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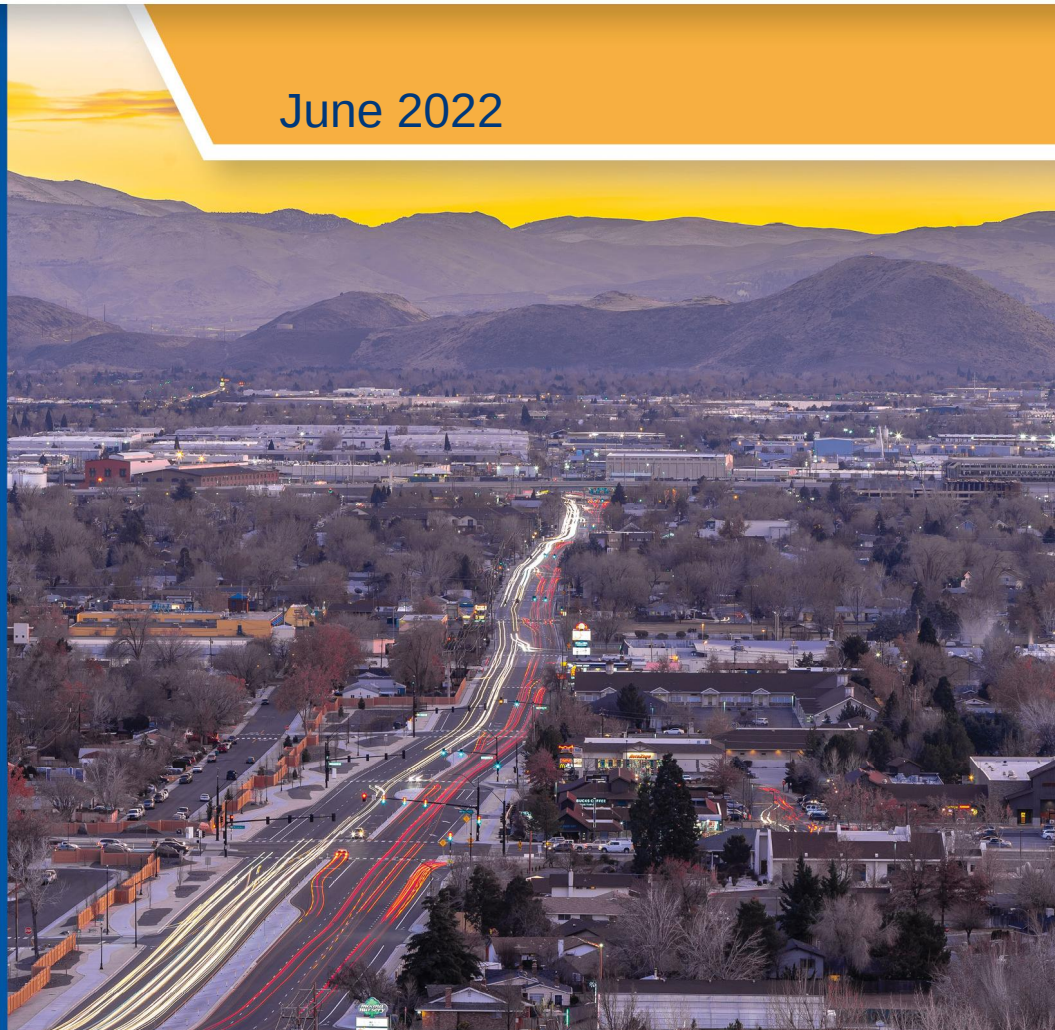
SPEED MANAGEMENT
ACTION PLAN

June 2022



SPEED MANAGEMENT ACTION PLAN

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AASHTO	American Association of State Highway and Transportation Officials
BLM	Bureau of Land Management
CMF	Crash Modification Factor
CRF	Crash Reduction Factor
CV	coefficient of variation
DPS	Department of Public Safety
EB	empirical Bayes
EPDO	Equivalent Property Damage Only
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
HSM	Highway Safety Manual
HSIP	Highway Safety Improvement Program
HVE	High-Visibility Enforcement

ITE	Institute of Transportation Engineers
GHSA	Governors Highway Safety Association
MAP-21	Moving Ahead for Progress in the 21st Century
mph	miles per hour
MPO	Metropolitan Planning Organization
MUTCD	Manual on Uniform Traffic Control Devices
NCATS	Nevada Citation and Accident Tracking System
NDOT	Nevada Department of Transportation
NHP	Nevada Highway Patrol
NHTSA	National Highway Traffic Safety Administration
NRS	Nevada Revised Statutes
NRSS	National Roadway Safety Strategy
NVACTS	Nevada Advisory Committee on Traffic Safety
OTS	Office of Traffic Safety
RSA	Road Safety Assessment
RTM	Regression to the Mean
SHSP	Strategic Highway Safety Plan
SMAP	Speed Management Action Plan
SPF	Safety Performance Functions
SSA	Safe System Approach
STMS	Strategic Traffic Monitoring Sites
TRINA	Traffic Records Information Access
TZD	Towards Zero Deaths
USDOT	United States Department of Transportation

1. OVERVIEW OF THE PLAN

This Speed Management Action Plan (SMAP) characterizes Nevada's speeding-related safety problems and speed management issues; identifies appropriate engineering, enforcement, and educational countermeasures and strategies; and outlines actions that the Nevada Department of Transportation (NDOT) and partner agencies can take to implement these strategies to reduce speeding and speed-related fatal and serious injury crashes. This SMAP will facilitate coordination and cooperation among various agency stakeholders including planners, designers and managers, enforcement officials, public health practitioners, and policymakers to implement a sustainable speed management program, and to target the most cost-effective and feasible countermeasures where they will have the greatest safety benefits.

The remainder of this section outlines the safety goals of the SMAP, the need for the SMAP, broadly describes the speed management approaches and the remaining SMAP content, defines terms used, and provides an overview of the problems and the action items for implementing strategies and actions.

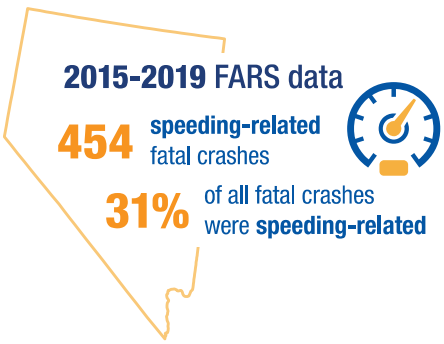
1.1. Safety Goals of the Plan

The safety goals of the SMAP are as follows:

- Reduce fatal and serious injury crashes in support of the Nevada Strategic Highway Safety Plan (SHSP)
- Incorporate the statewide speed management strategies and action items into the SHSP and track progress in the SHSP Action Tracking Tool
- Provide network screening guidance for agencies to determine areas of concern
- Improve compliance with speed limits and set target speed limits using the Countermeasures to Achieve Target Speed

1.2. Coordination with the Nevada SHSP and Other Safety Goals

The United States Department of Transportation (USDOT) *National Roadway Safety Strategy* (NRSS) outlines working towards a long-term goal of reaching zero roadway fatalities on our nation's roadways. The NRSS adopts the Safe System Approach (SSA) principles to guide activities and defines five core objectives: Safer People, Safer Roads, Safer Vehicles, Safer Speeds, and Post-Crash Care. The SMAP targets speeding-related fatalities and serious injuries, which is a leading cause of fatalities and serious injuries on Nevada's roadways, and serves as a strategy to further implement the SSA and achieve the goals set forth in the NRSS.



Achieving the goals set forth in the SMAP will not only contribute to NRSS, but it will also contribute to Nevada's SHSP safety goals. In 2010, Nevada adopted a statewide goal of Zero Fatalities, consistent with the national Toward Zero Deaths (TZD) strategy sponsored by the Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration (NHTSA), the American Association of State Highway and Transportation Officials (AASHTO), and the Governors Highway Safety Association (GHSA). In 2010, as an interim goal to reach Zero Fatalities,

Nevada established the goal of reducing fatalities by year 2030 to half of those recorded in 2008, and a target of zero fatalities in 2050.

To meet the target of zero fatalities in 2050, it is important to focus on reducing speed on Nevada roadways.

1.3. Need for the SMAP

This section describes the general magnitude of the safety problems related to speeding.

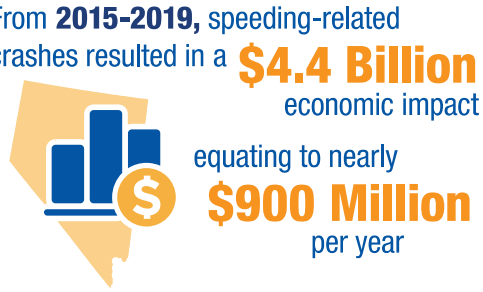
1.3.1. Speeding-related Crashes

The most recent five-year crash period at the time the SMAP started was 2015-2019. During this time frame, there were 454 speeding-related fatal crashes, representing 31% of all fatal crashes within Nevada. Nearly 60% of the speeding-related fatal crashes involved impaired driving, and almost half involved lane departures.

Speeding-related crashes are more common on high-speed roads but less likely to result in a fatality or serious injury. Speeding-related crashes are more severe on Functional Classification 3 and 4 roadways (Principal Arterial: Other and Minor Arterial), where most of these crashes are intersection-related. Additionally, when speeding-related crashes are compared to population, data shows that speeding-related crashes are over-represented in the rural areas of Nevada.

1.3.2. Estimated Comprehensive Cost of Crashes to Society

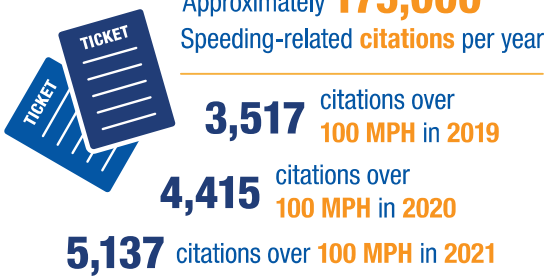
Over the five-year study period (2015- 2019), speeding-related crashes resulted in a $4.4 billion economic impact for the state of Nevada in comprehensive costs to society in addition to the personal loss of life and health. The personal loss of life and health equates to nearly $1 billion per year in economic impact for speeding-related crashes in Nevada.



1.3.3. Prevalence of Speeding

Speeding is widespread throughout Nevada. From 2015 to 2019, there was an average of 175,000 speeding-related citations per year (57% in Clark County, 13% in Washoe County, and 30% in the remaining counties).

An alarming trend in Nevada is that speeding-related citations for speeds at or above 100 miles per hour (mph) has been steadily increasing, from 3,517 in 2019 to 5,137 in 2021. This is almost a 50% increase in speed-related citations at or above 100 mph in a two-year period. It is important to note that this is a trend that has been observed throughout the United States and is likely a result of the pandemic and more opportunities for speeding as roads were not as congested.



1.3.4. Other Major Issues and Challenges

Other issues were identified with respect to speed zoning; planning, design, and other engineering problems; enforcement; and public information and education.

1.4. Plan Approaches

This SMAP identifies engineering countermeasures to help better manage speeds and to target related safety issues that may contribute to excessive speeds. Since it is only possible for engineering countermeasures to treat a small portion of the road network each year, NDOT should also seek ways to improve enforcement and adjudication to support established limits. Even if all roads are well-designed to support reasonable and safe speed limits, highly-visible and committed enforcement is needed to support those limits. **Section 3** describes the problems in more detail. Speed management is a complex endeavor that requires commitment of all stakeholders to work together. In addition, many strategies and actions will require the support of policymakers. Accordingly, this SMAP includes technical information that may be useful to planners, designers, and engineers, as well as information relevant for law enforcement, injury prevention specialists, policymakers, and other public stakeholders.

Some of the challenges of implementing effective speed management countermeasures can be met through activities that:

- Specifically address the barriers to a more systematic approach to implementing effective solutions
- Prioritize strategies based on factual information and best practice knowledge
- Strengthen existing partnerships, communication, and working toward mutually agreeable solutions

For example, some engineering countermeasures with proven safety benefits (e.g., roundabout intersection designs), are likely to improve mobility as well as safety. Roadway reconfigurations (or four- to three-lane conversions) may help reduce speeds and crashes while providing space for other uses such as bicycle lanes or parking for local businesses. Other speed management measures may similarly support multiple goals. The SMAP's strategies and action items should foster inter-agency and inter-departmental collaboration and implementation of effective countermeasures.

Challenging some of the existing beliefs about speed may also be important to maximize success. For example, widespread, low-level speeding may be as much or even more of a safety problem as flagrant, but less frequent, very high speeding. The Highway Safety Manual (HSM) estimates that a 2-mph reduction in average operating speed from 30 mph will yield a 34% reduction in fatal crashes.

This SMAP will help stakeholders, including NDOT, public safety agencies, injury prevention partners, and other stakeholders work together to identify optimal solutions to reduce opportunities and motivations to speed. Stakeholders will also identify to improve road design solutions to reduce fatalities and serious injuries in a cost-effective manner.

The SMAP incorporates the following types of approaches to help meet the safety goals and sustain the program:

- Develop proactive and coordinated approaches to roadway planning, roadway design, and other speed management countermeasures to reduce the opportunities to speed and lower the risk of serious harm on improved or new roads.
- Use a systematic approach to identify and target treatments to locations with speed or safety issues.

- Use comprehensive and coordinated enforcement, educational, and engineering countermeasures to improve motorist compliance with speed limits and with the basic speed rule. Seek the support of multiple stakeholders and the public for effective speed management and crash reduction strategies.

1.5. Action Plan Summary

Speed limit review, engineering, and design strategies, enforcement and educational measures will be implemented through this SMAP. As mentioned, there are three basic approaches to implementation of strategies and countermeasures: proactive, comprehensive, and systematic:

- A **proactive approach** aims to foster creation of self-enforcing roadway designs appropriate to the land use and user needs (functions of the road) to reduce future speeding and injury risk. The approach aims to develop collaborative and consistent policies, procedures, and safety guidance in speed-limit setting and design for new projects and roadway improvements.
- The overarching objectives of the **comprehensive approach** are to seek community support for the program, coordinate various stakeholders and engage the community in setting and enforcing appropriate limits, and to complement and enhance the effectiveness of design and engineering measures with locally tailored communications and educational measures.
- A **systematic approach** is used to identify and coordinate treatment of existing speeding and speed-related safety problems with cost-effective countermeasures (engineering and enforcement-related measures), and to integrate this approach with other safety plans and safety focus areas.

Table 1 provides an overview of the SMAP strategies and actions that were selected as most promising or needed by stakeholders and NDOT. This list was developed with input from stakeholders and describes the strategy along with actions associated with the strategy. It is recommended that the strategies and actions be incorporated into the SHSP as well as the SHSP Action Tracking Tool to track progress.

In addition to defining strategies and actions, the SMAP also includes a Strategies to Achieve Desired Operating Speeds Matrix. This matrix identifies countermeasures that may be used to achieve desired operating speeds across all roadway environment classifications. The countermeasures included in the matrix are national best practices documented by FHWA for reducing speeds on facilities and are allowable on arterials and collectors when consistent with the roadway environment classification of the roadway.

Table 1 – Strategies and Actions

Strategy 1	**Communications and Education** **Frame the speeding and speed-related safety problem and build support for effective policies and comprehensive actions to seek and leverage funding and improve effectiveness of enforcement and engineering countermeasures (Comprehensive)**
Actions	▪ Seek support for technologies to improve enforcement reach and effectiveness (e.g., automated enforcement or safety cameras) ▪ Improve communications regarding the safety reasons for speed management efforts to increase support for effective policies and strategies
Strategy 2	**Setting Speed Limits** **Develop a task force to engage on target speed and speed limit setting and safety (SHSP Safe Speed Task Force) (Comprehensive, Proactive)**
Actions	▪ Develop guidance and procedures for setting more uniform speed limits for different land uses and road types ▪ Develop a collaborative speed limit-setting process among State and local stakeholders ▪ Conduct outreach/training to decision-makers and/or practitioners ▪ Provide outreach on impacts of speeds and speed limits on safety
Strategy 3	**Plan/Design for Speed Management** **Develop an inter-agency speed and safety assessment process to review plans, designs, and implementation to ensure that new projects meet sound speed management design and operations principles for the area land uses and intended purposes of the road (Proactive)**

Actions	▪ Prioritize speed-managing designs (such as roundabouts, fewer lanes, narrower lanes, shifting alignments) that will have long-lasting effects when designing non-freeway roads
	▪ Conduct speed and safety reviews of all new and pending plans/designs to ensure that:
	  ▪ Design is matched to elicit speeds close to the intended speed limit (self-enforcing)
	  ▪ Operations features are coordinated with target speeds (signal timing)
	▪ Set or revise speed limits early in the new project process
	▪ Consider specific designs, signs, and markings to apply to similar road types throughout the state (self-explaining designs)

Table 1 – Strategies and Actions (CONTINUED)

Strategy 4	**Systemic Actions and Strategies in High Crash Corridors**
	Develop and implement a systematic speed and safety treatment prioritization process (Systemic)
Actions	▪ Conduct network screening to prioritize roads (corridors, roadway segments, intersections) with potential speeding-related safety issues ▪ Take advantage of maintenance and operations opportunities to implement design or engineering improvements to reduce speed, and consider countermeasures identified in the Strategies to Achieve Desired Operating Speed Matrix ▪ Apply consistent/similar countermeasures to similar location/problem types as identified in the Strategies to Achieve Desired Operating Speed Matrix ▪ If speeding is an issue along a corridor, implement the appropriate countermeasures for the roadway environment located within the Strategies to Achieve Desired Operating Speed Matrix
Strategy 5	**Enforcement and Publicity on High Crash Corridors**
	Develop and implement a sustainable, high-visibility enforcement (HVE)and adjudication program targeting areas of the network where serious crashes occur (Comprehensive treatment in conjunction with systematic)
Actions	▪ Support HVE efforts for aggressive driving and speed with strong multiple-channel messaging and outreach to encourage appropriate speeds ▪ Implement automated enforcement with civil penalties in areas where supplemental or continuous enforcement is needed (starting with school and work zones)
Strategy 6	**Systemic Speed Review within the Highway Safety Improvement Program (HSIP) and Other Safety Programs**
	Implement speed and safety reviews within the HSIP program, and coordinate with other transportation safety plans (Systematic)
Actions	▪ Implement corridor or area-wide speed reviews and speed management countermeasures if needed to supplement spot safety improvements ▪ Coordinate with law enforcement to supplement or provide enhanced enforcement before engineering measures can be implemented
Strategy 7	**Speed and Speeding-Related Data**
	Identify opportunities to improve speed and speeding-related data (Proactive)
Actions	▪ Identify how Fatality Analysis Reporting System (FARS) data can be incorporated into the Nevada Citation and Accident Tracking System (NCATS) dataset to close the gap in reporting speeding-related fatal crashes ▪ Determine methods to track and monitor speed along corridors

1.6. Evaluation and Performance Measures

The primary measures of program effectiveness are:

- Reduction in speeding-related fatalities to zero by 2050.
- Number of actions that are completed.

