Computerising the New Zealand Land Registry Office

by

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I. THE NATURE OF THE PROJECT

This approach to the topic of computerising the New Zealand Land Registry Office has been of an original nature rather than a study of the works of others. The principal method was to conduct a series of interviews with people having knowledge of the present land Transfer System, and of computers. It is important to note from the outset that on the one hand manufacurers of computers and on the other hand users of computers must endeavour to familiarise themselves with the capabilities and needs of their opposite number respectively, because if no common ground is found, the system will work badly and probably be useless to the operator, whatever field he is involved in. For this reason I have attempted in this paper to put myself in the position of a "go-between" for computer technicians and the Land Registry Office.

The result at which I arrive will necessarily be rather general both as to the type of computer system to be utilised, and as to its cost. It would be necessary for a qualified systems analyst to spend several months of careful planning to arrive at a specific system to satisfy the needs of the prospective user.

The paper will take the following general form: first, the present New Zealand Torrens system will be briefly outlined together with its shortcomings as seen by Registry Office Staff and users of the system. Included will be figures for usage and projected usage of land registration and search facilities. Secondly, computer units and peripherals that could possibly be used for a system such as this are described briefly, followed by a slightly more detailed discussion of units I consider to be most useful in the present hypothetical system. A computation of approximate prices of these units follows, along with an informed guess at running costs.

The paper concludes with a chapter on human consideration in the system, both as regards Land Registry Office staff and the legal profession.

II. The Present Land Transfer System

A. General

Land Transfer Registries are at present located at Auckland, Hamilton, Gisborne, Hawke's Bay, Taranaki, Wellington, Marlborough, Nelson, Westland, Canterbury, Otago and Southland. Solicitors in towns other than the above must do all searching and registration by making their own communications with the office containing the titles concerned. This of course involves expenditure of money and much valuable time, and lessens the efficiency and safety of the system due to the possibility of other dealings being registered ahead of one's own. Indeed there are many difficulties in the present system.

Delays being encountered under the present system are long, and becoming longer. The volume of work increases year by year, and the ability of Land Registry Office staff to handle the load is increasingly strained, purely because of human limitations. It is obvious that some way of speeding the system up must be found before the delays and consequent inconvenience and insecurity of title become intolerable. The delays at present between presentation of documents for registration, and actual registration are measurable in weeks and even months. This sort of situation must not be allowed to develop to the extent that it has tended to in Australian Land Regisry Offices, where delays have increased to many times the size of those experienced in New Zealand. Insecurity of title can result despite the fact that registrations achieve priority according to the time of their presentation in the office. Evidence of this is the operation of s. 39 of the Land Transfer Act 1952. The case of *I.A.C. Finance Pty Ltd.* v. *Courtenay*[2] is an example of such insecurity. In that case a transfer of some land was lodged in the local registry office for registration by the vendor's solicitor who had authority to do this. When a contract for repurchase by the vendor was entered into, the solicitor, without authority, uplifted the documents from the office before the staff had had time to register them. The repurchase contract was not completed but despite this the vendor resold to a third party with notice of the first transfer. For various reasons, the original purchasers were held to be entitled to priority of registration, but only after this expensive litigation had reached the High Court of

[2] (1963) 110 C.L.R. 550.

Australia. Inconvenience arises when a title is searched by a person between the time of presentation of someone else's document for registration, and its actual registration. Strictly speaking, the office's journal, which shows documents received in previous weeks, should be consulted as part of every search. However, this is tedious and even uncertain, as one can never be sure what the exact backlog of Land Registry Office work is, and some documents might take longer for the office to process than others. If every law clerk was to search this record, there would be quite some rush on it, especially as the book must also be in considerable demand for the making of entries in it.

At present there are a number of deeds titles still in existence in Land Registry Offices in New Zealand. These are few in number, and rarely, if ever used. It will undoubtedly be possible to ignore these titles when conversion is made to an automated system. The titles are kept separate at present, and can surely be kept separate from the computerised titles during and after conversion. There are so few deeds titles that no problem will occur in dealing with them manually, and they can slowly be converted to Torrens title and computerised as the need arises. The Limitation Act 1950 should cure them all in time anyway.

In one recent article[1] an idea was proffered that under a computerised system the duties of Land Registry Office staff would become less clerical, and more professional or intellectual in nature.

Theodore B. F. Ruoff[3] has discussed briefly the nature of these intellectual duties. Examples would be: quasi-judicial powers of the District Land Registrar under the Land Transfer Act; statements of difficult concepts of law in reasonably simple and understandable form for inclusion in certificates of title; advising solicitors on difficult problems of Land Transfer law. This latter task involves about 50 percent of the time of the Auckland District Land Registrar and his four senior staff members.

Under the present operation of the system, owners or mortgagees of plots of land hold duplicate certificates of title which can be legally used to represent the present state of the title, despite the fact that any sensible person would realise that the Register copy must always be searched. It is known that duplicate certificates are frowned on in official circles, and it could possibly be recommended that under either the present system, or an automated one, the practice be altered by amending s. 36 of the Land Transfer Act 1952 and several other sections which refer to title duplicates, such as

[1] D. J. Whalan, "Electronic Computer Technology and Torrens System".
[3] "An Englishman Looks at the Torrens System" (1957), 82.

s. 40 and s. 75. Duplicate titles are rarely kept up to date, and some interests in land, such as liens and caveats, are only entered on the Registry Office copy of the title. Under a computerised system, search copies would be printed out, valid at the time of printing only, and the computer's own record of the state of titles could be made the only legal up-to-date copy. There must still, however, be duplicate copies of titles which can be held as evidence of title by Registered Proprietors and as security by mortgagees, especially equitable mortgagees. Thus it may be necessary in amending these statutory provisions to provide for the retention of the duplicate title system for this purpose, but to forbid such titles to be represented as the true copies of the state of the register. A full search of the register should always be made before transactions involving land are entered into.

