

CADASTRES AND LAND INFORMATION SYSTEMS IN COMMON LAW JURISDICTIONS

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PART

ABSTRACT

The application of the cadastral concept in common law jurisdictions is reviewed. The relationship between a cadastre and a statewide parcel based land information system is highlighted. The origins and evolution of cadastres are described. The characteristics and development of existing land administration systems in common law jurisdictions are discussed. It is suggested that there is a considerable misconception of the term cadastre, particularly concerning the role of land registration in a modern cadastre. The situations in North America and Australia are highlighted. A conceptual model for a parcel based land information system based on a juridical cadastre is proposed.

INTRODUCTION

The concept of the European cadastre and the term "cadastre" have been increasingly promoted in common law countries over the last two decades. In virtually no jurisdiction has the concept been fully introduced, even though the term has found acceptance in many countries. The concept has been misunderstood and different interpretations made of the term. In some jurisdictions the term has become unpopular with land administrators. The promotion of the concept in a number of countries has consequently become counter productive. This article aims to clarify the cadastral concept and to examine its application in common law jurisdictions (i.e., countries which use English land law). The European origins of cadastre are reviewed to assist in giving a better understanding of the concept.

As an aid to applying cadastral principles in common law jurisdictions, an attempt is made to highlight the major differences between them and their European counterparts. One of the limitations in applying these principles is the perception of the cadastral concept in these jurisdictions. In many cases the misuse of the term "cadastre" has led to a misconception of the basic cadastral principles. As an example, the perception of cadastres is reviewed in Australia, England and North America.

A final objective of the article is to clarify the role of the cadastre, and particularly the juridical (in preference to the term legal) cadastre, in a statewide parcel based land information system. It is argued that the establishment of a juridical cadastre is a desirable prerequisite for the development of such a land information system. This is not to reduce the importance of environmental, social

or economic data in a statewide land information system, but to suggest that from a practical point of view, the development of a broad land information system will be more politically and economically justified if designed around a juridical cadastre in the early stages. To support this approach, a conceptual model for a statewide parcel based land information system in common law jurisdictions is outlined.

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THE CADASTRAL CONCEPT

It is impossible to give a definition of a cadastre which is both terse and comprehensive (Dowson and Sheppard, 1956; p.47). No two cadastres are the same. The form of the cadastre in each state or country is usually a consequence of the jurisdiction's historical development, its laws and custom and, to a large extent, its form of conveyancing and method of introduction of land registration.

A definition of cadastre which would have general acceptance is as follows:

A 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 any buildings or structures thereon.

The land parcel is usually the smallest parcel having individual ownership, which may be termed the legal parcel. This parcel is the basic building block of the cadastre. There are some cases, however, when this parcel is not suitable and it must be divided into smaller units. This is usually for valuation, assessment, or rating (fiscal) purposes or for land use classification. In a considerable number of cases the legal parcels must be aggregated to form the larger ratable/land use parcel.

Even though a precise definition of cadastre is difficult, Dowson and Sheppard point out that the distinctive character of any cadastre is readily recognised and may be expressed as the marriage of:

- (1) a technical record of the parcellation of the land through any given territory, usually represented on plans of suitable scale; and
- (2) an authoritative documentary record, whether of a fiscal or proprietary nature or of the two combined, usually embodied in appropriate associated registers.

In order to better understand the concept of cadastre, it is beneficial to examine the essential elements of a modern cadastre. These have been described numerous times by such authorities as Dale (1976), Blachut (1973), McLaughlin (1975), Larsson (1975), Henssen (1975) and Ziemann (1975), and may be summarised as follows:

- (1) A series of large-scale maps showing property boundaries, all buildings and structures on the land and the major natural features. In urban areas scales of 1 : 1000, 1 : 500 or even 1 : 100 are used, decreasing to about 1 : 2500, or less, in rural areas.

- (2) A register or number of registers containing information on ownership, valuation, land use and any other matters dealt with by the cadastre, for every land parcel. Of prime importance is that the basis of the cadastre is land parcels; not buildings, people or any other criteria. Even though many modern cadastres maintain information on fiscal matters within the cadastral registers, it is in general the legal component of the cadastre which has prime importance. The majority of the registers in the cadastre relate to legal matters, particularly concerning ownership and other legal interests in land, and conveyancing matters. The basic parcel must be common to all registers.

The cadastre must be complete, that is, every parcel of land in the state or jurisdiction must be displayed on the maps and included in the respective registers. Ideally, this would include all state owned parcels including reserves, parks, roads and unalienated land, if applicable.

- (3) Each parcel in the cadastre must have a unique common identifier to be used by all authorities dealing with parcel based information. This is the key that connects the maps and registers in the system. Ideally, the use of this identifier by all authorities would be enforceable at law. Common identifiers include:

(4)

(a) volume number and folio number derived from title registration ;

(b) recorded survey plan number and parcel number;

(c) rectangular land survey system descriptions (as found in the United States and Canadian rectangular survey systems);

(d) municipal, village or regional unit and parcel number;

(e) map number and parcel number;

(f) municipality, suburb or region and street address; and

(g) geographic coordinates.

For a detailed discussion of land unit identification, refer to Ziemann (1976), and Moyer and Fisher (1973). In the Australian context reference should be made to Sedunary (1983) and Bullock (1984).

- (5) The cadastre must be dynamic, that is, it must be continually updated. There must be legally enforceable procedures which require that all changes to the information in the cadastre must automatically and immediately update the registers and large scale maps.

- (6) The information in the registers must be correct and preferably have legal status and be "guaranteed" by the state. This aspect particularly applies to title registration but equally could apply to all encumbrances or matters affecting title. (For a detailed discussion of the term "guarantee" reference should be made to Simpson, 1976, pp.175-187.)

The contents of the registers should be public, within reasonable limits. It must be available to all government authorities.

(7)

- (8) The large-scale mapping system must be supported by a permanently marked and well maintained, coordinated survey system. Such a system is mandatory so as to be able to integrate all forms of spatial information.

- (9) The cadastre must include an unambiguous definition of parcel boundaries both in map form and on the ground; this is usually the result of cadastral surveys. The most common method of carrying this out is to permanently monument the parcel boundaries. These monuments are then surveyed by ground methods with the corresponding measurements being displayed on technical maps or plans. In such a system the boundaries of each parcel can be precisely defined and located on the ground even if the boundary monuments are missing or disturbed.

