

11. SURVEY DRAFTING

This chapter will cover all the requirements with regards to the final presentation of a survey CAD drawing.

These specifications and dimensions refer generally to CAD drawings at a scale of 1:1000. Where other scales are used these must be 'natural' scales and all symbols must be changed in relation to the scale used.

11.1 Drafting of topographical plans

11.1.1 Drawing requirements

- a) The standard sheet size shall be A0 except if otherwise specified.
- b) Where the extent of the surveyed area covers an area greater than a single A0 sheet then the final CAD work submitted shall comprise of a 'Continuous Model' drawing and A0 drawing sheets or as otherwise specified by the Client.
- c) Continuous Model drawing
 - i) Continuous Models shall be submitted in 2D and 3D formats. The DTM points feature codes heights and DTM triangles (TIN) must be included in the layer structure of such drawings.
 - ii) A Continuous Model must comprise a single 'CAD drawing' covering the entire surveyed area i.e. a single digital sheet.
 - iii) This digital drawing must conform to all the drafting requirements for A0 hard copy sheets and as further specified below.
 - iv) It is noted that the design engineers generally use this Continuous Model for their design work. Hard copy A0 design sheets are then extracted from this Continuous Model as suited to their requirements.
 - v) A title block and co-ordinate lists are not required for this type of 'digital drawing'.
- d) A0 drawing sheets
 - i) A0 drawings must be supplied in 2D format.
 - ii) No (TIN) triangles are required as a layer on the A0 sheets.

- iii) The Continuous Model as specified above must be used to extract the individual A0 survey sheets and in accordance with the approved sheet layout.
- iv) Provided that the Continuous Model was compiled in accordance with the drafting specifications then there should be minimal CAD work required to ensure that each A0 sheet is fully compliant with the drawing specifications.
- v) A0 hard copy drawings shall only be submitted on completion when instructed to do so.

11.1.2 General requirements for all CAD work

- a) Survey drawings must obviously conform to the southern hemisphere conventions i.e. reflecting the correct sign (negative or positive) with respect to the actual grid values.
- b) All observed 'spot shot' and feature codes must be incorporated into the Continuous Model in three separate layers i.e. code, height and position. The decimal point of the 'spot shot' must always represent the exact position where the 'spot shot' was surveyed.
- c) The DTM 'triangles' for topographical ground surveys must form part of the Continuous Model and be incorporated as a separate layer and named 'DTM triangles'. TIN files for photogrammetric, Lidar and laser scanning surveys can be submitted in a separate folder and not as a folder for the CAD work.
- d) Features determined by their grouped nature must be incorporated as separate CAD layers and as specified in **Annexure 20**. The layer structures must be recorded by layer name and not layer number. Careful checks are to be carried out to ensure features of the same or similar nature are not incorporated in different layers.
- e) Lettering must be undertaken so that it reads as viewed from the bottom or the bottom right hand corner of a sheet.
- f) Unless otherwise specified, only drafting symbols as per **Annexures 19 and 21** may be used.
- g) An Overlap between adjacent A0 sheets is not required.
- h) The North Direction sign must be reflected on each sheet so that it is in a prominent and easily visible position.
- i) A 'schedule block' for the co-ordinate list must be shown on the left hand side of the main title block. The co-ordinates of all Permanent Survey Control which appear on the sheet only must be listed.
- j) All datum information as it applies to the coordinates listed must be noted in the 'schedule block' of co-ordinates in the position shown.
- k) Plan numbers shall be obtained from the Client.

11.2 Drafting

11.2.1 The Material

Where the final drawings are required to be on film then such film must comprise of double matt and a stable base transparent film material of high quality.

Film parameters must comply with the following:

- Be between 0,075mm and 0,15mm thick;
- Be 841mm wide; and
- Be 1189mm in length (i.e. A0 Size).

11.2.2 Sheet size

The Continuous Model digital sheet size shall be determined on a case by case basis.

The individual sheet sizes shall be based on the A0 Deutsches Institut für Normung (DIN) size and guided further by specific Survey Requirements or as specified by the Client.

