Fibre Infrastructure Strategy

Annual Update

2017 December 07

Chief Financial Officer's Department - Information Technology

EXECUTIVE SUMMARY

The telecommunications environment is constantly evolving and it is important for municipalities to take a future-oriented and proactive approach to meeting the needs of City services and the community. Since Council approved the Fibre Infrastructure Strategy in September 2015, Administration has been working diligently on implementing the recommended actions and this report outlines the progress made on all recommendations.

PROGRESS ON FIBRE INFRASTRUCTURE STRATEGY

The progress update to previous recommendations is below:

1. **Canadian Radio-television and Telecommunications Commission (CRTC)**
   Administration continues to actively participate in CRTC engagement processes as appropriate to protect municipal interests and influence the direction of connectivity for the community. In 2017, The City did not participate directly with any CRTC interventions, but provided support to Calgary 9-1-1 in their responses for NG 9-1-1 interrogatories.

2. **Federal Government: Modernization of Telecommunications and Broadcasting Act**
   In the 2017 Budget[1], the Federal Government announced a new strategy called "Canada's Digital Future". A key element of that strategy is the overhaul and modernization of the laws governing television, telecommunications and the Internet. The Government's stated objective is to "position Canada's Internet and wireless service providers, creative entrepreneurs, and cultural leaders to deal with … the disruptive changes and increased competition due to globalization[2]".

   Changes to the Telecom and Broadcasting Act may impose restrictions on how municipalities govern their rights-of-way and assets, such as poles and facilities and these sweeping changes could last for decades.

   IT has informed Intergovernmental and Corporate Strategies (ICS), who will engage all relevant business units to determine a City position that will go before Council. ICS has also initiated communication with the Federation of Canadian Municipalities (FCM) on the issue. It will be important for all municipalities to engage in public hearings related to modifications of the Act.

3. **Policy/Bylaw**
   The Municipal Rights-of-Way (ROW) Bylaw, scheduled to take effect 2018 January 1 is currently being challenged in the provincial courts by the large carriers (Telus, Shaw, Bell, Rogers).

   ROWs are expected to be flooded with new telecom infrastructure as new technologies are adopted and implemented, for example Small Cell (5G) wireless networks.

4. **Greenfield**
   The City's fibre team has submitted designs for 14 new developments to the ENMAX Power Services Corporation (EPSC). Two projects have been completed: Savanna and

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[1] 2017 March 22, Canada Budget 2017, p. 106, "Canada's Digital Future"

Carrington. Constructing City fibre infrastructure along major roads for future City services within the Four-Party Trench reduces costs by approximately 75% relative to building independently.

5. **Capital Budget**

The second construction season is nearing its conclusion. The 2017 season is forecasted to spend $8.99M. Due to delays in contract negotiations with the shallow utility consortium, greenfield fibre infrastructure was slow to start. The Fibre Cable Duct and Wireless (FCDW) Steering Committee approved that fibre infrastructure funding be used to focus on connecting existing City stranded facilities. The long-range financial forecast presented as part of the approved Fibre Infrastructure Strategy can be found in Appendix 2. In 2018, the long-range financial forecast will be reviewed to adjust for actuals and industry changes.

Capital Budget	2016		2017		2018	
	Recast	Actual Spend	Recast	Forecast Spend	Recast	Forecast Spend
IT Fibre Reserve	$800K	$800K	$820K	$820K	$800K	$800K
City Fibre Plan	$6.65M	$5.16M	$4.18M	$8.17M	$5.85M	$3.35M
Total	**$7.45M**	**$5.96M**	**$5M**	**$8.99M**	**$6.65M**	**$4.15M**

6. **General Progress Outline**

Fibre optics is not just for City office buildings any more, but is being used to connect a variety of devices. As an example, there are 234 Traffic Controllers connected to City fibre. When City assets are connected directly to the City Network (fibre, wireless), The City avoids paying third-party providers. As an example, the average cost to connect a building via a third-party provider is $825 per month. When 209 City buildings are connected to City fibre, The City avoids approximately $2M (209 sites x $825/month x 12 months) in annual third-party costs.

Progress	New 2017 Connections	Total Fibre Connected	Notes
City buildings connected	25	209	Approximately $2M annual cost avoidance
City field assets connected	5	82	LRT Stations, Water Plants, 19 Help Phones, 6 Digital Signs, Parks, Underpasses, Airport Tunnel, etc.
Traffic intersections, signs and sensors connected	70	234	Approximately $1M in annual cost avoidance.

