CARSON AREA
METROPOLITAN PLANNING ORGANIZATION

PEDESTRIAN SAFETY GUIDELINES

Draft April 2010

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Acknowledgments

The Carson Area Metropolitan Planning Organization Pedestrian Safety Guidelines were developed from a template prepared by a group of dedicated individuals from various organizations that are committed to reducing the number of lives taken prematurely on our nation's roadways. The national template was prepared by the following individuals.

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Introduction

On a population basis, Nevada has one of the highest pedestrian fatality rates, at 2.9 fatalities per 100,000 population, compared to the national rate of 1.6. Most of the pedestrian fatalities (92%) occurred in the most populous counties (Clark and Washoe). In 2007, pedestrian fatalities comprised approximately 12 percent of the State's traffic fatalities.

In August 2008, the Nevada Department of Public Safety (DPS), Office of Traffic Safety (OTS) requested that the National Highway Traffic Safety Administration (NHTSA) meet with representatives from Nevada DPS to define key issues of concern regarding pedestrian safety. The Nevada Pedestrian Safety Program Technical Assessment was conducted in Reno and arrangements were made for State program experts and key individuals to deliver briefings and provide support materials to the Assessment Team. The Assessment Team interviewed more than 40 presenters, with some being contacted following their presentations to provide additional information and clarification.

NHTSA has recommended that local governments develop a Pedestrian Safety Action Plan (PSAP). During May 2009, the Federal Highway Administration (FHWA) held workshops over a three-day period to present to local stakeholders a variety of techniques aimed at enhancing pedestrian safety and to develop the framework of the Carson Area Metropolitan Planning Organization (CAMPO) guidelines using a template that allowed participants to provide their input directly to FHWA staff and their consultant. Participants included staff from the FHWA, OTS, the Nevada Department of Transportation (NDOT), the City of Carson City and Douglas County (both members of CAMPO), the Carson City School District, and the Safe Routes to School coordinator for Carson City.

The primary goal of these guidelines is to offer recommendations on how to enhance the pedestrian safety within the CAMPO area. Pedestrians make up 11 percent of the fatalities in the United States. To reduce the number of crashes involving pedestrians requires a plan that helps communities focus on countermeasures that have the greatest crash reduction factors. However, there are additional "side" benefits of improved pedestrian safety. When pedestrians feel safe, they are more likely to choose to walk for recreation and other situations. Walking saves energy, is good for the environment and promotes public health. To encourage more walking requires a plan that helps communities develop strategies for investing in pedestrian facilities and programs. Measures to improve pedestrian safety help to create a great community in general. The public is demanding safe, walkable communities. We live in a mobile society where businesses are choosing to locate in the best places to live. Creating a great walking environment is central to economic development and quality of life.

As previously mentioned, this document was developed from a national template. The template was created through a joint effort of the FHWA, NHSTA, and Pedestrian and Bicycle Information Center. These guidelines are meant to be a "living" document in that it will be updated as state and local policies evolve within the CAMPO area. The purpose of these guidelines is not only to identify existing policy, but to identify some of the deficiencies that exist regarding pedestrian safety and to offer suggestions on how to remedy these deficiencies.

I. Goals/Objectives/Commitment

Goals

Goals are needed for a pedestrian plan to be successful in reducing pedestrian crashes and increasing the number of pedestrian trips. They allow for the development of practical and achievable strategies; they also provide a way to measure progress over time.

Pedestrian fatalities are very rare within the CAMPO area. As such, the local agencies have not adopted any specific goals toward reducing pedestrian fatalities. Through its Regional Transportation Plan (RTP), CAMPO has differed to NDOT's Strategic Highway Safety Plan (SHSP) when addressing pedestrian safety concerns. In this document, NDOT has identified pedestrian safety as a critical area, and has a stated goal of reducing pedestrian fatalities and injuries by 33 percent over three years. The SHSP is currently being implemented. NDOT will be revising their stated goal and exploring pedestrian fatality rates versus actual numbers of incidences. As already mentioned, Carson City has experienced very few pedestrian fatalities in the past several years, which would not warrant specific stated goals.

Each Plan also requires specific and measurable objectives designed to reduce the risk factors that lead to crashes as well as to encourage more walking. If recognized and embraced, they help provide the rationale for allocating resources to implement necessary countermeasures. Carson City has worked closely with NDOT and the local Safe Routes to School coordinator to implement pedestrian improvements in the vicinity of all Carson City elementary and middle schools. City staff has discussed adopting a policy of focusing future improvements around the schools as a priority, then moving on to the commercial areas with heavy foot traffic. The Safe Routes to School coordinator would like to establish objectives for increasing the number of students that walk to school.

NDOT has proposed to develop objectives for reducing pedestrian fatalities based on metropolitan planning organization and local agency objectives. Some general goals to enhance the pedestrian environment for the CAMPO member agencies to consider include the following: improve pedestrian connectivity, include bike lanes on local roadways when appropriate and possible, improve the sidewalks in the vicinity of schools, establish targets to complete a pre-determined number of sidewalk gaps per year, and update a pre-determined number of signed bike routes per year.

Commitment to safety for all modes including pedestrians (pedestrians are included in the definition of "traffic") should be a top goal and priority of local transportation agencies. Once this commitment is made, it allows transportation agencies to allocate funds in reducing all crash types, including pedestrian crashes.

As previously stated, NDOT has policies regarding its commitment to safety. Carson City and Douglas County identify safety policies in their respective transportation plans. The Carson City School District measures safety at their facilities based upon a variety of performance standards. They have begun to change their focus on safety from a busing perspective to that of a walking perspective.

II. Land Use and Site Design

Land use patterns impact pedestrian crashes. Pedestrian crash severity is higher in suburban, auto-oriented locations where speeds are faster and drivers don't expect pedestrians. Pedestrian crashes are less severe in established, traditional urban areas where drivers are more aware of pedestrians. Sample land use and site design techniques that encourage more walking and help manage speed and therefore affect crash rates include:

1) Buildings that define roadways. Buildings located at the back of the sidewalk give the driver sense of enclosure; buildings set back with large parking lots in front can give the impression of wide high-speed roads.
2) Mixed-use development: Buildings with retail on the bottom and housing on the top encourage pedestrian activity.
3) Roadway connectivity encourages walking because of the reduced travel distance to reach destinations (cul-de-sacs without connector paths reduce pedestrian connectivity).
4) Parking should not be placed between the sidewalk and buildings; on-roadway parking is a very effective way to slow traffic and encourage pedestrian-oriented development.
5) Access management principles should be extended to parking: single lots serving multiple stores are preferred over single stores each with its own parking and driveway(s).
6) School siting and space requirements should ensure that schools are placed in neighborhoods, have pedestrian access and allow for shared facilities with parks and community centers.

Carson City is currently working to improve the pedestrian environment in its downtown area. The entire downtown corridor is designated for mixed-use on the City's Land Use Map. In addition, the Land Use Map identifies six Mixed-Use Activity Centers at key locations throughout the City. The locations of the Activity Centers were selected based upon their proximity to major gateway corridors, where they are easily accessible to adjacent residential and employment uses and may be more readily served by existing and future transit. The Carson City Master Plan encourages infill and higher density development, which is more conducive to a pedestrian environment. Parking is based on the ratio of buildings to the number of spaces available. Parking requirements differ depending on the location of the development and the type of land use it is. The City has development standards that define typical site design. In addition, the City has developed its own access management standards. As much of Carson City is built out, the existing schools will likely be improved as needed to accommodate future students. There are no plans to build any new schools at this time.

The Nevada DOT does not have much control over local land use, but does have specific access management standards that are applied to state owned roads on city streets. In these situations, new developments require permits from NDOT before they can proceed with construction. Douglas County has largely adopted NDOT's access management standards. Most of Douglas County is rural, and there is a desire to maintain its rural character. Therefore, land use practices that are typical in areas of higher development are not completely relevant or applicable to most areas in Douglas County. However, the portion of Douglas County that is in the CAMPO area is largely developed.

Carson City has plans to implement a “road diet” on Carson Street, the main thoroughfare through downtown Carson City, when funding becomes available. Currently, Carson Street is owned by NDOT, but will be turned over to Carson City within the next year along with several other State-owned roads. Standards are being developed specifically for the downtown area to address improvements such as street furniture, lighting, and other amenities. Carson City is also looking into the possibility of implementing a pedestrian wayfinding system to encourage walking and direct tourists and residents alike to the many attractions in the capital city. The Jump Around Carson (JAC) transit system in Carson City currently offers free rides to senior citizens in an effort to accommodate the significant senior population. This age group is oftentimes largely transit-dependent and it is important to have a highly accessible and continuous pedestrian infrastructure to support transit connections for seniors, and riders of all ages.

The Nevada DOT is in the process of updating its access management standards, and both Carson City and Douglas County have committed to updating all applicable planning documents with an emphasis on pedestrian safety.

III. Public Involvement

Public involvement is another excellent way to get a better product. It also builds public support for programs and policies to reduce pedestrian crashes. To be effective, stakeholders must feel listened to and heard.

Both NDOT and CAMPO have their own Public Participation Plan that they follow regarding updates to federally required documents. In addition to the public, specific stakeholders are targeted for their input as they relate to the plan that is being developed, and working groups are often formed to provide feedback as development of that plan progresses. CAMPO has extended the guidelines in their Public Participation Plan to apply to other planning documents that are not federally required, such as these Pedestrian Safety Guidelines. CAMPO also has a policy in place regarding public participation when there are any proposed service or fare changes to the transit providers in the CAMPO area.

All of the local agencies, including the Carson City School District, actively seek out public participation in all matters that affect local residents. In addition, all of the local entities are subject to the open meetings laws that the State has adopted. Public participation is carried out through individual and public notice, open meetings and open houses, and a variety of avenues and formats to provide comment. All entities are committed to continue to explore ways to increase public response for any situation that it is warranted.

