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Accountability: A Canadian municipal examination on the impact of vehicle and equipment training programs on preventable collisions with municipal fleet assets

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ABSTRACT

Annually, close to 1,000 Canadian workers die due to work-related injuries, exposures and disease. A lack of training and skills can contribute to this loss of life for many.

Employers of all kinds, including municipalities, have a responsibility to protect workers and reduce risk to the organization through training activities. Known hazards, like the operation of vehicles and equipment require training before a worker can be deemed competent.

Inevitably, preventable and non-preventable collisions will occur involving fleet vehicles and equipment. Documenting and analyzing preventable collisions as part of a collision investigation program, can help organizations understand why preventable collisions are occurring and how they may prevent further accidents.

Survey respondents for this research study revealed that as a municipal fleet grows in size (more than 1000 fleet assets) and as municipal populations grow, municipalities are more likely to use a centralized and consistent training program. Further, municipalities with centralized and consistent training programs are more likely than municipalities with other training types to have a collision investigation program. Lastly, municipalities who provided preventable collision data through the survey, six of seven use a centralized training approach.

This research reveals that municipalities are not measuring the impact and effectiveness of vehicle and equipment training programs. Additionally, municipalities are not using collision related data to understand why preventable collisions are occurring, influence training programs and reduce risk in meaningful ways. The costs of collisions is not being documented across the silos that exist in the municipal organizational structure. Lastly, from a policy

perspective, requirements for fleet operators to document and analyze collision data should be a baseline expectation to protect their drivers and others sharing the road.

Ultimately more research and data is required to support municipalities across Canada and the vehicle and equipment training programs they offer.

ACKNOWLEDGEMENT

To say I am both happy and proud to have reached this milestone would be an understatement. The submission of my Major Research Paper marks the end of my time as a part-time student in the University of Western's Local Government Program resulting in a Master's Degree in Public Administration. Public service has been a passion throughout my life and this program re-affirmed that. Achieving this goal would not have been possible without the support of many passionate and understanding people in my life.

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through each course and your patience with my extreme level of passion for vehicle and equipment training programs. As well, I would like to thank my co-worker at the City of Burlington in Fleet Services, Dave Hickerson. Dave taught me a lot about the field of vehicle and equipment training. Dave shared his knowledge and passion for what he does without hesitation when I came into a new role with little prior knowledge. In many ways, Dave inspired this review of municipal training approaches.

Next, I would like to thanks my cohort of Covid-19 pandemic classmates. Although we embarked on this learning journey at the onset of a global crisis in March of 2020, each one of you have managed to navigate new territory in your careers, your home life and your education – at the same time! Each one of you should be commended for the commitment, dedication and focus that you have shown during unprecedented times of uncertainty. Despite all of the external factors, we worked together to achieve this. We shared our experiences, and supported each other through each assignment, deadline and course to reach this milestone. I am truly grateful for the mentorship, guidance and friendship you have provided me along the way.

Last but certainly not least, I would like to thank my research advisor Dr. Dave Armstrong. Dave has been a consistent and trusted sounding board for my thoughts, analysis and writing throughout this process. I truly appreciate all of your feedback and know that with your support, we have provided a valuable piece of research and analysis in the field of vehicle and equipment training. You have challenged my thinking and pushed me to be a better writer.

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Section 1: Background

According the a recent report form the University of Regina, Canadian workers compensation boards reported that 925 workers died due to work-related causes in 2020 (Tucker & Keefe, 2021). Although not all of these deaths include an individuals operating a vehicle or piece of equipment leading to death, even one death while operating a vehicle or piece of equipment is too many. Keeping all workers safe while in the workplace is enshrined in legislation that all employers must adhere to under Canadian law. The Occupational Health & Safety Act, R.S.O. 1990, c. O.1, Section 25 & 26 requires each employer properly train and provide guidance on the operation of equipment to the employee, instruct the worker and advise of hazards. As well, the Municipal Act, 2001, SO 2001, c 25 outlines in Section 448 (2), that a municipality can be liable for a tort committed by an employee or a person acting under the instructions of an employee. Not only is it crucial for an organization to ensure that their employees get home safely from work each day, it is also a requirement of law that each employee is properly trained in the use of the equipment they need to do their job. If an employee is not comfortable that they have been properly trained on how to operate vehicle and equipment, a number of remedies are guaranteed to them through the Ministry of Labour that can be used to support an investigation or work stoppage after the employee requests additional training. Training can be expensive for an employer to undertake however, we all know those work stoppages and even more so, the short term and long-term costs of a workplace death are substantially more. Mothers, fathers, grandmothers, grandfathers, daughters, sons, brothers and sisters all died while on the job in 2020 (Tucker, 2021). The families and coworkers of these 925 individuals will

never be the same and if the actions of an employer can prevent any of these deaths, we must work together to accomplish that.

In a municipal environment, vehicle and equipment operators offer critical services to the community each day including transit service, road maintenance, snow clearing, turf and park maintenance, tree maintenance, waste collection, water and sewer maintenance, emergency services, and security services. These services contribute to the well-being and safety of all residents, businesses and stakeholders. Put simply, the City could not operate without these vehicle and equipment operators.

