 66 kV OHL equipment is 350 kV at sea level and the 60 seconds power frequency withstand level is 140 kV.

8.7.4. Hardware Equipment & Components

Table 17: List of Equipment/Components

Equipment/Component	Eskom Drawing
Insulator (Long Rod): 66 kV, 31 mm/kV, 120 kN	D-DT-7029
Insulator (Long Rod): 132 kV, 31 mm/kV, 120 kN	D-DT-7014
Line Post Insulator - Horizontal: 66 kV, 31 mm/kV, 5.3 kN	D-WC-7600-01-06, D-WC-7600-01-13, D-DT-7031
Insulator - Shield Wire/OPGW Strain: 120 kN	D-DT-7012
D-Shackle (Straight Bolt Type): 120 kN	D-DT-7017
Clevis - Ball: 120 kN	D-DT-6059
Socket - Clevis: 120 kN	D-DT-7021
Sag Adjustor: 120 kN	D-DT-7042
Thimble Clevis: 120 kN	Buy Out - To Suite
Terminal Lug	D-DT-3074
Dead End Clamp (Compression Type)	D-DT-7000
Extension Link 350 mm (Double): 120 kN	D-DT-7041
Pistol Grip Clamp: 70 kN	D-DT-7022
Parallel Groove Clamp - Aluminium (Cond. Range 6.6 - 18.9 mm)	Buy Out - To Suite
Preformed Helically Dead End	Buy Out - To Suite
Yoke Plate - Triangle: 120 kN	D-DT-7015
EUT-B Clamp	D-DT-6099
Multi-Frequency Vibration Damper	D-DT-7005 Buy Out - To Suite (for existing OPGW)
Temporary Stay Assembly (Non - Adjustable): 115 kN	D-DT-7310
Non-Insulated Type - Down Lead Clamps for direct bonding of existing OPGW onto Iscor Substation Gantry	Buy Out - To Suite

8.8. Vibration Control

Vibration control dampers shall be installed for all phase conductors, OPGW and shield wires. Only multi-frequency type Stockbridge dampers will be used, as per Eskom drawing D-DT-7005. The dampers shall be installed in accordance with the following Eskom standards:

- 240-98155879 Rev 1 : Vibration Dampers for Single Conductor Sub-Transmission Lines.
- 240-110403330 Rev 2 : OPGW Hardware and Installation Requirements for Overhead Lines.

The table below is an extract from Eskom standard 240-98155879 Rev 1 and is used as a guideline for the selection of the number of multi-frequency vibration dampers required per span.

Table 18: Determining the Number of Multi-Frequency Stockbridge Vibration Dampers Required

Span (m)	Number of dampers per span per conductor	Arrangement of dampers per conductor	Damper placement
0 to 369	2	1 damper at each end	0.7 x L from ends
370 to 550	4	2 dampers at each end	0.6 x L from 1st damper
551 to 730	6	3 dampers at each end	0.9 x L from 2nd damper

With reference to the new 66 kV branch line, the span lengths are less than 369 m. Therefore, in terms of the table above the design falls within the 0 to 369 m category, thus one vibration damper shall be installed at each end of a conductor.

The positioning of the multi-frequency vibration dampers for Chicadee and Kingbird ACSR conductors shall be in accordance with the table below, as taken from the Eskom standard 240-98155879 Rev 1. (Note: The table below is an extract from the relevant Eskom standard and the values contained within the table are all based on a wind velocity of 4m/s).

Table 19: Damper Positions for a Wind Velocity of 4 m/s (Chicadee & Kingbird ACSR)

Conductor Type	V (m/s)	W (kg/m)	H (N)	D (m)	L (m)	Damper Position 1 from ends (m)	Damper Position 2 from ends (m)
Chickadee	4	0.643	11350	0.01887	1.69	1.19	2.20
Kingbird	4	1.028	18146	0.0239	2.14	1.50	2.79

From the table above the installation position of the vibration dampers can be derived as being 1.19 m from the "dead ends" for Chicadee ACSR conductors, and 1.50 m for Kingbird ACSR conductors.

As specified in Eskom standard '240-98155879 - Vibration Dampers for Single Conductor Sub-Transmission Lines', the following equations govern the vibration damper positioning:

- $Fc = \frac{0.185 \times V}{D}$ in Hz
- $L = \frac{1}{2 \times Fc} \times \sqrt{\frac{H}{W}}$ in m

- $L = \frac{2.703}{v} \times D \times \sqrt{\frac{H}{W}}$ in m
- C = H/W
- H = C* W in N

Where:

- Fc is the critical frequency (frequency giving rise to shortest loop length).
- L is the loop length (m).
- V is the wind speed perpendicular to the conductor (m/s).
- D is the conductor diameter (m).
- H is the conductor tension (N).
- W is the conductor mass per unit length (kg/m).

The position of the damper is measured from the point of contact between the dead end or suspension hardware and the conductor. A damper is placed on each end of the span at a distance of 70% of the loop length, i.e. 0.7 x L.

Table 20: Damper Positions for a Wind Velocity of 4 m/s (OPGW & Oak AAAC)

OPGW / Shield Wire Type	ZTT 16 kA / 1 sec 48-Core OPGW Type ZTT201012011	Oak AAAC
Diameter (m)	0.0169	0.01395
Wind Velocity (m/s)	4 (Average)	4 (Average)
Mass per unit length (kg/m)	0.558	0.325
C-value	2100	2100
Tension (N)	16,550 (25% of UTS)	8,332.5 (25% of UTS)

Given the above, and the technical data for Oak AAAC & OPGW contained in Sections 8.2 & 8.3 respectively, the positions of the vibration dampers for the two aforementioned conductors shall typically be as follows:

Table 21: Damper Positions for a Wind Velocity of 4 m/s (Oak AAAC & OPGW)

Conductor Type	V (m/s)	W (kg/m)	H (N)	D (m)	L (m)	Damper position 1 from ends (m)
OPGW (16 kA/1 sec)	4	0.558	16,550	0.0169	1.966	1.377
Oak AAAC	4	0.325	8,332.5	0.01395	1.509	1.057

8.9. R, X, B & SIL of Line

The approximate per unit positive sequence impedances (p.u./km) for Chicadee ACSR conductor on a monopole structure (spacing = 1500 mm) are as follows:

Table 22: Positive Sequence Impedances for Chickadee ACSR 66kV Line (1500mm phase spacing)

Reactance (ohms/km)	0.3471
Impedance (ohms/km)	0.3890
AC resistance @ 75^{0}C (ohms/km)	0.1756
DC resistance @ 20^{0}C (ohms/km)	0.1427
Internal inductance (mH/km)	0.05551
Total inductance (mH/km)	1.105
Capacitance (nF/km)	5.53

Surge impedance loading (SIL) is the power delivered by a lossless line to a load resistance equal to the surge impedance $Z_c=\sqrt{(L/C)}$.

The impact of SIL on short sub-transmission power lines strung with single conductors is minimal. It is however a requirement to demonstrate that the power transfer capacity of the 66 kV Chickadee ACSR line is adequate to transfer power to Iscor / Ystervark Substations.

The SIL for a Chicadee ACSR conductor line at 66 kV can be calculated using the following formula:

$$SIL = \frac{{V_{rated}}^2}{Z_c} = \frac{{V_{rated}}^2}{\sqrt{(\frac{L}{C})}}$$

The parameters used to calculate the SIL are given in the table below:

Table 23: Parameters for SIL for Chicadee ACSR 66 kV Line (1500 mm)

Conductor Description	L [H]	C [uF]	Z_c [Ω]	SIL [MW]
Chicadee (assuming 6.6 km line)	0.007293	0.036498	447.01	~ 9.745 MW

P_{max} represents the theoretical steady-state stability limit of a lossless line. If an attempt were made to exceed this steady state limit, then synchronous machines at the sending end would lose synchronism with those at the receiving end.

The wavelength of a lossless line being operated at 50 Hz is equal to the following:

$$\lambda = \frac{1}{f\sqrt{LC}} = \frac{3 \times 10^8}{50} = 6000\ km$$

$$1/\sqrt{LC} = 3\ x\ 10^8 \text{ m/s}$$

8.10. Magnetic & Electric Field Effects

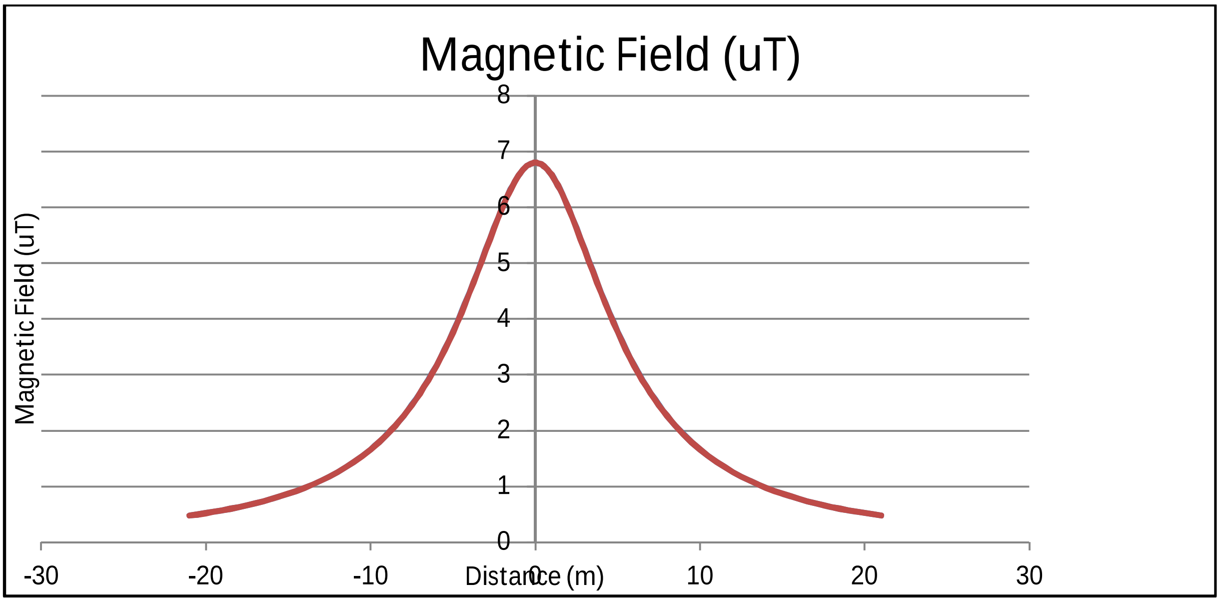


Figure 27: Magnetic Field Distribution at 100 MVA Loading

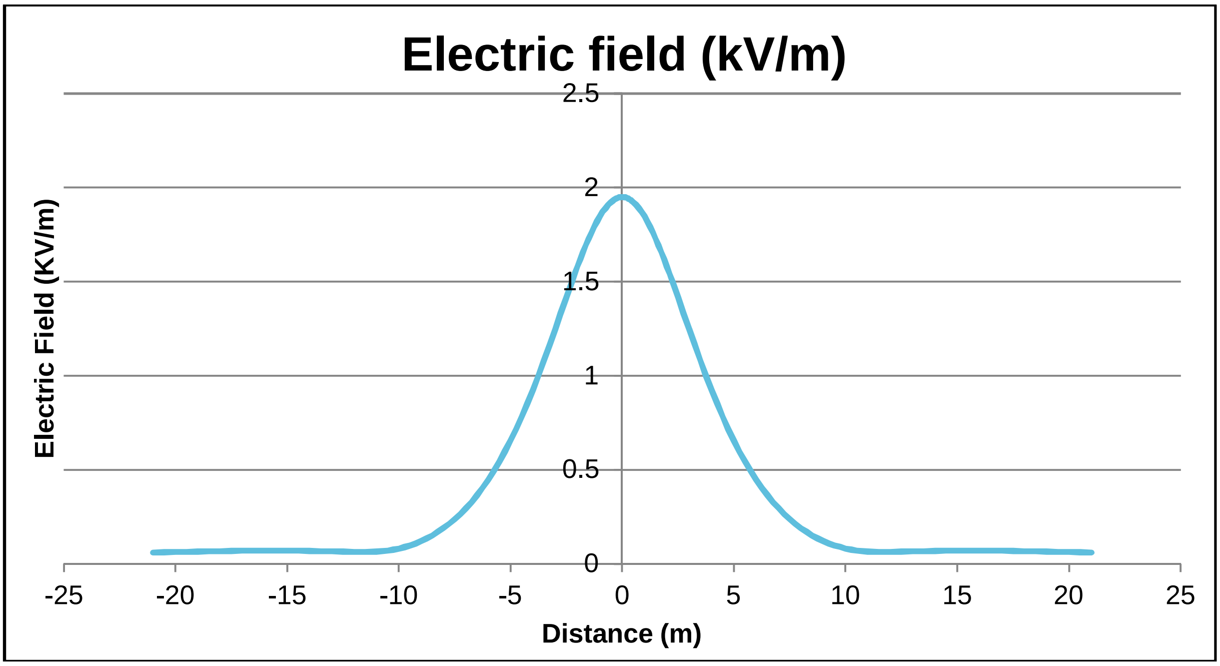


Figure 28: Electric Field Distribution at 100 MVA Loading

8.11. Bird Control

No additional bird control measures have been incorporated into the design of the branch line, as the existing Blouwater-Iscor 66 kV OHL is not equipped with any such measures. Furthermore, referencing Section 5.3.4 in this document, including the current project EMPr (refer to FDP document 'Ystervark Branch Lines - Iscor/Blouwater 66 kV Lines - Book 2, Job no. 153272156-00001'), it is stated that although Red Data species could occur within the area of the branch line, including globally & regionally threatened avifauna species, the main flight path of the birds is expected to lie to the east of the study area.

8.12. Special Tests

The Contractor shall in accordance with Eskom's requirements, conduct special tests on the respective equipment as listed below. These tests shall be undertaken by a SANAS accredited test facility:

- Testing of OPGW equipment.
- Testing of compression crimps.
- Stay pull testing via an approved stay test rig.

Eskom reserves the right to advise not to undertake one or more of the tests. The Contractor will be required to confirm well in advance with Transnet and Eskom if any of the mentioned tests should not be undertaken.

8.13. Labelling

Labelling of the structures shall be in accordance with the following Eskom standards & specifications:

- 240-75660336 Rev 1 : Substation and Network Equipment Label Specification.
- 240-120804300 Rev 2 : Standard for the Labelling of Electrical Equipment within Eskom Wired Network.

The respective label names shall be as follows:

1 B L O / I S C 18	2 B L O / I S C 18	1 B L O / I S C 19	2 B L O / I S C 19	1 B L O / I S C 24	2 B L O / I S C 24
1 B L O / I S C 25	2 B L O / I S C 25	1 B L O / I S C 26	2 B L O / I S C 26	1 B L O / I S C 27	2 B L O / I S C 27
1 B L O / I S C 28	2 B L O / I S C 28	1 B L O / I S C 29	2 B L O / I S C 29	1 B L O / I S C 30	2 B L O / I S C 30

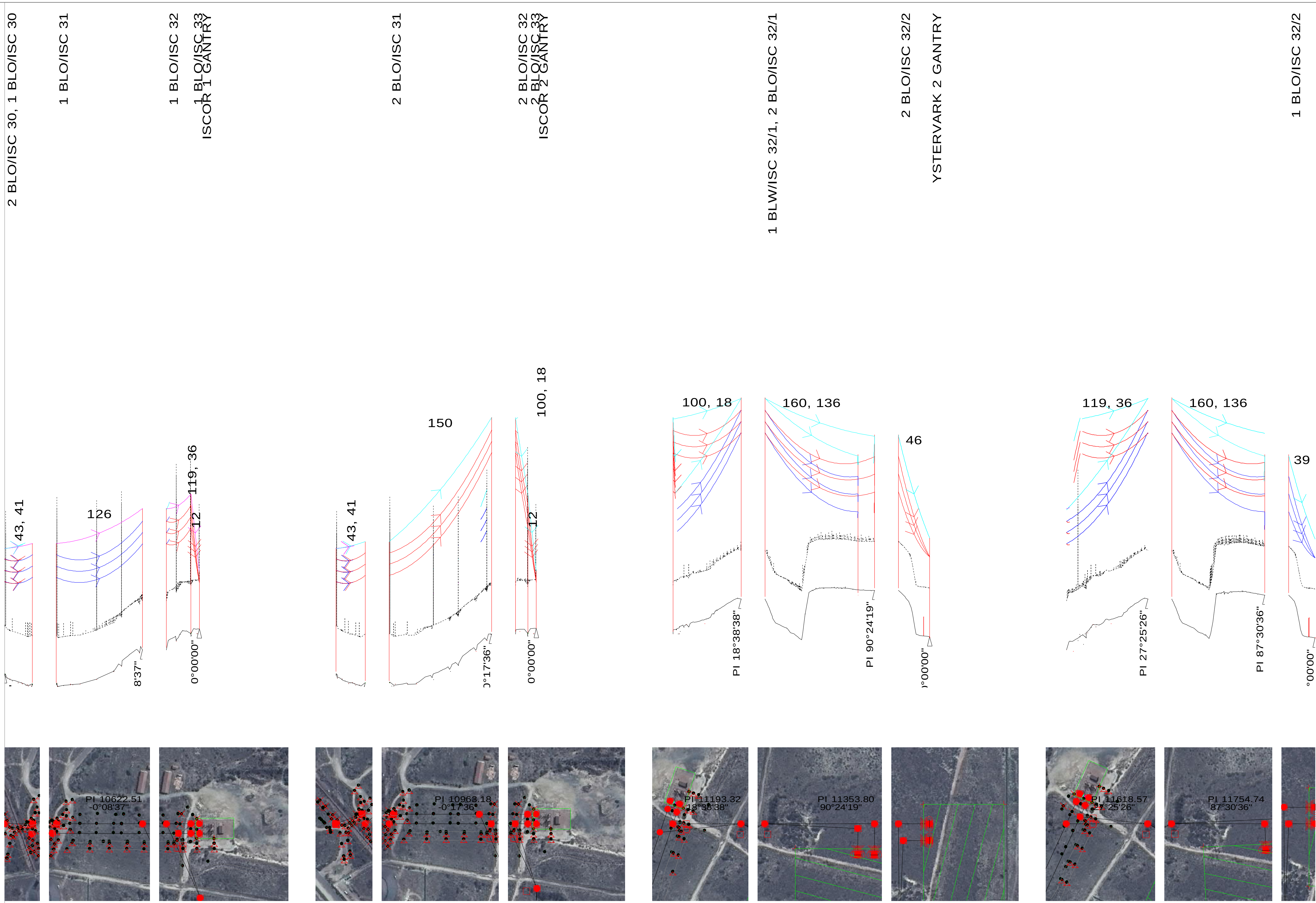
1 B L O / I S C 31	2 B L O / I S C 31	1 B L O / I S C 32	2 B L O / I S C 32	1 B L O / I S C 33	2 B L O / I S C 33

1 B L O / I S C 32 / 1	2 B L O / I S C 32 / 1	1 B L O / I S C 32 / 2	2 B L O / I S C 32 / 2

Note: Line crossing labels will not be applicable for this project.

8.14. Templated Profile

PLS-CADD Drawing



55.0 m Horiz. Scale

5.0 m Vert. Scale

8.15. Sag & Tension Charts

PLS-CADD Version 16.20x64   6:18:12 PM Wednesday, February 19, 2020
AECOM South Africa
Project Name: 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\NM\10022020\transnet blw_isc 20200210.don'
Line Title: 'Line strung at 70°C - Method 4 models'

Criteria Notes:
Tippler 3 - Bulk Power - Blouwater to Iscor 66kV Branch Line

Criteria based on SANS-10280-2013 & ESKOM spec DSP_34-1683 for sub-transmission lines constructed with steel pole structures.

Selected sections include:
Structures: 1 BLO/ISC 31 - YSTERVARK 1 GANTRY
Circuits: All

Section Sagging Data

Circuit	Sec. No.	Cable File Name	From Str.	To Str.	Voltage (kV)	Ruling Span (m)	Sagging Data: Condition	Sagging Data: Temp. (deg C)	Sagging Data: Catenary Constant (m)	Sagging Data: Horiz. Tension (N)	Sagging Data: Weather Case	Display: Condition	Display: Catenary Constant (m)
	17	ac-88-659.wir	1 BLO/ISC 31	1 BLO/ISC 32	0	126.1	Creep RS	15.0	2100.0	15813.9	15°C EDT	Creep RS	2100.1
	18	ac-88-659.wir	1 BLO/ISC 32	1 BLO/ISC 33	0	35.8	Creep RS	15.0	300.0	2259.1	15°C EDT	Creep RS	300.2
	19	ac-88-659.wir	1 BLO/ISC 33	ISCOR 1 GANTRY	0	9.5	Creep RS	15.0	300.0	2259.1	15°C EDT	Creep RS	300.8
	45	chickadee.wir	1 BLO/ISC 31	1 BLO/ISC 32	66	126.1	Creep RS	15.0	1800.0	11337.7	70°C Hot	Creep RS	831.0
	46	chickadee.wir	1 BLO/ISC 33	ISCOR 1 GANTRY	66	9.9	Creep RS	15.0	285.8	1800.0	70°C Hot	Creep RS	71.1
	47	chickadee.wir	2 BLO/ISC 31	2 BLO/ISC 32	66	148.9	Creep RS	15.0	1800.0	11337.7	70°C Hot	Creep RS	924.1
	48	chickadee.wir	2 BLO/ISC 33	ISCOR 2 GANTRY	66	10.0	Creep RS	15.0	158.8	1000.0	70°C Hot	Creep RS	64.0
	55	chickadee.wir	1 BLO/ISC 32	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	66	118.0	Creep RS	15.0	1800.0	11337.7	70°C Hot	Creep RS	794.9
	56	chickadee.wir	2 BLO/ISC 32	2 BLO/ISC 33	66	16.1	Creep RS	15.0	476.3	3000.0	70°C Hot	Creep RS	116.8
	57	chickadee.wir	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	1 BLO/ISC 32/2	66	135.5	Creep RS	15.0	1800.0	11337.7	70°C Hot	Creep RS	870.7
	60	chickadee.wir	1 BLO/ISC 32	1 BLO/ISC 33	66	35.8	Creep RS	15.0	304.8	1919.9	70°C Hot	Creep RS	179.2
	61	chickadee.wir	2 BLO/ISC 32	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	66	99.8	Creep RS	15.0	1800.0	11337.7	70°C Hot	Creep RS	708.0
	64	chickadee.wir	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	2 BLO/ISC 32/2	66	160.6	Creep RS	15.0	1800.0	11337.7	70°C Hot	Creep RS	967.8
	65	kingbird	2 BLO/ISC 32/2	YSTERVARK 2 GANTRY	66	44.3	Creep RS	15.0	300.0	3025.5	70°C Hot	Creep RS	200.0
	66	kingbird	1 BLO/ISC 32/2	YSTERVARK 1 GANTRY	66	37.8	Creep RS	15.0	300.0	3025.5	70°C Hot	Creep RS	183.7
	70	oak	2 BLO/ISC 31	2 BLO/ISC 32	0	148.9	Creep RS	15.0	2100.0	6694.8	15°C EDT	Creep RS	2100.7
	71	oak	2 BLO/ISC 32	2 BLO/ISC 33	0	16.0	Creep RS	15.0	501.9	1600.0	15°C EDT	Creep RS	501.7
	72	oak	2 BLO/ISC 33	ISCOR 2 GANTRY	0	9.5	Creep RS	15.0	501.9	1600.0	15°C EDT	Creep RS	501.7
	73	oak	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	1 BLO/ISC 32/2	0	136.0	Creep RS	15.0	2100.0	6694.8	15°C EDT	Creep RS	2099.8
	74	oak	2 BLO/ISC 32/2	YSTERVARK 2 GANTRY	0	44.1	Creep RS	15.0	300.0	956.4	15°C EDT	Creep RS	299.9
	75	oak	1 BLO/ISC 32/2	YSTERVARK 1 GANTRY	0	37.7	Creep RS	15.0	300.0	956.4	15°C EDT	Creep RS	299.7
	78	oak	2 BLO/ISC 32/2	YSTERVARK 2 GANTRY	0	44.1	Creep RS	15.0	300.0	956.4	15°C EDT	Creep RS	299.9
	79	oak	1 BLO/ISC 32/2	YSTERVARK 1 GANTRY	0	37.7	Creep RS	15.0	300.0	956.4	15°C EDT	Creep RS	299.7
	80	oak	1 BLO/ISC 32	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	0	118.3	Creep RS	15.0	2100.0	6694.8	15°C EDT	Creep RS	2099.9
	81	oak	2 BLO/ISC 32	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	0	99.6	Creep RS	15.0	4587.6	14625.4	15°C EDT	Creep RS	4587.7
	84	oak	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	2 BLO/ISC 32/2	0	160.4	Creep RS	15.0	4457.5	14210.6	15°C EDT	Creep RS	4455.7

Section Geometry Data

Notes: Lengths are arc lengths along the wire at 15 (deg C), Creep.
Lengths are adjusted for the number of phases, the number of subconductors and to exclude the length of strain insulators.
Lengths are computed with any concentrated loads removed.

Circuit	Sec. No.	Cable File Name	From Str.	To Str.	Number of Phases	Wires Per Phase	Min. Span (m)	Max. Span (m)	Ruling Span (m)	Total Cable Length (m)
	17	ac-88-659.wir	1 BLO/ISC 31	1 BLO/ISC 32	1	1	126.2	126.2	126.1	126.0
	18	ac-88-659.wir	1 BLO/ISC 32	1 BLO/ISC 33	1	1	35.9	35.9	35.8	35.6
	19	ac-88-659.wir	1 BLO/ISC 33	ISCOR 1 GANTRY	1	1	12.3	12.3	9.5	14.6
	45	chickadee.wir	1 BLO/ISC 31	1 BLO/ISC 32	3	1	126.2	126.2	126.1	371.8
	46	chickadee.wir	1 BLO/ISC 33	ISCOR 1 GANTRY	3	1	12.2	12.2	9.9	38.4
	47	chickadee.wir	2 BLO/ISC 31	2 BLO/ISC 32	3	1	149.8	149.8	148.9	445.0
	48	chickadee.wir	2 BLO/ISC 33	ISCOR 2 GANTRY	3	1	12.3	12.3	10.0	38.5
	55	chickadee.wir	1 BLO/ISC 32	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	3	1	118.9	118.9	118.0	350.2

56	chickadee.wir	2 BLO/ISC 32	2 BLO/ISC 33	3	1	18.3	18.3	16.1	55.1
57	chickadee.wir	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	1 BLO/ISC 32/2	3	1	135.9	135.9	135.5	397.7
60	chickadee.wir	1 BLO/ISC 32	1 BLO/ISC 33	3	1	35.9	35.9	35.8	100.6
61	chickadee.wir	2 BLO/ISC 32	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	3	1	99.8	99.8	99.8	290.5
64	chickadee.wir	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	2 BLO/ISC 32/2	3	1	160.7	160.7	160.6	471.7
65	kingbird	2 BLO/ISC 32/2	YSTERVARK 2 GANTRY	3	1	45.6	45.6	44.3	131.9
66	kingbird	1 BLO/ISC 32/2	YSTERVARK 1 GANTRY	3	1	38.7	38.7	37.8	110.2
70	oak	2 BLO/ISC 31	2 BLO/ISC 32	1	1	149.8	149.8	148.9	150.5
71	oak	2 BLO/ISC 32	2 BLO/ISC 33	1	1	18.3	18.3	16.0	20.6
72	oak	2 BLO/ISC 33	ISCOR 2 GANTRY	1	1	12.4	12.4	9.5	14.6
73	oak	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	1 BLO/ISC 32/2	1	1	136.2	136.2	136.0	136.4
74	oak	2 BLO/ISC 32/2	YSTERVARK 2 GANTRY	1	1	45.9	45.9	44.1	46.8
75	oak	1 BLO/ISC 32/2	YSTERVARK 1 GANTRY	1	1	39.2	39.2	37.7	39.5
78	oak	2 BLO/ISC 32/2	YSTERVARK 2 GANTRY	1	1	45.9	45.9	44.1	46.8
79	oak	1 BLO/ISC 32/2	YSTERVARK 1 GANTRY	1	1	39.2	39.2	37.7	39.5
80	oak	1 BLO/ISC 32	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	1	1	119.2	119.2	118.3	120.2
81	oak	2 BLO/ISC 32	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	1	1	99.6	99.6	99.6	99.6
84	oak	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	2 BLO/ISC 32/2	1	1	160.5	160.5	160.4	160.6

Stringing Chart Report

Section #17 from structure #1 BLO/ISC 31 to structure #1 BLO/ISC 32, start set #1 '', end set #1 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\ac-88-659.wir', Ruling span (m) 126.132
Sagging data: Catenary (m) 2100, Horiz. Tension (N) 15813.9 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 20.2 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 2.2 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
126.2	0.65	0.68	0.71	0.75	0.79	0.83	0.88	0.93	0.98	1.05	1 BLO/ISC 31	4.66

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
126.2	4.35	4.45	4.56	4.68	4.80	4.93	5.07	5.22	5.37	5.54	1 BLO/ISC 31	4.66

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
23263	22217	21166	20110	19097	18104	17107	16154	15245	14357

Stringing Chart Report

Section #18 from structure #1 BLO/ISC 32 to structure #1 BLO/ISC 33, start set #1 '', end set #1 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\ac-88-659.wir', Ruling span (m) 35.8083
Sagging data: Catenary (m) 300, Horiz. Tension (N) 2259.14 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 3.2 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 0.3 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
35.9	0.41	0.45	0.48	0.52	0.55	0.58	0.61	0.63	0.66	0.69	1 BLO/ISC 32	1.95

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
35.9	3.48	3.63	3.76	3.89	4.01	4.12	4.22	4.31	4.40	4.49	1 BLO/ISC 32	1.95

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
2934	2700	2511	2352	2218	2101	2002	1914	1836	1766

Stringing Chart Report

Section #19 from structure #1 BLO/ISC 33 to structure #ISCOR 1 GANTRY, start set #1 '', end set #1 'EW'
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\ac-88-659.wir', Ruling span (m) 9.47329
Sagging data: Catenary (m) 300, Horiz. Tension (N) 2259.14 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 3.2 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 0.1 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
12.3	0.03	0.04	0.05	0.07	0.09	0.13	0.16	0.19	0.22	0.24	1 BLO/ISC 33	-10.30

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
12.3	0.93	1.03	1.18	1.39	1.65	1.92	2.16	2.36	2.53	2.67	1 BLO/ISC 33	-10.30

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
6327	5116	3949	2852	2011	1481	1173	982	856	766

Stringing Chart Report

Section #45 from structure #1 BLO/ISC 31 to structure #1 BLO/ISC 32, start set #2 '', end set #2 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\chickadee.wir', Ruling span (m) 126.139
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 11337.7 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 25.7 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 8.9 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
126.2	0.62	0.65	0.68	0.71	0.75	0.80	0.85	0.91	0.97	1.05	1 BLO/ISC 31	4.46

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
126.2	4.27	4.36	4.47	4.58	4.70	4.84	4.99	5.16	5.34	5.54	1 BLO/ISC 31	4.46

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
20220	19360	18470	17564	16658	15721	14786	13854	12927	12008

Stringing Chart Report

Section #46 from structure #1 BLO/ISC 33 to structure #ISCOR 1 GANTRY, start set #2 '', end set #2 'Main Set'
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\chickadee.wir', Ruling span (m) 9.89816
Sagging data: Catenary (m) 285.772, Horiz. Tension (N) 1800 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 4.6 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 0.3 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
12.2	0.02	0.03	0.04	0.05	0.08	0.12	0.16	0.20	0.23	0.26	1 BLO/ISC 33	-8.80

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
12.2	0.79	0.88	1.02	1.24	1.57	1.91	2.20	2.42	2.59	2.74	1 BLO/ISC 33	-8.80

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
6764	5423	4076	2768	1729	1160	879	727	631	563

Stringing Chart Report

Section #47 from structure #2 BLO/ISC 31 to structure #2 BLO/ISC 32, start set #2 '', end set #2 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\chickadee.wir', Ruling span (m) 148.937
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 11337.7 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 26.5 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 11.4 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
149.8	0.90	0.94	0.99	1.04	1.09	1.16	1.23	1.30	1.39	1.49	2 BLO/ISC 31	16.30

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
149.8	5.14	5.25	5.38	5.51	5.66	5.82	6.00	6.19	6.39	6.61	2 BLO/ISC 31	16.30

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
19773	18913	18040	17166	16280	15381	14502	13631	12768	11943

Stringing Chart Report

Section #48 from structure #2 BLO/ISC 33 to structure #ISCOR 2 GANTRY, start set #2 '', end set #2 'Main Set'
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\chickadee.wir', Ruling span (m) 9.96181
Sagging data: Catenary (m) 158.762, Horiz. Tension (N) 1000 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 2.1 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 0.1 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
12.3	0.04	0.05	0.09	0.13	0.17	0.20	0.23	0.26	0.28	0.31	2 BLO/ISC 33	-8.79

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
12.3	1.04	1.27	1.60	1.95	2.22	2.43	2.61	2.76	2.89	3.00	2 BLO/ISC 33	-8.79

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
3936	2654	1662	1128	868	722	627	563	512	474

Stringing Chart Report

Section #55 from structure #1 BLO/ISC 32 to structure #1 BLW/ISC 32/1, 2 BLO/ISC 32/1, start set #3 '', end set #2 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\chickadee.wir', Ruling span (m) 117.953
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 11337.7 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 25.7 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 8.1 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
118.9	0.55	0.57	0.60	0.63	0.67	0.71	0.75	0.81	0.86	0.93	1 BLO/ISC 32	14.76

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
118.9	4.02	4.11	4.20	4.31	4.43	4.56	4.70	4.86	5.03	5.23	1 BLO/ISC 32	14.76

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
20372	19503	18617	17701	16783	15834	14886	13922	12980	12044

Stringing Chart Report

Section #56 from structure #2 BLO/ISC 32 to structure #2 BLO/ISC 33, start set #3 '', end set #2 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\chickadee.wir', Ruling span (m) 16.0693
Sagging data: Catenary (m) 476.287, Horiz. Tension (N) 3000 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 7.9 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 0.5 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
18.3	0.03	0.04	0.05	0.06	0.08	0.11	0.16	0.20	0.24	0.28	2 BLO/ISC 32	-9.89

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
18.3	1.00	1.08	1.18	1.33	1.53	1.81	2.13	2.43	2.67	2.87	2 BLO/ISC 32	-9.89

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
8848	7574	6275	4972	3730	2667	1926	1491	1232	1064

Stringing Chart Report

Section #57 from structure #1 BLW/ISC 32/1, 2 BLO/ISC 32/1 to structure #1 BLO/ISC 32/2, start set #3 '', end set #2 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\chickadee.wir', Ruling span (m) 135.539
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 11337.7 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 26.1 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 10.1 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
135.9	0.73	0.76	0.80	0.84	0.88	0.93	0.99	1.06	1.13	1.22	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	-9.63

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
135.9	4.62	4.72	4.83	4.96	5.09	5.24	5.40	5.58	5.77	5.97	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	-9.63

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
20039	19188	18307	17412	16501	15592	14669	13751	12857	11989

Stringing Chart Report

Section #60 from structure #1 BLO/ISC 32 to structure #1 BLO/ISC 33, start set #4 '', end set #2 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\chickadee.wir', Ruling span (m) 35.7969
Sagging data: Catenary (m) 304.808, Horiz. Tension (N) 1919.9 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 5.0 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 0.9 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
35.9	0.33	0.39	0.44	0.48	0.53	0.57	0.61	0.65	0.69	0.72	1 BLO/ISC 32	2.15

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
35.9	3.13	3.36	3.58	3.77	3.94	4.10	4.24	4.37	4.50	4.61	1 BLO/ISC 32	2.15

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
3042	2631	2324	2096	1916	1773	1655	1557	1473	1402

Stringing Chart Report

Section #61 from structure #2 BLO/ISC 32 to structure #1 BLW/ISC 32/1, 2 BLO/ISC 32/1, start set #4 '', end set #4 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\chickadee.wir', Ruling span (m) 99.8116
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 11337.7 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 25.3 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 6.2 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
99.8	0.38	0.40	0.42	0.44	0.46	0.49	0.52	0.56	0.60	0.65	2 BLO/ISC 32	2.67

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
99.8	3.34	3.41	3.49	3.58	3.68	3.79	3.91	4.04	4.20	4.36	2 BLO/ISC 32	2.67

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
20674	19800	18895	17987	17032	16075	15084	14093	13086	12099

Stringing Chart Report

Section #64 from structure #1 BLW/ISC 32/1, 2 BLO/ISC 32/1 to structure #2 BLO/ISC 32/2, start set #5 '', end set #2 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\chickadee.wir', Ruling span (m) 160.559
Sagging data: Catenary (m) 1800, Horiz. Tension (N) 11337.7 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 26.9 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 12.8 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
160.7	1.04	1.09	1.14	1.20	1.27	1.34	1.42	1.51	1.60	1.71	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	-7.00

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
160.7	5.53	5.66	5.79	5.94	6.10	6.27	6.45	6.65	6.86	7.08	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	-7.00

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
19518	18666	17815	16950	16073	15217	14351	13510	12697	11916

Stringing Chart Report

Section #65 from structure #2 BLO/ISC 32/2 to structure #YSTERVARK 2 GANTRY, start set #2 '', end set #2 'Main Set'
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\kingbird', Ruling span (m) 44.2807
Sagging data: Catenary (m) 300, Horiz. Tension (N) 3025.5 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 4.8 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 0.5 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
45.6	0.68	0.73	0.79	0.84	0.89	0.94	0.99	1.03	1.07	1.11	2 BLO/ISC 32/2	-10.99

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
45.6	4.46	4.64	4.81	4.97	5.12	5.25	5.38	5.50	5.61	5.72	2 BLO/ISC 32/2	-10.99

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
3977	3666	3410	3196	3019	2865	2731	2613	2509	2416

Stringing Chart Report

Section #66 from structure #1 BLO/ISC 32/2 to structure #YSTERVARK 1 GANTRY, start set #2 '', end set #2 'Main Set'
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\kingbird', Ruling span (m) 37.7888
Sagging data: Catenary (m) 300, Horiz. Tension (N) 3025.5 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 4.8 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 0.5 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
38.7	0.43	0.49	0.54	0.59	0.64	0.69	0.73	0.77	0.81	0.85	1 BLO/ISC 32/2	-8.50

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
38.7	3.56	3.78	3.99	4.17	4.34	4.49	4.63	4.76	4.88	4.99	1 BLO/ISC 32/2	-8.50

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
4482	3967	3569	3264	3018	2815	2647	2504	2382	2274

Stringing Chart Report

Section #70 from structure #2 BLO/ISC 31 to structure #2 BLO/ISC 32, start set #1 '', end set #1 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\oak', Ruling span (m) 148.915
Sagging data: Catenary (m) 2100, Horiz. Tension (N) 6694.8 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 19.4 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 7.3 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
149.8	0.80	0.85	0.91	0.97	1.03	1.11	1.19	1.28	1.38	1.48	2 BLO/ISC 31	16.50

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
149.8	4.86	5.00	5.16	5.33	5.51	5.70	5.91	6.13	6.36	6.60	2 BLO/ISC 31	16.50

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
11196	10554	9923	9302	8702	8125	7569	7036	6536	6067

Stringing Chart Report

Section #71 from structure #2 BLO/ISC 32 to structure #2 BLO/ISC 33, start set #1 '', end set #1 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\oak', Ruling span (m) 15.9954
Sagging data: Catenary (m) 501.882, Horiz. Tension (N) 1600 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 5.4 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 2.6 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
18.3	0.04	0.04	0.05	0.06	0.08	0.11	0.14	0.18	0.22	0.26	2 BLO/ISC 32	-10.09

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
18.3	1.04	1.13	1.24	1.37	1.55	1.77	2.04	2.31	2.57	2.79	2 BLO/ISC 32	-10.09

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
4112	3500	2921	2366	1860	1416	1072	833	678	575

Stringing Chart Report

Section #72 from structure #2 BLO/ISC 33 to structure #ISCOR 2 GANTRY, start set #1 '', end set #1 'EW'
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\oak', Ruling span (m) 9.53592
Sagging data: Catenary (m) 501.882, Horiz. Tension (N) 1600 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 5.2 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 1.3 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
12.4	0.02	0.02	0.03	0.03	0.04	0.06	0.08	0.12	0.16	0.21	2 BLO/ISC 33	-10.29

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
12.4	0.74	0.80	0.88	0.98	1.11	1.30	1.56	1.89	2.20	2.45	2 BLO/ISC 33	-10.29

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
4232	3617	3019	2437	1891	1387	959	657	484	388

Stringing Chart Report

Section #73 from structure #1 BLW/ISC 32/1, 2 BLO/ISC 32/1 to structure #1 BLO/ISC 32/2, start set #1 '', end set #1 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\oak', Ruling span (m) 135.954
Sagging data: Catenary (m) 2100, Horiz. Tension (N) 6694.8 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 19.4 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 6.5 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
136.2	0.65	0.69	0.74	0.79	0.84	0.90	0.97	1.05	1.13	1.23	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	-7.68

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
136.2	4.38	4.51	4.65	4.81	4.97	5.15	5.34	5.55	5.77	6.00	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	-7.68

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
11320	10669	10027	9397	8778	8181	7607	7055	6527	6040

Stringing Chart Report

Section #74 from structure #2 BLO/ISC 32/2 to structure #YSTERVARK 2 GANTRY, start set #1 '', end set #1 'EW'
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\oak', Ruling span (m) 44.0708
Sagging data: Catenary (m) 300, Horiz. Tension (N) 956.4 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 4.0 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 7.9 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
45.9	0.70	0.76	0.82	0.87	0.93	0.98	1.03	1.07	1.12	1.16	2 BLO/ISC 32/2	-13.54

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
45.9	4.53	4.72	4.90	5.06	5.21	5.36	5.49	5.61	5.73	5.85	2 BLO/ISC 32/2	-13.54

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
1255	1156	1074	1006	948	898	855	817	784	753

Stringing Chart Report

Section #75 from structure #1 BLO/ISC 32/2 to structure #YSTERVARK 1 GANTRY, start set #1 '', end set #1 'EW'
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\oak', Ruling span (m) 37.6805
Sagging data: Catenary (m) 300, Horiz. Tension (N) 956.4 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 3.8 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 7.3 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
39.2	0.46	0.51	0.57	0.62	0.67	0.72	0.77	0.81	0.85	0.90	1 BLO/ISC 32/2	-11.05

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
39.2	3.66	3.88	4.08	4.27	4.44	4.60	4.75	4.88	5.01	5.13	1 BLO/ISC 32/2	-11.05

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
1392	1238	1117	1021	944	881	827	782	743	709

Stringing Chart Report

Section #78 from structure #2 BLO/ISC 32/2 to structure #YSTERVARK 2 GANTRY, start set #3 '', end set #3 'EW2'
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\oak', Ruling span (m) 44.0708
Sagging data: Catenary (m) 300, Horiz. Tension (N) 956.4 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 4.0 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 7.9 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
45.9	0.70	0.76	0.82	0.87	0.93	0.98	1.03	1.07	1.12	1.16	2 BLO/ISC 32/2	-13.54

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
45.9	4.53	4.72	4.90	5.06	5.21	5.36	5.49	5.61	5.73	5.85	2 BLO/ISC 32/2	-13.54

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
1255	1156	1074	1006	948	898	855	817	784	753

Stringing Chart Report

Section #79 from structure #1 BLO/ISC 32/2 to structure #YSTERVARK 1 GANTRY, start set #4 '', end set #3 'EW2'
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\oak', Ruling span (m) 37.6805
Sagging data: Catenary (m) 300, Horiz. Tension (N) 956.4 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 3.8 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 7.3 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
39.2	0.46	0.51	0.57	0.62	0.67	0.72	0.77	0.81	0.85	0.90	1 BLO/ISC 32/2	-11.05

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
39.2	3.66	3.88	4.08	4.27	4.44	4.60	4.75	4.88	5.01	5.13	1 BLO/ISC 32/2	-11.05

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
1392	1238	1117	1021	944	881	827	782	743	709

Stringing Chart Report

Section #80 from structure #1 BLO/ISC 32 to structure #1 BLW/ISC 32/1, 2 BLO/ISC 32/1, start set #5 '', end set #1 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\oak', Ruling span (m) 118.308
Sagging data: Catenary (m) 2100, Horiz. Tension (N) 6694.8 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 19.2 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 5.6 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
119.2	0.50	0.53	0.56	0.60	0.64	0.69	0.75	0.81	0.88	0.95	1 BLO/ISC 32	14.86

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
119.2	3.82	3.93	4.06	4.20	4.35	4.50	4.68	4.87	5.07	5.29	1 BLO/ISC 32	14.86

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
11482	10821	10161	9511	8873	8257	7654	7074	6518	5995

Stringing Chart Report

Section #81 from structure #2 BLO/ISC 32 to structure #1 BLW/ISC 32/1, 2 BLO/ISC 32/1, start set #5 '', end set #6 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\oak', Ruling span (m) 99.5703
Sagging data: Catenary (m) 4587.64, Horiz. Tension (N) 14625.4 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 35.3 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 2.6 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
99.6	0.18	0.18	0.19	0.19	0.20	0.20	0.21	0.22	0.23	0.23	2 BLO/ISC 32	2.74

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
99.6	2.28	2.31	2.34	2.37	2.41	2.45	2.48	2.53	2.57	2.62	2 BLO/ISC 32	2.74

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
22373	21804	21222	20628	20031	19415	18797	18161	17523	16877

Stringing Chart Report

Section #84 from structure #1 BLW/ISC 32/1, 2 BLO/ISC 32/1 to structure #2 BLO/ISC 32/2, start set #6 '', end set #1 ''
Cable 'C:\Users\mabuzan\Documents\Projects\TRANSNET Saldanha\OH Lines\PLS-CADD\Understrung Option\oak', Ruling span (m) 160.397
Sagging data: Catenary (m) 4457.53, Horiz. Tension (N) 14210.6 Condition C Temperature (deg C) 15
Weather case for final after creep 15°C EDT, Equivalent to 34.7 (deg C) temperature increase
Weather case for final after load 15°C 1050Pa max Wind, Equivalent to 6.3 (deg C) temperature increase
Results below for condition 'Initial RS'
Calculations done using actual span lengths and vertical projections

Span Length (m)	Mid Span Sag 0 C (m)	Mid Span Sag 5 C (m)	Mid Span Sag 10 C (m)	Mid Span Sag 15 C (m)	Mid Span Sag 20 C (m)	Mid Span Sag 25 C (m)	Mid Span Sag 30 C (m)	Mid Span Sag 35 C (m)	Mid Span Sag 40 C (m)	Mid Span Sag 45 C (m)	Left Struct Number	Span Vertical Projection (m)
160.5	0.47	0.49	0.50	0.51	0.53	0.55	0.57	0.59	0.61	0.63	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	-5.02

Span Length (m)	3 Wave Time 0 C Sec.	3 Wave Time 5 C Sec.	3 Wave Time 10 C Sec.	3 Wave Time 15 C Sec.	3 Wave Time 20 C Sec.	3 Wave Time 25 C Sec.	3 Wave Time 30 C Sec.	3 Wave Time 35 C Sec.	3 Wave Time 40 C Sec.	3 Wave Time 45 C Sec.	Left Struct Number	Span Vertical Projection (m)
160.5	3.72	3.77	3.83	3.88	3.94	4.01	4.08	4.15	4.23	4.31	1 BLW/ISC 32/1, 2 BLO/ISC 32/1	-5.02

Horiz Tension 0 C (N)	Horiz Tension 5 C (N)	Horiz Tension 10 C (N)	Horiz Tension 15 C (N)	Horiz Tension 20 C (N)	Horiz Tension 25 C (N)	Horiz Tension 30 C (N)	Horiz Tension 35 C (N)	Horiz Tension 40 C (N)	Horiz Tension 45 C (N)
21736	21153	20574	19968	19368	18749	18121	17491	16854	16208

8.16. Staking Table

Table 24: Staking Table

Structure Number	X Easting (m)	Y Northing (m)	Centerline Z Elevation (m)	TIN Z Elevation (m)	Ahead Span (m)	Line Angle (deg)	Transverse Axis Azimuth (deg)	Struct. Height (m)	Embedded Length (m)
1 BLO/ISC 31	10496.295	-93254.56	-3652531.19	7.432	7.432	126.218	-20.0858	210.3141	18.5
1 BLO/ISC 32	10622.513	-93136.16	-3652574.92	11.939	11.939	119.224	-0.1435	200.1995	18.5
1 BLO/ISC 33	10658.374	-93102.489	-3652587.26	14.192	14.2	12.204	0	200.1277	18.5
ISCOR 1 GANTRY	10670.578	-93091.03	-3652591.46	14.74	14.74	0	0	20.1277	6.15
2 BLO/ISC 31	10813.368	-93264.88	-3652542.28	7.551	7.551	149.815	-40.7797	220.6791	18.5
2 BLO/ISC 32	10963.184	-93124.36	-3652594.23	14.03	14.03	99.608	-0.2933	200.1426	28.5
2 BLO/ISC 33	10981.455	-93107.19	-3652600.478	14.242	14.242	12.259	0	199.9959	18.5
ISCOR 2 GANTRY	10993.714	-93095.67	-3652604.67	14.8	14.8	0	0	199.9959	6.15
1 BLW/ISC 32/1, 2 BLO/ISC 32/1	11193.322	-93127.11	-3652693.8	18.7	18.7	160.475	18.6439	280.904	26.5
2 BLO/ISC 32/2	11353.798	-93182.59	-3652844.38	19.85	19.85	45.551	90.4052	335.4285	20.4
YSTERVARK 2 GANTRY	11399.349	-93225.22	-3652828.33	13.669	13.669	0	0	20.6311	10.64
1 BLO/ISC 32/2	11754.743	-93180.47	-3652819.08	19.22	19.22	38.69	87.5099	336.8254	18.4

9. Eskom Standards & Specifications

The following main, but not necessarily limited to, Eskom standards & specifications shall apply, including any others mentioned in this document:

- 240-130615862 Rev 1 : Earthing of Transmission Line Towers.
- D-WC-7600-04-04 Rev 0 : Earthing Details HV Earth Electrodes for Steel Monopoles.
- 06TB-08 : Bifurcation (Splitting) of Shield Wires.
- 240-75884074 Rev 1 : Standard Sub Transmission Lines Section 9: Steel Mono Pole 132 kV Compact Line Tower Series.
- 240-75883378 Rev 1 : Specification for Steel Pole Overhead Line Supports.
- 240-75883830 Rev 1 : Steel Grades and Welding Requirements for Steelwork and Overhead Line Hardware Components.
- 240-47172520 : The Standard for the Construction of Overhead Powerlines.
- 240-75883896 Rev 1 : Outdoor Post and Long Rod Insulators for New and Refurbished Powerlines for 66 kV and 132 kV Standard.
- 240-75883154 Rev 1 : Current Carrying Compression Fittings for Overhead Sub-Transmission Systems.
- 240-75884092 Rev 1 : Sub-Transmission Lines Section 14: Assembly and Informative Drawings For 66 kV and 132 kV Lines Standard.
- 240-110403330 Rev 2 : OPGW Hardware and Installation Requirements for Overhead Lines.
- 240-70733995 : Optical Distribution Frame / Patch Panel / Patch Box.
- 240-98155879 Rev 1 : Vibration Dampers for Single Conductor Sub-Transmission Lines.
- 240-75660336 Rev 1 : Substation and Network Equipment Label Specification.
- 240-120804300 Rev 2 : Standard for the Labelling of Electrical Equipment within Eskom Wired Network.
- 240-125010764 : Duct Fibre Installation Standard.

It will still be the responsibility of the Contractor to comply with all Eskom standards, specifications & requirements.

10. Execution Plan and Temporary Arrangements

10.1. Constructability Plan

The following high-level execution plan has been received from the Contractor, on how they intend to carry out the works. The below referenced items should be read for information purposes only at this stage, as the Contractor will be required to submit detailed method statements for all works, for approval by Transnet & Eskom respectively.

General

- Bush clearing of the centre-line will be performed in strict accordance with limitations detailed in the BA and associated EA and as documented in the EMPr.
- Route topographic survey, profiling, tower position pegging and marking fence crossings for gate positions will be performed by a suitably Eskom-approved land surveyor.
- Servitude gates will be installed at fence and road crossings;
- Nomination of foundation types will be by the Contractor but verified by an independent civil engineer;
- Foundations for all intermediate self-supporting structures will be prepared in accordance with the limitations by the BA and EA.
- Self-supporting strain structure foundations will be designed to accommodate the soil types identified and nominated at the specific positions;
- All foundations of the 66 kV T-off line will be excavated and cast prior to beginning erection of monopoles with foundations for self-supporting strain structures cast such that provision is made for sufficient curing time (ideally 28 days) before erecting the poles on the foundations;
- Monopole sections, components and line hardware will be delivered to foundation positions and assembled on site, including for fitting of all associated hardware and running blocks;
- Temporary structures and safety nets will be erected as necessary and in accordance with the Contractor's method statements;
- Erection of monopole structures will be performed using suitable truck-mounted cranes;
- Stringing will be performed using tension stringing techniques by a single contractor who is Eskom-approved for conductor stringing and both Eskom- and Supplier-approved for OPGW stringing;
- The new terminal tower for the 66 kV Blouwater - Iscor line at Iscor substation will have to be assembled prior to the removal of the existing terminal structures in order to minimize the outage required.

Pre-Outage Work

- Structure 1 BLO/ISC 32/1 and BLO/ISC 32/1 (Double-circuit structure) can be erected without any outage required;
- Line terminal structures 1 BLO/ISC 32/2 and 2 BLO/ISC 32/2 can be erected without any outage;
- Install earthing for structures;
- Foundation for structure 2 BLO/ISC 32 needs to be constructed while Line 1 and Line 2 is alive;
- Foundation for structure 1 BLO/ISC 32 needs to be constructed while Line 1 and Line 2 is alive;

- String phase conductor between 1 BLO/ISC 32/1, 1 BLO/ISC 32/2 and Ystervark gantry;
- String phase conductor between 2 BLO/ISC 32/1, 2 BLO/ISC 32/2 and Ystervark gantry;

Outage Work

Outage Work: 66 kV Line 2 to Iscor Gantry

- Appropriate back stays to be placed on existing structure 2 BLO/ISC 31;
- Erect new terminal structure 2 BLO/ISC 32;
- String phase conductor between existing 2 BLO/ISC 32/1, 2 BLO/ISC 32 and existing 2 BLO/ISC 32/1;
- String OPGW between existing 2 BLO/ISC 31, 2 BLO/ISC 32, 2 BLO/ISC 32/1, 2 BLO/ISC 32/2 and the Ystervark terminal structure;
- Install earthing for structures;

Outage Work: 66 kV Line 1 to Iscor Gantry

- Appropriate construction back stays to be placed on existing structure 1 BLO/ISC 31;
- Erect new terminal structure 1 BLO/ISC 32;
- String phase conductor between existing 1 BLO/ISC 32/1, 1 BLO/ISC 32 and existing 1 BLO/ISC 32/1;
- String phase conductor between existing 1 BLO/ISC 31 and 1 BLO/ISC 32;
- Install earthing for structures;

Outage Work: T-off Structures to Ystervark Gantry

- Outage required for both 66 kV Blouwater- Iscor Lines in order to perform the crossing section from 1 BLO/ISC 32 to 1 BLO/ISC 32/1.

- String phase conductor between existing 1 BLO/ISC 32 and structure 1 BLO/ISC 32/1.

- String phase conductor between new structures 2 BLO/ISC 32, 2 BLO/ISC 32/1 and the Ystervark terminal structure 2 BLO/ISC 32/2.

- String Oak conductor between new structure 1 BLO/ISC 32 and 1 BLO/ISC 32/1.

Underground fibre cable

The approved scope of works for the installation of underground fibre cable includes:

- Conducting Geotechnical studies and land surveying. The preliminary identified route will follow the power line corridor from Blouwater to Iscor substation and then looped out to the new Ystervark substation. The route length is approximately 6km.

- The existing fibre protection and telemetry will remain commissioned until the completion and commissioning of the underground fibre cable.

Underground works requirements

- Prior to the excavation for the duct, the route will be cleared of any obstruction, such as trees, shrub, tree roots, rocks, etc, to allow for minimum safe working area for trenching as per safety plan [Civil Works Procedure and Requirements (SANS 2001-DP3)].

- Underground sub-ducting for laying the cable will be used, direct buried fibre cable shall not be acceptable. Sub-ducts shall be laid and jointed and shall be evenly supported for their full lengths on the bedding, which shall have been evenly and thoroughly compacted. [Laying of duct, sub-duct, hauling of FOC Procedure (SANS 10340-2:2006 & SANS 2001-DP3)].

Route Markers

- An approved marker post type must be installed on all areas where fibre is buried along the route at regular intervals. Marker posts must also be installed at cable deviations or change of direction to enable the accurate location of the cable.

Manholes

- Each manhole and handhole must be buried at a depth of 200mm.
- The maximum distance between manholes must not exceed 4km.
- Each manhole needs to cater for about 30 m of total fibre slack (15 m from either direction), which must be neatly managed (stored) on slack management trays.

Fibre-Optic Termination Panel

- All fibre terminations must be terminated onto a Fibre-Optic Termination Panel at the end points. Provision must be made to allow specific fibre cores to be spliced all the way through to the terminal equipment, if needed.

Pre-installation Tests

- Pre-testing the fibre prior to installation to ensure that the losses due to laying/blowing the fibre are within accepted tolerances.

Post-installation Tests

- Bi-directional test results of all of the installed fibre cores provided.
- Tests for the Attenuation, Chromatic dispersion and Polarization mode dispersion must be conducted.
- All the tests must adhere to these SANS standards, SANS 60793-1-42:2018, SANS 60793-1-48:2007 and SANS 60793-1-40:2001.

Installation Works

- Pre test the cable for losses.

- Install the fibre cable in the sub-ducting by blowing or laying the fibre cable in the sub-duct.
- Terminate the fibre cable in the respective patch panels.
- Perform the post installation tests.
- If the test results are acceptable, commission the fibre network.

As-Build Documentation

On completion of the works and prior to handover, the as-built documentation and complete system descriptions will be handed over to the client.

As built drawings Drawings in Bentley Microstation or Microstation compatible format files must be supplied in addition to PDF format pages complete with title sheet and index sheet.

Quality Control

- Routine inspections of the line will be performed by the project engineers and Eskom's Clerk of Works (CoW) during the construction phase to ensure that technical quality and design standards are met;
- Routine inspections will be performed throughout the project duration by the project ECO to ensure that the EA conditions are met and that all work is performed in accordance with the approved EMP;
- Rehabilitation and reinstatement of any disturbed areas will be addressed during construction and after construction completion and will be a determining factor of final hand-over;
- Combined inspections and snagging will be performed by Eskom and the Project Engineers at notified Completion and all snagging items ("punch list") will be addressed and corrected prior to Hand-over.
- The Contractor shall provide all as-built information as per Annexure F of 240-47172520.

10.2. Temporary Arrangements

At present there are no planned temporary arrangements. Given the dynamics of this project, and its criticality on the overall Transnet Tippler 3 project, it is foreseen that possible adhoc temporary arrangements will come to fruition during the construction phase. Should this occur, Transnet will engage with Eskom accordingly.

11. Final Bill of Materials & Bill of Quantities

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV OVERHEAD LINE BOQ

POWER PLANT

JOB NAME	Job Name: Ystervark Branch Lines - Blouwater/Iscor 66kV Lines
JOB NUMBER:	Job Number: 153272156-00001
BOM TYPE:	FINAL BOM & BOQ
PREPARED BY :	Ndumiso Mabuza
Tel No	Tel: 021 950 7500
DATE PREP. :	Friday, February 21, 2020

WCOU_BOM-18-04 REV : 0

Eskom

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QTY	SAP	REFERENCE	Rev	DESCRIPTION
	STRUCTURES			
1	NON-STANDARD	CONTRACT NO: 405411		1 BLO/ISC 32 INCLUDING ACCESSORIES (BASE PLATE, HOLDING DOWN BOLTS, LADDER, CAP PLATES, LUGS ETC)
1	NON-STANDARD	CONTRACT NO: 405412		2 BLO/ISC 32 INCLUDING ACCESSORIES (BASE PLATE, HOLDING DOWN BOLTS, LADDER, CAP PLATES, LUGS ETC)
1	NON-STANDARD	CONTRACT NO: 405408		1 & 2 BLW/ISC 32/1 INCLUDING ACCESSORIES (BASE PLATE, HOLDING DOWN BOLTS, LADDER, CAP PLATES, LUGS ETC)
1	NON-STANDARD	CONTRACT NO: 405409		1 BLW/ISC 32/2 INCLUDING ACCESSORIES (BASE PLATE, HOLDING DOWN BOLTS, LADDER, CAP PLATES, LUGS ETC)
1	NON-STANDARD	CONTRACT NO: 405410		2 BLW/ISC 32/2 INCLUDING ACCESSORIES (BASE PLATE, HOLDING DOWN BOLTS, LADDER, CAP PLATES, LUGS ETC)
	1 BLO / ISC 31 - PHASE CONDUCTOR STRAIN ASSEMBLY			
6	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
3	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
3	222125	D-DT- 6059	9	CLEVIS BALL, 120 kN
3	167609	D-DT- 7029	9	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN
3	10259	D-DT- 7021	5	SOCKET CLEVIS, 120 kN
3	168745	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
3	168960	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR
	2 BLO / ISC 31 - PHASE CONDUCTOR STRAIN ASSEMBLY			
6	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
3	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
3	222125	D-DT- 6059	9	CLEVIS BALL, 120 kN
3	167609	D-DT- 7029	9	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN
3	10259	D-DT- 7021	5	SOCKET CLEVIS, 120 kN
3	168745	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
3	168960	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR

	1 BLO / ISC 32 - PHASE CONDUCTOR STRAIN ASSEMBLY			
18	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
9	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
9	222125	D-DT- 6059	9	CLEVIS BALL, 120 kN
9	167609	D-DT- 7029	9	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN
9	10259	D-DT- 7021	5	SOCKET CLEVIS, 120 kN
9	168745	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
3	401742	D-DT- 6099	4	CLAMP STRAIN, EUT-B
9	168960	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR
	2 BLO / ISC 32 - PHASE CONDUCTOR STRAIN ASSEMBLY			
18	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
9	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
9	222125	D-DT- 6059	9	CLEVIS BALL, 120 kN
9	167609	D-DT- 7029	9	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN
9	10259	D-DT- 7021	5	SOCKET CLEVIS, 120 kN
9	168745	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
3	401742	D-DT- 6099	4	CLAMP STRAIN, EUT-B
9	168960	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR
	1 & 2 BLO / ISC 32-1 - PHASE CONDUCTOR STRAIN ASSEMBLY			
24	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
12	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
12	222125	D-DT- 6059	9	CLEVIS BALL, 120 kN
12	167609	D-DT- 7029	9	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN
12	10259	D-DT- 7021	5	SOCKET CLEVIS, 120 kN
12	168745	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
12	168960	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR
6	180641	D-DT- 7031	8	LINE POST INSULATOR ASSEMBLY - HORIZONTAL 66kV, 31mm/kV, 5.3 kN INSULATOR, WITH TRUNION CLAMP (INCLUDES ARMOUR ROD SET)
	1 BLO / ISC 32-2 - PHASE CONDUCTOR STRAIN ASSEMBLY (CHICADEE)			
6	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
3	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
3	222125	D-DT- 6059	9	CLEVIS BALL, 120 kN
3	167609	D-DT- 7029	9	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN
3	10259	D-DT- 7021	5	SOCKET CLEVIS, 120 kN
3	168745	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
3	168960	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR

	1 BLW / ISC 32-2 - PHASE CONDUCTOR STRAIN ASSEMBLY (KINGBIRD)			
6	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
3	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
3	222125	D-DT- 6059	9	CLEVIS BALL, 120 kN
3	167607	D-DT- 7014	9	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN
3	10259	D-DT- 7021	5	SOCKET CLEVIS, 120 kN
3	168747	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
3	168893	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT KINGBIRD ACSR
	2 BLO / ISC 32-2 - PHASE CONDUCTOR STRAIN ASSEMBLY (CHICADEE)			
6	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
3	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
3	222125	D-DT- 6059	9	CLEVIS BALL, 120 kN
3	167609	D-DT- 7029	9	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN
3	10259	D-DT- 7021	5	SOCKET CLEVIS, 120 kN
3	168745	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
3	168960	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR
	2 BLO / ISC 32-2 - PHASE CONDUCTOR STRAIN ASSEMBLY (KINGBIRD)			
6	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
3	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
3	222125	D-DT- 6059	9	CLEVIS BALL, 120 kN
3	167607	D-DT- 7014	9	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN
3	10259	D-DT- 7021	5	SOCKET CLEVIS, 120 kN
3	168747	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
3	168893	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR
	ISCOR SUBSTATION GANTRY - PHASE CONDUCTOR STRAIN ASSEMBLY FOR CHICADEE CONDUCTOR			
12	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
6	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
6	222125	D-DT- 6059	9	CLEVIS BALL, 120 kN
6	167609	D-DT- 7029	9	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN
6	10259	D-DT- 7021	5	SOCKET CLEVIS, 120 kN
6	243440	D-DT- 7022	14	CLAMP STRAIN, PISTOL GRIP 3B
6	168960	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR

	YESTERVARK SUBSTATION GANTRY - PHASE CONDUCTOR STRAIN ASSEMBLY FOR KINGBIRD CONDUCTOR			
12	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
6	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
6	222125	D-DT- 6059	9	CLEVIS BALL, 120 kN
6	167607	D-DT- 7014	11	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN
6	10259	D-DT- 7021	5	SOCKET CLEVIS, 120 kN
6	243440	D-DT- 7022	14	CLAMP STRAIN, PISTOL GRIP 3B
6	168893	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR
	1 BLO / ISC 31 - OPGW STRAIN ASSEMBLY			
4	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
2	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
2	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)
2	N/A	D-DT- 3026	16	THIMBLE CLEVIS, 120 kN
2	N/A	BUY OUT - TO SUITE		PREFORMED HELICALLY DEAD END ASSEMBLY TO OPGW MANUFACTURER SPECIFICATIONS (INCLUDES REINFORCING HELICAL ARMOUR ROD SET)
2	N/A	BUY OUT - TO SUITE		MULTI-FREQUENCY VIBRATION DAMPER TO FIT OPGW
	2 BLO / ISC 31 - OPGW STRAIN ASSEMBLY			
2	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
1	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
1	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)
1	N/A	BUY OUT - TO SUITE		THIMBLE CLEVIS, 120 kN
1	N/A	BUY OUT - TO SUITE		PREFORMED HELICALLY DEAD END ASSEMBLY TO OPGW MANUFACTURER SPECIFICATIONS (INCLUDES REINFORCING HELICAL ARMOUR ROD SET)
1	N/A	BUY OUT - TO SUITE		MULTI-FREQUENCY VIBRATION DAMPER TO FIT OPGW
	1 BLO / ISC 32 - OPGW STRAIN ASSEMBLY			
4	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
2	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
2	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)
2	N/A	BUY OUT - TO SUITE		THIMBLE CLEVIS, 120 kN
2	N/A	BUY OUT - TO SUITE		PREFORMED HELICALLY DEAD END ASSEMBLY TO OPGW MANUFACTURER SPECIFICATIONS (INCLUDES REINFORCING HELICAL ARMOUR ROD SET)
2	N/A	BUY OUT - TO SUITE		MULTI-FREQUENCY VIBRATION DAMPER TO FIT OPGW

	SUBSTATION GANTRY - OPGW STRAIN AND TERMINATION ASSEMBLY			
1	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
1	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
1	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)
1	-	BUY OUT - TO SUITE		THIMBLE CLEVIS, 120 kN
1	-	BUY OUT - TO SUITE		PREFORMED HELICALLY DEAD END ASSEMBLY TO OPGW MANUFACTURER SPECIFICATIONS (INCLUDES REINFORCING HELICAL ARMOUR ROD SET)
1	-	BUY OUT - TO SUITE		PARALLEL GROOVE CLAMP - ALUMINIUM (CONDUCTOR RANGE 6.6 - 18.9 mm)
1	-	BUY OUT - TO SUITE		MULTI-FREQUENCY VIBRATION DAMPER TO FIT OPGW
1	222095	D-DT- 3074	8	LUG, ALUMINIUM INDENT CRIMP
36	-	BUY OUT - TO SUITE		NON-INSULATED DOWNLEAD CLAMPS FOR OPGW, SECURELY FIXED TO GANTRY COLUMN AT 500mm INTERVALS DOWN TO DOME ENCLOSURE (±18m / 500mm)
	2 BLO / ISC 31 - SHIELD WIRE STRAIN ASSEMBLY			
3	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
1	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
1	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)
1	402497	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
1	226767	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC
	1 BLO / ISC 32 - SHIELD WIRE STRAIN ASSEMBLY			
3	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
1	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
1	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)
1	402497	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
1	226767	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC
1	N/A	BUY OUT - TO SUITE		PARALLEL GROOVE CLAMP - ALUMINIUM (CONDUCTOR RANGE 6.6 - 18.9 mm)
	2 BLO / ISC 32 - SHIELD WIRE STRAIN ASSEMBLY			
9	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
3	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
3	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)
3	402497	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
3	226767	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC
1	N/A	BUY OUT - TO SUITE		PARALLEL GROOVE CLAMP - ALUMINIUM (CONDUCTOR RANGE 6.6 - 18.9 mm)

	SUBSTATION GANTRY - SHIELD WIRE STRAIN ASSEMBLY			
15	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
5	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
5	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)
5	241886	D-DT- 7041	2	EXTENSION LINK 350mm (DOUBLE), 120kN
5	401310	D-DT- 7022	14	CLAMP STRAIN, PISTOL GRIP TYPE 3B, 70kN
5	226767	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC
5	222095	D-DT- 3074	8	LUG, ALUMINIUM INDENT CRIMP
	1 & 2 BLO / ISC 32-1 - SHIELD WIRE STRAIN ASSEMBLY			
12	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
2	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
2	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)
2	168861	D-DT- 7015	8	YOKE PLATE - TRIANGLE, 120kN
4	402497	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
4	226767	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC
2	-	BUY OUT - TO SUITE		PARALLEL GROOVE CLAMP - ALUMINIUM (CONDUCTOR RANGE 6.6 - 18.9 mm)
	1 BLO / ISC 32-2 - SHIELD WIRE STRAIN ASSEMBLY (WITHOUT BIFURCATION)			
3	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
1	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
1	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)
1	402497	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
1	226767	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC
	1 BLO / ISC 32-2 - SHIELD WIRE STRAIN ASSEMBLY (WITH BIFURCATION)			
6	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN
1	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN
1	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)
1	168861	D-DT- 7015	8	YOKE PLATE - TRIANGLE, 120kN
2	402497	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY
2	226767	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC
1	-	BUY OUT - TO SUITE		PARALLEL GROOVE CLAMP - ALUMINIUM (CONDUCTOR RANGE 6.6 - 18.9 mm)

	2 BLO / ISC 32-2 - SHIELD WIRE STRAIN ASSEMBLY (WITHOUT BIFURCATION)				
3	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	
1	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN	
1	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	
1	402497	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY	
1	226767	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC	
	2 BLO / ISC 32-2 - SHIELD WIRE STRAIN ASSEMBLY (WITH BIFURCATION)				
6	163406	D-DT- 7017	5	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	
1	175857	D-DT- 7042	6	SAG ADJUSTOR, 120 kN	
1	167605	D-DT- 7012	4	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	
1	168861	D-DT- 7015	8	YOKE PLATE - TRIANGLE, 120kN	
2	402497	D-DT- 7000	8	COMPRESSION DEAD END CLAMP ASSEMBLY	
2	226767	D-DT- 7005	8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC	
1	-	BUY OUT - TO SUITE		PARALLEL GROOVE CLAMP - ALUMINIUM (CONDUCTOR RANGE 6.6 - 18.9 mm)	
	CONDUCTOR & SHIELD WIRE				
2950 m	0171326	D-DT-3136	13	COND,ACSR CHICADEE 18.87D GRS	0.643
300 m	0401188	D-DT-3136	13	COND,ACSR KINGBIRD 23.90D GRS	1.038
800 m	0403107	D-DT-3136	13	COND,AAAC OAK 13.95D GRS	0.325
7050 m	NON-STANDARD	AS PER DATASHEET		48-CORE SINGLE MODE UNARMOURED DUCT FIBRE	
0 m	NON-STANDARD	AS PER DATASHEET		OPGW, ZTT201012011 GRS OPGW	
	EARTHING				
170 m				50MM x 3MM ANNEALED COPPER STRAP	
10 m	0401188	D-DT-3136	13	COND,ACSR KINGBIRD 23.90D GRS	1.038
50 m				$16mm^2$ 1-CORE CU ICEW EARTH CABLE	
250 m		D-DT-3139	7	$16mm^2$ CU BARE EARTH CABLE	
3 m		D-WC-6022-32-06-01		$65.4mm^2$ BARE COPPER EARTH LEAD	
2 m		D-WC-6022-32-14-00		HEAT SHRINK TUBING	
2 m				NON-TENSION JOINT, BIMETALLIC	
10 m				BONDED STEEL STRAPPING AT 1000MM CENTRES	
10 m		D-DT-8020	6	COPPER CRIMP FERRULE	
		BONDING CLAMPS AND STRAPPNG			
100 m				316L STAINLESS STEEL BANDIT STRAPPING, BUCKLES, AND ALL OTHER ACCESSORIES (PRICE/ROLL)	
SUM				WELDING AND BRAZING	

