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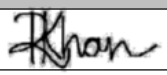
Raeesa Khan	Design leader	06 July 2023	

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1. REVISION CONTROL

Revision Number	Date issued	Brief details of updates	Approved by
1	August 2015	First issue	R.Vajeth
2.	July 2023	Second issue	F.Mokhonoana

Contents

Page

Foreword 4

1. Executive Summary 5
   - 1.1.1 Abbreviations 6

2. Document Content 6
   - 2.1 Scope of work 6
     - 2.1.1 Details of existing tower 39 8
     - 2.1.2 Basic drawing of the existing and new layout 8
     - 2.1.3 New profile and tower positions 9
     - 2.1.4 Free issue material 10
     - 2.1.5 Details for new tower. 11
   - 3. Details for 518H foundations 12

4. Conclusions 12

5. APPENDICES 13
   - 5.1 Hardware Drawings 13

6. Foundation design information 15
   - 6.1 Accepted Foundation drawings 15
   - 6.2 Accepted concrete mix 21
   - 6.3 Concession request 23
   - 6.4 Stub details - 518H Soil Type 3 24
   - 6.5 Stub details - 518H Soil Type 1 and 2 25

Foreword

This document was compiled to list the requirements to lift the new Kusile – Zeus 400 kV, tower 39. The line was renamed to Kusile – Zeus 400 kV from Apollo – Kendal 400 kV line 1, due the construction of the Kusile access road. The span between towers 39 and 40 is under clearance and needs to be raised, in order to maintain a minimum clearance of 12 m, under full load from the road to the conductor.

This activity of raising the span was done at the same location on the Kendal – Duvha 400 kV line in early 2015, which was successful.

1. Executive Summary

With the construction of the new Kusile access road between the existing N12 and D686 roads, the Apollo- Kendal 400 kV line 1 was renamed to the Kusile – Zeus 400 kV line. It was found that the vertical clearances of the Kusile – Zeus 400 kV line, between towers 39 and 40, did not satisfy the 12m requirement stipulated for roads which will be used for heavy/ abnormal loads. The normal OSHACT requirement for 400 kV lines over major roads is 9.3m, under full load of the line, but since this road is an access road to Kusile and alternative route for the other industries in the area, a 12m vertical clearance is requested which will be used for heavy/ abnormal loads.

In order to achieve the desired 12m clearance at full load of the line, a new 518H tower of conductor attachment height of 26m will be installed to replace tower 39. The new tower will be placed 30m away from the existing tower 39, towards tower 40.

By installing this new 518H tower, we raise the clearance above the 12m level.

Existing triple Dinosaur conductor and existing 2x19/2.65 earthwire will be maintained. No new joints or conductor will be required.

The new tower will be equipped with new phase and earthwire hardware and new glass insulators.

The existing tower 39, will be removed in stages as the new 518H (new 39) will be erected.

1.1.1 Abbreviations

LES	Line Engineering Services
SOW	Scope of Work
CAH	Conductor Attachment Height

2. Document Content

2.1 Scope of work

In order to rectify the under clearance, on the Kusile – Zeus 400 kV line between towers 39 and 40, it is recommended to install a new 518H tower of CAH of 26m, 30m away from existing tower 39 towards 40. The existing tower 39 should be removed. This addition of a new higher suspension tower will pick up the conductor to above 12m clearance over the road at full load.

Table 2.1 lists the basic scope of work developed by LES but will be discussed with the appointed contractor for acceptance and changes that will be required by them to execute the work safely.

It noted that the foundations for the tower has been completed. The scope of work will therefore focus on the work above ground level, tower assembling, erection and dressing as well as conductor stringing and regulating. LES recommends that the installed foundations be checked, to ensure that all specifications are met according to the accepted design drawings and TRMSCAAC 6.0.

Table 2-1 – Summarised scope of work

Item no	Basic description of steps to follow (not limited to these).
1	Site establishment by contractor
2	Foundation checks to be complete and sent through to LES for acceptance
3	Build tower up to safe level depending on the clearances (waist level)
4	Pre-assembly new tower in sections near new position.
5	Get outage on line
6	Install mitigation between road and new tower on tower 40 side, to prevent conductor and earthwards from touching the road.
7	Place conductor and earthwires of existing tower 39 in running blocks. May require placing existing towers 38 and 37 in running blocks as well.
8	Build new tower 39 in sections around phase and earthwires.
9	Attach phase and earthwires to new tower 39 with running blocks
10	Dismantle old tower 39 in sections.
11	Regulate and clamp in phases and earthwires on new tower 39. Remove running blocks from other towers.

NOTE:

1. Care must be taken by the contractor to safeguard all free issue materials and tower steelwork, as the area can be prone to theft.

2. Eskom will provide the contractor with method statements for the construction work, which must be used to develop their specific project method statements for the activities they will be executing.

3. Contractor is to adhere to specific steps stipulated in their method statements when doing activities like clamping in of the conductors, etc, to avoid any fatalities.

2.1.1 Details of existing tower 39

Existing tower 39 is a self- supporting suspension tower 512 series. This tower will be removed after the new tower is installed.

Figure 2.1 - Picture of the existing tower 39

Figure 2.2 -Picture of the tower 40 remains

2.1.2 Basic drawing of the existing and new layout

The diagrams below show the existing layout and new layout of the spans between towers 39 and 40.

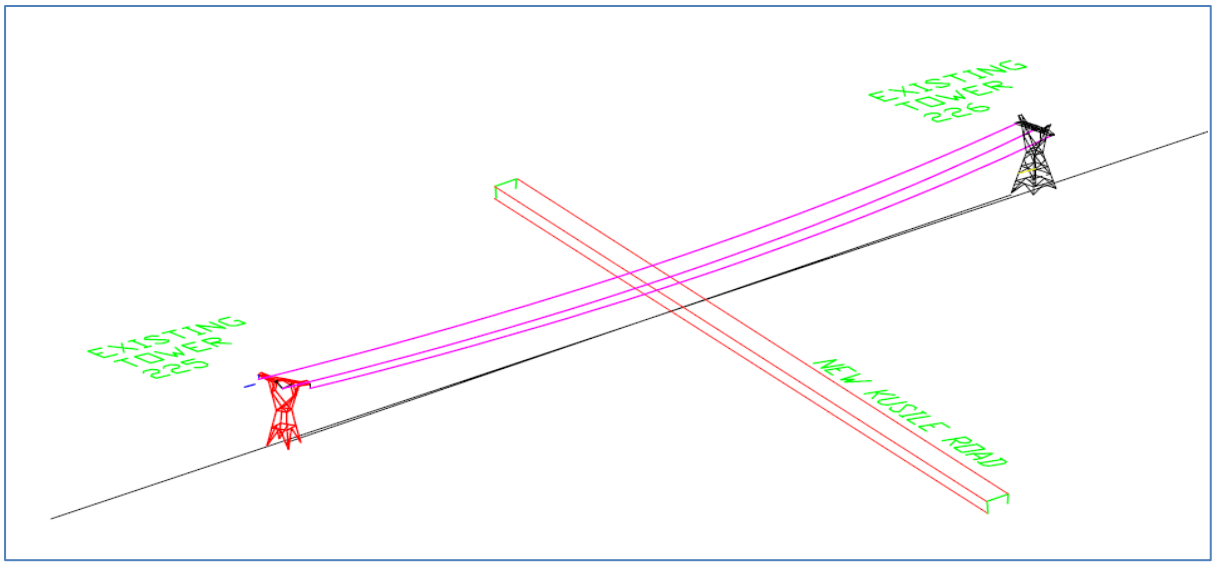


Figure 2.3- Current layout

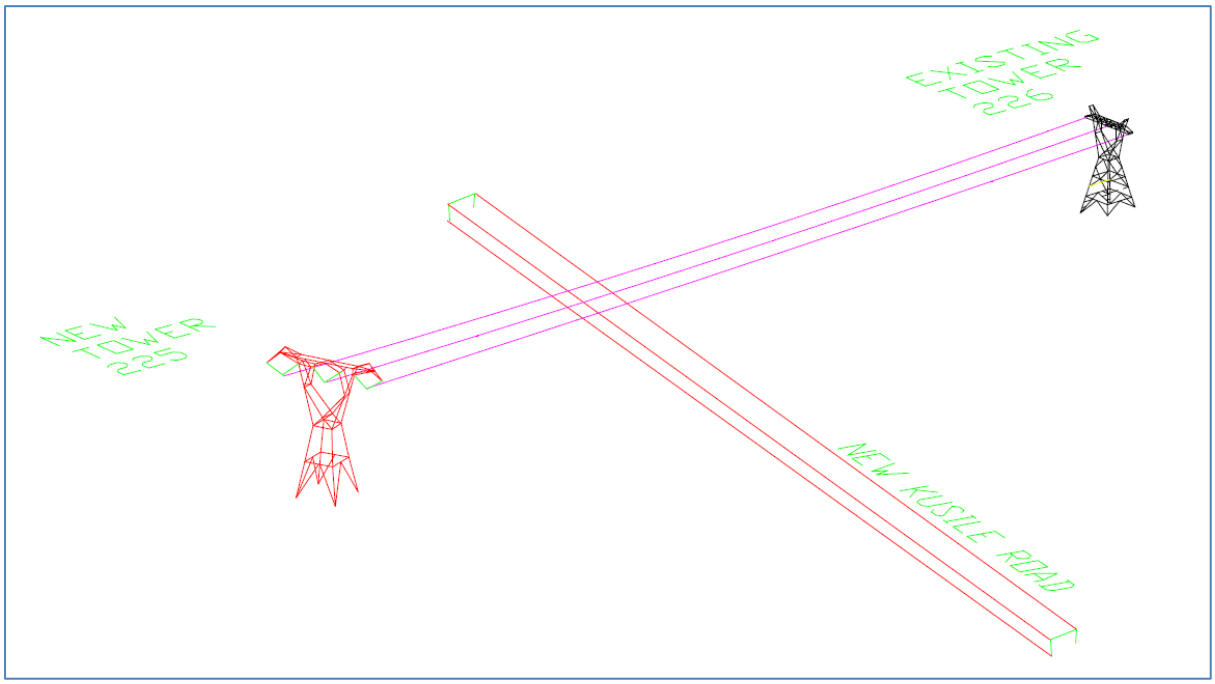


Figure 2.4 – Projected layout after the new tower

2.1.3 New profile and tower positions

The profile below is indicative of the lines previous name, Apollo – Kendal 400 kV as well as the new tower positions. The line is now named the Kusile – Zeus 400 kV line. Tower 225, and tower 226 on the Apollo – Kendal 400 kV line is tower 39 and tower 40 on the Kusile - Zeus 400 kV line.