For my Master's Research Paper for the Local Government Program at the University of Western Ontario, I will examine whether vehicle and equipment training programs work in a municipal setting. By "work", I mean do vehicle and equipment training programs actually function the way they are intended – to effectively ensure vehicle and equipment operators have the necessary skills to operate fleet assets and reduce the number of preventable collisions. Specifically, I will complete a Canadian municipal examination on the impact of vehicle and equipment training programs on the number of preventable collisions that occur with municipal fleets. Municipalities across Canada, of varying sizes, have different types of internal training programs for employees who must operate City fleet vehicles and equipment as part of their daily work. The great majority of municipalities in Canada will employ some number of staff to operate fleet assets, whether it be an ice resurfacer, a snow plow, a riding lawn mower or even a simple passenger vehicle. The level of skill, professionalism and awareness of legislated requirements to operate the various types of vehicles and equipment from heavy-duty aerial trucks and cranes in forestry, to a grass trimmer, varies greatly. A

professional driver, who has been properly trained and meets a set of standards, will greatly reduce the municipality's operational risk and likely the costs related to preventable collisions involving these same operators and vehicles.

My interest in this topic is based in the fact that fleet managers are responsible to ensure that fleet assets meet or exceed lifecycle targets in order to decrease the capital budget requirements for fleet vehicles. Given that the operation of a fleet asset is a critical component of the asset lifecycle, the safe operation and maintenance of the asset by operating groups, must be taught to ensure that the fleet can reach its expected lifecycle. Operating groups from across departments, divisions and sections of an organization are responsible for the operation of vehicles and equipment so a robust training program must be provided, which can transfer knowledge throughout these various groups. I think vehicle and equipment training and collision investigation and review are important aspects for any organization that operates fleet vehicles, as I believe we can reduce the number of collisions simply through training and analyzing collision data. It is also a primary function of an employee in any leadership role to ensure that the employees who work on their teams go home safe everyday.

I am a municipal fleet manager myself however; I did not provide responses to the survey on behalf of the municipality, which I work for. I also obtained ethics review board approvals for the survey questions and delivery methods for the survey. Asked for factual data and the data analysis should not be bias in anyway.

I am hoping that this research can confirm that we can reduce preventable collisions through centralized training programs. One less collision for any municipality can make a big difference for a municipal worker and their family.

My research question is:

- Do Canadian municipal vehicle and equipment training programs have an impact on the number of preventable collisions that occur with the municipal fleet?

This question is relevant, as municipalities are required by law to provide equipment training to educate on each piece of equipment and complete hands-on training on the safe operations of vehicles and equipment. A comprehensive program will also include consistent and thorough documentation of vehicle and equipment training as well as periodic retraining depending on risk level, training complexity, incident/accident frequency and seasonal demand. The program must ensure employees are properly equipped and possess the knowledge and skills to undertake their respective tasks safely and efficiently. Municipalities across Canada use a variety of training models and program types to train their employees on the use of necessary vehicles and equipment to support service delivery. Additionally, vehicle and equipment training is important to Canadian municipalities as most are consistently asked by Council members and taxpayers to deliver more services with a smaller budget. One huge cost for many municipalities is insurance premiums. As part of the evaluation process when an insurer considers what premium is appropriate, the insurer considers the number and type of licenced and non-licensed vehicles and equipment as well as the history of preventable collisions with municipal fleet vehicles. A poor or non-existent training program for vehicles and equipment may unnecessarily expose the corporation to risk and ultimately increase premium costs due to

preventable collisions. Many people think of the direct costs of a preventable collision being the repair work required on the municipal fleet asset, however may not think of other potential costs, including fleet asset replacement, employee injury, lost time, 3rd party vehicle repair, property damage, 3rd party injury claims, litigation and so on. Depending on the severity of the preventable collision and the negligence assigned to the municipality, incidents like this could cost a municipality millions of dollars. Recent accidents and subsequent lawsuits in British Columbia and Ontario have brought negative media attention to the municipalities affecting their reputation and budgets. Examples of this include, in 2019, a City of Ottawa municipal employee died after being struck in an incident involving two garbage trucks. The employee with the city's public works and environmental services department, suffered critical injuries and was taken to the Ottawa Hospital's Civic campus trauma unit, but was pronounced dead on route. Another example in 2010 in Toronto, a City employee succumbed to his injuries when he failed to negotiate the ramp onto the Don Valley Parkway in the early morning hours. The driver, and his passenger, went off the road, rolled through a guardrail, struck a tree and the vehicle then rolled onto its side. The passenger escaped with serious but non-life threatening injuries. Lastly, in 2015, a Northern Ontario municipal employee died when a truck struck him, while reversing into a vehicle maintenance shop. These accidents involving vehicle and equipment are heartbreaking for the families and coworkers of those who are lost. In any case involving a critical incident, the Ministry of Labour will investigate the accident. Once an inspector is assigned and completes the investigation, the inspector can issue orders to prevent this type of incident from happening again. The inspector may also choose to lay charges if they feel that the employer has been at fault and their actions led to the workplace injury or

fatality. Charges can range from monetary fines to jail time, depending on the severity of the incident for both individuals involved, their Supervisors and the municipality. Fines can be compounded and assigned as the Ministry of Labour chooses. These fines and subsequent lawsuits can cost both employees and taxpayers significantly. Should a municipality not have sufficient reserves in place, this can have a significant impact on the tax rate. A municipality's reputation may also incur noteworthy damages because of accidents and collisions. From decreased public trust from residents to bad publicity that could impact economic development and tourism, the reputation of a municipality is critical in all aspects. Lastly and arguably most detrimental, a catastrophic injury in the workplace or death in the workplace will undoubtedly impact a municipality's ability to attract and retain skilled and best in class labour. The inability to attract skilled labour will further impact service delivery.

