# ARIZONA
# Vulnerable Road User Safety Assessment
## November 2023

ADOT | Arizona Department of Transportation

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# STATUTORY NOTICE

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23 USC 409 – Discovery and admission as evidence of certain reports and surveys

Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement or potential accident sites, hazardous roadway conditions, or railway-highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

# ADOT DIRECTOR'S LETTER

*November 15, 2023*

*Ensuring the safety of every Arizonan on our roads is paramount. This is especially true for our most vulnerable road users: pedestrians, bicyclists, and road workers.*

*In line with our commitment to transportation safety, I am pleased to share Arizona's Vulnerable Road User Safety Assessment, prepared by the Arizona Department of Transportation (ADOT).*

*This statewide strategic plan focuses on reducing injuries and fatalities among vulnerable road users (VRUs) in Arizona. The assessment evaluates historical crashes involving VRUs, VRU activity levels, and locations of underserved populations and proposes strategies and programs to improve VRU safety in Arizona.*

*I extend my gratitude to all partners and stakeholders for their dedication to creating safer travels for everyone.*

*Sincerely,*

DocuSigned by:
Jennifer Toth
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*Jennifer Toth*

*ADOT Director*

# EXECUTIVE SUMMARY

The Vulnerable Road User Safety Assessment (VRUSA) is a statewide initiative to improve safety for Vulnerable Road Users (VRU) in the Arizona. The assessment evaluates historical crashes involving VRUs, VRU activity levels, locations of underserved populations, and stakeholder consultation to develop strategies and programs to improve VRU safety in Arizona.

**A VULNERABLE ROAD USER (VRU) IS:**

- A non-motorist (pedestrian, bicyclist, other cyclist)
- Person on personal conveyance
- Worker on foot in a roadway work zone
- Roadway incident responder (e.g., first responder) working a roadway incident on foot
- Does not include motorcycle or e-bike riders

## Safety Improvement Areas

Quantitative analysis was performed to identify Safety Improvement Areas (SIAs) in Arizona. SIAs are locations that likely require more attention and resources for safety enhancements to improve safety for VRUs. The quantitative analysis process followed to identify SIAs included analysis of existing VRU crash data, equity considerations, and VRU activity.

- Phoenix
- White Mountain Apache Tribe
- Yuma
- Tucson
- Gila River Indian Community
- Mesa
- Golden Valley
- Prescott
- Catalina
- Apache Junction

## Program of Projects and Strategies

A program of projects and strategies was developed to be utilized by agencies throughout the state, including a state safety program inventory and safety improvement strategies. The safety program inventory aimed to provide information on the overall scope of VRU safety efforts in the state and aid stakeholders in making connections. Arizona's safety program inventory comprises agencies, plans, programs, funding sources, and databases applicable to VRU safety.

Safety improvement strategies were developed following a review of existing safety efforts and discussion with stakeholders. Countermeasures from Stakeholder Meeting 1, Stakeholder Meeting 2, and existing local, regional, and statewide plans were summarized to develop a comprehensive list of safety improvement countermeasures. Identified countermeasures were then applied to a wide variety of criteria to develop the VRU Safety Countermeasures Selection Matrix Tool, intended to be used by stakeholders at all levels of government to aid the selection of appropriate countermeasures to address VRU safety challenges in their community.

The VRU Safety Countermeasures Selection Matrix Tool is categorized by type (Engineering, Education, Enforcement, Emergency Services, and Data Collection) and cost of the strategy (low, medium, and high). Each countermeasure was assessed against the SSA Effectiveness Criteria (Separated Space, Separated Time, Increase Attentiveness and Awareness, Reduce Speeds, and Reduce Impact Forces) and applicability criteria dependent on the countermeasure type.

# INTRODUCTION

The Vulnerable Road User Safety Assessment (VRUSA) is a statewide initiative to improve safety for Vulnerable Road Users (VRU) in the state of Arizona. The assessment evaluates historical crashes involving VRUs, VRU activity levels, and locations of underserved populations to develop strategies and programs to improve VRU safety in Arizona. According to presidential Executive Order 13985, underserved populations are those that have been systemically denied a full opportunity to participate in aspects of economic, social, and civic life. The VRUSA was developed in accordance with the federal "Bipartisan Infrastructure Law" and is included as part of the Highway Safety Improvement Program (HSIP). The VRUSA applies to all public roadways in Arizona, not just those owned or operated by ADOT.

## Background and Purpose

In recent years, VRU fatalities have been a growing issue throughout the country. The National Highway Traffic Safety Administration (NHTSA) reported that fatalities for pedestrians have increased by 13% from 2020 to 2021, and by 5% for bicyclists across the nation. Recent trends have made addressing VRU safety a priority for the Federal Highway Administration (FHWA).

The VRUSA, required of each state by FHWA, is an assessment of safety performance focusing on VRUs that will produce a plan to improve safety for VRUs. The VRUSA will serve as a first step in the development of Arizona's 2024 Strategic Highway Safety Plan (SHSP) and Active Transportation Safety Action Plan (ATSAP). Outcomes from the VRUSA will be incorporated in both upcoming plans. Subsequent VRUSAs will be completed with routine SHSP updates.

## What is a VRU?

A VRU is a non-motorist using the roadway network, including pedestrians (people walking), bicyclists (people riding bicycles), other cyclists (e.g., 3-wheeler and 4-wheeler pedalcyclists, excluding e-bike riders), and people on various forms of personal conveyance (e.g., scooters, skateboards). It is important to note that current State statutes and crash-coding do not provide distinct treatment and categorization of the full range of electric mobility devices, including e-bikes, e-scooters, and e-unicycles. Policies should be implemented to provide clarity on treatment and categorization of these modes of travel. VRUs also include workers on foot in a roadway work zone and roadway incident responders on foot. Because of their vulnerability on the roadway network, VRUs are at risk for fatal and serious injury crashes.

**A VULNERABLE ROAD USER (VRU) IS:**

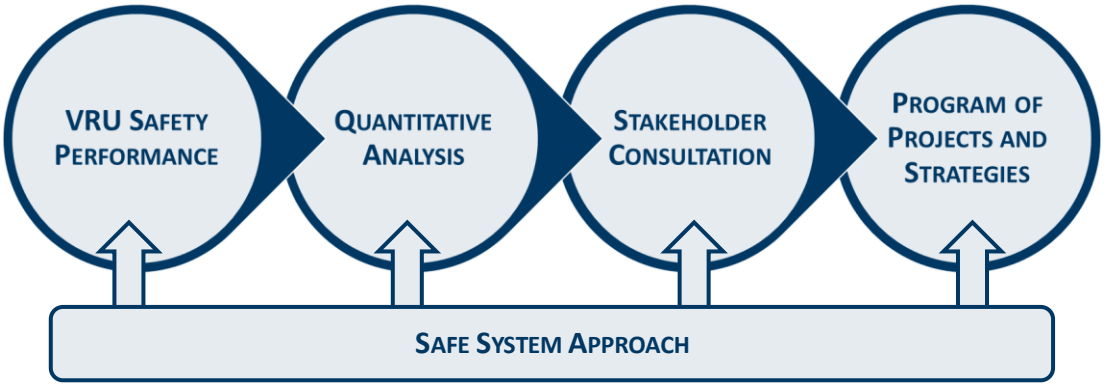
- A non-motorist (pedestrian, bicyclist, other cyclist)
- Person on personal conveyance
- Worker on foot in a roadway work zone
- Roadway incident responder (e.g., first responder) working a roadway incident on foot
- Does not include motorcycle or e-bike riders

## VRUSA Process

The VRUSA is comprised of five sections, shown in **Figure 1**. The five components are:

1. **Safe System Approach.** This section includes a review of how the Safe System Approach was considered as part of the VRUSA, including separating users in time and space, increasing awareness and attentiveness, reducing speeds, and reducing impact forces. The Safe System Approach was also integrated where appropriate throughout all components of the assessment.
2. **VRU Safety Performance.** This section includes an analysis of existing VRU serious injury and fatal crash data from 2013 through 2022. Historical crash data was analyzed by time, location, condition, and victim characteristics to provide an existing snapshot of VRU safety in Arizona. The state's VRU crash and fatality rates were compared to those of the nation.
3. **Quantitative Analysis.** This section includes an analysis of a combination of VRU crash data, equity data of underserved communities and demographics, and VRU activity data to identify VRU Safety Improvement Areas (SIAs) throughout the state.
4. **Stakeholder Consultation.** This section reviews the stakeholder engagement process, including stakeholder meetings, and a summary of outcomes from engagement efforts.
5. **Program of Projects and Strategies.** This section includes the identification of potential projects and strategies to reduce safety risks for VRU in SIAs that can applied to all of Arizona.

*Figure 1. VRUSA Components*



# SAFE SYSTEM APPROACH

The VRUSA implements the Safe System Approach (SSA) framework to inform analysis of existing conditions and development of projects and strategies to improve VRU safety in Arizona. The SSA was considered in all elements of Arizona's VRUSA. The SSA requires all elements of the transportation system shown in the graphic below to work together to create a safer transportation system. It is a holistic and comprehensive approach that provides a guiding framework to make places safer for all people.

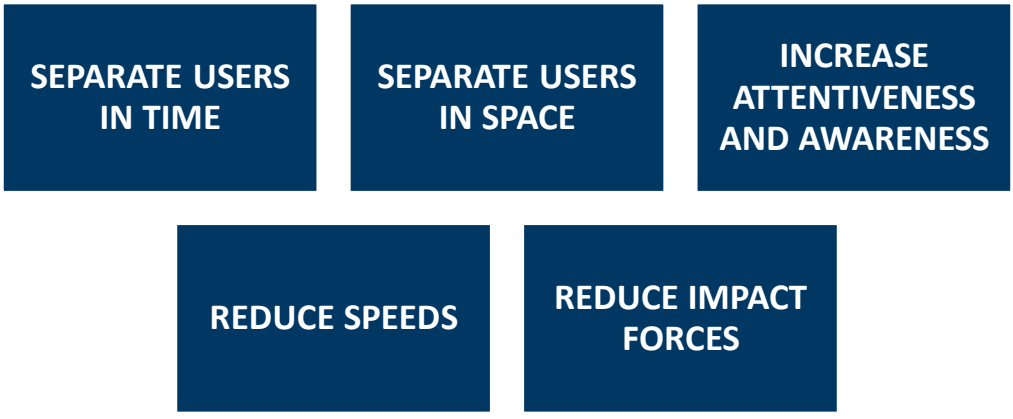
**SAFE SYSTEM APPROACH:**

"A roadway design that emphasizes minimizing the risk of injury or fatality to road users; and that: takes into consideration the possibility and likelihood of human error; accommodates human injury tolerance by taking into consideration likely crash types, resulting impact forces, and the ability of the human body to withstand impact forces; and takes into consideration vulnerable road users"*(23 U.S.C. 148(a)(9))*


*Source: United States Department of Transportation*

The SSA aims to minimize the possibility of injuries or fatalities to road users through a holistic view of the roadway system by implementing adequate roadway design, considering likeliness of human error, and accommodating human injury tolerance by considering impact energy that the body can tolerate. The SSA identifies a key component of roadway safety to be quality data. Data-driven approaches allow municipalities, tribes, and other governmental organizations to prioritize areas of high risk. The SSA includes the components shown in **Figure 2**. All components work together to reduce risk of serious injuries and fatalities.

*Figure 2. SSA Components*




*Source: United States Department of Transportation*

Consideration of the SSA throughout the Arizona VRUSA process is summarized below.

## VRU SAFETY PERFORMANCE

Crash analysis performed in the VRUSA focused on pedestrian and bicyclist serious injuries and fatalities. Focusing analysis on serious and fatal injuries and person data rather than crash data aligns with SSA and USDOT's National Highway Safety Strategy.

## QUANTITATIVE ANALYSIS

Understanding a wide variety of contributing factors to VRU safety in Arizona provided context on how to implement safer roadways and safer conditions for people with more tolerance for errors by travelers. Observing VRU safety under the lens of equity and VRU activity provided a comprehensive analysis of key trends in VRU safety.

## STAKEHOLDER CONSULTATION

VRUSA stakeholder consultation was a collaborative effort among local agencies, regional agencies, state agencies, tribal agencies, and community advocates. Stakeholders provided significant insight into local knowledge of VRU safety-related challenges and SSA-related solutions to aid in the development of the program of projects and strategies in the VRUSA.

## PROGRAM OF PROJECTS AND STRATEGIES

The resulting program of projects and strategies encapsulated existing planning efforts from all levels of government within the state, compiling SSA strategies related to engineering, enforcement, education, emergency services, and data collection.

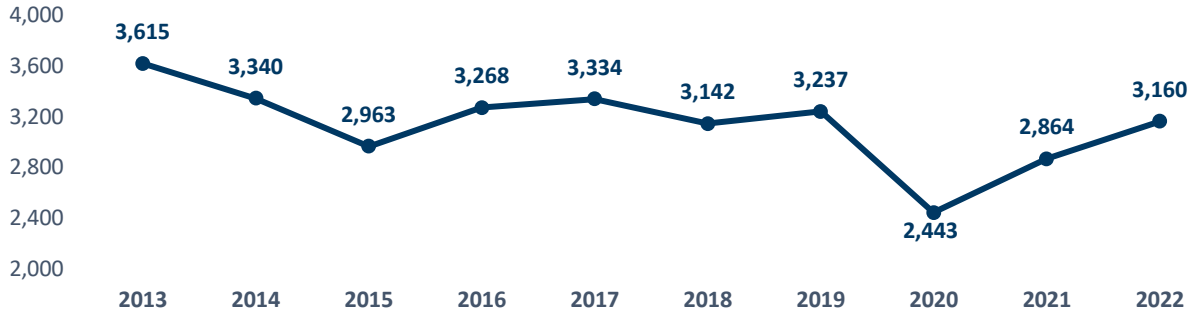
# OVERVIEW OF VRU SAFETY PERFORMANCE

Statewide VRU crash data was provided by the Arizona Department of Transportation (ADOT) for the most recent ten-year period (2013-2022). The historic crash and person data was obtained through ADOT's Arizona Crash Information System (ACIS). Trends amongst persons involved in VRU crashes, particularly serious injury and fatal crashes, were analyzed by numerous factors to review existing VRU safety performance on all public roadways in Arizona.

## Historical Safety Trends

VRUs involved in crashes of any severity level for the past ten years in Arizona are shown in **Figure 3**. The number of VRUs involved in crashes has decreased by 13%, with 2020 (when COVID-19 Pandemic restrictions were in effect) having the lowest number of VRUs involved in crashes. VRU involvement in crashes has increased following the COVID-19 Pandemic, increasing 29% from 2020 to 2022., but it is still lower than in 2019.

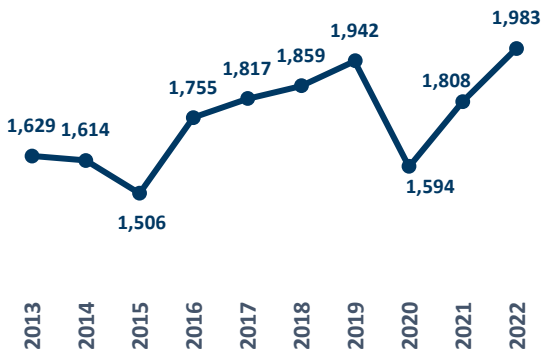
*Figure 3. VRUs Involved in Crashes per Year, 2013-2022*




*Source: Arizona Crash Information System (ACIS), 2013-2022*

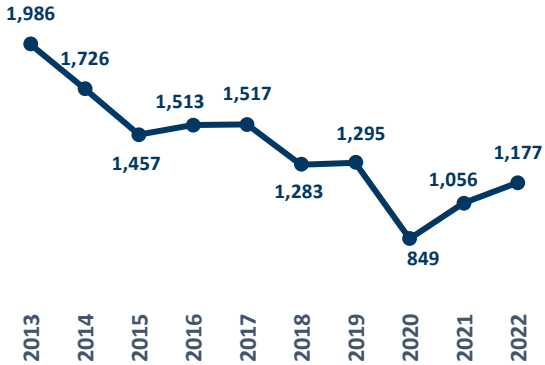
Pedestrians and bicyclists involved in crashes of any severity level by year are shown in **Figure 4** and **Figure 5**, respectively. The number of bicyclists involved in crashes of any severity level has generally decreased over the last ten years (with a 41% decrease between 2013 and 2022) while the number of pedestrians involved in crashes of any severity level has generally increased over the last ten years (with a 22% increase between 2013 and 2022). In 2013, the composition of VRU crashes was 45% pedestrians and 55% bicyclists. In 2022, the composition of VRU crashes was 63% pedestrians and 27% bicyclists. It is important to note pedestrian-involved and bicyclist-involved crashes that do not result in severe injuries or fatalities have historically been believed to be underreported, potentially skewing crash data.

*Figure 4. Pedestrians Involved in Crashes by Year, 2013-2022*




*Source: ACIS, 2013-2022*

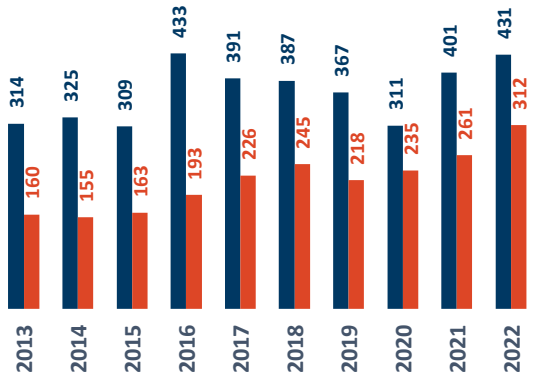
*Figure 5. Bicyclists Involved in Crashes by Year, 2013-2022*




*Source: ACIS, 2013-2022*

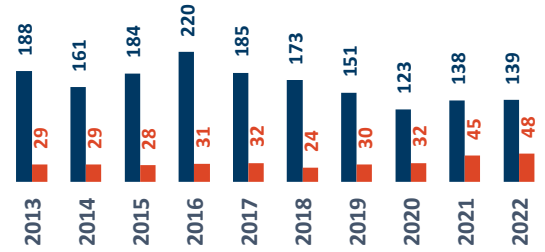
VRU serious injuries and fatalities are shown for pedestrians and bicyclists in **Figure 6** and **Figure 7**, respectively. In the past ten years, there were an average of 217 pedestrian fatalities per year and 33 bicyclist fatalities per year, with there being 312 pedestrian fatalities and 48 bicyclist fatalities in 2022. Pedestrian fatalities have increased by 95% between 2013 and 2022 while bicyclist fatalities have increased by 66% in that same timeframe. For both pedestrians and bicyclists, the ratio of fatalities to total crashes of any severity level has increased between 2013 and 2022, going from 10% to 16% for pedestrians and from 1% to 4% for bicyclists.

*Figure 6. Pedestrian Serious Injuries and Fatalities by Year, 2013-2022*




*Source: ACIS, 2013-2022*

*Figure 7. Bicyclist Serious Injuries and Fatalities by Year, 2013-2022*




*Source: ACIS, 2013-2022*

SERIOUS INJURY FATAL

## VRU Safety by Crash Characteristic

VRU serious injuries and fatalities caused by crashes were analyzed by characteristics of the crash, including time of crash, crash location, and crash conditions as defined in the standardized crash report, to determine if there are readily identifiable trends that likely contribute to unsafe conditions for VRUs.

## VRUS INVOLVED IN CRASHES BY TIME

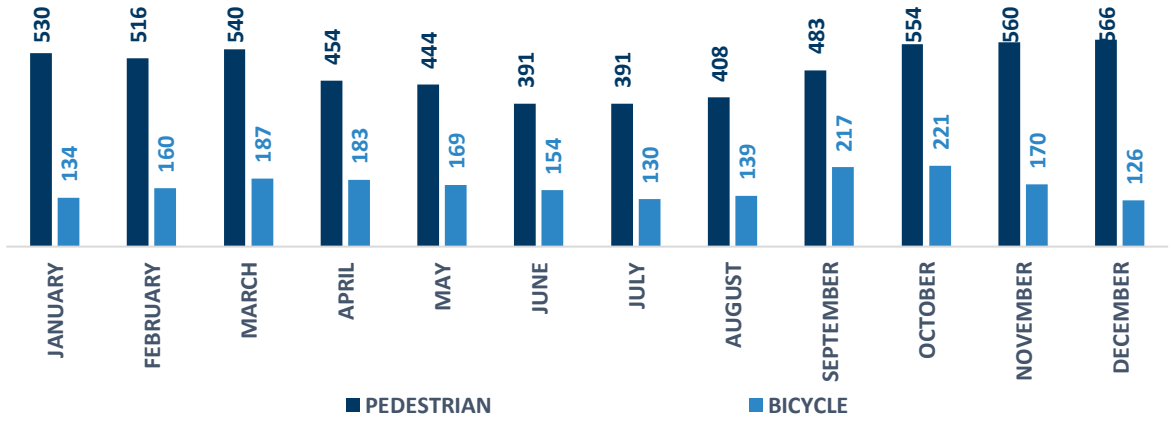
VRUs involved in serious injury and fatal crashes by month during 2013-2022 are shown in **Figure 8**. **Table 1** shows the average number of serious injury and fatal crashes by season. The number of pedestrians involved in serious injury and fatal crashes was higher in the fall and winter months, with an average of 535 pedestrians seriously injured or killed in a crash in the fall and winter (September to February) compared to 438 pedestrians seriously injured or killed in the spring and summer (March to August). The number of bicyclists involved in serious injury and fatal crashes was higher in the spring and fall months, with an average of 191 bicyclists seriously injured or killed in a crash in the spring and fall compared to 141 bicyclists seriously injured or killed in the summer and winter. **Figure 9** shows VRU serious injuries and fatalities by the day of week and time of day during 2013-2022. Pedestrians involved in serious injury and fatal crashes were most common in the evening and overnight, whereas bicyclists involved in serious injury and fatal crashes were most common during the day.

*Table 1. VRU Serious Injuries and Fatalities by Season, 2013 - 2022*

| SEASON | PEDESTRIAN | BICYCLIST |
|---|---|---|
| Winter (Dec-Feb) | 537 | 140 |
| Spring (Mar-May) | 479 | 180 |
| Summer (June-Aug) | 397 | 141 |
| Fall (Sep-Nov) | 532 | 203 |

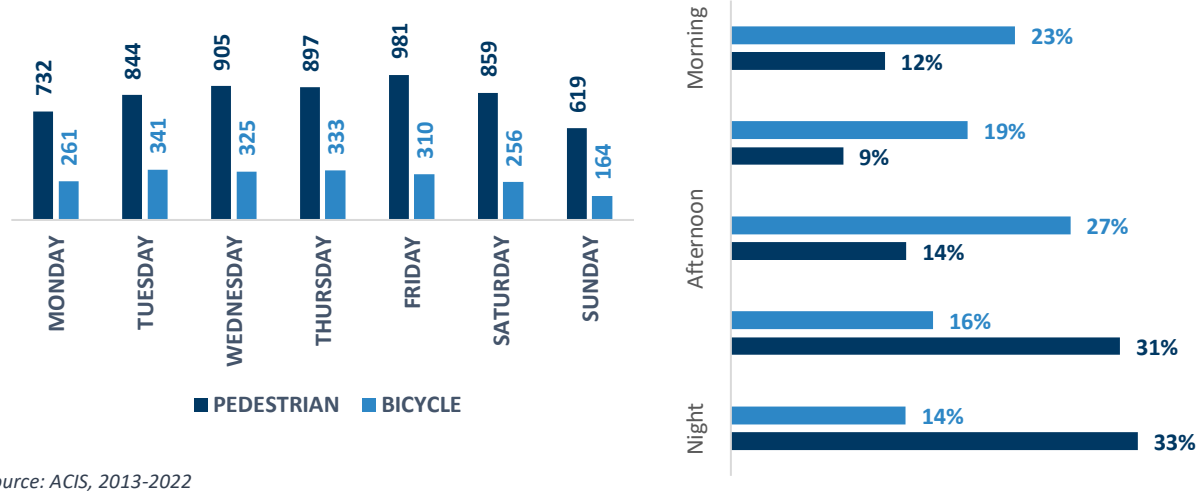
*Source: ACIS, 2013-2022*

*Figure 8. VRU Serious Injuries and Fatalities by Month, 2013-2022*




*Source: ACIS, 2013-2022*

*Figure 9. VRUs Serious Injuries and Fatalities by Day of Week and Time of Day, 2013-2022*



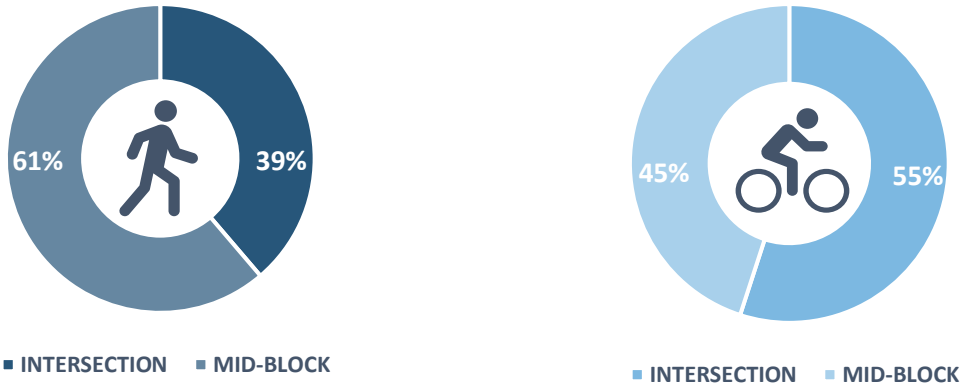

*Source: ACIS, 2013-2022*

## VRUS INVOLVED IN CRASHES BY LOCATION

### *By Roadway Location*

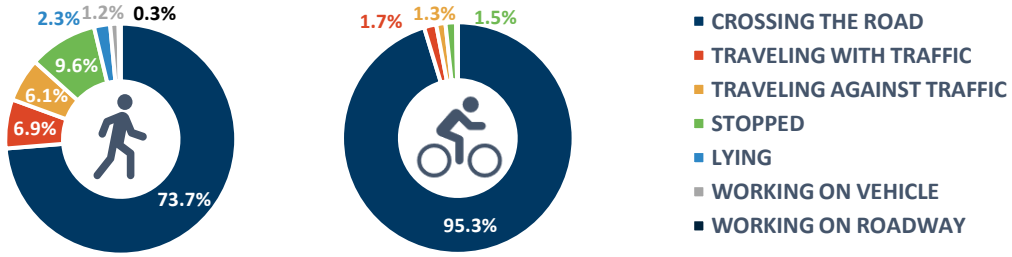
VRU serious injuries and fatalities by roadway location are shown in **Figure 10** and by maneuver are shown in **Figure 11**. Pedestrians involved in serious injury and fatal crashes were most often struck mid-block (61%), with 39% struck at an intersection. Bicyclists involved in serious injury and fatal crashes were most often struck at an intersection (55%), with 45% struck at mid-block locations. The majority of VRU fatalities occurred when crossing the road for both pedestrians (74%) and bicyclists (95%).

*Figure 10. VRU Serious Injuries and Fatalities by Roadway Location, 2013-2022*




*Source: ACIS, 2013-2022*

*Figure 11. VRU Fatalities by Maneuver, 2013-2022*




*Source: ACIS, 2013-2022*

**74%** of pedestrian fatalities occurred when the pedestrian was crossing the road

**95%** of bicyclist fatalities occurred when the bicyclist was crossing the road

### *By County*

VRU serious injuries and fatalities in 2013-2022 were highly concentrated in urban areas of the state, as shown in **Figure 12**. VRU serious injuries and fatalities by county are shown in **Table 2**. Pedestrian and bicyclist serious injuries and fatalities were most common in Maricopa County, Pima County, and Pinal County, correlating with the counties of higher populations. Pedestrian serious injuries and fatalities were more spread out throughout the state than bicycle serious injuries and fatalities, with notable quantities of pedestrian serious injuries and fatalities also prevalent in Coconino County, Mohave County, and Navajo County.

**244** Average pedestrian serious injuries per county

**142** Average pedestrian fatalities per county

**111** Average bicyclist serious injuries per county

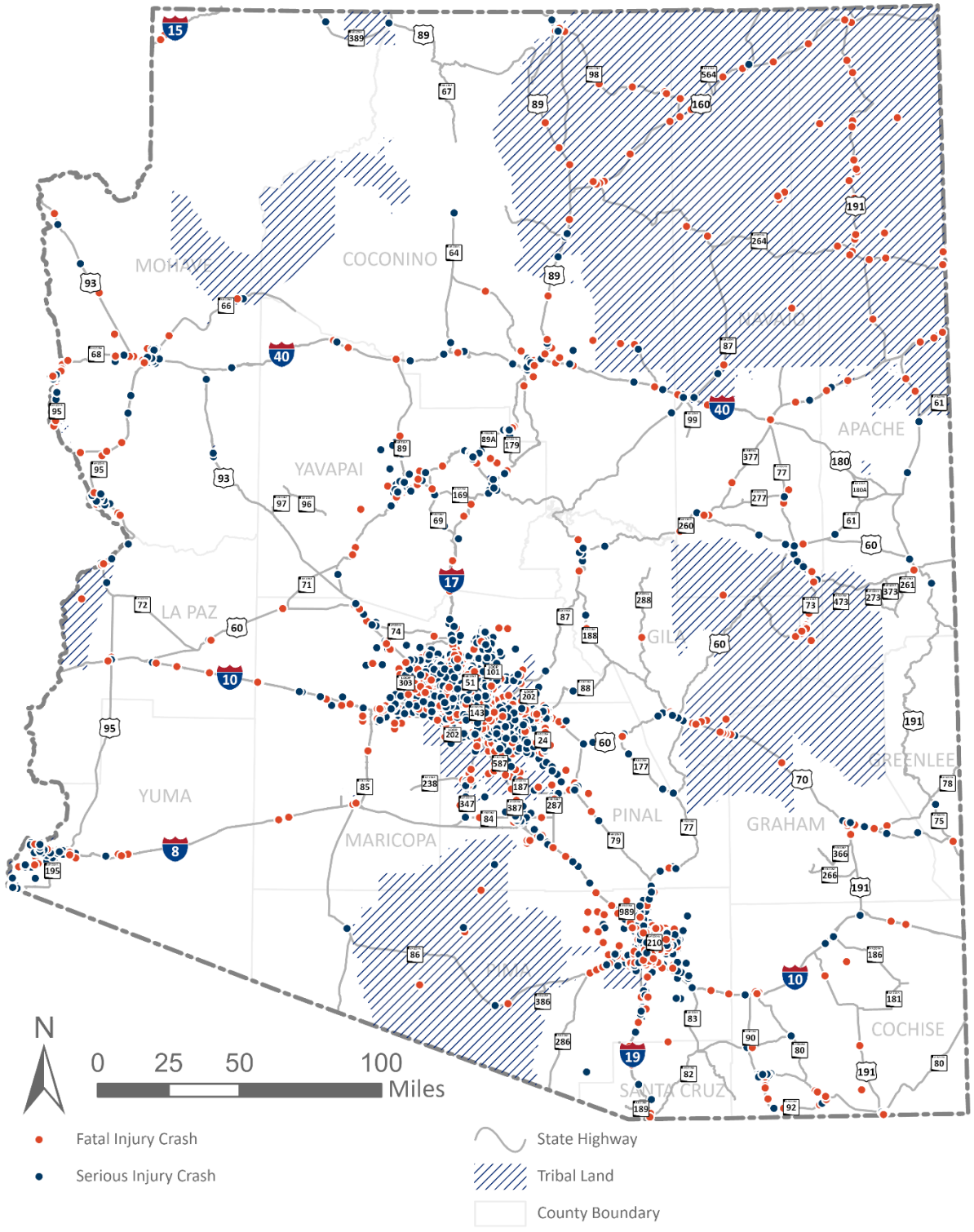
**22** Average bicyclist fatalities per county

*Table 2. VRU Serious Injuries and Fatalities by County, 2013-2022*

| COUNTY | PEDESTRIAN FATALITIES | PEDESTRIAN SERIOUS INJURIES | BICYCLIST FATALITIES | BICYCLIST SERIOUS INJURIES |
|---|---|---|---|---|
| **Greenlee** | 0 | 1 | 0 | 0 |
| **Graham** | 10 | 7 | 5 | 8 |
| **La Paz** | 11 | 3 | 1 | 2 |
| **Apache** | 39 | 6 | 0 | 4 |
| **Santa Cruz** | 5 | 22 | 1 | 5 |
| **Gila** | 27 | 75 | 0 | 29 |
| **Navajo** | 49 | 3 | 4 | 4 |
| **Cochise** | 20 | 60 | 9 | 47 |
| **Yuma** | 43 | 88 | 6 | 47 |
| **Mohave** | 53 | 26 | 6 | 11 |
| **Yavapai** | 32 | 80 | 7 | 56 |
| **Coconino** | 68 | 32 | 7 | 12 |
| **Pinal** | 70 | 87 | 16 | 47 |
| **Pima** | 346 | 543 | 63 | 262 |
| **Maricopa** | 1,362 | 2,632 | 200 | 1,125 |
| **Unknown** | 32 | 4 | 3 | 3 |
| **Total Fatalities** | 2,167 | 3,669 | 328 | 1,662 |

*Source: ACIS, 2013-2022*

*Figure 12. Statewide VRU Serious Injury and Fatal Crashes*




*Source: ACIS, 2013-2022*

### *By Tribal Nation*

In Arizona, there are currently 22 federally recognized Tribal Nations, listed below in **Table 3**. Of all VRU fatalities, 7% occur on tribal lands. The high ratio of VRU fatalities to serious injuries within tribal boundaries is likely due to limited data submitted to ADOT for all crash severities.

*Table 3. VRU Serious Injuries and Fatalities by Tribal Nation, 2013-2022*

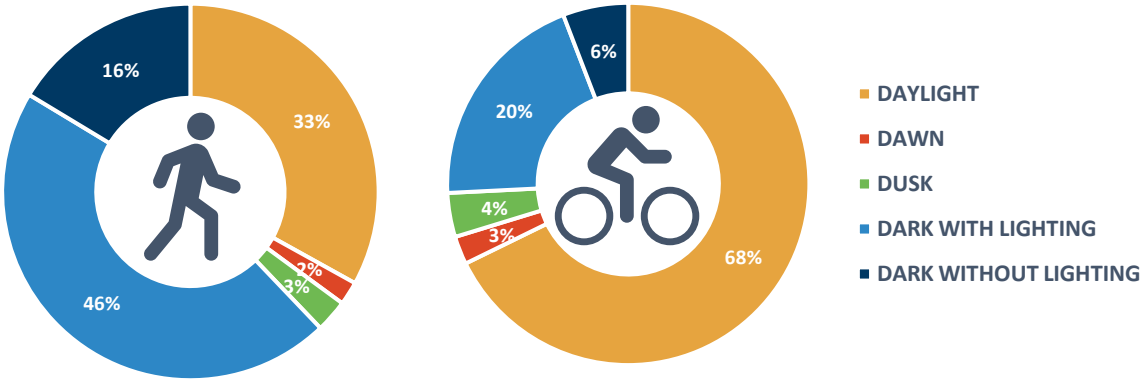
| TRIBAL NATION | PEDESTRIAN FATALITIES | PEDESTRIAN SERIOUS INJURIES | BICYCLIST FATALITIES | BICYCLIST SERIOUS INJURIES |
|---|---|---|---|---|
| Ak-Chin Indian Community | 0 | 2 | 0 | 1 |
| Cocopah Indian Tribe | 3 | 0 | 1 | 1 |
| Colorado River Indian Tribe | 4 | 1 | 4 | 4 |
| Fort McDowell Yavapai Nation | 1 | 0 | 1 | 0 |
| Fort Mojave | 3 | 4 | 0 | 0 |
| Fort Yuma Quechan Tribe | 0 | 1 | 0 | 0 |
| Gila River Indian Community | 28 | 11 | 7 | 6 |
| Havasupai Tribe | 0 | 0 | 0 | 0 |
| Hopi Tribe | 6 | 0 | 0 | 0 |
| Hualapai Tribe | 1 | 0 | 1 | 0 |
| Kaibab Band of Paiute Indians | 0 | 0 | 0 | 0 |
| Navajo Nation | 67 | 6 | 3 | 2 |
| Pascua Yaqui Tribe | 2 | 0 | 0 | 1 |
| Pueblo of Zuni | 0 | 0 | 0 | 0 |
| Salt River Pima-Maricopa Indian Community | 13 | 7 | 1 | 7 |
| San Carlos Apache Tribe | 14 | 0 | 2 | 1 |
| San Juan Southern Paiute Tribe | 0 | 0 | 0 | 0 |
| Tohono O'odham Nation | 9 | 9 | 0 | 0 |
| Tonto Apache Tribe | 0 | 3 | 0 | 0 |
| White Mountain Apache | 22 | 3 | 0 | 0 |
| Yavapai-Apache Tribe | 0 | 0 | 0 | 0 |
| Yavapai-Prescott Indian Tribe | 1 | 1 | 0 | 0 |

***Source: ACIS, 2013-2022***

## VRUS INVOLVED IN CRASHES BY LIGHTING CONDITION

Trends in VRU involvement in serious injury and fatal crashes by lighting conditions were analyzed to identify key safety indicators related to lighting conditions. Pedestrian serious injuries and fatalities most often occurred when it was not daylight (67% of pedestrian serious injuries and fatalities). Contrarily, most bicyclist serious injuries and fatalities occurred during daylight (68% of bicyclist serious injuries and fatalities). **Figure 13** shows the percentage of VRU serious injuries and fatalities by lighting condition.

