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## REGULAR COUNCIL

TO: **Mayor & Council**

DATE: **December 12, 2019**

FROM: **General Manager, Engineering**

FILE: **o620-20 (CPP19)**

SUBJECT: **Opportunities to Reduce the Duration and Costs of the Capital Infrastructure Projects**

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## RECOMMENDATION

The Engineering Department recommends that Council receive this report for information.

## INTENT

The purpose of this report is to advise Council of the actions taken and those that are planned to reduce the duration and costs of the Engineering Capital Infrastructure Projects.

## BACKGROUND

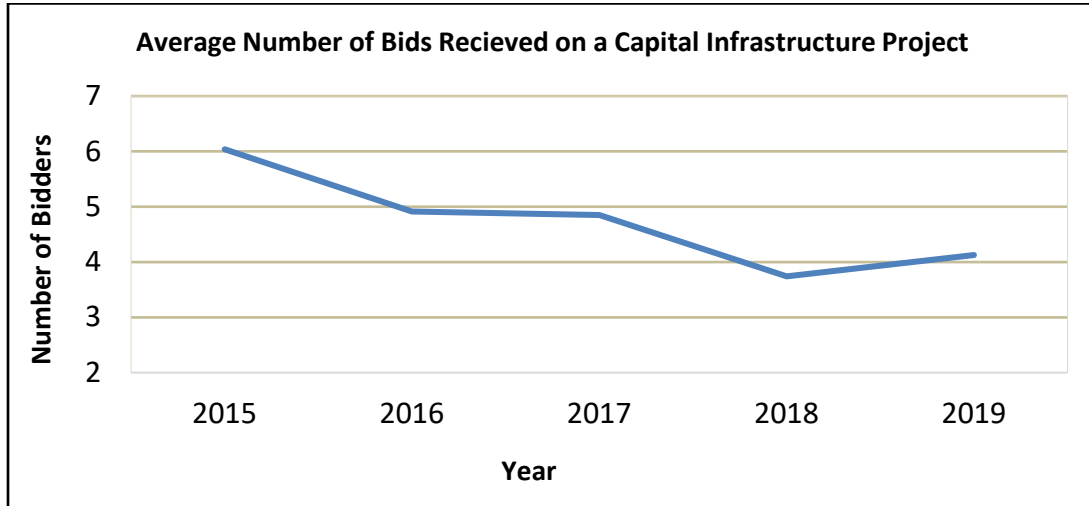
The annual Capital Infrastructure Program (the “Program”) delivers projects included in the Engineering Department’s 10-Year (2018-2027) Servicing Plan (the “Projects”). Annually, the Program typically has a value of \$75 to \$115 million. Projects planned for construction next year are outlined in the City’s 2020 Capital Construction Program, which is scheduled to be published in January 2020.

In addition to projects delivered by the City, there are investments made to City infrastructure through Land Development projects. Furthermore, major infrastructure projects are planned within the City and within the region in the near future, such as the:

- Skytrain extension along Fraser Highway;
- Pattullo Bridge Replacement;
- Metro Vancouver projects;
- Broadway Subway Project; and
- YVR Airport Expansion.

## DISCUSSION

With major regional and municipal capital infrastructure projects planned, the region is competing for resources from the construction industry who have indicated that they are challenged to meet increasing demands for construction services. As a result, the construction industry has increasingly become more selective in the projects pursued and their pricing is reflective of the increase in demand for construction services. As illustrated below, the average number of bidders the City has received on past projects has generally been declining over the past five years.



Although there are other external factors that influence the number of contractors that participate in the City’s construction contract bids, there are opportunities for the City to increase participation and address barriers which may discourage a contractor from participating in a bid for a Project.

### **Delivery of Capital Infrastructure Program**

Traditionally, Projects are delivered in a three-stage process of: design by an engineering consultant; bid through a publicly advertised tendering process; and built by a contractor with the contract awarded to the lowest bid price. Typically, it takes two to four years to deliver a Project from when it is initiated, with the design of a project taking one to three years depending on the complexity, the need to acquire lands to construct the project, and external approvals required for the project.