- Adoption of an NDOT policy to use the Strategies to Achieve Desired Operating Speeds Matrix.
- Number of locations where Strategies to Achieve Desired Operating Speeds Matrix are implemented.
- Reduction in 85th percentile speeds to target speed at locations where Countermeasure to Achieve Target Speeds are implemented.

Process and implementation measures should also be used to track and link program efforts to safety outcomes, and to improve and sustain the program. Specific countermeasures may be evaluated, as feasible, to determine treatment effects in the local context.

1.7. Sustaining and Updating the Plan

As the stakeholders continue to meet and advance the strategies and actions items as part of the SHSP, it is important to consider the following:

- The implementation timeline for this initial plan is five years but can be changed as needed. Depending on the strategies and action items that are advanced, some strategies and actions will likely require a longer time frame to fully develop and implement or may be ongoing strategies and actions to maintain.
- The SMAP is a working document and may be updated and revised as actions or strategies are refined and revised.
- SMAP implementation and safety progress should be monitored with appropriate measures throughout the implementation period. The SMAP should be fully evaluated around the end of the implementation period as to how much of the plan was implemented and whether safety goals were met.
- To sustain and build the program, the SMAP should be updated near the end of the initial plan period. The update will incorporate input from the SMAP evaluation, an updated problem identification, and incorporation of new proven countermeasures.

1.8. Organization of this Document

This document has been organized into the following sections:

- **Section 1. Overview of the Plan** describes the safety goals of the SMAP, need for the SMAP, a summary of strategies and action items, evaluation, and updates.
- **Section 2. Definitions of Terms** includes definitions of terms used in the SMAP.
- **Section 3. Speeding-Related Safety Problems** describes Nevada's speeding-related fatal and serious injury crash problems. It also describes general speed management issues that may limit effectiveness of managing speeds within Nevada.
- **Section 4. Strategies, Action Items, and Countermeasures** describes the solutions to problems identified in Section 3 and identifies and defines countermeasures to set target speeds.
- **Section 5. Multi-Year Implementation Plan** outlines the proposed strategies and action items that may be implemented, the evaluation plan, and the SMAP renewal processes.
- **Appendices** provide additional support and background for the document.

2. DEFINITIONS OF TERMS

The following are definitions for terms used in this document.

Basic Speed Rule – The Basic Speed Rule requires vehicle operators to drive at a speed that is reasonable and prudent. As a corollary to this rule, State laws usually provide that every person shall drive at a safe and appropriate speed when approaching and crossing an intersection or railroad grade crossing, when approaching and going around a curve, when approaching a hill crest, when traveling upon any narrow or winding roadway, and when special hazards exist with respect to pedestrians or other traffic or by reason of weather or highway conditions. Nevada's Basic Speed Rule states "It is unlawful for any person to drive or operate a vehicle of any kind or character at: (a) A rate of speed greater than is reasonable or proper, having due regard for the traffic, surface and width of the highway, the weather and other highway conditions. (b) Such a rate of speed as to endanger the life, limb, or property of any person. (c) A rate of speed greater than that posted by a public authority for the particular portion of highway being traversed. (d) A rate of speed that results in the injury of another person or of any property. (e) In any event, a rate of speed greater than 80 miles per hour." (NRS 484B.600)

Comprehensive approach – A comprehensive approach aims to make use of the full range of strategies to address speeding-related safety problems related to the road user, the streets and highways, the vehicle, the environment, and the management system. Comprehensive strategies in the SMAP include engineering and design, enforcement and judicial measures, education and publicity, management strategies, policies, evaluation, and coordinating the strategies to achieve the bottom-line safety targets.

Coordinated approach – The goal of a coordinated approach to any traffic safety area, including speed management is "to move away from independent activities of engineers, law enforcement, educators, judges, and other highway safety specialists," including injury prevention and publicity experts, and to promote the formation of working groups and alliances that represent all the elements of the safety system. In so doing, the team can draw upon their combined expertise and resources to reach the bottom-line goal of targeted reduction of crash fatalities and injuries.

Countermeasure – Essentially, this is a treatment to reduce the frequency and/or severity of crashes. Treatments may include design or engineering, enforcement, and education and awareness-related measures.

Crash modification factor (CMF) – Multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure. Standard errors of the estimate give an idea of the quality of the estimate and potential variation of effect.

Crash reduction factor (CRF) – Estimate of the percentage reduction in crashes due to a particular countermeasure. The crash modification factor (CMF) can be used to estimate expected crash reduction percentages (1 – CMF) * 100.

Design Speed – The speed the roadway was designed for.

Federal Functional Roadway Classifications – the following descriptions are from the FHWA.

- **1 – Interstates** – Interstates are the highest classification of Arterials and were designed and constructed with mobility and long-distance travel in mind. Roadways in this functional classification category are officially designated as Interstates by the Secretary of

Transportation, and all routes that comprise the Dwight D. Eisenhower National System of Interstate and Defense Highways belong to the Interstate functional classification category and are considered Principal Arterials.

- **2 – Principal Arterial: Other Freeways and Expressways** – Roadways in this category look very similar to Interstates. While there can be regional differences in the use of the terms 'freeway' and 'expressway', for the purpose of functional classification, the roads in this category have directional travel lanes that are usually separated by some type of physical barrier, and their access and egress points are limited to on- and off-ramp locations or a very limited number of at-grade intersections. Like Interstates, these roadways are designed and constructed to maximize their mobility function, and abutting land uses are not directly served by them.
- **3 – Principal Arterial: Other** – These roadways serve major centers of metropolitan areas, provide a high degree of mobility and can also provide mobility through rural areas. Unlike their access-controlled counterparts, abutting land uses can be served directly. Forms of access for Other Principal Arterial roadways include driveways to specific parcels and at-grade intersections with other roadways.
- **4 – Minor Arterial** – Minor Arterials provide service for trips of moderate length, serve geographic areas that are smaller than their higher Arterial counterparts and offer connectivity to the higher Arterial system. In an urban context, they interconnect and augment the higher Arterial system, provide intra-community continuity, and may carry local bus routes.
- **5 – Major Collector and 6 – Minor Collector** – Collectors serve a critical role in the roadway network by gathering traffic from Local Roads and funneling them to the Arterial network. Within the context of functional classification, Collectors are broken down into two categories: Major Collectors and Minor Collectors. Until recently, this division was considered only in the rural environment. Currently, all Collectors, regardless of whether they are within a rural area or an urban area, may be sub-stratified into major and minor categories. The determination of whether a given Collector is a Major or a Minor Collector is frequently one of the biggest challenges in functionally classifying a roadway network. In the rural environment, Collectors generally serve primarily intra-county travel (rather than statewide) and constitute those routes on which (independent of traffic volume) predominant travel distances are shorter than on Arterial routes. Consequently, more moderate speeds may be posted.
- **7 – Local Road** – Locally classified roads account for the largest percentage of all roadways in terms of mileage. They are not intended for use in long distance travel, except at the origin or destination end of the trip, due to their provision of direct access to abutting land. Bus routes generally do not run on Local Roads. They are often designed to discourage through traffic. As public roads, they should be accessible for public use throughout the year. Local Roads are often classified by default. In other words, once all Arterial and Collector roadways have been identified, all remaining roadways are classified as Local Roads

Highway Safety Improvement Program (HSIP) – The HSIP is a core Federal-aid program. The goal of the program is to achieve a significant reduction in traffic fatalities and serious injuries on all public roads, including non-State-owned public roads and roads on tribal lands. The HSIP requires a data-driven, strategic approach to improving highway safety on *all* public roads that focuses on performance." This program was continued by Moving Ahead for Progress in the 21st Century (MAP-21), the federal transportation law that went into effect October 21, 2012.

KABCO – All Crashes (letter identifiers for crash severity as developed by the National Safety Council) are outlined below:

- K - Fatal Crash
- A - Suspected Serious Injury Crash
- B - Suspected Minor Injury Crash
- C - Possible/Unknown Injury Crash
- O/PDO - Property Damage Only Crash

Proactive approach – A proactive approach is a practice of planning and designing new roads or street improvements that considers intended target speeds and appropriate speed limits in the very earliest stages. A proactive approach aims to engage safety and mobility goals and various stakeholders in the planning, design, and operation of streets and highways to target speeds appropriate to the land uses and purposes of the road to minimize future problems (See self-enforcing road design) .

Operating speed – The speeds at which vehicles actually travel under free-flow (unconstrained or uncongested) conditions. The most often used measure of operating speed is the 85th percentile speed (defined below).

Roadway environment – Projects are uniquely planned and designed to be in harmony with the surrounding land use characteristics and the intended uses of the roadway. To this end, a roadway environment system comprising nine roadway environment classifications has been developed. The roadway environment classifications and associate target speed determine key design criteria elements for arterials and collectors.

Self-enforcing road design – A self-enforcing roadway design, which may be an objective of the proactive approach, is road design that reinforces established limits and reduces opportunities to speed. The goal of such designs is to increase consistency of design with limits, and to minimize the need for traffic law enforcement to enforce speed limits because the road itself induces drivers to adopt operating speeds that are within established limits.

Self-explaining road design – This includes the development of a consistent design and appearance for each roadway purpose or roadway environment category. Self-explaining designs complement self-enforcing design by making the type of road, and associated speed limit(s), more readily evident to drivers.

Speed limit – Speed limit is the posted maximum speed allowed on a roadway.

Speed zoning – Speed zoning is the establishment of safe and reasonable speed limits.

Speed-related crash – crashes that are more severe due to the speed at impact, even if vehicles are driving the speed limit.

Speeding-related crash – A speeding-related crash is defined as a crash in which speeding is determined by the officer to be a factor in the crash. This can include an officer noting on the crash report “in excess of the posted limit” or “in excess of safe speed for conditions.” Officers responding to and reporting on the crash make these assessments.

Statutory speed limit – Statutory speed limit is a law that specifies specific speed limits on specific categories of roadways.

Target speed – Target speed is the highest speed at which vehicles should operate on a roadway in a specific context. It should be set so the kinetic energy in a crash is such that fatal and serious injury crashes do not result when crashes occur and must be consistent with the level of multimodal activity generated by adjacent land uses, to provide both mobility for motor vehicles and a supportive environment for pedestrians, bicyclists, and public transit users.

Systemic approach – In this document, the systemic approach to safety involves widely implementing improvements based on high-risk roadway features or behaviors correlated with speed-related crashes.

Systematic approach – In this document, the systematic approach is defined as a process to identify and prioritize locations where speeding-related crashes are concentrated or greater than expected, and to apply systematic diagnosis and treatment of the problems. Diagnosis should include checks for consistency between speed limits, road design and operations (such as signal timing), and operating speeds. The systematic approach then follows up with application of appropriate countermeasures, including potential changes to speed limits to rectify inconsistencies and improve safety. Countermeasures may include design and engineering changes as well as application of enforcement and educational measures.

85th percentile speed – The speed at or below which 85 percent of vehicles travel.

3. SPEEDING-RELATED SAFETY PROBLEMS

The following sections summarize the data used for the crash and citation data analysis and provide key findings and takeaways.

3.1. Data Used

The following data was used for the identification of speeding-related problems on Nevada roadways.

- NCATS crash data (2015-2019)
- FARS data, (2015-2019)
- US Census Bureau – 2020 Geography Data
  - Urban versus rural boundaries
  - Population in urban versus rural locations
- NDOT speed limit database
- NDOT functional classification database
- NDOT curve database (excludes functional classification 7)
- Nevada Crash Dashboard
- NDOT Traffic Records Information Access (TRINA)
- Nevada Highway Patrol (NHP) citation data

3.2. State Problems

Crash data was analyzed to identify general characteristics of the speeding and severe crash problems in Nevada. This section characterizes speeding-related crashes and identifies where and when crashes are concentrated throughout the state of Nevada.

3.2.1. Crash Data Summary

The following sections summarize data analysis conducted as part of this Plan. Additional data analysis tables, graphs, and charts are in **Appendix A**.

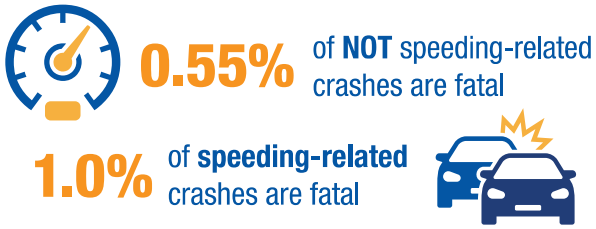
Disparity in Crash Data

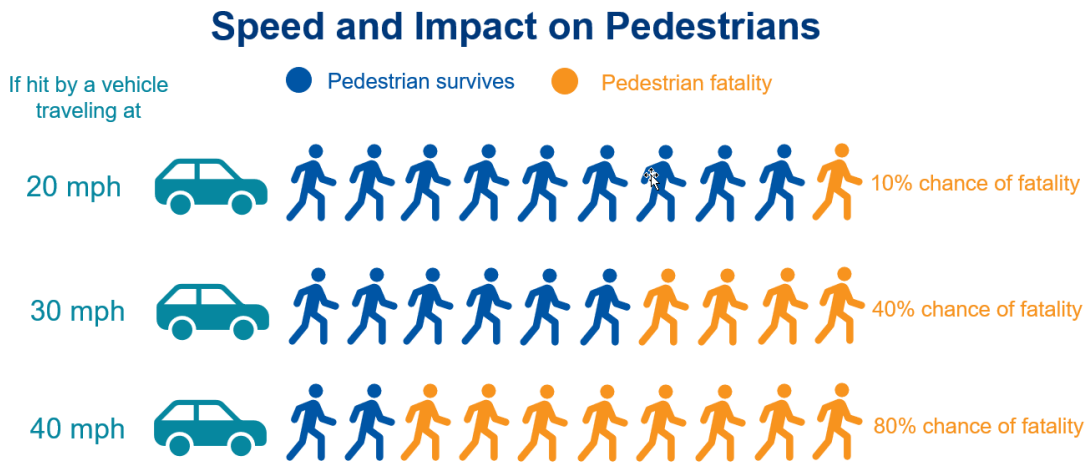
Speeding-related fatal crash counts vary between data sources. NCATS uses information from responding law enforcement officers. In the event of fatal crashes, more information is obtained post-crash that includes analyses such as speed studies, crash forensics, officer narratives, and citations issued after the crash that include additional information that is compiled into FARS. As a result, some of this information is not reinput into NCATS, which results in discrepancies. It is also believed that speeding-related crashes are underrepresented in the NCATS data, especially for less severe crashes.

Speeding-Related Crashes are More Severe

Speeding-related crashes are more severe not only for pedestrians, but for all road users as well. In Nevada, 0.55% of not-speeding-related crashes result in fatalities, and 1% of speeding-related crashes result in fatalities.

The data shows that speeding-related crashes are twice as likely to result in fatalities.

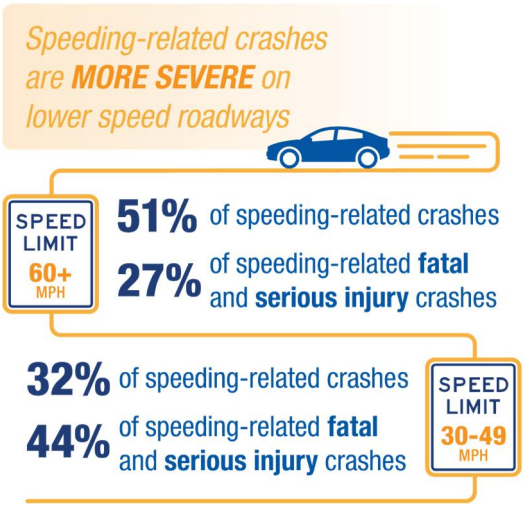




Vehicle Speed Comparison to Chance of Pedestrian Injury and Fatality, Data Source: US Department of Transportation, Literature Reviewed on Vehicle Travel Speeds and Pedestrian Injuries. March 2000.