*Figure 13. VRU Serious Injuries and Fatalities by Lighting Condition, 2013-2022*

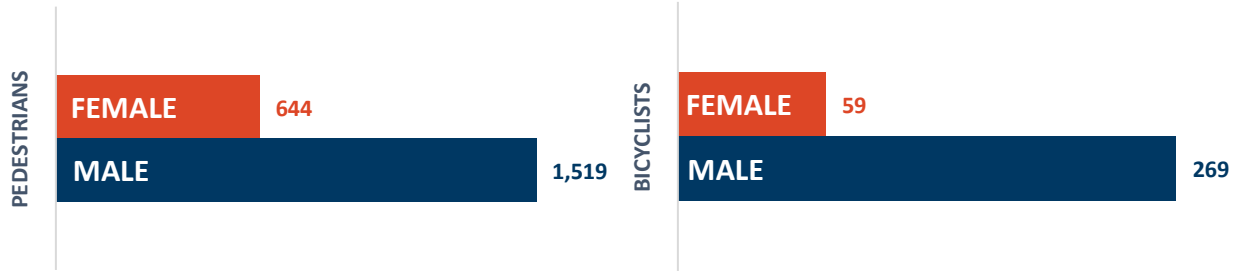



*Source: ACIS 2013-2022*

## VRUS INVOLVED IN CRASHES BY GENDER

VRU fatalities by gender are shown in **Figure 14.** For both pedestrian and bicyclist fatalities, males comprise the majority of VRU fatalities, with female fatalities accounting for only 30% of all pedestrian fatalities and 18% of all bicyclist fatalities.

*Figure 14. VRU Fatalities by Gender, 2013-2022*

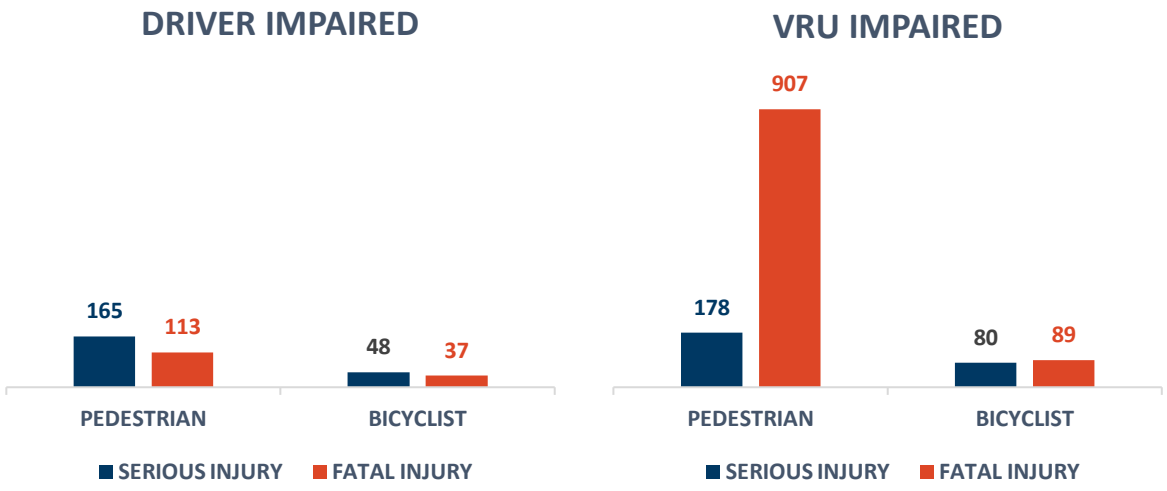



*Source: ACIS 2013-2022*

## VRUS INVOLVED IN CRASHES BY IMPAIRMENT CONDITION

The presence of impairment was assessed in serious and fatal crashes involving a VRU between 2013 and 2022. **Figure 15** shows the number of pedestrian and bicyclist serious injuries and fatalities when the vehicle driver or VRU person was impaired by alcohol or drugs. Approximately 42% of all pedestrian fatalities involved an impaired pedestrian, whereas 5% of pedestrian fatalities involved an impaired vehicle driver. Approximately 27% of all bicyclist fatalities involved an impaired bicyclist, whereas 11% of bicyclist fatalities involved an impaired vehicle driver.

*Figure 15. VRU Serious Injuries and Fatalities involving Alcohol and Drug Use, 2013-2022*

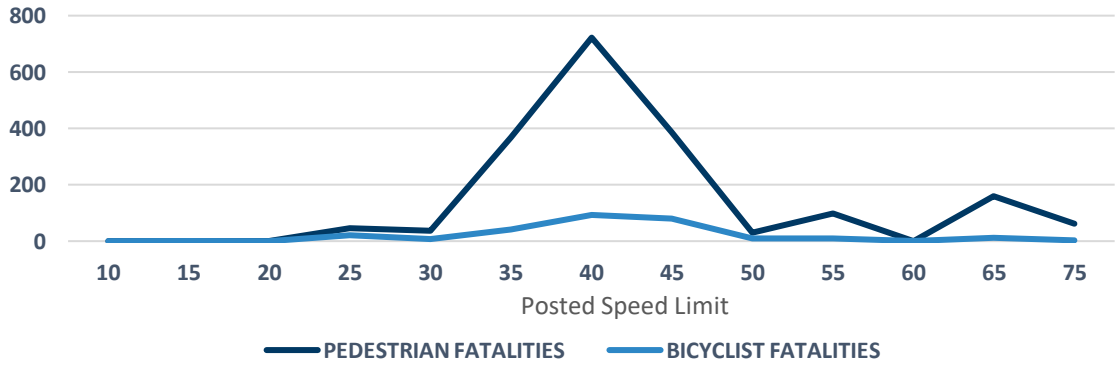



*Source: ACIS 2013-2022*

## VRUS INVOLVED IN CRASHES BY VEHICLE SPEED

Motor vehicle speed has been identified as an important factor in VRU safety. Of all pedestrian fatalities, at least 7% occurred when the motor vehicle was identified as speeding (i.e., noted in the crash report as exceeding the posted speed limit or, more often, as driving too fast for conditions). For bicyclists, at least 13% of fatalities occurred when the motor vehicle was speeding. **Figure 16** shows pedestrian and bicyclist fatalities by posted speed limit, showing that most fatalities take place on roadways with posted speeds higher than 30 miles per hour.

*Figure 16. VRU Fatalities by Posted Speed Limit*

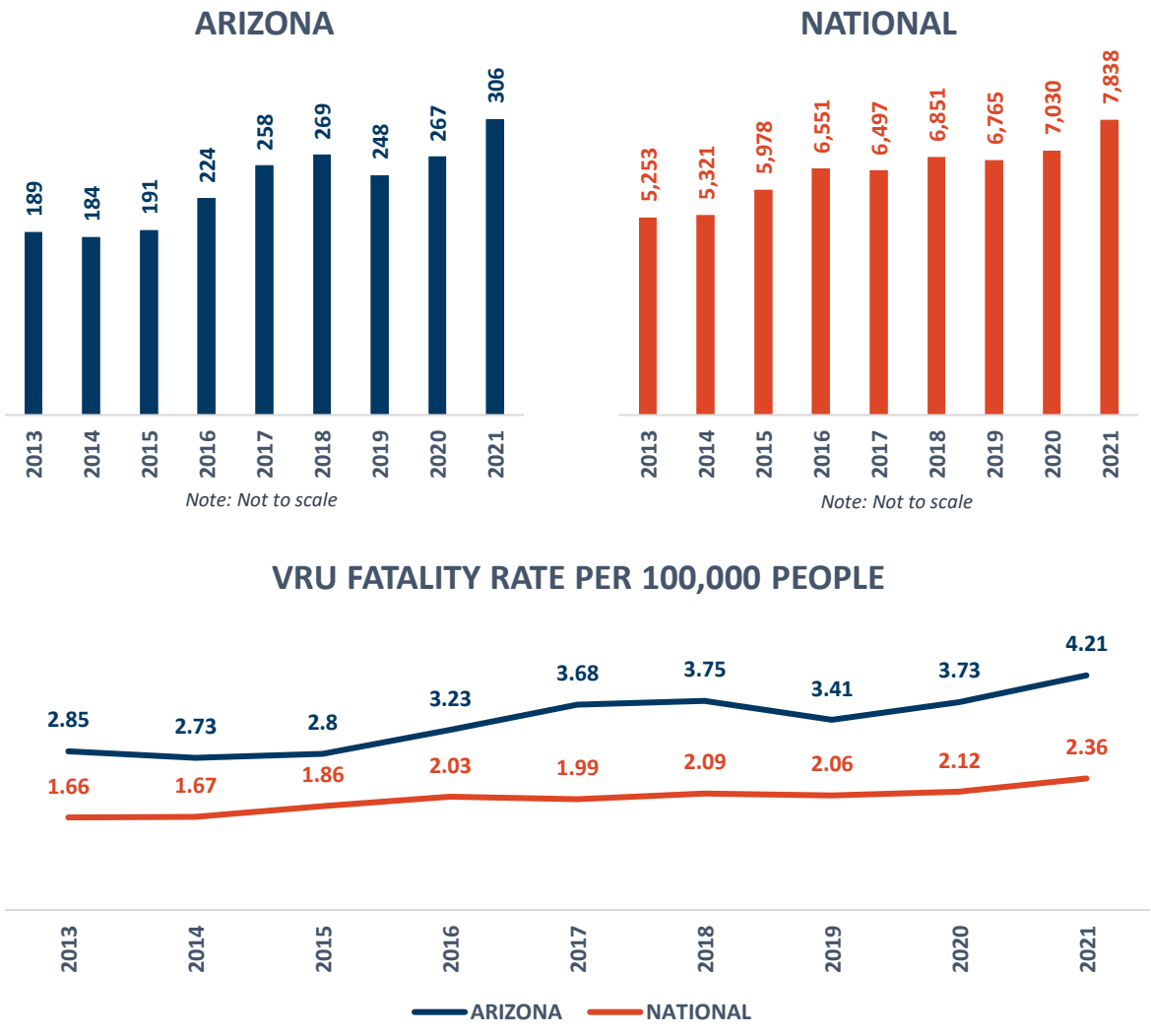



*Source: ACIS 2013-2022*

## National Context

NHTSA's Fatality Analysis Reporting System (FARS) provides yearly motor vehicle crash data on a national scale. This data includes VRU crash data that can be compared to the VRU data provided at the state level by the Arizona Crash Information Systems (ACIS). As shown in **Figure 17**, Arizona has experienced similar growth in VRU fatalities during the analysis period of 2013-2021 compared to the nation. Although Arizona's VRU fatalities have generally shown the same upward trend over time as the nation's VRU fatalities, Arizona's VRU fatality rate significantly exceeds the national average, at 4.21 VRU fatalities per 100,000 people compared to the national VRU fatality rate of 2.36.

*Figure 17. VRU Fatalities National Comparison, 2013-2021*




*Source: FARS, 2020 Census*

## Existing Arizona Safety Plans and Programs

There are several agencies responsible for transportation safety planning, including for VRU safety. These include local municipalities, Metropolitan Planning Organizations (MPOs), Councils of Government (COGs), tribes, and ADOT. Many of these agencies have developed safety plans that identify VRU-related safety issues and problem areas along with potential countermeasures, goals, and action items. These existing plans play an important role in the VRU, as they can help identify local and regional existing VRU safety issues and solutions. Summaries of the content of many of these plans are provided below. Several of these plans are in the process of being updated.

| | |
|---|---|
| **City of Phoenix Road Safety Action Plan** | This plan, released by the City of Phoenix in 2022, stresses the frequency of roadway crashes within the City. The plan follows the guidance of the Vision Zero movement, which aims to reduce the number of fatal and serious injury crashes to zero. The document lists different countermeasures and implementation steps to help reach this goal. |
| **City of Tucson Pedestrian Safety Action Plan** | Adopted in 2020, this plan provides a pedestrian focus for the City of Tucson and guiding principles for safety improvements. The plan uses a data-driven approach to identify and forecast crash patterns and details several strategies, implementation methods, and countermeasures to work towards improving pedestrian safety. |
| **CAG Strategic Transportation Safety Plan** | Central Arizona Government (CAG) is the COG that focuses on the region of rural Pinal and Gila counties in central Arizona. CAG's 2017 safety plan identifies recognized strategies, programs, and projects based on crash data and public outreach to reduce the frequency of transportation-related fatalities and serious injuries. |
| **CYMPO Regional Strategic Transportation Safety Plan** | Central Yavapai Metropolitan Planning Organization (CYMPO) is a planning agency focused on the north-central region of Arizona. CYMPO's 2018 plan uses a data-driven approach to identify crash patterns and develop crash reduction objectives driven by fatal and serious injuries. |
| **FMPO Regional Strategic Transportation Safety Plan** | The Flagstaff Metropolitan Planning Organization (FMPO), now known as Metroplan, is responsible for the City of Flagstaff and portions of Coconino County. FMPO's 2018 plan provides a framework for reducing fatal and serious injury crashes on public roads in the FMPO region. It identifies crash trends, emphasis areas, performance measures, and potential projects. |
| **LHMPO Strategic Transportation Safety Plan** | The Lake Havasu Metropolitan Planning Organization (LHMPO) is located in western Arizona and is focused on the region of Lake Havasu City and parts of Mohave County. LHMPO's 2017 plan aims to shrink the threat of death and serious injury to all transportation users in the LHMPO region. |
| **MAG Strategic Transportation Safety Plan** | The Maricopa Association of Government (MAG) planning area includes the Phoenix metro area, all of Maricopa County, and some of Pinal County. MAG's 2020 safety plan institutes a culture of safety at the regional level. The mission statement for this plan was to "Establish a regional culture of safety where everyone helps to ensure their own safety and the safety of others through their actions, attitudes, and behaviors." |
| **NACOG Regional Strategic Transportation Plan** | In 2018, the Northern Arizona Council of Governments (NACOG) published their safety plan. NACOG spans across central and northeastern Arizona. The main goal of NACOG's plan was to achieve zero fatalities and was accompanied by other supporting objectives. The plan also highlighted action items and other implementation strategies to move towards the completion of their goal. |

| | |
|---|---|
| **PAG Strategic Transportation Safety Plan** | The Pima Association of Governments (PAG) released their safety plan in 2016. PAG's planning region focuses on southcentral Arizona, including Tucson and Pima County. Similar to other plans, the main theme of this plan was to work towards zero fatalities. Implementation and education opportunities were some of the strategies listed in this plan to help achieve their goal. |
| **SCMPO Strategic Transportation Safety Plan** | The Sun Corridor Metropolitan Planning Organization (SCMPO) prepared their safety plan in 2016. SCMPO is located between MAG, PAG, and CAG and includes Casa Grande. SCMPO's plan focused on many similar strategies as other safety plans, including the identification of proven countermeasures. |
| **SVMPO & SEAGO Strategic Highway Safety Plan** | The Sierra Vista Metropolitan Planning Organization (SVMPO) and the Southeastern Arizona Governments Organization (SEAGO) agreed to a joint venture in 2018 and published their safety plan together. Similar to other plans in the state, this document identified problem areas and development countermeasures to implement to help reduce fatal and serious injury crashes. Both planning organizations are located in southeastern Arizona. |
| **WACOG Strategic Transportation Safety Plan** | The Western Arizona Council of Governments (WACOG) released their plan in 2018 with the specific goal of seeing the rates of fatal and serious injuries fall year over year in their region. Several strategies and implementation measures were listed. WACOG's planning region is located in western and northwestern Arizona. |
| **YMPO Strategic Transportation Safety Plan** | The Yuma Metropolitan Planning Organization (YMPO) published their safety plan in 2019. This document provided guidelines and recommended implementation standards to help reduce the fatal and serious crash rates across their region in southwestern Arizona. This plan included priority emphasis areas such as vulnerable users, under the age of 25, over the age of 65, and nighttime crashes. |
| **ADOT Bicyclist Safety Action Plan** | This 2018 plan presents and analyzes bicycle crash data, crash hot spots, program opportunities, and potential countermeasures for the state highway system. Funding sources, future goals, and next steps are also key talking points of this plan. The plan also recognized that the focus of the plan does not incorporate or address all the state's bicycle crashes, as it does not include crashes off the state highway system. |
| **ADOT Pedestrian Safety Action Plan** | This 2017 statewide plan detailed countermeasures, research opportunities, reporting recommendations, enforcement improvements, funding strategies, and legislation recommendations all with the goal of improving pedestrian safety. Additionally, the Vision Zero ideology was a guiding focal point of this document. |
| **ADOT Complete Transportation Guidebook** | This document was created in 2016 as a tool to include sustainable practices in transportation planning efforts for the state of Arizona. The guidebook complements other ADOT strategies, goals, and values. The Complete Transportation Guidebook establishes sustainable strategies and tools to help move people, not just vehicles. |
| **ADOT Bicyclist & Pedestrian Count Strategy Plan** | This statewide plan detailed a specific focus on bicyclists and pedestrians and aimed to develop a volume database as well as a framework for collecting and distributing data across a range of stakeholders. This 2018 plan includes a review of existing methods and programs for bicycle and pedestrian data collection and the development of an implementation framework. |

## RECOMMENDED STRATEGIES FROM EXISTING PLANS

With safety as the common factor, many of these plans shared mutual strategies for improving pedestrian and bicyclist safety for their agencies. Recommended strategies across the plans are summarized in **Table 4**.

***Toolkit Development*** involves the programming and development of pedestrian and bicyclist safety toolkits as an action item.

***Mid-block Improvements*** include enhancements between intersections such as pedestrian hybrid beacon (i.e., HAWK) and bike HAWK crossings to improve VRU facilities and reduce their risk.

***School Focus Areas*** refer to strategies that focus on improving VRU travel to, from, and around schools. Programs like Safe Routes to School are a tool that is frequently mentioned in this area.

***Speed Limits*** take in several strategies, such as the reduction of speed limits, variable speed limits, and nighttime speed limits to help mitigate high-risk incidents for pedestrians and bicyclists.

***Crosswalk Improvements*** encompass a range of improvements like the removal, improvement, or addition of crosswalks and facilities such as raised medians, bike lanes, Americans with Disabilities Act (ADA) amenities, and pavement markings.

***Signal Improvements*** refer to enhancements such as pedestrian and bicyclist push-button installation and changes to traffic signal timings.

***Lighting*** involves the improvement of lighting conditions for pedestrians and bicyclists.

***Implementation Standards*** consider the revision or update of design standards and policy for pedestrian or bicycle facilities.

***Prioritizing a High Injury Network (HIN***) involves the designation of problem areas and focusing on those areas to optimize the benefit-to-cost ratio of different implementation countermeasures and strategies.

***Complete Streets*** refers to the specific call for complete streets implementation, though many complete streets values can be found in the other strategies listed.

***Enforcement*** calls for better enforcement of current and recommended laws, regulations, and policies.

***Community Education*** involves educating the community on current and recommended legislation, enforcement, and programs focused on VRU safety to enhance the success of these different strategies.

***Data*** includes the increased and more frequent collection and evaluation of data to better identify potential trends and inform future strategies.

*Table 4. Recommended Strategies from Existing Plans*

| PLAN | RECOMMENDED STRATEGIES FROM EXISTING PLANS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TOOLKIT DEVELOPMENT | MID-BLOCK IMPROVEMENTS | SCHOOL FOCUS AREAS | SPEED LIMITS | CROSSWALK IMPROVEMENTS | SIGNAL IMPROVEMENTS | LIGHTING | IMPLEMENTATION STANDARDS | PRIORITIZE HIN | COMPLETE STREETS | ENFORCEMENT | COMMUNITY EDUCATION | DATA |
| City of Phoenix Road Safety Action Plan (2022) | ● | ● | ● | ● | ● | | | | ● | | | | ● |
| City of Tucson Pedestrian Safety Action Plan (2020) | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| CAG Strategic Transportation Safety Plan (2017) | | | | | ● | ● | ● | | | | | | |
| CYMPO Regional Strategic Transportation Safety Plan (2018) | | | | | ● | ● | | | | | | | |
| FMPO Regional Strategic Transportation Safety Plan (2018) | | | | ● | ● | | ● | ● | ● | | | ● | ● |
| LHMPO Strategic Transportation Safety Plan (2017) | | | | | ● | | ● | | ● | ● | ● | ● | |
| MAG Strategic Transportation Safety Plan (2020) | ● | ● | ● | ● | ● | ● | ● | | ● | | ● | ● | ● |
| NACOG Regional Strategic Transportation Safety Plan (2018) | | | | | ● | ● | | | | | | | |
| PAG Strategic Transportation Safety Plan (2016) | | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| SCMPO Strategic Transportation Safety Plan (2016) | | ● | ● | | ● | ● | ● | | ● | ● | | ● | |
| SVMPO & SEAGO Strategic Highway Safety Plan (2018) | | ● | ● | | ● | ● | ● | | ● | ● | | ● | |
| WACOG Strategic Transportation Safety Plan (2018) | | ● | | | ● | ● | ● | ● | ● | ● | | ● | |
| YMPO Strategic Transportation Safety Plan (2019) | | | | | ● | ● | ● | ● | ● | ● | | ● | ● |
| ADOT Bicyclist Safety Action Plan (2018) | | | | | ● | | | ● | ● | | ● | ● | ● |
| ADOT Pedestrian Safety Action Plan (2017) | | | ● | | ● | | ● | ● | ● | | ● | ● | ● |
| ADOT Complete Transportation Guidebook (2016) | | | | ● | ● | ● | | ● | | | | | ● |
| ADOT Bicyclist & Pedestrian Count Strategy Plan (2018) | | | | | | ● | | | | | | | ● |

## Key Takeaways

- The number of pedestrians involved in crashes of any severity level has generally increased over the last ten years while the number of bicyclists involved in crashes of any severity level has generally decreased over the last ten years.
- The composition of VRU crashes of any severity level in 2022 was 63% pedestrian and 27% bicyclists, which is a shift from 2013, when the composition of VRU crashes was 45% pedestrians and 55% bicyclists.
- Pedestrian fatalities have nearly doubled (increased by 95%) between 2013 and 2022 while bicyclist fatalities have increased by 66% in that same timeframe.
- The number of pedestrians involved in serious injury and fatal crashes is highest in the fall and winter months while the number of bicyclists involved in serious injury and fatal crashes is highest in the spring and fall.
- Pedestrians involved in serious injury and fatal crashes were most common in the evening and at night, whereas bicyclists involved in serious injury and fatal crashes were most common during the day.
- Most pedestrians involved in serious injury or fatal crashes were struck at mid-block locations whereas bicyclists involved in serious injury or fatal crashes were typically struck at intersections.
- The majority of VRU serious injury and fatal crashes occurred when crossing the road for both pedestrians and bicyclists.
- VRU fatalities were typically male.
- Alcohol or drug impairment was involved in almost half of all pedestrian fatalities and over one-quarter of bicyclist fatalities; the overwhelming majority of these (87%) involve impairment of the VRU rather than the motorist.
- Most pedestrian and bicyclist fatalities happened on roads with speed limits greater than 30 mph.
- Arizona's VRU fatality rate of 4.21 VRU fatalities per 100,000 people is almost double the national average of 2.36 VRU fatalities per 100,000 people.
- The most common safety countermeasure strategies recommended by existing safety plans include crosswalk improvements, signal improvements, the prioritization of identifying a high-injury network for future improvements, and community education efforts.
- The prevailing theme among existing safety plans is the "Vision Zero" approach, aiming to reduce fatal and serious injury crashes to zero.

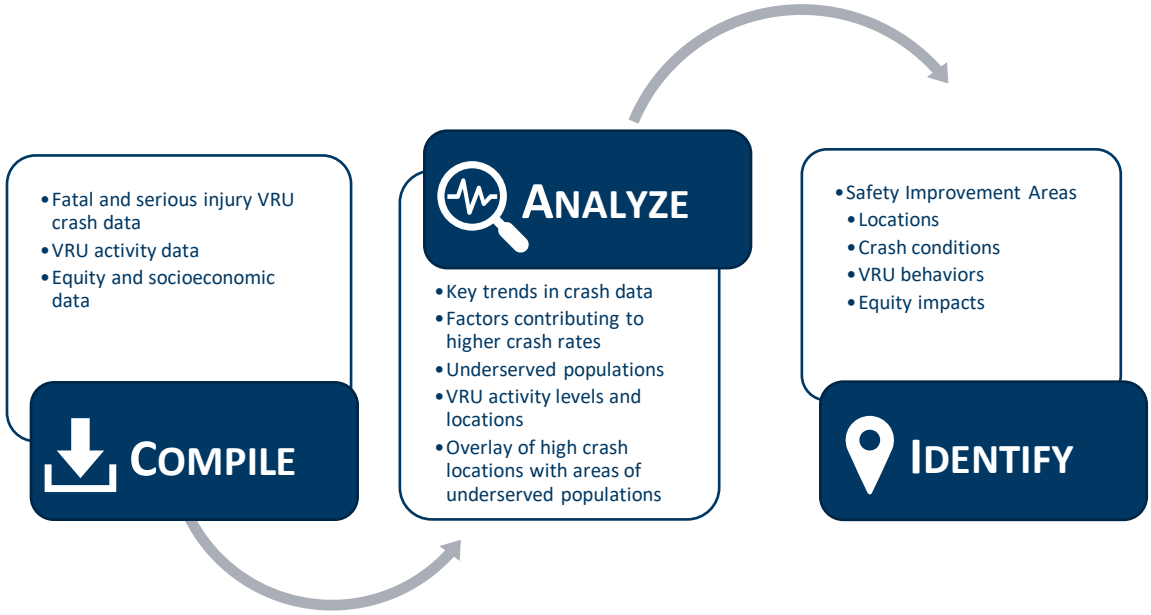
# QUANTITATIVE ANALYSIS

Quantitative analysis was performed to identify Safety Improvement Areas (SIAs) in Arizona. SIAs are locations that likely require more attention and resources for safety enhancements to improve safety for VRUs. The quantitative analysis process followed to identify SIAs included analysis of existing VRU crash data, equity considerations, and VRU activity.

## Quantitative Analysis Methodology

The quantitative analysis methodology is shown in **Figure 18**. The three main steps in the quantitative analysis process are compiling data, analyzing key trends and factors, and identifying SIAs.

*Figure 18. Quantitative Analysis Methodology*




### COMPILE

The following data sources were compiled to help identify locations where safety improvements are likely needed to improve VRU safety.

**VRU Crash Data**

Pedestrian and bicyclist-involved reported serious injury and fatal crashes were obtained for the last 10 years (2013-2022) from the Arizona Crash Information System (ACIS).

**VRU Activity Data**

Pedestrian and bicyclist activity data was obtained through user volume data from Replica, with information on pedestrian and bicycle trip locations and lengths.

**Equity Data**

Multiple equity sources were reviewed to perform the equity analysis component for underserved populations, including:

- Census Bureau, 2020
- Social Vulnerability Index
- Justice40
- EJ Mapper

### ANALYZE

To identify Arizona's SIAs, the compiled data was analyzed and layered. The various data sources were compiled to find the following:

- Key trends in VRU crash data
- Factors contributing to higher crash rates (measured as VRU crashes/mile of VRU travel)
- Areas of underserved populations
- Areas of pedestrian and bicyclist activity
- Overlay of high VRU crash locations with areas of underserved populations

### IDENTIFY

SIAs were identified through the analysis and overlay of the compiled data. Areas of high crash rates were overlayed with areas of underserved populations to create a prioritization score. SIA candidates were ranked by the combined prioritization score, with the top 10 ranked SIAs identified as the recommended SIAs.

## VRU Crash and Activity Data Review

VRU crash and activity data were compared to identify key trends in locations of safety challenges. VRU activity data was provided as activity trips from the fall of 2022 from Replica Network Volumes Puller. Replica derives VRU activity information from locational data provided by telecommunications companies and field observations data. It is important to note that although Replica is a national data source for pedestrian and bicyclist activity, the pedestrian and bicyclist trip data may be incomplete at a granular scale, particularly for pedestrians and bicyclists not carrying cell phones when they travel. The following sections summarize statewide VRU activity levels and locations and VRU crash rates by activity level.

### STATEWIDE ACTIVITY

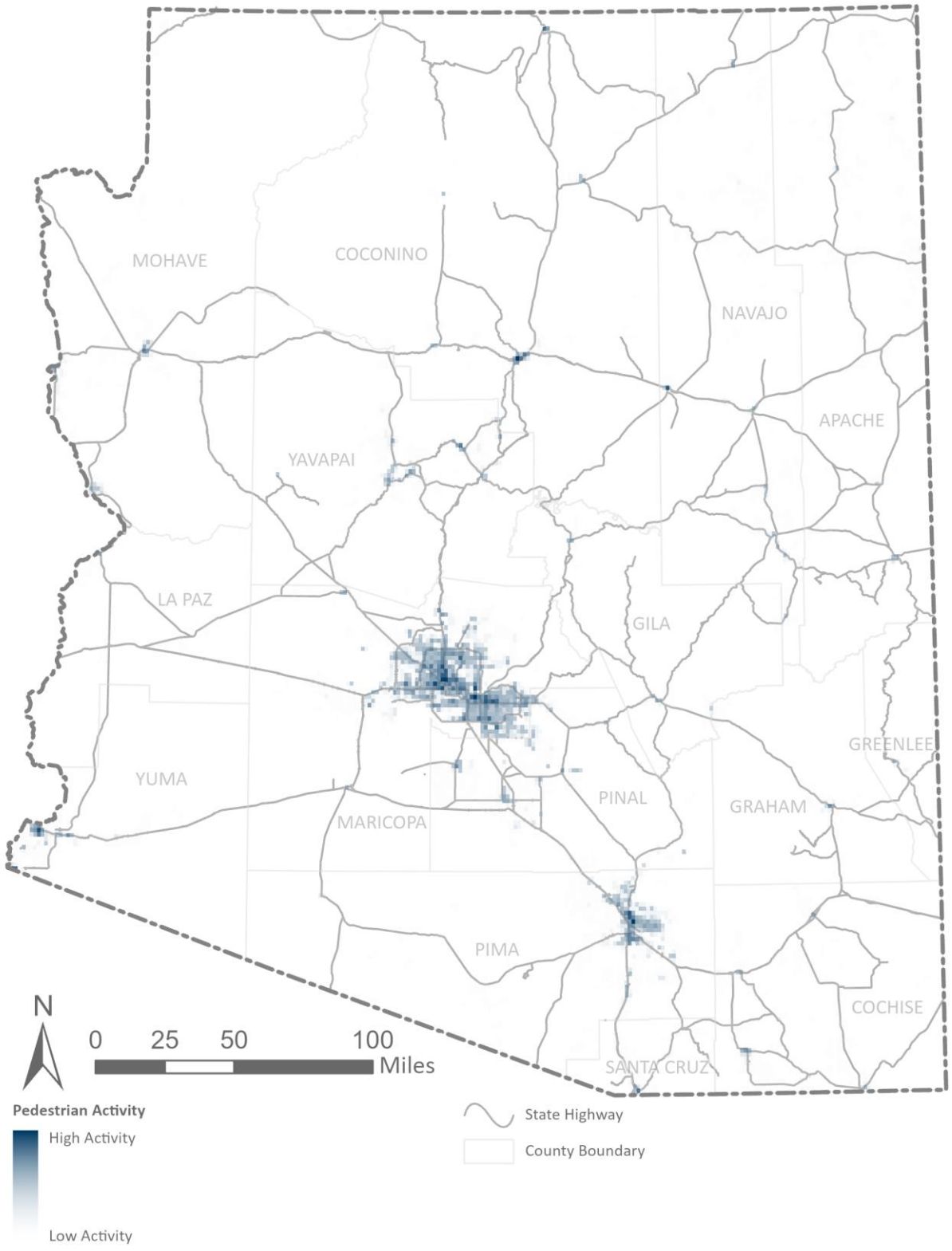
Pedestrian and bicyclist activity levels and locations are shown in **Figure 19** and **Figure 20,** respectively. Pedestrian and bicyclist activity levels are generally highest in the urbanized parts of the state.

### VRU CRASH RATES BY ACTIVITY

VRU serious injury and fatality data was overlaid with VRU activity data to form hexagonal areas (two miles per side) covering the entire state. The overlay creates a similarly-sized set of "hextiles" for use in developing and comparing VRU fatal and serious injury crash rates.

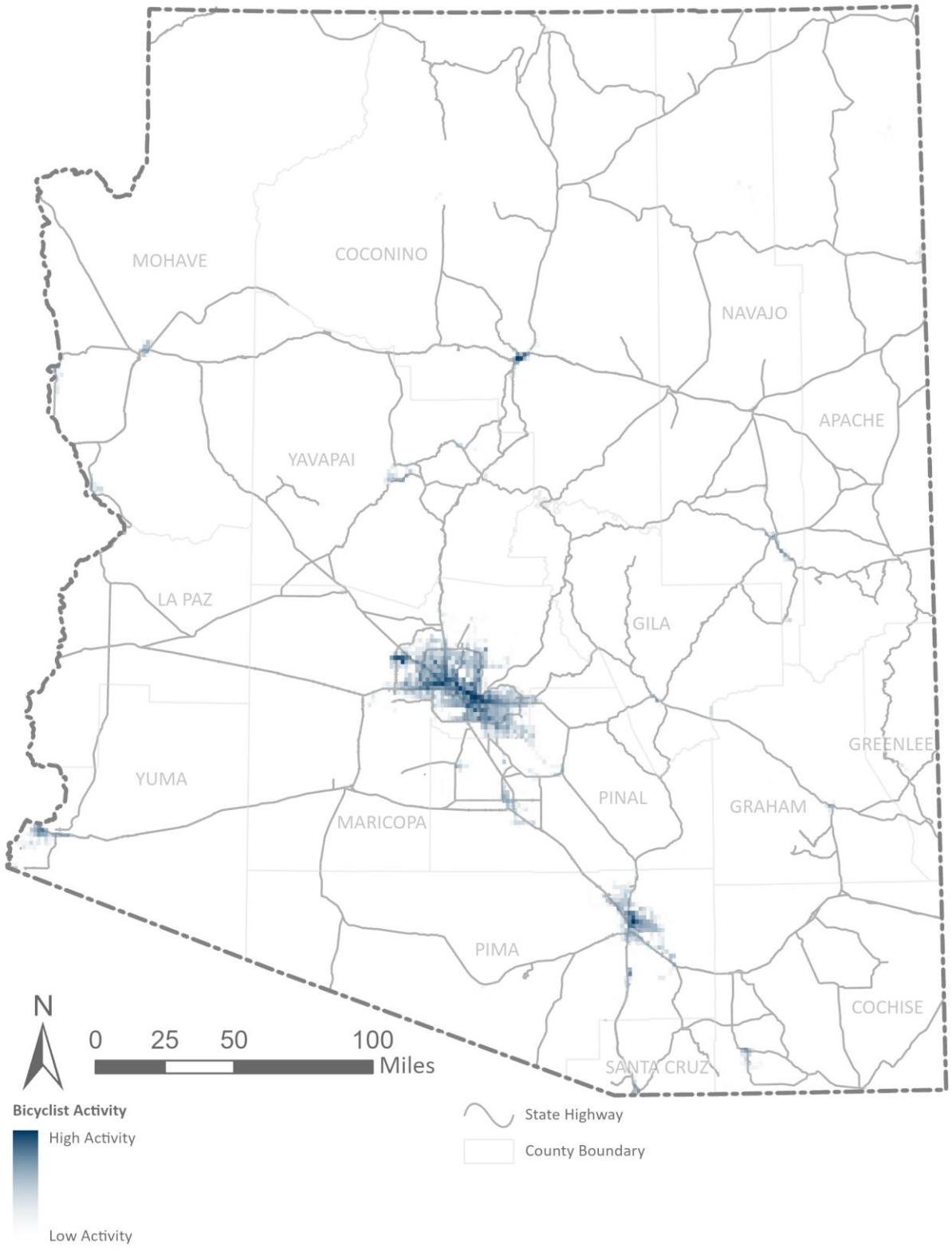
Using the activity data, pedestrian and bicyclist miles traveled were calculated using the number of trips and segment length. Activity miles and number of VRU fatal and serious injury crashes were summed for each hextile. Pedestrian and bicyclist crash rates were then calculated for each hextile by dividing the total number of crashes by the total miles traveled by pedestrians and bicyclists within each hextile. Pedestrian and bicyclist safety concern locations were identified using the resulting crash rates. More detailed activity data is shown for the recommended SIAs in **Appendix A**.

