WALKABILITY AND PEDESTRIAN SAFETY IN THUNDER BAY

CITY OF Thunder Bay
Superior by Nature
Lakehead UNIVERSITY
Thunder Bay District Health Unit

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WALKING IS ONE OF THE MOST ACCESSIBLE & AFFORDABLE MODES BY WHICH WE TRAVEL.

Healthy community design and pedestrian safety can promote walking and encourage people to incorporate physical activity into their daily lives.

Introduction **1**
- Purpose 3

Thunder Bay in Context **5**
- Transportation trends 5
- Demographics and population health 6
- Walkability and pedestrian safety initiatives in Thunder Bay 9
- Steps in the right direction 11
  - Planning 11
  - Engineering 12
  - Education and encouragement 14
  - Enforcement 15
  - Evaluation 16

Pedestrian-Vehicle Collision Analysis **17**
- Data 17
- Key findings 18
  - When are collisions happening? 18
  - Where are collisions happening? 21
  - Who is involved in collisions? 25
  - Why and how are collisions happening? 26

Community Perceptions of Walkability and Pedestrian Safety **33**
- Data 33
- Key findings 35
  - Respondent demographics and walking behaviour 35
  - Perceived neighbhourhood walkability 37
  - A closer look at access to amenities 39
  - Satisfaction with walkability and safety 40
  - Priority municipal government action 41

Conclusions **43**

Recommendations **45**

Closing Remarks **48**

Appendices 49

References 51

INTRODUCTION

Walking is a healthy, inclusive, and sustainable mode of transportation. Almost every trip begins and ends with a walk, and walking is an accessible mode of transport for children, youth, seniors, and people with a low socioeconomic status. Choosing to walk for transportation or recreation is an effective way to incorporate physical activity into a daily routine. Walking can help community members meet minimum physical activity recommendations, thereby reducing the risk of chronic diseases such as type 2 diabetes, heart disease, and some cancers.[1] Walking can also improve mental health outcomes by reducing stress levels, anxiety, and depression, in addition to providing opportunities for enhanced social interaction and cohesion.[2,3] Modifying the built environment and creating more opportunities for walking is one of the most cost-effective interventions to increase physical activity at a population level and an opportunity to improve population health overall. When members of a community walk instead of drive a motor vehicle, there are also environmental and economic benefits such as reductions in greenhouse gas emissions, lower levels of air and noise pollution, reduced healthcare costs, reduced road maintenance, and lower infrastructure costs.[5,6,7]

Walkability, a measure of how easy, safe, and enjoyable it is to walk in a neighbourhood, can have a large impact on walking behaviour and willingness to use walking for transport and recreation. Public health, planning, and transportation researchers have identified key factors that influence walkability and promote walking. These important factors include access to amenities and destinations, residential density, positive walking experiences, street and sidewalk connectivity, and safety.[8,9,10,11] Walkable communities encourage walking by investing in appropriate and safe infrastructure, which increases comfort and convenience of a route while also reducing the risk of collisions.[12,13,14] Research consistently shows that people who live in neighbourhoods that are walkable are more physically active than those living in neighbourhoods that do not support walking. A recent study in Ontario showed that neighbourhoods with higher walkability were associated with a decrease in obesity and a decreased incidence of diabetes.[16] Providing appropriate infrastructure for walking also takes into account the needs of those with mobility issues or visible/non-visible disabilities. Appropriate, well-maintained sidewalks and walking infrastructure are essential to provide access to transit stops, especially for those using mobility devices. A walkable community offers a safe and enjoyable walking experience for citizens of all ages and abilities.

Despite the numerous benefits of walking and walkable environments, pedestrians are vulnerable road users and are at greater risk of injury or fatality due to collisions with motor vehicles.[17] A pedestrian is a person moving from place to place by foot, or using an assistive mobility device or other small-wheeled devices that provide personal mobility (e.g., skateboard, skates, segways, strollers, or scooter).[18] Safety and related concerns caused by vehicle traffic (e.g., traffic speed, volume, road crossing

WALKABILITY IS A MEASURE OF HOW EASY, SAFE, AND ENJOYABLE IT IS TO WALK IN A NEIGHBOURHOOD.

> Collisions are not accidents. Collisions are predictable and avoidable… Every traffic 'accident' is in fact not an accident at all, but more precisely a collision that would not happen without cause.
>
> - Thunder Bay Police Service. 2016 Traffic Management Plan

> A community that supports walking as a primary means of transportation reaps all sorts of benefits – for health, safety, the environment, the economy, and community life.
>
> - Canada Walks

> Ontarians not only need to walk, they need to walk safely.
>
> - Pedestrian Death Review, 2012. Office of the Chief Coroner for Ontario

conditions, etc.) have been identified as primary influencers on mode choice in walkability studies,[19] and actual and perceived pedestrian safety can have a large impact on residents' desire and willingness to walk in and around their neighbourhood.[20]

The safety of pedestrians should take precedence over all other modes of transportation. Pedestrian-vehicle collisions can have major consequences for those individuals involved in a collision as well as their families, employers, and the community as a whole. Safe pedestrian routes are particularly important to support citizens who do not have the option of driving, such as older adults without a drivers license, children, youth, and individuals who cannot afford a car. Promoting safety for pedestrians also promotes other modes of transportation, including cycling and taking transit, with benefits for all citizens.[21,22,23] Transport Canada estimates that annual cost of road collisions to the Canadian economy, including health care, environmental damage, lost productivity, and induced traffic congestion, is $CDN 62.7 billion.[24] With appropriate policy and programming, the vast majority of collisions are preventable.

When it comes to pedestrian safety, the old saying of "safety in numbers" rings true: in cities where there are more people walking and biking, collision frequencies decline and walking rates increase.[25,26,27] Increasing the total number of people walking for transport or recreation can be an effective strategy to improve pedestrian safety. Safety is a central aspect of walkability and strategies aimed at improving pedestrian safety must be prioritized as communities aim to improve overall walkability.[28]

To encourage more people to walk and reap the associated health, economic, and social benefits, communities must be walkable and safe for pedestrians. When cities plan for transportation modes other than motor vehicles, modify the built environment to enhance walkability, and prioritize the safety of vulnerable road users, communities become vibrant, safe, healthy, and connected.

Purpose

Cities need an evidence-based understanding of walkability and pedestrian safety issues to support policy and programming aimed at promoting walking and reducing collisions. In Thunder Bay, this evidence is currently limited. The Walkability and Pedestrian Safety in Thunder Bay report aims to address this gap. The purpose of this report is to examine walkability and pedestrian safety in the context of Thunder Bay and to identify key issues and opportunities to improve walkability and pedestrian safety in our community. First an in-depth analysis of pedestrian-vehicle collisions that occurred in Thunder Bay between 2004 and 2013 was conducted. The collision analysis examines **who** was involved in reported pedestrian-vehicle collisions, **when** and **where** collisions occurred, and explores factors that could explain **why and how** collisions occur. Second, a survey examining community walkability and perceptions of safety issues was conducted to capture the perspective of pedestrians and to provide a more in-depth understanding of priority issues and opportunities to improve walkability. Together, key findings from the collision analysis and the community perception survey provide a comprehensive overview of walkability and pedestrian safety issues in the City of Thunder Bay and a foundation for identifying strategies to promote walking and prevent future collisions.

> **Evidence-based analysis of traffic collision data… helps to identify the real issues affecting road safety as seen through long-term trends and location mapping.**
>
> – Vision Zero: Toronto's Road Safety Plan, 2017-2021

VISION:

THUNDER BAY: HEALTHY, VIBRANT, CONNECTED, STRONG

– Becoming our Best, Thunder Bay 2015-2018 Strategic Plan

THUNDER BAY IN CONTEXT

Transportation trends

Despite the numerous benefits of walking - such as improved health outcomes and positive environmental effects - driving motor vehicles remains the primary mode of transportation in cities across Canada, including the northern City of Thunder Bay. A result of the 1970 amalgamation of two cities, Port Arthur and Fort William, Thunder Bay is a long, sprawling city with a population of 107,909 spread out over 328.24 km^2.[30] The population density of Thunder Bay is 328.6 people per square kilometre. By comparison, the Ontario City of London has a population of 383,822, a total land area of 420.8km^2, and a population density of 913.1 people per square kilometre.[31] Thunder Bay has one of the lowest population densities of any Canadian city, and faces the challenge of limited funding available to maintain the current walking infrastructure. The 2016 Asset Management Plan[32] of the City of Thunder Bay analyzed existing sidewalk network and identified an annual funding requirement of $4.8 million to repair and maintain sidewalks. However, the average funding made available for sidewalks was only $1.3 million. The same plan identified that 70% of the City's sidewalks are in poor condition and in need of replacement in the short-term.

Historically, Thunder Bay has been an automobile centric city with a transportation system oriented towards automobiles. Thunder Bay's pattern of infrastructure development can be attributed to the plans laid out in the municipality's Transportation Master Plan (TMP). The TMP is a major planning and policy document that guides infrastructure investments for the entire transportation system. A TMP typically has a horizon of 20 years; however, until 2017 the City relied on a document that was first written in 1987, with an update in 1989. The 1987 TMP was largely car-centric, overlooked the safety of pedestrians and other active modes, and operated under the prediction that Thunder Bay's population would increase by between 0.23% and 0.37% each year over a 25-year horizon. It also predicted a large growth in the labour force population, a continued decrease in household size, and ongoing urban sprawl. It determined that roads would be widened and the network expanded to accommodate the increase in automobile traffic created by these changes. Contrary to these predictions, Thunder Bay's population has been decreasing, and between 2011 and 2016 the City saw a -0.4 population percentage change.[33]

Due to a low population density and an automobile-oriented transportation system, Thunder Bay residents continue to rely heavily upon personal motor vehicles; the use of active transportation such as cycling and walking are low compared to other cities across Canada. In 2011, only 5% of workers in Thunder Bay reported commuting to work by foot. In the same year, the Ontario cities of Kingston and Peterborough saw 8.5% and 7% of workers commuting by foot, respectively (see Figure

1). Also during that year, Victoria, BC had the highest proportion of workers commuting by foot at 10%. In 2011, the majority of workers in Thunder Bay (88.5%) commuted by car, truck, or van.[34] Active modes of transportation accounted for less than 10% of the total trips to work,[35] further confirming that Thunder Bay is a car-centric city.

Demographics and population health

Across Canada, increased dependency on motorized vehicles has contributed to a reduction in physical activity levels.[36] Being physically active is one of the most important modifiable lifestyle behaviours that can help prevent the onset of many chronic diseases. In 2013-2014, 41.3% of Thunder Bay residents reported they were physically inactive during leisure time.[37] In addition, 35.9% of Thunder Bay residents reported being overweight, and 24.5% reported being obese.[38]

Thunder Bay residents typically present health indicators of concern when compared to provincial averages.[39] In 2012, the leading cause of death in Thunder Bay was cardiovascular disease (223.8 deaths per 100,000 people). This mortality rate is higher than the Ontario

Figure 1: **Proportion of workers commuting to work on foot by census metropolitan areas (2011)**

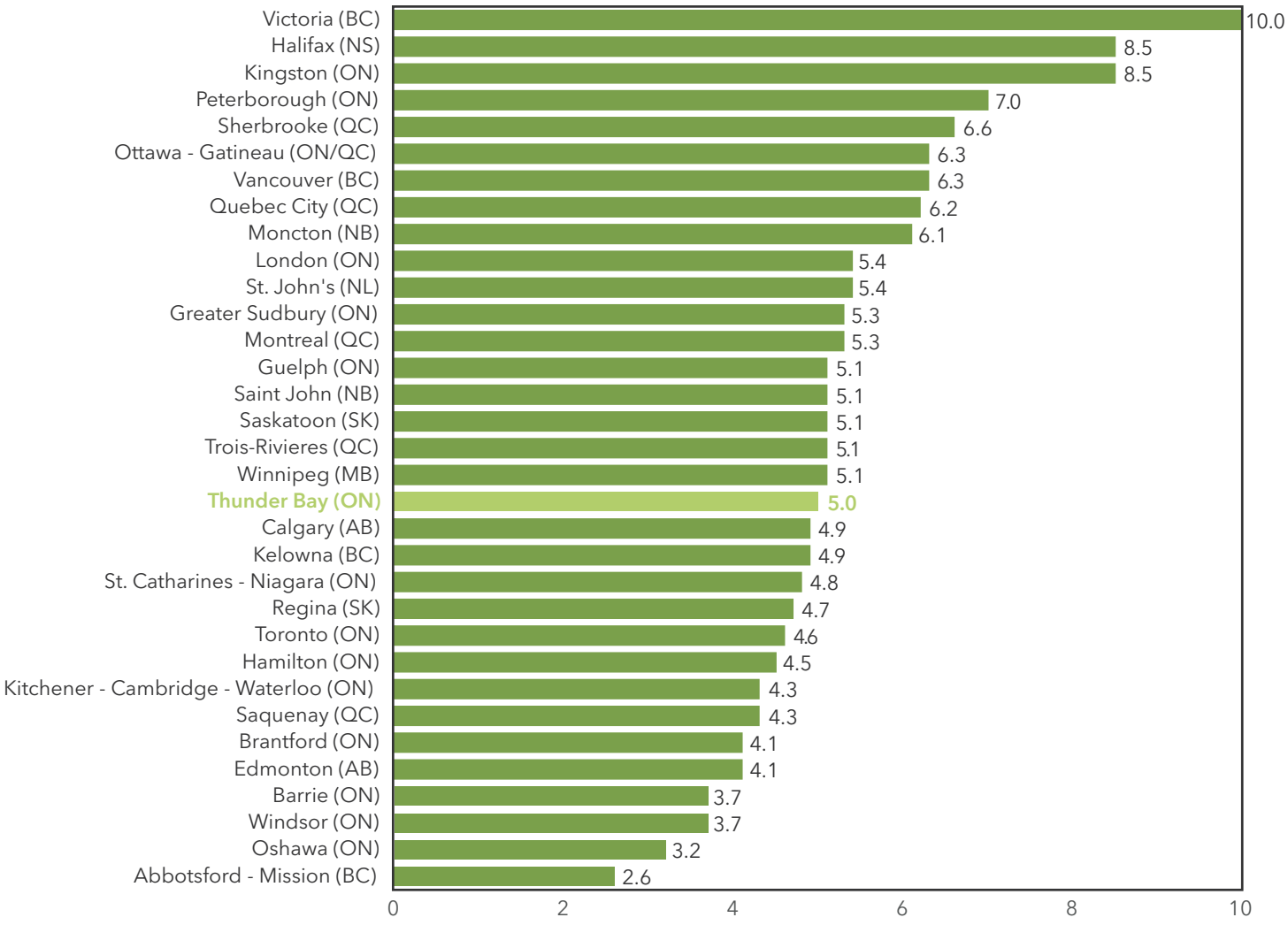


Figure 2: **Proportion of Thunder Bay workers commuting to work by car, truck or van, by public transit, on foot, or by bicycle, 2011**

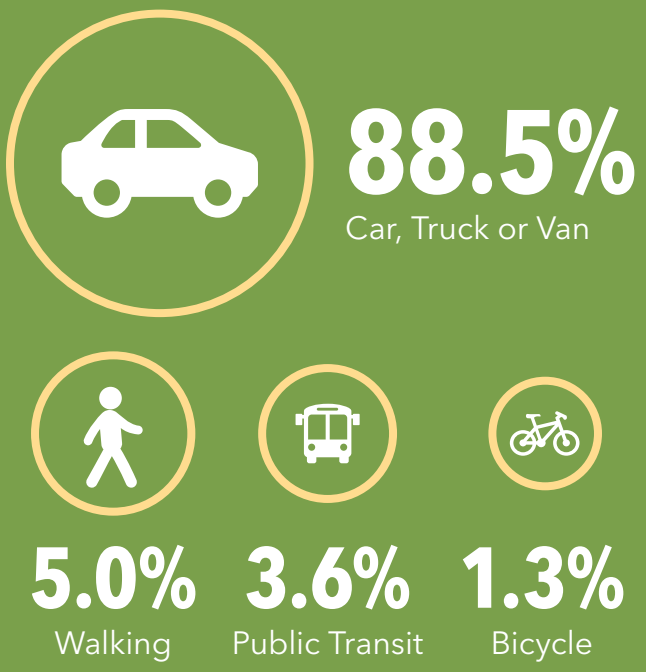
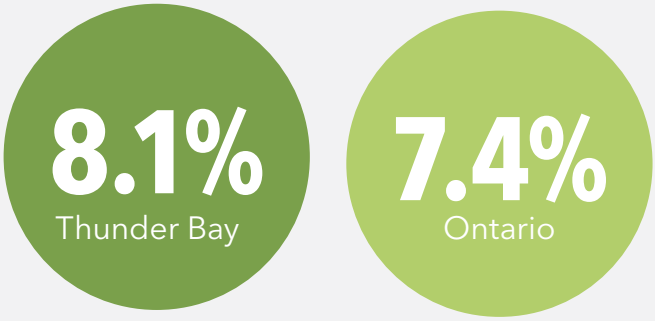


Figure 3: **Diabetes prevalence in Thunder Bay compared to Ontario. Canadian Community Health Survey (2013/2014).**



DIABETES PREVALENCE

average of 180.7 deaths per 100,000 people. Cancer was the second leading cause of death (222.7 deaths per 100,000 people), and this mortality rate is also higher than the provincial average of 201.8 deaths per 100,000 people.[40] In the same year, Thunder Bay had the second highest rate of diabetes mortality (37.1 deaths per 100,000 people) in the province. This is higher than the average Ontario rate of 20.4 deaths per 100,000 people.[41]

As of July 1, 2015, estimates showed that for the first time ever, there were more people aged 65 years and older in Canada than children aged 0 to 14 years. Nearly one in six Canadians, or 16.1%, was at least 65 years old.[42] Thunder Bay is a part of this trend; in 2016, 20% of Thunder Bay's population was 65 and older.[43] This proportion will likely increase, as the cohort of baby boomers becomes senior citizens. In light of an aging population and associated health issues, the number of licensed drivers can be expected to decline.

