Title: Cooperative Development of a Cadastral Base map for British Columbia

or:

Seven Steps to Cadstral Nirvana.

Author: Dilsher S. Virk:

Biodata: Mr. Virk is a graduate of the Imperial College of Science & Technology, UK and an associate of the City and Guilds Institute of London. Mr. Virk has over thirty years experience in Information Technology and Geomatics.

After ten years working experience with Geomatics in the Oil, Gas and minerals exploration field, Mr. Virk incorporated DV Digital Videosystems Ltd. (Trade name UniTech) in Calgary, Alberta. UniTech is a full service IT consultancy with specialization in Geomatics. UniTech moved to Victoria, British Columbia, CANADA in 1986. DV/UniTech has undertaken numerous assignments for Federal, Provincial and Corporate clients in IT and Geomatics.

Table of Contents

1. Introduction – Project Scope

In British Columbia, for the past four years, the Provincial (State) Government, Local Municipal Governments and the Utilities Sector (Electricity [Hydro], Gas, Telephone, Cable TV etc.) are compiling a common base map for their joint benefit, using the "Non Profit Society" business framework.

Membership is voluntary, and to date, no legislative changes have been made to force potential members to join.

Much progress has been made, but many challenges remain.

British Columbia (BC) is the westernmost province of Canada. It is mountainous, with a rugged coastline, running from Washington in the South, up to Alaska.

BC covers an area of 95 million hectares (947 800 km2), larger than France and about the size of Rajasthan, Madhya Pradesh and Maharashtra combined.

While the major population centers are the lower mainland around Vancouver, and the south- east coast of Vancouver Island, there are many communities scattered through the vast territory with forestry, mining, ranching and most recently, oil and gas as major employers. There is only one accepted legal Provincial Land Ownership Registry. Other rights (e.g. water, mineral, etc.) are issued and controlled by many provincial, federal and local departments. A central information resource, the Integrated Land and Resource Registry (ILRR) project is providing a clearing-house for all land and resource rights in BC. ILLR is a work in progress.

There are 133 Local government entities in BC, from large and sophisticated ones, such as the City of Vancouver, to very small communities, where all municipal functions are covered by just one person. The level of application of GIS technology is also equally diverse, advanced to none at all.

The coast was settled, starting about the time of the discovery of a sea passage to Vancouver by the Spanish explorer, Juan Perez around 1774. Survey records date almost as far back as this and is an added complication, compared to the provinces that were settled later and have better continuity in the land survey history. Native first nations land rights precede even these more recent ones.

Today there are about 1.5 million registered "cadastral" land parcels in BC. The word 'cadastral' is not used much outside the land management field, but it simply means, *"A public record, survey, or map of the value, extent, and ownership of land, possibly as a basis of taxation."*

In my extensive reading of the cadastral literature, it has always been a source of disappointment, that there were not more concrete cost figures stated. Now that I find myself contributing to this body of work, I realize that any figures quoted without a very detailed explanation of the parameters whereby they are derived could be misleading, and as such I have steered away from quoting numbers as far as possible. I would be pleased to discuss these issues at any time in person.

2. Project Genesis – How did it get started?

A great deal has been written about digital mapping in the cadastral domain (Ref. a). In the age of paper and mylar maps, the transfer and sharing of base maps was relatively cumbersome. Digital mapping offers the capability of sharing selective mapping coverage with much greater ease. However, it is still common practice for entities, to compile their own digital maps with only very general application of some broad standards. The result has traditionally been mismatched coordinates.

For example, a city would compile one map of property and infrastructure; this would be compiled independently by the Regional District, and then again by the Provincial Government. Similarly, utility companies for power distribution, communications etc. would again have to generate and maintain their own maps, inconsistently derived from one or more of the above sources.

Conceptually, there is a very strong argument for all entities to share the same map base, so that duplication of an update is minimized and cooperative business processes are facilitated. Where good spatial data is shared, significant gains have been shown in business process improvement.

For example the telephone company TELUS, in cooperation with some cities, has implemented a "Digital Plan Submission and Approval" workflow, that has reduced the, plan approval time, in some cases from six weeks to six days.

