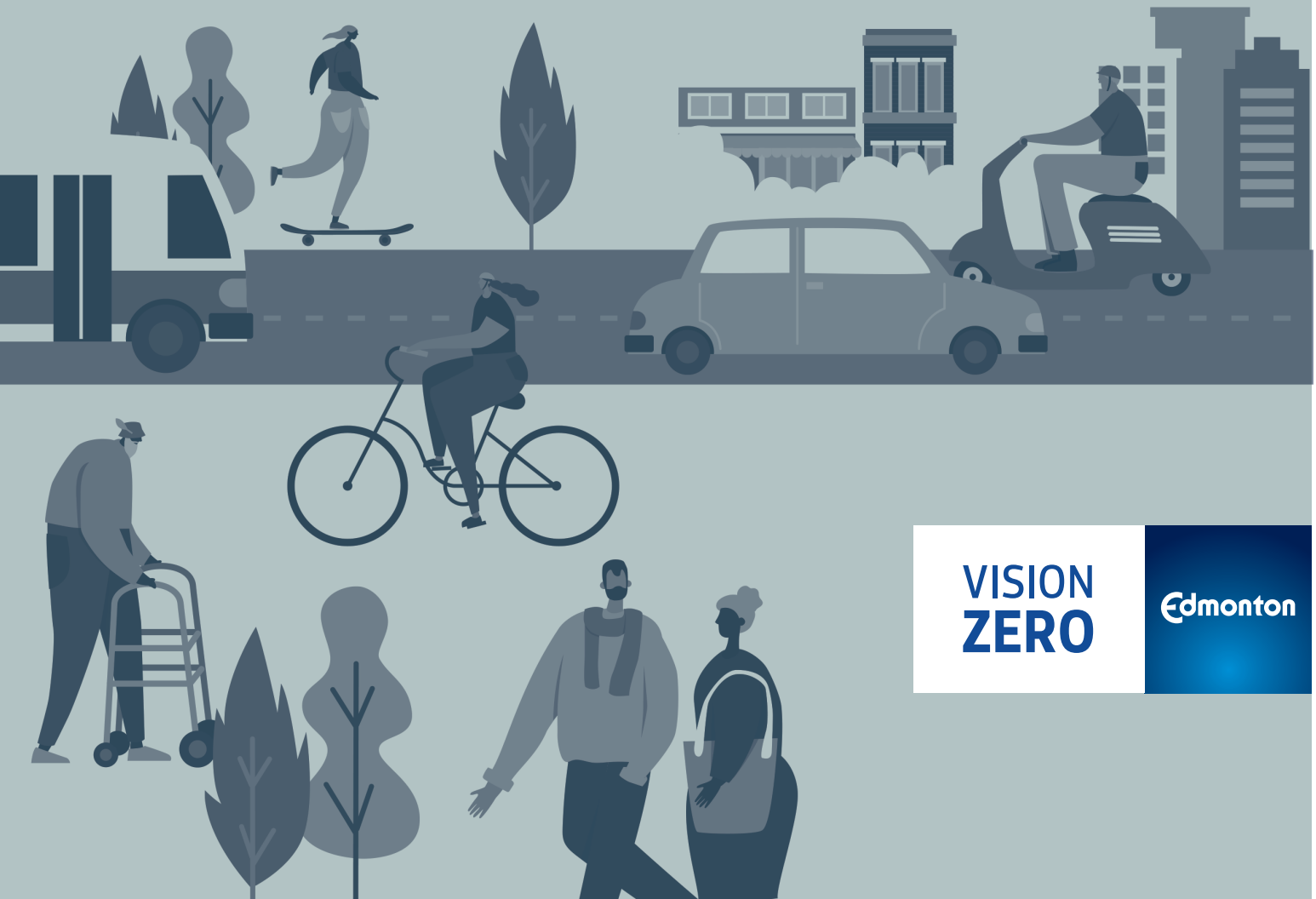
Crash and Equity Analyses Technical Report

Safe Mobility Strategy 2021–2025



VISION ZERO

Edmonton

Contents

Executive Summary

The *Safe Mobility Strategy 2021–2025* (*Safe Mobility Strategy*) is Edmonton's new approach to advancing Vision Zero. Its goal of zero traffic related fatalities and serious injuries is a key component that will help the City achieve transformational impacts in the community.

The crash and equity analyses are in line with the fifth principle of the *Safe Mobility Strategy*: "We are informed by analytics, lived experience, and research." The crash analysis showed us what types of crashes are happening and where they are happening. The equity analysis helped us to uncover disproportionate traffic safety impacts for various communities. Understanding current crash patterns and the communities who are most impacted by traffic safety issues is an important step to create a plan that will lead to meaningful change where it is needed most.

Crash Analysis

Crash analysis is one way to identify deficiencies in the transportation system that lead to fatalities and serious injuries. The analysis helps to identify levers for change that will address crash types and locations that contribute disproportionately to severe crashes.

To complete the analysis, five years of crash data (2015 to 2019) from the City of Edmonton's crash database were used. The crash data is derived from Edmonton Police Service collision reports. Each crash is geolocated and cross-referenced with infrastructure data. Common characteristics of the crashes are uncovered by summarizing data across different combinations of variables. A High Injury Network analysis also allows us to identify crash-prone corridors.

Equity Analysis

There are a number of communities that may require consideration because they experience greater mobility challenges and are more vulnerable to failures in the transportation system. Equity-seeking communities are both geographic (neighbourhoods that are impacted by the High Injury Network) and identity based (including, but not limited to, Indigenous Peoples, ethnic, linguistic, sexual and gender minorities, and people with disabilities).

The equity analysis helps to understand how different communities may experience transportation safety across Edmonton by analyzing the distribution of members of the communities across the city and evaluating access to transportation and exposure to crashes.

Main Conclusions

1. Five crash types lead to the majority of traffic fatalities and serious injuries — following too close, driving off the road, failing to yield to people who have the right of way, failing to comply with traffic signals, and turning left across the path of others
2. Crashes are concentrated disproportionately along certain arterial roads
3. Crashes are concentrated in 15 neighbourhoods and disproportionately affect low-income, Indigenous Peoples, and linguistic minorities by virtue of where they live
4. Young adults and men are more often involved and at fault in serious injury and fatal crashes
5. Multiple data limitations need to be addressed to better understand lived experience, crashes, and exposure

Introduction

The development of the *Safe Mobility Strategy* was guided by its purpose and five principles.

Purpose

Achieve Vision Zero through safe and livable streets in Edmonton.

Principles

- We all move
- We all deserve to move safely
- We are connected
- We are successful when we work together
- We are informed by analytics, lived experience, and research

The *Safe Mobility Strategy* is also a Gender-Based Analysis Plus (GBA+) pilot project for the City of Edmonton. The process aims to identify inequality and discrimination, and create solutions that work to increase traffic safety for all Edmontonians.

The crash and equity analyses support the GBA+ process by analyzing traffic safety impacts for various communities. The analyses are also in line with the fifth principle of the *Safe Mobility Strategy*: "We are informed by analytics, lived experience, and research." Understanding current crash patterns and the communities most impacted by traffic safety issues is an important step to creating meaningful change where it is most needed.

Crash Analysis

The Safe System Approach is people-centered and views human life and health as paramount to all else. A Safe System is one that accommodates and compensates for the inevitability that we, as humans, will make mistakes while navigating our streets. It focuses on the primary known causes of traffic-related crashes to reduce serious injury and fatalities by:

- Managing the forces that injure people in a crash to the level that our bodies can tolerate without serious injury
- Making the transportation system more accommodating and "forgiving" of human error
- Minimizing the amount of unsafe user behaviour

A crash analysis is one way to identify particular deficiencies in the transportation system that lead to fatalities and serious injuries. The analysis helps to identify levers for change that will address the crash types and locations that contribute disproportionately to severe crashes.

To complete the analysis, five years of crash data (2015 to 2019) from the City of Edmonton's crash database were used. Crash reports are created for any crash on public property involving a motor vehicle reported to the Edmonton Police Service where there is at least $2,000 of property damage. Each crash is geolocated and characteristics of the crash (such as pre-crash maneuvers, time of day, season) and of the people involved (such as age, gender) are recorded.

Types of Crash Analyses Performed

The quantitative crash analysis was completed using five different approaches:

1. Descriptive Analysis

This analysis is used to understand basic patterns in crash data such as modes of travel, severity, parties involved, temporal characteristics (e.g., time of day, day of year), and selected roadway characteristics (e.g., intersection vs midblock, roadway classification).

