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Road to Wellness:

A case study on equitable solutions for improving air quality through the lens of road safety and transportation

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Contents

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Parachute Vision Zero creates case studies that feature a variety of issues and examples of Vision Zero from across Canada and around the world. We hope these practical, evidence-based case studies will help educate, inform and inspire those who are interested in road safety and getting to zero. We share when we publish new case studies through our e-newsletter, **Word on the Street**.

Background on road safety, climate change and air quality

Climate change has emerged as one of the most pressing global challenges, with far-reaching implications for various sectors, including transportation, air quality and public health (Feulner, 2017). In Canada, the effects of climate change are becoming increasingly evident, prompting the need for comprehensive strategies to mitigate its impacts (Feulner, 2017). This section provides an overview of the interconnections among climate change, air quality and road safety, with a specific focus on Canada.

Canada, as a vast country with diverse landscapes, is particularly vulnerable to the effects of climate change. Rising temperatures, changing precipitation patterns and extreme weather events are already being observed across the country (Giorgi & Meleux, 2007). These changes have direct implications for air quality as they can influence the formation and dispersion of pollutants (Giorgi & Meleux, 2007). The changing climate can exacerbate air pollution issues in several ways. Increased temperatures and prolonged heatwaves can enhance the formation of ground-level ozone, a harmful pollutant known to cause respiratory problems and other health issues (Stieb & Liu, 2014). Changes in precipitation patterns can also affect air quality by influencing the deposition and transport of pollutants (Stieb & Liu, 2014).

The emission of greenhouse gases (GHGs) from human activities has given rise to climate change, which now poses a global threat evident in various regions across Canada. Both Eastern and Western coastal communities are currently facing the brunt of extreme weather occurrences such as floods, severe storms and rising sea levels. Likewise, the central provinces of Ontario and Quebec are grappling with warmer climates and an upsurge in heat-related illnesses (Climate Action Network Canada, n.d.). In the arid Prairies, agricultural systems are particularly susceptible to shifting

weather patterns, including irregular precipitation (Climate Action Network Canada, n.d.). Without intervention, these events have profound and far-reaching consequences on the overall well-being, safety and economic prosperity of Canadian residents, especially those belonging to marginalized populations.

The transportation sector, including road transport, is a major contributor to greenhouse gas emissions in Canada, driving climate change (Chapman, 2007). Vehicle emissions, including nitrogen oxides, particulate matter and volatile organic compounds, contribute to air pollution, particularly in urban areas with high traffic congestion (Chapman, 2007). This pollution has significant health implications, with studies linking exposure to respiratory diseases, cardiovascular conditions and premature death, especially among vulnerable populations (Climate Action Network Canada, n.d.).

Recognizing the urgent need to address climate change, improve air quality and enhance road safety, the federal government has implemented various initiatives and policies (Government of Canada, n.d.):

- National Climate Change Strategies (including the **National Adaptation Strategy**): Canada has committed to reducing its GHG emissions as part of the Paris Agreement. The Pan-Canadian Framework on Clean Growth and Climate Change outlines a comprehensive approach to reducing emissions from various sectors, including transportation. Measures include promoting the adoption of electric vehicles, improving public transit systems and implementing stricter vehicle emission standards.

- Air Quality Management: Provincial, territorial and municipal governments in Canada have implemented air quality management programs to monitor and regulate pollutants. These programs involve monitoring air quality, developing emission reduction strategies and implementing measures to mitigate pollution sources, including those from the transportation sector.

Purpose of this case study

The purpose of this case study is to examine the intersection of air quality, road safety and public health, particularly focusing on the impact of motor vehicles on air pollution and the associated health consequences. While initiatives are being conducted across Canada, this case study will focus on the cities of Montreal and Edmonton.

This case study aims to raise awareness about the links among transportation, air quality and public health, with a specific emphasis on underserved communities and urban neighbourhoods.

By exploring the challenges and opportunities in these intersections, the case study aims to identify effective solutions for improving air quality, promoting road safety and enhancing public health outcomes.

To explore the relationship among air quality, road safety and public health, we interviewed four professionals in the field:

- **Christie Pelletier**, Director, Safe Mobility, City of Edmonton.

- **Nancy Badeau**, Team Lead Engineer, City of Montreal and **Christian Trottier**, Planning Advisor, Sustainable Mobility Strategy Division, City of Montreal

- **Bartek Komorowski**, Planning Advisor, Team Lead, City of Montreal

Throughout this study, the thoughts and experiences of these professionals will be referenced. Full interview responses can be found in the Appendix.

Key terms and the link to Sustainable Development Goals (SDGs)

Defining key terms

Air quality: The measure of the cleanliness and healthiness of the air we breathe, primarily determined by the levels of pollutants, such as particulate matter (PM), ozone (O_3), nitrogen oxides (NOx) and volatile organic compounds (VOCs).

Climate change: Refers to long-term shifts and alterations in global or regional climate patterns, primarily attributed to human activities, such as the burning of fossil fuels, deforestation and industrial processes.

Equity: Refers to fairness, justice and equality in access, distribution and outcomes, particularly regarding the benefits and burdens of environmental and health-related factors.

