# CONTENTS

## Executive Summary

## Introduction

1. Where the Data Comes From
2. Emerging Data Sources

## Crash Trends

1. Nationwide Crash Statistics
2. Citywide Safety Trends
3. Bicycle Involved Crash Trends
4. Pedestrian Involved Crash Trends
5. Crash Trends by Village

## Network Screening And Systemic findings

1. Corridor Screening and Systemic Findings
2. Intersection Screening and Systemic Findings
3. Social Equity Analysis

## Safety Strategies

1. Introduction
2. Developing Safety Interventions
3. Street Safety Toolbox
4. High Crash Corridor Segments
5. Speed Reduction Strategies
6. Education and Enforcement
EXECUTIVE SUMMARY
NO MATTER HOW A PERSON TRAVELS, SAFETY IS OUR TOP PRIORITY!
The Key Corridors Master Plan (KCMP) establishes a new vision for Phoenix’s streets so that everyone, no matter where they live or how they get around, can travel safely. There is no single policy or tool that will transform Phoenix’s street safety overnight, but as a supplement to the KCMP, this Safety Analysis and Strategies Report provides the City with a framework to systematically build a safer transportation system and save lives.

PHOENIX BY THE NUMBERS (2018)

- **30,575** total crashes reported
- **208** fatal crashes
- **741** serious injury crashes

....WHAT DOES THAT MEAN?

- A crash takes place every 17 minutes.
- A serious injury crash happens every 11.8 hours.
- A fatal crash occurs every 1.8 days.
- A pedestrian fatality occurs every 3.5 days!
- 50% of fatal crashes were pedestrian or bicycle related.
- Every 11.3 hours a pedestrian gets hit.
- Nearly 34 people get injured in traffic collisions every day.
- Every 23.2 hours a person riding a bicycle gets hit.
- An alcohol-related crash occurs every 9.2 hours.
CITYWIDE CRASH TRENDS

Crashes trends over the last three years has stayed steady.

Total Crashes (2014-2018)

How Severe are the Crashes?

Fatal crashes have been steadily increasing year over the years.

Fatal Crashes (2014-2018)

What Type of Crashes are Occurring?

76% of fatal crashes were intersection related.

73% of serious injury crashes were intersection related.

32% of serious injury crashes were cited as “failure to yield”.

39% of fatal and serious injury crashes occurred at a traffic signal.

1% of fatal crashes were bicycle related.

50% of fatal crashes were pedestrian related.

25% of all crashes were cited as “speeding too fast”.
How Does Phoenix Compare?

Pedestrian Fatalities per 100K Population
- Seattle: 1.1
- Houston: 3.0
- Phoenix: 5.0
- Denver: 1.8
- Dallas: 4.1

Bicycle Fatalities per 100K Population
- Seattle: 0.23
- Houston: 0.30
- Phoenix: 0.53
- Denver: 0.16
- Dallas: 0.55

Phoenix has one of the lowest total number of crashes per 100,000 population among its peer cities.

However, among peer cities, Phoenix is:
- Highest in pedestrian fatality rates
- Tied for highest in bicycle fatality rates

What High Risk Behaviors Impact Crashes?

Driver Distraction

- Distraction Involved
- No Distraction
- Unknown/Not Reported

11% of fatal crashes involved driver distraction

Impaired Driving

Alcohol was involved in:
- 35% of fatal crashes
- 10% of serious injury crashes

NOT ALCOHOL RELATED:
- No Injury: 69%
- Possible Injury: 11%
- Minor Injury: 11%
- Serious Injury: 3%
- Fatal: 0%

ALCOHOL RELATED:
- No Injury: 54%
- Possible Injury: 16%
- Minor Injury: 16%
- Serious Injury: 8%
- Fatal: 6%
Where are Crashes Occurring?

Based on a roadway and intersections Equivalent Property Damage Only (EPDO) performance measure, high-injury crash segments and intersections were identified. The following provides a summary of findings for these locations. For priority locations, risk factors were identified.

### High Injury Crash Segments
- **132** high priority crash segments
- 102 segments are located in disadvantaged areas
- 27 of the 102 segments are in Maryvale

### High Injury Crash Intersections
- **105** high priority crash intersections
- 51 intersections are located in disadvantaged areas
- 31 of the 51 intersections are in Maryvale and Alhambra

### High Injury Risk Factors

Risk factors are roadway, land use, or behavioral characteristics associated with increased crash and injury risk. These factors may be used to identify locations where crashes have not yet occurred to make proactive safety improvements. The following risk factors were determined for intersections and roadway segments.

#### High Injury Crash Segments
- Nearly 70% segments had limited crossing opportunities
- Over 75% had frequent driveway access
- 40% of segments are located near freeway/highway interchanges
- Other factors included high volume arterials, presence of transit stops with limited crossing opportunities

#### High Injury Crash Intersections
- Several signalized intersections had one of more approaches with negative offset at left-turn lanes
- Nearly 60% of signalized intersections may have older signal equipment and configuration
- Most intersections have an on-street transit stop in the vicinity
- All intersections were along high-volume roads
01. INTRODUCTION
INTRODUCTION

The Key Corridors Master Plan (KCMP) sets the foundation for rethinking the way we plan and design our transportation system by shifting the focus from moving cars to moving people. As a supplement to the KCMP, this Safety Analysis and Strategies Report outlines the City of Phoenix’s current state of transportation safety and recommends potential strategies to address safety issues. Together these documents provide a framework for transforming the way we move through and around the City.

Designing for Safety

The 2019 Dangerous by Design report by the National Complete Streets Coalition highlights ongoing safety problems for people walking and cycling on our roadways. In 2018 alone, one pedestrian was killed every 88 minutes in traffic crashes nationwide. Phoenix joins in this epidemic with having the 22nd highest pedestrian danger index in the Nation. Since 2014, pedestrians and cyclists have accounted for nearly 49% of all traffic deaths since 2014. The facts are clear – the nation is suffering from a roadway safety crisis.

No matter how a person travels, safety is the City’s top priority. The KCMP establishes a new vision for Phoenix’s streets so that everyone, no matter where they live or how they get around, can travel safely. As illustrated in the graphic in the following page, KCMP integrates safety into the overall street design process. Building off the KCMP, the Safety Analysis Report outlines:

- Current assessment of transportation safety;
- System safety evaluation;
- Framework for designing safer streets;
- Tools to address important safety issues; and
- Strategies for education and enforcement.

There is no single policy or tool that will transform Phoenix’s street safety overnight, but this report provides a framework to systematically build a safer transportation system and save lives.

As a companion to the Key Corridors Master Plan, this Safety Analysis and Strategies Report identifies current safety issues and needs and creates a framework to systematically build a safer transportation system and save lives.

Using This Report

This plan is an informational document intended to provide the City with valuable data on where, how, and why crashes happen. The results of this plan can be used to identify crash trends and contributing factors to help identify locations for future studies and to develop strategies for implementing design, policy, and other countermeasures to reduce crashes.
GOING FROM PLAN TO PROJECT:

HOW TO IMPLEMENT THE KEY CORRIDORS MASTER PLAN

1. Use online map to determine street function and place type.
2. Use street typologies to establish user priorities and design standards.
3. Reference High Crash Corridors and identify safety issues.
4. Consult the safety toolbox to improve dangerous conditions.
5. Evaluate design alternatives: City policies; Public input.
6. Design.
7. Construct.
Where the Data Comes From

Every year, the City of Phoenix obtains raw crash data from the Arizona Department of Transportation’s (ADOT) Arizona Crash Information System (ACIS) database. This database is developed from information entered on the standard Arizona Crash Report form by law enforcement officers responding to each crash incident. Upon receiving the data from ADOT, City staff perform a series of post-processing routines to scrub the data. The scrubbing process includes:

- Removal of non-city related crashes;
- Cataloging intersection related crashes;
- Identifying pedestrian and bicycle crashes;
- Capturing violations and crash characteristics; and
- Determining the city-specific crash metrics.

For this Plan, the City post-processed crash data spanning five years (from 2014 to 2018) was used for the safety assessment. Crashes used for this assessment do not include those that occurred on freeways, highways, interstate ramps, and other ADOT maintained facilities. Crashes that occurred within unincorporated Maricopa County land were also excluded from the safety assessment.

Overview of Crashes in Phoenix (in 2018)

- **30,575 TOTAL CRASHES REPORTED**
- **208 FATAL CRASHES**
- **741 SERIOUS INJURY CRASHES**
Emerging Data Sources

Traffic safety crash data obtained from police reports might provide an expansive view of traffic safety risks but is not exhaustive. Traffic safety assessments traditionally rely on data obtained from police reports. Even with the extensive efforts to accurately collect and analyze crash data, not all crashes are recorded, and some may be incorrectly reported. Thus, many cities and states are looking at other emerging data sources such as data from hospitals, telematics, and insurance companies, to broaden their understanding of traffic safety risks. The following section outlines the potential traffic safety data sources that the City might consider for future safety assessment updates.

Hospital Injury Data

- More accurate and reliable due to coding standards
- Required to maintain by designated trauma centers
- More detailed demographic information provided

While traditional traffic data identifies crashes by injury severity, hospitals collect extensive data beyond typical crash reports that provide great insight into traffic safety risks. Additionally, there may be instances where a person might not realize they need medical attention at the scene of the crash and might visit the hospital after the crash. Much of this data is available through the Trauma Registry that designated trauma centers are required to maintain for all qualifying admits and submit to state-level public health departments. Key benefits of data obtained through hospitals includes:

- More accurate and reliable as it is entered by trained medical professionals and thoroughly describes the injuries sustained in a crash.
- Codified in a standard manner according to the International Statistical Classification of Diseases and Related Health Problems (ICD) codes which allows for detailed analysis of the types of injuries most prevalent in traffic crashes.
- Captures more detailed demographic information, such as age or race/ethnicity.

The following examples demonstrate the enormous potential of using hospital data to broaden a City’s understanding of traffic crashes.

San Francisco Case Example

The City of San Francisco provides an excellent example of how public agencies working to improve traffic safety can incorporate data from hospitals to better understand traffic safety risks in their communities. The City partnered with Zuckerberg San Francisco General Hospital and Trauma Centre, the only Level-One trauma center in San Francisco, and developed a Transportation-related Injury Surveillance System (TISS). This system links existing transportation-related injury and fatality data such as the San Francisco Police Department crash reports, with hospitalization and Medical Examiner’s Office data, into a comprehensive database to conduct accurate, coordinated and timely monitoring of transportation-related injuries and deaths.

National Syndromic Surveillance Program (NSSP)

In addition to the trauma registry, limited data from emergency departments are available in real-time through the National Syndromic Surveillance Program (NSSP). The NSSP, coordinated by the Center for Disease Control, collects patient encounter data from emergency departments to detect, characterize, monitor, and respond to events of public health concern. This data is available almost instantaneously on NSSP’s ESSENCE platform for real-time tracking once the emergency departments enter patient information. Multiple cities, such as Austin, Chicago, and San Francisco, have used the ESSENCE system to track injuries to users of new mobility devices such as e-scooters and e-bikes. However, using the ESSENCE system to effectively track traffic crash injuries requires substantial coordination between hospitals, medical professionals, and the public health department to establish standards of data entry by the emergency department staff.

The City of San Francisco found evidence of under-reporting of crashes at the scene of incidence – approximately 20% of pedestrian injuries and 25% of cyclist injuries attended to at the hospital were not included in the police records.
Billing Data
Beyond data from emergency departments, there is an opportunity to use billing data or discharge data from hospitals to augment the city’s understanding of traffic crash injuries and their severity. Researchers from the Ann and Robert H. Laurie Children’s Hospital of Chicago linked data from Illinois Hospital Discharge Data System with crash report data from Illinois Department of Transportation, albeit with about 50% success rate, to assess the kind of injuries sustained in traffic crashes and if there is any correlation between the location characteristics of a crash and the type of injuries sustained. They found that for ages less than 19 years old, severe and fatal injuries were more likely in crashes in lower-density areas, while mild and moderate injuries were more likely in higher density areas.

Telematics Data
Telematics can be used to obtain a wide variety of data such as vehicle speeds, instances of hard braking and accelerations, and inappropriate turning movements. Vehicles on the road are a potential source of real-time traffic safety data with the application of telematics. Telematics is a fleet management and tracking system using GPS technology, cameras, and sensors and can be used to obtain a wide variety of data such as vehicle speeds, instances of hard braking and accelerations, and inappropriate turning movements. Local governments usually maintain and operate some of the largest fleets of vehicles in their jurisdiction. Data from the government-owned fleet can be collected through onboard devices installed in the vehicles. Anonymized data from private vehicles are available to purchase from multiple vendors. Vendors such as HERE, Google, Waze, and Inrix collect data from privately owned vehicles. Moreover, a few vendors apply analytics on the data to obtain information such as near misses, vehicle breakdowns, dangerous road conditions, and sudden traffic incidences in real-time. Telematics data can be used to develop less risky routes for heavy vehicles, having them avoid corridors that require frequent hard braking, and better inform root cause analysis of any unfortunate incident. Data from telematics vendors could help guide emergency response services too.

New York City Case Example
New York City’s Department of Transportation (DOT), which operates one of the largest fleets of municipal vehicles, and NYC’s Department of Citywide Administrative Services (DCAS) are currently collaborating with Geotab, a telematics vendor, to harvest a slew of data, including traffic safety-related data. The DOT is also using telematics to track street redesign projects and to measure their before and after safety result. Additionally, using vehicle sensors, the City is also assessing roadway condition information (such as rough surfaces, potholes, or cracks in the roadway) which can be safety issues, especially for people biking.

Insurance Company Data
Multiple insurance companies also collect data from their drivers via onboard diagnostic devices or smartphone applications. For example, insurance companies monitor distracted driving behavior through applications installed on the driver’s phone and obtain data on driving behavior through onboard devices installed on vehicles. Arity is a technology company established by Allstate, one of the largest car insurers, to provide insights built on over 20 billion miles of driving data collected by Allstate.
Data from Automated Enforcement

Automated enforcement equipment can be used to identify potentially dangerous drivers.

The number of violations at each automated enforcement location is a strong indicator of the traffic safety risks at the location. Additionally, the automated enforcement equipment, red-light cameras and speed cameras capture the license plates of almost every vehicle not abiding by the signals or the posted speed limits respectively. This data can be used to identify potentially dangerous drivers that are likely to be involved in a severe traffic crash.

Chicago Case Example

Using license plate data from Chicago’s automated enforcement system and matching it to the city’s record of vehicles involved in a crash, the University of Chicago’s Harris School of Public Policy helped the Chicago Department of Transportation formulate decision rules to identify at-risk drivers for various levels of intervention.

The study’s recommendation was to institute a 3-stage intervention to target vehicles most likely to be involved in a severe traffic crash. Through machine learning applied to the license plate data, the study recommended the following thresholds for interventions:

- Stage 1 intervention for vehicles that receive 2 or more citations in the last 3 months.
- Stage 2 intervention for vehicles that receive 3 or more citations in the last 30 months.

Similar opportunities exist for Phoenix to obtain insights from its automated enforcement data.

Conclusion

While each of the emerging data sources adds value to understanding traffic safety risks, a few are easier to employ than others. For example, obtaining data from hospitals requires significant coordination with the trauma centers in the city and requires buy-in from multiple stakeholders such as the public health department, hospital administrators, and the medical professionals in the emergency rooms.

On the other hand, as Phoenix already has a robust automated enforcement program, the applications of this data can be quickly realized. The data gathered through automated enforcement equipment could help identify the most dangerous drivers and target driver education efforts.

Data available from telematics vendors and insurance companies is the easiest to obtain and the Street Transportation Department is best situated to inform policies and infrastructure design improvements through this data. For example, the telematics data from millions of vehicles on speeding and hard braking can be used to identify hotspots of dangerous driving behaviors and inform enforcement efforts as well as redesign efforts to make the city streets safer. This data can be expanded by installing telematics equipment on the city fleets too.
02.

CRASH TRENDS
The following chapter introduces trends in transportation safety that have occurred throughout the City from 2014 to 2018 and compares those trends to what is happening to peer cities throughout the nation. Understanding these larger trends helps to identify the critical factors impacting transportation safety that need to be addressed.

Nationwide Crash Statistics
To determine how safety on Phoenix’s streets compare to cities throughout the Nation, a peer agency review was conducted. Peer cities are those places that are similar to Phoenix in terms of demographics, land area, population, character, and available data. For this assessment, the following cities were identified for review: Seattle, Dallas, Denver, and Houston. This peer agency review provides the City with a baseline assessment of how well the City is performing and to identify aspirational cities that Phoenix can strive to model based on their safety records.

Historical Crash Trends
Between 2014 and 2018, there were over 145,000 crashes within the City of Phoenix. As illustrated below, Phoenix has historically had significantly fewer crashes than Houston, but far more than Seattle. When compared to total population; however, Phoenix has one of the lowest total number of crashes per 100,000 population among its peer cities. Of all peer agencies reviewed, all cities have experienced an increase in crashes since 2014 except for Seattle, who saw a 5% reduction in crashes. Since 2014, crashes in Phoenix have increased by over 18%.
How Does Phoenix Compare?

The following provides a summary of key crash statistics for Phoenix and peer cities.

### Fatal Crashes Per 100,000 Population

<table>
<thead>
<tr>
<th>City</th>
<th>Fatal Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seattle</td>
<td>2.7</td>
</tr>
<tr>
<td>Houston</td>
<td>9.6</td>
</tr>
<tr>
<td>Dallas</td>
<td>13.1</td>
</tr>
<tr>
<td>Denver</td>
<td>7.4</td>
</tr>
<tr>
<td>Phoenix</td>
<td>11.4</td>
</tr>
</tbody>
</table>

Phoenix has one of the highest traffic fatalities per 100,000 population among its peer cities.

### Total Crashes Per 100,000 Population

<table>
<thead>
<tr>
<th>City</th>
<th>Total Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phoenix</td>
<td>42</td>
</tr>
<tr>
<td>Houston</td>
<td>55</td>
</tr>
<tr>
<td>Seattle</td>
<td>77</td>
</tr>
<tr>
<td>Dallas</td>
<td>52</td>
</tr>
<tr>
<td>Denver</td>
<td>75</td>
</tr>
</tbody>
</table>

### Fatal Crashes Per 100,000 Population

<table>
<thead>
<tr>
<th>City</th>
<th>Fatal Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seattle</td>
<td>1.1</td>
</tr>
<tr>
<td>Houston</td>
<td>3.0</td>
</tr>
<tr>
<td>Phoenix</td>
<td>5.0</td>
</tr>
</tbody>
</table>

### Fatal Crashes Per 100,000 Population

<table>
<thead>
<tr>
<th>City</th>
<th>Fatal Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seattle</td>
<td>0.23</td>
</tr>
<tr>
<td>Houston</td>
<td>0.30</td>
</tr>
<tr>
<td>Phoenix</td>
<td>0.53</td>
</tr>
</tbody>
</table>

### Pedestrian-Related Crashes

While Phoenix has one of the lowest total pedestrian crashes per 100,000 population, it has the highest fatality rate – with 5.0 pedestrian fatalities per 100,000 population. Interestingly, Seattle has the highest total pedestrian crashes, but the lowest fatality rate per 100,000 population.

### Bicycle-Related Crashes

In comparison to peer cities, Phoenix is exactly in the middle in terms of total bicycle related crashes per 100,000 population. However, in terms of fatalities, Phoenix nearly ties with Denver for the highest bicycle fatality rate among peer cities – with 0.53 bicyclist fatalities per 100,000 population.

To combat these safety issues, the peer cities have adopted policies, steps, and policies to improve safety for all users. Most notably, all peer cities have adopted a Vision Zero goal of ending traffic deaths and serious injuries by 2030. Additional measures by the peer cities include:

- Seattle has also announced that it will reduce speed limits to 25 MPH throughout the city, double the number of safety-enhanced traffic signals, invest in engineering changes to create safer streets, create a new crash review task force, and launch additional traffic safety education and enforcement tactics.
- Denver hired dedicated Vision Zero staff and developed a Vision Zero Working Group to ensure the implementation and success of the Vision Zero program.
- Online crash statistic dashboards and story maps have been developed by peer cities to provide transparency to residents and to track progress of different safety initiatives to accomplish Vision Zero goals.
Citywide Safety Trends

Between 2014 and 2018, a total of 145,263 crashes were reported on Phoenix roadways, with an overall increase of more than 18 percent over the five-year time period. The following section outlines key crash characteristics to help better understand the “who,” “what,” “when,” “where,” and “how” of transportation safety in Phoenix.

How Severe are the Crashes?

Since 2014, Phoenix has experienced an increase in fatal crashes and a decrease in serious injuries resulting from crashes involving motor vehicles. According to the Arizona Strategic Traffic Safety Plan, this same trend can be seen statewide.

**Fatal Crashes**
- Fatal crashes have been steadily increasing year over year.
- Fatal crashes accounted for 0.7% of all crashes reported. Up 5% from 2017 to 2018.
- Nearly 50% of all fatal crashes involved a pedestrian.

**Serious Injury Crashes**
- Serious injury crashes are on the decline. 3.1% of crashes resulted in a fatality or serious injury.
- 16% reduction in serious injury crashes from 2017 to 2018.
Figure 1. Serious Injury and Fatal Crashes

- Low Density of Serious and Fatal Crashes
- High Density of Serious and Fatal Crashes

Key:
- Freeway
- Arterial
- Collector/Local
- River/Wash/Canal
- Park

Who is Involved?

In a traditional crash data report, passenger vehicles and freight vehicles are grouped together in the crash database as vehicles. Vehicles make up the largest percentage of user types involved in crashes on Phoenix streets.

**Vehicles Only Crashes**

96.2% of crashes involved vehicles only
12% were single vehicle crashes
Crash trends have been steady for the last three years

**Bicycle Involved Crashes**

Bicyclist involved crashes are on the decline - 27% reduction from 2017
1.2% of crashes involved a bicyclist in 2018
7% of those resulted in a fatality

**Pedestrian Involved Crashes**

2.5 percent of crashes involved a pedestrian in 2018 - 7% increase in pedestrian crashes from previous year
14% of those resulted in a fatality.
Figure 2. Pedestrian and Bicycle Involved Crashes

- Bicyclist
- Pedestrian
- Freeway
- Arterial
- Collector/Local
- River/Wash/Canal
- Park

What Type of Crashes are Occurring?

While every crash is unique, they are often categorized according to the circumstances of the crash. Each vehicle crash can be grouped into different collision types, including rear-end crashes, angle crashes, left/right hand turn crashes, and head on crashes. Each crash type can indicate a particular problem that may be addressed through a targeted engineering, enforcement, or behavioral countermeasure. As illustrated below, rear-end and angle crashes make up over 50% of all crashes on Phoenix streets.

What Types of Crashes Resulted in Serious Injuries and Fatalities?

The graphs below illustrate the distribution of fatal crashes and serious injury crashes by crash type, respectively. Pedestrian fatalities account for over 44% of all fatal crashes in the City, in addition to another 18.7% of serious injury crashes. Nearly 5% of fatal crashes and 7% of serious injury crashes were bicycle-involved.
Where are the Crashes Happening?

Understanding the locational context of crashes is an important step in identifying location specific safety issues that may be addressed through a targeted engineering, enforcement, or behavioral countermeasure. Intersection related crashes are identified as crashes that occur within 150 Feet of an intersection. On Phoenix streets, there is a disproportionate split between crashes occurring at intersections and along corridors, with nearly 72% of all crashes occurring at intersections.

Crash Severity by Location

According to the Arizona Strategic Traffic Safety Plan, between 2016 and 2018, 28% of all fatalities and 44% of all serious injuries in Arizona occurred at or were related to an intersection. In Phoenix, these rates are significantly higher with 75% of fatal and 73% of serious injury crashes occurring at or related to an intersection.

To gain a better understanding of why the high severity crashes may be occurring and possible mitigation strategies, high severity crashes at intersections and roadways were broken down by crash types, see below.

Injury Classification on Crash Type by Location

<table>
<thead>
<tr>
<th>Crash Type</th>
<th>Not Intersection Related</th>
<th>Intersection Related</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fatal</td>
<td>Serious Injury</td>
</tr>
<tr>
<td>Angle</td>
<td>1%</td>
<td>4%</td>
</tr>
<tr>
<td>Backing</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Head On</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Left Turn</td>
<td>1%</td>
<td>3%</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>11%</td>
<td>6%</td>
</tr>
<tr>
<td>Rear End</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td>Sideswipe</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>Single Vehicle</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>U Turn</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Other/Unknown</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

76% of all fatal crashes were intersection related
73% of all serious injury crashes were intersection related
39% of all fatal and serious injury crashes occurred at a traffic signal.
Figure 3. Crash Density

Low Density

High Density

Freeway

Arterial

Collector/Local

River/Wash/Canal

Park

When do Crashes Occur?

Evaluating time of day, day of the week, and month crashes occurred can help identify contributing factors such as motor vehicle volumes and street lighting. The following section outlines when crashes occurred during the period of 2014-2018.

### Time of Year

While there is a slight decrease in crashes during the summer months, the total number of crashes stays fairly consistent throughout the year. Fatal and serious crashes have slight increases in March and October.

