



GEO DATA
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SURVEY & CADASTRAL DATABASE MANAGEMENT

COMPANY PROFILE

APPENDIX B

SOFTWARE SOLUTIONS

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SURVEY & CADASTRAL DATABASE SOLUTIONS

Geodata Australia (GA) provides a range of stand-alone Land Administration tools for spatial definition and cadastral database management.

The GA philosophy is that those tools operate with an uncomplicated data structure. Cadastral outcomes are all variations or permutations of spatial and administrative data. All the data needed for those permutations is stored in a single readable project data file which is accessed by all the GA tools.

1. GEOSURVEY – Survey data and coordinate geometry tool

GeoSurvey is a practical application developed over 20 years for the needs of the NSW Association of Consulting Surveyors Computer Group. The software development has been driven by the varied functionality and interoperability demands of the user group, resulting in expansive survey and GIS outcomes and flexibilities. It is a very effective tool focused on the needs of cadastral surveyors across any state, national or international jurisdiction.

Functionality includes:

- Survey reductions and Coordinate Geometry computations.
- Road and drainage design capability
- Topographical digital terrain modelling,
- Volume calculations
- Plan Plotting.

Features include:

- A single executable file which simplifies installation (no Registry entries or other intrusive procedures are necessary to make the programme work).
- All data for a job stored in one ASCII format file.
- A user-friendly and un-cluttered user interface.
- Data processing achieved quickly and efficiently (rapid screen refresh).
- A high degree of input and output flexibility.
- Flexible formats ensure interaction with the latest survey equipment.
- Very large job capability (will manage in excess of 500,000 points).
- Accommodates and interacts with a wide range of proprietary software packages.
- Translation tables used to switch codes, symbols, layers etc during the file translation process.
- Automatic and extensive stringing of features implemented for selected codes at any time.
- The operations carried out for geometry calculations can be logged to a transaction file and this file can be replayed to automatically regenerate complete parcel layouts to automate minor amendments.
- The annotated plan functionality automatically renders the Land Titles Office plan text and allows the user to edit the text as required.
- Conversions - ASCII files, ACS, 12D, CivilCad, Autocad DXF, Geocomp, Microstation, MOSS, MX, Surpac, Trimble, Landmark, Mapinfo, 3DD, LandXML, ESRI CEXML

GeoSurvey (GS) has been developed so that it provides all the functionality for the smallest survey firm to upload & download electronic field data, complete all necessary survey computations and with enough CAD functionality to prepare final survey plans to the standard of the relevant Land Titles Office.

GeoSurvey outputs survey boundary spatial outcomes into the cadastral database management tool 'GeoCadastré' that has been incorporated in the ESRI ArcGIS platform (See Footnote 1). That incorporation ensures there are no issues in ESRI data interoperability.

GeoSurvey software (similar to GeoCadastré) is a 'stand alone' package which outputs a 'CEXML' (or LandXML) file that stores the survey data with all cadastral attributes. The CEXML file is imported directly into the ESRI geodatabase through the 'Append File' functionality in the Cadastral Editor menu. The CEXML file structure is the joint IP of Geodata & ESRI, however access to the data schema is not restricted so it can serve as a universal transfer file format for cadastral data. The format is based on the existing GeoSurvey/GeoCadastré file format (developed by Elfick and Fletcher) and was jointly developed for ESRI and the geodatabase. At the time, attempts were made to utilise existing XML storage/transfer file formats in use around the world, however none of them fully represented the survey and cadastral functionality required for the cadastral fabric modelling, inherent in the ESRI Cadastral fabric database. CEXML is the format that cadastral data is migrated within the geodatabase, so GS is unique in its ability to connect to the geodatabase.

Customisation of GS to date has always been done on an open basis as a way of expanding the functionality of the product. It is likely that most customisations required by one particular user may be of benefit others. Any customisations required are done reasonably efficiently, tested and supplied back to the client as soon as possible and forms the latest version of the product which is then available to all customers on support.

There are no specific 'releases' as with major software vendors. There are considerable benefits in that all users are operating standard workflows so there is no issue with varied customisations and the widespread use troubleshoots functionality problems very quickly and training is standard.