Speeding-Related Crashes are More Severe on Lower Speed Roadways

On roads with speed limits greater than 60 mph, speeding-related crashes are more common and result in over half of all speeding-related crashes. However, roads with speed limits greater than 60 mph represent less than one-third of fatal and serious injury crashes. Approximately one-third of speeding-related crashes occur on roads with speed limits between 30 and 49 mph, but almost half of speeding-related fatal and serious injury crashes occur on roads with these speed limits.



Speeding-Related Crashes are More Severe on Functional Class 3 and 4 Roadways

Similar to the relation of speeding-related crash severity with posted speed limits, speeding-related crashes are also more severe on Functional Class 3 "Principal Arterial: Other" and Functional Class 4 "Minor Arterial" roadways. Approximately one-third of all crashes occur on Functional Class 3 and 4 roadways, yet almost half of fatal and serious injury speeding-related crashes occur on Functional Class 3 and 4 roadways.

Speeding-related crashes are
***MORE SEVERE** on Principal Arterial: Other and Minor Arterial roadways*

32% of all crashes

47% of **fatal** and **serious injury** crashes

Speeding-Related Crashes are Intersection-Related

Speeding-related crashes are
INTERSECTION-RELATED

62% Principal Arterial: Other

71% Minor Arterial

Throughout Nevada, nearly half of all speeding-related crashes occur at intersections. However, for Functional Class 3 and 4 roadways (where almost half of the speeding-related fatal crashes and serious injuries occur), the percentage of speeding-related crashes at intersections is much higher, 62% and 71% respectively.

Speeding-Related Fatal Crashes by Select Emphasis Area

More than half of all bicycle and pedestrian fatal and serious injury crashes are speeding-related, nearly one-third of all motorcycle fatal and serious injury crashes are speeding-related, and one-quarter of unrestrained fatal and serious injury crashes are speed-related.

51% of all **BICYCLE AND PEDESTRIAN** fatal and serious injury crashes are speeding-related

29% of all **MOTORCYCLE** fatal and serious injury crashes are speeding-related

25% of all **UNRESTRAINED** fatal and serious injury crashes are speeding-related

11% of all **IMPAIRED** fatal and serious injury crashes are speeding-related

Speeding-Related Fatal and Serious Injury Crashes are More Prominent in the Daylight

More than half of speeding-related fatal and serious injury crashes occurred in daylight conditions, with 4:00 PM – 7:00 PM being the most common time frame for speeding-related fatal and serious injury crashes.

Speeding-related fatal and serious injury crashes are more prominent in ***DAYLIGHT CONDITIONS***

51% in daylight

4:00 - 7:00 PM is most common for fatal and serious injury speeding-related crashes

Speeding-related fatal and serious injury crashes are over-represented in ***RURAL COUNTIES***

6% of Nevada's population lives in **Rural Counties**

15% of all speeding-related crashes

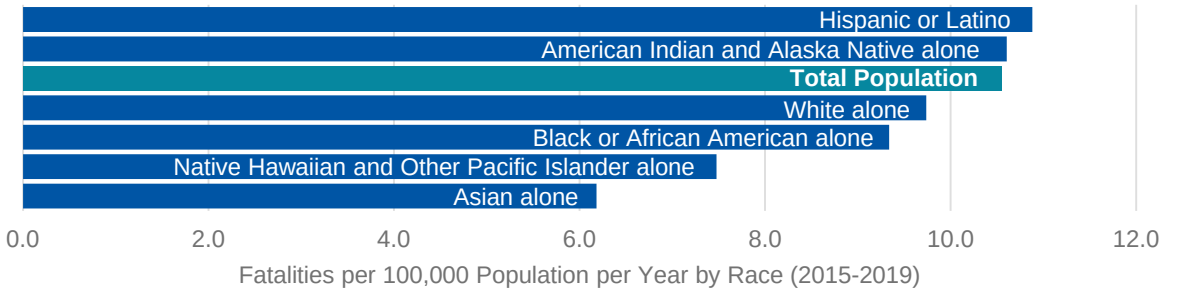
28% of **fatal and serious injury** speeding-related crashes

Speeding-Related Crashes are Over-Represented in Rural Counties

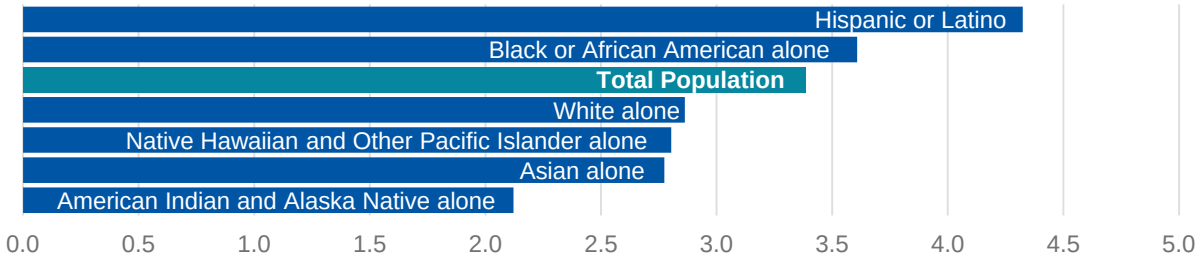
Six percent of Nevada's population lives in rural counties. Fifteen percent of all speeding-related crashes occur in rural counties, and nearly one-third of fatal and serious injury crashes occur in rural counties. Speeding-related crashes are over-represented in rural counties in Nevada based on the crash data compared to population.

Fatality Rate by Race/Ethnicity

Hispanic or Latino and American Indian and Alaska Native alone race/ethnicities have a slightly higher fatality rate per 100,000 population when compared to the total population fatality rate in Nevada. For speeding-related fatalities in Nevada, Hispanic or Latino and Black or African American alone have speeding-related fatality rates higher than the average. It should be noted that some race/ethnicities had very small sample sizes.



Fatalities per 100,000 Population per Year by Race (2015-2019)



Speeding-Related Fatalities per 100,000 Population per Year by Race (2015-2019)

Source: 2015-2019 FARS Data (Nevada).
Note: Total fatalities: eight Native Hawaiian and Other Pacific Islander fatalities. Speed-related fatalities: four American Indian and Alaska Native alone fatalities, as well as three Native Hawaiian and Other Pacific Islander alone fatalities. As such it should be noted that these rates were calculated with low sample sizes.

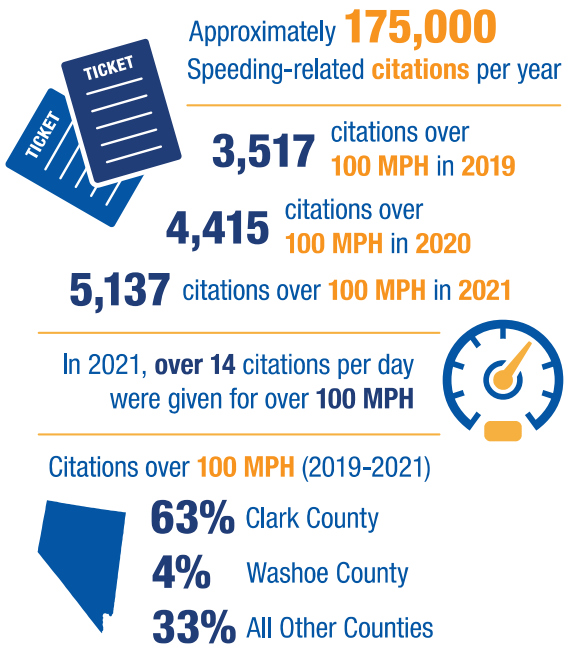
3.2.2. Before and After Speed Limit Crash Data

NDOT Traffic Operations Division conducts speed zone studies at locations based on requests received through the NDOT District Offices. The Traffic Operations Division coordinates with the Traffic Information Division to collect and analyze speed data. Based on a field review of the location, crash data, operating speeds (85th percentile, 50th percentile [mean], pace speed, percent of vehicles in the pace), and USLIMITS2, the Traffic Operations Division makes recommendations for modifications to speed limits within the study area. NDOT maintains a tabular record of all the speed zone studies that have been completed since June 2015. Four locations where speed limits were modified as a result of the speed zone studies were reviewed for before and after crash analysis. Based on the analysis, no correlation could be drawn between the raising or lowering of speed limits and changes to total crash rates, fatal and serious injury crash rates, or speeding-related crash rates. Additional information is included in **Appendix A**.

3.2.3. Citation Data Summary

The Nevada Department of Public Safety (DPS) Office of Traffic Safety (OTS) provided speed citation data for the state. From 2015 to 2019, there was an average of 175,000 speeding-related citations per year (57% in Clark County, 13% in Washoe County, and 30% in the remaining counties).

Additionally, speed citation data for speeds at or above 100 mph for 2019, 2020, and 2021 was provided. Based on the data, there were a total of 13,069 citations for speed at or above 100 mph with a 3,517 occurring in 2019, 4,415 in 2020, and 5,137 in 2021. The total number of citations for Clark and Washoe County is 8,263 (63%) and 521 (4%), respectively. One third of citations for over 100 mph occurred in the remaining counties throughout Nevada.



It is important to note that in 2020, excessive speeding was a trend that was observed throughout the United States and was likely a result of the pandemic and more opportunities for speeding as roads were not as congested. However, this appears to be a trend, as excessive speeding continued to increase in 2021.

3.2.4. Other Issues

This section describes other speed management or policy issues that affect the safety, credibility, and enforceability of speed limits, or the improvement, design, safe operation, and maintenance of roads to reduce speeding-related fatal and serious injury crashes and support Nevada's SHSP goals.

Speed Zoning Issues

Appropriately set speed limits represent a concerted effort to balance safety and travel efficiency for all modes of travel. This section describes current policies, practices and other issues that may limit effectiveness of speed limits as a safety measure.

- Speed limit setting methods (statutory and zoning) and other policies are included in **Appendix B**. The Nevada Revised Statutes (NRS) 484A.430, 484B.163, and 484B.620

along with the Manual on Uniform Traffic Control Devices (MUTCD) Section 2B.13 define speed zoning for Nevada. Additionally, NDOT's 2020 Operations and Safety Study Process guidelines further outline speed zoning for Nevada. While this process generally follows traditional speed zoning methods, there is not a process in place for countermeasures to reduce speeds to achieve target speeds for the roadway.

- Currently, speed zone study requests are received through the NDOT District Offices. Often the requests are based on concerns that drivers are driving too fast on the road. Based on the current process, if data collection results in speeds higher than the speed limit, the speed limit could be raised as opposed to making recommendations on how to reduce speeds to target speeds based on the roadway environment.
- Informed public opinion regarding the trade-offs of safety risks and mobility are not included in the process, and outcomes may send mixed messages to drivers about safe operating speeds, especially when the speed limit is increased.

Planning, Design, and Other Engineering Issues

This section describes planning, design, and engineering practices that may undermine speed limits as a safety countermeasure or reduce effective targeting of appropriate countermeasures.

Problems that may result include low credibility of speed limits leading to low levels of driver compliance, low levels of enforcement or high enforcement tolerances because many drivers exceed limits, or speed limits that are higher than safe operating or design speed. Perceptual issues may also undermine speed limits as a safety measure in general. For example, speed limits may be perceived by drivers as too low for the road design and create challenges to enforcement but be perceived locally as correct for the land use, number of conflict points, and purposes of the road.

- It is important to plan and design new/improved roads for the target speed. Ideally, the target speed, speed limit, and design speed should all be the same.
- Target speed, speed, limit, and design speed should be set for new roads, with appropriate input and consideration of the roadway environment before design begins.
- There should be systematic identification and prioritization of existing roads for speed limit and safety review, followed by implementing appropriate limits and supporting engineering and enforcement countermeasures.
- Spot safety assessments should regularly incorporate consideration of speeding and related crash issues.
- Agencies should work together in implementing speed transition areas and speed zones from rural to developed areas.

Enforcement Issues

This section describes issues with the availability and commitment of enforcement resources, targeting of resources, publicity issues, support for technologies to aid enforcement, and support of enforcement by the courts to uphold swift and certain penalties for violations.

- Law enforcement has limited resources to allocate to speed enforcement in both the rural and urban areas of the state. With limited resources, enforcement could be targeted in the locations where safety issues are the greatest.
- Currently, speed safety cameras (or automated enforcement) are not an option in Nevada due to current NRS 484A.600. In years past, there has been a lack of support for speed

safety cameras. This is currently a legislative priority for the Nevada Advisory Committee on Traffic Safety (NVACTS).

- Recent changes in NRS have reduced adjudication or penalties for speeding citations.

Public Information and Education Issues

This section characterizes problems with public communications and education of varied stakeholders about the risks of speeding and the importance of managing speed (road safety agencies and policymakers) or obeying limits (drivers).

- Conveying the importance of managing the risks of speeding to decision-makers, law enforcement, and the public to make informed decisions.
- Gaining public buy-in for crash-reducing engineering, enforcement, and educational countermeasures. Efforts need to be made to garner public input, but also to communicate the risks and address concerns about speed management countermeasures.
- Speed enforcement programs should be publicized to improve driver compliance with speed limits and speed-deterrent effects of enforcement programs.

3.3. Key Takeaways from Data Analysis

Following are some key takeaways from the data analysis.

- **Crash Data**
  - There is a disparity in crash data due to the extra data and time spent on reporting fatalities in FARS, and the data does not get tied back into NCATS. As such, speeding-related fatalities are under-represented in NCATS.
  - Speeding-related crashes are twice as likely to result in fatalities.
  - Speeding-related crashes are more common on high-speed roads but are less severe.
  - Speeding-related crashes are more severe on Functional Classification 3 and 4 roadways (Principal Arterial: Other and Minor Arterial) and are most common at intersections along these roadways.
  - Speeding-related crashes are over-represented in rural counties when crash data is compared to population.
- **Before and After Data**
  - No correlation could be drawn from before and after speed zoning studies and changes in speed limits.
- **Citation Data**
  - There are approximately 175,000 speed-related citations per year.
  - The number of citations for driving over 100 mph have been significantly increasing since 2019.
- **Other Issues**
  - Other issues were identified with respect to speed zoning; planning, design and other engineering problems; enforcement; public information and education.

4. STRATEGIES, ACTION ITEMS, AND COUNTERMEASURES

This section describes alternate actions that may be used to address identified problems, select and implement strategies and countermeasures, and to systematically assess and treat roadways and intersections identified through network screening or other means. This section also outlines alternate engineering and enforcement countermeasures that may be used to treat specific crash and safety problems.

4.1. Statewide Speed Management Strategies and Actions

The main focus of NDOT's proactive strategies and actions will be to foster creation of appropriate and self-enforcing roadway designs over time by engaging to develop more collaborative and consistent policies, procedures, and guidance in speed zoning and design. Speed zoning should be undertaken early in the planning and design process in conjunction with other major decisions about the purpose and design of the road. Among considerations, careful attention should be given to the current and future land uses and safety and mobility needs of the users considering the road's purpose in the network for each mode of travel.

A key focus of NDOT's comprehensive strategies is to build support among the public and law enforcement community to enforce and support established limits and to improve enforcement effectiveness in targeting and reducing serious crashes due to speeding. Enforcement and publicity are especially needed to supplement design and engineering when road designs or limits cannot be changed, or design and engineering measures are insufficient to achieve the safer operating speeds. It may also be desirable to engage with other stakeholders to seek changes in policies that may limit the use of effective tools or make other policy changes (e.g., increase funding for enforcement, authorize use of safety cameras, or others).

Table 3 through **Table 8** describe strategies and related action items that NDOT, counties, metropolitan planning organizations (MPOs), and other partners may use to address the jurisdiction-wide and other speed management issues identified in **Section 3**. The strategies and related action items were presented in a stakeholder workshop held on October 5, 2021, where stakeholders had the option to vote on their priorities and were further refined by the Technical Advisory Committee (TAC). Most of the strategies and related action items outlined in **Table 3** through **Table 8** do not have proven crash reduction or safety effects, but flow from best speed management principles or provide the framework for a sustainable speed management program, particularly for a TZD approach.

Table 2 – Communications and Education

Strategy 1
Frame the speeding and speed-related safety problem and build support for effective policies and comprehensive strategies, to seek and leverage funding, and to improve effectiveness of enforcement and engineering countermeasures (Comprehensive)
Action Items
▪ Seek support for technologies to improve enforcement reach and effectiveness (e.g., automated enforcement or safety cameras) ▪ Improve communications regarding the safety reasons for speed management efforts to increase support for effective policies and strategies
Issues to be Addressed
▪ Lack of support or difficulty in setting or garnering support for appropriate speed limits, enforcement strategies, or engineering strategies (e.g., road diets, roundabouts) ▪ Widespread speeding above limits ▪ Policies or funding priorities that limit speed enforcement ▪ Lack of resources for enforcement ▪ Challenges to enforcing in certain areas ▪ Legal or other barriers to implementing automated enforcement (automated enforcement is not legally allowed in Nevada per NRS 484A.600.)

