

SURVEY AND PLAN PRACTICE GUIDELINES FOR WESTERN POWER TRANSMISSION LINE EASEMENTS

These guidelines are issued under regulation 26A of the Licensed Surveyors (Guidance of Surveyors) Regulations 1961 to authorise the survey of Western Power transmission line easements by methods other than those set forth in those regulations.

1. SCOPE

- 1.1 These guidelines are applicable to the following two situations of determining the spatial definition of easements:
 - 1.1.1 by local re-establishment and calculation, and
 - 1.1.2 by calculation from the Spatial Cadastral Database (SCDB).
- 1.2 The survey methods for each of the above situations will be similar, but there will be some data transfer processes to consider if calculating from the SCDB.
- 1.3 No ground marking of easements for transmission lines will be required.
- 1.4 These guidelines are applicable to easements over both Crown and freehold land.
- 1.5 These guidelines are also applicable to the depiction of easements on deposited plans that are to be lodged at DOLA.

2. LOCAL RE-ESTABLISHMENT AND CALCULATION

2.1 General provisions

- 2.1.1 It is the surveyor's responsibility to ensure that the survey method used is appropriate for the circumstances, and that the work is proven.
- 2.1.2 Survey methods should conform to the basic principles of survey as defined in the *Licensed Surveyors (Guidance of Surveyors) Regulations 1961*.
- 2.1.3 To facilitate verification of the survey and integration with the SCDB, rigorous connections to the State Geodetic Survey (geodetic connections) are required. In remote areas a surveyed connection should be made to each geodetic station within 10km of the transmission line. In areas with a greater density of geodetic stations, geodetic connections should be made at intervals of not more than 5km.
- 2.1.4 The geodetic connections should be in accordance with Section 4 of these guidelines.
- 2.1.5 Where GPS is used, the survey must be carried out in accordance with DOLA's current Survey and Plan Practice Manual.

2.2 Field Notes

- 2.2.1 The field notes of the survey must be lodged in a standard cadastral field book certified by a licensed surveyor holding a current practising certificate.
- 2.2.2 The following information is to be recorded in the field book:
 - 2.2.2.1 Normal requirements of cadastral re-establishment,
 - 2.2.2.2 Validation of SSMs from reference marks,
 - 2.2.2.3 All connections from SSMs to cadastral points,
 - 2.2.2.4 Any additional control placed, and connections from that control to cadastral points, whether measured or calculated,

2.2.2.5 Marking and referencing details with relevant abutting information (eg lot on plan, CT, road name)

2.2.2.6 Feature information (eg fences, terrain, access) and,

2.2.2.7 Any other relevant information.

2.2.3 It will not be necessary to include all the easement dimensions in the field book.

2.3 The Plans

2.3.1 The plans should be drafted as specified for easement only plans in DOLA's current Survey and Plan Practice Manual and in Notice to Surveyors T1/2001.

2.3.2 The plan type will be "Freehold" and the purpose will be "Easement".

2.3.3 Each plan must be compatible with the easement documents that Western Power intend to register. The extent of each plan must be consistent with the proposed registration actions of Western Power such that, upon registration of the documents, the whole of the plan can be approved. Surveyors need to consult with Western Power as to the registration requirements. Where any uncertainty exists surveyors should prepare individual easement plans for each affected parcel.

2.3.4 Plans are to be lodged at DOLA's Customer Service Counter in Midland. No fee is charged for the lodgement of an easement only plan.

2.3.5 CSD files based on MGA coordinates are to be prepared, in accordance with the requirements specified by the Inspector of Plans and Surveys, for each individual plan and lodged at DOLA.

2.3.6 Where the survey is based on GPS observations, the relevant plans should bear the following statement: "*Survey dimensions derived from GPS observations*".

2.3.7 The following notation is to be placed within the graphic area of the plan:

"Surveyed in accordance with Survey and Plan Practice Guidelines for Western Power Transmission Line Easements under regulation 26A of the Licensed Surveyors (Guidance of Surveyors) Regulations 1961",

and the notation "Reg 26A" is to be added to the "approved" box in the title block.