Given the demographic trends and population health outcomes in Thunder Bay, encouraging walking and modifying the built environment to enhance walkability and pedestrian safety is more important than ever.

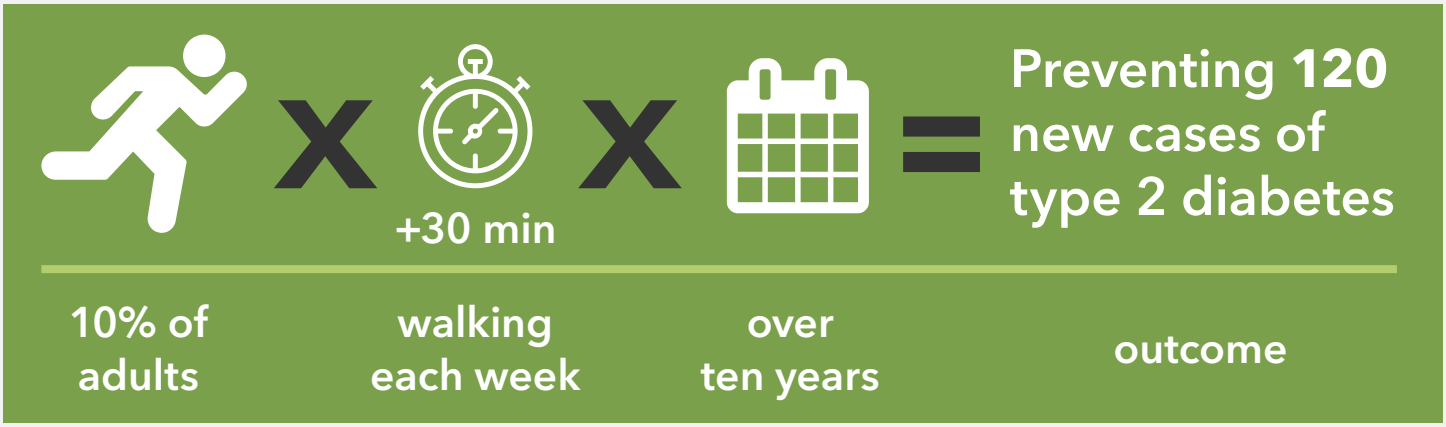
> **"35.9% of Thunder Bay residents are overweight and 24.5% are obese.**
>
> – Canadian Community Health Survey (2013/2014)

> **"In Thunder Bay, 41.3% of the population are physically inactive during leisure time.**
>
> – Canadian Community Health Survey (2013/2014)

RESEARCH SHOWS THAT INCREASING WALKING CAN DECREASE THE INCIDENCE OF CHRONIC DISEASES

Using a validated population health model called the Diabetes Population Risk Tool, we can predict how many new cases of type 2 diabetes could be prevented in Thunder Bay by increasing the level of walking activity in the adult population.

LOW SCENARIO



HIGH SCENARIO

Sawula, E. 2017. Application of the Diabetes Population Risk Tool (DPoRT). Active Transportation Intervention Scenario. To view the full report, visit the Thunder Bay District Health Unit website www.tbdhu.com.

Walkability and pedestrian safety initiatives in Thunder Bay

In 2015, the municipality of Thunder Bay, in partnership with the Thunder Bay District Health Unit, applied for a **WALK Friendly Community** designation through Canada Walks. **WALK Friendly Communities** is a recognition program that encourages municipalities to create and improve the conditions for walking by awarding Bronze, Silver, Gold or Platinum designations.[44] The program uses a framework to assess 5 dimensions of a community's walk friendliness, including: **planning, engineering, education** and **encouragement, enforcement** and **evaluation**. This program "allows municipalities to benchmark their level of walkability, give walking a prominent profile in community planning and design, and encourage municipal governments to set targets for ongoing improvements."[45] As a result of the 2015 application, Thunder Bay received an Honourable Mention from Canada Walks, indicating that there is still a great deal of work to be done to transform the City into a walkable community. Canada Walks provided a feedback report including strengths and top priorities for improving walkability.

ONTARIO CITIES WITH A WALK FRIENDLY DESIGNATION

Silver
Hamilton, Kitchener, Mississauga

Bronze
Ottawa, London, Minto, Pelham, Richmond Hill, Smith Falls, Wasaga Beach

FEEDBACK FROM CANADA WALKS 2015: WALK FRIENDLY COMMUNITIES DESIGNATION PROGRAM

Strengths

- Mobility Coordinator position is in place at the City
- Committed community partners
- Active Living Corridors
- Multi-use trails for recreational walking
- Opens Streets events and other street festivals
- Snow clearing policy

Priorities for improving walkability

- Develop a Pedestrian Mobility Plan
- Develop land use policies that require infrastructure to support walking
- Reduce speed limits on neighbourhood streets and in the downtown areas
- Develop a well-resourced Transportation Demand Management program
- Invest in continuous and connected sidewalks to better accommodate walkers of all ages and abilities
- Implement Complete Streets policy
- Invest in School Travel Planning

To view the complete feedback report from Canada Walks, visit the Thunder Bay District Health Unit website www.tbdhu.com.

PEDESTRIAN EXPERIENCES IN THUNDER BAY

The following vignettes describe several typical walking experiences based on the perspective and experiences of the City of Thunder Bay Mobility Coordinator.

Christie really enjoys her evening walks at Prince Arthur's Landing. During most of the year she walks down to the waterfront from her house on Peter Street a few times a week. There are sidewalks the whole way there and, although access to Prince Arthur's Landing is limited, she has figured out a route to get there that is fairly direct. Because of the hills, in the wintertime, sidewalks can be slippery – scary when going downhill and challenging getting back up. When she used to live in Ottawa, she regularly walked to work; she has found that it is hard to get into this same habit in Thunder Bay. Working in an office off Balmoral Street, the lack of sidewalks prohibits her from walking to her place of work. With the speed of traffic and rather desolate walk, it is not worth the stress so she drives, even though it's only an 8-minute drive.

Eileen has thoroughly enjoyed retirement since leaving the workforce in 1994. She likes having the freedom to spend time with her friends, be active, and cook. Living at Patterson Court, on May Street has been ideal because of the short walk to both Patterson Park and a nearby grocery store. The grocery store wasn't always in that location, and getting groceries was very difficult, especially in the wintertime. Since she doesn't drive, Eileen had to wait outside in all weather conditions to take a bus - sometimes waiting up to 30 minutes for a bus to arrive. Thankfully, the new store opened up and groceries are only a 10-minute walk away, for now. Since entering her 80's, Eileen has noticed a definite decrease in her walking pace and often finds it hard to cross the 5 lanes of traffic on May Street, even with the pedestrian signal. This is especially an issue in the wintertime, with slippery sidewalks and piles of snow. If there was more walking time and more salt and sand, she would feel much safer.

Matthew lives in Parkdale and drives to work as a personal support worker at Hogarth Riverview Manor. Sometimes he takes Arthur Street and other times Victoria Avenue to get to work. At one time or another, he's contemplated walking to work but it seems too far. Taking Arthur Street it's nearly 5kms to work and taking the multi-trails is about 3kms but the trails are confusing and dark, plus he has to pick up his kids from school. Even though he would enjoy taking a walk after work and this would relieve a lot of the stress that builds throughout the day, it's just not a practical choice.

Shari works at the Northwest Community Health Centre on Simpson Street. She doesn't mind the walk on the residential streets in her neighbourhood, as there are plenty of sidewalks and lots of yards and houses to see. As long as it is light out, she feels pretty safe during the walk. But come fall, she wishes that there was better lighting on the sidewalk. She enjoys working at the Health Centre because of the area: a quick walk to the corner store for some groceries or across the street for a bite to eat at lunch. The only problem is, Simpson Street has only two crossings on its entire length; one at each end. That means that she has to 'j-walk' to get across. Drivers don't appreciate this and often speed up when they see her or inch towards her aggressively; she's glad she's not the one with kids trying to cross. She's really relieved that a new pedestrian crossover is going in at Simpson Street and Ogden Street It should make the whole area safer and more accessible

Steps in the right direction

Although the City of Thunder is not measuring up to other cities across Ontario or Canada when it comes to promoting walkability and ensuring pedestrian safety, positive progress has been made. Recognizing that walkable and safe streets are key to Thunder Bay's vision of becoming a vibrant, healthy, safe, and connected community; the City, with the support of organizations like the Thunder Bay District Health Unit, Thunder Bay Police Services, and EcoSuperior Environmental Programs, has taken steps to create an environment that promotes walking and is safe for pedestrians. Below, recent progress towards improving walkability and pedestrian safety is summarized in terms of **planning**, **engineering**, **education** and **encouragement**, **enforcement** and **evaluation**.

Planning

Planning-related strategies focus on community plans, land-use planning, and zoning policies that create safer, more walkable communities. Examples of planning and policy developments that have been adopted by the City of Thunder Bay are listed below:

- The City Council-approved the **EarthCare Sustainability Plan 2014-2020**[47] which includes the following objectives under its Mobility section:

  A. Public and private infrastructure are both strategically used to create seamless, barrier-free options for bicycling, walking, and transit use in order to create a cleaner, greener, more beautiful Thunder Bay.

  B. Citizens of all ages and abilities are inspired to adopt more active modes of transportation, leading to a higher quality of life.

  C. Thunder Bay is a leader in developing policies to support sustainable modes of transportation in order to be recognized as a best-run City.

- The **2015-2018 Corporate Strategic Plan**[48] identifies several supportive goals, including:

  Goal 7.1: Give priority to integration of 'Complete Streets' guidelines on key corridors.

  Goal 10.3: Expand the quality of the pedestrian environment in order to improve the City's walkability and connectivity.

- Many City policy documents, guidelines, and plans reference a Complete Streets philosophy as a recommended action, including:

  - The **EarthCare Sustainability Plan 2014-2020**[49]
  - The **2018 Official Plan**
  - The 2012 **Image Route Guidelines and Detailed Streetscape Designs**

- The **Active Transportation Plan** is currently under revision and will be complete by the end of 2017.

- An active transportation (pedestrian and cyclist) **Wayfinding Plan** is in consultation stages as of Fall of 2017.

- The **Image Route Guidelines and Detailed Streetscape Designs** and **Urban Design Guidelines**

COMMUNITY HIGHLIGHT:
TRANSPORTATION MASTER PLAN

A Transportation Master Plan (TMP) is a major planning and policy document that guides all transportation infrastructure investments based on a municipality's population forecast. Modern TMPs consider all modes of travel, including automobile, pedestrian, cyclist, transit, and goods movement.

Typically, a TMP has a 20-year horizon, but in 2017, Thunder Bay's TMP was approaching its 30th year. This policy document was completed in 1987 with an update in 1989, and had a very strong focus on the movement of automobiles within Thunder Bay with little attention to active transportation and safety. An updated TMP, including, Active Transportation Planning, collision prevention strategies, and a shift in focus to the environment, social determinants of health, and equity, was long overdue.

In early 2017, the City of Thunder Bay hired a consulting firm to develop the new TMP. The TMP is scheduled to be completed by the end of 2017.

- A strong **snow clearing policy** and substantial budget allocated to plowing all sidewalks during the winter months

Engineering

Engineering strategies improve the built environment through infrastructure enhancements such as improvements to the roadway, traffic signals, crosswalks, etc. Thunder Bay has made investments in numerous built environment initiatives in the past several years:

- Arundel & Hudson and Bay Street **Active Living Corridors**.
- **Traffic calming** measures, such as curb extensions on Algoma Street South.
- Installation of three **pedestrian crossovers** on Algoma Street (2016), Walsh Street (2017), and Simpson Street (2017), with a plan for more to be installed each year.
- Efforts to improve **connectivity** of the multi-use trail system.
- Filling **gaps** in the sidewalk network (e.g., Edward Street, High Street)

COMMUNITY HIGHLIGHT:
ARUNDEL/HUDSON ACTIVE LIVING CORRIDOR

An active living corridor enhances pedestrian and cyclist safety and comfort and reduces barriers to physical activity through various engineering treatments, such as installing dedicated pedestrian and cyclist facilities, road reconfiguration, and traffic calming. In 2012, the City of Thunder Bay decided to use the planned reconstruction of Arundel Avenue as an opportunity to re-design the corridor and Lyon Boulevard West intersection to improve the accessibility, utility, and connectivity of the corridor for pedestrians and cyclists. As a result, the Arundel/Hudson Active Living Corridor was created. The updated corridor included features such as a 2-way multi-use trail, a bike lane, a painted buffer between automobile lanes and the trail, new connections to existing multi-trails, and a much smaller intersection at Lyon Boulevard West for improved safety.

Over the years, as usage has increased, so has the demand for more safety features. In 2015, flexible bollards were installed in the buffer zone to improve separation between cars and people. Also in 2015, the corridor was extended 1.5kms down Hudson Avenue. In 2016, new, high-visibility cross-rides were painted at all intersections to improve the visibility of trail users. What was once a rural two-lane corridor with gravel shoulders has turned into a major activity hub linking residents to active living, transit, city parks, and trails. This is an example of how changes in the layout of a roadway can cascade into a long-term commitment to improving the vitality and activity in a community.

Education and encouragement

Education and encouragement related strategies improve awareness and understanding. This may be achieved through signage, media, safety campaigns, classes, and advocacy. Current educational and encouragement focused initiatives include:

- The Thunder Bay District Health Unit plays a key role in education and encouragement around walkability. The TBDHU chairs the **Thunder Bay Walkability Committee**, which is a multi-disciplinary advocacy group to encourage and build support for walkability. Some of the activities of the Committee include:
  - Pedestrian **Wayfinding** Sign campaign
  - Community **meetings and workshops**
  - **Presentations** to City Council
  - 2015 **tour of walkable infrastructure** with City Council
- Yearly participation in the national **Commuter Challenge**.
- Annual **Open Streets Program**.
- Pedestrian **crossover education** campaign.
- Yearly participation in **Jane's Walk** program

COMMUNITY HIGHLIGHT: PEDESTRIAN CROSSOVER EDUCATION CAMPAIGN

Thunder Bay has seen a high demand among residents for mid-block crossings, or pedestrian crossovers, however, the City of Thunder Bay was initially hesitant to implement pedestrian crossovers without supportive legislation. The 2016 amendments to the Highway Traffic Act created a supportive legal environment in which the City could install pedestrian crossovers.

