



Canada's Tournament Capital

Technology in Solid Waste Trucks

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Division Director Sign Off

Executive Summary

The City's Sanitation division is seeking approval to add technology to its fleet of residential trucks to improve operational efficiencies, reduce recycling/organics contamination, and reduce costs associated with "go-backs" for missed collections.

With the addition of a third stream of collection for organics, a shift to a new model of collection with separate routes for garbage, recycling, and organics, a younger workforce with higher uptake and reliance on technology, and a fast-growing City, our Sanitation division has a growing need for improved efficiencies using routing technology. Staff are currently using paper maps to complete their routes which is not conducive to the dynamic operational flow that is required within the division. Missed collections with significant administration and operational time spent to assess and potentially send trucks back, currently results in an estimated annual cost of \$45,000.

High contamination in recycling is becoming increasingly costly for the City, with service level failure credits (penalties) from Recycle BC that escalate annually when the City fails to meet contamination reduction targets. In 2022, the City received \$65,000 in penalties for high contamination and is on track to see more in 2023. The current strategy used by staff to reduce contamination involves manual recycling audits. While these audits help to increase education and awareness, the scale is limited to less than 2% of carts that are set-out. The technology being proposed in this business case can audit 100% of carts and provide custom and direct resident education through an automated system.

Staff have researched options and recommend installing two new systems:

- routing technology on all 17 side-load trucks
- artificial intelligence (AI) technology on the seven trucks that collect recycling

Routing technology for 17 trucks would cost an estimated \$150,000 in capital and \$65,000 in annual operating. AI technology for seven trucks costs \$92,000 in capital and \$51,000 in annual operating.

Situational Overview (Terms of Reference)

The Sanitation division is looking to introduce some enhanced technologies to be outfitted for solid waste collection trucks to improve routing efficiencies, reduce recycling/organics contamination, and reduce costs associated with "go-back" for missed collections.

With the introduction of organics as a third commodity stream in the sanitation division and using a dual-pass system of collection, several new routes have been implemented across all five collection zones. In addition to these changes, staff turnover and a younger workforce contribute to a greater need for technology to assist with consistency of new routes and new staff.

As part of the agreement with Recycle BC, the City has an obligation to reduce contamination in recycling. The City's present contamination reduction strategy of performing cart inspections and direct education for the past several years is not effectively helping to meet the City's required contamination rate target of 3%.

In 2022, the City received \$65,000 in penalties related to contaminated recycling and is on track to receive more penalties in 2023. The challenge with the current system is that staff are only able to inspect a fraction of the number of recycling carts set out on a given day (less than 2%). AI technology can capture contamination data from all routes and communicate personalized messages regarding specific contaminants with residents through automated systems.

Recycle BC has indicated that the service level failure credits could potentially be used to help fund innovative systems that reduce contamination. Other communities have partnered with Recycle BC to fund AI technology using service level failure credits. Staff anticipate that up to \$50,000 could be available through credits to support AI technology.

The other technology being proposed will provide an operational improvement related to the amount of time spent dealing with “missed collections” in response to residents’ calls. From November 2022 to November 2023 there were 1,783 calls from the public for missed pickup. With the current system, there is no way to validate whether the operator missed the cart or if the cart was not out at the time of collection, and often a truck is sent back for “missed collections”.

Staff estimate a rough cost of \$50 in fuel, truck time, and administration for every missed collection. Assuming that a truck was sent back for half of all calls received, the total annual cost would be roughly \$45,000. This is a costly and inefficient system that could be overcome with the introduction of an enhanced technology to validate collection and ensure that operators are accurately following their assigned routes.

Options (Alternatives) Considered

Staff have investigated and identified potential solutions to address both issues with contamination and missed carts and have proposed two technologies currently in use by neighbouring municipalities: routing technology that supports collection efficiencies and service validation (missed pickups), and AI technology that supports contamination reduction.

Option 1: install routing technology on all 17 side-load trucks and install AI technology in 7 trucks.

Option 2: install routing technology on all 17 side-load trucks and install AI technology in 4 trucks.

Routing technology provides consistent orientation and training for new hires and ensures continuous collection and efficiency when new operators are covering a route for vacations, sick days, and training days. Crew leaders would be able to assign routes to specific operators and make any necessary routing adjustments for mechanical failures in real time via the technology. With the addition of tablets in all trucks, there will eventually be the opportunity for digital time sheets, safety tailgate forms, and better overall tracking.

The routing technology would notify operators when they have completed their route or if there are any missed areas. There is also the ability to highlight special pickups and carts that have been placed on a “Do Not Collect” list because of high levels of contamination.

Many carts are already equipped with technology tags that are used for inventory control and to track how many carts are set out for collection on any given day. As carts inevitably get moved

from their assigned properties, the tags can be scanned when carts are tipped and can be used to either determine where a cart belongs or to re-assign it to another existing property.

Technology can validate that a cart was tipped and gives operators the ability to mark carts as “not out.” This will greatly improve efficiency by reducing the administrative/operator time, equipment wear-and-tear, and re-routing with fewer requirements to go back for missed carts.

AI technology is currently in use by several municipal collectors to reduce contamination. This technology has the capability to scan material from carts as they are tipped, identifies common types of contamination, and automatically prepares a letter with a photo of the contamination that is directed to the occupants. This will greatly support the City’s goal to reduce recycling contamination and prevent further fines from Recycle BC. In addition, Recycle BC has indicated that they would be open to a partnership that would support the City’s efforts to reduce contamination.

