

Review and Recommendations on Underground Locates

Date: February 6, 2025

To: General Government Committee

From: Chief Engineer and Executive Director, Engineering and Construction Services

Wards: All

SUMMARY

The purpose of the report is to provide an update on the actions taken in response to GG8.25 - Review and Recommendations on Underground Locates. The report summarizes the series of improvements that have been implemented and work that will continue over the long-term.

The identification and management of underground infrastructure are essential to the broader capital delivery process and cannot be addressed in isolation. These challenges, deeply rooted in the complexity of aging urban environments, have persisted for decades and remain a critical aspect of every capital delivery project. While no single solution can fully resolve these issues, methods for managing them continue to evolve.

The outlined improvements address key challenges associated with underground infrastructure through measures such as adopting advanced technologies, improving data management practices, and refining processes to enhance project planning and execution. These initiatives include enhanced as-built record management, the implementation of advanced tools like multi-channel ground-penetrating radar (MCGPR) and adherence to updated Utility Engineering standards (ASCE 38-22), the development of a risk evaluation matrix, advanced subsurface engineering processes, and targeted training.

It is important to note that, despite thorough planning and advanced investigative techniques, there are instances where the true conditions of underground infrastructure only become apparent during excavation. To address these uncertainties during construction, additional processes are being developed to enable rapid and effective responses. These measures will be reviewed in the forthcoming Update on the Review of Capital Delivery Models report.

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 actions will have future financial impacts relating to additional utility investigations completed and the potential new resources, tools and technology to do this. These costs may be offset partially or entirely by reduced construction costs, change orders, 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>

At its meeting on December 6, 2023, the General Government Committee adopted Item GG8.25, requesting the following:

1. Requested the Chief Engineer and Executive Director, Engineering and Construction Services to report back in the first quarter of 2025 with an update on the actions taken to address the identification and management of underground utilities.

A copy of the General Government Committee Decision Document can be found at: <https://secure.toronto.ca/council/agenda-item.do?item=2023.GG8.25>

COMMENTS

Following the adoption of GG 3.22 by the General Government Committee on April 20, 2023, Engineering and Construction Services (ECS) completed a comprehensive review of the City's processes, procedures, manuals, and data along with those of other jurisdictions. Specific actions were identified to improve capital infrastructure delivery processes by minimizing current gaps in the identification and management of subsurface infrastructure and increase design confidence.

The actions focus on changes to current processes and practices in the areas of project planning, record keeping, field investigations and training. These actions identified below 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 including change orders, improved construction scheduling, reduced construction delays and greater customer satisfaction and stakeholder confidence.

Obtaining and Mapping As-Built Information

The City is developing and implementing an enhanced process to expand on current practices for obtaining, mapping, and archiving as-built information for underground 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 and as-built records will allow designers and construction teams to have access to current and precise information during the critical design phase, and throughout project delivery.

A working group was established to identify any discrepancies that may exist within existing processes, manuals and Standard Operating Procedures (SOP) regarding the collection and storage of engineering as-built information. The group reviewed existing practices and manuals and determined that gaps and inconsistencies existed in various documents. Actions were taken to correct these inconsistencies, including process improvements, roles and responsibilities clarification, and updating the manuals and SOP content.

The following revisions improve content in manuals, usability, and effectiveness in guiding users through various tasks:

- Implement recommended updates to ECS manuals that fully align with as-built submission processes. **Action – Complete.**
- Enhance the roles and responsibilities for developing and tracking submitted as-built records, monitoring for compliance, verifying for accuracy and completeness. **Action – Complete.**
- Ensure reporting responsibilities and collection of as-built information is supported in capital works management applications, including milestones for receiving/archiving as-builts, and the review/validation of the as-built drawings. **Action – Process Mapping Complete.**
- Ensure tracking details are implemented in the City's capital program and construction project management system (As-Built Received, As-Built Reviewed and

Checked/Validating, As-Built Forwarded to Utility Mapping and confirmation of updating data base). **Action – Process Mapping Complete.**

New Risk Evaluation Matrix and Guide

A new risk evaluation matrix and guide has been developed to guide City project managers in selecting the appropriate level of underground infrastructure/utility investigation to increase design confidence and accuracy. The guide includes a matrix to assist City project managers in selecting an appropriate Subsurface Utility Engineering (SUE) Utility Quality Level during project design, while considering project-specific requirements to manage utility conflict risks and uncertainties. Use of this guide will improve selecting and specifying Utility Investigation scope, with the intent of reducing conflicts and change orders encountered during construction.

