

# **Coordinate Based Cadastre Test Project**

## **Summary Report**

**August 2002**

**The Alberta Land Surveyors' Association gratefully acknowledges the  
financial support of**

**The Alberta Real Estate Foundation  
City of Calgary  
City of Edmonton  
Director of Surveys  
Natural Resources Canada**

## **Coordinate Based Cadastre Test Project**

### **Summary Report**

#### **History**

The Study Group on the Coordinate Based Cadastre was established by the Alberta Land Surveyors Association as a result of a motion at the 1996 AGM to strike a committee “to investigate the feasibility of changing to a coordinate based cadastre.” Over the next three years the Study Group met regularly and sought the input and advice of experts and stakeholders in an effort to define the CBC within the Alberta context; to identify the technical, legal, and institutional changes that would be required to implement a coordinate cadastre; and to enumerate the potential costs and benefits that might flow from such an implementation.

The Study Group produced a comprehensive report summarizing its research in February of 1999. Among the principal findings of the Study Group were the following:

1. In assessing the pros and cons of a coordinate based cadastre it is important to consider both the traditional and non-traditional roles of the cadastre, and all the forms and uses of cadastral information.
2. The cadastre in Alberta is in fact a hybrid system of mathematically defined and monument defined boundaries.
3. The destruction of monumented boundaries in urban centres is a principal limitation of the monumented system.
4. The momentum of technological change will make serious consideration of a coordinate based cadastre inevitable.
5. The ALSA has a key role, and a responsibility, to act proactively to guide the future evolution of the survey system through the present period of technological change, economic restraint, and governmental deregulation.
6. The Study Group found no evidence that the definition of boundaries by coordinates would not be accepted by the general public.
7. The Study Group found little in the experience of other Canadian or international jurisdictions which would serve to either prove or disprove the viability of a coordinate based cadastre in Alberta.
8. The Study Group finds nothing in law that would prevent the enactment of legislation enabling the creation of coordinate survey areas.

9. Significant technical development will be required to support the implementation of a coordinate based cadastre.
10. A coordinate based cadastre will not require substantial changes be made to the cadastral system in Alberta.
11. Coordinate boundary definition potential offers a more effective, reliable and economic alternative to monumentation in urban areas.
12. The realization of the benefits of a coordinate based cadastre will depend in large part upon the implementation of an efficient and effective bureaucratic structure for the management and administration of coordinated boundary information.

The recommendations of the Study Group included the following:

1. Serious consideration be given to the development of a coordinate based alternative which eliminates the requirement for the monumentation of lots in urban areas.
2. The Association take immediate steps to improve the survival rate of urban monumentation until such time as a viable coordinate based approach can be demonstrated.
3. The Association act to manage the impact of technological and institutional change to ensure the cadastral system remains current, accessible, reliable and responsive to user needs. To this end the ALSA should:
  - 3.1 Develop accuracy and reliability standards for cadastral surveys which are consistent with the needs of end users and reflect variations in land use, property value, and the nature of the interest being defined.
  - 3.2 Ensure that an accurate, reliable, accessible and effective control framework is maintained, and that a uniform and consistent implementation of the CSRS, HPN, and ACS technologies is achieved across the province.
  - 3.3 Ensure that future geodetic datum revisions are effectively managed to minimize their impact on the cadastre and avoid the confusion and loss of confidence that would inevitably result from frequent or large changes in coordinate values.
  - 3.4 Encourage the development of a GPS infrastructure providing accurate real-time access to the geodetic reference framework.
  - 3.5 Develop standards for GPS reference stations in consultation with service providers.
  - 3.6 Encourage and provide opportunities for continuing professional development to ensure cadastral surveyors are able to keep pace with technology.

4. The ALSA initiate a multi-agency steering committee to design and manage a pilot project directed toward developing a suitable working model for an urban coordinate layer, testing it under everyday working conditions, and gathering the information required to properly assess the merits of a permanent implementation.

The report of the Study Group was distributed to the ALSA membership and the cadastral community for comment and feedback. In the autumn of 1999 the Study Group was asked to prepare a proposal for a test project for submission to the membership. A proposal was submitted to council in February of 2000, and was subsequently debated and approved by the membership at the Annual General Meeting in April of 2000.