My hypothesis is that a robust centralized municipal training program for vehicles and equipment will reduce the number of preventable collisions that occur with municipal fleet assets. In 2005, Robert Rodriguez defined centralized training as a central function assuming accountability for managing learning and development throughout the organization. By contrast, decentralized training pushes control and responsibility for training out to the various business units. For the purpose of my research, I have compared two training models and three training types that municipalities may likely execute. Centralized and decentralized training are defined as categorized below:

FIGURE 1 - CENTRALIZED VERSUS DECENTRALIZED TRAINING MODEL COMPARISON

Centralized Training Model Characteristics	Decentralized Training Model Characteristics
• Central accountability for managing learning and development • Training design, delivery and documentation is likely to be consistent across operating groups and training type • Trainers are subject matter experts as they focus on training solely	• Control and responsibility for training pushed to various business units • Training design, delivery and documentation is likely to be inconsistent across operating groups and training types • Trainers are not subject matter experts as they have another job but support training as they are able to

The training type comparison will include:

(1) No vehicle and equipment training program offered by the municipality

(2) Decentralized, vehicle and equipment training upon hire, which includes reading and/or listening to an instructor and no hands on skills demonstration or assessment

(3) Decentralized, vehicle and equipment training upon hire includes reading and/or listening to an instructor, and hands on skill demonstrations for each operator evaluated by competent evaluator

(4) Decentralized, vehicle and equipment training upon hire, which includes reading and/or listening to an instructor and hands on skill demonstrations for each operator evaluated

by a competent evaluator. Also included will be periodic scheduled retraining and/or skills assessment throughout employment.

(5) Centralized, vehicle and equipment training upon hire, which includes reading and/or listening to an instructor, and no hands on skills demonstration or assessment

(6) Centralized, vehicle and equipment training upon hire includes reading and/or listening to an instructor, and hands on skill demonstrations for each operator evaluated by a competent evaluator

(7) Centralized, vehicle and equipment training upon hire includes reading and/or listening to an instructor, and hands on skill demonstrations for each operator evaluated by a competent evaluator. Also included will be periodic scheduled retraining and/or skills assessment throughout employment.

In a decentralized training model, in-class and hands-on vehicle and equipment training is often performed by individuals who are not professional trainers. Trainers in a decentralized training model often have other core responsibilities to their role and have not participated in any formal education program to learn the important skills needed. A skilled vehicle and equipment trainer will be educated on how to develop clear training instructions, how to develop training tools and resources using various technology and hands-on approached, coordinate training delivery and formulate training delivery for operators of varying educational and professional backgrounds.

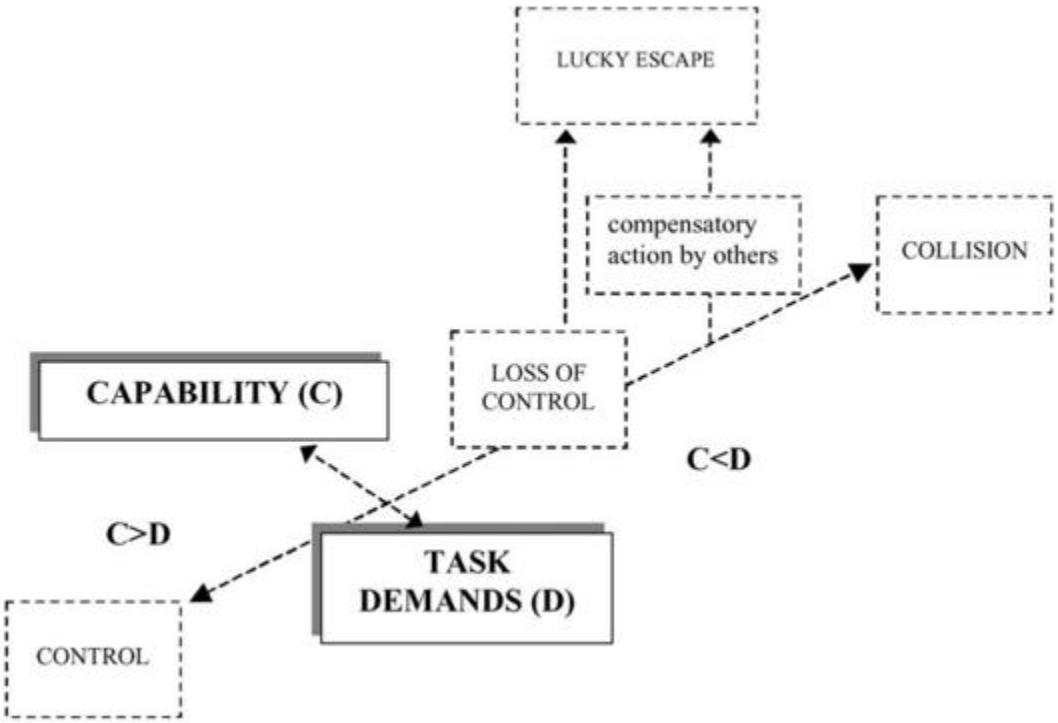
FIGURE 2 - TRAINING TYPE COMPARISON

Training Characteristics	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6	Type 7
Centralized (C) or Decentralized (D)	N/A	D	D	D	C	C	C
Training Upon Hire - Theory	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Training Upon Hire – Hands On	N/A	No	Yes	Yes	No	Yes	Yes
Retraining and/or Skills Assessment throughout employment	N/A	No	No	Yes	No	No	Yes

Section 2: Literature Review

Ray Fuller, former professor for the School of Psychology and contributor to the Psychological Society of Ireland, provided an abundance of research in driver behaviour aimed to develop a general theory of driver behaviour. Fuller believed that when analyzing vehicle accidents and prevention, task difficulty was a measure of the task-capability interface (TCI) model. This model acknowledged a dynamic ongoing interaction between task demand and driver capability.