Table 3 – Setting Speed Limits

Strategy 2
Develop a task force to engage on target speed and speed limit setting and safety (SHSP Safe Speed Task Force) (Comprehensive, Proactive)
Action Items
▪ Develop guidance and procedures for setting more uniform speed limits for different land uses and road types ▪ Develop a collaborative speed limit setting process among State and local stakeholders ▪ Conduct outreach/training to decision-makers and/or practitioners ▪ Provide outreach on impacts of speeds and speed limits on safety
Issues to be Addressed
▪ Speeds too high/low for local priorities and concerns ▪ Mismatch of road designs, speed limits, and user needs ▪ Varied methods, decision-processes, and outcomes in setting speed limits which may affect safety of limits implemented ▪ Difficulty in enforcing speed limits where inferred design speed or actual design speed is significantly higher than limit ▪ Lack of agreement among jurisdictions about appropriate speed limits on similar road types

Table 4 – Plan/Design for Speed Management

Strategy 3
Develop an inter-agency speed and safety assessment process to review plans, designs, and implementation to ensure that new projects meet sound speed management design and operations principles for the area land uses and intended purposes of the road (Proactive)
Action Items

▪ Prioritize speed-managing designs (such as roundabouts, fewer lanes, narrower lanes, shifting alignments) that will have long-lasting effects when designing non-freeway roads
▪ Conduct speed and safety reviews of all new and pending plans/designs to ensure that:
  ▪ Design is matched to elicit speeds close to the intended speed limit (self-enforcing)
  ▪ Operations features are coordinated with target speeds (signal timing)
▪ Set or revise speed limits early in the new project process
▪ Consider specific designs, signs, and markings to apply to similar road types throughout the state (self-explaining designs)

Issues to be Addressed
▪ Operating speeds that are incompatible with operational or geometric features ▪ Designs and operating speeds that are incompatible with user needs and area land uses ▪ Reactive approach to identifying problems and providing safety treatments not as effective as initial good design ▪ Lack of self-enforcing/self-explaining roadway designs ▪ Difficulty in enforcing speed limits where inferred design speed or actual design speed is significantly higher than speed limit ▪ Inconsistent design or design exceptions that contribute to unsafe speeds and crashes at those locations ▪ Reactive approach to managing speed and providing safety treatments not as effective as initial good design

Table 5 – Systemic Actions and Strategies in High Crash Corridors

Strategy 4
Develop and implement a systematic speed and safety treatment prioritization process (Systematic)
Action Items
▪ Conduct network screening to prioritize roads (corridors, roadway segments, intersections) with potential speeding-related safety issues ▪ Take advantage of maintenance and operations opportunities to implement design or engineering improvements to reduce speed, and consider countermeasures identified in the Strategies to Achieve Desired Operating Speed Matrix ▪ Apply consistent/similar countermeasures to similar location/problem types as identified in the Strategies to Achieve Desired Operating Speed Matrix ▪ If speeding is an issue along a corridor, implement the appropriate countermeasures for the roadway environment located within the Strategies to Achieve Desired Operating Speed Matrix
Issues to be Addressed
▪ This systematic approach should be used for each of the prioritized problem corridors/areas identified through network screening – e.g., RE2T (Rural Town), RE3R (Suburban Residential), and RE4 (Urban General) to prioritize appropriate treatments for the safety issues identified

Table 6 – Enforcement and Publicity on High Crash Corridors

Strategy 5
Develop and implement a sustainable, HVE and adjudication program targeting areas of the network where fatal or serious injury crashes occur (Comprehensive treatment in conjunction with Systematic)
Action Items
▪ Support HVE efforts for aggressive driving and speed with strong multiple-channel messaging and outreach to encourage appropriate speeds ▪ Implement automated enforcement with civil penalties in areas where supplemental or continuous enforcement is needed (starting with school and work zones
Issues to be Addressed
▪ Widespread speeding above limits ▪ Difficulty maintaining special or enhanced enforcement programs due to resource limitations ▪ Insufficient enforcement resources ▪ Challenges enforcing in certain areas or times

Table 7 – Systemic Speed Review within the HSIP and Other Safety Programs

Strategy 6
Implement speed and safety reviews within the HSIP program, and coordinate with other transportation safety plans (Systematic)
Action Items
▪ Implement corridor or area-wide speed reviews and speed management countermeasures if needed to supplement spot safety improvements ▪ Coordinate with law enforcement to supplement or provide enhanced enforcement before engineering measures can be implemented
Issues to be Addressed
▪ Speeding at intersections ▪ Roadway/lane departure crashes related to speeding ▪ Pedestrian safety and mobility problems; inappropriate speeds in pedestrian areas with few places to safely cross ▪ Bicycle safety and mobility problems; difficulty for bicyclists to share higher speed roads creating difficult crossings and turns ▪ Spot safety problems related to speeding

Table 8 – Speed and Speeding-Related Data

Strategy 7
Identify opportunities to improve speed and speeding-related data (Proactive)
Action Items
▪ Identify how FARS data can be incorporated into the NCATS dataset to close the gap in reporting speeding-related fatal crashes ▪ Determine methods to track and monitor speed along corridors
Issues to be Addressed
▪ Disparity of speeding-related fatal crash data between NCATS and FARS ▪ Understanding where speeding is an issue to prioritize enforcement and engineering improvements

4.2. Countermeasures to Set Target Speeds

As mentioned, the systematic approach is the process used to identify, prioritize, and treat existing safety and speed management problems by corridors or other areas in a cost-effective manner. **Table 5**, **Table 6**, and **Table 7** describe three potential strategies that may be used to implement a systematic approach to treating corridors or other areas of concern. The strategies provide an organizational framework for selecting and developing cost-effective treatment packages of countermeasures. The systematic approach to diagnose and treat speeding-related problems can be applied to corridors, segments, or intersections identified through network screening, or through other screening processes (e.g., significant change in traffic volume, or land use change)

to target measures where they are most needed and will have the most cost-effective safety impacts. Additional information on network screening guidance is in **Appendix C**.

The following sections describe effective countermeasures that may be selected and implemented to address speeding-related and speed management problems based on the roadway environment and desired target speeds.

Measures that reduce travel speeds may be expected to have effects on reducing the occurrence of more severe crashes of all types. Although individual diagnosis and treatment decisions should be performed for each corridor or area, application of more uniform designs, markings, and other proven treatments for similar area and roadway environments may be helpful toward achieving more self-enforcing and self-explaining road designs. Such treatments could improve consistency of the message to drivers about safe speeds in similar land use and roadway environments and help improve overall driver perception of safe and appropriate speeds.

4.2.1. Roadway Environment

Projects should be uniquely planned and designed to be in harmony with the surrounding land use characteristics and the intended uses of the roadway. To this end, a roadway environment system comprising nine roadway environment classifications has been developed. **Table 9** contains the roadway environment classifications developed for Nevada.

Table 9 – Roadway Environment

Roadway Environment		Description	Target Speed (mph)
RE1	Natural	Adjacent land is in a Bureau of Land Management (BLM), natural or wilderness condition, including lands unsuitable for settlement due to BLM or natural conditions.	60-70
			50-60
RE2	Rural	Sparsely settled lands; may include desert, agricultural land, grassland, woodland, and wetlands.	55-70
			50-60
RE2T	Rural Town	Small concentrations of developed areas immediately surrounded by rural and natural areas; includes rural and historic towns.	40-45
			30-35
			≤ 25
RE3R	Suburban Residential	Mostly residential uses within large blocks and a disconnected/sparse roadway network.	40-45
			30-35
			≤ 25
RE3C	Suburban Commercial/ Industrial	Mostly non-residential uses with large building footprints and large parking lots. Buildings are within large blocks.	40-45
			35
			≤ 30
RE4	Urban General	Mix of uses set within small blocks with a well-connected roadway network. May extend long distances. The roadway network usually connects to residential neighborhoods immediately along the corridor or behind the uses fronting the roadway.	40-45
			35
			30
RE5	Urban/ Small Town Center	Mix of uses set within small blocks with a well-connected roadway network. Typically concentrated around a few blocks and identified as part of the community, town, or city of a civic or economic center.	35
			30
			25
RE6	Urban Core	Areas with the highest densities and with building heights typically greater than four floors within urbanized areas (population >250,000). Buildings have mixed uses, are built up to the roadway, and are within a well-connected roadway network.	30-35
			25
RE7	Entertainment District	Areas with casinos and other tourist-related land uses such as hotels, gaming establishments, and large crowd generators such as arenas, theatres, and other tourist-related attractions.	30-35
			25

The roadway environment classifications and associated target speed determine key design criteria elements for arterials and collectors. This does not apply to Interstates or other grade-separated facilities, where the primary function of these facilities is to move vehicles quickly.

It is important to note that the roadway environment is different than functional classification of a roadway. The roadway environment was developed to take into account the surrounding land uses in order to develop a target speed. **Table 10** contains three different roads identified

as Functional Classification 3 in the NDOT Access Management System and Standards, 2017 Edition, along with their associated roadway environment:

- US 50 near Fallon – This is a rural two-way two-lane stretch of roadway.
- St. Rose Parkway in Henderson – This is an eight-lane arterial surrounded by commercial and big-box retail uses.
- US 50 in Ely – This is a two-way two-lane roadway through the downtown area of Ely.

Table 10 – Functional Classification Versus Roadway Environment

Location	Functional Classification*	Roadway Environment
US 50 near Fallon	Functional Class 3, Other Principal Arterial	RE1 (Natural)
St. Rose Parkway in Henderson	Functional Class 3, Other Principal Arterial	RE3C (Suburban Commercial/Industrial)
US 50 in Ely	Functional Class 3, Other Principal Arterial	RE2T (Rural Town)

** Source: NDOT Access Management System and Standards, 2017 Edition*

Although these roads all have the same functional classification, they operate in very different environments and their associated target speeds and countermeasures to achieve target speed should be different. Hence, it is important to identify a roadway environment classification as opposed to functional classification to apply countermeasures that are in line with the surrounding roadway environment to manage and reduce speeds based on the context of the roadway.

4.2.2. Speed Management Countermeasures

This section describes countermeasures that may be used to achieve desired operating speeds across all roadway environment classifications. The countermeasures described in this section are national best practices documented by the FHWA for reducing speeds on facilities and are allowable on arterials and collectors when consistent with the roadway environment classification of the roadway.

NDOT recognizes a range of design speeds for each roadway environment classification. For very low speed conditions (35 mph or less) the roadway environment classification target speed range indicates the upper end of desirable operating speeds. For instance, the target speed range for RE4 is 30-45 mph, but in conditions where on-street parking is present, a 35 mph or lower target speed should be used. Additionally, when the current design speed of a roadway exceeds the allowable range for the roadway environment classification or exceeds the target speed for conditions within the roadway, the countermeasures described in this section can be used to achieve a lower operating or target speed.

Countermeasures have been grouped into two different categories: along roadways and at intersections. A brief description is provided for each of the countermeasures, but more detailed information is not provided, as it is assumed that practitioners planning and designing roadways should be familiar with these countermeasures.

Along Roadways

- **Speed safety cameras** – cameras used for documenting speed and associated software for issuing citations for speeding (speed safety cameras are currently not legal in Nevada)
- **Lane narrowing** – narrowing of the lanes using pavement markings, median, etc.
- **Technology-driven solutions** – could include speed feedback signs, speed monitoring cameras, Strategic Traffic Monitoring Sites (STMS), etc.
- **In-pavement speed limit markings** – pavement markings indicating the speed limit
- **Transverse lane markings** – pavement markings placed across the lane perpendicular to direction of travel
- **Gateway treatment** – placed at community entrance to remind drivers of changing roadway character
- **Addition of median or two-way left-turn lane (TWLTL)** – raised island or painted TWLTL to narrow travel lanes
- **Horizontal deflection** – horizontal movement of the driver from the intended path of travel (could include chokers or chicanes)
- **Medians and pedestrian refuge islands** – raised islands and areas to provide refuge for individuals crossing the street
- **Roadway reconfiguration (four- to three-lane conversion)** – reducing the number of lanes by reallocating roadway space for other uses (e.g., bike lanes, center turn lanes, medians, parking, etc.)
- **Landscaping** – roadside plantings used to create vertical friction
- **Terminated vista** – providing a terminated view ahead, indicating a roadway does not extend indefinitely
- **On-street parking** – parking provided within the roadway cross-section
- **Vertical deflection** – vertical movement of the driver from the intended path of travel (could include speed humps, speed cushions, or speed tables)

At Intersections

- **Increase visibility** – increase the visibility of an intersection through enhancements such as oversized signage, retroreflective posts, duplicate signage, etc.
- **Roundabout** – large, raised circular islands at the middle of major intersections, around which all oncoming vehicles must traverse
- **Small modern roundabouts and mini roundabouts (not traffic circles)** – roundabouts designed for lower travel speeds
- **Bulb-outs/neck down** – mid-block curb extensions that narrow road by extending the sidewalk or widening the planting strip
- **Textured surfaces** – decorative pavement treatment in the center of an intersection
- **Diagonal diverter** – placement of a barrier diagonally across an intersection
- **Raised intersection/vertical deflection** – a raised plateau, with ramps on all approaches where roads intersect
- **Neighborhood traffic circle (not roundabouts)** – a raised round island in the center of a neighborhood intersection
- **Transverse rumble strips** – raised grooved patterns installed on the roadway travel lane perpendicular to the direction of travel on stop approaches

4.2.3. Countermeasures to Achieve Target Speed

To achieve target speed, the different roadway environments were broken down by target speeds, and applicable countermeasures were assigned based on target speed and roadway environment.

The design speed of the roadway should be changed to match the target speed when possible by using the identified countermeasures, recognizing this may have to occur incrementally depending on the magnitude of the difference between the current operating speed and the target speed. Speed studies per the most current version of NDOT's 2020 Operations and Safety Study Process guidelines, Appendix A, Speed Zone Studies should be conducted to determine if the target speed countermeasures are working and to reset the speed limit as the operating speeds change over time.

When selecting countermeasures from **Table 11** and **Table 12**, practitioners should consider a variety of factors including the following:

- The roadway environment
- Desired operating speed
- Existing operating speed
- Existing and future community needs
- Existing and future multimodal needs
- Safety of roadway users
- Emergency response vehicles

The countermeasures in **Table 11** and **Table 12** are generally more effective when multiple countermeasures are used in combination with one another.

Table 11 – Countermeasures to Achieve Target Speed Along Roadways

Roadway Environment		Description	Target Speed (mph)	Speed Safety Cameras	Lane Narrowing	Technology-Driven Solutions	In-Pavement Speed Limit Markings	Transverse Lane Markings	Gateway Treatment	Addition of Median or TWLTL	Horizontal Deflection	Medians and Pedestrian Refuge Islands	Roadway Reconfiguration	Landscaping	Terminated Vista	On-street Parking	Vertical Deflection
RE1	Natural	Adjacent land is in a BLM, natural or wilderness condition, including lands unsuitable for settlement due to BLM or natural conditions.	60-70	X		X											
			50-60	X	X	X											
RE2	Rural	Sparsely settled lands; may include desert, agricultural land, grassland, woodland, and wetlands.	60-70	X		X											
			50-60	X	X	X											
RE2T	Rural Town	Small concentrations of developed areas immediately surrounded by rural and natural areas; includes rural and historic towns.	40-45	X	X	X	X	X	X	X	X						
			30-35		X	X	X	X	X	X	X	X	X	X	X	X	
			≤ 25		X	X	X	X	X	X	X	X	X	X	X	X	X
RE3R	Suburban Residential	Mostly residential uses within large blocks and a disconnected/sparse roadway network.	40-45		X	X				X	X						
			30-35		X	X				X	X	X	X	X	X		
			≤ 25		X	X				X	X	X	X	X	X	X	X
RE3C	Suburban Commercial/ Industrial	Mostly non-residential uses with large building footprints and large parking lots. Buildings are within large blocks.	40-45	X	X	X				X	X						
			35		X	X				X	X	X	X	X	X		
			≤ 30		X	X				X	X	X	X	X	X	X	X
RE4	Urban General	Mix of uses set within small blocks with a well-connected roadway network. May extend long distances. The roadway network usually connects to residential neighborhoods immediately along the corridor or behind the uses fronting the roadway.	40-45	X	X	X				X	X	X					
			35		X	X				X	X	X	X	X	X	X	
			30		X	X				X	X	X	X	X	X	X	X
RE5	Urban/ Small Town Center	Mix of uses set within small blocks with a well-connected roadway network. Typically concentrated around a few blocks and identified as part of the community, town, or city of a civic or economic center.	35		X	X				X		X	X	X		X	
			30		X	X				X	X	X	X	X	X	X	
			25		X	X				X	X	X	X	X	X	X	X
RE6	Urban Core	Areas with the highest densities and with building heights typically greater than four floors within urbanized areas (population >250,000). Buildings have mixed uses, are built up to the roadway, and are within a well-connected roadway network.	30-35		X	X				X	X	X	X	X	X	X	
			25		X	X				X	X	X	X	X	X	X	X
RE7	Entertainment District	Areas with casinos and other tourist-related land uses such as hotels, gaming establishments, and large crowd generators such as arenas, theatres, and other tourist-related attractions.	30-35		X	X				X		X	X	X	X		X
			25		X	X				X		X	X	X	X		X

Table 12 – Countermeasures to Achieve Target Speed at Intersections

Roadway Environment		Description	Target Speed (mph)	Increase Visibility	Roundabout	Small Modern Roundabouts and Mini-Roundabouts	Bulb- Outs/ Neck Down	Textured Surfaces	Diagonal Diverter	Raised Intersection / Vertical Deflection	Neighborhood Traffic Circles	Transverse Rumble Strips
RE1	Natural	Adjacent land is in a BLM, natural or wilderness condition, including lands unsuitable for settlement due to BLM or natural conditions.	60-70	X								X
			50-60	X								X
RE2	Rural	Sparsely settled lands; may include desert, agricultural land, grassland, woodland, and wetlands.	60-70	X								X
			50-60	X								X
RE2T	Rural Town	Small concentrations of developed areas immediately surrounded by rural and natural areas; includes rural and historic towns.	40-45	X	X							X
			30-35	X	X	X	X	X				
			≤ 25	X	X	X	X	X	X	X	X	
RE3R	Suburban Residential	Mostly residential uses within large blocks and a disconnected/sparse roadway network.	40-45	X	X							
			30-35	X	X	X	X	X				
			≤ 25	X	X	X	X	X	X	X		
RE3C	Suburban Commercial/ Industrial	Mostly non-residential uses with large building footprints and large parking lots. Buildings are within large blocks.	40-45	X	X							
			35	X	X	X	X	X				
			≤ 30	X	X	X	X	X	X	X		
RE4	Urban General	Mix of uses set within small blocks with a well-connected roadway network. May extend long distances. The roadway network usually connects to residential neighborhoods immediately along the corridor or behind the uses fronting the roadway.	40-45	X	X							
			35	X	X	X	X	X				
			30	X	X	X	X	X	X	X	X	
RE5	Urban/Small Town Center	Mix of uses set within small blocks with a well-connected roadway network. Typically concentrated around a few blocks and identified as part of the community, town, or city of a civic or economic center.	35	X	X		X					
			30	X	X	X	X	X	X			
			25	X	X	X	X	X	X	X	X	
RE6	Urban Core	Areas with the highest densities and with building heights typically greater than four floors within urbanized areas (population >250,000). Buildings have mixed uses, are built up to the roadway, and are within a well-connected roadway network.	30-35	X	X	X	X	X	X			
			25	X	X	X	X	X	X	X		
RE7	Entertainment District	Areas with casinos and other tourist-related land uses such as hotels, gaming establishments, and large crowd generators such as arenas, theatres, and other tourist-related attractions.	30-35	X	X	X	X	X		X		
			25	X	X	X	X	X		X		

4.3. Coordination with Spot Safety and Other Safety Plans and Programs

A pragmatic approach to speed management should use many ways to systematically implement speed and safety review and implement countermeasures, such as those included within the Countermeasures to Achieve Desired Target Speed, along with other safety programs, including the HSIP and any other programs. In addition, it may be prudent to incorporate speed and safety, along with multi-modal user assessments, into planned maintenance and operations improvement programs.

