On the Road to Underground Utility Data Standards

Submitted on behalf of the Association of Ontario Land Surveyors and the Regional Public Works Commissioners of Ontario By Walter Kowalenko, OLS, OLIP

"Out of sight and out of mind" is a cliché that summarizes the state of records defining the location of underground utilities in the road allowance. A North Carolina State University report states there is an average of one death per day due to punctured utilities. In 2003, eight persons were killed in Etobicoke as a result of a gas line ruptured during road construction. In order to minimize such accidents, regulatory agencies and industry involved in underground utility construction focus on improving safety practices when breaking ground in the vicinity of underground utilities. The Regional Public Works Commissioners of Ontario (RPWCO) and the Association of Ontario Land Surveyors (AOLS) are of the view that high quality as-built records of underground utilities, assembled into continuous maps, are also essential to safe work around utilities and for the efficient management of the utility construction life cycle.

This article will cover the goals of the Regional Public Commissioners of Ontario and the Association of Ontario Land Surveyors relating to utility data standards; the forces driving change; best practices to support the proposed changes; how the initiative will benefit the users of the road allowance; and some of the opportunities on the horizon.

Several groups are starting to take notice that there is considerable opportunity to improve underground utility data management in the context of road excavation. Lack of knowledge about the location of underground utilities costs municipalities millions of dollars per year due to productivity losses caused by delays to road and utility construction. The evolution of spatial and information technology has evolved to the point that undertaking a project to improve the quality and availability of underground utility data is not only possible but a necessity.

In this regard, the RPWCO and the AOLS have established several goals relating to utility data management. The first goal is to improve the quality of records defining the location of underground utilities. This would be accomplished through the development of standards for as-built drawings of underground utility records.

The second goal is to assemble the records defining the location of underground utilities into continuous maps and to store those maps in one or more accessible databases per municipality or region. Due to the amount of construction activity in the road allowance and the need by many to know what lies beneath the surface, developing centralized or distributed data bases for data access is a simple yet important concept to pursue.

The third goal concerns the development of standards for planned construction activity in the road allowance. This is probably the simplest goal of the initiative and would address such questions as who, what, where, and when construction is being proposed and reliability of the construction schedules.

And finally, the AOLS intends to improve the permanence of property boundary markers. What does this mean and how is it related to underground utilities? Due to the haphazard way that many utilities are placed, they often interfere with the placement of iron survey stakes marking property boundaries.

The Association of Ontario Land Surveyors

The Association of Ontario Land Surveyors is responsible for protecting the interests of the public by regulating the professional practice of its members involved in cadastral surveying, geographic information management, hydrography, photogrammetry and geodetic surveying.

The AOLS has become involved in the underground utility issues for several reasons:

- property markouts can affect the safety and efficiency of survey crews and public;
- the location of underground utilities impacts the form of monuments defining property boundaries;
- there is a need to maintain minimum road width standards in new subdivisions to ensure there is adequate space for underground services;
- utility locates must be obtained before placing an iron stake marking the boundary; and
- the quality of underground utility locates could use significant improvement.

The Regional Public Works Commissioners of Ontario

The Regional Public Works Commissioners of Ontario represent the senior management of 17 Ontario municipalities involved in the delivery of municipal services and the management of related infrastructure.

The goals of the RPWCO include:

- Requiring reliable and accurate as-built utility drawings and other records, showing the location of underground plant, as a condition of road cut permit approval;
- Establishing electronic plan and sketch submission formats to facilitate the assembly of the utility records into one or more databases; and
- Establishing data standards for planned construction activity in the road allowance to facilitate the development of construction planning, coordination and permitting systems.

Urgent Need for Action

Why pursue this initiative you might ask? Space in the road allowances of urban centres is diminishing. There are more telecoms in the market place; many are vying for space to place their conduits; there are traffic signal conduits; space for trees is particularly important, and so on. Underground utility congestion is particularly problematic in major urban centres. Traffic congestion is increasing in urban centres, the public is frustrated with the long road construction schedules. We need better methods of planning and coordinating construction activities in the road allowance. The large number of constructors in the road allowance adds to the complexity of road and utility construction coordination and traffic management.

Infrastructure maintenance and reconstruction costs are also increasing due to construction delays and redesigns caused by unexpected subsurface anomalies. Road construction projects often go over budget due to schedule slippage

and construction project scope changes caused by unexpected underground utilities. Anecdotally, it has been observed that many road contractors in North America bid low on road construction projects because they expect to make their profit from construction project scope changes caused by unexpected underground utilities.

Public and worker safety is being compromised as a result of unknown buried utilities. An example is the eight deaths that occurred in 2003 in Toronto during a road reconstruction project. Could these deaths have been prevented had the excavator and utility locator access to complete, up-to-date composite underground utility maps and a collection of lateral service connection records?

The timeliness and quality of utility locates, from the surveyor's perspective, also needs significant improvement. The two week turn around time for locates can impact the closing dates of real estate transactions.

In many cases, it is impossible to place boundary markers on a property corner due to the proximity of underground utilities. Safety regulations require hand digging when a utility is within one metre of an area where ground is to be broken. Hand digging presents a significant paradox for survey crews since survey markers must be placed in undisturbed ground in order to ensure their long-term stability.

