APPENDIX A. NATIONAL PEDESTRIAN STUDY REVIEW

This chapter is a review of pedestrian crash trends in Minnesota and across the United States. This review relies primarily on information from published federal, state, and local crash and safety studies. Crash trends, current research, and best practices are gleaned from these reports and applied as applicable to the Minneapolis Pedestrian Crash Study.

Studies Considered

Nine studies were reviewed to inform the Minneapolis Pedestrian Crash Study. These studies vary in date, data used, purpose, and audience. Four of the reports provide national trends and/or compare pedestrian crashes between geographic areas. Four of the reports provide an in-depth look at pedestrian crash trends within a large city. One of the reports provides a review of pedestrian crashes across Minnesota. This section provides an overview of each report in terms of purpose and methodology. The results and findings of the reports are synthesized together in the Findings section. The reports reviewed are summarized in **Table A-1**.

Table A-1. Reports Reviewed for the Minneapolis Pedestrian Crash Study

Report Title	Year	Author/Agency	Geographic Scope
Strategic Agenda for Pedestrian and Bicycle Transportation	2016	Federal Highway Administration	National
Dangerous by Design 2016	2016	Smart Growth America	National
Bicycling & Walking in the United States Benchmarking Report	2016	Alliance for Biking and Walking	National
Pedestrian Traffic Fatalities by State	2017	Governors Highway Safety Association	National
Minnesota Motor Vehicle Crash Facts	2015	Minnesota Department of Public Safety	Statewide
City of Chicago Pedestrian Crash Analysis Summary Report	2011	Chicago Department of Transportation	City
New York City Pedestrian Safety Study & Action Plan	2010	New York City Department of Transportation	City
Don't Cut Corners: Left Turn Pedestrian & Bicycle Crash Study	2016	New York City Department of Transportation	City
Seattle 2015 Traffic Report	2015	Seattle Department of Transportation	City
City of Seattle Bicycle and Pedestrian Safety Analysis	2016	Seattle Department of Transportation	City

Strategic Agenda for Pedestrian and Bicycle Transportation

- Author: U.S. Department of Transportation Federal Highway Administration
- Year Published: 2016

The United States Department of Transportation (USDOT) Federal Highway Administration's (FHWA) Strategic Agenda for Pedestrian and Bicycle Transportation (The Agenda) is a policy and investment framework for pedestrian and bicycle initiatives through 2021. The Agenda articulates goals and supporting actions to promote safe, accessible, comfortable, and connected bicycle and pedestrian networks; ensure the safety of nonmotorized travelers; ensure equitable access for everyone to jobs, schools, and essential services; and to expand transportation options and choices for all. The Agenda establishes two national goals:

- Achieve an 80 percent reduction in pedestrian and bicycle fatalities and serious injuries in 15 years and zero pedestrian and bicycle fatalities and serious injuries in the next 20 to 30 years.
- Increase the percentage of short trips represented by bicycling and walking to 30 percent by the year 2025. Short trips are defined as trips five miles or less for bicyclists and one mile or less for pedestrians.

The majority of the document outlines the actions the FHWA will take to achieve those two goals.

Dangerous by Design 2016

- Author: Smart Growth America
- Year Published: 2017

Smart Growth America's Dangerous by Design is a report that ranks the 104 largest metro areas in the country (which includes the Minneapolis-Saint Paul-Bloomington region) by a "Pedestrian Danger Index," or PDI. PDI is a calculation based on the share of local commuters who walk to work and the most recent data on pedestrian deaths. First developed in the 1990s by the Surface Transportation Policy Partnership and used more recently by Smart Growth America's Transportation for America program, PDI is the rate of pedestrian deaths relative to the number of people who walk to work in the region. The 2016 report is the fourth edition of this study. Measuring danger as a rate, and not an absolute count, corrects for cities that may have higher numbers of deaths simply as a function of higher numbers of people on foot overall. For the first time, the 2016 update to this study includes a racial and income-based examination of pedestrian fatalities through the use of Fatality Analysis Reporting System (FARS) and American Community Survey (ACS) data.

Bicycling & Walking in the United States Benchmarking Report

- Author: Alliance for Biking & Walking
- Year Published: 2016

The Alliance for Biking & Walking has been tracking biking and walking data across the U.S. through the Benchmarking Project since 2003. Every two years, the project team releases an updated report with the most recent data available. This report collects and compares data between states and between the 50 most populous cities – including Minneapolis. The data used includes national sources managed by public agencies and state and city surveys.

Pedestrian Traffic Fatalities by State

- Author: Governors Highway Safety Association
- Year Published: 2017

The Governors Highway Safety Association releases an annual Pedestrian Traffic Fatalities by State report. The most recent report estimated the number of nationwide pedestrian fatalities in 2016 by applying historical seasonal trends to preliminary data from the State Highway Safety Offices for the first six months of 2016. The report analyzes and compares state-level data on fatalities and details actions taken by selected states to improve pedestrian safety.

Minnesota Motor Vehicle Crash Facts

- Author: Minnesota Department of Public Safety
- Year Published: 2016

The Minnesota Motor Vehicle Crash Facts summarizes the crashes, deaths, and injuries that occurred on Minnesota roadways during 2015 (the most recent full-year data available). The report details historical information on crashes statewide, factors contributing to crashes, and details many of these crash trends by mode. This summary only considers the information presented for the pedestrian crashes.

New York City Pedestrian Safety Study & Action Plan

- Author: New York City Department of Transportation
- Year Published: 2010

The New York City Pedestrian Safety Study and Action Plan reports the results of an analysis of over 7,000 pedestrian crashes and recommends actions to improve pedestrian safety. The study modeled crash frequency to understand factors impacting high-frequency crash locations using mapping software and statistical analysis tools. The study also modeled crash severity to understand why some crashes resulted in fatalities while others resulted in severe injuries.

The primary dataset used in the study included all New York City fatal and serious injury pedestrian/vehicle crashes from 2002 to 2006. The researchers relied heavily on crash data from the New York State Department of Transportation (NYSDOT), which was derived from police officer reports. Severe injuries were classified according to NYSDOT criteria.

Don't Cut Corners: Left Turn Pedestrian & Bicycle Crash Study

- Author: New York City Department of Transportation
- Year Published: 2016

New York City Department of Transportation (DOT) developed the Left Turn Pedestrian and Bicycle Crash Study to advance New York City's Vision Zero Initiative to eliminate traffic deaths and serious injuries.