Other transportation plans and safety action plans, including modal plans, should be consulted to ensure that speed management measures and priorities are coordinated with overall safety and mobility goals for each jurisdiction/area. Countermeasures may serve multiple goals through good coordination.

5. MULTI-YEAR IMPLEMENTATION PLAN

Speeding is a complex issue that interacts with varied human cultural, economic and political, environmental, and roadway issues. Because of the inherent relationship between speed and severe crashes and fatalities, speed management should be a central tenet of a road safety program that aims to reduce fatalities and injuries. This section describes strategies and actions to enable NDOT and local stakeholders to arrive at locally acceptable solutions to better manage speed appropriate to conditions and to reduce speeding-related fatalities and serious injuries. Commitment to sustain a cooperative approach to speed management that balances safety and mobility goals, to implementation, and to consider varied points of view by all partners is essential to success. Input from non-traditional partners, such as injury prevention experts and two-way communications with the public and stakeholders, may also be essential to communicate the need for speed management, to build support, and to implement strategies that a majority of the public (all transportation stakeholders) deems appropriate. The following sections outline strategies and actions along with tools for implementing, evaluating, and renewing the SMAP.

5.1. Proposed Strategies and Actions

This section outlines speed management strategies and actions NDOT has elected to use to reduce fatalities and serious injuries.

Table 1 provides strategies and action items, as detailed in **Section 4**. This list was developed with input from stakeholders and describes the strategy along with actions associated with the strategy. It is recommended that the strategies and actions be incorporated into the SHSP as well as the SHSP Action Tracking Tool to track progress.

5.2. Evaluation Plan

The goals of this SMAP are to reduce fatalities and serious injuries and to improve speed compliance. The primary measures of program effectiveness are safety measures:

- Reduction in speeding-related fatalities to zero by 2050.
- Number of actions that are completed.
- Adoption of an NDOT policy to use the Strategies to Achieve Desired Operating Speeds Matrix.
- Number of locations where Strategies to Achieve Desired Operating Speeds Matrix are implemented.
- Reduction in 85th percentile speeds to target speed at locations where Countermeasure to Achieve Target Speeds are implemented.

The program will be evaluated with respect to changes in crashes, especially fatal and serious injury crashes and speeding-related crashes compared with trends absent the program. Speed measurements provide earlier feedback than crash trends and are a good indicator of safety risk.

The timing of crash-based evaluations will depend on when and how many measures are implemented, and the availability of sufficient years and number of crashes for evaluation. Additional technical assistance is available to help determine appropriate evaluation methods to control for other trends and safety programs.

Ongoing tracking of strategies and actions as part of the SHSP will also be used to help document program efforts and provide support for findings relating to the program. Near the end of the SHSP implementation period, it is recommended to perform an assessment of whether the safety goals of the SMAP were met. It is recommended to communicate the results to decision-makers and the public and use results to help develop ambitious targets for an updated SMAP and SHSP.

It may be important to evaluate specific countermeasures to provide additional information about program effects as well as feedback about countermeasures effectiveness in the local context.

5.3. SMAP Update

The SMAP will be a working document, with additional implementation actions, schedules, and other updates incorporated as needed during the five-year plan period.

Near the end of five years, following the plan evaluation, update the SMAP incorporating lessons learned from the evaluation and implementation experiences, as well as from an updated problem assessment.

APPENDIX A

CRASH AND CITATION DATA SUMMARY TABLES

DATA ANALYSIS

1 Key Takeaways from Crash Data

1.1 NCATS Data

- #1 – Disparity in speeding-related crash data
  - NCATS 280 speeding-related fatal crashes
  - FARS 454 speeding-related fatal crashes
  - Speeding-related crashes are under-represented in NCATS
- #2 – Speeding-related crashes tend to be more severe
  - 1% of speeding-related crashes are fatal crashes
  - 0.55% of not speeding-related crashes are fatal crashes
- #3 – Speeding-related crashes are more common on high-speed roads, but less severe on those roadways
  - Speed limit between 60-69 mph
    - 45% of all speeding-related crashes
    - 17% of speeding-related fatal and serious injury crashes
- #4 – Speeding-related crashes are more severe on lower speed roadways
  - Speed limit between 30-49 mph
    - 32% of all speeding-related crashes
    - 44% of speeding-related fatal and serious injury crashes
- #5 – Speeding-related crashes are more severe on Functional Classification 3 and 4 roadways (Principal Arterial: Other and Minor Arterial)
  - 32% of all crashes
  - 47% of fatal and serious injury crashes
- #6 – Speeding-related crashes on Functional Classification 3 and 4 roadways (Principal Arterial: Other and Minor Arterial) are intersection-related
  - 62% Functional Classification 3
  - 71% Functional Classification 4
- #7 – Speeding-related fatal and serious injury crashes by select emphasis area
  - Bicycle and pedestrian – 51% of all bicycle and pedestrian crashes are speeding-related
  - Motorcycle – 29% of all motorcycle crashes are speeding-related
  - Impaired – 11% of all impaired crashes are speeding-related*
  - Unrestrained – 25% of all unrestrained crashes are speeding-related*

    * Likely underreported due to additional investigations and timing of crash reports going to NCATS
- #8 – Speeding-related fatal crashes are slightly more prominent in daylight conditions
  - 51% in daylight
  - 3:00 – 6:00 PM – most common

- #9 – Speeding-related crashes are over-represented in rural counties
  - Rural Counties make up 6% of the population of Nevada
  - 15% of all speeding-related crashes
  - 30% of fatal speeding-related crashes

1.2 FARS Data

- #10 – Fatal Crashes and select overlapping SHSP Emphasis Areas
  - 60% Impaired Crashes
  - 44% Lane Departure Crashes
  - 33% Intersection Crashes
  - 32% Unrestrained Crashes
  - 27% Motorcyclists Crashes
  - 15% Older Drivers
  - 14% Young Drivers
- #11 – Fatal Crashes by time of day
  - Slightly higher at night
- #12 - Fatal Crashes by crash type
  - Single vehicle
  - Angle

1.3 Before and After Data

- No correlation could be drawn

1.4 Citation Data

- #13 – Approximately 175,000 speeding-related citations per year
- #14 – Citations over 100 MPH
  - 3,517 in 2019
  - 4,415 in 2020
  - 5,137 in 2021

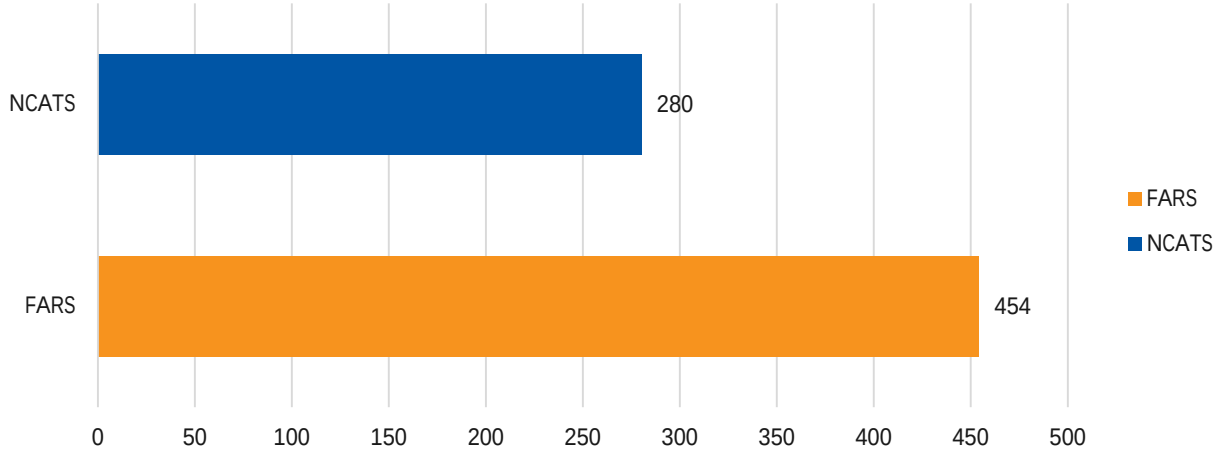
2 Speeding-related Fatal Crashes by Data Source

Note: Speeding-related fatal crash counts vary between data sources. The Nevada Citation and Accident Tracking System (NCATS) uses information from responding law enforcement officers. In the event of fatal crashes, more information is obtained post-crash that includes analyses such as speed-studies, crash forensics, officer narratives and citations issued after the crash that include additional information that is compiled into the Fatality Analysis Reporting System (FARS). As a result, some of this information is not reinput into the NCATS which results in discrepancies. **Table 1** shows the difference in speeding-related fatal crashes between the two data sources.

Table 1 – Speeding-related Fatal Crashes by Data Source

	2015-2019	
	NCATS	FARS
Speeding-related Fatal Crashes	280	454
Total FARS Fatal Crashes	1,477	

Source: 2015-2019 Crash Data obtained from NDOT, 2015-2019 FARS Data.
Note: FARS has 454 speeding-related fatal crashes, of which 450 can be tied back to crashes in the database provided by the NDOT.



Source: 2015-2019 Crash Data obtained from NDOT, 2015-2019 FARS Data.
Note: FARS has 454 speeding-related fatal crashes, of which 450 can be tied back to crashes in the database provided by the NDOT.

Figure 1 – Speeding-related Fatal Crashes by Data Source

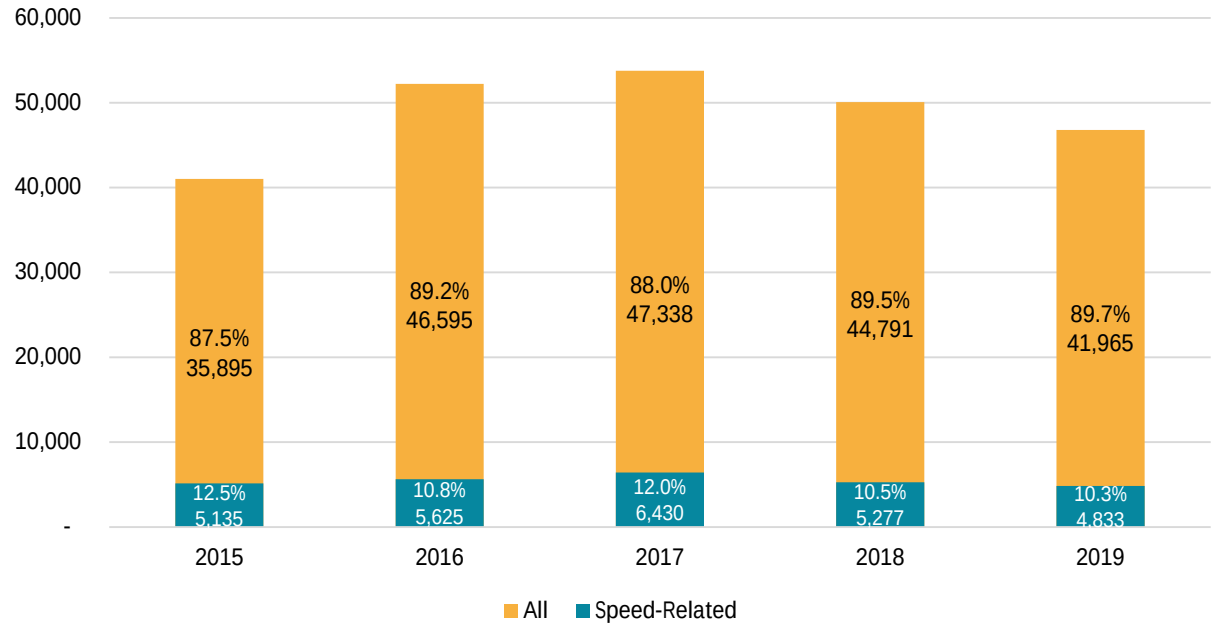
3 NCATS Data

3.1 Speeding-related Crashes and All Crashes

Table 2 – Speeding-related Crashes and All Crashes

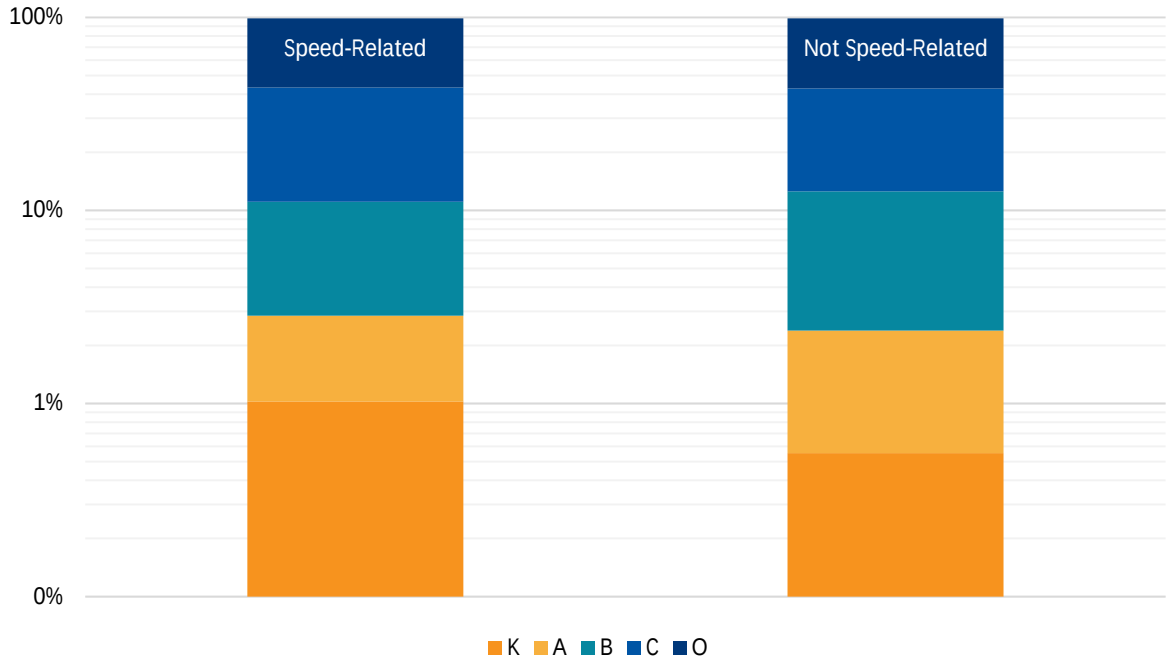
	2015	2016	2017	2018	2019	Total	Percent
Speeding-related Crashes	5,135	5,625	6,430	5,277	4,833	27,300	11.2%
Not Speeding-related Crashes	35,895	46,595	47,338	44,791	41,965	216,584	88.8%
All Crashes	41,030	52,220	53,768	50,068	46,798	243,884	100.0%

Source: 2015-2019 Crash Data obtained from NDOT.



Source: 2015-2019 Crash Data obtained from NDOT.

Figure 2 – Speeding-related Crashes and All Crashes



Source: 2015-2019 Crash Data obtained from NDOT.
Note: The Y-Axis of this figure is on a logarithmic scale.

Figure 3 – Speeding-related Crashes and All Crashes

3.2 Speeding-related Fatal and Serious Injury Crashes and All Fatal and Serious Injury Crashes

Table 3 – Speeding-related Fatal and Serious Injury Crashes

	Fatal		Serious Injury		Fatal and Serious Injury	
	Crashes	%	Crashes	%	Crashes	%
Speeding-related Crashes	280	18.9%	498	11.1%	778	13.1%
Not Speeding-related Crashes	1,199	81.1%	3,975	89.8%	5,174	86.9%
All Crashes	1,479	100.0%	4,473	100.0%	5,952	100.0%

Source: 2015-2019 Crash Data obtained from NDOT. Percentages reported are a fraction of fatal and serious injury crashes.