FIGURE 3 - FULLER'S TASK CAPABILITY MODEL



Driver capability is defined as the logical characteristics of a driver including the information processing capacity and speed, physical reach, motor coordination, flexibility and strength. Capability can vary between drivers and within the same driver at different times due to energy levels and focus. Driver task demands are dependent on a number of interacting elements including the environment, traffic or obstacles and speed. Environmental factors include visibility, road alignment, road markings, road signs and signals, road surface, curve radii, sight lines, etc. Road users also create further demands on the driver including the number and type of vehicles and their driving behaviours. Other objects including parked cars, lighting and buildings may increase a driver's task demands and/or distraction. Lastly, speed of the vehicle, which the driver controls directly, can be a major factor in the driver task demands. The faster

the vehicle is travelling, the less time the driver has to analyze task demands and the quicker they must make decisions. According to another study between the interaction and communication in dynamic control tasks, the handling of a car or ship can be compared in in-person related aspects, tool or device aspects and task demands.

Mayhew and Simpson found that although driver education programs for new drivers aim to produce “safer” drivers, the programs have not been effective in lowering the number of preventable collisions for trained drivers. Several studies have found that training has not reduced the number of accidents and that training actually provides a safety risk as participants are permitted to drive at a younger age. This research identified five critical gaps in reducing the number of accidents, including that training failed to teach the knowledge and skills for safe driving, that young drivers are not motivated to use safety skills, that driver training causes overconfidence for young drivers, that driver education fails to address lifestyle issues and lastly that driver training fails to address the unique needs of each student. Although the majority of municipal vehicle and equipment operators are likely adults, municipalities still traditionally employ a large number of young drivers seasonally for park maintenance activities. As well, this research reminds us that driver training does not guarantee a reduction in accidents. Training must be specific to the critical skills needed for that specific operational use, the specific piece of equipment and the driver’s needs and abilities (i.e., Fuller’s driver capability). The driver must also be aware of the consequences of not operating a vehicle or equipment properly including accident damages to vehicle, equipment, person or property, increased equipment downtime, accident investigation and discipline.

According to an IOP Conference Series: Earth and Environmental Science article from 2021, 1.35 million people are killed in road accidents every year (E V Ageev et al, 2021). The main reasons for the high accident rate include the inability of vehicle operators to perceive the surrounding objective reality, which does not allow them to correctly assess the situation; they lack the ability or willingness to make and implement a decision that ensures traffic safety. In cases where the operator has received all the necessary information, a traffic violation may have resulted from an incorrect assessment of the situation. In this study, drivers who were permitted to drive before receiving the necessary driver training were found to have a decreased ability to assess situations and failed to make the right decision, as they did not have the practical skills to operate the vehicle. Studies have shown that the students who have received professional training are more adapted to driving a vehicle compared to the control group who have not. Komaki, Heinzmann and Lawson (1980) at San Jose State University found that operators from the municipal public works department only realized increased safety behaviour while operating vehicles and equipment after feedback was incorporated into the training process. Once observations and feedback are incorporated into the training, the number of safe observations greatly increased, almost doubling, across all three training types that were evaluated.

A recent study from the University of South Britany in France examined the impact of training programs on the ability of trainee watch officers to make decisions in collisions avoidance situations. Although this research uses ships as opposed to vehicles and equipment, the evaluation and analysis of scenarios while operating an asset can be quite similar. Results showed that decision-making exercises did tend to improve the trainees' capacity to analyse a

complex situation; however, they did not have a clear impact on the manoeuvre performed (Chauvin et al, 2009). Additionally, the study showed a significant difference in that trainees who experienced complex avoidance situations during on-the-job training performed much better than those who did not.

Taken together, these articles provide a clear picture of the value of employee training. Training regimes that include reading and/or listening to an instructor, hands on skill demonstrations for each operator evaluated by a competent evaluator and periodic scheduled retraining and/or skills assessment throughout employment can lead to an increased skill level of the driver and then likely reduce the number of preventable collisions. Just reading documentation or listening to a lecture on safe driving practices is not sufficient to increase safety alone.

For those unfamiliar with these situations, imagine acquiring a new vehicle to drive your family around. When we purchase a new vehicle, the buttons look differently and are in different places, the ignition, parking brake, seat and mirror adjustments may operate differently. This is a relatable example for most people. Further, imagine the car as a manual transmission and your only driving experience is on cars with automatic transmissions. You could just get in the car and learn by trial and error (e.g., not training). You could learn by watching a YouTube video or reading a description of how to do it. Finally, you could learn by having a competent trainer demonstrate for you and provide you feedback as you try the techniques discussed in real time. The last scenario will no doubt result in more competent driving.

Scenarios similar to these happen with snow plows used for winter maintenance activities. These five tonne vehicles are much larger, have poor sight lines, include a large front plow and

wing, use a series of controls to select the spread rate and spread pattern of materials and require the driver to follow a pre-defined route. These considerations along with the challenges that come along with traffic and poor road conditions increase the complexity for winter maintenance drivers. Given that in Canada, we experience snow for 4-5 months of the year, many winter maintenance drivers forget the required skills between seasons requiring re-orientation and training with the equipment.

This study evaluates the hypothesis that hands on, real-world training scenarios better prepare drivers for difficult decisions that they may face while operating a vehicle.

Section 3: Research Design and Methods

Review of the above literature provides overall context as it relates to vehicle and equipment training types, and the effectiveness of training on the number and type of collisions. Additionally, this research highlights a gap where further study can be targeted in the context of municipal fleet vehicles and equipment. It will add evidence to the impact of training on the number of preventable collisions.

My research design will test the hypothesis that a robust centralized municipal training program for vehicles and equipment will reduce the number of preventable collisions that occur with fleet assets. Additionally I will look to evaluate whether or not the cost of centralized training programs can provide a return on investment through repair and litigation cost avoidance. The type of vehicles and equipment operated by municipal fleets across the country is quite similar. The difference between vehicle and equipment training types and their

subsequent effectiveness in reducing preventable collisions is likely quite heterogeneous and remains unexplored.

