TORONTO

REPORT FOR ACTION

Review and Recommendations on Underground Locates

Date: November 20, 2023
To: General Government Committee
From: Chief Engineer and Executive Director, Engineering and Construction Services
Wards: All

SUMMARY

The purpose of the report is to respond to GG3.22 - Review and Recommendations on Underground Locates. The report summarizes the current processes and challenges related to underground locates and outlines a series of improvements to be implemented both immediately and over the long-term.

What you find under the streets of Toronto is as complex and old as the city itself. Unknown underground infrastructure presents a significant challenge in construction, particularly in older cities like Toronto where some of the infrastructure dates back more than 150 years. While the current City and its pre-amalgamation entities installed a considerable amount of underground infrastructure, so did City agencies such as the TTC, as well as private and third-party utility companies like Bell, Rogers, Enbridge and Toronto Hydro. This was all done over a long period of time, with different record-keeping systems and practices.

When construction teams inadvertently encounter unknown underground infrastructure, it can lead to dangerous situations posing a threat to worker and public safety, impact the environment, disrupt essential services to the community and it almost always causes delays, leading to extended timelines, increased costs, prolonged traffic disruptions and public frustration.

Significant resources and substantial efforts have been invested by the City of Toronto in identifying and mapping underground utilities. While progress has been made, the issue of unintentionally encountering underground infrastructure remains a problem for large, older municipalities across North America. However, new processes and technologies are continuing to emerge, which may provide a viable option for the City of Toronto to explore, learn from, and implement for a better outcome.

This staff report outlines how underground locates and utility mapping are currently being undertaken, some of the most significant challenges, and proposes a plan to improve the process including:

- Obtaining and mapping as-built information. (Q2 2024)
- A new risk evaluation matrix. (Q2 2024)
- Staff training and development. (Q4 2024, on-going)
- Implementing advanced Subsurface Utility Engineering processes. (Q4 2025)
- Develop a tieback-specific database and policy. (Q3 2024)
- Ongoing best practice research.
- Monitoring and coordination.

This report highlights specific measures to address the identification and management of underground infrastructure, however, neither the issue nor the solutions should be isolated from the broader project delivery process. For example, allocating sufficient time for planning and designing a project, aids in resolving this and other issues encountered during the capital delivery process.

RECOMMENDATIONS

The Chief Engineer and Executive Director, Engineering and Construction Services recommends that:

1. The General Government Committee receive this report for information.

FINANCIAL IMPACT

There is no direct financial impact resulting from the adoption of the recommendations in this report. However, the adoption of the immediate actions will have future financial impacts relating to additional utility investigations completed and the potential new tools and technology to do this. These costs may be offset in part or whole by a reduction in construction costs, change orders and/or project delays.

Additional costs will be included for consideration as part of the future Capital Budget and Plan submissions for Transportation Services and Toronto Water.

DECISION HISTORY

At its meeting on April 20, 2023, the General Government Committee adopted Item GG3.22, requesting the following:

1. City staff to report back to General Government Committee by the end of 2023 with:
a. a review of practice for how the city and contractors currently report on underground infrastructure prior to construction design.

b. recommendations on how to improve the process to better understand underground locates of infrastructure prior to design.

A copy of the General Government Committee Decision Document can be found at: https://secure.toronto.ca/council/agenda-item.do?item=2023.GG3.22

COMMENTS

Since the adoption of Item GG3.22 by the General Government Committee on April 20, 2023, Engineering and Construction Services has completed a review of its internal processes and guidelines as well as those of other jurisdictions in both Canada and the United States.

Current Practices, Ongoing Challenges and Industry Changes

Gathering accurate data related to existing utilities and buried infrastructure starts in project planning and continues throughout all phases of project development.

Engineering and Construction Services policy and practices for identifying underground infrastructure are included in the Capital Works Procedures Manual (2021) which is used to guide all aspects of project development. The sections in the manual related to utilities were developed and refined in accordance with industry-wide best practices and are based on the principles of Subsurface Utility Engineering. This manual is used by both internal and external designers for the delivery of linear watermain, sewer and roadways contracts.