### Day of Week

As shown below, Saturday and Sunday historically have experienced the lowest number of crashes. Fatal and serious injury crashes follow a similar trend, with lower total serious and fatal crashes occurring on Saturday and Sunday.
Total Crashes by Time of Day

Severe Injury and Fatal Crashes by Time of Day

28% of pedestrian involved crashes occurred between 6pm – 9pm.

36% of bicycle involved crashes occurred between 3pm – 6pm.

34% of severe injury and fatal pedestrian crashes occurred between 3pm – 6pm.

22% of severe injury and fatal bicycle crashes occurred between 9am - Noon.
How do Light Conditions Impact Crashes?

As previously noted, the majority of crashes occurred during the daytime. As illustrated below, however, 61.6% of serious injury and fatal crashes occurred during dark conditions.

How do Road Conditions Play a Role?

Crashes happen in all weather conditions and potentially impacting road conditions. As illustrated below, the majority of crashes occurred during dry conditions. Over 3.7% of all crashes, and 3.9% of serious injury crashes, occurred on a wet roadway surface.
What Contributing Actions Led to Crashes?

Identification of actions that led to a crash, as classified in crash database, provides information about conditions contributing to crashes. The crash database has 29 categories to classify crash causes. Examples of contributing actions include failing to yield the right of way, motorist inattentive or distracted, chemical impairment, or disregarding a traffic control device. It’s important to note that “Speed Too Fast” does not necessarily mean the person was exceeding the speed limit but rather the person was traveling too fast for the conditions at the time.

Contributing Actions for All Crashes

- 27.3% of fatal crashes occurred from crossing the road
- 24.4% of all crashes occurred from turning left
What High Risk Behaviors Impact Crashes?

High risk behaviors include driver behaviors that can result in serious or fatal crashes, such as impaired driving, speeding, and distracted driving. Crash data can aid in identifying times and places where traffic enforcement might be used as a treatment. The following outlines police citation and human behavior factors that may have contributed to crashes.

**Personal Citations**

The most commonly cited personal violation cited was failure to yield, with 27% of all crashes and 30% of serious injury and fatal crashes. 25% of all crashes were cited as speeding too fast. Fatal crashes were largely cited as failure to yield, speeding too fast, and disregard for a traffic signal.

**Distracted Driving**

Distracted driving includes any activity that can potentially pull a driver’s attention away from driving. Three major types of distractions are visual, when the line of sight leaves the road; manual, when the driver’s hands leave the wheel; and lack of focus, when attention is directed away from driving. A crash is defined as related to distracted driving if the officer records a driver distraction on the crash report for any unit involved in the crash. Distracted driving tends to be under-reported in crash data due to the difficulty of determining whether a driver was distracted at the time the crash occurred.

**Crashes by Driver Distraction**

11% of fatal crashes were cited as involving driver distraction.
Impaired Driving

Impaired driving includes instances when the driver of a vehicle is under the influence of alcohol. A crash is classified as alcohol-related if the reporting officer suspected the driver of the at-fault vehicle of being under the influence of alcohol.

Relation to Alcohol for All Crashes

- No Injury
- Possible Injury
- Minor Injury
- Serious Injury
- Fatal

Relation to Alcohol for Bicycle Involved Crashes

- No Injury
- Possible Injury
- Minor Injury
- Serious Injury
- Fatal

Relation to Alcohol for Pedestrian Involved Crashes

- No Injury
- Possible Injury
- Minor Injury
- Serious Injury
- Fatal

35% of fatal crashes involved alcohol
10% of serious injury crashes involved alcohol
19% of fatal bicycle involved crashes involved alcohol
3% of serious injury bicycle involved crashes involved alcohol
42% of fatal pedestrian related crashes involved alcohol
16% of serious injury pedestrian related crashes involved alcohol
Bicycle Involved Crash Trends

Bicycling in Phoenix is a popular recreation and commute travel choice and with its popularity comes with the challenge of ensuring cyclists are safe both on-road and off-road. The following section summarizes crash characteristics of bicycle involved crashes that have occurred in Phoenix from 2014-2018.

**Bicyclist Involved Crashes by Severity**

<table>
<thead>
<tr>
<th>Year</th>
<th>All Crashes</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>457</td>
<td>44</td>
<td>11</td>
</tr>
<tr>
<td>2015</td>
<td>453</td>
<td>59</td>
<td>9</td>
</tr>
<tr>
<td>2016</td>
<td>519</td>
<td>76</td>
<td>8</td>
</tr>
<tr>
<td>2017</td>
<td>518</td>
<td>61</td>
<td>12</td>
</tr>
<tr>
<td>2018</td>
<td>377</td>
<td>51</td>
<td>2</td>
</tr>
</tbody>
</table>

2,234 Bicycle crashes (2014-2018)

2,173 Injuries

42 Fatalities

**Bicycle Involved Crashes by Time**

<table>
<thead>
<tr>
<th>Time</th>
<th>Bicycle Involved</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 PM - 9 PM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 PM - Midnight</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Primary Violation of Bicyclist Crashes**

<table>
<thead>
<tr>
<th>Violation</th>
<th>Fatal and Serious Crashes</th>
<th>All Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsafe Lane Change/Passing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traveling in Opposing Lane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ran STOP Sign</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inattention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failed to Yield</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failed to Keep in Lane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disregarded Signal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did Not Use Crosswalk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

77% Crashes were intersection related

73% occurred during dark conditions

16% of serious injury and fatal crashes were caused by failure to yield
Figure 4. Bicycle Crashes By Severity

- Fatal
- Serious Injury
- Minor or No Injury

Freeway
Arterial
Collector/Local
River/Wash/Canal
Park

Pedestrians are some of the most vulnerable users of public roadways. Crashes involving these roadway users may result in more serious injuries simply because pedestrians do not have the protection of a vehicle. The following section summarizes crash characteristics of pedestrian involved crashes that have occurred in Phoenix from 2014-2018.

### Pedestrian Involved Crashes by Severity

- **2014**: 582 (All Crashes), 57 (Serious Injury), 67 (Fatal)
- **2015**: 677 (All Crashes), 55 (Serious Injury), 67 (Fatal)
- **2016**: 684 (All Crashes), 85 (Serious Injury), 91 (Fatal)
- **2017**: 722 (All Crashes), 178 (Serious Injury), 91 (Fatal)
- **2018**: 773 (All Crashes), 171 (Serious Injury), 105 (Fatal)

### Pedestrian Involved Crashes by Time

- **Midnight - 3 AM**: 0 (All Crashes), 0 (Serious Injury), 0 (Fatal)
- **3 AM - 6 AM**: 123 (All Crashes), 67 (Serious Injury), 67 (Fatal)
- **6 AM - 9 AM**: 577 (All Crashes), 55 (Serious Injury), 67 (Fatal)
- **9 AM - Noon**: 684 (All Crashes), 85 (Serious Injury), 91 (Fatal)
- **Noon - 3 PM**: 722 (All Crashes), 178 (Serious Injury), 91 (Fatal)
- **3 PM - 6 PM**: 773 (All Crashes), 171 (Serious Injury), 105 (Fatal)
- **6 PM - 9 PM**: 0 (All Crashes), 0 (Serious Injury), 0 (Fatal)
- **9 PM - Midnight**: 0 (All Crashes), 0 (Serious Injury), 0 (Fatal)

### Primary Violation of Pedestrian Crashes

- **Walked on Wrong Side**: 0 (Fatal and Serious Crashes), 0 (All Crashes)
- **Unknown**: 0 (Fatal and Serious Crashes), 55 (All Crashes)
- **Other**: 0 (Fatal and Serious Crashes), 20 (All Crashes)
- **None**: 0 (Fatal and Serious Crashes), 105 (All Crashes)
- **Inattention**: 0 (Fatal and Serious Crashes), 0 (All Crashes)
- **Failed to Yield**: 0 (Fatal and Serious Crashes), 20 (All Crashes)
- **Disregarded Signal**: 0 (Fatal and Serious Crashes), 20 (All Crashes)
- **Did Not Use Crosswalk**: 0 (Fatal and Serious Crashes), 40 (All Crashes)


3,035 Injuries

407 Fatalities

47% occurred during daylight conditions

75% crashes were intersection related

64% of fatal pedestrian crashes were crossing mid-block
Figure 5.
Pedestrian Crashes By Severity

- Fatal
- Serious Injury
- Minor or No Injury

Freeway
Arterial
Collector/Local
River/Wash/Canal
Park

Crash Trends by Village

Understanding the geographic location of crashes aids in identifying areas that experience a disproportionate rate of crashes. The following section outlines crash characteristics by City of Phoenix Villages.

Total Crashes by Year

Since 2014, crashes have increased by 56% in Rio Vista, 42% in Estrella, and 37% in North Gateway.

Pedestrian and Bicycle Crashes by Village

Over 26% of all bicycle crashes occurred in Camelback East (13.4%) and North Mountain (12.8%).

Nearly 30% of all pedestrian crashes occurred in Alhambra (16.2%) and Maryvale (13.7%).

18% of all fatal pedestrian occurred in Alhambra.
Figure 6. Crashes by Village

03. NETWORK SCREENING AND SYSTEMIC FINDINGS
NETWORK SCREENING AND SYSTEMIC FINDINGS

This section describes the network screening and systemic evaluation of the City’s roadway network. For the purposes of this analysis, the KCMP network was utilized which includes all arterials, collectors, and local streets of significance. Freeways, ramps, state highways, and other non-city operated roadways were excluded from the analysis. Crashes were geocoded and stratified as either intersection related or roadway segment crashes and tagged to the KCMP roadway network.

**Equivalent Property Damage Only (EPDO)**

The Equivalent Property Damage Only (EPDO) performance measure assigns weight to individual crashes based on the severity of the crash. The weighting is based on the cost of a property-damage-only (PDO) crash, giving each crash a relative severity score in terms of a PDO crash. The weighting factors used for the network screening are based on the crash costs by severity and derived from Maricopa Association of Governments’ (MAG) Road Safety Program. Table 1 illustrates the crash cost for each crash severity type and the corresponding EPDO weights. The weights generally reflect an order of magnitude difference between the societal costs of fatal, severe injury, minor injury, and no-injury crashes.

<table>
<thead>
<tr>
<th>Crash Severity Type</th>
<th>Crash Cost</th>
<th>EPDO Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>$9,515,371</td>
<td>890.9</td>
</tr>
<tr>
<td>Severe Injury</td>
<td>$550,499</td>
<td>51.5</td>
</tr>
<tr>
<td>Minor Injury</td>
<td>$149,132</td>
<td>13.9</td>
</tr>
<tr>
<td>Possible Injury</td>
<td>$103,145</td>
<td>9.6</td>
</tr>
<tr>
<td>No Injury</td>
<td>$10,680</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Corridor Screening and Systemic Findings**

This section describes the citywide corridor screening and systemic evaluation.

**High Injury Crash Segments**

The EPDO score for roadway segments was calculated by multiplying the number of crashes for each severity type with the corresponding EPDO weights and aggregating the results using the formula below:

\[
\text{EPDO Score} = \text{Fatal EPDO Weight} \times \text{Number of Fatal Crashes} + \text{Severe Injury EPDO Weight} \times \text{Number of Severe Injury Crashes} + \text{Minor Injury EPDO Weight} \times \text{Number of Minor Injury Crashes} + \text{Possible Injury EPDO Weight} \times \text{Number of Possible Injury Crashes} + \text{No Injury EPDO Weight} \times \text{Number of No Injury Crashes}
\]

EPDO score for each segment was then annualized by dividing the score by the number of years of crash data used in the analysis. Based on their EPDO score, segments were prioritized into three tiers.

- **Tier 1** represents highest priority segments, with an EPDO score of two standard deviations above the mean.
- **Tier 2** represents medium priority segments, with an EPDO score of one standard deviation above the mean.
- **Tier 3** represents low priority segments.

**Priority Crash Segments**

Figure 7 illustrates the high-injury network, or Tier 1 segments throughout the City, while Table 2 lists Tier 1, Tier 2, and Tier 3 segments by village. Table 3 lists the top 25 high priority crash segments in the City based on their EPDO score.
Table 2: Number of High Injury Crash Segments by Tier

<table>
<thead>
<tr>
<th>Village</th>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahwatukee Foothills</td>
<td>1</td>
<td>7</td>
<td>92</td>
<td>100</td>
</tr>
<tr>
<td>Alhambra</td>
<td>20</td>
<td>27</td>
<td>197</td>
<td>244</td>
</tr>
<tr>
<td>Camelback East</td>
<td>9</td>
<td>23</td>
<td>185</td>
<td>217</td>
</tr>
<tr>
<td>Central City</td>
<td>3</td>
<td>13</td>
<td>297</td>
<td>313</td>
</tr>
<tr>
<td>Deer Valley</td>
<td>13</td>
<td>25</td>
<td>193</td>
<td>231</td>
</tr>
<tr>
<td>Desert View</td>
<td>0</td>
<td>6</td>
<td>84</td>
<td>90</td>
</tr>
<tr>
<td>Encanto</td>
<td>7</td>
<td>20</td>
<td>93</td>
<td>120</td>
</tr>
<tr>
<td>Estrella</td>
<td>8</td>
<td>16</td>
<td>120</td>
<td>144</td>
</tr>
<tr>
<td>Laveen</td>
<td>2</td>
<td>6</td>
<td>58</td>
<td>66</td>
</tr>
<tr>
<td>Maryvale</td>
<td>30</td>
<td>29</td>
<td>240</td>
<td>299</td>
</tr>
<tr>
<td>North Gateway</td>
<td>1</td>
<td>4</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>North Mountain</td>
<td>15</td>
<td>35</td>
<td>164</td>
<td>214</td>
</tr>
<tr>
<td>Paradise Valley</td>
<td>8</td>
<td>25</td>
<td>227</td>
<td>260</td>
</tr>
<tr>
<td>Rio Vista</td>
<td>0</td>
<td>1</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>South Mountain</td>
<td>15</td>
<td>29</td>
<td>122</td>
<td>166</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>132</strong></td>
<td><strong>266</strong></td>
<td><strong>2107</strong></td>
<td><strong>2505</strong></td>
</tr>
</tbody>
</table>

Table 3: Top 25 Priority Crash Segments by EPDO Score

<table>
<thead>
<tr>
<th>Segment</th>
<th>No Injury</th>
<th>Possible Injury</th>
<th>Minor Injury</th>
<th>Serious Injury</th>
<th>Fatal</th>
<th>Total Crashes</th>
<th>EPDO Score</th>
<th>EPDO Priority</th>
<th>Tier</th>
<th>Village</th>
</tr>
</thead>
<tbody>
<tr>
<td>N 35th Ave: Indian School Rd to Campbell Ave</td>
<td>87</td>
<td>22</td>
<td>18</td>
<td>8</td>
<td>6</td>
<td>141</td>
<td>1261.8</td>
<td>1</td>
<td>Tier 1</td>
<td>Alhambra</td>
</tr>
<tr>
<td>W Indian School Rd: 35th Ave to 31st Ave</td>
<td>101</td>
<td>32</td>
<td>16</td>
<td>5</td>
<td>5</td>
<td>159</td>
<td>1069.2</td>
<td>2</td>
<td>Tier 1</td>
<td>Alhambra</td>
</tr>
<tr>
<td>N 43rd Ave: Encanto Blvd to McDowell Rd</td>
<td>85</td>
<td>26</td>
<td>13</td>
<td>3</td>
<td>4</td>
<td>131</td>
<td>847.2</td>
<td>3</td>
<td>Tier 1</td>
<td>Maryvale</td>
</tr>
<tr>
<td>W Lower Buckeye Rd: 67th Ave to 75th Ave</td>
<td>51</td>
<td>19</td>
<td>12</td>
<td>1</td>
<td>4</td>
<td>87</td>
<td>803.5</td>
<td>4</td>
<td>Tier 1</td>
<td>Estrella</td>
</tr>
<tr>
<td>W Indian School Rd: 19th Ave to 23rd Ave</td>
<td>167</td>
<td>36</td>
<td>22</td>
<td>8</td>
<td>3</td>
<td>236</td>
<td>781.4</td>
<td>5</td>
<td>Tier 1</td>
<td>Encanto</td>
</tr>
<tr>
<td>W Northern Ave: 23rd Ave to 27th Ave</td>
<td>194</td>
<td>47</td>
<td>20</td>
<td>5</td>
<td>3</td>
<td>269</td>
<td>771.6</td>
<td>6</td>
<td>Tier 1</td>
<td>North Mountain</td>
</tr>
<tr>
<td>W Indian School Rd: 43rd Ave to 47th Ave</td>
<td>133</td>
<td>33</td>
<td>22</td>
<td>4</td>
<td>3</td>
<td>195</td>
<td>727.6</td>
<td>7</td>
<td>Tier 1</td>
<td>Maryvale</td>
</tr>
<tr>
<td>W McDowell Rd: 51st Ave to 55th Ave</td>
<td>70</td>
<td>29</td>
<td>20</td>
<td>5</td>
<td>3</td>
<td>127</td>
<td>712.0</td>
<td>8</td>
<td>Tier 1</td>
<td>Maryvale</td>
</tr>
<tr>
<td>N 19th Ave: Rose Garden Ln to Utopia St</td>
<td>57</td>
<td>21</td>
<td>18</td>
<td>7</td>
<td>3</td>
<td>106</td>
<td>709.0</td>
<td>9</td>
<td>Tier 1</td>
<td>Deer Valley</td>
</tr>
<tr>
<td>E McDowell Rd: 32nd St to 36th St</td>
<td>107</td>
<td>31</td>
<td>13</td>
<td>5</td>
<td>3</td>
<td>159</td>
<td>703.7</td>
<td>10</td>
<td>Tier 1</td>
<td>Camelback East</td>
</tr>
<tr>
<td>E Broadway Rd: 16th St to 24th St</td>
<td>68</td>
<td>27</td>
<td>17</td>
<td>4</td>
<td>3</td>
<td>119</td>
<td>689.0</td>
<td>11</td>
<td>Tier 1</td>
<td>South Mountain</td>
</tr>
<tr>
<td>N 67th Ave: Roosevelt St to Van Buren St</td>
<td>76</td>
<td>23</td>
<td>25</td>
<td>2</td>
<td>3</td>
<td>129</td>
<td>684.6</td>
<td>12</td>
<td>Tier 1</td>
<td>Estrella</td>
</tr>
<tr>
<td>E McDowell Rd: 40th St to 44th St</td>
<td>64</td>
<td>20</td>
<td>12</td>
<td>6</td>
<td>3</td>
<td>105</td>
<td>681.4</td>
<td>13</td>
<td>Tier 1</td>
<td>Camelback East</td>
</tr>
<tr>
<td>N 43rd Ave: Indian School Rd to Osborn Ave</td>
<td>101</td>
<td>19</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>138</td>
<td>670.9</td>
<td>14</td>
<td>Tier 1</td>
<td>Maryvale</td>
</tr>
<tr>
<td>W Greenway Rd: 19th Ave to 29th Ave</td>
<td>75</td>
<td>22</td>
<td>15</td>
<td>2</td>
<td>3</td>
<td>117</td>
<td>654.6</td>
<td>15</td>
<td>Tier 1</td>
<td>Deer Valley</td>
</tr>
<tr>
<td>W Van Buren St: 27th Ave to 31st Ave</td>
<td>64</td>
<td>11</td>
<td>12</td>
<td>5</td>
<td>3</td>
<td>95</td>
<td>653.7</td>
<td>16</td>
<td>Tier 1</td>
<td>Estrella</td>
</tr>
<tr>
<td>W Northern Ave: 35th Ave to 39th Ave</td>
<td>48</td>
<td>20</td>
<td>10</td>
<td>4</td>
<td>3</td>
<td>85</td>
<td>652.0</td>
<td>17</td>
<td>Tier 1</td>
<td>North Mountain</td>
</tr>
<tr>
<td>N 19th Ave: Bell Rd to Grovers Ave</td>
<td>38</td>
<td>14</td>
<td>13</td>
<td>4</td>
<td>3</td>
<td>72</td>
<td>646.7</td>
<td>18</td>
<td>Tier 1</td>
<td>Deer Valley</td>
</tr>
<tr>
<td>W Northern Ave: 31st Ave to 35th Ave</td>
<td>86</td>
<td>15</td>
<td>7</td>
<td>2</td>
<td>3</td>
<td>113</td>
<td>620.9</td>
<td>19</td>
<td>Tier 1</td>
<td>North Mountain</td>
</tr>
<tr>
<td>N 35th Ave: Butler Ave to Northern Ave</td>
<td>57</td>
<td>13</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>82</td>
<td>618.8</td>
<td>20</td>
<td>Tier 1</td>
<td>North Mountain</td>
</tr>
<tr>
<td>S 7th St: Ewing St to Broadway Rd</td>
<td>25</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>41</td>
<td>600.8</td>
<td>21</td>
<td>Tier 1</td>
<td>South Mountain</td>
</tr>
<tr>
<td>N 83rd Ave: Thomas Rd to Encanto Blvd</td>
<td>40</td>
<td>15</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>64</td>
<td>588.3</td>
<td>22</td>
<td>Tier 1</td>
<td>Maryvale</td>
</tr>
<tr>
<td>N 51st Ave: McDowell Rd to Roosevelt St</td>
<td>167</td>
<td>41</td>
<td>23</td>
<td>4</td>
<td>2</td>
<td>237</td>
<td>574.4</td>
<td>23</td>
<td>Tier 1</td>
<td>Maryvale</td>
</tr>
<tr>
<td>W Bethany Home Rd: 23rd Ave to 27th Ave</td>
<td>178</td>
<td>50</td>
<td>18</td>
<td>3</td>
<td>2</td>
<td>251</td>
<td>569.8</td>
<td>24</td>
<td>Tier 1</td>
<td>Alhambra</td>
</tr>
<tr>
<td>W Broadway Rd: 15th Ave to 19th Ave</td>
<td>36</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>43</td>
<td>558.7</td>
<td>25</td>
<td>Tier 1</td>
<td>South Mountain</td>
</tr>
</tbody>
</table>

132 Tier 1 Priority Crash Segments Identified

23% of all Tier 1 Priority Crash Segments are in Maryvale. Six of the top 25 high injury crash segments are located in Maryvale.