	DISMANTLING AND REMOVAL OF MATERIAL (CONDUCTORS, HARDWARE ASSEMBLIES, MASTS, STAYS, TEMPORARY STRUCTURES ETC)			
SUM				DISMANTLING AND REMOVAL OF CONDUCTORS, SHIELD WIRE, OPGW, DUCT FIBRE OPTIC CABLES
SUM				TRANSPORTATION OF CONDUCTORS, SHIELD WIRE, OPGW, DUCT FIBRE OPTIC CABLES TO ESKOM BRACKENFELL DEPOT
SUM				DISMANTLING AND REMOVAL OF HARDWARE ASSEMBLIES
SUM				LOADING, OFF-LOADING, RIGGING AND TRANSPORTATION OF HARDWARE ASSEMBLIES TO ESKOM BRACKENFELL DEPOT
SUM				DECOMMISSIONING, DISMANTLING AND LOWERING TO GROUND OF REDUNDANT EXISTING TERMINAL STRUCTURES (1 BLO/ISC 30 AND 2 BLO/ISC 30)
SUM				LOADING, OFF-LOADING, RIGGING, TRANSPORTATION OF TERMINAL STRUCTURES TO ESKOM BRACKENFELL DEPOT
SUM				DECOMMISSIONING, DISMANTLING AND REMOVAL OF STAYS AND TEMPORARY STRUCTURES
SUM				LOADING, OFF-LOADING, RIGGING AND TRANSPORTATION OF STAYS AND TEMPORARY STRUCTURES TO ESKOM BRACKENFELL DEPOT
	MISCELLLANEOUS			
		FO JOINTS AND TERMINATIONS		
4				48-CORE SC-APC TYPE CONECTOR TERMINATION SET FOR SMFO CABLE, INCLUDING PATCH LEADS, GLANDS ETC
3				48-CORE SC-APC TYPE CONECTOR JOINTS FOR SMFO CABLE, INCLUDING PATCH LEADS, GLANDS ETC
4				
		SIGNAGE		
8		D-DT-5050s1	**3**	Line Designation Labels
		D-DT-5050s2	**2**	Line Crossing Labels
8		D-DT-5050s1	**3**	Pole Identification Label
4		D-DT-5047s3	**2**	R Phase Disk Label
4		D-DT-5047s3	**2**	W Phase Disk Label
4		D-DT-5047s3	**2**	B Phase Disk Label

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

CIVIL

JOB NAME	Job Name: Ystervark Branch Lines - Iscor/Blouwater 66 kV Lines	WCOU_BOM-18-04	REV : 0	This document is the property of Eskom
JOB NUMBER:	Job Number: 153272156-00001			
BOM TYPE:	FINAL BOM & BOQ			
PREPARED BY :	Francois Ricketts			
Tel No	Tel: 021 950 7500			
DATE PREP. :	Wednesday, 06 November 2019			

CIVIL BILL OF MATERIALS

QTY		REFERENCE	Rev		DESCRIPTION
	MAST FOUNDATIONS, COVER SLABS AND DRAW BOXES				SAP
	TOTAL CONCRETE AND BRICK				25 MPa Concrete, use 355 kg cement, 0.70 m3 sand (max 5% moisture) and 0.78 m3 stone (19 mm). Cement : Water Ratio = 1.7
19,8 m³		1924701-2-330-C-LA-0001-02-00-AE	0		Total Concrete (Draw boxes)
32016,6		1924701-2-330-C-LA-0001-02-00-AE	0		Total Clay/Stock Brick
141		1924701-2-330-C-LA-0001-02-00-AE	0		50kg Pockets of Cement
15,4 m³		1924701-2-330-C-LA-0001-02-00-AE	0		m³ Stone (19mm stone size)
13,9 m³		1924701-2-330-C-LA-0001-02-00-AE	0		m³ Sand
19,8 m³		1924701-2-330-C-LA-0001-02-00-AE	0		Total Concrete (Cover slabs)
32016,6		1924701-2-330-C-LA-0001-02-00-AE	0		Total Clay/Stock Brick
141		1924701-2-330-C-LA-0001-02-00-AE	0		50kg Pockets of Cement
15,4 m³		1924701-2-330-C-LA-0001-02-00-AE	0		m³ Stone (19mm stone size)
13,9 m³		1924701-2-330-C-LA-0001-02-00-AE	0		m³ Sand
30,0 m³		1924701-2-330-C-LA-0001-02-00-AE	0		Total Concrete (Bollards)
213		1924701-2-330-C-LA-0001-02-00-AE	0		50kg Pockets of Cement
23,4 m³		1924701-2-330-C-LA-0001-02-00-AE	0		m³ Stone (19mm stone size)
21,0 m³		1924701-2-330-C-LA-0001-02-00-AE	0		m³ Sand
213,7 m³		FD2222/09/19	1		Total Concrete (Mast Bases)
1518		FD2222/09/19	1		50kg Pockets of Cement
166,7 m³		FD2222/09/19	1		m³ Stone (19mm stone size)
149,6 m³		FD2222/09/19	1		m³ Sand
	MISCELLANEOUS				25 MPa Concrete, use 355 kg cement, 0.70 m3 sand (max 5% moisture) and 0.78 m3 stone (19 mm). Cement : Water Ratio = 1.7
132 No.		1924701-2-330-C-LA-0001-02-00-AE	0		Steel H section 1830mmx152mmx152mmx23mm
132 No.		1924701-2-330-C-LA-0001-02-00-AE	0		Concrete pipe 300mm diameter Class 50D Spigot and socket - 1830mm
31,7 m³		1924701-2-330-C-LA-0001-02-00-AE	0		Cement and Sand mix 1:6 for bollards
2.772 t		1924701-2-330-C-LA-0001-02-00-AE	0		High tensile steel for sleeve box bases, covers and foundations
14.206 t		FD2222/09/19	1		High tensile steel for mast bases
33 No.		1924701-2-330-C-LA-0001-02-00-AE	0		Heavy Duty Polymer Concrete Cover Lockable
27160 m		1924701-2-330-C-LA-0001-02-00-AE	0		32mm diameter HDD Sleeves
710m		1924701-2-330-C-LA-0001-02-00-AE	0		200mm diameter HDPE sleeve for 4No. 32mm diameter ducts for Horizontal Directional Drilling
24320 m		1924701-2-330-C-LA-0001-02-00-AE	0		Approved danger tape
40534 No.		1924701-2-330-C-LA-0001-02-00-AE	0		Concrete cover slabs 230mmx450mmx50mm
1368,0 m³		1924701-2-330-C-LA-0001-02-00-AE	0		m³ Sand G7 Import Backfilling

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV SUBSTATION BOM

WCOU_BOM-18-04

CIVIL

JOB NAME	Job Name: Ystervark Branch Lines - Iscor/Blouwater 66 kV Lines
JOB NUMBER:	Job Number: 153272156-00001
BOM TYPE:	FINAL BOM & BOQ
PREPARED BY :	Francois Ricketts
Tel No	Tel: 021 950 7500
DATE PREP. :	Wednesday, 06 November 2019

LASTEST REV : 0

Eskom

CIVIL BILL OF QUANTITIES

BASED ON MEW SUBSTATION BOQ rev. 11

CODE	DESCRIPTION	UNIT	QTY.	ADD. QTY.	LABOUR & PLANT B, P&G %	RATE (R)	POINTS/ UNIT	HOURS	TOTAL HOURS	TOTAL (R)	POINTS TOTAL
		CIVIL ACTIVITIES									
	Site Clearance										
	Fibre and cable trench	m^2	800								
	Bases	m^2	52								
	Draw boxes	m^2	74								
	Excavation:										
	Excavations soft and intermediate (Trenches)	m^3	2640,0								
	Excavation hard (Trenches)	m^3	6160,0								
	Excavations soft and intermediate (Draw boxes)	m^3	33,4								
	Excavation hard (Draw boxes)	m^3	78,0								
	Horizontal Directional Drilling (Intermediate material) 200mm, Multiple locations	m	200,0								
	Horizontal Directional Drilling (Hard rock material) 200mm Multiple locations	m	510,0								
	Excavations soft (Bases)	m^3	113,6								
	Excavation hard (Bases)	m^3	263,3								
	Shoring										
	Shoring	m^2	208,6								
	Sleeves										
	Install and lay 32mm diameter sleeves	m	27160,0								
	Install and lay concrete cover slabs	No.	40533,3								
	Backfill and compact										
	Backfill and compact (Normal)	m^3	5244,0								
	Backfill and compact (Road reserves)	m^3	672,8								
	Clearing of excess material to spoil										
	Clearing of excess material to spoil	m^3	1368,0								
	Foundations										
	Setting & Marking of foundations	each	38,0								
	Concrete formwork	m^2	208,6								
	Place concrete	m^3	253								
	Finishing:										
	Finishing Foundation	each	38								
	Bollards	each	132,0								
	SUBTOTAL (CIVIL PP ACTIVITIES)										

12. Credit Bill of Materials

WESTERN CAPE OPERATING UNIT PROJECT ENGINEERING - HV OVERHEAD LINE BOQ				
POWER PLANT				
JOB NAME			Job Name: Ystervark Branch Lines - Blouwater/Iscor 66kV Lines	WCOU_BOM-18-04 REV : 0
JOB NUMBER:			Job Number: 153272156-00001	Eskom
BOM TYPE:			FINAL BOM & BOQ	This document is the property of Eskom
PREPARED BY :			Ndumiso Mabuza	
Tel No			Tel: 021 950 7500	
DATE PREP. :			Friday, February 21, 2020	
QTY	**SAP**	**REFERENCE**	**Rev**	**DESCRIPTION**
	DISMANTLING AND REMOVAL OF MATERIAL (CONDUCTORS, HARDWARE ASSEMBLIES, MASTS, STAYS, TEMPORARY STRUCTURES ETC)			
SUM				EXISTING CHICADEE CONDUCTOR FROM ISCOR SUBSTATION GANTRY TO STRUCTURES 1 BLW / ISC 31 and 2 BLW / ISC 31
SUM				EXISTING 12kA 24-CORE OPGW BETWEEN EXISTING 2 BLO / ISC 30 AND 2 BLW / ISC 31
SUM				EXISTING 12kA 24-CORE OPGW BETWEEN EXISTING ISCOR SUBSTATION GANTRY AND 2 BLW / ISC 31
SUM				EXISTING 12kA 24-CORE OPGW AT THE DOME JOINT AT THE EXISTING 12 OF THE DUFERCO 66kV OHL
SUM				EXISTING 12kA 24-CORE OPGW 2 BLO/ISC 13 AND STRUCTURE 12 OF THE DUFERCO 66kV OHL INCLUDING HARDWARE
SUM				EXISTIMG HARDWARE ASSEMBLIES ON EASTERN SIDE OF STRUCTURES 1 BLO / ISC 31 AND 2 BLO / ISC 31 INCLUDING ON ISCOR SUBSTATION GANTRY
SUM				

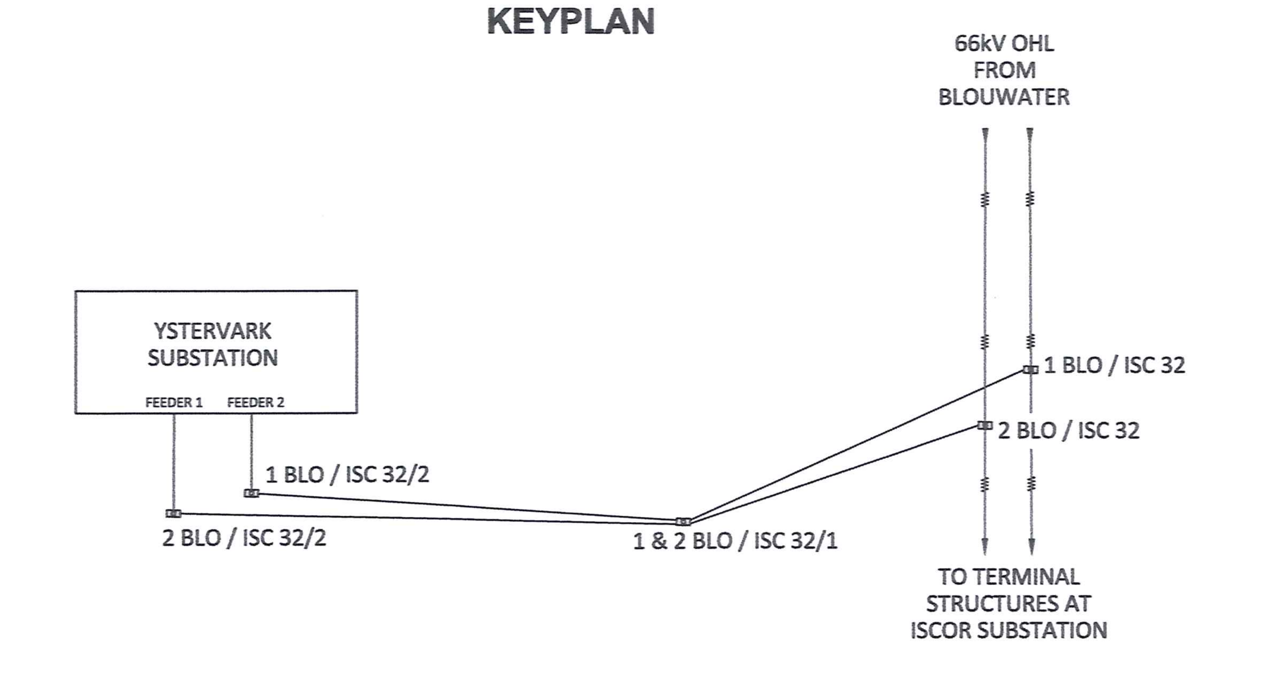
13. Drawings

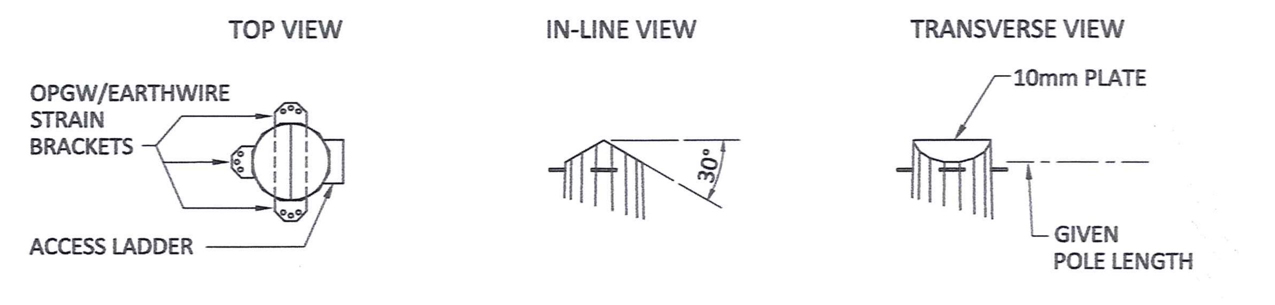
13.1. Transnet Drawings Issued to Contractor

Drawing No	Drawing Name	Rev
1924701-2-300-E-DE-0062	66kV Branch Line Mast - T-Off Structure (1 BLO / ISC 32)	00
1924701-2-300-E-DE-0063	66kV Branch Line Mast - T-Off Structure (2 BLO / ISC 32)	00
1924701-2-300-E-DE-0064	66kV Branch Line Mast - Strain Structure (1 & 2 BLO / ISC 32/1)	00
1924701-2-300-E-DE-0065	66kV Branch Line Mast - Terminal Structure (1 BLO / ISC 32/2)	00
1924701-2-300-E-DE-0066	66kV Branch Line Mast - Terminal Structure (2 BLO / ISC 32/2)	00
1924701-2-300-E-DE-0067	66kV Branch Line Masts - 1 BLO / ISC 31 OPGW Strain Configuration	00
1924701-2-300-E-DE-0068	66kV Branch Line Masts - 2 BLO / ISC 31 OPGW and Shield Wire Strain Configuration	00
1924701-2-300-E-DE-0069	66kV Branch Line Masts - 1 BLO / ISC 32 OPGW and Shield Wire Strain Configuration	00
1924701-2-300-E-DE-0070	66kV Branch Line Masts - 2 BLO / ISC 32 Shield Wire Strain Configuration	00
1924701-2-300-E-DE-0071	66kV Branch Line Masts - Substation Gantry OPGW Strain and Termination Configuration	00
1924701-2-300-E-DE-0072	66kV Branch Line Masts - Substation Gantry Shield Wire Strain Configuration (Typical)	00
1924701-2-300-E-DE-0073	66kV Branch Line Masts - 1 BLO / ISC 31 and 2 BLO / ISC 31 Phase Conductor Strain Configuration	00
1924701-2-300-E-DE-0074	66kV Branch Line Masts - 1 BLO / ISC 32 and 2 BLO / ISC 32 Phase Conductor Strain Configuration	00
1924701-2-300-E-DE-0075	66kV Branch Line Masts - Substation Gantry Phase Conductor Strain Configuration (Typical)	00
1924701-2-300-E-DE-0076	66kV Branch Line Masts - 1 & 2 BLO / ISC 32/1 Shield Wire Strain Configuration	00
1924701-2-300-E-DE-0077	66kV Branch Line Masts - 1 & 2 BLO / ISC 32/1 Phase Conductor Strain Configuration	00

1924701-2-300-E-DE-0078	66kV Branch Line Masts - 1 BLO / ISC 32/2 and 2 BLO / ISC 32/2 Shield Wire Strain Configuration	00
1924701-2-300-E-DE-0079	66kV Branch Line Masts - 1 BLO / ISC 32/2 and 2 BLO / ISC 32/2 Phase Conductor Strain Configuration	00
1924701-2-300-E-DE-0080	66kV Branch Line Masts – Substation Gantry OPGW Strain and Termination Configuration	00
1924701-2-300-E-DE-0081	66kV Branch Line Masts – Substation Gantry Shield Wire Strain Configuration (Typical)	00
1924701-2-300-E-DE-0082	66kV Branch Line Masts – Substation Gantry Phase Conductor Strain Configuration	00
1924701-2-300-E-LA-0062	66kV Branch Line Mast Positions & Clearances	03
1924701-2-300-E-LA-0063	Eskom Blouwater-Iscor 66kV Overhead Line - Overall Layout	OB
1924701-2-330-C-LA-0001	Iron Ore Tippler 3 Project Bulk Power Upgrade Eskom Blouwater - Iscor Optic Fibre Line Sh 1	03
1924701-2-330-C-LA-0001	Iron Ore Tippler 3 Project Bulk Power Upgrade Eskom Blouwater - Iscor Optic Fibre Line Sh 2	04

KEYPLAN





DETAILS AT TOP OF POLE

SINGLE CIRCUIT T-OFF STRUCTURE, 14m CAH

MAST NUMBER	1 BLO / ISC 32
PHASE CONDUCTOR : TYPE 1	CHICADEE ACSR
OPGW CONDUCTOR	EXISTING OPGW
SHIELD CONDUCTOR	OAK AAAC
VERTICAL ϕ - ϕ SPACING (m)	1.50
VERTICAL ε - ϕ SPACING (m)	1.50
CONDUCTOR ATTACHMENT HEIGHT (m)	14
SIDES	12
APPROXIMATE TOTAL LENGTH (m)	18.5
TIP DIAMETER (mm)	300
BASE DIAMETER (mm)	950
WALL THICKNESS (mm)	8
BASE PLATE O.D. (mm)	MANUFACTURER TO CONFIRM
BASE PLATE I.D (mm)	MANUFACTURER TO CONFIRM
BASE PLATE THICKNESS (mm)	MANUFACTURER TO CONFIRM
H.D. BOLTS (qty)	MANUFACTURER TO CONFIRM
H.D BOLTS DIAMETER (mm)	MANUFACTURER TO CONFIRM
H.D. BOLT PCD (mm)	MANUFACTURER TO CONFIRM
WORKING TIP LOAD (kN)	67.3
BASE G.L MOMENT (kNm)	1245
BASELINE ESKOM STANDARD FOUNDATION REF (kNm)	2000
APPROXIMATE MASS (tons)	2.66
APPROXIMATE MAST UTILISATION (%)	70

ADDITIONAL NOTES:

1. THE DESIGN OF THESE STRUCTURES IS GENERALLY IN ACCORDANCE WITH ASCE STANDARD 48-11 DESIGN OF STEEL TRANSMISSION POLE STRUCTURES. MANUFACTURE AND INSTALLATION SHOULD ALSO MEET THE REQUIREMENT OF THE SAME PUBLICATION.
2. POLES WILL HAVE THE LOWEST NUMBER OF SLIP JOINTS IN CONFORMANCE WITH THE LIMITATION IMPOSED BY THE LENGTH OF THE GALVANIZING BATH. SLIP JOINTS LENGTH IS TO BE 1.5 TIMES LARGEST I.D. OF THE FEMALE SECTION.
3. FULL PENETRATION WELDS ARE TO BE USED ON:
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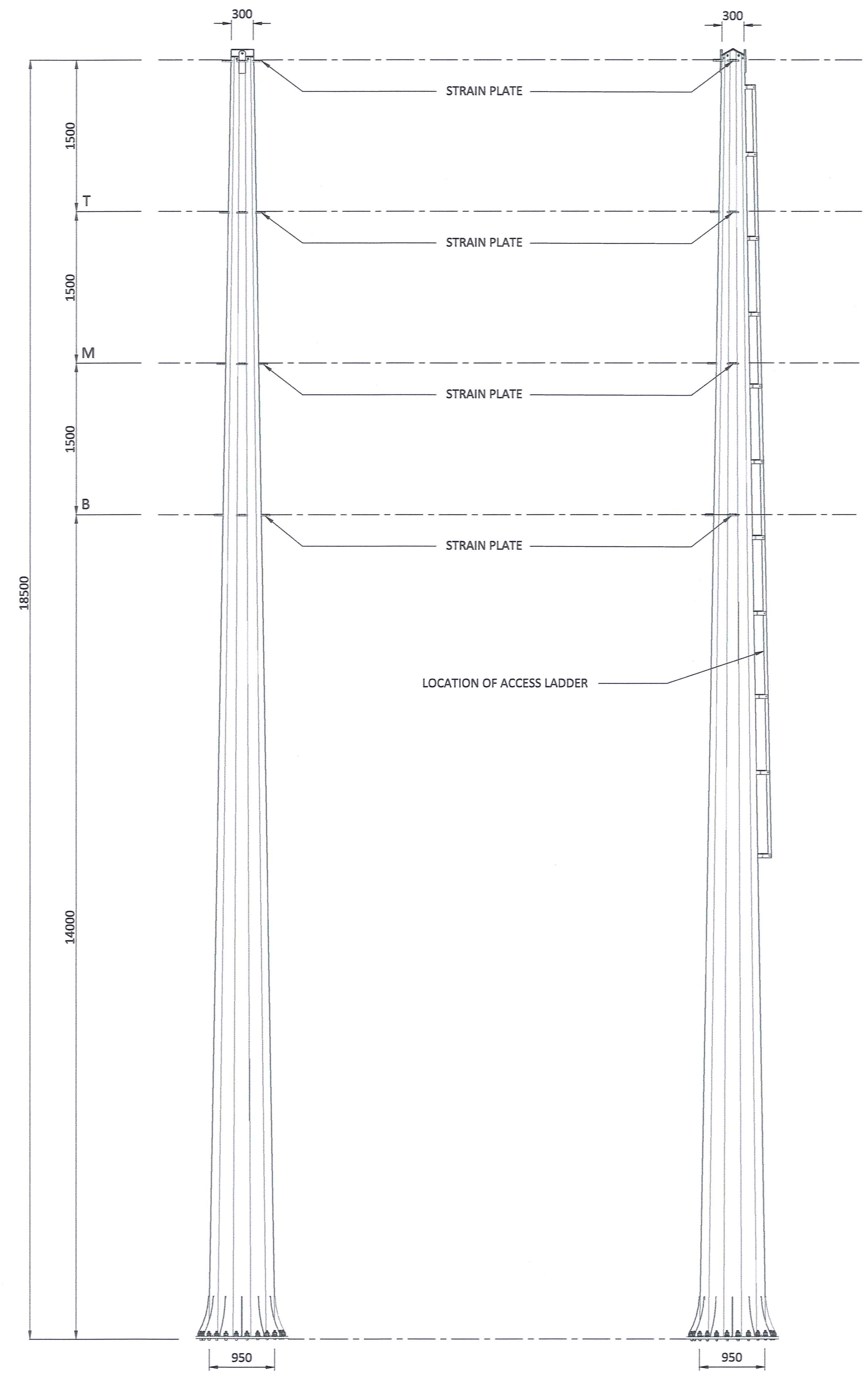
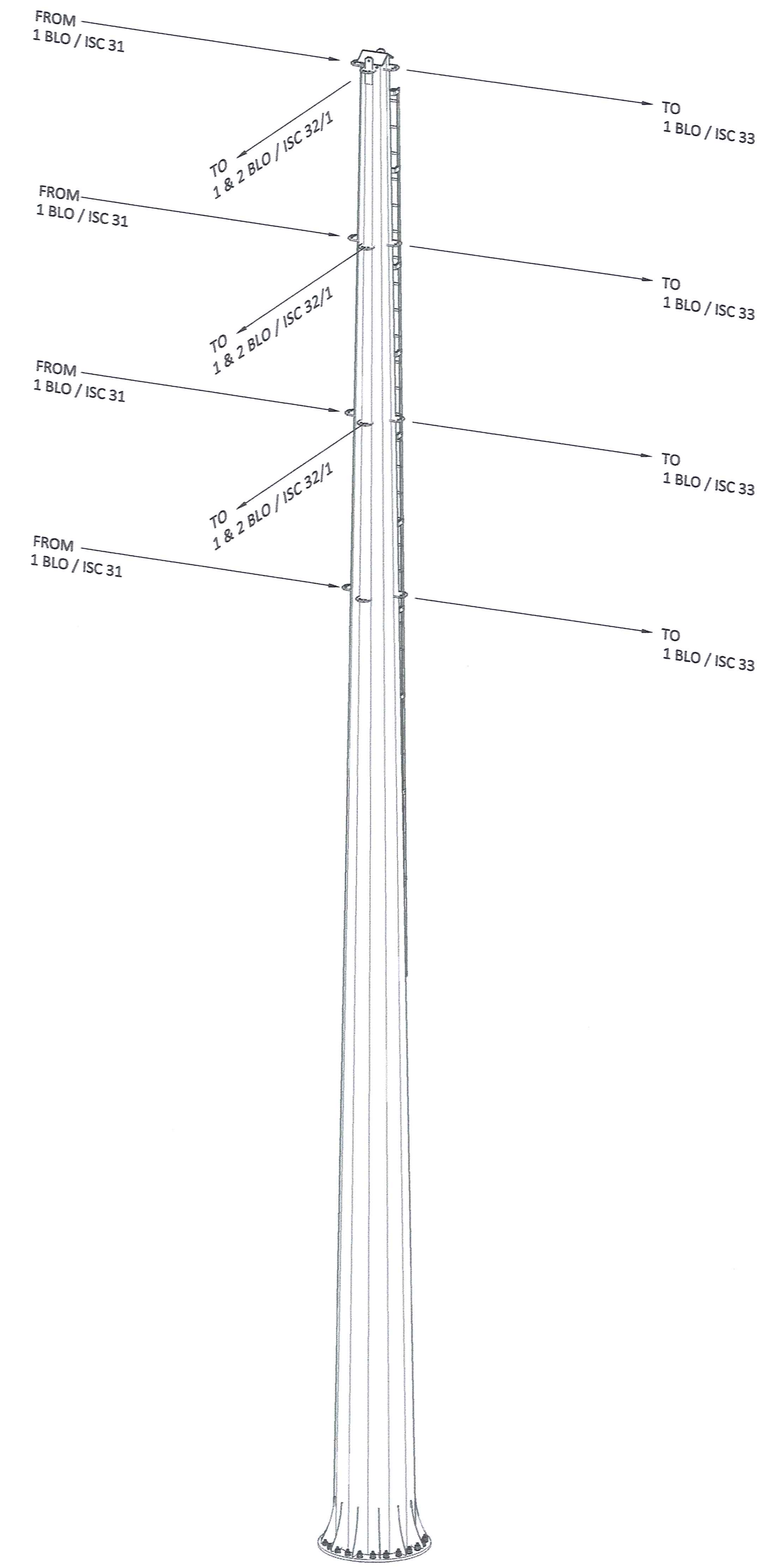
4. ACCESS LADDERS ARE REQUIRED ON ALL STRUCTURES FROM APPROXIMATELY 6m ABOVE GROUND LEVEL.
5. FOR FURTHER INFORMATION, REFER TO RESPECTIVE ESKOM STANDARDS AND SPECIFICATIONS.
6. MATERIAL : S355JR STEEL.
7. WELDING TO BE 8mm CONTINUOUS SEAL TO SANS 10162, UNLESS REQUIRED OTHERWISE.
8. HOP DIP GALVANIZING TO SANS 121.
9. STRESS RELIEVING TO BE APPLIED IN ACCORDANCE WITH SANS 121 TOLERANCES:
   - ON DIMENSION 2mm
   - ON DRILLING CENTRE'S 2mm



TRANSVERSE VIEW **IN-LINE VIEW**



ISOMETRIC VIEW

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REFERENCE DRAWINGS

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
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REVISIONS

CONTRACTOR / CONSULTANT

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DRAWN	DD		'20 02 17
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DESIGNED	NM		'20 02 17
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OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME	C PYM	DATE
SIGNATURE		'20 02 17
REG. NUMBER	201270126	
SCALE :	N.T.S.	A1

Transnet Capital Projects
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TABLE BAY BUILDING, TYGERBERG PARK,
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TEL: 021 940 1999
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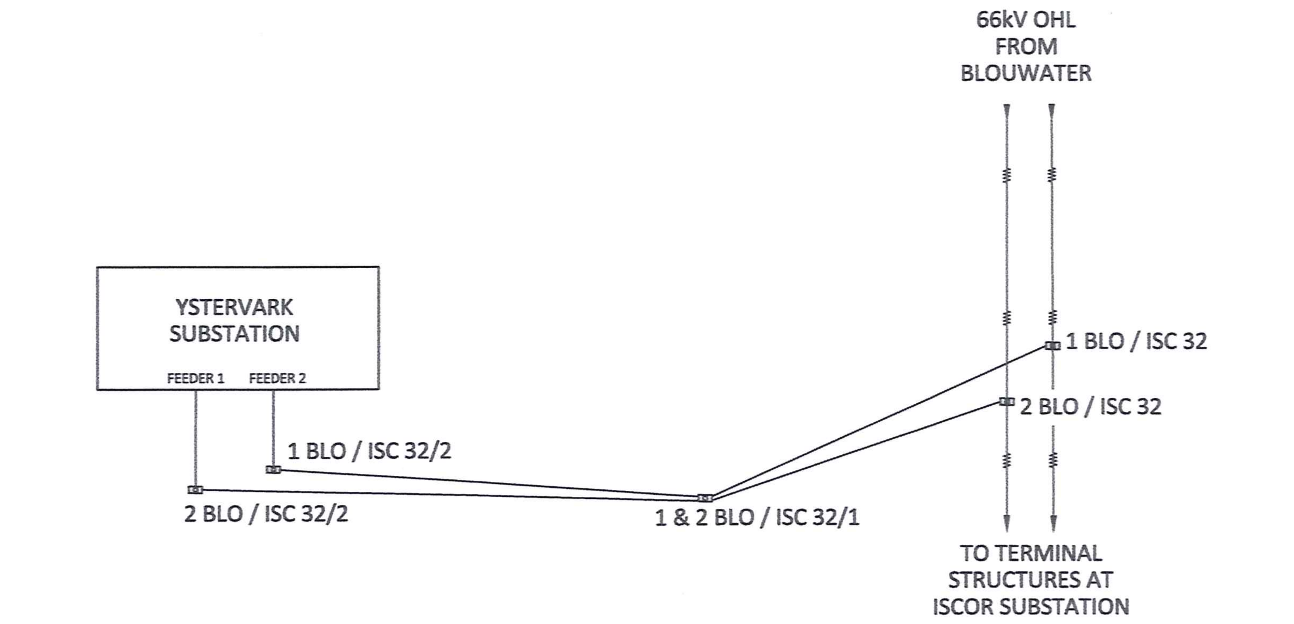
TRANSNET

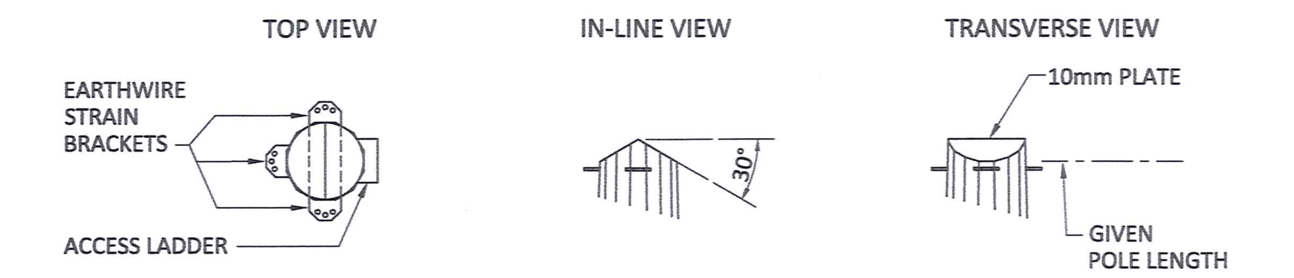
PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT BULK POWER UPGRADE : 66 kV BRANCH LINE MAST - T-OFF STRUCTURE (1 BLO / ISC 32)

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0062	01	00	AE

KEYPLAN





DETAILS AT TOP OF POLE

SINGLE CIRCUIT T-OFF STRUCTURE, 24m CAH

MAST NUMBER	2 BLO / ISC 32
PHASE CONDUCTOR : TYPE 1	CHICADEE ACSR
OPGW CONDUCTOR	NONE
SHIELD CONDUCTOR	OAK AAAC
VERTICAL ϕ - ϕ SPACING (m)	1.50
VERTICAL E - ϕ SPACING (m)	1.50
CONDUCTOR ATTACHMENT HEIGHT (m)	24.00
SIDES	12
APPROXIMATE TOTAL LENGTH (m)	28.5
TIP DIAMETER (mm)	350
BASE DIAMETER (mm)	1050
WALL THICKNESS (mm)	10
BASE PLATE O.D. (mm)	MANUFACTURER TO CONFIRM
BASE PLATE I.D (mm)	MANUFACTURER TO CONFIRM
BASE PLATE THICKNESS (mm)	MANUFACTURER TO CONFIRM
H.D. BOLTS (qty)	MANUFACTURER TO CONFIRM
H.D BOLTS DIAMETER (mm)	MANUFACTURER TO CONFIRM
H.D. BOLT PCD (mm)	MANUFACTURER TO CONFIRM
WORKING TIP LOAD (kN)	77.8
BASE G.L MOMENT (kNm)	2217
BASELINE ESKOM STANDARD FOUNDATION REF (kNm)	3000
APPROXIMATE MASS (tons)	5.51
APPROXIMATE MAST UTILISATION (%)	86

ADDITIONAL NOTES:

1. THE DESIGN OF THESE STRUCTURES IS GENERALLY IN ACCORDANCE WITH ASCE STANDARD 48-11 DESIGN OF STEEL TRANSMISSION POLE STRUCTURES. MANUFACTURE AND INSTALLATION SHOULD ALSO MEET THE REQUIREMENT OF THE SAME PUBLICATION.
2. POLES WILL HAVE THE LOWEST NUMBER OF SLIP JOINTS IN CONFORMANCE WITH THE LIMITATION IMPOSED BY THE LENGTH OF THE GALVANIZING BATH. SLIP JOINTS LENGTH IS TO BE 1.5 TIMES LARGEST I.D. OF THE FEMALE SECTION.
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4. ACCESS LADDERS ARE REQUIRED ON ALL STRUCTURES FROM APPROXIMATELY 6m ABOVE GROUND LEVEL.
5. FOR FURTHER INFORMATION, REFER TO RESPECTIVE ESKOM STANDARDS AND SPECIFICATIONS.
6. MATERIAL : S355JR STEEL.
7. WELDING TO BE 8mm CONTINUOUS SEAL TO SANS 10162, UNLESS REQUIRED OTHERWISE.
8. HOP DIP GALVANIZING TO SANS 121.
9. STRESS RELIEVING TO BE APPLIED IN ACCORDANCE WITH SANS 121 TOLERANCES:
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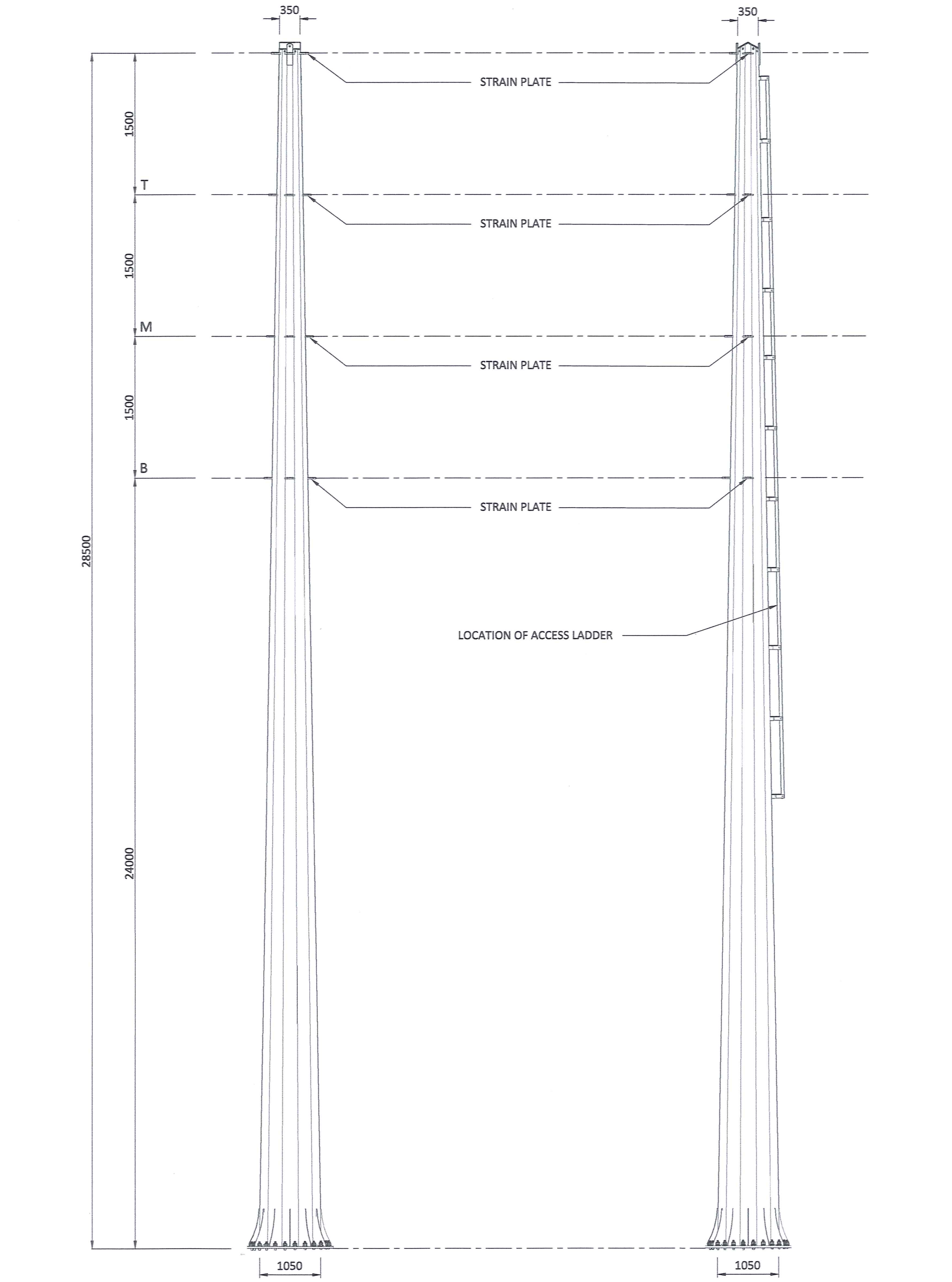
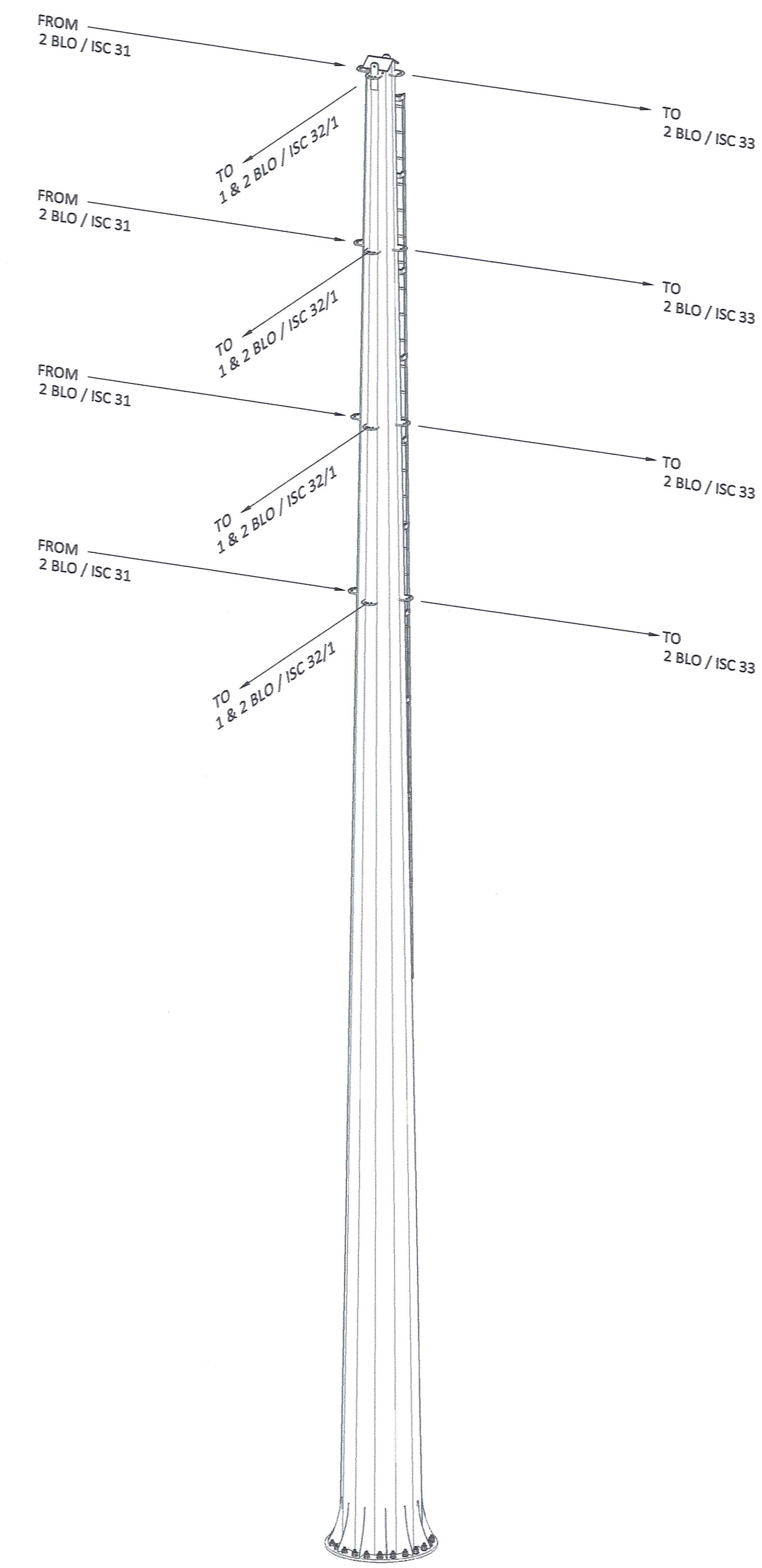


TRANSVERSE VIEW **IN-LINE VIEW**



ISOMETRIC VIEW

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TRANSNET CAPITAL PROJECTS

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PR.ENG. / PR.TECH./PR. ARCH

NAME C PYM — DATE '20 02 17
SIGNATURE
REG. NUMBER 201270126
SCALE : N.T.S. A1

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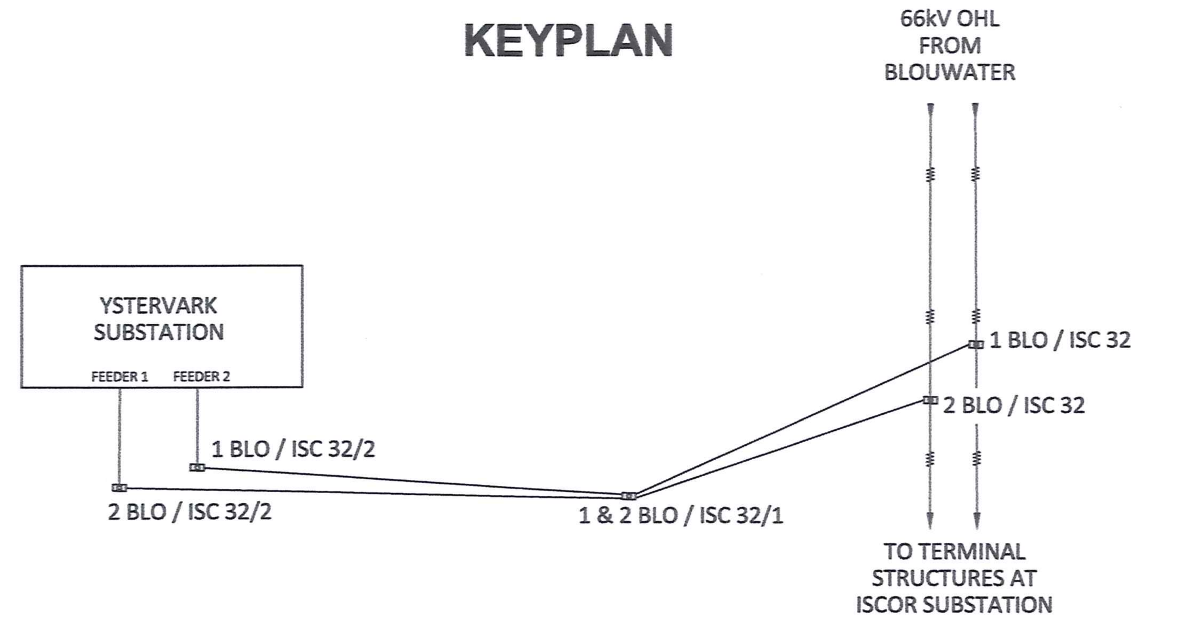
TRANSNET

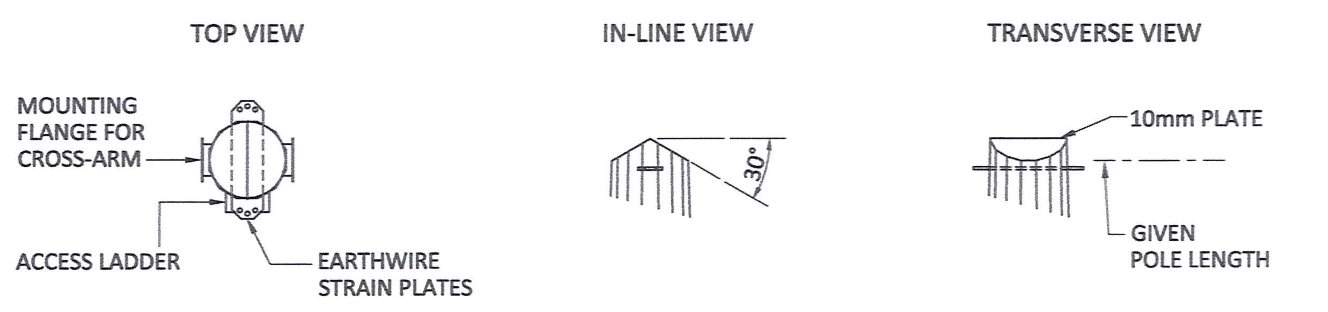
PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MAST -
T-OFF STRUCTURE (2 BLO / ISC 32)

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0063	01	00	AE

KEYPLAN





DETAILS AT TOP OF POLE

DOUBLE CIRCUIT STRAIN STRUCTURE, 22m CAH

MAST NUMBER	1 & 2 BLO / ISC 32/1
PHASE CONDUCTOR : TYPE 1	CHICADEE ACSR
OPGW CONDUCTOR	NONE
SHIELD CONDUCTOR	OAK AAAC
VERTICAL ϕ - ϕ SPACING (m)	1.50
VERTICAL Ɛ - ϕ SPACING (m)	1.50
CONDUCTOR ATTACHMENT HEIGHT (m)	22
SIDES	12
APPROXIMATE TOTAL LENGTH (m)	26.5
TIP DIAMETER (mm)	350
BASE DIAMETER (mm)	1050
WALL THICKNESS (mm)	10
BASE PLATE O.D. (mm)	MANUFACTURER TO CONFIRM
BASE PLATE I.D (mm)	MANUFACTURER TO CONFIRM
BASE PLATE THICKNESS (mm)	MANUFACTURER TO CONFIRM
H.D. BOLTS (qty)	MANUFACTURER TO CONFIRM
H.D BOLTS DIAMETER (mm)	MANUFACTURER TO CONFIRM
H.D. BOLT PCD (mm)	MANUFACTURER TO CONFIRM
WORKING TIP LOAD (kN)	84.1
BASE G.L MOMENT (kNm)	2229.3
BASELINE ESKOM STANDARD FOUNDATION REF (kNm)	3000
APPROXIMATE MASS (tons)	5.51
APPROXIMATE MAST UTILISATION (%)	84

ADDITIONAL NOTES:

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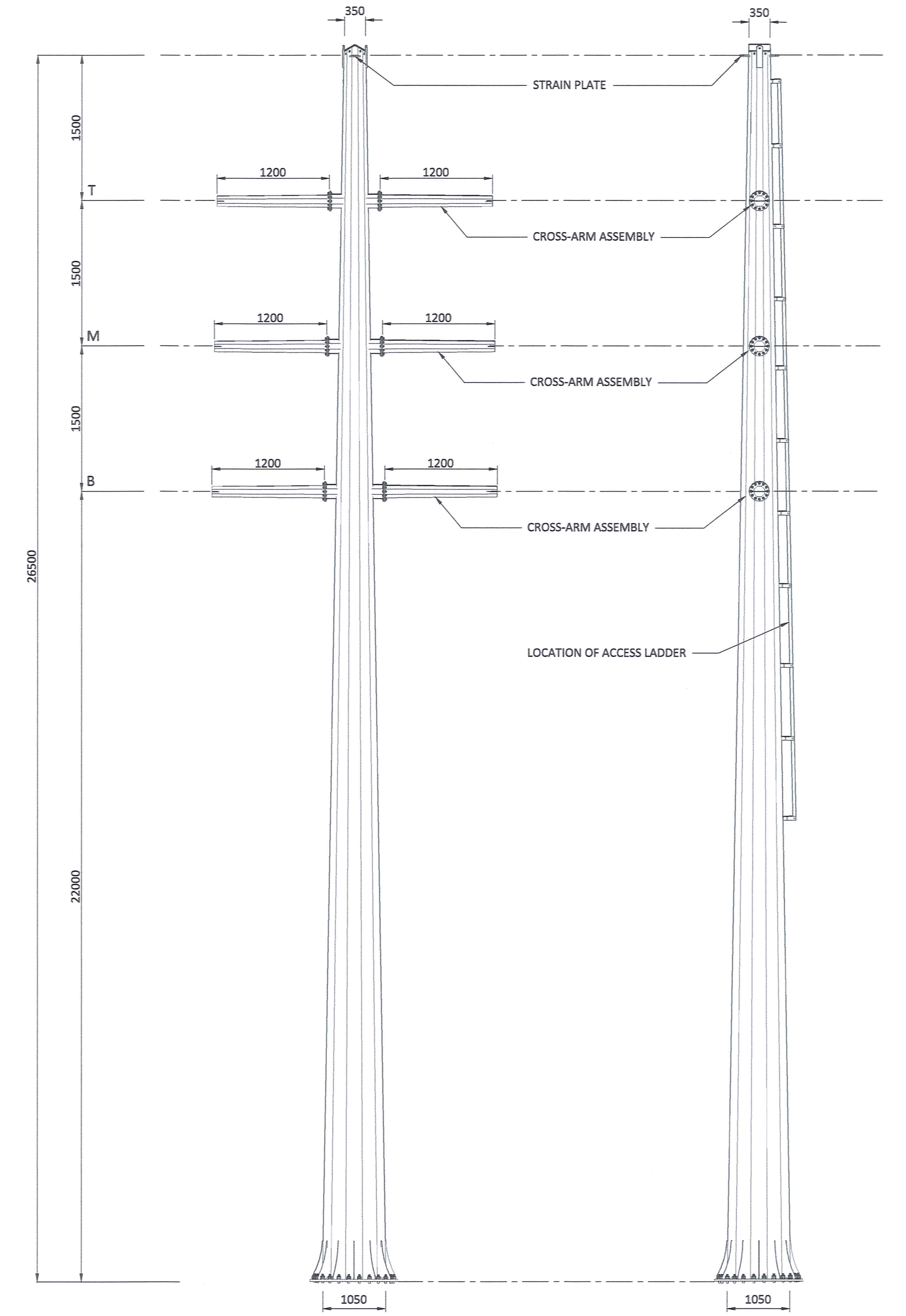
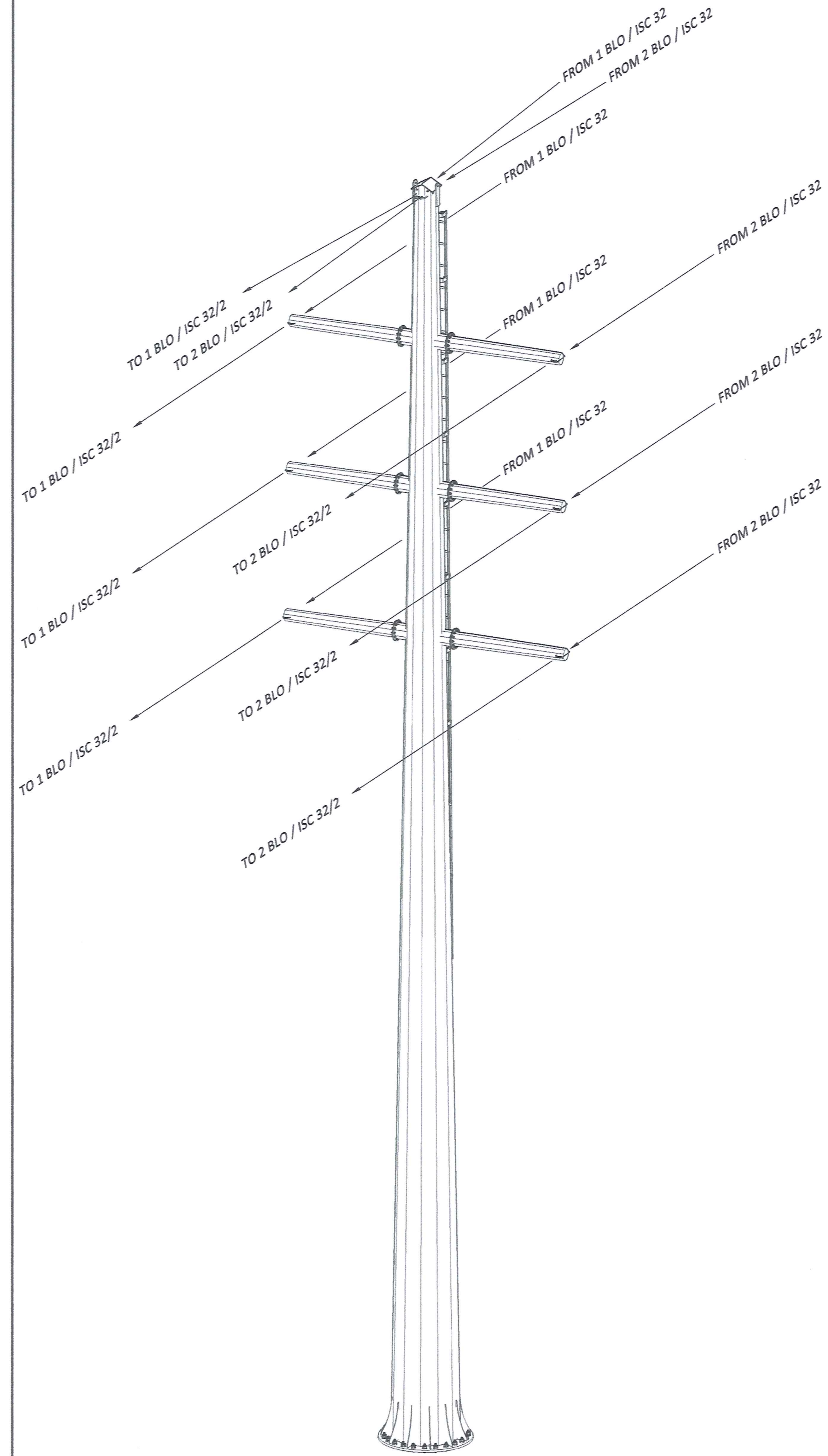


IN-LINE VIEW

TRANSVERSE VIEW



ISOMETRIC VIEW

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TRANSNET CAPITAL PROJECTS

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PR.ENG. / PR.TECH./PR. ARCH

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SIGNATURE		'20 02 17
REG. NUMBER	201270126	
SCALE :	N.T.S.	A1

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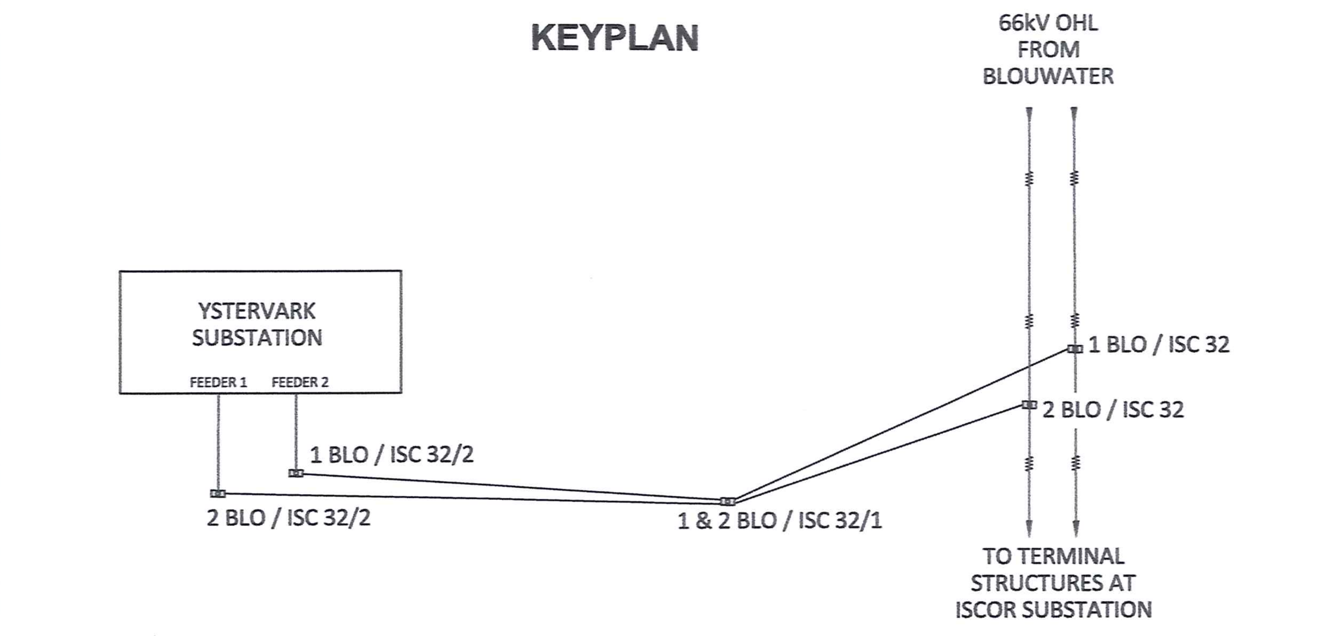
TRANSNET

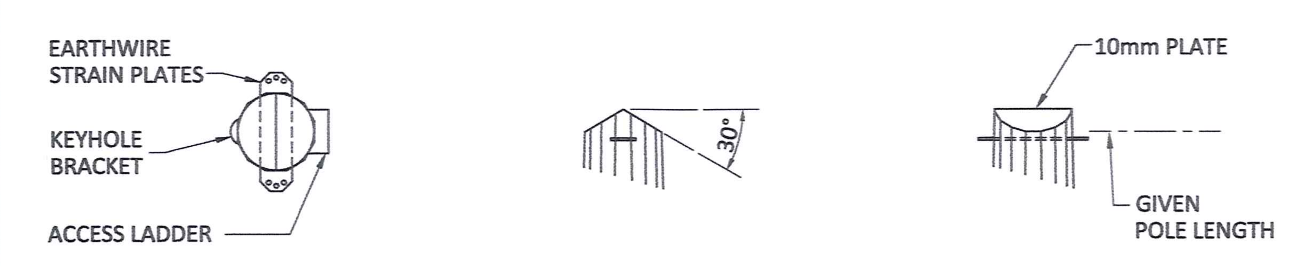
PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MAST -
STRAIN STRUCTURE (1 & 2 BLO / ISC 32/1)

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0064	01	00	AE

KEYPLAN





DETAILS AT TOP OF POLE

SINGLE CIRCUIT TERMINAL STRUCTURE, 11m CAH

MAST NUMBER	1 BLO / ISC 32/2
PHASE CONDUCTOR : TYPE 1	CHICADEE ACSR
PHASE CONDUCTOR : TYPE 2	KINGBIRD ACSR (CLOSING SPAN)
OPGW CONDUCTOR	NONE
SHIELD CONDUCTOR	OAK AAAC
VERTICAL ϕ - ϕ SPACING (m)	2.35
VERTICAL E - ϕ SPACING (m)	2.7
CONDUCTOR ATTACHMENT HEIGHT (m)	11
SIDES	16
APPROXIMATE TOTAL LENGTH (m)	18.4
TIP DIAMETER (mm)	350
BASE DIAMETER (mm)	1300
WALL THICKNESS (mm)	12
BASE PLATE O.D. (mm)	MANUFACTURER TO CONFIRM
BASE PLATE I.D (mm)	MANUFACTURER TO CONFIRM
BASE PLATE THICKNESS (mm)	MANUFACTURER TO CONFIRM
H.D. BOLTS (qty)	MANUFACTURER TO CONFIRM
H.D BOLTS DIAMETER (mm)	MANUFACTURER TO CONFIRM
H.D. BOLT PCD (mm)	MANUFACTURER TO CONFIRM
WORKING TIP LOAD (kN)	210.16
BASE G.L MOMENT (kNm)	3867
BASELINE ESKOM STANDARD FOUNDATION REF (kNm)	4500
APPROXIMATE MASS (tons)	4.70
APPROXIMATE MAST UTILISATION (%)	21.7 (INITIAL)

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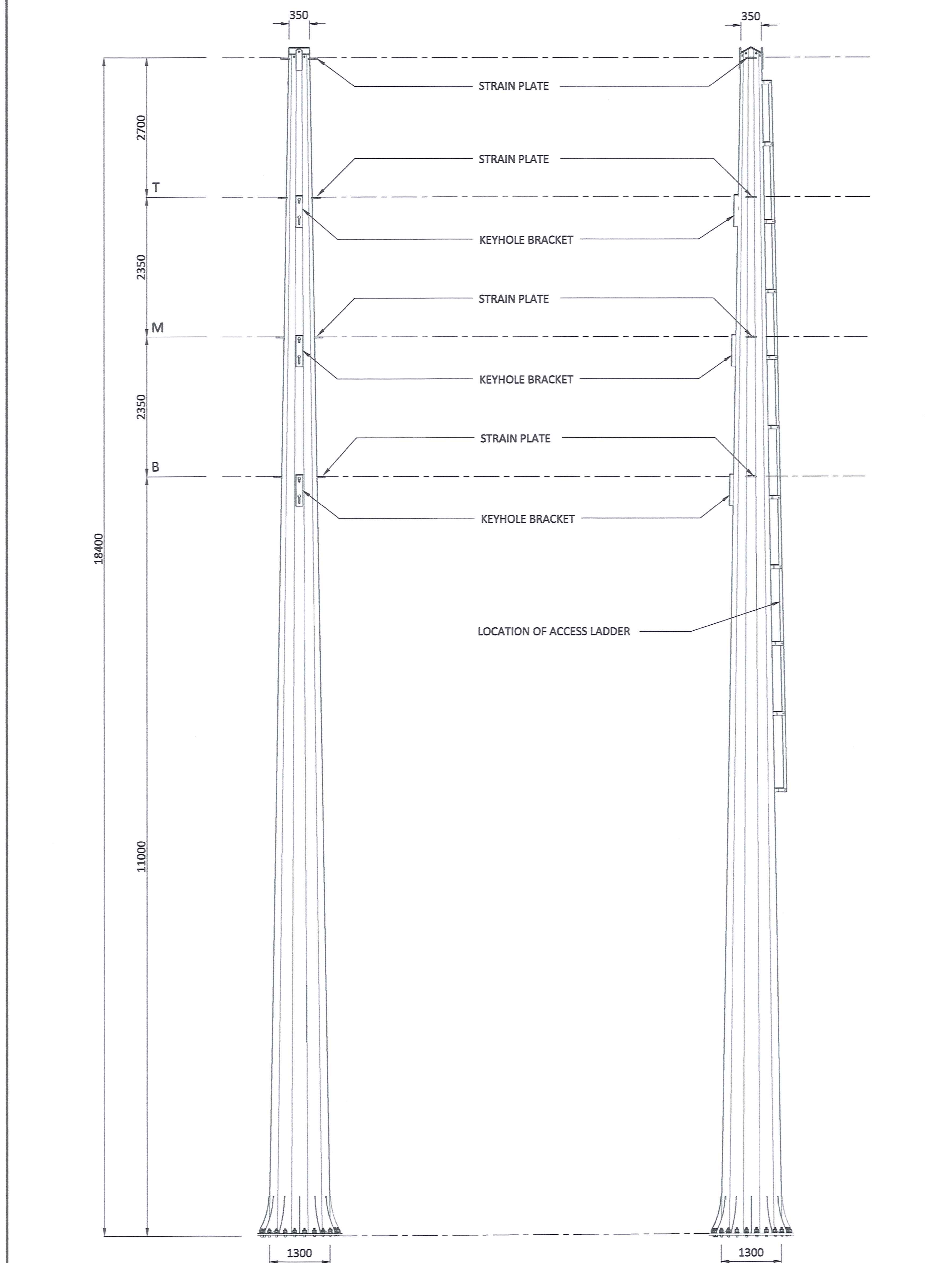
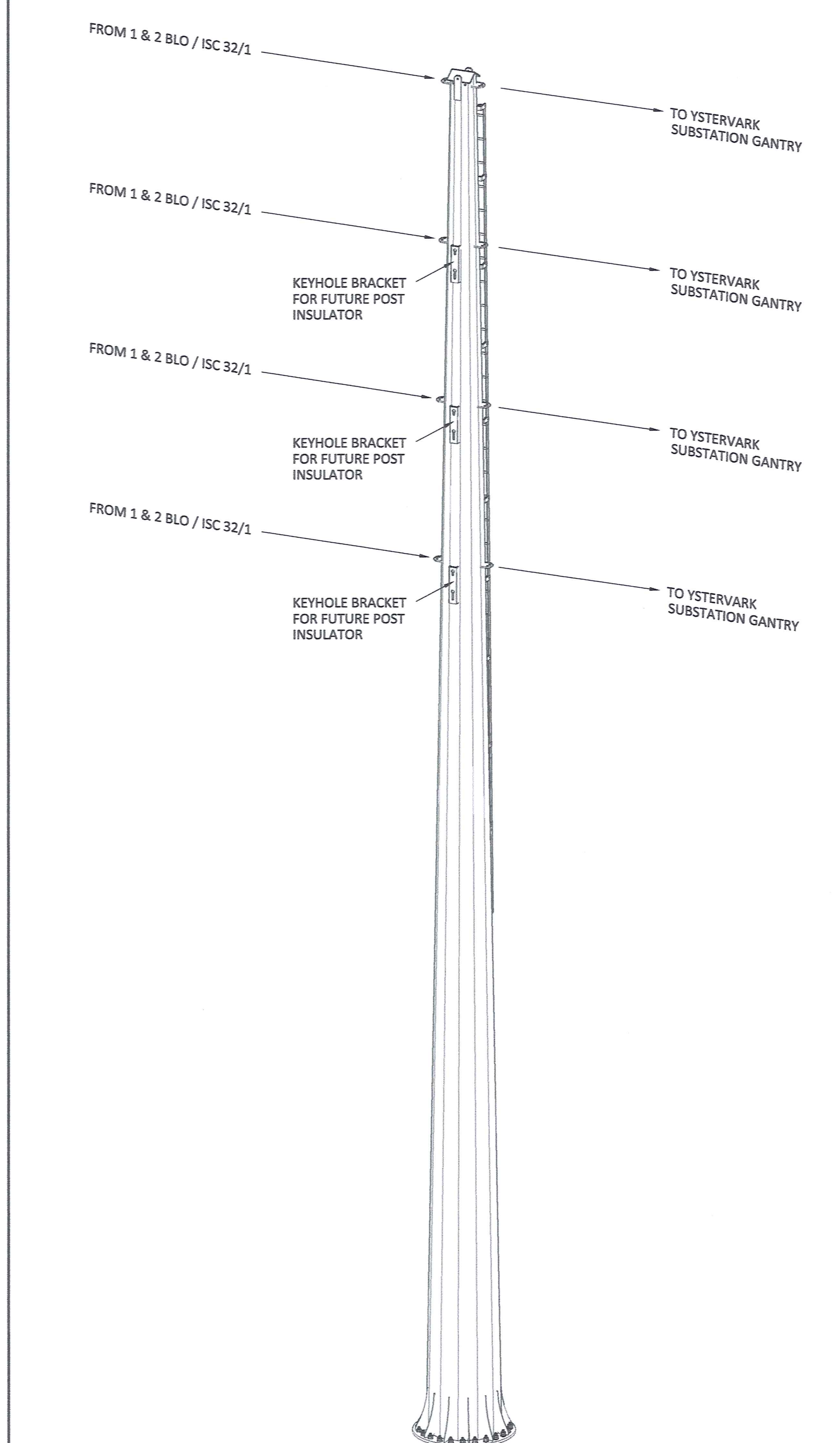