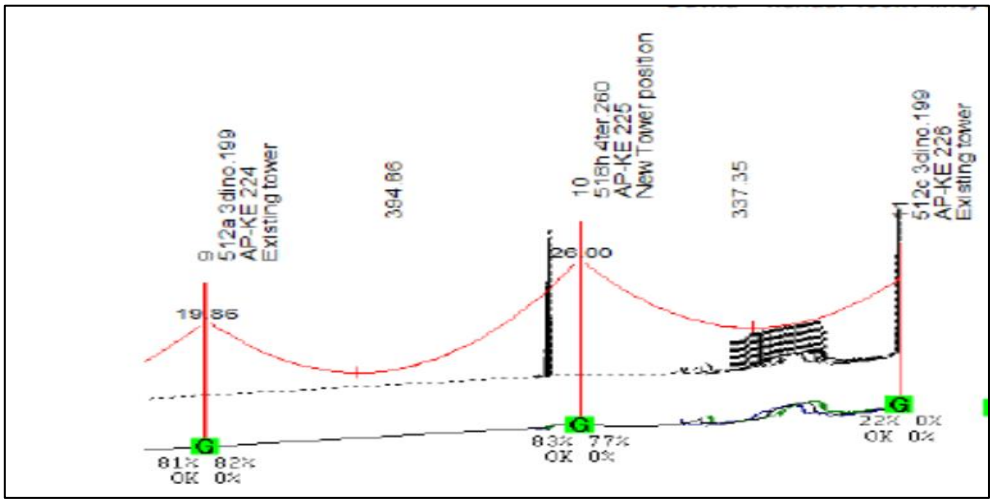


Figure 2.5 - Profile of new solution

Staking Table

Structure Number	Station (m)	X Easting (m)	Y Northing (m)	Centerline Z Elevation (m)	TIN Z Elevation (m)	Ahead Span (m)	Line Angle (deg)	Transverse Axis Azimuth (deg)	Structure Name	Structure Description	Struct. Height (m)	Tower Number
10	3238.482	-10276.4	-2874002	1518.558	0	337.347	0	264.8136	518h 4ter.260	518H Self Supporting tower	32.14	AP-KE 225

Figure 23.6 New proposed Tower positions.

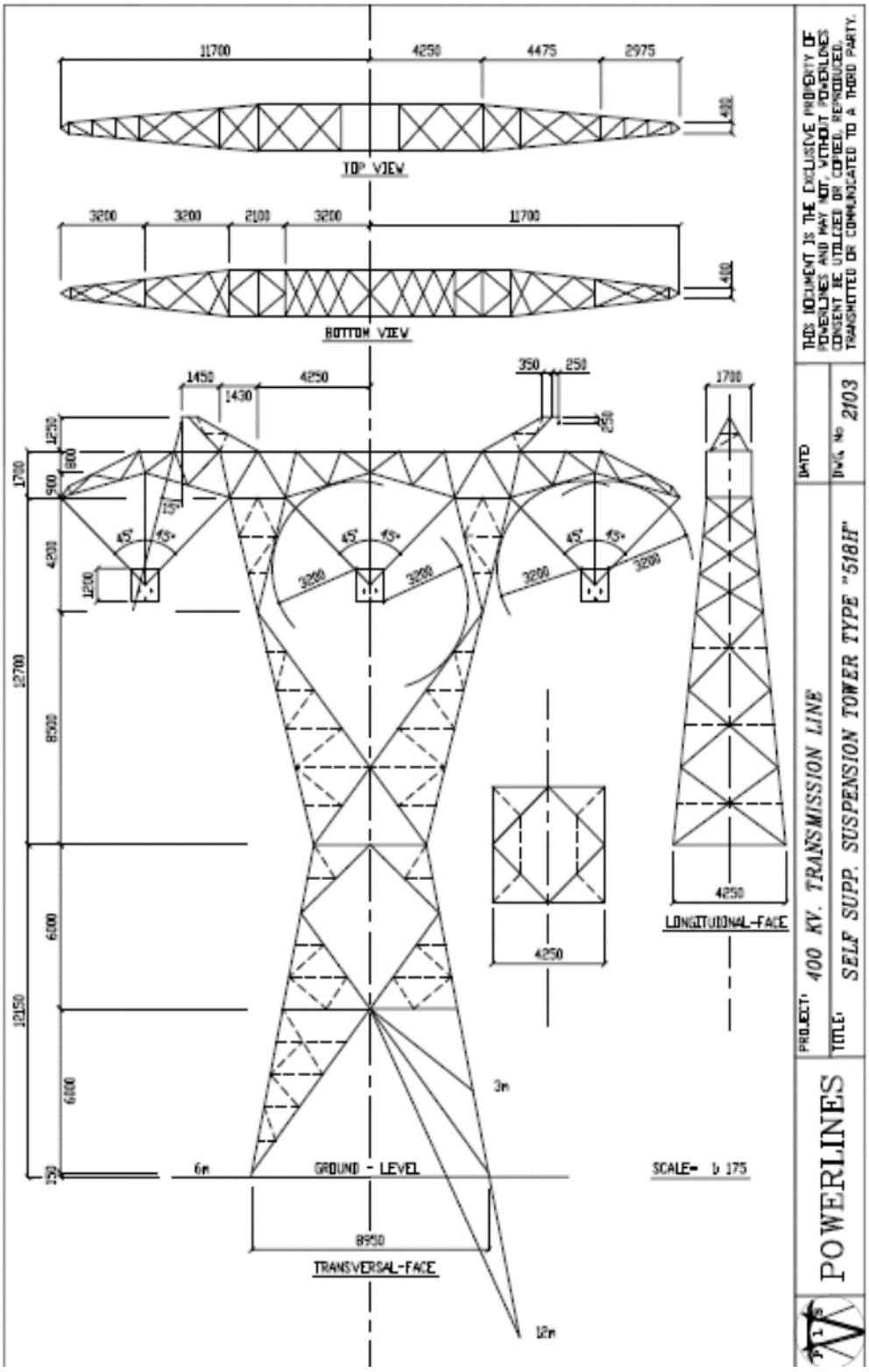
2.1.4 Free issue material

Eskom will provide the contractor with all new hardware for the new 518H structure. The existing 3x Dinosaur and 2x 19/2.65 earthwire will remain. New glass discs will also be supplied.

No	Item description	Quantity
1	V-assembly for triple Dinosaur configuration	3
2	Suspension Earthwire assemblies for 19/2.65	2
3	210kN standard glass discs	140.

2.1.5 Details for new tower.

The new tower is a 518H, of CAH 26m



3. Details for 518H foundations

For the new tower, it is recommended that standard pad and chimney foundations be utilised. Eskom will supply the contractor with standard designs for this tower, which the contractor can use or design new foundations. Basic details for this tower loading are depicted below, to which the foundation designer must apply additional factors to increase the strength and performance of the foundations.

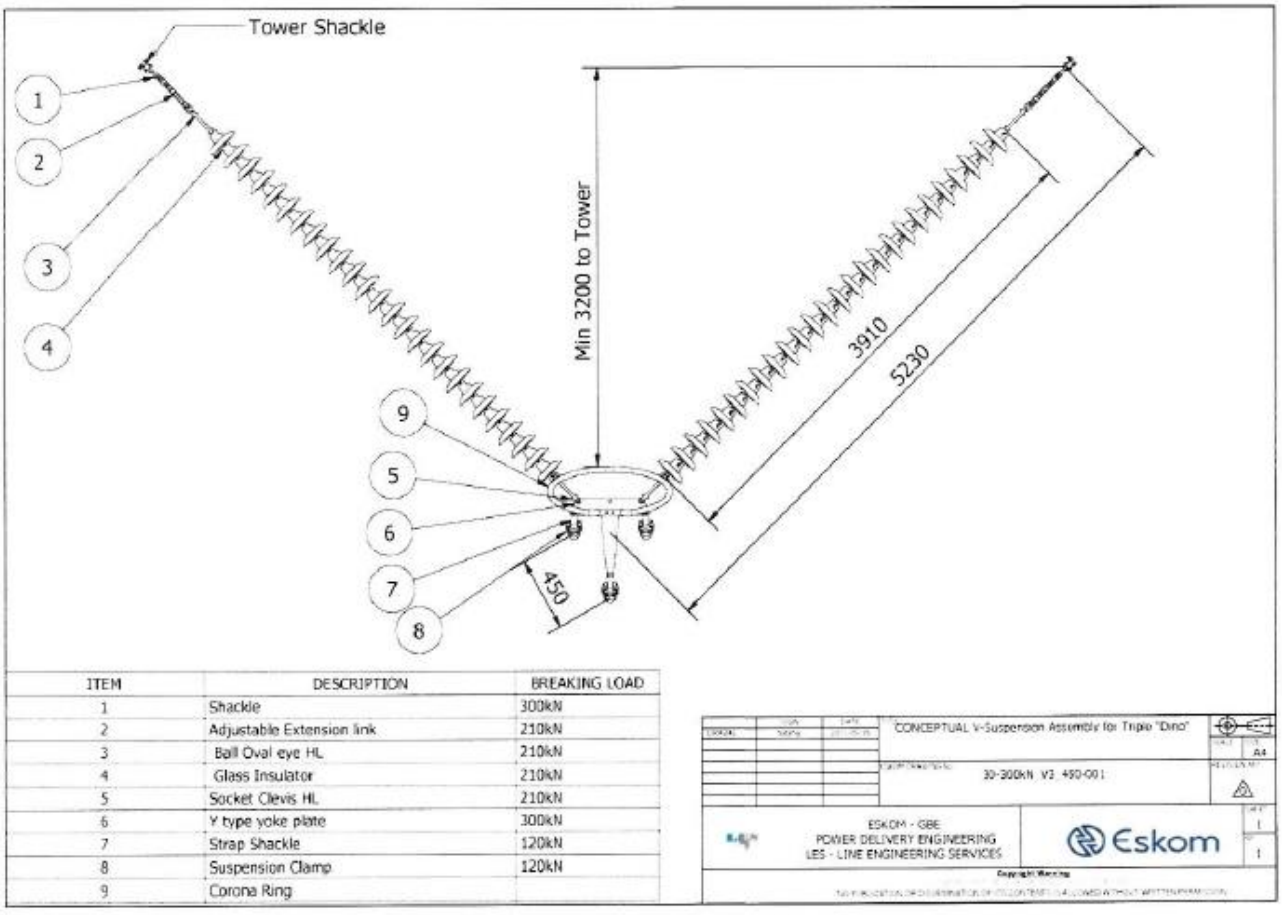
SELF-SUPPORTING TOWERS (ALL LOADS IN kN)
TOWER TYPE
518H
COMPRESSION
C = 754
X = 30
Y = 25
UPLIFT
U = 592

4. Conclusions

In order to maintain within the required statutory clearances for road crossings, the span between towers 39 and 40 on the Kusile – Zeus 400 kV line will be lifted. A new 518H tower will replace the existing tower 39, on the Kusile – Zeus 400 kV line. It is recommended to increase the clearance to minimum 12 m at full load. This current recommendation is based on a similar exercise done on the Kendal – Duvha 400 kV line which runs parallel to the Kusile – Zeus 400 kV line. This was executed successfully in early 2015.