### **Scope of The Test Project**

The scope of work of the coordinate cadastre test project included the following elements:

1. An investigation of monument survival in urban subdivisions to quantify the extent of monument loss and the effectiveness of delayed posting.
2. A survey of land surveyors and the development community to examine current industry practices in urban subdivision development with respect to the use and effectiveness of delayed posting.
3. The collection of survey data and stakeholder feedback in two monumented and two coordinate-based subdivisions over a five year period.
4. Liaison with council and other ALSA committees to follow up on the technical, legislative, and data management issues identified in the Study Group Report.

Tasks 1 and 2 were intended to expand on the earlier investigations of the Study Group and the University of Calgary which indicated that up to half of urban monuments were destroyed in the initial subdivision development process, and that delayed posting was only marginally effective in improving monument survival.

The purpose of Task 3 was to collect real-world comparative data reflecting the costs, efficiency, and reliability of surveying under the monumented and coordinate regimes. Approval was sought from the Director of Surveys to extend the delayed posting period for the subject subdivisions to five years to allow an analysis of the impact of not monumenting parcel corners on subsequent survey and land use/development activities. Pairs of subdivisions would be sought in Calgary and Edmonton so as to encompass a representative range of survey conditions and institutional factors. Feedback would be sought throughout the test period from stakeholders involved in land development and surveying within either subdivision. These would include surveyors, the municipality, the utilities, the developer, and landowners. The goal of the information gathering process was to compare the time and resources required to complete similar types of

surveys in both types of subdivisions such as building stakeouts, utility surveys, RPRs and re-subdivisions. Information would also be sought concerning the nature and frequency of occurrence of boundary uncertainty problems.

The test project was also to provide a focus for the discussion of regulatory and technical issues, and for the development of straw man standards and procedures to support survey operations in a coordinated area. Under Task 4, the CBC Test Project Steering Committee would make specific recommendations to council concerning the issues to be addressed by ALSA committees.

Funding for the Test Project was secured in October of 2000. The project was underwritten by the Alberta Land Surveyors Association, the Alberta Real Estate Foundation, the Municipalities of Calgary and Edmonton, the Director of Surveys, and Natural Resources Canada Legal Survey Division.

A Steering Committee comprised of members from the ALSA, the Director Of Surveys Branch, and the Municipalities of Edmonton and Calgary was formed to direct the project and report to council. Dr. Brian Ballantyne and Mr. Khaleel Khan of the Cadastral Studies Group at the University of Calgary were contracted to undertake the investigations. Work commenced early in 2001. A report finalizing the outcome of Tasks 1, 2 and 4 was submitted to council in December 2001. Task 3, the monitoring of test subdivisions over a five year period, does not appear to be feasible at this time.

### **Monument Survival in Urban Subdivisions**

The Study Group concluded that the high rate of destruction of urban lot corners in new subdivisions represents a serious limitation to the effectiveness and integrity of the monumented cadastre. Task 1 of the Test Project involved a more thorough investigation of the extent of monument loss in Calgary and Edmonton. This work was to expand on an initial investigation by Dr. Ballantyne of Calgary subdivisions. The expanded investigation included subdivisions from both Edmonton and Calgary, subdivisions that were posted prior to development (immediate posting), as well as subdivisions posted at some later stage of development (delayed posting).

A total of 26 subdivisions were inspected. Fifteen of these were in Calgary, and eleven were in Edmonton. Fifteen of the subdivisions were delayed posting subdivisions. All of the subdivision plans were registered between 1989 and 1998. The subdivisions ranged in size from a few lots to 150 lots, with most falling in the 50-100 lot range. The subdivisions were well distributed spatially, and involved several land surveyors and developers.

Approximately 750 lot corners were searched for. A typical search involved measuring to the corner location and performing an electromagnetic scan. A positive scan return was recorded as a “detected” monument. Monuments that were obviously problematic for scanning were exposed for confirmation. In addition, approximately 20-30% of the

detected locations were exposed and inspected to determine monument condition and look for evidence of disturbance.