A Bicycle and Pedestrian Advisory Board (BPAB) is another excellent way to get a better product. They also build public support for policies, programs and policies to reduce pedestrian crashes. To be effective, stakeholders must be involved in the review of policies, programs and projects.

Currently, there are not any local BPABs, though downtown business groups address pedestrian issues at times. Carson City is open to the idea of forming a BPAB that would be advisory to staff.

Other governmental agencies are also stakeholders. Building positive, working relationships is essential for coordination on regional planning issues; it also provides a way to coordinate on solving specific problems such as identifying high crash locations where additional enforcement may be needed, and coordinating transit stops with crossing locations.

Many state and local agencies work together to promote the safety, health, and welfare of the residents throughout the CAMPO area. The following list provides examples of the way this multi-agency coordination occurs.

- State-run agencies, such as the Rural Center for Independent Living (RCIL), which passes funds on to non-profit groups that provide services to persons with disabilities, work to improve pedestrian access for all potential users.
- The Transportation Director of the Carson City School District coordinates with Transportation Directors of other Nevada school districts through the Nevada Department of Education and NHTSA on transportation-related issues. The school districts also work

with the Nevada Highway Patrol (NHP), who inspect school buses throughout the year, and have assistance from their respective Sherriff's Office to enforce traffic laws around the schools.

- The City of Carson City has had a successful partnership with the School District and NDOT through the Safe Routes to School program.
- The Office of Traffic Safety and NDOT collaborate on bicycle and pedestrian initiatives.
- The state and local agencies also coordinate with Nevada's tribal organizations to improve the pedestrian environment around and within the local Colonies.
- The Carson City Parks and Recreation Department coordinates with Public Works and other departments to establish the area's multi-use paths and offer programs to encourage residents to pursue active and healthy lifestyles.

Despite the good working relationships that exist in the CAMPO area, there is always room for improvement when it comes to inter-agency coordination. The Sheriff's Office from each county is continuing to explore ways to better work with public. One of the challenges that the many of the county Sheriff's Offices face regarding pedestrian safety is a shortage of officers assigned to traffic enforcement. From an education perspective, suggestions have been made to encourage more participation from local health departments to help promote the health benefits of choosing to walk as a form of transportation when practical.

Special interest groups are also important stakeholders. These include business, advocacy and neighborhood groups as well as more broadly representative community leaders. Building positive, working relationships is essential for building support for solving pedestrian safety issues at the neighborhood level. The local agencies that have representation on CAMPO consistently work with special interest groups to better their respective communities. Some of the following are examples of these groups.

- Carson City has a Downtown Business Association that is interested in pedestrian issues, as a healthy pedestrian environment is often good for business.
- Muscle Powered is an advocacy group in Carson City that primarily addresses bicycle issues, but has members dedicated to pedestrian issues as well.
- The Carson Valley Trails Association in Douglas County promotes hiking and biking throughout the recreation-rich Carson Valley.
- Carson City is home to several non-profit groups such as OARC, REACH, and Friends in Service Helping (FISH) which provide services for those with disabilities and/or living in poverty. The City of Carson City regularly contacts these organizations when seeking input on transportation and transit-related issues.
- WE CAN is a federally sponsored program that is run through local non-profit organizations with a focus on health and nutrition.
- Nevada Hispanic Services provides services specifically to the Hispanic population living within the CAMPO area.
- The Boys and Girls Club in Carson City has a partnership with the local schools which allows children to be bussed between the schools and the club.
- In general, there are groups such as the Carson City Chamber of Commerce, Carson Kiwanis, Churches, and parent teacher organizations (PTO) that take an active interest in the general pedestrian infrastructure within the CAMPO area.

CAMPO will continue to work with special interest groups as appropriate and as they relate to specific projects. In working with special interest groups, CAMPO will adhere to the policies described in the Public Participation Plan.

Individual stakeholder involvement is an excellent way to get a better product. Public stakeholders should be viewed as partners who are the on-the-ground scouts who can identify problems, needs and opportunities. To be effective, stakeholders must be involved in a regular, ongoing and systematic way. Additionally, they must be listened to and responded to when they contact your agency.

In addition to special interest groups, CAMPO and its member agencies provide opportunities for individuals to get involved in the decision-making process. The City of Carson City has highly accessible and responsive staff that will address the concerns of individual residents. Recently, traffic calming devices such as speed tables, radar speed signs, and general enforcement activities have been implemented in various residential neighborhoods as a result of requests from individuals to improve the pedestrian safety near their homes.

Another example of this responsiveness was demonstrated when the City agreed to allow a company that develops products for persons with disabilities to conduct an inventory of a segment of sidewalk using a prototype of a new device that measures the overall accessibility of the sidewalk.

Although the CAMPO member agencies are responsive to the requests of its residents regarding pedestrian safety issues, there is a need for a more structured way to track requests for fixing sidewalks and other pedestrian related calls. Possible solutions include improvements to the member agency websites to better direct individuals to the appropriate staff members, or to fill out an on-line form regarding the nature of their concerns.

IV. Data Collection, Analysis and Prioritization

Identifying where crashes occur can be an inexpensive easy way to identify high crash locations, corridors and neighborhoods. It can be done electronically or on a simple pin map that is done by hand. Typically, five years of crash data should be displayed. In rapidly changing areas, three years might be appropriate. In older areas that are not changing, seven years may be appropriate. Once completed, it should be used as a baseline to focus resources and select counter measures.

The Nevada DOT collects and compiles an extensive amount of data regarding several types of crashes. This crash data is available to local entities, including CAMPO, upon request, and can be provided in a variety of formats, including a map-based format. The data can also be customized to address the specific queries of the requesting entity. For example, CAMPO can request a map from NDOT showing just the pedestrian crashes in the area.

Computerized, timely, geo-coded pedestrian crash data are extremely useful to determine whether pedestrian crashes are occurring at a) spot locations, b) along corridors, c) in a neighborhood area, d) throughout an entire jurisdiction (poor standard practice such as failing to install pedestrian indicators at signals), or e) among certain populations (e.g., children, older adults). Typically, five years of crash data should be displayed. In rapidly changing areas, three years might be appropriate. In older areas that are not changing, seven years may be appropriate. In addition to crash reports agencies should look at other sources of data such as hospitals. Once categorized, this information can be used to select countermeasures, focus resources, and set priorities for engineering, education and enforcement programs.

The data can also be used in crash typing. Crash typing categorizes all crashes based on situational and behavioral circumstances and is a way to target countermeasures in engineering, education and enforcement programs at very specific types of crashes.

As previously mentioned, NDOT can provide crash data that in a geo-coded format containing all of the attributes that are found on Standard Form 5 (used when reporting crashes). Currently, the Nevada Citation & Accident Tracking System (NCATS) is updated quarterly, offering fairly timely availability of the data.

NCATS is working to improve their process of collecting data as well making it more readily available. Ideally, they would like to make the data available instantaneously as it is collected. They also would like have the ability to plot citations on a map, in addition to the accident data.

Pedestrian counts along with field observations (e.g., driver yielding, conflicts, and pedestrian assertiveness) can be very useful in understanding pedestrian behavior and in considering the need for facilities. Counts and behavior studies, when combined with crash data, can also provide insights into specific crash causes and potential countermeasures. On-site observations will often reveal behavior patterns that lead to design changes. Before and after counts can be used to measure success which in turn can be used to help secure funding. Pedestrian counts are also important to assess when and where signals, stop signs and marked crosswalks should be installed.

Unfortunately, there are not very many accurate sources of data that exist regarding pedestrian activity. The U.S. Census Bureau collects data regarding journey to work information, but this does not account for the myriad of additional pedestrian activity that occurs for students and recreational activity. In Carson City, a student database has been developed through the Safe Routes to School program in which templates exist for counting pedestrians. The Safe Routes to School coordinator routinely observes student and driver behavior around schools. In addition, NDOT has done pedestrian counts at high crash locations and other spot locations of interest or concern.

The City of Carson City periodically surveys riders using the Jump Around Carson (JAC) transit system. Though this survey targets only users of the JAC fixed route buses, it provides valuable information about how those riders got to the bus stop. It also reveals whether or not those riders own an automobile.

To improve the quantity and quality of pedestrian data, NDOT, CAMPO's member agencies, and the Safe Routes to School (SRTS) coordinator have proposed to do the following.

- All: Get information from the American Community Survey (ACS) as it becomes available to monitor the "big picture" for those pedestrians that walk to work.
- Carson City: Conduct a boarding survey for the JAC transit system.
- SRTS: Routinely observe student and driver behavior near schools and outside of school areas as well.
- NDOT and local agencies: When doing manual traffic counts include pedestrians as well, where applicable.
- NDOT and local agencies: Where appropriate require a traffic impact study which includes pedestrians.
- SRTS: Enhance current Safe Routes to School walk to school day counts.
- NDOT and local agencies: Consider periodic pedestrian counts based by location.

Sidewalk inventories help identify system gaps and unsafe conditions. Sidewalk inventories can simply identify where sidewalks do or do not exist. More extensive sidewalk inventories assess the condition of existing sidewalks (frequently done for ADA purposes). When combined with crash data, pedestrian counts, behavior studies and traffic characteristics, they can be very useful in prioritizing locations for improving existing sidewalks, filling in short gaps between existing sidewalks and installing new sidewalks.
It is recognized that completing comprehensive sidewalk inventories can be expensive. When resources are scarce, an alternative approach is to inventory smaller areas focused around schools, neighborhood commercial areas, neighborhood centers and facilities that serve people with special needs.