TRANSVERSE VIEW

IN-LINE VIEW



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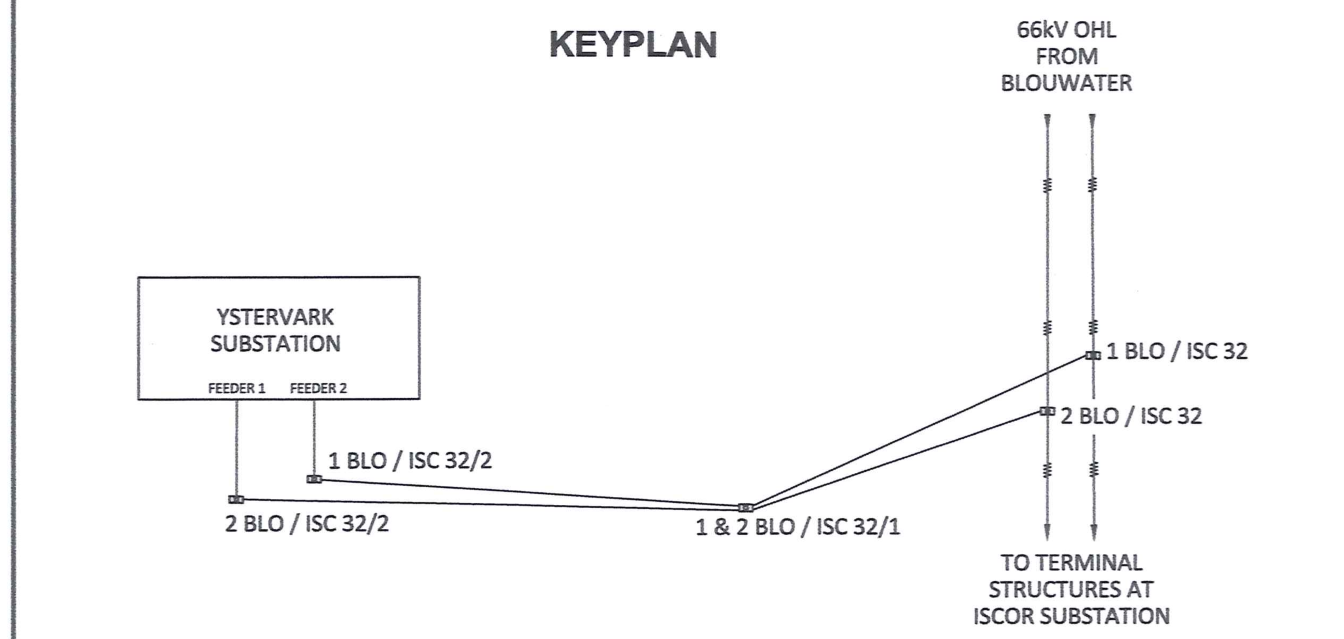
TRANSNET

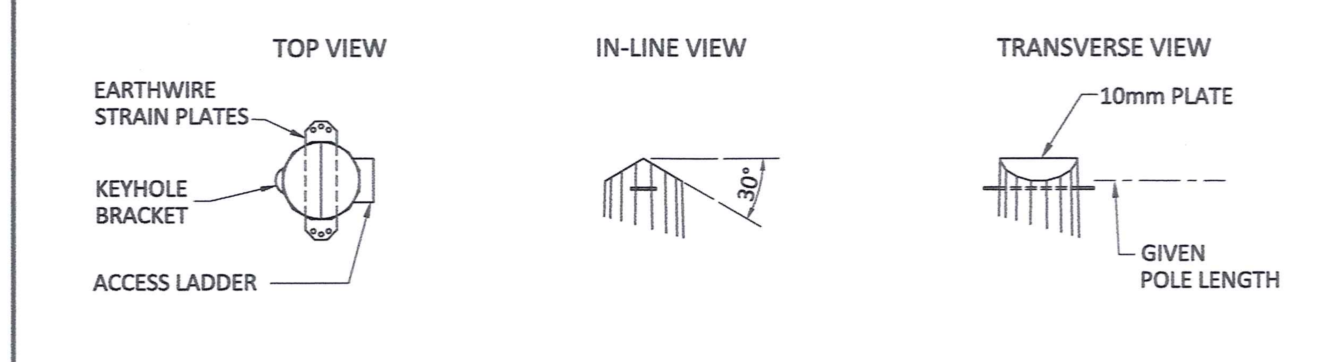
PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT BULK POWER UPGRADE : 66 kV BRANCH LINE MAST - TERMINAL STRUCTURE (1 BLO / ISC 32/2)

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1 9 2 4 7 0 1	2	3 0 0	E	D E	0 0 6 5	0 1	0 0	AE

KEYPLAN





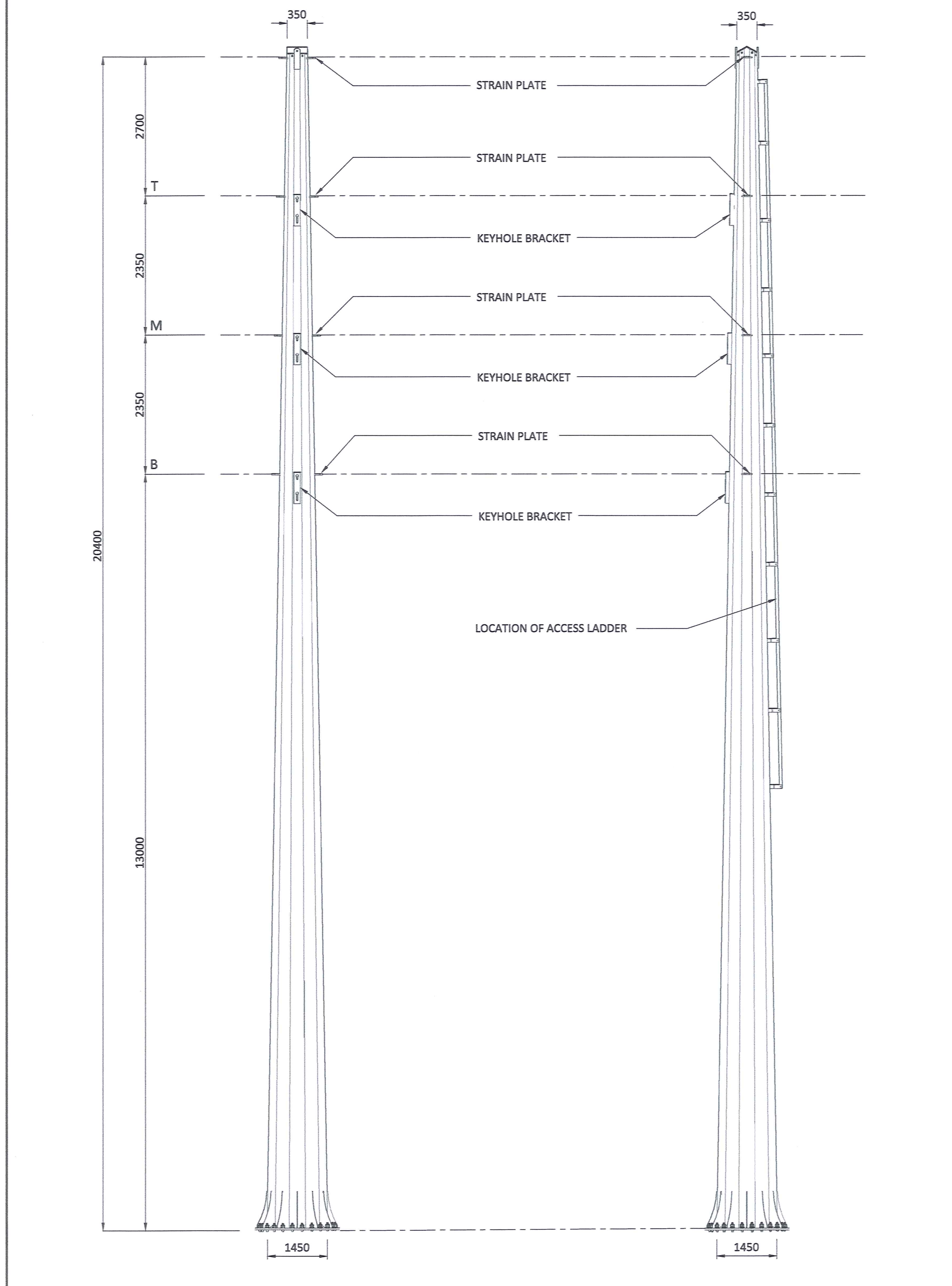
DETAILS AT TOP OF POLE

SINGLE CIRCUIT TERMINAL STRUCTURE, 13m CAH

MAST NUMBER	2 BLO / ISC 32/2
PHASE CONDUCTOR : TYPE 1	CHICADEE ACSR
PHASE CONDUCTOR : TYPE 2	KINGBIRD ACSR (CLOSING SPAN)
OPGW CONDUCTOR	NONE
SHIELD CONDUCTOR	OAK AAAC
VERTICAL ϕ - ϕ SPACING (m)	2.35
VERTICAL Ɛ - ϕ SPACING (m)	2.7
CONDUCTOR ATTACHMENT HEIGHT (m)	13
SIDES	16
APPROXIMATE TOTAL LENGTH (m)	20.4
TIP DIAMETER (mm)	350
BASE DIAMETER (mm)	1450
WALL THICKNESS (mm)	12
BASE PLATE O.D. (mm)	MANUFACTURER TO CONFIRM
BASE PLATE I.D (mm)	MANUFACTURER TO CONFIRM
BASE PLATE THICKNESS (mm)	MANUFACTURER TO CONFIRM
H.D. BOLTS (qty)	MANUFACTURER TO CONFIRM
H.D BOLTS DIAMETER (mm)	MANUFACTURER TO CONFIRM
H.D. BOLT PCD (mm)	MANUFACTURER TO CONFIRM
WORKING TIP LOAD (kN)	217.70
BASE G.L MOMENT (kNm)	4441
BASELINE ESKOM STANDARD FOUNDATION REF (kNm)	5000
APPROXIMATE MASS (tons)	5.66
APPROXIMATE MAST UTILISATION (%)	30.0 (INITIAL)

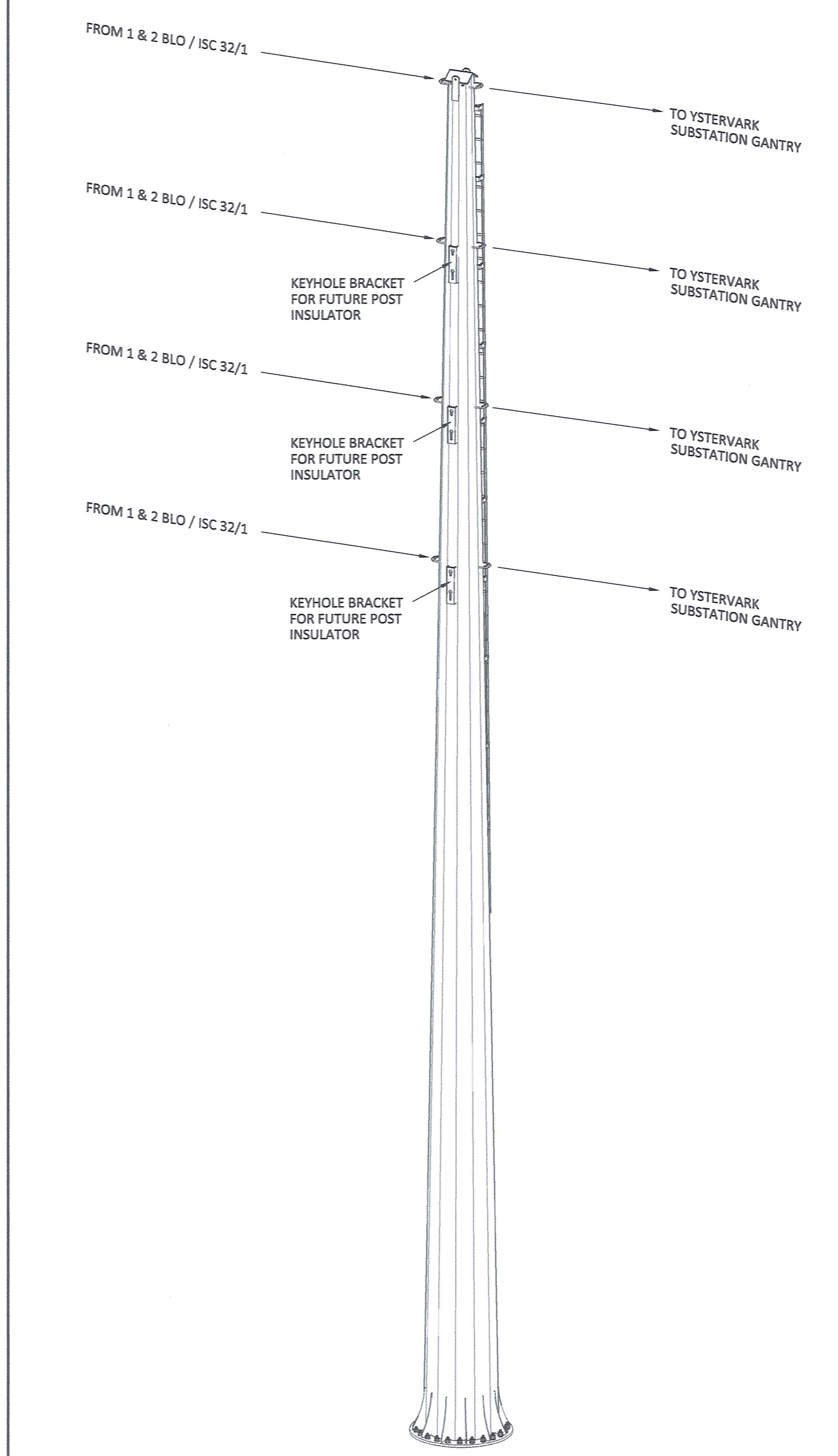
ADDITIONAL NOTES:

1. THE DESIGN OF THESE STRUCTURES IS GENERALLY IN ACCORDANCE WITH ASCE STANDARD 48-11 DESIGN OF STEEL TRANSMISSION POLE STRUCTURES. MANUFACTURE AND INSTALLATION SHOULD ALSO MEET THE REQUIREMENT OF THE SAME PUBLICATION.
2. POLES WILL HAVE THE LOWEST NUMBER OF SLIP JOINTS IN CONFORMANCE WITH THE LIMITATION IMPOSED BY THE LENGTH OF THE GALVANIZING BATH. SLIP JOINTS LENGTH IS TO BE 1.5 TIMES LARGEST I.D. OF THE FEMALE SECTION.
3. FULL PENETRATION WELDS ARE TO BE USED ON:
   - ALL SECTIONS JOINED BY THE CIRCUMFERENTIAL WELDS.
   - ALL LONGITUDINAL WELDS WITHIN 75mm OF CIRCUMFERENTIAL WELDS OR IN THE FEMALE SECTION OF A SLIP JOINT.
4. ACCESS LADDERS ARE REQUIRED ON ALL STRUCTURES FROM APPROXIMATELY 6m ABOVE GROUND LEVEL.
5. FOR FURTHER INFORMATION, REFER TO RESPECTIVE ESKOM STANDARDS AND SPECIFICATIONS.
6. MATERIAL : S355JR STEEL.
7. WELDING TO BE 8mm CONTINUOUS SEAL TO SANS 10162, UNLESS REQUIRED OTHERWISE.
8. HOP DIP GALVANIZING TO SANS 121.
9. STRESS RELIEVING TO BE APPLIED IN ACCORDANCE WITH SANS 121 TOLERANCES:
   - ON DIMENSION 2mm
   - ON DRILLING CENTRE'S 2mm



TRANSVERSE VIEW

IN-LINE VIEW



ISOMETRIC VIEW

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES

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3. THIS DRAWING DEPICTS THE DESIGN INTENT ONLY, NOT THE FINAL DESIGN
4. THE MAST SHALL BE IN FULL COMPLIANCE WITH ESKOM WCOU, AND WHERE APPLICABLE, NATIONAL REQUIREMENTS.
5. FOR FINAL DESIGN PURPOSES, THE CONTRACTOR SHALL ALSO CROSS REFERENCE THE DRAWING WITH THE WORKS INFORMATION, TECHNICAL SPECIFICATIONS, BOQ, ESKOM (FDP) FINAL DESIGN PACKAGE AND ANY OTHER ASSOCIATED CONTRACT DOCUMENTATION.

AECOM

CAPE TOWN OFFICE
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TYGER WATERFRONT
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FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

NO.	DESCRIPTION	BY	CHKD	APPD	DATE
00	ISSUED FOR CONSTRUCTION.	DD	CP	CP	2020-02-17

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE
DRAWN	DD		'20 02 17
CHECKED	KS		'20 02 17
DESIGNED	NM		'20 02 17
CHECKED	CP		'20 02 17

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME	C PYM	DATE
SIGNATURE		'20 02 17
REG. NUMBER	201270126	
SCALE :	N.T.S.	A1

Transnet Capital Projects
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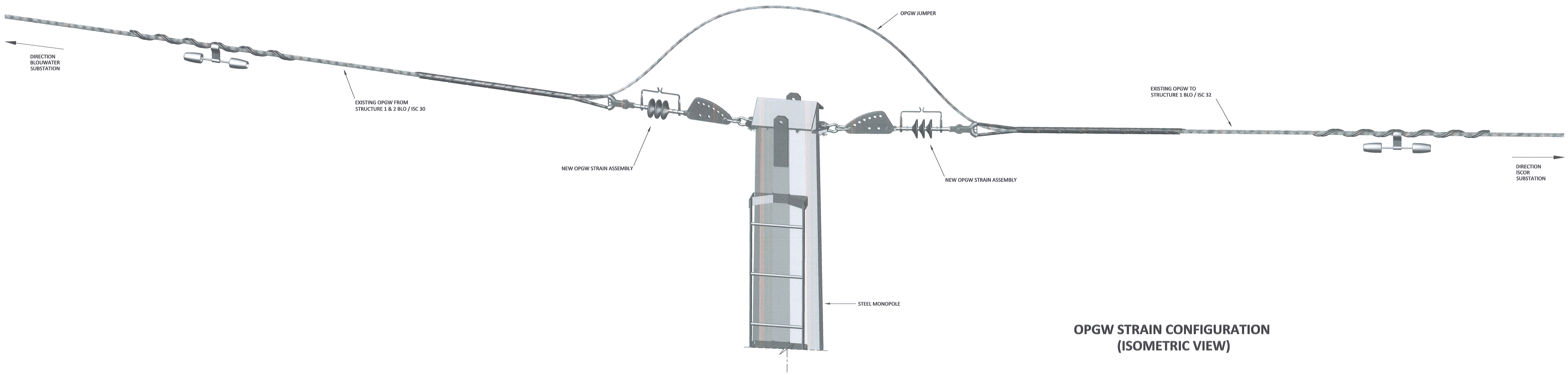
163 UYS KRIGE DRIVE, PLATTEKLOOF,
8001
TEL: 021 940 1999
FAX: 086 677 2455

PORT OF SALDANHA

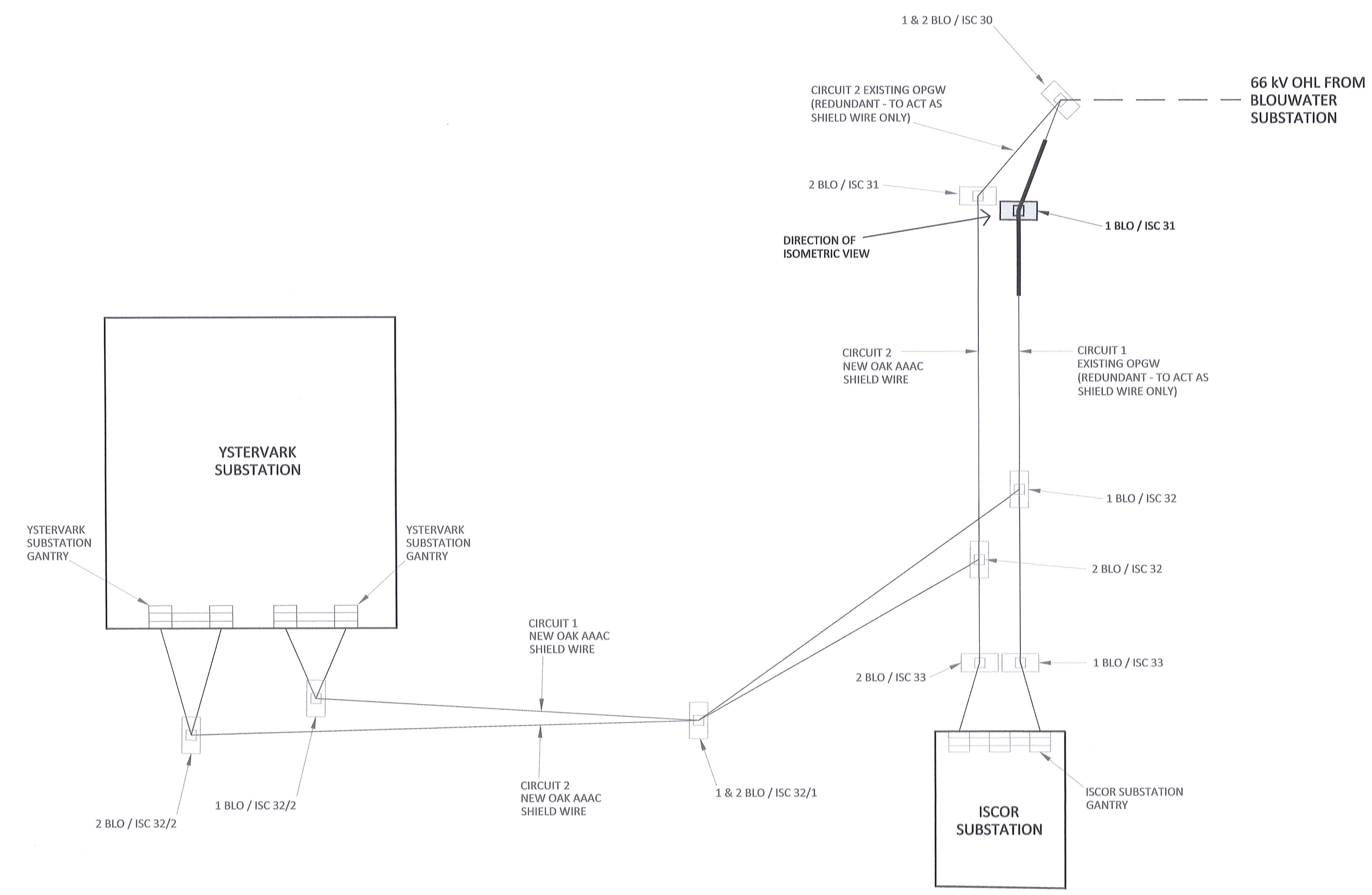
IRON ORE TIPPLER 3 PROJECT BULK POWER UPGRADE : 66 kV BRANCH LINE MAST - TERMINAL STRUCTURE (2 BLO / ISC 32/2)

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1 9 2 4 7 0 1	2	3 0 0	E	D E	0 0 6 6	0 1	0 0	AE



OPGW STRAIN CONFIGURATION (ISOMETRIC VIEW)

KEYPLAN



OPGW STRAIN ASSEMBLY DETAIL

ITEM	OPGW STRAIN ASSEMBLY DESCRIPTION	QTY (PER ASSEMBLY)	QTY (PER STUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	4	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	2	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	2	D-DT- 7012	0167605
4	THIMBLE CLEVIS, 120 kN	1	2	BUY OUT - TO SUITE	-
5	PREFORMED HELICALLY DEAD END ASSEMBLY TO OPGW MANUFACTURER SPECIFICATIONS (INCLUDES REINFORCING HELICAL ARMOUR ROD SET)	1	2	BUY OUT - TO SUITE	-
6	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OPGW	1	2	BUY OUT - TO SUITE	-

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
00	ISSUED FOR CONSTRUCTION	DD	CP	CP	2020-02-17

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CONTRACTOR / CONSULTANT

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DESIGNED	NM		'20 02 17
CHECKED	CP		'20 02 17

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME C PYM | DATE

SIGNATURE | '20 02 17

REG. NUMBER 201270126

SCALE : N.T.S. A0

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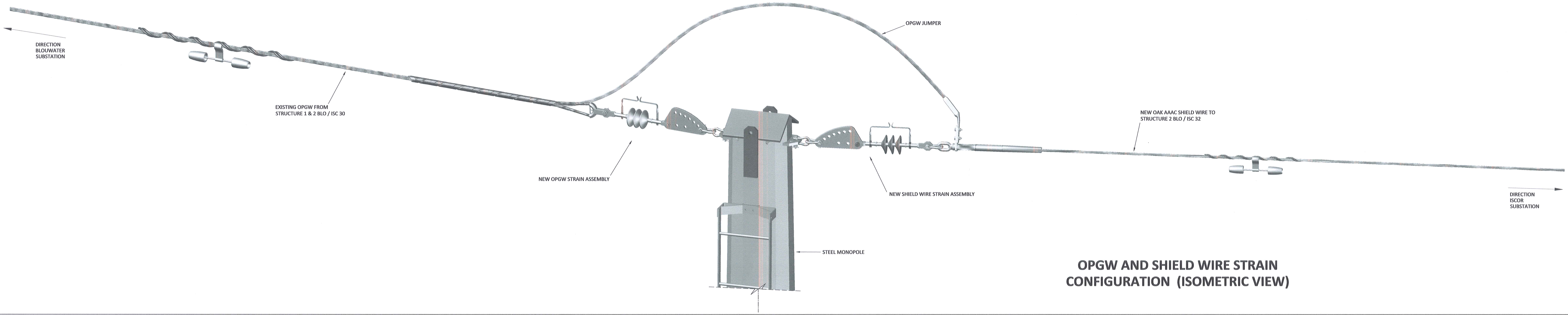
TRANSNET

PORT OF SALDANHA

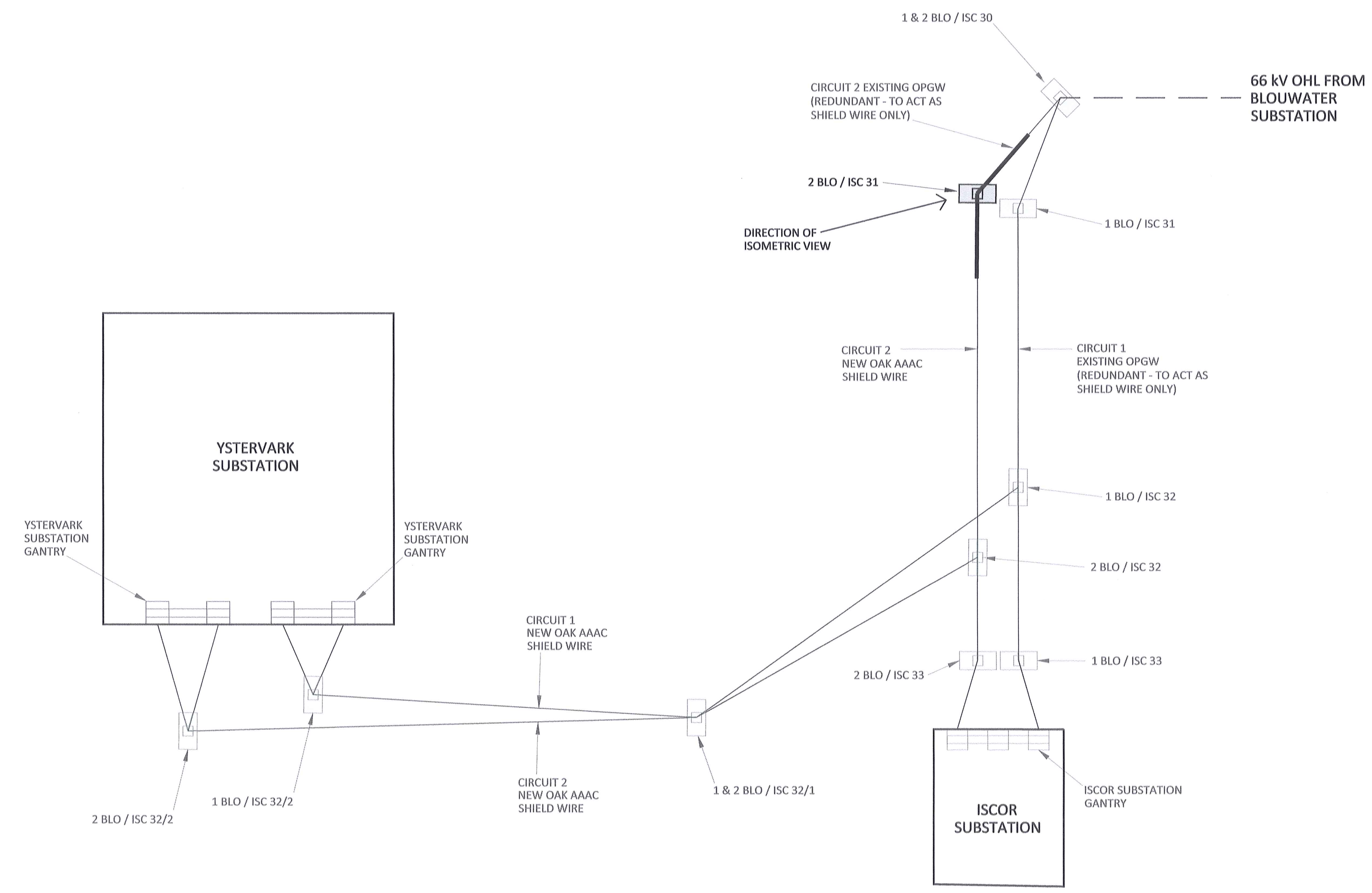
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS - 1 BLO / ISC 31
OPGW STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0067	01	00	AE



OPGW AND SHIELD WIRE STRAIN CONFIGURATION (ISOMETRIC VIEW)

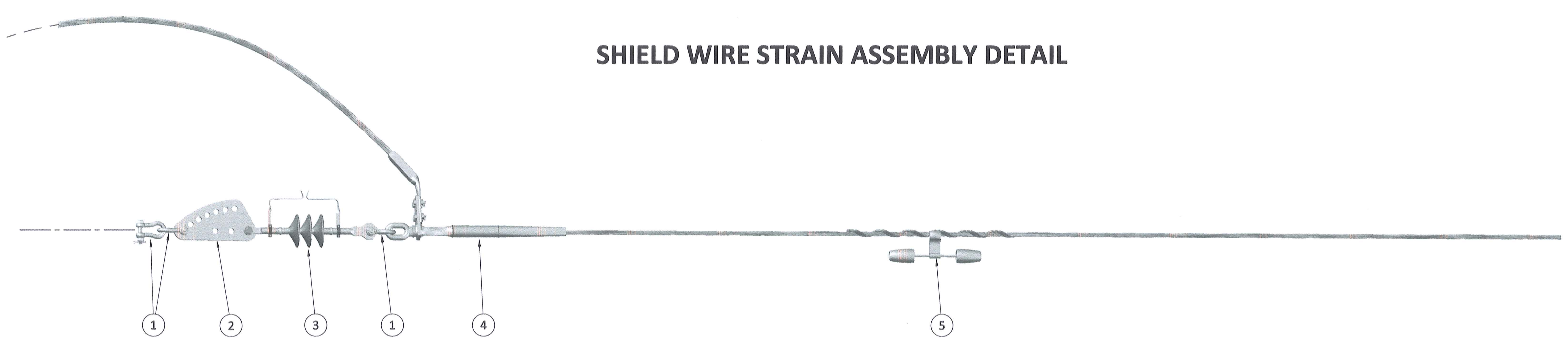
KEYPLAN



OPGW STRAIN ASSEMBLY DETAIL

ITEM	OPGW STRAIN ASSEMBLY DESCRIPTION	QTY	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	D-DT- 7012	0167605
4	THIMBLE CLEVIS, 120 kN	1	BUY OUT- TO SUITE	-
5	PREFORMED HELICALLY DEAD END ASSEMBLY TO OPGW MANUFACTURER SPECIFICATIONS (INCLUDES REINFORCING HELICAL ARMOUR ROD SET)	1	BUY OUT- TO SUITE	-
6	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OPGW	1	D-DT- 7005	0226767

SHIELD WIRE STRAIN ASSEMBLY DETAIL



ITEM	SHIELD WIRE STRAIN ASSEMBLY DESCRIPTION	QTY	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	3	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	D-DT- 7012	0167605
4	COMPRESSION DEAD END CLAMP ASSEMBLY	1	D-DT- 7000	0402497
5	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC	1	D-DT- 7005	0226767

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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00	ISSUED FOR CONSTRUCTION	DD	BS	RS	2020-02-17

REVISIONS

CONTRACTOR / CONSULTANT

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CHECKED	CP	[signature]	'20 02 17

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME: C PYM
SIGNATURE: [signature] DATE: '20 02 17
REG. NUMBER: 201270126
SCALE: N.T.S.
A0

Transnet Capital Projects
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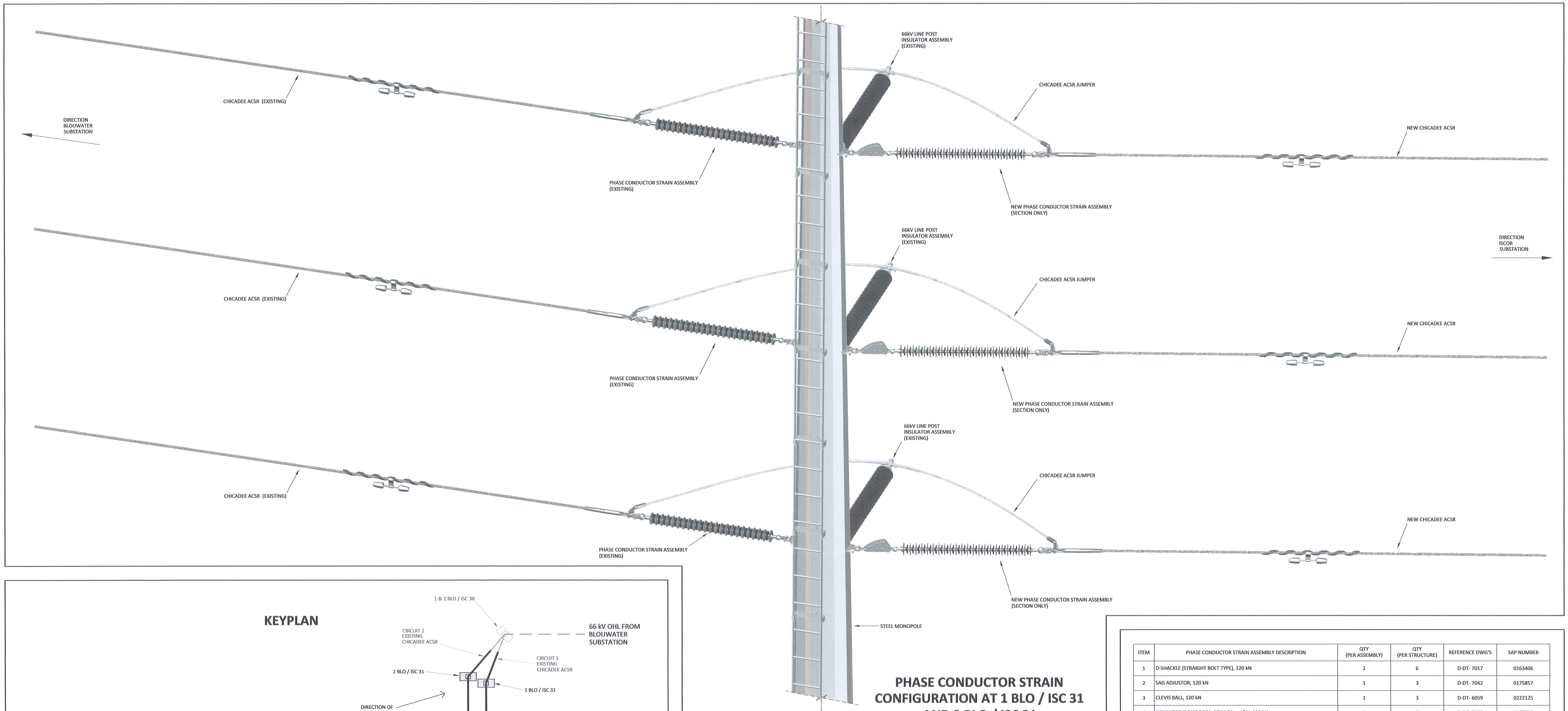
TRANSNET

PORT OF SALDANHA

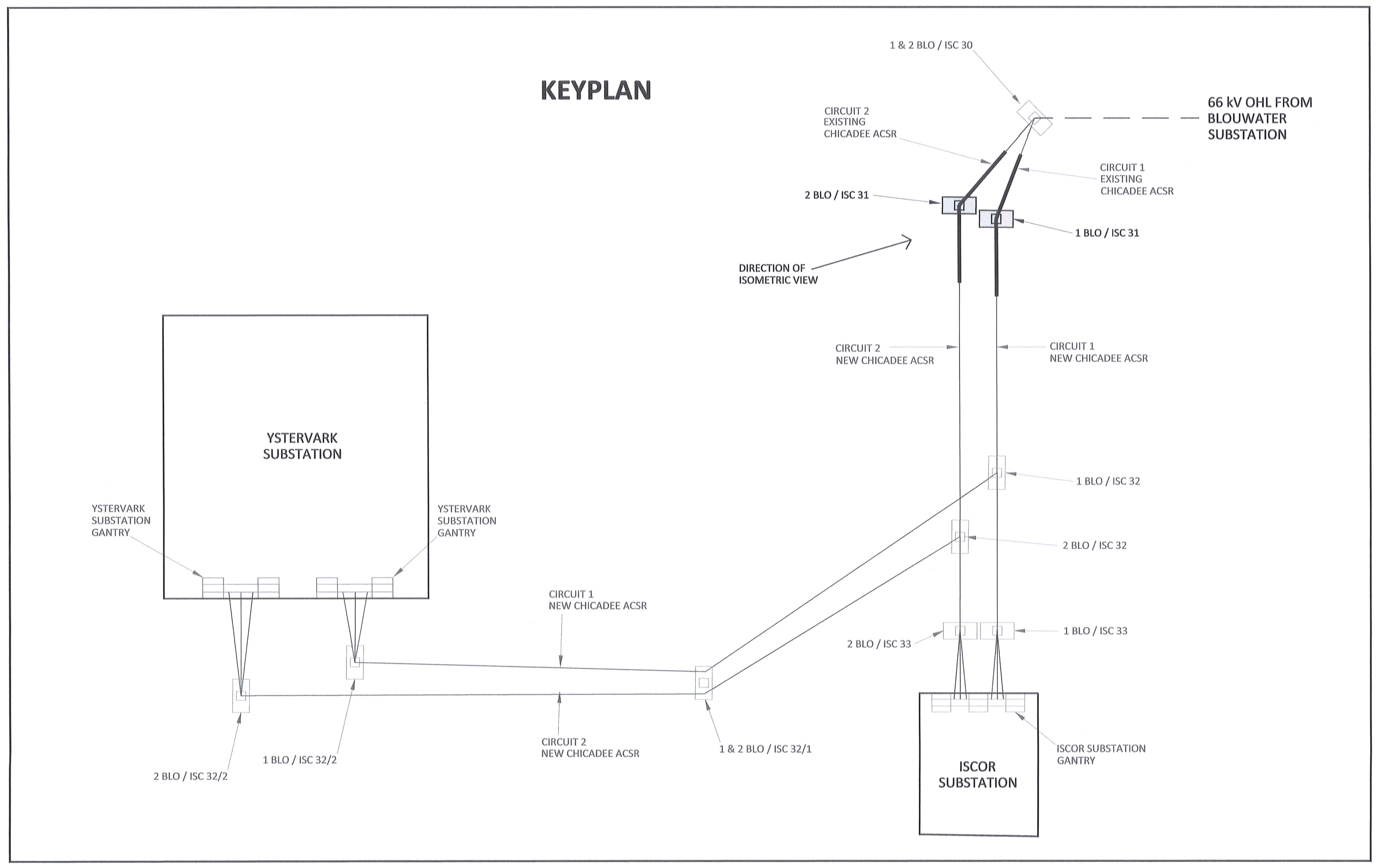
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS - 2 BLO / ISC 31
OPGW AND SHIELD WIRE STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0068	01	00	AE

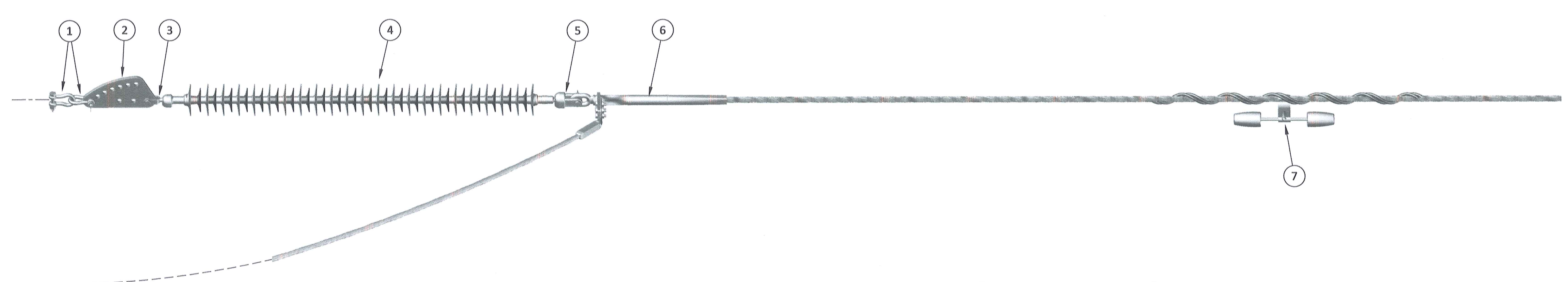


PHASE CONDUCTOR STRAIN CONFIGURATION AT 1 BLO / ISC 31 AND 2 BLO / ISC 31 (ISOMETRIC VIEW)

KEYPLAN



ITEM	PHASE CONDUCTOR STRAIN ASSEMBLY DESCRIPTION	QTY (PER ASSEMBLY)	QTY (PER STRUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	6	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	3	D-DT- 7042	0175857
3	CLEVIS BALL, 120 kN	1	3	D-DT- 6059	0222125
4	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN	1	3	D-DT- 7029	0167609
5	SOCKET CLEVIS, 120 kN	1	3	D-DT- 7021	0010259
6	COMPRESSION DEAD END CLAMP ASSEMBLY	1	3	D-DT- 7000	0168745
7	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR	1	3	D-DT- 7005	0168960



PHASE CONDUCTOR STRAIN ASSEMBLY DETAIL (SECTION ONLY)

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES

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TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME: C PYM
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TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS -
1 BLO / ISC 31 AND 2 BLO / ISC 31
PHASE CONDUCTOR STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
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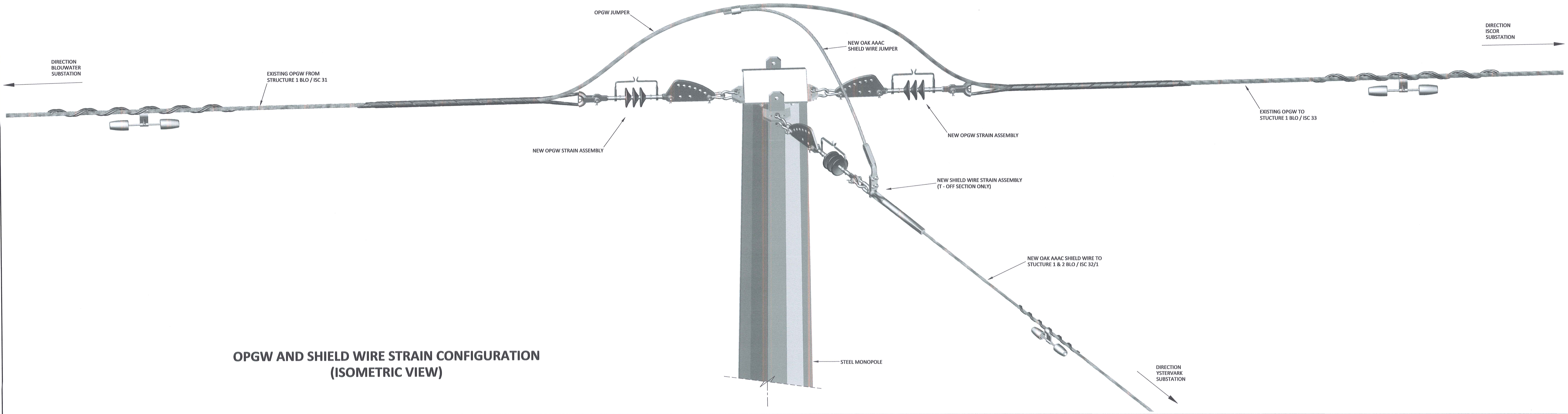
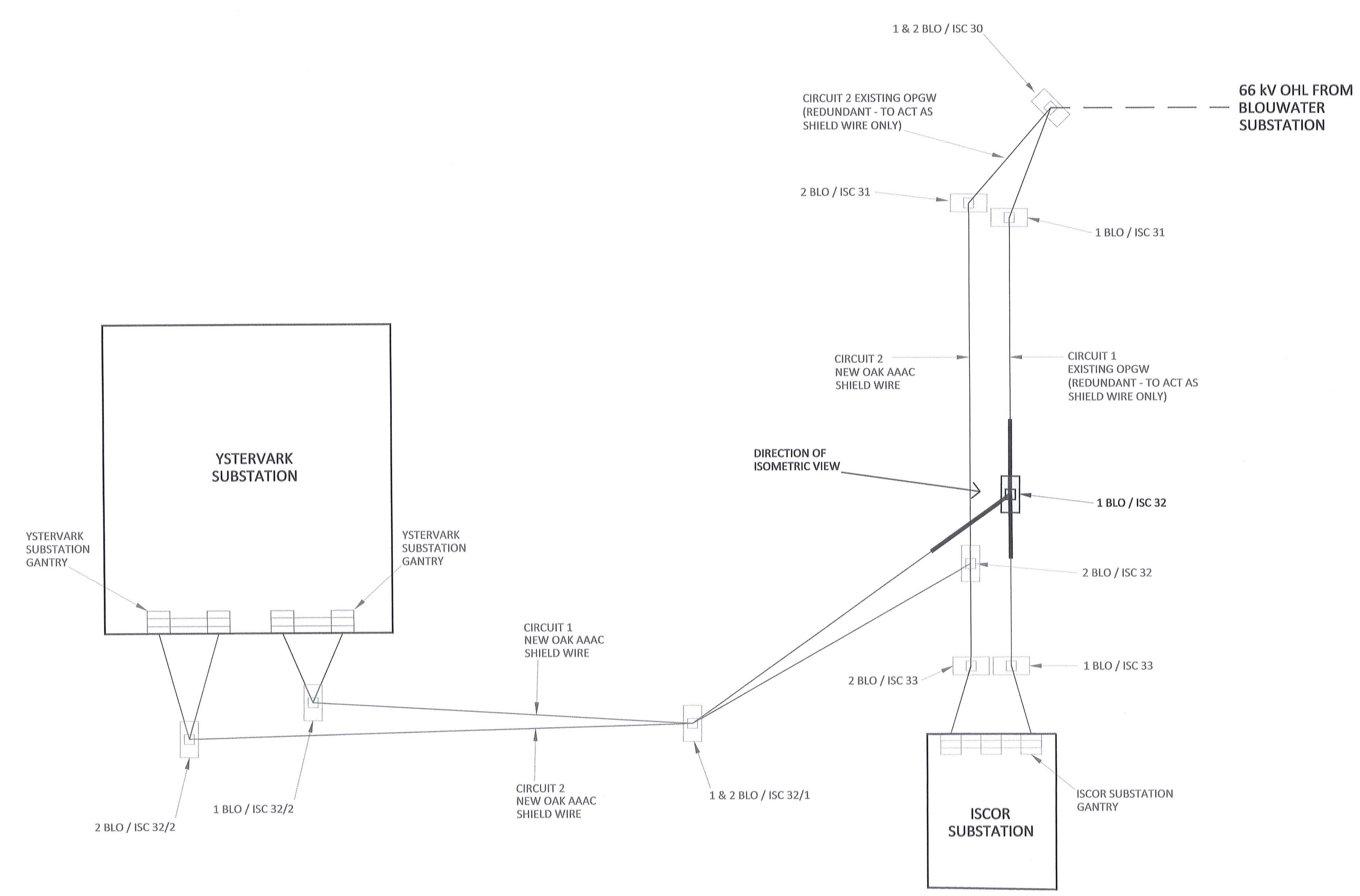
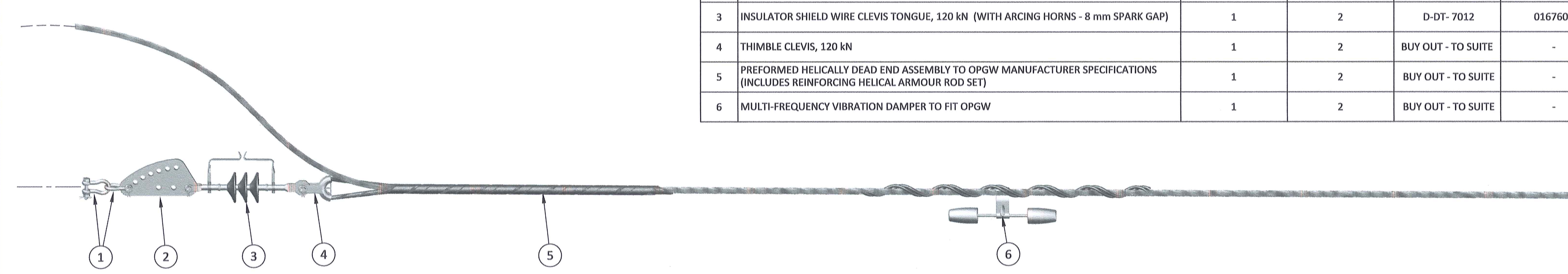


OPGW AND SHIELD WIRE STRAIN CONFIGURATION (ISOMETRIC VIEW)

KEYPLAN

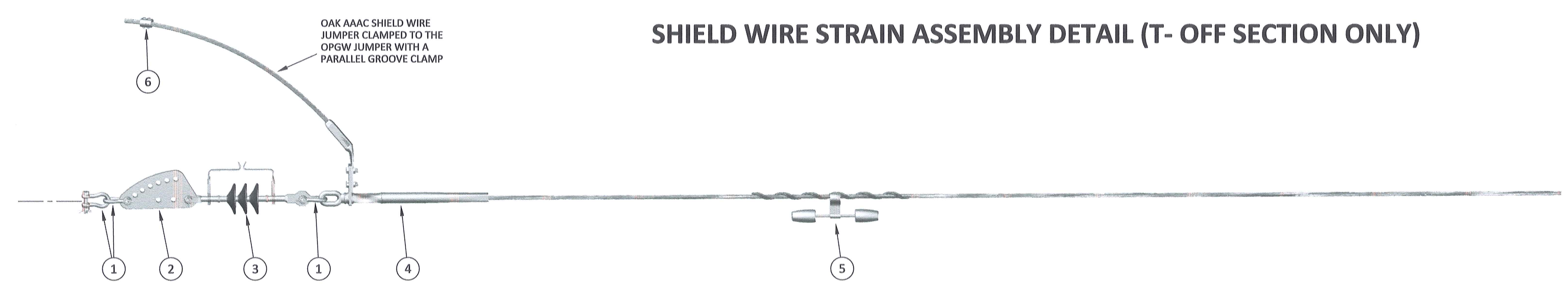


OPGW STRAIN ASSEMBLY DETAIL



ITEM	OPGW STRAIN ASSEMBLY DESCRIPTION	QTY (PER ASSEMBLY)	QTY (PER STUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	4	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	2	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	2	D-DT- 7012	0167605
4	THIMBLE CLEVIS, 120 kN	1	2	BUY OUT - TO SUITE	-
5	PREFORMED HELICALLY DEAD END ASSEMBLY TO OPGW MANUFACTURER SPECIFICATIONS (INCLUDES REINFORCING HELICAL ARMOUR ROD SET)	1	2	BUY OUT - TO SUITE	-
6	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OPGW	1	2	BUY OUT - TO SUITE	-

SHIELD WIRE STRAIN ASSEMBLY DETAIL (T- OFF SECTION ONLY)



ITEM	SHIELD WIRE STRAIN ASSEMBLY DESCRIPTION	QTY	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	3	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	D-DT- 7012	0167605
4	COMPRESSION DEAD END CLAMP ASSEMBLY	1	D-DT- 7000	0402497
5	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC	1	D-DT- 7005	0226767
6	PARALLEL GROOVE CLAMP - ALUMINIUM (CONDUCTOR RANGE 6.6 - 18.9 mm)	1	BUY OUT - TO SUITE	-

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES

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TRANSNET CAPITAL PROJECTS

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PR.ENG. / PR.TECH./PR. ARCH

NAME: C PYM
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SCALE: N.T.S.
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Transnet Capital Projects
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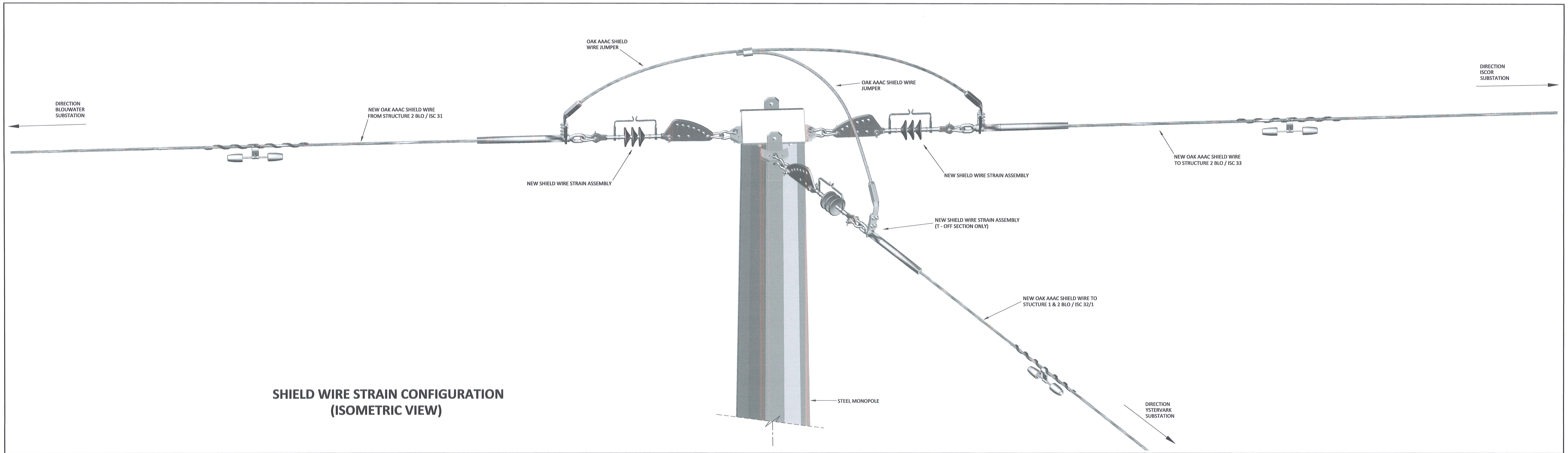
TRANSNET

PORT OF SALDANHA

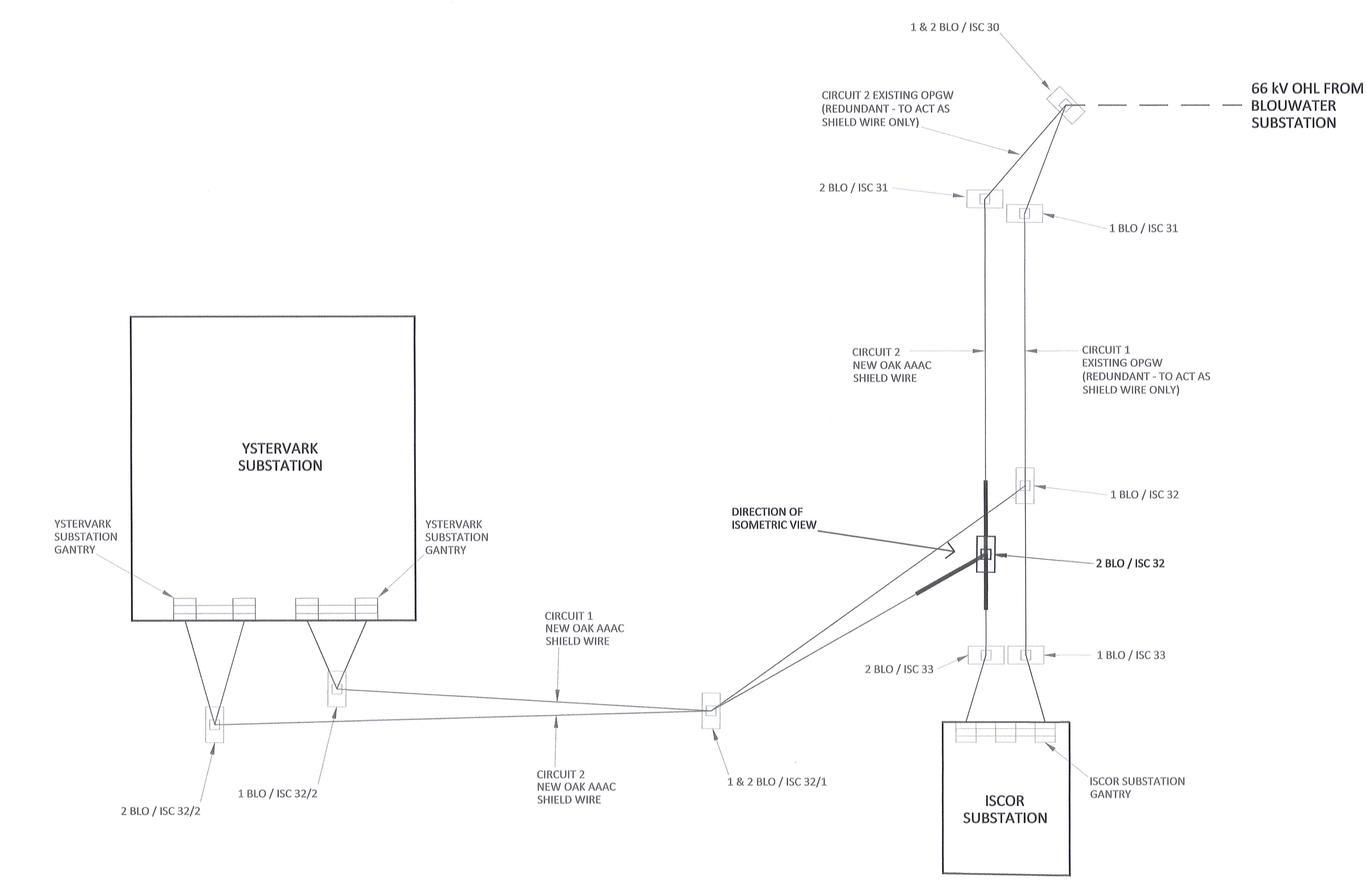
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS - 1 BLO / ISC 32
OPGW AND SHIELD WIRE STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1 9 2 4 7 0 1	2	3 0 0	E	D E	0 0 7 0	0 1	0 0	AE

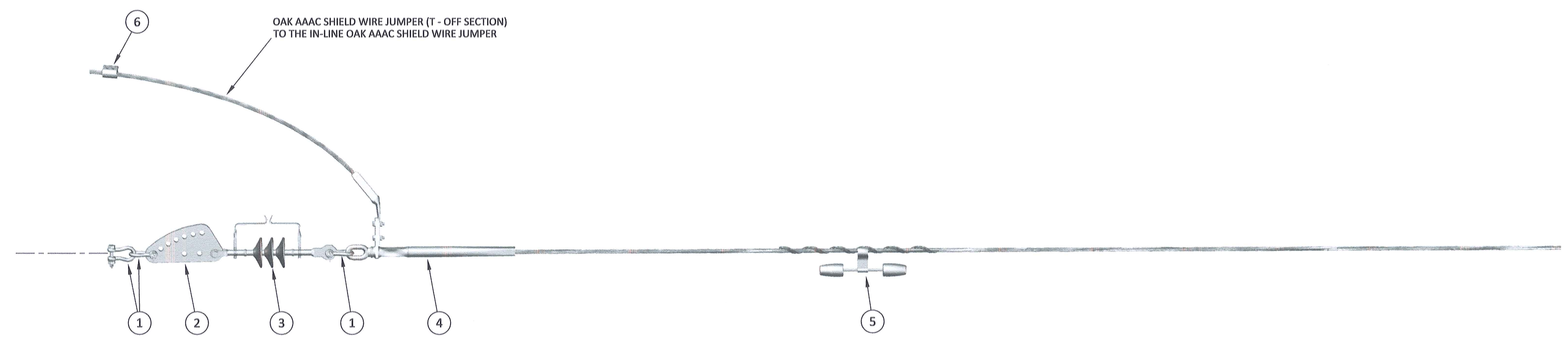
SHIELD WIRE STRAIN CONFIGURATION (ISOMETRIC VIEW)



KEYPLAN



SHIELD WIRE STRAIN ASSEMBLY DETAIL



ITEM	SHIELD WIRE STRAIN ASSEMBLY DESCRIPTION	QTY (PER ASSEMBLY)	QTY (PER STRUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	3	9	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	3	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	3	D-DT- 7012	0167605
4	COMPRESSION DEAD END CLAMP ASSEMBLY	1	3	D-DT- 7000	0402497
5	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC	1	3	D-DT- 7005	0226767
6	PARALLEL GROOVE CLAMP - ALUMINIUM (CONDUCTOR RANGE 6.6 - 18.9 mm)	-	1	BUY OUT - TO SUITE	-

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

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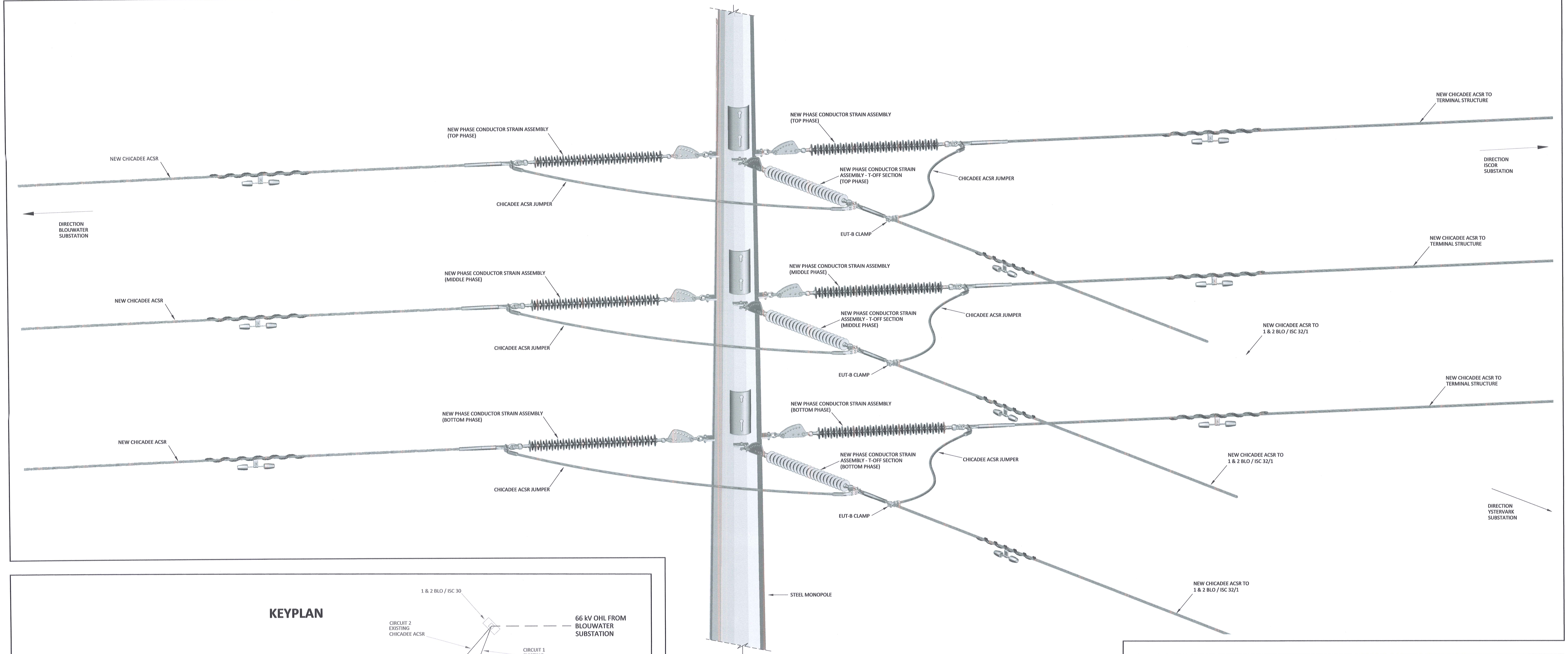
TRANSNET

PORT OF SALDANHA

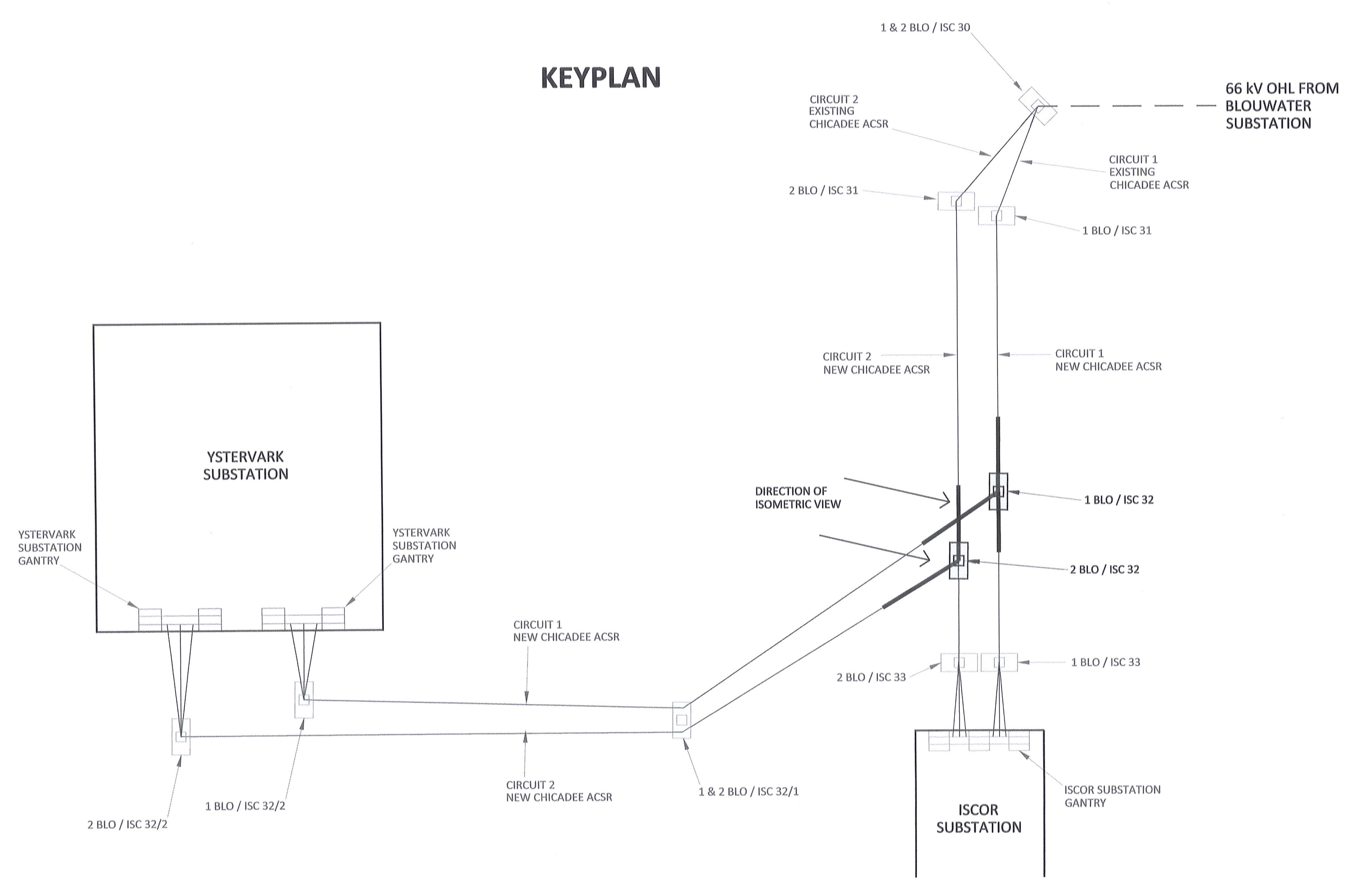
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS - 2 BLO / ISC 32
SHIELD WIRE STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0071	01	00	AE

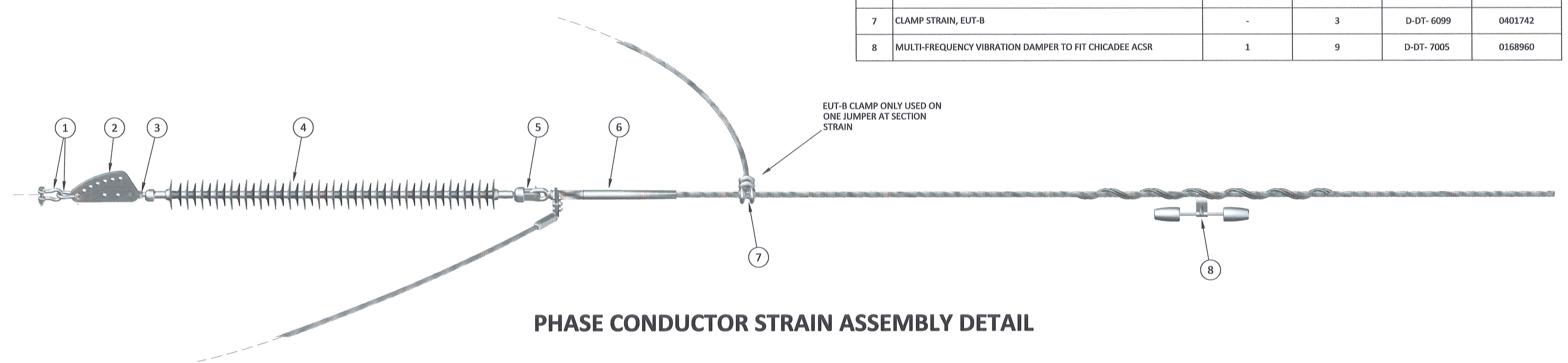


PHASE CONDUCTOR STRAIN CONFIGURATION AT 1 BLO / ISC 32 AND 2 BLO / ISC 32 (ISOMETRIC VIEW)

KEYPLAN



ITEM	PHASE CONDUCTOR STRAIN ASSEMBLY DESCRIPTION	QTY (PER ASSEMBLY)	QTY (PER STUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	18	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	9	D-DT- 7042	0175857
3	CLEVIS BALL, 120 kN	1	9	D-DT- 6059	0222125
4	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN	1	9	D-DT- 7029	0167609
5	SOCKET CLEVIS, 120 kN	1	9	D-DT- 7021	0010259
6	COMPRESSION DEAD END CLAMP ASSEMBLY	1	9	D-DT- 7000	0168745
7	CLAMP STRAIN, EUT-B	-	3	D-DT- 6099	0401742
8	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR	1	9	D-DT- 7005	0168960



PHASE CONDUCTOR STRAIN ASSEMBLY DETAIL

REFERENCE DRAWINGS

DRAWING NO.	REFERENCE

NOTES

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OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME: C PYM
SIGNATURE: DATE: '20 02 17
REG. NUMBER: 201270126
SCALE: N.T.S.
A0

Transnet Capital Projects
TRANSNET LTD (TRADING AS TRANSNET CAPITAL PROJECTS) : REG. NO. 1990/000900/06
TABLE BAY BUILDING, TYGERBERG PARK,
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8001
TEL: 021 940 1999
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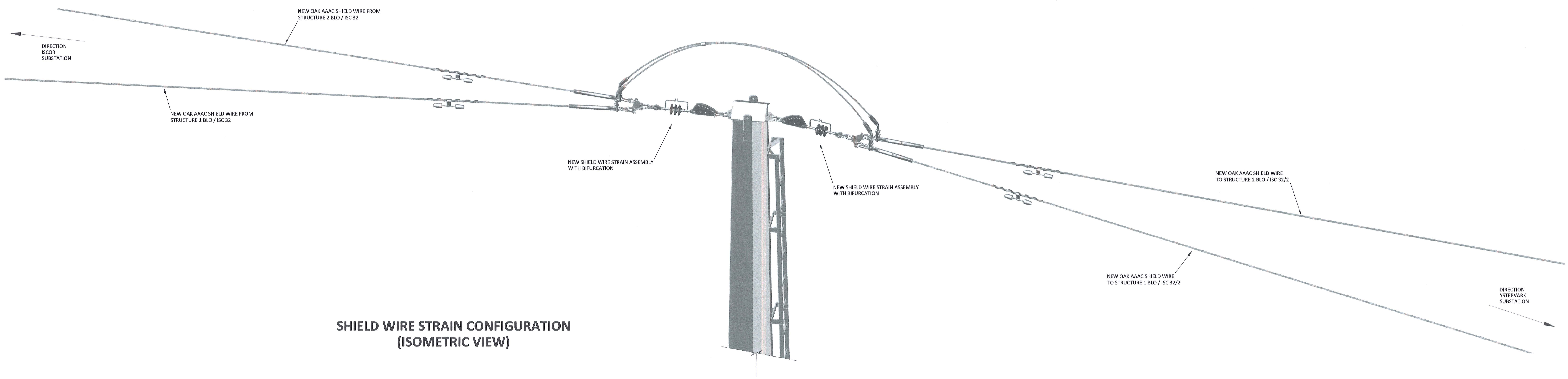
TRANSNET

