1999 New Zealand Institute of Surveyors & FIG Commission VII Conference & AGM
Bay of Islands, 9-15th October 1999

Cadastre 2014 Reforms in New Zealand

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ABSTRACT

This paper discusses the various reforms impacting on the NZ Cadastral survey system. Recent and proposed initiatives to develop the cadastre to meet growing needs for more effective land processes and land information are identified. These are related and compared to the statements in FIG Commission 7's publication "Cadastral 2014", to access NZ's progress in Cadastral reforms.

1. Introduction

A number of commentators have identified the role of the Cadastre as providing the link between humankind and land. It is the framework by which humankind relates to and identifies with land, and decides its uses, whether in a nomadic or tribal structure, with its apparently informal cadastre, or in the highly structured, documented and accurate cadastre of many developed countries. So as humankind and society changes and develops, so does its interaction with land, with a general trend to greater intensity and complexity, and for greater mobility in land markets and democracy in land use. Accordingly the importance of managing the key interfaces between the physical and human environments is becoming more urgent, with associated growing demands for information about those interactions. These demands are being facilitated, and in turn driven by technological advances. These advances both facilitate analysis of data and in turn demand even more data, and then precipitate more technological advances and dependencies on those technologies.

The operation of a cadastre creates, links and binds information about and to the land (Maseyk 1992) and hence can provide much of the information, and means for managing information, about humankind's interaction with land.

The development or reform of cadastral systems needs to recognise its role as an integrated information system, addressing the totality of land and all its attributes (Dale 1990), as well as a transactional system. Because of the relatively long term

impacts the cadastral system can have on the landscape and land settlement (50 to 100+ years) it also needs to be constructed and managed in a way that it is able to anticipate and respond to trends.

A necessary focus in any cadastral system is the efficient and timely processing of the many transactions made on it. At the same time it needs to be appreciated that these transactions together with the geodetic infrastructure, provide an information system, strongly linked to other resource planning, development and administration functions. These in turn generate more transactions on the system and updates to the database. This focus is evident in New Zealand with quite specific deliverables, of quantity, timeliness, revenue, set out and reported on in annual departmental performance and purchase agreements. At the same time there is a growing appreciation of the wider applications of the information system created and maintained by land transactions.

2. Background

Over the last decade or so, cadastral systems have gained increasing international prominence, resulting from a growing recognition of the infrastructural and enabling role they play in economic and social development and in sustainable resource management. Associated with this have been other wider economic reforms which have challenged the traditional function of systems such as the cadastre and conventional ways of managing these. Any number of seminars and conferences have been devoted to this topic over the last decade, e.g.

1990 National Conference on Cadastral Reform, Melbourne, Australia
1992 International Conference on Cadastral Reform, Melbourne, Australia
1995 New Zealand Australia Cadastral Conference, Wellington, NZ
1996 UN Inter-regional Meeting of Cadastral Experts, Bogor, Indonesia

It is also noteworthy that the UN and World Bank have given considerable priority to the establishment of modern cadastral systems as part of its development programme.

Cadastral system changes in New Zealand in the mid 1980s were characterised by:

- The introduction of computer mapping technology to create a digital cadastral database for both the recording and management of cadastral data, for land administration and for medium and large scale GIS applications.
- The introduction of full cost recovery for provision and maintenance of the cadastral survey system for access to data, and for regulatory processes.
- DOSLI was also charged with maximising revenues and accordingly initiated some value-added services in addition to its core regulatory functions.
- The extensive use of existing cadastral records and new survey activity to effect the massive identification and transfer of Government land assets to State Owned Enterprises (SOEs) or other forms of privatisation, and for the settlement of Maori Land claims. This process is continuing as further Government assets are prepared for sale and land claims are negotiated.
- Major restructuring of longstanding departments of state into more single function focussed departments, and SOEs, resulting (among others) in the Department of Survey and Land Information (DOSLI), established in 1986.

3. Reform Initiatives (1986 - 1996)

In 1994, as the result of an internal restructuring, DOSLI initiated proposals for the development of the Survey System, in partnership with the NZ Institute of Surveyors and the Survey Board of New Zealand. (Robertson 1995)
There had also been similar, separate, investigations into the automation of the LT Registry function. At the same time the pace of wider Government reforms continued unabated, with two major impacts for government cadastral functions.