50% of all Tier 1 Priority Crash Segments are in Maryvale, Alhambra, and North Mountain.
Risk Factors for High Injury Crash Segments
For the top 25 high injury crash segments, a detailed evaluation was performed to identify potential risk factors associated with each segment. The following roadway characteristics were reviewed for locations to determine potential risk factors:

- Roadway classification
- Number of vehicle lanes
- Presence of median
- Posted speed
- Traffic volumes
- Roadway geometry
- Pedestrian crossing gaps
- Segment near freeway interchange
- On-street parking
- Intersection density
- Driveway density
- Presence of transit stop

Based on review of the risk factors, roadway characteristics, and crash locations for the top 25 high injury segments, the following predominant potential risk factors were identified:

Over 80% of top 25 segments identified were high-volume arterials and major arterials

40% of the top 25 segments were located near freeway/highway interchanges

Nearly 70% of the top 25 segments had limited pedestrian crossing opportunities for significant distances (0.5 miles+)

Over 75% of the top 25 segments had frequent driveway access. This in combination with higher speeds and higher volumes may result in unsafe traveling conditions

Seven of the top 25 segments had higher intersection density and median type of two-way-left-turn-lane. This typically increases the conflict points and in turn results in unsafe travel conditions especially for left-turn movements

Transit stops were present on ten of the top 25 segments with limited crossing opportunities

Table 4 summarizes the risk factors for the top 25 high injury crash segments. To mitigate these risk factors, Chapter 4 outlines safety interventions and strategies to systematically build a safer transportation system.
Table 4: Risk Analysis of High Injury Crash Segments

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N 35th Ave: Indian School Rd to Campbell Ave</td>
<td>1261.8</td>
<td>1</td>
<td>Tier 1</td>
<td>Alhambra</td>
<td>MA</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>24K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Indian School Rd: 35th Ave to 31st Ave</td>
<td>1069.2</td>
<td>2</td>
<td>Tier 1</td>
<td>Alhambra</td>
<td>MA</td>
<td>6</td>
<td>Raised</td>
<td>40</td>
<td>56K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 43rd Ave: Encanto Blvd to McDowell Rd</td>
<td>847.2</td>
<td>3</td>
<td>Tier 1</td>
<td>Maryvale</td>
<td>AT</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>39K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Lower Buckeye Rd: 67th Ave to 75th Ave</td>
<td>803.5</td>
<td>4</td>
<td>Tier 1</td>
<td>Estrella</td>
<td>AT</td>
<td>3</td>
<td>TWLTL</td>
<td>40</td>
<td>16K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Indian School Rd: 19th Ave to 23rd Ave</td>
<td>781.4</td>
<td>5</td>
<td>Tier 1</td>
<td>Encanta</td>
<td>MA</td>
<td>6</td>
<td>TWLTL</td>
<td>35</td>
<td>43K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Northern Ave: 23rd Ave to 27th Ave</td>
<td>771.6</td>
<td>6</td>
<td>Tier 1</td>
<td>North Mountain</td>
<td>AT</td>
<td>7</td>
<td>TWLTL</td>
<td>40</td>
<td>46K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Indian School Rd: 43rd Ave to 47th Ave</td>
<td>727.6</td>
<td>7</td>
<td>Tier 1</td>
<td>Maryvale</td>
<td>MA</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>34K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W McDowell Rd: 51st Ave to 55th Ave</td>
<td>712.0</td>
<td>8</td>
<td>Tier 1</td>
<td>Maryvale</td>
<td>AT</td>
<td>5</td>
<td>TWLTL</td>
<td>45</td>
<td>26K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 19th Ave: Rose Garden Ln to Utopia St</td>
<td>709.0</td>
<td>9</td>
<td>Tier 1</td>
<td>Deer Valley</td>
<td>MA</td>
<td>4</td>
<td>TWLTL</td>
<td>45</td>
<td>26K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E McDowell Rd: 32nd St to 36th St</td>
<td>703.7</td>
<td>10</td>
<td>Tier 1</td>
<td>Camelback East</td>
<td>AT</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>28K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E Broadway Rd: 16th St to 24th St</td>
<td>689.0</td>
<td>11</td>
<td>Tier 1</td>
<td>South Mountain</td>
<td>AT</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>25K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 67th Ave: Roosevelt St to Van Buren St</td>
<td>684.6</td>
<td>12</td>
<td>Tier 1</td>
<td>Estrella</td>
<td>AT</td>
<td>4</td>
<td>TWLTL</td>
<td>40</td>
<td>31K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E McDowell Rd: 40th St to 44th St</td>
<td>681.4</td>
<td>13</td>
<td>Tier 1</td>
<td>Camelback East</td>
<td>AT</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>35K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 43rd Ave: Indian School Rd to Osborn Ave</td>
<td>670.9</td>
<td>14</td>
<td>Tier 1</td>
<td>Maryvale</td>
<td>AT</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>37K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Greenway Rd: 19th Ave to 29th Ave</td>
<td>654.6</td>
<td>15</td>
<td>Tier 1</td>
<td>Deer Valley</td>
<td>AT</td>
<td>4</td>
<td>TWLTL</td>
<td>40</td>
<td>30K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Van Buren St: 27th Ave to 31st Ave</td>
<td>653.7</td>
<td>16</td>
<td>Tier 1</td>
<td>Estrella</td>
<td>AT</td>
<td>5</td>
<td>TWLTL</td>
<td>35</td>
<td>18K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Northern Ave: 35th Ave to 39th Ave</td>
<td>652.0</td>
<td>17</td>
<td>Tier 1</td>
<td>North Mountain</td>
<td>AT</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>38K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 19th Ave: Bell Rd to Grovers Ave</td>
<td>646.7</td>
<td>18</td>
<td>Tier 1</td>
<td>Deer Valley</td>
<td>MA</td>
<td>5</td>
<td>TWLTL</td>
<td>45</td>
<td>24K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Northern Ave: 31st Ave to 35th Ave</td>
<td>620.9</td>
<td>19</td>
<td>Tier 1</td>
<td>North Mountain</td>
<td>AT</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>45K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 35th Ave: Butler Ave to Northern Ave</td>
<td>618.8</td>
<td>20</td>
<td>Tier 1</td>
<td>North Mountain</td>
<td>MA</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>32K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S 7th St; Elwood St to Broadway Rd</td>
<td>600.8</td>
<td>21</td>
<td>Tier 1</td>
<td>South Mountain</td>
<td>MA</td>
<td>4</td>
<td>TWLTL</td>
<td>40</td>
<td>25K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 83rd Ave: Thomas Rd to Encanto Blvd</td>
<td>588.3</td>
<td>22</td>
<td>Tier 1</td>
<td>Maryvale</td>
<td>AT</td>
<td>6</td>
<td>TWLTL</td>
<td>45</td>
<td>44K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N 51st Ave: McDowell Rd to Roosevelt St</td>
<td>574.4</td>
<td>23</td>
<td>Tier 1</td>
<td>Maryvale</td>
<td>MA</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>42K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Bethany Home Rd: 23rd Ave to 27th Ave</td>
<td>569.8</td>
<td>24</td>
<td>Tier 1</td>
<td>Alhambra</td>
<td>AT</td>
<td>6</td>
<td>TWLTL</td>
<td>40</td>
<td>43K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Broadway Rd: 15th Ave to 19th Ave</td>
<td>558.7</td>
<td>25</td>
<td>Tier 1</td>
<td>South Mountain</td>
<td>AT</td>
<td>5</td>
<td>TWLTL</td>
<td>40</td>
<td>16K+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Identified potential risk

* MA = Major Arterial, AT = Arterial
* TWLTL = Two-way-left-turn-lane
Intersection Screening and Systemic Findings

This section describes the citywide intersection screening and systemic evaluation. To identify intersection crashes, each crash was first geocoded, and intersection related crashes were identified. A 150 feet buffer around each intersection was used to extract intersection crashes and each crash was then tagged with the corresponding intersection name. This process helped identify the number of crashes at each intersection.

High Injury Crash Intersections

Similar to the network screening process, Equivalent Property Damage Only (EPDO) intersection screening performance measure from the AASHTO Highway Safety Manual (HSM) was used to identify high injury crash intersections. EPDO weights for each crash severity type as illustrated in Table 1 was utilized. The EPDO score for intersection was calculated by multiplying the number of crashes for each severity type with the corresponding EPDO weights and aggregating the results using the formula below:

\[
\text{EPDO Score} = \text{Fatal EPDO Weight} \times \text{Number of Fatal Crashes} \\
+ \text{Severe Injury EPDO Weight} \times \text{Number of Severe Injury Crashes} \\
+ \text{Minor Injury EPDO Weight} \times \text{Number of Minor Injury Crashes} \\
+ \text{Possible Injury EPDO Weight} \times \text{Number of Possible Injury Crashes} \\
+ \text{No Injury EPDO Weight} \times \text{Number of No Injury Crashes}
\]

EPDO score for each intersection was then annualized by dividing the score by the number of years of crash data used in the analysis. Based on their EPDO score, intersections were prioritized into three tiers.

- **Tier 1** represents highest priority intersections, with an EPDO score of two standard deviations above the mean.
- **Tier 2** represents medium priority intersections, with an EPDO score of one standard deviation above the mean.
- **Tier 3** represents low priority intersections.

Priority Crash Intersections

Figure 8 illustrates the high-injury intersections, or Tier 1 intersections throughout the City, while Table 5 lists Tier 1, Tier 2, and Tier 3 intersections by village. Table 6 lists the top 25 high priority crash intersections in the City based on their EPDO score.

<table>
<thead>
<tr>
<th>Village</th>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahwatukee Foothills</td>
<td>3</td>
<td>1</td>
<td>67</td>
<td>71</td>
</tr>
<tr>
<td>Alhambra</td>
<td>20</td>
<td>16</td>
<td>153</td>
<td>189</td>
</tr>
<tr>
<td>Camelback East</td>
<td>10</td>
<td>14</td>
<td>178</td>
<td>202</td>
</tr>
<tr>
<td>Central City</td>
<td>1</td>
<td>12</td>
<td>255</td>
<td>268</td>
</tr>
<tr>
<td>Deer Valley</td>
<td>14</td>
<td>26</td>
<td>129</td>
<td>169</td>
</tr>
<tr>
<td>Desert View</td>
<td>0</td>
<td>5</td>
<td>67</td>
<td>72</td>
</tr>
<tr>
<td>Encanto</td>
<td>7</td>
<td>7</td>
<td>114</td>
<td>128</td>
</tr>
<tr>
<td>Estrella</td>
<td>3</td>
<td>18</td>
<td>93</td>
<td>114</td>
</tr>
<tr>
<td>Laveen</td>
<td>2</td>
<td>4</td>
<td>43</td>
<td>49</td>
</tr>
<tr>
<td>Maryvale</td>
<td>21</td>
<td>22</td>
<td>168</td>
<td>211</td>
</tr>
<tr>
<td>North Gateway</td>
<td>0</td>
<td>0</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>North Mountain</td>
<td>15</td>
<td>19</td>
<td>116</td>
<td>150</td>
</tr>
<tr>
<td>Paradise Valley</td>
<td>3</td>
<td>11</td>
<td>141</td>
<td>155</td>
</tr>
<tr>
<td>Rio Vista</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>South Mountain</td>
<td>6</td>
<td>11</td>
<td>124</td>
<td>141</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>105</strong></td>
<td><strong>166</strong></td>
<td><strong>1679</strong></td>
<td><strong>1950</strong></td>
</tr>
</tbody>
</table>

105 Tier 1 Priority Crash Intersections Identified

20% of all Tier 1 Priority Crash Intersections are in Maryvale. Six of the top 25 high injury crash intersections are located in Alhambra.

53% of all Tier 1 Priority Crash Intersections are in Maryvale, Alhambra, and North Mountain.
<table>
<thead>
<tr>
<th>Intersection</th>
<th>No Injury</th>
<th>Possible Injury</th>
<th>Minor Injury</th>
<th>Serious Injury</th>
<th>Fatal</th>
<th>Total Crashes</th>
<th>EPDO Score</th>
<th>EPDO Priority</th>
<th>Tier</th>
<th>Village</th>
</tr>
</thead>
<tbody>
<tr>
<td>59th Av &amp; Indian School Rd</td>
<td>135</td>
<td>31</td>
<td>26</td>
<td>4</td>
<td>5</td>
<td>201</td>
<td>1091.7</td>
<td>1</td>
<td>Tier 1</td>
<td>Maryvale</td>
</tr>
<tr>
<td>43rd Av &amp; Thunderbird Rd</td>
<td>56</td>
<td>24</td>
<td>17</td>
<td>5</td>
<td>4</td>
<td>106</td>
<td>869.3</td>
<td>2</td>
<td>Tier 1</td>
<td>North Mountain</td>
</tr>
<tr>
<td>51st Av &amp; Thomas Rd</td>
<td>151</td>
<td>47</td>
<td>23</td>
<td>5</td>
<td>3</td>
<td>229</td>
<td>771.3</td>
<td>3</td>
<td>Tier 1</td>
<td>Maryvale</td>
</tr>
<tr>
<td>Cave Creek Rd &amp; Greenway Pkwy</td>
<td>51</td>
<td>24</td>
<td>22</td>
<td>7</td>
<td>3</td>
<td>107</td>
<td>724.7</td>
<td>4</td>
<td>Tier 1</td>
<td>Paradise Valley</td>
</tr>
<tr>
<td>27th Av &amp; Bethany Home Rd</td>
<td>147</td>
<td>37</td>
<td>13</td>
<td>4</td>
<td>3</td>
<td>204</td>
<td>713.0</td>
<td>5</td>
<td>Tier 1</td>
<td>Alhambra</td>
</tr>
<tr>
<td>7th St &amp; McDowell Rd</td>
<td>135</td>
<td>40</td>
<td>18</td>
<td>2</td>
<td>3</td>
<td>198</td>
<td>709.7</td>
<td>6</td>
<td>Tier 1</td>
<td>Encanto</td>
</tr>
<tr>
<td>43rd Av &amp; Glendale Av</td>
<td>112</td>
<td>38</td>
<td>16</td>
<td>2</td>
<td>3</td>
<td>171</td>
<td>695.7</td>
<td>7</td>
<td>Tier 1</td>
<td>Alhambra</td>
</tr>
<tr>
<td>7th Av &amp; Bell Rd</td>
<td>56</td>
<td>27</td>
<td>14</td>
<td>5</td>
<td>3</td>
<td>105</td>
<td>688.6</td>
<td>8</td>
<td>Tier 1</td>
<td>Deer Valley</td>
</tr>
<tr>
<td>71st Av &amp; Thomas Rd</td>
<td>60</td>
<td>17</td>
<td>13</td>
<td>4</td>
<td>3</td>
<td>97</td>
<td>656.9</td>
<td>9</td>
<td>Tier 1</td>
<td>Maryvale</td>
</tr>
<tr>
<td>12th St &amp; Northern Av</td>
<td>69</td>
<td>15</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>99</td>
<td>633.4</td>
<td>10</td>
<td>Tier 1</td>
<td>Camelback East</td>
</tr>
<tr>
<td>43rd Av &amp; Peoria Av</td>
<td>107</td>
<td>40</td>
<td>26</td>
<td>8</td>
<td>2</td>
<td>183</td>
<td>610.1</td>
<td>11</td>
<td>Tier 1</td>
<td>North Mountain</td>
</tr>
<tr>
<td>43rd Av &amp; Bethany Home Rd</td>
<td>122</td>
<td>39</td>
<td>29</td>
<td>6</td>
<td>2</td>
<td>198</td>
<td>598.9</td>
<td>12</td>
<td>Tier 1</td>
<td>Alhambra</td>
</tr>
<tr>
<td>35th Av &amp; Bethany Home Rd</td>
<td>201</td>
<td>42</td>
<td>32</td>
<td>3</td>
<td>2</td>
<td>280</td>
<td>598.0</td>
<td>13</td>
<td>Tier 1</td>
<td>Alhambra</td>
</tr>
<tr>
<td>35th Av &amp; Bell Rd</td>
<td>94</td>
<td>36</td>
<td>36</td>
<td>5</td>
<td>2</td>
<td>173</td>
<td>596.8</td>
<td>14</td>
<td>Tier 1</td>
<td>Deer Valley</td>
</tr>
<tr>
<td>83rd Av &amp; Indian School Rd</td>
<td>103</td>
<td>40</td>
<td>23</td>
<td>7</td>
<td>2</td>
<td>175</td>
<td>590.6</td>
<td>15</td>
<td>Tier 1</td>
<td>Maryvale</td>
</tr>
<tr>
<td>35th Av &amp; Glendale Av</td>
<td>113</td>
<td>40</td>
<td>22</td>
<td>6</td>
<td>2</td>
<td>183</td>
<td>579.5</td>
<td>16</td>
<td>Tier 1</td>
<td>Alhambra</td>
</tr>
<tr>
<td>11th Av &amp; Indian School Rd</td>
<td>14</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>23</td>
<td>567.4</td>
<td>17</td>
<td>Tier 1</td>
<td>Encanto</td>
</tr>
<tr>
<td>63rd Av &amp; Lower Buckeye Rd</td>
<td>13</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>27</td>
<td>561.0</td>
<td>18</td>
<td>Tier 1</td>
<td>Estrella</td>
</tr>
<tr>
<td>16th St &amp; Broadway Rd</td>
<td>80</td>
<td>29</td>
<td>14</td>
<td>8</td>
<td>2</td>
<td>133</td>
<td>550.0</td>
<td>19</td>
<td>Tier 1</td>
<td>South Mountain</td>
</tr>
<tr>
<td>59th Av &amp; Thomas Rd</td>
<td>133</td>
<td>40</td>
<td>20</td>
<td>3</td>
<td>2</td>
<td>198</td>
<td>547.0</td>
<td>20</td>
<td>Tier 1</td>
<td>Maryvale</td>
</tr>
<tr>
<td>35th Av &amp; Northern Av</td>
<td>94</td>
<td>42</td>
<td>17</td>
<td>4</td>
<td>2</td>
<td>159</td>
<td>545.0</td>
<td>21</td>
<td>Tier 1</td>
<td>North Mountain</td>
</tr>
<tr>
<td>16th St &amp; Southern Av</td>
<td>83</td>
<td>26</td>
<td>19</td>
<td>6</td>
<td>2</td>
<td>136</td>
<td>538.1</td>
<td>22</td>
<td>Tier 1</td>
<td>South Mountain</td>
</tr>
<tr>
<td>35th Av &amp; Greenway Rd</td>
<td>85</td>
<td>41</td>
<td>18</td>
<td>3</td>
<td>2</td>
<td>149</td>
<td>533.8</td>
<td>23</td>
<td>Tier 1</td>
<td>Deer Valley</td>
</tr>
<tr>
<td>27th Av &amp; Camelback Rd</td>
<td>199</td>
<td>59</td>
<td>35</td>
<td>10</td>
<td>1</td>
<td>304</td>
<td>532.8</td>
<td>24</td>
<td>Tier 1</td>
<td>Alhambra</td>
</tr>
<tr>
<td>40th St &amp; Broadway Rd</td>
<td>108</td>
<td>29</td>
<td>20</td>
<td>4</td>
<td>2</td>
<td>163</td>
<td>531.1</td>
<td>25</td>
<td>Tier 1</td>
<td>South Mountain</td>
</tr>
</tbody>
</table>
Figure 8. High Injury Crash Intersections

- Tier 1 Intersection
- Tier 2 Intersection
- Tier 3 Intersection
- Freeway
- Arterial
- Collector/Local
- River/Wash/Canal
- Park


[Map of Phoenix with marked intersections]
Risk Factors for High Injury Crash Intersections

For the top 25 high injury crash intersections, a detailed evaluation was performed to identify potential risk factors associated with each intersection. The following characteristics were reviewed for locations to help determine potential risk factors:

- Intersection control type
- Lighting
- Intersection geometry (presence of offset approaches, skew, sight distance, etc.)
- Presence of marked crosswalks
- Presence of left/right turn lanes
- Presence of transit stops
- Intersection near freeway interchange
- Traffic volumes
- Number of vehicle lanes

Based on review of the risk factors, intersection characteristics, and crash locations for the top 25 high injury crash intersections, the following predominant potential risk factors were identified:

- All of the top 25 intersections identified were high-volume arterials and major arterials
- Nearly 60% of the signalized intersections may have older signal equipment and configuration
- Two intersections were two-way stop sign controlled with low lighting conditions and no marked crosswalks or intersection striping
- 18 of the 23 signalized intersections had one or more approaches with negative offset at left-turn lanes
- 14 of 25 intersections have on-street transit stop in the vicinity which may be a contributing risk factor considering all intersections experience high traffic volumes

Table 7 summarizes the risk factors for the top 25 high injury intersections. To mitigate these risk factors, Chapter 4 outlines safety interventions and strategies to systematically build a safer transportation system.
### Table 7: Risk Analysis of High Injury Crash Intersections

<table>
<thead>
<tr>
<th>Intersection</th>
<th>EPDO Score</th>
<th>EPDO Priority</th>
<th>Tier</th>
<th>Village</th>
<th>Intersection Control Type</th>
<th>Lighting</th>
<th>RISK FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>59th Av &amp; Indian School Rd</td>
<td>1091.7</td>
<td>1</td>
<td>Tier 1</td>
<td>Maryvale</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>43rd Av &amp; Thunderbird Rd</td>
<td>869.3</td>
<td>2</td>
<td>Tier 1</td>
<td>North Mountain</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>51st Av &amp; Thomas Rd</td>
<td>771.3</td>
<td>3</td>
<td>Tier 1</td>
<td>Maryvale</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>Cave Creek Rd &amp; Greenway Pkwy</td>
<td>724.7</td>
<td>4</td>
<td>Tier 1</td>
<td>Paradise Valley</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>27th Av &amp; Bethany Home Rd</td>
<td>713.0</td>
<td>5</td>
<td>Tier 1</td>
<td>Alhambra</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>7th St &amp; McDowell Rd</td>
<td>709.7</td>
<td>6</td>
<td>Tier 1</td>
<td>Encanto</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>43rd Av &amp; Glendale Av</td>
<td>695.7</td>
<td>7</td>
<td>Tier 1</td>
<td>Alhambra</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>7th Av &amp; Bell Rd</td>
<td>688.6</td>
<td>8</td>
<td>Tier 1</td>
<td>Deer Valley</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>71st Av &amp; Thomas Rd</td>
<td>656.9</td>
<td>9</td>
<td>Tier 1</td>
<td>Maryvale</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>12th St &amp; Northern Av</td>
<td>633.4</td>
<td>10</td>
<td>Tier 1</td>
<td>Camelback East</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>43rd Av &amp; Peoria Av</td>
<td>610.1</td>
<td>11</td>
<td>Tier 1</td>
<td>North Mountain</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>43rd Av &amp; Bethany Home Rd</td>
<td>598.9</td>
<td>12</td>
<td>Tier 1</td>
<td>Alhambra</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
<tr>
<td>35th Av &amp; Bethany Home Rd</td>
<td>598.0</td>
<td>13</td>
<td>Tier 1</td>
<td>Alhambra</td>
<td>S</td>
<td>P</td>
<td>P P P P</td>
</tr>
</tbody>
</table>

- **59th Av & Indian School Rd**: Negative offsets at left-turn lanes; 35% left turn crashes; 3 of 5 fatal crashes due to left turns; 4% fatal and serious injury crashes.
- **43rd Av & Thunderbird Rd**: Positive offsets at left-turn lanes; Number of signal heads less than number of lanes; 34% left turn crashes; 6% fatal and serious injury crashes.
- **51st Av & Thomas Rd**: Positive offsets in E-W direction and negative offset in N-S direction at left-turn lanes; Number of signal heads less than number of lanes; 32% left turn crashes; 3% fatal and serious injury crashes.
- **Cave Creek Rd & Greenway Pkwy**: Positive offsets at left-turn lanes; Number of signal heads less than number of lanes; 34% left turn crashes; 8% fatal and serious injury crashes; E-W street has a skewed approach.
- **27th Av & Bethany Home Rd**: Negative offsets at left-turn lanes; 29% left turn crashes; 3% fatal and serious injury crashes.
- **7th St & McDowell Rd**: Negative offsets at left-turn lanes; 21% left turn crashes; 3% fatal and serious injury crashes.
- **43rd Av & Glendale Av**: Positive offsets in E-W direction and negative offset in N-S direction at left-turn lanes; Number of signal heads less than number of lanes; 37% left turn crashes; 3% fatal and serious injury crashes.
- **7th Av & Bell Rd**: Positive offsets in E-W direction and negative offset in N-S direction at left-turn lanes; Number of signal heads less than number of lanes; 32% left turn crashes; 7% fatal and serious injury crashes.
- **71st Av & Thomas Rd**: Positive offsets in E-W direction and negative offset in N-S direction at left-turn lanes; Number of signal heads less than number of lanes; 37% left turn crashes; 7% fatal and serious injury crashes.
- **12th St & Northern Av**: Negative offsets at left-turn lanes; 34% left turn crashes; 3% fatal and serious injury crashes.
- **43rd Av & Peoria Av**: Positive offsets in N-S direction and negative offset in E-W direction at left-turn lanes; Number of signal heads less than number of lanes; 35% left turn crashes; 5% fatal and serious injury crashes.
- **43rd Av & Bethany Home Rd**: Positive offsets on two approaches and negative offset on other two approaches at left-turn lanes; 33% left turn crashes; 3% fatal and serious injury crashes.
- **35th Av & Bethany Home Rd**: Negative offsets at left-turn lanes; Number of signal heads less than number of lanes; 30% left turn crashes; 2% fatal and serious injury crashes.
Table 7: Risk Analysis of High Injury Crash Intersections (Continued)

<table>
<thead>
<tr>
<th>Intersection</th>
<th>EPDO Score</th>
<th>EPDO Priority</th>
<th>Tier</th>
<th>Village</th>
<th>Intersection Control Type</th>
<th>Lighting</th>
<th>Intersection Geometry</th>
<th>Presence of Marked Crosswalks</th>
<th>Presence of Left/Right Turn Lanes</th>
<th>Presence of Transit Stops</th>
<th>Intersection near Freeway Interchange</th>
<th>Traffic Volumes</th>
<th>Number of Vehicle Lanes</th>
</tr>
</thead>
<tbody>
<tr>
<td>35th Av &amp; Bell Rd</td>
<td>596.8</td>
<td>14</td>
<td>Tier 1</td>
<td>Deer Valley</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>83rd Av &amp; Indian School Rd</td>
<td>590.6</td>
<td>15</td>
<td>Tier 1</td>
<td>Maryvale</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Positive offsets at left-turn lanes; Number of signal heads less than number of lanes; 37% left turn crashes; 4% fatal and serious injury crashes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35th Av &amp; Glendale Av</td>
<td>579.5</td>
<td>16</td>
<td>Tier 1</td>
<td>Alhambra</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Positive offsets at left-turn lanes; 5% fatal and serious injury crashes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11th Av &amp; Indian School Rd</td>
<td>567.4</td>
<td>17</td>
<td>Tier 1</td>
<td>Encanto</td>
<td>TW</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td></td>
<td></td>
<td>Unsignalized intersection; no lighting; 20% fatal or serious injury crashes; 8-lane street; missing pedestrian crossing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>63rd Av &amp; Lower Buckeye Rd</td>
<td>561.0</td>
<td>18</td>
<td>Tier 1</td>
<td>Estrella</td>
<td>TW</td>
<td>L</td>
<td>M</td>
<td>M</td>
<td></td>
<td></td>
<td>Unsignalized intersection; limited lighting; 4 of 30 fatal crashes; missing pedestrian crossing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16th St &amp; Broadway Rd</td>
<td>550.0</td>
<td>19</td>
<td>Tier 1</td>
<td>South Mountain</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Negative offsets at left-turn lanes; 32% left turn crashes; 8% fatal and serious injury crashes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>59th Av &amp; Thomas Rd</td>
<td>547.0</td>
<td>20</td>
<td>Tier 1</td>
<td>Maryvale</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Negative offsets at left-turn lanes; 34% left turn crashes; 2% fatal and serious injury crashes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35th Av &amp; Northern Av</td>
<td>545.0</td>
<td>21</td>
<td>Tier 1</td>
<td>North Mountain</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Positive offsets at left-turn lanes; Number of signal heads less than number of lanes; 28% left turn crashes; 6% fatal and serious injury crashes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16th St &amp; Southern Av</td>
<td>538.1</td>
<td>22</td>
<td>Tier 1</td>
<td>South Mountain</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Positive offsets in E-W direction and negative offset in N-S direction at left-turn lanes; 28% left turn crashes; 5% fatal and serious injury crashes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35th Av &amp; Greenway Rd</td>
<td>533.8</td>
<td>23</td>
<td>Tier 1</td>
<td>Deer Valley</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Negative offsets at left-turn lanes; Number of signal heads less than number of lanes; 26% left turn crashes; 3% fatal and serious injury crashes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27th Av &amp; Camelback Rd</td>
<td>532.8</td>
<td>24</td>
<td>Tier 1</td>
<td>Alhambra</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Negative offsets at left-turn lanes; Number of signal heads less than number of lanes; 27% left turn crashes; 3% fatal and serious injury crashes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40th St &amp; Broadway Rd</td>
<td>531.1</td>
<td>25</td>
<td>Tier 1</td>
<td>South Mountain</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Negative offsets at left-turn lanes; Number of signal heads less than number of lanes; 22% left turn crashes; 4% fatal and serious injury crashes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Identified potential risk

S = Signal; TW = Two-way Stop Control; P = Present; M = Missing; L = Limited
Social Equity Analysis

Viewing Phoenix through an “equity lens” allows us to measure how disadvantaged areas of the city are affected by crashes and help prioritize investments in those areas. To identify population areas that may be at a disadvantage from a socioeconomic or transportation mobility perspective, a socioeconomic model was developed. The socioeconomic equity model uses census block group data from the American Community Survey (ACS) to determine levels of socioeconomic need based on combined densities of the following indicators:

- **Age**: children and elderly populations
- **Ethnicity**: minority populations
- **Disabled Populations**: persons that have cognitive, visual, and physical disabilities
- **Low-Income**: households that are financially less likely to own a vehicle
- **Vehicle Ownership**: households with limited or no access to a vehicle

Because an individual can meet more than one of the qualifying attributes (i.e., a person could be living in poverty and be a minority), the index intentionally counts individuals multiple times to generate an index that evaluates the relative equity disadvantage of the block group. The villages of Maryvale, Alhambra, North Mountain, Camelback East, and South Mountain have some of the highest number of disadvantaged population groups in the City.