The intersection of Algoma Street and Cornwall Avenue was selected as the location for the pilot crossover site in 2016. Before the crossovers could be installed, a partnership was established between the City of Thunder Bay, the Thunder Bay District Heath Unit, and Community Traffic Awareness Committee, with funding from the Ministry of Transportation to launch a pedestrian crossover education campaign. The intent was to increase community awareness of this new type of facility; to increase understanding of the physical appearance of pedestrian crossovers; and to instruct citizens on how to properly and safety interact with pedestrian crossovers as both drivers and pedestrians. Education components included: educational brochures, promotional magnets, print and radio ads, news articles, television interviews, a media launch, presentations to community groups, community events, educational videos, social media material, interactive website, and demo equipment.

Additional crossovers will be installed in Thunder Bay each year from a list of 34 potential sites. To date, three crossovers have been installed. Two more crossovers were installed in September and October of 2017, on Walsh Street, and Simpson Street.

Enforcement

Enforcement refers to initiatives that reinforce existing laws or policies and reduce negative behaviours such as speeding, or disobeying traffic signals in collaboration with local law enforcement. Enforcement activities are most effective when implemented in conjunction with education. Enforcement efforts in Thunder Bay include:

- The **Thunder Bay Police Service** has committed to working closely with City Engineers as they plan and implement infrastructure changes to accommodate greater safety for alternate forms of transportation. Efforts towards greater walkability include:
  - Education campaigns, such as "**Traffic Tuesday**" educational videos on traffic safety and strong social media engagement.
  - **Zone Watch** focus on pedestrian safety.
  - Representation on the **Community Traffic Awareness Committee**.

COMMUNITY HIGHLIGHT: ZONE WATCH

"The Thunder Bay Police Service has developed a community based online forum which identifies current neighbourhood crime and safety issues and allows for practical solutions. The Zone Watch program creates a partnership between police and citizens of Thunder Bay and Oliver Paipoonge. The heart of the program is a series of online forums, providing the opportunity for Zone Watch members to dialogue with police on a variety of subjects including crime trends, crime prevention and enforcement efforts to make our neighbourhoods safe.[50]

In 2016, Zone Watch members chose pedestrian safety as one of their priority issues in Thunder Bay. As part of this initiative, Zone Watch members raised awareness about being visible as a pedestrian at night, distributed reflective materials, and also handed out "good tickets" (tickets to the Thunder Bay Border Cats baseball games) to pedestrians who were observed correctly using crossing facilities.

Evaluation

Data, surveillance, and monitoring are essential to produce an evidence-based understanding of walkability and safety issues and to evaluate the impacts of existing initiatives. Evaluation activities include:

- In partnership with the Thunder Bay Police Services, the City of Thunder Bay has maintained a **Collision Database** of collisions that have occurred in Thunder Bay since 2004.
- In 2016 the City Parks and Open Spaces division purchased a **mobile pedestrian counter** to be used on the multi-use trails.
- In 2018 the construction of a multi-use trail at Attikokan drive (Confederation College) will include the installation of a **pedestrian/ cyclist counter**.

While the City of Thunder Bay has made advances in each of the areas of planning, engineering, education and encouragement, enforcement, and evaluation, there are many opportunities to improve the pedestrian environment and pedestrian safety in our community. This report investigates the current state of pedestrian safety and walkability and provides recommendations for improving walkability in Thunder Bay.

PEDESTRIAN-VEHICLE COLLISION ANALYSIS

In the following section, the data that were used for the pedestrian-vehicle collision analysis are described. Key findings are summarized in terms of when and where pedestrian-vehicle collisions occurred, who was involved in the collisions, and why and how the collisions may have occurred.

Data

The pedestrian-vehicle collision data used for this report were obtained from the City of Thunder Bay collision records database. Collision data were originally collected using Motor Vehicle Accident report forms and entered into the database by the Thunder Bay Police Services. All reported collisions involving at least one pedestrian and one motor vehicle, resulting in property damage, injury or fatality that occurred between January 1st 2004 and December 31st 2013 were extracted from the collision records database by the City of Thunder Bay Traffic Technologist. The collision records dataset included numerous attributes describing the collision itself, environmental conditions at the time of the collision, and driver and pedestrian characteristics. Although collision data were available for 2014, 2015, and 2016, a third party completed data input at this time and there were concerns about missing data. As such, these years were not included in the analysis. Also, due to changes in reporting procedures during the study period, records in the dataset were compared to paper records for 2009-2012 to identify any missing data. Any pedestrian-vehicle collisions that were identified from the paper records but were not included in the original data extraction were added to the database prior to analysis.

ArcGIS software and the collision address variable were used to geocode each collision (i.e., converting addresses into geographic coordinates) enabling collision mapping and a more in-depth spatial analysis. Additional spatial datasets were also gathered and utilized in the collision analysis including: a) a dataset of city wards, b) a dataset indicating the location of schools, and c) a road network file (all provided by the City of Thunder Bay). Information on estimated ward-level population was also acquired from the City of Thunder Bay Archives. Prior to analyzing the collision dataset, data were cleaned in an effort to amend incorrect, incomplete or duplicated information.

There are limitations of the collision data and analyses that should be acknowledged when interpreting the findings presented in this report. First, some of the variables in the collision dataset had large amounts of missing data. Some variables (e.g., traffic control function) were excluded due to high amounts of missing data. Second, although the collision dataset included a large number of variables, certain important attributes were not available. In particular, age and gender of the pedestrian

involved in each collision were not available. Third, detailed information on typical number of walking trips and pedestrian traffic volume are not available in the context of Thunder Bay. To accurately capture the underlying population at risk of being involved in a pedestrian-vehicle collision, additional data on walking trips and traffic volumes are needed. Finally, the collision data obtained from the Thunder Bay Police Services only capture reported collisions. The data presented in this report may not capture all pedestrian collisions that have occurred in Thunder Bay from 2004-2013.

Key findings

From 2004 to 2013, a total of 634 reported pedestrian-vehicle collisions occurred in Thunder Bay; 8 pedestrians were fatally injured as a result of a collision with a motor vehicle. The majority of collisions (81.5%) resulted in non-fatal injuries.

Figure 5: **Thunder Bay reported pedestrian-vehicle collisions from 2004-2013**

634 collisions involving pedestrians were reported between 2004-2013 in Thunder Bay

8 of those collisions resulted in a fatal injury

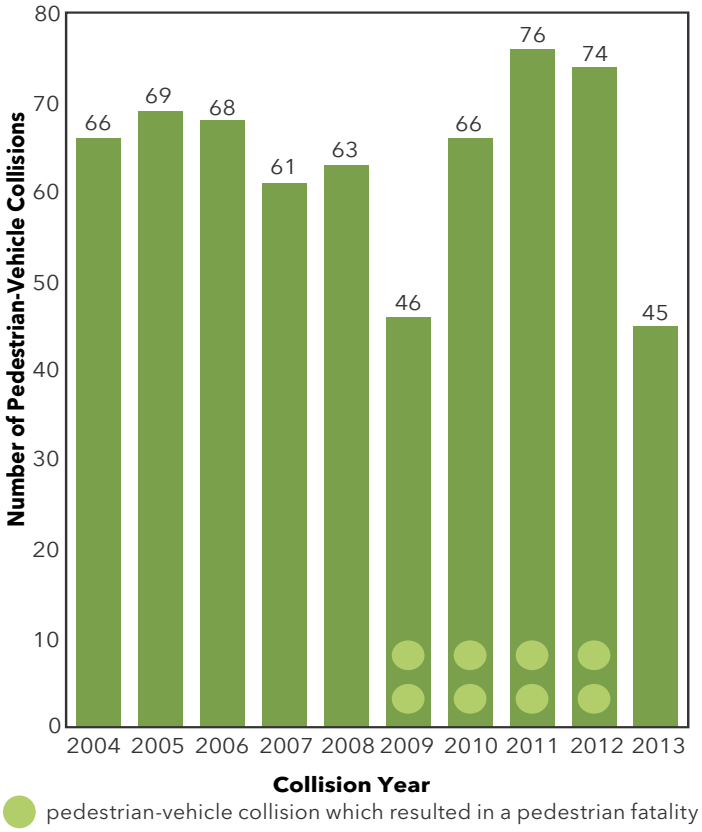
When are collisions happening?

This section summarizes temporal trends in reported pedestrian-vehicle collisions in Thunder Bay at various time scales.

Annual trends

On average, 63 reported pedestrian-vehicle collisions occurred each year between 2004 and 2013. Figure 5 depicts the number of collisions that occurred each year and illustrates that there is no consistent increasing or decreasing trend over the ten-year period. The largest number of collisions occurred in 2011 (n=76) while the fewest number of collisions occurred in 2013 (n=45).

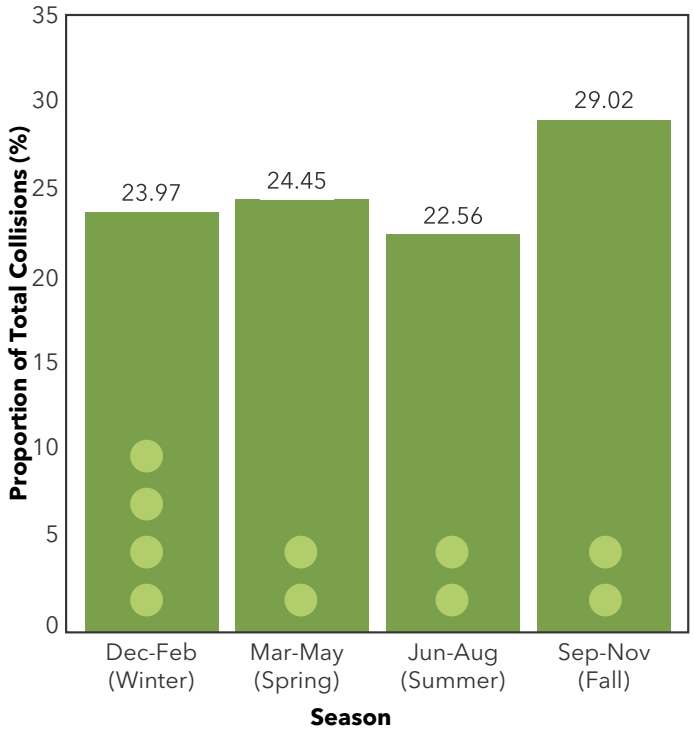
Figure 5: **Total number of reported pedestrian-vehicle collisions by year (2004-2013)**



Seasonal and monthly trends

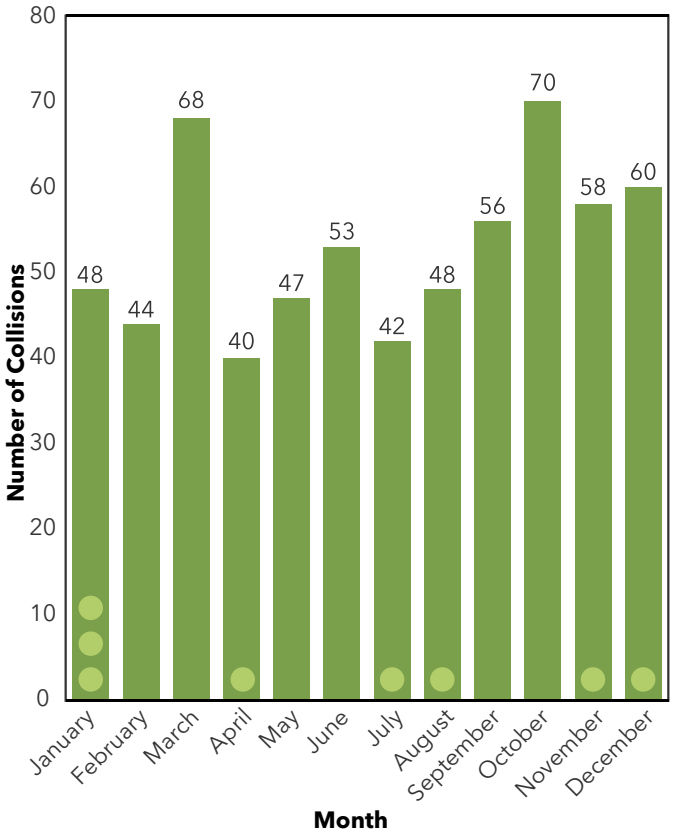
Reported pedestrian-vehicle collisions were most common during the fall (29.0%) as depicted in Figure 6. There was an average of approximately 5 reported pedestrian-vehicle collisions per month over the ten year study period. As shown in Figure 7, collisions occurred more frequently in October (70 collisions), followed by March (68 collisions). It might be expected to see a greater number of collisions in the summer months due to higher volumes of pedestrian traffic when weather conditions are more favourable, for walking, however, this was not observed in Thunder Bay. There may be lower vehicular traffic volumes in summer months but unfortunately, this cannot be determined without representative pedestrian counts and traffic volume data.

Figure 6: **Proportion of reported pedestrian-vehicle collisions by season (2004-2013)**



pedestrian-vehicle collision which resulted in a pedestrian fatality

Figure 7: **Total number of reported pedestrian-vehicle collisions by month (2004-2013)**

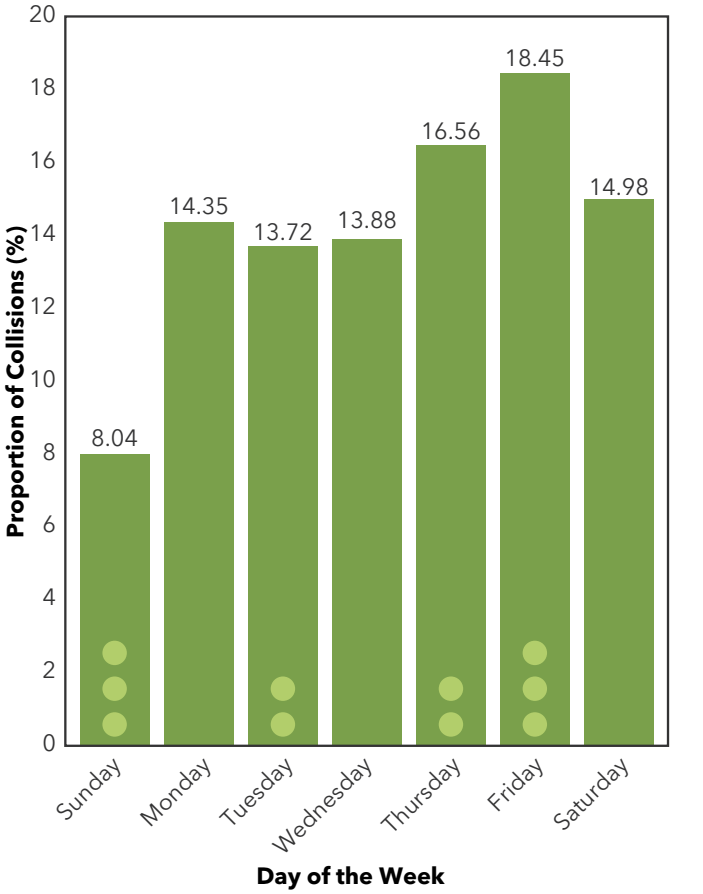


pedestrian-vehicle collision which resulted in a pedestrian fatality

Day of the week

Figure 8 illustrates that the majority (76.96%) of reported pedestrian-vehicle collisions occurred on weekdays. This may reflect increased vehicular and pedestrian traffic on weekdays when people commute to work and school as compared to weekends. The highest proportion of reported collisions was 18.4%, which occurred on Fridays. The lowest number of collisions occurred on Sundays (8.04%). Similar trends were seen in a pedestrian safety study from Vancouver[51] and in the Chief Coroner for Ontario Pedestrian Death Review.[52] These data suggest that targeted enforcement initiatives to reduce collisions could be most effective on Fridays and least effective on Sundays.