Currently, the typical approach employed by Engineering and Construction Services involves several steps:

As-Built Records and Mapping

We internally search through our as-built records to gather information on existing City-owned underground infrastructure. Engineering and Construction Services also assembles utility mapping of City-owned infrastructure within the downtown core based on as-built information supplied by City divisions and agencies. This information is available for City-led projects and private projects (for a fee).

Communication with Utility Companies

We have regular meetings with utility companies, including bi-weekly with Toronto Hydro related, to capital coordination. We also share our project drawings with utility companies at the 30% and 90% design stages and work with them to identify any potential conflicts. In the initial stages of design when a project is defined, underground infrastructure is assessed for potential conflicts and risk to project delivery. A Utility Design Initiation Notice (DIN) is issued to all utilities located within the right of way and limits of the proposed project. It notifies utilities of the upcoming work, seeks to obtain as-built drawings indicating the existing and abandoned plant locations and recommends that utilities conduct an inspection of all existing infrastructure in need of

repairs, relocation, or upgrades, prior to commencement of the City project — all of which supports the identification of any conflicts with existing and planned utilities.

Utility owners within the right of way are encouraged to complete these reviews because they understand that following the completion of many City capital projects there could be a five-year moratorium on permits for excavation within the project limits.

Design of lower complexity projects typically relies on underground information supplied by the utilities. Higher complexity works as determined through a project risk assessment would undertake Subsurface Utility Engineering investigations.

Subsurface Utility Engineering

Subsurface Utility Engineering is an engineering practice to establish the location of buried utilities more accurately with the goal of reducing project risk.

Subsurface Utility Engineering is required for underground engineering design projects and for some surface engineering projects which involve road alterations, utility relocations, streetscaping and TTC track work. The Subsurface Utility Engineering industry has four defined levels of investigation, where increased cost and effort may produce better accuracy. The City uses all levels depending on the type of construction and location, including the highest two levels when needed:

- Quality Level B in which information is obtained through the application of appropriate surface geophysical methods to determine the existence and approximate horizontal position of subsurface utilities.

- Quality Level A provides the highest level of accuracy in locating and identifying underground utilities. This level involves the actual exposure and precise horizontal and vertical positioning of utilities. As Quality Level A, or daylighting, involves physically exposing utilities it can be disruptive to the local area and therefore is usually only done when it is determined that critical subsurface information is needed based on an initial utility information assessment or Subsurface Utility Engineering Quality Level B work.

Engineering and Construction Services has broadened the scope of the Subsurface Utility Engineering implementation over the last few years. When looking at projects where Subsurface Utility Engineering is applicable and beneficial, the Subsurface Utility Engineering accounted for roughly 0.55% of capital project expenditures in 2021, which increased to approximately 0.72% in 2023, for a total 2023-spend on Subsurface Utility Engineering of approximately $2.6 million. The approximate cost of Subsurface Utility Engineering investigations for capital projects delivered by Engineering and Construction Services in the last three years is $6.8 million.

Despite using these numerous, effective processes, due to the age and complexity of Toronto, and considerable variation in the processes for different utility companies, in some cases the accuracy, completeness, and currency of information pertaining to existing underground utilities are often incomplete. This shortfall hinders the ability of both internal and external designers to make well-informed decisions, subsequently

impacting the project's risk assessment negatively. This issue is further exacerbated when project scope changes occur in the later stages of design.

Additionally, there has been a significant expansion of underground utilities in the last number of years due to the growing demand for high-speed communications infrastructure as well as the overall growth and development that has taken place within the city.

This challenge is not limited to Toronto. Conflicts with buried utilities, outlined and documented by other jurisdictions, have resulted in additional project costs ranging from 1.3%[1] to 4.8%[2] of the total project costs.

As a result, a number of industry-specific policies have been developed in the last 15 years.