High Injury Locations in Disadvantaged Areas

Figure 9 to the right illustrates census block groups with high rates of disadvantaged population groups in relation to high injury intersections and corridors. In relation to high-injury locations, areas with high concentrations of disadvantaged population groups include:

- The villages of Alhambra and Maryvale have the highest concentration of disadvantaged population groups and high-injury intersections and corridors.
- Areas along I-10, SR 2020, US-60, and I-17
- McDowell Road, Thomas Road, Indian School Road, 43rd Avenue, and 83rd Avenue west of US-60
- 43rd Avenue, 35th Avenue, 27th Avenue, and Northern Avenue in Alhambra
- Bell Road from 7th Avenue to SR -51
- 32nd Street, Thomas Road, and McDowell Road in Camelback East
- Southern Avenue, Broadway Avenue, 16th Street, and 24th Street in South Mountain

Table 8 lists the number of high-injury segments and intersections in disadvantaged areas in each village. The villages of Alhambra and Maryvale have the highest concentration of disadvantaged population groups and high-injury intersections and corridors.
Table 8: High-Injury Segments and Intersections in Disadvantaged Areas By Village

<table>
<thead>
<tr>
<th>Village</th>
<th>Tier 1 Segments</th>
<th>Tier 1 Intersections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahwatukee Foothills</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Alhambra</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Camelback East</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Central City</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Deer Valley</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Desert View</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Encanto</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Estrella</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Laveen</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Maryvale</td>
<td>27</td>
<td>16</td>
</tr>
<tr>
<td>North Gateway</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>North Mountain</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Paradise Valley</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Rio Vista</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>South Mountain</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>102</strong></td>
<td><strong>51</strong></td>
</tr>
</tbody>
</table>

Pedestrian and Bicyclist Involved Crashes in Disadvantaged Areas

Figure 10 illustrates census block groups with high rates of disadvantaged population groups in relation to fatal and serious injury pedestrian and bicyclist involved crashes. In total, over 49 percent of all fatal and serious injury pedestrian and bicycle related crashed occurred in areas with high disadvantaged population groups. In relation to disadvantaged population groups, areas that experience high concentrations of pedestrian and bicyclist-involved crashes includes:

- 83rd Avenue, Indian School Road, Thomas Road, and McDowell Road in Maryvale
- 27th Avenue and 36th Avenue in Alhambra
- Cave Creek Road and Bell Road in Paradise Valley
- McDowell Road, Thomas Road, and Indian School Road in Camelback East
- Northern Avenue and McDowell Road east of I-17
- Central Avenue, Broadway Avenue, and Southern Avenue in South Mountain
Figure 9. High-Injury Locations in Disadvantaged Block Groups

- Tier 1 Intersection
- Tier 2 Intersection
- Tier 1 Segment
- Tier 2
- Disadvantaged Block Group
- Most Disadvantaged Block Group

Sources: US Census Bureau AIC 2011-2015 5-Year Estimates
City of Phoenix 2010, ADOT 2016, NHD 2018, ALRHS 2018
Figure 10. Pedestrian and Bicyclist Involved Crashes in Disadvantaged Block Groups

- Fatal Ped or Bike Crash
- Serious Injury Ped or Bike Crash
- Disadvantaged Block Group
- Most Disadvantaged Block Group
- Freeway
- Arterial
- Collector/Local
- River/Wash/Canal
- Park

City of Phoenix 2018, ARUP 2018, VTRD 2018, ALRPS 2018
04. Safety Strategies
SAFETY STRATEGIES

Introduction
The Key Corridors Master Plan establishes a new vision for Phoenix’s streets, and ensuring that everyone—no matter where they live or how they get around—can travel safely is critical to the Plan’s vision. The Safety Analysis and Strategies Report outlines a process for designing safer streets, tools to address important safety issues as well as strategies for education and enforcement. There is no single policy or tool that will transform Phoenix’s street safety overnight, but the Safety Analysis and Strategies Report provides a framework to systematically build a safer transportation system and save lives.

Developing Safety Interventions
The Safety Action Plan includes a step-by-step process to develop safety interventions—from initial analysis through implementation and evaluation. This process prioritizes data-driven planning and community knowledge to identify existing problems and develop solutions, taking a project from analysis, to design, to construction.

Safety Toolbox
The street safety toolbox identifies and details 58 design interventions that directly address a full range of corridor safety issues and corridor safety goals. The toolbox details cost guidance, timeline estimates and appropriate locations for each intervention, as well as potential interim strategies. The street safety toolbox is organized to help planners, designers and engineers easily review and select the right combination of design strategies to improve safety on a specific corridor or intersection.

High-Crash Corridor Concept Designs
The Safety Action Plan identifies and assesses five specific high-crash corridors in Phoenix. These corridors have experienced particularly high numbers of deaths and serious injuries in the past half-decade. After identifying existing issues and problem areas, concept designs and policy changes are recommended for each corridor.

Speed Reduction Strategy
Speed is a leading factor in traffic crashes, and the Safety Action Plan includes a strategy for prioritizing and implementing speed reductions throughout Phoenix. This strategy is based on prioritizing speed reductions to address safety issues, increase safety and comfort for people walking and biking and further priorities articulated in PlanPHX.

Education and Enforcement
The Safety Action Plan prioritizes design intervention strategies to most effectively improve safety on Phoenix’s streets. But design improvements should be accompanied by smart and appropriately targeted education and enforcement strategies. Collectively, design, education and enforcement will create a safer transportation system for all users.
SAFETY INTERVENTION OVERVIEW

PROCESS

ANALYSIS
- Gather Baseline Data
- Analyze Crash Data
- Gather Community Knowledge
- Consult the Street Typologies

DESIGN
- Develop Interventions & Design Using:
  - Street Safety Toolbox
  - Street Typologies
  - Street Planning and Design Guidelines

IMPLEMENTATION
- Determine Project Type
  - Targeted Safety Project
  - Corridor Transformation Project
- Consider Timing and Opportunities for Coordination
- Evaluate Need for Interim Improvements

EVALUATION
- Gather Post-Intervention Data
- Measure Impact

OUTCOMES

- Summarize Issues & Needs
- Set Project-Specific Goals
- Concept Design
- Project Construction
- Communicate Results
- Refine Design
- Build Momentum
Developing Safety Interventions

Establishing a consistent process for analyzing, designing, implementing and evaluating safety interventions will enable Phoenix to efficiently use available resources to deliver more projects faster. The process for developing safety interventions involves four phases:

1. Analyzing existing conditions and crash data to determine issues and goals in collaboration with the surrounding community;
2. Using a combination of resources to identify safety improvements and design safer streets;
3. Coordinating with planned construction to deliver projects efficiently and using low-cost, readily available materials to delivery projects quickly; and
4. Evaluating projects to continually refine project designs, communicate the benefits to the public and build support for future projects.

Analysis

The analysis phase should establish consensus around existing safety issues, identify additional issues and needs in the study area, and develop specific goals for the project. The following steps should be included in the analysis phase.

Gather Baseline Data

Understanding the existing conditions is a crucial first step in developing safety interventions. The following data should be collected for most projects:

- Right-of-way width
- Lane widths
- Existing curb radii
- Speed limit
- Sidewalk conditions
- Distance between pedestrian crossings
- Pedestrian and bicycle crossing markings and signals
- Bicycle infrastructure
- Traffic signals and traffic control devices
- Lighting
- Transit stops and facilities

Depending on the scale of the project, the follow data may also be useful:

- Counts of people walking/biking
- Discrepancies in actual vehicle speed versus target speed
- Transit ridership
- Demographics of surrounding communities
- Signal timing plans

Analyze Crash Data

Analyzing data from previous crashes (looking at a sample of at least five years) will be the primary means for identifying safety issues. Crash analysis should include:

- Location of crashes
- Nature of crashes (i.e. turning motion)
- Users involved in crashes
- Severity of user injury
- Time of day of crashes
- Other common contributing factors (i.e. speed, turning, visibility, failure to yield)

Gather Community Knowledge

As part of the T2050 Mobility Improvements Program, a series of neighborhood mobility studies are being conducted detailing existing conditions, past safety issues, community feedback and proposed interventions. Staff should review completed neighborhood mobility studies to find any overlap with the corridor under study. Neighborhood Mobility Studies should be used as an informational reference point, not a list of final recommendations for corridor safety improvements.

In addition to examining the neighborhood mobility studies, corridor safety interventions should seek further community input and knowledge. The degree of community engagement will likely vary depending on the project’s scale. Smaller, targeted improvements may only include a survey of nearby residents and other stakeholders, while larger projects should include more in-depth engagement.

Quantitative data and observations often don’t reveal every issue and need, so it is also necessary to learn from those who use the corridor every day. Gathering community knowledge also establishes trust and buy-in, which is particularly important for substantial corridor reconstruction plans.
Consult the Street Typologies

While safety is the top priority in corridor safety interventions, major capital improvements typically occur only every few decades. As these opportunities are rare, safety improvements should be paired with a plan to upgrade all aspects of the corridor to align with the recommendations in the Key Corridors Master Plan’s street typologies.

Each typology prescribes a plan for allocating street space to specific users and guidance on street elements, such as sidewalks, landscaping, medians and flex zones. Staff should compare existing conditions to those proposed in the street typologies to identify needed upgrades. Developing corridor intervention plans that rely on the typologies ensures not only improved safety but improved function and comfort as well.

Summarize Issues and Needs

Following the evaluation of existing conditions, analysis of crash data, community input, and consultation of the street typologies, the issues and opportunities for the project should be summarized. This summary should:

- Identify the acute problem(s) (i.e. high rate of pedestrian injuries).
- Identify where the acute problem(s) occur (i.e. at a specific crossing).
- Determine common contributing factors (i.e. high vehicle speed, poor visibility).
- Identify additional needs based on community input and the street typologies in the Key Corridors Master Plan (i.e. sidewalk upgrades or enhanced bicycle facilities).

Set Project-Specific Goals

Finally, prior to designing the safety interventions, it is important to set project-specific goals. These goals should typically include a mix of qualitative metrics (e.g., reductions in average vehicle speeds or the percentage of vehicles traveling above the speed limit) and qualitative feedback from the community (e.g., perceptions of safety and comfort and changes in behavior). Setting these corridor-specific goals will help staff select the proper design tools and also holds the project accountable during post-implementation review.

Design

Once the issues and needs have been summarized and project-specific goals are set, staff should utilize the following resources to design safety interventions:

- The Street Safety Toolbox within the Safety Action Plan details a number of design tools that can be used to address common safety issues.
- The street typologies within the Key Corridors Master Plan provides guidance on street elements depending on the corridor’s functional classification, modal emphasis, and place type.
- The Street Planning and Design Guidelines provides detailed engineering guidance on street design elements.

When selecting tools and design measures, staff should consider:

- The level or intensity of intervention needed to reach corridor-specific goals;
- Interventions that can address multiple issues at the same time;
- Interventions that both improve safety and enhance user function, comfort and access;
- Interventions that respond best to community knowledge and needs; and
- Interventions that anticipate future corridor needs and conditions.
Implementation

Safety interventions will typically fall into two categories:

- **Targeted Safety Projects** involve interventions that require permanent improvements but do not significantly change corridor configuration or the existing allocation of space to street users. A Targeted Safety Project may include, for instance, installing curb bump-outs, pedestrian countdown timers and high-visibility crosswalks at a specific intersection.

- **Corridor Transformation Projects** involve interventions that require significant reconfiguration of the corridor and/or involve a substantial repurposing of space. A Corridor Transformation Project may include, for instance, repurposing a vehicle travel lane to construct a separated cycle track and simplifying a complex intersection by reorienting intersecting streets.

Corridors or intersections identified for safety interventions may already be scheduled for repaving, utility work or reconstruction. Coordinating safety interventions with planned construction can be an effective means to get improvements installed quickly and cost efficiently. Targeted Safety Projects, for instance, may be able to be incorporated into existing repaving or reconstruction plans.

When repaving or reconstruction plans are scheduled more than a year out (or when there is no planned construction forthcoming), staff should evaluate whether there is an opportunity to make improvements in the short-term using low-cost, readily available materials like paint, flexible delineators, and planters. These types of interim improvements can lead to positive safety outcomes much faster than full-reconstruction requires and also offer an opportunity for staff to gather data and public feedback to optimize a project’s final design.

Evaluation

Once a safety intervention is completed (regardless of the type of project or whether it is permanent or only an interim improvement) it is critical to evaluate its effectiveness against the project-specific goals identified during the analysis phase.

Project evaluations first and foremost help staff understand whether specific safety tools that have been implemented are successfully addressing the issues identified during the analysis phase. Project evaluations can also help communicate the project’s impacts to the community and elected officials and help build the case for future projects.
Street Safety Toolbox

The street safety toolbox identifies and details 59 design interventions that directly address a full range of corridor safety issues and corridor safety goals. The toolbox is designed as a resource for planners, designers and engineers to locate and identify specific design strategies for improving street safety. Most often, an existing safety issue will require a combination of strategies, and the toolbox makes it easy to see a large set of options.

The following page summarizes all 59 tools in one matrix, including guidance on costs, timeline, appropriate location types, as well as an indication as to whether a viable interim solution exists. The matrix also identifies which outcomes the tool achieves:

1. Traffic calming
2. Safer crossings
3. Higher visibility
4. Safer turns
5. Safer Intersections
6. Overall safer walking
7. Overall safer bicyclist

Finally the tools are then described in detail, separated into four larger buckets: Tools to calm traffic; Tools for Safer Intersections; Tools for biking; Tools for walking and crossing the street.
### Street Safety Toolbox

<table>
<thead>
<tr>
<th></th>
<th>Cost</th>
<th>Timeline</th>
<th>Location</th>
<th>Interim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow Lanes</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Narrow Curb-to-Curb Width</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Chicanes and Neckdowns</td>
<td>2</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Signal Timing</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Shared Street</td>
<td>2</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>2</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Speed Table</td>
<td>2</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Diverter</td>
<td>2</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Speed Feedback Sign</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Road Diet</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>One-Way to Two-Way Conversion</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Mini Traffic Circle</td>
<td>2</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Access Management</td>
<td>2</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>On-Street Parking</td>
<td>2</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Small Curb Radius (Real &amp; Effective)</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Hardened Centerline</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Daylit Intersection</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Remove Slip Lanes</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Slow Turn Wedge</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Movement Restriction</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>No-Turn-On-Red Restriction</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Simplified Intersection</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Offset Left-Turn Lane</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Shared Lane Bicycle Marking</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Bicycle Boulevard</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Advisory Bicycle Lane</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Striped/Painted Bicycle Lane</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>One-Way Street Contra-Flow Bicycle Lane</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Buffered Bicycle Lane</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Protected Bicycle Lane/Cycle Track</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Raised Cycle Track</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Off-Street Shared-Use Path</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td>Cost</td>
<td>Timeline</td>
<td>Location</td>
<td>Interim</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>------</td>
<td>----------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>Vertical Protection</td>
<td>1</td>
<td>M</td>
<td>A</td>
<td>Yes</td>
</tr>
<tr>
<td>Increased Bicycle Pavement Markings</td>
<td>2</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Bike Box</td>
<td>3</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Two-Stage Turn Queue Box</td>
<td>4</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Bicycle Intersection Stripping</td>
<td>5</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Conflict Marking (Driveways)</td>
<td>6</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Bicycle Signal</td>
<td>7</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Automated Cyclist Detection</td>
<td>8</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Green Wave Signal Coordination</td>
<td>9</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Protected Intersection</td>
<td>10</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Transit Stop Protected Bicycle Lane</td>
<td>11</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Appropriately Wide, Continuous Sidewalks</td>
<td>12</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>ADA Curb Ramp</td>
<td>13</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>High-Visibility Crosswalk</td>
<td>14</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Mid-Block Crossing</td>
<td>15</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>In-Street Pedestrian Crosswalk Sign</td>
<td>16</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Curb Extension</td>
<td>17</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Refuge Island</td>
<td>18</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Raised Crossing</td>
<td>19</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Raised Intersection</td>
<td>20</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Rectangular Rapid Flashing Beacon</td>
<td>21</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Pedestrian Hybrid Beacon</td>
<td>22</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Signal Phasing and Crossing Timing</td>
<td>23</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Pedestrian Countdown Timer</td>
<td>24</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Automated Pedestrian Detection</td>
<td>25</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Mark All Crossings</td>
<td>26</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Frequent Marked Crossings</td>
<td>27</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Street Trees and Plantings</td>
<td>28</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>Street Lighting</td>
<td>29</td>
<td>M</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

**Legend**

- **Cost**: Low (1), Medium (2), High (3)
- **Timeline**: Short (4), Medium (5), Long (6)
- **Location**: Minor Street (m), Major Street (M), All Streets (A)
- **Interim**: Yes (interim options viable)

Interim project costs likely to be lower than permanent cost estimate shown.
Vehicle speeds are influenced by how fast a driver feels they can safely travel. Narrower travel lanes require greater caution to maintain the lane and avoid conflicts, leading to lower vehicle speeds and improved safety.

Curb-to-curb width can impact vehicle speeds, particularly on multi-lane streets or streets with parking lanes but very little parking use. For instance, six narrow lanes across still results in an overall wide curb-to-curb width and can create a wide open visual for drivers, encouraging faster speeds. Reducing the total number of lanes and/or width of lanes reduces the overall width and can encourage safer speeds and driving behavior.

Paint, flexposts and barriers (if needed) can create narrow lanes in the interim, before more complete reconstruction.

Opportunity for short-term implementation

<table>
<thead>
<tr>
<th>Cost:</th>
<th>$$$$ Low</th>
<th>$$$$ High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeline:</td>
<td>Short</td>
<td>Long</td>
</tr>
<tr>
<td>Location:</td>
<td>All Streets</td>
<td>All Streets</td>
</tr>
</tbody>
</table>
CHICANE AND NECKDOWN

Chicanes feature offset curb extensions on alternating sides of a street. Chicanes force drivers to navigate streets in a non-linear fashion, requiring slower speeds and more attention.

Chicanes can be created temporarily with paint and bollards or more permanently with curb bump-outs.

✓ Opportunity for short-term implementation

SIGNAL TIMING

Traffic signals along a stretch of road should be timed for the desired vehicle speed. For example, if a road has a speed limit of 25 mph but the signal timing requires cars to travel 30 mph in order to make every green light, drivers are incentivized to travel at 30 mph. Proper signal timing can reinforce posted traffic speeds and increase safety. (Photo: Utah DOT)

Cost: $$$ Low/Medium/High
Timeline: Medium
Location: Minor Streets

Cost: $$$ Medium
Timeline: Medium
Location: Major Streets
**SHARED STREET**

Shared streets are spaces that prioritize pedestrians throughout the entirety of the right of way, but still allow bicycle, vehicle and loading access. Shared streets can be used either in residential or commercial settings. Many shared streets consist of a continuous, flush surface across the entire roadway width with textured pavement or unique materials to reinforce pedestrian priority.

Narrow shared streets often feature one continuous right of way where pedestrians and very light vehicle traffic mix. On wider streets, although the surface remains flush, different pavement materials, bollards, benches and planters delineate space for vehicles and space for pedestrians. However, pedestrians still have the right to cross through the delineated vehicle space. On wider shared streets, parking can even be included. Unlike pedestrian malls, shared streets maintain limited, slow vehicle access. Commercial shared streets should permit easy loading and unloading at designated hours. (Photo: Site Design)

<table>
<thead>
<tr>
<th>Cost:</th>
<th>$$$$ Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeline:</td>
<td>Long</td>
</tr>
<tr>
<td>Location:</td>
<td>Minor Streets</td>
</tr>
</tbody>
</table>

**MEDIAN**

Medians reduce curb-to-curb width and create a narrower field of travel—resulting in more cautious driving behavior and lower speeds. They also provide separation between vehicles traveling in opposite directions, which reduces head-on collisions. Medians can span the entire length of a block or can target priority areas, such as pedestrian crossings.

Medians can be created in the interim using paint, flexposts, movable curbs barriers and planters.

- Opportunity for short-term implementation

<table>
<thead>
<tr>
<th>Cost:</th>
<th>$$$$ Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeline:</td>
<td>Medium</td>
</tr>
<tr>
<td>Location:</td>
<td>Major Streets</td>
</tr>
</tbody>
</table>
SPEED TABLE

Speed tables are flat-topped traffic control devices. Speed tables are typically installed in the middle of a block and require vehicles to slow to avoid driver discomfort or vehicle damage. As opposed to speed humps, speed tables are designed so that the driver experiences a slight elevation change but both wheel axels can rest on the table. This helps prevent damage to longer vehicles like fire trucks and buses.

Cost: $$$ Low
Timeline: Short
Location: Minor Streets

DIVERTER

A diverter blocks through vehicular movement along a street but allows bicycles and pedestrians to continue traveling through. Diverters are usually built at intersections, requiring vehicles to turn left or right. Diverters help disrupt lengthy vehicle straightaways that can lead to high speeds and can also redirect non-local vehicular traffic to create low-stress walking and biking routes.

Bicycle diverters can be built in the interim using paint, flexposts, plastic curbs and barriers. Clear signage is also important for interim diverters.

(Photograph: City of Long Beach)

Opportunity for short-term implementation

Cost: $$$ Medium
Timeline: Short
Location: Minor Streets
When appropriately complemented with police enforcement, Speed Feedback Signs can be an effective method for reducing speeds at a specific location and are most effective for a limited time period.

---

Roadway repurposing, or a road diet, reduces the overall number and/or size of travel lanes on a street—often going from four travel lanes to two travel lanes with a center left turn lane—and repurposes that space for other purposes, such as bicycle facilities, dedicated transit facilities, or public space. Roadway repurposing has demonstrated safety benefits, often reducing travel speeds and making it easier and safer for people walking to cross the street. Because most road diets include a center left turn lane, these benefits can often be achieved with minimal impact on vehicle travel times. Studies have shown that the common road diet converting from four travel lanes to two travel lanes with a center left turn lane can work on streets with volumes as high as 23,000 vehicles per day.

- **Opportunity for short-term implementation**

---

**SPEED FEEDBACK SIGN**

- **Cost:** $$$ Low
- **Timeline:** Short
- **Location:** All Streets

**ROADWAY REPURPOSING (ROAD DIET)**

- **Cost:** $$$ Medium
- **Timeline:** Long
- **Location:** Major Streets
### One-Way to Two-Way Conversion

Converting one-way streets to two-way streets introduces a new element of caution. Oncoming traffic in the opposite lane requires drivers in both directions to be more cautious, thus leading to decreased speed. Conversions can also reduce excess lane capacity which acts to calm traffic.

*(Photo: City of Minneapolis)*

<table>
<thead>
<tr>
<th>Cost</th>
<th>$$$ High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeline</td>
<td>Long</td>
</tr>
<tr>
<td>Location</td>
<td>All Streets</td>
</tr>
</tbody>
</table>

### Mini Traffic Circle

Mini traffic circles are built in the direct center of an intersection and act as an impediment to direct linear vehicle travel, forcing the driver to slow in order to move around the circle.

Mini traffic circles can be implemented in the interim using paint, flexposts, plastic curbs and planters. Clear, reflective signage is important for interim deployments.