7. Fibre Optic Provider

The City operates as a fibre-optic provider and City IT licenses out excess fibre-optic capacity to other public-sector organizations, businesses or carriers. A web presence has been created on calgary.ca/darkfibre and an intake request form has been created through 3-1-1.

a. Revenue

IT has entered into agreements with many organizations who are interested in licensing dark fibre to connect facilities including carriers, Internet Service Providers (ISP), businesses, utilities and public-sector agencies. Per the Council approved Fibre Infrastructure Strategy, these revenues will continue to be transferred to the IT Reserve - Fibre Optic Program #751 to fund fibre deployments for City services and cover operating costs of the fibre plant.
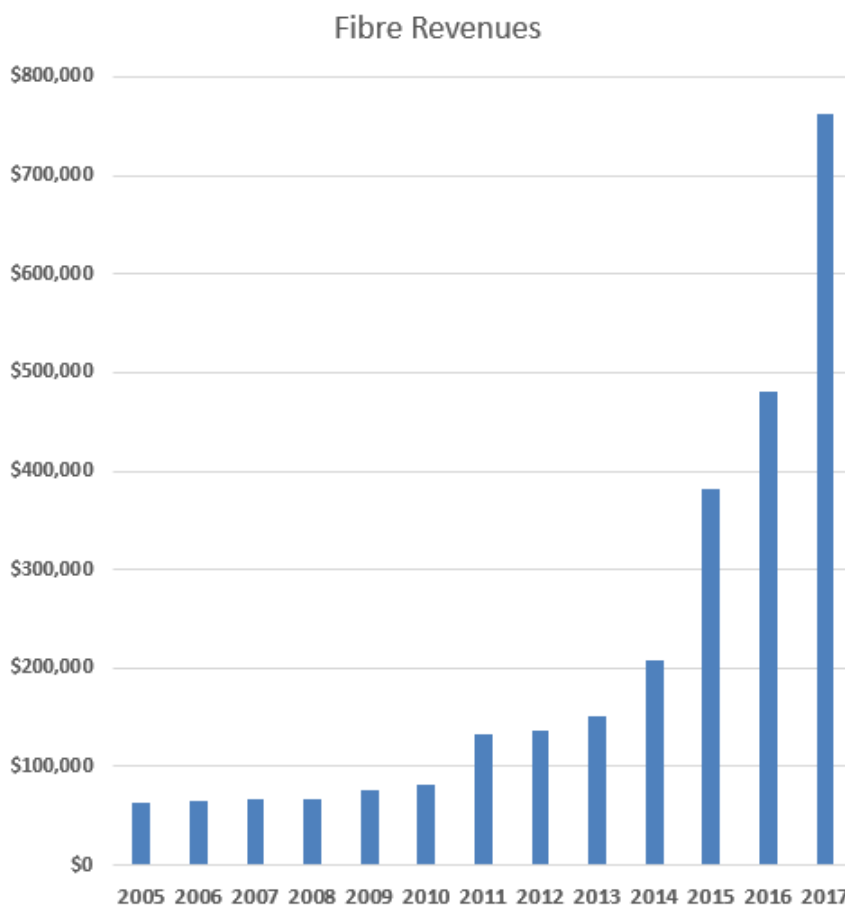

Figure 1: Fibre Revenues

8. Business Parks & Transit-oriented Developments

IT has been collaborating with Real Estate & Development Services to develop a fibre-optic deployment strategy and funding model. IT funded the fibre infrastructure for the Shawnessy Business Park, which was completed in 2017. Aurora Business Park has been identified as the pilot to determine feasibility and funding models for future builds.

IT also collaborates with Calgary Economic Development (CED) and participated in the Amazon bid which contained a fibre optic component.

9. Annual Updates

This report serves as the second annual update and Administration will continue to provide annual updates on the progress of The City of Calgary's Fibre Infrastructure Strategy to Council through the Gas, Power & Telecommunications Committee. Next year's report will include updates relating to the 2019-2022 One Calgary budget cycle.

10. Updated Risk Assessment & Confidentiality

The risk assessment has been updated (see Attachment 2). There is a recommendation for this attachment to remain confidential pursuant to Section 24(1)(a) and (b) of the Freedom of Information and Protection of Privacy Act. This is subject to review every five years up to a limit of 15 years.

