

Underground Facilities The Need for Accurate Records in an Expanding Society

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Key words: buried utilities, pipelines, records, surveyors, professional responsibility, political campaign.

SUMMARY

Presentation Theme

Sustainable Development: With all of the development in Alberta and around the world, there is a need for accurate as-built mapping of buried facilities. Can we continue to bury pipelines, electrical and communications conduits, storage tanks, and other facilities without creating an accurate as-built map of all of these facilities and making the data accessible to all? If we don't, do we face a potential disaster?

Abstract

This presentation will review the present records environment in Alberta with regard to buried facilities, identifying some of the problems arising from this system of records, and to suggest measures which could be explored to alleviate these concerns.

In general, changes to present chaotic records systems are overdue, and very soon we will be forced to implement improvements from necessity, either because of the inefficiency of the present practices, or because of the occurrence of some major disaster.

Today's geographic information systems and land related information systems technology present an opportunity to implement major improvements.

This is a very simple problem but one with very serious consequences. In this day and age when we can access information from anywhere in the world, it is imperative that we have accurate, reliable, information available for all underground facilities. Alberta has a labyrinth of underground pipes and other facilities that are the lifeline to our economic well being and our quality of life. We must maintain accurate records of those facilities for public safety as well as to expedite future economic development.

Despite the fact that this paper will focus on the existing situation in the Province of Alberta, Canada, the concerns and potential solutions are applicable in every jurisdiction of the world.

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1. GEOGRAPHICAL CONTEXT

The Province of Alberta, Canada has a population of slightly more than 3 million people and an area of 661,000 square kilometres. Over half of the province is undeveloped and mostly uninhabited. There is however considerable resource development throughout the province including the more remote and uninhabited portions. Most of this resource development is related to petroleum and natural gas extraction and therefore a major offshoot of this industry is an extensive array of underground pipelines to transport the natural product to refineries and the refined product to markets throughout Alberta, Canada and the United States.

The Alberta Land Surveyors' Association is the professional organization that has the responsibility of regulating the practice and profession of cadastral surveying within the province.

2. UNDERGROUND INFRASTRUCTURE

Alberta has over 1 million km of buried infrastructure including over 300,000 km of high pressure oil and gas pipelines. This infrastructure is worth over \$1 billion.

Over the last number of years the Alberta Land Surveyors' Association has been concerned about the need for accurate locational information for buried facilities. As the professional association responsible for the provision of surveying services in the Province of Alberta it is part of our mandate to be concerned about issues that affect public safety as they pertain to the accurate determination of property boundaries and facilities constructed relative to those boundaries.

In this regard the association has launched a political campaign to discuss the need for more specific regulation of buried facilities. This is not a concern about any particular type of buried facility but rather the proposal deals with all buried infrastructure.

When we speak of buried facilities (or buried infrastructure) we are not just referring to buried pipelines and electrical or communication conduits. The same principles apply to capped wellheads, underground storage tanks, land fill sites, mines and any other works that may someday need to be relocated or may cause serious property damage or public harm if accidentally uncovered or inadvertently struck.

Speaking of mines, you may recall the trauma in the summer of 2002 in Pennsylvania, USA, where mine workers inadvertently dug through the wall into another old mine shaft that was flooded with water, resulting in their entrapment for several days. It was only because of the accurate location of the new mine shaft that rescuers knew where to drill down and rescue

them. But the cause of the accident in the first place was the result of the lack of accurate up-to-date records of the older shaft.

Throughout the world there are many old mine shafts and tunnels with virtually no records of their location and often even of their existence. In many cases these old mine shafts exist in urban areas under presently developed lands. Despite the need for better records of mine shafts, it does not make economic sense to spend millions of dollars searching for and locating these old shafts. But when we do discover them, or possibly when working in the vicinity of them, it would only be prudent to get an accurate location of all potential shafts, map the location, and make the information of public record.

I may have digressed a bit from my main point but the situation with the mine rescue in Pennsylvania is a real and recent illustration of the problem caused by a lack of, or inaccurate records of buried infrastructure.

I would now like to discuss some specific observations about a number of common aspects of our buried infrastructure in Alberta.

2.1 Gas Co-op Lines

In Alberta, thousands of miles of gas co-op pipelines were installed in the 1970's to connect every households in the province to natural gas. This was a huge undertaking, and was accomplished expeditiously and very economically. One of the legacies left as a result of this program, however, was a dearth of accurate records of the location of these lines. Construction crews went from parcel to parcel laying plastic pipe, but often detouring around the slightest body of water, stand of trees, rock outcrop, haystack, or other obstacle without recording the actual location of the diversion.

