PROFESSIONAL SURVEYORS CANADA
GÉOMÈTRES PROFESSIONNELS DU CANADA

CSA Standard Review – S250 Mapping of Underground Utility Infrastructure

Professional Surveyors Canada
Underground Infrastructure and Mapping Working Group

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Professional Surveyors Canada (PSC) is a not for profit association representing the interests of the public and Professional Surveyors across Canada. Our membership constitutes the foremost experts on land tenure, surveying, and cadastral mapping in Canada. PSC has been advocating for mapping for many years. Attached is our position paper on Underground Infrastructure in Canada for your review. This paper and position papers on recent federal legislation regarding underground infrastructure is available on our website at https://www.psc-gpc.ca/news-and-connect/initiatives/position-papers/.

Our membership has reviewed the draft standards for S250 and has several concerns and suggestions to improve the standard. These have been submitted through your online portal, will constitute a position paper to be published on our website, and are noted below.

Section 3 – Definitions:

1. **As-built** — a representation of the as-constructed situation showing the position and features of components as actually put in place.
   Note: *See definition of **Record** and Annex B for information on the distinction between record and as-built drawings.*

Suggested Amendment:

As-built — a survey and graphic representation of the as-constructed facility, showing the position and features of components as actually put in place.

There is a deeply rooted misunderstanding of this term. Given that as-built drawings do not actually show the as-constructed location of a facility, whereas Record Drawings do show the as-surveyed location, we recommend that this revised definition be used and that cross references to 'record', record drawings' and to Annex B be removed.

2. **Cadastral** — relating to an official register of land parcel ownership.

Suggested Amendment:

Cadastral — of or relating to a cadastre; showing or recording property boundaries, subdivision lines, buildings, and related details

The current definition of Cadastral is incorrect and misleading. This definition will work better with your document.

3. **Subsurface utility engineering (SUE)** — a term used in CI/ASCE 38-02 to refer to a process for managing project risks by identifying and controlling the quality of underground utility infrastructure information used in the design, development, and construction of an infrastructure project.
   Note: *A comparable service is subsurface utility infrastructure mapping, which can be considered an alternative service to SUE.*

Suggested Amendment:

Subsurface Utility Mapping (SUM) – a term used to refer to the process of locating and recording underground utility infrastructure to a specified standard of horizontal a vertical accuracy.

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Given the CSA Standard S250 is called **Mapping of Underground Utility Infrastructure** the term used to describe the process should be reflective of this. Subsurface Utility Mapping, SUM, is a better term. SUE encompasses the term 'engineering' which is a tightly controlled and trademarked term in Canada. Professional Surveyors Canada has fielded complaints in Ontario that SUE is being used to prevent non engineering practitioners from surveying underground infrastructure. This is surely not the intent, but it is the effect. Using the term 'Engineering' alone suggests that the entire scope of mapping UI can be completed by a professional engineer. Suggesting that SUE is comparable to subsurface utility ~~infrastructure~~ mapping is a false statement.

Given that the only use of SUE in this standard is in reference to correcting errors discovered in mapping systems, replacing references to SUE with SUM would be appropriate.

Section 4.4.3 – Map data interoperability:

4. The owner should maintain their records in a geospatial mapping system to facilitate data sharing. To better enable data interoperability, the owner may consider adopting open data definitions in order to structure their records.

   Note: *An example of an open data definition can be found in the Open GIS Consortium LandInfra / infraGML Standards for Infrastructure. See https://www.opengeospatial.org/standards/infragml*

Although PSC commends the reference to OGC standards, we are concerned that the link will eventually break and should be revised to the main OGC website URL.

Section 4.6.4.1 – Base Mapping - General:

5. Where available, owners in the same geographic area should use a common landbase for the purposes of this Standard. In addition, when possible, owners should use composite mapping, which may include cadastral, topographical, and/or orthorectified images. Users should be aware of any accuracy limitations of base mapping. While digital maps may permit the extraction of coordinates at the millimeter level, the absolute positioning of the mapping information may be meters or tens of meters from true, depending on the age, origin, and location of the map.

Suggested Amendment:

Owners in the same geographic area should use a common mapping standard. In addition, when possible, owners should use composite mapping, which may include cadastral, topographical, and/or orthorectified images. Users should be aware of any accuracy limitations of base mapping. While digital maps may permit the extraction of coordinates at the millimeter level, the absolute positioning of the mapping information may be meters or tens of meters from true, depending on the age, origin, and location of the map. A licensed surveyor should be retained to define property boundaries on the ground in accordance with provincial legislation and regulations where applicable.

