XXV FIG Congress 2014

"Engaging the Challenges, Enhancing the Relevance"

Managing Inaccurate Historical Survey Records in a Future Accurate Digital World

Ian Harper

Geodata Australia

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OUTLINE

1. **Technology Driven Transitions of Cadastral Outcomes.**
   - I. **Manual Processes to Digital Processes**
   - II. **Mapping Database to a Survey Database**
2. **The Survey Database Technology**
   - I. **Project Strategies & Outcomes**

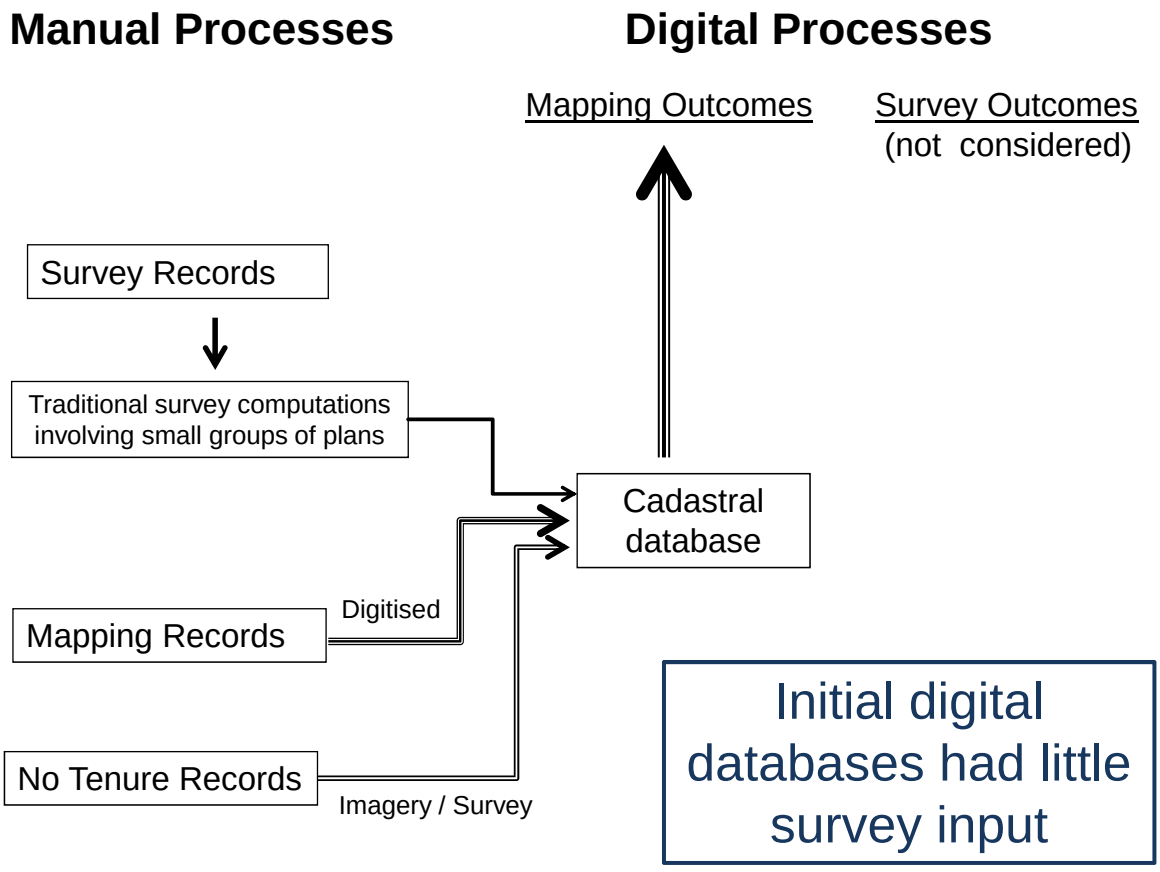
The Cadastral Database Technology Transitions

1. Manual Processes to Digital Processes

Digitising Tenure Maps – provides digital representation for administration purposes

A 'cost effective' mapping solution

The Technology Transitions – Manual to Digital



The Technology Transitions
Mapping Solutions to Survey Solutions

When the spatial quality of a Land Administration Database is not meeting the business needs of any jurisdiction, consideration needs to be given to moving to a **Survey Database** (SD) structure.

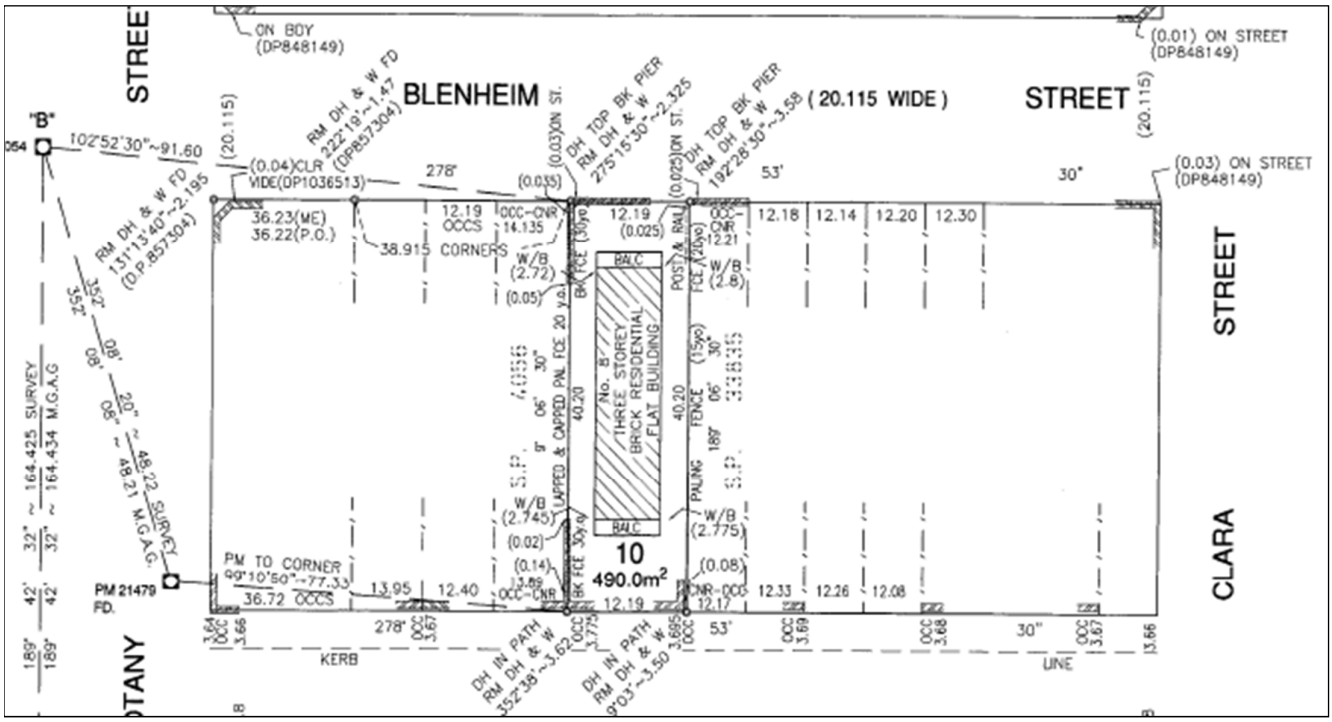
Seeking greater administration efficiencies provides an opportunity for Surveyors.

Existing Survey Solutions – Hard Copy Survey Records

Survey Records are the legal documents defining land boundaries. They are used for accurate local boundary determinations on the ground.

They require considerable field survey interpretation and definition so they only relevant to a small area of a large databases.

Survey Records – Historical Database of measurements used in title definition



THE SURVEY DATABASE SOLUTION

Use of survey logic to integrate modern accurate measurement and position outcomes to more accurately represent inaccurate legal survey measurement records.

It facilitates the transition from a system defined by static historical survey records to an interactive, dynamic and intelligent digital database.

THE SURVEY DATABASE SOLUTION

The process is a completely different logic from the way survey data has been managed in the past.

In the past measurements were adjusted line by line and parcel by parcel to generate a mesh that defined the cadastre in a survey cogo format.

The SD process adjusts shapes/objects (surveys) to fit together to define the cadastral model. New accurate surveys retain their shape better than old ones to make them fit together.