*Figure 19. Pedestrian Activity Levels*




*Source: Replica, Fall 2022*

*Figure 20. Bicyclist Activity Levels*




*Source: Replica, Fall 2022*

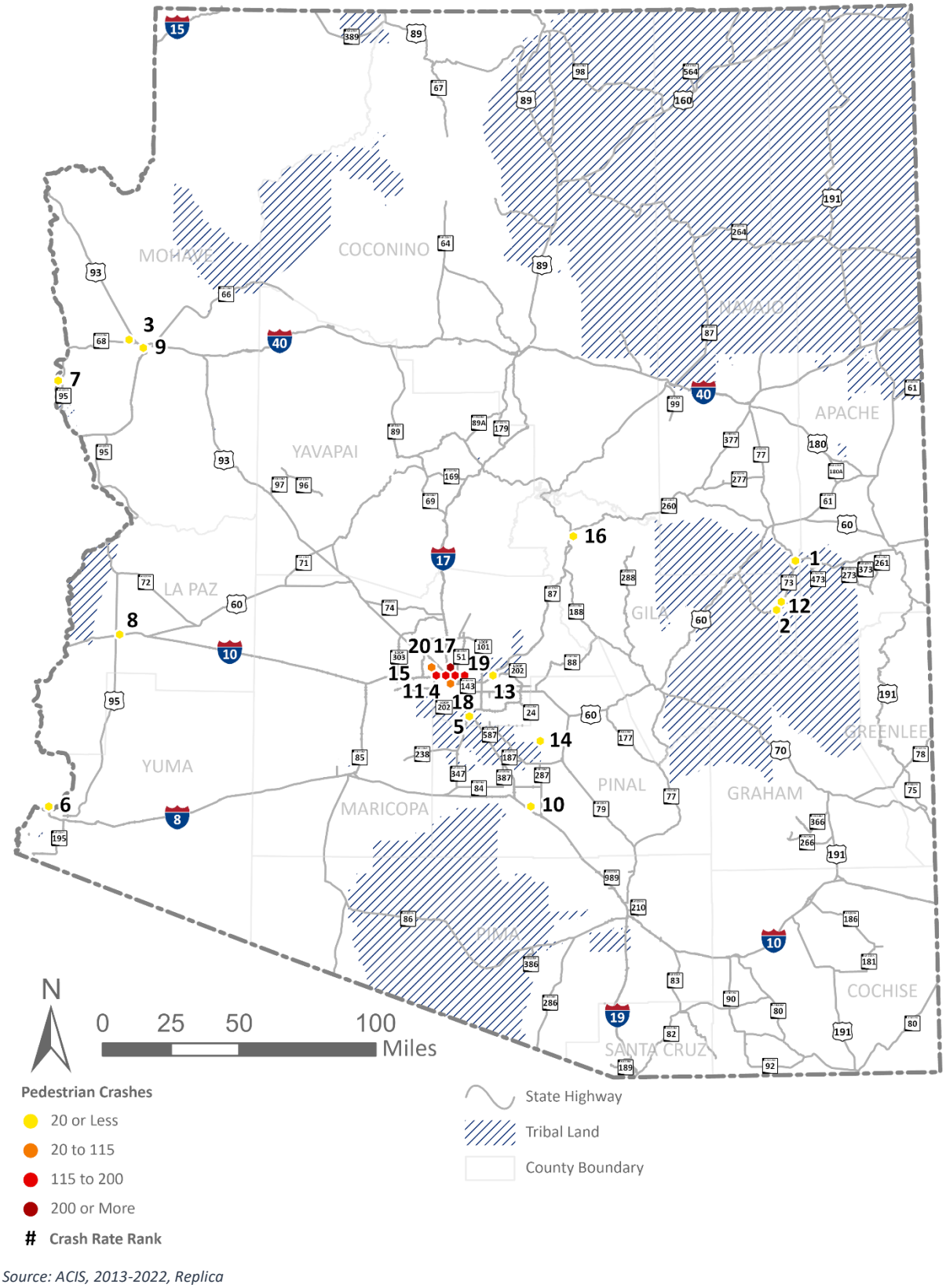
### *Pedestrian Safety Concern Locations*

Locations of significant pedestrian safety concern were identified through development of a pedestrian crash rate, dividing the number of pedestrian serious injury and fatal crashes by pedestrian miles traveled. **Table 5** and **Figure 21** shows the hextile locations with the 20 highest pedestrian crash rates.

*Table 5. Pedestrian Safety Concern Locations*

| RANK | HEXTILE LOCATION | SERIOUS INJURY AND FATAL PEDESTRIAN CRASHES | PEDESTRIAN MILES TRAVELED | SERIOUS INJURY AND FATAL PEDESTRIAN CRASH RATE PER MILE |
|---|---|---|---|---|
| **1** | Hon-Dah | 4 | 20 | 0.200 |
| **2** | Fort Apache | 8 | 440 | 0.018 |
| **3** | Golden Valley | 6 | 350 | 0.017 |
| **4** | Phoenix (Downtown South) | 114 | 8,577 | 0.013 |
| **5** | Lone Butte (SR 347/I-10) | 5 | 403 | 0.012 |
| **6** | Yuma (4th Ave/2nd St) | 6 | 561 | 0.011 |
| **7** | Fort Mojave | 5 | 491 | 0.010 |
| **8** | Quartzsite | 4 | 412 | 0.010 |
| **9** | Kingman (Clacks Canyon) | 4 | 418 | 0.010 |
| **10** | Eloy | 4 | 431 | 0.009 |
| **11** | Phoenix (Catalina Village/Alhambra) | 189 | 22,500 | 0.008 |
| **12** | Whiteriver | 9 | 1,092 | 0.008 |
| **13** | Mesa (Mesa Dr/McKellips Rd) | 18 | 2,350 | 0.008 |
| **14** | San Tan Valley | 5 | 691 | 0.007 |
| **15** | Phoenix (Cartwright/Westridge Park) | 169 | 23,895 | 0.007 |
| **16** | Payson | 6 | 856 | 0.007 |
| **17** | Phoenix (Villa Novena) | 231 | 32,987 | 0.007 |
| **18** | Phoenix (I-10/7th St/Thomas Rd) | 177 | 25,670 | 0.007 |
| **19** | Phoenix (Rancho Hermoso/ McDowell Rd/Thomas Rd) | 187 | 27,349 | 0.007 |
| **20** | Phoenix (Maryvale Terrace)/Glendale (Ironwood Terrace/Three Fountains) | 112 | 16,768 | 0.007 |

*Figure 21. Top 20 Pedestrian Crash Rates*




*Source: ACIS, 2013-2022, Replica*

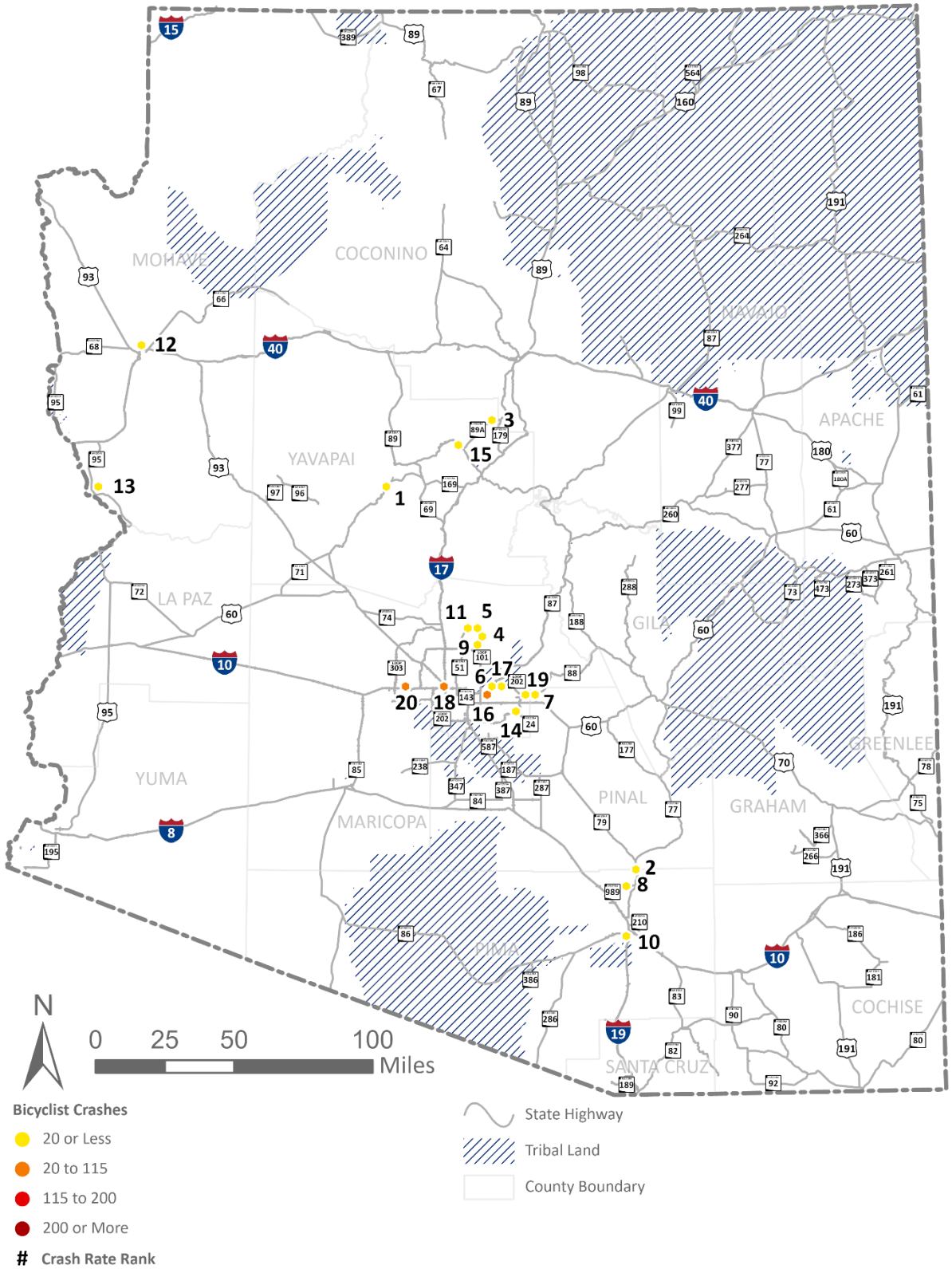
### *Bicyclist Safety Concern Locations*

Locations of significant bicyclist safety concern were identified through development of a bicyclist crash rate, dividing the number of bicyclist serious injury and fatal crashes by bicyclist miles traveled. **Table 6** and **Figure 22** shows the hextile locations with the 20 highest bicyclist crash rates.

*Table 6. Bicyclist Safety Concern Locations*

| RANK | HEXTILE LOCATION | SERIOUS INJURY AND FATAL BICYCLIST CRASHES | BICYCLIST MILES TRAVELED | SERIOUS INJURY AND FATAL BICYCLIST CRASH RATE PER MILE |
|---|---|---|---|---|
| **1** | Prescott | 5 | 557 | 0.009 |
| **2** | Saddlebrooke/Catalina | 4 | 451 | 0.009 |
| **3** | Sedona | 5 | 641 | 0.008 |
| **4** | Scottsdale (Reata Pass) | 6 | 810 | 0.007 |
| **5** | Scottsdale (Pima Rd/Lone Mountain Rd) | 4 | 582 | 0.007 |
| **6** | Mesa (McKellips Rd/Mesa Dr) | 8 | 1,430 | 0.006 |
| **7** | Apache Junction | 13 | 2,400 | 0.005 |
| **8** | Oro Valley | 7 | 1,640 | 0.004 |
| **9** | Scottsdale/Phoenix (Hayden Rd/Pinnacle Peak Rd) | 10 | 2,378 | 0.004 |
| **10** | Tucson (I-19/Irvington Rd) | 16 | 3,811 | 0.004 |
| **11** | Phoenix (Cave Creek) | 4 | 1,052 | 0.004 |
| **12** | Kingman (New Kingman-Butler) | 9 | 2,397 | 0.004 |
| **13** | Lake Havasu City | 11 | 2,951 | 0.004 |
| **14** | Mesa/Gilbert (Power Rd) | 6 | 1,746 | 0.003 |
| **15** | Cottonwood | 5 | 1,523 | 0.003 |
| **16** | Mesa (Alma School Rd/Main St/University Dr) | 45 | 13,901 | 0.003 |
| **17** | Mesa (McKellips Rd/McDowell Rd) | 4 | 1,240 | 0.003 |
| **18** | Phoenix (Thomas Rd/I-10/I-17) | 45 | 14,140 | 0.003 |
| **19** | Mesa (Broadway Rd/ 4th Ave)/Apache Junction (Mountain Rd/110th St) | 10 | 3,189 | 0.003 |
| **20** | Goodyear/Litchfield Park/Avondale | 22 | 7,124 | 0.003 |

*Figure 22. Top 20 Bicyclist Crash Rates*




*Source: ACIS, 2013-2022, Replica*

## Equity Data Review

Pedestrian and bicyclist crashes and fatalities have varying impacts on different communities. When analyzing VRUs, important factors like demographics can help provide insight on challenges faced by underserved populations throughout the state. Equity ensures that specific needs of underserved communities are considered and addressed.

Using crash frequency, density, or rate can help determine high-crash areas, however, by also incorporating the local demographics of high-crash areas, outreach efforts can be tailored to the community to be more effective and equitable. Furthermore, these underserved communities tend to be overlooked, prioritizing safety improvements in high-crash areas that are also home to underserved populations will provide meaningful safety improvements.

To ensure the most comprehensive approach was taken to incorporate equity in crash analysis and safety improvements, data from four different sources/tools were utilized in determining the overall equity of an area: Justice 40, the Social Vulnerability Index (SVI), EJScreen, and a proprietary Equity Needs Analysis using Census data. Each tool uses different measurements to display equity severity. This measurement was converted to a scoring system on a zero-to-five-point scale. Once each scale was overlayed statewide, the scores were then combined to establish a 20-point scale from the four sources to create a comprehensive lens to view equity in Arizona.

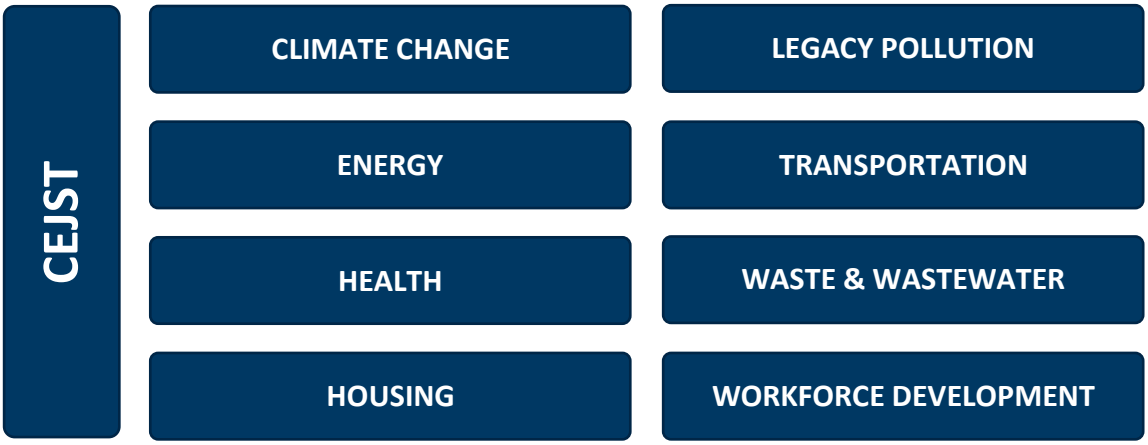

**EQUITY** is defined by Executive Order 13985 to advance racial equity and support for underserved communities. It states:

> "the consistent and systemic fair, just and impartial treatment for all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; member of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality."

## JUSTICE 40 DESIGNATED PLACES

The Justice 40 Initiative originates from Executive Order 14008. It encourages federal agencies to direct at least 40 percent of benefits in climate, clean energy, and transportation areas towards underserved communities. Identification of underserved communities is done through the Climate and Economic Justice Screening Tool (CEJST) created by the White House Council on Environmental Quality (CEQ), which utilizes a variety of publicly available data to determine what makes a community underserved and which "burdens" are most common. The CEJST is also complemented by the Equitable Transportation Community (ETC) Explorer. The burdens listed in the CEJST are shown in **Figure 23**. The Justice 40 burden threshold scores were scaled and applied to score block groups statewide, as shown in **Figure 25**.

*Figure 23. CEJST Categories of Burdens*

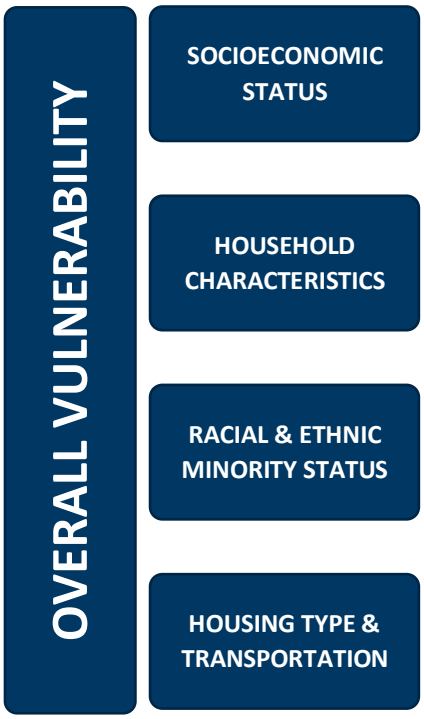



*Source: Climate And Economic Justice Screening Tool Methodology*

## SOCIAL VULNERABILITY INDEX

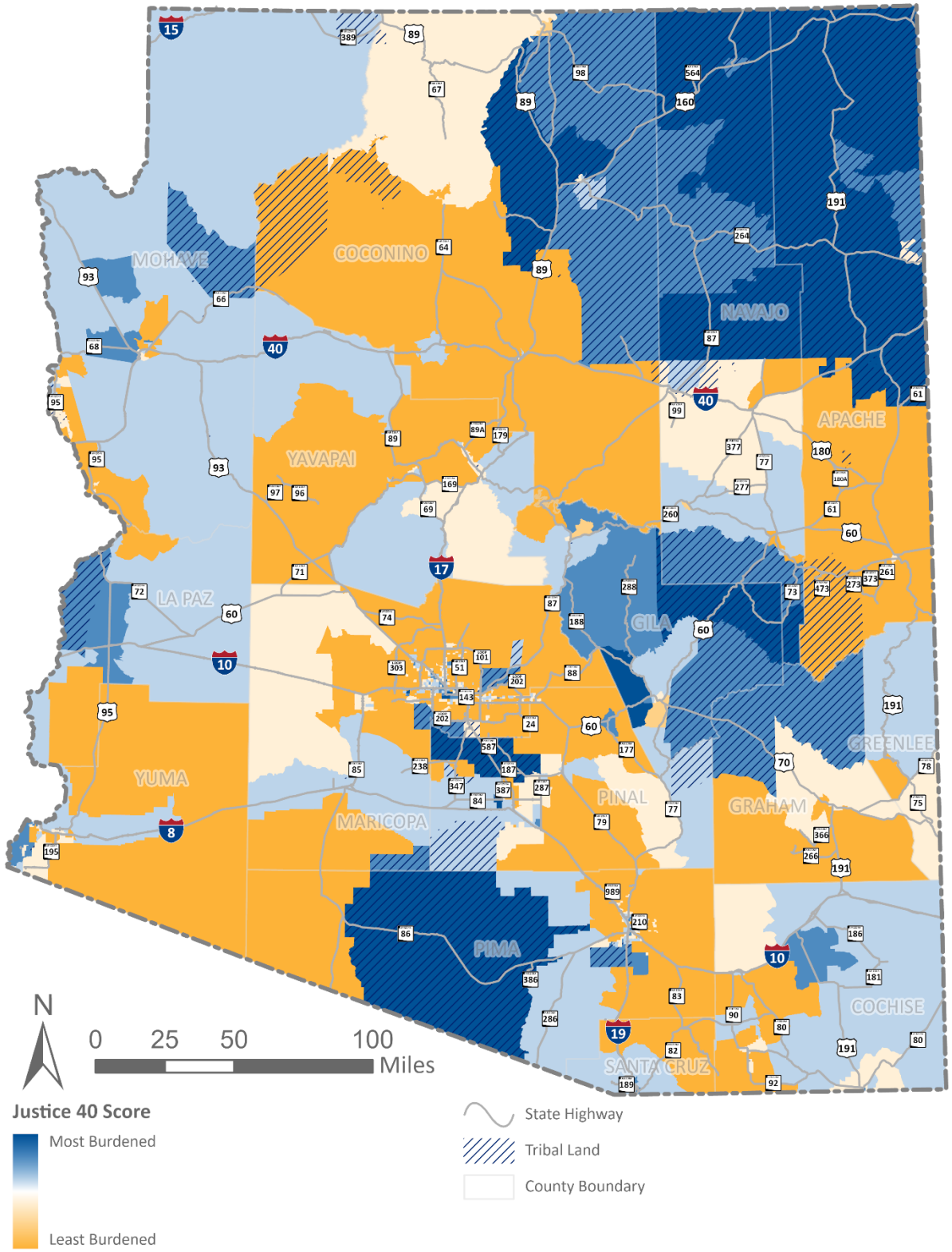
The Social Vulnerability Index (SVI) is a tool used by various agencies to determine the risk and resiliency of communities in the face of disaster, ranging from natural disasters such as tornados to manmade mishaps such as chemical spills. The primary agency is the Center for Disease Control (CDC), facilitated by the CDC's Agency for Toxic Substances and Disease Registry (ATSDR). The ATSDR then created the SVI through its Geospatial Research, Analysis, and Services Program (GRASP) to "help public health officials and emergency response planners identify and map the communities that will most likely need support before, during, and after a hazardous event." The SVI uses 16 U.S. Census variables, including age, crowding, and disabilities, to help identify communities that may need support in the face of disaster. Overall vulnerability is determined for each census tract and is calculated as percentiles from zero to one, with higher values indicating greater vulnerability. SVI social factors are shown in **Figure 24**. The SVI Overall Vulnerability percentile scores were scaled and applied to score census tracts statewide, as shown in **Figure 26**.

*Figure 24. SVI Social Factors*



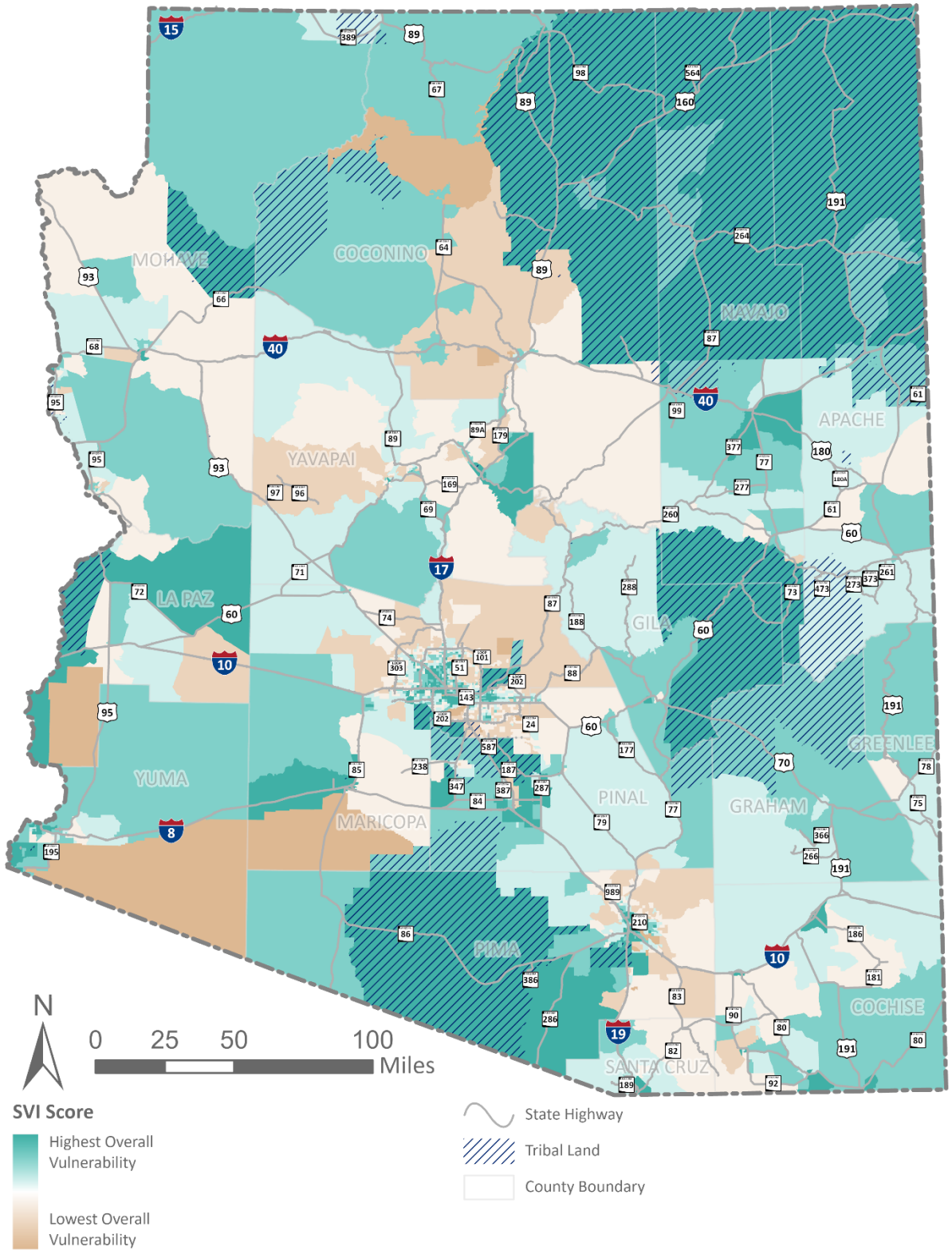

*Source: Agency For Toxic Substances And Disease Registry Social Vulnerability Index*

*Figure 25. Justice 40 Score*




*Source: Climate And Economic Justice Screening Tool Methodology*

*Figure 26. Social Vulnerability Index Score*

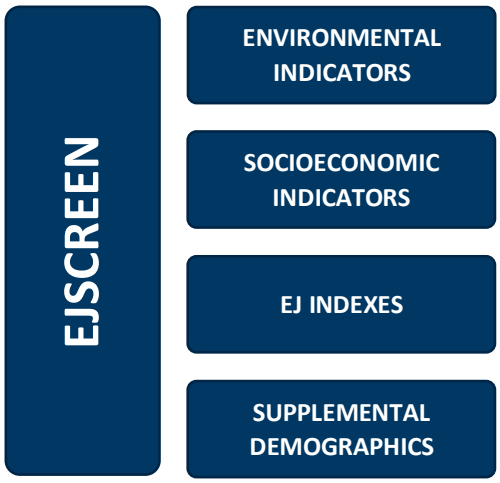



*Source: Agency For Toxic Substances And Disease Registry Social Vulnerability Index*

## EJSCREEN

The Environmental Justice Screening and Mapping Tool (EJScreen/EJ Mapper) stems from the 1994 Executive Order 12898, wherein the Environmental Protection Agency (EPA) was tasked with determining where and what the potential for disproportionate environmental impact would be in the United States. EJScreen in its current form was released to the public in 2015 and is updated annually, with the most current version utilizing 2021 5-year American Community Survey (ACS) estimates at the block group level. **Figure 27** shows the EJScreen indicators and indexes. The number of supplemental indexes greater than the 80$^{th}$ percentile in the EJScreen tool were used to score the 2020 block groups, as shown in **Figure 29**.

*Figure 27. EJ Screen Indicators and Indexes*

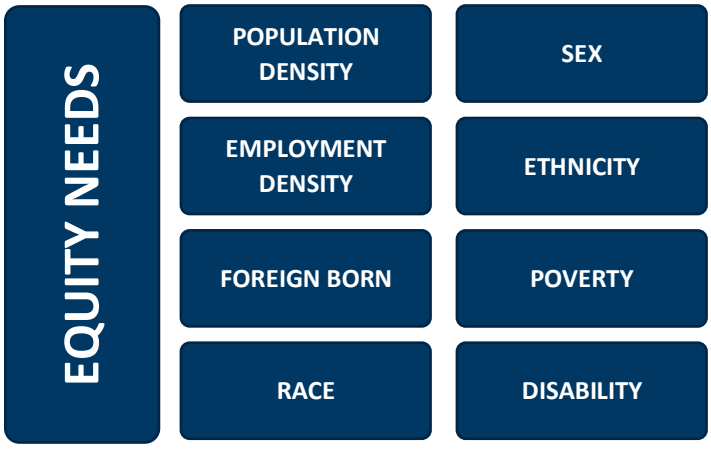



*Source: US Environmental Protection Agency Environmental Justice Screening And Mapping Tool*

## EQUITY NEEDS ANALYSIS

An equity needs tool was developed to analyze demographics data for the state by block group. This analysis is based on 2020 Census data, including population, employment, race/ethnicity, sex, income, and disability status. **Figure 28** shows the demographics included in the equity needs analysis. The distribution of the propensity score in 2020 block groups is shown below in **Figure 30**. As this analysis focused on access to transit, nearly all scores above two are located in urban areas.

*Figure 28. Equity Needs Components*

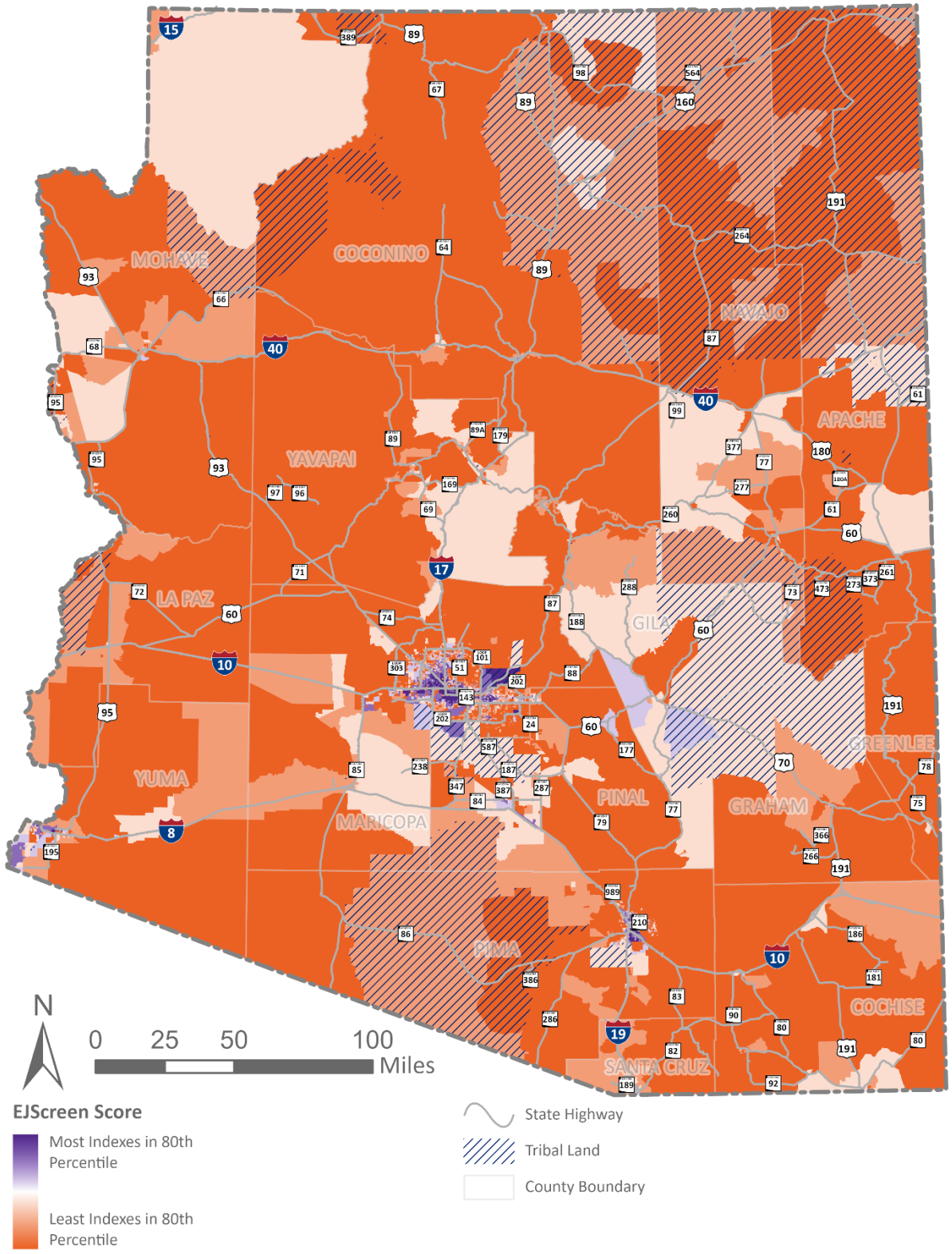



*Source: US Census Bureau 2020 ACS*

## COMPREHENSIVE EQUITY SCORE

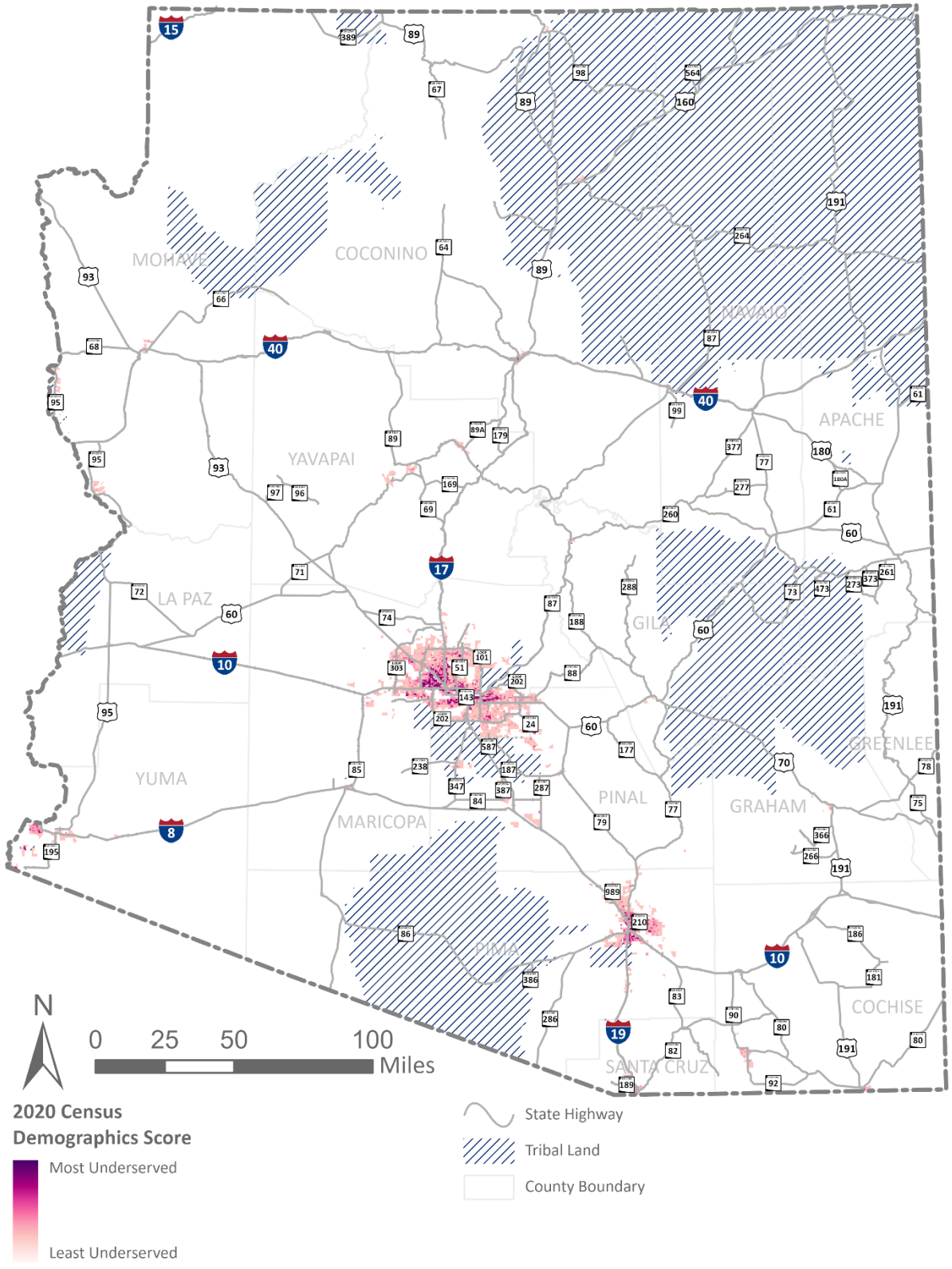
Following the scoring of each equity dataset on a scale of 0 to 5, a combined equity score was applied to each block group to rank locations on a scale from 0 (least underserved) to 20 (most underserved). **Figure 31** shows the comprehensive equity score, following the combination of the four equity sources.

