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Final Literature Review

Regional Transportation Commission of Southern Nevada

January 2025
Contract No. 24-066

RTC SAFE STREETS FOR ALL SOUTHERN NEVADA ACTION PLAN

Notice

This document and its contents have been prepared and are intended solely as information for the Regional Transportation Commission of Southern Nevada and use in relation to the in-depth literature review of national, local academic safety studies, reports and initiatives and incorporate metrics, methodology, outcomes, best practices, and recommendations for the Safe Streets for All Southern Nevada Action Plan.

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Contents

Tables

Figures

List of Abbreviations

AAA	All Ages and Abilities
AADT	Annual Average Daily Traffic
AASHTO	Association of State Highway Transportation Officials
ADA	Americans with Disabilities Act
ADAS	Advanced Driver Assistance Systems
ADOT	Arizona Department of Transportation
ALISS	Accident Location Identification Surveillance System
APAC	Action Plan Advisory Committee
ASMP	Austin Strategic Mobility Plan
BayVIZ	Bay Area Vision Zero
BCR	Benefit-Cost Ratio
BIL	Bipartisan Infrastructure Law
BRT	Bus Rapid Transit
CCSD	Clark County School District
CCTV	Closed-Circuit Television
CEA	Critical Emphasis Areas
CHS	Community Health Score
CICMP	Citywide Intersection Crash Mitigation Program
CMAQ	Congestion Mitigation and Air Quality
CMF	Crash Modification Factor
CMS	Congestion Management System
CRF	Crash Reduction Factor
CSAP	Comprehensive Safety Action Plan
DRCDC	Denver Regional Crash Data Consortium
DRCOG	Denver Regional Council of Governments
DSDS	Dynamic Speed Display Signs
DUI	Driving Under the Influence
EJScreen	Environmental Justice Screening and Mapping Tool
EMS	Emergency Medical Services
FACES	Family and Community Engagement Services
FHWA	Federal Highway Administration
FRI	Fuel Revenue Index
FTA	Federal Transit Administration
GFA	Geographic Focus Areas
GIS	Geographic Information System
GPS	Global Positioning System
GSDG	Global Street Design Guide
HAWK	High-Intensity Activated Crosswalk
HCN	High Crash Network
HCT	High-Capacity Transit
HIN	High Injury Network
HSIP	Highway Safety Improvement Program
HSM	Highway Safety Manual
ITS	Intelligent Transportation Systems
KABCO	Injury scale ratings representing police-reported injury severity as assessed by law enforcement responding to investigate the scene
LED	Light-Emitting Diode
LiDAR	Light Detection and Ranging
LOC	Level of Comfort
LOS	Level-of-Service
LPI	Leading Pedestrian Interval
MAG	Maricopa Association of Governments
MAIS	Maximum Abbreviated Injury Scale

MBTA	Massachusetts Bay Transit Authority
MIRE	Model Inventory of Roadway Elements
MPO	Metropolitan Planning Organization
MTIS	Multimodal Transportation Investment Study
NACTO	National Association of City Transportation Officials
NDOT	Nevada Department of Transportation
NHTSA	National Highway Traffic Safety Administration
NOFO	Notice of Funding Opportunity
NRSS	National Roadway Safety Strategy
NTSB	National Transportation Safety Board
PDO	Property Damage Only
PHB	Pedestrian Hybrid Beacons
PLACE	Policies for Livable Active Communities and Environments
PM	Project Manager
PSP	Project Safety Process
PTASP	Public Transportation Agency Safety Plan
QALY	Quality-Adjusted Life Years
RDP	Regional Data Platform
RNP	Rural Neighborhood Preservation
RRFB	Rectangular Rapid Flashing Beacons
RSAP	Road Safety Action Plan
RTC	Regional Transportation Commission
RTP	Regional Transportation Plan
RTSIMS	Regional Transportation Safety Information Management System
SANDAG	San Diego Association of Governments
SCAG	Southern California Association of Governments
SHSP	Strategic Highway Safety Plan
SMAP	Speed Management Action Plan
SMP	Safety Management Plan
SMS	Safety Management System
SRTS	Safe Routes to School
SSC	Speed Safety Camera
STBG	Surface Transportation Block Grant
STP	Surface Transportation Program
TA	Transportation Alternatives
TAC	Technical Advisory Committee
TAG	Technical Advisory Group
TIP	Transportation Improvement Program
TSMO	Transportation System Management and Operations
TSP	Transportation Safety Plan
TWLTL	Two-Way Left-Turn Lane
UDOT	Utah Department of Transportation
UNR	University of Reno
USDOT	United States Department of Transportation
VMT	Vehicle Miles Traveled
VRU	Vulnerable Road User
WFRC	Wasatch Front Regional Council

1. Introduction

The Regional Transportation Commission (RTC) of Southern Nevada's Safe Streets for All Southern Nevada Action Plan aims to create safer, more accessible streets for all users by reducing traffic fatalities and severe injuries throughout Southern Nevada. This Literature Review has been conducted to inform the development of the Action Plan by identifying best practices, effective strategies, and lessons learned from other jurisdictions that have implemented Vision Zero and safety-related initiatives. By reviewing current plans, projects, federal guidance, and emerging trends, this document provides a comprehensive foundation for building the region's action plan, ensuring it aligns with proven safety practices.

2. Contextual Background

Southern Nevada faces significant transportation safety challenges, including rising traffic fatalities, particularly among vulnerable road users such as pedestrians and bicyclists. The region's urban growth, high levels of vehicle dependence, and complex roadway network have contributed to increasing safety concerns. In response, the RTC has prioritized the development of a safety action plan under the Federal Highway Administration's (FHWA) Safe Systems Approach, which emphasizes reducing risks for all road users through a holistic and equitable approach. The Action Plan is built around key objectives, including:

- Reducing traffic-related fatalities and serious injuries to zero.
- Enhancing safety for non-motorized users (pedestrians, bicyclists).
- Implementing cost-effective, impactful safety improvements.
- Promoting equity in transportation safety, especially in underserved communities.

This literature review plays a critical role in helping the region identify and prioritize strategies to achieve these goals. It provides insights into the successes and challenges of peer metropolitan planning organizations (MPOs) and benchmark communities, current safety plans and projects, and federal guidance that will shape the Action Plan.

3. Literature Review

This section briefly overviews known policies, plans, academic studies, crash statistics, organizational structures, decision-making structures, and non-motorist protection strategies related to vision zero programs and the real societal cost of motor vehicle crashes and fatalities. These documents help identify best practices, additional considerations, and alternative processes. A detailed summary of the plans and studies reviewed, and a review of the findings is presented in Appendix A. The following subsections provide a summary of the items reviewed and findings, organized by the following areas:

- Peer MPOs and Model Communities
- Current Plans and Projects
- Federal/National Guidance and Tools
- Trends and Best Practices

3.1 Peer MPOs and Model Communities

The review of peer MPOs, regional councils, and model communities was conducted to identify the best practices of projects, studies, and initiatives, which include:

- City of Los Angeles - Vision Zero: Eliminating Traffic Deaths in Los Angeles by 2025
- Los Angeles County - Vision Zero: A Plan for Safer Roadways 2020 - 2025
- City of Austin, TX - Vision Zero Action Plan
- Denver Regional Council of Governments (DRCOG) - Taking Action on Regional Vision Zero
- Denver Regional Crash Data Consortium (DRCDC)
- Hillsborough Safe Streets Now Vision Zero Action Plan
- City of Phoenix, AZ - Road Safety Action Plan
- City of Boston, MA - Vision Zero Action Plan
- Truckee Meadows Vision Zero Action Plan
- Wasatch Front Comprehensive Safety Action Plan (CSAP)
- Vision Zero Central Florida Safety Action Plan
- The San Diego Association of Governments (SANDAG) - Vision Zero Action Plan
- Regional Transportation Commission (RTC) of Washoe County – Street and Highway Program Policy
- DRCOG – Policy Statement on State Legislative Issues
- MetroPlan Orlando – Internal Operating Procedures
- Hillsborough Transportation Planning Organization (TPO) Transportation Improvement Program

3.2 Current Plans and Projects

The current plans and projects from state, regional, and local jurisdictions were reviewed to incorporate the recommended projects into the Action Plan, which include:

- City of Las Vegas - Vision Zero Action Plan
- City of Las Vegas - Citywide Intersection Crash Mitigation Program (CICMP)
- On Board Mobility Plan
- Reimagine Boulder Highway
- Clark County Safe Routes to School (SRTS) Strategy
- Southern Nevada Transportation Safety Plan
- North Las Vegas Citywide Pedestrian & Bicycle Plan
- Southern Nevada Strong Regional Plan
- Regional Transportation Plan: Let’s Go 2050
- Southern Nevada Regional Bicycle and Pedestrian Plan
- Regional Walkability Plan
- Pedestrian Comfort Study and Demonstration Project
- Nevada Strategic Highway Safety Plan (SHSP)
- Nevada Speed Management Action Plan (SMAP)

- One Nevada Transportation Process
- NDOT Safety Management Plans (SMPs)
- Las Vegas Mini-Roundabout Test Installation

3.3 Federal/National Guidance and Tools

The current federal guidance and tools as well as other industry best practice documents were reviewed to incorporate the recommended projects into the Action Plan, which include:

- National Roadway Safety Strategy
- FHWA Vision Zero Toolkit
- FHWA Safe System Roadway Design Hierarchy
- Model Inventory of Roadway Elements (MIRE)
- Crash Modification Factors (CMF) Clearinghouse
- FHWA Proven Safety Countermeasures
- Safe System Alignment Framework (Project-Based and Policy-Based)
- National Public Transportation Safety Plan
- AASHTO Guide for the Development of Bicycle Facilities, 5th Edition
- School Zone Speed Study in Nevada
- National Association of City Transportation Officials (NACTO) City Limits: Setting Safe Speed Limits on Urban Streets
- NACTO Don't Give Up at the Intersection
- NACTO and the Global Designing Cities Initiative Designing Streets for Kids
- National Transportation Safety Board (NTSB) Reducing Speeding-Related Crashes Involving Passenger Vehicles

3.4 Trends and Best Practices

Trends and best practices were developed from the literature review and additional research to:

- Evaluate organizational structures and decision-making structures for peer metropolitan planning organizations leading implementation of regional-scale safety and Vision Zero plans.
- Review existing policies and criteria for RTC, state, and local agency transportation project funding prioritization.
- Evaluate implementation of safety-related policies recommended in the Southern Nevada Regional Bicycle and Pedestrian and Regional Walkability Plans; and identify barriers to implementation.
- Review comparative safety and crash statistics regarding different travel modes (i.e., pedestrian, bicycle, transit, personal vehicle). The comparative mode analysis must document the differences in being involved in a crash and becoming severely injured or dying.
- Break statistical data down by best practices for reporting socioeconomic and demographic data.
- Review strategies used to protect vulnerable road users commonly included in Vision Zero plans throughout the country including, but not limited to, vertical barriers separating bicycle lanes, high visibility markings on the transportation network, low-cost treatments to improve roadway safety, No Turn on Red, No U-Turns in School Zones, and using cameras as an enforcement technique at intersections.
- Review and quantify the real societal cost of motor vehicle crashes and fatalities.

- Review academic studies that demonstrate best practices, theories, and tools to reduce crashes, injuries, and fatalities throughout the transportation network.

4. Core Findings and Strategic Takeaways

The literature review and benchmarking analysis across regional safety action plans and peer communities revealed several strategies and best practices that can strengthen our approach to developing and implementing the RTC's Safe Streets for All Southern Nevada Action Plan. To ensure both effectiveness and sustainability, this section provides an overview of three critical dimensions for successful transportation safety planning: effective strategies and methodologies for plan development, key themes and recommendations in safety plans, and common challenges and lessons learned from implementation. The detailed findings under each of these dimensions can be found in Appendix A.11 – Action Matrix.

4.1 Effective Strategies and Methodologies for Plan Development

A strong, adaptable foundation in safety plan development is essential for ensuring both effectiveness and longevity. Successful safety plans follow a structured approach, incorporating stakeholder engagement, public outreach, and targeted methodologies to identify and prioritize safety interventions. Key strategies and methodologies that emerged from this effort and are characteristic of successful safety plans include:

- **Data-Driven Approaches:** Data analysis plays a crucial role in identifying high-risk areas, prioritizing interventions, and tailoring solutions. Leveraging crash data and safety metrics helps create targeted action plans that focus on the most critical safety challenges. For example, the **City of Las Vegas Vision Zero Action Plan** uses a High Injury Network (HIN) to focus resources on the roadways with the highest incidence of fatalities and serious injuries.

  Additionally, the **Wasatch Front CSAP** incorporates an equity lens using a locally defined Equity Priority Index, which identifies transportation-disadvantaged communities. By factoring in social vulnerability, environmental burden, and transportation insecurity, the plan ensures safety improvements are directed to areas most in need.
- **Pilot Demonstration Projects**: Testing innovative interventions through pilot projects enables stakeholders to assess effectiveness before committing to large-scale implementation. The **RTC Pedestrian Comfort Study** conducted low-cost, temporary installations (e.g., curb extensions and high-visibility crosswalks) across multiple jurisdictions to evaluate improvements in pedestrian safety and comfort. This approach provides valuable insights into community responses and effectiveness, allowing cities to make informed decisions.
- **Public Education and Engagement**: Public involvement and feedback are essential to the success of safety initiatives. Engagement activities, such as surveys, focus groups, and interactive mapping, gather insights on community concerns and ensure safety measures align with public needs. The **City of Las Vegas Vision Zero Action Plan** exemplifies this approach by using interactive maps to collect feedback from residents on traffic safety concerns, making the community an active participant in the plan's development and implementation.
- **Regional Collaboration and Clear Accountability**: Vision Zero safety action plans benefit from clear collaboration across regional stakeholders, with distinct roles, responsibilities, and timelines to ensure coordinated action. For instance, the **DRCOG Taking Action on Regional Vision Zero** assigns specific responsibilities to each stakeholder, establishing immediate, short-, medium-, and long-term performance metrics to track progress and ensure accountability.
- **Continuous Monitoring and Evaluation:** Effective safety plans include a robust feedback loop that ensures regular assessment of progress and adaptive management based on the findings. Incorporating ongoing reviews,

annual updates, and data-driven adaptability allows for responsive changes to emerging needs. For instance, the **City of Austin, TX, Vision Zero Action Plan** conducts quarterly reviews and issues an annual Vision Zero report card, allowing stakeholders to monitor progress and adjust as needed.

- **Funding and Financial Strategies:** Identifying sustainable funding sources is vital to implementing safety improvements. The **DRCOG Taking Action on Regional Vision Zero** plan addresses this challenge by securing financial support from federal, state, and local sources and utilizing innovative financing mechanisms to overcome budgetary limitations. This diversified funding strategy enhances the resilience and feasibility of safety improvements.

4.2 Key Themes and Recommendations in Safety Plans

Effective safety plans provide robust strategies and interventions that target the unique needs of the community while focusing on core safety goals. The "what" of a safety plan should cover multidimensional interventions across policy, infrastructure, enforcement, and education, with an emphasis on protecting vulnerable road users. Common strategies that have demonstrated success from the literature review include:

- **Funding and Resource Allocation:** Safety plans require diversified and sustainable funding sources, therefore securing resources across federal, state, and local levels allows for comprehensive and ongoing safety improvements. For example, the **DRCOG Taking Action on Regional Vision Zero** plan emphasizes a multitiered funding approach that leverages innovative financing mechanisms, ensuring consistent support for Vision Zero initiatives.
- **Infrastructure and Roadway Design:** Designing streets that cater to the safety and mobility needs of all users is central to achieving Vision Zero. Safe infrastructure elements, like protected bike lanes, pedestrian refuges, and improved lighting, are critical in reducing conflicts and enhancing overall road safety. The **North Las Vegas Citywide Pedestrian & Bicycle Plan** exemplifies this approach with a comprehensive network that includes protected bike lanes and enhanced pedestrian crossings, prioritizing safe, connected routes for cyclists and pedestrians. This approach helps create inclusive roadways that encourage safer travel for everyone.
- **Policy and Legislative Action:** Supportive policies and legislation are essential to reinforce infrastructure improvements and promote safer behaviors. Lowering speed limits, instituting automated enforcement, and increasing penalties for violations are proven methods to reduce safety risks. The **Nevada SMAP** advocates for policy changes to enforce speed limits in school zones and high-risk areas, with a focus on creating legislative framework that supports enforcement.
- **Public Engagement and Education:** Engaging the public and raising awareness through targeted education initiatives are crucial for gaining community support and changing unsafe behaviors. Effective campaigns communicate the importance of traffic safety and promote shared responsibility. The **Hillsborough Safe Streets Now Vision Zero Action Plan** illustrates this with the "One Message, Many Voices" campaign, designed to educate the community on safer road behaviors. This public involvement fosters a culture of safety that aligns with Vision Zero's goals, helping ensure infrastructure improvements are well-received by the public.
- **Safe Systems Approach:** The Safe Systems approach is a comprehensive framework that considers every road user, vehicle, and speed level to minimize crash risks and their impact. This model, adopted by the majority of the safety plans reviewed, structures safety interventions holistically based on Safe Users, Safe Roadways, Safe Vehicles, Safe Speeds, and Post-Crash Care.
- **Safety for Vulnerable Road Users (VRUs):** Equitably improving safety for VRUs, such as pedestrians and cyclists, is essential to achieving Vision Zero. This approach prioritizes underserved areas that face higher risks of fatalities and serious injuries, ensuring safety improvements reach those most affected. The **City of Austin, TX, Vision Zero Action Plan** introduced pedestrian-activated signals and narrower streets to promote safety and walkability.

- **Technology and Data Integration:** Incorporating advanced technology and data-driven insights into safety planning enables more accurate monitoring, evaluation, and decision-making. Tools like light detection and ranging (LiDAR) and crash data dashboards provide real-time information that supports proactive safety management. For instance, the **DRCOG Taking Action on Regional Vision Zero** plan employs a crash data dashboard for public access, ensuring accountability and fostering community trust in the safety improvement process.

4.3 Common Challenges and Lessons Learned

When developing and implementing transportation safety plans, identifying and mitigating potential pitfalls can prevent delays and improve stakeholder and public support. The literature review revealed some challenges that can be encountered, such as:

- **Insufficient Stakeholder Engagement and Buy-in:** Early and comprehensive engagement with all stakeholders is essential for plan success. When stakeholders are not involved from the beginning, projects risk delays, limited commitment, and a lack of urgency in execution. In the **WFRC's CSAP**, due to insufficient initial stakeholder engagement, there was a lack of momentum and alignment on infrastructure improvements. Effective plans ensure early engagement across all levels to drive timely and cohesive implementation.
- **Overly Ambitious Timeline:** Setting realistic timelines is crucial, as overly aggressive deadlines can compromise quality and lead to rushed planning. The **WFRC CSAP** experienced challenges in meeting initial deadlines due to overly ambitious timelines that did not account for approval processes. Successful projects balance urgency with feasibility, allowing adequate time for approvals and stakeholder alignment to avoid rushed decisions and substandard outcomes.
- **One-Size-Fits-All Solutions:** Applying generic approaches without considering specific community needs or unique local contexts can result in ineffective solutions. For example, in the **RTC Pedestrian Comfort Study**, certain temporary installations were not well-received in Mesquite and Boulder City due to differing local preferences and conditions. Tailoring interventions to community needs ensures greater acceptance and effectiveness, fostering long-term support for safety initiatives.
- **Insufficient Public Awareness and Education:** Infrastructure improvements alone are not always enough; public education is also needed to encourage proper use and acceptance. In Las Vegas, the **Mini-Roundabout Test Installation** faced mixed results due to low public awareness about correct roundabout navigation.
- **Lack of a Robust Program Performance Management Framework:** A comprehensive performance management framework is essential to track progress, evaluate effectiveness, and support continuous improvement**.** The **Clark County School District (CCSD) SRTS program** struggled with progress assessment due to the absence of a robust performance evaluation framework. Incorporating detailed metrics and ongoing assessments in safety programs enables clear measurement of outcomes, supports accountability, and informs any necessary adjustments.
- **Insufficient Upfront Financial Planning and Long-Term Funding Allocation:** Long-term financial planning is critical to sustain programs over time and avoid funding gaps that can interrupt progress. The **CCSD SRTS program** encountered challenges due to limited upfront financial planning. Effective safety programs prioritize sustainable funding by developing a multi-year implementation plan and securing diverse funding sources to ensure resources are available throughout program lifecycles.

4.4 Recommendations for Policies and Procedures

Policies and procedures setting up safety projects and programs for funding and implementation are necessary to ensure these projects are brought to life. After reviewing the policies and procedures of peer communities, the following emerged as key recommendations for policies and procedures development and update:

- **Safety as a Core Principle in Transportation Planning:** Policies should emphasize the importance of safety across all transportation projects, as seen in DRCOG's Taking Action on Regional Vision Zero plan. Safety should not be an afterthought but a fundamental consideration in project selection and implementation. The inclusion of safety-focused funding, such as DRCOG's efforts to **establish a dedicated funding stream** for enforcement measures (e.g., red-light cameras and speed enforcement), demonstrates a model for institutionalizing safety initiatives.
- **Establish a Safety-Focused Committee for Project Development:** Create a dedicated committee responsible for identifying and prioritizing safety-related projects in collaboration with regional partners. A structured, prioritized project list will help streamline funding processes, minimize unnecessary competition, and ensure timely implementation**. MetroPlan Orlando's TSMO Committee** serves as a model, bringing together representatives from federal, state, regional, and local agencies to develop and recommend traffic operations and safety project priorities, including studies, plans, and infrastructure improvements.
- **Multimodal Accessibility:** A modern safety policy should ensure the equitable distribution of resources to address the needs of all transportation users. **RTC Washoe County's policy** emphasizes serving users of all abilities, from motorists and freight movers to pedestrians, bicyclists, older adults, and children. This aligns with the principles of Complete Streets, which are reinforced by **RTC's Complete Streets Project revenue fund** aimed at enhancing safety through multimodal-friendly infrastructure.
- **Integration of Safety into Funding Prioritization:** Agencies like **RTC Washoe County** and **Hillsborough TPO** have embedded safety into their funding mechanisms. RTC Washoe's Street and Highway Program Policy includes specific provisions for spot safety improvements and pavement preservation. Hillsborough TPO explicitly integrates "Improving Safety" as a project ranking criterion, factoring in fatality and injury rates per 100 million vehicle miles traveled. These examples highlight the need for structured funding allocation that prioritizes projects with high safety benefits.

APPENDICES

Appendix A. Detailed Literature Review

A.1 Introduction

The RTC Safe Streets for All Southern Nevada Action Plan is designed as a community-driven action plan, leveraging new data sources to prioritize equitable mobility projects. These projects will utilize cost-effective, impactful strategies aimed at achieving the ambitious goal of zero traffic fatalities and serious injuries in Clark County. The Action Plan adopts the Federal Highway Administration's (FHWA) Safe System Approach, which is recognized as a holistic and effective method to address and mitigate transportation system risks by incorporating multiple layers of protection for all road users. The Safe System Approach is grounded in five main objectives: safer road users, safer vehicles, safer speeds, safer roads, and post-crash care.

This document provides an overview of known policies, plans, academic studies, crash statistics, organizational and decision-making structures, as well as non-motorist protection strategies related to Vision Zero programs and the societal cost of motor vehicle crashes and fatalities. The review focuses best practices and insights from peer Metropolitan Planning Organizations (MPOs), benchmark communities, and federal guidance to inform and prioritize strategies for the Action Plan. The following subsections summarize the items reviewed and key findings, organized by the following areas:

- Peer MPOs and Model Communities
- Current Plans and Projects
- Federal/National Guidance and Tools
- Implementation of Safety-Related Policies
- Crash Statistics
- Strategies for Pedestrians and Bicycles
- Real Societal Cost
- Academic Studies
- Best Practices
- Action Matrix

A.2 Peer MPOs and Model Communities

The review of peer MPOs, regional councils, and model communities was conducted to identify the best practices of projects, studies, and initiatives, which include:

- City of Los Angeles - Vision Zero: Eliminating Traffic Deaths in Los Angeles by 2025
- Los Angeles County - Vision Zero: A Plan for Safer Roadways 2020 - 2025
- City of Austin, TX - Vision Zero Action Plan
- Denver Regional Council of Governments (DRCOG) - Taking Action on Regional Vision Zero
- Denver Regional Crash Data Consortium (DRCDC)
- Hillsborough Safe Streets Now Vision Zero Action Plan
- City of Phoenix, AZ - Road Safety Action Plan

- City of Boston, MA - Vision Zero Action Plan
- Truckee Meadows Vision Zero Action Plan
- Wasatch Front Comprehensive Safety Action Plan (CSAP)
- Vision Zero Central Florida Safety Action Plan
- The San Diego Association of Governments (SANDAG) - Vision Zero Action Plan
- Regional Transportation Commission (RTC) of Washoe County – Street and Highway Program Policy
- DRCOG – Policy Statement on State Legislative Issues
- MetroPlan Orlando – Internal Operating Procedures
- Hillsborough Transportation Planning Organization (TPO) Transportation Improvement Program

A.2.1 City of Los Angeles - Vision Zero: Eliminating Traffic Deaths in Los Angeles by 2025

The August 2015 City of Los Angeles Vision Zero: Eliminating Traffic Deaths in Los Angeles by 2025 was developed to reduce the likelihood of fatality and severe injury crashes through strategic, data-driven approaches of engineering, enforcement, education, evaluation, and community engagement.

The City of Los Angeles Vision Zero states it is fundamental to the Vision Zero strategy to have a safe system where vehicles move at reasonable speeds. The principles of Vision Zero are stated to be:

- Traffic deaths are preventable and unacceptable
- Human error is inevitable and unpredictable
- Engineering, education, enforcement, evaluation, and equity are essential to a safe system
- Human life takes priority over other objectives of the road system
- Speed is a fundamental predictor of crash survival
- Government policies at all levels should be coordinated to promote safety as the highest priority

The City's crash statistics led to the consideration of Vision Zero, which include:

- Consequences of infractions are most severe for people walking and bicycling
- People walking and bicycling are over-represented among traffic deaths
- People walking and bicycling are involved in only 14% of all collisions, but account for almost half of all traffic deaths
- 30% of those killed or severely injured while walking or bicycling are youth and older adults
- Black pedestrians trying to cross the street were passed by twice as many cars and experienced wait times that were 32% longer than white pedestrians

The established goals of the Vision Zero plan are to reduce citywide traffic deaths by 20 percent by 2017, prioritize pedestrian deaths involving older adults and children, and eliminate traffic deaths citywide by 2025.

To create walkable streets that help reduce the disproportionate serious injury and fatality crashes with the bicycle and pedestrian road users, an HIN was created and reviewed with vulnerable communities using the Plan for a Healthy Los Angeles' Community Health and Equity Index. This review showed 65% of all fatalities and serious injuries involving people walking occur on just 6% of the street network, all schools prioritized for safety improvements are within ¼-mile

of the HIN, and a correlation between the HIN and areas with the poorest health outcomes. The next steps include detailed crash profiling to inform the engineering toolkit, educational campaigns, and enforcement.

In addition, there are several ongoing initiatives related to safety in the City. The Los Angeles Vision Zero builds upon those initiatives to prioritize areas with the greatest need to aid with acquiring funding and implement safety improvements. The approach used in the plan involves similar areas of the E's of safety, committing to the following:

- **Engineer** and plan our streets to anticipate human error and minimize the consequences of mistakes
- **Enforce** traffic safety laws in areas that have high collision rates to protect our most vulnerable road users
- **Educate** the public through safety campaigns that reinforce positive driving, bicycling, and walking behavior
- **Evaluate** and monitor our progress continuously to ensure we remain on-track to reach our targets
- **Partner** with the community, especially as we work toward implementing safety improvements at the neighborhood level; and implement with a focus on equity

A Vision Zero Executive Steering Committee has been established to coordinate, implement and evaluate near-term and longer-term actions to maintain the goals and actions formed from the plan. The established Task Force will also focus on engineering, education, enforcement, funding, data, and evaluation to ensure progress on the immediate actions. The document concluded with a call to action for the public to build support and accountability around the vision for safer streets and provides information on how to do so and keep informed on the initiative's progress.

A.2.2 Los Angeles County - Vision Zero: A Plan for Safer Roadways 2020 - 2025

The November 2019 Los Angeles County Vision Zero: A Plan for Safer Roadways 2020 - 2025 was developed to achieve zero deaths and severe injuries among those traveling on unincorporated county roadways. Three principles guide the plan:

- **Health Equity:** The plan prioritizes addressing health disparities by focusing on practices that disadvantage certain populations, especially vulnerable road users, thereby working toward reducing traffic-related health inequities.
- **Data-Driven Process:** The plan uses crash data to identify collision hotspots, understand the root causes, and prioritize interventions where they are needed most.
- **Transparency:** Regular updates and open communication with the public ensure the County remains accountable and keeps residents informed on progress and traffic safety efforts.