For a detailed description of a modern cadastre in the European tradition, refer to Williamson (1981), where the cadastre in the Canton de Vaud in Switzerland is analysed. For a description of the German cadastral system refer to Simpson (1976) and Toms (1978).

It should be recognised that the elements described above are considered an ideal to be worked towards. Most developing and many developed countries cannot justify or afford such an ideal in the short term. In these cases countries should adopt appropriate systems which are economically and politically acceptable but which can evolve with time towards the ideal.

As stated, it is difficult to give an absolute definition of a cadastre since the systems differ between countries due to varying historical development and local laws in the same manner. It is difficult to classify cadastres into different types (see Larsson, 1971); however, the following classifications are made in most of the literature on the subject:

(1) fiscal cadastres:

(2) juridical cadastres: and

(3) multi-purpose cadastres.

Fiscal cadastres were developed to raise revenue through taxation of land, whereas juridical cadastres were created to record ownership and all other legal interests in land. Multi-purpose cadastres were developed when additional registers or information were added to the basic fiscal and/or legal components within the cadastre. The components of a multi-purpose cadastre are as described above for the modern cadastre, although the registers and maps may contain more information on such aspects as zoning and environmental matters and may be designed to readily produce relevant statistics on the matters stored in the registers. The major aspect which differentiates a multi-purpose cadastre is that the inventory of land parcels and the large-scale maps showing all parcel boundaries are used as a base for many other authorities and purposes. For example, this data base, with supporting maps, could be used by all the service authorities for electricity, water, sewerage, gas and telephone reticulation, for planning and local government administration, for transportation and environmental studies, for private industry, for administration and social services, and for census information.

Due to the increasing attention being given land information systems (LIS),

there has been considerable confusion between such systems and cadastres, and particularly multi-purpose cadastres. LIS can be considered to be part of the family of geographic information systems (National Research Council, 1983; McLaughlin and Wunderlich, 1983). In their own right LIS are very broad as shown by the definition accepted by the International Federation of Surveyors (United Nations, 1983):

A Land Information System is a tool for legal, administrative and economic decision-making and an aid for planning and development which consists on the one hand of a data base containing spatially referenced land-related data for a defined area, and on the other hand, of procedures and techniques for the Systematic collection, updating, processing and distribution of the data.. The base of a land information system is a uniform spatial referencing system for the data ill the system, which also facilitates the linking of data within the system with other land related data.

Land information systems can take on many forms depending on the purpose for which they are designed. For example, environmental information systems and road and utility network systems are all forms of LIS, however, the largest category comprises parcel based LIS. It is these information systems which include cadastres or cadastral systems. In simple terms cadastral systems are forms of LIS but not all LIS are parcel based or are concerned with the cadastre. For a general overview of the distinction between cadastres and LIS reference should be made to the Report of the Meeting of the Ad Hoc Group of Experts on Cadastral Surveying and Land Information Systems (United Nations, 1983).

Braasch (1975) and Blachut *et al.* (1979, p.239) have further categorised cadastres by the surveying method adopted and the associated accuracy, as follows:

- (1) graphical cadastres;
- (2) numerical cadastres; and
- (3) computational cadastres.

Examples of these can be seen in Williamson (1981). It should be noted that these classifications do not always differentiate one cadastre from another since it is quite common to find aspects of all these categories within one cadastre, as evidenced in the cadastre of the Canton de Yaud. Even though the method of survey adopted in a cadastre can have a significant influence on the operation of that system, it is not considered that these classifications have direct relevance to this discussion. For further information on cadastral surveys in common law jurisdictions refer to Dale (1976), McEntyre (1978) and Williamson (1983).

Even though many modern cadastres contain both legal and fiscal records, it should be emphasised that it is usually the legal records which are paramount in the system. They are generally the central components in a modern cadastre since they provide the basic data for the maintenance of the records. Such records as valuation, service or utility details, and land use information are secondary components.

As can be seen from the foregoing discussion on cadastres, there are two major parts in any cadastre: the registers, and the map. The registers are generally maintained by legal or clerical personnel. The maps, on the other hand, are

usually maintained by cadastral surveyors and draftsmen operating within legal guidelines. The main purpose of cadastral surveys is to delineate on the ground, and on the map, the location of a parcel, its boundaries and its area: firstly, the general map showing the boundaries, any structures and major physical features, together with all identifying parcel numbers, street names and descriptive detail; and secondly, the technical map showing all the numerical data used to construct the map, such as survey control, traverses, radiations or coordinate references for each piece of detail located by the cadastral survey.

It is important to note that the prime role of cadastral surveys in a European cadastre is usually to update the cadastral maps. The technical maps or plans are just means to assist in compiling and maintaining this basic cadastral map. The subdivision process is an integral part of updating this map. In general, new titles are not issued until the basic map is updated and checked.

As Dale (1976, p. 2) points out, a secondary objective of cadastral surveys is to provide information for a multi-purpose cadastre to satisfy the overall information requirements of land administration. This necessitates collecting details on such matters as land use, soil and vegetation types, land capability, any structures on the land and in general any relevant environmental information. The potential for surveyors to incorporate these tasks in cadastral surveys has been long recognised and sometimes practised; however, in general, this is not the case. In most countries, cadastral surveys are generally concerned only with the determination of boundaries and the preparation of the associated maps or plans.

THE ORIGINS OF CADASTRE

An insight into the development and history of cadastres is helpful in gaining a better understanding of the cadastral concept and in isolating the basic elements inherent in cadastral systems since no two cadastres are the same. Also, since the cadastral concept is continually developing, such an analysis helps to gain insight into the trends and potential of the concept.

Many examples of official records or ownership and taxation have been documented, some dating as far back as 3000 BC. In Ancient Egypt (Dowson and Sheppard, 1956, p.2). Even though many of the early systems were designed for fiscal and, in some cases, legal purposes, it appears that all fell short of the concept of the modern cadastre. In general, they were written registers and were not based on comprehensive large-scale maps.