Technological Change - Opportunity

The Province has built an admirable parcel map indexing system in support of the land registration systems and there is no reason why a similar approach cannot be taken with the assembly of underground utility information. We should also go one step further and ensure that the survey records entering the registry system are geographically referenced, or integrated, to a defined datum, coordinate system and map projection. Consider the benefits of accurate and current records of parcels and underground utilities geo-referenced to a common framework.

With the proliferation of CAD, GIS and GPS units and their varying degrees of resolution and accuracy used by the utility companies, data exchange with municipalities will be a significant problem in the future in the absence of well defined standards. Utilities deal with many municipalities and many other utility companies. The benefits of standards for utility data and interconnected databases to share data would, therefore, be significant.

The province has also made progress recently with the development of the provincial street centreline network. This could be used as a basis for an indexing system for utility construction planning and the dispatch of utility locate services to a location.

Finally, there have been significant advances in the past 10 years in regard to:

- spatial data processing, integration and dissemination;
- international standards and interoperability specifications for geospatial data and applications; and

- best practices for safety when excavating around underground utilities.

Best Practices

These are all great developments, particularly the best practices developed by the Ontario Region Common Ground Alliance; however, specifications and best practices have limited impact if they are not backed up with standards of quality that, to some degree, are regulated and mandatory.

The American Society of State and Highway Transportation Officials recommends the best practice of preparing certified as-built utility drawings and composite utility mapping. Composite utility mapping programs have been in effect in Toronto and Ottawa for over sixty years.

The Japanese ROADIS System

Following an assessment of best practices in North America, the Japanese took the concept of a composite map of underground utilities one step further and assembled a database of underground utilities which is used by the three levels of government and the utility agencies in that country. ROADIS consists of the following three subsystems related to road administration:

- Road and Utility Management;
- Road Construction and Coordination; and
- Road Utility Permitting.

Benefits of Data Standards for Underground Utilities

A document prepared by the Strategy Policy Branch of Industry Canada entitled "Standards Systems, A Guide for Canadian Regulators," states that standards have become key determinants of economic competitiveness. The positive effects of standardization include the following:

- technical efficiency, by increasing the ease with which one firm's products can be substituted for, or combined with, those of another;
- interchangeability and compatibility of products, contributing to higher levels of productivity through exploitation of economies of scale and scope;
- efficiency of resource allocation (producing goods to meet recognized standards can reduce the amount of information customers need to make informed purchase decisions);
- improved information that can reduce the risk of product failure and consumer perception of such risk;
- technical and product innovation through the use of leading-edge standards; and
- reduced translation costs (such as those for moving data between systems using different software).

From a municipal perspective, graphic and tabular data standards for records defining the location of underground utilities will contribute to significant efficiencies in the infrastructure lifecycle and specifically improve: construction planning, coordination, preliminary design, utility drawing

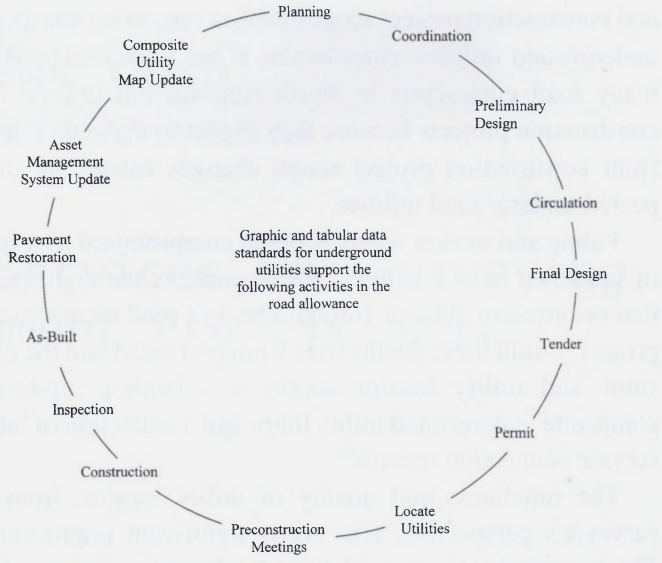

Figure 1: Data standards can significantly improve all of these activities

circulation, preparation of final design drawings, project tendering, permitting, utility locates, road and utility construction, inspection, as-built drawing preparation, pavement restoration, asset management and composite utility map assembly (Figure 1).

Opportunities on the Horizon

Major infrastructure improvements are being planned for the future in many large and well-established urban centres. The roads and underground facilities will be excavated, repaired or replaced. This presents a unique window of opportunity for municipalities to improve the quality of the records defining the location of underground utilities.

The Provincial Ministry of Infrastructure Renewal will be providing $7.5 billion in grants to 25 growth areas in the province over the next 5 years. We should seize this opportunity and systematically improve the quality of the records defining the location of underground services when those utilities are located and exposed during construction. The cost of obtaining reliable records defining the location of underground utilities is minor in comparison to the cost of infrastructure asset construction and maintenance.

The project to improve the quality of records defining the location underground utility records will take several years of concerted effort to achieve its objectives and perhaps decades to fully implement in the large urban centres. Will it be worth the effort? Better questions might be "What are the alternatives?" and "How much will future construction costs escalate and worker safety be compromised due to the surprises in the subsurface space of municipal road allowances?"

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