**SPECIAL ARTICLE**

## SOME ASPECTS OF CONTROL SURVEY

*by A.C. McEwen*

In any jurisdiction, when a novel idea such as cadastral control survey is contemplated, it is not only inevitable but desirable that attention should be turned to the experience of other areas. Property surveyors, like many other professional people, are often parochial in outlook and, owing to the burden of their everyday duties and the comparatively restricted nature of their work, usually lack the time and inclination to investigate matters which appear to them to be of no immediate concern. At the same time, however, it is highly dangerous to assume that a solution that has proved satisfactory in one country can always be taken from its context and applied without further consideration to an apparently similar problem elsewhere.

When speaking of control for cadastral survey purposes, possibly one of the most discussed yet confused notions is the meaning and object of a co-ordinate system. It would be profitable then to devote some thought to this topic in an attempt to discover what such a system is and what it can do for us in Ontario.

Topographic Mapping Control

For the topographic mapping of large areas, wide acceptance is given to the principle of a framework of reference points which are suitably distributed and whose positions, as they increase in density, are calculated to descending orders of precision. The overriding rule being that of working from the whole to the part. The position of each point is then computed in terms of co-ordinate values, east or north from some convenient arbitrary origin and based on the particular type of projection most suitable for the area under consideration. From these co-ordinated values the reference points are plotted on map sheets and form the framework for the location of the required detail. As an aid to identification, lines are drawn at regular intervals to provide a geographical or a grid reference which, because of the shape of the earth, must necessarily contain some distortion. There is little need to stress these fundamental matters, but it should always be kept in mind that the lines drawn on a map sheet exist in imagination, rather than reality; that their establishment on the ground would frequently be quite impracticable; that their exactitiude or otherwise is simply a reflection of the field observations and that it is the physical framework on the ground that provides the governing feature. If this is appreciated, much of the misunderstanding concerning so-called absolute co-ordinate values will disappear.

Most countries have now established this type of framework and it will generally be found that the need for topographic maps, especially for military purposes, has been the motivating factor. Let us now consider why and how cadastral surveys have been or can be adapted to this principle.

Perhaps it should be stressed that, in cadastral work, relative rather than absolute position of boundaries has been the traditional objective. The concern of the land owner being the relationship between his property corners, not their precise distance from some remote and arbitrary origin. If this is true, why then bother at all with the overall picture; why not treat each property in isolation, without troubling ourselves with additional complications of academic rather than practical interest?

The answer lies in the historical development of a country and its own particular economic needs. I will now try to illustrate.

The very expression "cadastral survey" relates historically to the provision of information for taxation purposes and possibly the most famous example was the Domesday Survey of Norman England. Since boundaries were usually physically identifiable and since area was expressed in economic terms - such as the amount of land necessary to support a family - there was seldom any need to define boundaries in terms of measured distances. This pattern with its emphasis on the simple identification of a property, and its economic classification, has pervaded the English system of land registration right down to the present day. Yet more than most countries can England claim to have a co-ordinated survey system, the key to which is the work undertaken by a national organization known as the Ordnance Survey.

The English System

For land registration purposes, the Ordnance Survey prepares what might be called topographic map sheets, without contours. Physical features, both natural and artificial, are shown and the location of triangulation stations and bench marks is also indicated. Every parcel of land which is physically enclosed is given a separate number and is shown with its area to three decimal places of an acre. It should be noted, however, that the details of ownership are not shown - only the physical limits such as hedges and fences. All this information, which is constantly kept up to date, is derived ultimately from triangulation and traverse. But - and this is the feature of the English system - not a single bearing or measured distance appears on the parcel plans. It would be a digression to elaborate on the subject and it is sufficient to state that under the English Land Registration Act - which is in effect the parent of our Ontario Land Titles Act - there are no requirements for surveys as we understand them. Land transfer is based almost entirely on the information provided by the Ordnance Survey map sheets; measurements are almost never used and except in a few rare instances there is no such thing as a legal survey stake. Yet to state that England has a co-ordinated survey system - which is basically true - is to imply something very different from what an Ontario Land Surveyor would have in mind.

The system just outlined, or some modification of it, has worked well enough in those countries where physical boundaries have existed for many centuries. When expansion of empire drew settlers to other parts of the world, the need was felt for a more orderly form of colonization than the old feudal style of land grabbing and it became necessary to indicate the extent of alienated land by demarcated survey. The rectangular township system - which, incidentally, does not appear to have much application outside North America - no doubt seemed at the time to provide the best method, and, of course, we in Ontario have been bound and restricted by it ever since. This is no criticism; grants of land based on mathematical survey were unknown on any large scale before the North American colonization and the countries which developed later - such as Australia and New Zealand - were in a position to observe the results of the earlier experiments. It should also be realized that, in the strict cadastral sense, Ontario has a co-ordinated survey system. However laborious and frustrating it might be, it would be possible, on the basis of existing information, to compile map sheets based on the original township layouts and to plot on them every single registered parcel of land. Partial compilations of this nature are, of course, made for assessment purposes. This is almost the exact reverse of the English method; there they plot accurately from physical conditions and derive recorded boundaries from them; here we record the boundaries in detail but don't always commit ourselves as to physical conditions.

