

PAPER ONE

**" PREPARING THE WAY FOR FUTURE DEMANDS ON ACCURATE
CADASTRAL LOCATION OF RESOURCES "**

by

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PREPARING THE WAY FOR FUTURE DEMANDS ON ACCURATE CADASTRAL LOCATION OF RESOURCES

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ABSTRACT

Our communities are demanding accurate records of all natural resources to enable careful management of these finite assets in order to achieve "environmentally sustainable management".

This paper outlines a scenario that will assist in the accurate location of the extent of these resources by using existing cadastral records (with some adjustment) together with the integration of Global Positioning Systems (GPS).

INTRODUCTION

The conference theme **AFTER RESOURCE DEVELOPMENT - WHAT NEXT?** is a thought-provoking question enveloping all possible aspects which suggests that the 'what next' is "sustainable management of those resources". However there are some fundamental and basic principles which must be considered very carefully for humanity's future existence on this planet.

The outcomes from 'Agenda 21' of the United Nations Conference on Environment and Development at Rio De Janeiro, Brazil, from 3-14 June 1992 and the World Bank Conference on Environmental

Sustainable Development, Washington DC, USA, 30 September - 1 October 1993 address relevant issues on this topic.

Consideration must be given to the distinction between concepts of "sustainable economic growth" - which is not possible in the longer term in the world of finite resources - and "sustainable development" which is a concept of enhancing people's standards of living or overall well-being. This must be undertaken with much greater efficiency of resource use and less pollution than current patterns of production and consumption - ie a truly sustainable future. Any consideration of a sustainable future for humanity will require a fundamental shift in thinking and behaviour - that is a 'paradigm shift' from "development" versus "environment" to "environmentally sustainable development" or in other words a partnership between environment and development.

The commonly used phrase is "sustainable management" and when this is introduced into the decision-making process on natural and physical resources, due consideration must be given to the following two factors:

- * to more adequately consider the use of the earth's resources, with particular emphasis on conserving resources for future generations ie better environmental stock-taking, and
- * to more fully value the environmental costs of activities and policies in our decision-making process to protect any bio-physical resources ie better environmental valuations

These factors are connected and the relationship should be recognised in policy-decision making.

The New Zealand Resource Management Act 1991 takes cognizance of this by promoting the purpose and principles of sustainable management of natural and physical resources. "Sustainable

management" in the context of the Act means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety (Resource Management Act 1991)

In order to achieve all or part of the above the following information relating to those resources is required.

- * records of interests/ownership
- * where the information is held
- * the physical location of the resource
- * the size/shape/area of the resource with due consideration to all cultural and social parameters

In this paper I wish to address the spatial relationship between the cadastre and natural and physical resources. This encompasses how cadastral data (in conjunction with other records or data bases) contribute to the location and management of these resources.

CADASTRAL SYSTEM IN NEW ZEALAND

The generally accepted definition of cadastre is '.... a complete and up-to-date official register or inventory of land parcels in any state or jurisdiction containing information about the parcels regarding ownership, valuation, location, area, land use and usually buildings or structures thereon'. (Williamson, I P, 1994)

Because New Zealand was one of the younger British colonies settled, advantage could be taken of the survey and cadastral experience in India, Africa, North America and Australia. In other words New Zealand was able not only to develop on well-tested survey techniques and information systems but could also adapt these to its situation.

Improving the system is a continuing process.

The result is that New Zealand has an integrated survey system. This provides essential support to the Torrens Land Registration System, land administration and various national infrastructure systems. All cadastral land surveys are conducted by professionally qualified surveyors and the resulting survey plans are verified and deposited with a single statutory government agency. All boundary angles are monumented and coordinated. These, and supplementary survey marks, together with occupation that generally is consistent with the cadastral pattern, are widely used as a base for the fixing of utilities and other property features and assets.

Land tenure is recorded by the Crown for the Crown estate - the Registrar General of Lands for freehold and private land, and the Maori Land Court for Maori land. Land title in each case is based on the national integrated survey system.

BACKGROUND TO DEVELOPMENT

Prior to 1970 little use was made of computers in land related disciplines but since this time considerable advances have been made and will continue to be made.

Initially survey records/index maps were drawn manually to scale using the dimensions shown on each plan of survey to form part of the cadastral records.

This task took considerable time which was made difficult by the rapid economic growth in land subdivision between 1950-1970.

Considerable alterations and additions, principally in the urban area, were necessary. Consequently some plotting accuracy in these

records was lost because of the large number of records being entered and the scale of the record sheet in relation to more complex design of subdivisions.