In line with the Vision Zero Pedestrian Safety Action Plans, this study utilizes a data-driven approach to examine crashes. DOT took an exhaustive look at the problem of left turn pedestrian and bicyclist injuries (including fatalities) in New York City, querying five years of citywide crash data, manually reviewing 1,105 crash reports drawn from the most problematic locations citywide, and analyzing 478 intersections where treatments were installed. The study relies on these findings to provide recommendations for additional engineering, planning, and education efforts to prevent and mitigate left turn failure to yield pedestrian and bicyclist injuries.

City of Chicago Pedestrian Crash Analysis Summary Report

- Author: Chicago Department of Transportation
- Year Published: 2011

The Chicago Department of Transportation (CDOT) used data from the Illinois Department of Transportation to analyze all crashes in Chicago from 2005 to 2009 involving a pedestrian and a motor vehicle, where the first point of contact for the vehicle was a pedestrian. The analysis included information on all pedestrians involved in the crash, not just the pedestrian first hit. The results of the analysis helped to inform the development of Chicago's Pedestrian Plan and public awareness campaign.

City of Seattle Traffic Report

- Author: Seattle Department of Transportation
- Year Published: 2015

The City of Seattle releases an annual report on traffic trends in the city every year. This comprehensive report has information on all modes. The report summarizes volumes, speeds, collisions, and other data such as contributing factors when possible.

City of Seattle Bicycle and Pedestrian Safety Analysis

- Author: Seattle Department of Transportation
- Year Published: 2016

City of Seattle Bicycle and Pedestrian Safety Analysis analyzed bicycle and pedestrian crashes that occurred from 2007 to 2014 to identify problems to address through street design and traffic operations. Information such as crash type, actions of people walking, biking, or driving, and roadway configuration were considered to understand the relationship between where, how, and to the extent possible, why crashes happen. The analysis explored factors contributing to all pedestrian and bicycle crashes across the city and the most common factors associated with higher rates of severe crashes (i.e., fatal or serious injury).

Findings

Pedestrian Fatalities

NATIONAL TRENDS

The Bicycling & Walking in the U.S. 2016 Benchmarking Report noted that while the national pedestrian fatality rate has declined greatly since the 1980, there has been a recent upward trend post-2009 (**Figure A-1**).

The Strategic Agenda concurred that the steady downward trend of non-motorized fatalities through the 1990s and early 2000s has reversed and that incidents of nonmotorized traveler fatalities have gone up every year since 2009 (**Figure A-3**).

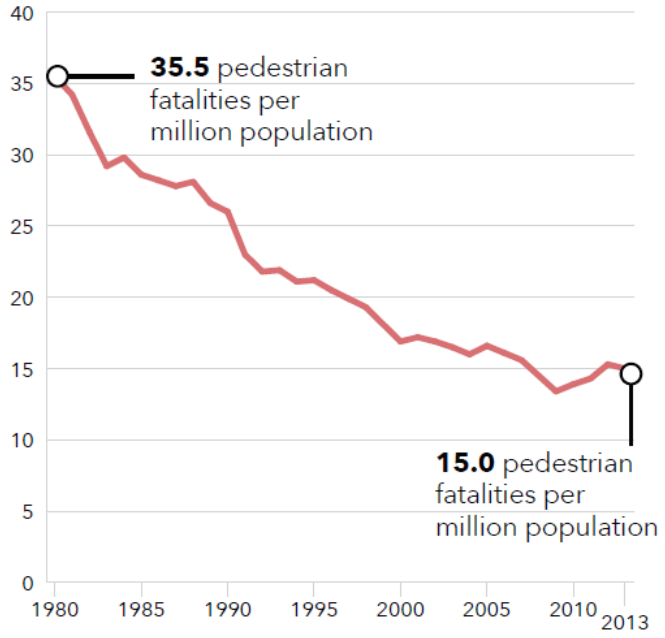

Figure A-1. Pedestrian Fatality Rate 1980 - 2013

Data Source: FARS, ACS, 1980 - 2013; Originally pulled from Bicycling & Walking in the U.S. 2016 Benchmarking Report

The Pedestrian Traffic Fatalities by State report found that pedestrian fatalities increased by 25 percent from 2010 to 2015 and account for a steadily increasing percentage of total traffic fatalities. It estimates that fatalities in 2016 increased 11 percent over 2015. Thirty-four states saw increases in fatalities and fifteen states had decreases.

The percentage of trips taken by a non-motorized mode is also increasing. According to the National Household Travel Survey (NHTS), in 2009 there were 41 billion pedestrian trips and 4.1 billion bicycle trips. Combined, this represented 11.5 percent of all trips. This is an increase from 36.5 billion trips (9.5 percent of all trips) in 2001 and 23.7 billion trips (6.25 percent of all trips) in 1995. The two studies together suggest that fatalities are increasing at a greater rate than growth in walking/biking.

STATE TRENDS

The Bicycling & Walking in the United States 2016 Benchmarking Report noted that, when analyzed in three-year periods, pedestrian fatalities across Minnesota have marginally declined over the last decade. There were 115 statewide pedestrian fatalities from 2005–2007. That number dropped to 102 in 2008–2010, but then rose to 109 in 2011–2013.

Compared to other states, Minnesota's pedestrian fatality rate is low. The Pedestrian Traffic Fatalities by State report found that at 0.75 pedestrian fatalities per 100,000 population in 2015, Minnesota had the fourth lowest fatality rate in the country. However, pedestrian fatalities in Minnesota in the first six months of 2016 increased 64 percent over the first six months of 2015, from 14 to 23 deaths.

The Minnesota Motor Vehicle Crash Facts noted the significant rise in pedestrian crashes between 2014 and 2015. As stated in that report, there were 911 crashes that involved at least one pedestrian in Minnesota in 2015. This is an 11 percent increase from 2014 and is the highest level since 2007. Pedestrian fatalities statewide also increased between 2014 and 2015 (**Figure A-2**). Crash Facts also noted the injury severity discrepancy between pedestrian crashes and other traffic crashes. In 2015, nearly five percent of all pedestrian crashes resulted in a death; one-half of one percent of all traffic crashes resulted in a death in that same year.

