Smart Transportation Action Plan

Edmonton

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Executive Summary

The mobility sector is on the cusp of a major paradigm shift. Advances in automation, connectivity, electrification, and shared mobility are creating new ways to move people, goods, and services. The emergence of new transportation technologies and mobility options will shift current transportation systems and bring exciting potential benefits to consider and plan for as we work towards achieving the City of Edmonton's strategic goals.

The Smart Transportation Action Plan prioritizes actions for the City in the mobility sector in the short (2 - 3 years) or immediate term. This plan outlines actions that are both new and in progress to better inform what the City is currently doing, and what could be done, to prepare for emerging transportation technologies. Eventually, these actions will feed into and integrate with the City's broader city building strategies and plans. Thisprimarily includes the new City Plan, which will incorporate the Transportation Master Plan where long term direction for the City on smart transportation will be provided.

The Smart Transportation Action Plan was developed through a multi-stage process informed by a state of practice review; input from City staff, industry, and academia; research with citizens; and validated through expert advice from a Subject Matter Expert Think Tank. The action items outlined in this report have been organized under four key focus areas:

- **People:** Any mobility system is about moving people and goods in a safe and accessible manner, providing a choice of options for everyone to get from A to B. This section focuses on quality, access and ease of service, along with engagement and educational opportunities for emerging transportation services.

- **Climate:** Emissions from transportation have a major impact on our environment and are a major contributor to climate change. We can mitigate these impacts through integration of transportation and land use, increasing trips made by active transportation and transit, and electrifying vehicles. In adopting smart transportation, and particularly autonomous vehicle technology, we will need to focus on a shared model of mobility, centred around a backbone of public transit services.

- **Mobility Systems:** Transportation infrastructure is the backbone upon which the mobility system is built, playing an essential role in moving people and goods safely and efficiently. But how we use and interact with the system is also important so we need to a create a system that is safe, simple to use, and as efficient as possible for everyone.

- **City Function:** The City as a whole will be challenged to think differently under this new mobility paradigm. Impacts on the City of Edmonton's operational capabilities will be felt, both internally and externally to the organization. The City will enable innovative mobility projects through improvements to its fleet, data management and collaboration.

Implementation of the action items outlined in this report will guide the City in planning for emerging transportation technologies in the short and immediate term while ensuring that the City is preparing for the long term transportation policy and planning changes that will be necessary in the future.

Actions

1	Guided by the City's Public Engagement Policy, create engagement plans when developing or partnering on new mobility projects and services. Use tools such as Gender-Based Analysis Plus (GBA+) to capture diverse needs given the intersectionality of identities and experiences that Edmontonians represent.
2	Consider how the City's ongoing strategy for Vision Zero will need to expand to include consideration for emerging transportation technology and emerging mobility needs.
3	Considering the idea of 'the City as a Lab', explore opportunities for locally developed solutions to be tested and validated at the City. Continue to identify options or ways that the City can invest in or establish mechanisms for financial support to local start-ups and initiatives.
4	Continue to design the Smart Fare system with consideration for making the mobility system more economical and equitable for all, recognizing that Smart Fare can be a mechanism for the City to offer approved concession fares to vulnerable populations.
5	Continue to research emerging transportation technologies and the impacts new mobility models may have on the city and its people by partnering and formalizing relationships with post-secondary institutions and other municipalities.
6	Through the Startup in Residence (STIR) program, propose Smart Transportation opportunities, and more broadly Smart Cities opportunities, that may be the problem that a startup works to solve.
7	Working from insights on current customer journeys, develop/use representative personas to identify how emerging technologies will impact the future mobility needs.
8	Building on City campaigns, such as Change for Climate, develop educational resources to advance and create understanding around new mobility while considering different subsets of the population.
9	Install publicly accessible charging infrastructure to support the electrification of transportation.
10	Work with surrounding municipalities, the Province, and other key stakeholders to ensure cross-boundary alignment and cooperation. This could include traffic technology interoperability, regional electric vehicle charging station networks, electricity grid readiness.
11	Assess the potential for a Mobility as a Service (MaaS) system to support an integrated trip planning, trip management and fare payment service for public transit, ride share, bike share, car share, and other mobility services to enable multi-modality and sustainable transportation options.

12	Undertake a phased approach to adopting bike and other modal (e.g. scooter) sharing opportunities, to determine the best delivery format for the City of Edmonton, including potential infrastructure and parking requirements. Considerations should be given for potential docking types, and for electrification.
13	Continue to understand the environmental impacts of new mobility through scenario modelling.
14	Lead by example and continue to transition the City's fleet of vehicles towards electric and low carbon fuels.
15	As part of the development of the City Plan: - Develop a Vision for Mobility that sets out where and how the City envisions new and emerging mobility options will integrate with the broader transportation system. This Vision for Mobility will serve as the basis for the City's research and pilot programs around new mobility options. - Establish a mode hierarchy that prioritizes the effective movement of people and goods. - Undertake a mobility pricing study to understand how the relative pricing of different modes of travel in Edmonton impacts travel behaviours and choices. - Conduct scenario planning and regional travel demand modelling to better understand potential implications of Smart Transportation.
16	Develop a car share policy to clarify City requirements for parking permissions and boundaries. In developing the a car share policy, assess curb parking requirements, and the economic implications.
17	Continue to consider smart transportation pilot projects on which the City could partner. Evaluate participation in the project based on cost, benefit to Edmontonians, and alignment with City goals.
18	Consider what appropriate parking requirements should be, how parking could be better shared between different users, and how to accommodate the growth in adoption of Smart Transportation technologies.
19	Continue the replacement of streetlights with connected 'smart streetlights'. Investigate the feasibility of additional functionalities, such as allowing for connected vehicle infrastructure which could be used for parking inventory monitoring, air quality monitoring, and travel time data collection.
20	Partner on the Electric Automated (ELA) shuttle pilot project, evaluate results, and apply learnings to potential future pilot projects.
21	Continue to partner with the University of Alberta and Government of Alberta on the Active-Aurora Connected Vehicle Test bed project.
22	Conduct a study on the feasibility of adaptive signals and connected technologies on compatible corridors.

23	Implement the actions identified from the ETS study on how new mobility options can be used to bridge first-mile-last-mile gaps in transit service for areas of the city without fixed route transit service.
24	Establish an internal task force on smart transportation across departments within the City of Edmonton.
25	Engage other major cities across the province and country to exchange best practices and to collaborate on research and pilots.
26	Pursue partnerships with academia, the private sector, non-profits, utilities, regional partners, and other orders of government to advance new mobility.
27	Coordinate with other orders of government and the private sector to understand cyber security and protect the personal information of people.
28	Continue work on Business Continuity Planning to ensure continuity of operations during disruptions, including, but not limited to severe weather, data breaches, flooding, chemical spills, vehicle accidents, police incidents, etc. Evaluate the improvement of Business Continuity Planning with smart transportation technologies.
29	Incorporate a new approach when evaluating major transit infrastructure that includes - as part of the business case assessment - the costs, benefits, and other implications of connected technology with existing City infrastructure.
30	Assess long term user-pay and privately funded options.
31	Develop City regulations, permits, and policies for new mobility to align with City goals.
32	Continue to explore opportunities for City vehicle-use reduction through programs and services such as carshare.
33	Continue to implement telematics systems on City fleet to, among other things, manage fuel consumption and optimize routes.
34	Advocate with federal and provincial partners to align and establish federal and provincial policies and regulations that enable a smart transportation system.
35	As part of agreements that enable mobility service providers to operate in the city, establish policies that stipulate clear data and reporting requirements in line with the City's data protocol and identified needs.