3. CALCULATIONS FROM THE SCDB

3.1. General provisions

3.1.1. A method that satisfies the key factors of certainty of position (within adequate tolerances) and reasonable cost is a calculation of the easement boundaries using DOLA's Spatial Cadastral Database (SCDB). This method relies upon the spatial relationship of the physical infrastructure with the boundaries defined in the SCDB.

3.1.2. The SCDB must be spatially upgraded using the surveyed easement alignment and/or control traverse before definition of the easement can be undertaken. Areas of the SCDB that are upgraded for this purpose must be done in accordance with DOLA's requirements. The appendix gives an indication of the process involved in upgrade of the SCDB and plan preparation.

3.1.3. Definition of easements by calculation from the upgraded SCDB can only be accepted where the accuracy of the SCDB is sufficient to provide certainty of position within adequate tolerances.

3.1.4. Spatial Upgrade transactions on the SCDB require that area of the database to be “locked”. It is therefore important that the time taken to upgrade a transaction area is minimised. Transaction areas should be of a manageable size and each transaction must be completed within 4 weeks.

3.2. Procedure

3.2.1. Spatial Accuracy

3.2.1.1. In general, a nominal accuracy of 0.1 metres in urban areas and 0.5 metres in rural or pastoral areas for the upgraded SCDB is required to achieve an adequate degree of positional certainty.

3.2.1.2. If the area has been spatially upgraded but not achieved the aforementioned accuracies, additional geodetic connections will be necessary.

3.2.1.3. The geodetic connections should be in accordance with Section 4 of these guidelines.

3.2.1.4. Where GPS is used, the survey must be carried out in accordance with DOLA’s current Survey and Plan Practice Manual.

3.2.2. Easement boundaries

3.2.2.1. In the case of existing transmission lines a survey to determine the position of all the physical elements of the infrastructure that need to be contained within the easement must be carried out. For new lines where easement definition is required prior to construction a centreline survey is necessary. In both instances these surveys are to be lodged in accordance with 2.2.1.

3.2.2.2. This survey must provide positions that are compatible with the boundary definition. The aim is to achieve certainty that the structure falls completely within the easement. This would mean that a margin of error depending upon the expected relative accuracy is allowed when determining the clearance between the structure and the boundary.

3.2.2.3. The easement dimensions are calculated within the spatially upgraded SCDB to completely enclose the existing infrastructure based upon the surveyed position. Intersections with other land boundaries are also calculated and shown on the plan.

3.2.3. Spatial verification

3.2.3.1. The SCDB is a digital cadastral model that has been constructed from a limited number of surveyed connections between cadastral marks and permanent marks of the State geodetic survey network.

3.2.3.2. An estimate of the spatial accuracy of any point in this model can be given by a statistical analysis of the least square adjustment results. This is expressed in the SCDB as the “circular error” (arithmetic mean of the major and minor semi-axes of the error ellipse).

3.2.3.3. The accuracy of this estimate can be tested by comparing the positions of a set of surveyed boundary points that have not been used in the adjustment process with their modelled positions.

3.2.3.4. The method of survey and the accuracy of measurements shall be such that there is less than a 5% probability that the actual error in position of any surveyed boundary point within the area of interest exceeds the accuracy statement for that point in the SCDB.