A weak point in the present system is felt to exist in the operation of the "Disaster Duplicate" system, a system by which copies of all certificates of title in New Zealand are supposed to be made and stored in another part of the country as a means of avoiding the total destruction of these important records in the event of civil disaster. Auckland titles are stored in Blenheim. The weak point stems from the fact that the duplicate records are not kept up to date. In 1959, microfilm copies were made of all Auckland titles as they then existed, and stored in Blenheim. Neither new titles, nor the changed state of existing titles have been added to the Blenheim collection since then, although the Land Registry Office is at present microfilming current titles during the conversion to smaller certificate sizes. These new microfilms will again be sent to Blenheim. Thus the disaster duplicates are brought up to date only every few years. A result of this practice is discussed in literature published on the chaos in Land Registry Offices following civil disasters in Napier (earthquake, 1932), and Papua (World War II), where complete offices were destroyed. In these places interim titles were apparently issued, and declared absolute if not challenged after a certain length of time! The mess is still not finally resolved, and it says little for the security of titles envisaged and advocated by Torrens for the system he pioneered. A computer will be seen to be helpful in providing immediate duplicate material.

There at present exists a problem of attempting to search titles for which the searcher does not know the legal description. At present one must know where the property concerned is situated, as a map covering the whole residential area, say of Auckland or Whangarei, must be studied. This map, known as the R-plan, is divided into smaller numbered areas, each of which refers to a separate large map of the area, showing all roads and plots of land. One finds the road

and the location of the property in the street. Each lot has its title number written on it. This procedure can be tedious and time consuming, but must only be done where knowledge of the land concerned is so sketchy as to prohibit enquiry of local authorities as to the legal description, which they hold for rating and other purposes. A computerised improvement on the R-plan system will be discussed in a section of this paper on special problems and aspects of a computerised Land Transfer system.

B. Business Volume

Calculations must now be made of the requirements of a computerised Land Transfer system, by reference to capacities and work loads experienced at present and in the past. Firstly, in the Auckland office there are about 10,000 registrations per month. It could perhaps be assumed that in the same time in the same office, there is a maximum of about 20,000 searches, remembering that many searches do not culminate in registrations, such as surveys for developments of reserves and subdivisions. Some people also make multiple searches of properties, especially surrounding the land in which they are interested; for instance, people looking up rights of way and fencing covenants concerning neighbouring land.

If there are 20,000 Auckland searches per month, there would be approximately 1,000 searches per working day. 1969 figures show that on the basis of registrations completed, Auckland has one-third of all New Zealand Land Registry Office business (107,000 registrations out of 324,000), so that in New Zealand there must be about 3,000 searches per day. Registrations would equal approximately 1,400 per day, or 27,000 per month. It seems that allowance must be made for an annual increment in New Zealand registrations of about 11,500 per year.

For the purpose of calculating storage capacity within a computer, and the number of titles at present in use, a calculation of future titles, must be made as follows:

Titles in 1964	1,136,000
Increase in 1965	35,000
Increase in 1966	40,000
Increase in 1967	42,000
Increase in 1968	46,000
Increase in 1969	50,000
Titles in 1969	1,349,000

The annual change in increment seems to be approximately "plus 4,000", so that 1970 should produce an increase of about 54,000 in the number of titles stores, giving a total of 1,403,000 titles. Therefore it seems that future storage capacities should be calculated roughly to allow for an increment in the annual addition of titles, of about 4,000.

If it is an economic proposition, it might be possible to store within a computer copies of all instruments relating to transactions registered or noted on certificates of title currently stored in Land Registry Offices. There are usually several of these per title, and they could prove to be a problem economically and physically to store in a computer, unless they could be drastically reduced in size by summarising their contents. It is also worth considering altering present conveyancing practice to this end, by statutorily implying conditions, covenants and the like, and allowing for specific negativing of some or all of these in individual documents, and the specific inclusion of special ones as desired in individual cases. This suggestion is discussed more fully in Chapter VI.

III. Computers, an Introduction

A. General

Essentially a post-World War II innovation, the computer, or "data processing unit", was invented and developed to handle series of operations upon many kinds of information, chiefly scientific or for business purposes, to achieve desired results. Very simply, most computers are made up of several units doing specific tasks within the system, and all for vastly differing tasks, at varying costs, and working at different speeds. It should here be noted that in computer terms, a slow speed involves several seconds of time, whilst a high speed is a matter of millionths of a second. Ever since the invention of data processing units, technology in this field has advanced to such an extent that speeds of computer operations are increased by many times, and costs often reduced by many times, due to the invention of new types of components, and to the refinement of older ones. This fact has an important application to the subject of the present research, and to many other computer uses: one can expect in the future that machinery will become obsolete and outdated by newer, faster, more economical units. It cannot be stressed enough that current modern equipment might not be in use in a few years' time, and that much more advanced machinery will be available for the same tasks. The basic operations should remain however, even though the methods by which they are accomplished will advance.

Any data processing system is made up of a number of units, the key one of which is the Central Processing Unit (CPU). The other units consist of a storage device, or "memory" section of the computer; the input unit at which information which is to be processed or stored is inserted; and the output device, from whence stored material or a processed result is received.

B. CPU

This is often referred to by the man-in-the-street, as the "thinking" part of the computer. It is not true of course that computers can think as can the human brain. The CPU is made up of a series of intricate electronic circuits and components, and its function could be aptly described as being the "nerve centre" of the system, and it consists of two parts; the arithmetic-logical unit, and the control section. The former is the performer of the tasks required to be done on information or data fed into the computer, and the latter consists of a "console" for a human operator to request the tasks to be performed, usually by a push-button method. As said above, the computer does not think for itself, but will only act on input data in the manner allowed for in the "program" controlling it at the time. This program is a series of instructions to, or capabilities of, the machine, entered into the storage or memory unit before the machine can be requested to act on those instructions and process any data fed into it. Even the simplest of computing operations must be allowed for in the program. As an example, if one wished to enter data into the computer, and add this data (say of a lease or mortgage of a plot of land) to material (the Torrens title) already stored in the memory unit, and receive a print-out of the new state of the title, one would have to instruct the processing unit as to how to do each of these three operations, in some part of the program. The computer, now loaded with these "capabilities" will do these actions as instructed at any point in time while that particular program is stored in its "memory". A program is written for a computer in any one of several special languages which are translations from any human language, into a machine-readable language represented on several different input media, which actuate components inside the computer storage.

