

Defining boundaries using only coordinates: Appealing to plasticity

Dr. Brian Ballantyne

brian.ballantyne@nrcan.gc.ca

Abstract:

Defining parcel boundaries using only coordinates means that the boundaries are not demarcated with survey monuments, and that the coordinates are linked to an accurate reference frame. Sporadic and ill-informed debate since 1966 about using only coordinates was supplemented by rigorous analyses for the Canadian Council on Geomatics (1999) and the Alberta Land Surveyors Association (2001). The analyses found that that the technical, social and legal barriers to using coordinates were not insurmountable and that survey monuments were not overly reliable. However, the recommendations to monitor two residential subdivisions that used only coordinates fell on deaf years. The debate is now being rekindled with an appeal to the plasticity of the survey institution mind-set.

Introduction:

The use of coordinates, such as Northings and Eastings, to define boundaries has been debated on an ad hoc basis since at least 1966, when Hadfield weighed in facetiously that a frustrated surveyor might think it “a dandy idea to get rid of stakes.” Intermittent rhetorical flourishes and unsubstantiated assertions, always in the guise of best serving the public, prevailed for the next three decades. In 1997 the Canadian Council on Geomatics (CCOG) resolved that research take place on the implications of adopting a coordinates-only approach to defining real property corners. Three recommendations ensued (Ballantyne, 1999). This was followed in 2000 by the Alberta Land Surveyors Association (ALSA) investigation of a coordinate based cadastre test project. Five recommendations ensued (Ballantyne, 2001).

Neither set of recommendations was acted upon for the most part, owing to reluctance, if not fear, on the part of the Canadian land surveying community. The purpose of this paper is to assuage such fears, to rekindle the debate about using coordinates to define parcel boundaries, and to address the fixation on monuments within the surveying community. Such fears and fixations are likely the result of institutional inertia. Only by constant exposure to the coordinate debate can any sort of plasticity be achieved in the institutional mind-set.

Plasticity refers to the capacity of portions of the human brain to change their physical characteristics (shape and size) as expertise is acquired. The acquisition and use of spatial knowledge in creating mental maps of a large city, for example, have demonstrated plasticity in changes in the hippocampus. This shows the “possibility of local plasticity in the structure of the

healthy adult human brain as a function of increasing exposure to an environmental stimulus” (Maguire, 2000). It is, as yet, unclear whether such plasticity is due to “neuronal size, neurogenesis or perhaps dendritic or axonal arborisation” (Maguire, 2006).

This paper is structured in three parts: the findings from the Canadian study, the findings from the Alberta study, and the situation as of 2008. It is critical that terms be defined forthwith. Boundaries have typically, but not always, followed a three-part process of coming into being – they are defined by the party (Crown, landowner) who has legal rights in the land; they are demarcated on the ground by a surveyor (posts, bars, pins, pits, mounds); they are delineated on plans and maps. The use of coordinates is predicated on deleting demarcation from the process – the boundary is defined and then delineated. To be clear: defining boundaries using only coordinates means that monuments are not placed in the ground to mark the boundaries. This debate is not about giving coordinate values to monuments to allow for a coordinate based geographic information system (Andreasson, 2006). Such digital systems have long existed and will continue to flourish, even to the extent of being touted about by the well-equipped traveler (Valery, 2007), but they are not part of this debate.

Canada-wide findings:

Much rhetoric was dispelled about coordinates never or at least seldom having been used to define boundaries. In fact, many boundaries have never been monumented by surveyors in Canada, for a variety of reasons. First, natural features have been used to define boundaries, obviating the need for survey monuments. Most riparian parcels in Canada have as their water boundary the bank (ordinary high water mark), water’s edge, or *ad medium filum*. The southerly part of the boundary between Alberta and British Columbia was defined in 1871 as the watershed of the Rocky Mountains; much of it is not yet demarcated with monuments.