*Figure 29. EJScreen Score*



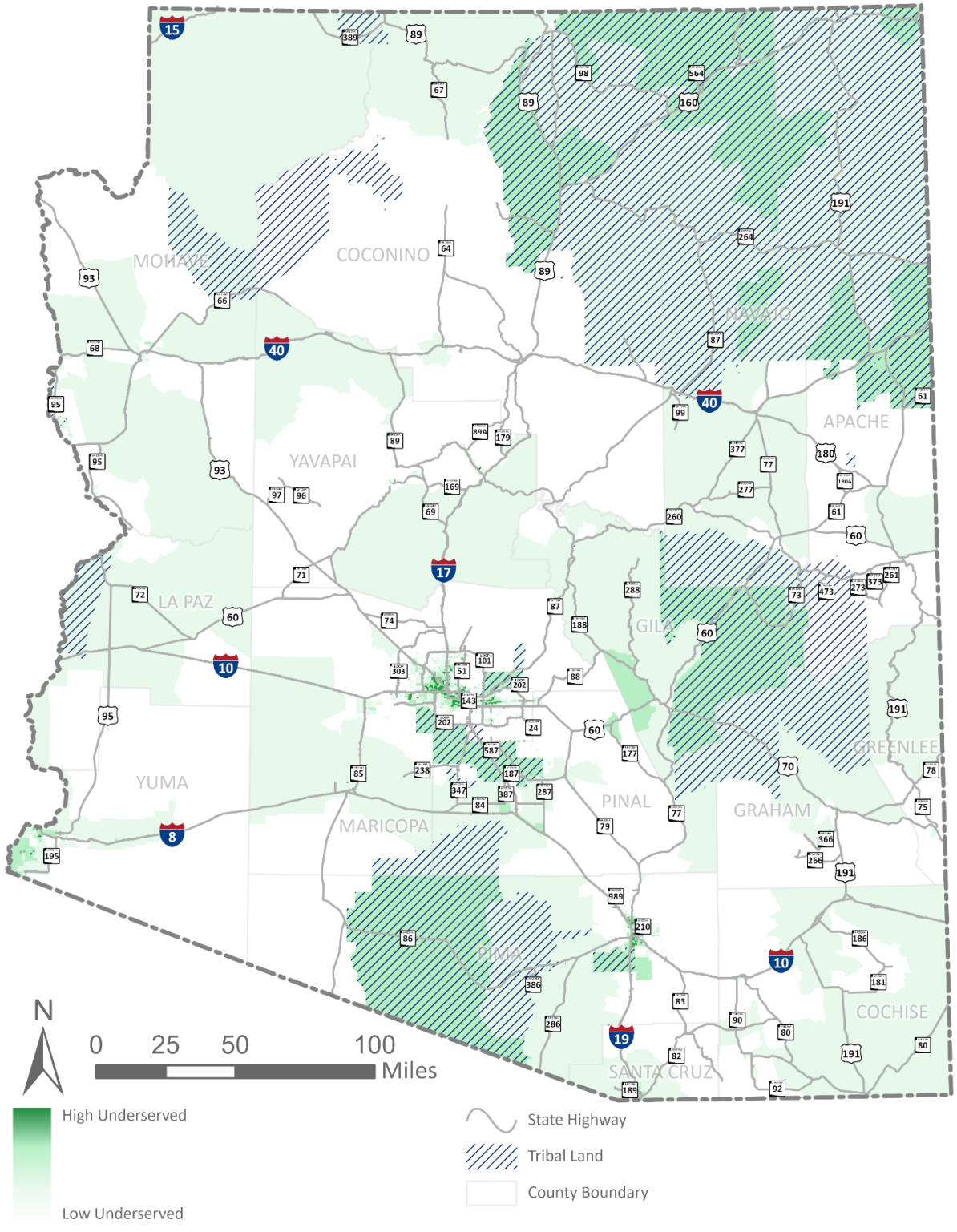

*Source: US Environmental Protection Agency Environmental Justice Screening And Mapping Tool*

*Figure 30. Equity Needs Score*




*Source: 2020 Census*

*Figure 31. Comprehensive Equity Score*



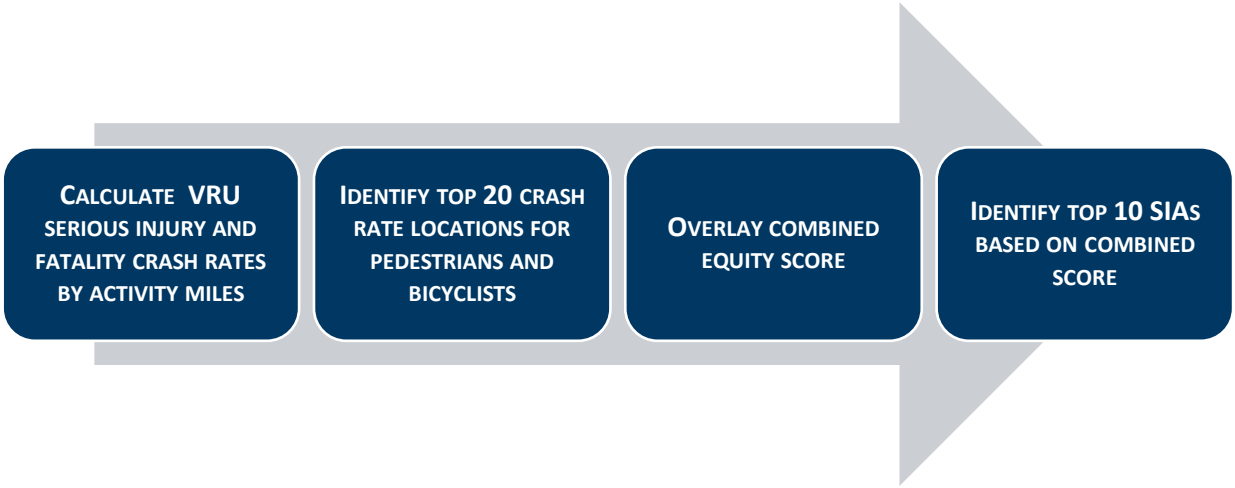
# SAFETY IMPROVEMENT AREAS

The quantitative analysis scores for VRU crash history, VRU activity, and equity considerations were used to determine high-risk locations in most need of VRU safety improvements, which for purposes of the VRUSA are termed SIAs. Safety countermeasures identified for the highest-ranked SIAs are expected to also be applicable statewide as a guide for all communities in Arizona. The sections below outline the methodology, potential SIA identification and prioritization, and recommended SIAs for the Arizona VRUSA.

## Overview of Methodology

The SIA selection methodology process is shown in **Figure 32** and expanded on in the following sections.

*Figure 32. SIA Selection Methodology*




## SIA Candidates

Following the identification of the top 20 crash rate hextiles for both pedestrians and bicyclists, potential SIAs were prioritized further to identify 10 final SIAs. Two hextile locations are within the top 20 for both pedestrian and bicyclist crash rates, resulting in 38 total top hextile locations. These hextile locations were then grouped geographically and jurisdictionally to develop the following list of 22 potential SIA candidates:

- Apache Junction
- Catalina
- Cottonwood
- Eloy
- Fort Mojave
- Gila River
- Glendale
- Golden Valley
- Goodyear
- Kingman
- Lake Havasu City
- Mesa
- Oro Valley
- Payson
- Phoenix
- Prescott
- Quartzsite
- Scottsdale
- Sedona
- Tucson
- White Mountain Apache
- Yuma

A scoring system was developed to rank the 22 SIA candidates, accounting for the sum of the scores for the pedestrian crash rate, bicyclist crash rate, and equity score for each SIA candidate. **Table 7** shows the ranked SIA candidates by total score. The top 10 SIA candidates are highlighted in green font in the table.

## Recommended Safety Improvement Areas

The recommended SIAs are the top 10 ranked candidate SIAs. These are shown in **Figure 33** and listed below in rank order from highest to lowest. **Appendix A** provides a safety snapshot for each recommended SIA, utilizing 2013-2022 ACIS data.

- Phoenix
- White Mountain Apache Tribe (WMAT)
- Yuma (City)
- Tucson
- Gila River Indian Community (GRIC)
- Mesa
- Golden Valley (Mohave County)
- Prescott
- Catalina (Pima County)
- Apache Junction

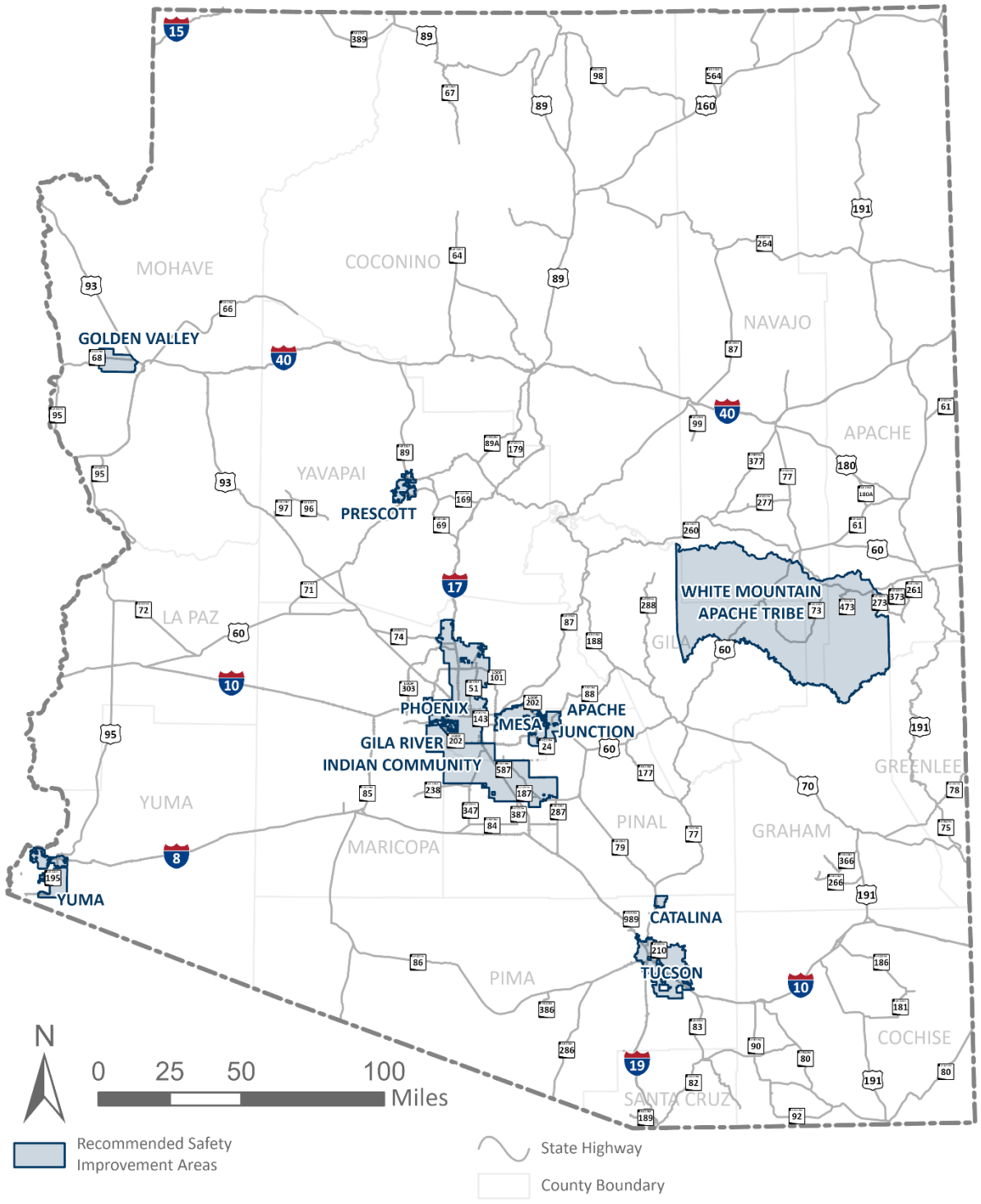
These 10 recommended SIAs cover:

| | |
|---|---|
| **14** | of the top 20 pedestrian safety hextile locations |
| **9** | of the top 20 bicyclist safety hextile locations |
| **62%** | of VRU serious injury and fatal crashes statewide (2013-2022) |
| **7** | locations with high underserved populations |

*Table 7. Safety Improvement Area Candidates*

| SIA RANK | SAFETY IMPROVEMENT AREA | PEDESTRIAN CRASH RATE SCORE | BICYCLIST CRASH RATE SCORE | EQUITY SCORE | COMBINED SCORE |
|---|---|---|---|---|---|
| 1 | Phoenix | 17 | - | 20 | 37 |
| 2 | White Mountain Apache Tribe | 19 | - | 13 | 32 |
| 3 | Yuma | 15 | - | 16 | 31 |
| 4 | Tucson | - | 11 | 19 | 30 |
| 5 | Gila River Indian Community | 16 | - | 13 | 29 |
| 6 | Mesa | - | 15 | 14 | 29 |
| 7 | Golden Valley | 18 | - | 9 | 27 |
| 8 | Prescott | - | 20 | 7 | 27 |
| 9 | Catalina | - | 19 | 8 | 27 |
| 10 | Apache Junction | - | 14 | 13 | 27 |
| 11 | Quartzsite | 13 | - | 11 | 24 |
| 12 | Eloy | 11 | - | 13 | 24 |
| 13 | Sedona | - | 18 | 6 | 24 |
| 14 | Fort Mojave | 14 | - | 9 | 23 |
| 15 | Kingman | 12 | - | 10 | 22 |
| 16 | Glendale | 1 | - | 19 | 20 |
| 17 | Scottsdale | - | 17 | 2 | 19 |
| 18 | Goodyear | - | 1 | 18 | 19 |
| 19 | Lake Havasu City | - | 8 | 10 | 18 |
| 20 | Oro Valley | - | 13 | 3 | 16 |
| 21 | Cottonwood | - | 6 | 10 | 16 |
| 22 | Payson | 5 | - | 8 | 13 |

*Figure 33. Recommended Safety Improvement Areas*



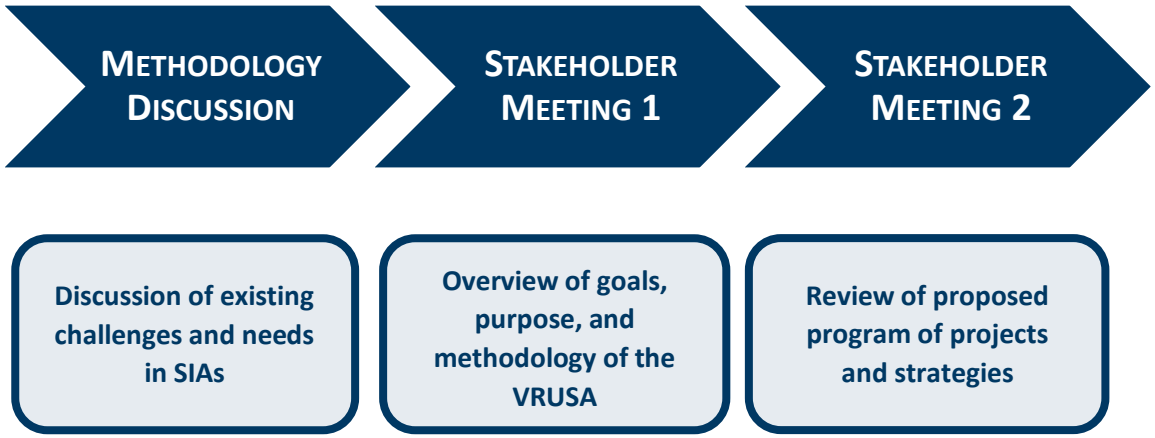
# SUMMARY OF CONSULTATION

Stakeholder consultation is a key component of the VRUSA process. Collaboration and discussion with partners across the state allow for the development of countermeasures that are believed to be applicable to challenges and solutions across all of Arizona. The sections below summarize the engagement process and takeaways in the VRUSA.

## Engagement Process

The stakeholder engagement process for the VRUSA involved a wide variety of statewide partners, including state agencies, tribal agencies, regional agencies, local agencies, and community advocate groups. The stakeholder engagement process aimed to involve stakeholders in all aspects of the VRUSA development albeit at different times and different levels. The stakeholder engagement process included three virtual meetings, each aimed to engage a different group of stakeholders. **Figure 34** shows the engagement meetings that were conducted as part of the VRUSA.

*Figure 34. Stakeholder Meetings*




VRUSA stakeholders were divided into two groups: technical stakeholders and stakeholder partners. Technical stakeholders were involved in reviewing the methodology of the assessment and a wider group comprising the technical stakeholders and stakeholder partners was involved in the two stakeholder meetings and reviewing the draft VRUSA document. The stakeholders in each stakeholder group are shown below. The following sections outline the content for each stakeholder meeting as well as the results.

### TECHNICAL STAKEHOLDERS

- Arizona Department of Transportation
- Federal Highway Administration
- Federal Transit Administration
- Arizona Governor's Office of Highway Safety

### STAKEHOLDER PARTNERS

- Regional government councils (COGs and MPOs)
- Tribal partners
- Arizona Department of Health Services
- Arizona Department of Public Safety
- Local governments
- Local and regional transit agencies
- Bicycle advocacy groups
- Pedestrian advocacy groups

## METHODOLOGY DISCUSSION

The Methodology Discussion meeting was the first stakeholder engagement effort. The meeting took place on September 5, 2023. Invitees included representatives from ADOT, FHWA, the Arizona Governor's Office of Highway Safety (GOHS), and the Inter Tribal Council of Arizona (ITCA). Twenty-three technical stakeholders attended, including representatives from ADOT and FHWA. The Methodology Discussion aimed to review the VRUSA components and proposed methodology for the Arizona VRUSA and obtain feedback on potential refinements to the methodology.

## STAKEHOLDER MEETING 1

The local, tribal, and regional jurisdictions corresponding to the 10 recommended SIAs were invited to Stakeholder Meeting 1, along with agencies and advocacy groups that have statewide interests, to provide context and input on VRU safety within their jurisdictions as well as to share ideas, resources, and lessons learned from promoting VRU safety.

Stakeholder Meeting 1 took place on September 13, 2023. A total of 67 stakeholders attended, including local representatives from eight of the 10 identified SIAs as well as many statewide partners. The stakeholder meeting provided an overview of the VRUSA, a review of safety conditions in the SIAs, and associated discussion.

Attendees were provided with a safety snapshot handout of each SIA, including maps of pedestrian and bicyclist fatal and serious crashes and activity along with summary crash statistics. Discussion was facilitated using a virtual polling system. Questions to guide discussion included:

- Why do you think current VRU crash patterns are happening where they are happening in your community?
- What conditions are contributing to VRU safety issues in your community?
- Are the high crash areas on the pedestrian map of your community where you would expect it to be?
- Are the high crash areas on the bicyclist map for your community where you would expect them to be?
- What have you found to be effective pedestrian and/or bicycle improvements in your community?
- What lessons learned on improving VRU safety in your community would you like to share?
- What barriers are hindering implementation of VRU safety improvements?
- What are common challenges for getting support for VRU safety projects in the community?

Key takeaways from Stakeholder Meeting 1 are summarized below. Stakeholders reported that the following conditions were most commonly contributing to VRU safety issues in their community:

- **DISTRACTED TRAVELING**
- **HIGH VEHICLE SPEEDS**
- **LACK OF VRU FACILITIES**
- **IMPAIRED TRAVELING**
- **LACK OF LIGHTING**
- **CAR-CENTRIC DESIGN**
- **LACK OF SEPARATION BETWEEN VRUS AND VEHICLES**
- **INCOMPLETE CRASH DATA**

Stakeholder reported the following lessons learned when working to improve VRU safety in their communities:

## EDUCATION

- Coordination between local and regional agencies
- Need to improve engagement so that the community is involved in VRU safety
- Local surveys and focus groups indicate high interest in VRU safety
- Education of all road users about VRU safety

## ENFORCEMENT

- Poor crash data makes it difficult to fund improvements

## ENGINEERING

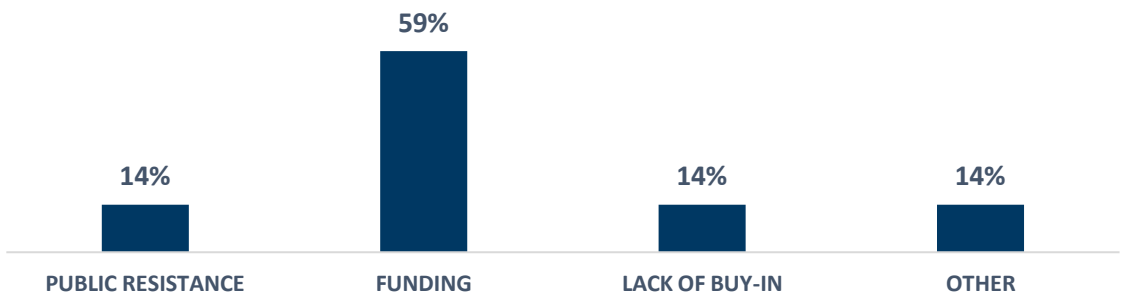
- VRU improvements do not get the same attention as roadway improvements
- Implementation of narrow vehicle lanes, reduced speeds, and additional lighting is helpful

## EMERGENCY SERVICES

- CLAS standards should be presented at all levels of traffic safety planning and emergency response initiatives to ensure Diversity, Inclusion, Equity, and Accessibility are considered

Barriers hindering implementation of VRU safety improvements are shown in **Figure 35**. The highest barrier reported by stakeholders was funding availability.

*Figure 35. Barriers Hindering Implementation of VRU Safety Improvements*



## STAKEHOLDER MEETING 2

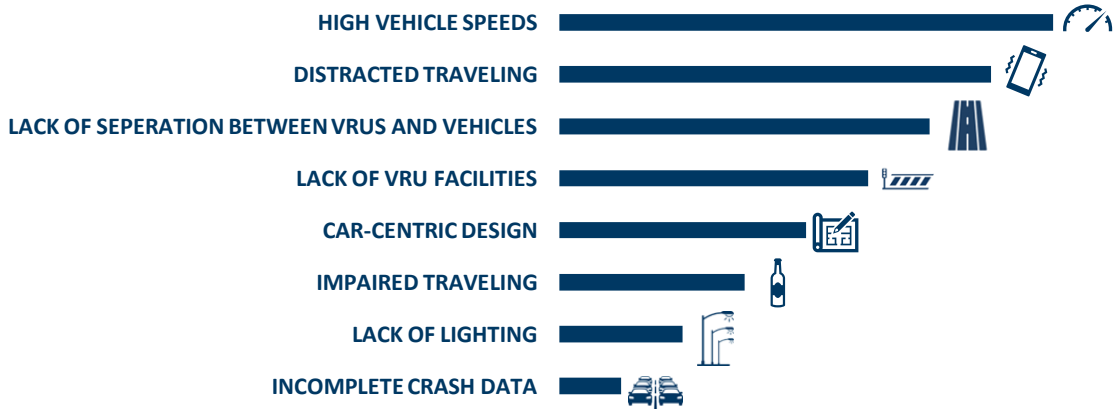
Stakeholder Meeting 2 was held on October 3, 2023. Stakeholder meeting invitations were extended to all stakeholder partners across the state, including state departments, regional agencies, local agencies, and advocacy groups to obtain context and input on VRU safety across the state and obtain feedback and input on the draft developed countermeasure toolkit.

A total of 80 stakeholders attended Stakeholder Meeting 2, including representatives from Arizona Department of Public Safety, Arizona Department of Health Services, and other regional and local partners throughout the state. The stakeholder meeting provided an overview of the VRUSA, the identified SIAs, and review of the draft Safety Improvement Strategies countermeasures toolbox.

Attendees were provided with a draft Safety Improvement Strategies Toolkit and provided an overview of feedback obtained in Stakeholder Meeting 1. Discussion was facilitated using a virtual polling system. Questions to guide discussion included:

- Please rank the conditions identified in Stakeholder Meeting 1 from highest to lowest impact in your community.
- What ideas do you have to overcome the barriers identified in Stakeholder Meeting 1?
- Is there any additional support your community would like from ADOT?
- What countermeasures have you seen effectively applied in your community?
- What countermeasures would you like to see more of in your community?

Key takeaways from Stakeholder Meeting 2 are summarized below. Stakeholders ranked the conditions identified in Stakeholder Meeting 1 as most prevalent in their community. High speeds and distracted traveling ranked the highest among conditions contributing to VRU safety.




When asked to share ideas on how to overcome barriers in improving VRU safety, comment responses included:

- Continued follow-through on safety efforts (e.g., implement VRU projects)
- Identify additional funding opportunities
- Improve design standards and policies to include VRU best practices
- Improve education
- Shift culture of safety to see VRUs as important as vehicle users

Stakeholders were asked what countermeasures have been effectively implemented in their communities. Common responses included:

| | | | | |
|---|---|---|---|---|
| **Speed reduction** | **Improved lighting** | **Bicycle facilities** (e.g., separated bike lanes and buffered bike lanes) | **Law enforcement presence in high vulnerability areas** | **Well-trained EMS and trauma system to reduce length of post-crash care** |
| **Off-street routes** (e.g., utility corridors) | **Road Safety Assessments** | **Safe Routes to School** | **Improved design standards** | **Education campaigns** |

Stakeholders reported that they would like to see more of the following countermeasures in their community:

| | | | | |
|---|---|---|---|---|
| **Mandatory and Frequent Training for Vehicle Drivers** | **Effective and Continuous Enforcement** | **Additional Pedestrian Facilities** | **Additional Bicyclist Facilities** | **Equitable Road Maintenance and Snow Removal** |
| **Improved design standard** | **Road Safety Assessments** | **Safe Routes to School** | **Speed Reduction** | **Lane Reconfigurations** |

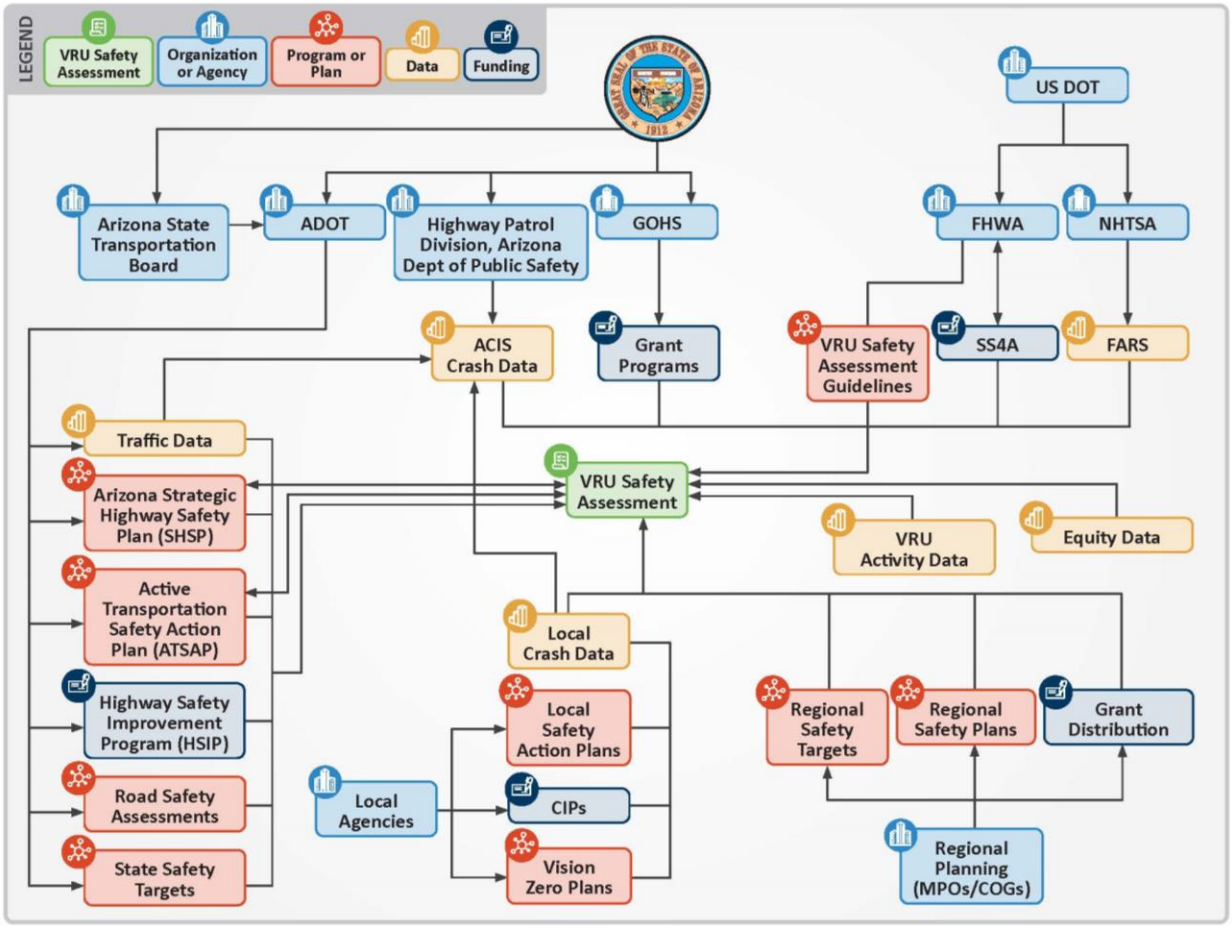
# PROGRAM OF PROJECTS AND STRATEGIES

Following the identification of safety improvement areas and stakeholder consultation, a program of projects and strategies was developed for Arizona. The program of projects and strategies includes a state safety program inventory and safety improvement strategies. The state safety program inventory provides stakeholders with a snapshot of VRU safety efforts in Arizona. The safety improvement strategies are a list of countermeasures aimed to provide stakeholders with an initial guide to identify possible strategies to improve VRU safety.

## Safety Program Inventory

To aid local, regional, and statewide partners, the Arizona VRUSA reviewed existing programs involving VRU safety. This inventory aimed to provide information on the overall scope of VRU safety efforts in the state and aid stakeholders in making connections. Arizona's safety program inventory comprises agencies, plans, programs, funding sources, and databases applicable to VRU safety and is shown in **Figure 36**.

*Figure 36. Arizona Safety Program Inventory*



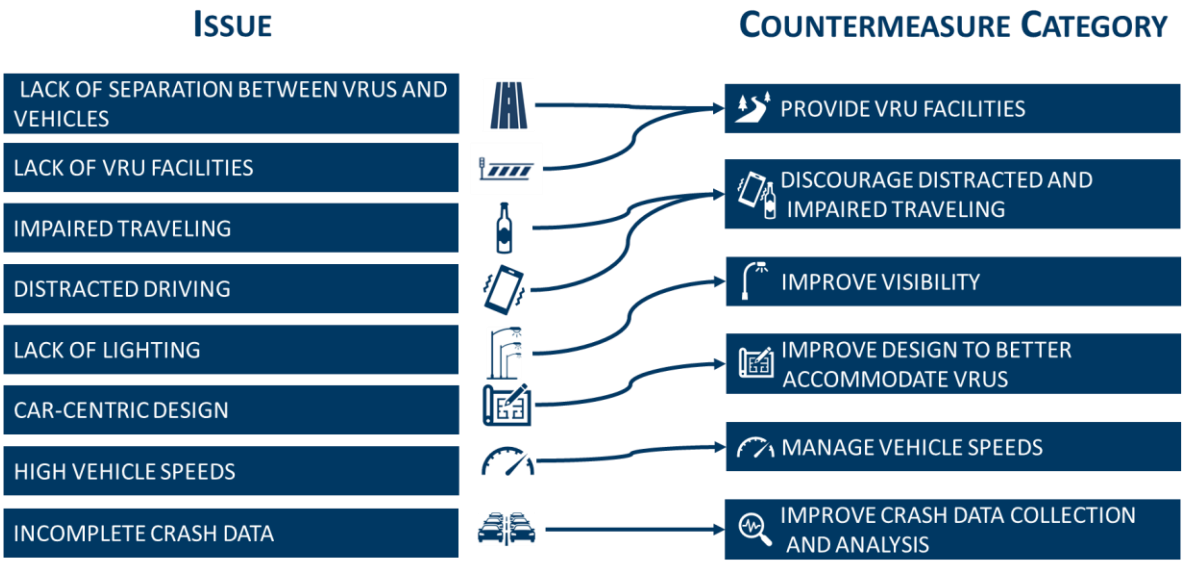

## Safety Improvement Strategies

Safety improvement strategies were developed following a review of existing safety efforts and discussion with stakeholders. Countermeasures from Stakeholder Meeting 1, Stakeholder Meeting 2, and existing local, regional, and statewide plans were summarized to develop a comprehensive list of safety improvement countermeasures. Identified countermeasures were then applied to a wide variety of criteria to develop the VRU Safety Countermeasures Selection Matrix Tool. This tool is intended to be used by stakeholders at all levels of government to aid the selection of appropriate countermeasures to address VRU safety challenges in their community.

### COUNTERMEASURE CATEGORY DEVELOPMENT

Issues identified in the review safety plans and in the stakeholder consultation process were collected and combined to establish countermeasure categories. The countermeasure categories are intended to aid the user of the toolbox in identifying what countermeasures would aim to improve the specific VRU safety challenges in their community. The countermeasure categories resulting from the issue review are shown in **Figure 37**.

*Figure 37. Countermeasure Categories*




## COUNTERMEASURE APPLICABILITY

A wide variety of conditions and criteria were applied to the identified countermeasures. The resulting countermeasures are intended to prioritize solutions that are:

- Low-cost
- Proven effective
- Broad application
- Easy to implement
- Eligible for multiple funding sources
- Related to specific roadway conditions and user types

To achieve an understanding of the above goals, each countermeasure was categorized by budget level, countermeasure type based on the 4 E's of Transportation Safety, SSA effectiveness criteria, and applicability criteria for each countermeasure type.

### *Budget*

Understanding the associated cost is an important first step in identifying the appropriate countermeasure to mitigate VRU safety in a community. Each countermeasure was ranked by general cost. Costs have been categorized as low, medium, and high. It is important to note that many costs associated with countermeasures are dependent on the size of implementation.

### *Countermeasure Type*

Countermeasure types were developed utilizing the 4 E's of Transportation Safety and the added category of data collection. Users can prioritize solutions by the type of countermeasure they want to implement. The countermeasure types are shown below.

