The City of Calgary

Fibre Infrastructure Strategy Annual Update

2022 May 27

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 2021 annual update.

In 2020, the pandemic caused one of the most disruptive events in our lifetimes. Connectivity became a lifeline to many citizens and businesses. Despite vaccinations and therapeutics, the COVID-19 pandemic is still prevalent in our society applying pressure to economic, social, and technological domains. City fibre supplies critical communications infrastructure to support business unit demands for services and provides capabilities to pivot when extreme conditions arise. City fibre also provides these capabilities to other essential providers such as Alberta Health Services and power utility providers increasing the resiliency of these services to our citizens.

By the end of 2021, over 900 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 2021, revenues saw a modest increase due to several reasons, including the effects of the pandemic and shifting priorities both internally and externally.

The total capital budget approved for the 2019 to 2022 budget cycle is $12 million. An additional $6 million in capital infrastructure funding through the Government of Alberta Municipal Stimulus Program was invested in 2021 to accelerate fibre builds.

We have interviewed large cities across Canada and have learned that The City of Calgary has the most advanced fibre optic network in Canada. This capability is a differentiator that The City will be able to leverage for years to come.

Background

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 The City's 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 continues to excel as a smart, safe, and prosperous city now and into the future.

2015 – 2021 Accomplishments

a. Connecting Assets

As of the end of 2021, over 900 facilities and assets (e.g. traffic controllers) have been fibre-connected, increasing business-unit capabilities with unlimited bandwidth and avoiding third party communication costs estimated to be $8 million per year.

Current trends indicate that devices like traffic controllers, sensors, and antennae are connecting at a faster rate. The Internet of Things (IoT) is expected to increase demands for connectivity far into the future.

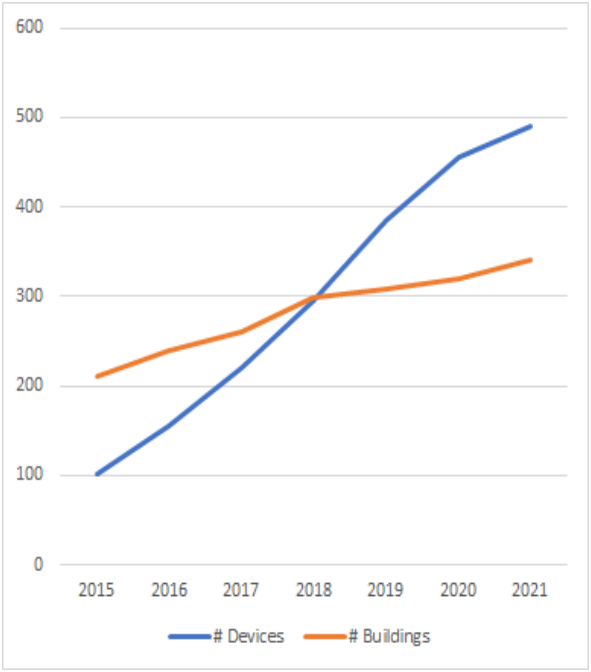

Figure 1: 2020 Trends in Number of Assets Connected with City Fibre

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.

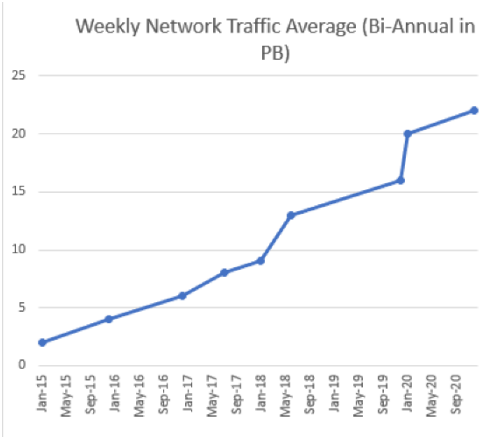

Figure 2: CCN: Bandwidth Consumption for City services [1 Petabyte (PB) = 1 million Gigabyte]

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

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 1000% (*see Figure 2)* 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 network. The more reliable the network, the more reliable the service. Back in 2015, the network was only up 65% of the time. Now that a significant portion is on fibre optics, the network is up 99% of the time. City fibre now reaches close to 40% of traffic controllers, resulting in an increase of service uptime and improving traffic flow through the city.