✔️ Opportunity for short-term implementation

<table>
<thead>
<tr>
<th>Cost</th>
<th>$$$ Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeline</td>
<td>Short</td>
</tr>
<tr>
<td>Location</td>
<td>Minor Streets</td>
</tr>
</tbody>
</table>
**ACCESS MANAGEMENT**

Driveway access interrupts sidewalk continuity and introduces pedestrian-vehicular conflict points. Access management as a policy controls the location, spacing, and design of driveways. Good access management practices limit the presence of driveways, particularly redundant ones, to maintain safety.

**ON-STREET PARKING**

On-street parking helps reduce effective curb-to-curb widths, provides a form of separation between the travel way and sidewalk, and requires drivers to be more alert. These factors can lead to safer driving speeds and increase comfort and safety for people walking. (Photo: Matt Alaniz)

---

**ACCESS MANAGEMENT**

| Cost:     | $$$$ Medium |
| Timeline: | Long |
| Location: | Major Streets |

**ON-STREET PARKING**

| Cost:     | $$$$ Low |
| Timeline: | Medium |
| Location: | All Streets |
SMALL CURB RADIUS (REAL & EFFECTIVE)

Curb radii significantly impact turning vehicle speeds. Small curb radii require turning drivers to slow significantly before making their turn. A slow turn provides more reaction time to detect pedestrians and requires a shorter stopping distance, making it easier to avoid a crash. Pedestrians are particularly vulnerable around turning vehicles because of blind spots; therefore, slowing a vehicle’s turning speed can yield significant safety benefits.

Curb radii can easily be tightened in the interim using paint and flexposts.

Opportunity for short-term implementation

HARDENED CENTERLINE

Hardened centerlines are typically created by installing low plastic barriers and flexible delineators on top of centerlines at intersections. They discourage left-turning vehicles from crossing over the center line of the receiving street, forcing a tighter and slower turn. (Photo: City of New York)

Cost: $$$ Medium
Timeline: Medium
Location: All Streets

Cost: $$$$ Low
Timeline: Short
Location: All Streets
**DAYLIT INTERSECTION**

Daylit intersections create clear, visible sight lines between people driving and people crossing a street, often by removing barriers near a crosswalk or intersection. Daylit intersections usually restrict parking within 20-25 feet of crossing to ensure proper pedestrian sightlines.

Cost: $$$ Low
Timeline: Short
Location: All Streets

**REMOVE SLIP LANE**

Slip turn lanes allow vehicles to make right-hand turns at high speeds, resulting in dangerous conditions for crossing pedestrians. Removing slip lanes requires all vehicles to make a full stop at the intersection.

In the short-term, slip lanes can be closed using planters, flexible delineators, paint, and other materials and the former slip lane can be repurposed for public space.

Cost: $$$ Medium
Timeline: Medium
Location: Major Streets

✓ Opportunity for short-term implementation
SLOW TURN WEDGE

A slow-turn wedge uses paint, low plastic barriers and plastic flexible delineators to create a tighter turn radius. Slow-turn wedges are an appropriate short-term solution before permanent curb work can be completed or can be a long-term solution that allows emergency vehicles, buses and garbage trucks to still make a turn. (Photo: City of New York)

✓ Opportunity for short-term implementation

MOVEMENT RESTRICTION

Restrictions that prevent particular vehicle movement at an intersection can be used to reduce or eliminate conflicts with people walking and biking. Restrictions can also calm traffic by eliminating some portion of cut-through traffic.

Cost: $$$$ Low
Timeline: Short
Location: All Streets

Cost: $$$$ Low
Timeline: Short
Location: All Streets
NO-TURN-ON-RED RESTRICTION

No Turn on Red Restrictions prohibit turning vehicles from making right turns at a red light. Turning vehicles present a danger for people walking due to blind spots created by vehicle frames and the need for the driver to pay attention to multiple directions at once. Restricting right-on-red actions by drivers is one way to reduce a particularly dangerous form of this conflict.

SIMPLIFIED INTERSECTION

Simplified intersections eliminate excessive or confusing intersection legs, with intersecting streets as close to perpendicular as possible. Complex intersections feature more than two streets crossing at the same point, streets crossing at offset points or streets crossing at odd angles. These intersections often feature wide turning radii (which increase vehicle speeds), excessive pavement (which increases pedestrian crossing distances) and an excessive number of pedestrian crossings required to reach the other side of the street. Simplifying intersections decrease pedestrian crossing distances, reduces the number of pedestrian crossings, slows vehicles and increases public space.

Paint, flexible delineators and planters can simplify intersections effectively in the short-term and at low cost. If proven successful, these tactics can inform long-term, permanent reconstruction.

Cost: $$ Low
Timeline: Short
Location: Major Streets

Cost: $$$ High
Timeline: Long
Location: All Streets
OFFSET LEFT-TURN LANES

Offset left-turn lanes are used at intersections (signalized intersections with permissive or permissive/protective left turns or unsignalized intersections) to improve visibility for drivers turning left. Moving the left-turn lanes laterally can alleviate situations where the vehicle in the opposing turn lane blocks the turning driver’s view of oncoming traffic.

Cost: $$$ Low
Timeline: Short
Location: Major Streets
**SHARED LANE MARKING**

Shared lane markings, also known as sharrows, signify to vehicles and bicyclists that bicycles can share the lane and indicate the proper riding position for people biking. Sharrows are not a robust safety tool and are to be used on very low-volume streets, but sharrows can help raise driver awareness and designate a preferred route for bicyclists.

**BICYCLE BOULEVARD**

Bicycle boulevards are low-volume neighborhood streets designated and designed to give people biking travel priority. Using pavement markings, signs, and speed and volume management measures, bicycle boulevards discourage vehicular through trips creating a safe and comfortable bicycling environment for people of all ages and abilities.

Bicycle boulevards can be implemented in the interim using paint, flexposts, planters and plastic curbs. (Photo: Payton Chung)

- **Opportunity for short-term implementation**

<table>
<thead>
<tr>
<th><strong>Cost:</strong></th>
<th>$$$$ Low</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timeline:</strong></td>
<td>Short</td>
</tr>
<tr>
<td><strong>Location:</strong></td>
<td>Minor Streets</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Cost:</strong></th>
<th>$$$$ Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timeline:</strong></td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Location:</strong></td>
<td>Minor Streets</td>
</tr>
</tbody>
</table>
Advisory bicycle lanes indicate space for bicycle travel and two-way vehicle travel on narrow roads that would otherwise be a shared roadway. They use dashed roadway striping to create a single center lane dedicated to vehicle travel in both directions and edge lanes that give priority to bicyclists. When two oncoming vehicles need to pass, they can cross over into the bicycle-priority space after yielding to bicyclists. Advisory bike lanes are appropriate only on low-volume streets.

(Photo: Streets.mn)

Striped and painted bicycle lanes demarcate right-of-way that is specifically designated for people biking. The addition of green paint can draw additional attention to the bicycle lane or specific conflict points. Because striped/painted bicycle lanes do not provide physical separation between vehicles and people biking, they are most appropriate on streets with low to moderate travel speeds and volumes.

Cost: $$$ Low
Timeline: Medium
Location: Minor Streets

Cost: $$$ Low
Timeline: Short
Location: Minor Streets
Contra-flow bicycle lanes provide two-way bicycle travel on one-way streets. Protective elements, such as curbs or flexible delineators, are necessary to ensure oncoming vehicles do not cross over into bicycle lanes. One-way streets with high rates of two-way bicycle flow indicate a need for legalized two-way bicycle travel. Contraflow bicycle lanes are most appropriate on streets with very few driveways or other turning conflicts across the bicycle facility.

Contra-flow bicycle lanes on one way streets can be implemented in the interim using paint, flexposts and plastic curbs.

Buffered bicycle lanes provide buffer space on one or both sides of the bicycle lane to create greater separation between bicyclists and passing vehicles and/or on-street parking. While buffered bicycle lanes provide more separation between people biking and vehicles than standard painted bicycle lanes, they are still most appropriate on streets with low to moderate travel speeds and volumes.
**PROTECTED BICYCLE LANE/CYCLE TRACK**

Protected bicycle lanes, or cycle tracks, run at street level but are physically separated from vehicular travel lanes. Separation can be achieved through a variety of treatments, including: a) flexible delineators or bollards; b) parking lanes; c) curbs or concrete medians; or d) planters with landscaping. Protected lanes prevent vehicles from entering bicycle facilities. Special attention should be given to designing areas where protected lanes intersect with vehicular or pedestrian traffic.

Protected bicycle lanes can be implemented in the interim by realigning existing paint and/or reassigning existing street use. Paint, flexports and bollards can all create safe and functional protected bicycle lanes quickly.

![Image of protected bicycle lane/cycle track]

- **Opportunity for short-term implementation**
- **Cost:** $$$ Medium
- **Timeline:** Medium
- **Location:** All Streets

---

**RAISED CYCLE TRACK**

Raised cycle tracks are located at sidewalk level, vertically separated from vehicular travel lanes. Separation between cyclists and pedestrians can be achieved through planters or landscaping. When raised cycle tracks run adjacent to sidewalks, distinct materials or surface colors are used, as well as a buffer, in order to maintain separation between people walking and biking. Paint, signage and signals are implemented at points where vehicular or pedestrian traffic crosses the cycle track (intersections, driveways, etc.).

![Image of raised cycle track]

- **Cost:** $$$ Medium
- **Timeline:** Medium
- **Location:** All Streets
An off-street shared use path is a bicycle and pedestrian facility that is physically separated from vehicular traffic by an open space or barrier and either within the street right-of-way or within an independent right-of-way. Off-street shared-use paths work well for corridors not well served by the on-street bikeway network as well as for sections within the network that facilitate long-distance commuting. Off-street paths are also recommended for corridors with high vehicle speeds and/or volumes. (Photo: Prince William County)

Adding vertical protection in the buffer space between the bike lane and street can increase user comfort. A study conducted by Portland State University examined the perceived comfort of different types of buffers and means of protections for bike lanes and found that vertical elements (including a raised concrete curb, flexible delineators, and planters) helped create more comfortable facilities—particularly among less experienced cyclists (The Influence of Bike Lane Buffer Types on Perceived Comfort and Safety of Bicyclists and Potential Bicyclists, 2015). The preferred width of the buffer space, according to the NACTO Urban Bikeway Design Guide, is 3 ft.

A number of different means can be used to provide vertical protection, including:
- **Temporary Treatments**
  - Flexible delineators and plastic bollards
  - Wheel stops and other low, modular barriers
  - Planter boxes
  - Concrete or plastic jersey barriers
- **Permanent Treatments**
  - Raised curb
  - Landscaped median
  - Elevated/Raised Bike Lane (sidewalk-level or intermediate between street and sidewalk)

(Photo: Streetsblog LA)
The MUTCD (Chapter 9C, 2009 Edition) dictates that bicycle pavement markings “should be placed at the beginning of a bicycle lane and at periodic intervals along the bicycle lane based on engineering judgment.” AASHTO’s Guide for the Development of Bicycle Facilities provides more precise guidance, recommending pavement markings be spaced as often as every 100 ft. in urban areas (Chapter 4-20, Fourth Edition).


While not directly analogous to bicycle pavement markings, both MUTCD (Chapter 9C, 2009 Edition) and NACTO’s Urban Bikeway Design Guide recommend that shared lane markings (“sharrows”) be placed no greater than 250 ft apart. (Photo: MUTCD (Chapter 9C, 2009 Edition)

A bike box is a designated area between the vehicle stop bar and the crosswalk, marked or painted to give bicyclists a safe space to stop at an intersection. Bike boxes bring visibility to bicyclists at intersections and give bicyclists a jump on the next green light to help prevent collisions with turning vehicles. (Photo: Gerald Fittipaldi)
Two-stage turn queue boxes provide a safe way for bicyclists to make a left-turn on multi-lane signalized streets. In a two-stage turn, a person biking crosses into the intersection where they are provided a space to wait and turn their bicycle 90 degrees so that they can then proceed straight when the street they just crossed receives a green light. *(Photo: Tony Webster)*

Bicyclists crossing at intersections are especially vulnerable to drivers making turns. Bicycle intersection striping demarcates space for people biking through intersections. Paint and prominent signage let drivers know they are crossing the bicycle right-of-way and must yield when making turns. Similar to crosswalks, striping through an intersection guides bicyclists along an intended path. White dashed markings are typically used and can be supplemented by green paint to increase visibility and draw attention to potential conflicts. *(Photo: Gordon Werner)*

**TWO-STAGE TURN QUEUE BOX**

**BICYCLE INTERSECTION STRIPING**

**Cost:** $$$ Low

**Timeline:** Short

**Location:** Major Streets

**Cost:** $$$ Low

**Timeline:** Short

**Location:** All Streets
CONFLICT MARKING (DRIVEWAYS)

Conflict markings can be applied at driveways and other curb cuts to alert drivers to the presence of bicyclists. Dashed green paint is typically used to draw attention to potential conflicts. (Photo: City of Seattle)

BICYCLE SIGNAL

Bicycle signals are bicycle-specific traffic signals installed at signalized intersections to indicate when cyclists enter an intersection and restrict conflicting vehicles. At most intersections, bicyclists will be required to follow vehicular signals. However, bicycle-specific signals may improve a particularly busy or dangerous intersections. Bicycle-specific signals look like standard traffic signals, but typically feature a cut-out shape of a bicycle in front of the light, similar to pedestrian signals with the silhouette of a person or hand. These signals may be used to give bicyclists a leading start on vehicular traffic, stop bicycles while vehicles are given turning permissions, or signal bicycle-specific permissions in a situation such as a contra-flow bicycle lane that goes against one-way vehicle traffic. Bicycle-specific signals can also be used as redundant signals to clarify permissions in particularly complicated or busy intersections.

Cost: $$$$ Medium
Timeline: Short
Location: Major Streets
AUTOMATED CYCLIST DETECTION

Automatic cyclist detectors are sensors that can be embedded in the pavement at signalized crossing to automatically detect the presence of a cyclist. These detectors can trigger a bicycle-only signal or trigger a normal signal phase. The detectors should be marked on the pavement so that bicyclists know where they need to stop to trigger the signal. (Photo: City of Phoenix)

GREEN WAVE SIGNAL COORDINATION

A green wave is a coordinated signage and signal-timing system that enables uninterrupted bicycle travel along a corridor as long as the posted speed is maintained. Green waves support seamless, and therefore faster, bicycle travel and can also prevent bike bunching at intersections.

<table>
<thead>
<tr>
<th>Cost:</th>
<th>$$$$</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeline:</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td>Major Streets</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost:</th>
<th>$$$$</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeline:</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td>Major Streets</td>
<td></td>
</tr>
</tbody>
</table>
PROTECTED INTERSECTION

Protected intersections separate people biking from motor vehicle traffic by setting back the bikeway from turning cars and using corner islands to encourage slower turns. Protected intersections improve visibility of people biking and create clearer expectations for all users’ behavior through the use of signs, paint, and pavement markings.

Protected intersections can be implemented in the interim using paint, flexposts and plastic curbs.

☑️ Opportunity for short-term implementation

---

TRANSIT STOP PROTECTED BICYCLE LANE

Bicycle lanes often share space with transit stops or sit in the path of travel for a transit vehicle pulling over. One option to reduce the chance of a bicycle-bus collision and keep bicycle traffic moving is to bend the bicycle lane behind the transit stop waiting area. In this condition, the bicycle lane should run at the level of the sidewalk to give transit riders an accessible path across the bicycle lane. Special attention should be paid to ensuring there is enough space for a ramp off a bus to land well clear of the lane. This treatment can be used even when the main bicycle lane is not itself elevated. (Photo: Adam Coppola)

Cost: $$$$ Medium
Timeline: Medium
Location: Major Streets

Cost: $$$$ Medium
Timeline: High
Location: Major Streets
APPROPRIATELY WIDE AND CONTINUOUS SIDEWALKS

Sidewalks should be a minimum 5 feet wide and ideally at least 6 feet. When sidewalks are immediately adjacent to the curb, width should increase to a minimum of 8 feet to accommodate street lights, signage, seating and separation from vehicle traffic. A sidewalk immediately adjacent to the curb with street trees should measure at least 10 feet wide to accommodate the 5-foot width needed for tree planters to ensure healthy trees. Sidewalks are only as good as the network they exist within. Connected, continuous sidewalks on both sides of a street ensure maximum pedestrian accessibility. Even a small sidewalk gap can negate significant accessibility benefits. (Photo: Kingman, AZ)

ADA CURB RAMP

ADA curb ramps are required by law at crossings to allow users with mobility limitations to safely and comfortably cross. These curb ramps also benefit sidewalk users with strollers and people wheeling objects.

Cost: $$$$ Medium
Timeline: High
Location: All Streets

Cost: $$$$ Medium
Timeline: Short
Location: All Streets
TOOLS FOR WALKING AND CROSSING THE STREET

HIGH-VISIBILITY CROSSWALK

High visibility crosswalks are more visible to drivers than standard parallel crosswalk lines, alerting them to the presence of pedestrians. Continental crosswalks feature wide painted bars in line with traffic flow and create more visible crosswalk markings. Similarly, zebra crossings display the wide painted bars at a diagonal and ladder markings include a striped boundary around parallel wide painted bars. Crosswalks need to be repainted when the paint wears off in order to maintain the high-visibility nature.

Cost: $$$ Low
Timeline: Short
Location: All Streets

MID-BLOCK CROSSING

Mid-block crossings are those that occur outside of an intersection. They are appropriate along long blocks or blocks with high pedestrian activity. Mid-block crossings enhance pedestrian networks and increase accessibility. Mid-block crossings can benefit from curb-extensions and should feature parking restrictions within 20-25 feet of the crossing to ensure motorist visibility of pedestrians and pedestrian visibility of vehicles. Signage and pedestrian warning lights may help increase motorist awareness; crosswalk markings are required.

Cost: $$$ Medium
Timeline: Medium
Location: All Streets
**TOOLS FOR WALKING AND CROSSING THE STREET**

**IN-STREET PEDESTRIAN CROSSWALK SIGN**

In-street pedestrian crosswalk signs are temporary or permanent signs placed in the street, adjacent to crosswalks, to alert motorists to the presence of pedestrians. In-street pedestrian crosswalk signs have proven more effective than signs outside of the curb-to-curb, particularly because an obstacle in the road can increase motorist caution, increase awareness of a crossing and decrease speed as a result. Creating a gateway of in-street signs has proven particularly effective at increasing motorist yielding.

---

**Curb Extension**

A curb extension (bump-out) extends the sidewalk and aligns pedestrians with a parking lane. Curb extensions often occur at corners but can be implemented mid-block too. Curb extensions reduce crossing distances, slow turning vehicles, and improve pedestrian visibility.

In permanent form, curb extensions require rebuilding the curb and sidewalk. However, curb extensions can be extremely effective with much less construction and cost. Paint, bollards and planters can create an immediate but effective curb extension.

✔️ Opportunity for short-term implementation

---

**Cost:** $$$ Low

**Timeline:** Short

**Location:** All Streets

---

**Cost:** $$$ Medium

**Timeline:** Short

**Location:** All Streets


**RAISED INTERSECTION**

Raised intersections raise the entire area of an intersection, including crossings, to the level of the sidewalk. This vertical shift signals to motorists that they are approaching an area they should treat with caution, gives pedestrians more visibility and forces motorists to slow down or risk damaging their vehicles. Raised intersections may benefit from flexible delineators at corners in high-traffic areas to prevent vehicles from using the sidewalk to facilitate turning. Raised intersections may require reconfiguring current drainage engineering.

**RECTANGULAR RAPID FLASHING BEACON**

Rectangular Rapid Flashing Beacons (RRFB) are user-activated warning lights. People walking or biking push a button to activate the warning lights before attempting to cross the roadway. The unique flashing pattern of the RRFBs have been shown to induce vehicle yielding at a much higher rate than traditional warning lights. Care should be taken to ensure that the button used to activate the RRFB is easy to reach for children, people in wheelchairs, and people biking without needing to dismount. (Photo: City of Lincoln)

---

**Cost:** $$$ High

**Timeline:** Medium

**Location:** All Streets

---

**Cost:** $$$ Medium

**Timeline:** Short

**Location:** Major Streets
Pedestrian hybrid beacons are overhead, pedestrian-activated signals placed at uncontrolled, marked crosswalks that, when activated, stop motor vehicle traffic and allow pedestrians and/or people biking to safely cross the roadway. Pedestrian hybrid beacons are often installed at locations where pedestrians need to cross the street and vehicle speeds and/or volumes are high, but traffic signal warrants are not met. (Photo: Arizona DOT)

Leading Pedestrian Intervals (LPI) are signals that allow pedestrians to start crossing the street before vehicular traffic in the same direction is given the green light. The walk signal is lit before the vehicle signal, giving pedestrians a head-start on crossing the street, which increases visibility and reinforces the need for drivers to yield to people crossing. A Lagging Left Turn phase holds left-turning cars until through traffic has passed; the left turn phase comes after through traffic. This signal phasing removes potential pedestrian conflict with turning vehicles by isolating their phases.

Signalization is important to reducing potential conflicts and maintaining efficient movement. But signalization options can greatly impact the pedestrian and bicycle experience. An intersection experiencing elevated pedestrian injuries and fatalities or that requires long wait times should be considered for signalization. The safety of vulnerable users should not be lost on a desire to only maintain efficient and fast vehicle movement.

Cost: $$$$ High
Timeline: Medium
Location: Major Streets

Cost: $$$$ Low
Timeline: Short
Location: Major Streets
Pedestrian countdown timers are traffic signals that indicate how much time pedestrians have to complete a crossing. This can reduce pedestrian anxiety and prevent pedestrians unexpectedly caught in the middle of traffic when their signal phase ends.

Automated pedestrian detection is a sensor embedded in the pavement or mounted above the sidewalk that automatically recognizes when a pedestrian is present and triggers the pedestrian signal at the next phase. At signalized intersections when pedestrian crossings are not frequent enough to warrant fixed-time pedestrian signal phases, manual pedestrian activation can be difficult or onerous (especially for pedestrians with limited mobility). Automated pedestrian detection eliminates these issues.

**Cost:** $$$ Medium

**Timeline:** Short

**Location:** All Streets

**Cost:** $$$ Medium

**Timeline:** Medium

**Location:** Major Streets
MARK ALL CROSSINGS

Outside of exceptional circumstances, every crossing at an intersection should be marked. Leaving one crossing unmarked forces a pedestrian to potentially triple their crossing distance and triple their time spent at risk within the roadway. Additionally, intersections with missing crossings often see pedestrians making that unmarked crossing anyways. Seeing no markings, drivers are less likely to be looking for pedestrians crossing, putting the pedestrian and driver in greater danger.

FREQUENT MARKED CROSSINGS

Frequent marked pedestrian crossings can increase pedestrian accessibility, reduce travel time and increase the number of amenities available to pedestrians. Frequent marked crossings can also reduce the number of pedestrians attempting to cross at unmarked points where motorists are not expecting a potential conflict. High and/or consistent numbers of pedestrians attempting crossings at un-marked locations may indicate demand for more frequent crossings. Although frequency of crossings will depend on surrounding land uses, the surrounding street grid and the type of street, the National Association of City Transportation Officials (NACTO) suggests that pedestrians should not have to walk more than a total of three minutes out of their way to legally cross a street (including walking to the crossing and doubling back to get to the other side of their original location). This rule of thumb suggests marked pedestrian crossings roughly every 800 feet.

Cost: $$$$ Low
Timeline: Short
Location: All Streets
STREET TREES AND PLANTINGS

Street trees and plantings can help narrow a driver’s perceived visual field of travel. Vertical elements alongside a road give drivers a sense of increased confinement, which can lead to increased caution and lowered speeds. (Photo: Arizona State University)

STREET LIGHTING

Street lighting is a light fixture on a pole that illuminates the public way. Ample street lighting provides an increased sense of safety for pedestrians and also helps increase pedestrian visibility to motorists. Human-scaled lighting lower to the ground creates a more intimate, inviting and protective environment. (Photo: City of San Bruno)

Cost: $$$ Medium
Timeline: Medium
Location: All Streets

Cost: $$$ High
Timeline: Medium
Location: All Streets
High Crash Corridor Segments

Five high-crash corridors have been selected for analysis and intervention recommendations. These corridors have all experienced particularly high rates of deaths and serious injuries since 2014, especially among pedestrians and bicyclists. The high-crash corridor assessment follows the strategy laid out in Developing Corridor Interventions to identify recommendations for improving safety.

RESEARCH

Existing characteristics are identified for each high-crash corridor, including right-of-way, speed limit and volume. Crash statistics from 2014-2018 are also detailed, including specific figures of pedestrians and bicyclists killed or seriously injured (KSI). Specific problem spots within the corridor are also identified, as well as overall corridor-wide safety issues. Additionally, non-safety user function, comfort and access issues are also identified, as well as co-beneficial opportunities. Collecting community knowledge would be an additional, crucial step in the research process.

Design

Each high-crash corridor’s street typology was identified to determine appropriate lane alignments, amenities and priority users. Then, based on street typology as well as identified safety issues, corridor-specific goals were developed. Finally, the Street Safety Toolbox was consulted to identify interventions to address the specific safety issues observed. The recommended designs detailed for each high-crash corridor reflect safety improvements, as well as access, user function and comfort improvements recommended for each typology.

Implementation

All high-crash corridors detailed here fall under the corridor safety improvement project type, Corridor Transformation. The recommendations detailed would all require substantial reconstruction and/or reorganization of existing corridor function and design in order to achieve safety goals. From here, the next steps would be to engage with the community, consider timing and other existing reconstruction plans and then identify any rapid interim safety project needs.