**ENGINEERING:** tools and resources to address safety concerns, including roadway design, traffic engineering, maintenance, and planning

**EDUCATION:** outreach campaigns and initiatives to promote and teach safe roadway behavior, including drivers and VRUs

**ENFORCEMENT:** ensure that roadway users are following the rules of the road

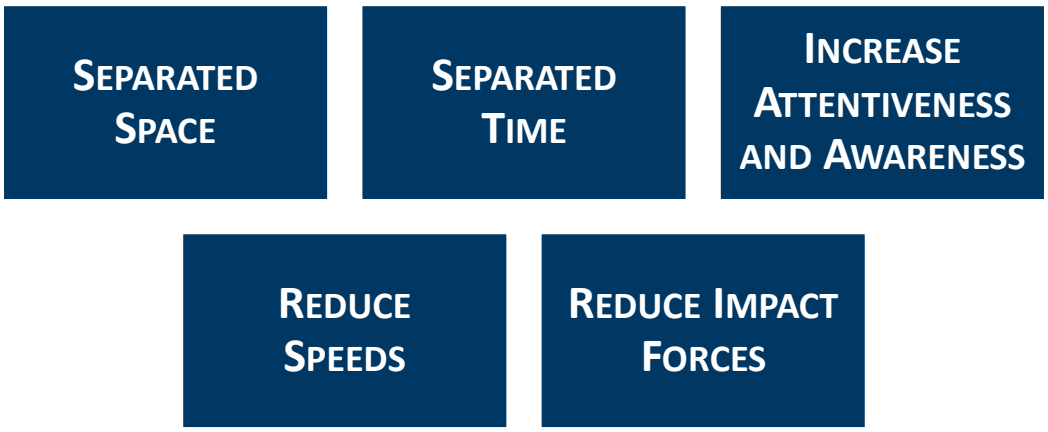
**EMERGENCY SERVICES:** practices to ensure that the processes involving emergency services are streamlined to improve response time

**DATA COLLECTION:** benchmarking efforts through data collection and analysis

### *SSA Effectiveness Criteria*

Countermeasures were also compared to the SSA to determine their effectiveness with each SSA aspect. Countermeasures were noted as effectively addressing an SSA aspect with either a "Yes" or "Sometimes" response, where applicable, for each of the SSA criteria shown in **Figure 38**:

*Figure 38. SSA Effectiveness Criteria*

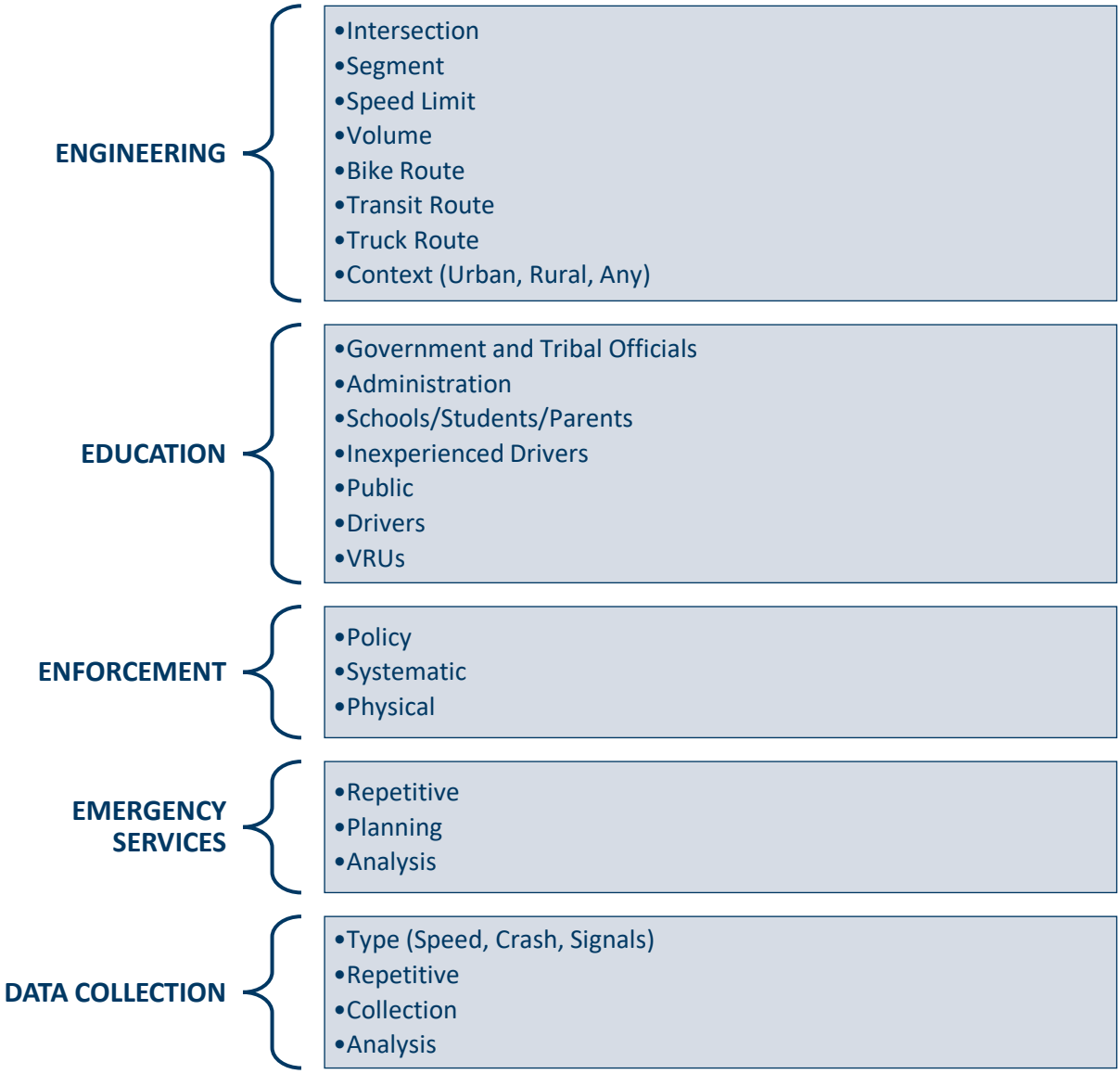



*Source: United States Department of Transportation*

### *Applicability Criteria*

Applicability criteria were applied to each countermeasure dependent on the countermeasure type. This allows users to further determine which countermeasure will be most effective for their location, audience, and more. **Figure 39** shows the applicability criteria by countermeasure type.

*Figure 39. Countermeasure Type by Applicability Criteria*



## VRU SAFETY COUNTERMEASURES SELECTION MATRIX TOOL

The VRU Safety Countermeasures Selection Matrix Tool is shown below and is categorized by type and relative cost (countermeasure costs compared to each other) of the strategy. Countermeasures are derived from review of previous planning efforts and stakeholder input.

# Low Cost

The following sections outline the low-cost countermeasures for each countermeasure type. The tables below outline the low engineering, education, enforcement, and data collection countermeasures and their associated applicability. There are no low-cost emergency service countermeasures. Cost categories may be altered based on implementation conditions.

## ENGINEERING

**Table 8** provides low-cost engineering countermeasures. **Table 9** shows the applicability of each low-cost engineering countermeasure.

*Table 8. Low-Cost Engineering Countermeasures*

| COUNTERMEASURE | SEPARATED SPACE | SEPARATED TIME | INCREASE ATTENTIVENESS AND AWARENESS | REDUCE SPEEDS | REDUCE IMPACT FORCES |
|---|---|---|---|---|---|
| **Improve Design to Better Accommodate VRUs** | | | | | |
| Improve intersection geometry using advance stop and yield lines | | ● | ● | | ● |
| Utilize the Safe Routes to School program | | | ● | | |
| Evaluate signal phasing and timing (e.g., add flashing yellow left-turn arrow, reduce through and left-turn conflicts) for improvements | | ● | ● | | ● |
| Include additional lateral space for bicycles on roadway cross-sections | ● | | | | ● |
| Improve sight distance and visibility between drivers and VRUs | | | ● | | |
| Update existing policies and standards to better promote systemwide VRU safety countermeasures. | ◐ | ◐ | ● | ◐ | ◐ |
| Address existing policies and standards that encourage wider roads and flared intersections that later require safety countermeasures. | ◐ | ◐ | ● | ◐ | ◐ |
| **Discourage Distracted and Impaired Traveling** | | | | | |
| Implement rumble strips | | | ● | | |
| Install chevrons on curves | ● | | ● | ◐ | |
| **Manage Vehicle Speeds** | | | | | |
| Reduce speed limits | | | | ● | ● |
| **Provide VRU Facilities** | | | | | |
| Identify grant programs eligible for VRU funding, including federal, regional, and local funds | ● | | | | ● |
| **Improve Visibility** | | | | | |
| Increase visibility of traffic control devices (oversized regulatory signs, retroreflective signposts) | ● | | ● | | ● |
| Proactively maintain pavement markings | ● | ● | ● | ● | |
| **General** | | | | | |
| Improve maintenance frequency of existing VRU facilities | ● | | ● | | ● |

LEGEND: ● YES ◐ SOMETIMES

*Table 9. Low-Cost Engineering Applicability*

| COUNTERMEASURE | INTERSECTION | SEGMENT | SPEED LIMIT (MPH) | VOLUME (VPD) | BIKE ROUTE | TRANSIT ROUTE | TRUCK ROUTE | CONTEXT |
|---|---|---|---|---|---|---|---|---|
| **Improve Design to Better Accommodate VRUs** | | | | | | | | |
| Improve intersection geometry by implementing advance stop and yield lines | ✓ | | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Utilize the Safe Routes to School program | ✓ | ✓ | <45 | <45K | ✓ | ✓ | | ANY |
| Evaluate signal phasing and timing (e.g., add flashing yellow left-turn arrow, reduce through and left-turn conflicts) for improvements | ✓ | | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Include additional lateral space for bicycles on roadway cross-sections | | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Improve sight distance and/or visibility between drivers and VRUs (e.g., daylighting) | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Update existing policies and standards to better promote systemwide safety countermeasures. | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Address existing policies and standards that encourage wider roads and flared intersections that later require safety countermeasures. | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| **Discourage Distracted and Impaired Traveling** | | | | | | | | |
| Implement rumble strips | | ✓ | ANY | ANY | ✓ | ✓ | ✓ | RURAL |
| Install chevrons on curves | | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| **Manage Vehicle Speeds** | | | | | | | | |
| Reduce speed limits | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| **Provide VRU Facilities** | | | | | | | | |
| Identify federal grant programs eligible for VRU funding | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| **Improve Visibility** | | | | | | | | |
| Increase visibility of traffic control devices (oversized regulatory signs, retroreflective signposts) | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Proactively maintain pavement markings | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| **General** | | | | | | | | |
| Improve maintenance frequency of existing VRU facilities | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |

CONTEXT: RURAL, URBAN, ANY

## EDUCATION

**Table 10** shows low-cost education countermeasures. **Table 11** shows the applicability of each low-cost education countermeasure.

*Table 10. Low-Cost Education Countermeasures*

| COUNTERMEASURE | SEPARATED SPACE | SEPARATED TIME | INCREASE ATTENTIVENESS AND AWARENESS | REDUCE SPEEDS | REDUCE IMPACT FORCES |
|---|---|---|---|---|---|
| **Improve Design to Better Accommodate VRUs** | | | | | |
| Include VRU safety as a primary project evaluation criterion in Transportation Improvement Programs (TIPs) | ● | ● | ● | ● | ● |
| Integrate Safe System principles into all levels of transportation planning | ● | ● | ● | ● | ● |
| **Discourage Distracted and Impaired Traveling** | | | | | |
| Identify best practices for promoting and/or implementing Safe Driving pledge campaigns | | | ● | | |
| Train school crossing guards and coordinate with them to identify safety issues to share with students and the general public | ● | ● | ● | ● | ● |
| Utilize Dynamic Message Signs for impaired driving educational messages | | | ● | | |
| Implement a campaign on Driving Under the Influence (DUI) dangers and penalties | | | ● | | |
| **Improve Crash Data and Analysis** | | | | | |
| Provide information to government and tribal officials on crash trends regularly | | ● | ● | ● | ● |
| **Improve Visbility** | | | | | |
| Promote the use of pedestrian and bicyclist safety lights and reflective wrist/ankle bands | ● | ● | ● | ● | |
| **General** | | | | | |
| Engage more with key VRU advocacy groups | | ● | ● | ● | ● |
| Promote the use of helmets | ● | ● | ● | ● | ● |
| Engage with population groups or communities experiencing high numbers of fatal or serious VRU crashes | | ● | ● | ● | ● |

LEGEND: ● YES ● SOMETIMES

*Table 11. Low-Cost Education Applicability*

| COUNTERMEASURE | AUDIENCE | | | | | | |
|---|---|---|---|---|---|---|---|
| | GOVERNMENT AND TRIBAL OFFICIALS | ADMINISTRATION | SCHOOLS/STUDENTS/ PARENTS | INEXPERIENCED DRIVERS | PUBLIC | DRIVERS | VRUS |
| **Improve Design to Better Accommodate VRUs** | | | | | | | |
| Include VRU safety as a primary project evaluation criterion in TIPs | | ✓ | | | | | |
| Integrate Safe System principles into all levels of transportation planning | | ✓ | | | | | |
| **Discourage Distracted and Impaired Traveling** | | | | | | | |
| Identify best practices for promoting and/or implementing Safe Driving pledge campaigns | | | | | ✓ | ✓ | |
| Train school crossing guards and coordinate with them to identify safety issues to share with students and the general public | | | ✓ | ✓ | ✓ | | |
| Utilize Dynamic Message Signs for impaired driving educational messages | | | | | | ✓ | |
| Implement a campaign on DUI dangers and penalties | | | | | ✓ | ✓ | ✓ |
| **Improve Crash Data and Analysis** | | | | | | | |
| Provide information to government and tribal officials on crash trends regularly | ✓ | ✓ | | | | | |
| **Improve Visibility** | | | | | | | |
| Promote the use of pedestrian and bicyclist safety lights and reflective wrist/ankle bands | | | | | ✓ | | ✓ |
| **General** | | | | | | | |
| Engage more with key VRU advocacy groups | | | ✓ | | | | ✓ |
| Promote the use of helmets | | ✓ | | | ✓ | | ✓ |
| Engage with population groups or communities experiencing high numbers of fatal or serious VRU crashes | | ✓ | | | ✓ | ✓ | ✓ |

## ENFORCEMENT

**Table 12** shows low-cost enforcement countermeasures. **Table 13** shows the applicability of each low-cost enforcement countermeasure.

*Table 12. Low-Cost Enforcement Countermeasures*

| COUNTERMEASURE | SEPARATED SPACE | SEPARATED TIME | INCREASE ATTENTIVENESS AND AWARENESS | REDUCE SPEEDS | REDUCE IMPACT FORCES |
|---|---|---|---|---|---|
| **Discourage Distracted and Impaired Traveling** | | | | | |
| Increase enforcement of laws and ordinances banning any use of a cell phone while driving | | | ● | | |
| Conduct high-visibility impaired traveling saturation patrols for both drivers and VRUs | | | ● | | |
| **Manage Vehicle Speeds** | | | | | |
| Increase enforcement of speeding and red-light running | | | ● | ● | |
| Implement targeted enforcement in school zones | | | ● | ● | |
| **General** | | | | | |
| Increase enforcement of laws designed to promote VRU safety (e.g., jaywalking, wrong-way riding, and vehicles encroaching on bicyclists) | ◐ | ◐ | ● | ◐ | ◐ |
| Conduct targeted enforcement at high-risk locations | ◐ | ◐ | ● | ◐ | ◐ |

LEGEND: ● YES ◐ SOMETIMES

*Table 13. Low-Cost Enforcement Applicability*

| COUNTERMEASURE | POLICY | SYSTEMATIC | PHYSICAL |
|---|---|---|---|
| **Discourage Distracted and Impaired Traveling** | | | |
| Increase enforcement of ordinances banning any use of a cell phone while driving | ✓ | | ✓ |
| Conduct high-visibility impaired traveling saturation patrols for both drivers and VRUs | | | ✓ |
| **Manage Vehicle Speeds** | | | |
| Increase enforcement of speeding and red-light running | | | ✓ |
| Implement targeted enforcement in school zones | | | ✓ |
| **General** | | | |
| Increase enforcement of laws designed to promote VRU safety (e.g., jaywalking, wrong-way riding, and vehicles encroaching on bicyclists) | | ✓ | ✓ |
| Conduct targeted enforcement at high-risk locations | | | ✓ |

## DATA COLLECTION

**Table 14** shows low-cost data collection countermeasures. **Table 15** shows the applicability of each low-cost data collection countermeasure.

*Table 14. Low-Cost Data Collection Countermeasures*

| COUNTERMEASURE | SEPARATED SPACE | SEPARATED TIME | INCREASE ATTENTIVENESS AND AWARENESS | REDUCE SPEEDS | REDUCE IMPACT FORCES |
|---|---|---|---|---|---|
| **Improve Design to Better Accommodate VRUs** | | | | | |
| Evaluate signal phasing and timing (e.g., add flashing yellow left-turn arrow, reduce through and left-turn conflicts) for improvements | | ● | ● | | ● |
| Provide information to government and tribal officials on crash trends regularly | | ● | ● | ● | ● |
| Provide data to support safety analyses, justify VRU improvement projects, and establish performance measures | ● | | | | ● |
| Submit crash data electronically to ADOT statewide crash database | ● | | | | ● |
| **General** | | | | | |
| Engage more with key VRU advocacy groups | | ● | ● | ● | ● |

LEGEND: ● YES ● SOMETIMES

*Table 15. Low-Cost Data Collection Applicability*

| COUNTERMEASURE | DATA TYPE | REPETITIVE | COLLECTION | ANALYSIS |
|---|---|---|---|---|
| **Improve Design to Better Accommodate VRUs** | | | | |
| Evaluate signal phasing and timing (e.g., add flashing yellow left-turn arrow, reduce through and left-turn conflicts) for improvements | SIGNAL | | ✓ | ✓ |
| Provide information to government and tribal officials on crash trends regularly | CRASH | ✓ | ✓ | |
| Provide data to support safety analyses, justify VRU improvement projects, and establish performance measures | CRASH | | ✓ | ✓ |
| Submit crash data electronically to ADOT statewide crash database | CRASH | ✓ | ✓ | |
| **General** | | | | |
| Engage more with key VRU advocacy groups | PUBLIC | | ✓ | ✓ |

## Medium Cost

The following sections outline the medium-cost countermeasures for each countermeasure type. The tables below outline the medium-cost engineering, education, enforcement, emergency services, and data collection countermeasures and their associated applicability. Cost categories may be altered based on implementation conditions.

### ENGINEERING

**Table 16** provides medium-cost engineering countermeasures. **Table 17** shows the applicability of each medium-cost engineering countermeasure.

*Table 16. Medium-Cost Engineering Countermeasures*

| COUNTERMEASURE | SEPARATED SPACE | SEPARATED TIME | INCREASE ATTENTIVENESS AND AWARENESS | REDUCE SPEEDS | REDUCE IMPACT FORCES |
|---|---|---|---|---|---|
| **Improve Design to Better Accommodate VRUs** | | | | | |
| Require VRU accommodation in the project assessment phase (e.g., roundabouts) | ● | ● | ● | ● | ● |
| Improve pedestrian signal equipment (e.g., APS and PPB) | | ● | ● | | |
| Develop an ADA Transition Plan | ● | ● | ● | | |
| Install guardrail | ● | | ● | | ● |
| Conduct Road Safety Assessments (RSAs) at high-risk locations | ● | ● | ● | ● | ● |
| Develop a Bicyclist Safety Assessment (BSA) program | ● | ● | ● | ● | ● |
| Develop and implement Complete Streets program and guidelines | ● | | ● | ● | ● |
| Implement a road diet (i.e., narrowing or reduction of travel lanes) | ● | | ● | ● | |
| **Discourage Distracted and Impaired Traveling** | | | | | |
| Increase the use of Intelligent Transportation System (ITS) strategies in work zones and incident management (e.g., dynamic message signs and dynamic lane merge systems) | | | ● | ● | ● |
| Implement shoulder improvements | ● | | ● | | ● |
| **Manage Vehicle Speeds** | | | | | |
| Evaluate roadway speeds regularly | | | ● | ● | |
| Install speed feedback signs | | | ● | ● | |
| Implement variable speed limit signs | | | ● | ● | |
| **Provide VRU Facilities** | | | | | |
| Install pedestrian hybrid beacons (i.e., HAWKs), pedestrian traffic signals, or flashing beacons at VRU crossings | ● | ● | ● | ● | |
| Evaluate midblock and multi-lane uncontrolled crosswalks to determine if they should remain, be improved, or be removed | ● | ● | ● | ● | |
| Bring VRU facilities into compliance with ADA requirements | ● | ● | ● | | |
| Provide bicycle detection at signalized intersections | | ● | ● | ● | ● |
| **General** | | | | | |
| Improve maintenance frequency of existing VRU facilities | ● | | ● | | ● |

LEGEND: ● YES ● SOMETIMES

*Table 17. Medium-Cost Engineering Applicability*

| COUNTERMEASURE | INTERSECTION | SEGMENT | SPEED LIMIT | VOLUME | BIKE ROUTE | TRANSIT ROUTE | TRUCK ROUTE | CONTEXT |
|---|---|---|---|---|---|---|---|---|
| **Improve Design to Better Accommodate VRUs** | | | | | | | | |
| Require VRU accommodation in the project assessment phase (e.g., roundabouts) | ✓ | ✓ | ≤ 55 | ≤ 80K | ✓ | ✓ | ✓ | ANY |
| Improve pedestrian signal equipment (e.g., APS and PPB) | ✓ | | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Develop an ADA Transition Plan | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Install guardrail | | ✓ | ANY | ANY | ✓ | ✓ | ✓ | RURAL |
| Conduct Road Safety Assessments (RSAs) at high-risk locations | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Develop a Bicyclist Safety Assessment (BSA) program | ✓ | ✓ | ANY | ANY | ✓ | ✓ | | ANY |
| Develop and implement Complete Streets program and guidelines | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Implement a road diet (i.e., narrowing or reduction of travel lanes) | | ✓ | ≤45 | <30K | ✓ | ✓ | | ANY |
| **Discourage Distracted and Impaired Traveling** | | | | | | | | |
| Increase the use of Intelligent Transportation System (ITS) strategies in work zones and incident management (e.g., dynamic message signs and dynamic lane merge systems) | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Implement shoulder improvements | | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| **Manage Vehicle Speeds** | | | | | | | | |
| Evaluate roadway speeds regularly | | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Install speed feedback signs | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Implement variable speed limit signs | | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| **Provide VRU Facilities** | | | | | | | | |
| Install pedestrian hybrid beacons (i.e., HAWKs), pedestrian traffic signals, or flashing beacons at VRU crossings | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Evaluate midblock and multi-lane uncontrolled crosswalks to determine if they should remain, be improved, or be removed | | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Bring VRU facilities into compliance with ADA requirements | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Provide bicycle detection at signalized intersections | ✓ | | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| **General** | | | | | | | | |
| Improve maintenance frequency of existing VRU facilities<br>CONTEXT: RURAL, URBAN, ANY | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |

## EDUCATION

**Table 18** provides medium-cost education countermeasures. **Table 19** shows the applicability of each medium-cost education countermeasure.

*Table 18. Medium- Cost Education Countermeasures*

| COUNTERMEASURE | SEPARATED SPACE | SEPARATED TIME | INCREASE ATTENTIVENESS AND AWARENESS | REDUCE SPEEDS | REDUCE IMPACT FORCES |
|---|---|---|---|---|---|
| **Discourage Distracted and Impaired Traveling** | | | | | |
| Improve safety public awareness, education, and training for all road users to promote safer driving behaviors | | | ● | | |
| Develop public relations campaigns highlighting the risks of distracted and impaired driving | | | ● | | |
| Support an education and outreach campaign that creates a serious dialogue about "traffic safety culture" | | | ● | | |
| Initiate a safe driving campaign for elderly drivers | | | ● | | |
| Conduct mock crash demonstrations for high school students | | | ● | | |
| **General** | | | | | |
| Increase funding for VRU safety programs | ● | | | | ● |
| Develop public-private campaigns to expand outreach events | | | ● | | |

LEGEND: ● YES ● SOMETIMES

*Table 19. Medium-Cost Education Applicability*

| COUNTERMEASURE | AUDIENCE | | | | | | |
|---|---|---|---|---|---|---|---|
| | GOVERNMENT AND TRIBAL OFFICIALS | ADMINISTRATION | SCHOOLS/STUDENTS/ PARENTS | INEXPEREINCED DRIVERS | PUBLIC | DRIVERS | VRUS |
| **Improve Design to Better Accommodate VRUs** | | | | | | | |
| Improve safety public awareness, education, and training for all road users to promote safer driving behaviors | | ✓ | | | ✓ | ✓ | ✓ |
| Develop public relations campaigns highlighting the risks of distracted and impaired traveling | | | | | ✓ | ✓ | ✓ |
| Support an education and outreach campaign that creates a serious dialogue about "traffic safety culture" | | | | | ✓ | ✓ | ✓ |
| Initiate a safe driving campaign for elderly drivers | | | | ✓ | | ✓ | |
| Conduct mock crash demonstrations for high school students | | | ✓ | | | ✓ | ✓ |
| **General** | | | | | | | |
| Increase funding for VRU safety programs | | ✓ | | | | | |
| Develop public-private campaigns to expand outreach events | ✓ | ✓ | | | ✓ | | |

## ENFORCEMENT

**Table 20** shows medium-cost enforcement countermeasures. **Table 21** shows the applicability of each medium-cost enforcement countermeasure.

*Table 20. Medium-Cost Enforcement Countermeasures*

| COUNTERMEASURE | SEPARATED SPACE | SEPARATED TIME | INCREASE ATTENTIVENESS AND AWARENESS | REDUCE SPEEDS | REDUCE IMPACT FORCES |
|---|---|---|---|---|---|
| **Manage Vehicle Speed** | | | | | |
| Establish "safety corridors" with increased fines for violations | | | ● | ● | |

LEGEND: ● YES ● SOMETIMES

*Table 21. Medium-Cost Enforcement Applicability*

| COUNTERMEASURE | POLICY | SYSTEMATIC | PHYSICAL |
|---|---|---|---|
| **Discourage Distracted and Impaired Driving** | | | |
| Establish "safety corridors" with increased fines for violations | ✓ | | ✓ |

## EMERGENCY SERVICES

**Table 22** shows medium-cost emergency services countermeasures. **Table 23** shows the applicability of each medium-cost emergency service countermeasure.

*Table 22. Medium-Cost Emergency Services Countermeasures*

| COUNTERMEASURE | SEPARATED SPACE | SEPARATED TIME | INCREASE ATTENTIVENESS AND AWARENESS | REDUCE SPEEDS | REDUCE IMPACT FORCES |
|---|---|---|---|---|---|
| **Discourage Distracted and Impaired Traveling** | | | | | |
| Increase the use of Intelligent Transportation System (ITS) strategies in work zones and incident management (e.g., dynamic message signs and dynamic lane merge systems) | | | ● | ● | |
| **General** | | | | | |
| Develop traffic incident management protocols that promote VRU safety | ● | ● | ● | ● | ● |
| Evaluate emergency medical service and trauma registry data to help fill in data gaps in crash data | | | ● | | |

LEGEND: ● YES ● SOMETIMES

*Table 23. Medium-Cost Emergency Services Applicability*

| COUNTERMEASURE | REPETITIVE | PLANNING | ANALYSIS |
|---|---|---|---|
| Increase the use of Intelligent Transportation System (ITS) strategies in work zones and incident management (e.g., dynamic message signs and dynamic lane merge systems) | ✓ | ✓ | ✓ |
| **General** | | | |
| Develop traffic incident management protocols that promote VRU safety | | ✓ | |
| Evaluate emergency medical service and trauma registry data to help fill in data gaps in crash data | ✓ | ✓ | ✓ |

## DATA COLLECTION

**Table 24** shows medium-cost data collection countermeasures. **Table 25** shows the applicability of each medium-cost data collection countermeasure.

*Table 24. Medium-Cost Data Collection Countermeasures*

| COUNTERMEASURE | SEPARATED SPACE | SEPARATED TIME | INCREASE ATTENTIVENESS AND AWARENESS | REDUCE SPEEDS | REDUCE IMPACT FORCES |
|---|---|---|---|---|---|
| **Manage Vehicle Speed** | | | | | |
| Evaluate roadway speeds regularly | | | ● | ● | |
| **Improve Crash Data and Analysis** | | | | | |
| Update crash data and performance measures annually | | ● | ● | ● | ● |
| Update intersection and segment crash analysis annually to determine high-priority locations | ● | ● | ● | ● | |
| **General** | | | | | |
| Evaluate emergency medical service and trauma registry data to help fill in data gaps in crash data | | | ● | | |

LEGEND: ● YES ● SOMETIMES

*Table 25. Medium-Cost Data Collection Applicability*

| COUNTERMEASURE | DATA TYPE | REPETITIVE | COLLECTION | ANALYSIS |
|---|---|---|---|---|
| **Manage Vehicle Speed** | | | | |
| Evaluate roadway speeds regularly | SPEED | ✓ | ✓ | ✓ |
| **Improve Crash Data and Analysis** | | | | |
| Update crash data and performance measures annually | CRASH | ✓ | ✓ | |

| COUNTERMEASURE | DATA TYPE | REPETITIVE | COLLECTION | ANALYSIS |
|---|---|---|---|---|
| Update intersection and segment crash analysis annually to determine high-priority locations | CRASH | ✓ | | ✓ |
| **General** | | | | |
| Evaluate emergency medical service and trauma registry data to help fill in data gaps in crash data | CRASH | ✓ | ✓ | ✓ |

## High Cost

The following sections outline the high-cost countermeasures for each countermeasure type. The tables below outline the high engineering, education, and data collection countermeasures and their associated criteria. There were no high-cost enforcement or emergency service countermeasures. Cost categories may be altered based on implementation conditions.

### ENGINEERING

**Table 26** provides high-cost engineering countermeasures. **Table 27** shows the applicability of each high-cost engineering countermeasure.

*Table 26. High-Cost Engineering Countermeasures*

| COUNTERMEASURE | SEPARATED SPACE | SEPARATED TIME | INCREASE ATTENTIVENESS AND AWARENESS | REDUCE SPEEDS | REDUCE IMPACT FORCES |
|---|---|---|---|---|---|
| **Improve Design to Better Accommodate VRUs** | | | | | |
| Implement raised medians or barriers | ● | | ● | ● | ● |
| Implement a roundabout | | | ● | ● | ● |
| Construct pork chop islands to create a refuge island | ● | | ● | ◐ | ◐ |
| Use a tighter radius at corners to lower vehicle speeds while turning | | | ● | ● | ● |
| **Manage Vehicle Speeds** | | | | | |
| Implement traffic calming measures | ◐ | ◐ | ● | ● | ◐ |
| Implement on-street parking | ● | | ● | ◐ | ◐ |
| **Provide VRU Facilities** | | | | | |
| Install pedestrian facilities (e.g., marked crosswalks, raised crosswalks, refuge islands, and sidewalks, HAWK) | ● | ● | ● | ◐ | ◐ |
| Install bicycle facilities (e.g., bike lanes, separated bike lanes, bike boulevards, and off-road multi-use paths, Bike HAWK) | ◐ | | ● | ◐ | ◐ |
| **Improve Visibility** | | | | | |
| Improve roadway lighting, particularly at high-risk VRU-vehicle conflict areas | | ● | ● | ● | ● |

LEGEND: ● YES ◐ SOMETIMES

*Table 27. High-Cost Engineering Applicability*

| COUNTERMEASURE | INTERSECTION | SEGMENT | SPEED LIMIT | VOLUME | BIKE ROUTE | TRANSIT ROUTE | TRUCK ROUTE | CONTEXT |
|---|---|---|---|---|---|---|---|---|
| **Improve Design to Better Accommodate VRUs** | | | | | | | | |
| Implement raised medians or barriers | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Implement a roundabout | ✓ | | ≤45 | ≤45K | ✓ | ✓ | ✓ | ANY |
| Construct pork chop islands to create a refuge island | ✓ | | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| Use a tighter radius at corners to lower vehicle speeds while turning | ✓ | | ANY | ANY | ✓ | ✓ | | ANY |
| **Manage Speed** | | | | | | | | |
| Implement traffic calming measures | ✓ | ✓ | ≤35 | ≤35 | ✓ | ✓ | ✓ | ANY |
| Implement on-street parking | | ✓ | ≤35 | ≤35 | ✓ | ✓ | | ANY |
| **Provide VRU Facilities** | | | | | | | | |
| Install pedestrian facilities (e.g., marked crosswalks, raised crosswalks, refuge islands, and sidewalks, HAWK) | ✓ | ✓ | ≤55 | ANY | ✓ | ✓ | ✓ | ANY |
| Install bicycle facilities (e.g., bike lanes, separated bike lanes, bike boulevards, and off-road multi-use paths, Bike HAWK) | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| **Improve Visibility** | | | | | | | | |
| Improve roadway lighting, particularly at high-risk VRU-vehicle conflict areas | ✓ | ✓ | ANY | ANY | ✓ | ✓ | ✓ | ANY |
| CONTEXT: RURAL, URBAN, ANY | | | | | | | | |

## EDUCATION

**Table 28** provides high-cost education countermeasures. **Table 29** shows the applicability of each high-cost education countermeasure.

*Table 28. High-Cost Education Countermeasures*

| COUNTERMEASURE | SEPARATED SPACE | SEPARATED TIME | INCREASE ATTENTIVENESS AND AWARENESS | REDUCE SPEEDS | REDUCE IMPACT FORCES |
|---|---|---|---|---|---|
| **Improve Design to Better Accommodate VRUs** | | | | | |
| **Include bicyclists as State Highway Users** | ● | ● | ● | ● | |

LEGEND: ● YES ● SOMETIMES

*Table 29. High-Cost Education Applicability*

| COUNTERMEASURE | AUDIENCE | | | | | | |
|---|---|---|---|---|---|---|---|
| | GOVERNMENT AND TRIBAL OFFICIALS | ADMINISTRATION | SCHOOLS/STUDENTS/ PARENTS | INEXPERIENECED DRIVERS | PUBLIC | DRIVERS | VRUS |
| **Improve Design to Better Accommodate VRUs** | | | | | | | |
| **Include bicyclists as State Highway Users** | | ✓ | | | ✓ | ✓ | ✓ |

## Implementation Guidance

To accompany the VRU Safety Countermeasures Selection Matrix Tool, possible funding programs that agencies may pursue are summarized in the following section. Potential funding programs for VRU safety improvements include:

- Highway Safety Improvement Program (HSIP)
- Safe Streets and Roads for All (SS4A) Grant Program
- Surface Transportation Block Grant (STBG) Program
- Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grant Program
- Reconnecting Communities and Neighborhoods (RCN) Program
- Capital Investment Grants Program Transit Oriented Development (TOD) Pilot Program
- Strengthening Mobility and Revolutionizing Transportation (SMART) Grant
- Highway User Revenue Fund (HURF)
- Local Transportation Assistance Funds (LTAF)
- Regional Transportation Funds
- Local Funds

Additional funding sources are available from state agencies, regional agencies, and local agencies. Many funding opportunities prioritize safety projects, making these programs a great opportunity for VRU safety improvements. Examples of safety-focused funding sources include HSIP and SS4A. For other sources, safety is not the primary focus but is still a component of consideration, such as in the RAISE and SMART grant programs.