5. APPENDICES

5.1 Hardware Drawings



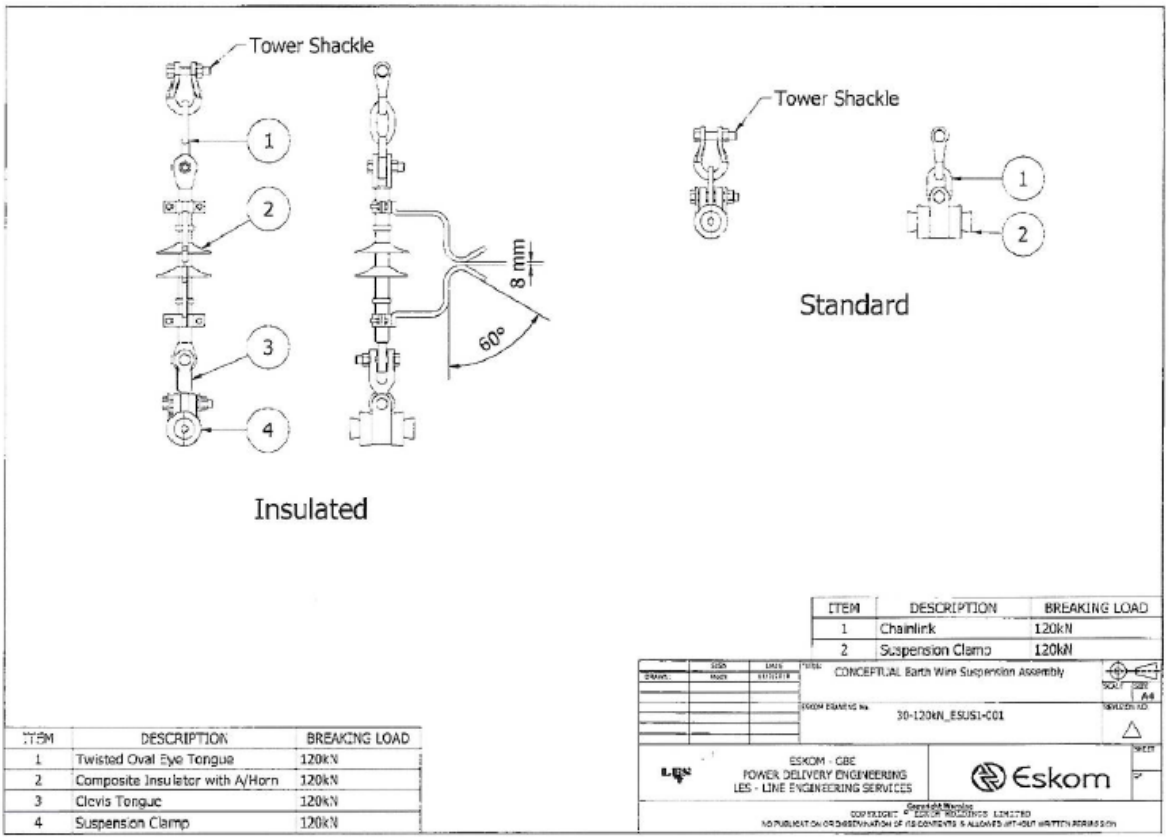
ITEM	DESCRIPTION	BREAKING LOAD
1	Shackle	300kN
2	Adjustable Extension link	210kN
3	Ball Oval eye HL	210kN
4	Glass Insulator	210kN
5	Socket Clevis HL	210kN
6	Y type yoke plate	300kN
7	Strap Shackle	120kN
8	Suspension Clamp	120kN
9	Corona Ring	

CONCEPTUAL V-Suspension Assembly for Triple "Dino"