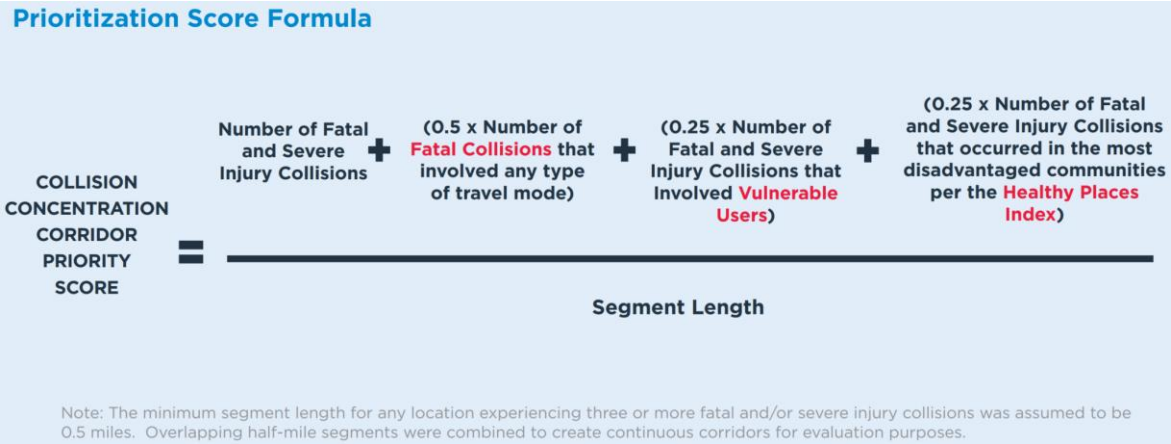
Los Angeles County explains the need for a Vision Zero Action Plan due to the increase in traffic deaths and elaborates on how the affected population is disproportionate to certain groups, such as pedestrians, bicyclists, motorcyclists, and people between the ages of 15 and 34. The action plan benefits the County by developing sustainable and healthier communities by promoting alternative modes of transportation. The plan also incorporated training and collaboration efforts with regional agencies for the County to promote awareness of traffic safety throughout the unincorporated communities. The plan lists the six primary collision factors, which include:

- Unsafe speed
- Improper turning
- Driving or bicycling under the influence of alcohol or drugs
- Driver failing to yield to another driver

- Pedestrian violation
- Failure to yield to traffic controls

To prioritize interventions, the plan identifies collision concentration corridors—half-mile roadway segments with three or more fatal or severe injury collisions. The Prioritization Score Formula, illustrated in Figure A-1, was used to score these corridors.

Figure A-1 - Prioritization Score Formula



Source: Adopted from [5]

Prior to the project final draft, Public Health and Public Works staff engaged stakeholders as follows:

- Attending community events and meetings
- Engaging with community-based organizations, special interest groups, and non-profit agencies
- Conducting a public survey on traffic safety experiences and perceptions

The drafted plan was published online for review, and the staff promoted the release and the corresponding traffic safety survey with additional community meetings. For additional public engagement, the plan suggests the County to:

- Develop and scope Vision Zero driven infrastructure projects through community-based participation.
- Use existing community meetings and events to have community conversations regarding traffic safety needs and desired enhancements.
- Partner with schools, neighborhood block clubs, homeowner associations, town councils, senior centers, and community-based organizations to share information.
- Seek additional grant funding and increase funding for outreach when planning for projects.
- Host demonstration projects to provide communities with interactive opportunities to experience possible enhancements.
- Partner with artists and incorporate the arts into the community engagement process.
- Create culturally relevant and inclusive engagement materials available in predominant languages.

The development of the plan was also supported by:

- **Coordinating Team:** key staff from Public Works and Public Health (Policies for Livable Active Communities and Environments (PLACE) Program in the Division of Chronic Disease and Injury Prevention)
- **Core Team:** leadership and staff from Public Works and Public Health
- **Action Plan Advisory Committee (APAC):** staff from the California Highway Patrol, Public Health, Public Works, Regional Planning, Parks and Recreation, Sheriff, Fire, Health Services, Internal Services, County Counsel, Chief Executive Office, Chief Information Office, and County Board of Supervisors

The plan's roadway enhancements aim to manage vehicle speeds, enhance visibility, and provide separation for travel modes, which include:

- Pedestrian Activated Warning Beacons
- Separated Bikeways
- Left-Turn Signal Phasing
- Roadway Lighting
- High Visibility Crosswalks
- Temporary Roadway Enhancements
- Refuge Islands
- Speed Humps (also referred to as Speed Bumps or Speed Cushions)
- Guardrail
- Roadway Reconfigurations
- Roundabouts
- Curve Warning Signs
- Traffic Circles (also known as Roundabouts)
- Curb Extensions (also known as Bulbouts)
- Pedestrian Signal Timing: Leading Pedestrian Intervals, Pedestrian Scrambles, Semi-Exclusive Pedestrian Operations

The plan also explains the importance of regional collaborations and efforts to improve traffic, which include:

- Data Analysis
- Partnering Across Jurisdictions
- Coordinating Communications for Culture Change

For implementation the plan has 5 objectives to ensure the guiding principles are incorporated into the actions:

1. Enhance County Processes and Collaboration
2. Address Health Inequities and Protect Vulnerable Users
3. Collaborate with Communities to Enhance Roadway Safety
4. Foster a Culture of Traffic Safety
5. Be Transparent, Responsive, and Accountable

Each objective is tied to specific benchmarks and metrics to track progress. The plan also identifies the lead agencies responsible for implementation, but stresses community support and adequate funding will be critical to its success.

A.2.3 City of Austin, TX - Vision Zero Action Plan

The May 2016 City of Austin, TX, Vision Zero Action Plan develops traffic safety goals and projects for 2016-2018. This Vision Zero Action Plan aims to be a multi-pronged approach that includes:

- **Holistic approach to land use and transportation:** The plan emphasizes the integration of transportation and land use planning to reduce traffic-related fatalities by promoting compact development and encouraging alternative modes of transport.

- **Complete Streets approach to street design:** Austin's Vision Zero Action Plan prioritizes street designs that accommodate all road users—pedestrians, bicyclists, transit riders, and motorists—making roads safer for everyone.
- **Traffic engineering and infrastructure:** The plan focuses on traffic safety improvements through enhanced engineering solutions, such as redesigned intersections and traffic calming devices.
- **Enforcement and prosecution of dangerous behaviors:** This includes increasing enforcement efforts to deter risky driving behaviors such as speeding, distracted driving, and Driving Under the Influence (DUI).
- **Education and culture change:** The plan aims to raise public awareness about road safety through education campaigns that foster a culture of safety.
- **Public health, equity, and related issues:** The plan acknowledges the social and economic disparities in traffic deaths and injuries, and it seeks to reduce these gaps by prioritizing safety improvements in vulnerable communities.
- **Policy analysis and changes at the local and regional level:** The plan recommends policy reforms to support Vision Zero objectives at both the local and regional levels.

Land use and street design are emphasized as a major contributor to crashes due to the promotion of driving to get around disconnected land use, longer walking distances, and uncomfortable non-motorized roadway user conditions. Figure A-2 showcases street designs that support slow roadway speeds that promote alternative modes and traffic safety.

Figure A-2 - Street Design and Land Use for Traffic Safety

Source: Adopted from [6]

To improve pedestrian safety and promote walking with street design, the Vision Zero Action Plan lists the following suggestions:

- Adding features such as pedestrian-activated signals with crosswalks on long blocks
- Changing land use patterns and the Land Development Code, street design, and signalization can make walking more comfortable, convenient, and safe. This also supports reducing incidents of “failure to yield.
- Promoting compact and connected development patterns — connected street networks, and mixed land uses
- Considering narrower Street widths, changes in road alignment, and traffic calming devices such as medians, pinch points, roundabouts, and chicanes can reduce travel speeds.
- Reducing the mileage of streets without sidewalks

The plan also acknowledges human error contributes to crashes and identifies six key risky behaviors:

- Improper Movements
- Driver Inattention or Distraction
- Failure to Yield Right-of-Way
- Speeding
- DUI
- Failure to Stop

In addition to land use, the document also speaks to social, economic, and geographic disparities in traffic deaths and serious injuries. It discusses disparities in safety for minorities, people with lower income, and those with less education. The document mentions economic disparities when the estimated annual cost of data and injury crashes is over half a billion dollars when health care and other related hard costs are included. One step to understanding these issues is to collect robust data. In the meantime, the City has begun addressing many aspects of transportation safety. These efforts include continuous improvements to the design and engineering of our streets for people of all ages, abilities, and traveling by all modes. These efforts are led by the Austin Transportation Department, to implement the City’s Complete Streets Policy.

The plan outlines ongoing and shorter-term actions aimed at addressing the top contributing factors to injuries and deaths. Key initiatives include:

- **Targeting the top contributing factors** (e.g., speeding, failure to yield)
- **Uniting transportation safety efforts** across city departments and community partners
- **Creating a framework** for continuous monitoring and improvement of transportation safety actions

In addition, it provides medium and long-term actions that should be considered, supported by initial outreach, and gathering support during the ongoing and shorter-term actions. Actions that should occur from 2016 through 2018 are considered critical actions. They are organized into the following categories: Evaluation, Engineering, Enforcement, Education, and Policy. Each category includes existing initiatives, responsible agencies, cost estimates, and the amount of funding currently available.

The inclusion of a continuous review of the plan was deemed important for the implementation of the plan. Thus, the Vision Zero Task Force and Vision Zero Program would convene quarterly to monitor and review updates to the Vision Zero Action Plan to meet the City’s goal of zero deaths and serious injuries. They are also allowed to provide recommendations for design, policy changes, and establish subcommittees to develop measures to assist with targets.

The Vision Zero Task Force consists of different City departments, state agencies, federal agencies, institutions, and community groups of different backgrounds. The Vision Zero Program is staffed and funded to improve transportation safety through enforcement, multimodal street design, engineering, and education.

The Executive Council (composed of Planning and Zoning, Transportation, Police, Health and Human Services, Public Works, Emergency Medical Services (EMS), Law, and Fire departments) coordinate the implementation of the plan and report the actions back to the Vision Zero Task Force.

An annual Vision Zero report card was created to track goals, inform changes, and develop new actions for the Vision Zero Action Plan. The tracked items are used to guide the second year of the Vision Zero Action Plan and presented to the Vision Zero Task Force and City Council annually. These tracked items include:

- Total fatal and incapacitating injury crashes
- Fatal and incapacitating injury crashes by mode
- Fatal and incapacitating injury crashes at hotspot locations with targeted interventions
- Fatal and incapacitating injury crashes involving top contributing factors
- Progress metrics for actions toward the goal of zero deaths by 2025

The Vision Zero plan also drives forward the broader Austin Strategic Mobility Plan (ASMP), which integrates various mobility programs under one cohesive vision.

A.2.4 Denver Regional Council of Governments (DRCOG) - Taking Action on Regional Vision Zero

The DRCOG developed their Regional Vision Zero Plan through extensive collaboration with local, regional, and state stakeholders, supported by public engagement efforts such as a crowd-sourced map of safety issues. The plan is based on detailed data analysis of fatal and serious-injury crashes over a five-year period. It outlines key initiatives, an implementation timeline, and measures to track progress toward safety improvements. Key implementation areas identified in the plan are:

- **Collaboration between agencies:** Building stronger partnerships among local governments, transportation agencies, and community organizations to ensure coordinated efforts in traffic safety.
- **Raising awareness and adoption of Vision Zero:** Engaging the public and stakeholders to promote the adoption of Vision Zero principles and driving behavior change.
- **Designing and retrofitting roadways for safety:** Implementing street designs and infrastructure improvements aimed at reducing crashes and protecting all road users.
- **Improving data collection and reporting:** Strengthening systems for collecting, analyzing, and reporting crash data to inform evidence-based decisions.
- **Securing increased funding and resources:** Identifying and pursuing additional funding sources to support safety improvements and Vision Zero initiatives.
- **Supporting safety-focused legislation and policies**: Advocating for policies and legislation that promote safer roads, such as the recent Senate Bill 23-200, which allows for the use of safety cameras for enforcement.

These six principles form the backbone of a comprehensive strategy to create safer roadways, emphasizing proactive safety measures and collaboration with communities.

Safe System Approach:
A cornerstone of DRCOG's Vision Zero Plan is the Safe System Approach, which recognizes creating a safe transportation network requires addressing multiple factors, including safe speeds, roads, vehicles, and road users. The approach anticipates human error and focuses on reducing the severity of crashes when they do occur. By adopting this multifaceted strategy, DRCOG aims to create a transportation system that is resilient to human mistakes, reducing the likelihood of fatalities and serious injuries.

Speed Management and Infrastructure:
Speed management is a pivotal element in the DRCOG Vision Zero Plan. Recognizing the direct link between speed and crash severity, the plan includes a region-wide review of speed limits, particularly on high-risk corridors within the high-injury network. Proposed infrastructure modifications, such as road diets, traffic calming measures, and optimized signal timing, are designed to reduce vehicle speeds naturally. The plan also emphasizes the importance of public education and enforcement in fostering safer driving habits.

Equity in Transportation Safety:
Equity is a fundamental principle of the DRCOG Vision Zero Plan. Historical disparities in traffic safety outcomes have disproportionately impacted underserved communities. To address these inequalities, the plan prioritizes safety interventions in communities that have been most affected by dangerous traffic conditions. This equity-focused approach ensures the benefits of Vision Zero are distributed fairly, reducing transportation inequities that have persisted for years. Additionally, the plan emphasizes improving infrastructure for pedestrians, cyclists, and transit users, creating a safer environment for all road users, particularly those who rely on alternative modes of transportation.

High-Injury Network and Behavior Profiles:
A critical component of the DRCOG Vision Zero Plan is the identification of a regional high-injury network. This network helps prioritize safety interventions in the areas with the highest crash risks. In addition to crash profiles, the plan includes detailed behavior profiles, which provide insights into the behaviors of different road users. By analyzing risk factors associated with specific groups (e.g., young drivers, distracted drivers, older pedestrians), the plan enables more targeted interventions tailored to the needs of these populations.

Implementation Strategy and Accountability:
The DRCOG Vision Zero Plan adopts a pragmatic and forward-thinking implementation strategy, outlining immediate, short-term, medium-term, and long-term actions. Responsibilities are clearly assigned to various stakeholders, ensuring accountability for each action. Performance metrics are established to track progress toward Vision Zero goals, and adaptive management techniques allow the plan to evolve as new data and insights become available. For example, the development of a Complete Street Toolkit and the identification of key corridors for safety improvements demonstrate early progress. A StoryMap data tool, shown in Figure A-3, allows quick access to crash analysis, enabling data-driven decisions.

Figure A-3 - Denver Regional Vision Zero StoryMap

Source: Adopted from [7]

Financial Strategies:
Understanding the critical role of funding, DRCOG has integrated financial strategies into its Vision Zero Action Plan. The plan identifies potential funding sources at the federal, state, and local levels and explores ways to leverage existing transportation funds for safety improvements. Innovative financing mechanisms are also considered, reflecting a practical approach to overcoming the financial challenges that often arise in Vision Zero implementation.

A.2.5 Denver Regional Crash Data Consortium (DRCDC)

Throughout the federal fiscal year 2023, DRCOG collaborated with a wide array of stakeholders across the Denver region and the State of Colorado. This effort was part of a comprehensive initiative to explore and demonstrate the value of establishing a regional crash data consortium, inventory the region's data needs, and identify and address common challenges in crash data collection, processing, and analysis. The DRCDC is a collaborative effort involving local, state, and federal stakeholders aimed at improving the accuracy and coordination of crash data in the Denver region. Funded by a National Highway Traffic Safety Administration (NHTSA) 405c grant, the consortium focuses on identifying and addressing challenges in crash data collection, processing, and analysis. This initiative aims to enhance traffic safety by leveraging the collective resources of over 100 regional stakeholders representing more than 60 organizations. The key goals of the DRCDC include:

- **Improving data quality:** Ensuring crash data is accurate and complete.
- **Enhancing timeliness:** Reducing the time it takes to collect and analyze crash data.
- **Facilitating data integration:** Ensuring data from various sources can be combined and compared effectively.

In March 2024, the Consortium published a Regional Crash Data Needs Assessment Report to inform and guide the consortium's work throughout federal fiscal year 2024 and beyond. The needs assessment is complemented by DRCOG's Regional Crash Data Inventory, which highlights key themes and insights gathered from stakeholders across the state and the Denver region. The "Stakeholder Engagement Process" section of the inventory details the methods

DRCOG staff used to collect and compile the data that informed this needs assessment, offering a comprehensive overview of the engagement efforts that shaped the findings [8].

A.2.6 Hillsborough Safe Streets Now Vision Zero Action Plan

The Hillsborough Safe Streets Now Vision Zero Action Plan, published in 2017, represents a comprehensive approach to eliminating traffic fatalities and severe injuries in Hillsborough County, Florida. This plan is characterized by its data-driven methodology and community-focused strategies. The planning process involved extensive data analysis of crash patterns, road conditions, and demographic factors, combined with community engagement to understand local concerns and priorities. The plan emphasizes collaboration between various stakeholders, including local government agencies, law enforcement, community organizations, and residents. The plan is structured around the "5 E's" of traffic safety, which form the foundation for its comprehensive framework to improve road safety:

- **Engineering:** Implementing infrastructure improvements, including road redesigns, protected bike lanes, improved pedestrian crossings, and traffic calming measures in high-risk areas based on crash data analysis.
- **Education:** Developing public education and awareness campaigns aimed at all road users to promote safe driving behaviors and increase understanding of traffic laws. These campaigns focus on fostering mutual respect between drivers, cyclists, and pedestrians.
- **Enforcement:** Targeting high-risk behaviors, such as speeding and running red lights, through equitable enforcement of traffic laws. Special attention is given to areas with a high incidence of severe crashes.
- **Equity:** Addressing disparities in traffic safety outcomes by ensuring safety improvements and resources are distributed equitably across all communities in Hillsborough County, with a focus on vulnerable and underserved populations.
- **Evaluation:** Establishing a robust system for ongoing data collection, performance monitoring, and analysis to track the progress of safety interventions and inform future updates to the plan.

The Hillsborough Vision Zero Action Plan highlights 19% of the county's fatal and incapacitating crashes occur on just 4% of major roads. The top 20 severe crash corridors, including Brandon Boulevard, Gibsonton Drive/Boyette Road, Hillsborough Avenue, Fletcher Avenue, and Dale Mabry Highway, are identified for targeted improvements. Aggressive driving is a significant factor in these areas, with 36% of crashes attributed to behaviors such as failure to yield, speeding, and running red lights. Vulnerable road users, particularly pedestrians and bicyclists, are at high risk, with one in four injury crashes involving these groups resulting in serious injury or death.

Hillsborough County is noted as one of the most dangerous areas for walking and biking, with dark, unlit roads and intoxicated driving being major contributors to fatal crashes involving pedestrians and bicyclists. The plan showcases the effectiveness of projects like the Fletcher Avenue Complete Street Project, which reduced severe crashes from 48 (2012-2013) to 25 (2015-2016). Law enforcement efforts are recommended to focus on the top 20 corridors with the highest incidents of severe crashes involving aggressive driving. A significant portion of severe crashes in Hillsborough County occur under dark, no-lighting conditions, with 39% of fatal pedestrian crashes, 24% of fatal bicycle crashes, and 19% of fatal vehicle crashes happening in such conditions. The Vision Zero Action Plan lists the top 20 corridors where lighting improvements are most needed to enhance safety and reduce the rate of severe crashes.

The plan outlines several key action tracks and goals, including:

- Paint Saves Lives
  - Using high-visibility markings to raise driver awareness of pedestrians and cyclists
  - Implementing low-cost treatments to improve roadway safety

- One Message, Many Voices
  - Increasing awareness of Vision Zero to influence safer behaviors
  - Engaging with victims of traffic violence and their families
- Consistent and Fair
  - Leveraging existing resources of the Community Traffic Safety Team
  - Establishing a Vision Zero "Consistent & Fair" corridor program
- The Future Will Not Be Like the Past
  - Updating policies, standards, and procedures to foster a culture of safety
  - Creating a safe multimodal transportation system through good design, lighting, and connected facilities

For each action track, the plan provides specific goals, measures of success, priority actions, and a timeline for implementation. It identifies the organizations responsible for leading and supporting each action, as well as potential resources needed. The plan also emphasizes annual progress reports, shown in Figure A-4, and community engagement to monitor effectiveness and identify new safety opportunities.

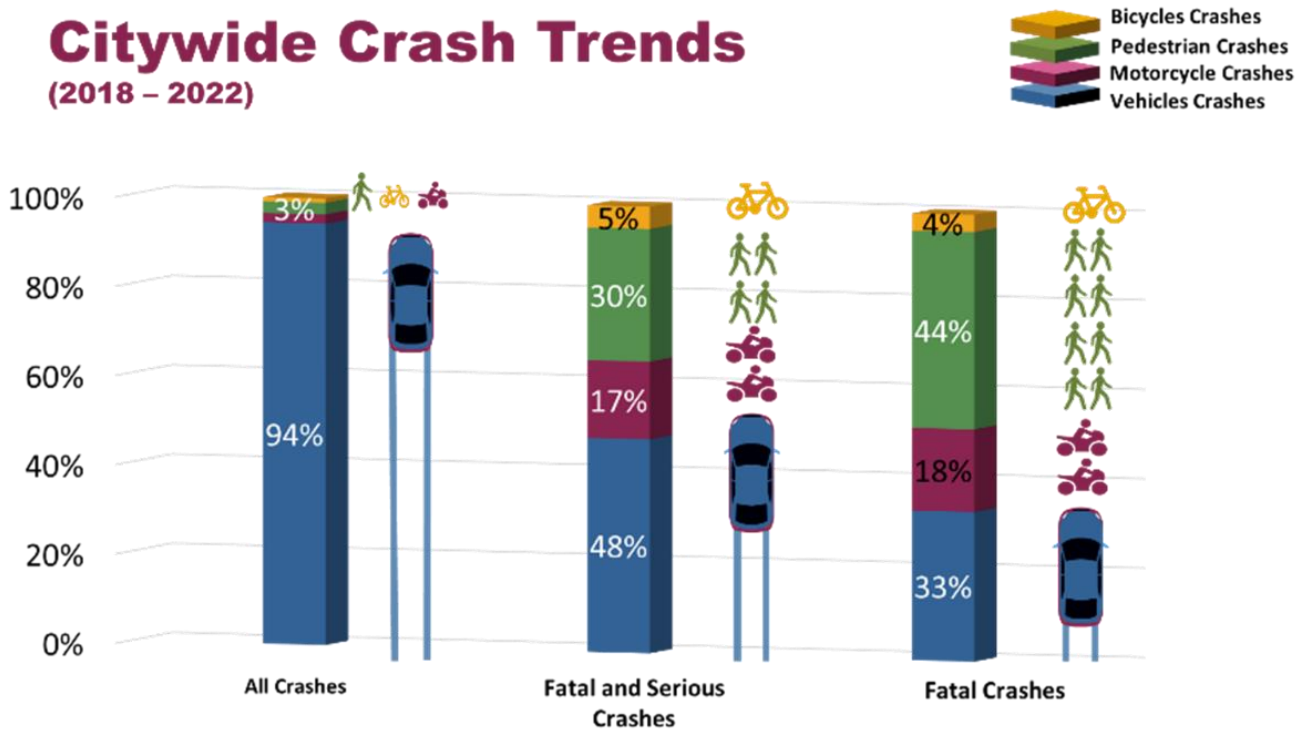
Figure A-4 - Vision Zero Hillsborough Progress Report 2018-2020

Source: Adopted from [9]

A.2.7 City of Phoenix, AZ - Road Safety Action Plan

The City of Phoenix Road Safety Action Plan, adopted in 2022, represents a comprehensive approach to improving traffic safety in Arizona's largest city. This plan is characterized by its data-driven methodology and focus on addressing the unique challenges of a rapidly growing desert metropolis. The planning process involved an in-depth analysis of crash data, shown in Figure A-5, identification of high-risk areas and behaviors, and engagement with diverse community stakeholders. The plan emphasizes collaboration between various city departments, including transportation, police, public works, and community development, as well as partnerships with community organizations, advocacy groups, and residents.

Figure A-5 - Phoenix Citywide Crash Trends



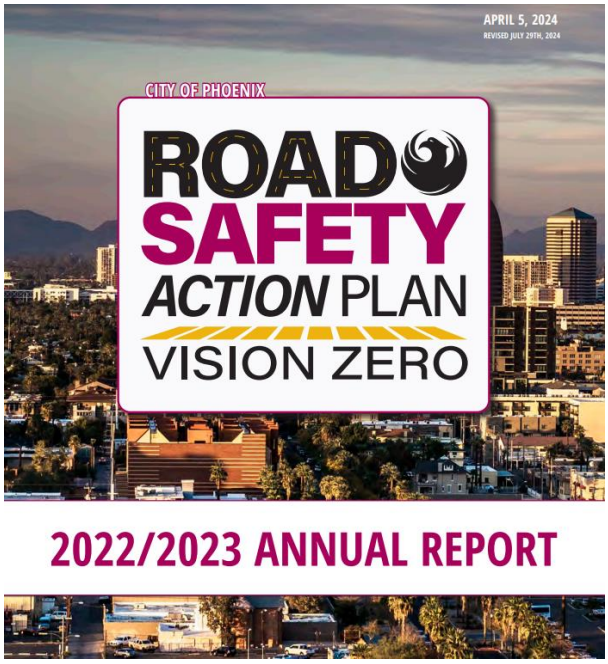
Source: Adopted from [10]

The plan integrates the FHWA Safe Systems Approach, designing transportation systems to anticipate human errors and mitigate crash impacts, emphasizing a holistic view of road safety. The plan targets high-risk crash types through annual programs, focusing on the HIN and applying broad safety improvements Citywide. The plan applies a systemic evaluation process by analyzing crash, roadway, and traffic data to prioritize safety decisions, modernizing analysis tools, and using these tools to incorporate safety into planning and project development. Finally, the plan integrates the Five E's of safety: Evaluation, Engineering, Enforcement, Education, and Equity to create a safe transportation network for all users. The Phoenix Vision Zero Road Safety Action Plan outlines several key outcomes and findings:

- The ultimate goal is to achieve zero traffic-related fatalities and serious injuries by 2050.
- Interim targets include a 25% reduction in fatal crashes by 2027 and a 60% reduction by 2035, using 2020 as the baseline year.
- The plan identifies and prioritizes 41 strategies based on effectiveness, application, and cost. These strategies focus on the 5 E’s: evaluation, engineering, enforcement, education, and equity.
- High-priority strategies include proactive enforcement of the HIN, expanded DUI enforcement, and enhanced enforcement of school zone laws.
- The plan emphasizes systemic actions beyond the HIN, incorporating continuous evaluation, engineering, enforcement, and education initiatives to address safety concerns Citywide.
- Systemic evaluation actions include improving crash data sharing between departments, modernizing safety analysis tools, and implementing a centralized tracking system for traffic and safety study requests.
- The plan proposes 31 performance measures directly connected to 15 objectives across five focus areas. These measures guide implementation, assess impact, and inform strategy adjustments.

- An annual Vision Zero Status Report, shown in Figure A-6, will benchmark progress, highlight project statuses, and showcase safety improvements.
- The Vision Zero Task Force, composed of a multi-departmental team, will oversee plan implementation. This includes an Executive Task Force, Road Safety Action Plan (RSAP) Implementation Team, and Community Advisory Committee.
- The Task Force will use tools like the crash data dashboard to track performance metrics and make data-driven decisions.
- Equity is integrated into each strategy, ensuring safety improvements benefit all communities, particularly underserved areas identified through the RSAP Equity Analysis.
- Immediate actions include expanding pedestrian and bicyclist education, developing roadway safety awareness campaigns, and improving street lighting on the HIN.

Figure A-6 - City of Phoenix Road Safety Action Plan Annual Report Cover Page



Source: Adopted from [11]

A.2.8 City of Boston, MA - Vision Zero Action Plan

The City of Boston Vision Zero Action Plan, adopted in September 2023, is a comprehensive strategy to eliminate fatal and serious traffic crashes in the City by 2030. The plan builds upon the City's initial commitment to Vision Zero in 2015 and previous action plans. It employs a data-driven approach, leveraging an interactive online map of injury and fatal crashes by mode, with data starting from 2015. The plan is the result of collaborative efforts by the Vision Zero Task Force, which includes representatives from various city departments, agencies, and community organizations. The plan

emphasizes several key strategies to eliminate traffic fatalities and serious injuries by 2030. The primary focus areas, shown in Figure A-7, include:

- **Holding Ourselves Accountable for Results:** Utilizing data-driven approaches, such as the High Crash Network (HCN), to identify and prioritize areas for safety improvements and to track progress over time.
- **Reducing Speeds and Building Safer Streets:** Implementing evidence-based design approaches to make streets safer, particularly targeting 4+ lane roads for lane reductions, speed humps, and other traffic calming measures.
- **Advocating for Safer Large Vehicle Design:** Partnering with organizations like the Volpe Center and Livable Streets Alliance to improve vehicle design, particularly focusing on reducing blind zones and enhancing driver training for large vehicles.
- **Engaging Bostonians with Vision Zero:** Prioritizing equitable decision-making in transportation projects, with a focus on vulnerable populations and high-risk areas. This involves community engagement and empowering local organizations to participate in transportation planning.