In much of the settlement elsewhere it was usually felt undesirable, owing to the topography or other factors, to employ regular mathematical patterns. A settler could, and in some countries still can, acquire in unsurveyed territory a parcel of land restricted in some cases to area but not, as a rule to shape or location. The procedure would be roughly equivalent to the staking of a claim by a prospector in Ontario. The settler would plant temporary markers to indicate his desired boundaries and would usually be allowed to commence development. When the survey authority had sufficient time or staff they would survey the settler's boundaries, straighten out any conflict with prior titles and reduce the area staked to its legal maximum.

This type of development led in many of the colonial and former colonial territories to an enormous jigsaw pattern of properties. Lacking even the type of co-ordination that our Township Lot system provides, the only way to identify properties was by the crude method of naming the adjoining proprietors. Largely in order to provide a coherent system of registration and to know which land had been alienated and where, it became necessary to tie in parcels and groups of parcels by traverse or triangulation to the control framework which, as indicated earlier, had usually already been established for topographic military mapping. Since this basic control existed, the property surveyors were encouraged to extend and adapt it to their own requirements. Hence we find in a great many parts of the world, including some which are allegedly backward and underdeveloped, excellent cadastral work, mathematically co-ordinated to overall control. Nevertheless, it should not be forgotten that much of this work commenced only because of the difficulty in identifying parcels in the Land Registry and the use of co-ordinates, while they have facilitated retracement and harmony of computation, has been primarily for indexing purposes. The computed co-ordinate values for individual property corners are kept solely for the use of surveyors and the resultant plan of survey, which appears in a form very similar to our own, provides the sole description of the property.

Description by Co-ordinates

It is sometimes suggested that the establishment of a co-ordinate system would permit the description of property corners in terms of immutable mathematical values. What would be the effect of this? It has already been mentioned that the physical points of a control framework govern its accuracy and that the expression "absolute co-ordinates" is somewhat illusory. Any attempt at the definitive description of property boundaries solely by a set of figures would, it is submitted, meet the hostility of the courts which have time and again insisted on the importance of physical evidence when considering questions of title. Let me cite just one example. In an Australian case a dispute arose regarding the location of a State boundary which was described as the 141st meridian of East longitude. Examination showed that the actual demarcated boundary, which existed for many years, was over 2 miles away from this meridian. The courts held that the true boundary was that marked on the ground.

A recent Ontario case poses another interesting question: Where a pair of semi-detached houses was so constructed that one house had a room on the ground floor that protruded across the centre line of the building although that line was the dividing line both in the basement and the second floor, it was held that the right to the full use of the room was not an easement or a quasi-easement, but full ownership of the room, which, although it did not rest directly on the soil was

supported by the surrounding parts of the building and was land within the statutory meaning. Any attempt to describe these portions of land solely by co-ordinates would evidently involve the use of a third dimension.

It is therefore apparent that even though a surveyor may claim ability to replace a monument exactly where its co-ordinate values say it should be, he will not necessarily be defining the limit of title. In other words, the co-ordinate values may be subordinate to other forms of evidence.

The state of Michigan, for example, is currently trying to adapt the State Co-ordinate System to property surveys and these are a few of the provisions of the draft Bill:-

(1) Use of co-ordinates in land description is permissive, not compulsory.

(2) Description by co-ordinates is supplemental to recorded descriptions and, in the event of conflict, the recorded description shall prevail.

(3) No purchaser or mortgagee shall be required to rely on a description which depends solely on co-ordinates.

When considering a co-ordinate system as a method of establishing "permanent" boundaries in Ontario, some thought should be given to Section 23 (2) of the Land Titles Act, which reads: "The description of the land in the entry of ownership shall not, as against adjoining owners, be conclusive as to the boundaries or extent thereof."

This section might seem to be anomalous to Surveyors who attempt to establish boundaries with mathematical precision, and once again, the reason is historical. The Land Titles Act is based on the English Act of 1875 (Lord Cairns' Act) which did not guarantee boundaries. This problem had of course been considered, but the difficulty lay in precisely determining which part of a physical boundary, such as a hedge, fence or wall, comprised the actual legal limit. It was felt that to attempt to fix and guarantee boundaries would compel neighbours who had no other desire than to live in harmony with each other, to press their claims through litigation or risk losing them for ever.

This principle of "general boundaries" passed to what has been described as the English, rather than the Torrens, System of Land Titles and may now be found in England itself, Ontario, Tanganyika, Kenya and some other countries.