Figure 8: **Proportion of reported pedestrian-vehicle collisions by day of the week (2004-2013)**

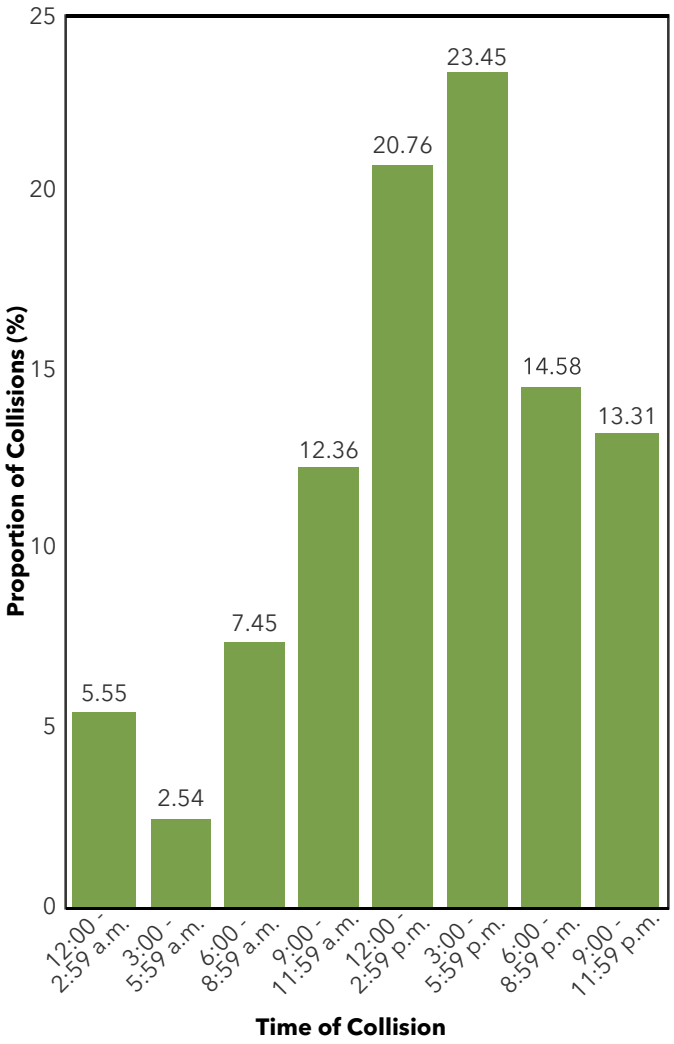


pedestrian-vehicle collision which resulted in a pedestrian fatality

Time of day

Information on the time of day was available for 631 (99.5%) of reported pedestrian-vehicle collisions (see Figure 9). Of these collisions, the highest proportion (23.4%) occurred between 3:00-5:59 p.m., followed by 20.8% between 12:00-2:59 p.m. Similar high-collision times have been identified in other communities.[53] These high collision times indicate periods during the day when targeted enforcement initiatives could be most effective.

Figure 9: **Proportion of reported pedestrian-vehicle collisions by time of day (2004-2013)**



pedestrian-vehicle collision which resulted in a pedestrian fatality

Where are collisions happening?

This section describes the most common locations of pedestrian-vehicle collisions and illustrates the spatial distribution of collisions using maps created in ArcGIS mapping software.

Collision location

Information on the collision location was available for 630 (99.4%) of reported pedestrian-vehicle collisions and is summarized in Table 1. Of these collisions, more occurred at intersections (50.5%) than at non-intersections (23.5%). Almost 14% occurred in parking lots and the remaining 12.4% occurred in other locations such as driveways and overpasses or bridges.

Table 1: **Reported pedestrian-vehicle collisions by collision location (2004-2013)**

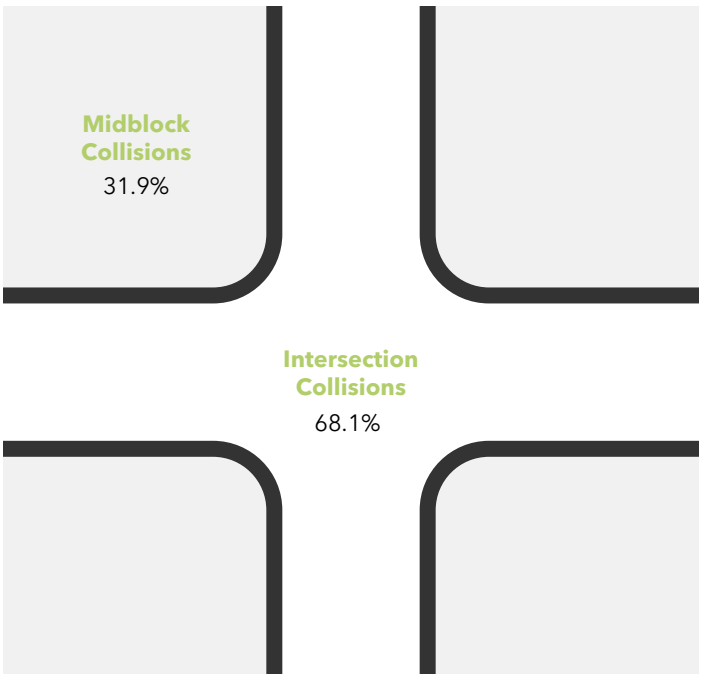
Collision Location	Frequency	Percent (%)*
Intersection	318	50.48
Non-intersection	148	23.49
Parking Lot	86	13.65
At/near driveway	64	10.16
Other	14	2.22
Total	**630**	**100.00**

*Missing values were removed before calculating percentages.

Intersection versus midblock collisions

A large majority of pedestrian-vehicle collisions occurred at intersections. Approximately 68% of all collisions occurred at an intersection compared to 31.5% at a midblock location. Six of the 8 fatal pedestrian injuries occurred in collisions that occurred in an intersection, and the remaining 2 occurred at mid-block locations.

Figure 10: **Proportion of pedestrian-vehicle collisions by midblock or intersection location (2004-2013)**

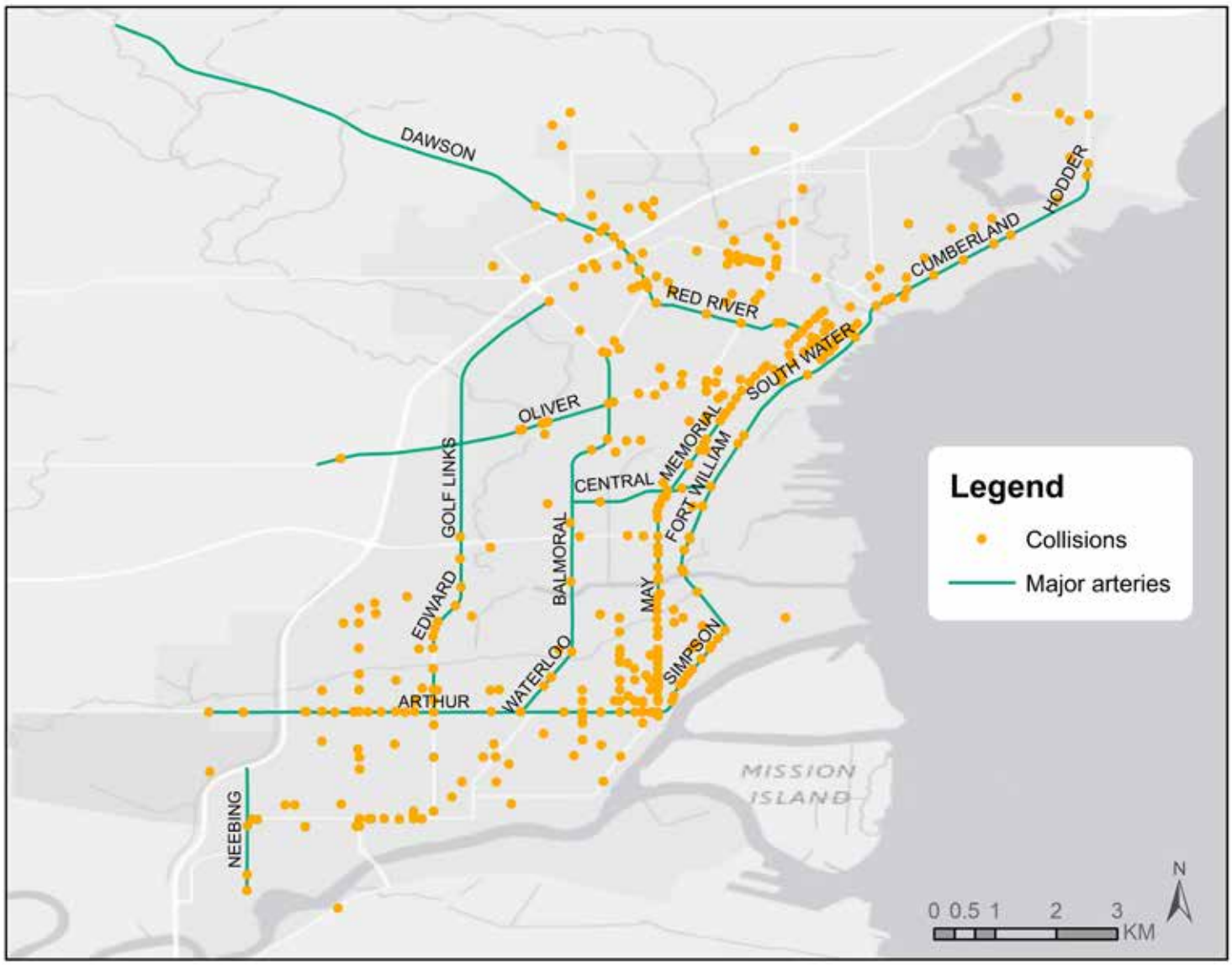


Road type

Information on 'road type' was available for 618 (97.4%) of reported pedestrian-vehicle collisions. Of these collisions, 33.5% occurred on a major arterial road (roads designed and constructed to carry large volumes of through-traffic travelling at moderate speeds throughout the City), 29.9% occurred on a local road (roads designed and constructed to provide property access and carry low volumes of traffic), 20% occurred on a minor arterial road (roads designed and constructed to carry moderate volumes of through-traffic travelling at moderate speeds throughout the City) and 15% occurred on collectors (roads designed and constructed to carry moderate volumes of

medium-distance traffic travelling at moderate speeds between local and arterial roads). The majority of collisions occurred on major arterial roads where there are likely large volumes of both vehicular and pedestrian through-traffic. Reduced speed levels and traffic calming measures on local roads and along major arterial roads that are important for pedestrians could be an effective strategy to reduce pedestrian-vehicle collisions and encourage additional walking for transport. Research has illustrated the effectiveness of both reduced speed level and traffic-calming measures in terms of reducing collisions and reducing injuries across numerous different settings.[54,55]

Figure 11: **Spatial distribution of pedestrian-vehicle collisions in Thunder Bay (2004-2013)**



City ward

Information on 'ward' was available for 624 of reported pedestrian-involved collisions. Of these collisions, 42.8% occurred in the McKellar ward followed by 15.9% in the Red River ward and 14.7% in the Westfort ward. McKellar ward includes both the north and south downtown areas, and it is reasonable to suspect that there is more pedestrian activity in those areas. These data suggest that McKellar ward is a priority area for future engineering, education and encouragement, and enforcement strategies.

Table 2: **Reported pedestrian-vehicle collisions by ward (2003-2014)**

Ward	Frequency	Percent (%)*	Population
McKellar	267	42.79%	16,784
Red River	99	15.87%	18,536
Westfort	92	14.74%	16,005
Northwood	66	10.58%	13,134
Current River	62	9.94%	13,405
McIntyre	32	5.13%	16,284
Neebing	6	0.96%	8,911

*Missing values were removed before calculating percentages.

NB: For those cases that occurred on ward boundaries, 50% of cases were assigned to each bordering ward.

NB. Estimated population counts by ward are derived from eligible voter data in 2014

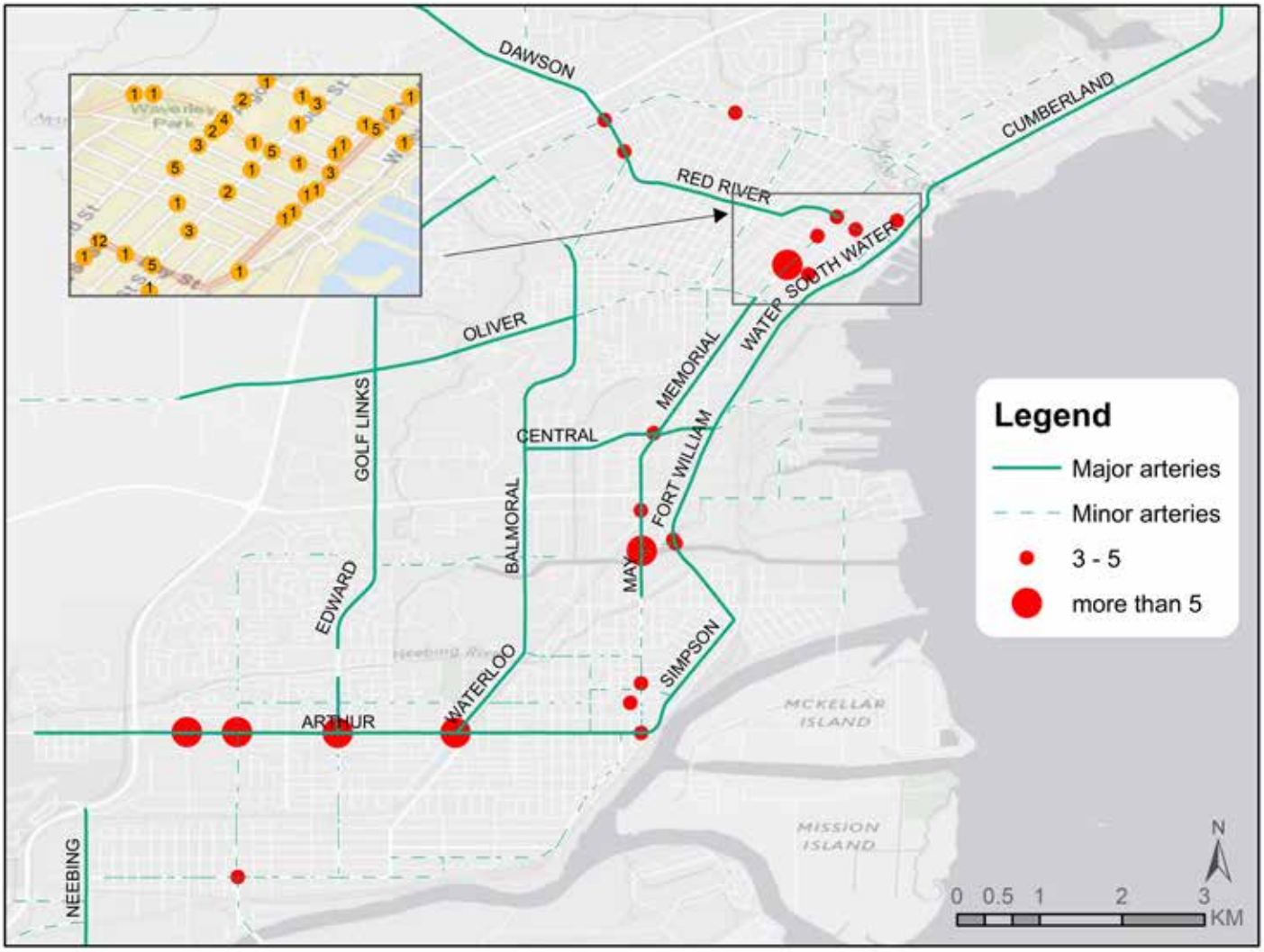
Collision hotspots

Collision hotspots, locations where more than 3 reported pedestrian-vehicle collisions occurred over the ten-year period, are depicted in Figure 12. Priority collision hotspots - locations where 6 or more reported pedestrian-vehicle collisions occurred - are summarized in Table 3. Notably, 4 priority hotspot locations were located along Arthur Street. Arthur Street, Algoma Street, and Memorial Avenue are all considered "Image Routes" and are key corridors where many businesses and services are located. There is likely to be higher levels of pedestrian and vehicle traffic along these streets, increasing the risk of pedestrian-vehicle collisions. These areas could benefit from lowered speed limits or other traffic calming measures. These collision hotspots could be locations for more in-depth analysis of collisions, conditions, and other factors, and could serve as ideal locations to focus engineering, enforcement and/or education campaigns.