INTRODUCTION

A New Mobility Paradigm

The mobility sector is experiencing a period of immense change. New technologies and operating models are presenting new ways to move people, goods, and services through cities here in Canada and around the world. Some of these changes are evolutions of existing mobility options, while others are significantly different.

Many of the emerging mobility options provide opportunities for more convenient models of access, which have the potential to significantly benefit parts of the population that have had their mobility limited by varying circumstances. Greater digital connectivity, new business models, and changing behaviours and preferences across population cohorts have made these emerging mobility options more convenient and appealing.

Innovation in four main areas is enabling much of the current wave of change relating to the emergence of new transportation technologies and mobility options. These are Automated, Connected, Electric, and Shared (referred to as ACES as shown in Figure 1)

Because of these advancements, people now have unprecedented access to information about the conditions of the transportation system and the mobility options available to them through connected mobile applications on smartphones and devices. Sharing of vehicles such as cars, bikes, and scooters has become much easier. Improvements to battery technology is making electric vehicles and other electric modes more cost effective and accessible. Advanced sensors and artificial intelligence are helping to improve the safety of our roads through driver assistance systems like automatic braking and lane-keep technologies. The promise of fully autonomous vehicles is also becoming more real by the day as technology companies and car manufacturers alike push towards bringing this to fruition.

While changes in the mobility sector bring exciting potential benefits, there are also challenges to consider and plan for as we work towards achieving the City's strategic goals and commitments as a member of the global community.. For example the City of Edmonton is a signatory to the Edmonton Declaration recognizing that immediate and urgent action is needed to decrease greenhouse gas emissions and curb global warming. With many new mobility services and technologies still on the horizon, the City is uniquely positioned to build off experiences from other cities around the world, and proactively manage, prepare for and enable the transformation of the mobility system in Edmonton.

The Smart Transportation Action Plan will feed into and integrate with the City's broader city building strategies and plans, such as the new the City Plan, and guide prioritization of actions - in progress and new - related to the mobility sector over the next two to three years. Some trends have a clear trajectory, which will enable the City to act on these directly. For example, electric vehicles are becoming more reliable and their adoption more commonplace, making it increasingly clear how the City should prepare. Other trends which the City is less certain about may require continued exploration, such as autonomous vehicles which are still developing and so how they will interact with people in cities is unclear.

As the mobility sector continues to evolve, the City's response to emerging opportunities and challenges will need to adapt. More extensive engagement with Edmontonians, key stakeholders and partners will continue to steer the City's current and future actions around Smart Transportation.

Smart Transportation in Action

The City has been actively exploring emerging transportation technologies and mobility models across a number of areas, tackling opportunities and challenges from different perspectives:

- The ACTIVE AURORA project—a partnership across all three levels of government, academia and industry—is a connected vehicle testbed network that has placed three test locations on Edmonton streets.

- The City has explored 'smart streetlights' as part of its ongoing streetlight replacement program, which provides the ability for adaptive lighting dimming, with potential for roadway monitoring and greater connectivity in the future.

- The City has established agreements to bring curbside electric vehicle charging and partnered on an electric autonomous vehicle pilot in the city in order to gain a better understanding of citizen perception to inform future City planning.
- Simultaneous to the development of this Smart Transportation Action Plan, the City has also developed an Electric Vehicle Strategy to help Edmonton achieve its low carbon and climate resilience goals.

Appendix A of this Action Plan provides greater details on smart transportation project currently underway

"Automated, Connected, Electric, and Shared" Defined

Automated systems enable vehicles, both light and heavy to navigate and respond to complex operating environments with little to no human input. Although colloquially referred to as 'driverless' vehicles or systems, there are actually different degrees of automation, representing varying levels of human driver participation required, and the type of environment that can be operated in. The standard for autonomous vehicles developed by SAE (Society for Automotive Engineers) International defines six levels from 0 to 5, with 0 being no automation, and 5 being full automation (autonomy).

Connected systems use new and existing forms of communication technology to enable interaction between vehicles, devices, and other objects over wireless networks to gather and disseminate information. Sharing of real-time and off-line information offer valuable opportunities to improve operational efficiency, infrastructure maintenance, and more importantly, enable greater use of safety related features.

Electric vehicles and systems operate on electric power rather than carbon based fuels. Support for a shift away from internal combustion engines and towards electric vehicles and other forms of zero and low-emission forms of propulsion is gaining momentum in cities around the world, including the City of Edmonton. Recognition of the air quality and broader environmental impacts of carbon based fuels is a key motivator for this shift.

Shared systems enable the sharing of assets or services between individuals, such as carshare, bikeshare, and rideshare. Part of the sharing economy, this trend is enabled by the convergence of technology and evolving business models. Though sharing networks for transportation have long existed, advancement and proliferation of mobile technologies have expanded its access and use to the mainstream. A key benefit of shared mobility is the potential for shifts away from private vehicle ownership towards multi-modality

Figure 1: ACES – Understanding what each facet of ACES stands for

SECTION 1: THE APPROACH

Smart Transportation for a Smart City

A Smart City leverages technology to provide an innovative ecosystem that co-creates solutions to contribute to improving the overall quality of life.

The City of Edmonton has embraced a Smart City approach that extends beyond technology to focus on innovations that effectively and efficiently improve the quality of life for its people. In line with Edmonton's Smart City Strategy, smart transportation is not just about making use of technology in transportation, it is about making use of innovations to produce mobility and city-building outcomes that best serve the diverse range of people that live, work and play in this city. Multi-modality is key to making Edmonton livable for all, and the City has made an ongoing effort to expand the LRT network in all directions, increase the number of protected cycling facilities across the city, and improve pedestrian safety to accomplish this vision.