C. Input and Output Devices

These are units through which the initial program or the data to be processed or stored is entered into the system, and through which stored data or processed results are received from the system. Input units "read" coded data, either the initial program discussed above,

or the subsequent data to be processed. (One input unit on a computer can do both tasks.) The coded data are recorded on any one of several "machine-readable" media; for instance, "punched" cards, "punched" tape, magnetic tape, and paper documents utilising characters in magnetic ink.

In all cases there are machine units to "sense" the punched holes or magnetic patches, and transfer the material sensed to the CPU or the storage units, in an electronic manner. The same methods, and one or two others, are used to receive the data from the computer at the output unit. A full discussion of the various type of input and output units appears in the next section of this paper.

D. Storage

The program or set of instructions to the machine is found here. So, too, is material to be permanently stored for future reference, and all data to be processed by the CPU must pass through this unit. An IBM instruction manual aptly describes storage units as "electronic filing cabinets, completely indexed, and almost instantaneously accessible to the computer". The computer can sort, file, and classify different types of information received from the input unit, and is able to take data from storage, process it(i.e. calculate new information), and place the result back into storage instead of printing it out, if so requested from the console, and if the program includes this action as one of the machine's capabilities. Many different types of storage unit exist, all differing in capacity, cost, and speed of access. These, too, will be discussed in the next section. Storage can be random-access involving immediate location by the computer, or sequential access involving the need to sort through data until the needed material is found, much as one plays a tape recording through.

IV. Computer Units and Peripherals (General)

A. Input Units

It should be noted here that a number of types of input machines are usable as output machines also. Where this is the case it will be pointed out.

1. *Punched Cards.* This medium is about the oldest form of input, and consists of postcard-size pieces of card with eighty vertical columns marked on them. Each column can represent one character or letter, which is determined by the combination of holes punched in each individual column. A "typewriter" punches the cards, which are then fed into the computer in a pile, like the consecutive pages of a book. A "card-reader" or sensor notes the combinations of punched holes and transmits the data into the system. This method

is comparatively very slow, but inexpensive. It is also a common output method.

2. *Paper Tape.* A similar input method is by means of paper tape, also with holes punched in it, this time in parallel rows or "channels" along its length. A paper tape punch similar to the card punch is used to record the data. A reader senses and transmits the data to storage. This medium has the advantage over cards of being continuous and much less bulky. The input of it is at about the same speed, a "slow" 150 characters per second, and of a similar order of expense.

3. *Teletype Unit.* This unit seems to be a useful machine, though still rather slow for transmission of a great amount of material like Land Registry material. It consists of a typewriter connected directly to the computer storage (it is mounted on the controlling console), and transmitting material directly into the system, with no necessity for a "reader" as with the above two systems. Its cost is slightly less than that of a card punch machine, and a second saving occurs from the fact that no "reading" machinery is necessary. A similar unit is a very common output method: a large machine prints out a typescript copy of whatever is required from the storage unit.

4. *The Visual Display Unit (VDU).* This unit is an accessory for most input systems: it consists of a cathode-ray tube or television-like screen on which one can see the input data as it is recorded in the system by means of the keyboard connected to it. This unit is more important as an output unit and will be discussed more fully under that heading. As such it may be important for a computer system such as the one under discussion.

5. *Magnetic Tape* is another very common input medium, and is extremely fast compared with the "punched" media discussed above. A large volume of data can be recorded on one tape; about 10,000,000 characters. It is thus much less bulky even than paper tape. This method of input (and, just as importantly, of output) operates at very great speeds—in 1968, 640,000 characters per second. Unfortunately this great speed of input is limited severely by the speed at which data can be recorded on the tape: for the initial input of non-computerised material, a "typewriter" must once again be used. The position would be different if, say, one were transferring Register data from one computerised system to another (for instance, a conversion from an "old" to a modern computer at some time in the future), whence magnetic tape could be used as output from one computer at the (1968) rate of 640,000 characters per second, and immediately used as input for the new computer at the same rate.

(Speeds in the future are likely to be higher: witness the change between 1964 and 1968 of 340,000 characters per second, to 640,000 characters per second.) It is even possible to transfer magnetically taped data from one location to another by telegraph, between two magnetic tape transmission terminals of the IBM 7701 or 7702 types (1964 models). It is possible to convert paper tape data to magnetic tape for faster input, through a converter IBM 7765 (1964). This would not speed up initial conversion of Registry titles and other material, as one is still limited by the speed of operation of the paper tape writing machine. It would thus be of no advantage and needlessly costly to interpose an extra step in the input process. If one were to use the magnetic tape input process, a typewriter-like machine would have to be used. It is rather more expensive than the paper and card-writing machines, but is recommended for systems where much bulky material is to be introduced. This is because of the huge capacity of these tapes, leading to far less bulk of input material compared to cards and paper tape. Data is recorded on the tape as magnetised spots called "bits". The material can be retained on the tape for an indefinite length of time, or immediately erased, leaving the tape available for re-use. Modern types are ½ inch wide and come in lengths of up to 2,400 feet per reel. The data is recorded in parallel tracks or channels along the tape, each row of "bits" across the tape representing one row of data (not merely one character as with punched cards). As at 1968 it was possible to obtain character densities of the order of 1,600 characters per inch.

