For Information Only

Cost Comparison - Use of City Forces versus Contractors - Paris Street Watermain Break

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Recommendation

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Introduction

During the 2012 budget meeting held on December 5, 2011 Council requested an information report explaining the cause and detailing the costs emanating from a watermain break repair on Paris Street about 30m south of the intersection of Ramsey Lake Road. This report provides the requested information including a detailed explanation of the mechanisms causing the break and a cost comparison between the City's contracted service provider and City forces for the same repair.

The watermain break was on 900mm "Hypresscon" concrete pressure pipe installed in 1993. Given the relatively young age of the infrastructure involved staff commissioned a forensic investigation to establish the cause of the break and provide a condition assessment of the pipe itself. This report also presents the findings of the forensic investigation.

Background

On October 10, 2011 staff discovered a leak on the 900mm "Hypresscon" water main located on the west side of Paris Street and south of the intersection of Ramsey Lake Road. The leak occurred in a particularly sensitive location as the large watermain involved conveys water from the Ellis Reservoir and the Wanapitei Water Treatment Plant and David Street Filtration Plant to the entire south end of the Sudbury Distribution System. The location of the break had some additional risk factors to consider; Health Sciences North is located adjacent to the break location and both the intersection of Paris St at Ramsey Lake Road and Paris Street itself are extremely busy multi-lane thoroughfares.

Because of the sensitivity of the location, substantial preplanning was conducted prior to commencing the repair to deal with several potentially significant risk issues:

- Arrangements for full time police presence for traffic control and to assure access to the hospital for emergency vehicles;
- Coordination with hospital officials to maintain an uninterrupted water supply and minimize disruptions to hospital services;
- Public notifications to the travelling public through regular public service announcements and public advisories.

Following completion of preparations for traffic control and alternate water supply for the hospital (and contingency plans); excavation commenced on October 15 to effect the repairs. Because of the scope of the work and the requirement to work around the clock and weekends the City's contractor was called in to perform the repair. Once the pipe was exposed, it was confirmed that the pipe was leaking at a pipe joint which eventually caused a break at a pipe joint. Closed circuit television camera inspection identified a second area of concern south of the original location. Excavation at another suspected break location about 50m south of the initial location was also undertaken. Repairs to both areas of the watermain were completed on October 19 and final road restoration was completed using permanent repair methodology (See Appendix 1) October 27, 2012.

Part A – Forensic Investigation

Forensic Assessment Report

The watermain that failed is a 900mm 'Hypresscon" concrete pressure pipe installed in 1993 to American Water Works Association (AWWA) Standard C301. This type of pipe is known to be very dependable with a typical expected lifespan of at least 75 years. Greater Sudbury has experienced very few breaks on our inventory of this type of pipe, therefore based on industry experience this break was considered to be premature. Consequently, staff commissioned Genivar Inc. to investigate and determine the cause of the break and provide a general condition assessment of the watermain.

The following is a summary of relevant extracts from the Genivar Report to illustrate findings related to the cause of the break:

Cause of the Break (Initial Location)

- Based on the assessment, it is believed that the break was caused by improper installation of the rubber gasket around the spigot of the pipe at the invert.
- At the break location the gasket was found to be not properly embedded within the spigot groove but rather protruding outside the spigot and pinched between the spigot and bell.
- The pinched gasket eventually permitted water to leak outside the pipe causing localized deterioration of the pipe which eventually caused the watermain to break.

The Genivar Report goes on to explain the failure mechanism through the following progression of events:

1. *"Over time, leaking water from the pinched gasket location would have eroded the pipe's concrete liner and would have caused deterioration of the grout surrounding the joint. The initial water leakage may have been minor and may not have been detectable during commissioning. Any initial watermain leakage may have been within the allowable two hour leakage according to provincial hydrostatic testing guidelines*
2. *As the concrete liner eroded a larger crack would be created resulting in increased water leakage that would undermine the existing pipe bedding.*

3. *The existing lateral forces on the pipe combined with compromised bedding would have further increased the gap at the obvert (top)of the joint resulting in increased flows from the pipe joint and an increase in pressure that would ultimately exceed the pipe's loading capacity leading to the break."*

Genivar also concluded that the recent (2009) major road reconstruction on this section of Paris St. would not have contributed to the break of the watermain as only road resurfacing and curb relocation occurred at the watermain break location.

Second Potential Break Location (52m South of Original Break Location)

A closed circuit television (CCTV) investigation of adjacent sections of watermain identified an open crack on the internal lining of the pipe at a second location about 52m south of the original location of the break. Genivar states that upon excavation to permit further investigation the crack was found to minor with little penetration into the concrete liner and the crack did not pose any issues to the structural integrity of the pipe.

Watermain Condition Assessment

The Genevar report also provided a general condition analysis of a 187m section of the water main via CCTV inspection extending 64m north and 123m south of the initial break location. This inspection confirmed that except for the one break location, the watermain was found to be in good condition.