- 3.2.3.5. Verification can be achieved by making redundant geodetic connections to cadastral points within the area of interest that are not used in the spatial upgrade process. These can be used to verify the reliability of the adopted geodetic connections, and to provide a ground truth for upgraded points in the SCDB.
- 3.2.4. Field Notes
 - 3.2.4.1. The field notes of the survey are to be prepared in accordance with section 2.2 of these guidelines.
- 3.2.5. The Plans
 - 3.2.5.1. The plans are to be drafted in accordance with section 2.3 of these guidelines.
 - 3.2.5.2. The following additional notations (where appropriate) are to be placed within the graphic area of the plan:
 - “Dimensions derived from the Spatial Cadastral Database as at <date of final adjustment/calculation>”*
 - “Calculations have been made on the GDA94 and distances reduced to mean ground level”.*

4. GEODETIC CONNECTIONS

4.1. Survey

- 4.1.1. For each connection provide sufficient data to enable MGA coordinates to be derived for a cadastral point.
- 4.1.2. Locate and validate existing cadastral points. Marks must be renovated or replaced in accordance with the requirements of the Licensed Surveyors (Guidance of Surveyors) Regulations 1961. Additional reference marks are to be placed at cadastral points occupied with GPS.
- 4.1.3. Validate the horizontal stability of the controlling SSM from reference marks.
- 4.1.4. Survey the connection using the following technique:
 - 4.1.4.1. Observe a GPS baseline between the controlling SSM and the cadastral point.
 - 4.1.4.2. Where practicable, provide redundant measurements that will confirm the connection.
 - 4.1.4.3. The GPS baseline observation may be of any type (static, rapid static, kinematic) as long as the required accuracy is achieved.

4.2. Accuracy

- 4.2.1. The method of survey and accuracy of measurements shall be such that there is less than a 5% probability that the actual error in the positional accuracy (coordinate) of the cadastral mark with respect to the SSM will exceed r millimetres provided by the formula:

$$r = c(d + 0.2)$$

Where d is the direct distance between the two points in kilometres and c is as specified in the following table:

URBAN	25
RURAL	40
PASTORAL	90

4.3. Field Notes

The field notes of the survey are to be prepared in accordance with section 2.2 of these guidelines, with particular note of the following matters:

- 4.3.1. For GPS baselines, both the ellipsoidal (GDA94) and mean ground level distances, and the calculated mid azimuths are to be clearly documented in the field book.
- 4.3.2. MGA coordinates are not generally to be shown in field notes as they are subject to change should any readjustment of the controlling SSMs be undertaken. However a listing of the base station and input coordinates, and the cadastral points and their derived MGA coordinates, is required in the case of a GPS RTK survey.
- 4.3.3. Details of the GPS hardware type including serial numbers of receivers and antennae plus the software version used for reduction of observations must be recorded on the index page of the lodged field book/s together with calibration details for EDM and bands, if used.
- 4.3.4. Sufficient information should be recorded to demonstrate that the required accuracy has been achieved.
- 4.3.5. To facilitate cross referencing it is important that the following details are clearly shown in the field notes for each connection:
 - 4.3.5.1. Original (Orig) distances between the GPS connection point and adjacent cadastral bends or corners,
 - 4.3.5.2. Lot or location numbers, road names or numbers, reserve numbers, etc,
 - 4.3.5.3. Clear details of the search used including the page number(s) of Field Book(s) together with details of the Field Book(s) containing the centreline or "as-constructed" survey, and
 - 4.3.5.4. Survey Index Plan reference.

INSPECTOR OF PLANS AND SURVEYS

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DEFINITION OF EASEMENTS USING THE SCDB

1. SCDB transaction area (1) of minimal size for a section of the easement extracted and released to contractor.
2. Spatial Upgrade “only” of the area (1) carried out by the contractor using DOLA software (Spatial Editor). New polygons for the easement cannot be created during this spatial upgrade stage.
3. Spatially Upgraded area (1) returned to DOLA for validation and reloading
4. SCDB transaction area (2) of minimal size for the next section of the easement extracted and released to contractor.
5. Read only copy of SCDB transaction area (1) of the easement now spatially upgraded released to contractor.
6. Contractor defines the easement by calculation from the upgraded SCDB read only copy using DOLA software (Spatial editor), and creates easement polygons as required with control and connections to boundaries.
7. Contractor prepares plans and CSD files and lodged them at DOLA.
8. DOLA uses normal business processes for the infrastructure plans.
9. Steps 1-6 repeated until project completed.

The following chart indicates the process involved:



