Health Assessment on the Impact of the Bernalillo County Pedestrian and Bicyclist Safety Action Plan:

Accessibility and Safety on Mountain View's Second Street

Bernalillo County Place Matters Team, Mountain View Elementary School's Community Action Team, Mountain View Neighborhood Association, and Vecinos de Mountain View

6/25/2012

CONTRIBUTORS

Magdalena Avila
Maria Bolivar
Aurea Cardiel
Juan Dominguez
Nora Garcia
Lizet Marques
Daniel Michel
Geniveve Montoya
Esther Morales
Marla Painter
Armando Perez
Margarita Perez-Pulido
Rachel Riboni
Kyra Ryan
Lauro Silva
Sybil Wertheim

RESOURCES

Enrique Cardiel
Matt Cross-Guillen
Richard Meadows
Srikanth Paladugu
Kitty Richards

EDITOR / CONTRIBUTOR

J. McEntire llc

ACKNOWLEDGEMENT

Health Impact Partners

Table of Contents

Maps and Figures

I. EXECUTIVE SUMMARY

The Health Impact Assessment (HIA) examines the impact of the Bernalillo County Pedestrian and Bicyclist Safety Action Plan (Plan) on accessibility and safety on Second Street in the Mountain View neighborhood. The Plan is a ten-year Facility Master Plan that includes suggested capital improvement projects for Second Street and other streets in Mountain View, which are the focus of the HIA.

The Bernalillo County Place Matters Team, with input from its community engagement specialists, took guidance from the Mountain View community. In researching policies that could favorably impact accessibility and safety issues, a Mountain View resident recommended conducting a HIA on the Plan. The HIA partners recognized that the Plan and its potential recommendations for physical infrastructure improvements could support the neighborhood's objectives to increase safety and accessibility for pedestrian and bicycle travel, especially for children and persons with mobility disabilities.

Community residents worked with the Place Matters Team to provide several "Impact Questions" on the physical aspects of Second Street that deprive them of safe access to walking and bicycling opportunities. The assessment of nine Impact Questions led to findings that support the capital improvement projects suggested in the Plan, plus additional recommendations for the area.

Figure 1. Impacts of Proposed Improvements

Project	Evidence of Safety Increase	Evidence of Access Increase
Multi-use trail on 2nd St.	●	●
Sidewalks on neighborhood streets	●	●
Crosswalks, marked	○	●
Lighting on Second Street	●	●
Lighting on neighborhood streets	●	●

Very Positive = ● Moderately Positive = ○

The HIA finds that the projects being assessed would have significant positive effects on health (Figure 1, above). Improvements in safety and access for pedestrians and bicyclists will be Very Positive for most project items. The marked crosswalks will be Moderately Positive, yet are likely to be Very Positive if additional safety features, such as beacon lights or advance stop lines, are installed. Prominent stakeholder concerns that will be addressed include safety and accessibility issues due to the absence on Second Street of sidewalks, marked crosswalks, and street lights.

Changes in the Mountain View area due to the County's Plan and associated capital projects could change attitudes and behavior about pedestrian and bicycle travel. This could lead to a shift in travel mode by students at Mountain View Elementary School, people with physical disabilities, and other residents. The potential health effects include decreased unintentional injuries attributed to traffic accidents, increased long-term patterns of physical activity, and increased interaction in the community; all leading to improved mental health and decreased obesity, diabetes, cardiovascular disease and other chronic diseases.

II. INTRODUCTION

In 2010, the Bernalillo County Place Matters Team (Team) was invited by Human Impact Partners to participate in two days of training on HIA. In response, the Team, County staff, and community members attended the training. Subsequently, the Team received funding from Human Impact Partners for three HIAs. Based on community needs, a commitment from community members to participate, and on-going work in Mountain View and the International District, the Team elected to conduct one HIA in the International District and two in the Mountain View neighborhood area.

Recognizing the importance of pedestrian and bicycle facilities as part of the County's overall transportation system, for the first time the County has developed a draft Pedestrian and Bicyclist Safety Action Plan (Plan). The Plan is a ten-year Rank 2 facility master plan that: 1) identifies pedestrian and bicyclists issues by County planning areas, 2) provides an overview of plans, studies, and ordinances related to pedestrian and bicycle facilities, 3) provides an inventory of existing facility needs, 4) proposes policy changes, and 5) proposes capital projects based on a prioritization process. The list of capital projects includes infrastructure improvements on Second Street SW and a few other streets in Mountain View.

This HIA examines the impact of the Bernalillo County Pedestrian and Bicyclist Safety Action Plan on accessibility and safety on Second Street in the Mountain View neighborhood.

III. BACKGROUND and SCREENING

Human health is affected by many factors in our neighborhoods, from the quality of air that we breathe to access to quality schools and employment opportunities. A HIA asks the question: How will the changes brought about by a policy, project, or plan positively or negatively impact the health of residents living in the affected community?

HIA principles honor the expertise of those living in communities that are directly affected by the proposed policy, project or plan. As such, this HIA incorporates scientific observation and results from outreach to historically marginalized, isolated, and disempowered population groups living in the Mountain View neighborhood in Bernalillo County, New Mexico.

It is also a multi-media HIA on a website that includes text, videos, photos, and drawings created during the outreach process with the goal of representing the life experiences of Mountain View residents who use Second Street on a daily basis (www.bcplacematters.com).

Tasks required for a successful HIA include:

Screening: The group decides whether or not to conduct a HIA on a particular policy, project, or plan, defines the timeline, and assigns respective roles.

Scoping: The group decides on the health outcomes (e.g., accident injuries/fatalities) they wish to analyze and the method they wish to employ (e.g., literature search).

Assessment: The group analyzes data and conducts qualitative and quantitative research to estimate the magnitude and direction of potential effects on health.

Recommendations and Monitoring: The group assesses the impact of the HIA on decision-making and examines the actual effects of the policy, project, or plan on health.

Bernalillo County's Pedestrian and Bicyclist Safety Action Plan

The primary goal of the Plan is to ensure safety for all travelers along county roads, particularly for vulnerable populations, such as children on route to schools, and the elderly and disabled on route to transit stops and community services. Other goals include: 1) providing residents with transportation choices for travel to work, school, and shopping, 2) promoting healthy lifestyles and recreational opportunities through daily exercise for residents of all abilities and ages, and 3) reducing energy usage and improving air quality.

If the Plan is passed, future sector development plans should consider the Plan's policy recommendations. Other recommendations of the Plan include:

- Revising the County's street standards by incorporating complete streets policies to improve and provide for safe pedestrian and bicycle access;
- Following pedestrian and bicycle facilities design criteria for large subdivisions and master planned developments;
- Requiring traffic impact studies for large commercial projects;
- Identifying potential pedestrian and bicycle projects and funding sources including County's general obligation (GO) bonds and federal funding through Mid Region Council of Government's (MRCOG) transportation improvement program (TIP) process; and
- Promoting coordination with partner agencies.

Plan Approval Process

Bernalillo County staff held a series of public meetings on the Plan to receive public comment, including sessions at the Mountain View Community Center in the late spring of 2011. Mountain View residents who attended the meetings stated their top priority is pedestrian safety on Second Street.

Two procedural steps are required prior to Plan adoption: 1) Plan approval by the County Planning Commission (CPC), and if approved, 2) Plan approval and adoption by the Bernalillo County Commissioners (BCC). Public comment on the Plan is welcome and encouraged at each of these junctures. The CPC recommended approval of the Plan at their May 2, 2012 hearing. The BCC will hear the Plan at their June 26, 2012 meeting.

The Plan proposes pedestrian and bicycle improvements as capital projects based on a prioritization process. The proposed list of capital projects includes infrastructure improvements valued at $3.9 million in the Mountain View area, with $2 million of that dedicated to Second Street. Other areas of the county are identified with capital projects as well, for a total of nearly $106 million dollars.

Capital Improvement Planning Process

A capital improvement is a "substantial, nonrecurring expenditure for a physical improvement with a long useful life of ten years or greater and represents a public investment in infrastructure."[1] Bernalillo County has a continuous six-year Capital Improvement Plan (CIP) that links community needs to the County's capital expenditures. The County bonds between $15 million and $20 million in each bond cycle every two years.

Because of demands for limited funding, the County evaluates competing requests for capital projects based on ideas from residents and neighborhood groups, agency

submissions, and a prioritization process. Prioritization is based on the number of people served by the project, proximity to schools, parks and recreation facilities, community centers, health clinics, libraries, and bus stops, number of vehicular crashes, number of households without autos, and the project's potential for closing gaps in the existing transportation network.

Through the CIP process, Bernalillo County Commissioners (BCC) select capital projects for placement in the 2012 general obligation bond package. The County sought input from residents on capital projects with a deadline for submissions of May 17, 2012. Once selected by the BCC, the project lists will be placed on the county's general election ballot on November 6, 2012.

Literature Review

Safety on roads is a relevant topic in the state and in Bernalillo County. New Mexico has one of the highest pedestrian fatality rates in the nation, about three times the national average. "Pedestrians account for 26.5% of all highway fatalities in Bernalillo County (compared to 12% for the US). In 2009, there were 254 crashes in Bernalillo County involving pedestrian fatalities and injuries."[2]

The average vehicle crash death rate in New Mexico was 1.4 times higher than the national rate from 1999 through 2006.[3] The Centers for Disease Control and Prevention (CDC) has recently conducted an assessment of state level land-use policies that support physical activity, and designated New Mexico as a state that does not support community scale urban design/land use policy.[4] According to the CDC, crash-related deaths cost $435 million annually in New Mexico ($400 million in medical costs and $35 million in lost wages).

Screening

In researching policies that could favorably impact accessibility and safety issues, Mountain View resident, Nora Garcia, recommended conducting a HIA on the Plan. She had learned about the Plan and its goal of improving multi-modal accessibility at one of the County's public meetings. Fortunately, the Plan's timing was in sync with the timing of this HIA.

During the course of investigating the timing of the Plan, residents also learned about the University of New Mexico Design Planning Assistant Center's studio class project, a visioning process with Mountain View stakeholders to re-design Second Street. Residents felt the HIA could inform this effort as well. The Bernalillo County Place Matters Team, with input from its community engagement specialists, and direction from the community decided to focus on Second Street accessibility and safety issues within the context of the Plan.

Residents of two neighborhood groups, the Mountain View Neighborhood Association and Vecinos de Mountain View, have long desired a safer Second Street. Parents of students attending Mountain View Elementary School are concerned about how conditions on Second Street impact the health and safety of their children. Residents believe that improved accessibility and safety along Second Street, via capital projects, could contribute to visual and tangible results.

Accessibility is particularly important for many of the 400 residents of Joy Junction, New Mexico's largest homeless shelter. This population is likely to increase in the near future because of Joy Junction's plans to expand its residential facilities. Access for the homeless to job centers is challenging because they either do not have reliable transportation or cannot easily and safely traverse Second Street to reach the local bus stops.

IV. SCOPING

The goal of the scoping phase of the HIA was to identify how the Plan might positively, or negatively, impact the following priorities: 1) increased physical activity, reduced motor vehicle use, and increased social cohesion through improved pedestrian and bicycle access, and 2) safety – for all populations, particularly vulnerable populations; and how achieving these priorities might impact the overall health and well-being of residents. Because of the community's sole emphasis on safety issues regarding access to and on Second Street, it was decided that accessibility and safety should be the themes for the research questions.

The inadequate infrastructure of Second Street, along with the physical barrier caused by the railroad tracks that run parallel to the street, inhibits residents' access to important community destinations, such as the Mountain View Elementary School, a small convenience store, the local community center, and a commuter rail station for the Rail Runner train. Heavy truck traffic associated with industries located in Mountain View contributes to a dangerous mix of truck, passenger car, bicycle, and pedestrian travel along Second Street, Mountain View's "main street."

Community-driven Process

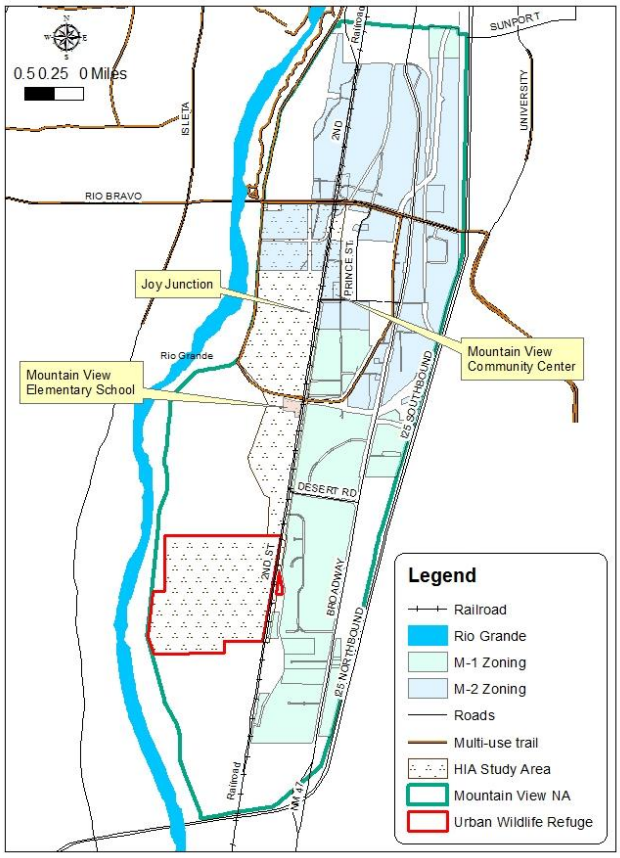
This HIA emanated from residents' deep concerns regarding the accessibility and safety of Second Street, particularly for those who are the most vulnerable. Input to the HIA was collected through minutes and notes taken during eighteen meetings with the Mountain View Neighborhood Association, Vecinos de Mountain View, and Mountain View Elementary School Community Action Team (comprised of parents of children attending Mountain View Elementary School).

In addition to meetings with various organizations, individual interviews with other community members, including elementary school students, were conducted and videotaped. Interviews incorporated questions on pedestrian/bicycle access, accessibility for vulnerable populations, traffic, and feelings of social cohesion and/or isolation.

The Community of Mountain View

The study area for the HIA is the Second Street corridor in Mountain View, which is over three miles in length (Map 1). It is bordered by the Rail Runner Station at Woodward to the north and the proposed Urban Wildlife Refuge to the south. The area includes the intersection of Rio Bravo and Second Street and encompasses the Mountain View Community Center on Prosperity Road. The majority of Mountain View's residents live to the west of Second Street.

Second Street Corridor and Mountain View



Map 1

Mountain View's population is 4,936 persons. Many of Mountain View's residents are property owners, with 74% of the homes owner-occupied.[5] Vulnerable

population groups include low-income, young and elderly people, and homeless families.

Twenty-eight percent of Mountain View's residents are living below 150% of the Federal Poverty Level ($16,245.00 per year for an individual), compared with 25% of Bernalillo County's residents. Mountain View residents are predominantly Hispanic (75%), with 51% speaking a language other than English at home.

Mountain View has a greater population of young people under the age of eighteen (27%) compared to Bernalillo County (24%). Mountain View's elderly population is 9%, compared to Bernalillo County at 12.2%. These population figures do not include the population of Joy Junction, a shelter for homeless families which serves 400 individuals, including eighty children who attend local schools.

Mountain View residents spend a higher proportion of their household budgets on transportation, at 29%, than all County residents, at 24%.[6] However, possibly due to barriers to accessing transit, very few use public transit to commute to work, at .2%, compared to all County residents at 1.5%. Some residents at Joy Junction use the bus: 30 to 60 people out of 300 to 400 clients. A school bus serves the young student population, including children living at Joy Junction.

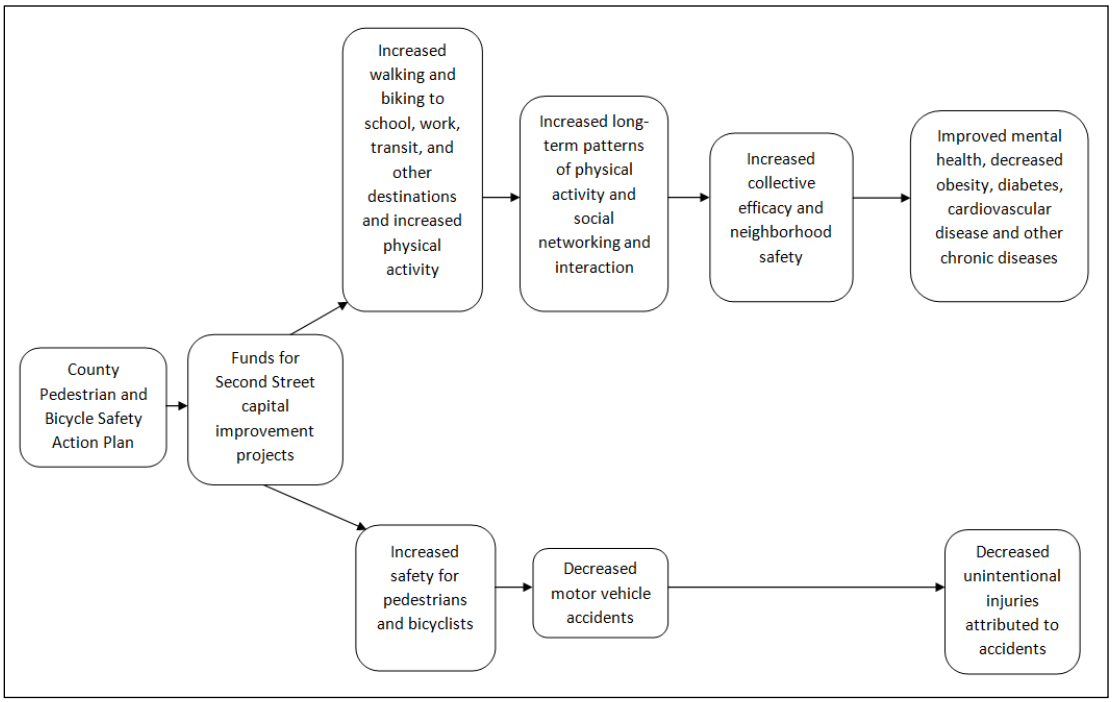
Health Status

Rates of chronic diseases, such as cardio-vascular disease and diabetes, are disproportionately high among Mountain View residents when compared to the rest of Bernalillo County. The cardio-vascular disease death rate is 256 per 100,000 people, the second highest death rate in the county. The diabetes death rate is 48.5 per 100,000 people, the highest death rate in the county. The death rates of Mountain View residents from cancer, unintentional injury, homicide, and self-injury are also the highest in the county.[7]

The Albuquerque Public School district reports that 34.4% of Mountain View Elementary School students are overweight or obese compared to 32.8% in all participating elementary schools. Fifth grade students at Mountain View Elementary School had a higher rate of obesity, 37.3%, when compared to younger students in the school.[8]

The potential health effects of increased accessibility and safety on Second Street include decreased injury or mortality from traffic accidents, decreased stress, increased physical activity, and greater social cohesion in the community (Figure 2).

Figure 2: Health Impacts from Plan Passage and Capital Project Funding



Historical and Current Land-Uses

Traditionally, Mountain View was an agricultural community that became zoned for heavy industry in the 1960's; 44% of the area is zoned M-1 and M-2.[9] The neighborhood now contains two Superfund Sites (abandoned hazardous waste sites) and numerous polluting industries that abut residential properties and agricultural land. Mountain View houses the heaviest industrial uses in the county. As described by resident Nora Garcia, "Mountain View is an underdeveloped community burdened by manufacturing and heavy industrial usage. The community is constantly subjected to hazardous substances from industrial operations that contaminate the ground water and heavy truck traffic that pollutes the air."

Industrial land uses include bulk fuel storage terminals, the City's only wastewater treatment plant, a chlorine manufacturer, and numerous auto salvage yards. Surface and groundwater sources are contaminated by petroleum, creosote, solvents, and other hazardous substances.

Recent development includes a warehouse distribution center of food products, and a larger office and beverage distribution center is planned nearby, at Rio Bravo Blvd. and Prince Street. Proximity to Interstate 25 and access from Rio Bravo Blvd. is advantageous for these warehouse related land uses.

Although industrialized, Mountain View still maintains its agricultural roots, and is home to 42% of the agricultural land in the county. Residential and commercial uses comprise 11% of the total land. [10]

Throughout the years, several attempts have been made to address Second Street accessibility and safety issues, and the land-use mix in Mountain View. In 2005, in response to a myriad of environmental and land-use problems, residents participated in the Mountain View Sector Development Plan visioning/planning sessions. The Mountain View Sector Plan was not approved by the County Commission following a lengthy planning and review process.

In 2009, the BCC approved the International Sunport Station Area Sector Development Plan for the area surrounding the Rail Runner Station, located near the northern boundary of Mountain View on the north side of Rio Bravo Blvd. Although the Sector Plan encourages a mix of commercial and residential land uses for transit oriented development, existing land zoned for heavy industrial use within the Plan's boundaries did not get re-zoned.

In 2011, Price's Dairy, a 570 acre tract of agricultural land at the south end of Second Street, was proposed as the Southwest's first US Fish and Wildlife Service "Urban Wildlife Refuge." Elected officials who sponsor and support this proposal are involved with securing funds for the purchase of the tract. It is possible that Second Street improvements that support access to the refuge will be included in the Service's future plans.

While several residents have described Mountain View as a community with a rural character where people don't feel the need to lock their doors, many also cited lack of a sense of community and isolation as significant problems which are directly related to the lack of walking paths and shared open space. In the words of resident Marla Painter, "It's harder to stay healthy here. There's nowhere to walk or exercise where people feel safe. Kids don't go out and play. People are feeling imprisoned on their own property." Residents also feel that Second Street and the railroad create physical barriers between the west and east sides of the community and to accessing the Mountain View Community Center and other neighborhoods.

V. ASSESSMENT FINDINGS

The prioritized research questions that emerged for study within the HIA were identified by residents during the video documentation process conducted by the Team. The issues identified by Mountain View residents were:

1. Heavy truck traffic and diesel emissions
2. Lack of sidewalks or narrow sidewalks
3. Lack of street lights

4. Absence of speed humps
5. Perception of fear, insecurity, lack of safety
6. Lack of speed limit signage and high speeds
7. Lack of crosswalks
8. Lack of bike lanes and bike paths
9. Absence of accessibility for mobility impaired individuals
10. Safety concerns associated with the use of the AMAFCA channel as a walking path

The tenth item was included as an impact of Item 2, "Lack of sidewalks or narrow sidewalks".

The findings are organized with a baseline description of conditions, followed by impact research questions that examine health outcomes as they relate to safety and accessibility.

Existing Conditions of Second Street

Within the study area, Second Street is designated a Collector road in the Albuquerque metropolitan area's functional classification roadway system. It is owned and maintained by Bernalillo County. The roadway right-of-way is 60 feet, with pavement width of 24 feet, two traffic lanes, no shoulders, and drainage swales. There are a few scattered shade trees but generally no landscaping or other pedestrian amenities along the corridor. The drainage swales are prominent on the east side between the street and railroad tracks.

The current conditions along Second Street are unsafe, with high traffic volumes and speeds, narrow, degraded or non-existing sidewalks, and inadequate lighting. Second Street also lacks bike lanes, marked crosswalks, traffic signals, and visual buffers, such as fencing, that limit views into the industrial sites. These conditions discourage multi-modal access.[11] [12]

On a given day, Second Street conveys an average of 12,400 vehicles north of Prosperity and 5,600 vehicles south of Prosperity. Approximately 220 heavy trucks use Second Street north of Prosperity during daylight hours. Truck traffic is higher to the south of Prosperity with 330 vehicles.[13]

Approximately 30 bicyclists and 20 pedestrians have been counted during daylight hours at Second Street and Rio Bravo Blvd. Although the study area's segment of Second Street is 3.05 miles in length, it has only 365 feet of walkways, in just two locations – near the school and in front of Albuquerque's Wastewater Treatment Plant. The school crossing at Mountain View Elementary provides a faded crosswalk, flashing beacons that work during school hours, and warning signage.

Transit service is provided by the Route 51 service on Second Street between Rio Bravo Blvd. and Prosperity Road. It runs on weekdays nearly every hour from 5:30 am to 6:00 pm, and on Saturdays from 6:30 am to 6:00 pm. There are three stops on Second Street: one just south of Rio Bravo Blvd., at the wastewater treatment plant and just north of Prosperity. The bus stop on Prosperity is across from the community center, and it is the only one that has a bench. None are supported by bus shelters.

Route 51 only covers a small portion of the community along Second Street. There are no stops south of Prosperity. The bus route loops around local streets in Mountain View. An average of 38 boardings and 33 alightings occur daily at the bus stop just north of Prosperity Road. Additionally, 54 boardings and 14 alightings occur daily across from Mountain View Community Center.[14] Bus riders account for most, but not all, of pedestrians along Second Street.

The four-mile Chris Chavez multi-use trail passes through the Mountain View community along the South Diversion storm water channel and Rio Bravo Blvd. The trail intersects Second Street at Rio Bravo Blvd. and at the AMAFCA channel just north of Mountain View Elementary School.

Traffic Crashes

In addition to numerous vehicle-vehicle crashes occurring between 2000 and 2010 a vehicle-bicycle crash also occurred within the study area resulting in a fatality; an extremely unfortunate reminder of the existing dangerous conditions along Second Street and Prosperity.

Rio Bravo Blvd. is a major east-west arterial that provides access to Interstate 25 east of Mountain View. According to a regional study, between 2000 and 2008 the intersection at Rio Bravo Blvd. and Second Street experienced up to twice the county's average crash rates, fatal and injury crash rates, and heavy truck related crash rates. In 2008 this intersection was over capacity and it was forecasted to be severely congested by 2015.[15]

Residents are concerned about traffic congestion at the intersection of Second Street and Rio Bravo Blvd. At a December 2011 meeting, parents suggested this intersection could be safer if the timing of traffic lights allowed enough time for vehicles to clear the intersection.

Improvement Projects

Traffic signals with left turn lanes are currently being installed by the County at the Prosperity and Second Street intersection. The project includes pedestrian countdown signal heads, ADA curb ramps (for future sidewalks), marked crosswalks, and street lighting. The railroad crossing arms, just east of the

intersection, will need to be relocated away from Prosperity's roadway to allow for improved pedestrian movement.

The New Mexico Department of Transportation (NMDOT) is seeking funding to improve safety at the northern point of the HIA area, the Second Street and Rio Bravo Blvd. intersection. Improvements could potentially include railroad crossing arms at all four intersections, additional turning lanes on Second Street, high visible crosswalks, ADA curb ramps, and median refuges on Rio Bravo Blvd.

ABQ Ride will be installing two bus shelters on the route. One will be located at the stop at Mary Avenue and the other across from the Mountain View Community Center on Prosperity Road.

The County is currently in design for trail reconstruction and other improvements to the Chris Chavez trail using a $1 million federal grant.

Impact Research Questions

The following section examines each Impact Research Question related to safety and access to Second Street by Mountain View residents. Information on the baseline condition, community input on the condition, proposed improvements in the Plan, and evidence on the impact of the proposed improvement are provided with each Research Question.

What is the impact of heavy truck traffic?

1. Existing conditions and community concerns

As noted previously, truck traffic on Second Street ranges from 220 to 330 vehicles per day. Truck restriction signage is not provided.

In March 2011, a fuel tanker crashed into a house as the driver attempted to avoid another crash involving two passenger cars. In 2008, a six year old boy was hit and killed by a heavy truck as he was walking along Prosperity to the Mountain View Community Center.

Parents at the school indicated their concern about heavy truck traffic, and other residents noted the heavy truck traffic and diesel emissions associated with it. Another observed that the presence of heavy truck traffic—a factor affecting multi-modal accessibility and safety—was not considered in the Plan.

Plan's potential to address impact

The Plan does not indicate a proposed change in truck traffic. County staff observes that multiple strategies for rerouting truck traffic away from the school and residential areas will need to be considered.[16]

Association between the impact and health

In the literature review, a study conducted in North Carolina shows that the chance of a vehicle related injury being fatal increases by as much as 370% when the vehicle is a truck.[17] For bicyclists, large trucks can increase hazardous conditions in several circumstances, including the "exaggerated lateral" movement that trailers make while traveling down a street. Also, truck trailers "off-track" while turning right, potentially hitting bicyclists or pedestrians. Overall, compared to other vehicles, "some trucks have longer stopping distances, limited visibility (e.g., blind spots), and problems with nighttime visibility."[18]

2. What is the impact of the lack of sidewalks or narrow sidewalks?

Existing conditions and community concerns

Sidewalks are absent on most of Second Street. Only 120 feet of paved sidewalk exists near the convenience store and the Mountain View Elementary School; the remaining sidewalk is located on the Wastewater Treatment Plant site.

Students use the AMAFCA channel as an alternative for a walking path to/from Second Street. The channel drains storm water, which can be dangerous during the summer rains, regionally known as the monsoon season.

The community would like to see the proposed multi-use trail located on the west side of Second Street because of concerns about the incompatibility of the railroad with pedestrian/bicycle access. If placed on the east side of Second Street, some Mountain View Elementary School parents suggest that sidewalks be separated by a fence or barrier shielding pedestrians from traffic and the railroad.

Plan's potential to address impact

The capital projects listed in the draft Plan include a multi-use trail on the east side of Second Street between Woodward Rd. and the proposed Urban Wildlife Refuge. In addition, the project list includes: 1. Sidewalks on Shirk Lane between the ditch and Second Street, which will improve connectivity to the school; 2. Sidewalks on Prince, Prosperity, Williams, and Murray, which will improve connectivity to the community center; and 3. Sidewalks on Desert Rd. between Second Street and Broadway.

Association between the impact and health

The literature reveals that narrow or degraded sidewalks are among the features that are likely to discourage walking as a mode of transport as well as recreational activity.[19] Walking along roadways accounts for 10% to 15% of all pedestrian crashes.[20] Safety is also a concern when the sidewalk is only separated from a vehicular travel lane by a curb and gutter, especially with posted vehicular speeds

of 40 mph and 45 mph. Landscaping, or street planting areas, provide buffers between the motor vehicle traffic and pedestrians. Naderi examined the safety effects of urban streetscape improvements along five arterial roadways in downtown Toronto, and concluded that the addition of roadside features such as trees and concrete planters reduced crashes by 5% to 20%.[21]

The literature confirms that people with disabilities benefit from pedestrian features such as wider sidewalks and improved crosswalks, which also support universal design objectives.[22] Miami-Dade County in Florida was experiencing a significant number of pedestrian injuries and fatalities with the senior population. As a result, the County put special emphasis on pedestrian safety and intersection improvements. Safety was enhanced by improvements to crosswalk markings, lighting, signs, striping, median/refugee islands, *sidewalks*, signals, and pavement conditions and accessibility.[23] (*Emphasis added.*)

3. What is the impact of the lack of street lights?

Existing conditions and community concerns

The Team observed that there are a total of eleven street lights on Second Street. Four are located to the south of Rio Bravo Blvd. Four others are on the corner of Second Street and Prosperity and three are at Desert Rd. The County recently installed lights at Prosperity Avenue and Second Street as part of the traffic signalization project at that intersection.

School parents indicated that a lack of street lights is a concern, and stated that pedestrians along Second Street and Prosperity could not be seen by drivers at night. Residents would like more traffic lights on Second Street at Prosperity and Bowers. Resident observations during interviews were as follows: There are too few street lights along Second Street making walking or bicycling at night extremely dangerous, with four lights at the intersection of Second Street and Rio Bravo Blvd., and three privately owned lights at the intersection of Second Street and Desert Rd. Further, only two of four lights were functioning in the area of the Mountain View Community Center.

Plan's potential to address impact

The Plan proposes lighting at the following locations: Second Street between Woodward Rd. and Desert Rd; Shirk Lane between the ditch and Second Street, on Prince, Prosperity (these may be installed), Williams, and Murray; and on Desert Rd. between Second Street and Broadway.

Recent night-time counts by County Public Works have found as many as 20 pedestrians using Second Street at Prosperity Road.[24]

Association between the impact and health

Conditions that include inadequate street lights discourage multi-modal access.[25] North Carolina's Department of Transportation observed that one-half of bicyclist fatalities occurred during non-daylight conditions, which likely exceeded the proportion of riding that occured at these times.[26] As noted above, walking along roadways accounts for 10% to 15% of all pedestrian crashes in the US, and 50% of pedestrian crashes happen at night.[27]

The American Association of State Highway and Transportation Officials (AASHTO) notes that intersections may warrant higher lighting levels than roadway segments, and, with good design, lighting can enhance safety in the bicycling and pedestrian environment. [28] The Miami Dade County study included street lighting in their projects, concluding that safety was enhanced with this and other improvements.[29]

4. What is the impact of the absence of speed humps?

Existing conditions and community concerns

Speed humps, as defined by Bernalillo County, are "traffic-calming devices that can be deployed where the desired speed is in the range of 15-30 mph." The humps are asphalt mounds constructed on streets intended to reduce speeds along a length of the street.[30] There are no speed humps on Second Street.

Parents at the school noted that the absence of traffic calming measures, such as speed humps, crosswalks, and beacon lights, near the school zone is a concern.

Plan's potential to address impact

Speed humps are not recommended in the Plan's list of capital projects for Second Street or other roads in Mountain View.

Bernalillo County's Traffic Calming policy supports speed humps as well as other devices, including diverters/barriers, mid-block islands, raised medians, and traffic circles. These measures are not included as *pedestrian and bicycle safety improvements* in the Plan for Mountain View. Several criteria are utilized to determine whether speed humps should be installed. Specific to Second Street, the criterion for the average weekday traffic volume, less than 3,000 vehicles, would not be met.

Association between the impact and health

Traffic calming devices tend to change the actual configuration of the roadway where vehicles travel and park. Traffic calming techniques are a countermeasure supported by AASHTO in its guide to reduce collisions involving bicycles. Based on evidence, the study and its companion guides recommend a variety of road

narrowing measures, devices on road sections, and at intersections, all of which are aimed to slow and calm traffic. AASHTO notes that speed humps can create hazards for bicyclists who are riding on the street, although their safety can be supported if the speed hump is designed so that there is a flatter vertical surface on the sides.[31] The multi-use trail proposed in the Plan would not slow traffic, but it would separate the pedestrians and bicyclists from traffic.

5. What is the impact of the perception of fear, insecurity, and lack of safety?

Existing conditions and community concerns

A primary goal of the County's Plan is to ensure the safety for all travelers along county roads, particularly for vulnerable populations, such as children on route to schools, and the elderly and disabled on route to transit stops and community services.

Residents of Joy Junction described a lack of safety when they use the bus stop on Prosperity by the community center, which is on a gravel shoulder of the road.

The Plan did not address perceptions of fear, insecurity, and lack of safety.

Association between the impact and health

According to the literature, aesthetics, safety, and convenience of nearby facilities are important to whether people feel safe at bus stops.[32] A 2002 California Department of Transportation survey found that passengers were more afraid after dark, and most fearful while waiting for a bus than when on it.[33]

Many parents restrict their children from walking outside because of real crime and *fear for their safety*.[34] (*Emphasis added*.) Good lighting on roadways, bridges, tunnels, and multi-use paths is promoted as "important for personal security."[35]

6. What is the impact of speed limits?

Existing conditions and community concerns

Second Street has a speed sign for 45 mph just south of Rio Bravo Blvd., and one for 40 mph at Valley High Road. A speed study can be requested of County Public Works to determine if this speed is appropriate or might be lowered. Speed enforcement can also be improved by electronic message boards displaying speed information and by working with Sheriff's Department.

Parents from the school noted that the speed limit should be lowered and better enforced.

Association between the impact and health

Traffic speeds are the primary determinants of crash severity.[36] [37] An overwhelming proportion of traffic-related injuries and fatalities occur along roadways that are "dangerous by design" because they have been engineered for speeding cars, with little or no provision for people on foot, in wheelchairs, in strollers, or on bicycles.[38]

High operating speeds give drivers less time to react to unforeseen hazards (and people who are walking, bicycling, or standing). A study in the UK showed that a pedestrian struck by a vehicle traveling 40 mph has an 85% chance of being killed. This fatality rate drops to 45% at 30 mph, and to 5% at 20 mph or less. Lower speeds profoundly impact pedestrian safety.[39]

Speed reductions achieved through traffic calming have measurable safety benefits. A detailed meta-analysis of 33 studies found that area-wide traffic-calming programs reduced injury accidents by about 15%, with a smaller reduction on main roads of 10%.[40]

With regards to the elderly, a quantitative and qualitative study of seniors in Georgia showed that they faced real and consistent traffic-related health risks due to the high volume of speeding vehicles. Recommendations were to implement traffic calming measures and lower speed limits within certain distances of senior centers, creating a "senior safety zone" similar to a school zone for children.[41]

A principle of the World Health Organization is that the vulnerability of the human body should be a limiting design parameter for the traffic system and speed management.[42]

7. What is the impact of the lack of crosswalks?

Existing conditions and community concerns

Second Street lacks marked crosswalks. There is a new, well-marked crosswalk at Prosperity, as part of the traffic signalization project. According to Sarah Carrillo, Mountain View Elementary principal, another crosswalk, at Mountain View Elementary School, is very faded and leads to an unsafe place on the east side of Second Street.

Plan's potential to address impact

The Plan includes (marked) crosswalks where sidewalks and the multi-use trail are suggested. NMDOT's potential project at the Rio Bravo Blvd. intersection could include high visible crosswalks and median refuges. Overall, marked, or painted, crosswalks can be requested by County residents through County Public Works.

Association between the impact and health

The literature confirms that people with disabilities benefit from pedestrian features such as improved crosswalks, which also support universal design objectives.[43]

Crosswalk safety can be improved with beacon technologies, which have flashing lights to warn vehicle drivers. The Miami Dade County study reveals that, when crosswalks were present without beacon lights, the elderly had a two times greater risk of injury than when no stop sign *or crosswalk* was present.[44] *(Emphasis added.)*

Research in Canada on the effectiveness of driver and pedestrian behavior modification strategies include the use of pedestrian-activated flashing beacons at mid-block crosswalks, and crosswalks on major roads at intersections not controlled by traffic signals. Another intervention to increase the conspicuity or visibility of crosswalks is the "advance stop line." Placed fifty feet upstream of a crosswalk rather than the standard four feet, they cause a higher percentage of drivers to stop well in advance of the crosswalk rather than encroaching on it. Studies of these countermeasures have demonstrated changes in behavior of motorists and/or pedestrians.[45]

An additional device used with marked crosswalks is promising in terms of pedestrian and bicycle safety. Zig-zag pavement markings were tested in Loudoun County, Virginia, where a multi-use trail crosses many highways. The markings, installed in advance of two marked crossings, increased the awareness of approaching motorists, who responded by reducing speeds within the marking zones.[46] Research that identifies effective methods to increase motorists' knowledge about the new devices is expected.

The proposed crosswalks would likely have a positive effect on slowing traffic and providing safe access to the "other side of the street" for pedestrians. The visual markings on the road emphasize the crosswalk, and state law requires motorists to yield to pedestrians within the crosswalk area, but compliance by motorists may be a challenging issue. The current research supports the installation of associated devices that help to modify behavior with marked crosswalks.

8. What is the impact of the absence of bike lanes and bike paths?

Existing conditions and community concerns

Second Street lacks bike lanes or a bike path. Parents from the school suggested that a bike path and walkway were needed between the proposed Urban Wildlife Refuge and Rio Bravo Blvd.

Resident and bicyclist Maria Globus observed: "Although there are 7.5 miles of bike trail in a loop that runs along the Bosque, I don't see many other cyclists in Mountain View and certainly not on Second Street which does not have any bike lanes." She continued, "When you go on the shoulder, you have to go in the chopped up gravel, sand, and glass. When you're in the road, cars and trucks are coming at you. If the trucks were gone, it would be doable. There are nice places in the South Valley to cycle, but Second Street is difficult to impossible."

Plan's potential to address impact

The Plan in its current draft version proposes that Second Street be improved with a multi-use trail between Woodward Rd. and Desert Rd., resulting in improved connections to the community center, the school, and the Rail Runner station.

Association between the impact and health

The American Association of State Highway and Transportation Officials (AASHTO) adopted a national safety goal of decreasing bicycle related fatalities by 50%, or 1,000 per year over 20 years. Its study examines how this goal can be achieved with proven countermeasures that reduce the number of crashes. Those countermeasures include bike lanes. Research in Toronto showed that bike lanes provide a consistent and predictable space for bicyclists, making them easier to detect.[47]

9. What is the impact of the absence of accessibility for wheelchairs and strollers?

Existing conditions and community concerns

Interviews with residents reflected huge limitations, such as large chunk of asphalt and gravel, to travelling on Second Street by those confined to a wheelchair. Other persons with mobility disabilities are not able to safely and comfortably move on Second Street.

Association between the impact and health

As noted above, evidence indicates that an overwhelming proportion of traffic-related injuries and fatalities occur along roadways that are "dangerous by design,"

and Second Street fits that description, there being no separated pathway for walking and few devices for safe crossings.

Vulnerable Populations

Children

Under the guidance of Principal Sara Carrillo, teachers at the Mountain View Elementary School conducted a brief survey on walking among their students. Of 385 students surveyed, only thirty-five walked to school, although 127 students stated they would like to walk to school. Of the students who walked to and from school, many passed through the small convenience store's parking lot, which is unmarked and experiences relatively high traffic flow. According to Maria Bolivar, the school's teaching assistant, teachers do not encourage students to participate in National Walk to School Day because of safety concerns. A high-risk neighborhood with unsafe features such as high traffic volumes and speeds, narrow or degraded sidewalks, poorly connected streets, and poor or no lighting is likely to discourage walking as a mode of transport.[48]

Nationally, during 2003, vehicle collisions killed 390 pedestrians and 130 cyclists under the age of 15 years.[49] Children use and perceive the built environment differently than adults, and they are particularly vulnerable to fatalities and injuries.[50] Automobile-oriented designs restrict children's independent travel and increases the danger to child pedestrians and cyclists.[51]

In order to achieve greater multi-modal access for children to schools, many states including New Mexico and local communities have launched Safe Routes to School programs, which utilize public funds for walking and bicycling infrastructure improvements.

The Plan cites this program as a funding resource for the capital projects on Shirk Lane between the ditch and Second Street, though the federal funding for the continuance of the state's program is not secure.

Low-Income and Minority Populations

Mountain View not only has a higher population of young people (26% are 18 years or younger), but also has a higher proportion of residents who are Hispanic (77%) and low-income (28%). Research shows that pedestrian crashes occur more frequently in environmental justice areas, which are characterized as "industrialized areas with low-income and minority populations."[52] [53] Using data from four California communities, researchers found that pedestrian injuries were greater in areas characterized by higher unemployment, lower median household incomes, younger populations, and greater traffic flow.[54]

A King County, Washington study found that pedestrian injuries and fatalities were greater in communities having lower median home values, regardless of the level of pedestrian activity or population density.[55] A study conducted in Montreal, a dense urban city, reveals that the rate of traffic crashes with injuries in street intersections is related to the traffic volume; and there were 4.3 times more injuries and 6.3 times more pedestrians injured in areas with low-income households.[56]

Based on relationships found in research and professional practice, the Team finds that all proposed projects would positively impact safety and access (Figure 1). The degree of impact varies, and there are additional actions that could be taken to maximize the levels of safety and access. Such actions are discussed in the recommendations section.

Figure 1: Proposed Physical Improvements, Impacts

Project	Evidence of Safety Increase	Evidence of Access Increase
Multi-use trail on 2nd St.	●	●
Sidewalks on neighborhood streets	●	●
Crosswalks, marked	○	●
Lighting on Second Street	●	●
Lighting on neighborhood streets	●	●

Very Positive = ● Moderately Positive = ○

VI. RECOMMENDATIONS

The Team recommends Plan adoption. The Team also feels that Mountain View's circumstances allow for the prioritization of capital projects along Second Street.

Mountain View has a large population of 4,936 residents. The proposed capital projects, such as a multi-use trail, will contribute to connectivity with Mountain View's school, community center, Bosque and the proposed Urban Wildlife Refuge, bus stops and Rail Runner Station. Further, NMDOT proposed projects at the intersection of Second Street and Rio Bravo Blvd. could alleviate some of the safety concerns of accidents resulting in injuries/fatalities and further enhance the safety

and accessibility features associated with the Plan's capital projects. Mountain View residents have the greatest burden of chronic diseases within the county. Capital projects can begin to relieve this burden by increasing physical activity and providing a safer pedestrian/bicycle environment.

The findings of this assessment provide evidence and community support for the sidewalks, multi-use trail, marked crosswalks and streetlights capital projects in the Plan. They will support safety and pedestrian/bicycle accessibility.

Additional recommendations include:

1. Develop and implement health, safety and social equity criteria as part of the Capital Improvement Plan and funding of capital projects.
2. Install traffic calming devices, such as street humps, or other successful mitigation features identified in the literature.
3. Improve safety features of Mountain View Elementary School's school zone, to include a crossing guard, crosswalk (with safety features such as beacon lighting and advance crosswalk markings), median refuge, and posts with arms and beacon lights.
4. Install multi-use trails on the west side of Second Street, along with barriers separating bicycle, pedestrian, and vehicular traffic.
5. Install crosswalks (with safety features such as beacon lighting), street lights, and traffic signals (with countdown pedestrian signals and curb balls) at major pedestrian crossings throughout the study area.
6. Install bus shelters at bus stops located along Second Street and on Prosperity (across from the community center).
7. Install speed limit signage at 40 mph throughout the stretch of Second Street.
8. Install sidewalks and other walking paths and apply American Disabilities Act design standards for improved accessibility by the mobility impaired.
9. Install landscaping and/or fencing to serve as a buffer to railroad and industry on the east side of Second Street.
10. Reroute truck traffic to improve pedestrian/bicycle safety and reduce particulate matter and diesel emissions.
11. Develop design elements that encourage gathering at places such as the proposed Urban Wildlife Refuge, the Bosque and the Rail Runner Station and appropriate zoning to encourage social spots such as local coffee shops adjacent to trails.

These actions will support the safety and accessibility goals of Mountain View residents. Team partners will monitor the process of these activities and/or participate in them.

VII. CONCLUSION

The HIA process has identified potential positive impacts of the Plan if implemented in the Mountain View area of Bernalillo County. The Plan's potential to improve traffic safety and increase accessibility for pedestrians, bicyclists, and transit users could lead to improved health outcomes of Mountain View residents and, in particular, children and persons with mobility disabilities.

If designed properly, infrastructure improvements consisting of sidewalks, a multi-use trail, marked crosswalks and lights could contribute to neighborhood connectivity and social cohesion. These infrastructure improvements could also improve the tie-in with desirable destinations such as the proposed Urban Wildlife Refuge at the south end of Second Street and the Rail Runner Station at the north end.

The value of conducting the HIA and utilizing its findings is likely to include greater communication and coordination amongst County agencies and residents of Mountain View as the proposed capital improvement projects are considered for approval, then designed and constructed.

VIII. REFERENCES

[1] Bernalillo County, Capital Improvement Projects Ordinance.

[2] Bernalillo County, March 2012. Pedestrian and Bicyclist Safety Action Plan, draft.

[3] Complete Indicator Profile of Injury: Motor Vehicle Traffic Crash Deaths. Available from http://ibis.health.state.nm.us/indicator/complete_profile/injuryMVCDeath.html.

[4] Centers for Disease Control and Prevention. State Indicator Report on Physical Activity, 2010. Atlanta, GA: U.S. Department of Health and Human Services. Retrieved from http://www.cdc.gov/physicalactivity/downloads/PA_State_Indicator_Report_2010.pdf.

[5] US Census Bureau, 2006-2010 American Community Survey 5-Year Estimates. Retrieved from http://www.census.gov/acs/www/.

[6] Center for Neighborhood Technology, 2010. Housing and Transportation Affordability Index. Retrieved from: http://htaindex.cnt.org/

[7] NM Department of Health, 2009. Albuquerque-Bernalillo County Health Equity Assessment Tool.

[8] Albuquerque Public Schools, 2010. APS Healthy Weight Assessment Project, Report for the 2009-2010 School Year.

[9] Bernalillo County, 2007. Mountain View Sector Development Plan. Retrieved from South Valley Partners for Environmental Justice, at: http://www.svpartners.org/pdf/MVSDP%20REVISION%2W0%20EDITS.pdf.

[10] UNM Design Planning Assistance Center presentation, March 2012. Retrieved from http://www.mv2ndstreet.org.

[11] Dumbaugh, E., & Rae, R. 2009. Safe Urban Form: Revisiting the Relationship Between Community Design and Traffic Safety. *J of the Am Planning Association*. 75, 309-329.

[12] Ernst, M., & Shoup, L. 2008. Dangerous by Design: Solving the Epidemic of Preventable Pedestrian Deaths (and Making Great Neighborhoods). Surface Transportation Policy Partnership & Transportation for America.

[13] US Foods Traffic Impact Assessment, 2011. Bernalillo County.

[14] MRCOG Transit Survey, 2012.

[15] Bernalillo County Place Matters, 2011. Health Impact Assessment on NMRT's Request for a Special Use Permit: Prepared for the Bernalillo County Planning Commission April 6, 2011 Hearing. Retrieved from http://www.bcplacematters.com.

[16] Correspondence with R. Meadows, Bernalillo County Public Works Department, June 2012

[17] Kim J.K., Ulfarsson G.F., Shankar V.N., & Mannering F.L. 2010. A Note on Modeling Pedestrian-injury Severity in Motor-vehicle Crashes with the Mixed Logit Model. *Accid Anal Prev*, 42, 1751-8.

[18] Raborn, C., Torbic, D., Gilmore, D., Thomas, L., Hutton, J., Pfefer, R., Neuman, T. 2008. Guidance for Implementation of the AASHTO Strategic Highway Safety Plan, Volume 18: A Guide for Reducing Collisions Involving Bicycles. NCHRP Report 500, Transportation Research Board. P. 41

[19] Dumbaugh, E. and Rae, R. 2009. Safe Urban Form: Revisiting the Relationship Between Community Design and Traffic Safety. *J of the Am Planning Association*. 75, 309-329.

[20] Bernalillo County, 2011. Pedestrian and Bicyclist Safety Action Plan (draft).

[21] Naderi, J. R. 2003. Landscape design in the clear zone: The effects of landscape variables on pedestrian health and driver safety. In Transportation Research Board, Second Annual Conference Proceedings [CD-ROM]. Washington, DC: Transportation Research Board.

[22] Victoria Transport Policy Institute. 2011. Traffic Calming: Roadway Design to Reduce Traffic Speeds and Volumes, Transportation Demand Management (TDM) Encyclopedia.

[23] Cevallos, F., & McCarthy, D. 2011. Traffic Safety Plan for Elderly Pedestrians. Miami-Dade Public Works Department.

[24] Miovision Lighting Warrant Pedestrian Survey, 2012. Bernalillo County.

