New Zealand Land Tenure Beyond 2000: Full Integration and Automation of the New Zealand Survey and Title Systems

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Abstract

Land Information New Zealand has been charged with the development of a strategy for the integrated automation of the survey and title systems. This is a new programme with new management structure and new objectives. The preliminary phase to determine user requirements has been granted funding approval by Cabinet. Following completion of this phase, approval for the rest of the programme will be sought.

This paper explores the principles, impacts and opportunities of this new integrated system from a survey perspective. The automation strategy will involve a redesign of systems and processes to allow the full benefits of automation to be realised.

A fundamental principle of this concept is that the survey and title transactions will merge into a single digital land transaction. This will enable surveyors and solicitors to develop new relationships for creating and submitting transactions in land.

The impact of an integrated land tenure system on the existing survey and title systems is one of complete process automation with the implied digital conversion of "physical records". This digital conversion would not simply be a change of format from paper to static digital records such as scanned plans (although it may include this for historical records). It would also involve creation of live and intelligent digital records that play an active role in automated processes.

This automation strategy will not only retain the principles of the survey and title systems, but will extend them and completely alter the way in which they operate. It will also enable Land Information New Zealand to meet its vision of providing world class land and seabed information services.

Introduction

Background

Prior to the restructuring of the former Department of Survey and Land Information (DoSLI), Survey System management embarked on a programme of change for the current survey system. The primary drivers were to:

- reduce costs;
- improve efficiencies;
- meet changing requirements of the National Spatial Reference System; and to
- ensure that the survey system could take full advantage of developing technology capabilities (which in turn dictate new user requirements).

Analysis confirmed that the current survey system is reaching its limit of cost-effective improvement and would not be able to meet the envisaged needs of the users of the 21st century and beyond.

The restructuring of DoSLI, and the subsequent creation of Land Information New Zealand resulted in this programme being reassessed in terms of the new Department's vision and business drivers.

The New Department - Land Information New Zealand

The restructuring and refocusing of the former DoSLI as Land Information New Zealand was designed to ensure the effective and efficient delivery of public good land - related services in order to maintain and accelerate New Zealand's economic growth. The Chief Executive and staff identified the following business drivers for the new Department (Land Information NZ, 1996a):

- focus on core business functions of maintenance and provision of core data, processes and information
- improve Department efficiency and effectiveness
- fully integrate the former Land Titles Office and DoSLI functions
- contract non-core functions
- provide a platform for 3rd party services

Government Outcomes - Survey and Titles Responsibilities

The principle functions which must be undertaken by the Survey and Tiles systems to meet the Government's requirements are set out in Figure 1.

This illustrates that, in addition to specific Crown Related services, Land Information New Zealand's principle function is the management of core land information.

SURVEY AND TITLE AUTOMATION

In order to meet the Department's business drivers and Government outcomes concerning the management of land information, a Survey and Title Automation Strategy project was commissioned. (LINZ, 1996a)

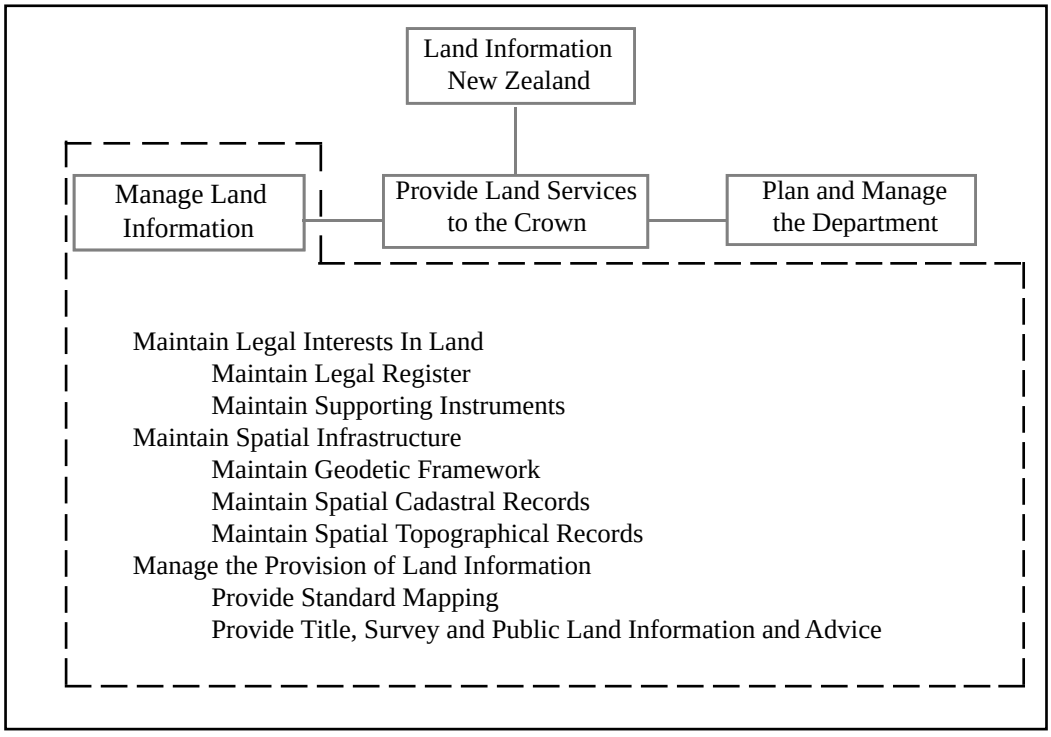


Figure 1 Land Information NZ Business Functions

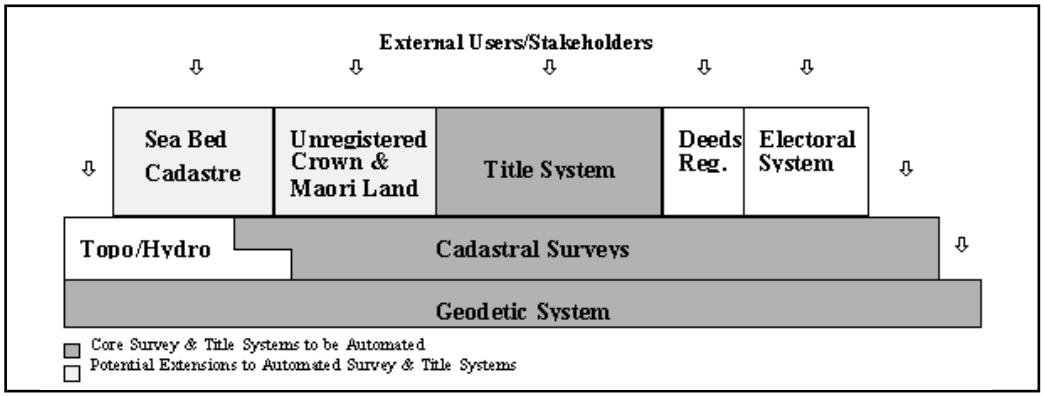


Figure 2 Core components of the proposed Automated Survey & Title Systems and users / stakeholders interests

Automation Systems Strategic Vision

The vision is of a fully digital information systems environment within the Department which is closely integrated with external users of land information. The vision recognises that information is a key strategic resource for the Department and therefore the exploitation of the capabilities of technology and the adoption of 'best practice' in information management are pivotal to the success of the new Department meeting its business objectives.

The diagram shown in Figure 2 represents a high level view of the Survey and Title Automation building blocks and the relationships to other LINZ businesses as well as users/ stakeholders.

Strategy - Phase One

This stage consists of projects which will review current legislation, define the records which will be core to the Survey & Title Automation Programme, obtain users requirements of the geodetic, cadastral survey and title systems and proceed with initial data and process analysis.

The two objectives of this stage are:

- Obtain sufficient information to present a comprehensive business case to government for approval of stage two funding.
- Identify and specify the business needs, based on user requirements, in order to provide the main input for the subsequent design and build projects.

Design Core Land Record Project

This project has been completed and the following Entity Relationship Model (also known as a Data Model) illustrates the major business entities and their relationships to one another. It is a conceptual definition of the target Survey and Title Core Land Record.

Key Points of the Core Land Record Model:

The Core Land record model:

- supports the vision of an integrated Survey and Title record through a single data model
- supports the transition period from a paper-based to digital system
- the conversion of paper records to "intelligent" records is the key enabler for process re-design
- includes the automation and redefinition of the business rules/processes which will realise the primary benefits
- provides for the survey plan and title to be seen as views of the digital data set.