The following recommendations are ultimately specific to each corridor’s context and safety needs. However, these high-crash corridor recommendations can also be read as a reference of ideas for additional corridors. Proposed designs are subject to several considerations that may affect their implementation. These include underground utility conflicts, right of way acquisition needs, community and business preferences regarding access and design considerations, and overall project costs.
Indian School Road
(83rd Ave to 67th Ave)

Functional Class: Major Arterial

Modal Emphasis: Vehicle/Transit

Existing Cross Section: 6 lanes (3-1-2)

Existing Speed Limit: 45 MPH

Volume: ~25,000 Vehicles per Day

Existing Curb-to-Curb: 60 feet plus frontage road

Existing Sidewalks: 5-6 feet, no buffers


Issues:
Indian School Road currently features significant gaps between crossings (~.5 mile), no marked crossings across most intersecting streets and large turning radii. Four of the pedestrians killed or seriously injured on this corridor were attempting a crossing. Further, 26% of all crashes on the corridor involved speeding, and seven individuals who were killed or seriously injured were involved in a speed-related crash.

Problem Locations:
71st Dr/Ave is a signalized intersection but features just one crosswalk (bottom picture, at right)

69th Dr has seen multiple KSI pedestrian crashes involving people attempting to cross the street
Indian School Rd Re-Design

Speed Limit

Considering Indian School’s crash history and the prevalence of speed-related crashes, the legal speed limit is recommended to be reduced to 35 MPH. The design changes recommended below will aid in achieving this speed reduction. In conjunction with the speed limit reduction, a highly visible police enforcement effort should be launched that focuses on educating drivers about the new speed limit. Additional measures, such as speed feedback signs, should also be used to help reinforce the lower speed limit. Automated enforcement would also increase compliance with the new speed limit.

Design

The corridor currently features significant setbacks on both the north and south sides of the street as well as a frontage road on the south side between Amelia Ave and 76th Ave. It is recommended that these setbacks and most of the frontage road be converted into landscaped buffers between the sidewalk and the road, creating a buffer between sidewalk users and traffic. Portions of the shared middle turn lane could also be converted into a landscaped median to physically restrain continuous pavement width and visually constrain perceived width as part of an effort to reduce speeding. These medians would be achievable if driveway access points were consolidated, which would also help reduce conflicts between vehicles and pedestrians and bicyclists. Additionally, as a major arterial, limiting access points may also improve traffic flow.

It is recommended that the frontage road between 81st Ave and 76th Ave be repurposed as landscaped space to both provide more space and a more comfortable experience to pedestrians, as well as to allow space for plantings that can help narrow the perceived width of the street in an effort to slow vehicle speeds. The portion of frontage road between Amelia Ave and 81st Ave may need to be preserved to maintain sufficient access to 80th Ave, but this short stretch could be redesigned as a low-speed shared street.

Curb radii on side streets should be tightened and every crossing of a north-south street should be marked with high-visibility crosswalks. Curb bump-outs could be added to the 79th Ave intersection. Additionally, intersections currently served by traffic signals should have high-visibility crosswalks at every leg. The complicated intersection of 71st Ave/Dr would benefit from updated markings and an additional crossing, and pedestrian-focused signal timing here would maximize pedestrian safety. Leading pedestrian intervals are recommended for all signalized intersections along the corridor.

Further, it is recommended that intersections at 81st Ave, 77th Ave and 73rd Ave should have high-visibility crosswalks at all legs as well as pedestrian hybrid beacons on Indian School Rd. At 69th Drive, a new mid-block crossing could be installed, featuring a high-visibility crosswalk and a pedestrian hybrid beacon. These four new crossings would halve the distance between crossings along the corridor, which significantly increases pedestrian accessibility and reduces the incentive to cross at an unmarked crossing. The proposed new crossings also align with bus stops, providing safer, more direct access to transit, which can help reduce attempted crossings at unmarked locations.

Transit Stops

While the number and relative location of existing bus stops should remain the same, many bus stops could be repositioned closer to marked crossings in an effort to encourage transit users to cross the street at marked crossings. Additionally, eliminating bus pullouts would keep the bus within the travel lane, speeding up service. Given the level of bus ridership along the corridor, all bus stops should have large concrete boarding pads and shelters.

Finally, street trees and other plantings are recommended to provide shade to pedestrians while also narrowing the perceived field of vision for drivers, with the goal of reducing vehicle speeds.

Potential Interim Strategies:

- Test closure of frontage roads recommended for conversion to landscaped space using paint, barriers and planters
- Tighten curb radii on side streets and install interim curb bump-outs using paint and flexposts
- Install high-visibility crosswalk markings as soon as possible (not necessary to wait for full reconstruction)
McDowell Rd
(51st Ave to 35th Ave)

**Functional Class:** Arterial

**Modal Emphasis:** Vehicle/Freight

**Existing Cross Section:** 6 lanes (3-1-2)

**Existing Speed Limit:** 40 MPH

**Volume:** ~21,000 Vehicles per Day

**Existing Curb-to-Curb:** 60 feet

**Existing Sidewalks:** 5 ft (9 ft portions of N side), no buffers

**Crash Statistics (2014-2018):** 16 KSI (10 pedestrians)

**Issues:**

McDowell Rd currently features large gaps between crossings (~.5 mile), which is significant considering 80% of pedestrians killed or seriously injured in crashes between 2014-2018 were attempting a crossing. This corridor also features frequent curb cuts and turn lanes. Further, 24 percent of all crashes on the corridor involved speeding, and 3 individuals who were killed or seriously injured were involved in a speed-related crash.

**Problem Locations:**

50th Ave intersection features no crosswalks and sweeping turning radii (middle picture at right)

48th Dr features a seemingly unnecessary right turn lane that likely encourages fast turning speeds

47th Ave intersection features unaligned and uneven crossings

43rd Ave intersection features excessively wide right turn lane on northeast side

41st Ave intersection is missing crosswalks at two legs

37th Ave intersection is missing crosswalks at three legs
McDowell Rd Re-Design

Speed limit

Considering McDowell’s crash history and the prevalence of speed-related crashes, the legal speed limit is recommended to be reduced to 35 MPH. The design changes recommended below will aid in achieving this speed reduction and should be accompanied by targeted police enforcement and clear signage communicating the changes. Speed feedback signs and automated enforcement would also increase compliance with the new speed limit.

Design

McDowell meets many of the criteria identified in the FHWA’s Road Diet Informational Guide. Considering the existing traffic volumes and low volume-to-capacity ratio (0.36), three westbound lanes were deemed to be unnecessary, it is recommended that one westbound lane be eliminated. This would reduce pedestrian crossing distances and also narrow overall curb-to-curb width in an effort to reduce speeding. Several right-turn lanes could also be eliminated and the right-turn lane at 43rd Ave should be narrowed to further reduce crossing distances and overall curb-to-curb width. Combined, these lane reductions would allow for a wider buffer between the sidewalk and the road, resulting in a more comfortable pedestrian experience and a larger buffer between pedestrians and vehicles. This wider buffer also provides more space for enhanced transit amenities as well as shade plantings.

It is recommended that portions of the shared middle turn be converted into a landscaped median to physically restrain continuous pavement width and visually constrain perceived width as part of an effort to reduce speeding. Consolitdating driveway access points would make these medians feasible and also help reduce conflict points with pedestrians and bicyclists. Additionally, as an arterial, limiting access points may also improve traffic flow.

Curb radii on side streets should be tightened and every crossing of a north-south street should have high-visibility crosswalks. Sweeping turning radii at 50th Ave should be reduced, and curb bump-outs could be added to the 50th Ave, 48th Dr and 36th Ave intersections to reduce crossing distances and slow turning vehicles. Further, the southern portion of 37th Ave could be narrowed where it meets McDowell Rd. Additionally, intersections currently served by traffic signals should have high-visibility crosswalks at every leg, and leading pedestrian intervals are recommended for all signalized intersections.

Further, it is recommended that intersections at 48th Dr, 41st Ave and 37th Ave have high-visibility crosswalks at all legs as well as pedestrian hybrid beacons on McDowell Ave. At 45th Ave, we recommend replacing the existing midblock crossing just east of the intersection with a new traffic signal. Considering the prevalence of vulnerable street users in the area (due to the large senior home complex at the intersection) as well as the large development parcels to the southeast of the intersection, a full traffic signal may be justified. These four new crossings would halve the distance between crossings along the corridor, which significantly increases pedestrian accessibility and reduces the incentive to cross at an unmarked crossing. The proposed crossings also align with bus stops, providing safer, more direct and convenient access to transit services, which can help reduce attempted crossings at unmarked locations.

Transit Stops

Eliminating the eastbound bus stop between 43rd Ave and 41st Ave would reduce redundant stops, but the westbound stop between 43rd Ave and 41st Ave should be retained to maintain access to the grocery store on the north side of the street. Otherwise, it is recommended that the number and relative location of existing bus stops remain the same, but many bus stops could be repositioned closer to marked crossings in an effort to encourage transit users to cross the street at marked crossings. Additionally, bus pullouts should be eliminated in order to keep the bus within the travel lane, speeding up service. All bus stops should have large concrete boarding pads and shelters.

Finally, street trees and other plantings are recommended along the corridor to provide shade to pedestrians while also narrowing the perceived field of vision for drivers, with the goal of reducing vehicle speeds.

Potential Interim Strategies:

- Close right-turn lanes using barriers, paint and signage
- Test elimination of one westbound lane using paint, barriers and signage
- Tighten curb radii on side streets and install interim curb bump-outs using paint and flexposts
- Install high-visibility crosswalk markings as soon as possible (not necessary to wait for full reconstruction)
McDowell and 45th Focus Area
19th Ave  
(Grovers Ave to Greenway Rd)

**Functional Class:** Major Arterial  
**Modal Emphasis:** Transit/Vehicle  
**Existing Cross Section:** 6 lanes (3-1-2)  
**Existing Speed Limit:** 45 MPH  
**Volume:** ~15,000 Vehicles per Day  
**Existing Curb-to-Curb:** 72 feet  
**Existing Sidewalks:** 5 ft, mainly no buffer  
**Crash Statistics (2014-2018):** 18 KSI (6 pedestrians, 3 bicyclists)

**Issues:**  
19th Ave currently features large gaps between crossings (~.5 mile), which is significant considering 100 percent of pedestrians killed or seriously injured in crashes between 2014-2018 were attempting a crossing. Further, 20 percent of all crashes on the corridor involved speeding.

**Problem Locations:**  
Grandview Rd intersection features large slip lane, allowing very fast vehicle turns (third picture, at right)  
Multiple pedestrian fatalities between Bell Rd and Village Dr where a person walking was attempting to cross the street
Speed Limit

Considering the crash history on 19th Ave, the prevalence of speed-related crashes and the likely increase in pedestrian activity with improved transit service, the legal speed limit is recommended to be reduced to 35 MPH. The design recommended below will aid in achieving this speed reduction. In addition to design changes, additional enforcement and education will be necessary. A combination of high-visibility police enforcement focused on training, automated enforcement, and speed feedback signs will help educate drivers on the change and increase compliance.

Design

19th Ave meets many of the criteria identified in the FHWA’s Road Diet Informational Guide. Considering the existing volumes and low volume-to-capacity ratio (.25) the current alignment of three northbound and two southbound lanes is likely excessive. Additionally, as a transit-priority street that sees high ridership, this re-design recommends a dedicated bus lane in each direction. The resulting alignment of one bus lane in each direction and one vehicle lane in each direction, plus a shared middle turn lane, should adequately serve existing volumes and provide enhanced service to the corridor’s priority users. The overall result would be the elimination of one travel lane, which would reduce pedestrian crossing distances and narrow the total curb-to-curb width. With the addition of dedicated bus lanes, the right-turn lanes on 19th Ave should be removed, but vehicles should be allowed to use the bus lane to make right turns at intersections. Removing the existing right turn lanes would further reduce crossing distances and overall curb-to-curb width. Together, these lane reductions would allow for a wider buffer between the sidewalk and the road, resulting in a more comfortable pedestrian experience. This wider buffer would also provide more space for enhanced transit amenities and shade plantings.

It is recommended that portions of the center turn lane be converted into a landscaped median to shrink continuous pavement width and visually constrain perceived width to reduce speeding. This re-design also recommends consolidating driveway access points (and limiting curb cuts with future development), which helps reduce conflict points with pedestrians and bicyclists. Additionally, as a major arterial, limiting access points may also improve traffic flow.

Every crossing of an east-west street should be marked with high-visibility crosswalks. It is recommended that the large slip lane at Grandview Rd be removed, and bump-outs be added to the Angela Dr, Village Dr and Grandview Rd intersections to reduce crossing distances and slow turning vehicles. Further, Grandview Rd could be narrowed at 19th Ave. Additionally, intersections currently served by traffic signals should have high-visibility crosswalks at every leg, and leading pedestrian intervals are recommended for all signalized intersections.

Further, it is recommended that pedestrian hybrid beacons and high-visibility crosswalks be installed at the intersections at Village Dr, Grandview Rd and Tierra Buena Ln. These three new crossings would halve the distance between crossings along the corridor, which increases pedestrian accessibility and reduces the incentive to cross at an unmarked crossings. The proposed crossings align with bus stops, providing safer, more direct access to transit.

Transit Stops

The two northbound bus stops just south and north of Angela Dr could also be consolidated into a single stop at Village Dr. This consolidation would align the northbound stop with the southbound stop, maximizing the new marked crossings and pedestrian hybrid beacon at Village Dr. Otherwise, the location of existing bus stops along the corridor should remain the same, but many bus stops could be repositioned closer to marked crossings to encourage transit users to cross the street at marked crossings. Additionally, bus pullouts should be eliminated to keep the bus in the travel lane and speed up service. All bus stops should have large concrete boarding pads and enhanced shelters along 19th Ave.

Finally, street trees and other plantings are recommended along the corridor to provide shade and narrow the perceived field of vision for drivers, with the goal of reducing vehicle speeds.

Potential Interim Strategies:

- Test implementation of dedicated bus lane using paint, cones, barriers and signage
- Remove slip lane at Grandview Rd using paint, flexposts and barriers
- Tighten curb radii on side streets and install interim curb bump-outs using paint and flexposts
- Install high-visibility crosswalk markings as soon as possible (not necessary to wait for full reconstruction)
Broadway Rd
(16th St to 24th St)

**Functional Class:** Arterial

**Modal Emphasis:** Vehicle/Transit

**Existing Cross Section:** 6 lanes (3-1-2)

**Existing Speed Limit:** 45 MPH

**Volume:** ~25,000 Vehicles per Day

**Existing Curb-to-Curb:** 60 feet

**Existing Sidewalks:** 4-6 ft, no buffer

**Crash Statistics (2014-2018):** 7 KSI (4 pedestrians, 1 bicyclist)

**Issues:**

Broadway Rd currently features large gaps between crossings (~.5 mile), which is significant considering 4 pedestrians were killed or seriously injured while attempting a crossing. Additionally, 17 percent of all crashes on the corridor involved speeding.

**Problem Locations:**

Three crashes where a person walking or biking was killed or seriously injured while attempting to cross the street between 18th St and 22nd St
Broadway Rd Re-Design

Speed Limit

Due to Broadway’s crash history and speed issues, it is recommended that the legal speed limit be reduced to 35 MPH. A combination of design changes, enforcement, and signage and messaging will assist with education and compliance.

Design

Broadway Rd meets many of the criteria identified in the FHWA’s Road Diet Informational Guide. Considering the existing traffic volumes and volume-to-capacity ratio (0.55) it was determined that one eastbound lane could be removed. This would reduce pedestrian crossing distances and narrow the overall curb-to-curb width in an effort to reduce speeding. The lane reduction would also allow for a wider buffer between the sidewalk and the road, resulting in a more comfortable pedestrian experience and a larger buffer between pedestrians and vehicles. This wider buffer would also provide more space for enhanced transit amenities and shade plantings. This re-design also recommends consolidating driveway access points (and limiting curb cuts with future development), which helps reduce conflict points with pedestrians and bicyclists. Additionally, as an arterial, limiting access points may also improve traffic flow.

It is recommended that every crossing of an north-south street be marked with high-visibility crosswalks, and intersections currently served by traffic signals should have high-visibility crosswalks at all legs. Leading pedestrian intervals are recommended for all signalized intersections. Instead of the existing mid-block crossing just east of 18th St, it is recommended that pedestrian hybrid beacons and marked crossings be installed at the intersection of 18th St. At 22nd St, all legs should be marked with high-visibility crosswalks. Additionally, new pedestrian hybrid beacons and high-visibility crosswalks should be added to the 20th St intersection. These proposed crossings would reduce the distance between crossings on the corridor by one third, which increases pedestrian accessibility and reduces the incentive to cross at an unmarked crossing. The proposed crossings and enhanced crossings at 18th St and 22nd St also align with bus stops, providing safer, more direct access to transit, which can help reduce attempted crossings at unmarked locations.

Transit Stops

It is recommended that the number and relative location of existing bus stops remain the same, but many bus stops could be repositioned closer to marked crossings in an effort to encourage transit users to cross the street at marked crossings. Additionally, bus pullouts should be eliminated to keep the bus within the travel lane and speed up service. All bus stops should have large concrete boarding pads and shelters.

Finally, street trees and other plantings are recommended along the corridor to provide shade to pedestrians while also narrowing the perceived field of vision for drivers, with the goal of reducing vehicle speeds.

Potential Interim Strategies:

- Test elimination of one eastbound lane using paint, barriers and signage
- Tighten curb radii on side streets and install interim curb bump-outs using paint and flexposts
- Install high-visibility crosswalk markings as soon as possible (not necessary to wait for full reconstruction)
**7th St**
(Deer Valley Rd to Utopia Rd)

**Functional Class:** Major Arterial

**Modal Emphasis:** Vehicle/Freight

**Existing Cross Section:** 7 lanes (3-1-3) and 6 lanes (2-1-3)

**Existing Speed Limit:** 45 MPH

**Volume:** ~24,000 Vehicles per Day

**Existing Curb-to-Curb:** 94 feet north of Beardsley, 76 feet south of Beardsley

**Existing Sidewalks:** 5 ft, no buffer south of Beardsley

**Crash Statistics (2014-2018):** 14 KSI (2 pedestrians)

**Issues:**

7th St currently features large curb-to-curb width and long gaps between crossings (~.5 mile). The intersections with Beardsley Rd also pose major challenges. 15 percent of all crashes on the corridor involved speeding.

**Problem Locations:**

Striped, on-street bicycle lanes are dangerous considering adjacent traffic volumes and speeds

Oversized shared middle turning lane (second picture, at right)

Southern intersection with Beardsley Rd experienced 4 crashes were a person was killed or seriously injured
7th St Re-Design

Speed Limit

Considering the crash history and prevalence of speed-related crashes, the legal speed limit is recommended to be reduced to 40 MPH. Design changes below will aid in achieving this speed reduction.

Design

The corridor currently features a significant setback on the west side between Beardsley Rd and Utopia Rd. This setback could be redesigned to include a 10-ft wide shared-use path to safely carry pedestrians and bicyclists. Further, the existing sidewalks on both the east and west sides of 7th St between Beardsley and Deer Valley could be expanded to 10-ft wide shared-use paths, taking bicyclists out of the right-of-way and onto a protected path.

Significant portions of shared middle turn lanes and striped medians could be converted into landscaped medians to physically restrain continuous pavement width and visually constrain perceived width as part of an effort to reduce speeding. Specifically, the large shared middle turn lane between Beardsley Rd and Behrend Dr should be replaced with a series of landscaped medians and left-turn lanes. These medians would be more feasible if driveway access points along the corridor were consolidated, which also helps reduce vehicle conflicts with pedestrians and bicyclists. Additionally, as a major arterial, limiting access points may also improve traffic flow.

Curb radii on side streets should be tightened to slow down vehicles turning off 7th St. These slow turns are particularly crucial to ensure that turning vehicles have enough time to spot and stop for bicyclists on the parallel shared-use paths. Driveways that cross the shared-use paths should be marked with high-visibility warning paint, and the shared-use path should jog around the northbound bus stop between Behrend Dr and Wickieup Ln to help reduce transit user-bicyclist conflicts. Additionally, every crossing of a north-south street should be marked with high-visibility crosswalks, and intersections currently served by traffic signals should have high-visibility crosswalks at every leg. Leading pedestrian intervals are recommended for all signalized intersections.

It is recommended that a new mid-block crossing with a high-visibility crosswalk and pedestrian hybrid beacons been added between Behrend Dr and Wickieup Ln. This new crossing would help transit users safely access bus stops at this point and halve the distance between crossings between Beardsley Rd and Utopia Rd. Additionally, high-visibility crosswalks should be added at Irma Ln, Rose Garden Ln, and Lone Cactus Dr to help southbound transit users access bus stops more safely (although transit ridership at these stops is low enough that pedestrian hybrid beacons are not recommended). These proposed crossings would significantly increase pedestrian accessibility and save transit users up to 15 minutes—the current amount of time needed to walk to an existing marked crossing and reach a bus stop. All proposed crossings align with bus stops, providing safer, more direct access to transit, which can help reduce attempted crossings at unmarked locations.

Transit Stops

It is recommended that two bus stops be significantly relocated. The northbound bus stop just north of Behrend Dr should be moved south to align with the southbound bus stop and to maximize the utility of the new mid-block crossing. The northbound bus stop north of Beardsley Rd should be moved just south of Beardsley Rd. The existing bus stop north of Beardsley Rd serves no discernable destination, and moving the stop 750 feet south helps make up for the stop north of Behrend Dr also moving south. Otherwise, the number and relative location of existing bus stops should remain the same, but many bus stops could be repositioned closer to marked crossings in an effort to encourage transit users to cross the street at marked crossings. Additionally, bus pullouts should be eliminated to keep the bus within the travel lane and speed up service.

Finally, street trees and other plantings are recommended along the corridor to provide shade while also narrowing the perceived field of vision for drivers, with the goal of reducing vehicle speeds.

Potential Interim Strategies:

- Better define turning movements in large shared middle turn lane between Beardsley Rd and Behrend Dr using paint, barriers and signage
- Tighten curb radii on side streets and install interim curb bump-outs using paint and flexposts
- Install high-visibility crosswalk markings as soon as possible (not necessary to wait for full reconstruction)
Speed Reduction Strategies

Speed is a major determinant of both the likelihood and severity of traffic crashes. Drivers traveling at higher speeds have narrower fields of vision, are less likely to yield to pedestrians, and require greater stopping distances. Likewise, higher travel speeds increase the risk of severe injuries and death by increasing the force during a collision. Speed is particularly critical in crashes involving people biking or walking, since these users are not protected by a vehicle frame and absorb the full impact during collisions. A person walking hit by a car traveling 40 mph has an 85% chance of dying. If the vehicle is traveling 20 mph, the chance of a fatality drops to 5%.

Three components should be part of any speed reduction strategy:

1. Design Strategies
   The street safety toolbox features extensive details on design interventions that can reduce speed and improve street safety. Design interventions from the toolbox that specifically address vehicle speed reduction include:
   - Narrow lanes
   - Narrow curb-to-curb width
   - Chicane and neckdown
   - Remove slip lane
   - Shared street
   - Median
   - Speed table
   - Diverter
   - Small curb radius
   - Hardened centerline
   - Slow turn wedge
   - Movement restriction
   - Coordinated corridor signal timing
   - Speed feedback sign
   - Road diet
   - One-way to two-way conversion
   - Mini traffic circle
   - Access management
   - On-street parking
   - Bicycle boulevard
   - One-way street contra-flow bicycle lane
   - Protected bicycle lane/ cycle track

2. Education and Enforcement:
   The final section in the Safety Action Plan details education and enforcement strategies to improve street safety. Strategies specifically focused on speed reduction include:
   - Targeted enforcement of corridors with high crash rates, with vulnerable users, adjacent to village cores and that feature excessive existing speeds. Enforcement should also be targeted at violations that put street users at the greatest risk of death and serious injury.
   - Automated enforcement methods, including cameras that capture and report significant vehicle speeding violations.
   - Clear signage and education whenever a speed limit change is implemented.

A person walking hit by a car traveling 40 mph has an 85% chance of dying. At 20 mph, the chance of a fatality drops to 5%.

3. Lower Posted Speed Limit
   Cities around the country are increasingly recognizing the imperative to lower speed limits and reduce vehicle speeds on their streets. In December 2019, Seattle announced it was lowering the speed limit on all major roads to 25 miles per hour. Boston lowered the citywide default speed limit to 25 miles per hour in January 2017 and has seen the proportion of vehicles traveling over 35 miles per hour fall 29.3% (IIHS study). While lowering the posted speed limit may not be sufficient to reduce vehicle speeds, it can be an important component of an overall speed reduction strategy. Considering the need to improve safety for all users on Phoenix’s street, the City should develop a targeted approach toward reducing speed limits and travel speeds in critical locations.
Locations for Reducing Speed Limits

High-Crash Corridors

Speed is a frequent contributor to serious crashes, and addressing high vehicle speeds will likely always be a major factor in improving safety on high-crash corridors.