Greenhouse gases (GHGs): Gaseous substances – such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) – that trap heat in the Earth's atmosphere, contributing to the greenhouse effect and climate change.

Multi-modal transportation: Refers to a transportation system that integrates multiple modes of travel, such as walking, cycling, public transit and car-sharing, providing individuals with diverse and sustainable transportation options.

Nitrogen oxides (NOx): A group of harmful gases, primarily produced by burning fossil fuels, that contribute to air pollution and the formation of ground-level ozone and smog.

Particulate matter (PM): Tiny particles suspended in the air, including dust, soot and other pollutants, that can be inhaled and have adverse effects on respiratory and cardiovascular health.

Sustainable Development Goals (SDGs): A set of 17 global goals adopted by the United Nations in 2015, aiming to address various global challenges, including poverty, inequality, climate change and sustainable development.

Vision Zero: An approach that aims to eliminate all traffic-related fatalities and severe injuries, focusing on creating safe and sustainable transportation systems.

Volatile organic compounds (VOCs): Organic chemicals that can easily vaporize at room temperature and contribute to the formation of ground-level ozone and smog. They are often released from various sources, including vehicle emissions and industrial processes.

Link to Sustainable Development Goals (SDGs)

The link between the topics of air quality, road safety and climate change to the Sustainable Development Goals (SDGs) is significant. The SDGs are a set of 17 interconnected goals adopted by the United Nations, aiming to address global challenges and promote sustainable development by 2030 (United Nations, n.d.). Here's how these topics align with specific SDGs:

Goal 3: Good Health and Well-being: Addressing air quality and reducing pollution is directly linked to promoting good health and well-being. Improving air quality can reduce the risk of respiratory and cardiovascular diseases, thereby contributing to achieving this goal.

Goal 11: Sustainable Cities and Communities: The topics of air quality, road safety and climate change are closely tied to creating sustainable cities and communities. Implementing measures to reduce air pollution, enhance road safety and promote sustainable transportation options align with this goal's objectives.

Goal 13: Climate Action: Climate change mitigation and adaptation efforts are crucial for addressing the environmental impacts associated with transportation and air quality. By reducing greenhouse gas emissions and promoting sustainable transportation options, countries can contribute to achieving the targets set under Goal 13.

Goal 17: Partnerships for the Goals: Collaborative efforts among different stakeholders, including public health organizations, transportation agencies and environmental

groups, are essential for achieving sustainable development objectives. By fostering partnerships and co-operation, the various actors can work together to address the interlinkages among air quality, road safety, climate change and the SDGs.

Addressing air quality, road safety and climate change aligns with multiple SDGs, including goals 3, 11, 13 and 17. These topics are interconnected and contribute to the broader agenda of promoting sustainable development and improving the well-being of individuals and communities globally (United Nations, n.d.).

Impact of motor vehicles on air quality and health

Transportation and air quality

Motor vehicles play a significant role in contributing to air pollution and its subsequent health impacts. The transportation sector, including road transport, is a major contributor to greenhouse gas (GHG) emissions, which are the primary drivers of climate change. In Canada, the transportation sector is responsible for 27 per cent of GHG emissions, making it imperative to address the intersection of road safety and climate change mitigation (Natural Resources Canada, n.d.).

Motor vehicles emit various pollutants, including nitrogen oxides (NOx), particulate matter (PM) and volatile organic compounds (VOCs), all of which contribute to air pollution. The combustion of fossil fuels, particularly gasoline and diesel, releases these pollutants into the atmosphere during vehicle operation (Chlopek et al., 2019). As a result, urban areas with high traffic congestion often experience localized air quality issues, exacerbating the health risks associated with poor air quality (Chlopek et al., 2019).

Nitrogen oxides (NOx) are released primarily through the burning of fossil fuels and contribute to the formation of ground-level ozone and smog (Chlopek et al., 2019). These pollutants can irritate the respiratory system, leading to respiratory symptoms, reduced lung function and increased susceptibility to respiratory infections (Chlopek et al., 2019).

Particulate matter (PM) consists of tiny particles suspended in the air, including dust, soot and other pollutants. These particles can be directly emitted from vehicle exhaust or form through chemical reactions in the atmosphere (Chlopek et al., 2019). PM can penetrate deep into the lungs and even enter the bloodstream, posing risks to respiratory and cardiovascular health. Long-term exposure to PM is associated with chronic respiratory diseases, cardiovascular conditions and increased mortality rates (Valavanidis et al., 2008).

Volatile organic compounds (VOCs) are organic chemicals that can easily vaporize at room temperature (Chlopek et al., 2019). They are released from various sources,

including vehicle emissions and industrial processes. VOCs contribute to the formation of ground-level ozone and smog, which can cause respiratory irritation, exacerbate asthma symptoms and impact lung function (Valavanidis et al., 2008).

Transportation plays a significant role in determining air quality, as the ways people travel have a direct impact on emissions and pollution levels. Christie Pelletier, the Director of Safe Mobility for the City of Edmonton, emphasizes the importance of active transportation in combating climate change and creating a healthier city. According to Pelletier, prioritizing the safety of pedestrians, cyclists and users of micro-mobility options can encourage and facilitate the use of active transportation modes, resulting in a reduction in the number of personal vehicles on the roads and ultimately leading to decreased emissions and improved air quality.

