The Development of an Australian Standard in Subsurface Utility Engineering (SUE)

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ABSTRACT

While the location of subsurface utilities often appears on design plans, due to the lack of historical evidence utility locations may not be exactly as shown or the records may not fully account for all the buried utility systems. This lack of reliable information during design and construction activities can result in costly conflicts, delays, utility service disruptions, redesigns, personal injuries to workers, and even lost lives. Standards Australia (SA) has begun the formal process of developing an Australian Standard for the practice of Subsurface Utility Engineering (SUE). SUE is an engineering process that combines civil engineering, geophysics, survey and CADD/GIS. It provides much more accurate information on the location and condition of subsurface utilities than has been traditionally available. The 24-36 month process, which began in May 2010, commenced with a needs assessment and input from various constituents. The first official meeting of the Technical Development Committee, comprising representatives of government, private industry, research, academia, users, suppliers and professional organisations, was held in August 2011, and the Committee has begun to draft the proposed Standard. There may be an opportunity for the work to develop into a joint Australia-New Zealand Standard. A major challenge for the Development Committee is that this is a "consensus" Standard. Although each party recognises the value of a Standard, each member represents different and often disparate interests. Unless consensus can be reached, the development of the Standard will lie on the shelf, similar to the recommendations from the 1977 ISNSW Seminar which originally advocated it 35 years ago. This paper outlines the process of developing the Australian Standard, the net benefit to the community, progress of the project to date and a review of the key elements proposed for the Standard. SA anticipates that the new standard will be published in March 2013.

KEYWORDS: *Subsurface Utility Engineering, SUE, Australian Standard, Standards Australia.*

1 INTRODUCTION

The concept of Subsurface Utility Engineering (SUE) was introduced to APAS at the 2011 conference in Bathurst, NSW (Gordon, 2011). SUE is an engineering process that combines civil engineering, geophysics, survey and CADD/GIS. It provides much more accurate information on the location and condition of subsurface utilities than has been available to date. Knowing precisely "where and what" a subsurface utility is, its condition and its status in its asset lifecycle can significantly reduce the occurrence of interference and conflict with valuable infrastructure.

In an effort to improve public safety and reduce costly property damage, Standards Australia (SA) has begun the process of developing an Australian Standard for the practice of Subsurface Utility Engineering. Broad definitions of SUE are already in place and promoted by governmental agencies in the United States (American Society of Civil Engineers, 2003) and Canada (Canadian Standards Association, 2011) and are being developed in the United Kingdom. Such a Standard will provide all levels of government, utility instrumentalities and developers with an understanding of the inefficiencies, risks and associated costs of the current practices of acquiring utility asset information.

The proposed Standard will recommend the absolute positioning of subsurface utilities in three dimensions as an improvement upon the current widely adopted methods of relative positioning. In countries prone to natural disasters, such as Australia and New Zealand, or terrorist attacks, such as the USA, absolute positioning appears to be a logical and necessary improvement when called upon to locate critical subsurface utility assets after the event.

2 NET BENEFITS TO SOCIETY

Historically, inaccurate or incomplete subsurface utility records have resulted in unintentional strikes on subsurface utilities by construction organisations and members of the public. However, with a SUE standard, many of these conflicts can be avoided. A United States Department of Transport (USDOT) guidebook (United States Department of Transport Federal Highway Administration, 2003) states that the proper use of SUE will eliminate many of the utility problems typically encountered on highway projects.

Studies in the United States (Department of Building Construction, Purdue University, 2000; Pennsylvania State University, 2007) and Canada (University of Toronto, 2005) have demonstrated that adopting a SUE process results in significant net tangible benefits to society. Consequently, SUE standards have become a routine standard of care requirement on highway and bridge design projects in the United States (American Society of Civil Engineers, 2003) and Canada (Canadian Standards Association, 2011).

3 COST BENEFIT

According to a survey conducted by Toronto University in 2004, two broad categories of savings emerged from using SUE – quantifiable and qualitative savings (University of Toronto, 2005). The Purdue University study (Department of Building Construction, Purdue University, 2000) quantified a total of US$3.41 in avoided costs for every US$1.00 spent on SUE. Subsequent university studies elsewhere have concluded higher benefits (Pennsylvania State University, 2007).

To relate these benefit/cost studies to Australia, we can use information supplied by the former Roads and Traffic Authority of New South Wales (RTA), now Roads & Maritime Services (RMS). RMS has a mature SUE process operating from within its Surveying Branch. RMS's 2009 Annual Report indicated that the RMS managed a road network that includes 17,981 km of RMS-managed State roads. Expenditure on capital works on these roads was $2,262,000,000 in 2008-09. To show the potential financial benefits of using SUE, let us assume that it was only used on projects encompassing one fifth, or 20%, of these funds

($452,400,000). Typically in the United States, 10% of total project expenditures are allocated to preconstruction and 5% of these preconstruction expenditures are spent on the SUE process. Thus, $452,400,000 x 0.10 x 0.05 = $2,262,000. As a reality check, this amount is well below the 2010-11 expenditure of RMS ($2.8 million) for the location and mapping of subsurface utilities in Sydney alone using in-house and contract resources. Adopting the conservative Canadian savings outlined above, $2,262,000 x 3.41 = $7,713,420 in benefit.