[25] Ernst, M., & Shoup, L. 2008. Dangerous by Design: Solving the Epidemic of Preventable Pedestrian Deaths (and Making Great Neighborhoods). Surface Transportation Policy Partnership & Transportation for America.

[26] Kim J.K., Ulfarsson G.F., Shankar V.N., & Mannering F.L. 2010. A Note on Modeling Pedestrian-injury Severity in Motor-vehicle Crashes with the Mixed Logit Model. *Accid Anal Prev*, 42, 1751-8.

[27] Bernalillo County, 2011. Pedestrian and Bicyclist Safety Action Plan (draft).

[28] Raborn, C., Torbic, D., Gilmore, D., Thomas, L., Hutton, J., Pfefer, R., Neuman, T. 2008. Guidance for Implementation of the AASHTO Strategic Highway Safety Plan, Volume 18: A Guide for Reducing Collisions Involving Bicycles. NCHRP Report 500, Transportation Research Board. P. 98.

[29] Cevallos, F., & McCarthy, D. 2011. Traffic Safety Plan for Elderly Pedestrians. Miami-Dade Public Works Department.

[30] Bernalillo County, Traffic Calming Policy for Neighborhood Streets, 2001.

[31] Raborn, C., Torbic, D., Gilmore, D., Thomas, L., Hutton, J., Pfefer, R., Neuman, T. 2008. Guidance for Implementation of the AASHTO Strategic Highway Safety Plan, Volume 18: A Guide for Reducing Collisions Involving Bicycles. NCHRP Report 500, Transportation Research Board. p. 110

[32] Pikora, T., Giles-Corti, B., Bull, F., Jamrozik, K., Donovan, R. 2003. Developing a framework for assessment of the environmental determinants of walking and cycling. *Soc Sci Med* 56, 1693–1703.

[33] Loukaitou-Sideris, A. & Fink, C. 2009. Addressing Women's Fear of Victimization in Transportation Settings: A Survey of U.S. Transit Agencies. *Urban Affairs Review* 44: 554 originally published online 28 August 2008. DOI: 10.1177/1078087408322874

[34] Jutras, S. 2003. 'Go outside and play! Contributions of an urban environment to the developing and wellbeing of children,' *Canadian Psychology-Psychologie Canadienne*, Vo. 44, pp. 257-266.

[35] Raborn, C., Torbic, D., Gilmore, D., Thomas, L., Hutton, J., Pfefer, R., Neuman, T. 2008. Guidance for Implementation of the AASHTO Strategic Highway Safety Plan, Volume 18: A Guide for Reducing Collisions Involving Bicycles. NCHRP Report 500, Transportation Research Board.

[36] Litman, T., & Fitzroy S. 2005. Safe Travels: Evaluating Mobility Management Traffic Safety Impacts, Victoria Transport Policy Institute, Victoria, Canada. Can be retrieved at http://www.vtpi.org.au/saftrav.pdf.

[37] Gorder, P. 2002. The Impact of Speed and Other Variable on Pedestrian Safety in Maine. *Accid Anal Prev*., 36, 533-543.

[38] Ernst, M., & Shoup, L. 2008. Dangerous by Design: Solving the Epidemic of Preventable Pedestrian Deaths (and Making Great Neighborhoods). Surface Transportation Policy Partnership & Transportation for America.

[39] Ewing, R. and Dumbaugh, E. 2009. The Built Environment and Traffic Safety: A Review of Empirical Evidence. *J of Planning Literature*, 23, 347-367.

[40] Blivk, Rune 2001. Area Wide Traffic Calming Schemes: A Meta-Analysis of Safety Effects. Accident Analysis and Prevention. Vol. 33 pp 327-336.

[41] Shendell, D.H., Johnson, M.L., Sanders, D.L., Nowakowski, A.C.H., Yang, J., Jeffries, C., Weisman, J.E., Moulding, M. 2011. Community Built Environment Factors and Mobility Around Senior Wellness Centers: the Concept of "Safe Senior Zones," *J of Env Health*, (73)7, 9-18.

[42] Peden, M., Scurfield, R., Sleet, D., Mohan, D., Hyder, A., Jarawan, E., & Mathers, C. 2004. *World Report on Road Traffic Injury Prevention*. Geneva: World Health Organization.

[43] Victoria Transport Policy Institute. 2011. Traffic Calming: Roadway Design to Reduce Traffic Speeds and Volumes. Transit Oriented Development (TOD): Using Public Transit to

Create More Accessible and Liveable Neighborhoods. Transportation Demand Management (TDM) Encyclopedia.

[44] Koepsell T., McCloskey L., Wolf M., Moudon A.V., Buchner D., Kraus J., & Patterson M. 2002. Crosswalk Markings and the Risk of Pedestrian-motor vehicle Collisions in Older Pedestrians, *JAMA*. 288, 2136-43.

[45] Van Houten, R. and Malenfant JE. 1999. Canadian Research on Pedestrian Safety. USDOT. Federal Highway Safety Administration.

[46] Dougald, L., Dittberner, R., Sripathi, H. 2012. Creating Safer Mid-Block Pedestrian and Bicycle Crossing Environments: The Zig-Zag Pavement Marking Experiment, Transportation Research Board Annual Meeting 2012 Paper #12-1247. Retrieved at http://docs.trb.org/prp/12-1247.pdf

[47] Raborn, C., Torbic, D., Gilmore, D., Thomas, L., Hutton, J., Pfefer, R., Neuman, T. 2008. Guidance for Implementation of the AASHTO Strategic Highway Safety Plan, Volume 18: A Guide for Reducing Collisions Involving Bicycles. NCHRP Report 500, Transportation Research Board.

[48] Dumbaugh, E. and Rae, R. 2009. Safe Urban Form: Revisiting the Relationship Between Community Design and Traffic Safety. *J of the Am Planning Association*. 75, 309-329.

[49] National Highway Traffic Safety Administration 2003. Safe Routes to School: Overview. Retrieved from http://www.nhtsa.gov.

[50] Roberts, I., Marshall, R., Lee-Joe, T. 1995. The Urban Traffic Environment and the Risk of Child Pedestrian Injury: A Case-Crossover Approach. *Epidemiology*, 6, 169-171.

[51] Wendel, A.M., Dannenberg, A.L., & Frumkin, H. 2008. Designing and Building Healthy Places for Children, *Int. J. Environment and Health*, 2, 338–355.

[52] Roberts, I., Marshall, R., & Lee-Joe, T. 1995. The Urban Traffic Environment and the Risk of Child Pedestrian Injury: A Case-Crossover Approach. *Epidemiology, 6*, 169-171.

[53] Cottrill, C., & Piyushimita, T. 2010. Evaluating Pedestrian Crashes in Areas with Low-Income or Minority Populations, *Accid. Anal Prev*, 42, 1718-1728.

[54] LaScala, E.A., P.J., Gruenewald, & Johnson F.W. 2004. An Ecological Study of the Locations of Schools and Child Pedestrian Injury Collisions. *Accid, Anal Prev*, 36, 569–576.

[55] Moudon A.V., Lin L., Jiao J., Hurvitz P., & Reeves P. 2011. The Risk of Pedestrian Injury and Fatality in Collisions with Motor Vehicles, a Social Ecological Study of State Routes and City Streets in King County, Washington, *Accid Anal Prev*, 43, 11-24.

[56] Morency, P., Gauvin, L., Plante, C., Fournier, M., & Morency, C. 2012. Neighborhood Social Inequalities in Road Traffic Injuries: The Influence of Traffic Volume and Road Design. *Am J of Public Health*, (102)6.