As previously presented, vehicle and equipment training matters. It is a key responsibility governed by legislation for employers and supervisors in the workplace. Additionally, residents expect good governance in municipal operations. Good governance means that as public servants we manage risk to the organization and are fiscally accountable for our service delivery. Risks managed through vehicle and equipment training delivery include legislative requirements, liability, asset management, service delivery risk and reputational risk. A large number of city services require the use of vehicles and equipment as mentioned above and without training, service delivery for many of our residents is at risk. This study is being done to evaluate whether the investment in municipal vehicle and equipment training programs results in reduced collisions and increases fleet safety for vehicle and equipment operators across the country. Further, it seeks to evaluate the heterogeneity in the effectiveness of each type of training programs.

Section 3.1: Case Selection

The main study instrument used for this analysis is an online survey developed and executed online through Qualtrics. Survey participants were recruited from across the country. To ensure a cross section from across the country was surveyed, the top five largest Cities by population for each Canadian province were identified and their municipal fleet managers were invited to participate. Depending on the province, the population size of the five largest Cities varied greatly. These Cities targeted because they should have larger fleets and more data available to draw from. Additionally, I requested support from the Canadian Association of

Municipal Fleet Managers (CAMFM). This national group of municipal fleet professionals is a membership organization representing precisely the prospective participants we were trying to recruit. I reached out to the groups directly via a recruitment email or through CAMFM requesting that they send my contact information and a brief description of the study to their members.

Regardless of recruitment method, those who participated spent roughly 20-30 minutes to complete the survey. Each participant was notified in advance of the survey that municipal data was required to provide responses to the survey including fleet size, municipal budget and collisions. Participants were given three weeks to respond with a single e-mailed reminder after two weeks of non-response.[1]

The five largest municipalities in each province are:

FIGURE 4 - FIVE LARGEST MUNICIPALITIES IN EACH PROVINCE

Municipality	Province	Municipality	Province
Airdie	Alberta	Abbotsford	British Columbia
Calgary	Alberta	Burnaby	British Columbia
Edmonton	Alberta	Richmond	British Columbia
Lethbridge	Alberta	Surrey	British Columbia
Red Deer	Alberta	Vancouver	British Columbia
Brandon	Manitoba	Conception Bay South	Newfoundland
Portage la Prarie	Manitoba	Corner Brook	Newfoundland

[1] The survey was conducted in accordance with the ethics guidelines by the Western University Non-Medical Research Ethics Board. The study procedures were approved as protocol 120796 by the NMREB.

Steinback	Manitoba	Mount Pearl	Newfoundland
Winkler	Manitoba	Paradise	Newfoundland
Winnipeg	Manitoba	St. John's	Newfoundland
Bathurst	New Brunswick	Brampton	Ontario
Fredericton	New Brunswick	Hamilton	Ontario
Moncton	New Brunswick	Mississauga	Ontario
Quispamsis	New Brunswick	Ottawa	Ontario
Saint John	New Brunswick	Toronto	Ontario
Amherst	Nova Scotia	Gatineau	Quebec
Cape Breton	Nova Scotia	Laval	Quebec
Halifax	Nova Scotia	Montreal	Quebec
New Glasgow	Nova Scotia	Quebec City	Quebec
Truro	Nova Scotia	Sherbrooke	Quebec
Charlottetown	P.E.I.	Moose Jaw	Saskatchewan
Kensington	P.E.I.	Prince Albert	Saskatchewan
Stratford	P.E.I.	Regina	Saskatchewan
Summerside	P.E.I.	Saskatoon	Saskatchewan
Three Rivers	P.E.I.	Swift Current	Saskatchewan

The scope of this project is a national review of municipal vehicle and equipment training programs. Municipalities included are a mix of single-tier and two-tier government structures.

Section 3.2: Data Sources

The main source of data for this study are the survey responses from each municipality. Each municipal respondent was asked to review a letter of information and provide consent to participate. Those who provided consent responded to a single online survey at a location of their choosing which took 20-30 minutes to complete. When initially contacted, prospective participants were informed that municipal data will be requested on fleet size, municipal budget and collisions. This ensured that prospective participants had a full understanding of what was be asked of them ahead of time. Participants were given three weeks to respond with a single e-mailed reminder after two weeks of non-response. Each municipal respondent has been asked to provide quantitative and qualitative data on the characteristics of each municipality, the municipal budget, the weather, the fleet, vehicle and equipment operators, the vehicle and equipment training program, and collisions. Some of the data is public data however some is not. These data sets were compiled and analyzed.

Section 3.3: Operationalizing Concepts

I used the data to describe the variation in preventable crashes (my dependent variable) and to discover the extent to which variation in training types between municipalities corresponds with variation in preventable vehicle collisions. In particular, I am interested in whether the investment in municipal vehicle and equipment training programs results in reduced collisions and increased fleet safety for vehicle and equipment operators across the country. Ideally, I will use the data to evaluate heterogeneity in the effectiveness of these programs. I will also then consider the cost of preventable collisions between each training type to determine if there is rationale to believe that increasing investment in the training program can reduce the costs of preventable collisions. Preliminarily, I expect that a municipality with a robust centralized

training program like training type (6) or (7) will have fewer preventable collisions than other decentralized training programs.