In 2005, Carson City retained a consultant to do a complete inventory of the City's sidewalks. The inventory included geo-coding existing sidewalks, missing sidewalks, ramps, obstructions, widths, and various hazards for sidewalks in need of maintenance or replacement. The City is exploring ways to best update and maintain the database.

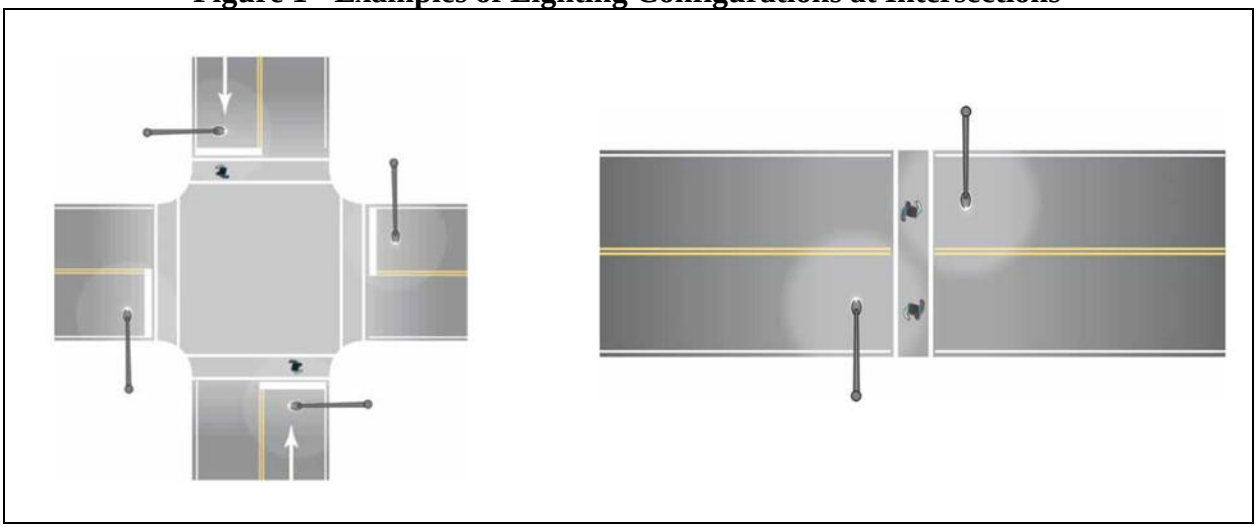
Marked crosswalk inventories at controlled, uncontrolled, intersections and midblock locations are needed to establish annual re-marking programs and to work with local transit agencies (wherever there is a transit stop, there needs to be a location to cross the roadway). When combined with crash data, pedestrian counts, behavior studies and traffic characteristics, they can be very useful in prioritizing locations for evaluating the crosswalk and then identifying measures to upgrade and improve the crosswalk. Maintaining an up-to-date inventory of marked crosswalks is particularly important since the majority of pedestrian crashes involve crossing the roadway. ADT (Average Daily Traffic), road widths (number of lanes) and speeds are three of the most important factors to consider when evaluating crosswalks. When combined with actual crash data and pedestrian counts, this information can be very useful in prioritizing locations for making crossing improvements and determining where to install new marked crosswalks.

The Nevada DOT and the City of Carson City currently maintain an inventory of all of their respective crosswalks. In addition, NDOT identifies and focuses maintenance on crosswalks at high crash locations. The Nevada DOT and the CAMPO member agencies routinely conduct traffic counts within their respective jurisdictions. At the state level, NDOT maintains a database of ADT counts as well as road inventory data and this information is readily available to the public.

Carson City is considering coordinating with the Safe Routes to School program to prioritize crosswalk maintenance near schools. As with the sidewalk database, the City is exploring ways to best update and maintain a crosswalk database. All entities will continue to openly share information regarding crosswalks.

Lighting Inventory: Providing appropriate lighting at pedestrian crossing locations is one of the most important factors to consider when evaluating and improving crosswalks. A disproportion of pedestrian crashes occurs at night. When combined with actual crash data and pedestrian counts, information about lighting can be very useful in prioritizing locations for making lighting improvements.

Figure 1 - Examples of Lighting Configurations at Intersections



The Nevada DOT and the CAMPO member agencies each maintain information regarding lighting information in their respective jurisdictions. Carson City uses lighting with measures to reduce light pollution. The placement of lighting in Carson City is based upon a combination of a uniformity ratio, spacing, height, wattage, and zoning and road classifications. Douglas County uses similar criteria. Both Carson City and Douglas County require pedestrian lighting (a maximum of 15 ft high) in their respective business districts.

Carson City has received requests for improved lighting in certain areas. Conversely, the Carson City School District has established lighting to deter crime at its schools, but oftentimes residential neighbors have requested that the lights be shut off. Carson City is considering switching to a LED lighting system to cut down on costs. Additionally, the City is open to requests to expand its pedestrian lighting to areas outside of the downtown, where appropriate.

Existing projects and programs should be a listed and described in one place to allow for overall agency coordination and to avoid duplication. Examples include programs to repair sidewalks, install new sidewalks, install new curb ramps, install countdown signals, upgrade crosswalks, implement safe routes to school programs and implement enforcement and education programs.

Carson City has an annual pedestrian improvement program, which includes activities such as sidewalk repairs (including ramps) and filling in areas with gaps in connectivity. However, the extent of this program can vary from year-to-year depending on available funding. Additionally, the City incorporates pedestrian improvements as a part of the overall construction during significant road projects. The City has also begun a program to upgrade pedestrian signals at signalized intersections to incorporate a pedestrian countdown system indicating the allowable time for a safe crossing. The Nevada DOT focuses resources on improvements at all high crash locations.

The Carson City School District, as part of the Safe Routes to School program, offers a bicycle education program, two walk to school day events during the school year, and a curbside management program addressing congestion and safety issues with parents dropping off/picking up their children. In addition, the School District has conducted traffic flow studies on school sites and periodically requests the Carson City Sheriff's Office or Nevada Highway Patrol to conduct enforcement activities at its schools.
The Carson City School District has indicated that it will consistently update its crossing guard program and ensure that all crossing guard staff are continually trained. Carson City is committed to improving pedestrian access through such measures as removing obstructions from sidewalks, reassessing goals for its annual ramp program, and updating the lighting program. Douglas County has indicated that it will inventory their existing pedestrian facilities and pursue development of a program for implementing ADA-compliant ramps.

Pedestrian crash data along with other data (described earlier) should always be considered when prioritizing agency projects and programs. This will help ensure that all projects and programs make pedestrian improvements where appropriate. Since most pedestrian infrastructure is built in conjunction with other projects, inclusion of pedestrian crash data when prioritizing projects is of particular importance.

At the state level, the Office of Traffic Safety (OTS) prioritizes all projects based on crash data, while NDOT considers local plans along with crash data when prioritizing projects. Carson City takes a more informal approach at prioritizing projects, but crash data is often a factor in the decision making process.

Carson City is considering a performance based approach to prioritizing projects based upon a recent initiative to collect data for performance measures. Some potential resources to consider when prioritizing projects could include the use of pedestrian crash maps, count data (pedestrian/traffic), and sidewalk inventory data.

Prioritizing pedestrian safety improvements is the final step once all appropriate data has been collected. Priorities should be established based on a variety of factors including safety consequences, cost, travel demand, availability of right-of-way, federal/state mandates (such as ADA requirements) and public support. Countermeasures can be phased and divided into temporary or permanent improvements. (Note: Many pedestrian improvements can be made in conjunction with other projects regardless of their priority. See section on funding)

Each of the agencies that participated in the development of this plan indicated that they do not routinely prioritize or rank pedestrian safety improvements based on crash data, along with other data, primarily due to the low number of crashes within the CAMPO area. However, there was a general consensus to make better use of the data available and to create a needs list in order to better prioritize projects and secure funding.

V. Providing Funding

Complete Streets (also called routine accommodation) is the most cost-effective funding strategy for reducing pedestrian crashes and encouraging more walking by including pedestrian improvements in all projects, programs and maintenance activities. The majority of pedestrian infrastructure (including accessibility improvements) is built in conjunction with other projects. This approach allows for significant improvements over time, even if there is no special funding available for pedestrian safety improvements.

When developing larger projects, NDOT considers pedestrian issues where applicable. ADA improvements are always implemented as part of a larger project, but pedestrian improvements largely depend upon a combination of available funding and local preferences. As with NDOT, Carson City implements pedestrian improvements where possible and when it is appropriate, and always implements ADA upgrades as a part of any larger project.

Dedicated funds and set-asides for pedestrian projects allow for immediate action in addressing high crash locations, corridors, and other targeted areas. They can be federal, state or local funds and are often a percentage of another fund.

The state pursues and provides a variety of funding dedicated to pedestrian safety projects and programs. For example, OTS receives grant funding for community programs (Section 402) which can be directed toward non-profit corporations, government agencies, and community organizations; enforcement and incentive (Section 406); traffic and safety records (Section 408); and alcohol awareness/prevention (Section 410). They also provide "mini" grants of up to $2,000 for bike and pedestrian programs. In addition, state funding is available for motorcycle safety. NDOT receives funding for their highway safety improvement program, as well as passes through federal Safe Routes to School funding to local entities. The Carson City Regional Transportation Commission (RTC) sets aside funding acquired through gas tax for pedestrian and ADA improvements. The City also seeks funding for pedestrian improvements through other federal programs such as the US DOT Transportation Enhancements program and Housing and Urban Development (HUD) Community Development Block Grants (CDBG). The CAMPO member agencies are committed to continue to pursue all grant opportunities associated with pedestrian and bicycle improvements.