30-300kN V3 450-001

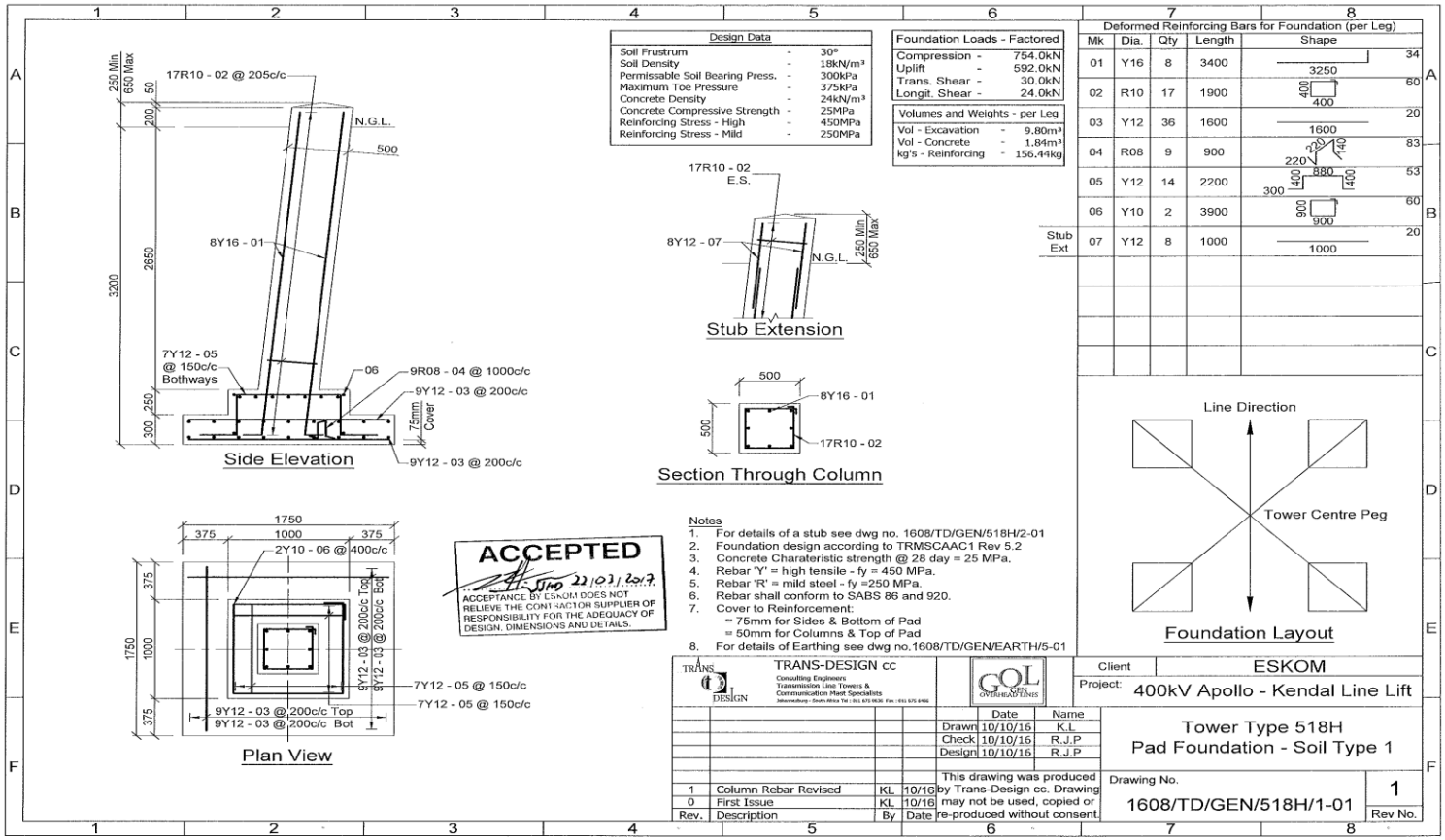
ESKOM - GBE
POWER DELIVERY ENGINEERING
LES - LINE ENGINEERING SERVICES

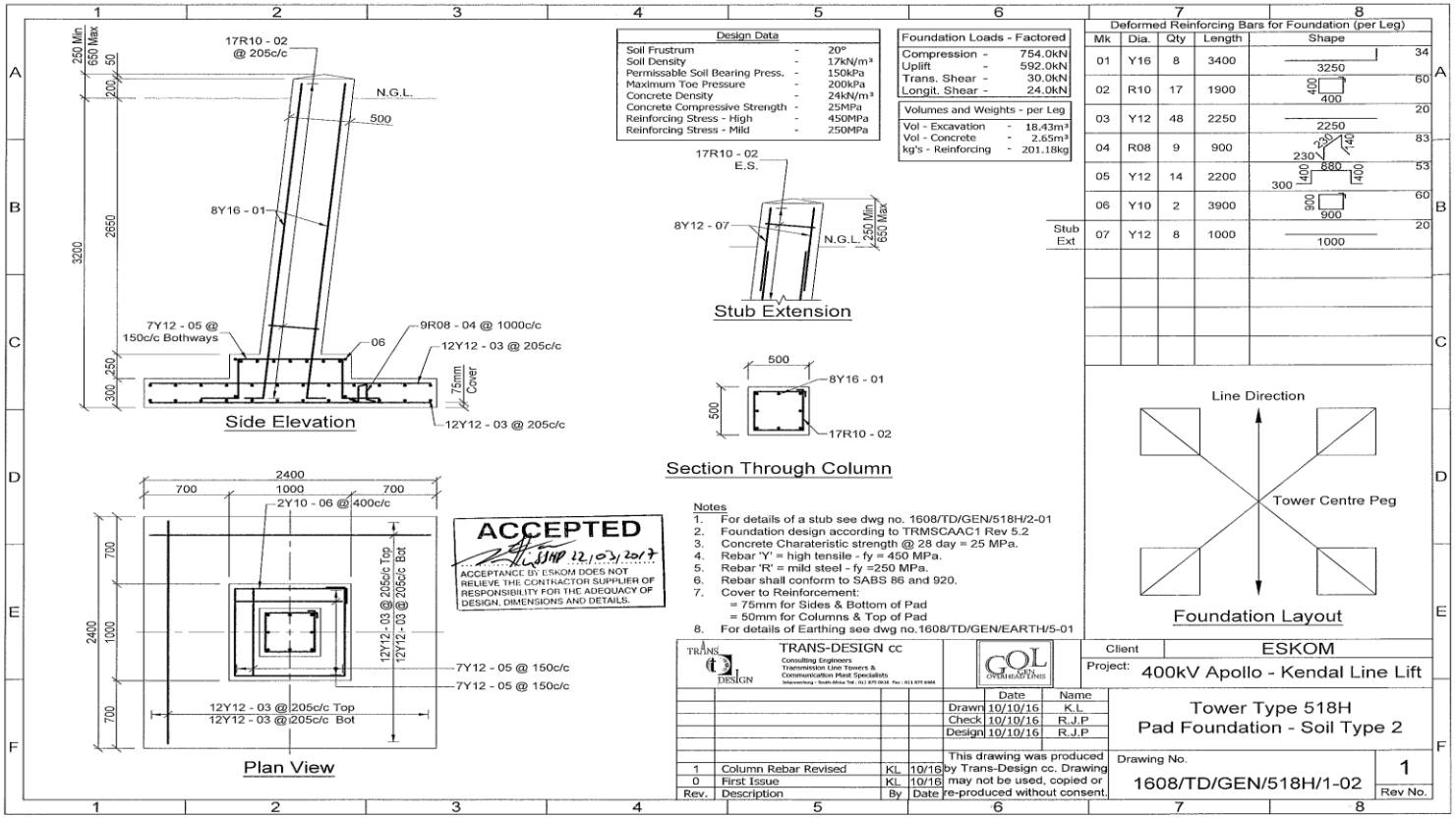
Eskom

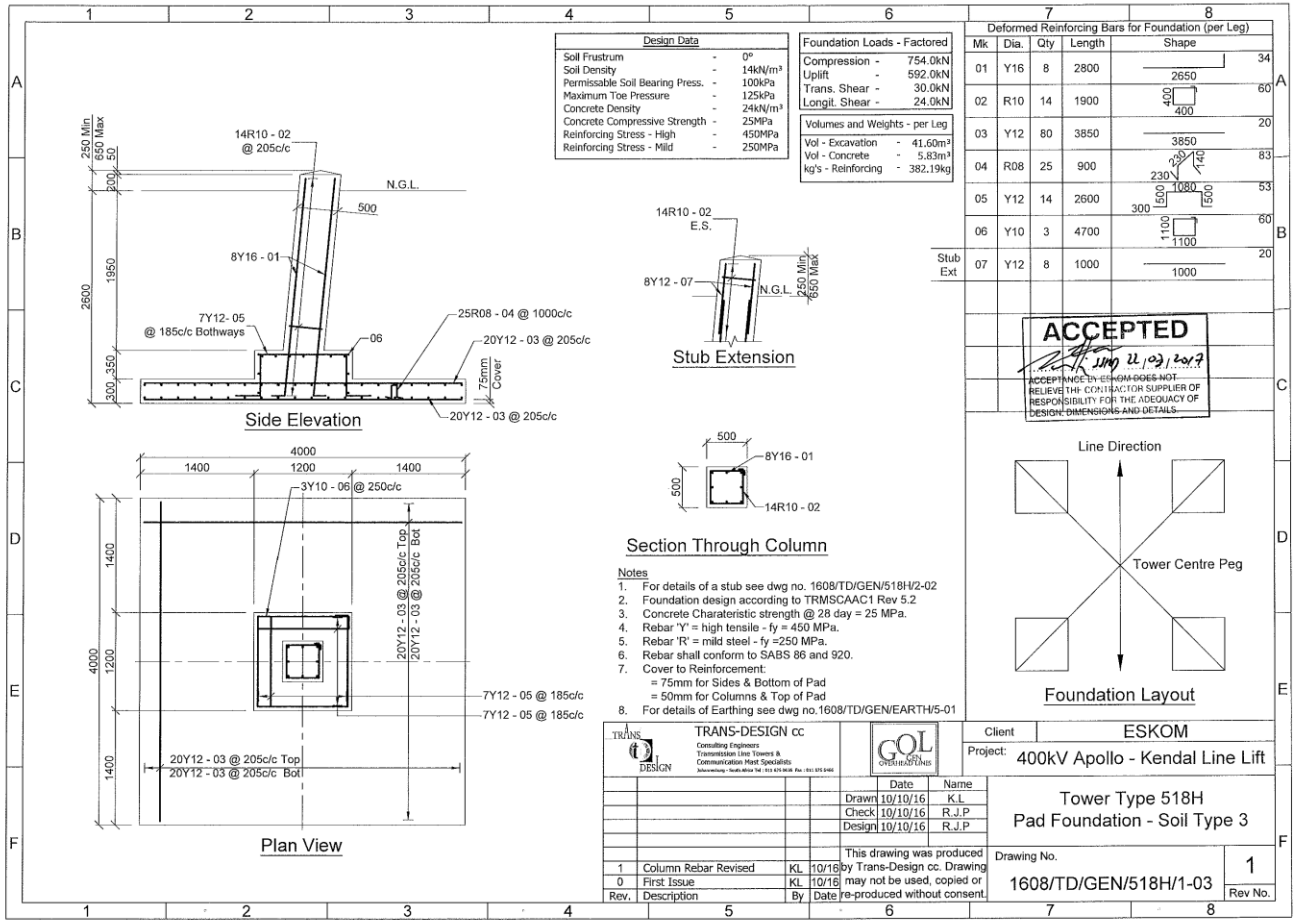

Tower Shackle
1
2
3
4
8 mm
60°
Insulated
Tower Shackle
1
2
Standard
ITEM DESCRIPTION BREAKING LOAD
1 Chainlink 120kN
2 Suspension Clamp 120kN
CONCEPTUAL Earth Wire Suspension Assembly
30-120kN_ESUS1-001
ESKOM - GBE
POWER DELIVERY ENGINEERING
LES - LINE ENGINEERING SERVICES
Eskom
ITEM DESCRIPTION BREAKING LOAD
1 Twisted Oval Eye Tongue 120kN
2 Composite Insulator with A/Horn 120kN
3 Clevis Tongue 120kN
4 Suspension Clamp 120kN

6. Foundation design information

6.1 Accepted Foundation drawings




17R10 - 02 @ 205c/c
N.G.L.
500
8Y16 - 01
7Y12 - 05 @ 150c/c Bothways
06
9R08 - 04 @ 1000c/c
12Y12 - 03 @ 205c/c
75mm Cover
12Y12 - 03 @ 205c/c
Side Elevation
Design Data
Soil Frustrum - 20°
Soil Density - 17kN/m³
Permissable Soil Bearing Press. - 150kPa
Maximum Toe Pressure - 200kPa
Concrete Density - 24kN/m³
Concrete Compressive Strength - 25MPa
Reinforcing Stress - High - 450MPa
Reinforcing Stress - Mild - 250MPa
Foundation Loads - Factored
Compression - 754.0kN
Uplift - 592.0kN
Trans. Shear - 30.0kN
Longit. Shear - 24.0kN
Volumes and Weights - per Leg
Vol - Excavation - 18.43m³
Vol - Concrete - 2.65m³
kg's - Reinforcing - 201.18kg
17R10 - 02 E.S.
8Y12 - 07
N.G.L.
Stub Extension
500
8Y16 - 01
17R10 - 02
Section Through Column
2400
700
1000
700
2Y10 - 06 @ 400c/c
12Y12 - 03 @ 205c/c Top
12Y12 - 03 @ 205c/c Bot
7Y12 - 05 @ 150c/c
7Y12 - 05 @ 150c/c
12Y12 - 03 @ 205c/c Top
12Y12 - 03 @ 205c/c Bot
Plan View
ACCEPTED
ACCEPTANCE BY ESKOM DOES NOT RELIEVE THE CONTRACTOR SUPPLIER OF RESPONSIBILITY FOR THE ADEQUACY OF DESIGN, DIMENSIONS AND DETAILS.
Notes
1. For details of a stub see dwg no. 1608/TD/GEN/518H/2-01
2. Foundation design according to TRMSCAAC1 Rev 5.2
3. Concrete Charateristic strength @ 28 day = 25 MPa.
4. Rebar 'Y' = high tensile - fy = 450 MPa.
5. Rebar 'R' = mild steel - fy =250 MPa.
6. Rebar shall conform to SABS 86 and 920.
7. Cover to Reinforcement:
= 75mm for Sides & Bottom of Pad
= 50mm for Columns & Top of Pad
8. For details of Earthing see dwg no.1608/TD/GEN/EARTH/5-01
Deformed Reinforcing Bars for Foundation (per Leg)
Mk | Dia. | Qty | Length | Shape
01 | Y16 | 8 | 3400 | 3250 | 34
02 | R10 | 17 | 1900 | 400 400 | 60
03 | Y12 | 48 | 2250 | 2250 | 20
04 | R08 | 9 | 900 | 230 230 140 | 83
05 | Y12 | 14 | 2200 | 300 400 880 400 | 53
06 | Y10 | 2 | 3900 | 900 900 | 60
Stub Ext 07 | Y12 | 8 | 1000 | 1000 | 20
Line Direction
Tower Centre Peg
Foundation Layout
TRANS-DESIGN cc
Consulting Engineers
Transmission Line Towers & Communication Mast Specialists
Client ESKOM
Project: 400kV Apollo - Kendal Line Lift
Date Name
Drawn 10/10/16 K.L
Check 10/10/16 R.J.P
Design 10/10/16 R.J.P
Tower Type 518H
Pad Foundation - Soil Type 2
This drawing was produced by Trans-Design cc. Drawing may not be used, copied or re-produced without consent.
Drawing No. 1608/TD/GEN/518H/1-02
Rev No. 1
1 Column Rebar Revised KL 10/16
0 First Issue KL 10/16
Rev. Description By Date