2. Human Actions

This includes analysis of behavioural causes of fatal and serious injury crashes. Behaviour occurs in response to the environment. The analysis provides a high-level understanding of these behavioural patterns and the types of crashes that require attention. *It should be noted that, due to the way the data are documented and reported, there is limited information pertaining to distraction or speeding that may have led or been a contributing factor or cause in the crash.*

3. Crash Dynamics

This includes analysis of the relative movements (for example, a person driving straight and a person making a left turn) of parties involved in crashes. Understanding the dynamics at play in each type of crash is the first step towards systemic analysis.

4. Systemic Analysis

This analysis examines crashes based on intersecting different factors of fatal and serious injury crashes to help us understand how combinations of factors may influence where serious injury and fatal crashes occur across the city.

5. High Injury Network

This analysis technique identifies the corridors in Edmonton where there are higher numbers of fatal and serious injury crashes. It shifts the attention away from individual crash sites and onto systemic safety issues that are repeated along certain roads. The analysis has been conducted for each mode of transportation.

Methodology

The descriptive analysis simply breaks down and summarizes the crash data to uncover basic patterns. The next three types of crash analyses listed above are obtained by combining crash report data with information about the types of infrastructure that exist at each location. The combined datasets are cross-tabulated and summarized using various combinations of variables to identify common crash characteristics.

The methodology to identify the High Injury Network is more complex and reflects the portions of the network with the highest density of high severity crashes for each mode. To calculate the density of high severity crashes, the street network is divided into 1-km segments. Once these street segments are identified, crashes are associated with segments based on if the crash occurred within the segment. The total number of crashes associated with each segment is then tabulated by severity and mode.

The High Injury Network focuses on fatal and serious injury crashes. However, especially for less frequently used modes, a high frequency of minor injury crashes can indicate the propensity for fatal and serious injury crashes to occur in the future. To derive this benefit while keeping focused on addressing fatal and serious injury crashes, all injury crashes are included in the analysis, but fatal and serious injury crashes are given a higher weight. For instance, if a weight of 10 were selected, 10 minor injury crashes would have to occur within a given segment to achieve the same level priority as if one fatal or serious injury crash occurred.

With a weight selected for each mode, the final step is to identify a cut-off threshold for inclusion of a given street section in the High Injury Network. The goal of this process is to identify a manageable subset of the network to prioritize for implementing safety improvements. Based on Edmonton data and sensitivity analysis, the following weights and thresholds are used for the High Injury Networks:

Mode	Weight	Threshold
Pedestrian	5	20
Bicycle	3	6
Motorcycle	5	8
Motor Vehicle	10	80

Limitations of the Crash Analysis

The crash analysis has some important limitations that must be considered as they affect the overall understanding of crashes in Edmonton. Three main limitations affect the crash analysis: crash reporting gaps, lack of exposure data, and lack of qualitative data.

Crash Reporting Gaps

As noted above, crash data comes from police reports and are only created if a motor vehicle was involved, if the crash was reported to to the Edmonton Police Service, and if there was at least $2,000 of damage. As such, there is a gap in the data for crashes that do not involve a motor vehicle. For example, if a person walking was struck by an e-scooter rider and sustained injuries, or if a person riding their bicycle hit a pothole, fell off their bike, and sustained injuries, these crashes would not be reflected in the data.

The crash data also misses unreported crashes and near-crash events or non-injury crashes. When crashes are included in the database, there is typically limited socio-demographic data collected, which limits the ability to identify people and communities that are more likely to sustain fatal or serious injuries while moving around Edmonton.

Understanding Exposure

Exposure to traffic is an important determinant of the likelihood of being involved in a crash. Although the relationship is not linear, a higher volume of traffic typically translates to a higher number of crashes. Higher travelling speeds also translate to a higher likelihood of crashes happening, and when they do occur, speed increases the severity of the injuries sustained.

Currently, the City has limited data on walking and biking volumes. Multimodal traffic counts are often triggered by complaints or special projects and are therefore not collected in a systematic fashion. Similarly, speed surveys are also often conducted based on complaints or collected regularly at a limited number of locations in Edmonton.

Finally, the City does not have comprehensive data on the location of existing infrastructure. For example, if a sidewalk is missing on a given road, it increases the exposure of people walking. Knowing where infrastructure is currently located and the quality of that infrastructure is essential to understand exposure.

Lack of Qualitative Data

Crash data can only provide so much information. There are safety effects that can only be identified through lived experience. The City of Edmonton's 311 service and other tools can provide some of that information based on information provided by Edmontonians. This information can help identify locations and areas of concern not currently captured, but these tools have their own limitations:

- There are missing voices: not everyone knows the tools exist and not everyone can or wants to use them
- Issues are not always logged consistently in the same way or using the same wording over time by those who do use the tools
- These tools, by their nature, focus on complaints or requests

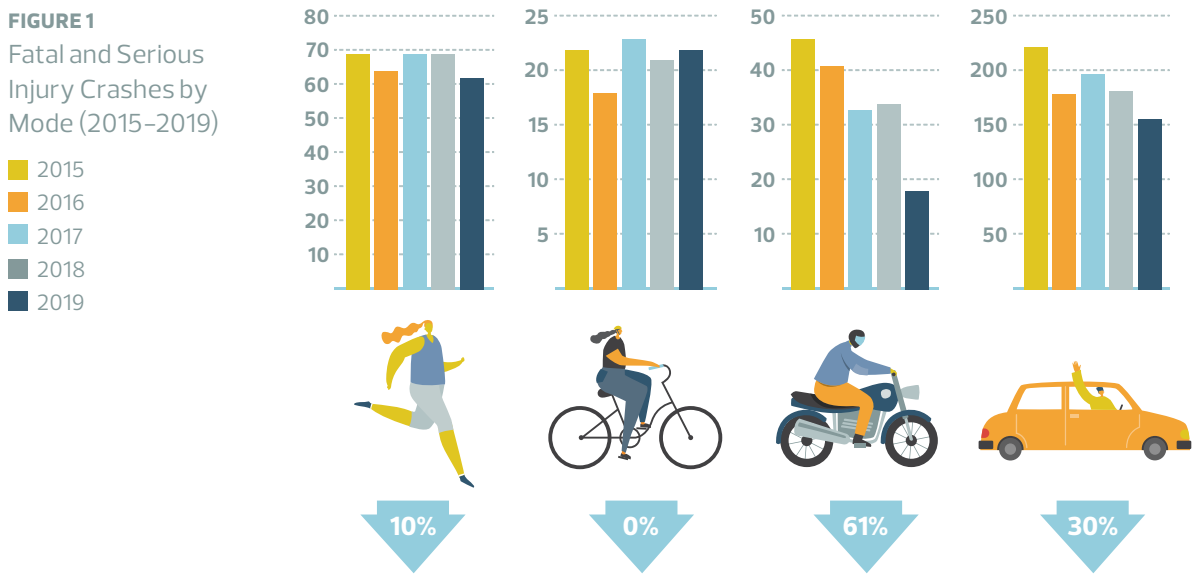
During the development of the *Safe Mobility Strategy*, engagement activities provided an opportunity to gather lived-experience data. Findings from these engagement activities are summarized in the What We Heard report for Phase 1 engagement. Implementation of the *Safe Mobility Strategy*, including scoping and delivery of traffic safety projects and programs, will continue to incorporate lived experiences to supplement quantitative data with qualitative data.

Crash Analysis: Findings

FINDING ONE: Progress has been made to decrease fatal and serious injury crashes in the past 5 years, but it is not equal for all modes.

Motorcycle and motor vehicle crashes have decreased 61% and 30%, respectively, from 2015 to 2019, while crashes involving people walking have only slightly decreased (10%) and crashes involving people cycling have remained unchanged.

FIGURE 1
Fatal and Serious Injury Crashes by Mode (2015–2019)



The notable decrease in motorcycle and motor vehicle crashes may be attributed to safety countermeasures that were deployed as part of the *Edmonton Road Safety Strategy 2016–2020*. These included targeting deployment of engineering countermeasures at intersections, such as installing high visibility backplates on signals and protected left turn phasing. Enforcement countermeasures were also deployed, such as the installation of intersection safety cameras at 55 intersections to enforce speeding and red-light running.

The stable number of serious and fatal injuries sustained by people walking and cycling must be considered with caution since exposure data is limited. For example, between 2015 and 2019, the Downtown Bike Network and many other protected bike lanes were built, creating a resurgence of interest in cycling and significant growth in bicycle trips. Anecdotal evidence suggests more people are cycling on Edmonton streets, and the limited number of locations where counting equipment is installed confirms this. If more people are cycling, a stable number of crashes rather than an increase should in fact be considered a positive outcome. Without extensive city-wide data on cycling volumes, it is hard to draw clear conclusions.

Bicycle use is increasing across Edmonton and, notably, where all ages and abilities bike routes have been installed

Edmonton's active transportation network has been expanding. Through Neighbourhood Renewal, Arterial Renewal, Complete Streets, and the Active Transportation Capital Programs, sidewalks, bus stops, curb ramps, shared-use paths, and protected bike lanes have been added to neighbourhood and arterial streets. Specific projects have also been used to fill significant gaps and barriers to walking and cycling, including the Downtown Bike Network, Terwillegar Park Bridge, and the Valley Line LRT. All of these investments are improving the connectivity, safety, comfort, and ease of travelling on foot and by bicycle and that is paying dividends by increasing the number of trips being made by bike and the health, environment, economic, and livability benefits that come with it.

Since 2005, daily bike trips have increased by

100%

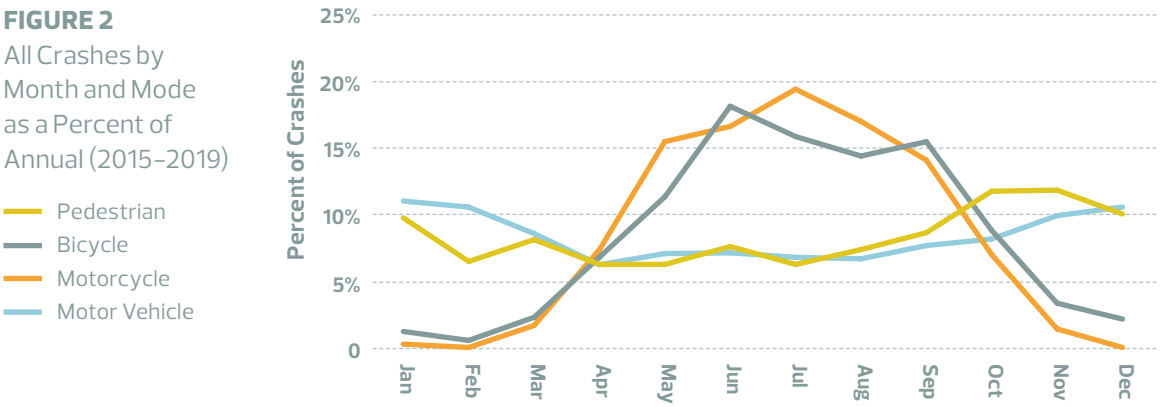
(25,300 in 2005 and 54,800 in 2015)

Household Travel Survey

FINDING TWO: 50% of all crashes occur in the five months between October and February.

Seasonality influences crashes in Edmonton, with winter conditions and lighting important factors of crash risk. When considering all crashes, regardless of severity, clear seasonal trends can be observed.

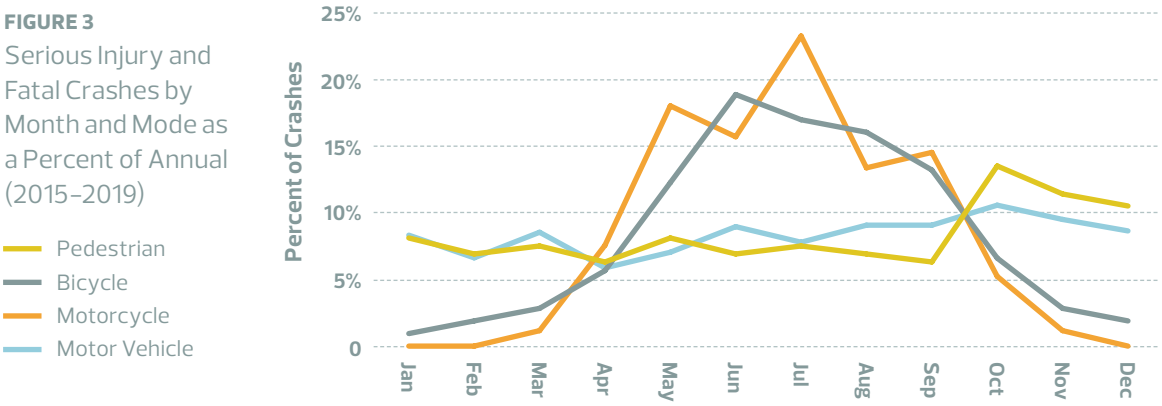
FIGURE 2
All Crashes by Month and Mode as a Percent of Annual (2015–2019)



Crashes involving people cycling or riding motorcycles are concentrated between May and September because these modes are used more in warmer months. The opposite trend is true for crashes with peoples walking or driving motor vehicles – more crashes occur during winter months. For people walking, the most crash-prone months are October and November when shorter days and changes to sunlight reduce visibility, and winter conditions start to appear.

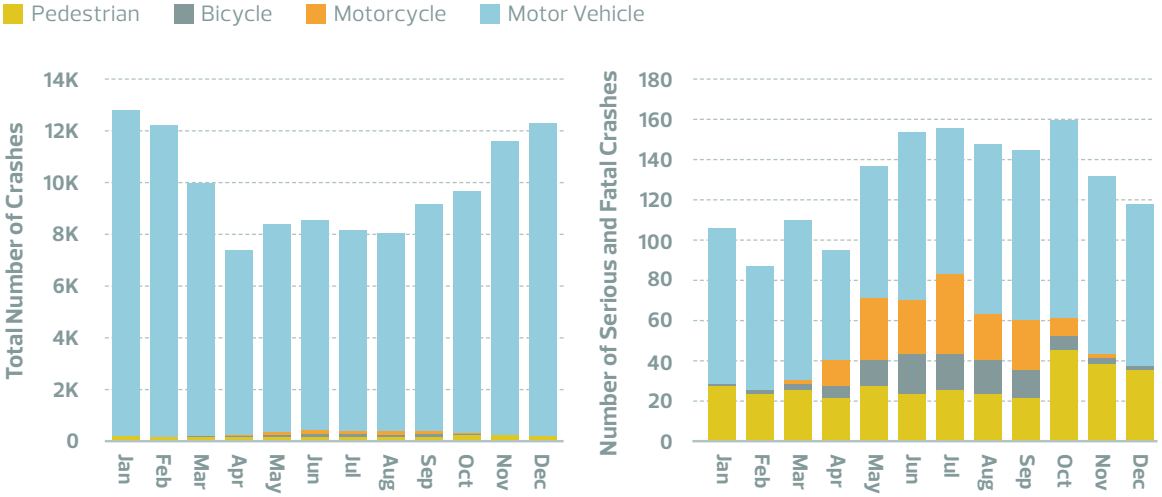
Similar trends for serious injury and fatal crashes are present, although October emerges as the month most prone to crashes for people walking (13.5% of yearly serious injury and fatal crashes) and driving (10.5% of yearly serious injury and fatal crashes).

FIGURE 3
Serious Injury and Fatal Crashes by Month and Mode as a Percent of Annual (2015–2019)



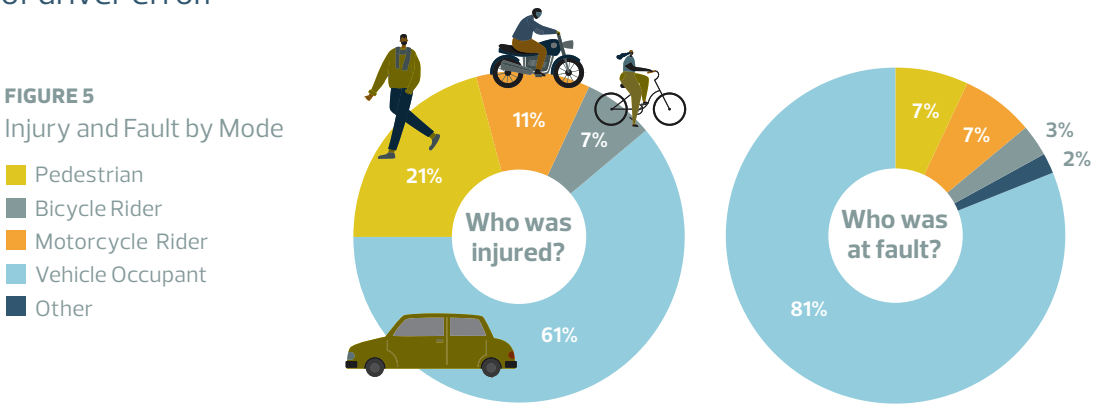
Another way to review seasonal crash patterns is to look at the total number of crashes instead of crashes per month as a percentage of the annual crashes. The following figure illustrates the number of crashes by mode per month and the variation that occurs throughout the year. While the total number of crashes is highest in the winter months, the highest number of fatal and serious injury crashes occur in non-winter months. In other words, while total crashes increase in winter, the surge in crashes does not lead to more fatal and serious injuries, rather resulting in more minor injuries and property damage only.

FIGURE 4
Number of Crashes by Month and Mode (2015–2019)



FINDING THREE: 80% of all fatal and serious injury crashes are the result of driver error.

FIGURE 5
Injury and Fault by Mode



This finding may appear to be assigning blame to drivers, but it actually illustrates that the transportation system is not forgiving of driver errors. Driver or not, everybody makes mistakes. However, the risks are not borne evenly between people travelling using different modes.

Motor vehicles are designed to absorb energy to protect their occupants. They are not designed well to absorb impacts or protect people outside the vehicle. Crashes involving people walking, biking, and motorcycling represent less than 3% of all crashes (fatal, serious injury, minor injury, property damage). From the above figure, people walking, biking, and motorcycling are severely injured in 39% of crashes that result in serious or fatal injuries, which is significantly more than the proportion of the total number of crashes (i.e., 3%). This illustrates the vulnerability of people when travelling outside a motor vehicle.

Human Vulnerability

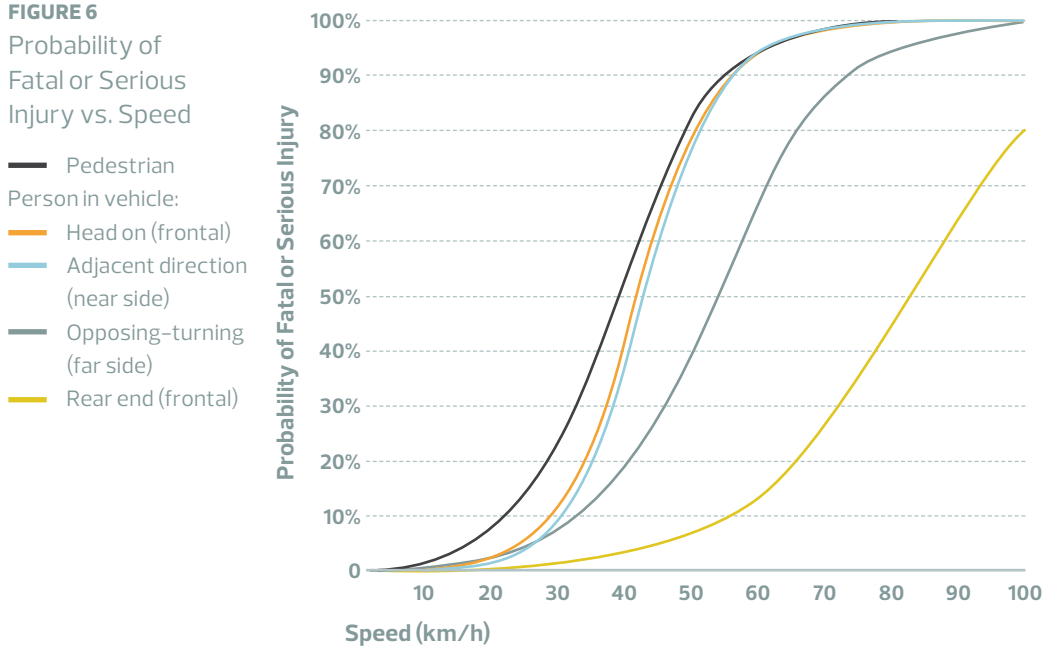
The vulnerability of the human body to injury has been well-researched. The Abbreviated Injury Scale is used to classify and describe the severity of injuries and was developed for the Society of Automotive Engineers in 1969. The six-point scale is depicted below and scores of 3 or higher are used in the Safe System approach as they represent the serious injury to fatal crashes.

Abbreviated Injury Scale	Severity of Injury	Type of Injury
1	Minor	Superficial
2	Moderate	Reversible injuries; medical attention required
3	Serious	Reversible injuries; hospitalization required
4	Severe	Life threatening; not fully recoverable without care
5	Critical	Non-reversible injury; not fully recoverable even with medical care
6	Maximum	Fatal

The scale is used to inform the design of roads and intersections as well as the design of vehicles to create a system that considers the vulnerability of the human body during different types of potential crashes.[1] In crashes involving people walking and cycling, people are extremely vulnerable to the kinetic energy that is passed onto them when struck by a motor vehicle because they are unprotected. People can tolerate crashes at higher speeds when travelling inside vehicles because vehicles are designed to absorb kinetic energy during crashes through the design of crumple zones and due to the structure and frame of the vehicle. Transport Canada[2] has safety standards for motor vehicles. Crash tests for frontal and side impacts performed by the National Highway Traffic Safety Association[3] and the Insurance Institute for Highway Safety[4] are used to evaluate and rate manufactured vehicles based on their safety performance.

The following figure illustrates the probability of a fatal or serious injury collision for different types of crashes at different speeds.[5] The vertical axis represents an increasing probability of a serious injury or fatality when struck by a vehicle driven at increasing speeds, which is indicated along the horizontal axis. Each line in the figure is for a different type of crash including for a person walking/cycling (i.e., Pedestrian), a person driving that is struck from the side (i.e., Adjacent direction and Opposing-turning), a person driving that is struck in the front (i.e., Head-on), and a person driving struck from behind (i.e., Rear-end).

FIGURE 6
Probability of Fatal or Serious Injury vs. Speed



1 Jurewicz C et al. Exploration of vehicle impact speed – injury severity relationships for application in safer road design. Transportation Research Procedia, 2016, 14:4247–4256.

2 https://www.tc.gc.ca/en/services/road/safety-standards-vehicles-tires-child-car-seats/safety-standards-vehicles.html

3 https://www.nhtsa.gov/ratings

4 https://www.iihs.org/ratings/about-our-tests#frontal-crash-tests

5 Jurewicz C et al. Exploration of vehicle impact speed – injury severity relationships for application in safer road design. Transportation Research Procedia, 2016, 14:4247–4256.

It is also important to note that the age of a person also changes the risk of injury or death. Research shows that a 70-year-old person struck by a person driving a vehicle at any given speed has a similar risk of death as that of a 30-year-old person struck at a speed of about 20 km/h more.[6] From the figure, fatality or serious injury for all potential crash types decreases as the speed of the crash decreases, with crashes that involve only vehicles leading to a lower probability of serious injury or death at higher speeds than when the crash involves a person walking.

The critical impact speed for each crash type can be defined using the figure, from research findings, and from practices used in The Netherlands and Sweden in support of Vision Zero as outlined in the following table.[7] The design of streets and the speed of these streets have a significant role in reducing serious injury and fatal crashes by limiting travel to speeds that the human body can tolerate. However, improved design and regulation of vehicles is required to get to zero.

Road Type and Usage	Safe Speed (km/h)
Roads with possible conflicts between motor vehicles and people walking or cycling	30 or less
Intersections with possible side impact conflicts between motor vehicles	50 or less
Roads with possible frontal conflicts between motor vehicles	70 or less
Roads with no possible frontal or side impact conflicts (only impact with infrastructure or rear-end, such as a freeway)	≥ 100

6 Tefft, B C. Impact speed and a pedestrian's risk of severe injury or death. Accident Analysis and Prevention, 2013, 50:871–878.

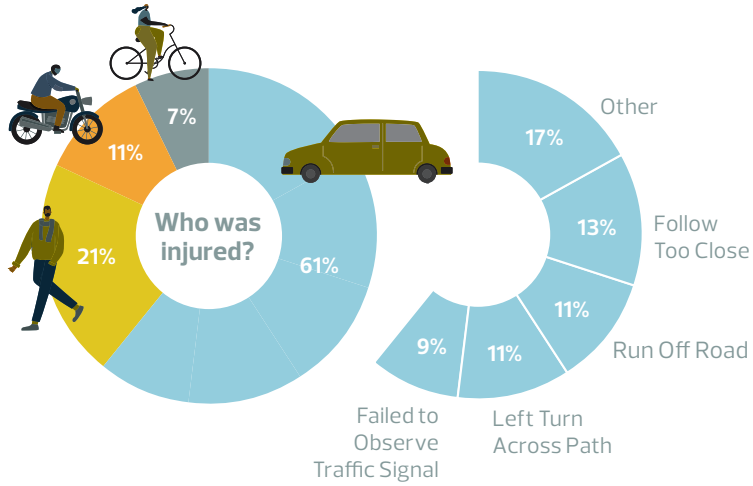
7 Jurewicz C et al. Exploration of vehicle impact speed – injury severity relationships for application in safer road design. Transportation Research Procedia, 2016, 14:4247–4256.
Tingcall C et al. Vision Zero – An ethical approach to safety and mobility. Presented at the 6th ITE International Conference Road Safety & Traffic Enforcement: Beyond 2000, Melbourne, 1999.
Wegman F et al. Advancing Sustainable Safety: National Road Safety Outlook for 2005-2020. The Hague, SWOV, 2006.
Wramborg P. The New Approach to Traffic Planning and Street Design – Growth, Account and Implementation. Presented at Road Safety on Three Continents Conference, Moscow, 2001.