11.2.3 Sheet layout and the sheet layout key plan

a) Individual Sheet Layout

The drafting space must be maximised unless otherwise specified. For all road surveys the sheet layout must be directional from left to right where the direction is determined by the direction of increasing route chainage and section numbers. For non-road/non-linear related surveys, the north orientation must always point towards the sheet top.

b) Sheet Layout key plan

Prior to commencing with the final drafting of a strip or block the Surveyor must submit a sheet layout key plan to the Client for his approval. This must be to a minimum scale of 1:50 000. Plan numbers will be allocated by the Client and must be reflected on the final sheet layout key plan and in the defined spaces therefore. This also then forms a part of the Cadastral Key Plan. Also refer to Paragraph 11.2.3(c) on Key Plans.

c) Cadastral key plan

The Cadastral key plan must be prepared on a standard A0 sheet and at an appropriate scale, showing the following information:

- i) The survey sheets and sheet numbers;
- ii) The cadastre within the project area. In urban (towns etc.) areas, block corners and street names are adequate;
- iii) All Permanent Survey Control together with its number;
- iv) The extent of the survey area. For road surveys the edges of the road must also be shown; and
- v) All rivers and primary railway lines.

This sheet will generally be sheet 1 of the A0 sheet range to be submitted.

d) Standardization and uniformity of drafting procedures

In order to standardize drafting procedures, all digital maps must reflect a standardised look with respect to CAD layer names and terms used, colours, line weights and symbols.

Where there is a need for a specific configuration for the CAD work then this must be defined by the Client.

e) Co-ordinate grids and grid values

- i) The relevant coordinate grid must appear on each hard copy or digital plan produced. The grid lines shall be 200mm apart and must extend across the plan using a line weight of 0 (zero). (i.e. the use and depiction of single crosses displaying the grid line intersections is not permitted).
- ii) The complete coordinate value must be depicted on both ends of the grid lines using a 2.5mm letter size together with a line weight of 0 (zero).
- iii) Unless otherwise specified, the table below indicates the grid intervals for various mapping scales that must be utilised:

PLAN SCALE	GRID INTERVAL (METRIC)
1:100	20 metres
1:200	40 metres
1:500	100 metres
1:1000	200 metres
1:2000	400 metres
1:5000	1000 metres

- iv) In addition to the above, grid lines must conform to the following:
 - Between any two grid lines the scaled measured distance must be within .3mm of the theoretical distance; and
 - The scaled distance for a metre must be within .3mm of its theoretical distance.

11.2.4 Spot heights

- a) Where spot heights are annotated so as to emphasise certain topographical features then such Annotation must be aligned parallel with the bottom of the sheet.
- b) It is again noted the decimal point of the spot height must serve as the position where the spot shot was surveyed. Spot heights must be depicted with one decimal point of a meter.
- c) Spot heights must be of a text height and width of 1.8mm.

11.2.5 Contours

- a) Contours must be depicted in two shades of brown.
- b) Index contours, which generally occur at an interval 5 x (five times) that of the specified contour interval, must be drawn at a line weight of 1 (one) and must reflect the full contour value above mean sea level (MSL). The intermediate contours must be drawn at a line weight of 0 (zero), with only the last two digits of their value shown.
- c) The text of the contour values must be 2.0mm text size and line weight 0 (zero).
- d) Contour values must be depicted at both ends of each contour line and at intervals of ± 400 mm measured along the contour line.
- e) Generally the topography will determine the contour interval. Generally one meter contours are specified for 1:1000 scale drawings in moderate terrain.

11.2.6 Control points

- a) Ground control
 - i) All Control beacons embedded in concrete must be depicted by two concentric circles of 1.5mm and 3.0mm diameter respectively.