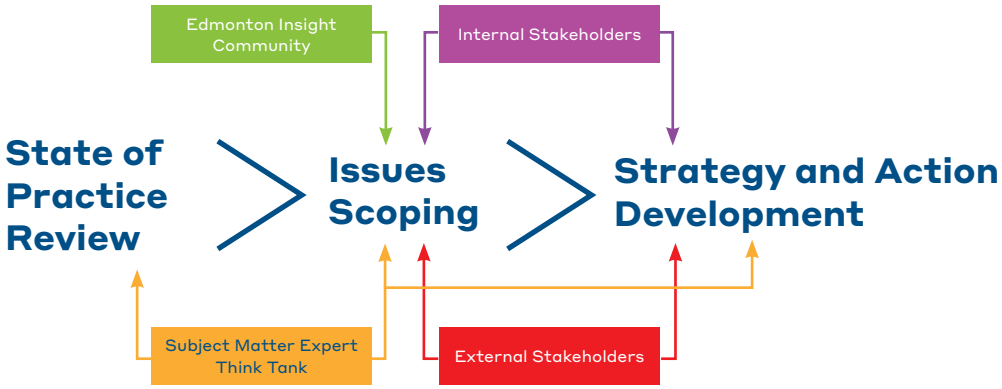
Changes in the mobility sector offer both opportunities and challenges to achieving a future of livability and multi-modality. This Smart Transportation Action Plan has been developed to better position the City and the people of Edmonton to leverage emerging technologies, to improve quality of life and help get us closer to our collective vision for the future. Making transportation in Edmonton truly smart will require the collective efforts of government, academia, industry and the people of Edmonton.

Creating the Approach

Adopting the people-centred approach outlined in Edmonton's Smart City Strategy this Smart Transportation Action Plan was developed through a multi-stage process guided by input from the public, other orders of government, industry, and academia, and validated through expert advice from a subject matter expert (SME) "think tank". An online survey, targeted interviews, and stakeholder workshops were used to gather insights to inform the issues scoping and strategy development stages of the project.

The SME think tank identified big picture issues and opportunities that are likely to arise as new transportation technologies and transportation models emerge. Each stakeholder group then helped us better understand the potential implications from different perspectives. Collectively, these contributions have helped to focus the City's efforts around key opportunities and challenges, and have highlighted additional considerations that need to be addressed in the realm of Smart Transportation, and more broadly, across the transportation and mobility system.

From all of these inputs, this Action Plan was developed that outlines the actions that the City will continue or begin within the next two to three years. The comprehensiveness of this approach also provided insight into the the long range planning and actions around smart transportation which will be a valuable input into the Transportation Master Plan within the City Plan which is currently in development. This Action Plan will ensure that the City takes immediate steps to be well positioned for future smart transportation moves that will be guided by the City Plan.



We engaged...		...to help us...
Edmonton Insight Community	Online citizen panel made up of volunteer Edmonotonians	...understand the current degree of public awareness around emerging transportation technologies and mobility options, and to get an initial sense of priorities and concerns from a public perspective.
Internal Stakeholders	Staff from across City of Edmonton business areas	...understand current initiatives related to smart transportation already happening across City of Edmonton business areas and to understand challenges associated with smart transportation planning.
External Stakeholders	Representatives from industry, other levels of government and academic institutions in Edmonton	Understand foreseeable opportunities and challenges from the perspective of industries and broader society as a whole.
Subject Matter Expert Think Tank	Multi-disciplinary panel of experts from around the world	...support the scoping of opportunities and challenges, and to advise the City on industry best practices in Smart Transportation.

Figure 2: Engagement Activities Across our 3-step Process

What We've Heard So Far

The following themes highlight the feedback we have heard from the public, key stakeholders and partners to date. These themes informed the plan's principles, which subsequently guided the strategic actions and near term direction for the City.

There's no need to be "bleeding edge"

Edmontonians want Edmonton to be leading edge, but not 'bleeding edge'. Committing to technologies prematurely risks the City going down the wrong path. Cities all over the world are implementing and testing smart transportation technologies. Learning from the findings of others, and conducting pilot testing on the ground will allow Edmonton to be intentional about the adoption of new technologies and to choose solutions that best suit the environment of Edmonton.

A "people-centric" approach

Putting people before technology is key to technology development and use. New technologies need to improve the experiences of all users, not diminish it. Even if the introduction of Smart Transportation is an overall benefit to the city, the disruption to people's lives needs to be minimized. Concerns regarding equity of access to mobility for the elderly and those experiencing poverty or mobility/accessibility issues need to be addressed and given special consideration when making decisions.

Safety and security

Concerns arise regarding the physical safety of driverless and automated technologies, and vulnerabilities to cyber-attacks and hacking. There is interest in technologies that will increase safety for the city, such as technologies that address impaired driving. Increased digitization of the transportation system will result in an increased amount of data. It is important that this data is handled by following security and privacy legislations and best practices, especially when public private partnerships exist.

Keep in mind the low carbon future we want and need

Potential improvements to efficiency in transportation technology could have positive effects on carbon emission reductions on a per vehicle basis, but could also risk inducing increased demand for travel that negatively impacts our efforts to slow climate change. Emerging technologies have the potential to shift mobility; depending on how the City and its partners respond that can either positively or negatively impact the changing climate. The City needs to ensure that actions taken on the smart transportation front help rather than hinder achieving the long term goals of the Edmonton Declaration and the City's civic operations Greenhouse Gas Management Plan. By starting the thinking early on new mobility, Edmonton can position itself to be able to shape how these new technologies can improve its transportation system. In doing so this helps us limit the impacts on our urban form and climate; creating conditions for catalyzing low carbon solutions at a faster pace and large in magnitude.

Innovate without compromising current needs

Current and traditional modes of transportation should not be compromised for the advancement of smart transportation. People should still have access to safe, affordable and reliable modes of transportation that suit their needs and preferences. The City will need to balance innovation and the implementation of new technologies with the maintenance and enhancement of current transportation systems.

Impacts on the physical realm of transportation

The introduction of new and additional forms of transportation may require the sharing of current transportation infrastructure such as curbs, roads, and pick-up and drop off points. Road space and curb space must be properly managed with a prioritized mode hierarchy. In some cases, emerging transportation choices will be given higher priority over existing modes based on their ability to achieve the City's mobility goals.

Guiding Principles

The principles presented here have been used to guide the formulation of actions in this Action Plan, and will serve as anchors to ground future actions as the City continues to learn more about the emerging changes.

