The City of Calgary
Fibre Infrastructure Strategy
Annual Update

2020 January 29

Chief Financial Officer's Department - Information Technology

Executive Summary

On 2015 September 28, the Fibre Infrastructure Strategy was presented and unanimously approved by Council. This report serves as the 2019 annual update.

By the end of 2019, over **670** facilities and assets (e.g. traffic controllers) have been fibre-connected while **avoiding** third-party communication costs estimated to be **$8 million per year.**

In 2019, revenues reached an important milestone surpassing the **$1 million** threshold, which represents a **180% increase** from 2015 and is well above the **$180 thousand** originally projected in the strategy.

Two large organizations invested a combined total of **$1 million** in capital to extend City fibre to their critical facilities. City fibre increases the resiliency of their mission critical networks which ultimately serve the citizens of Calgary.

New opportunities for revenue exist with the evolution of mobile networks to 5G/Small Cells. 5G/Small Cells require considerable fibre infrastructure. Though most Wireless Service Providers will build their own fibre facilities, there is always opportunities to provide City fibre to meet their requirements.

The City and ENMAX Telecommunications Services Inc. (ETSI), a subsidiary of ENMAX Corporation, are working on a partnership to leverage assets like streetlight poles and power poles to serve the 5G market. An agreement is expected to be in place by 2020 Q1.

Due to the current economic situation, the One Calgary (2019-2022) capital budget of $8 million for the Fibre Infrastructure Strategy is considerably less than the Action Plan (2015-2018) capital budget of $20 million.

The capital budget reduction has impacted the original objectives of the Fibre Infrastructure Strategy and the pace of progress has slowed.

Background

On 2015 September 28, the Fibre Infrastructure Strategy was presented and unanimously approved by Council.

The Fibre Infrastructure Strategy is critical to ensure The City of Calgary continues to provide fibre optic to deliver next-generation municipal services in a cost-effective manner.

Investment in City fibre is even more important today and into the next business cycle as our dependence on technology and data increases. City fibre is fundamental to delivering City services which contributes to **resiliency**, service **growth** and innovation and is the **foundation** of all networks which City business units rely on to ensure The City of Calgary continues to excel as a smart, safe and prosperous city now and into the future.

2015 – 2019 Accomplishments

a. **Connecting Assets**
    In 2019, over **670** facilities and assets (e.g. traffic controllers) are fibre-connected, increasing business-unit capabilities with unlimited bandwidth and **avoiding** third party communication costs estimated to be **$8 million per year.**

	Installed in 2019	Total Fibre Connected Assets 2001 - 2019	Notes
City Buildings (Staff Located)	13	312	Approximately $8 million annual cost avoidance
City Field Assets	28	361	Traffic Cabinets, Help Phones, Digital Signs, CCTV, Parks, Pump and Lift Stations, Wireless Towers, Security Gates, Scale House, Underpasses, Airport Tunnel, BRT's etc.
Total	41	673	

Table 1: 2019 Number of Assets Connected with City Fibre

b. Enabling Networks

City fibre enables numerous networks for City business units, civic partners, post-secondary institutions and external agencies. The City alone has more than 20 different networks specific to its applications. As an example, the network that operates the Light Rail Transit is much different than the network that ensures clean water, but both rely on City fibre.

Figure 1: CCN: Bandwidth Consumption for City services [1 Petabyte (PB) = 1 million Gigabyte]

City fibre allows business units to upgrade their networks quickly and easily to enable new types of services. As an example, Calgary Police Service was able to upgrade their network to facilitate body cameras and other new innovations due to the capacity that City fibre affords.