1. The transfer in 1995 of the Land Transfer Registry to DOSLI, as a consequence of the restructuring of the Department of Justice.
2. A comprehensive report on DOSLI which recommended a fundamental restructuring, to separate out the core regulatory and service delivery functions required to be provided by Government, from those added value services which could be provided commercially in a competitive environment.

Accordingly Land Information New Zealand (LINZ) was set up as a core government department, along with a State Owned Enterprise, Terralink NZ Ltd, in July 1996. The mandate of the new department recognised the significance of the spatial data infrastructure to New Zealand's economy as a strategic asset (Ansell & Collins, 1995), and the importance of continuing government provision of this. However the means of provision were not prescribed, leaving the department to choose the most effective methods of purchasing these services. (Ballard, 1999) A major objective of the new department was also to integrate the survey and title processes and to investigate and report on the automation of the survey and title systems. From the survey perspective this investigation built on the work already being done to develop the survey system, with the added feature of integration of systems with the title processes, and with a clearer identification of what were the core regulatory functions to be assessed for automation.

4. Recent Strategic Drivers

The major strategic drivers or initiatives emerging and impacting on the cadastral survey system in New Zealand can be summarised as:

- Government identification of a number of Strategic Result Areas, setting a broad and longer term framework for Government policy that will:
  - encourage business to develop capacity.
  - maintain and enhance competitiveness.
  - promote the efficient use of resources and protect the environment.
  - encourage a knowledge-based economy and technical skills

- Government privatisation or outsourcing of many of its functions, and concentrating on the retention of "core" Government or public interest functions. In New Zealand, surveying is already substantially privatised by virtue of a strong private survey sector undertaking all cadastral work for individual land owners or developers and for various government agencies, and more recently, Government's core geodetic and mapping work under contract. As well, much of the added value work arising from the widespread use by other sectors of the survey system and associated cadastral databases has been privatised.

- Occupational deregulation, with the principal objective of reducing direct costs to Government and compliance costs to users, whilst minimising risk to the public, and maintaining current levels of integrity of the systems.

- Technological development, making many formerly specialist tasks more routine and technology more accessible. It is also facilitating the management and application of digital spatial data.

- Strongly growing community demand for spatial information, for an expanding range of political, social, economic and environmental applications.

- Growing demand by the community, business and Government for improved quality and delivery of products and services, and accountability for performance.

5. Reform Initiatives 1996-1999

As a result of the above drivers a number of reforms were initiated in LINZ:
- Cadastral Surveyor Accreditation
- Occupational Regulatory Framework
- Outsourcing of Geodetic Surveys and Survey Maintenance
- Survey and Title Automation (Land*online*)

5.1 Cadastral Surveyor Accreditation & Audit

In New Zealand cadastral and related survey activity is regulated by the provision of a national survey system and standards, by plan audit and approval, and by the registration of surveyors to carry out surveys. The basic objective is to ensure the efficiency and integrity of the survey system, sound subdivisional procedures, security of tenure and of land boundaries, and reliable cadastral mapping or databases. Hawkey (1977), provides a comprehensive description of the integrated nature of the New Zealand survey system.

The Cadastral Surveyor Accreditation and Audit System is a process designed to provide the Government with assurance as to the quality of the data submitted into the system, by focussing on QA and audit rather than on mass manual checking of selected details. Once implemented the Automated system (Land*online*) will automate many of these checks as part of the process of input data validation to ensure the database retains its integrity and reliability, particularly for future applications. Accreditation thus becomes a key component of the automated systems currently being built, principally in that an automated system will operate far more efficiently if both the input data and the existing data, and the field work, are of good and consistent quality and durability. The accreditation system can also contribute to occupational regulation by providing a process for regular monitoring of a surveyor's competency and performance.