6. *Optical Readers.* In 1967 it was noted in an article[4] that "optical scanners" were in existence and that hopefully in two to three years, efficient ones at reasonable prices would become available. In part this prediction has come about. From then being able to read certain types of typescript placed carefully in allotted portions of standardised simple documents, IBM have developed an optical reader which can read hand-printed numbers also placed in certain allotted spaces on such documents, and written in pencil, and black, purple, red and green inks, and also imprinted numbers. It also reads one style of IBM output typescript and several commercial typescripts, not necessarily in specially allotted spaces on a document, but only in upper-case (capitals) form. The machine is rather limited, as can be seen, and would not, unfortunately, be useful in converting the present Land Registry Office records to a computer system. The optical reader operates by focusing a powerful light-and-

[4] D. J. Whalan, "Electronic Computer Technology and Torrens System" (1967), 40 A.L.J. 413.

dark sensing ray upon the document being read, and transmitting the dark, written-on areas of the document through its electronic circuits to the computer storage. The most remarkable features of the most up-to-date IBM optical scanner are its re-scanning and on-line correction possibilities. If the machine encounters a broken or illegible character, it re-scans it ten times in a fraction of a second, and if it still fails to read the number, it is shown on the "viewer" which displays all the date being read, and an operator can use a special keyboard to insert the correct number. The whole machine operates at split-second speeds, and one can only hope that it can be developed further in years to come in order that one could be used to convert a great bulk of material such as comprises the present Land Transfer Register. It might even not be too much to expect that this type of machine might ultimately be able to read and record diagrams such as those on certificates of title and deposited plans. However, technicians are unwilling to predict either of these two possible advances, and only point to past amazing developments in types of machinery, speeds of operation, and reduction of costs.

7. *Magnetic Characters* can be read by a special reading device, and constitute yet another input medium. These characters are found on simple standard-form documents such as cheques (account numbers). The advantage is that the characters can be read by both humans and computers; however, the use of this medium is expensive in any large quantity and would be useless for bulky documents like Land Transfer titles, and their related instruments.

8. *The Input of Line Drawings, a Special Problem.* A problem that will be encountered, is the input of deposited plan and title diagrams. It appears that a machine known as the "D-mac pencil follower", marketed by the D-mac company in Scotland, is at present the only solution to this difficulty.

The machine consists of a "table" on to which is placed the diagram to be copied. The table is usually three feet square. There is a "head" or "pencil" which is moved manually along the lines of the diagram by the person operating the machine. As the end of one line is reached, a foot or hand-switch is pushed, and the line just traced is electronically recorded by means of a "bug" under the table top which has followed the movement of the pencil above. Several types of pencil are available for different jobs: all are connected to the rest of the machinery by a flex. There are two ways of recording the information gained from this process. The first method involves feeding the data directly ("on line" or electronically) to a connected computer storage unit. This would probably be the case in a Land Registry conversion. The second method is to utilise

another D-mac product, a console and output unit which visually displays the information being recorded, on a screen, and at the same time prints out the information in machine-readable form such as magnetic tape, to be used in a later computer data input operation.

This latter method would be unnecessary in the conversion being considered in this paper, as diagrammatic data could be put into the system concurrently with other data from titles. Non-utilisation of the second piece of machinery will halve capital and operation costs for this process.

To transmit typescript data inscribed on a diagram such as is found on titles or deposited plans, a typewriter is mounted on the unit. Deposited plan numbers, road names, flat numbers, and other information would have to be recorded.

There are six types of "pencil" available with this peripheral. Some take the form of a needle mounted on a "block" or a "stick", and others utilise cross-hairs that must be sighted against points on a diagram being followed. Some are magnetic for greater accuracy in copying photographs, but these are unnecessary for our present purpose. The two types most useful to the present system would be the needle mounted on a "stick" or one on a "block". The "block" head is the more accurate but usable only for straight-line diagrams. The "stick" head could be used on diagrams consisting partly of curves such as river and sea boundaries.

To check for mistakes, the D-mac VDU can be used, or a computer's own VDU or other output unit. If a mistake is found it is possible to return the pencil to the last correct co-ordinate on the map, press an erase button, and recommence.

The New Zealand agents for this machine[5] have worked out an approximate maximum price for one of these machines, including importing costs and installation costs. The company has also calculated costs on the basis of importing a machine itself, and leasing time to interested individuals and corporations.

Several sizes of unit are available:

A 100 cm by 45 cm table, complete with one pencil, console and output unit for either paper tape or card punch, teleprinter or typewriter: £UK3,995 F.O.B;

A table of 100 cm by 100 cm with similar accessories is £UK4,605 F.O.B;

A table of 122 cm by 122 cm is available, no cost being specified, as it is made to order only.

[5] Elekon Overseas Limited.

"Pencils" over and above the one supplied as standard for all three units, cost £20.

Keyboards are extra at £130 to £350, depending on the number of characters needed.

A table without console and output is about half the cost of the complete table and accessories.

All prices are quoted as at 1st January 1970, in British pounds, and are freight on board only. Costs of freight, insurance and import duties are therefore still to be taken account of. The capital cost of a unit for the Land Transfer system conversion should not exceed $NZ10,000 made up of £UK3,300 for table minus console and output, £20 for the extra pencil, and a 46-character keyboard at £350, and including importing costs.

A member of the agent's staff predicted that the future might see a development, by D-mac or some other company, of a type of light-sensitive optical scanner that could read diagrams. Such a machine would undoubtedly be of great assistance in computerising the Land Transfer Register.

B. Output Units

1. *Punched Cards, Paper Tape, and Magnetic Tape,* as discussed above, are available, magnetic tape being by far the quickest, but none of them readable by human beings, and therefore useful only as input media for the same or another computer, and useless as print-outs in the searching of Land Transfer documents.

2. *Line Printers* of various types will have to be utilised in the system under consideration. These print out required data on paper, and this can be read by humans. Electronic circuits in the computer actuate a "wheel", a "wire matrix", a "chain", or a typewriter.

The "wheel" method involves utilising 120 wheels side by side in the printer, each having characters on dyes around their perimeters. Each wheel is used for one column down the printed page, and is electronically actuated to strike one of its 48 characters against the page, pressing it against a carbon roller behind. All four types of line printer have a "paper-transport" to move the paper automatically as printing progresses. The 120 wheels allow for 120 characters per line, including gaps between words, although this number can be reduced and the sheet divided into several columns. Print speeds in 1964 were 150 characters per second. Two types of printing are available: upper-case (capitals) and lower-case (capitals and small letters). Both include all punctuation and numbers. Speed for lower-case is much slower than for upper-case, and is more expensive. It

appears that if this printer were used in the system, the slower and more expensive unit would have to be used, as small letters are used in such things as subsection numbers in statutes.