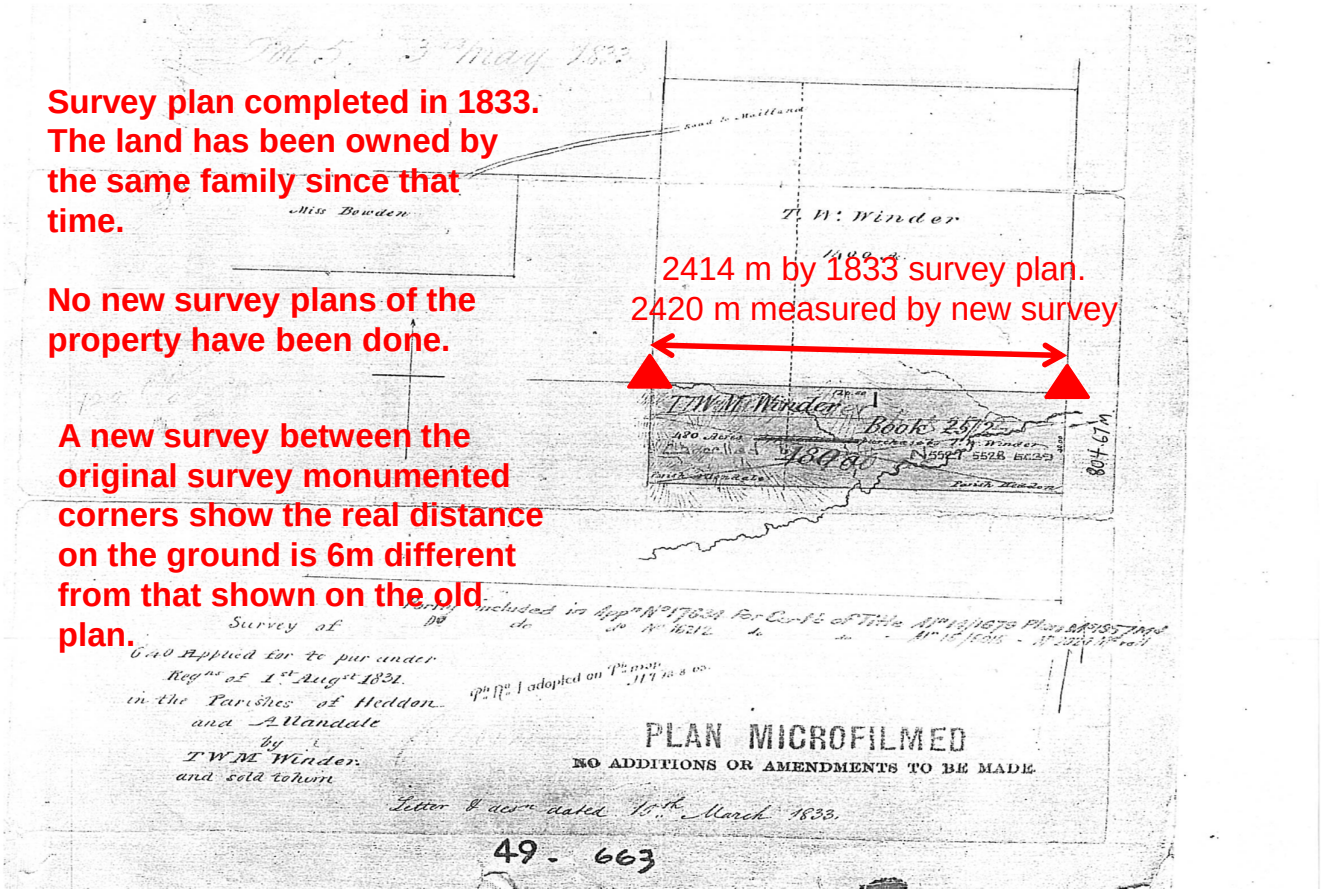
THE SURVEY DATABASE SOLUTION

It can retain original intelligence from historical survey records that may include:

- Parcel and other survey measurements that may assist in database connectivity and wider database spatial accuracy
- Title Identifiers (Lot / Plan)
- Area noted on Plan
- Date
- Indication of plan spatial quality based on age but amendable
- Other features deemed relevant to non-spatial land administration needs (ePlan attributes)

However, they do not ‘fit’ easily into a structured digital environment.

The Technology Transitions – Survey Records



THE SURVEY DATABASE SOLUTION

Higher accuracy requires a rigorous process and validation as data and needs apply.

Each stage of the process has separate measurable data validation or analysis tools:

1. **Entering the dimensions of survey parcels from the record documents or new survey data** - A misclose is reported for every parcel and every loop of other control or cadastral measurement information entered from a plan.
2. **Joining the parcels into a fabric with no overlaps or gaps** - Residuals are reported for every new point joined to the database to determine how well the new survey 'fits' with the existing survey database.
3. **Adjusting the database with weighting applied to all measurements on a per plan/survey basis** – A report is generated for every adjustment reporting on comparisons for all parcels and lines between the model and the original observations. This assists in finding incorrect or poor data.

CREATING A SURVEY DATABASE

1. From Mapping Databases

Migrates a mapping database to an initial survey database by reverse engineering to generate survey dimensions and spatially upgrade as needs and resources allow.

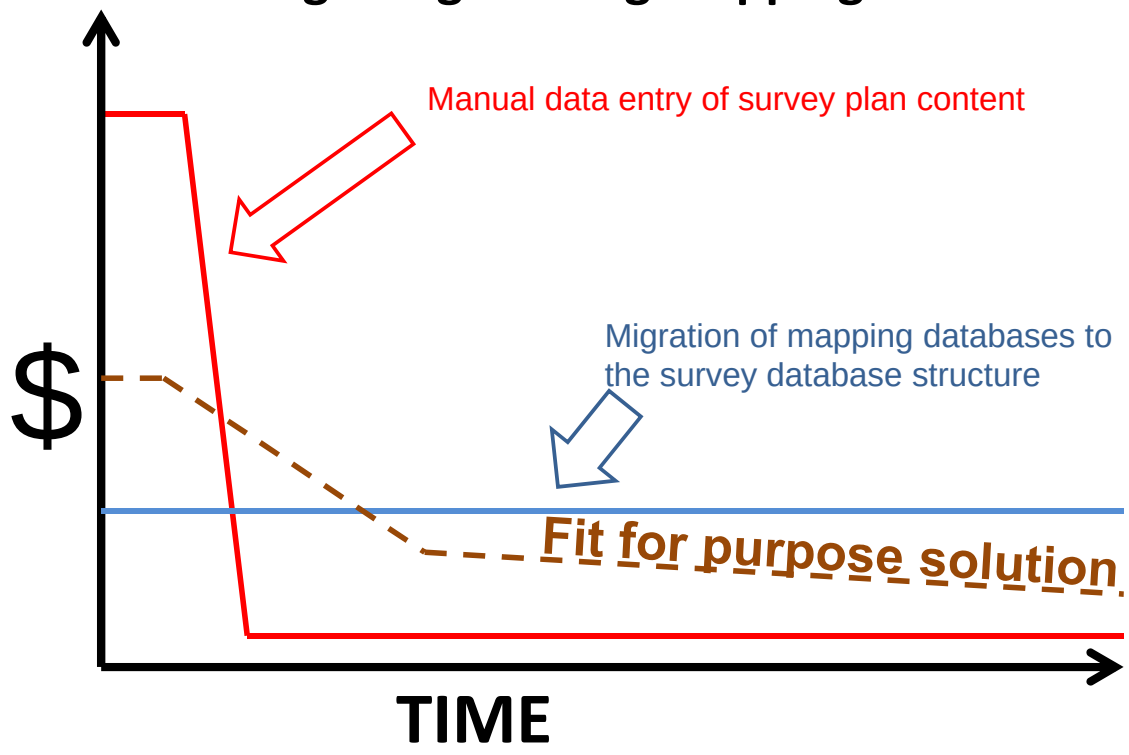
Cost effective starting option.

2. Entering original Measurement From Survey Records

Cadastral Survey records are the underlying data source but require significant understanding and computational manipulation. This has been automated in the SURVEY DATABASE technology.

Generates the highest spatial outcomes and efficiencies

Business Case comparisons between manual data entry and migrating existing mapping databases



The up-front costs of manual data entry are quickly amortised by efficient management and spatial upgrading compared with managing a combination of good survey data and digitised data.

CREATING A SURVEY DATABASE

The Fit for Purpose Solution

The Challenge

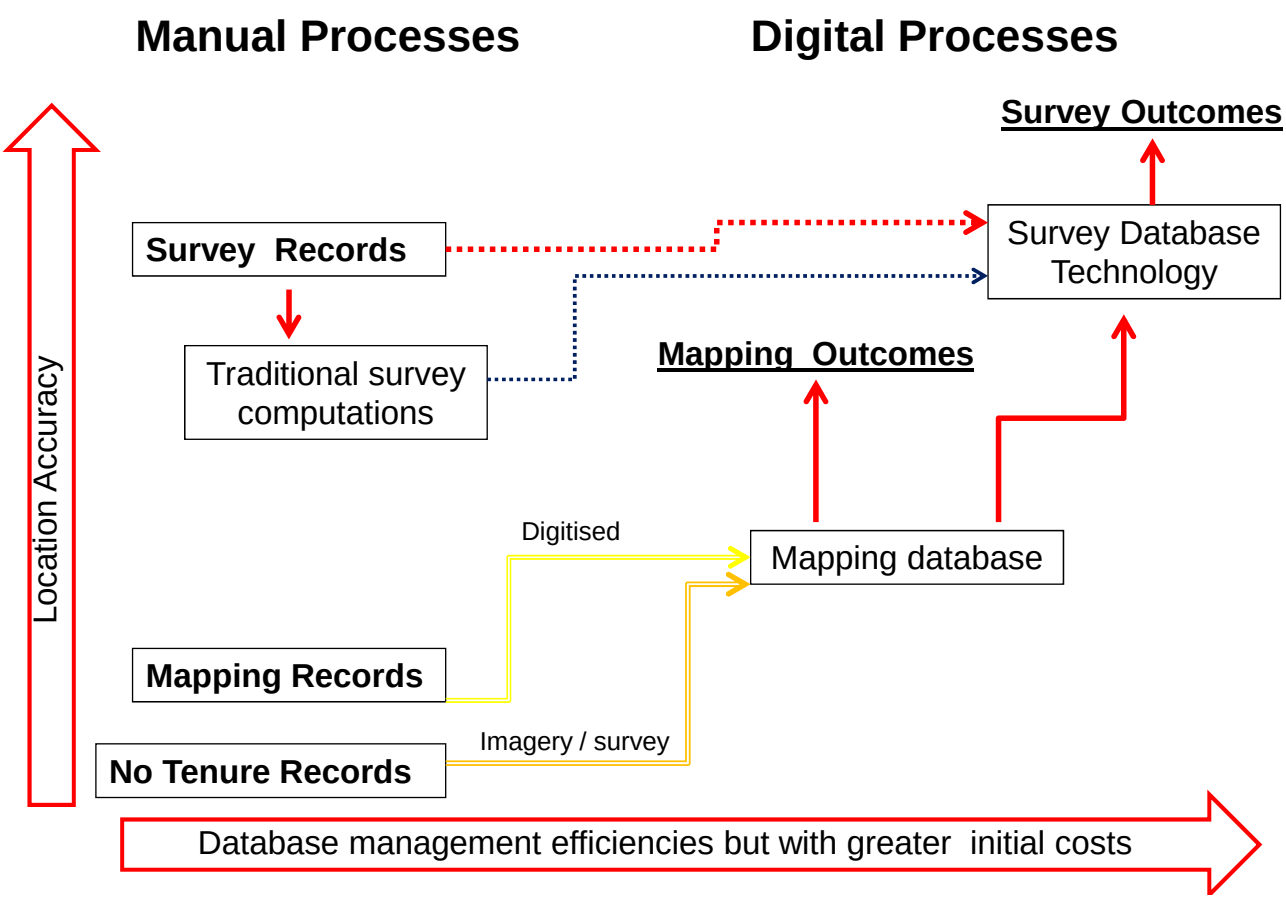
Which Survey Database option to use?