This guide provides a methodology to assess SUE Utility Investigation needs for various construction projects within the City of Toronto, while reducing gaps identified during the review of current practice, 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 purpose of this guide is to provide ECS project managers an understanding of SUE and its application in the City's construction projects. It aims to streamline the process of determining when to apply different SUE levels by outlining a clear methodology that considers the complexities and risks associated with Toronto's underground infrastructure and allowing ECS project managers to follow a consistent approach in the amount and type of SUE conducted on underground infrastructure projects. This consistency is crucial for maintaining standards, improving outcomes, and ensuring infrastructure safety and reliability.

The following actions have been taken:

- Collaborate with consultants, project engineers and SUE experts to establish the guide objectives. **Action – Complete.**
- Develop risk evaluation matrix and guide for internal review. **Action – Complete.**
- Finalize and implement risk evaluation matrix and guide. **Action – Complete.**
- Train staff. **Action – Complete Q1 2025.**

Training and Development

The City is training designers and project managers (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.

The following actions have been taken:

- Collaborate with design supervisors, project engineers and SUE experts (internal and external) to establish the training objectives. **Action – Complete.**
- Develop high level objectives including syllabus, instructors, and duration of the training sessions. **Action – Complete.**

- Prepare training material and share with Committee. **Action – Complete.**
- Finalize training material. **Action – Complete.**
- Conduct Training sessions. **Action – Complete.**

Advanced Subsurface Engineering Processes

Explore and pilot the use of more advanced subsurface engineering processes including requiring SUE 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.

The following actions have been taken:

- Review existing RFP for City Delivered Ground Penetrating Radar (GPR) SUE Services. **Action – Complete.**
- Undertake a Pilot Project utilizing Multi-Channel Ground Penetrating Radar (MCGPR) technology to accurately establish the location of underground utilities within the right-of-way. Two pilot study locations were chosen, including a Local Road Reconstruction project (Sentinel Road - Dovehouse Avenue to Fonthill Place), and a Major Road reconstruction project (College Street and McCaul Street). The Pilot Study Summary will contain recommendations regarding the effectiveness and cost benefits of using MCGPR for linear Capital Works Program projects and outline proposed criteria for use of MCGPR in a future decision matrix. **Action – Underway, Completion Q2 2025.**
- The information from this pilot study will be utilized to develop a risk evaluation matrix and specifications for the use of MCGPR. **Action - Q2 2025.**
- Develop language for SUE service contracts to include options for industry standard locate techniques, including MCGPR. **Action - Q2 2025.**
- Update Engineering Survey standards to ensure all consultants comply with the most current standards (American Society of Civil Engineers, ASCE). **Action - Q2 2025.**

Develop a Tieback-specific Database and Policy

Establish a comprehensive database to track the presence 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 including the right of way. Work with the relevant City divisions to develop a detailed policy for tieback installation and maintenance.

Toronto Water is leading the development of a plan for managing substructural infrastructure including shoring, piles and tiebacks with support from ECS, Toronto Building, Transportation Services, Parks and Recreation and Corporate Real Estate Management.

While this work is underway, ECS has implemented an interim process to identify existing shoring systems and tiebacks in the Municipal Right of Way during preliminary design to help avoid conflicts during construction.

The work is on-going and will recommend an approach for avoiding and minimizing impacts from substructural infrastructure.

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.

Extensive research was done in 2024 on best practices as part of the work for “Advanced Subsurface Engineering Processes” and “New Risk Evaluation Matrix”. ECS will continue to advance further research in the field of subsurface utility engineering in 2025 through the Transportation Association of Canada and by participating in seminars and conferences.

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.

A Monitoring and Coordination Plan that incorporates the ongoing evaluation of emerging practices and the implementation of processes improvements will be developed in 2025, after the implementation of the previous items.

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

CONTACT

Mobushar Pannu, P.Eng., Director, Design and Construction, Roadways, Engineering and Construction Services, Telephone: 416-392-8412, Email: Mobushar.Pannu@toronto.ca

Mika Raisanen, P.Eng., Director, Design and Construction, Linear Underground Infrastructure, Engineering and Construction Services, Telephone: 416-392-0867, Email: Mika.Raisanen@toronto.ca

SIGNATURE

Jennifer Graham Harkness, P.Eng.
Chief Engineer and Executive Director, Engineering and Construction Services