As expected, the ICIS project encountered numerous obstacles, both technical and "political". These problems are not unique to the GIS field, and parallels are to be found in the integration of information systems across administrative boundaries.

Discussions around the duplication of effort and how to improve and share mapping information among the various entities in BC started in 1999. These were at a working level, and eventually led to the joint commissioning, of a project study report by a consultant.

On the basis of that report, it was agreed that data sharing between Utilites, Local Governments and the Provincial Government could be mutually advantageous. A "pilot" data-sharing agreement was constructed and sent out to local governments.

3. How did it evolve?

Mainly owing to a lack of dedicated resources, the follow up to the pilot agreement was not strong and a good deal of momentum was lost. Finally a non-profit society (Integrated Cadastral Information Society) was founded and a board was appointed. The society had three classes of member:

1. **Provincial Government (equiv. to State Government)**[◊]
2. **Local Governments – Cities, Towns, Villages etc. - 133**
3. **Utilities – Power, telephone, cable TV etc. 6 to 8**

Membership was confirmed by signature of the "ICIS Data Sharing Agreement". A copy of this agreement can be found at the ICIS website – www.icisociety.ca .

Each partner contributes to the project as shown in the table below:

ICIS Partner	Role
Utilities	Provide 75% of project cash funding through membership fees, also overlay registered infrastructure on base cadastral map.
Provincial Government & Government Agencies	Provide expert resources in the form of contract supervision and quality control of compilation contractors + remaining 25% of funding through membership fees, and data from provincial and crown corporations
Local Government (Municipal)	Provide data for ICIS cadastral base. Where digital data poor, incomplete or absent, it is compiled by ICIS. Local governments pay no fees but contribute valuable data where existing GIS systems are in place.

In June of 2002, I was appointed as the first general manager for the project. Initially, it was assumed that this was a one-person job, and I attempted to get started in this mode. It became abundantly clear very soon, that the task was a much larger one than initially estimated.

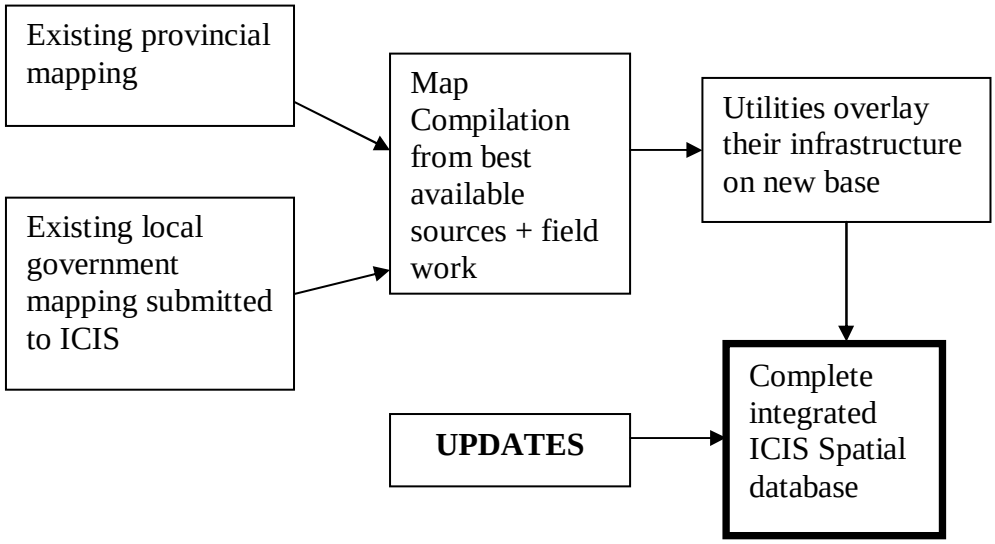
Assistance was contracted to specifically address Local Government Relations – the difficult task of persuading the 133 local governments to join the society and participate.

It was, and remains a difficult task to devise a strong business case for local government participation. It is a great credit to the public relations people, who helped me, that we were gradually, over the next couple of years, able to get 123 local governments to sign the data- sharing agreement.

◊ While one branch of government takes primary responsibility, there are many ministries that do not act as one entity in most instances. Crown corporations and other quasi government agencies are even more disparate.