If adopted, this technology has the potential to benefit not only the Sanitation division but other divisions as well (e.g. Streets for plowing, sweeping, potholes, etc.).

Financial Considerations (Benefit/Cost Analysis)

Option 1

Description of Costs		2024	2025	2026	2027	2028
Capital: One-Time Purchase						
	Routing technology (17 trucks)		\$110,000			
	AI technology (7 trucks)		\$92,000			
<i>Total Capital</i>			<i>\$202,000</i>			
Operating: Ongoing						
	Tech Support (routing)		\$116,000	\$116,000	\$116,000	
	AI technology (7 trucks)		\$51,000	\$51,000	\$51,000	
	Fuel Savings (\$2.00 / l)		(\$8,000)	(8,000)	(8,000)	
	Penalty Reduction		(\$48,750)	(97,500)	(146,250)	
	Re -Run Other impacts		(\$40,000)	(40,000)	(40,000)	
<i>Total Operating</i>			<i>\$59,250</i>	<i>\$10,500</i>	<i>(\$38,250)</i>	
<i>Potential funding for AI</i>			<i>(\$50,000)</i>			
Total Spend By Year			\$211,250	\$10,500	(\$38,250)	

Description of Costs – Support Operations		2024	2025	2026	2027	2028
Operating: Implementation						
	IT Support (Internal/External)	\$20,000	\$20,000			
	Risk Support	\$10,000				

Based on the level of capital investment and the potential savings and fee reductions, there is an expected positive impact and return on this investment.

Option 2

Description of Costs		2024	2025	2026	2027	2028
Capital: One-Time Purchase						
	Routing technology (17 trucks)		\$110,000			
	AI technology (3 trucks)		\$44,000			
<i>Total Capital</i>			<i>\$154,000</i>			
Operating: Ongoing						
	Tech Support (routing)		\$116,000	\$116,000	\$116,000	
	AI technology (3 trucks)		\$40,000	\$40,000	\$40,000	
	Fuel Savings (\$2.00 / l)		(\$8,000)	(8,000)	(8,000)	
	Penalty Reduction		(\$26,000)	(\$52,000)	(\$78,000)	
	Re -Run Other impacts		(\$40,000)	(40,000)	(40,000)	
<i>Total Operating</i>			<i>\$82,000</i>	<i>\$56,000</i>	<i>\$30,000</i>	
<i>Potential funding for AI</i>			<i>(\$20,000)</i>			
Total Spend By Year			\$216,000	\$56,000	\$30,000	

Description of Costs – Support Operations		2024	2025	2026	2027	2028
Operating: Implementation						
	IT Support (Internal/External)	\$20,000	\$20,000			
	Risk Support	\$10,000				

This project will offset operational spending at year four.

Risk Analysis

There are risks on both sides of the case for technology in trucks. Financial and social risks associated with not adding technology to trucks include potential future costs/penalties associated with ongoing contamination in recycling. In 2022, the cost of contamination in recycling to the City was \$65,000 based on a 100% failure rate during 13 audits. Penalties for contaminated recycling escalate annually when the City fails to meet contamination reduction targets. In 2022, the levy was \$5000 per load, which escalates to \$10,000 per load in 2023, \$15,000 in 2024 to a maximum of \$20,000 per load by 2025. There is also potential for increased costs for contamination in organics.

The impacts to employee morale and mental health are also a risk factor, with ongoing calls from public and responding to their concerns around missed collections. Knowing if a cart was out or not at collection time simplifies the conversation for both staff and residents.

As with any technology used to collect data, there is always a concern with privacy. The technology captures images of private property and contents of waste collected. The necessary privacy impact assessments will be done to ensure the City meets legislated privacy requirements.

Environmental Stewardship

There are several environmental benefits associated with this business case. Reducing contamination in recycling supports the bigger picture around making recycling more sustainable and competitive. High contamination makes it more costly to meet market requirements and can limit the ability to market material. For example, a recycling processor must spend more time and resources removing contamination during sorting. Conversely, keeping contamination low means recycled material is more competitive in markets in relation to virgin materials, thus lowering greenhouse gas impacts.

Further environmental benefits come from service validation through routing technology that reduces the need to send trucks back for a “missed collection”. A rough estimate of 5 litres of fuel per missed pickup equates to over 4,000 litres of fuel used to send trucks back over the period of one year.

Routing technology further reduces missed collections because the technology shows the drivers any areas of the route that have not been completed so they don’t miss parts of their route.

Proposed Schedule



Conclusion/Recommendation

Administration is recommending Option 1: implement routing technology on the fleet of residential trucks and AI technology on the seven residential trucks that collect recycling. Pending approval of the business case, staff would work with the Procurement division to source the technology, as well as engage with IT and GIS. The technology is cloud-based and thus does not require any support for installation or maintenance from IT, but it does require parcel and container data, which would require support from GIS. The technology could be installed by the end of 2024, and there is truly minimal tax impact, as the rest of the project could be funded from the Solid Waste Reserve.

Completed by the Corporate Services Department

Proposed Funding Options

Funding		2024	2025	2026	2027	2028
Funding Source						
	Solid Waste Reserve		\$211,250	\$10,500		