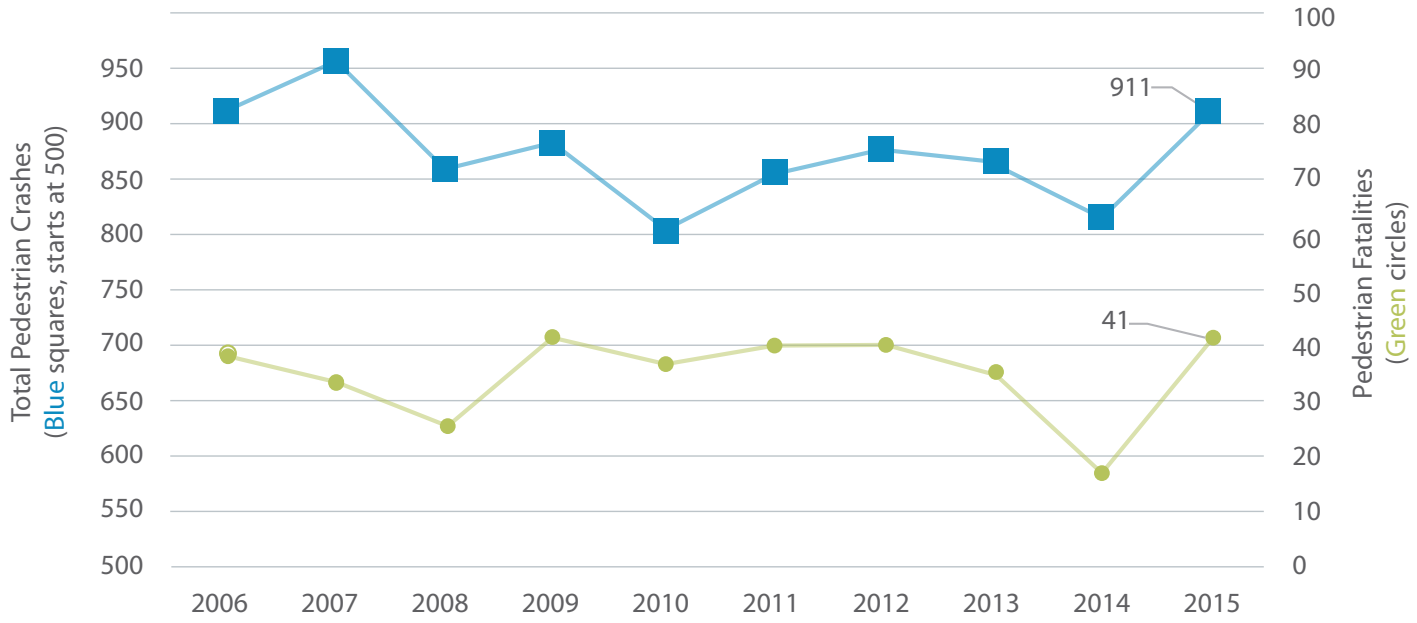

Figure A-2. Pedestrian Crashes and Fatalities in Minnesota, 2006–2015

Figure adapted from Minnesota Motor Vehicle Crash Facts (2015) data

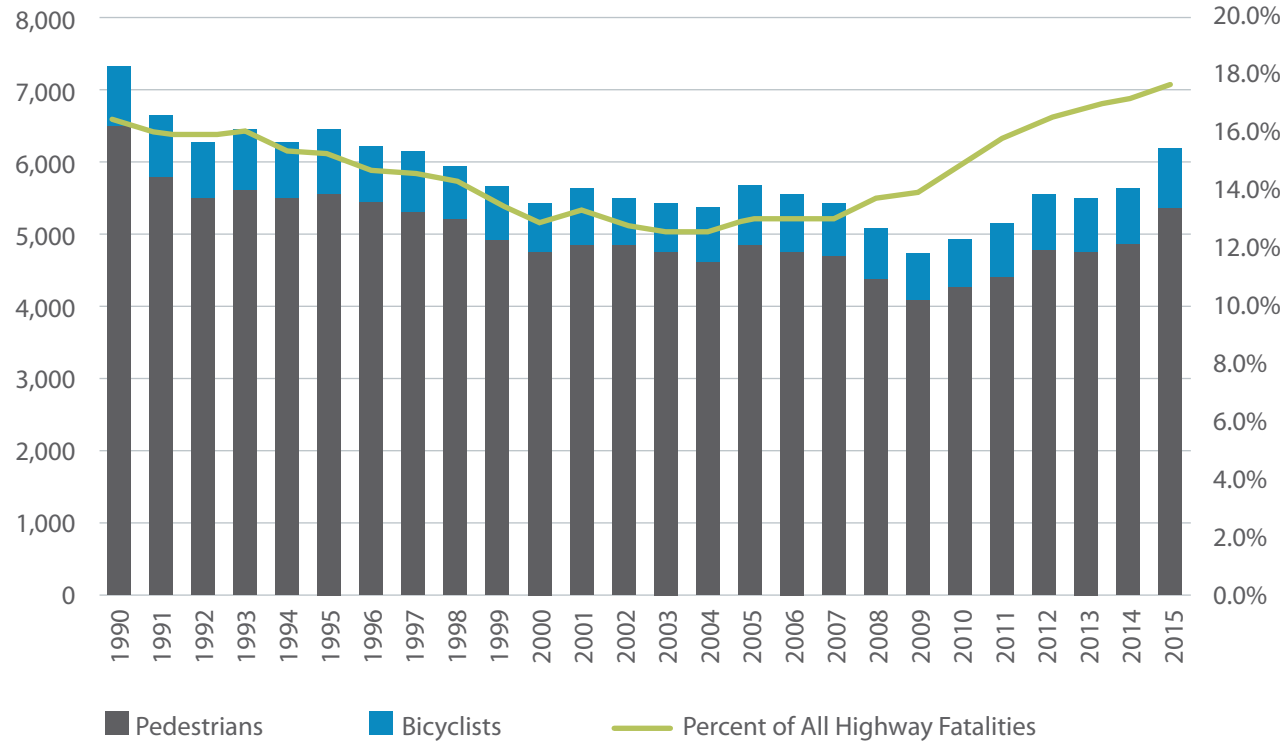

Figure A-3. United States Pedestrian and Bicycle Fatalities, 1990–2015

Figure originally from the Strategic Agenda, data from the National Highway Traffic Safety Administration

CITY TRENDS

NEW YORK CITY

As stated in the New York City Pedestrian Safety Study & Action Plan, New York City has seen a 63 percent decrease in all traffic fatalities between 1990 and 2009, and pedestrian fatality and injury rates dropped about 40 percent from the 1990s to the 2000s. While significant progress has been made, the New York City Department of Transportation aims to further reduce traffic fatalities by 50 percent by 2030.