The Relevance

- Cost
- The nature and quality of the survey data
- The desired spatial outcome

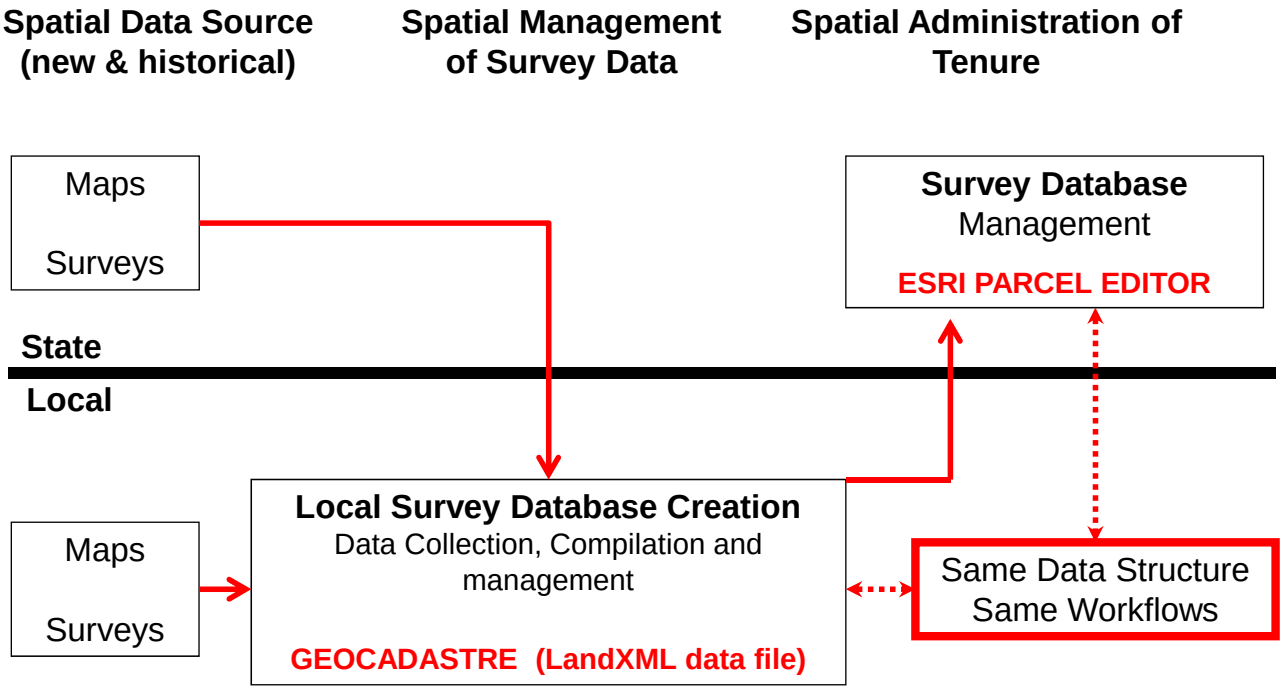
In generating large survey databases both options should be considered for different areas to provide the optimum outcomes.

The Technology Transitions – Mapping to Survey



Business Model For the Survey Database Transition

Linking Local Resources with State Digital Infrastructure.



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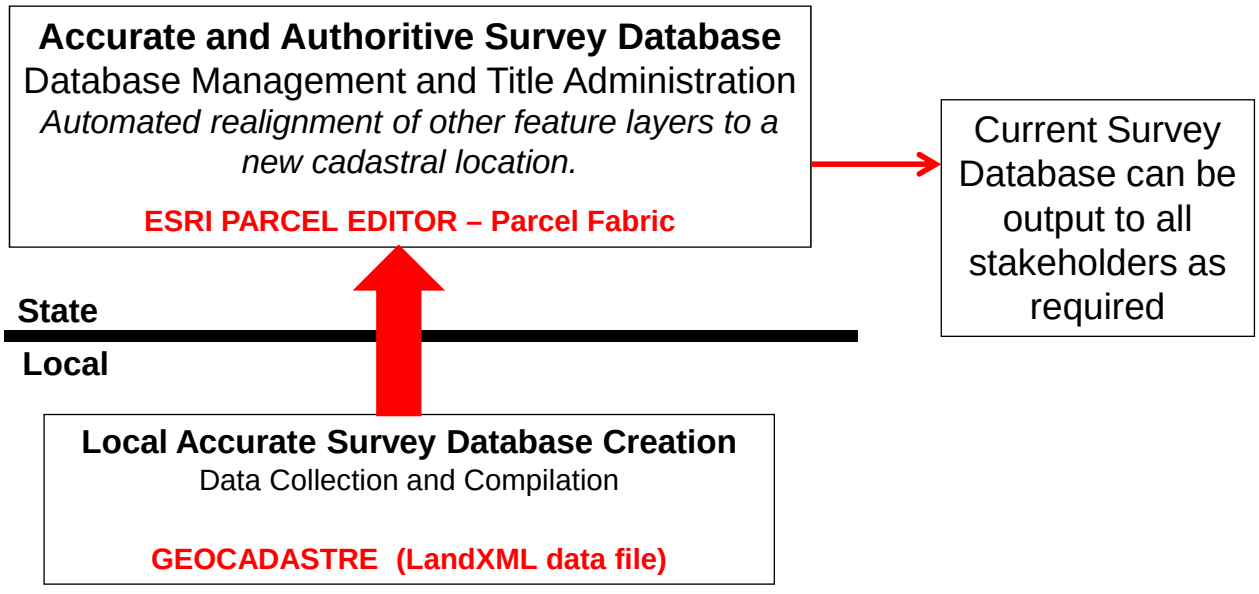


COTS survey database solution with the same data structure and workflows at a local level that is scalable to a State Administration level.

Systems For the Future

LOCAL SURVEY DATABASE SOLUTION – OUTCOMES

Stand-alone software solution capable of being used in the field or remote locations.

Local authorities or resources (surveyors) generating the intelligent survey outcomes that feed into an **ACCURATE** and **AUTHORITATIVE** state cadastral model.

In developing countries local resources can be trained in basic survey techniques to generate a local database, providing employment and engagement in their property administration.

Systems For the Future

THE SURVEY DATABASE SOLUTION

The GeoCadastre (GC) local solution is used in Australia by many local government and utilities to manage their local cadastral survey databases for over 15 years.

The Survey Database/Parcel Fabric solution at a State level is available as Parcel Editor around the world in the ESRI ArcGIS enterprise system.

Northern Territory, New South Wales and TASMANIA also use the GC process as a data entry and compilation tool to feed historical survey plan data into their Spatial Data Infrastructure.

Systems For the Future

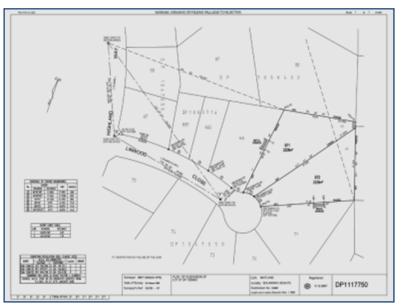
e-GOVERNMENT FACILITATION

In NSW the SD technology is being utilised as part of the ePlan automation of the lodgement and examination of LandXML survey plan files creating new titles, introducing recognisable e-government efficiencies.

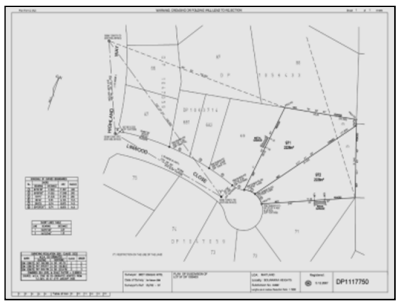
Under optimum conditions a new title survey can be lodged, examined and registered in several days rather than 1-3 months under existing manual methods.