Design Data
Soil Frustrum - 0°
Soil Density - 14kN/m³
Permissable Soil Bearing Press. - 100kPa
Maximum Toe Pressure - 125kPa
Concrete Density - 24kN/m³
Concrete Compressive Strength - 25MPa
Reinforcing Stress - High - 450MPa
Reinforcing Stress - Mild - 250MPa
Foundation Loads - Factored
Compression - 754.0kN
Uplift - 592.0kN
Trans. Shear - 30.0kN
Longit. Shear - 24.0kN
Volumes and Weights - per Leg
Vol - Excavation - 41.60m³
Vol - Concrete - 5.83m³
kg's - Reinforcing - 382.19kg
Deformed Reinforcing Bars for Foundation (per Leg)
Mk | Dia. | Qty | Length | Shape
01 | Y16 | 8 | 2800
02 | R10 | 14 | 1900
03 | Y12 | 80 | 3850
04 | R08 | 25 | 900
05 | Y12 | 14 | 2600
06 | Y10 | 3 | 4700
Stub Ext 07 | Y12 | 8 | 1000
14R10 - 02 @ 205c/c
N.G.L.
8Y16 - 01
7Y12- 05 @ 185c/c Bothways
06
25R08 - 04 @ 1000c/c
20Y12 - 03 @ 205c/c
75mm Cover
Side Elevation
14R10 - 02 E.S.
8Y12 - 07
Stub Extension
ACCEPTED
ACCEPTANCE BY ESKOM DOES NOT RELIEVE THE CONTRACTOR SUPPLIER OF RESPONSIBILITY FOR THE ADEQUACY OF DESIGN, DIMENSIONS AND DETAILS.
4000
1400
1200
3Y10 - 06 @ 250c/c
20Y12 - 03 @ 205c/c Top
20Y12 - 03 @ 205c/c Bot
7Y12 - 05 @ 185c/c
Plan View
Section Through Column
Line Direction
Tower Centre Peg
Foundation Layout
Notes
1. For details of a stub see dwg no. 1608/TD/GEN/518H/2-02
2. Foundation design according to TRMSCAAC1 Rev 5.2
3. Concrete Charateristic strength @ 28 day = 25 MPa.
4. Rebar 'Y' = high tensile - fy = 450 MPa.
5. Rebar 'R' = mild steel - fy =250 MPa.
6. Rebar shall conform to SABS 86 and 920.
7. Cover to Reinforcement:
= 75mm for Sides & Bottom of Pad
= 50mm for Columns & Top of Pad
8. For details of Earthing see dwg no.1608/TD/GEN/EARTH/5-01
TRANS-DESIGN cc
Consulting Engineers
Transmission Line Towers & Communication Mast Specialists
Client ESKOM
Project: 400kV Apollo - Kendal Line Lift
Drawn 10/10/16 K.L
Check 10/10/16 R.J.P
Design 10/10/16 R.J.P
Tower Type 518H
Pad Foundation - Soil Type 3
1 Column Rebar Revised KL 10/16
0 First Issue KL 10/16
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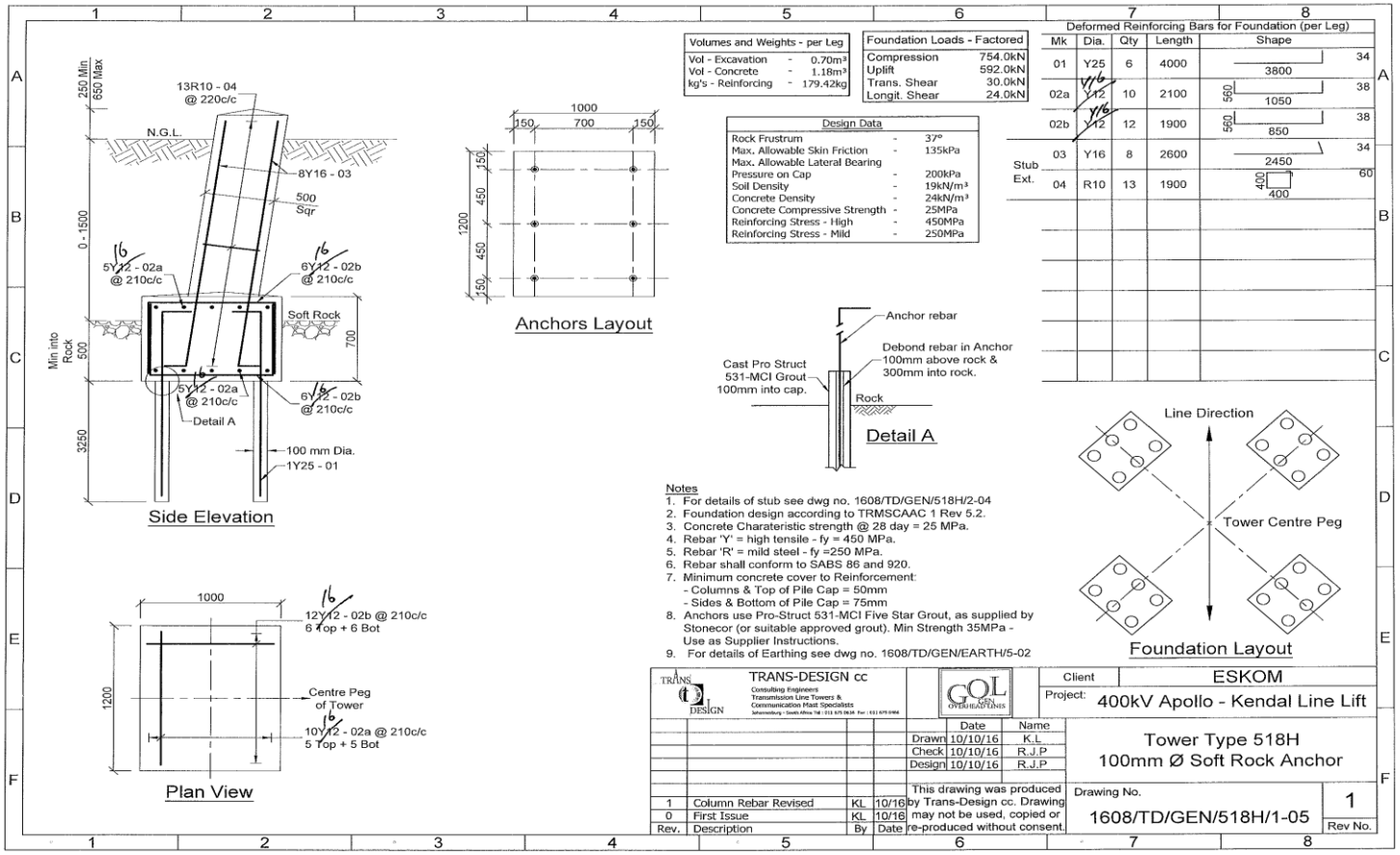
Drawing No. 1608/TD/GEN/518H/1-03
Rev No. 1