Citizen Focused	**Maintain a people-centric lens.** The City puts the people who live and work here first. Our mobility and transportation system should connect people to what matters to them. We shape our decisions around making the city safe, secure, accessible and equitable to all, physically, geographically, and financially. We engage with all Edmontonians to keep everyone informed through multiple mediums, to include those of us with limited digital/technological access.
	Build the city that Citizens say they want. We listen to our people. Our decisions are examined to ensure they align with our citizen's desires and Council's goals. Opportunities and challenges are addressed with the City's vision, goals and objectives in mind
Climate Leadership	**Harness mobility transition to help achieve a low-carbon Edmonton.** The City strives to be a leader in sustainability and catalyzing low carbon solutions in the community. As a signatory to the Edmonton Declaration, that City recognizes that immediate and urgent action is needed to decrease greenhouse gas emissions and curb global warming. This will be a priority consideration when implementing smart transportation solutions.
	Create a mobility system that is transit-centric, focused on shared-mobility, and enables active transportation. In adopting smart transportation, and particularly autonomous vehicle technology, the City will ensure that it is focused on shared model of mobility and implementation is focused around a backbone of public transit services. New mobility options will be used to complement existing transit while seeking to improve the quality of service, rather than decreasing it. The City will ensure that the implementation of new mobility options does neglect or impede on active modes of transportation, but rather support it.
Innovation	**Design strategies that are scalable, adaptable, and proven.** The city is growing and our strategies must be able to grow with us. Strategies that are implemented now must be scalable and adaptable to the city in the future as patterns in land use, travel, and behaviour change. Applying proven technologies will help the city mature and develop long-lasting solutions that make best use of the City's resources.
	Invest in Edmonton-grown talent. We support innovation born in Edmonton. Our academic and research institutions are developing new and innovative solutions in the mobility sector and beyond. Providing opportunities for these initiatives to grow will spur long term economic health and vitality for the city and help to attract and retain talent and investment.
Integrated	**Align efforts and look for cross-benefits.** When developing or testing new mobility solutions and technology, we will consider how solutions could contribute and benefit other City programs and services. We will draw on the expertise of others in the City to achieve the best possible outcomes for people. We recognize that we get best results when we align our ideas, knowledge, and efforts.
Partnerships	**Collaborate with others.** The City encourages collaboration across its public and private entities to develop solutions and deliver services. We coordinate to ensure solutions that work for Edmontonians, the city, our businesses, and our communities.
	Value data as an asset. The City relies on data to make informed decisions. We act as a steward, collecting and sharing data transparently for the benefit of the public. We manage information responsibly and uphold the integrity and privacy of the data.

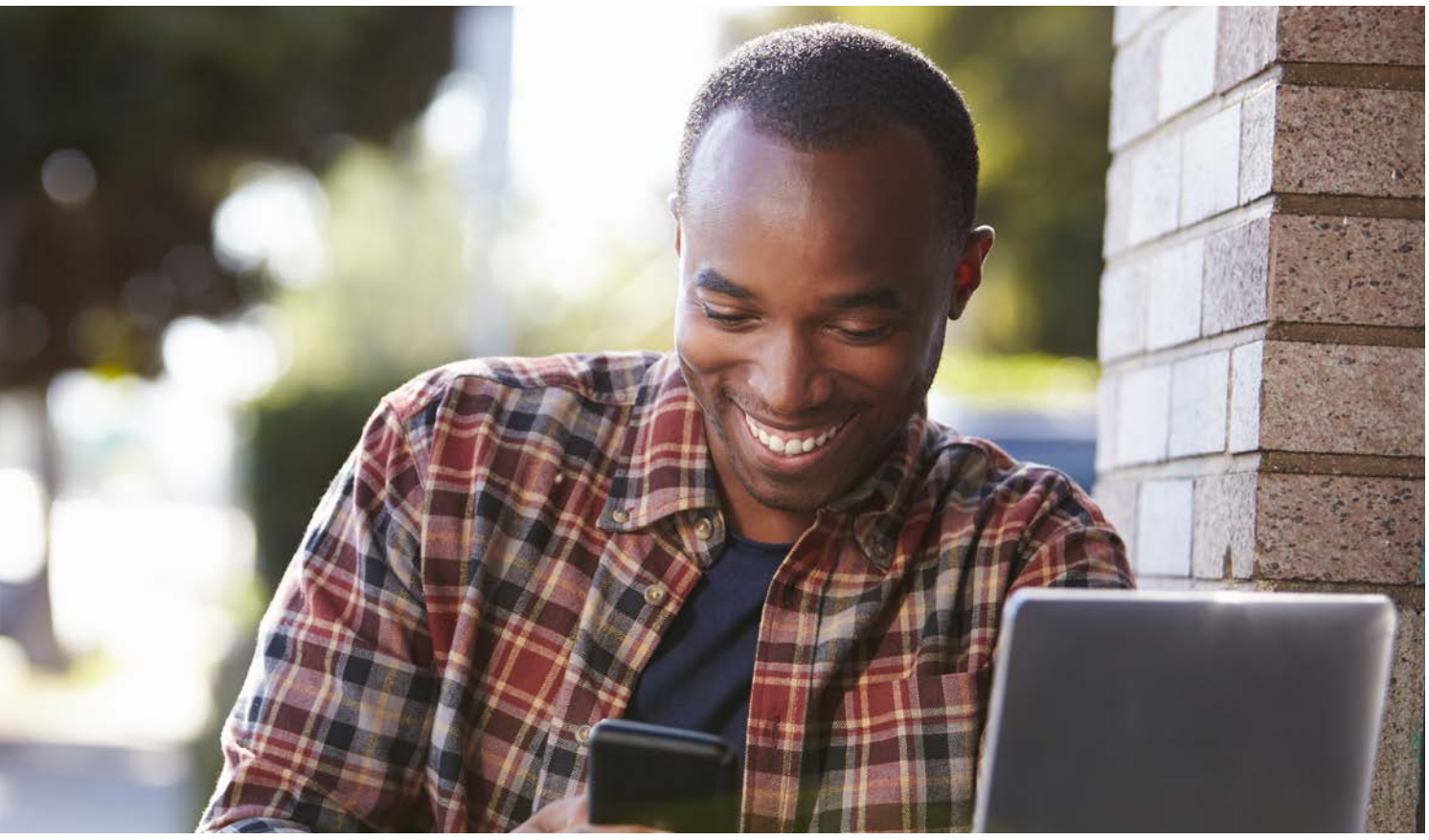
SECTION 2: THE PLAN

Thinking About Mobility and Beyond

Mobility touches every part of life in the city and has broad implications for Edmonton's social, economic, and environmental well-being.

Much has changed in transportation infrastructure over recent years. Transit is becoming more competitive in many areas of our city, supported in large part by the continued expansion of the Light Rail Transit (LRT) network. As well, the growth of pedestrian and cycling facilities is helping more people use active modes for daily travel. While we continue to progress these traditional projects, we must also look at the immediate and medium term for emerging opportunities to ensure that the City is prepared for the long term transportation policy and planning changes resulting from smart transportation.

While this Action Plan is primarily about mobility, it also considers interdisciplinary impacts beyond mobility, including how operational departments might need to respond and how the City can take advantage of emerging technologies. While planning for mobility, the City must also focus on health, safety, and access. The actions in this Action Plan are intended to not only improve mobility, but also to advance communities, economies and environments in the City of Edmonton and beyond.



The following four sections present further information about the City's current thinking in focus areas, provides considerations when thinking about the potential implications of emerging technologies and transportation models on the City of Edmonton, and outlines the actions for the City to progress in the next two to three years. Appendix B of this Action Plan provides an overview of each action and; dependant and related actions; orders of magnitude costs; and potential partners for implementation.

The actions within the four focus areas are further divided into two categories:

C Actions that the City are currently doing, will continue to do, and will need to build on or expand to support the implementation of the Smart Transportation Action Plan.

N New actions that the City will pursue to support the implementation of the Smart Action Plan. The Smart Transportation Working Group (described in the first action in the City Function focus area) will be the mechanism through which the new actions will be further vetted with City businesses areas and prioritized

People

This focus area outlines impacts on quality of life for people who live, work and play in Edmonton. The City will put people first when approaching mobility of the future. The quality, access and ease of service will be paramount along with engagement and educational opportunities for emerging transportation services.