Survey Plan Transition

Paper Plan → Tiff file → LandXML



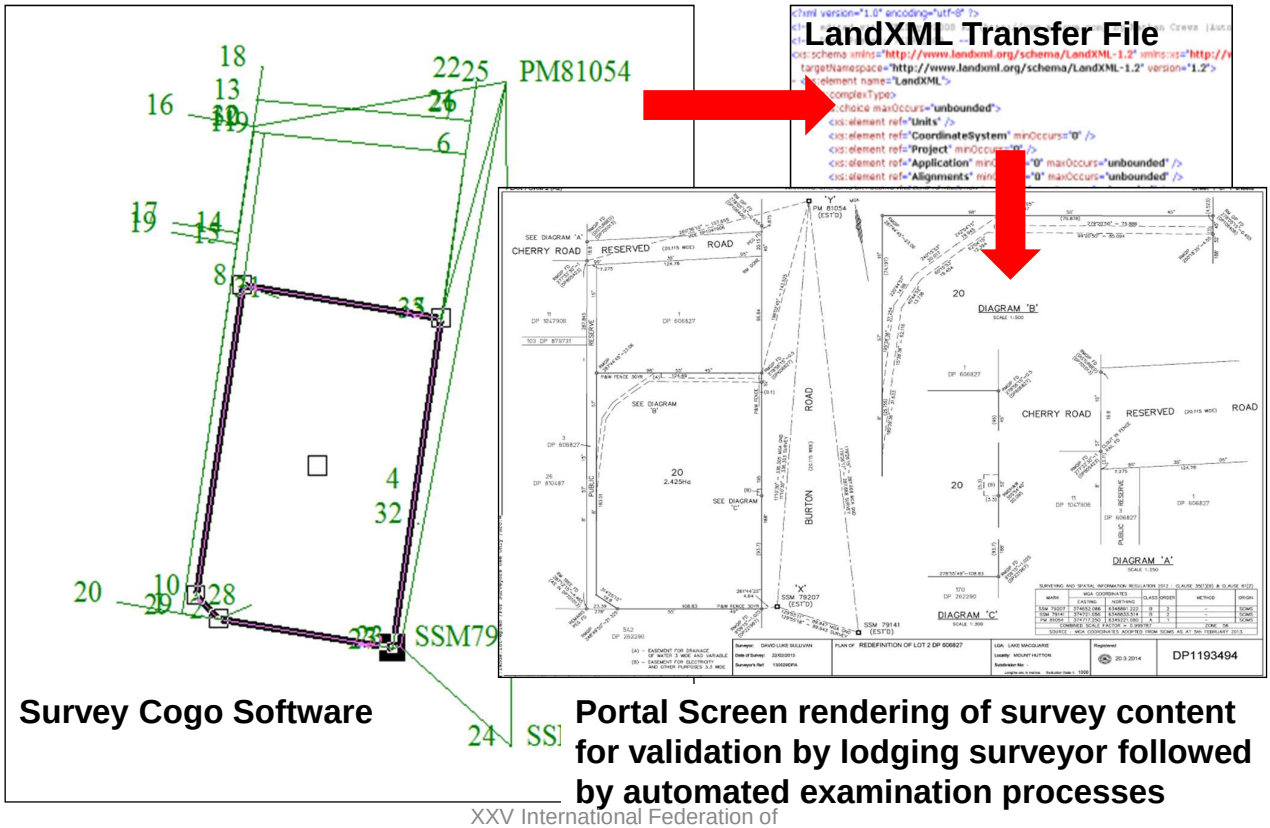
Hard Copy



Digital Image

Intelligent Digital Data Transfer File

NSW ePlan Workflows



Survey Cogo Software

Portal Screen rendering of survey content for validation by lodging surveyor followed by automated examination processes

NSW ePlan Workflows

When the LandXML file is lodged the results of over 40 tests of survey and jurisdictional requirements are immediately reported back to the lodging surveyor.

Once all tests are approved the survey undergoes further spatial examination.

For further details contact:
Chris Wilcox – NSW LPI ePlan Project – Sydney
Chris.wilcox@lpi.nsw.gov.au

Systems For the Future

Historical workflows and Systems were developed for old technology.

Consideration should be given to changes in those workflows and systems rather than develop new tools to manage old systems.

Ensure that a stakeholders with a conservative approach to change do not affect the transition.

Systems For the Future

The Challenge

- Accuracy

The Relevance

- Cost - can be amortised by increased efficiencies
- Implementation strategies - Governance
- A high level of detail required across a significant dataset

Systems For the Future

The Challenge

- The perception and an expectation outside the survey profession that technology will provide all the answers.

The Relevance

- The complexity of boundary definition based on historical records of varied quality is not understood.
- Higher level measurement and data management tools are available to all.

Systems For the Future

The Challenge

- The Role of Surveyors

The Relevance

- An Accurate and Authoritive SURVEY DATABASE will depend on surveyors for :
  - Creation
  - Management
  - Governance
- Addressing current/future challenges
  - 3D cadastre
  - Dynamic Datums

SURVEY DATABASE PROJECTS – Urban/Rural Fringe

Model required for road infrastructure Project.

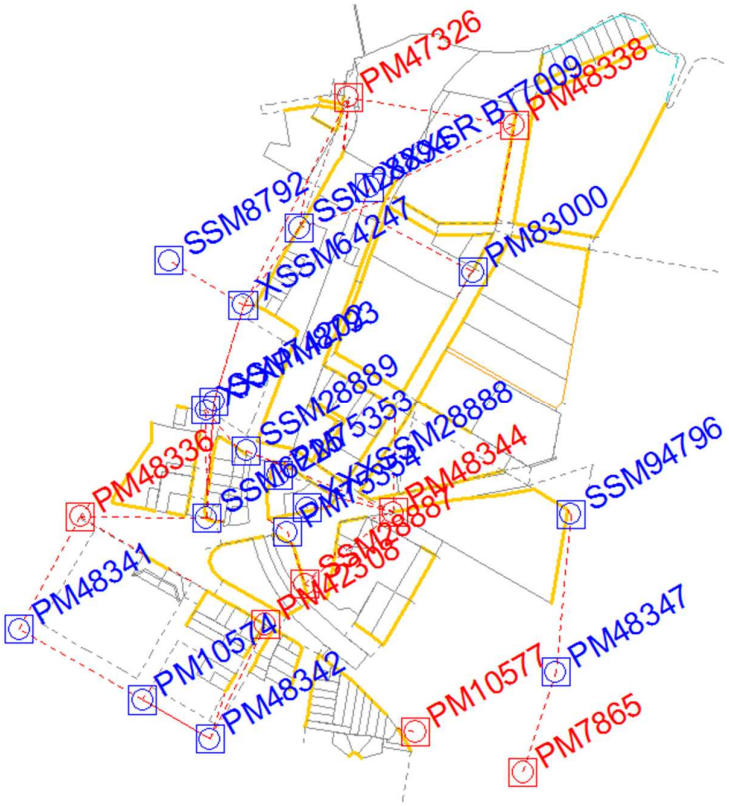
SURVEY DATABASE PROJECTS – Urban Rural Fringe

- 80 Plans
- 131 Parcels
- 27 Control Pts

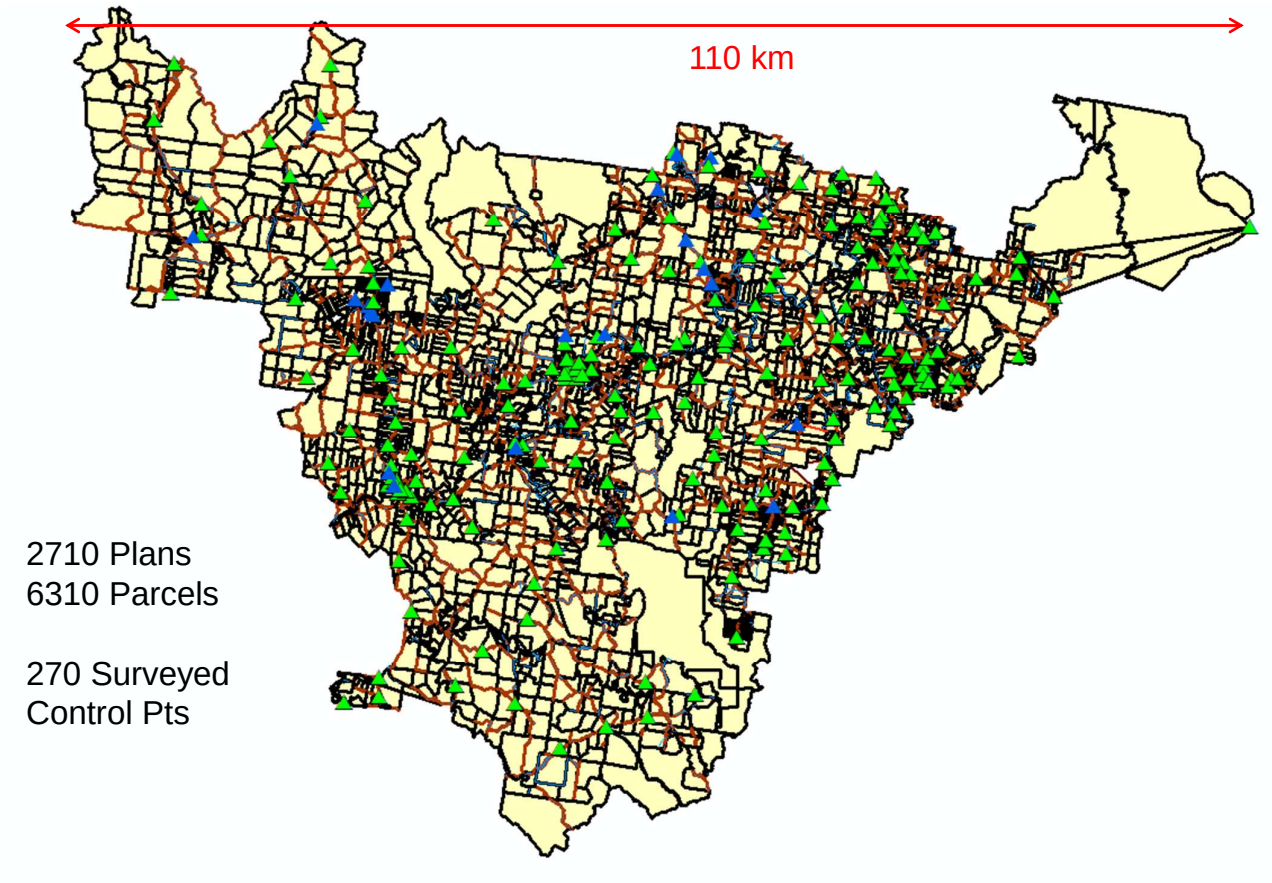
Control shown is identified on existing survey plans so limited extra field work was needed

Precision:

- Urban - 50mm
- Rural - 100 – 300 mm



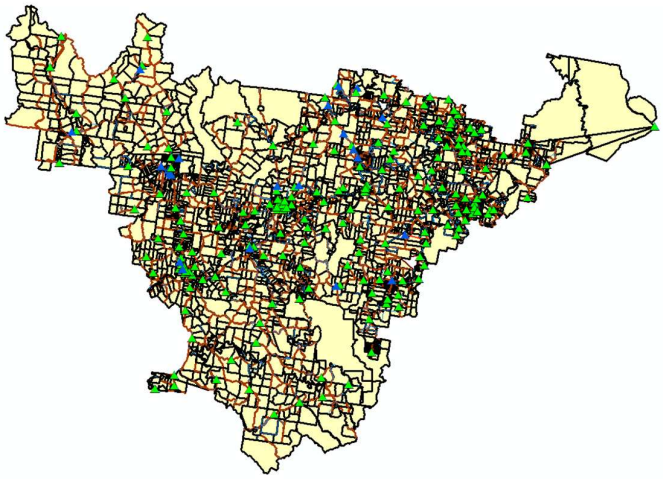
SURVEY DATABASE PROJECTS – Remote Rural



SURVEY DATABASE PROJECTS – Remote Rural

ISSUES

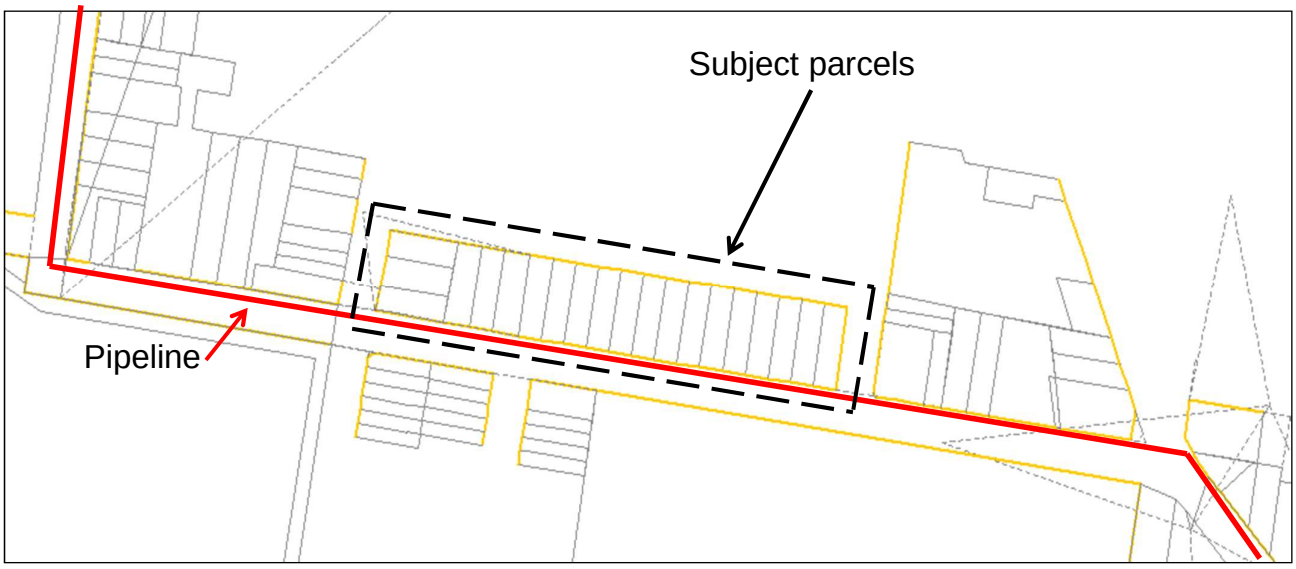
- Rugged area
- Many old & inaccurate survey plans
- Poor survey connectivity across creeks & roads



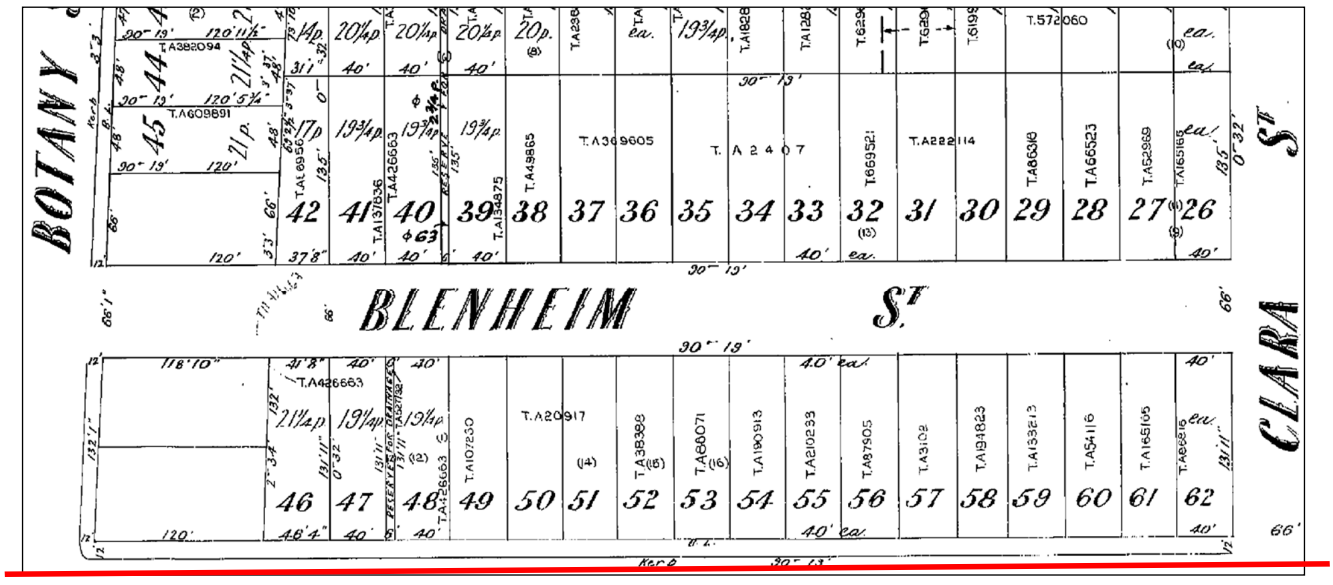
OUTCOMES

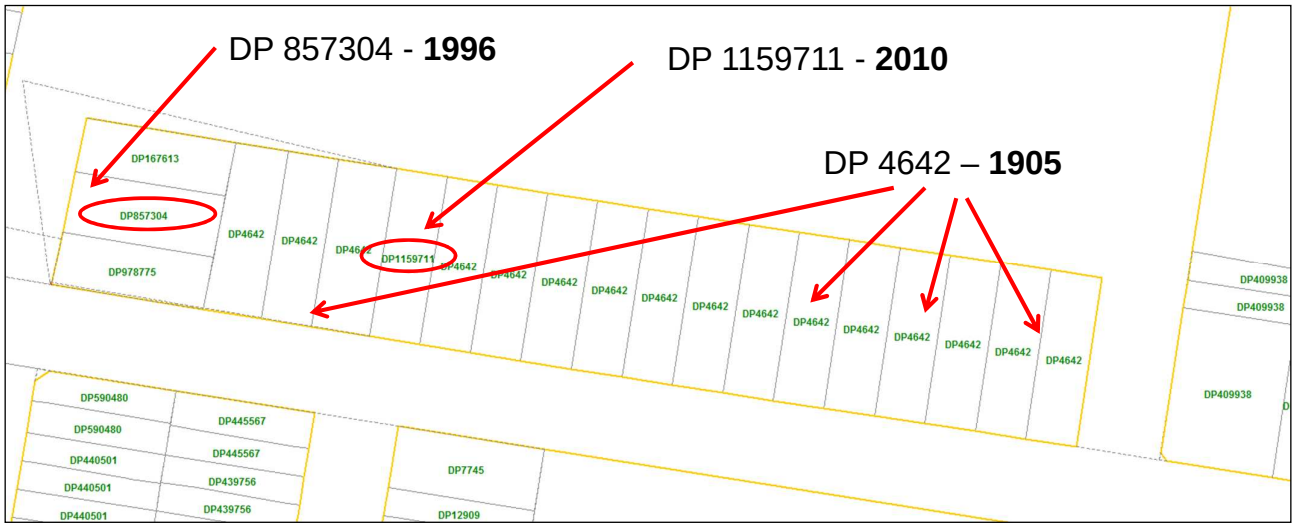
- Not cost effective to do plan data entry other than within urban/village areas or new survey plans
- Considerable survey control required to overcome survey plan data shortfall