VI. Education and Enforcement

Education

Public education is essential to reduce pedestrian crashes. It also builds public support for programs, projects and policies to reduce pedestrian crashes. To be effective, it must target those behaviors within selected age groups that will most likely result in fewer pedestrian crashes.

As mentioned earlier, the Safe Routes to School program currently funds education programs aimed at reducing pedestrian crashes. The Carson City School District schools offer a great bike safety program. All parties agreed that there should be more emphasis on pedestrian safety education. State representatives acknowledged that more effort should be toward both promoting and pursuing grants, particularly those that are pedestrian-focused and not just bicycle-focused. There was also a general recognition for the need to focus pedestrian safety education efforts toward middle school students. Some other suggestions included developing a pedestrian safety program that is delivered to parents by health providers, implementing a bike/walk/run to work day, and developing a pedestrian safety town similar to the one in Sacramento, CA.

Partnerships with non-profit groups, the private sector, and other local governmental agencies is an excellent way to get the entire community involved in safety education projects and programs. This includes schools, neighborhood groups, advocacy organizations and local businesses, as well as local health departments, hospitals and public safety officials such as firefighters and other first responders.

State agencies currently partner with non-profit organizations like the Ron Wood Family Resource Center, Hispanic service organizations, local tribes to promote education projects and programs for reducing pedestrian crashes. In addition, they work with higher education institutions to promote safety among college and university students. The Office of Traffic Safety runs the Joining Forces program, in which the state and local governments provide data and resources to address safety issues. The City of Carson City and the Carson City School District have an interlocal agreement to share facilities such as sports fields. Though not a partnership in the traditional sense, the human resources departments of all the state and local agencies involved promote a wellness program within their respective organizations. Some suggestions to improve outreach include partnering with local businesses, the health community, and churches to promote safety messaging.

Enforcement

Enforcement is an essential element of an overall program to reduce pedestrian crashes. To be effective, in must be done in partnership with the community and law enforcement while targeting motorist and pedestrian behaviors that will most likely result in fewer pedestrian crashes.

In addition to the routine enforcement at the state and local levels, the Carson City School District often requests enforcement activity at specific schools. According to the school district, state and local law enforcement are very supportive. If there are not any specific requests, officers patrol schools on a regular rotation.

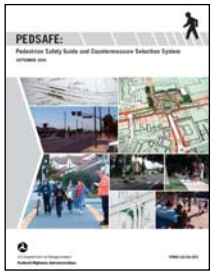
Despite the support and cooperation from state and local officers, there is room for improvement, specifically for better curbside management at pick up/drop off zones. The Joining Forces program could be expanded to provide more enforcement in the CAMPO area. Another issue that was mentioned was that when school bus drivers report motorists passing stopped buses, it oftentimes does not result in any enforcement action such as a fine. Consequently, many bus drivers have stopped reporting such incidents. Additionally, the comment was made that local judges could benefit from further education regarding pedestrian safety issues.

Collaboration with local law enforcement is an essential element of an enforcement program to reduce pedestrian crashes. To be effective, it must be done in partnership with schools and other community leaders. As mentioned previously the Joining Forces program encourages collaboration between the state and local governments.

VII. Engineering Countermeasures

This section presents the most commonly used and effective pedestrian crash countermeasures. Each section includes a picture to illustrate a particular point or countermeasure, The countermeasures follow the outline of Chapter 5 of FHWA's *How to Develop a Pedestrian Safety Action Plan* manual (order will vary slightly).

There are numerous policy, planning, and design guidelines that transportation planners and engineers can use; however, only a few address pedestrian designs thoroughly. AASHTO has recently published the *Guide for Planning, Design, and Operation of Pedestrian Facilities.* An example of a state pedestrian design guide is Washington Department of Transportation's *Pedestrian Facilities Guidebook*; one city/regional example is *Planning and Designing for Pedestrians: Model Guidelines for the San Diego Region.* Additionally, FHWA has an excellent publication: *PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System* (FHWA-SA-04-003). The *Manual on Uniform Traffic Control Devices* (MUTCD) should be used for selecting appropriate traffic controls: signs, traffic signals, marked crosswalks, and other pavement markings.



Many of the above-mentioned pedestrian policy, planning, and design guidelines were used to develop the following list of some of the more effective countermeasures in terms of improving pedestrian safety. They should also be used by jurisdictions for guidance to fix spot problems and to update and improve agency design manuals, practices and procedures. The actual countermeasure chosen must fit in the context of a particular roadway.

Design manuals and standard specifications should ensure roadways and intersections are designed to maximize pedestrian safety and access. This includes intersection design, curb radii, marked crosswalks, design speed, number of lanes, signal warrants, transit stop design, sidewalk widths, sidewalk setbacks etc. Updating them can be a fairly big effort but can be done once the crash countermeasures have been identified. To start, it is important to identify existing manuals and specifications.

In general, all agencies that do design work refer to the MUTCD and the AASHTO Guide for Planning for standard specifications. The Nevada DOT has developed its own manual with specifications that many local governments also refer to, and has adopted a Context Sensitive Design policy. In addition to the above, CAMPO member agencies have adopted their own local standards.

All agencies are committed to updating their respective standards to make them more pedestrian friendly, and will consider developing more detailed design guidelines for specific improvements that go beyond the minimum specifications. The CAMPO member agencies will also consider adopting a complete streets policy.

American Disabilities Act (ADA) transition plans are required in all communities to ensure that all pedestrian facilities will become accessible over time.

Carson City is in the process of updating its ADA transition plan, as the current plan does not address transit projects among other issues. However, Carson City, as well as the other CAMPO member agencies, complies with ADA requirements on all new projects. In addition, the City upgrades several existing non-compliant facilities on an annual basis.

1. Walking-along-the-road crashes

Paved shoulders provide room for pedestrians to walk away from traffic; they also provide room for bicyclists and increase safety for motor vehicle operators. To be effective paved shoulders should be 6 ft wide or more; 4 ft is considered the minimum acceptable width. Where parking is expected shoulders should be 8 to 10 ft. A painted (thermoplastic preferred) edge line should define the edge of the travel lane next to the shoulder.

The Nevada DOT routinely provides paved shoulders on all new roads and major rebuilds, and is currently conducting a system-wide evaluation of the shoulders on existing roads. Carson City requires shoulders on all newly constructed roadways in rural areas and sidewalks in the urbanized area. Douglas County requires a minimum of a four-foot paved shoulder on all collectors and a minimum of five feet if the collector is part of the bike plan. Douglas County is also developing a plan for updating shoulders on their roadway network.

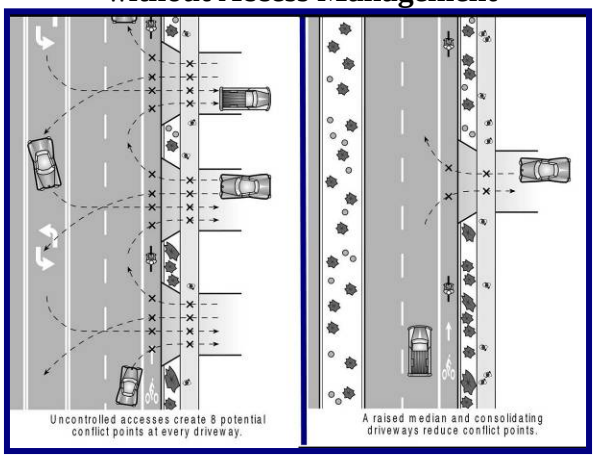
Sidewalks reduce walk-along-the-road crashes by providing positive separation from traffic. Continuous and connected sidewalks are needed along both sides of roadways to prevent unnecessary roadway crossings. Sidewalks should be buffered with a planter strip to increase pedestrian safety and comfort; separation makes it easier to meet ADA requirements for a continuous level passage and for a clear passage around obstacles.

Depending on the location, NDOT constructs sidewalks on all facilities where it is appropriate. Sidewalks are required for all new development in the Carson City urbanized area. As with the City, Douglas County constructs sidewalks in its urban areas. Both Carson City and Douglas County require a minimum of a five-foot buffer between sidewalks and commercial parking lots. In the downtown area it is a minimum of 8 feet. However, Douglas County requires a six-foot buffer between the sidewalk and the curb for all new development in the urban areas; whereas, Carson City allows for developer flexibility. Carson City encourages eight-foot sidewalks where possible or appropriate, and a furniture zone (offset sidewalk) for downtown redevelopment.

Access management can be achieved through the installation of medians and a reduction in the number of driveways. Both countermeasures limit the number of left turns across sidewalks where pedestrians are vulnerable.

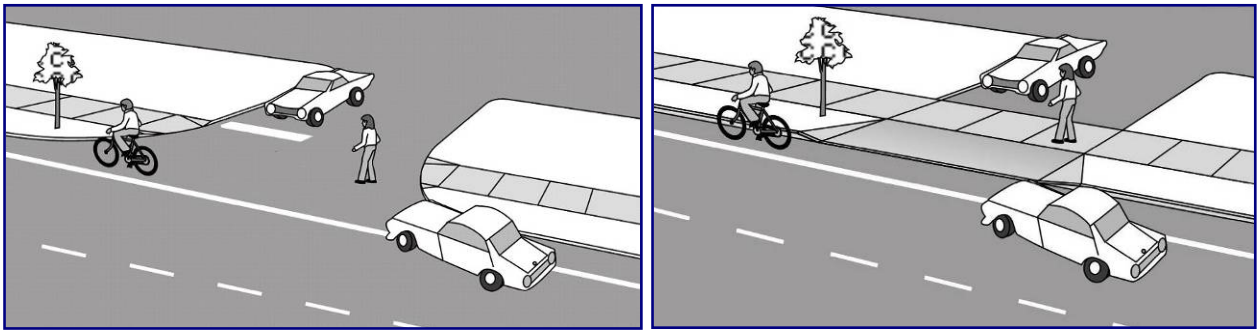
Many of the roadways where an access management policy would be appropriate are owned by the state, as such, NDOT manages access through its permitting process. The CAMPO member agencies primarily reference NDOT guidelines for access management, but have respective local policies when and where the situation applies. The Nevada DOT is currently revising their access management guidelines with a goal of being more proactive toward future development. The CAMPO member agencies will likely differ to NDOT guidelines as they are updated.