Although a significant number of European countries compiled cadastres in the late eighteenth and early nineteenth centuries, it is generally accepted that most of the continental European cadastres were modelled after or gained their inspiration from the French cadastre of Napoleon I, which was commenced in 1808. It is generally considered that this cadastre was the forerunner of today's modern cadastres. Both the French cadastre and all the European cadastres of this period were purely fiscal cadastres; the multi-purpose role of cadastres had not yet developed. The use of cadastres for legal purposes did not commence until the middle or latter part of the nineteenth century. This is of fundamental importance when considering the development of cadastral systems in common law countries.

Henssen (1975) considers that the reason for the establishment of fiscal cadastres throughout continental Europe at the beginning of the nineteenth

century was due to the widely accepted economic principles of the Physiocrat movement of that period. The physiocrats argued that land was the basis of all riches and, therefore, funds for the maintenance of society should be obtained by the taxation of land (this was a particularly valid argument prior to industrialisation). During this period, and for a long time afterwards, the majority of state revenue in Europe came from land taxes.

One of the important lessons which can be learnt from studying the history of the French cadastre is the importance of large-scale maps and a systematic cadastral survey for establishing a cadastre. The French Constituent National Assembly agreed to the setting up of a cadastre in 1790; however, it took 18 years of numerous failures and false starts before it was recognised that a cadastre must be based on large-scale maps showing the boundaries of all land parcels (Hampel, 1978; Simpson, 1976, p.405; Dowson and Sheppard, 1956, p.49). The basic cadastral plans in the French cadastre were prepared at scales of 1: 1250 and 1:2500.

History has shown that a complete cadastre created for the purpose of a more equitable taxation system was only possible if the mapping was based on sound surveying principles—even though the surveying technology was entirely orientated to the requirements of a tax cadastre. Hampel (1978) states that Napoleon I soon realised that the surveying work could be utilised for other purposes than taxation. He claims Napoleon once stated that: "A good cadastre will be the best complement of my civil law code to achieve systematic order in the area of real estate property. The plans must be so developed and be made so exact that they will permit at any time to define and record boundaries of land property limits and to prevent the confusion or law suits otherwise arising", and at another time he said: "The cadastre just by itself could have been regarded as the real beginning of the Empire, for it meant a secure guarantee of land ownership ...".

Even though Napoleon recognised the benefits of a multi-purpose cadastre which served both the fiscal and legal requirements of the state, it was not recognised that, in general, multi-purpose cadastres require a more accurate surveying and mapping system than that required of a fiscal cadastre. In fact, to this day the French cadastre is used principally for fiscal purposes. All evidence of proprietary interests in France is recorded in Deeds Registries—there is no registration of title in France; however, the registry offices and the local offices of the Cadastral Service do work closely together (also see Simpson, 1976, pp.404- 414).

Germany was the first European country to take the important step of introducing registration of title based on the cadastral survey. These moves were commenced in the mid-nineteenth century and were extended to the whole of Germany in 1900. Other countries followed in the same direction; for example, Austria in 1900, Denmark in 1926, Norway in 1935, Sweden in 1932, Switzerland in 1912 and Yugoslavia in 1930. In all these countries, the specifications for cadastral survey have been upgraded to accommodate their requirements for title registration.

The development of a modern cadastre (incorporating legal data and proprietary interests) from a taxation cadastre (utilising no mapping base) and the importance of cadastral surveying and large-scale mapping in such a system is succinctly described by Simpson (1976, p. 122):

Cadastre (as a fiscal record without maps) and deeds registration remained distinct and unconnected until the development of survey techniques. The production of accurate large-scale maps made land survey a satisfactory method of indicating and identifying land parcels, and the purpose of tax or of title. Systematic land survey then became an integral part of the modern cadastre, and naturally the cadastral map also began to be used for demarcating the land parcels referred to in the deeds recorded in the deeds registers. Thus the cadastral survey had originated as a device (the record for the administrative convenience of the state came 10 years later) to meet the needs of individual proprietors for parcel demarcation in their land dealing.

Dowson and Sheppard (1956, p. 49) also commented that the development of fiscal cadastres to include the legal details of proprietary interests was a natural evolutionary process. They claim that fiscal cadastres, if well maintained, tend "progressively to develop and to crystallise the rights of the taxpayers to the use, occupancy and ultimate ownership of the land in respect of which they are taxed". The taxation records consequently develop with time into formal proprietary records and are finally given judicial recognition.

The years which saw an increase in importance of legal matters in the cadastre paralleled the period of industrialisation. This was a time when land taxes were reducing in importance while the taxation due to industrial development was increasing. Therefore, the importance of pure tax cadastres began to decline.

Whatever the reasons, there has been a change in emphasis over the years in the cadastre from being a fiscal register to that of a legal register serving the requirements of registration of title. In parallel with this development has been a corresponding increase in the emphasis placed on the cadastral survey and the large-scale maps. Simpson (1976, p. III) goes so far as to say: "It is, in fact, 'cadastral survey' which is of prime importance, and 'cadastre' in its original form, i.e., purely a fiscal record without maps, is almost irrelevant to our theme of registration of title".

To aid in understanding the application of cadastral principles to common law jurisdictions, it is worthwhile highlighting the relationship between the legal and fiscal components in European cadastres. In the French system, the cadastre office, which maintains the cadastral (primarily fiscal) records and maps, appears paramount. The registry office is closely connected but is not the central focus. In the German cadastres, the cadastre office has a similar role but the system has been upgraded, particularly in the cadastral surveying and mapping area, such that this office supports and is complementary to the land title register. "The primary responsibility of each cadastre office is maintaining the real property cadastre ...for its district ..., i.e., the definitive records that identify each land parcel and locate each property line and building, using both geographic coordinates and large-scale maps laid out in a grid that completely covers the district" (Barr and Stoppler, 1981). Basically the cadastre office provides the surveyor map component and the title registry the legal component for the title registration system in Germany. Moves are underway in some German states to share a single data base between the title registries and the cadastre offices such that the present duplication of data entry in their separate files will be eliminated (Barr and Stoppler, 1981).

In many of the Swiss cadastres there is one office which has manually combined most of the functions found in the cadastre offices and title registries of Germany, a situation closer to the ideal (Williamson, 1981). Cadastral surveying and mapping is undertaken in general by non-government surveyors, even though they operate under strict guidelines. They function as an integral part of the overall cadastral system.