PORT OF SALDANHA

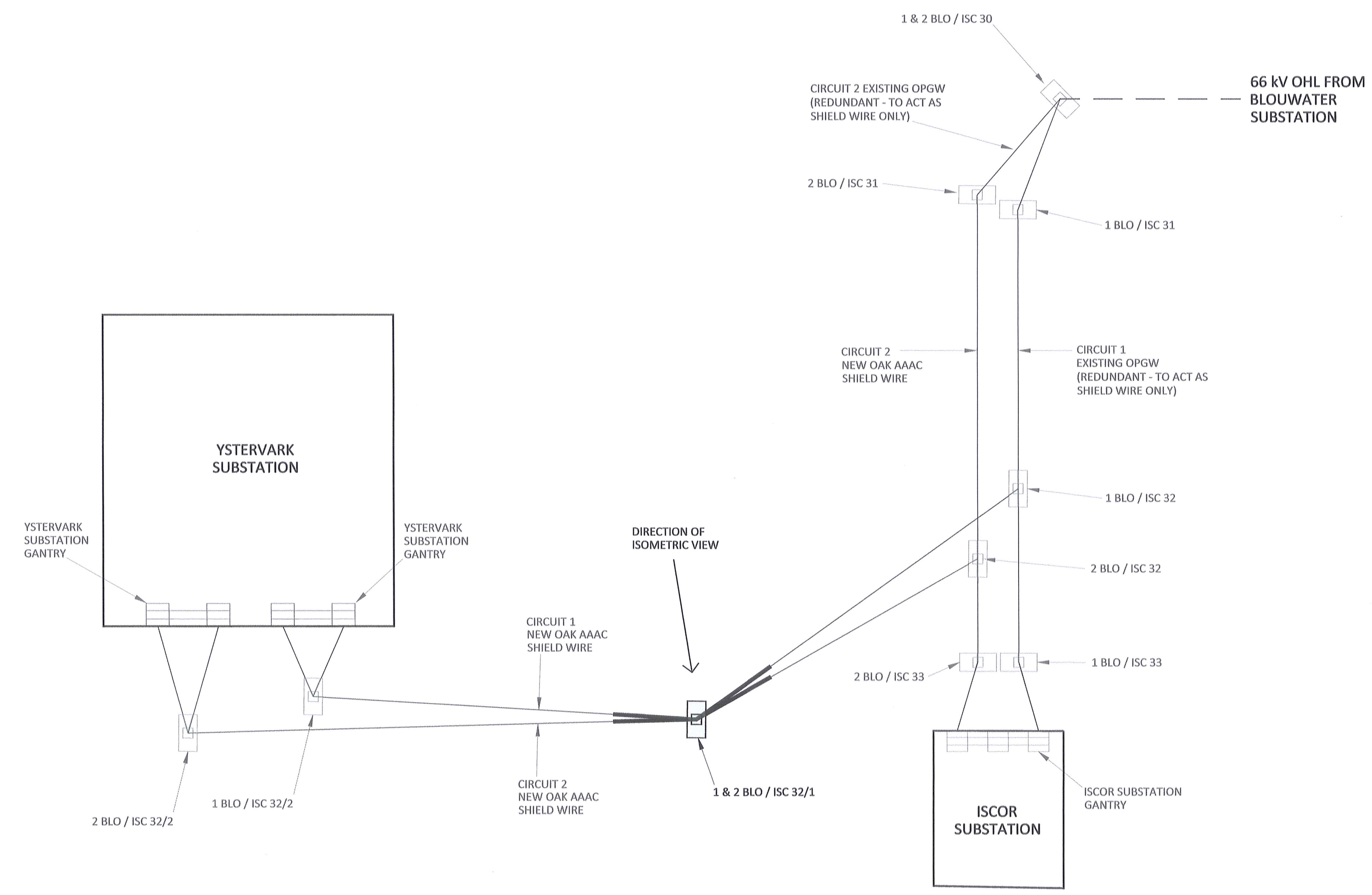
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS -
1 BLO / ISC 32 AND 2 BLO / ISC 32
PHASE CONDUCTOR STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0072	01	00	AE

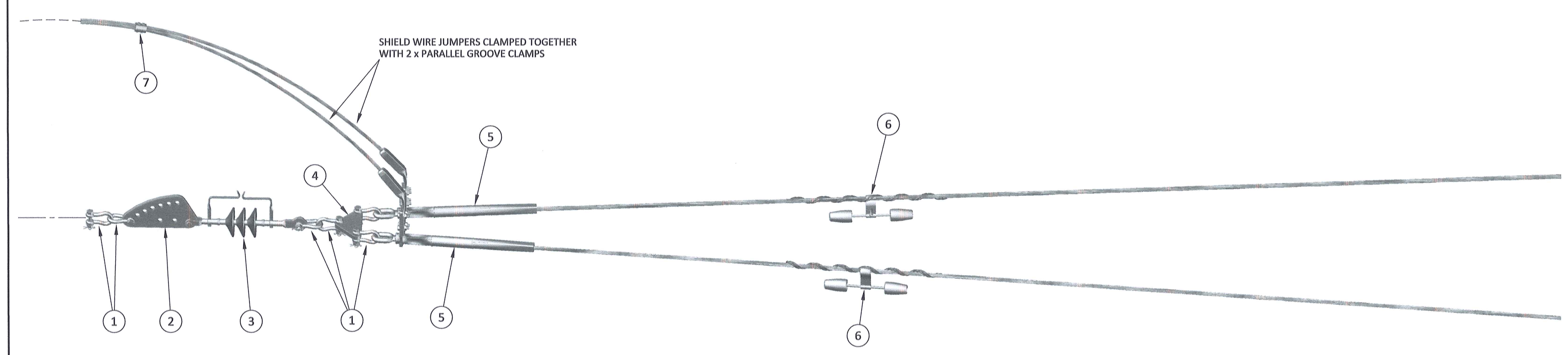


SHIELD WIRE STRAIN CONFIGURATION (ISOMETRIC VIEW)

KEYPLAN



SHIELD WIRE STRAIN ASSEMBLY WITH BIFURCATION DETAIL



ITEM	SHIELD WIRE STRAIN ASSEMBLY DESCRIPTION	QTY (PER ASSEMBLY)	QTY (PER STUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	6	12	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	2	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	2	D-DT- 7012	0167605
4	YOKE PLATE - TRIANGLE, 120kN	1	2	D-DT- 7015	0168861
5	COMPRESSION DEAD END CLAMP ASSEMBLY	2	4	D-DT- 7000	0402497
6	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC	2	4	D-DT- 7005	0226767
7	PARALLEL GROOVE CLAMP - ALUMINIUM (CONDUCTOR RANGE 6.6 - 18.9 mm)	-	2	BUY OUT - TO SUITE	-

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

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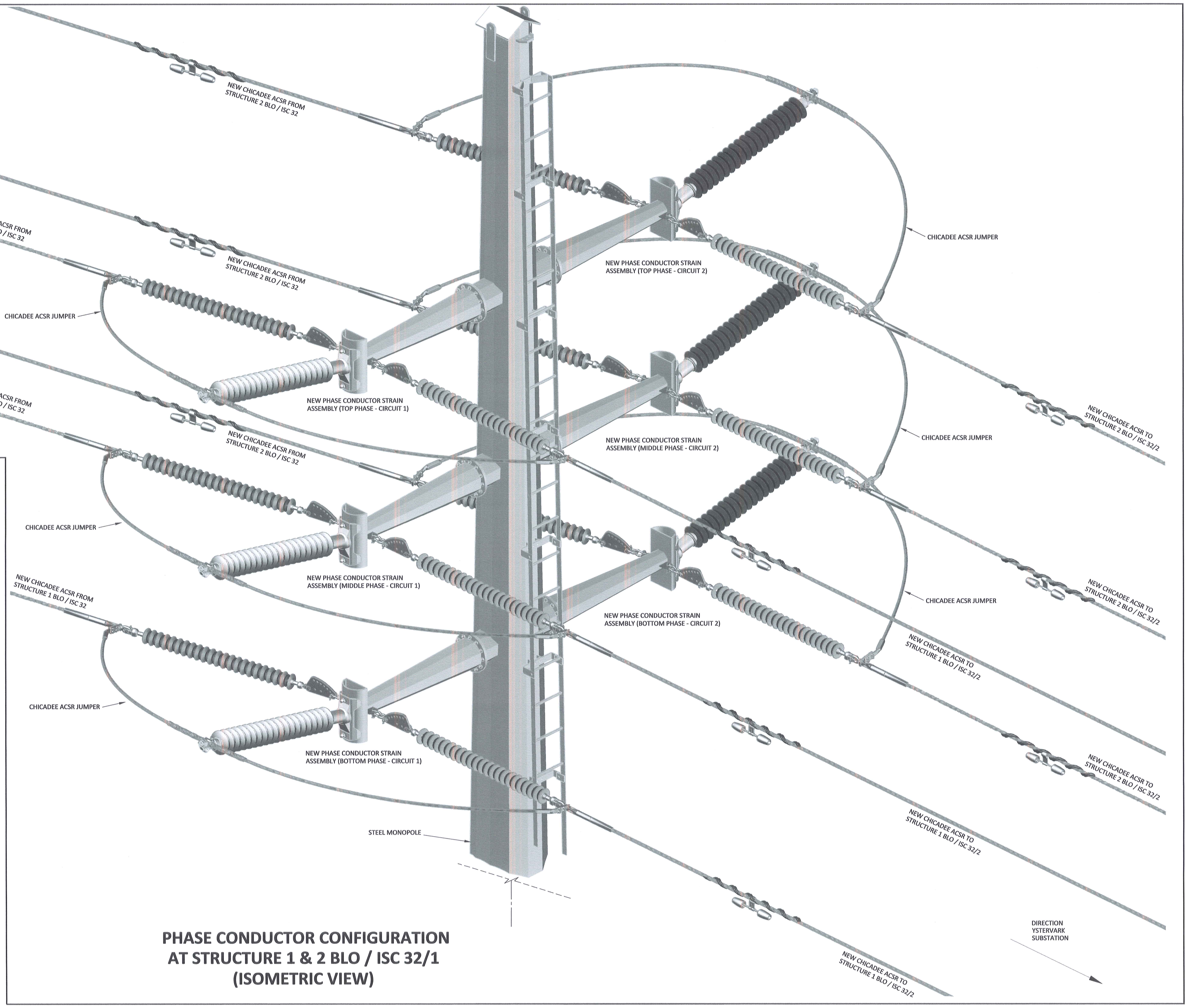
TRANSNET

PORT OF SALDANHA

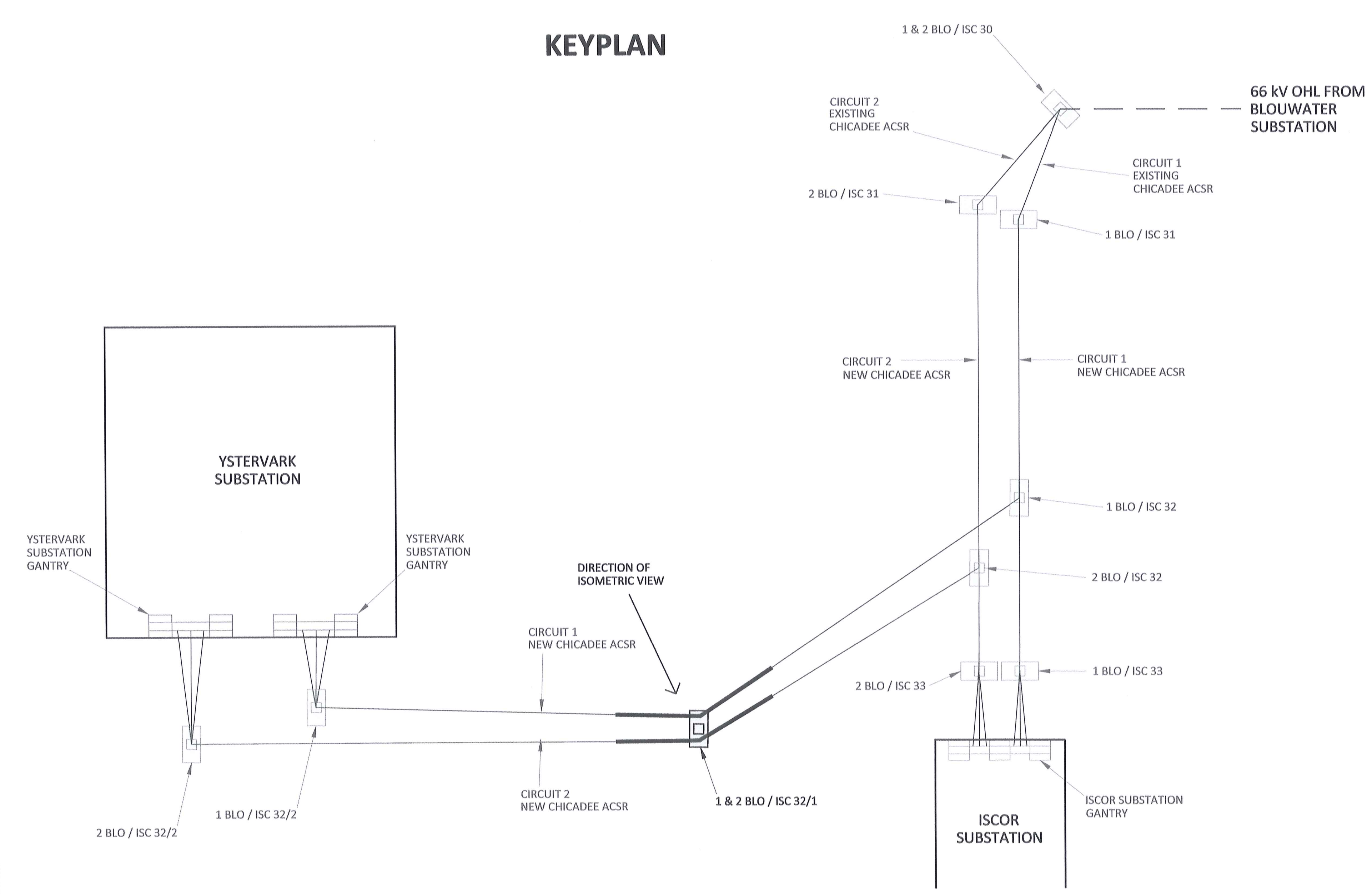
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS - 1 & 2 BLO / ISC 32/1
SHIELD WIRE STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1 9 2 4 7 0 1	2	3 0 0	E	D E	0 0 7 3	0 1	0 0	AE

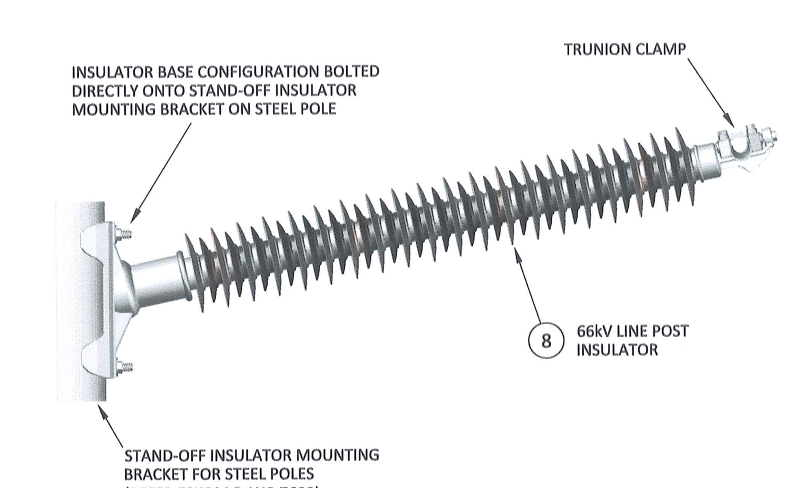


PHASE CONDUCTOR CONFIGURATION AT STRUCTURE 1 & 2 BLO / ISC 32/1 (ISOMETRIC VIEW)

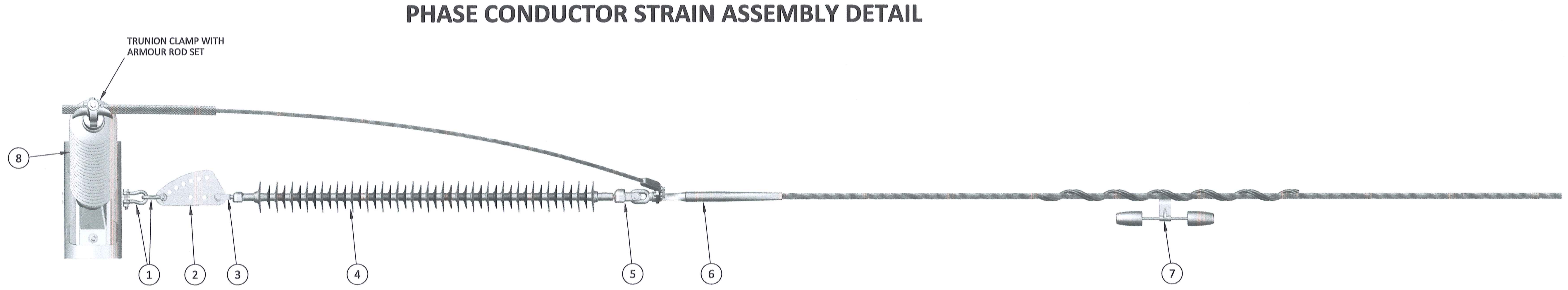
KEYPLAN



66kV LINE POST INSULATOR ASSEMBLY DETAIL



PHASE CONDUCTOR STRAIN ASSEMBLY DETAIL



ITEM	PHASE CONDUCTOR STRAIN ASSEMBLY DESCRIPTION	QTY (PER ASSEMBLY)	QTY (PER STUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	24	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	12	D-DT- 7042	0175857
3	CLEVIS BALL, 120 kN	1	12	D-DT- 6059	0222125
4	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN	1	12	D-DT- 7029	0167609
5	SOCKET CLEVIS, 120 kN	1	12	D-DT- 7021	0010259
6	COMPRESSION DEAD END CLAMP ASSEMBLY	1	12	D-DT- 7000	0168745
7	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR	1	12	D-DT- 7005	0168760
8	LINE POST INSULATOR ASSEMBLY - HORIZONTAL 66kV, 31mm/kV, 5.3 kN INSULATOR, WITH TRUNION CLAMP (INCLUDES ARMOUR ROD SET)	-	6	D-DT- 7031	0180641

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME: C PYM — DATE: '20 02 17
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REG. NUMBER: 201270126
SCALE: N.T.S. — A0

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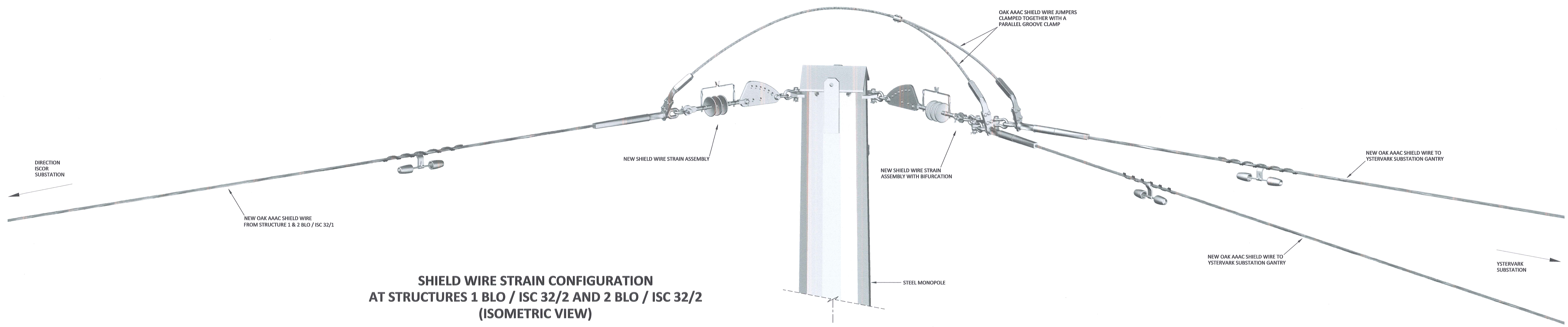
TRANSNET

PORT OF SALDANHA

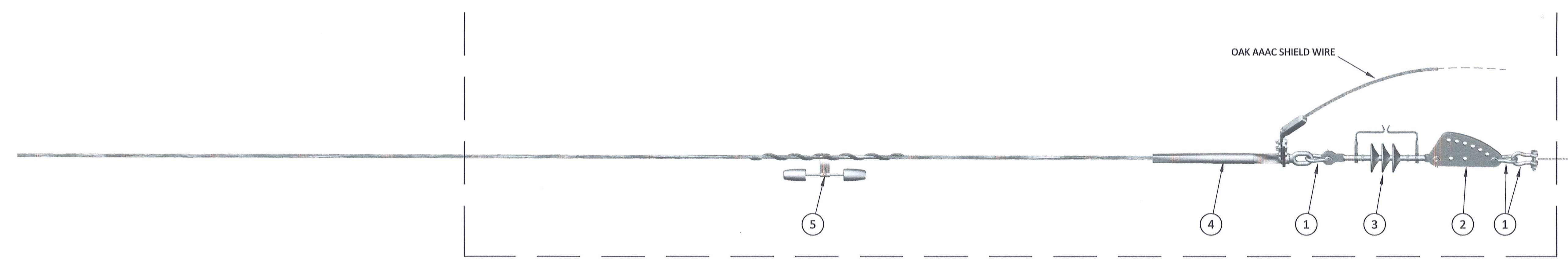
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH MASTS - 1 & 2 BLO / ISC 32/1
PHASE CONDUCTOR STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0074	01	00	AE

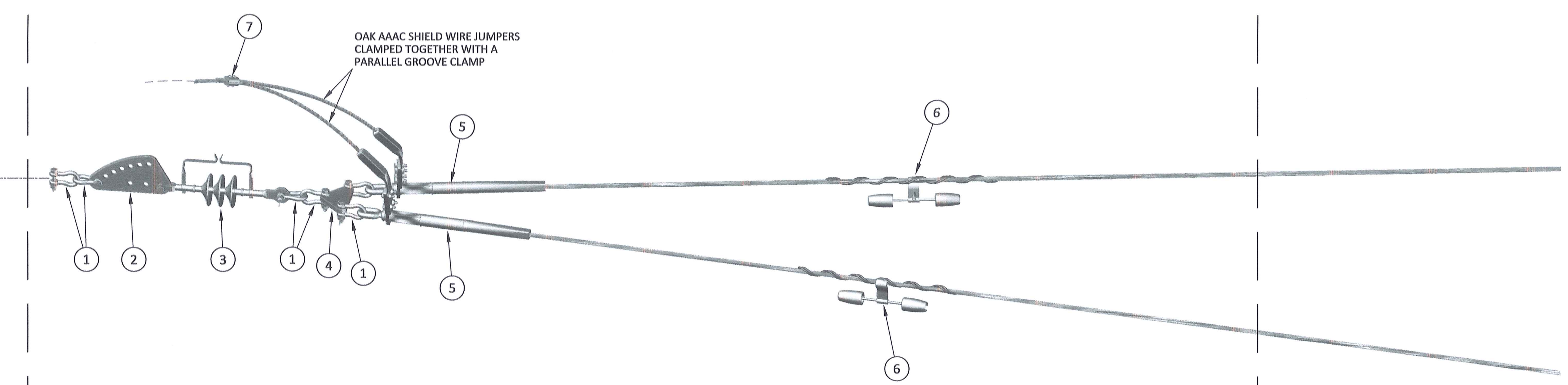
SHIELD WIRE STRAIN CONFIGURATION
AT STRUCTURES 1 BLO / ISC 32/2 AND 2 BLO / ISC 32/2
(ISOMETRIC VIEW)



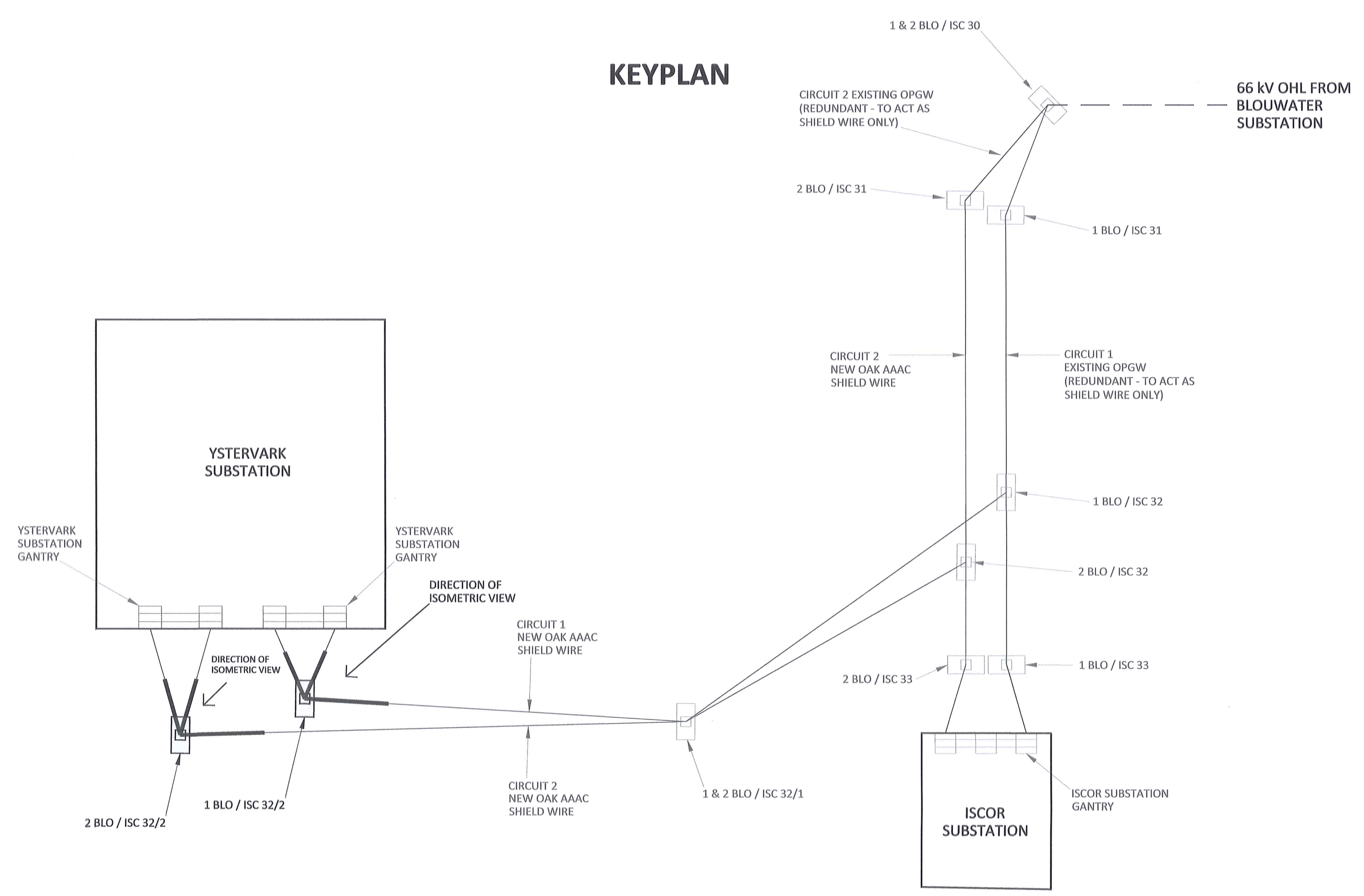
SHIELD WIRE STRAIN ASSEMBLY DETAIL (WITHOUT BIFURCATION)



SHIELD WIRE STRAIN ASSEMBLY DETAIL (WITH BIFURCATION)



KEYPLAN



ITEM	SHIELD WIRE STRAIN ASSEMBLY DESCRIPTION (WITHOUT BIFURCATION)	QTY (PER ASSEMBLY)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	3	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	D-DT- 7012	0167605
4	COMPRESSION DEAD END CLAMP ASSEMBLY	1	D-DT- 7000	0402497
5	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC	1	D-DT- 7005	0226767

ITEM	SHIELD WIRE STRAIN ASSEMBLY DESCRIPTION (WITH BIFURCATION)	QTY (PER ASSEMBLY)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	6	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	D-DT- 7012	0167605
4	YOKE PLATE - TRIANGLE, 120kN	1	D-DT- 7015	0168861
5	COMPRESSION DEAD END CLAMP ASSEMBLY	2	D-DT- 7000	0402497
6	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC	2	D-DT- 7005	0226767
7	PARALLEL GROOVE CLAMP - ALUMINIUM (CONDUCTOR RANGE 6.6 - 18.9 mm)	1	BUY OUT - TO SUITE	-

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME: C PYM
SIGNATURE: [signature] DATE: '20 02 17
REG. NUMBER: 201270126
SCALE: N.T.S. A0

Transnet Capital Projects
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8001
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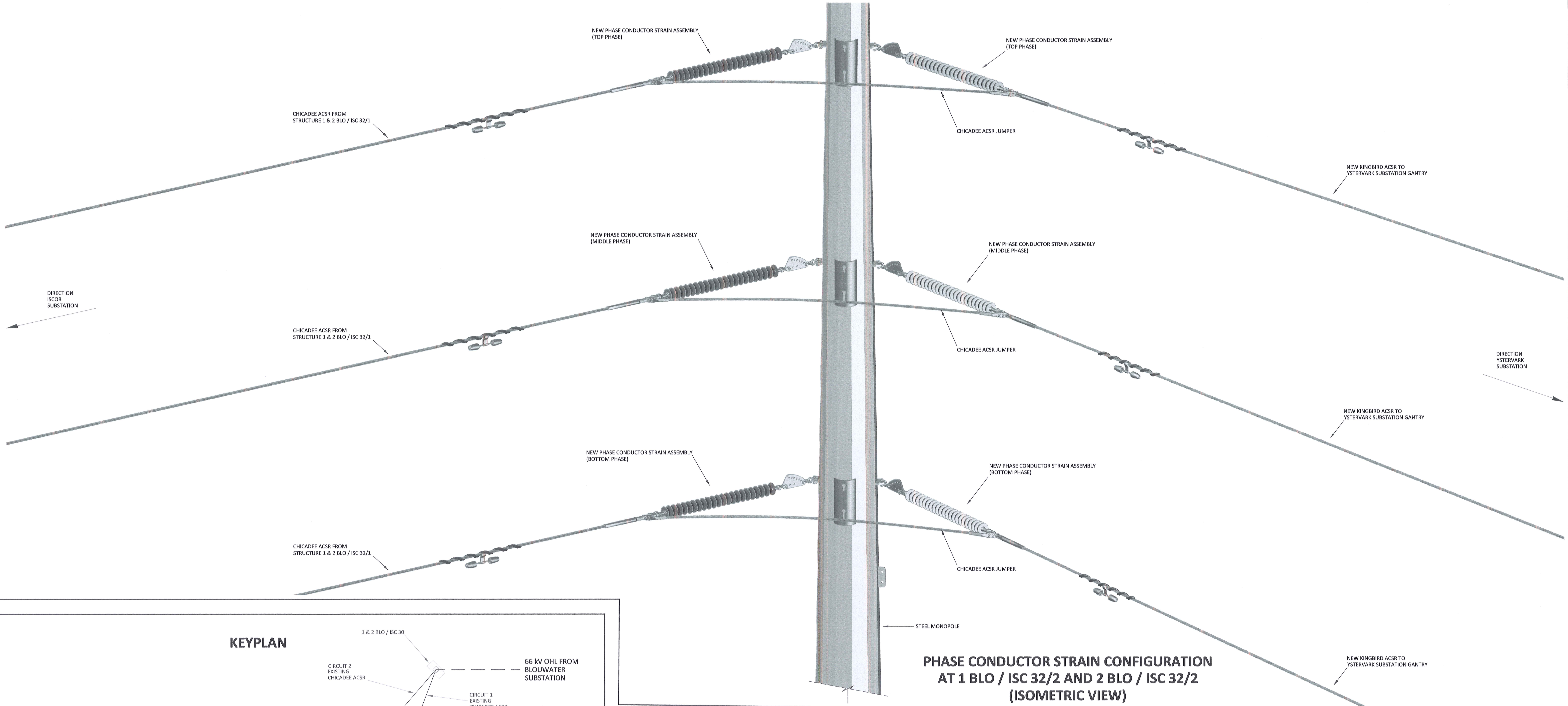
PORT OF SALDANHA

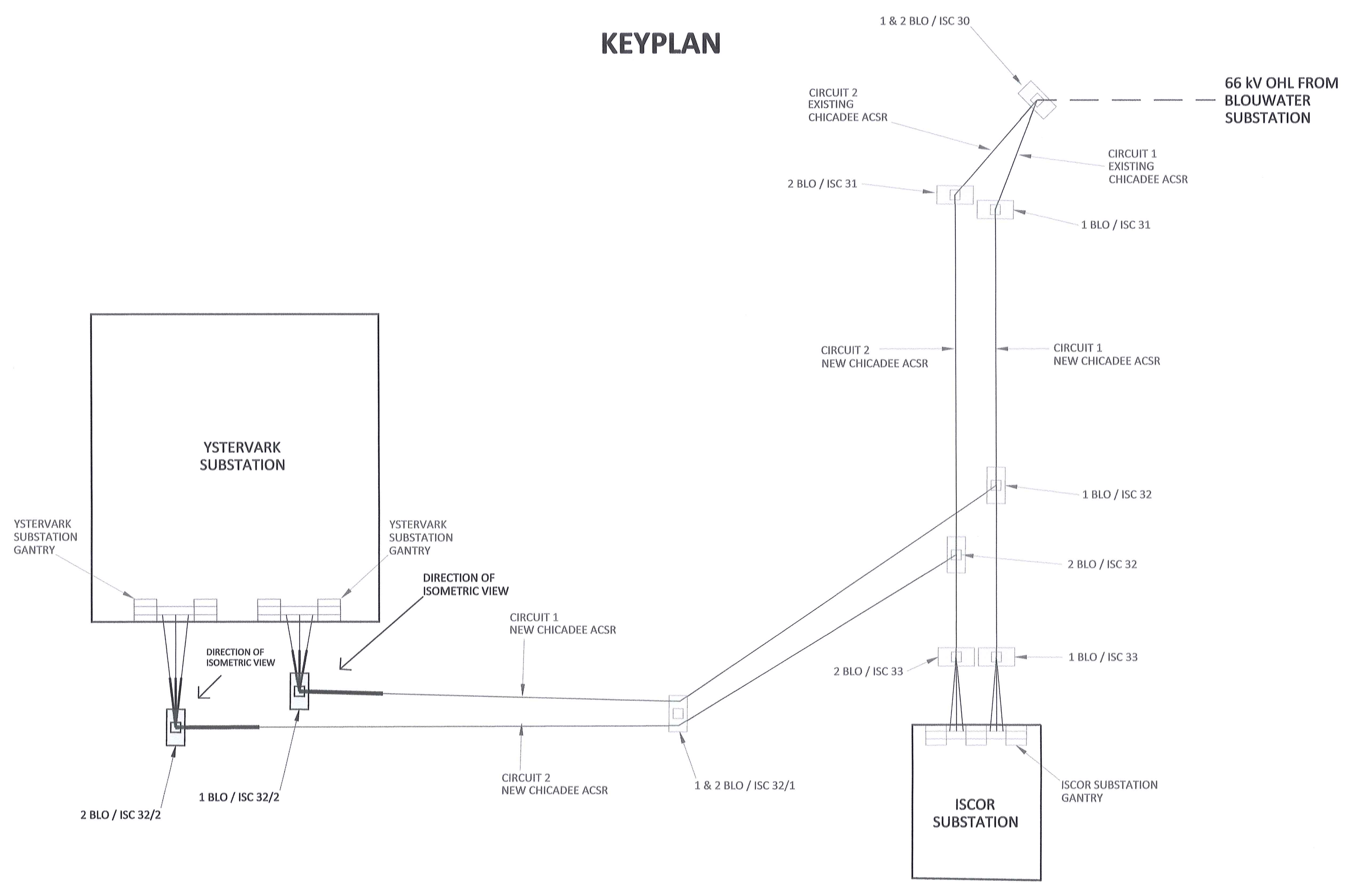
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS -
1 BLO / ISC 32/2 AND 2 BLO / ISC 32/2
SHIELD WIRE STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0075	01	00	AE



PHASE CONDUCTOR STRAIN CONFIGURATION AT 1 BLO / ISC 32/2 AND 2 BLO / ISC 32/2 (ISOMETRIC VIEW)

KEYPLAN



PHASE CONDUCTOR STRAIN ASSEMBLY DETAIL

ITEM	PHASE CONDUCTOR STRAIN ASSEMBLY DESCRIPTION (FOR CHICADEE ACSR)	QTY (PER ASSEMBLY)	TOTAL QTY (PER STRUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	6	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	3	D-DT- 7042	0175857
3	CLEVIS BALL, 120 kN	1	3	D-DT- 6059	0222125
4	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN	1	3	D-DT- 7029	0167609
5	SOCKET CLEVIS, 120 kN	1	3	D-DT- 7021	0010259
6	COMPRESSION DEAD END CLAMP ASSEMBLY	1	3	D-DT- 7000	0168745
7	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR	1	3	D-DT- 7005	0168960

ITEM	PHASE CONDUCTOR STRAIN ASSEMBLY DESCRIPTION (FOR KINGBIRD ACSR)	QTY (PER ASSEMBLY)	TOTAL QTY (PER STRUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	6	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	3	D-DT- 7042	0175857
3	CLEVIS BALL, 120 kN	1	3	D-DT- 6059	0222125
4	INSULATOR (LONG ROD), 132kV, 31mm/kV, 120 kN	1	3	D-DT- 7014	0167607
5	SOCKET CLEVIS, 120 kN	1	3	D-DT- 7021	0010259
6	COMPRESSION DEAD END CLAMP ASSEMBLY	1	3	D-DT- 7000	0168747
7	MULTI-FREQUENCY VIBRATION DAMPER TO FIT KINGBIRD ACSR	1	3	D-DT- 7005	0168893

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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TRANSNET CAPITAL PROJECTS

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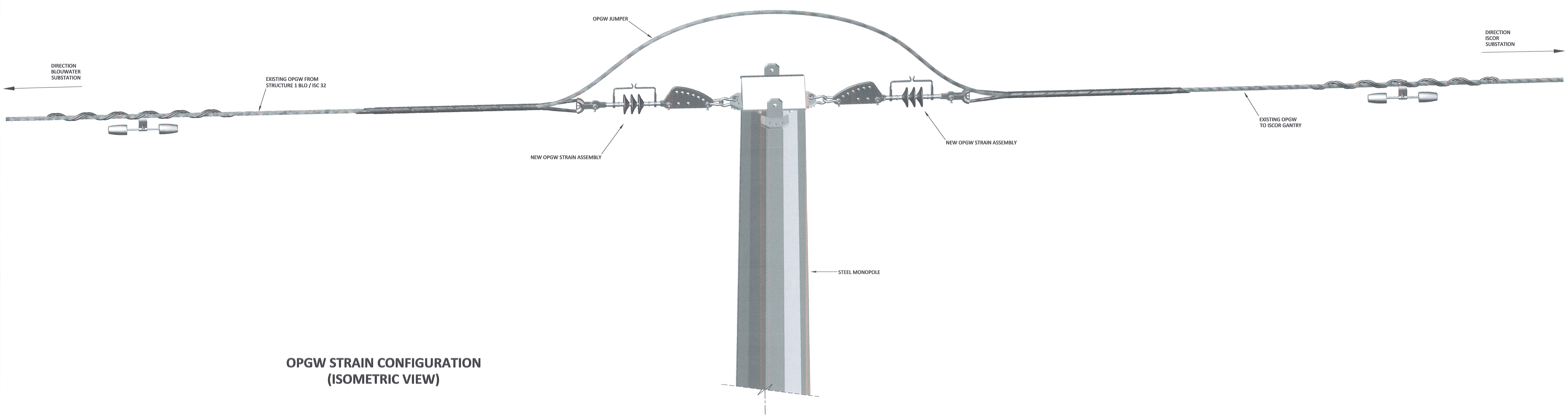
TRANSNET

PORT OF SALDANHA

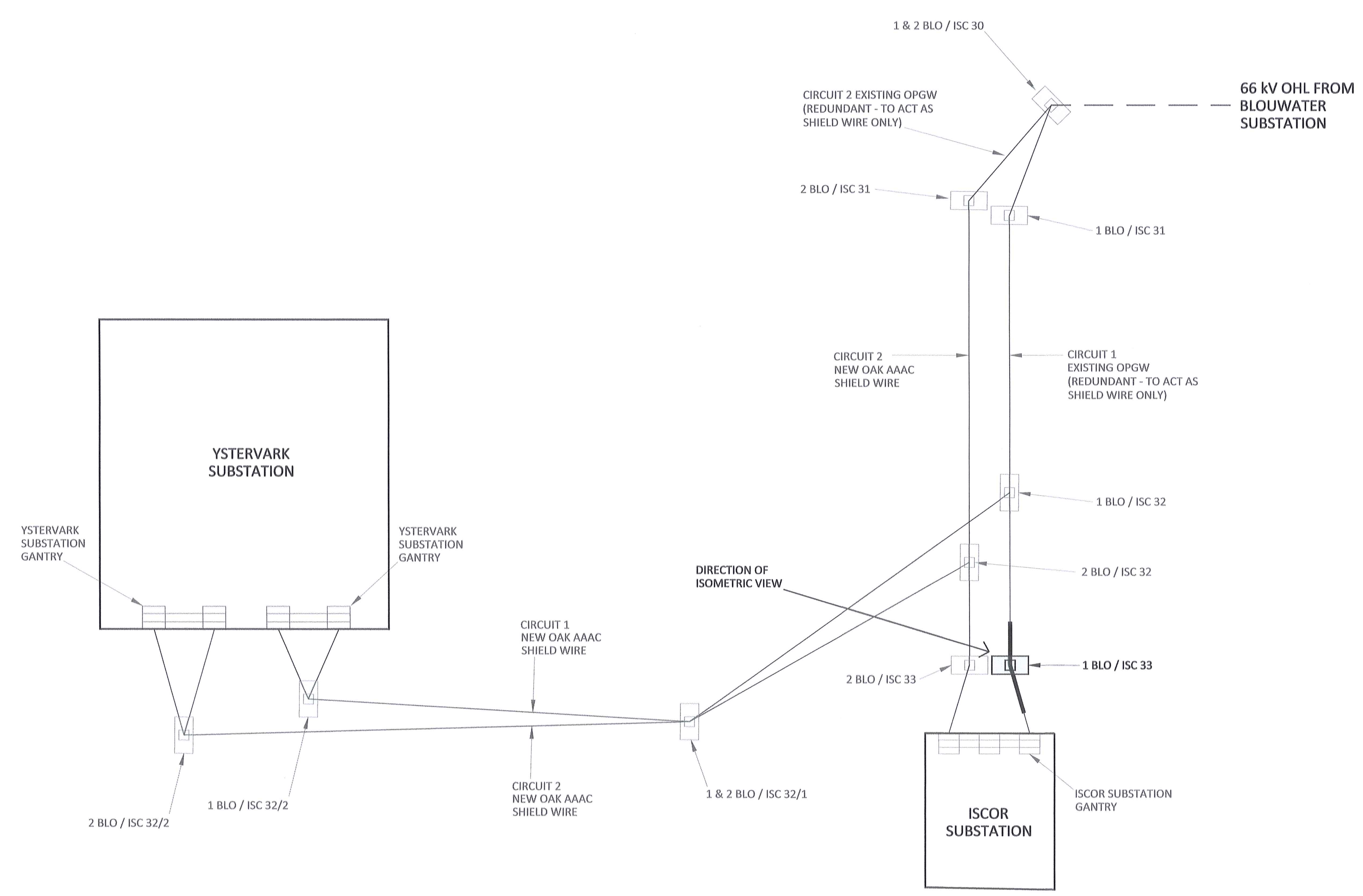
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS -
1 BLO / ISC 32/2 AND 2 BLO / ISC 32/2
PHASE CONDUCTOR STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0076	01	00	AE

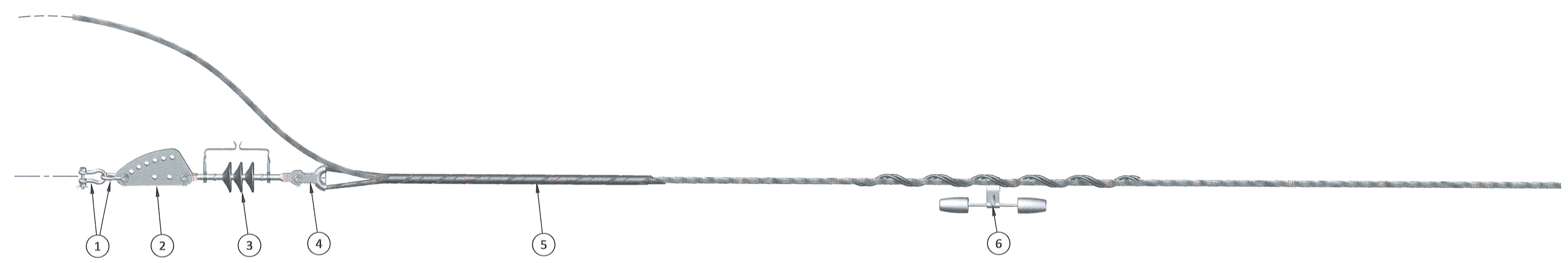


OPGW STRAIN CONFIGURATION (ISOMETRIC VIEW)

KEYPLAN



OPGW STRAIN ASSEMBLY DETAIL



ITEM	OPGW STRAIN ASSEMBLY DESCRIPTION	QTY (PER ASSEMBLY)	QTY (PER STUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	4	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	2	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	2	D-DT- 7012	0167605
4	THIMBLE CLEVIS, 120 kN	1	2	BUY OUT - TO SUITE	-
5	PREFORMED HELICALLY DEAD END ASSEMBLY TO OPGW MANUFACTURER SPECIFICATIONS (INCLUDES REINFORCING HELICAL ARMOUR ROD SET)	1	2	BUY OUT - TO SUITE	-
6	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OPGW	1	2	BUY OUT - TO SUITE	-

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME: C PYM — DATE: '20 02 17
SIGNATURE: [signature]
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SCALE: N.T.S. — A0

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PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT BULK POWER UPGRADE : 66 kV BRANCH LINE MASTS - 1 BLO / ISC 33 OPGW STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
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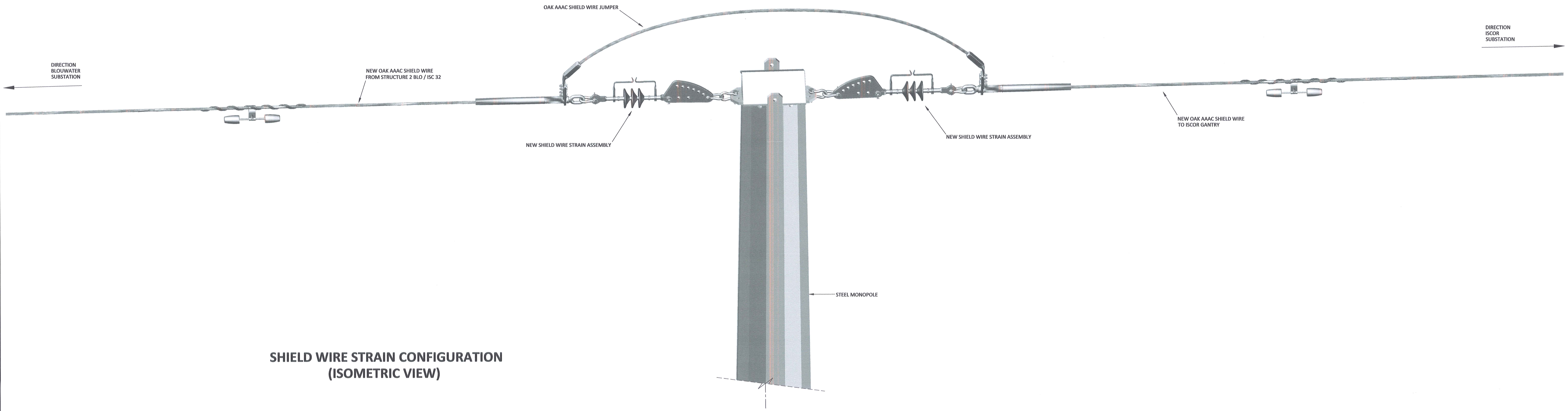
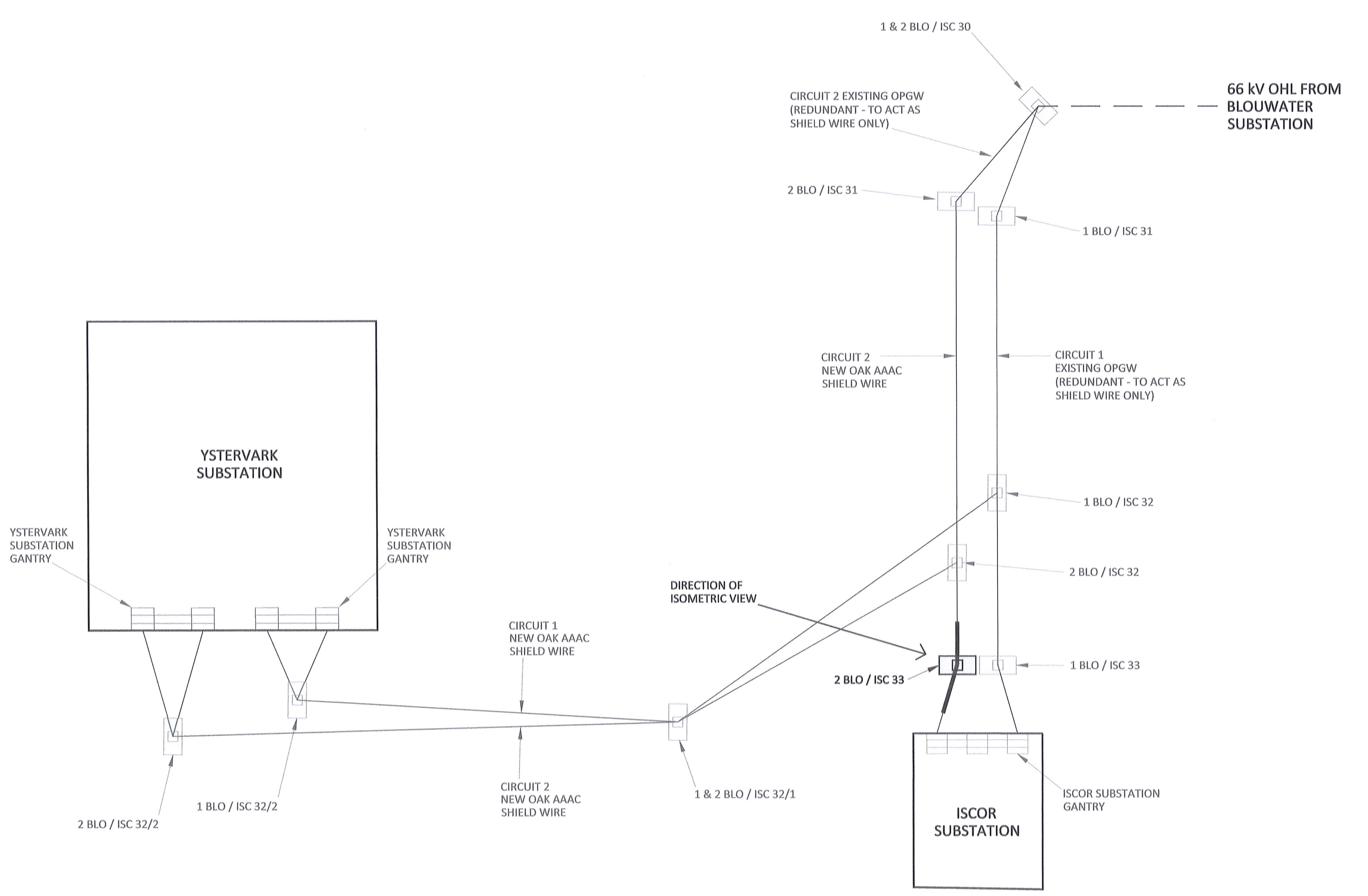
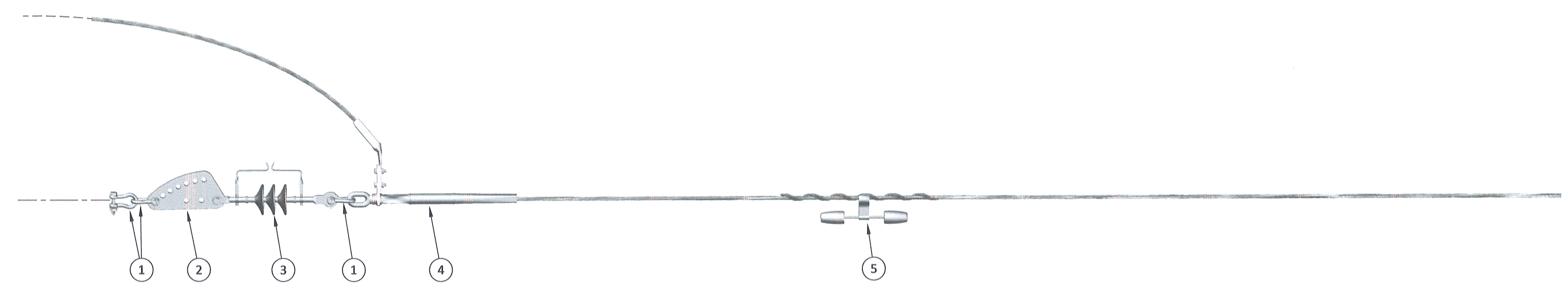


SHIELD WIRE STRAIN CONFIGURATION (ISOMETRIC VIEW)

KEYPLAN



SHIELD WIRE STRAIN ASSEMBLY DETAIL



ITEM	SHIELD WIRE STRAIN ASSEMBLY DESCRIPTION	QTY (PER ASSEMBLY)	QTY (PER STRUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	3	6	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	2	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	2	D-DT- 7012	0167605
4	COMPRESSION DEAD END CLAMP ASSEMBLY	1	2	D-DT- 7000	0402497
5	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC	1	2	D-DT- 7005	0226767

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
00	ISSUED FOR CONSTRUCTION	DD	CP	CP	2020-02-17

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE
DRAWN	DD	[signature]	'20 02 17
CHECKED	KS	[signature]	'20 02 17
DESIGNED	NM	[signature]	'20 02 17
CHECKED	CP	[signature]	'20 02 17

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME C PYM — DATE '20 02 17
SIGNATURE [signature]
REG. NUMBER 201270126
SCALE : N.T.S. — A0

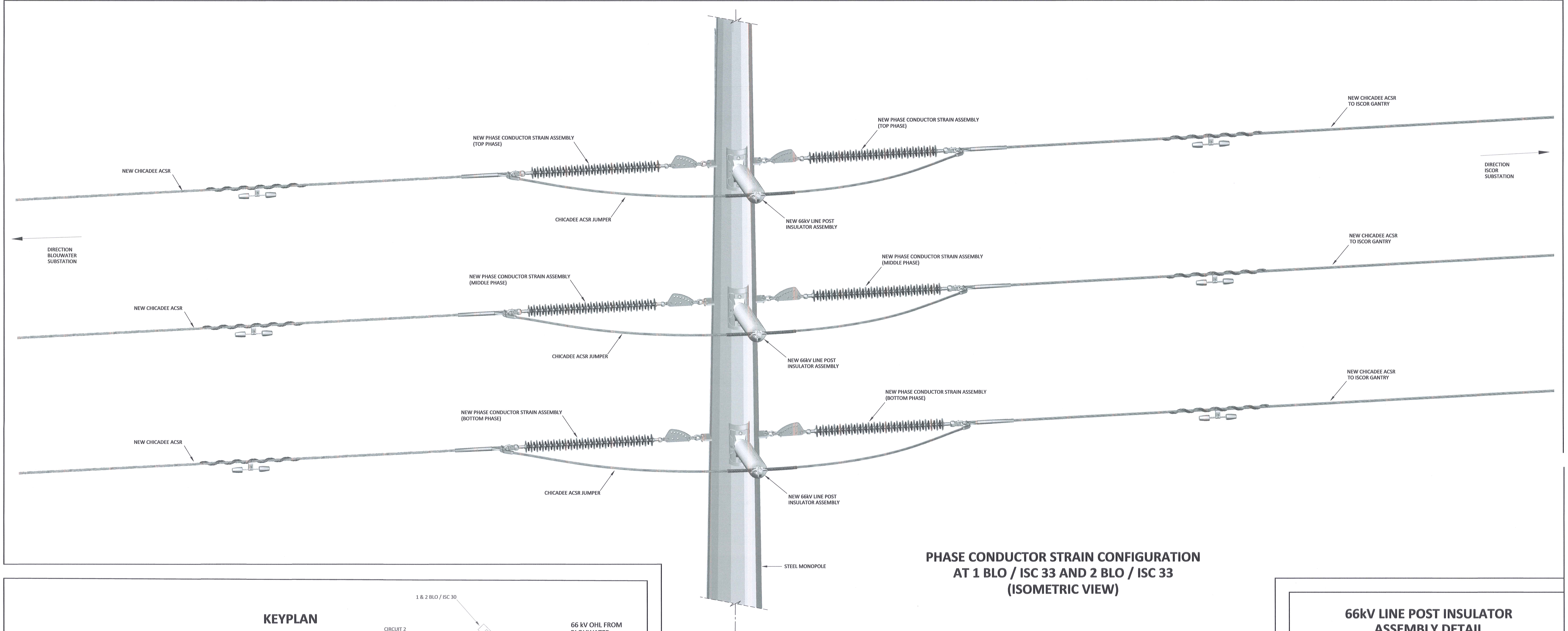
Transnet Capital Projects
TRANSNET LTD (TRADING AS TRANSNET CAPITAL PROJECTS) : REG. NO. 1990/000900/06
TABLE BAY BUILDING, TYGERBERG PARK,
163 UYS KRIGE DRIVE, PLATTEKLOOF,
8001
TEL: 021 940 1999
FAX: 086 677 2455

TRANSNET

PORT OF SALDANHA

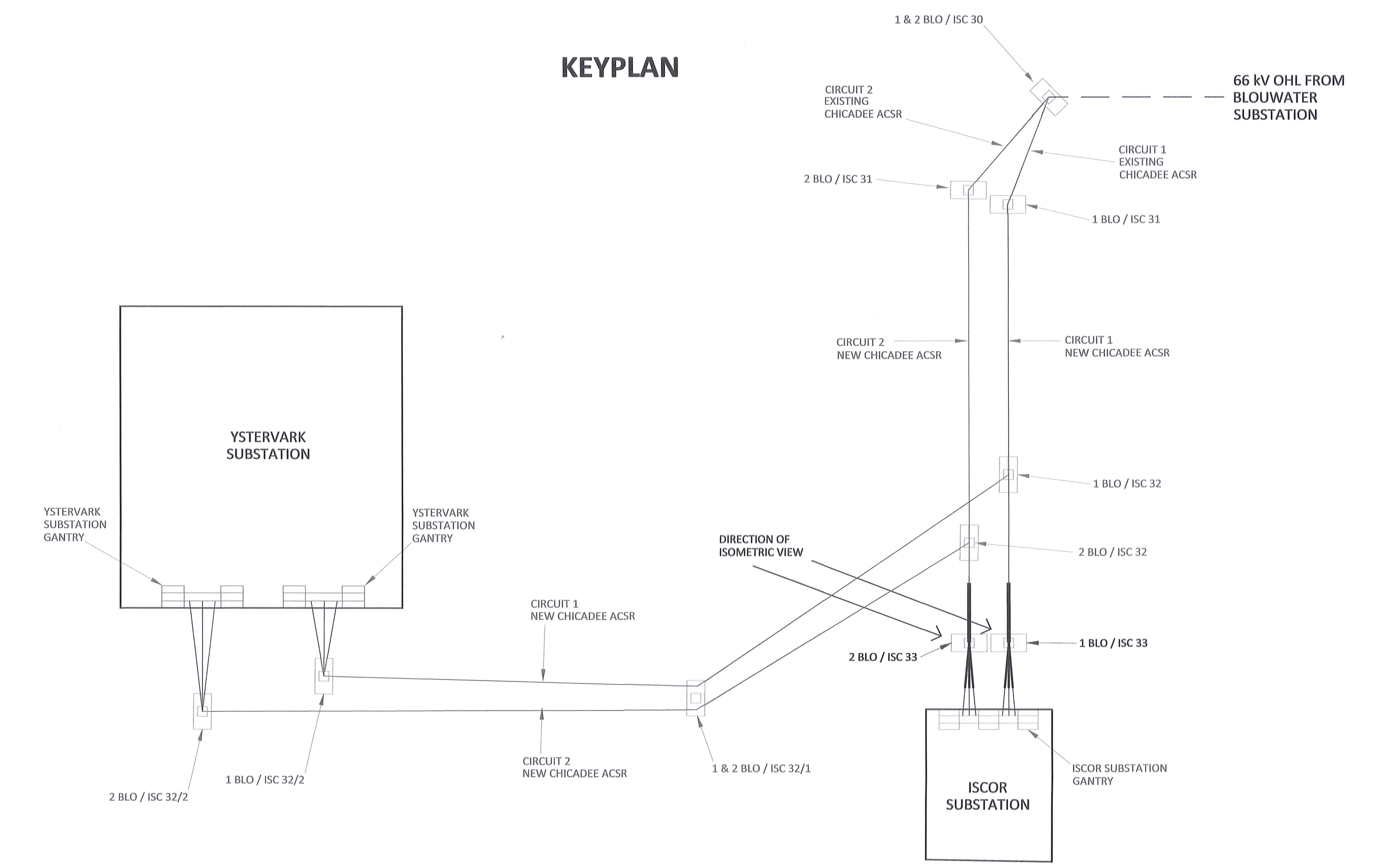
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS - 2 BLO / ISC 33
SHIELD WIRE STRAIN CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0078	01	00	AE

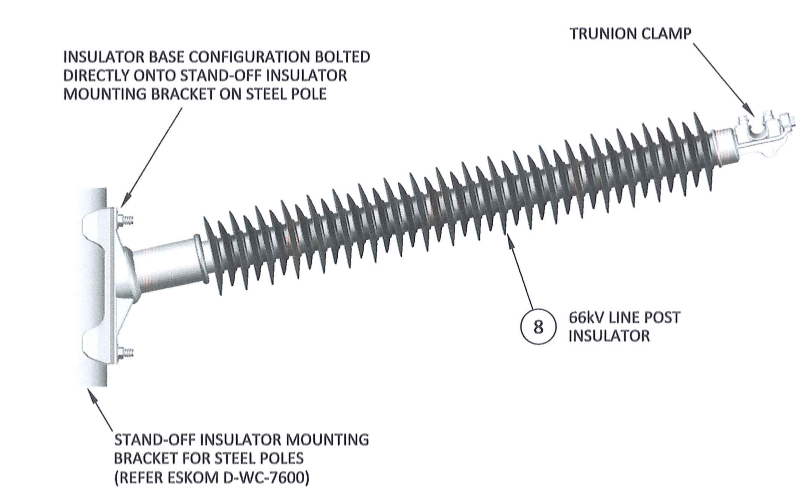


PHASE CONDUCTOR STRAIN CONFIGURATION AT 1 BLO / ISC 33 AND 2 BLO / ISC 33 (ISOMETRIC VIEW)

KEYPLAN

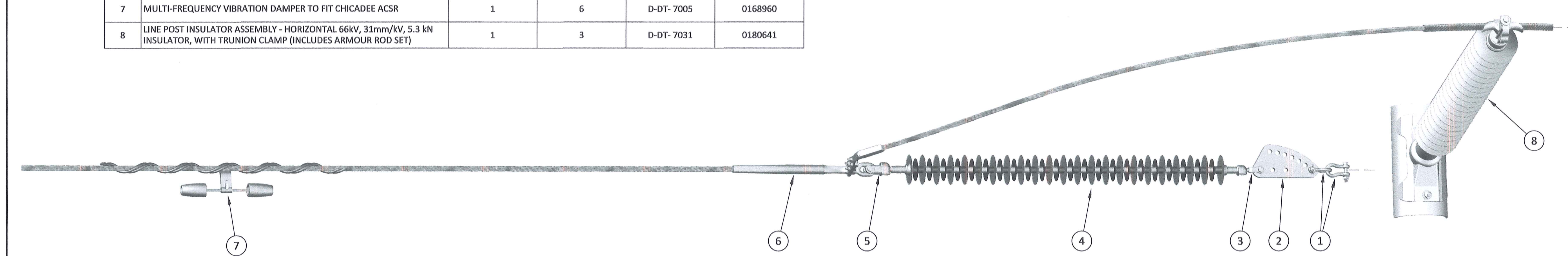


66kV LINE POST INSULATOR ASSEMBLY DETAIL



PHASE CONDUCTOR STRAIN ASSEMBLY DETAIL

ITEM	PHASE CONDUCTOR STRAIN ASSEMBLY DESCRIPTION	QTY (PER ASSEMBLY)	QTY (PER STUCTURE)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	12	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	6	D-DT- 7042	0175857
3	CLEVIS BALL, 120 kN	1	6	D-DT- 6059	0222125
4	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN	1	6	D-DT- 7029	0167609
5	SOCKET CLEVIS, 120 kN	1	6	D-DT- 7021	0010259
6	COMPRESSION DEAD END CLAMP ASSEMBLY	1	6	D-DT- 7000	0168745
7	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR	1	6	D-DT- 7005	0168960
8	LINE POST INSULATOR ASSEMBLY - HORIZONTAL 66kV, 31mm/kV, 5.3 kN INSULATOR, WITH TRUNION CLAMP (INCLUDES ARMOUR ROD SET)	1	3	D-DT- 7031	0180641



DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
00	ISSUED FOR CONSTRUCTION	DD	CP	CP	2020-02-14

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE
DRAWN	DD		'20 02 14
CHECKED	KS		'20 02 14
DESIGNED	NM		'20 02 14
CHECKED	CP		'20 02 14

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME: C PYM — DATE: '20 02 14
SIGNATURE:
REG. NUMBER: 201270126
SCALE: N.T.S.
A0

Transnet Capital Projects
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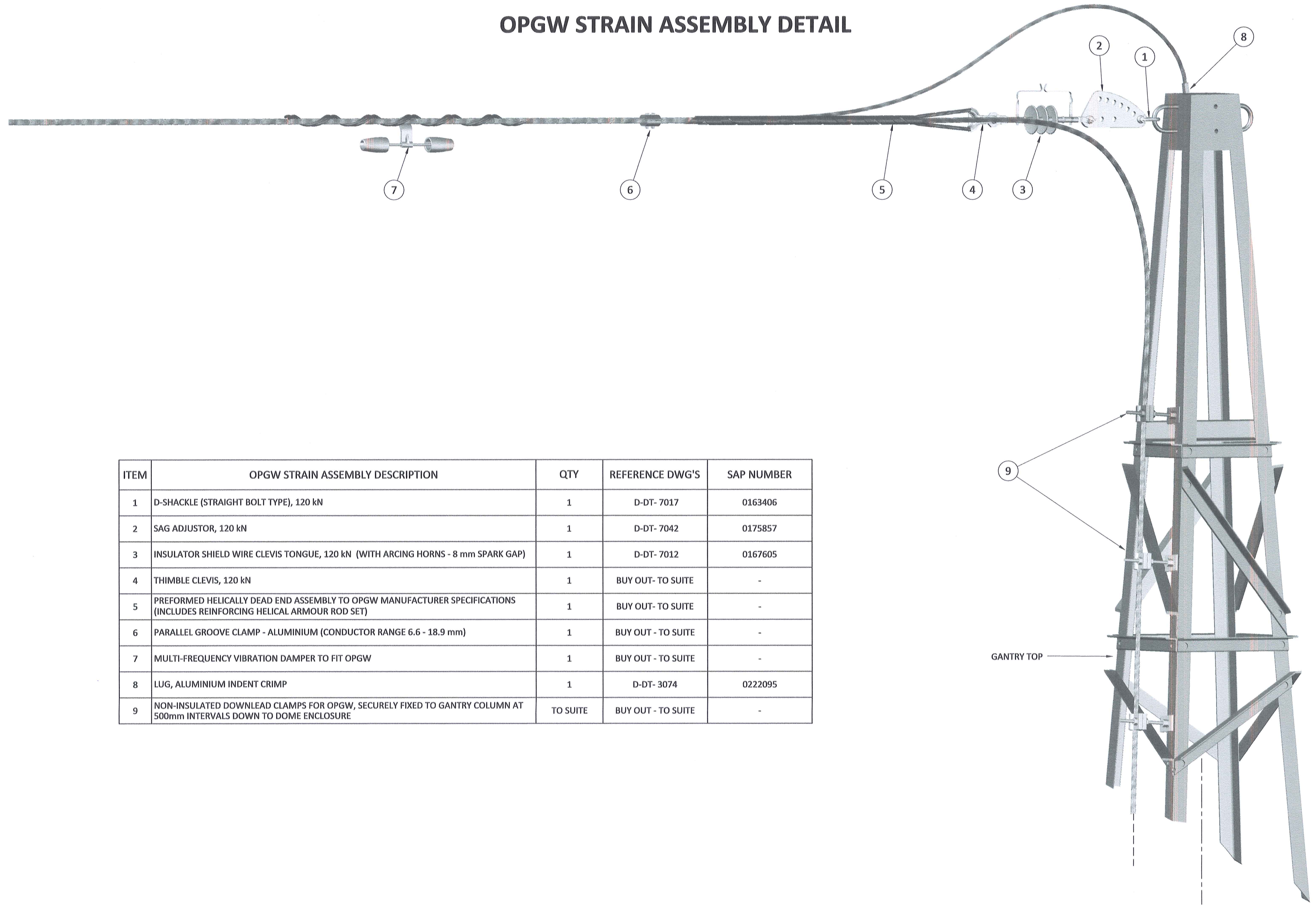
TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS -
1 BLO / ISC 33 AND 2 BLO / ISC 33
PHASE CONDUCTOR STRAIN CONFIGURATION

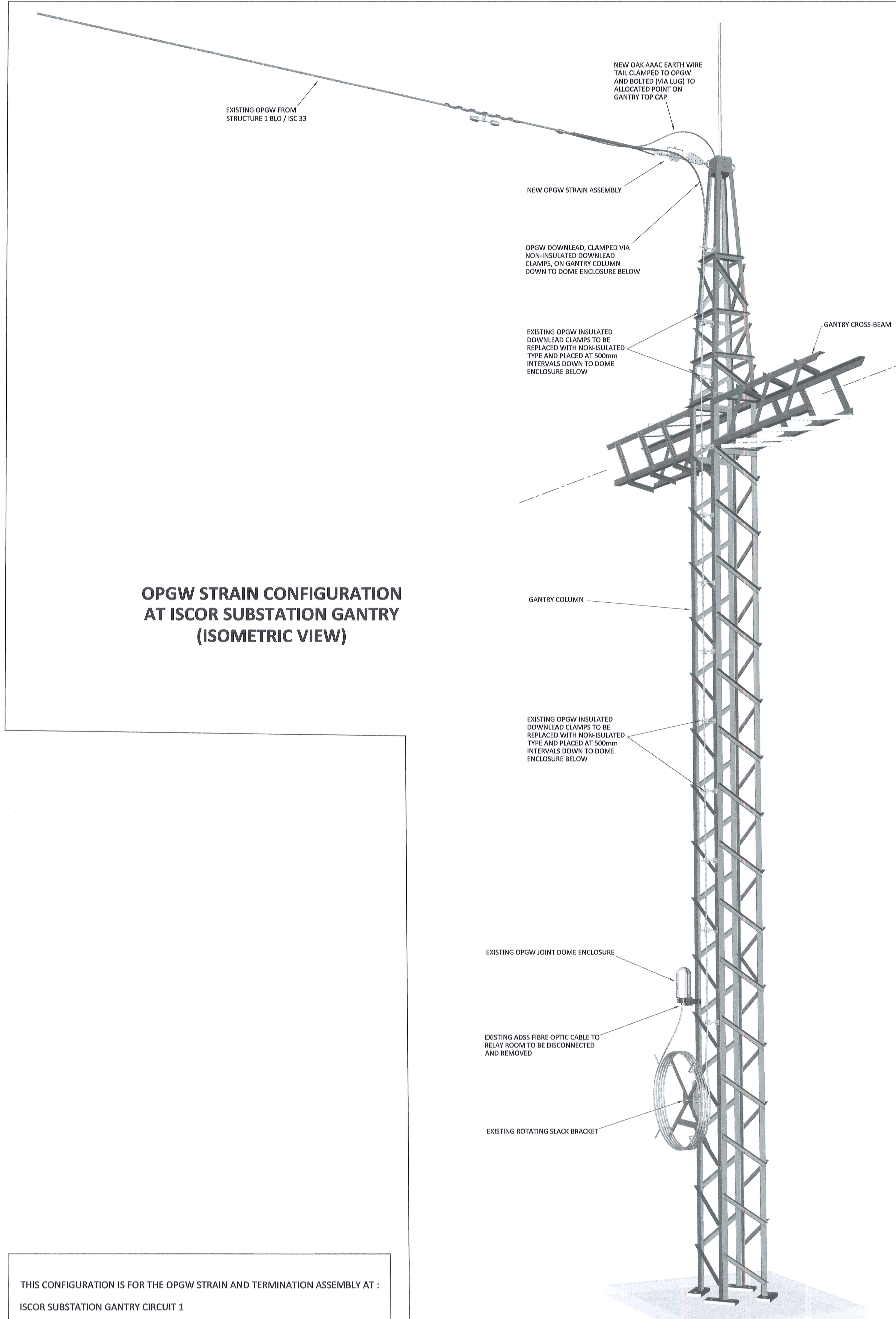
PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0079	01	00	AE