This confirms that although manufacturer's warranties had long since expired, the 900mm watermain condition is consistent with manufacturer's expectations and should continue to maintain its integrity for the remainder of its expected lifespan.

Part B - Repair Costs

On October 15, 2011 the City's contractor (under authority of Tender Eng 11-42: Emergency Water & Wastewater Repairs) commenced work to repair the broken watermain. Total costs for the repair total to approximately $351,300 which includes the costs for policing (traffic control), CCTV inspection of adjacent pipe sections, pipe entry, and visual inspections, pipe and repair materials, and road reconstruction and paving, materials, equipment, and labour.

Comparison with City Forces

To develop a cost comparison between completing the repair with City forces compared to Contractor it was necessary to use key assumptions. These key assumptions are presented in **Appendix 1** which is attached to this report.

The total repair costs for City forces to perform the repair are estimated at **$417,400**. A breakdown of the details of this cost comparison is presented in Table 1 below:

Table 1 – Actual Contracted Costs versus Estimated City Costs

Cost	Contractor	City Estimate
Police Traffic Control	$40, 627	$40, 627
Pipe & Repair Parts	$63,580	$63,580
Inspections- (CCTV & Visual)	$2,737	$2,737
Contractor – Labour & Equipment	$244,400	$310,500
Total	**$351,300**	**$417,408**

The cost difference of just over **$66,100** is primarily from Collective Bargaining Agreement requirements that restrict employees from working shift work and specifies premium pay rates apply for any work done by CGS employees prior to 8 am or after 4:30 pm Monday to Friday or for any work on weekends.

To reduce the cost difference between contractors and City forces to complete more of these types of repairs in the future, we continue to explore any opportunity to obtain consent from the local union for straight time afternoon and weekend shifts which could reduce a portion of this cost difference.

Additionally, we continue working on building greater operational efficiencies into the routine procedures for infrastructure repairs both within the Water / Wastewater and Roads operational Divisions.

Appendix 1: Key Assumptions

To make a cost comparison between the City and contractor the following key assumptions were used to develop the estimate for City staff costs:

1. **Common Costs** - Many of the costs are independent of labour and some equipment costs and so would remain whether the repair was completed by either City forces or contractors. For example, police traffic control, pipe & repair materials, preplanning and contingency (to deploy emergency hose reel) if necessary, and inspections would be the same under each scenario.

2. **Permanent Road Restoration Methodology** - To produce overall savings, permanent road restoration methodology was used. Despite the additional time and resources spent during this initial repair phase this methodology was implemented in an effort to minimize future settlement and / or differential heaving of the road sub-base granular materials leading to future rework.

   Permanent road repair methodology prescribes the use of native materials where appropriate and a compaction procedure for granular backfill materials that stipulates that the material be backfilled in 46cm lifts and compacted to minimum compaction standards before adding the next layer of material. Achieving proper compaction standards depends on the moisture content of the material being compacted. If the material is too wet or too dry compaction standards cannot be achieved. This factor significantly impacted the completion timing of the road repair portion of this job because wet weather and conditions made compaction work difficult. However, the increased time and costs will be beneficial in the long term.

3. **Staffing** - City staff costs have been substituted directly for each contractor employee; crew sizes, productivity, and employee work hours were rated equally for our cost comparison.

4. **Collective Bargaining Agreement** – With the exception of the two notes below, the current CGS Collective Bargaining Agreement (CBA) requirements have been factored into estimating costs for City forces, including necessary premium rates associated with evenings and weekend work.

i) Overtime premiums for City staff were calculated and time and one half for all overtime despite the fact that some portion of the premiums would be payable at double time for Sunday work because of difficulties in estimating this distinction. Meal allowances were not calculated although would likely have applied.
ii) It should be noted that only base hourly rates for City staff were used for the estimates as it would not be possible to accurately estimate the Pay for Knowledge Premiums for Ministry of Environment certification licenses in the labour cost estimate without knowing exactly which specific employees were on site.

These differences will result in marginally understating the CGS' labour cost estimates.

5. **Employment Standards Act** – Because of the significant impact on costs, full compliance with the Employment Standards Act maximum daily and weekly hours of work criteria have been factored into the cost estimates.

This cost is driven by the requirement to provide employees in Ontario 11 hours of rest between shifts. For City staff, this means that if this 11 hour period is infringed on by extra work hours (ie overtime), staff must still be paid their base 40 hour week even though they may still be on the rest period and unavailable for work for portions of that entire period.

6. **Staff Availability** - Internal CGS staff would make themselves available to perform the repair work during overtime work periods daily for the 12 days including two weekends because overtime work is voluntary.

7. **Effect on Other Work Priorities** – Because these types of repairs would occupy a high percentage of existing Distribution and Collection employee resources if City crews performed it, we may have been left vulnerable if required to respond to other core maintenance work activities during this period. We have assumed no other core maintenance activities or emergencies requiring City Distribution and Collection crews would occur and can also be safely deferred. Accordingly, because of this assumption we have not attributed any costs to this issue.