Volumes and Weights - per Leg
Vol - Excavation - 0.70m³
Vol - Concrete - 1.18m³
kg's - Reinforcing - 179.42kg
Foundation Loads - Factored
Compression 754.0kN
Uplift 592.0kN
Trans. Shear 30.0kN
Longit. Shear 24.0kN
Design Data
Rock Frustrum - 37°
Max. Allowable Skin Friction - 135kPa
Max. Allowable Lateral Bearing Pressure on Cap - 200kPa
Soil Density - 19kN/m³
Concrete Density - 24kN/m³
Concrete Compressive Strength - 25MPa
Reinforcing Stress - High - 450MPa
Reinforcing Stress - Mild - 250MPa
Deformed Reinforcing Bars for Foundation (per Leg)
Mk | Dia. | Qty | Length | Shape
01 | Y25 | 6 | 4000 | 3800
02a | Y16 | 10 | 2100 | 1050
02b | Y16 | 12 | 1900 | 850
03 | Y16 | 8 | 2600 | 2450
Stub Ext. 04 | R10 | 13 | 1900 | 400
13R10 - 04 @ 220c/c
N.G.L.
8Y16 - 03
500 Sqr
5Y12 - 02a @ 210c/c
6Y12 - 02b @ 210c/c
Soft Rock
Min into Rock 600
700
Detail A
100 mm Dia. 1Y25 - 01
3250
0 - 1500
250 Min 650 Max
Side Elevation
Anchors Layout
Anchor rebar
Debond rebar in Anchor 100mm above rock & 300mm into rock.
Cast Pro Struct 531-MCI Grout 100mm into cap.
Rock
Detail A
Notes
1. For details of stub see dwg no. 1608/TD/GEN/518H/2-04
2. Foundation design according to TRMSCAAC 1 Rev 5.2.
3. Concrete Charateristic strength @ 28 day = 25 MPa.
4. Rebar 'Y' = high tensile - fy = 450 MPa.
5. Rebar 'R' = mild steel - fy =250 MPa.
6. Rebar shall conform to SABS 86 and 920.
7. Minimum concrete cover to Reinforcement:
- Columns & Top of Pile Cap = 50mm
- Sides & Bottom of Pile Cap = 75mm
8. Anchors use Pro-Struct 531-MCI Five Star Grout, as supplied by Stonecor (or suitable approved grout). Min Strength 35MPa - Use as Supplier Instructions.
9. For details of Earthing see dwg no. 1608/TD/GEN/EARTH/5-02
Line Direction
Tower Centre Peg
Foundation Layout
12Y12 - 02b @ 210c/c 6 Top + 6 Bot
10Y12 - 02a @ 210c/c 5 Top + 5 Bot
Centre Peg of Tower
Plan View
TRANS-DESIGN cc
Consulting Engineers
Transmission Line Towers & Communication Mast Specialists
Client ESKOM
Project: 400kV Apollo - Kendal Line Lift
Drawn 10/10/16 K.L
Check 10/10/16 R.J.P
Design 10/10/16 R.J.P
Tower Type 518H
100mm Ø Soft Rock Anchor
Drawing No. 1608/TD/GEN/518H/1-05
Rev No. 1
1 Column Rebar Revised KL 10/16
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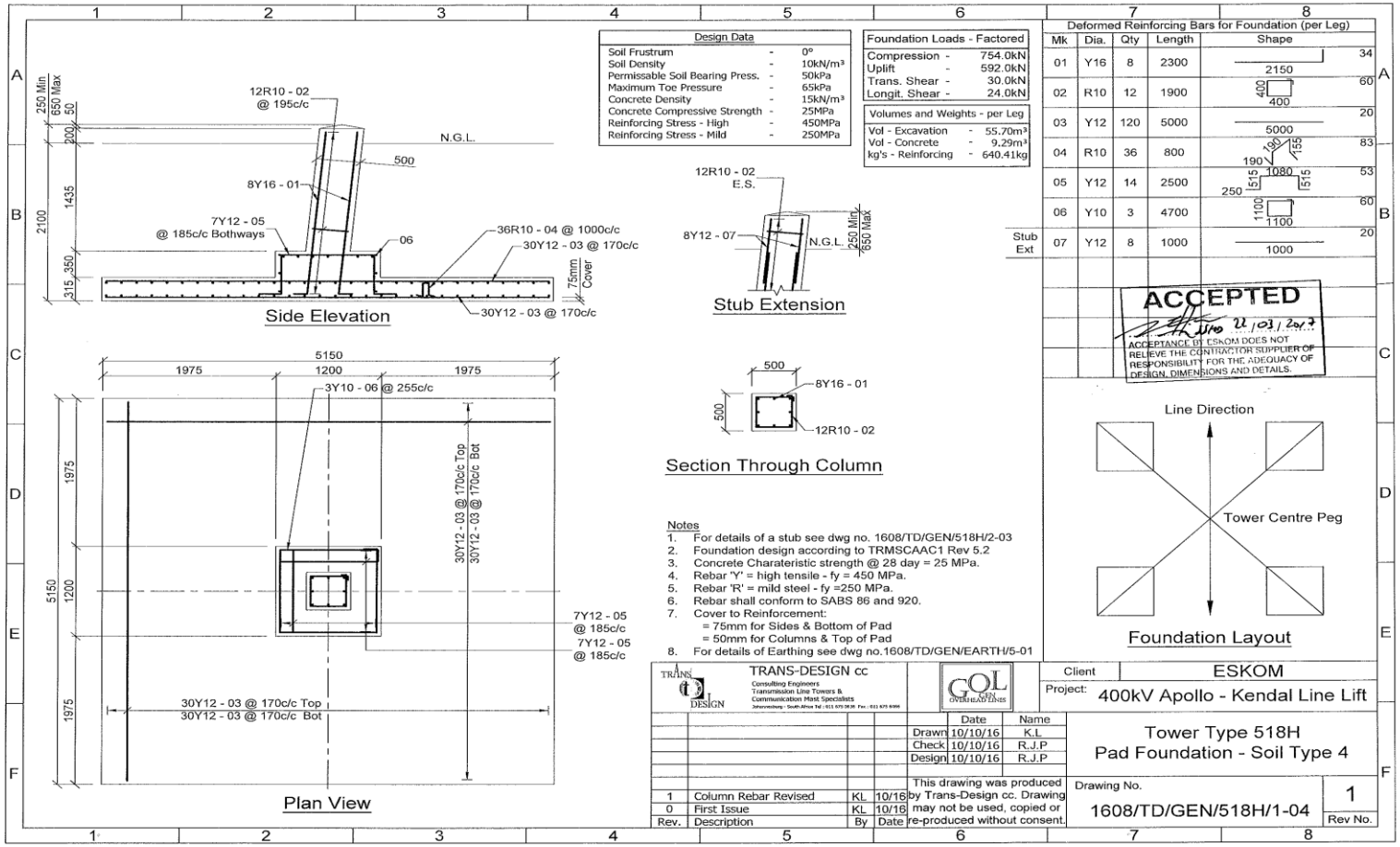
Design Data
Soil Frustrum - 0°
Soil Density - 10kN/m³
Permissable Soil Bearing Press. - 50kPa
Maximum Toe Pressure - 65kPa
Concrete Density - 15kN/m³
Concrete Compressive Strength - 25MPa
Reinforcing Stress - High - 450MPa
Reinforcing Stress - Mild - 250MPa
Foundation Loads - Factored
Compression - 754.0kN
Uplift - 592.0kN
Trans. Shear - 30.0kN
Longit. Shear - 24.0kN
Volumes and Weights - per Leg
Vol - Excavation - 55.70m³
Vol - Concrete - 9.29m³
kg's - Reinforcing - 640.41kg
Deformed Reinforcing Bars for Foundation (per Leg)
Mk Dia. Qty Length Shape
01 Y16 8 2300
02 R10 12 1900
03 Y12 120 5000
04 R10 36 800
05 Y12 14 2500
06 Y10 3 4700
Stub Ext 07 Y12 8 1000
12R10 - 02 @ 195c/c
8Y16 - 01
7Y12 - 05 @ 185c/c Bothways
06
36R10 - 04 @ 1000c/c
30Y12 - 03 @ 170c/c
N.G.L.
Side Elevation
12R10 - 02 E.S.
8Y12 - 07
Stub Extension
3Y10 - 06 @ 255c/c
30Y12 - 03 @ 170c/c Top
30Y12 - 03 @ 170c/c Bot
7Y12 - 05 @ 185c/c
30Y12 - 03 @ 170c/c Top
30Y12 - 03 @ 170c/c Bot
Plan View
Section Through Column
Notes
1. For details of a stub see dwg no. 1608/TD/GEN/518H/2-03
2. Foundation design according to TRMSCAAC1 Rev 5.2
3. Concrete Charateristic strength @ 28 day = 25 MPa.
4. Rebar 'Y' = high tensile - fy = 450 MPa.
5. Rebar 'R' = mild steel - fy =250 MPa.
6. Rebar shall conform to SABS 86 and 920.
7. Cover to Reinforcement:
= 75mm for Sides & Bottom of Pad
= 50mm for Columns & Top of Pad
8. For details of Earthing see dwg no.1608/TD/GEN/EARTH/5-01
Line Direction
Tower Centre Peg
Foundation Layout
ACCEPTED
ACCEPTANCE BY ESKOM DOES NOT RELIEVE THE CONTRACTOR/SUPPLIER OF RESPONSIBILITY FOR THE ADEQUACY OF DESIGN, DIMENSIONS AND DETAILS.
TRANS-DESIGN cc
Consulting Engineers
Transmission Line Towers & Communication Mast Specialists
GOL OVERHEAD LINES
Client ESKOM
Project: 400kV Apollo - Kendal Line Lift
Drawn 10/10/16 K.L
Check 10/10/16 R.J.P
Design 10/10/16 R.J.P
Tower Type 518H
Pad Foundation - Soil Type 4
1 Column Rebar Revised KL 10/16
0 First Issue KL 10/16
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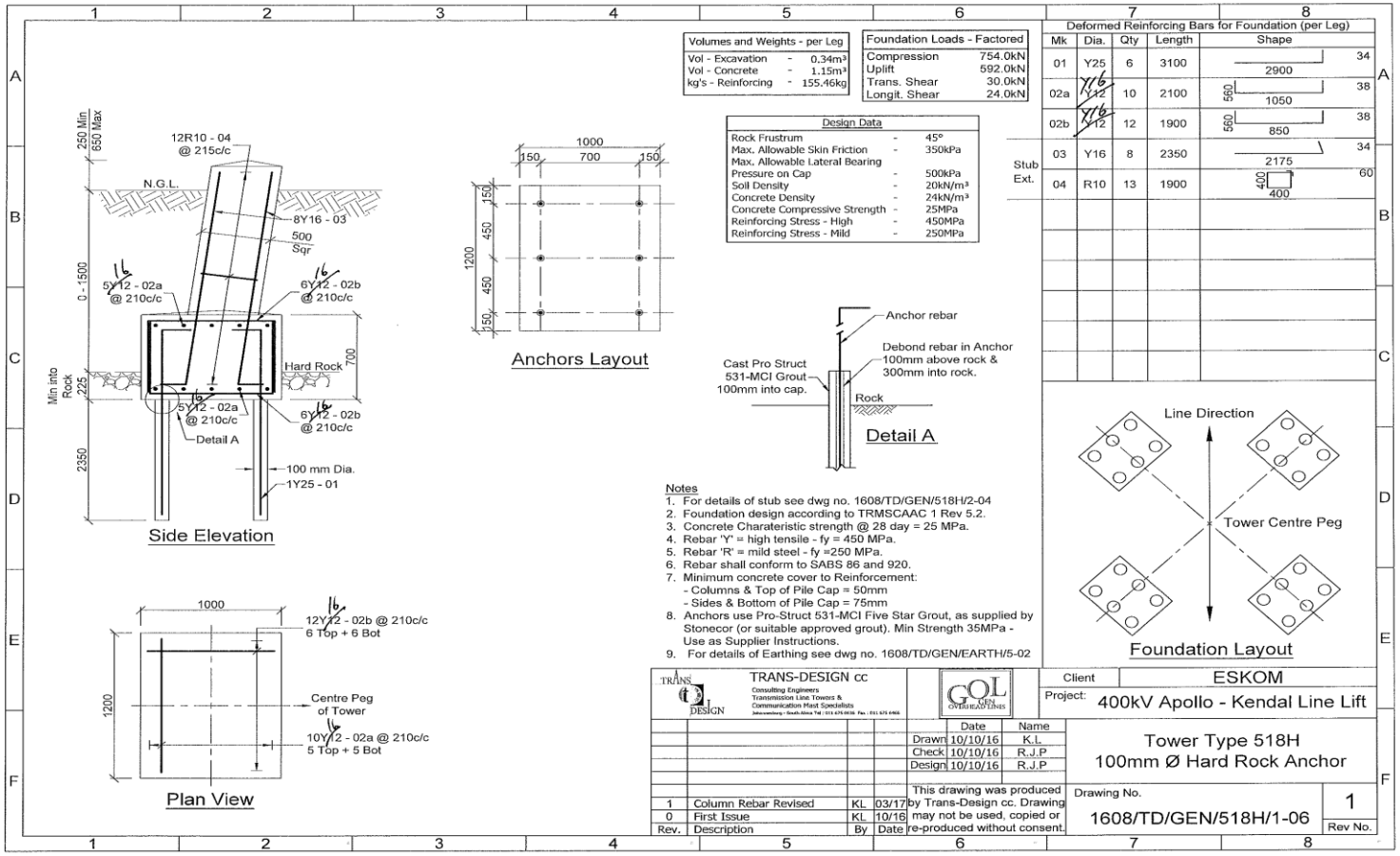
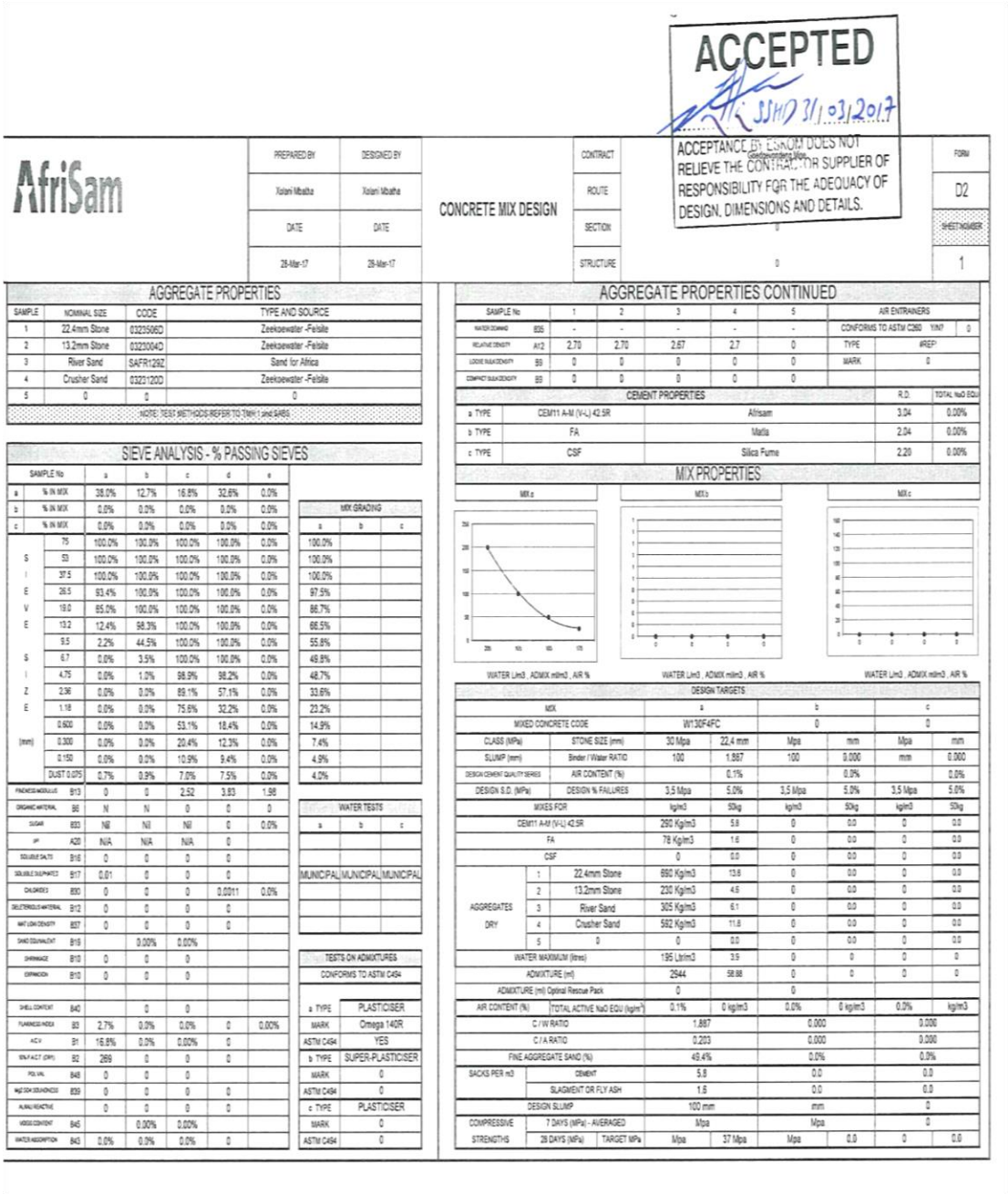
Drawing No. 1608/TD/GEN/518H/1-04
Rev No. 1