"Wire-matrix" printing consists of clusters of wires arranged together in small rectangles of five by seven wires—47 of such "rectangles", including one for each letter of the alphabet (upper-case and lower-case), and numbers and punctuation. Selected wires in each rectangle are pressed against an inked ribbon for printing—120 characters per line are again possible. Printing speeds from this device are considerably better than those from the "wheel" unit, being in 1964, 500-1,000 lines per minute. The speed in that range depends on the particular model of printer used.

The "chain" method involves an electro-mechanical line revolving like a chain around two wheels, and each link is the "chain" holding one character on a dye. Each character is printed as it becomes positioned opposite a mechanically actuated hammer on the opposite side of the paper—132 positions are possible per line, and the speed is 1,285 lines per minute. The chain is easily changed or replaced.

The typewriter method speaks for itself, except that the keys are automatically triggered. The speed is about 600 lines per minute (1964 figures). Spacing and carriage return are automatic.

3. *Visual Display Units.* Basically cathode-ray tubes, these units can also be supplied to display upper-case or lower-case scripts, the former once again being cheaper—136 characters can be shown per line and the unit can be used separately from, or in conjunction with, a line-printer or other output unit. Diagrams can be presented for a moderate extra expense, and can be called on to the screen in a much shorter time than it takes to print out the diagrams. Diagrams of tolerable complexity can be produced, and alphameric and numeric information can be produced on the diagram. It can thus be seen that graphic information can be stored and retrieved from storage, but a problem arises with the input of such data if one does not wish to go through with the complicated process of supplying the X and Y co-ordinates of all points to be joined on the diagram, and the radii of curves. It can be seen that this would be a prohibitively time-consuming process when transmitting certificates of title and deposited plans into storage during the initial conversion. It seems current technology can only supply the D-mac pencil follower discussed above, to overcome the problem. Where line-printers are used in conjunction with VDU's, it is possible to obtain a print-out of a diagram, but at the present stage of technological development, it is rather a slow process. Co-ordinates of points of conjunction of lines can be printed, and these may be joined by dashes. The method of

printing is not through computer memorisation of the position of lines, but is taken from co-ordinates of points, angles between lines, and radii of curves to be plotted. At present it seems that the input and output of Land Registry diagrams will be the clumsiest part of a computerised system.

C. The Console

This unit is the means of control of the system, similar to a telephone exchange. It consists of a collection of buttons, switches, lights, and a keyboard, and is used to request actions of the computer within the capabilities and limitations of the program (described previously). Instructions can be given to the computer by means of the keyboard on the console, or by means of pushing certain buttons to accomplish standard operations. The processing of data into the computer is done on a question and answer basis, the computer demanding instructions on the printer on the console such as "what type of transaction", and being replied to by the console operator with the instructions like "mortgage cancellation".

D. Storage

First, a distinction must be made between main and auxiliary storage. Main storage is that part of the computer in which data is held while being processed by the CPU. The data is immediately accessible to the CPU, and thus this storage must have a capacity to hold a usable amount of data at any one time—that is the document or documents being processed or searched, and also the program for the whole system, that is the instructions for processing. The purpose of the auxiliary storage unit is permanent bulk storage of the data held within the system. This material is not directly accessible to the CPU but is located and transferred there via the main storage unit in a matter of seconds or parts of seconds.

There are several types of storage units manufactured:

1. *Core Storage.* This unit consists of hundreds of small magnetic cores with wires passing through them, and placed in "planes" or flat squares of 16,384 cores. Electric current passing through the wires magnetises the cores and thus stores the information. This method is rather expensive and limited in size of storage, and so is perhaps best used for main storage only. It works at very high speeds.

2. *Magnetic Drum Storage.* This consists of a constant speed rotating cylinder coated with magnetic material which may be magnetised in spots on one of the several tracks on the drum, by a magnetic core near the perimeter of the drum, as the drum rotates past that

core. The core is called a "read-write" head. It was originally used only as a high-capacity, immediate-access storage device for storing data that was repeatedly referred to during the operation, or as a supplementary facility for main storage. More recently it has been developed for program storage, and as temporary storage for much used random-access operations involving limited quantities of data.

c. *Magnetic Disc Storage.* This involves the use of any number of phonograph-like discs, stacked one above the other, with a gap into which a read-write head can be inserted to read from and write on to, each surface of each disc, the data to be stored. A large quantity of data can be stored at a reasonable cost. Location time within the computer is fast, as access is by random method, and thus quicker than sequential access in which a whole tape must follow through like a tape on a tape recorder, to find the information required. New data recorded on a disc erases the old, just as on magnetic tape and magnetic drums. Discs turn at 2,400 revolutions per minute, and can have up to 500 tracks of data per disc. Convenient disc packs are marketed: groups of six discs mounted together and usable as a unit and removable, to be held in a disc-library if unused for a period.

4. *Data Cell Storage* is used for large quantities of data. It consists of a large cylinder placed vertically in its driving unit, and containing strips of magnetic film approximately 2 inches wide and 12 inches long. Each strip has 200 tracks for recording data. These strips are grouped in tens, each group being called a sub-cell. Twenty sub-cells make up a complete data cell. The cell drive can hold ten data cells. Access is direct, and the whole drive can accommodate many times the quantity of data of other storage devices, holding up to 400,000,000 characters.

5. *Magnetic Tape* is a relatively slow-access storage medium, being sequential. It is not to be used for systems requiring very large bulk storage.