Christian Trottier, Planning Advisor, Sustainable Mobility Strategy Division, City of Montreal, also highlights the need to address air pollution through a reduction in car dependency. Trottier suggests that promoting sustainable modes of transportation, such as walking, cycling and public transit, is crucial to combat the detrimental effects of air pollution. By actively working to reduce the number of car trips and advocating for a shift toward cleaner and greener transportation options, significant progress can be made in improving air quality.

The travel modes people use have far-reaching consequences for air quality and public health. By prioritizing active transportation and sustainable modes of travel, people can significantly reduce the emissions that contribute to air pollution. Creating supportive environments where people can walk, cycle or use public transit through policies and infrastructure is crucial for improving air quality, combating climate change and creating healthier and more vibrant cities.

Impact of air pollution on well-being

Air pollution has a significant impact on overall well-being, affecting both physical and mental health. Exposure to polluted air can lead to a range of adverse health effects, compromising the well-being of individuals and communities. Here are some key impacts of air pollution on well-being:

Respiratory health: Air pollution, particularly fine particulate matter (PM2.5) and pollutants such as nitrogen dioxide (NO2) and ozone (O3), can cause or worsen respiratory conditions such as asthma, chronic obstructive pulmonary disease (COPD) and bronchitis. Prolonged exposure to polluted air can lead to respiratory symptoms, reduced lung function and increased risk of respiratory infections (Valavanidis et al., 2008).

Cardiovascular health: Air pollution is linked to an increased risk of cardiovascular diseases such as heart attacks, strokes and hypertension. Fine particulate matter and pollutants such as nitrogen oxides can penetrate deep into the bloodstream, triggering

inflammation, oxidative stress and the development of atherosclerosis. These effects contribute to cardiovascular events and long-term cardiovascular health issues (Valavanidis et al., 2008).

Allergies and allergic reactions: Air pollution can worsen allergies and trigger allergic reactions in susceptible individuals. Pollutants can interact with allergens such as pollen, increasing the severity and frequency of allergic symptoms, including sneezing, coughing, itching and watery eyes (Lee et al., 2013).

Neurological and cognitive effects: Emerging research suggests that air pollution may have detrimental effects on brain health and cognitive function. Fine particulate matter and air toxins can enter the brain through the respiratory system, potentially contributing to neuroinflammation, oxidative stress and the development or progression of neurodegenerative diseases, as well as impacting cognitive abilities (Clifford et al., 2016).

Mental health: Long-term exposure to air pollution has been associated with adverse mental health outcomes, including increased stress levels, depressive symptoms and anxiety. The psychological impact of living in areas with high levels of air pollution, combined with the health risks it poses, can contribute to a decreased sense of well-being and overall quality of life (Buoli et al., 2018).

Equity and air pollution

It is important to acknowledge that the impacts of air pollution are not distributed evenly across populations. Certain groups, such as children, older adults, pregnant individuals and those with pre-existing respiratory or cardiovascular conditions, are particularly vulnerable to the harmful effects of air pollution. In addition to individual susceptibility, socioeconomic factors also play a role, as disadvantaged communities often bear a disproportionate burden of air pollution and its associated health consequences.

Pelletier emphasizes the differential exposure to air pollution experienced by different groups and areas. Equity-deserving communities, which can be defined based on geographic or identity-based factors, may face increased exposure to air pollution due to factors such as higher levels of traffic passing through their neighbourhoods, leading to higher emissions. This unequal distribution of air pollution is a concern for health equity, as it exacerbates existing disparities in health outcomes.

To address these disparities and promote equity in air pollution management, comprehensive strategies and interventions are necessary. One crucial aspect is reducing emissions through the adoption of clean energy sources and the implementation of policies that prioritize sustainability. By transitioning to cleaner technologies and reducing the reliance on fossil fuels, communities can mitigate the production of harmful pollutants, thereby improving air quality for all residents.

Urban planning also plays a pivotal role in addressing air pollution and promoting equity. By prioritizing the development of green spaces, creating mixed-use neighbourhoods and implementing zoning regulations that separate industrial areas from residential areas, cities can minimize the exposure of vulnerable populations to harmful pollutants. Additionally, urban planners can encourage the use of transportation modes, such as walking, cycling and public transit to reduce the reliance on private vehicles and decrease overall emissions.

Pelletier also highlights the importance of creating safe and accessible zero-emissions mobility options to overcome barriers faced by communities in adopting active transportation modes. Measures such as reducing speed limits and investing in the expansion of bike networks can help promote active transportation and reduce reliance on cars, contributing to improved air quality and enhanced health outcomes. Edmonton City Council's recent approval of a $100-million investment over four years for the rapid expansion of the city's bike network demonstrates a commitment to creating equitable access to safe and connected active transportation infrastructure.