GEOSURVEY – ESRI SURVEY ANALYST COMPARISONS

The ESRI Survey Analyst Extension (SA)¹ has been a useful survey tool for GIS mapping applications in the past but it has never been embraced by cadastral surveyors who make field measurements, return to the office and make comparisons with previous survey plans & make an intuitive decision on the "exact" spatial location of a cadastral boundary. Survey Analyst was developed for GIS mapping whereas surveyor's coordinate geometry software was developed to meet the needs of the cadastral surveyor and in the past that natural separation has existed. ESRI recognised that divide and the incorporation of the Cadastral Editor was a major step towards providing 'survey definition' functionality and its survey precision outcomes within the geodatabase.

GS functions outside the ESRI platform as a much more focused and powerful tool for surveyors to manage their survey data.

GeoSurvey(GS), Survey Analyst(SA) and most coordinate geometry software have similar functionality to generate basic points and lines in a coordinated database.

¹ ESRI's Survey Analyst extension was discontinued with the release of ArcGIS version 10 in which the Cadastral editor functionality has been incorporated into core ArcGIS exposed at Arc Editor level.

If singular points or features are being measured, that data could be imported and computations could be easily completed in SA, however for larger surveys, more efficient survey functionality should be utilized.

GS and other survey software is preferred by surveyors as the workflows are focused on survey information outcomes for boundary definition and specific data collection for urban design, digital terrain modelling, road and drainage engineering design, volume computations etc. GS is designed to efficiently and accurately reflect the status of the area being surveyed and output all those outcomes to more complex engineering design software or seamlessly into SA and the geodatabase via the ESRI SurveyXML format.

The GeoSurvey survey workflow benefits include:

- GS is a universal translator of survey field data into specific data formats from customized libraries which provide considerable reduction in office computations and operator/drafting errors.
- Through coding formats, the surveyor makes the decision on the data presentation format in the field. When the data is downloaded into GS, the field coding is recognised and the required attributes are automatically assigned. This includes automatic generation of:
 - Representative library symbols for points -circles, triangles, any prepared shapes with field coding for size - tree shapes to accurately spatially represent trunk sizes, spread and note height, colours, orientation of feature symbols, etc.
 - Lines between points where required (i.e. road centerlines & kerbs, power lines, cables, structure shapes, buildings or any linear feature).
 - Specific line types from – e.g. dashed lines with ticks indicating fence lines, pipes etc.
 - Allocation of points and line types to specific layers
- Different data libraries can be utilized to provide standard feature attributes which may be conditional on data prepared for different jurisdictions.

GeoSurvey is efficient because:

- The ESRI environment is subject to the database rules and structure. Surveyors generally prefer to work outside that and then upload their computed outcomes to Survey Analyst and the geodatabase.
- It's simplicity as 'stand alone' software provides speed of computation
- It is more conducive to using in the field by surveyors
- Software updates are regularly available as new functionality is requested

2. GEOCADASTRE – Survey and cadastral data management tool

GeoCadastrre is a unique survey based process to create and manage a numerical cadastral dataset which can provide spatial precision to GIS cadastral layers. The process has been separately licensed as the cadastral management engine within the ESRI database environment.

Using survey rules the GeoCadastrre process replicates and automates the workflows adopted by surveyors to define cadastral boundaries.

GeoCadastrre features:

- A rigorous “least squares” technique to weight the accuracy of the survey measurement data and adjust the parcel network to geodetic control points.
- Generates “survey accurate” coordinates as attributes to all points in the parcel network.
- Links the cadastrre to GPS.
- Creates and exports the cadastral dataset in file structures suitable for object oriented databases.
- Provides the framework for electronic lodgement, automated plan examination and cadastral update process.
- Includes functionality to compare datasets and create vector transition files to resolve the 'Associativity' between different feature layers in GIS.

GeoCadastrre software characteristics are:

- Uses a single executable file which simplifies installation (no Registry entries or other intrusive procedures are necessary to make the programme work).
- Creates a co-ordinated Numeric Cadastrre from Survey Plans. (The Numeric Cadastrre is defined as the complete and precise parcel network derived from original survey plans, preserving their mathematical integrity and co-ordinated to the geodetic grid of choice).
- Preserves all historical plan details (when they are recorded during data entry).
- Stores the point co-ordinates as an attribute of the point.