Urban Infrastructure
High Accuracy Cadastral Modelling



DP 4642 - 1905




DP 857304 - **1996**
DP 1159711 - **2010**
DP 4642 – **1905**
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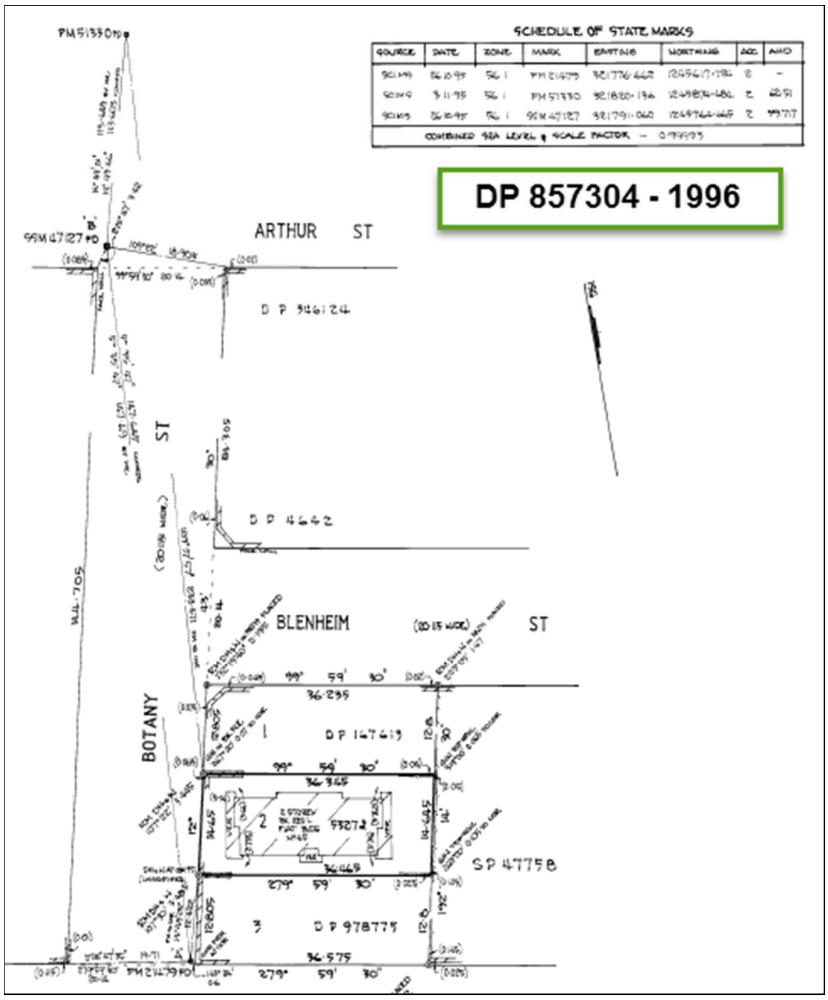
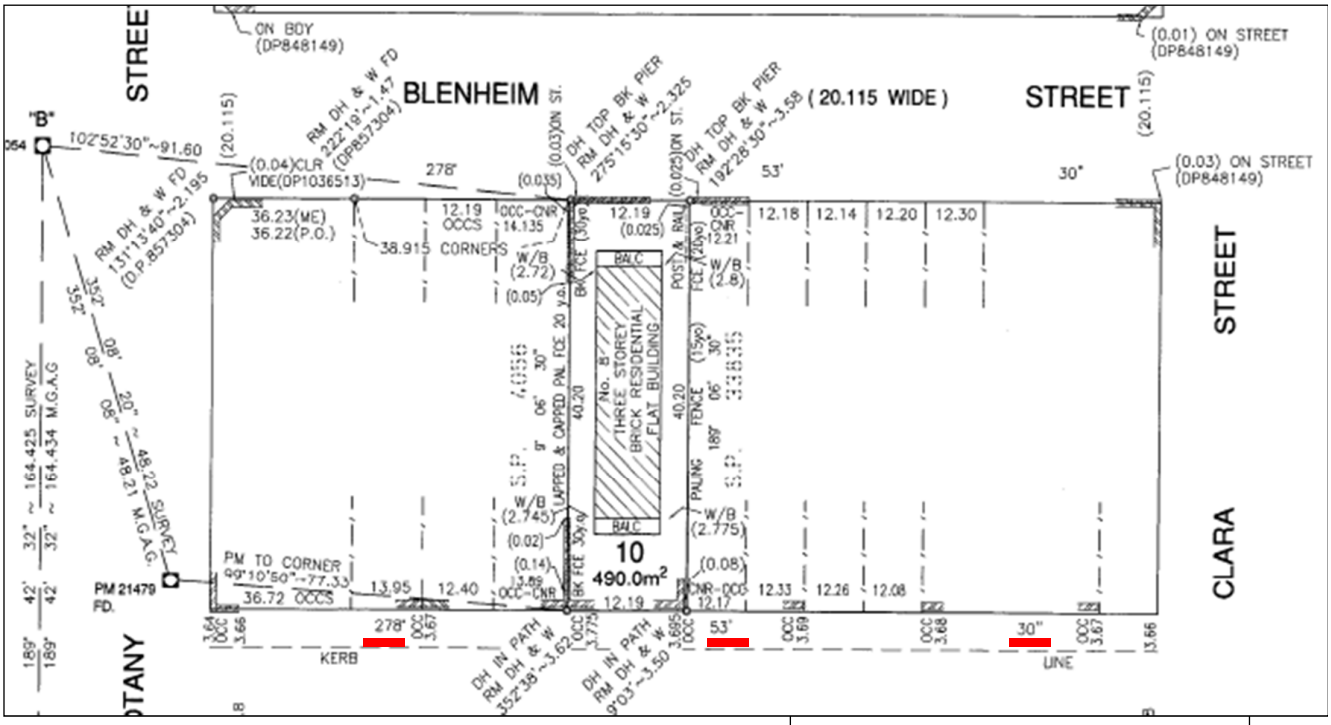
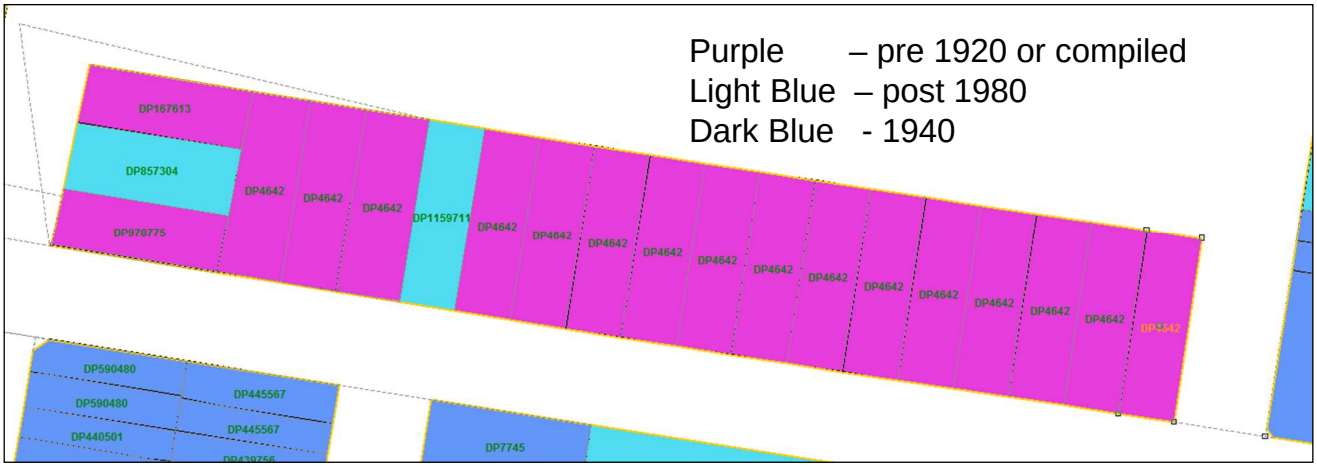
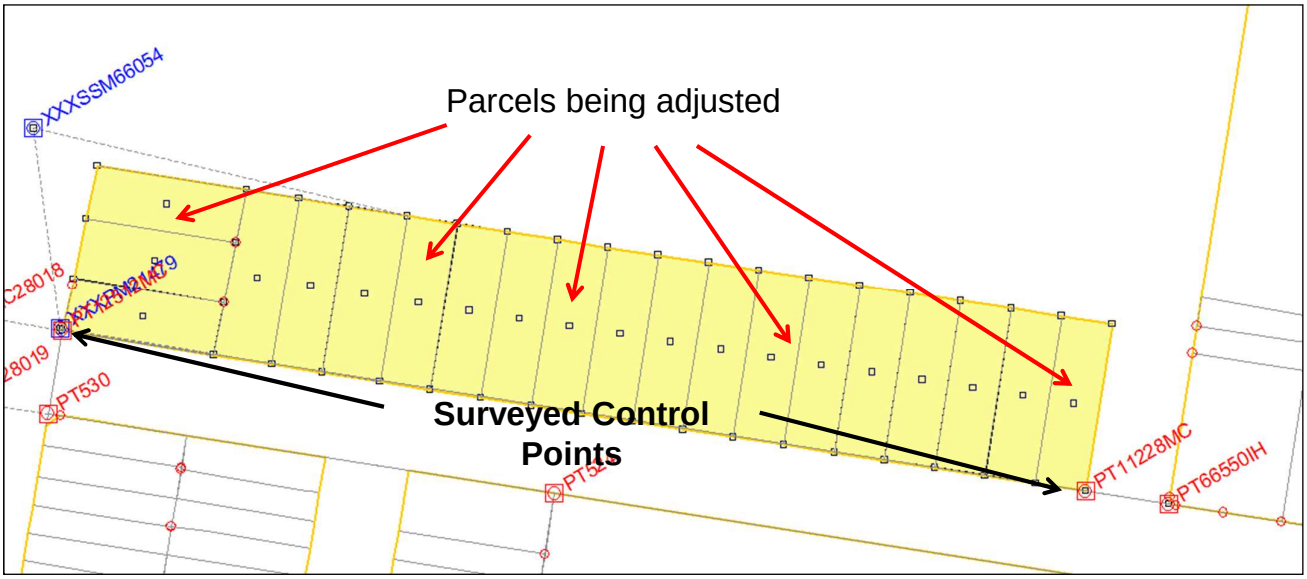