Addressing air pollution requires a multi-faceted approach that prioritizes equity considerations. By recognizing the disproportionate burden of air pollution on certain populations and communities, policymakers, city planners and communities can work together to implement comprehensive strategies that prioritize clean air, enhance public and active transportation options, and create healthier environments for everyone. By doing so, we can protect public health, promote equity and foster thriving communities.

Solutions for better air quality, health, and road safety

Road safety solutions for improving air quality

To enhance air quality and road safety, the following are examples of measures that can be implemented:

- **Open streets initiatives**: Closing certain roads for short periods of time to motorized vehicles and transforming them into pedestrian- and cyclist-friendly spaces. This encourages active transportation and reduces vehicle emissions.

- Well-designed drop-off zones: Creating designated areas for drop-offs and pick-ups, away from main traffic flow, to reduce congestion and idling. This helps minimize emissions in areas with high vehicle turnover.

Multi-modal transport solutions

Promoting a diverse range of transportation options can contribute to better air quality and road safety:

- Public transit: Encouraging the use of buses, trains, trams and other forms of public transportation rather than private vehicles. This reduces traffic congestion and decreases emissions.

- Bike and scooter sharing programs: Establishing bike and scooter-sharing systems to provide easily accessible transportation options for short-distance trips. This promotes active transportation, reduces car dependency and improves air quality.

Active transportation and road safety integration

Active transportation modes, such as walking and biking, offer numerous benefits for air quality, health and road safety. Strategies to encourage their use can include:

- Infrastructure improvements: Developing safe and well-connected pedestrian and cycling infrastructure, including dedicated and protected bike lanes, bike racks and pedestrian-friendly crossings. This enhances road safety for active transportation users.

- Education and awareness campaigns: Promoting the benefits of walking and biking for personal health and the environment.

Electric vehicles (EVs)

Adopting electric vehicles can contribute to improved air quality and road safety. Considerations include:

- Benefits of EVs: Encouraging the use of electric vehicles, which produce zero tailpipe emissions, reducing air pollution and improving air quality.

- Limitations and challenges: Addressing concerns such as limited charging infrastructure, higher upfront costs and ensuring sustainable electricity sources for EVs.

- Safety considerations: Ensuring the safe operation and maintenance of EVs, including battery safety measures and proper disposal of old batteries.

Importance of green spaces and work-from-home policies

Enhancing green spaces and implementing work-from-home policies can have positive impacts on air quality and road safety:

- Creating and maintaining parks, gardens and urban green areas can improve air quality by absorbing pollutants and providing a buffer against traffic emissions.

- Encouraging remote work options reduces commuting-related emissions and traffic congestion. This contributes to improved air quality and road safety.

Subsidized transit passes for promoting active transportation

Providing subsidized transit passes to individuals can encourage the use of public transit and active transportation modes:

- Offering discounted or subsidized transit passes promotes public transit usage, reducing private vehicle trips and associated emissions.

- Developing integrated transportation networks allows for easy and affordable transfers between different modes of transport, including public transit and active transportation options.

Implementing these solutions can contribute to improved air quality, enhanced road safety and sustainable transportation, thereby contributing to the overall well-being and health of individuals and communities.

Moving forward

Road safety professionals can play a significant role in promoting better air quality and public health. By integrating air quality considerations into road safety planning and initiatives, they can effectively contribute to reducing emissions and improving the overall health outcomes of communities. Collaboration among road safety professionals, public health organizations, environmental groups, transportation agencies and communities are essential to address the intricate intersection of air quality, road safety and public health.

However, several challenges and opportunities exist for future action. The challenges encompass limited resources, competing priorities and the necessity for comprehensive data to drive informed decision-making. Road safety professionals should advocate for policies and funding that prioritize both road safety and air quality, while also striving to integrate air quality monitoring and mitigation strategies into transportation planning processes.

Opportunities for future action lie in leveraging technological advancements, such as intelligent transportation systems and data analytics, to enhance road safety measures and reduce emissions. Additionally, promoting sustainable transportation options and fostering behaviour change toward active transportation can yield substantial positive impacts on air quality and public health.

The pivotal role of road safety professionals in addressing the intricate relationship among air quality, road safety and public health cannot be overstated. By acknowledging the interconnected nature of these issues and forging collaborations with relevant stakeholders, road safety professionals can significantly contribute to creating healthier and safer communities. Overcoming challenges and capitalizing on opportunities for future action will be vital in achieving sustainable and equitable outcomes for air quality, road safety and public health.

Appendix A: Expert interviews

Christie Pelletier
Director, Safe Mobility, City of Edmonton

Are there key strategies in your Vision Zero plan that address the link between transportation and air pollution?

The City of Edmonton's **Safe Mobility Strategy 2021-2025** is an innovative approach designed to accelerate our journey to **Vision Zero** through safe and livable streets by 2032. The Safe Mobility Strategy supports the advancement of the City's **ConnectEdmonton** strategic goals to create a safe, healthy, urban and climate-resilient city for all residents, and the **City Plan**, which aims to help Edmonton grow into a city of two million people. Active transportation is an important part of how we combat climate change and support a healthy and vibrant city, therefore, the City Plan goal is to have people use active modes of travel or public transit for 50 per cent of their trips.