The most developed cadastre in Europe is arguably the Swedish system which is gradually being incorporated into the Swedish Land Data Bank System (Central Board for Real Estate Data, 1983). The system has developed into a true multi-purpose cadastre or parcel based land information system. As in other European cadastres the system comprises two major components. Firstly the traditional cadastre component is administered through a number of local Real Property Register Agencies which are under the control of the National Land Survey. These agencies are responsible for such items concerning the land parcel as area, location, land use, centroid coordinates and valuation, as well as the basic cadastral maps. Secondly the legal or title registration component is administered through a number of local Land Register Agencies under the control of the National Court Administration. These agencies are responsible for information about the legal owner, mortgages and other legal encumbrances affecting each parcel. Both the Land Register Agencies and the Real Property Register Agencies are connected to and update the central Land Data Bank. Even though the system is primarily based around the previously described two major components, the system also has a multi-purpose role, for example, by supplying urban and regional planners with various land related data.

In summary it could be said that the two major components in modern European cadastres are the cadastral mapping and property system, and the land title registries. The comments by Barr and Stoppler (1981) directed at West Germany, characterise most modern European cadastres: "...the records of the German states are remarkable for their definitive legal status, for their uniformity of coverage and for the sharing of data among offices made possible by common use of standard parcel and building identifiers and standard terminology."

The following points should be noted from this historical review regarding European cadastres (in addition to those outlined in the previous section):

- (1) Maps are a central component of the modern European cadastre. The cadastral maps are used as the official maps to depict ownership, to the extent that in the Swiss cadastres the boundaries depicted on the map are "guaranteed" by statute. In this case the general bounds and location of each parcel are guaranteed (Article 668, Swiss Civil Code). In principle the plan has precedence over the ground monuments unless there is irrefutable evidence to prove the map is incorrect. This does not mean that the numerical surveyor the resulting coordinates and areas are guaranteed, but just the graphical representation.
- (2) The updating of the cadastral maps is an integral part of the legal subdivision process. In general this results in a new title being issued *lifter* the cadastral map has been officially updated and after unique identifiers have been given to the new parcels. This is in contrast to the approach adopted in most common law jurisdictions (with the exception of Great

Britain), where a title is issued usually based on a single Isolated survey plan of the parcel.

- (3) A study of the evolution of cadastral systems has seen a steady decline in the importance of fiscal cadastres, with a corresponding increase in the importance of juridical cadastres. The consequence of this evolution is that in general, the European cadastres became polarised around two major components. The first component is based around the traditional cadastre office. The emphasis of this office is now primarily directed at the maintenance of the real property data in the system which is highlighted by the production and updating of a series of large scale cadastral maps. The second component is based around the title or deeds registries (hereafter jointly referred to as land registries) which maintain the legal data for each land parcel such as proprietary interests and legal encumbrances. The trend is now to maintain the information from the cadastre and land registry offices in one office or central data base.

This century has seen an increasing emphasis on cadastres taking a multi- purpose role. This trend has been accelerated over the last decade due to computerisation, with cadastres starting to form the basis of an integrated parcel based land information system.

- (4) The evolution from fiscal cadastres to juridical cadastres has seen a gradual increase in the accuracy and precision of the associated cadastral surveys. It is generally accepted that a juridical cadastre requires a more accurate graphical representation than that required for its fiscal counterpart. The standards for cadastral surveys in many systems, however, have repeatedly come under challenge. Realistic standards based on user requirements should be the goal for any system (Arter, 1960; McLaughlin *et III.*, 1977;
- (5) Dale, 1976; Warren, 1978; Williamson, 1983).

Due to the existence of relatively modern fiscal cadastres, title registration developed in Europe as a closely linked system to the fiscal registers. Consequently, a common cadastral base map was adopted using common parcels and parcel identifiers which linked the map with the various registers. This has not been the case in common law jurisdictions, as discussed in the following section.

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COMMON LAW CADASTRAL SYSTEMS

The preceding discussion of the cadastral concept and the origins of cadastre have been almost totally concerned with European cadastres. This is justifiable since Europe is "the cradle of present day cadastres". (Henssen, 1975). The primary objective of this article, however, is to examine the perception and to promote the concept of cadastres as a foundation for a parcel based land information system in Common law countries. In these countries there are fundamental differences' in the land administration systems which should be recognised before attempts are made to introduce modern cadastral concepts.

Most countries outside Continental Europe do not operate cadastres as previously described. This particularly applies to common law countries. The use of the term "cadastre" in these countries is therefore inappropriate. It is preferable to refer to their systems as "cadastral systems". In most of these countries the term will usually include their systems of conveyancing, land registration (i.e., title and/or deeds registration) and cadastral surveying. In such systems these components will usually be weakly linked out of necessity, although in many cases they will operate as separate entities.

Even though the majority of countries around the world would not operate true cadastres, most would claim to carry out cadastral surveying. In these countries the end result of such surveys varies greatly. It may range from integrated large-scale maps, to maps or plans of single parcels based on isolated boundary surveys. The term "cadastral surveying", however, is generally used in most common law countries to apply to surveys used primarily to determine boundaries of legal parcels. For a detailed analysis of the principles of such surveys, particularly in Commonwealth countries, refer to Dale (1976).

The existing cadastral systems in England, Australia and North America are briefly reviewed as examples of the major developed countries using the English legal system. England is examined because it is the origin of the legal system and since most of the land administration systems under discussion had their beginnings during British colonial rule. Australia, Canada and the U.S.A. are examined because of the current concern in these countries for improving land administration systems and for introducing parcel based land information systems. Australia is of particular interest due to the development of the Torrens system of title registration in South Australia and the subsequent influence of that system around the world. The U.S.A. is also of interest due to the development and application of much of the technology which is making computerised land information systems a reality. It should be noted that in one respect, Australia, Canada and the U.S.A. are not typical of most other common law countries. None of these countries as a whole operates a cadastral survey system based on a coordinated control network although there are small jurisdictions within each which do; for example the city of Saint John in Canada, the State of Hawaii in the U.S.A. and the Australian Capital Territory. Cadastral surveys based on the fixed boundary, "isolated" survey approach are usually used. These countries also exhibit the range of land registration methods found in most common law countries. Australia uses title registration in the form of the Torrens system almost exclusively, Canada uses deeds registration in the eastern provinces and title registration in the west, while the U.S.A. uses deeds registration almost exclusively.