Strategy - Phase Two

On funding approval the design and build projects of the Core Record Information Management System (CRiMs) and Geodetic Management System (GMS) will commence. In addition, the projects which are required for data conversion will be defined and implemented. It is envisaged, that this will include scanning, conversion, reformatting and back capture of all the required data from paper and existing digital records.

Impact from a survey perspective

The building blocks defined in Figure 2 indicate that the Survey System will have a significant and active role in the management of the Department's Core Land Record, as well as providing a spatial infrastructure for its other users. The following sections discuss the principles and, user requirements, impacts and opportunities of a New Zealand's Geodetic survey system.

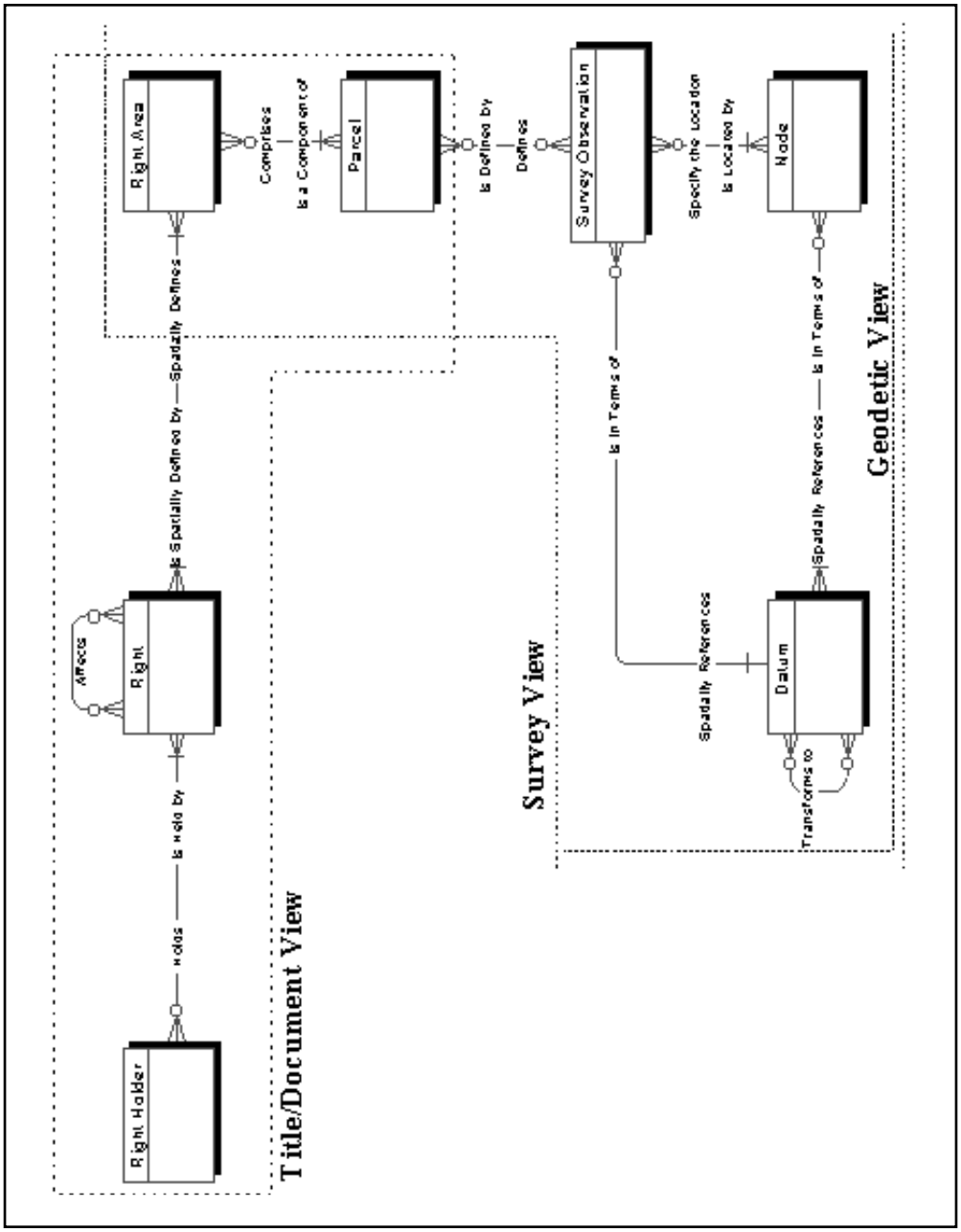


Figure 3 Entity Relationship Conceptual Data Model (Land Information NZ, 1996b)

Automated Core Record Information Management system

Fundamental Principles

With the proposed automation of Land Information NZ's Survey and Title business one of the basic principles that will not be compromised is the Department's primary role of protecting the land tenure system and the "state guarantee of title". Also any changes to the management of cadastral data should not diminish the integrity of the data that the Department holds.