V. The System and its Cost

Very briefly, one can now state the general pattern of the system being studied here. Computer units will be selected; plans will be made for conversion to the automated system, and staff trained for this; the machinery will be installed by the manufacturers. The system will be programmed (i.e. given its instructions and capabilities); the present Land Transfer titles, and perhaps documents relating to transactions, presently stored in Registry Offices, will be fed into storage; searches can then be made by requesting print-outs of the current state of titles, and registrations will be made giving instruc-

tions for this task and feeding in detail of transactions. New titles will be created and recorded by feeding in data exactly as during the initial conversion. The system will apparently be similar to computerised libraries already in existence, where material is fed in, stored, and referred to, except that the present application should be somewhat simpler, as less "browsability" will be required, because most searchers know where to look for their material (i.e. they know its classification). One of the main problems that will be encountered during conversion will be the non-availability for use of titles as they are converted. This problem does not occur during the conversion of most libraries, as alternative sources of material are often available, or a wait of a day or two is possible. Here, however, titles must be readily accessible when required, or economic loss or hardship could occur. The conversion will therefore have to be planned so as to have often-used titles unavailable at the least inconvenient times. It cannot be stressed enough that proper planning for any conversion such as this is vital. The computer technicians must be given an adequate understanding of the ultimate user's requirements of the system, and the user must take steps to acquaint himself with the types of machinery he can be supplied with. Only in this way can an efficient, useful system be set up, and the principle is no different from that involved in the sale and purchase of new cars! Many library conversions in the United States have been inefficient, and even useless, because of lack of adherence to this principle. The current manually-operated Land Transfer system has been analysed above. This, and an analysis of the system as it might exist in the future, are important prefaces to a conversion.

It is now necessary to make an informed guess at the types of computer units and peripherals that would be most useful for the present application. This is not a system analysis, which would take a professional systems analyst many months of work. Costs of units are given in round figures.

In 1970, approximately 1,349,500 land titles will be held in New Zealand. One should therefore allow for 1,500,000 titles in registry offices in a very few years' time, and for further increases after that. Huge storage capacities will be necessary. It is believed that it would be more economical on capital and operational costs to have one national computer for land registration, rather than two or more, particularly as usage or processing time of the data stored, will be small in quantity in computer terms. It seems fairly obvious that a data cell storage unit will be required for such a huge quantity of data as comprises the present register. The access time of half a second for this unit is relatively slow when compared to one-tenth

of a second for disc storage, but is so little different for our purposes as not to present a problem.

Prices can be quoted by IBM on a monthly rental basis or a capital cost of purchase. For a system such as the one contemplated here, the usage of machinery (for retrieval in searching and input in transactions) would be relatively light by computer standards, so the machinery should operate economically without wearing out before the generally accepted ten-year maximum life. Rentals are cheaper than outright purchase only if the use does not exceed four years. Monthly rentals are therefore usually calculated as one forty-eighth of the capital cost. In the present application the only real need for rental or contract usage of machinery might be if the initial filing of all New Zealand certificates of title were to be done by optical scanner. There are two models of scanner available (and other firms make similar ones): IBM 1287 and IBM 1288. The cost of these is about $110,000 each capital, with an additional $30,000 if handwriting is to be read. Taking into account the fact that these are very fast and could complete the conversion job many times quicker than the two years using punched cards, paper tape or magnetic tape, a purchase would not be justified, as its job would be completed long before the four years. There is, however, a technological drawback at present with regard to optical scanners: they are not yet sufficiently advanced to read any type of document placed under them—special paper must be used and the characters must be placed in specified positions on that paper. Thus all certificates of title would first have to be converted manually to a form readable by optical scanner, and one might as well therefore leave out the optical scanner and do one's manual conversion straight to the machine-readable form for input, say paper tape or magnetic tape, and thus save money. Also, diagrams are as yet unable to be read by these peripherals. Rental rates for optical scanners are $2,500 per month, or $3,200 if handwriting is to be read. Computer technicians are unwilling to predict optical scanners capable of reading any given document, or of transmitting diagramatic information into storage, but most agree that technology is unpredictable and extremely rapid in its advances, and that the future might see scanners developed for these purposes.

Some costs for other units and peripherals that are considered useful for the present system can now be given. The costs are exclusive of import cost and duty, freight, and insurance charges, which will amount to something like 20 percent of the capital cost. Installation charges are included in the capital costs given, but line costs (New Zealand Post Office) must be separately negotiated. In New

Zealand, Post Office lines will have to be used for communications as they are the only comprehensive communication network in the country. Because a Government Department (the Justice Department) would be administering the system, the Post Office would be the most logical choice for communication, for it is not subject to the delays and inconveniences of ordinary telegraph lines. In the estimates following, running costs are something entirely separate, and include such things as accommodation for the machinery (which must be fireproof and air-conditioned), wages, and electricity and paper costs.

A basic computer that would apparently be suitable for the amount of processing that would be done in the present system is the IBM 64.K. Model 30. This is the basic CPU, with all its circuits and electronic components. It would cost about $159,000. The central control console to be attached to this CPU would cost $10,000. For the initial conversion of Land Registry Office records, an input-writing machine for say punched cards, paper or magnetic tape, would cost $22,000 and the input machine itself, with operating rate of say 1,000 cards per minute, $13,000. The data cell storage unit would cost $110,000, and the control unit necessary for input and output, $40,000. A remote-lines control box for communication links with the terminals throughout New Zealand would cost $10,000, and a large printer would cost $26,000. All the above briefly discussed units would be attached to the central national computer. In addition to this, there will have to be terminals throughout New Zealand, attached to the computer for the purpose of searching titles and registering transactions. These will have to be situated in present Land Registry Office centres and in perhaps a few other large centres. To calculate the number of terminals necessary throughout New Zealand it would be necessary to do mathematical calculations involving such variables as population of towns, amount of Land Registry Office business of towns and their outlying districts, comparative costs of having a terminal or phoning the nearest terminal, and the desirability and convenience of each of these alternatives, the amount of business at peak hours of the day or week, and the amount of time needed by each person for searching and for registration.