While occupants of motor vehicles are protected by the safety features included in the vehicle design, they can still sustain serious injury or fatal injuries.

FIGURE 7
Motor Vehicle Collision Causes

- Pedestrian
- Bicycle Rider
- Motorcycle Rider
- Vehicle Occupant

The chart on the left shows who was injured in each collision. The chart on the right hand side breaks down what contributes to each crash where a driver is at fault.

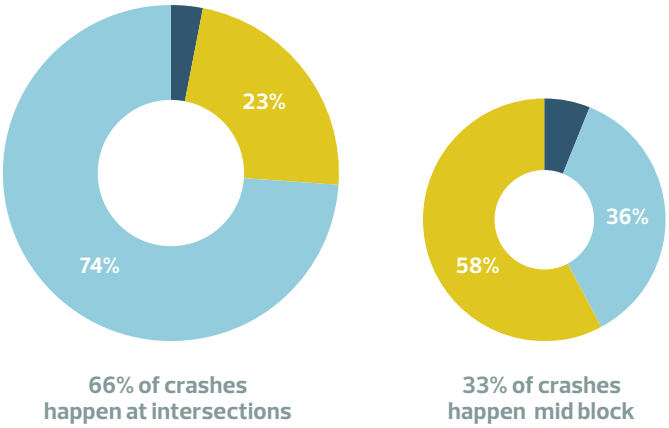


Many of these crash causes can be partially mitigated through engineering measures, but driver behaviour is also a factor. Behaviours such as aggressive or distracted driving and speeding contribute to the likelihood and severity of crashes. These types of behaviours are not well captured in crash data.

FINDING FOUR: At intersections, 74% of fatal and serious injury crashes involving a person walking are caused by drivers failing to yield.

FIGURE 8
Fatal and Serious Injury Crashes Involving a Person Walking and Right of Way

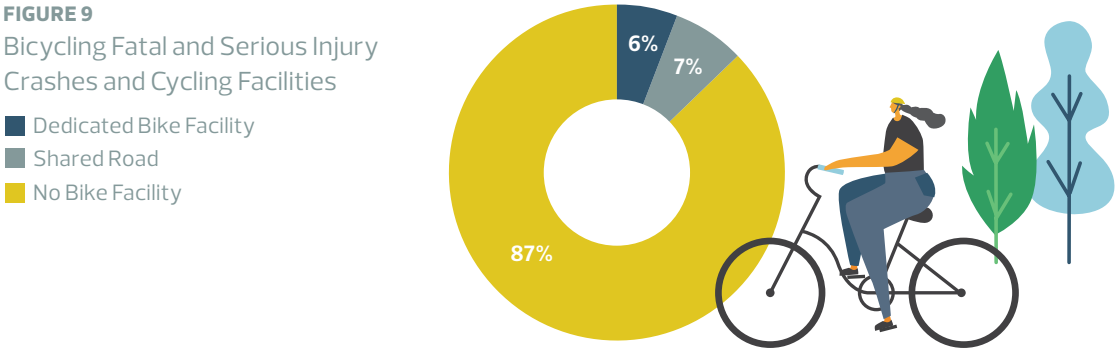
- Failed to Yield to a Pedestrian
- Pedestrian Error
- Other



Approximately two out of every three crashes that involve a person walking happen at an intersection. As shown in the figure above, in 74% of these crashes, the person crossing the intersection had the right of way when they were struck by the vehicle driver. In most cases, crashes with a person walking at intersections involve the person driving making a left or right turn at a signalized intersection, with left turns being more prevalent.

FINDING FIVE: 87% of bicycling fatal and serious injury crashes occur on streets without bike facilities.

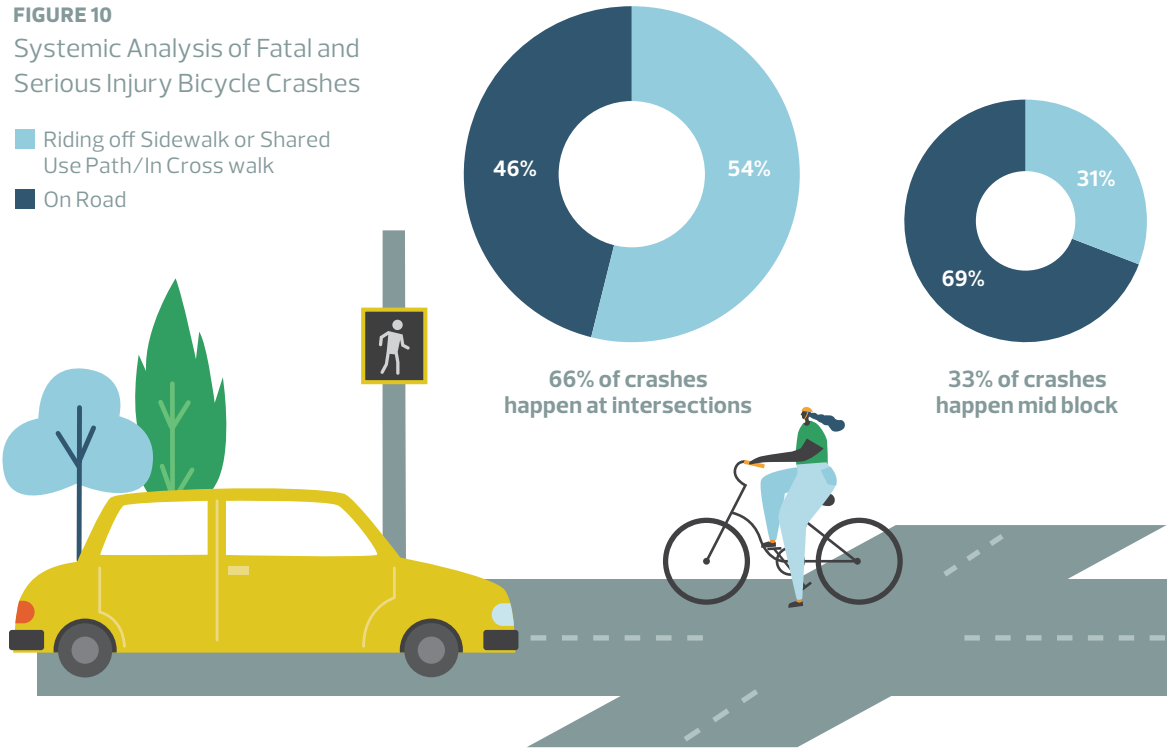
FIGURE 9
Bicycling Fatal and Serious Injury Crashes and Cycling Facilities



The implications of this finding are not straightforward. More data regarding exposure is required to understand the relative crash risk of cycling on streets with and without facilities. While only a fraction of city streets have bicycle facilities, it can also be reasonably expected that more people would cycle where infrastructure is provided. This assumption is based on experience in Edmonton and from research studies and industry best practices. Without comprehensive cycling volume data, it is not possible to fully understand crash risk.

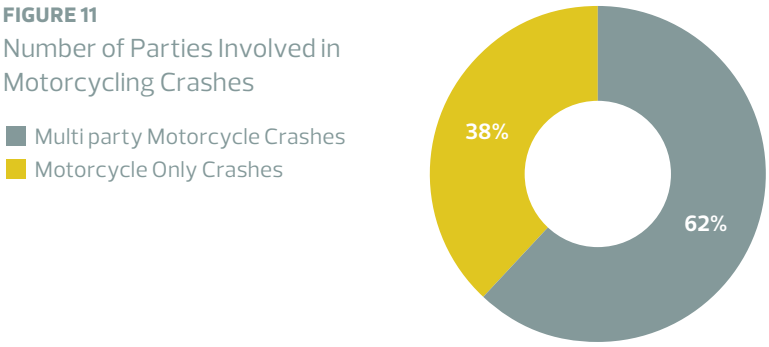
As shown in the following figure, like crashes involving a person walking, about two thirds of crashes involving a person cycling occur at intersections. Of these, about half of the crashes happen when the person cycling is in the crosswalk that connects to a shared-use path or sidewalk and the other half are on the road surface that connect to on-street bike lanes, protected bike lanes, or in a lane that is shared with motor vehicles. A common crash dynamic involves a driver making a turn in front of a person cycling off a sidewalk or shared-use path to cross through the intersection.

