Ensuring Quality During Construction on Linear Infrastructure Capital Projects

Presented To:	Operations Committee
Meeting Date:	January 22, 2024
Type:	Correspondence for Information Only
Prepared by:	Miranda Edwards Engineering Services
Recommended by:	General Manager of Growth and Infrastructure

Report Summary

This report provides information regarding how quality is maintained during construction on linear infrastructure capital projects.

Relationship to the Strategic Plan, Health Impact Assessment and Community Energy & Emissions Plan (CEEP)

Ensuring quality during the construction of linear infrastructure projects supports Council's Strategic Plan 2019-2027 goal area of Asset Management and Service Excellence by demonstrating a commitment to ensuring infrastructure renewal projects are being completed to optimize the asset's useful service life.

Financial Implications

There are no financial implications associated with this report.

Background

On May 15, 2023, Operations Committee passed Resolution OP2023-11 directing staff to provide a report for information detailing construction methods and quality assurance on linear infrastructure capital projects.

Examples of linear infrastructure capital projects can include the replacement or upgrading of existing watermain, sanitary mains and storm sewer mains, rebuilding or widening of an existing road replacing the granular material and asphalt, and replacement or installation of new concrete curb and sidewalk.

Provincial and Federal legislation and guidelines, as well as engineering and industry standards and best practices govern, construction materials and methodologies, and quality, on all linear infrastructure capital projects.

Ontario Provincial Standards for Roads and Public Works

The Ontario Provincial Standards for Roads and Public Works (OPS) organization is owned jointly by the Ontario Ministry of Transportation (MTO) and the Municipal Engineers Association (MEA) and the standards have been in use across Ontario by the MTO and municipalities since 1984. These standards provide municipalities and the construction industry with consistent, cost-effective, and dependable standards for building highways and roadways across the province.

Ontario Provincial Standard Specifications (OPSS) outline material requirements, equipment requirements, construction methods, quality control and quality assurance requirements, and payment details for construction activities. Examples of construction activities can include paving, concrete, drainage, grading and structural work.

All construction projects on the City's roadways adhere to OPSS and the standards are included in all tenders. The City of Greater Sudbury has been using these standards since its amalgamation, with the various municipalities and the Region adopting these standards throughout the 1990's. As well, all new roads built by private developers that are accepted by the City must follow OPS Specifications.

As part of Growth & Infrastructure's (G&I) commitment to continued improvement, a committee has been in place to review legislative guidelines and standards, including the OPS Specifications, and implement updates. In 2017, the committee was separated into four committees and a more formal structure, closely following the OPS structure for reviewing and updating standards, was implemented. These committees have representation across G&I, including Planning Services, Infrastructure Capital Planning Services, Linear Infrastructure Services and Engineering Services. These committees include Materials and Grading, Pipe and Appurtenances, OPSS Updates and Basis of Payment.

Quality Assurance

Quality control (QC) on a construction project includes methods or testing that the Contractor must follow to ensure that the materials being placed, or the construction methodologies being used, will meet the contract requirements. Quality assurance (QA) includes methods or testing that the Owner undertakes to ensure that the products that they are receiving and making payment for meet the quality standards set out in the contract document.

OPSS requires that material testing conducted by an owner be completed by an independent laboratory certified by the Canadian Council of Certified Laboratories (CCIL). The specifications also outline the appropriate MTO laboratory standards that must be followed to complete the material testing. The laboratory standards and the certification requirements ensure consistent testing across all certified laboratories and across all projects.

Quality control and quality assurance are performed on all linear infrastructure capital projects as outlined in the OPSS, or other legislation, for the applicable construction activity being performed or material being placed.

Paving Works

Examples of common paving activities include the placement of hot mix asphalt (HMA), asphalt recycling and surface treatment. Quality assurance for these works includes the sampling and testing of the asphalt cement, emulsion or rejuvenator properties, the gradation of the granular materials, meaning to ensure that the stone sizes meet the requirements for the type of granular material used in the mix of the asphalt and the in-place compaction of the asphalt material. Another common material that is evaluated in paving is tack coat. This is the sprayed liquid material placed between lifts of HMA to ensure that the layers are bonded together, achieving the desired strength and thickness of the asphalt structure.