Table 3: **Priority reported pedestrian-vehicle collision hotspots in Thunder Bay**

Hotspots	Number of collisions
Algoma St @ Bay St	12
Arthur St @ Edward St	11
Arthur St @ Mountdale St	8
Arthur St @ Waterloo St	6
Arthur St @ James St	6
Memorial St @ Isabel	6

Figure 12: **Pedestrian-vehicle collision hotspots in Thunder Bay (2004-2013)**



Distance to nearest school

Information on the distance to the nearest school was available for 626 (98.7%) of the reported pedestrian-vehicle collisions. Schools included primary, secondary, and post-secondary institutions. Of these collisions, 15.8% occurred within 250m of the nearest school and 34% occurred between 250m and 500m of the nearest school. Therefore, half of all pedestrian-vehicle collisions occurred within 500m of the nearest school. Improving pedestrian safety around schools should be a priority and could be addressed by various strategies, including installing appropriate facilities for walking, traffic calming measures, and police enforcement.

School Travel Planning is an initiative that was recommended by Canada Walks in order to improve walkability in Thunder Bay.

Table 4: **Reported pedestrian-vehicle collisions by distance to the nearest school**

Distance to nearest school (m)	Frequency	Percent (%)*
More than 500m	314	50.16
Between 250 and 500m	213	34.03
Less than 250m	99	15.81
Total	**626**	**100.00**

*Missing values were removed before calculating percentages.

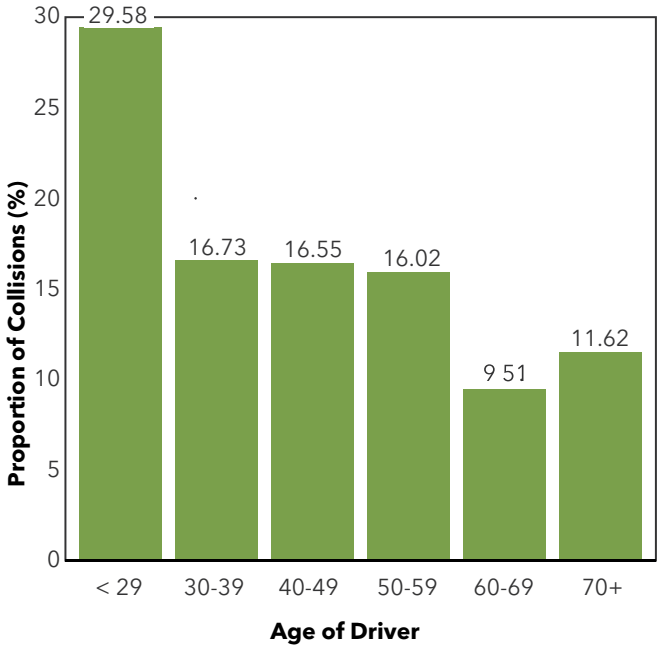
Who is involved in collisions?

This section describes the available demographic information about the drivers involved in reported pedestrian-vehicle collisions that occurred between 2004 and 2013. Unfortunately, data on age and gender of the pedestrians involved were not available.

Driver age

The average age of drivers involved in reported pedestrian-vehicle collisions during the ten-year study period was 43.1 years. Drivers less than 29 years of age represented the highest proportion of drivers involved in reported pedestrian-vehicle collisions (29.58%), as seen in Figure 13. New drivers do not have as much experience as older age groups, and there could be an opportunity to target driving schools to incorporate education around pedestrian safety awareness.

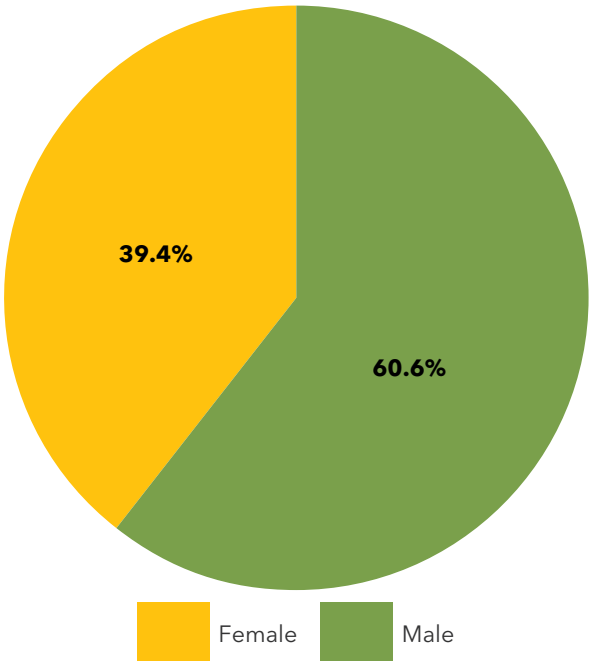
Figure 13: **Proportion of reported pedestrian-vehicle collisions by age of driver (2004-2013)**



Driver gender

Male drivers were more commonly involved in reported pedestrian-vehicle collisions in Thunder Bay. 60.6% of collisions involved a male driver compared to 39.4% involving a female driver. The Chief Coroner for Ontario Pedestrian Death Review report found that 67% of collisions resulting in pedestrian fatalities involved male drivers.[56] These data suggest that education campaigns aimed at improving pedestrian safety could be most effective if focused on male drivers.

Figure 14: **Proportion of reported pedestrian-vehicle collisions by driver gender (2004-2013)**



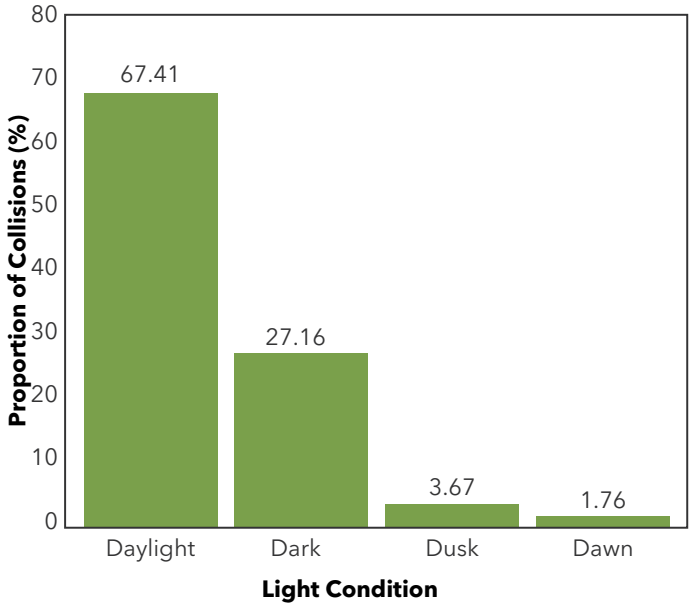
Why and how are collisions happening?

Pedestrian-vehicle collisions are influenced by many factors, including driver and pedestrian actions, infrastructure, and the environment. This section describes the conditions and actions surrounding reported pedestrian-vehicle collisions between 2004 and 2013. It is important to note that these data are descriptive and without accurate data about the underlying population at risk (i.e., number of pedestrian trips and pedestrian traffic volume data), findings must be interpreted with caution.

Light condition

Information on 'light condition' was available for 626 (98.7%) of reported pedestrian-vehicle collisions. Of these collisions, more happened during daylight (67.4%) and dark (27.2%) than during dusk or dawn (5.4%). Improved pedestrian-scale lighting could address the fair number of collisions that occur during dark conditions. The provision of pedestrian-scale lighting varies throughout the City, with less than 2% of sidewalks and 8% of multi-use trails having pedestrian-scale lighting installed.[57]

Figure 15: **Proportion of reported pedestrian-vehicle collisions by light condition (2004-2013)**



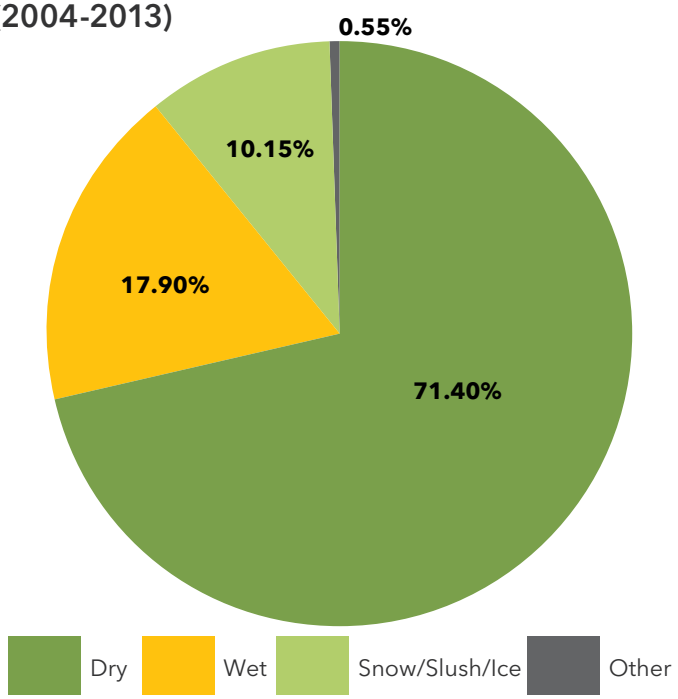
Weather

Information on 'weather' was available for 626 (98.7%) of reported pedestrian-vehicle collisions. Of these collisions, most (86.9%) happened when the weather was good, compared to when the weather created poor visibility (13.1%; i.e. rain, snow, freezing rain, drifting snow, strong wind, fog, mist, smoke, and dust).

Road surface condition

Information on 'road surface' was available for 542 (85.5%) of reported pedestrian-vehicle collisions. Of these collisions, most (71.4%) happened on dry roads, compared to wet roads (17.9%) or roads covered with snow, slush or ice (10.2%).

Figure 16: **Proportion of reported pedestrian-vehicle collisions by road surface condition (2004-2013)**



Driver action

For reported pedestrian-vehicle collisions where information about driver action was available, 39.2% of drivers were driving properly and 40.7% were not driving properly (failed to yield, disobeyed traffic signal, etc.) Driver action is summarized in Table 5.

Table 5: **Reported pedestrian-vehicle collisions by driver action (2004-2013)**

Driver Action	Frequency	Percent (%)*
Driving properly	258	39.31
Failed to yield right-of-way	194	29.48
Disobeyed traffic signal	20	3.04
Improper turn	15	2.28
Lost control	11	1.67
Following too close	9	1.37
Speeding and Speed too fast for conditions	11	1.67
Improper lane change and Improper passing	8	1.22
Other	132	20.06
Total	**658**	**100.00**

*Missing values were removed before calculating percentages.

*Some collisions involved more than one vehicle, as such, the total number of driver actions exceeds the total number of collisions.

Pedestrian action

For pedestrians with available 'pedestrian action' information, 31.3% of pedestrians crossed with right-of-way and 20.6% of pedestrians crossed without right-of-way. This could indicate that the distances between crossing opportunities are too great, resulting in pedestrians crossing the street without the right-of-way.

Table 6: **Reported pedestrian-vehicle collisions by pedestrian action (2004-2013)**

Pedestrian action	Frequency	Percent (%)*
Crossing with right-of-way	192	31.32
Crossing without right-of-way	126	20.55
On sidewalk or shoulder	53	8.65
Running onto roadway	39	6.36
Coming from behind parked vehicle	32	5.22
Crossing with no traffic control	31	5.06
Walking on roadway	24	3.92
Pedestrian crossover	9	1.47
Playing or working on highway	8	1.31
Person getting on/off vehicle	7	1.14
Other	92	15.01
Total	**613**	**100.00**

*Missing values were removed before calculating percentages.

Driver condition

For drivers with available 'driver condition' information, 75.8% of drivers were reported as 'normal', 19.2% of drivers were distracted, and 3.6% of drivers had been drinking or were impaired by alcohol. With the evolution of technology and handheld devices, distracted driving has become a significant public health issue. Continued efforts to eliminate distracted and impaired driving are essential.

Table 17: **Proportion of reported pedestrian-vehicle collisions by driver condition (2004-2013)**

75.8%
Normal

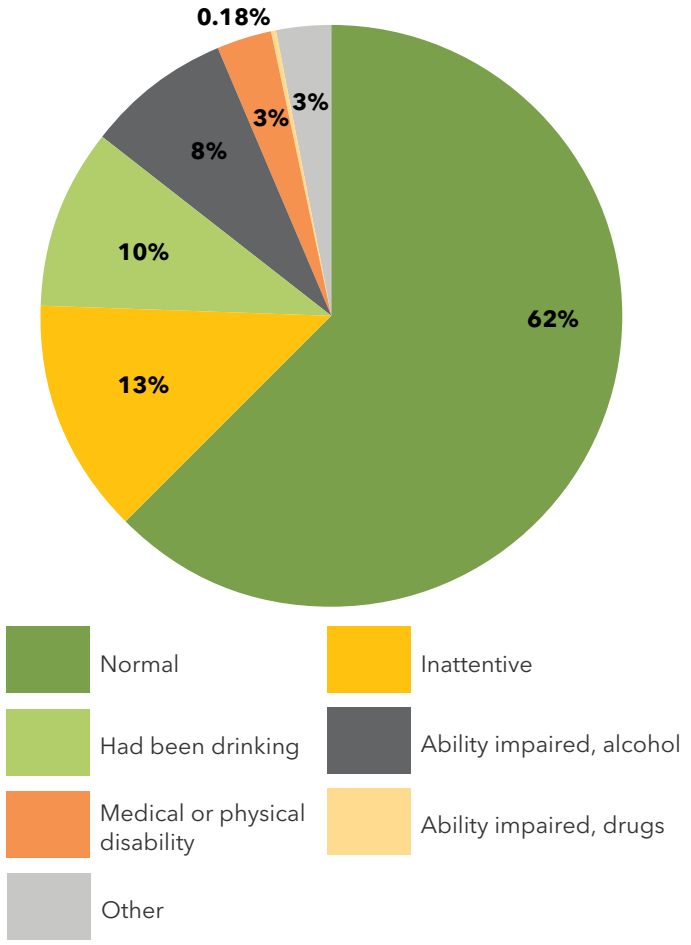
19.2%
Inattentive

3.6%
Impaired, alcohol

Pedestrian condition

For those reported pedestrian-vehicle collisions where information describing pedestrian condition was available, 62.3% of pedestrians were not impaired, 13.0% of pedestrians were inattentive, and 18.4% of pedestrians had been drinking or were impaired by alcohol. This is quite high compared to other cities. In Toronto for example, about 5% of pedestrians had been drinking at the time of a collision.[58]

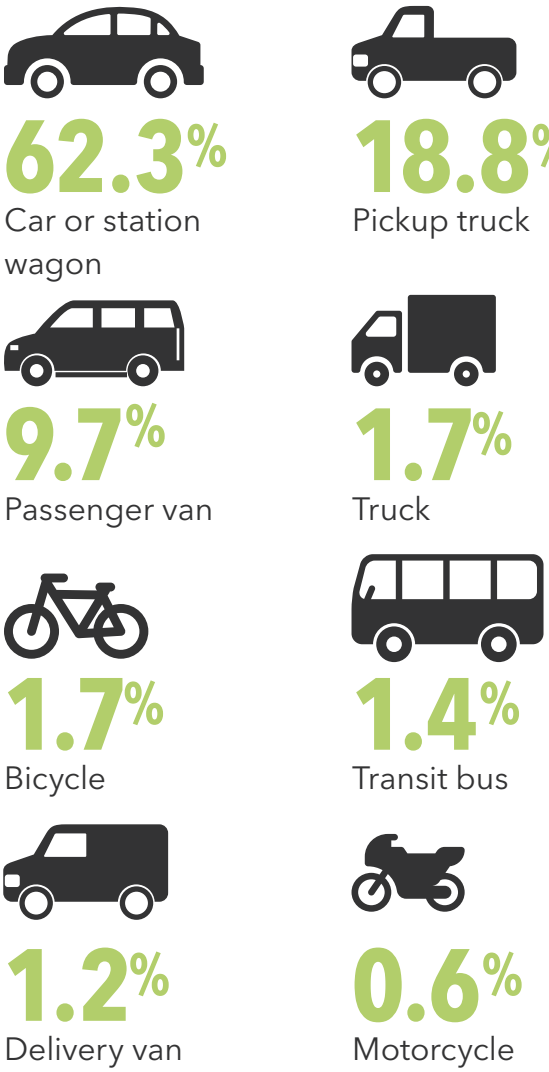
Figure 18: **Proportion of reported pedestrian-vehicle collisions by pedestrian condition (2004-2013)**



Vehicle type

Information on 'vehicle type' was available for 663 vehicles involved in reported pedestrian-vehicle collisions. In these collisions, the majority of vehicles involved (62.3%) were automobiles/station wagons, followed by pickup trucks (18.8%). Some municipalities have identified that collisions between pedestrians and transit buses are common. This is not the case in Thunder Bay. In addition, collisions between bicycles and pedestrians are rare, accounting for only 1.7% of all collisions.