Due to the proximity of England to its European neighbours, it is interesting to review the reasons why England did not adopt a European cadastral system. Such a review assists in understanding the evolution of land administration systems in general. First, change comes very slowly to land administration systems. There is much static information in cadastral systems which requires a substantial effort to change. In general, the only way that change will come about is in slow incremental steps. Major change can only occur because of a total commitment by the respective government. Such reforms usually accompany basic social changes within a country and usually occur during periods of

instability in a country, during a revolution or after the occupation of a country by a foreign power. The impetus for Western Europe came from the French Revolution and the subsequent influence of Napoleon I. As mentioned previously, Napoleon saw the creation of a cadastre as an integral component in administering the Empire and a more just system of taxing the land. The introduction of a cadastre for over 100 million parcels understandably required a total commitment of both monetary and human resources by the Government. It is highly unlikely that the introduction of cadastres on the scale which resulted in Western Europe during this period would have occurred had it not been for the French Revolution and the formation of the Napoleonic Empire.

In England, no such revolution occurred and consequently the systems of land ownership, land law and land taxation have seen no dramatic changes for nearly 1,000 years (maybe with the exception of the modifications to English land law in 1925). What changes have occurred have been evolutionary. The last time that England was occupied by a foreign power was with the Norman Invasion in 1066. This invasion by William the Conqueror was followed a number of years later by the famous Domesday survey, really the only systematic survey of ownership, area, and valuation of lands which has been carried out in England to this day.

Secondly, the difference between the European and English systems was partly due to economic and administrative causes. England, during this period was basically a country of large landholders with which the State dealt directly. The State did not have to concern itself with the detailed knowledge of the tenants, holdings. In Europe, however, the better agricultural land was extensively owned by many small landholders who had to be dealt with directly by the taxing authority (Dowson and Sheppard, 1956, p.49). Consequently, a more sophisticated and comprehensive land administration system had to be created.

Today in England the major activity in the cadastral area is in the completion of title registration to replace deed registration, and the creation of parcel based land information systems at a local government level for land administration and assessment. In both these areas England has achieved some very notable successes, but due to the title registry being closed to the public there is no flow of information between the registry and any other authority. The two major systems have developed and operate in isolation. The sole purpose of the land registry is to support a system of conveyancing. Fortunately the English concept of a closed registry was not promoted outside the British Isles and is not generally the case in common law countries. On the other hand, most European countries only permit limited public access to title information.

One of the central components of the title registration system in England is a complete large scale topographic map series prepared by the Ordnance Survey. The parcel framework which is derived from these maps is usually determined by the Title Registry based on the general boundary concept. The Ordnance Survey maps are a true multi-purpose base which are used by many authorities, although they do not have a cadastral overlay: they are purely topographic (except in some rural areas). In common law jurisdictions, the English system, which includes Wales and Ireland in a modified form, is unique. The concept of the English cadastral system as such has not been transferred, although the over-riding influence in all the English colonies has been the English legal system, and from the cadastral perspective, the English system of conveyancing.

in most common law countries other than Britain, the over-riding difference between them and European countries is that they have no large scale cadastral map base on which to build a modern cadastre. Today, in North America, Australia and many other countries, the objective of creating a complete large scale cadastral map base is the primary concern for improving parcel based land information systems. Some of the reasons for the lack of such a base are explored below. There are a few countries such as New Zealand which have a relatively well organised cadastral system. This system includes a complete and up-to-date, albeit less than ideal, large scale cadastral mapping base. Such countries, however, are not the norm.

One distinction between most European and common law jurisdictions is that in the latter the legal systems to support the alienation of land, and the transferring and recording of proprietary interests in land, came before the establishment of any fiscal systems. These quasi-legal systems have always been central to land administration in common law countries. Fiscal systems have been a more recent development. They usually have a secondary role in the land administration system and often have little or no links with the legal system. They have often developed their own mapping system and their own form of parcel.

The quasi-Legal land administration systems which were introduced into British colonies were in two areas, as mentioned. One concerned the alienation and management of Crown or state lands, together with the associated cadastral survey, and the other concerned the establishment of a secure system for transferring and recording proprietary interests in land. The operation of both of these systems were major social and political issues in the early days of most of the colonies. As an example, the conveyancing issue was of such importance in South Australia in the middle of the last century that it was sufficient to promote Sir Robert Torrens to Premier of that state.

The systems for the management of Crown lands and alienation were usually dominated by surveyors in some form of department of lands. During the period of land settlement in the colonies, such departments were usually large and very influential. These departments usually attempted to establish some form of cadastral mapping system, such as parish and county or township series showing all the original alienated parcels. Unfortunately, these departments were no longer interested in the land once it was alienated and consequently did not chart any subsequent mutation. On the other hand, the systems for conveyancing were concerned with alienated and freehold lands and were generally administered by a land registration office dominated by legally oriented or clerical personnel. As countries became settled, the influence of the surveying based Crown lands departments tended to diminish, whereas the influence of the land registration office increased. Today the major activity in developed common law jurisdictions mainly concerns freehold lands.

Most subdivisions of alienated land are based on individual accurate isolated surveys of the particular parcels. In general the parcels are only connected by survey to adjoining parcels. At best, mutations are plotted on charting maps but since neither the surveys nor charting maps are based on any geometrically controlled mapping system, the depiction of the mutation is only approximate. Often the new boundaries are not plotted but a notation is made on a charting map to indicate the existence of the mutation. In summary, the basis of the

common law systems is the individual isolated survey maps.

Some of the characteristics of the systems for administering conveyancing and subdivisions in common law jurisdictions are:

- (1) The cadastral surveys which support these activities are often controlled by land registry personnel who either have a legal or clerical background. Such people tend to have little knowledgeable interest in cadastral surveying and mapping.
- (2) In some jurisdictions there has been a sense of mistrust and non-cooperation between the government departments administering the conveyancing and subdivision process and the personnel responsible for maintaining the cadastral survey system.
- (3) The cadastral surveying system is primarily concerned with supporting a secure land registration system, not a cadastral mapping system. Most of the emphasis is concerned with maintaining a high standard for each individual "isolated" survey. Due to the high professional and technical standards of the surveyors and lawyers in most common law jurisdictions, secure conveyancing and land registration systems have developed.
- (4) Whereas most land registration systems in common law countries result in a reasonably secure system for registering and transferring interests in land, in their present form those systems usually are not designed to support an efficient land administration system integrated between a number of departments. In general these systems are concerned only with individual dealings on individual parcels, treated in isolation from other parcels in the system. The central theme of these systems is to support a land market based on the "user pays" principle. It is not designed to support the broader needs of government nor the land administration system.