Figure A-7 - Vision Zero Boston Promises Action in Four Critical Areas

Source: Adopted from [12]

The Vision Zero Action Plan reports several significant findings and outcomes:

- **Crash Data Trends:** Since the first Vision Zero Action Plan in 2016, the 3-year rolling average of injury crashes for pedestrians and cyclists has decreased by 50% and 40%, respectively. Fatal traffic crashes have also decreased but have not yet reached zero.
- **HCN:** The updated HCN identifies approximately 25 miles of City-owned roadways with the highest densities of crashes for each mode. This network is crucial for prioritizing safety interventions and capital investments.
- **Speed Reduction Impact:** Speed humps and other traffic calming measures implemented in neighborhoods have successfully reduced vehicle speeds and improved safety. The "Safety Surge" initiative aims to expand these measures Citywide.
- **Vehicle Safety Improvements:** Collaborative efforts have led to the development of new vehicle safety standards, including side guards and Advanced Driver Assistance Systems (ADAS) for large vehicles, which are crucial for protecting vulnerable road users.

The Plan also outlines several implementation steps and funding mechanisms:

- **Speed Hump Program:** The City has proactively identified streets eligible for speed humps and has developed a three-year implementation plan to install these safety features. Additional zones will be added on a rolling basis.
- **Intersection Safety Enhancements:** Boston plans to redesign 25-30 intersections annually using street safety tools to improve sightlines, reduce speeds, and create safer crossings for pedestrians and cyclists.
- **Partnerships and Grants:** The City collaborates with various organizations and secures grants, such as the Partnership for Healthy Cities, to fund research and implementation of safety measures. Coordination with the Massachusetts Bay Transit Authority (MBTA) and other stakeholders is also vital for expanding transit and bike networks.

A.2.9 Truckee Meadows Vision Zero Action Plan

The Truckee Meadows Vision Zero Action Plan, updated in 2022, and developed for the Reno-Sparks metropolitan area in Nevada, outlines a comprehensive strategy to eliminate traffic fatalities and severe injuries. The plan employs a data-driven approach to identify and address the most pressing road safety issues in the region. The plan is the result of a collaborative effort between multiple jurisdictions and agencies in the Truckee Meadows area, including the cities of Reno and Sparks, and Washoe County. This multi-agency coordination ensures a cohesive regional approach to traffic safety. The plan aims to achieve zero traffic fatalities and serious injuries by 2030 through a comprehensive, data-driven approach. The plan integrates:

- **Safe System Approach:** Implement a holistic strategy that addresses all aspects of traffic safety, including safe road users, safe vehicles, safe speeds, safe roads, and post-crash care. This approach emphasizes designing roads that are forgiving of human errors and reduce crash severity through crash prevention and impact mitigation.
- **Data-Driven Decision Making:** Use crash data and systemic safety analyses to identify high-risk locations and prioritize interventions. A critical tool in this effort is the development of an HIN, which focuses on corridors with the highest crash frequencies and severities.
- **Community and Stakeholder Engagement:** Build a culture of safety by engaging local stakeholders—including law enforcement, schools, and community organizations—in public outreach, education, and safety initiatives. This strategy promotes community participation in shaping safety improvements.
- **Infrastructure Improvements:** Focus on multimodal infrastructure projects that enhance safety for all road users, especially pedestrians and cyclists. Key projects include traffic calming measures, improved lighting, and the construction of dedicated pedestrian and bicycle facilities.
- **Equity Considerations:** Target interventions in underserved areas where traffic fatalities and severe injuries are disproportionately high. Ensure safety improvements benefit all communities, particularly those with vulnerable populations.

The Vision Zero Truckee Meadows initiative has identified several key findings and outcomes since its inception:

- **High Pedestrian Fatalities:** Pedestrians represent a significant proportion of traffic fatalities, accounting for 27% of deaths despite making up a small percentage of road users. This underscores the need for targeted pedestrian safety interventions.
- **Effective Safety Campaigns:** The implementation of safety campaigns, such as pedestrian safety zones and speed feedback signs, has contributed to a decline in pedestrian fatalities in recent years.
- **Disparities in Crash Data:** Over 60% of fatal and serious injury crashes occur in underserved areas, which comprise less than one-third of the population. This highlights the importance of focusing safety efforts at these high-risk areas.
- **Systemic Approach Success:** Applying a systemic approach to safety, including the use of the HIN, has enabled the identification and prioritization of high-risk corridors, leading to more efficient and effective interventions.
- **Stakeholder Collaboration:** The establishment of the Vision Zero Task Force, comprising various local agencies and community members, has been instrumental in advancing the safety agenda and fostering a collaborative approach to traffic safety.

The implementation of the Vision Zero Truckee Meadows Action Plan involves a series of strategic actions supported by dedicated funding:

- **Action Items:** The plan outlines specific action items, including the expansion of the Task Force, development of regional lighting standards, integration of traffic calming measures, and regular updates to signal timing for pedestrian safety.
- **Capital Projects:** Funding has been secured for several multimodal capital improvement projects across the region, targeting high-risk corridors identified through data analyses. These projects include enhancements to pedestrian and bicycle infrastructure, improved street lighting, and traffic calming installations.
- **Continuous Monitoring and Evaluation:** The Task Force is committed to regularly collecting and reporting data on project outcomes to measure success and inform future actions. This involves ongoing evaluation of crash data, traffic volumes, and the effectiveness of implemented countermeasures.
- **Community Outreach and Education:** Efforts are underway to increase public awareness and engagement through educational campaigns, workshops, and partnerships with local organizations. These initiatives aim to foster a culture of safety and encourage community participation in achieving the Vision Zero goals [13].

A.2.10 Wasatch Front Comprehensive Safety Action Plan (CSAP)

The Wasatch Front CSAP, developed by the Wasatch Front Regional Council (WFRC) in collaboration with local transportation and government entities, employs a strategic framework based on the Safe System Approach. The CSAP was funded through the Safe Streets and Roads for All Grant Program, part of the Bipartisan Infrastructure Law (BIL), which provides $5 billion over five years to enhance roadway safety nationwide. The development of the plan involved a comprehensive safety analysis, which was conducted across the Wasatch Front Region, divided into 11 Geographic Focus Areas (GFAs) for more targeted evaluation.

The Regional Safety Analysis conducted as part of the CSAP provided critical insights into the safety challenges within the Wasatch Front Region. The analysis was informed by four key sub-analyses:

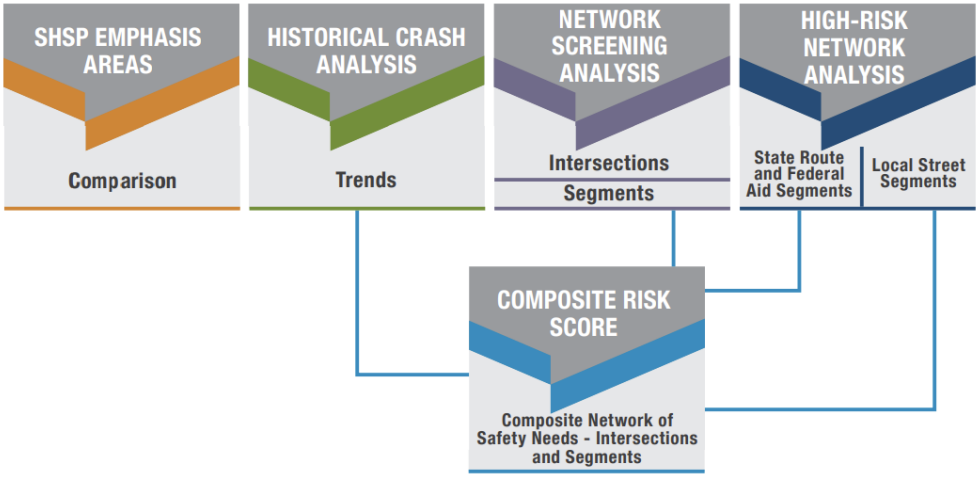
1. **Strategic Highway Safety Plan (SHSP) Emphasis Area Analysis:** This analysis compared the regional safety emphasis areas to those identified statewide by the Utah SHSP. The findings highlighted intersections, roadway

departures, and speed management as the top safety concerns. Specifically, intersections were identified as the highest-risk areas for fatalities and serious injuries, particularly in urban areas like Salt Lake City.

2. **Historical Crash Analysis:** The analysis of crash trends from 2018 to 2022 revealed a worrying increase in fatal crashes over the five-year period. It was noted fatal and serious injury crash rates were particularly high on locally-owned Federal Aid Urban routes, likely due to higher speeds and increased conflict points with other road users, including pedestrians and bicyclists.
3. **Network Screening Analysis:** This analysis focused on identifying high-risk intersections and road segments that are candidates for safety improvements. The findings were used to develop a Composite Network, highlighting the top 10% of State Route and locally-owned Federal Aid Route segments with the greatest safety needs.
4. **High-Risk Network Analysis:** This component of the analysis identified segments of the road network that are prone to specific types of crashes, such as roadway departures. The results were used to prioritize locations for targeted safety interventions.

The comprehensive analysis culminated in the creation of a Composite Risk Score as shown in Figure A-8, which helped prioritize segments and intersections across the region that require immediate safety improvements. The analysis also identified key crash types contributing to fatalities and serious injuries, with left-turn crashes at intersections, roadway departures, and crashes involving active transportation (e.g., pedestrians and cyclists) being the most prevalent.

Figure A-8 - Safety Analysis Layers in Wasatch Front Comprehensive Safety Action Plan



Source: Adopted from [14]

The safety analysis conducted as part of the CSAP revealed several critical insights into the nature and distribution of traffic-related fatalities and serious injuries in the Wasatch Front Region. The analysis, which examined crash data from 2018 to 2022, identified intersections, roadway departures, and speed management as the most significant areas of concern. These findings were consistent across multiple GFAs, with urban areas like Salt Lake City showing higher rates of pedestrian-related crashes, while more rural areas exhibited higher instances of roadway departures. Additionally, the plan incorporated an equity analysis that highlighted transportation-disadvantaged communities, using a locally-defined equity priority index. This index considered factors such as transportation insecurity, environmental burden, and social vulnerability, ensuring safety improvements are prioritized in areas where they are most needed.

In response to the identified safety challenges, the CSAP outlines a series of strategic actions aimed at significantly reducing traffic fatalities and serious injuries. The plan's cornerstone is the Regional Safety Commitment Resolution,

adopted by WFRC in 2024, which sets a target of reducing these incidents by 50% by 2040. To achieve this, the CSAP provides a Safety Countermeasures Toolbox, which includes a range of proven safety interventions tailored to the specific needs of the region's diverse road users. The toolbox is complemented by case study project sheets that offer practical examples of how these countermeasures can be applied in various contexts.

The plan also emphasizes the importance of best practices in safety policies, processes, and enforcement. Recommendations are structured around the five Safe System Elements: Safe Users, Safe Roadways, Safe Vehicles, Safe Speeds, and Post-Crash Care. WFRC is tasked with leading the implementation of these strategies, with a focus on continuous monitoring and evaluation. An annual review of crash data and the effectiveness of implemented measures will guide ongoing efforts to improve road safety across the region. Moreover, the CSAP encourages local jurisdictions to integrate safety into their transportation planning and project prioritization processes, ensuring sustained progress towards the region's safety goals.

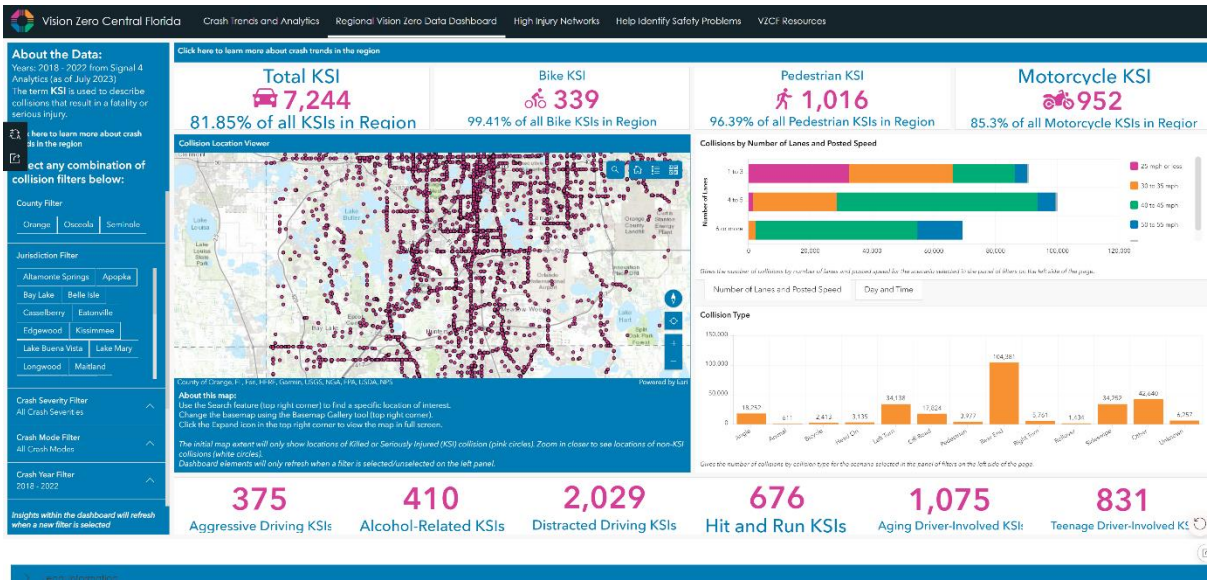
A.2.11 Vision Zero Central Florida Safety Action Plan

Vision Zero Central Florida is a collaborative initiative led by MetroPlan Orlando in partnership with local jurisdictions to develop comprehensive Vision Zero Safety Action Plans for the three-county region, as well as for each individual county and city. The plan aims to transform road designs, educate and engage the public, and work closely with law enforcement to save lives. The Safe System Approach used in the plan shifts some responsibility from road users to those who plan, design, and maintain the transportation system. The plan acknowledges human vulnerability and designs the transportation network to minimize serious consequences of crashes. The key findings of the plan are as follows:

- **HIN:** Although only 2% of roads are part of the HIN, they account for 41% of traffic deaths. This highlights the importance of targeted interventions in these critical areas to significantly reduce fatalities.
- **Vulnerable Road Users:** Pedestrians, bicyclists, and motorcyclists are disproportionately involved in fatal and serious injury crashes, particularly in underserved communities. Addressing the safety needs of these road users is a central focus of the plan.
- **Behavioral Factors:** Risky behaviors, including alcohol consumption, speeding, and lack of seatbelt use, are significant contributors to fatal crashes. These behaviors are being targeted through enforcement and public awareness campaigns.
- **Community Impact:** Many of the high-risk roads are located in transportation underserved communities, emphasizing the need for equitable safety interventions to address the disproportionate impact of crashes on these populations.

As part of the Vision Zero Central Florida initiative, a public online data dashboard, shown in Figure A-9, was developed to track and visualize crash data statistics and trends, and inform the decision making process on targeted safety interventions.

Figure A-9 - Vision Zero Central Florida Data Dashboard



Source: Adopted from [15]

The process for identifying crash reduction countermeasures in the plan involves several key steps. First, global countermeasures that can be implemented across the entire transportation network are identified through a high-level screening. Next, the HIN is analyzed in detail to understand the specific conditions of each segment or intersection, which helps in refining potential countermeasures. Planned improvements along these segments are also identified to avoid redundant efforts. Potential countermeasures are then pinpointed for the top HIN segments, taking into account engineering guidelines and professional judgment. Finally, projects are prioritized for implementation based on specific criteria. The key criteria used for project prioritization, emphasizing different factors that determine which safety projects are prioritized, include:

- **Safety History (50%):** Focuses on areas with the highest number of fatal and serious injury crashes based on safety scores.
- **Transportation Underserved (15%):** Prioritizes areas where underserved communities are disproportionately affected by crashes and would benefit the most from safety improvements.
- **Safety Benefit (15%):** Considers the potential impact of the proposed safety improvements.
- **Regional Benefit (10%):** Gives priority to projects located on multiple HINs, indicating a broader regional impact.
- **Timeline (10%):** Prefers projects that can be implemented quickly, as these can start saving lives sooner [16].

A.2.12 The San Diego Association of Governments (SANDAG) - Vision Zero Action Plan

SANDAG is actively developing a Vision Zero Action Plan to tackle regional traffic safety challenges. The plan will be data-driven, drawing on best practices from both national and international sources to create a comprehensive approach. One of the primary goals is to identify a safety-focused network that pinpoints locations with the highest rates of fatalities and serious injuries.

The Vision Zero Action Plan will recommend several key strategies, including:

- **Context-sensitive road designs:** Adapting road infrastructure to better suit the needs and safety of all road users, particularly in high-risk areas.
- **Promoting safer travel speeds:** Implementing speed management measures to reduce the risk and severity of crashes.
- **Encouraging responsible travel behavior:** Promoting public awareness campaigns and enforcement strategies aimed at reducing dangerous behaviors, such as impaired or distracted driving.

Though the plan is still in development and not yet publicly available, SANDAG aims to incorporate input from stakeholders, including local governments, transportation agencies, and the community. This collaborative approach will ensure the plan reflects the unique safety challenges of the San Diego region while aligning with broader Vision Zero goals [17].

A.2.13 Regional Transportation Commission (RTC) of Washoe County – Street and Highway Program Policy

RTC Washoe County's Street and Highway Program Policy, updated in 2023, was developed to guide decision-making processes for projects throughout the region. RTC Washoe County is responsible for the fair and equitable use of limited funding to meet the region's transportation needs. While the policy is not a specific Vision Zero or traffic safety document, implementing safety improvements and ensuring their funding are key parts of RTC Washoe's Street and Highway Program. It addresses the scope of services eligible for RTC fuel tax use for corridor improvements as well as the funding programs for traffic engineering spot improvements and pavement preservation. RTC Washoe specifies their responsibility is to plan and carry out projects that provide street and highway access to users of all abilities, including everyone from motorists and commercial goods movers to pedestrians, bicyclists, older adults, and children. To facilitate the completion of Complete Street projects and relevant safety improvements, RTC Washoe also maintains a Complete Streets Project revenue fund.

A.2.14 DRCOG – Policy Statement on State Legislative Issues

The DRCOG Policy Statement on State Legislative Issues, adopted in 2019, outlines the MPO's key state policy issues, shared aspirational vision of the counties and municipalities of the Denver region, and associated performance measures to achieve this vision. DRCOG specifically outlines its support to improve the safety of drivers, transit riders, pedestrians, and bicyclists, as part of their board-adopted Taking Action on Regional Vision Zero plan that established the goal of eliminating traffic deaths and severe injuries on the transportation system. To facilitate this, DRCOG plans to increase transportation funding to create a reliable, dedicated funding stream for safety projects such as safety cameras for red-light running and speeding enforcement. While no dedicated prioritization matrix is outlined in this document, it states the board will consider investments for safety projects through the Transportation Improvement Program.

A.2.15 MetroPlan Orlando – Internal Operating Procedures

MetroPlan Orlando's Internal Operating Procedures outlines the agency's purpose, vision, and procedures to provide leadership in transportation planning for the Orlando and Kissimmee metropolitan areas. As part of its operating procedures, MetroPlan Orlando established a standing Transportation Systems Management and Operations (TSMO) committee consisting of staff from federal, state, regional, and/or local agencies with planning and engineering expertise. Members of this committee are charged with developing and recommending a list of traffic operations and TSMO project priorities to be implemented with Congestion Management System (CMS) Box funds and/or MetroPlan Orlando's share of District Five Allocated Surface Transportation Program (STP) and State funds. These projects may

include, but are not limited to, studies, plans, installing traffic control devices, safety improvements, TSMO deployments, and more.

A.2.16 Hillsborough Transportation Planning Organization (TPO) Transportation Improvement Program (TIP)

The Hillsborough TPO TIP identifies proposed transportation improvements to be implemented across Hillsborough County over five fiscal years, in line with federal requirements. To rank submitted projects for prioritization, the Hillsborough TPO includes “Improving Safety” as a performance criterion. This category includes measures related to fatalities, serious injuries, cyclist and pedestrian serious injuries, and the rate of fatalities and injuries per 100 million vehicle miles traveled. Including improving safety as a criterion helps improve the ranking of projects with the greatest safety impact, helping them get funded and implemented.

A.3 Current Plans and Projects

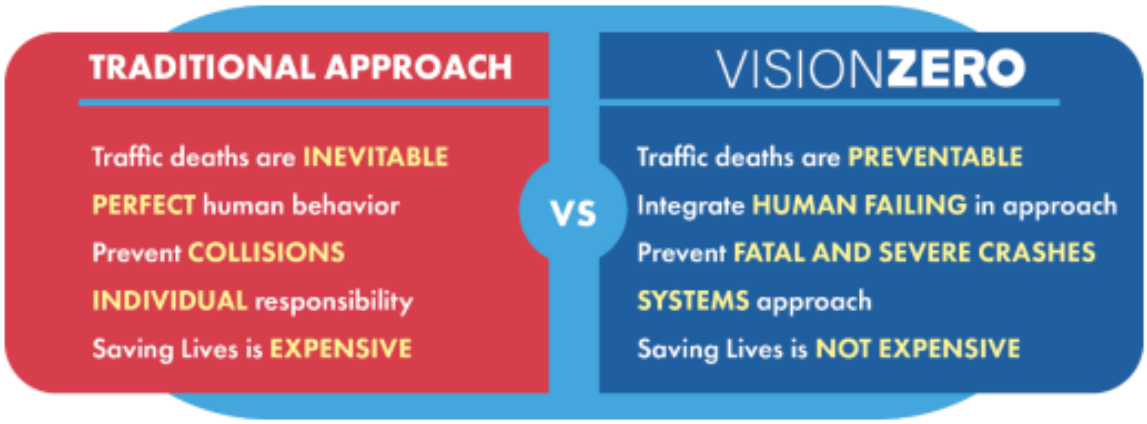
The current plans and projects from state, regional, and local jurisdictions were reviewed to incorporate the recommended projects into the action plan.

- City of Las Vegas - Vision Zero Action Plan
- City of Las Vegas - Citywide Intersection Crash Mitigation Program (CICMP)
- On Board Mobility Plan
- Reimagine Boulder Highway
- Clark County Safe Routes to School (SRTS) Strategy
- Southern Nevada Transportation Safety Plan
- North Las Vegas Citywide Pedestrian & Bicycle Plan
- Southern Nevada Strong Regional Plan
- Regional Transportation Plan: Let’s Go 2050
- Southern Nevada Regional Bicycle and Pedestrian Plan
- Regional Walkability Plan
- Pedestrian Comfort Study and Demonstration Project
- Nevada Strategic Highway Safety Plan (SHSP)
- Nevada Speed Management Action Plan (SMAP)
- One Nevada Transportation Process
- NDOT Safety Management Plans (SMPs)
- Las Vegas Mini-Roundabout Test Installation

A.3.1 City of Las Vegas - Vision Zero Action Plan

The August 2022 City of Las Vegas Vision Zero Action Plan was developed in response to the City’s high number of traffic fatalities and serious injuries. The plan adopted the FHWA Safe System Approach, which acknowledges human error in road use and emphasizes designing roads to minimize crash severity. This shift in the approach, summarized in Figure A-10, marks a transition towards creating safer streets for all users.

Figure A-10 - Shift in Approach



Source: Adopted from [1]

The plan incorporated engagement and collaboration with the inclusion of the City of Las Vegas Vision Zero Technical Advisory Committee (TAC), a virtual public meeting, and a public survey. The TAC included City of Las Vegas staff, elected officials, safety stakeholders, and the public to create safe, healthy, and equitable mobility for all. The TAC meetings included conversations about factors for crashes, locations of high concern, and prioritization of corridors and locations. Follow-up conversations with the TAC were about crash costs, the High Injury Network (HIN) and Communities of Concerns (CoC), and the City's countermeasures. All meetings contributed to the development of the Action Plan.

The virtual public meeting included a video explaining the Vision Zero Action Plan process. The public survey allowed participants to provide input on improving transportation safety, which included an interactive map to provide feedback on locations of concern for traffic safety. The HIN identifies roadways with the highest concentration of fatalities and serious injuries, while the CoC highlights areas with underserved populations. Using this data-driven approach, the City developed strategies to address these critical areas. The strategies implemented include:

- Reform the City's Approach to Transportation Safety
- Create Safe Streets for All
- Implement Safe Speeds
- Promote a Culture of Safety
- Enhance Communication, Transparency, & Accountability

A.3.2 City of Las Vegas - Citywide Intersection Crash Mitigation Program (CICMP)

The 2021 City of Las Vegas CICMP is an engineering effort to provide safe roadways by targeting high crash intersections using intersection roadway conditions, crash analysis, traffic and roadway engineering, and the application of the American Association of State Highway Transportation Officials (AASHTO) Highway Safety Manual (HSM), the FHWA's Systemic Approach, and the FHWA Crash Modification Factors (CMF) Clearinghouse. The analysis from the CICMP was used by the City to apply for federal funding.

The high-crash intersections were identified by analyzing the intersections with the highest number of crashes, highest crash rates, and those involving vulnerable road users – particularly pedestrians and bicyclists. Using the FHWA's

Systemic Approach (illustrated in Figure A-2), the program developed countermeasures to enhance intersection safety and traffic operations. The FHWA's Systemic Approach comprises three elements: the first element consists of four steps, while the second and third elements each have one step.

Figure A-11 - FHWA's Systemic Approach

Source: Adopted from [2]

As a part of the FHWA's Systemic Approach, the City established three elements as part of their CICMP:

- **Element 1:** This element guides the CICMP through a step-by-step process to select, recommend, and prioritize intersection countermeasures based on crash data and risk analysis.
- **Element 2:** The program evaluates the balance between systemic safety investments (focused on network-wide improvements) and traditional safety projects (focused on individual intersections). This includes both low-cost, near-term solutions and long-term infrastructure upgrades.
- **Element 3:** Finally, the CICMP provides a baseline evaluation of how effective the Systemic Approach is and how it can influence future roadway conditions and safety.

A data analysis was conducted to identify the high crash intersections to complete the steps of the FHWA's Systemic Approach. The data used in the CICMP were aerial imagery, geometry of the street network, signal timing data, field visits, turning movement volumes, and recent crash data.

The crash data evaluation included identifying target crash types, identifying focus facility types, identifying and evaluating risk roadway factors, and screening and prioritizing candidate locations. To identify target crash types, the CICMP used two initial criteria parameters: high-signalized intersection crash locations involving all crashes and high-signalized intersection crash locations involving pedestrians and bicyclists. To identify focus facility types, the CICMP facility types were refined and prioritized based on high crash intersections within City limits, intersections not classified as highway/freeway facilities (including freeway segments and ramps), and intersections with recorded turning movement traffic volumes. To identify and evaluate risk roadway factors and screen and prioritize candidate locations, a list of risk factors was used, which was expanded from the Systemic Approach, including:

- Roadway and Intersection Features
  - Number of through lanes
  - Presence, number, and length of left-turn and right-turn lanes
  - Allowance of right-turn-on-red
  - Allowance and signing of U-turns
  - Intersection control device
  - Left-turn phasing
  - Number of signal heads versus number of lanes
  - Presence of retroreflective backplates
  - Through lane alignment
  - Overhead versus pedestal mounted signal heads
  - Presence and type of median
  - Pedestrian crosswalk presence, crossing distance, and signal head type
  - Presence of bicycle facilities
  - Presence of on-street parking
  - Location and presence of bus stops including bus turnouts
  - Presence of lighting
  - Driveway density and distances from intersection
  - Presence of advanced warning signs
  - Freeway access
- Traffic Volume
  - Annual Average Daily Traffic (AADT) volumes
  - Intersection turning movement volumes
- Other Features
  - Posted speed limit or operating speed
  - Presence of nearby railroad crossing
  - Presence of automated enforcement
  - Adjacent land use, such as schools, commercial, or alcohol-sales establishments
  - Location and presence of bus stop facilities

The HSM and CMF Clearinghouse were referenced to estimate the degree to which each roadway factor contributes to increases in target crash frequencies within a facility type.

From the analysis of the entire City limits of Las Vegas, ten intersections were selected by the City's Transportation Engineering Division for further analysis and recommendations. Five intersections were selected based on the highest overall crash locations for all transportation modes. The other five intersections were based on crash locations with the highest pedestrian and bicycle involved crashes. The key initial findings from the two analyses were used to develop countermeasures for each of the ten selected intersections.

The HSM was utilized to identify countermeasures and analyze costs. The first part focused on the steps taken to identify applicable countermeasure methods and evaluated Element 1 of the Systemic Tool by selecting countermeasures based on their system network applicability. The second part summarizes the effects of the evaluated

countermeasures on the candidate locations and calculates their economic value through planning-level cost estimates and benefit-cost analysis. When determining the appropriate CMF, the CICMP took the steps shown in Figure A-12.