At the core of the Safe Mobility Strategy are four themes and several key actions, which together form a holistic approach to achieving Vision Zero. Several Safe Mobility programs and initiatives help to address the connection between transportation and air pollution, particularly through efforts to increase safety for vulnerable road users. Increasing safety for people walking, rolling, cycling or using micro mobility will facilitate and encourage the use of active transportation and contribute to a reduction in the number of personal vehicles on the roads, therefore reducing emissions and improving air quality.

How do car emissions impact underserved communities and urban neighbourhoods within your municipality?

As shown in the **Crash and Equity Analysis Technical Report** (completed to support the development of the Safe Mobility Strategy), some communities experience greater exposure to traffic and crashes and face greater mobility challenges than others. Equity-deserving communities can be geographic-based (i.e., by virtue of their location within an urban area) and/or identity-based (including, but not limited to, Indigenous Peoples, ethnic, linguistic, sexual and gender minorities, and people with disabilities). Some areas and groups are exposed to more traffic traveling through their neighbourhoods and therefore higher emissions. This problem may be further impacted by a lack of equitable access to transit or infrastructure to support safe travel by way of non-motorized forms of transportation, which can lead to a greater reliance on personal vehicles and therefore greater emissions and public exposure to air pollutants.

From an environment and climate resilience perspective, generally homes near busy roadways have lower dollar values and health research has shown evidence of increased health effects linked to the proximity of roads. Due to this, lower income

residents who live in proximity to roads are likely to be at a higher risk than other residents further from roads. This differential exposure to air pollution between these two groups is a concern for health equity and air pollution exposure inequalities are often associated with lower income populations that are concentrated in proximity to high-traffic roads. These health impacts can be further compounded if residents in proximity to roadways experience further air pollution exposure due to their occupation or personal habits, which are also influenced by socio-economic status.

Do you have any potential solutions to address this issue?

As outlined above, several Safe Mobility programs help to increase safety for road users of all types across the city, including in underserved communities. When people are safer and feel safer, they are more likely to use sustainable modes of travel if those opportunities exist, which contributes to a reduction in personal vehicle use and resulting emissions.

The City of Edmonton's Bylaw 15982 (an amendment to bylaw 14600) prohibits vehicles from idling in areas designated as no-idling zones. This bylaw applies across all communities in Edmonton, with the city placing signs in city right-of-way areas in front of schools or hospitals.

Currently, the City Plan encourages commercial and multi-family development on major roadways, which creates challenges for reducing air pollution exposure. While corridors remain the primary source of development, the Zoning Bylaw Renewal Initiative that is underway may offer opportunities for a greater diversity of housing forms and some forms of commercial developments on neighbourhood streets with significantly lower pollution exposure.

What are some challenges and opportunities for future action to promote better air quality and public health through road safety initiatives?

Challenges include:

• Urban sprawl, which contributes to more people driving and driving longer distances.

• In a winter city, some residents may be reluctant to use non-motorized forms of transportation during the colder months.

• Actual and perceived barriers to the use of active transportation: for example, lack of connectivity to safe infrastructure and concerns about physical safety.

• Lack of public awareness and recognition of the health risks and impacts of regular exposure to poor air quality.

- Unclear municipal role in air pollution management.

- Climate change predictions of hotter temperatures in the future, which can increase the severity of air quality events.

Opportunities include:

- Continuing to strategically allocate funding and resources to support the equitable implementation of safe and connected infrastructure for active transportation. For example, Edmonton City Council recently approved an investment of $100 million over four years for rapid expansion of the bike network.

- Expanding and improving upon equitable access to public transit, particular for those living in underserved communities and outlying areas.

- Continuing to enhance winter maintenance for sidewalks, shared pathways and bike lanes.

- Shifting the culture around active transportation: for example, challenging the perceived "war on cars" narrative.

- Increase public notification during periods of deteriorated air quality and connect to road safety messaging.

- Supporting public adoption of zero-emissions vehicles to reduce the ground-level air pollution load emitted from personal vehicle transportation.

- Adopting urban designs that reduces the public's exposure to on-road air pollution sources.

- Increase tree planting around roadways with high air pollution loading, which serve to intercept air pollution before public exposure.

- Deployment of on-street air quality monitoring to improve and enhance transportation modeling to better understand and evaluate air quality outcomes in road designs.

Increasing active transportation is one way to reduce emissions. In your experience, what are the biggest barriers to promoting active transportation?

As highlighted above, barriers to promoting active transportation can include feeling unsafe using active modes, having sufficient funding and resources to allocate to safe and connected active transportation infrastructure, urban sprawl, poor weather conditions and the "car culture" embedded in some communities.

The development of new mobility options, particularly around electric options, presents incredible opportunities, but also some significant challenges. For example, e-bikes allow people to travel quicker to destinations with less effort and make hills and valleys far easier for people to manage. We've heard from people with a broad range of fitness levels and abilities that have renewed their love for biking as a result of switching from a human-powered bike to an e-bike. But there are two significant challenges: 1) cost, as e-bikes are considerably more expensive than human-powered bikes; and 2) secure bike parking, or the lack of secure bike parking. And the issue of bike parking is not just with e-bikes, but the example does highlight the crux of the issue. Through our public engagement activities on active transportation, we hear stories about people who avoid the perils of bike theft by riding a "throw-away" bike. Basically, a bike that is so cheap and worn that it either is not a candidate bike for bike thieves or that, if stolen, the impact is minimal to the owner in terms of the cost of the theft. It is challenging to make biking a practical and convenient option for people when good, efficient bikes can only be used for recreational trips (which are likely roundtrip) and less efficient bikes are used for commuting and other functional purposes.