Looking first at the entire sample in aggregate, 74% of the lot corners searched for were “detected”, and 95% of the detected monuments which were exposed and inspected were judged to be “acceptable” or “intact”. Assuming that the 5% judged disturbed holds for the entire sample yields a projected global “reliability” rate of 70%.

As expected, the reliability of the delayed posting subdivisions was better than those subdivisions which were posted prior to development. The reliability rate for immediate posting subdivisions was virtually the same in Edmonton and Calgary at 59% and 62% respectively. The reliability rate for delayed posting subdivisions was 68% in Edmonton, and 78% in Calgary.

### **Consultation With the Survey & Development Community**

Task 2 of the Test Project sought further information from land surveyors, municipalities, utilities and developers concerning their perceptions of the extent, causes and impact of urban monument destruction; their usage and practice with respect to delayed posting; and their views on monumented versus coordinate defined boundaries.

Questionnaires were distributed by e-mail to all Alberta Land Survey firms, as well as, 17 municipalities, 112 members of the Urban Development Institute, and 5 utility companies. The questionnaires were followed up by telephone. In all, responses were received from approximately 60 Alberta Land Surveyors, 4 municipalities, 8 developers, and one utility. The following general observations can be extracted from the responses:

#### Urban Monument Destruction:

- The estimates of urban monument loss provided by surveyors confirmed the findings under Task 1. The typical estimate provided was of the order of 30-40% of urban monuments are destroyed by construction activities. Delayed posting is perceived as reducing the rate of monument loss.

#### Delayed Posting Practices:

- Approximately 70% of ALSA respondents indicated that they employed the delayed posting provision of the Surveys Act, and that they employed delayed posting in approximately half of their subdivisions. Delayed posting was typically used in “larger” subdivisions. The principal benefits were perceived as speeding transfer of title, providing flexibility in the timing of posting to suit weather and ground conditions, and reducing the impact of major construction activities on monument destruction.
- The majority of surveyors indicated that they prefer to post lot corners after the installation of utilities and sidewalks, but before foundation staking, fencing and

final landscaping. However, there are frequent exceptions. Most notably, shallow utility companies (gas, electricity, telephone, cable) often require posting prior to utility installation.

- The developer, builder, and utilities often employ different surveyors. In such cases, the surveyors for the builder and shallow utilities typically ask the developer's surveyor to post lots prior to foundation or utility staking. A number of surveyors voiced the concern that extending the delayed posting period, or implementing a coordinate only approach, would download significant additional cost and liability onto the surveyors providing foundation or utility stakeouts. On the other hand, several surveyors noted that they do routinely perform stakeouts from control when working within their own subdivisions.
- Delayed posting typically occurs within a 4-6 months of plan registration. The majority of surveyors responding felt the current one year limit is adequate in most circumstances, and noted that extensions are easily obtained if required.

#### Coordinates Versus Monuments:

- The responses received from all sectors indicated a strong preference for monumented boundaries.
- All groups voiced the concern that coordinate defined boundaries would limit the ability of landowners to determine the extent of their parcels.
- There are clear concerns within the survey community that the current control infrastructure would not support economic survey operations in a coordinate based cadastre, and that given the present cost of GPS equipment and the declining network of monumented coordinate control, an early implementation of a CBC would add a substantial integration cost to surveys.
- The majority of surveyors indicated that they felt it would still be necessary to place temporary marks at lot corners even if posting were not required.

The investigation of delayed posting practices raised two questions concerning boundary definition in delayed posting subdivisions:

1. Do the posts planted in a delayed posting subdivision govern boundaries when planted, or only after the posting affidavit is registered?
2. If a property corner cannot be posted, what governs its location?

The first question arises because it would appear to be fairly common practice for the developer's surveyor to post lots on a piecemeal or staged basis at the request of other surveyors performing utility or building stakeouts within the subdivision. The committee is of the opinion that piecemeal posting creates a boundary uncertainty and liability

exposure in the interval between posting and the registration of a posting affidavit, particularly where the posts are used by others to stake improvements. In larger subdivisions involving phased development a significant period of time may lapse between posting and registration of the posting affidavit.

The second question arises because improvements often make property corners unsuitable for posting. The question then becomes - do the coordinates shown on the plan govern the location of that property corner, or is it governed by the dimensions to the surrounding posted lot corners?