Figure A-12 - CICMP CMF Steps

1) Defined the Base Condition (*Chapter 3*)	a. Selected and evaluated the target facility type, which was intersections i. Cataloged items such as area type, traffic control, number of approaches, number of lanes b. Calculated number of crashes for the existing base conditions i. Calculated the safety performance of the existing base conditions through crash rates
2) Applied the CMF to Estimate the Safety Performance for the Condition with the Countermeasure of Interest	a. Selected an appropriate CMF utilizing the FHWA's CMF Clearinghouse, shown in **Figure 5** i. To improve the confidence in safety analyses performed using CMFs, the CMF Clearinghouse provides a quality rating for each CMF to help analysts select the CMFs that have been developed through the most thorough analyses – for the CICMP, a minimum required CMF quality level of 3-stars was used b. Calculated the crashes with the countermeasure by multiplying the existing base conditions crashes by the selected CMF
2) Calculated Combined Countermeasure Effects, When Applicable	a. Defined the scenario of interest i. Identified ALL crashes as target crash types for the countermeasures of interest b. Determined the potential for overlapping effects among countermeasures i. Potential overlap is defined with respect to the target crashes and represents the likelihood that the individual countermeasure would address the same crash types c. Categorized the magnitude of individual countermeasure effects and selected the combined countermeasure method to estimate the combined effect of two or more countermeasures, when applicable i. The maximum effect of any countermeasure or combination of counter-measures is a crash reduction of 100-percent, or a CMF of zero (0.0)

Source: Adopted from [3]

To calculate a Benefit-Cost Ratio (BCR), the benefits and costs were translated into a monetary value and were broken down into crash costs and capital costs. Crash costs were developed utilizing the NDOT Performance Management Report, Crash Cost Per Definition [4]. Planning-level capital cost estimates in 2020 dollars were calculated for each CICMP intersection and broken down into the following three categories:

- Minor Traffic Signal Improvements – Includes Poles, Mast Arms, Signal Heads, Retroreflective Backplates, Pedestrian Push Buttons, U-Turn Signs, and Luminaires
- Roadway Improvements – Includes Left-Turn Pockets (Plus Right-of-Way), Right-Turn Pockets (Plus Right-of-Way), Transit Turnouts, and Speed Limit Signs
- Pedestrian Realm Improvements – Includes Pedestrian Ramps and Crosswalks

The calculated BCRs can aid in prioritizing projects as they reflect the project's present value versus project cost. Hence, a project with a BCR higher than one would indicate the identified project is viable, and the higher the BCR, the better the return on the investment. The BCR and countermeasures were included in the summaries of the ten intersections. The main countermeasures were:

- Signalized Intersection Countermeasure #1 – Minor Traffic Signal Upgrades
- Signalized Intersection Countermeasure #2 – Left-Turn Lanes and Left-Turn Phases at Signalized Intersections

- Pedestrian Countermeasure #1 – Development of Municipality-Wide Pedestrian Safety Action Plans
- Pedestrian Countermeasure #2 – Reducing Pedestrian Crashes Through Innovative Crosswalks and Lowering Speed Limits
- Hit-and-Run Countermeasure #1 – Allow Undocumented Immigrants to Receive a Driver's License

Additionally, improvements to the Level-of-Service (LOS) and queueing at each of the CICMP intersections was reviewed. LOS was mitigated with the combination of:

- Adding left-turn pocket(s)
- Increasing the length of existing left-turn pocket(s)
- Adding right-turn pocket(s)
- Increasing the length of existing right-turn pocket(s)
- Adding through lane(s)
- Optimizing the signal
    - Note: Optimizing the signal only optimized the selected signal and did not optimize or synchronize the adjacent signals in the signal network

After providing the recommendations and near- and long-term improvements, the CICMP provided funding sources, which include:

- Highway Safety Improvement Program (HSIP)
- Surface Transportation Block Grant Program (STBG)
- Transportation Alternatives (TA) Set-Aside Program
- Congestion Mitigation and Air Quality Improvement Program (CMAQ)

Although the Systemic Approach provided is recommended by FHWA, it is recommended the approach in the City should be evaluated to determine its success.

A.3.3 On Board Mobility Plan

The July 2020 RTC On Board Mobility Plan is a regional mobility plan that lays out a roadmap to modernize and transform the way people travel in Southern Nevada. The Plan was developed by analyzing transit demands, peer reviews, market assessments, and cost estimates. In addition, an extensive stakeholder engagement campaign was developed with interviews, surveys, public meetings, pop-up events, and a Technical Advisory Group (TAG). The TAG included staff from local planning and public works departments and representatives from business groups, community organizations, and regional authorities. The engagement allowed the Plan to understand the community's perceptions, priorities, and aspirations. The findings of the engagement and analysis were used to consider the major needs of the community to provide additional and new services for the region and create a transportation system that is more convenient, more comfortable, and safer. The plan developed and aimed to achieve the eight "big moves", which include:

1. Build High-Capacity Transit System
2. Expand Transit Service to Maximize Access to Jobs and Housing
3. Make All Travel Options Safer and More Secure
4. Make Short Trips Easier

5. Expand Service for Seniors, Veterans, and People with Disabilities
6. Improve Connections to Major Destinations
7. Provide Reliable Transit for Resort Corridor Employees
8. Leverage New Technology to Improve Mobility

The plan recommends 64 projects, each aligned with one or more of the "big moves." For each project, the plan provides details on expected benefits, challenges, companion strategies, and next steps to ensure effective implementation. In addition to High-Capacity Transit (HCT), the plan addresses technology improvements and the need for equitable services across the region. The plan outlines the following critical actions for moving forward:

- Developing a funding plan to support the projects
- Creating a detailed short-term implementation plan to guide initial efforts
- Advancing project development for the first HCT projects
- Incorporating recommendations into upcoming roadway projects
- Future-proofing the plan by continuously updating technology recommendations and strategies to adapt to emerging trends and innovations

By addressing the region's most pressing mobility needs and future-proofing its recommendations, the RTC On Board Mobility Plan aims to create a transportation system that is convenient, comfortable, and safer for all users [18].

A.3.4 Reimagine Boulder Highway

The April 2020 RTC Reimagine Boulder Highway: Boulder Highway Multimodal Transportation Investment Study (MTIS) identifies and analyzes potential improvements to Boulder Highway between Wagon Wheel Drive and Charleston Boulevard to promote a corridor for all transportation modes.

Engagement on the MTIS was a coordinated effort among local agency staff, a TAC, elected officials, business owners, advocacy groups, and other stakeholders with RTC and NDOT. Stakeholders and the public were actively engaged in a six-step process corresponding to phases, decision points, and outcomes. The engagement activities were:

- **Community events & transit outreach:** Direct interaction with residents to share updates and gather feedback
- **News stories:** Shared with jurisdictions and elected officials to keep them informed of developments
- **A project website:** Including background information, NDOT short-term projects, a contact form, and a direct link to an online survey
- **Email blasts:** Sent to TAC members, local jurisdictions, and stakeholders, which were then shared with the business community and neighborhoods
- **Press releases:** Sent to local transportation reporters to raise public awareness
- **Social media posts:** Used to reach a broader audience, ensuring consistent engagement with the community
- **Digital geo-targeted ads:** Aimed at specific regions to increase survey participation and inform the public

During the final phase of the public engagement, the community and stakeholders were asked to review the plan with included costs and phasing and provide general feedback. The established corridor goals include:

- Provide safe non-motorized travel
- Improve vehicle safety

- Support transit culture
- Reliable movement of people in the corridor
- Support economic redevelopment

The proposed concepts include separating modes to repurpose existing right of way. This promotes efficient safety for all modes and increases the accessibility to locations along the corridor. The concept is introducing Bus Rapid Transit (BRT) to the corridor with the flexibility to become rail, traffic calming via medians and center stations, narrower travel lanes, and an Intelligent Transportation Systems (ITS) infrastructure investment. These improvements are within the realm of transit and vehicles. The pedestrian realm incorporates pedestrian and bicycle facilities, providing additional comfort and ease of access to businesses. More crosswalks and smart lighting on the corridor will also be introduced.

The MTIS was developed as an implementation plan to continue regional coordination and includes implementation phasing, steps to be taken to implement this plan, and associated costs of implementing identified components. Access2040: the Regional Transportation Plan for Southern Nevada, Nevada's SHSP, RTC's Complete Streets Policy and Guidelines, and RTC's Southern Nevada Strong were used to gather more information on the regional projects.

The planning process consists of six steps (Figure A-13), including public engagement to understand the community's greatest concerns within the corridor, sharing a draft concept plan and gauging public approval and proposed solutions, and sharing the final concept plan including costs and phasing for public feedback. While the final plan did not change from the draft, stakeholders, property owners, and community members were asked to review the plan. MTIS also includes a toolkit for improvements for bicycle facilities, transit demand management, transit facilities, intersection types lighting facilities, and pedestrian facility detailing guides [19].

Figure A-13 - Six Steps Planning Process

Source: Adopted from [19]

A.3.5 Clark County Safe Routes to School (SRTS) Strategy

The RTC SRTS Strategy, developed in January 2017 by the Clark County School District (CCSD), is part of an international program designed to promote walking and bicycling to school safely by identifying and implementing improvements, programs, and policies. The CCSD SRTS program focuses on two key areas:

1. **Infrastructure Investments:** These include capital improvements that address gaps and safety needs in the walking and bicycling network surrounding schools.
2. **Non-Infrastructure Programs:** These initiatives are aimed at educating and encouraging children and their parents, providing enforcement of safe travel behaviors, and evaluating the success of the program.

As part of the SRTS Strategy, walk audits are conducted to identify infrastructure improvements and the jurisdiction needed to complete the improvements. The plan provided the observed common issues from the recent 15 conducted walk audits:

- School exit locations often concentrate pedestrians into a single space
- Pedestrians crossing the street away from marked crosswalk
- Congestion on local roads and minor collectors is typical where neighborhood schools enter and dismiss along only one street or on a small, local street
- Rural Neighborhood Preservation (RNPs) restrictions encourage more rural neighborhood character with undesignated space, namely no curb, gutter, sidewalk, bike lanes, or streetlights
- Double and triple parking is very common along the curb lines nearest schools
- Drivers have often been observed making illegal U-turns on roadways after picking up or dropping off students

Over 500 infrastructure recommendations from 65 walk audits are divided among Clark County, CCSD, City of Henderson, City of Las Vegas, and City of North Las Vegas to implement. By the completion of the report, 13% have been implemented. CCSD SRTS promotes bicycling and walking through campaigns and events such as Family and Community Engagement Services (FACES) and a 15- to 20-unit bike fleet. The program is also starting a data collection program that includes parent surveys and student hand tallies from participating schools. The database will generate reports, including each school's CCSD SRTS Program Annual Report and annual report cards.

Needs and Equity Analysis:
To prioritize future resources, the CCSD SRTS program conducts needs analyses to identify schools that would benefit from additional resources and programs. An equity needs analysis was also conducted to focus on schools in disadvantaged areas, particularly those with low-income students or low English proficiency. This analysis was based on the Regional Bicycle and Pedestrian Plan for Southern Nevada. Addressing these equity gaps is crucial, as underserved communities often lack continuous sidewalks and bicycle accommodations, leading to increased traffic collisions near disadvantaged school.

Program Challenges and Funding:
The report emphasizes the need for a diverse range of funding sources to sustain and expand the program. It also highlights the challenges in evaluating program success, noting a need for more robust data to assess the effectiveness of current activities. The report includes a list of potential funding opportunities that could help support the continuation and expansion of the SRTS program [20].

A.3.6 Southern Nevada Transportation Safety Plan

The RTC of Southern Nevada Transportation Safety Plan (TSP), published in August 2015, seeks to achieve zero fatalities. The TSP focuses on evaluating the cause of crashes, developing strategies, and identifying measures to eliminate fatalities and serious injuries to improve transportation safety. The recommendations from the TSP are incorporated into the RTC long-range Regional Transportation Plan.

The TSP included five primary tasks:

- Data Collection and Crash Analysis
- Selection and Categorization of Critical Emphasis Areas (CEAs)
- Development of Plan Vision, Goal, and Targets
- Identification of CEA Contributing Factors and Focus Areas

- Plan Implementation

TSP leads with a data-driven approach with several crash characteristics to provide a holistic perspective of the crashes over five years (2008-2012), which includes:

- General Analysis
  - Month
  - Day of Week
  - Hour of Day
  - Weather Factors
  - Lighting
  - Crash Type
- Driver Analysis
  - Driver Age
  - Gender
- Driver Behavior Analysis
  - Aggressive Driving
  - Distracted Driving
  - Impaired Driving
  - Lane Departure
- Person Analysis
  - Road User
- Person Behavior Analysis
  - Vehicle Occupant Restraint Use
  - Motorcycle Helmet Use
  - Child Safety Seat Use
- Roadway Characteristics Analysis
  - Number of Lanes
  - Posted Speed Limit
  - Roadway Factors
  - Work Zone
- Vehicle Analysis
  - Vehicle 1 Type

The TSP categorized the CEAs with significant engineering components as Category 1 CEAs, while all other CEAs were listed as Category 2 CEAs. As determined by the TAC, the TSP focuses on the eleven CEAs, which include:

- **Category 1 CEAs:** Crash Type Pedestrians, Bicyclists, and Road Characteristics
- **Category 2 CEAs:** Aggressive Driving, Speeding, Distracted Driving, Impaired Driving, Motorcyclists, Occupant Protection, Young Road Users, and Older Road Users

The vision, goals, and targets are based on the CEA categories, which were then used to identify CEA Contributing Factors and Focus Areas. The TSP and CEAs focus areas are implemented through two different methods. One method is for the TSP to be implemented through CEA Action Plans. The other method is through the application of safety evaluations and assessments in all aspects of the transportation project development process. The TSP also provides a toolbox of strategies, high-priority strategies, and a summary of possible funding sources that can be used to implement the TSP. The TSP provides recommended policies, projects, and studies for each Category 1 CEA. Based on the toolbox of strategies and the specific crash characteristics, a list of proven high-priority strategies for implementation was determined, as shown in Table A-1.

In the TSP, the HSM is promoted to emphasize the promotion of safety through the planning for roadway projects through the Project Safety Process (PSP), which establishes a consistent approach to quantifying the expected safety impacts of proposed transportation improvements throughout the project development process. The following considerations should be remembered throughout the PSP:

- Safety evaluations should be conducted by someone who has completed HSM training
- The PSP is based on applying the principles found within the HSM to the extent feasible
- All project evaluations should include the annual reduction in crashes and a Crash Reduction Factor (CRF)
- All safety improvement alternatives should include a BCR.

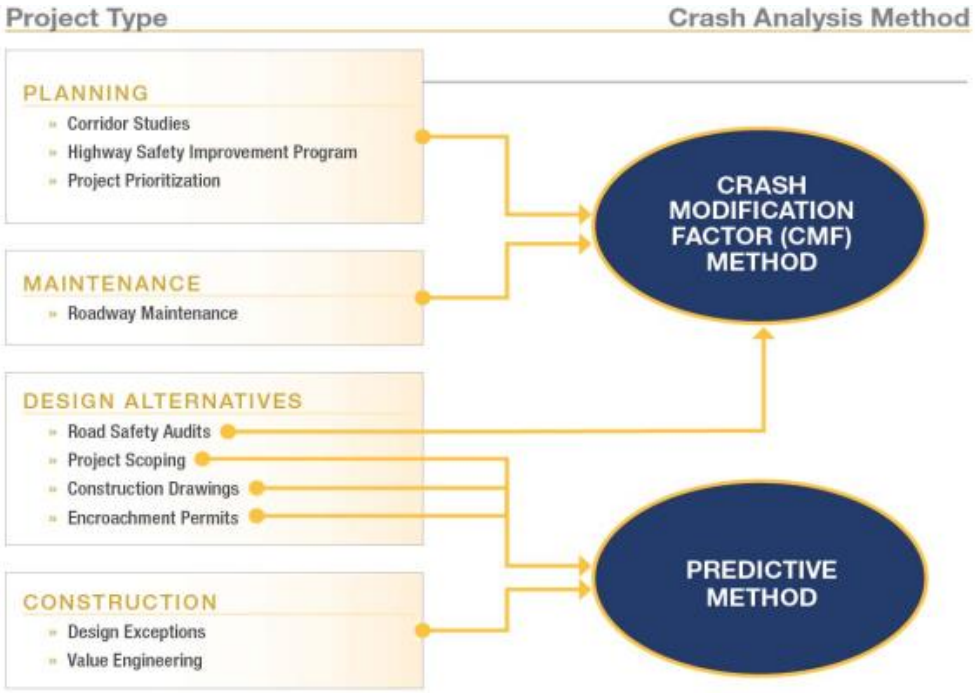
Table A-1 - Proven High-Priority Strategies for Implementation

Engineering Strategies	Enforcement Strategies	Education Strategies
▪ Construct pedestrian refuge islands and raised medians ▪ Develop and implement regional roadway, intersection, horizontal curves, and pedestrian lighting standards ▪ Implement traffic calming techniques ▪ Implement standards in the Clark County Area Access Management Guide ▪ Improve signal operations and coordination ▪ Increase use of road diets at appropriate locations ▪ Install longitudinal shoulder and centerline rumble strips and stripes ▪ Install roundabouts at appropriate locations ▪ Provide and improve left- and right-turn lanes and channelization at intersections ▪ Upgrade traffic signal backplates with retroreflective boarders ▪ Widen and/or pave shoulders	▪ Conduct well publicized DUI patrols and checkpoints ▪ Support enactment, publication, and enforcement of a graduated licensing system ▪ Support incarceration of DUI offenders ▪ Support requirement of ignition interlocks as a condition for license reinstatement ▪ Support seizure of vehicles or license plates and suspension of driver's license administratively upon arrest ▪ Support targeted enforcement	▪ Increase seatbelt use by older drivers and passengers ▪ Provide enhanced public education to population groups with lower-than-average restraint use rate

Source: Adopted from [21]

The TSP mentions the different analyses per project type, as seen in Figure A-14. The CMF Method is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site. The equation for the process is provided in the document and can be found in Part D of the HSM.

Figure A-14 - Crash Analysis Method by Project Type



Source: Adopted from [21]

The TSP also included summaries of information from the FHWA's website on transportation funding that can be used towards the implementation of this plan.

A.3.7 North Las Vegas Citywide Pedestrian & Bicycle Plan

The October 2019 North Las Vegas Citywide Pedestrian & Bicycle Plan aims to encourage and accommodate active transportation which includes walking, rolling, bicycling, or other means. The plan intends to achieve this by expanding the pedestrian and bicycle network and closing the gaps between the disjointed existing network. The plan builds on existing plans and promotes the recommended network, supports safety, health and wellness, equity, and economic growth. The equity analysis of the existing network reviews socioeconomic criteria, including seniors, youth, access to vehicles, non-white population, income, gaps, comfort, cohesion, accessibility, directness, alternatives, and safety.

Engagement was divided into two phases, focusing on opportunities and barriers (Figure A-15) and feedback on recommendations. This engagement was conducted via online surveys, interactive maps, and in-person pop-up events during community events. Safety was the main community concern and supported recommendations, especially at major street crossings.

Figure A-15 - Barries to Walking and Biking

Source: Adopted from [22]

The plan provides a recommended network, policies, programs, and implementation strategies. The recommended network focused on connection and access for All Ages and Abilities (AAA) by providing high comfort designs including physical separation from traffic or, in the case of neighborhood byways, using low-volume, low-speed streets, separated bike lanes, shared-use paths, side paths, and wide and buffered sidewalks. The intent of improving the 239 miles is to:

- Make regional connections
- Provide better access to the Upper and Lower Wash trails
- Establish better North-South connectivity
- Utilize low-volume, low-speed streets
- Ensure safe crossings at major streets and intersections

The policies and programs recommended by the plan are:

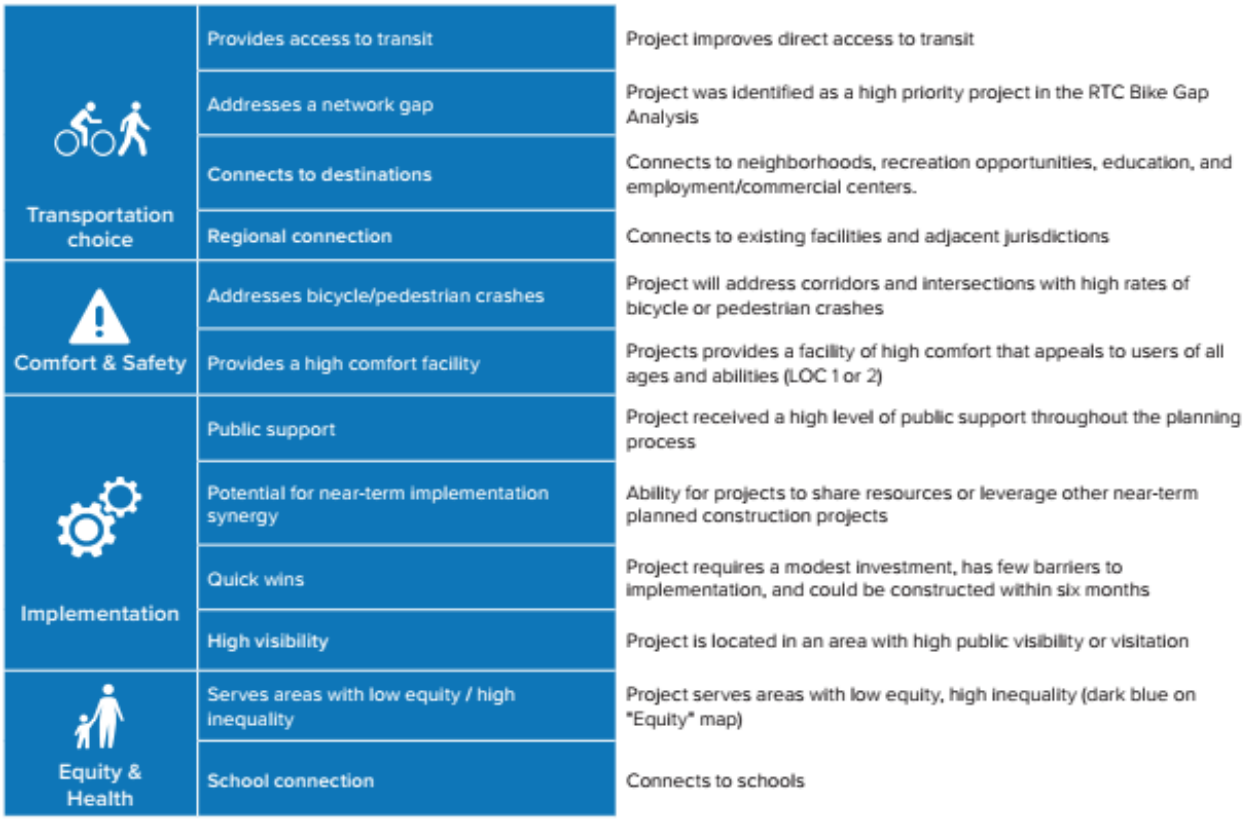
- Enhanced standards for pedestrian connectivity
  - Increased connectivity index requirement
  - Shorter maximum block length
  - Enhanced cul-de-sac standards
  - Better pedestrian access to regional trails and neighborhoods
  - Unified wayfinding and branding system
- Enhanced Complete Street standards that can be incorporated into standard street cross-sections
- Better accommodation of bicyclists with end-of-trip facilities through enhanced building code and land development standards
- Allowing bicycles on sidewalks except in areas designated as priority pedestrian zones
- Measuring the success of active transportation investments through:

- Performance tracking
- Establishing bicycle and pedestrian counting programs

- Establishing priority pedestrian zones near commercial, employment, or transit centers with heightened standards for pedestrian comfort
- Considerations for emerging mobility trends

Figure A-16 categorizes the criteria used when prioritizing recommended projects and their relative plan/goal/objective to help identify quick wins, which are described as projects that can be completed within six months of the plan adoption with minimal planning, investment, and resources [22].

Figure A-16 - Prioritized Recommended Projects

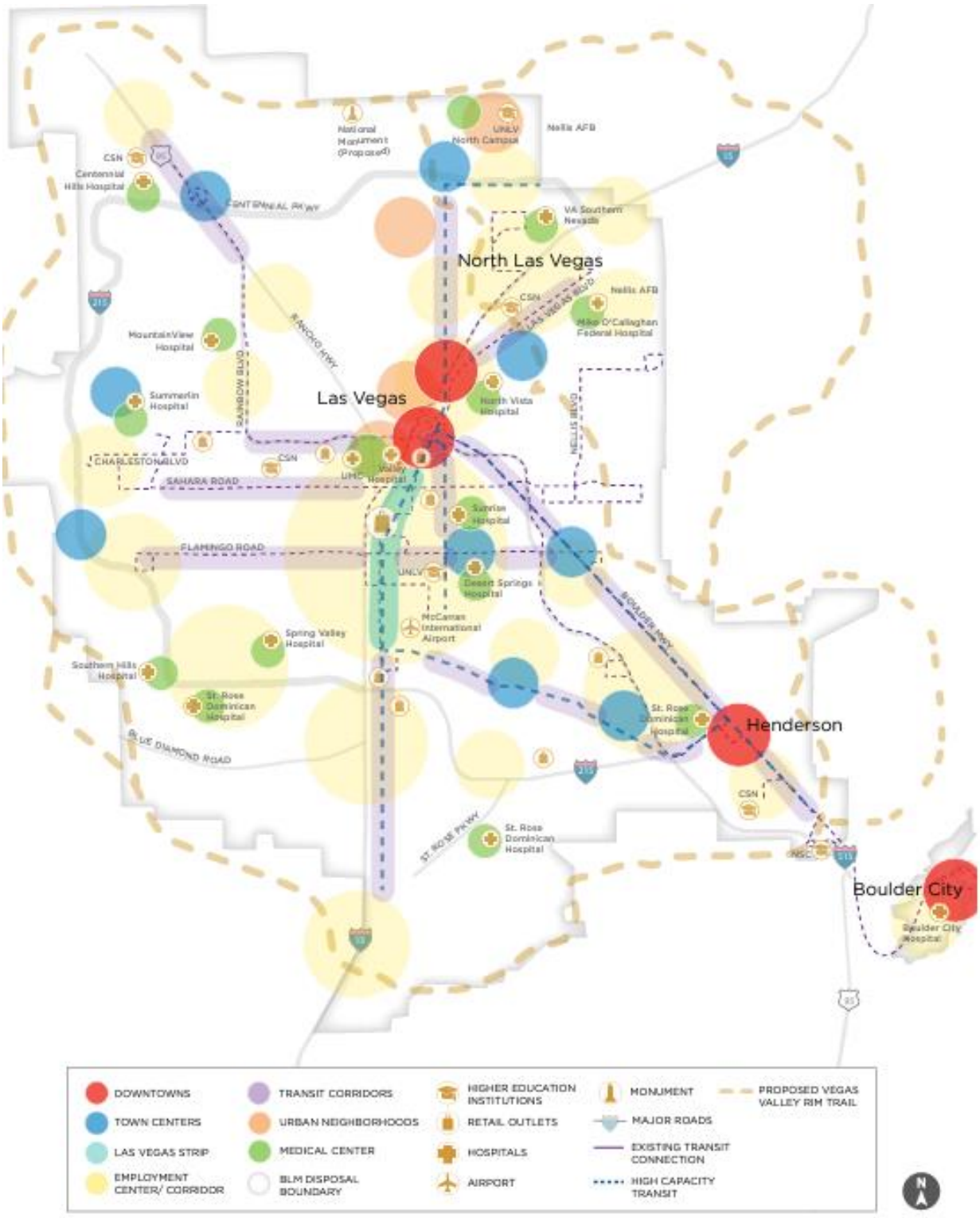


Source: Adopted from [22], *Level of Comfort (LOC)*

A.3.8 Southern Nevada Strong Regional Plan

The first iteration of the Southern Nevada Strong plan represents an unprecedented effort to develop a vision for Southern Nevada. The planning process and finalized plan emphasized the importance of shaping individuals' health and quality of life, and included a broad and extensive community outreach element. An important outcome of this plan was to develop a shared regional vision, as shown in Figure A-17.

Figure A-17 - Southern Nevada Strong Vision Map



Source: Adopted from [23]

Key elements of the vision included:

- Multiple modes of transportation are available, safe, and convenient
- Schools are located in walkable and bikeable communities
- New growth occurs in existing neighborhoods and vacant and underused sites are redeveloped
- Downtowns provide a variety of jobs and services, including housing, commercial, and employment opportunities
- Redevelopment occurs along future transit corridors
- Underutilized retail and industrial land along key corridors are repurposed, and attracts targeted industries
- More people can live close to work via consideration of jobs-housing balance

The plan is organized around the region's top three priorities, which include:

1. Improve Economic Competitiveness and Education
2. Invest in Complete Communities
3. Increase Transportation Choice

The third priority, increasing transportation choice, is the most relevant for this effort. The plan identifies a series of challenges, along with transportation-related opportunities and priorities across the region. Major themes related to the region's challenges include car dependency and associated transportation cost burdens, improved pedestrian and bicycle facilities, and roadway congestion. Opportunities identified to address these challenges include developing a modern transit system; improving pedestrian and bicycle facilities via policies, design concepts, and funding strategies; and developing a multimodal network to help relieve congestion. These opportunities and challenges were formulated into three goals:

- **Goal 1:** Develop a modern transit system that is integrated with vibrant neighborhood and employment centers, better connecting people to their destinations
- **Goal 2:** Connect and enhance bike and pedestrian facilities throughout the region
- **Goal 3:** Develop a safe, efficient road network that supports all transportation modes

The plan also identifies several priority transportation corridors, including I-11, the Bruce Woodbury 215 Beltway, Las Vegas Boulevard, Flamingo Road, and Maryland Parkway. These non-interstate corridors were chosen for their strategic role in connecting high-density residential areas with employment centers.