Volumes and Weights - per Leg
Vol - Excavation - 0.34m³
Vol - Concrete - 1.15m³
kg's - Reinforcing - 155.46kg
Foundation Loads - Factored
Compression 754.0kN
Uplift 592.0kN
Trans. Shear 30.0kN
Longit. Shear 24.0kN
Design Data
Rock Frustrum - 45°
Max. Allowable Skin Friction - 350kPa
Max. Allowable Lateral Bearing Pressure on Cap - 500kPa
Soil Density - 20kN/m³
Concrete Density - 24kN/m³
Concrete Compressive Strength - 25MPa
Reinforcing Stress - High - 450MPa
Reinforcing Stress - Mild - 250MPa
Deformed Reinforcing Bars for Foundation (per Leg)
Mk Dia. Qty Length Shape
01 Y25 6 3100 2900
02a Y16/Y12 10 2100 560 1050
02b Y16/Y12 12 1900 560 850
03 Y16 8 2350 2175
Stub Ext. 04 R10 13 1900 400 400
12R10 - 04 @ 215c/c
N.G.L.
8Y16 - 03
500 Sqr
5Y12 - 02a @ 210c/c
6Y12 - 02b @ 210c/c
Hard Rock
Min into Rock 225
0 - 1500
700
2350
Detail A
100 mm Dia. 1Y25 - 01
250 Min 650 Max
Side Elevation
1000
150 700 150
1200
150 450 450 150
Anchors Layout
Anchor rebar
Debond rebar in Anchor 100mm above rock & 300mm into rock.
Cast Pro Struct 531-MCI Grout 100mm into cap.
Rock
Detail A
Line Direction
Tower Centre Peg
Foundation Layout
Notes
1. For details of stub see dwg no. 1608/TD/GEN/518H/2-04
2. Foundation design according to TRMSCAAC 1 Rev 5.2.
3. Concrete Charateristic strength @ 28 day = 25 MPa.
4. Rebar 'Y' = high tensile - fy = 450 MPa.
5. Rebar 'R' = mild steel - fy =250 MPa.
6. Rebar shall conform to SABS 86 and 920.
7. Minimum concrete cover to Reinforcement:
- Columns & Top of Pile Cap = 50mm
- Sides & Bottom of Pile Cap = 75mm
8. Anchors use Pro-Struct 531-MCI Five Star Grout, as supplied by Stonecor (or suitable approved grout). Min Strength 35MPa - Use as Supplier Instructions.
9. For details of Earthing see dwg no. 1608/TD/GEN/EARTH/5-02
1000
12Y12 - 02b @ 210c/c 6 Top + 6 Bot
Centre Peg of Tower
1200
10Y12 - 02a @ 210c/c 5 Top + 5 Bot
Plan View
TRANS-DESIGN cc
Consulting Engineers
Transmission Line Towers & Communication Mast Specialists
GOL OVERHEAD LINES
Client ESKOM
Project: 400kV Apollo - Kendal Line Lift
Date Name
Drawn 10/10/16 K.L
Check 10/10/16 R.J.P
Design 10/10/16 R.J.P
Tower Type 518H
100mm Ø Hard Rock Anchor
Rev. Description By Date
1 Column Rebar Revised KL 03/17
0 First Issue KL 10/16
This drawing was produced by Trans-Design cc. Drawing may not be used, copied or re-produced without consent.
Drawing No. 1608/TD/GEN/518H/1-06
Rev No. 1

6.2 Accepted concrete mix



ACCEPTED
SJHD 31/03/2017
ACCEPTANCE BY ESKOM DOES NOT RELIEVE THE CONTRACTOR/SUPPLIER OF RESPONSIBILITY FOR THE ADEQUACY OF DESIGN, DIMENSIONS AND DETAILS.

AfriSam

PREPARED BY	DESIGNED BY
Xolani Mbatha	Xolani Mbatha
DATE	DATE
28-Mar-17	28-Mar-17

CONCRETE MIX DESIGN

CONTRACT	
ROUTE	
SECTION	0
STRUCTURE	0

FORM D2 — SHEET NUMBER 1

AGGREGATE PROPERTIES

SAMPLE	NOMINAL SIZE	CODE	TYPE AND SOURCE
1	22.4mm Stone	0323506D	Zeekoewater -Felsite
2	13.2mm Stone	0323004D	Zeekoewater -Felsite
3	River Sand	SAFR1292	Sand for Africa
4	Crusher Sand	0323120D	Zeekoewater -Felsite
5	0	0	0

NOTE: TEST METHODS REFER TO SANS 1 and SABS

SIEVE ANALYSIS - % PASSING SIEVES

SAMPLE No		a	b	c	d	e
a	% IN MIX	38.0%	12.7%	16.8%	32.6%	0.0%
b	% IN MIX	0.0%	0.0%	0.0%	0.0%	0.0%
c	% IN MIX	0.0%	0.0%	0.0%	0.0%	0.0%
SIEVE (mm)	75	100.0%	100.0%	100.0%	100.0%	0.0%
	53	100.0%	100.0%	100.0%	100.0%	0.0%
	37.5	100.0%	100.0%	100.0%	100.0%	0.0%
	26.5	93.4%	100.0%	100.0%	100.0%	0.0%
	19.0	65.0%	100.0%	100.0%	100.0%	0.0%
	13.2	12.4%	98.3%	100.0%	100.0%	0.0%
	9.5	2.2%	44.5%	100.0%	100.0%	0.0%
	6.7	0.0%	3.5%	100.0%	100.0%	0.0%
	4.75	0.0%	1.0%	98.9%	98.2%	0.0%
	2.36	0.0%	0.0%	89.1%	57.1%	0.0%
	1.18	0.0%	0.0%	75.6%	32.2%	0.0%
	0.600	0.0%	0.0%	53.1%	18.4%	0.0%
	0.300	0.0%	0.0%	20.4%	12.3%	0.0%
	0.150	0.0%	0.0%	10.9%	9.4%	0.0%
	DUST 0.075	0.7%	0.9%	7.0%	7.5%	0.0%
FINENESS MODULUS	B13	0	0	2.52	3.83	1.98
ORGANIC MATERIAL	B6	N	N	0	0	0
SUGAR	B33	Nil	Nil	Nil	0	0.0%
pH	A20	N/A	N/A	N/A	0	
SOLUBLE SALTS	B16	0	0	0	0	
SOLUBLE SULPHATES	B17	0.01	0	0	0	
CHLORIDES	B30	0	0	0	0.0011	0.0%
DELETERIOUS MATERIAL	B12	0	0	0	0	
WET LOW DENSITY	B37	0	0	0	0	
SAND EQUIVALENT	B19		0.00%	0.00%		
SHRINKAGE	B18	0	0	0		
EXPANSION	B10	0	0	0		
SHELL CONTENT	B40		0	0		
FLAKINESS INDEX	B3	2.7%	0.0%	0.0%	0	0.00%
ACV	B1	16.8%	0.0%	0.00%	0	
10% F.A.C.T. (DRY)	B2	269	0	0	0	
POLISH	B48	0	0	0		
MAGNESIUM SOUNDNESS	B39	0	0	0	0	
ALKALI REACTIVE		0	0	0	0	
VOIDS CONTENT	B45		0.00%	0.00%		
WATER ABSORPTION	B43	0.0%	0.0%	0.0%	0	

MIX GRADING		
a	b	c
100.0%		
100.0%		
100.0%		
97.5%		
86.7%		
66.5%		
55.8%		
48.8%		
48.7%		
33.6%		
23.2%		
14.9%		
7.4%		
4.9%		
4.0%		

WATER TESTS		
a	b	c
MUNICIPAL	MUNICIPAL	MUNICIPAL

TESTS ON ADMIXTURES	
CONFORMS TO ASTM C494	
a TYPE	PLASTICISER
MARK	Omega 140R
ASTM C494	YES
b TYPE	SUPER-PLASTICISER
MARK	0
ASTM C494	0
c TYPE	PLASTICISER
MARK	0
ASTM C494	0

AGGREGATE PROPERTIES CONTINUED

SAMPLE No		1	2	3	4	5	AIR ENTRAINERS	
WATER DEMAND	B35	-	-	-	-	-	CONFORMS TO ASTM C260	Y/N? 0
RELATIVE DENSITY	A12	2.70	2.70	2.67	2.7	0	TYPE	#REF!
LOOSE BULK DENSITY	B9	0	0	0	0	0	MARK	0
COMPACT BULK DENSITY	B9	0	0	0	0	0		

CEMENT PROPERTIES			R.D.	TOTAL NaO EQU
a TYPE	CEM11 A-M (V-L) 42.5R	Afrisam	3.04	0.00%
b TYPE	FA	Matla	2.04	0.00%
c TYPE	CSF	Silica Fume	2.20	0.00%