To reduce the cost and duration of each Project, staff consulted with major stakeholders, such as contractors who commonly work for the City, member municipalities, major material suppliers, engineering consulting firms, and conducted a literature research of best practices.

As a result of these efforts, staff have identified various actions for implementation to reduce construction costs and durations for each Project in the Program. These actions can be summarized as follows:

- Permitting road closures;
- Avoiding relocating third-party utilities (BC Hydro, Telus, FortisBC, etc.);
- Avoiding impacts to watercourses, which requires Provincial environmental approvals;
- Revised contract provisions;
- Innovative contracting techniques;
- Extended hours of work; and
- Other minor contract provisions and optimization changes.

A complete summary of each action is described in Appendix “I”.

## Next Steps

A number of identified actions have been implemented in 2019, and other actions for implementation in 2020 will include:

- Alternative bidding methods, such as A+B Bidding on select projects, to promote innovation, collaboration, and potential to reduce construction costs and durations;
- Disposal of select materials (asphalt and concrete) for certain projects at the City's Stokes Pit site so that the Engineering Operations Division may recycle this material for reuse;
- Modifying project designs to avoid the relocation of utility poles, impacts to watercourses, and land acquisitions on a project case-by-case basis; and
- Optimize the design phase processes by improving the project management process.

To measure the success of these actions, staff have established the following metrics for the Program:

- Number of bidders participating in a capital infrastructure project, with the aim to receive a higher participation for bids in 2020 than in past years;
- Contract durations when measures such as A+B Bidding, road closures, and extended hours of work are implemented, with the aim to reduce the duration of a project;
- Cost associated with third-party utility relocations (i.e., BC Hydro, Telus, FortisBC, etc.) with the aim to reduce the cost of relocations for major road widening projects; and
- Project schedules associated with third-party utility relocations for major road widening projects, with the aim of eliminating project delays associated with said relocations.

## SUSTAINABILITY CONSIDERATIONS

The Engineering Department's actions to reduce the duration and cost of the Program supports the objectives of the City's Sustainability Charter 2.0. In particular, this work relates to Sustainability Charter 2.0 themes of Infrastructure. Specifically, this work supports the following Desired Outcome ("DO") and Strategic Direction ("SD"):

- All Infrastructure DO2: Infrastructure systems provide safe, reliable and affordable services; and
- Materials and Waste SD13: Work with local businesses and organizations to maximize the recovery and reuse of local materials and waste products as part of the circular economy.

## CONCLUSION

The cost and duration of construction projects have been increasing. Following consultation with the construction industry and other stakeholders, several actions have been taken in 2019, and several more are planned 2020, to reduce the cost and duration of the City's Engineering Capital Infrastructure Projects.

Scott Neuman, P.Eng.  
General Manager, Engineering

JA/VJ/cc

Appendix "I" – Opportunities to Reduce Construction Costs

### Opportunities to Reduce Construction Costs

#### Road Closures

Allowing road closures was identified through the consultation as an opportunity that had the greatest potential to reduce costs and accelerate projects. The stakeholders surveyed recognized that temporary road closures during construction also have benefits, such as improved safety to workers and the travelling public, improved overall quality of work, reduction in overall congestion in construction areas resulting from the expedited construction schedule, and reduction in the amount of temporary construction needed; however, they need to be evaluated for congestion impacts on the surrounding network.

The reduction of costs and acceleration of construction schedule was demonstrated this year through the construction of 192 Street widening between 32 Avenue and 48 Avenue, which as a result of allowing a road closure accelerated the completion of the project allowing the project to be completed in 64% less time than originally estimated if 192 Street was left open to all traffic during construction. Furthermore, the City saved 27% on the cost of construction inspection and administration as a result of allowing the road closures, and based on discussions with contractors, road closures may result in savings of approximately 10% to the construction value of the project.

The City has used full road closures successfully on a variety of projects this year, ranging from full-depth reconstruction of a roadway, deep utility installations, to bridge replacements. This year the City allowed temporary road closures for 13 Projects which allowed these projects to be completed in a shorter duration. Notable projects include the following:

- 192 Street Road Widening from 40 Avenue to Colebrook Road;
- 192 Street Road Widening from 32 Avenue to Colebrook Road; and
- Anderson Creek Bridge Replacement (closure of Colebrook Road).