### **Monitoring of Coordinate Only Subdivisions**

The Steering Committee has been unable to initiate Task 3, the monitoring of two coordinates-only subdivisions over a 5 year deferred posting period, owing to the following practitioner concerns and technical obstacles:

- The committee has been unable to find an acceptable and cost effective means of providing a coordinate control framework to those working in the proposed test subdivisions.
- Various surveyors and end users have expressed concern or opposition to working from reference control due to cost, technical, and liability factors.
- The cost of GPS technology still presents an economic obstacle to some participants.
- Some participants who require boundary location lack the technical capacity to function in a coordinate based environment.
- The posting of a subdivision after a 5 year period would be problematic and expensive owing to the presence of structures, landscaping, and fences. In addition, utilities have expressed concern about placing reference posts which do not fall on lot corners.

As a result of these factors, a number of firms who would operate within the proposed test subdivision currently lack the technical capacity to function in a coordinate-only environment, or would incur significant additional costs in doing so.

### **Conclusions**

The survival rate of urban monumentation in the sampled subdivisions ranged from 60% in immediate posting subdivisions, to 73% in delayed posting subdivisions. These statistics are confirmed by the estimates provided by ALSA members interviewed. The principal causes of monument destruction in delayed posting subdivisions appear to be installation of shallow utilities, lot grading, landscaping and fencing by builders and landowners.



The majority of ALSA respondents routinely employ deferred monumentation. Approximately 70% of members surveyed indicated that they employed delayed posting in half of their subdivisions. The principal benefits were perceived as speeding transfer of title, providing flexibility in the timing of posting to suit weather and ground conditions, and reducing the impact of major construction activities on monument destruction.

The use of deferred posting does clearly improve monument survival. However, the 73% rate of survival in delayed posting subdivisions is only marginally better than the 60% survival rate in immediate posting subdivisions. The committee is of the opinion that these statistics should concern surveyors.

The 1999 Report of the Study Group on the Coordinate Based Cadastre identified four pre-requisites to the implementation of a coordinate based cadastre:

1. **Control Infrastructure** – the development of an accurate, reliable, and accessible infrastructure for coordinate control;
2. **Technical Capacity** - the development of the technical capacity within the survey community to effectively function entirely within a coordinate environment;
3. **Acceptance** – the acceptance of the concept of coordinate defined boundaries by the survey profession, other technical and legal professional groups and disciplines, and the lay public;
4. **Legislation** – to permit the legal definition of boundaries by coordinates.

The committee's efforts to initiate a pilot confirm the fundamental importance of these four foundation blocks. The lack of a suitable control infrastructure, and the lack of technical capacity and training within some sectors, proved major obstacles. These technical requirements will be met in time. However, the pilot also encountered a high degree of reluctance, if not outright resistance, by many practitioners and end-users to any move toward coordinate boundary definition.

The survey community sees the lack of a suitable coordinate control infrastructure as a major restraint to the early implementation of a CBC. There is a strong perception within the survey community that integration costs would be prohibitive in the near term, given the high costs of GPS, the slow development of active control, and the declining state of monumented control networks.

It would also appear that a significant portion of the industry presently lacks the technical capacity to function in a coordinate-only environment, or would incur significant additional costs or liability in doing so.

Stakeholder consultation revealed a strong preference for monumented boundaries in all sectors, and a common concern that a coordinate cadastre would limit the ability of landowners to determine the extent of their parcels.

Consequently, the steering committee concludes that the test subdivision concept as originally put forward is not viable at this time.

### **Recommendations**

The committee offers four recommendations:

- 1. The ALSA investigate means to improve the survival of urban monumentation in both immediate and delayed posting subdivisions.**
- 2. The ALSA raise the issue of urban monument destruction with the Urban Development Institute, the Alberta Real Estate Foundation, the Alberta Urban Municipalities Association, and the Alberta Home Builders Association to raise the awareness of developers, builders, utilities and landowners of impacts associated with monument destruction.**
- 3. The ALSA develop an information brochure for distribution to realtors and the general public describing boundary monuments and emphasizing their importance.**
- 4. The committee recommends that the monitoring of coordinates-only test subdivisions not proceed at this time.**