Climate

This focus area outlines the impacts on Edmonton's environment and the climate. Emissions from transportation have an impact on our environment and are a major contributor to climate change. The City can mitigate these impacts through integration of transportation and land use, increasing trips made by active transportation and transit, and electrifying vehicles. In adopting smart transportation, and particularly autonomous vehicle technology, we will need to focus on an electric shared model of mobility, centred around a backbone of public transit services.

Mobility System

This focus area outlines impacts on the conditions within Edmonton's mobility system, including the land use choices and infrastructure that supports this system. The City will navigate the uncertainty of new mobility through the help of its citizens, working with people to determine the impact of technologies that may be adopted. The City recognizes that land use and transportation are intimately linked. Innovative transportation initiatives will only create a partial solution unless carefully tied to land use plans to provide services where people need them most. Using all of this information the City will create policies and plans that improve the quality of life for everyone.

City Function

This focus area outlines impacts on the City of Edmonton's operational capabilities, both internal and external to the organization. The City will enable innovative mobility projects through improvements to its fleet, data management, and collaboration.

Thinking About People

Any smart transportation solution should be centred around what it means for people. The mobility system is about moving people and goods in a safe and accessible manner, providing a choice of options for everyone to get from A to B. The arrival of new technologies and emerging mobility options introduces added opportunities and challenges to meet the needs of our people.

Things to Consider

Edmonton is a diverse city full of people with varied backgrounds, experiences, perspectives, and lifestyles. Solutions in Smart Transportation will have to be similarly diverse to meet these variable needs and enable people across the city to choose from mobility options that work for them. Understanding and engaging with these various parts of the population will be key to success.

The prevailing trend in the city has been to travel by private automobiles. This provides the benefit of personal convenience, but increasingly comes at the cost of more congestion, affordability, negative impacts to air quality and the environment, and detrimental impacts on the health and wellness of Edmontonians. Understanding the negative externalities of the current transportation system can help to mitigation these effects when adopting new technologies in the future.

As the city has grown and diversified, it has become ever more apparent that continued emphasis on travel by private vehicles alone will not be able to adequately meet the needs of everyone in the city and more attention and investment should shift to a multi-modal approach that considers all modes, including public transit, shared mobility, walking, and cycling. Affordable public transportation remains paramount and work is underway to tackle this barrier for those struggling with poverty, for example through the End Poverty initiative.

Emerging models of transportation, such as on-demand vehicle-for-hire services, provide opportunities for more convenient curb-to-curb transport. However, for many people, getting from the curb to the door is a challenge. The City's DATS (Disabled Adult Transit Service) currently serves these needs through door-to-door services. Moving forward, it will be important to ensure that emerging models of transportation improve on rather than detract from services such as these.

Edmonton has a strong culture of innovation, and leads the country in connected vehicle testing. There is an opportunity for the city to position itself as a leader in the emerging mobility space and an attractive location to foster the development of new and emerging sectors.

Safety is often touted as a potential outcome of emerging transportation technologies such as connected and autonomous vehicles, but it is not a given. The City will need to work with intention to make this a reality through policies around vehicle operations within the city and the way in which road space and transportation infrastructure is designed or redesigned.

Priority People Actions

1) Guided by the City's Public Engagement Policy, create engagement plans when developing or partnering on new mobility projects and services. Use tools such as Gender-Based Analysis Plus (GBA+) to capture diverse needs given the intersectionality of identities and experiences that Edmontonians represent.

2) Consider how the City's ongoing strategy for Vision Zero will need to expand to include consideration for emerging transportation technology and emerging mobility needs.

3) Considering the idea of 'the City as a Lab', explore opportunities for locally developed solutions to be tested and validated at the City. Continue to identify options or ways that the City can invest in or establish mechanisms for financial support to local start-ups and initiatives.

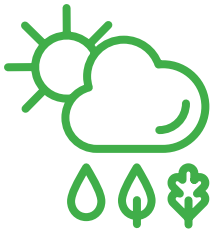
4) Continue to design the Smart Fare system with consideration for making the mobility system more economical and equitable for all, recognizing that Smart Fare can be a mechanism for the City to offer approved concession fares to vulnerable populations.

5) Continue to research emerging transportation technologies and the impacts new mobility models may have on the city and its people by partnering and formalizing relationships with post-secondary institutions and other municipalities.

6) Through the Startup in Residence (STIR) program, propose Smart Transportation opportunities, and more broadly Smart Cities opportunities, that may be the problem that a startup works to solve.

7) Working from insights on current customer journeys, develop/use representative personas to identify how emerging technologies will impact the future mobility needs.

8) Building on City campaigns, such as Change for Climate, develop educational resources to advance and create understanding around new mobility while considering different subsets of the population.



Thinking About Climate

Transportation is the second largest contributor to greenhouse gas emissions, is a major consumer of energy, and impacts air quality in our city. Electrifying transportation is one way we can reduce these impacts. However, there will need to be a continued focus on a mobility system that integrates land use and transportation, is people-propelled, and transit-centric. In adopting smart transportation, and particularly autonomous vehicle technology, we will need to focus on a shared model of mobility, centred around a backbone of public transit services.

Things to Consider

A widely recognized risk related to some emerging mobility options, most notably ride-hailing services and eventually fully autonomous vehicles, is the possibility of increased travel demand if the focus remains on personal transport rather than shared transport. In addition to more trips made by individual travellers, rides with zero-occupants might also be a possibility as vehicles shuttle around the city to get to their waiting passengers. Left unmanaged, this could lead to even further levels of congestion and emissions as the city grows.

Changes in transportation technology are offering opportunities to provide higher order transit differently, such as through automated and platooned vehicles. Any new technologies introduced into the City's transportation system needs to build on and build up the City's existing public transit network, rather than detract from it.

The City has a valuable opportunity to lead by example in its operations and services to demonstrate environmental stewardship and leadership to the community. The City can signal to those looking to partner and provide mobility services in Edmonton that environmental and low carbon solutions are important, welcomed, and encouraged. The City has the ability to demonstrate feasibility of technology in its fleet, signal the importance of environmental preservation to staff and citizens, influence other orders of government, design a transportation system with a low carbon lens, and reduce impacts through regulation and policy.

Dense, mixed-use communities make it easy for people to conveniently access multiple modes, including walking, cycling and transit. Likewise, mobility options also impact the way people make decisions about where to live, work, and play. The impacts of smart technology will be experienced in City infrastructure from charging stations for electric vehicles, parking changes, a change in road widths, curb value, and repurposed roadway into cycling lanes, sidewalks or other future valuable uses. Smart Transportation must be partnered with smart land use decisions in order to make the city function effectively.

Priority Climate Actions

9) Install publicly accessible charging infrastructure to support the electrification of transportation.