5.2 Occupational Regulatory Framework

This is part of Government policy to reduce costs by reducing unnecessary entry barriers to occupations. The New Zealand Government has set out a framework for assessing the need for any statutory or other regulatory protection of an occupation, and a process for establishing any such protection. The key point of the framework is that the extent and nature of any regulation of an occupation depends on the nature or extent of the risk or harm that incompetent, reckless or dishonest practice poses to the public. Within this framework there are options for:

- regulation by the market only;
- self regulation;
- varying levels of Government regulation such as licensing registration or name protection.

Clearly the underlying policy drivers are the reduction of cost to consumers by reduced entry controls allowing greater competition, and a reduction of cost and risk to Government in maintaining regulatory and administrative systems. The policy options are currently being developed, but there is some appreciation that the nature of risks to land owners and the public from defective surveys or subdivisions warrants a significant degree of regulation. The issue then becomes how best to effect this.

5.3 Geodetic Strategy and New Datum

The geodetic system provides a country with the basis for managing all geographical or spatial activity, whether local, national or global. Recognising that there were a number of significant drivers for change impacting on the geodetic system, LINZ initiated a strategic review to ensure that it could continue to meet emerging needs efficiently for the foreseeable future. Results of this review have been the development of a Geodetic Strategic Business Plan (LINZ 1998) for the next ten years and the introduction of a geocentric datum, New Zealand Geodetic Datum 2000 (NZGD 2000). Major drivers for the new datum were the need for an accurate and more consistent control framework to convert and automate existing cadastral records, and to provide a framework facilitating the use of new survey technologies, in particular GPS. (Grant, 1995) (Dawidowski & Blick, 1998)

5.4 Survey and Title Automation, or Land*online*

This major initiative of LINZ will have far reaching and very significant impacts and benefits to the survey system. It is designed to bring the partially digital and paper based processes of the current and predecessor departments fully into the electronic age. It builds on a number of earlier initiatives, such as DCDB, Survey System Strategy, LIS and Land Title Link. Its major features of relevance to the survey profession are:

- Integration of the survey and title processes and information, as key components of land development, settlement and resource use activity.

- Establishment of Survey - accurate Digital Cadastral (SDC) areas, where boundary dimensions will be held and made available digitally, and where boundary positions

will be accurately co-ordinated in terms of the new geodetic datum and framework of geodetic control marks.

- Ability to remotely access plan images, SDC coordinates, attribute parcel data and geodetic data.

- Ability to remotely pre-validate new survey data against the official SDC values and current topology.

The key component of the automated system is the land parcel, with links to the spatial and observational data, and to the various tenures, attributes and rights associated with the parcel. The survey system already supports and integrates a variety of tenures and records, such as:

- Fee simple title and other interests registered under the Land Transfer System including strata title.
- Public or other Crown land holdings including reserves, public purposes, roads and leases of Crown Land.
- Individually and multiply owned land held under the Maori Land Court.
- Other interests such as:
  - cultural sites
  - protected area covenants
  - utility easements
  - mining and marine Licences
  - hazardous and contaminated site restrictions
- Crown Land allocations.

Automation has been designed to take these various interests and forms of ownership into account, so as to have the capacity to manage the growing complexity and variety of land interests, rights and restrictions, and potentially to integrate these into a single tenure system. In addition, the existing parcel based DCDB is used by all local government and most major utility companies as a basis for recording their administrative responsibilities, assets and utilities. An important part of the automation design is to appreciate how it fits in with all the other processes and functions involved in land administration, development and settlement, so that it is better able to respond to these needs.

A particular application is the use of the cadastral parcel base, in conjunction with statistical area units (mesh blocks) and street address, to support national census taking and to enable the redistribution and definition of constituency boundaries for national and local government electoral processes. This linkage of spatial address or location data and socio-economic census data has a growing number of applications in public administration and commercial activity.

In summary Land*online* will provide a continuous parcel based cadastral database of the country, containing survey observations fully integrated with the geodetic framework in SDC areas. It will also be linked to Land Transfer and other tenure information, and to street addresses. This will be of considerable benefit to a wide range of users, e.g. GIS, utility and land administrators, who have a need for a digitally available up-to-date and accurate spatial database, with links to street address, parcel appellation and title. The ability for this database to be used to support a wide range of

other large scale mapping, GIS or remote sensing applications is considerable, and likely to expand enormously, creating significant opportunities for commercial added value initiatives.