Do you have strategies in place to overcome these barriers?

Strategies to overcome these barriers relate to increasing actual and perceived safety and creating equitable access to safe and accessible zero emissions mobility options. Some examples are outlined below.

Speed limit reduction is a key action outlined in the Safe Mobility Strategy. Vehicles traveling at higher speeds translate into slower reaction times and longer stopping distances; therefore, speed plays a significant role in the severity of crashes, particularly for vulnerable road users.

- In 2021, Edmonton implemented a reduction in the default speed limit from 50 km/h to 40 km/h, with a focus on residential streets, the downtown core and high pedestrian areas. Lower speeds mean greater protection for our most vulnerable road users including pedestrians, cyclists, users of micro mobility, seniors and children. This in turn will help to facilitate an increase in the use of active transportation across demographics.

- Safe Mobility also operates an **Automated Enforcement program** to promote safe speeds across the city and collaborates with the Edmonton Police Service on enforcement for speed and other risk factors (i.e. distraction, impairment) to increase safety on our roads.

Other Safe Mobility programs designed to help calm traffic and enable active modes include:

- **Vision Zero Street Labs Program** uses adaptable traffic calming measures to test out new solutions to increase traffic safety in neighbourhoods.

- Through engineering upgrades, the **Safe Crossings Program** increases safety for road vulnerable road users while crossing the street.

- The new Safe Routes to School Program implements adaptable curb extensions and Rapid Flashing Beacons at priority crossings near schools.

- The **Edmonton Bike Plan** and **Bike Plan Implementation Guide** support active transportation and safe and direct routes for people across the city.

- Edmonton City Council recently approved an investment of $100 million over four years for rapid expansion of the bike network.

- The Bike Plan also calls for the development of a city-wide secure bike parking strategy.

The **Summer Streets Program** is designed to promote active transportation through the creation of safe spaces for people walking, rolling and cycling and contribute to a more climate-resilient future.

Policies and design standards, such as the **Complete Streets Design and Construction Standards**, intend to proactively design roads for all road users in Edmonton, therefore supporting active transportation.

The City of Edmonton actively supports sustainability **Mobility Choices** including walking, cycling, micro mobility (**rentable e-scooters and e-bikes**), public transit, car sharing and electric vehicles.

The **Edmonton Community Energy Transition Strategy** is focused on achieving the goal of safe and accessible zero emissions mobility. Strategies include:

- Ensure a safe, accessible, and comfortable active transportation system that enhances walking and cycling.

- Ensure the establishment and expansion of a zero emissions public transit system that is safe, convenient, reliable, and connected across the Edmonton region.

- Support the transition to electric and other zero emissions vehicles.

- Support the changing transportation system needs of a low carbon city.

Overall, Edmonton's City Plan identifies numerous key outcomes to ensure a safe, healthy, urban and climate resilient city. Examples include:

- Edmontonians feel safe and secure in their communities and benefit from public spaces and infrastructure that support health and well-being.

- Edmontonians have the ability to live locally, with access to diverse and affordable housing options in communities that support their daily needs.

- Edmontonians live closer to what they need and are supported by walkable communities, active transportation networks and greater connectivity across all travel modes.

- Edmontonians benefit from improved public transit and high-quality active transportation networks that reduce greenhouse gas emissions.

What role do you see road safety professionals playing in addressing air pollution and promoting public health?

- Helping to reduce the number of personal vehicles on the road can help mitigate climate change and improve air quality by reducing emissions. Road safety professionals can play a role through the implementation of evidence-based policies, standards and plans (e.g., engineering, education, enforcement, engagement) that encourage and facilitate equitable access to, and use of, sustainable modes of travel. This includes building and upgrading safe infrastructure for pedestrians, cyclists and other non-motorized forms of travel along with the promotion of public transit options.

- Increase public awareness of the health and safety concerns related to poor air quality on and around roadways and active paths. Enhance and improve assessment of air pollution outcomes as part of the roadway design processes.

- A broader question that needs attention is exploration into the benefits and impacts of arterial roads, specifically as they relate to those who live along them. In addition to arterial roads creating challenging crossing conditions for active mobility, arterial roads also generate relatively higher levels of GHGs, noise and light compared to lower-order roadways. The pollutants significantly impact the health and quality of life of those who live along or near them. And, as mentioned previously, we tend to put our higher-density developments along arterials, providing a buffer for the more expensive and desirable (and, often, lower-density) developments into the suburbs. Higher-density developments tend to be home for lower-income and other equity-seeking groups. This is an area that requires further research and understanding.

What opportunities do you see for collaboration between public-health-focused organizations, such as Parachute, and transportation agencies to promote better air quality and public health?