In addition to increasing transportation choices, the plan emphasizes the importance of improving transit accessibility and safety, with a focus on pedestrian and bicycle infrastructure. One recommendation is the implementation of RTC's Regional Schools Multimodal Transportation Access Study, which aims to improve the safety of school environments by enhancing pedestrian and bicycle facilities. The plan also addresses neighborhood safety, covering topics like crime, personal security, environmental hazards, and housing safety. While these aspects are not transportation-specific, they are essential to creating safe and resilient communities across Southern Nevada [23].

RTC is currently in the process of updating the Southern Nevada Strong plan.

A.3.9 Regional Transportation Plan: Let's Go 2050

The RTC adopted the Let's Go 2050 Regional Transportation Plan (RTP) in January 2025, replacing the Access 2050 RTP. This plan identifies federally funded and regionally significant projects that will be developed in Southern Nevada over the next 20+ years. A community survey about transportation priorities identified safety as the top transportation concern for the region. The vision for the plan is that Southern Nevada provides a world-class transportation system that offers a variety of safe, convenient, and accessible travel choices to all members of our diverse community. Goal 1 of Let's Go 2050 is safety: to provide for the safety and security of people walking, bicycling, rolling, riding transit, and using automobiles.

Safety is one of several metrics used to quantify and compare the benefits of various projects for potential inclusion in the plan. The agency used a project benefits calculator to measure potential impacts across seven key areas: safety, multimodal, congestion, infrastructure, environmental, economic, and equity. Although all benefit categories are weighted equally, safety-related metrics appear in multiple categories. Within the safety category, benefits related to crash reductions are quantified, including those involving injuries, fatalities, and Property Damage Only (PDO). Safety is also considered under the economic category using the dollar value of crashes.

The region's progress towards reaching the plan's stated goals is measured using a series of performance measures, including several safety-related measures. The safety-related measures align with federal and state requirements. These include a five-year rolling average of fatalities and serious injuries, the rate of fatalities and serious injuries per 100 million vehicle miles traveled (VMT), and the number of non-motorized fatalities and serious injuries [24].

A.3.10 Southern Nevada Regional Bicycle and Pedestrian Plan

The Regional Bicycle and Pedestrian Plan is an effort to continue building a high-quality, non-motorized network in Southern Nevada. The plan aims to create a safe, connected, and convenient walking and bicycling system that can accommodate recreational and transportation trips. The plan outlines a series of goals for achieving this vision, including:

- **Comfort and Safety:** Developing comprehensive facilities spread throughout Southern Nevada that make bicycling and walking safe, convenient, and comfortable for people of all ages and abilities
- **Access:** Improving access to community destinations across Southern Nevada through walking and bicycling, including connections to transit
- **Education and Encouragement:** Encouraging a wider range of participation, appreciation, and awareness of walking and bicycling through program efforts geared towards all ages and abilities
- **Equity and Health:** Recognizing the impact of the transportation system on air quality and community health while providing gateways of opportunity to underserved communities

Along with the four goal areas, the plan also outlines a series of recommended policies and programs using the "5 E's Framework" of Engineering, Evaluation, Education, Encouragement, and Enforcement. Recommendations were made in the following areas:

- Engineering
  - Bicycle parking
  - Bike share
  - Complete Streets

    - Street network and layout
    - SRTS
    - Wayfinding
- Evaluation
    - Bicycle and pedestrian counts
    - Street network and layout
    - Crash data evaluation
    - Funding
    - Active transportation benefits
- Education
    - Improve active transportation safety through education
    - Trip planning and wayfinding
    - Build competency and a culture of bicycling
    - Build capacity for active transportation programs
- Encouragement
    - School and workplace [25] encouragement
    - Organize events and activities
- Enforcement
    - Promote positive behaviors
    - Improve legislation to protect bicyclists and pedestrians

The plan also includes a chapter providing detailed design guidance for pedestrian and bicycle facilities, drawing from national best practices. This chapter is an excellent resource for regional plans and facility design.

The final chapter of the plan, Infrastructure and Implementation, outlines a plan for adding and/or improving “High Comfort Facilities” for walking and bicycling across the region, including separated bike lanes, buffered bike lanes, bicycle boulevards, and shared-use paths and side paths. This chapter includes a series of maps showing existing and proposed facilities of various types and summarizes proposed buildout in terms of mileage and percent of facilities considered high comfort. Recommendations are then stratified by planning area (Las Vegas, North Las Vegas, Henderson, Boulder City, and the remainder of Clark County).

This chapter also discusses the role of on-street changes in achieving a high-comfort network, such as parking removal, lane narrowing, and road diets. Finally, a methodology for scoring projects is provided. The Existing Conditions section of the plan notes the role of vehicle speed on pedestrian and bicycle crash outcomes, for example, fatalities and the severity of injuries. The top 3 obstacles or concerns noted in the plan’s outreach were safety concerns, weather, and lack of convenience. The safety concerns were often related to inadequate lighting or high traffic volumes.

Overall, plan recommendations are focused on increasing the region’s total mileage of bicycle and pedestrian facilities and improving their comfort; both of which are also likely to bring safety improvements. The plan’s evaluation and scoring system (Figure A-18) placed a relatively high weight on comfort and safety, assigning 8 out of a total of 25 points. Five of those eight points were allocated to projects that help address bicycle and pedestrian crashes [25].

Figure A-18 - The Regional Bicycle and Pedestrian Plan Scoring Methodology

	Overall Criteria Weight	Sub-Criteria	Sub-Criteria Score	Description
 Comfort & Safety	8	Addresses Bicycle/Pedestrian Crashes	5	Project will address corridors and intersections with high rates of bicycle or pedestrian crashes
		Provides a high comfort facility	3	Projects provides a facility of high comfort that appeals to users of all ages and abilities (LOC 1 or 2)
 Access	5	Provides access to transit	2	Project improves direct access to transit
		Addresses a network gap	3	Project was identified as a high priority project in the RTC Bike Gap Analysis
 Equity / Health	3	Serves areas with low equity / high inequality	2	Project serves areas with low equity, high inequality (orange or red on "Equity" map)
		Addresses populations with health issues	1	Project addresses areas with high age-adjusted death rates due to heart disease, stroke, diabetes, or certain cancers
 Regional Significance	5	Connects multiple jurisdictions with biking or walking facilities	2	Project connects multiple jurisdictions
		Connects to bike share station	1	Project improves direct access to a bike share station and provides a route for users to use
		Consistency with local and regional plans	2	Project supports recommendations from other local and regional planning efforts
 Feasibility	4	Public support	2	Project received a high level of public support throughout the planning process
		Potential for Near-Term Implementation Synergy	1	Ability for projects to share resources or leverage other near-term planned construction projects (road resurfacing, utility work from TIP, FRI-C, FRI2, etc.)
		Quick Wins	1	Project requires a modest investment, has few barriers to implementation (paint only, no roadway redesign), and could be constructed within six months

Source: Adopted from [25], *Fuel Revenue Index (FRI)*

A.3.11 Regional Walkability Plan

The April 2022 Southern Nevada Regional Walkability Plan outlined the following vision: “Southern Nevada is a place where walking and rolling are safe, convenient, and enjoyable options for people of all ages and abilities to travel for work, recreation, and other daily activities.” Nested beneath the vision statement were a series of seven goals related to pedestrians and pedestrian facilities in Southern Nevada, including:

1. Community Health
2. Safety
3. Connectivity
4. Equity
5. Sustainability
6. Education
7. Funding and Implementation

A key outcome of the plan was the identification of Priority Pedestrian Zones and Networks in each of the region’s six jurisdictions, including the City of Las Vegas, City of North Las Vegas, City of Henderson, Boulder City, Mesquite, and portions of Clark County, as shown in Figure A-19. These priority zones were identified to help focus improvements in areas with high existing or expected pedestrian activity. Note, the plan also contains zoomed-in/inset maps for each jurisdiction.

The Priority Pedestrian Network typically includes high-capacity transit, major street commercial, downtown/ main street commercial, primary connectors, and neighborhood streets. The street typologies were developed to help categorize the type of needs and potential improvements. The zones are contiguous areas, including blocks or a collection of blocks, which may overlap with portions of the network.

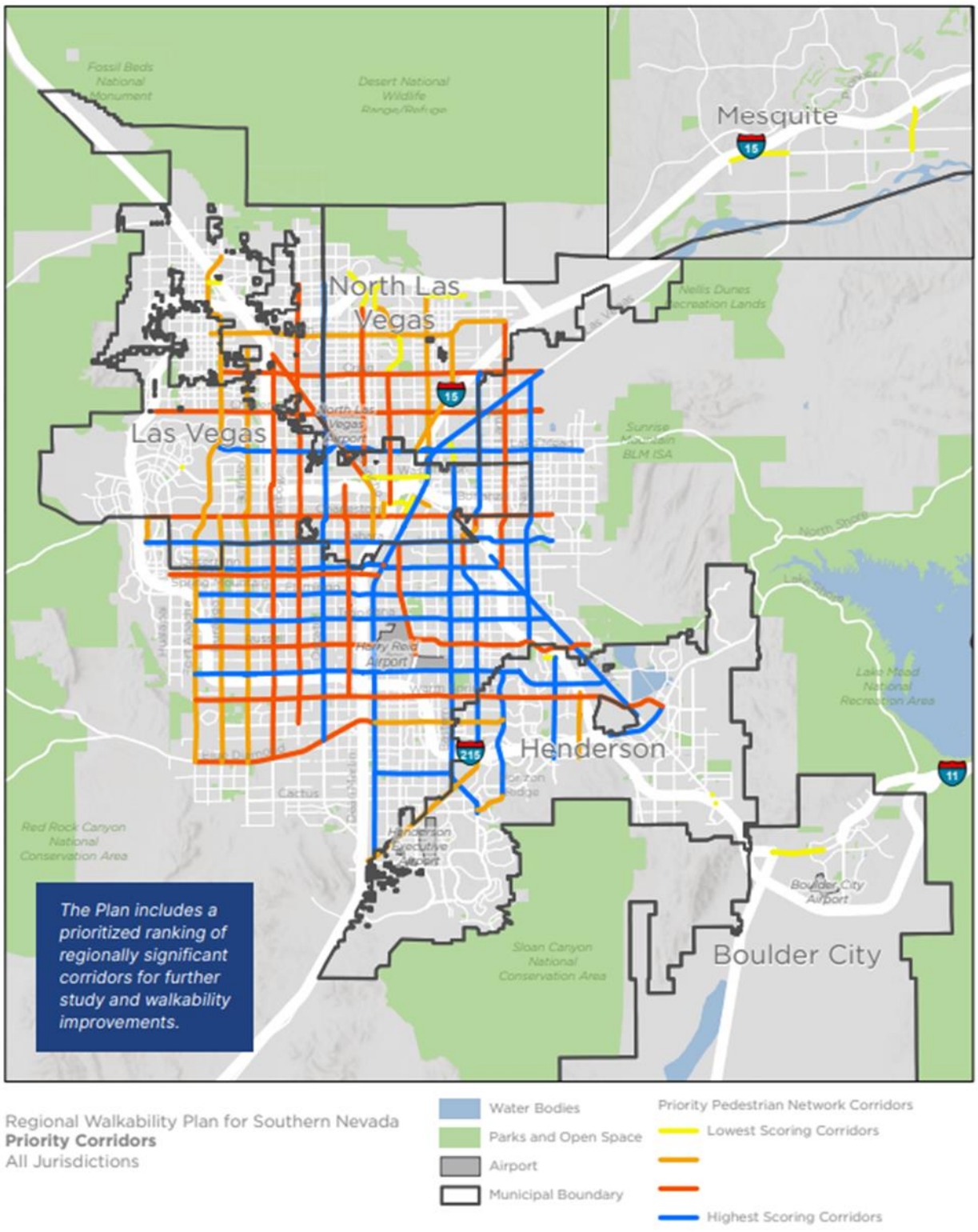
Potential improvements are depicted according to the typology and divided into amenities within the pedestrian zone, amenity zone, enhancement zone, or travel zone.

The plan also includes an improvement toolbox, which describes a series of potential treatments, applicability, and benefits. The toolbox has a section devoted to strategies, policies, programs to accompany infrastructure improvements, and concludes with a discussion of implementation considerations.

Safety is a key element of the plan’s vision and one of the seven defined goals. The safety goal is to “eliminate fatalities and severe injuries involving people walking and rolling through the addition and improvement of pedestrian-oriented infrastructure.” The plan takes an infrastructure-related approach to improving pedestrian safety. The existing conditions section highlights areas that need pedestrian safety improvements and categorizes them into top challenges and opportunities. Safety was a key theme heard during many of the study’s outreach and engagement efforts. The priority zones identified in each jurisdiction are largely areas with substantial safety concerns, and the majority of the tools in the Improvement Toolbox have been shown to improve pedestrian safety, including traffic calming, protected bicycle facilities, improved lighting, enhanced crosswalks, and right-sized travel lanes to name a few.

In summary, the plan recommends implementation of the tools in the Improvement Toolbox to improve known safety issues in the priority zones and includes a prioritized ranking of the regionally significant corridors for further study and walkability improvements [26].

Figure A-19 - Southern Nevada Regional Walkability Plan



Source: Adopted from **[26]**

A.3.12 Pedestrian Comfort Study and Demonstration Project

The RTC commissioned the 2019 Pedestrian Comfort Study and Demonstration Project to help identify innovative strategies to address the challenges of the pedestrian environment in Southern Nevada. The final report documents existing conditions, best practices/case studies, public outreach efforts, and the results of five demonstration projects.

Along with the study, the RTC also implemented a series of demonstration projects to develop, implement, and evaluate innovative ideas for improving pedestrian comfort. One demonstration project was implemented in each of the agency's jurisdictions (Boulder City, Clark County, Las Vegas, Mesquite, North Las Vegas). The demonstrations included high-visibility crosswalks, shade structures, curb extensions, buffers, sidewalk art, and pedestrian refuge islands.

The study documents the results of these five projects, including changes in sight distance, turning speed, turning radius, and yield rate, along with qualitative changes. The qualitative changes were assessed with a survey asking respondents about their level of comfort and whether they'd like to see the improvements made permanent. A focus group mobile tour was also held at each location. In some areas, the results of the general resident surveys differed substantially from the focus groups. Survey responses and reactions also varied substantially between cities. For example, in Mesquite and Boulder City, the majority of respondents indicated the temporary improvements did not make them feel more comfortable, and they would not like to see the improvements made permanent. In contrast, respondents in Las Vegas and North Las Vegas did feel more comfortable and wanted to see the improvements made permanent. Focus group participants in all areas responded favorably to the temporary improvements.

Of the treatments installed, curb extensions and high visibility crosswalks were generally well received by the community. Some residents also would like to see permanent shade structures installed, along with Rectangular Rapid Flashing Beacons (RRFB) or Pedestrian Hybrid Beacons (PHB) at pedestrian crossings. The data collected, along with resident responses, provide useful information about the potential success of these types of pedestrian treatments across southern Nevada.

Safety was a key driver of this study and series of demonstration projects, noting pedestrian safety issues are often exacerbated in underserved areas. The existing conditions section of the study included a pedestrian crash analysis which explored the impacts of speed, traffic volume, and signalized intersection density on safety outcomes. The study's findings are consistent with national research showing higher vehicle speeds result in more serious injuries and fatalities for pedestrians. In addition, locations with a higher density of unsignalized intersections were less walkable than locations with a lower density of unsignalized intersections. This is because unsignalized intersections are considered more challenging for pedestrians to cross.

Overall, the purpose of the demonstration projects was to improve pedestrian comfort and safety in the hopes of encouraging more people to walk. Each project aimed to address or mitigate known safety issues, such as inadequate lighting and high traffic volumes.

The study also includes descriptions of various treatments and how they can improve pedestrian safety, including a more detailed section outlining recommended crossing treatments at both unsignalized and signalized intersections. Unsignalized intersection treatments include raised crosswalks, marked mid-block crosswalks, RRFBs, PHBs, High-Intensity Activated Crosswalks (HAWKs), reduced corner radii, curb extensions, median refuge islands, and advance stop lines. Signalized intersection treatments include pedestrian traffic signal enhancements, left turn signal phasing, channelized right turn lanes, pedestrian scrambles, and curb extensions as shown in Figure A-20.

Figure A-20 - Clark County Demonstration Project: Katie Avenue and Cambridge Street

Source: Adopted from [27]

The study also emphasizes the importance of speed management in mitigating or preventing serious pedestrian injuries and fatalities. This can be achieved through speed management techniques, including a variety of vertical and horizontal elements. Finally, the study discusses the role of policies, development patterns, infrastructure improvements, and improving pedestrian safety [27].

A.3.13 Southern Nevada Transportation Impacts on Health Study

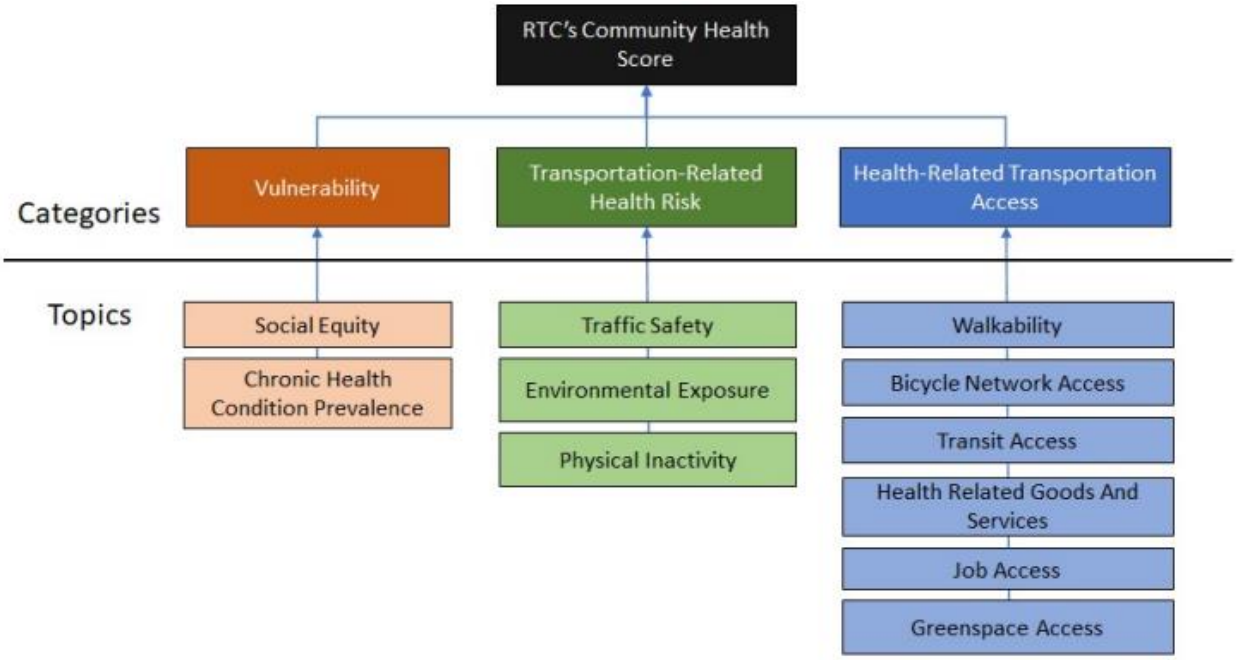
The RTC commissioned the Transportation Health Study to better understand the relationship between transportation and health-related impacts, costs, and benefits across the region. The study also:

- Estimated the costs related to these impacts
- Suggested a framework for integrating health outcomes into future RTP plans, projects, and programming
- Identified health outcomes to be tracked through performance measures
- Increased community awareness of the connection between transportation, health, and equity

The RTC Community Health Score (CHS), illustrated in Figure A-21, was created as part of this study and used local data to estimate health outcomes. The study considered three main categories of factors in developing the CHS, which include vulnerability, transportation-related health risk, and health-related transportation access:

1. **Vulnerability:** Identifying populations at higher health risks due to socioeconomic factors.
2. **Transportation-Related Health Risk:** Assessing the health risks directly associated with transportation, such as pollution exposure and access to active transportation.
3. **Health-Related Transportation Access:** Evaluating the ease of accessing healthcare and essential services via transportation.

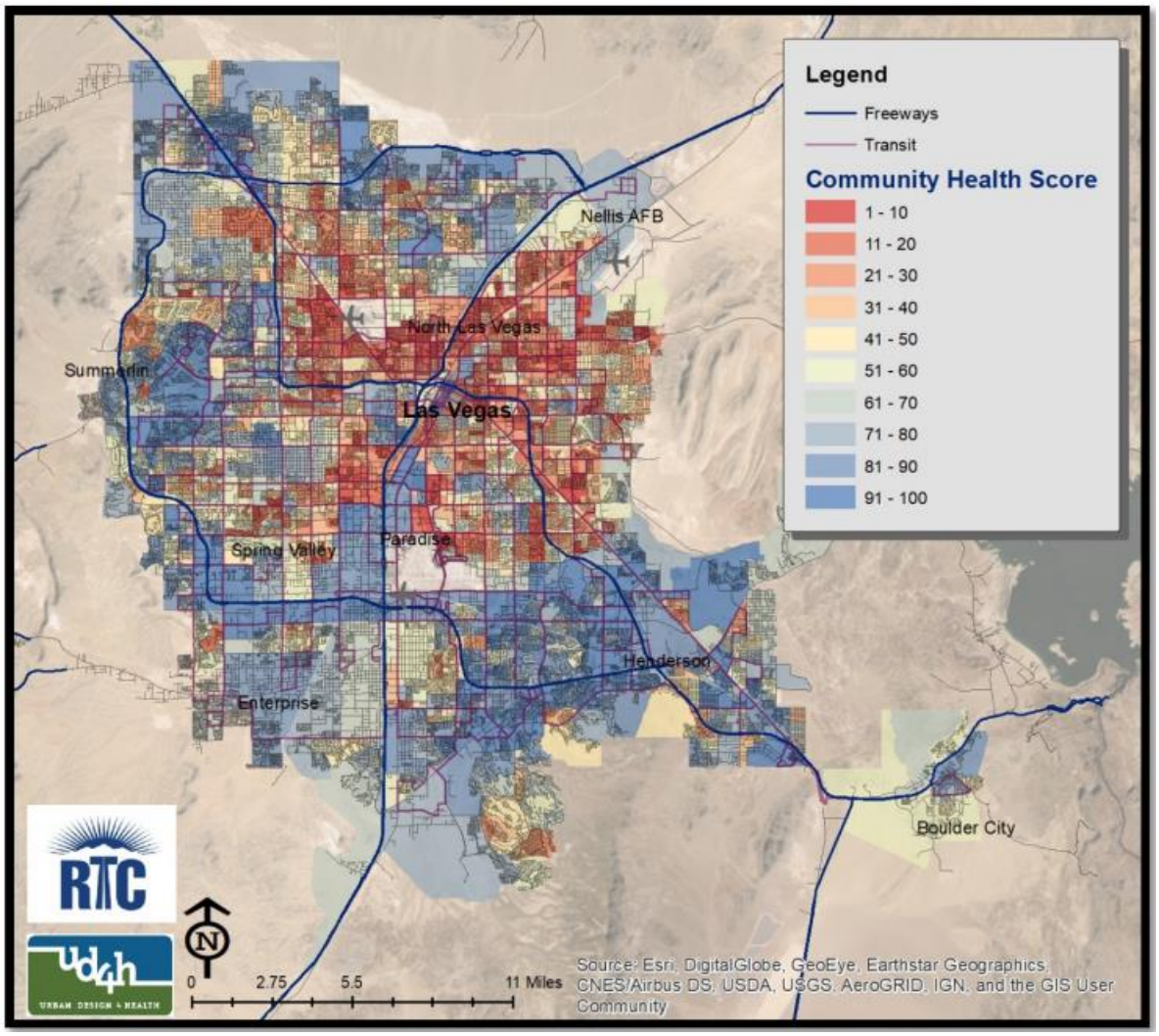
Figure A-21 - The RTC's CHS Input Data



Source: Adopted from [28]

A key outcome of the study was a set of strategies and related performance indicators to be used in the next update of the RTP. The study also produced an online CHS Map shown in Figure A-22, which is especially useful for visualizing areas of need and potential inequities. Areas with the lowest composite health score (i.e., those facing the most health challenges) are coincident with some of the areas with the lowest household incomes and highest minority populations. This map is intended to assist decision makers by integrating measures of community health with specific transportation projects. The study recommended overlaying proposed projects on the CHS map to better understand the potential benefits and/or impacts of an individual project or package of projects. This evaluation can be completed with the entire package of CHS components or using individual components.

Figure A-22 - The RTC's CHS Map (lower values indicate locations with more health vulnerability concerns)



Source: Adopted from [28]

The study team also engaged in scenario planning to explore a future with additional HCT investments, higher land use and employment density around HCT stations, and adjusted household incomes for households in the vicinity of HCT station (based on the 2020 On Board Mobility Plan). This scenario showed positive health-related impacts related to increased access to transit and more compact development.

The Transportation Health Study notes traffic safety has historically been the focus of many plans and studies, as more severe crashes lead to injuries and even fatalities. However, safety is also discussed in this study in the context of how it affects human and community health. For example, the safety of streets and sidewalks is mentioned as a concern, as unsafe walking and bicycling conditions tend to inhibit active transportation.

More practically, the study mentions the importance of including safety measures in the RTP/TIP and having a way to measure their impacts on health. “Improve Safety” is included as one of the Primary Strategies for Access 2050, along with a recommendation to add fatality/injury counts and rate (per miles traveled) for each walking and bicycling to the

existing list of fatalities and serious injuries for vehicles, and the combined non-motorized measure. Thus, the new list of indicators would read:

- Fatality Rate
- Serious Injury Rate
- Number of Fatalities
- Number of Serious Injuries
- Number of Pedestrian Fatalities/Serious Injuries
- Number of Bicycle Fatalities/Serious Injuries

A.3.14 Nevada Strategic Highway Safety Plan (SHSP)

Nevada's SHSP is a comprehensive, statewide safety plan designed to identify the leading causes of fatalities and serious injuries on Nevada's roadways. It provides a coordinated framework for reducing the crashes that lead to these outcomes, aligning efforts across state agencies and stakeholders. The SHSP sets out clear, statewide goals aimed at improving road safety and reducing the number of fatalities and serious injuries.

To achieve these goals, the SHSP adopts a multi-faceted approach, focusing on six core areas known as the 6 "Es" of traffic safety:

1. **Equity:** Ensuring traffic safety solutions benefit all communities, particularly underserved or vulnerable populations.
2. **Engineering:** Applying best practices in roadway design and infrastructure improvements to make Nevada's roads safer for all users.
3. **Education:** Raising public awareness and educating road users on safe behaviors, such as wearing seatbelts, obeying speed limits, and avoiding distracted driving.
4. **Enforcement:** Implementing targeted law enforcement strategies to address risky behaviors like speeding, impaired driving, and failure to yield.
5. **EMS/Emergency Response/Incident Management:** Improving emergency response times and ensuring first responders have the tools and training needed to quickly and effectively handle traffic incidents.
6. **Everyone:** Engaging all road users, agencies, communities, and stakeholders in efforts to improve traffic safety, recognizing achieving zero fatalities requires collective responsibility.

The SHSP sets out specific performance goals, such as reducing the number of traffic-related fatalities and serious injuries by a certain percentage over the next few years. Progress is tracked using performance metrics, which allow stakeholders to monitor the effectiveness of implemented strategies and make necessary adjustments [29].

A.3.15 Nevada Speed Management Action Plan (SMAP)

The SMAP characterizes Nevada's speed and speeding-related safety problems and speed management issues; identifies appropriate engineering, enforcement, and educational countermeasures and strategies; and outlines actions that the NDOT and partner agencies can take to implement these strategies to reduce speeding and speed-related fatal and serious injury crashes.

The SMAP is a strategic initiative that addresses Nevada's speed-related safety issues and provides a comprehensive framework for reducing speeding and speed-related fatal and serious injury crashes. The plan identifies key speeding-

related safety challenges in the state; outlines appropriate engineering, enforcement, and educational countermeasures; and details actions NDOT and partner agencies can implement to mitigate these issues.