While full road closures will not be appropriate or necessary for all capital infrastructure projects, the benefits of allowing temporary road closures are clear for some projects. The City has received positive feedback from contractors' project personnel, businesses and residents who have been affected by temporary road closures but acknowledge that some public concerns arise regarding the impacts of detours. Also, local access must typically be maintained to avoid undue impacts to businesses and residents and for access by emergency services.

Based on the significant potential to accelerate a project and reduce costs by allowing a road closure, staff will evaluate projects planned for construction in 2020 that would be suitable for a temporary road closure during construction. Generally, the following analysis is undertaken to determine whether a temporary road closure should be considered for a capital infrastructure project:

- Undertaking a constructability analysis during project design to determine the feasibility of a temporary road closure and the potential cost and schedule benefits that can be realized compared to traditional means of construction;
- Evaluation of alternative routes to ensure emergency response services, residents, and the travelling public are provided an effective and efficient alternative route during the temporary road closure; and
- Impact of a temporary road closure to local businesses and residents.

As keeping traffic moving is an important priority for the City, the City also has a number of programs and initiatives aimed to help residents move around the City in a safe and effective manner, such as the Traffic Management Centre, traffic Twitter account, road obstruction dynamic map, and the road closure memo process which is circulated to both internal and external stakeholders, including emergency services and media outlets.

### Third-party Utility Infrastructure

Capital infrastructure projects can, at times, trigger relocations for external utilities, such as BC Hydro, Telus and FortisBC utilities. The City's road widening projects typically require that third-party utilities be relocated. This involves either relocating the utility poles and overhead lines or constructing underground systems. The City pays third-party utility agencies to carry out the work.

Over the past three years the City has paid approximately \$5.8 million solely for BC Hydro and Telus relocations associated with major road widening projects, as shown in the table below.

<b>PROJECT</b>	<b>BC Hydro &amp; Telus Relocation Cost</b>	<b>Total Project Cost</b>
80 Avenue Road Widening between 128 Street and 132 Street (Completed)	\$266,298	\$3,956,000
100 Avenue Road Widening between King George Boulevard and 148 Street (Completed)	\$1,862,705	\$16,000,000
128 Street Road Widening between 64 Avenue and 68 Avenue (Completed)	\$406,779	\$5,000,000
24 Avenue Road Widening between 161A Street and 165 Street (Pole relocations outstanding)	\$377,824	\$5,800,000
192 Street Road Widening between 32 Avenue and 40 Avenue (Pole relocations outstanding)	\$937,502	\$9,500,000
64 Avenue Road Widening between 192 Street and 196 Street	\$297,753	\$3,814,109
160 Street Road Widening between 26 Avenue and 32 Avenue (Anticipated 2020 Cost)	\$1,309,108	\$10,000,000
64 Avenue Road Widening between 184 Street and Fraser Highway (Anticipated 2020 Cost)	\$323,653	\$10,000,000
<b>TOTAL</b>	<b>\$5,781,622</b>	<b>\$64,070,109</b>

The cost of relocating these facilities represents approximately 9% of cost of these road widening projects. Of these completed road widening projects, all of these projects were delayed between three to six months of their anticipated completion dates as a direct result of the relocations not being completed on time, which results in additional indirect costs incurred by the City.

The relocation of BC Hydro and telecommunication facilities are often a challenge, as the City has no direct control nor Operating Agreement on BC Hydro or telecommunication companies and their allocation of resources to Surrey projects. As a result of these utility relocation delays, City contractors often submit claims due to the delay for the additional costs of bonding, insurance, site traffic control, and escalation in materials and labour costs to maintain the contract in effect until the utilities have been removed allowing the contractors to complete the remaining contracted scope of work.