Second, there has been wide-spread use of limited monumentation. Starting in the 1780’s, the single-front and double front systems of townships in Ontario only monumented the two front parcel corners; the two rear parcel corners were not monumented. The Dominion Land Survey system that spread after 1871 across five provinces - from north-western Ontario to British Columbia - did not require full monumentation. Typically, in a section containing four $\frac{1}{4}$ sections (and thus nine parcel corners), only three corners were monumented. Within the province of Alberta, legislation between 1912 and 1988 required no monuments to be placed at parcel corners on plans of subdivision; only block corners were monumented.

Third, there has been much use of both informal and formal deferred monuments, by which parcels are created when plans of subdivision are registered using coordinates to define boundaries. In Atlantic Canada, such deferred monumentation takes place on ad hoc basis.

British Columbia allows for a block outline survey for the purposes of subdivision, highway or forest service road, meaning that some 2,000 parcels are created annually using only coordinates. Larger subdivisions in Alberta also make use of the legislative freedom to dispense with immediately monumenting.

Fourth, New Brunswick legislation permits a surveyor to not plant monuments to mark corners of parcels in subdivisions, if two conditions are met. There must be sufficient reliable control points close to the subdivision, and coordinates must be calculated for each parcel corner. Some 1,000 parcels have been created since 1973 within the Saint John Integrated Survey Area (ISA) whose boundaries are defined using only coordinates.

None of the four extant systems – of using natural features in place of monuments, of limiting monuments, of deferring monuments, of dispensing with monuments – appears to have been unduly hindered by technical, social or legal barriers over the history of the settlement of Canada. Nor does the wide-spread use of coordinates to define boundaries appear to have hindered the creation of many parcels, and of the orderly transfer, development and subdivision of such parcels. The analysis concluded that defining boundaries using coordinates was dependent on four factors:

- Access to cadastral coordinates which are linked to an accurate, distortion-free reference frame such as NAD83 (Canada Spatial Reference System).
- The ability of land surveyors to employ adjustment and measuring methodology.
- Legislation that allows boundaries to be defined using only coordinates.
- Social and institutional acceptance, by surveyors, developers, individual landowners, builders, First Nations, municipalities and the resource extractions industries.

The latter point is significant, in addressing assertions about how landowners actually want their boundaries defined. Some 380 landowners (urban residential and rural) were questioned from eight communities across Canada. Only 37% of respondents knew that their boundary was demarcated and had actually seen and used the monument. Most landowners (54%) had little use for survey monuments. They preferred that their boundaries were represented by a visible physical feature; either natural (such as a watercourse) or artificial (such as a fence).

The findings suggested three recommendations:

- Monitoring two residential subdivisions over a five-year period whose boundaries would be defined using only coordinates.
- Encouraging the integration of all new parcel boundaries to the CSRS.
- Better protecting boundary monuments.

The first recommendation is most germane to using only coordinates to define boundaries. Although it was not directly acted upon, it led indirectly to the Alberta-based analysis.

Alberta findings:

ALSA commissioned a study that was based on two premises. The first premise was that survey monuments only serve as a public utility if they are reliable; reliability is a direct function of surviving the ravages of the development and construction process. The second premise was that reliability must be empirically determined. Reliability was defined by whether the monument that originally demarcated a boundary could be relied upon in a boundary re-establishment – did it still exist, and, if so, was it in its original position?

Such determination meant looking at the state of boundaries that are immediately demarcated with survey monuments, and of those boundaries whose monumentation is deferred. Twenty-six plans of subdivision were examined in Edmonton and Calgary; they were a mixture of immediate and deferred monumentation subdivisions.. From these, over 800 boundary monuments were sought in the field.

The findings were:

- Despite being the common practice, only 61% of immediate monumentation is reliable.
- Only 72% of deferred monumentation is reliable.
- Most monuments are rendered unreliable through the process of building houses and landscaping parcels (as represented by concrete swales in the rear of the parcel).