6. Cadastre 2014

Cadastre 2014 (FIG 1998), developed from extensive international study into cadastral reforms, provides an excellent framework for the analysis of recent reforms in New Zealand, recognising however that these are the result of singular cultural, social and economic drivers, not necessarily applicable to other nations.

6.1 Statement 1

Cadastre 2014 will show the complete legal situation of land, including public rights and restrictions.

Traditionally the cadastre in New Zealand has confined itself to recording ownership or status of land, including reserved or public use areas. The cadastral subdivisional survey process does however require a full knowledge and analysis of all of the public and private rights and restrictions on land as well as physical constraints, features and services. In general public rights or restrictions (apart from access or service easements, height restrictions or convenants) have not been recorded on titles to land, but instead generally by local authorities in their own record systems. Most of these systems make varying use of LINZ cadastral maps or databases to record these rights. These also record some public restrictions, such as flood prone areas, hazardous and contaminated sites and public access over titles.

The Resource Management Act and Building Act require Local Authorities to provide, respectively, a Land Information (LIM), or a Property Information Memorandum (PIM), to any enquirers (for a fee). These memorandums are in effect a report or a dossier of all information the administering authority may have about the land or property being enquired of. There is however no assurance that they are always complete or accurate in all respects.

There seems to be little doubt that, as a result of growing environmental concerns and also commercial efficiencies there will be a requirement to record a variety of public restrictions, or rights to public resources over privately owned land. It is not certain that central government would do this, but at a technical level it is certainly possible to make use of basic data from Land*online*, to ensure a spatially integrated reference system as a basis for managing and integrating such information. This is possibly the next major development for the cadastral system in New Zealand. Robertson (1996) has noted the role of the cadastre as an environmental management tool.

6.2 Statement 2

The separation between ‘maps’ and ‘registers’ will be abolished.

The situation described in Cadastre 2014, of separately administered survey and title

systems, has applied in New Zealand since 1876, when the current survey (Palmer 1875) and Torrens systems were introduced. While these systems were in different government agencies there was close operational alignment between survey and title processes. There are also separate title or recording systems for Maori and Crown Land (although based on a common survey system).

With the bringing together of survey and title into one new organisation (LINZ) in 1996, we had, and took, the opportunity to further integrate or align the existing manual or partly automated processes for survey and land title systems inherited from the respective predecessor agencies. Public land tenure administration is still spread among various government and local government agencies, and Maori land is administered by the Maori Land Court.

Land*online* is designed to achieve a fuller integration of both processes and data flows. It will also require a more integrated organisational structure and a combined skill base for administering the system and for carrying out the various survey and registration tasks. As systems and routine actions are progressively automated total staff numbers will reduce, with a consequential focus on enhancing and broadening technical and analytical skills of remaining staff to handle complex, conflicting or innovative transactions. There will also be a need to provide advice to government and the public, and to manage the information systems.

6.3 Statement 3

The cadastral mapping will be dead. Long live modelling.

The main points to make here are that, with traditional cadastral mapping, the form of the map virtually defines the database. There is a concentration on those data attributes that can be readily depicted on a map. The design characteristics of the cadastral map will be largely static and must attempt to satisfy as many applications as possible. The difficulty with this is that there are many important attributes of a cadastre which are not readily depicted in map form without cluttering, e.g, the changing spatial and legal state of the cadastre with time; the steady accumulation of survey observations which occurs at the same time as a general attrition of survey marks. Also, cadastral data is increasingly being put to a wider range of purposes and one design for the mapping view cannot meet all requirements.

The advantage of cadastral data modelling is that the cadastral map becomes a view of the database – not the database itself. It is one of many ways of accessing the data – a powerful tool but not the only data access mechanism. The structured database can support many types of view including textual reports, hierarchical structures and a variety of spatial views, each of which can be tailored appropriately to a particular application or just to user preference. Those numerical and textual processes which are not map-based can co-exist with the cadastral mapping view and can be based on the same authoritative data.