These substantial savings are primarily the result of two processes:
1. Project designers seriously considering accurate SUE information when designing projects, thereby avoiding spending money for unnecessary utility relocations and later during construction for delay claims.
2. Actual subsurface utility location immediately prior and during the construction stage of a road project, avoiding costs for utility hits and ensuring that all on site are aware of the location of the subsurface utility services.

These benefits are also recognised elsewhere across Australia. New South Wales RailCorp and Main Roads Western Australia (Main Roads Western Australia, 2009) have also adopted SUE-based standards for the mapping of subsurface utility services.

The cost of conflicts with subsurface utility infrastructure is not often appreciated, particularly in comparison with the cost of natural disasters. These costs represent a saving to the community had the subsurface utility asset not been hit. For example, the $800 million cost of one incident in September 2009 where a contractor cut through Telstra cables in York Street, Sydney exceeded the current loss (in 2006 dollars) from the 1976 and 1986 Sydney hailstorms ($730 million and $710 million respectively), equated to 70% of the current loss from Cyclone Madge in 1973 and was almost equivalent to the original loss figures of the 1989 Newcastle earthquake. The important consideration is, whereas natural disasters cannot be avoided, the impact of strikes on subsurface utility infrastructure can be significantly reduced by using the SUE process.

The adoption of absolute positioning of subsurface utility infrastructure in three dimensions is also of significant value to society in the aftermath of a natural disaster or a major terrorist incident. Instead of relying on relative positioning to structures which may not survive the event, absolute positioning is referenced to a global reference system. Even if major movement has occurred, this movement is measurable and the application of movement data to the original position of the subsurface utility can be made to determine its new position.

The proposed Standard should also increase consumer confidence in a utility organisation’s records management system by reducing inaccurate mapping and increasing the quality of stored information.

4 THE SUE INITIATIVE

Standards Australia has two pathways for Standards development: *Externally Funded* and *Resourced*. The *Resourced* pathway is available at no cost provided that the project meets certain criteria and resources are available. By October 2010, sufficient funds had been pledged to commence the SUE Standard project under the *Externally Funded* development pathway.

Principal financial contributors are:

- Australian Local Government Association (ALGA)
- Austroads
- Essential Energy
- National Utility Locating Contractors Association (NULCA)
- NSW Board of Surveying & Spatial Information (BOSSI)
- Roads & Maritime Services (RMS)
- Roads Australia
- South Australia Department of Transport Energy & Infrastructure
- Vac Group Pty Ltd
- Water Services Association of Australia (WSAA)

Funding has also been committed by the Emergency Information Coordination Unit of LPI NSW (EICU), the Surveying & Spatial Sciences Institute (SSSI), Dial Before You Dig and the Surveying and Mapping Industry Council of NSW (SMIC). These additional funds may be required (i) during the project for out-of-pocket expenses by committee members and (ii) once the Standard is published for education, training and the 5-year review of the Standard. This management of the funding is an independent initiative of SMIC, and SMIC takes full responsibility for the collection and disbursement of funds apart from amounts contracted directly with stakeholders by Standards Australia. SA does not oversee the collection or distribution of these funds by SMIC, and SA does not authorise any organisation to collect any funds on behalf of SA or any of its committees. For transparency stakeholders should be aware that Mark Gordon is the Chair of Standards Australia Committee IT-036 Subsurface Utility Engineering and also the Chairman of SMIC.

5 SA STANDARDS DEVELOPMENT PROCESS

Standards Australia (SA) is an independent, non-governmental organisation that leads and promotes a respected and unbiased standards development process. SA represents Australia on the International Organisation for Standardisation (ISO). A number of principles continue to be the basis for all SA Standards. These include open committee discussions for all parties of interest, a balanced representation on working committees, an 80% agreement with a lack of sustained opposition ("consensus"), and neutral facilitation by SA staff.

Once funding had been pledged, the next step in the process was to form a Technical Development Committee, which is responsible for developing and drafting the Standard. Typically, the Committee is comprised of representatives from national "umbrella" organisations representing many interests. It reports back to, and obtains advice from, those interests. Sectors of interest are determined by Standards Australia, and may include consumer/community groups, employer bodies, government (federal, state and local), independent professional and technical bodies, manufacturers/suppliers, regulatory and controlling bodies, researchers/academics and testing organisations, unions/employees, and user and purchasing bodies.