As the local governments joined the society, where possible, a copy of their data was provided to ICIS. Using this data, and other survey records as available, the provincial mapping office began to compile the most recent property information into the cadastral map with the assistance of private sector contractors. In many cases additional fieldwork was performed, to establish accurate survey points by GPS or conventional survey methods.

Simplified Data Flow Overview:



As the maps were compiled, they were made available to members both via CD copies or internet downloads. Member utility was enhanced, by the use of "Spatial Direct" software from Safe Systems of Vancouver, to enable real time translation into the user's desired format.

4. Essential Ingredients for success

a. **Good Governance**
b. **Strong political support/ patronage**
c. **Sustainable financial model**
d. **Leadership with a Vision**

While these principles are easy to articulate, in reality conditions are usually far from ideal. Active measures to improve these "essential ingredients" need to be taken.

Education, at all levels, must be an ongoing effort if the project is to succeed. This may be through workshops, facilitated sessions or formal training courses.

Selling and reselling of the project,t at the political level, is usually essential to the survival of the project, as people and organizations change over time.

Board management needs to be at a sufficiently high level to see the long-term strategic value of the outcomes and not get bogged down in short term concerns. Projects of this nature span over decades, and shorter predictions of completion generally prove to be false in reality.

5. Lessons Learned

The project presented numerous challenges and for a clearer understanding, they are separated into three broad categories:

A. Management and Governance
B. Technical/Geomatics
C. Remaining Challenges

A. <u>Management and Governance</u>

The initial consultant report supporting the establishment of ICIS had recommended that one senior management resource, from each of the sectors (Province, Local Gov. & Utilities), spends six months in consultation, to design the governance and management framework for ICIS. In fact, the process was drastically abbreviated, and the General Manager had to cope with an inexperienced board of fifteen members (five from each class). My own experience with board governance was limited and I was in need of help. Fortunately I was able to enlist resources that were adept, both in local government relations as well as corporate governance.

One of the most problematic components is the joint representation of towns and cities. These tend to be only very loosely associated. Therefore, the joint representation of the local government members is the most diffused. There is no single body that represents this group in a coherent way.

Lesson number 1 – Take time to design the governance model in light of local conditions.

There was no strong link among the local governments and the board representation, neither between the Provincial Government members on the board and the Provincial Government membership as a whole. This is likely to be the case in most jurisdictions, so that it falls to the members of the society to improve communication between the members and their board representatives. Therefore:

Lesson number 2 – Budget for significant internal communication cost.

The Utilities presented the least problem in terms of governance. They were clearly aware of the cost benefit to their own operations, and communicated

their requirements with the best clarity. They were also small in number and more or less at the same high level of technical sophistication.

The local governments provided the biggest challenge, starting with the sheer number of them (133). Just the task of communicating with these entities at multiple levels was daunting. It eventually took a roughly estimated 4 man-years of effort to recruit 130 of these. This was just to the point of signing the data sharing agreement, and does not include the additional effort required to insure active participation.

Lesson number 3 – Budget for significant member communications cost.

As we started this process relatively late in BC, many towns and cities, had already developed sophisticated GIS applications on their base maps. The cost of adjusting to a new base map is prohibitive for many of these members, and potential members are discouraged by its potential cost. The pride of ownership of the existing record and its accuracy can prove to be a formidable barrier.

Here there was disagreement – the Province insisted that all must conform to the "accurate" provincial base, where others agreed that we could live with the high accuracy of the larger cities. A compromise was eventually reached to accept the accurate mapping of the larger cities, with the intent that ICIS would arbitrate the discrepancies at the boundaries between these entities. This debate remains ongoing.