Section 4: Survey Analysis & Findings

In the three-week recruitment period, 18 responses were collected from municipalities across Canada including 10 from Ontario, and one each from eight other provinces: British Columbia, Alberta, Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Saskatchewan, and Prince Edward Island. If missing data was available publicly (e.g., city budget), this data was filled in from the City's website to offer a more robust set of data to analyze. Blanks were left for any data that is not publicly available. Overall, 69 people were recruited for the survey, resulting in a response rate of 26%. Although I would have preferred a better response rate, there are still some interesting results that can obtained from the survey and shed light on the efficacy, performance and sustainability of vehicle and equipment training programs throughout Canada. Participants were asked 24 questions in total. Two questions were branched in nature so if the respondent answered no to either of these questions, it would decrease the number of survey questions the respondent saw.

One set of questions asked respondents to describe basic details about the municipality they were responding on behalf of including the name of the municipality, single-tier versus two-tier government, population size, province the municipality is in, 2022 capital and operating budgets and months per year the municipality experienced winter conditions. As noted above, the majority of the survey respondents represented Ontario municipalities. Ten of the seventeen municipalities who responded had a population size of 250,001 or more, six had a

population of 50,001 to 250,000 and one municipality had a population of 15,000 or less. Twelve respondents were from two-tier municipalities and five were from single-tier municipalities. Another set of questions looked at the composition of the municipal fleet as well at the vehicle and equipment training program offered by the municipality.

Two-tier municipalities were more likely than single-tier municipalities to have centralized and consistent training programs with retraining training in place. Table 1 shows the cross-tabulation of training programs by municipal structure. Fifty percent of single-tier municipalities have centralized and consistent training programs; that number is 60% for two-tier municipalities. With the small number of observations, the differences are not statistically significant. Two-tier municipalities also had more likelihood to be larger centers with a population of 250,000 people or more (80% vs 50% for single-tier municipalities). Ontario was the only province with two-tier municipalities.

TABLE 1: TRAINING PROGRAMS BY MUNICIPAL STRUCTURE

	Single-Tier	Two-Tier
Decentralized	4 (33%)	0 (0%)
Centralized, Inconsistent	2 (17%)	2 (40%)
Centralized, Consistent	6 (50%)	3 (60%)

Main entries are cell counts, column percentages in parentheses

The main dependent variable in the study is the number of preventable collisions. Seven respondents reported preventable accidents in 2019, 2020 and 2021 that ranged from 23 to 448. One respondent reported the total number of accidents (between 229 and 346, but could not distinguish between the number of preventable and non-preventable accidents). Obviously, municipalities with bigger fleets will have more preventable accidents, but the preventable accident *rate* may be more interesting. The number of fleet assets only identifies a range, so I used the centre of each category as an estimate of the fleet size. For fleets over 1000, I used 1001 as the estimate. I also calculated preventable accidents per 10,000 population as a proxy for the preventable accident rate. For each municipality, I used the average number of preventable accidents from 2019-2021 as the estimate for the number of preventable accidents. The average accident rate per 10,000 people and the average accident rate per fleet size are correlated at approximately 0.54, indicating that these are similar, though still distinct measures of the accident rate.

For the survey, winter conditions were defined as having an average temperature of 0 degrees or lower. Respondents were asked how many months of winter conditions were experienced in 2021. Those municipalities that experienced more months of winter conditions experienced higher accident rates on average. The difference between 2-3 months and 4-5 months is quite small, thus I grouped them together, but those municipalities with 6-7 months of winter conditions had considerably higher rates. Table 2 gives the accident rates by months of winter conditions.

TABLE 2: AVERAGE ACCIDENT RATE BY MONTHS OF WINTER CONDITIONS

	Preventable Accidents per Fleet Size	Preventable Accidents per 10,000 Population	N
2-5	0.07	1.2	4
6-7	0.19	4.59	3

Of the municipalities that provided a survey response, ten had populations of 250,000 people or more. Traditionally, the larger the municipal population, the more staff they have dedicated to managing risk to the organization and to ensuring staff have a solid training foundation in which to work from. In the case of vehicle and equipment training, training is both a legislated requirement and a value added activity to ensure service delivery expectations are met.

Municipalities with 1001 or more fleet assets are more likely to employ multiple full-time dedicated staff to vehicle and equipment training than those with 1000 or less fleet assets. Table 3 shows this relationship. In fact, only municipalities with more than 1000 vehicles have 11 ore more full-time employees dedicated entirely to training. Municipalities with fewer than 1000 vehicles have no more than four full-time dedicated trainers. The smaller municipalities are more likely to have greater numbers of part-time trainers – those who split their responsibilities between training and other functions. This demonstrates that municipalities recognize that as the size of the fleet grows, and the number of operators grow, more attention is required to ensure that operators are aware of the hazards that exist while operating vehicles and equipment. Municipalities make more of an effort to ensure that their staff have a baseline understanding on the types of vehicles and equipment they will use and how to

properly operate and maintain each asset. Municipalities assume more risk based on the # of assets they have, the # of employees that operate assets and look to address this risk through dedicated full-time staff to training. The more risk that a municipality has, the more often they look to manage risk through training, and documentation. Training and documentation supports a sustainable and safe work environment by ensuring employees are comfortable with vehicle and equipment operation and maintenance as well as protecting supervisors and taxpayers from the impacts of litigation should risk not be managed.

TABLE 3: NUMBER OF FULL-TIME TRAINING EMPLOYEES (ROWS) BY FLEET SIZE (COLUMNS)

	51-400	401-1000	1001+
0-1	PT: 3 (76%)	PT: 5 (63%)	PT: 1 (17%)
	FT: 2 (50%)	FT: 6 (75%)	FT: 1 (17%)
2-4	PT: 0 (0%)	PT: 2 (25%)	PT: 1 (17%)
	FT: 2 (50%)	FT: 2 (25%)	FT: 2 (33%)
5-7	PT: 0 (0%)	PT: 0 (0%)	PT: 0 (0%)
	FT: 0 (0%)	FT: 0 (0%)	FT: 1 (17%)
11+	PT: 1 (25%)	PT: 1 (13%)	PT: 4 (67%)
	FT: 0 (0%)	FT: 0 (0%)	FT: 2 (33%)

PT refers to full-time employees who have part-time training responsibilities
FT refers to full-time employees who have full-time training responsibilities
Main entries are cell counts, column perentages (by PT/FT status) in parentheses.