# APPENDIX A

# ARIZONA VRUSA

ADOT | Arizona Department of Transportation

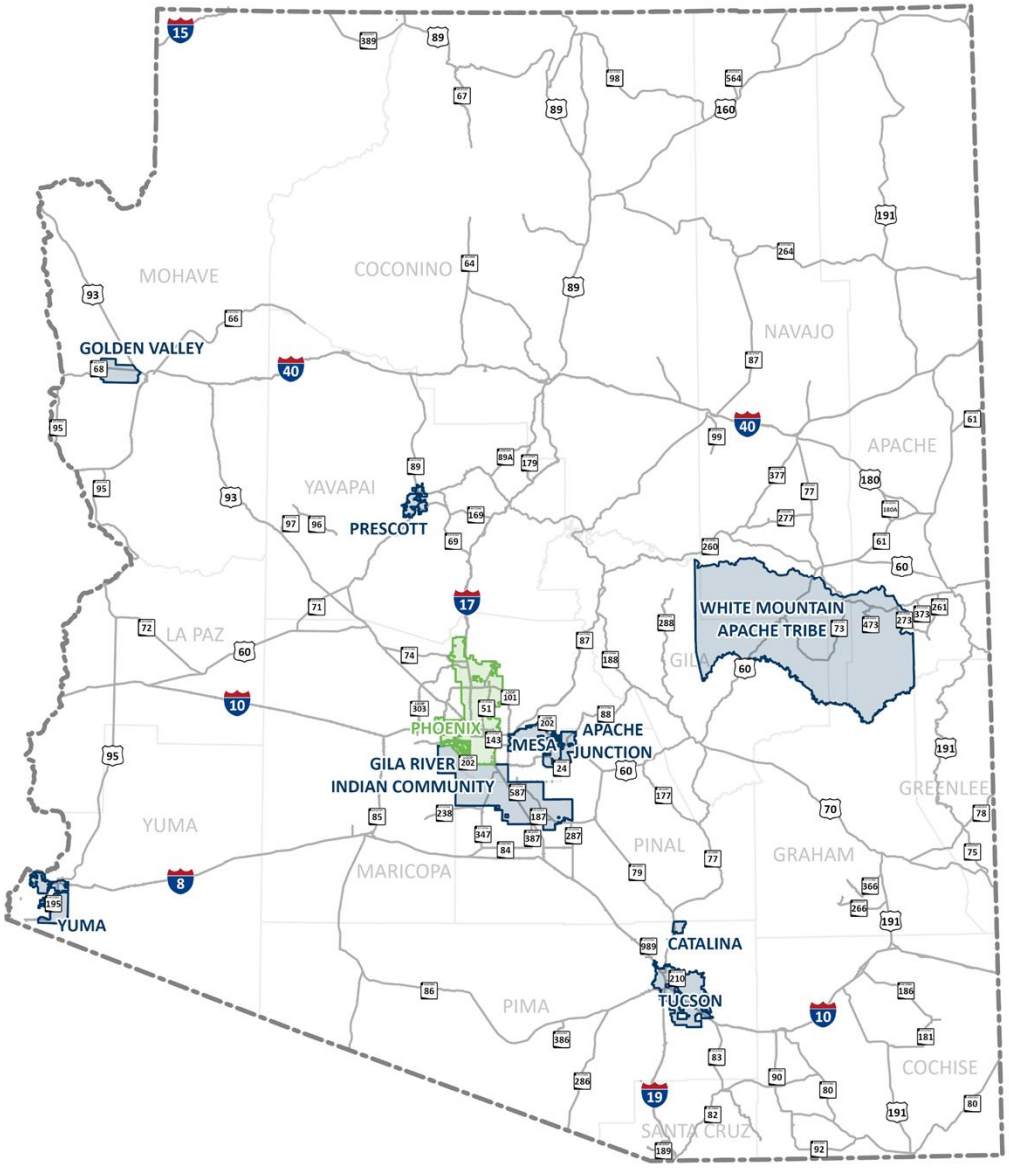
## SAFETY IMPROVEMENT AREA

# Phoenix

## VRU Safety Snapshot

| | |
|---|---|
| 11,413 | pedestrian and bicyclist crashes |
| 877 | pedestrian fatalities |
| 91 | bicyclist fatalities |
| 11.8% | of pedestrian crashes resulted in a fatality |
| 2.3% | of bicyclist crashes resulted in a fatality |

*Source: Arizona Crash Information System (ACIS), 2013-2022*



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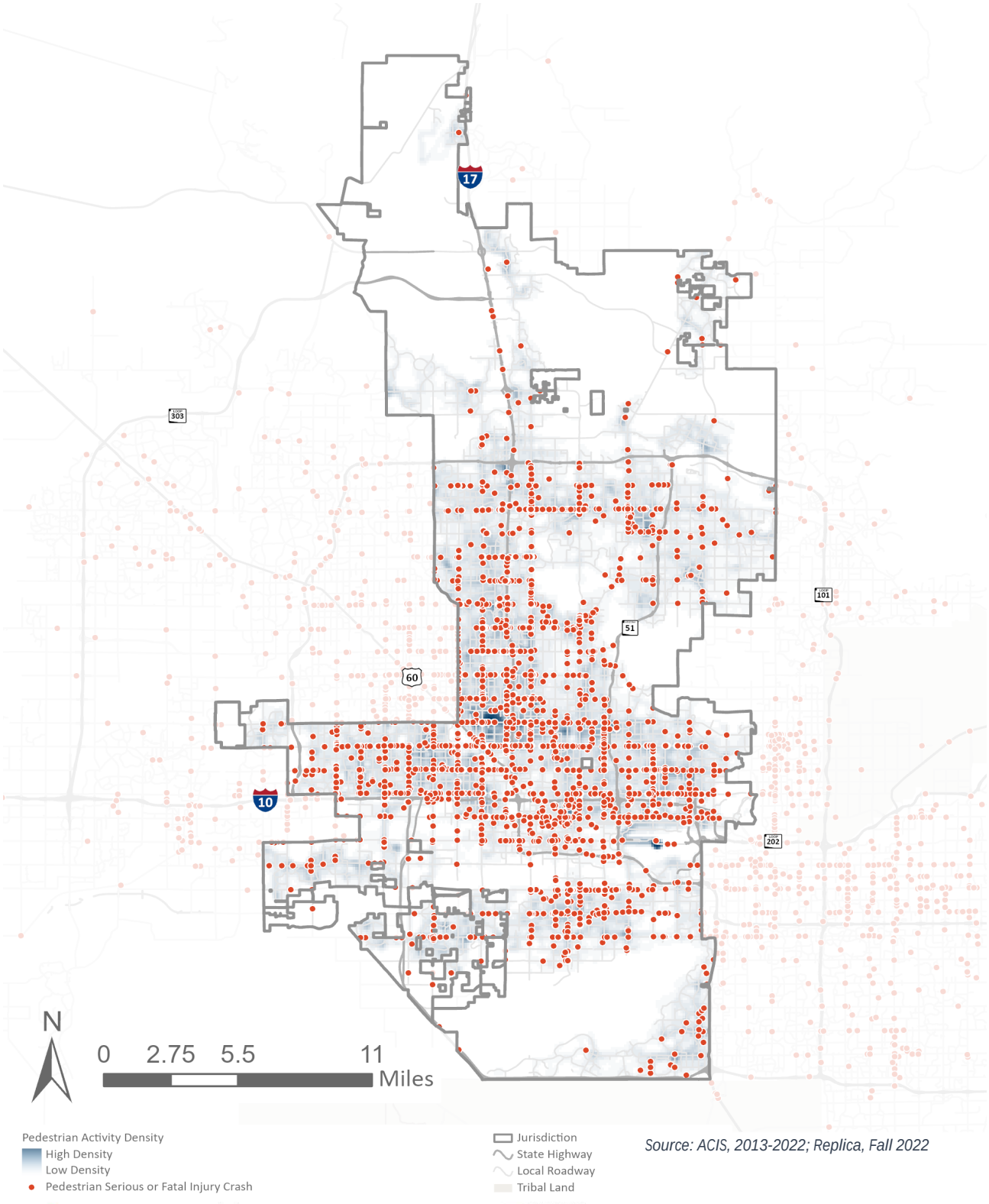
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Phoenix

## PEDESTRIAN ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

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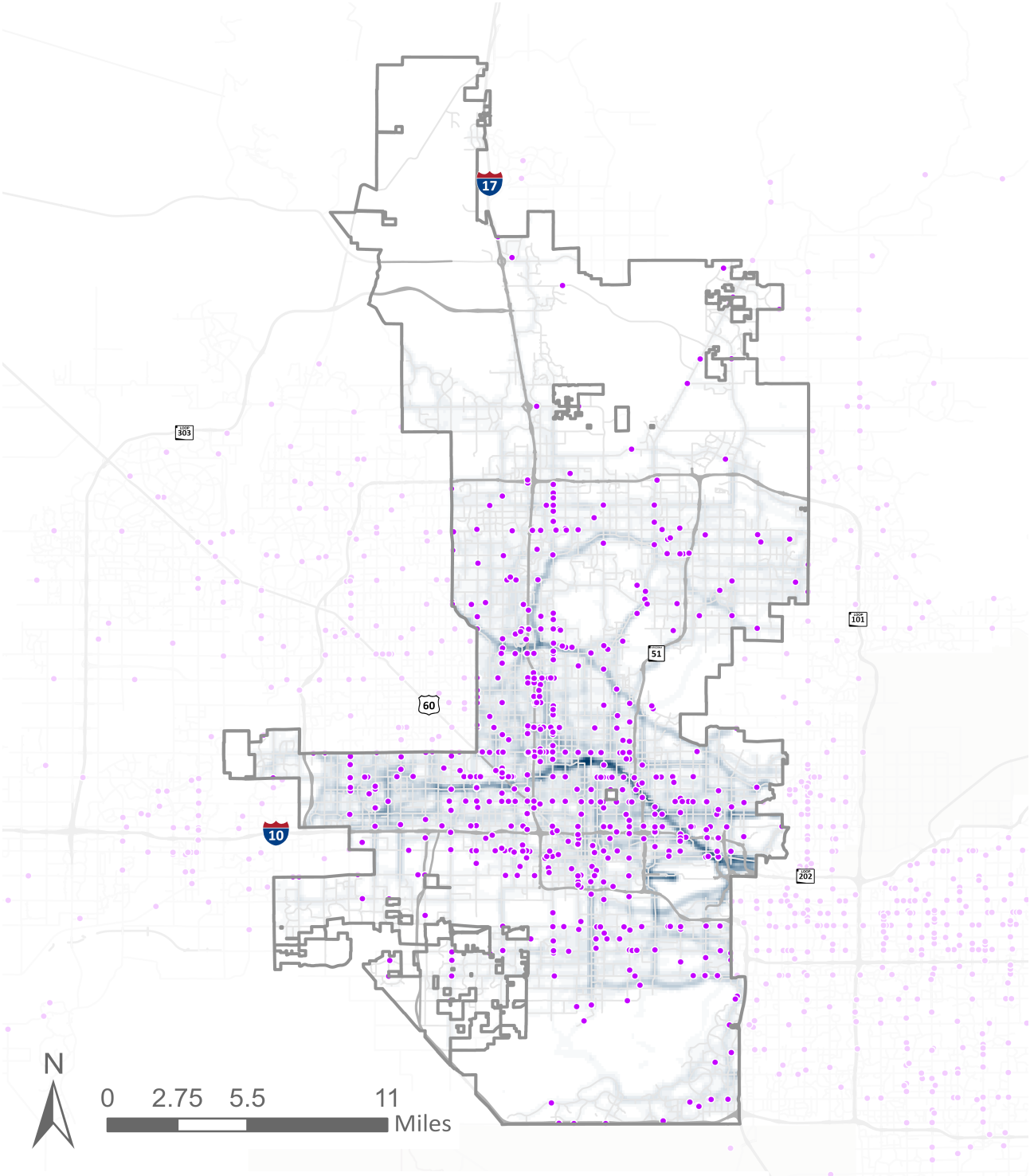
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Phoenix

## BICYCLIST ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

ADOT | Arizona Department of Transportation

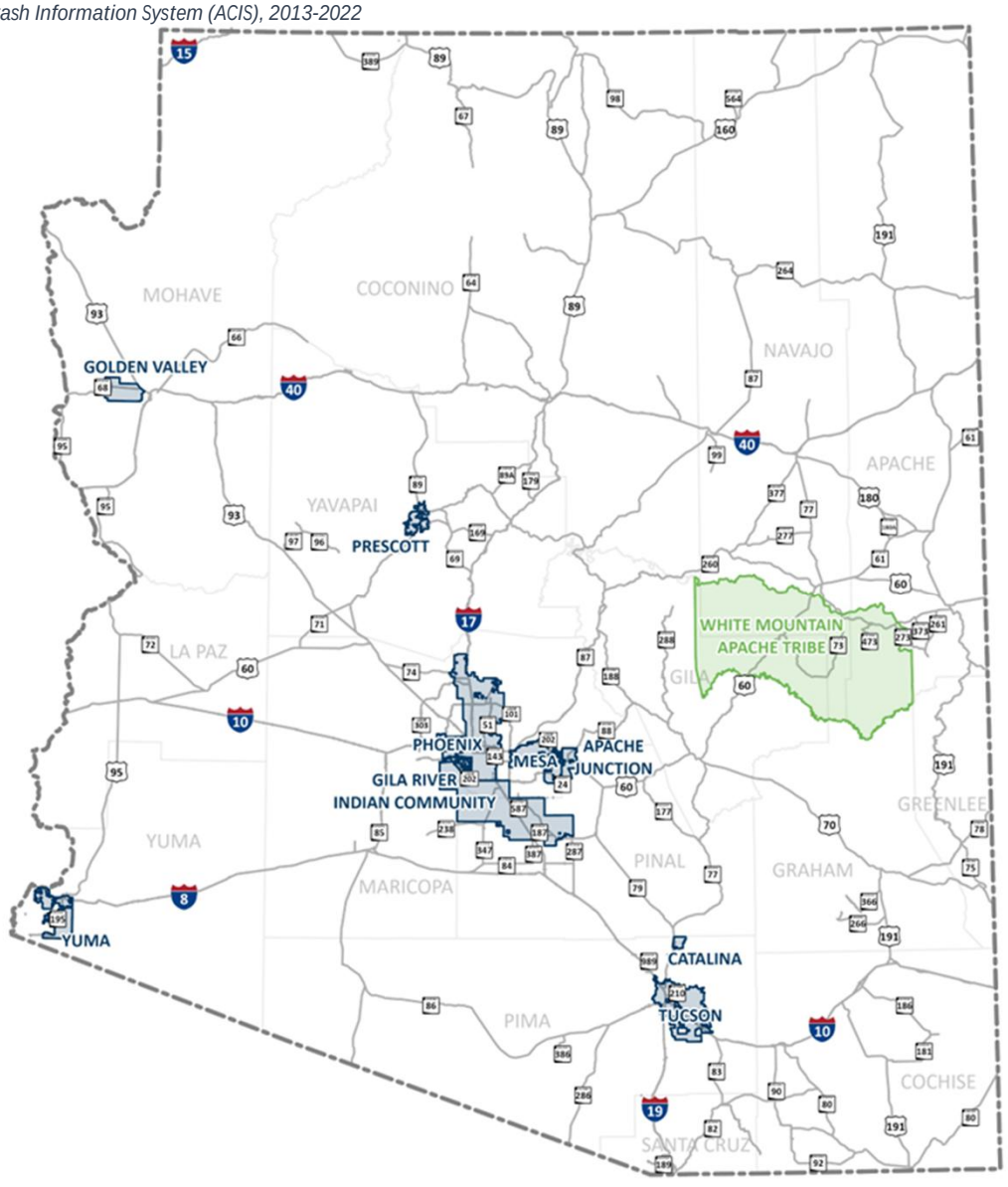
## SAFETY IMPROVEMENT AREA

# White Mountain Apache Tribe

## VRU Safety Snapshot

| | |
|---|---|
| 33 | pedestrian and bicyclist crashes |
| 22 | pedestrian fatalities |
| 0 | bicyclist fatalities |
| 66.7% | of pedestrian crashes resulted in a fatality |
| 0% | of bicyclist crashes resulted in a fatality |

*Source: Arizona Crash Information System (ACIS), 2013-2022*



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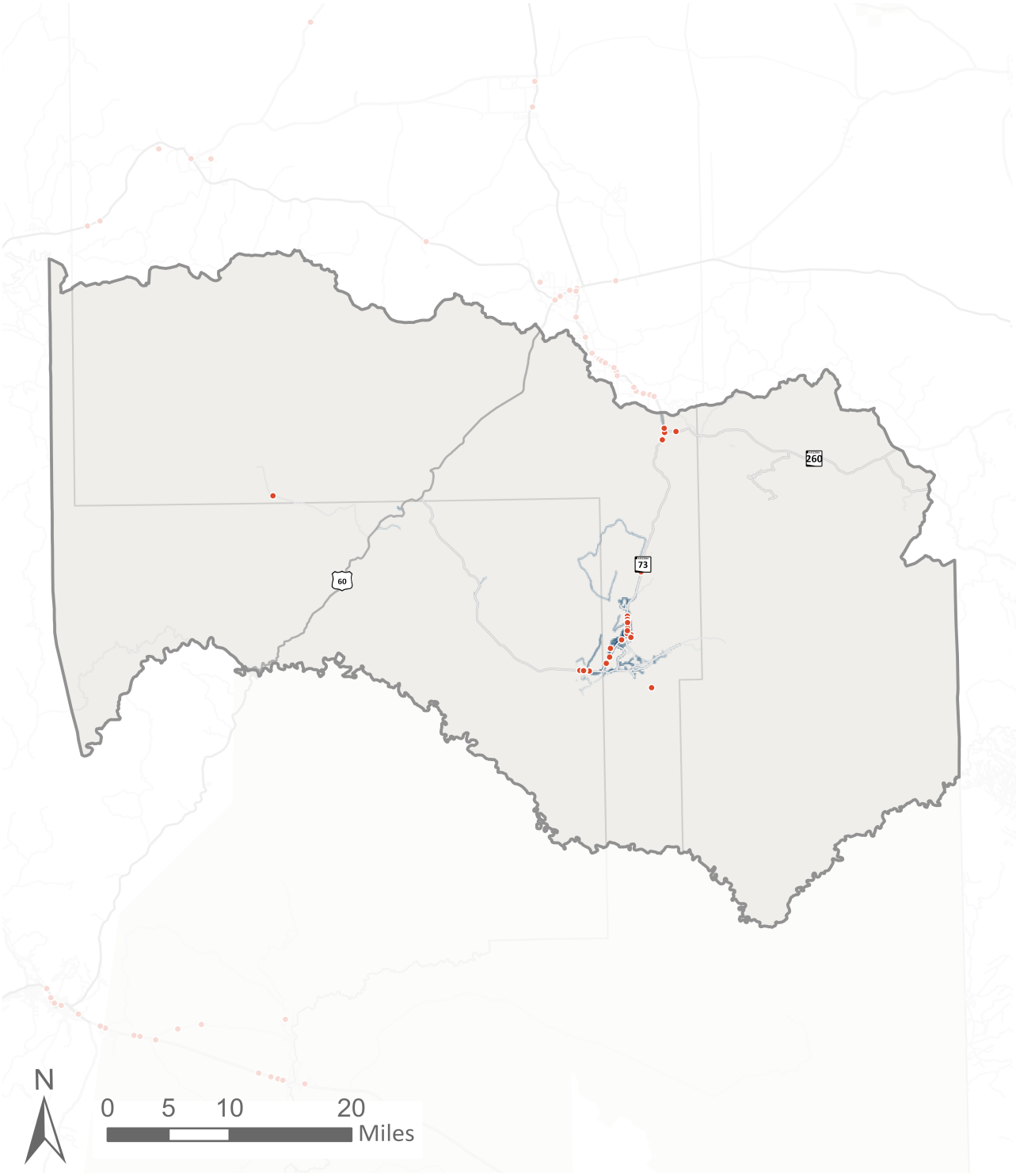
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# White Mountain Apache Tribe

## PEDESTRIAN ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

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# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# White Mountain Apache Tribe

## BICYCLIST ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES


*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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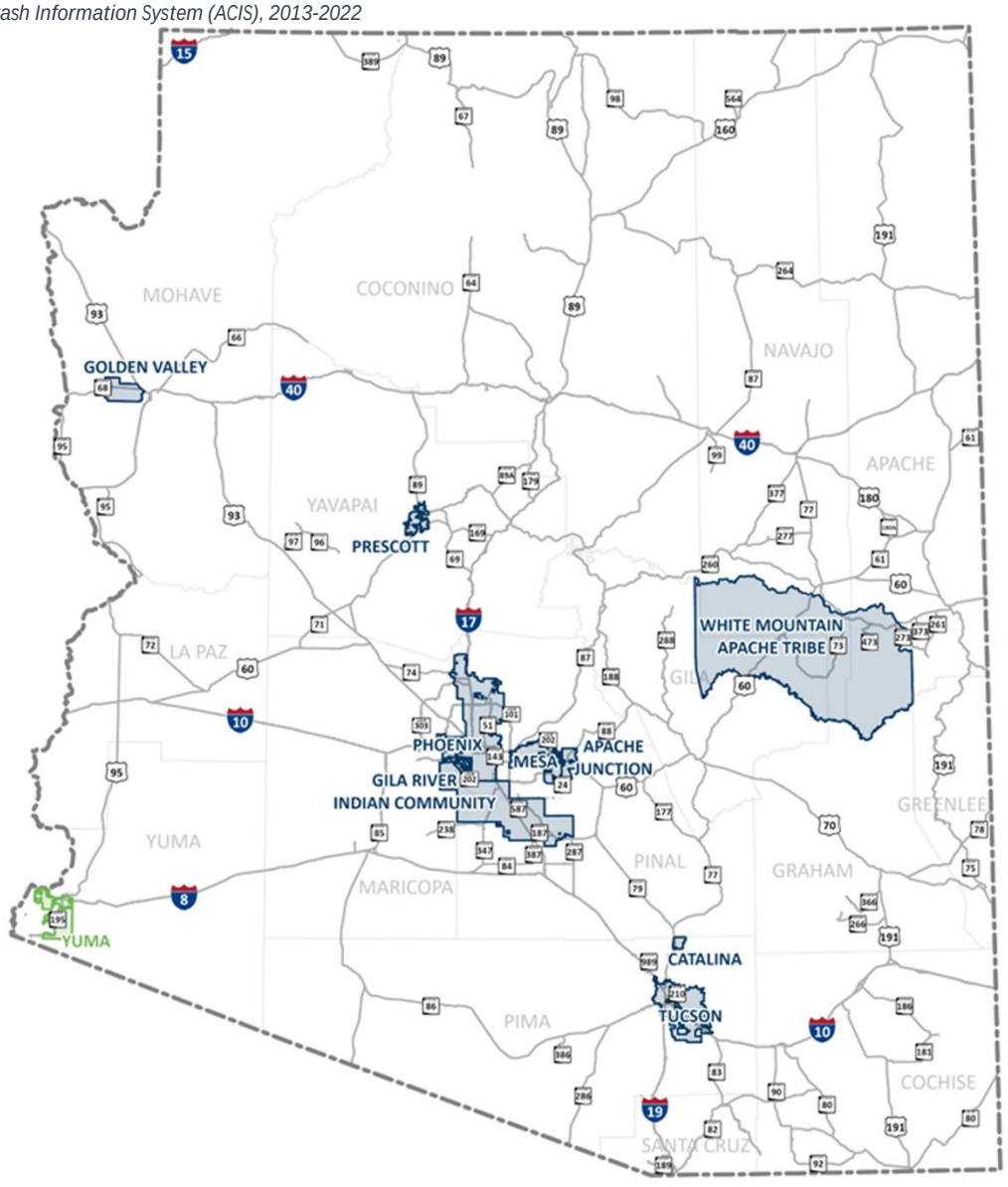
## SAFETY IMPROVEMENT AREA

# Yuma

## VRU Safety Snapshot

| | |
|---|---|
| 498 | pedestrian and bicyclist crashes |
| 24 | pedestrian fatalities |
| 4 | bicyclist fatalities |
| 10.0% | of pedestrian crashes resulted in a fatality |
| 1.5% | of bicyclist crashes resulted in a fatality |

*Source: Arizona Crash Information System (ACIS), 2013-2022*



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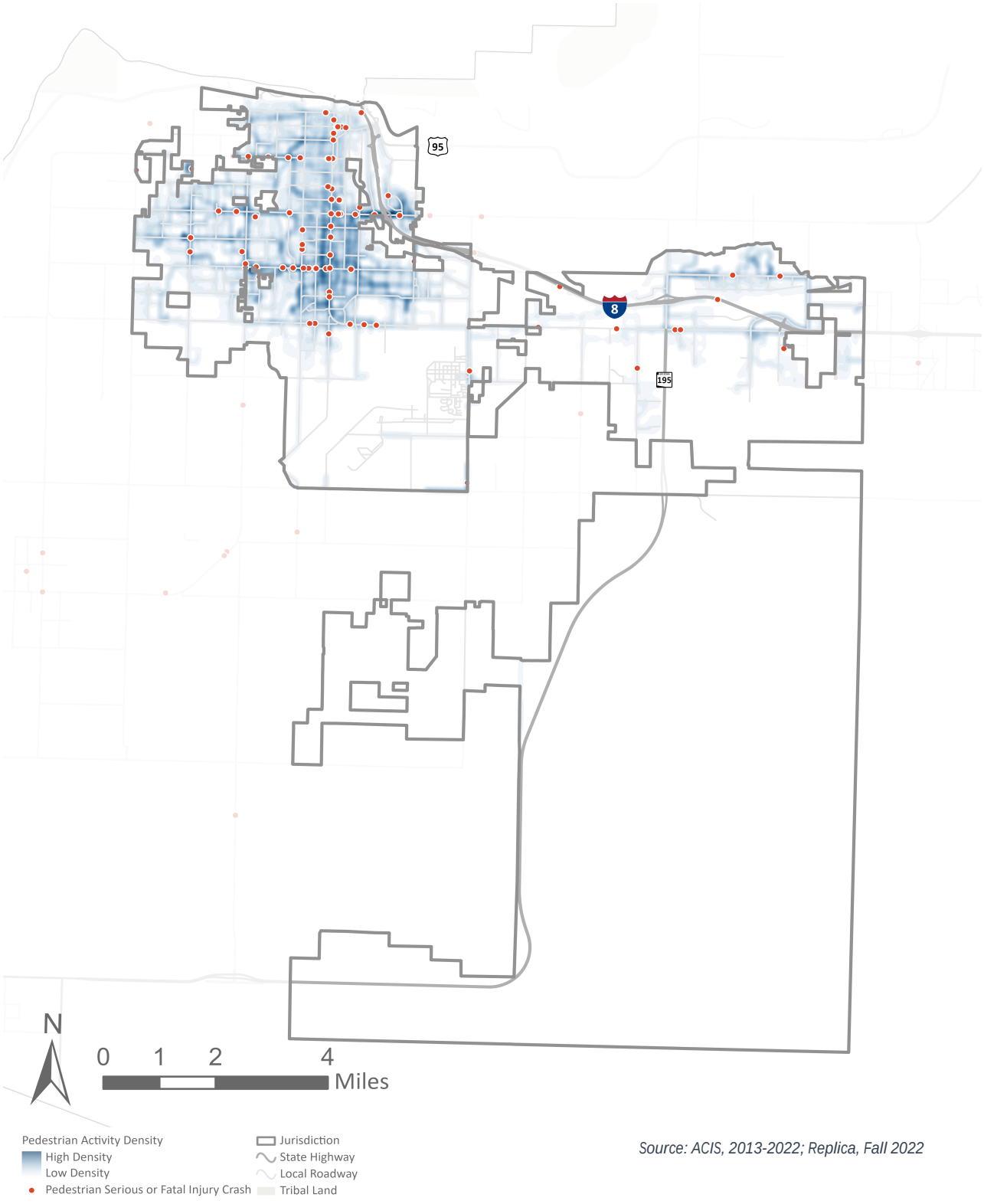
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Yuma

## PEDESTRIAN ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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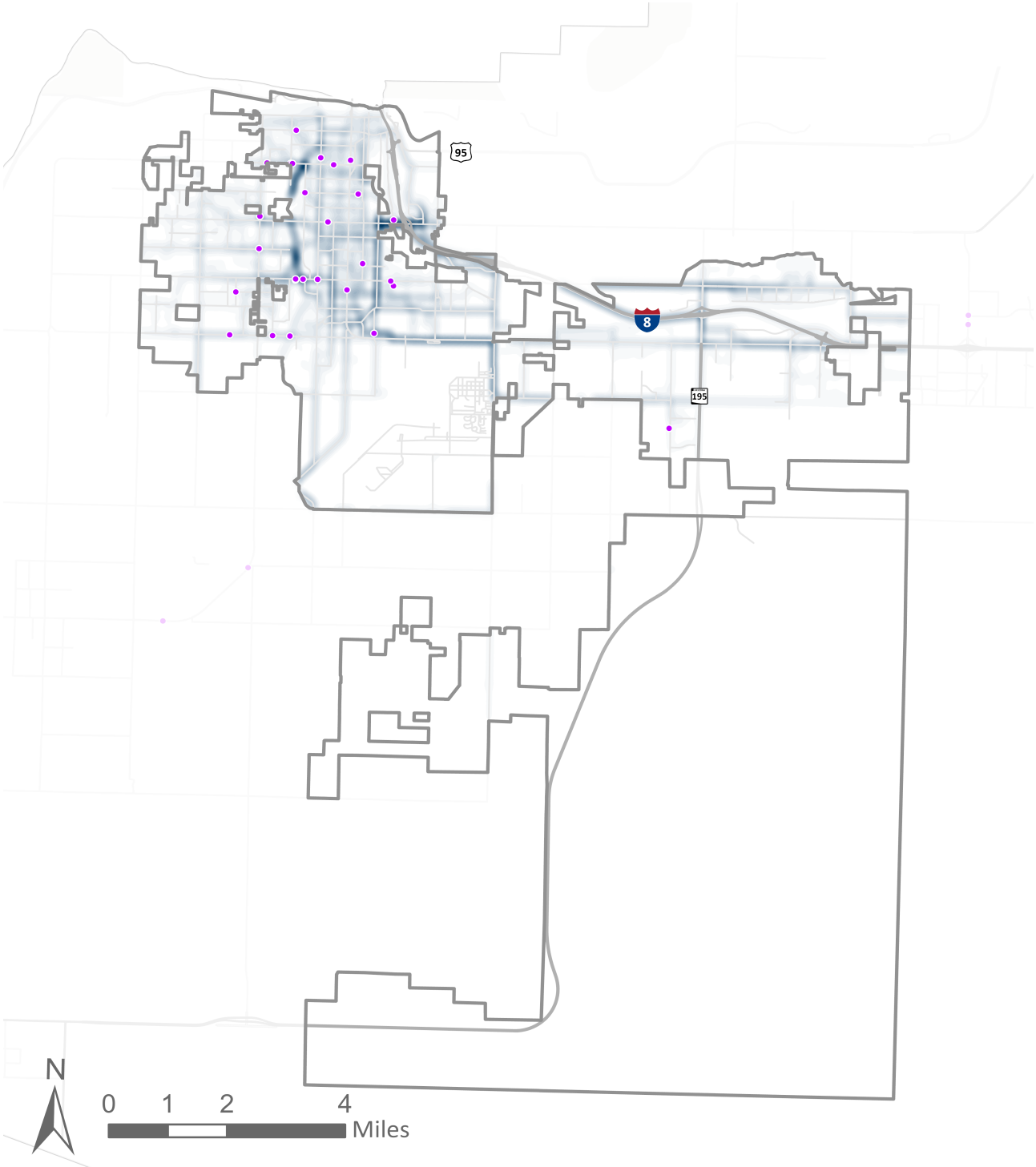
## SAFETY IMPROVEMENT AREA

# Yuma

## BICYCLIST ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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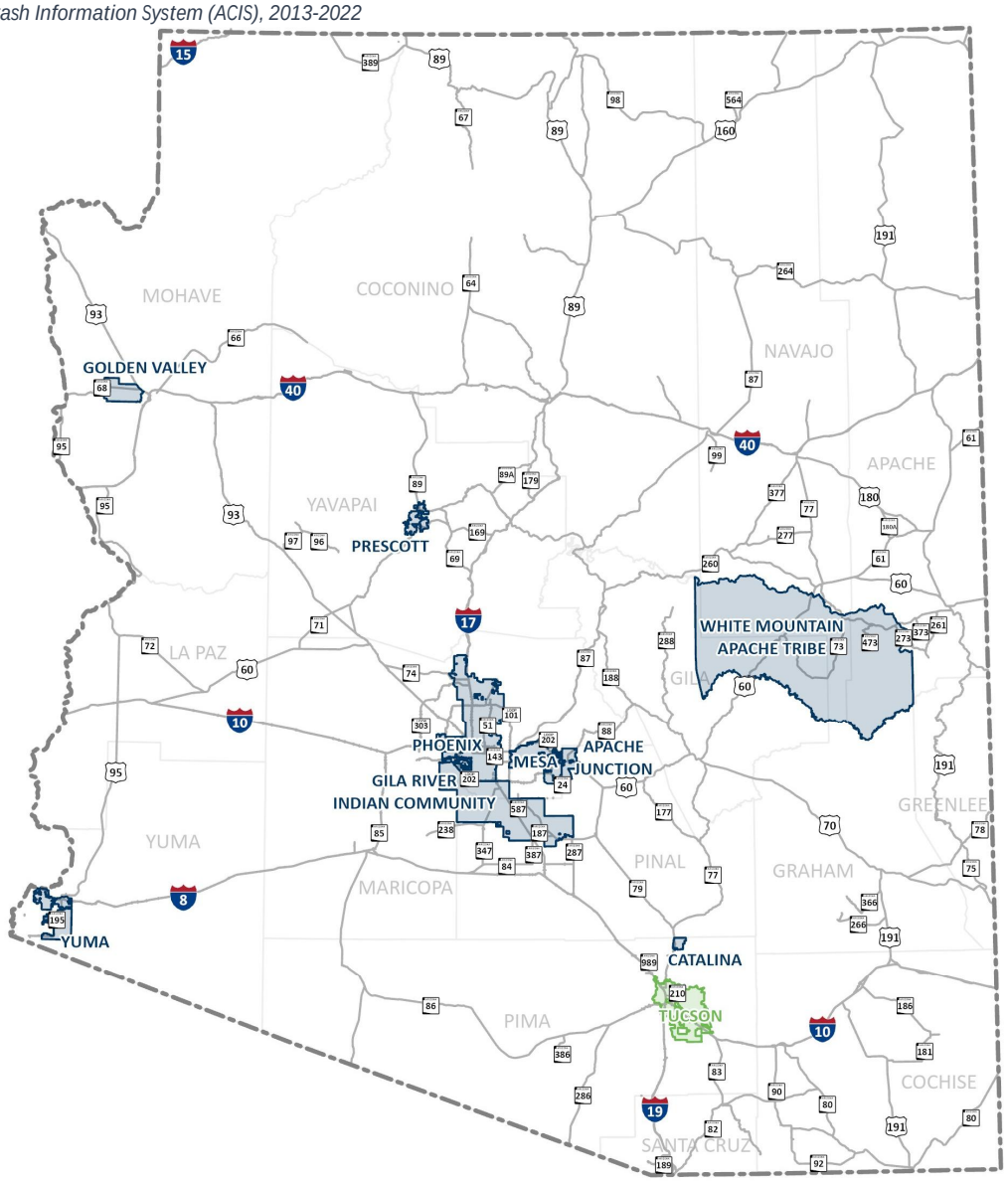
## SAFETY IMPROVEMENT AREA

# Tucson

## VRU Safety Snapshot

| | |
|---|---|
| 3,652 | pedestrian and bicyclist crashes |
| 259 | pedestrian fatalities |
| 39 | bicyclist fatalities |
| 12.5% | of pedestrian crashes resulted in a fatality |
| 2.5% | of bicyclist crashes resulted in a fatality |

*Source: Arizona Crash Information System (ACIS), 2013-2022*



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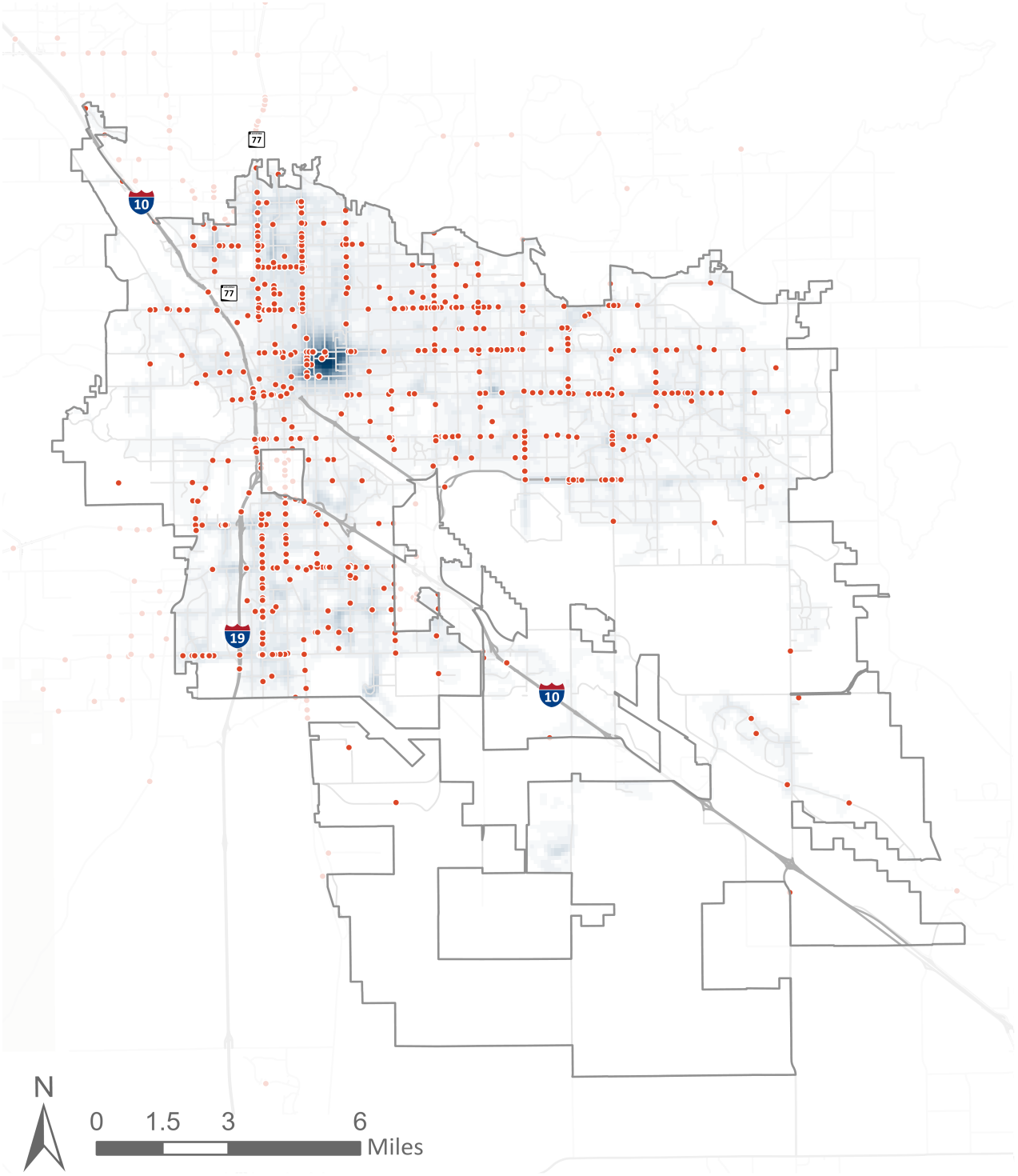
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Tucson