The Calgary City Net (CCN) is The City's largest, most resilient network which provides high bandwidth, redundancy and security for business units. CCN's success is represented by the rate of adoption by business units. During the last budget cycle, the CCN's bandwidth demands have increased **700%** (*see Figure 1)* as business units deploy connected devices to enrich and modernize their services.
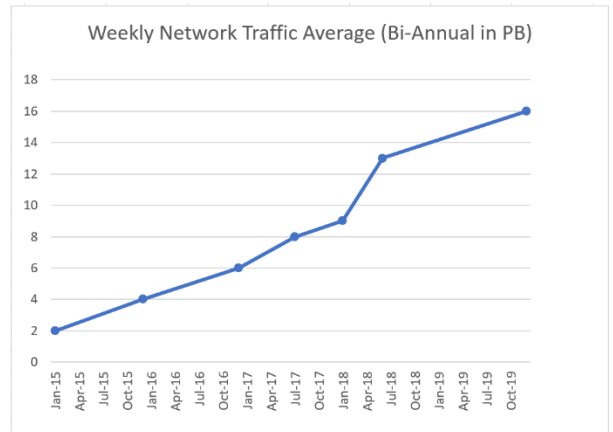
c. Increasing Resiliency

City fibre increases the resiliency of City services which, in turn, enriches citizen confidence. When a city **owns** its fibre, it can respond with greater agility during extreme events. This was exemplified during the 2013 flood where a catastrophic loss in network resources was mitigated due to the control, agility and capacity afforded through City fibre. This could not have been achieved without full control of the fibre asset.

City fibre increases the resiliency of all services that leverage it. As an example, the Roads department can monitor and control traffic signals remotely through their Management Information System for Transportation (MIST) network. The more reliable the network, the more reliable the service. Back in 2015, the network was only up 65% of the time – but now that a significant portion is on fibre optics, the network is up 98% of the time. City fibre reaches over **340** traffic controllers, resulting in an **increase** of service uptime by **50%** (*see Figure 2)* improving traffic flow through the city.
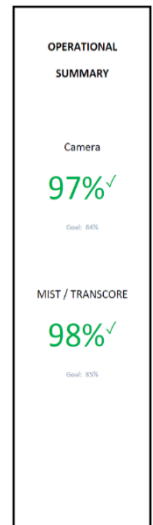
Figure 2: Traffic Network Uptime

City fibre also enhances the resiliency of **mission critical networks** operated by other agencies that offer **critical services** to citizens. Healthcare and power utility organizations license City fibre to strengthen the resilience of their services.

d. Other Notable Accomplishments:
- 2019 revenues broke through the $1 million milestone.
- Calgary Police Service (CPS) exclusively uses City fibre to build their core network and recently upgraded that network to accommodate body camera technology.
- The new Calgary Remand Center is now fibre-connected.
- Shepard's Solar Project is now fibre-connected.
- New Southwest BRT stations are connected to City fibre.
- Calgary 911 and Corporate Security are leveraging City fibre for enhanced services and increased resiliency.
- The Calgary Public Library has standardized on City fibre.
- The City won the Ministers Award for Municipal Excellence for Municipal Owned Fibre Infrastructure (2016).
- University of Calgary research on Quantum Key Distribution published their findings in Nature Photonics in 2016. Access to City fibre was acknowledged in the research paper "Quantum teleportation across a metropolitan fibre network" to assist in testing their research in a real-life environment.
- The City won the Ministers Award for Municipal Excellence for Municipally Owned Internet of Things (IoT) Wireless Network (2018). This network is enabled by City fibre.
- The Calgary Internet Exchange is rapidly growing, in part due to City fibre making Internet faster for everyone.
- Participated in a number of Canadian Radio-television and Telecommunications Commission consultations influencing policy to include municipal interests.
- Calgary Economic Development (CED) includes City fibre as a technology enabler to attract companies to Calgary.
- Participated in regional efforts to increase the importance of municipal fibre through speaking engagements, presentation to rural council and local meetings.
- Contribute and respond to provincial consultations like the Provincial Broadband Strategy.
- City fibre transports video from over 3,000 cameras used by Corporate Security, Transit, Roads and Calgary Parking Authority.
- Fibre infrastructure plays an important role in security by design.
- City fibre is a key element to delivering on business-friendly initiatives for Living Labs in conjunction with CED.

City Fibre Strategy Alignment

The Fibre Infrastructure Strategy is aligned with all Citizen Priorities and 2019-2022 Council Directives for One Calgary. As an example, "A City that Moves" will rely on "innovative technologies and partnerships" with "public, private sector and non-profit entities in conjunction with The City, to deliver programs to improve our transportation network, adopt new transportation business models, and position Calgary as a city that moves into the future". Just as we move people, goods and services, fibre optics moves information – the digital version of people, goods and services.