- Research and evaluation: support and collaborate on research and evaluation initiatives to inform strategies to improve air quality and public health through the devel-

opment and enhancement of access to and use of safe, connected and sustainable modes of travel.

- Go beyond mode shift to transit and active mobility and highlight how zoning and other development practices, along with the transportation network and street design, have contributed to poor air quality conditions and highlight groups that tend to be disproportionately impacted by those practices. I would imagine municipalities would be quick to get on board with a research project if you can highlight good and poor examples from their city.

- Another area for collaboration is assisting municipalities in assessing the benefits, from an air quality and noise perspective, of initiatives such as adding more bike links and connections, improved transit service and greener fleets, and the implementation of mass transit.

- Policy development: advocate for the development and implementation of evidence-based policies to promote better air quality and public health at the federal, provincial / territorial and municipal levels of government.

- Education and awareness: engage in collaborative strategies to increase awareness of the air quality and public health benefits of sustainable modes of travel to continue to slowly shift the culture and reduce the reliance on personal vehicles.

- Monitoring: support the development and deployment of an on-road air quality monitoring network to better understand the public risk from air pollution exposure.

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Nancy Badeau
Team Lead Engineer, City of Montreal (Road Safety)

and

Christian Trottier
Planning Advisor, Sustainable Mobility Strategy Division, City of Montreal

Are there key strategies in your Vision Zero plan that address the link between transportation and air pollution?

Not officially in the Action Plan. But as we see Vision Zero with fewer cars and more pedestrians and bicyclists, we are aware of the direct effects on the air quality. To obtain approval of the municipal council we are asked to answer several questions on if and how the project has an impact on climate change, GHG emissions systematically.

As of 2008, there was an objective that all increases in demand of trips would be taken by active and collective transportation (transit), and it had already been decided that we would build a network for cycling. We are continuing these efforts and currently building the "Le REV, Réseau express vélo" (rapid express network). A lot is being done to encourage people to take their bikes, not only for recreation but for work trips as well. There are efforts being made for pedestrians such as shared streets and lots more pedestrian-only streets.

Is there a dependency on transit or is Montreal more of a walking, biking and cars city?

The use of transit varies in different neighbourhoods. Students tend to rely on buses, metros and trains, especially toward suburban areas where additional networks are being developed. The reliance on transportation modes in Montreal depends on the location, as the city is quite diverse in this aspect. If you reside on the outskirts, owning a car may be necessary, while downtown areas are often highly walkable, making bikes even unnecessary at times.

In terms of car ownership, approximately 75 per cent of residents in east/west areas own a car, whereas only 25 per cent in central areas possess one. Shared bike programs are expanding in popularity and coverage. Even if one resides further from the city centre, there are still viable trip options available. The "REV" initiative initially started in the central area and is planning to extend its services next year.

Biking tends to be more of a leisure activity in suburban areas, while in central areas, it is more often used as a means of transport. Biking and walking programs to encourage active transportation to schools are being implemented throughout the city. The focus on creating safer school infrastructure has led to increased adoption of biking and walking.

How do car emissions impact underserved communities and urban neighbourhoods within your municipality?

As far as we know, the car emissions impact is more problematic along the highways and next to the Port, which is in provincial jurisdiction. That comes usually with noise pollution and a heat island.

The Public Health Department has studied the inequities of different neighbourhoods on the Island of Montreal. There is a wide variety of neighbourhoods: disadvantaged or underprivileged neighbourhoods have more arterial roads than more privileged ones.

Do you have any potential solutions to address this issue?

The city is currently developing the "Quartier inclusif et résilient" (QIR) (inclusive and resilient neighbourhood), which considers these kinds of issues. QIR will prioritize actions in the most disadvantaged areas.

This is the beginning of a project like this, to find out which sociodemographic indicators have the largest impact and vulnerability associated with climate change. We want to see where and for whom is it most critical. The intention and vision are to put more action in this area more than other areas. We have three projects planned for next year and then we will see for each sector, what is more critical and what can we do.

What are some challenges and opportunities for future action to promote better air quality and public health through road safety initiatives?

Road safety initiatives are often seen as mobility concerns and it comes in competition with other road measures (i.e., maintenance, development). As the resources are limited, it's often difficult to integrate these road safety initiatives with what should be done in priority. There is an educational challenge about that. Designers don't always see the consequence of road design on air quality and public health. Nevertheless, our department takes charge of these challenges by the development of a directory with guidelines (Répertoire des pratiques d'aménagement des rue / Inventory of street design practices).

Right of way is limited in certain areas of Montreal, making choices difficult. We are often faced with competing initiatives such as larger sidewalks vs bike infrastructure vs vegetation.

With competing resources, we have developed the search for opportunities to integrate different needs within one project.

What is an example of a project like this?

There are several projects where we apply this principle. For example, as soon as we know they are going to be working on what's underground (sewers, water mains), the first question that's asked is are there any other aspects we can improve as well. For example, presently we're working on a project where last year they worked on what's underground and this year they are redoing the geometry and they integrated island refuges for pedestrians when they cross. We assess if we improve access to greenspace by adding canopy with trees, if we can improve the safety of sidewalks, if we can increase space for pedestrians by adding refuge islands. We have been doing this for several years and the engineer and the architect working together to make sure it's an integrated project.