Accuracy Standards

The proposed Survey Regulations (1997) have been prepared to be "output oriented" rather than "prescriptive" and process driven. However there are accuracy, and monumentation standards in the Regulations that the cadastral surveyor is required to comply with before a survey dataset is accepted for integration into the Department's authoritative spatial record. The proposed new Survey Regulations and accreditation of surveyors to undertake cadastral surveys in NZ will make surveyors more accountable for the quality of the data submitted and Land Information NZ will focus more on maintaining the integrity of the survey system. Land Information NZ will seek to be responsive to the "intent" and quality of the data lodged rather than its "legal form".

The professional surveyor's prime responsibilities will be to ensure that the survey accuracy, survey definition, and record completeness of data lodged meet the required standards and the Department will be responsible for the accuracy standards, the integration of survey datasets into its spatial record, and for the integrity of those records.

Random and routine audit procedures comprising field survey inspections and office data examination will be undertaken by Land Information NZ to verify that compliance with the accuracy standards has been achieved by the surveyor and to support the proposed accreditation system.

Survey Accurate Coordinate Cadastre

The fundamental building block for the survey component of an automated cadastral Core Record Information Management System is a coordinate network that will allow efficient electronic validation of new survey data. Crucial to this validation process is a requirement that there be a national geodetic control framework in place to underpin the integration of all cadastral survey data into a single database. The accuracy of any set of coordinates can only be as good as the coordinate system that they are derived from so in an efficient automated environment cadastral survey datasets need to have their coordinates derived from the geodetic system.

A clarification needs to be made here that a survey accurate coordinate cadastre does not give the coordinate any legal significance, or status, and the hierarchy of evidence of the physical "monument in the ground" still takes precedence over its coodinated value. The coordinate will not constitute cadastral evidence in its own right.

The coordinates provide a summary of survey data that will enable existing survey marks to be more easily found and verified. In conjunction with other survey evidence the coordinates may allow for boundary monuments to be reinstated. However, the historical survey data still remains the core evidence of establishing, and verifying, boundary location. It is not necessary, or desirable, for the role of the boundary monument to be changed by automation.

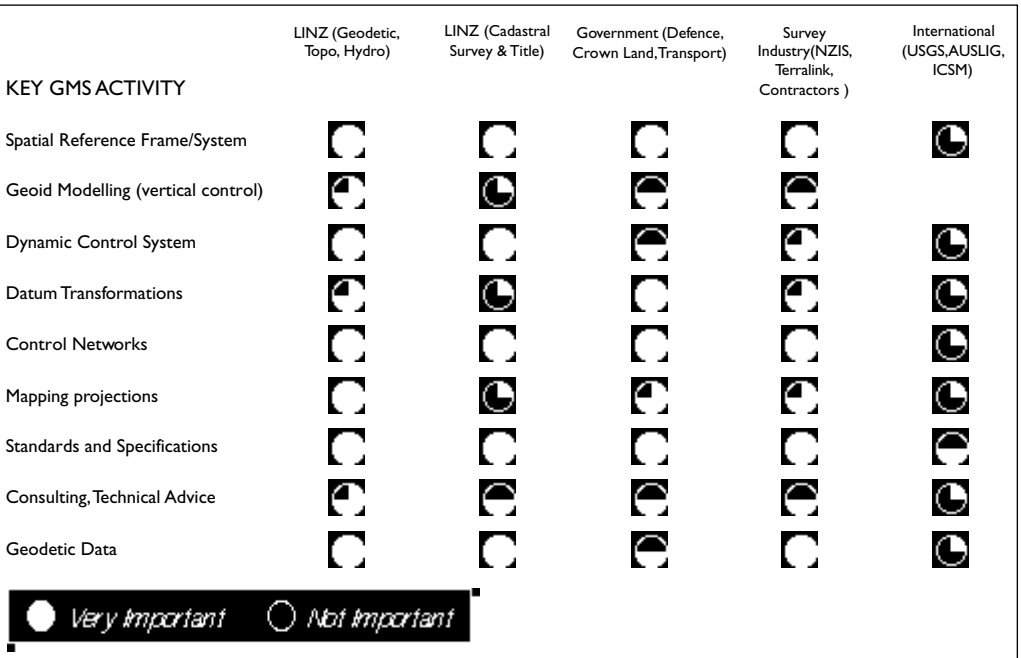
This supports the principle that in the case of a disagreement with the Core Record Information Management System (being a representation or summary of the survey data), the historical survey data, presently in the form of approved plans , or in the future - digital transactions, will remain the core evidence of boundary location.