OPGW STRAIN ASSEMBLY DETAIL

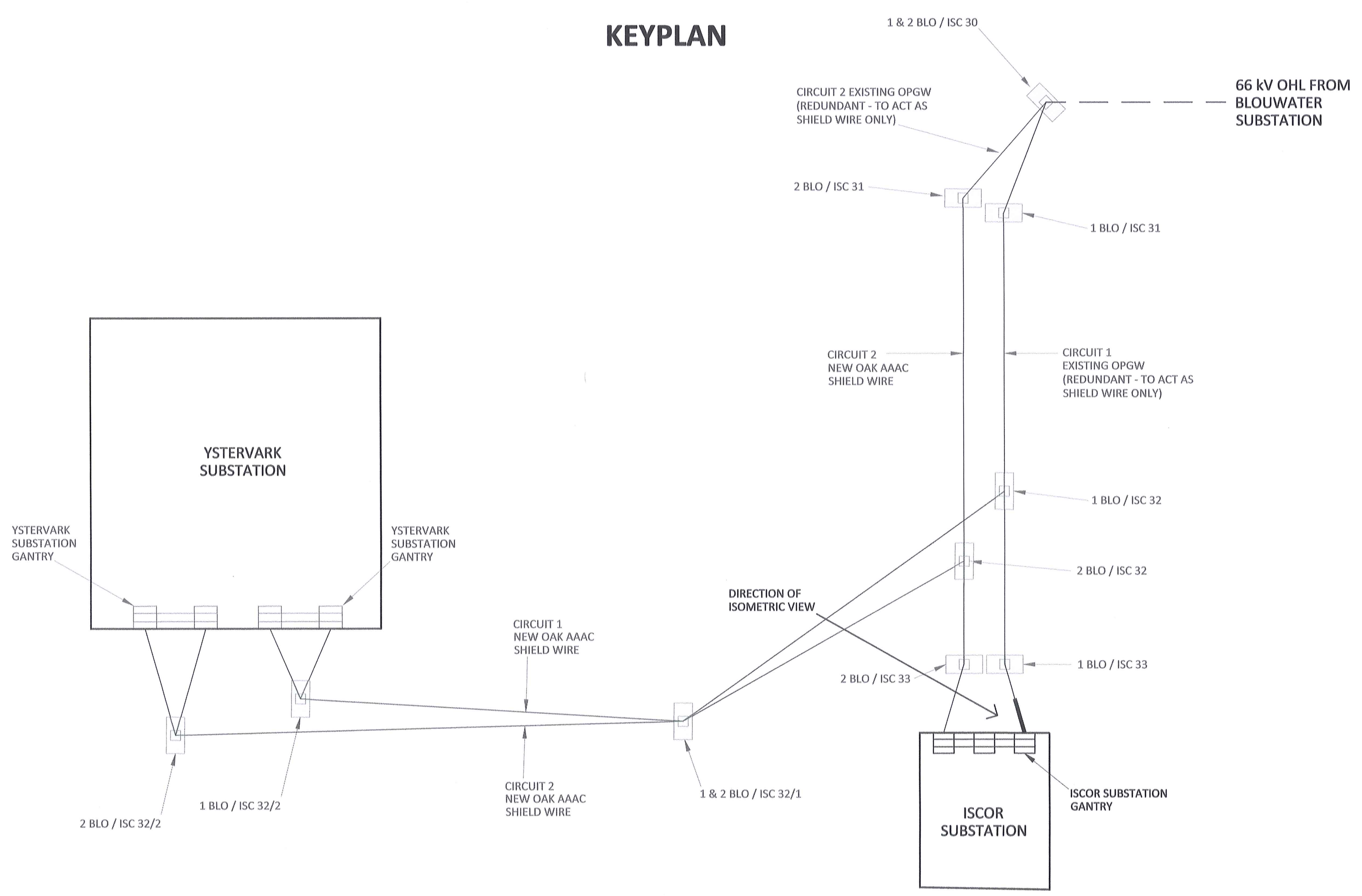


ITEM	OPGW STRAIN ASSEMBLY DESCRIPTION	QTY	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	1	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	D-DT- 7012	0167605
4	THIMBLE CLEVIS, 120 kN	1	BUY OUT- TO SUITE	-
5	PREFORMED HELICALLY DEAD END ASSEMBLY TO OPGW MANUFACTURER SPECIFICATIONS (INCLUDES REINFORCING HELICAL ARMOUR ROD SET)	1	BUY OUT- TO SUITE	-
6	PARALLEL GROOVE CLAMP - ALUMINIUM (CONDUCTOR RANGE 6.6 - 18.9 mm)	1	BUY OUT - TO SUITE	-
7	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OPGW	1	BUY OUT - TO SUITE	-
8	LUG, ALUMINIUM INDENT CRIMP	1	D-DT- 3074	0222095
9	NON-INSULATED DOWNLEAD CLAMPS FOR OPGW, SECURELY FIXED TO GANTRY COLUMN AT 500mm INTERVALS DOWN TO DOME ENCLOSURE	TO SUITE	BUY OUT - TO SUITE	-

OPGW STRAIN CONFIGURATION AT ISCOR SUBSTATION GANTRY (ISOMETRIC VIEW)



KEYPLAN



THIS CONFIGURATION IS FOR THE OPGW STRAIN AND TERMINATION ASSEMBLY AT :

ISCOR SUBSTATION GANTRY CIRCUIT 1

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
00	ISSUED FOR CONSTRUCTION	DD	CP	CP	2020-02-17

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE
DRAWN	DD	Daul	'20 02 17
CHECKED	KS		'20 02 17
DESIGNED	NM		'20 02 17
CHECKED	CP	Cpm	'20 02 17

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME	C PYM	DATE
SIGNATURE		'20 02 17
REG. NUMBER	201270126	
SCALE :	N.T.S.	A0

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8001
TEL: 021 940 1999
FAX: 086 677 2455

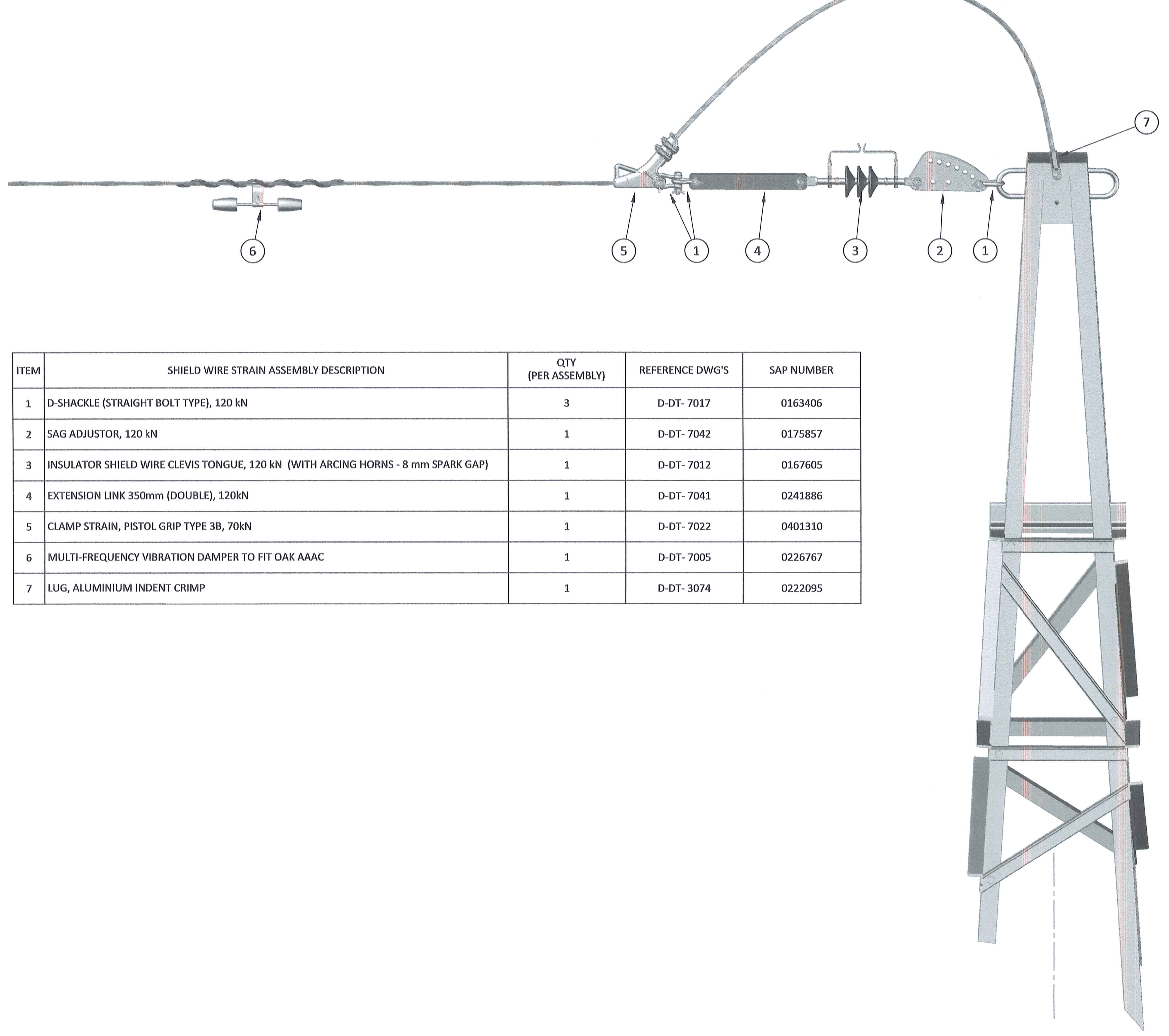
TRANSNET

PORT OF SALDANHA

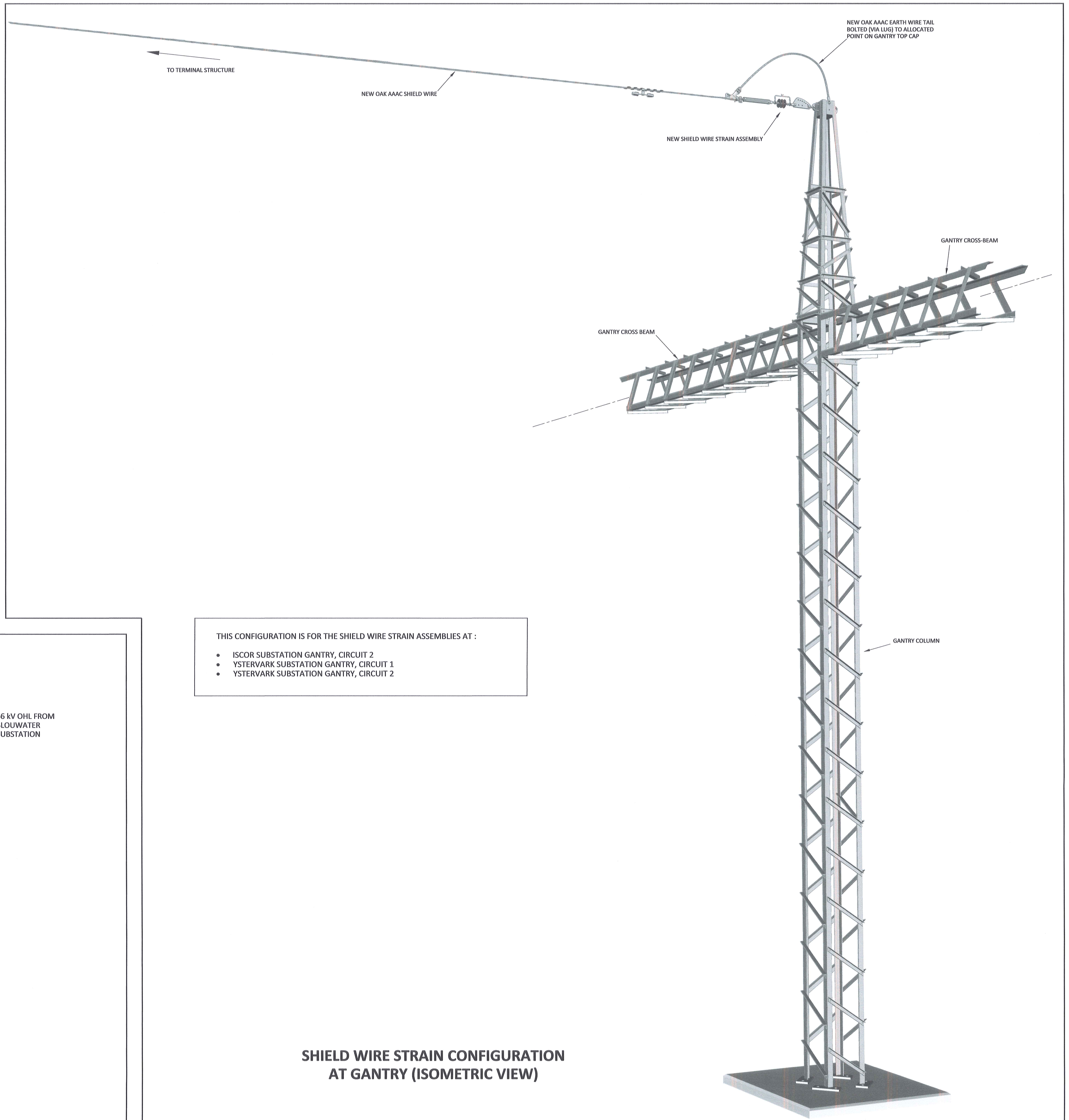
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS - SUBSTATION GANTRY
OPGW STRAIN AND TERMINATION CONFIGURATION

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0080	01	00	AE

SHIELD WIRE STRAIN ASSEMBLY DETAIL



ITEM	SHIELD WIRE STRAIN ASSEMBLY DESCRIPTION	QTY (PER ASSEMBLY)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	3	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	D-DT- 7042	0175857
3	INSULATOR SHIELD WIRE CLEVIS TONGUE, 120 kN (WITH ARCING HORNS - 8 mm SPARK GAP)	1	D-DT- 7012	0167605
4	EXTENSION LINK 350mm (DOUBLE), 120kN	1	D-DT- 7041	0241886
5	CLAMP STRAIN, PISTOL GRIP TYPE 3B, 70kN	1	D-DT- 7022	0401310
6	MULTI-FREQUENCY VIBRATION DAMPER TO FIT OAK AAAC	1	D-DT- 7005	0226767
7	LUG, ALUMINIUM INDENT CRIMP	1	D-DT- 3074	0222095

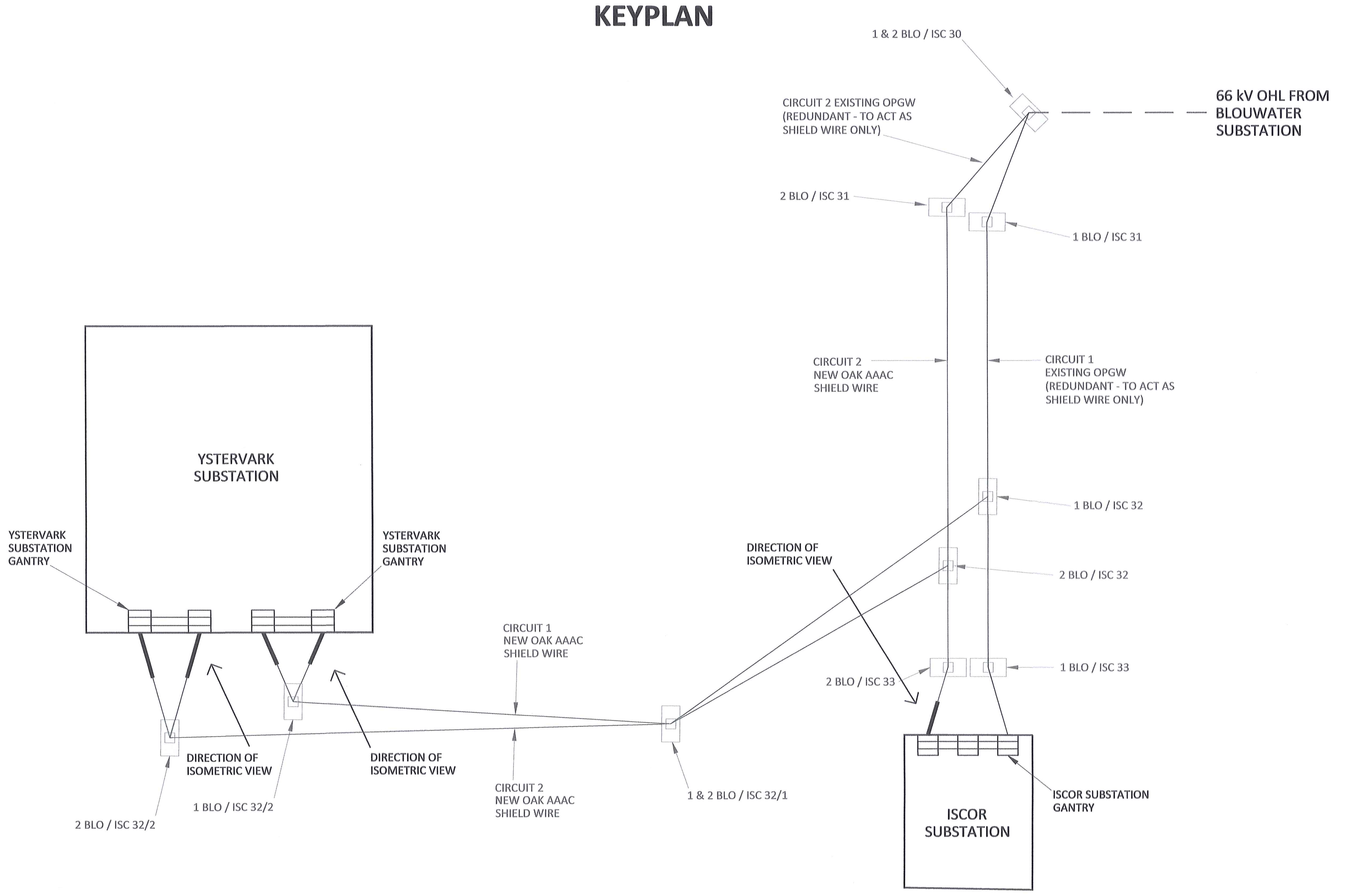


THIS CONFIGURATION IS FOR THE SHIELD WIRE STRAIN ASSEMBLIES AT :

- ISCOR SUBSTATION GANTRY, CIRCUIT 2
- YSTERVARK SUBSTATION GANTRY, CIRCUIT 1
- YSTERVARK SUBSTATION GANTRY, CIRCUIT 2

SHIELD WIRE STRAIN CONFIGURATION AT GANTRY (ISOMETRIC VIEW)

KEYPLAN



DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
00	ISSUED FOR CONSTRUCTION	DD	CP	CP	2020-02-17

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE
DRAWN	DD	[signature]	'20 02 17
CHECKED	KS	[signature]	'20 02 17
DESIGNED	NM	[signature]	'20 02 17
CHECKED	CP	[signature]	'20 02 17

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME: C PYM
SIGNATURE: [signature] DATE: '20 02 17
REG. NUMBER: 201270126
SCALE : N.T.S.
A0

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8001
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FAX: 086 677 2455

TRANSNET

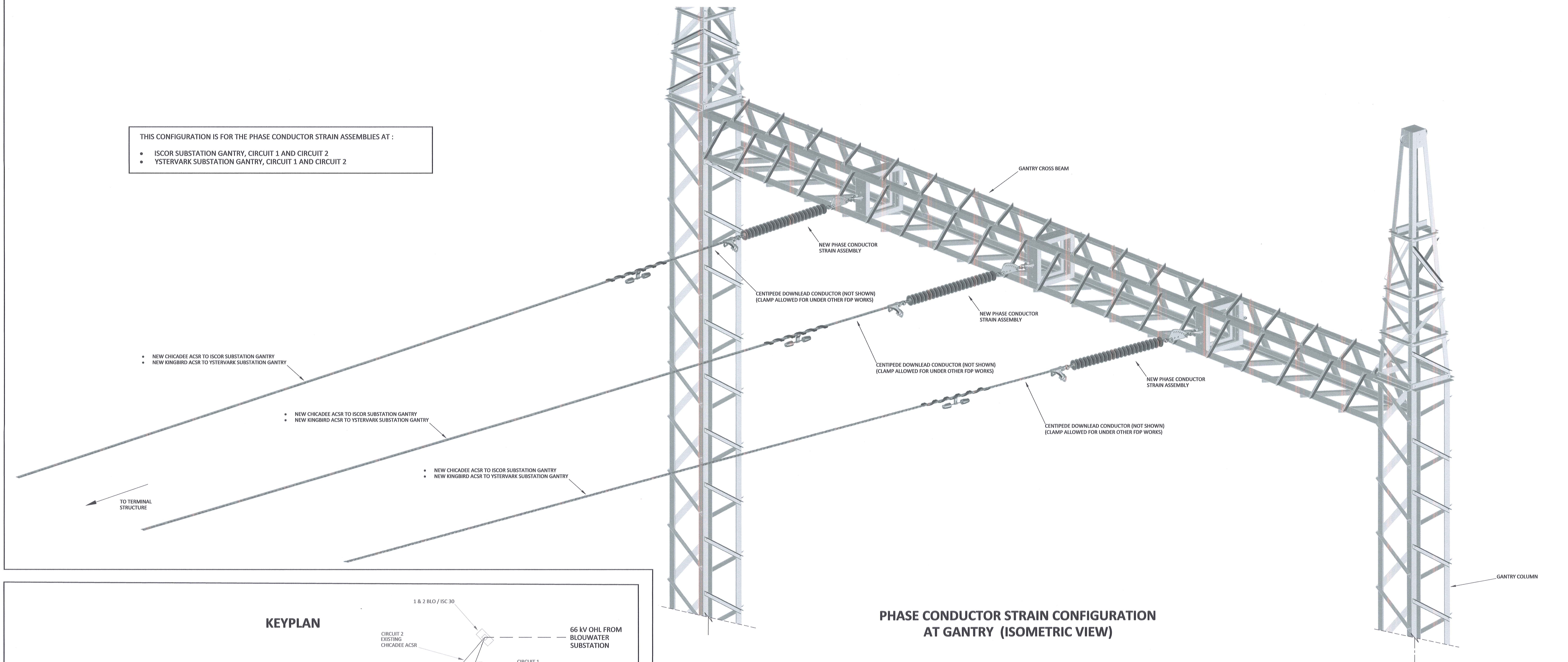
PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS - SUBSTATION GANTRY
SHIELD WIRE STRAIN CONFIGURATION (TYPICAL)

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0081	01	00	AE

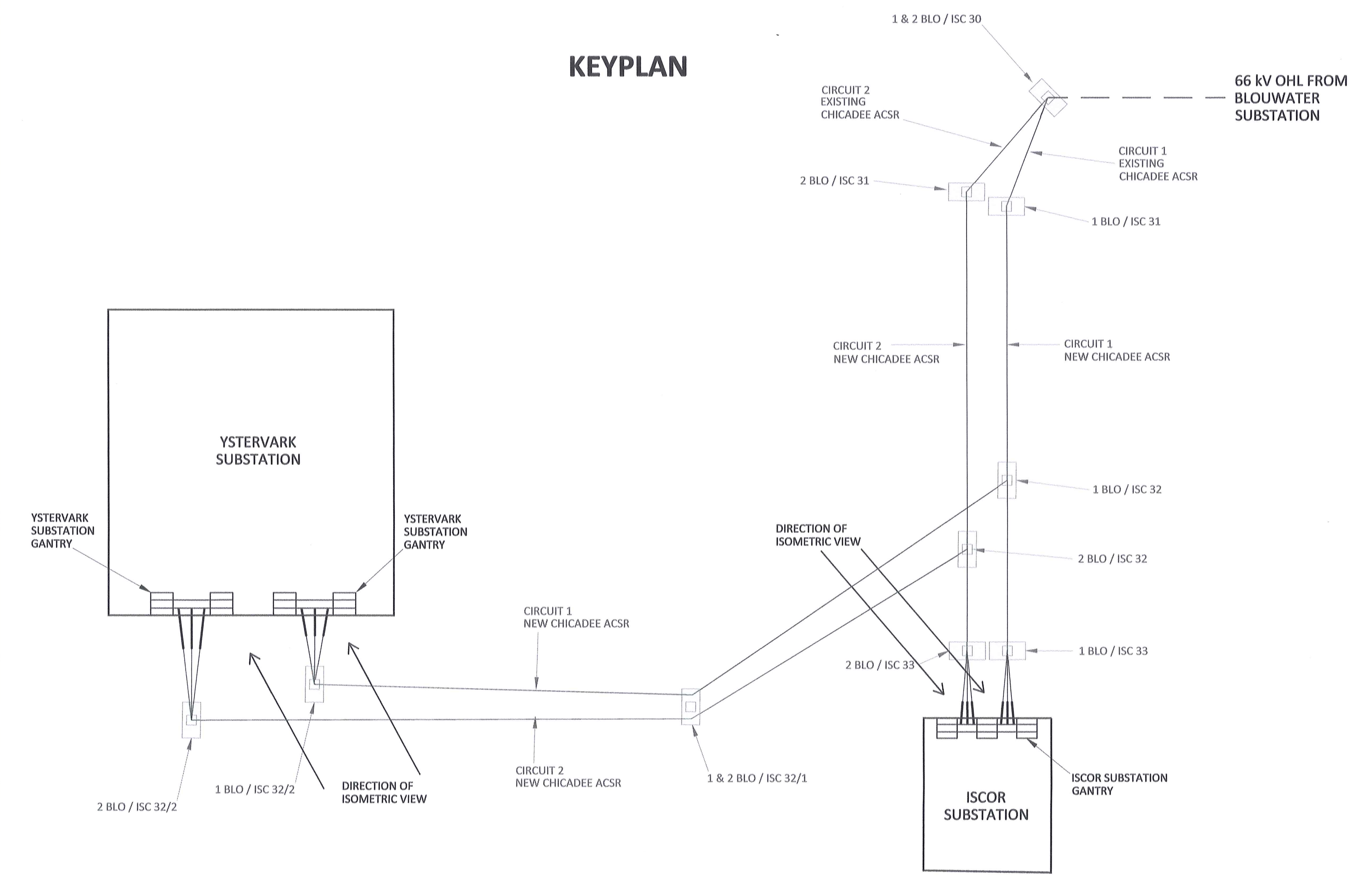
THIS CONFIGURATION IS FOR THE PHASE CONDUCTOR STRAIN ASSEMBLIES AT :

- ISCOR SUBSTATION GANTRY, CIRCUIT 1 AND CIRCUIT 2
- YSTERVARK SUBSTATION GANTRY, CIRCUIT 1 AND CIRCUIT 2

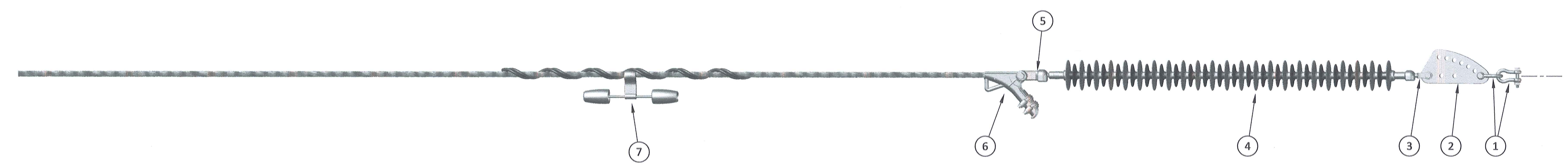


PHASE CONDUCTOR STRAIN CONFIGURATION AT GANTRY (ISOMETRIC VIEW)

KEYPLAN



PHASE CONDUCTOR STRAIN ASSEMBLY DETAIL



ISCOR SUBSTATION GANTRY

ITEM	PHASE CONDUCTOR STRAIN ASSEMBLY DESCRIPTION (FOR CHICADEE ACSR)	QTY (PER ASSEMBLY)	TOTAL QTY (AT GANTRY)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	6	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	3	D-DT- 7042	0175857
3	CLEVIS BALL, 120 kN	1	3	D-DT- 6059	0222125
4	INSULATOR (LONG ROD), 66kV, 31mm/kV, 120 kN	1	3	D-DT- 7029	0167609
5	SOCKET CLEVIS, 120 kN	1	3	D-DT- 7021	0010259
6	CLAMP STRAIN, PISTOL GRIP TYPE 3B	1	3	D-DT- 7022	0243440
7	MULTI-FREQUENCY VIBRATION DAMPER TO FIT CHICADEE ACSR	1	3	D-DT- 7005	0168960

YSTERVARK SUBSTATION GANTRY

ITEM	PHASE CONDUCTOR STRAIN ASSEMBLY DESCRIPTION (FOR KINGBIRD ACSR)	QTY (PER ASSEMBLY)	TOTAL QTY (AT GANTRY)	REFERENCE DWG'S	SAP NUMBER
1	D-SHACKLE (STRAIGHT BOLT TYPE), 120 kN	2	6	D-DT- 7017	0163406
2	SAG ADJUSTOR, 120 kN	1	3	D-DT- 7042	0175857
3	CLEVIS BALL, 120 kN	1	3	D-DT- 6059	0222125
4	INSULATOR (LONG ROD), 132kV, 31mm/kV, 120 kN	1	3	D-DT- 7014	0167607
5	SOCKET CLEVIS, 120 kN	1	3	D-DT- 7021	0010259
6	CLAMP STRAIN, PISTOL GRIP TYPE 3B	1	3	D-DT- 7022	0243440
7	MULTI-FREQUENCY VIBRATION DAMPER TO FIT KINGBIRD ACSR	1	3	D-DT- 7005	0168893

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES

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NO.	DESCRIPTION	BY	CHKD	APPD	DATE
00	ISSUED FOR CONSTRUCTION	DD	CP	CP	2020-02-17

REVISIONS

CONTRACTOR / CONSULTANT			
TITLE	NAME	SIGN	DATE
DRAWN	DD		'20 02 17
CHECKED	KS		'20 02 17
DESIGNED	NM		'20 02 17
CHECKED	CP		'20 02 17

OPERATING DIVISIONS — TITLE | NAME | SIGN | DATE

TRANSNET CAPITAL PROJECTS — TITLE | NAME | SIGN | DATE

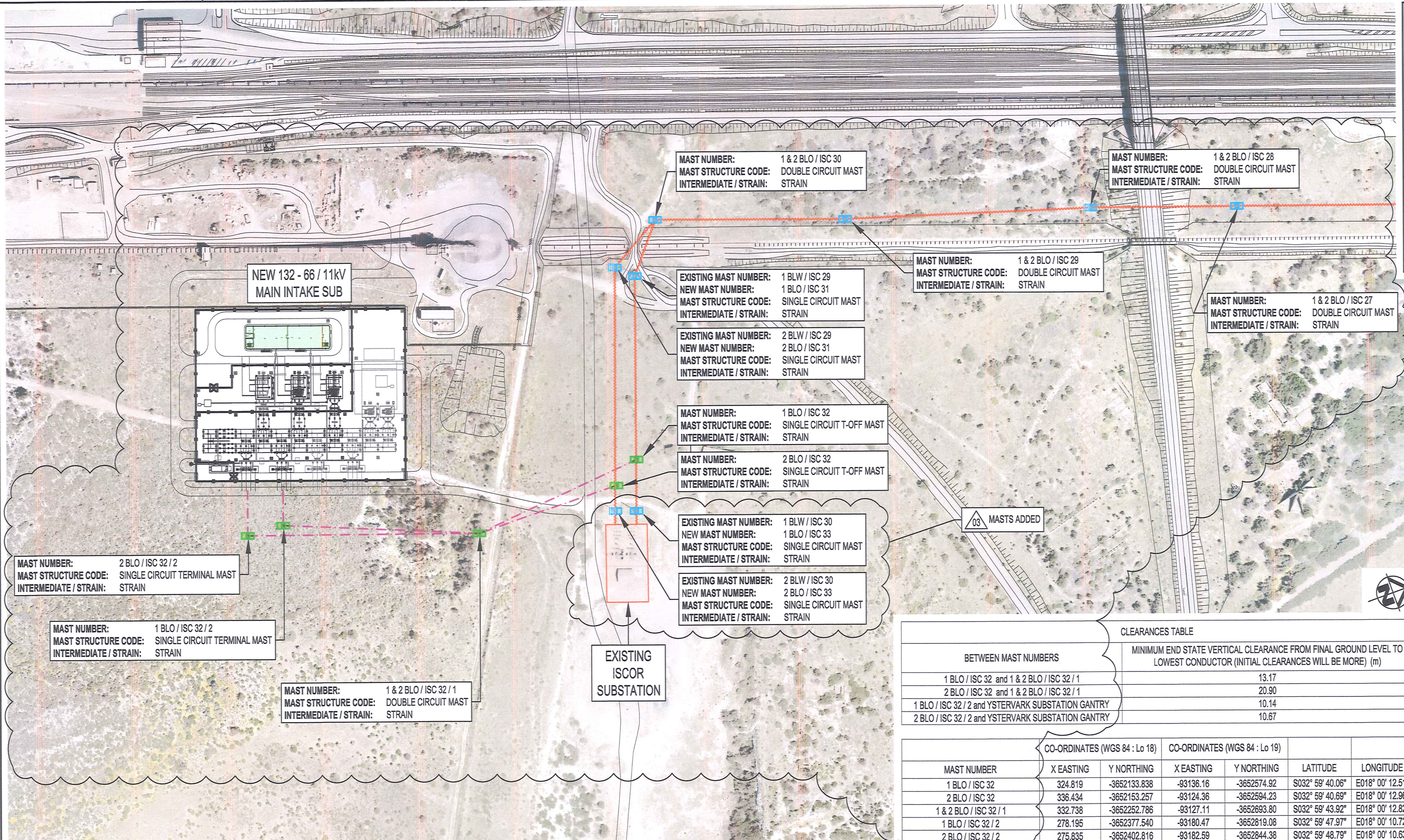
PR.ENG. / PR.TECH./PR. ARCH
NAME: C PYM — DATE: '20 02 17
SIGNATURE
REG. NUMBER: 201270126
SCALE : N.T.S. — A0

Transnet Capital Projects
TRANSNET LTD (TRADING AS TRANSNET CAPITAL PROJECTS) : REG. NO. 1990/000900/06
TABLE BAY BUILDING, TYGERBERG PARK,
163 UYS KRIGE DRIVE, PLATTEKLOOF,
8001
TEL: 021 940 1999
FAX: 086 677 2455

PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
66 kV BRANCH LINE MASTS - SUBSTATION GANTRY
PHASE CONDUCTOR STRAIN CONFIGURATION (TYPICAL)

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	300	E	DE	0082	01	00	AE



LEGEND :

- EXISTING ESKOM 66kV OVERHEADLINE LINE MAST AND FOUNDATION STRUCTURE
- NEW ESKOM 66kV OVERHEADLINE LINE MAST AND FOUNDATION STRUCTURE
- EXISTING ESKOM 66kV OVERHEAD LINES
- NEW ESKOM 66kV OVERHEAD BRANCH LINES

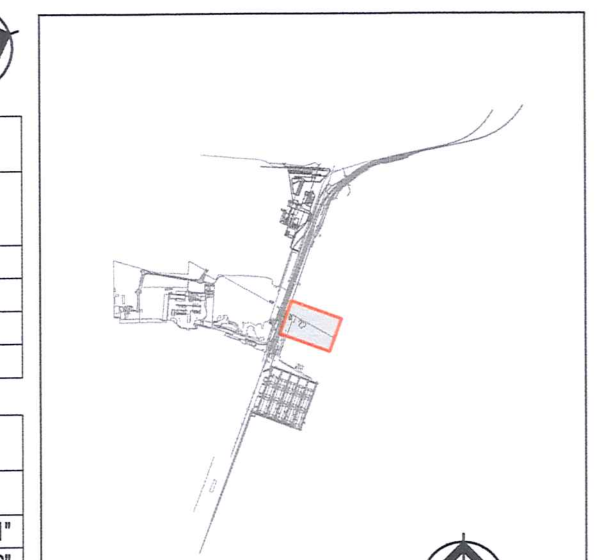
NOTES :

1. FINAL CO-ORDINATES PROVIDED SHALL BE CONFIRMED WITH THE EMPLOYER PRIOR TO SETTING OUT ON SITE

CLEARANCES TABLE

BETWEEN MAST NUMBERS	MINIMUM END STATE VERTICAL CLEARANCE FROM FINAL GROUND LEVEL TO LOWEST CONDUCTOR (INITIAL CLEARANCES WILL BE MORE) (m)
1 BLO / ISC 32 and 1 & 2 BLO / ISC 32 / 1	13.17
2 BLO / ISC 32 and 1 & 2 BLO / ISC 32 / 1	20.90
1 BLO / ISC 32 / 2 and YSTERVARK SUBSTATION GANTRY	10.14
2 BLO / ISC 32 / 2 and YSTERVARK SUBSTATION GANTRY	10.67

	CO-ORDINATES (WGS 84 : Lo 18)		CO-ORDINATES (WGS 84 : Lo 19)			
MAST NUMBER	X EASTING	Y NORTHING	X EASTING	Y NORTHING	LATITUDE	LONGITUDE
1 BLO / ISC 32	324.819	-3652133.838	-93136.16	-3652574.92	S032° 59' 40.06"	E018° 00' 12.51"
2 BLO / ISC 32	336.434	-3652153.257	-93124.36	-3652594.23	S032° 59' 40.69"	E018° 00' 12.96"
1 & 2 BLO / ISC 32 / 1	332.738	-3652252.786	-93127.11	-3652693.80	S032° 59' 43.92"	E018° 00' 12.82"
1 BLO / ISC 32 / 2	278.195	-3652377.540	-93180.47	-3652819.08	S032° 59' 47.97"	E018° 00' 10.72"
2 BLO / ISC 32 / 2	275.835	-3652402.816	-93182.59	-3652844.38	S032° 59' 48.79"	E018° 00' 10.63"



KEYPLAN

SCALE: NTS

NOTES

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2. THE CONTRACTOR SHALL VERIFY ALL CONDITIONS, DIMENSIONS AND LEVELS ON THE SITE AND NOTIFY THE NEC SUPERVISOR OF ANY VARIATIONS BEFORE CONSTRUCTION.

DRAWING NO.	REFERENCE
.	.

REFERENCE DRAWINGS

NO.	DESCRIPTION	BY	CHKD	APPD	DATE
03	ISSUED FOR CONSTRUCTION. ALL MAST NUMBERS REVISED. MASTS 1 BLO/ISC 33 AND 2 BLO/ISC 33 ADDED.	DD	CP	CP	2012-02-17
02	ISSUED FOR CONSTRUCTION. CLEARANCES REVISED	DEM	BS	CP	2019-08-19
01	ISSUED FOR CONSTRUCTION : • CO-ORDINATE TABLE ADDED; • NEW MAST NUMBERS ADDED WHERE APPLICABLE; & • HOLD CLOUD ADDED	KS	BS	CP	2018-05-08
00	ISSUED FOR CONSTRUCTION	KS	BS	CP	2018-04-16

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE		
DRAWN	DD	[signature]	'20	02	17
CHECKED	KS	[signature]	'20	02	17
DESIGNED	NM	[signature]	'20	02	17
CHECKED	CP	[signature]	'20	02	17

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE
.	.		. . .

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE
.	.		. . .

PR.ENG. / PR.TECH./PR. ARCH

NAME: C PYM

SIGNATURE: [signature] DATE: '20 02 17

REG. NUMBER: 201270126

SCALE : 1 : 200 A2

Transnet Capital Projects

TRANSNET LTD (TRADING AS TRANSNET CAPITAL PROJECTS) : REG. NO. 1990/000900/06

TABLE BAY BUILDING, TYGERBERG PARK, 163 UYS KRIGE DRIVE, PLATTEKLOOF, 8001

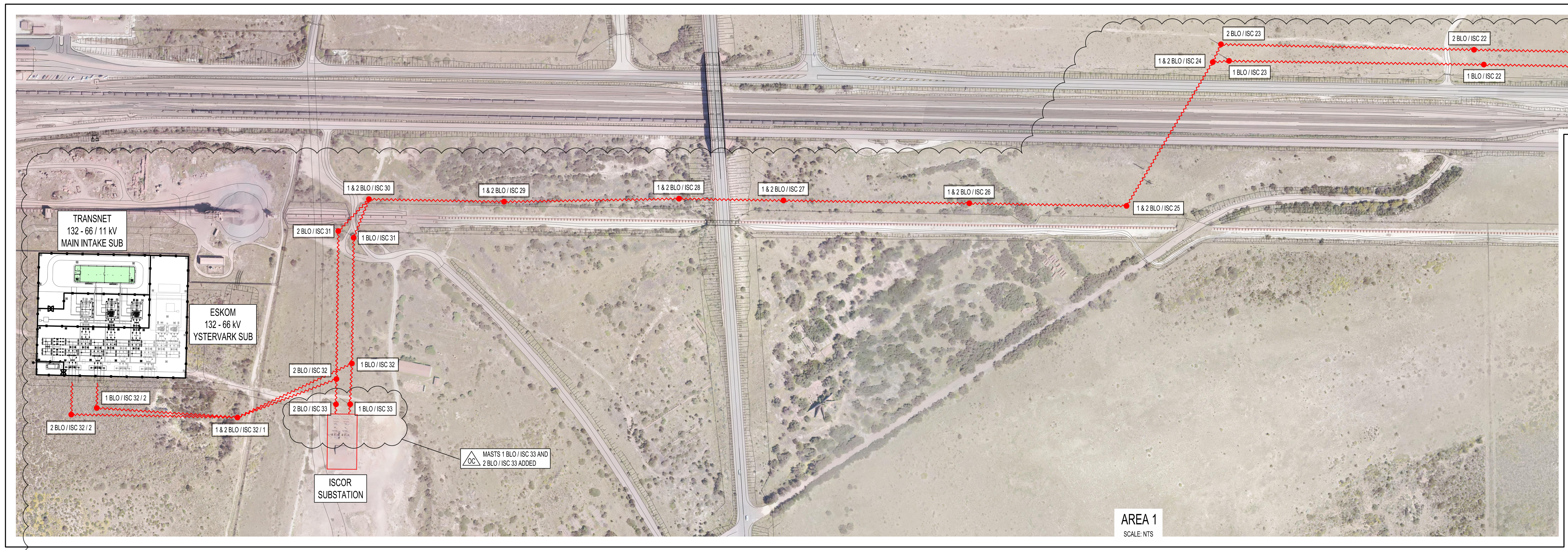
TEL: 021 940 1999 FAX: 086 677 2455

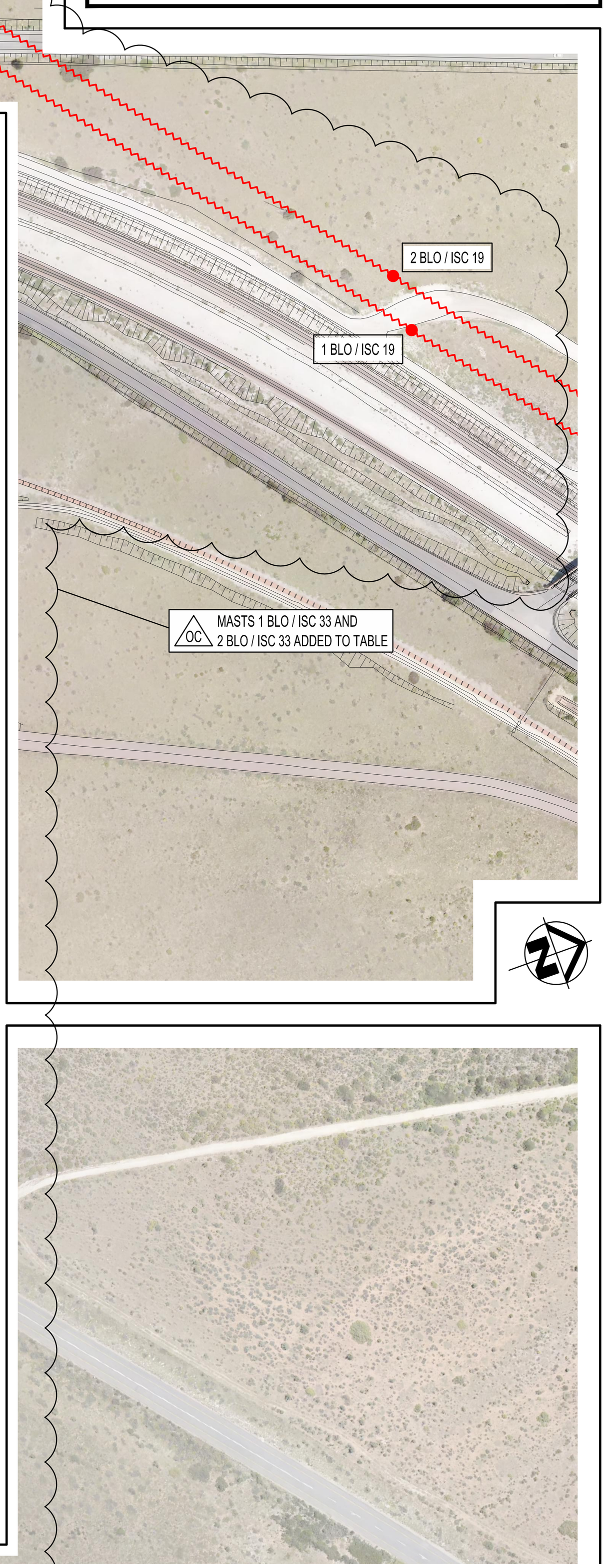
TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT BULK POWER UPGRADE : 66kV BRANCH LINE MAST POSITIONS & CLEARANCES

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
192470 1	2	300	E	LA	0062	01	03	AE

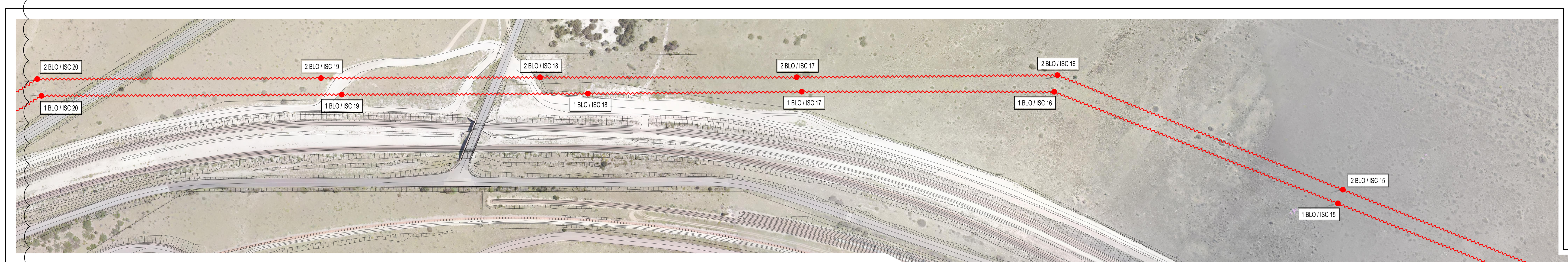




LEGEND:

- STEEL MONOPOLE STRUCTURE
- LATTICE STRUCTURE
- OVERHEAD LINE

MAST NUMBER	CO-ORDINATES (WGS 84 : Lo 19)		CO-ORDINATES (WGS 84 : Lo 18)		STRUCTURE TYPE (SELF SUPPORTING)	INTERMEDIATE / STRAIN ON PHASES	INTERMEDIATE / STRAIN ON SHIELD WIRE(S)	SINGLE / DOUBLE CIRCUIT
	X	Y	X	Y				
1 BLO / ISC 33	-93102.520	-36552567.290	357.6550	-36523146.156	STEEL MONOPOLE (TERMINAL)	STRAIN	STRAIN	SINGLE
2 BLO / ISC 33	-93107.340	-3652600.4300	352.8280	-3652160.3880	STEEL MONOPOLE (TERMINAL)	STRAIN	STRAIN	SINGLE
1 BLO / ISC 32 / 2	-93180.356	-3652818.994	278.310	-3652377.455	STEEL MONOPOLE (TERMINAL)	STRAIN	STRAIN	SINGLE
2 BLO / ISC 32 / 2	-93182.545	-3652844.264	275.881	-3652402.700	STEEL MONOPOLE (TERMINAL)	STRAIN	STRAIN	SINGLE
1 & 2 BLO / ISC 32 / 1	-93127.027	-3652693.792	332.821	-3652252.779	STEEL MONOPOLE	STRAIN	STRAIN	DOUBLE
1 BLO / ISC 32	-93139.915	-3652572.442	321.088	-3652131.325	STEEL MONOPOLE (T-OFF)	STRAIN	STRAIN	SINGLE
2 BLO / ISC 32	-93130.592	-3652591.488	330.229	-3652150.457	STEEL MONOPOLE (T-OFF)	STRAIN	STRAIN	SINGLE
1 BLO / ISC 31	-93253.945	-3652530.911	207.470	-3652088.716	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
2 BLO / ISC 31	-93264.828	-3652542.811	196.476	-3652100.511	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
1 & 2 BLO / ISC 30	-93284.213	-3652504.770	177.455	-3652062.292	STEEL MONOPOLE	STRAIN	STRAIN	DOUBLE
1 & 2 BLO / ISC 29	-93239.007	-3652382.473	223.817	-3651940.443	STEEL MONOPOLE	STRAIN	STRAIN	DOUBLE
1 & 2 BLO / ISC 28	-93186.138	-3652222.274	278.200	-3651780.771	STEEL MONOPOLE	STRAIN	STRAIN	DOUBLE
1 & 2 BLO / ISC 27	-93151.328	-3652127.669	313.904	-3651686.511	STEEL MONOPOLE	STRAIN	STRAIN	DOUBLE
1 & 2 BLO / ISC 26	-93089.725	-3651959.360	377.097	-3651518.813	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	DOUBLE
1 & 2 BLO / ISC 25	-93037.424	-3651817.053	430.742	-3651377.025	STEEL MONOPOLE	STRAIN	STRAIN	DOUBLE
1 & 2 BLO / ISC 24	-93141.129	-3651692.950	328.232	-3651251.955	STEEL MONOPOLE	STRAIN	STRAIN	DOUBLE
1 BLO / ISC 23	-93136.943	-3651677.625	332.563	-3651236.672	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
2 BLO / ISC 23	-93154.631	-3651679.669	314.858	-3651238.548	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
1 BLO / ISC 22	-93052.683	-3651446.777	419.004	-3651006.660	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
2 BLO / ISC 22	-93069.333	-3651451.035	402.316	-3651010.759	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
1 BLO / ISC 21	-92966.860	-3651213.493	507.030	-3650774.227	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
2 BLO / ISC 21	-92982.242	-3651214.941	491.637	-3650775.528	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
1 BLO / ISC 20	-92886.622	-3650998.742	589.296	-3650560.270	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
2 BLO / ISC 20	-92899.818	-3650988.674	576.198	-3650550.079	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
1 BLO / ISC 19	-92659.546	-3650819.116	818.044	-3650382.829	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
2 BLO / ISC 19	-92685.098	-3650818.975	792.497	-3650382.445	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
1 BLO / ISC 18	-92473.416	-3650672.011	1005.544	-3650237.514	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
2 BLO / ISC 18	-92519.251	-3650687.945	959.564	-3650253.010	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
1 BLO / ISC 17	-92312.197	-3650543.152	1167.962	-3650110.206	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
2 BLO / ISC 17	-92324.619	-3650535.276	1155.617	-3650102.213	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
1 BLO / ISC 16	-92120.587	-3650392.971	1360.970	-3649961.868	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
2 BLO / ISC 16	-92128.017	-3650378.415	1353.680	-3649947.243	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
1 BLO / ISC 15	-91839.002	-3650308.767	1643.313	-3649880.351	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
2 BLO / ISC 15	-91843.414	-3650295.448	1639.028	-3649866.992	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
1 BLO / ISC 14	-91596.246	-3650237.332	1886.712	-3649811.232	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
2 BLO / ISC 14	-91603.669	-3650224.535	1879.411	-3649798.367	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
1 BLO / ISC 13	-91329.704	-3650159.504	2153.953	-3649735.948	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
2 BLO / ISC 13	-91330.453	-3650142.822	2153.363	-3649719.261	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
1 BLO / ISC 12	-91070.032	-3650209.473	2413.112	-3649788.376	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
2 BLO / ISC 12	-91069.076	-3650195.468	2414.201	-3649774.382	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
1 BLO / ISC 11	-90895.548	-3650243.885	2587.244	-3649824.440	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
2 BLO / ISC 11	-90884.338	-3650231.838	2598.567	-3649812.501	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
1 BLO / ISC 10	-90739.708	-3650274.684	2742.768	-3649856.715	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
2 BLO / ISC 10	-90690.323	-3650270.078	2792.190	-3649852.579	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
1 BLO / ISC 09	-90558.933	-3650311.117	2923.171	-3649894.860	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
2 BLO / ISC 09	-90554.647	-3650295.624	2927.603	-3649879.410	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
1 & 2 BLO / ISC 08	-90455.803	-3650314.532	3026.253	-3649899.254	LATTICE TOWER	INTERMEDIATE	INTERMEDIATE	DOUBLE
1 & 2 BLO / ISC 07	-90295.005	-3650331.765	3186.864	-3649918.012	LATTICE TOWER	STRAIN	STRAIN	DOUBLE
1 & 2 BLO / ISC 06	-90038.116	-3650439.110	3442.696	-3650027.781	LATTICE TOWER	INTERMEDIATE	INTERMEDIATE	DOUBLE
1 & 2 BLO / ISC 05	-89805.709	-3650535.992	3674.149	-3650126.857	LATTICE TOWER	INTERMEDIATE	INTERMEDIATE	DOUBLE
1 & 2 BLO / ISC 04	-89558.987	-3650639.366	3919.854	-3650232.560	LATTICE TOWER	STRAIN	STRAIN	DOUBLE
1 BLO / ISC 03	-89394.170	-3650863.971	4082.514	-3650458.698	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
2 BLO / ISC 03	-89379.580	-3650855.152	4097.185	-3650450.019	STEEL MONOPOLE	STRAIN	STRAIN	SINGLE
1 BLO / ISC 02	-89218.048	-3651000.134	4257.317	-3650596.515	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
2 BLO / ISC 02	-89209.716	-3650988.569	4265.757	-3650585.031	STEEL MONOPOLE	INTERMEDIATE	INTERMEDIATE	SINGLE
1 BLO / ISC 01	-89039.140	-3651140.160	4434.869	-3650738.220	STEEL MONOPOLE (TERMINAL)	STRAIN	STRAIN	SINGLE
2 BLO / ISC 01	-89029.761	-3651129.900	4444.344	-3650728.051	STEEL MONOPOLE (TERMINAL)	STRAIN	STRAIN	SINGLE



DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

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3. THIS DRAWING SHALL ONLY BE USED FOR INFORMATION PURPOSES AND IS SUBJECT TO CHANGE.

AECOM

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REG. No. 1966/006628/07

NO.	DESCRIPTION	BY	CHKD	APPD	DATE
OC	ISSUED FOR INFORMATION. ALL MAST NUMBERS REVISED	DD	CP	CP	2020-02-19
OB	ISSUED FOR INFORMATION	KS	BS	CP	2018-12-04
OA	ISSUED FOR INTERNAL REVIEW	KS	BS	CP	2018-12-03

REVISIONS

CONTRACTOR / CONSULTANT

TITLE	NAME	SIGN	DATE
DRAWN	DD		'20 02 19
CHECKED	KS		'20 02 19
DESIGNED	NM		'20 02 19
CHECKED	CP		'20 02 19

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS

TITLE	NAME	SIGN	DATE

PR.ENG. / PR.TECH./PR. ARCH

NAME	C PYM	DATE
SIGNATURE		'20 02 19
REG. NUMBER	201270126	
SCALE :	AS SHOWN	A0

Transnet Capital Projects
TRANSNET LTD (TRADING AS TRANSNET CAPITAL PROJECTS) : REG. NO. 1990/000900/06
TABLE BAY BUILDING, TYGERBERG PARK,
163 UYS KRIGE DRIVE, PLATTEKLOOF,
8001
TEL: 021 940 1999
FAX: 086 677 2455

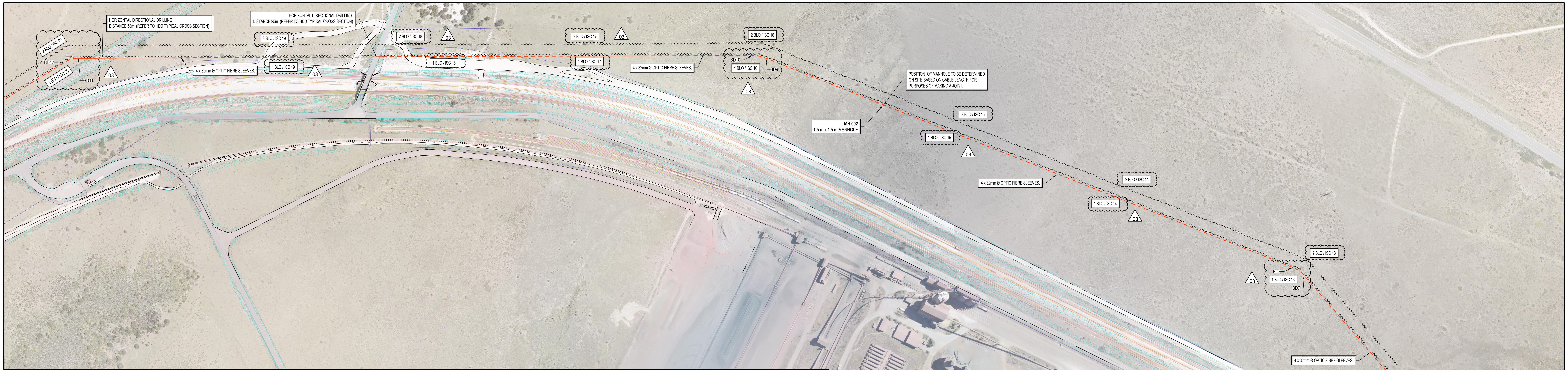
TRANSNET

PORT OF SALDANHA

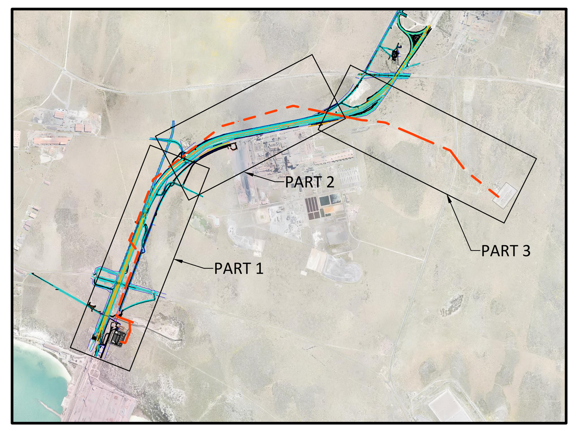
IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE :
ESKOM BLOUWATER-ISCOR
66 kV OVERHEAD LINE - OVERALL LAYOUT

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1 9 2 4 7 0 1	2	3 0 0	E	L A	0 0 6 3	0 1	O C	AE

DETAIL LAYOUT - PART 1
SCALE 1:2000




DETAIL LAYOUT - PART 2
SCALE 1:2000



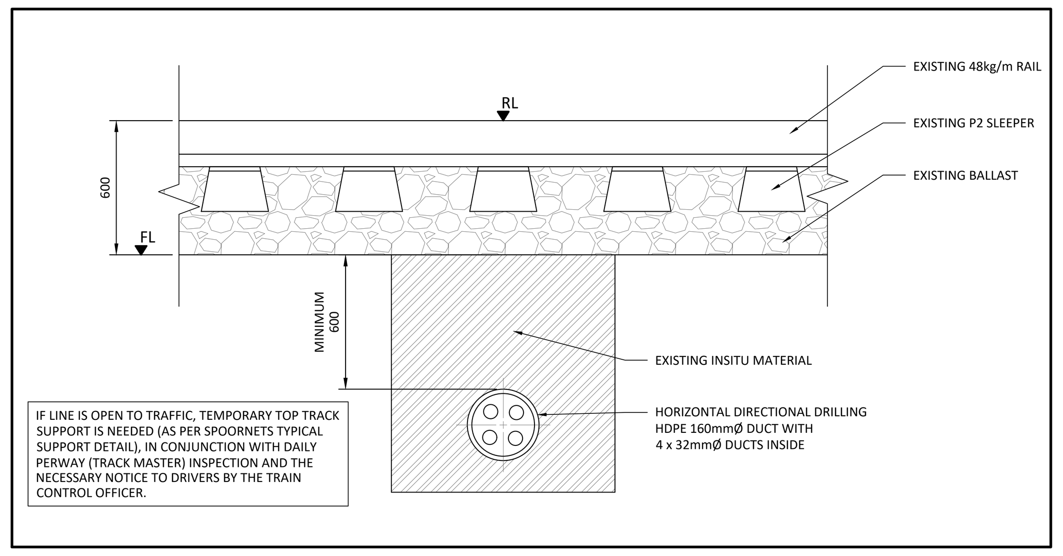
KEY PLAN
SCALE 1:2000

COORDINATES		
POINT	Y	X
MH 001	-4 450.226	3 650 753.374
MH002	-1 543.574	3 649 911.923
MH003	-324.187	3 651 236.228
MH004	-427.405	3 651 377.579
MH005	-172.818	3 652 066.113
MH006	-326.781	3 652 141.407

03

BEND IN FIBRE SLEEVES		
POINT	Y	X
BD1	-3 650.461	4.083
BD2	-3 650.246	3.921
BD3	-3 650.234	3.906
BD4	-3 649.928	3.195
BD5	-3 649.923	3.176
BD6	-3 649.897	2.923
BD7	-3 649.740	2.164
BD8	-3 649.741	2.144
BD9	-3 649.961	1.372
BD10	-3 649.970	1.354
BD11	-3 650.555	0.599
BD12	-3 650.571	0.588
BD13	-3 651.008	0.422
BD14	-3 652.378	0.282
BD15	-3 652.384	0.269
BD16	-3 652.095	0.202

03



HORIZONTAL DIRECTIONAL DRILLING
TYPICAL CROSS SECTION
SCALE : 1:20

LEGEND:

- MANHOLE
- 4 x 32mm Ø SLEEVES
- 1 x 160mm Ø SLEEVE - HORIZONTAL DIRECTIONAL DRILLING (HDD)

DRAWING NO.	REFERENCE

REFERENCE DRAWINGS

NOTES

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4. REFER TO TECHNICAL SPECIFICATIONS DOCUMENT No. 1924701-2-300-C-SP-0001 FOR ALL CIVIL SPECIFICATIONS.

5. REFER TO WORKS INFORMATION AND SITE INFORMATION DOCUMENTS FOR INFORMATION REGARDING THE FOLLOWING:
   a) SITE CONDITIONS
   b) FULL DESCRIPTION OF WORKS
   c) CONTRACTOR'S DESIGN
   d) OTHER CONTRACT PACKAGES THAT MAY TALE PLACE BEFORE, DURING OR AFTER THIS CONTRACT.
   e) WORKS BY OTHERSS

6. ACTUAL POSITION OR NEED FOR THIS MANHOLE SHALL BE DETERMINED ON SITE IN CONSULTATION WITH THE INSTALLATION CONTRACTOR, AND OMITTED IF NOT REQUIRED.