I also look at the relationship between fleet size and training program type. Table 4 shows these results. Municipalities with 1001 or more fleet assets more likely to operate a centralized training program most of which also offer periodic retraining throughout the duration of an operator's employment. This data demonstrates that municipalities recognize the complexity of vehicle and equipment operations that is inherent when there are more vehicle and equipment assets. The complexity of vehicle and equipment operations can be impacted by a

variety of elements including: the number and types of vehicles and equipment, the different makes, models and years of equipment, the services that the equipment is relied upon to deliver, the level of professionalism and skill required to provide the level of service, and the varying backgrounds and levels of experience that an employee may bring to the organization upon hire. Presumably, all of these factors seem to have impacted the managers of large fleets of 1001 assets or more to offer a centralized training program. For municipalities with 400 or fewer fleet assets, there is a lot of variation in the type of training program chosen.

TABLE 4: TRAINING PROGRAMS BY NUMBER OF VEHICLE ASSETS

	51-400	401-1000	1001 +
Decentralized	2 (50%)	2 (25%)	1 (17%)
Centralized, Inconsistent	0 (0%)	3 (38%)	1 (17%)
Centralized, Consistent	2 (50%)	3 (38%)	4 (67%)

Main entries are cell counts, column percentages in parentheses

The survey also asked questions about vehicle collision investigation programs at municipalities and whether or not preventable collisions and the costs associated with them are tracked year over year. A preventable collision is defined by the Transportation Safety Association of Ontario as a collision where the driver failed to do everything reasonable to avoid a collision. Based on survey responses, fourteen of eighteen (78%) municipalities have a collision investigation program. A collision investigation program is defined as the analysis of collisions involving fleet vehicles to determine the type of collision: Preventable, non-preventable.

Despite the existence of these programs, five of the fourteen municipalities with collision investigation programs are unsure or do not track the number of preventable collisions year over year. Two municipalities that do track preventable collisions, did not provide their yearly data. When looking at the seven municipalities who provided preventable collision data, six use a centralized training approach (four of them consistent). In 100% of two-tier municipalities (n=5) had collision investigation programs as opposed to 75% (n=12) of single-tier municipalities. Further, municipalities with centralized and consistent training programs are more likely than municipalities with other training types to have a collision investigation program (83%, n=6 vs 75%, n=12, respectively). One possible explanation for this relationship is that the training program is more robust and preventable collision results can be used to inform future vehicle and equipment training. This informed training based on municipal experience should be used to retrain individuals involved in the collision directly as well as for training with newly hired employees to make them aware of hazards and the preventable collisions have occurred in the past. This awareness is shared in an effort to prevent future preventable collisions.

Two-tier municipalities have a lower accident rates compared to single-tier municipalities. Table 5 presents these figures. One reason for this difference could be the services, which are provided by both single and two-tier municipalities. Often two-tier municipal fleet services are not directly responsible for transit or police services. Based on the survey responses we received, two of the four single-tier municipalities provided collision data for transit and police services. As we know, police services operate 24 hours a day, 7 days a week and transit services can be quite similar. This means that these services are on the road more often and have a

greater opportunity for a collision simply based on the number of hours in a year that they provide service. We can speculate that since the number of hours and opportunity for collisions is greater for police and transit services, this may be the reason that single-tier municipalities have a higher rate of collisions than two-tier municipalities.

TABLE 5: AVERAGE ACCIDENT RATES BY MUNICIPALITY STRUCTURE

	Preventable Accidents per Fleet Size	Preventable Accidents per 10,000 Population
Single-tier (N=4)	0.16	3.76
Two-Tier (N=3)	0.07	1.17

Section 5: Discussion & Recommendations

Given the results of this survey, it is clear that even large municipalities are not gathering and analyzing vehicle and equipment collision data in a valuable ways. It appears that most municipalities recognize that as the fleet size grows, more attention and resources need to be put into training however the impact of the training resources is not being evaluated. Of the eighteen municipalities that responded to the survey, 14 said they have a collision investigation program. When the subsequent questions were asked to provide data on the number of preventable collisions year over year, only seven of the fourteen municipalities who said they had a collision investigation program were able to provide this data. The decrease in the response rate between these two questions indicates a clear opportunity to better understand the collision investigation programs. According to the Infrastructure Health & Safety Association, collision investigation programs are meant to determine collision preventability, identify training needs, make logical recommendations for changes to ensure a safer vehicle

operation, and build a database to understand how, where and why collisions are happening. These components of a collision investigation program are intended to work in tandem to reduce preventable collisions. Ultimately in a business or government environment, collision investigation is also meant to reduce the costs to the corporation for collisions, injuries and litigation as well. I suspect that there could be some hesitation from fleet managers around sharing collision data for confidentiality reasons however all survey participants were assured that all responses would be anonymous in nature. From a policy perspective, the fact that we are not analyzing collision data as a baseline expectation for businesses and government agencies responsible to operating vehicles is startling. If the provinces responsible for licensing fleet operators and drivers required that all businesses and government agencies used collision analysis to make their fleet safer, our roads throughout the country would likely experience less preventable collisions, less injury and less death. In Ontario, joint health and safety committees are legislatively required for workplaces with 20 or more people. The primary functions of these committees are to identify actual and potential hazards in the workplace, obtain information from the employer relating to health and safety in the workplace, inspecting the workplace on a regular basis, being consulted and present during health and safety related testing and recommending health and safety improvements in the workplace. The employer is required to establish, select and support health and safety committee members in performing their functions as well as providing information relating to hazards in the workplace. Given that vehicle and equipment operation and collisions is a hazard in the workplace, we must prescribe the analysis of these collisions in order to prevent further injury and loss. Analysis of collisions could include the type of vehicles involved, the type of collision, the status of the vehicle at the