SCHEDULE OF STATE MARKS
DP 857304 - 1996
ARTHUR ST
BLENHEIM ST
BOTANY
D P 4642
D P 147619
D P 978775
SP 47758

DP 1159711 - 2010

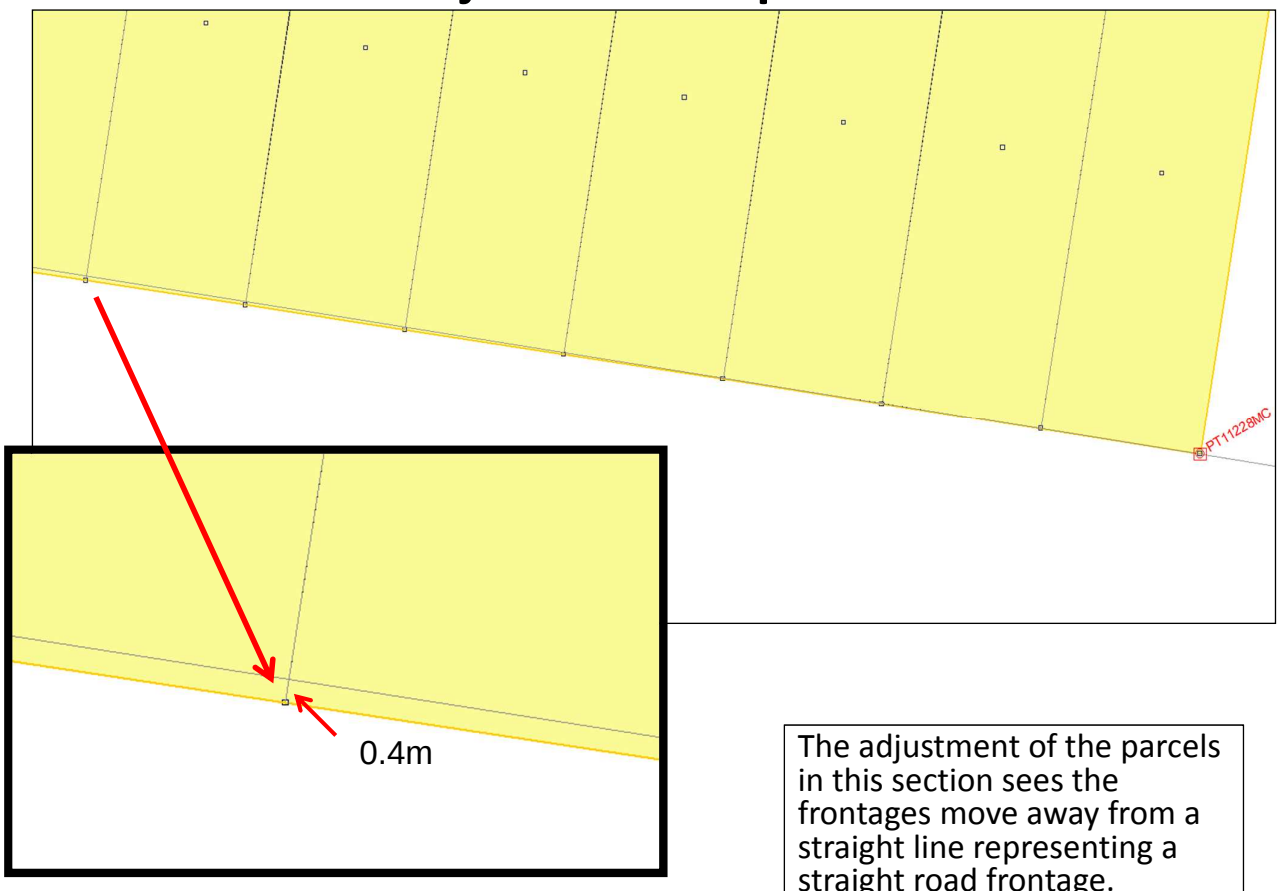


Parcel weighting by colour.



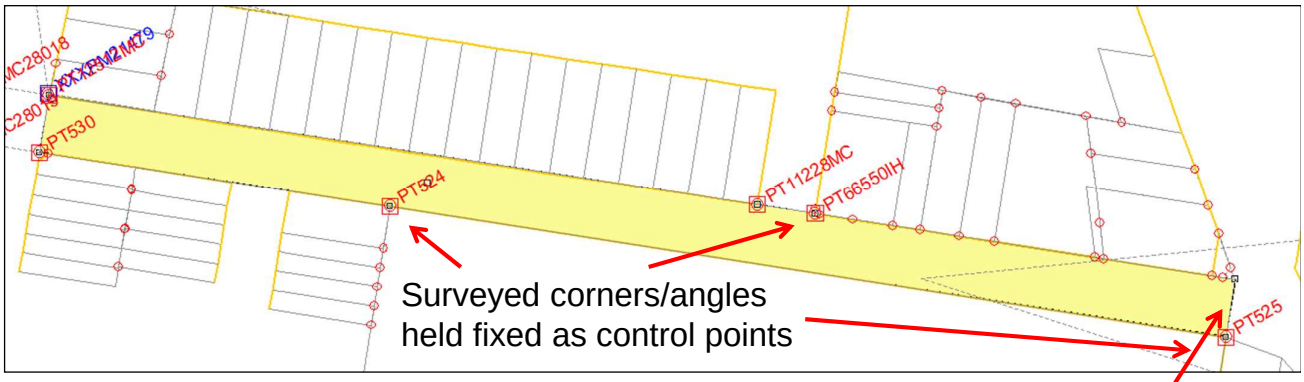


Adjustment of parcels

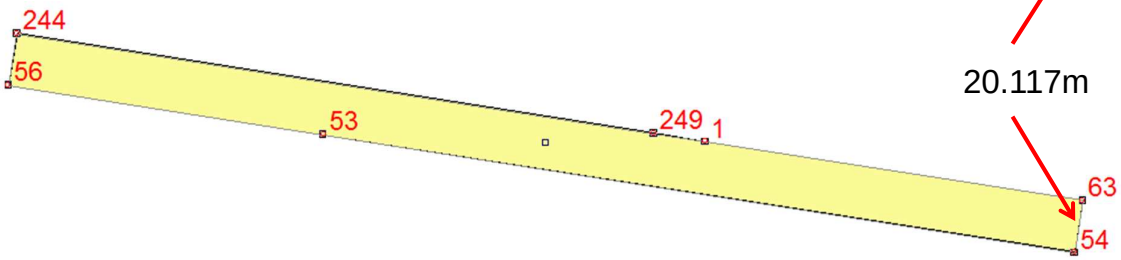


The adjustment of the parcels in this section sees the frontages move away from a straight line representing a straight road frontage.

As cadastral/survey databases seek higher levels of accuracy, survey issues must become constraints in the adjustment. In this case, consideration is needed of either survey monuments or road widths.

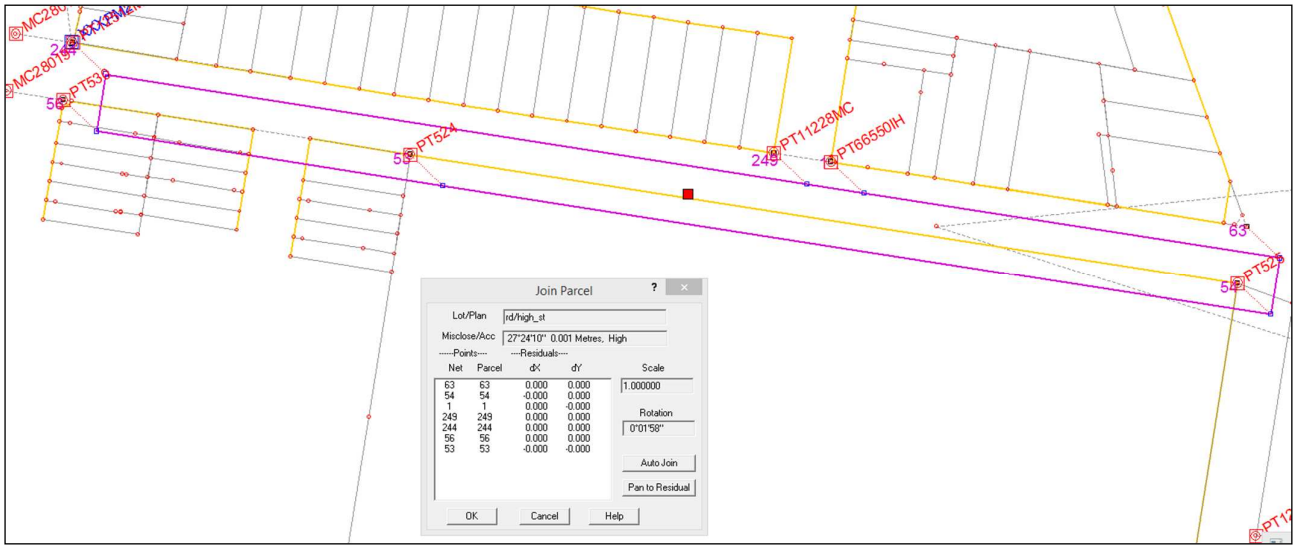


A ‘road’ parcel with the highest weighting is generated that reflects the relationship between surveyed control points to hold the road alignment fixed