## PEDESTRIAN ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

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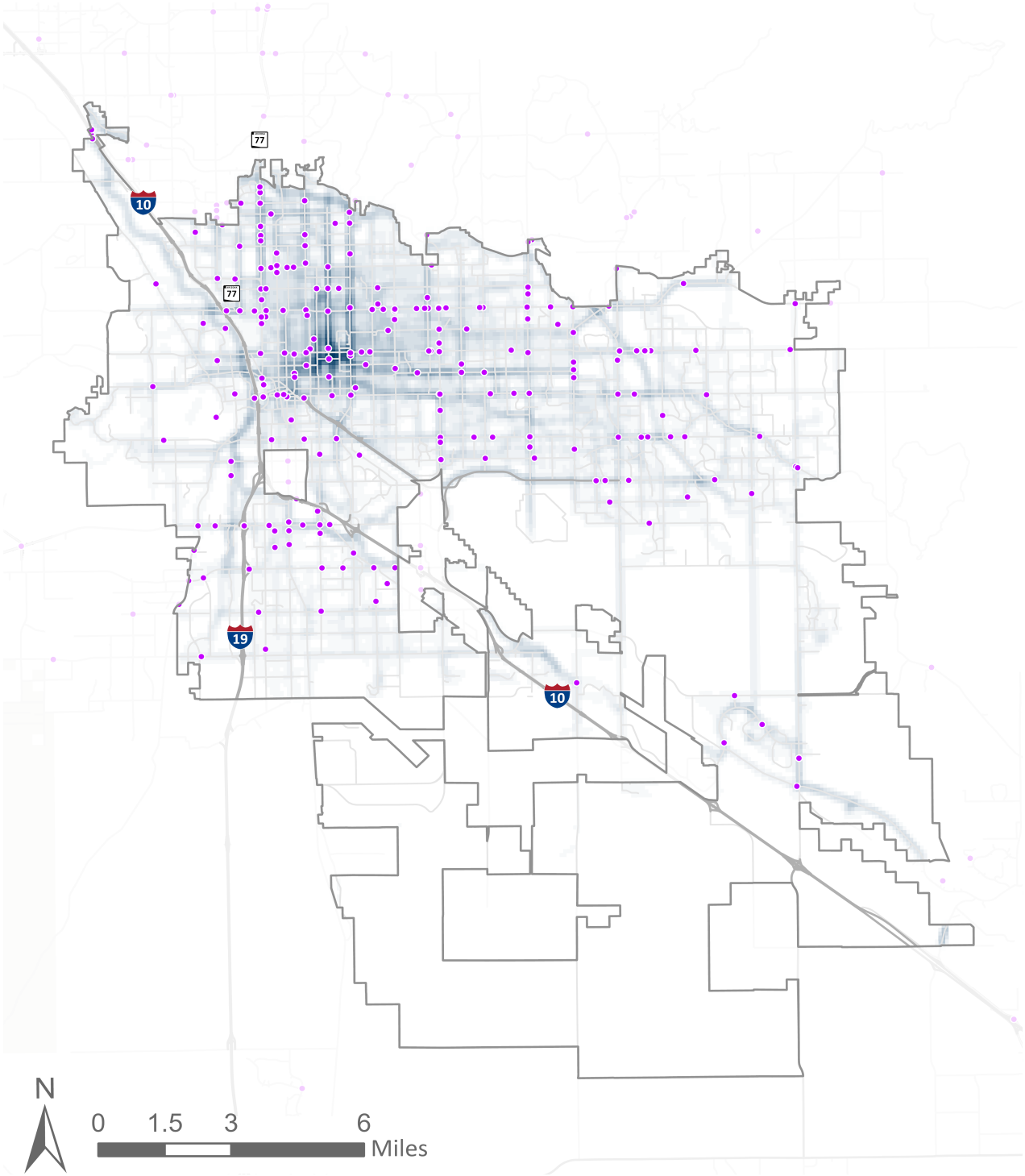
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Tucson

## BICYCLIST ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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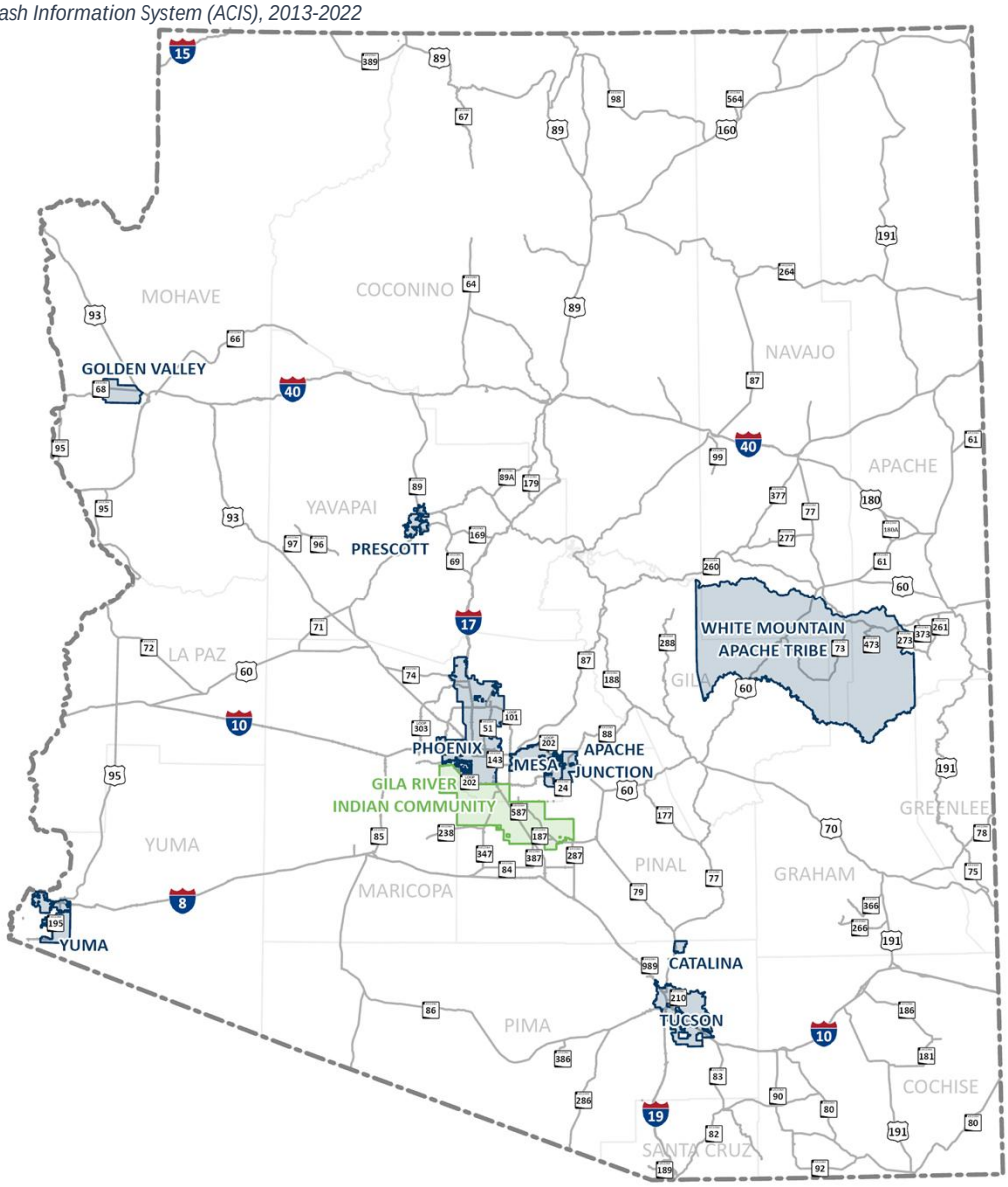
## SAFETY IMPROVEMENT AREA

# Gila River Indian Community

## VRU Safety Snapshot

| | |
|---|---|
| 67 | pedestrian and bicyclist crashes |
| 26 | pedestrian fatalities |
| 5 | bicyclist fatalities |
| 50.0% | of pedestrian crashes resulted in a fatality |
| 3.3% | of bicyclist crashes resulted in a fatality |

*Source: Arizona Crash Information System (ACIS), 2013-2022*



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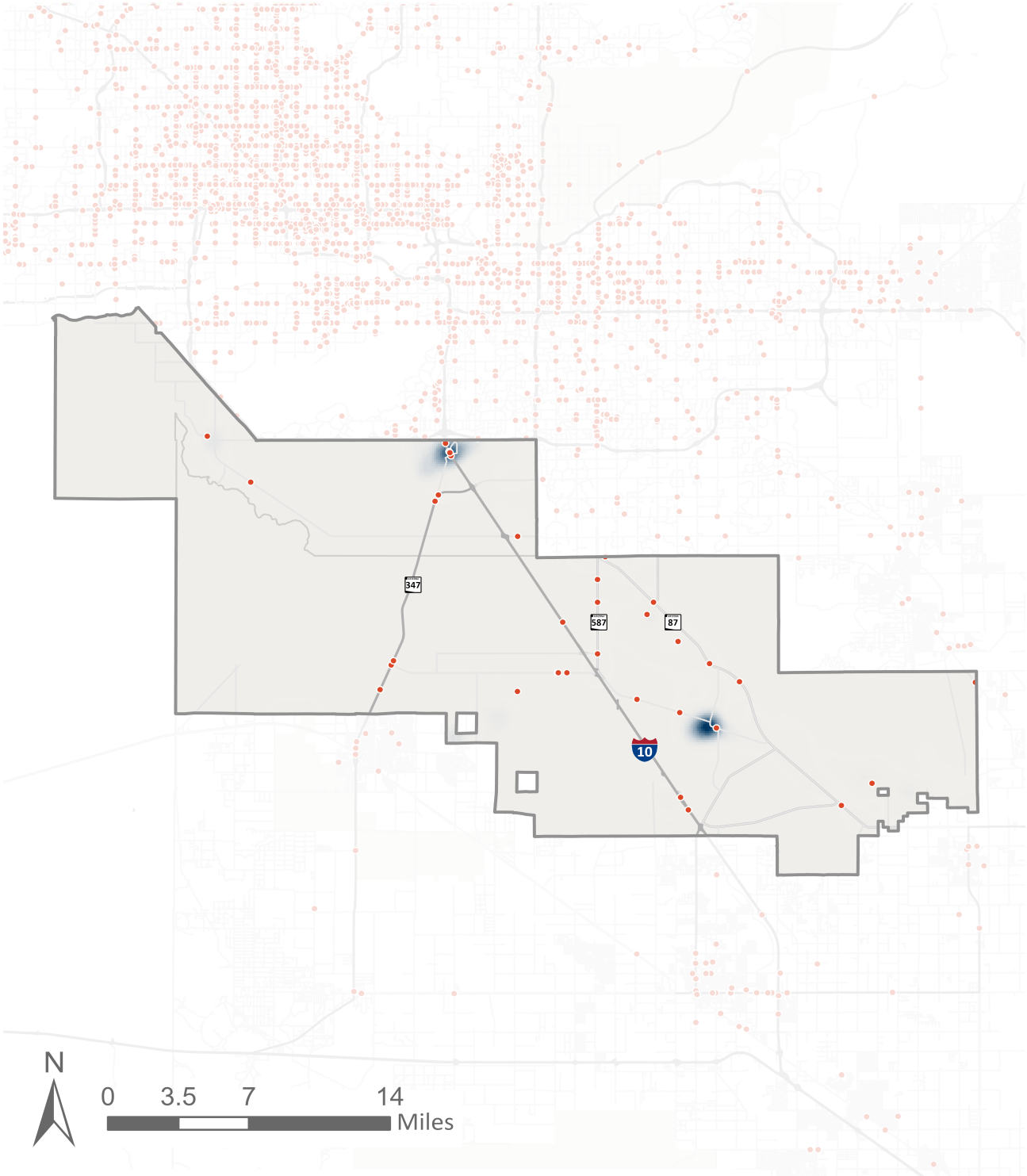
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Gila River Indian Community

## PEDESTRIAN ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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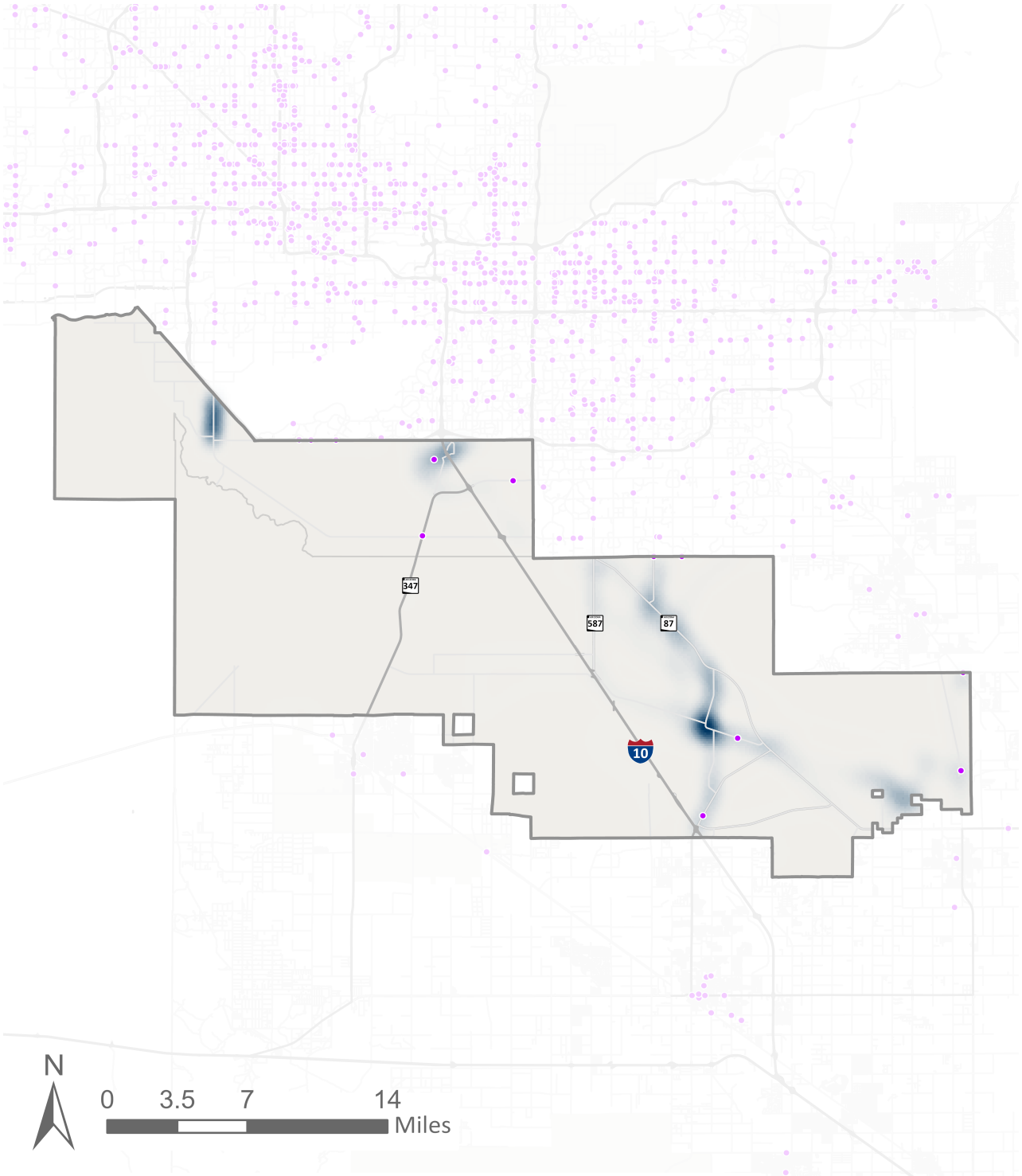
## SAFETY IMPROVEMENT AREA

# Gila River Indian Community

## BICYCLIST ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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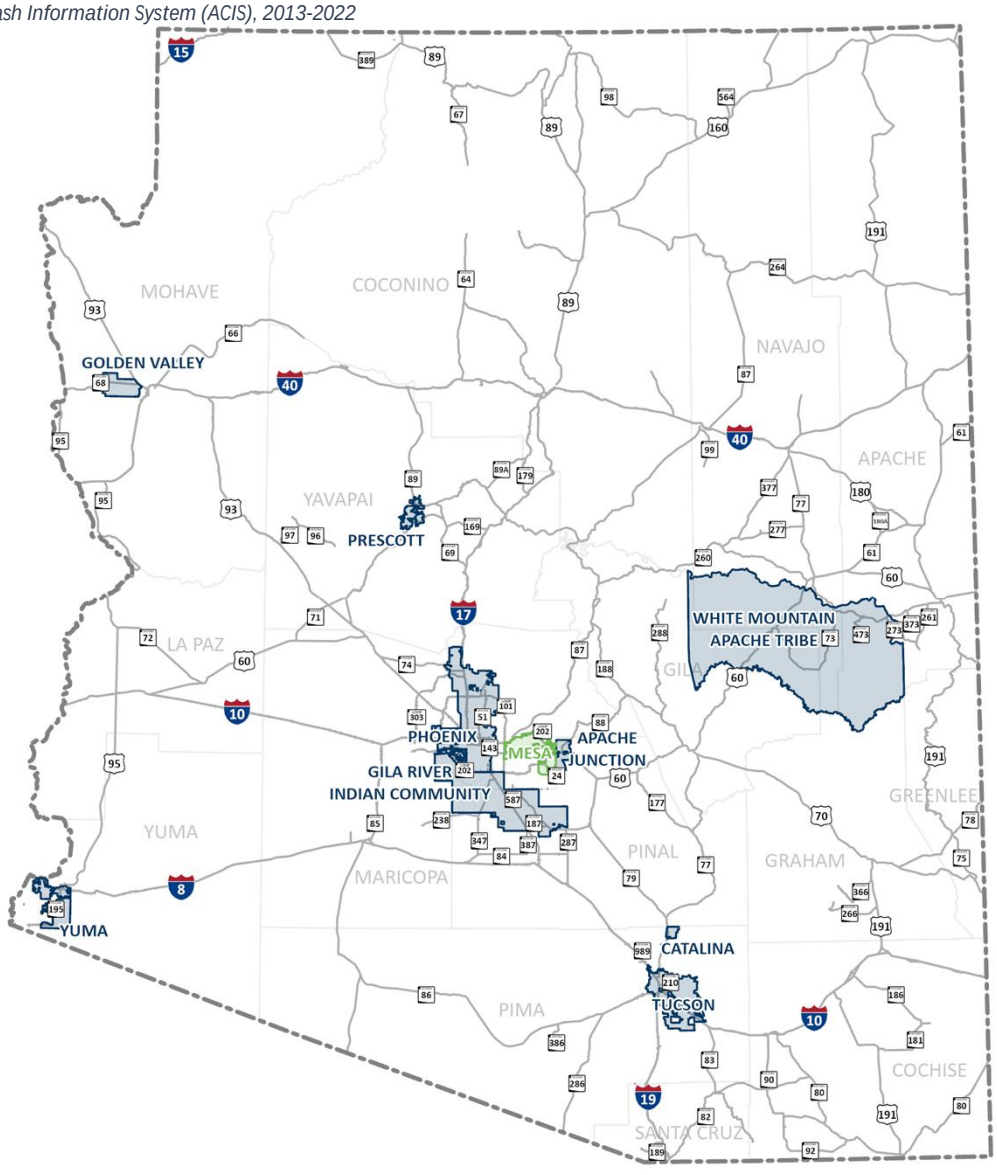
## SAFETY IMPROVEMENT AREA

# Mesa

## VRU Safety Snapshot

| | |
|---|---|
| 2,058 | pedestrian and bicyclist crashes |
| 92 | pedestrian fatalities |
| 19 | bicyclist fatalities |
| 11.3% | of pedestrian crashes resulted in a fatality |
| 1.5% | of bicyclist crashes resulted in a fatality |

*Source: Arizona Crash Information System (ACIS), 2013-2022*



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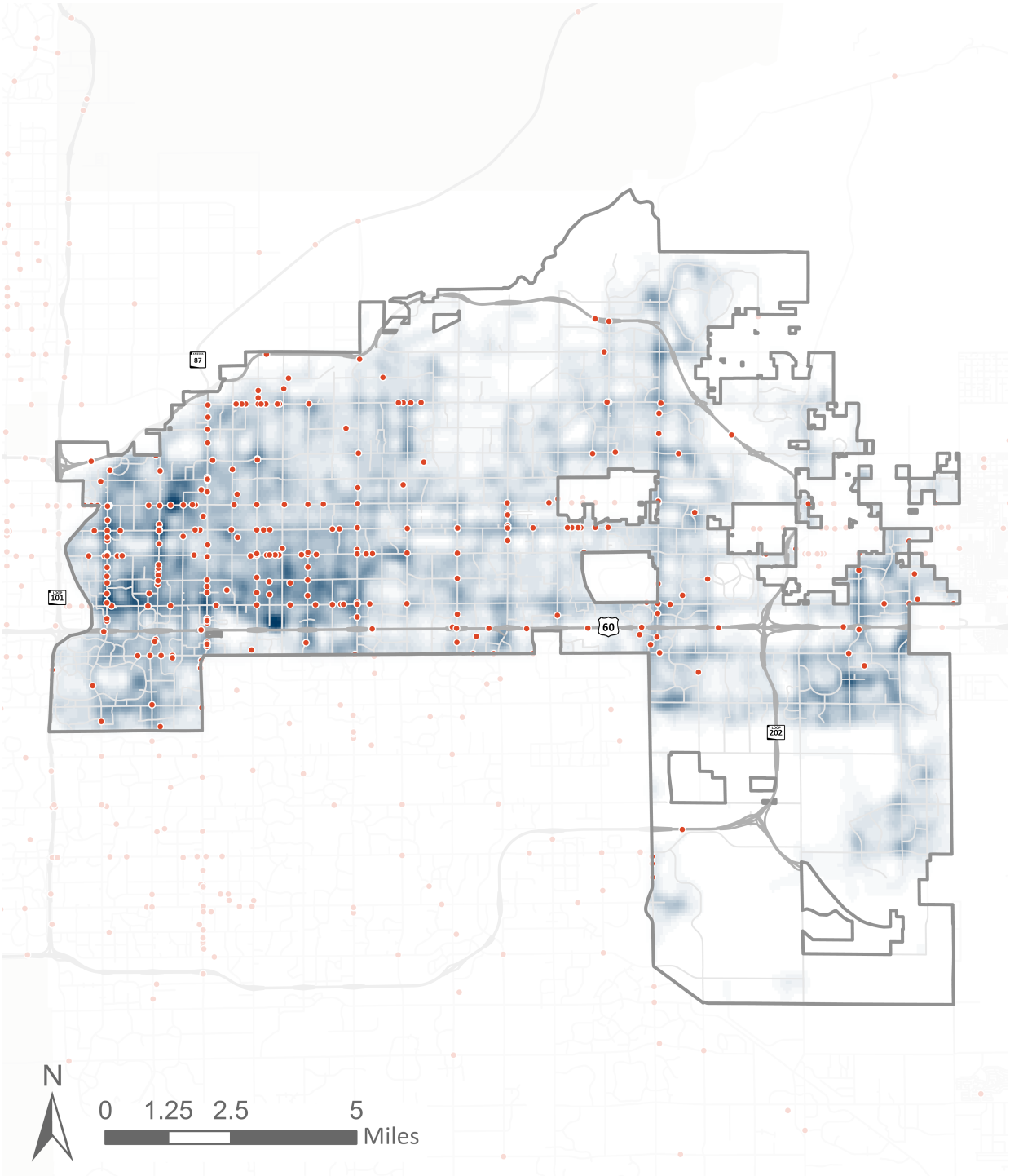
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Mesa

## PEDESTRIAN ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

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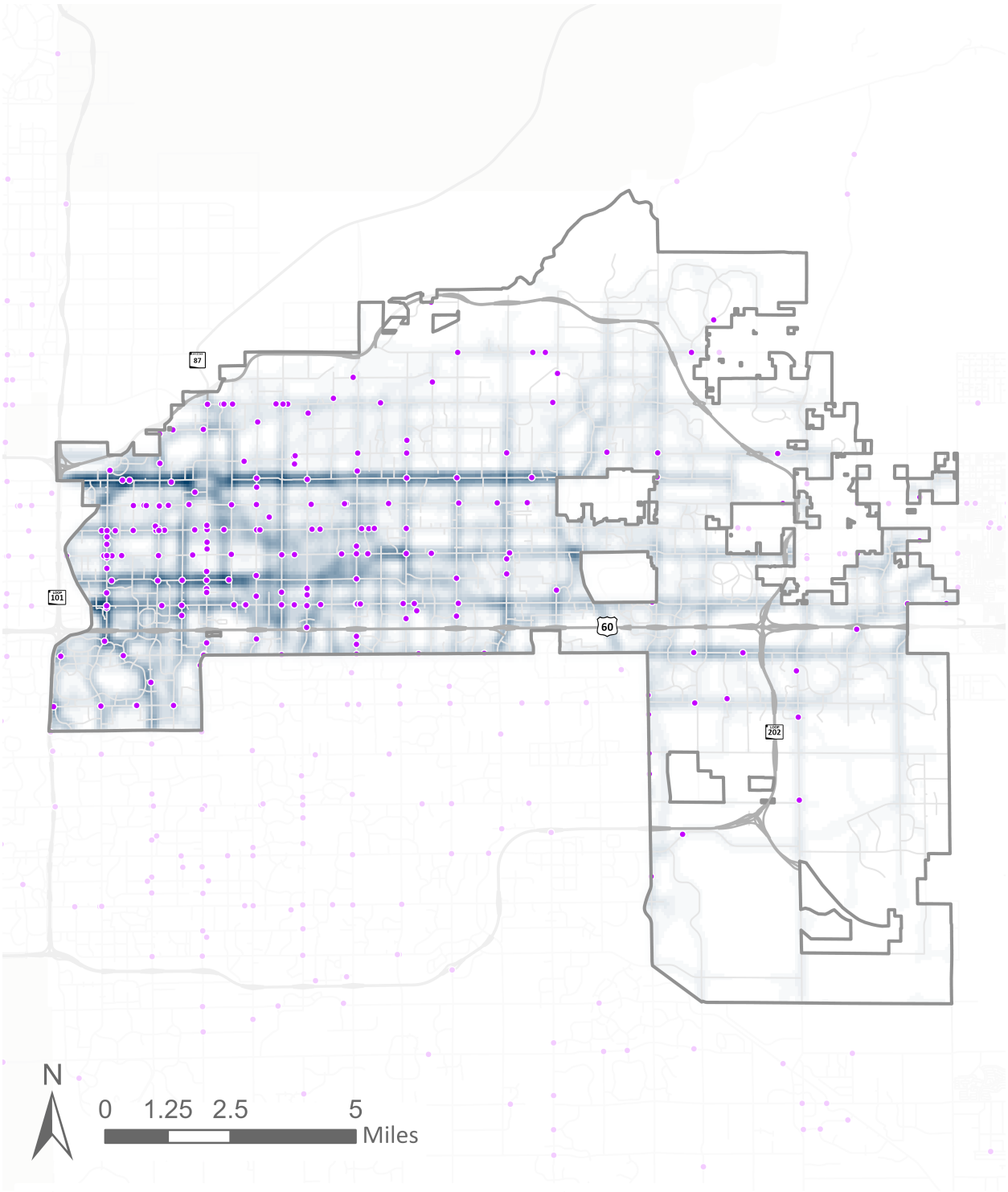
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Mesa

## BICYCLIST ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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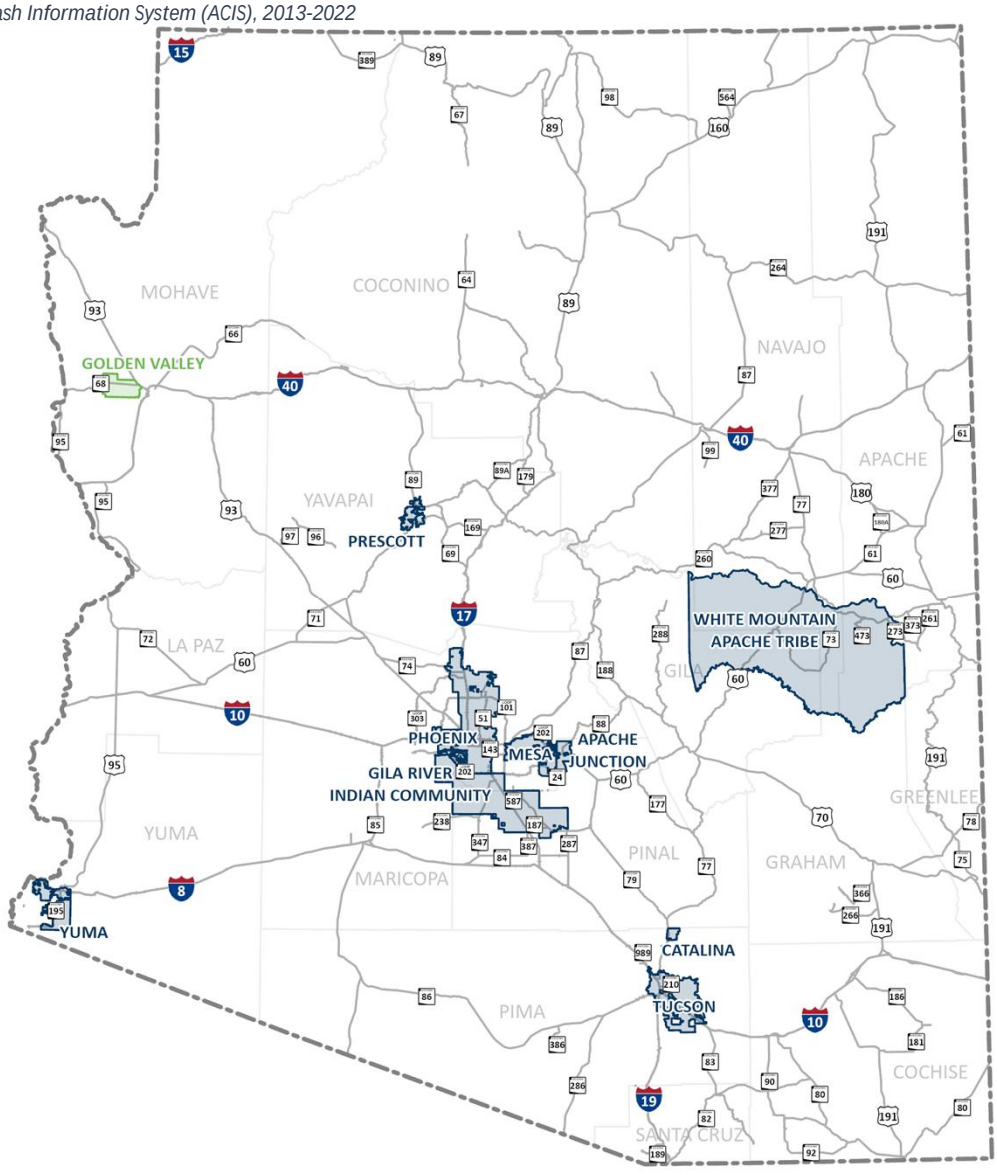
## SAFETY IMPROVEMENT AREA

# Golden Valley

## VRU Safety Snapshot

| | |
|---|---|
| 16 | pedestrian and bicyclist crashes |
| 6 | pedestrian fatalities |
| 0 | bicyclist fatalities |
| 46.0% | of pedestrian crashes resulted in a fatality |
| 0.0% | of bicyclist crashes resulted in a fatality |

*Source: Arizona Crash Information System (ACIS), 2013-2022*



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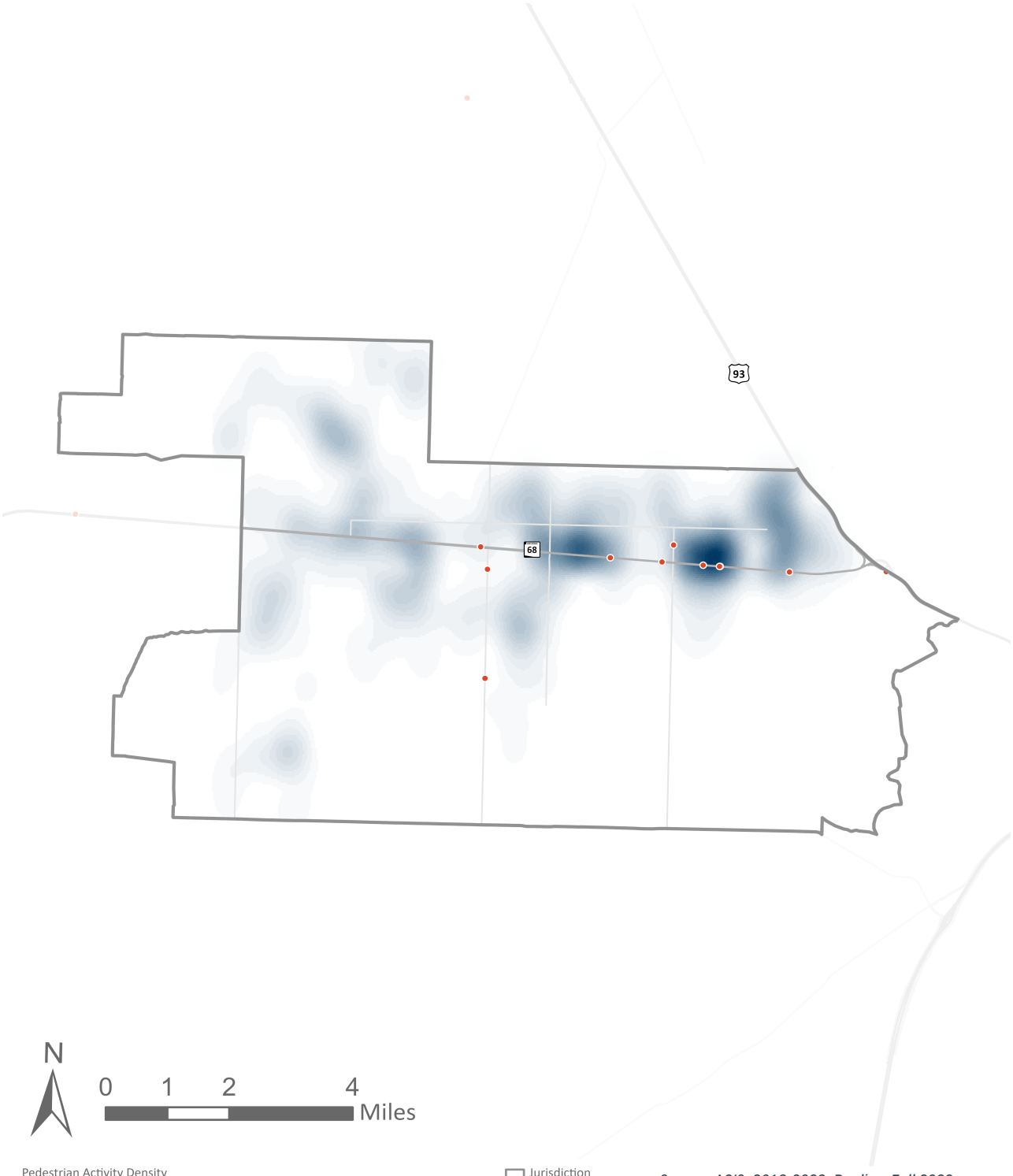
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Golden Valley

## PEDESTRIAN ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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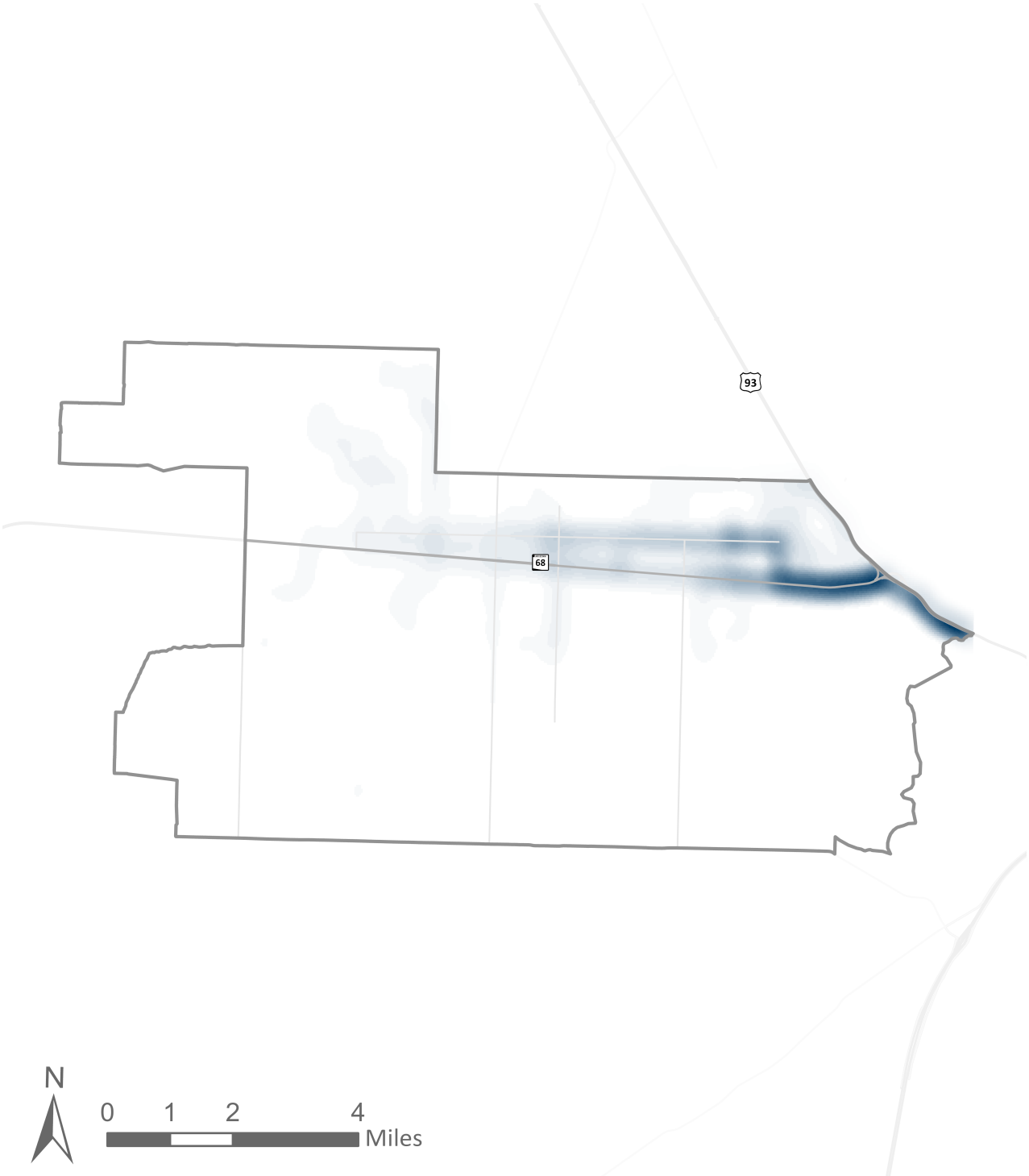
## SAFETY IMPROVEMENT AREA