In 2009, New York City's pedestrian fatality rate was 1.8 per 100,000 residents. 52 percent of those killed in crashes from 2005–2009 were pedestrians. When involved in a crash, pedestrians were 10 times more likely to be killed than those traveling in cars.

CHICAGO

As stated in the City of Chicago 2011 Pedestrian Crash Analysis Summary Report, the absolute number and rate of pedestrian crashes and fatalities fell between 2005 and 2009. In 2005, there were 121 pedestrian crashes per 100,000 residents. In 2009, that number fell to 110 crashes per 100,000 residents.

SEATTLE

Pedestrian crashes in Seattle have been generally decreasing since 2006. Data from the 2014 Traffic report data shows that 2009 was the worst year for Seattle pedestrians in the recent past with 11 fatalities.

MINNEAPOLIS

In addition to analyzing statewide trends, The Bicycle & Walking in the U.S. 2016 Benchmarking Report also compared trends in large cities. The report's data indicated that pedestrian fatalities have been marginally increasing relative to its population growth in Minneapolis over the last decade.

In addition to analyzing trends over time, The Bicycle & Walking in the U.S. 2016 Benchmarking Report also compared trends between the largest U.S. cities. Minneapolis tied for the fifth lowest pedestrian fatality rate for walking commuters of the 51 largest cities between 2005 and 2013 (**Figure A-4**). Data for the 52 cities studied in this report indicate an inverse relationship between walking levels in a city and pedestrian fatality rates. In other words, cities with the highest rates of pedestrian fatalities are among those with the lowest levels of walking.

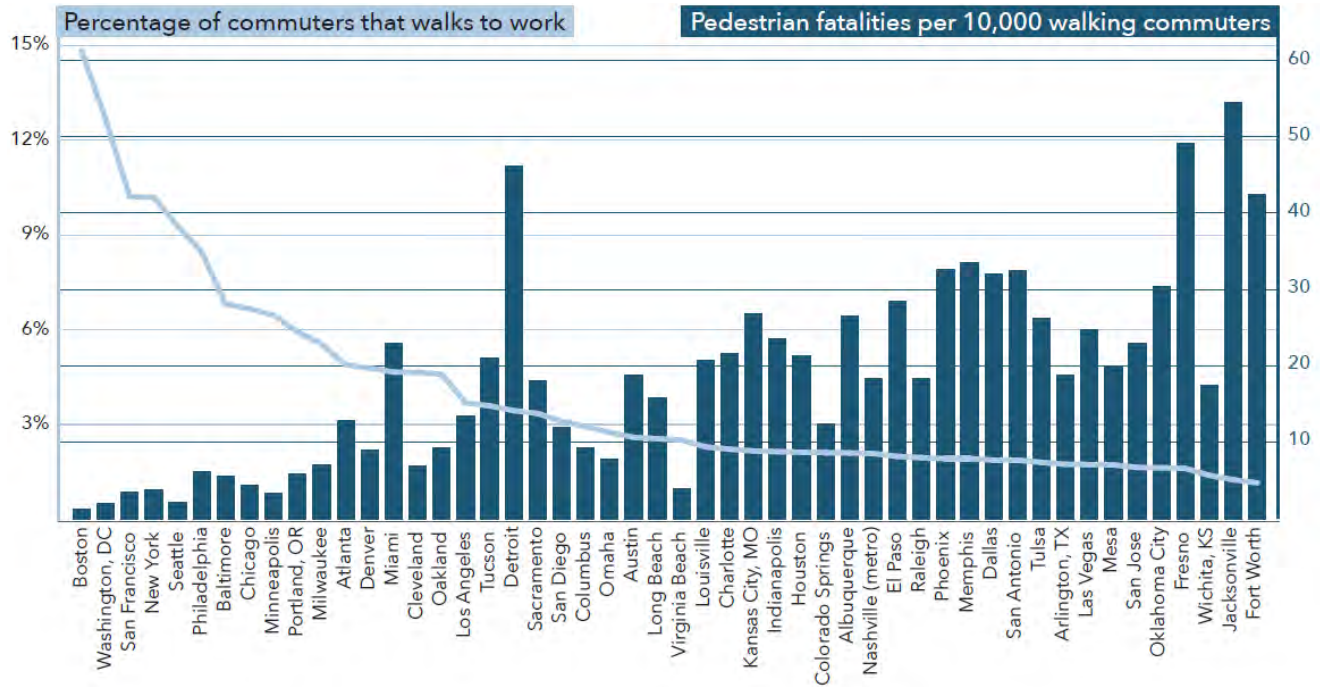

Figure A-4. City Walking and Pedestrian Fatality Rates

An inverse relationship exists between walking levels in a city and pedestrian fatality rates.

Data from FARS, ACS. Source: Bicycling and Walking in the United States 2016 Benchmarking Report

A possible explanation is that in places where more bicyclists and pedestrians are present, motorists are accustomed to sharing the roadways with bicyclists and are more aware of pedestrians at crossings. However, the infrastructure, such as signed routes, bike lanes, and sidewalks that contribute to increased bicycling and walking also likely contribute to increased safety.

The Dangerous by Design report concurs that the Minneapolis metro area is relatively safe for pedestrians when compared to other large cities. The weighted average PDI for all 104 metro areas included in the analysis is 64.1. The Minneapolis metro area had a PDI of 28.7 and ranked 91st of the largest 104 metro areas on PDI. Because higher PDI numbers correspond to higher rates of pedestrian deaths, being low on the list indicates a safer city for pedestrians.

The Dangerous by Design report noted that most metro areas' PDIs have improved since 2014. Thirty out of 51 metro areas had lower PDIs in 2016 compared to 2014. The Minneapolis-Saint Paul metro area was consistent with that trend; the region's PDI decreased four percentage points between 2014 and 2016 (**Table A-2**).