The lack of a large scale cadastral mapping base in Commonwealth countries has been discussed by Dale (1981). He highlights the traditional lack of integration between topographic mapping and cadastral surveys in these jurisdictions. The situation arises because cadastral surveys are often controlled by a different department than that controlling topographic mapping. Even when they are in the same department there is often a polarisation between the two. This situation highlights the singular role of cadastral surveys in common law jurisdictions.

The lack of an efficient cadastral base in these countries has led to much duplication of effort in land administration. Utility authorities, local government organisations and departments responsible for valuation all have a need for a cadastral base map with the associated property records. Due to the non-existence of such a system at a central government level, the individual authorities have tended to develop their own systems. Since many of these authorities are statutory and self funding, they have often been in a better position to introduce modern systems, albeit designed solely for their own purposes, than central government. This has particularly been the case for many utility and local government authorities who have consequently introduced state-of-the-art computer systems. In a sense each authority establishes its own small cadastral system.

As was mentioned previously, most common law jurisdictions have developed some form of valuation or assessment system based on "tax maps", subsequent to the establishment of the land registration systems. Unfortunately these systems are usually not in the tradition of the European fiscal cadastres. The maps are designed to give a pictorial view only. The maps and parcels are often not to scale and only show parcels of interest to the valuation system. These parcels are often an aggregation or division of the legal parcel. Also the subdivision or mutation process is part of the conveyancing or land registration process and is consequently only loosely connected to the valuation or tax map system. Even recognising the deficiencies of such tax map systems, they are in many cases the only pictorial representation of land parcels in many jurisdictions. This is particularly the case in the U.S.A.

Often the tax maps are used for charting purposes by the land registries. In some cases the valuation roll or data base is also used as a first approximation in creating a parcel based land information system. Such has been the case with the land Ownership and Tenure System (IOTS) in South Australia and the land Registration and Information Service (IRIS) in Canada. In one sense there is an analogy between the European fiscal cadastres, and the common law systems of tax maps and valuation rolls. The major difference is that the systems outside Europe lack the accuracy, completeness and systems to support the integrity of information which is characteristic of their European counterparts.

Since European countries had existing cadastral systems, it has been a relatively easy matter to introduce registration of title. Due to the deficiencies or non-existence of valuation systems in the common law jurisdictions, the European approach for introducing title registration has not been possible. Consequently these jurisdictions have had to use complex and usually expensive methods for conversion (see Simpson, 1976). In the past there has been considerable pressure and justification to introduce title registration, as in Australia. One of the advantages of title registration is that it is parcel based (although there are some deeds registration systems, such as Ontario, which have ~ parcel index, but these are not the norm) and can therefore be used to help build a complete cadastral map. With deeds registration systems practised in common law countries, it is much more difficult to develop such a map.

In the developed common law countries, there is now no significant political, social or economic pressure outside government to introduce title registration. The conveyancing systems are not an apparent expense on the government since the systems are based on the "user pays" principle. The individuals in these systems can usually afford the expense of considerable solicitors or attorneys fees, a survey fee on most or many conveyances, and even title insurance, in addition to considerable government charges such as stamp duty. In many developing countries these expenses are simply not acceptable. If such systems as practised in the "developed" countries were permitted in the "developing" countries, negotiable titles and mortgages could be difficult to obtain, the land market could be effected and the economy could suffer.

A final characteristic of common law countries which limits and complicates the introduction of a modern cadastral system is the lack of a clear understanding of the cadastral concept. The misconception of cadastres has been particularly evident in North America and Australia. This has led to difficulties in introducing

statewide parcel based land information systems centred on the cadastre. It has sometimes led to the term cadastre becoming unpopular among many land administrators. The perception of cadastres in North America and Australia is briefly examined in the following sections.

to be continued)

CADASTRES AND LAND INFORMATION SYSTEMS IN COMMON LAW JURISDICTIONS

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School of Surveying,
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PART II

(("ntinu..dfrom No. 217, p. 129)

III; NORTH AMERICAN PERCEPTION OF CADASTRES

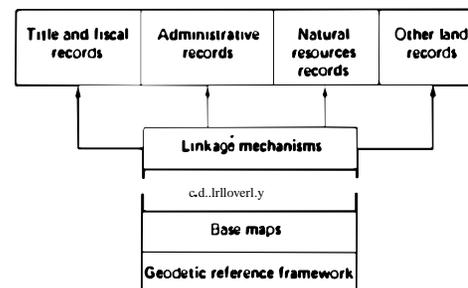
The concepts and benefits of an efficient cadastral system are widely recognised in North America. This is evidenced by: numerous conferences such as the Second Molds Conference in 1978 titled "Implementation of a Modern Multipurpose Land Data System"; a number of detailed reports, such as the reports published by the National Research Council (NRC) (1980 and 1983) in the U.S.A. titled "Need for a multipurpose Cadastre" and "Procedures and Standards for a Multi-purpose Cadastre" respectively; and The introduction of several programmes at a state-wide level to improve land administration, the most notable being the Land Registration and Inronnation Service in the Maritime Provinces in Canada. For a comprehensive list of activity in North America in this area, reference should be made to the National Research Council publications mentioned above.

North America, and the U.S.A., in particular, is in a considerably worse position with regard to its cadastral system than, most probably, any other developed nation in the world today. In contrast to most developed countries, an outmoded system of deeds registration operates throughout North America with the exception of the central and western provinces of Canada and, to a minor extent, a few of the jurisdictions of the U.S.A.

Many of the attempts to introduce title registration into the U.S.A. and to a lesser extent Eastern Canada in recent years have met with insurmountable obstacles and difficulties. Therefore, unlike Britain and most Commonwealth countries, there is no existing title register to help in constructing a land information system. Also, unlike Britain and some Commonwealth Countries, there has been very little large-scale mapping done in North America which would be suitable as a base for a modern cadastre. Therefore, the North American perception of cadastres tends not to be influenced by the existing cadastral system to the same extent as in Australia, since any moves towards introducing a cadastre will require a re-organisation of the existing cadastral components at the most basic level. Consequently, the view of modern Cadastres tends to be theoretical and idealistic in nature. Understandably, if the North Americans are starting from "scratch", they might as well aim at the "ideal" system.