With the introduction of computer graphics and the philosophy that digital records should be available over the whole country, the inaccuracies of the manual system were carried forward into the digitisation. These inaccuracies were apparent when numerical entry of new survey plans took place. The digital cadastral database (DCDB) covered the country and in its infancy was just that - a digitised record of the manual system. As entry of numerical coordinates from plans increased a parcel adjustment technique to accommodate the new data was established.

DEVELOPMENT

The Resource Management Act 1991, Local Government Act and government reforms, with emphasis on accountability for resource use and deregulation, created a need for organisations to have an accurate record of their assets. The DCDB was seen as a vehicle which local bodies and other agencies could access to set up their own land information systems for this and other purposes. This would provide information/records relating to each parcel of land over which they had jurisdiction eg resource use consents, licences, rating and position of utilities.

Another factor to be considered was the introduction of new technology such as GPS which enables the users to fix their assets with much greater speed and accuracy. With this technology available to land surveyors, as well as resource managers, engineers, geologists and land agents and the whole community at large, a new meaning to the cadastral record infrastructure system and applications is

evolving.

New Zealand is now faced with the challenge of how best to utilise existing systems to meet future client needs.

There are two major considerations

- (a) how to portray the existing cadastre information in DCDB promptly in an up-to-date version
- (b) how to provide the user of GPS with the relevant transformation parameters to allow the conversion of GPS Data to local coordinate system(s) (or vice versa).

INVESTIGATION OF DCDB ENHANCEMENT

New Zealand has in effect a numerical data system, albeit manual, based on the dimensions shown on survey plans and geodetic control. The dimensions within these plans have a good internal consistency and have been connected to a local coordinate system.

It is both unnecessary and totally impracticable to remeasure a substantial part of the cadastral pattern in order to provide a uniform system of accurate coordinates. The alternative is to use the existing dimension data and geometry and apply control as needed to "stabilise" the cadastre pattern.

The boundary dimensions once recorded will facilitate automatic generation of titles and will meet land valuation requirements regarding boundary dimensions.

At present three pilot project areas have been selected and systems have been put in place to capture cadastral data. This will then be analysed to see whether this information meets the requirements for upgrading the spatial accuracy of cadastral boundary positions within

the DCDB. The important criteria is to quickly recognise problems using the philosophy in total quality management "do it once, do it right", and to learn from the experience and progressively improve processes. (Refer to diagram 1)

PROVIDING TRANSFORMATIONAL FORMULAE FOR GPS USERS

The New Zealand Geodetic Datum 1949 (NZGD49) was created using several measured (invar band/tape) baselines 8-18km in length, classical triangulation measured by theodolite (T3) to First Order Standards between 1930-46 and astronomical observations (latitude, longitude and azimuth) observed over the same period. In terms of modern survey accuracy there is evidence of several variations and anomalies which are thought to be due to a combination of the inevitable limitations of the old methods of triangulation and/or the effects of tectonic plate movement (NZ lies on the boundary between two tectonic plates like Papua New Guinea). Investigations are currently underway that will provide the user of GPS with transformation formulae to convert from/to New Zealand's existing reference system NZGD49 to World Geodetic System 1984 (WGS84) or another appropriate global system.

Bevin and Hall (1994) outlined this investigation by first determining the accuracy of the 1949 datum by comparing it with all types of modern and recent high quality measurement technology such as earth deformation study (EDS) surveys, scale control from electronic distance measurement (EDM), Doppler, GPS and astronomical observations.

The next step was to have a reliable comparison over the whole country between the NZGD49 and WGS84. To achieve this a list of 30 stations throughout the country was selected for GPS measurement.

Naturally First Order Stations and modern control stations were occupied. (Refer to diagram 2)

The preliminary analysis and conclusion by Bevin and Hall (1994) is that the transformation between WGS84 and current NZGD49 is not consistent. Because of this it may be necessary to divide the country into areas and supply a set of transformation parameters for each based on a greater density of comparisons and possible readjustment of existing data in terms of the GPS network.

CONCLUSION

The introduction of GPS has the potential to completely change the cost and methods of boundary definition in the near future. Also GPS is a positioning system which will be used by the whole community - even the layman will find it relatively easy to measure the extent of physical and natural resources. There is no point in having coordinate accuracy of cadastral patterns to the nearest metre if the general public is able to obtain position to the centimetre. However, for this information to be of the widest possible use it must be put in a format compatible with other databases, and in particular to an enhanced cadastre.

