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LEVERAGING INFRASTRUCTURE DATA

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With over 14 million miles of utilities in the U.S. alone, challenges are great for the infrastructure industry to mitigate risk, manage efficiently, and reduce the costs involved with aging and crumbling infrastructures. The issue is magnified as one considers the 3.2 trillion (US) dollar worldwide infrastructure market.

Trenchless technologies such as directional drilling and subsurface utility engineering ("SUE") have emerged over the past decade to aid in the safe locating, mapping, construction, maintenance and repair of these subsurface structures.

However, redundant data capture, poor record keeping, non-integrated data systems and inaccurate and hard-to-find, unqualified utility maps still plague the industry. New field technological advances alone can not solve these inefficiencies without vast improvements in the management of infrastructure data.

Fortunately, technology exists that helps organizations greatly improve the way infrastructure data is managed. One major movement in trenchless technologies comes from the leveraging of integrated intra- and inter-organizational data systems utilizing the power of the Internet, geographic information systems (GIS) and the benefits of other useful work flow integration software.

It is feasible to merge field survey data capture with standardized metadata (data about data) process to improve existing subsurface records and provide this data for multiple business applications.

Anyone who has to research existing utility records can testify to the difficulty, inefficiency and bureaucratic red tape associated with this undertaking. Furthermore, most utility records are old, inaccurate and not immediately available, or accessible in electronic format. As a result, existing utility records are typically of limited value.

Therefore, survey crews are routinely hired to verify topographic data, such as manhole covers and valves. That alone is never enough.

In the United States, Subsurface Utility Engineering (SUE) has become a federally sponsored service in the United States used to locate and map existing utilities to improve the quality of utility maps.

SUE providers do this in two steps. First SUE providers use technologies such as radio detection, electromagnetic metal detection, vibratory and even Ground Penetrating Radar (GPR) to obtain a two-dimensional profile (sub-meter accuracy) of existing utilities so potential conflicts with current project plans can be determined.

Then, at those points of conflict, SUE providers use pneumatic vacuum technologies to safely dig small (12" x 12") holes to expose any existing subsurface utilities to determine their exact three-dimensional location, and therefore provide the highest quality information available (accuracy within centimeters).

However, this data is virtually never captured in a database that can be used for future designers, maintenance or repair staff. Integrating the use of SUE data is one vital element to the trend towards improving the management of infrastructure data over the Internet.

Following is a list of other significant problems with current operations:

LACK OF QUALIFIED MAPS

Existing subsurface utility and pipeline maps are not standardized in terms of format, software or quality. Many existing records are decades old, inaccurate and in paper format. Many files have been updated or converted to Computer-Aided Drafting and Design (CADD) software and some to spatially based database software, GIS.

TIMELINESS AND ACCURACY OF DATA

Since most utility records are old, inaccurate and difficult to access, they are limited in their usefulness to the vast majority of infrastructure projects.

LACK OF ACCESS TO DATA

With the proliferation of CADD and GIS systems, there is no system in place to integrate that information for applications such as engineering design, preventing catastrophic events, managing moving and changing assets in the field, field maintenance and repairs.

SHARING OF DATA WITHIN AND BETWEEN COMPANIES

The viability of data sharing and eliminating redundant data capture is an important facet of future improvement of organizational systems integration. The value of sharing utility location maps is numerous. Project managers need to research records from many entities and having all the data in one format accessible through the Internet will expedite the process and mitigate risks.

The following elements are needed to manage infrastructure more efficiently:

GIS

GIS is the key architecture that allows for the production and maintenance of infrastructure databases that can incorporate SUE data and existing records in one standard format.

Simply stated, a GIS lets users combine layers of information about a specific location or object (i.e.: a piece of infrastructure) to provide a better understanding of

that object and its relation to other objects in space. The layers of information you combine depends on your purpose - finding the best location for a new plant, analyzing environmental damage, managing field crews to maximize utilization, and so forth. A full GIS requires hardware, software, data, trained users, and sound analysis methods for interpreting the results generated by the GIS.

Metadata, again, means data about data, and standardizing the way in which metadata is qualified and stored is therefore a key element in making that GIS data useful. For instance, knowing whether that data is a certain quality level (reliable or not) determines what the user of the data should do next, whether to use an SUE firm to improve the quality or rely on the data to make design decisions.

INTERNET AND WIRELESS TECHNOLOGIES

With GPS becoming ubiquitous, getting information out to field staff is easy through existing handheld computers. Field crews can download key data needed to operate more efficiently, and field equipment (i.e., backhoes, etc.) can feature integrated shut down mechanisms when they come too close to existing facilities.

BUILT-TO-OWN OR ASP & RDS MODELS

To develop this type of infrastructure management system, organizations have two choices:

1. Build their own systems, which includes buying hardware, software, training and hiring and maintaining of technical staff.
2. Hire outside services such as Application Service Providers (ASP, outsourced hardware, software and staff) to manage their own systems. To share data between entities, Regional Data Servers (RDS) are placed to communicate with existing database systems so that this data can be routed throughout the Internet. This option will likely be the most economical.

WORKFLOW INTEGRATION

Workflow software further increases the value of this system by making all organizational process and protocol electronic and manageable through the Internet. Permitting, vendor management, document repositories, approvals and information flows are examples.

Once all of these elements are combined, the organization can fully integrate all of its departments' divergent data systems into one and gain maximum synergies.

What These Systems Do For Infrastructure Organizations:

LEVERAGE INFRASTRUCTURE DATA

Infrastructure data will be accessible 24 hours a day, 365 days a year and become useful across and between functions of different organizations which will result in more efficient operations and cooperativeness within and between entities. Facility owners will control risks involving projects around their facilities and construction companies will have better data accessible anytime and anywhere.

LEVERAGE HUMAN CAPITAL

These systems will enable organizations to employ fewer people with more time for additional work because of the electronic process improvements of inside and outside field staff.

IMPROVE BUSINESS EFFICIENCIES

Knowledge of infrastructure location and quality of that data allows for better faster and more precise decision making throughout an organization, therefore mitigating errors, redundant activities and resulting in considerable economic gains. Typical applications include selection, planning, strategic planning, marketing, permitting, design, new construction, maintenance and repair and emergency response systems.

PRODUCT DIFFERENTIATION

With this system, there is a significant opportunity to gain customer efficiencies, improved customer intimacy, product differentiation in the competitive space and greater cost-competitiveness.