

**Transportation Report to
Priorities and Finance Committee
2021 February 16**

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PFC2021-0025
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Mount Royal University – Artificial Intelligence Digital Twin for Trucks

RECOMMENDATION(S):

1. That the Priorities and Finance Committee recommend Council approve this application for the Council Innovation Fund for Mount Royal University's Artificial Intelligence Digital Twin for Trucks Program in the amount of \$50,000.
2. That the Priorities and Finance Committee direct Administration to report back to PFC indicating how the money was spent and outcomes of the project within 12 months of its end date, as per the Council Innovation Fund Terms of Reference.
3. That Report PFC2021-0025 be forwarded to the 2021 March 1 Combined meeting of Council.

HIGHLIGHTS

The proposed Council Innovation Fund application is sponsored by Councillor Chahal, Chair of The Calgary Goods Movement and Logistics Advisory Group. The application supports a request from Mount Royal University (MRU) for \$50,000, to develop an artificial intelligence (AI)-powered digital twin platform for trucks. A digital twin for trucks is a virtual replica of a physical truck, used to better understand and manage its condition and behavior.

- Throughout the COVID-19 pandemic, Calgarians have relied on the delivery of goods and services more than ever to meet their daily needs. From accommodating e-commerce deliveries to home delivery of groceries and meals, goods movement plays a significant role in supporting citizens. Goods move in many ways, and trucks continue to be an essential mode of service.
- What does this mean to Calgarians?
 - The project will engage the local transportation and logistics industry, apply leading research in the area and use new technology to improve industry outcomes such as predicting equipment failure and reducing the total cost of ownership for small and medium-sized trucking companies.
 - The project will advance innovation for the trucking industry, allowing operators to improve productivity and safety, and create jobs in our local technology and transportation sectors.
- Why does this matter?
 - Digital Transformation, the method of converting services/businesses, by swapping manual processes with digital processes, is rapidly becoming a primary driver of innovative solutions for many industries worldwide, including here in Canada, and Calgary in general.
 - This project would not only make our organization (and city) a leader in this type of technology for Goods Movement but could also help perpetuate the digital transformation of other services throughout the organization in the future.
- For the most part, mobility trends have indicated that truck traffic has stayed steady on Calgary's road network through the duration of the COVID-19 pandemic. This general consistency emphasizes the importance of supply chains to Calgary's essential businesses and Calgarians as a whole.
- The Council Innovation Fund grant will be used towards students and researchers who will be conducting the studies and analyses for the project.

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- Information and outcomes from the MRU project will be made available to The City. The City will have access to all the project's learnings to help understand the benefits to City fleet vehicles, specifically in improving operational efficiencies if the technology is adopted. This understanding will further enable city services to conduct pilot projects using the technology.
- The project supports the implementation of Strategic Direction 6 of the Calgary Goods Movement Strategy, "Enable data collection and collaboration on goods movement research".
- Strategic Alignment to Council's Citizen Priorities: A prosperous city
- The Council Innovation Fund (CIF) has been in place since 2011 to encourage innovative and pilot projects that have the potential to support or contribute to the goals of Council and that have city-wide application. The CIF Terms of Reference are included as Attachment 1.

DISCUSSION

Mount Royal University - AI Digital Twin for Trucks Project

MRU proposes to develop and run a Digital Twin platform for Calgary's small and mid-sized trucking sector. The university will provide faculty, student and lab support (via the CN Supply Chain Data Analytics Lab), from data capture to deployment. A broader description of the project details and work is outlined in the Application for Council Innovation Fund (Attachment 2).

Background on Digital Twin Technology and Truck Digital Twins

A digital twin is a virtual depiction of a process, service, or physical object. It monitors and simulates the object's actual condition and behavior. The virtual model is continuously and automatically connected to the physical object and updates itself to reflect real-world changes. By creating simulations, digital twins can understand the system from the past and optimize the present to predict future performance. The global digital twin market has increased significantly over the last few years and is expected to continue growing in the coming years.

In trucking, AI-powered "Digital Truck Twins" can be used in various applications across the value chain. These applications can include (but are not limited to) monitoring a truck's health, providing predictive maintenance, predicting equipment failure, improving fuel savings, managing fleets, and reducing Total Cost of Ownership (TCO). The digital twin platform can provide an overview of the truck's state and ensure that it is as efficient as possible, thereby decreasing TCO.

Opportunity for Truck Digital Twins in Calgary

Calgary has a substantial number of small and medium-sized trucking companies that can significantly benefit if they could access the innovative technology of a digital twin for trucks. While truck manufacturers and large fleet owners have the resources to invest and build technology for their purpose, most small fleet owner-operators will not.