FIGURE 10
Systemic Analysis of Fatal and Serious Injury Bicycle Crashes



FINDING SIX: 38% of fatal and serious injury motorcycle crashes are single-vehicle crashes.

FIGURE 11
Number of Parties Involved in Motorcycling Crashes



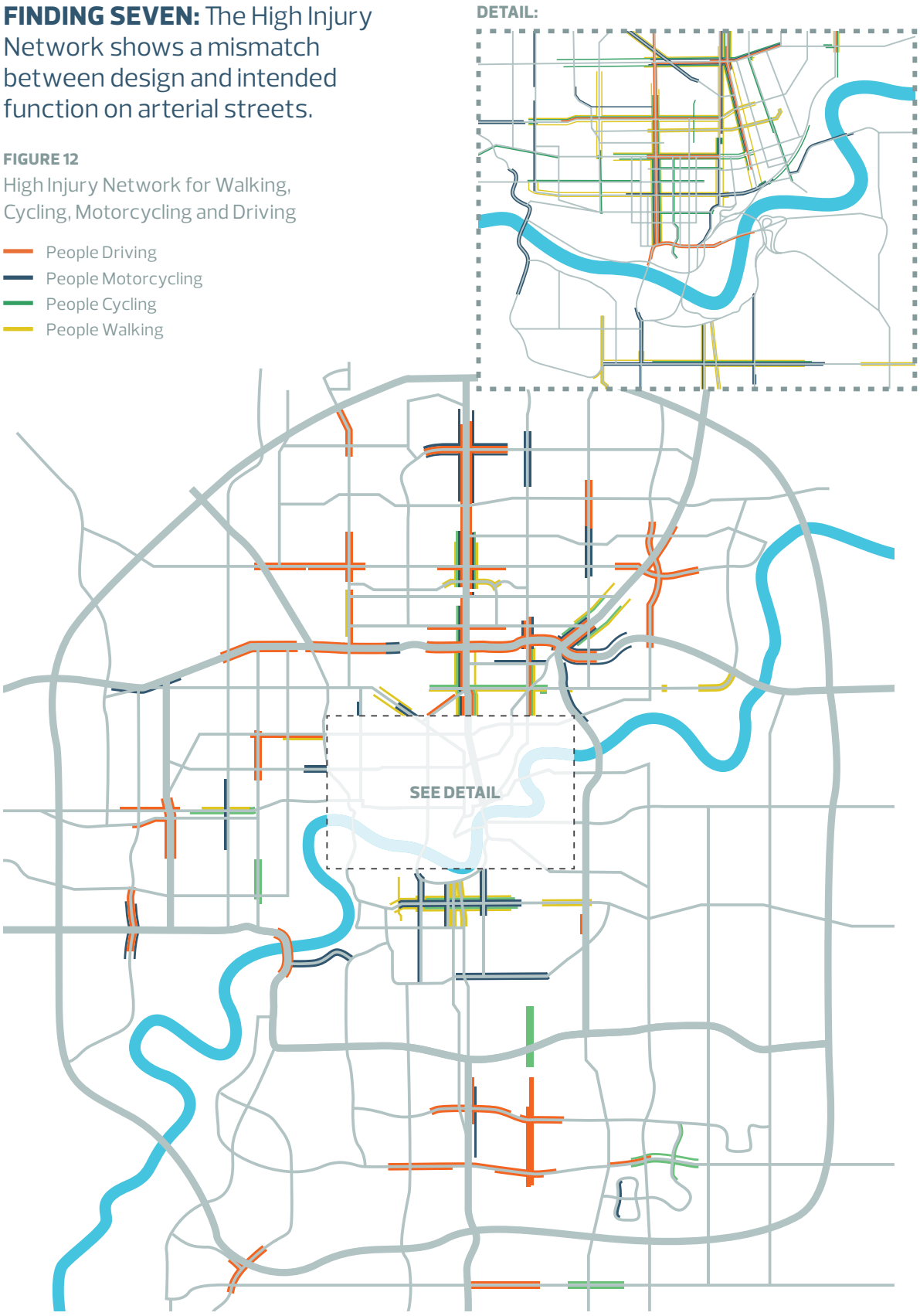
Crash dynamics for motorcycle crashes differ markedly from other modes. Single-vehicle crashes are particularly prevalent, comprising 38% of all fatal and serious injury motorcycle crashes. The single party motorcycle crashes include riders hitting objects, running off the road, or falling off their motorcycle. As a comparison, single vehicle crashes for motor vehicles represent 16% of all fatal and serious injury crashes. The second most prevalent crash type involving motorcycles is left turns across the path of motorcycle riders when the rider is travelling straight.

Motorcycle riders are considered "vulnerable road users" because of the lack of physical protection offered by the vehicle. That factor, combined with the ability to travel at high speeds, means the consequences of a crash are often serious. Road design and behaviour have a role to play to limit speed, but other factors such as road maintenance are also important to reduce single-party crashes by motorcycle riders.

FINDING SEVEN: The High Injury Network shows a mismatch between design and intended function on arterial streets.

FIGURE 12

High Injury Network for Walking, Cycling, Motorcycling and Driving



The High Injury Network for each mode (walking, cycling, motorcycling, and driving) is shown in the maps above. Arterial streets are prominent in all the High Injury Networks. Some arterial streets are on the High Injury Networks for all modes. City centre streets are more prevalent on the High Injury Networks for active modes of transportation, while for driving and motorcycling, arterial streets identified in the analysis are located throughout the city.

The review of the High Injury Network for each mode highlights the disconnect between the design and operation of these streets and their intended function. On many of these arterial streets, the design does not reflect the likelihood of human error and allows crashes to occur. When an error occurs, the travel speed permitted by the street design means the impact of the crash is more likely to result in fatal or serious injury.

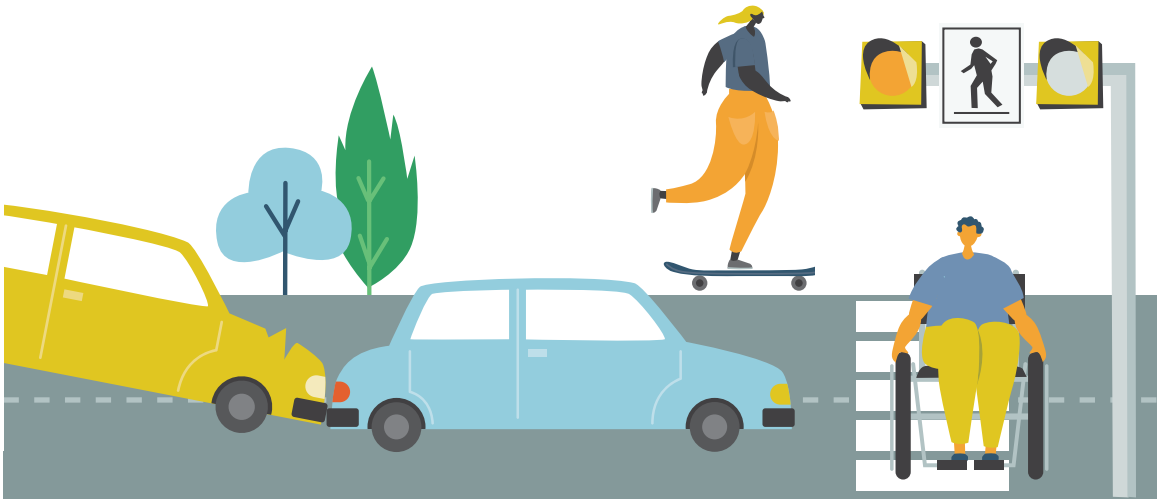
It is also important to note the street design conditions present along the High Injury Network exist elsewhere in Edmonton. While crashes may have not yet occurred at these locations due to chance, there is a need to take a proactive and systematic approach to addressing design and operational issues across the city to realize Vision Zero.