Recognizing these challenges, the City has secured a 20-year Operating Agreement with FortisBC. Further, in the absence of a formal Operating Agreement, the City, BC Hydro and telecommunication companies have committed to work collaboratively and have adopted the following approaches for coordinating relocations of BC Hydro and telecommunication facilities to ensure these relocations are completed in a timely and cost-effective manner:

- Established quarterly meetings to enhance communications and timely coordination with the objective of facilitating and expediting project progress;
- Early involvement of BC Hydro and telecommunication companies to ensure utility pole relocations designs are progressed at the same schedule of the City capital infrastructure projects; and
- Promote relocations of utility poles in advance to the City proceeding with its capital infrastructure project where appropriate.

To prevent delays in project completions, this year the City is piloting a new initiative to commence the relocation of utility poles in advance of the road widenings and will be piloting this approach for the 64 Avenue road widening between 184 Street and Fraser Highway and 160 Street road widening between 26 Avenue and 32 Avenue.

Furthermore, given the significant cost of relocating utility poles for road widening projects, staff are evaluating opportunities to modify project designs to avoid the relocation of utility poles on a project case-by-case basis.

### **Contract Provisions**

The City and member municipalities follow the Provincially endorsed Master Municipal Construction Documents (“MMCD”) for the construction of municipal infrastructure. The MMCD was developed in 1989 through a collaboration of local governments, engineering consultants, and contractors. The MMCD’s primary focus is to provide a consistent contract document for municipal infrastructure work that balances the risk between the contractor and the City by providing equitable contract terms and conditions.

As with a number of member municipalities, the City supplements the MMCD, through the City of Surrey Supplementary Master Municipal Construction Document (“SMMCD”) to capture unique requirements of our capital infrastructure projects, as well as unique supplemental contract conditions. Through the City’s consultation with member municipalities and contractors, certain City supplementals were identified as being weighted in the favour of the City, which may result in an increased cost of risk being added to the contract price of capital infrastructure projects by contractors. Specifically, two contract conditions were identified by contractors that are negatively influencing contract prices:

### Unknown Underground Utilities

The SMMCD places the risk and responsibility for unknown utilities with the contractor. With the extensive number of underground infrastructure within the roadways consisting of municipal utilities (i.e., storm, sanitary, and water main) and external utilities (i.e. BC Hydro, telecommunication companies, FortisBC, and Metro Vancouver), there are circumstances when the location of underground infrastructure is unknown and becomes in conflict with proposed underground infrastructure causing delays and added costs to the contractors.

To provide a more equitable allocation of risk associated with unknown underground infrastructure, the City will be amending the SMMCD to a more balanced risk approach, wherein the risk of unknown underground infrastructure owned by the City will be borne by the City, while the risk of unknown third-party infrastructure (i.e., BC Hydro, Telus, etc.) is borne by the contractor.

To reduce the risk of unknown underground infrastructure, during the design stage staff are implementing underground utility location programs which will aim to locate underground infrastructure through surveys and pre-location digs. Furthermore, the City has implemented additional measures to ensure that new underground infrastructure installed in the City are adequately recorded and documented.

### Quantity Variations

The MMCD provides for a unit price contract, whereby a contractor typically buys material, adds a mark-up for overhead, profit and risk, and agrees to perform the work for a unit price (i.e., per metre of water main or tonnage of asphalt). If during construction the quantities of an item vary by more than 15%, the MMCD allows either party to renegotiate a reasonable unit price. The City's SMMCD removes the quantity variation clause, and thus neither party have opportunity to renegotiate a unit price.

As illustrated below, staff evaluated capital infrastructure projects from 2018 to understand how often quantity variations occur based on typical payment items found on capital infrastructure projects such as curbing, sidewalks, materials import, and asphalt.

Item	2018 Tended Projects	
	Quantity Variation in 2018 Projects (Tendered vs Actual)	Quantity Variation
Curbing	99%	-1%
Sidewalks	102%	+2%
Common Excavation	88%	-12%
Imported Granular fill	103%	+3%
Granular Sub-base (75mm minus)	86%	-14%
Granular Base (19mm minus)	104%	+4%
Asphalt Paving – lower course	68%	-32%
Asphalt Paving – upper course	81%	-19%

Staff determined quantities estimated are generally within the acceptable 15% quantity variation tolerance specified by MMCD, with exception to paving quantities. As a result, the City will likely benefit from reinstating the MMCD quantity variation provision as the risk of exceeding the MMCD quantity variation limit of 15% is low.