- ii) Control beacon's name/number must be contained within a circle of 25mm diameter and placed in an appropriate position 'joined' together with the direction and using a line weight of 1 (one). The name/number indicated at its plotted position must then be removed i.e. not shown.
 - iii) Control beacon's name/number must correlate to that scribed on the aluminium plate fixed to the concrete and be indicated by a line weight of 1 (one) and 2.5mm text height.
 - iv) The Permanent Survey Control heights must be depicted to three decimal points of a metre where such heights were determined by the use of spirit levelling.
 - v) The Photo Control Points (P.C.) must be depicted by a 3mm diameter circle reflecting a horizontal and a vertical diametric line. The text conventions shall be as above for the Permanent Survey Control.
- b) Photogrammetric control
- i) Aerial triangulated points must be depicted by a circle of 3mm radius and no diametric lines.
 - ii) The name/number and height must be depicted using a 1.8mm text size. All other conventions are as per paragraph 11.2.6(a) "Ground Control".
 - iii) 'Tie' points must be depicted as aerial triangulated points provided that the number must be prefixed by the letters CP.
 - iv) Photo centres must be depicted by a 'cross' of 4mm lengths and using a line weight of 1 (one).

All such numbering must be aligned parallel to the direction of the strip using a 1.8 text height and text width. The strip number must be depicted on the LHS of the 'cross'. The exposure number must be depicted in full and to the right of the 'cross'. Both such numbers must be underlined where such underlining is 15mm in length and to which an 'arrowhead' is added and pointing in the direction of the flight line.

11.2.7 Detail

- a) Symbols Sizes (refer also to **Annexure 21** for the list of symbols and sizes)

- i) Symbols Sizes

Symbols sizes must be depicted at an appropriate scale or as otherwise directed in this document.

ii) Text sizes

The text sizes are indicated next to each symbol as listed (Refer to **Annexure 21**).

Text sizes must conform to the specifications in this document but shall always be greater than or equal to 1.8mm in height and 1.8mm in width.

General Annotation must be depicted with line weights of 1 (one) and with 2.5mm text sizes.

iii) Line thicknesses

The line thicknesses are indicated next to each symbol as listed (Refer to **Annexure 21**).

NB. All text shall be 'upright' where only capital letters or numerals are permitted.

iv) Colours

The colour intensity for **Red**, intensity of **Green**, and intensity of **Blue** (RGB) must comply with colour table.

b) Detail to be shown

Refer to the topographical survey specifications for all detail that must be depicted on the final plans.

11.2.8 Utilities

a) Roads

The status and official road number for all roads must be depicted as follows:

- Names of streets must be depicted as indicated on the relevant General Plan of such township or as determined from field records; and
- Road destinations must be depicted at road ends.

b) Bridges (NB: All dimensions shall be recorded in millimetres)

The name and number of a Bridge (e.g. B12: Glenroy Bridge) must be depicted (where this information may be obtained from the Client if a name and/or number is not displayed on the Bridge structure) must include the number of spans together with their horizontal and vertical dimensions (e.g. 3/1200 X 1600, i.e. number of openings/horizontal dimension X vertical dimension of the openings).

c) Culverts

Unless otherwise specified, the Culverts size, its dimensions and invert levels must be depicted on the CAD drawing and as specified in **Annexure 17**.

Note: Surveyors may be instructed to compile a Culvert schedule. Refer to Annexure 22.

- i) Box Culverts: Indicate the number of openings and horizontal and vertical dimensions (e.g. 2/4000mm x 2500mm BC).
- ii) Pipe Culverts: Indicate the number of openings and the diameter (e.g. 600mm Ø PC or 3/600mm Ø PC).

d) Railway Lines

- i) The names of all railway stations and railway sidings must be depicted.
- ii) The destinations must be depicted at both ends of a railway line as shown on each drawing.

e) Power and Telephone Lines

i) Telephone Lines

Telephone poles shall not be connected with a continuous line but depicted by means of a short line on either side of the symbol circle.

ii) Power Lines

The specified symbol must be used, (i.e. power poles must be connected by a continuous line and the 'zigzag' symbol inserted approximately midway between the power poles or pylons.)

The height clearance (NB: not MSL) between the electrical conductor and the ground surface must be shown on the drawing at the position where it was surveyed. At least two such points must be depicted between poles or pylons. With respect to a road survey, such positions must be relative to a left and right edge of the road.