For argument's sake one could assume that perhaps twenty such terminals might be needed, as it would be impossible for the purposes of the present project to undertake mathematical calculations involving all the above variables. The cost of each terminal would be about $5,000 for console and VDU, with an extra $4,000 for each small printer. With say twenty terminals, a figure of $180,000 would

have to be spent, excluding the cost of communication lines. An IBM unit similar to the terminal that would be used for a system based on the IBM 64.K.30 is the IBM 2770 terminal. This terminal is in fact designed for use on IBM System 360, a slightly different system, but the principles of operation of the IBM 2770 are similar to the terminals that would be required in the present system. The IBM 2770 consists of a basic console, keyboard, and printer, and can transmit data over common carrier public communication networks. There can be any two of the following optional devices connected to it: IBM 2265 VDU; IBM 2502 Card Reader and/or IBM 545 Output Punch; IBM 1017 Paper Tape Reader and/or IBM 1018 Paper Tape Punch; IBM 1255 Magnetic Character Reader; two IBM 50 Magnetic Data Inscribers.

An addition of all figures mentioned in the above cost discussion will give a total capital cost of $570,000 for the system. It should be noted in this regard that the figure of $13,000 for purchase of an input machine for use during conversion could be replaced by a sum of $15,000 for six months' rental of an optical scanner; however, it is obvious that because of the limited capabilities of present scanners, it would be necessary to convert present Land Registry Office records to a standard form able to be read by scanners, and this would add a very large figure to the $15,000 quoted, and make this method an uneconomic proposition until such time as scanners are developed that are capable of reading line drawings and ordinary typescript placed on any document and paper. At present it would be necessary to utilise a machine called a "D-mac pencil follower", discussed previously in Chapter IV to transmit line drawings on certificates of title and deposited plans. The cost of this is about $10,000. To the overall figure of $580,000 is added 20 percent for import costs and duties, and insurance: this gives a total capital cost of $696,000.

An important note must be made here with regard to capital costs. A figure approaching $750,000 dollars may seem frighteningly high for a conversion of the Land Transfer system, even when taking into account the vastly greater convenience, speed, and security given by the new system. It is worth noting that a system as described above could be utilised by the Government for a great deal more than just the Land Transfer system as it exists at the present time. As will be discussed in a later section of this paper, it will be possible to include several things such as Town and Country Planning zonings, statutory charges and equitable interests on the register, which although not matters of title, affect interests in land, and especially the value of

these interests. In addition to this, the vast quantity of unused time on the computer still available, could be utilised for basically similar purposes to the Land Transfer system. This could include general usage by other Government Departments and even Regional Authorities. These usages would be similar to the present projects of the Auckland Regional Authority and its Dunedin counterpart, of computerising regional land use information such as soil types, building heights, population densities and traffic patterns. The Land Transfer system as envisaged in this paper would leave much unused computer time, but very little unused storage. It would herefore possibly be necessary to increase the storage capacity before being able to allot time to other concerns. It is worth noting in regard to maximum utilisation of computer time, that some systems marketed by IBM and other manufacturers are capable of "concurrent programming". This means that several uses can be made of one computer at any one time, simply due to the fact that the main (core) storage unit is divided into partitions, each of these being dedicated to one particular usage, and each working independently of and concurrent to the others. This could be another way of using the Government's capital outlay to the maximum.

Costs of operation are equally important in any computer system, but less easily calculated. An IBM advertising publication contains figures obtained in a comparative study of costs by a management consultant firm in the United States. According to this survey in 1960, out of every $100, $54 had to be spent on machinery for $46 on personnel costs. This is presumed to be capital cost of purchase, and running cost throughout the approximate eight to ten-year life span of a computer. The study predicted that the 1970 ratio would be 21 : 79 for machinery and manpower. This presumably takes account of lowered capital costs due to more advanced technology and economy of production, and also the rising cost of labour. The figures are of course United States ones, and the picture might be different in New Zealand, with a possible lower ratio than one to four, especially after higher capital costs in New Zealand are taken into account due to import costs, import duties, and insurance. It might be that the ratio in New Zealand be one to three, and that after adding an operating figure of $2,250,000, and allowing for maintenance costs of say $100,000, that the overall cost for about eight years' working life of the system, would hopefully not exceed $3,100,000. When one takes into account that for the addition of some small extra running costs, several uses can be made of the computer by bodies other than the Land Registry Office, the system becomes even more desirable.

With regard to renewal, computers seldom have a useful working life of more than eight years, and exceptionally ten. After this length of time, parts wear out, and defects delay a computer's normally quick and accurate operation. Its equipment also becomes outdated and the parts even superseded by vastly better machinery. Technology advances so fast in the field of automation that it definitely becomes desirable to attempt to keep up with it.

VI. Some Special Aspects and Problems

A. Several Users of One Title

It would be possible for two people to search a title, or to register a transaction upon one and the same title, but it may not be desirable that they should be able to do so at the same time, particularly if someone is registering a transaction. To overcome this it would be possible to include in the program instructions to the effect that it inform the second person who wishes to use the title, that it is "engaged". It would even be possible to program the computer to hold the title "engaged" while other titles are searched. A computer can do almost any complicated action as long as the program contained in its memory at the time allows for it.

B. Storage of Land Transfer Instruments

There are many thousands of these lengthy documents stored in the archives of Land Registry Offices. To put them into a computer without the help of a scanner to read them would be tedious and expensive. There are only really two alternatives to storing them manually as at present:

(i) to reduce them to standard form documents;
(ii) put them into storage by tedious paper tape or magnetic tape input.

The first alternative might be objected to by conveyancers, but it is surely a sensible solution to what could become a pressing problem. An example of a useful shortened standard form document is Form E of the Second Schedule to the Land Transfer Act 1952, apparently little used at present. Another similar way of shortening documents is to imply as many as possible commonly used covenants in instruments, and by statute allow conveyancers to alter, delete, or add covenants as needed, in other words, extend the operation of s. 68 and the Fourth Schedule of the Property Law Act 1952. This would surely be shorter than writing in all covenants intended to be used. Theodore Ruoff,[6] feels that documents should be in standard form for

[6] "The Land Registry Yesterday, Today and Tomorrow" (1969), 66 Law Soc. Gaz. 358.

ease of storage and reading, and he instances the cases of standard-form documents used in Britain by both estate developers and Building Societies for their mortgages, both without any outcry from the public or the legal profession.