3.3 Speeding-related Crashes by Urban and Rural Areas

Table 4 – Speeding-related Urban and Rural Crashes

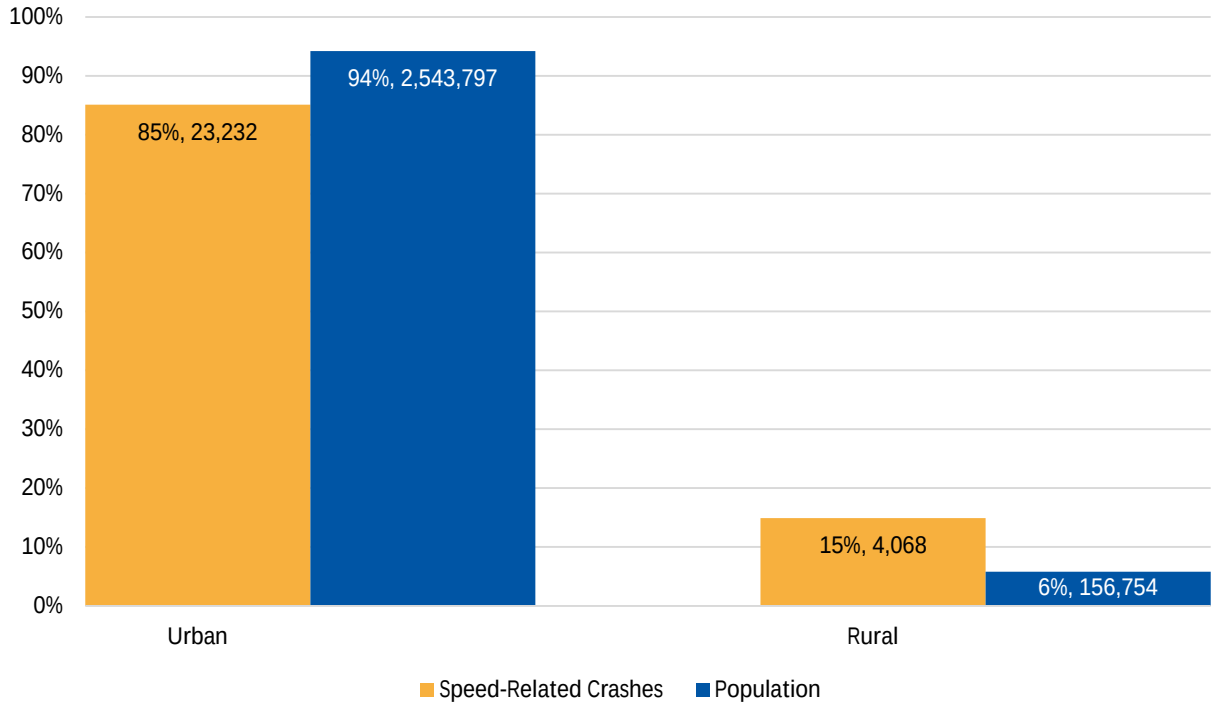
	Fatal Speeding-related		Serious Injury Speeding-related		Total Speeding-related	
	Crashes	%	Crashes	%	Crashes	%
Urban Crashes	195	69.6%	369	74.1%	23,232	85.1%
Rural Crashes	85	30.4%	129	25.9%	4,068	14.9%
Total Speeding-related Crashes	280	100.0%	498	100.0%	27,300	100.0%

Sources: 2015-2019 Crash Data obtained from NDOT, US Census Bureau - 2020 Geography Data.

Table 5 – Speeding-related Urban and Rural Crashes and Population

	Total Speeding-related		Population		Difference
	Crashes	%	Value	%	%
Urban Crashes	23,232	85.1%	2,543,797	94.2%	-8.9%
Rural Crashes	4,068	14.9%	156,754	5.8%	+8.9%
Total Speeding-related Crashes	27,300	100.0%	2,700,551	100.0%-	-

Sources: 2015-2019 Crash Data obtained from NDOT, US Census Bureau – 2010 Census, US Census Bureau - 2020 Geography Data.



Sources: 2015-2019 Crash Data obtained from NDOT, US Census Bureau – 2010 Census.

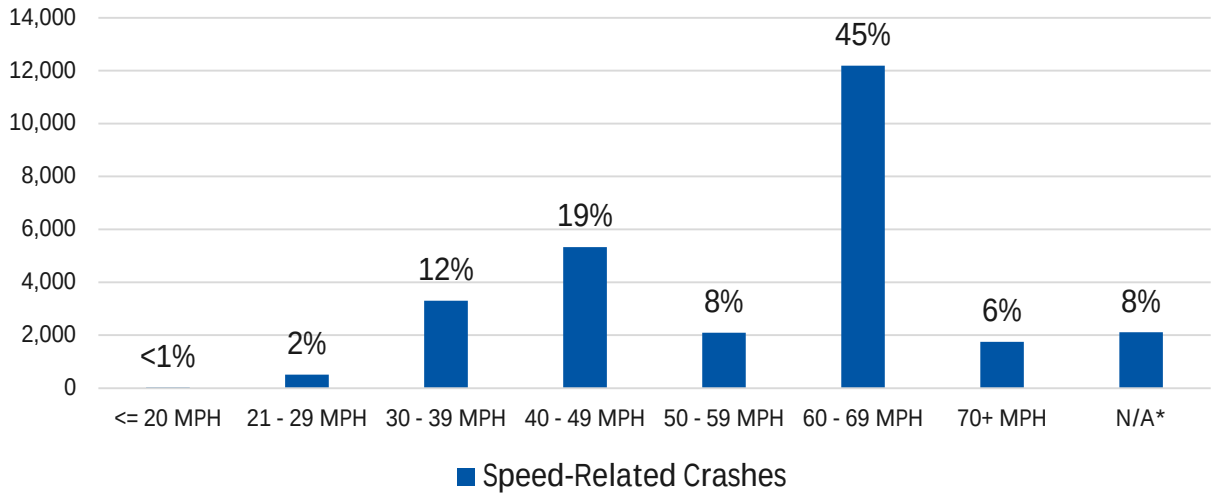
Figure 4 – Speeding-related Crashes and All Crashes

3.4 Speeding-related Crashes by Posted Speed Limit

Table 6 – Speeding-related Crashes by Posted Speed Limit

Speed Limit	Speeding-related		Total	
	Crashes	%	Crashes	%
<= 20 MPH	23	0.1%	290	0.1%
21 - 29 MPH	509	1.9%	8,693	3.6%
30 - 39 MPH	3,300	12.1%	56,462	23.2%
40 - 49 MPH	5,331	19.5%	74,149	30.4%
50 - 59 MPH	2,091	7.7%	18,299	7.5%
60 - 69 MPH	12,189	44.6%	51,147	21.0%
70+	1,748	6.4%	9,659	4.0%
Not Available	2,109	7.7%	25,185	10.3%
Total	27,300	100.0%	243,884	100.0%

Source: 2015-2019 Crash Data obtained from NDOT. Speed Limit data obtained from NDOT.



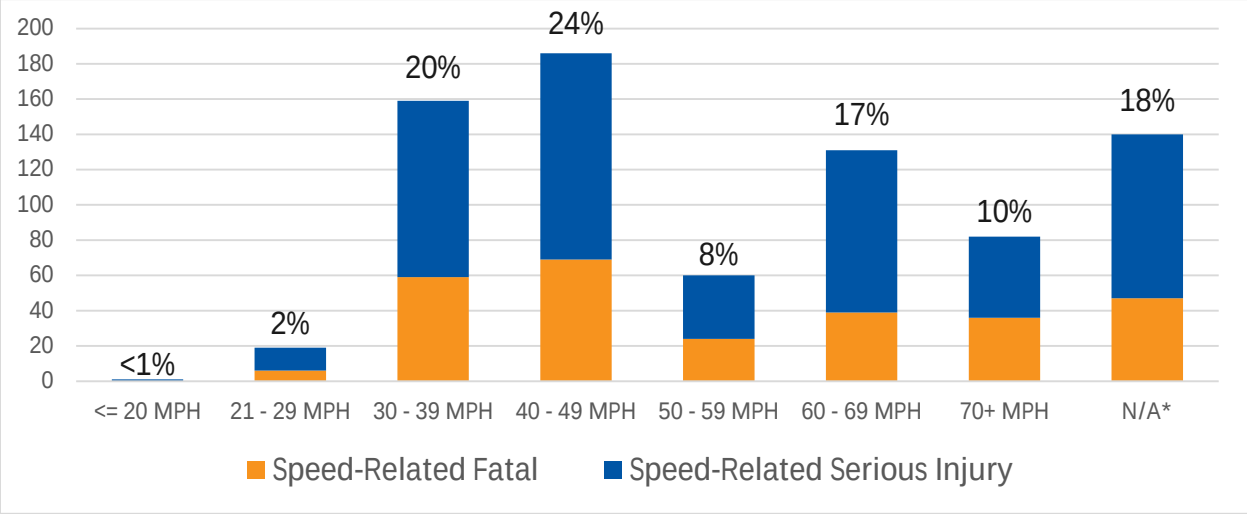
Source: 2015-2019 Crash Data obtained from NDOT. Speed Limit data obtained from NDOT.
**Speed Limit data not available.*

Figure 5 – Speeding-related Crashes by Posted Speed Limit

Table 7 – Speeding-related Fatal and Serious Injury Crashes by Posted Speed Limit

Speed Limit (MPH)	Speeding-related Fatal		Speeding-related Serious Injury		Speeding-related Fatal and Serious Injury		Total Fatal and Serious Injury	
	Crashes	%	Crashes	%	Crashes	%	Crashes	%
<= 20	0	0.0%	1	0.2%	1	0.1%	4	0.1%
21 - 29	6	2.1%	13	2.6%	19	2.4%	191	3.2%
30 - 39	59	21.1%	100	20.1%	159	20.4%	1,500	25.2%
40 - 49	69	24.6%	117	23.5%	186	23.9%	1,871	31.4%
50 - 59	24	8.6%	36	7.2%	60	7.7%	506	8.5%
60 - 69	39	13.9%	92	18.5%	131	16.8%	584	9.8%
70+	36	12.9%	46	9.2%	82	10.5%	527	8.9%
N/A*	47	16.8%	93	18.7%	140	18.0%	769	12.9%
Total	280	100.0%	498	100.0%	778	100.0%	5,952	100.0%

Source: 2015-2019 Crash Data obtained from NDOT. Speed Limit data obtained from NDOT.
** Speed Limit data not available.*



Source: 2015-2019 Crash Data obtained from NDOT. Speed Limit data obtained from NDOT.
** Speed Limit data not available.*

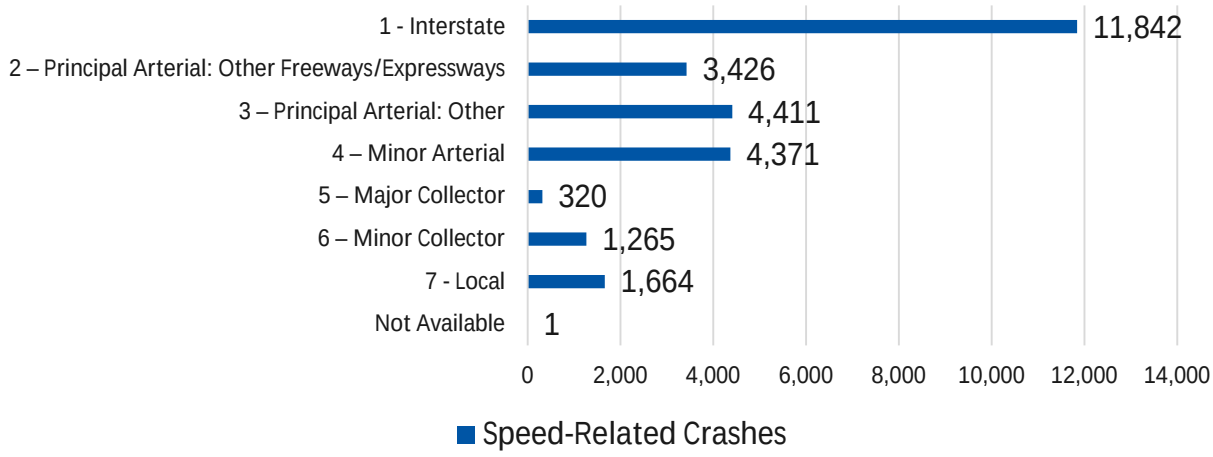
Figure 6 – Speeding-related Fatal and Serious Injury Crashes by Posted Speed Limit

3.5 Speeding-related Crashes by Functional Classification

Table 8 – Speeding-related Crashes by Functional Classification

Functional Classification	Speeding-related		Total	
	Crashes	%	Crashes	%
1 - Interstate	11,842	43.4%	49,818	20.4%
2 – Principal Arterial: Other Freeways/ Expressways	3,426	12.5%	14,899	6.1%
3 – Principal Arterial: Other	4,411	16.2%	56,276	23.1%
4 – Minor Arterial	4,371	16.0%	74,636	30.6%
5 – Major Collector	320	1.2%	2,247	0.9%
6 – Minor Collector	1,265	4.6%	24,111	9.9%
7 - Local	1,664	6.1%	21,892	9.0%
Not Available	1	<0.1%	5	<0.1%
Total	27,300	100.0%	243,879	100.0%

Source: 2015-2019 Crash Data obtained from NDOT. Functional Class roadway data obtained from NDOT.



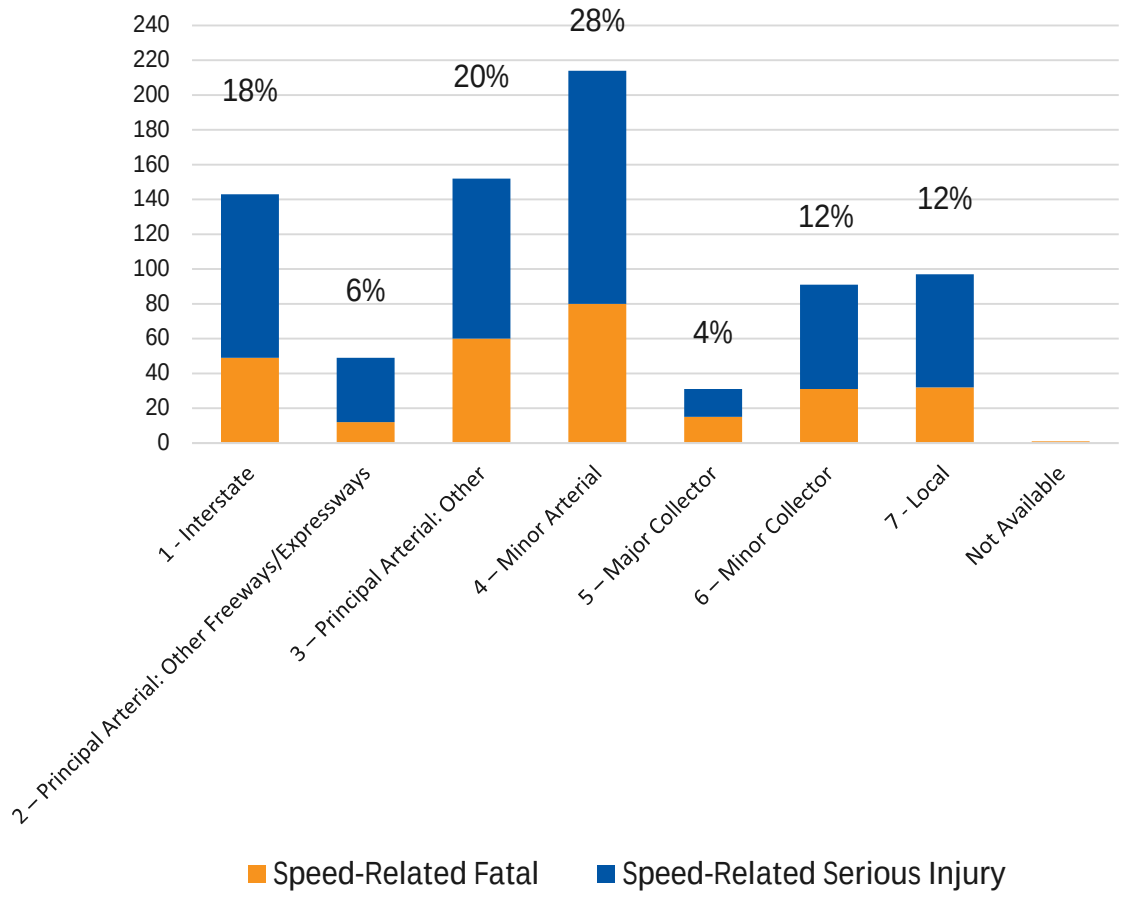
Source: 2015-2019 Crash Data obtained from NDOT. Functional Class roadway data obtained from NDOT.

Figure 7 – Speeding-related Crashes by Functional Classification

Table 9 – Speeding-related Fatal and Serious Injury Crashes by Functional Classification

Functional Classification	Speeding-related Fatal		Speeding-related Serious Injury		Speeding-related Fatal and Serious Injury		Total Fatal and Serious Injury	
	Crashes	%	Crashes	%	Crashes	%	Crashes	%
1 - Interstate	49	17.5%	94	18.9%	143	18.4%	630	10.6%
2 – Principal Arterial: Other Freeways/ Expressways	12	4.3%	37	7.4%	49	6.3%	178	3.0%
3 – Principal Arterial: Other	60	21.4%	92	18.5%	152	19.5%	1,648	27.7%
4 – Minor Arterial	80	28.6%	134	26.9%	214	27.5%	2,145	36.0%
5 – Major Collector	15	5.4%	16	3.2%	31	4.0%	151	2.5%
6 – Minor Collector	31	11.1%	60	12.0%	91	11.7%	645	10.8%
7 - Local	32	11.4%	65	13.1%	97	12.5%	550	9.2%
Not Available	1	0.4%	0	0.0%	1	0.1%	5	0.1%
Total	280	100.0%	498	100.0%	778	100.0%	5,952	100.0%

Source: 2015-2019 Crash Data obtained from NDOT. Functional Class roadway data obtained from NDOT.