In retrospect, and admittedly, hindsight is 20-20, it is suggested that perhaps the government, should have put a few more financial resources into the program to ensure that accurate as built records were made at the time of construction, in order to provide better as built records for these lines. We expect that surveys were the least of their worries when this program was proposed, and hence the builders of the gas co-op pipelines had to make due with the resources they had.

2.2 High Pressure Oil and Gas Lines

On the other hand, high pressure oil and gas pipelines, as opposed to low pressure gas co-op lines, are almost universally planned and laid out based on accurate surveys of their right-of-ways, which are then filed in the Land Titles Office. Subsequently, confining easements are registered, based on legal right of way plans, to protect the legal interests of both the landowner and the pipeline operator. The lines are normally buried to sufficient depth not to be of concern to normal day by day operations. Until recently, pipeline plans also included a profile of the ground surface referenced to geodetic elevation above sea level as well as accurately depicting the horizontal location with reference to property boundaries.

2.3 Alberta One Call

In the last number of years, since the initiation of the Gas Co-op system, we have seen the birth of what is called the Alberta One Call system. Alberta One Call is a system that most utility companies subscribe to and which the public can access at no charge. The utility companies provide the general location of their lines to Alberta One Call who index them geographically so that when a member of the public calls, they can advise if there are any lines crossing a particular parcel and if so, they arrange for the utility company or private contractors to go out and mark the location of the buried pipeline so that the caller will know where not to dig. This system was not initiated solely because of the need to do “locates” on gas co-op lines, but also for telephone, electrical conduits, fibre-optics, high pressure oil and gas lines, and more recently the Supernet. Our society has become very reliant on a massive and efficient labyrinth of underground utilities that provide us with the quality of life that we take for granted. It is imperative that we protect this lifeline of modern convenience.

2.4 Need for Accurate Records

Modern society has also become dependent on the need for accurate locational records of all natural and man-made features on the surface of the earth. All new infrastructure must be designed efficiently based on positional data relative to existing conditions on the ground. It is not efficient to design a facility only to find during construction that an unforeseen buried facility is encroaching on the work site. Mega dollars must then be spent on delays and redesign to revise the plans, or have the existing facility relocated. Alberta One Call will locate buried facilities for construction but not solely for planning purposes.

Another major concern is for disaster management. In the event of a disaster it is important that the disaster management team have accurate records of underground facilities in the event that it may be necessary to locate a pipeline to avoid further explosive consequences. In a disaster situation it may not be possible to go out onto the land to locate the facility particularly when time is of the essence. Forest fires may or may not fall into the category of disasters but very often forest fires occur in the vicinity of existing high pressure oil and gas lines and gas co-op lines.

We must also be concerned about the safety of private landowners and others who use or work the land. Landowners are not always aware of their responsibilities to call Alberta One Call when doing work on their own land. New owners and tenants may not be aware of buried facilities or often assume that they are buried deep below the surface. It is not uncommon for a landowner or a lessee, to go out and dig a dugout or drainage ditch, or in the urban context to build a retaining wall or new flower bed, using steel bars to stake down the timbers. The latter appears to be what happened in a recent accident when a man and his wife were killed, and their house totally destroyed as a result of an explosion when a steel bar severed the gas service line.

Surveyors experience similar problems in placing or replacing monuments on property boundaries. We are aware of two cases where a 36 inch survey post went through a gas line and one case where a survey post struck an underground electrical cable. In all three instances

the pipes or conduit were along a property boundary rather than within the road or right of way where they were supposedly constructed. Most likely, the installation of the underground facility was responsible for destroying the survey monument in the first place.

The technology is now here to make this job of location more practical. We note that some Gas Co-ops are using Global Positioning Systems to locate new gas co-op lines. That's great! If done properly with survey grade GPS, and accurately integrated into the cadastral framework, problems will be avoided in the future.

Alberta has a very efficient, simple, inexpensive, reliable, and accurate property rights system. The basis of this system is a cadastral framework made up of a systematic township survey covering the entire province - in fact all of western Canada, and a simple method of subdivision and demarcation of property boundaries. This system forms the basis of a land management system that is used by all levels of government, utility companies, developers and private landowners.