The GeoCadastrre process inputs survey measurement data from original title plans or coordinates. The cadastral outcomes are weighted to reflect the integrity of those original survey observations. The process builds a cadastral database model equivalent in spatial precision to the survey data entered.

Electronic survey data can also imported or existing coordinated cadastral databases can be migrated as a means to create a starting cadastral fabric. More accurate recent survey data can then be added and the process of building an accurate cadastrre is commenced.

The survey based GeoCadastrre process provides a more rigorous solution than the mapping based database creation solutions used in the past. The outcomes of the GeoCadastrre process are database accuracy and greater database management efficiencies.

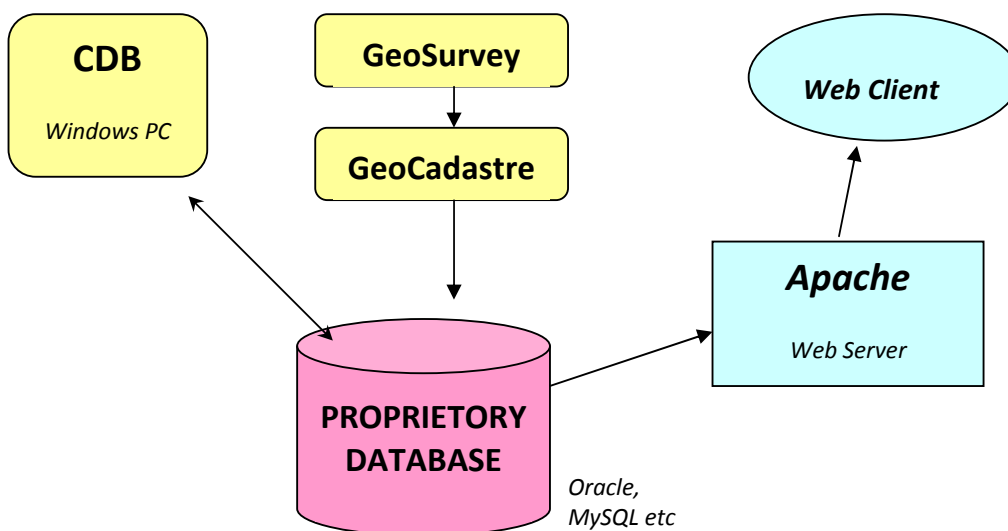
3. CDB – Cadastral Management Database

The aim of the CDB system is to create and manage a land parcel boundary network to survey accuracy. It stores the dimensional data from survey data or survey records and their derived co-ordinates. It has facilities for updating the database while maintaining its geometric integrity.

The cadastral data is stored in a standard SQL database or other suitable databases and can be accessed via web applications. The associated programs which are used to manipulate and join the data are GeoCadastrre and GeoSurvey.

Land boundaries are defined by metes and bounds or coordinates, with each parcel being located by its relationship with adjacent boundaries. Part of this process has been the collection of data from all existing cadastral survey records and the processing of this data to generate reliable coordinates for all parcel corners.

This package allows a move to implement a “Coordinated Cadastre” where corners are defined by their position on the surface of the earth and incorporates the ability to manage a dynamic geodetic environment.



The CDB system is capable of the following broad functions:

- Store all Cadastral survey data or coordinates
- Store the data as a seamless fabric
- Store original bearing and distance data (where available) and the topology of the boundary network.
- Displays the continuous fabric for all database users but limits ability to make changes
- Process regular updates
- Store all historical data
- Extract a local area for manipulation and updating
- Lock extracted data to prevent overlapping updates
- Data is stored in universal geographic coordinates in the GDA94 and can be extracted in MGA94 in a user selected zone or any other geodetic format or zone.
- Every point in the database is allocated a unique point id and a co-ordinate. Parcels lines are defined by the unique id of each end point.