11. Fibre License Rate Structure

The availability of dark fibre is new to Calgary and rates will need to be tested and evaluated for the first few years. The current pricing model was determined based on researching rates in other cities, uptake of service and changing market conditions including the regulatory environment. These rates are consistent with the Action Plan, based on cost recovery. It is important that Administration can adjust and adapt rates in this continually-changing technology landscape. Rates will be adjusted, if required and appropriate, based on future market changes.

The current rate model strives to accomplish the following objectives:
1. Produce revenues to meet the Fibre Infrastructure Strategy objectives
2. Provide a simple and predictable rate for customers – accomplished via a flat rate model
3. Provide a mechanism for customers to accelerate City fibre builds – capital rebate model.

The flat rate model is based on a customer's relative cost to license a strand of fibre between any two points for approximately $1000 for one fibre strand per month.

The capital rebate model is required in certain situations where The City does not have fibre to the location the customer requests. Under these circumstances, the customer is obligated to pay the capital to build City fibre to the requested location. Even though the customer pays for this construction, The City retains 100% ownership of the asset and then reduces the license fee until the customer recovers an equivalent value to their original investment. Under this model, no City money is used to connect the customer and The City obtains a valuable asset.

12. Calgary Internet Exchange (YYCIX)

The burgeoning Calgary Internet Exchange (YYCIX) will attract larger Internet service and content providers to our community. With support from City Fibre Infrastructure, YYCIX has quickly become the fourth largest IX in Canada. Recognizing the importance and value of having an IX in our community, The City of Calgary has been supporting the "start-up" of the YYCIX. In 2015, The City provided fibre and allowed the YYCIX to create a presence in a City data centre. This City-hosted site makes the YYCIX more resilient and accessible by community peers. Currently, all post-secondary institutes in Calgary and hundreds of K-12
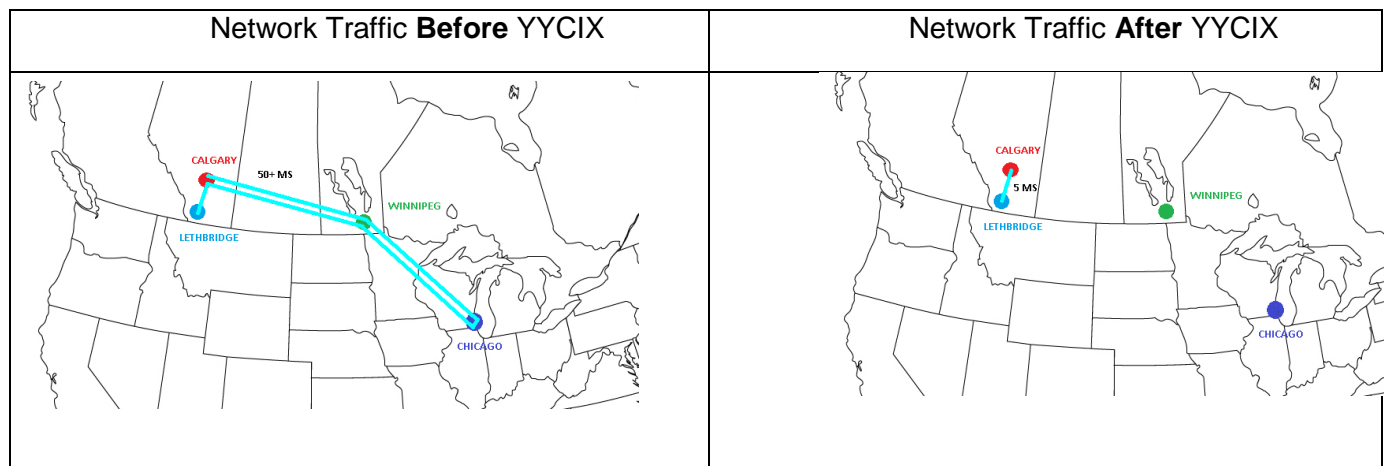
schools in the province are benefiting from the YYCIX. The City will continue to support the growing success of the YYCIX.

a) What is an Internet Exchange?

An Internet Exchange (IX) is a place where networks meet. They are an important aspect of the Internet and allow various networks to interconnect and move vast amounts of information and data between networks quickly without an exchange of money. All users benefit from being connected together. In Canada, there is a large one in Toronto (TORIX) along with a few smaller ones across Canada. Video - https://www.de-cix.net/about/what-is-an-ix/

b) What are the benefits of an IX?