Crash Analysis: Conclusions

Overall, the five crash types that occur most frequently in Edmonton and lead to fatalities and serious injuries are when drivers:

- Don't yield to people who have the right of way
- Follow too closely
- Turn left across the path of others
- Drive off the road
- Run red lights and fail to comply with traffic signals

Crashes occur throughout Edmonton, but some streets, typically arterials, are more prone to crashes than others. These findings highlight the need to improve street design and operation, while also addressing behaviour issues that may be contributing to serious and fatal injury crashes. These aspects will be addressed in the *Safe Mobility Strategy*.



Equity Analysis

There is an expectation that public goods, such as access to safe and comfortable infrastructure that allows people to walk, bike, take transit, or drive to their desired destinations, will be distributed in a manner that benefits and provides equal opportunity to all. There are, however, people who experience disadvantage and marginalization, resulting in disproportionately negative impacts of the transportation system. When communities experience limitations of the transportation system, we have a case of "transportation poverty."

Transportation poverty is the combination of transportation disadvantage and sociodemographic disadvantage that limits accessibility and social inclusion. It accounts for the disparate impacts of the existing transportation system as well as the demographic factors that can lead to disproportionate burdens. An equitable transportation system allows all people within the system to reach their desired destination safely and with a comparable level of efficiency and ease. Exclusion from, or limited access to, a safe and effective transportation system creates transportation disadvantage.

There are a number of populations that may require consideration because they experience greater mobility challenges and are more vulnerable to failures in the transportation system. The Edmonton Community Foundation lists groups they consider Equity-Seeking Communities. These include:

- Indigenous Peoples
- Ethnic minorities
- Linguistic minorities
- Sexual and gender minorities
- People with disabilities

The equity analysis helps to understand how different populations may experience transportation safety across Edmonton.

Types of Equity Analyses Performed

The equity analysis was completed using four different approaches:

1. **Demographics Analysis**

   This analysis identifies vulnerable populations and maps the distribution of those vulnerable populations across Edmonton.

2. **Transportation Access Analysis**

   This analysis evaluates access to mobility options such as the bike network, bus network, and road network for different communities. It is centered on accessibility rather than safety, which plays a supporting role in safe mobility.

3. Safety Risks Analysis

This analysis builds on the demographics analysis and the crash analysis. Evaluated at the neighbourhood level, the analysis uncovers how different communities are exposed to crash risk within their home neighbourhood.

4. Crash Demographics Analysis

This analysis is centered on the people directly involved in crashes to identify potential trends in the people who are injured during crashes.

Methodology

The demographics analysis relied on municipal and federal census data which was mapped by postal code or neighbourhood depending on data availability.

This data was used in the safety risks analysis by comparing neighbourhood demographics with the number of fatal and serious injury crashes that occurred in each neighbourhood during the period of 2015 to 2019. By comparing the distribution of Edmonton's population with the distribution of each equity-seeking community in each neighbourhood, it is possible to identify communities that are disproportionately impacted by traffic safety issues.

Finally, the crash demographics analysis uses the crash report data described in the Crash Analysis section to identify populations that are disproportionately involved in and are victims of crashes.

Limitations of the Equity Analysis

Lack of Data and Granularity

The census data used in the analysis included Indigenous Peoples, visible minorities[8], and non-official language speakers (i.e., non-English and non-French speakers). Unfortunately, data were not available about ability/disability or sexual and gender minorities. There are other populations that may have disproportionate transportation burdens including immigrant households, youth, older adults, people with limited educational attainment, and people with low incomes and those experiencing unemployment. These populations were included in the analysis using the available census data. People travelling with young children, shift workers, single-headed households, and people experiencing homelessness may face additional barriers to the transportation system as well. However, data were not available to examine impacts on these populations.

While in some cases data was available at the postal code level, this was not the case for all variables and data aggregation at the neighbourhood level was necessary. Aggregating data over larger geographical areas can mask important disparities between different areas of a neighbourhood.

Finally, the crash reports include minimal demographic information: only age and gender (limited to male and female) are recorded, limiting the ability to evaluate crash risk and impact across different demographic groups.

8 "Visible minority" is a term used by Statistics Canada. "Racialized communities" is another way to refer to groups of people who may receive unequal treatment (intentional or not) based on perceived physical characteristics, such as skin colour or race.

Quantitative Data Limitations for Equity Analysis

The needs of different communities may differ and the challenges for any given community cannot be captured comprehensively with quantitative data. In addition to this quantitative analysis, meaningful public engagement is needed to understand how different people experience the transportation system including those that are and are not represented in the equity analysis.

Engagement activities undertaken as part of development of the *Safe Mobility Strategy* specifically sought to identify missing voices and engage with communities that may experience negative transportation impacts. Building relationships with communities is an ongoing process.

Equity Analysis: Findings

FINDING ONE: There are 15 particularly crash-prone neighbourhoods in Edmonton.

FIGURE 13
High Crash Neighbourhoods

High crash neighbourhoods were identified as those where 10% of Edmonton's population lives and experiences the highest number of crashes. This translates to 15 neighbourhoods where 23 or more serious injury or fatal crashes occurred in 2015 to 2019. Identifying high-crash neighbourhoods is an important first step to understanding potential differences in crash risk that we face.

FINDING TWO: Low-Income Households, Indigenous Peoples, and Linguistic minorities are exposed to higher numbers of fatal and serious injury crashes by virtue of where they live in Edmonton.

10% of Edmontonians live in a high-crash neighbourhood. If exposure to crashes was distributed equally, 10% of different equity-seeking communities would also live in these high-crash neighbourhoods. This is not the case:

- 20% of low-income households live in a high-crash neighbourhood
- In contrast, 7% of high-income households live in a high-crash neighbourhood
- 13% of people who identify as Indigenous live in a high-crash neighbourhood
- 14% of people who primarily speak a language other than English or French at home live in a high-crash neighbourhood

Neighbourhoods are relatively large areas and analyzing demographic data at this level can lead to generalizations. For example, when analyzing more detailed income data by postal code, it becomes apparent that within high-crash neighbourhoods, low-income households tend to be located closer to arterial roads, such as 107 Avenue, Whyte Avenue, 124 Street, and 156 Street, which is a street type that was identified as being higher risk in the crash analysis.

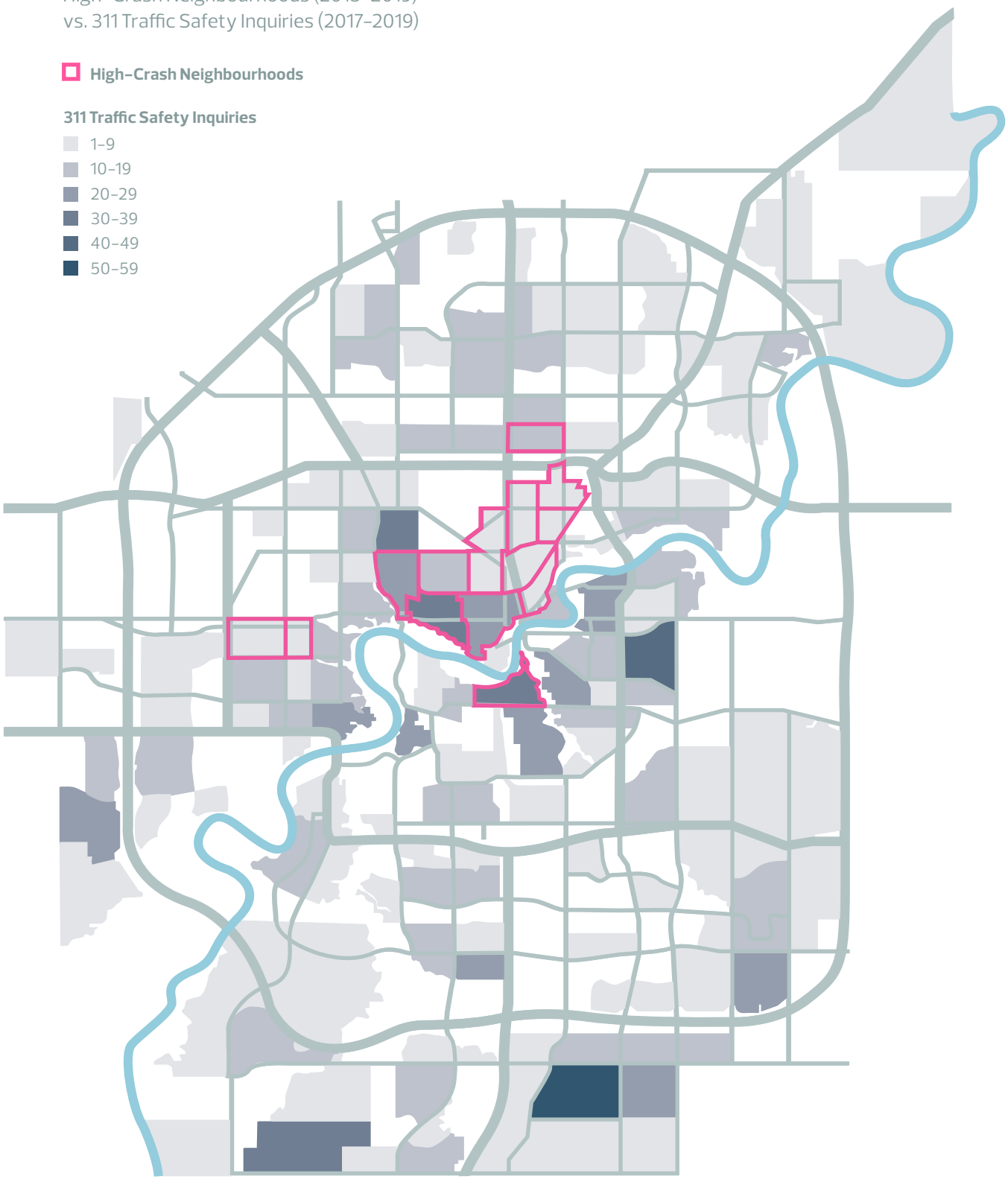
FINDING THREE: Reported public concerns and complaints do not match high-crash neighbourhoods.