03

AECOM

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FAX: +27 (0)21 950 7502
REG. No. 1966/006628/07

NO.	DESCRIPTION	BY	CHKD	APPD	DATE
03	MANHOLE MH 007 OMITTED. ROUTE BETWEEN ISKOR SUBSTATION AND NEW MAIN INTAKE SUBSTATION REVISED, NOTE 6 ADDED, SLOW BENDS SETTING OUT ADDED, MANHOLE SETTING OUT REVISED & POLE NUMBERS REVISED.	CW	FvL	FR	2020-04-02
02	MANHOLES OMITTED	CW	FvL	FR	2020-03-19
01	HORIZONTAL DIRECTIONAL DRILLING TYPICAL CROSS SECTION ADDED, LEGEND AMENDED AND HDD PLAN LAYOUT NOTES UPDATED	CW	FvL	FR	2020-02-12
00	ISSUED FOR CONSTRUCTION	CW	JVB	FR	2019-11-01

REVISIONS

CONTRACTOR / CONSULTANT			
TITLE	NAME	SIGN	DATE
DRAWN	C.W.		20 04 02
CHECKED	F.v.L.		20 04 02
DESIGNED	F.v.L.		20 04 02
CHECKED	F.R.		20 04 02

OPERATING DIVISIONS			
TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS			
TITLE	NAME	SIGN	DATE
DRAWN			
CHECKED			
DESIGNED			
CHECKED			

PR.ENG. / PR.TECH./PR. ARCH		
NAME	F RICKETTS	DATE
SIGNATURE		20 04 02
REG. NUMBER	201270037	
SCALE :	AS SHOWN	A0

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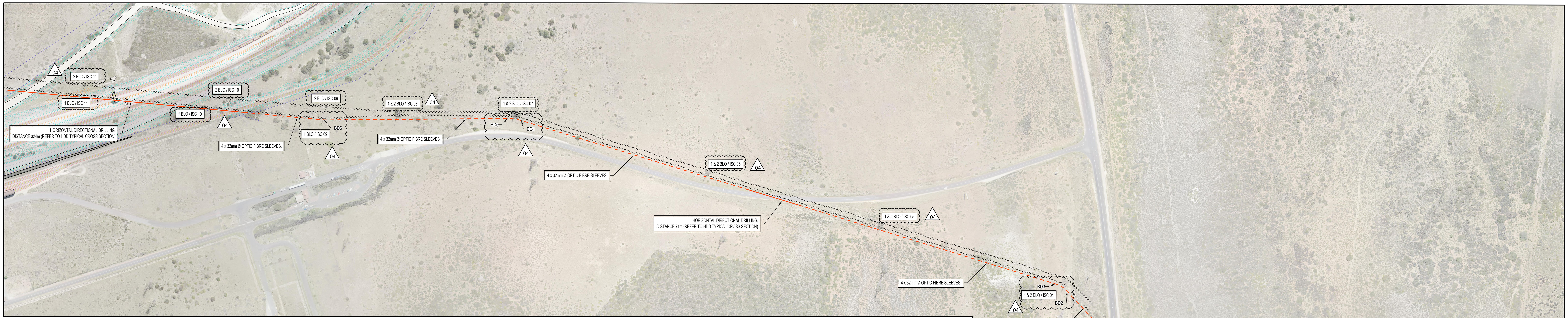
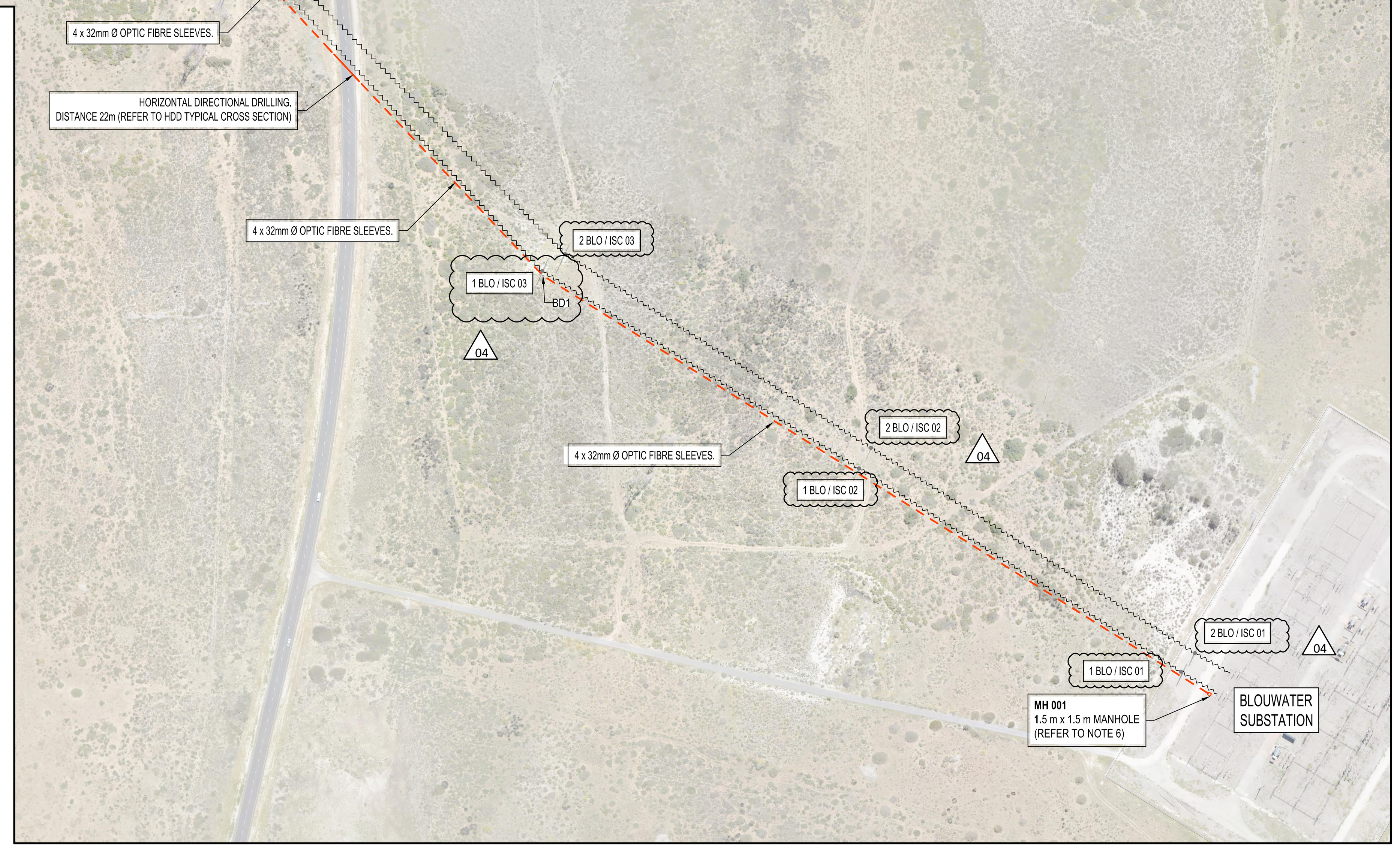
TABLE BAY BUILDING, TYGERBERG PARK,
163 UYS KRIGE DRIVE, PLATTEKLOOF, 8001
TEL: 021 940 1999
FAX: 086 677 2455
TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT BULK POWER UPGRADE: ESKOM BLOUWATER - ISCOR OPTIC FIBRE LINE - SHEET 1

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1 9 2 4 7 0 1	2	3 3 0	C	L A	0 0 0 1	0 1	0 3	AE





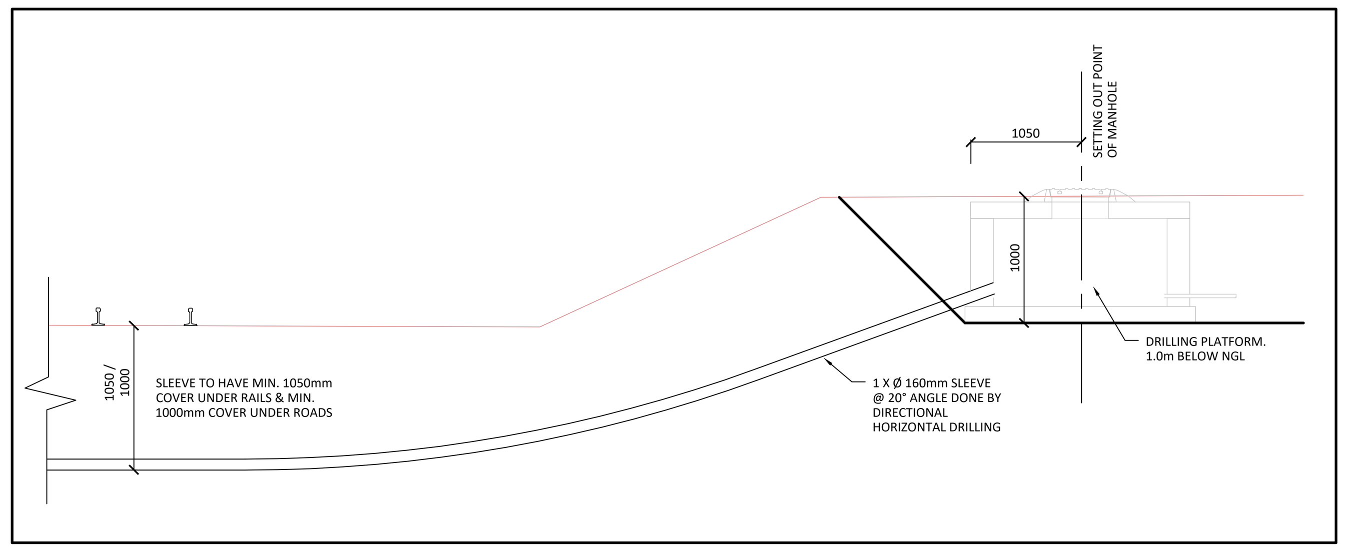
DETAIL LAYOUT - PART 3
SCALE 1:2000

COORDINATES		
POINT	Y	X
MH 001	-4 450.226	3 650 753.374
MH002	-1 543.574	3 649 911.923
MH003	-324.187	3 651 236.228
MH004	-427.405	3 651 377.579
MH005	-172.818	3 652 066.113
MH006	-326.781	3 652 141.407

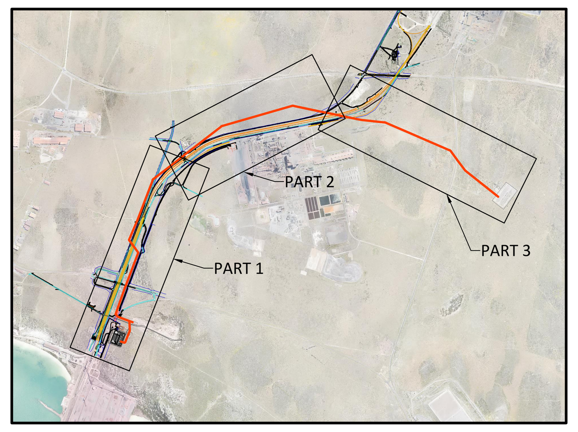
04

BEND IN FIBRE SLEEVES		
POINT	Y	X
BD1	-3 650.461	4.083
BD2	-3 650.246	3.921
BD3	-3 650.234	3.906
BD4	-3 649.928	3.195
BD5	-3 649.923	3.176
BD6	-3 649.897	2.923
BD7	-3 649.740	2.164
BD8	-3 649.741	2.144
BD9	-3 649.961	1.372
BD10	-3 649.970	1.354
BD11	-3 650.555	0.599
BD12	-3 650.571	0.588
BD13	-3 651.008	0.422
BD14	-3 652.378	0.282
BD15	-3 652.384	0.269
BD16	-3 652.095	0.202

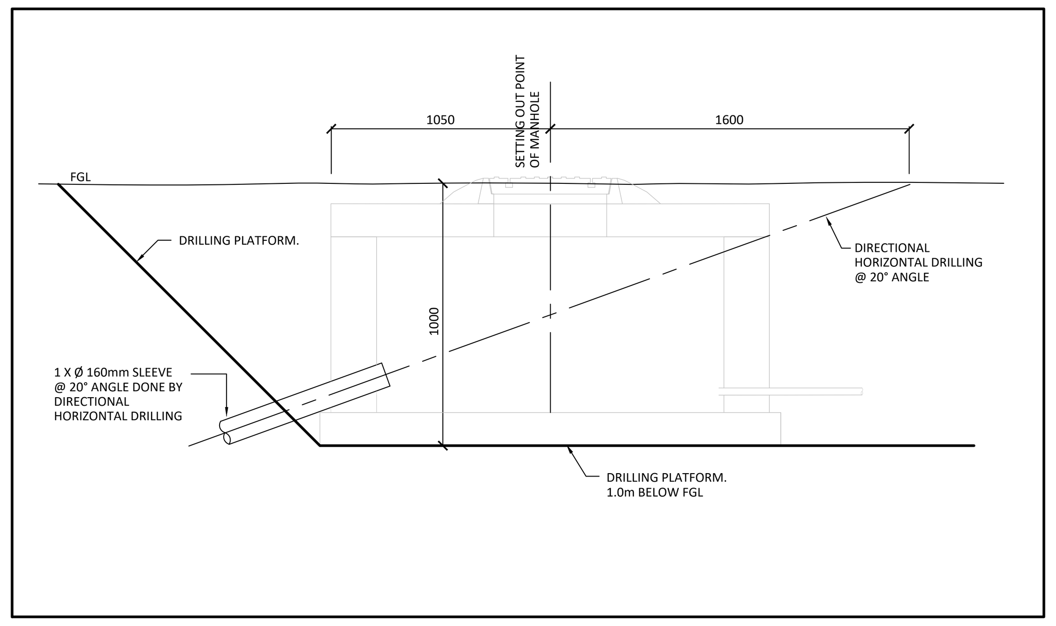
04



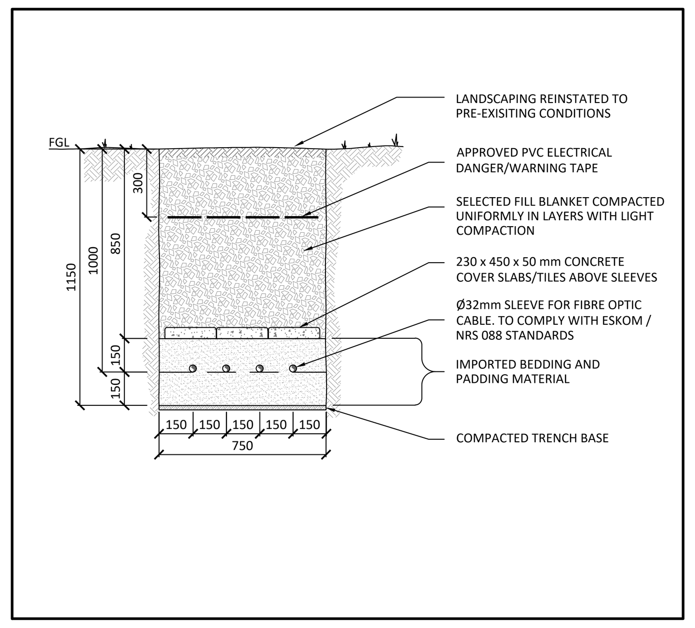
TYPICAL HORIZONTAL DRILLING SECTION
SCALE : NTS



KEY PLAN
SCALE 1:2000



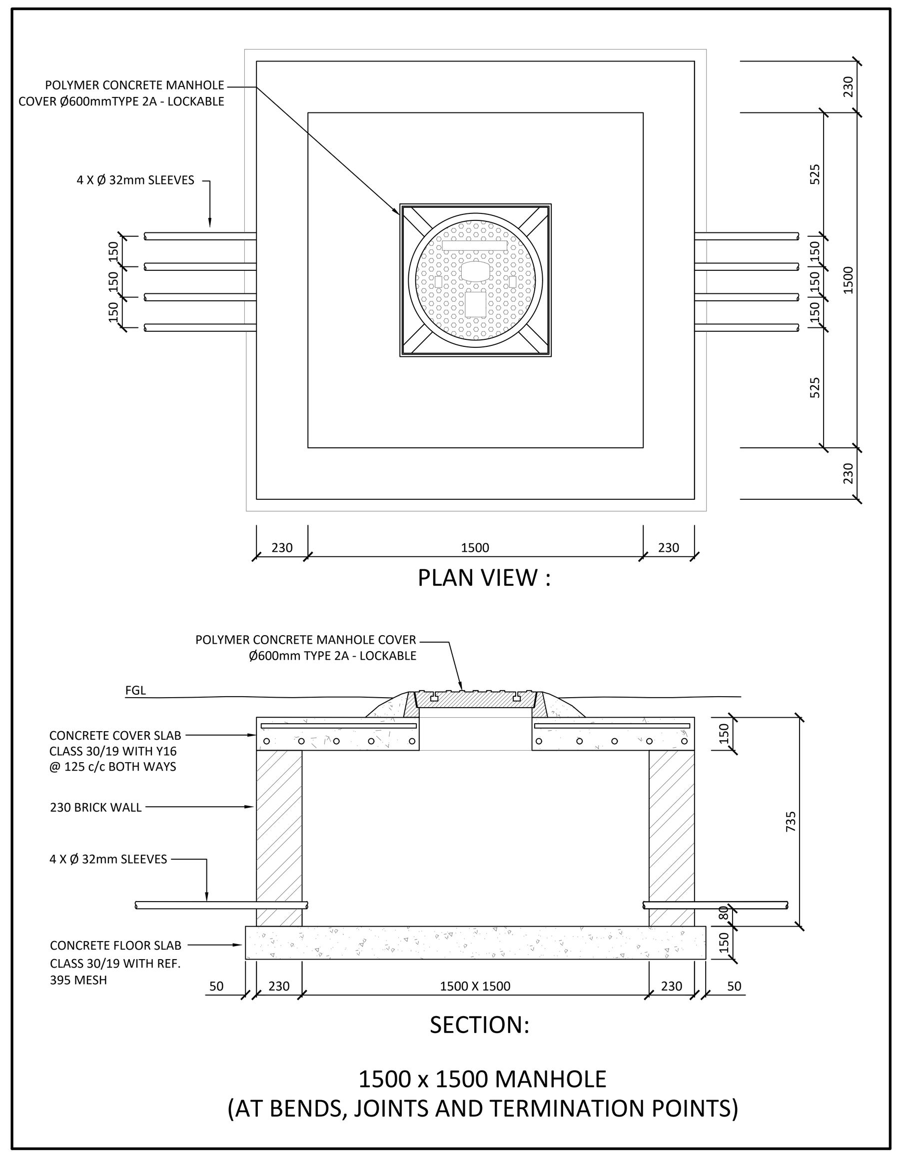
DETAIL AT HORIZONTAL DRILLING
SCALE : NTS



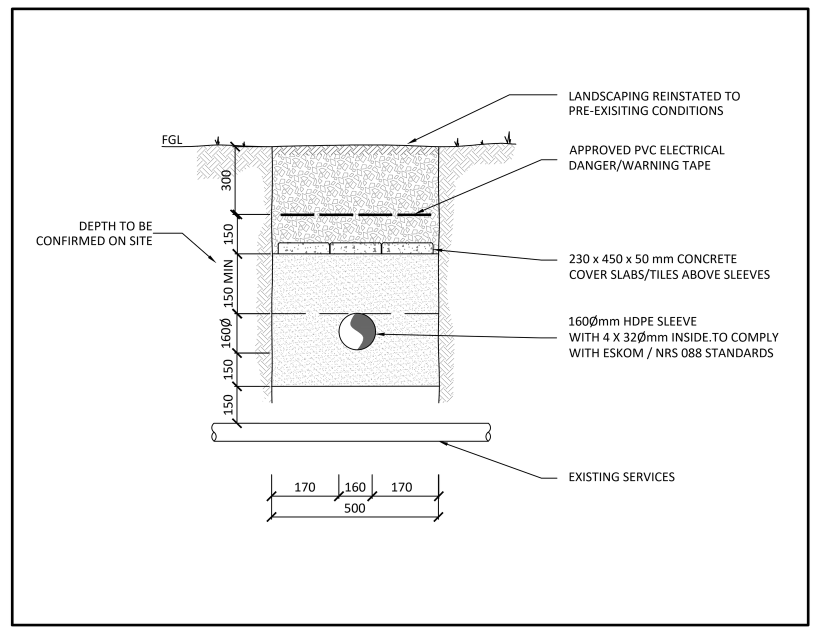
TRENCH DETAIL
SCALE : NTS

LEGEND:

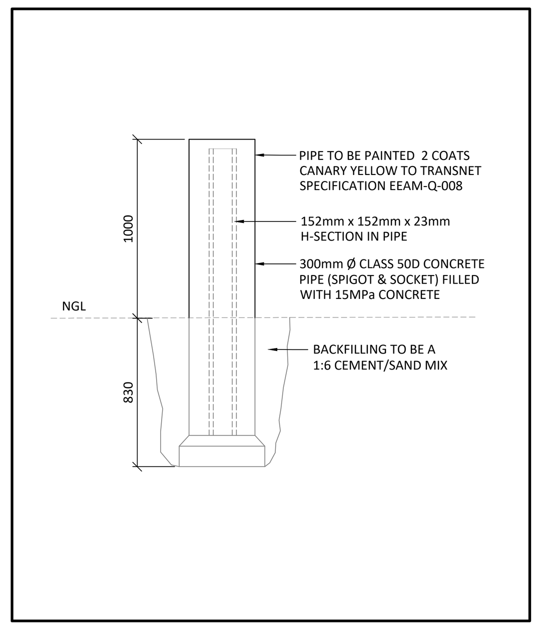
- MANHOLE
- 4 x 32mm Ø SLEEVES
- 1 x 160mm Ø SLEEVE - HORIZONTAL DIRECTIONAL DRILLING (HDD)



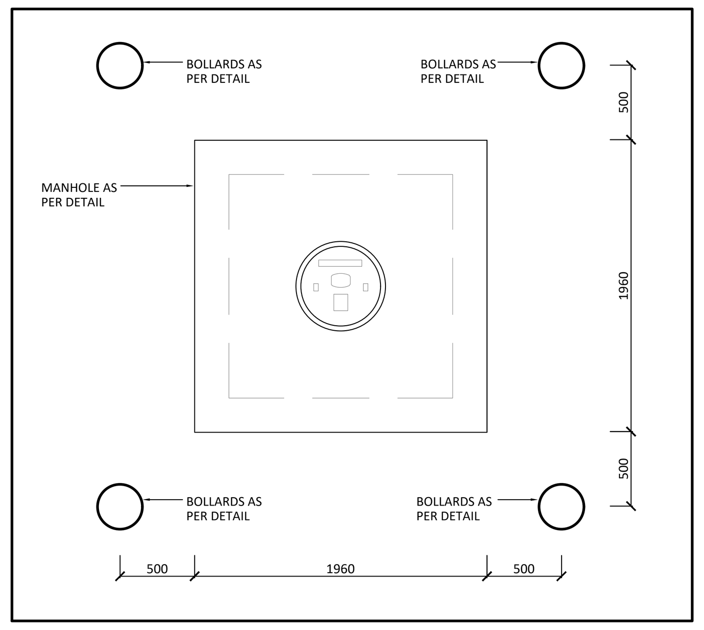
MANHOLE DETAIL
SCALE: NTS



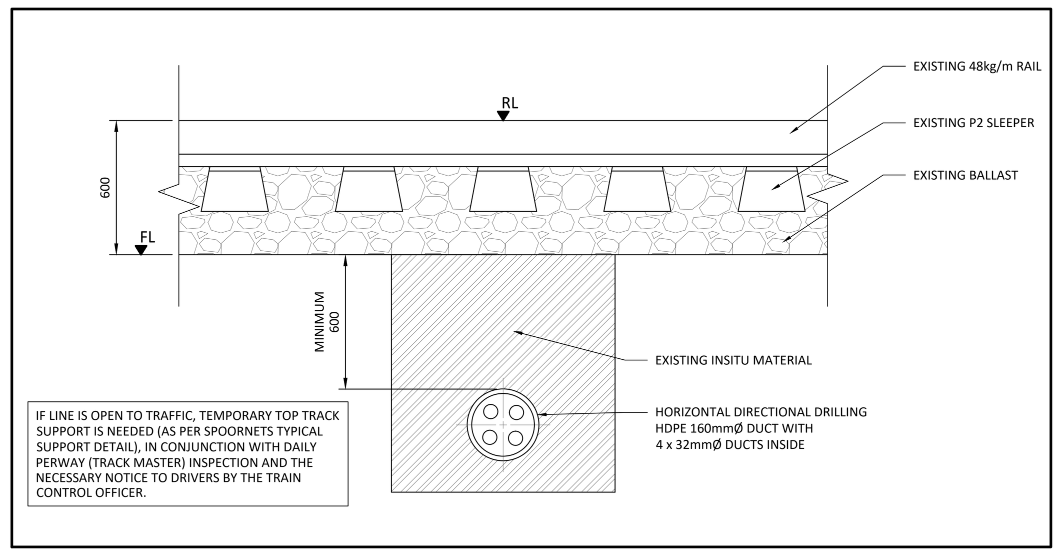
TRENCH DETAIL CROSSING EXISTING SERVICES
SCALE : NTS



BOLLARD DETAIL
SCALE 1:25



BOLLARD PLACING DETAIL
SCALE : NTS



HORIZONTAL DIRECTIONAL DRILLING
TYPICAL CROSS SECTION
SCALE : 1:20

DRAWING NO. | REFERENCE

REFERENCE DRAWINGS

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04

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03	MANHOLES OMITTED	CW	FvL	FR	2020-03-19
02	HORIZONTAL DIRECTIONAL DRILLING TYPICAL CROSS SECTION ADDED, LEGEND AMENDED AND HDD PLAN LAYOUT NOTES UPDATED.	CW	FvL	FR	2020-02-12
01	DIMENSIONS ON DETAIL RECTIFIED	CW	JVB	FR	2019-12-04
00	ISSUED FOR CONSTRUCTION	CW	JVB	FR	2019-11-01

REVISIONS

CONTRACTOR / CONSULTANT					
TITLE	NAME	SIGN	DATE		
DRAWN	C.W.		20	04	02
CHECKED	F.v.L.		20	04	02
DESIGNED	F.v.L.		20	04	02
CHECKED	F.R.		20	04	02

OPERATING DIVISIONS

TITLE	NAME	SIGN	DATE

TRANSNET CAPITAL PROJECTS			
TITLE	NAME	SIGN	DATE
DRAWN			
CHECKED			
DESIGNED			
CHECKED			

PR.ENG. / PR.TECH./PR. ARCH

NAME	F RICKETTS	DATE
SIGNATURE		20 04 02
REG. NUMBER	201270037	
SCALE :	AS SHOWN	A0

Transnet Capital Projects
TRANSNET LTD (TRADING AS TRANSNET CAPITAL PROJECTS) : REG. NO. 1990/000900/06
TABLE BAY BUILDING, TYGERBERG PARK,
163 UYS KRIGE DRIVE, PLATTEKLOOF, 8001
TEL: 021 940 1999
FAX: 086 677 2455

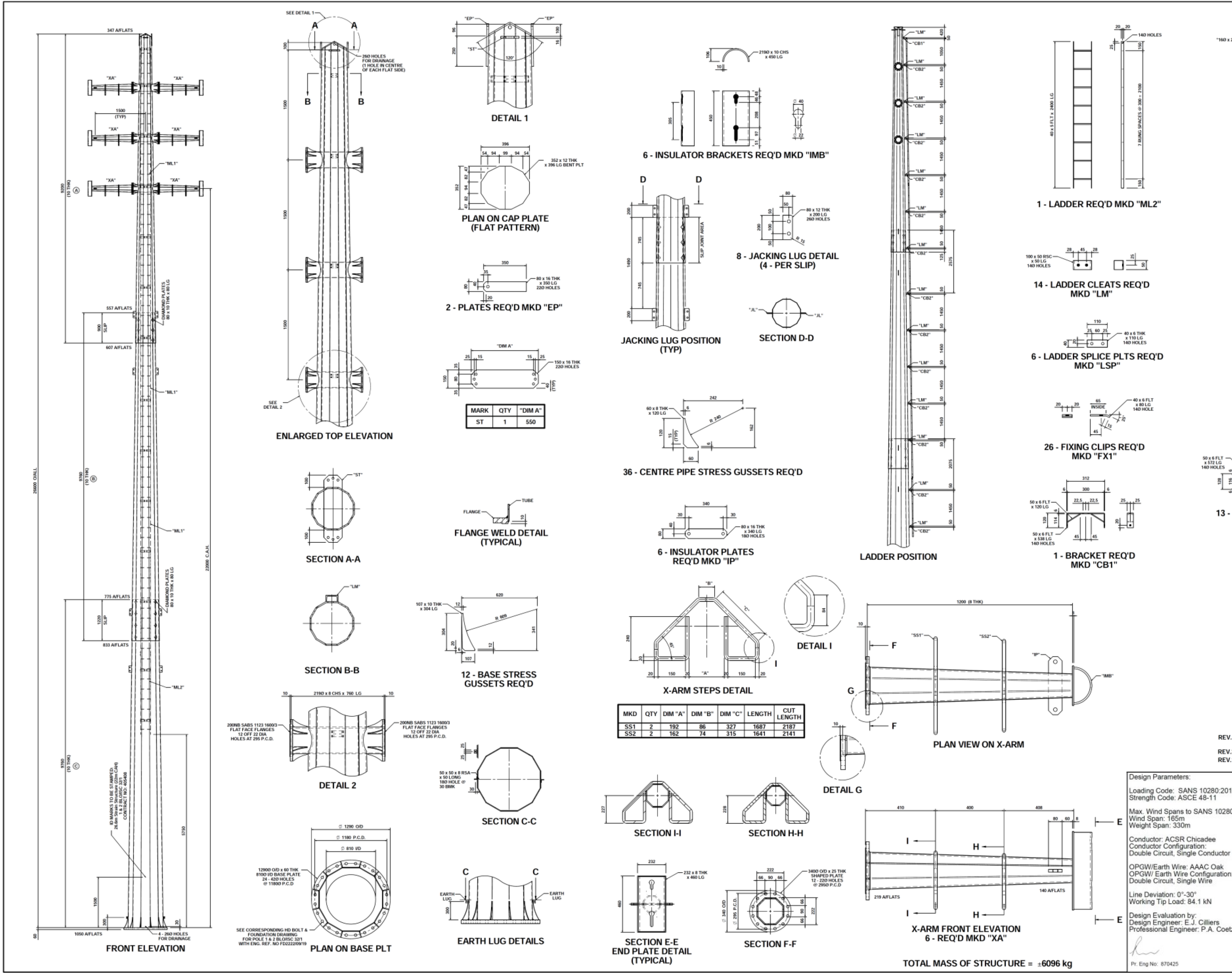
TRANSNET

PORT OF SALDANHA

IRON ORE TIPPLER 3 PROJECT
BULK POWER UPGRADE:
ESKOM BLOUWATER - ISCOR
OPTIC FIBRE LINE - SHEET 2

PROJECT NUMBER	OD	FBS	DIS	TYPE	DRAWING NO.	SHEET	REV	ID
1924701	2	330	C	LA	0001	02	04	AE

13.2. Contractor Received Final Design Drawings (Structures)



MARK	QTY	"DIM A"
ST	1	550

MKD	QTY	DIM "A"	DIM "B"	DIM "C"	LENGTH	CUT LENGTH
SS1	2	192	86	327	1687	2187
SS2	2	162	74	315	1641	2141

TOTAL MASS OF STRUCTURE = ±6096 kg

NOTE :

- ALL MATERIAL TO BE S355JR
- STEELWORK TO BE HOT DIP GALVANISED TO ISO SABS 1461/SANS121
- ALL BOLTS TO BE GRADE 8.8 H.D. GALVANISED
- ALL PARTS AND SHAFTS TO BE CLEARLY MARKED. STAMPING OF MARKS ON SHAFTS TO BE BETWEEN DIAMONDS, BOTTOM SECTION TO BE STAMPED ON POSITION SHOWN.
- TOLERANCES - ON DIMENSIONS = 2mm (OR AS NOTED)
  - ON DRILLING CENTRES = 2mm
- ALL SIDES OF SHAFTS TO BE PARALLEL WITHIN 4mm AS PER PLANS (CHECK SQUARENESS AND DIAGONAL DIMENSIONS)
- STRAIGHTNESS TO BE LENGTH/500mm OVER TOTAL SHAFT SECTION LENGTH
- ALL ANCHOR PLATES TO PROTRUDE A MINIMUM OF 70mm
- ON SEAM WELDING & BACKGRINDING REQUIREMENTS ON SLIP JOINT AREA'S SEE WELD MEMO 15/5/2011 REV.1
- ALL WELDS TO BE 6mm C.F.W. (U.O.N.)
- WELDING TERMS AND SYMBOLS AWS A2.1 - 93 WELDING SPECIFICATION TO AWS D1.1 : 2010 AND OR TO ENGINEERING SPECIFICATIONS: SANS 2001 - CSI : 2005
- STRUCTURE ACCORDING TO ESKOM DSP 34-1683 WHERE APPLICABLE

- IF IN DOUBT: ASK !

REV.3 STRUCTURE NUMBERS REVISED J.H.B. 10/02/'20
REV.2 NOTE ADDED J.H.B. 16/10/'19
REV.1 STRUCTURE HEIGHT INCREASED KEYHOLE BRACKET REVISED J.H.B. 02/10/'19

Design Parameters:

Loading Code: SANS 10280:2012
Strength Code: ASCE 48-11

Max. Wind Spans to SANS 10280:2012
Wind Span: 165m
Weight Span: 330m

Conductor: ACSR Chicadee
Conductor Configuration:
Double Circuit, Single Conductor

OPGW/Earth Wire: AAAC Oak
OPGW/ Earth Wire Configuration:
Double Circuit, Single Wire

Line Deviation: 0°-30°
Working Tip Load: 84.1 kN

Design Evaluation by:
Design Engineer: E.J. Cilliers
Professional Engineer: P.A. Coetzer

Pr. Eng No: 870425

STRUCTA technology
2 DUTTON STREET
MEYERTON, GAUTENG
SOUTH AFRICA
TEL: +27 (16) 362 9100
FAX: +27 (16) 362 9116

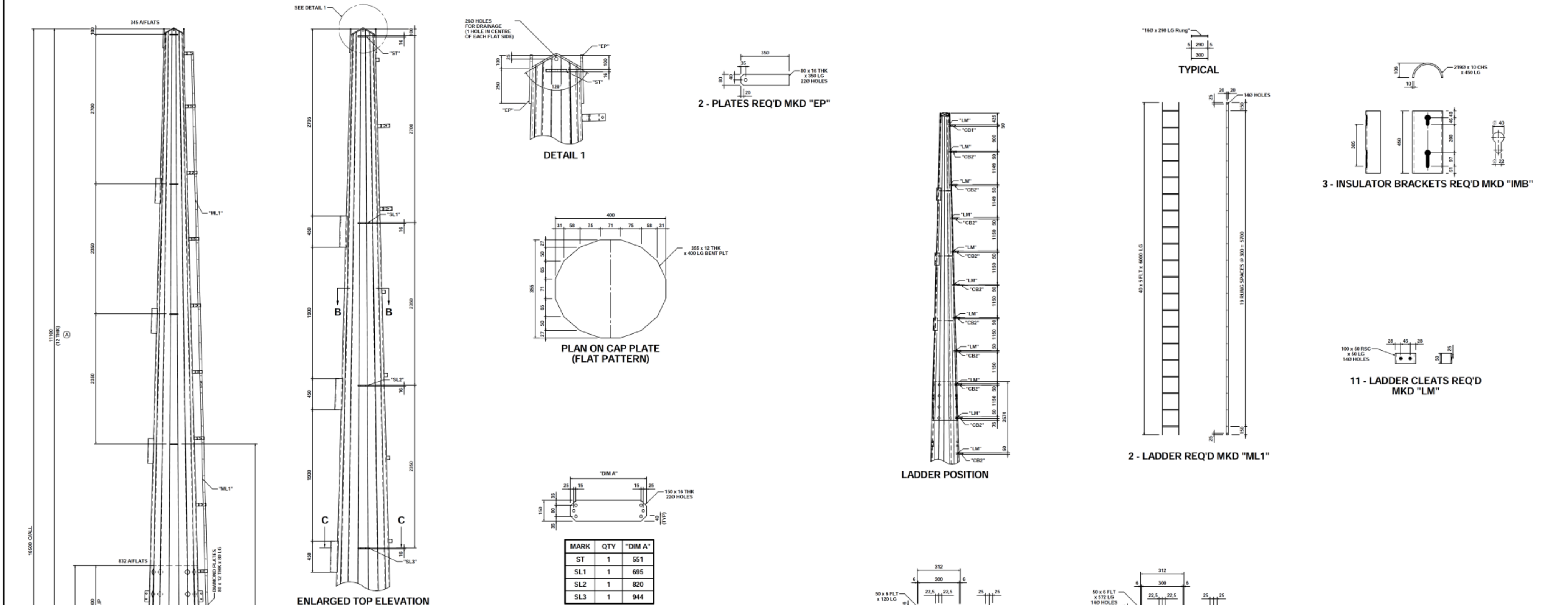
CLIENT: KHATO THENGA JV INC.

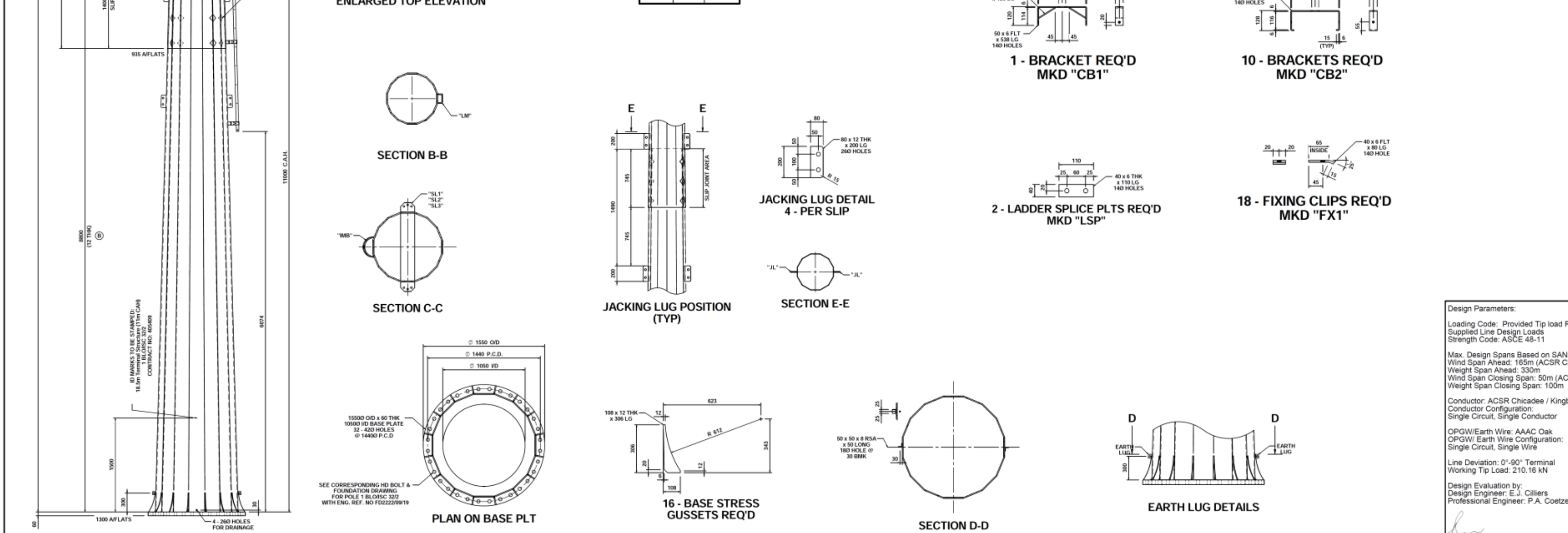
PROJECT: (1 OFF) 26.6m Strain Structure (22m CAH)

1 & 2 BLO/ISC 32/1

TITLE:
GENERAL ARRANGEMENT & DETAILS

		DATE: & SIGNATURE	SCALE:
DRAWN	J.H.B.	SEP 2019	N.T.S.
CHECKED	G.H.	SEP 2019	
CONTRACT NO:	405408		REVISION
DRAWING NO:	1 OF 1		3





MARK	QTY	"DIM A"
ST	1	551
SL1	1	695
SL2	1	820
SL3	1	944

TOTAL MASS OF STRUCTURE = ±5574 kg

NOTE :

- ALL MATERIAL TO BE S355JR
- STEELWORK TO BE HOT DIP GALVANISED TO ISO SABS 1461/SANS121
- ALL BOLTS TO BE GRADE 8.8 H.D. GALVANISED
- ALL PARTS AND SHAFTS TO BE CLEARLY MARKED. STAMPING OF MARKS ON SHAFTS TO BE BETWEEN DIAMONDS, BOTTOM SECTION TO BE STAMPED ON POSITION SHOWN.
- TOLERANCES - ON DIMENSIONS = 2mm (OR AS NOTED)
  - ON DRILLING CENTRES = 2mm
- ALL SIDES OF SHAFTS TO BE PARALLEL WITHIN 4mm AS PER PLANS (CHECK SQUARENESS AND DIAGONAL DIMENSIONS)
- STRAIGHTNESS TO BE LENGTH/500mm OVER TOTAL SHAFT SECTION LENGTH
- ALL ANCHOR PLATES TO PROTRUDE A MINIMUM OF 70mm
- ON SEAM WELDING & BACKGRINDING REQUIREMENTS ON SLIP JOINT AREA'S SEE WELD MEMO 15/5/2011 REV.1
- ALL WELDS TO BE 6mm C.F.W. (U.O.N.)
- WELDING TERMS AND SYMBOLS AWS A2.1 - 93 WELDING SPECIFICATION TO AWS D1.1 : 2010 AND OR TO ENGINEERING SPECIFICATIONS: SANS 2001 - CSI : 2005
- STRUCTURE ACCORDING TO ESKOM DSP 34-1683 WHERE APPLICABLE

- IF IN DOUBT: ASK !

REV.3 STRUCTURE NUMBERS REVISED J.H.B. 10/02/'20
REV.2 NOTE ADDED J.H.B. 16/10/'19
REV.1 STRUCTURE HEIGHT INCREASED KEYHOLE BRACKET DETAIL ADDED & LADDER POSITION REVISED J.H.B. 02/10/'19

Design Parameters:

Loading Code: Provided Tip load Ratings / Supplied Line Design Loads
Strength Code: ASCE 48-11

Max. Design Spans Based on SANS 10280
Wind Span Ahead: 165m (ACSR Chicadee)
Weight Span Ahead: 330m
Wind Span Closing Span: 50m (ACSR Kingbird)
Weight Span Closing Span: 100m

Conductor: ACSR Chicadee / Kingbird
Conductor Configuration:
Single Circuit, Single Conductor

OPGW/Earth Wire: AAAC Oak
OPGW/ Earth Wire Configuration:
Single Circuit, Single Wire

Line Deviation: 0°-90° Terminal
Working Tip Load: 210.16 kN

Design Evaluation by:
Design Engineer: E.J. Cilliers
Professional Engineer: P.A. Coetzer

Pr. Eng. No: 870425

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FAX: +27 (16) 362 9116

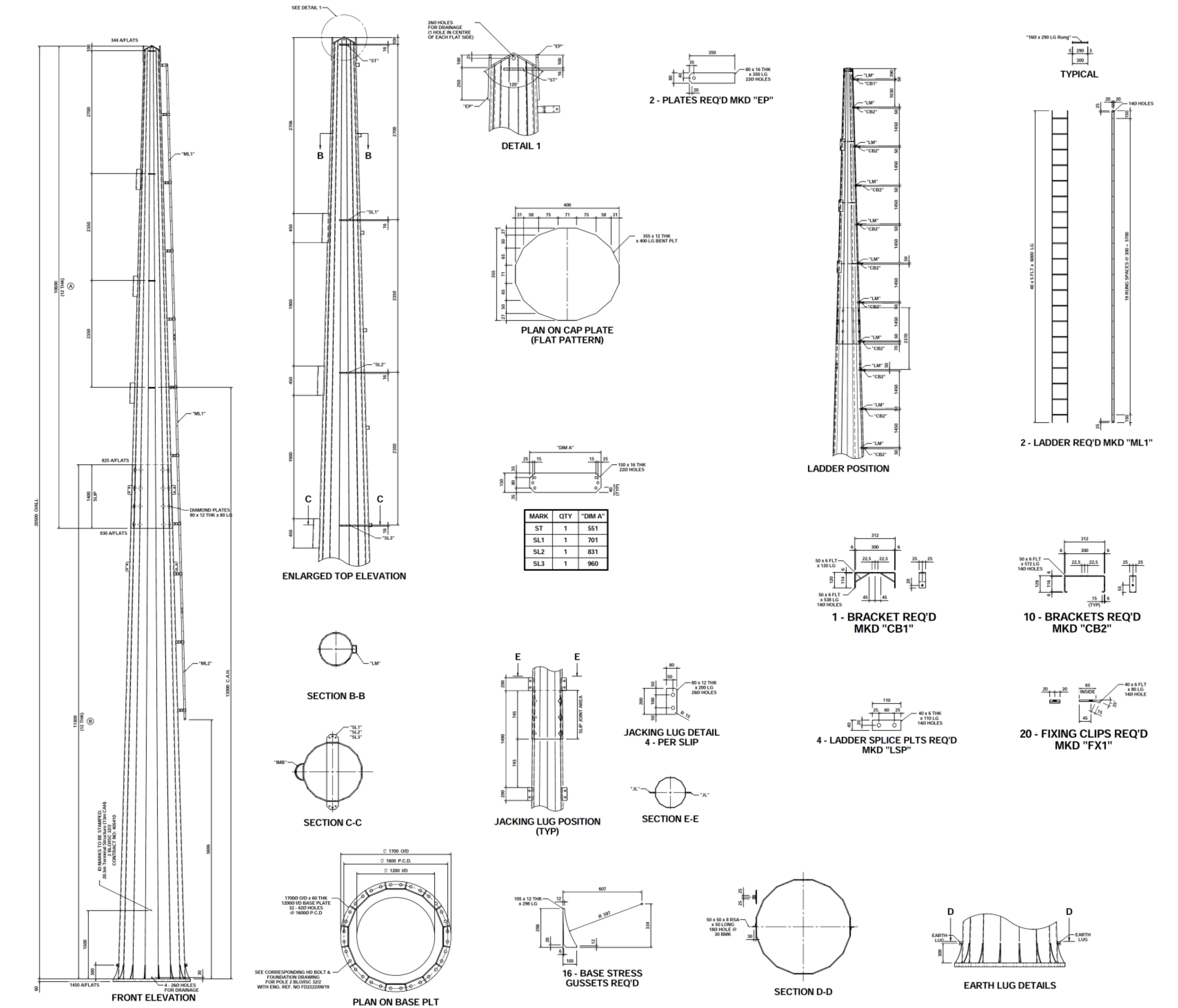
CLIENT: KHATO THENGA JV INC.

PROJECT: (1 OFF) 18.5m Terminal Structure (11m CAH)

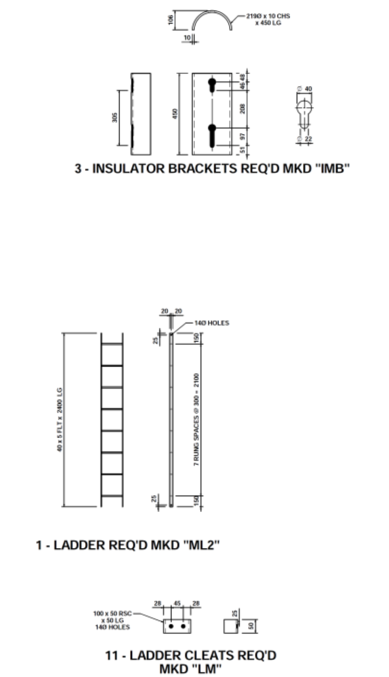
1 BLO/ISC 32/2

TITLE:
GENERAL ARRANGEMENT & DETAILS

		DATE: & SIGNATURE	SCALE:
DRAWN	J.H.B.	SEP 2019	N.T.S.
CHECKED	G.H.	SEP 2019	
CONTRACT NO:	405409		REVISION
DRAWING NO:	1 OF 1		3



MARK	QTY	"DIM A"
ST	1	551
SL1	1	701
SL2	1	831
SL3	1	960



NOTE :

- ALL MATERIAL TO BE S355JR
- STEELWORK TO BE HOT DIP GALVANISED TO ISO SABS 1461/SANS121
- ALL BOLTS TO BE GRADE 8.8 H.D. GALVANISED
- ALL PARTS AND SHAFTS TO BE CLEARLY MARKED. STAMPING OF MARKS ON SHAFTS TO BE BETWEEN DIAMONDS, BOTTOM SECTION TO BE STAMPED ON POSITION SHOWN.
- TOLERANCES - ON DIMENSIONS = 2mm (OR AS NOTED)
  - ON DRILLING CENTRES = 2mm
- ALL SIDES OF SHAFTS TO BE PARALLEL WITHIN 4mm AS PER PLANS (CHECK SQUARENESS AND DIAGONAL DIMENSIONS)
- STRAIGHTNESS TO BE LENGTH/500mm OVER TOTAL SHAFT SECTION LENGTH
- ALL ANCHOR PLATES TO PROTRUDE A MINIMUM OF 70mm
- ON SEAM WELDING & BACKGRINDING REQUIREMENTS ON SLIP JOINT AREA'S SEE WELD MEMO 15/5/2011 REV.1
- ALL WELDS TO BE 6mm C.F.W. (U.O.N.)
- WELDING TERMS AND SYMBOLS AWS A2.1 - 93 WELDING SPECIFICATION TO AWS D1.1 : 2010 AND OR TO ENGINEERING SPECIFICATIONS: SANS 2001 - CSI : 2005
- STRUCTURE ACCORDING TO ESKOM DSP 34-1683 WHERE APPLICABLE

- IF IN DOUBT: ASK !

REV.3 STRUCTURE NUMBERS REVISED J.H.B. 10/02/'20
REV.2 NOTE ADDED J.H.B. 16/10/'19
REV.1 STRUCTURE HEIGHT INCREASED KEYHOLE BRACKET DETAIL ADDED & LADDER POSITION REVISED J.H.B. 02/10/'19

TOTAL MASS OF STRUCTURE = ±6587 kg

Design Parameters:

Loading Code: Provided Tip load Ratings / Supplied Line Design Loads
Strength Code: ASCE 48-11

Max. Design Spans Based on SANS 10280
Wind Span Ahead: 165m (ACSR Chicadee)
Weight Span Ahead: 330m
Wind Span Closing Span: 50m (ACSR Kingbird)
Weight Span Closing Span: 100m

Conductor: ACSR Chicadee / Kingbird
Conductor Configuration:
Single Circuit, Single Conductor

OPGW/Earth Wire: AAAC Oak
OPGW/ Earth Wire Configuration:
Single Circuit, Single Wire

Line Deviation: 0°-90° Terminal
Working Tip Load: 217.70 kN

Design Evaluation by:
Design Engineer: E.J. Cilliers
Professional Engineer: P.A. Coetzer

Pr. Eng. No: 870425

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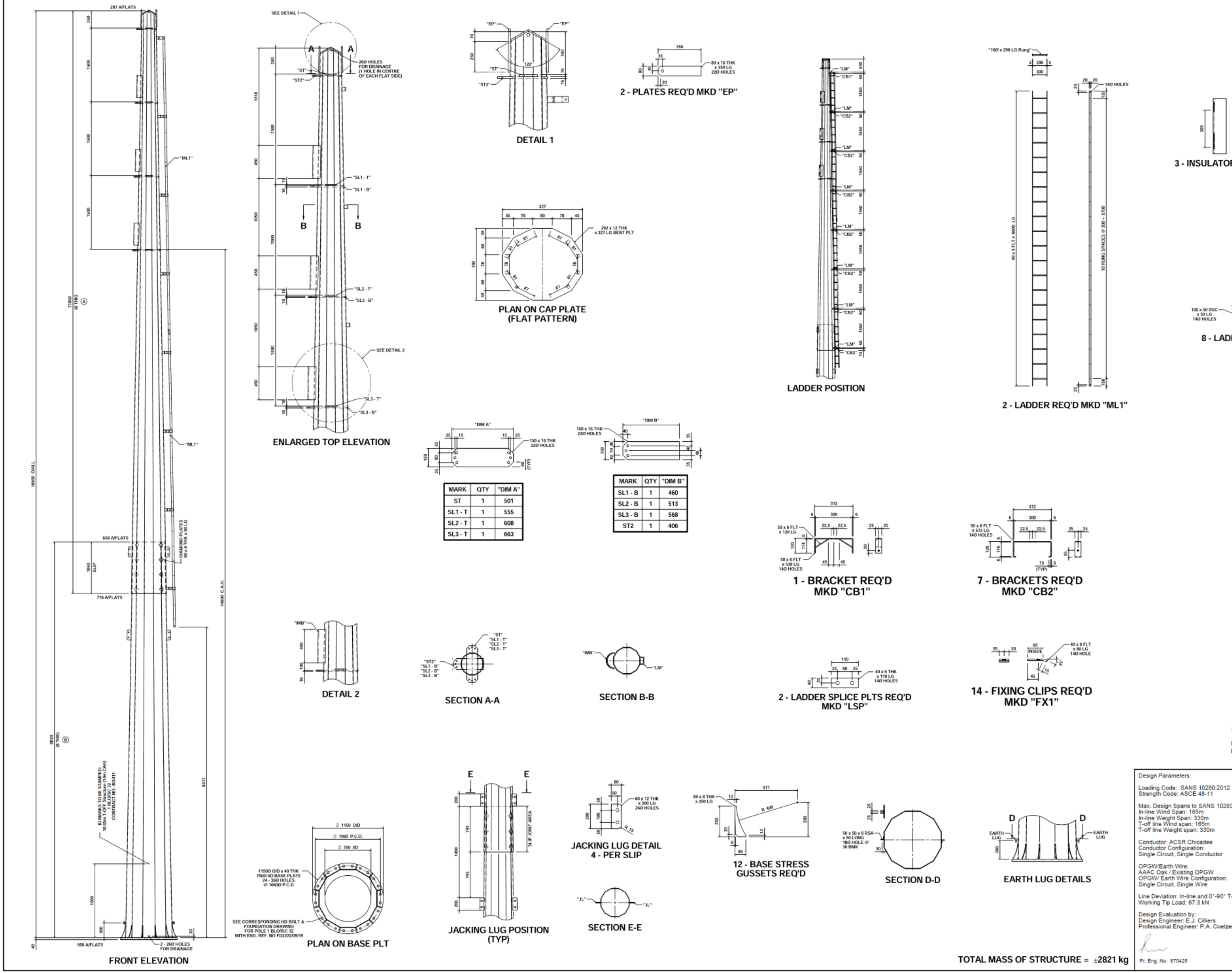
CLIENT: KHATO THENGA JV INC.

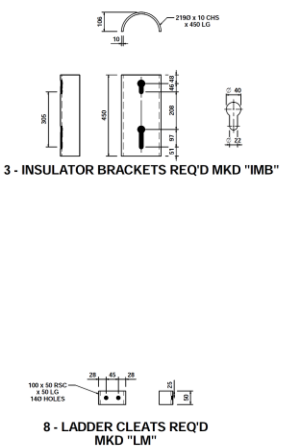
PROJECT: (1 OFF) 20.5m Terminal Structure (13m CAH)

2 BLO/ISC 32/2

TITLE: GENERAL ARRANGEMENT & DETAILS

		DATE: & SIGNATURE	SCALE:
DRAWN	J.H.B.	SEP 2019	N.T.S.
CHECKED	G.H.	SEP 2019	
CONTRACT NO:	405410		REVISION
DRAWING NO:	1 OF 1		3





MARK	QTY	"DIM A"
ST	1	501
SL1 - T	1	555
SL2 - T	1	608
SL3 - T	1	663

MARK	QTY	"DIM B"
SL1 - B	1	460
SL2 - B	1	513
SL3 - B	1	568
ST2	1	406

NOTE :

- ALL MATERIAL TO BE S355JR
- STEELWORK TO BE HOT DIP GALVANISED TO ISO SABS 1461/SANS121
- ALL BOLTS TO BE GRADE 8.8 H.D. GALVANISED
- ALL PARTS AND SHAFTS TO BE CLEARLY MARKED. STAMPING OF MARKS ON SHAFTS TO BE BETWEEN DIAMONDS, BOTTOM SECTION TO BE STAMPED ON POSITION SHOWN.
- TOLERANCES - ON DIMENSIONS = 2mm (OR AS NOTED)
  - ON DRILLING CENTRES = 2mm
- ALL SIDES OF SHAFTS TO BE PARALLEL WITHIN 4mm AS PER PLANS (CHECK SQUARENESS AND DIAGONAL DIMENSIONS)
- STRAIGHTNESS TO BE LENGTH/500mm OVER TOTAL SHAFT SECTION LENGTH
- ALL ANCHOR PLATES TO PROTRUDE A MINIMUM OF 70mm
- ON SEAM WELDING & BACKGRINDING REQUIREMENTS ON SLIP JOINT AREA'S SEE WELD MEMO 15/5/2011 REV.1
- ALL WELDS TO BE 6mm C.F.W. (U.O.N.)
- WELDING TERMS AND SYMBOLS AWS A2.1 - 93 WELDING SPECIFICATION TO AWS D1.1 : 2010 AND OR TO ENGINEERING SPECIFICATIONS: SANS 2001 - CSI : 2005
- STRUCTURE ACCORDING TO ESKOM DSP 34-1683 WHERE APPLICABLE

- IF IN DOUBT: ASK !

REV.3 STRUCTURE NUMBERS REVISED J.H.B. 10/02/'20
REV.2 NOTE ADDED J.H.B. 16/10/'19
REV.1 STRUCTURE HEIGHT INCREASED STRAIN PLATES REVISED & LADDER POSITION REVISED J.H.B. 02/10/'19

TOTAL MASS OF STRUCTURE = ±2821 kg

Design Parameters:

Loading Code: SANS 10280:2012
Strength Code: ASCE 48-11

Max. Design Spans to SANS 10280:2012
In-line Wind Span: 165m
In-line Weight Span: 330m
T-off line Wind span: 165m
T-off line Weight span: 330m

Conductor: ACSR Chicadee
Conductor Configuration:
Single Circuit, Single Conductor

OPGW/Earth Wire:
AAAC Oak / Existing OPGW
OPGW/ Earth Wire Configuration:
Single Circuit, Single Wire

Line Deviation: In-line and 0°-90° T-OFF line
Working Tip Load: 67.3 kN

Design Evaluation by:
Design Engineer: E.J. Cilliers
Professional Engineer: P.A. Coetzer

Pr. Eng. No: 870425

STRUCTA technology
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MEYERTON, GAUTENG
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TEL: +27 (16) 362 9100
FAX: +27 (16) 362 9116

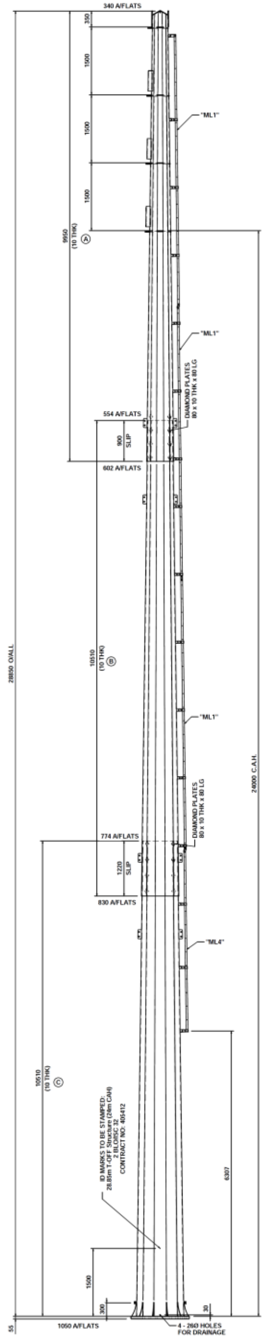
CLIENT: KHATO THENGA JV INC.

PROJECT: (1 OFF) 18.85m T-OFF Structure (14m CAH)

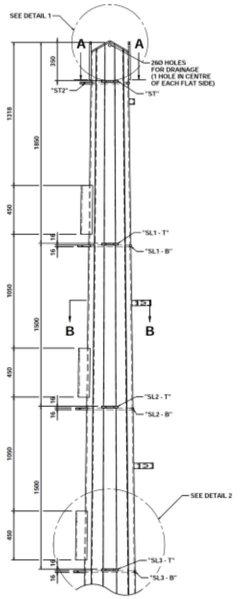
1 BLO/ISC 32

TITLE:
GENERAL ARRANGEMENT & DETAILS

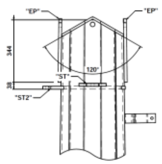
		DATE: & SIGNATURE	SCALE:
DRAWN	J.H.B.	SEP 2019	N.T.S.
CHECKED	G.H.	SEP 2019	
CONTRACT NO:	405411		REVISION
DRAWING NO:	1 OF 1		3



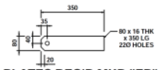
FRONT ELEVATION



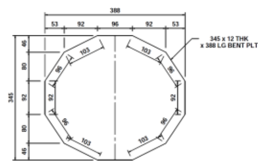
ENLARGED TOP ELEVATION



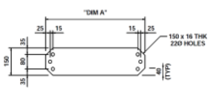
DETAIL 1



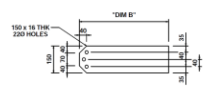
2 - PLATES REQ'D MKD "EP"



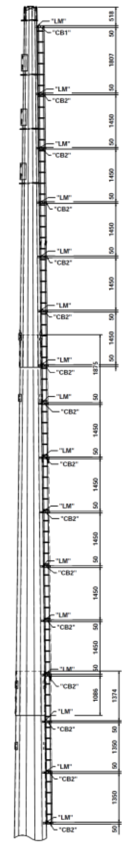
PLAN ON CAP PLATE (FLAT PATTERN)



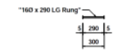
MARK	QTY	"DIM A"
ST	1	550
SL1 - T	1	589
SL2 - T	1	628
SL3 - T	1	668



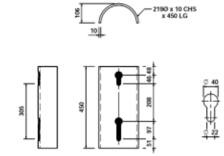
MARK	QTY	"DIM B"
SL1 - B	1	494
SL2 - B	1	533
SL3 - B	1	573
ST2	1	455



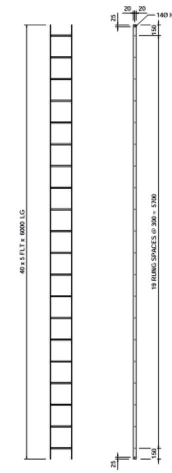
LADDER POSITION



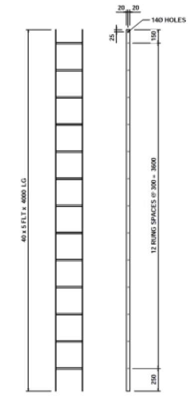
TYPICAL



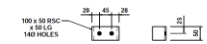
3 - INSULATOR BRACKETS REQ'D MKD "IMB"



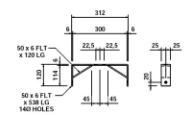
3 - LADDER REQ'D MKD "ML1"



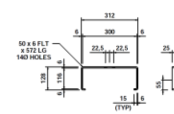
1 - LADDER REQ'D MKD "ML4"



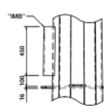
17 - LADDER CLEATS REQ'D MKD "LM"



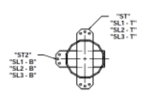
1 - BRACKET REQ'D MKD "CB1"



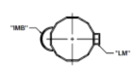
15 - BRACKETS REQ'D MKD "CB2"



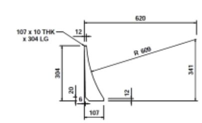
DETAIL 2



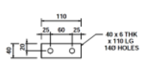
SECTION A-A



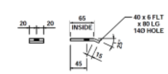
SECTION B-B



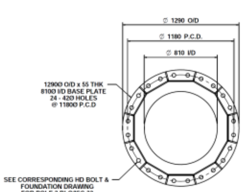
12 - BASE STRESS GUSSETS REQ'D



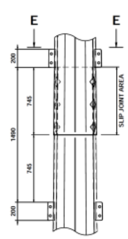
6 - LADDER SPLICE PLTS REQ'D MKD "LSP"



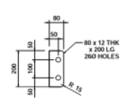
30 - FIXING CLIPS REQ'D MKD "FX1"



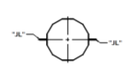
PLAN ON BASE PLT



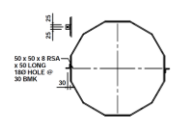
JACKING LUG POSITION (TYP)



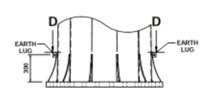
8 - JACKING LUG DETAIL (4 - PER SLIP)



SECTION E-E



SECTION D-D



EARTH LUG DETAILS

NOTE :

- ALL MATERIAL TO BE S355JR
- STEELWORK TO BE HOT DIP GALVANISED TO ISO SABS 1461/SANS121
- ALL BOLTS TO BE GRADE 8.8 H.D. GALVANISED
- ALL PARTS AND SHAFTS TO BE CLEARLY MARKED. STAMPING OF MARKS ON SHAFTS TO BE BETWEEN DIAMONDS, BOTTOM SECTION TO BE STAMPED ON POSITION SHOWN.
- TOLERANCES - ON DIMENSIONS = 2mm (OR AS NOTED)
  - ON DRILLING CENTRES = 2mm
- ALL SIDES OF SHAFTS TO BE PARALLEL WITHIN 4mm AS PER PLANS (CHECK SQUARENESS AND DIAGONAL DIMENSIONS)
- STRAIGHTNESS TO BE LENGTH/500mm OVER TOTAL SHAFT SECTION LENGTH
- ALL ANCHOR PLATES TO PROTRUDE A MINIMUM OF 70mm
- ON SEAM WELDING & BACKGRINDING REQUIREMENTS ON SLIP JOINT AREA'S SEE WELD MEMO 15/5/2011 REV.1
- ALL WELDS TO BE 6mm C.F.W. (U.O.N.)
- WELDING TERMS AND SYMBOLS AWS A2.1 - 93 WELDING SPECIFICATION TO AWS D1.1 : 2010 AND OR TO ENGINEERING SPECIFICATIONS: SANS 2001 - CSI : 2005
- STRUCTURE ACCORDING TO ESKOM DSP 34-1683 WHERE APPLICABLE

- IF IN DOUBT: ASK !

REV.3 STRUCTURE NUMBERS REVISED J.H.B. 10/02/'20
REV.2 NOTE ADDED J.H.B. 16/10/'19
REV.1 STRUCTURE HEIGHT INCREASED STRAIN PLATES REVISED & LADDER POSITION REVISED J.H.B. 02/10/'19

Design Parameters:

Loading Code: SANS 10280:2012
Strength Code: ASCE 48-11

Max. Design Spans to SANS 10280:2012
In-line Wind Span: 165m
In-line Weight Span: 330m
T-off line Wind span: 165m
T-off line Weight span: 330m

Conductor: ACSR Chicadee
Conductor Configuration:
Single Circuit, Single Conductor

OPGW/Earth Wire:
AAAC Oak / Existing OPGW
OPGW/ Earth Wire Configuration:
Single Circuit, Single Wire

Line Deviation: In-line and 0°-90° T-OFF line
Working Tip Load: 77.8 kN

Design Evaluation by:
Design Engineer: E.J. Cilliers
Professional Engineer: P.A. Coetzer

Pr. Eng. No: 870425

TOTAL MASS OF STRUCTURE = ±5920 kg

STRUCTA technology
2 DUTTON STREET MEYERTON, GAUTENG SOUTH AFRICA
TEL: +27 (16) 362 9100 FAX: +27 (16) 362 9116

CLIENT: KHATO THENGA JV INC.

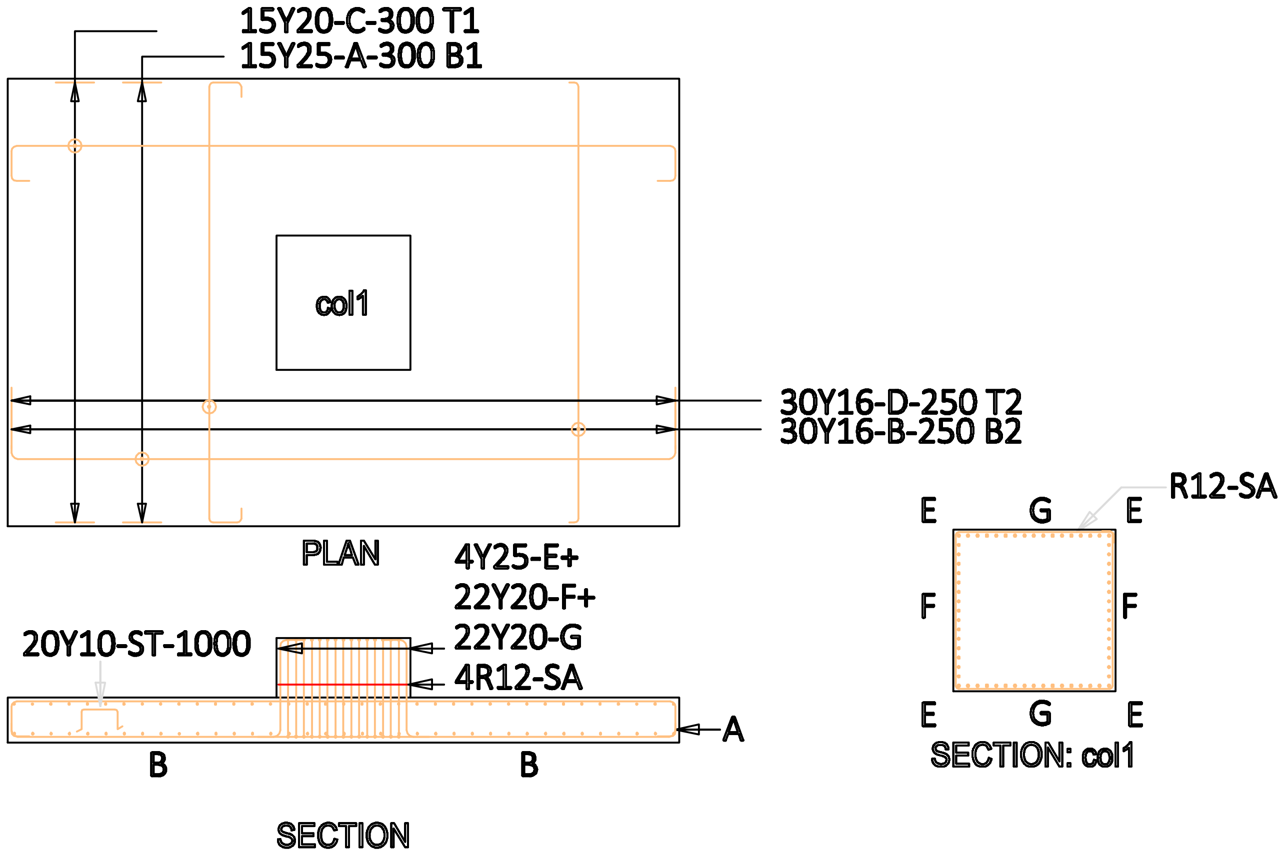
PROJECT: (1 OFF) 28.85m T-OFF Structure (24m CAH)

2 BLO/ISC 32

TITLE: GENERAL ARRANGEMENT & DETAILS

		DATE: & SIGNATURE	SCALE:
DRAWN	J.H.B.	SEP 2019	N.T.S.
CHECKED	G.H.	SEP 2019	
CONTRACT NO:	405412		REVISION
DRAWING NO:	1 OF 1		3

13.3. Contractor Received Final Design Drawings (Foundations)



REINFORCING SCHEDULE																	
ITEM	NO	SIZE	MARK	BARS PER MEMBER	DIA	TOTAL NUMBER	LENGTH	TOTAL LENGTH	SHAPE CODE	A	B	C	D	E	COMMENT	MASS
FOUNDATION PAD/PLINTH	1 NO OFF	7200 L x 4200 W x 600 H	A	15	Y25	15	7350	110250	38	180	7100	180			PAD HORIZONTAL	425
			B	30	Y16	30	4250	127500	38	120	4100	120			PAD HORIZONTAL	201
			D	30	Y16	30	5200	156000	55	190	430	4100	430	190	PAD HORIZONTAL	247
			C	15	Y20	15	8350	125250	55	240	470	7100	470	240	PAD HORIZONTAL	309
			E	4	Y25	4	1800	7200	54	300	1300	300			PLINTH VERTICAL	28
			F	22	Y20	22	1700	37400	54	240	1300	300			PLINTH VERTICAL	92
			G	22	Y20	22	1700	37400	54	240	1300	300			PLINTH VERTICAL	92
			SA	4	R12	4	5900	23600	60	1440	1440				PLINTH HORIZONTAL	21
			ST	20	Y10	20	1900	38000	83	350	470	350	350		PAD STOOL	23
CUTTING & BENDING TO COMPLY WITH SANS 282; MINIMUM HOOK, BEND & RADIUS TO COMPLY WITH SANS 920.															TOTAL MASS (KG)	1438

REINFORCING NOTES

1 REINFORCEMENT CONCRETE COVER SPECIFICATION:
- STUB COLUMNS 30mm TO LINKS
- BASES: TOP & SIDES 50mm
BOTTOM 75mm

2 R - HOT ROLLED MILD STEEL, fy = 250MPa
Y - HOT ROLLED HIGH-YIELD STEEL, fy = 450MPa

3 REINFORCEMENT TO BE BENT TO SANS 282 & FIXED SO THAT ALL CROSSING BARS ARE FIXED.

4 ALL WORKS TO SANS 1200

5 DIMENSIONS TO BE VERIFIED ON SITE

6 ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED

REINFORCING ABBREVIATIONS

IF	=	INSIDE FACE
EW	=	EACH WAY
EF	=	EACH FACE
NF	=	NEAR FACE
FF	=	FAR FACE
ALT	=	ALTERNATE
STG	=	STAGGERED
TOG	=	TOGETHER
ABR	=	ALTERNATE BARS REVERSED
T1	=	TOP ONE
T2	=	TOP TWO
B1	=	BOTTOM ONE
B2	=	BOTTOM TWO
OF	=	OUTSIDE FACE
T	=	TOP
B	=	BOTTOM

DESIGN ENGINEER

APPROVALS			DATE
DRAWN	JAC		10/02/2020
CHECKED	JAC		10/02/2020
RESP. ENG.	JAC		10/02/2020

REVISIONS

REV	DATE	BY	DESCRIPTION
0	12/09/2019	JAC	FOUNDATION DESIGN
1	30/09/2019	JAC	REVISED AS PER COMMENTS
2	09/10/2019	JAC	STRUCTURE NUMBER CHANGED
3	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
4	27/11/2019	JAC	ALL BLOCKS SIGNED
5	10/02/2020	JAC	STRUCTURE NAME CHANGED

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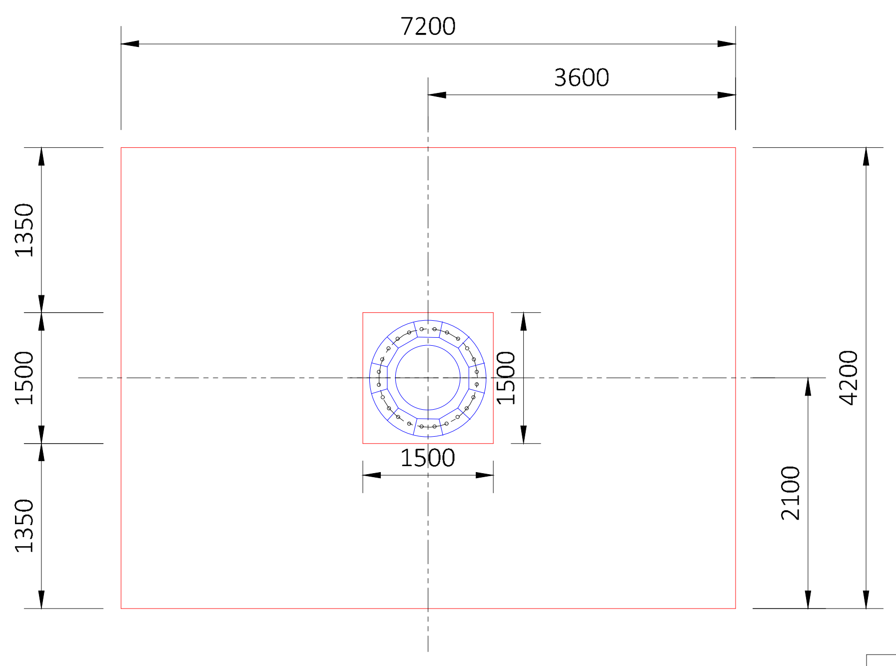
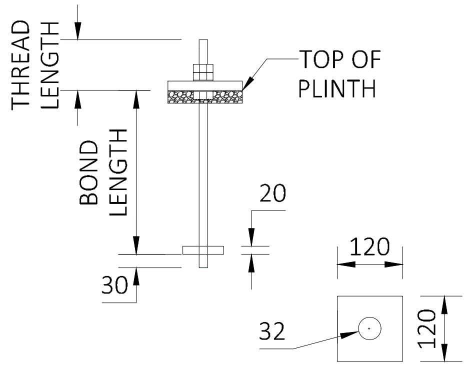
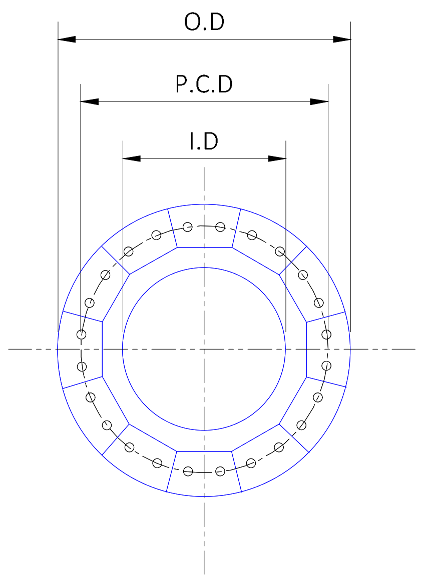
PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE
TITLE	REINFORCEMENT DETAILS FOR 18.5m T-OFF STRAIN STRUCTURE - 1 BLO/ISC 32
ENG. REF. NO	FD2222/09/19
CLIENT	ASCENG

SCALE:	DWG NO		DWG SIZE	REV NO.
NTS	1	2	A3	5



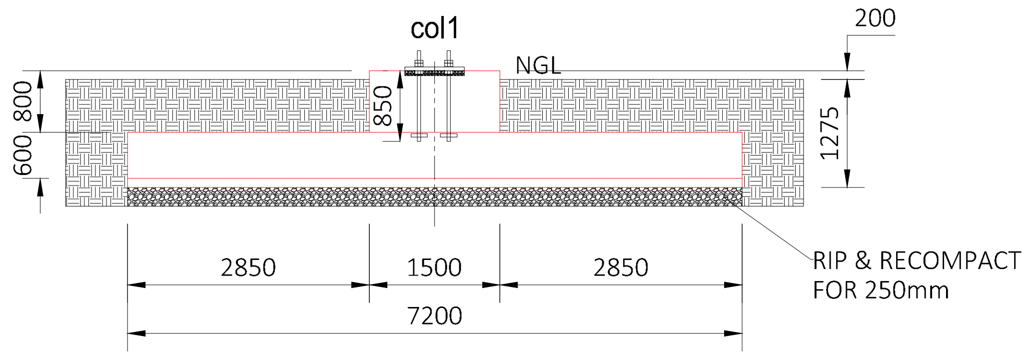
PLAN





BASE PLATE DETAIL

STRUCTURE AGL (m)	BASEPLATE						
		OD (mm)	PCD (mm)	ID (mm)	MIN THK (mm)	GUSSET THK (mm)	
18.50		1150	1060	750	40	8	
H.D BOLTS GRADE 8.8							
	QTY	SIZE (mm)	O/A LENGTH (mm)	BOND LENGTH (mm)	THREAD LENGTH (mm)	WELD (mm)	PLATE
18.50	24	M30	1100	820	190	10	120X120X20