The Fibre Infrastructure Strategy aligns with the Resilient Calgary action "Apply a Resilience Lens to Strengthen Public Infrastructure Investment Decisions". When The City owns its own fibre infrastructure, it has maximum control over the network and can respond quickly during times of crisis (i.e. 2013 flood).

The Fibre Infrastructure Strategy aligns with One Calgary's IT Solutions and Support service plan as it provides the foundational infrastructure for all communications for all business units.

The Fibre Infrastructure Strategy aligns with Calgary Economic Development's Economic Strategy for Calgary titled "Calgary in the New Economy" by supporting the Business Environment focus area to "Extend dark fibre footprint of technology and innovation to provide solutions to city challenges". The City licenses its dark fibre enabling entrepreneurs, businesses and tech companies the opportunity to build fast and reliable networks.

Stranded Facilities

Connectivity demands for field computing, IoT, 5G and smart city solutions are increasing every day, and this should be considered the new normal. These new demands emphasize the change in society and how cities need to adapt quickly.

Smart and resilient cities will be impacted by the rapid evolution and adoption of technology and reliance on data. What this means for The City of Calgary is that connectivity through fibre and wireless will experience **sustained and continuous** demand incenting a greater integrated approach in the planning process for both public and private sectors. By incorporating digital infrastructure into an integrated solution, The City can mitigate new technology being "bolted on" to assets with a preferred, seamless and aesthetically attractive solution emerging.

Lesson Learned: *Stranded facilities are no longer finite as sustained and continuous demands for connectivity is the new normal.*

Greenfield

Greenfield communities offered an opportunity to advance City fibre with additional cost reduction by taking advantage of the four-party trench agreement with Atco, ENMAX, Telus and Shaw. By leveraging this opportunity, The City experienced a **75% savings** in traditional construction costs. Greenfield opportunities and investment were less than projected due to the reduction of residential development and investment.

Lesson Learned: Leveraging the four-party trench is a cost-effective method of expanding City fibre.

2019 Status Update: Due to capital funding constraints, this opportunity cannot be fully leveraged as capital is directed towards greater priorities*.*

Business Parks and Transit-Oriented Developments
Business Parks and Transit-Oriented Developments are also opportunities to expand City fibre. Though only one opportunity was leveraged, there has been no indication of future undertakings. IT continues to work towards strengthening the value proposition with Real Estate and Development Services (RE&DS).

Revenues
As part of the Fibre Infrastructure Strategy, The City operates as a dark-fibre-optic provider and licenses excess fibre-optic capacity to other public-sector organizations, businesses and/or carriers. This revenue is growing and serves to finance further construction activities. In 2019, revenues reached an important milestone breaking the **$1 million milestone**, which represents a **180% increase** from 2015 revenues and is well above the **$180 thousand** originally projected in the strategy. Through Council support of the fibre strategy, a dramatic increase in revenue growth has been achieved (*see Figure 3*). Though revenue growth has been better than anticipated, a better understanding of the market is incenting a more targeted and focused approach to revenues. Emerging markets spurred by the trend to densify networks (5G/Small Cell, IoT) will provide new revenue opportunities.
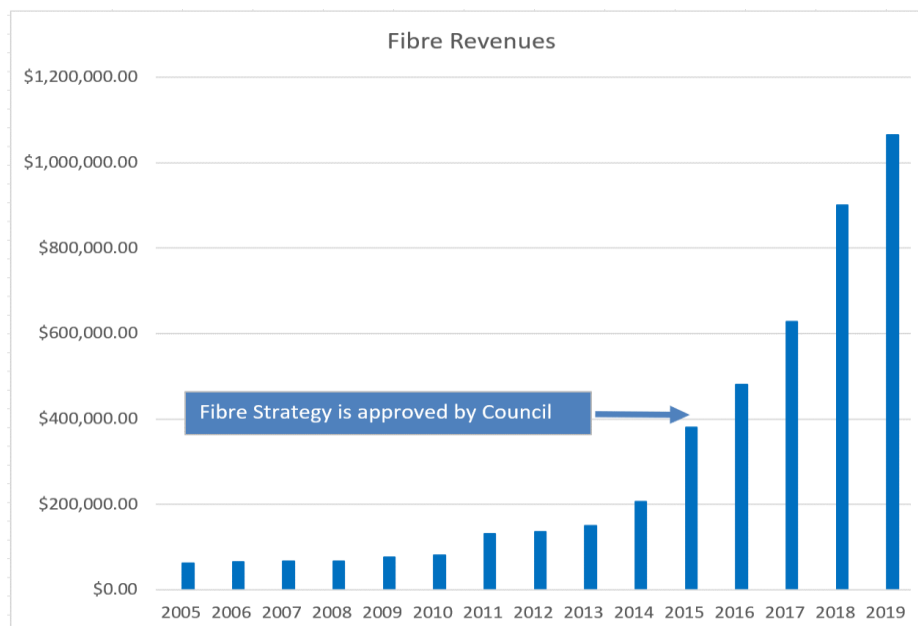