Edmontonians can make traffic safety inquiries through 311. The City responds to these inquiries with additional review, analysis, and implementation of safety measures. When comparing the volume of traffic safety inquiries received from different neighbourhoods with high-crash neighbourhoods, it was found that neighbourhoods with high numbers of inquiries were typically not the high-crash neighbourhoods that we have identified. By relying solely on inquiries to direct interventions, the City's efforts focus on neighbourhoods that are not experiencing the highest risk. This has resulted in an inequitable distribution of resources and interventions.

Neighbourhoods where high numbers of 311 inquiries do overlap with high-crash neighbourhoods occur in mixed-use communities where there are higher population or employment densities as well as street-oriented retail corridors. Examples include the Strathcona neighbourhood with Whyte Avenue, 99 Street, and 109 Street and the Oliver and Downtown neighbourhoods with Jasper Avenue, 104 Avenue, 109 Street, 97 Street, and 124 Street.

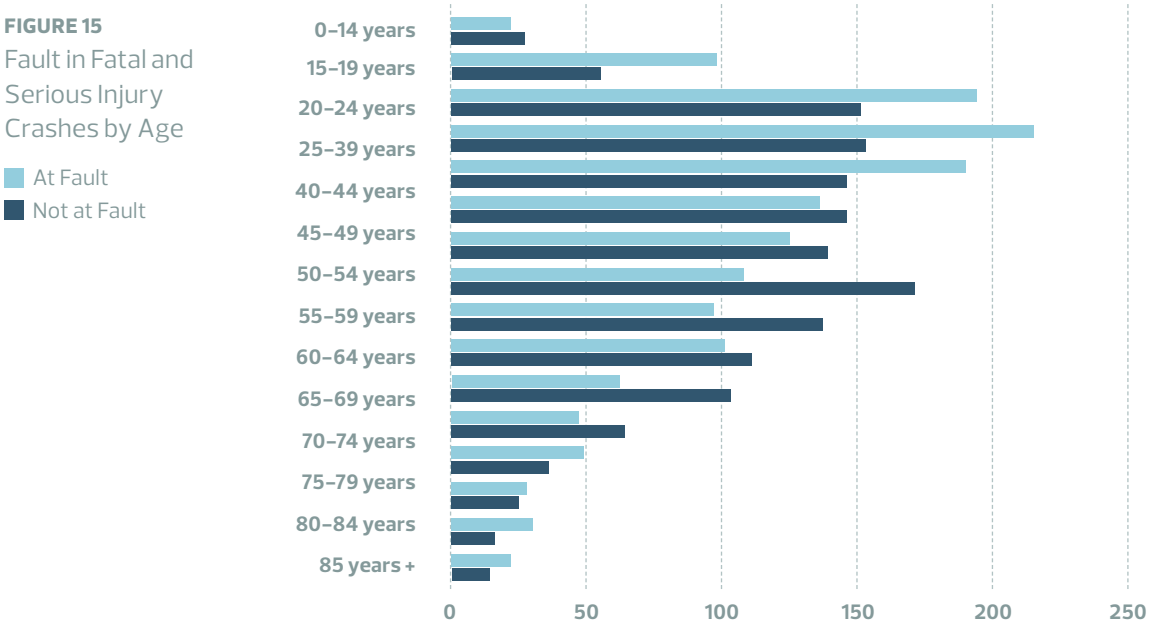
FIGURE 14

High-Crash Neighbourhoods (2015–2019)
vs. 311 Traffic Safety Inquiries (2017–2019)



FINDING FOUR: 15 to 34-year-olds are the party at fault in 46% of all fatal and serious injury crashes.

FIGURE 15
Fault in Fatal and Serious Injury Crashes by Age



15 to 34-year-olds only represent 31% of the Edmonton population, but they are involved in 40% of all fatal and serious injury crashes, and are injured themselves in 39% of those crashes. They are at fault in 46% of fatal and serious injury crashes. This finding speaks to a need for culture change around traffic safety and education, particularly for young men. Nearly two thirds (63%) of those injured in serious injury and fatal crashes are men, and men are at-fault in 64% of fatal and serious injury crashes.

Equity Analysis: Conclusions

Overall, the equity analysis identified geographic and identify-based communities that have been disproportionately impacted by traffic safety issues:

- 15 neighbourhoods are exposed to the highest number of crashes in Edmonton.
- Low-income households, Indigenous Peoples and linguistic minorities were found to be disproportionately exposed to crash risk by virtue of where they live.
- Due to current processes that rely on inquiries to direct traffic safety interventions, neighbourhoods that are currently more prone to crashes may not receive the attention their streets require.
- Young adults and men are involved in serious injury and fatal crashes at a disproportionate rate.
- There is a need for ongoing engagement and relationship-building, particularly with equity-seeking communities.

The findings highlight the need for a continued and expanded focus on equity for the *Safe Mobility Strategy*, as well as indications that culture and behaviour change may contribute to a Safe System.

Conclusions

The below conclusions will be used to develop the *Safe Mobility Strategy* and its associated actions. Based on the crash and equity analyses, the *Safe Mobility Strategy* will continue, enhance and expand efforts to:

- Improve street design and operation
- Address user behaviour, ability, and skill
- Collect more thorough and complete data
- Incorporate equity into analysis, decision making, and prioritization

Five crash types lead to the majority of traffic fatalities and serious injuries.

These include:

1. Drivers not yielding to people who have the right of way
2. Drivers following too closely
3. Drivers turning left across the path of others
4. Drivers driving off the road
5. Drivers running red lights and failing to comply with traffic signals

Crashes are concentrated disproportionately along certain arterial streets.

The High Injury Networks for different modes of transportation highlight that arterial roads often operate in a way that does not match their intended function. For example, if we want to encourage travel over longer distances and have higher speeds, we need to better manage access locations and turning movements which result in serious injuries and fatalities if a crash occurs. Likewise, walking and transit access along main streets are priorities and the design of the intersections should support walking access including priority at signals and lower speeds where conflicts between people walking and driving may occur.

Crashes are concentrated in 15 neighbourhoods and disproportionately affect low-income households, Indigenous Peoples, and linguistic minorities.

The fifteen high-crash neighbourhoods are home to a higher proportion of these equity-seeking communities, who are exposed to crash risk simply by virtue of where they live.

Young adults and men are more often at fault in serious injury and fatal crashes.

The analysis of demographic data noted in the crash reports shows that young adults, particularly young men, are disproportionately the party responsible for serious injury and fatal crashes. More work is needed to understand motivations, values and other factors that contribute to this disproportionate crash involvement.

Multiple data limitations need to be addressed.

More focused conversations about lived experience must take place to fully understand traffic safety concerns in Edmonton.

Engagement activities throughout the development of the *Safe Mobility Strategy* attempted to capture some of the lived experience of Edmontonians. Building relationships and keeping these conversations going, particularly with equity-seeking communities, is an ongoing process and are an integral part of the way forward.

Data collection must be expanded to account for exposure and crashes that do not involve motor vehicles.

Hospital records, in particular, can be leveraged to gain a better understanding of crashes involving people who are not driving motor vehicles or motorcycles. Data is also required to factor volumes of people cycling and walking to better understand exposure.