The Committee collectively represents the views of all stakeholders. In order to maintain the credibility and transparency of the standards development process, there are no special rights or privileges conferred on funding organisations. Funding organisations essentially contribute to a process but they do not buy the outcome of that process, i.e. they do not influence the outcome beyond that provided by the representative of their national organisation on the

Committee.

Whilst funding was being confirmed, a preliminary meeting of the SUE Standard Technical Development Committee was held on 21 March 2011. Standards Australia appointed Mark Gordon (Austroads) as Chair, supported in the capacity of Deputy Chair by independent international expert, Nick Zembillas. Nick has been a member of both the USA and Canadian Standards development committees.

Membership of the Technical Development Committee currently includes the following organisations:

- **Users:** Australian Local Government Association (ALGA), Australasian Railway Association (ARA).
- **Suppliers:** Dial Before You Dig, Energy Networks Australia (ENA), Water Services Association of Australia (WSAA), NBN Co.
- **Technical Associations:** Institute of Public Works Engineering Australia (IPWEA), Streets Opening Conference, National Utility Locating Contractors Association (NULCA).
- **Industrial Associations:** Australian Services Union.
- **Professional Associations:** Geospatial Information & Technology Association (GITA) ANZ, Surveying & Spatial Sciences Institute (SSSI), Engineers Australia (EA).
- **Government:** ANZLIC – The Spatial Information Council, Austroads.
- **Academia:** University of New South Wales (UNSW).
- **Regulatory:** Heads of Workplace Safety Authorities (HSWA).

6 MOVING FORWARD

The SA Standards development process contains seven distinct stages:

1. **Concept**: Defining and evaluating a new project initiative.
2. **Initiation**: Formally initiating the project and undertaking detailed project planning.
3. **Design**: Completing the design of the Standard or solution.
4. **Build**: Building the Standard, including public consultation.
5. **Implementation**: Approval for publication and delivering the Standard.
6. **Finalisation**: Formal closure of the project.
7. **Benefits Realisation**: Ensuring the benefits envisaged at the start of the project have been realised.

At this point in time, Stage 2 – initiation – is complete and Stage 3 has been commenced. Stage 3 involves the development of the content for the Standard, including discussion and consensus on the draft and editing it for public comment. It is most important to engage as many stakeholders as possible to ensure that consensus can be realised, and this is a primary reason for continuing education through presentations at seminars and conferences. Utility authorities, public works and transportation officials in addition to other stakeholders must be made aware of the development of the Standard so that they have the opportunity to take an interest or contribute to its development. It is far better to be an active participant rather than have a final Standard imposed without the advantage of time to analyse, plan, and prepare for any changes in current procedures. Further education will take place in conjunction with Stage 6, when an industry education and training program will be launched. Stage 7 will take place 12 months after the publication of the Standard, for a review of actual benefits realised. The review process is then repeated every 5 years, so that the Standard maintains its currency.

Subject to consensus, it is anticipated that the Standard will be approved and in place by March 2013.

7 KEY ELEMENTS PROPOSED

Although it is still too early in Stage 3 of the process to identify what the proposed Standard will contain, the current key requirements of the Australian SUE Standard, as identified by the stakeholders, are:

- To build on accepted best practices and processes through detailed research and analysis.
- Application of Quality Levels A, B, C, D currently adopted in overseas Standards and Guidelines such as the American Society of Civil Engineers' ASCE-3802 Standard *Guideline for the Collection and Depiction of Existing Subsurface Utility Data* (American Society of Civil Engineers, 2003) and the Canadian draft CSA S250 Standard *Mapping of Underground Utility Infrastructure* (Canadian Standards Association, 2011).
- The adoption of the locational absolute accuracy in three dimensions for the highest Quality Level (A).
- The inclusion of comprehensive metadata to identify the nature of a subsurface utility, its condition and status.
- To ensure the Standard is in plain English, with a content that is realistic, achievable and practical without placing an undue burden on practitioners and utility organisations.

An Australian Standard is not compulsory. However, it is hoped that the SUE Standard will be adopted by utility organisations and regulators as reflecting best practice. It is expected that there will be widespread support for the Standard and that this support will be exhibited through a modification by stakeholders of their internal processes, practices and systems. Most importantly, it would be ideal if government organisations in charge of the transport corridors in which most utilities are located insist on the adoption of the Standard for the placement, repair or relocation of utility services within those corridors to the extent that such activity reflects the highest quality level and locational absolute accuracy.

8 CONCLUDING REMARKS

In Australia, inaccuracies and inconsistencies in subsurface utility information have been recognised as major contributors to unnecessary and avoidable cost overruns, service disruptions, redesigns and personal injuries since at least an Institution of Surveyors NSW seminar on the topic in March 1977 (ISNSW, 1977). The development and adoption of an Australian Standard in the location and mapping of subsurface utilities, known as Subsurface Utility Engineering, will provide immediate tangible benefits to our society and provide the foundation for more efficient design and construction activities in the future.

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