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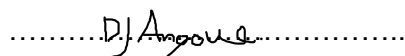
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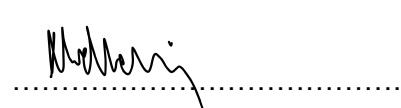
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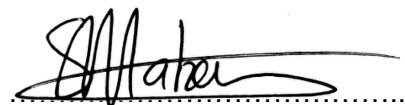
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## **EXECUTIVE SUMMARY**

The purpose of this document is to provide a standard procedure that will be followed for conducting topographical surveys for the Eskom Substations in Transmission (and/or Distribution). The standard sets out the required detail to be included in a topographical survey that will aid the substation engineering designer to perform engineering work, from concept to final design stage of the engineering cycle.

The standard is to be adhered to by all stakeholders interested in obtaining a topographical survey

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## 1. INTRODUCTION

The quality and accurate survey data substation engineering receives is an integral part of the design and construction of new and extending existing substations and access roads, thus this standard provides a guidance in the procedures to be undertaken to produce a topographical survey that will enable substation engineering designers to perform engineering work.

## 2. SUPPORTING CLAUSES

### 2.1 SCOPE

The quality and accurate survey data substation design receives is an integral part of the design and construction of new and extending existing Substations and Access roads.

#### 2.1.1 Purpose

The purpose of this document is to assist substation engineering designers to request the minimum survey requirements for designing substations from the Eskom Tx Engineering and GIS to perform or to appoint a Professional Land Surveyor to produce an accurate and quality product according to the minimum specifications of this document.

#### 2.1.2 Applicability

This document shall apply to Substation Engineering Department within Group Technology, Power Delivery Engineering in Eskom.

### 2.2 NORMATIVE / INFORMATIVE REFERENCES

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

#### 2.2.1 Normative

- [1] ISO 9001:2015 Quality Management Systems.
- [2] Occupation Health and Safety Act. 1993 (No 85 of 1993)

#### 2.2.2 Informative

- [3] Land Survey Act, Act No. 8 of 1997
- [4] TMH 11: Standard Survey Methods

### 2.3 DEFINITIONS

#### 2.3.1 Classification

**Controlled disclosure:** controlled disclosure to external parties (either enforced by law, or discretionary).

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## 2.4 ABBREVIATIONS

Abbreviation	Description
A.M.S.L	Above Mean Sea Level
ASCII	American Standard Code for Information Interchange
CAD	Computer-Aided Design
DGN	MicroStation Design File
DTM	Digital Terrain Model
DXF	Drawing Exchange Format
ECW	Enhanced Compression Wavelet
GIS	Geographic Information System
GPS	Global Positioning System
I.L.	Invert Level
ISO	International Organisation for Standardisation
Lidar	Light Detection and Ranging
PDE	Power Delivery Engineering
T.L.	Terrace Level
TMH	Technical Methods for Highways
T.O.C.	Top of Concrete
Tx	Transmission
WGS	World Geodetic System

## 2.5 ROLES AND RESPONSIBILITIES

The following sections may contain specific functions within each of the following roles and responsibilities related to the works of conducting a substation survey:

**Substation Designers** to ensure all survey requirements are indicated clearly before commencement of project.

**Land Surveyors** to conduct topographical surveys within the parameters of this standard not forgoing the legislative and regulatory bodies of their profession.

## 2.6 PROCESS FOR MONITORING

Survey Data received on agreed time frame.

## 2.7 RELATED/SUPPORTING DOCUMENTS

Not Applicable.

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### 3. SURVEY REQUIREMENTS FOR SUBSTATIONS

This document outlines the different survey data required at different stages of the substation designs or revisions process.

#### 3.1 SITE SELECTION

The minimum survey requirements at site selection stage, is to request for Digital Elevation Model Data or DTM and a 1: 50 000 Geographical maps from Tx Engineering and GIS.