This project brings critical insights to trucking data, which can be used by small and medium-sized trucking companies in Calgary to improve their operational efficiencies. Mount Royal University students shall develop the technology in collaboration with its technology partners

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and then offer it as a service to Calgary trucking companies on a no-profit, no-loss basis. Subsequent commercialization will be done per guidelines of the Office of Research at MRU.

There is a gap in Maintenance & Repair (M&R) costs as vehicles age. By using enhanced prediction tools, and effectively utilizing the existing life of a truck's components, that gap can be bridged. Hence, if small and mid-sized trucking companies can use a digital twin for their fleet, they can better manage M&R costs. Based on a recent report on lifecycle strategy, with calculations derived from AI-powered TCO software, M&R costs on a 2015 truck compared with a new 2020 truck can provide savings of approximately \$12,000. With a fleet of 100 trucks, this can amount to an annual savings of \$1.2 million.

Consultation with Internal Business Units

Joint discussions with Fleet Services and IT at The City indicated two potential opportunities where a Digital Twin for Trucks would benefit City services in the future:

- A digital twin could help Fleet Services proactively maintain its units to avoid expensive failures, improving unit uptime and reducing life cycle costs.
- Further analysis of Fleet Service's maintenance database can provide insight into future improvements of the equipment specifications. As a result, The City could improve its mobile asset reliability and longevity, and reduce life cycle costs.

It was suggested that the digital twin could benefit Transit and CPS fleet maintenance as well.

Next Steps

Upon approval of funding, MRU will work with a team of AI experts (from Braintoy Inc.) to develop a project plan.

STAKEHOLDER ENGAGEMENT AND COMMUNICATION (EXTERNAL)

- Public Engagement was undertaken
- Public Communication or Engagement was not required
- Public/Stakeholders were informed
- Stakeholder or customer dialogue/relations were undertaken

The project was presented to The Calgary Goods Movement and Logistics Advisory Group (Advisory Group) on December 8, 2020. Calgary Economic Development, a member of the Advisory Group has also been engaged on the project and believe it will advance innovation in Calgary for the trucking industry. The project was discussed with the Dean of the Faculty of Business & Communication Studies at Mount Royal University (MRU) who supports the proposal on behalf of MRU. Additionally, the project was presented at the Truck Route Committee Meeting on January 7, 2021. The Alberta Motor Transport Association (AMTA), a participant of the Truck Route Committee, has 15,000 members in Alberta and is eager to provide access to early adopters of this platform. Letters of support from these groups are attached.

IMPLICATIONS

Social

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The AI Digital Twin for Trucks project allows for small and mid-sized trucking companies in Calgary to access the same innovative technology as larger companies. This results in equal opportunities for Calgary-based owner operators.

Environmental

Almost 30% of Canada's greenhouse gas emissions come from the transportation industry. A large part of this is because of long-haul trucks. A digital twin will track the fuel consumption of a truck during a trip and can then optimize that value and predict what the fuel use could have been. By leveraging that data, fuel economy can be enhanced to reduce carbon emissions.

Economic

The AI Digital Twin for Trucks project allows smaller businesses to save money, thereby supporting local Calgary communities. MRU supply chain/transportation faculty supervisors will be offering an in-kind contribution to the project. It is also anticipated that the one-time investment of \$50,000 will be matched by other grant sources, including Mitacs (a national not-for-profit organization that supports academic research involving students), and Western Economic Diversification Canada (a federal department that promotes economic growth in Western Canada).

Service and Financial Implications

Council Innovation Fund request

This Council Innovation Fund application is requesting one-time funding of \$50,000. As of December 31, 2020, the balance in the Council Innovation Fund is \$2.716 million.

Current and Future Operating Budget:

No operating budget impacts.

Current and Future Capital Budget:

No capital budget impacts.

RISK

Lack of support from industry – Success of this project relies on active participation from trucking companies. Initial engagement with industry stakeholders and fleet operators created interest and support.

Limited implementation opportunities – This project uses new and sophisticated technology. The benefits may not be realized if participants fail to leverage the data/outcomes to make operational changes. Education and encouragement for fleet operators to seek alternative resources for support will help reduce this risk.

ATTACHMENT(S)

1. Attachment 1 – Terms of Reference for the Council Innovation Fund
2. Attachment 2 – Application for Council Innovation Fund
3. Attachment 3 – Letter of Support from Goods Movement and Logistics Advisory Group
4. Attachment 4 – Letter of Support from Calgary Economic Development
5. Attachment 5 – Letter of Support from Mount Royal University

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Department Circulation

General Manager	Department	Approve/Consult/Inform
Doug Morgan	Transportation	Approve
Carla Male	CFO	Inform