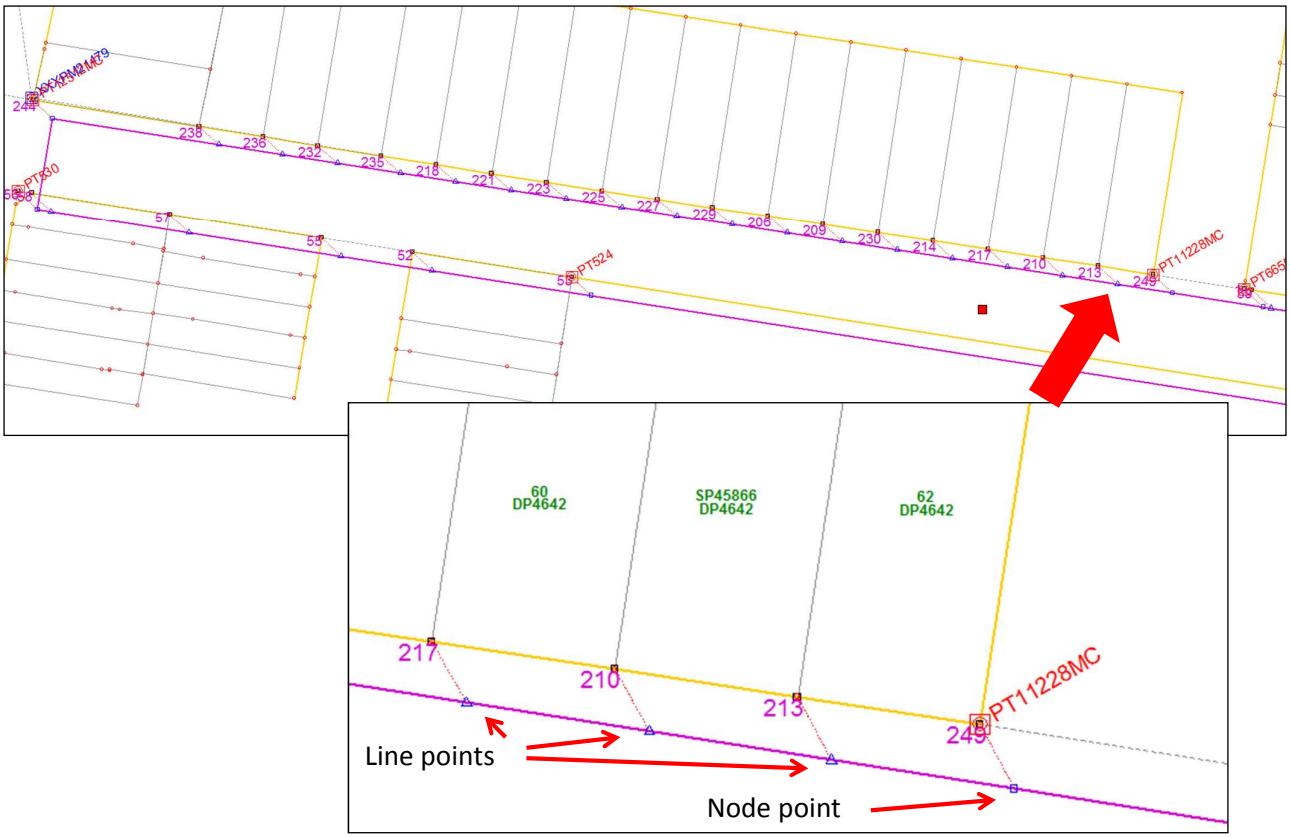


Joining ‘road’ parcel to model

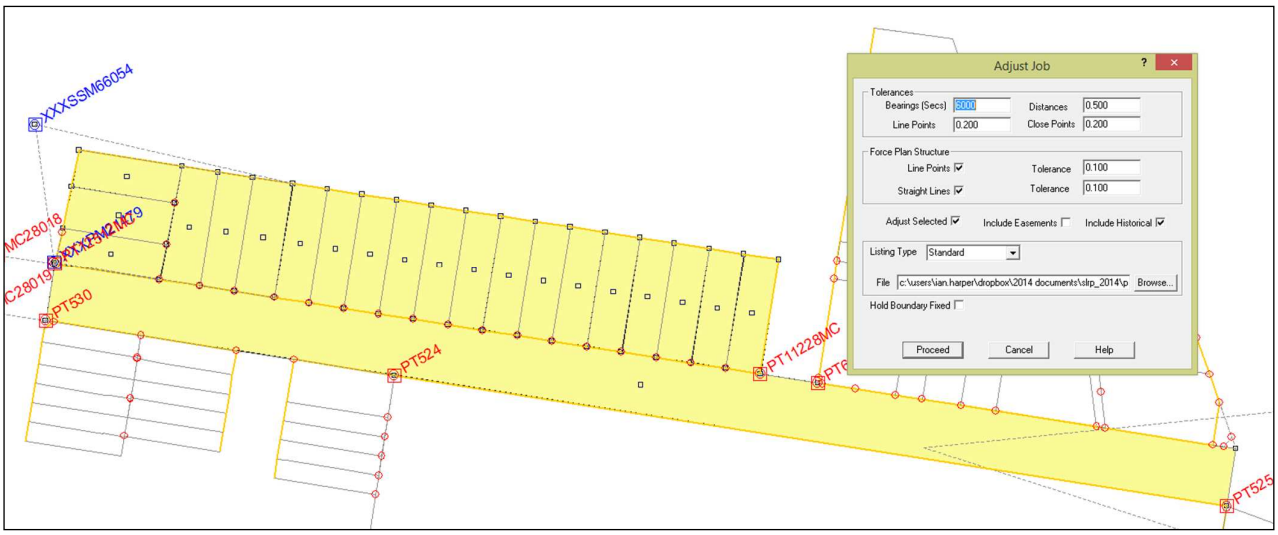
Connecting nodes/corners/angles



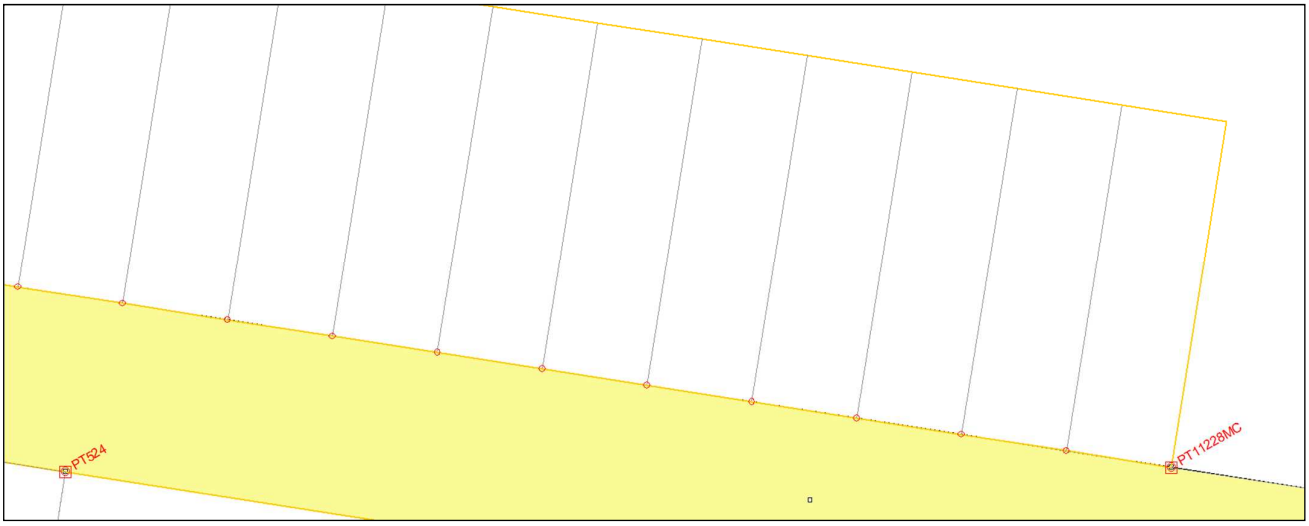
To maintain points on a straight line they are connected as ‘line Points’



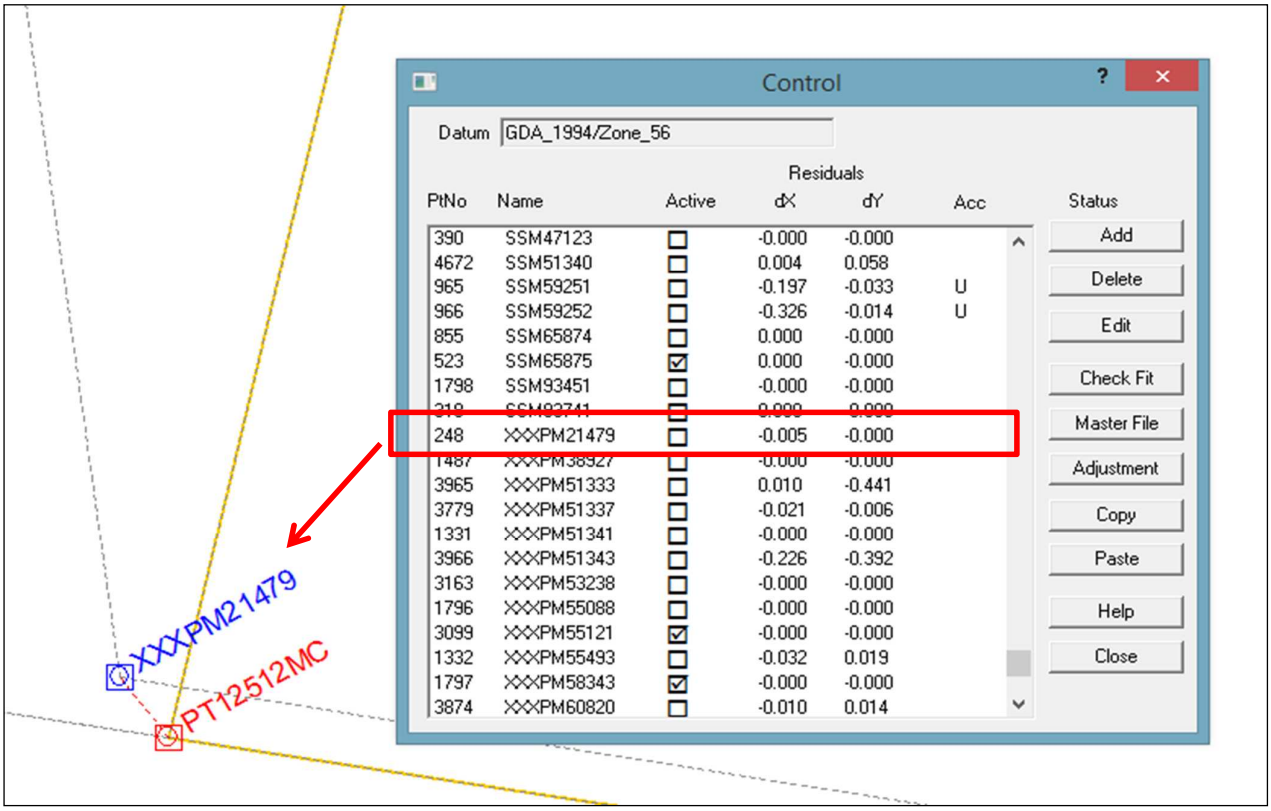
The parcels are adjusted with the ‘road’ parcel



Line Points are held to the ‘road’ parcel boundary line to maintain the ‘co-linear survey intent.



Check on Control Point not held fixed in adjustment – provides an independent check on the survey database.



Systems For the Future

The Challenge

- The Role of Surveyors

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THANK YOU

Ian HARPER – GEODATA AUSTRALIA

harper@geodata.com.au

Acknowledgements

Chris Wilcox – NSW LPI ePlan Project – Sydney

Chris.wilcox@lpi.nsw.gov.au