These two changes to the SMMCD will result in closer alignment of the City's capital infrastructure project contracts with the MMCD and member municipalities, which in turn will reduce contractors adding unnecessary risk premiums into their tenders.

### **Innovative Contracting Techniques**

Staff, through discussions with stakeholders, have identified opportunities to select contractors not only based on the lowest price but also the shortest duration in which a contractor can complete the project. This form of bidding is commonly called "A+B Bidding", whereby contractors bid on the time and dollar amount to complete a project. The contract is then awarded to the lowest combination of time and cost. This form of A+B Bidding has been successfully used in the United States. The City plans to pilot this form of bidding on the 64 Avenue road widening project between 184 Street and Fraser Highway, which is scheduled for construction early next year. At the discretion of the General Manager, Engineering, Project selection for A+B Bidding will be applied on projects with significant impacts to motorists on major arterial and collector roads.

Staff this year also piloted the following innovative contracting techniques in an effort to increase the participation in public tenders for capital infrastructure projects thus reducing construction costs:

- Delayed Construction Start Dates: Typically, MMCD contracts require contractors to commence work once the contract has been awarded; however, this may limit participation of contractors to bid a project, as a contractor may not have adequate resources to immediately undertake the work. Allowing flexible start dates allows the contractor to effectively manage their resources and may increase the participation of potential bidders on a project. The City will continue to evaluate opportunities for delayed construction start dates on a project case by case basis.
- Alternative Bidding: Alternative bidding allows contractors to provide an alternative bid from what is provided in the project contract document. Allowing alternative bids promotes innovation, collaboration, and has the potential to reduce construction costs and durations.

The City successfully piloted flexible start date and alternative bidding for Contract No. 1218-005-11 Bridgeview Water Main and Storm Sewer Replacement, which resulted in higher (6) than average participation of contractors in the bid.

### **Extended Hours of Work**

Contractors are generally permitted to work between 7:00 am and 10:00pm. Staff explored the opportunity to allow contractors to work 24-hours a day, seven days a week, or beyond typical construction hours, in an effort towards accelerating the delivery and reducing the cost of capital construction projects.



This opportunity was piloted as part of Contract No. 1716-070-21 – 192 Street Widening from 40 Avenue to Colebrook Road. In this contract, contractors were required to indicate the cost or savings to the City and a savings in the duration of construction, should the City permit contractors to work 24-hours a day, seven days a week. Based on the contractors' submissions, it was determined that certain factors lead to marginal time savings and potential increase in cost. The increase in cost was due to labour premiums resulting from longer work hours and the lack of labour in the region. As a result, contractors proposed to run longer shifts (12 hours per day) rather than working 24-hours a day, seven days a week.

Furthermore, earlier this year staff surveyed residents who recently experienced construction from a capital infrastructure project to understand their level of support for 24-hours a day and seven days a week construction. The results indicated that residents were not generally supportive of 24-hours a day, and seven days a week construction; however, residents were supportive of allowing extended hours of work if it meant the project would be completed sooner.

Based on the feedback received, staff are actively evaluating opportunities for contractors to work extended hours, especially during the summer which will reduce construction durations, or at night on a project case-by-case basis and where appropriate. This year the City allowed extended hours of work and night work for four capital infrastructure projects, and typically, for road paving work on major arterial roads where it is more effective to undertake this work during the night when traffic volumes are lower.

### **Other Opportunities**

The following actions have also been implemented for the Program which will reduce construction costs and durations of projects:

- Disposal of select materials (asphalt and concrete) for certain projects at the City's Stokes Pitt site so that the Engineering Operations Division may recycle this material for reuse;
- Use of recycled products, such as on-site gravels and excavation materials;
- Optimization of construction advertisements to occur early in the year which has shown to result in more favourable pricing;
- Enhanced communication with contractors to promote interest in upcoming capital infrastructure projects to increase the number of bids received;
- Improvements to the traffic permitting process by allowing contractors to submit applications for traffic permits earlier in the contract award process;
- Shortlist qualified contractors to ensure best value for specialized project; and
- Optimize the design phase processes by improving the project management process.