Table A-2. 2011–2016 Minneapolis Area PDI

Metro Area (MSA)	2011 PDI	2014 PDI	2016 PDI	Change in PDI since 2014
Minneapolis-St. Paul-Bloomington, MN-WI	35.1	32.2	28.7	-4.0

Source: Adapted from Dangerous by Design (2016)

Demographics

Seniors, people of color, and low-income populations are disproportionally represented among pedestrians in crashes compared to their representation of the population. Even after controlling for the relative amounts of walking among these populations, as was done in the Dangerous by Design report, the risks continue to be higher for people of color and older adults—indicating that these people most likely face disproportionately unfavorable conditions for walking.

AGE

YOUTH

- The Bicycling & Walking in the U.S. 2016 Benchmarking Report notes that people under the age of 18 made up 21 percent of the population of the state of Minnesota between 2005 and 2013, but comprised 10 percent of pedestrian fatalities.

SENIORS

- The Bicycling & Walking in the U.S. 2016 Benchmarking Report notes that seniors made up 14 percent of the population of Minnesota between 2005 and 2013 but comprised 24 percent of the pedestrian fatalities.
- The Dangerous by Design report notes that adults 65 years and older are at higher risk of being struck and killed by a car while walking than people in other age groups.
- Seniors were disproportionately impacted by crashes in the New York City Pedestrian Safety Study, accounting for 38 percent of pedestrian fatalities and 28 percent of severe injuries but only 12 percent of the population.
- The Chicago Pedestrian Crash Analysis report noted that seniors had a low overall crash rate but were overrepresented in fatal and serious injury crashes.

GENDER

Men are more likely to be both drivers and pedestrians in pedestrian crashes. While this holds true statewide and nationwide, the trend is even more pronounced in New York: the majority of pedestrian crash victims in every age category were male, with the greatest gender disparity for males under age 13.

- As stated in Minnesota Motor Vehicle Crash Facts 2015, males accounted for 68 percent of all pedestrian fatalities and 53 percent of pedestrian injuries in Minnesota.
- In the New York City Pedestrian Safety Study, 80 percent of crashes involved male drivers, with the likelihood of crashes peaking for men from age 40-49 and spiking again over age 80.
- In the Chicago Pedestrian Crash Analysis report, nearly 65 percent of drivers were male (in crashes where the driver's gender was known).
- Male pedestrians in Chicago were overrepresented in crashes but not to the same extent as males nationwide (52 percent of crashes in Chicago versus 69 percent nationwide). The greatest gender disparity in crashes was in the 0 to 4 and 5 to 14 age groups, where male pedestrian crash rates greatly exceeded female crash rates.

PEOPLE OF COLOR

- The Bicycling & Walking in the U.S. 2016 Benchmarking Report notes that people of color or of Hispanic/Latino origin made up 18 percent of the population between 2005 and 2013 but comprised of 21 percent of the pedestrian fatalities.
- The Dangerous by Design report notes that people of color, particularly Native Americans and African Americans, are at higher risk of being struck and killed by a car while walking than people in other demographics (**Figure A-5**).
- The New York City Pedestrian Safety Study found that neighborhoods with higher percentages of Black and Hispanic residents experienced higher crash rates, but Black and Hispanic pedestrians were not involved in more fatal pedestrian crashes than average. The study notes that this suggests that the problem stems from dangerous environmental conditions and driver behavior in certain localities, rather than the actions of Black and Hispanic pedestrians. Foreign-born residents account for 36 percent of residents but 51 percent of fatalities.
- The breakdown of pedestrian fatalities by race aligned closely with the racial makeup of Chicago's population as stated in the Chicago Pedestrian Crash Analysis report. Black pedestrians were slightly overrepresented (34 percent of the overall population but 36 percent of fatal crashes.)

INCOME

- The Bicycling & Walking in the U.S. 2016 Benchmarking Report found that census tracts with higher poverty rates had four times as many pedestrian crashes as census tracts with lower poverty rates.
- The analysis done by Smart Growth America in the Dangerous by Design report showed that the lower a metro area's median household income, the more likely it is that its residents will be killed by cars while walking.