Figure 19: **Proportion of reported pedestrian-vehicle collisions by vehicle type (2004-2013).**

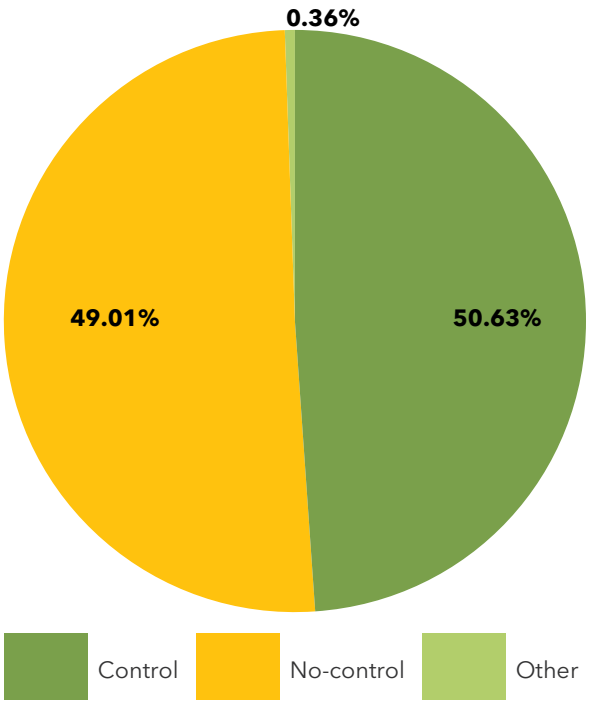


*Note that 2.6% of collisions involved vehicle types not listed.
*Some collisions involved more than one vehicle, and as such, the total number of vehicle types exceeds the number of collisions that occurred.

Traffic control

Information on the existence of traffic control measures was available for 555 (87.5%) of reported pedestrian-vehicle collisions. Possible traffic control measures include traffic signals, stop signs, yield signs, pedestrian crossovers/ crosswalks. Nearly half (49.01%) of all collisions occurred at a location lacking a traffic control.

Figure 20: **Proportion of reported pedestrian-vehicle collisions by traffic control (2004-2013)**

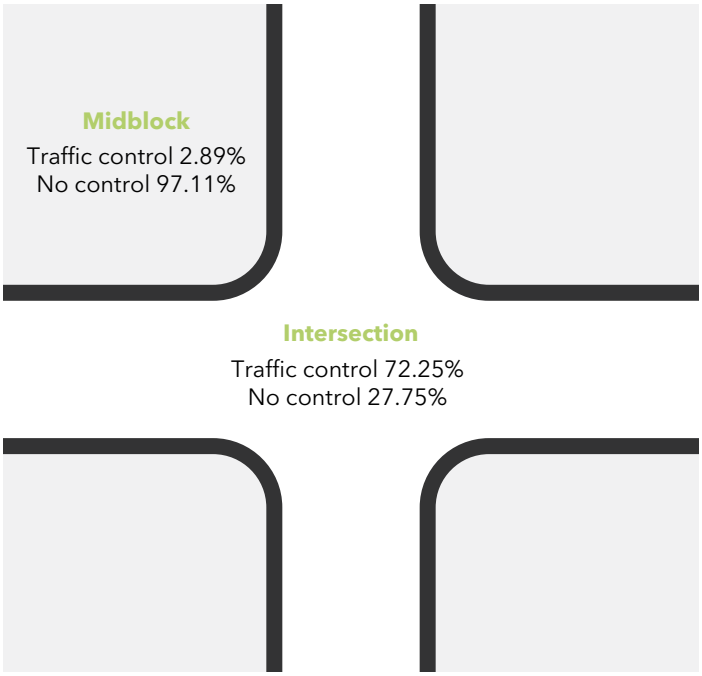


Collision location type by traffic control

Information on intersection versus midblock location and the presence of traffic control was available for 555 (87.5%) of reported pedestrian-vehicle collisions. Of these collisions, most occurred at intersections that had some form of traffic control (72.2%); 27.8% of the collisions occurred at intersections that did not have a traffic control. Notably, almost all of the reported pedestrian-vehicle collisions that occurred midblock did not have a traffic control (97.1%). This is to be expected given that

midblock crossings had not been installed in Thunder Bay until the first crossover installation at Algoma and Cornwall in 2016. The large proportion of pedestrian-vehicle collisions that occur midblock without a traffic control highlights that the installation of traffic controls at midblock locations is a major opportunity to improve pedestrian safety.

Figure 21: **Proportion of reported pedestrian-vehicle collision location type by traffic control (2004-2013)**



Vehicle Manoeuvre

Information on 'vehicle manoeuvre' was available for 595 reported pedestrian-vehicle collisions. Of these, the majority of collisions involved vehicles that were going straight ahead (51.1%), followed by vehicles turning left (13.8%), vehicles turning right (12.9%), and vehicles reversing (10.8%).

Table 7: **Proportion of reported pedestrian-vehicle collisions by vehicle manoeuvre (2004-2013)**

Manoeuvre	Frequency	Percent (%)*
Going ahead	304	51.09
Turning left	82	13.78
Turning right	77	12.94
Reversing	64	10.76
Slowing or stopping	25	4.20
Stopped	16	2.69
Overtaking	8	1.34
Parked	7	1.18
Changing lanes and pulling away/onto shoulder or curb	7	1.18
Other	5	0.84
Total	**595**	**100.00**

*Missing values were removed before calculating percentages.

Intersection collision typology

Reported pedestrian-vehicle collisions at intersection locations were classified into specific types based on the collision typology developed by the City of Toronto.[58] Collision types were created using data from the 'collision location', the 'vehicle manoeuvre', and the 'pedestrian action' variables. For those collisions occurring at an intersection these three variables were available for only 180 collisions. Therefore, this analysis is conducted on a subset of collisions and should be interpreted with some caution. Nevertheless, the collision typology does provide insight into the types of reported pedestrian-vehicle collisions that occur most commonly in Thunder Bay. The most common collisions types occurring at intersections include vehicles turning left while a pedestrian crossed with right-of-way (26.1%) and vehicles turning right while pedestrian crossed with right-of-way

(23.8%). These data suggest that collisions occurring while pedestrians have the right-of-way at intersections are common compared to collisions where pedestrians do not have the right-of-way. A significant proportion of collisions also occurred when vehicles were going straight and the pedestrian had the right-of-way (19.4%).

Table 8: **Reported pedestrian-vehicle collisions by intersection collision type (2004-2013)**

Intersection collision types	Frequency	Percent (%)*
Vehicle turns left while pedestrian crosses with right-of-way	47	26.11
Vehicle turns right while pedestrian crosses with right-of-way	43	23.88
Vehicle is going straight through intersection while pedestrian crosses with right-of-way	36	20.00
Vehicle is going straight through intersection while pedestrian crosses without right-of-way	35	19.44
Vehicle turns left while pedestrian crosses without right-of-way	10	5.55
Vehicle turns right while pedestrian crosses without right-of-way	9	5.00
Total	**180**	**100.00**

*Missing values were removed before calculating percentages.

COMMUNITY PERCEPTIONS OF WALKABILITY AND PEDESTRIAN SAFETY

This section summarizes the results of a community survey that was conducted to examine perceptions of walkability and pedestrian safety in the context of Thunder Bay. The methods used and key findings related to perceived walkability, satisfaction with walking infrastructure, and pedestrian safety are summarized in the following sections.

Data

A pedestrian intercept survey was conducted to examine perceptions of walkability and pedestrian safety in Thunder Bay. A convenience sampling strategy was used to recruit pedestrians to participate in the survey at 30 pre-selected locations across the City of Thunder Bay. The 30 locations were identified by randomly selecting 30 dissemination area (DA) census units within City of Thunder Bay. Subsequently, a specific location was selected within each of the 30 pre-selected DAs. This approach allowed for random selection of locations and ensured geographic coverage across the City. Data collectors were instructed to approach all pedestrians until a total of 10 surveys were completed at each location for a total sample size of 300. Only those pedestrians 18 years of age or older who resided in Thunder Bay were eligible to participate. Data were gathered on different days of the week and at different hours of the day between 8:00 am and 8:00 pm between August and October 2016 by a team of two researchers.

The data collection instrument was developed to examine perceptions of walkability and pedestrian safety among residents of Thunder Bay. The instrument contained a total of 67 questions pertaining to i) demographics and walking behaviour, ii) perceived neighbourhood walkability, iii) satisfaction with walkability and safety and iv) priorities for municipal government action. Perceived neighbourhood walkability was assessed using a modified version of the Neighbourhood Environment Walkability Scale – Abbreviated (NEWS-A).[59] The NEWS-A scale assesses key aspects of the built environment known to influence walkability including: land use diversity and mix, connectivity, infrastructure and safety for walking, aesthetics, and traffic related hazards. Numerous scales and tools have been developed and are available to assess neighbourhood walkability; the NEWS-A scale was selected for the survey as it has been tested and validated in numerous settings.[60,61,62] The NEWS-A was modified for the Thunder Bay context based input from Thunder Bay District Health Unit staff, the City of Thunder Bay staff,

and members of the Thunder Bay Walkability Committee. Using the NEWS-A scoring protocol, sub-category scores and an overall walkability score were calculated. The overall walkability score was calculated as the sum of mean scores in the following 5 sub-categories: land use diversity and access to amenities (14-item category), street connectivity (3-item category), infrastructure and safety for walking (7-item category), aesthetics (2-item category) and traffic hazards (3-item category). Sample items for each of the 5 sub-categories in the walkability score are illustrated in Table 9. Items were reversed coded when needed. A higher value reflects higher walkability across the sub-categories and the final walkability score. The survey also included questions aimed at assessing levels of satisfaction with walkability and safety, as well as one question about ways in which the municipal government should improve walkability and pedestrian safety in Thunder Bay. The instrument was reviewed by members of the Thunder Bay Walkability Committee and is available from the Thunder Bay District Health Unit.

Limitations of the pedestrian survey data should be acknowledged when interpreting the findings presented in this report. First, a convenience sample was used. However, it was a sufficiently large sample of pedestrians with experience walking in their neighbourhoods. Additionally, the data were collected at a large number of diverse locations across the City, on different days, and different times of the day. Second, only one respondent resided in Neebing ward participated in the survey such that this ward was excluded from ward specific analyses. Third, respondents were allowed to self-define 'neighbourhood'; it is likely that different respondents may define neighbourhood in different ways. Finally, as with all survey research, when reviewing these data, care must be taken to drawing inferences beyond the sampled population.

Table 9: **Sub-categories and sample items used to generate a walkability score**

Walkability score sub-categories (total items in sub-category)	Example survey item	Possible responses
Land use diversity and access to amenities (14)	"If you walked from your home, about how long would it take to get to the nearest supermarket"	1-5 min; 6-10 min; 11-20 min; 21-30 min; 31+ mins; don't know
Connectivity (3)	"The sidewalk network in my neighbourhood is well connected and complete."	Strongly disagree; somewhat disagree; strongly agree; somewhat agree
Infrastructure and safety for walking (7)	"There are many four-way intersections in my neighbourhood"	Strongly disagree; somewhat disagree; strongly agree; somewhat agree
Aesthetics (2)	"There are many attractive natural sights, buildings, or homes in my neighbourhood"	Strongly disagree; somewhat disagree; strongly agree; somewhat agree
Traffic hazards (3)	"There is so much traffic along the street I live on that it makes it difficult or unpleasant to walk"	Strongly disagree; somewhat disagree; strongly agree; somewhat agree

Key findings

Three hundred pedestrians completed the survey. Due to a large amount of missing data, 4 respondents were excluded prior to analysis. In the following sections, key findings from the community survey are presented.

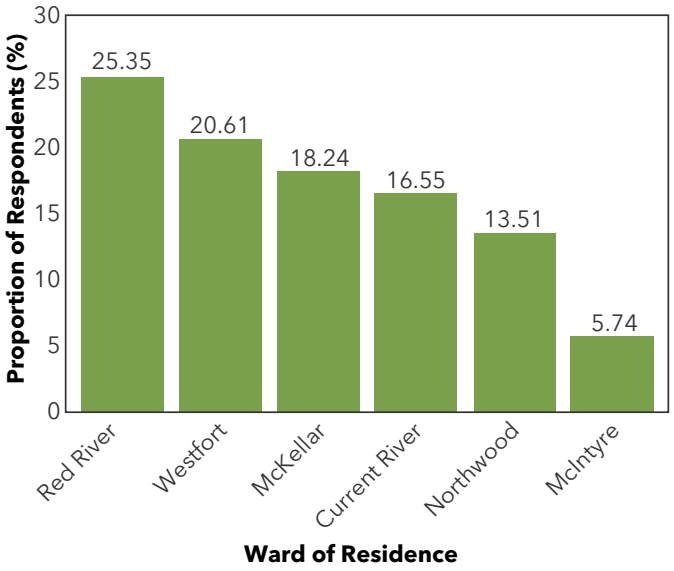
Respondent demographics and walking behaviour

This section provides a description of the sample in terms of key demographic information and walking behaviour. Because survey participants were intercepted while walking, these data describe the characteristics of walkers in Thunder Bay.

Ward of residence

The ward of residence is illustrated in Figure 22 for all 296 survey respondents. The top 3 wards represented were: Red River (25.34%), Westfort (20.61%) and McKellar (18.24%).

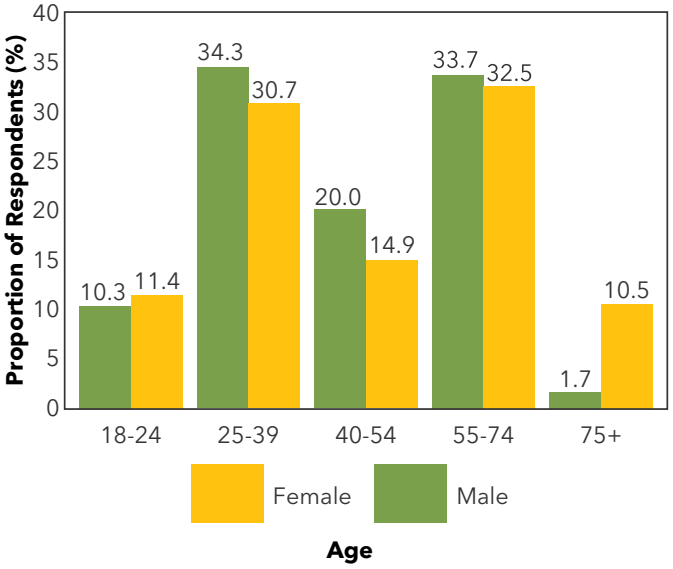
Figure 22: **Proportion of respondent residence by ward**



Age and gender

The top 3 age groups represented by survey respondents who reported their age were: 55-74 years (33.22%), 25-39 years (32.20%) and 40-54 years (17.97%). More than half of survey respondents who reported their gender were female. Figure 23 depicts the distribution of respondents by age and gender.