Increasing active transportation is one way to reduce emissions. In your experience, what are the biggest barriers to promoting active transportation?

Basically, a lot of people are ready to travel by active transportation, but the offer is not suitable for their needs. We must act but there's often some resistance. It's easier when we turn the social acceptability into social mobilization, which needs education and communication. We must combat misperceptions about the exaggeration of anticipated losses for automobile travel and parking when we change the repartition of space between road, cycle path and sidewalk. When these barriers are lifted, the city and the elected officials can act easily and faster and that's what we have seen in the central neighbourhoods where the rate of active transportation is quite high.

What has resistance looked like?

It's not just from residents, it can be from businesses – they think their customers come by car and they have their own perceptions and stick to them. The statistics show otherwise. It's a lot about understanding the other's needs. It's often pedestrians vs cyclists and, especially with older pedestrians, it can be scary to share the road with cyclists. Additionally, for individuals with mobility limitations, or those who are disabled, it can be scary and dangerous to be beside cyclists, in the same path. Buses as well: they need configuration for folks with wheelchairs, so they don't want a bike path in the way of that.

Do you have strategies in place to overcome these barriers?

Sometimes, we must act first to demonstrate the effectiveness of some measures. With the support of elected officials, we can deploy pilot projects (also called transitional design) that can demonstrate the relevance of some actions, which can increase active transportation. That's what we have done with the Réseau express vélo (REV). It has been so successful that some people use it now to criticize the city that we are not doing enough for the citizens. Now, we have a Vision vélo Plan 2023-2027, which provides for the implementation of many more REV all around the city.

We can also make links with associations to reach citizens. For example, we have the "Plan climat 2030" (Climate Plan 2030) supported by many local organizations such as "Montréal en commun", which is supported by the city, with the mission to federate many actors in the business community. There is also "Transition en commun" (also supported by the city), which is an alliance based on collaborative governance with many local associations. Moreover, they have a workgroup specifically on de-motorization. Otherwise, there are other standard consultations methods that the city uses for projects.

What role do you see road safety professionals playing in addressing air pollution and promoting public health?

We see a role in these issues. The professionals may not have all the answers and solutions, but they should ask questions: How are these projects affecting people living close to these roads? How can we improve the projects to promote public health? What are the limits of the project of active transportation? And so on.

Road safety professionals often work with professionals from other disciplines as it is a multidisciplinary field.

What opportunities do you see for collaboration between public-health-focused organizations, such as Parachute, and transportation agencies to promote better air quality and public health?

Share knowledge, especially about what can really have effects on public health. We must distinguish what seems to be the solution and what really works based on evidence: Benchmarking, surveys on who does what, best practices, accountability.

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Bartek Komorowski
Planning Advisor, Team Lead, City of Montreal

Are there key strategies in your Vision Zero plan that address the link between transportation and air pollution?

The Vision Zero Plan does not explicitly address air pollution. That said, one of the plan's four focus areas is reducing the vehicle kilometres travelled through land use and transportation policies and planning. The actions in this focus area have the potential to help reduce air pollution.

What are some challenges and opportunities for future action to promote better air quality and public health through road safety initiatives?

The key challenge is not to focus only on traditional road safety measures, such as safety countermeasures and awareness campaigns, but rather to consider the impacts of urban planning and transportation planning on road safety. Measures to reduce automobile dependency and promote the use of less risk-generating modes of transportation, such as public transit and the active modes, should be recognized as contributing to road safety.

Increasing active transportation is one way to reduce emissions. In your experience, what are the biggest barriers to promoting active transportation?

The biggest of barriers to use of active transportation in Canadian cities is the lack and poor quality of infrastructure for the active modes. This is compounded by the land use patterns, particularly outside of historic city centres, that do not support the use of these modes.

Implementing better infrastructure for pedestrians and cyclists is politically fraught as it generally requires the removal of on-street parking spaces or travel lanes, which politicians and many citizens fear will aggravate road congestion. Changing land use patterns isn't easy either, namely due to NIMBYism.

Do you have strategies in place to overcome these barriers?

When we implement projects that entail significant reallocation of road space to other uses, we often do so first on a temporary/pilot project basis, letting locals know that the street will be restored to its original state if the project doesn't succeed. This tends to increase social acceptability; by the time we start implementing the permanent version of the project, there is much less opposition than initially, and contentious public consultations processes can be avoided.

What role do you see road safety professionals playing in addressing air pollution and promoting public health?

Road safety professionals should advocate for the reduction of car dependency. Car use generates more risk than the use of other modes but also creates more tailpipe and non-tailpipe air pollution and contributes to sedentary lifestyles.

What opportunities do you see for collaboration between public-health-focused organizations, such as Parachute, and transportation agencies to promote better air quality and public health?

The reduction of car dependency and the promotion of public and active transportation should be a shared goal for agencies interested in road safety, air quality and public health, for the reasons outlined in my answers above.

Researched and written by Parachute intern Ravia Arora, MPH student, University of Waterloo.

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