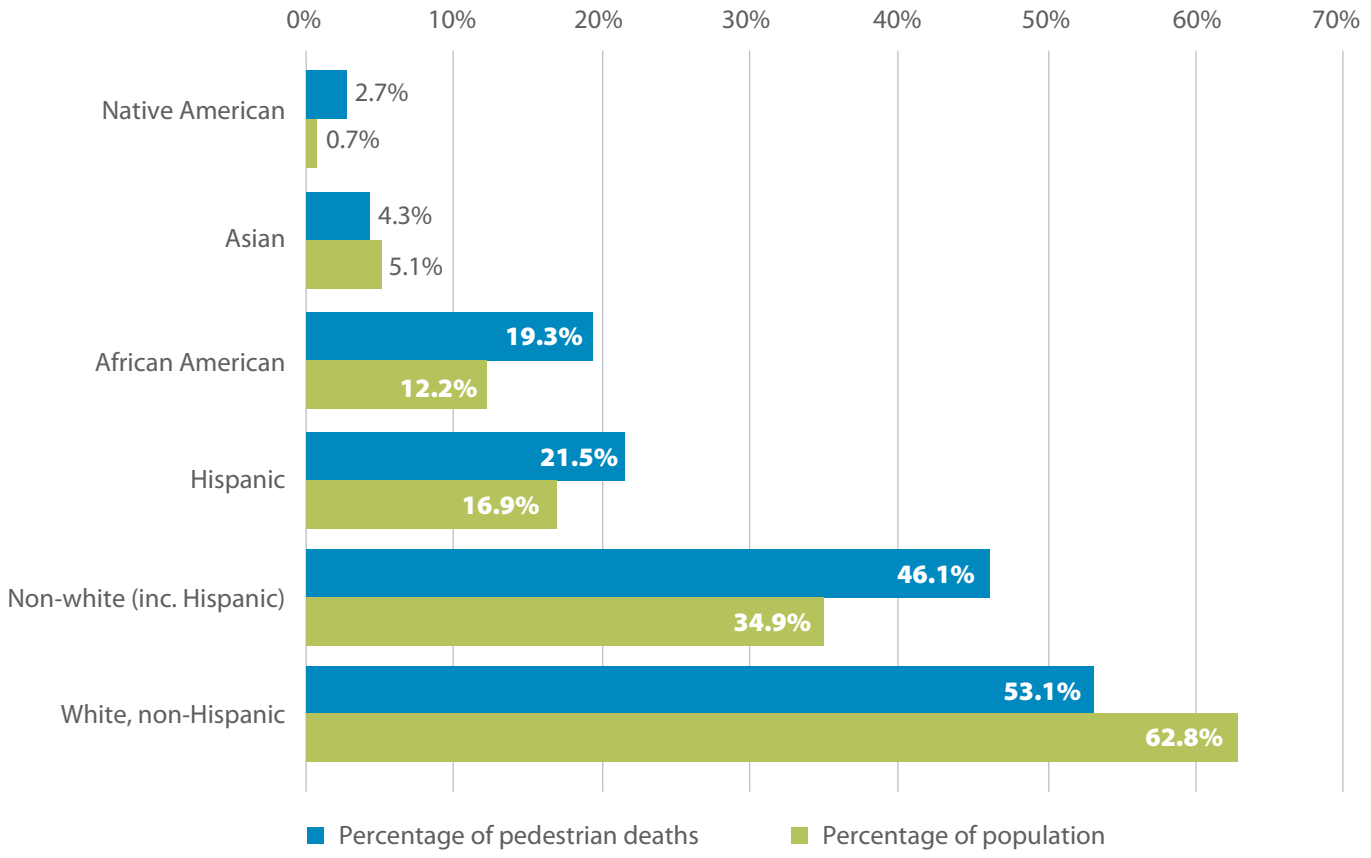

Figure A-5. Pedestrian Deaths by Race/Ethnicity Relative to U.S. Population, 2005–2014

Source: Dangerous by Design (2016)

COMMENTARY ON REASONS FOR DEMOGRAPHIC FINDINGS

The Dangerous by Design report provided some reasons for these demographics trends.

- *"Some of these outcomes are due to the fact that low income communities and communities of color have more people who walk and they tend to walk more. The risk of being hit as a pedestrian goes up the more often one is a pedestrian. And for many, walking is a necessity, not a choice, and individuals are forced to increase their exposure to these risks. "*
- *"In other cases, it is not just a matter of increased risk from increased exposure. Instead, after controlling for the amount of walking, risks continue to be higher—indicating disproportionately unsafe conditions for pedestrians."*

Pedestrian Crash Characteristics

LOCATION

According to Minnesota Motor Vehicle Crash Facts 2015, just over half (51 percent) of pedestrian crashes in 2015 occurred in urbanized regions populated with more than 250,000 people. Studies in Seattle, Chicago, and New York City also suggest that urbanized areas have a higher likelihood of pedestrian crashes.

INTERSECTIONS

In more urban settings, pedestrian crashes occur more frequently at intersections. In more rural or suburban settings, pedestrian crashes occur at non-intersection locations.

The City of Chicago 2011 Pedestrian Crash Analysis Summary Report found that Chicago has a higher proportion of intersection crashes than is typical nationally, with four in five fatal and serious injury crashes occurring within 125 feet of the midpoint of an intersection. Seattle had similar findings, with nearly three out of four (73 percent) of pedestrian crashes occurring at an intersection.

In 2015 in Minnesota, nearly one-third (32 percent) of pedestrians killed and one-quarter (26 percent) of pedestrians injured were trying to cross a road at a location without a crosswalk or signal. Thirteen percent of pedestrians injured were crossing the road at a signalized intersection and were crossing with the signal. In urban New York City, nearly three in four crashes where pedestrians were killed or seriously injured occurred at intersections. According to New York's study, the rest of the U.S. follows a pattern more similar to statewide Minnesota where three in four such crashes occur at non-intersection locations. The New York study attributes this difference to high intersection density, which encourages crossing at intersections rather than mid-block, and sidewalks on nearly all streets, which reduces crashes from walking along the roadway.

The findings from Chicago's 2011 Pedestrian Crash Analysis further highlight the difference in pedestrian crash locations in urban verses rural/suburban locations. Inside Chicago's central business district (CBD), pedestrians were most commonly in the crosswalk at the time of a crash. Outside the CBD, pedestrians were most commonly in the roadway. Children under age 14 were more likely to be struck on local streets, mid-block, and not in a crosswalk than other age groups. Senior pedestrians were more likely to be hit when walking in a crosswalk than other age groups.

SIGNALS

In New York City, more pedestrians were hit while crossing an intersection with the signal than were hit when crossing against the signal. However, crashes were more deadly when the pedestrian was crossing against the signal, especially for children.

ARTERIAL STREETS

In both Chicago and New York City, arterial streets accounted for a disproportionate number of pedestrian fatalities. Chicago's arterial streets accounted for 50 percent of fatality and serious injury crashes, despite representing only 10 percent of total street miles. The top twelve neighborhood high-crash corridors in Chicago were all arterials, and eight of those were four-lane roadways. Crashes on New York City's arterial streets were two-thirds more likely to be deadly than crashes on non-arterial streets. In New York City, roads with four or more travel lanes had more pedestrian crashes than roads less than 30 feet wide.

BIKE LANES

The New York City study found that the presence of bike lanes on a street improved pedestrian safety, even when controlling for other factors. Crashes on streets with bike lanes were about 40 percent less likely to be fatal.

TIMING OF PEDESTRIAN CRASHES

TIME OF YEAR

In Minnesota, Chicago, and New York City, pedestrian crashes peak in the late fall months of October through December. The time-of-year pedestrian crash and fatality trends for Minnesota are shown in **Figure A-6**.

The New York City Pedestrian Safety Study and Action Plan found that more crashes took place in November and December than in other months, possibly due to increased shopping, alcohol use, and traffic volumes associated with the holidays, as well as poor road conditions and decreased daylight.