10) Work with surrounding municipalities, the Province, and other key stakeholders to ensure cross-boundary alignment and cooperation. This could include traffic technology interoperability, regional electric vehicle charging station networks, electricity grid readiness.

11) Assess the potential for a Mobility as a Service (MaaS) system to support an integrated trip planning, trip management and fare payment service for public transit, ride share, bike share, car share, and other mobility services to enable multi-modality and sustainable transportation options.

12) Undertake a phased approach to adopting bike and other modal (e.g. scooter) sharing opportunities, to determine the best delivery format for the City of Edmonton, including potential infrastructure and parking requirements. Considerations should be given for potential docking types, and for electrification.

13) Continue to understand the environmental impacts of new mobility through scenario modelling.

14) Lead by example and continue to transition the City's fleet of vehicles towards electric and low carbon fuels.

Thinking About Mobility Systems

While transportation infrastructure is the backbone of the mobility system that moves people and goods through our city, it is also important to consider how we use and interact with the system, making it as safe, simple to use, and efficient as possible for everyone. We recognize that land use and transportation are intimately linked. Innovative transportation initiatives will only create a partial solution unless carefully tied to land use plans to provide services where people need them most. By planning early for new mobility, Edmonton will position itself to be able to shape how these new technologies can improve our transportation system while considering the impacts on our urban form, climate, and citizen access to mobility.

Things to Consider

New mobility options like dynamic ride-sourcing, shared bicycle and scooter systems, and up to the minute transit information makes these modes of travel more competitive with the convenience offered by private automobiles. New mobility options could create more congestion but the newness of these technologies allows the City to provide guidance on how best to harness these benefits to create a more efficient mobility system.

Some infrastructure changes and upgrades will have to be made to enable change. To encourage adoption of technologies such as electric vehicles, more charging infrastructure will be needed. Likewise, to fully take advantage of connected vehicle technologies, road and sidewalk infrastructure will need to be enabled for connectivity. How road, parking, and curb space is managed may also need to be reconsidered as emerging mobility options result in more pick-ups and drop-offs. Parking space might become less valuable, while curb space becomes more so. Existing parking lots may need to be repurposed, and could unlock potential for redevelopment and infill. There also may be a shift in parking to the edges away from high-value land in the core.

Changes happening in transportation also enable opportunities for infrastructure change. One plausible benefit of fully autonomous vehicles is that they will not only be able to travel closer together front to end, but also side to side, meaning that road widths may not need to be as wide as they are today. This additional space could be re-allocated towards other uses such as bike lanes or wider sidewalks.

To fully take advantage of connected vehicle technologies, road and sidewalk infrastructure will need to be enabled for connectivity. How road, parking, and

curb space is managed may also need to be reconsidered as emerging mobility options result in more pick-ups and drop-offs. Parking space might become less valuable, while curb space becomes more so. Existing parking lots may need to be repurposed, and could unlock potential for redevelopment and infill. There also may be a shift in parking to the edges away from high-value land in the core.

Priority Mobility Systems Actions

15) As part of the development of the City Plan:

- Develop a Vision for Mobility that sets out where and how the City envisions new and emerging mobility options will integrate with the broader transportation system. This Vision for Mobility will serve as the basis for the City's research and pilot programs around new mobility options.
- Establish a mode hierarchy that prioritizes the effective movement of people and goods.
- Undertake a mobility pricing study to understand how the relative pricing of different modes of travel in Edmonton impacts travel behaviours and choices.
- Conduct scenario planning and regional travel demand modelling to better understand potential implications of Smart Transportation.

16) Develop a car share policy to clarify City requirements for parking permissions and boundaries. In developing the a car share policy, assess curb parking requirements, and the economic implications.

17) Continue to consider smart transportation pilot projects on which the City could partner. Evaluate participation in the project based on cost, benefit to Edmontonians, and alignment with City goals.

18) Consider what appropriate parking requirements should be, how parking could be better shared between different users, and how to accommodate the growth in adoption of Smart Transportation technologies.

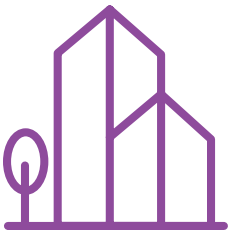
19) Continue the replacement of streetlights with connected 'smart streetlights'. Investigate the feasibility of additional functionalities, such as allowing for connected vehicle infrastructure which could be used for parking inventory monitoring, air quality monitoring, and travel time data collection.

20) Partner on the Electric Automated (ELA) shuttle pilot project, evaluate results, and apply learnings to potential future pilot projects.

21) Continue to partner with the University of Alberta and Government of Alberta on the Active-Aurora Connected Vehicle Test bed project.

22) Conduct a study on the feasibility of adaptive signals and connected technologies on compatible corridors.

23) Implement the actions identified from the ETS study on how new mobility options can be used to bridge first-mile-last-mile gaps in transit service for areas of the city without fixed route transit service.



Thinking About City Function

Transportation is tied to almost everything we do. Almost everyone travels, to varying degrees and distances. Similarly, most City business areas, services and functions will be impacted by emerging transportation technologies. Integrating strategic actions into day to day operations will position the City to maintain our Smart Transportation for a Smart City approach. The City as a whole will be challenged to think differently under this new mobility paradigm.

Things to Consider

Although many of the changes happening are related to the transportation system, many of the opportunities and challenges will have impacts on all parts of the City. From City Operations, Policing and Emergency Services to Citizen Services and Human Resources – all parts of the City need to be stakeholders in the change process.

The City does not operate in isolation, and neither do the changes happening in the transportation sector. Opportunities and challenges extend beyond the city's boundaries, and so collaboration and alignment will be necessary at a regional, provincial and federal level to ensure consistency across boundaries.

Change is happening quickly, and the City will be challenged to keep pace. In areas that the City is not suited to address on its own, partnerships will need to be sought. Integrating more flexibility into procurement specifications, evaluations, and processes may need to be explored, particularly if the City wishes to pursue pilot projects and strategic partnerships with private service providers and benefit from advancements in technology.

Many of the changes happening in this digital age also generate a wealth of data about how people use the transportation system and other City assets. The City has an opportunity to use this data to better inform its decision making. However, with the mass of data that is collected internally, and data that could be obtained through partnerships with ex-ternal parties, the City will be challenged to store, maintain, disseminate, and make effective use of the data available.

Priority City Function Actions

24) Establish an internal task force on smart transportation across departments within the City of Edmonton.

25) Engage other major cities across the province and country to exchange best practices and to collaborate on research and pilots.

26) Pursue partnerships with academia, the private sector, non-profits, utilities, regional partners, and other orders of government to advance new mobility.

27) Coordinate with other orders of government and the private sector to understand cyber security and protect the personal information of people.

28) Continue work on Business Continuity Planning to ensure continuity of operations during disruptions, including, but not limited to severe weather, data breaches, flooding, chemical spills, vehicle accidents, police incidents, etc. Evaluate the improvement of Buisness Continuity Planning with smart transportation technologies.