Figure 2 - Example of a Roadway with and without Access Management



Driveways should be designed to look like driveways, not roadway intersections: sidewalks should continue through the driveway, the level of the sidewalk should be maintained, and the driveway should be sloped so that the driver goes up and over the sidewalk (picture on right). Driveways should be away from intersections. The number and width of driveways should be minimized.

Figure 3 - Example of a Gap and Continued Sidewalk and Driveway Configuration



When considering the location and design of driveways, NDOT also considers whether the proposed driveway is in a residential or commercial area, and has standard specifications for each. Similarly, Carson City encourages driveways that are designed from the pedestrian perspective, but also considers the average daily traffic (ADT) estimated to be generated by the proposed development. As with the other entities, Douglas County requires adequate spacing between all proposed driveways and existing intersections.

Illumination greatly increases the driver's ability to see pedestrians walking along the road at night. Double-sided lighting should be provided along wide arterial roadways; this enables drivers to see pedestrians along the road, who may decide to cross anywhere, anytime.

Carson City routinely provides lighting on both sides of the roadway, with the intersections being the starting point, and spacing each additional light pole toward the mid-block. The City also requires developers to provide lighting for any new development. Both NDOT and Douglas County review proposed developments on a case-by-case basis, but lighting is always a part of the discussion.

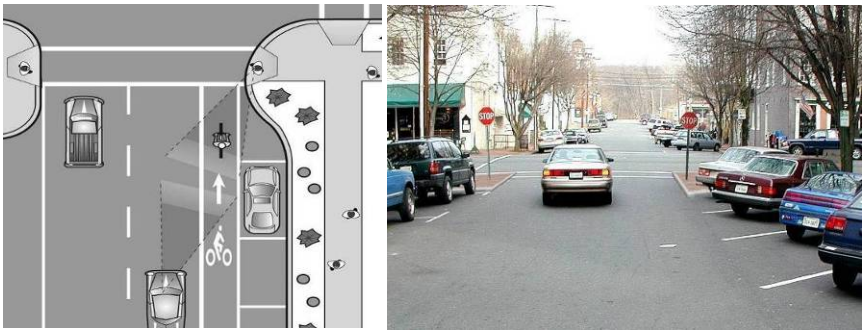
2. Crossing the road crashes

Mid-Block Pedestrian accessible crossing islands reduce crashes substantially at uncontrolled locations, especially on busy multi-lane roadways where gaps are difficult to find. A properly designed island breaks an otherwise complex crossing maneuver into two easier steps: a pedestrian looks left, finds an acceptable gap in one direction, crosses to the island, then looks right and finds a second gap.

Regarding crossing islands, the CAMPO member agencies are admittedly more reactive than proactive. There are no written policies specifically addressing crossing islands, and it is often a lengthy process to get approval when trying to implement this type of infrastructure on state-owned roadways. Both NDOT and the member agencies would consider establishing criteria for crossing islands as part of a greater access management policy. It was suggested that criteria for crossing island installation include the evaluation of pedestrian generators where there is a demonstrated need to cross a multi-lane arterial.

Curb extensions reduce the total crossing distance on roadways with on-roadway parking and increase visibility: the waiting pedestrian can better see approaching traffic and drivers can better see pedestrians' waiting to cross the road, as their view is no longer blocked by parked cars.

Figure 4 - Example of a Curb Extension



Carson City installs curb extensions on a case-by-case basis as there is no formal policy that has been adopted. However, it is understood that these types of improvements are

generally implemented in the downtown area. As with crossing islands, the City would explore developing prioritization criteria for curb extensions, such as at marked crosswalks with no traffic control or at skewed intersections.

Illumination greatly increases the driver's ability to see pedestrians crossing the road. Increased lighting should be provided at identified primary crossing points.

Carson City staggers their lighting evenly from the intersections toward the middle of the block. However, Carson City admitted that lighting is often an afterthought on major capital projects, and should be given more attention. Additionally, Douglas County stated that there may be some crosswalks that are not at intersections that may need to be reviewed for appropriate lighting.

3. Popular crossing countermeasures and how to improve them

The public often responds to a tragic pedestrian crash with a call for an immediate solution. Commonly requested solutions include traffic signals, flashers, overcrossings or undercrossings, or marked crosswalks. While these can be effective solutions in certain places, in some instances they are not appropriate or effective.

a. Traffic signals

The primary purpose of a traffic signal is to assign right-of-way and create gaps in traffic that otherwise would be hard to find. The *MUTCD* warns against the overuse of signals for a variety of reasons. Inappropriate traffic signals may increase crashes. Traffic signals are expensive, from $70,000 to $300,000 for one intersection, not including any associated road widening.

But in some cases, the only solution to crossing a busy roadway is to install a pedestrian crossing signal. This is especially true in locations where there is no other signal for a quarter of a mile or more in an area with lots of pedestrian activity.

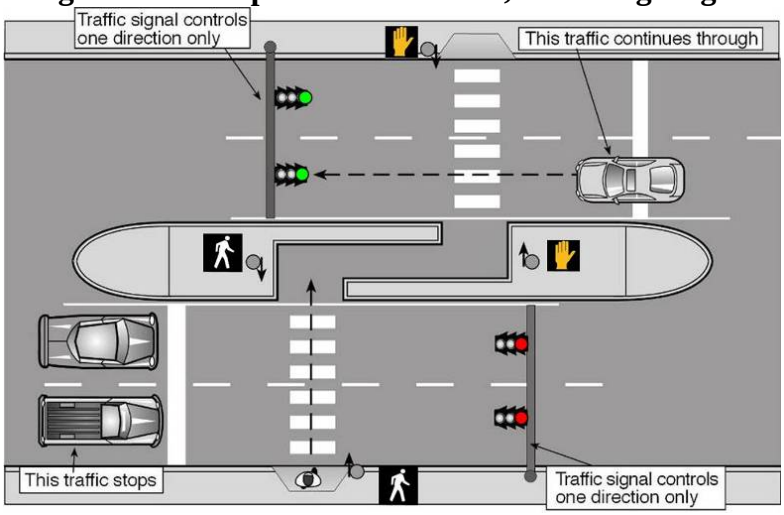
Traffic signals at intersections may be the only way to create a gap for pedestrians to cross busy multi-lane highways with significant volumes. Since it's difficult to meet MUTCD warrants for a pedestrian signal based solely on existing pedestrian counts, it may be necessary to anticipate how many pedestrians might cross once a signal is installed.

In the CAMPO area, traffic signals are installed based upon meeting warrants, and the decision is not pedestrian driven. In Carson City, there are a limited number of streets; therefore, there are

very limited locations, if any, where pedestrians need to cross a street where there is not already some sort of traffic control in place.

A mid-block, two-stage traffic signal at a crossing island helps reduce impacts on motor vehicle flow while helping the pedestrian cross multi-lane roadways. The pedestrian stops one direction of traffic at a time, and the two crossings are separated with a fenced-in median island.

Figure 5 - Example of a Mid-Block, Two-Stage Signal



Again, none of the CAMPO member agencies have criteria specifically for the installation of a mid-block, two-stage traffic signal, and there are no examples of this type of design in the CAMPO area. However, flashers of a similar design are used at some locations. Due to the nature of the built environment, it is not likely that this type of control will be need in the near future.

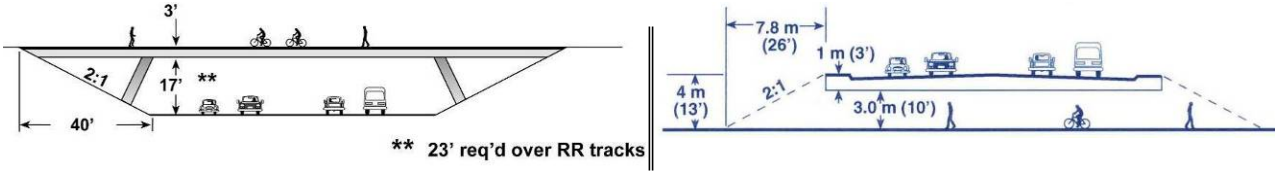
b. Overcrossing or undercrossing

These solutions are appealing because they create complete separation of pedestrians from motor vehicle traffic. However, in practice this rarely occurs because:

a) Overcrossings and undercrossings are expensive and cannot be provided at most locations where pedestrians want to cross
b) Undercrossing are often prone to security problems due to low visibility
c) The out-of-distance travel is so inconvenient many pedestrians will refuse to walk this extra distance and cross at-grade
d) Overcrossings or undercrossings are seldom used, and drivers are frustrated when they see pedestrians crossing in the vicinity of an overcrossing or undercrossing; this in turn increases the risk to pedestrians crossing at-grade

The high cost of an overcrossing or undercrossing makes them impractical for all but a few locations. Overcrossings and undercrossings should only be considered at locations where there are high pedestrian volumes, no other alternatives and topography allows easy access. (river crossings, depressed highway/railways).

Figure 6 - Examples of a Pedestrian Overcrossing and Undercrossing



There are a few existing over and under passes in the CAMPO area, but there are no criteria referencing the construction of these types of facilities.

c. Marked crosswalks alone

It is important to create safe places for pedestrians to cross roadways at regular intervals. Marked crosswalks should only be installed where there is an expectation of a significant (where most people cross may differ on rural, suburban, and rural environments) number of pedestrians such as near a school, park or other generator. Without the associated features mentioned so far (signage, islands, curb extensions, illumination etc.), marked crosswalks on their own do not necessarily increase or decrease the security of a pedestrian crossing the roadway, if placed with the following criteria.