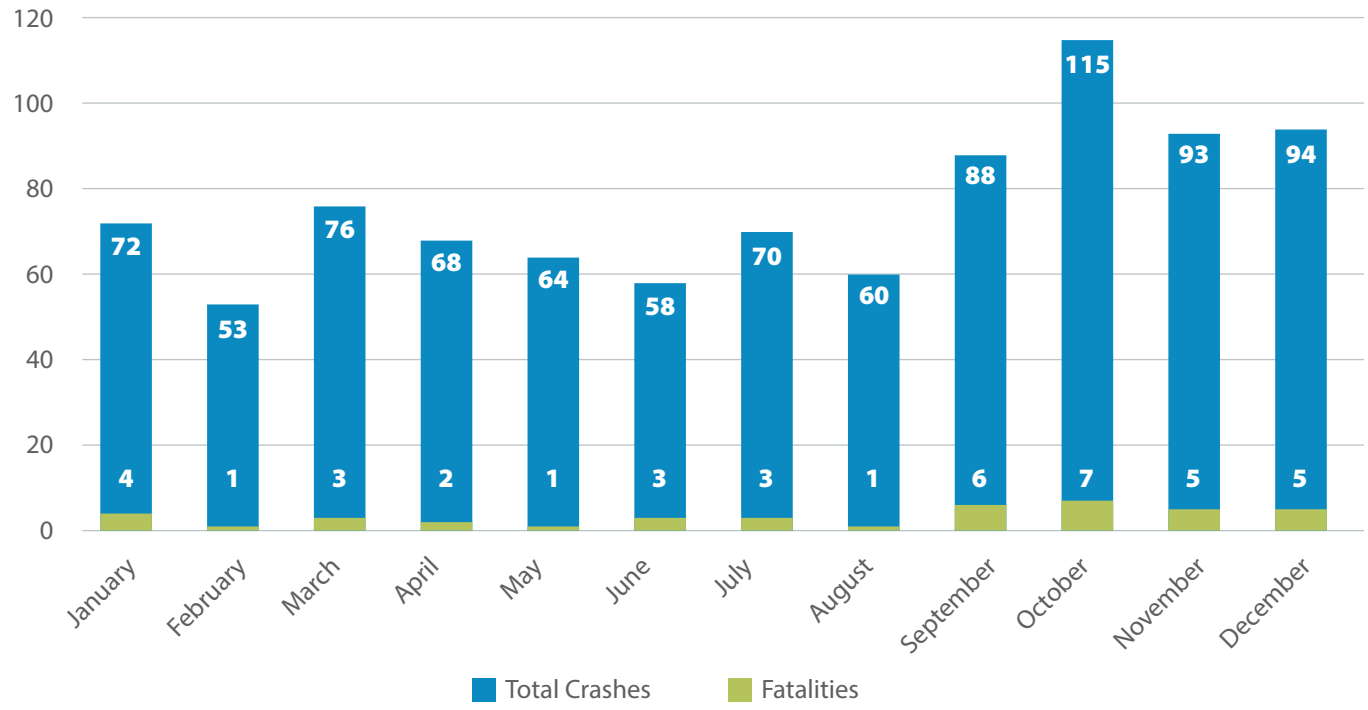

Figure A-6. 2015 Pedestrian Crashes and Fatalities by Month in Minnesota

Source: Adapted from Minnesota Motor Vehicle Crash Facts (2015)

TIME OF DAY

Nationwide, 74 percent of 2015 pedestrian fatalities occurred after dark, according to the Pedestrian Traffic Fatalities by State report.

Mirroring national trends, in Minnesota, Chicago, and New York City, pedestrian crashes peak in the afternoon and are most deadly in the late-night hours.

According to Minnesota Motor Vehicle Crash Facts 2015, about one-third (33 percent) of pedestrian crashes occurred during the weekday rush period (6am-9am or 3pm-6pm). One out of four (24 percent) fatal pedestrian crashes occurred during the late-night hours (9pm to 3am).

The New York City Pedestrian Safety Study and Action Plan found that 40 percent of crashes occurred in the late afternoon and early evening (3pm to 9pm). Crashes from 3am to 6am were twice as deadly as those occurring in other time periods, likely due to decreased traffic volumes that allow for higher vehicle speeds.

Per the City of Chicago 2011 Pedestrian Crash Analysis Summary Report, crashes were more likely to occur on Thursdays and in the afternoon and evening (3pm to 9pm). Crash rates throughout the day varied by age: senior pedestrians were the only age group most likely to be hit midday, and crashes late at night were more likely to involve 19 to 29-year-olds.

CRASH CAUSES

DRIVER BEHAVIOR

In Minnesota, Chicago, and New York City, driver inattention and failure to yield were top factors in pedestrian crashes.

According to Minnesota Motor Vehicle Crash Facts 2015, driver failure to yield was a contributing factor for 38 percent of all pedestrian crashes in 2015. 21 percent of crashes cited driver inattention or distraction as a contributing factor.

The New York City Pedestrian Safety Study and Action Plan found that in cases where pedestrians were seriously injured or killed, 36 percent of crashes involved driver inattention and 27 percent of crashes involved driver failure to yield.

The City of Chicago 2011 Pedestrian Crash Analysis Summary Report found that failure to yield was the most common motorist action at the time of a pedestrian crash, representing the primary factor in 48 percent of crashes where motorist action was known.

The Pedestrian Traffic Fatalities by State report suggests that the growing use of smartphones by all road users could be a significant source of distraction. Annual multimedia messages increased by 45 percent from 2014 to 2015 and data usage more than doubled.

TURNING MOVEMENTS

In Minnesota, Chicago, and Seattle, left turning crashes were much more common than right turning crashes. In Minnesota, one-third (31 percent) of vehicles involved in pedestrian crashes were making a turn, with left turns more common in crashes than right turns (**Figure A-7**).

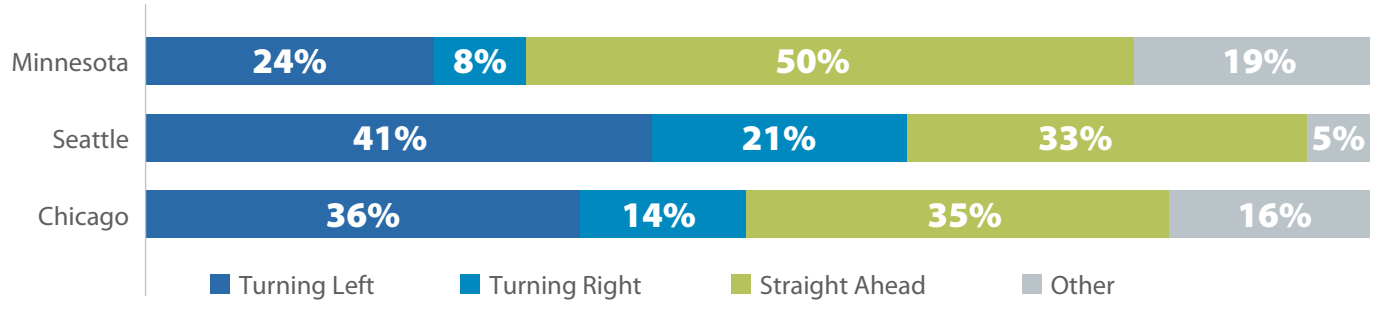

Figure A-7. Vehicle Movement Prior to Pedestrian Crash

Source: Adapted from Minnesota Motor Vehicle Crash Facts (2015), the City of Chicago Pedestrian Crash Analysis Summary Report (2011), and the City of Seattle Pedestrian Safety Analysis (2016)