Source: 2015-2019 Crash Data obtained from NDOT. Functional Class roadway data obtained from NDOT.

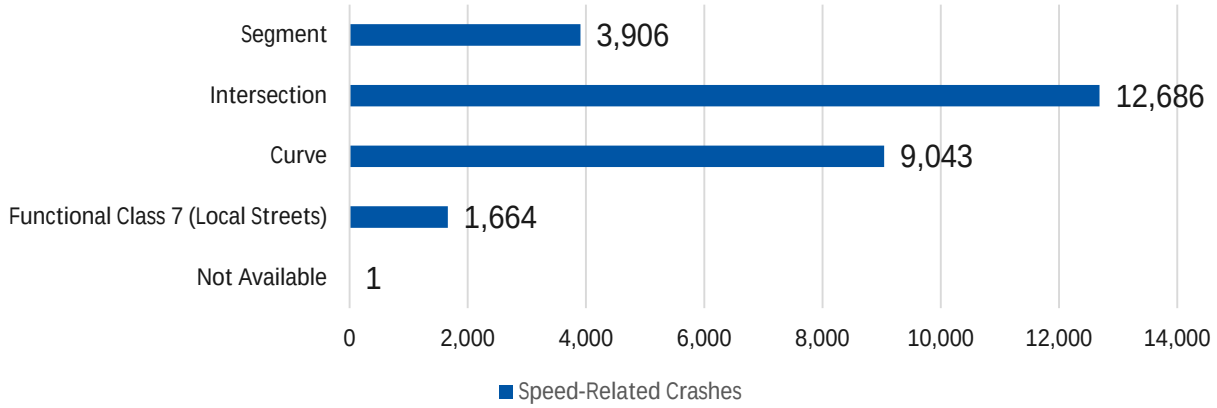
Figure 8 – Speeding-related Fatal and Serious Injury Crashes by Functional Classification

3.6 Speeding-related Crashes by Roadway Geometry

Table 10 – Speeding-related Crashes by Roadway Geometry

	Speeding-related		Total	
	Crashes	%	Crashes	%
Segment	3,906	14.3%	18,021	7.4%
Intersection	12,686	46.5%	148,583	60.9%
Curve	9,043	33.1%	55,383	22.7%
Functional Class 7 (Curve data not available)	1,664	6.1%	21,892	9.0%
Not available	1	0.0%	5	0.0%
Total	27,300	100.0%	243,884	100.0%

Source: 2015-2019 Crash Data obtained from NDOT. Curves were not available for Functional Class 7.



Source: 2015-2019 Crash Data obtained from NDOT. Curves were not available for Functional Class 7.

Figure 9 – Speeding-related Crashes by Roadway Geometry

Table 11 – Speeding-related Crashes by Selected Emphasis Areas

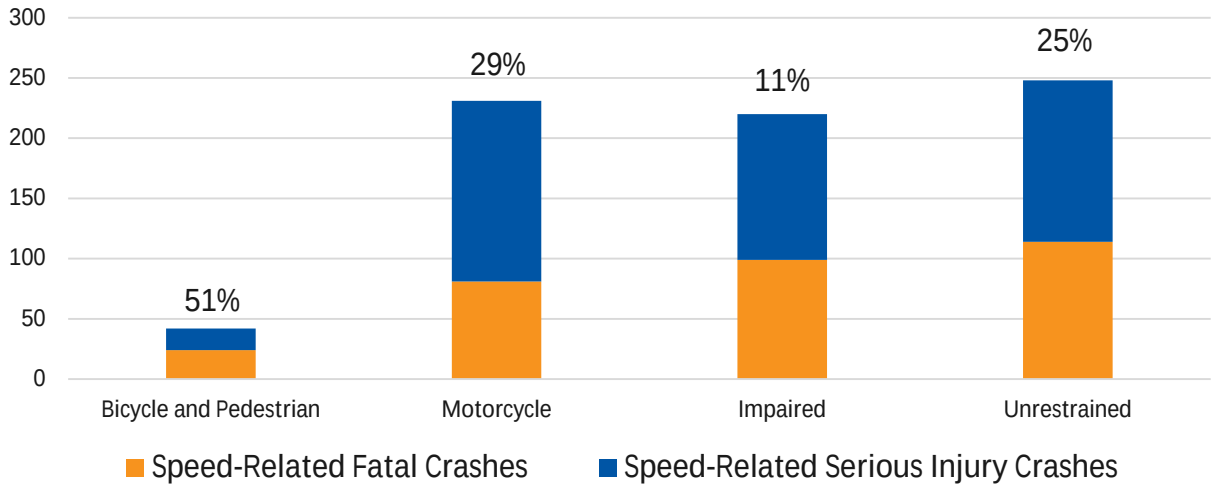
	Speeding-related		Total	
	Crashes	%	Crashes	%
Bicycle and Pedestrian	83	1.3%	6,532	100.0%
Motorcycle	785	11.8%	6,633	100.0%
Impaired	1,949	12.7%	15,362	100.0%
Unrestrained	977	13.0%	7,516	100.0%

Source: 2015-2019 Crash Data obtained from NDOT.

Table 12 – Speeding-related Fatal and Serious Injury Crashes by Selected Emphasis Areas

	Speeding-related Fatal		Speeding-related Serious Injury		Speeding-related Fatal and Serious Injury		Total Speeding-related	
	Crashes	%	Crashes	%	Crashes	%	Crashes	%
Bicycle and Pedestrian	24	28.9%	18	21.7%	42	50.6%	83	100.0%
Motorcycle	81	10.3%	150	19.1%	231	29.4%	785	100.0%
Impaired	99	5.1%	121	6.2%	220	11.3%	1,949	100.0%
Unrestrained	114	11.7%	134	13.7%	248	25.4%	977	100.0%

Source: 2015-2019 Crash Data obtained from NDOT.



Source: 2015-2019 Crash Data obtained from NDOT.

Figure 10 – Speeding-related Crashes by Roadway Geometry

3.7 Speeding-related Crashes by Lighting Condition

Table 13 – Speeding-related Crashes by Lighting Condition

Lighting Condition		Speeding-related Crashes	Percent
Dawn		479	1.8%
Daylight		16,168	59.2%
Dusk		508	1.9%
Dark	Dark - No Lighting	1,419	5.2%
	Dark - Spot Lighting	4,704	17.2%
	Dark - Continuous Lighting	2,054	7.5%
	Dark - Unknown Lighting	64	0.2%
Other/Unknown		1,904	7.0%
Total		27,300	100.0%

Source: 2015-2019 Crash Data obtained from NDOT.

3.8 Speeding-related Fatal and Serious Injury Crashes by Lighting Condition

Table 14 – Speeding-related Fatal and Serious Injury Crashes by Lighting Condition

Lighting Condition		Fatal and Serious Injury Speeding-related Crashes	Percent
Dawn		23	3.0%
Daylight		398	51.2%
Dusk		12	1.5%
Dark	Dark - No Lighting	95	12.2%
	Dark - Spot Lighting	115	14.8%
	Dark - Continuous Lighting	129	16.6%
	Dark - Unknown Lighting	3	0.4%
Other/Unknown		3	0.4%
Total		778	100.0%

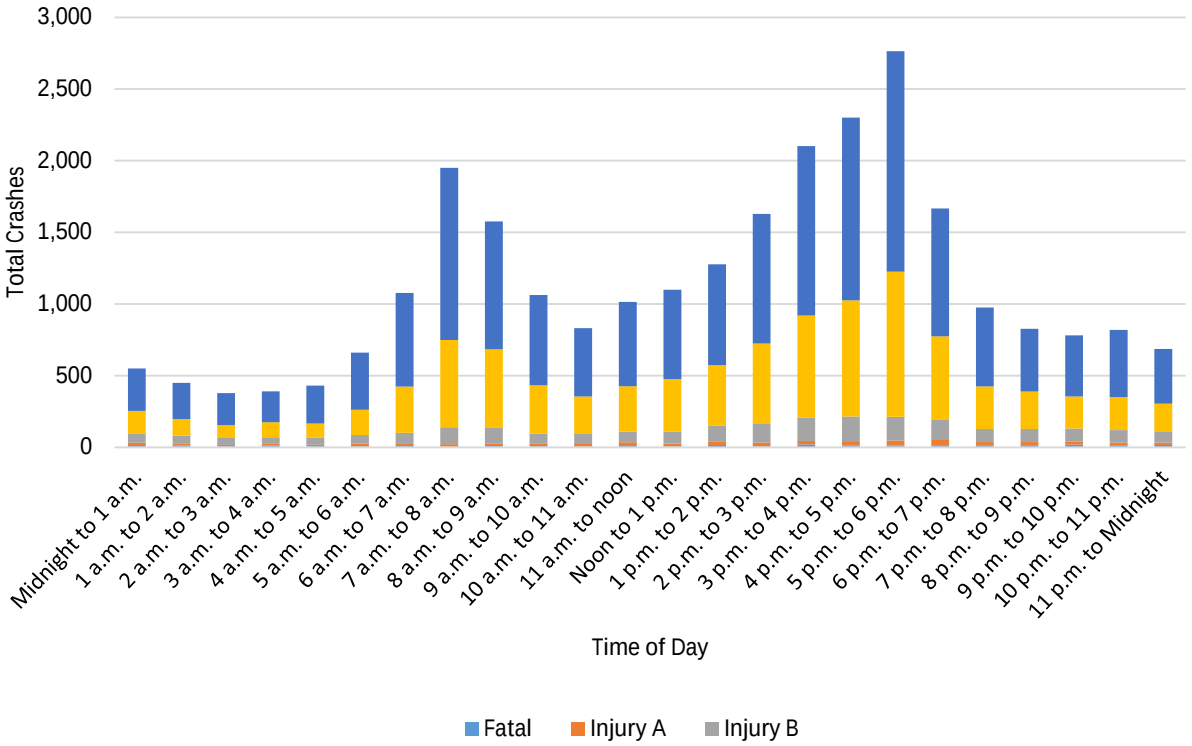
Source: 2015-2019 Crash Data obtained from NDOT.

3.9 Speeding-related Crashes by Time of Day

Table 15 – Speeding-related Crashes by Time of Day

Time of Day (Hour)	Speeding-related					
	Fatal	Injury A	Injury B	Injury C	PDO	Total
Midnight to 1 a.m.	9	23	62	161	295	550
1 a.m. to 2 a.m.	13	12	57	116	252	450
2 a.m. to 3 a.m.	7	10	53	85	223	378
3 a.m. to 4 a.m.	12	13	45	105	216	391
4 a.m. to 5 a.m.	8	10	51	97	265	431
5 a.m. to 6 a.m.	7	19	60	176	399	661
6 a.m. to 7 a.m.	9	20	72	323	653	1,077
7 a.m. to 8 a.m.	5	17	119	608	1,201	1,950
8 a.m. to 9 a.m.	9	19	111	545	892	1,576
9 a.m. to 10 a.m.	8	16	72	337	630	1,063
10 a.m. to 11 a.m.	6	17	75	257	476	831
11 a.m. to Noon	16	20	73	317	589	1,015
Noon to 1 p.m.	7	20	84	366	622	1,099
1 p.m. to 2 p.m.	17	25	111	421	703	1,277
2 p.m. to 3 p.m.	7	27	129	561	905	1,629
3 p.m. to 4 p.m.	20	25	162	713	1,182	2,102
4 p.m. to 5 p.m.	13	31	171	811	1,275	2,301
5 p.m. to 6 p.m.	12	36	165	1,013	1,538	2,764
6 p.m. to 7 p.m.	14	37	144	580	891	1,666
7 p.m. to 8 p.m.	15	22	91	297	551	976
8 p.m. to 9 p.m.	15	22	91	262	437	827
9 p.m. to 10 p.m.	19	22	91	223	426	781
10 p.m. to 11 p.m.	15	19	87	230	468	819
11 p.m. to Midnight	17	16	74	198	381	686
Total	280	498	2,250	8,802	15,470	27,300

Source: 2015-2019 Crash Data obtained from NDOT.



Source: 2015-2019 Crash Data obtained from NDOT.

Figure 11 – Speeding-related Crashes by Time of Day

3.10 Speeding-related Functional Class 3 (Principal Arterial: Other) Crashes by Roadway Geometry

Table 16 – Speeding-related Functional Class 3 (Principal Arterial: Other) Crashes by Roadway Geometry

Emphasis Area	Speeding-related	
	Crashes	Percent
Segment	1,227	27.8%
Intersection	2,743	62.2%
Curve	441	10.0%
Total	4,411	100.0%

Source: 2015-2019 Crash Data obtained from NDOT.

3.11 Speeding-related Functional Class 4 (Minor Arterial) Crashes by Roadway Geometry

Table 17 – Speeding-related Functional Class 4 (Minor Arterial) Crashes by Roadway Geometry

Emphasis Area	Speeding-related	
	Crashes	Percent
Segment	852	19.5%
Intersection	3,101	70.9%
Curve	418	9.6%
Total	4,371	100.0%

Source: 2015-2019 Crash Data obtained from NDOT.

4 FARS Data

FARs data is available on the Nevada crash dashboard at: https://zerofatalitiesnv.com/

5 Before and After Speed Limit Crash Data

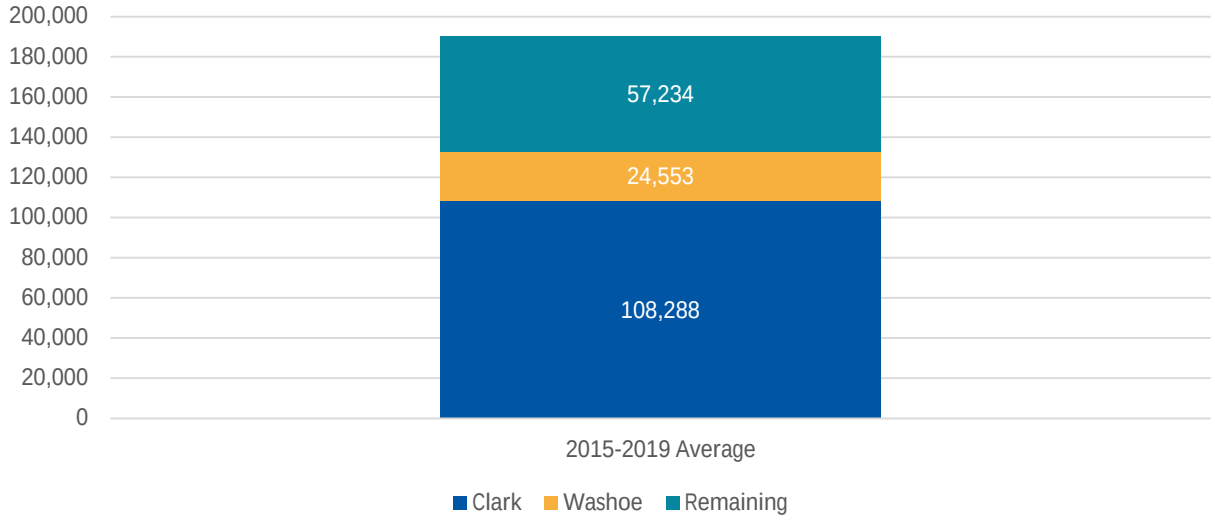
Table 18 – Before and After Corridor Crash Summary

Location	Number of Crashes			Crash Rate (per HMVMT)
N Durango Dr: Oso Blanca Rd - Farm Rd* (45 mph to 40 mph). Installed 11/30/2016.	Total	Before	69	330.3
		After	103	479.7
	KA	Before	2	9.6
		After	1	4.7
	Speeding-related	Before	7	33.5
		After	15	69.9
	KA Speeding-related	Before	0	0.0
		After	1	4.7
SR 445: MM 7.80 - 9.10 (45 mph to 55 mph). Installed 12/9/2016.	Total	Before	11	72.4
		After	19	100.4
	KA	Before	1	6.6
		After	1	5.3
	Speeding-related	Before	2	13.2
		After	1	5.3
	KA Speeding-related	Before	0	0.0
		After	0	0.0
US 95: MM 118.40 - 120.30 (35/45 mph to 45 mph). Installed 8/2/2016.	Total	Before	1	9.4
		After	2	15.4
	KA	Before	0	0.0
		After	0	0.0
	Speeding-related	Before	0	0.0
		After	0	0.0
	KA Speeding-related	Before	0	0.0
		After	0	0.0
US 95A: MM 23.50 - 24.50 (45/55 mph to 60 mph). Installed 3/2/2016.	Total	Before	4	142.3
		After	7	198.7
	KA	Before	0	0.0
		After	1	28.4
	Speeding-related	Before	0	0.0
		After	1	28.4
	KA Speeding-related	Before	0	0.0
		After	0	0.0

Source: 2013-2015, 2017-2019 Crash Data obtained from NDOT, NDOT Traffic Records Information Access.