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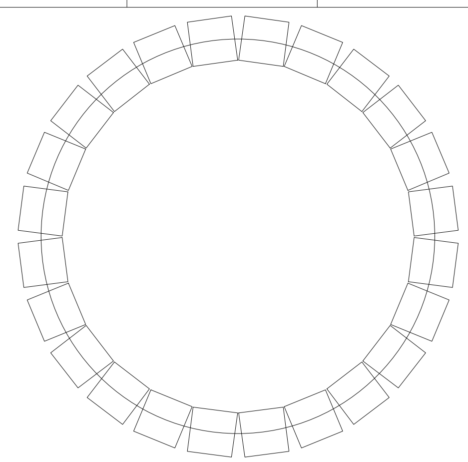

END PLATE ON P.C.D

CONCRETE NOTES

1 CONCRETE CUBE CRUSHING STRENGTH AT 28 DAYS
2 CONCRETE GRADES UNLESS OTHERWISE SHOWN
- SURFACE BEDS 25MPa
- STRUCTURAL FOUNDATIONS 25MPa
- MASS CONCRETE 10MPa
- 75mm BLINDING LAYER 10MPa
- SOILCRETE 80kg/cu.m.
3 ALL WORKS TO SANS 1200
4 DIMENSIONS TO BE VERIFIED ON SITE
5 ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED
6 75mm BLINDING UNDER PROVIDED FOR FULL EXTENT OF FOUNDATION
7 ALL EXPOSED CONCRETE TO BE CHAMFERED 25 x 25mm
8 ALL EXPOSED CONCRETE SURFACES TO BE WOOD FLOAT FINISHED, UNLESS OTHERWISE NOTED
9 PLINTH TO EXTEND 200m ABOVE GROUND, 600mm SOIL COVER

SOIL NOTES

1 SOIL TYPE 3
- MIN INTERNAL ANGLE OF FRICTION 10°
- MIN SOIL DENSITY 14KN/m³
- MIN BEARING CAPACITY 100KPa
2 ALL BACKFILL MATERIAL TO BE LAID & THOROUGHLY COMPACTED IN MAXIMUM 200mm LAYERS.
3 FOUNDATION BEDDING TO BE HORIZONTAL & FIRM WITH ALL LOOSE OR WATERLOGGED MATERIAL REMOVED, ENGINEER TO BE CONTACTED IF UNFORESEEN FOUNDING CONDITIONS ENCOUNTERED
4 RIP & RE-COMPACT BOTTOM OF FOUNDATION FOR A 250mm LAYER
5 IF FOUNDATION IS WATERLOGGED THEN DUMP ROCK AND FINES SHOULD BE PLACED 500mm UNDERNEATH AND COMPACTED IN 250mm LAYERS WITH A 50 MICRON SHEET PLACED ABOVE FILL

BASE PLATE & H.D BOLT NOTES

1 50mm NON-SHRINK GROUTING FOR NON STRUCTURAL PURPOSES WITH TWO 30mm DIAMETER WEEPHOLES
2 30mm OVERLENGTH ON BOLT PROJECTION
3 GRADE 8.8
4 NUTS & 2 WASHERS PER BOLT
5 BOTTOM PLATE TO BE WELDED

QUANTITIES

1 CONCRETE VOLUME: 22.30m³
2 EXCAVATION VOLUME: 38.60m³
3 REINFORCEMENT MASS: 1438KG

UNFACTORED LOADS		
LOAD FACTOR - 1.5		
COLUMN 1		
TOTAL		
SHEAR	MOMENT	VERTICAL
84.70	1345.00	76.30

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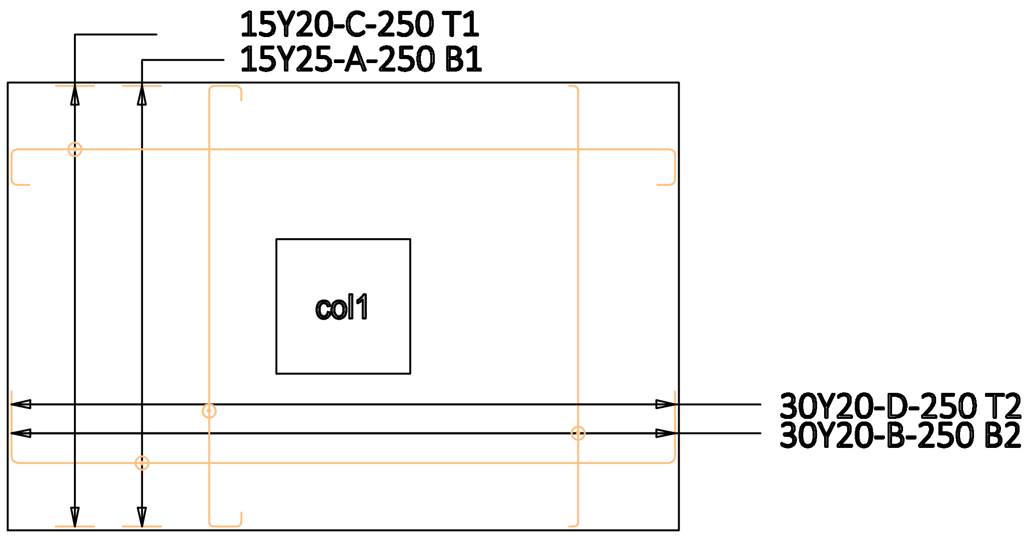
DESIGN ENGINEER			
APPROVALS			DATE
DRAWN	JAC		10/02/2020
CHECKED	JAC		10/02/2020
RESP. ENG.	JAC		10/02/2020

REVISIONS

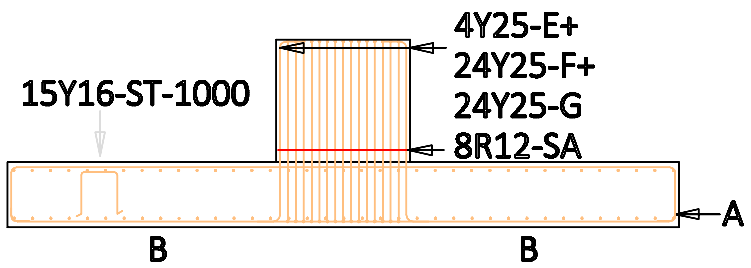
REV	DATE	BY	DESCRIPTION
0	12/09/2019	JAC	FOUNDATION DESIGN
1	30/09/2019	JAC	REVISED AS PER COMMENTS
2	09/10/2019	JAC	STRUCTURE NUMBER CHANGED
3	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
4	27/11/2019	JAC	ALL BLOCKS SIGNED
5	10/02/2020	JAC	STRUCTURE NAME CHANGED

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE
TITLE	CONCRETE DETAILS FOR 18.5m T-OFF STRAIN STRUCTURE - SOIL TYPE 3 - 1 BLO/ISC 32

ENG. REF. NO	FD2222/09/19	SCALE: NTS	DWG NO	DWG SIZE	REV NO.
CLIENT	ASCENG		2 2	A3	5



PLAN



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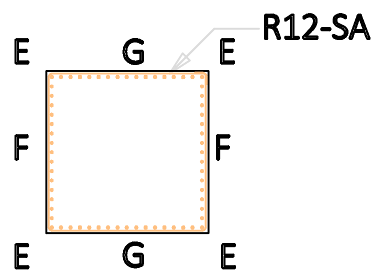

SECTION: col1

REINFORCING NOTES

1 REINFORCEMENT CONCRETE COVER SPECIFICATION:
- STUB COLUMNS 30mm TO LINKS
- BASES: TOP & SIDES 50mm
BOTTOM 75mm

2 R - HOT ROLLED MILD STEEL, fy = 250MPa
Y - HOT ROLLED HIGH-YIELD STEEL, fy = 450MPa

3 REINFORCEMENT TO BE BENT TO SANS 282 & FIXED SO THAT ALL CROSSING BARS ARE FIXED.

4 ALL WORKS TO SANS 1200

5 DIMENSIONS TO BE VERIFIED ON SITE

6 ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED

REINFORCING ABBREVIATIONS

IF = INSIDE FACE
EW = EACH WAY
EF = EACH FACE
NF = NEAR FACE
FF = FAR FACE
ALT = ALTERNATE
STG = STAGGERED
TOG = TOGETHER
ABR = ALTERNATE BARS REVERSED
T1 = TOP ONE
T2 = TOP TWO
B1 = BOTTOM ONE
B2 = BOTTOM TWO
OF = OUTSIDE FACE
T = TOP
B = BOTTOM

REINFORCING SCHEDULE

ITEM	NO	SIZE	MARK	BARS PER MEMBER	DIA	TOTAL NUMBER	LENGTH	TOTAL LENGTH	SHAPE CODE	A	B	C	D	E	COMMENT	MASS
FOUNDATION PAD/PLINTH	1 NO OFF	7400 L x 3600 W x 900 H	A	15	Y25	15	7500	112500	38	180	7300	180			PAD HORIZONTAL	433
			B	30	Y20	30	3700	111000	38	140	3500	140			PAD HORIZONTAL	274
			D	30	Y20	30	5200	156000	55	240	730	3500	730	240	PAD HORIZONTAL	385
			C	15	Y20	15	9100	136500	55	240	780	7300	780	240	PAD HORIZONTAL	337
			E	4	Y25	4	2900	11600	54	300	2400	300			PLINTH VERTICAL	45
			F	24	Y25	24	2900	69600	54	300	2400	300			PLINTH VERTICAL	268
			G	24	Y25	24	2900	69600	54	300	2400	300			PLINTH VERTICAL	268
			SA	8	R12	8	7100	56800	60	1740	1740				PLINTH HORIZONTAL	51
			ST	15	Y16	15	2500	37500	83	400	750	400	400		PAD STOOL	59
CUTTING & BENDING TO COMPLY WITH SANS 282; MINIMUM HOOK, BEND & RADIUS TO COMPLY WITH SANS 920.															TOTAL MASS (KG)	2120

DESIGN ENGINEER			
APPROVALS			DATE
DRAWN	JAC		10/02/2020
CHECKED	JAC		10/02/2020
RESP. ENG.	JAC		10/02/2020

REVISIONS

REV	DATE	BY	DESCRIPTION
0	12/09/2019	JAC	FOUNDATION DESIGN
1	30/09/2019	JAC	REVISED AS PER COMMENTS
2	09/10/2019	JAC	STRUCTURE NUMBER CHANGED
3	14/11/2019	JAC	FOUNDATION SIZE CHANGED
4	27/11/2019	JAC	ALL BLOCKS SIGNED
5	10/02/2020	JAC	STRUCTURE NAME CHANGED

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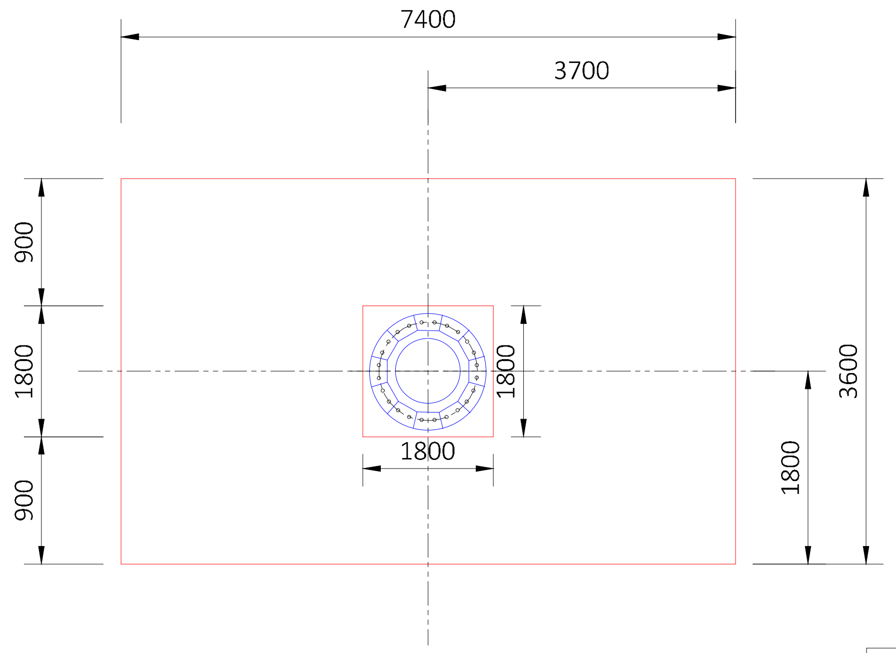
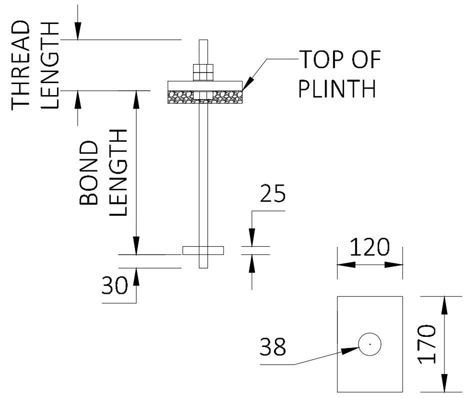
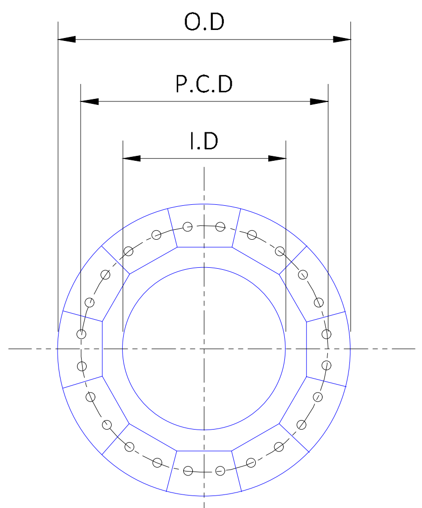
STRUCTAKONSULT (PTY) LTD

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE					
TITLE	REINFORCEMENT DETAILS FOR 28.5m T-OFF STRAIN STRUCTURE - 2 BLO/ISC 32					
ENG. REF. NO	FD2222/09/19	SCALE: NTS	DWG NO		DWG SIZE	REV NO.
CLIENT	ASCENG		1	2	A3	5



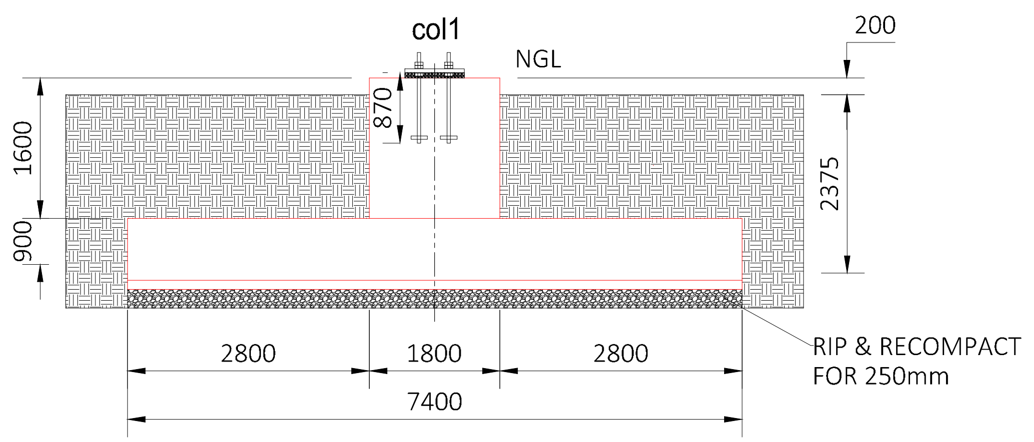
PLAN



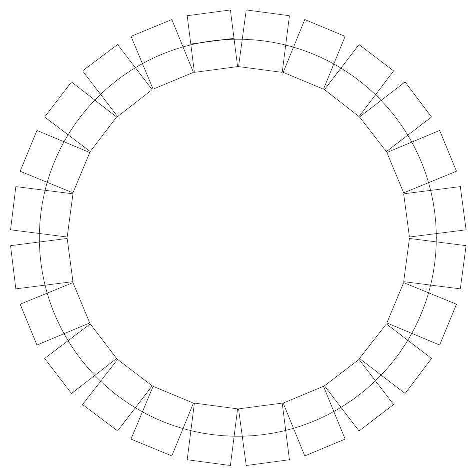


BASE PLATE DETAIL

STRUCTURE AGL (m)	BASEPLATE						
		OD (mm)	PCD (mm)	ID (mm)	MIN THK (mm)	GUSSET THK (mm)	
28.50		1290	1180	810	55	10	
H.D BOLTS GRADE 8.8							
	QTY	SIZE (mm)	O/A LENGTH (mm)	BOND LENGTH (mm)	THREAD LENGTH (mm)	WELD (mm)	PLATE
28.50	24	M36	1170	840	220	12	130X170X25



SECTION



END PLATE ON P.C.D

CONCRETE NOTES

1 CONCRETE CUBE CRUSHING STRENGTH AT 28 DAYS
2 CONCRETE GRADES UNLESS OTHERWISE SHOWN
- SURFACE BEDS 25MPa
- STRUCTURAL FOUNDATIONS 25MPa
- MASS CONCRETE 10MPa
- 75mm BLINDING LAYER 10MPa
- SOILCRETE 80kg/cu.m.

3 ALL WORKS TO SANS 1200
4 DIMENSIONS TO BE VERIFIED ON SITE
5 ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED
6 75mm BLINDING UNDER PROVIDED FOR FULL EXTENT OF FOUNDATION
7 ALL EXPOSED CONCRETE TO BE CHAMFERED 25 x 25mm
8 ALL EXPOSED CONCRETE SURFACES TO BE WOOD FLOAT FINISHED, UNLESS OTHERWISE NOTED
9 PLINTH TO EXTEND 200m ABOVE GROUND, 600mm SOIL COVER

SOIL NOTES

1 SOIL TYPE 2
- MIN INTERNAL ANGLE OF FRICTION 20°
- MIN SOIL DENSITY 16KN/m³
- MIN BEARING CAPACITY 150KPa

2 ALL BACKFILL MATERIAL TO BE LAID & THOROUGHLY COMPACTED IN MAXIMUM 200mm LAYERS.
3 FOUNDATION BEDDING TO BE HORIZONTAL & FIRM WITH ALL LOOSE OR WATERLOGGED MATERIAL REMOVED, ENGINEER TO BE CONTACTED IF UNFORESEEN FOUNDING CONDITIONS ENCOUNTERED
4 RIP & RE-COMPACT BOTTOM OF FOUNDATION FOR A 250mm LAYER
5 IF FOUNDATION IS WATERLOGGED THEN DUMP ROCK AND FINES SHOULD BE PLACED 500mm UNDERNEATH AND COMPACTED IN 250mm LAYERS WITH A 50 MICRON SHEET PLACED ABOVE FILL
6 FROM DCP READINGS TAKEN SOIL PRESSURE > 300KPA > MAX SOIL PRESSURE 200KPA

BASE PLATE & H.D BOLT NOTES

1 50mm NON-SHRINK GROUTING FOR NON STRUCTURAL PURPOSES WITH TWO 30mm DIAMETER WEEPHOLES
2 30mm OVERLENGTH ON BOLT PROJECTION
3 GRADE 8.8
4 NUTS & 2 WASHERS PER BOLT
5 BOTTOM PLATE TO BE WELDED

QUANTITIES

1 CONCRETE VOLUME: 31.20m³
2 EXCAVATION VOLUME: 63.30m³
3 REINFORCEMENT MASS: 2120KG

UNFACTORED LOADS		
LOAD FACTOR - 1.5		
COLUMN 1		
TOTAL		
SHEAR	MOMENT	VERTICAL
87.60	2221.00	128.50

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STRUCTAKONSULT (PTY) LTD

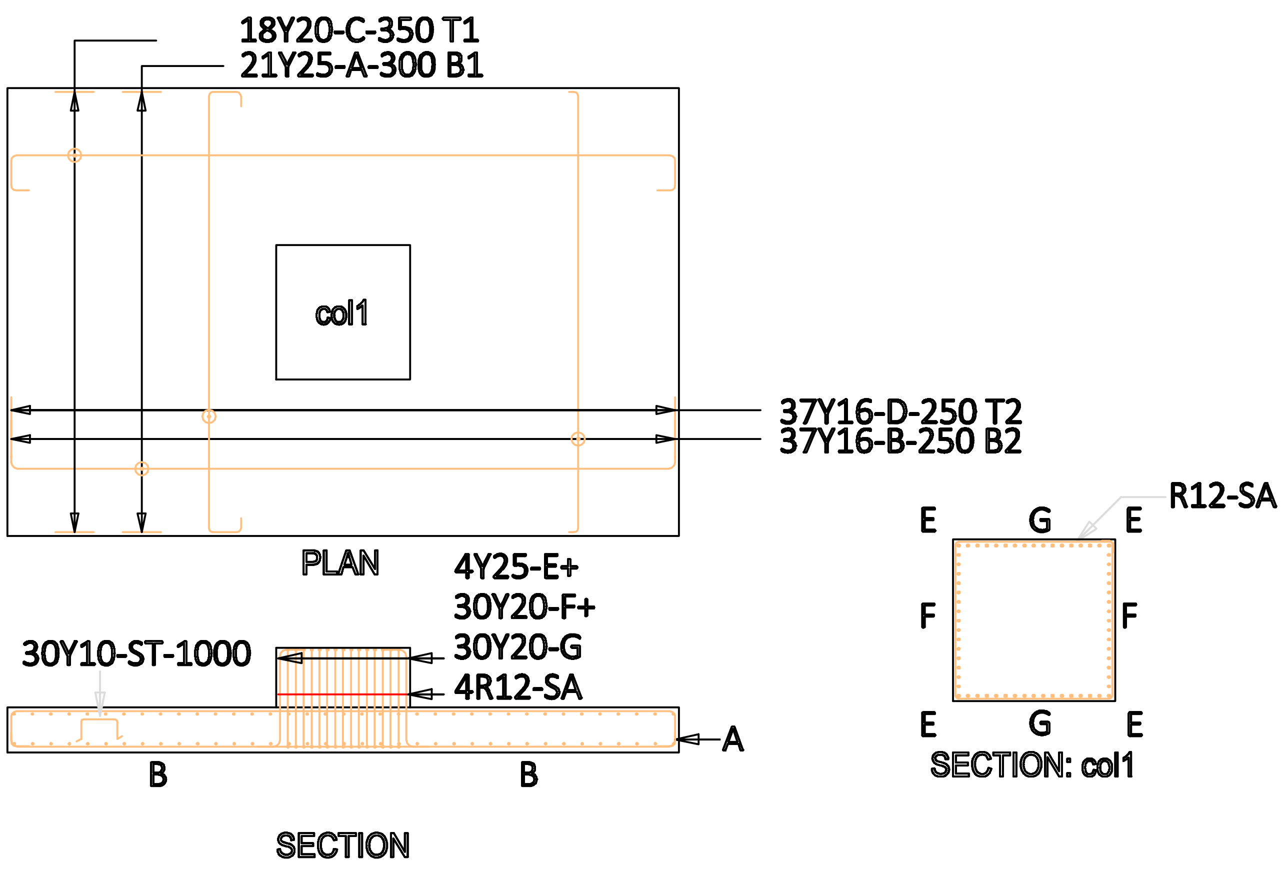
DESIGN ENGINEER			
APPROVALS			DATE
DRAWN	JAC		10/02/2020
CHECKED	JAC		10/02/2020
RESP. ENG.	JAC		10/02/2020

REVISIONS

REV	DATE	BY	DESCRIPTION
0	12/09/2019	JAC	FOUNDATION DESIGN
1	30/09/2019	JAC	REVISED AS PER COMMENTS
2	09/10/2019	JAC	STRUCTURE NUMBER CHANGED
3	14/11/2019	JAC	FOUNDATION SIZE CHANGED
4	27/11/2019	JAC	ALL BLOCKS SIGNED
5	10/02/2020	JAC	STRUCTURE NAME CHANGED

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE
TITLE	CONCRETE DETAILS FOR 28.5m T-OFF STRAIN STRUCTURE - SOIL TYPE 2 - 2 BLO/ISC 32
ENG. REF. NO	FD2222/09/19
CLIENT	ASCENG

SCALE:	DWG NO	DWG SIZE	REV NO.
NTS	2 2	A3	5



REINFORCING SCHEDULE																	
ITEM	NO	SIZE	MARK	BARS PER MEMBER	DIA	TOTAL NUMBER	LENGTH	TOTAL LENGTH	SHAPE CODE	A	B	C	D	E	COMMENT	MASS
FOUNDATION PAD/PLINTH	1 NO OFF	9000 L x 6000 W x 600 H	A	21	Y25	21	9150	192150	38	180	8900	180			PAD HORIZONTAL	740
			B	37	Y16	37	6050	223850	38	120	5900	120			PAD HORIZONTAL	354
			D	37	Y16	37	7000	259000	55	190	430	5900	430	190	PAD HORIZONTAL	409
			C	18	Y20	18	10150	182700	55	240	470	8900	470	240	PAD HORIZONTAL	451
			E	4	Y25	4	1800	7200	54	300	1300	300			PLINTH VERTICAL	28
			F	30	Y20	30	1700	51000	54	240	1300	300			PLINTH VERTICAL	126
			G	30	Y20	30	1700	51000	54	240	1300	300			PLINTH VERTICAL	126
			SA	4	R12	4	7100	28400	60	1740	1740				PLINTH HORIZONTAL	25
			ST	30	Y10	30	1900	57000	83	350	470	350	350		PAD STOOL	35
CUTTING & BENDING TO COMPLY WITH SANS 282; MINIMUM HOOK, BEND & RADIUS TO COMPLY WITH SANS 920.															TOTAL MASS (KG)	2293

REINFORCING NOTES

1 REINFORCEMENT CONCRETE COVER SPECIFICATION:
- STUB COLUMNS 30mm TO LINKS
- BASES: TOP & SIDES 50mm
BOTTOM 75mm

2 R - HOT ROLLED MILD STEEL, fy = 250MPa
Y - HOT ROLLED HIGH-YIELD STEEL, fy = 450MPa

3 REINFORCEMENT TO BE BENT TO SANS 282 & FIXED SO THAT ALL CROSSING BARS ARE FIXED.

4 ALL WORKS TO SANS 1200

5 DIMENSIONS TO BE VERIFIED ON SITE

6 ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED

REINFORCING ABBREVIATIONS

IF	=	INSIDE FACE
EW	=	EACH WAY
EF	=	EACH FACE
NF	=	NEAR FACE
FF	=	FAR FACE
ALT	=	ALTERNATE
STG	=	STAGGERED
TOG	=	TOGETHER
ABR	=	ALTERNATE BARS REVERSED
T1	=	TOP ONE
T2	=	TOP TWO
B1	=	BOTTOM ONE
B2	=	BOTTOM TWO
OF	=	OUTSIDE FACE
T	=	TOP
B	=	BOTTOM

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STRUCTAKONSULT (PTY) LTD

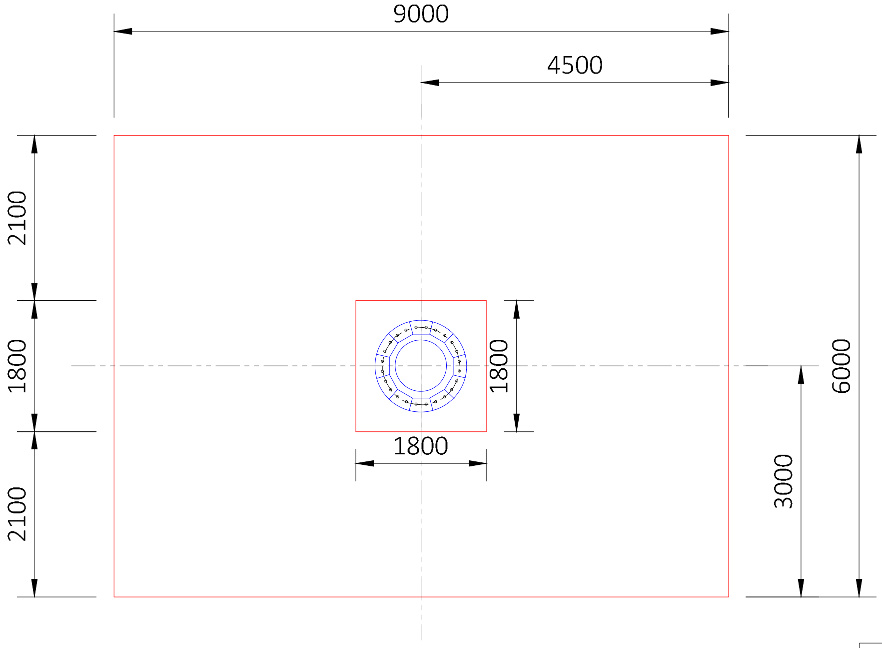
DESIGN ENGINEER

APPROVALS			DATE
DRAWN	JAC		10/02/2020
CHECKED	JAC		10/02/2020
RESP. ENG.	JAC		10/02/2020

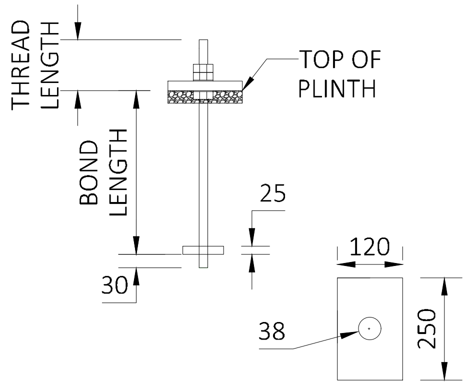
REVISIONS

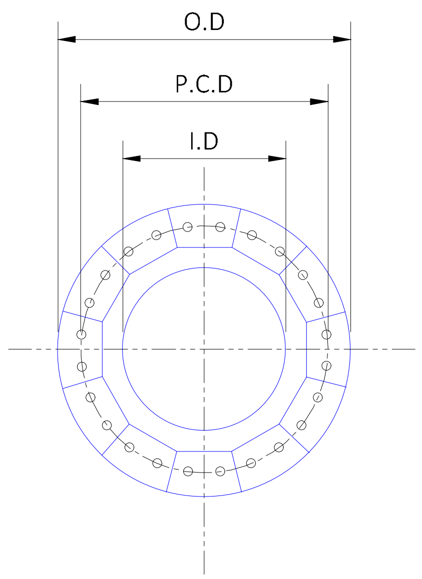
REV	DATE	BY	DESCRIPTION
0	12/09/2019	JAC	FOUNDATION DESIGN
1	26/09/2019	JAC	REVISED AS PER COMMENTS
2	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
3	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
4	27/11/2019	JAC	ALL BLOCKS SIGNED
5	10/02/2020	JAC	STRUCTURE NAME CHANGED

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE
TITLE	REINFORCEMENT DETAILS FOR 26.5m 30° STRAIN STRUCTURE - 1&2 BLO/ISC 32/1
ENG. REF. NO	FD2222/09/19
SCALE:	NTS
DWG NO	1 2
DWG SIZE	A3
REV NO.	5
CLIENT	ASCENG



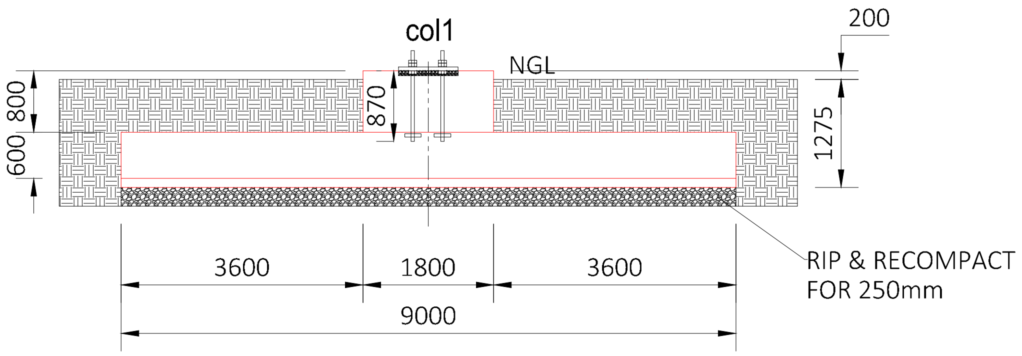
PLAN



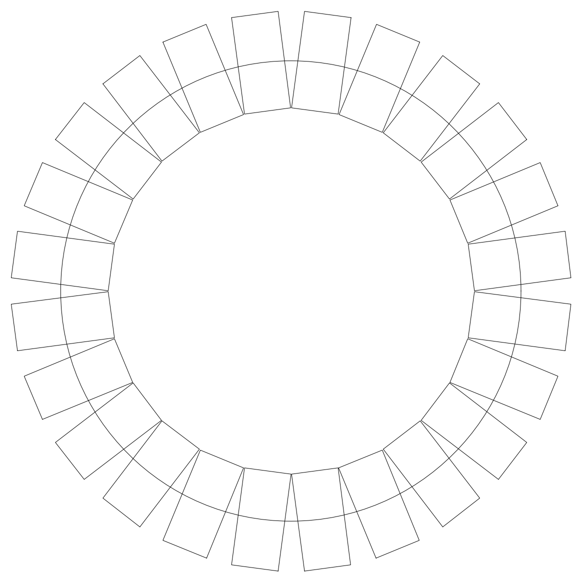


BASE PLATE DETAIL

STRUCTURE AGL (m)	BASEPLATE						
		OD (mm)	PCD (mm)	ID (mm)	MIN THK (mm)	GUSSET THK (mm)	
26.50		1290	1180	810	60	10	
H.D BOLTS GRADE 8.8							
	QTY	SIZE (mm)	O/A LENGTH (mm)	BOND LENGTH (mm)	THREAD LENGTH (mm)	WELD (mm)	PLATE
26.50	24	M36	1180	840	230	12	120X250X25



SECTION



END PLATE ON P.C.D

CONCRETE NOTES

1 CONCRETE CUBE CRUSHING STRENGTH AT 28 DAYS
2 CONCRETE GRADES UNLESS OTHERWISE SHOWN
- SURFACE BEDS 25MPa
- STRUCTURAL FOUNDATIONS 25MPa
- MASS CONCRETE 10MPa
- 75mm BLINDING LAYER 10MPa
- SOILCRETE 80kg/cu.m.

3 ALL WORKS TO SANS 1200
4 DIMENSIONS TO BE VERIFIED ON SITE
5 ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED
6 75mm BLINDING UNDER PROVIDED FOR FULL EXTENT OF FOUNDATION
7 ALL EXPOSED CONCRETE TO BE CHAMFERED 25 x 25mm
8 ALL EXPOSED CONCRETE SURFACES TO BE WOOD FLOAT FINISHED, UNLESS OTHERWISE NOTED
9 PLINTH TO EXTEND 200m ABOVE GROUND, 600mm SOIL COVER

SOIL NOTES

1 SOIL TYPE 3
- MIN INTERNAL ANGLE OF FRICTION 10°
- MIN SOIL DENSITY 14KN/m³
- MIN BEARING CAPACITY 100KPa

2 ALL BACKFILL MATERIAL TO BE LAID & THOROUGHLY COMPACTED IN MAXIMUM 200mm LAYERS.
3 FOUNDATION BEDDING TO BE HORIZONTAL & FIRM WITH ALL LOOSE OR WATERLOGGED MATERIAL REMOVED, ENGINEER TO BE CONTACTED IF UNFORESEEN FOUNDING CONDITIONS ENCOUNTERED
4 RIP & RE-COMPACT BOTTOM OF FOUNDATION FOR A 250mm LAYER
5 IF FOUNDATION IS WATERLOGGED THEN DUMP ROCK AND FINES SHOULD BE PLACED 500mm UNDERNEATH AND COMPACTED IN 250mm LAYERS WITH A 50 MICRON SHEET PLACED ABOVE FILL

BASE PLATE & H.D BOLT NOTES

1 50mm NON-SHRINK GROUTING FOR NON-STRUCTURAL PURPOSES WITH TWO 30mm DIAMETER WEEPHOLES
2 30mm OVERLENGTH ON BOLT PROJECTION
3 GRADE 8.8
4 NUTS & 2 WASHERS PER BOLT
5 BOTTOM PLATE TO BE WELDED

QUANTITIES

1 CONCRETE VOLUME: 39.10m³
2 EXCAVATION VOLUME: 68.90m³
3 REINFORCEMENT MASS: 2293KG

UNFACTORED LOADS		
LOAD FACTOR - 1.5		
COLUMN 1		
TOTAL		
SHEAR	MOMENT	VERTICAL
122.50	2726.00	128.40

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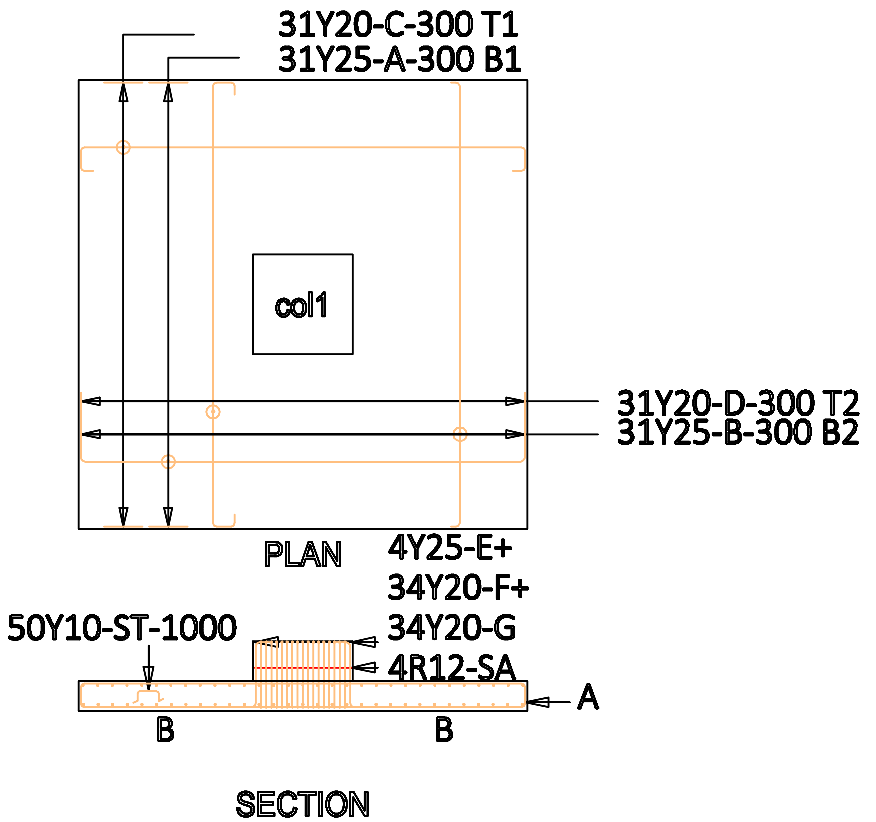
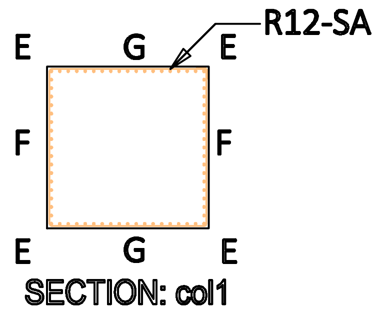
DESIGN ENGINEER				REVISIONS			
				REV	DATE	BY	DESCRIPTION
				0	12/09/2019	JAC	FOUNDATION DESIGN
				1	26/09/2019	JAC	REVISED AS PER COMMENTS
APPROVALS			DATE	2	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
DRAWN	JAC		10/02/2020	3	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
CHECKED	JAC		10/02/2020	4	27/11/2019	JAC	ALL BLOCKS SIGNED
RESP. ENG.	JAC		10/02/2020	5	10/02/2020	JAC	STRUCTURE NAME CHANGED

STRUCTAKONSULT (PTY) LTD

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE
TITLE	CONCRETE DETAILS FOR 26.5m 30° STRAIN STRUCTURE - SOIL TYPE 3 - 1&2 BLO/ISC 32/1
ENG. REF. NO	FD2222/09/19
CLIENT	ASCENG

SCALE:	DWG NO	DWG SIZE	REV NO.
NTS	2 2	A3	5





REINFORCING SCHEDULE																
ITEM	NO	SIZE	MARK	BARS PER MEMBER	DIA	TOTAL NUMBER	LENGTH	TOTAL LENGTH	SHAPE CODE	A	B	C	D	E	COMMENT	MASS
FOUNDATION PAD/PLINTH	1 NO OFF	9000 L x 9000 W x 600 H	A	31	Y25	31	9150	283650	38	180	8900	180			PAD HORIZONTAL	1092
			B	31	Y25	31	9150	283650	38	180	8900	180			PAD HORIZONTAL	1092
			D	31	Y20	31	10050	311550	55	240	430	8900	430	240	PAD HORIZONTAL	770
			C	31	Y20	31	10150	314650	55	240	470	8900	470	240	PAD HORIZONTAL	777
			E	4	Y25	4	1800	7200	54	300	1300	300			PLINTH VERTICAL	28
			F	34	Y20	34	1700	57800	54	240	1300	300			PLINTH VERTICAL	143
			G	34	Y20	34	1700	57800	54	240	1300	300			PLINTH VERTICAL	143
			SA	4	R12	4	7900	31600	60	1940	1940				PLINTH HORIZONTAL	28
			ST	50	Y10	50	1900	95000	83	350	470	350	350		PAD STOOL	59
CUTTING & BENDING TO COMPLY WITH SANS 282; MINIMUM HOOK, BEND & RADIUS TO COMPLY WITH SANS 920.															TOTAL MASS (KG)	4132

REINFORCING NOTES

1 REINFORCEMENT CONCRETE COVER SPECIFICATION:
- STUB COLUMNS 30mm TO LINKS
- BASES: TOP & SIDES 50mm
BOTTOM 75mm

2 R - HOT ROLLED MILD STEEL, fy = 250MPa
Y - HOT ROLLED HIGH-YIELD STEEL, fy = 450MPa

3 REINFORCEMENT TO BE BENT TO SANS 282 & FIXED SO THAT ALL CROSSING BARS ARE FIXED.

4 ALL WORKS TO SANS 1200

5 DIMENSIONS TO BE VERIFIED ON SITE

6 ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED

REINFORCING ABBREVIATIONS

IF = INSIDE FACE
EW = EACH WAY
EF = EACH FACE
NF = NEAR FACE
FF = FAR FACE
ALT = ALTERNATE
STG = STAGGERED
TOG = TOGETHER
ABR = ALTERNATE BARS REVERSED
T1 = TOP ONE
T2 = TOP TWO
B1 = BOTTOM ONE
B2 = BOTTOM TWO
OF = OUTSIDE FACE
T = TOP
B = BOTTOM

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STRUCTAKONSULT (PTY) LTD

DESIGN ENGINEER

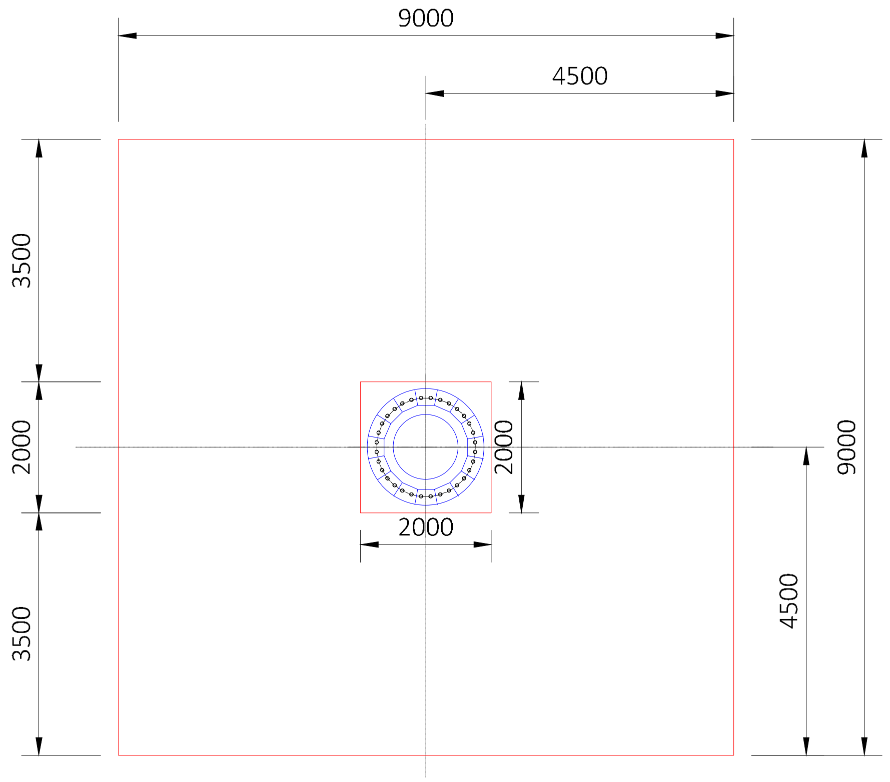
APPROVALS			DATE
DRAWN	JAC		10/02/2020
CHECKED	JAC		10/02/2020
RESP. ENG.	JAC		10/02/2020

REVISIONS

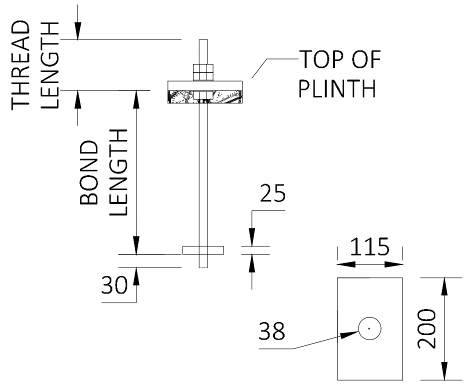
REV	DATE	BY	DESCRIPTION
0	12/09/2019	JAC	FOUNDATION DESIGN
1	30/09/2019	JAC	REVISED AS PER COMMENTS
2	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
3	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
4	27/11/2019	JAC	ALL BLOCKS SIGNED
5	10/02/2020	JAC	ALL BLOCKS SIGNED

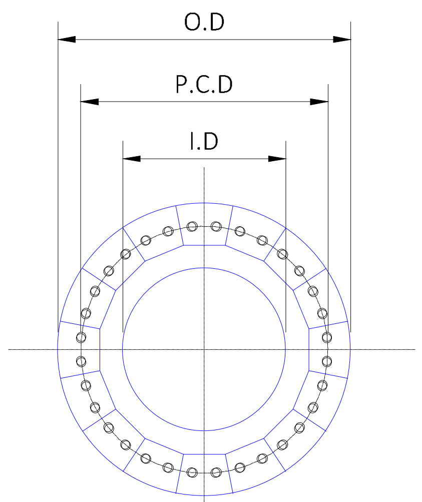
PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE
TITLE	REINFORCEMENT DETAILS FOR 18.4m TERMINAL STRAIN STRUCTURE - 1 BLO/ISC 32/2
ENG. REF. NO	FD2222/09/19
CLIENT	ASCENG

SCALE:	DWG NO		DWG SIZE	REV NO.
NTS	1	2	A3	5



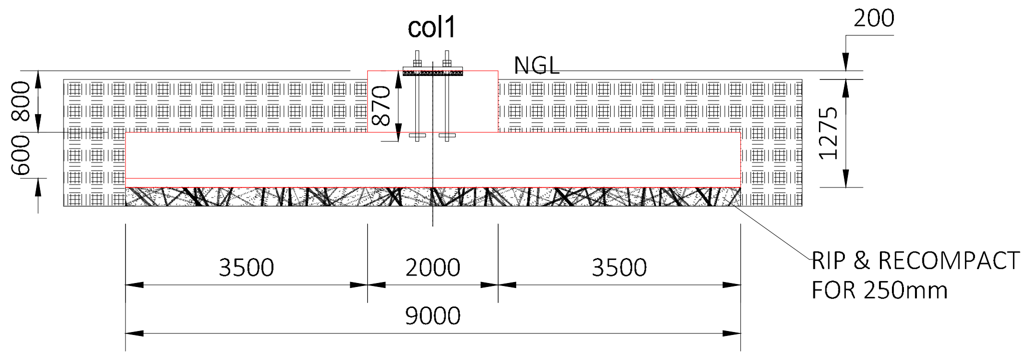
PLAN





BASE PLATE DETAIL

STRUCTURE AGL (m)	BASEPLATE						
		OD (mm)	PCD (mm)	ID (mm)	MIN THK (mm)	GUSSET THK (mm)	
18.40		1550	1440	1050	60	12	
H.D BOLTS GRADE 8.8							
	QTY	SIZE (mm)	O/A LENGTH (mm)	BOND LENGTH (mm)	THREAD LENGTH (mm)	WELD (mm)	PLATE
18.40	32	M36	1180	840	230	12	115X200X25



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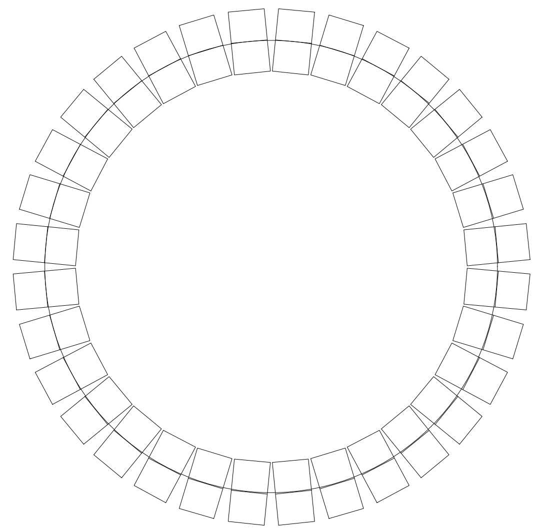

END PLATE ON P.C.D

CONCRETE NOTES

1 CONCRETE CUBE CRUSHING STRENGTH AT 28 DAYS
2 CONCRETE GRADES UNLESS OTHERWISE SHOWN
- SURFACE BEDS 25MPa
- STRUCTURAL FOUNDATIONS 25MPa
- MASS CONCRETE 10MPa
- 75mm BLINDING LAYER 10MPa
- SOILCRETE 80kg/cu.m.
3 ALL WORKS TO SANS 1200
4 DIMENSIONS TO BE VERIFIED ON SITE
5 ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED
6 75mm BLINDING UNDER PROVIDED FOR FULL EXTENT OF FOUNDATION
7 ALL EXPOSED CONCRETE TO BE CHAMFERED 25 x 25mm
8 ALL EXPOSED CONCRETE SURFACES TO BE WOOD FLOAT FINISHED, UNLESS OTHERWISE NOTED
9 PLINTH TO EXTEND 200m ABOVE GROUND, 600mm SOIL COVER

SOIL NOTES

1 SOIL TYPE 3
- MIN INTERNAL ANGLE OF FRICTION 10°
- MIN SOIL DENSITY 14KN/m³
- MIN BEARING CAPACITY 100KPa
2 ALL BACKFILL MATERIAL TO BE LAID & THOROUGHLY COMPACTED IN MAXIMUM 200mm LAYERS.
3 FOUNDATION BEDDING TO BE HORIZONTAL & FIRM WITH ALL LOOSE OR WATERLOGGED MATERIAL REMOVED, ENGINEER TO BE CONTACTED IF UNFORESEEN FOUNDING CONDITIONS ENCOUNTERED
4 RIP & RE-COMPACT BOTTOM OF FOUNDATION FOR A 250mm LAYER
5 IF FOUNDATION IS WATERLOGGED THEN DUMP ROCK AND FINES SHOULD BE PLACED 500mm UNDERNEATH AND COMPACTED IN 250mm LAYERS WITH A 50 MICRON SHEET PLACED ABOVE FILL

BASE PLATE & H.D BOLT NOTES

1 50mm NON-SHRINK GROUTING FOR NON-STRUCTURAL PURPOSES WITH TWO 30mm DIAMETER WEEPHOLES
2 30mm OVERLENGTH ON BOLT PROJECTION
3 GRADE 8.8
4 NUTS & 2 WASHERS PER BOLT
5 BOTTOM PLATE TO BE WELDED

QUANTITIES

1 CONCRETE VOLUME: 57.90m³
2 EXCAVATION VOLUME: 103.30m³
3 REINFORCEMENT MASS: 4132KG

UNFACTORED LOADS		
LOAD FACTOR - 1.5		
COLUMN 1		
TOTAL		
SHEAR	MOMENT	VERTICAL
211.00	3884.80	72.10

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STRUCTAKONSULT (PTY) LTD

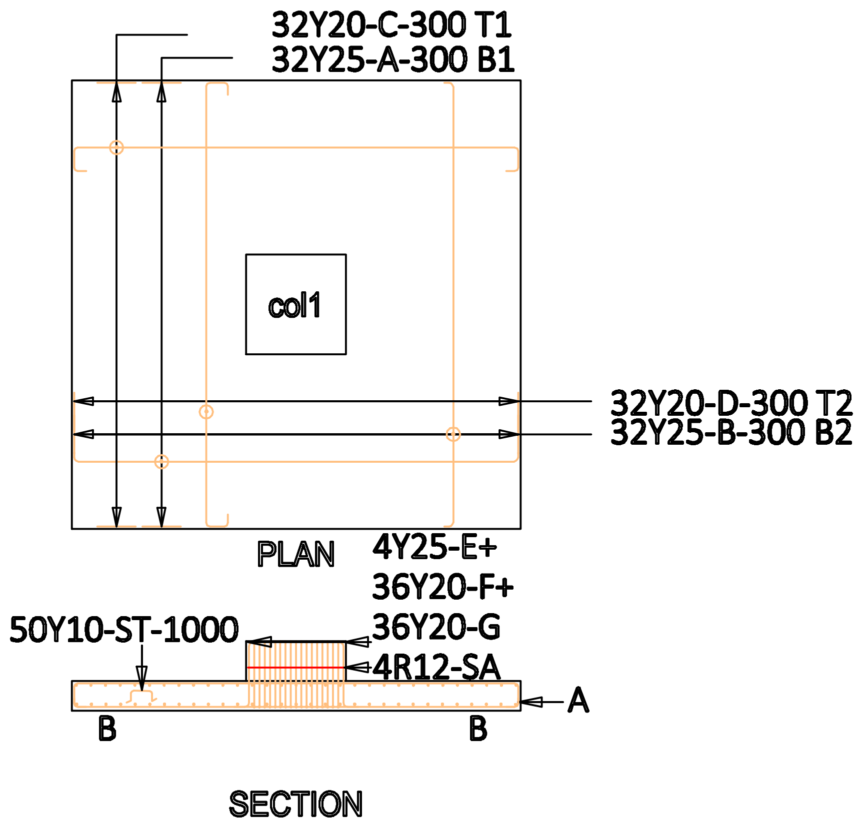
DESIGN ENGINEER			
APPROVALS			DATE
DRAWN	JAC		10/02/2020
CHECKED	JAC		10/02/2020
RESP. ENG.	JAC		10/02/2020

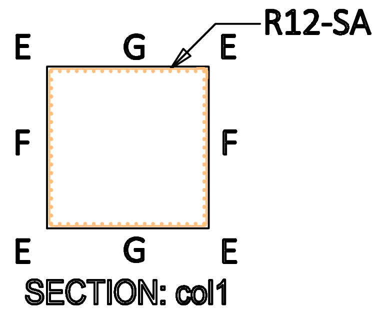
REVISIONS

REV	DATE	BY	DESCRIPTION
0	12/09/2019	JAC	FOUNDATION DESIGN
1	30/09/2019	JAC	REVISED AS PER COMMENTS
2	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
3	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
4	27/11/2019	JAC	ALL BLOCKS SIGNED
5	10/02/2020	JAC	ALL BLOCKS SIGNED

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE
TITLE	CONCRETE DETAILS FOR 18.4m TERMINAL STRAIN STRUCTURE - SOIL TYPE 3 - 1 BLO/ISC 32/2
ENG. REF. NO	FD2222/09/19
CLIENT	ASCENG

SCALE:	DWG NO	DWG SIZE	REV NO.
NTS	2 2	A3	5





REINFORCING SCHEDULE																
ITEM	NO	SIZE	MARK	BARS PER MEMBER	DIA	TOTAL NUMBER	LENGTH	TOTAL LENGTH	SHAPE CODE	A	B	C	D	E	COMMENT	MASS
FOUNDATION PAD/PLINTH	1 NO OFF	9500 L x 9500 W x 600 H	A	32	Y25	32	9650	308800	38	180	9400	180			PAD HORIZONTAL	1189
			B	32	Y25	32	9650	308800	38	180	9400	180			PAD HORIZONTAL	1189
			D	32	Y20	32	10550	337600	55	240	430	9400	430	240	PAD HORIZONTAL	834
			C	32	Y20	32	10650	340800	55	240	470	9400	470	240	PAD HORIZONTAL	842
			E	4	Y25	4	1800	7200	54	300	1300	300			PLINTH VERTICAL	28
			F	36	Y20	36	1700	61200	54	240	1300	300			PLINTH VERTICAL	151
			G	36	Y20	36	1700	61200	54	240	1300	300			PLINTH VERTICAL	151
			SA	4	R12	4	8700	34800	60	2140	2140				PLINTH HORIZONTAL	31
			ST	50	Y10	50	1900	95000	83	350	470	350	350		PAD STOOL	59
CUTTING & BENDING TO COMPLY WITH SANS 282; MINIMUM HOOK, BEND & RADIUS TO COMPLY WITH SANS 920.															TOTAL MASS (KG)	4474

REINFORCING NOTES

1 REINFORCEMENT CONCRETE COVER SPECIFICATION:
- STUB COLUMNS 30mm TO LINKS
- BASES: TOP & SIDES 50mm
BOTTOM 75mm

2 R - HOT ROLLED MILD STEEL, fy = 250MPa
Y - HOT ROLLED HIGH-YIELD STEEL, fy = 450MPa

3 REINFORCEMENT TO BE BENT TO SANS 282 & FIXED SO THAT ALL CROSSING BARS ARE FIXED.

4 ALL WORKS TO SANS 1200

5 DIMENSIONS TO BE VERIFIED ON SITE

6 ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED

REINFORCING ABBREVIATIONS

IF = INSIDE FACE
EW = EACH WAY
EF = EACH FACE
NF = NEAR FACE
FF = FAR FACE
ALT = ALTERNATE
STG = STAGGERED
TOG = TOGETHER
ABR = ALTERNATE BARS REVERSED
T1 = TOP ONE
T2 = TOP TWO
B1 = BOTTOM ONE
B2 = BOTTOM TWO
OF = OUTSIDE FACE
T = TOP
B = BOTTOM

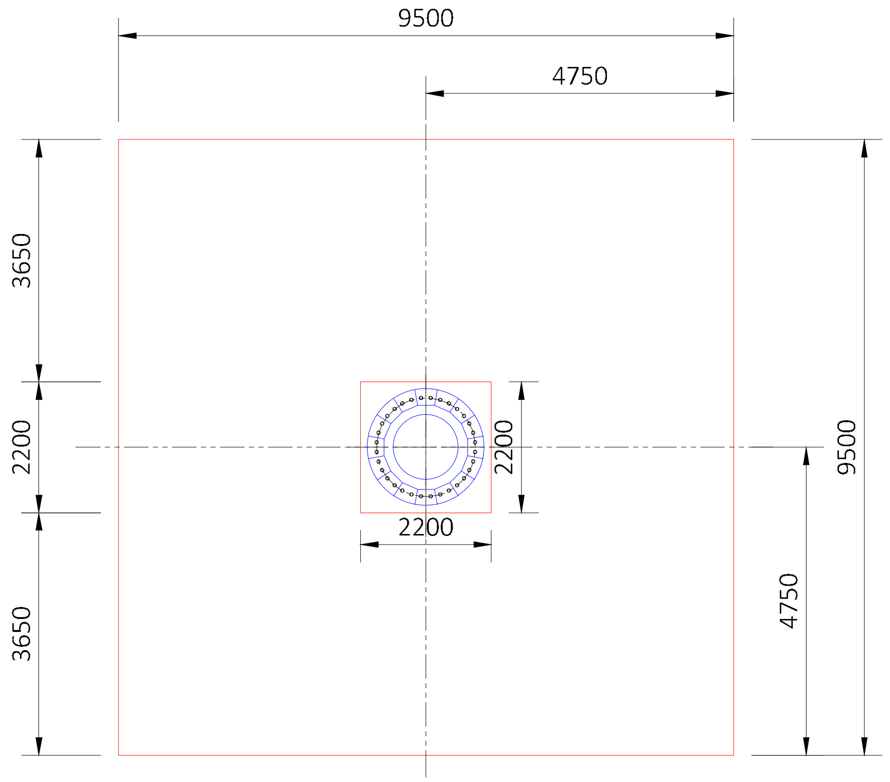
STRUCTA konsult

DESIGN ENGINEER				REVISIONS			
				REV	DATE	BY	DESCRIPTION
				0	12/09/2019	JAC	FOUNDATION DESIGN
				1	30/09/2019	JAC	REVISED AS PER COMMENTS
APPROVALS			DATE	2	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
DRAWN	JAC		10/02/2020	3	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
CHECKED	JAC		10/02/2020	4	27/11/2019	JAC	ALL BLOCKS SIGNED
RESP. ENG.	JAC		10/02/2020	5	10/02/2020	JAC	STRUCTURE NAME CHANGED

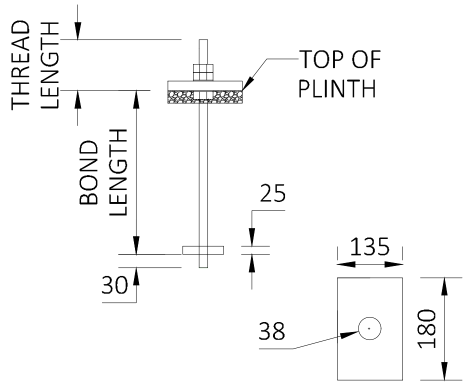
STRUCTAKONSULT (PTY) LTD

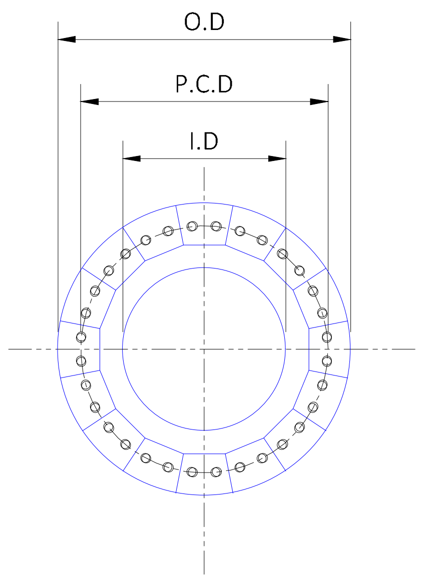
PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE
TITLE	REINFORCEMENT DETAILS FOR 20.4m TERMINAL STRAIN STRUCTURE - 2 BLO/ISC 32/2
ENG. REF. NO	FD2222/09/19
SCALE:	NTS
CLIENT	ASCENG

DWG NO		DWG SIZE	REV NO.
1	2	A3	5



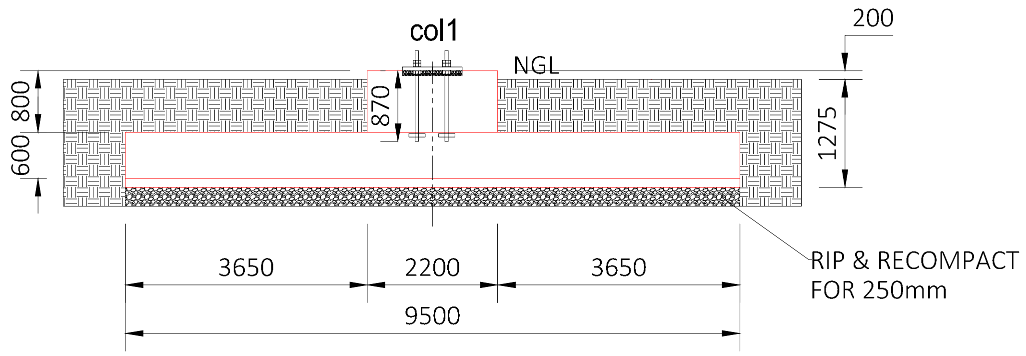
PLAN



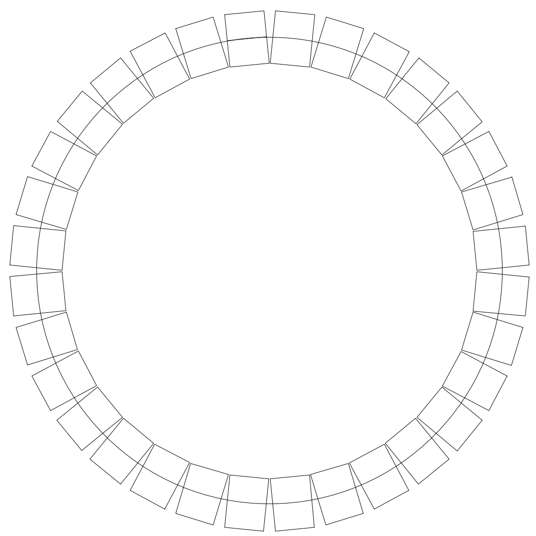


BASE PLATE DETAIL

STRUCTURE AGL (m)	BASEPLATE						
		OD (mm)	PCD (mm)	ID (mm)	MIN THK (mm)	GUSSET THK (mm)	
20.40		1700	1600	1200	60	12	
H.D BOLTS GRADE 8.8							
	QTY	SIZE (mm)	O/A LENGTH (mm)	BOND LENGTH (mm)	THREAD LENGTH (mm)	WELD (mm)	PLATE
20.40	32	M36	1180	840	230	12	135X180X25



SECTION



END PLATE ON P.C.D

CONCRETE NOTES

1 CONCRETE CUBE CRUSHING STRENGTH AT 28 DAYS
2 CONCRETE GRADES UNLESS OTHERWISE SHOWN
- SURFACE BEDS 25MPa
- STRUCTURAL FOUNDATIONS 25MPa
- MASS CONCRETE 10MPa
- 75mm BLINDING LAYER 10MPa
- SOILCRETE 80kg/cu.m.

3 ALL WORKS TO SANS 1200
4 DIMENSIONS TO BE VERIFIED ON SITE
5 ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED
6 75mm BLINDING UNDER PROVIDED FOR FULL EXTENT OF FOUNDATION
7 ALL EXPOSED CONCRETE TO BE CHAMFERED 25 x 25mm
8 ALL EXPOSED CONCRETE SURFACES TO BE WOOD FLOAT FINISHED, UNLESS OTHERWISE NOTED
9 PLINTH TO EXTEND 200m ABOVE GROUND, 600mm SOIL COVER

SOIL NOTES

1 SOIL TYPE 3
- MIN INTERNAL ANGLE OF FRICTION 10°
- MIN SOIL DENSITY 14KN/m³
- MIN BEARING CAPACITY 100KPa

2 ALL BACKFILL MATERIAL TO BE LAID & THOROUGHLY COMPACTED IN MAXIMUM 200mm LAYERS.
3 FOUNDATION BEDDING TO BE HORIZONTAL & FIRM WITH ALL LOOSE OR WATERLOGGED MATERIAL REMOVED, ENGINEER TO BE CONTACTED IF UNFORESEEN FOUNDING CONDITIONS ENCOUNTERED
4 RIP & RE-COMPACT BOTTOM OF FOUNDATION FOR A 250mm LAYER
5 IF FOUNDATION IS WATERLOGGED THEN DUMP ROCK AND FINES SHOULD BE PLACED 500mm UNDERNEATH AND COMPACTED IN 250mm LAYERS WITH A 50 MICRON SHEET PLACED ABOVE FILL

BASE PLATE & H.D BOLT NOTES

1 50mm NON SHRINK GROUTING FOR NON STRUCTURAL PURPOSES WITH TWO 30MM DIAMETER WEEPHOLES
2 30mm OVERLENGTH ON BOLT PROJECTION
3 GRADE 8.8
4 NUTS & 2 WASHERS PER BOLT
5 BOTTOM PLATE TO BE WELDED

QUANTITIES

1 CONCRETE VOLUME: 64.80m³
2 EXCAVATION VOLUME: 115.10m³
3 REINFORCEMENT MASS: 4474KG

UNFACTORED LOADS		
LOAD FACTOR - 1.5		
COLUMN 1		
TOTAL		
SHEAR	MOMENT	VERTICAL
220.00	4491.10	84.70

DESIGN ENGINEER			REVISIONS			
			REV	DATE	BY	DESCRIPTION
			0	12/09/2019	JAC	FOUNDATION DESIGN
			1	30/09/2019	JAC	REVISED AS PER COMMENTS
APPROVALS		DATE	2	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
DRAWN	JAC	10/02/2020	3	14/11/2019	JAC	REVISED FOR DOCUMENT CONTROL
CHECKED	JAC	10/02/2020	4	27/11/2019	JAC	ALL BLOCKS SIGNED
RESP. ENG.	JAC	10/02/2020	5	10/02/2020	JAC	STRUCTURE NAME CHANGED

STRUCTA konsult

STRUCTAKONSULT (PTY) LTD

PROJECT	TIPPLER 3 - E004 - 66KV BRANCH LINE				
TITLE	CONCRETE DETAILS FOR 20.4m TERMINAL STRAIN STRUCTURE - SOIL TYPE 3 - 2 BLO/ISC 32/2				
ENG. REF. NO	FD2222/09/19	SCALE: NTS	DWG NO	DWG SIZE	REV NO.
CLIENT	ASCENG		2 2	A3	5

14. TEF DRT Meeting Minutes

	Meeting minutes	Unique Identifier	240-54043701	Rev	4
Eskom		Document Type	Template		
		Next review date	November 2015		
		Effective Date	22 November 2012		

Meeting Name: DRT MEETING			
Date: 13 October 2016	Venue: Buzzbar Boardroom, 1st Floor, PT&M Building, Brackenfell		Meeting No.: 09/2016
Attendance Register			
1.1 MEMBERS			
Name	**Initials**	**Designation & Area represented**	**Attendance**
1. Ahilan Kailasanathan	**AK**	**Network Planning Manager**	Present
2. Barbara van Geems	**BvG**	**Land Development Manager**	Apology
3. Charles Kadalie	**CK**	**Electrification Planning Manager**	Not Present
4. Erlind Segers	**ES**	**Network Engineering and Design - HV Design Manager**	Not Present
5. Piet Calitz	**PC**	**Network Engineering & Design Manager**	Not Present
6. Vikesh Bhikha	**VB**	**Network Engineering and Design – MV Line and Electrification Design Manager**	Present
7. Jan van Bosch	**JvB**	**WCOU Zone Engineer**	Not Present
1.2 SUBS			
1. Graham Hector	GH	Land Development	Not Present
2. Hasheem Hendricks	HH	Project Engineering – MV Line & Electrification Design	Present
3. Hennie Mostert	HM	Plant – Quality of Supply	Present
4. Leon Drotsche	LAD	Electricity Delivery – Network Services	Apology
5. Johan (Poen) Mostert	PM	Project Engineering – Substation Design	Present
6. Bradley Asia	BA	Project Engineering – HV Lines	Present
7. Stefan Terblance	ST	SI WCOU	Present

8. Zaid Barden	ZB	Atlantic Zone Management	Present
9. Muzafar Ebrahim	ME	Network Planning	Apology
10. Asanda Tshoko	AT	NED - HV	Present
11. Willem Vermeulen	WV	Vredendal CNC	Present
12. Juan Atkinson	JA	NED - HV	Present
13. Martin Keulder	MK	Land Developement	Present
14. Hennie Mostert	HM	Plant – Quality of Supply	Present
15. Hasheem Hendricks	TH	NED - MV	Present
16. Bradley Box	BB	GAU (WC)	Present
17. Stefan Terblanche	ST	SI WCOU	Present
18. Elsje Basson	EB	Net-Ops	Present
19. Alwyco Schreuder	AS	PE- AC	Present
20. Christian Truter	CT	TRANSNET	Present
21. Zeyaad Pandey	ZP	NED - HV	Present
22. Llewellyn Floris	LF	NED - HV	Present
23. Owen Peters	OP	Land Developement	Present
24. Gideon Gqomfa	GG	NED –HV TELE	Present
25. Dirk Aggenbag	DA	AECOM	Present
26. Colin Pym	CP	AECOM	Present
27. Derek Thomas	DT	AECOM	Present
28. Rose-Marie Taylor	RT	NED - HV	Present
29. Rameez Hendricks	RH	NED - HV	Present

30. Rashaad Buffkins	RB	SI	Present
31. Quaseem Mohamed	QM	NED - HV	Present
32. Mastura Bardien	MB	NED - HV	Present
33. Edgar-John Kleinveld	EK	PLANNING	Present
34. Aziem Sulaiman	AS	NED-HV	Present
35. Aldrey Africa	AA	PE -AC	Present
36. Etienne du Preez	EdP	AECOM	Present
37. Greg Branfield	GB	AECOM	Present
38. Jane Swarbeck	JS	BESA	Present
39. Peet Swart	PS	TRANSNET	Present
40. Thokozani Mhlongo	TM	TRANSNET	Present

General

The emergency preparedness process for the “Buzzbar” board room and emergency exits were discussed with all present at the start of the meeting.