Nevada has identified several specific speed-related safety problems, including high rates of speeding on rural highways, excessive speeds in urban areas, and a high incidence of speed-related crashes among younger drivers. The SMAP highlights these issues as major contributors to traffic fatalities and serious injuries across the state. The SMAP proposes a range of engineering, enforcement, and educational strategies to reduce speeding, including:

- **Engineering Countermeasures**
  - Implementing traffic calming measures such as road diets, speed humps, and narrower lanes in areas with high speeding rates.
  - Improving speed limit signage and ensuring speed limits are appropriately set based on road conditions and usage.
  - Introducing Dynamic Speed Display Signs (DSDS) in areas with frequent speeding incidents to encourage drivers to slow down.
- **Enforcement Strategies**
  - Increasing the use of automated speed enforcement (e.g., speed cameras) in high-risk areas.
  - Conducting targeted speed enforcement campaigns, particularly in areas identified as having a high frequency of speed-related crashes.
- **Educational Initiatives**
  - Developing public awareness campaigns focused on the dangers of speeding and the benefits of adhering to speed limits.
  - Collaborating with schools and community organizations to promote safe driving behaviors among young drivers.

The SMAP outlines specific actions for NDOT and its partner agencies to implement these strategies, including:

- **Infrastructure improvements** designed to reduce speeds, such as speed humps, roundabouts, and road narrowing projects.
- **Policy** updates to review and adjust speed limits in areas with high crash rates.
- **Enhanced collaboration** with law enforcement agencies to ensure targeted speed enforcement is consistent and well-publicized.
- **Ongoing public education campaigns** to raise awareness about the dangers of speeding and the benefits of compliance with speed limits.

The plan also emphasizes the importance of data-driven decision-making in implementing these strategies. NDOT and partner agencies are tasked with collecting and analyzing crash data to monitor the effectiveness of speed management efforts, making adjustments as needed to improve outcomes.

To track progress, the SMAP sets clear performance targets, including reducing speed-related fatalities and serious injuries by a specific percentage within a set timeframe. The plan encourages regular reporting and evaluation of these efforts, ensuring any necessary adjustments can be made to keep Nevada's roads safer for all users [30].

A.3.16 One Nevada Transportation Process

The One Nevada Transportation Plan is the state's long-range transportation planning process, which equips the NDOT and its partners with the strategic direction and essential actions to meet Nevada's current and future transportation needs.

The One Nevada Transportation Plan is built on a foundation of six critical goal areas as shown in Figure A-23. These goals encompass an array of transportation issues and opportunities and reflect the priorities of Nevada's public and transportation partners. NDOT uses a data-driven approach that incorporates statewide crash data to prioritize projects.

Figure A-23 - One Nevada Goals

Enhance Safety – Consistent with NDOT's commitment to Zero Fatalities, this goal is focused on eliminating fatalities on all public roads and for all modes of travel by building, maintaining, and operating the safest transportation system possible.

Preserve Infrastructure – The condition of our transportation system is essential to Nevada's economic vitality, visitor experience, and traveler safety. Maintaining transportation assets in a state of good repair protects our state's investments and minimizes costly improvements made too late.

Optimize Mobility – Mobility means moving people and goods more efficiently, more safely, and more reliably. Making strategic investments in improvements and technologies will enhance mobility—providing better connections and accessibility.

Transform Economies – Transportation is essential to Nevada's ability to attract and efficiently move people and support commerce. A supportive and innovative infrastructure framework increases the contribution of our transportation system to Nevada's economic competitiveness.

Foster Sustainability – Sustainability applies to both environmental and financial considerations—by designing, operating, and maintaining a transportation system using materials, technologies, and features to minimize impacts to our natural resources and reduce long-term maintenance costs

Connect Communities – This goal supports vibrant neighborhoods and connects residents to local resources and amenities. It strengthens livability and quality of life by providing better connections, greater transportation choices, and more innovative transportation services for all travelers.

The Long-Range Transportation Plan's prioritization effort aims to give value to each project on how well it aligns with NDOT's One Nevada Goal areas. This value is based on qualitative and quantitative data of how well a project addresses issues and the existing conditions. The prioritization value is weighted and compared with a weighted cost and each prioritized project is assigned a total score and rank.

Enhance Safety is currently the number one goal of the Department and carries the highest weight in this process. The ranking of projects in relation to safety is currently accomplished by analyzing crash data for severity per mile within a rural area and severity per 100M VMT within an urban area. Projects with the greatest safety need are assigned a higher rank and are prioritized for delivery by the Department.

A.3.17 NDOT Safety Management Plans (SMPs)

NDOT prioritizes the safety, connectivity, and mobility of all state roads across Nevada. As part of this mission, NDOT is implementing a series of SMPs across the state to address specific safety concerns in targeted areas. These SMPs are designed to thoroughly analyze crash data, evaluate accessibility challenges, and incorporate insights from public and stakeholder input alongside roadway engineering best practices. By addressing these factors, the SMPs aim to create safer, more efficient roadways for all users, including pedestrians, cyclists, and motorists.

Each SMP is developed through an extensive analysis of crash data, focusing on factors such as the frequency, severity, and types of crashes occurring in specific locations. This analysis helps to identify high-risk areas and understand contributing factors such as excessive speeds, impaired driving, and road design deficiencies. Additionally, NDOT evaluates accessibility challenges, such as gaps in pedestrian or cycling infrastructure, to ensure all road users can navigate safely and efficiently.

The development of these plans includes robust public engagement, allowing residents, local businesses, and community organizations to share their concerns and offer suggestions. NDOT gathers this input through a variety of methods, including public meetings, surveys, and feedback sessions. Stakeholders such as local governments, law enforcement, and advocacy groups are also involved to ensure the plans reflect a diverse range of perspectives and address the unique needs of different regions.

The SMPs align closely with the objectives set forth in the Nevada SHSP, which aims to reduce the number of crashes, fatalities, and serious injuries on Nevada's roadways. In addition to safety, the SMPs also focus on enhancing mobility and connectivity, ensuring Nevada’s transportation network is accessible and efficient for all users. These plans provide actionable strategies to improve road safety, such as redesigning high-crash intersections, installing traffic calming measures, and enhancing pedestrian and bicycle facilities. Several SMPs have been implemented or are currently in development across various regions of Nevada. For example, an SMP targeting urban pedestrian safety might focus on improving crosswalk visibility and adding pedestrian signals at high-risk intersections. In rural areas, SMPs may address issues such as high-speed crashes or wildlife-vehicle collisions by implementing measures like rumble strips or improved signage.

NDOT tracks the success of these SMPs through a series of performance metrics, which include reductions in crash rates, improvements in roadway safety infrastructure, and feedback from the community. The goal is to create measurable improvements in road safety, with a specific focus on reducing fatalities and serious injuries.

A.3.17.1 East Flamingo Road (SR 592) SMP

The study segment of East Flamingo Road, shown in Figure A-24, between Paradise Road and Pecos Road, experienced 1,014 crashes between 2016 and 2020. Nineteen of these were fatal crashes, and 20 were serious injury crashes. The study noted many of these crashes occurred at night/during dark conditions.

Figure A-24 - East Flamingo Road (SR 592) Safety Management Plan Cover

Source: Adopted from [31]

The corridor also saw a significant number of crashes involving vulnerable road users, including:

- **Pedestrian crashes:** 74
- **Bicycle crashes:** 22
- **Motorcycle crashes:** 26

Of the 19 fatal crashes, 12 involved pedestrians and 2 involved bicyclists, underscoring the critical need to improve pedestrian and bicycle infrastructure along the corridor. The SMP proposes a series of short-term, mid-term, and long-term improvements, organized by priority and feasibility.

Short-term Improvements included:

- **Retroreflective Backplates:** Installation on all traffic signal heads to enhance visibility, especially during low-light conditions.
- **Improved Streetlighting:** Upgrading streetlights with high-efficiency Light-Emitting Diode (LED) technology to improve nighttime visibility and reduce crash risks.
- **Street Markings:** Enhancements to road markings, including high-visibility crosswalks and lane markings to improve safety for pedestrians and cyclists.
- **Maintenance:** Routine roadway maintenance to ensure existing infrastructure, such as traffic signals and pavement, is functioning optimally.

Mid-term Improvements included:

- **Traffic Signal Modifications:** Adding mid-block crossings and modifying signal timings to prioritize pedestrian safety and reduce the risk of vehicle-pedestrian collisions.

- **Americans with Disabilities Act (ADA) Modifications:** Upgrading sidewalks and intersections to comply with ADA standards, ensuring accessibility for all users.
- **School Crossing Safety Enhancements:** Improving safety near schools by adding crossing guards, updated signals, and better signage.
- **Clark County Fire Department Station 18 Emergency Signal:** Installing an emergency signal to prioritize fire and emergency vehicles, enhancing response times.
- **Speed Management Strategies:** Introducing speed reduction measures, such as road diets or speed humps, to decrease speeding and improve safety for all road users.

Long-term improvements focus on redesigning the entire corridor to better accommodate different modes of transportation. Several Corridor Alternatives have been proposed, including:

- **Center-Running Transit:** Introducing dedicated bus lanes in the center of the road to reduce congestion and improve transit reliability.
- **Center-Running Transit and Bike Lanes:** Adding protected bike lanes alongside center-running transit, creating a safer environment for cyclists and transit users.
- **Three Travel Lanes:** Reducing the number of travel lanes from four to three, which would allow for additional pedestrian and bicycle infrastructure.
- **Two Travel Lanes with Bus Lanes:** Allocating one lane in each direction for general traffic, with the remaining space dedicated to bus lanes and cycling infrastructure.
- **Buffered Shared Bus/Bike Lane:** A shared lane for buses and bicycles, separated from vehicle traffic by a buffer zone to improve safety for both modes.

These alternatives are designed to address the corridor's unique challenges while improving overall safety, mobility, and connectivity for pedestrians, cyclists, transit users, and motorists [31].

A.3.17.2 East Carey Avenue SMP

The study segment of East Carey Avenue, between I-15 and N Sloan Lane, experienced 439 crashes between 2015 and 2019. Of these, 4 were fatal crashes and 17 involved serious injuries. Additionally, the corridor saw 11 pedestrian crashes and 7 bicycle-related crashes, highlighting the need for improvements to enhance pedestrian and cyclist safety.

To address the safety challenges on East Carey Avenue, a series of improvements were proposed, including:

- **Buffered Bike Lanes:** The addition of buffered bike lanes along the corridor to create a safer environment for cyclists. The buffer between the bike lane and vehicle traffic will provide additional space and protection for bicyclists, reducing the risk of collisions.
- **Widened Sidewalks:** Expanding sidewalks to accommodate a higher volume of pedestrians and improve pedestrian accessibility and comfort, particularly in areas with frequent pedestrian crashes.
- **Pedestrian Crossings with Flashers:** Installing RRFBs or similar flashing devices at key pedestrian crossings to improve visibility and encourage vehicles to stop for pedestrians.
- **Traffic Calming Measures:** Implementing a range of traffic calming strategies to reduce vehicle speeds and improve overall safety. These may include speed humps, narrower travel lanes, or chicanes to discourage speeding and promote safer driving behavior.

These improvements are designed to reduce crash frequency and severity, particularly for pedestrians and cyclists, and improve overall mobility along the corridor.

The crash rate on East Carey Avenue is significantly higher than average for similar roadways in the region, particularly for vulnerable road users such as pedestrians and cyclists. The high number of pedestrian and bicycle-related crashes underscores the need for targeted infrastructure improvements to enhance safety for non-motorized users.

These proposed improvements will be implemented in phases, with short-term actions focused on pedestrian crossing enhancements and traffic calming measures, followed by mid-term improvements like sidewalk widening and bike lane installation. Long-term solutions may include more comprehensive corridor redesigns to further enhance safety and mobility for all users [32].

A.3.17.3 East Bonanza Road SMP

The East Bonanza Road SMP focuses on enhancing safety along a critical corridor between Las Vegas Boulevard and Nellis Boulevard in Las Vegas, Nevada. The plan divides the corridor into three segments, each based on roadway width and surrounding land use, with targeted safety improvements for each section.

Segment 1: Las Vegas Boulevard to Bruce Street:

This segment will retain its current configuration with 4 travel lanes and a Two-Way Left-Turn Lane (TWLTL), maintaining the existing road design. The plan recommends adding safety enhancements, such as ADA-compliant upgrades at intersections, pedestrian refuge islands, and improved traffic signal timing. These changes are intended to reduce midblock crossing risks and improve accessibility for pedestrians with disabilities.

Segment 2: Bruce Street to Eastern Avenue:

In this segment, the plan proposes buffered bike lanes, parking lanes, and a raised median to separate opposing traffic flows and provide additional protection for cyclists. The raised median will help reduce the potential for head-on collisions, while the buffered bike lanes will create a safer environment for cyclists by providing a designated space that separates them from moving vehicles. Additional improvements include enhanced street lighting and midblock pedestrian crossings equipped with RRFBs for increased visibility and safety.

Segment 3: Eastern Avenue to Nellis Boulevard:

For this final segment, the plan proposes shared bike/bus lanes along with a raised median. The shared bike/bus lanes aim to promote efficient, multimodal travel by allowing buses and bicycles to coexist in the same lane, prioritizing transit users while still providing space for cyclists. The raised median will continue to improve safety by reducing conflicts between opposing directions of travel. In addition, this segment will benefit from access management strategies, revised right-turn channelization, and further traffic calming measures to manage speeds and reduce crash risks.

Across all segments, the plan calls for several corridor-wide improvements:

- **ADA Upgrades:** Ensuring all pedestrian crossings, sidewalks, and transit stops are fully accessible.
- **Pedestrian Refuge Islands:** Installing safe havens for pedestrians crossing wide roads.
- **Midblock Crossing Warning Devices:** Implementing RRFBs to increase driver awareness and reduce pedestrian-involved crashes.
- **Traffic Calming Measures:** Installing measures like speed humps or narrowing lanes to discourage speeding.
- **Signal and Pavement Marking Upgrades:** Upgrading signals for improved visibility and replacing or enhancing pavement markings to ensure they meet modern safety standards.

The East Bonanza Road SMP projects significant crash reductions across all segments due to the proposed safety measures. For instance, the installation of pedestrian refuge islands and RRFBs is expected to reduce pedestrian-involved crashes by approximately 20-30%, while the raised medians will contribute to a 15-25% reduction of head-on collisions.

In terms of cost-effectiveness, each proposed improvement has been evaluated using a BCR analysis. The BCRs for all recommendations exceed 1.0, indicating the benefits of the safety improvements far outweigh the costs. For example, the buffered bike lanes and raised medians in Segment 2 are expected to yield a BCR of 2.5, meaning the economic benefits are 2.5 times greater than the costs [33].

A.3.17.4 Jones Boulevard and Cheyenne Avenue SMP

The Jones Boulevard and Cheyenne Avenue SMP aims to improve safety along two key corridors in Las Vegas, Nevada: Jones Boulevard, between Smoke Ranch Road and Rancho Drive, and Cheyenne Avenue, between Torrey Pines Drive and Decatur Boulevard. These corridors were selected due to their above-average crash frequencies and rates at both corridor and intersection levels, coupled with limited pedestrian and bicycle infrastructure.

The plan identifies several high priority improvements to address the immediate safety concerns along both corridors, which include:

- **Completing Missing Sidewalk Segments:** Filling in gaps in the pedestrian network to ensure continuous sidewalks, reducing the likelihood of pedestrian crashes.
- **Improving Street Lighting:** Upgrading street lighting to improve visibility, especially at night, which is expected to reduce nighttime crashes and improve pedestrian safety.
- **Upgrading Pedestrian Crossings:** Installing high-visibility crosswalks, pedestrian refuge islands, and RRFBs at key locations to reduce pedestrian-involved crashes.
- **Signalized Intersection Improvements:** Adding features such as retroreflective backplates, new signal head placements, and enhanced signal timing to reduce the risk of collisions, especially at high-traffic intersections.

In addition to the high-priority measures, the plan outlines a series of additional improvements, including:

- **Sidewalk Widening:** Expanding sidewalks to accommodate more pedestrian traffic and improve safety by separating pedestrians from vehicle lanes.
- **Streetlight Relocation:** Adjusting the placement of streetlights to provide more even and effective illumination along the corridor.
- **Speed Management:** Implementing measures such as speed humps and narrower lanes to reduce speeding and improve overall traffic safety.
- **Dilemma Zone Detection:** Installing detection systems at intersections to help prevent vehicles from running red lights or making unsafe stopping decisions when signals change.
- **Intersection Closed-Circuit Television (CCTV) Cameras:** Installing cameras to monitor traffic behavior and provide real-time data for traffic management and safety analysis.
- **Lane Reductions and Access Management:** Reducing the number of travel lanes where feasible and implementing access management strategies, such as consolidating driveways, to reduce conflict points and improve traffic flow.

A safety performance analysis estimated the proposed improvements would reduce crashes by 66 along Jones Boulevard and 285 along Cheyenne Avenue over a 20-year period. These reductions are expected to occur across

various crash types, including pedestrian-involved and intersection-related crashes. The analysis also found all proposed improvements have positive BCRs, particularly lower-cost interventions such as retroreflective backplates and traffic signal modifications, which have some of the highest returns on investment.

The Jones Boulevard and Cheyenne Avenue SMP provides a comprehensive approach to addressing safety concerns along these two high-crash corridors. By prioritizing pedestrian infrastructure, improving lighting, and implementing traffic management strategies, the plan aims to significantly reduce crashes and enhance safety for all road users. The positive BCRs reinforce the cost-effectiveness of these improvements, making them both financially viable and impactful for reducing crashes [34].

A.3.18 Las Vegas Mini-Roundabout Test Installation

The City of Las Vegas introduced mini-roundabout test installations on Cimarron Road at Via Olivero Avenue, O'Bannon Drive, and El Parque Avenue. These installations included speed cushions and additional pavement markings with oversized signs at some intersections. Data was collected for each intersection before and after its installation, which was used to report the changes in speed and traffic volume findings to the community, shown in Table A-2.

Table A-2 - Speed and Volume Pre/Post-Installation

Improvement		Pavement Markings/Oversized Signs		Mini-Roundabouts	Speed Cushions	
Data Collection Location		Cimarron Rd	Buffalo Dr	Cimarron Rd	O'Bannon Dr	Via Olivero Rd
85th %ile Speed	Pre-Installation	40	46	42	48	40
	Post-Installation	42	47	37	43	34
	% Difference	6%	1%	-13%	-10%	-16%
Average Speed	Pre-Installation	35	42	36	36	34
	Post-Installation	36	40	31	32	25
	% Difference	3%	-4%	-14%	-11%	-28%
Volumes	Pre-Installation	6,594	21,640	5,497	529	489
	Post-Installation	5,497	24,710	3,966	319	472
	% Difference	-17%	14%	-28%	-40%	-3%

Source: Adopted from [35]

The data indicated that mini-roundabouts and speed cushions were generally more effective at reducing speeds and traffic volumes compared to larger signs and pavement markings. For example, intersection speeds decreased by 13% with mini-roundabouts and up to 16% with speed cushions, while intersections with larger signs and pavement markings showed only slight changes, with speeds even increasing by 1% in one location and up to 6% in another. In terms of traffic volumes, reductions were observed at all locations with mini-roundabouts and speed cushions, particularly along Cimarron Road, where volumes dropped by as much as 28%. However, some locations experienced increased traffic, as seen along Buffalo Drive, where volumes rose by 14%, possibly due to drivers rerouting or preferring different routes post-installation.

Feedback from the community and City maintenance staff was mixed. While some residents appreciated the speed reduction benefits of the mini-roundabouts, others expressed concerns about navigating the roundabouts and their

impact on traffic flow. Similarly, the City's maintenance staff noted mini-roundabouts required more upkeep compared to traditional intersections, particularly in terms of maintaining signage and pavement markings [35].

A.4 Federal/National Guidance and Tools

Federal guidance and tools were reviewed to incorporate their recommendations into the action plan, as well as other national best practices, which include:

- National Roadway Safety Strategy
- FHWA Vision Zero Toolkit
- FHWA Safe System Roadway Design Hierarchy
- Model Inventory of Roadway Elements (MIRE)
- Crash Modification Factors (CMF) Clearinghouse
- FHWA Proven Safety Countermeasures
- Safe System Alignment Framework (Project-Based and Policy-Based)
- National Public Transportation Safety Plan
- AASHTO Guide for the Development of Bicycle Facilities, 5th Edition
- School Zone Speed Study in Nevada
- National Association of City Transportation Officials (NACTO) City Limits: Setting Safe Speed Limits on Urban Streets
- NACTO Don't Give Up at the Intersection
- NACTO and the Global Designing Cities Initiative Designing Streets for Kids
- National Transportation Safety Board (NTSB) Reducing Speeding-Related Crashes Involving Passenger Vehicles

A.4.1 National Roadway Safety Strategy

The National Roadway Safety Strategy (NRSS) is a comprehensive plan initiated by the United States Department of Transportation (USDOT) aimed at significantly reducing traffic fatalities and serious injuries on the nation's roadways. It serves as a key component of the USDOT's broader goal to reach zero roadway deaths, often referred to as "Vision Zero." The NRSS outlines a multi-faceted approach that includes safe road design, vehicle safety technologies, enhanced data collection and analysis, and increased public awareness. It emphasizes a "Safe System" approach, which seeks to create redundancies in road safety measures, so if one safety layer fails, others will protect road users. The NRSS also calls for increased collaboration between federal, state, local, and tribal governments, as well as private sector and non-profit organizations, to achieve its ambitious safety goals.

A.4.2 FHWA Vision Zero Toolkit

The FHWA Vision Zero Toolkit is a resource developed by the FHWA to support communities in adopting and implementing Vision Zero strategies aimed at eliminating traffic fatalities and serious injuries. The toolkit provides guidance on a data-driven approach to traffic safety, emphasizing the integration of Safe System principles. It offers best practices, case studies, policy recommendations, and tools to help agencies at various levels (local, regional, and state) implement Vision Zero effectively. The toolkit also highlights the importance of collaboration among stakeholders, including transportation agencies, law enforcement, public health officials, and the community, to create safer road environments for all users.

The toolkit is organized into four sections, representing different phases of a successful Vision Zero initiative:

- Section 1 describes how to build support for Vision Zero and establish a team of partners to lead the work.
- Section 2 focuses on the Vision Zero Action Plan, a key element of any Vision Zero initiative.
- Section 3 outlines actions and considerations that may be useful when implementing your Vision Zero Action Plan, emphasizing the importance and complexity of meaningful and equitable community engagement.
- Section 4 offers ways to deepen your engagement in and understanding of Vision Zero, including a list of resources that may help guide you.

The guide is designed to be flexible, allowing users to skip to sections that best meet their needs and support their Vision Zero journey.

A.4.3 FHWA Safe System Roadway Design Hierarchy

The FHWA Safe System Roadway Design Hierarchy is a tool developed by the FHWA to help transportation agencies prioritize safety countermeasures in alignment with the Safe System Approach. The hierarchy consists of four tiers, arranged from most to least effective in eliminating traffic-related fatalities and serious injuries:

- **Remove Severe Conflicts**: Eliminating high-risk conditions by separating road users moving at different speeds or directions.
- **Reduce Vehicle Speeds**: Implementing design features and speed management strategies to lower vehicle speeds and reduce kinetic energy in potential crashes.
- **Manage Conflicts in Time**: Using traffic control devices to separate users in time when they must occupy the same space.
- **Increase Attentiveness and Awareness**: Alerting road users to potential conflicts so they can take appropriate action.

The hierarchy emphasizes physical changes to the system are more effective than relying on road users to make safe decisions. It supports multiple elements of the Safe System Approach. The document also mentions how this hierarchy aligns with Complete Streets and FHWA's Proven Safety Countermeasures and provides examples of countermeasures for each tier. The ultimate goal is to achieve zero deaths and serious injuries on the nation's roadways [36].

A.4.4 Model Inventory of Roadway Elements (MIRE)

The MIRE is a comprehensive database framework developed by the FHWA to improve roadway safety analysis and decision-making. MIRE provides a standardized set of roadway and traffic data elements that can be collected and maintained to support various safety analysis tools and methods.

A.4.5 Crash Modification Factors (CMF) Clearinghouse

The CMF Clearinghouse is a comprehensive online resource that provides information about the effectiveness of various road safety measures. It offers a database of CMFs: numerical values used to estimate the expected change in crash frequency after implementing a specific road safety treatment or countermeasure. For example, an intersection that is a candidate for a traffic signal installation is expected to experience 5.2 total crashes for the year. After installing a traffic signal with a CMF of 0.56, the expected total crashes would be 2.9 crashes per year (5.2 x 0.56=2.9). CMFs

can also be represented as a Crash Reduction Factor, representing the factor as a percentage decrease in crashes instead (100 x (1-CMF)=CRF). Common uses of CMFs/CRFs include identifying how to capture the greatest safety gain with limited funds, identifying cost-effective strategies and locations, comparing safety outcomes across different alternatives and locations, checking the reasonableness of new evaluations against existing CMFs, and checking the validity of assumptions in cost-benefit analyses. The Clearinghouse also allows users to search for CMFs based on various criteria including road type, crash type, and specific countermeasures. Each CMF in the database is associated with a quality rating ranging from 1-5 stars, helping users determine the reliability of the data. The CMF Clearinghouse is a valuable tool for transportation engineers, planners, and safety professionals to identify effective strategies for reducing crashes and improving road safety.

A.4.6 FHWA Proven Safety Countermeasures

The FHWA Proven Safety Countermeasures are a set of strategies and tools identified by the FHWA that have been proven through research and real-world application to effectively reduce serious injuries and fatalities on the nation's roadways. These countermeasures are intended to guide transportation professionals and decision-makers in implementing safety improvements that are both effective and cost-efficient. The proven safety countermeasures include:

- **Speed Management:**
  - Appropriate Speed Limits for All Road Users
  - Speed Safety Cameras
  - Variable Speed Limits
- **Pedestrian/Bicyclist:**
  - Bicycle Lanes
  - Crosswalk Visibility Enhancements
  - Leading Pedestrian Interval
  - Medians and Pedestrian Refuge Islands in Urban and Suburban Areas
  - Pedestrian Hybrid Beacons
  - RRFB
  - Road Diets (Roadway Reconfiguration)
  - Walkways
- **Roadway Departure:**
  - Enhanced Delineation for Horizontal Curves
  - Longitudinal Rumble Strips and Stripes on Two-Lane Roads
  - Median Barriers
  - Roadside Design Improvements at Curves
  - SafetyEdge℠
  - Wider Edge Lines
- **Intersections:**
  - Backplates with Retroreflective Borders
  - Corridor Access Management
  - Dedicated Left- and Right-Turn Lanes at Intersections
  - Reduced Left-Turn Conflict Intersections

- Roundabouts
- Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections
- Yellow Change Intervals

- **Crosscutting:**
  - Lighting
  - Local Road Safety Plans
  - Pavement Friction Management
  - Road Safety Audit

A.4.7 Safe System Alignment Framework (Project-Based and Policy-Based)

The FHWA has developed two robust frameworks designed to measure and enhance alignment with the Safe System Approach, a strategy focused on creating safer roadways by addressing all elements of the transportation system. These frameworks provide a structured methodology to assess both specific projects and broader policies, ensuring safety considerations, including equity, are thoroughly integrated into decision-making processes.

A.4.7.1 Project-Based Alignment Framework

The Safe System Project-Based Alignment Framework is specifically designed to evaluate roadway locations and potential improvements through the lens of the Safe System Approach. This framework allows for a detailed comparison of alternatives for specific locations, helping to determine which options offer the greatest safety benefits. It includes a quantitative scoring matrix that evaluates key elements such as Safe Roads and Safe Speeds, considering factors like Crash Exposure, Crash Likelihood, and Crash Severity for both vulnerable road users and motor vehicle occupants. Additionally, it incorporates qualitative safety prompts to capture other Safe System Approach elements—Safe Road Users, Safe Vehicles, Post-Crash Care—as well as equity considerations. This comprehensive approach ensures all relevant factors are considered when assessing existing conditions and evaluating project alternatives, ultimately guiding decision-makers toward the best solutions.

A.4.7.2 Policy-Based Alignment Framework

The Safe System Policy-Based Alignment Framework provides a tool for assessing policies, plans, processes, programs, and documents through the Safe System lens. It is built around core principles such as the unacceptability of deaths and serious injuries, human fallibility and vulnerability, shared responsibility, proactive safety measures, redundancy, and equity. This framework allows agencies to benchmark and track progress in aligning their practices with Safe System Approach principles, identify gaps in existing policies, and generate strategies to improve alignment. The assessment process can be undertaken individually or as a group and follows a five-phase adoption process: initiation, development, execution, evaluation, and integration. This structured approach not only raises awareness of Safe System Approach -related practices and strategies but also drives meaningful changes in agency business practices, fostering a safer and more equitable transportation system [36].

A.4.8 National Public Transportation Safety Plan

The National Public Transportation Safety Plan, updated in April 2024, outlines the Federal Transit Administration's (FTA) strategic approach to managing safety risks in the nation's public transportation systems. This plan builds on the

previous 2017 version and aligns with new requirements from the Bipartisan Infrastructure Law (Infrastructure Investment and Jobs Act). The key components of the Plan are:

- **Safety as a Top Priority:** The plan reinforces the USDOT's goal of zero transportation-related fatalities and serious injuries. It highlights the adoption of Safety Management Systems (SMS) to enhance safety across public transportation modes.
- **Safety Performance Criteria:** The plan introduces safety performance measures and targets that must be adhered to by agencies subject to the Public Transportation Agency Safety Plan (PTASP) regulation. It emphasizes a performance-based approach to reduce injuries and fatalities.
- **Voluntary Minimum Safety Standards:** The plan includes voluntary minimum safety standards and recommended practices for transit systems, addressing various aspects like transit worker safety, pedestrian and bicyclist safety, rail grade crossing safety, and bus transit safety. The plan also covers precautionary and reactive actions necessary to ensure public and personnel safety during emergencies, developed in consultation with the Secretary of Health and Human Services.