29) Incorporate a new approach when evaluating major transit infrastructure that includes - as part of the business case assessment - the costs, benefits, and other implications of connected technology with existing City infrastructure.

30) Assess long term user-pay and privately funded options.

31) Develop City regulations, permits, and policies for new mobility to align with City goals.

32) Continue to explore opportunities for City vehicle-use reduction through programs and services such as carshare.

33) Continue to implement telematics systems on City fleet to, among other things, manage fuel consumption and optimize routes.

34) Advocate with federal and provincial partners to align and establish federal and provincial policies and regulations that enable a smart transportation system.

35) As part of agreements that enable mobility service providers to operate in the city, establish policies that stipulate clear data and reporting requirements in line with the City's data protocol and identified needs.

FIRST STEP ON THE ROAD AHEAD

The Smart Transportation Action Plan has been developed to guide the City in its prioritization of actions to prepare for emerging transportation technologies and trends over the next two to three years. It identifies already-in-progress and future actions to pursue in the short term to address the emerging opportunities and challenges we have today, and to ensure that the City is prepared for the long term transportation policy and planning changes that will arise from smart transportation.

Although this is a City of Edmonton plan, the actions do not stop at its borders geographically or administratively. As this Action Plan moves forward, continued collaboration with the City's stakeholders and partners regionally and beyond will be critical.

Our world is ever changing, and the transportation system will continue to evolve with it. In this Action Plan, we have focused on four main areas of mobility innovation that are driving change right now: automated, connected, electric and shared mobility. However, many other trends are on the horizon and their impact and relevance to the City of Edmonton may increase or diminish as we continue into the future.

This Action Plan sets out an initial step for the City to take in its journey ahead, but it is expected that this will be a living document and stream of work that will continually evolve as we learn more about and progress further into the new mobility paradigm. The guiding principles are intended to serve as an ongoing resource to refer to and to ground the City's approach. Should further actions outside of the current Action Plan be needed in the future the Guiding Principles will ensure that regardless of the conditions, the City's response to emerging technologies and transportation models is centred around the ultimate vision of building a city that increases livability, wellness and connectedness of Edmontonians.

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Appendix A

Ongoing Smart Transportation Projects Across the City

In order to effectively plan for the coming changes to the mobility sector, the City has already begun exploring emerging technologies and mobility models across a number of areas. The following highlights several of the major projects taking place across the city. These have served to inform the development of this Smart Transportation Action Plan, and will serve as the pick-up point at which the City proceeds with further strategies and actions in this realm.

ACTIVE-AURORA

ACTIVE-AURORA[1] is the first connected vehicle test-bed network in Canada. The project represents a partnership among all three levels of government, academic institutions and several industry partners, and has served as a catalyst for connected vehicle research and deployment in Alberta and the rest of Canada. There are currently three on-road test-beds in Edmonton being used to explore the potential of connected vehicle technology on the ground as part of the ACTIVE component of the project. Research on these test-beds will primarily evaluate how connected vehicle technology can be applied to improve the safety of the transportation network, manage traffic demand, increase roadway capacity during peak periods and smooth traffic flow on busy roads. Since becoming operational in September 2016, a number of local and multinational corporations have entered into agreements to test products and services using the ACTIVE-AURORA test beds.

Smart Streetlights

The Smart Streetlights program initially began in 2013 as part of the adaptive lighting dimming pilot project in the Woodcroft community.[2] The original intent was to reduce energy consumption by dimming lights during off-peak periods when there is decreased pedestrian and vehicular traffic. As the program has expanded, further functionalities have been uncovered, including opportunities for traffic data collection, parking availability and occupancy monitoring, and air quality detection. To date, a total of 400 streetlight units have been converted to smart streetlights across the city.

Curbside EV Charging Pilot

In addition to enabling a fast-charging corridor between Edmonton and Calgary, ATCO electric is also working with the City on a pilot to bring curbside Electric Vehicle (EV) charging services to public roads. This five-year project will see up to 10 dual-port Level 2 curbside charging stations installed at curbside parking spaces around the city. Locations for the chargers are still being finalized, but the stations are expected to be operational before the end of 2018. This project has been made possible through funding provided by ATCO, supplemented by funding support from Natural Resources Canada, and with parking and curb space provided by the City of Edmonton.

1 https://www.alberta.ca/release.cfm?xID=4342706B2F973-F636-E821-D94C9596D4DB4460

2 https://www.edmonton.ca/transportation/on_your_streets/street-lighting.aspx

Autonomous Vehicle Pilot Project

In the fall of 2018 the City of Edmonton will pilot an electric autonomous vehicle (AV) project with people and partners. As one of the first public facing AV pilots in Canada, this low-speed pilot is intended to help Edmontonians become more familiar with the technology by experiencing it first hand. The City will collect feedback from people throughout the pilot to help inform city planning related to AVs in the future. The pilot project will feature an EasyMile EZ10 autonomous vehicle named ELA (short for "electric autonomous"). ELA will operate on test routes carrying up to 11 passengers at a time, travelling at approximately 15 km/h with an attendant on-board to oversee the vehicle and provide back-up response.

Whitemud Drive Variable Speed Pilot Study

In 2015, The City of Edmonton partnered with University of Alberta to undertake a variable speed pilot with the purpose of easing congestion and possibly reducing collisions. The City installed vehicle detection systems every kilometre beneath Whitemud Drive and entry ramps for the pilot study area to gain an understanding of real time traffic volumes. This allows for calculation of optimum speeds for smooth traffic flow and variable speed signs would be set accordingly. During periods of high congestion, the City was aiming to avoid 'shock waves' that travel backward from vehicles so that there would still be room for other vehicles on merge onto the freeway from entry ramps. The pilot was deemed a success with lowered congestion rates and travel times.[3]

3 http://transformingedmonton.ca/get-there-faster-slow-down/

Appendix B

Overview of Actions

Focus Area	Action #	New (N) or Continuing (C) Action	Action	Order of Magnitude Cost	Dependant and Related Actions	Potential Partners to the City in Implementation
People	1	N	Guided by the City's Public Engagement Policy, create engagement plans when developing or partnering on new mobility projects and services. Use tools such as Gender-Based Analysis Plus (GBA+) to capture diverse needs given the intersectionality of identities and experiences that Edmontonians represent.	$	8	Community and Non-Profit Groups
People	2	N	Consider how the City's ongoing strategy for Vision Zero will need to expand to include consideration for emerging transportation technology and emerging mobility needs.	$$	9	Private Mobility Vendors
People	3	N	Considering the idea of 'the City as a Lab', explore opportunities for locally developed solutions to be tested and validated at the City. Continue to identify options or ways that the City can invest in or establish mechanisms for financial support to local start-ups and initiatives.	$$	9	Community and Non-Profit Groups
People	4	C	Continue to design the Smart Fare system with consideration for making the mobility system more economical and equitable for all, recognizing that Smart Fare can be a mechanism for the City to offer approved concession fares to vulnerable populations.	$	4, 9 ,17	Community and Non-Profit Groups, Private Mobility Vendors
People	5	C	Continue to research emerging transportation technologies and the impacts new mobility models may have on the city and its people by partnering and formalizing relationships with post-secondary institutions and other municipalities.	$	9, 13, 22, 14	Academic Researchers
People	6	C	Through the Startup in Residence (STIR) program, propose Smart Transportation opportunities, and more broadly Smart Cities opportunities, that may be the problem that a startup works to solve.	$$	9	Community and Non-Profit Groups
People	7	C	Working from insights on current customer journeys, develop/use representative personas to identify how emerging technologies will impact the future mobility needs.	$$	1,12	Community and Non-Profit Groups
People	8	C	Building on City campaigns, such as Change for Climate, develop educational resources to advance and create understanding around new mobility while considering different subsets of the population.	$		N/A (City-undertaking)
Climate	9	N	Install publicly accessible charging infrastructure to support the electrification of transportation.	$$$		All levels of Government, Private Sector