Figure 3: Current Revenues

Understanding that future demand will be continuous, and to mitigate risks arising from capital funding short falls, more emphasis on becoming **self-funded** is highly recommended. Revenues of $3 million to $4 million will provide a reasonable base to effectively deliver digital infrastructure.

2019 Status Update: In 2019, most of the large revenue opportunities were funded by customers, reducing the demands on The City's capital budget.

Future Opportunities
5G/Small Cell and the Evolution of Wireless Opportunities
5G/Small Cell is the next advancement in mobile and wireless technology important to connected, resilient and smart cities. It refers to wireless infrastructure that will enable many sectors and drive the digital economy by enabling automation, connected and autonomous vehicles, smart homes and field sensors. 5G/Small Cell represents a major uplift in infrastructure for Wireless Service Providers. It's more than a small antenna on a pole, it also encompasses fibre optics, large cabinets, new power cables, power meters, networking equipment, etc.

The drive for advancing wireless infrastructure is both a risk and an opportunity for The City. Wireless Service Providers' successful deployment of 5G will depend on access to municipal assets like streetlight poles and facilities resulting in thousands of third-party assets integrating with City assets. New standards, processes and agreements will manage both operational and financial risks while preserving aesthetics and public safety.

Integrated planning can mitigate the operational and financial risks affiliated with wireless infrastructure deployment on City assets and presents opportunities for new sources of revenues. Wireless infrastructure requires fibre optic to transport data and some Wireless Service Providers lack sufficient fibre optic to achieve this. Other potential sources of revenue can be found in attachment fees for antennas or co-location fees in City buildings.

2019 Status Update: The 5G opportunity is being addressed through the collaboration of numerous business units and individuals throughout the Corporation (Law & Legislative Services, Supply, Treasury, Corporate Analytics & Innovation, Information Technology and Roads). The following represents some of the initiatives underway which have been communicated via the confidential 2019 October 10 5G Ready by 2020 Report (GPT2019-1245).

1. Create the processes, agreements, standards and guidelines necessary to accelerate wireless infrastructure deployment in a cost-effective manner.
2. Develop a partnership opportunity with ENMAX to leverage streetlight and utility poles under a common infrastructure model. An agreement is anticipated 2020 Q1.
3. Strengthen the collaboration with Wireless Service Providers to facilitate 5G deployment.

Smart City, Economic Diversity, Digital Economy, Innovation, Collaboration
As The City of Calgary, in collaboration with community stakeholders, builds our communities' smart city strategy, continued investment in digital infrastructure is key to success. A smart city invests in technology and data solutions to provide excellent services to citizens.

To support Council's Business-Friendly directive, and as part of the smart city focus of diversifying our economy, The City of Calgary is partnering with CED to create the "Calgary as a Living Lab" initiative. As one of the largest owners of infrastructure in Calgary, The City is formalizing the process to open our infrastructure (where suitable) for companies and researchers to test, try and demo their products in real-world environments. The goal is to accelerate the commercialization of new products, services and research findings. It is not intended as a route for City solutions as there are avenues for those requests through existing procurement channels. For example, The City opened up Shephard Landfill for companies like Lougheed-Martin and NASA to test drone technologies. The Calgary Film Centre was used by an augmented reality software company to demo their products to potential clients.