A.4.9 AASHTO Guide for the Development of Bicycle Facilities, 5th Edition

The AASHTO Guide for the Development of Bicycle Fatalities, 5th Edition is a resource developed by AASHTO to provide guiding information on the planning, design, and operation of bikeways along streets, roads, and highways in addition to independent paths. Recommendations on providing supportive bicycle facilities and recommendations for the maintenance of bicycle facilities are also included in this guide. The guide is intended to supplement local and state guidance, providing information to assist the bicycle facility designer in choosing the features, design, and materials for the project.

While the guide focuses on the physical infrastructure to support and develop bicycle facilities, it highlights the importance of education, encouragement, evaluation, and enforcement programs to support participation in a community's overall bicycle program and evaluate the effectiveness of engineering countermeasures.

A.4.10 School Zone Speed Study in Nevada

School Zone Speed Study in Nevada is a study completed by the University of Nevada, Reno in partnership with the Nevada Department of Public Safety, Office of Traffic Safety to assess speed compliance and the distribution of vehicle speeds in school zones across Nevada, and review school zone speed management strategies. After analyzing 15 school zones in both Southern and Northern Nevada, the analysis showed that 34% of drivers adhered to the posted speed limits and 85% of drivers across all sites traveled at speeds exceeding the reduced speed limit during school zone speed control. To address this issue, the study recommends engineering, enforcement, and education (the "Three E's). This can include but is not limited to improved engineering through physical infrastructure, automated enforcement through Speed Safety Cameras (SSCs), and education to teach bicyclists, pedestrians, and drivers safe practices. Each method can improve school zone safety, however the study underscores that SSCs are recognized as the five-star method among the FHWA's proven safety countermeasures.

A.4.11 National Association of City Transportation Officials (NACTO) City Limits: Setting Safe Speed Limits on Urban Streets

The NACTO City Limits: Setting Safe Speed Limits on Urban Streets document was developed by NACTO, in partnership with a working group of major United States cities, to provide guidance on how to set speed limits on urban streets. Utilizing a Safe Systems approach to reduce traffic fatalities and injuries, the document offers alternative guidance to highway-focused federal recommendations, outlining ways for engineers and planners to set the limit at the speed that will create the best, safest conditions for all road users. This document focuses on three tools for setting speed limits on urban streets:

- Setting default speed limits on many streets at once.
- Designating slow zones in sensitive areas.
- Setting corridor speed limits on high-priority major streets using a Safe Speed Study.

The three tools, used individually or in combination, are designed to provide flexible ways to create safe conditions for cities nationwide regardless of their authority to set speed limits.

A.4.12 NACTO Don’t Give Up at the Intersection

Don’t Give Up at the Intersection was developed to expand on NACTO’s Urban Bikeway Design Guide by outlining intersection design treatments to reduce vehicle-bike and vehicle-pedestrian conflicts. It outlines tools to reduce turning speeds, increase the visibility of people bicycling, and give priority at intersections to people bicycling. Protected intersections, dedicated intersections, and minor street crossings are a few design strategies the guide highlights to help cities create comprehensive, connected, and safe bike networks.

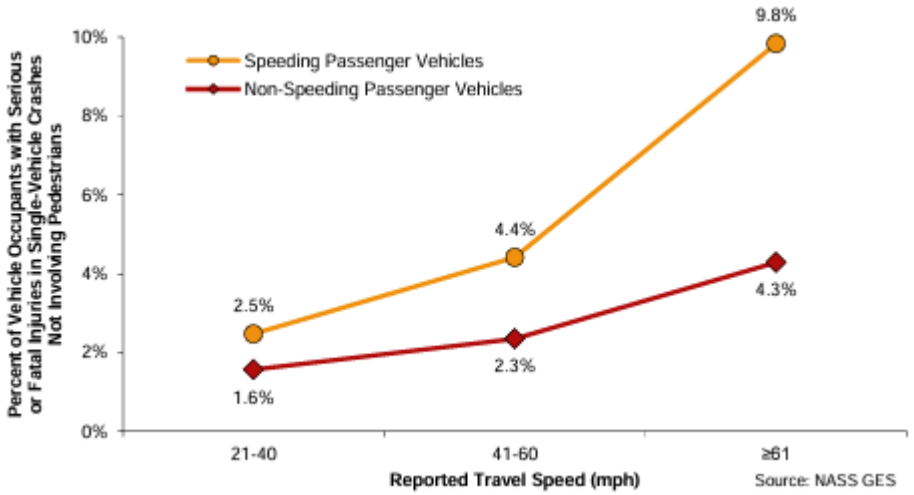
A.4.13 NACTO and the Global Designing Cities Initiative Designing Streets for Kids

Designing Streets for Kids is a supplemental guide that builds upon the people-first approach outlined in NACTO and the Global Designing Cities Initiative’s Global Street Design Guide (GSDG), while providing a particular focus on the specific needs of children and their caregivers as pedestrians, cyclists, and transit users in urban streets around the world. The recommended solutions center around making streets safe and healthy, comfortable and convenient, inspirational and educational to better serve everyone. As outlined in the guide, the fundamental goals and outcomes of designing child-friendly streets should be improved and independent mobility, as well as quality public space.

A.4.14 National Transportation Safety Board (NTSB) Reducing Speeding-Related Crashes Involving Passenger Vehicles

The NTSB conducted a study on reducing speeding-related crashes to summarize the risks of speeding and focus on countermeasures addressing passenger vehicle driver behavior. Utilizing quantitative and qualitative methods including interviews with national, state, and local traffic safety stakeholders, the study found speed and speeding increase the likelihood of being involved in a crash and the severity of injuries sustained by all road users in a crash. This correlation is illustrated in Figure A-25.

Figure A-25 - Percent of Vehicle Occupants with Serious or Fatal Injuries by Reported Speed



Source: Adopted from [37]

To facilitate speed reductions, the study recommends systems such as USLIMITS2 and the Safe System Approach as alternative methods to the 85th percentile method to change speed limits in speed zones. The study did not find strong evidence that the 85th percentile speed equated to the speed with the lowest crash involvement rate and can unintentionally lead to higher operating speeds. Systems such as USLIMITS2 allow staff to incorporate crash statistics and other factors in addition to the 85th percentile speed, helping set speeds at levels that consider the vulnerability of all road users. The study also found automated speed enforcement can effectively reduce speeding-related crashes, fatalities, and injuries, and recommends the authorization of their use in states across the country.

A.5 Implementation of Safety-Related Policies

To effectively implement safety-related policies, the RTC should establish a robust project selection process that ensures full integration with the Performance-Based Benefit Calculator and the RTP project selection framework. This process should be designed to evaluate and prioritize projects based on both short- and long-term safety needs within local jurisdictions while aligning with broader regional safety goals.

The project selection criteria should also include a comprehensive evaluation of the potential risks and consequences of not implementing proposed safety improvements. This analysis should consider how the absence of these improvements might hinder progress toward achieving regional safety targets, such as reducing crash rates or serious injuries. For example, failing to install critical pedestrian safety infrastructure could increase the risk of pedestrian-related crashes in high-traffic areas, delaying progress toward regional safety objectives.

A critical component of this process is assessing the financial feasibility of proposed projects. By analyzing available funding sources, the RTC can ensure resources are allocated efficiently, and selected projects remain sustainable over time. Incorporating funding availability assessments into the project selection process will help prevent delays in implementation and maximize the impact of safety improvements.

By integrating these considerations into the project selection process, the RTC can ensure that safety initiatives are prioritized strategically. This approach supports both immediate safety needs and future requirements, aligning with the overarching goal of reducing traffic fatalities and serious injuries across the region.

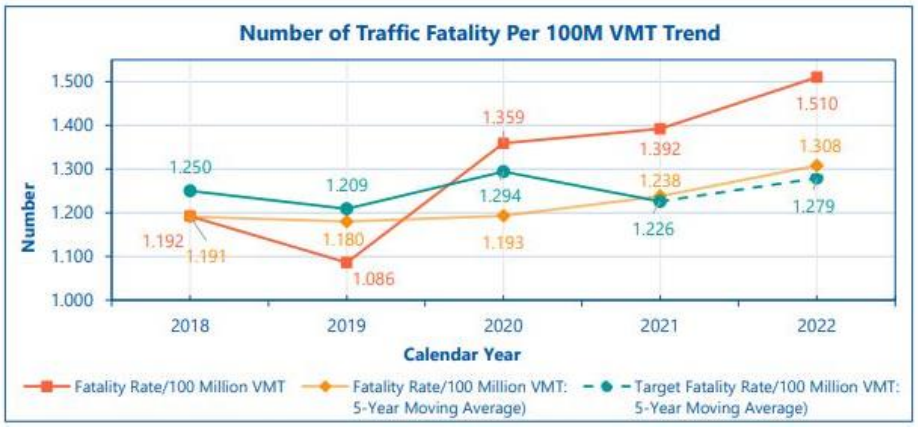
A.6 Crash Statistics

Crashes are collected by local police departments and compiled nationally by NHTSA. NHTSA publishes a variety of data and statistics related to road safety such as pedestrian safety and bicyclist safety. In 2022, NHTSA reported the following statistics [38]:

- A pedestrian was killed every 70 minutes in traffic crashes.
  - There were 7,522 pedestrian fatalities, and more than 67,000 pedestrian injuries nationwide.
- There were 1,105 bicyclist fatalities.

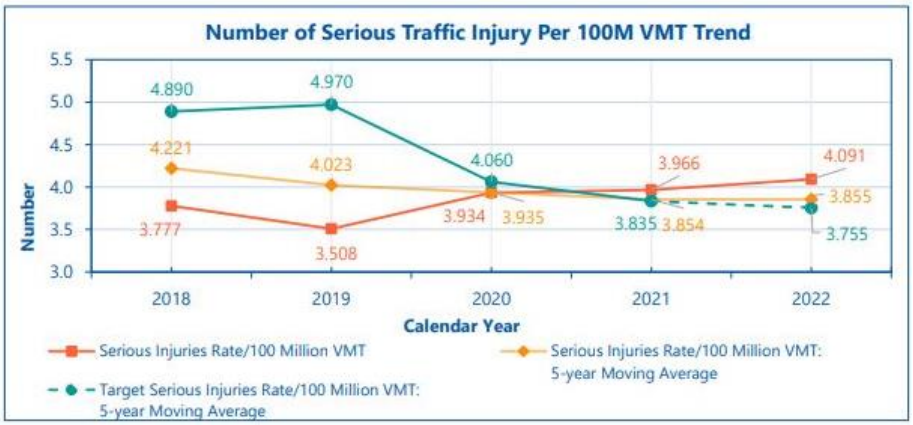
Statistical trends are also reviewed in Vision Zero plans and as a part of traffic safety reviews. In Nevada, from 2018 to 2022, the number of fatalities per 100M VMT, illustrated in Figure A-26, and the number of serious injuries per 100M VMT, illustrated in Figure A-27, has been on an increasing trend since 2019. The number of non-motorized fatalities and serious injuries per 100M VMT has been increasing since 2020, illustrated in Figure A-28.

Figure A-26 - Nevada Number of Traffic Fatalities Per 100M VMT Trend 2018 - 2022



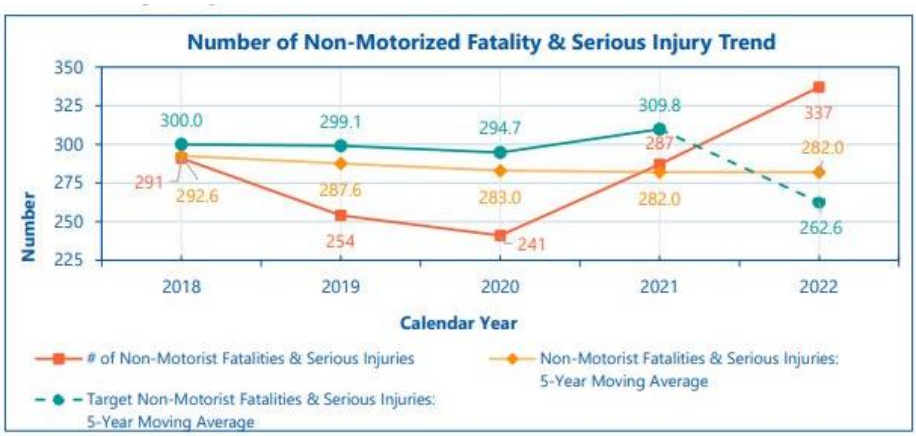
Source: Adopted from [23]

Figure A-27 - Nevada Number of Serious Injuries Per 100M VMT Trend 2018 - 2022



Source: Adopted from [23]

Figure A-28 - Nevada Number of Non-Motorized Fatality and Serious Injury Trend 2018 - 2022



Source: Adopted from [23]

There is also an emphasis on reviewing the data from different perspectives to understand the needs and opportunities of a community. Most Vision Zero plans review the statistics by severity, location, time of day, and cause to determine the main areas with the deadliest rates, low cost, and time for improvements. NHTSA's three major behavioral focus areas are speeding involvement, alcohol-impaired driving, and restraint use (seatbelt or child restraint). These factors are analyzed to see the need for policing enforcement and a culture shift on safety, which can be seen in some Vision Zero plans. The main reviewed factor is speed involvement due to the increased severity of crashes for both parties, especially pedestrians and bicyclists. The SMAP was solely created to combat speed issues within Nevada due to the impact speed has on pedestrian and non-motorized road users, as summarized in Figure A-29.

Figure A-29 - Speed and Impact on Pedestrians

Source: Adopted from [24]

Socioeconomic demographics also contribute to the statistical story of the crash data. To expand the characteristics profile of the crashes, socioeconomic demographics, such as age, sex, income, and race, must be reviewed with the intention of equitable practices and considerations. In addition, the Environmental Justice Screening and Mapping Tool (EJScreen) could be used to review historically disadvantaged communities, considering the socioeconomic demographic over time [39].

A.7 Strategies for Pedestrians and Bicycles

Pedestrian and bicyclist protection is essential to increasing safety and promoting alternative transportation modes. Vision Zero plans incorporate safety strategies for these forms of transportation, including vertical barriers separating bike lanes, high visibility markings on the transportation network, low-cost treatments to improve roadway safety, No Turn on Red, No U-Turns in School Zones, using cameras as an enforcement technique at intersections, and more. In coordination with the five E's of Vision Zero (engineering, education, encouragement, evaluation, and enforcement), these strategies are used to create a holistic approach to the mitigation of non-motorist interaction with vehicles. However, there are additional strategies that explain policy and coordination, including:

- Temporary demonstrations projects of improvements
- Incorporation of information on cyclist and pedestrian safety into driver education courses
- Programs to teach safe walking and biking practices, particularly for children and new cyclists
- Campaigns to educate drivers about sharing the road safely with cyclists and pedestrians

Some examples of supportive projects and strategies mentioned in the reviewed documentation are:

- Establish a process to conduct regular bicycle and pedestrian counts and identify count locations [5].
- Incorporation of pedestrian and bicyclist protection in local and regional jurisdiction plans [5].
- Pedestrian countdown timer, modify signal phasing (implement a leading pedestrian interval), implement systemic signing and visibility improvements at signalized intersection, and install curb ramps [2].

- Promotion of land use changes for walkable street design [6].

The November 2023 NDOT Vulnerable Road User (VRU) Safety Assessment emphasizes the need for equity within the review of traffic safety, in addition to listing strategies and programs to reduce VRUs' high-risk areas. The report also acknowledges the need for engineering judgement and human behavior changes, such as patience at crosswalks, obeying traffic laws, and being visible to vehicles. Strategies and programs to reduce VRUs high-risk areas include [40]:

- Installing sidewalks, bike lanes, and traffic calming measures. Sidewalks and bike lanes provide a dedicated space for VRUs to travel.
- Traffic calming measures can help slow down traffic and make it safer for VRUs to cross the street.
- Protected bike lanes are separated from traffic by a physical barrier, such as a curb or a barrier made of plastic or metal bollards. This helps to protect cyclists from traffic and make them more visible to other road users.
- Low speed zones are areas where the speed limit is reduced to 20 mph or less. This helps slow down traffic and make it safer for VRUs to cross the street or walk along the side of the road.
- Shared space is a type of road design that eliminates traditional traffic controls, such as stop signs and traffic lights. This forces drivers and VRUs to share the road and be more aware of each other.
- Raising awareness of the dangers faced by VRUs.
- Education programs can teach VRUs about the importance of following the rules of the road and being aware of their surroundings.

A.8 Real Societal Cost

The cost of a crash is more than the person involved in the crash and the possible contribution of the person. It is a calculation of the total losses, which includes the tangible costs: medical costs, lost productivity, legal and court costs, emergency service costs, insurance administration costs, congestion costs, property damage, and workplace losses***;*** and the intangible costs such as the physical pain and emotional suffering of people injured in crashes and their families, which is known as Quality-Adjusted Life Years (QALY). Together, these costs create a comprehensive cost per crash which is mainly conducted at the national level.

One of the earliest sources for the real societal cost of motor vehicle crashes and fatalities is the HSM Crash Cost Estimates, which is based on the 2005 Crash Cost Estimates by Maximum Police-Reported Injury within Selected Crash Geometries. The estimates are updated based on inflation and economic changes such as income and wage growth. Table A-3 shows the crash cost assumption being used by NDOT, which is the HSM Crash Cost Estimates updated to 2022 costs using the U.S. Bureau of Labor Statistics Consumer Price Index data. The latest recommended monetized value is shown in Table A-4 [41].

Table A-3 - Crash Cost Assumptions

Crash Severity	Crash Cost per Event
Fatal (K)	$7,337,676
Suspected Serious (A)	$386,649
Suspected Minor (B)	$141,190
Possibly/Claimed (C)	$79,313
PDO (O)	$12,763

Source: Adopted from [41]

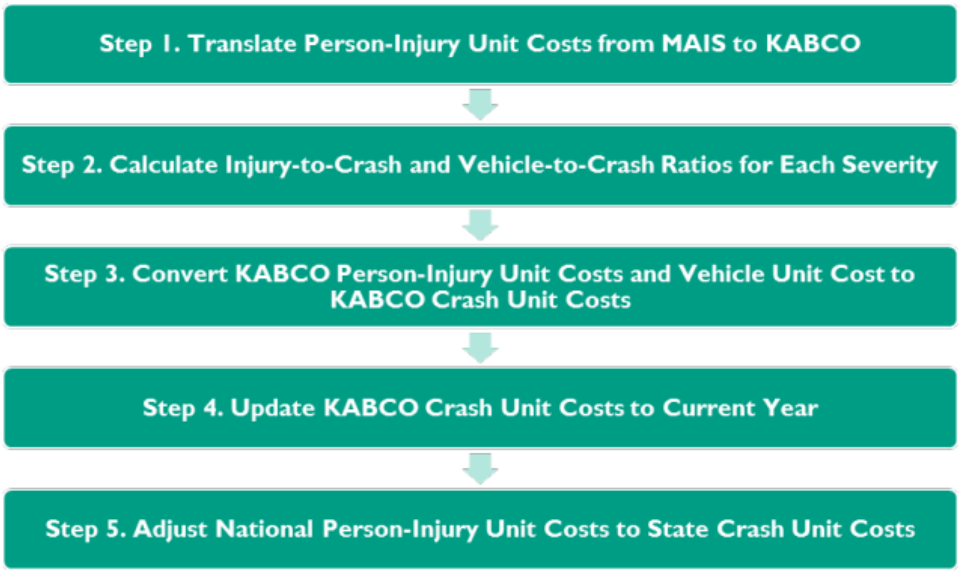
Table A-4 - Recommended Monetized Value(s)

KABCO	Monetized Value (2022$)
O – No Injury	$4,000
C – Possible Injury	$78,500
B – Non-incapacitating	$153,700
A – Incapacitating	$564,300
K – Killed	$11,800,000
U – Injured (Severity Unknown)	$21,900
# Accidents Reported (Unknown if Injured)	$162,600

Source: Adopted from [41]

Adjusting the national crash cost to reflect state-specific cost and injury levels is recommended when possible. This is due to the difference in cost of living, income, and medical costs, and better distribution of the factors necessary to develop the cost estimates. The Crash Costs for Highway Safety Analysis provides steps to develop national KABCO crash unit costs and the State-specific adjustment shown in Figure A-30.

Figure A-30 - Process to convert National Crashes Cost to State Level



Source: Adopted from [41], *Maximum Abbreviated Injury Scale (MAIS)*

In 2019, the estimated economic cost for crashes in Nevada was $2.6 million. Statistics like these, which focus on the annual economic costs, are used to compare the amount to the amount needed for roadway improvements, including safety. For instance, Austin's Vision Zero Plan states Austin annually quantifies the cost of injury and fatal crashes to Austin residents as over half a billion dollars, relating the cost to the cost of 800 miles of new sidewalks (35% of total missing miles) or 7,000 new pedestrian hybrid beacons. The statement and document convey the prevention of crashes could lead to the financial cost being utilized to support needed safety and VRU facilities, such as bicycle lanes, sidewalks, additional traffic signals, and more. The cost of crashes is not only to the existing population and road users but also to the future of society.

A.9 Academic Studies

Two academic studies that demonstrate best practices and tools to reduce crashes, injuries, and fatalities throughout the transportation network were reviewed to identify any new trends, including:

- Worldwide Approach to Vision Zero: Implementing Road Safety Strategies to Eliminate Traffic-Related Fatalities
- Nevada Department of Transportation Report No. 744-18-803 Proof-of-Concept Research of Roadside LiDAR Sensing Multimodal Traffic

A.9.1 Worldwide Approach to Vision Zero: Implementing Road Safety Strategies to Eliminate Traffic-Related Fatalities

The Worldwide Approach to Vision Zero: Implementing Road Safety Strategies to Eliminate Traffic-Related Fatalities explains Vision Zero strategies need to be complemented with government commitment; reduction or control of speed, design, and safety features included in the process; as well as the development of safety culture. The central ideas of Vision Zero include:

- Traffic injuries are preventable, not accidental.
- Experts from all sectors, including road users, share responsibility for road safety.
- Transportation systems should be designed and accommodating to common road user's errors to prevent death or serious injury.
- Humans should not be subjected to kinetic forces that can fatally harm or seriously injure.
- Traffic safety is a social equity issue.
- Assistance from high-income to low-income countries should adjust for local conditions and needs.
- Prevention strategies should take into consideration local practices and knowledge, not just professional guidelines.

Vision Zero originated in Sweden, developed by a multidisciplinary team focusing on public health and injury prevention. The Safe System Approach, a key part of Vision Zero, was later adopted in countries like Australia and New Zealand (2003), based on four core principles:

1. Human Performance Limitations
    - Challenges in navigating intersections
    - Difficulties with overtaking vehicles
    - Staying within lanes under various conditions
    - The effects of driver fatigue
2. Human Tolerance to Violent Forces
    - Vehicles should be designed to protect passengers from common crash types
    - Road design should respect the biomechanical limits of vulnerable road users
3. Safe Road Use
    - Road safety is a shared responsibility
    - Road users must comply with speed limits, avoid impairment, and use proper restraints
4. Creating a Forgiving Road Transport System
    - Roads should be designed to anticipate human errors and mitigate the effects of crashes by adhering to physical laws and creating buffers to protect users

In terms of traffic strategies, New York's approach focuses on pedestrian safety and signal timing adjustments, using tools like Leading Pedestrian Intervals (LPIs) and protected intersections. These strategies are designed to give vulnerable users priority and create safer crossings, as shown in Figure A-31 [42].

Figure A-31 - New York pedestrian and traffic signal strategies

NYC signal strategies	Mode of action	Benefit
Leading Pedestrian Interval (LPI)	Signal to walk given 6–10 s prior to parallel movement of traffic	Pedestrians cross free from conflict with turning vehicles and establish presence in crosswalk
Barnes Dance	Pedestrians allowed to cross in any direction while all traffic is stopped	Crossings are free from conflict, but only phase pedestrians are allowed to cross
Split Phase	Signal to walk given while vehicles are prevented to turn thru crosswalk; dedicated turn lanes required	Crossings are free from conflict, and turning movement proceeds better
Split Pedestrian Crossings	Signal to walk allows pedestrians to walk across service road and then wait on the median and complete crossing when traffic in the main roadway is stopped	Eliminates the need to cross long distances in one interval
Recessed Crosswalks	The crosswalk is moved (recessed) 60 to 80 ft. Pedestrian separators are erected. A separate signal coordinates with intersection signal	Motorists can turn free from conflict, and pedestrians cross at the recessed crosswalk free from turning vehicles
Arterial Timing Patterns	Adjusting signal cycle lengths based on overall traffic flow patterns	Can provide more time for long pedestrian crossings or reduce the time need to wait for the signal to walk
Accessible Pedestrian Signals	Provide audible messages to walk or wait	Informs and assists the visually impaired
Leading Bus Interval	Installed for traffic operational needs and available intersection geometry	Can reduce traffic and adjust for mass transit needs
Split LPI	The key difference between Split LPI and LPI is that turning traffic is held, but parallel traffic is released concurrent with pedestrians	More efficient than an LPI but requires turning lane

Source: Adopted from [42]

A.9.2 NDOT Report No. 744-18-803 Proof-of-Concept Research of Roadside LiDAR Sensing Multimodal Traffic

University of Nevada, Reno conducted a study around using Light Detection and Ranging (LiDAR) sensors for roadside analysis. The findings were included in the NDOT Report No. 744-18-803 Proof-of-Concept Research of Roadside LiDAR Sensing Multimodal Traffic in May 2022.

A LiDAR instrument consists of a laser, a scanner, and a specialized Global Positioning System (GPS) receiver. LiDAR can scan objects in 3-dimensional (3D) space and report their locations accurately under different illumination conditions. LiDAR sensors are being proposed to gather data on roadway conditions.

Research and field testing of roadside LiDAR at University of Reno (UNR) has demonstrated roadside LiDAR, components illustrated in Figure A-32, is an effective solution for sensing the movements of all road users for both permanent deployment and short-term data collection. This technology can assist with collecting and assessing large amounts of data related to corridors, intersections, and improvement evaluations.

Figure A-32 - Hardware components of a roadside LiDAR sensing deployment

Equipment	Quantity	Description
VLP-32c 32-Channel LiDAR	1	32-channel LiDAR, provide 360-degree LiDAR cloud points to cover the whole intersection and extend sensing distance along Boulder Hwy.
New Dell Rugged Latitude 5420 Laptop	1	8th Gen Intel® Core™ i7-8650U Processor (Quad Core, 8M Cache, 1.9GHz,15W, vPro); 32G DDR4 Memory; 256G solid state hard drive; work temperature range is –20°F to 145°F
External Hard Drive	3	WD 4TB Black My Passport Portable External Hard Drive
Network Switch	1	D-Link 5 Port Gigabit Unmanaged Metal Desktop Switch (DGS-105)
LTE Wireless Connection Device	1	For remote monitoring of the system status, hard drive usage and real-time system alert to the UNR team's email box.
Temperature Data Logger	1	
Electrical Enclosure	1	29*24*12 inch, Type 3R Enclosure, Steel, Weather flo with Fan

Source: Adopted from [43]

Specifically for this project, the roadside LiDAR Sensing device used was a 360-degree LiDAR. The device was chosen because it is easy to install and move with high resolution and accuracy of spatial measurements and function in any light conditions. LiDAR has the ability to count and record multimodal movements such as vehicle turns, near misses, crashes, parking, queue length, speed, pedestrian crossings, micromobility counts, and more.

Users of this process need to understand the details of installation, maintenance, the influence of different weather conditions, and how to use the all-traffic trajectory data in engineering tasks, decision-making, and data analysis. The user must also determine the best method to classify the data into categories, which can be conducted in various ways. The project used a feature-based offline classification method combined with historical trajectory information to classify roadway users. This approach allowed the 3D scans to be understood as particular silhouettes. The AdaBoost and RUSBoost methods were recommended for classifying imbalanced datasets. Examples of different road user clusters can be seen in Figure A-33.

Figure A-33 - Examples of different road user clusters collected by 32-laser roadside LiDAR

Source: Adopted from [43]

LiDAR-based trajectory data is similar to video-based data already used in various roadway data analyses. Table A-5 shows general recommendations for other analysts to refer to when choosing which type to use.