In the Torrens Group boundaries are not usually expressly guaranteed, though this is implied. Even a guaranteed boundary, however, will be subject to rectification for mistake.

Most of the countries that have successfully adapted a cadastral control survey have one thing in common. Property surveys, whether private or public, are under the direction of a public official - the Surveyor General or local equivalent - who issues and enforces regulations and examines the survey work performed. Examples of complete direction are found in New Zealand and in many of the Colonial and former Colonial territories. In other countries where this principle was not established at an early date the direction has required special legislative enactment and one example is the Survey Co-ordinating Act which became law in

the State of Victoria, Australia, in 1940. Some of the main provisions are:-

Survey Co-ordination Act - Victoria 1940

(1) The establishment of a Central Plan Office in the Department of Crown Lands and Surveys, under the Surveyor General.

(2) Within 12 months from the commencement of the Act, every public authority that either makes surveys or has survey plans lodged therein shall submit a list of such plans to the Surveyor General; and thereafter quarterly returns are required.

(3) After the commencement of the Act no public authority may commence a survey until notice is received by the Surveyor General.

(4) The Surveyor General may prescribe the survey connections to be made, the establishment of permanent marks and the submission of a plan immediately upon its completion.

(5) The Central Plan Register is open to all authorized surveyors and an annual index of plans is published.

(6) Upon completion of third order triangulation or standard traverse in any area, the Surveyor General may establish a "proclaimed survey area" and thereafter every survey therein, whether made by private or departmental surveyor, shall be directly connected or in such indirect manner as the Surveyor General may approve.

(7) Surveyor General may carry out surveys for the purpose of the Act, out of public funds.

(8) Surveyor General has power to exempt from any provision of the Act, whether for public or private survey, where undue expense or inconvenience would be caused.

Some of the provisions of this Act bear similarity to recommendations submitted by the Association to the Minister of Lands and Forests in February, 1962, contained in A Brief Recommending Changes in the Administration of Land Surveying in the Province of Ontario.

Many of our members are no doubt familiar with the content of this Brief, which basically recommends the appointment of a Director of Surveys, under the direction of the Surveyor General of Ontario and the progressive expansion of horizontal control, based on the existing geodetic triangulation in the Province. The Minister has informed the Association that control survey has received approval in principle, but that before any decision can be made regarding the various recommendations, more information must be provided to show, firstly, what portion of present survey costs in the surveying of privately owned lands can be attributed to the lack of survey evidence and, secondly, what estimated savings and benefits will accrue to the people of Ontario if the recommendations are adopted. The Association is asked to provide this information and the Committee on Control Surveys is being given the job.

It is evident that if we in Ontario expect to obtain maximum benefit from control survey, there will have to be changes, not only in legislation but in attitude, especially with regard to the availability and exchange of survey information. The

control of a survey may take more than one form - it might involve digging deep with a spade; it might involve measuring from a point which one has previously established or it might involve seeking the aid of another surveyor, through the work that he has done. This may not be an appropriate time to discuss the controversial question of free exchange of field notes, but it is submitted that those who control the public purse strings could perhaps be forgiven if they insisted as a prerequisite to the provision of funds for a control system, maximum efforts by surveyors themselves to alleviate at least some of the existing expense, delay and confusion caused by the private, and in some cases, secret, possession of survey information.

Mention has been made of the recent control survey of Metropolitan Toronto, carried out by the Geodetic Survey of Canada. It may not be widely known that the same organization also undertook a control survey for the City of Toronto, as long ago as 1918.

This survey consisted of precise traverse, connected to triangulation, and is divided into four main traverses, as follows:

Reference Survey For The City of Toronto 1918-1919

(1) Victoria Park from Queen Street to Eglinton Avenue; west along Eglinton and its production to Royal York Road; south on Royal York Road to the Lake

(2) North from Eglinton Avenue along Bayview Avenue to York Mills Road; west along York Mills Road and Wilson Ave. to Bathurst Street; south along Bathurst Street to Eglinton Ave.

(3) South from Eglinton Avenue along Dufferin Street to the Lake

(4) Along Pape Avenue, from approximately O'Connor Drive to Eastern Avenue.

The total length of traverse is approximately 36 miles. 61 permanent concrete monuments were established and many iron pins were set as temporary hubs. Ties were taken to approximately 80 Lot corners, including posts and boundary stones at several main intersections. Ties were also taken to some buildings and curbes.

To the best of my knowledge this survey was never put to any practical use by local surveyors and the only retracement appears to have been the tying-in of a few of the monuments by the City of Toronto Surveyor. One cannot help feeling that this is an example of good work wasted.

With the establishment of the new control network, the pattern has once again been set and it will now be up to us whether or not it is to achieve the fullest application and significance.

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