Figure 3: 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

- The University of Calgary's research on City Fibre as a Sensor was published in the Journal of Applied Geophysics (December 2020).
- The University of Calgary's research on Quantum Key Distribution was published in *"Quantum teleportation across a metropolitan fibre network"* in Nature Photonics (2016) with an acknowledgment of the use of The City's fibre.
- The City won the Ministers Award for Municipal Excellence for Municipally Owned Internet of Things Wireless Network (2018). This network is enabled by City fibre.
- The City won the Minister's Award for Municipal Excellence for Municipally Owned Fibre Infrastructure (2016).
- City fibre is a key element to delivering on business-friendly initiatives for Living Labs in conjunction with Calgary Economic Development.
- The Calgary Internet Exchange is rapidly growing, in part, due to City fibre making Internet faster for everyone.
- Calgary Economic Development includes City fibre as a technology enabler to attract companies to Calgary.

City Fibre Strategy Alignment

Connectivity plays an important role in all aspects of our society: economic, social, health, education, resilience, and next-generation municipal services. Just as we move people, goods, and services, fibre optics moves information – the digital version of people, goods, and services.

Stranded Facilities

Connectivity demands for field computing, the Internet of Things, 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 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.

Cost Avoidance

Building infrastructure and self-provisioning services is always weighed against leasing infrastructure and services. Comparing the two scenarios is difficult to do with one metric or model; rather, a comparison on various models provides insights into how The City avoids third party service costs. The following are some cost-avoidance scenarios:

1. City fibre avoids leasing third party fibre at a cost of $28 million per year.
2. The City's Calgary City Net fibre network avoids approximately $8 million per year in third-party network services.
3. City fibre-connected traffic controllers avoids operating costs of $2.3 million per year.

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 2021, revenues reached $1.2 million and steady growth going forward is anticipated.