Most recently, the Building Transit Faster Act, 2020 came into force introducing measures to streamline project delivery of priority transit projects. Part IV of the Act set out authorities that enable stronger coordination of utility relocation works with Metrolinx.

In 2015 the Transportation Association of Canada published a Survey of Utility Coordination Practices in the Toronto Area because of the impacts on projects related to the identification of underground infrastructure and utility relocation processes.

The Ontario Regional Common Ground Alliance in 2008, found that project owners should have a thorough and accurate understanding of the utility companies' infrastructure that exists within a project area and that this can be improved using subsurface utility engineering investigations which are able to accurately map the location of subsurface utility infrastructure using non-destructive locating techniques.

Actions to Improve the Current Practices

The objective of the actions proposed below is to reduce the gaps identified during the review of the current practice and are based on interviews with City of Toronto staff, review of available underground locate data, review of various internal guidelines, procedures, manuals, and review of risk mitigation processes used in other jurisdictions.

The actions focus on changes to current processes and practices in the areas of project planning, field investigations and training. These actions will increase the initial cost of design however it is expected that the increase may be offset in part or whole, by reduced construction costs and change orders, more accurate construction scheduling, and greater customer satisfaction. They include:

1 James H Anspach, Philip J. Meis "The Newly Revised ACSE 38 and how it applies to Utility Engineering", American Society of Civil Engineers, April 2022

2 Paul Goodrum, et. al. "An Analysis of the Direct and Indirect Cost of Utility and Right-of-Way Conflicts on Construction Roadway Projects", Kentucky Transportation Center, August 2006

Obtaining and Mapping As-Built Information (Q2 2024)

Developing and implementing a process with Transportation Services to expand on current processes to obtain and map as-built information for buried City infrastructure within the right of way that could impede construction. This will create a more accurate and comprehensive database of underground City assets. This detailed mapping will help designers and construction teams have access to current and precise information during the critical design phase and throughout project delivery.

New Risk Evaluation Matrix (Q2 2024)

Develop and implement a new risk evaluation matrix to guide project managers in selecting the appropriate level of underground infrastructure/utility investigation to increase design confidence. This will help project managers make more informed decisions about the level of investigation needed and ensures that resources are allocated effectively, focusing on areas with higher risk.

Training and Development (Q4 2024, on-going)

Train designers (internal and external) in the changes to the underground locate and utility management processes to ensure they are well informed and equipped to handle the complexities of underground infrastructure.

Advanced Subsurface Engineering Processes (Q4 2025)

Explore and potentially pilot the use of more advanced subsurface engineering processes including requiring Subsurface Utility Engineering consultants to comply with the latest standards (e.g., ASCE 38-22) and the development of 3D models using multichannel ground penetrating radar and other geophysical assessment techniques. These advanced methods could, in some cases, provide a clearer picture of what lies beneath the surface, allowing for more precise planning and reduced risks.

Develop a Tieback-specific Database and Policy (Q4 2024)

Establish a comprehensive database to track the existence of existing tiebacks at various locations. This documentation is vital for future reference, especially for municipal infrastructure projects, to facilitate efficient planning and maintenance of urban spaces. Also, work with the relevant City divisions to develop a detailed policy for tieback installation and maintenance.

Ongoing Best Practice Research

Conduct annual jurisdictional scans and research on technology adoption and innovation as well as document and data management to understand the efficacy, cost, and implementation of potential new strategies in a field that is advancing rapidly.

Monitoring and Coordination

Monitor the effectiveness of the proposed measures, including identifying any potential additional coordination with internal and external agencies to support continuous

improvement and the adoption of a unified approach to managing underground infrastructure.

The City will work to implement these strategies and conduct this additional research over the course of the next two years.

The identification and management of underground infrastructure presents a persistent challenge, one that has existed for some time and is expected to continue into the future. While there is no single solution to this issue, methods for managing it are evolving. City staff have consistently adopted and will continue to pursue emerging tools and technologies to meet this challenge.

This report has been prepared in consultation with staff from Transportation Services and Toronto Water.

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SIGNATURE

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