- Two-lane roads: No significant difference in crashes
- Multilane roads *(3 or more lanes):*
  - Under 12,000 ADT: no significant difference in crashes
  - Over 12,000 ADT without median: crashes marked > crashes unmarked
  - Over 15,000 ADT and with median: crashes marked > crashes unmarked

- The study also made the following observations
  - Medians reduce crashes by 40 percent
  - Pedestrians over 65 are over-represented in crashes relative to crossing volumes
  - No evidence was found to indicate that pedestrians are less vigilant in marked crosswalks.

As mentioned earlier, NDOT and the City of Carson City currently maintain an inventory of all of their respective crosswalks. In addition, NDOT identifies and focuses maintenance on crosswalks at high crash locations. However, there is not currently a program for either jurisdiction addressing upgrades or the installation of new crosswalks.

d. Textured, Stamped, Colored Crosswalks

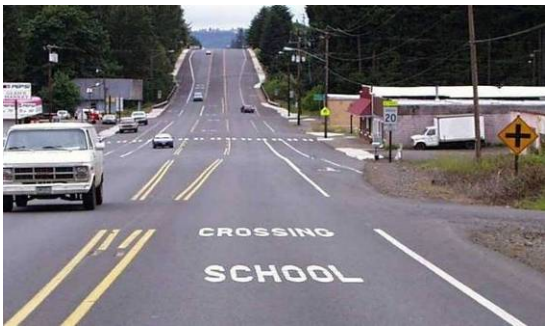
Textured and/or colored crosswalks are another popular request. Things to consider: they are less visible to drivers than white marked crosswalks, they may create maintenance problems, and they are difficult for pedestrians with disabilities to negotiate. They should only be used at signalized locations and should always include white paint as required in the MUTCD (two-parallel lines, ladder etc).

In downtown Carson City, some textured colored crosswalks have been installed, but there is a concern with the maintenance of these crosswalks, as they are often more costly to maintain. In addition, some agencies, such as NDOT, are hesitant to pursue this type of design due to a concern about meeting ADA compliance. It would

be beneficial to develop design guidelines for textured crosswalks along with a policy describing where they would and would not be appropriate. For example, they should not be installed at uncontrolled locations.

e. Improving marked crosswalks: As previously mentioned**,** marked crosswalks on their own do not necessarily increase or decrease the security of a pedestrian crossing the roadway. However, their safety can be increased with high visibility pavement markings, advanced stop bars and proper signing

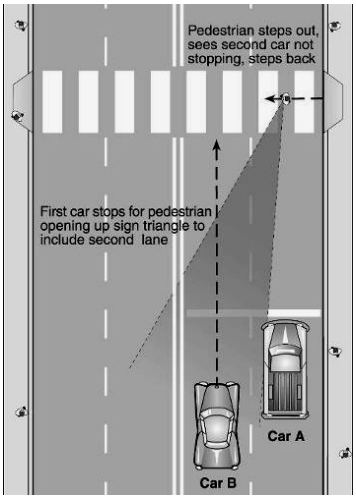
Using high visibility markings: This ensures that drivers see the crosswalk, not just the pedestrian. Two parallel lines indicating a marked crosswalk can be almost invisible to the motorist. Ladder style (piano keys) markings should always be used at locations without positive traffic control and are advised at locations with positive traffic control (signals, stop signs).



The City of Carson City is currently making the transition to high-visibility crosswalks at all locations. Douglas County has proposed to install high-visibility crosswalks on all collectors.

High visibility crosswalk markings with advance stop bar (or yield line) and signs at uncontrolled intersections help prevent "multiple-threat" crashes on multi-lane roadways: a driver in the curb lane (Car A) stops to let a pedestrian cross, but so close to the crosswalk as to mask a driver in the adjacent lane (Car B) who is not slowing down. Car B does not have time to react and the pedestrian is struck at high speed. The advance stop bar (or yield line) requires Car A to stop back 30 feet (+/-) so the pedestrian can see if Car B is not stopping. This enables the pedestrian to wait, or even pull back if he has started to proceed into Car B's lane.

Figure 7 - Example of a High Visibility Crosswalk



All CAMPO member agencies, as well as NDOT, currently install advance stop/yield bars with signs at crosswalks on multi-lane roadways. All agencies revise their guidelines regarding advance stop/yield bars to reflect the current version of the MUTCD.

Stop bars at controlled intersections help keep motor vehicles from encroaching into the marked crosswalk. When combined with ladder style marked crosswalks, they also make it clear that the pedestrian is to walk in the ladder area, not between the stop bar and a parallel line.

The standard practice in the CAMPO area is to install advance stop bars from four to six feet ahead of the intersection. All agencies are committed to working with their respective maintenance crews to update advance stop bars that are in need.

Proper signing at uncontrolled marked crosswalks increases the driver's awareness of a pedestrian crossing. Best practice includes an advanced warning sign and a sign with an arrow at the marked crosswalk using MUTCD compliant fluorescent green walking pedestrian signs.

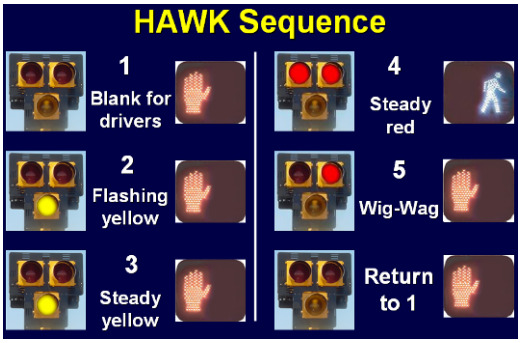
All agencies routinely provide MUTCD compliant advanced warning signs and crosswalk signs at pedestrian crossings.

In Street Pedestrian Crossing (flop over), mid-road yield or stop signs at uncontrolled marked crosswalks increase the driver's awareness of a pedestrian crossing. They are often used at school crossings and other locations with vulnerable populations.

In general, these types of traffic control measures are not used within the CAMPO area. However, NDOT is considering placement of removable, mid-road yield/stop signs at two pilot locations to evaluate their effectiveness.

The High Intensity Activated Crosswalk (HAWK) signal uses traditional traffic and pedestrian signal heads but in a different configuration. It includes a sign instructing motorists to "stop on red" and a "pedestrian crossing" overhead sign. When not activated, the signal is blanked out. The HAWK signal is activated by a pedestrian push button or passive pedestrian sensor. The overhead signal begins flashing yellow and then solid yellow, advising drivers to prepare to stop. The signal then displays a solid red and shows the pedestrian a "Walk" indication. Finally, an alternating flashing red signal indicates that motorists may proceed when safe, after coming to a full stop. The pedestrian is shown a flashing "Don't Walk" with a countdown indicating the time left to cross.

Figure 8 - Example of a HAWK Sequence



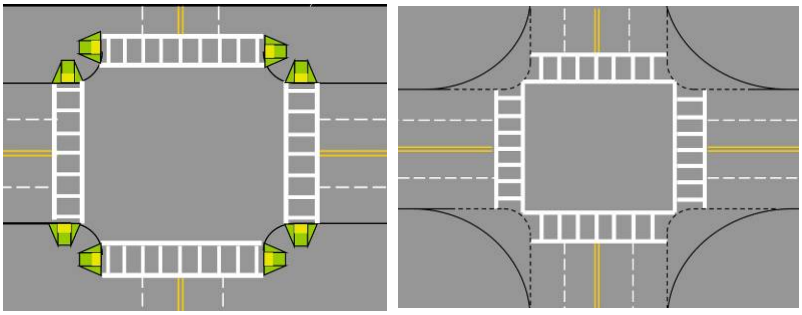
Currently, HAWK signals are not used anywhere within the CAMPO area, but could be considered where appropriate.

4. Intersection geometry:

Intersection geometry has a profound effect on pedestrian safety as it determines to a large extent whether or not drivers will perceive pedestrians, the length of crosswalks, and the speed of approaching and turning vehicles. Intersection design will determine whether best practices for meeting ADA requirements can be applied. For example, tight curb radii will usually allow for two ramps at each corner as opposed to just one. A tight, square intersection is particularly important for the older driver who may find it impossible to turn his/her head to see motorists coming into the intersection at an obtuse angle.

Tighter curb radii benefit pedestrians by shortening the crossing distance, bringing crosswalks closer to the intersection, increasing visibility of pedestrians, and slowing right-turning vehicles. The appropriate radius must be calculated for each corner of an intersection; difficult turns for occasionally occur (for example a large moving truck turning onto a local roadway using a part of another lane).

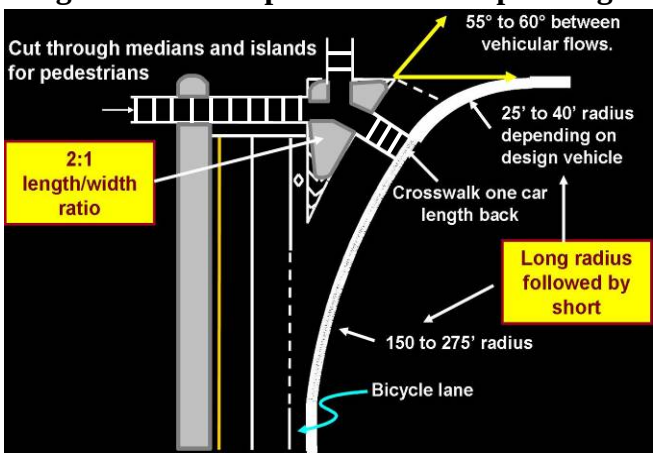
Figure 9 - Examples of Improved Curb Radii



Both Carson City and Douglas County have standards for curb returns based upon the road type, and they typically range anywhere from 15 to 35 feet. Though both entities have their own standards, AASHTO standards are always referenced. The Nevada DOT coordinates with the local governments when working within their jurisdictions. Carson City will review and revise their standards as needed, and Douglas County has given more consideration to standards for pedestrians.