MIX PROPERTIES

MIX a | MIX b | MIX c

WATER L/m3 . ADMIX ml/m3 . AIR % | WATER L/m3 . ADMIX ml/m3 . AIR % | WATER L/m3 . ADMIX ml/m3 . AIR %

DESIGN TARGETS

MIX			a		b		c	
MIXED CONCRETE CODE			W130F4FC		0		0	
CLASS (MPa)	STONE SIZE (mm)		30 Mpa	22.4 mm	Mpa	mm	Mpa	mm
SLUMP (mm)	Binder / Water RATIO		100	1.887	100	0.000	mm	0.000
DESIGN CEMENT QUALITY SERIES	AIR CONTENT (%)			0.1%		0.0%		0.0%
DESIGN S.D. (MPa)	DESIGN % FAILURES		3.5 Mpa	5.0%	3.5 Mpa	5.0%	3.5 Mpa	5.0%
MIXES FOR			kg/m3	50kg	kg/m3	50kg	kg/m3	50kg
CEM11 A-M (V-L) 42.5R			290 Kg/m3	5.8	0	0.0	0	0.0
FA			78 Kg/m3	1.6	0	0.0	0	0.0
CSF			0	0.0	0	0.0	0	0.0
AGGREGATES DRY	1	22.4mm Stone	690 Kg/m3	13.8	0	0.0	0	0.0
	2	13.2mm Stone	230 Kg/m3	4.6	0	0.0	0	0.0
	3	River Sand	305 Kg/m3	6.1	0	0.0	0	0.0
	4	Crusher Sand	592 Kg/m3	11.8	0	0.0	0	0.0
	5	0	0	0.0	0	0.0	0	0.0
WATER MAXIMUM (litres)			195 L/m3	3.9	0	0	0	0
ADMIXTURE (ml)			2544	58.88	0	0	0	0
ADMIXTURE (ml) Optinal Rescue Pack			0		0			
AIR CONTENT (%)	TOTAL ACTIVE NaO EQU (kg/m³)		0.1%	0 kg/m3	0.0%	0 kg/m3	0.0%	kg/m3
C / W RATIO			1.887		0.000		0.000	
C / A RATIO			0.203		0.000		0.000	
FINE AGGREGATE SAND (%)			49.4%		0.0%		0.0%	
SACKS PER m3	CEMENT		5.8		0.0		0.0	
	SLAG/MENT OR FLY ASH		1.8		0.0		0.0	
DESIGN SLUMP			100 mm		mm		0	
COMPRESSIVE STRENGTHS	7 DAYS (MPa) - AVERAGED		Mpa		Mpa		0	
	28 DAYS (MPa)	TARGET MPa	Mpa	37 Mpa	Mpa	0.0	0	0.0

NAHUSA CONCRETE
quality • quantity • quickly

KUSILE

49353P

Revision Date	20/03/2013
Revision Number	1

Cement Blend: 70/30 %
Stone Size: 19 mm
Concrete Class: 35 MPa
Slump: 120 mm
Use: PUMP

Designed by: Jacques Smith
Designed date: 20/03/2013

CEMENT / WATER RATIO : 2,22
WATER / CEMENT RATIO : 0,45

QUANTITIES PER m³	
MATERIAL	WEIGHT (kg)
WATER (lt)	189
OPC CEM I 52.5 ex PPC	294
DURA POZZ ex ASH RESOURCES	126
19mm Quartzite ex Afrimat	0
26.5mm Dolerite ex B&E	0
19mm Dolerite ex B&E	1050
13mm Dolerite ex B&E	0
Washed River Sand ex Honingkranz	850
Washed River Sand ex Cluver	0
Crusher Sand ex Afrimat	0
Optima 100 ex Chryso (ml)	0
OMEGA 136 ex Chryso (ml)	2100

QUOTATION OFFICE UPLOADED
By:
On:
Signed:

PLANT UPLOADED
By:
On:
Signed:

CUBE RESULTS	
7 DAY	28 DAY
33,18 Mpa	48,61 Mpa

ACCEPTED
31/03/2017
ACCEPTANCE BY ESKOM DOES NOT RELIEVE THE CONTRACTOR SUPPLIER OF RESPONSIBILITY FOR THE ADEQUACY OF DESIGN, DIMENSIONS AND DETAILS.

6.3 Concession request

GOL GEN OVERHEAD LINES

FORM
CONCESSION REQUEST
GOL/SHEQ/FRM/7

Page 1 of 2

TO (CUSTOMER): Eskom Transmission	EMAIL/FAX No:
ATT.: Emmanuel Dlamini	YOUR REF: Apollo-Kendal Line Lift
FROM: Renier Van Coller	DESIGNATION: Managing Director
DATE: 30 March 2017	OUR REF: APLKND.Con1

PART " A" – To be completed by GEN OVERHEAD LINES

1. Request No.:	1	2.Date raised:	30/03/17	3.ORIGINATOR:	R van Coller
4.Position: Managing Director				5.Signature:	

6. DESCRIPTION OF CONCESSION REQUESTED: Approval of submitted concrete mix designs,

6.1. LIST Attached: ☑ Yes ☐ No ☒√

7. Reason/Justification for Concession Request:
Supplier in area can not conform to Eskom Transmission line Specifications, but all mix designs are approved and used on construction of Kusile power station, and suppliers are not adaptable to change their mix designs for 15cubic meters of concrete

8. REVIEWER:		9. Position:		10. Signature:	

11. AFFECTED ITEM ☐ Process ☑ Product ☐ Material ☐ Design ☑ Specification ☐ Drawing ☐ Other

12. Affected COST: 12.1 Increase ☐ Decrease ☐ Unchanged ☑ Amount.....	13. Affected TIME: 13.1 Increase ☐ Decrease ☐ Unchanged ☐ Amount.....

14. Affected Factors: CA Approval ☐ QA/QC ☐ Contractual ☐ Function ☐ Performance ☐ Integrity/Reliability ☐ Interchangeability ☐ Appearance ☐ Strength ☐ Code compliance ☑ Safety ☐ Item Life ☐ Others ☐ None ☐

15. Documents affected by Request

Ref. No.	Title	Section	Rev. No.	Date

16. Request submitted to

Customer		For Attention		Department	Date

PART "B" – To be completed by CUSTOMER's Representative

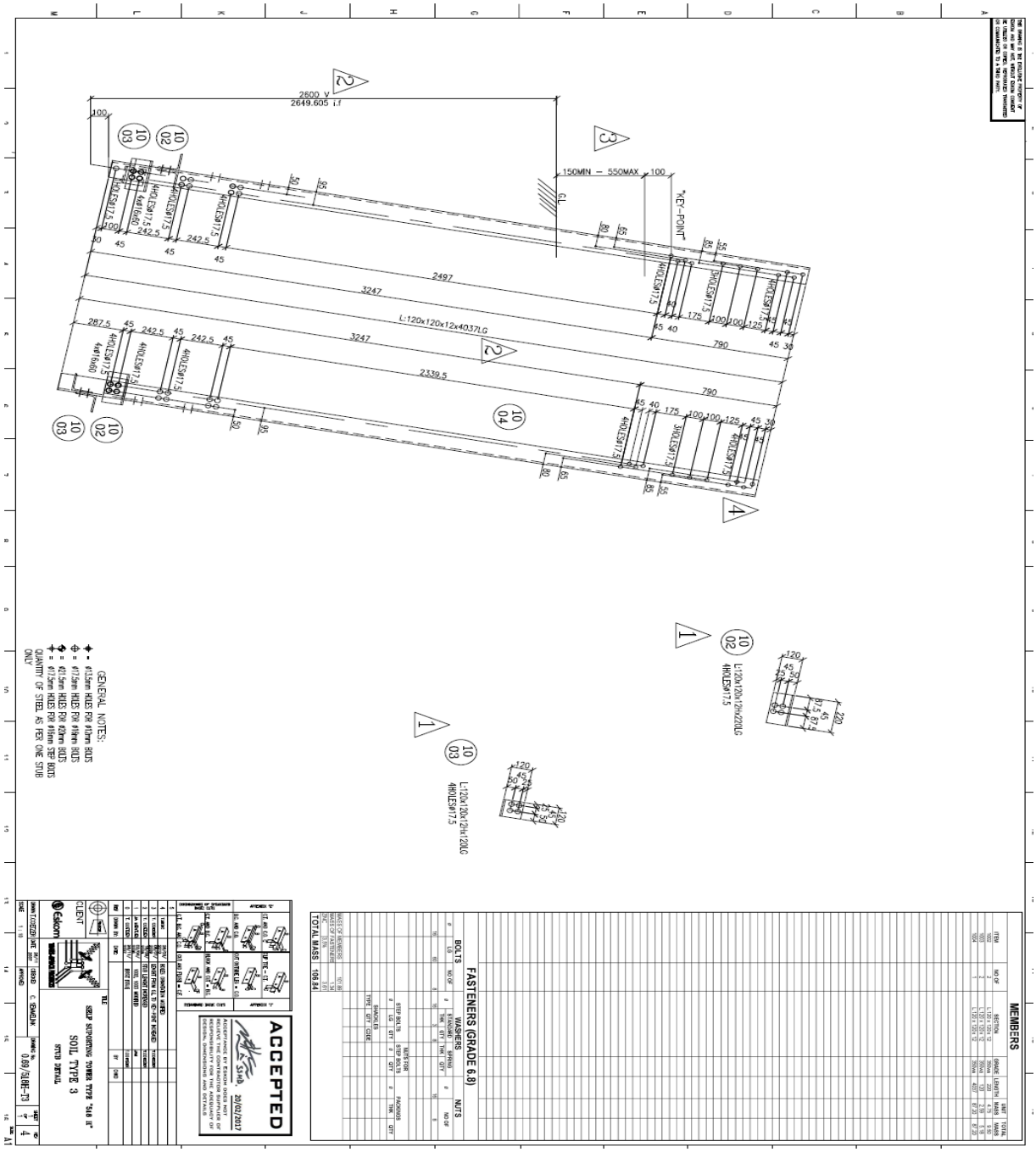
1. Name of Receiving REVIEWER:	2. Department:	3. Position:	4.Signature:	5. Date:
SHAKIR DUDHIA	PDE-LES	Civil Engineer		31/03/2017

6.Condition for Concession ACCEPTANCE:
Shuttering / formwork MAST remain in place for a minimum of 7 days after pouring of concrete due to high f/s ash content.

7.Reason for Concession REJECTION:

C

6.4 Stub details - 518H Soil Type 3



6.5 Stub details - 518H Soil Type 1 and 2