The term 'landbase' is undefined and should not be used in this context. We have added a refence to professional surveyors as the legislated means of defining boundaries on the ground. PSC commends the working group for including this section into the document, as the use of cadastral mapping for underground utility design is a common cause of utility trespass.

Section 4.6.4.3 – Landbase Mapping

6. When landbase mapping is used, streets, addresses, text/annotation, measurements, draft plans, and geospatial reference point features shall use a defined coordinate, projection system and datum.

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Suggested Amendment:

4.6.4.3 Mapping

When mapping is used, streets, addresses, text/annotation, measurements, draft plans, and geospatial reference point features shall use a defined coordinate system, projection system and datum.

The term 'landbase' is not a proper industry term and is not required. Simply referring to the product as 'Mapping' is sufficient and succinct. 'Landbase mapping' can be replaced by 'mapping' throughout this standard.

Section 5.3.2 – Projection or Coordinate System

7. The location of utility infrastructure shall be recorded and maintained such that it can be provided in accordance with a commonly used reference system (e.g., coordinates of latitude and longitude are most suited to accommodate GIS systems). If an owner maintains a GIS or CAD-based mapping system, a common projection or coordinate system shall be used so that data can be easily shared with others. As-built drawing coordinates shall correspond to the standard reference datum and identify the projection system of eastings and northings and the elevations employed.

Suggested Amendment:

Section 5.3.2 –Coordinate Systems

The location of utility infrastructure shall be recorded and maintained such that it can be provided in accordance with a commonly used reference system ~~(e.g., coordinates of latitude and longitude are most suited to accommodate GIS systems).~~ If an owner maintains a GIS or CAD-based mapping system, a common horizontal and vertical datum and projection shall ~~projection or~~ be used so that data can be easily shared with others. As-built drawing coordinates shall correspond to the standard reference datum and identify the projection system of eastings and northings and the elevations employed.

In the opinion of PSC, the use of latitude and longitude is the least suited coordinate format for this purpose. Geodetic coordinates by nature have the greatest risk of misinterpretation in datum and epoch. These variables lead to use of data with small shifts and distortions which are not caught and more commonly lead to actual errors in construction and mapping.

A projection and a datum make up a coordinate system. The terms Projection and Coordinate System are not interchangeable.

5.5 Accuracy of as-built records

The precise horizontal and vertical location of underground utilities shall be measured and recorded while exposed to an accepted geodetic datum with a 95% confidence level by a competent individual. When creating as-built records, the spatial accuracy of the data shall be specified as in Table 1:

Table 1
Positional accuracy of as-built records
(See Clauses 5.5 and 5.6.2 and Figures 2–6.)

Accuracy level	Description	Reference
1	The measurements shall be taken and tied into an absolute reference as described in Clause 5.3, and that reference system shall be stated on the drawing. The position shall be accurate to ± 25 mm in the x, y, and z coordinates.	**Absolute**

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2	The measurements shall be taken and tied into an absolute reference as described in Clause 5.3, and that reference system shall be stated on the drawing. The position shall be accurate to ± 100 mm in the x, y, and z coordinates.	**Absolute**
3	The measurements shall be taken and tied into either a relative feature as described in Clause 5.4 or geodetic datum as described in Clause 5.3, and such features referenced on the drawing. The position shall be accurate to ± 300 mm in the x, y, and z coordinates.	**Relative** or **Absolute**
4	The measurements shall be taken and tied into either a relative feature as described in Clause 5.4 or geodetic datum as described in Clause 5.3, and such features referenced on the drawing. The position shall be accurate to ± 1000 mm in the x, y, and z coordinates.	**Relative** or **Absolute**

NOTE: *Where the accuracy levels of all of the x, y, and z coordinates are not the same, the accuracy level to be ascribed to the infrastructure shall be determined by the least accurate coordinate.*

Accuracy level 1 is not reasonably obtainable in an absolute frame over a long distance with undulating infrastructure. Perhaps accuracy level 2 is sufficient to convey the information necessary. Further, there is no current standard of the following,

A. Specifications for where on large UI a measurement is taken.
B. Where on a buried pipe or UI, where tracer wire is to be set.

PSC commends the CSA working group for S250 on your attention to detail in this document, and we look forward to reviewing the final revised document. You can find out more about PSC and our positions by visiting www.psc-gpc.ca.

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