Village Cores and Pedestrian and Bicycle Activity Centers

Phoenix has articulated a clear goal of making it easier, safer and more comfortable for people to walk and bike in the city’s village cores. Village cores, which serve as public gathering and commercial epicenters around Phoenix are likely to see higher numbers of people on foot and bicycle. Vulnerable street users, including pedestrians and bicyclists, are potentially most at risk for death or serious injury when vehicle speeds are excessively high. Reducing speeds within village cores can help protect these vulnerable users while also creating a more welcoming environment.

Outside of Phoenix’s village cores, other areas with high levels of bicycle and pedestrian should also be targeted for speed reductions.

Phoenix’s street typologies define the following target speeds for streets with pedestrian/bicycle modal emphasis and streets with enhanced pedestrian/bicycle facilities.

<table>
<thead>
<tr>
<th></th>
<th>Downtown Core</th>
<th>Regional/Urban Center</th>
<th>Suburban Commuter</th>
<th>Neighborhood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterials</td>
<td>25</td>
<td>25</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Collectors</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
</tbody>
</table>

Overall Scan of Target vs. Existing Speeds

Phoenix’s street typologies define target speeds for all streets, depending on functional classification, place type, and modal emphasis. Phoenix should conduct a systemic scan of existing speed limits and speed data compared to the target speeds articulated within the street typologies. Corridors that experience existing speeds higher than target speeds should be prioritized for speed reduction strategies. The greater the difference between target and existing speeds, the more impact speed reduction strategies can have on improving safety.

Phoenix’s street typologies define the following target speeds for major arterials and arterials with vehicle, freight, or transit modal emphasis.

<table>
<thead>
<tr>
<th></th>
<th>Downtown Core</th>
<th>Regional/Urban Center</th>
<th>Suburban Commuter</th>
<th>Neighborhood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterials</td>
<td>25 - 35</td>
<td>35-40</td>
<td>40-45</td>
<td>40-45</td>
</tr>
</tbody>
</table>

Prioritizing Speed Reduction

It is recommended that Phoenix employ a tiered approach towards lowering speed limits and reducing vehicle speeds, focusing first on the most critical locations:

1. High-Crash Corridors
2. Village Cores and Pedestrian and Bicycle Activity Centers
3. Areas Where Existing Speeds Exceed Target Speeds

High-crash corridors should be prioritized as locations that first receive speed reduction interventions. High-crash corridors have a demonstrated history of serious injuries and deaths, and therefore, speed reduction strategies have the potential to save the most lives when employed on these corridors. The five concept designs for Indian School Rd, McDowell Rd, 19th Ave, Broadway Rd, and 7th Ave all illustrate how design strategies can be combined with changes to the posted speed limit and education and enforcement to create a holistic speed reduction strategy.

Prioritizing village cores and pedestrian and bicycle activity centers helps reduce speeds around our streets’ most vulnerable users. Even small speed reductions can significantly reduce the chance of death or serious injuries among pedestrians and bicyclists. And so, speed reduction strategies can see a high rate of return in these activity centers.

Finally, speed reduction strategies should be prioritized on corridors that see the highest difference between target speeds and existing speeds. Target speeds are set in accordance with corridor priority users and those users’ needs and safety. Interventions that bring a corridor closer to its target speed improve safety and comfort for priority users and vulnerable users.
Examples of Speed Reduction Strategies

In addition to the speed reduction examples included in the five high crash corridors examined above, the following examples illustrate how Phoenix can implement a comprehensive speed reduction strategy on bicycle and pedestrian priority streets and in village cores.

E Roeser Rd

**Functional class:** Minor Collector  
**Modal Emphasis:** Bicycle  
**Place Type:** Neighborhood  
**Existing Cross Section:** 2 lanes, 5’ bike lanes  
**Existing Speed Limit:** 35 MPH  
**Volume:** ~7,000  
**Existing Curb-to-Curb:** 38-42 feet

**Lower Posted Speed Limit**  
Roeser Rd is a minor collector street with an existing speed limit of 35 MPH. Based on its functional classification, emphasis on providing a high level of comfort for people bicycling and neighborhood place type, the target speed for Roeser is 25 MPH. It is recommended that the posted speed limit be lowered to 25 MPH.

**Design Strategies**  
Design changes should also be implemented to encourage drivers to travel at safer speeds. Currently, lane widths along Roeser range from 14-16’. It is recommended that lane widths be reduced to 10’. In addition to encouraging safer speeds, this will also create an additional 8-12’ of space that can be used to enhance the existing bicycle facilities.

**Education and Enforcement**  
In addition to lowering the posted speed limit and narrowing travel lanes, education and enforcement efforts should be used to increase compliance with the new speed limit. These efforts could include the installation of speed feedback signs and high-visibility police enforcement focused on educating violators. It is recommended that these efforts be targeted around the many schools and parks located along Roeser Rd. Lastly, the use of automated speed cameras could also be deployed at key intersections near schools and parks (e.g., 7th St, 16th St, 32nd St, 48th St). Developing a comprehensive school safe zone and park safe zone program could help systematize these efforts.

4th St (Filmore St to Garfield St)

**Functional class:** Collector  
**Modal Emphasis:** Pedestrian  
**Place Type:** Downtown Core  
**Existing Cross Section:** 3 lanes (northbound), on-street parking (varies west side and both sides)  
**Existing Speed Limit:** 35 MPH  
**Volume:** ~4,000  
**Existing Curb-to-Curb:** 50 feet

**Lower Posted Speed Limit**  
4th St is a collector street with an existing speed limit of 35 MPH. Based on its functional classification, emphasis on providing a high level of comfort for people walking and downtown core place type, the target speed for 4th is 25 MPH. It is recommended that the posted speed limit be lowered to 25 MPH.

**Design Strategies**  
Considering the existing traffic volume (< 4,000 vehicles per day) and number of travel lanes, there is an opportunity to reduce the number of travel lanes on 4th St. Reducing the street’s curb-to-curb width would help encourage lower speeds. Currently there is on-street parking on the west side of 4th St on all three blocks but there is only on-street parking on the east side of 4th St between McKinley St and Garfield St. The lane on the east side of 4th St is 20’ and, without on-street parking, likely encourages high travel speeds. It is recommended that on-street parking be added on the east side for all three blocks. With the addition of on-street parking on the east side (and considering that Pierce St, McKinley St, and Garfield St all have on-street parking on both sides of the street), curb extensions should be added to all legs of each intersection. The addition of curb extensions will help slow turning speeds and reduce pedestrian crossing distance.

**Education and Enforcement**  
Pairing the lower speed limit and design strategies described above with the use of speed feedback signs and high-visibility police enforcement focused on educating violators could aid in lowering speeds on 4th St. Deploying additional static or dynamic signage highlighting the new speed limit would also help raise awareness.
E Paradise Village Pkwy S (E Cactus Rd to N Tatum Blvd)

**Functional class:** Collector  
**Modal Emphasis:** Pedestrian  
**Place Type:** Regional Center + Village Core  
**Existing Cross Section:** 2 travel lanes with two-way left turn lane  
**Existing Speed Limit:** 35 MPH  
**Volume:** ~9,000  
**Existing Curb-to-Curb:** 48 feet

**Lower Posted Speed Limit**  
Paradise Village Pkwy is a collector street with an existing speed limit of 35 MPH. Based on its functional classification, emphasis on providing a high level of comfort for people walking and location within a village core, the target speed for this street is 25 MPH. It is recommended that the posted speed limit be lowered to 25 MPH.

**Design Strategies**  
Paradise Village Pkwy currently features 18’ travel lanes with a 12’ two-way left turn lane. In the short-term, the travel lanes could be narrowed to 10’ using paint and temporary materials. Another potential short-term intervention could install chicanes using a combination of flexible delineators, planters, and striping. Either of these interventions could help to lower driver speeds. In the long-term, Paradise Village Pkwy could be redesigned with a narrow curb-to-curb width and the excess space could be repurposed to create a buffer between the sidewalk and street. Portions of the two-way left turn could also be converted to a landscaped median between driveway access points to physically restrain continuous pavement width and visually constrain perceived width.

**Education and Enforcement**  
In addition to lowering the posted and the design strategies described above, the use of speed feedback signs and static or dynamic signage highlighting the new speed limit would assist with driver compliance.

W Cheryl Dr (N 35th Ave to N 31st Ave)

**Functional class:** Collector  
**Modal Emphasis:** Transit/Pedestrian  
**Place Type:** Neighborhood + Village Core  
**Existing Cross Section:** 2 travel lanes with two-way left turn lane  
**Existing Speed Limit:** 35 MPH  
**Volume:** ~9,000  
**Existing Curb-to-Curb:** 50 feet

**Lower Posted Speed Limit**  
Cheryl Dr is a collector street with an existing speed limit of 35 MPH. Based on its functional classification, emphasis on serving transit and people walking and location within a village core, the target speed for this street is 25 MPH. It is recommended that the posted speed limit be lowered to 25 MPH.

**Design Strategies**  
E Paradise Village Pkwy S currently features 14’ travel lanes with a 12’ two-way left turn lane. One strategy to reduce vehicle speeds would be to restripe the street—narrowing the travel lanes to 11’ and creating a 3’ painted buffer (which could be enhanced with flexible delineators, planters, or bollard) between the bicycle lane and travel lane. Additionally, portions of the two-way left turn could be converted to a landscaped median which would reduce the continuous pavement width and perceived width of people driving.

**Education and Enforcement**  
Because Cherly Dr is a bus route, specific outreach to Valley Metro and education for bus drivers about the speed limit reduction would be necessary. To increase driver compliance with the 25 MPH speed limit, speed feedback signs and additional static or dynamic signage that draws attention to the new speed limit could both be utilized.
Education and Enforcement

EDUCATION

Public Awareness Campaigns

Public awareness campaigns target wide audiences with the goal of sharing information and shaping safer street behaviors. These campaigns should target specific users, specific behaviors, specific geographies and/or specific times of year. Targeted campaigns narrow costs and help focus attention on the most important safety issues. Public awareness campaigns can take shape in many forms and may often combine multiple tactics:

- **Earned Media Campaigns** develop events and strategies to help safe streets information reach the public through news media outlets.
- **Paid Media Campaigns** purchase radio, television, print and/or billboard space to promote safe street information.
- **Face-to-Face Outreach** includes education at community events or on city streets, talking to users directly about safe street use.

A 2013 campaign in Eureka, CA, used earned and paid media as well as outreach events to spread a “Heads UP” message aimed at increased awareness among all street users. Nearly 50 percent of all drivers surveyed after the campaign said they have changed their habits while driving, and 65% of pedestrians said that drivers were more aware of pedestrians following the campaign.¹

Youth and Teen Education

Forming safe habits at a young age can help develop a lifetime of safe street use. Phoenix’s recently-launched “Pedestrian Safety Activity Book” is distributed to city classrooms to help educate young children on safe street use.

Strong driver’s education programs can also help reduce dangerous behavior and improve teen driver safety, but driver’s education is not currently required to obtain a license in Arizona. A 2015 study out of the University of Nebraska-Lincoln found that young drivers who had not completed a driver’s education program were 75 more likely to get a ticket, 24 percent more likely to be involved in a fatal or serious-injury accident and 16 percent more likely to have an accident.²

In Oregon, driver’s education includes classroom training and supervised driving instruction that focuses on risk assessment to help young driver anticipate problems. The Oregon program has helped reduce crashes, citations and suspensions among young drivers. A 2018 study by the Oregon Department of Transportation found that in 91 percent of crashes with a teen driver, the driver had not taken a driver’s education course.³

Advocating for stronger driver’s education requirements or more substantial financial assistance for teens to attend quality driver’s education programs could help improve safety for all street users.

Elected Leadership Policy Education

Education is not only for street users, but for actors who influence policy and decisions. Educating elected leaders on policies and programs that increase street safety helps influence funding and political support for safer streets.

Community Stakeholder Education and Dialogue

Educating community stakeholders and leaders on policies and programs that increase street safety helps: 1) Develop community support for safe streets projects; 2) Better prepares community stakeholders to advocate to elected leaders for safer streets. Any education should also be considered a two-way dialogue that allows decision makers to receive feedback from community stakeholders that ultimately helps tailor more nuanced, appropriate, responsive and successful street safety initiatives.

---

² https://newsroom.unl.edu/releases/2015/08/13/Study:+Driver’s+education+significantly+reduces+teen+crashes,+tickets
User Feedback Education
User feedback can educate motorists on current behavior. Speed feedback signs immediately show motorists their current speed next to the required speed limit, with the aim raising awareness of unsafe behavior. In Ann Arbor, a program was tested that observed rates of motorists yielding for pedestrians across the city and published city-wide yielding rates on roadside signs updated weekly. Every week, the signs were updated with the past week’s yielding rate and the record yielding rate. Stopping for pedestrians increased from 28.5% to 62.5% at crossing sites that included increase enforcement and from 34.2% to 53% at generalization sites that did not receive enforcement.

Large Vehicle Training
A large vehicle training program, such as one implemented in San Francisco, helps educate drivers of large vehicles on safe strategies or operating in urban spaces. In San Francisco, the training is video-based and informs large vehicle drivers about the dangers and challenges of driving on crowded urban streets near people walking and biking. All large vehicle drivers who work for the city, as well as contractors with the San Francisco Municipal Transportation Agency (SFMTA), are required to watch the video or go through a comparable training.

ENFORCEMENT
Automatic Enforcement Red Light Cameras
Phoenix Police have previously reported a 57 percent reduction in red-light-running crashes at red light camera sites across the city. Phoenix should move to re-establish a contract for red-light cameras with a transparent process for placing each camera.

Automatic Enforcement Speed Cameras
Speed cameras are automatic detection systems that identify the vehicles of drivers who are speeding. Speed cameras have been commonly deployed in school zones in cities across the US but could serve to protect areas with other vulnerable populations, such as senior homes. A 2010 study assessing nine individual studies reported reductions in the proportion of speeding vehicles between 14-65% when automatic speed cameras were in place and a reduction of fatal and serious-injury crashes between 11-44%. Scottsdale, Chandler, Mesa and Paradise Valley all currently use automatic enforcement speed cameras. Phoenix should move to re-establish a contract for speed cameras with a transparent process for placing each camera.

Data-Driven Enforcement
Data-Driven Enforcement is a strategy that uses crash and injury data to prioritize resources in areas that are the most dangerous for street users. Data-Driven Enforcement can also use demographic and public health data to prioritize resources in areas with vulnerable street users. Data-driven enforcement strategies should prioritize intervening for actions that are most likely to lead to fatalities or serious injuries. This helps ensure that enforcement meets its goal of enhancing safety and helps prevent over-policing or over-ticketing communities. San Francisco is one city that has specifically adopted a data-driven strategy aimed at fatality-serious-injury-focused enforcement.

Equity-Driven Enforcement
An Equity-Driven Enforcement strategy acknowledges historical trends that shows street users from minority communities have been ticketed disproportionately and develops an enforcement strategy that does not put an unfair burden on minority communities. An Equity-Driven Enforcement strategy also explores systemic and built histories that put under-resourced and minority communities at a greater risk for violations. For instance, an enforcement strategy that targets bicyclists on sidewalks may disproportionately target communities who do not have safe bicycle infrastructure and must use sidewalks because they have no other safe option.

Diversion Programs
Criminal or civil punishment is not the only effective tool to correct or deter unsafe actions—especially low-level offenses. Diversion programs, such as the Defensive Driving Program (DDF), allow drivers who commit lower-level offenses to complete an educational program and have the charge dismissed. DDPs present traffic safety information and aim to improve safe driving behaviors and avoid unnecessary risk through either online or in-person classes.

4 https://www.cdc.gov/motorvehiclesafety/calculator/factsheet/speed.html
AHWATUKEE FOOTHILLS
CRASH TRENDS (2014-2018)

2,868 Total Crashes
98 Bicycle Involved Crashes
56 Pedestrian Involved Crashes

Total Crashes by Year

How Severe are the Crashes?
Serious Injury and Fatal Crashes by Year

Who is Involved?
Vehicle Only
Bicycle Involved
Pedestrian Involved

67% increase in fatalities since 2014
6% decrease in serious injury crashes since 2014
What Type of Crashes are Occurring?

Crashes by Type

Fatal Crashes by Type

Serious Injury Crashes by Type

Where are the Crashes Happening?
When do Crashes Occur?

**Total Crashes by Day of Week**

![Graph showing total crashes by day of week.](image)

**Total Crashes by Month**

![Graph showing total crashes by month.](image)

**Total Crashes by Time of Day**

![Graph showing total crashes by time of day.](image)
Bicycle Involved Crash Trends

**Bicyclist Involved Crashes by Severity**

- **All Crashes**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Year</th>
<th>All Crashes</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>26</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2015</td>
<td>15</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>17</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>25</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2018</td>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Bicycle Involved Crashes by Time**

- **Bicycle Involved**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Time</th>
<th>Bicycle Involved</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td>6</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td>14</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td>11</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td>12</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td>13</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td>13</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>6 PM - 9 PM</td>
<td>13</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>9 PM - Midnight</td>
<td>13</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Pedestrian Involved Crash Trends

**Pedestrian Involved Crashes by Severity**

- **All Crashes**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Year</th>
<th>All Crashes</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>14</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>11</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>12</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>2018</td>
<td>13</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Pedestrian Involved Crashes by Time**

- **Pedestrian Involved**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Time</th>
<th>Pedestrian Involved</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td>6</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td>14</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td>11</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td>12</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td>13</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td>13</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>6 PM - 9 PM</td>
<td>13</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>9 PM - Midnight</td>
<td>13</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
ALHAMBRA
CRASH TRENDS (2014-2018)

16,836 Total Crashes
289 Bicycle Involved Crashes
541 Pedestrian Involved Crashes

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

Vehicle Only

Bicycle Involved

Pedestrian Involved

Who is Involved?
What Type of Crashes are Occurring?

Crashes by Type

- Rear End: 30%
- Angle: 20%
- Sideswipe: 17%
- Left Turn: 15%
- Single Vehicle: 10%
- Pedestrian: 3%
- Bicycle: 2%
- Head On: 1%
- U Turn: 1%
- Backing: 1%
- Other: 0%
- Unknown: 0%

Fatal Crashes by Type

- Pedestrian: 58%
- Left Turn: 11%
- Bicycle: 7%
- Single Vehicle: 6%
- Angle: 6%
- Rear End: 4%
- Head On: 3%
- Sideswipe: 2%
- U Turn: 1%

Serious Injury Crashes by Type

- Pedestrian: 37%
- Left Turn: 28%
- Angle: 21%
- Rear End: 18%
- Single Vehicle: 13%
- Bike: 11%
- Sideswipe: 5%
- Head On: 3%
- Backing: 1%

Where are the Crashes Happening?

Crashes by Location

- Not Intersection Related: 26.4%
- Intersection Related: 73.6%
When do Crashes Occur?

Total Crashes by Day of Week

Total Crashes by Month

Total Crashes by Time of Day
CAMELBACK EAST CRASH TRENDS (2014-2018)

15,631 Total Crashes
312 Bicycle Involved Crashes
413 Pedestrian Involved Crashes

Total Crashes by Year

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

Who is Involved?

Vehicle Only

Bicycle Involved

Pedestrian Involved
What Type of Crashes are Occurring?

Crashes by Type

- Rear End: 31%
- Angle: 21%
- Sideswipe: 15%
- Left Turn: 18%
- Single Vehicle: 9%
- Pedestrian: 3%
- Bicycle: 2%
- Head On: 1%
- U Turn: 1%
- Backing: 1%
- Other: 0%
- Unknown: 0%

Fatal Crashes by Type

- Pedestrian: 64%
- Angle: 13%
- Single Vehicle: 12%
- Left Turn: 7%
- Head On: 1%
- Bike: 1%
- Rear End: 1%
- Other: 0%
- Unknown: 0%

Serious Injury Crashes by Type

- Pedestrian: 26%
- Left Turn: 22%
- Angle: 19%
- Single Vehicle: 9%
- Rear End: 9%
- Bike: 8%
- Sideswipe: 4%
- Head On: 2%
- U Turn: 1%

Where are the Crashes Happening?

Crashes by Location

- Not Intersection Related: 29.3%
- Intersection Related: 70.7%
When do Crashes Occur?

**Total Crashes by Day of Week**

- **All Crashes**
- **Fatal and Serious Injury**

**Total Crashes by Month**

- **All Crashes**
- **Fatal and Serious Injury**

**Total Crashes by Time of Day**

- **Vehicle Only**
- **Pedestrian Involved**
- **Bicycle Involved**
Bicycle Involved Crash Trends

**Bicyclist Involved Crashes by Severity**
- All Crashes
- Serious Injury
- Fatal

**Bicycle Involved Crashes by Time**
- Bicycle Involved
- Serious Injury
- Fatal

Pedestrian Involved Crash Trends

**Pedestrian Involved Crashes by Severity**
- All Crashes
- Serious Injury
- Fatal

**Pedestrian Involved Crashes by Time**
- Pedestrian Involved
- Serious Injury
- Fatal
CENTRAL CITY
CRASH TRENDS (2014-2018)

12,268
Total Crashes

245
Bicycle Involved Crashes

304
Pedestrian Involved Crashes

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

56% increase in fatalities since 2014
34% increase in serious injury crashes since 2014

Who is Involved?
What Type of Crashes are Occurring?

Crashes by Type

Fatal Crashes by Type

Serious Injury Crashes by Type

Where are the Crashes Happening?

Crashes by Location
When do Crashes Occur?

Total Crashes by Day of Week

Total Crashes by Month

Total Crashes by Time of Day

Vehicle Only
Pedestrian Involved
Bicycle Involved
DEER VALLEY
CRASH TRENDS (2014-2018)

12,592
Total Crashes

177
Bicycle Involved
Crashes

216
Pedestrian Involved
Crashes

Total Crashes by Year

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

17% decrease in fatalities since 2014

15% decrease in serious injury crashes since 2014

Who is Involved?
What Type of Crashes are Occurring?

Crashes by Type

- Rear End: 30%
- Angle: 20%
- Sideswipe: 17%
- Left Turn: 15%
- Single Vehicle: 10%
- Pedestrian: 3%
- Bicycle: 2%
- Head On: 1%
- U Turn: 1%
- Backing: 1%
- Other: 0%
- Unknown: 0%

Fatal Crashes by Type

- Pedestrian: 31%
- Single Vehicle: 22%
- Left Turn: 20%
- Angle: 19%
- Unknown: 2%
- Sideswipe: 2%
- Rear End: 2%
- Bicycle: 1%
- Head On: 1%

Serious Injury Crashes by Type

- Left Turn: 28%
- Angle: 24%
- Single Vehicle: 14%
- Pedestrian: 12%
- Sideswipe: 8%
- Rear End: 7%
- Bicycle: 3%
- Head On: 2%
- U Turn: 2%

Where are the Crashes Happening?

Crashes by Location

- Not Intersection Related: 28.5%
- Intersection Related: 71.5%
When do Crashes Occur?

Total Crashes by Day of Week

Total Crashes by Month

Total Crashes by Time of Day
Bicycle Involved Crash Trends

**Bicyclist Involved Crashes by Severity**

- **All Crashes**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Year</th>
<th>All Crashes</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>39</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>37</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2016</td>
<td>40</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>31</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2018</td>
<td>30</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

**Bicycle Involved Crashes by Time**

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Bicycle Involved</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td>47</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td>48</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td>71</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td>70</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td>68</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td>68</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>6 PM - 9 PM</td>
<td>68</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>9 PM - Midnight</td>
<td>68</td>
<td>20</td>
<td>6</td>
</tr>
</tbody>
</table>

Pedestrian Involved Crash Trends

**Pedestrian Involved Crashes by Severity**

- **All Crashes**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Year</th>
<th>All Crashes</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>47</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>2015</td>
<td>48</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>2016</td>
<td>71</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>2017</td>
<td>70</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>2018</td>
<td>68</td>
<td>20</td>
<td>6</td>
</tr>
</tbody>
</table>

**Pedestrian Involved Crashes by Time**

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Pedestrian Involved</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td>47</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td>48</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td>71</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td>70</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td>68</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td>68</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>6 PM - 9 PM</td>
<td>68</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>9 PM - Midnight</td>
<td>68</td>
<td>20</td>
<td>6</td>
</tr>
</tbody>
</table>
DESSERT VIEW
CRASH TRENDS (2014-2018)

2,254 Total Crashes
19 Bicycle Involved Crashes
14 Pedestrian Involved Crashes

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

No fatalities reported in 2018
20% decrease in serious injury crashes since 2014

Who is Involved?

Vehicle Only
Bicycle Involved
Pedestrian Involved
What Type of Crashes are Occurring?

Crashes by Type

- Rear End: 44%
- Angle: 14%
- Sideswipe: 10%
- Left Turn: 14%
- Single Vehicle: 15%
- Pedestrian: 1%
- Bicycle: 1%
- Head On: 0%
- U Turn: 1%
- Backing: 0%
- Other: 0%

Fatal Crashes by Type

- Left Turn: 45%
- Angle: 27%
- Bicycle: 9%
- Single Vehicle: 9%
- Rear End: 9%

Serious Injury Crashes by Type

- Rear End: 47%
- Single Vehicle: 35%
- Left Turn: 24%
- Angle: 18%
- Pedestrian: 9%
- Bicycle: 7%
- Sideswipe: 5%
- Head On: 2%

Where are the Crashes Happening?

Crashes by Location

- Not Intersection Related: 41.8%
- Intersection Related: 58.2%
When do Crashes Occur?