Over the years this system has developed to include an accurate parcel and cadastral mapping program whereby all surveyed parcels are mapped electronically and these records are available in a digital form for the use of all land management agencies and departments. This system is a state of the art computerized mapping data base. An obvious addition to this system is an accurate database for underground infrastructure.

One of the problems is that there is no single repository of information related to pipelines. Each of over 1600 petroleum companies has their own records. The Energy and Utility Board maintains a data base of proposed pipeline locations; right of way plans are filed in the Land Titles Offices; and utility companies, Gas Co-ops and municipalities each maintain their own records. One complete comprehensive database with all as built information is required in order to properly manage the underground infrastructure.

As custodians of the property boundary system, land surveyors feel it is their responsibility to bring to the attention of governments and other affected agencies, any concerns that have the potential for serious problems, as well as systems that can improve our quality of life.

For many years we have been concerned about the proliferation of buried facilities and the lack of accurate records of their location. A further complication is the proliferation of various public and private record systems some of which are not well maintained.

2.5 Urban Infrastructure

It is rather ironic that in the urban context, deep utilities such as water, sanitary and storm sewer - utilities that pose little or no danger to public safety, are located and mapped with precision, yet shallow utilities such as gas and electric conduits are sometimes laid just below ground level with no accurate as-built record of their location. They can be located approximately by electronic scoping activities or by hand exposure when it is necessary to lay a new line or construct something else in the near vicinity. Some of the emerging new utilities such as cable that we are beginning to rely on so heavily for data transmission are often found

to be within spade depth of the surface. Virtually no utilities, other than municipally owned sewer and water lines and some oil and gas lines have a vertical elevation referenced to a standard datum.

We are not suggesting for a minute that we must go back and dig up all of these buried facilities to locate them. What we are suggesting is that we need to establish regulations to require the accurate recordation of the as-built location of all buried facilities from this point forward.

3. THE FIVE PRINCIPLES

The Alberta Land Surveyors' Association has established the following five principles that are fundamental to allowing the construction of any facility that is buried beneath the ground:

- It is a privilege - not a right to bury anything under ground!
- For that privilege an operator must provide an accurate as-built location of that facility.
- The location of all buried facilities must be of public record in a central repository or data base.
- All buried facilities should be buried at least one metre below the surface, and facilities that pose a danger to public safety should either be buried deeper or encased in a protective casing.
- Buried facilities should be accurately located horizontally and vertically with reference to a standard datum that is readily recognizable by operators and the general public.

There are some excellent, well thought out regulations for some facilities, however they need to be applied strictly and universally to all underground facilities. There are also some excellent safety standards for operating in the vicinity of buried facilities. The basic issue however is not one of working around the problem but avoiding the problem in the first place through proper planning and facility management. Reliable, accurate records must be a prerequisite for the construction of all underground facilities.

This is a very simple problem but one with very serious consequences. In this day and age when we can access information from anywhere in the world, it is imperative that we have accurate, reliable, information available for all underground facilities. In Alberta we have a labyrinth of underground pipes and other facilities that are the life line to our economic well being and our quality of life. We must maintain accurate records of those facilities for public safety as well as to expedite future economic development.

4 CONCLUSION

To summarize:

- The Alberta Land Surveyors' Association feels that Alberta needs a Buried Facilities Act that sets standards for the accurate as built location of all buried facilities because of safety needs as well as the need for comprehensive planning for future infrastructure design and construction.
- We are not suggesting that existing facilities need to be dug up and mapped but only the need for mapping of new facilities, and old facilities that are exposed by other activity.
- We are addressing the need for accurate location of all buried facilities not just linear pipelines.
- The technology is available to obtain this information accurately and efficiently.

As surveyors we are close to the problems associated with poor records on a day-to-day basis. As professionals we have a responsibility to our governments and citizens to bring these issues forward and to advocate for systems and regulations that will bring added safety and security to the general public. The accurate recordation of the location of underground infrastructure is one of those issues.

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BIOGRAPHICAL NOTES

The Alberta Land Surveyors' Association (ALSA), established in 1910, is a self-governing professional association legislated under the Land Surveyors Act. The Association regulates the practice of land surveying for the protection of the public and administration of the profession.

G. K. (Ken) Allred is a past president of the Alberta Land Surveyors' Association. He is also a recently elected Vice President of FIG and was chair of Commission 1 - Professional Practice from 1994-98.

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