The survey part of Landonline will be populated with DCDB data but will, from that point on, evolve into a fully structured cadastral survey and title database. External users with access to the modelled data will be able to add their own structured data to the cadastral data. (Grant pers com)

In New Zealand digital conversion of cadastral maps or records sheets (DCDB) was commenced in 1985, and completed in 1996, with the effect that from that point paper cadastral maps were no longer used, and all recording and maintenance was done digitally. Whilst it was a fully modelled database it was designed on the basis of providing a map or spatial view, with the ability to provide paper outputs from the database by simple enquiry. The DCDB is a fully structured and topologically complete database. However it lacks full numerical accuracy or consistency of coordinate values, and thus it currently has only limited application to large scale uses. The DCDB is in effect an intermediate step towards a fully modelled cadastral database.

The spatial database to be built for Land*online* will comprise a conversion of the existing DCDB, together with selected numeric capture (mainly in urban and intensive rural areas) to create a Survey accurate Digital Cadastre (SDC). The underlying premise is that, while individual survey measurements tend to be of good accuracy, some of that accuracy can be lost through inconsistencies in the way surveys are connected, or in the governing control framework.

A significant feature of Land*online* is that the geodetic and cadastral components are managed within one spatial system, although there will be distinct receipt, validation and update processes. Cadastral surveys in SDC areas will be required to connect to the geodetic control, and in this way will be able to contribute directly to the maintenance of the control framework. This process will also maintain accurate and consistent coordination of land parcels, as a basis for large scale urban mapping GIS applications. The new datum and associated survey control network (referred to above) will generally be at densities of 300-500m in urban areas to control the capture of dimensions of plans into the new spatial database and adjustment of that data.

The existing DCDB is already used to spatially manage and define street addressing, statistical, electoral and administrative areas, and the new database will continue this function. The achievement of numerical accuracy and reliable geodetic coordinates in SDC (urban-intensive rural) is of considerable interest to service and utility agencies, who at times have found the spatial inconsistencies of the DCDB at larger scales, to be frustrating. There is considerable and growing interest among the GIS user community in the new data model, particularly with its improved links between parcels and attributes.

6.4 Statement 4

Paper and pencil - cadastre will have gone.

The key issue here is the future role of the plan. Surveyors build structured databases in their survey software. LINZ is building a structured survey database also. During a transitional period, the method of transferring data from the surveyor to the cadastral database will continue to be the traditional method – the survey plan. LINZ will enter the data into the database for subsequent processing and updating. However, as digital lodgement is implemented, probably in 2002, the role of the survey plan as a data transfer format becomes redundant. All we need is a digital format to effect database to database communications (surveyor's software to the automated system). The

survey plan may continue in its other role of providing a **view** of the survey to the surveyor's client, local authorities, etc. However, this role of providing a view of the structured data is much more efficient and flexible if it is separated from the requirements of a transfer format. Thus the survey plan, where it is required at all, changes from being a "paper and pencil" input to the cadastral system to being a digitally generated output of the database.

Recently revised Survey Regulations (1998) have anticipated this development by defining a Cadastral Survey Dataset (CSD) which can be administratively specified to be either digital or paper. Current paper plan presentation requirements are specified in a separate schedule to the Regulations. Fully digital lodgement and validation also raises issues of electronic signatures and security, which are being addressed in a number of other sectors as well.

One aspect, referred to in Cadastre 2014, was the need for sophisticated software and associated development skills to handle spatial data and objects. This has certainly been a constraint in the development of Land*online*, in that the contractor had difficulty in obtaining suitable sufficient people with skills in spatial design and software. LINZ had to augment these from its own resources, which in turn had been built up over a number of years of training and other in-house digital development of survey systems. Although LINZ has some significant skills in this area, much of this was committed to providing technical and business advice and testing, and it is fair to say that we have struggled to provide resources while still running the business.

6.5 Statement 5

Cadastre 2014 will be highly privatized. Public and private sector are working closely together.