This DTM is ASCII data (xyz co-ordinates) that can be used to produce contours. These contours can be superimposed on the 1 : 50 000 Geographical Map to determine the location of the sites in relationship to Town/Access roads and Power lines. Preliminary cut/fill volumes are also obtained to assist in the geotechnical investigation to select the preferred site.<sup>1</sup>

#### 3.2 CONCEPT DESIGN

A request to Tx Engineering and GIS should be made to obtain whether a Lidar Survey is available.

The Lidar survey consist of CAD files in DGN and DXF format, i.e.:

- Imagery files in ECW format
- Laser points in ASCII format

The above files may be used to orient the substation to the correct position, access road routes can be determined and preliminary geometric designs can be carried out.

If a Lidar survey is not available a full topographical survey is required as described in the final design stage.

#### 3.3 FINAL DESIGN

A request to Tx Engineering and GIS should be made to appoint a qualified Professional Land Surveyor to produce a detailed Topographical/Engineering survey of the selected site.

The area to be surveyed should be indicated on a 1: 50 000 map or the property boundary/Substation servitude co-ordinates negotiated by the Lands and Rights Department.

The scope must cover the following:

- The survey to be in WGS 84 ellipsoid.
- All topographical features to be shown on the survey in DGN or DFX format
  - Farm boundaries, trees, bush and vegetation, rock outcrops, rivers, dry water courses, soil erosion, etc.
  - Poorly drained areas, roads, power lines, telephone lines, internet connectivity cabling/fibre, existing structures/buildings,
  - Grave yards, heritage and archaeological sites,

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<sup>1</sup> The accuracy of the data is very poor and can only be used for planning purposes.

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- Existing culverts, manholes, water, sewer, oil, or other form of matter transported in pipelines, (depict top and invert levels).
- The survey must depict all the buried and underground services.
- Labelled contours A.M.S.L. at 0.5m intervals.
- Nearest national/district road with road number and kilometre marker.
- A 50m wide strip either side of T-junction if access road connects directly to a national/district road.
- Existing registered servitudes.
- Bench marks with co-ordinates and descriptions.
- The accuracy of the survey to Real Time GPS =  $\pm 30\text{mm}$

Electronic survey data required from the survey must be in ASCII format (x,y and z co-ordinates values in columns).

A survey report consisting of equipment and personnel used, control beacon/trig stations, methodology on how the survey was compiled and results and general findings.

### 3.4 SUBSTATION EXTENSIONS

The Substation engineering designers are required to mark up an existing Key Plan/Sketch indicating the area where the extension is required and existing column foundations. The marked up drawing is then sent to Tx Engineering and GIS who will appoint a professional Land Surveyor to produce a detailed Topographical/Engineering survey of the marked extension.

The scope must cover the following:

- The survey to be in WGS 84 ellipsoid.
  - All topographical features to be shown on the survey in DGN or DFX format –
  - All marked column foundations with T.O.C. and existing T.L., Existing structures/buildings,
  - Pylons, yard and security fences, top and bottom of cut/fill embankments, existing culverts, and
  - Manholes top and invert levels, drainage channels and outlets, any visible services.
- The survey must depict all the buried and underground services.
- Labelled contours A.M.S.L. at 0.5m intervals.
- Bench marks or existing setting out beacons with co-ordinates and descriptions.
- The accuracy of the survey to Real Time GPS =  $\pm 30\text{mm}$

Electronic survey data required from the survey must be in ASCII format (x,y and z co-ordinates values in columns).

A survey report consisting of equipment and personnel used, control beacon/trig stations, methodology on how the survey was compiled and results and general findings.

## 4. AUTHORISATION

This document has been seen and accepted by:

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## 5. REVISIONS

Date	Rev.	Compiler	Remarks
June 2016	1	D.J Angove	New Document Required
February 2022	2	S Mabena	Document Amendment

## 6. DEVELOPMENT TEAM

The following people were involved in the development of this document:

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## 7. ACKNOWLEDGEMENTS

None.

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