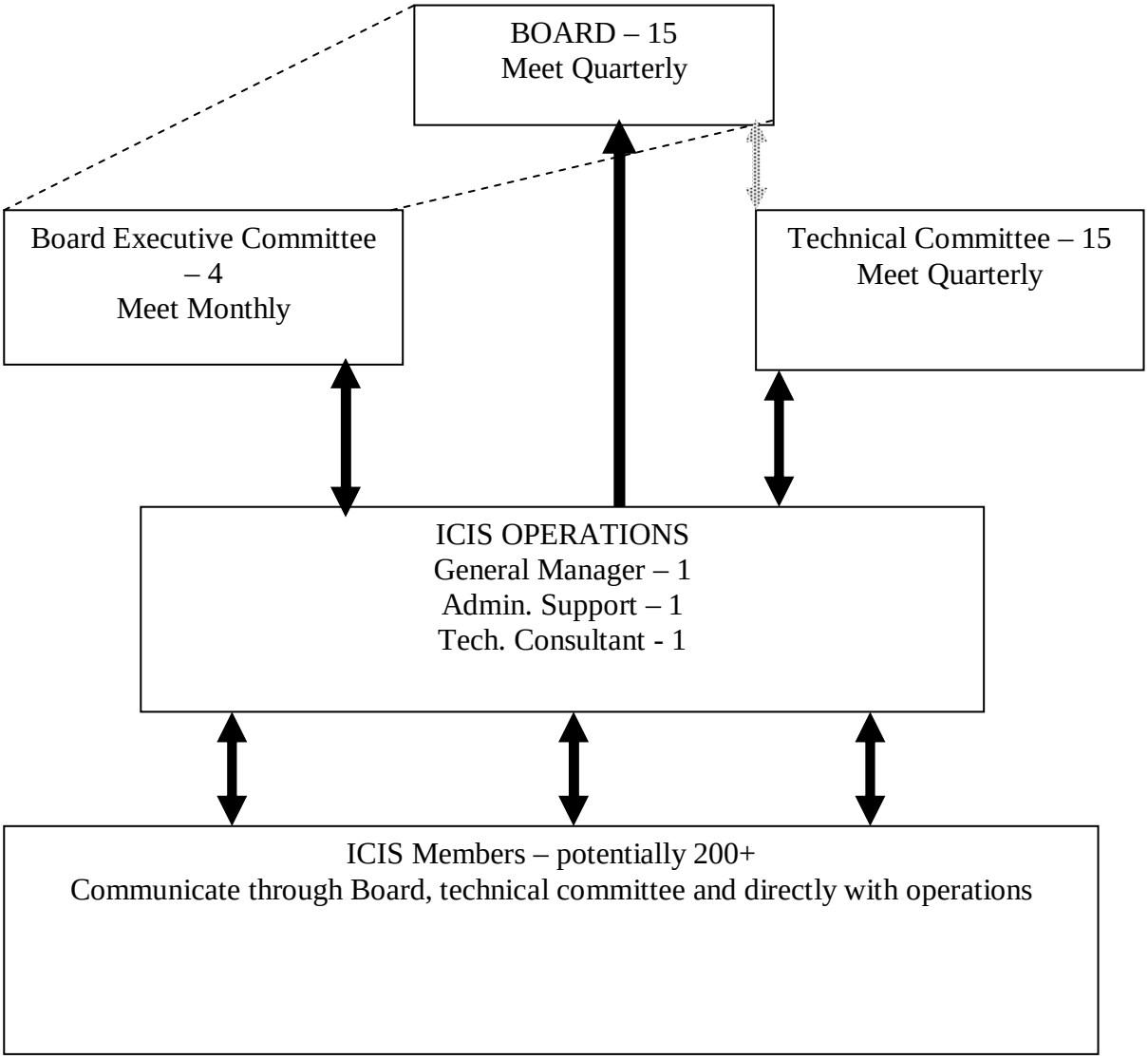
The approximate model used, and the number of persons engaged, are shown in the diagram below.

It appears that many projects consider the "compilation cost" as the major factor in the budget. In fact, the internal and external communications costs, as in the case of ICIS, to keep the project moving, are likely to be very significant. These communication costs must include both data communications (collection/dissemination) and member relationship costs.

Lesson number 4 – Budget for significant cost beyond "compilation" alone.

Number of persons engaged in ICIS functions

(Approximate - Does not show
2 “sales/PR” resources engaged for 2 years in the past)



B. Technical/Geomatics

A very significant hurdle exists always in such projects, in estimating the effort required to achieve a particular compilation rate to a given standard. Needless to say, our estimate along with many others, was very optimistic. Even when warning signs were evident, it was not possible to gain support for revised targets.