Cadastral surveying in New Zealand has been characterised by a well established and versatile private sector which has traditionally carried out all surveys of private land and most government land on contract. The private surveyor is involved in all aspects of land subdivision, from initial economic and legal assessment, to site surveys, design, planning consents, roading and services and final survey for issue of titles to the land, thus making a major contribution to land management and administration. Registration of surveyors to carry out cadastral survey is in effect a delegation of statutory functions and is a form of privatisation of a government function. (Allred 1994). This has been further reinforced by the introduction of the process of accreditation of surveyors referred to above.

The government, through the Office of the Surveyor-General in LINZ, provides the regulatory supervision and administrative control of cadastral survey, by setting standards and policies, approving and auditing inputs, and maintaining the records. It also specifies the programmes for geodetic control network maintenance, statutory processes and database maintenance. While government regulation and maintenance of systems has often been perceived as a cost, it provides significant benefits to surveyors and their clients, in that it ensures common and consistent standards, the ability to share and reuse survey information, and the ability to retrieve survey marks and information.

An important feature of the system, arising from the statutory framework, is the partnership and shared responsibility of the private and public sectors for the integrity and efficiency of the survey system, and consequent security of land boundaries and reliability of land information. Further development of Land*online* should enable surveyors to compare their surveys with the database and automated business rules and to effectively pre-validate much of their own work. If all tests are passed then the survey could be automatically approved. The only interventions would be where complexity or inconsistency required manual expert assessment, and regular audits.

6.6 Statement 6

Cadastre 2014 will be cost recovering.

The importance of the spatial data system (of which the cadastre is a key component) to the New Zealand economy and its significance as a strategic government asset was reaffirmed by Ansell & Collins (1995) in their review of DOSLI.

The survey system is regarded as a strategic government asset, and up until about 1985/86 was largely funded by the Crown, with a small level of recovery from statutory fees. From 1985/86 progressive cost recovery was introduced for plan lodgement and approval and for access to survey data. This was further extended in 1989 with the introduction of a levy on land transfers to fund the maintenance of the survey system network and records. The rationale for this was that existing parcels could be transferred without the need for resurvey or title insurance because of the standard of survey and maintenance of the survey framework and records, and the level of public confidence in the system. Government accordingly agreed that land purchasers were the major beneficiary of the survey system and should therefore contribute to it. Other users, e.g. of DCDB or geodetic data, paid by way of data fees.

The cadastral system, both survey and title, is now fully cost recovered, mainly through statutory fees levied on transactions and data fees, and in fact has returned in recent years a surplus of about $5-8m per year. The Land*online* development is also being funded by current users, by way of additional fees. These will cease in 2003. Existing fees will also be reviewed as automation is completed and transaction and maintenance costs reduced.

7. Summary and Conclusions

The New Zealand cadastre has already achieved, or is in the process of achieving most of the objectives identified in Cadastre 2014. The major ones where further opportunities lie are in the complete or integrated recording of both private and public rights and restrictions, and in the development of a fully survey accurate spatial database forming a basis for the spatial integration management and use of land based data - a truly multipurpose cadastre.

These achievements build on the early adoption and continuing maintenance of sound national survey systems and administration in a developing country. More recent advances have been in response to the major economic reforms and restructuring in New Zealand from the mid 1980s to now and to technological advances. Future drivers are likely to be the rapidly growing demand for better quality and more readily

accessible (on-line) spatial information, much of it for land management or environmental needs, but also to support a more participatory and informed community, and to reduce business risk and uncertainty.

A key objective of cadastral reform must be to ensure that it provides a system that allows a nation to effectively and efficiently manage its land resources in a way that meets the economic and social aspirations of that nation. So cadastral reforms must understand and analyse those needs, the capabilities of technologies available to us, and anticipate future demands.

It is our belief that recent and current reforms in New Zealand are aligned to Cadastre 2014 in that they will provide the nation with low cost, speedy and accessible means of carrying out land transactions, and a comprehensive fully digital information system readily and cheaply available to the public, asset managers, business and policy makers. But in all of these things history and society will have to be the ultimate judge of our success.

ACKNOWLEDGEMENTS

The contributions of Don Grant and Anselm Haanen, who reviewed the paper and provided valuable insights on the Land*online* project are acknowledged. So also is Judith Stanesby who typed up and revised the several drafts of the paper.

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