The City of Chicago 2011 Pedestrian Crash Analysis Summary Report found that 52 percent of crashes at signalized intersections involved a driver making a turning movement, and 70 percent of those crashes involved a left turn. Crashes in the CBD were more likely to involve turning movements and left turns than those outside the CBD.

The City of Seattle Traffic Report found that there were twice as many crashes involving a left-turn than involving a right turn.

However, according to Minnesota Motor Vehicle Crash Facts 2015, nearly half (48 percent) of the vehicles involved in pedestrian injury crashes in 2015 (and nearly four in five involved in fatal pedestrian crashes) were moving straight ahead in the roadway prior to the crash. However, this is likely due to the statewide (rather than urban) nature of this dataset.

ADDITIONAL FACTORS

According to Minnesota Motor Vehicle Crash Facts 2015, obscured driver vision was a factor for nine percent of all pedestrian crashes.

The New York City Pedestrian Safety Study and Action Plan found several additional factors that contributed to the frequency and severity of pedestrian crashes. These factors include:

- **Lane Changing** Lane changing increased the deadliness of crashes.
- **Unsafe Speeds** Serious crashes where drivers were traveling at excessively high speeds were twice as deadly as those where drivers were traveling at safe speeds.
- **Influence of Alcohol** Eight percent of fatal crashes involved a driver who was under the influence of alcohol.

The City of Chicago 2011 Pedestrian Crash Analysis Summary Report discovered that 40 percent of fatal crashes were hit-and-runs, and about two hit-and-run crashes per day occurred that resulted in a pedestrian injury or fatality. Additionally, taxis were involved in crashes at a higher rate within the CBD than in the city as a whole.

The Pedestrian Traffic Fatalities by State report found that alcohol was involved in half of nationwide pedestrian fatalities in 2015, with 34 percent of crashes involving a pedestrian under the influence of alcohol (blood alcohol concentration of 0.08 grams per deciliter or higher) and 15 percent of crashes involving a driver under the influence of alcohol.

Summary of Factors

The studies reviewed as part of the Minneapolis Pedestrian Crash Study have suggested that these factors may influence pedestrian safety:

- **Poor infrastructure conditions -** Lack of or inadequate facilities, uneven or unmaintained surfaces, blocked paths, connectivity issues, difficult street crossings, and poor lighting.
- **Unsafe driver behavior or traffic characteristics -** Habits displayed by drivers, such as operating vehicles aggressively, negligently, while impaired or distracted, as well as traffic patterns associated with higher crashes such as congestion.
- **Unsafe pedestrian or bicyclist behaviors -** Failure to exhibit safe walking and bicycling behaviors, such as ignoring traffic signs or texting while walking or biking.

DESIGN RECOMMENDATIONS

The New York City Safety Study recommended installing countdown pedestrian signals at 1,500 intersections, re-engineering 60 miles of streets and 20 major intersections, and launching pilot programs to test the safety of neighborhood 20 mph zones and improve visibility at left turns.

Other studies provided a more general set of tools that planners, engineers, and policymakers could use as appropriate, such as:

- Wide sidewalks
- Curb extensions
- Refuge islands
- Pedestrian countdown signals
- Leading pedestrian interval signal timing
- Midblock crossings (especially at transit stops)
- Pedestrian hybrid beacons
- Planting street trees
- Restricted right turns on red at signals
- Compact intersections
- Back-in angled parking and smaller curb radii
- Pedestrian overpasses/underpasses
- New traffic signals where warranted
- Provision of ample crossing time
- Improved street lighting
- High visibility crosswalks
- Roundabouts in place of stop signs and signals
- Restricted and protected left turns

Some general design considerations recommended by the national studies include:

- Improving the visibility of pedestrians and reducing the speed of vehicles (using many of the tools listed)
- Enforcing the traffic laws and speeds of automobiles, supplementing traditional enforcement with automated enforcement
- Educating the public on the necessity of progress

Public awareness campaigns around drunk or distracted driving, speed limit enforcement, and reminding pedestrians to cross streets safely are all important to improving pedestrian safety.

Other common recommendations were to reduce the number of lanes or narrow travel lanes as well as designate space for every mode on the street and clarify where each user should travel.

POLICY RECOMMENDATIONS

Minnesota already has many of the plans and policies in place to increase pedestrian safety, as noted in the Bicycling & Walking in the United States 2016 Benchmarking Report. This report and others did note several plans/policies that Minnesota is missing that other states or cities have implemented:

- **Incentives -** Governments or employers can use incentives to encourage bicycling or walking to work to further create safety in numbers for pedestrians. Examples of these incentives include offering a place to shower, lockers, or secured bike parking, allowing flexible schedules or casual dress, and providing gift certificates or bonuses.
- **Vulnerable Road User Law -** Vulnerable road user laws vary state-by-state and are intended to increase protection for pedestrians, bicyclists, and other non-car road users. They often increase penalties for violating existing laws that impact vulnerable road users and prohibit certain actions being taken towards them such as throwing an object or harassment.
- **Trip Reduction Law -** As a way to manage traffic congestion and alleviate air pollution, trip reduction laws can require local, regional, or state governments or employers to encourage the use of alternative forms of transportation and develop programs that reduce drive-alone trips.
- **Safe Streets Policy -** At a city or agency level, set a vision/goal for safer streets to allow transportation agency staff to find appropriate design solutions, regardless of prevailing speed. Having a policy foundation encourages the design and redesign of streets to include features that encourage safer – and slower – driving speeds. Setting this goal enables design professionals to employ tools to provide pedestrians with safe options.