Lesson number 5 – Believe the productivity history.

Care must be taken in designing the compilation workflow, to account for complete and accurate record of adjustments made and reasoning behind the adjustments. Before the map can be accepted as "accurate", the quality control sign-off, should include as broad a range of user requirements as possible, within the budget.

Competent contractual resources are not readily available and must be selected and trained. The history developed by these contractors in the process of map compilation, is often not captured well, or lost after the fact. This, results in huge inefficiencies when returning to the same area for an update, or communicating with the area concerned, regarding the reason for adjustments incorporated into the new compiled base map.

Lesson number 6 – In addition to technical specifications, provide strict historical and anecdotal recording guidelines to compilation contractors, index and archive, that record and include the names of personnel.

An essential component of a cadastral system, is the digital survey plan standard. The design and control of this essential electronic document will have a profound effect on the update efficiency of the system. In Alberta, for example, the cost of update dropped by 50%, with the introduction of the digital survey plan submission standard. In the BC case, the approved digital survey plan standard is still under way. Simpler standards are now in place and are in operation (e.g. City of Surrey), and have been adopted as an interim standard by ICIS.

Lesson number 7 – Adopt a simple digital survey plan standard as early as possible.

C. Remaining Challenges

i) Adjustment for more new accurate survey data submissions.

The techniques for adjusting an old survey "fabric" when new and more accurate data "patches' become available is not a well developed science. Australia and New Zealand appear to have the best approaches I have seen to date. (Ref. D)

ii) Update synchronization

Given that we have compiled a new cadastral map, and that it has been accepted by the membership, how do we accept and include updates on an ongoing basis?

iii) Funding

The funding model initially envisaged for ICIS has proved not to be sustainable.

Greater success has been possible, for example in New Brunswick, where all the direct beneficiaries of the improved and current cadastre, such as land titles, assessment (property tax) authority and survey branches are under one administrative umbrella. The cost of maintenance of the cadastral base can then be seen to be a small fraction of the overall provincial revenue flow generated from these sources, and the business processes supported y them.

Another possible model is the one adopted by Alberta, where a flat rate "survey plan fee" is levied when each new survey or subdivision plan is submitted. These additional revenues are directly applied to the cadastral update effort.

4. Future Directions

While society proceeded on its course, the administrative environment in which it began has changed drastically.

The Land Title Branch, formerly a provincial government function, has been created as a Crown Corporation "independent" of the government. The Surveyor General of BC is now attached to this office. It is clear, that this powerful grouping, with all the land transfer revenues flowing to it, will wish to influence the creation and custody of the cadastral base.

Technology has advanced to allow the use of remote map bases as "overlays" in any modern web- enabled work-station. While this may relieve some of the direct explicit exchange of information, it is still essential for some applications (e.g. engineering design), that the maps conform to a common base.

Since the initial surveys of the Cadastre are conducted and documented by surveyors, it is logical that they play a pivotal role in this scenario. It is only recently, however, that surveyors are being schooled in geo-referencing of their work. Geomatics courses in Universities and Technical Schools need to amplify and augment courses related to digital cadastral compilation and maintenance.

A great deal of work is yet to be done to make the ICIS project a completed working and sustainable entity. Initial indications are, that where matched and current digital cadastral and infrastructure data are available, tremendous economies in workflow improvement can be realized.

References

A. **Piotr Cichocinski,** University of Mining and Metallurgy**,** Kraków, Poland **- Digital Cadastral Maps in Land Information Systems,** *LIBER QUARTERLY, ISSN 1435-5205*

B. The Cadastral Template Project. Daniel STEUDLER, Switzerland, Ian P. WILLIAMSON and Abbas RAJABIFARD, Australia, and Stig ENEMARK, Denmark, **FIG Working Week 2004Athens, Greece, May 22-27, 2004**

C. Cadastral Template - A Worldwide Comparison of Cadastral Systems - http://www.cadastraltemplate.org/

D. MAGIC REVISITED: An Object-Oriented Solution to the Cadastral Maintenance Problem. The Australian Surveyor, March 1993, Vol. 38, No. 1, p.39-49