"Lamb/pork-chop" shaped islands between an exclusive right-turn lane and through lanes shorten the crossing distance, reduce pedestrian exposure and improve signal timing. The island enables pedestrians and drivers to negotiate one conflict separately from the others. The island should have the longer tail pointing upstream to the approaching right-turn driver; so drivers approach at close to 90º and are looking at the crosswalk. The crosswalk is placed one car length back from the intersecting roadway so the driver can move forward once the pedestrian conflict has been resolved. The right-tuning driver can focus on cross traffic and the pedestrian can focus on cross or through traffic.

Figure 10 - Example of "Pork Chop" Design



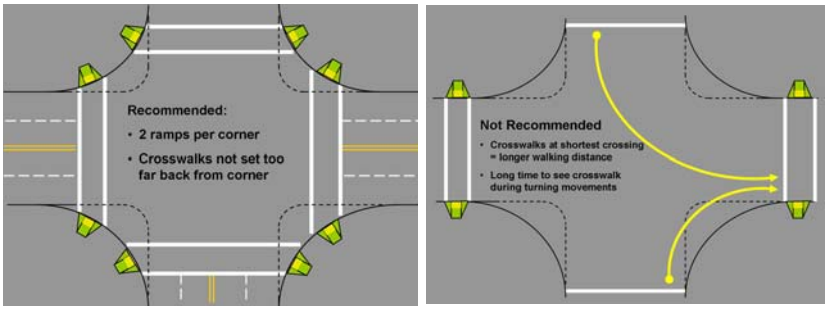
The "pork chop" design has been has been installed at several locations in and around the CAMPO area; for example, at Clearview Drive and South Carson Street in Carson City and US 395 and Waterloo Lane in Douglas County. However, there are no existing design guidelines at the state or local level. All agencies will continue to implement this design where appropriate, and NDOT is looking into adding this type of island to its design specifications. Once that is accomplished, they will likely provide training to the local agencies on how to construct the pork chop design.

Median islands at controlled intersections channelize and slow down left-turning vehicles. However, signalized intersections should be designed to allow pedestrians to cross the entire roadway during a single signal cycle.

All agencies have and will continue to routinely provide pedestrian accessible median islands at controlled intersections where appropriate. Carson City and NDOT have not installed any with the nose design (see photo above), though this design is in NDOT's standards.

Proper curb ramp placement and design ensures that pedestrians cross in crosswalks, close to the intersection, where drivers can see them, and without undue delay. Curb ramps should be aligned with the crosswalk direction of travel which can only be achieved with two ramps at a corner. Ramps (wings not included) must be wholly contained within the marked crosswalk. Poorly placed or oriented ramps force wheelchair users to make long detours and they may not cross in the allotted time at a signalized intersection or they may be crossing outside the crosswalk lines where drivers don't expect them.

Figure 11 - Example of Proper Curb Ramp Placement



For all agencies, the standard is to provide two curb ramps at all corners of signalized intersections, though on occasion, one ramp has been installed due to geometric constraints or right-of-way issues. Carson City installs individual curb ramps on a case-by-case basis, but is very responsive to justified individual needs.

5. Signalized Intersections:

All signalized intersections where pedestrians are reasonably expected to cross should have the following characteristics.

Pedestrian signal indications ensure pedestrians will know when the signal phasing allows them to cross, and when they should not be crossing. On one-way roadways a pedestrian approaching from the opposite direction cannot see the vehicle signal heads and may not realize an intersection is signalized, nor know when it is safe to cross. Left turn arrows are not visible to the pedestrian.

All jurisdictions routinely provide pedestrian signal indicators at signalized intersections. There are a few locations that lack indicators, but many have been upgraded over time.

Marked crosswalks at signalized intersections indicate to the driver where to expect pedestrians and help keep the crossing area clear of vehicles. All legs of a signalized intersection should be marked though considerations should be made where there are no facilities or destinations.

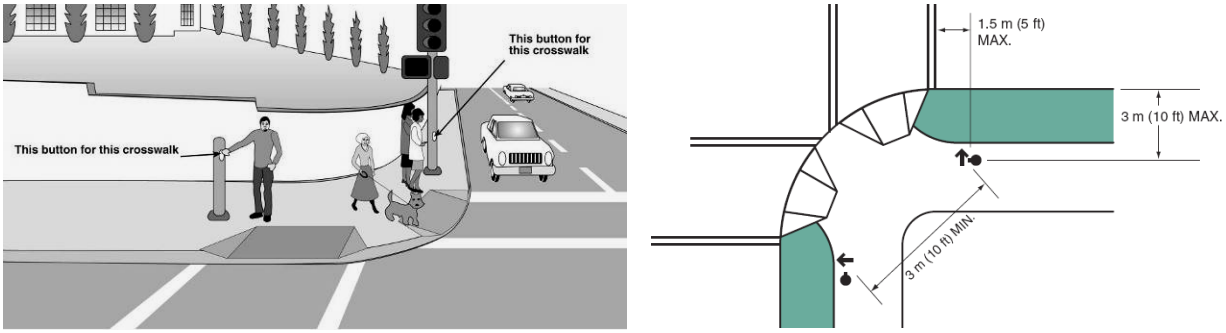
The general goal for all jurisdictions is to provide marked crosswalks on all four legs of an intersection. However, there are certain situations where it is not always appropriate. For example, if there is a double left turn, it is safer to avoid crossing the street where this turning movement occurs. In that case, three crosswalks, as opposed to four, are the most desirable.

A WALK signal long enough to get pedestrians started and a clearance interval long enough to ensure a pedestrian can fully cross the roadway is required by the MUTCD. The new MUTCD assumes a pedestrian speed of 3.5 feet/second. In some states, such as California, 2.8 feet/second is approved for use at locations where there are vulnerable populations.

In the CAMPO area, all local governments, as well as the state, follow MUTCD guidelines, and are in the process of transitioning to the standards found in the newest version.

Location of push buttons placed where a pedestrian who is in a wheelchair or is visually impaired can easily reach them, and that clearly indicate which crosswalk the button regulates. Where a preset cycle operates, push buttons are not needed. Typically, this will be in downtown/central business districts and other areas of high pedestrian use where pedestrians can be expected at every signal cycle.

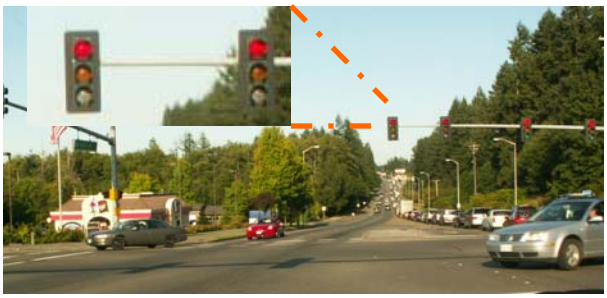
Figure 12 - Example of Proper Push Button Locations



Although there are standards and specifications for the placement of push buttons, they are not always installed correctly in the CAMPO area, and all jurisdictions are guilty of this. Consequently, there are often too many buttons on one pole. This may make it difficult to meet ADA guidelines. The suggestion was made to eliminate push buttons in downtown areas in the future or when upgrading signals by splitting intersections. For example, to provide push buttons for main arterial crossings, but not for minor arterials since the heavier traffic is on the major arterial. In addition, more attention should be given to making all new push buttons ADA compliant.

Signal timing techniques to reduce the incidence of crashes that occur while the pedestrian is crossing with the WALK signal include protected left-turn phases, lead pedestrian intervals and pedestrian countdown signals.

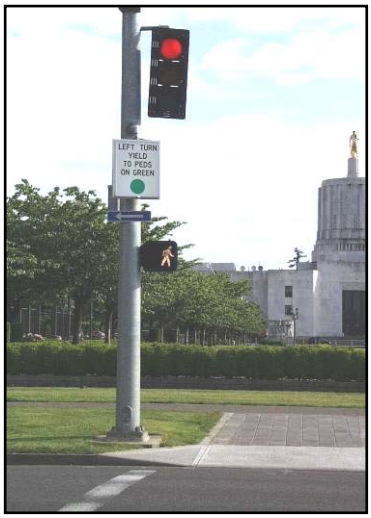
Protected left-turn phases that allow pedestrians to cross without interference from left-turning drivers; red (then green) left turn arrows make it clear to drivers they must wait before turning (especially important where there are double right or double left turns).



Within the CAMPO area, there are quite a variety of signal types. NDOT provides protected left turns at high crash locations. In the Las Vegas area, NDOT eliminates protective permissive turns during peak traffic hours when there is a higher occurrence of crashes. There are also areas where NDOT has implemented a flashing yellow arrow which has been included in the newest version of the MUTCD. Douglas County has some signals that revert to protected left turns for a second time within the same cycle if there is not any oncoming traffic. All jurisdictions said that they would continue to monitor various signal combinations for the best application such as a flashing yellow arrow, elimination of protective permissive turns during

peak hours, and explore using an actuated pedestrian push button signal to create a protected phase. Of course, the best solution for each location would vary as there are several factors that are unique to each situation.

Lead Pedestrian Interval (LPI) reduces conflicts between turning vehicles and pedestrians when turning vehicles encroach into the crosswalk before pedestrians leave the curb. The LPI releases pedestrians 3-5 seconds prior to the green light for vehicles so pedestrians can enter and occupy the crosswalk before turning drivers enter it.