Access to City fibre is a fundamental enabler for a large number of these technology tests as connectivity is often required. Often these ventures are limited in scope and resources; thus, providing access to municipal infrastructure at rates that encourage its use is critical to success.

2019 Status Update: The Living Labs program is achieving success with numerous projects assisting companies advance their technology.

Miscellaneous Opportunities
From time to time, unique opportunities arise which can contribute to the expansion of City fibre. These opportunities can contribute in reducing construction costs, providing conduit (Greenline) and possible funding.

Regulatory, Legislation and Advocacy
Consistent with the 2015 Fibre Infrastructure Strategy, The City's participation as an advocate in the regulatory and legislative domain is still a priority to ensure that municipal interests are represented.

Of importance is the legislative review of the Telecommunications, Broadcasting and Radiocommunications Acts. This review was initiated to modernize the Acts in relation to how technology is evolving in our society. An expert panel was assembled and a call for comments was initiated 2018 September.

Early indications suggest that some proposed legislative amendments will have significant ramifications to municipalities - impacts that could last for decades. The most significant risk municipalities face is **loss of jurisdictional control** over some components of municipal infrastructure and assets. This is mainly driven by the

proliferation of wireless technologies like 5G/Small Cell, whereby the wireless carriers want access to municipal assets (streetlight poles, buildings) to install antennas. Though advanced wireless networks are attractive to any modern city, a careful balance between municipal and industry interests are important considerations. By participating in the review, The City has helped shape and influence the legislative outcomes.

*2019 Status Update***:** The following represents recent communication from the legislative review panel.

> 2019 June 26: The Broadcasting and Telecommunications Legislative Review expert panel released their findings in a paper called "What We Heard Report". It's important to note that **no large cities** were interviewed as part of the process.

> 2020 January 31: The expert panel is scheduled to release their final report to the Federal Government.

Advocacy and regulatory participation remain a high priority of the Fibre Infrastructure Strategy to protect municipal interests.

One Calgary (2019- 2022) Capital Budget
Due to the current economic situation, the One Calgary (2019-2022) capital budget was significantly decreased compared to the Action Plan (2015-2018) budget.

An approved capital budget for One Calgary (2019-2022) of $4 million was increased to $8 million by Council at the 2019 November Adjustment to One Calgary Service Plans and Budgets. In comparison, the Action Plan (2015-2018) capital budget was $20 million.

The current 2019- 2022 capital budget of $8 million is funded entirely from the IT Reserve which is sourced from fibre revenues and recoveries. In this cycle, the Fibre Infrastructure Strategy will not achieve all of its objectives at the same rate seen in the 2015-2018 period. Revenue is expected to flatline with only modest growth as not all opportunities can be pursued. Fibre builds to City facilities and assets (traffic controllers) will be prioritized and will not achieve the same rate of connectivity.

Under these constraints. it is unlikely that self-funding of the Fibre Infrastructure Team can be achieved as forecasted in the 2015 strategy.

Essentially, the Fibre Infrastructure Team will be operating in a similar manner before this Council-approved strategy where additional funding was realized in 2015 to 2018. Though this is not ideal, the momentum and accomplishments over the last budget cycle have resulted in considerable gains.

In the 2019-2022 budget cycle, the Fibre Infrastructure Team will continue to focus on:

a. Leveraging capital projects such as Greenline, Bus Rapid Transitway's Airport Trail, etc.
b. Collaborating with stakeholders such as Transportation, Water, Facility Management, Integrated Civic Facilities, CPS, Calgary 911, Planning and Development, RE&DS and ENMAX.
c. Pursuing alternate funding sources such as grants or joint builds.
d. Establishing partnerships to leverage opportunities to expand the fibre plant or generate additional revenues through technology advancements like 5G, automated meter reading, smart city applications, etc.
e. Reducing deployment costs by leveraging ENMAX's utility pole infrastructure.
f. Promoting and marketing dark fibre through speaking engagements.

Works Cited

Government of Canada Innovation, Science and Economic Development Canada and Canadian Heritage, "*Government of Canada launches review of Telecommunications and Broadcasting Acts",* https://www.canada.ca/en/canadian-heritage/news/2018/06/government-of-canada-launches-review-of-telecommunications-and-broadcasting-acts.html, (June 5, 2018).

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