The "ideal" multi-purpose cadastre is conceptualised as a "public operationally and administratively integrated land information system, which supports continuous, readily available and comprehensive land-related information at the parcel

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(NRC, I/HO. p. 14).

level" (NCR, 19KO, p. 13). Its components are depicted in Figure I and are as follows:

- (1) a reference frame, consisting of a geodetic network;
- (2) a series of current, accurate large-scale maps;
- (3) a cadastral overlay delineating all cadastral parcels;
- (4) a unique identifying number assigned to each parcel; and
- (5) a series of registers, or land data files, each including a parcel index for purposes of information retrieval and linking with information in other data files.

The terminology used to denote the system described above varies widely throughout North America; however, the system description is the same, with one or two exceptions. The following terminology has been used to describe such a system:

- (1) multi-purpose cadastre;
- (2) land records system;
- (3) modern cada- tre;
- (4) cadastre;
- (5) land information system;
- (6) land records and resource information system;
- (7) land data system;
- (8) multi-purpose land data system;
- (9) land data bank;
- (10) land record- information system; and
- (11) land data service centre.

The general view of cadastres and the interchangeability of terms in North America is summarised by Larsen (1978) as follows:

Th' l.""s "[I'J i,!!;"'olol/ s)'SL'11' ", " Kt'OK'ophi.'ol i,fomolol/ s)'Slr'11' " 0, " ,t'sou,(t' i,fom,olol/ S)'Slr'11' " o,t' 'l'olol(!!!. 1/1'11' ol/d ofll'n o,t' us/d il/ll'chon- gl'ohl)' ..ilh "lol/d 't'(o,d.1' ol/d " ll/ulti- pu,post! COdaS/1'";

The perception of the modern cadastre in North America can be seen as something much more than a system containing fiscal and legal records of land parcels. The North American view of such a cadastre contains, with equal emphasis, title and fiscal records, administrative records, records of natural resources, and many other land records. This concept is in contrast to the European, and particularly the

Queensland, B01h works have discussed the definition of cadastres and cadastral surveys,

Hallmann accepts the Oxford English Dictionary definition of "cadastre" and "cadastral survey", The role of taxation is paramount in these definitions; however, Hallmann accepts that the term " cadastral survey " has been varied 10 encompass any survey made with the object of obtaining an accurate and detailed definition of real estate boundaries. In contrast to this, he concedes that, internationally, the term "cadastral surveyor" includes 01 her practices such as valuation, and consequently he favours the use of the term " boundary surveyor" for use in Australia.

A different view is taken by Brown. In regard 10 his work, he considers that 'land, as the subject of rights, duties and obligations, will be presented here as part of the cadastre, defined by cadastral surveys made, for the most part, by cadastral surveyors". However, Brown takes a narrow view of the term "cadastral" since he considers that it refers to ownership of land, " namely, the nature, the extent, the evidence, of, and/or restrictions on, right of ownership ".

Murphy (1980) basically supports the cadastral concept and its application in Australia, as outlined by Brown. Murphy considers, for example, that the " Victorian cadastre " consists of the deeds and title registers located in the Registrar-General's Department, together with the associated "Cadastral Plans and Survey Information". No mention is made or valuation, large-scale mapping, conveyancing or subdivision Conlr01 processes.

Of major intereslO any discussion on the perception of cadastres and cadastral surveyors is the position in Victoria, where the term "cadastral survey" is given legal recognition in the Surveyors Act, 1978, as roll0WS:

" Cadastral survey" means any survey made for or in connection with or for tht' purpose of making or obtaining any plan or survey data to be used for or in connection with any dealing or matter -
(a) relating 10 the alienation of Crown lands ;
(b) relating to or affecting title to any lands ;
(c) relating to the determination re-establishment identification or adjustment of the boundaries tif any lands,

Again, the narrow view of "cadastral survey " is adopted in this legislation. The term in this context only refers to survey measurements of real property boundaries - matters such as valuation are not mentioned,

The ongoing discussion supports the view that, in general, the cadastral Concept is misunderstood in Australia. Several authors, pirl'iculary Toms, have researched the Conceptually and have: grasped its implications but, in general, the perception or tht: Concept by such authors as Brown and Murphy reflects the view of the majority in Australia. This interpretation considers that cadastres already exist in Australia based around the conveyancing system. The central elements of these systems are title registration and cadastral surveying.

It is incorrect to term such systems "cadalstres" because it is misleading and since it distorts the view or what constitutes a true cadastre. It is for this reason, and also because of general opinion, that it is suggested that such Australian systems Should be termed " cadastral systems " -a general and less specific term

In contrast to this, the term "cadastral surveying" is so universally adopted

in Australia, and even enshrined in lcgislation, that it has to be adopted; however, it is a narrow view of the term since, in Australia, it is only concerned with isolated, non-coordinated surveys ofland parcels.It has little to do with large-scale cadastral mapping and has nothing to do with valuation. It is principally designed to scrve the legal requirements for the issue of titles as an adjunct to the conveyancing process.

A STATEWII>E PARCEL-BASEI> LAND> INFORMATION SYSTEM CENTRED AROUND A JURII>ICAL CADASTRE

The major problem with the introduction of parcel-based land information systems in common law jurisdictions is to find some economically justified system which will produce a complete up-to-date register or parcels based on large scale cadastral maps. The only realistic approach is to adopt an existing parcel based system and develop it to meet the land information system requirements. In common law jurisdictions, the choice is usually between the existing land registration and cadastral surveying system, and the land valuation or assessment system. Considering the issues discussed throughout this article, it is suggested that a system should be developed from and based around the existing legal property records. This approach has been adopted for the Western Australian land infonnation system. The *Syst'm Rt'f'r't'nc't' Guidt'* (Western Australian Government, 1982) makes the following observation regarding their strategic plan :

If tilt' Land Information System is to bt'nt'jit urban plannt'rs and otitl'rs, th't'ir rt'U'uir't'ments need to ride an the back of other developments which can be mori? easily cost Justift't'd. This is accomplisht'd from a foundation built on tht' It'gal cadastr' and its accompanying graphical repr't's't'ntation

Further, the *Syst'm Rt'f'ert'nc't' Guidt'* makes the following statement regarding data integrity:

...tilt' initial developments M U ST bt' built on the primary (statutory) sources of informatian ...hert' tilt' maintenance of tht' sourct' data is part of an e.\isting administrative process such us conve'oning und land development procedures.