H & S Specifications

All Project Engineers & Consultants to ensure that the H & S Specifications as required by the Construction Regulations are supplied as part of their Final Design (Volume 3) Documents – Action all Project Engineers & Consultants.

Building Orientation

All new buildings to be orientated in such a way that the entrance door is facing away from the rains – an arrow pointing due north to be placed on all drawings showing the building - Action all Project Engineers & Consultants.

	Meeting minutes	Unique Identifier	240-54043701	Rev	4
		Document Type	Template		
		Next review date	November 2015		
		Effective Date	22 November 2012		

Constructability Check

To avoid delays in project approvals, ensure that a constructability check has been performed and discussed with all the relevant stakeholders present before coming to the TEF - Action all Project Engineers & Consultants.

Item	Description	Action	Responsible Person
1.	Opening, Welcome and Apologies		VB
2.	Zero Harm Contact		
3.	Adoption of Agenda & Declaration of Interest		

Disclosure Classification (e.g. Public)

Item	Description	Action	Responsible Person
4.	**Acceptance of minutes and review of action items from 14 July 2016**	**4.2 WS-STM-1408-1557-00001 Pinotage – Blue Downs 132kv D/C Line** Project Category: Strengthening Project Initiator: Sicelo Ngxonono 021 980 3445 Project Engineer: Thandinkosi Mtsotso 021 980 3262 Project Co-ordinator: Phuti Moloto 021 980 3221 Programme Manager: Lusanda Ntombana 021 980 3532 **PROJECT APPROVED**	
5.	**Acceptance of minutes and review of action items from 22 September 2016**	**5.1 WS-STM-1408-1557-00002 Pinotage – Firgrove 132kV Line** Project Category: Strengthening Project Initiator: Sicelo Ngxonono 021 980 3445 Project Engineer: Nabil Mohamed 021 980 3961 Project Co-ordinator: Phuti Moloto 021 980 3221 Programme Manager: Lusanda Ntombana 021 980 3532 **PROJECT APPROVED** **5.2 IPP46445446-00001 Klawer Wind Farm 22kV Line** Project Category: Direct Customer Project Initiator: Zoe Lincoln 021 980 7541 Project Engineer: Martha Mahlatji 021 980 3681 Project Co-ordinator: Wayne Roberts 021 980 3654 Programme Manager: Ryan De Leeuw 021 980 3048 **PROJECT APPROVED**	

Item	Description	Action	Responsible Person
		5.3 IPP46445446-00002 Klawer SS 22kV Bay to Wind Farm Project Category: Direct Customer Project Initiator: Zoe Lincoln 021 980 7541 Project Engineer: Aziem Sulaiman 021 980 3178 Project Co-ordinator: Wayne Roberts 021 980 3654 Programme Manager: Ryan De Leeuw 021 980 3048 **PROJECT APPROVED**	
6.	New Items	**6.1 153272156-00001 Ystervark Branch Lines – Iscor/Blouwater 66kV Line** Project Category: Strengthening Project Initiator: Edgar John 021 980 3058 Project Engineer: Masturah Barodien 021 980 4043 Project Co-ordinator: Aldrey Africa 021 980 3688 Programme Manager: Denver Croy 021 980 4007 a.) The Terminal Towers to be 132kV Structures. b.) The closing spans will be132kV, King-bird conductors with 132kV insulators and corresponding hardware. c.) Transnet to secure a servitude between Pole 33 and 34 for the future 132kV Line. d.) OPGW to be bonded with the Gantry. e.) Revise constructability plan where stringing can take place prior to any outages.’	AECOM AECOM AECOM AECOM AECOM AECOM

Item	Description	Action	Responsible Person
		f.) Include OPGW upgrade from Blouwater on the Iscor Line. Parties to determine whether OPGW or ADSS is the required telecoms cable. g.) Fibre optic upgrade to be investigated. (Consult with Gideon) **PROJECT APPROVED SUBJECT TO NEW ACTION ITEMS** **6.2 153272156-00002 Ystervark FDR Control Plant– Iscor/Blouwater 66kV Line** Project Category: Strengthening Project Initiator: Edgar John 021 980 3058 Project Engineer: Garth van Heerden 021 980 3369 Project Co-ordinator: Aldrey Africa 021 980 3688 Programme Manager: Denver Croy 021 983 4007 a.) Eskom to provide the labeling standard for SED's. b.) Eskom ED technicians to be present on site while ABB does the work. **PROJECT APPROVED SUBJECT TO ACTION ITEMS** **6.3 153272156-00003 Ystervark 66kV-132kV S/S** Project Category: Strengthening Project Initiator: Edgar John 021 980 3058 Project Engineer: Garth van Heerden 021 980 3369 Project Co-ordinator: Aldrey Africa 021 980 3688 Programme Manager: Denver Croy 021 983 4007 a.) Consultant to confirm that Eskom will have access to all the equipment. b.) Make space available for a future breaker on the customer feeders. c.) Embankment (Cut) to be retained with a wall (or blocks) Consultant to give feedback on Embankments.	AECOM AECOM / GG PM AECOM AECOM AECOM AECOM

Item	Description	Action	Responsible Person
		d.) Store room to be prepared for future battery room. e.) No pump required for the toilet water supply. f.) LED lighting design to be supplied by the consultant. g.) Consultant to liaise with Burton Witbooi regarding new door structures. h.) Investigate bird control at Iscor Substation. i.) Juan Atkinson to find out about the metering panel layout standard. j.) DC module to be looked at, liaise with Rashaad Buffkins. k.) Add QOS recorder and VECTO II. l.) One panel is sufficient for the Telecoms (for front and side Entry). m.) Transnet to confirm if pulse is needed to Synchronize meters with Eskom metering. NTP/GPS time Synch should suffice and is preferred. n.) Check that the spacing between the double Busbars is sufficient for constructability – no clearance construction difficulty extending the Busbars. ESP to be looking at live points. **GENERAL:** - Outages required for works: outages to be conducted during Transnet's annual shut down period. - Temporary power supply to be supplied/accommodated for in the FDP. - A plan is to be provided. **PROJECT APPROVED SUBJECT TO ACTION ITEMS** *NB: the approval is with the exception of the OPGW/ADSS that needs to be addressed by all the relevant fibre specialists*. **6.4 153272156-00004 Ystervark 66kV Breakers & Protection**	AECOM AECOM AECOM / BW AECOM / JA AECOM / RB AECOM AECOM AECOM AECOM AECOM

Item	Description	Action	Responsible Person
		Project Category: Strengthening Project Initiator: Edgar John 021 980 3058 Project Engineer: Garth van Heerden 021 980 3369 Project Co-ordinator: Aldrey Africa 021 980 3688 Programme Manager: Denver Croy 021 983 4007 a.) Transformer tripping modifications – it must trip via the new breaker. b.) Installation of the new breakers can be done before the outage. c.) Check the tripping if there's no dead zone between the CT & the breaker. d.) The Patch panel to be upgraded to 48core at Iscor Substation. **PROJECT APPROVED SUBJECT TO ACTION ITEMS**	**AECOM** **AECOM** **AECOM** **AECOM**
	Meeting was adjourned at Next meeting	**12h30** **03 November 2016**	

Minutes submitted by: Asanda Tshoko

Approved by: ____________________

TEF ChairpersonDate

Record of Decision

Ref Number	Item name	Date	Decision
001			
002			
003			
004			

Date:					

15. Additional Design Related Information

Sansom, Brett

From:	Masturah Barodien <BarodiM@eskom.co.za>
Sent:	Friday, 11 October 2019 10:03
To:	Sansom, Brett
Cc:	Bonga Ntshangase Transnet Capital Projects Table Bay; Sibusiso Gwamanda Transnet Capital Projects Carlton centre (Sibusiso.Gwamanda@transnet.net)
Subject:	RE: Tippler 3 - E004 - 66 kV Branch Line - Stand-off Insulator Base & Structure Bracket

Hi Brett,

The rounded/cylindrical bracket and attachment is dependent on the insulator base and vice versa -because insulator bases vary from suppliers and the type of insulator base must therefore be confirmed from the supplier. The requirement for additional channel attachment arises when the steel pole bracket and insulator base do not fit.

The square bracket attachment is used when the insulator base is circular with 4 bolt holes as shown in D-WC-7600-02-07_00. The square bracket in D-WC-7600-02-07_00 accommodates for the circular (insulator) base and the cylindrical insulator base.

As the proposed insulator base you sent (145-241-015) is cylindrical and fits on the cylindrical bracket (D-WC-7600-02-02_02) as shown in the picture -then it is acceptable. Just note that the bolt and bolt hole sizes must correspond on the insulator base and cylindrical bracket.

Regards
Mastura

From: Sansom, Brett [mailto:Brett.Sansom@aecom.com]
Sent: 09 October 2019 02:26 PM
To: Masturah Barodien
Cc: Bonga Ntshangase Transnet Capital Projects Table Bay; Sibusiso Gwamanda Transnet Capital Projects Carlton centre (Sibusiso.Gwamanda@transnet.net)
Subject: Tippler 3 - E004 - 66 kV Branch Line - Stand-off Insulator Base & Structure Bracket

Hi Masturah

Can you please advise, the Eskom WC standard shows the brackets required for the stand-off insulators (please see attached) on the steel monopoles, we just want to confirm the following:

1. Must the brackets be the round bracket (D-WC-7600-02-02) only or with the additional square bracket (D-WC-7600-02-07). It is not always clear as it effects the base type & dimensions of the stand-off insulators which Eskom WC accepts.

2. Will the round bracket on its on suffice, with the proposed base of the insulator looking as per the below (see also attached example drawing of insulator base), or must the insulator base be as per the attached photo if the round bracket on its own is acceptable.

3. There is a concern that if the additional square bracket must be included, then the proposed bases of the insulators may not fit.

As you are aware, the Eskom D-DT drawings do not show the actual base requirements of the insulators, with every region having its own requirement regarding the base type & dimensions. Hence we just like to confirm before finale acceptance on the structures shop drawings are given.

Your soonest reply will be appreciated.

Thanks

Brett Sansom Pr. Tech Eng, CEM, CEA, GSAP (New + Existing Buildings)
Senior Electrical Technologist, Buildings and Places, SA West
D +27-21-950-7696
M +27-71-940-7405
brett.sansom@aecom.com

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P.O. Box 112, Bellville, 7535
Cape Town, Western Cape, South Africa
T +27-21-950-7500
aecom.com

Sansom, Brett

From: Masturah Barodien <BarodiM@eskom.co.za>
Sent: Wednesday, 21 August 2019 11:39
To: Sansom, Brett
Subject: RE: Weekly Eskom FDPs Approval Tracking Meeting.

Hi Brett,

Form 15 is the DRA inputs. This is not a requirement anymore.

Regards
Mastura

From: Sansom, Brett [mailto:Brett.Sansom@aecom.com]
Sent: 21 August 2019 09:35 AM
To: Masturah Barodien
Subject: FW: Weekly Eskom FDPs Approval Tracking Meeting.

Hi Masturah

With regards to the above, can you please advise what 'Form 15' is.

Thanks

Brett Sansom Pr. Tech Eng, CEM, CEA, GSAP (New + Existing Buildings)
Senior Electrical Technologist, Buildings and Places, SA West
D +27-21-950-7696
M +27-71-940-7405
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From: Masturah Barodien <BarodiM@eskom.co.za>
Sent: Thursday, 25 July 2019 09:48
To: Sibusiso Gwamanda Transnet Capital Projects Carlton centre <Sibusiso.Gwamanda@transnet.net>; Sansom, Brett <Brett.Sansom@aecom.com>; Gideon Gqomfa <GqomfaG@eskom.co.za>
Cc: Aldrey Africa <AfricaA@eskom.co.za>; Shantal Gordon <GordonSh@eskom.co.za>; Garth Van Heerden <vHeerdG@eskom.co.za>; Bonga Ntshangase Transnet Group Capital Table Bay <Bonga.Ntshangase@transnet.net>
Subject: RE: Weekly Eskom FDPs Approval Tracking Meeting.

Good day Brett and Sibusiso,

Hope all is well.

Submittal of line construction works of the 66kV Ystervark Branch Line is to contain items listed in the checklist attached.

Please also include a table for structure usage % .

Kind regards
Mastura Barodien

-----Original Appointment-----
From: Sibusiso Gwamanda Transnet Capital Projects Carlton centre [mailto:Sibusiso.Gwamanda@transnet.net]
Sent: 15 July 2019 07:18 PM
To: Aldrey Africa; Bonga Ntshangase Transnet Group Capital Table Bay; Bonginkosi Cele Transnet Group Capital JHB; Sansom, Brett; Cassidy Gray Transnet National Ports Authority SLD; Christian Truter; Garth Van Heerden; Gideon Gqomfa; Howard Russo; Jabulani Nkanyani Transnet National Port Authority JHB; Masturah Barodien; Shantal Gordon; Tonny Mhondiwa
Cc: Let Tsotetsi Transnet Group Capital SLD; Philip Wahl
Subject: Weekly Eskom FDPs Approval Tracking Meeting.
When: 17 July 2019 02:00 PM-04:00 PM (UTC+02:00) Harare, Pretoria.
Where: Salkor Building Offices, Saldanha.

Good day everyone,

Following the meeting we had in Cape Town at the AECOM offices on the 25th June 2019, you are invited to the weekly meetings to be held for the purposes of tracking the approval of the Eskom FDPs for the Ystervark Substation as part of the Saldanha Tippler 3 Project.

The Boardroom details & dialing in details will be shared with you in due course.

Regards,
Sibusiso Gwamanda (TGC Engineering Manager on the Saldanha Tippler 3 Project) .

<< File: ATT70779 1.jpg >>

Sibusiso Gwamanda, Pr Eng|Senior Manager Electrical – Engineering & Design Services (Centre of Excellence)
BSc Elec Eng (Natal) | MBA (Wits)
Transnet Group Capital| Engineering & Design Services
Tel:+27 11 308 4779 | Cell:+27 82 445 7726
Transnet SOC Ltd | 1st Floor D Wing, Transnet Head Office, 9 Country Estate Drive, Waterfall 5 – Ln, Midrand, 1662
E-mail: sibusiso.gwamanda@transnet.net | http://www.transnet.net

<< File: 119071519175901181.png >>

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Sansom, Brett

From:	Masturah Barodien <BarodiM@eskom.co.za>
Sent:	Friday, 14 June 2019 14:05
To:	Bonga Ntshangase Transnet Group Capital Table Bay (Bonga.Ntshangase@transnet.net) (Bonga.Ntshangase@transnet.net); Sansom, Brett; Sibusiso Gwamanda Transnet Capital Projects Carlton centre (Sibusiso.Gwamanda@transnet.net)
Cc:	Gideon Gqomfa; Marumo Kgare; Aldrey Africa; Owen Peters
Subject:	RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Good day All,

Please be informed that the pconceptual sleeve/manhole design for OPGW was conditionally approved at Eskom WCOU Dx DRT on 13/06/2019.

The condition for approval is that the wayleave agreement must include (the new) underground services and access along the route to underground services for Eskom operation and maintenance.

Will send minutes of DRT as soon as they are formally compiled.

Regards
Mastura

From: Masturah Barodien
Sent: 03 June 2019 09:23 AM
To: Sibusiso Gwamanda Transnet Capital Projects Carlton centre (Sibusiso.Gwamanda@transnet.net); Bonga Ntshangase Transnet Group Capital Table Bay (Bonga.Ntshangase@transnet.net) (Bonga.Ntshangase@transnet.net); Sansom, Brett (Brett.Sansom@aecom.com)
Cc: Gideon Gqomfa; Marumo Kgare
Subject: RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Good day Brett,

Please find feedback from the DRT presentation for underground ducting of OPGW at Blouwater Ystervark below:

- Please include cost estimate for ducting vs poles. This can be a rough estimate 50% accuracy.
- Civil requirements? include soil type/backfill classification. Trench reinstatement requirements, etc.
- Will the entire route be directional drilling? How much km trenching and how much drilling? etc.

Kind regards
Mastura

From: Rolivhuwa Nemakonde Transnet Group Capital CPT [mailto:Rolivhuwa.Nemakonde@transnet.net]
Sent: 28 May 2019 09:11 AM

To: Masturah Barodien
Subject: RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Morning Masturah,

I have uploaded the files on the link,

Kindly let me know receipt of the documents by signing and returning the attached transmittal.

Regards
Rolivhuwa

From: Masturah Barodien [mailto:BarodiM@eskom.co.za]
Sent: 27 May 2019 04:50 PM
To: Rolivhuwa Nemakonde Transnet Group Capital CPT <Rolivhuwa.Nemakonde@transnet.net>
Subject: RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Good day Rolivhuwa,

I am having problems with viewing the document in the link provided.
Could you alternatively send the information via the ZendTo portal:
https://zendto.eskom.co.za/

Regards
Mastura Barodien

From: Rolivhuwa Nemakonde Transnet Group Capital CPT [mailto:no-reply@sharepointonline.com]
Sent: 27 May 2019 03:40 PM
To: Masturah Barodien
Cc: Rolivhuwa Nemakonde Transnet Group Capital CPT
Subject: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Good afternoon Masturah,

please see link to the Presentation of Tippler 3 Bulk Power Ystervark branch Lines. This is the submission of the sleeve Manhole system draft design to be presented at the Eskom June 2019 DRT meeting for approval.

apologies for sending a link, the files are big to go through email.

Kindly confirm receipt by signing a copy of the attached transmittal and return back to me.

regards
Roli

This link only works for the direct recipients of this message.

E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines

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Microsoft Corporation, One Microsoft Way, Redmond, WA 98052

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Sansom, Brett

From:	Masturah Barodien <BarodiM@eskom.co.za>
Sent:	Tuesday, 09 July 2019 12:30
To:	Sansom, Brett; Sibusiso Gwamanda Transnet Capital Projects Carlton centre (Sibusiso.Gwamanda@transnet.net) (Sibusiso.Gwamanda@transnet.net)
Cc:	Gideon Gqomfa
Subject:	RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Hi Brett,

Please note the comments in the below emails regarding the FO manhole and sleeve as you proceed with the design.

Man holes are based on the installation method, but should maximise the cable length , refer to SAN 10340-2.

Regards
Mastura

From: Gideon Gqomfa
Sent: 08 July 2019 04:25 PM
To: Masturah Barodien
Cc: Sibusiso Gwamanda Transnet Capital Projects Carlton centre (Sibusiso.Gwamanda@transnet.net) (Sibusiso.Gwamanda@transnet.net); Sansom, Brett (Brett.Sansom@aecom.com)
Subject: RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Hi Masturah

There should be less or no manholes in the FO route, where a 90 degrees bend is required, a slow bend can be used.

The manholes can be install where necessary or when requested by the FO Contractor due to certain circumstances identified on site.

With Regards
Gideon

From: Masturah Barodien
Sent: 03 July 2019 02:27 PM
To: Gideon Gqomfa
Subject: RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Hi Gideon,

Hope all is well.

You had previously mentioned that the number of manholes on the ducting design is excessive. Please indicate if there should be less manholes.
According to Khalil/Zeyaad there may not even need to be manholes on bends as the OPGW fibre can pass through most bends.

Can you kindly confirm what is the requirement for number of manholes on fibre ducting so Aecom can be informed to change their design accordingly.

Regards
Mastura

From: Masturah Barodien
Sent: 18 June 2019 10:32 AM
To: 'Sansom, Brett'
Subject: RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Good morning Brett,

The additional information should form part of the detailed design in the final design package for the Ystervark Branch line and Fibre Optic ducting project (153272156-00001).

The wayleave approvals is more urgent as the project was approved (at DRT) on the condition of wayleave and environmental approval.

Regards
Mastura

From: Sansom, Brett [mailto:Brett.Sansom@aecom.com]
Sent: 14 June 2019 02:20 PM
To: Masturah Barodien
Subject: RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Hi Masturah

With regards to the below, do you still need the additional information as requested?

Thanks

Brett Sansom Pr. Tech Eng, CEM, CEA, GSAP (New + Existing Buildings)
Senior Electrical Technologist, Buildings and Places, SA West
D +27-21-950-7506
M +27-71-940-7405
brett.sansom@aecom.com

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P.O. Box 112, Bellville, 7535
Cape Town, Western Cape, South Africa
T +27-21-950-7500
aecom.com

From: Masturah Barodien <BarodiM@eskom.co.za>
Sent: Friday, 14 June 2019 14:05
To: Bonga Ntshangase Transnet Group Capital Table Bay (Bonga.Ntshangase@transnet.net) (Bonga.Ntshangase@transnet.net) <Bonga.Ntshangase@transnet.net>; Sansom, Brett <Brett.Sansom@aecom.com>; Sibusiso Gwamanda Transnet Capital Projects Carlton centre (Sibusiso.Gwamanda@transnet.net) <Sibusiso.Gwamanda@transnet.net>
Cc: Gideon Gqomfa <GqomfaG@eskom.co.za>; Marumo Kgare <KgareM@eskom.co.za>; Aldrey Africa <AfricaA@eskom.co.za>; Owen Peters <PetersOw@eskom.co.za>
Subject: RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Good day All,

Please be informed that the pconceptual sleeve/manhole design for OPGW was conditionally approved at Eskom WCOU Dx DRT on 13/06/2019.

The condition for approval is that the wayleave agreement must include (the new) underground services and access along the route to underground services for Eskom operation and maintenance.

Will send minutes of DRT as soon as they are formally compiled.

Regards
Mastura

From: Masturah Barodien
Sent: 03 June 2019 09:23 AM
To: Sibusiso Gwamanda Transnet Capital Projects Carlton centre (Sibusiso.Gwamanda@transnet.net); Bonga Ntshangase Transnet Group Capital Table Bay (Bonga.Ntshangase@transnet.net) (Bonga.Ntshangase@transnet.net); Sansom, Brett (Brett.Sansom@aecom.com)
Cc: Gideon Gqomfa; Marumo Kgare
Subject: RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Good day Brett,

Please find feedback from the DRT presentation for underground ducting of OPGW at Blouwater Ystervark below:

- Please include cost estimate for ducting vs poles. This can be a rough estimate 50% accuracy.
- Civil requirements? include soil type/backfill classification. Trench reinstatement requirements, etc.
- Will the entire route be directional drilling? How much km trenching and how much drilling? etc.

Kind regards
Mastura

From: Rolivhuwa Nemakonde Transnet Group Capital CPT [mailto:Rolivhuwa.Nemakonde@transnet.net]
Sent: 28 May 2019 09:11 AM
To: Masturah Barodien
Subject: RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Morning Masturah,

I have uploaded the files on the link,

Kindly let me know receipt of the documents by signing and returning the attached transmittal.

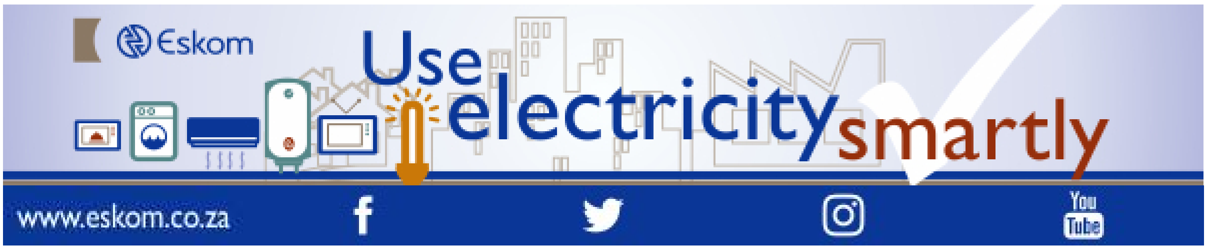
Regards
Rolivhuwa

From: Masturah Barodien [mailto:BarodiM@eskom.co.za]
Sent: 27 May 2019 04:50 PM
To: Rolivhuwa Nemakonde Transnet Group Capital CPT <Rolivhuwa.Nemakonde@transnet.net>
Subject: RE: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Good day Rolivhuwa,

I am having problems with viewing the document in the link provided.
Could you alternatively send the information via the ZendTo portal:
https://zendto.eskom.co.za/

Regards
Mastura Barodien



From: Rolivhuwa Nemakonde Transnet Group Capital CPT [mailto:no-reply@sharepointonline.com]
Sent: 27 May 2019 03:40 PM
To: Masturah Barodien
Cc: Rolivhuwa Nemakonde Transnet Group Capital CPT
Subject: Rolivhuwa Nemakonde Transnet Group Capital CPT shared the folder "E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines" with you.

Good afternoon Masturah,

please see link to the Presentation of Tippler 3 Bulk Power Ystervark branch Lines. This is the submission of the sleeve Manhole system draft design to be presented at the Eskom June 2019 DRT meeting for approval.

apologies for sending a link, the files are big to go through email.

Kindly confirm receipt by signing a copy of the attached transmittal and return back to me.

regards
Roli

This link only works for the direct recipients of this message.

E004 - Presentation Tippler 3 Bulk Power Ystervark branch Lines

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Tippler 3: Bulk Power: PLS CADD Findings on Blouwater-Iscor 66 kV Line Existing Structures

OVERVIEW

PURPOSE

- To undertake PLS CADD, PLS Tower and PLS Pole modelling on existing structures to determine their suitability to cater for new 16 kA/1 sec OPGW.

- Document findings in a report and submit to stakeholders for review (*Report Reference: 1924701-2-300-E-RPT-0008 - Tippler 3 Bulk Power Supply - 66kV OHL Design Verification Report*).

- Necessary discussions with stakeholders to determine way forward based on findings of the modelling as noted in the report.

- Present possible solutions to stakeholder for consideration.

PROPOSED SOLUTIONS FOR CONSIDERATION

REPLACE MASTS (PREFERRED OPTION)

- This will encompass the replacement of all respective existing structures, with new masts that will be able to cater for the new OPGW.

Pros:

- Best and preferred solution.
- Tried and tested infrastructure. Fits in easily with existing installation configuration.
- Lowest risk of damage, vandalism, theft etc. to coms cable (ie. OPGW).
- Very important factor mentioned above considering criticality of the infrastructure/loads supplied by the OHL (ie. major SA port and Sunrise LPG).

PROPOSED SOLUTIONS FOR CONSIDERATION

- Familiar and standard infrastructure for Contractor(s) to install.
- Works fall within existing Eskom servitude.
- Relatively easy & fast to commission.

Cons:

- Probably most expensive option.
- Quite significant amount of works of the installation that can only be done during shut period.
- May effect current Environmental Authorisation (EA).

PROPOSED SOLUTIONS FOR CONSIDERATION

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ADSS STRINGING ON EXISTING MASTS

The works here would involve the stringing of ADSS (All dielectric, self supporting) fibre optic cable along lower portions of the masts.

Pros:

- One of the least expensive options.
- String portion, including installation of assemblies can be done relatively quick.
- Can be easily integrated into existing installation.
- Relatively easy & fast to commission.

PROPOSED SOLUTIONS FOR CONSIDERATION

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Cons:

- Eskom typically not in favour of this solution due to various reason.
- Eskom may very well not allow the ADSS to be strung during live line conditions.
- ADSS much more prone to damage, vandalism, theft and the like.
- Special, non-standard fixing materials to be made to fix ADSS to masts, may be an issue if emergency replacements are required.
- PLS CADD remodelling to be undertaken again to confirm existing masts will be able to cater for ADSS.
- May effect current Environmental Authorisation (EA).

PROPOSED SOLUTIONS FOR CONSIDERATION

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SLEEVE/MANHOLE SYSTEM

The infrastructure entails underground sleeves, with manholes at strategic locations, in which the fibre optic cables will be installed.

Pros:

- Independent of actual OHL, hence construction wont be impeded by OHL status.
- Can be installed within existing Eskom servitude.
- Can be relatively easy integrated with existing system.
- Relatively easy & fast to commission.

PROPOSED SOLUTIONS FOR CONSIDERATION

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Cons:

- Expensive.
- Not a typical Eskom standard installation.
- Prone to damage, vandalism, theft and the like.
- Directional drilling will be required to install sleeves under provincial road, special approvals will be required.
- May effect current Environmental Authorisation (EA).

PROPOSED SOLUTIONS FOR CONSIDERATION

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WIRELESS COMMUNICATIONS

The installation would involve installing radio, or similar, links and the like in order for Blouwater, Iscor & Ystervark Substations to communicate with one another.

Pros:

- Relatively in-expensive compared to most other proposed solutions, depending on the extent of the installations.
- Installation of the systems comparatively fast.
- Relatively easy & quick commissioning.
- Flexibility.
- Will most likely not effect current EA.

PROPOSED SOLUTIONS FOR CONSIDERATION

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Cons:

- Long distances of transmission between Substations (e.g. Blouwater to Iscor, Ystervark) reduces signal strength.
- Wireless signals prone to be disrupted by infrared, other radio signal, weather, structures and the like.
- Possible limited data transfer vs OPGW/Fibre optic cables.
- Speed.
- Possible security issues.

Note: The above should not be seen as the only disadvantages, relevant Eskom departments could provide further insight as to their experiences regarding the limitations of wireless technology used in Eskom systems.

PROPOSED SOLUTIONS FOR CONSIDERATION

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STRENGTHENING OF EXISTING STRUCTURES

The strengthening of the existing structures would include, but not be limited to the use of stays for monopoles & adding members onto the lattice towers.

Pros:

- Attain stronger structures without the need for complete re-build.
- Economical compared to tower replacement.
- Possible time saving.

PROPOSED SOLUTIONS FOR CONSIDERATION

Cons:

- Most works can only be undertaken during outage period.
- Re-analysis required.
- Towers remain aged (lattice).
- Challenging execution (i.e. outages, construction).
- Foundation verifications required. No information available on existing foundations.
- Stays will need to be suitably marked to avoid accidental vehicle damage (larger footprint).

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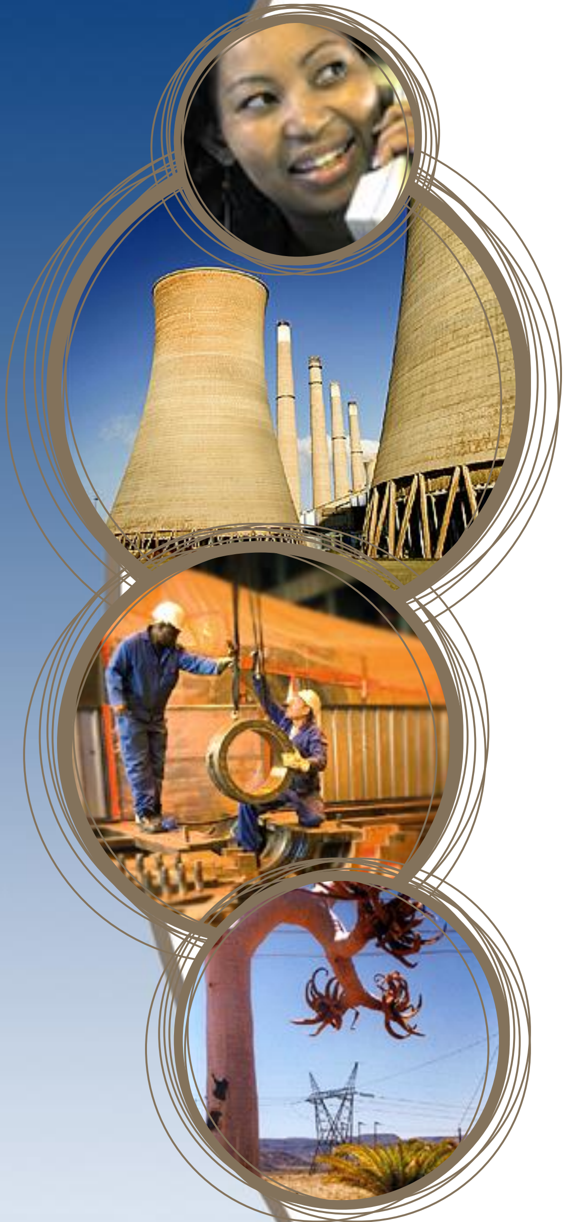
20 YEARS OF FREEDOM
south africa 1994 - 2014

THANK YOU



Eskom

Project Name : Transnet Saldanha NMD Upgrade - New Ystervark s/s

Project ID : 153272156

Job Name : Ystervark branch lines - Iscor/Blouwater 66kV line’s

Job ID : 153272156-00001

Proposed Fibre Optic Sleeve Manhole System

AECOM TRANSNET

Overview

PURPOSE

- Present the conceptual proposed fibre optic sleeve manhole system, to allow for direct communications from Blouwater to Iscor/Ystervark s/s.
- Discuss the benefits of the system, and highlight potential challenges which could be experienced when implementing and operating the system, including actions to be taken.

Sleeve/Manhole System

- The infrastructure entails underground sleeves, with manholes at strategic locations, in which the fibre optic cables will be installed.

- The proposed route of the system will be from Blouwater s/s, running along the 66 kV Blouwater-Iscor OHL within the current line reserve, up to Iscor & Ystervark s/s.

- The current proposed core allocation of the fibre optic cables is 48, Eskom to advise if more is required for future requirements.

- The fibre optic cables & sleeves will be in accordance with Eskom standards.

- Manholes will be custom designed for the application, with the proposal of utilising polymer cement manhole covers (anti-theft type).

- Proposed manhole sizes = 600 mm x 600 mm along all straight lines, and 1.5 m x 1.5 m at all bend & termination points & special locations.

- 4 x Sleeves to be installed, allows for redundancy in sleeves for the installation of future fibre optic cables if needed.

Sleeve/Manhole System

- Cement cover slabs & electrical danger tape to be installed over all sleeves along the route, for added notification protection whenever future excavations are conducted in the area of the sleeves. The aforementioned to be in accordance with Eskom standards as well.

- 1 - 2 Joints in fibre optic cables, depending on available drum lengths.

Benefits of system

- Eskom already employs sleeve/manholes systems ie. no special training requirements.
- Independent of actual OHL, hence construction wont be impeded by OHL status, and can be installed without any foreseen major factors.
- Will be installed within existing Eskom OHL servitude and can be relatively easy integrated with existing systems.
- Relatively easy & fast to commission.
- Field crews can operate, maintain and do repairs easily ie. all infrastructure at ground level.
- Future installation of fibre optic cables can be done easily, without affecting the existing cables.
- Actual sleeve/manhole system can be extended if needed easily, depending on future requirements.
- Proposed polymer cement manholes to be used to reduce risk of theft.

Challenges/Actions

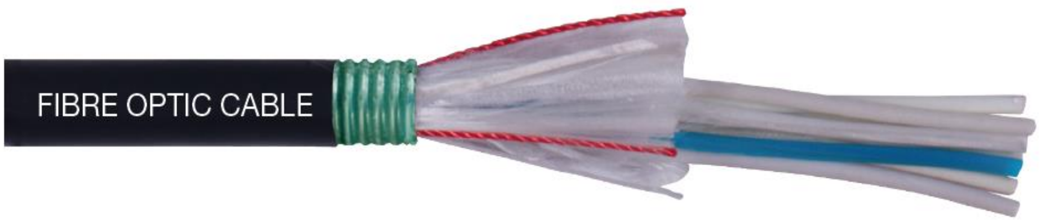
- Expensive.
- Prone to damage, vandalism, theft and the like.
- Polymer cement covers typically not heavy duty, can be easily damaged if heavy vehicles drive over them. Concrete bollards or similar can be placed around manholes in high operational areas ie. inside Port area, to help reduce the risk of damage.
- Directional drilling will be required to install sleeves under provincial roads, bridges, and rail tracks, special approvals will be required.
- Installation of Eskom standard sleeves may be challenging in soil sections where directional drilling has occurred. May require the addition of larger sleeves, with the Eskom sleeves then installed inside them.
- The current Environmental Authorisation (EA) will most likely have to be amended, hence project delays will in all likelihood occur.
- Additional ground profile surveys & geotechnical studies to be taken in the route areas where the aforementioned is not available.

Fibre Optic Cables

- Propose to use 48 multi-core single mode HDD duct fibre optic cables, suitable for the blowing/jetting installation method - Eskom to advise preference on unarmoured (metal-free) or armoured type.

Typical illustration of cables:

Unarmoured (Metal-free)



Armoured

Fibre Optic Cables

- Fibre optic cables to also be in accordance with NRS 088-1:2007, and the Eskom specifications received as showed in the next slides.

ANNEX C

NRS 088-1:2007 Schedule A/B - Technical particulars (DUCT) Optical Fibres

DESCRIPTION	SCHEDULE A PARTICULARS OF ESKOM'S REQUIREMENTS	SCHEDULE B GUARANTEED TECHNICAL PARTICULARS OFFERED	REMARKS
1. No. of fibres	24		
2. Type of Fibres	Single Mode as per clause 2.1		
3. Mode field diameter (i) at 1300nm (ii) at 1550 nm	 9.2 $\pm 0.4 \mu$m 10.50 $\pm$ 1.0 μm		
4 Cladding diameter	125 μm $\pm$ 1.0 μm		
5. Mode field concentricity error	≤ 0.5 µm		
6. Cladding non-circularity	≤ 1.0 %		
7. Cladding Configuration (depressed / matched / other)	 Specify		
8. Attenuation Coefficient (a) at 1290 - 1340 nm (b) at 1550 nm	 < 0,36 dB / km < 0,25 dB / km		
9. Chromatic dispersion coefficient (i) at 1300 nm (ii) at 1550 nm	 < 3,5 ps / nm.km <18 ps / nm.km		
10. Proof Test	≥ 1%		
11. Polarization mode dispersion (PMD)	≤ 0.5 ps / $\sqrt{\ }$ km		
12. Fibre Curl (ROC)	≥ 4.0 m		
13. Macrobending performance (clause 2.4.1.4) Additional attenuation at 1550nm	< 0.05 dB		

Tel (021) 980 3828
Fax 021 980 3474

ANNEX C(continued)

NRS 088-1:2007 Schedule A/B - Technical particulars (DUCT) Cable

DESCRIPTION	SCHEDULE A PARTICULARS OF ESKOM'S REQUIREMENTS	SCHEDULE B GUARANTEED TECHNICAL PARTICULARS OFFERED	REMARKS
1. Cable outer diameter (mm)	Specify		
2. Diameter of bedding layer (mm)	Specify		
3. Weight of Cable (kg/km)	Specify		
4. Ultimate Tensile Strength (N)	Specify		
5 Maximum short term load (maximum strain less than 33% fibre proof strain level) (a) Armoured Cable (N) (b) Metal-free Cable (N)	 Specify Specify		
6. Test Load (where fibre strain does not exceed 0.2% in the fibres) (a) Armoured Cable (N) (b) Metal-free Cable (N)	 Specify Specify		
7. Maximum Continuous Load (fibre under no strain) (a) Armoured Cable (N) (b) Metal-free Cable (N)	 Specify Specify		
8. Minimum Bending Radius (mm) (a) Armoured Cable (b) Metal-free Cable	 ≤ 250 mm ≤ 150 mm		
9. Crush Resistance See clauses 2.2.10 and 2.4.2.2 (a) Armoured Cable (b) Metal-free Cable	 ≥ 5000 N ≥ 2500 N		
10. Impact Resistance (a) Armoured Cable (b) Metal-free Cable	 ≥ 50 x 2 Nm ≥ 10x 2 Nm		
11. Cable Bending Comply with clause 2.4.2.4	Yes		
12. Temperature Cycling Comply with clause 2.4.2.5	Yes		
13. Water penetration	Yes		

Comply with clause 2.4.2.6			
14. Rodent Proof	Yes		
15. Maximum Cable Length available per drum (a) Armoured Cable (m) (b) Metal-free Cable (m)	Specify Specify		

Compiled by: Gideon Gqomfa
Tel (021) 980 3828
Fax 021 980 3474

ANNEX D
TSP 41-586 SCHEDULE A/B - TECHNICAL PARTICULARS

DESCRIPTION	COLUMN A PARTICULARS OF ESKOM'S REQUIREMENTS	COLUMN B GUARANTEED TECHNICAL PARTICULARS OFFERED	REMARKS
1. Glands	PVC		
2. Mounting Brackets	Position selectable?		
3. 12/24 holes	Specify.		
4. Hole Spacing	Punched to spec?		
5. ST Bulkhead Connectors with dust caps	Included?		
6. Pigtail Clips	Included?		
7. Fibre Clamps	Installed?		
8. Splice Organiser	Included?		
9. Bracket Bolts and Nuts	Supplied?		
10. Metal Finish and Paint Work	Completed to Spec?		

Sleeves

- Sleeves shall be in accordance with Eskom standard D-DT-8081, SAP Number 0234529 - 32 mm dia. See next slide for D-DT drawing.

SPEC SHEET

SAP MATERIAL No.:	0234529
SHORT DESCRIPTION:	DUCT,FIBRE OPTIC HDPE 32mm OD D8081

TECH. DESCRIPTION:

FIBRE OPTIC CABLE DUCT *
32mm OUTER DIAMETER * 26mm INNER DIAMETER *
SUITABLE FOR DIRECT BURIAL * 10 BAR PRESSURE RATING *
MANUFACTURED USING VIRGIN HDPE WITH SOLID CO-EXTRUDED
PERMANENT LUBRICATING INNER LAYER *
UV STABLISED * COLOUR : YELLOW *
SUPPLIED WITH PRE-INSTALLED PILOT ROPE / DRAW WIRE OF BREAKING STRAIN 1000N (MIN) *
MARKED WITH CONTRASTING LETTERING AT 1 METER INTERVIALS SHOWING DATE OF
MANUFACTURER, DUCT DIMENSIONS, SEQUENTIAL METER MARKING *
SUPPLIED ON WOODEN DRUMS * DRUM LENGTH TO SUIT PROJECT *
ESKOM DRAWING No. D-DT-8081 *

SAP MATERIAL No.:	0234539
SHORT DESCRIPTION:	DUCT,TWIN FIBRE OPTIC DTS D8081

TECH. DESCRIPTION:

TWIN FIBRE OPTIC DUCT FOR DISTRIBUTED TEMPERATURE SENSING (DTS) *
ASSEMBLY OUTER SIZE = 12.3 x 17.3mm (NOMINAL) *
DUCT CONSISTS OF :
2 x 5mm OUTER DIAMETER PRIMARY TUBES (3.5mm INNER DIAMETER)
WITH LOW FRICTION PERFORMANCE *
METAL FREE MOISTURE BARRIER AROUND THE PRIMARY TUBE PAIR *
FLEXIBLE PE INNER SHEATH THICKNESS = 1.5mm (NOMINAL) *
DURABLE PE OUTER SHEATH THICKNESS = 1.9mm (MINIMUM) *
OUTER SHEATH UV STABLISED * COLOUR : ORANGE *
SUITABLE FOR DIRECT BURIAL *
SUPPLIED WITH PRE-INSTALLED RIPCORD FOR INNER SHEATH REMOVAL *
MARKED WITH CONTRASTING LETTERING AT 1 METER INTERVIALS SHOWING DATE OF
MANUFACTURER AND SEQUENTIAL METER MARKING *
TESTED TO ASTM D1693 FOR ENVIRONMENTAL STRESS CRACK RESISTANCE (ESCR)*
TESTED TO IEC 60794-1-2-E3 FOR CRUSH TEST USING PLATE LOADED WITH 700N FOR 60 SECONDS *
SUPPLIED ON DRUMS * DRUM LENGTH TO SUIT PROJECT *
ESKOM DRAWING No. D-DT-8081 *

ITEM	:-	FIBRE OPTIC DUCTS
MATERIAL SPECIFICATION	:-	
CORROSION SPECIFICATION	:-	
STANDARD SPECIFICATION	:-	
ESKOM SPECIFICATION	:-	D-DT-8081
TEST & CERTIFICATION REQUIREMENTS	:-	

INSPECTION	Yes	No	ESKOM RELEASE NOTE	Yes	No

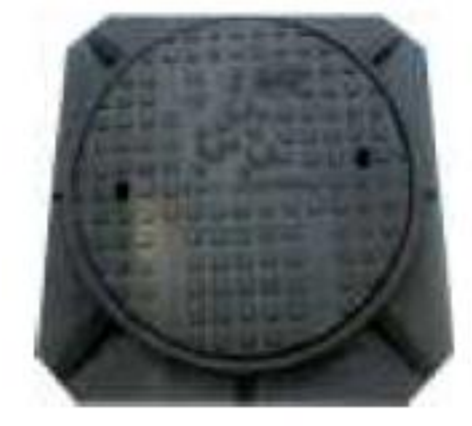
IDENTIFICATION:- INDELIBLE MANUFACTURES TRADEMARK & PART No. ON ALL ITEMS

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	REF. DWGS

AUTH:	R. KELLY	DATE:	15/07/08	SCALE NTS	Eskom Distribution	SAP No: 0234529 0234539		
CHKD:	R. KELLY	DATE:	15/07/08	CAD REF: SERIES 8000		SET	SHEET	REV
DRAWN:	P.A. VERMAAK	DATE:	23.05.2008	FILE No: 8081	**D-DT-8081**	1	1	0

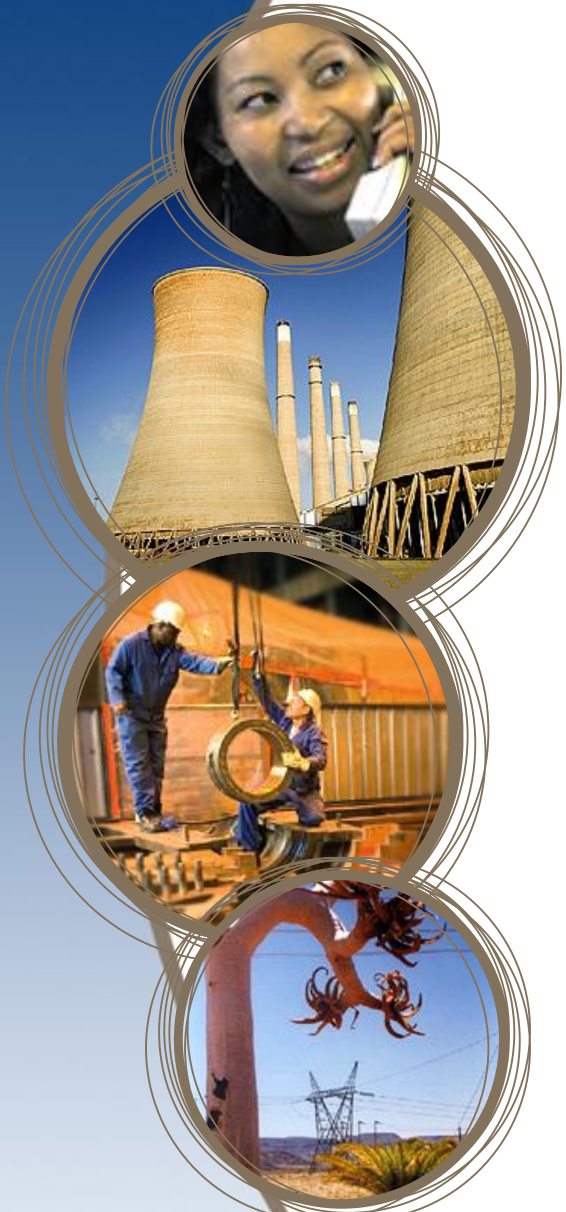
Conceptual Proposed Route & Manhole Details

- Illustration of polymer cement manhole cover.



LEGEND:
MANHOLE
4 x Ø 32mm SLEEVES
TRANSNET 132 - 66 / 11 kV MAIN INTAKE SUB
ESKOM 132 - 66 kV YSTERVARK SUB
ISCOR SUBSTATION
AREA 1
SCALE: NTS
TYPICAL CABLE TRENCH DETAIL
SCALE: NTS
PLAN VIEW :
PLAN VIEW :
SECTION:
SECTION:
600 x 600 MANHOLE
(IN-LINE APPLICATION)
TYPICAL MANHOLE DETAILS
SCALE: NTS
1500 x 1500 MANHOLE
(AT BENDS AND TERMINATION POINTS)
AREA 2
SCALE: NTS
AREA 3
SCALE: NTS
AREA 4
SCALE: NTS
BLOUWATER SUBSTATION
KEYPLAN - AREA 1
KEYPLAN - AREA 2
KEYPLAN - AREA 3
KEYPLAN - AREA 4
SCALE: NTS
TRONOX
ARCELORMITTAL
BLOUWATER SUBSTATION

Thank you



Project Name : Transnet Saldanha NMD Upgrade - New Ystervark s/s

Project ID : 153272156

Job Name : Ystervark branch lines - Iscor/Blouwater 66kV line's

Job ID : 153272156-00001

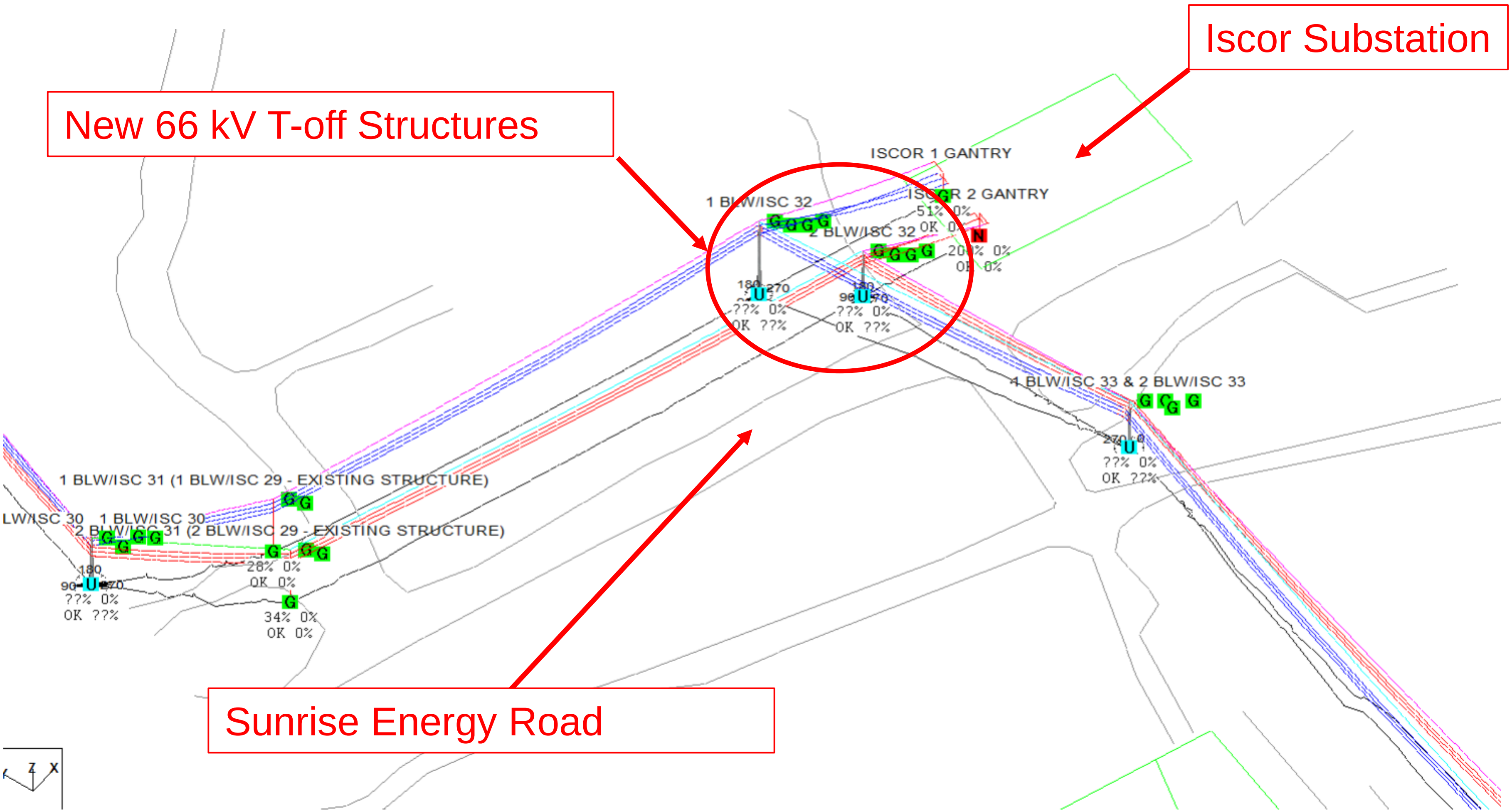
T-off Structures Redesign Findings & Recommendations

Overview

PURPOSE

- Present the results for the investigation exercise undertaken, pertaining to the 66 kV Branch Line T-off structures redesign proposal, to allow on-site constructability of these structures & associated circuitry with envisaged no overall Port power outage requirements.
- Discuss the pros and cons of each option that was investigated.
- Recommend the preferred solution best fit for the abovementioned.
- Ensure that the recommended preferred solution does not interrupt power supply to the Saldanha Port i.e. prevent a complete power outage.
- Ensure that the regulatory and project specific clearance requirements are satisfied, especially the minimum 13 m clearance requirement over the Sunrise Energy road.
- Reference figure overleaf depicting the current T-off structure design.

Overview



Iscor Substation
New 66 kV T-off Structures
Sunrise Energy Road
ISCOR 1 GANTRY
ISCOR 2 GANTRY
1 BLW/ISC 32
2 BLW/ISC 32
1 BLW/ISC 33 & 2 BLW/ISC 33
1 BLW/ISC 31 (1 BLW/ISC 29 - EXISTING STRUCTURE)
2 BLW/ISC 31 (2 BLW/ISC 29 - EXISTING STRUCTURE)
1 BLW/ISC 30

Design Criteira

Item	Description	Clearance Requirement
1	Outdoor earth: minimum safety clearance	0.8 m
2	Phase to phase clearance	1.0 m
3	Ground clearance	5.9 m
4	Building structures not part of the power line	3.2 m
5	Clearance to 66kV power lines other than TRANSNET	1.4 m
6	Clearance to TRANSNET power lines	2.0 m
7	Clearance to TRANSNET telephone lines	1.8 m
8	Clearance to abnormal load routes and freeways	7.5 m
9	Ground clearance to Sunrise Energy access road (minimum)	13 m

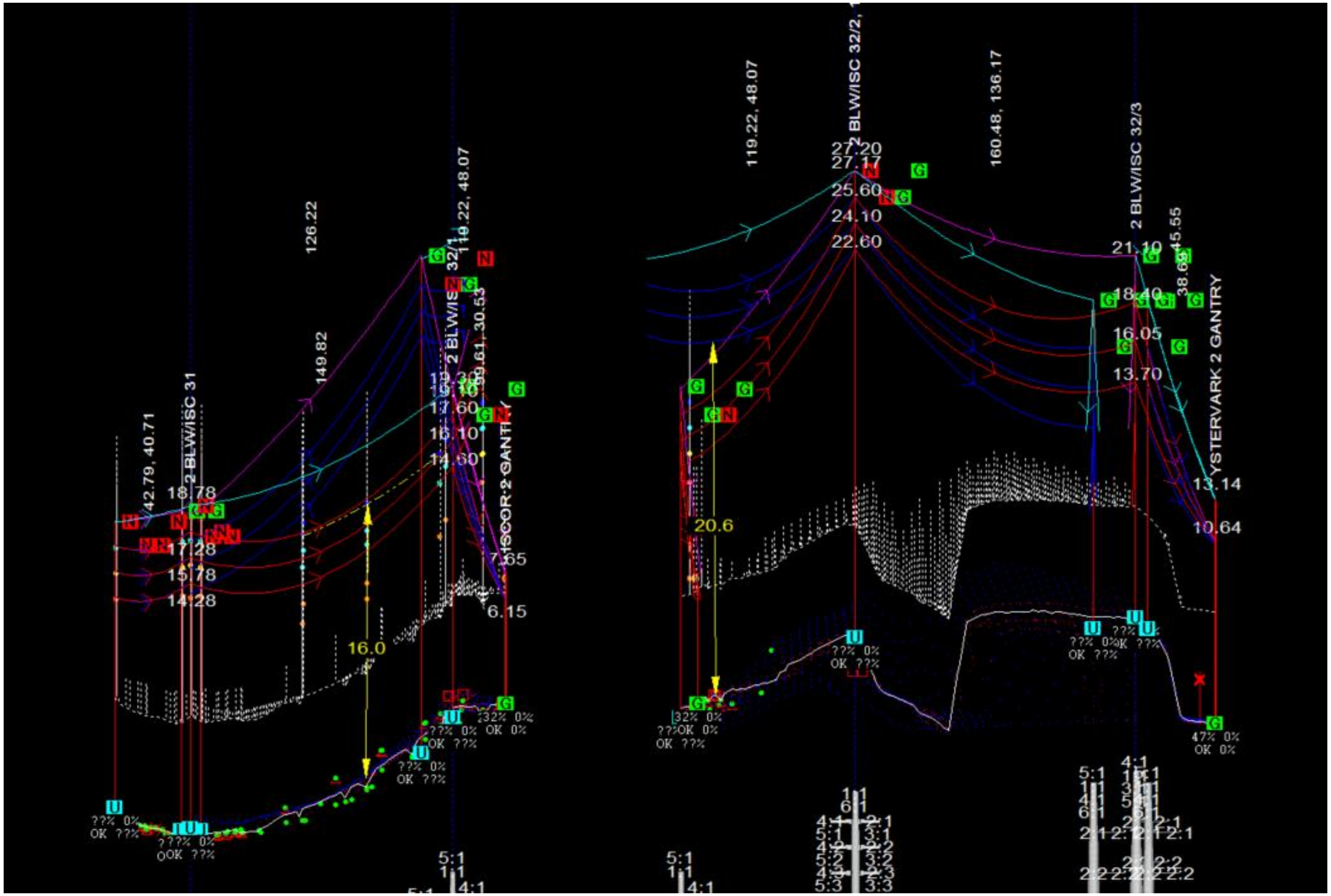
Investigation Options

OPTION 1

- Over-pass design with 29.0 m pole installed at structure 1 BLW/ISC 32/1 and a 19.2 m pole installed at 2 BLW/ISC 32/1.
- Design option meets all clearance criteria as per design criteria.
- Design option achieves a minimum of 20 m clearance over the Sunrise Energy access road and a 4m clearance to the earth-wire of the power line circuit it is crossing (2 BLW/ISC). Circuit 2 (2 BLW/ISC) also meets the 13 m clearance requirement over the Sunrise Energy access road.
- Design option requires an outage on both circuits of the existing Blouwater - Iscor 66 kV overhead line which is not desirable for Transnet.

Investigation Options

OPTION 1



Investigation Options

OPTION 2

- Under-pass design with 19.2 m pole installed at structure 1 BLW/ISC 32/1 and a 29 m pole installed at 2 BLW/ISC 32/1. This option requires that the span from 1 BLW/ISC 32/1 to 1 BLW/ISC 32/2 would be swung over first from the existing line to the T-off.

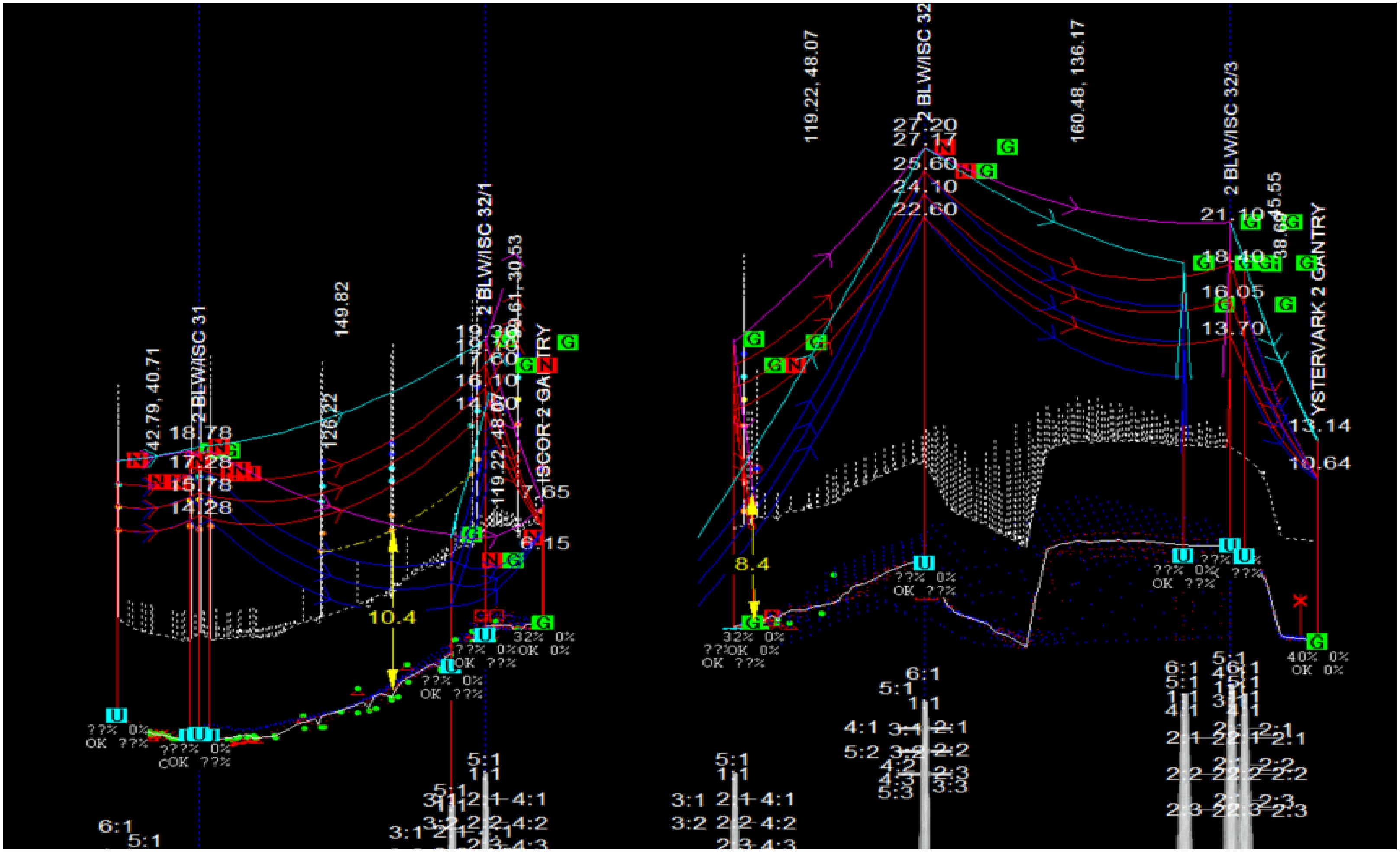
- Design option does not simultaneously meet the 2 key clearance criteria (13 m clearance to Sunrise Energy access road and clearance to line above) .

- Decreasing the height of structure 1 BLW/ISC 32/1 in order to achieve clearance from the earth-wire of circuit 1 BLW/ISC to the lowest conductor of the circuit above (2 BLW/ISC) results in clearance violations to the Sunrise Energy Access road below.

- This design option is not technically viable due to the requirement that the span from 1 BLW/ISC 32/1 to 1 BLW/ISC 32/2 has to be swung over first from the existing line to the T-off.

Investigation Options

OPTION 2



Investigation Options

OPTION 3

- Under-pass crossing design with 19.2 m pole installed at structure 1 BLW/ISC 32/1 and a 29 m pole installed at 2 BLW/ISC 32/1. This option requires that structure 2 BLW/ISC 32/1 be installed first in order to raise the height of circuit 2 BLW/ISC and create adequate space below it for the T-off span from structure 1 BLW/ISC 32/1 to structure 1 BLW/ISC 32/2 to be installed, thereby achieving the required minimum clearance to the Sunrise Energy access road.

- Option meets all clearance criteria as per design criteria and is constructible.

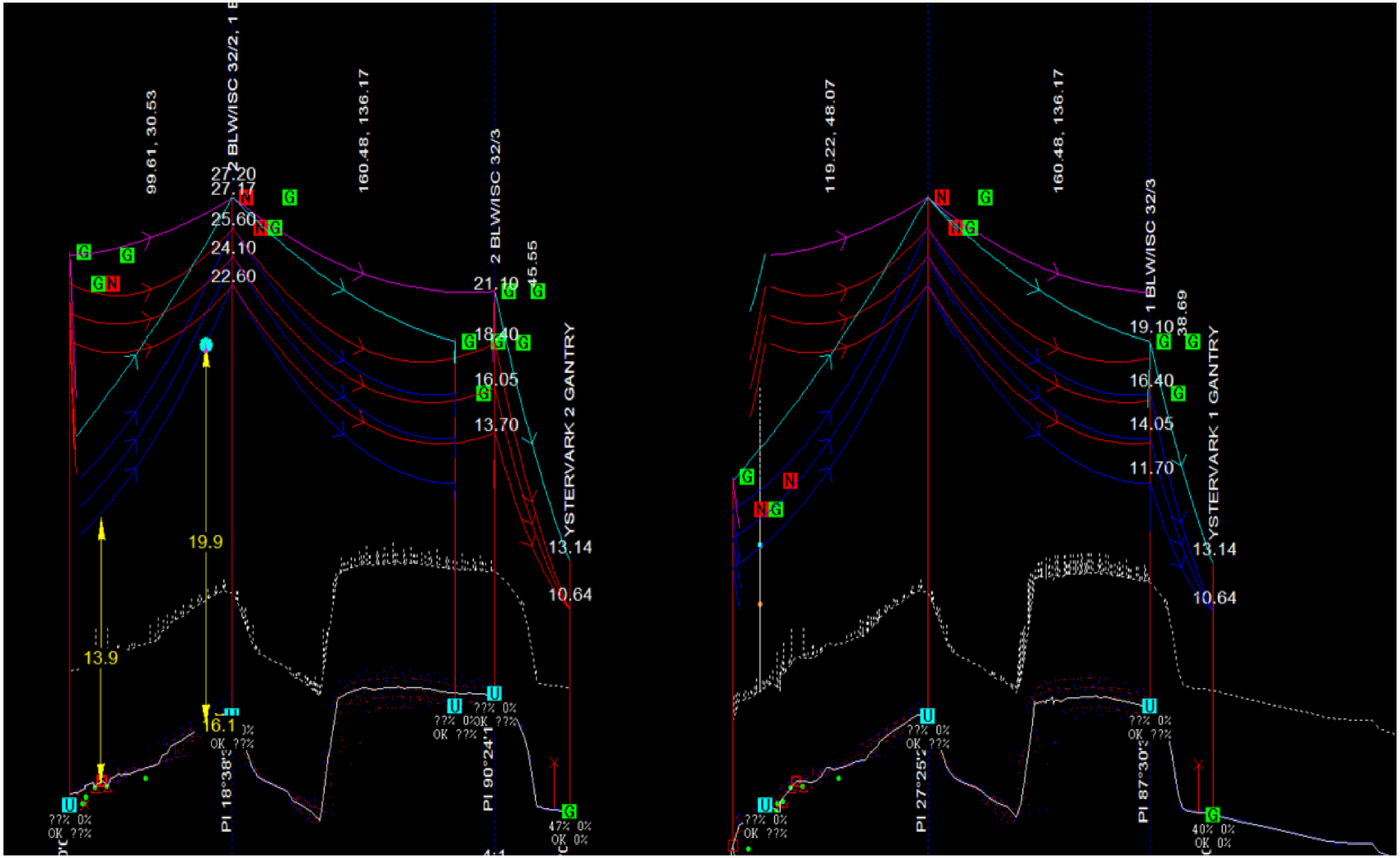
- This design option achieves a minimum clearance of 13.9 m to ground over the entire T-off span and a clearance of 19.9 m directly above the Sunrise Energy access road. A clearance of 3.6 m from the earth-wire of the T-off span of the 1 BLW/ISC circuit to the lowest conductor of the raised circuit 2 BLW/ISC is also achieved.

- Design option is envisaged to not require a total power outage to the Saldanha Port, only one circuit at a time.

- Height of structures 2 BLW/ISC 32/1 and 2 BLW/ISC 32/2 can be further reduced by approximately a maximum height of 5m if required/desired.

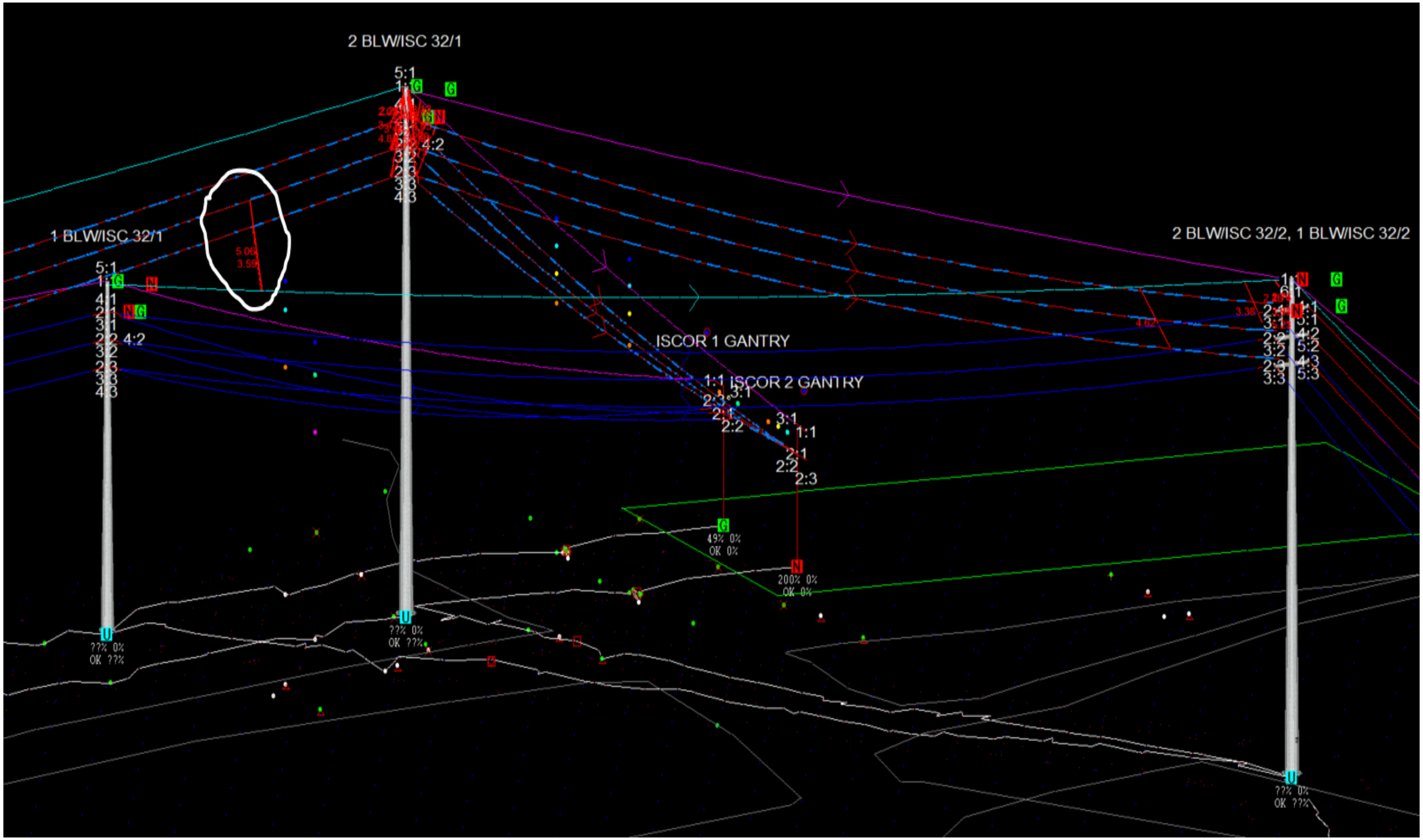
Investigation Options

OPTION 3



Investigation Options

OPTION 3



Preferred Option

- Option 3 is the preferred option.
- No envisaged need for total Port power outage, hence should not effect any operations.
- Relatively easy & fast to construct and commission.
- Not foreseen that any physical live line work must be undertaken.
- Provided that proper safe working procedures are followed, along with all statutory & project safety requirements, the T-off structures & associated circuitry should be able to be constructed by switching off respectively one 66 kV circuit at a time.

Thank you

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