Focus Area	Action #	New (N) or Continuing (C) Action	Action	Order of Magnitude Cost	Dependant and Related Actions	Potential Partners to the City in Implementation
Climate	10	N	Work with surrounding municipalities, the Province, and other key stakeholders to ensure cross-boundary alignment and cooperation. This could include traffic technology interoperability, regional electric vehicle charging station networks, electricity grid readiness.	$	14	All levels of Government
Climate	11	N	Assess the potential for a Mobility as a Service (MaaS) system to support an integrated trip planning, trip management and fare payment service for public transit, ride share, bike share, car share, and other mobility services to enable multi-modality and sustainable transportation options.	$	2, 9, 10, 17	Neighbouring Municipalities, Private Mobility Vendors
Climate	12	N	Undertake a phased approach to adopting bike and other modal (e.g. scooter) sharing opportunities, to determine the best delivery format for the City of Edmonton, including potential infrastructure and parking requirements. Considerations should be given for potential docking types, and for electrification.	$	4, 11, 17, 28	Private Mobility Vendors
Climate	13	C	Continue to understand the environmental impacts of new mobility through scenario modelling.	$		N/A (City-undertaking)
Climate	14	C	Lead by example and continue to transition the City's fleet of vehicles towards electric and low carbon fuels.	$$$		N/A (City-undertaking)
Mobility System	15	N	As part of the development of the City Plan: - Develop a Vision for Mobility that sets out where and how the City envisions new and emerging mobility options will integrate with the broader transportation system. This Vision for Mobility will serve as the basis for the City's research and pilot programs around new mobility options. - Establish a mode hierarchy that prioritizes the effective movement of people and goods. - Undertake a mobility pricing study to understand how the relative pricing of different modes of travel in Edmonton impacts travel behaviours and choices. - Conduct scenario planning and regional travel demand modelling to better understand potential implications of Smart Transportation.	$$-$$$	2, 3, 5, 6, 7, 17, 10	N/A (City-undertaking)

Focus Area	Action #	New (N) or Continuing (C) Action	Action	Order of Magnitude Cost	Dependant and Related Actions	Potential Partners to the City in Implementation
Mobility System	16	N	Develop a car share policy to clarify City requirements for parking permissions and boundaries. In developing the a car share policy, assess curb parking requirements, and the economic implications.	$	10	N/A (City-undertaking)
Mobility System	17	N	Continue to consider smart transportation pilot projects on which the City could partner. Evaluate participation in the project based on cost, benefit to Edmontonians, and alignment with City goals.	$$-$$$	16, 18, 26, 29	Private Mobility Vendors, Researchers
Mobility System	18	N	Consider what appropriate parking requirements should be, how parking could be better shared between different users, and how to accommodate the growth in adoption of Smart Transportation technologies.	$$	2, 9, 10	N/A (City-undertaking)
Mobility System	19	N	Continue the replacement of streetlights with connected 'smart streetlights'. Investigate the feasibility of additional functionalities, such as allowing for connected vehicle infrastructure which could be used for parking inventory monitoring, air quality monitoring, and travel time data collection.	$$$		Provincial Government
Mobility System	20	C	Partner on the Electric Automated (ELA) shuttle pilot project, evaluate results, and apply learnings to potential future pilot projects.	$	8	Private Mobility Vendors, Academic Researchers
Mobility System	21	C	Continue to partner with the University of Alberta and Government of Alberta on the Active-Aurora Connected Vehicle Test bed project.	$	5	Academic Researchers
Mobility System	22	C	Conduct a study on the feasibility of adaptive signals and connected technologies on compatible corridors.	$$$	5, 21	N/A (City-undertaking)
Mobility System	23	C	Implement the actions identified from the ETS study on how new mobility options can be used to bridge first-mile-last-mile gaps in transit service for areas of the city without fixed route transit service.	$$$	15	N/A (City-undertaking)
City Function	24	N	Establish an internal task force on smart transportation across departments within the City of Edmonton.	$		N/A (City-undertaking)
City Function	25	N	Engage other major cities across the province and country to exchange best practices and to collaborate on research and pilots.	$	5	All levels of Government
City Function	26	N	Pursue partnerships with academia, the private sector, non-profits, utilities, regional partners, and other orders of government to advance new mobility.	$		Academics, Private Sector, Non-Profit Groups, Adjacent Municipalities, All levels of Government

Focus Area	Action #	New (N) or Continuing (C) Action	Action	Order of Magnitude Cost	Dependant and Related Actions	Potential Partners to the City in Implementation
City Function	27	N	Coordinate with other orders of government and the private sector to understand cyber security and protect the personal information of people.	$		All levels of Government
City Function	28	N	Continue work on Business Continuity Planning to ensure continuity of operations during disruptions, including, but not limited to severe weather, data breaches, flooding, chemical spills, vehicle accidents, police incidents, etc. Evaluate the improvement of Buisness Continuity Planning with smart transportation technologies.	$		N/A (City-undertaking)
City Function	29	N	Incorporate a new approach when evaluating major transit infrastructure that includes - as part of the business case assessment - the costs, benefits, and other implications of connected technology with existing City infrastructure.	$	15	N/A (City-undertaking)
City Function	30	N	Assess long term user-pay and privately funded options.	$$		City, Private Sector
City Function	31	N	Develop City regulations, permits, and policies for new mobility to align with City goals.	$		N/A (City-undertaking)
City Function	32	C	Continue to explore opportunities for City vehicle-use reduction through programs and services such as carshare.	$	10	N/A (City-undertaking)
City Function	33	C	Continue to implement telematics systems on City fleet to, among other things, manage fuel consumption and optimize routes.	$$	15	N/A (City-undertaking)
City Function	34	C	Advocate with federal and provincial partners to align and establish federal and provincial policies and regulations that enable a smart transportation system.	$		All levels of Government
City Function	35	C	As part of agreements that enable mobility service providers to operate in the city, establish policies that stipulate clear data and reporting requirements in line with the City's data protocol and identified needs.	$		Private Mobility Vendors, Adjacent Municipalities