A suggested conceptual model for a state-wide parcel based land information system is shown in Figure 2. The model is designed around a juridical cadastre. In general it is based on the cadastral principles outlined earlier in this article. It is in accord with the trends of modern European cadastres although it takes into account the individual requirements of common law systems. It is in general accord with two of the most modern state-wide land information systems today, namely the Swedish and Western Australian systems.

The model is a modified form of the National Research Council (19BO) model. but with increased emphasis on the juridical cadastre and land registration in particular. It comprises four major components which can be directly related to existing land administration systems. as follows:

- (1) The geodetic reference framework and the topographic base map. Most common law jurisdictions have existing organisations which undertake these functions,
- (2) The cadastral data base or juridical cadastre. This is either one organisation

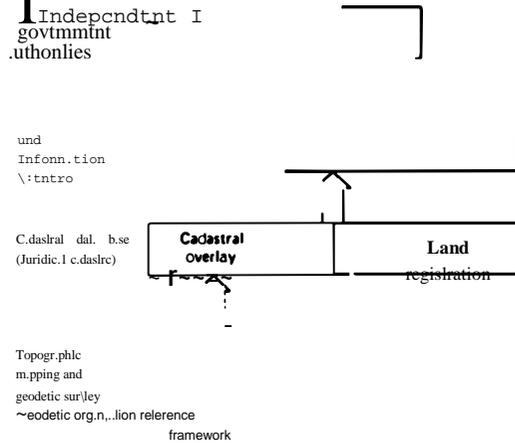


Fig 2 A statewide parcel-based land information system centred on a juridical cadastral

or two organisations under one administration. The land registration function would be undertaken within an existing deeds registry or land titles office. The cadastral overlay would be derived from the existing cadastral survey operations. The major difference from existing systems would be that the cadastral overlay or map would be a major component of the system. The primary role of cadastral surveying would be to update the cadastral map, not to prepare a single isolated survey to support the conveyancing system. The cadastral data base would be updated by the existing conveyancing and subdivision procedures.

(3) The land information centre is the linkage mechanism which connects cadastral data base to the individual data bases of secondary components in the land information system. This centre should have an independence and overall responsibility for the land information system.

(4) The existing independent government authorities should develop their own data bases using the up-to-date cadastral data base. Each authority should own and manage its data. Each authority should be able to access other authorities through the land information centre.

There are two main features of this model. Firstly, that it should be developed in an incremental and evolutionary manner based primarily on existing systems. Secondly, there should be an emphasis on using primary data sources such as the conveyancing and subdivision processes. To keep the system up-to-date. For more detailed discussion on such matters reference should be made to the System Reference Guide of the Western Australian Government (1982) and Williamson (1983).

CONCLUSION

The primary objective of this article is to promote the concept of a juridical cadastre as the foundation for a parcel-based land information system in common

law jurisdictions. As part of this objective the cadastral concept and the origins or cadastre have been reviewed. Such a review assists governments in gaining a better appreciation of the role and objects or the components in a land administration system. If the cadastral concept is not understood, a land administration system may lack coherence and direction.

The review of the historical development of cadastres highlights the dominance of the legal components in a modern European cadastre. This situation evolved gradually from a fiscal base. Today there are two central components in such a cadastre; firstly, the cadastral mapping and property system which is run by the cadastre office, and secondly, the land title registries. The trend is to maintain the property registers from both components on one data base.

European cadastral principles have relevance and can be very beneficial in common law land administration systems, but the principles cannot be applied directly. Consequently, a review has been made of the characteristics of common law cadastral systems which distinguish them from their European counterparts. In particular the systems in England, Australia and North America have been briefly considered. The major differences arise from conveyancing, land registration and cadastral surveying practices. The legal systems to support the alienation of land, and the recording and transfer of interests in land have a long-established history since colonisation. The fiscal systems in common law jurisdictions are not as sophisticated and have a much shorter history. This is in sharp contrast to the European experience. A critical result from the above developments is that, in common law systems, cadastral surveying is only concerned with conveyancing and the subdivision process on an individual parcel basis. Cadastral surveying is not directed at creating and maintaining a large-scale cadastral map.

These systems often result in much duplication of cadastral mapping and charting, particularly by utilities and local government authorities. Valuation systems also duplicate the cadastral mapping system, but they do not have the accuracy, completeness and systems to support the integrity of information, which is characteristic of their European counterparts.

A synthesis of the above investigations suggests that any future parcel based land information system should have a juridical cadastre as a central component. This will be easier in jurisdictions which operate a title registration system. In jurisdictions which operate deeds registration there may be a temptation to base the system on records other than those maintained in the land registration office. This approach is not recommended.

One of the other major limiting factors in introducing a land information system based on cadastral principles is that the cadastral concept is not clearly understood. In order to gain some insight into this problem, the perception of cadastres was briefly reviewed in North America and Australia.

The North American model of a multi-purpose cadastre is a concept or ideal; it is not a practical solution. The model suggests a lack of appreciation of the machinery which makes the European cadastres operate. On the other hand the model should not be considered a 'cadastre' in the European scene. The diversity of terms used across North America to describe the concept reinforces the theoretical nature and diversity of the research.

In Australia the cadastral concept is also not fully understood, nor are the principles generally pursued. Such a position has led to different perceptions of

CADASTRES AND LAND INFORMATION SYSTEMS IN COMMON LAW JURISDICTIONS

cadastres and their application in Australia. The general view is that Australia already has cadastres. Consequently the essential elements of a cadastre are often not reviewed or considered.

As an aid to explaining the role of a cadastre in a state-wide parcel based land information system, a conceptual model has been suggested. The model is a modified form of the North American model mentioned previously. The model is designed around a juridical cadastre. The major difference: is in the role of land registration.

ACKNOWLEDGEMENT

The author wishes to gratefully acknowledge the assistance given by Dr J. D. McLaughlin. University of New Brunswick and Professor D. W. Lambden. University of Toronto. in the review of this article.

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I. P. WILIAMSON

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