Total Crashes by Day of Week
- Total Crashes
- Fatal and Serious Injury

Total Crashes by Month
- Total Crashes
- Fatal and Serious Injury

Total Crashes by Time of Day
- Vehicle Only
- Pedestrian Involved
- Bicycle Involved
ENCANTO
CRASH TRENDS (2014-2018)

9,816
Total Crashes

195
Bicycle Involved
Crashes

284
Pedestrian
Involved Crashes

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

180% increase in fatalities since 2014

23% increase in serious injury crashes since 2014

Who is Involved?
What Type of Crashes are Occurring?

Crashes by Type

- **Rear End**: 33%
- **Angle**: 19%
- **Sideswipe**: 19%
- **Left Turn**: 14%
- **Single Vehicle**: 8%
- **Pedestrian**: 3%
- **Bicycle**: 2%
- **Head On**: 1%
- **U Turn**: 1%
- **Backing**: 1%
- **Other**: 0%
- **Unknown**: 0%

Fatal Crashes by Type

- **Pedestrian**: 51%
- **Single Vehicle**: 28%
- **Bicycle**: 6%
- **Bicycle**: 4%
- **Left Turn**: 4%
- **Rear End**: 2%
- **Head On**: 2%
- **Sideswipe**: 2%

Serious Injury Crashes by Type

- **Pedestrian**: 31%
- **Angle**: 28%
- **Left Turn**: 21%
- **Single Vehicle**: 13%
- **Rear End**: 13%
- **Bicycle**: 11%
- **Sideswipe**: 8%
- **Head On**: 3%
- **U Turn**: 1%

Where are the Crashes Happening?

Crashes by Location

- **Not Intersection Related**: 21.1%
- **Intersection Related**: 78.9%
When do Crashes Occur?

Total Crashes by Day of Week

- All Crashes
- Fatal and Serious Injury

Total Crashes by Month

- All Crashes
- Fatal and Serious Injury

Total Crashes by Time of Day

- Vehicle Only
- Pedestrian Involved
- Bicycle Involved
Bicycle Involved Crash Trends

Bicyclist Involved Crashes by Severity

<table>
<thead>
<tr>
<th>Year</th>
<th>All Crashes</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>34</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>39</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2016</td>
<td>48</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>48</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2018</td>
<td>26</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

Bicycle Involved Crashes by Time

<table>
<thead>
<tr>
<th>Time</th>
<th>Bicycle Involved</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td>10%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td>20%</td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td>30%</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td>40%</td>
<td>40%</td>
<td>0%</td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td>50%</td>
<td>50%</td>
<td>0%</td>
</tr>
<tr>
<td>6 PM - 9 PM</td>
<td>60%</td>
<td>60%</td>
<td>0%</td>
</tr>
<tr>
<td>9 PM - Midnight</td>
<td>70%</td>
<td>70%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Pedestrian Involved Crash Trends

Pedestrian Involved Crashes by Severity

<table>
<thead>
<tr>
<th>Year</th>
<th>All Crashes</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>54</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>2015</td>
<td>61</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>2016</td>
<td>61</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>2017</td>
<td>57</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>2018</td>
<td>51</td>
<td>17</td>
<td>6</td>
</tr>
</tbody>
</table>

Pedestrian Involved Crashes by Time

<table>
<thead>
<tr>
<th>Time</th>
<th>Pedestrian Involved</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td>10%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td>20%</td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td>30%</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td>40%</td>
<td>40%</td>
<td>0%</td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td>50%</td>
<td>50%</td>
<td>0%</td>
</tr>
<tr>
<td>6 PM - 9 PM</td>
<td>60%</td>
<td>60%</td>
<td>0%</td>
</tr>
<tr>
<td>9 PM - Midnight</td>
<td>70%</td>
<td>70%</td>
<td>0%</td>
</tr>
</tbody>
</table>
ESTRELLA
CRASH TRENDS (2014-2018)

10,780
Total Crashes

100
Bicycle Involved Crashes

142
Pedestrian Involved Crashes

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

38% increase in fatalities since 2014

10% decrease in serious injury crashes since 2014

Who is Involved?
What Type of Crashes are Occurring?

Crashes by Type

- Rear End: 28%
- Angle: 21%
- Sideswipe: 18%
- Left Turn: 15%
- Single Vehicle: 12%
- Pedestrian: 1%
- Bicycle: 1%
- Head On: 1%
- U Turn: 1%
- Backing: 1%
- Other: 0%
- Unknown: 0%

Fatal Crashes by Type

- Pedestrian: 37%
- Angle: 17%
- Left Turn: 17%
- Single Vehicle: 10%
- Head On: 8%
- Bike: 7%
- Rear End: 3%
- Unknown: 2%

Serious Injury Crashes by Type

- Angle: 28%
- Left Turn: 17%
- Single Vehicle: 14%
- Rear End: 13%
- Pedestrian: 10%
- Bike: 7%
- Sideswipe: 7%
- Head On: 2%
- U Turn: 1%
- Backing: 0%

Where are the Crashes Happening?

Crashes by Location

- Not Intersection Related: 29.9%
- Intersection Related: 70.1%
When do Crashes Occur?

Total Crashes by Day of Week

Total Crashes by Month

Total Crashes by Time of Day

Vehicle Only
Pedestrian Involved
Bicycle Involved
Bicycle Involved Crash Trends

Bicyclist Involved Crashes by Severity

- All Crashes
- Serious Injury
- Fatal

Bicycle Involved Crashes by Time

- Bicycle Involved
- Serious Injury
- Fatal

Pedestrian Involved Crash Trends

Pedestrian Involved Crashes by Severity

- All Crashes
- Serious Injury
- Fatal

Pedestrian Involved Crashes by Time

- Pedestrian Involved
- Serious Injury
- Fatal
LAVEEN
CRASH TRENDS (2014-2018)

2,771
Total Crashes

32
Bicycle Involved
Crashes

47
Pedestrian
Involved
Crashes

No fatalities reported in
2018
No change in number of
serious injury crashes
since 2014

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

Who is Involved?
What Type of Crashes are Occurring?

Crashes by Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear End</td>
<td>31%</td>
</tr>
<tr>
<td>Angle</td>
<td>18%</td>
</tr>
<tr>
<td>Sideswipe</td>
<td>12%</td>
</tr>
<tr>
<td>Left Turn</td>
<td>15%</td>
</tr>
<tr>
<td>Single Vehicle</td>
<td>18%</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>2%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>1%</td>
</tr>
<tr>
<td>Head On</td>
<td>1%</td>
</tr>
<tr>
<td>U Turn</td>
<td>1%</td>
</tr>
<tr>
<td>Backing</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>0%</td>
</tr>
<tr>
<td>Unknown</td>
<td>0%</td>
</tr>
</tbody>
</table>

Fatal Crashes by Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian</td>
<td>31%</td>
</tr>
<tr>
<td>Single Vehicle</td>
<td>22%</td>
</tr>
<tr>
<td>Left Turn</td>
<td>20%</td>
</tr>
<tr>
<td>Angle</td>
<td>19%</td>
</tr>
<tr>
<td>Unknown</td>
<td>2%</td>
</tr>
<tr>
<td>Sideswipe</td>
<td>2%</td>
</tr>
<tr>
<td>Rear End</td>
<td>2%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>1%</td>
</tr>
<tr>
<td>Head On</td>
<td>1%</td>
</tr>
<tr>
<td>U Turn</td>
<td>1%</td>
</tr>
</tbody>
</table>

Serious Injury Crashes by Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Turn</td>
<td>28%</td>
</tr>
<tr>
<td>Angle</td>
<td>24%</td>
</tr>
<tr>
<td>Single Vehicle</td>
<td>14%</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>12%</td>
</tr>
<tr>
<td>Sideswipe</td>
<td>8%</td>
</tr>
<tr>
<td>Rear End</td>
<td>7%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>3%</td>
</tr>
<tr>
<td>Head On</td>
<td>2%</td>
</tr>
<tr>
<td>U Turn</td>
<td>2%</td>
</tr>
<tr>
<td>U Turn</td>
<td>0%</td>
</tr>
</tbody>
</table>

Where are the Crashes Happening?

Crashes by Location

- Not Intersection Related, 29.9%
- Intersection Related, 70.1%
Bicycle Involved Crash Trends

Bicyclist Involved Crashes by Severity

<table>
<thead>
<tr>
<th>Year</th>
<th>All Crashes</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>12</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2018</td>
<td>6</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Bicycle Involved Crashes by Time

<table>
<thead>
<tr>
<th>Time</th>
<th>Bicycle Involved</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 PM - 9 PM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 PM - Midnight</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pedestrian Involved Crash Trends

Pedestrian Involved Crashes by Severity

<table>
<thead>
<tr>
<th>Year</th>
<th>All Crashes</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>7</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>11</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2016</td>
<td>6</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2017</td>
<td>9</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2018</td>
<td>14</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

Pedestrian Involved Crashes by Time

<table>
<thead>
<tr>
<th>Time</th>
<th>Pedestrian Involved</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 PM - 9 PM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 PM - Midnight</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MARYVALE CRASH TRENDS (2014-2018)

21,113 Total Crashes

219 Bicycle Involved Crashes

458 Pedestrian Involved Crashes

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Serious</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>50</td>
<td>10</td>
</tr>
<tr>
<td>2015</td>
<td>70</td>
<td>15</td>
</tr>
<tr>
<td>2016</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>2017</td>
<td>80</td>
<td>15</td>
</tr>
<tr>
<td>2018</td>
<td>60</td>
<td>10</td>
</tr>
</tbody>
</table>

33% increase in fatalities since 2014

10% increase in serious injury crashes since 2014

Who is Involved?

Vehicle Only

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Crashes</td>
<td>3669</td>
<td>4011</td>
<td>4379</td>
<td>4589</td>
<td>4465</td>
</tr>
</tbody>
</table>

Bicycle Involved

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle Involved</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Pedestrian Involved

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian Involved</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
What Type of Crashes are Occurring?

Crashes by Type

- Rear End: 27%
- Angle: 22%
- Sideswipe: 15%
- Left Turn: 17%
- Single Vehicle: 13%
- Pedestrian: 2%
- Bicyclist: 1%
- Head On: 1%
- U Turn: 1%
- Backing: 1%
- Other: 0%
- Unknown: 0%

Fatal Crashes by Type

- Pedestrian: 41%
- Left Turn: 15%
- Angle: 12%
- Head On: 11%
- Single Vehicle: 8%
- Sideswipe: 4%
- Bicyclist: 4%
- Rear End: 4%
- Other: 1%
- Unknown: 1%
- U Turn: 0%

Serious Injury Crashes by Type

- Left Turn: 21%
- Pedestrian: 20%
- Angle: 18%
- Single Vehicle: 13%
- Rear End: 12%
- Sideswipe: 7%
- Bike: 5%
- Head On: 4%
- U Turn: 1%
- Other: 0%

Where are the Crashes Happening?

Crashes by Location

- Not Intersection Related: 28.4%
- Intersection Related: 71.6%
When do Crashes Occur?

Total Crashes by Day of Week

Total Crashes by Month

Total Crashes by Time of Day

Vehicle Only
Pedestrian Involved
Bicycle Involved
Bicycle Involved Crash Trends

**Bicyclist Involved Crashes by Severity**

- **All Crashes**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>49</td>
<td>48</td>
<td>43</td>
<td>48</td>
<td>43</td>
</tr>
<tr>
<td>2015</td>
<td>4</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>2016</td>
<td>4</td>
<td>7</td>
<td>7</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2017</td>
<td>4</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2018</td>
<td>4</td>
<td>7</td>
<td>7</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Bicycle Involved Crashes by Time**

- **Bicycle Involved**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Time</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td>7</td>
<td>11</td>
<td>6</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6 PM - 9 PM</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9 PM - Midnight</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Pedestrian Involved Crash Trends

**Pedestrian Involved Crashes by Severity**

- **All Crashes**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2015</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2017</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2018</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

**Pedestrian Involved Crashes by Time**

- **Pedestrian Involved**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Time</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6 PM - 9 PM</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9 PM - Midnight</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
NORTH GATEWAY
CRASH TRENDS (2014-2018)

Total Crashes

- 491
- 12 Bicycle Involved Crashes
- 3 Pedestrian Involved Crashes

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year
- 50% decrease in fatalities since 2014
- 100% increase in serious injury crashes since 2014

Who is Involved?
What Type of Crashes are Occurring?

Crashes by Type

- Rear End: 20%
- Angle: 22%
- Sideswipe: 13%
- Left Turn: 13%
- Single Vehicle: 26%
- Pedestrian: 1%
- Bicycle: 2%
- Head On: 1%
- U Turn: 1%
- Backing: 0%
- Other: 0%

Fatal Crashes by Type

- Single Vehicle: 88%
- Pedestrian: 13%

Serious Injury Crashes by Type

- Single Vehicle: 32%
- Rear End: 27%
- Bicycle: 14%
- Left Turn: 9%
- Angle: 9%
- U Turn: 5%
- Sideswipe: 5%

Where are the Crashes Happening?

Crashes by Location

- Not Intersection Related: 38.5%
- Intersection Related: 61.5%
When do Crashes Occur?

### Total Crashes by Day of Week

![Chart showing total crashes by day of week.](chart)

- **Sun**
- **Mon**
- **Tue**
- **Wed**
- **Thu**
- **Fri**
- **Sat**

- **All Crashes**
- **Fatal and Serious Injury**

### Total Crashes by Month

![Chart showing total crashes by month.](chart)

- **Jan**
- **Feb**
- **Mar**
- **Apr**
- **May**
- **Jun**
- **Jul**
- **Aug**
- **Sep**
- **Oct**
- **Nov**
- **Dec**

- **All Crashes**
- **Fatal and Serious Injury**

### Total Crashes by Time of Day

![Chart showing total crashes by time of day.](chart)

- **Midnight - 3 AM**
- **3 AM - 6 AM**
- **6 AM - 9 AM**
- **9 AM - Noon**
- **Noon - 3 PM**
- **3 PM - 6 PM**
- **6 PM - 9 PM**
- **9 PM - Midnight**

- **Vehicle Only**
- **Pedestrian Involved**
- **Bicycle Involved**
Bicycle Involved Crash Trends

Bicycle Involved Crashes by Severity

- **All Crashes**
- **Serious Injury**
- **Fatal**

### 2014
- All Crashes: 5
- Serious Injury: 1
- Fatal: 0

### 2015
- All Crashes: 2
- Serious Injury: 1
- Fatal: 0

### 2016
- All Crashes: 4
- Serious Injury: 1
- Fatal: 0

### 2017
- All Crashes: 4
- Serious Injury: 0
- Fatal: 0

### 2018
- All Crashes: 4
- Serious Injury: 1
- Fatal: 0

Bicycle Involved Crashes by Time

- **Bicycle Involved**
- **Serious Injury**
- **Fatal**

Pedestrian Involved Crash Trends

Pedestrian Involved Crashes by Severity

- **All Crashes**
- **Serious Injury**
- **Fatal**

### 2014
- All Crashes: 97
- Serious Injury: 21
- Fatal: 13

### 2015
- All Crashes: 91
- Serious Injury: 16
- Fatal: 8

### 2016
- All Crashes: 116
- Serious Injury: 34
- Fatal: 15

### 2017
- All Crashes: 108
- Serious Injury: 22
- Fatal: 15

### 2018
- All Crashes: 129
- Serious Injury: 27
- Fatal: 22

Pedestrian Involved Crashes by Time

- **Pedestrian Involved**
- **Serious Injury**
- **Fatal**

Midnight - 3 AM
- All Crashes: 21
- Serious Injury: 13
- Fatal: 13

3 AM - 6 AM
- All Crashes: 16
- Serious Injury: 8
- Fatal: 8

6 AM - 9 AM
- All Crashes: 34
- Serious Injury: 15
- Fatal: 15

9 AM - Noon
- All Crashes: 22
- Serious Injury: 15
- Fatal: 15

Noon - 3 PM
- All Crashes: 27
- Serious Injury: 22
- Fatal: 22

3 PM - 6 PM
- All Crashes: 129
- Serious Injury: 27
- Fatal: 22

6 PM - 9 PM
- All Crashes: 108
- Serious Injury: 22
- Fatal: 15

9 PM - Midnight
- All Crashes: 116
- Serious Injury: 34
- Fatal: 15

[Graphs showing data for bicycle and pedestrian crashes by severity and time]
NORTH MOUNTAIN
CRASH TRENDS (2014-2018)

15,749
Total Crashes

297
Bicycle Involved
Crashes

408
Pedestrian
Involved Crashes

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

81% increase in fatalities since 2014

3% decrease in serious injury crashes since 2014

Who is Involved?

Vehicle Only

Bicycle Involved

Pedestrian Involved
What Type of Crashes are Occurring?

Crashes by Type

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear End</td>
<td>29%</td>
</tr>
<tr>
<td>Angle</td>
<td>21%</td>
</tr>
<tr>
<td>Sideswipe</td>
<td>15%</td>
</tr>
<tr>
<td>Left Turn</td>
<td>17%</td>
</tr>
<tr>
<td>Single Vehicle</td>
<td>11%</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>3%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>2%</td>
</tr>
<tr>
<td>Head On</td>
<td>1%</td>
</tr>
<tr>
<td>U Turn</td>
<td>1%</td>
</tr>
<tr>
<td>Backing</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>0%</td>
</tr>
<tr>
<td>Unknown</td>
<td>0%</td>
</tr>
</tbody>
</table>

Fatal Crashes by Type

- Rear End: 26%
- Angle: 19%
- Sideswipe: 18%
- Left Turn: 18%
- Single Vehicle: 13%
- Pedestrian: 9%
- Bicycle: 8%
- Head On: 3%
- U Turn: 3%
- Backing: 3%
- Other: 0%
- Unknown: 0%

Crashes by Location

- Not Intersection Related: 29.1%
- Intersection Related: 70.9%

Where are the Crashes Happening?

Crashes by Location

- Left Turn: 19%
- Pedestrian: 18%
- Angle: 13%
- Single Vehicle: 9%
- Rear End: 8%
- Bike: 3%
- Head On: 3%
- Sideswipe: 1%
- U Turn: 1%
When do Crashes Occur?

**Total Crashes by Day of Week**

- **All Crashes**
- **Fatal and Serious Injury**

**Total Crashes by Month**

- **All Crashes**
- **Fatal and Serious Injury**

**Total Crashes by Time of Day**

- **Vehicle Only**
- **Pedestrian Involved**
- **Bicycle Involved**
Bicycle Involved Crash Trends

Bicyclist Involved Crashes by Severity

- All Crashes
- Serious Injury
- Fatal

Pedestrian Involved Crashes by Severity

- All Crashes
- Serious Injury
- Fatal

Bicycle Involved Crashes by Time

- Bicycle Involved
- Serious Injury
- Fatal

Pedestrian Involved Crashes by Time

- Pedestrian Involved
- Serious Injury
- Fatal
PARADISE VALLEY CRASH TRENDS (2014-2018)

10,267 Total Crashes
170 Bicycle Involved Crashes
184 Pedestrian Involved Crashes

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

38% increase in fatalities since 2014
41% decrease in serious injury crashes since 2014

Who is Involved?

Vehicle Only

Bicycle Involved

Pedestrian Involved
What Type of Crashes are Occurring?

Crashes by Type

Fatal Crashes by Type

Serious Injury Crashes by Type

Where are the Crashes Happening?

Crashes by Location
When do Crashes Occur?

**Total Crashes by Day of Week**

- **All Crashes**
- **Fatal and Serious Injury**

**Total Crashes by Month**

- **All Crashes**
- **Fatal and Serious Injury**

**Total Crashes by Time of Day**

- **Vehicle Only**
- **Pedestrian Involved**
- **Bicycle Involved**
Bicycle Involved Crash Trends

**Bicyclist Involved Crashes by Severity**

- **All Crashes**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Year</th>
<th>All Crashes</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>31</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>37</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>39</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>38</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2018</td>
<td>25</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

**Bicycle Involved Crashes by Time**

- **Bicycle Involved**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Time</th>
<th>Bicycle Involved</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td>37</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td>22</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td>48</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td>48</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td>35</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td>42</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

Pedestrian Involved Crash Trends

**Pedestrian Involved Crashes by Severity**

- **All Crashes**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Year</th>
<th>All Crashes</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>37</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>2015</td>
<td>22</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2016</td>
<td>48</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>2017</td>
<td>35</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>2018</td>
<td>42</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

**Pedestrian Involved Crashes by Time**

- **Pedestrian Involved**
- **Serious Injury**
- **Fatal**

<table>
<thead>
<tr>
<th>Time</th>
<th>Pedestrian Involved</th>
<th>Serious Injury</th>
<th>Fatal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight - 3 AM</td>
<td>37</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>3 AM - 6 AM</td>
<td>22</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>6 AM - 9 AM</td>
<td>48</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>9 AM - Noon</td>
<td>48</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>Noon - 3 PM</td>
<td>35</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>3 PM - 6 PM</td>
<td>42</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

Pedestrian Involved Crashes by Time
PARADISE VALLEY

Crash Density

Total Crashes by Severity

High Crash Intersection and Segments

Pedestrian and Bicycle Crashes

- Fatal
- Serious Injury

Low Density - High Density

- Tier 1 Intersection
- Tier 1 Segment
- Tier 2 Intersection
- Tier 2 Segment
- Pedestrian
- Bicyclist
RIO VISTA
CRASH TRENDS (2014-2018)

108
Total Crashes

1
Bicycle Involved Crashes

1
Pedestrian Involved Crashes

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

Who is Involved?
What Type of Crashes are Occurring?

Crashes by Type

- Rear End: 12%
- Angle: 19%
- Sideswipe: 15%
- Left Turn: 15%
- Single Vehicle: 34%
- Pedestrian: 1%
- Bicycle: 1%
- Head On: 1%
- U Turn: 1%
- Backing: 1%

Fatal Crashes by Type

- Single Vehicle: 100%

Serious Injury Crashes by Type

- Left Turn: 20%
- Angle: 20%
- Sideswipe: 20%
- Pedestrian: 20%

Where are the Crashes Happening?

Crashes by Location

- Not Intersection Related: 39.8%
- Intersection Related: 60.2%
When do Crashes Occur?

**Total Crashes by Day of Week**

- Total Crashes
- Fatal and Serious Injury

**Total Crashes by Month**

- Total Crashes
- Fatal and Serious Injury

**Total Crashes by Time of Day**

- Vehicle Only
- Pedestrian Involved
- Bicycle Involved
SOUTH MOUNTAIN 
CRASH TRENDS (2014-2018)

16,836
Total Crashes

289
Bicycle Involved
Crashes

541
Pedestrian
Involved Crashes

How Severe are the Crashes?

Serious Injury and Fatal Crashes by Year

13% increase in fatalities since 2014
55% increase in serious injury crashes since 2014

Who is Involved?

Vehicle Only
Bicycle Involved
Pedestrian Involved
What Type of Crashes are Occurring?

**Crashes by Type**

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear End</td>
<td>30%</td>
</tr>
<tr>
<td>Angle</td>
<td>20%</td>
</tr>
<tr>
<td>Sideswipe</td>
<td>17%</td>
</tr>
<tr>
<td>Left Turn</td>
<td>15%</td>
</tr>
<tr>
<td>Single Vehicle</td>
<td>10%</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>3%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>2%</td>
</tr>
<tr>
<td>Head On</td>
<td>1%</td>
</tr>
<tr>
<td>U Turn</td>
<td>1%</td>
</tr>
<tr>
<td>Backing</td>
<td>1%</td>
</tr>
<tr>
<td>Other</td>
<td>0%</td>
</tr>
<tr>
<td>Unknown</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Fatal Crashes by Type**

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian</td>
<td>58%</td>
</tr>
<tr>
<td>Left Turn</td>
<td>11%</td>
</tr>
<tr>
<td>Angle</td>
<td>7%</td>
</tr>
<tr>
<td>Single Vehicle</td>
<td>6%</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>6%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>4%</td>
</tr>
<tr>
<td>Head On</td>
<td>3%</td>
</tr>
<tr>
<td>Sideswipe</td>
<td>2%</td>
</tr>
<tr>
<td>U Turn</td>
<td>1%</td>
</tr>
</tbody>
</table>

**Serious Injury Crashes by Type**

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian</td>
<td>37%</td>
</tr>
<tr>
<td>Left Turn</td>
<td>28%</td>
</tr>
<tr>
<td>Angle</td>
<td>21%</td>
</tr>
<tr>
<td>Rear End</td>
<td>18%</td>
</tr>
<tr>
<td>Single Vehicle</td>
<td>13%</td>
</tr>
<tr>
<td>Bike</td>
<td>11%</td>
</tr>
<tr>
<td>Sideswipe</td>
<td>5%</td>
</tr>
<tr>
<td>Head On</td>
<td>3%</td>
</tr>
<tr>
<td>Backing</td>
<td>1%</td>
</tr>
</tbody>
</table>

**Where are the Crashes Happening?**

**Crashes by Location**

- Not Intersection Related: 26.4%
- Intersection Related: 73.6%
When do Crashes Occur?

**Total Crashes by Day of Week**

- **All Crashes**
- **Fatal and Serious Injury**

**Total Crashes by Month**

- **All Crashes**
- **Fatal and Serious Injury**

**Total Crashes by Time of Day**

- **Vehicle Only**
- **Pedestrian Involved**
- **Bicycle Involved**