An entire community can benefit from having a local IX. It brings together many Internet Service Providers (ISPs), Content Providers (CPs) and businesses resulting in improved content service delivery for all. These benefits include improved Internet experience; encouraging competition, including smaller ISPs; lower prices; enhanced security, because traffic stays local and attracting large technology companies and content providers. Once an IX reaches the "critical mass point" and many companies are connected together, it can attract major Internet players such as ISPs like Hurricane Electric (already in Calgary) and content providers like Google and Netflix. Approximately 30-40% of City traffic goes through the IX (anti-virus, videos, patches, etc.) and that will continue to grow.

Network Traffic **Before** YYCIX	Network Traffic **After** YYCIX

13. Innovations using City of Calgary dark fibre

1. Quantum Key Distribution Network

The University of Calgary is a leader in Quantum key distribution systems, also referred to as "Quantum Encryption". The development of this technology was only possible through access to City Fibre, which led to major break through in quantum science and published in Nature Photonics Scientific Journal.

ITEM #7.3

2. **City Fibre as a Sensor (CFaaS).**
   Fibre has been used for seismic detection and pipeline detection for years now. Recently, the technology has advanced enough that it can be applied in a city environment. Working with the University of Calgary (U of C), under the Urban Alliance, and Professor Rob Ferguson, The City fibre has been turned into a sensor which spans between the U of C and Tuscany Light Rail Transit (LRT) Station. Under this test condition, detailed tracking of traffic on both sides of Crowchild Trail and the LRT reveal new opportunities for improvements in real time data, asset management and traffic flow. Due to the large data volumes produced by this technology, more research is needed to move this to a practical application, but the technology is promising.

CUSTOMER TESTIMONIALS

Based on our completed customer case study interviews, the results are overwhelmingly positive. Customers appreciate the dark fibre service offering and align with The City's vision to serve Calgarians and the commitment to the greater good of the community. Words used to describe their experience with the fibre team to-date: friendly, efficient, collaborative, professional, responsive and highly competent.

1. Calgary Public Library

Calgary Public Library has been using the City of Calgary fibre network since 2013. Initially, the fibre network was used to move the Library data centres to the Emergency Operations Centre and the Manchester data centres after the 2013 floods. Since the initial installation, the use has expanded to include the Village Square Library and most recently, the Nicolls Family Library at Westbrook Station.

We have found the network to be extremely reliable and the City staff excellent to work with. We continue to look for opportunities to further this partnership as we build new locations and fibre becomes available to existing facilities.

We believe that this partnership is an excellent example of maximizing tax payer investments, allowing for the best possible service to Calgarians.

2. Cybera

Cybera is a not-for-profit, technical agency that is helping Alberta advance its IT frontiers. CyberaNet is Alberta's publicly-funded, ultra-high-speed network that moves big data between the province's education institutions, researchers and IT entrepreneurs, and provincial, national and international research networks.

Cybera began utilizing the City's dark fibre infrastructure over 5 years ago to provide direct connectivity to the University of Calgary, MRU, SAIT, BVC, and Calgary Catholic School District. This connectivity enabled them to reduce Internet costs and gain access to new digital services and applications. Students and researchers can now carry out projects involving data intensive video/design projects and collaborate on more international research projects.

"It is very clear from our dealings with The City of Calgary that the public's interest is the main driver for this initiative. This aligns perfectly with Cybera's mandate, and makes our dealings run smoothly. For our peers and members, who all serve the public interest, there can be no better partner." – Robin Windsor, President & CEO, Cybera

Three words to describe the City's fibre team/service: friendly, collaborative and smart.

3. Calgary Catholic School District

Calgary Catholic School District (CCSD) is the largest Catholic school district in Alberta, serving more than 54,000 students in 105 schools located in Calgary, Airdrie, Cochrane, Chestermere and Rocky View County. They were looking for a cost-effective, scalable and flexible networking solution for their administration, 6000+ teachers and 55,000 students.

CCSD currently connects to an off-site data centre and will have the ability to connect to Cybera. Future high-tech school (pilot) connectivity.

"City fibre provides our staff and students with nearly unlimited access to digital resources and has a proven value proposition." – John Schutte, Director, IT, CCSD

Three words to describe the City's fibre team/service: collaborative, competent and trust-worthy.