Table A-5 - LiDAR-based and Vision-based trajectory data

	LiDAR-based	Vision-based	Comments
Device Cost		•	Cameras are currently much cheaper than LiDAR
Installation and maintenance accessibility	•	•	Installation takes about 30 minutes
Data storage	•		Video needs much more storage space for same time period than LiDAR since for one intersection at least 4 cameras are needed
Detection Range	•		Lidar shows longer detection range
Daytime Vehicle Volume	•	•	Both sensors show good daytime vehicle counting capability
Nighttime Vehicle Volume	•		Cameras may miss some vehicles at night
Daytime Pedestrian Volume	•	•	Both sensors show good daytime pedestrian counting performance
Nighttime Pedestrian Volume	•		The camera barely recognizes pedestrians at night
Vehicle Speed	•	•	Both sensors generate decent vehicle speed information
Pedestrian Speed	•		LiDAR shows brilliant speed detection for relatively small objects such as pedestrians/bicyclist

Source: Adopted from [43]

A.10 Best Practices

The reviewed documents mention several best practices and considerations for Vision Zero and safety action plans. The following are some best practices that should be considered in developing the RTC Safe Streets for All Southern Nevada Action Plan.

A.10.1 Task 1: Project Management and Coordination

Project Management was not prominently discussed in Vision Zero actions. Normally, project management of planning documents is focused on incorporating new information from the government body into the project, such as in the recommendations and limitations. Best practices for project management and coordination include reoccurring project meetings for the project team and continued coordination via email to ensure the project is on-time and following the project's vision. Some planning and construction projects also have major check-point meetings to discuss the project's success and direction. These meetings are part of the recurring meetings that take extra time and are specifically focused on elements that have changed from the beginning of the project, such as the report layout, overall vision, and political limitations.

A.10.2 Task 2: Literature Review

A key component to all planning documents, such as Vision Zero and safety action plans, is the Literature Review because the process focuses on understanding how the type of plan was conducted and successful in other places. There was not much mention of the literature review within the reviewed documents. However, a literature review is typically conducted by reviewing similar plans from cities, counties, regions, or countries that have been successful and comprehensive, and it includes elements similar to the reviewing entity seeking information on and recognized in the industry. Conclusions drawn from the review should help lead the plan's vision and process.

A.10.3 Task 3: Stakeholder and Community Engagement

Engagement is incorporated in reviewing the final draft of the Vision Zero and safety action plans, contributing to and brainstorming priorities and community needs, and considering existing and future plans, policies, and projects. A best practice is establishing a committee with community and jurisdiction staff to collaborate on community needs and develop project prioritization. Conduction of a survey on the draft to have a broad range of comments on the action plan projects is also common. There is a large emphasis on conducting a campaign or community meetings around a cultural shift to traffic safety as a community priority to support initiatives, change behaviors, and inform vulnerable communities.

A.10.4 Task 4: Pop-Up Temporary/Pilot Demonstration Projects

Temporary/Pilot Demonstration Projects are characterized by their short-term, flexible nature, allowing communities to test safety interventions on a temporary basis before committing to permanent changes. These projects typically involve the quick installation of materials like cones, paint, or temporary barriers to simulate potential roadway modifications, such as pedestrian crossings, bike lanes, or traffic calming measures. In 2023, the USDOT awarded 385 Safe Streets and Roads for All grants, including 48 Implementation Grants and 337 grants for planning and demonstration projects. USDOT describes these demonstration projects as "quick-build strategies to test out safety features such as separated bicycle lanes or curb extensions at intersections."

Several key considerations are essential for planning and executing demonstration projects. The materials used should be durable yet easily removable to minimize disruption. Clear communication with the public is crucial for informing them about the project's purpose and duration and for gathering feedback. Early engagement with local stakeholders ensures alignment with community needs. It's also important to consider the impact on emergency response and accessibility, avoiding disruptions to emergency vehicles or vulnerable populations. Lastly, a thorough before-and-after analysis, incorporating both quantitative data and community feedback, is vital to assess the project's effectiveness.

A.10.5 Task 5: Data Collection and Analysis

Data collection and analysis are major components of the Vision Zero and safety action plans reviewed. Data collection was usually relative to the start of the project's conception and focused on the areas of interest, such as roadway crashes by time, with a deep dive into the causes, locations, and conditions. Some documents, such as Las Vegas's CICMP, reviewed the city's intersections with the highest number of crashes and crash rates, focusing on the most vulnerable users, such as vehicle-pedestrian and vehicle-bicycle-involved crashes. Other elements that affect roadway utilization and design like land use, are incorporated into the analysis, such as in Austin, TX. The data should be reviewed thoroughly to ensure the information is accurate.

A.10.6 Task 6: Expedite and Enhance Regional Crash Data Collection and Reporting

DRCDC, along with its Regional Crash Data Inventory and Needs Assessment process, offers a strong model for the Southern Nevada region to follow in identifying crash data needs. The comprehensive approach used by DRCOG demonstrates how a well-structured stakeholder engagement process can effectively gather and compile the necessary data. This process could be highly beneficial for the RTC of Southern Nevada, providing a roadmap to assess regional crash data needs, engage with stakeholders, and develop targeted strategies to address identified challenges.

Another example of enhanced data collection and collaboration process is the Southern California Association of Governments' (SCAG) Regional Data Platform (RDP). The SCAG RDP is an advanced system designed to enhance collaborative data sharing and planning across the region. It provides local jurisdictions with access to modern tools, standardized datasets, and best practices to support more informed and effective planning. The RDP aligns with SCAG's Connect SoCal 2024 Regional Transportation Plan and Sustainable Communities Strategy, aiming to streamline data exchange and foster collaboration among planners and Geographic Information System (GIS) professionals throughout Southern California.

Further, the Regional Transportation Safety Information Management System (RTSIMS) tool developed by the MAG in Arizona is another example for a regional crash data inventory platform. Funded by the Arizona Department of Transportation (ADOT) and influenced by local agency feedback, RTSIMS allows users to perform both macro- and micro-level crash data analyses. The tool offers two main query options: Standard Reports for basic queries and Custom Reports for more complex analyses. RTSIMS also provides features like report generation, data export, and network screening for intersection safety assessments. The system relies on historical crash data from the ADOT Accident Location Identification Surveillance System (ALISS) database, covering the years 1999 through 2015, and is updated annually. Technical support and a user guide are available to assist users.

To expedite and improve regional crash data collection and reporting in Southern Nevada, the RTC could potentially consider implementing these strategies inspired by the aforementioned examples and initiatives:

1. **Collaborative Data Sharing:** The DRCDC exemplifies a successful multi-stakeholder approach. Leveraging resources from over 100 stakeholders, including local, state, and federal entities, this collaboration improves data accuracy and timeliness. Building such a consortium in the region could significantly enhance crash data quality and integration.
2. **Standardization Across Jurisdictions:** Adopt a standardized data format and reporting criteria across all SCAG RDP efforts.
3. **Enhanced Data Quality:** Invest in technologies that improve the accuracy and timeliness of crash data entry, such as automated reporting tools or mobile apps for first responders.
4. **Real-Time and Historical Data Integration:** Combining real-time data systems like Bay Area Vision Zero (BayVIZ) with historical databases, as seen in RTSIMS, allows for comprehensive analysis. This dual approach can improve traffic safety by providing both immediate insights and long-term trends.
5. **Advanced Data Platforms and Specialized Analysis Tools:** The integration of platforms like SCAG's RDP's, the Bay Area's Vision Zero BayViz, and tools like the MAG's RTSIMS underscores the importance of both standardized datasets and advanced analysis capabilities. These tools allow for real-time data visualization, detailed crash analysis, and customizable reporting, which together can significantly improve regional collaboration, data consistency, and transportation safety planning. Regions should consider adopting similar systems to streamline data collection, enhance safety analysis, and support informed decision-making.

6. **Public Access and Transparency:** Develop public-facing dashboards, which allow stakeholders and the public to view and interact with crash data, fostering accountability and community engagement.

Most Vision Zero and safety action plans are data-driven and collect data from various sources but, the most common is the local and state crash data aiming for the most recent data available at the start of the data analysis. The identification of the high serious injury and fatality corridors was a common step that can be conducted differently, such as looking in segments of a specific mile with a specific number of crashes or to focus on a specific number of the top intersections. The selection is based on the regions specific issues which can be determined by the type of crashes, causes of crashes, and involved road users. The determination of the key type of pattern changes needed is the first step. Then, the area and types of area with the most incidences of the cause of the pattern is identified. This can be achieved with a HIN.

A.10.7 Task 7: Update RTC's Policies and Procedures

In terms of policies and procedures, Vision Zero and safety action plans aim to imbed traffic safety within the polices and procedures focusing on supporting countermeasures for identified corridors and projects. These can be but are not limited to:

- Incorporate land use development policies
- Support legislative efforts related to setting and enforcing speed limits
- Develop a policy for mobility devices and new emerging alternative modes and technologies
- Incorporate identified areas for projects in funding searches

A.10.8 Task 8: Prioritize Capital Projects

Prioritization of the identified projects is subject to various considerations. The most common prioritization is to incorporate equity, whether that is the consideration of vulnerable populations (minorities, most affected age group, low-income), vulnerable roadway user crashes (pedestrian, bicyclist, motorcyclist), or proximity to points of interest that generate a lot of traffic. Engagement efforts may lead to the prioritization of capital projects. However, the main guide has been the timeframe, funding, and impact of some projects incorporating cost-benefit analysis. The best approach to prioritization is determined during each project based on its visions, goals, and actions.

A.10.9 Task 9: Implementation

The goals or objectives are identified to summarize the Vision Zero or safety action plan. These are used to guide the actions and initiatives for the implementation. These actions usually include policies and initiatives, FHWA Proven Safety Countermeasures, partnerships, funding sources, education campaigns, and training for staff and partners.

A.10.10 Task 10: Final Report/Deliverables

The final deliverables of Vision Zero and safety action plans should emphasize transparency and accessibility, ensuring all stakeholders—both public and private—can easily engage with the safety initiatives. To ensure comprehensive communication, public reporting should include clear and concise summaries of progress, challenges, and outcomes. These updates should be delivered through multiple channels, including online platforms, social media, community meetings, and printed materials, to reach a wide audience. The final deliverables should include:

- **Detailed documentation** of the plan’s strategies, goals, and metrics.

- **Actionable roadmap** for implementation and evaluation, ensuring the plan moves forward efficiently.
- **Visual reports, performance dashboards, and user-friendly summaries** that make the information accessible to non-experts.

Incorporating feedback mechanisms is essential. These mechanisms can include online surveys, community workshops, and interactive dashboards, allowing residents to provide input and track the impact of safety initiatives. By ensuring these deliverables are comprehensive, easy to understand, and widely accessible, the RTC can foster trust and community buy-in. This, in turn, will support the collaborative effort needed to achieve the Vision Zero goal of zero traffic fatalities and serious injuries.

To ensure continuous engagement and accountability, it is recommended to establish a dedicated team or task force to manage public outreach, feedback collection, and reporting. This will help ensure the community remains actively involved throughout the plan's implementation and evaluation phases.

A.10.11 Organizational Structures and Decision-Making Structures

These peer agency practices are provided for the RTC's consideration regarding the decision-making process, drawing from the insights gathered in the literature review, which include:

- Define clear roles and responsibilities for all stakeholders involved in safety planning and the decision-making process. If necessary, form a new Transportation Safety Committee to regularly address transportation safety in the region and oversee the implementation of the regional Safety Action Plan, using the committee's recommendations to guide RTP and capital improvement program (CIP) project selection and prioritization.
- Establish accountability mechanisms such as audits, performance reviews, and safety metrics to ensure compliance with federal safety protocols and procedures.
- Utilize tools to streamline the monitoring and management of safety tasks, communication, and decision-making processes.
- Employ data analytics to identify trends, predict potential risks, and support decision-making.
- Promote regional collaboration to enhance data collection and coordination with law enforcement, business owners, and the public. Consider creating a regional crash data decision-making body with representatives from various organizations including State and local agencies.
- Offer regular training programs to ensure all stakeholders and decisions makers understand safety policies and their roles, and foster continuous improvement by integrating feedback and lessons learned into the safety structure.
- Define a clear project selection process to ensure full integration with the Performance-Based Benefit Calculator and the RTP project selection process.
- Evaluate whether traffic safety divisions should operate under planning departments, public works departments, or as separate offices, considering how best to integrate safety efforts into broader transportation and community planning.
- Recognize there is no perfect decision-making structure that can be directly adopted from other regions; instead, it must be uniquely developed based on input from local stakeholders and the public, and the specific needs of the region.

A.11 Action Matrix

A.11.1 Comparative Analysis of Peer MPOs and Model Communities

Table A-6 presents a comparative analysis of various Vision Zero and regional safety plans from peer MPOs and model communities. The table categorizes each plan based on critical safety components that have been identified as trends and best practices in the literature. These components include whether the plan has been published recently (within the last five years), emphasizes collaboration, uses data-driven analysis, applies the Safe System Approach, identifies HINs, and includes specific countermeasures for speed management and intersection safety. Additional categories such as active transportation focus, equity considerations, community engagement, funding strategies, and implementation timeline were also examined. The analysis highlights the commonalities and unique strategies among different regions, showcasing how each approach addresses safety challenges and prioritizes resources.

Table A-6 - Comparative Analysis of Findings from Peer Communities

Plan Component	City of Las Vegas - Vision Zero Action Plan	City of Las Vegas - CICMP	City of Los Angeles - Vision Zero	Los Angeles County - Vision Zero	City of Austin, TX - Vision Zero Action Plan	DRCOG – Regional Vision Zero	Hillsborough - Vision Zero Action Plan	City of Phoenix, AZ - Road Safety Action Plan	City of Boston, MA - Vision Zero Action Plan	Truckee Meadows Vision Zero Action Plan	Wasatch Front CSAP	Vision Zero Central Florida
Action Plan Published in the Last Five Years	✓	✓		✓		✓		✓	✓	✓	✓	✓
Collaboration Emphasis	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Data-Driven Analysis	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Safe System Approach	✓	✓	✓			✓		✓	✓	✓	✓	✓
HIN Identification	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Speed Management Countermeasures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Intersection Safety Countermeasures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Active Transportation Focus	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓

Plan Component	City of Las Vegas - Vision Zero Action Plan	City of Las Vegas - CICMP	City of Los Angeles - Vision Zero	Los Angeles County - Vision Zero	City of Austin, TX - Vision Zero Action Plan	DRCOG – Regional Vision Zero	Hillsborough - Vision Zero Action Plan	City of Phoenix, AZ - Road Safety Action Plan	City of Boston, MA - Vision Zero Action Plan	Truckee Meadows Vision Zero Action Plan	Wasatch Front CSAP	Vision Zero Central Florida
Equity Considerations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Community Engagement	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Funding Strategies	✓	✓			✓							✓
Implementation Timeline	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓

A.11.2 Core Strategies for Effective Safety Plan Development

Table A-7 outlines fundamental approaches and methodologies used in the development of impactful safety plans. These strategies emphasize the importance of continuous monitoring, data-driven analysis, and equity considerations, among other factors. Examples from various cities and regions illustrate how these strategies have been effectively implemented. This matrix serves as a guide for developing resilient and adaptable safety plans that address immediate needs while laying the groundwork for sustainable progress.

Table A-7 - Core Strategies for Effective Safety Action Plans Development

Theme	Strategy for Plan Development	Example Implementation
Continuous Monitoring and Evaluation	Incorporating ongoing reviews, annual updates, and adaptability based on performance metrics and data.	**City of Austin, TX - Vision Zero Action Plan:** Regular quarterly reviews and an annual Vision Zero report card to track progress.
Continuous Monitoring and Evaluation	Implement a feedback loop for regular safety data reviews and evaluations of measures' effectiveness.	**Wasatch Front CSAP**: Annual reviews of crash data and implemented measures to ensure progress toward road safety goals.
Data-Driven Approach	Using crash data, injury data, and safety metrics to identify high-risk areas and develop a focused plan.	**City of Las Vegas - Vision Zero Action Plan**: HIN identified roadways with the highest fatalities and serious injuries.
Data-Driven Approach	Use of collision data and the Prioritization Score Formula to rank corridors with high fatal or serious injury collision rates and prioritize interventions accordingly.	**Los Angeles County - Vision Zero**: The plan identifies collision concentration corridors, which are half-mile segments with three or more fatal or severe injury collisions, using the Prioritization Score Formula to rank interventions based on risk.

Theme	Strategy for Plan Development	Example Implementation
Data-Driven Approach	Identify and rank locations with high crash rates using crash type and risk factors.	**City of Las Vegas' CICMP**: The plan focuses on identifying intersections with frequent crashes and provides a process for prioritization of key intersections that require safety interventions.
Data-Driven Approach	Utilize multiple sub-analyses to identify safety challenges, including crash data, risk assessment, and network screening.	**Wasatch Front CSAP**: Sub-analyses included Historical Crash Analysis (2018-2022), Network Screening Analysis for high-risk intersections, and Composite Risk Score to prioritize interventions.
Data-Driven Approach	Incorporate equity into safety analysis by identifying transportation-disadvantaged communities.	**Wasatch Front CSAP**: Equity analysis highlighted vulnerable communities using a locally-defined Equity Priority Index to prioritize safety improvements. This index considered factors such as transportation insecurity, environmental burden, and social vulnerability, ensuring safety improvements are prioritized in areas where they are most needed.
Data-Driven Approach	Develop a ranking system for prioritizing interventions based on multiple criteria.	**Vision Zero Central Florida Safety Action Plan**: Projects were prioritized using the following criteria: Safety History (50%), Transportation Underserved (15%), Safety Benefit (15%), Regional Benefit (10%), and Timeline (10%).
Data-Driven Approach	Use data tools and crash analysis to guide decision-making and prioritize safety interventions.	**DRCOG - Regional Vision Zero**: A StoryMap was used to enable quick access to crash analysis, helping guide safety decisions and identify key corridors for safety improvements.
Funding and Financial Strategy	Ensure financial sustainability by identifying multiple funding sources at different governmental levels.	**DRCOG - Regional Vision Zero**: Identified funding sources at federal, state, and local levels, with innovative financing mechanisms to overcome financial challenges in safety implementation.
Pilot Demonstration Projects	Implement short-term, low-cost, temporary safety installations (e.g., curb extensions, bike lanes, pedestrian refuges) to test effectiveness before committing to permanent changes.	**RTC Pedestrian Comfort Study**: Five demonstration projects were installed in different areas, including curb extensions and high-visibility crosswalks, to improve pedestrian comfort and safety.
Public Education and Engagement	Public surveys, focus groups, and interactive platforms to gather community insights and concerns.	**City of Las Vegas - Vision Zero Action Plan**: Used an interactive map to gather feedback on traffic safety concerns from the public.
Regional Collaboration and Clear Accountability	Outline clear roles and responsibilities for stakeholders, with short-, medium-, and long-term actions.	**DRCOG - Regional Vision Zero**: The plan assigns responsibilities across stakeholders with established performance metrics and phased actions (immediate, short-term, medium-term, long-term) to ensure accountability and track progress toward Vision Zero goals.
Regional Collaboration and Clear Accountability	Leverage collaboration across regional stakeholders to improve data accuracy and integration.	The **DRCDC** improves crash data quality and timeliness through collaboration between over 100 regional stakeholders.

A.11.3 Key Themes and Recommendations in Safety Plans

Table A-8 presents targeted and practical measures that align with the identified core themes of effective safety planning. From leveraging funding opportunities to designing safer infrastructure and implementing effective policy changes, this table provides a blueprint for translating strategic goals into actionable initiatives. The examples highlight successful applications of these strategies, offering a roadmap for future safety interventions.

Table A-8 - Recommended Safety Strategies/Actions

Theme	Recommended Safety Strategies/Actions	Example Implementation
Funding and Resource Allocation	Identify and leverage various funding sources for safety improvements, including federal, state, and local funds.	**DRCOG - Regional Vision Zero**: The plan outlines strategies to secure funding from multiple levels and explores innovative financing mechanisms to support Vision Zero projects and safety improvements.
Infrastructure and Roadway Design	Implement street designs that separate different road users (e.g., protected bike lanes, raised pedestrian crossings, mid-block crossings, medians, and improved lighting) to enhance safety for all.	**North Las Vegas Citywide Pedestrian & Bicycle Plan**: Provides a recommended network of high-comfort, safe, and connected pedestrian and bike facilities, including protected bike lanes and enhanced pedestrian crossings.
Infrastructure and Roadway Design	Develop a safe and integrated multi-modal transportation system, including pedestrian, bicycle, and public transit networks, with a focus on access, safety, and connectivity.	**Southern Nevada Regional Bicycle and Pedestrian Plan**: Plans to establish a high-comfort, multimodal network with integrated pedestrian and cycling infrastructure, to accommodate recreational and transportation trips.
Infrastructure and Roadway Design	Adopt Complete Streets principles in street redesigns to ensure roads are safe for all users, including non-motorists. Encourage land use policies that promote walkability and connectivity.	**Hillsborough Vision Zero Action Plan**: Implemented high-visibility markings, low-cost treatments, campaigns for increased awareness and policies to promote a safety culture, and a safe multimodal transportation system through good design, lighting, and connected facilities.
Infrastructure and Roadway Design	Ensuring multimodal connectivity and safe access to public transit for pedestrians and cyclists.	**East Flamingo SMP**: Proposed center-running transit lanes to improve safety and reduce congestion.
Infrastructure and Roadway Design	Implementing road diets, Complete Streets, and safety infrastructure like pedestrian refuge islands and traffic calming measures.	**City of Las Vegas - Vision Zero Action Plan**: Prioritized safety treatments along the HIN using Complete Streets principles and traffic signal modifications to improve safety.
Infrastructure and Roadway Design	Implement policies and infrastructure that prioritize user safety and minimize human error's impact.	**Wasatch Front CSAP**: The plan emphasized safety policies, processes, and enforcement. Recommendations are structured around the five Safe System Elements: Safe Users, Safe Roadways, Safe Vehicles, Safe Speeds, and Post-Crash Care.
Infrastructure and Roadway Design	Implement engineering solutions to improve roadway safety.	**Southern Nevada Transportation Safety Plan:** Proven strategies include constructing pedestrian refuge islands, raised medians, and improving signal operations and coordination. Traffic calming techniques and road diets were

Theme	Recommended Safety Strategies/Actions	Example Implementation
		recommended in high-risk areas to reduce speeds and improve safety for all road users.
Infrastructure and Roadway Design	Implement low-cost, high-impact infrastructure upgrades to improve visibility and safety.	**East Flamingo Road SMP**: Installation of retroreflective backplates, improved streetlighting with LED technology, high-visibility crosswalks, and routine maintenance.
Infrastructure and Roadway Design	Incorporate moderate-cost, pedestrian-centric improvements and traffic signal modifications to enhance safety.	**East Flamingo Road SMP**: Traffic signal modifications, mid-block crossings, ADA-compliant sidewalks, and school crossing safety upgrades.
Infrastructure and Roadway Design	Implement traffic calming measures and targeted speed enforcement to reduce speeds in key corridors.	**Jones Boulevard and Cheyenne Avenue SMP**: Speed humps, narrower lanes, and buffered bike lanes to discourage speeding and enhance pedestrian and cyclist safety.
Policy and Legislative Action	Lower speed limits in high-risk areas, introduce automated enforcement (e.g., speed cameras, red-light cameras), and install speed cushions/traffic calming measures. Focus on high-crash corridors.	**Nevada SMAP**: Prioritized speed reduction through automated enforcement tools in critical corridors, supported by traffic calming infrastructure like speed cushions and road diets.
Policy and Legislative Action	Advocate for legislative changes, such as stronger penalties for traffic violations, and support local governments in creating policies that support safety goals (e.g., speed limits, urban design standards).	**Nevada SMAP**: Advocated for policy changes to enforce speed limits in school zones and high-risk areas, with a focus on creating legislative framework that supports enforcement.
Policy and Legislative Action	Adjusting speed limits and implementing traffic calming measures in high-risk areas.	**City of Las Vegas - Vision Zero Action Plan**: Evaluated and adjusted speed limits in areas with vulnerable populations, including schools and parks.
Policy and Legislative Action	Support stronger enforcement through publicized campaigns and enhanced legal mechanisms.	**Southern Nevada Transportation Safety Plan:** DUI checkpoints and patrols were highly publicized, alongside enforcement campaigns focused on seatbelt usage, especially for older drivers. The plan also promotes ignition interlocks for DUI offenders and supports targeted enforcement.
Public Engagement and Education	Launching public awareness campaigns to educate communities on road safety, focusing on high-risk behaviors like speeding and distracted driving.	**Hillsborough Safe Streets Now Vision Zero Action Plan**: Launched the “One Message, Many Voices” campaign to increase awareness and influence safer behaviors.
Public Engagement and Education	Increase public education and awareness campaigns around traffic safety.	**Southern Nevada Transportation Safety Plan**: The plan focused on improving seatbelt usage through enhanced public education, targeting demographic groups with lower restraint use rates, and engaging with communities via safety education campaigns.
Public Engagement and Education	Target unsafe driving behaviors with public awareness campaigns and enforcement strategies.	**Vision Zero Central Florida Safety Action Plan**: Focus on risky behaviors such as speeding and DUI, combined with safety

Theme	Recommended Safety Strategies/Actions	Example Implementation
		awareness campaigns and education programs.
Safe System Approach	Structure recommendations around the five Safe System Elements: Safe Users, Safe Roadways, Safe Vehicles, Safe Speeds, and Post-Crash Care.	**Majority of plans reviewed** emphasized Safe System principles across roadway design, speed management, and VRU protection.
Safe System Approach	Structure recommendations around the five Safe System Elements: Safe Users, Safe Roadways, Safe Vehicles, Safe Speeds, and Post-Crash Care.	**Wasatch Front CSAP:** Developed the Safety Countermeasures Toolbox, which includes a range of proven safety interventions tailored to the specific needs of the region's diverse road users. The toolbox is complemented by case study project sheets that offer practical examples of how these countermeasures can be applied in various contexts.
Safety for Vulnerable Users	Ensure safety projects are equitably distributed, prioritizing interventions in underserved areas with high rates of crashes resulting in fatalities and serious injuries.	**Truckee Meadows Vision Zero Action Plan**: Prioritized safety improvements in low-income communities with high pedestrian fatality rates, including targeted lighting enhancements and traffic calming.
Safety for Vulnerable Users	Prioritizing improvements for pedestrians, cyclists, and VRUs by enhancing street lighting, crosswalks, and protected bike lanes.	**City of Austin, TX - Vision Zero Action Plan**: Introduced pedestrian-activated signals and narrower streets to promote safety and walkability.
Safety for Vulnerable Users	Targeting underserved communities for safety improvements to address disproportionate impacts on vulnerable populations.	**Vision Zero Central Florida**: Focused on VRUs and underserved communities that experience a disproportionate number of serious crashes.
Technology and Data	Implement data-driven safety monitoring tools such as LiDAR for real-time traffic monitoring, and crash analysis tools for predictive safety measures.	**LiDAR Sensing in Nevada**: Deployed LiDAR to monitor intersections for near-miss incidents and other risky behaviors, helping decision-makers prioritize safety improvements.
Technology and Data	Providing public access to crash data and safety metrics via online platforms for accountability and community engagement.	**DRCOG - Regional Vision Zero**: Created a crash data dashboard to monitor safety performance and inform future interventions.

A.11.4 Common Challenges and Lessons Learned

Table A-9 captures insights from past safety planning efforts, emphasizing challenges that can hinder the success of safety initiatives. These lessons underscore the importance of early stakeholder engagement, realistic timelines, robust performance management, and comprehensive financial planning. Additionally, these insights are crucial for shaping future safety plans, ensuring they are more effective, resilient, and responsive to community needs.

Table A-9 - Common Challenges and Lessons Learned

Lesson Learned	Description	Example Where Issues Occurred
Insufficient Stakeholder Engagement/Buy-in	Failing to involve all key stakeholders early can lead to a lack of urgency, delays in progress, and incomplete buy-in.	**WFRC CSAP** Delayed implementation of infrastructure improvements due to insufficient initial stakeholder engagement, and lack of sense of urgency.

Lesson Learned	Description	Example Where Issues Occurred
Overly Ambitious Timelines	Setting unrealistic deadlines can lead to rushed planning and subpar outcomes. Avoid setting aggressive timelines without proper capacity assessment.	**WFRC CSAP**: Struggled with delivering on initial deadlines due to overly ambitious timelines without considering approval timelines.
One-Size-Fits-All Solutions	Applying a uniform approach without considering local contexts, demographics, and unique safety challenges can lead to ineffective interventions.	**RTC Pedestrian Comfort Study**: Temporary installations like curb extensions were not well received in some communities (Mesquite and Boulder City) because of local conditions and community preferences.
Insufficient Public Awareness and Education	Implementing infrastructure changes without sufficient public education campaigns can result in low compliance and public dissatisfaction.	**Mini-Roundabout Test Installation in Las Vegas:** Low public awareness about how to use the new roundabouts led to mixed opinions and ineffective speed reductions.
Lack of a Robust Program Performance Management Framework	Without a strong performance management system, it is difficult to track progress and improve safety initiatives.	**CCSD SRTS Program**: The program struggled to assess success of performed activities because of the lack of a robust progress evaluation and performance management framework.
Insufficient Upfront Financial Planning and Long-Term Funding Allocation	Insufficient financial planning and lack of sustained funding threaten program continuity and growth.	The **CCSD SRTS Program** faced challenges due to a lack of upfront long-term funding and financial planning.

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