The findings suggested five recommendations, four of which had to do with the practice of deferring monuments and of enhancing the reliability of monuments. The fifth recommendation is most germane:

- That ALSA monitor four subdivisions in Calgary and Edmonton over a five-year period. Boundaries in two of the subdivisions would be defined using only coordinates; the boundaries in the other two subdivisions would be defined using monuments.

The effect of the recommendation was to extend the deferral period from a nominal one year to five years. However, ALSA decided not to monitor any subdivisions over any period for any purpose. The most cogent reason given for dispensing with further analysis was the assertion that many surveyors had expressed concern about the technical requirements and financial costs of working for five years in the two coordinated subdivisions.

A less cogent reason was hysteria that such analysis was the thin end of the wedge; that the migration in Alberta to using only coordinates in all subdivisions was a fait accompli. This hysteria was fuelled by the fear that such a willy nilly adoption of coordinates spelled the end of the significant revenue earned by ALSA through the sale of boundary monuments, leading to pronouncements that ALSA “has rejected the sole use of coordinates to define property boundaries (ALSA, 2002). The Alberta analysis, findings and recommendation left some surveyors strangely calm, while others were horribly terrified (Cook, nd).

In the interim:

British Columbia has recently adopted the use of coordinates to define mineral claim parcels. This is a significant departure from the tradition of demarcation - staking of each claim. The result has been a surge in staked and recorded claims, although Minerals Titles Online has not been without controversy. Questions have been raised about trespassing (given that a claimant can explore the claimed area even if surface rights vest in another), vandalism (owing to the marking of the surface parcel by the claimant), and liability of the holder of the surface rights (if the claimant is hurt while exploring over the surface parcel).

Finally, the use of coordinates to define boundaries is rearing its head in Manitoba. Manitoba Hydro is interested in surveying thousands of kilometers of transmission line corridor and is questioning the need to monument all parcel boundaries. This reticence is driven by a recognition of the role of coordinates, the scale and location of the work, and the declining number of land surveyors in Manitoba (Stark, 2007). It might also be that parcels of land within the treaty land entitlement process in Manitoba can more efficiently be surveyed using coordinates to define boundaries. Certainly, the use of coordinates would go some way to addressing both the low capacity within the survey community, and the Auditor General’s concern that planning for parcel surveys results in delays in converting land to reserve status under agreements with Manitoba (and Saskatchewan) First Nations (Auditor, 2005)

Conclusion:

This is not advocacy that boundaries necessarily be defined using only coordinates. It is advocating, ironically, that the debate be impartially pursued, and that the analysis be empirically based. This means that moving beyond the rhetoric that defining boundaries using monuments is good and that defining boundaries using only coordinates is bad (Barnes, 2007). The first assertion merely parrots the Red Queen, who, while Alice was refreshing herself, began “measuring the ground, and sticking little pegs in here and there” (Carroll, 1872). The second assertion merely parrots Gulliver, who was critical of the method of tailoring to which he was subjected, because the use of coordinates (involving a quadrant, a rule, and compasses) resulted

in his clothes being very ill made and quite out of shape. The tailor happened “to mistake a Figure in the Calculation” (Swift, 1735).

To the extent that the land surveying community is simply the aggregate of some 3,000 individuals, then individual plasticity should reduce resistance to the analyses, leading towards some (if not absolute) collective acceptance of the use of coordinates. Such institutional plasticity will allow for, at one extreme, the wide-spread adoption of coordinates to define boundaries. At the other extreme, plasticity will allow for the clinical trials required to test the hypothesis that extended monument deferral periods (in essence, using only coordinates) will not adversely affect the parcel.

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Biography:

Dr. Brian Ballantyne is a lawyer who serves as the Advisor to the Surveyor General and the International Boundary Commissioner, within the Canada Centre for Cadastral Management. He has degrees in land surveying, geography, environmental ethics and law; has published widely; and has worked in surveying as a consultant, professor, examiner, presenter, analyst and party chief. He has expertise in parcel boundaries.