In addition to laboratory testing completed on paving works, visual inspections are also completed. This includes review of all surfaces of placed asphalt for any defects such as segregation (which is open texture or separation of the aggregate throughout the asphalt surface), as well as smoothness of the asphalt surface.

Concrete Works

Examples of common concrete activities include placement of concrete curb and gutter, concrete sidewalks, in-place construction of culverts, and bridge rehabilitation. Quality assurance for these works include the sampling and testing of the concrete material properties and strength as well as testing to identify resiliency to the elements for bridges and large culverts.

In addition to laboratory testing that is completed on concrete works, visual inspections are also completed. This includes review of the surface of the concrete for any defects such as scaling, which is when the

concrete surface flakes off in small patches.

Pipe and Drainage Works

Examples of common pipe and drainage activities include installing watermain and sanitary forcemains (pressure mains), sanitary and storm sewer mains (gravity mains) and culverts. Quality assurance for these works include ensuring that the pipe is placed at the appropriate depths and grades (slope) as identified in the design, reviewing the inside of the gravity mains to ensure conformity and pressure testing of the pressure mains to ensure that they will withstand the designed pressures.

An important test that is completed in this category is the bacteriological testing of the watermain before it is allowed to be connected to the water system. This ensures no contaminates in the pipe. These requirements are set out by the Ministry of the Environment, Conservation and Parks (MECP) and the City of Greater Sudbury's Watermain Connection Protocol. Construction Services oversees all watermain connections, in collaboration with Distribution and Collections Services, and has approved approximately 120 watermain connections in the 2023 construction season.

Granular Materials

Examples of granular material activities include placing material to construct a road base, and to provide support for concrete curbs, sidewalks, pipes, culverts, and bridges. Quality assurance for these works include the sampling and testing of the gradation of the granular material, meaning to ensure that the stone sizes meet the requirements for the type of granular material. This is important for compaction as well drainage. Testing also includes the in-place compaction of the material as it is placed in the roadway as well as around all pipes and structure foundations.

Acceptance Criteria

In addition to outlining the laboratory tests to be completed on a specific material, the OPSS also outlines the sampling frequency, sampling method, type of sample to be taken, and size of the sample required for each material type that is to be tested. The Contractor is required to take the samples at locations randomly chosen by the Owner for quality control, quality assurance and for referee testing in case of dispute.

Test results are then evaluated in comparison to the criteria listed in the applicable OPSS. The OPSS identifies acceptable ranges for the material test results to be accepted into the work at full payment. There are also borderline ranges in which the material is subject to payment adjustments to be accepted into the work and there are rejectable ranges in which the material is required to be removed and replaced with acceptable material or subject to a more severe payment adjustment.

Summary of Material Testing - 2019 to 2023

The following chart illustrates the average number of samples taken annually for each material or test and the percent of test results accepted into the work.

Five Year Summary (2019 to 2023)

Material/Test	Number of Annual Avg. Samples	% of Results Accepted into the Work	% Results Borderline Range
Aggregate Gradation	95.2	99.7%	21.4%
Asphalt Mix Properties	135.4	98.8%	35.4%
Performance Graded Asphalt Cement (PGAC)	17.6	98.6%	0.0%
Tack Coat	20.4	89.4%	0.0%
Concrete Strength	190.2	98.9%	0.0%

Note:

1. Percent of results accepted into the work includes acceptable and borderline ranges.
2. Borderline test results are subject to payment adjustment.
3. Data reflects capital projects managed by internal resources.

Conclusion

Engineering Services provides project management, field inspection and quality assurance coordination to ensure that all contract requirements and quality standards for construction of linear infrastructure are met. Numerous tests are completed by City staff or the City's contracting partners on every project to ensure that the City is receiving the quality and value that is expected.

Resources Cited

1. Ontario Provincial Standards for Roads and Public Works, https://www.library.mto.gov.on.ca/SydneyPLUS/TechPubs/Portal/tp/opsSplash.asp
2. MTO Technical Publications, https://www.library.mto.gov.on.ca/SydneyPLUS/TechPubs/Portal/tp/TechnicalPublications.aspx