Geodetic Management System

User Requirements

The following preliminary conclusions have been drawn from discussions with users of the Land Information NZ geodetic System:

- Many users require a GPS compatible geodetic datum.
- Spatial accuracy requirements are often higher than



Note: Regional/Local Authorities, GIS users, Engineers and the Academic profession are still to be approached for their input.

Figure 4 User Requirements Summary

currently provided by New Zealand Geodetic Datum 1949.

- Although horizontal positioning is the main requirement of the geodetic system, there is a continuing requirement for orthometric heights and an increasing need for three dimensional positioning incorporating ellipsoidal heights.
- Reduced geodetic observations will need to be held on-line to allow:

efficient validation and integration of new geodetic data

generation of up-to-date and accurate coordinates on request

maintenance and application of velocity models.

Figure 4 is a high level summary of the feedback obtained.

New Zealand Geodetic Datum 2000

Grant (1995) outlines some of the options for defining a new geodetic datum which can maintain accuracy in the presence of continuous and pervasive earth deformation. The proposed "dynamic" datum will have the following design features:

- Dynamic modelling is necessary for continued automated processing of geodetic data and continued maintenance of coordinate system accuracy.
- As cadastral survey definition is based on boundary marks, the coordinates of these marks, and the supporting geodetic control marks, must necessarily change to reflect earth deformation.
- Maintenance of long range accuracy (made possible by GPS and dynamic modelling) will reduce the need for survey origins to be obtained locally. This, in turn, will facilitate efficient use of GPS base stations for cadastral and other surveys.
- The combination of 3D ellipsoidal coordinates and a geoid model will enable continued maintenance of the vertical control system without expensive conventional levelling.
- It is proposed that the new datum will be implemented

at a national network level (Zero, First & Second Order 2000) by 1 July 1998 and that the reference epoch for coordinates will be 1 January 2000. A national velocity model will enable data to be transformed to and from this reference epoch as required.

New Geodetic 2000 Network

Blick & Linnell (1997) outline the general features of the new geodetic network which will make New Zealand Geodetic Datum 2000 available to support the Survey & Title Automation Programme. Its features include:

- Accessible stations (generally drive-on access).
- A complete connection has been made to New Zealand Geodetic Datum 1949 1st Order marks to enable accurate transformation of historical data to the new datum.
- The horizontal & vertical networks have been integrated through observation of selected benchmarks by GPS.
- The network density for 3rd & 4th Order 2000 stations is primarily driven by cadastral survey requirements.
- The Number of geodetic "Orders" in the hierarchy may be reduced in the future as GPS cost/accuracy equation becomes less dependent on distance.

Conclusions

The Land Information NZ Survey & Title Automation Programme is currently at the stage of system analysis and definition of user requirements. The design, build and populate stages will depend on government acceptance of the business case to be presented.

The programme envisages full integration of the geodetic survey, cadastral survey and title systems. A single conceptual data model is being developed for the existing three systems and business process models will be aligned wherever practicable. This will allow Land Information NZ to realise internal cost savings in undertaking its functions and will also deliver significant savings to external users.

The efficient automation of survey data (geodetic or cadastral) will depend on provision of an accurate and accessible coordinate system. In particular, automation of cadastral survey data and processes will be increasingly reliant on an accurate geodetic infrastructure as it this system which enables the efficient association and management of digital spatial cadastral data.

Efficient automation of geodetic, cadastral survey title processes will also require intelligent data (digital data containing attributes which enable automated "business rules" to be applied). It is envisaged that intelligent records will be generated by back-capture of historical paper or digital records and, ultimately, digital lodgement of geodetic, cadastral survey and title transactions.

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Land Information NZ (1996d) Core Record Information Management System Preliminary User Requirements v1.0