There are no LPI signals currently within the CAMPO area, but there may be locations where this type of signal would be appropriate. All jurisdictions were open to the idea of installing a pilot at a few locations.

Pedestrian countdown signals tell the pedestrians how much time is left in the pedestrian clearance interval and encourages pedestrians to finish crossing before the crossing time runs out. It also reduces the number of pedestrians who initiate a crossing too late in the cycle.

The newest version of the MUTCD requires pedestrian countdown signals, and all jurisdictions have begun to install them throughout the CAMPO area.

6. Other techniques to slow traffic:

Road diets: reducing the number of travel lanes a pedestrian has to cross can be beneficial to all users. A well-documented technique takes a 4-lane undivided roadway (2 lanes in each direction) and reconfigures it to 2 travel lanes, a center-turn lane and 2 bike lanes (without changing the curb lines). The benefits for pedestrians include fewer lanes to cross and slower traffic speeds. The center-turn lane also creates space for pedestrian crossing islands. The bike lanes add a buffer for pedestrians as well as a place for bicyclists to ride. Variations include reducing a multi-lane one-way roadway by one lane; narrowing the travel lanes to slow traffic and create space for bike lanes; or moving the curbs in to narrow the roadway.

There have not been any "road diets" in the CAMPO area to date. However, Carson City has proposed to reduce the number of lanes on Carson Street in the downtown area from four lanes to two lanes with provisions for bike lanes. In addition, Carson City has implemented some "lane diets" where the lane width has been reduced to accommodate bicycle and pedestrian traffic. These types of measures will continue to be evaluated on a case-by-case basis.

Speed Management Policy - Arterial Roadway Design: high speeds make it harder to avoid a crash, and increase the severity of a crash and the likelihood of a fatality. Speed reduction should be a primary tool in reducing pedestrian crashes. Simply lowering speed limits is usually ineffective. Roadways must be redesigned to encourage lower speeds.

Carson City currently has an informal speed management policy and is experimenting with a variety of different treatments. When more data can be collected and evaluated, the City will create a written policy including education and enforcement elements.

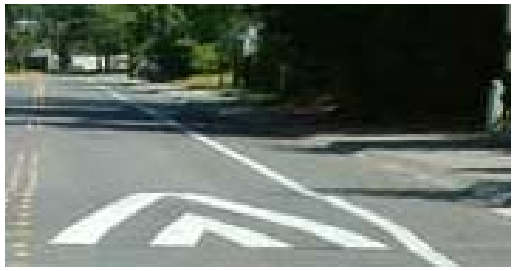
Speed Limits: Reducing speed is critical to reducing the frequency and severity of pedestrian crashes. While many of the countermeasures suggested in this document will have the effect of managing speed, it is also important to have policies in place that articulate optimal speed limits and objectives for reducing speed. This includes articulating how speeds limits are established.

Carson City uses 25 miles per hour (mph) or 35 mph on the majority of local streets. Though NDOT primarily operates higher speed facilities, they do have a process for requesting speed studies and will typically base speed limits on the 85th percentile speed. Carson City has acknowledged that when roads are built or rebuilt, design speeds should more closely reflect the desired speed.

Residential Roadway Design: residential roadways built in the last few decades are often wide and barren, encouraging speeds higher than appropriate such as roadways where children can be expected. Good residential roadway designs are narrow and have on-roadway parking, tight curb radii, short block lengths, buffered sidewalks with roadway trees, short building setbacks, and roadway lights (also see "V. Land Use and Site Design").

Carson City has recently revised their roadway width standard to include curb returns of 15 feet. Sidewalks on the curb are the standard. Douglas County uses a standard roadway width of 32 feet and includes a six-foot planter strip between the sidewalk and the curb. Carson City is open to considering two options for roadway design in their standard, one that includes the traditional curbside sidewalks, and one that includes a planter strip.

Traffic calming slows traffic inside neighborhoods. Common techniques include mini traffic circles, speed humps, diverters, chokers, and chicanes to break up long straight roadways. In general, traffic calming treatments which require road users to go side to side (chicanes and mini traffic circles) are preferred over treatments which require motorists to go up and down (speed humps). It is critical that traffic calming treatments be properly located and designed especially for emergency vehicles.

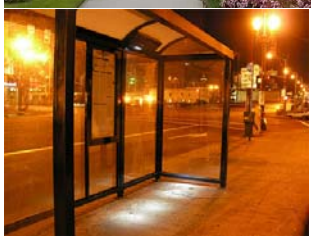


Currently, Carson City considers traffic calming on a case-by-case basis, but would like to expand to a more formal process for installing traffic calming countermeasures. Douglas County is open to exploring a few pilot locations to implement traffic calming treatments.

7. Transit-Related Countermeasures:

Many crashes involve a pedestrian crossing the roadway to access transit. Since pedestrian roadway-crossing solutions are applicable to transit stops, transportation agencies should collaborate with transit agencies to facilitate access and crossing. This is especially important if changes need to be made to the transit system. For example, transportation agencies can provide input on pedestrian patterns (counts) to help transit authorities decide where to place stops for adequate and efficient service, and cooperate in consolidating or adding transit stops as needed. While marking a crosswalk may not be necessarily at all locations; rather, locating stops where it is possible for a pedestrian to cross safely is recommended. This requires coordination between the transit agency and the

transportation authority which manages the roadway. This is particularly important in situations where school children use public transport. Sidewalks or paved shoulders provide pedestrian access to all transit stops. This is required to make them ADA accessible. Lighting should be provided at or near all transit stop locations to provide additional personal security.



The following policies are recommended:

Location of transit stops is critical for safety and accessibility. Transportation agencies should work with transit agencies to ensure that:

1. Bus stops are easily accessible: a stop should not be moved to a far side location if this location requires a lot of out-of-direction travel for users.
2. Bus stops are located where the driver can easily stop and move back into traffic.
3. Bus stops are located where passengers with disabilities can board the bus.

In Carson City, new stops are properly located. If need be, an existing stop can be changed or relocated in response to demand. Carson City does not currently have design guidelines for transit stops, but will occasionally reference larger transit systems such as the RTC Washoe in the Reno/Sparks area. The City makes use of Federal Transit Administration (FTA) funds to make bus stops accessible via existing sidewalks when necessary and appropriate. The standard in Carson City is to create stops at the far side location. In addition, they are located in coordination with street crossing areas. Though not always a top priority, the lighting near a proposed bus stop is a considering factor in the location. Carson City recognizes the benefit of design guidelines for locating transit stops and will develop them when they are able. Douglas County has recognized the need to make their transit stop more ADA accessible.

Transportation agencies should collaborate with transit agencies to facilitate access and crossing. The collaborating is critical since transit agencies need transportation agency support to make changes to their system. Transportation agencies should:

1. Provide input on pedestrian patterns (counts) to transit agencies for their consideration as they decide where to place stops for adequate and efficient service. Provide cooperation in consolidating or adding transit stops as needed. Transit agencies typically try to improve transit efficiency by minimizing the number of stops while recognizing that stops too far apart may deter pedestrian usage
2. Cooperate with transit agencies to move stops to locations where it is easier to cross the roadway. In general, far side locations are preferred for pedestrian safety, as pedestrians cross behind the bus, and the bus can leave without having to wait for pedestrians to cross. However, there are locations where a nearside stop is safer for operational reasons.
3. At mid-block locations, coordinate with transit agencies to place crosswalks (where warranted) behind the bus stop so pedestrians cross behind the bus, where they can see oncoming traffic; it also enables the bus driver to pull away without endangering pedestrians.

8. Work-zone related pedestrian crashes:

Work zones for public and private development must provide for safe and accessible pedestrian routes. Pedestrians should not be forced out into the roadway and detours should not be unreasonably long or inconvenient.

All jurisdictions refer to MUTCD guidelines for traffic control plans. Historically, the majority of complaints regarding specific traffic control plans for any of the entities have come from the bicycle community. All jurisdictions have acknowledged that more attention must be given to ADA issues in the work zone. It was suggested that a policy be written to address issues such as keeping sidewalks open to the extent possible, rerouting bicyclists into general purpose lanes where appropriate, and improving the signage for pedestrian and bicyclists. Also, enforcement of traffic plans is critical.

On a related note, it was mentioned that snow on sidewalks are an issue in winter months, particularly on NDOT controlled roads when plows oftentimes push the snow off of the roadway and onto the adjacent sidewalk. It was noted that the Carson City School District has a good working relationship with the City when it comes to keeping the sidewalks clear of snow, and that this model of coordination could be sought between the City and the state.

VIII. Evaluation/accountability

No plan will be successful unless it is implemented and continually evaluated. The following are some measures to consider:

a) Performance measures (benchmarks) evaluate whether a plan is meeting its goals (e.g. to reduce pedestrian crashes and increase walking). In all cases, performance measures must be measurable. Examples include, number of crashes involving pedestrians, number of injuries, number of fatalities (are they going down); and number of people walking (census, counts etc).

b) Infrastructure accomplishments can also be measured (e.g. miles of shoulders constructed; sidewalks built, crosswalks improved, ramps constructed, systems completed, etc.). Measuring infrastructure accomplishments is important though it is not an end in itself and should not be considered successful unless it reduces pedestrian crashes and increases use.

c) Other measurements include sales and events (e.g. walking shoes sold participation in public runs and walks; use of public transit etc.). While less scientific, these measurements give an indication of whether walking is generally increasing.

Evaluation of results ensures that implemented countermeasures are effective in reducing crashes and improving safety; it also helps ensure future funding opportunities if the plan is perceived as a success. Success should be measured against the objectives set forth in the Pedestrian Safety Action Plan – typically to reduce pedestrian crashes by a certain number and/or percentage.