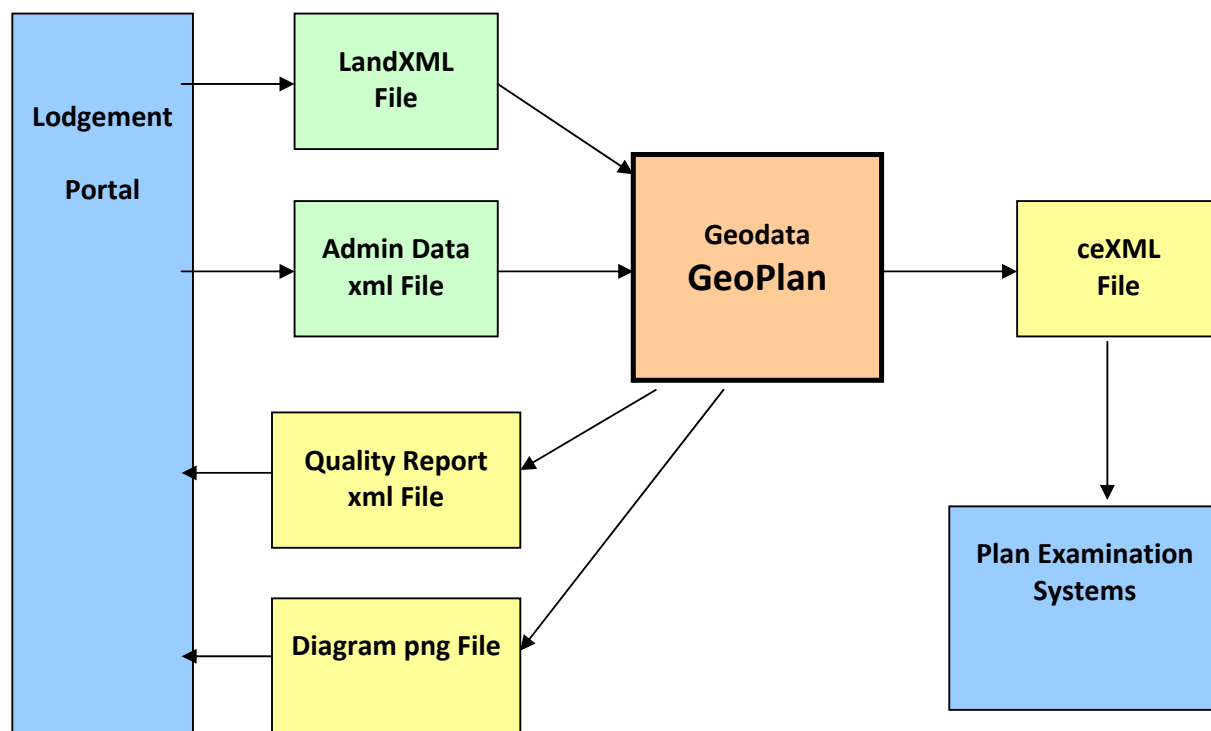
4. GEOPLAN – LandXML conversion tool

The GeoPlan application performs the following functions:

- Reads, analyses and quality checks a LandXML² file according to a certain ‘recipe’ for submissions of electronic plans. It performs a basic XML syntax check as well as checks to ensure the data model is correct and the acceptable LandXML tags are used and the data structure is correct.
- Reads in the portal submitted admin data for the user and plan
- Prepares a quality report listing the errors found in the submitted file.
- Prepares a CEXML (The XML format adopted by ESRI for ArcGIS – see Footnote 1) file containing the data in the LandXML file and the data in the Admin xml file. This file is for submission to the ESRI system software.
- Prepares a graphic image of the submitted plan on the portal in .png file format including dimensions and areas as computed from the submitted plan.

The Administration data format is specific to the statutory provisions of any jurisdiction.

Context Diagram



This electronic plan lodgment process offers considerable reduction in the time to register survey plans for property development as well reducing the load on Land Titles Office plan checking resources.

² The LandXML format developed for LPMA NSW is limited to the representation of a single plan which can have multiple parcels but the single plan cannot be exceeded. This does apply to the CEXML format as it is designed to represent or transfer many plans joined in a cadastral database fabric.