6 Speeding Citation Data

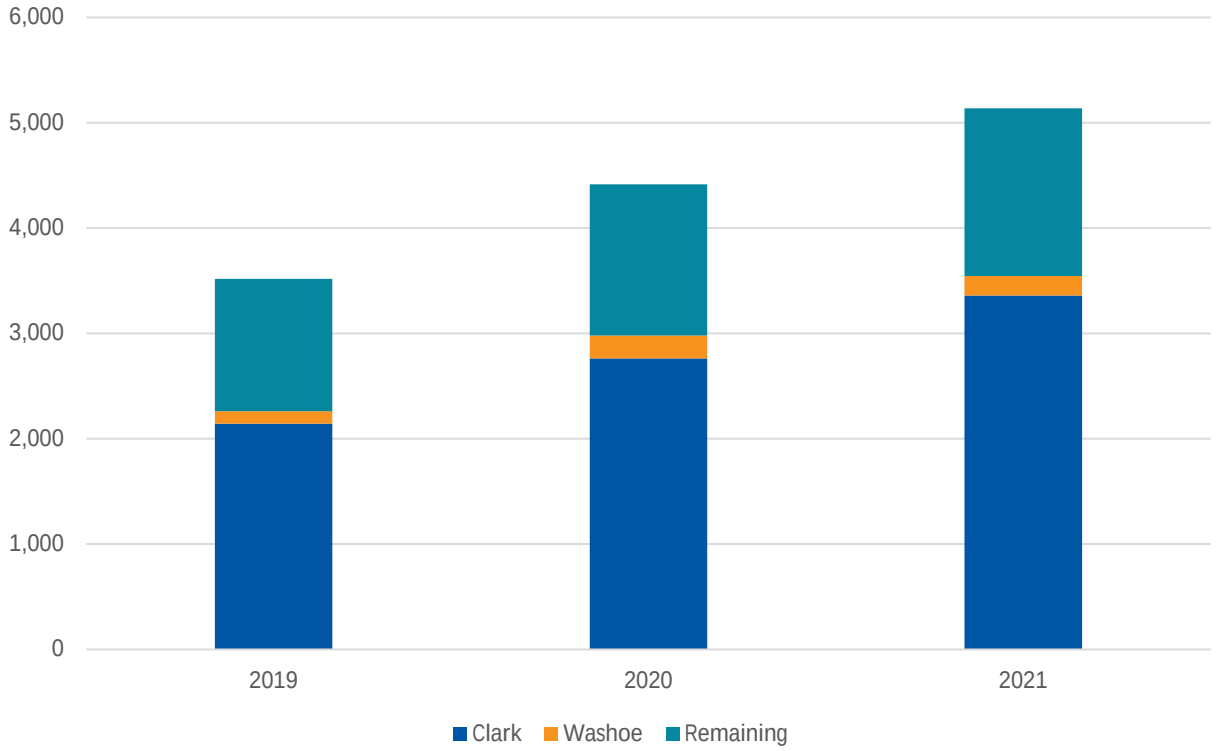
The Nevada Department of Public Safety (NDPS) Office of Traffic Safety (OTS) provided speed citation data for the state. From 2015 to 2019, there was an average of 175,000 speeding-related citations per year (57% in Clark County, 13% in Washoe County, and 30% in the remaining counties).



Sources: 2015-2019 Crash Data obtained from NDOT, Office of Traffic Safety, 2015-2019.

Figure 12 – Speeding-related Citations

Additionally, speed citation data for speeds at or above 100 miles per hour (MPH) for 2019, 2020, and 2021 was provided. Based on the data, there were a total of 13,069 citations for speed at or above 100 MPH with 3,517 occurring in 2019, 4,415 in 2020, and 5,137 in 2021. The total number of citations for Clark and Washoe County is 8,263 and 521, respectively.



Source: Office of Traffic Safety, 2019-2021.

Figure 13 – 100 MPH + Speed-Related Citations

APPENDIX B

EXISTING SPEED LIMIT POLICIES

The Nevada Revised Statutes (NRS) govern speed limit policies for NDOT and local agencies.

NRS Chapter 484A – Traffic Laws Generally – Powers of State and Local Authorities

- NRS 484A.430 Adoption of manual and specifications for devices for control of traffic by Department of Transportation.
  - The Department of Transportation shall adopt a manual and specifications for a uniform system of official traffic-control devices consistent with the provisions of chapters 484A to 484E, inclusive, of NRS for use upon highways within this State. The uniform system must correlate with and so far as possible conform to the system then current and approved by the American Association of State Highway Officials and the National Joint Committee on Uniform Traffic Control Devices.

NRS Chapter 484B – Rules of the Road – Restrictions on Speed

- NRS 484B.613 Speed limit: Establishment for vehicles on highways constructed and maintained by Department of Transportation; additional penalty for violation committed in work zone.
  - The Department of Transportation may establish the speed limits for motor vehicles on highways which are constructed and maintained by the Department of Transportation under the authority granted to it by chapter 408 of NRS.
  - Except as otherwise provided by federal law, the Department of Transportation may establish a speed limit on such highways not to exceed 80 miles per hour and may establish a lower speed limit:
    - Where necessary to protect public health and safety.
    - For trucks, overweight and oversized vehicles, trailers drawn by motor vehicles and buses.
  - A person who violates any speed limit established pursuant to this section may be subject to the additional penalty set forth in NRS 484B.130.
- NRS Chapter 484B.620 – Speed zones and signs.
  - The Department of Transportation may prescribe speed zones, and install appropriate speed signs controlling vehicular traffic on the state highway system as established in chapter 408 of NRS through hazardous areas, after necessary studies have been made to determine the need therefor, and to eliminate speed zones and remove the signs therefrom whenever the need therefor ceases to exist.
  - After the establishment of a speed zone and the installation of appropriate signs to control speed, it is unlawful for any person to drive a motor vehicle upon the road and in the speed zone in excess of the speed therein authorized.

The Manual on Uniform Traffic Control Devices (MUTCD)*, Section 2B.13, states:

- "When a speed limit within a speed zone is posted, it should be within 5 mph of the 85th-percentile speed of free-flowing traffic."
- It also identifies factors that may be considered when establishing speed limits:
  - Road characteristics, shoulder condition, grade, alignment, and sight distance
  - The pace
  - Roadside development and environment
  - Parking practices and pedestrian activity
  - Reported crash experience for at least a 12-month period

Speed Zone Study Procedures

NDOT's 2020 Operations and Safety Study Process guidelines, Appendix A, Speed Zone Studies:

- All speed study requests are received through the NDOT District offices
- Upon request, the Traffic Operations Division coordinates with the Traffic Information Division to collect and analyze speed data
  - Sets study limits
  - Schedules data collection
- Study results are compiled and submitted to Traffic Operations for review and recommendations
  - Speed zone study – data collection and analysis
    - Field review of the location
    - Analyze crash data
    - Record and analyze operating speeds (85th percentile, 50th percentile (mean), pace speed, % of vehicles in the pace, comparison of crash rate with similar roadways)
  - NDOT uses "USLIMITS" software for the initial recommended speed
    - http://safety.fhwa.dot.gov/USLIMITS/
    - Assists in the confidence in speed limits setting
- Speed zone study recommendations with support from District and Traffic Safety are coordinated with our local government partners and law enforcement agencies
- If no changes to the existing speed zones are recommended, the recommendation memo is finalized and submitted to the District office for completion
- Speed zone changes are recommended by Traffic Operations and authorized by the Director

Additional items that are considered: no passing zones, curve warning signage, advisory speed plaques and driver speed feedback signs.

APPENDIX C

NETWORK SCREENING GUIDANCE

This Appendix is intended to be an aid and provides background on the identification of speeding-related safety problems for **Section 3**.

There are many ways to screen a network to identify corridors, intersections, or roadway segments that may need safety treatment. The more advanced methods make use of safety performance functions and the empirical Bayes (EB) method to identify segments. These advanced methods are intended to address potential bias due to regression to the mean (RTM). To use such methods, there is a need for traffic volume data for all segments in the network. For the purpose of screening for speeding-related crashes, it is suggested that crash severity, as well as available crash data definitions of speeding-related crashes is used either together or separately and combined during the ranking process.

Network Screening Using Crash and Other Data

This section provides an overview of a process that can be used for screening the network in evaluating the potential to reduce the number/severity of speeding-related crashes. Based on the information provided in **Section 4** of the Highway Safety Manual (HCM), network screening involves five steps:

- Establish Focus
- Identify Network and Establish Reference Populations
- Select Performance Measures
- Select Screening Method
- Screen and Evaluate Results

Establish Focus

This step identifies the intended outcome of the network screening. In our context, the intent is to identify locations with a high number of speeding-related crashes that could benefit from different types of countermeasures. Speeding may include exceeding a safe speed for conditions and/or exceeding speed limits. Specific crash types or locations may also be used alone, or in combination with speeding-related and/or fatal and serious injury crash types.

Identify Network and Establish Reference Populations

This step refers to the types of sites and facilities that will be screened. The network/reference population may be decided based on which facility types/conditions/counties/areas have a large number of speeding-related crashes or rate of speeding-related crashes (i.e., Functional Class 3 “Principal Arterial: Other” and Functional Class 4 “Minor Arterial” Roadways”).

Sites could be divided into:

- Roadway segments
- Intersections

Depending on the performance measures that are selected (from the next step), there may be a need to group sites based on traffic control and number of legs, e.g., speeding-related crashes at four-leg stop controlled intersections may be screened separately from three-leg signalized intersections.

Select Performance Measures

Chapter 4 of the Highway Safety Manual (HSM) provides a discussion of 13 possible performance measures (they are presented in relative order of complexity, from least to most complex):

- Average crash frequency
- Crash rate
- Equivalent Property Damage Only (EPDO) average crash frequency
- Relative severity index
- Critical rate
- Excess predicted average crash frequency using method of moments
- Level of service of safety
- Excess predicted average crash frequency using Safety Performance Functions (SPFs)
- Probability of specific crash types exceeding threshold proportion
- Excess proportion of specific crash types (such as speeding-related and/or fatal and serious injury crashes)
- Expected average crash frequency with EB adjustment
- EPDO average crash frequency with EB adjustment
- Excess expected average crash frequency with EB adjustment

The selection of an appropriate performance measure may depend on at least two factors:

- Availability of data
- Potential for RTM bias

Regarding availability of data, some of the measures require traffic volume data while others need calibrated SPFs, which are mathematical equations that relate crash frequency with site characteristics including traffic volume. The other factor is the potential for bias due to RTM. RTM refers to the phenomenon when a period with a comparatively high crash frequency is observed, it is statistically probable that a lower crash frequency will be observed in the following period. The last three measures mentioned above make use of an approach called the EB method to account for the possible bias due to RTM. The use of the EB method requires the calibration of SPFs, which in turn, requires data on traffic volumes. Hence, for facilities without traffic volume data, the EB method cannot be applied.

Table C1 (adapted from Tables 4-1 and 4-2 of the HSM) indicate the data needs for the different performance measures and whether a particular method accounts for the potential bias due to RTM.

Table C1 – Safety Performance Measures with Data Needs

Performance Measure		Needed Data Inputs			Accounts for RTM
		Crash and Roadway Information for Categorization	Traffic Volume	SPF	
1.	Average crash frequency	X			No
2.	Crash rate	X	X		No
3.	EPDO average crash frequency	X			No
4.	Relative severity index	X			No
5.	Critical rate	X	X		No
6.	Excess predicted average crash frequency using method of moments	X	X		No
7.	Level of service of safety	X	X	X	No
8.	Excess predicted average crash frequency using SPFs	X	X	X	No
9.	Probability of specific crash types exceeding threshold proportion	X			N/A*
10.	Excess proportion of specific crash types	X			N/A*
11.	Expected average crash frequency with EB adjustment	X	X	X	Yes
12.	EPDO average crash frequency with EB adjustment	X	X	X	Yes
13.	Excess expected average crash frequency with EB adjustment	X	X	X	Yes

** N/A means not applicable. Unlike the other 11 measures, these two measures look at proportion of crashes and hence RTM is not an issue.*

Select Screening Method

The appropriate network screening method may depend on the type of facility being considered. For example, the screening method may be different for segments (roadway segment or ramp), nodes (intersection), and facilities/corridors (combination of segments and nodes).

Screening Methods for Segments

The simplest screening method for segments is to do a simple ranking where performance measures are calculated for all the segments under consideration and the results are ordered from high to low.

Two other methods: sliding window and peak search methods are more sophisticated and can be used to identify locations within a segment that may benefit from a countermeasure. For the sliding window and peak search method to work, it is necessary to know where exactly a crash occurred (it is not sufficient to just know that a crash occurred in a particular segment).

In the sliding window approach, a window of fixed length moves in defined increments and the calculations are performed at each window location. Each segment is characterized by the maximum value calculated at any window position within or overlapping the beginning or end of an adjacent segment. In doing so, there is an increased chance of detecting a high-risk site at the screening stage if the crash problem manifests itself in a window overlapping the adjacent site (Srinivasan et al., 2011). The second is the peak search approach. This approach makes use of incrementally growing window lengths that are selected so no windows span multiple roadway segments. The window starts at the left boundary of a road segment and increases in length incrementally until it reaches the end. At each increment, there is a specific window where an estimated crash count can be calculated. For example, a segment of 0.5 mile can produce windows with lengths of 0.1, 0.2, 0.3, 0.4, and 0.5 miles assuming an increment length of 0.1 mile. The window with the largest value of a particular measure is then tested for statistical significance. The test of significance is the coefficient of variation (CV) equal to the standard error of the estimate divided by the estimate. A limiting value of the CV is specified by the analyst, and values of CV below the limiting value pass the test. If the window passes the test, then the entire road segment is ranked by the largest value of the estimate per mile. If the test is not passed, then the window size is increased and the process starts again for the road segment. The advantage of this method is that localized safety problems are not overlooked by using too large a window, yet the statistical test ensures that they are in fact reliable estimates and not due to some randomness in the data (Srinivasan et al., 2011).

Screening Method for Nodes or Intersections

For intersections, a simple ranking method could be applied where the performance measures are calculated for each site and the results are used to rank the sites.

Screening Method for Facilities/Corridors

Similar to intersections, a simple ranking method could be applied where the performance measures are calculated for each site and the results are used to rank the corridors. The HSM indicates that corridors are recommended to be approximately five to 10 miles long to provide more stable results.

Screen and Evaluate Results

The results of the screening process would be a list of intersections/corridors ordered based on the selected performance measures. Those high on the list may need further review and diagnosis to determine if they will benefit from specific treatments.

Summary Comments Regarding Network Screening

The specific method that is used in network screening will depend not only on the data that are available in a particular state/jurisdiction, but the tools that are available as well. Some states have already implemented SafetyAnalyst and hence can make use of some of the more complex methods. Other states (e.g., North Carolina) use screening methods such as the sliding window, but they are used with only crash data, unlike SafetyAnalyst that makes use of the sliding window method in conjunction with traffic volume and SPFs. So, there is a wide variation among the different states in how network screening is conducted.

Diagnosis

The intent of diagnosis is the identification of the causes of the crashes and potential safety concerns or crashes that can be evaluated further.

Steps in Diagnosis (from the HSM):

This step includes descriptive statistics of crash conditions including counts by crash type, severity, and roadway/environmental conditions. It also includes the examination of crash patterns by location.

Step 2 – Assess supporting documentation

This goal of this step is to obtain and review documented information or input from local transportation professionals that provides additional perspective to the crash data review described in the previous step. The documentation reviewed may include traffic volumes for the study years, as-built plans, design criteria, maintenance logs, adverse weather conditions, and records of public comments and concerns.

Step 3 – Assess field conditions

This step will involve a review of roadway as well as traffic and other roadway user conditions. A formal road safety assessment (RSA) may be used as part of the diagnosis process. An RSA provides the ability to assess behaviors as well as other road conditions, and to identify safety issues from the perspective of different types of road users using diverse types of expertise. Thus, a formal RSA enhances the ability to fully consider all types of potentially appropriate treatments.

Most importantly, there will be need to collect data on traffic speeds and conduct an assessment of posted speed limits. These include USLIMITS2, an interactive expert decision-support tool, and others. USLIMITS2 provides a recommendation for speed limits for speed zones based on information about operating speed (85th and 50th percentile speed), site characteristics (the list of site characteristics depend on the type of facility, i.e., freeway, roads in undeveloped areas, and roads in developed areas). Crash information is also used when available. If for a particular roadway segment, the rate of crashes (both total and injury and fatal) are higher than the average for similar roadway segments, the system asks the user to conduct an investigation to determine whether the crash and injury rates could be reduced with engineering countermeasures. Depending on the user's response, the system recommends a speed limit for the speed zone. USLIMTS can be accessed at the following website being maintained by the FHWA: http://safety.fhwa.dot.gov/USLIMITS/.

Information on other speed limit setting approaches is provided in Methods and Practices for Setting Speed Limits: An Informational Report, sponsored by the Institute of transportation Engineers (ITE) and the Federal Highway Administration (FHWA) which is available at: http://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa12004/.

Most states also establish some speed limits by default through statutory limits. These limits are typically established and changed by legislative action. Statutory speed limits on roadway segments can typically be changed through speed limit and engineering studies and posting of zoned limits on sections of such roads. Ensure compliance with established laws and guidelines in performing these speed limit engineering reviews.

The information developed through the field assessment/RSA can be used to help determine the problems and the most appropriate countermeasures. These may include increasing or decreasing the posted speed limit, making design or other engineering improvements to the roadway, and enhancing enforcement and publicity of enforcement. In particular, supplemental enforcement may be needed if improvements cannot be made to the roadway right away, or roadway changes alone are insufficient to bring about compliance with desired speed limits.

Ideally, speed limits, design, and enforcement are considered as an entire package.