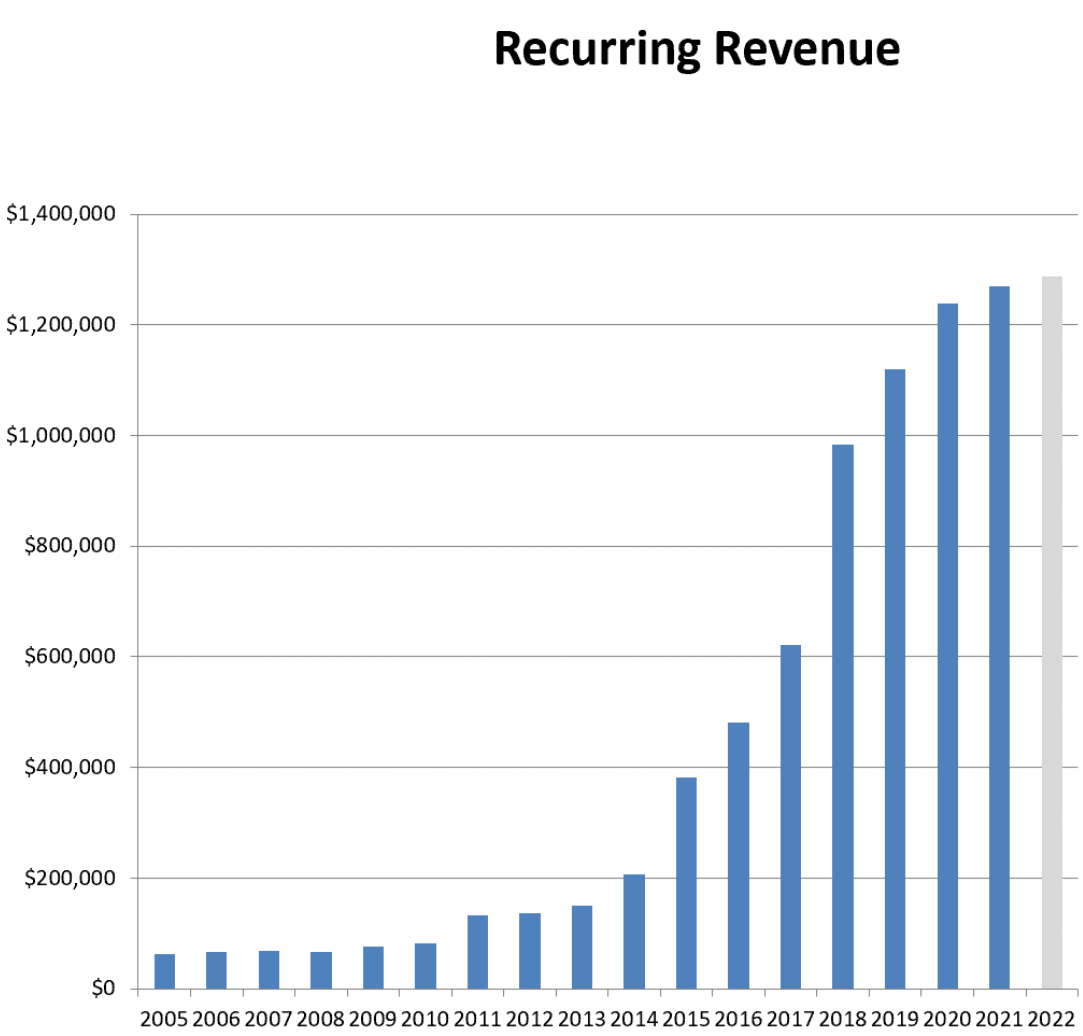

Figure 4: Recurring Revenue

Future Opportunities

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 has partnered with Calgary Economic Development to create the "Calgary as a Living Lab" initiative. As one of the largest owners of infrastructure in Calgary, The City has formalized 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 provided access to the Shepard 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.

The Living Labs program is achieving success with numerous projects assisting companies with advancing their technology.

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.

In previous reports, we highlighted the importance of 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.

Early indications suggest that some proposed legislative amendments will have significant ramifications to municipalities. The most significant risk municipalities face is loss of jurisdictional control over some components of municipal infrastructure and assets. Administration will continue to monitor the initiative for any changes.

One Calgary (2019- 2022) Operating and Capital Budgets

Due to the economic conditions at the time, the One Calgary (2019-2022) capital budget for fibre was significantly decreased compared to the Action Plan (2015-2018) budget. Revenues derived from dark fibre licenses are applied to the operating budget. Modest increases in revenue are expected.

Operating Budget:

The 2021 annual operating expenditure for The City's Fibre Team was $1.89 million. The estimated annual operating expenditure for 2022 is $1.83 million.

Capital Budget:

Total capital budget approved for 2019-2022 is $12 million. These funds are committed for new fibre projects such as intelligent intersections, stranded facilities, and next-generation City infrastructure.

An additional $6 million in capital infrastructure funding was obtained through the Government of Alberta Municipal Stimulus Program and invested in City fibre in 2021.

Future Opportunities

As network and fibre deployments continue to expand rapidly, there may be future opportunities for partnerships and collaborations that provide funding to expand the fibre infrastructure.

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

a. Leveraging capital projects such as Greenline, Bus Rapid Transit's Airport Trail, etc.
b. Collaborating with stakeholders such as Transportation, Water, Facility Management, Integrated Civic Facilities, Calgary Police Service, Calgary 911, Planning and Development, Real Estate & Development Services, 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

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