4. University of Calgary

The University of Calgary has a research team working on an encryption method that takes advantage of properties of light that must be described using quantum mechanics.
This method is not vulnerable to improvements of computer technology and
therefore outperforms currently used ways to encrypt electronic communications (email, e-banking, e-government, etc.) - an important feat in today's Information & Communications Technology (ICT)-dependent society. The researchers required dark fibre to test out quantum encryption in a "real world" environment, not just in a lab.

The research team was excited to learn of the City's dark fibre to enable them to conduct the testing they required. The City donated access to dark fibre and provided space in some of our facilities for test equipment. This ability to test in the real world has created a lot of visibility for the University of Calgary and may draw future research in this field.

"Being able to use the City's dark fibre has enabled our team to successfully test out our quantum encryption theories and we look forward to working with the City in the future. This has allowed us to reach a major milestone in our research that we couldn't have accomplished without access to dark fibre." - Wolfgang Tittel, Professor and AITF Strategic Research Chair in Quantum Secured Communication

Three words to describe the City's fibre team/service: efficient, professional, pleasant.

PROJECT COST AND FUNDING SOURCE

(As Presented 2015 September)

Project Cost & Funding Sources
The City of Calgary Fibre Network (Stranded Facilities & Greenfield)
For 2016 through 2030 ($000's)

Cumulative Years	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Total
Construction Cost																
Stranded Facilities	$ (6,000)	$ (3,000)	$ -	$ (3,000)	$ (3,000)	$ (3,000)	$ (3,000)	$ (3,000)								$ (24,000)
Greenfield	$ (500)	$ (4,000)	$ (3,500)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (56,000)
Total Capital Cost	$ (6,500)	$ (7,000)	$ (3,500)	$ (7,000)	$ (7,000)	$ (7,000)	$ (7,000)	$ (7,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (4,000)	$ (80,000)
Operation & Maintenance		$ (120)	$ (180)	$ (180)	$ (240)	$ (300)	$ (360)	$ (420)	$ (480)	$ (480)	$ (490)	$ (570)	$ (640)	$ (720)	$ (800)	$ (5,980)
TOTAL FUNDING REQUIRED	$ (6,500)	$ (7,120)	$ (3,680)	$ (7,180)	$ (7,240)	$ (7,300)	$ (7,360)	$ (7,420)	$ (4,480)	$ (4,480)	$ (4,490)	$ (4,570)	$ (4,640)	$ (4,720)	$ (4,800)	$ (85,980)
FUNDING SOURCES																
IT Reserve	$ 2,350	$ 150	$ -													$ 2,500
IT Capital Program - Funding relocation from Calgary City Net	$ 800															$ 800
Corporate Funding Approved (GP2015-0485)																
Reserve For Future Capital (1-time) - Stranded Facilities	$ 2,850	$ 2,850	$ -													$ 5,700
Reserve For Future Capital (1-time) - Greenfield	$ 500	$ 4,000	$ 3,500													$ 8,000
Corporate Funding Request For Future Years																
Corp. Funding TBD - Stranded Facilities				$ 2,715	$ 2,379	$ 2,008	$ 1,551	$ 1,008								$ 9,661
Corp. Funding TBD - Greenfield				$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 1,724	$ 1,448	$ 1,155	$ 902	$ 605	$ 281	$ -	$ 26,115
Revenue - to fund Stranded Facilities	$ 54	$ 121	$ 180	$ 465	$ 861	$ 1,292	$ 1,809	$ 2,412	$ 480	$ 480	$ 490	$ 570	$ 640	$ 720	$ 800	$ 11,373
Revenue - to fund Greenfield		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,276	$ 2,552	$ 2,845	$ 3,098	$ 3,395	$ 3,719	$ 4,083	$ 21,968
Other Potential Funding Sources																
Corporate Savings Account - 50% of IT Contribution																$ -
Customer Contribution																$ -
Operating - Expense Absorption/(Contribution to Reserve)	$ (54)															$ (54)
Debt																$ -
TOTAL FUNDING SOURCES	$ 6,500	$ 7,121	$ 3,680	$ 7,180	$ 7,240	$ 7,300	$ 7,360	$ 7,420	$ 4,480	$ 4,480	$ 4,490	$ 4,570	$ 4,640	$ 4,720	$ 4,883	$ 86,063
FUNDING EXCESS/(SHORTAGE)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 83	$ 83