time of the collision, road conditions, weather conditions, season, type of driver, frequency of collisions, etc. The analysis of collision data can and should be an essential and valuable component of any fleet service and health and safety program. The analysis will provide valuable insights for fleet operators, business owners and government agencies to support the delivery of vehicle and equipment training including training content and approach.

As we know from the research, two-tier municipalities have lower preventable accident rates. As noted above, this may be due in part to the type of vehicles and services offered by single and two-tier municipalities. From a training perspective, this data is quite important to utilize to inform your vehicle and equipment training priorities. With a limited budget, we look to leverage training in order to address the number of collisions accordingly. If municipalities were required to analyze collision data, they may find that certain services need to be targeted first in order to make the largest impact on reducing collisions. Training opportunities may focus on drivers who operate vehicles more frequently, drivers that drive in all weather and road conditions, drivers who may be expected to operate vehicles at higher rates of speeds to do their work, or driver's with less overall driving experience.

Only three of the eighteen municipalities responded 'yes' that they capture the costs of collisions involving fleet vehicles. Costs were to include the cost of repairing the vehicle, the cost of any lost time due to injury, the cost of litigation, etc. Of the three that responded 'yes' to capturing costs of collisions, only one municipality provided partial data on the cost of collisions from a repair perspective. Based on this data, it is again apparent that municipalities could be doing more to better understand and reduce the costs of vehicle collisions. Understanding the cost of preventable collisions year over year and their relationship with the

overall fleet size, can provide justification for the growth of a fleet training program. For example, if the number of fleet assets are growing along with the cost of preventable collisions, a municipal fleet manager may be able to justify the growth of a fleet training program through cost and risk avoidance. Without a baseline understanding of the costs of collisions, municipalities are unnecessarily exposed to risk as costs could compound without addressing the root of the costs and without pursing opportunities to mitigate the costs. A future opportunity for research that could support this gap in the municipal environment could be a workflow application that requires each operator to register and obtain a driver scorecard throughout their employment with an organization. The application could include minimum vehicle and equipment training requirements based on role, linking telematics data on driving behaviours and tracking collisions from end to end between all stakeholders including the driver, the driver's supervisor, fleet training, health & safety, risk management and legal. The application could provide notifications on when training for drivers may expire and alert the organization of any new driver legislation that needs to be addressed through e-learning or hands-on opportunities. With all drivers in the organization on one application, an organization is also better prepared to address emergency scenarios.

Three municipalities did not have a collision investigation program at all. Collisions, both preventable and non-preventable, can have a significant impact on operating budgets should the driver or occupants experience injury, the collision causes third party damage to property or people and for the vehicle repair. Additionally, many forget about the impact that collisions can have on the capital budget. A vehicle may be so badly damaged that the vehicle can no longer be driven and must be written off through an insurance claim. This leaves a capital

budget demand for a new asset to be purchased or rented. Significant repair work also impact capital budgets. The extent of capital repair will depend on the acquisition cost of the asset however it can also lead to extending the lifecycle of a capital asset. Each capital asset varies in acquisition cost from approximately $1,000 to $450,000. Considering the capital costs of a fleet, compared to the capital budgets of a municipality, it only makes sense to understand collision data in order to prevent future costs. The one municipality that provided the repair costs of collisions for 2021 identified that 93 total collisions cost the municipality $120,000 in vehicle repair only. The full costs of collisions is unknown but suspected to be significantly higher.

There are some caveats to the research conducted and seventeen observations are not ideal to draw from. In a best-case scenario, the research would have yielded fifty or more results in order to be more confident in the findings. In order to gather more responses in the future, I would not have conducted the survey in the summer months as many municipal fleet leaders take vacation time and I would have offered a small incentive to participate.

Section 6: Conclusion

Vehicle and equipment training as well as collision analysis can be a critical tool in reducing the number of workplace accidents that occur each year for municipalities. Infrastructure Health & Safety Association (IHSA), which is Ontario's health and safety resource, recommends that to better understand the concept of preventability and important elements of a proper collision investigation, a collision review committee and commercial motor vehicle collision investigation training are recommended. Today, it is clear that not enough is being done to protect vehicle

and equipment operators in municipalities across the country. This is made clear via an almost non-existent research library on this topic, the survey responses and observations gathered in this research and the lack of requirements from provincial bodies for fleet operators on collision investigation and reporting.

Municipal fleets of varying sizes should be analyzing and understanding their collisions in order to better protect their workers, supervisors and the organization. This data on collisions must be used to react to collision trends, influence training and re-training program content and educate drivers on the hazards and risks that exist while driving. As identified by Komaki, Heinzmann and Lawson, training feedback reinforcement is important to ensure sustainability over the long-term for health and safety standards in public works.

Future studies on municipal vehicle and equipment training programs should continue as not enough is known and understood today about the efficacy of different training approaches. Municipalities over time have built some skills around delivering training programs internally however accountability for the results and impacts of these programs is not currently being evaluated. For municipal organizations who may be looking to increase accountability and reduce vehicle collisions, there must be a fulsome review of vehicle and equipment training programs and vehicle collisions data.

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