C. Processing Instruments, and Security Precautions

If instruments are shortened as suggested above, there should be no problem, as regards time consumed, to process them immediately into storage (via a trained operator), at the time of actual registration. If instruments remain wordy, however, instruments may have to be collected at the Land Registry Office during a day or week, and processed into storage then. Whichever method is used, security precautions will have to be taken as at present. This will involve a check by an Assistant Land Registrar of signatures on documents, and of accurate processing of registration and instruments. This would entail full-time supervision of computer- or terminal-operators, by the Assistant Land Registrars. First, signatures could be checked. Then the contents of instruments, per medium, of VDU's mounted on the consoles, would be checked against the original copy of the instrument as the wording was typed out on the console typewriter. If desired, the computer could probably be programmed so that the entire instrument could be typed out in this way and checked on the screen by the Assistant Land Registrar, before a button was pushed to release the data into the computer's storage unit. In this way errors could be easily minimised, although it should be remembered that data in storage can be corrected at any time by the usual input methods.

D. The Disaster Duplicate System

The Disaster Duplicate System was mentioned earlier and shown to be inadequate. Two computerised improvements could be possible for this system. The first is to utilise two magnetic tape transmission terminals which transmit data one to the other by telegraph. Thus output from one storage unit becomes almost instantaneous input for another. Secondly, simple mailing of output copies of data could be used. The output could be microfilm or any other output medium, to be used as input in another computer or stored manually.

The drawback with the above two methods is the additional cost involved in a second storage and input-output unit. It might be adequate to store this material manually as already suggested, especially if the output medium is microfilm. The 3-M Company manufacture a fast, though expensive microfilm output peripheral.

E. Units of Measurement

Ruoff, in his article, "The Land Registry, Yesterday, Today and Tomorrow", refers to the British conversion of land titles from British units of measurement to metric ones. Due to New Zealand Government policy of a general changeover to metric units of measurement by 1975, it would seem advisable to convert Land Registry Office records to metric units whether or not the complete register is computerised. A computer would undoubtedly be the speediest and most convenient method of conversion, and it would be programmed to do the job either concurrently with, or separately from the main conversion of records to a computerised system.

F. Unknown Title Numbers

This problem as it exists was outlined earlier. Although the Land Registry Office would not operate accurately from a register compiled from property owners' names like the British Land Charges Department,[7] a small computer file could be maintained alongside the main one in storage, providing a correlation between street numbers and lot and deposited plan numbers. Some people would argue that street numbers might be too inaccurate for tracing title references, but the New Zealand postal system seems to operate reasonably well from them, and it could be argued that the use of street numbers for such a correlation file is surely more accurate than counting properties from the corner of a street, especially where no boundaries exist between one lot and the next.

G. The Register as "Everything"

Dr Douglas J. Whalan recently published an article entitled "Partial Restoration of the Integrity of the Torrens System Register: Notation of Trusts and Land Use Planning and Control".[8] The basic

[7] It is necessary to note at this point that an extremely interesting article on the British Land Charges Department just to hand has been written by Theodore B. F. Ruoff, entitled "A Computer for the Land Charges Department" (1970), 67 Law Soc. Gaz. 115. This article reveals that this British Government Department is expected to be computerised by 1973. Despite radical differences between the operation of that Department and our own Land Registry Offices, it is of great interest to note that similar computer units and peripherals will be put to use, especially cathode-ray terminals, in much the same way as this paper suggests for the New Zealand system. Also interesting to note in the article are searching questions by Ruoff as to whether progress is too fast or too slow in the action taken, and his conclusion that an automated system is desirable and easily adapted to. The learned author feels that if a computer can direct a manned moon landing without a hitch, it can carry out the very much simpler daily work of the Land Charges Department with similar accuracy!

[8] (1970) 4 N.Z.U.L.R. 1.

idea behind this article is to restore to the Torrens system a position of primacy as envisaged by its originator, and register all interests affecting a piece of land, to bind that land. Town and Country Planning zonings could usefully be included, both for ease of reference for searching before a transaction takes place, and also to utilise more fully all available computer operation time as suggested previously. Similarly, compulsorily taken land could be noted to this effect, as could drainage easements; nuisance, Health Act, noxious weeds and animal controls. All these things affect the value of land, and as such should be able to be conveniently searched along with matters of title which also affect values. A computer would be ideal for combining all these types of information together in automated-reference form, and could do the job much faster than any manual conversion of all existing reference sources and registries.

VII. Human Considerations

A change of practice in Land Registration would have certain inevitable effects on both Land Registry Office staff and law practitioners. The effect on the former was discussed in the section of this paper on the present Land Transfer system. It is sufficient to add here in this respect that properly trained "interface"-staff between solicitors using the system, and the machinery itself, will be required. The system must also of course be painstakingly planned in the initial stages, or it will be inconvenient and even useless. The working life of much of the present Land Registry Office staff would be taken up in achieving a smooth changeover if an automated system were to be called for tomorrow. It is not of course suggested that the very near future will see a system such as this, but it could be expected that, with continuing technological developments in computers and increasing delays and inconveniences in the system as it exists, an automated system will become definitely desirable or even necessary, within the next decade or two. It is interesting to note that the New South Wales Government has definite plans to have a computerised Torrens system in operation in the 1980s.

A well designed computer system should lead to speedier, more accurate land dealings and this should assist the development of good solicitor-client relationships. Searching will be similar to present practice, except automated and simpler. Stamp duties should probably be paid as at present, in a separate transaction. Registration would occur almost immediately on presentation of instruments. This latter fact, and a suggestion by Dr Whalan in his 1966 article, of provision for notices of priority of fixed maximum length to be entered to prevent adverse registration between searching, sale and

purchase contract, and settlement, would give greater security to solicitors' clients, and possibly lead to greater confidence in the legal profession. There would be no change in overall conveyancing and registration practice, but merely a vast improvement in efficiency.