# Golden Valley

## BICYCLIST ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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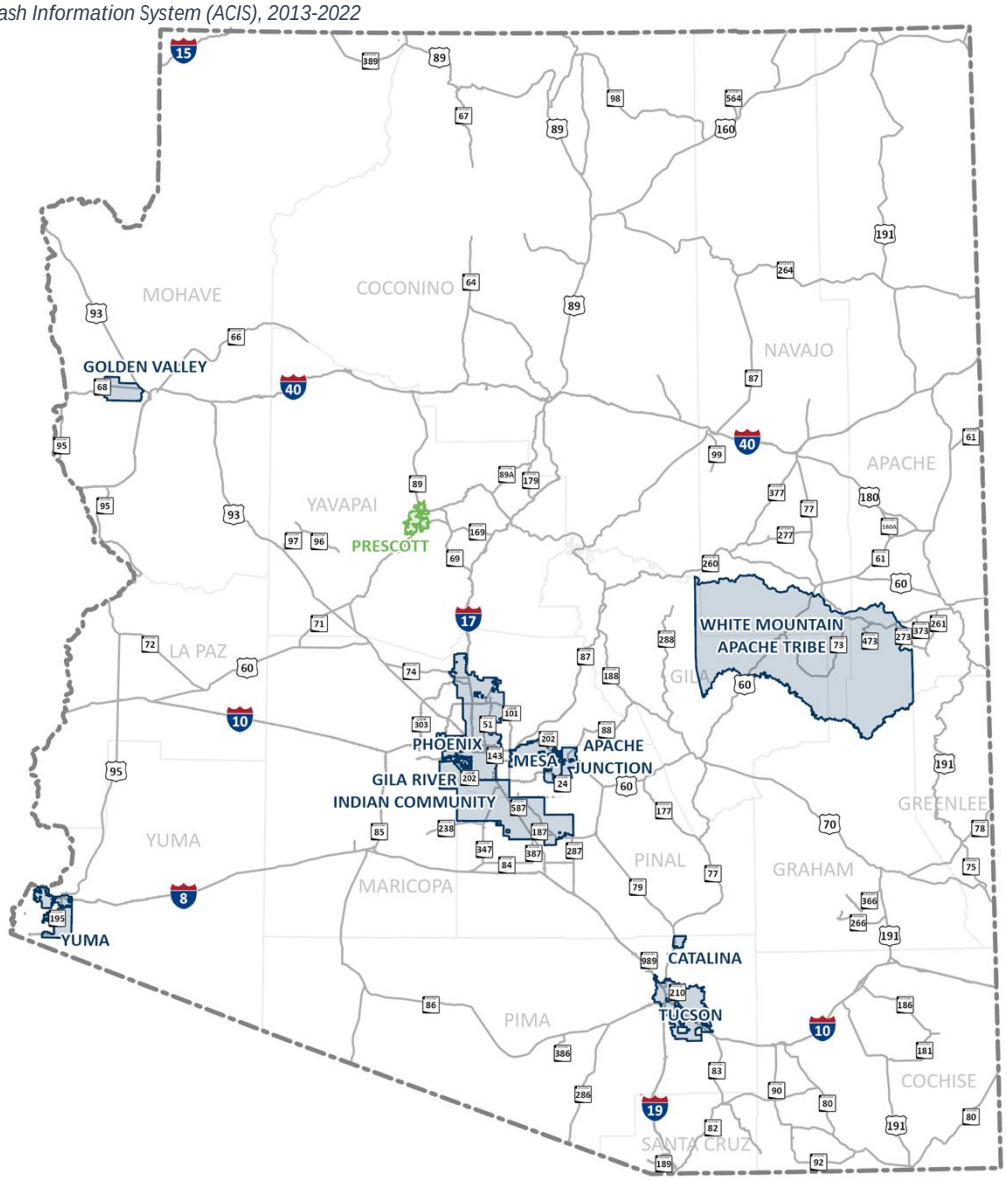
## SAFETY IMPROVEMENT AREA

# Prescott

## VRU Safety Snapshot

| | |
|---|---|
| 180 | pedestrian and bicyclist crashes |
| 5 | pedestrian fatalities |
| 2 | bicyclist fatalities |
| 5.6% | of pedestrian crashes resulted in a fatality |
| 2.2% | of bicyclist crashes resulted in a fatality |

*Source: Arizona Crash Information System (ACIS), 2013-2022*



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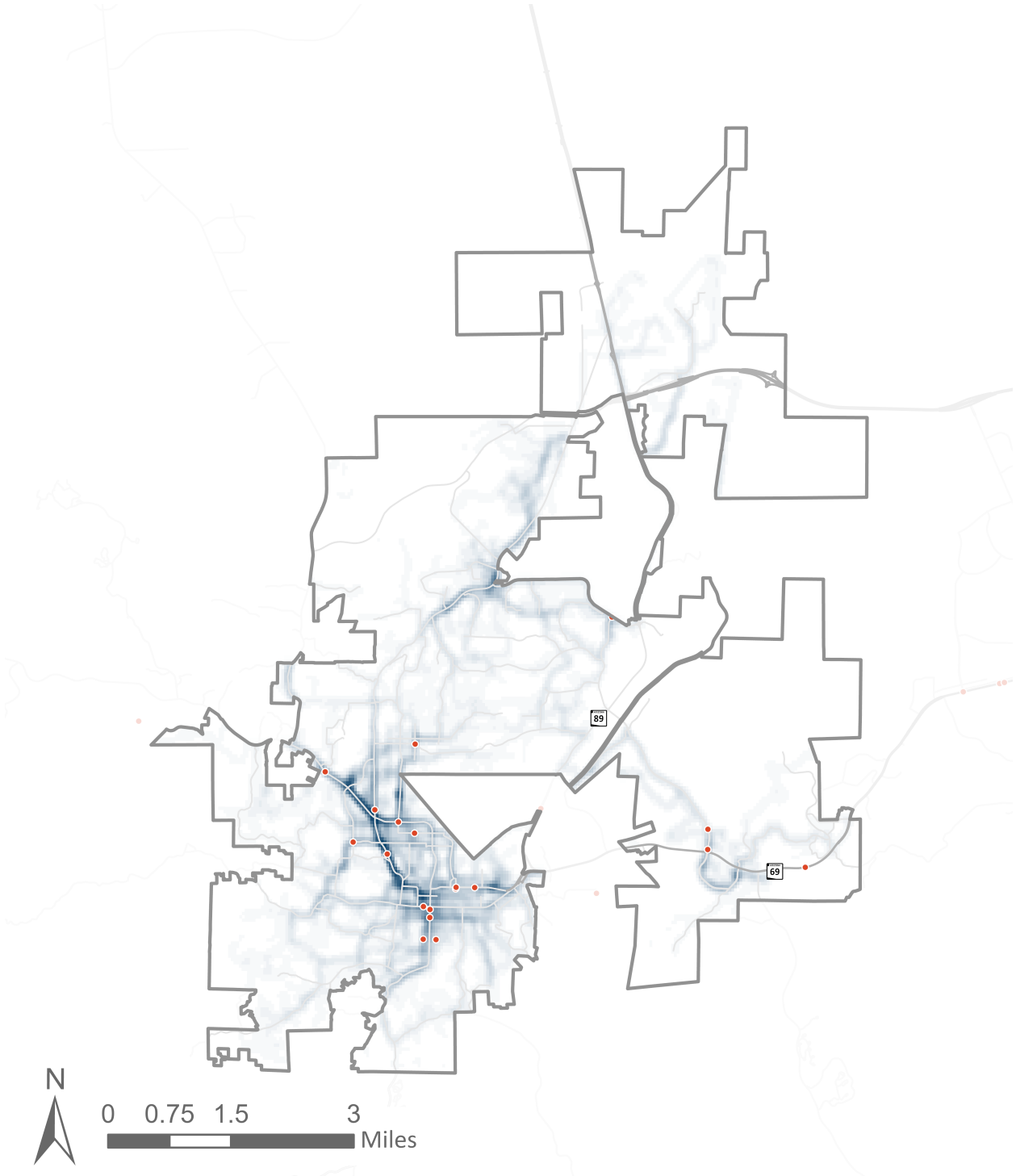
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Prescott

## PEDESTRIAN ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

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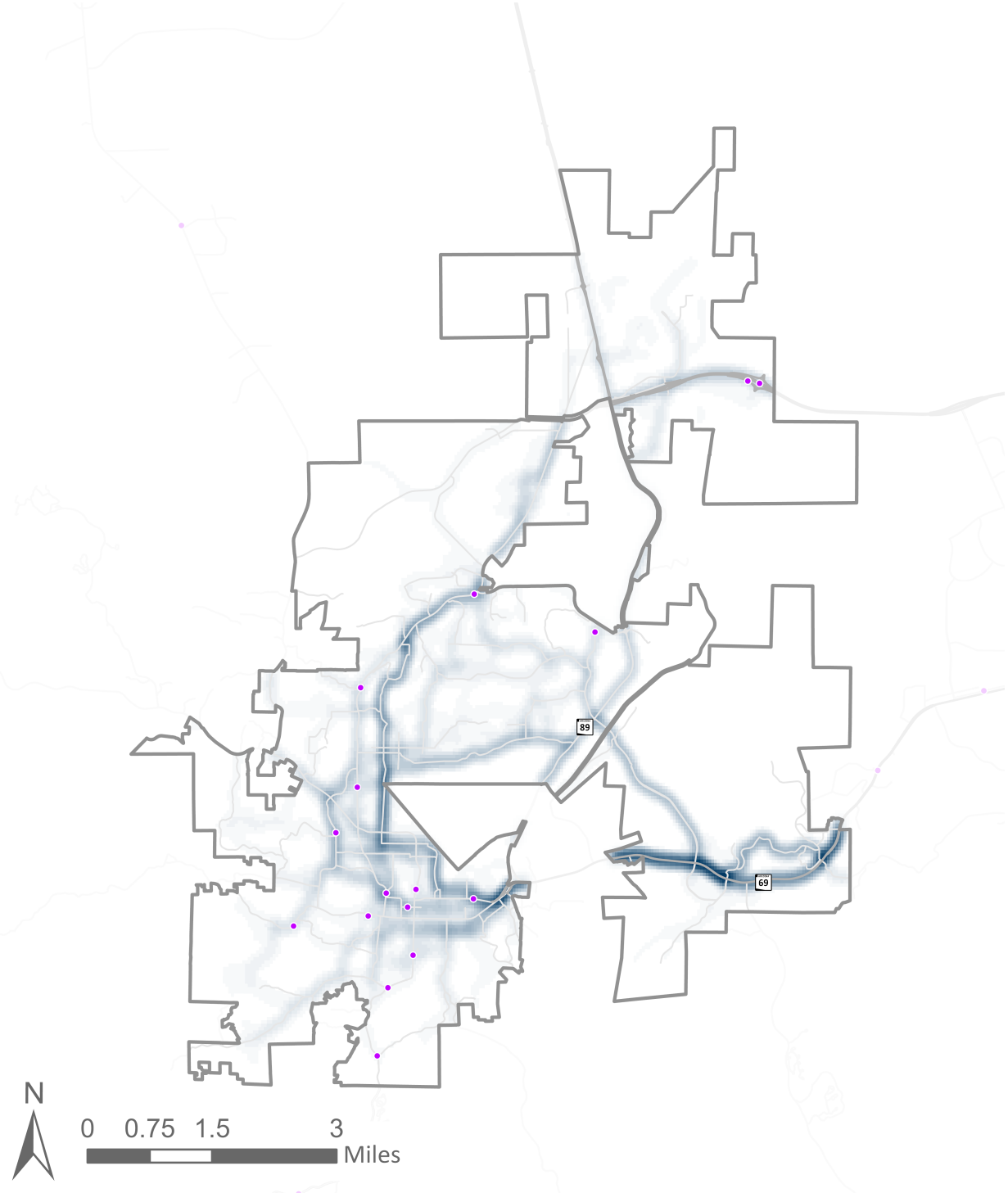
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Prescott

## BICYCLIST ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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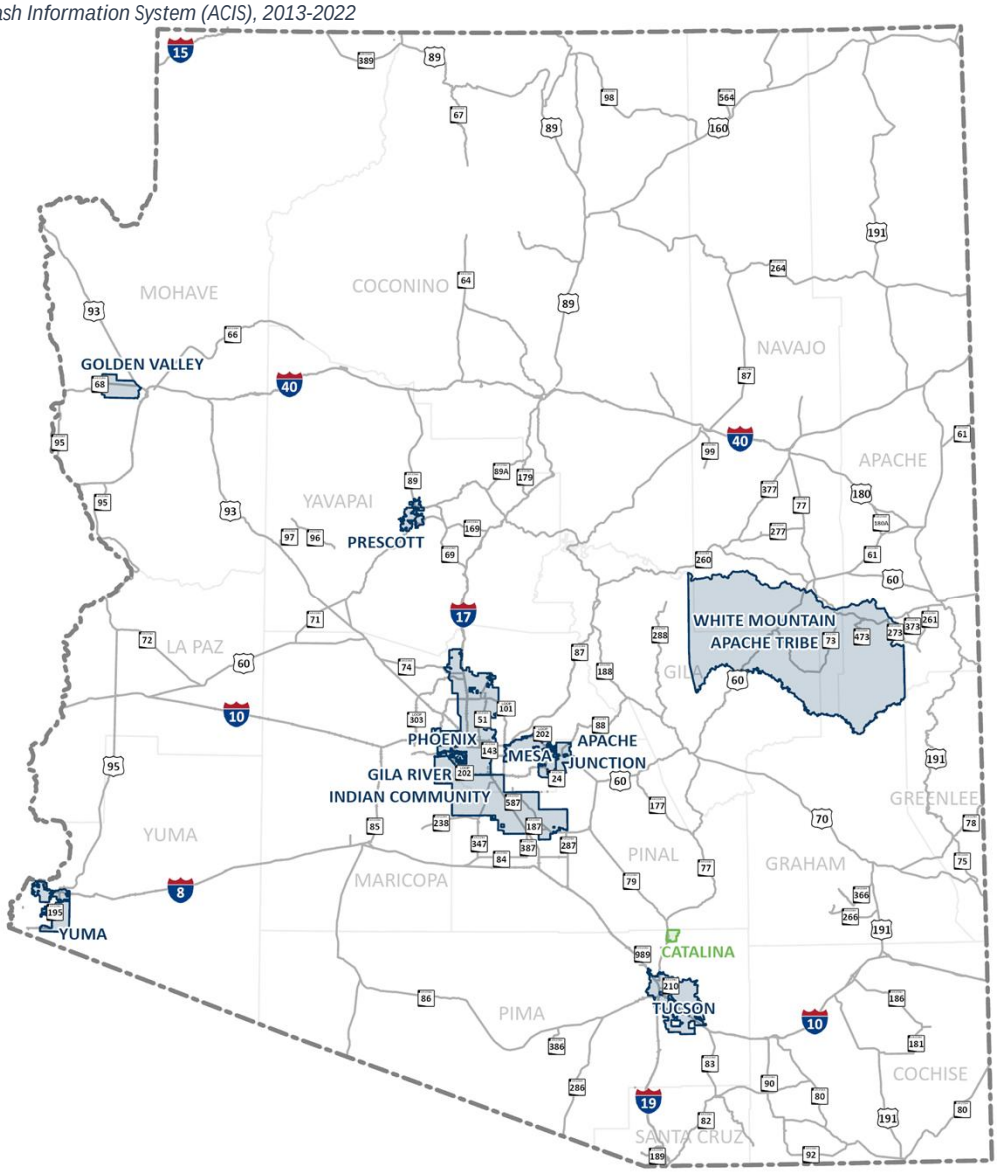
## SAFETY IMPROVEMENT AREA

# Catalina

## VRU Safety Snapshot

| | |
|---|---|
| 19 | pedestrian and bicyclist crashes |
| 2 | pedestrian fatalities |
| 1 | bicyclist fatalities |
| 22.0% | of pedestrian crashes resulted in a fatality |
| 10.0% | of bicyclist crashes resulted in a fatality |

*Source: Arizona Crash Information System (ACIS), 2013-2022*



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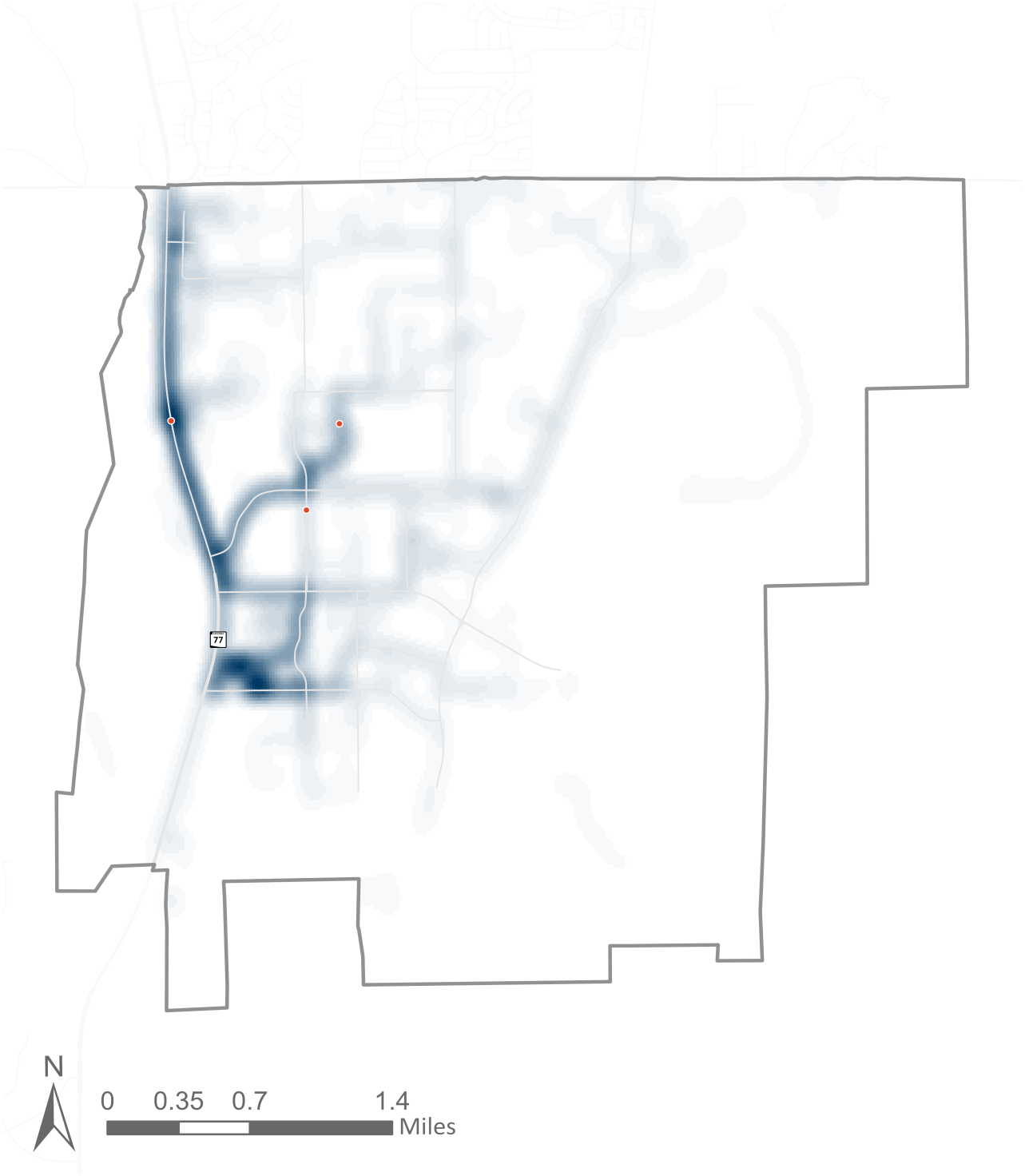
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Catalina

## PEDESTRIAN ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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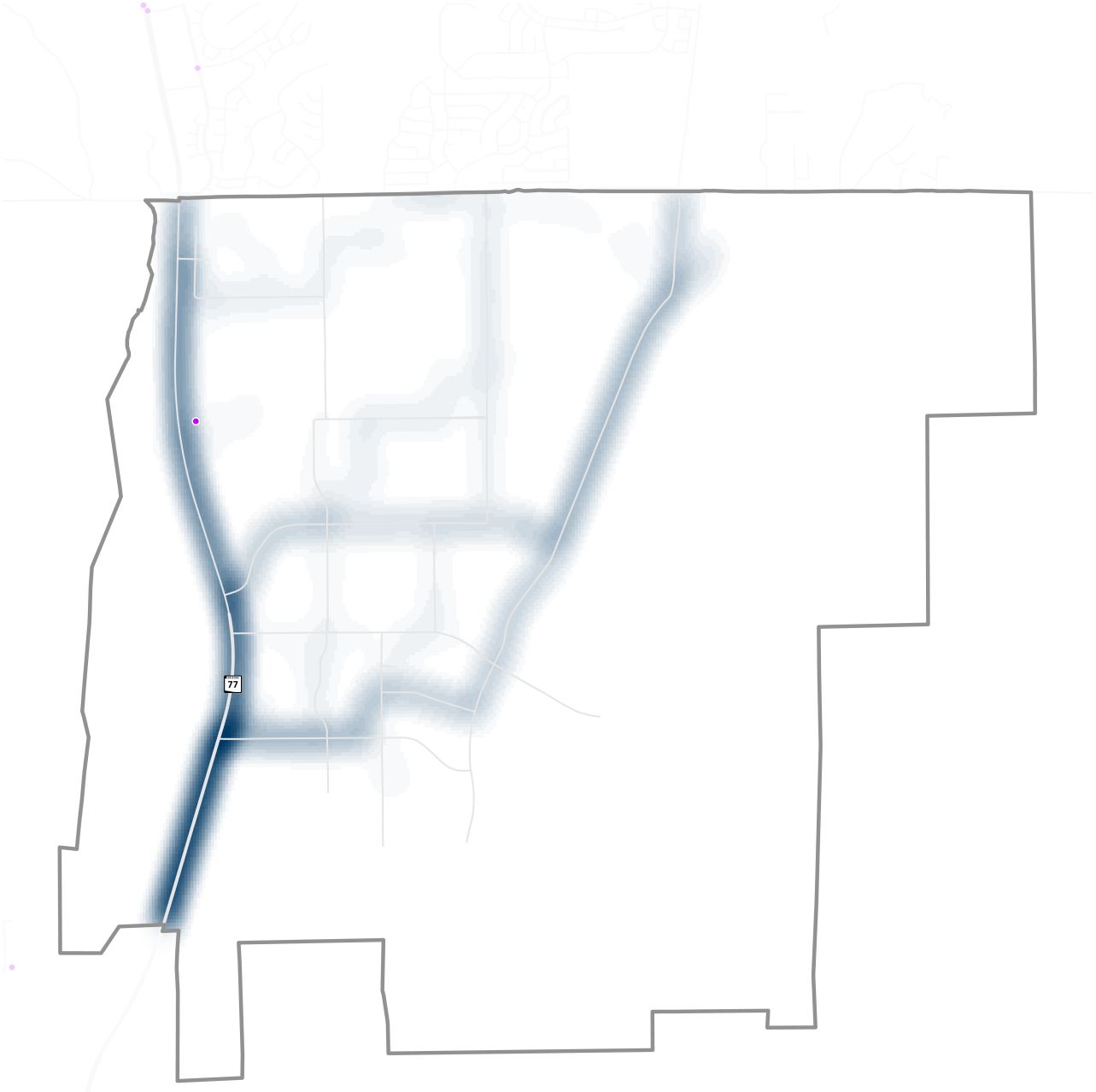
## SAFETY IMPROVEMENT AREA

# Catalina

## BICYCLIST ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




N

0 0.35 0.7 1.4 Miles

Bicyclist Activity Density
High Density
Low Density
Bicyclist Serious or Fatal Injury Crash

Jurisdiction
Tribal Land
Local Roadway
State Highway

*Source: ACIS, 2013-2022; Replica, Fall 2022*

# ARIZONA VRUSA

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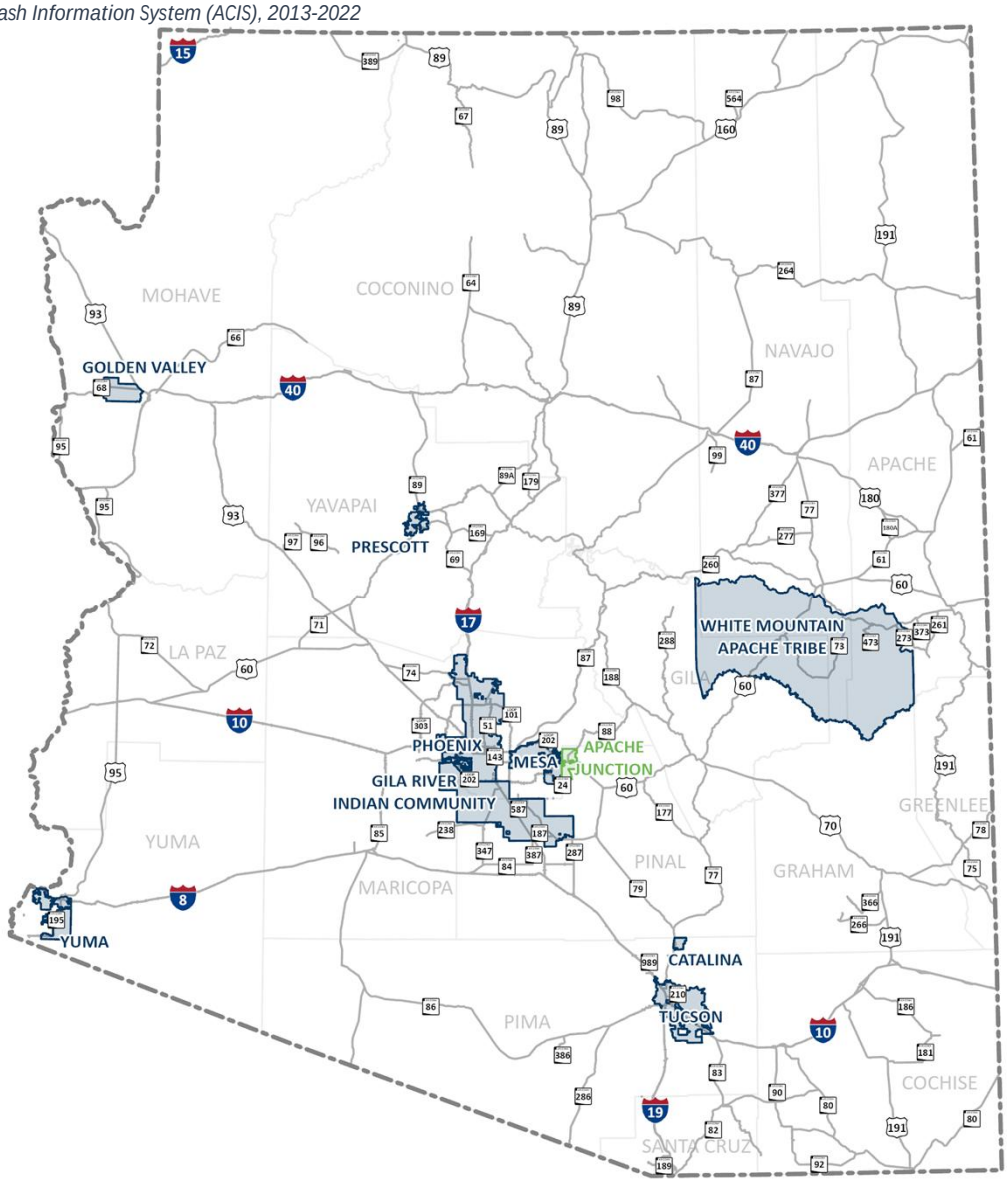
## SAFETY IMPROVEMENT AREA

# Apache Junction

## VRU Safety Snapshot

| | |
|---|---|
| 159 | pedestrian and bicyclist crashes |
| 8 | pedestrian fatalities |
| 3 | bicyclist fatalities |
| 15.0% | of pedestrian crashes resulted in a fatality |
| 2.8% | of bicyclist crashes resulted in a fatality |

*Source: Arizona Crash Information System (ACIS), 2013-2022*



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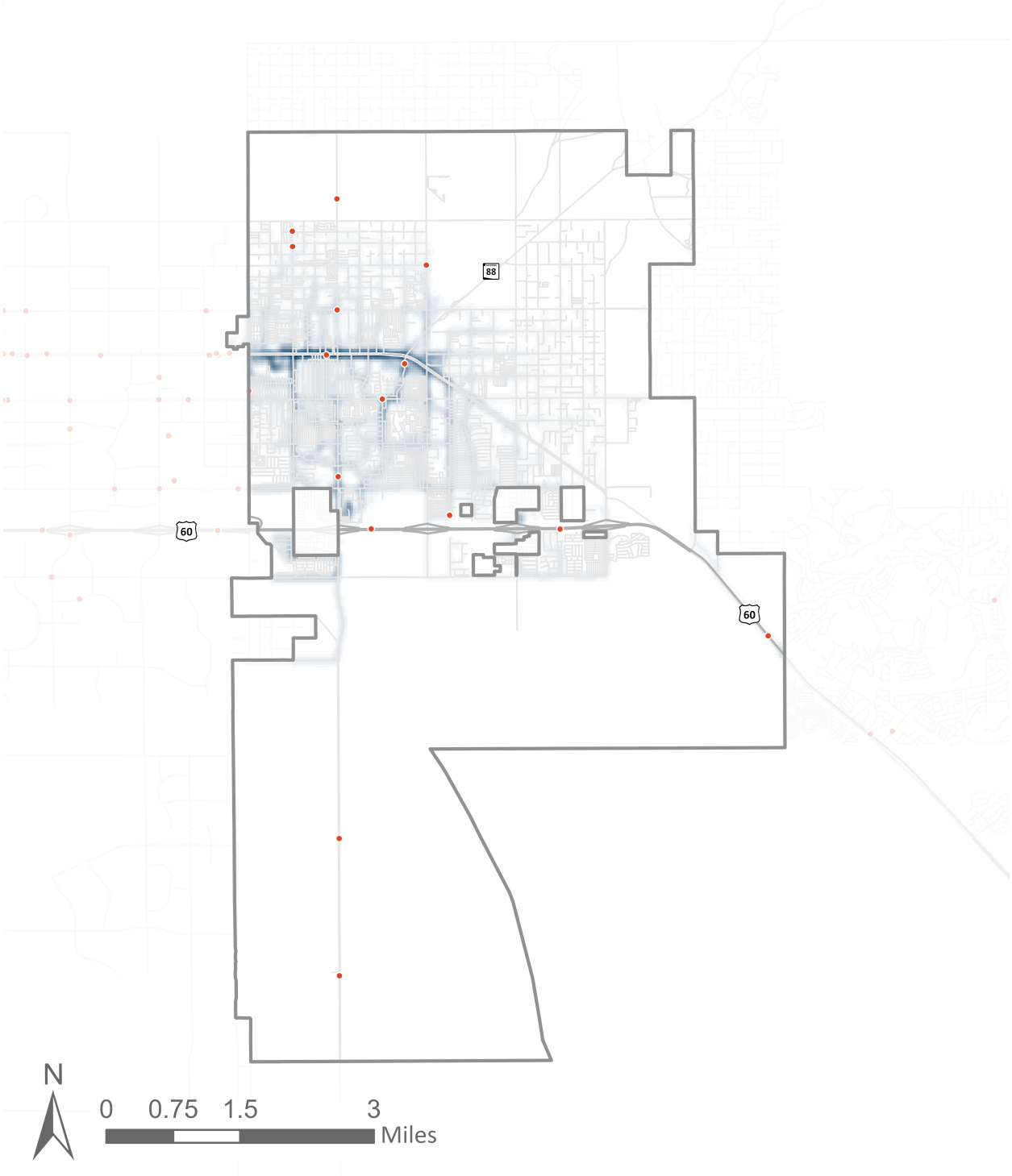
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Apache Junction

## PEDESTRIAN ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*

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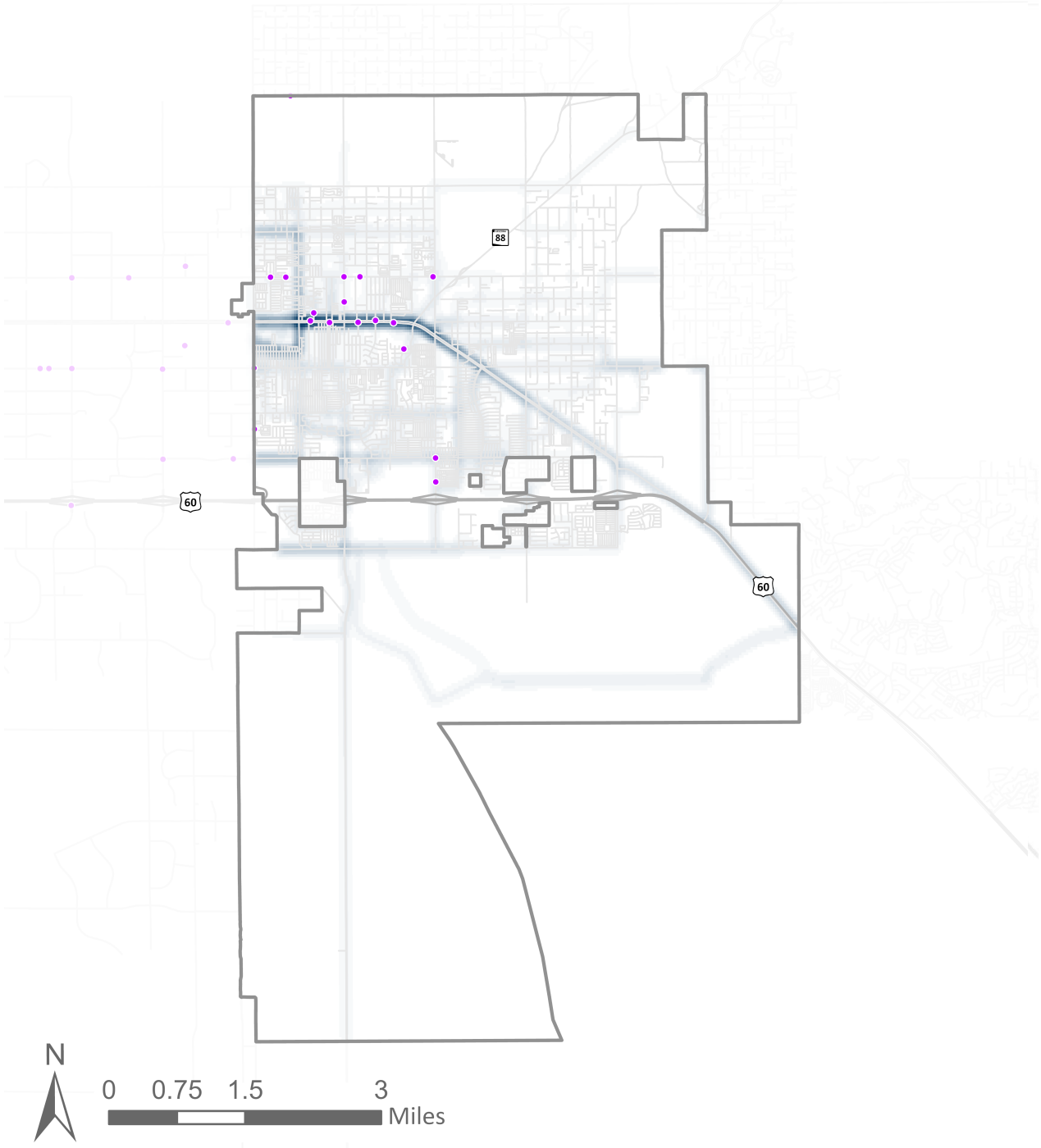
# ARIZONA VRUSA

## SAFETY IMPROVEMENT AREA

# Apache Junction

## BICYCLIST ACTIVITY AND FATAL OR SERIOUS INJURY CRASHES




*Source: ACIS, 2013-2022; Replica, Fall 2022*