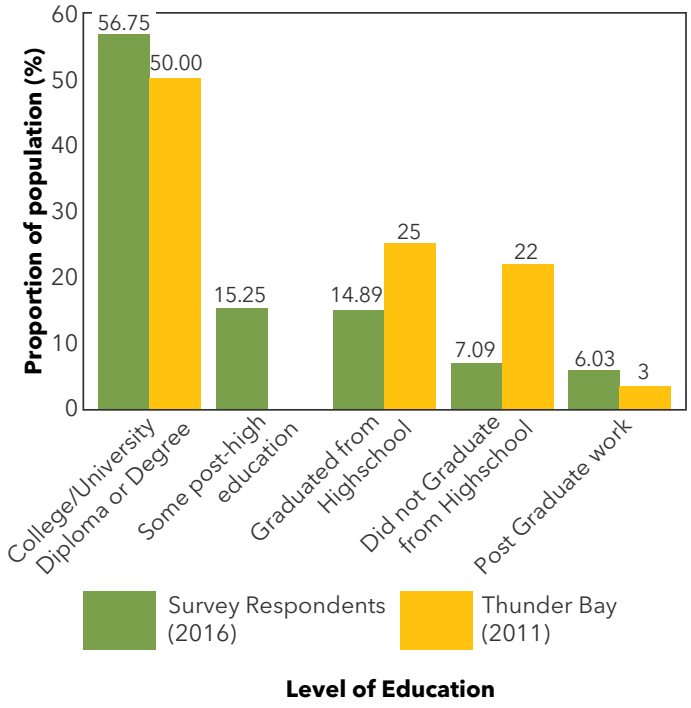
Figure 23: **Proportion of respondents by age and gender**



Education level

Slightly more than half (56.75%) of participants that reported their highest level of education completed a college/university diploma/ degree. Educational attainment was compared to totals for Thunder Bay from the 2011 National Household Survey,[63] and is depicted in Figure 24. Note that the National Household Survey did not measure an equivalent to "some post-high education" and this was a variable specific to the survey used by the research team. Since the majority of respondents reported having a college/university diploma or degree, it can be inferred that the walkers that were intercepted are likely able to afford a vehicle and do not have to rely on walking for transportation.

Figure 24: **Proportion of survey respondents and Thunder Bay population by education level**



Visible or non-visible disability

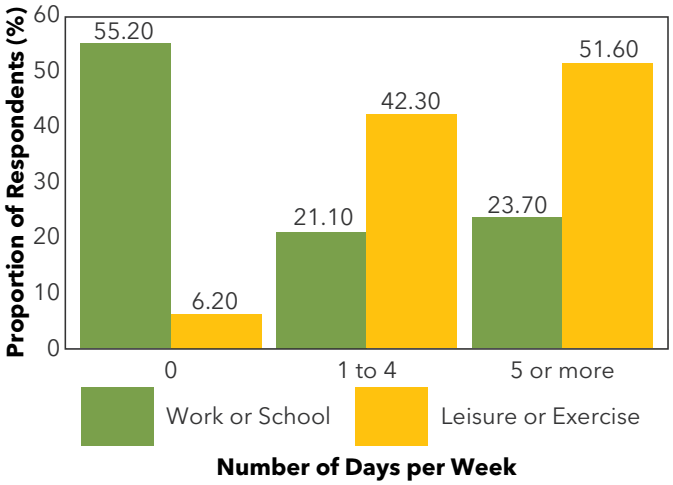
Overall, 11.95% of survey respondents reported having a visible and/or non-visible disability that influenced their perceptions of walkability or pedestrian safety, highlighting the importance of accessibility with regards to walking infrastructure.

Walking for recreation and transport

Just over half of the survey respondents (55.19%) reported that they do not commute to work or school by foot in a typical week in the summer months, while 21.10% of respondents reported that they walked to work or to school at least once a week. Approximately 23% reported that they commuted by foot 5 or more days in a typical week in the summer months. Comparatively, just over half of respondents (51.55%) walked for leisure and/or exercise 5

or more days in a typical week in the summer. This suggests that residents enjoy walking for recreational purposes but that there are barriers to walking for transportation to work or school.

Figure 25: **Proportion of respondents walking**

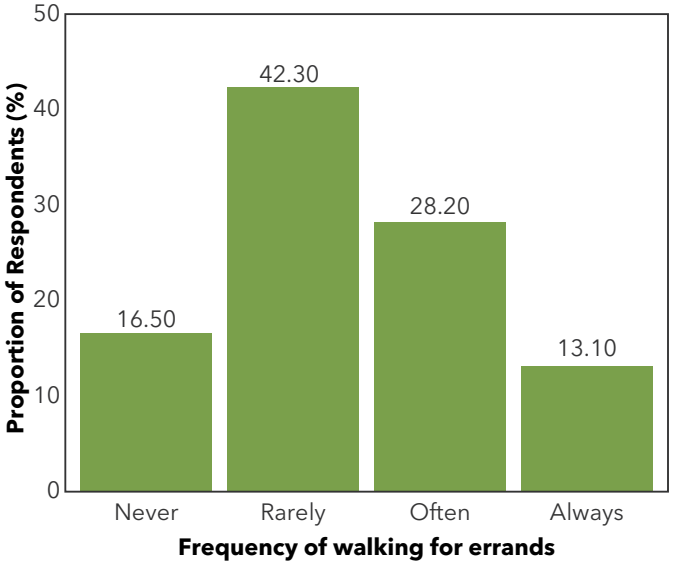


to work or school versus walking for leisure or exercise by number of days per week

Walking for errands

In a typical week in the summer, 16.50% of respondents never walked for errands and 42.30% rarely walked for errands, as shown in Figure 26. This suggests that there are barriers to walking to amenities and destinations.

Figure 26: **Proportion of respondents who walk to do errands**



Perceived neighbourhood walkability

As stated previously, the Neighbourhood Environment Walkability Scale - Abbreviated (NEWS-A), a validated scale, was adapted for the context of Thunder Bay to assess and quantify perceived walkability in Thunder Bay. The overall walkability score was calculated by combining the mean scores across 5 sub-categories as illustrated in Figure 27. Additional details are provided in Appendix 1. A mean value was calculated for all respondents in each of the 5 sub-categories; each sub-category is therefore scored out of 4 and the overall walkability score is out of 20 with higher values reflecting higher walkability. Sub-category and overall walkability scores were also calculated by ward; these results are presented in Appendix 2. Only survey respondents that answered over 80% of survey questions in a subscale were included in the score analyses.

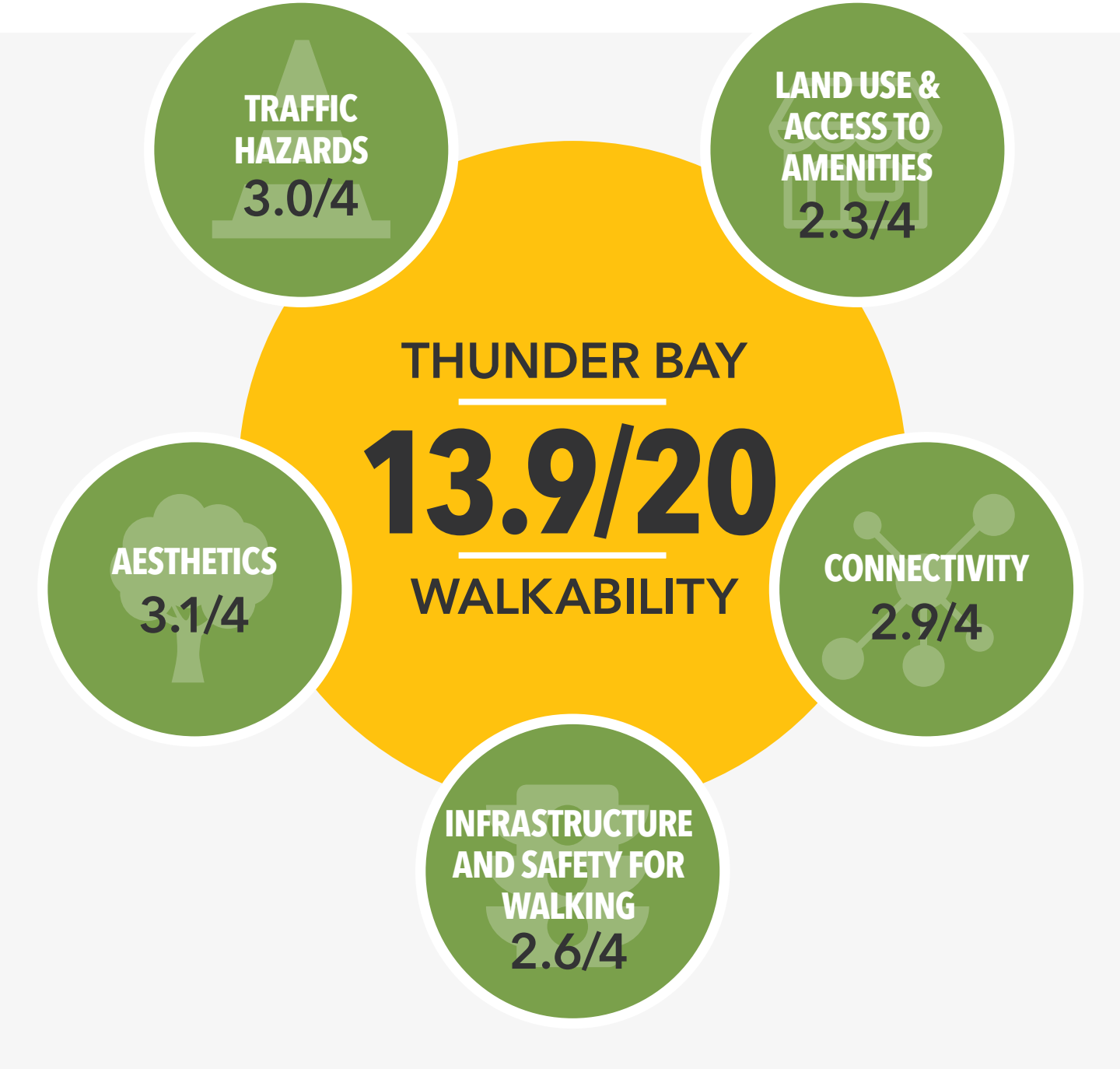
66%

of respondents would like to walk more than they are currently walking

Compared to research conducted throughout other cities in developed countries, the sub-category scores and the final walkability score for Thunder Bay indicate generally low perceived walkability with room for

improvement.[64,65] These findings also highlight areas that require more policy and programming to improve perceived walkability. Specifically, **infrastructure and safety for walking** and **land-use and access to amenities** are priority areas to ultimately improve perceived walkability in the community. Research has reported that many other cities worldwide perform poorly in terms of aesthetics.[66] This appears to be a strength in the context of Thunder Bay; aesthetics is certainly important for walkability overall but may be less effective at promoting walking for transport compared to walking for recreational purposes.

Figure 27: **Overall walkability score, calculated by combining the mean scores across 5 sub-categories**



A closer look at access to amenities

Access to amenities can encourage residents to walk and to integrate walking into their everyday lives and routines. Access to amenities was examined by asking survey participants how long it took them to walk to key amenities from their home. The results for access to amenities are displayed in Table 10 and reported as walkable (within a 10-minute walk from home) and not walkable (greater than a 10-minute walk from home). The results indicate that bus stops, parks, greenspaces, convenience stores, and multi-use trails were accessible and within walking distance for the most respondents. However, destinations such as places of work or school, libraries, and grocery stores were not within walking distance for the majority of respondents. This is consistent with the assumption that pedestrians in Thunder Bay walk mostly for leisure and exercise, but not for errands or commuting to work or school.

Table 10: **Access to amenities by walking distance**

If you walked from your home, about how long would it take to get to the nearest...	Within walking distance, % of respondents[1]	Not within walking distance, % of respondents[2]
Bus stop	**89.5**	**10.5**
Park or green space	**82.3**	**17.7**
Convenience store	**71.4**	**28.6**
Multi-use trail	**50.7**	**49.3**
Coffee place	46.1	53.9
Small grocery store	40.1	59.9
Recreation centre	39.0	61.0
Restaurant	**37.2**	**62.8**
Supermarket	**26.1**	**73.9**
Library	**15.4**	**84.6**
Your job or school	**13.6**	**86.4**

[1] Within walking distance combines 1-5 minutes and 6-10 minutes
[2] Not within walking distance combines 11-20 minutes, 21-30 minutes, and 31+ minutes

Satisfaction with walkability and safety

This section of the survey intended to determine how satisfied respondents were with numerous aspects of the walking environment and pedestrian safety in their neighbourhood.

Most notably, respondents were strongly or somewhat dissatisfied with the speed, noise, and amount of traffic in their neighbourhoods, the level of ice and snow removal from sidewalks in the winter, and safety from the threat of crime. Respondents were most satisfied with how easy and pleasant it is to walk in their neighbourhood, as well as the access to greenspace and parks. See Table 11 for complete summary of these findings.

Table 11: **Satisfaction with walkability and safety**

How satisfied are you with...	Strongly or somewhat satisfied (%)	Neutral (%)	Strongly or somewhat dissatisfied (%)
How easy and pleasant it is to walk	**85.14**	**8.45**	**6.42**
Access to greenspace or parks	**82.99**	**9.86**	**7.14**
Access to stores and restaurants	**69.38**	**16.67**	**13.94**
Proximity to schools	**67.14**	**26.86**	**6.01**
Connectivity of sidewalks	65.51	13.10	21.38
Access to public transportation	63.83	26.28	9.89
Safety from the threat of crime	55.45	16.67	27.89
Amount of traffic	51.20	19.80	29.01
Ice and snow removal from the sidewalks	**47.71**	**15.22**	**38.18**
Noise from traffic	**44.25**	**26.35**	**29.39**
Speed of traffic	**40.34**	**12.54**	**47.11**
Ice and snow removal from multi-use trails	**30.96**	**41.64**	**27.40**

THUNDER BAY RESIDENTS ARE SATISFIED WITH...