To accomplish this two main criteria are being investigated -

- * provision of transformation parameters to allow GPS data to be connected to existing datums
- * provision of more accurate cadastral systems to meet future needs of the community.

Schema of Survey Data Base

Diagram 1

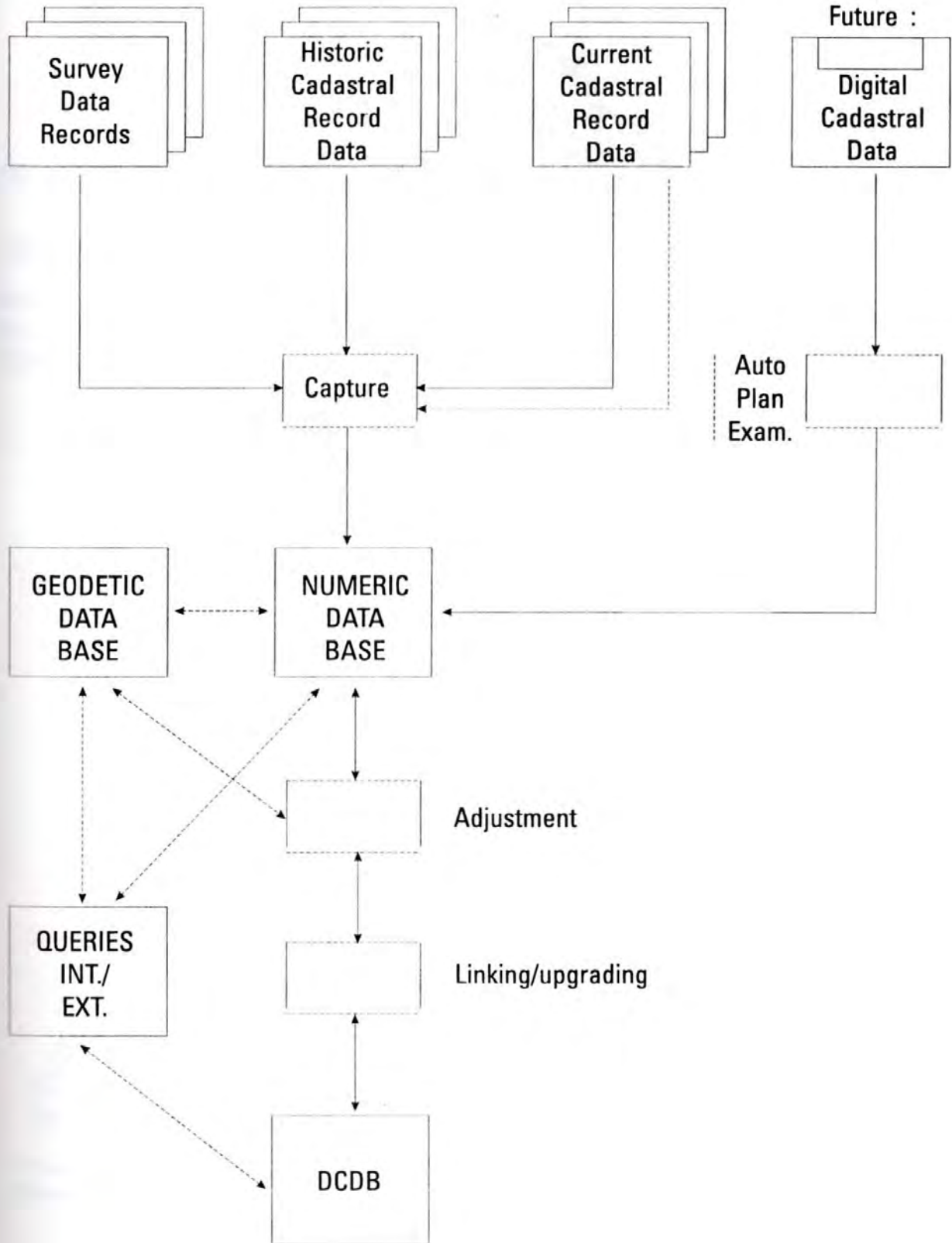
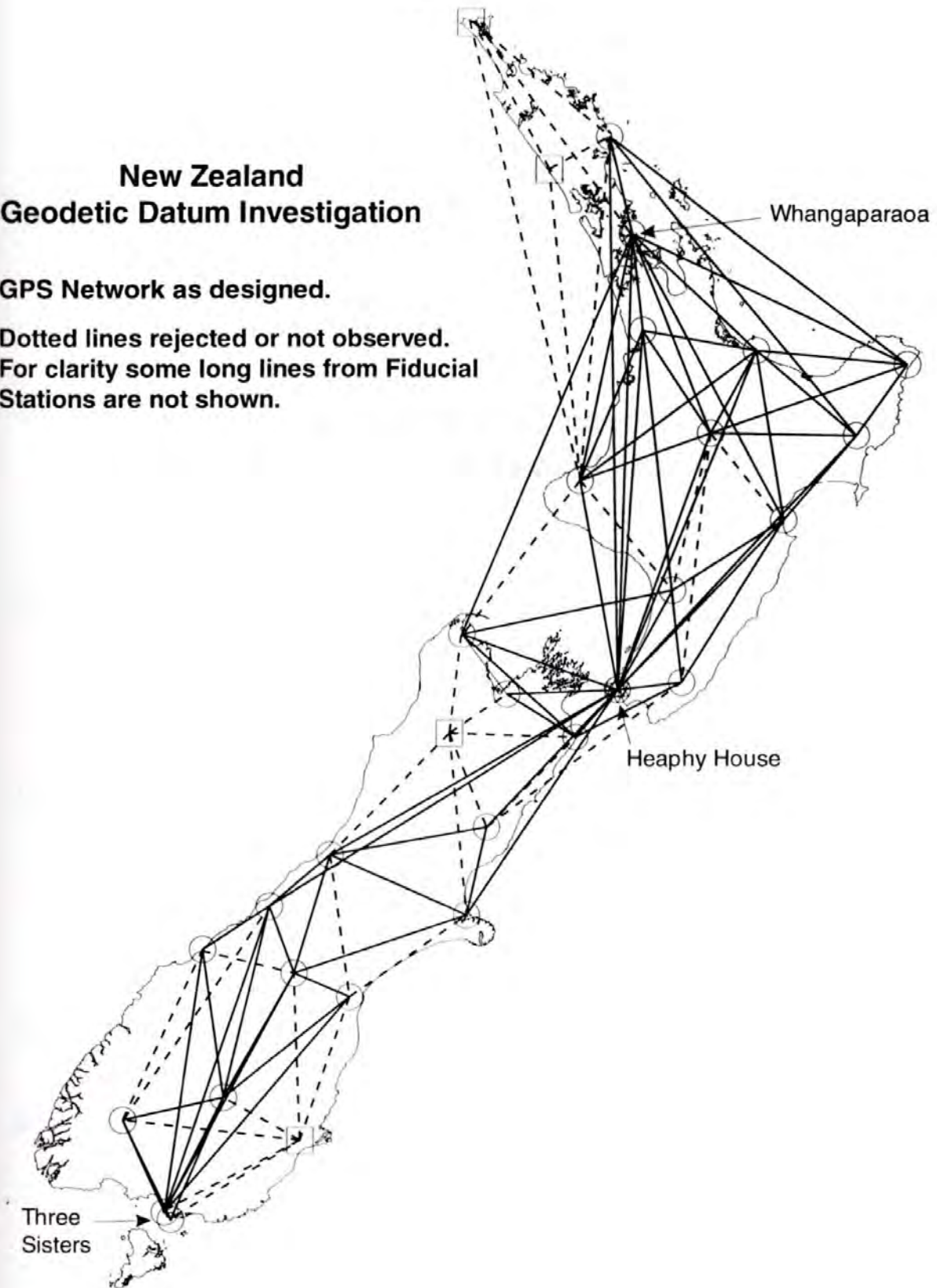


Diagram 2

New Zealand Geodetic Datum Investigation

GPS Network as designed.

Dotted lines rejected or not observed.
For clarity some long lines from Fiducial
Stations are not shown.



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BIOGRAPHICAL NOTES

Peter Chambers is currently Assistant Surveyor-General (Information Generation) Department of Survey and Land Information, Wellington, New Zealand. Peter joined the Department in 1959 and registered as a land surveyor in 1966. He spent his first 10 years undertaking cadastral and control surveys in the south of the South Island of New Zealand.

He has had two periods of teaching students all aspects of surveying with emphasis on cadastral surveying, namely at the Trentham Survey School, Wellington, and the Sarawak/Sabah School in East Malaysia. He has held the following senior positions in government - Assistant Chief Surveyor, Wellington, where he was involved with the administration of the cadastral system for the Wellington Land District, two years as Chief Surveyor for the New Zealand Forest Service and a period as Director of Surveys with the Department's Head Office in Wellington.

In his current position he has responsibility for development, implementation, monitoring, verification and review of standards for data generation appropriate to departmental and clients' land information requirements which includes surveying and photogrammetry.