11.2.9 Topography: cuts and fills

Straight lines (using a hatching symbol) must be used to depicted cuts and fills. The bottom of the cut or fill must be depicted by a broken line unless the cut or fill line is superimposed onto another feature line. The top and bottom of cuts and fills shall always be used as break lines in the DTM.

11.2.10 Contours, erosion, etc.

a) Contours

Contour values must be readable when viewed from the bottom or right hand side of the plan. These values must be depicted at the start and end of a contour line and also approximately every 400mm along the contour line. The contour value must be aligned with such contour line and where the full contour value for principal (index) contour is depicted and only the last two digits for the intermediate contour. Where the plan distance between principal contours is less than 10mm, then no intermediate contour values need be depicted.

It is imperative that care be taken to ensure that contour values at the start and end points of contours must not be depicted within the survey area. Within the survey area contour values must not cover any detail or a contour line.

Watercourses in such an eroded area must be depicted by the specified symbol with an arrow

b) Erosion

Indicating the direction of flow.

11.2.11 Buildings, trees, etc.

a) Buildings

All buildings must be depicted to reflect their actual shape and size and permanent buildings must be 'hatched'. Buildings such as schools, police stations, shops, factories, flats, offices, garages, hospitals, etc. shall be described according to the function they serve. Buildings for residential use will not have a description depicted.

b) Special features

Names of important features must be depicted.

11.2.12 Roads signs, etc.

- a) Road signs must be depicted as per the symbol list in **Annexure 21**. Photographs of all road signs must be supplied in a digital photograph folder. Road sign positions must be numbered on the drawing. This number must correspond to the relevant photograph number as depicted in the digital photograph album provided.

11.2.13 Vegetation

a) Cultivation

Only perennial crops are required to be described.

b) Orchards, vineyards and hedges

These must be fully described, (e.g. "Vineyard"). In the case of orchards the type of fruit shall also be recorded.

11.2.14 Drafting quality

Drafting shall be of a high quality where its neatness, uniform standard and clarity is of great importance. Generally all conventions described and specified must be fully adhered to so that the final drawing reflects a high quality, professional product.

11.3 Cadastral

11.3.1 The symbolisation of Cadastral boundaries must be strictly in accordance with the line symbols for different features and scales and as specified in the list of symbols in **Annexure 21**. Descriptions must correlate exactly as they appear on the title deed and SG Diagram. Where a re-designation has been effected, this fact must be noted. Text sizes must be as per the list of symbols but may be changed to suit changed circumstances where small properties exist, but shall not be less than 5mm in size.

Cadastral farm boundaries must be specifically highlighted in accordance with the requirements of the Client.

11.3.2 Information relating to all existing proclamations and/or declarations must be depicted on the plans in accordance with the list of symbols. The Road Reserve must be a solid line where these coincide with the boundary line of a registered property. In all other instances, a broken line must be used. The Road Reserve Beacon point numbers must correlate exactly with the proclamation/declaration.

The proclamation/declaration number and Gazette number and date must be depicted on each sheet at an appropriate location on the plan.

11.4 Title block, North Direction and sheet index

11.4.1 Title block

The title block layout and details must be obtained from the Client.

11.4.2 North Direction

The North Direction symbol must meet the requirements of the Client and shall appear on all sheets.

11.4.3 Sheet layout

Unless otherwise specified, sufficient space must be provided for a sheet layout in the right hand bottom corner of the working area of the sheet unless such provision is not already made for this in the individual title blocks. The sheet layout must depict at least three sheets of which the centre sheet is hatched so as to represent the active sheet. Sheet numbers must be depicted in the sheet layout. Where the sheet layout is complicated then more sheets should be depicted.

11.5 Office check

11.5.1 The Surveyor must submit the first completed sheet together with the relevant CAD data for approval prior to commencing with the remainder of the drafting work.

11.5.2 Field and office check records must be submitted together with the final plans.

11.6 Drafting symbols

11.6.1 For CAD and drafting symbols refer to **Annexure 21**.