- ✔ Access to greenspace in their neighbourhood
- ✔ How easy and pleasant it is to walk in their neighbourhood

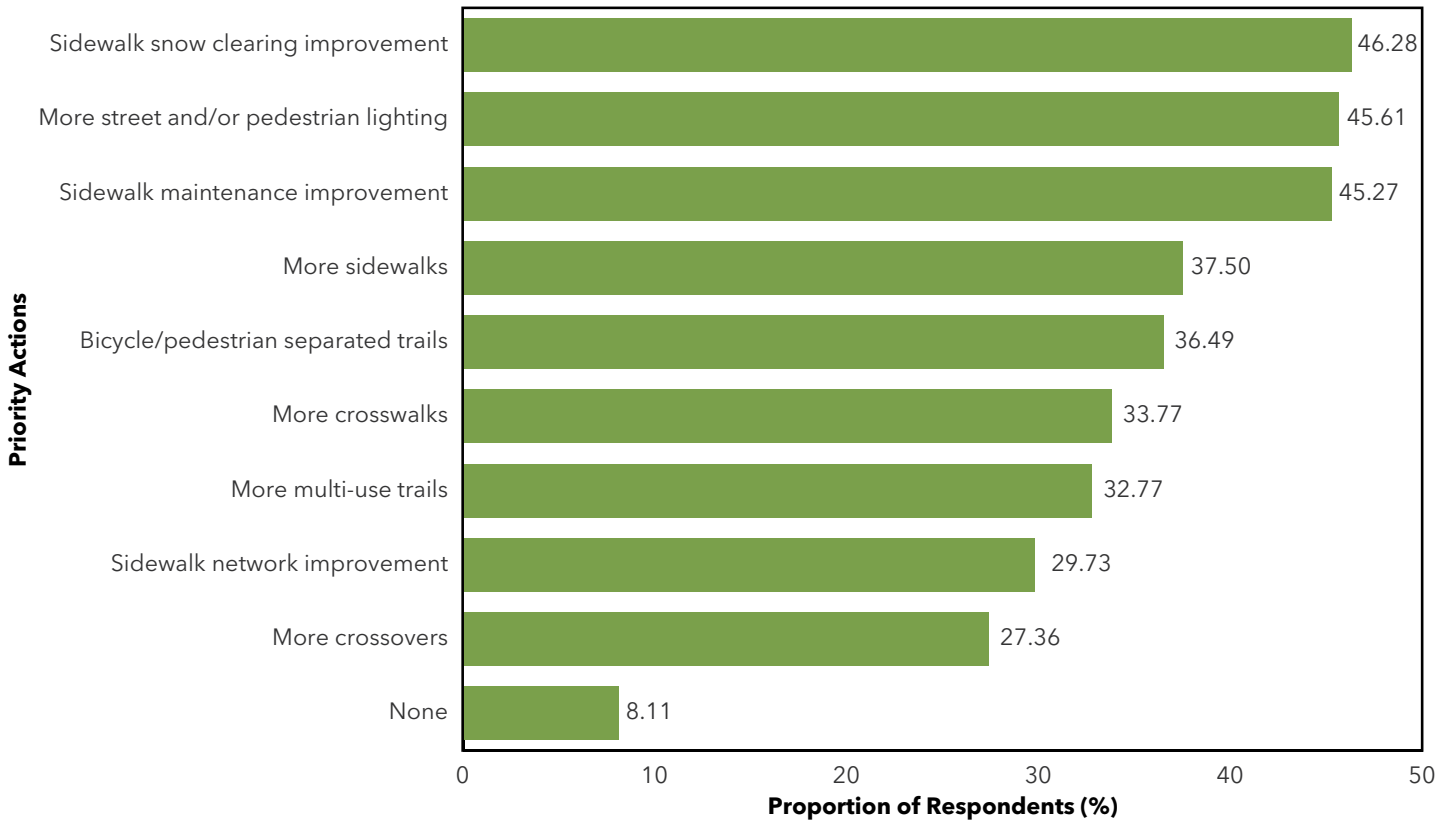
THUNDER BAY RESIDENTS ARE DISSATISFIED WITH...

- ✖ Speed, noise and amount of traffic in their neighbhourhood
- ✖ Ice and snow removal from sidewalks

Priority municipal government action

In order to understand what the Thunder Bay municipal government should prioritize in their efforts aimed to improve walkability and pedestrian safety in Thunder Bay, participants were asked: "What changes, if any, would you like to see your municipal government make to improve walkability and pedestrian safety in Thunder Bay?" Results are displayed in Table 12. The most common response was to improve sidewalk snow clearing, followed closely by more street and/or pedestrian lighting, and sidewalk maintenance improvement. These emerging themes speak to the current quality of walking infrastructure and the sidewalk network. While pedestrians in Thunder Bay enjoy walking, find it pleasant and easy, and want to walk more than they currently do, there is still a need to have well maintained, connected, and safe facilities to do so. Interestingly, more crossovers or crosswalks were not highlighted as a priority action. This could be because the majority of survey respondents were identified as recreational walkers, who may use multi-use trails and residential sidewalks but do not necessarily need to use pedestrian crossing facilities to access destinations.

Table 12: **Priorities for municipal government action**



CONCLUSIONS

Based on the key findings from the collision analysis and the community survey, the following main conclusions can be drawn:

Collision Analysis

When are collisions happening?

- There is no clear increasing or decreasing trend in the number of collisions across the ten-year study period
- October was the peak month for collisions
- More collisions occurred on Friday than any other day of the week
- Peak time for collisions coincided with peak commuting times

Where are collisions happening?

- The greatest proportion of collisions occurred at intersections
- The greatest proportion of collisions occurred on major arteries and local roads
- Half of all collisions occurred within 500m of a school
- The largest number of collisions occurred in the downtown areas
- Priority collision hotspots are located along 'Image Routes' where businesses and services are located and where there is likely higher pedestrian and vehicular traffic

Who is involved in collisions?

- The highest proportion of drivers involved in pedestrian-vehicle collisions were less than 29 years old, and were male

Why and how are collisions happening?

- The majority of collisions occurred during daylight, in clear weather conditions, and on a dry road surface
- 40.7% of collisions occurred while a driver was not driving properly (failed to yield, disobeyed traffic signal, etc.)
- 19.2% of drivers were inattentive and 13% of pedestrians were inattentive at the time of a collision
- 31.32% of the time, pedestrians involved in a collision were crossing with the right-of-way
- Nearly half of all collisions occurred at a location lacking a traffic control, and almost all of the collisions that occurred at a mid-block location lacked a traffic control
- Among those collisions that occurred at intersections, the most common collision type occurred when a vehicle turned left while a pedestrian crossed the street with right-of-way
- 3.6% of drivers and 18.4% of pedestrians had been drinking or were impaired by alcohol at the time of a collision

Community Survey Results

Respondent demographics and walking behaviour

- The top age group represented in the total sample was 55-74 years of age.

- Nearly 12% of survey respondents had a visible and/or non-visible disability that influenced their perceptions of walkability or pedestrian safety
- Walkers in Thunder Bay typically did not walk to commute to work or school, but a large majority walked for leisure or recreation
- 66% of respondents reported wanting to walk more than they currently do

Perceived neighbourhood walkability

- Based on the adapted Neighbourhood Environment Walkability Scale, Thunder Bay has a low walkability score relative to other comparable settings
- Aesthetics of the walking environment is a major strength in Thunder Bay while infrastructure and safety for walking and land-use and access to amenities are dimensions of walkability that could be improved

Access to amenities

- Amenities that are usually within walking distance of people's homes include bus stops, parks and greenspaces, convenience stores, and multi-use trails
- Amenities that are usually not within walking distance include places of work or school, supermarkets, grocery stores, and libraries

Satisfaction with walkability and safety

- Respondents were generally dissatisfied with the speed of traffic, the noise from traffic, and the amount of traffic in their neighbourhood
- Respondents were generally dissatisfied with ice and snow removal from sidewalks in the winter
- Respondents were highly satisfied with how easy and pleasant it is to walk in their neighbourhood, as well as access to greenspace and parks.

Priorities for municipal government action

- The top 3 priorities for municipal government action as identified by respondents were:

1. Sidewalk snow clearing and removal
2. More street and/or pedestrian lighting and
3. Sidewalk maintenance improvement

RECOMMENDATIONS

Walkability and pedestrian safety should be universal priorities for decision makers in the City of Thunder Bay. Improving walkability and pedestrian safety it will take a coordinated and sustained effort between the municipality's Engineering and Planning departments, educators, health professionals, community organizations, the Thunder Bay Police Service, and others to be achieved. Private developers and landowners also have a role to play in improving walkability, and it is necessary to harmonize public and private interests in community planning. The following section outlines recommendations that stakeholders can act upon and strive towards based on the analyses and findings presented in this report. Specific recommendations are categorized under the themes of **planning, engineering, education and encouragement, enforcement,** and **evaluation**.

Planning

- Develop and support a modern Transportation Master Plan which includes a Complete Streets policy and Vision Zero philosophies and prioritizes vulnerable road users
- Strengthen guidance documents, such as the Image Route and Detailed Streetscape Guidelines and the Urban Design and Landscape Guidelines
- Prioritize downtown cores with regards to future engineering, education and encouragement, and enforcement strategies
- Undertake a community-wide planning process to determine and establish pedestrian-oriented neighbourhoods with pedestrian priority zones
- Collaborate with School Boards on safe school access plans that prioritize safe, conflict-free walking zones for students

Engineering

- Reduce speed limits in residential neighbourhoods and in the downtown areas
- Invest in pedestrian-scale lighting, particularly in areas identified as pedestrian priority zones and along Image Routes
- Enhance pedestrian crossing treatments, especially at mid-block locations and with a focus on locations near schools
- Drawing on successes in other cities and available research, identify strategies to address the issue of drivers failing to yield right-of-way
- Pilot additional traffic calming measures as a strategy to reduce traffic volume, noise, and speed, and to reduce the risk of future collisions
- Improve walking routes to key amenities and destinations to promote walking for transport
- Ensure sidewalk quality and connectivity near key destinations
- Undertake a comprehensive site design review at collision hotspots and engage in targeted intersection re-design
- Improve snow clearing on sidewalks and enhance coordination of sidewalk and roadway clearing to reduce banks that block walking paths

Education and Encouragement

- Continue and augment distracted driving/walking education and outreach, including the use of social media
- Continue and augment impaired driving/walking education and outreach including the use of social media
- Provide education on the effectiveness of walkability in deterring crime by having "eyes on the street" to improve actual and perceived safety of walking routes
- Continue to champion the Commuter Challenge campaign to encourage walking as a viable mode of transport
- Investigate other campaigns and programs that would encourage active commutes (eg., Active Switch[67])
- Revive School Travel Planning initiatives, and leverage the Ontario government's recent funding commitment to Active and Safe Routes to School[68]
- Consider hiring a dedicated Active and Safe Routes to School Coordinator through the City of Thunder Bay

Enforcement

- Thunder Bay Police Services should take a leadership role in enforcing speed limits, particularly at times when collisions are common and at collision hotspot locations
- Use data on high collision times, days, locations, and behaviours presented in this report to target enforcement activities
- Strengthen partnerships between with the City of Thunder Bay, the Thunder Bay District Health Unit and the Thunder Bay Police Service

Evaluation

- Identify key walkability and pedestrian safety indicators to monitor progress on an annual basis
- Integrate a pre-and post-evaluation component to assess effectiveness of major engineering projects and investments
- Conduct an analysis of pedestrian-vehicle collisions every 5 years to better understand collisions trends and emerging issues and to monitor progress
- Evaluate progress on the recommendations made in this report in 5 years
- Conduct environmental scans at collision hotspots locations
- Develop an interactive online map of pedestrian-vehicle collisions that can also gather information on "near miss" collisions
- Use mobile pedestrian counters to collect data on pedestrian volume at key locations across the City
- Ensure collision database has minimal missing data points
- Develop a method for collecting information on pedestrian demographic information for pedestrians involved in collisions
- Invest in a comprehensive traffic information survey to gather representative data on pedestrian and vehicle trips in Thunder Bay (eg., Transportation Tomorrow Survey)

CLOSING REMARKS

A city that is walkable and safe for pedestrians benefits all community members. Healthy built environments are an investment in the City's future by protecting and supporting public health, reducing greenhouse gas emissions, revitalizing the local economy, and building a livable and inclusive community. In order to improve walkability and pedestrian safety in Thunder Bay, we must first understand it. This report presents a comprehensive picture of the state of walkability and pedestrian safety in Thunder Bay by analyzing ten-years of pedestrian-vehicle collision data and examining perceptions of walkability and pedestrian safety in our community. Drawing on the data and key findings, this report provides meaningful and achievable recommendations that will help transform Thunder Bay into a walkable community where pedestrians of all ages and abilities are safe and can incorporate healthy habits into daily life. Making progress on the key issues and recommendations outlined in this report will require the continued, enhanced, and integrated efforts from a range of stakeholders, additional data collection and research, and a commitment from municipal leadership.

> **"The General Theory of Walkability explains how, to be favored, a walk has to satisfy four main conditions: it must be useful, safe, comfortable, and interesting. Each of these qualities is essential and none alone is sufficient.**
>
> – Jeff Speck, Walkable City: How Downtown Can Save America, One Step at a Time

APPENDICES

Appendix 1: Items used to assess perceived walkability based on the NEWS-A

Sub-category A: Land-use and access to amenities

If you walked from your home, about how long would it take to get to the nearest…

- Convenience/small grocery store
- Supermarket
- Small grocery store
- Laundry/dry cleaners
- Library
- School
- Restaurant
- Coffee place
- Pharmacy/drug store
- Your job or school
- Bus stop
- Park
- Recreation center
- Multi-use trail

Responses: 1-5 minutes (4); 6-10 minutes (3); 11-20 minutes (2); 21-30 min, 31+min and don't know (1)

Sub-category B: Connectivity

- The distance between intersections where I can cross the street in my neighbourhood is usually short (100 metres or less; about the length of a football field or less).
- There are many alternative routes for getting from place to place in my neighbourhood. (I don't have to go the same way every time.)
- The sidewalk network in my neighbourhood is well connected and complete.

Responses: Strongly disagree (1) Somewhat disagree (2) Somewhat agree (3) Strongly agree (4)

Sub-category C: Infrastructure and safety for walking

- There are many four-way intersections in my neighbourhood.
- There are crosswalks and/or pedestrian signals at intersections to help pedestrians cross busy streets in my neighbourhood.
- The sidewalks in my neighbourhood are well-maintained (paved, even, and not a lot of cracks).
- In the winter months, the sidewalks in my neighbourhood are well-maintained and safe to walk on.
- I feel safe crossing the street in my neighbourhood.
- My neighbourhood sidewalks and trails are well-lit at night.
- The threat of crime in my neighbourhood makes it feel unsafe to go on walks at night.

Responses: Strongly disagree (1) Somewhat disagree (2) Somewhat agree (3) Strongly agree (4)

Sub-category D: Aesthetics

- There are trees along the streets in my neighbourhood.
- There are many attractive natural sights, buildings, or homes in my neighbourhood.

Responses: Strongly disagree (1) Somewhat disagree (2) Somewhat agree (3) Strongly agree (4)

Sub-category E: Traffic hazards

- There is so much traffic along the street I live on that it makes it difficult or unpleasant to walk in my neighbourhood.
- There is so much traffic along nearby streets that it makes it difficult or unpleasant to walk in my neighbourhood.
- Drivers are courteous towards pedestrians.

Responses: Strongly disagree (1) Somewhat disagree (2) Somewhat agree (3) Strongly agree (4)

Appendix 2: NEWS-A sub category and overall walkability scores by ward of residence

Ward	Land-use and access to amenities	Connectivity	Infrastructure and safety for walking	Aesthetics	Traffic Hazards	Total Walkability Score
McIntyre	2.33 (0.49) [n=17]	3.04 (0.84) [n=17]	2.59 (0.43) [n=17]	3.32 (0.83) [n=17]	3.16 (0.60) [n=17]	14.44 (1.89) [n=17]
Red River	2.51 (0.42) [n=75]	2.94 (0.62) [n=73]	2.53 (0.60) [n=74]	3.07 (0.60) [n=74]	2.86 (0.60) [n=74]	13.85 (1.70) [n=73]
McKellar	2.29 (0.51) [n=50]	2.89 (0.60) [n=50]	2.47 (0.52) [n=54]	3.00 (0.75) [n=53]	2.96 (0.53) [n=52]	13.65 (1.79) [n=53]
Northwood	2.30 (0.58) [n=40]	3.03 (0.70) [n=17]	2.75 (0.51) [n=40]	3.20 (0.65) [n=39]	3.11 (0.62) [n=39]	14.40 (1.89) [n=39]
Current River	2.30 (0.57) [n=47]	2.75 (0.67) [n=46]	2.43 (0.48) [n=45]	3.26 (0.68) [n=48]	3.06 (0.60) [n=48]	13.85 (2.08) [n=47]
Westfort	2.26 (0.56) [n=61]	2.95 (0.66) [n=56]	2.74 (0.56) [n=58]	3.05 (0.77) [n=59]	3.15 (0.65) [n=60]	14.00 (2.16) [n=58]
Overall	**2.34 (0.52) [n=290]**	**2.92 (0.66) [n=281]**	**2.58 (0.55) [n=288]**	**3.11 (0.70) [n=290]**	**3.02 (0.61) [n=290]**	**13.95 (1.92) [n=287]**

* Mean (SD) and [number of respondents included in analyses] are presented.
* Higher scores denote higher walkability.
NB: Only respondents who answered more than 80% of subscale questions were included in score analyses.

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